

***DRAINAGE ANALYSIS***  
*for*  
***Solar Energy Storage System***  
*ZP Battery Devco, LLC*  
*1355 Main Street*  
*Leicester, Massachusetts*

***September 21, 2021***



*[Handwritten signature]*  
*9-21-21*

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COVER SHEET

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**1.0**  
**DRAINAGE NARRATIVE**

## **1.0 NARRATIVE**

### **1.1 INTRODUCTION**

On behalf of our client, ZP Battery Devco, LLC, Hannigan Engineering, Inc. has prepared this Drainage Analysis and Report as part of the submittal package for Site Plan Review from the Town of Leicester for the construction of a new Energy Storage System (ESS). The Project will be situated on a portion of 1355 main street along the southerly side of Main Street (Route 9) in Leicester, Massachusetts.

The purpose of this analysis is to compare the pre-development and post-development peak flow rates to certain design points from the project. In particular, changes in peak rates of runoff generally associated with alterations of land use were studied. These alterations include land being transformed from areas of landscape (grass), woods, and brush to areas of grass, landscape, and impervious areas (rooftops, sidewalks and pavement). The effects of stormwater being re-directed to new areas as a result of the proposed construction and the associated drainage system were reviewed as well. For the purposes of this report, any developed areas which are not impervious will be considered to consist of lawn and landscape areas.

The U.S. Soil Conservation Service (SCS) methods were utilized for this analysis in order to establish land use and run-off characteristics in the determination of pre- and post-development peak run-off rates. All proposed development areas and subsequent impacts on stormwater runoff relative to this development have been incorporated within this analysis and report.

The drainage from the site currently flows to several low points throughout the property. In the area of the proposed development, an increase in impervious areas due the construction of the concrete pads to store the ESS along with the general clearing of the land will occur, requiring additional provisions be made to provide compliance with the Massachusetts Stormwater Regulations and the Local Stormwater Bylaw. These measures include the implementation of a dry detention basin to capture and detain a portion of the anticipated runoff from the development.

### **1.2 METHOD OF ANALYSIS**

The enclosed hydrologic calculations utilize the runoff estimating techniques developed by the USDA Soil Conservation Service (SCS). The following publications were used in the preparation of this report:

1. "Urban Hydrology for Small Watersheds"<sup>1</sup>
2. "National Engineering Handbook, Hydrology, Section 4" (NEH-4)<sup>2</sup>
3. "Handbook of Hydraulics" 6th ed. - E.F. Brater & H. Williams<sup>3</sup>
4. "Soil Survey Report for Northeastern Worcester County" 1985 ed. - USDA NRCS<sup>4</sup>

Using SCS publications and other texts on surface water hydrology, in conjunction with drainage software *HydroCAD* developed by Applied Microcomputer Systems<sup>5</sup>, Hannigan Engineering, Inc. has calculated peak rates of runoff relative to the subject site for conditions prior to development as well as conditions upon the completion of construction. The drainage software program *HydroCAD* calculates peak rates of runoff similarly to the computer program known as *Computer Programs for Project Formulations-Hydrology, Technical Release Number 20 (TR-20)*, developed by SCS. This program and series of programs are the technical standard utilized by engineers, Planning Boards, Conservation Commission, and Municipal Agencies throughout the region and across the country for the evaluation of storm water conditions.

The analysis reviews certain parameters of sub-watersheds surrounding the subject site and how these parameters are affected by various rainfall conditions. These parameters include land cover and use, soil strata and permeability, and variations in slope. These parameters are used to develop rainfall runoff characteristics,



which are used to analyze both pre and post development conditions within and surrounding the proposed construction activity. Some of these characteristics include times of concentration ( $T_c$ ), peak rates of runoff, runoff volume, and the time the peak rate of runoff occurs within the particular storm event.

Times of concentration were computed by using the SCS "Upland Method" as described in the aforementioned National Engineering Handbook and were utilized for the analysis of the individual watersheds. The Upland Method computes the time of travel of storm waters over segments of the watershed depending upon land conditions, such as surface roughness, channel configuration, slope of land, and flow patterns. The addition of these travel times determines the individual watershed Time of Concentration. This method translates to more accurate  $T_c$ 's than other more general methods.

### **1.3 SITE DESCRIPTION**

The Project will be situated on a portion of the #1355 Main Street property along the southerly side of Main Street (Route 9) in Leicester. The property is currently undeveloped and is comprised mostly of woodland and brush. It is noted that some areas of an existing gravel access way exist within the area of development that is associated with the previous use of the adjacent property at #1323 Main Street. Areas subject to protection under the Wetlands Protection Act and the Leicester Wetland Bylaws were reviewed and delineated by Caron Environmental. These areas are isolated to a Bordering Vegetated Wetland (BVW) along the southerly property line.

It is the intent of the Applicant to construct a new Energy Storage System (ESS) on a portion of #1355 Main Street. Access will be provided by a new gravel access drive which will extend in a southerly direction. This access drive will be terminated with a T-Turnaround configuration which will allow for service and emergency vehicles to enter and turnaround within the site. The proposed ESS system will be supported on the ground via a series of concrete pads along the access drive, with additional standalone electrical components. Additional provisions will be provided for the stormwater management system as well as electrical transmission infrastructure.

For the purpose of the analysis, certain design points were reviewed. The design points are where the pre-development drainage for the subcatchment areas of the watershed over the property are directed. The same design points have been utilized and reviewed for both pre- and post-development runoff conditions. The drainage from the site currently overland flows to several low points located around the property. These Design Points are as follows. It is noted that Design Point #1 (DP#1) receives the majority of the runoff from the proposed development.

Design Point #1 – Located at a low point within the onsite BVW along the southerly property line.

Design Point #2 – Located at a existing municipal catchbasin within Main Street to the east of the project.

Design Point #3 – Located at a low point located to the south east of the property on the abutting (#1323) property.

#### **1.4 SOIL CHARACTERISTICS**

Soil types for this analysis were based upon review of soils information contained in the SCS publication *Interim Soil Report for Worcester County, Massachusetts – Southern Part*. The original mapping has been reestablished via the Web Soil Survey as part of the National Cooperative Soil Survey under the Natural Resource Conservation Service and its website (<http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>). This mapping is the basis for the soil type determinations for this analysis.

The soils are classified by number and name by SCS and, subsequently, the Hydrological Soil Group has been designated within the Urban Hydrology for Small Watersheds manual. Soils within the subject watersheds are also hydrologically classified into different soil groups as defined by the Soil Conservation Service. The following table provides the SCS Hydrological Soil Group classification for each soil type.

<b><u>Soil Designation</u></b>	<b><u>Name</u></b>	<b><u>Hydrological Group</u></b>
305D	Paxton fine Sandy Loam	C
310B	Woodbridge Fine Sandy Loam	C/D

#### **1.5 RUNOFF CURVE NUMBERS**

The SCS runoff curve numbers used in all watershed modeling contained in this report are based on the Hydrologic Soil Groups and land uses below:

<b><u>Land Use</u></b>	<b><u>Hydrologic Soil Group</u></b>	<b><u>Curve #</u></b>
Grass Cover (good)	C	74
Woods (Good)	C	70
Gravel Surface	C	89
Impervious Area	NA	98

#### **1.6 DESIGN CRITERIA**

This drainage analysis was developed utilizing a Type III, 24-hour tropical storm as developed by SCS and required for this region. The storm frequencies and the corresponding 24-hour rainfall amounts are as follows:

<b><u>Storm Frequency (years)</u></b>	<b><u>Rainfall (inches)</u></b>
2	3.0
10	4.5
25	5.3
100	6.5



## **1.7 THE PROPOSED DRAINAGE SYSTEM**

The proposed drainage system captures stormwater runoff from the site via overland flow directed to as single detention basin prior to discharge. The majority of the proposed development will be captured and directed to this detention basin, with the remainder flowing overland, eventually make its way to one of the design points.

As with any development, changes in land use such as the transformation of woodland areas to lawn, landscape and impervious areas cause increased peak rates of runoff to the design points. These areas on this site consist of access drives and pad areas for ESS, as well as alterations in land use from woodland areas to open lawn and landscaped areas. In order to mitigate increases in peak rate of runoff, the site grading has been carefully designed to direct the majority of these land alterations to the storm drainage system. The majority of the runoff will be captured by a proposed dry detention basin located along the southerly limits of the project. This basin will provide the primary means of mitigating the peak rates of runoff from the development.

The detention basin will be equipped with a PVC sub-drain system and an outlet structure consisting of various orifices to control the discharge rate of the flow. During smaller storm events, the stormwater will back up in the detention basin controlled by the discharge flow allowed by the subdrain system and outlet control structure. Upon the completion of the storm event, these discharge control features will control the flow at or below pre-development rates until the stormwater has drained from the basin. It is noted that this subdrain system has a dual purpose of draining the basin between storm events and preventing groundwater from entering the basin from below. In addition to the subdrain and outlet structure of the detention basins, each basin will also be equipped with an emergency spillway. Based on the calculations, the emergency spillway will not experience flow in any storm event.

## **1.8 CONCLUSIONS**

As stated above, three Design Points have been established throughout the project area. Changes in land use are the predominant cause of increases in peak rate of runoff to these design points. Under proposed conditions, the majority of stormwater runoff will be captured by a proposed detention basin before being directed towards DP#1. The results of the Drainage Analysis and resulting decreases in peak rates of runoff are shown below in *Table 1*.

*Table #1: Peak Rates of Runoff*

Design Point		2-yr Storm	10-yr Storm	25-yr Storm	100-yr Storm
#1	Pre-	1.32	3.25	4.40	6.22
	Post-	1.29	3.02	4.00	5.59
#2	<b>Pre-</b>	<b>0.55</b>	<b>0.87</b>	<b>1.04</b>	<b>1.29</b>
	<b>Post-</b>	<b>0.56</b>	<b>0.88</b>	<b>1.05</b>	<b>1.30</b>
#3	Pre-	2.30	4.89	6.38	8.67
	Post-	2.30	4.89	6.38	8.67

All flows are in cubic feet per second.

As outline above, the post-development peak rates are of runoff have been mitigated for all Storm Events, with the noted exception of Design Point #2 (DP#2), during all storm events. The increase within this Design point is due to the small increase in area caused by access to the gravel driveway. To maintain the gutter flow within Main Street, a ridge will be created along the shoulder of the. This results in an increase to the contributing

watershed of approximately 95 s.f. This increase by default is unavoidable to maintain the existing drainage pattern. The resulting increase in combination with the added conversion of grass to gravel surface are the cause behind the increase. Furthermore, the increase in the peak rate of flow during all storm events is consistently 0.01 c.f.s. and is considered *de minimus* in nature.

The storm water management as outlined herein and as shown on the accompanying plans has the following positive values relative to storm water management:

- A) Attenuation of the 2-, 10-, 25- and 100-year storm events has mitigated increases in peak rates of runoff, or has been justified herein.
- B) The development adheres to the provisions of the Massachusetts Stormwater Management program with greater than 80% TSS removal.
- C) The Stormwater Operation and Maintenance Plan (OMP) attached, has been prepared to ensure long-term function of the system, as designed.

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<sup>1</sup>"Urban Hydrology for Small Watersheds (Technical Release Number 55); Engineering Division, United States Dept. of Agriculture, Soil Conservation Service (Jan. 1975)

<sup>2</sup>"National Engineering Handbook Section 4- Hydrology" ; United States Dept. of Agriculture, Soil Conservation Service (March 1985)

<sup>3</sup>"Handbook of Hydraulics" - 6th ed., E.F. Brater & H. Williams (1976)

<sup>4</sup>"Interim Soil Report for Southern Worcester County" 1995 ed., Published by the Southern Worcester County Conservation District, in cooperation with the United States Department of Agriculture, Natural Resources Conservation Service (1995)

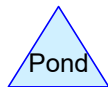
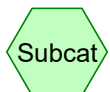
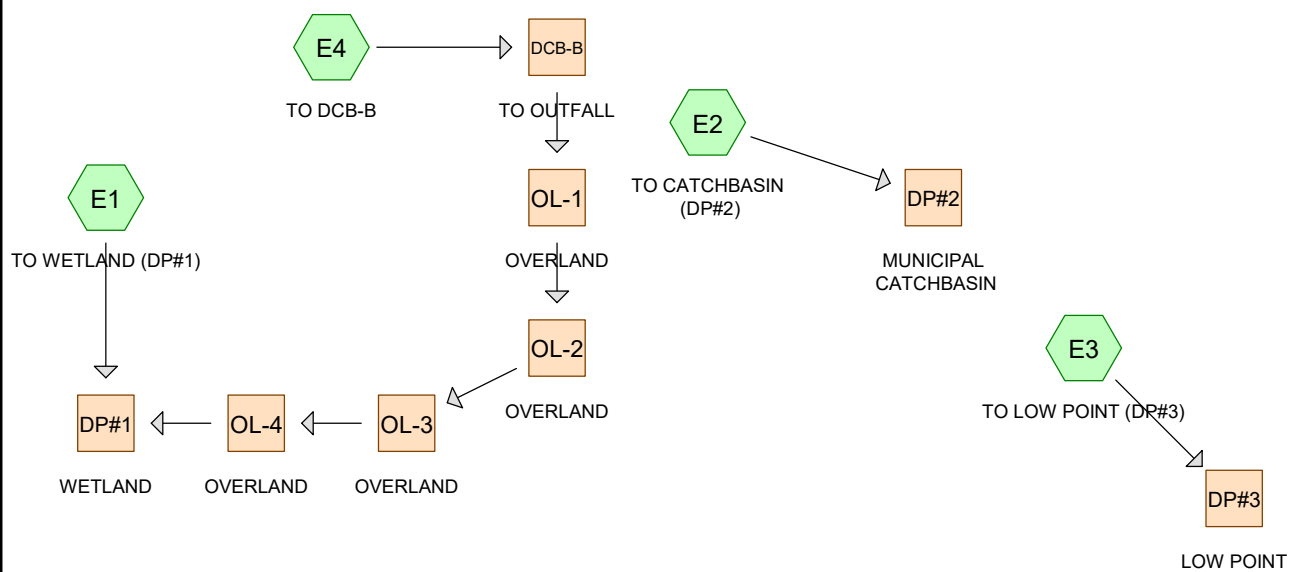
<sup>5</sup> "HydroCAD" Drainage software developed by Applied Microcomputer, Page Hill Road, Chocorua, NH



## **2.0**

# **HYDROLOGICAL CALCULATIONS**

**2.1**  
**PRE-DEVELOPMENT CALCULATIONS**



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**Area Listing (all nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
0.268	74	>75% Grass cover, Good, HSG C (E1, E2, E3, E4)
0.355	89	Gravel roads, HSG C (E1, E3)
0.657	98	Paved parking, HSG C (E1, E2, E3, E4)
2.881	70	Woods, Good, HSG C (E1, E2, E3)
<b>4.161</b>	<b>76</b>	<b>TOTAL AREA</b>



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**Soil Listing (all nodes)**

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
4.161	HSG C	E1, E2, E3, E4
0.000	HSG D	
0.000	Other	
<b>4.161</b>		<b>TOTAL AREA</b>

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**Ground Covers (all nodes)**

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.268	0.000	0.000	0.268	>75% Grass cover, Good	E1, E2, E3, E4
0.000	0.000	0.355	0.000	0.000	0.355	Gravel roads	E1, E3
0.000	0.000	0.657	0.000	0.000	0.657	Paved parking	E1, E2, E3, E4
0.000	0.000	2.881	0.000	0.000	2.881	Woods, Good	E1, E2, E3
<b>0.000</b>	<b>0.000</b>	<b>4.161</b>	<b>0.000</b>	<b>0.000</b>	<b>4.161</b>	<b>TOTAL AREA</b>	

**3010-Pre***Type III 24-hr 2-Year Rainfall=3.00"*

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E1: TO WETLAND (DP#1)** Runoff Area=84,498 sf 4.96% Impervious Runoff Depth=0.81"  
 Flow Length=512' Tc=13.5 min CN=72 Runoff=1.29 cfs 0.131 af

**Subcatchment E2: TO CATCHBASIN (DP#2)** Runoff Area=8,974 sf 85.31% Impervious Runoff Depth=2.35"  
 Flow Length=427' Slope=0.0600 '/' Tc=5.0 min CN=94 Runoff=0.55 cfs 0.040 af

**Subcatchment E3: TO LOW POINT (DP#3)** Runoff Area=82,313 sf 15.10% Impervious Runoff Depth=1.07"  
 Flow Length=356' Tc=5.0 min CN=77 Runoff=2.30 cfs 0.169 af

**Subcatchment E4: TO DCB-B** Runoff Area=5,470 sf 79.63% Impervious Runoff Depth=2.25"  
 Flow Length=217' Slope=0.0600 '/' Tc=5.0 min CN=93 Runoff=0.32 cfs 0.024 af

**Reach DCB-B: TO OUTFALL** Inflow=0.32 cfs 0.024 af  
 Outflow=0.32 cfs 0.024 af

**Reach DP#1: WETLAND** Inflow=1.32 cfs 0.154 af  
 Outflow=1.32 cfs 0.154 af

**Reach DP#2: MUNICIPAL CATCHBASIN** Inflow=0.55 cfs 0.040 af  
 Outflow=0.55 cfs 0.040 af

**Reach DP#3: LOW POINT** Inflow=2.30 cfs 0.169 af  
 Outflow=2.30 cfs 0.169 af

**Reach OL-1: OVERLAND** Avg. Flow Depth=0.03' Max Vel=0.63 fps Inflow=0.32 cfs 0.024 af  
 n=0.080 L=46.0' S=0.1087 '/' Capacity=122.10 cfs Outflow=0.31 cfs 0.024 af

**Reach OL-2: OVERLAND** Avg. Flow Depth=0.03' Max Vel=0.54 fps Inflow=0.31 cfs 0.024 af  
 n=0.080 L=211.0' S=0.0867 '/' Capacity=109.07 cfs Outflow=0.26 cfs 0.024 af

**Reach OL-3: OVERLAND** Avg. Flow Depth=0.04' Max Vel=0.39 fps Inflow=0.26 cfs 0.024 af  
 n=0.080 L=23.0' S=0.0304 '/' Capacity=64.61 cfs Outflow=0.25 cfs 0.024 af

**Reach OL-4: OVERLAND** Avg. Flow Depth=0.04' Max Vel=0.15 fps Inflow=0.25 cfs 0.024 af  
 n=0.080 L=128.0' S=0.0050 '/' Capacity=45.22 cfs Outflow=0.19 cfs 0.024 af

**Total Runoff Area = 4.161 ac Runoff Volume = 0.363 af Average Runoff Depth = 1.05"**  
**84.20% Pervious = 3.504 ac 15.80% Impervious = 0.657 ac**

**Summary for Subcatchment E1: TO WETLAND (DP#1)**

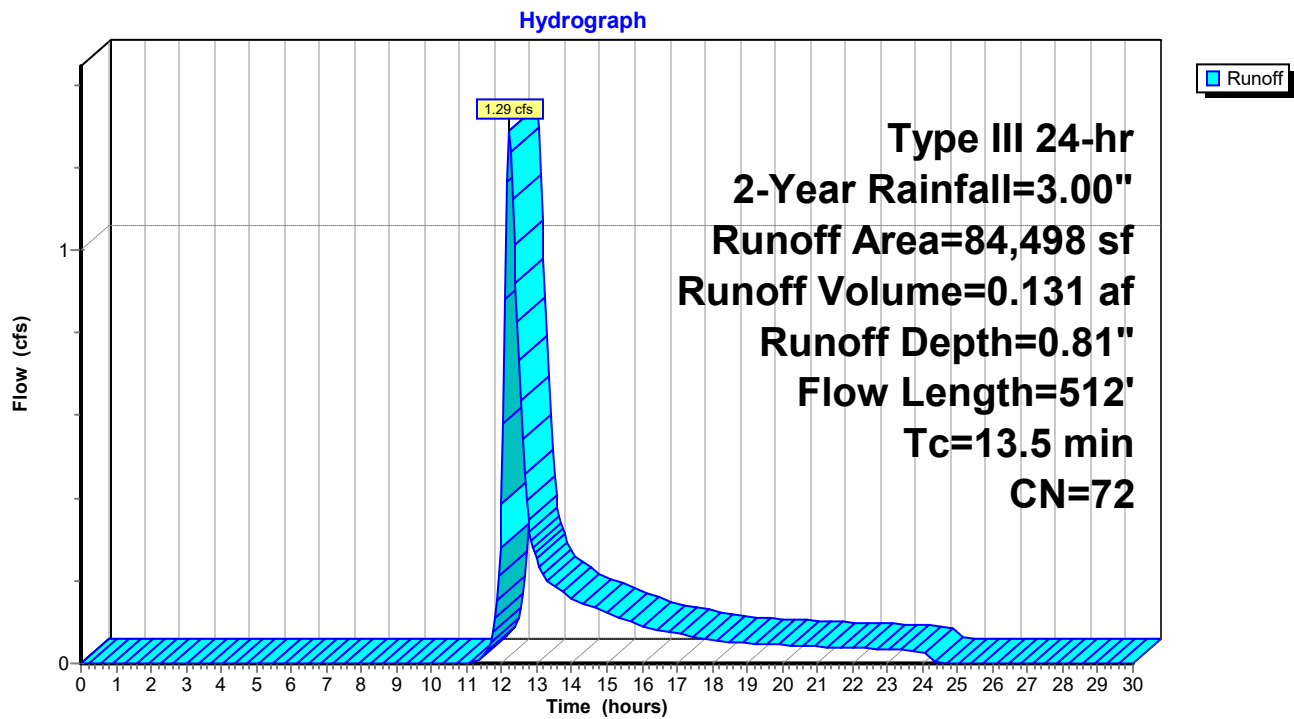
Runoff = 1.29 cfs @ 12.21 hrs, Volume= 0.131 af, Depth= 0.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
1,750	74	>75% Grass cover, Good, HSG C
75,547	70	Woods, Good, HSG C
4,194	98	Paved parking, HSG C
3,007	89	Gravel roads, HSG C
84,498	72	Weighted Average
80,304		95.04% Pervious Area
4,194		4.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	13	0.2150	0.13		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.00"
0.8	9	0.1000	0.19		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.00"
0.7	28	0.0060	0.64		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.5	50	0.0060	1.57		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.8	82	0.0120	1.76		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
1.2	106	0.0830	1.44		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
1.8	96	0.0300	0.87		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
6.0	128	0.0050	0.35		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.5	512	Total			



**Subcatchment E1: TO WETLAND (DP#1)**

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Type III 24-hr 2-Year Rainfall=3.00"

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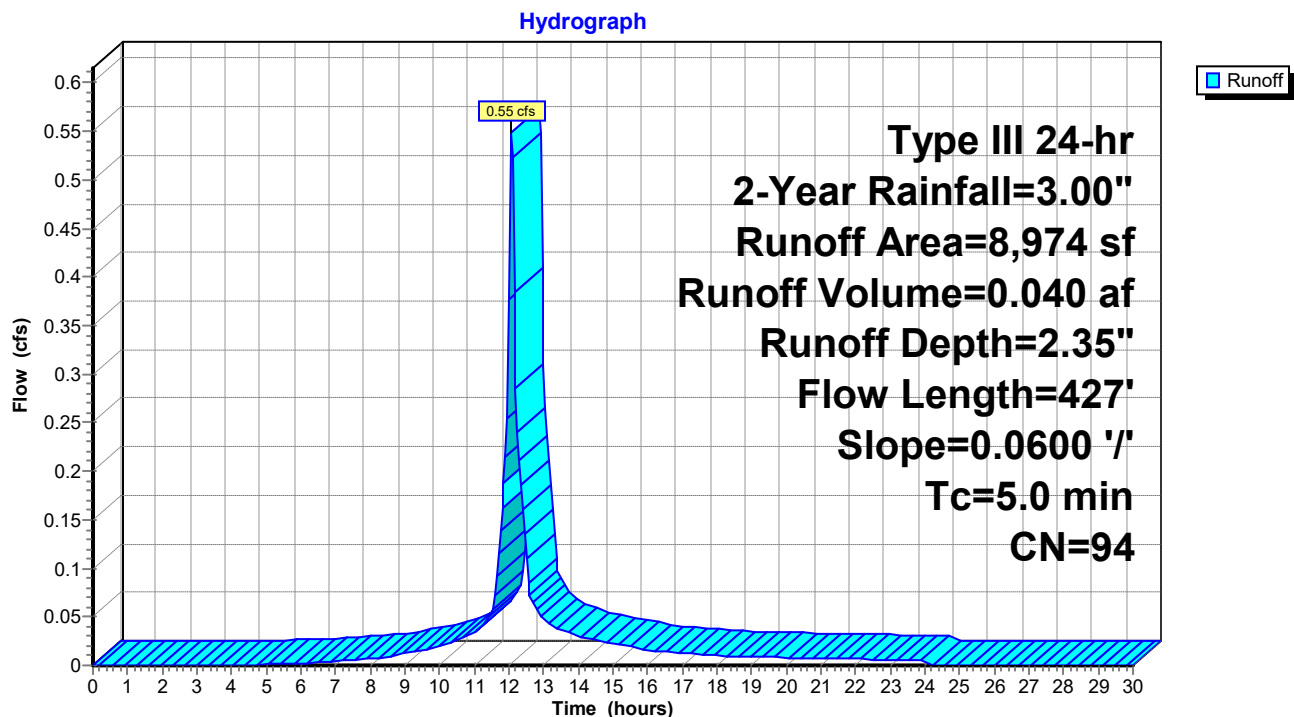
**Summary for Subcatchment E2: TO CATCHBASIN (DP#2)**

Runoff = 0.55 cfs @ 12.07 hrs, Volume= 0.040 af, Depth= 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
774	74	>75% Grass cover, Good, HSG C
544	70	Woods, Good, HSG C
7,656	98	Paved parking, HSG C
8,974	94	Weighted Average
1,318		14.69% Pervious Area
7,656		85.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0600	1.80		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
1.3	377	0.0600	4.97		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.8	427	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment E2: TO CATCHBASIN (DP#2)**

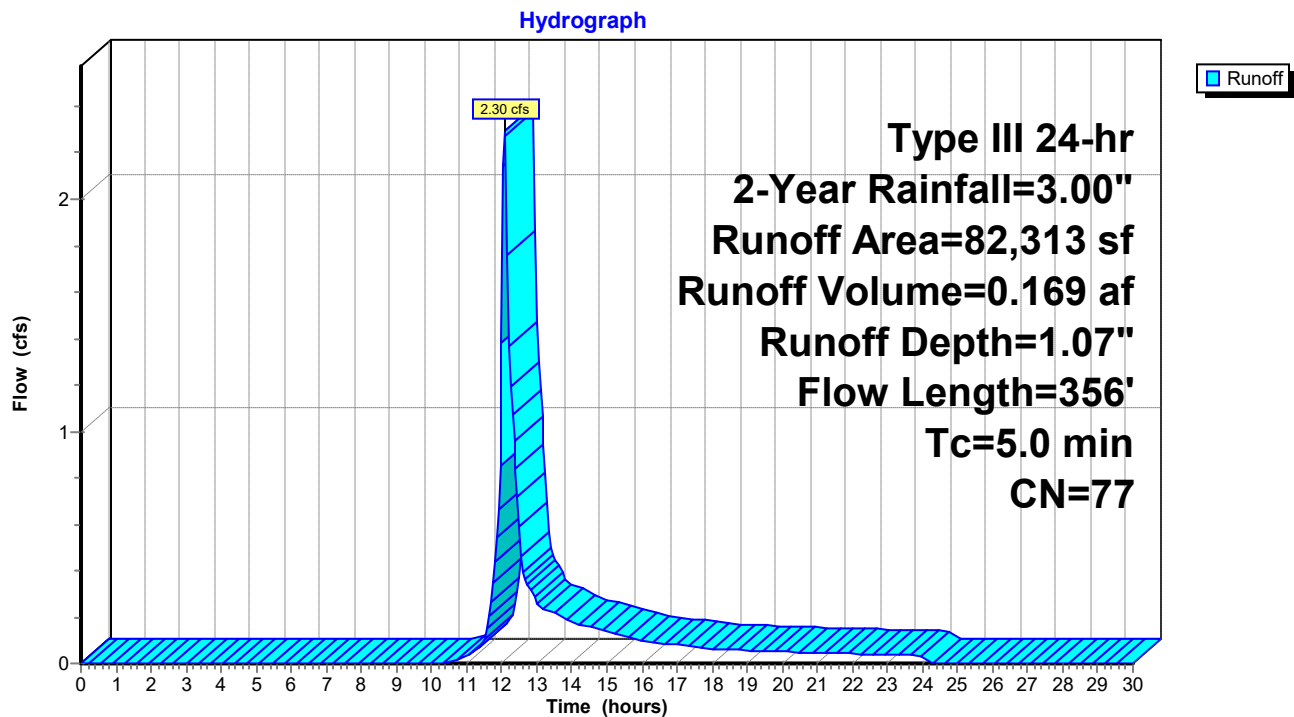
**Summary for Subcatchment E3: TO LOW POINT (DP#3)**

Runoff = 2.30 cfs @ 12.09 hrs, Volume= 0.169 af, Depth= 1.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
8,024	74	>75% Grass cover, Good, HSG C
49,390	70	Woods, Good, HSG C
12,433	98	Paved parking, HSG C
12,466	89	Gravel roads, HSG C
82,313	77	Weighted Average
69,880		84.90% Pervious Area
12,433		15.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	35	0.1400	2.35		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.2	15	0.0320	1.10		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.2	53	0.0320	3.63		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.3	54	0.0320	2.88		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
0.0	28	0.4200	10.43		<b>Shallow Concentrated Flow, GRASS/BRUSH</b> Unpaved Kv= 16.1 fps
1.4	171	0.1600	2.00		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
2.3	356	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment E3: TO LOW POINT (DP#3)**



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Type III 24-hr 2-Year Rainfall=3.00"

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**Summary for Subcatchment E4: TO DCB-B**

Runoff = 0.32 cfs @ 12.07 hrs, Volume= 0.024 af, Depth= 2.25"

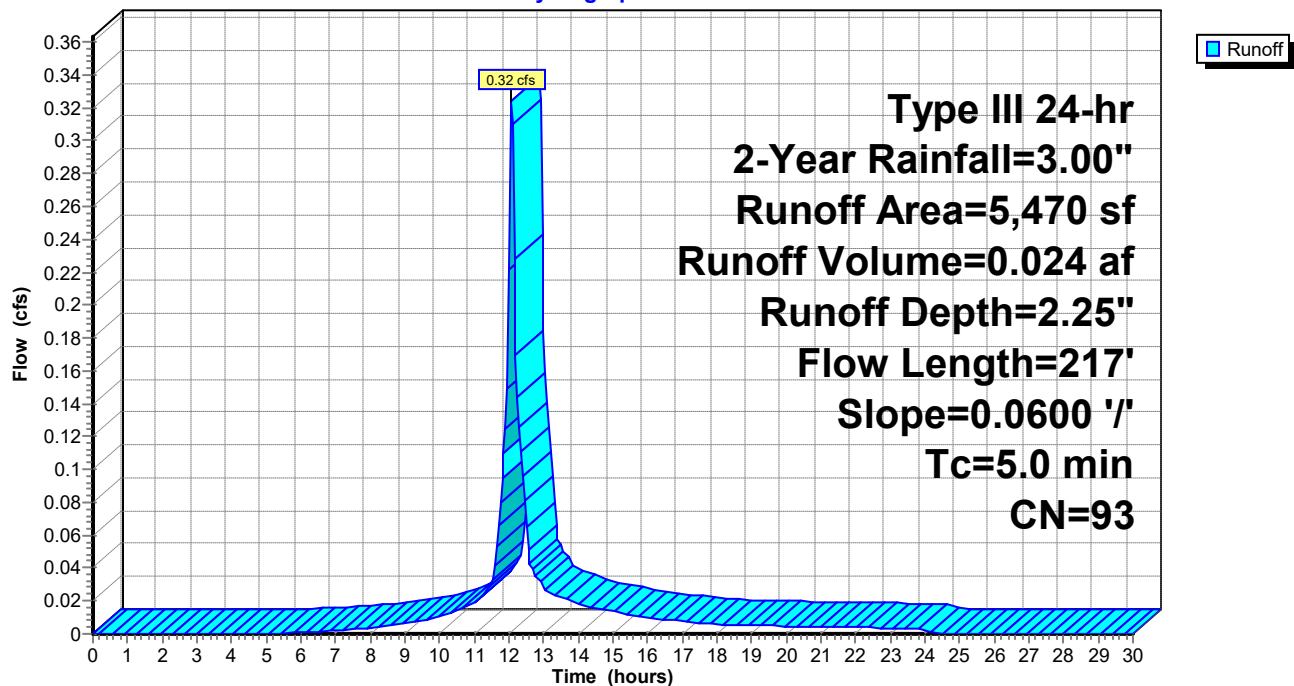
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
1,114	74	>75% Grass cover, Good, HSG C
4,356	98	Paved parking, HSG C
5,470	93	Weighted Average
1,114		20.37% Pervious Area
4,356		79.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0600	1.80		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.6	167	0.0600	4.97		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.1	217	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment E4: TO DCB-B**

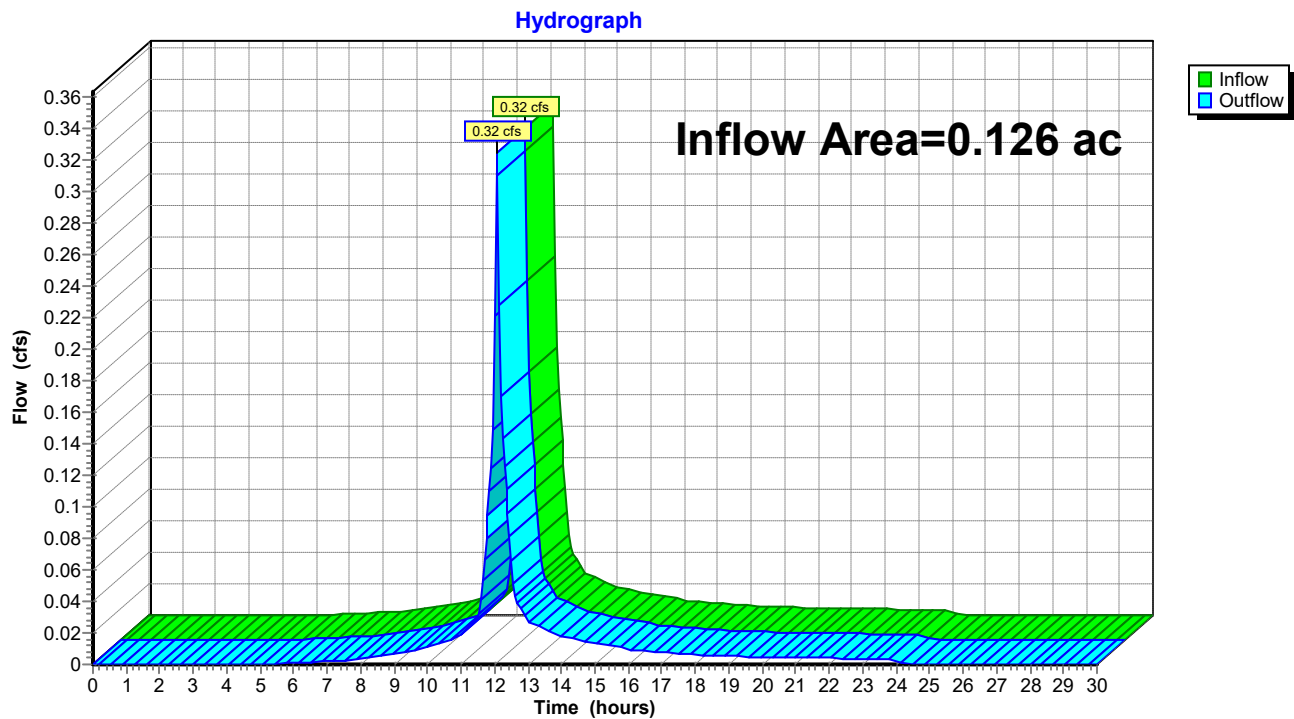
Hydrograph



**Summary for Reach DCB-B: TO OUTFALL**

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 2.25" for 2-Year event  
Inflow = 0.32 cfs @ 12.07 hrs, Volume= 0.024 af  
Outflow = 0.32 cfs @ 12.07 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.0 min

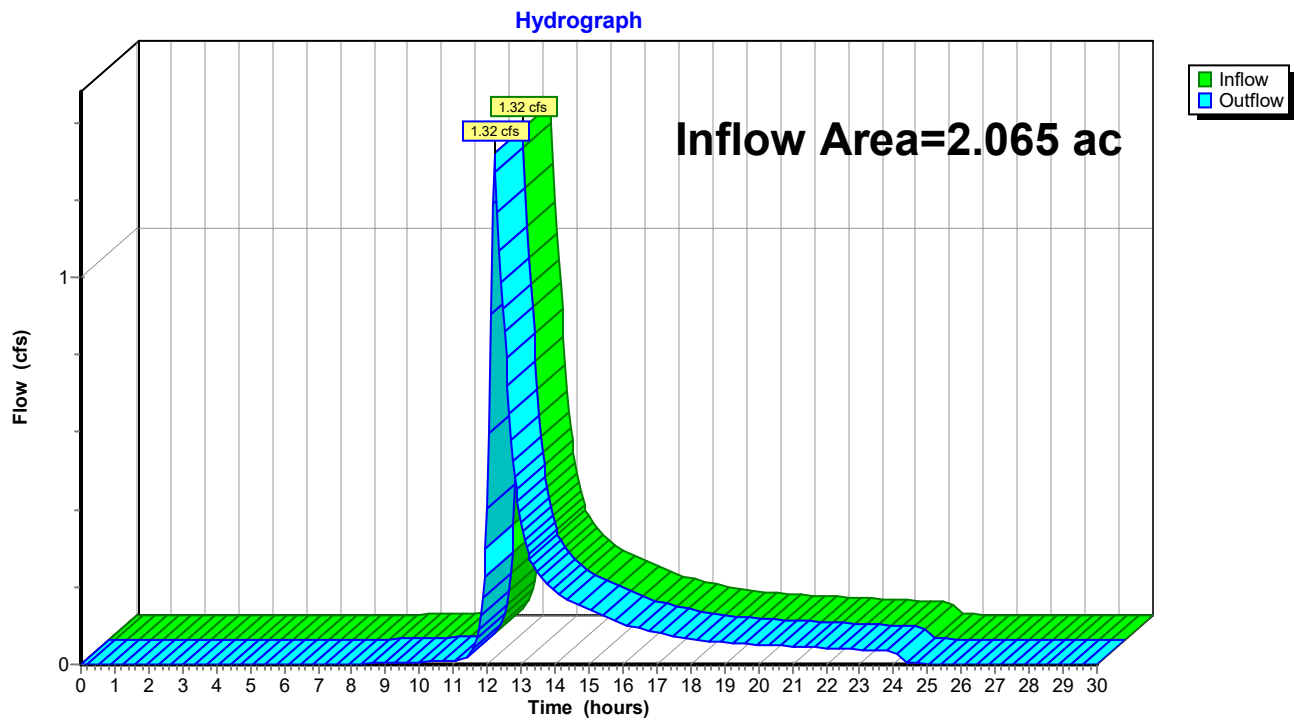
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DCB-B: TO OUTFALL**

**Summary for Reach DP#1: WETLAND**

Inflow Area = 2.065 ac, 9.50% Impervious, Inflow Depth = 0.90" for 2-Year event  
Inflow = 1.32 cfs @ 12.21 hrs, Volume= 0.154 af  
Outflow = 1.32 cfs @ 12.21 hrs, Volume= 0.154 af, Atten= 0%, Lag= 0.0 min

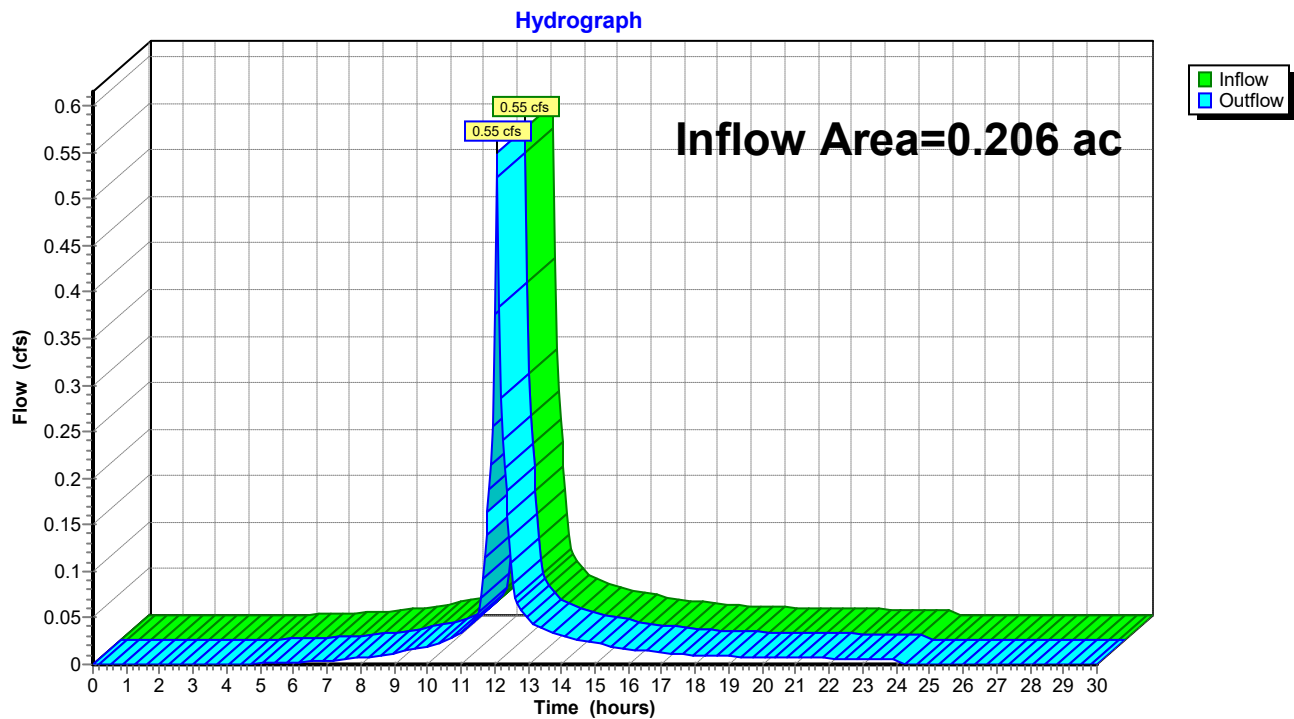
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#1: WETLAND**

**Summary for Reach DP#2: MUNICIPAL CATCHBASIN**

Inflow Area = 0.206 ac, 85.31% Impervious, Inflow Depth = 2.35" for 2-Year event  
Inflow = 0.55 cfs @ 12.07 hrs, Volume= 0.040 af  
Outflow = 0.55 cfs @ 12.07 hrs, Volume= 0.040 af, Atten= 0%, Lag= 0.0 min

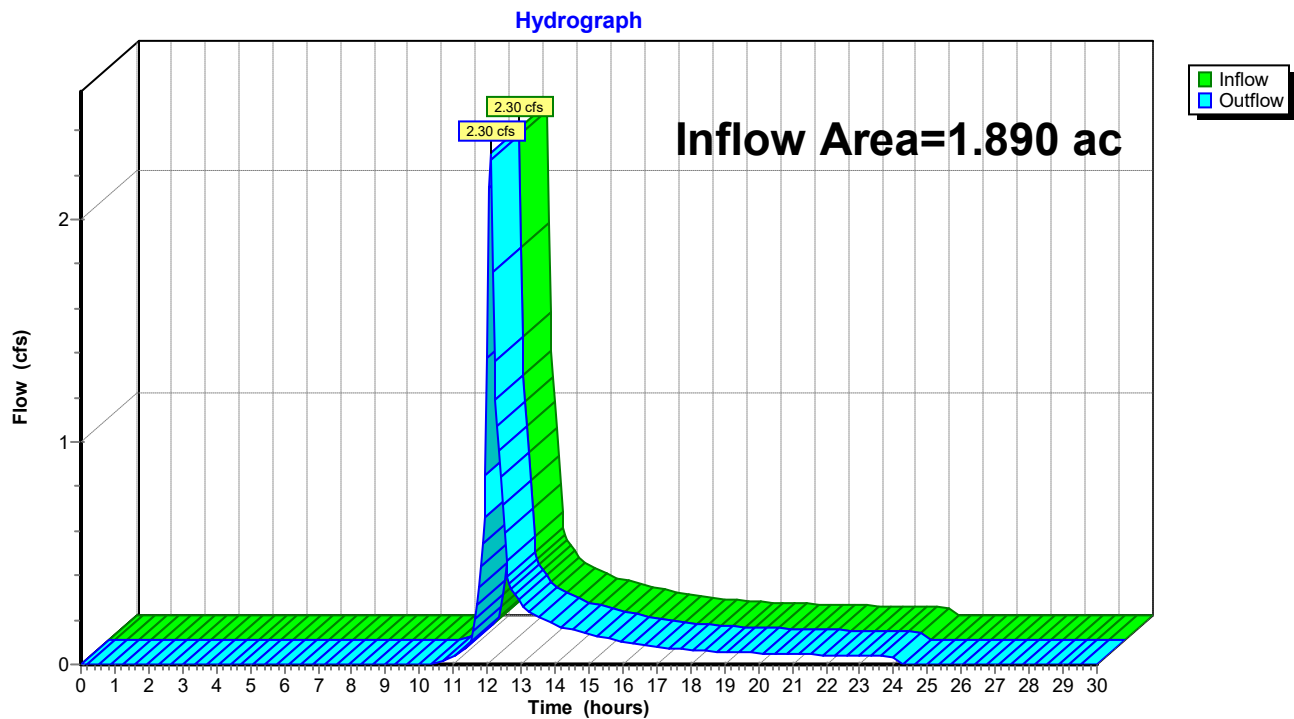
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#2: MUNICIPAL CATCHBASIN**

**Summary for Reach DP#3: LOW POINT**

Inflow Area = 1.890 ac, 15.10% Impervious, Inflow Depth = 1.07" for 2-Year event  
Inflow = 2.30 cfs @ 12.09 hrs, Volume= 0.169 af  
Outflow = 2.30 cfs @ 12.09 hrs, Volume= 0.169 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#3: LOW POINT**

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### Summary for Reach OL-1: OVERLAND

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 2.25" for 2-Year event  
Inflow = 0.32 cfs @ 12.07 hrs, Volume= 0.024 af  
Outflow = 0.31 cfs @ 12.11 hrs, Volume= 0.024 af, Atten= 5%, Lag= 2.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.63 fps, Min. Travel Time= 1.2 min

Avg. Velocity= 0.29 fps, Avg. Travel Time= 2.6 min

Peak Storage= 24 cf @ 12.09 hrs

Average Depth at Peak Storage= 0.03'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 122.10 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 35.00'

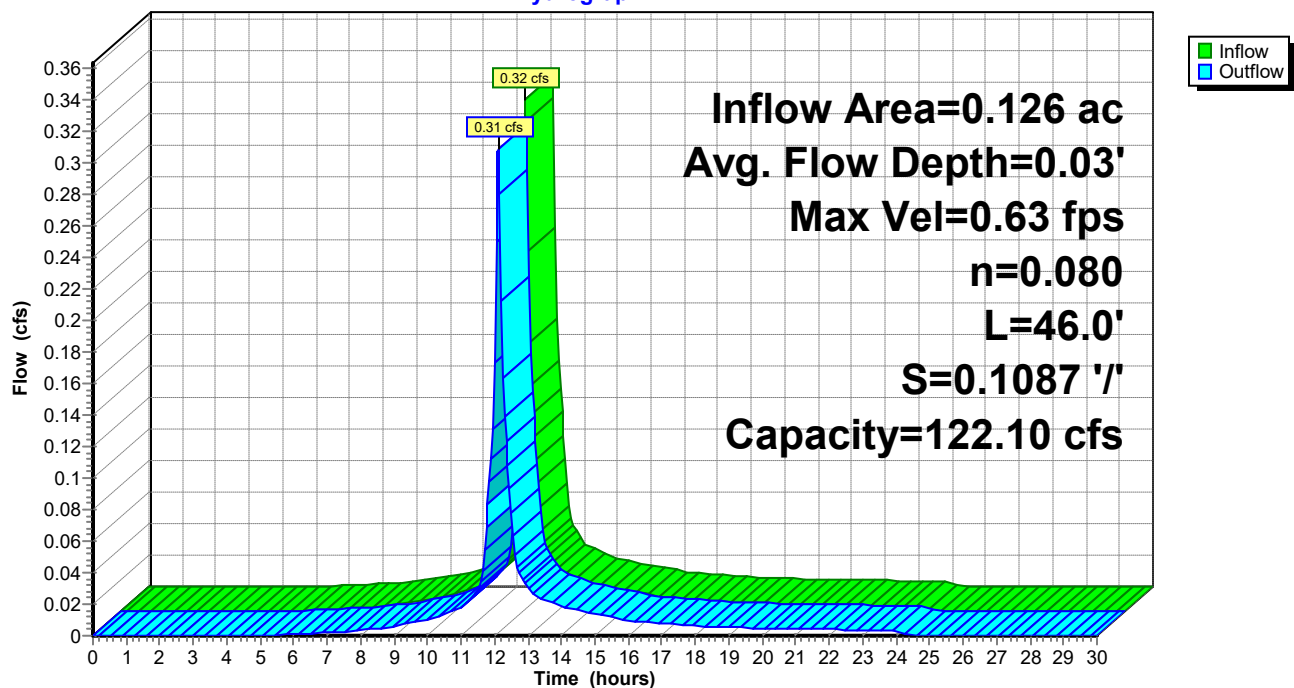
Length= 46.0' Slope= 0.1087 '/'

Inlet Invert= 109.00', Outlet Invert= 104.00'



### Reach OL-1: OVERLAND

#### Hydrograph



**Summary for Reach OL-2: OVERLAND**

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 2.25" for 2-Year event  
 Inflow = 0.31 cfs @ 12.11 hrs, Volume= 0.024 af  
 Outflow = 0.26 cfs @ 12.28 hrs, Volume= 0.024 af, Atten= 17%, Lag= 10.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.54 fps, Min. Travel Time= 6.5 min

Avg. Velocity= 0.26 fps, Avg. Travel Time= 13.5 min

Peak Storage= 102 cf @ 12.17 hrs

Average Depth at Peak Storage= 0.03'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 109.07 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

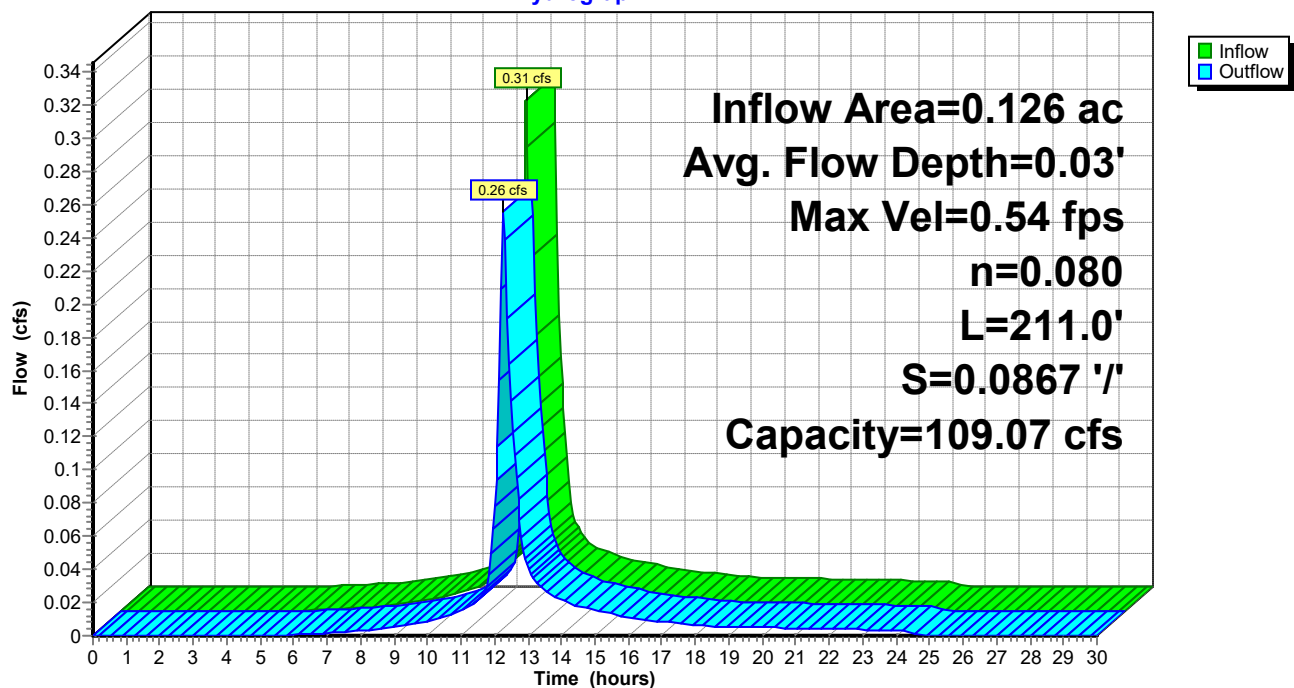
Side Slope Z-value= 10.0 '/' Top Width= 35.00'

Length= 211.0' Slope= 0.0867 '/'

Inlet Invert= 104.00', Outlet Invert= 85.70'

**Reach OL-2: OVERLAND**

Hydrograph



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### Summary for Reach OL-3: OVERLAND

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 2.25" for 2-Year event  
Inflow = 0.26 cfs @ 12.28 hrs, Volume= 0.024 af  
Outflow = 0.25 cfs @ 12.31 hrs, Volume= 0.024 af, Atten= 1%, Lag= 1.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.39 fps, Min. Travel Time= 1.0 min

Avg. Velocity = 0.16 fps, Avg. Travel Time= 2.4 min

Peak Storage= 15 cf @ 12.29 hrs

Average Depth at Peak Storage= 0.04'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 64.61 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 35.00'

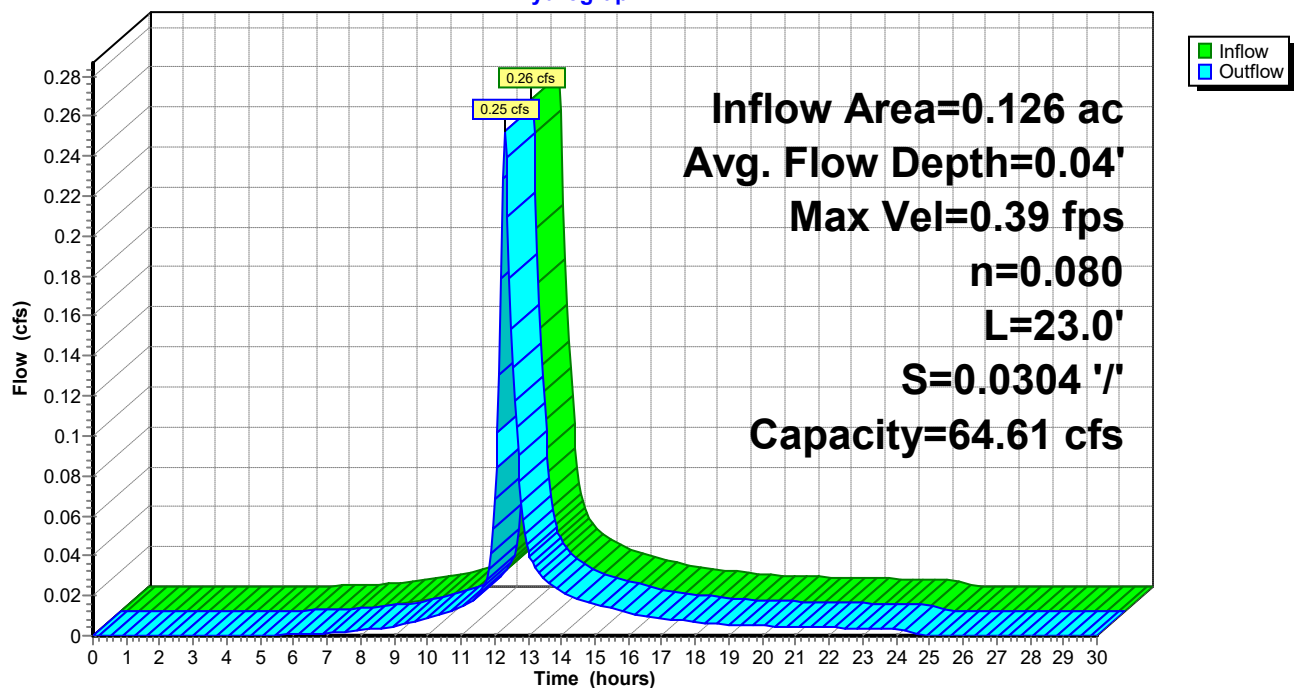
Length= 23.0' Slope= 0.0304 '/'

Inlet Invert= 85.70', Outlet Invert= 85.00'



### Reach OL-3: OVERLAND

Hydrograph





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### Summary for Reach OL-4: OVERLAND

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 2.25" for 2-Year event  
Inflow = 0.25 cfs @ 12.31 hrs, Volume= 0.024 af  
Outflow = 0.19 cfs @ 12.67 hrs, Volume= 0.024 af, Atten= 25%, Lag= 21.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.15 fps, Min. Travel Time= 13.8 min

Avg. Velocity= 0.06 fps, Avg. Travel Time= 32.9 min

Peak Storage= 158 cf @ 12.44 hrs

Average Depth at Peak Storage= 0.04'

Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 45.22 cfs

30.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 ' ' Top Width= 50.00'

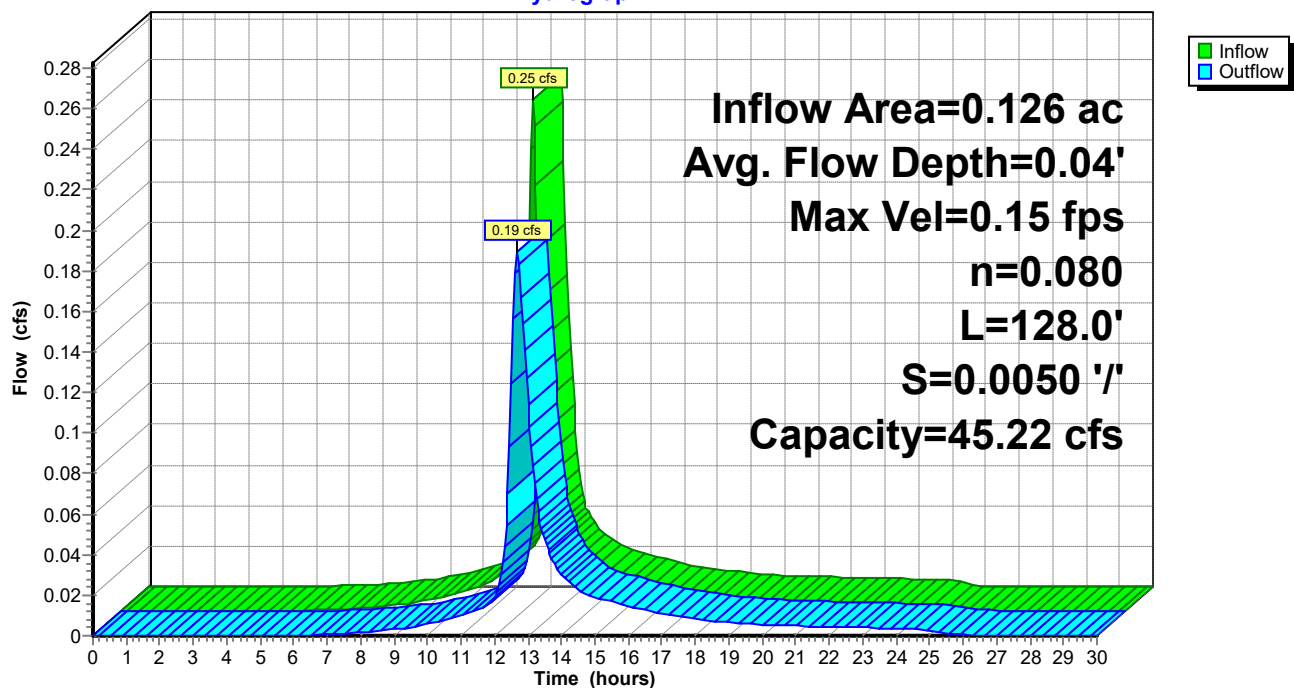
Length= 128.0' Slope= 0.0050 ' '

Inlet Invert= 85.00', Outlet Invert= 84.36'



### Reach OL-4: OVERLAND

Hydrograph



**3010-Pre**

Type III 24-hr 10-Year Rainfall=4.50"

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E1: TO WETLAND (DP#1)** Runoff Area=84,498 sf 4.96% Impervious Runoff Depth=1.82"  
Flow Length=512' Tc=13.5 min CN=72 Runoff=3.16 cfs 0.294 af

**Subcatchment E2: TO CATCHBASIN (DP#2)** Runoff Area=8,974 sf 85.31% Impervious Runoff Depth=3.82"  
Flow Length=427' Slope=0.0600 '/' Tc=5.0 min CN=94 Runoff=0.87 cfs 0.066 af

**Subcatchment E3: TO LOW POINT (DP#3)** Runoff Area=82,313 sf 15.10% Impervious Runoff Depth=2.21"  
Flow Length=356' Tc=5.0 min CN=77 Runoff=4.89 cfs 0.348 af

**Subcatchment E4: TO DCB-B** Runoff Area=5,470 sf 79.63% Impervious Runoff Depth=3.71"  
Flow Length=217' Slope=0.0600 '/' Tc=5.0 min CN=93 Runoff=0.52 cfs 0.039 af

**Reach DCB-B: TO OUTFALL** Inflow=0.52 cfs 0.039 af  
Outflow=0.52 cfs 0.039 af

**Reach DP#1: WETLAND** Inflow=3.25 cfs 0.333 af  
Outflow=3.25 cfs 0.333 af

**Reach DP#2: MUNICIPAL CATCHBASIN** Inflow=0.87 cfs 0.066 af  
Outflow=0.87 cfs 0.066 af

**Reach DP#3: LOW POINT** Inflow=4.89 cfs 0.348 af  
Outflow=4.89 cfs 0.348 af

**Reach OL-1: OVERLAND** Avg. Flow Depth=0.04' Max Vel=0.75 fps Inflow=0.52 cfs 0.039 af  
n=0.080 L=46.0' S=0.1087 '/' Capacity=122.10 cfs Outflow=0.50 cfs 0.039 af

**Reach OL-2: OVERLAND** Avg. Flow Depth=0.04' Max Vel=0.66 fps Inflow=0.50 cfs 0.039 af  
n=0.080 L=211.0' S=0.0867 '/' Capacity=109.07 cfs Outflow=0.43 cfs 0.039 af

**Reach OL-3: OVERLAND** Avg. Flow Depth=0.06' Max Vel=0.47 fps Inflow=0.43 cfs 0.039 af  
n=0.080 L=23.0' S=0.0304 '/' Capacity=64.61 cfs Outflow=0.42 cfs 0.039 af

**Reach OL-4: OVERLAND** Avg. Flow Depth=0.06' Max Vel=0.19 fps Inflow=0.42 cfs 0.039 af  
n=0.080 L=128.0' S=0.0050 '/' Capacity=45.22 cfs Outflow=0.34 cfs 0.039 af

**Total Runoff Area = 4.161 ac Runoff Volume = 0.747 af Average Runoff Depth = 2.15"**  
**84.20% Pervious = 3.504 ac 15.80% Impervious = 0.657 ac**

**Summary for Subcatchment E1: TO WETLAND (DP#1)**

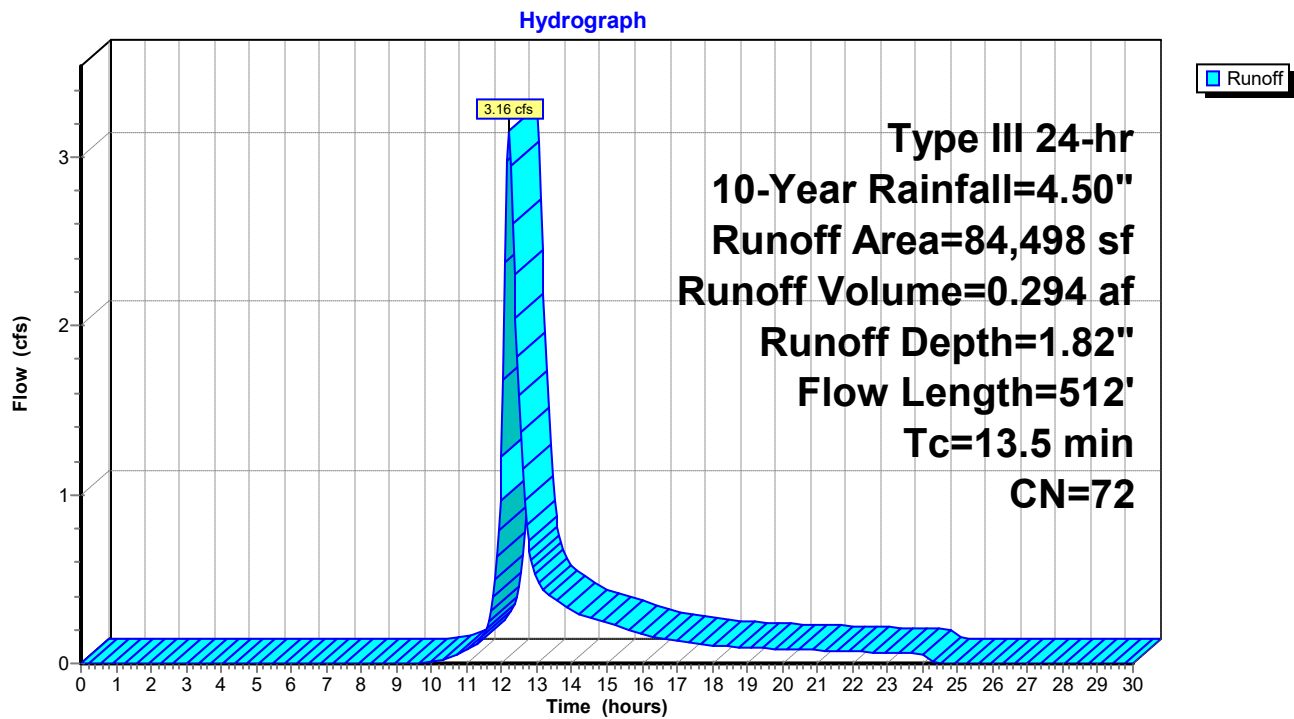
Runoff = 3.16 cfs @ 12.20 hrs, Volume= 0.294 af, Depth= 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,750	74	>75% Grass cover, Good, HSG C
75,547	70	Woods, Good, HSG C
4,194	98	Paved parking, HSG C
3,007	89	Gravel roads, HSG C
84,498	72	Weighted Average
80,304		95.04% Pervious Area
4,194		4.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	13	0.2150	0.13		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.00"
0.8	9	0.1000	0.19		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.00"
0.7	28	0.0060	0.64		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.5	50	0.0060	1.57		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.8	82	0.0120	1.76		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
1.2	106	0.0830	1.44		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
1.8	96	0.0300	0.87		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
6.0	128	0.0050	0.35		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.5	512	Total			

**Subcatchment E1: TO WETLAND (DP#1)**

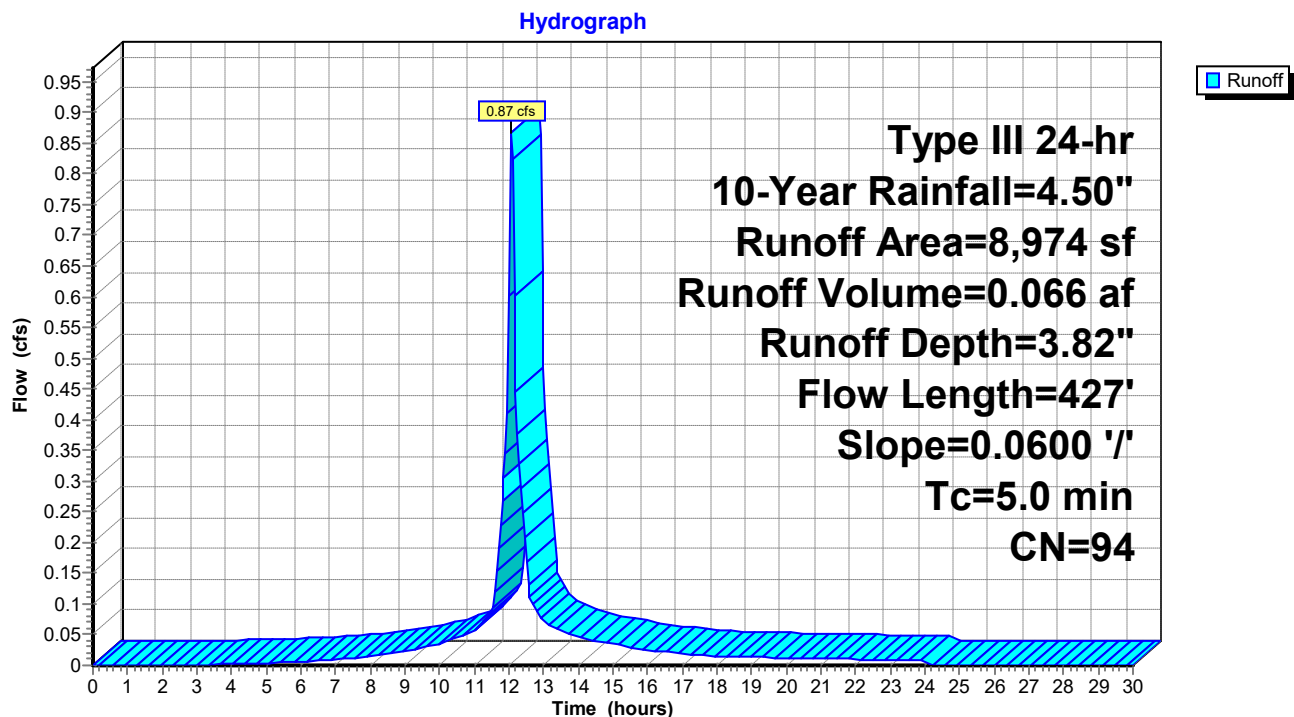
**Summary for Subcatchment E2: TO CATCHBASIN (DP#2)**

Runoff = 0.87 cfs @ 12.07 hrs, Volume= 0.066 af, Depth= 3.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
774	74	>75% Grass cover, Good, HSG C
544	70	Woods, Good, HSG C
7,656	98	Paved parking, HSG C
8,974	94	Weighted Average
1,318		14.69% Pervious Area
7,656		85.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0600	1.80		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
1.3	377	0.0600	4.97		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.8	427	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment E2: TO CATCHBASIN (DP#2)**

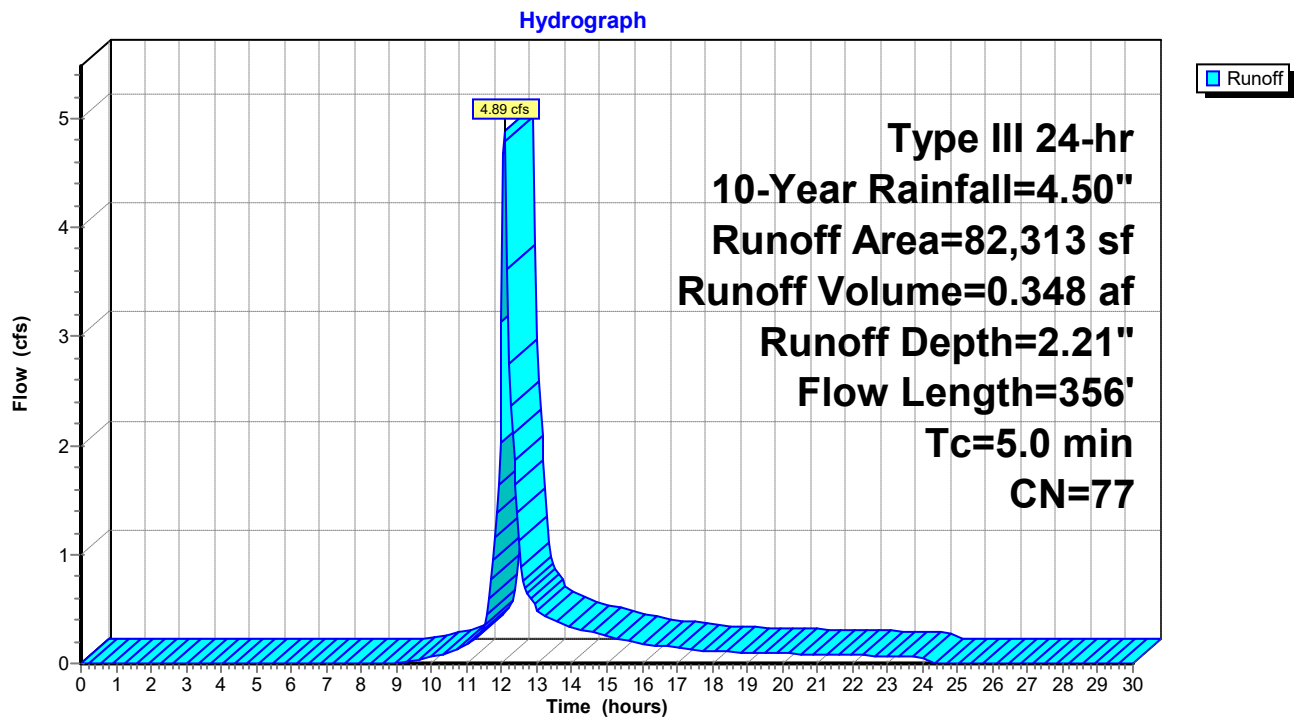
**Summary for Subcatchment E3: TO LOW POINT (DP#3)**

Runoff = 4.89 cfs @ 12.08 hrs, Volume= 0.348 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
8,024	74	>75% Grass cover, Good, HSG C
49,390	70	Woods, Good, HSG C
12,433	98	Paved parking, HSG C
12,466	89	Gravel roads, HSG C
82,313	77	Weighted Average
69,880		84.90% Pervious Area
12,433		15.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	35	0.1400	2.35		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.2	15	0.0320	1.10		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.2	53	0.0320	3.63		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.3	54	0.0320	2.88		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
0.0	28	0.4200	10.43		<b>Shallow Concentrated Flow, GRASS/BRUSH</b> Unpaved Kv= 16.1 fps
1.4	171	0.1600	2.00		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
2.3	356	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment E3: TO LOW POINT (DP#3)**

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Type III 24-hr 10-Year Rainfall=4.50"

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**Summary for Subcatchment E4: TO DCB-B**

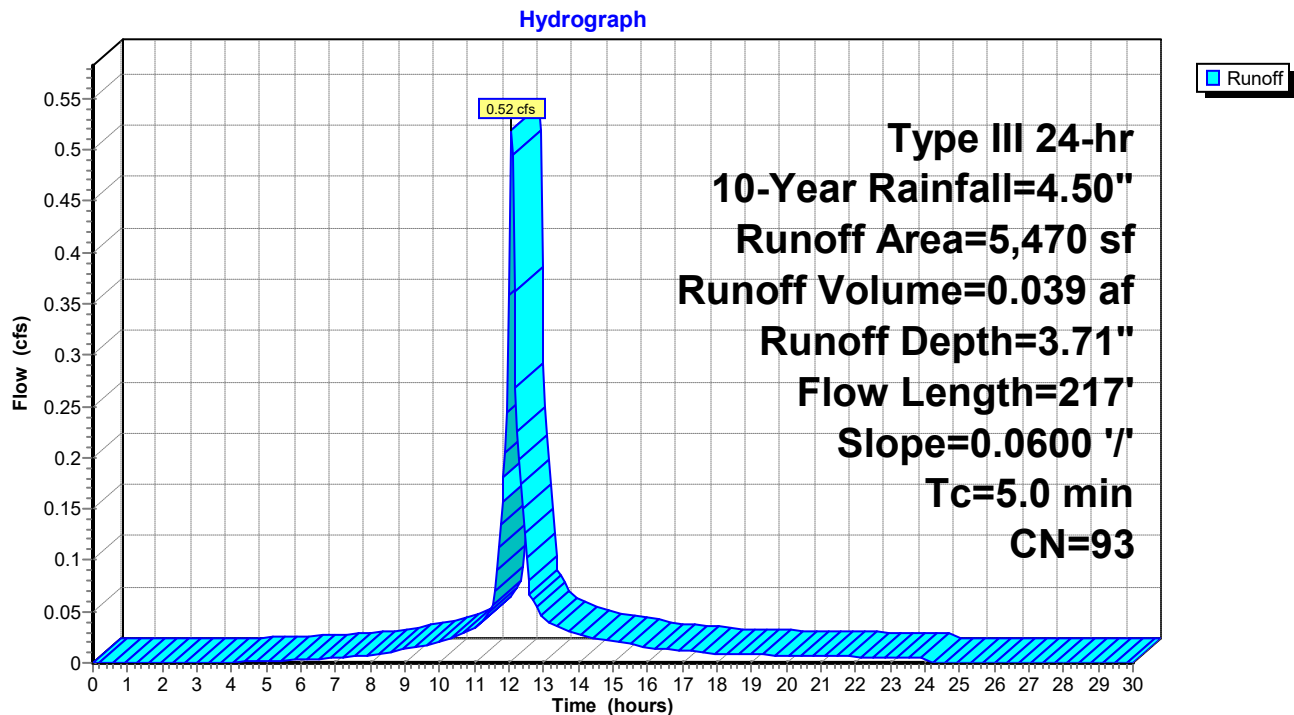
Runoff = 0.52 cfs @ 12.07 hrs, Volume= 0.039 af, Depth= 3.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,114	74	>75% Grass cover, Good, HSG C
4,356	98	Paved parking, HSG C
5,470	93	Weighted Average
1,114		20.37% Pervious Area
4,356		79.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0600	1.80		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.6	167	0.0600	4.97		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.1	217	Total, Increased to minimum Tc = 5.0 min			

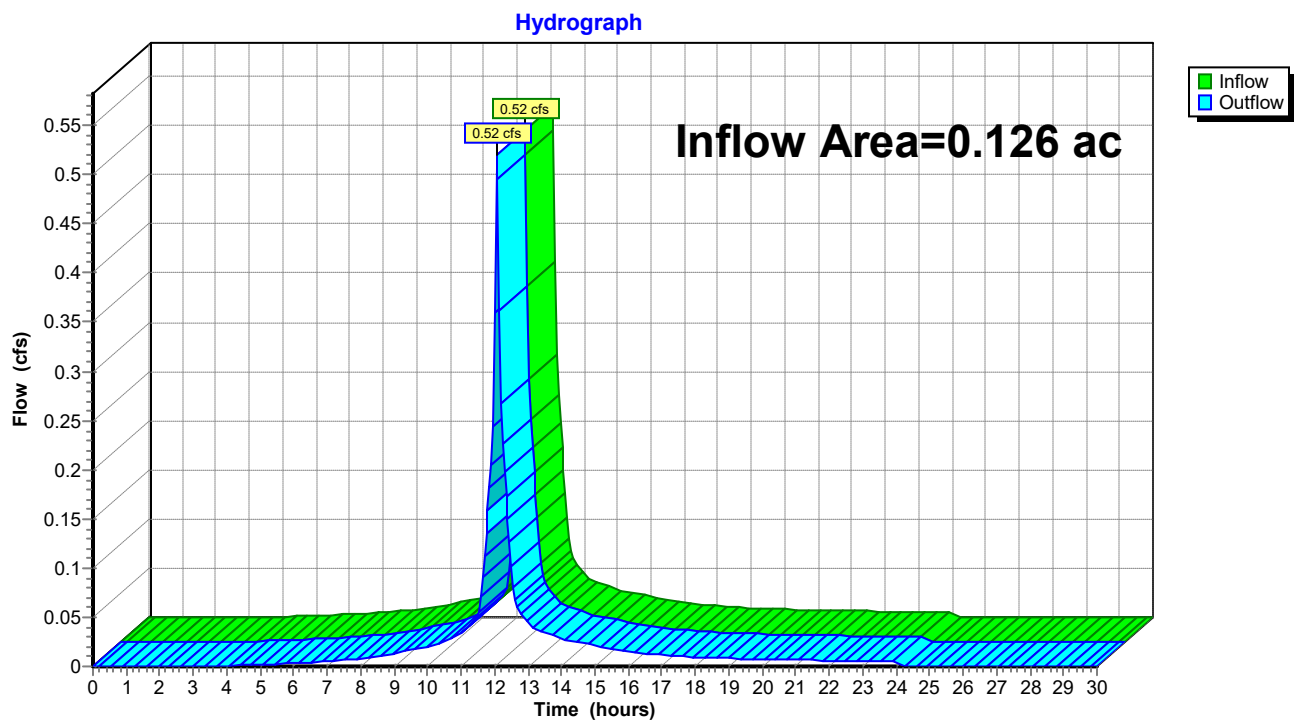
**Subcatchment E4: TO DCB-B**



**Summary for Reach DCB-B: TO OUTFALL**

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 3.71" for 10-Year event  
Inflow = 0.52 cfs @ 12.07 hrs, Volume= 0.039 af  
Outflow = 0.52 cfs @ 12.07 hrs, Volume= 0.039 af, Atten= 0%, Lag= 0.0 min

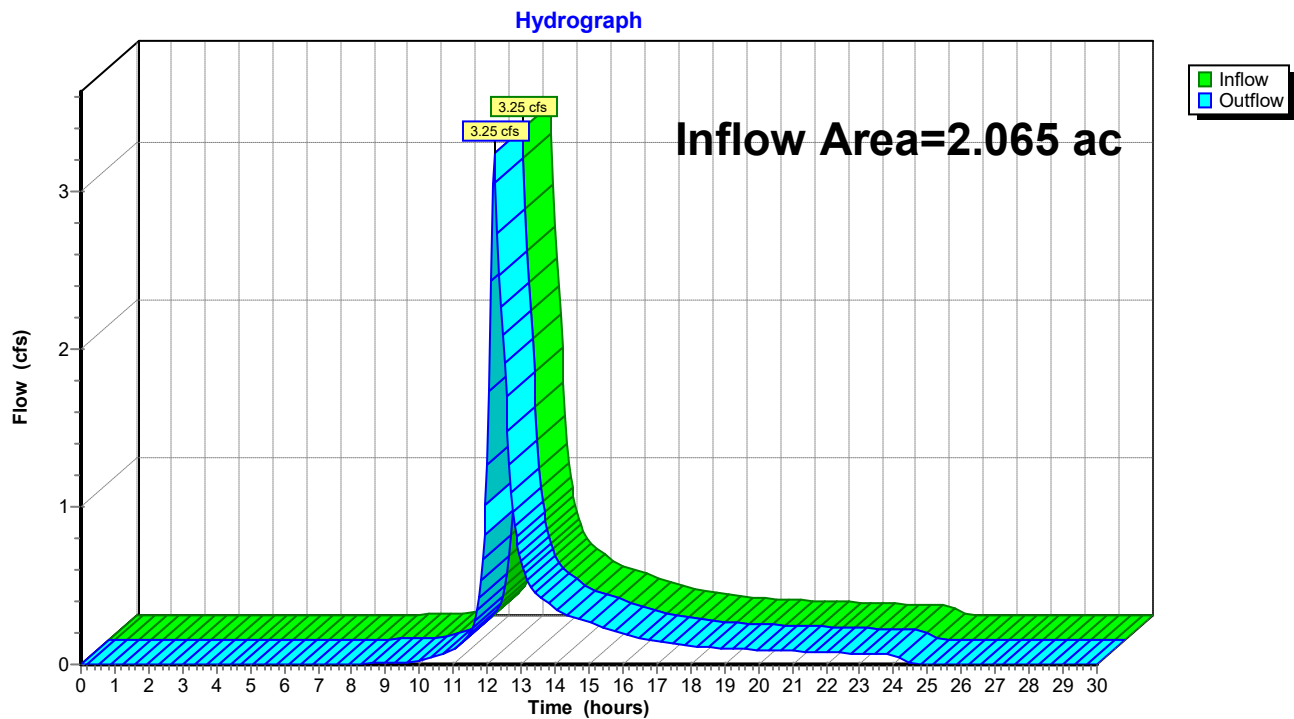
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DCB-B: TO OUTFALL**

**Summary for Reach DP#1: WETLAND**

Inflow Area = 2.065 ac, 9.50% Impervious, Inflow Depth = 1.94" for 10-Year event  
Inflow = 3.25 cfs @ 12.20 hrs, Volume= 0.333 af  
Outflow = 3.25 cfs @ 12.20 hrs, Volume= 0.333 af, Atten= 0%, Lag= 0.0 min

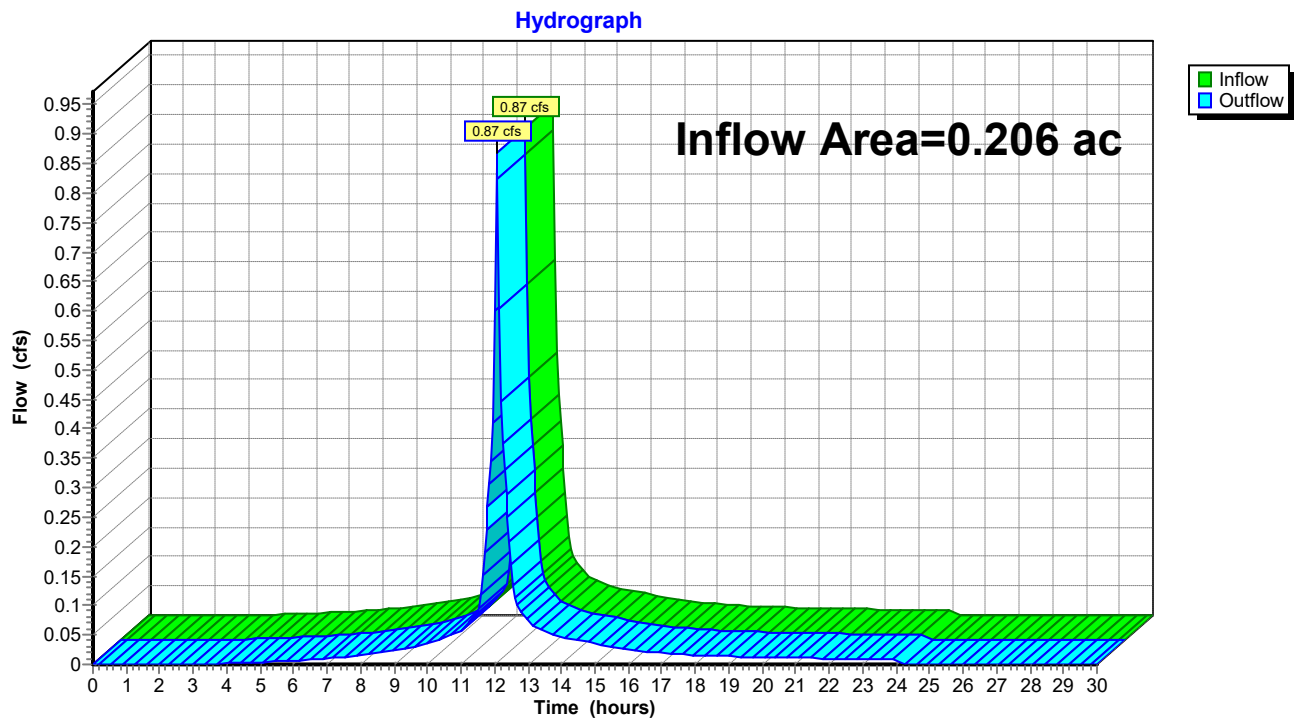
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#1: WETLAND**

**Summary for Reach DP#2: MUNICIPAL CATCHBASIN**

Inflow Area = 0.206 ac, 85.31% Impervious, Inflow Depth = 3.82" for 10-Year event  
Inflow = 0.87 cfs @ 12.07 hrs, Volume= 0.066 af  
Outflow = 0.87 cfs @ 12.07 hrs, Volume= 0.066 af, Atten= 0%, Lag= 0.0 min

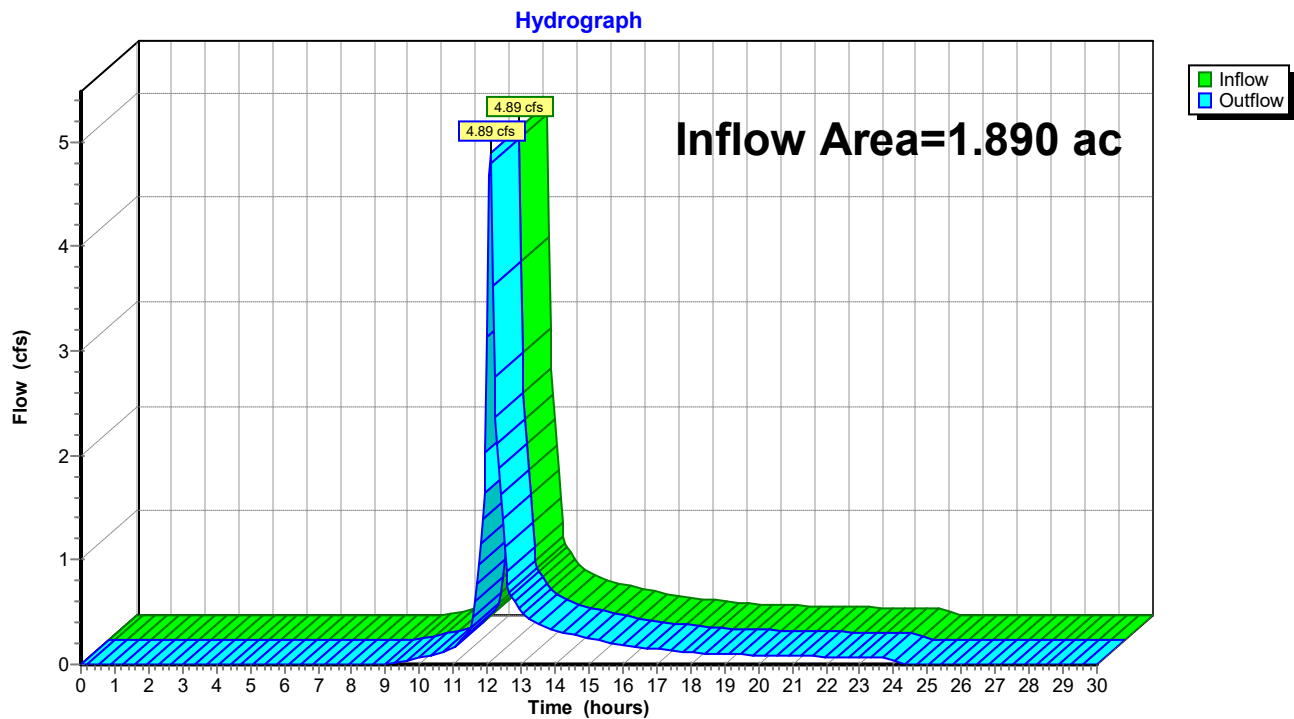
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#2: MUNICIPAL CATCHBASIN**

**Summary for Reach DP#3: LOW POINT**

Inflow Area = 1.890 ac, 15.10% Impervious, Inflow Depth = 2.21" for 10-Year event  
Inflow = 4.89 cfs @ 12.08 hrs, Volume= 0.348 af  
Outflow = 4.89 cfs @ 12.08 hrs, Volume= 0.348 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#3: LOW POINT**

## Summary for Reach OL-1: OVERLAND

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 3.71" for 10-Year event  
Inflow = 0.52 cfs @ 12.07 hrs, Volume= 0.039 af  
Outflow = 0.50 cfs @ 12.10 hrs, Volume= 0.039 af, Atten= 4%, Lag= 1.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.75 fps, Min. Travel Time= 1.0 min

Avg. Velocity = 0.30 fps, Avg. Travel Time= 2.6 min

Peak Storage= 31 cf @ 12.09 hrs

Average Depth at Peak Storage= 0.04'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 122.10 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

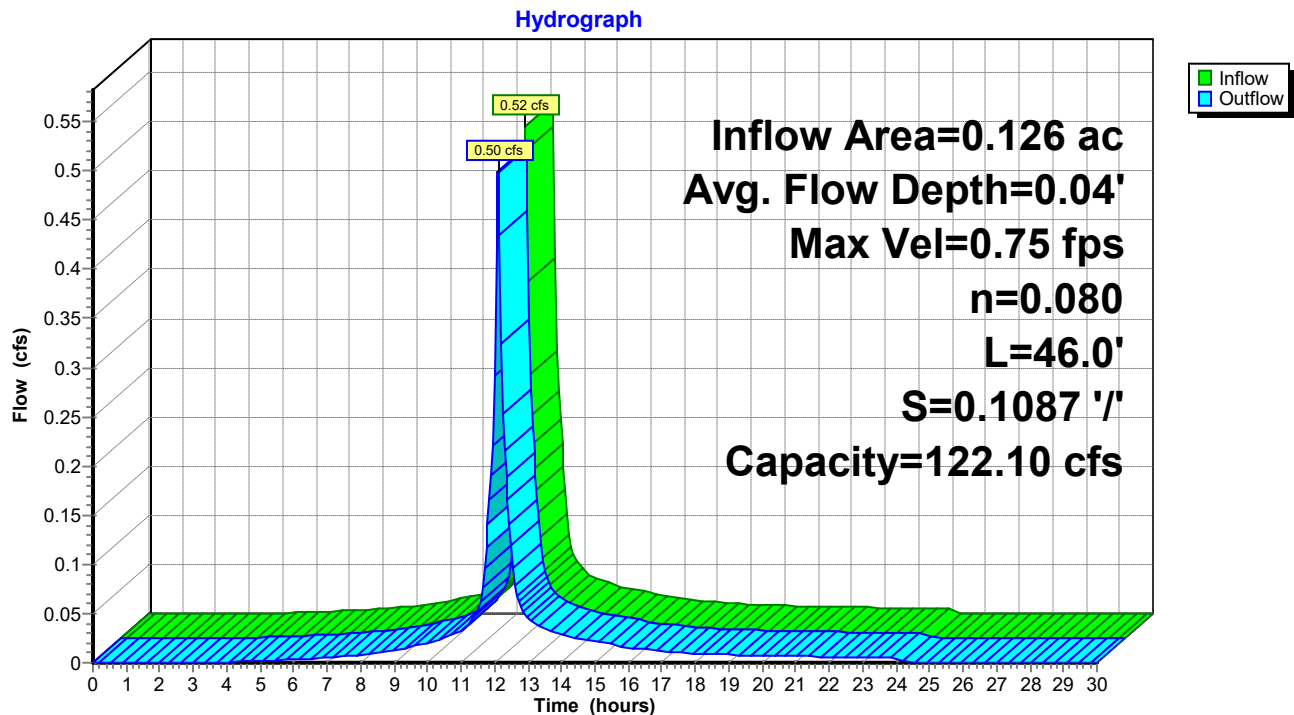
Side Slope Z-value= 10.0 ' /'    Top Width= 35.00'

Length= 46.0'    Slope= 0.1087 '/'

Inlet Invert= 109.00', Outlet Invert= 104.00'



## Reach OL-1: OVERLAND



**Summary for Reach OL-2: OVERLAND**

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 3.71" for 10-Year event  
 Inflow = 0.50 cfs @ 12.10 hrs, Volume= 0.039 af  
 Outflow = 0.43 cfs @ 12.25 hrs, Volume= 0.039 af, Atten= 14%, Lag= 8.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.66 fps, Min. Travel Time= 5.3 min

Avg. Velocity = 0.27 fps, Avg. Travel Time= 13.3 min

Peak Storage= 140 cf @ 12.15 hrs

Average Depth at Peak Storage= 0.04'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 109.07 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

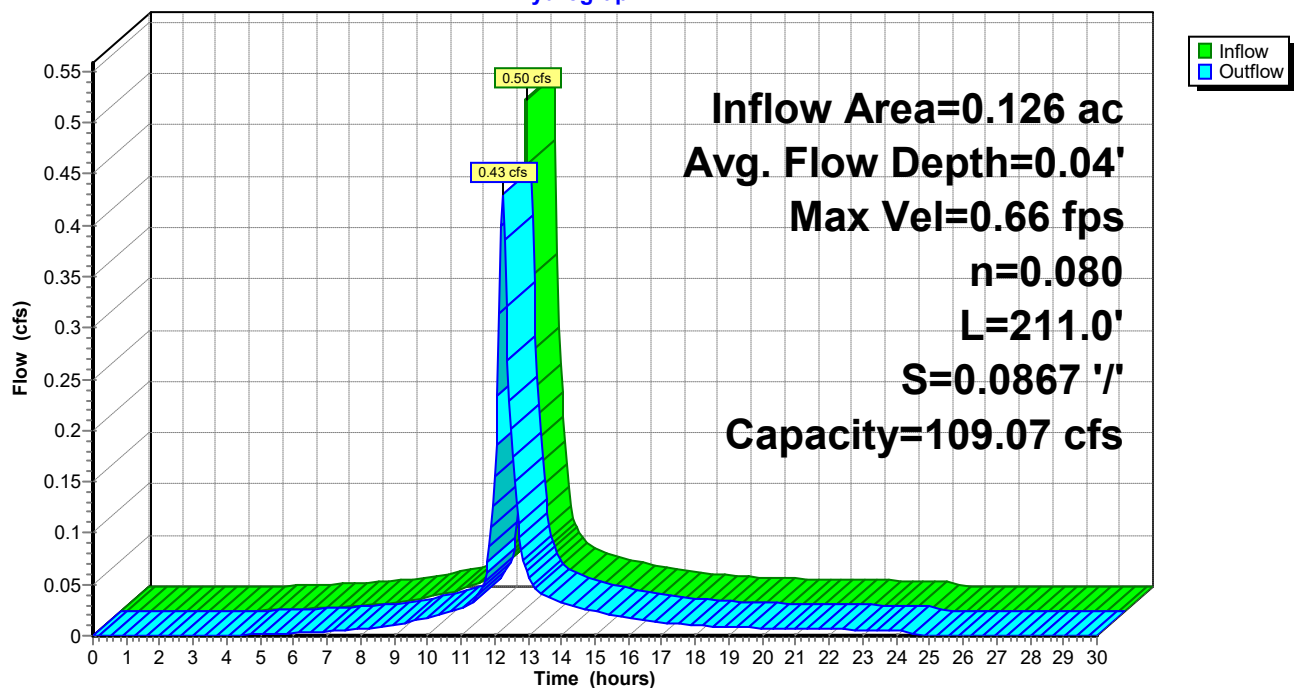
Side Slope Z-value= 10.0 '/' Top Width= 35.00'

Length= 211.0' Slope= 0.0867 '/'

Inlet Invert= 104.00', Outlet Invert= 85.70'

**Reach OL-2: OVERLAND**

Hydrograph



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### Summary for Reach OL-3: OVERLAND

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 3.71" for 10-Year event  
Inflow = 0.43 cfs @ 12.25 hrs, Volume= 0.039 af  
Outflow = 0.42 cfs @ 12.27 hrs, Volume= 0.039 af, Atten= 2%, Lag= 1.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.47 fps, Min. Travel Time= 0.8 min

Avg. Velocity = 0.16 fps, Avg. Travel Time= 2.3 min

Peak Storage= 21 cf @ 12.25 hrs

Average Depth at Peak Storage= 0.06'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 64.61 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 35.00'

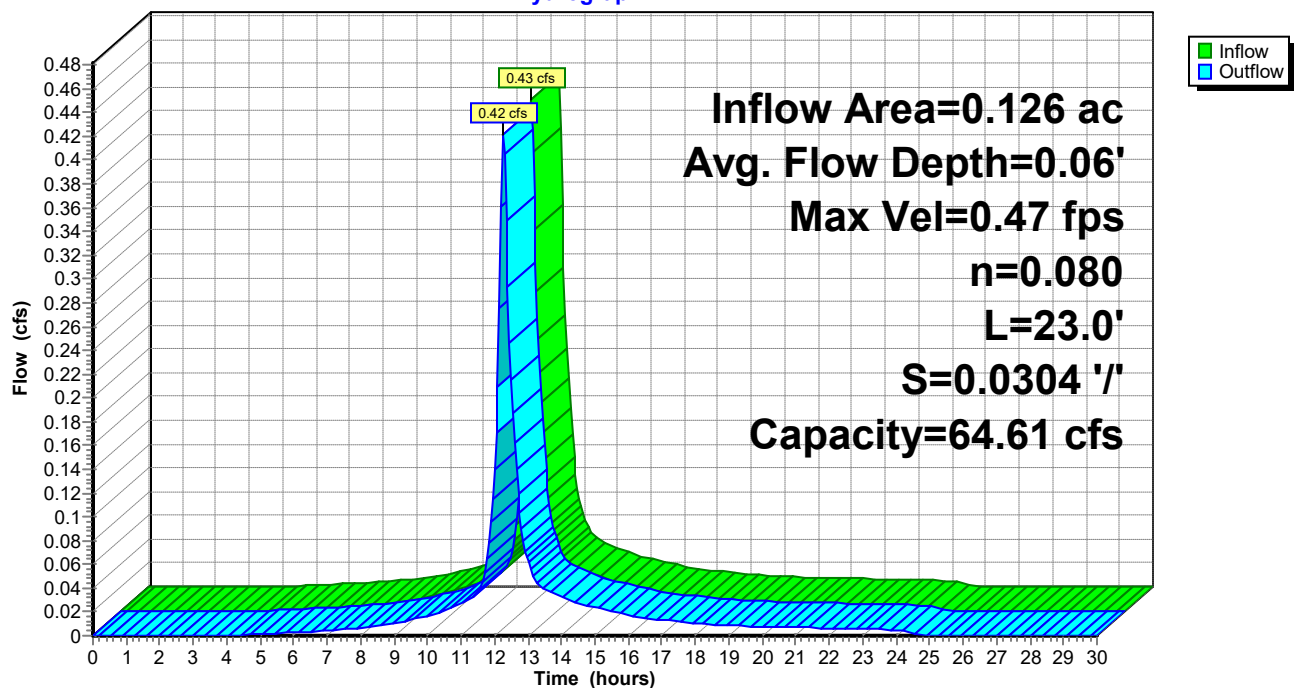
Length= 23.0' Slope= 0.0304 '/'

Inlet Invert= 85.70', Outlet Invert= 85.00'



### Reach OL-3: OVERLAND

#### Hydrograph



**Summary for Reach OL-4: OVERLAND**

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 3.71" for 10-Year event  
 Inflow = 0.42 cfs @ 12.27 hrs, Volume= 0.039 af  
 Outflow = 0.34 cfs @ 12.55 hrs, Volume= 0.039 af, Atten= 20%, Lag= 17.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.19 fps, Min. Travel Time= 11.1 min

Avg. Velocity= 0.07 fps, Avg. Travel Time= 31.5 min

Peak Storage= 224 cf @ 12.36 hrs

Average Depth at Peak Storage= 0.06'

Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 45.22 cfs

30.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

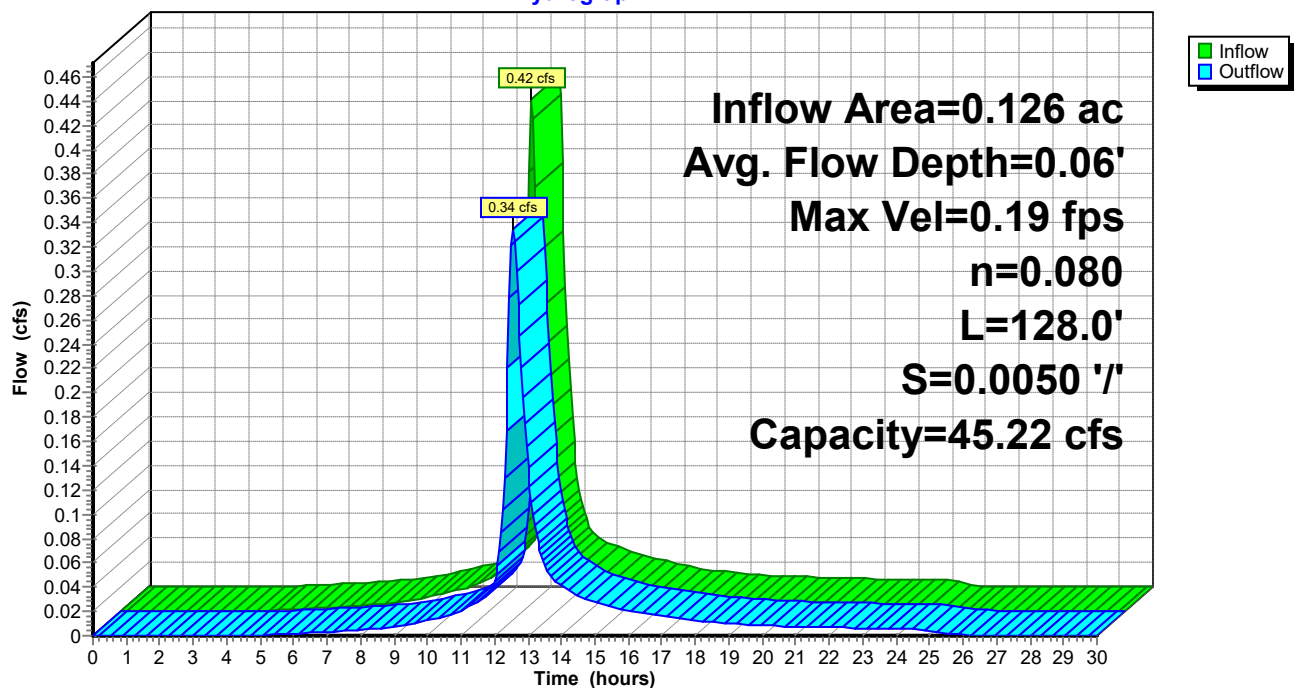
Side Slope Z-value= 10.0 '/' Top Width= 50.00'

Length= 128.0' Slope= 0.0050 '/'

Inlet Invert= 85.00', Outlet Invert= 84.36'

**Reach OL-4: OVERLAND**

Hydrograph





**3010-Pre***Type III 24-hr 25-Year Rainfall=5.30"*

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E1: TO WETLAND (DP#1)** Runoff Area=84,498 sf 4.96% Impervious Runoff Depth=2.43"  
 Flow Length=512' Tc=13.5 min CN=72 Runoff=4.28 cfs 0.393 af

**Subcatchment E2: TO CATCHBASIN (DP#2)** Runoff Area=8,974 sf 85.31% Impervious Runoff Depth=4.60"  
 Flow Length=427' Slope=0.0600 '/' Tc=5.0 min CN=94 Runoff=1.04 cfs 0.079 af

**Subcatchment E3: TO LOW POINT (DP#3)** Runoff Area=82,313 sf 15.10% Impervious Runoff Depth=2.88"  
 Flow Length=356' Tc=5.0 min CN=77 Runoff=6.38 cfs 0.453 af

**Subcatchment E4: TO DCB-B** Runoff Area=5,470 sf 79.63% Impervious Runoff Depth=4.49"  
 Flow Length=217' Slope=0.0600 '/' Tc=5.0 min CN=93 Runoff=0.62 cfs 0.047 af

**Reach DCB-B: TO OUTFALL** Inflow=0.62 cfs 0.047 af  
 Outflow=0.62 cfs 0.047 af

**Reach DP#1: WETLAND** Inflow=4.40 cfs 0.440 af  
 Outflow=4.40 cfs 0.440 af

**Reach DP#2: MUNICIPAL CATCHBASIN** Inflow=1.04 cfs 0.079 af  
 Outflow=1.04 cfs 0.079 af

**Reach DP#3: LOW POINT** Inflow=6.38 cfs 0.453 af  
 Outflow=6.38 cfs 0.453 af

**Reach OL-1: OVERLAND** Avg. Flow Depth=0.05' Max Vel=0.80 fps Inflow=0.62 cfs 0.047 af  
 n=0.080 L=46.0' S=0.1087 '/' Capacity=122.10 cfs Outflow=0.60 cfs 0.047 af

**Reach OL-2: OVERLAND** Avg. Flow Depth=0.05' Max Vel=0.71 fps Inflow=0.60 cfs 0.047 af  
 n=0.080 L=211.0' S=0.0867 '/' Capacity=109.07 cfs Outflow=0.52 cfs 0.047 af

**Reach OL-3: OVERLAND** Avg. Flow Depth=0.06' Max Vel=0.51 fps Inflow=0.52 cfs 0.047 af  
 n=0.080 L=23.0' S=0.0304 '/' Capacity=64.61 cfs Outflow=0.51 cfs 0.047 af

**Reach OL-4: OVERLAND** Avg. Flow Depth=0.06' Max Vel=0.21 fps Inflow=0.51 cfs 0.047 af  
 n=0.080 L=128.0' S=0.0050 '/' Capacity=45.22 cfs Outflow=0.41 cfs 0.047 af

**Total Runoff Area = 4.161 ac Runoff Volume = 0.972 af Average Runoff Depth = 2.80"**  
**84.20% Pervious = 3.504 ac 15.80% Impervious = 0.657 ac**

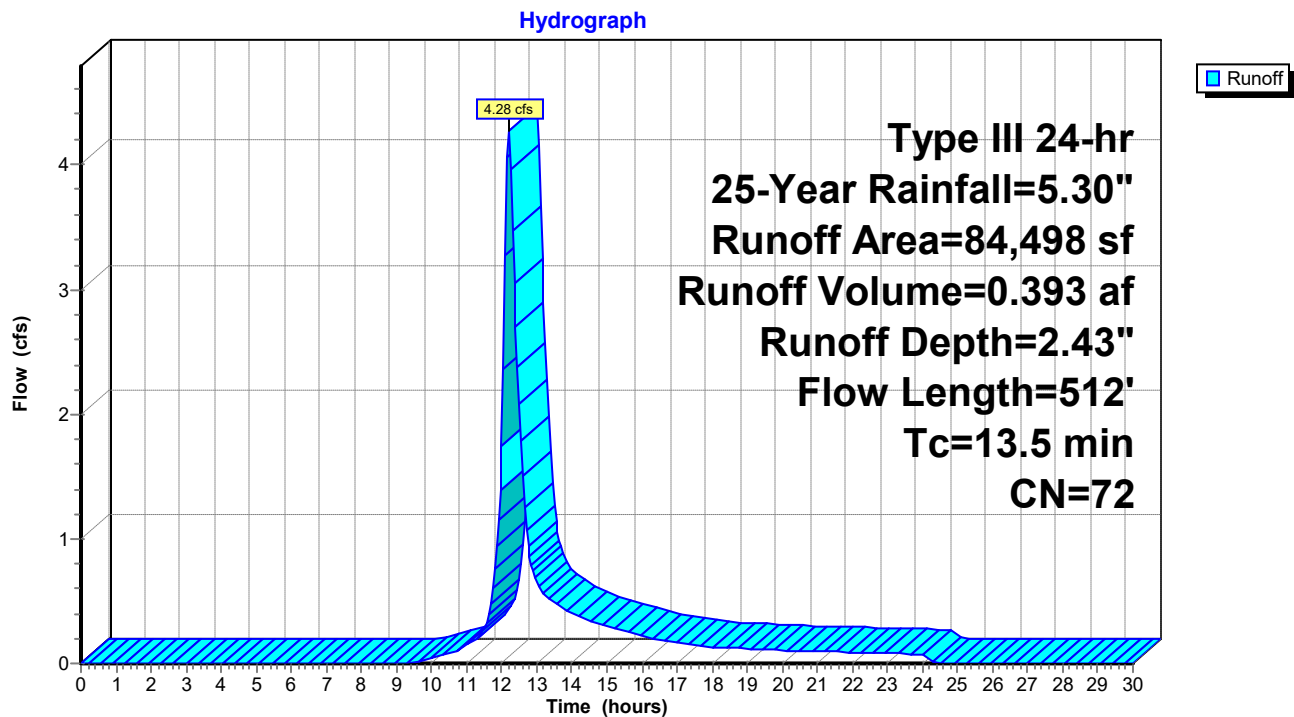
**Summary for Subcatchment E1: TO WETLAND (DP#1)**

Runoff = 4.28 cfs @ 12.19 hrs, Volume= 0.393 af, Depth= 2.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
1,750	74	>75% Grass cover, Good, HSG C
75,547	70	Woods, Good, HSG C
4,194	98	Paved parking, HSG C
3,007	89	Gravel roads, HSG C
84,498	72	Weighted Average
80,304		95.04% Pervious Area
4,194		4.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	13	0.2150	0.13		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.00"
0.8	9	0.1000	0.19		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.00"
0.7	28	0.0060	0.64		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.5	50	0.0060	1.57		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.8	82	0.0120	1.76		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
1.2	106	0.0830	1.44		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
1.8	96	0.0300	0.87		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
6.0	128	0.0050	0.35		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.5	512	Total			

**Subcatchment E1: TO WETLAND (DP#1)**

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Type III 24-hr 25-Year Rainfall=5.30"

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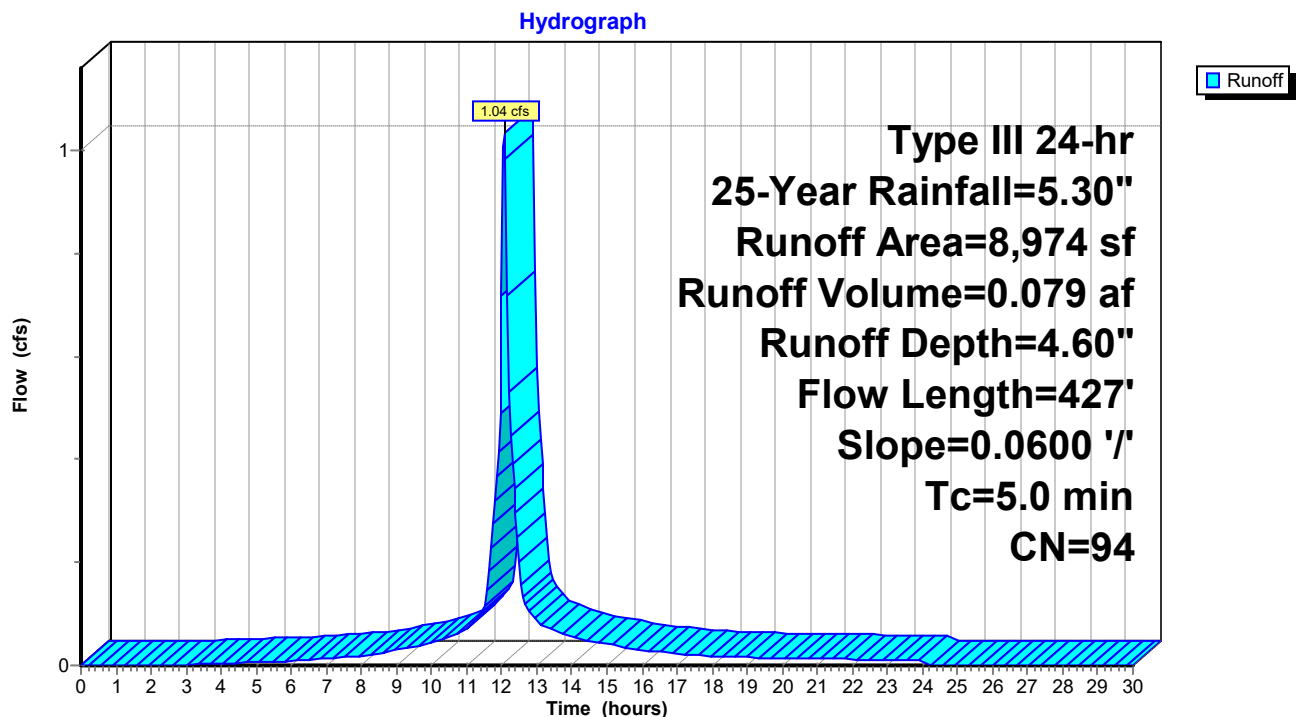
**Summary for Subcatchment E2: TO CATCHBASIN (DP#2)**

Runoff = 1.04 cfs @ 12.07 hrs, Volume= 0.079 af, Depth= 4.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
774	74	>75% Grass cover, Good, HSG C
544	70	Woods, Good, HSG C
7,656	98	Paved parking, HSG C
8,974	94	Weighted Average
1,318		14.69% Pervious Area
7,656		85.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0600	1.80		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
1.3	377	0.0600	4.97		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.8	427	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment E2: TO CATCHBASIN (DP#2)**

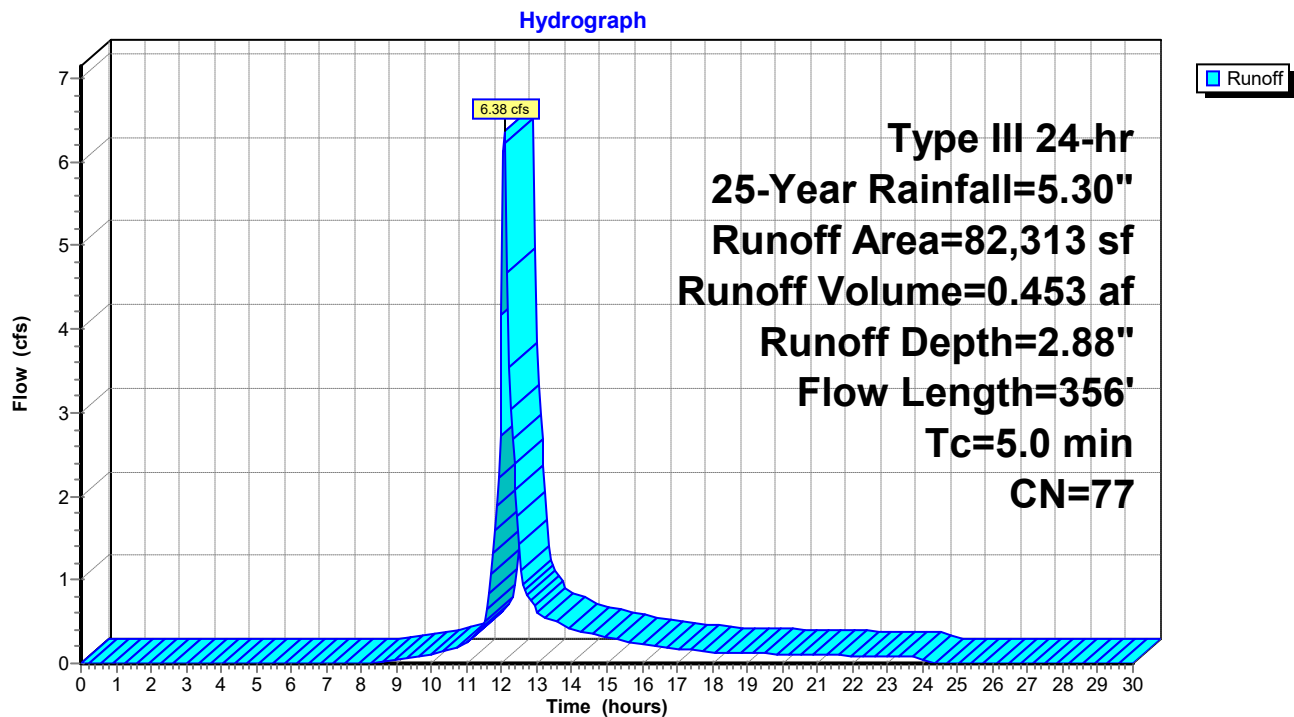
**Summary for Subcatchment E3: TO LOW POINT (DP#3)**

Runoff = 6.38 cfs @ 12.08 hrs, Volume= 0.453 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
8,024	74	>75% Grass cover, Good, HSG C
49,390	70	Woods, Good, HSG C
12,433	98	Paved parking, HSG C
12,466	89	Gravel roads, HSG C
82,313	77	Weighted Average
69,880		84.90% Pervious Area
12,433		15.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	35	0.1400	2.35		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.2	15	0.0320	1.10		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.2	53	0.0320	3.63		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.3	54	0.0320	2.88		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
0.0	28	0.4200	10.43		<b>Shallow Concentrated Flow, GRASS/BRUSH</b> Unpaved Kv= 16.1 fps
1.4	171	0.1600	2.00		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
2.3	356	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment E3: TO LOW POINT (DP#3)**

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Type III 24-hr 25-Year Rainfall=5.30"

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**Summary for Subcatchment E4: TO DCB-B**

Runoff = 0.62 cfs @ 12.07 hrs, Volume= 0.047 af, Depth= 4.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.30"

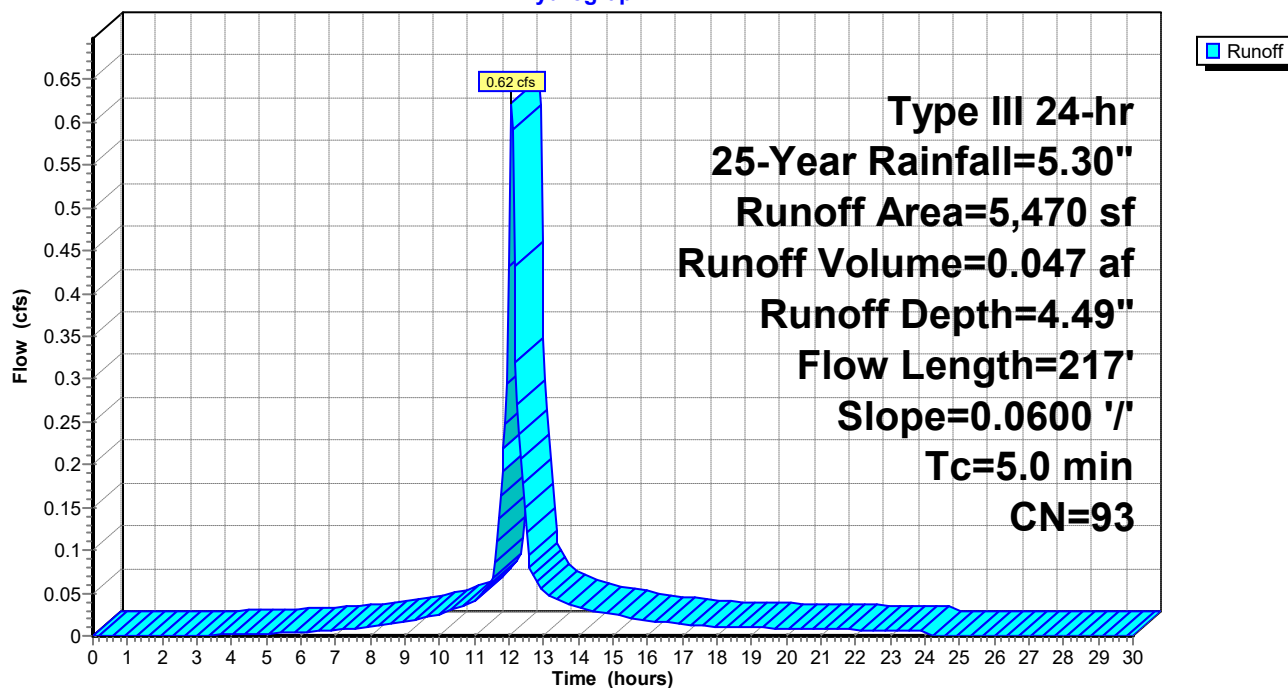
Area (sf)	CN	Description
1,114	74	>75% Grass cover, Good, HSG C
4,356	98	Paved parking, HSG C
5,470	93	Weighted Average
1,114		20.37% Pervious Area
4,356		79.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0600	1.80		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.6	167	0.0600	4.97		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.1	217	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment E4: TO DCB-B**

Hydrograph

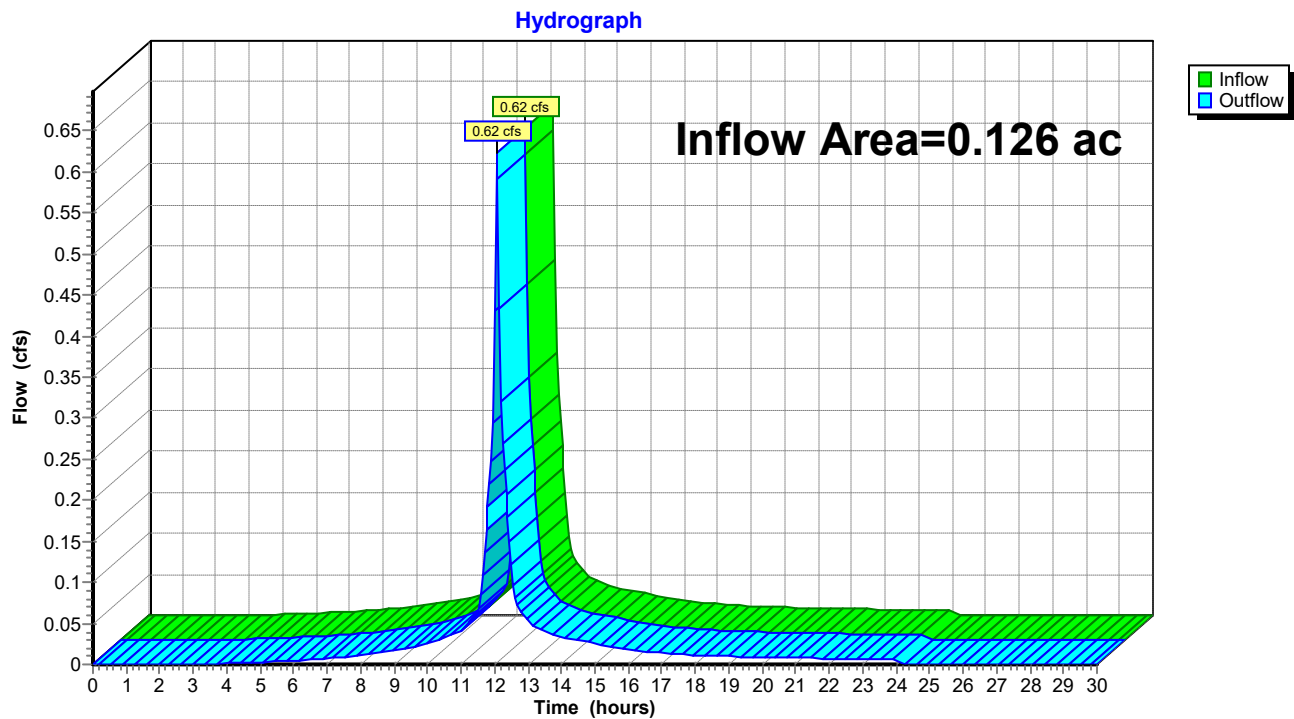




**Summary for Reach DCB-B: TO OUTFALL**

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 4.49" for 25-Year event  
Inflow = 0.62 cfs @ 12.07 hrs, Volume= 0.047 af  
Outflow = 0.62 cfs @ 12.07 hrs, Volume= 0.047 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DCB-B: TO OUTFALL**

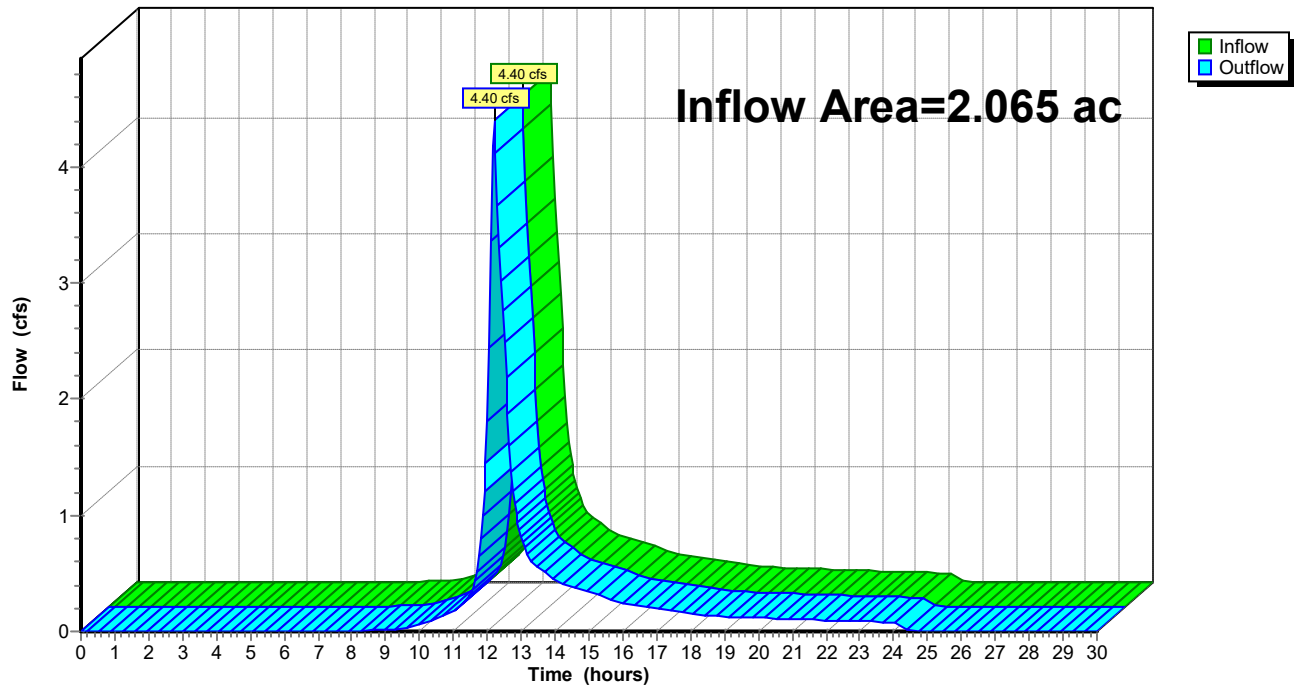
**Summary for Reach DP#1: WETLAND**

Inflow Area = 2.065 ac, 9.50% Impervious, Inflow Depth = 2.56" for 25-Year event  
Inflow = 4.40 cfs @ 12.20 hrs, Volume= 0.440 af  
Outflow = 4.40 cfs @ 12.20 hrs, Volume= 0.440 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#1: WETLAND**

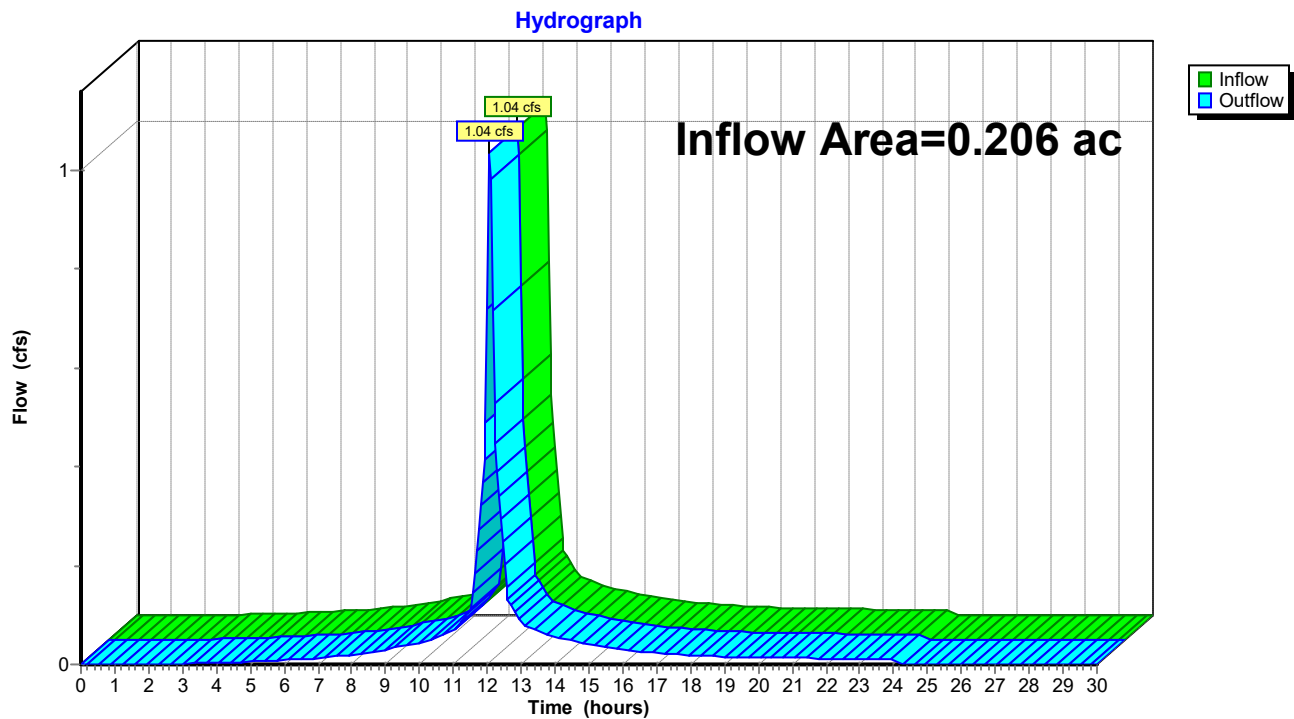
Hydrograph



**Summary for Reach DP#2: MUNICIPAL CATCHBASIN**

Inflow Area = 0.206 ac, 85.31% Impervious, Inflow Depth = 4.60" for 25-Year event  
Inflow = 1.04 cfs @ 12.07 hrs, Volume= 0.079 af  
Outflow = 1.04 cfs @ 12.07 hrs, Volume= 0.079 af, Atten= 0%, Lag= 0.0 min

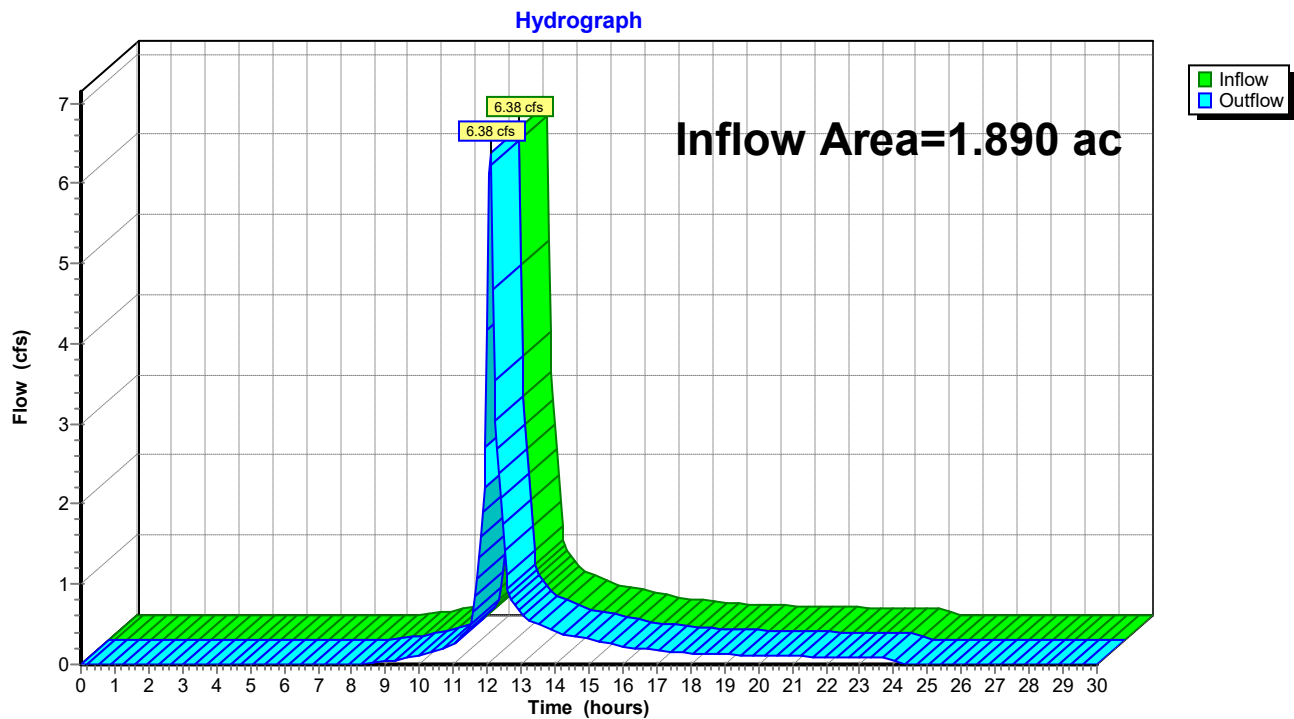
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#2: MUNICIPAL CATCHBASIN**

**Summary for Reach DP#3: LOW POINT**

Inflow Area = 1.890 ac, 15.10% Impervious, Inflow Depth = 2.88" for 25-Year event  
Inflow = 6.38 cfs @ 12.08 hrs, Volume= 0.453 af  
Outflow = 6.38 cfs @ 12.08 hrs, Volume= 0.453 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#3: LOW POINT**

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Type III 24-hr 25-Year Rainfall=5.30"

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### Summary for Reach OL-1: OVERLAND

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 4.49" for 25-Year event  
Inflow = 0.62 cfs @ 12.07 hrs, Volume= 0.047 af  
Outflow = 0.60 cfs @ 12.10 hrs, Volume= 0.047 af, Atten= 4%, Lag= 1.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.80 fps, Min. Travel Time= 1.0 min

Avg. Velocity= 0.30 fps, Avg. Travel Time= 2.6 min

Peak Storage= 35 cf @ 12.09 hrs

Average Depth at Peak Storage= 0.05'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 122.10 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 35.00'

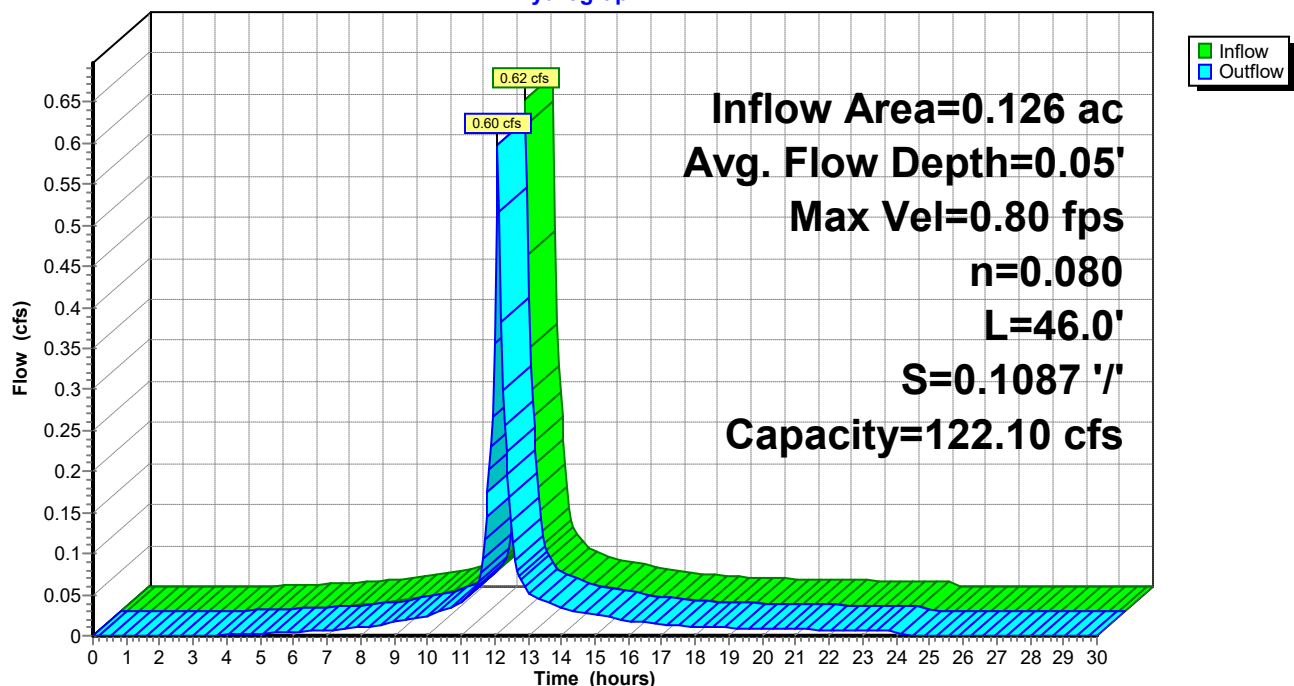
Length= 46.0' Slope= 0.1087 '/'

Inlet Invert= 109.00', Outlet Invert= 104.00'



### Reach OL-1: OVERLAND

#### Hydrograph



**Summary for Reach OL-2: OVERLAND**

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 4.49" for 25-Year event  
 Inflow = 0.60 cfs @ 12.10 hrs, Volume= 0.047 af  
 Outflow = 0.52 cfs @ 12.23 hrs, Volume= 0.047 af, Atten= 14%, Lag= 7.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.71 fps, Min. Travel Time= 4.9 min

Avg. Velocity= 0.27 fps, Avg. Travel Time= 13.1 min

Peak Storage= 157 cf @ 12.15 hrs

Average Depth at Peak Storage= 0.05'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 109.07 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

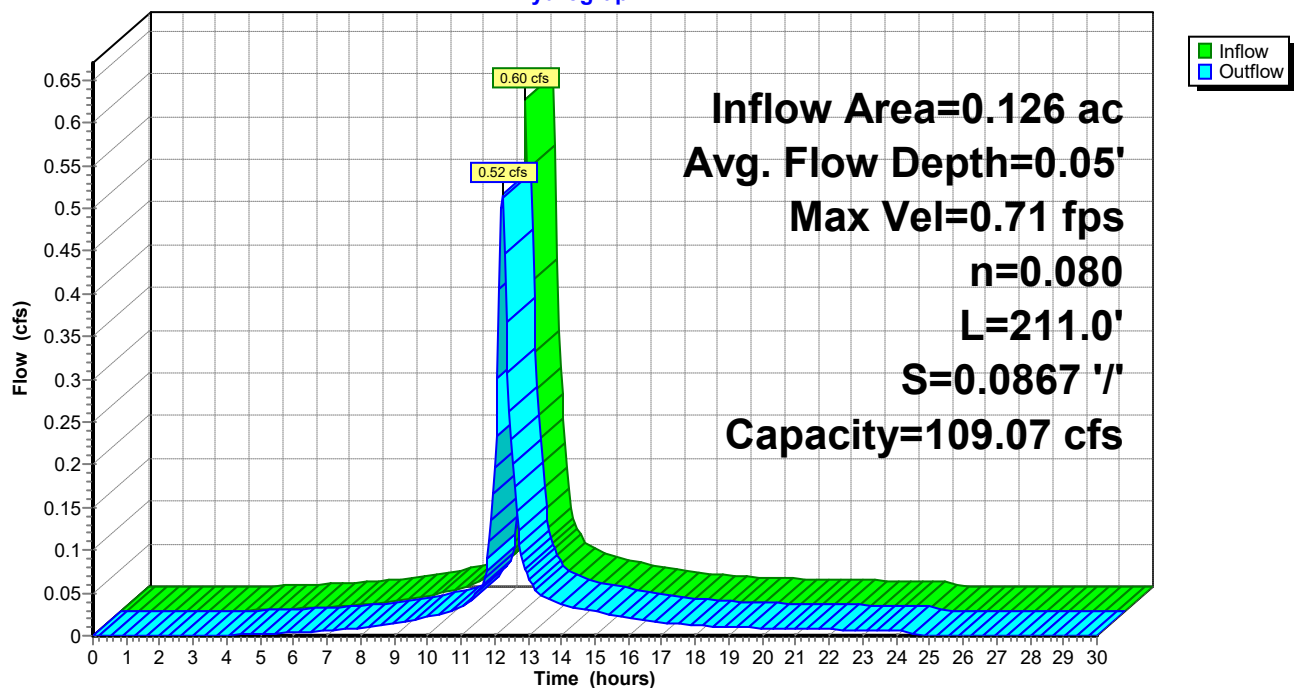
Side Slope Z-value= 10.0 '/' Top Width= 35.00'

Length= 211.0' Slope= 0.0867 '/'

Inlet Invert= 104.00', Outlet Invert= 85.70'

**Reach OL-2: OVERLAND**

Hydrograph



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### Summary for Reach OL-3: OVERLAND

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 4.49" for 25-Year event  
Inflow = 0.52 cfs @ 12.23 hrs, Volume= 0.047 af  
Outflow = 0.51 cfs @ 12.25 hrs, Volume= 0.047 af, Atten= 1%, Lag= 1.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.51 fps, Min. Travel Time= 0.8 min

Avg. Velocity = 0.17 fps, Avg. Travel Time= 2.3 min

Peak Storage= 23 cf @ 12.24 hrs

Average Depth at Peak Storage= 0.06'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 64.61 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 35.00'

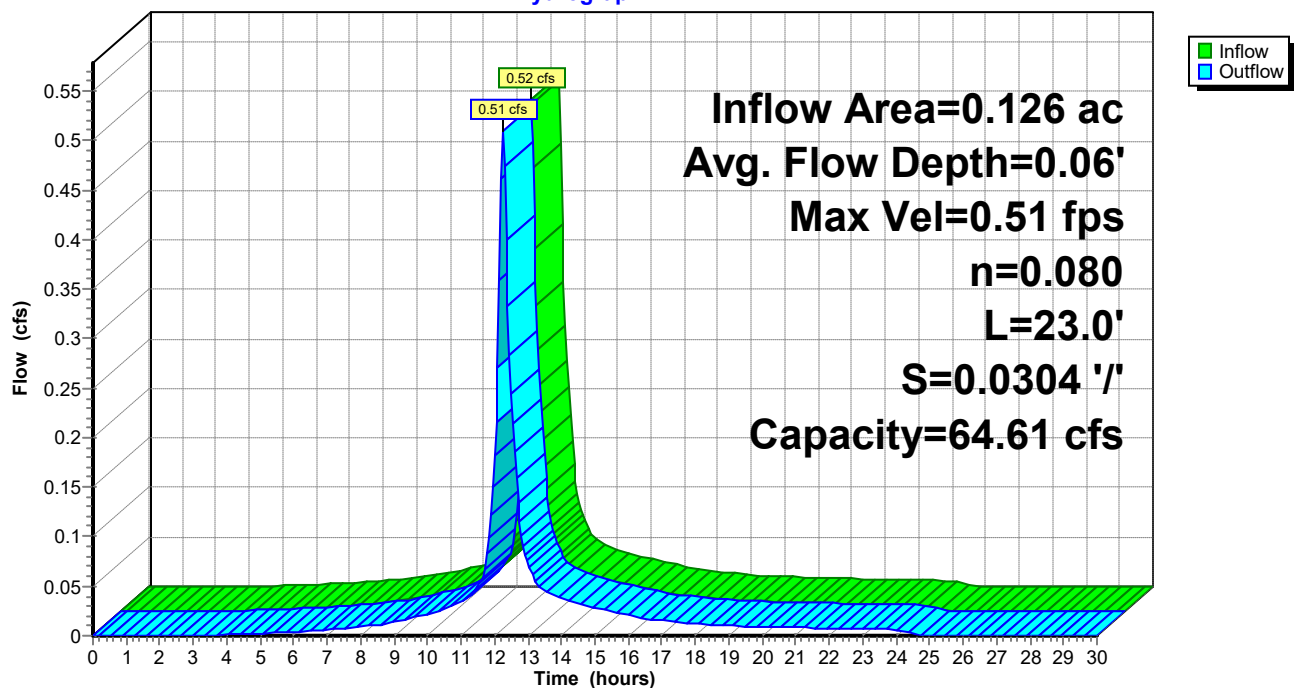
Length= 23.0' Slope= 0.0304 '/'

Inlet Invert= 85.70', Outlet Invert= 85.00'



### Reach OL-3: OVERLAND

#### Hydrograph



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Type III 24-hr 25-Year Rainfall=5.30"

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### Summary for Reach OL-4: OVERLAND

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 4.49" for 25-Year event  
Inflow = 0.51 cfs @ 12.25 hrs, Volume= 0.047 af  
Outflow = 0.41 cfs @ 12.52 hrs, Volume= 0.047 af, Atten= 19%, Lag= 15.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.21 fps, Min. Travel Time= 10.2 min

Avg. Velocity= 0.07 fps, Avg. Travel Time= 30.8 min

Peak Storage= 254 cf @ 12.35 hrs

Average Depth at Peak Storage= 0.06'

Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 45.22 cfs

30.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 50.00'

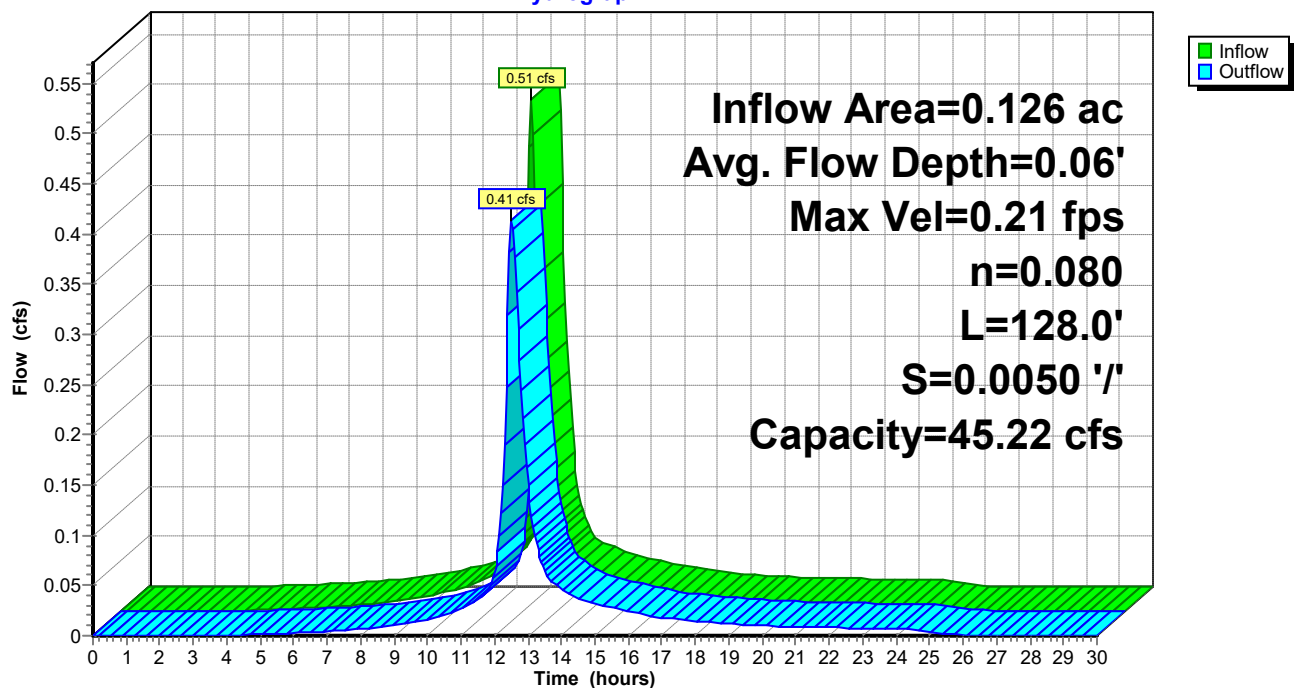
Length= 128.0' Slope= 0.0050 '/'

Inlet Invert= 85.00', Outlet Invert= 84.36'



### Reach OL-4: OVERLAND

Hydrograph





**3010-Pre***Type III 24-hr 100-Year Rainfall=6.50"*

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E1: TO WETLAND (DP#1)** Runoff Area=84,498 sf 4.96% Impervious Runoff Depth=3.41"  
 Flow Length=512' Tc=13.5 min CN=72 Runoff=6.04 cfs 0.551 af

**Subcatchment E2: TO CATCHBASIN (DP#2)** Runoff Area=8,974 sf 85.31% Impervious Runoff Depth=5.79"  
 Flow Length=427' Slope=0.0600 '/' Tc=5.0 min CN=94 Runoff=1.29 cfs 0.099 af

**Subcatchment E3: TO LOW POINT (DP#3)** Runoff Area=82,313 sf 15.10% Impervious Runoff Depth=3.92"  
 Flow Length=356' Tc=5.0 min CN=77 Runoff=8.67 cfs 0.617 af

**Subcatchment E4: TO DCB-B** Runoff Area=5,470 sf 79.63% Impervious Runoff Depth=5.68"  
 Flow Length=217' Slope=0.0600 '/' Tc=5.0 min CN=93 Runoff=0.78 cfs 0.059 af

**Reach DCB-B: TO OUTFALL** Inflow=0.78 cfs 0.059 af  
 Outflow=0.78 cfs 0.059 af

**Reach DP#1: WETLAND** Inflow=6.22 cfs 0.610 af  
 Outflow=6.22 cfs 0.610 af

**Reach DP#2: MUNICIPAL CATCHBASIN** Inflow=1.29 cfs 0.099 af  
 Outflow=1.29 cfs 0.099 af

**Reach DP#3: LOW POINT** Inflow=8.67 cfs 0.617 af  
 Outflow=8.67 cfs 0.617 af

**Reach OL-1: OVERLAND** Avg. Flow Depth=0.06' Max Vel=0.88 fps Inflow=0.78 cfs 0.059 af  
 n=0.080 L=46.0' S=0.1087 '/' Capacity=122.10 cfs Outflow=0.75 cfs 0.059 af

**Reach OL-2: OVERLAND** Avg. Flow Depth=0.06' Max Vel=0.78 fps Inflow=0.75 cfs 0.059 af  
 n=0.080 L=211.0' S=0.0867 '/' Capacity=109.07 cfs Outflow=0.65 cfs 0.059 af

**Reach OL-3: OVERLAND** Avg. Flow Depth=0.07' Max Vel=0.55 fps Inflow=0.65 cfs 0.059 af  
 n=0.080 L=23.0' S=0.0304 '/' Capacity=64.61 cfs Outflow=0.64 cfs 0.059 af

**Reach OL-4: OVERLAND** Avg. Flow Depth=0.08' Max Vel=0.23 fps Inflow=0.64 cfs 0.059 af  
 n=0.080 L=128.0' S=0.0050 '/' Capacity=45.22 cfs Outflow=0.54 cfs 0.059 af

**Total Runoff Area = 4.161 ac Runoff Volume = 1.327 af Average Runoff Depth = 3.83"**  
**84.20% Pervious = 3.504 ac 15.80% Impervious = 0.657 ac**

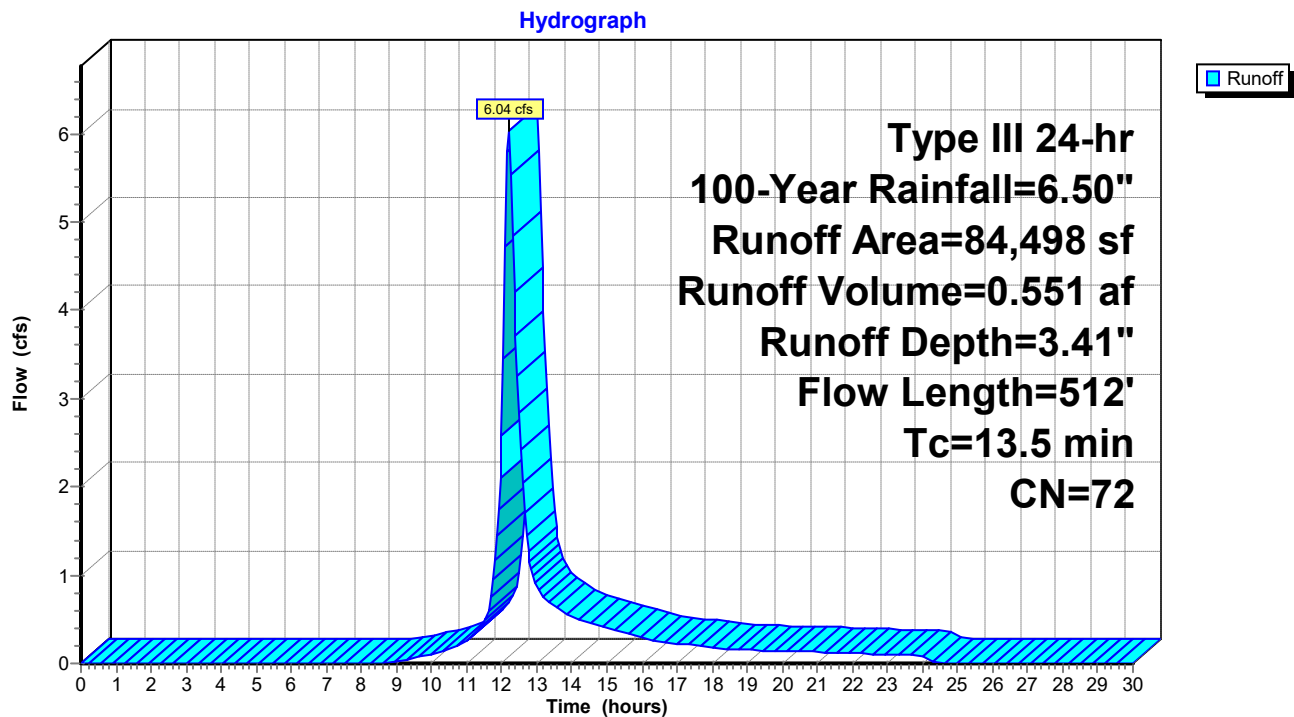
**Summary for Subcatchment E1: TO WETLAND (DP#1)**

Runoff = 6.04 cfs @ 12.19 hrs, Volume= 0.551 af, Depth= 3.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
1,750	74	>75% Grass cover, Good, HSG C
75,547	70	Woods, Good, HSG C
4,194	98	Paved parking, HSG C
3,007	89	Gravel roads, HSG C
84,498	72	Weighted Average
80,304		95.04% Pervious Area
4,194		4.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	13	0.2150	0.13		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.00"
0.8	9	0.1000	0.19		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.00"
0.7	28	0.0060	0.64		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.5	50	0.0060	1.57		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.8	82	0.0120	1.76		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
1.2	106	0.0830	1.44		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
1.8	96	0.0300	0.87		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
6.0	128	0.0050	0.35		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.5	512	Total			

**Subcatchment E1: TO WETLAND (DP#1)**

**3010-Pre**

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Type III 24-hr 100-Year Rainfall=6.50"

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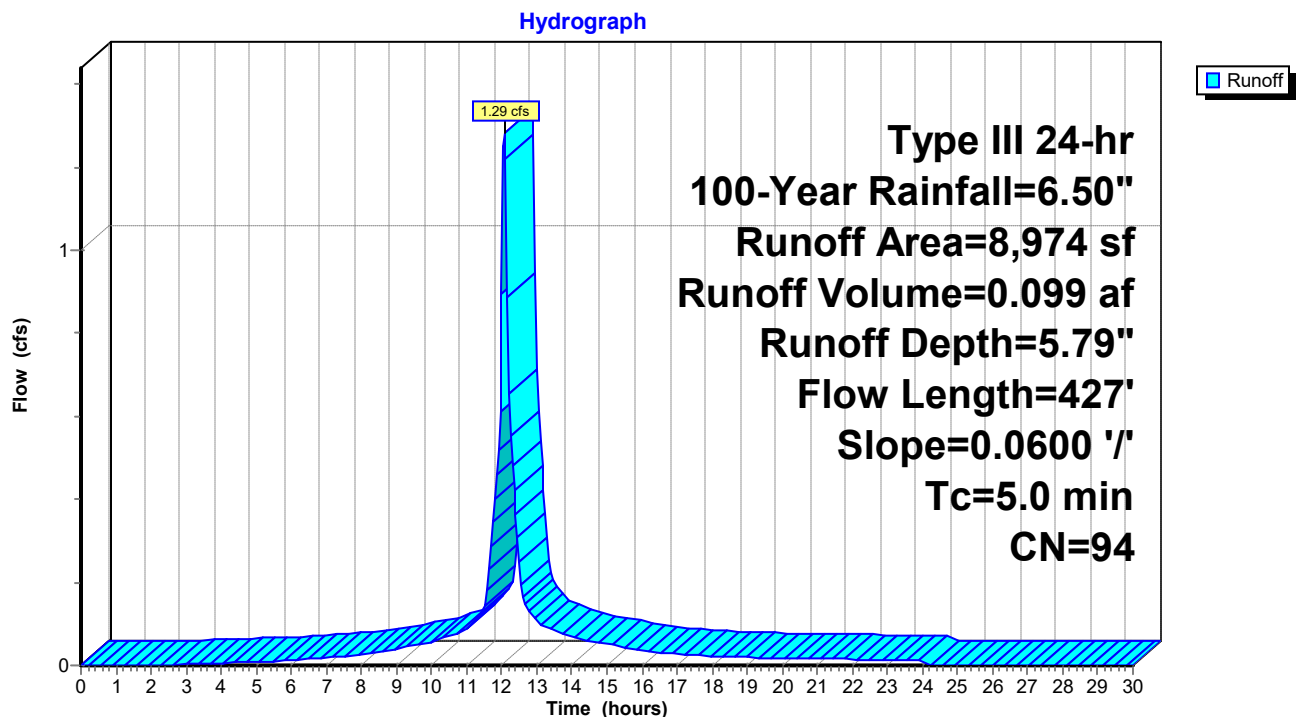
**Summary for Subcatchment E2: TO CATCHBASIN (DP#2)**

Runoff = 1.29 cfs @ 12.07 hrs, Volume= 0.099 af, Depth= 5.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
774	74	>75% Grass cover, Good, HSG C
544	70	Woods, Good, HSG C
7,656	98	Paved parking, HSG C
8,974	94	Weighted Average
1,318		14.69% Pervious Area
7,656		85.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0600	1.80		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
1.3	377	0.0600	4.97		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.8	427	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment E2: TO CATCHBASIN (DP#2)**

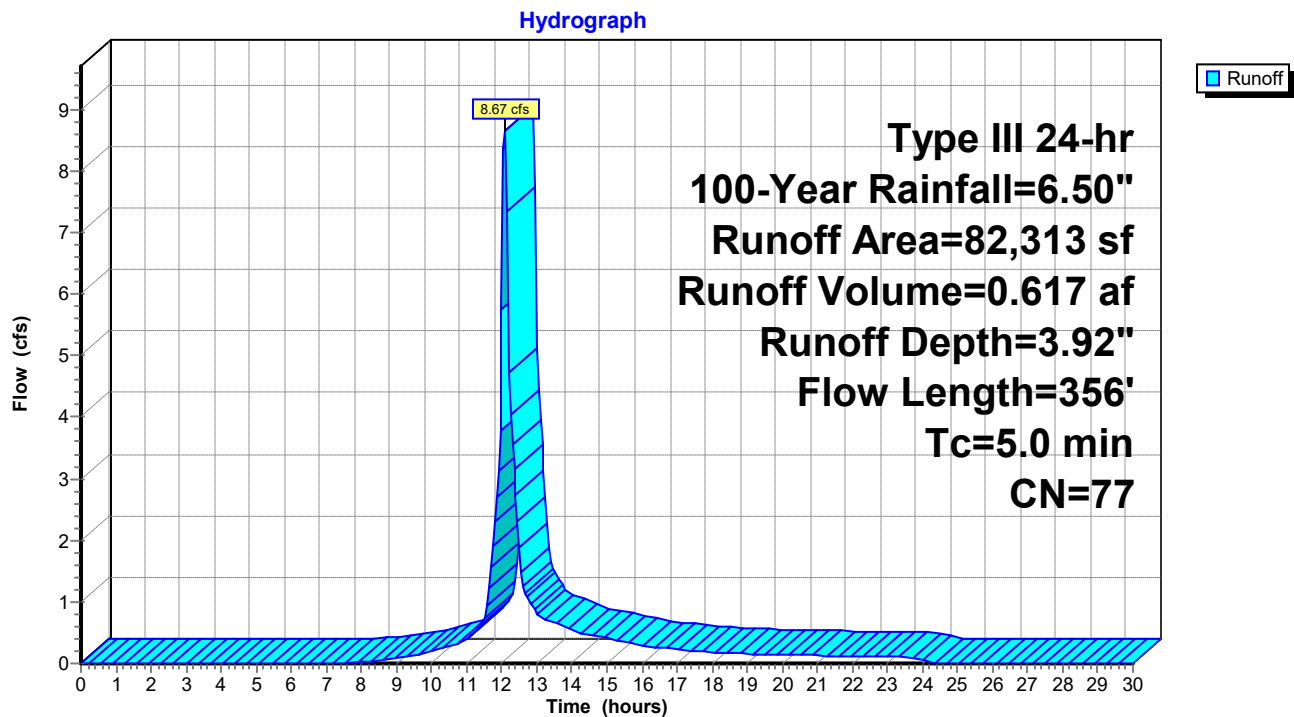
**Summary for Subcatchment E3: TO LOW POINT (DP#3)**

Runoff = 8.67 cfs @ 12.08 hrs, Volume= 0.617 af, Depth= 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
8,024	74	>75% Grass cover, Good, HSG C
49,390	70	Woods, Good, HSG C
12,433	98	Paved parking, HSG C
12,466	89	Gravel roads, HSG C
82,313	77	Weighted Average
69,880		84.90% Pervious Area
12,433		15.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	35	0.1400	2.35		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.2	15	0.0320	1.10		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.2	53	0.0320	3.63		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.3	54	0.0320	2.88		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
0.0	28	0.4200	10.43		<b>Shallow Concentrated Flow, GRASS/BRUSH</b> Unpaved Kv= 16.1 fps
1.4	171	0.1600	2.00		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
2.3	356	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment E3: TO LOW POINT (DP#3)**

**Summary for Subcatchment E4: TO DCB-B**

Runoff = 0.78 cfs @ 12.07 hrs, Volume= 0.059 af, Depth= 5.68"

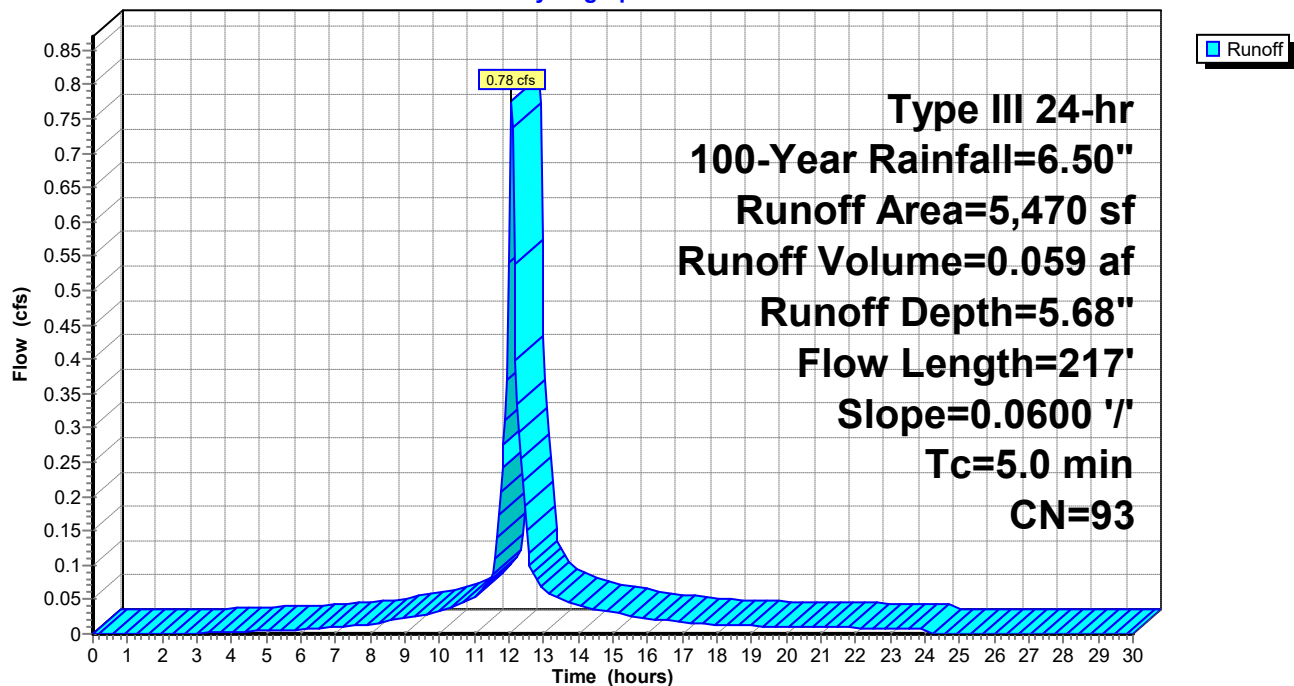
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
1,114	74	>75% Grass cover, Good, HSG C
4,356	98	Paved parking, HSG C
5,470	93	Weighted Average
1,114		20.37% Pervious Area
4,356		79.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0600	1.80		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.6	167	0.0600	4.97		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.1	217	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment E4: TO DCB-B**

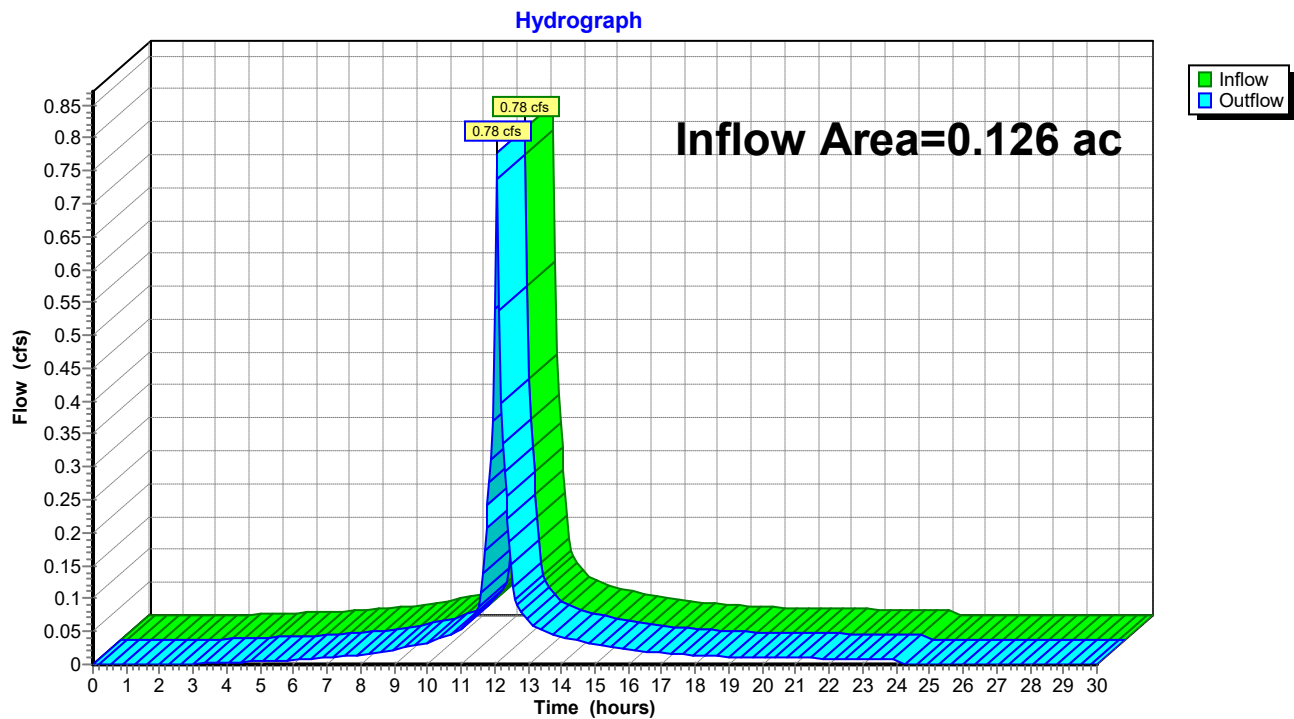
Hydrograph



**Summary for Reach DCB-B: TO OUTFALL**

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 5.68" for 100-Year event  
Inflow = 0.78 cfs @ 12.07 hrs, Volume= 0.059 af  
Outflow = 0.78 cfs @ 12.07 hrs, Volume= 0.059 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DCB-B: TO OUTFALL**



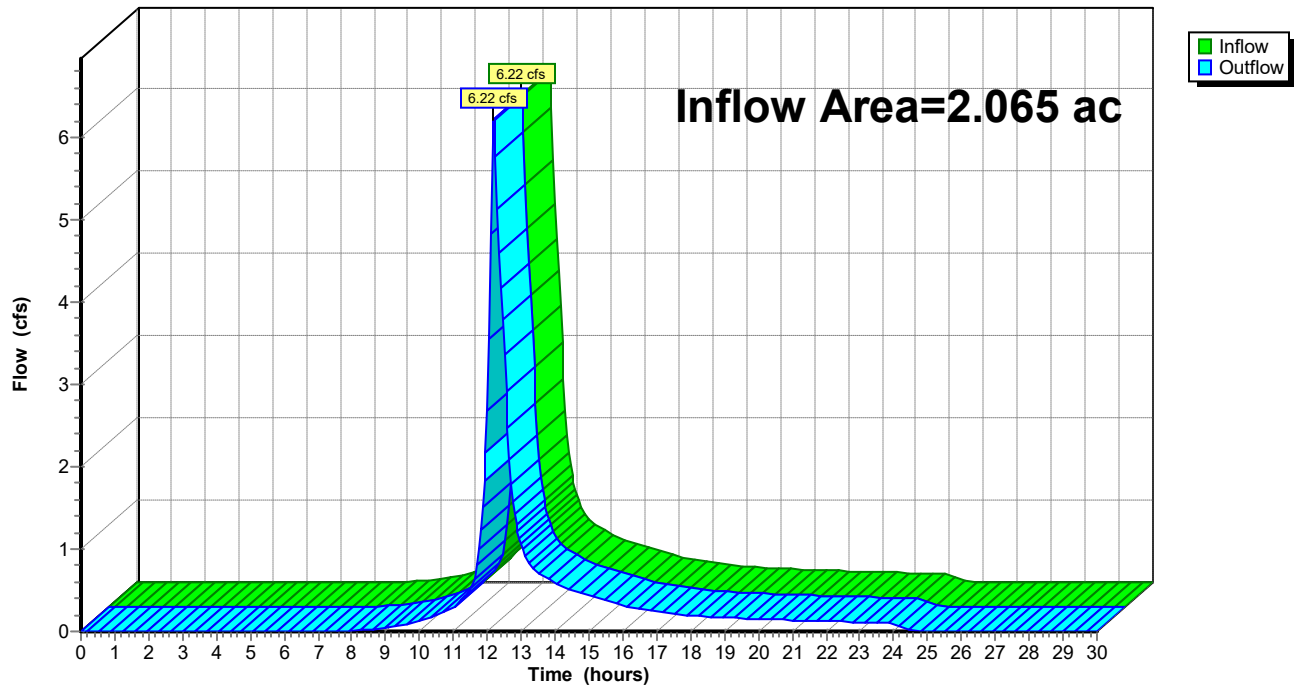
**Summary for Reach DP#1: WETLAND**

Inflow Area = 2.065 ac, 9.50% Impervious, Inflow Depth = 3.54" for 100-Year event  
Inflow = 6.22 cfs @ 12.19 hrs, Volume= 0.610 af  
Outflow = 6.22 cfs @ 12.19 hrs, Volume= 0.610 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#1: WETLAND**

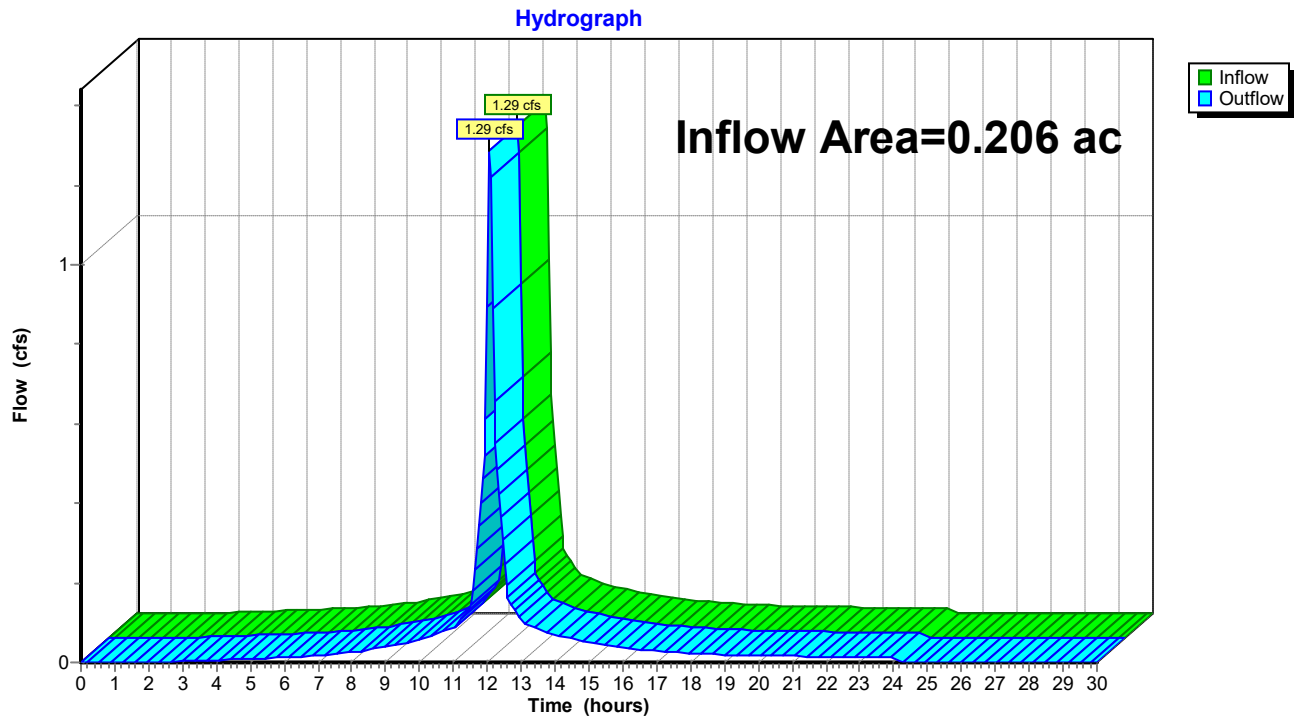
Hydrograph



**Summary for Reach DP#2: MUNICIPAL CATCHBASIN**

Inflow Area = 0.206 ac, 85.31% Impervious, Inflow Depth = 5.79" for 100-Year event  
Inflow = 1.29 cfs @ 12.07 hrs, Volume= 0.099 af  
Outflow = 1.29 cfs @ 12.07 hrs, Volume= 0.099 af, Atten= 0%, Lag= 0.0 min

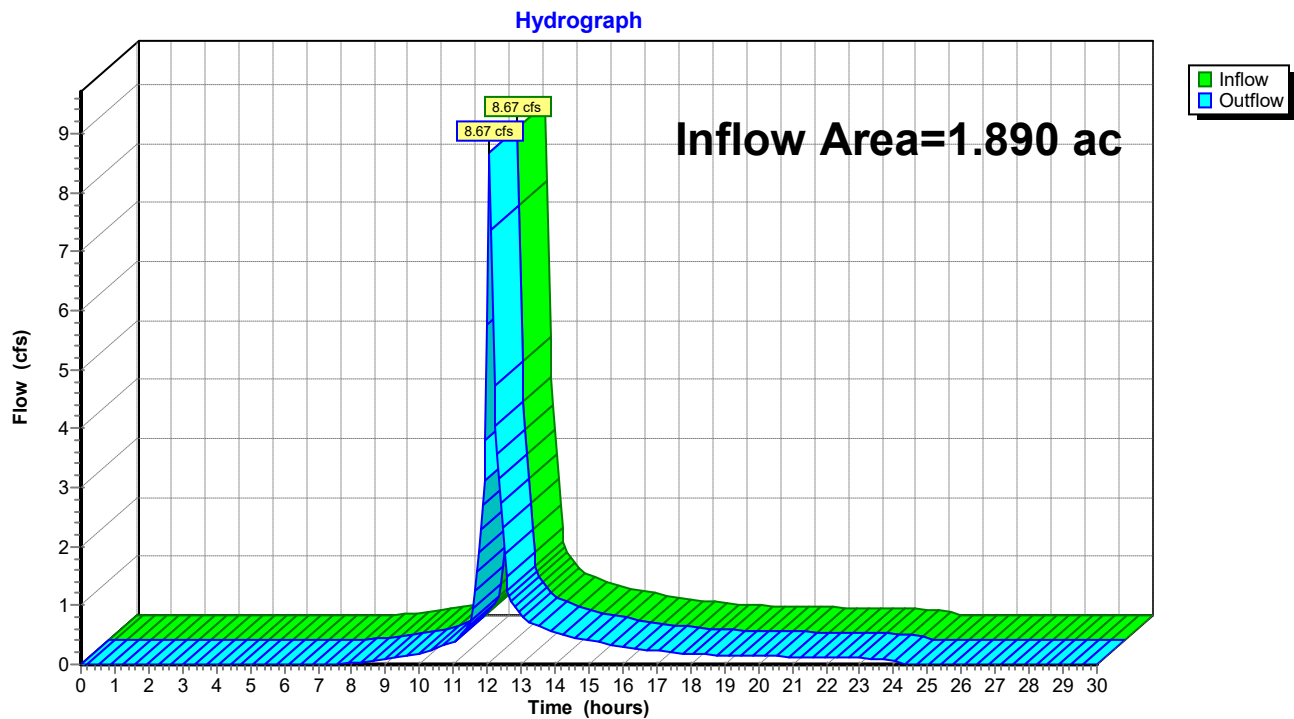
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#2: MUNICIPAL CATCHBASIN**

**Summary for Reach DP#3: LOW POINT**

Inflow Area = 1.890 ac, 15.10% Impervious, Inflow Depth = 3.92" for 100-Year event  
Inflow = 8.67 cfs @ 12.08 hrs, Volume= 0.617 af  
Outflow = 8.67 cfs @ 12.08 hrs, Volume= 0.617 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#3: LOW POINT**

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### Summary for Reach OL-1: OVERLAND

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 5.68" for 100-Year event  
Inflow = 0.78 cfs @ 12.07 hrs, Volume= 0.059 af  
Outflow = 0.75 cfs @ 12.10 hrs, Volume= 0.059 af, Atten= 4%, Lag= 1.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.88 fps, Min. Travel Time= 0.9 min

Avg. Velocity= 0.30 fps, Avg. Travel Time= 2.5 min

Peak Storage= 40 cf @ 12.08 hrs

Average Depth at Peak Storage= 0.06'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 122.10 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 35.00'

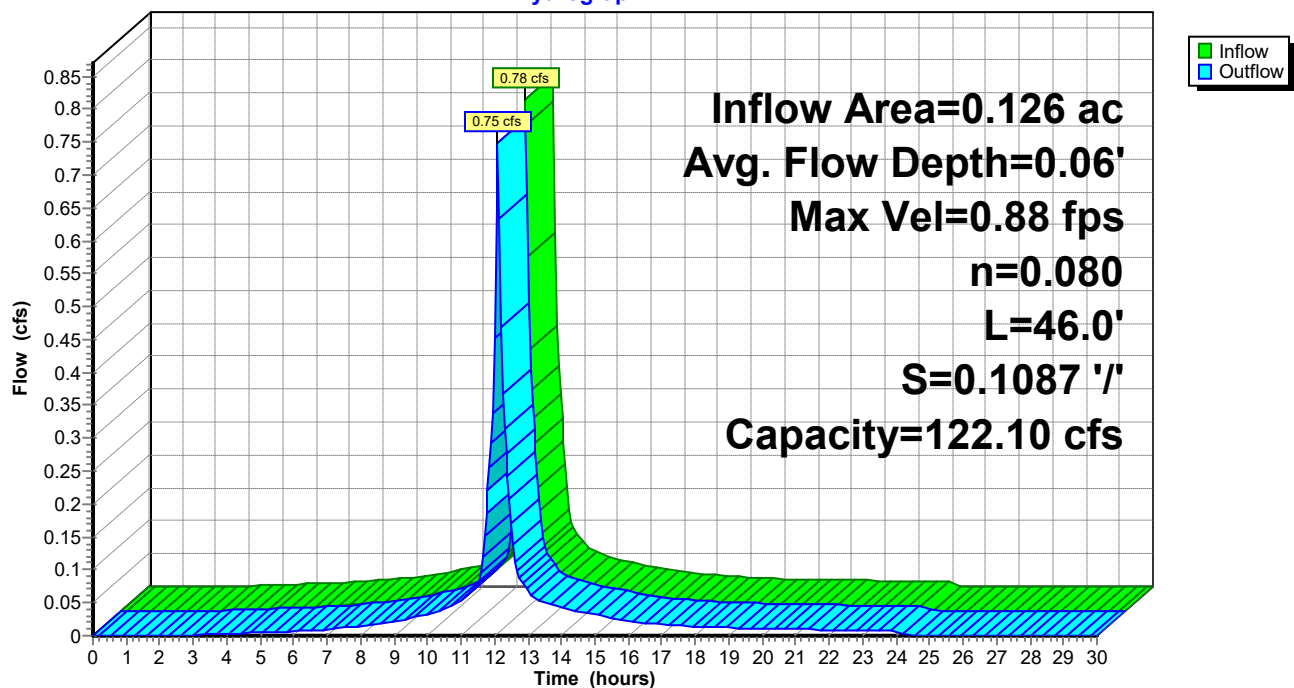
Length= 46.0' Slope= 0.1087 '/'

Inlet Invert= 109.00', Outlet Invert= 104.00'



### Reach OL-1: OVERLAND

#### Hydrograph



**Summary for Reach OL-2: OVERLAND**

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 5.68" for 100-Year event  
 Inflow = 0.75 cfs @ 12.10 hrs, Volume= 0.059 af  
 Outflow = 0.65 cfs @ 12.22 hrs, Volume= 0.059 af, Atten= 13%, Lag= 7.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.78 fps, Min. Travel Time= 4.5 min

Avg. Velocity = 0.27 fps, Avg. Travel Time= 12.9 min

Peak Storage= 182 cf @ 12.14 hrs

Average Depth at Peak Storage= 0.06'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 109.07 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

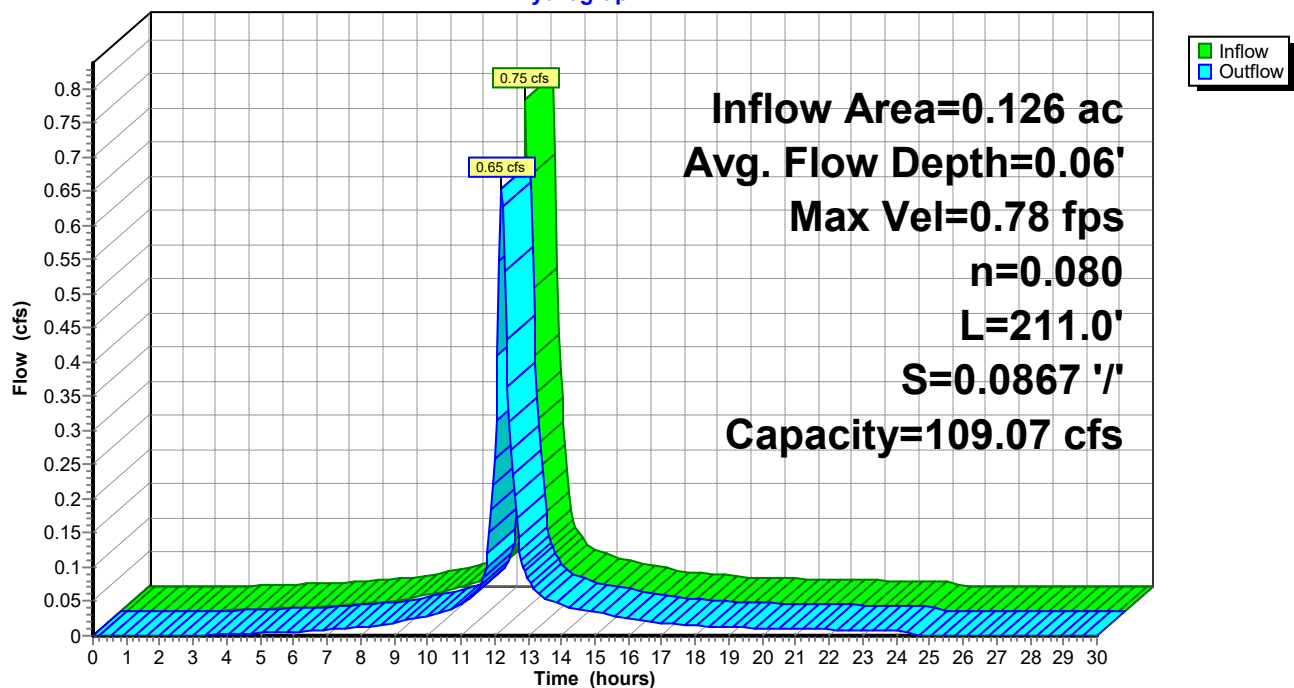
Side Slope Z-value= 10.0 ' ' Top Width= 35.00'

Length= 211.0' Slope= 0.0867 ' '

Inlet Invert= 104.00', Outlet Invert= 85.70'

**Reach OL-2: OVERLAND**

Hydrograph



**Summary for Reach OL-3: OVERLAND**

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 5.68" for 100-Year event  
 Inflow = 0.65 cfs @ 12.22 hrs, Volume= 0.059 af  
 Outflow = 0.64 cfs @ 12.24 hrs, Volume= 0.059 af, Atten= 2%, Lag= 1.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.55 fps, Min. Travel Time= 0.7 min

Avg. Velocity = 0.17 fps, Avg. Travel Time= 2.2 min

Peak Storage= 27 cf @ 12.23 hrs

Average Depth at Peak Storage= 0.07'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 64.61 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

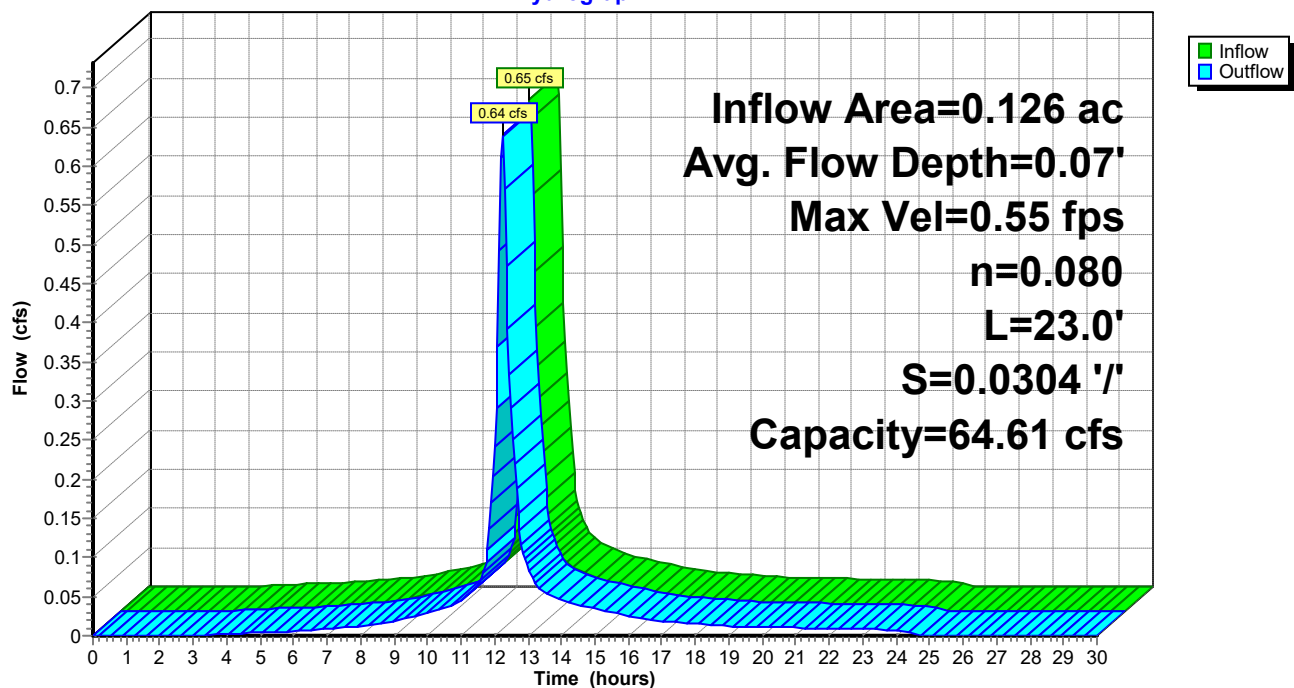
Side Slope Z-value= 10.0 ' ' Top Width= 35.00'

Length= 23.0' Slope= 0.0304 ' '

Inlet Invert= 85.70', Outlet Invert= 85.00'

**Reach OL-3: OVERLAND**

Hydrograph



**Summary for Reach OL-4: OVERLAND**

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 5.68" for 100-Year event  
 Inflow = 0.64 cfs @ 12.24 hrs, Volume= 0.059 af  
 Outflow = 0.54 cfs @ 12.47 hrs, Volume= 0.059 af, Atten= 16%, Lag= 14.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.23 fps, Min. Travel Time= 9.3 min

Avg. Velocity = 0.07 fps, Avg. Travel Time= 29.8 min

Peak Storage= 297 cf @ 12.32 hrs

Average Depth at Peak Storage= 0.08'

Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 45.22 cfs

30.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

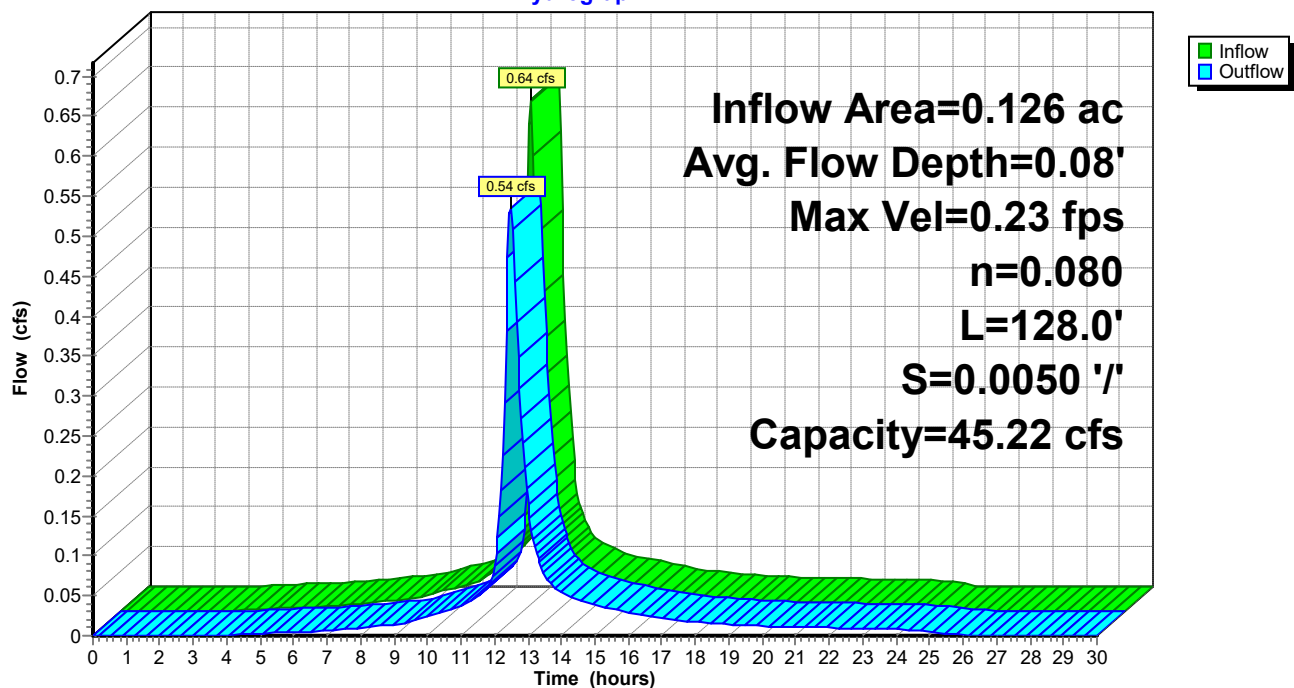
Side Slope Z-value= 10.0 '/' Top Width= 50.00'

Length= 128.0' Slope= 0.0050 '/'

Inlet Invert= 85.00', Outlet Invert= 84.36'

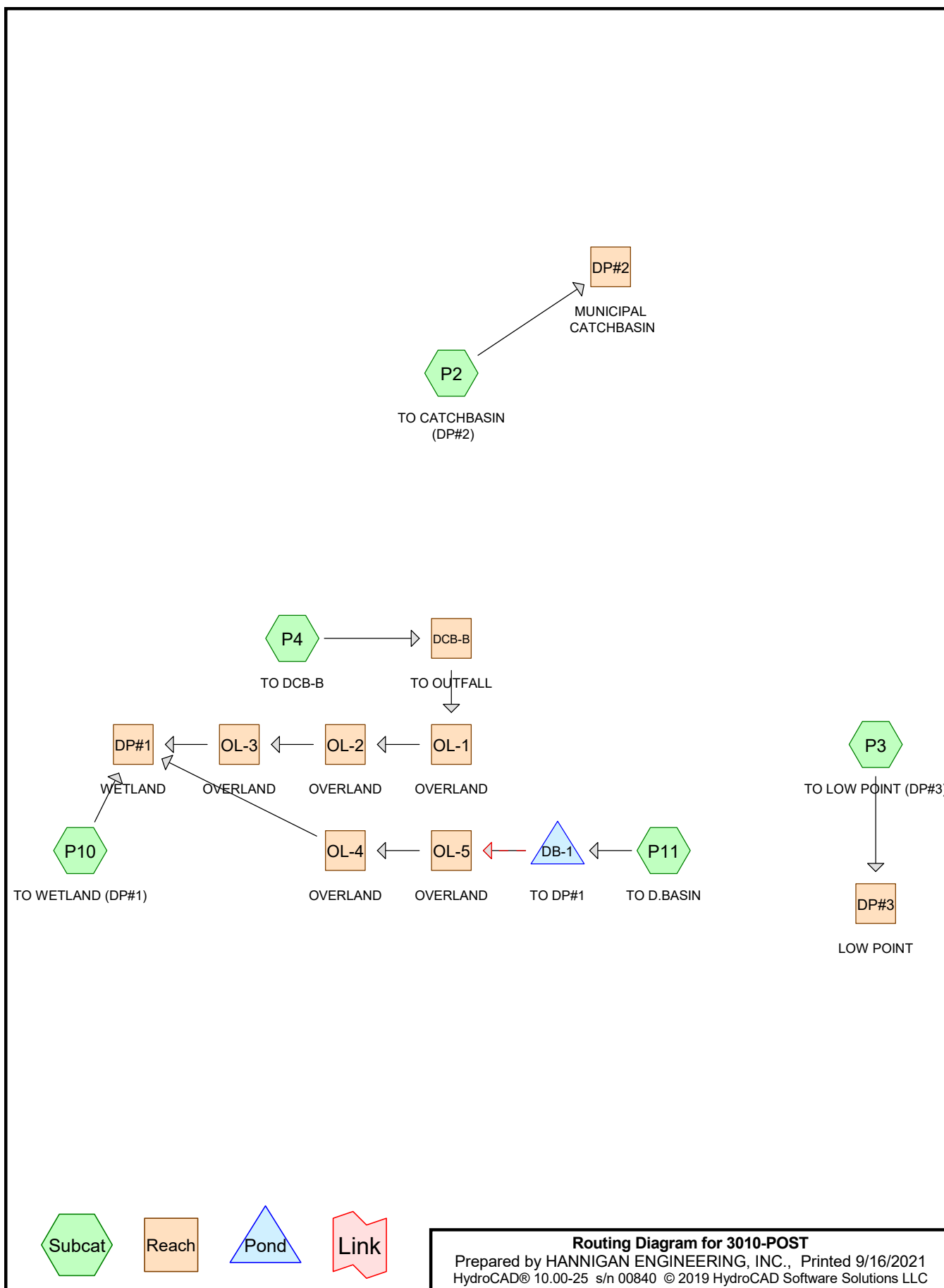
**Reach OL-4: OVERLAND**

Hydrograph



**2.2**  
**POST DEVELOPMENT CALCULATIONS**





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### Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.930	74	>75% Grass cover, Good, HSG C (P10, P11, P2, P3, P4)
0.467	89	Gravel roads, HSG C (P10, P11, P2, P3)
0.657	98	Paved parking, HSG C (P10, P2, P3, P4)
0.038	98	Unconnected pavement, HSG C (P10, P11)
2.069	70	Woods, Good, HSG C (P10, P2, P3)
<b>4.161</b>	<b>78</b>	<b>TOTAL AREA</b>

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#### Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
4.161	HSG C	P10, P11, P2, P3, P4
0.000	HSG D	
0.000	Other	
<b>4.161</b>		<b>TOTAL AREA</b>

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**Ground Covers (all nodes)**

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.930	0.000	0.000	0.930	>75% Grass cover, Good	P10, P11, P2, P3, P4
0.000	0.000	0.467	0.000	0.000	0.467	Gravel roads	P10, P11, P2, P3
0.000	0.000	0.657	0.000	0.000	0.657	Paved parking	P10, P2, P3, P4
0.000	0.000	0.038	0.000	0.000	0.038	Unconnected pavement	P10, P11
0.000	0.000	2.069	0.000	0.000	2.069	Woods, Good	P10, P2, P3
<b>0.000</b>	<b>0.000</b>	<b>4.161</b>	<b>0.000</b>	<b>0.000</b>	<b>4.161</b>	<b>TOTAL AREA</b>	

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#### Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	DB-1	87.40	87.00	30.0	0.0133	0.013	12.0	0.0	0.0

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Type III 24-hr 2-Year Rainfall=3.00"

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment P10: TO WETLAND (DP#1)** Runoff Area=66,334 sf 6.95% Impervious Runoff Depth=0.91"  
 Flow Length=537' Tc=13.2 min CN=74 Runoff=1.18 cfs 0.115 af

**Subcatchment P11: TO D.BASIN** Runoff Area=18,069 sf 6.88% Impervious Runoff Depth=1.25"  
 Flow Length=220' Tc=5.0 min CN=80 Runoff=0.60 cfs 0.043 af

**Subcatchment P2: TO CATCHBASIN (DP#2)** Runoff Area=9,069 sf 84.42% Impervious Runoff Depth=2.35"  
 Flow Length=427' Slope=0.0600 '/' Tc=5.0 min CN=94 Runoff=0.56 cfs 0.041 af

**Subcatchment P3: TO LOW POINT (DP#3)** Runoff Area=82,313 sf 15.10% Impervious Runoff Depth=1.07"  
 Flow Length=356' Tc=5.0 min CN=77 Runoff=2.30 cfs 0.169 af

**Subcatchment P4: TO DCB-B** Runoff Area=5,470 sf 79.63% Impervious Runoff Depth=2.25"  
 Flow Length=217' Slope=0.0600 '/' Tc=5.0 min CN=93 Runoff=0.32 cfs 0.024 af

**Reach DCB-B: TO OUTFALL** Inflow=0.32 cfs 0.024 af  
 Outflow=0.32 cfs 0.024 af

**Reach DP#1: WETLAND** Inflow=1.29 cfs 0.182 af  
 Outflow=1.29 cfs 0.182 af

**Reach DP#2: MUNICIPAL CATCHBASIN** Inflow=0.56 cfs 0.041 af  
 Outflow=0.56 cfs 0.041 af

**Reach DP#3: LOW POINT** Inflow=2.30 cfs 0.169 af  
 Outflow=2.30 cfs 0.169 af

**Reach OL-1: OVERLAND** Avg. Flow Depth=0.03' Max Vel=0.62 fps Inflow=0.32 cfs 0.024 af  
 n=0.080 L=66.0' S=0.1061 '/' Capacity=120.62 cfs Outflow=0.30 cfs 0.024 af

**Reach OL-2: OVERLAND** Avg. Flow Depth=0.05' Max Vel=0.36 fps Inflow=0.30 cfs 0.024 af  
 n=0.080 L=170.0' S=0.0235 '/' Capacity=56.81 cfs Outflow=0.24 cfs 0.024 af

**Reach OL-3: OVERLAND** Avg. Flow Depth=0.03' Max Vel=0.48 fps Inflow=0.24 cfs 0.024 af  
 n=0.080 L=189.0' S=0.0720 '/' Capacity=99.35 cfs Outflow=0.22 cfs 0.024 af

**Reach OL-4: OVERLAND** Avg. Flow Depth=0.04' Max Vel=0.15 fps Inflow=0.17 cfs 0.043 af  
 n=0.080 L=128.0' S=0.0050 '/' Capacity=45.22 cfs Outflow=0.17 cfs 0.043 af

**Reach OL-5: OVERLAND** Avg. Flow Depth=0.03' Max Vel=0.34 fps Inflow=0.17 cfs 0.043 af  
 n=0.080 L=31.0' S=0.0323 '/' Capacity=66.52 cfs Outflow=0.17 cfs 0.043 af

**Pond DB-1: TO DP#1** Peak Elev=89.37' Storage=446 cf Inflow=0.60 cfs 0.043 af  
 Primary=0.17 cfs 0.043 af Secondary=0.00 cfs 0.000 af Outflow=0.17 cfs 0.043 af

**Total Runoff Area = 4.161 ac Runoff Volume = 0.391 af Average Runoff Depth = 1.13"**  
**83.28% Pervious = 3.465 ac 16.72% Impervious = 0.696 ac**

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Type III 24-hr 2-Year Rainfall=3.00"

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**Summary for Subcatchment P10: TO WETLAND (DP#1)**

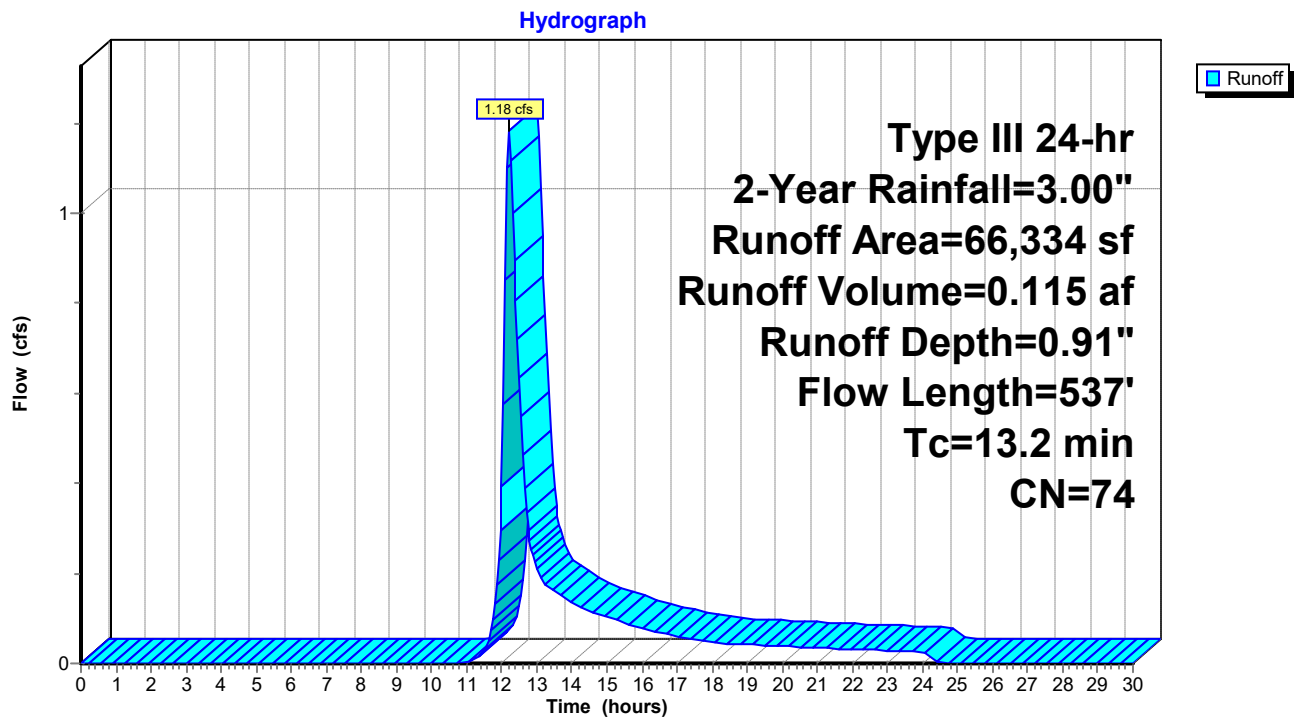
Runoff = 1.18 cfs @ 12.20 hrs, Volume= 0.115 af, Depth= 0.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
19,547	74	>75% Grass cover, Good, HSG C
40,200	70	Woods, Good, HSG C
4,194	98	Paved parking, HSG C
1,978	89	Gravel roads, HSG C
415	98	Unconnected pavement, HSG C
66,334	74	Weighted Average
61,725		93.05% Pervious Area
4,609		6.95% Impervious Area
415		9.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	13	0.2150	0.13		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.00"
0.8	9	0.1000	0.19		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.00"
0.7	28	0.0060	0.64		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.5	50	0.0060	1.57		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.3	28	0.0120	1.76		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
0.6	64	0.0120	1.76		<b>Shallow Concentrated Flow, grass</b> Unpaved Kv= 16.1 fps
0.2	65	0.0830	4.64		<b>Shallow Concentrated Flow, grass</b> Unpaved Kv= 16.1 fps
0.2	40	0.0300	2.79		<b>Shallow Concentrated Flow, grass</b> Unpaved Kv= 16.1 fps
2.2	112	0.0300	0.87		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
6.0	128	0.0050	0.35		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.2	537	Total			

**Subcatchment P10: TO WETLAND (DP#1)**



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Type III 24-hr 2-Year Rainfall=3.00"

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**Summary for Subcatchment P11: TO D.BASIN**

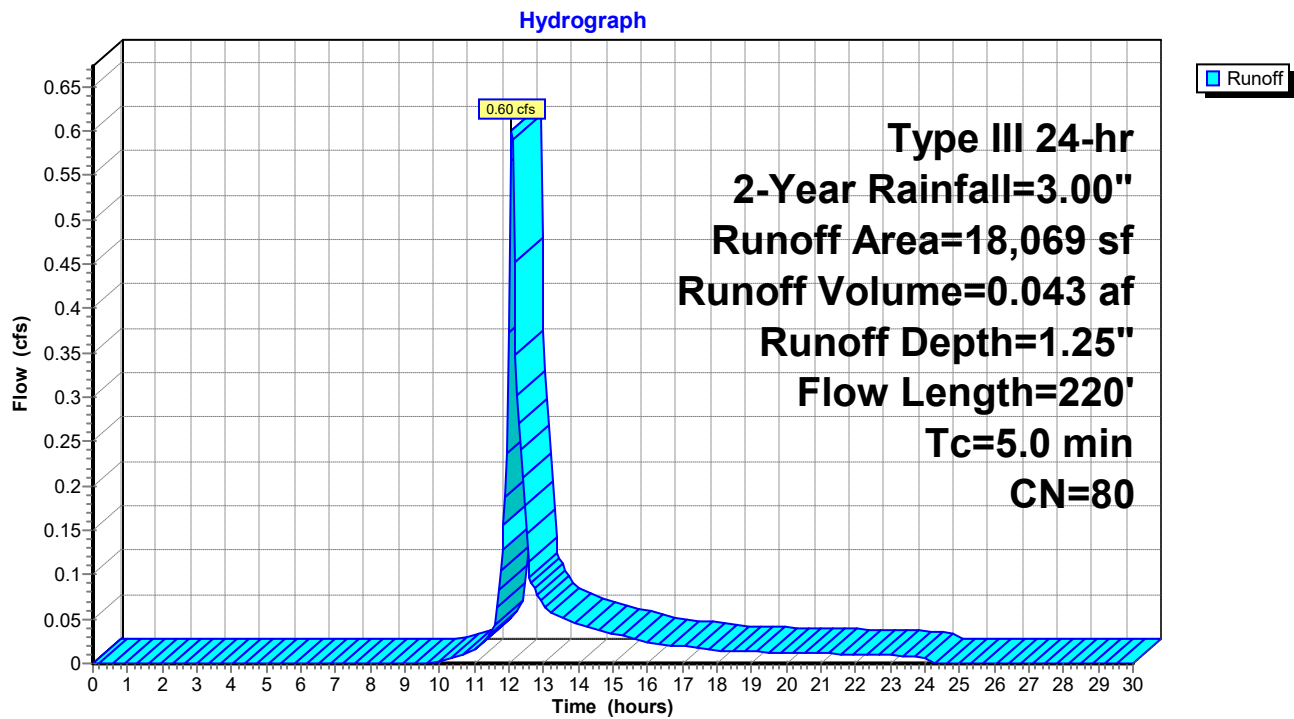
Runoff = 0.60 cfs @ 12.08 hrs, Volume= 0.043 af, Depth= 1.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
11,036	74	>75% Grass cover, Good, HSG C
1,244	98	Unconnected pavement, HSG C
5,789	89	Gravel roads, HSG C
18,069	80	Weighted Average
16,825		93.12% Pervious Area
1,244		6.88% Impervious Area
1,244		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	50	0.0830	2.05		<b>Sheet Flow, GRAVEL</b> Smooth surfaces n= 0.011 P2= 3.00"
0.0	13	0.0830	4.64		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
0.5	119	0.0550	3.78		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
0.1	38	0.5000	11.38		<b>Shallow Concentrated Flow, GRASS</b> Unpaved Kv= 16.1 fps
1.0	220	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment P11: TO D.BASIN**

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Type III 24-hr 2-Year Rainfall=3.00"

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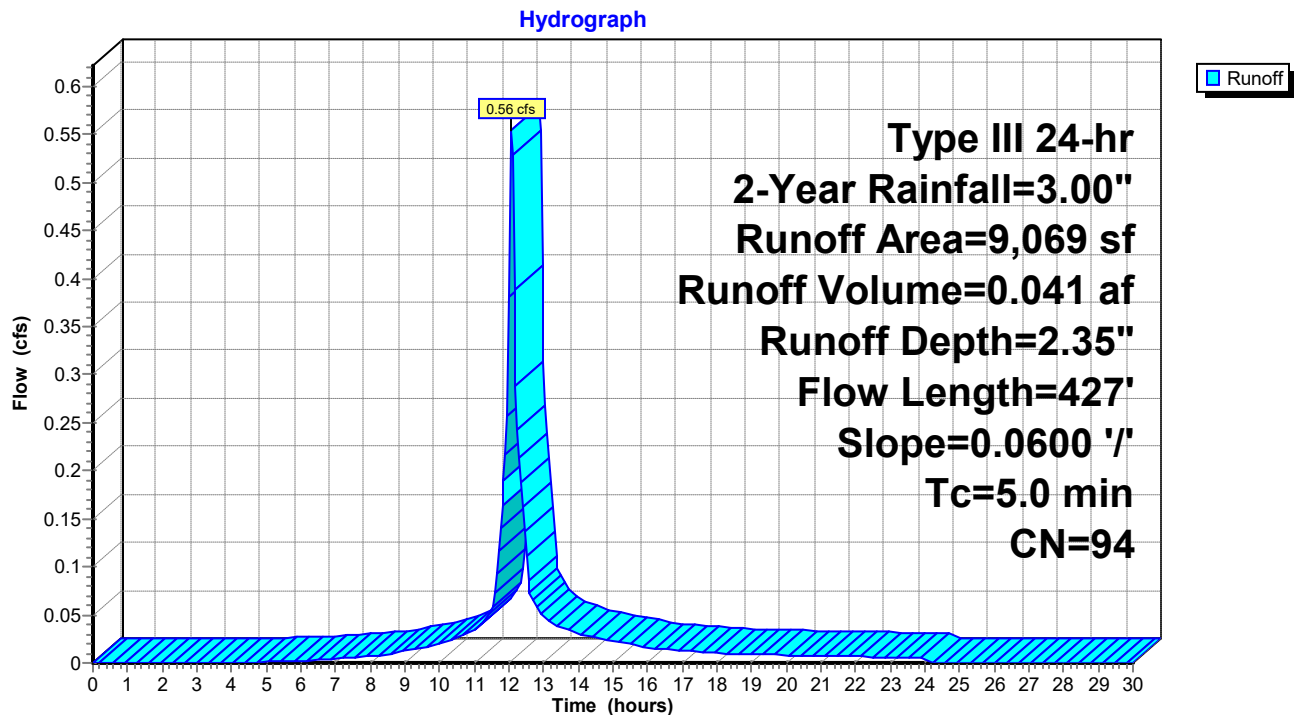
**Summary for Subcatchment P2: TO CATCHBASIN (DP#2)**

Runoff = 0.56 cfs @ 12.07 hrs, Volume= 0.041 af, Depth= 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
794	74	>75% Grass cover, Good, HSG C
523	70	Woods, Good, HSG C
7,656	98	Paved parking, HSG C
96	89	Gravel roads, HSG C
9,069	94	Weighted Average
1,413		15.58% Pervious Area
7,656		84.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0600	1.80		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
1.3	377	0.0600	4.97		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.8	427	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment P2: TO CATCHBASIN (DP#2)**

**3010-POST**

Type III 24-hr 2-Year Rainfall=3.00"

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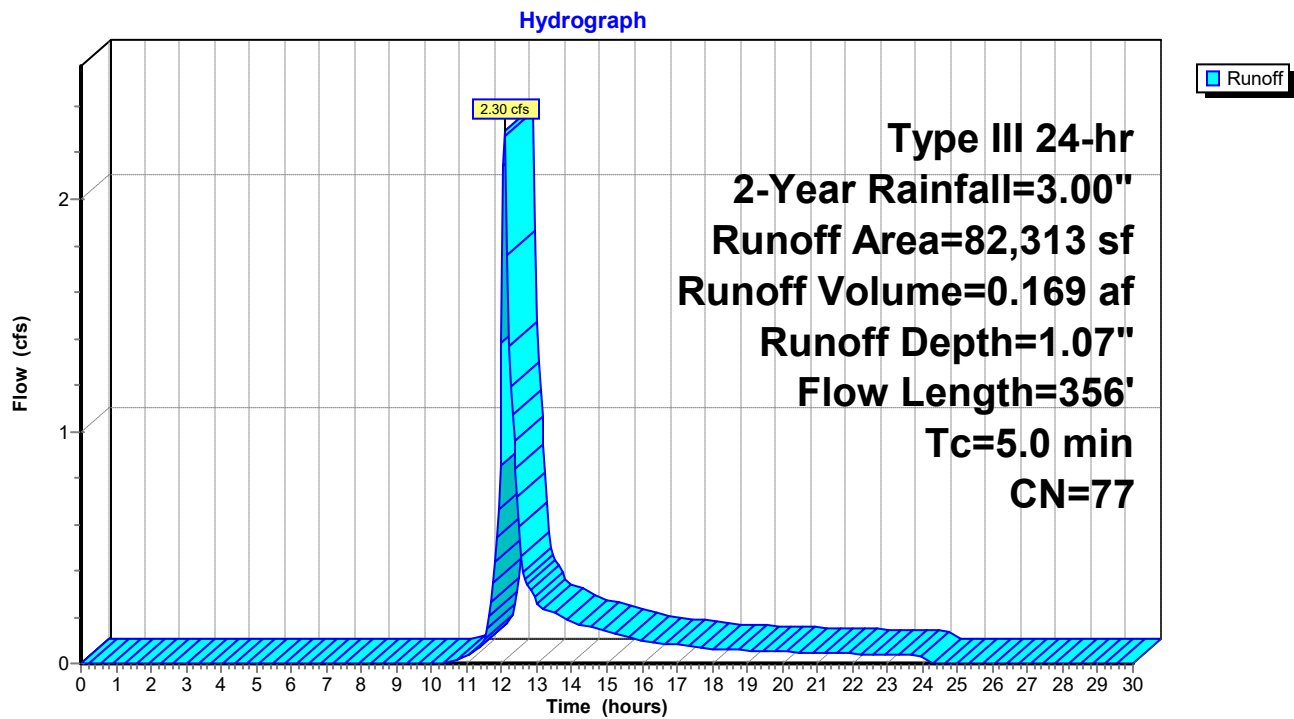
**Summary for Subcatchment P3: TO LOW POINT (DP#3)**

Runoff = 2.30 cfs @ 12.09 hrs, Volume= 0.169 af, Depth= 1.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
8,024	74	>75% Grass cover, Good, HSG C
49,390	70	Woods, Good, HSG C
12,433	98	Paved parking, HSG C
12,466	89	Gravel roads, HSG C
82,313	77	Weighted Average
69,880		84.90% Pervious Area
12,433		15.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	35	0.1400	2.35		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.2	15	0.0320	1.10		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.2	53	0.0320	3.63		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.3	54	0.0320	2.88		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
0.0	28	0.4200	10.43		<b>Shallow Concentrated Flow, GRASS/BRUSH</b> Unpaved Kv= 16.1 fps
1.4	171	0.1600	2.00		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
2.3	356	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment P3: TO LOW POINT (DP#3)**

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Type III 24-hr 2-Year Rainfall=3.00"

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**Summary for Subcatchment P4: TO DCB-B**

Runoff = 0.32 cfs @ 12.07 hrs, Volume= 0.024 af, Depth= 2.25"

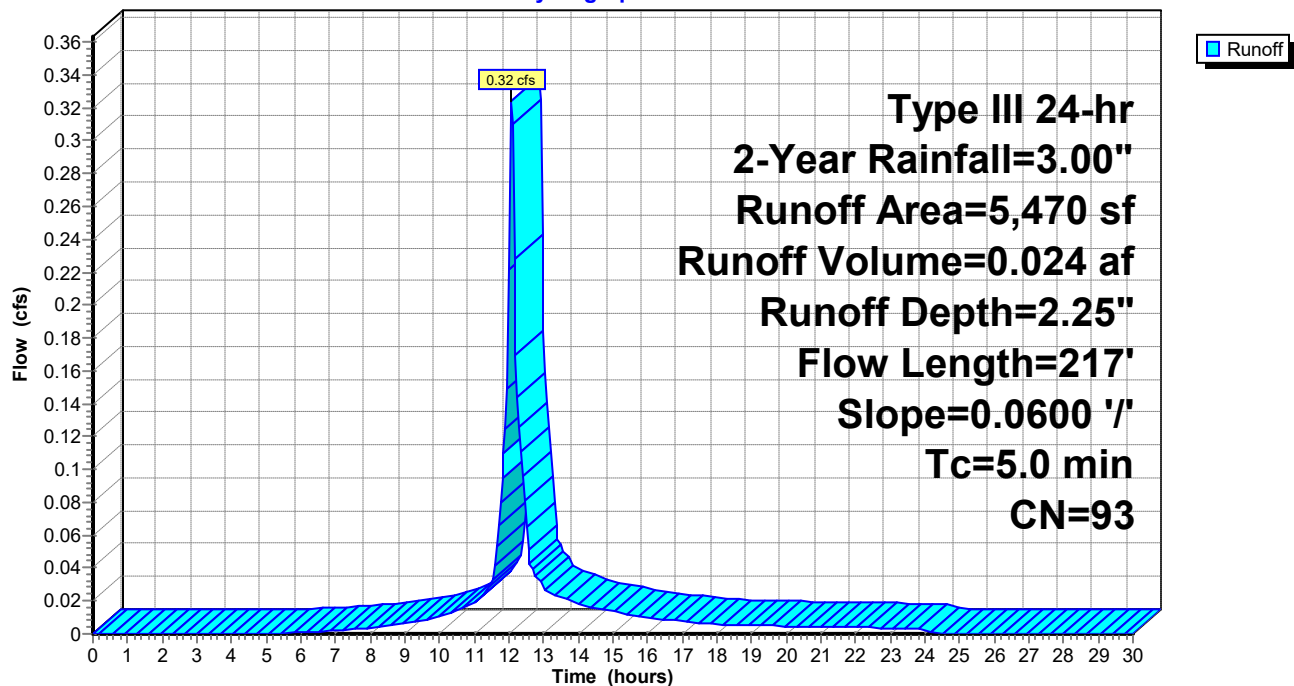
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Year Rainfall=3.00"

Area (sf)	CN	Description
1,114	74	>75% Grass cover, Good, HSG C
4,356	98	Paved parking, HSG C
5,470	93	Weighted Average
1,114		20.37% Pervious Area
4,356		79.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0600	1.80		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.6	167	0.0600	4.97		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.1	217	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment P4: TO DCB-B**

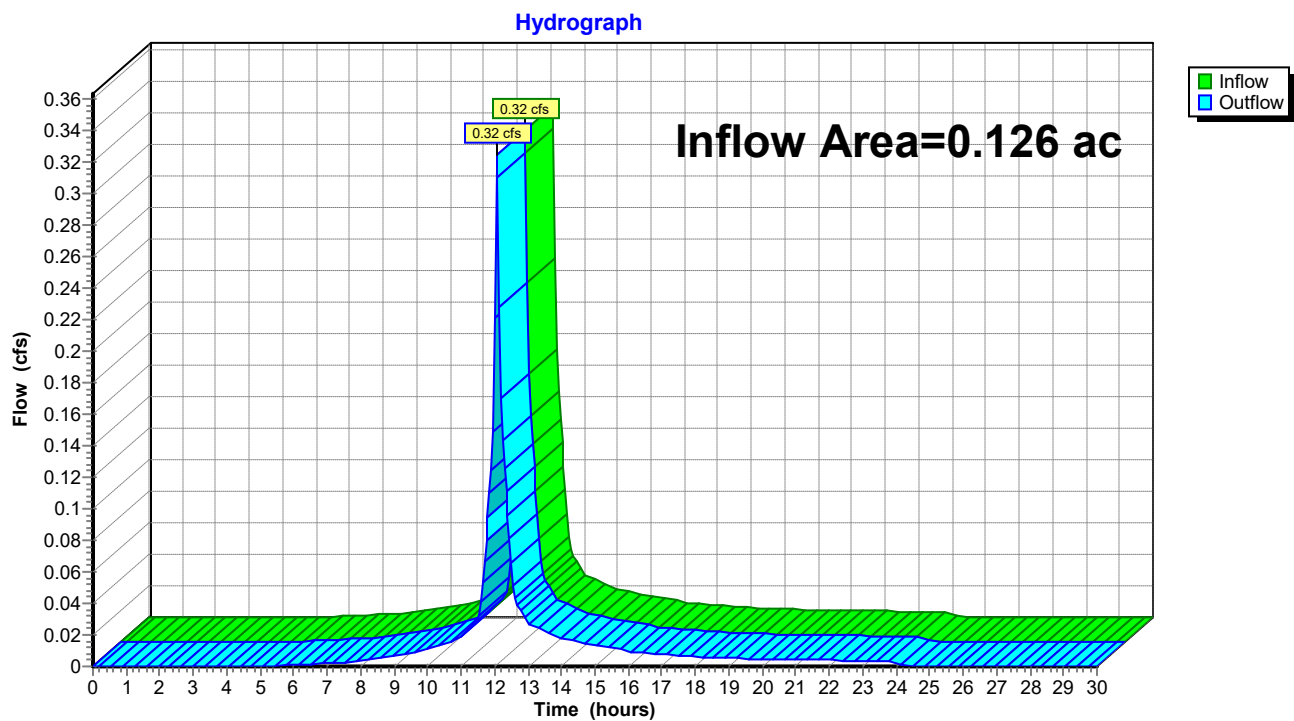
Hydrograph



**Summary for Reach DCB-B: TO OUTFALL**

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 2.25" for 2-Year event  
Inflow = 0.32 cfs @ 12.07 hrs, Volume= 0.024 af  
Outflow = 0.32 cfs @ 12.07 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DCB-B: TO OUTFALL**

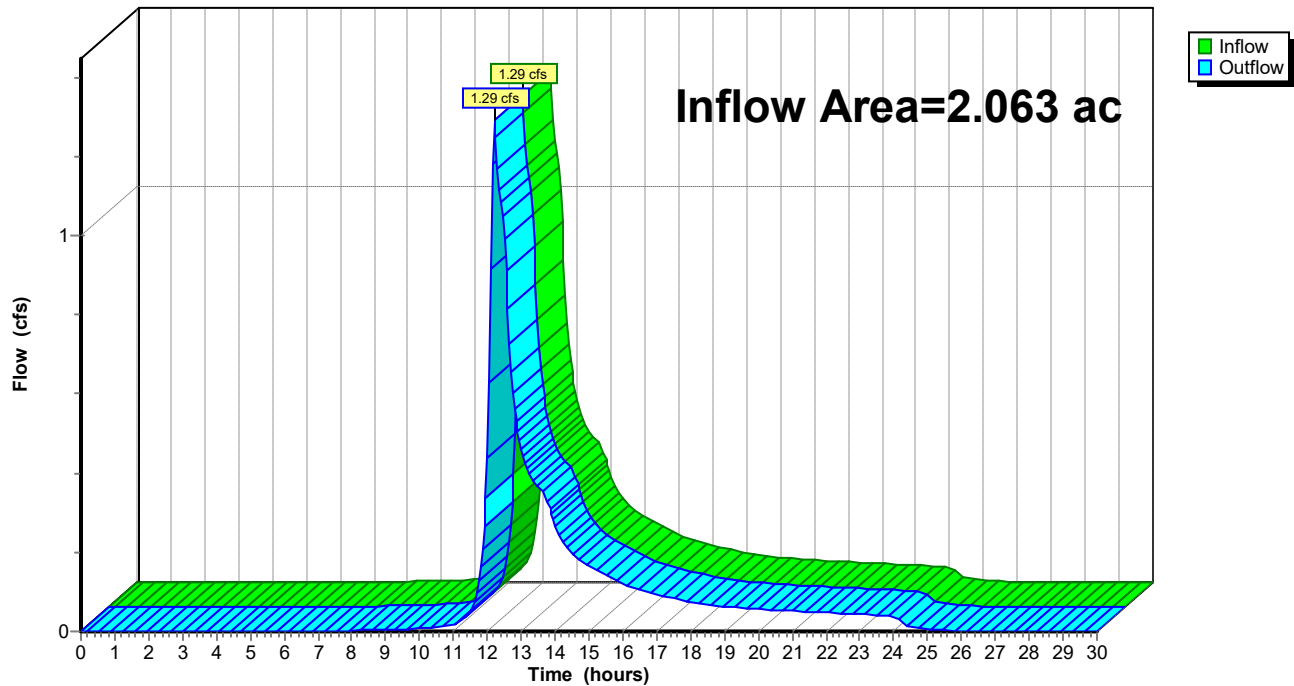
**Summary for Reach DP#1: WETLAND**

Inflow Area = 2.063 ac, 11.36% Impervious, Inflow Depth = 1.06" for 2-Year event  
Inflow = 1.29 cfs @ 12.21 hrs, Volume= 0.182 af  
Outflow = 1.29 cfs @ 12.21 hrs, Volume= 0.182 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#1: WETLAND**

Hydrograph

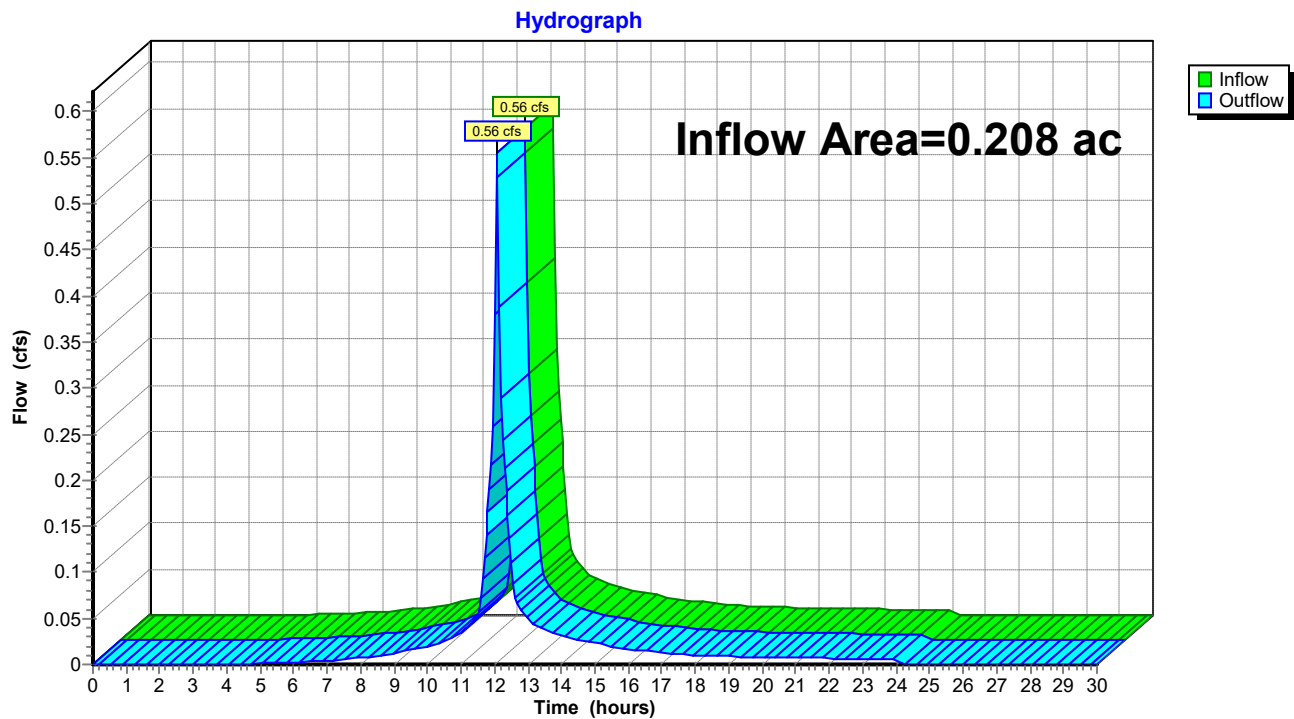




**Summary for Reach DP#2: MUNICIPAL CATCHBASIN**

Inflow Area = 0.208 ac, 84.42% Impervious, Inflow Depth = 2.35" for 2-Year event  
Inflow = 0.56 cfs @ 12.07 hrs, Volume= 0.041 af  
Outflow = 0.56 cfs @ 12.07 hrs, Volume= 0.041 af, Atten= 0%, Lag= 0.0 min

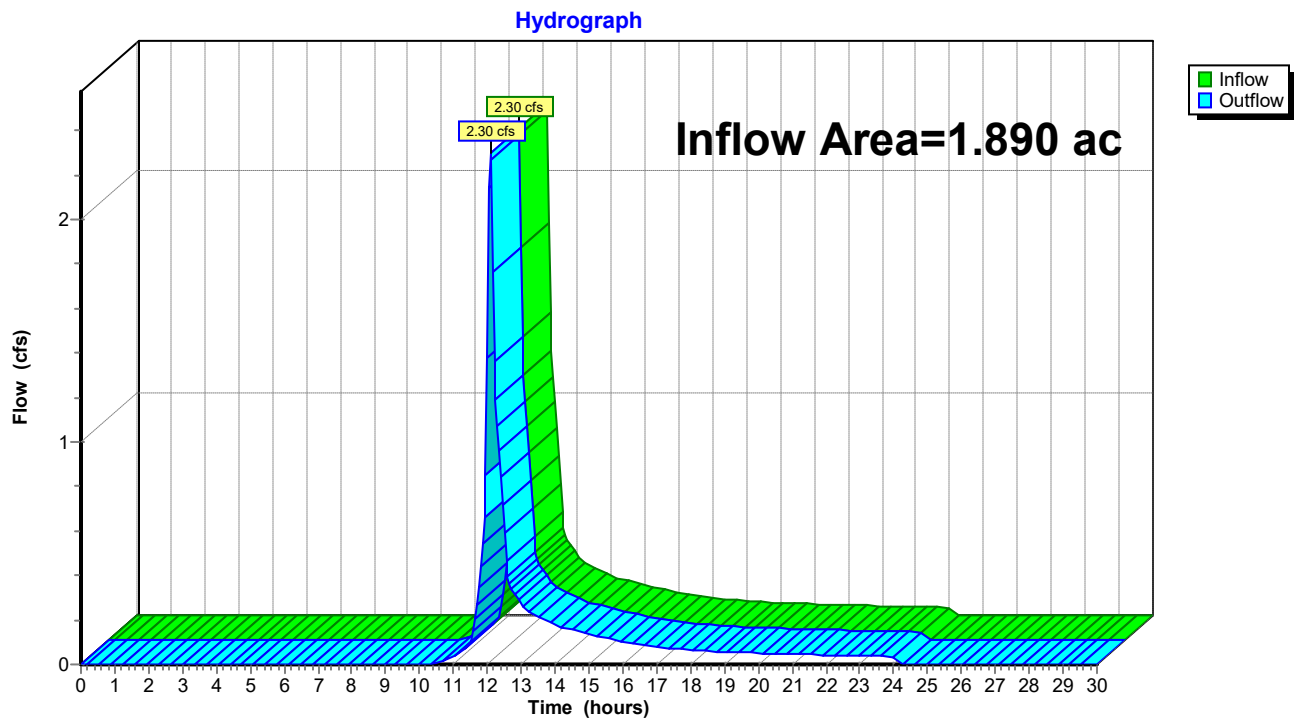
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#2: MUNICIPAL CATCHBASIN**

**Summary for Reach DP#3: LOW POINT**

Inflow Area = 1.890 ac, 15.10% Impervious, Inflow Depth = 1.07" for 2-Year event  
Inflow = 2.30 cfs @ 12.09 hrs, Volume= 0.169 af  
Outflow = 2.30 cfs @ 12.09 hrs, Volume= 0.169 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#3: LOW POINT**

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### Summary for Reach OL-1: OVERLAND

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 2.25" for 2-Year event  
Inflow = 0.32 cfs @ 12.07 hrs, Volume= 0.024 af  
Outflow = 0.30 cfs @ 12.13 hrs, Volume= 0.024 af, Atten= 7%, Lag= 3.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.62 fps, Min. Travel Time= 1.8 min

Avg. Velocity= 0.29 fps, Avg. Travel Time= 3.8 min

Peak Storage= 34 cf @ 12.10 hrs

Average Depth at Peak Storage= 0.03'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 120.62 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 35.00'

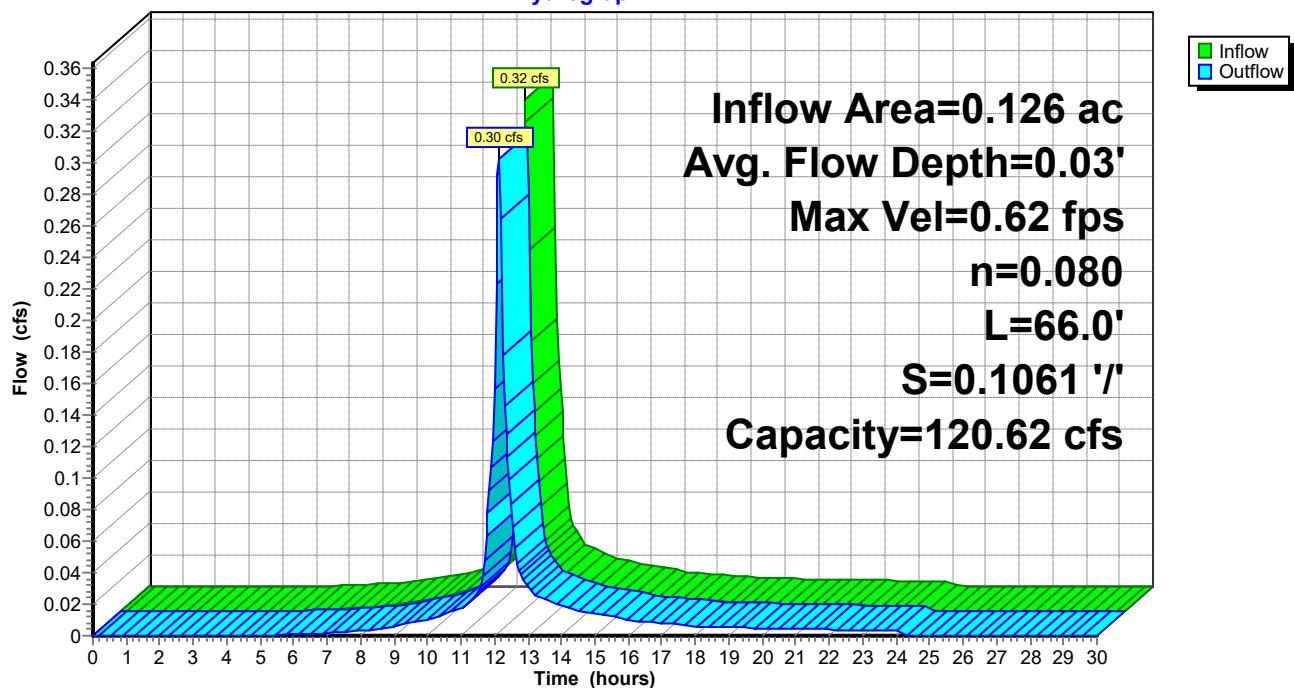
Length= 66.0' Slope= 0.1061 '/'

Inlet Invert= 109.00', Outlet Invert= 102.00'



### Reach OL-1: OVERLAND

#### Hydrograph



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### Summary for Reach OL-2: OVERLAND

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 2.25" for 2-Year event  
Inflow = 0.30 cfs @ 12.13 hrs, Volume= 0.024 af  
Outflow = 0.24 cfs @ 12.33 hrs, Volume= 0.024 af, Atten= 19%, Lag= 12.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.36 fps, Min. Travel Time= 8.0 min

Avg. Velocity= 0.14 fps, Avg. Travel Time= 20.2 min

Peak Storage= 119 cf @ 12.20 hrs

Average Depth at Peak Storage= 0.05'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 56.81 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 ' Top Width= 35.00'

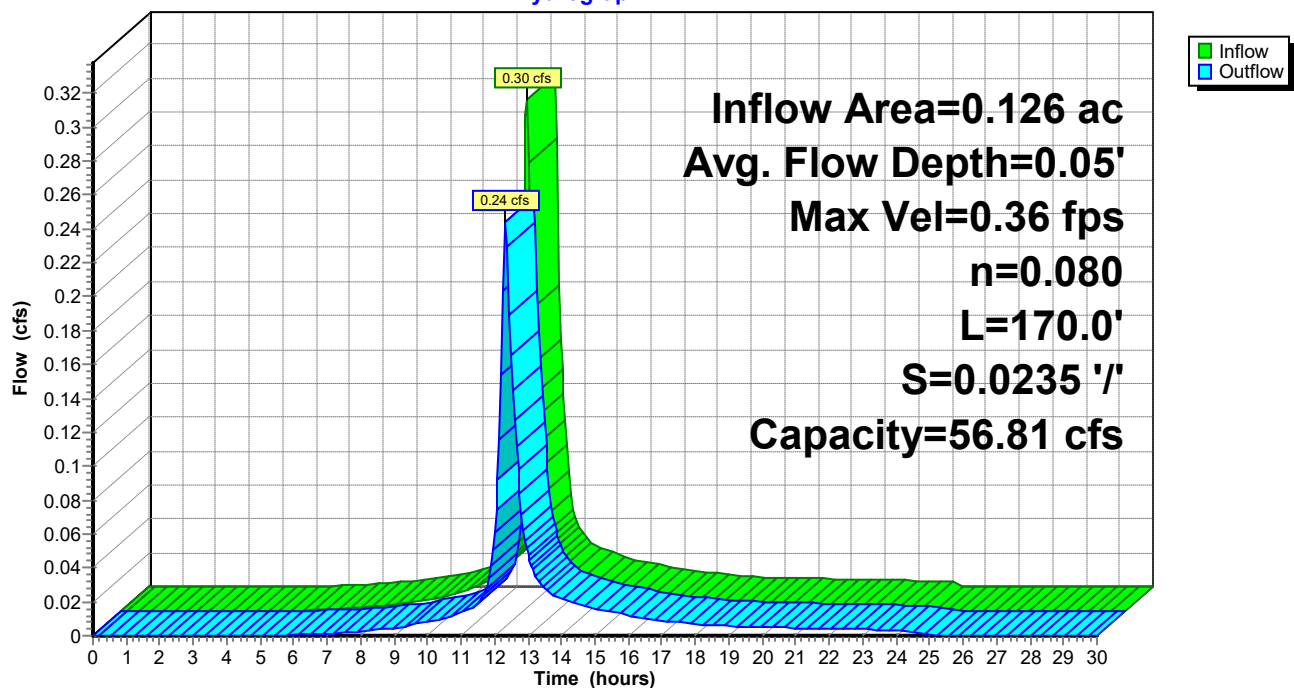
Length= 170.0' Slope= 0.0235 '/'

Inlet Invert= 102.00', Outlet Invert= 98.00'



### Reach OL-2: OVERLAND

#### Hydrograph



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### Summary for Reach OL-3: OVERLAND

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 2.25" for 2-Year event  
Inflow = 0.24 cfs @ 12.33 hrs, Volume= 0.024 af  
Outflow = 0.22 cfs @ 12.51 hrs, Volume= 0.024 af, Atten= 11%, Lag= 11.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.48 fps, Min. Travel Time= 6.6 min

Avg. Velocity= 0.24 fps, Avg. Travel Time= 13.3 min

Peak Storage= 87 cf @ 12.40 hrs

Average Depth at Peak Storage= 0.03'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 99.35 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 35.00'

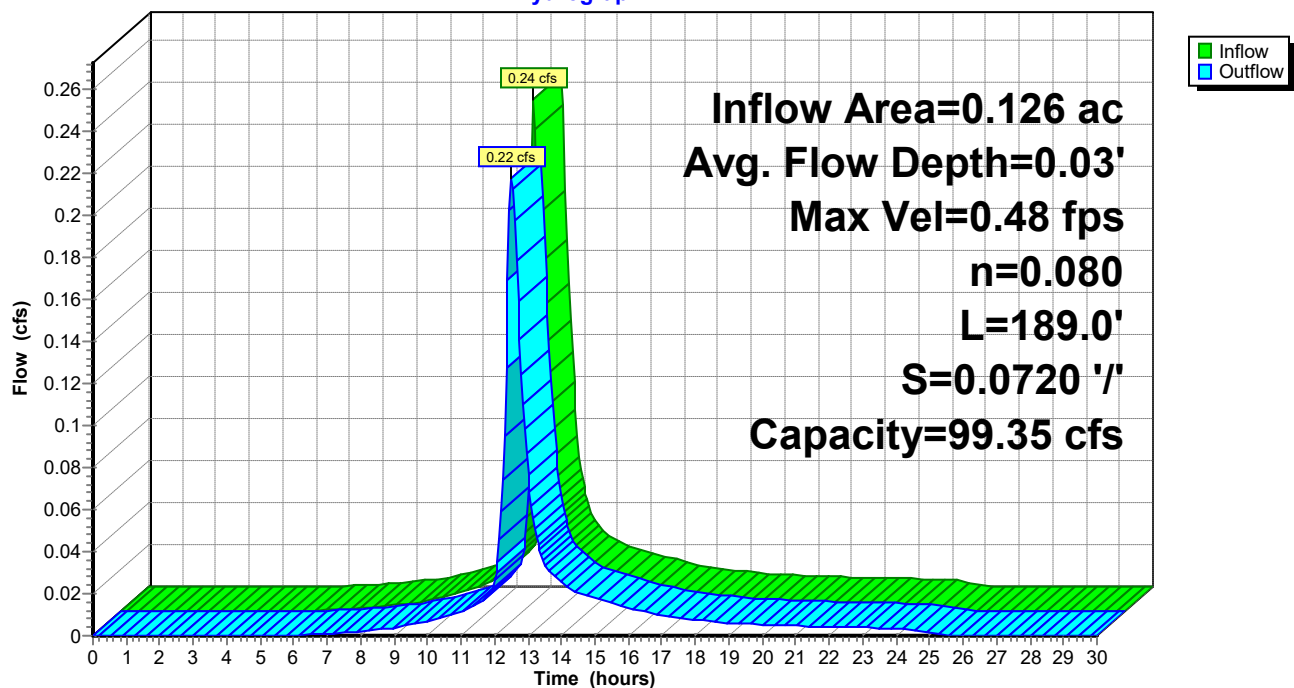
Length= 189.0' Slope= 0.0720 '/'

Inlet Invert= 98.00', Outlet Invert= 84.40'



### Reach OL-3: OVERLAND

#### Hydrograph



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Type III 24-hr 2-Year Rainfall=3.00"

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### Summary for Reach OL-4: OVERLAND

Inflow Area = 0.415 ac, 6.88% Impervious, Inflow Depth = 1.25" for 2-Year event  
Inflow = 0.17 cfs @ 12.15 hrs, Volume= 0.043 af  
Outflow = 0.17 cfs @ 13.55 hrs, Volume= 0.043 af, Atten= 0%, Lag= 84.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.15 fps, Min. Travel Time= 14.4 min

Avg. Velocity= 0.07 fps, Avg. Travel Time= 29.4 min

Peak Storage= 147 cf @ 13.35 hrs

Average Depth at Peak Storage= 0.04'

Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 45.22 cfs

30.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 ' Top Width= 50.00'

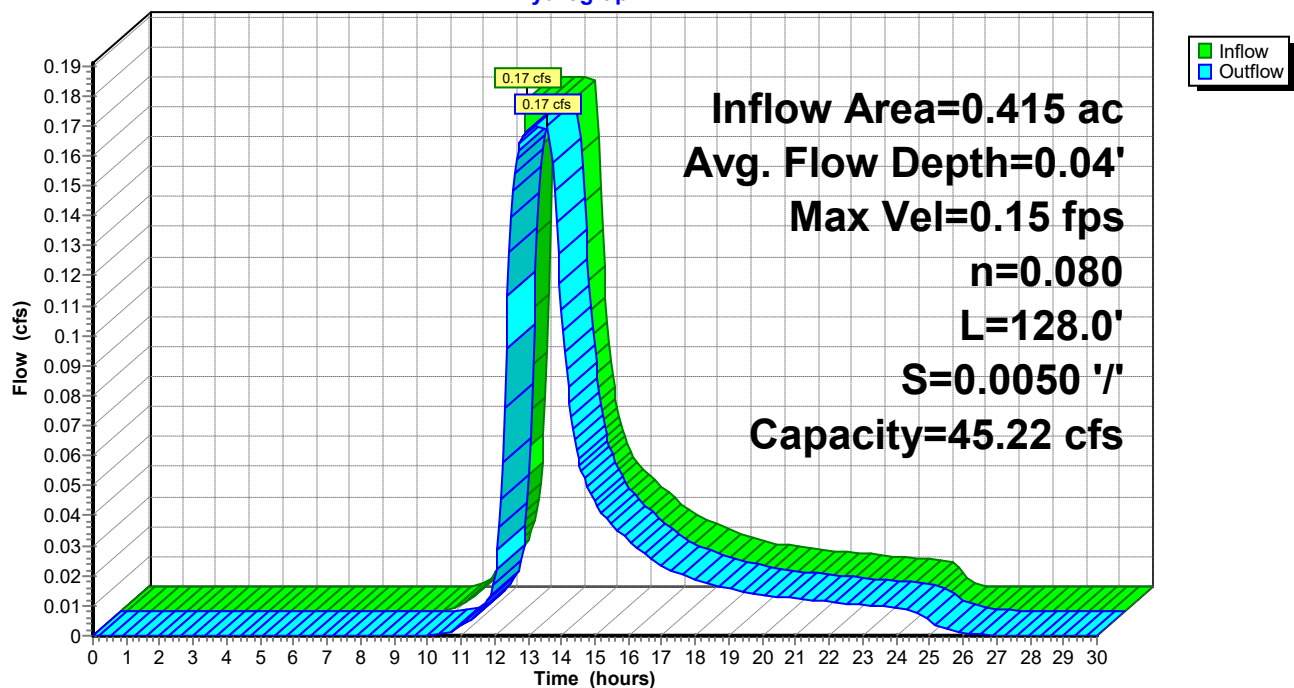
Length= 128.0' Slope= 0.0050 '/'

Inlet Invert= 85.00', Outlet Invert= 84.36'



### Reach OL-4: OVERLAND

#### Hydrograph



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Type III 24-hr 2-Year Rainfall=3.00"

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### Summary for Reach OL-5: OVERLAND

Inflow Area = 0.415 ac, 6.88% Impervious, Inflow Depth = 1.25" for 2-Year event  
Inflow = 0.17 cfs @ 12.05 hrs, Volume= 0.043 af  
Outflow = 0.17 cfs @ 12.15 hrs, Volume= 0.043 af, Atten= 0%, Lag= 6.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.34 fps, Min. Travel Time= 1.5 min

Avg. Velocity = 0.18 fps, Avg. Travel Time= 2.9 min

Peak Storage= 16 cf @ 12.10 hrs

Average Depth at Peak Storage= 0.03'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 66.52 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 35.00'

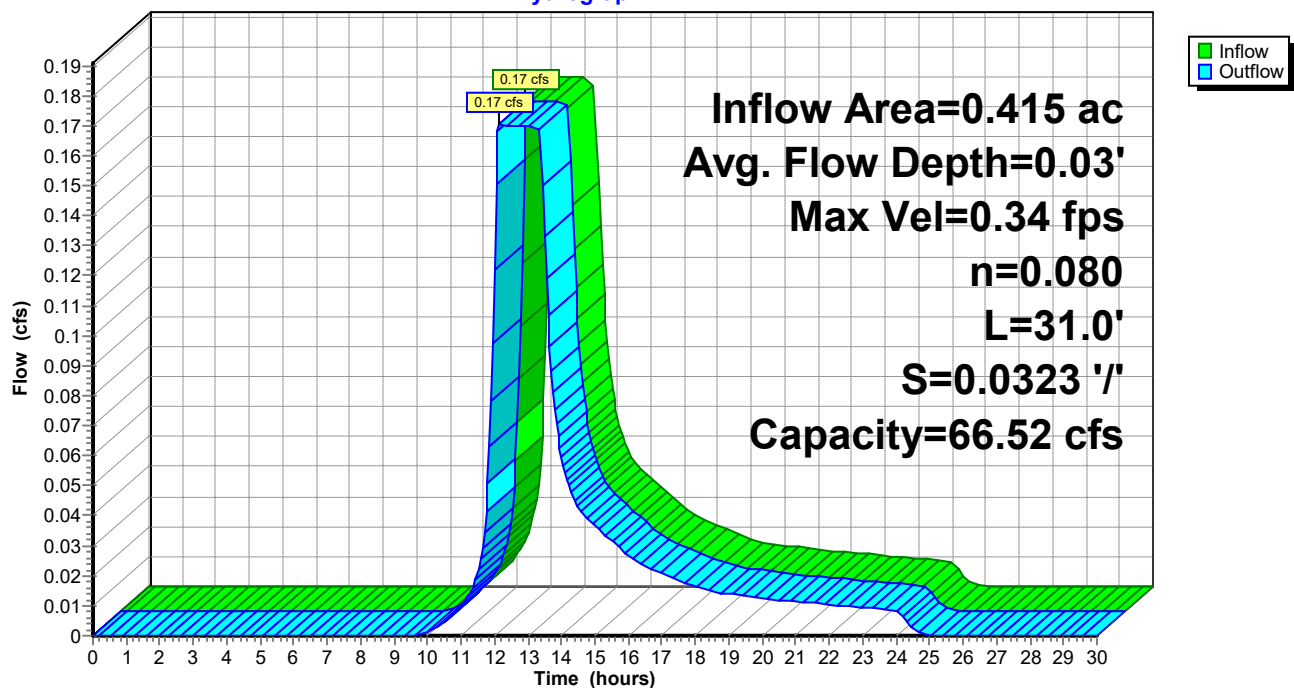
Length= 31.0' Slope= 0.0323 '/'

Inlet Invert= 86.00', Outlet Invert= 85.00'



### Reach OL-5: OVERLAND

#### Hydrograph



**Summary for Pond DB-1: TO DP#1**

Inflow Area = 0.415 ac, 6.88% Impervious, Inflow Depth = 1.25" for 2-Year event  
 Inflow = 0.60 cfs @ 12.08 hrs, Volume= 0.043 af  
 Outflow = 0.17 cfs @ 12.05 hrs, Volume= 0.043 af, Atten= 72%, Lag= 0.0 min  
 Primary = 0.17 cfs @ 12.05 hrs, Volume= 0.043 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
 Peak Elev= 89.37' @ 12.46 hrs Surf.Area= 1,308 sf Storage= 446 cf

Plug-Flow detention time= 22.7 min calculated for 0.043 af (100% of inflow)  
 Center-of-Mass det. time= 22.7 min ( 867.9 - 845.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	89.00'	5,994 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
89.00	1,090	0	0
90.00	1,676	1,383	1,383
92.00	2,935	4,611	5,994

Device	Routing	Invert	Outlet Devices
#1	Secondary	91.00'	<b>10.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Device 5	87.50'	<b>Special &amp; User-Defined</b> Head (feet) 0.00 1.00 15.00 Disch. (cfs) 0.000 0.170 0.170
#3	Device 5	90.50'	<b>2.6' long Sharp-Crested Rectangular Weir X 3.00</b> 2 End Contraction(s) 0.5' Crest Height
#4	Device 5	89.40'	<b>6.0" Vert. Orifice/Grate</b> C= 0.600
#5	Primary	87.40'	<b>12.0" Round Culvert</b> L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 87.40' / 87.00' S= 0.0133 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

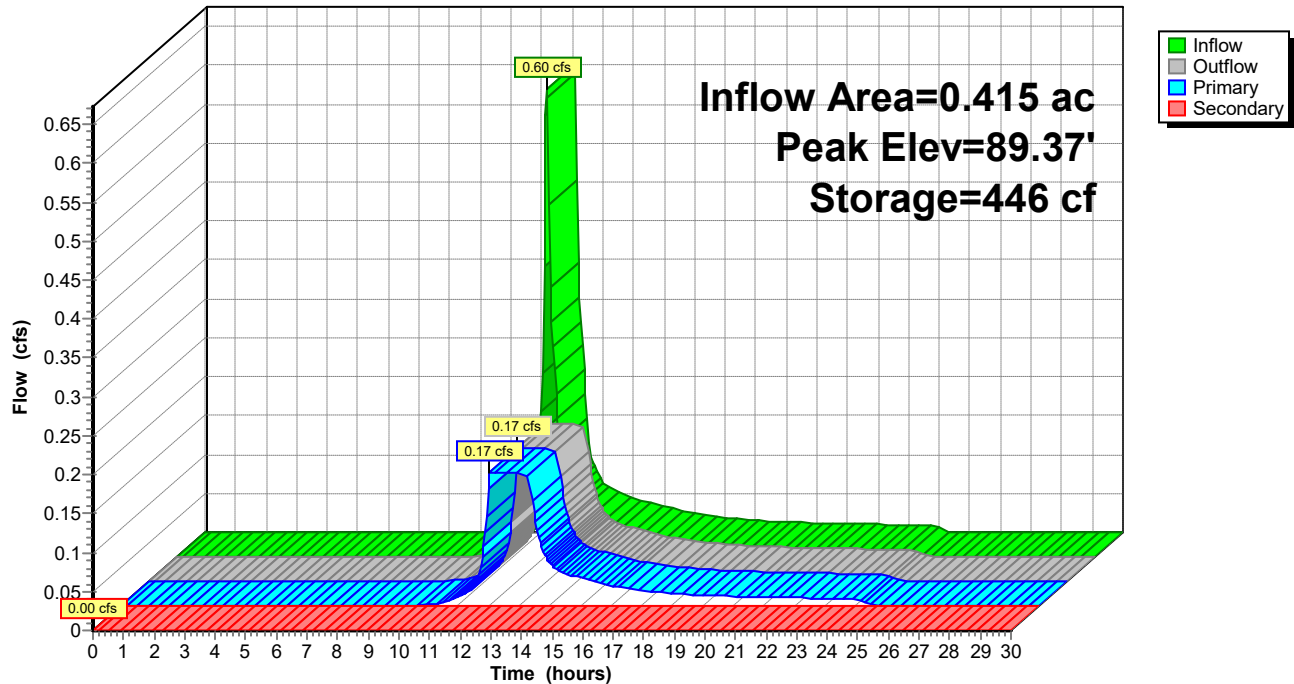
**Primary OutFlow** Max=0.17 cfs @ 12.05 hrs HW=89.17' (Free Discharge)

↑ **5=Culvert** (Passes 0.17 cfs of 3.36 cfs potential flow)  
 ↑ **2=Special & User-Defined** (Custom Controls 0.17 cfs)  
 ↑ **3=Sharp-Crested Rectangular Weir** ( Controls 0.00 cfs)  
 ↑ **4=Orifice/Grate** ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=89.00' (Free Discharge)

↑ **1=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)



**Pond DB-1: TO DP#1****Hydrograph**

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Type III 24-hr 10-Year Rainfall=4.50"

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment P10: TO WETLAND (DP#1)** Runoff Area=66,334 sf 6.95% Impervious Runoff Depth=1.97"  
 Flow Length=537' Tc=13.2 min CN=74 Runoff=2.73 cfs 0.250 af

**Subcatchment P11: TO D.BASIN** Runoff Area=18,069 sf 6.88% Impervious Runoff Depth=2.46"  
 Flow Length=220' Tc=5.0 min CN=80 Runoff=1.20 cfs 0.085 af

**Subcatchment P2: TO CATCHBASIN (DP#2)** Runoff Area=9,069 sf 84.42% Impervious Runoff Depth=3.82"  
 Flow Length=427' Slope=0.0600 '/' Tc=5.0 min CN=94 Runoff=0.88 cfs 0.066 af

**Subcatchment P3: TO LOW POINT (DP#3)** Runoff Area=82,313 sf 15.10% Impervious Runoff Depth=2.21"  
 Flow Length=356' Tc=5.0 min CN=77 Runoff=4.89 cfs 0.348 af

**Subcatchment P4: TO DCB-B** Runoff Area=5,470 sf 79.63% Impervious Runoff Depth=3.71"  
 Flow Length=217' Slope=0.0600 '/' Tc=5.0 min CN=93 Runoff=0.52 cfs 0.039 af

**Reach DCB-B: TO OUTFALL** Inflow=0.52 cfs 0.039 af  
 Outflow=0.52 cfs 0.039 af

**Reach DP#1: WETLAND** Inflow=3.02 cfs 0.374 af  
 Outflow=3.02 cfs 0.374 af

**Reach DP#2: MUNICIPAL CATCHBASIN** Inflow=0.88 cfs 0.066 af  
 Outflow=0.88 cfs 0.066 af

**Reach DP#3: LOW POINT** Inflow=4.89 cfs 0.348 af  
 Outflow=4.89 cfs 0.348 af

**Reach OL-1: OVERLAND** Avg. Flow Depth=0.04' Max Vel=0.75 fps Inflow=0.52 cfs 0.039 af  
 n=0.080 L=66.0' S=0.1061 '/' Capacity=120.62 cfs Outflow=0.49 cfs 0.039 af

**Reach OL-2: OVERLAND** Avg. Flow Depth=0.06' Max Vel=0.43 fps Inflow=0.49 cfs 0.039 af  
 n=0.080 L=170.0' S=0.0235 '/' Capacity=56.81 cfs Outflow=0.41 cfs 0.039 af

**Reach OL-3: OVERLAND** Avg. Flow Depth=0.04' Max Vel=0.59 fps Inflow=0.41 cfs 0.039 af  
 n=0.080 L=189.0' S=0.0720 '/' Capacity=99.35 cfs Outflow=0.37 cfs 0.039 af

**Reach OL-4: OVERLAND** Avg. Flow Depth=0.06' Max Vel=0.21 fps Inflow=0.43 cfs 0.085 af  
 n=0.080 L=128.0' S=0.0050 '/' Capacity=45.22 cfs Outflow=0.41 cfs 0.085 af

**Reach OL-5: OVERLAND** Avg. Flow Depth=0.06' Max Vel=0.49 fps Inflow=0.43 cfs 0.085 af  
 n=0.080 L=31.0' S=0.0323 '/' Capacity=66.52 cfs Outflow=0.43 cfs 0.085 af

**Pond DB-1: TO DP#1** Peak Elev=89.73' Storage=945 cf Inflow=1.20 cfs 0.085 af  
 Primary=0.43 cfs 0.085 af Secondary=0.00 cfs 0.000 af Outflow=0.43 cfs 0.085 af

**Total Runoff Area = 4.161 ac Runoff Volume = 0.788 af Average Runoff Depth = 2.27"**  
**83.28% Pervious = 3.465 ac 16.72% Impervious = 0.696 ac**

**3010-POST**

Type III 24-hr 10-Year Rainfall=4.50"

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**Summary for Subcatchment P10: TO WETLAND (DP#1)**

Runoff = 2.73 cfs @ 12.19 hrs, Volume= 0.250 af, Depth= 1.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
19,547	74	>75% Grass cover, Good, HSG C
40,200	70	Woods, Good, HSG C
4,194	98	Paved parking, HSG C
1,978	89	Gravel roads, HSG C
415	98	Unconnected pavement, HSG C
66,334	74	Weighted Average
61,725		93.05% Pervious Area
4,609		6.95% Impervious Area
415		9.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	13	0.2150	0.13		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.00"
0.8	9	0.1000	0.19		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.00"
0.7	28	0.0060	0.64		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.5	50	0.0060	1.57		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.3	28	0.0120	1.76		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
0.6	64	0.0120	1.76		<b>Shallow Concentrated Flow, grass</b> Unpaved Kv= 16.1 fps
0.2	65	0.0830	4.64		<b>Shallow Concentrated Flow, grass</b> Unpaved Kv= 16.1 fps
0.2	40	0.0300	2.79		<b>Shallow Concentrated Flow, grass</b> Unpaved Kv= 16.1 fps
2.2	112	0.0300	0.87		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
6.0	128	0.0050	0.35		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.2	537	Total			

# 3010-POST

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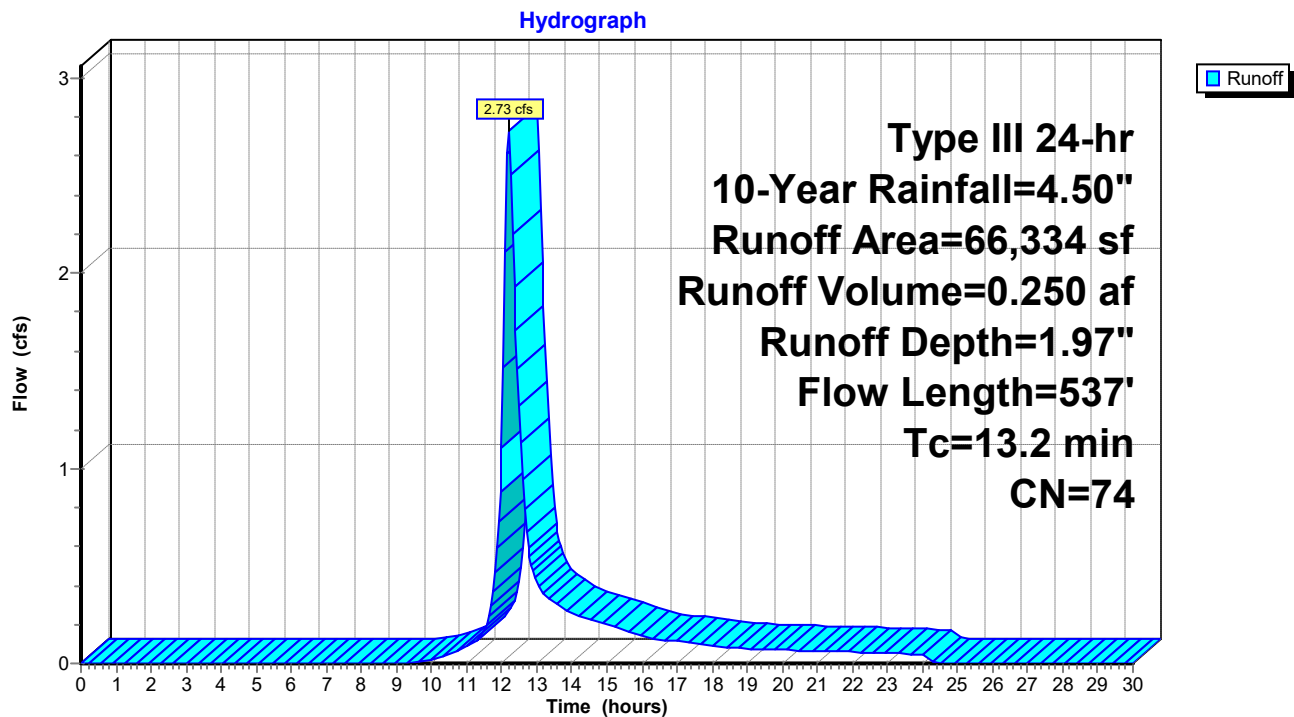
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Type III 24-hr 10-Year Rainfall=4.50"

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## Subcatchment P10: TO WETLAND (DP#1)



**3010-POST**

Type III 24-hr 10-Year Rainfall=4.50"

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**Summary for Subcatchment P11: TO D.BASIN**

Runoff = 1.20 cfs @ 12.08 hrs, Volume= 0.085 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
11,036	74	>75% Grass cover, Good, HSG C
1,244	98	Unconnected pavement, HSG C
5,789	89	Gravel roads, HSG C
18,069	80	Weighted Average
16,825		93.12% Pervious Area
1,244		6.88% Impervious Area
1,244		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	50	0.0830	2.05		<b>Sheet Flow, GRAVEL</b> Smooth surfaces n= 0.011 P2= 3.00"
0.0	13	0.0830	4.64		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
0.5	119	0.0550	3.78		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
0.1	38	0.5000	11.38		<b>Shallow Concentrated Flow, GRASS</b> Unpaved Kv= 16.1 fps
1.0	220	Total, Increased to minimum Tc = 5.0 min			

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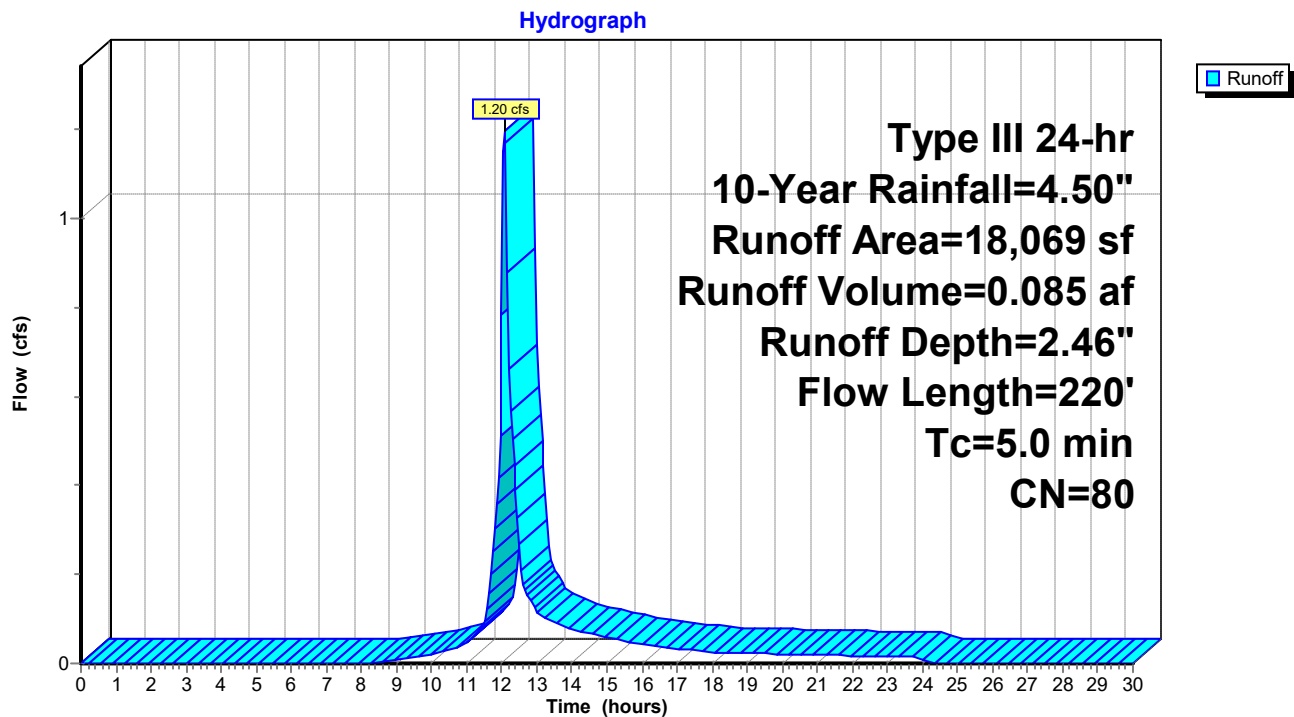
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Type III 24-hr 10-Year Rainfall=4.50"

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## Subcatchment P11: TO D.BASIN



**3010-POST**

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Type III 24-hr 10-Year Rainfall=4.50"

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**Summary for Subcatchment P2: TO CATCHBASIN (DP#2)**

Runoff = 0.88 cfs @ 12.07 hrs, Volume= 0.066 af, Depth= 3.82"

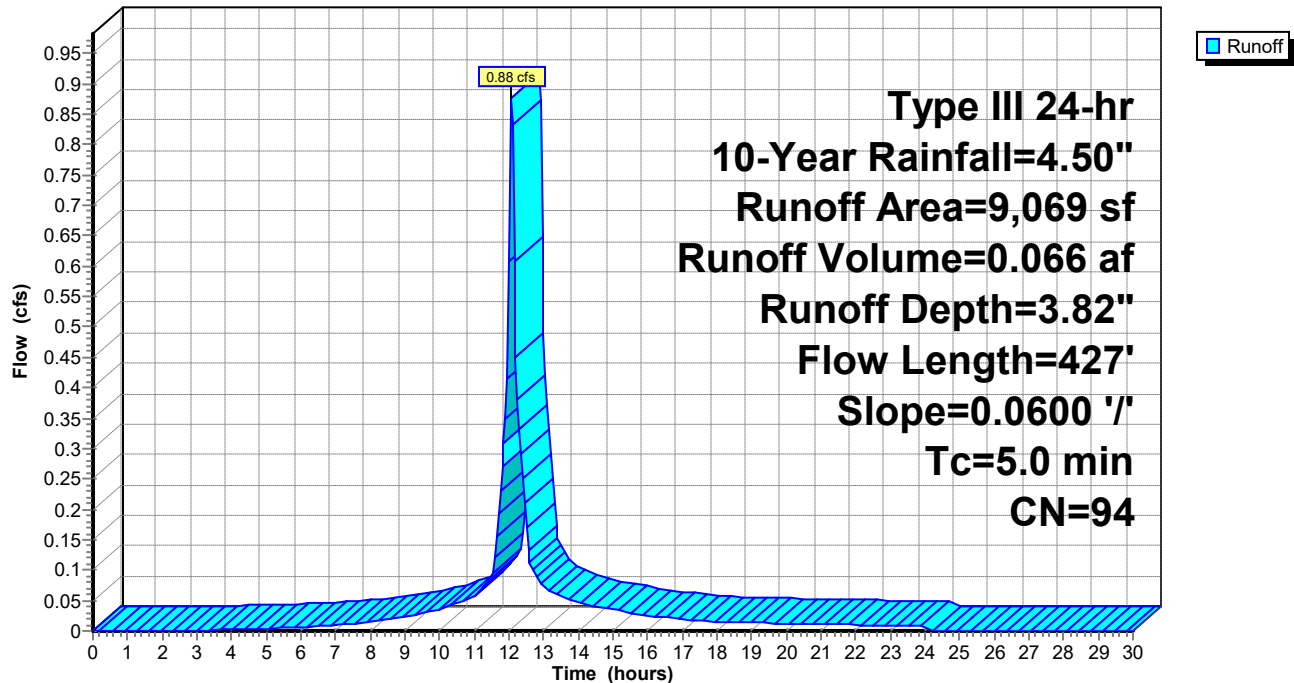
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
794	74	>75% Grass cover, Good, HSG C
523	70	Woods, Good, HSG C
7,656	98	Paved parking, HSG C
96	89	Gravel roads, HSG C
9,069	94	Weighted Average
1,413		15.58% Pervious Area
7,656		84.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0600	1.80		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
1.3	377	0.0600	4.97		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.8	427	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment P2: TO CATCHBASIN (DP#2)**

Hydrograph



**3010-POST**

Type III 24-hr 10-Year Rainfall=4.50"

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**Summary for Subcatchment P3: TO LOW POINT (DP#3)**

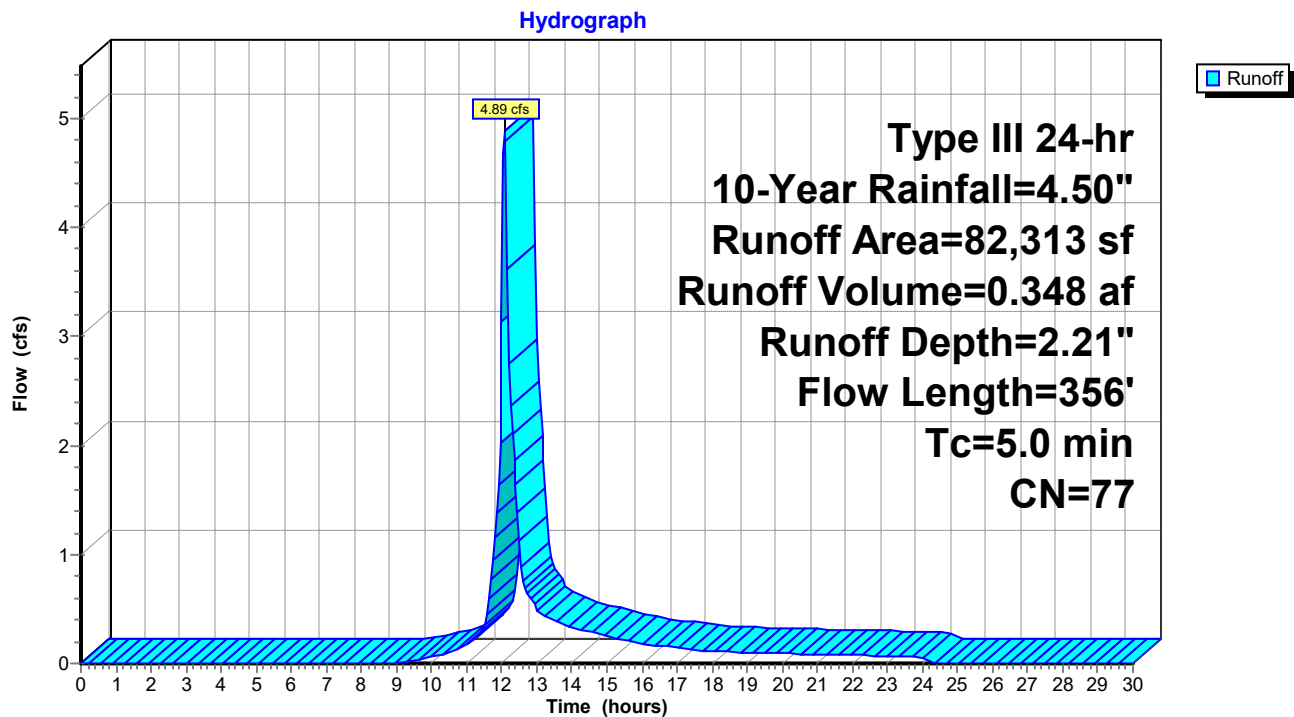
Runoff = 4.89 cfs @ 12.08 hrs, Volume= 0.348 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
8,024	74	>75% Grass cover, Good, HSG C
49,390	70	Woods, Good, HSG C
12,433	98	Paved parking, HSG C
12,466	89	Gravel roads, HSG C
82,313	77	Weighted Average
69,880		84.90% Pervious Area
12,433		15.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	35	0.1400	2.35		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.2	15	0.0320	1.10		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.2	53	0.0320	3.63		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.3	54	0.0320	2.88		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
0.0	28	0.4200	10.43		<b>Shallow Concentrated Flow, GRASS/BRUSH</b> Unpaved Kv= 16.1 fps
1.4	171	0.1600	2.00		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
2.3	356	Total, Increased to minimum Tc = 5.0 min			



**Subcatchment P3: TO LOW POINT (DP#3)**

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Type III 24-hr 10-Year Rainfall=4.50"

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**Summary for Subcatchment P4: TO DCB-B**

Runoff = 0.52 cfs @ 12.07 hrs, Volume= 0.039 af, Depth= 3.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Year Rainfall=4.50"

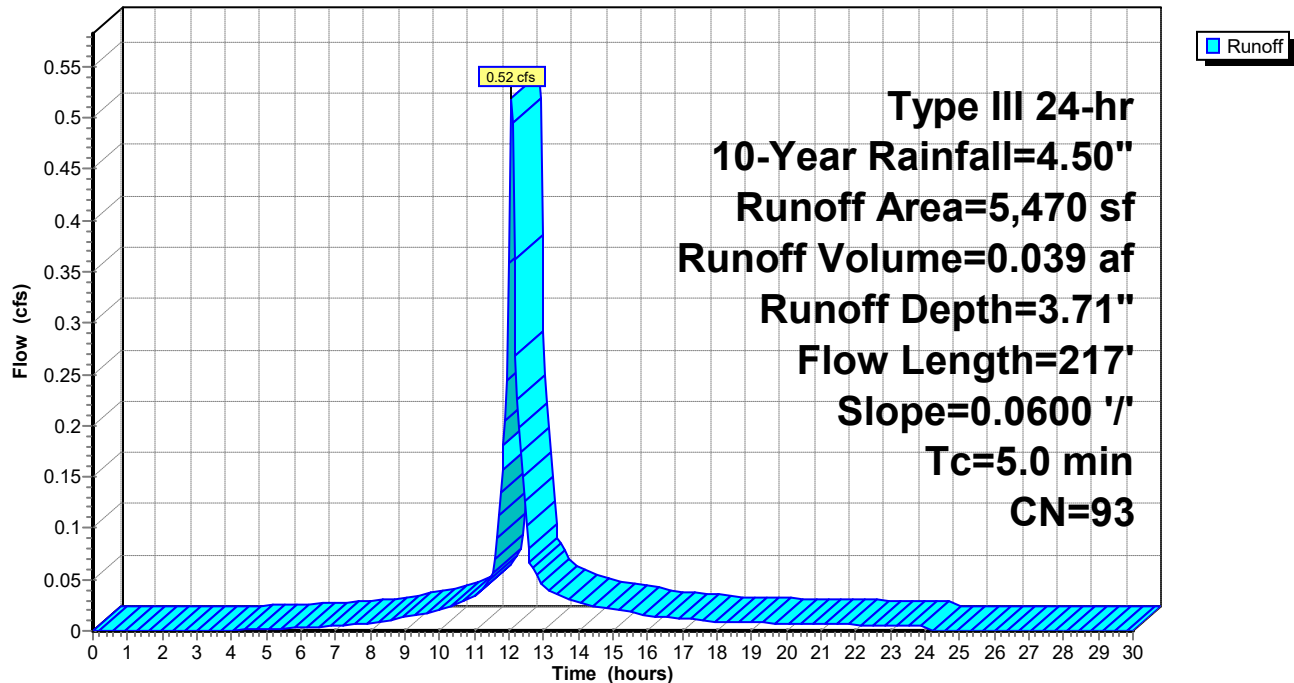
Area (sf)	CN	Description
1,114	74	>75% Grass cover, Good, HSG C
4,356	98	Paved parking, HSG C
5,470	93	Weighted Average
1,114		20.37% Pervious Area
4,356		79.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0600	1.80		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.6	167	0.0600	4.97		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.1	217	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment P4: TO DCB-B**

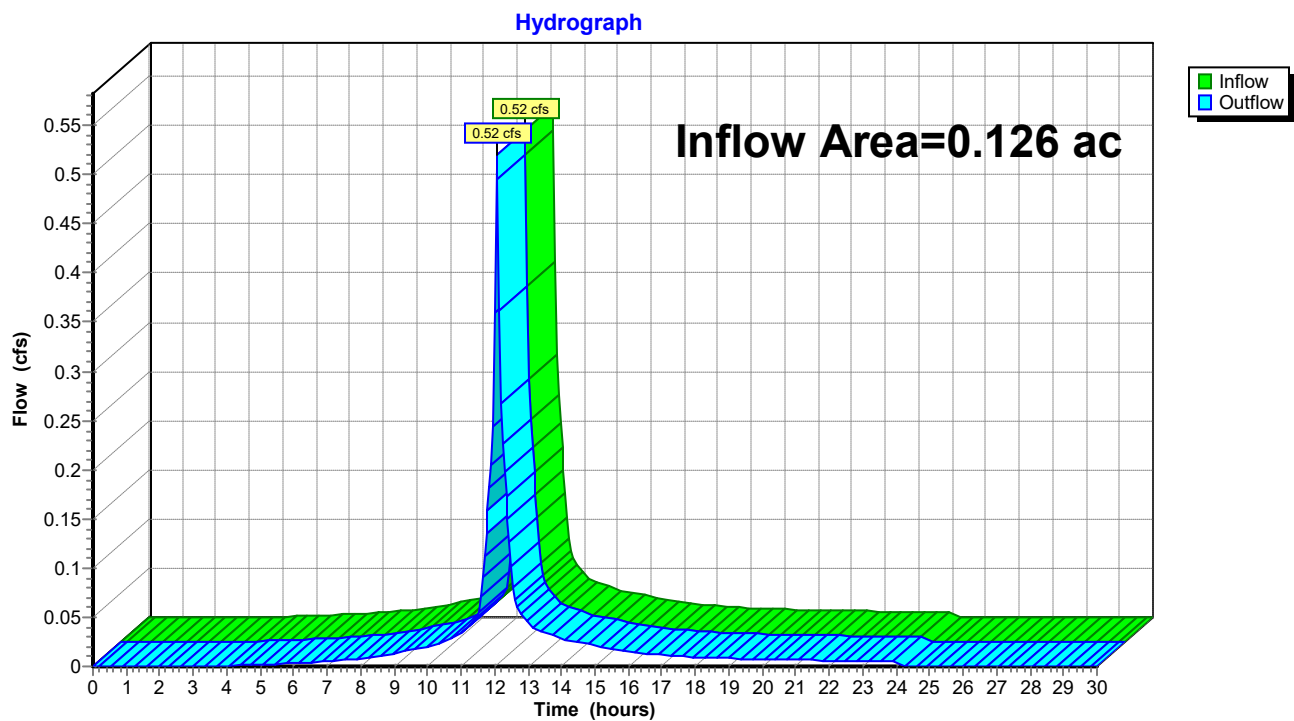
Hydrograph



**Summary for Reach DCB-B: TO OUTFALL**

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 3.71" for 10-Year event  
Inflow = 0.52 cfs @ 12.07 hrs, Volume= 0.039 af  
Outflow = 0.52 cfs @ 12.07 hrs, Volume= 0.039 af, Atten= 0%, Lag= 0.0 min

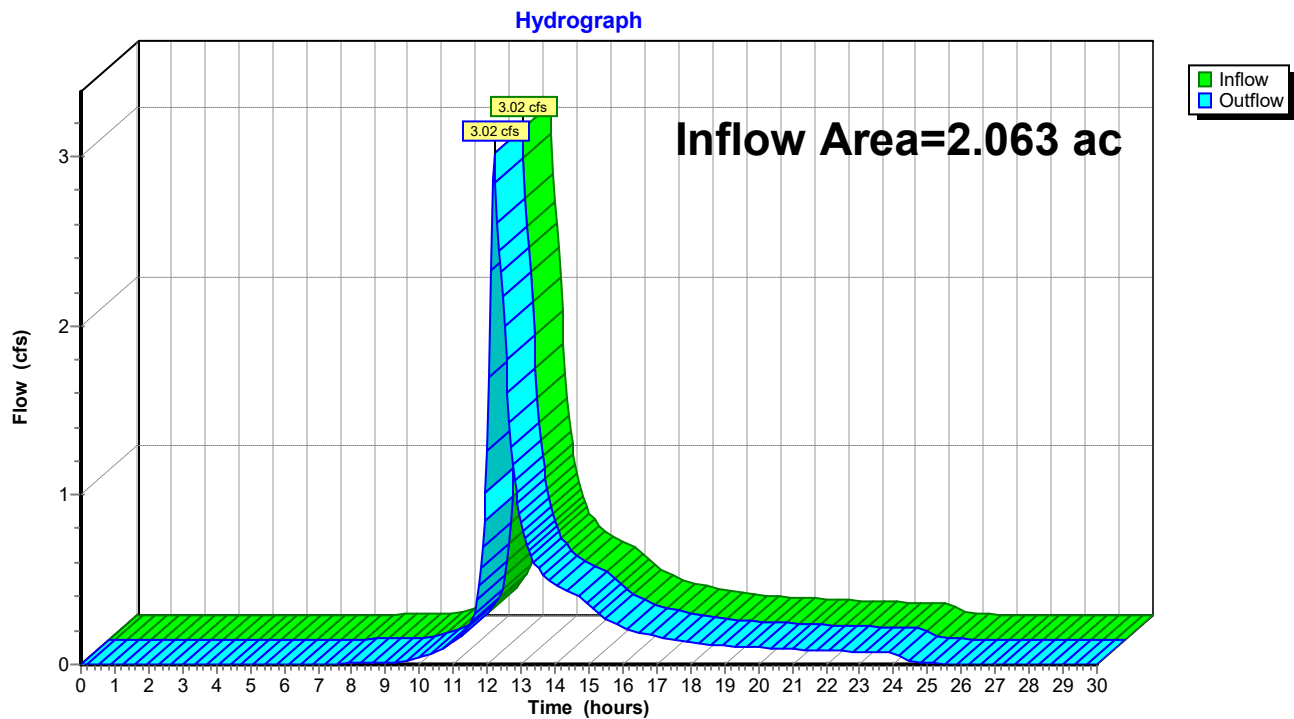
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DCB-B: TO OUTFALL**

**Summary for Reach DP#1: WETLAND**

Inflow Area = 2.063 ac, 11.36% Impervious, Inflow Depth = 2.18" for 10-Year event  
Inflow = 3.02 cfs @ 12.20 hrs, Volume= 0.374 af  
Outflow = 3.02 cfs @ 12.20 hrs, Volume= 0.374 af, Atten= 0%, Lag= 0.0 min

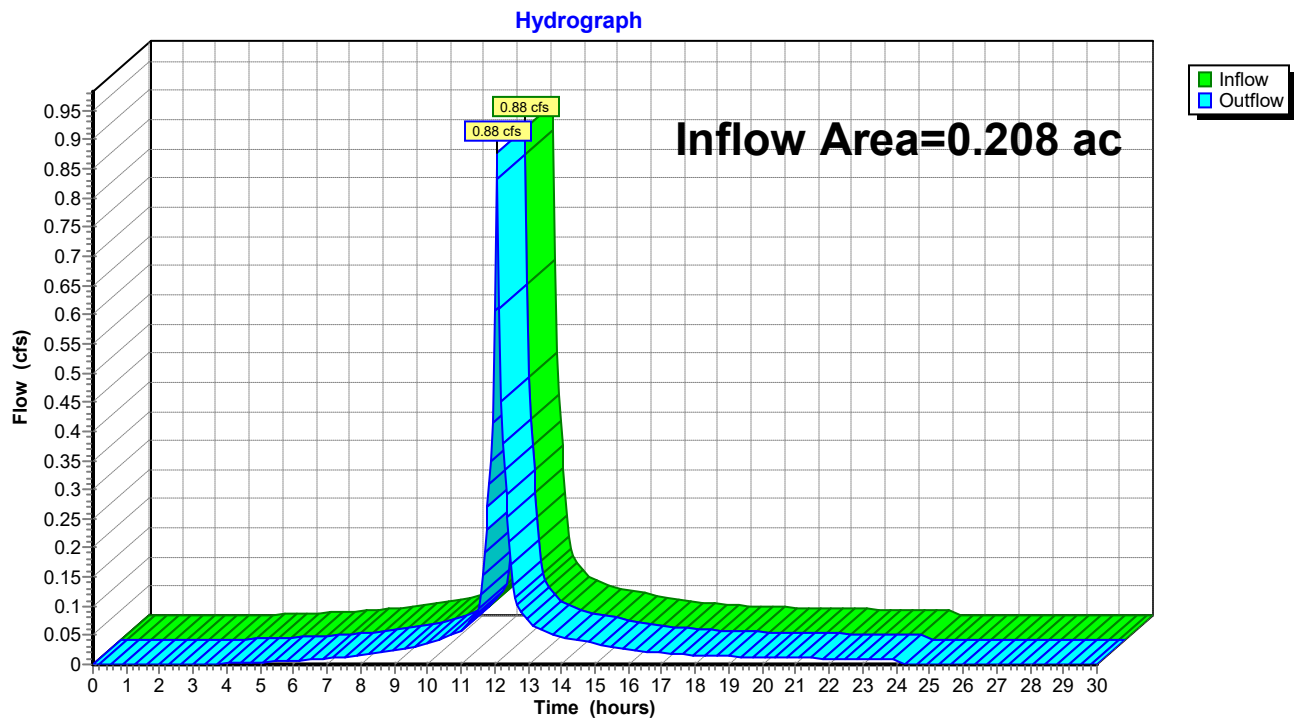
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#1: WETLAND**

**Summary for Reach DP#2: MUNICIPAL CATCHBASIN**

Inflow Area = 0.208 ac, 84.42% Impervious, Inflow Depth = 3.82" for 10-Year event  
Inflow = 0.88 cfs @ 12.07 hrs, Volume= 0.066 af  
Outflow = 0.88 cfs @ 12.07 hrs, Volume= 0.066 af, Atten= 0%, Lag= 0.0 min

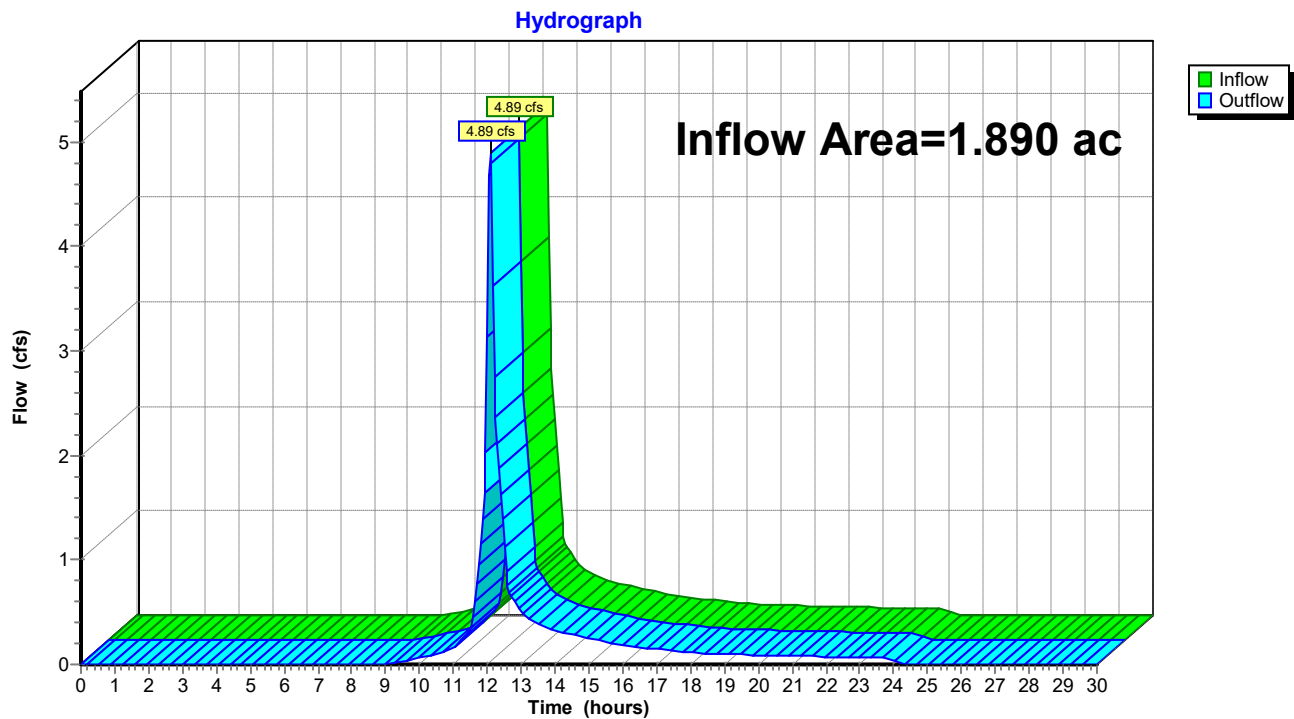
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#2: MUNICIPAL CATCHBASIN**

**Summary for Reach DP#3: LOW POINT**

Inflow Area = 1.890 ac, 15.10% Impervious, Inflow Depth = 2.21" for 10-Year event  
Inflow = 4.89 cfs @ 12.08 hrs, Volume= 0.348 af  
Outflow = 4.89 cfs @ 12.08 hrs, Volume= 0.348 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#3: LOW POINT**

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Type III 24-hr 10-Year Rainfall=4.50"

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### Summary for Reach OL-1: OVERLAND

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 3.71" for 10-Year event  
Inflow = 0.52 cfs @ 12.07 hrs, Volume= 0.039 af  
Outflow = 0.49 cfs @ 12.12 hrs, Volume= 0.039 af, Atten= 6%, Lag= 2.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.75 fps, Min. Travel Time= 1.5 min

Avg. Velocity= 0.29 fps, Avg. Travel Time= 3.8 min

Peak Storage= 45 cf @ 12.09 hrs

Average Depth at Peak Storage= 0.04'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 120.62 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 35.00'

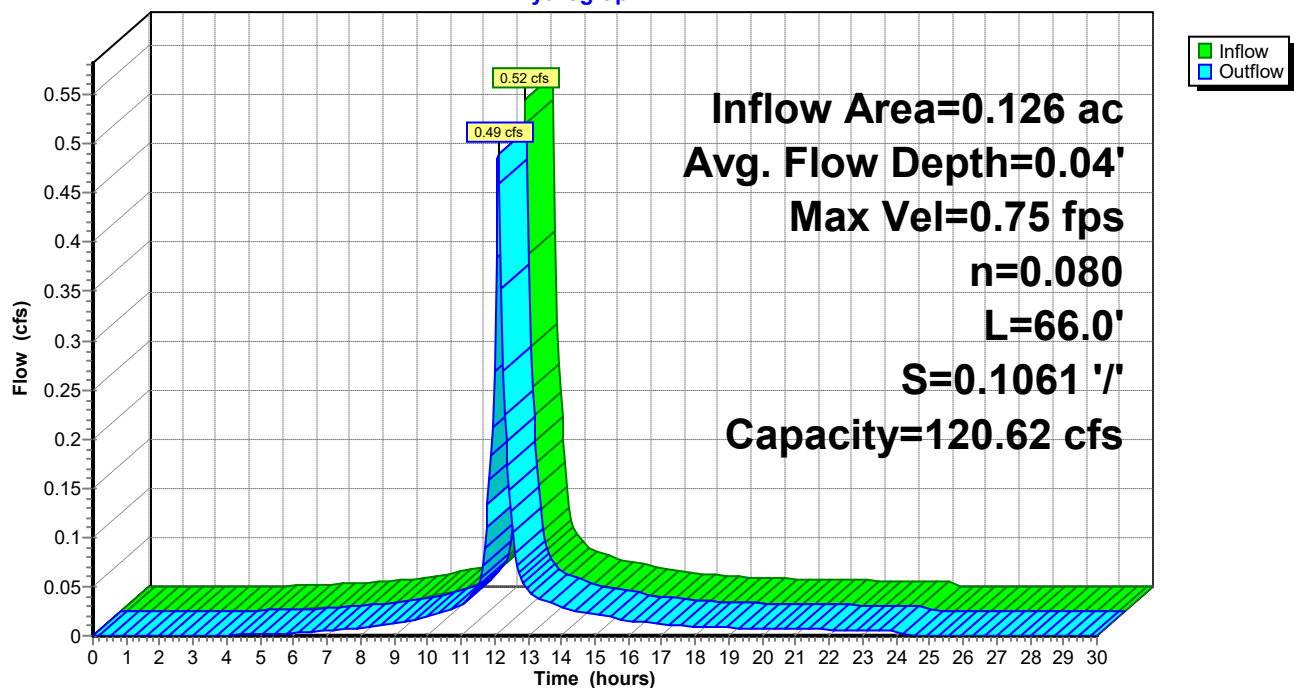
Length= 66.0' Slope= 0.1061 '/'

Inlet Invert= 109.00', Outlet Invert= 102.00'



### Reach OL-1: OVERLAND

#### Hydrograph



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### Summary for Reach OL-2: OVERLAND

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 3.71" for 10-Year event  
Inflow = 0.49 cfs @ 12.12 hrs, Volume= 0.039 af  
Outflow = 0.41 cfs @ 12.29 hrs, Volume= 0.039 af, Atten= 16%, Lag= 10.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.43 fps, Min. Travel Time= 6.6 min

Avg. Velocity = 0.15 fps, Avg. Travel Time= 19.4 min

Peak Storage= 164 cf @ 12.17 hrs

Average Depth at Peak Storage= 0.06'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 56.81 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 35.00'

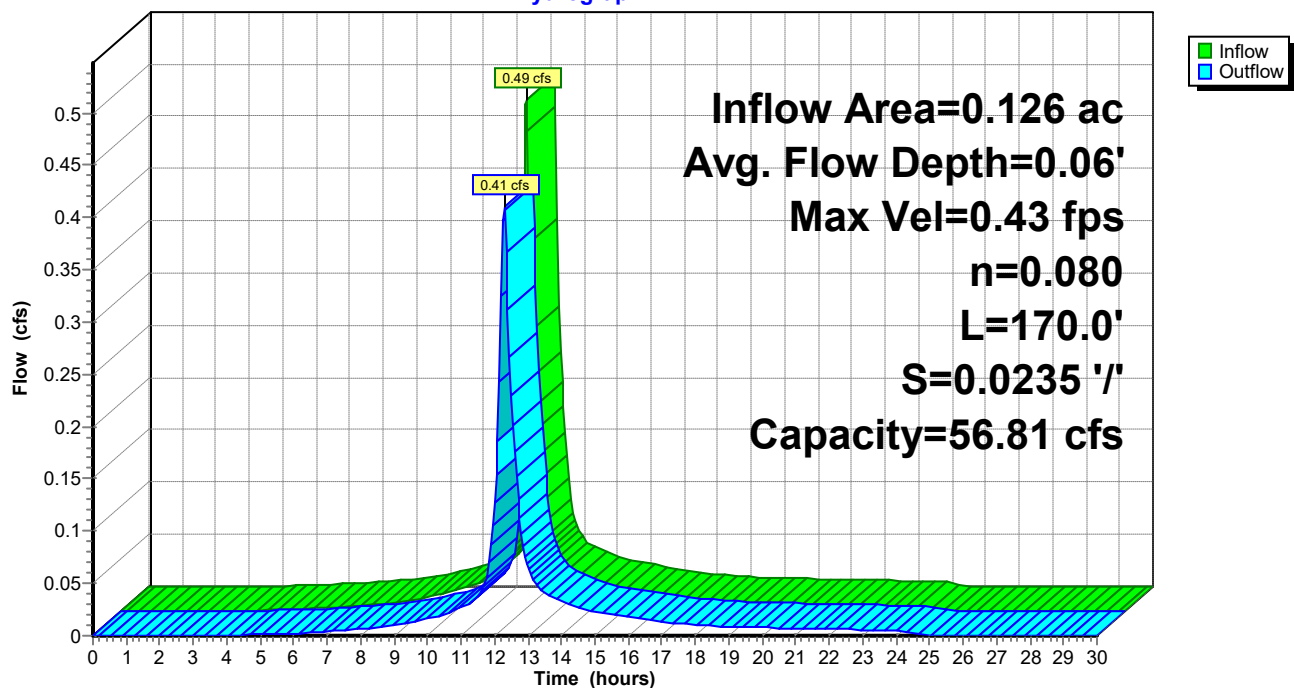
Length= 170.0' Slope= 0.0235 '/'

Inlet Invert= 102.00', Outlet Invert= 98.00'



### Reach OL-2: OVERLAND

#### Hydrograph





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Type III 24-hr 10-Year Rainfall=4.50"

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### Summary for Reach OL-3: OVERLAND

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 3.71" for 10-Year event  
Inflow = 0.41 cfs @ 12.29 hrs, Volume= 0.039 af  
Outflow = 0.37 cfs @ 12.43 hrs, Volume= 0.039 af, Atten= 9%, Lag= 8.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.59 fps, Min. Travel Time= 5.3 min

Avg. Velocity= 0.24 fps, Avg. Travel Time= 13.0 min

Peak Storage= 121 cf @ 12.34 hrs

Average Depth at Peak Storage= 0.04'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 99.35 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 35.00'

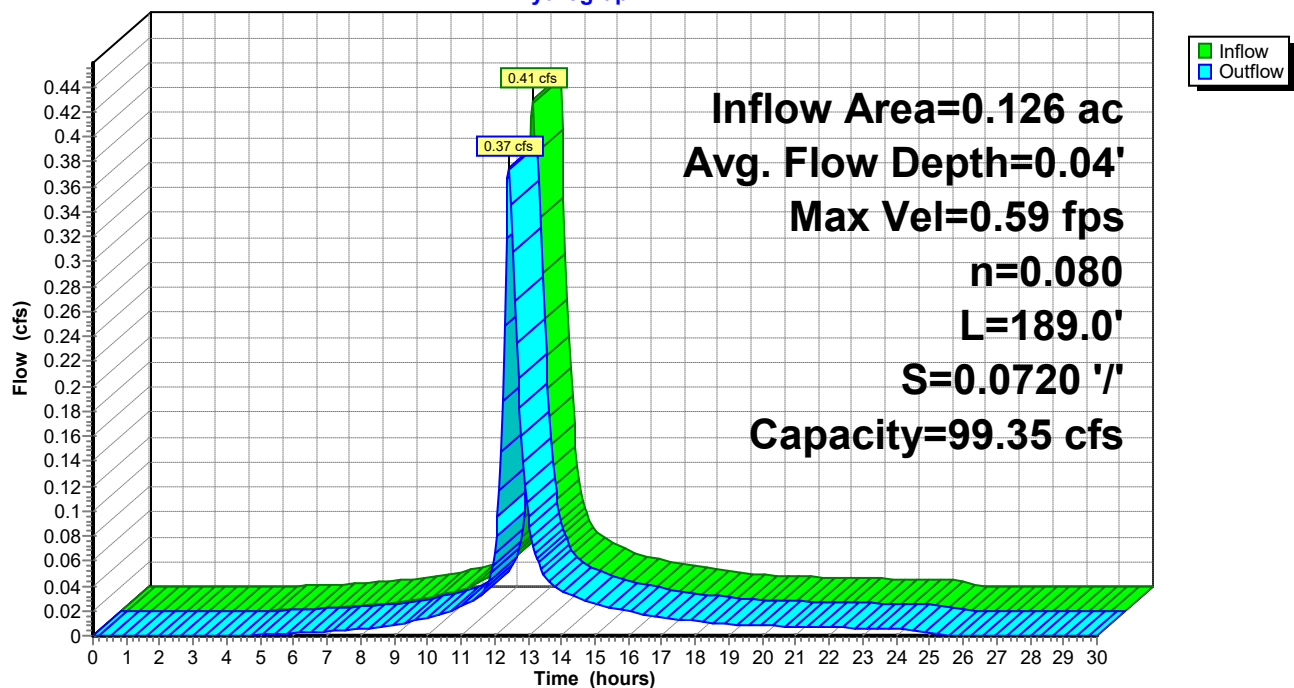
Length= 189.0' Slope= 0.0720 '/'

Inlet Invert= 98.00', Outlet Invert= 84.40'



### Reach OL-3: OVERLAND

#### Hydrograph



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Type III 24-hr 10-Year Rainfall=4.50"

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### Summary for Reach OL-4: OVERLAND

Inflow Area = 0.415 ac, 6.88% Impervious, Inflow Depth = 2.46" for 10-Year event  
Inflow = 0.43 cfs @ 12.39 hrs, Volume= 0.085 af  
Outflow = 0.41 cfs @ 12.69 hrs, Volume= 0.085 af, Atten= 6%, Lag= 17.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.21 fps, Min. Travel Time= 10.3 min

Avg. Velocity= 0.08 fps, Avg. Travel Time= 25.8 min

Peak Storage= 251 cf @ 12.52 hrs

Average Depth at Peak Storage= 0.06'

Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 45.22 cfs

30.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 50.00'

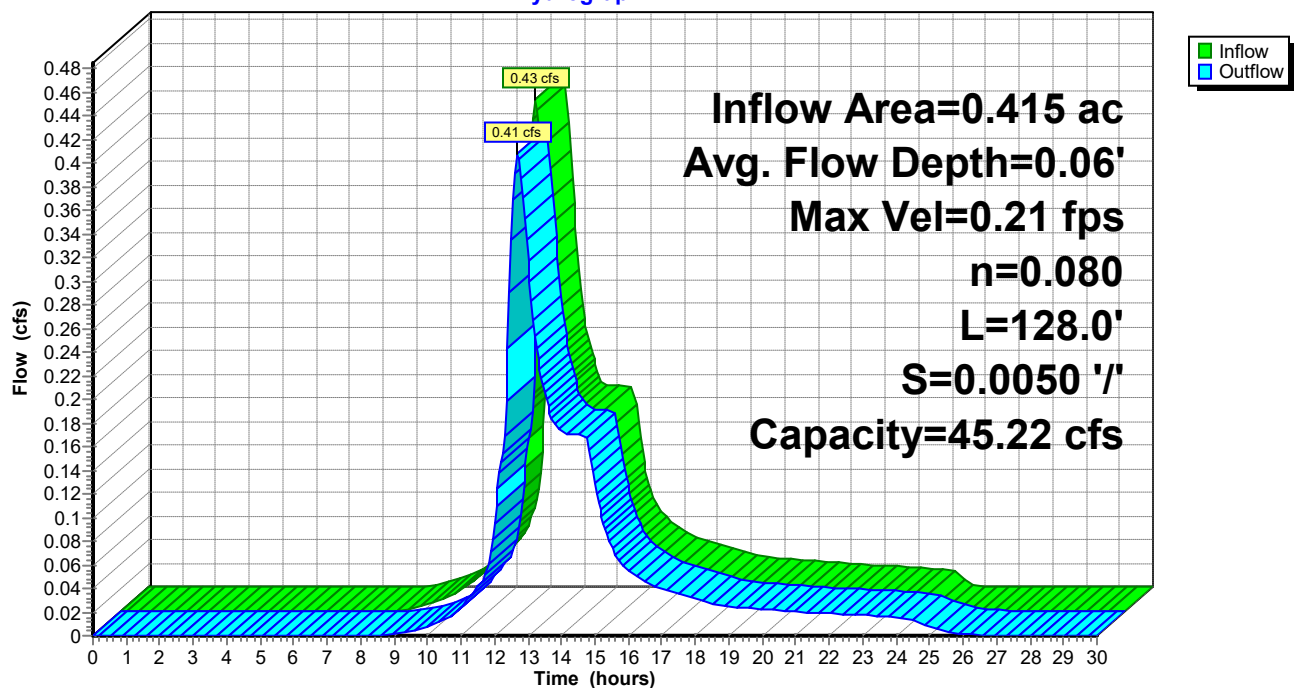
Length= 128.0' Slope= 0.0050 '/'

Inlet Invert= 85.00', Outlet Invert= 84.36'



### Reach OL-4: OVERLAND

#### Hydrograph



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Type III 24-hr 10-Year Rainfall=4.50"

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### Summary for Reach OL-5: OVERLAND

Inflow Area = 0.415 ac, 6.88% Impervious, Inflow Depth = 2.46" for 10-Year event  
Inflow = 0.43 cfs @ 12.36 hrs, Volume= 0.085 af  
Outflow = 0.43 cfs @ 12.39 hrs, Volume= 0.085 af, Atten= 0%, Lag= 1.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.49 fps, Min. Travel Time= 1.1 min

Avg. Velocity = 0.20 fps, Avg. Travel Time= 2.5 min

Peak Storage= 28 cf @ 12.37 hrs

Average Depth at Peak Storage= 0.06'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 66.52 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 35.00'

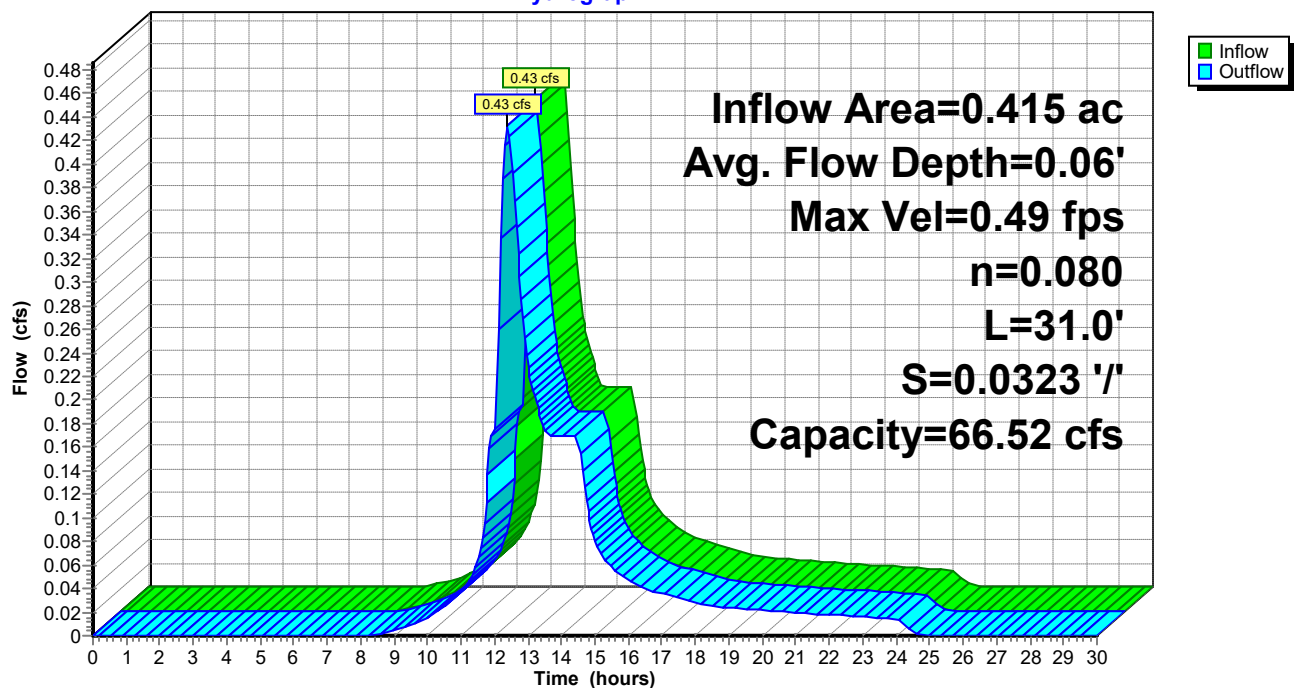
Length= 31.0' Slope= 0.0323 '/'

Inlet Invert= 86.00', Outlet Invert= 85.00'



### Reach OL-5: OVERLAND

#### Hydrograph



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Type III 24-hr 10-Year Rainfall=4.50"

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**Summary for Pond DB-1: TO DP#1**

Inflow Area = 0.415 ac, 6.88% Impervious, Inflow Depth = 2.46" for 10-Year event  
 Inflow = 1.20 cfs @ 12.08 hrs, Volume= 0.085 af  
 Outflow = 0.43 cfs @ 12.36 hrs, Volume= 0.085 af, Atten= 64%, Lag= 17.1 min  
 Primary = 0.43 cfs @ 12.36 hrs, Volume= 0.085 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
 Peak Elev= 89.73' @ 12.36 hrs Surf.Area= 1,515 sf Storage= 945 cf

Plug-Flow detention time= 29.5 min calculated for 0.085 af (100% of inflow)  
 Center-of-Mass det. time= 29.5 min ( 855.0 - 825.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	89.00'	5,994 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
89.00	1,090	0	0
90.00	1,676	1,383	1,383
92.00	2,935	4,611	5,994

Device	Routing	Invert	Outlet Devices
#1	Secondary	91.00'	<b>10.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Device 5	87.50'	<b>Special &amp; User-Defined</b> Head (feet) 0.00 1.00 15.00 Disch. (cfs) 0.000 0.170 0.170
#3	Device 5	90.50'	<b>2.6' long Sharp-Crested Rectangular Weir X 3.00</b> 2 End Contraction(s) 0.5' Crest Height
#4	Device 5	89.40'	<b>6.0" Vert. Orifice/Grate</b> C= 0.600
#5	Primary	87.40'	<b>12.0" Round Culvert</b> L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 87.40' / 87.00' S= 0.0133 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

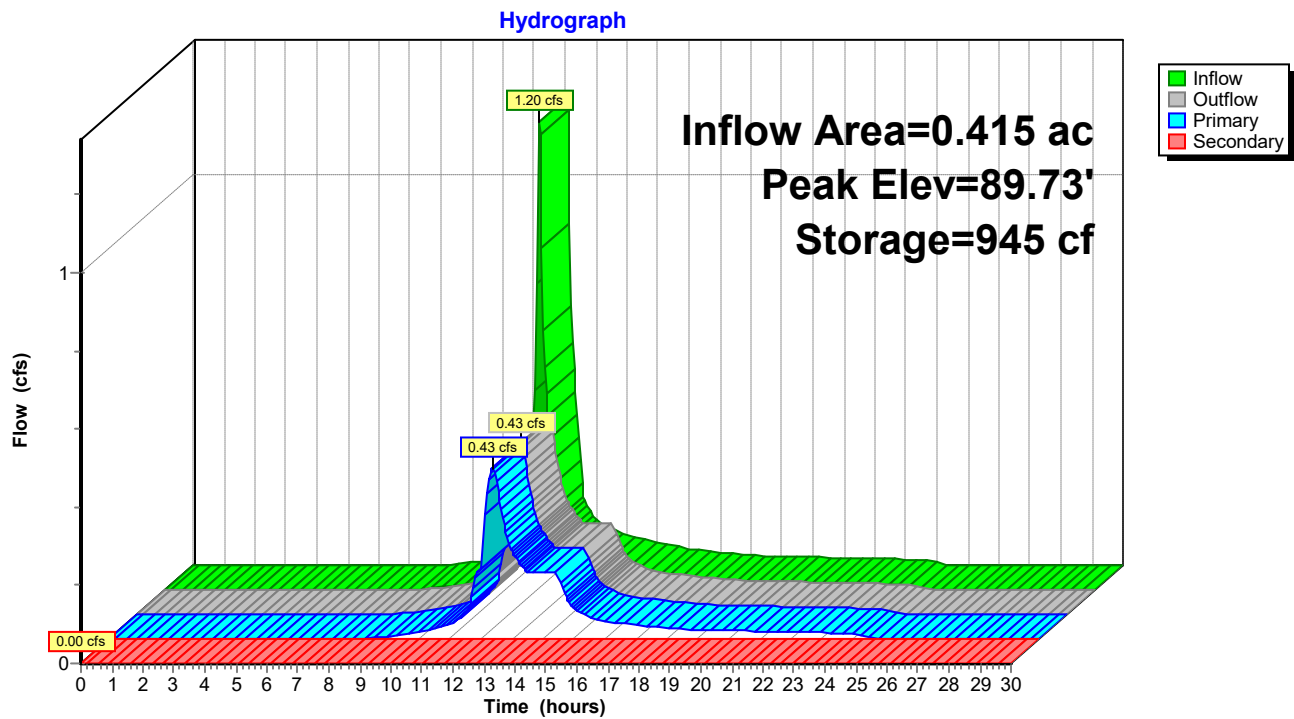
**Primary OutFlow** Max=0.43 cfs @ 12.36 hrs HW=89.72' (Free Discharge)

↑ **5=Culvert** (Passes 0.43 cfs of 4.03 cfs potential flow)  
 ↑ **2=Special & User-Defined** (Custom Controls 0.17 cfs)  
 ↑ **3=Sharp-Crested Rectangular Weir** ( Controls 0.00 cfs)  
 ↑ **4=Orifice/Grate** (Orifice Controls 0.26 cfs @ 1.94 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=89.00' (Free Discharge)

↑ **1=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

## Pond DB-1: TO DP#1



**3010-POST**

Type III 24-hr 25-Year Rainfall=5.30"

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment P10: TO WETLAND (DP#1)** Runoff Area=66,334 sf 6.95% Impervious Runoff Depth=2.61"  
 Flow Length=537' Tc=13.2 min CN=74 Runoff=3.64 cfs 0.331 af

**Subcatchment P11: TO D.BASIN** Runoff Area=18,069 sf 6.88% Impervious Runoff Depth=3.16"  
 Flow Length=220' Tc=5.0 min CN=80 Runoff=1.53 cfs 0.109 af

**Subcatchment P2: TO CATCHBASIN (DP#2)** Runoff Area=9,069 sf 84.42% Impervious Runoff Depth=4.60"  
 Flow Length=427' Slope=0.0600 '/' Tc=5.0 min CN=94 Runoff=1.05 cfs 0.080 af

**Subcatchment P3: TO LOW POINT (DP#3)** Runoff Area=82,313 sf 15.10% Impervious Runoff Depth=2.88"  
 Flow Length=356' Tc=5.0 min CN=77 Runoff=6.38 cfs 0.453 af

**Subcatchment P4: TO DCB-B** Runoff Area=5,470 sf 79.63% Impervious Runoff Depth=4.49"  
 Flow Length=217' Slope=0.0600 '/' Tc=5.0 min CN=93 Runoff=0.62 cfs 0.047 af

**Reach DCB-B: TO OUTFALL** Inflow=0.62 cfs 0.047 af  
 Outflow=0.62 cfs 0.047 af

**Reach DP#1: WETLAND** Inflow=4.00 cfs 0.487 af  
 Outflow=4.00 cfs 0.487 af

**Reach DP#2: MUNICIPAL CATCHBASIN** Inflow=1.05 cfs 0.080 af  
 Outflow=1.05 cfs 0.080 af

**Reach DP#3: LOW POINT** Inflow=6.38 cfs 0.453 af  
 Outflow=6.38 cfs 0.453 af

**Reach OL-1: OVERLAND** Avg. Flow Depth=0.05' Max Vel=0.80 fps Inflow=0.62 cfs 0.047 af  
 n=0.080 L=66.0' S=0.1061 '/' Capacity=120.62 cfs Outflow=0.59 cfs 0.047 af

**Reach OL-2: OVERLAND** Avg. Flow Depth=0.07' Max Vel=0.47 fps Inflow=0.59 cfs 0.047 af  
 n=0.080 L=170.0' S=0.0235 '/' Capacity=56.81 cfs Outflow=0.51 cfs 0.047 af

**Reach OL-3: OVERLAND** Avg. Flow Depth=0.05' Max Vel=0.64 fps Inflow=0.51 cfs 0.047 af  
 n=0.080 L=189.0' S=0.0720 '/' Capacity=99.35 cfs Outflow=0.46 cfs 0.047 af

**Reach OL-4: OVERLAND** Avg. Flow Depth=0.08' Max Vel=0.24 fps Inflow=0.61 cfs 0.109 af  
 n=0.080 L=128.0' S=0.0050 '/' Capacity=45.22 cfs Outflow=0.58 cfs 0.109 af

**Reach OL-5: OVERLAND** Avg. Flow Depth=0.07' Max Vel=0.55 fps Inflow=0.61 cfs 0.109 af  
 n=0.080 L=31.0' S=0.0323 '/' Capacity=66.52 cfs Outflow=0.61 cfs 0.109 af

**Pond DB-1: TO DP#1** Peak Elev=89.87' Storage=1,174 cf Inflow=1.53 cfs 0.109 af  
 Primary=0.61 cfs 0.109 af Secondary=0.00 cfs 0.000 af Outflow=0.61 cfs 0.109 af

**Total Runoff Area = 4.161 ac Runoff Volume = 1.020 af Average Runoff Depth = 2.94"**  
**83.28% Pervious = 3.465 ac 16.72% Impervious = 0.696 ac**

**3010-POST**

Type III 24-hr 25-Year Rainfall=5.30"

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**Summary for Subcatchment P10: TO WETLAND (DP#1)**

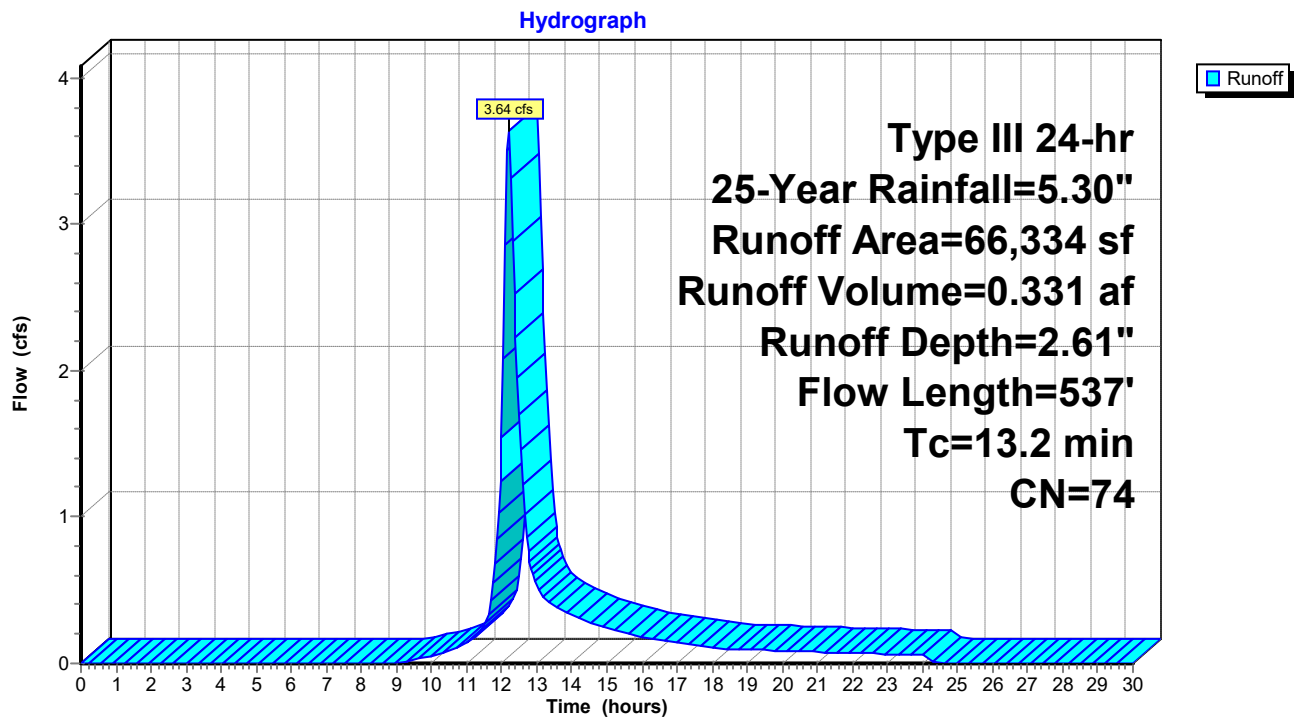
Runoff = 3.64 cfs @ 12.19 hrs, Volume= 0.331 af, Depth= 2.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
19,547	74	>75% Grass cover, Good, HSG C
40,200	70	Woods, Good, HSG C
4,194	98	Paved parking, HSG C
1,978	89	Gravel roads, HSG C
415	98	Unconnected pavement, HSG C
66,334	74	Weighted Average
61,725		93.05% Pervious Area
4,609		6.95% Impervious Area
415		9.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	13	0.2150	0.13		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.00"
0.8	9	0.1000	0.19		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.00"
0.7	28	0.0060	0.64		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.5	50	0.0060	1.57		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.3	28	0.0120	1.76		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
0.6	64	0.0120	1.76		<b>Shallow Concentrated Flow, grass</b> Unpaved Kv= 16.1 fps
0.2	65	0.0830	4.64		<b>Shallow Concentrated Flow, grass</b> Unpaved Kv= 16.1 fps
0.2	40	0.0300	2.79		<b>Shallow Concentrated Flow, grass</b> Unpaved Kv= 16.1 fps
2.2	112	0.0300	0.87		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
6.0	128	0.0050	0.35		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.2	537	Total			

**Subcatchment P10: TO WETLAND (DP#1)**



**3010-POST**

Type III 24-hr 25-Year Rainfall=5.30"

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**Summary for Subcatchment P11: TO D.BASIN**

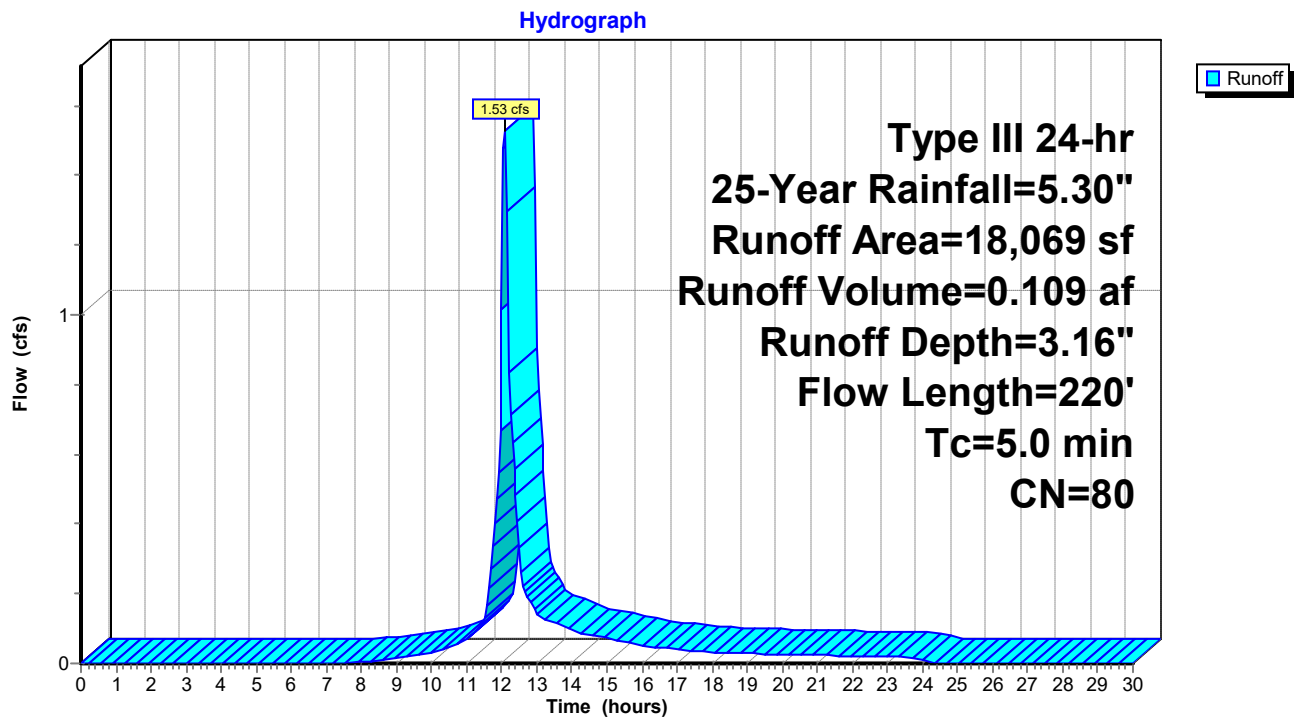
Runoff = 1.53 cfs @ 12.08 hrs, Volume= 0.109 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
11,036	74	>75% Grass cover, Good, HSG C
1,244	98	Unconnected pavement, HSG C
5,789	89	Gravel roads, HSG C
18,069	80	Weighted Average
16,825		93.12% Pervious Area
1,244		6.88% Impervious Area
1,244		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	50	0.0830	2.05		<b>Sheet Flow, GRAVEL</b> Smooth surfaces n= 0.011 P2= 3.00"
0.0	13	0.0830	4.64		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
0.5	119	0.0550	3.78		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
0.1	38	0.5000	11.38		<b>Shallow Concentrated Flow, GRASS</b> Unpaved Kv= 16.1 fps
1.0	220	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment P11: TO D.BASIN**

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Type III 24-hr 25-Year Rainfall=5.30"

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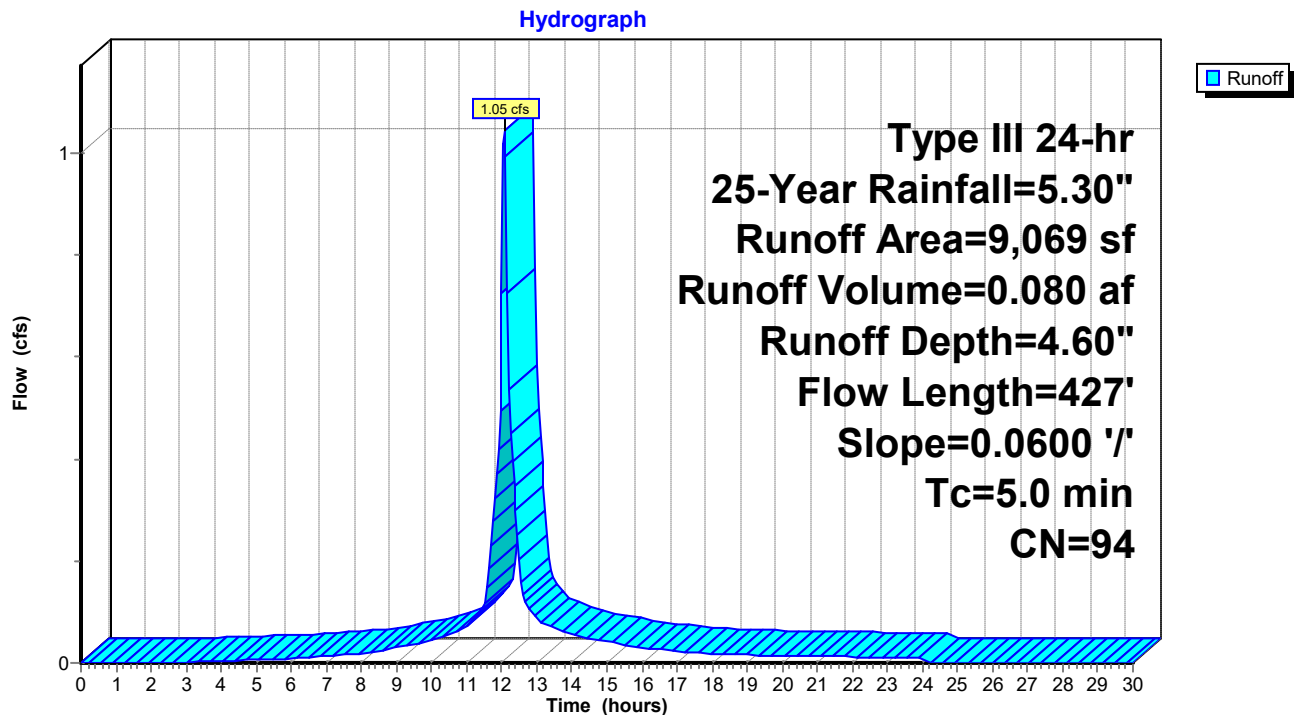
**Summary for Subcatchment P2: TO CATCHBASIN (DP#2)**

Runoff = 1.05 cfs @ 12.07 hrs, Volume= 0.080 af, Depth= 4.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
794	74	>75% Grass cover, Good, HSG C
523	70	Woods, Good, HSG C
7,656	98	Paved parking, HSG C
96	89	Gravel roads, HSG C
9,069	94	Weighted Average
1,413		15.58% Pervious Area
7,656		84.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0600	1.80		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
1.3	377	0.0600	4.97		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.8	427	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment P2: TO CATCHBASIN (DP#2)**

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Type III 24-hr 25-Year Rainfall=5.30"

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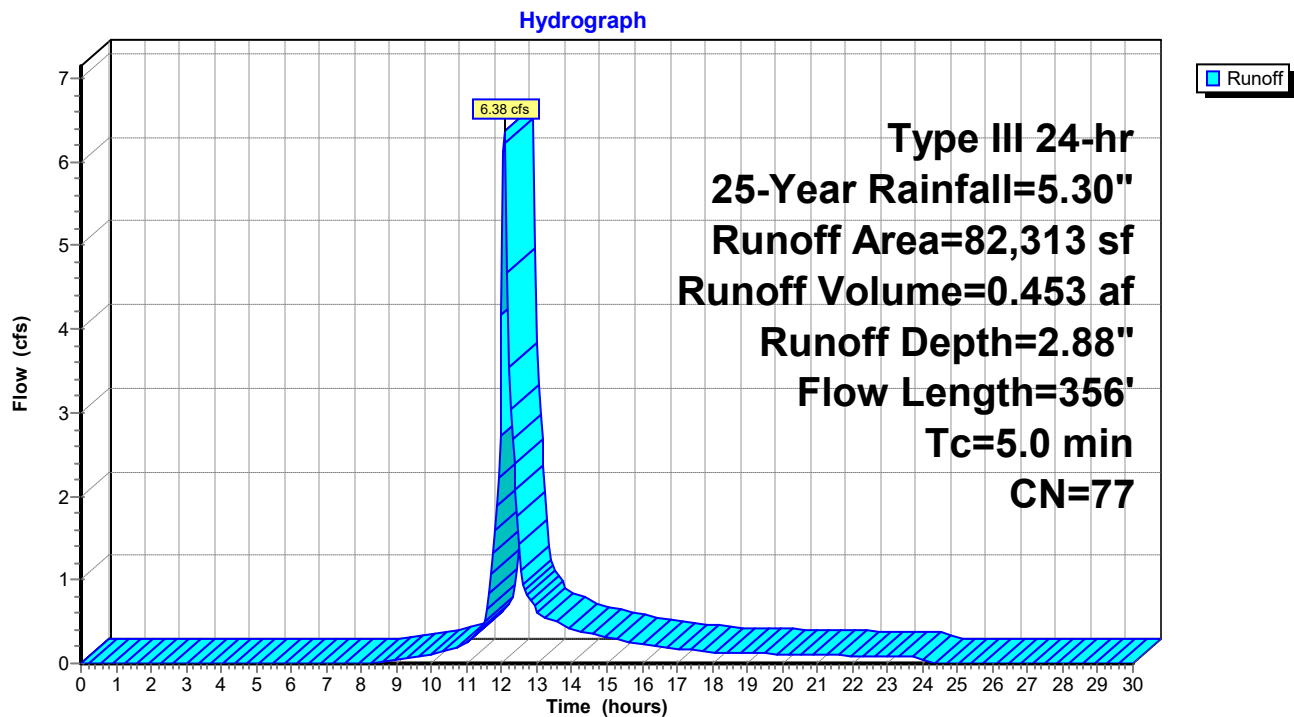
**Summary for Subcatchment P3: TO LOW POINT (DP#3)**

Runoff = 6.38 cfs @ 12.08 hrs, Volume= 0.453 af, Depth= 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
8,024	74	>75% Grass cover, Good, HSG C
49,390	70	Woods, Good, HSG C
12,433	98	Paved parking, HSG C
12,466	89	Gravel roads, HSG C
82,313	77	Weighted Average
69,880		84.90% Pervious Area
12,433		15.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	35	0.1400	2.35		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.2	15	0.0320	1.10		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.2	53	0.0320	3.63		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.3	54	0.0320	2.88		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
0.0	28	0.4200	10.43		<b>Shallow Concentrated Flow, GRASS/BRUSH</b> Unpaved Kv= 16.1 fps
1.4	171	0.1600	2.00		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
2.3	356	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment P3: TO LOW POINT (DP#3)**

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**Summary for Subcatchment P4: TO DCB-B**

Runoff = 0.62 cfs @ 12.07 hrs, Volume= 0.047 af, Depth= 4.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-Year Rainfall=5.30"

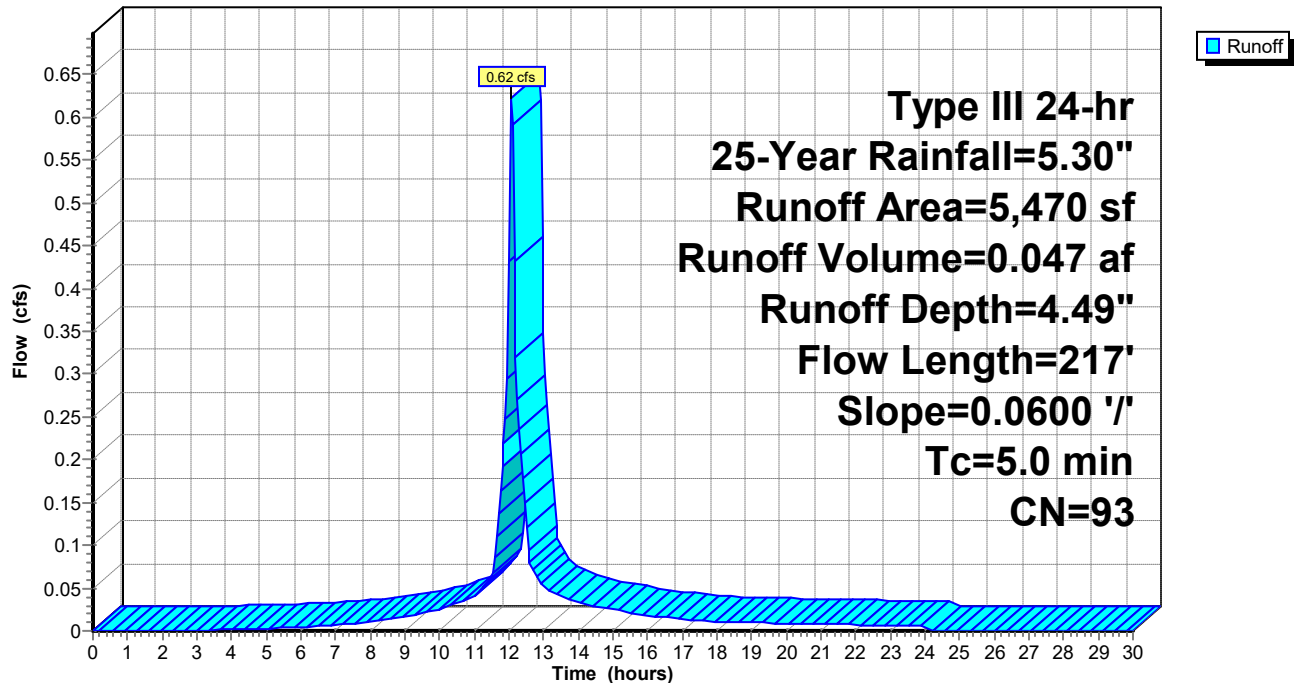
Area (sf)	CN	Description
1,114	74	>75% Grass cover, Good, HSG C
4,356	98	Paved parking, HSG C
5,470	93	Weighted Average
1,114		20.37% Pervious Area
4,356		79.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0600	1.80		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.6	167	0.0600	4.97		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.1	217	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment P4: TO DCB-B**

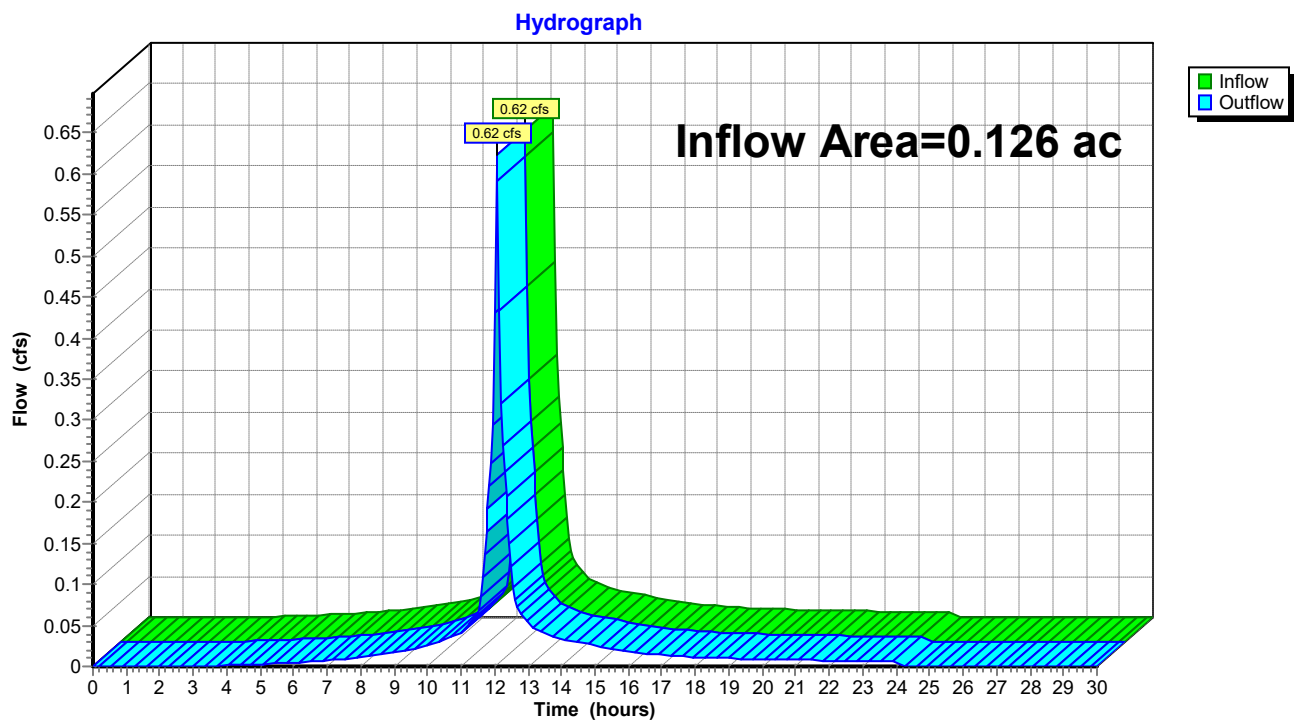
Hydrograph



**Summary for Reach DCB-B: TO OUTFALL**

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 4.49" for 25-Year event  
Inflow = 0.62 cfs @ 12.07 hrs, Volume= 0.047 af  
Outflow = 0.62 cfs @ 12.07 hrs, Volume= 0.047 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DCB-B: TO OUTFALL**

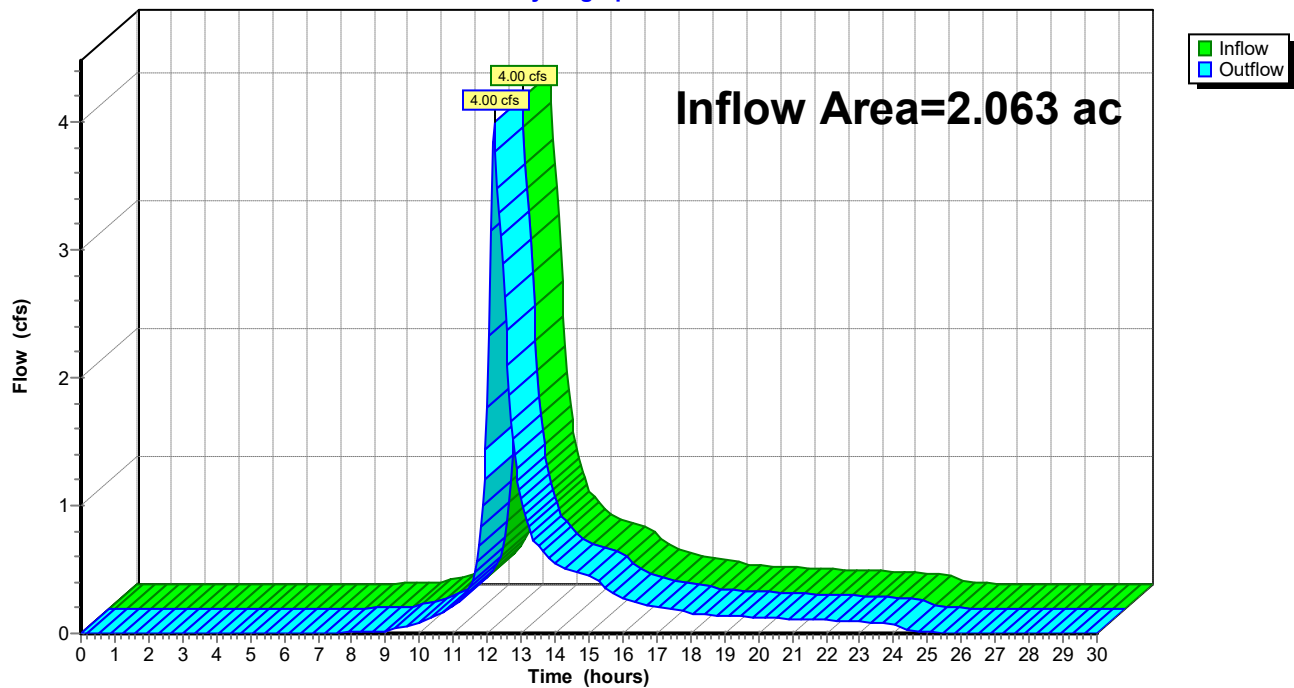
**Summary for Reach DP#1: WETLAND**

Inflow Area = 2.063 ac, 11.36% Impervious, Inflow Depth = 2.83" for 25-Year event  
Inflow = 4.00 cfs @ 12.20 hrs, Volume= 0.487 af  
Outflow = 4.00 cfs @ 12.20 hrs, Volume= 0.487 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#1: WETLAND**

Hydrograph

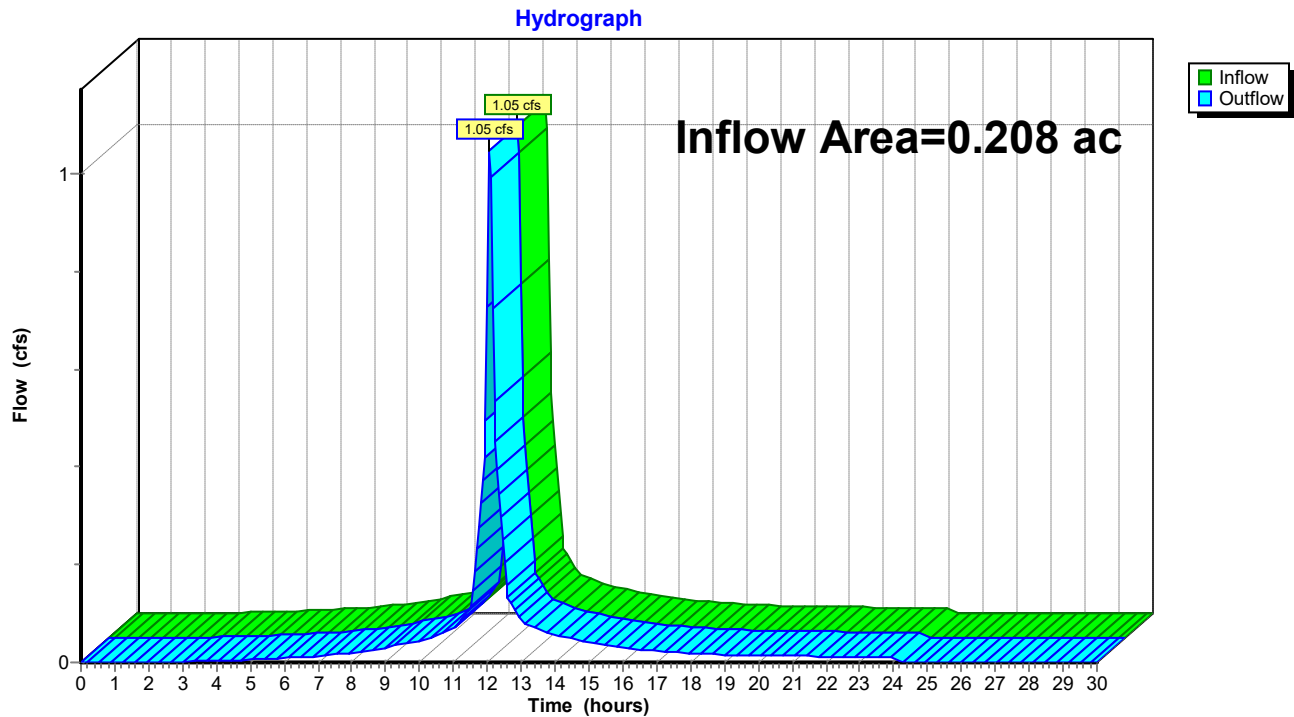




**Summary for Reach DP#2: MUNICIPAL CATCHBASIN**

Inflow Area = 0.208 ac, 84.42% Impervious, Inflow Depth = 4.60" for 25-Year event  
Inflow = 1.05 cfs @ 12.07 hrs, Volume= 0.080 af  
Outflow = 1.05 cfs @ 12.07 hrs, Volume= 0.080 af, Atten= 0%, Lag= 0.0 min

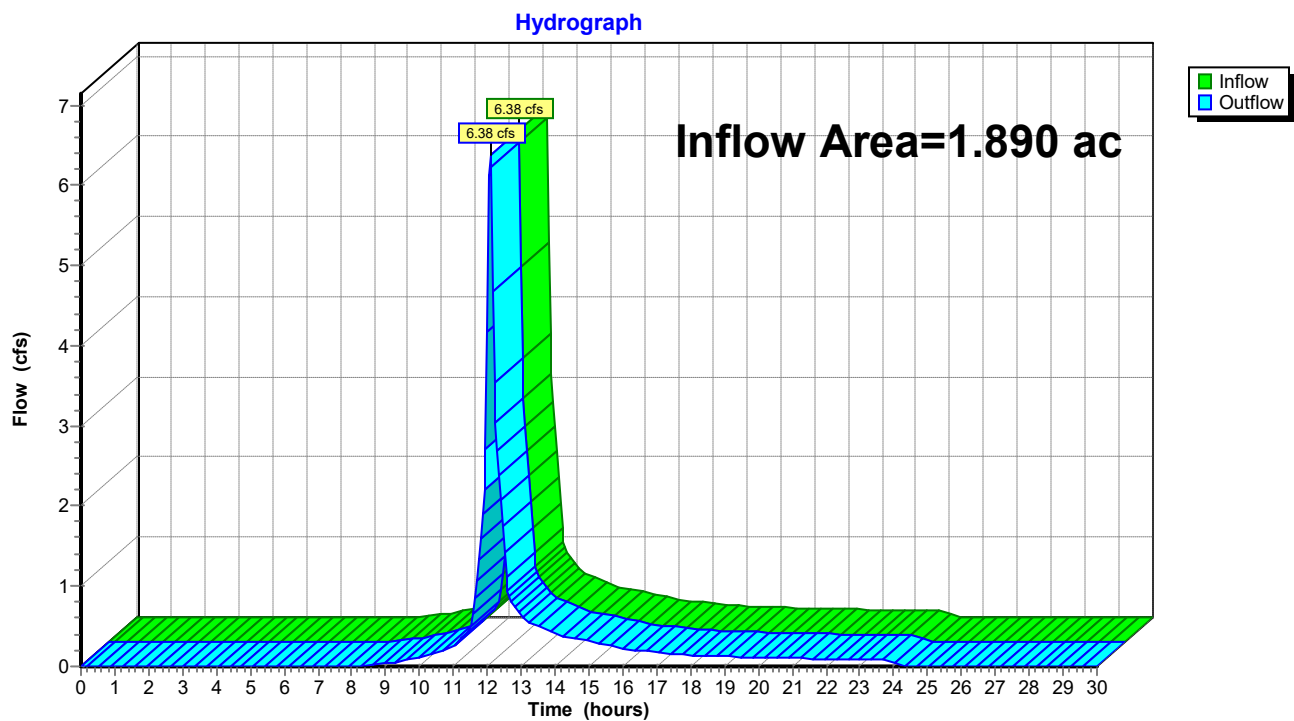
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#2: MUNICIPAL CATCHBASIN**

**Summary for Reach DP#3: LOW POINT**

Inflow Area = 1.890 ac, 15.10% Impervious, Inflow Depth = 2.88" for 25-Year event  
Inflow = 6.38 cfs @ 12.08 hrs, Volume= 0.453 af  
Outflow = 6.38 cfs @ 12.08 hrs, Volume= 0.453 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#3: LOW POINT**

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### Summary for Reach OL-1: OVERLAND

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 4.49" for 25-Year event  
Inflow = 0.62 cfs @ 12.07 hrs, Volume= 0.047 af  
Outflow = 0.59 cfs @ 12.11 hrs, Volume= 0.047 af, Atten= 6%, Lag= 2.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.80 fps, Min. Travel Time= 1.4 min

Avg. Velocity= 0.29 fps, Avg. Travel Time= 3.7 min

Peak Storage= 51 cf @ 12.09 hrs

Average Depth at Peak Storage= 0.05'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 120.62 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 35.00'

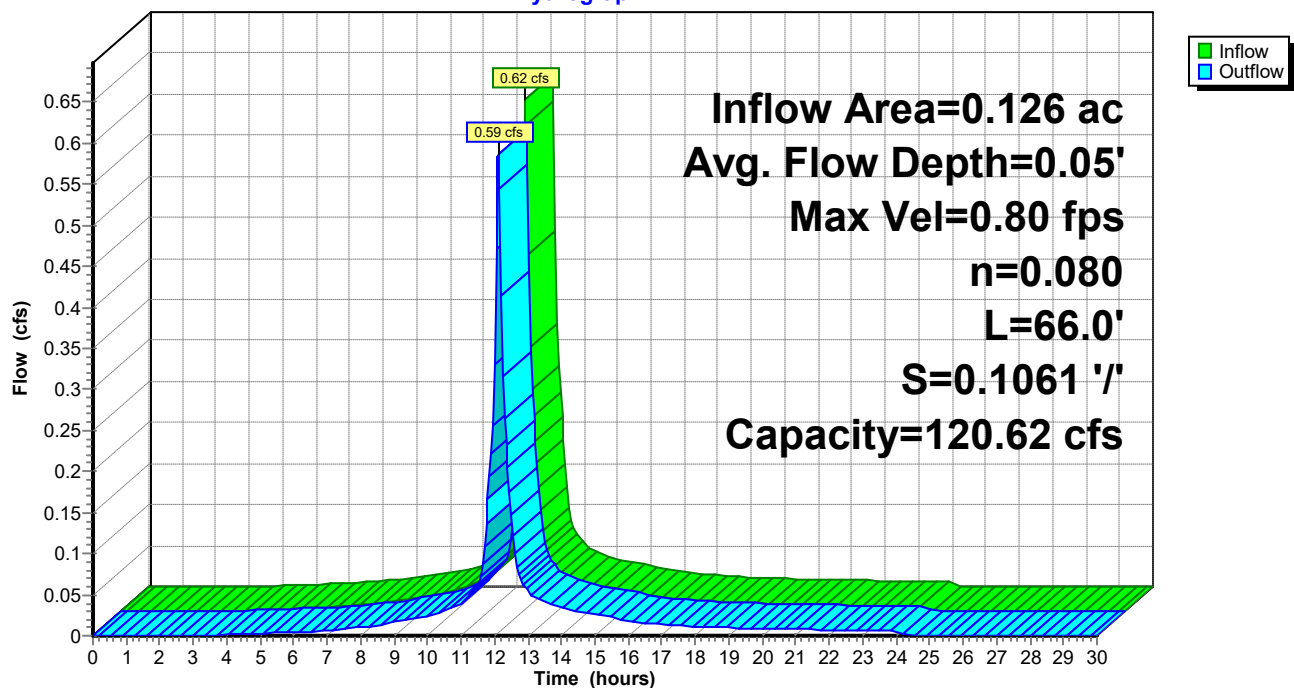
Length= 66.0' Slope= 0.1061 '/'

Inlet Invert= 109.00', Outlet Invert= 102.00'



### Reach OL-1: OVERLAND

Hydrograph



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### Summary for Reach OL-2: OVERLAND

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 4.49" for 25-Year event  
Inflow = 0.59 cfs @ 12.11 hrs, Volume= 0.047 af  
Outflow = 0.51 cfs @ 12.27 hrs, Volume= 0.047 af, Atten= 14%, Lag= 9.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.47 fps, Min. Travel Time= 6.1 min

Avg. Velocity = 0.15 fps, Avg. Travel Time= 19.0 min

Peak Storage= 185 cf @ 12.17 hrs

Average Depth at Peak Storage= 0.07'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 56.81 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 35.00'

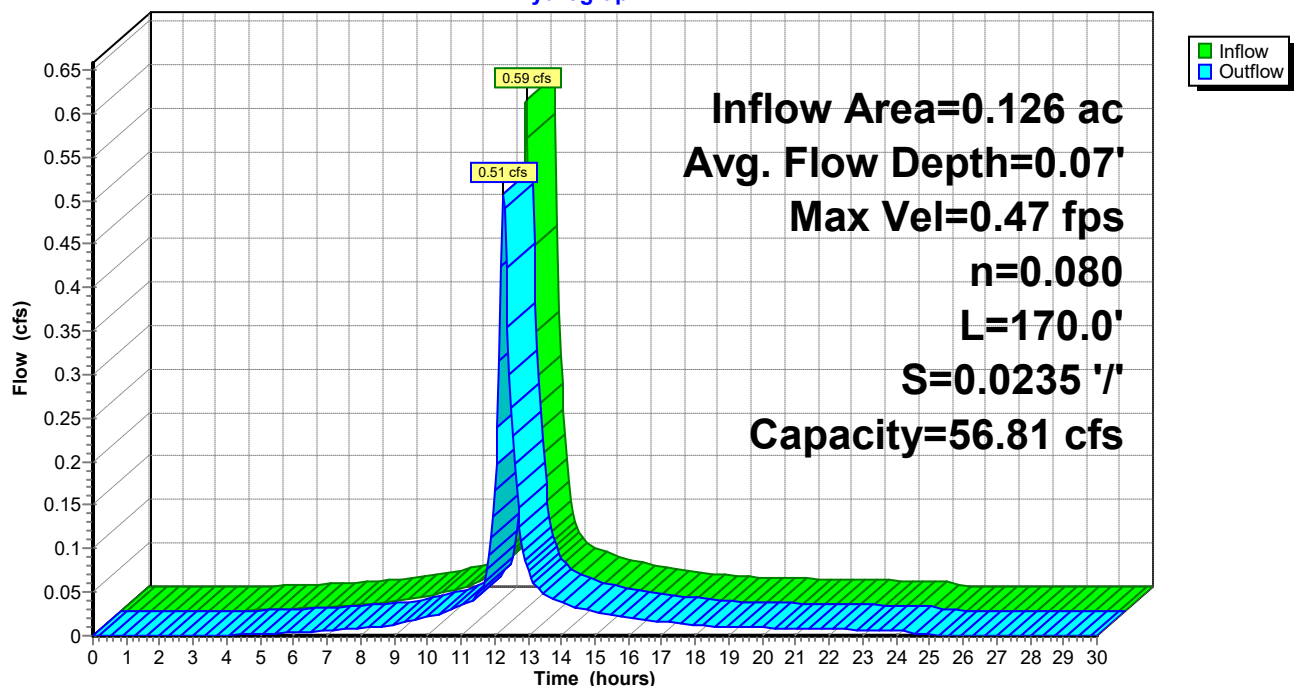
Length= 170.0' Slope= 0.0235 '/'

Inlet Invert= 102.00', Outlet Invert= 98.00'



### Reach OL-2: OVERLAND

Hydrograph



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### Summary for Reach OL-3: OVERLAND

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 4.49" for 25-Year event  
Inflow = 0.51 cfs @ 12.27 hrs, Volume= 0.047 af  
Outflow = 0.46 cfs @ 12.41 hrs, Volume= 0.047 af, Atten= 9%, Lag= 8.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.64 fps, Min. Travel Time= 4.9 min

Avg. Velocity= 0.25 fps, Avg. Travel Time= 12.8 min

Peak Storage= 138 cf @ 12.32 hrs

Average Depth at Peak Storage= 0.05'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 99.35 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 35.00'

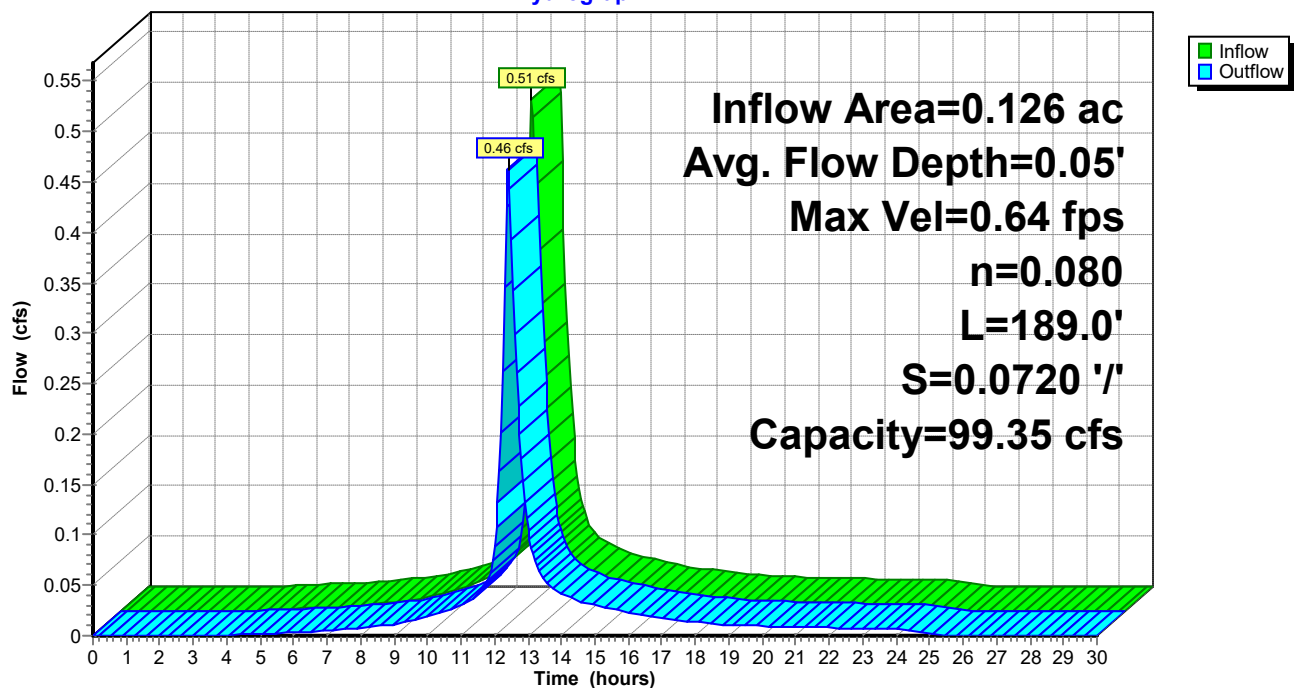
Length= 189.0' Slope= 0.0720 '/'

Inlet Invert= 98.00', Outlet Invert= 84.40'



### Reach OL-3: OVERLAND

#### Hydrograph



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Type III 24-hr 25-Year Rainfall=5.30"

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### Summary for Reach OL-4: OVERLAND

Inflow Area = 0.415 ac, 6.88% Impervious, Inflow Depth = 3.16" for 25-Year event  
Inflow = 0.61 cfs @ 12.34 hrs, Volume= 0.109 af  
Outflow = 0.58 cfs @ 12.62 hrs, Volume= 0.109 af, Atten= 4%, Lag= 16.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.24 fps, Min. Travel Time= 9.0 min

Avg. Velocity= 0.09 fps, Avg. Travel Time= 24.3 min

Peak Storage= 312 cf @ 12.48 hrs

Average Depth at Peak Storage= 0.08'

Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 45.22 cfs

30.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 50.00'

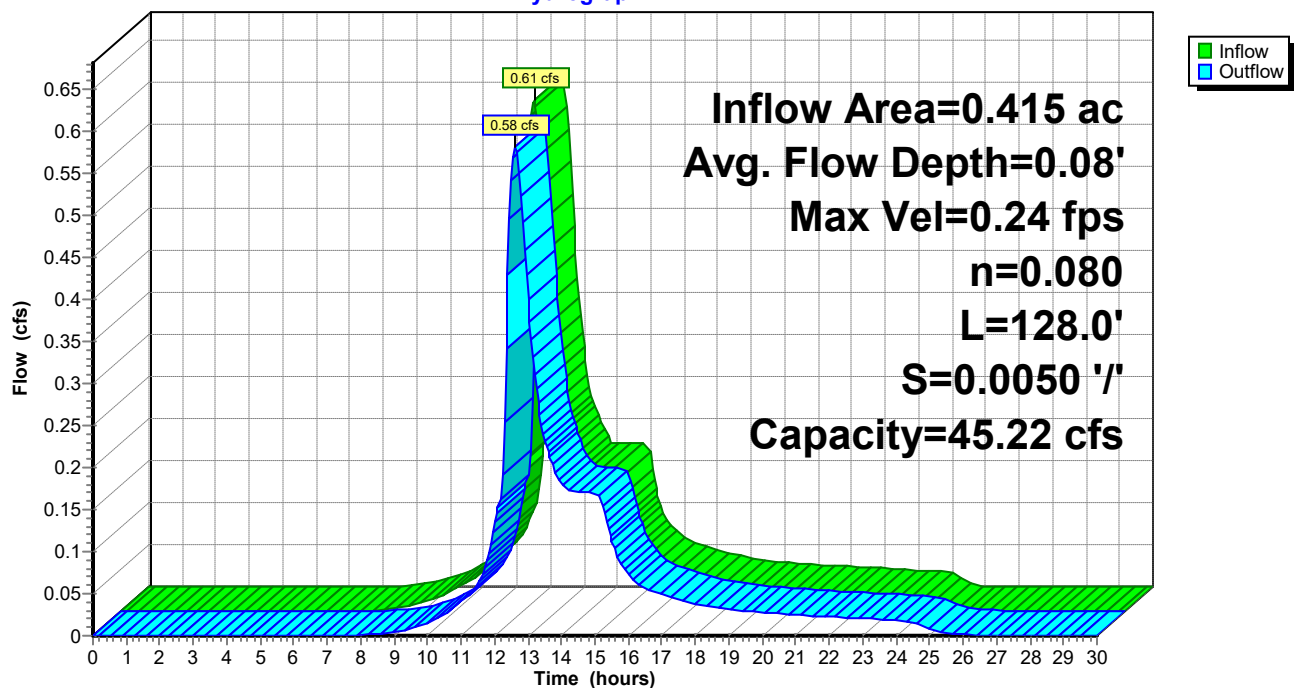
Length= 128.0' Slope= 0.0050 '/'

Inlet Invert= 85.00', Outlet Invert= 84.36'



### Reach OL-4: OVERLAND

#### Hydrograph



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Type III 24-hr 25-Year Rainfall=5.30"

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### Summary for Reach OL-5: OVERLAND

Inflow Area = 0.415 ac, 6.88% Impervious, Inflow Depth = 3.16" for 25-Year event  
Inflow = 0.61 cfs @ 12.32 hrs, Volume= 0.109 af  
Outflow = 0.61 cfs @ 12.34 hrs, Volume= 0.109 af, Atten= 0%, Lag= 1.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.55 fps, Min. Travel Time= 0.9 min

Avg. Velocity= 0.22 fps, Avg. Travel Time= 2.4 min

Peak Storage= 34 cf @ 12.32 hrs

Average Depth at Peak Storage= 0.07'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 66.52 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 35.00'

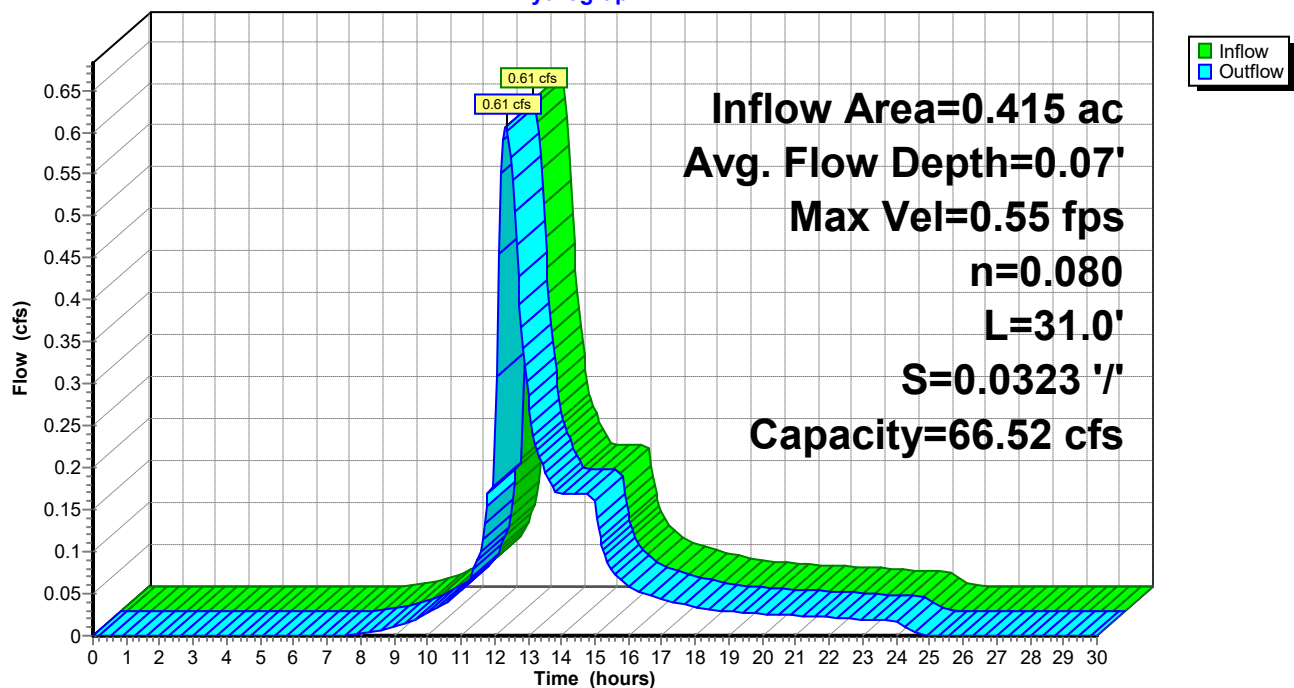
Length= 31.0' Slope= 0.0323 '/'

Inlet Invert= 86.00', Outlet Invert= 85.00'



### Reach OL-5: OVERLAND

#### Hydrograph



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Type III 24-hr 25-Year Rainfall=5.30"

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**Summary for Pond DB-1: TO DP#1**

Inflow Area = 0.415 ac, 6.88% Impervious, Inflow Depth = 3.16" for 25-Year event  
 Inflow = 1.53 cfs @ 12.08 hrs, Volume= 0.109 af  
 Outflow = 0.61 cfs @ 12.32 hrs, Volume= 0.109 af, Atten= 60%, Lag= 14.5 min  
 Primary = 0.61 cfs @ 12.32 hrs, Volume= 0.109 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
 Peak Elev= 89.87' @ 12.32 hrs Surf.Area= 1,601 sf Storage= 1,174 cf

Plug-Flow detention time= 29.4 min calculated for 0.109 af (100% of inflow)  
 Center-of-Mass det. time= 29.2 min ( 847.6 - 818.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	89.00'	5,994 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
89.00	1,090	0	0
90.00	1,676	1,383	1,383
92.00	2,935	4,611	5,994

Device	Routing	Invert	Outlet Devices
#1	Secondary	91.00'	<b>10.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Device 5	87.50'	<b>Special &amp; User-Defined</b> Head (feet) 0.00 1.00 15.00 Disch. (cfs) 0.000 0.170 0.170
#3	Device 5	90.50'	<b>2.6' long Sharp-Crested Rectangular Weir X 3.00</b> 2 End Contraction(s) 0.5' Crest Height
#4	Device 5	89.40'	<b>6.0" Vert. Orifice/Grate</b> C= 0.600
#5	Primary	87.40'	<b>12.0" Round Culvert</b> L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 87.40' / 87.00' S= 0.0133 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

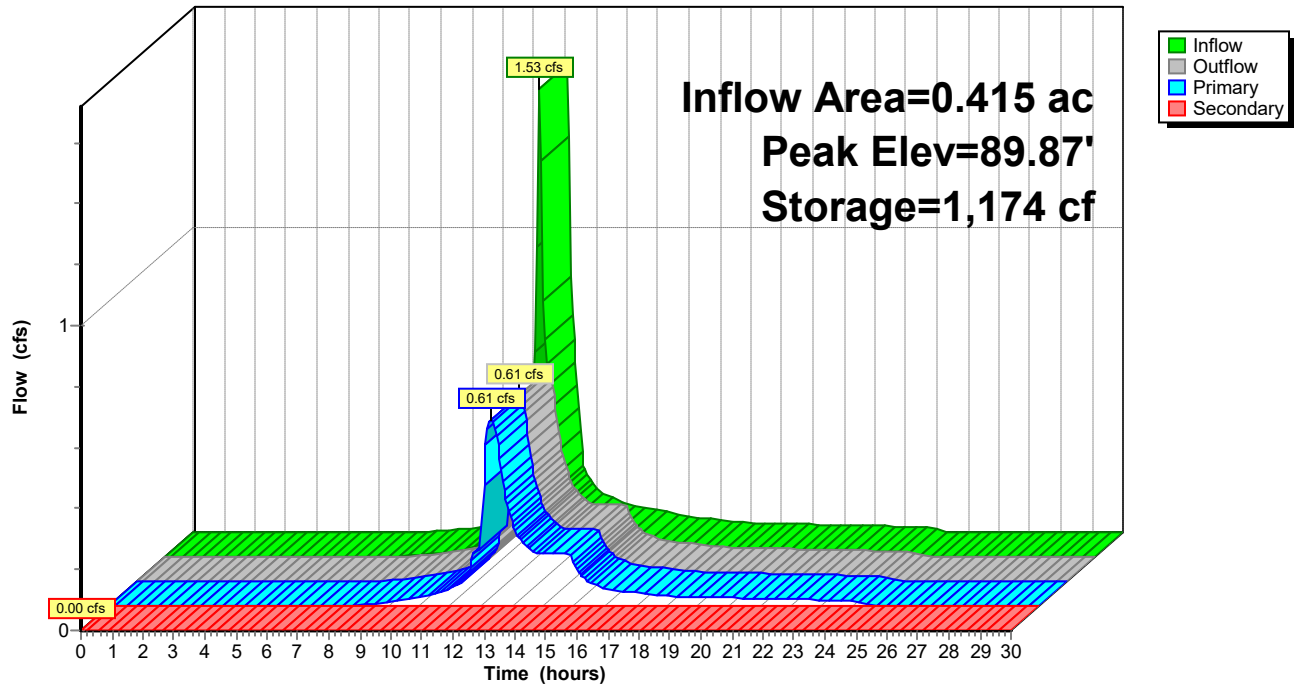
**Primary OutFlow** Max=0.62 cfs @ 12.32 hrs HW=89.87' (Free Discharge)

↑ **5=Culvert** (Passes 0.62 cfs of 4.19 cfs potential flow)  
 ↑ **2=Special & User-Defined** (Custom Controls 0.17 cfs)  
 ↑ **3=Sharp-Crested Rectangular Weir** ( Controls 0.00 cfs)  
 ↑ **4=Orifice/Grate** (Orifice Controls 0.45 cfs @ 2.34 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=89.00' (Free Discharge)

↑ **1=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)



**Pond DB-1: TO DP#1****Hydrograph**

**3010-POST**

Type III 24-hr 100-Year Rainfall=6.50"

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment P10: TO WETLAND (DP#1)** Runoff Area=66,334 sf 6.95% Impervious Runoff Depth=3.61"  
 Flow Length=537' Tc=13.2 min CN=74 Runoff=5.07 cfs 0.458 af

**Subcatchment P11: TO D.BASIN** Runoff Area=18,069 sf 6.88% Impervious Runoff Depth=4.24"  
 Flow Length=220' Tc=5.0 min CN=80 Runoff=2.06 cfs 0.146 af

**Subcatchment P2: TO CATCHBASIN (DP#2)** Runoff Area=9,069 sf 84.42% Impervious Runoff Depth=5.79"  
 Flow Length=427' Slope=0.0600 '/' Tc=5.0 min CN=94 Runoff=1.30 cfs 0.100 af

**Subcatchment P3: TO LOW POINT (DP#3)** Runoff Area=82,313 sf 15.10% Impervious Runoff Depth=3.92"  
 Flow Length=356' Tc=5.0 min CN=77 Runoff=8.67 cfs 0.617 af

**Subcatchment P4: TO DCB-B** Runoff Area=5,470 sf 79.63% Impervious Runoff Depth=5.68"  
 Flow Length=217' Slope=0.0600 '/' Tc=5.0 min CN=93 Runoff=0.78 cfs 0.059 af

**Reach DCB-B: TO OUTFALL** Inflow=0.78 cfs 0.059 af  
 Outflow=0.78 cfs 0.059 af

**Reach DP#1: WETLAND** Inflow=5.59 cfs 0.664 af  
 Outflow=5.59 cfs 0.664 af

**Reach DP#2: MUNICIPAL CATCHBASIN** Inflow=1.30 cfs 0.100 af  
 Outflow=1.30 cfs 0.100 af

**Reach DP#3: LOW POINT** Inflow=8.67 cfs 0.617 af  
 Outflow=8.67 cfs 0.617 af

**Reach OL-1: OVERLAND** Avg. Flow Depth=0.06' Max Vel=0.87 fps Inflow=0.78 cfs 0.059 af  
 n=0.080 L=66.0' S=0.1061 '/' Capacity=120.62 cfs Outflow=0.74 cfs 0.059 af

**Reach OL-2: OVERLAND** Avg. Flow Depth=0.08' Max Vel=0.51 fps Inflow=0.74 cfs 0.059 af  
 n=0.080 L=170.0' S=0.0235 '/' Capacity=56.81 cfs Outflow=0.64 cfs 0.059 af

**Reach OL-3: OVERLAND** Avg. Flow Depth=0.05' Max Vel=0.70 fps Inflow=0.64 cfs 0.059 af  
 n=0.080 L=189.0' S=0.0720 '/' Capacity=99.35 cfs Outflow=0.58 cfs 0.059 af

**Reach OL-4: OVERLAND** Avg. Flow Depth=0.10' Max Vel=0.27 fps Inflow=0.81 cfs 0.146 af  
 n=0.080 L=128.0' S=0.0050 '/' Capacity=45.22 cfs Outflow=0.79 cfs 0.146 af

**Reach OL-5: OVERLAND** Avg. Flow Depth=0.08' Max Vel=0.62 fps Inflow=0.81 cfs 0.146 af  
 n=0.080 L=31.0' S=0.0323 '/' Capacity=66.52 cfs Outflow=0.81 cfs 0.146 af

**Pond DB-1: TO DP#1** Peak Elev=90.11' Storage=1,574 cf Inflow=2.06 cfs 0.146 af  
 Primary=0.81 cfs 0.146 af Secondary=0.00 cfs 0.000 af Outflow=0.81 cfs 0.146 af

**Total Runoff Area = 4.161 ac Runoff Volume = 1.382 af Average Runoff Depth = 3.98"**  
**83.28% Pervious = 3.465 ac 16.72% Impervious = 0.696 ac**

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Type III 24-hr 100-Year Rainfall=6.50"

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**Summary for Subcatchment P10: TO WETLAND (DP#1)**

Runoff = 5.07 cfs @ 12.19 hrs, Volume= 0.458 af, Depth= 3.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
19,547	74	>75% Grass cover, Good, HSG C
40,200	70	Woods, Good, HSG C
4,194	98	Paved parking, HSG C
1,978	89	Gravel roads, HSG C
415	98	Unconnected pavement, HSG C
66,334	74	Weighted Average
61,725		93.05% Pervious Area
4,609		6.95% Impervious Area
415		9.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	13	0.2150	0.13		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.00"
0.8	9	0.1000	0.19		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.00"
0.7	28	0.0060	0.64		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.5	50	0.0060	1.57		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.3	28	0.0120	1.76		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
0.6	64	0.0120	1.76		<b>Shallow Concentrated Flow, grass</b> Unpaved Kv= 16.1 fps
0.2	65	0.0830	4.64		<b>Shallow Concentrated Flow, grass</b> Unpaved Kv= 16.1 fps
0.2	40	0.0300	2.79		<b>Shallow Concentrated Flow, grass</b> Unpaved Kv= 16.1 fps
2.2	112	0.0300	0.87		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
6.0	128	0.0050	0.35		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.2	537	Total			

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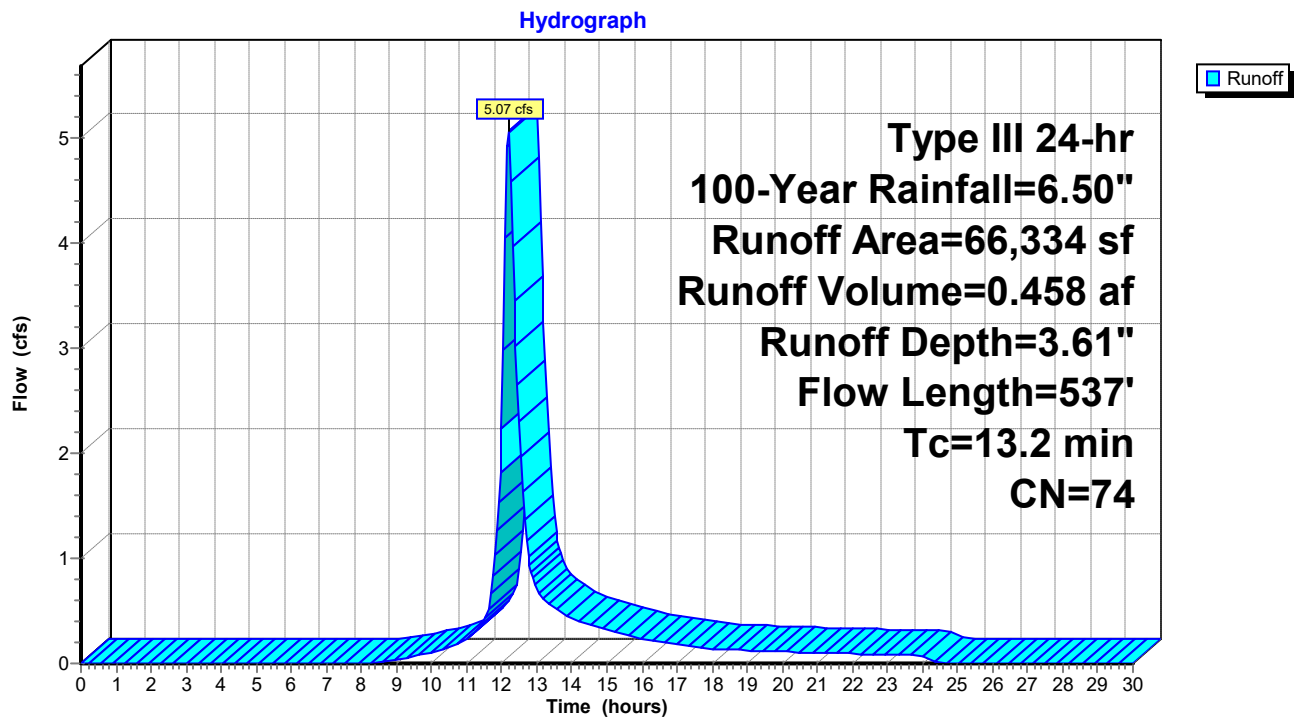
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Type III 24-hr 100-Year Rainfall=6.50"

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## Subcatchment P10: TO WETLAND (DP#1)



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Type III 24-hr 100-Year Rainfall=6.50"

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**Summary for Subcatchment P11: TO D.BASIN**

Runoff = 2.06 cfs @ 12.07 hrs, Volume= 0.146 af, Depth= 4.24"

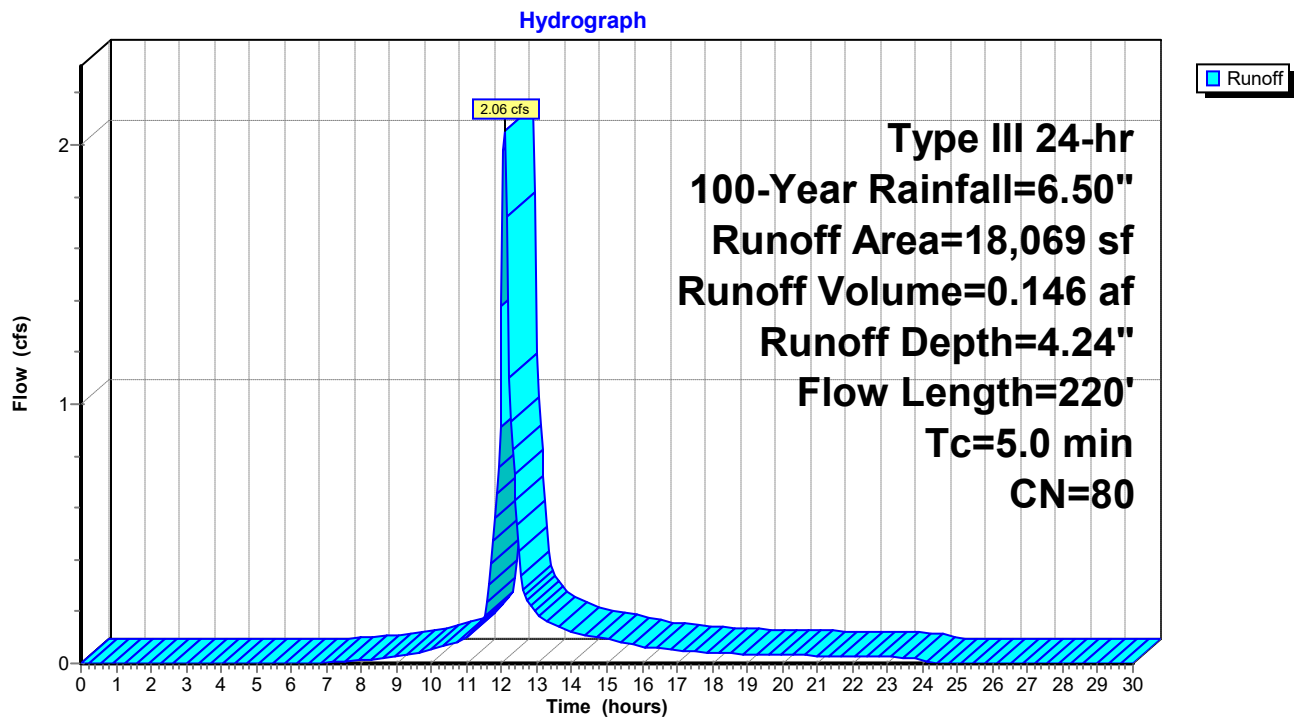
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
11,036	74	>75% Grass cover, Good, HSG C
1,244	98	Unconnected pavement, HSG C
5,789	89	Gravel roads, HSG C
18,069	80	Weighted Average
16,825		93.12% Pervious Area
1,244		6.88% Impervious Area
1,244		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	50	0.0830	2.05		<b>Sheet Flow, GRAVEL</b> Smooth surfaces n= 0.011 P2= 3.00"
0.0	13	0.0830	4.64		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
0.5	119	0.0550	3.78		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
0.1	38	0.5000	11.38		<b>Shallow Concentrated Flow, GRASS</b> Unpaved Kv= 16.1 fps
1.0	220	Total, Increased to minimum Tc = 5.0 min			

## Subcatchment P11: TO D.BASIN



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Type III 24-hr 100-Year Rainfall=6.50"

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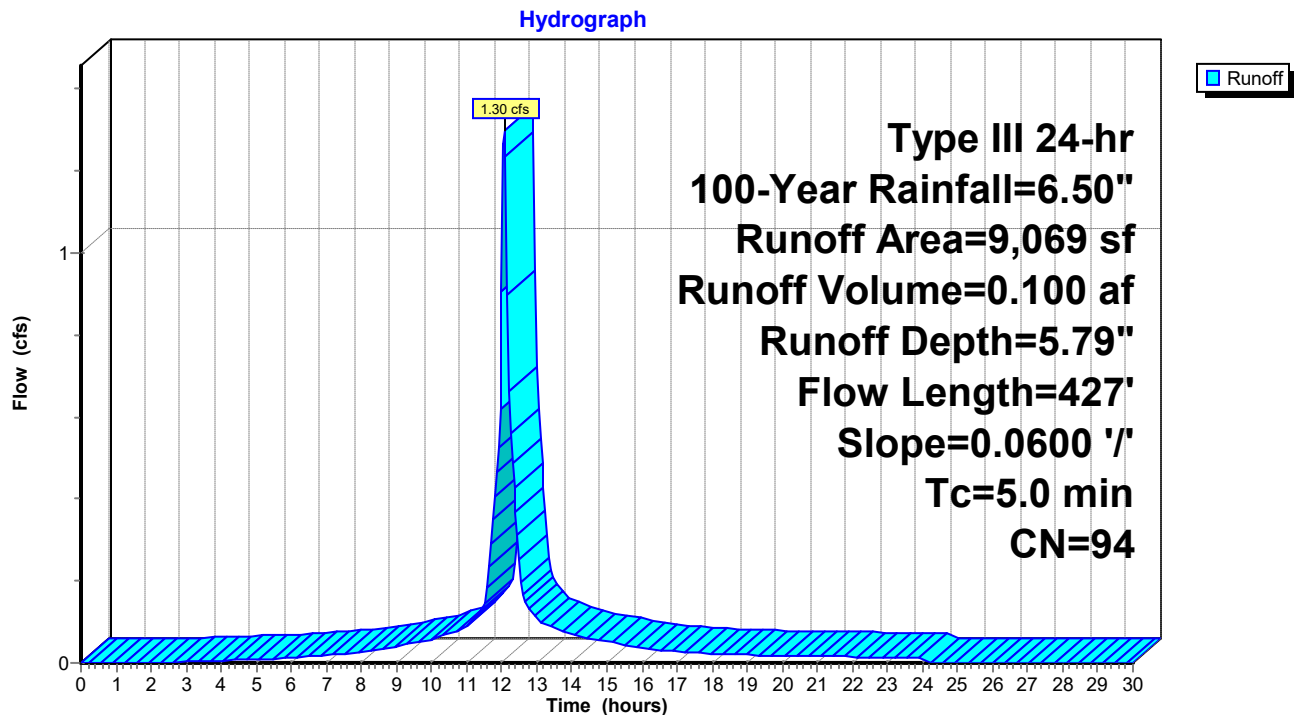
**Summary for Subcatchment P2: TO CATCHBASIN (DP#2)**

Runoff = 1.30 cfs @ 12.07 hrs, Volume= 0.100 af, Depth= 5.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
794	74	>75% Grass cover, Good, HSG C
523	70	Woods, Good, HSG C
7,656	98	Paved parking, HSG C
96	89	Gravel roads, HSG C
9,069	94	Weighted Average
1,413		15.58% Pervious Area
7,656		84.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0600	1.80		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
1.3	377	0.0600	4.97		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.8	427	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment P2: TO CATCHBASIN (DP#2)**

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Type III 24-hr 100-Year Rainfall=6.50"

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**Summary for Subcatchment P3: TO LOW POINT (DP#3)**

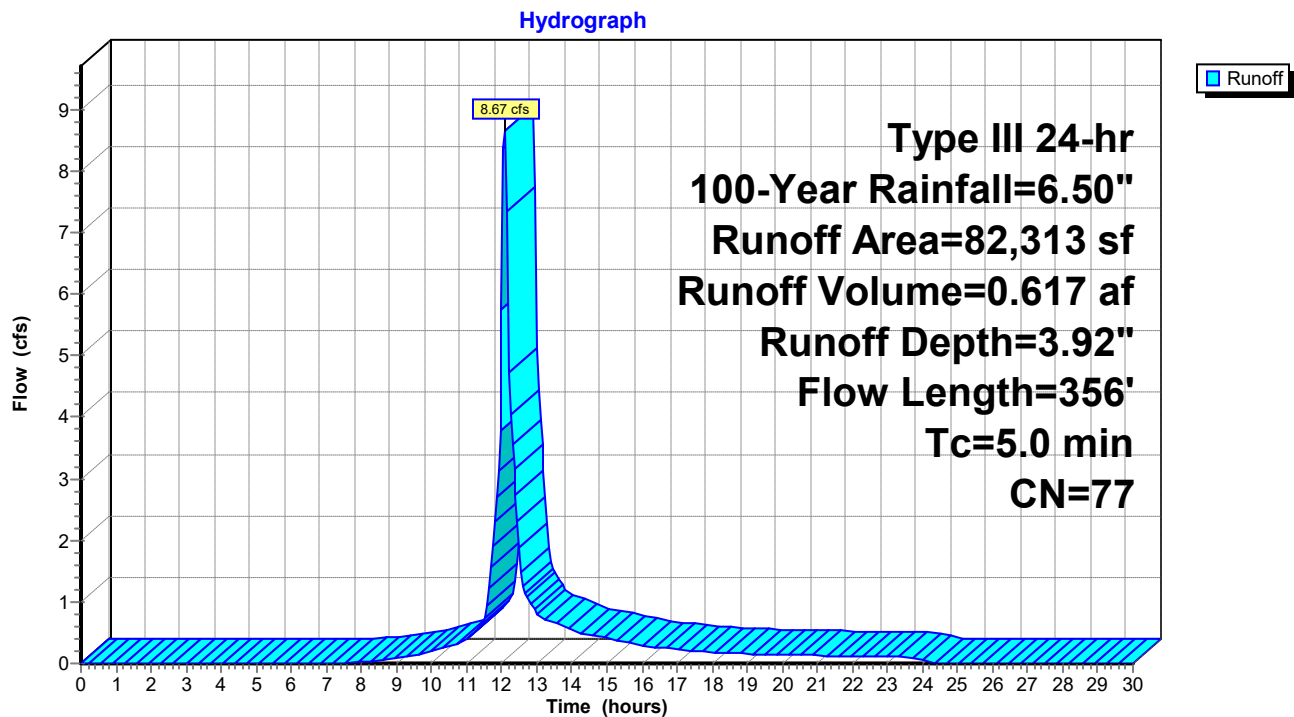
Runoff = 8.67 cfs @ 12.08 hrs, Volume= 0.617 af, Depth= 3.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
8,024	74	>75% Grass cover, Good, HSG C
49,390	70	Woods, Good, HSG C
12,433	98	Paved parking, HSG C
12,466	89	Gravel roads, HSG C
82,313	77	Weighted Average
69,880		84.90% Pervious Area
12,433		15.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	35	0.1400	2.35		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.2	15	0.0320	1.10		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.2	53	0.0320	3.63		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.3	54	0.0320	2.88		<b>Shallow Concentrated Flow, GRAVEL</b> Unpaved Kv= 16.1 fps
0.0	28	0.4200	10.43		<b>Shallow Concentrated Flow, GRASS/BRUSH</b> Unpaved Kv= 16.1 fps
1.4	171	0.1600	2.00		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
2.3	356	Total, Increased to minimum Tc = 5.0 min			



**Subcatchment P3: TO LOW POINT (DP#3)**

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**Summary for Subcatchment P4: TO DCB-B**

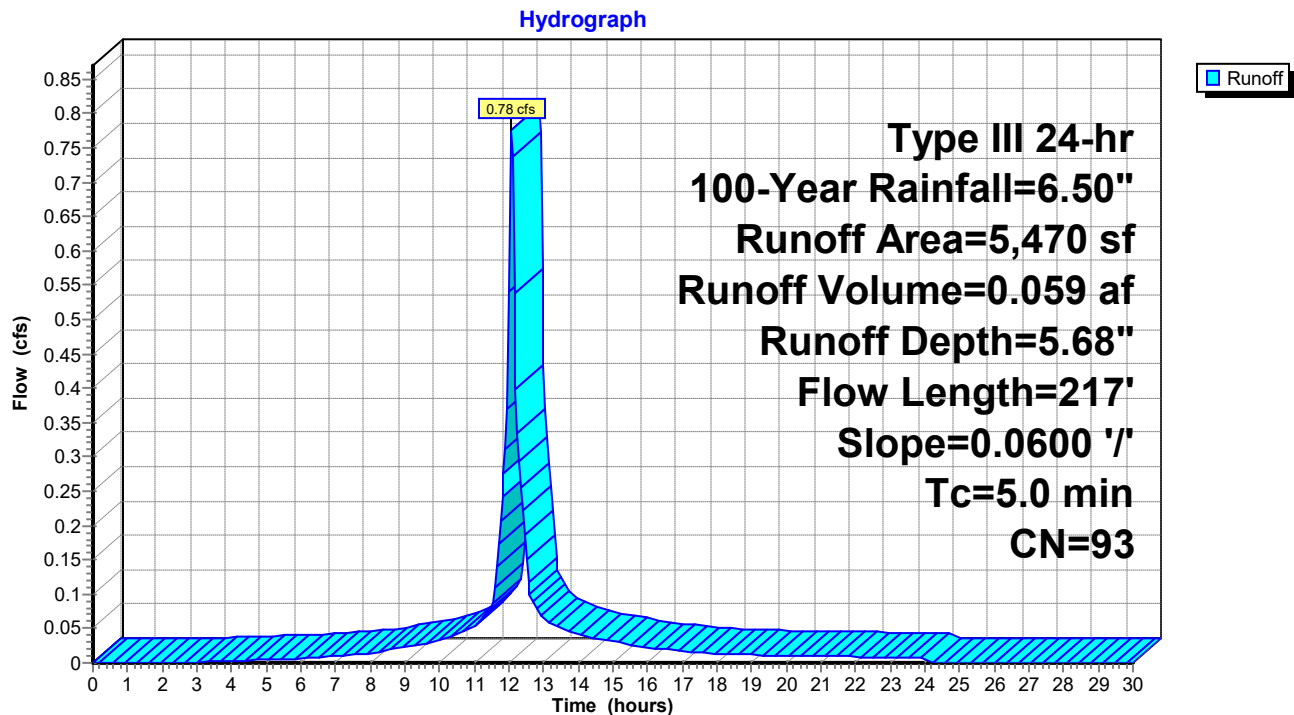
Runoff = 0.78 cfs @ 12.07 hrs, Volume= 0.059 af, Depth= 5.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
1,114	74	>75% Grass cover, Good, HSG C
4,356	98	Paved parking, HSG C
5,470	93	Weighted Average
1,114		20.37% Pervious Area
4,356		79.63% Impervious Area

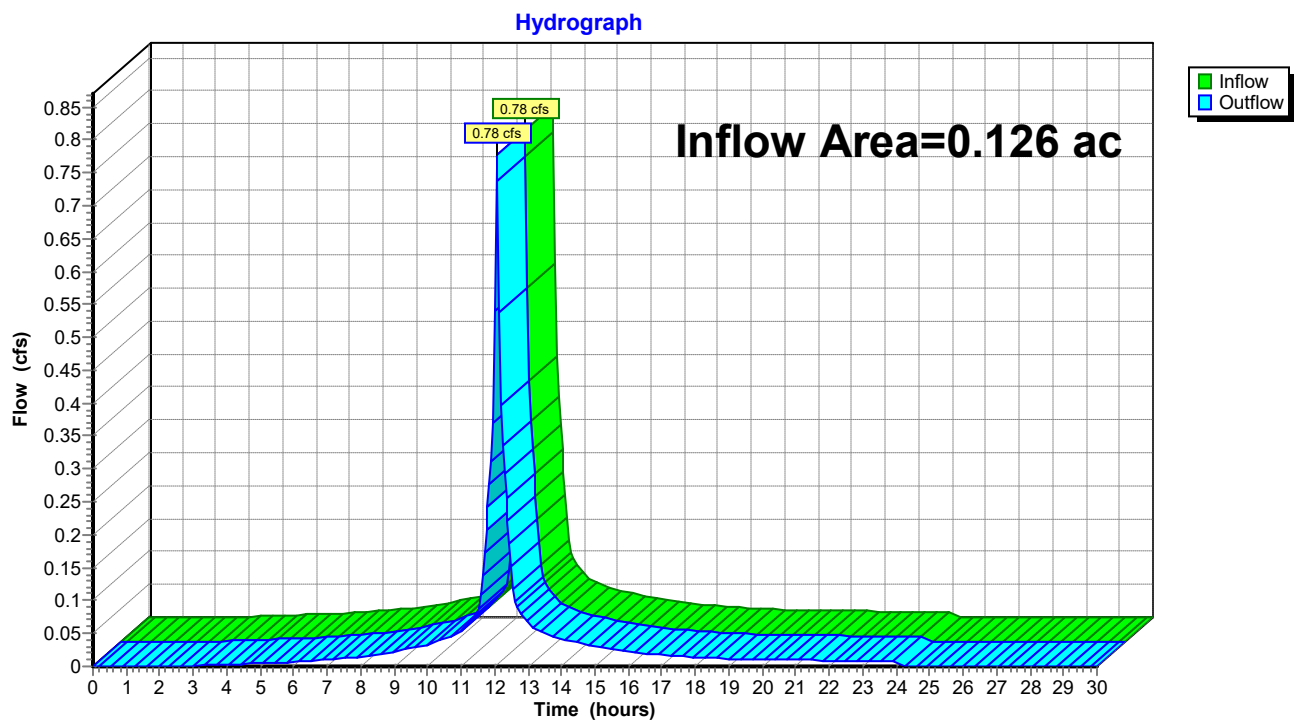
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	50	0.0600	1.80		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.00"
0.6	167	0.0600	4.97		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.1	217	Total, Increased to minimum Tc = 5.0 min			

**Subcatchment P4: TO DCB-B**

**Summary for Reach DCB-B: TO OUTFALL**

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 5.68" for 100-Year event  
Inflow = 0.78 cfs @ 12.07 hrs, Volume= 0.059 af  
Outflow = 0.78 cfs @ 12.07 hrs, Volume= 0.059 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DCB-B: TO OUTFALL**

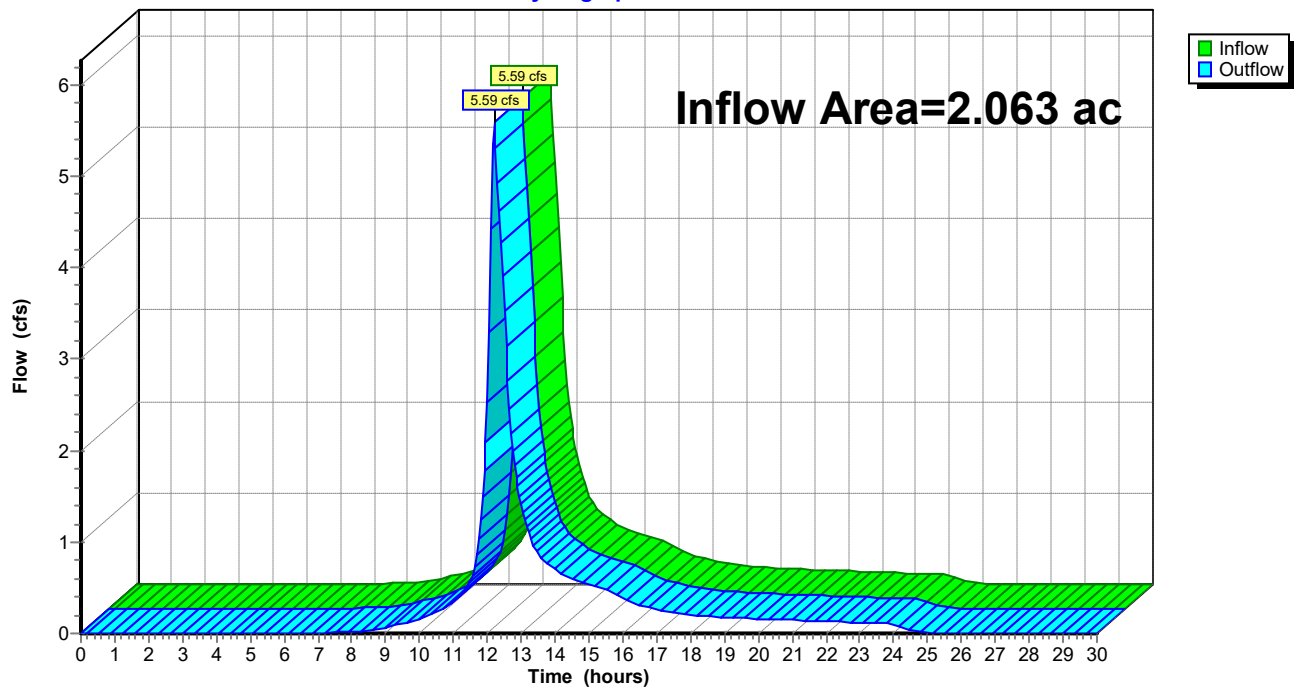
**Summary for Reach DP#1: WETLAND**

Inflow Area = 2.063 ac, 11.36% Impervious, Inflow Depth = 3.86" for 100-Year event  
Inflow = 5.59 cfs @ 12.20 hrs, Volume= 0.664 af  
Outflow = 5.59 cfs @ 12.20 hrs, Volume= 0.664 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#1: WETLAND**

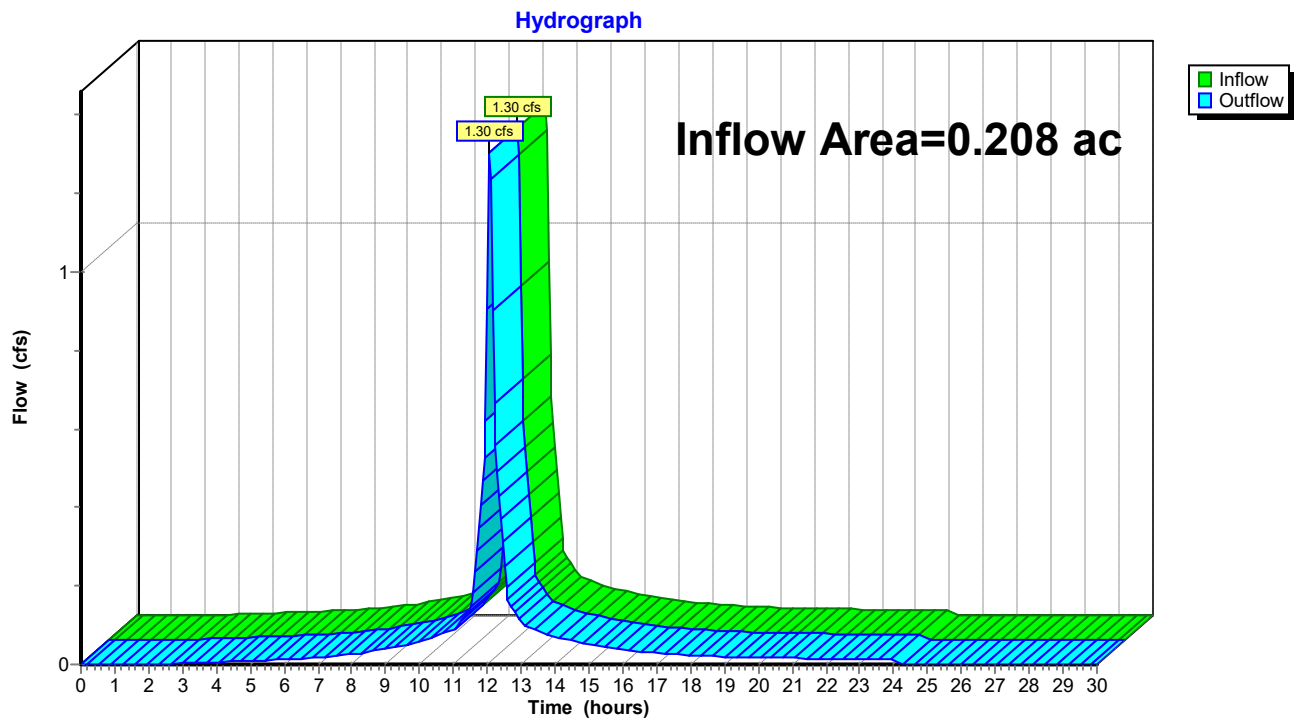
Hydrograph



**Summary for Reach DP#2: MUNICIPAL CATCHBASIN**

Inflow Area = 0.208 ac, 84.42% Impervious, Inflow Depth = 5.79" for 100-Year event  
Inflow = 1.30 cfs @ 12.07 hrs, Volume= 0.100 af  
Outflow = 1.30 cfs @ 12.07 hrs, Volume= 0.100 af, Atten= 0%, Lag= 0.0 min

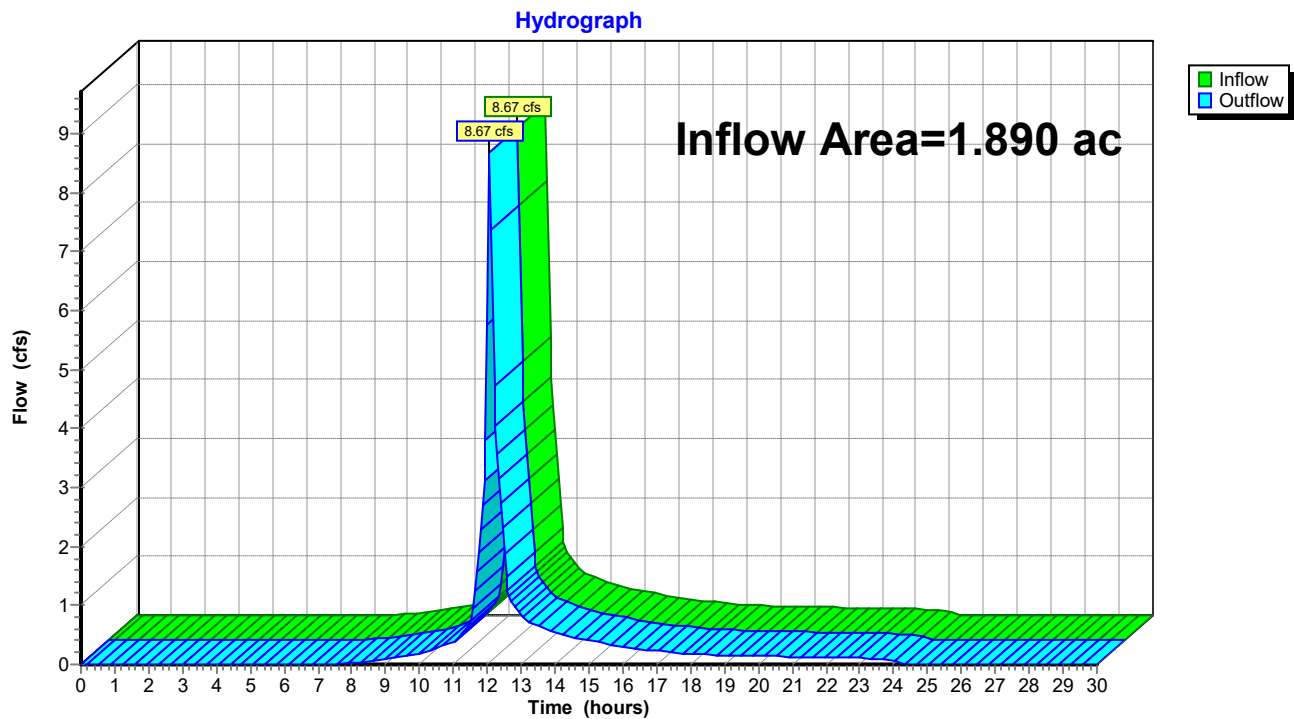
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#2: MUNICIPAL CATCHBASIN**

**Summary for Reach DP#3: LOW POINT**

Inflow Area = 1.890 ac, 15.10% Impervious, Inflow Depth = 3.92" for 100-Year event  
Inflow = 8.67 cfs @ 12.08 hrs, Volume= 0.617 af  
Outflow = 8.67 cfs @ 12.08 hrs, Volume= 0.617 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

**Reach DP#3: LOW POINT**

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### Summary for Reach OL-1: OVERLAND

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 5.68" for 100-Year event  
Inflow = 0.78 cfs @ 12.07 hrs, Volume= 0.059 af  
Outflow = 0.74 cfs @ 12.11 hrs, Volume= 0.059 af, Atten= 5%, Lag= 2.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.87 fps, Min. Travel Time= 1.3 min

Avg. Velocity= 0.30 fps, Avg. Travel Time= 3.7 min

Peak Storage= 58 cf @ 12.09 hrs

Average Depth at Peak Storage= 0.06'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 120.62 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 35.00'

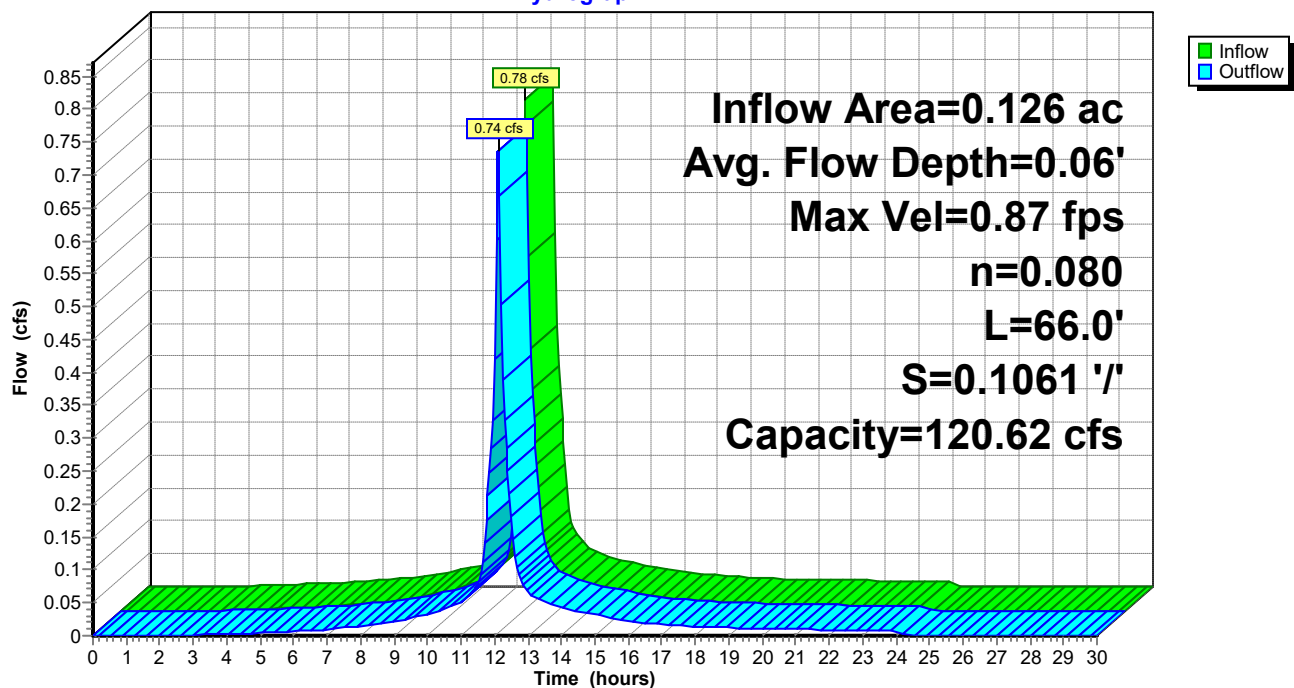
Length= 66.0' Slope= 0.1061 '/'

Inlet Invert= 109.00', Outlet Invert= 102.00'



### Reach OL-1: OVERLAND

#### Hydrograph



**Summary for Reach OL-2: OVERLAND**

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 5.68" for 100-Year event  
 Inflow = 0.74 cfs @ 12.11 hrs, Volume= 0.059 af  
 Outflow = 0.64 cfs @ 12.26 hrs, Volume= 0.059 af, Atten= 13%, Lag= 8.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.51 fps, Min. Travel Time= 5.5 min

Avg. Velocity = 0.15 fps, Avg. Travel Time= 18.4 min

Peak Storage= 215 cf @ 12.16 hrs

Average Depth at Peak Storage= 0.08'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 56.81 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

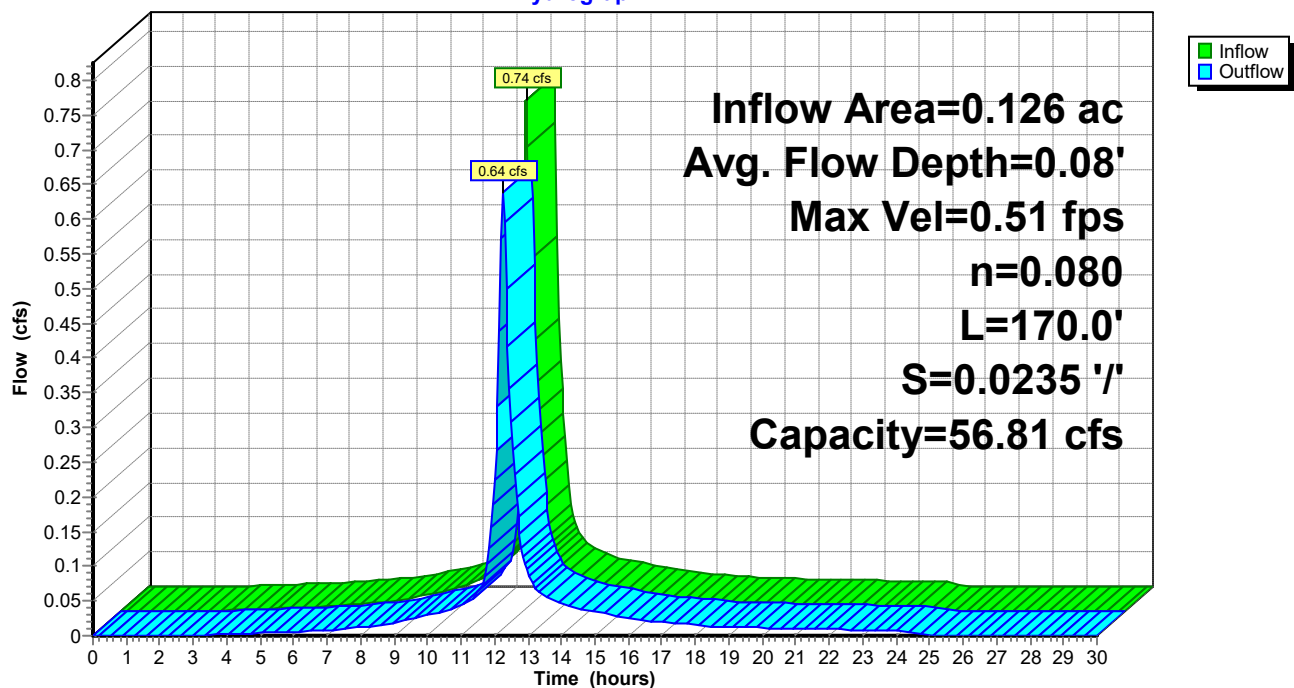
Side Slope Z-value= 10.0 ' ' Top Width= 35.00'

Length= 170.0' Slope= 0.0235 ' '

Inlet Invert= 102.00', Outlet Invert= 98.00'

**Reach OL-2: OVERLAND**

Hydrograph





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### Summary for Reach OL-3: OVERLAND

Inflow Area = 0.126 ac, 79.63% Impervious, Inflow Depth = 5.68" for 100-Year event  
Inflow = 0.64 cfs @ 12.26 hrs, Volume= 0.059 af  
Outflow = 0.58 cfs @ 12.38 hrs, Volume= 0.059 af, Atten= 8%, Lag= 7.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.70 fps, Min. Travel Time= 4.5 min

Avg. Velocity= 0.25 fps, Avg. Travel Time= 12.6 min

Peak Storage= 160 cf @ 12.30 hrs

Average Depth at Peak Storage= 0.05'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 99.35 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 ' Top Width= 35.00'

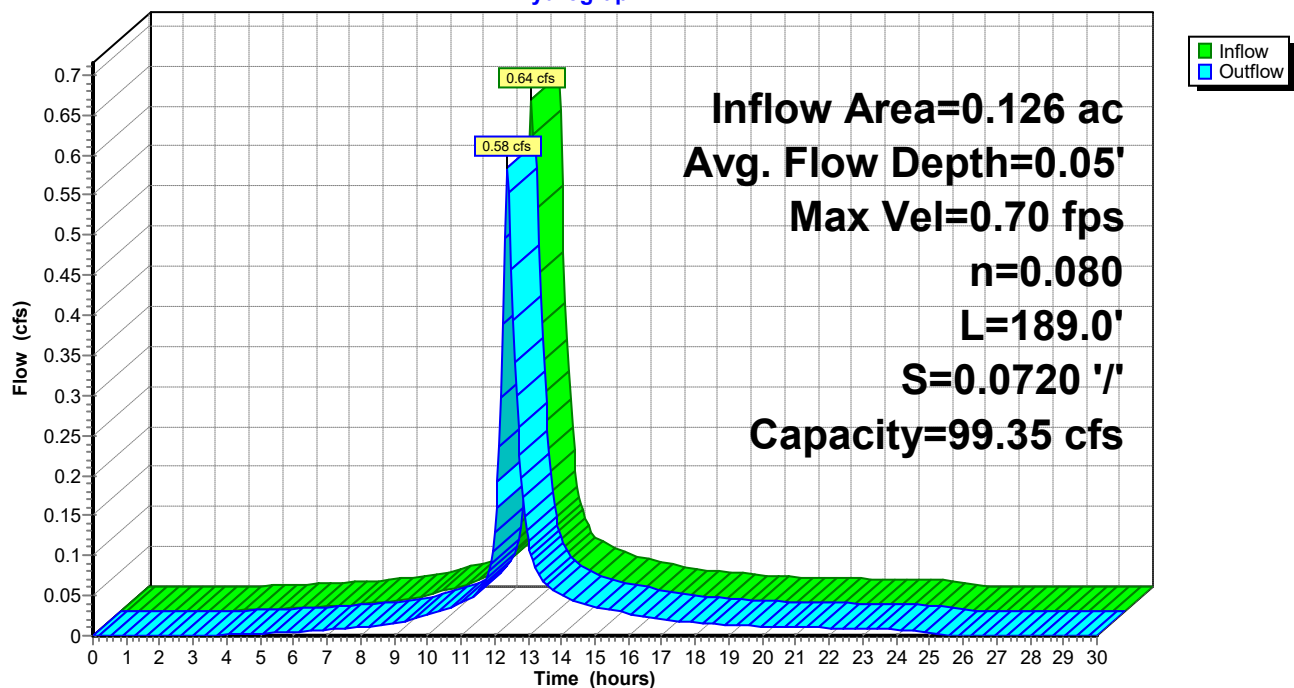
Length= 189.0' Slope= 0.0720 '/'

Inlet Invert= 98.00', Outlet Invert= 84.40'



### Reach OL-3: OVERLAND

#### Hydrograph



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### Summary for Reach OL-4: OVERLAND

Inflow Area = 0.415 ac, 6.88% Impervious, Inflow Depth = 4.24" for 100-Year event  
Inflow = 0.81 cfs @ 12.33 hrs, Volume= 0.146 af  
Outflow = 0.79 cfs @ 12.59 hrs, Volume= 0.146 af, Atten= 3%, Lag= 15.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.27 fps, Min. Travel Time= 7.9 min

Avg. Velocity= 0.09 fps, Avg. Travel Time= 22.6 min

Peak Storage= 377 cf @ 12.46 hrs

Average Depth at Peak Storage= 0.10'

Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 45.22 cfs

30.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

Side Slope Z-value= 10.0 '/' Top Width= 50.00'

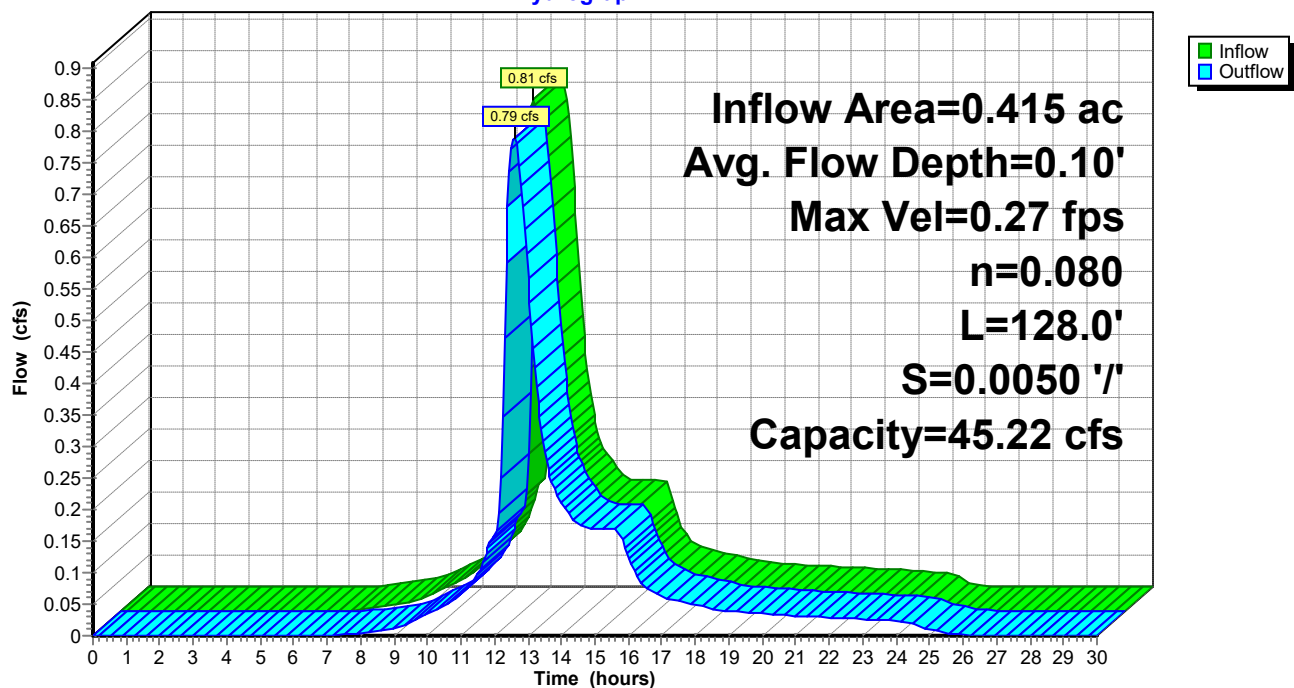
Length= 128.0' Slope= 0.0050 '/'

Inlet Invert= 85.00', Outlet Invert= 84.36'



### Reach OL-4: OVERLAND

Hydrograph



**Summary for Reach OL-5: OVERLAND**

Inflow Area = 0.415 ac, 6.88% Impervious, Inflow Depth = 4.24" for 100-Year event  
 Inflow = 0.81 cfs @ 12.31 hrs, Volume= 0.146 af  
 Outflow = 0.81 cfs @ 12.33 hrs, Volume= 0.146 af, Atten= 0%, Lag= 1.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Max. Velocity= 0.62 fps, Min. Travel Time= 0.8 min

Avg. Velocity= 0.23 fps, Avg. Travel Time= 2.2 min

Peak Storage= 41 cf @ 12.32 hrs

Average Depth at Peak Storage= 0.08'

Bank-Full Depth= 1.00' Flow Area= 25.0 sf, Capacity= 66.52 cfs

15.00' x 1.00' deep channel, n= 0.080 Earth, long dense weeds

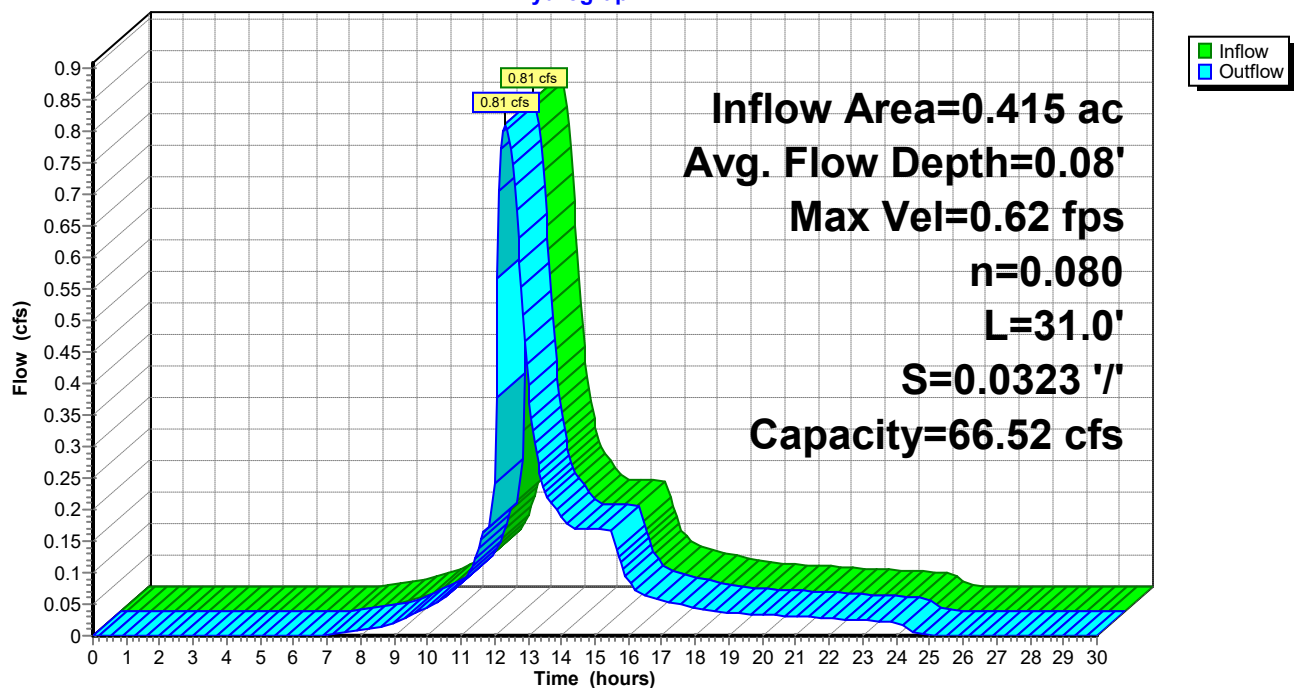
Side Slope Z-value= 10.0 '/' Top Width= 35.00'

Length= 31.0' Slope= 0.0323 '/'

Inlet Invert= 86.00', Outlet Invert= 85.00'

**Reach OL-5: OVERLAND**

Hydrograph



**Summary for Pond DB-1: TO DP#1**

Inflow Area = 0.415 ac, 6.88% Impervious, Inflow Depth = 4.24" for 100-Year event  
 Inflow = 2.06 cfs @ 12.07 hrs, Volume= 0.146 af  
 Outflow = 0.81 cfs @ 12.31 hrs, Volume= 0.146 af, Atten= 61%, Lag= 14.1 min  
 Primary = 0.81 cfs @ 12.31 hrs, Volume= 0.146 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
 Peak Elev= 90.11' @ 12.31 hrs Surf.Area= 1,746 sf Storage= 1,574 cf

Plug-Flow detention time= 29.7 min calculated for 0.146 af (100% of inflow)  
 Center-of-Mass det. time= 29.4 min ( 839.4 - 810.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	89.00'	5,994 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
89.00	1,090	0	0
90.00	1,676	1,383	1,383
92.00	2,935	4,611	5,994

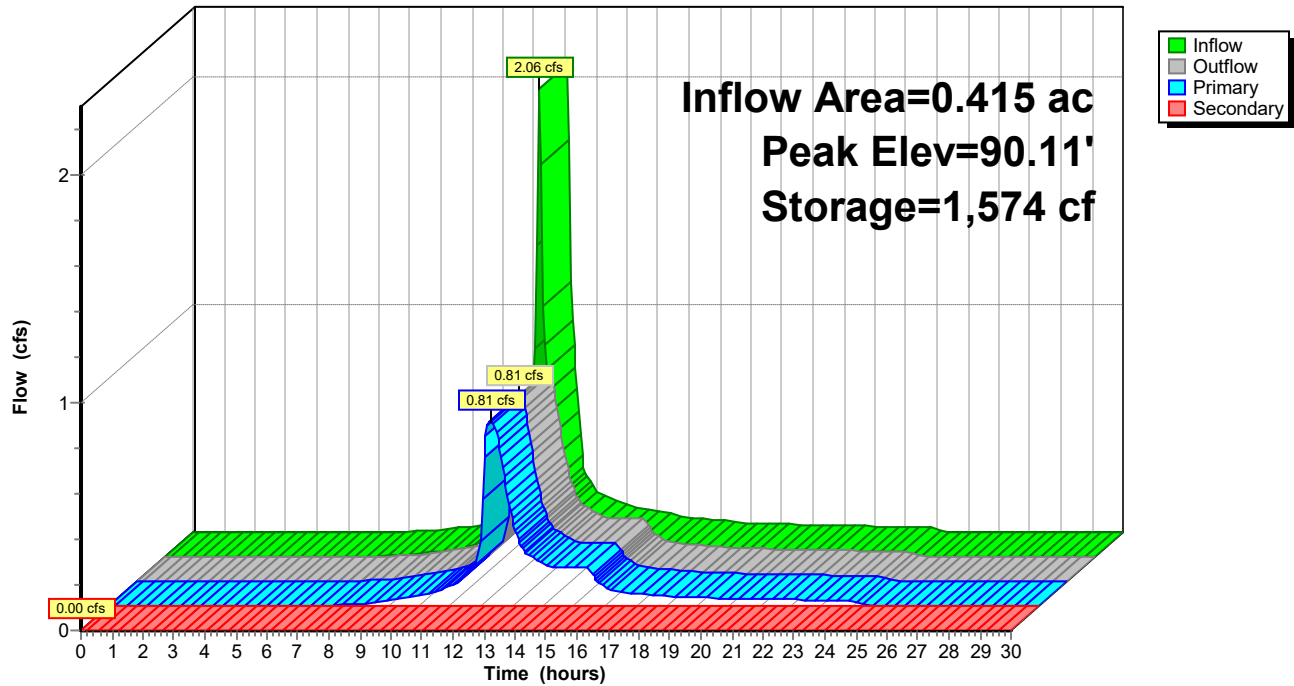
Device	Routing	Invert	Outlet Devices
#1	Secondary	91.00'	<b>10.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Device 5	87.50'	<b>Special &amp; User-Defined</b> Head (feet) 0.00 1.00 15.00 Disch. (cfs) 0.000 0.170 0.170
#3	Device 5	90.50'	<b>2.6' long Sharp-Crested Rectangular Weir X 3.00</b> 2 End Contraction(s) 0.5' Crest Height
#4	Device 5	89.40'	<b>6.0" Vert. Orifice/Grate</b> C= 0.600
#5	Primary	87.40'	<b>12.0" Round Culvert</b> L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 87.40' / 87.00' S= 0.0133 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.81 cfs @ 12.31 hrs HW=90.11' (Free Discharge)

↑ **5=Culvert** (Passes 0.81 cfs of 4.44 cfs potential flow)  
 ↑ **2=Special & User-Defined** (Custom Controls 0.17 cfs)  
 ↑ **3=Sharp-Crested Rectangular Weir** ( Controls 0.00 cfs)  
 ↑ **4=Orifice/Grate** (Orifice Controls 0.64 cfs @ 3.27 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=89.00' (Free Discharge)

↑ **1=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

**Pond DB-1: TO DP#1****Hydrograph**

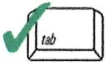
**3.0**  
**STORMWATER MANAGEMENT FORMS**





# Checklist for Stormwater Report

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



## A. Introduction

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

The Stormwater Report must include:

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

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

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

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

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

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



# Checklist for Stormwater Report

## B. Stormwater Checklist and Certification

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

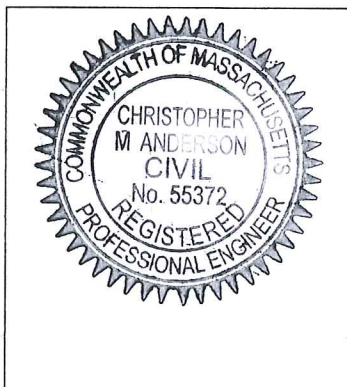
*Note:* Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that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

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

### Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



*Christopher M. Anderson* 9-21-21  
Signature and Date

## Checklist

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

- ☒ New development
- ☐ Redevelopment
- ☐ Mix of New Development and Redevelopment





# Checklist for Stormwater Report

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## Checklist (continued)

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

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☒ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☒ Other (describe): Dry Detention Basin

## Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.



# Checklist for Stormwater Report

## Standard 2: Peak Rate Attenuation

- ☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- ☒ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- ☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm. ***Peak rate mitigation has been achieved for all storm events with the exception of DP#2 during all storm events. This increase is due to the additional grading required in order to maintain the shoulder of the existing road and the installation of a small portion of the gravel drive. These increases are considered de minimus as the increase is consistently at 0.01 c.f.s in all storm events.***

## Standard 3: Recharge

- ☒ Soil Analysis provided.
- ☒ Required Recharge Volume calculation provided.
- ☐ Required Recharge volume reduced through use of the LID site Design Credits.
- ☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.
  - ☒ Static
  - ☐ Simple Dynamic
  - ☐ Dynamic Field<sup>1</sup>
- ☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.
- ☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- ☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- ☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
  - ☒ Site is comprised solely of C and D soils and/or bedrock at the land surface
  - ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
  - ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
  - ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- ☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- ☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.



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

# Checklist for Stormwater Report

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

## Checklist (continued)

### Standard 3: Recharge (continued)

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

### Standard 4: Water Quality

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

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





# Checklist for Stormwater Report

## Checklist (continued)

### Standard 4: Water Quality (continued)

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

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

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

### Standard 6: Critical Areas

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



# Checklist for Stormwater Report

## Checklist (continued)

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

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

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

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

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





# Checklist for Stormwater Report

## Checklist (continued)

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

- ☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- ☐ The project is **not** covered by a NPDES Construction General Permit
- ☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- ☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

### Standard 9: Operation and Maintenance Plan

- ☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
  - ☒ Name of the stormwater management system owners;
  - ☒ Party responsible for operation and maintenance;
  - ☒ Schedule for implementation of routine and non-routine maintenance tasks;
  - ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
  - ☐ Description and delineation of public safety features;
  - ☐ Estimated operation and maintenance budget; and
  - ☒ Operation and Maintenance Log Form.
- ☐ The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
  - ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
  - ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

### Standard 10: Prohibition of Illicit Discharges

- ☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- ☐ An Illicit Discharge Compliance Statement is attached;
- ☒ NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

## **Stormwater Compliance Documentation**

1355 Main Street, Leicester

September 21, 2021

### **Standard 1: No Untreated Discharges or Erosion to Wetlands**

The drainage from the site currently overland flows towards one of two points within the project area. The majority of the project area overland flows to a wetland area located along the southerly property line. It is noted that a portion of the existing roadway drainage infrastructure flows onto the locus property and sheet flows to this wetland area as well. The remaining runoff either is directed towards the municipal drainage system further to the east along Main Street or a low point located further to the southeasterly corner of the abutting property.

As part of the project the majority of the runoff will be directed towards a small dry-detention basin located along the southerly portion of the project. This will then discharge towards the aforementioned wetland.

Provided are the computations showing the calculations per the Connecticut DOT Drainage Manual, Section 11.13 that the proposed rip-rap aprons will provide adequate protection from scouring.

Equation-11.31

$$L=1.80(Q-5)/Sp^{(1.5)} + 10$$

Equation-11.33

$$W2=3Sp + 0.7La$$

*For 12-inch HDPE pipe (FE#1)*

$$Q_{max}=0.82 \text{ cfs (100-Year)}$$

$$Sp=12/12 \rightarrow 1.0 \text{ ft}$$

$$L=1.8(0.82-5)/(1^{1.5}) + 10 \rightarrow -7.5 + 10 = 2.5 \rightarrow 10 \text{ feet (min)}$$

$$W2=3(1.0) + 0.7(10) \rightarrow 3.0 + 7.0 = 10 \rightarrow 20.0 \text{ feet}$$

Provide an apron 10-feet long with a terminus width of 10 feet wide.

### **Standard 2: Peak Rate Attenuation**

*Table #1: Peak Rate of Runoff*

Design Point		2-yr Storm	10-yr Storm	25-yr Storm	100-yr Storm
#1	Pre-	1.32	3.25	4.40	6.22
	Post-	1.29	3.02	4.00	5.59
#2	Pre-	0.55	0.87	1.04	1.29
	Post-	0.56	0.88	1.05	1.30
#3	Pre-	2.30	4.89	6.38	8.67
	Post-	2.30	4.89	6.38	8.67

All flows are in cubic feet per second.

As outline above, the post-development peak rates of runoff have been mitigated for all Storm Events, with the noted exception of Design Point #2 (DP#2), during all storm events. The increase within this Design point is due to the small increase in area caused by the gravel driveway. In order to maintain the gutter flow within Main Street ridge is to be created to maintain the street drainage within the street, this results in an increase in the contributing watershed of approximately 95 s.f. This increase by default is unavoidable in order to maintain this drainage pattern. Furthermore, the increase in the peak rate of flow during all storm events is consistently 0.01 c.f.s. and is considered *de minimus*.

### **Standard 3: Stormwater Recharge**

**Project is located exclusively within an area of hydrological C (HSG-C) soils, as such compliance is provided to the maximum extent practicable.**

**Impervious Area Proposed:** (This area includes all proposed buildings, driveways, etc.)

The soils within the reviewed project area classified as HSG C:

Existing Impervious HSG-C: 0.00 s.f.

Proposed Impervious HSG-C: 1,658 s.f.

Net New Impervious HSG-A: +1,658 s.f.

Total New Impervious area = +1,658 s.f.

Total Project Impervious = 1,658 s.f.

#### **Required Recharge Volume:**

##### **Net Increase HSG Soil C**

Net New Impervious HSG C= 1,658 s.f.

HSG C: 1,658 s.f. x (0.25 in/12) = 35 c.f.

Required Recharge Volume = 35 c.f.

#### **Capture Rate:**

Total Impervious to DB#1	1,244 sf
<b>Net Captured Impervious</b>	<b>1,244 sf</b>

Capture Rate = 1,244 s.f. / 1,658 s.f. = 75%

*Compliance is provided, Capture rate in excess of 65%*

#### **Storage Volume Provided:**

Volume below lowest outlet within detention facility.

DB-1: 478 c.f. of storage volume provided

#### **Recharge Provided:**

**Total Volume Required: 35 c.f.**

Volume below lowest outlet within detention facility.

DB-1: 478 c.f. of storage volume provided

Required Recharge Volume = 35 c.f.

Provided Recharge Volume = 478 c.f.

*Compliance is provided to the maximum extent practicable*



**Drawdown Time: (72 Hours Max.)**

Time = Storage Volume / (K x Bottom Area)

Where K = Saturated Hydraulic Conductivity (inches/hour) (From table 2.3.3 1982 Rawls Rates – Mass Stormwater Handbook)

D-Basin #1: 478 c.f. of storage volume provided.

Time = 478 c.f. / (0.27 in/hr x (1 ft/ 12 in) x 1,090 s.f.) = **19.5 hrs**

Compliance is provided

**Standard 4: Water Quality**

Water Quality Volume (WQV) = Water Quality Depth x Impervious Area

Water Quality Depth = 1/2 inch

WQV = [(1/2 inch) / 12 inches/foot] x (1,658 s.f.) = 69 cf

The total new impervious surfaces created by the project are associated with the concrete pads that are used for the transformers. Because these pads are not associated with activities that typically generate sediment, for the purposes of this analysis they are also considered similar to roofs. Therefore, Water Quality Volume is not warranted under Stormwater Management Regulations

**Standard 5: Land Uses with Higher Potential Pollutant Loads**

Not Applicable

**Standard 6: Critical Areas**

Not Applicable

**Standard 7: Redevelopment**

Not Applicable

**Standard 8: Construction Period Controls**

Proper erosion controls have been incorporated into the submitted plans and details to ensure compliance with the standard.

**Standard 9: Operation and Maintenance Plan**

Operation and Maintenance plans for the project have been incorporated into the submitted plans and details to ensure compliance with the standard.

**Standard 10: Illicit Discharges to Drainage System**

No Illicit discharges to the drainage system will occur as a result of this proposed project. A No Illicit discharge statement shall be provided prior to construction.

**3010-POST**

Type III 24-hr Custom Rainfall=3.07"

Prepared by HANNIGAN ENGINEERING, INC.

Printed 9/16/2021

HydroCAD® 10.00-25 s/n 00840 © 2019 HydroCAD Software Solutions LLC

**Summary for Pond DB-1: TO DP#1**

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 0.415 ac, 6.88% Impervious, Inflow Depth = 1.30" for Custom event  
 Inflow = 0.63 cfs @ 12.08 hrs, Volume= 0.045 af  
 Outflow = 0.17 cfs @ 12.05 hrs, Volume= 0.045 af, Atten= 73%, Lag= 0.0 min  
 Primary = 0.17 cfs @ 12.05 hrs, Volume= 0.045 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Peak Elev= 89.40' @ 12.47 hrs Surf.Area= 1,322 sf Storage= 478 cf &lt;=Storage/Drawdown Volume

Plug-Flow detention time= 24.0 min calculated for 0.045 af (100% of inflow)

Center-of-Mass det. time= 23.8 min ( 867.7 - 844.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	89.00'	5,994 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
89.00	1,090	0	0
90.00	1,676	1,383	1,383
92.00	2,935	4,611	5,994

Device	Routing	Invert	Outlet Devices
#1	Secondary	91.00'	<b>10.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Device 5	87.50'	<b>Special &amp; User-Defined</b> Head (feet) 0.00 1.00 15.00 Disch. (cfs) 0.000 0.170 0.170
#3	Device 5	90.50'	<b>2.6' long Sharp-Crested Rectangular Weir X 3.00</b> 2 End Contraction(s) 0.5' Crest Height
#4	Device 5	89.40'	<b>6.0" Vert. Orifice/Grate C= 0.600</b>
#5	Primary	87.40'	<b>12.0" Round Culvert</b> L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 87.40' / 87.00' S= 0.0133 ' / S= 0.0133 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.17 cfs @ 12.05 hrs HW=89.18' (Free Discharge)

5=Culvert (Passes 0.17 cfs of 3.37 cfs potential flow)  
 2=Special & User-Defined (Custom Controls 0.17 cfs)  
 3=Sharp-Crested Rectangular Weir ( Controls 0.00 cfs)  
 4=Orifice/Grate ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=89.00' (Free Discharge)

1=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

**3.1**  
**OPERATION AND MAINTENANCE**

## **STORMWATER OPERATION, MAINTENANCE AND POLLUTION PREVENTION PLAN**

**ZP Battery Devco, LLC  
#1355 Main Street  
Leicester, Massachusetts**

### **RESPONSIBLE PARTY DURING CONSTRUCTION:**

*To Be Determined.*

### **RESPONSIBLE PARTY POST CONSTRUCTION:**

**ZP Battery Devco, LLC  
10 E. Worcester Street, Suite 3A  
Worcester, Massachusetts 01604**

### **BEST MANAGEMENT PRACTICES**

To prevent the migration of soils, Best Management Practices (BMP's) shall be employed. During construction, hay bales and silt fence will be installed as shown on the plans and also at additional locations on an as needed basis to provide sufficient erosion controls on the site. These components shall be installed to catch and trap the migrating soil materials and pollutants.

All applicable BMP's listed below and in the Department of Environmental Protection's Stormwater Management Handbooks (Volume 1: Overview of Massachusetts Stormwater Management Standards and Volume 2: Technical Guide for Compliance with Massachusetts Stormwater Management Standards) dated January 2008 (as amended), shall be incorporated in this project. This Plan shall be followed by the Homeowners Association and residents as required and amended by the Massachusetts Department of Environmental Protection's Stormwater Management Regulations

### **INSPECTION AND MAINTENANCE (DURING CONSTRUCTION)**

1. At all times, hay bales, siltation fabric fencing and wooden stakes sufficient to construct sedimentation control barrier a minimum of 50 feet long will be stockpiled on the site in order to repair established barriers which may have been damaged or breached.
2. Necessary erosion controls shall be in place prior to any clearing or construction on the site. Construction sequence shall be phased in such a manner that the on-site detention basins are stabilized and functioning prior to the establishment of any new impervious areas on the site. The Contractor shall provide temporary stilling or settling basins as needed to catch and trap any migrating soil materials and pollutants from the construction areas.
3. An inspection of all erosion control and stormwater management systems shall be conducted at least once every fourteen (14) calendar days and following significant storm events. Where sites have been finally or temporarily stabilized, or runoff is unlikely due to winter conditions, such inspections shall be conducted at least once every month. (EPA SWPPP IS REQUIRED FOR THIS PROJECT)



In case of any noted breach or failure, the General Contractor shall immediately make appropriate repairs to any erosion control system and notify the engineer of any problems involving storm water management systems.

A significant storm event shall be defined as all or one of the following thresholds.

- a. Any storm in which rain is predicted to last for twelve consecutive hours or more.
  - b. Any storm for which a flash flood watch or warning is issued.
  - c. Any single storm predicted to have a cumulative rainfall of greater than one inch.
  - d. Any storm not meeting the previous three thresholds but which would mark a third consecutive day of measurable rainfall.
4. If site inspections identify BMPs not operating effectively, maintenance must be performed as soon as possible and before the next storm event.
  5. If BMPs need modification or additional BMPs need to be added, implementation must be completed before the next storm if practicable. If implementation before the next storm event is impracticable, the situation must be documented in the construction log and alternative BMPs must be implemented as soon as possible
  6. The General Contractor shall also inspect the erosion control and stormwater management systems at times of significant increase in surface water runoff due to rapid thawing when the risk of failure of erosion control measures is significant.
  7. In such instances as remedial action is necessary, the General Contractor shall repair any and all significant deficiencies in erosion control systems within two days.
  8. The Department of Public Works and/or Conservation Commission shall be notified of any significant failure of storm water management systems and erosion and sediment control measures and shall be notified of any release of pollutants to a water body (stream, brook, pond, etc.).
  9. The General Contractor shall remove the sediment from behind the fence of the sedimentation control barrier when the accumulated sediment has reached one-half of the original installed height of the barrier.

## INSPECTION AND MAINTENANCE (POST-CONSTRUCTION)

It is the agreement of the responsible parties to finance, inspect, and perform (respectfully) the long-term maintenance of the erosion control devices and the stormwater management systems within the limits stated below.

1. A visual inspection of all erosion control and stormwater management systems shall be conducted by the above identified person(s) a minimum of once per month and after every major storm during the first six months of operation (a portion of that time must be in the growing season). Thorough investigations shall be conducted twice a year. Monthly maintenance requirements may be adjusted based upon the results obtained from the first year of operation.
2. **Maintenance Schedule**

<b><u>Structure Type</u></b>	<b><u>Inspection</u></b>	<b><u>Maintenance</u></b>	<b><u>Task</u></b>
Rip/Rap Aprons	Twice a Year	Every 10 Years	Remove Debris & Add Stone
Subdrains	Twice a Year	Every 4 Years	Replace Peastone
Detention Basins	Monthly (May-Oct)	Monthly (May-Oct)	Mow Grass Areas & Remove Debris  Remove Sediment if present
Outfall Structures	Twice a Year	Every 10 Years	Remove Debris & Add Stone

## LONG TERM POLLUTION PREVENTION PLAN

1. Trash and other debris shall be removed from landscaped and planted areas periodically as needed. Full inspection of the site shall be made on a semi-annual basis to ensure clean and neat appearance to the site. This measure will help in the overall performance of the onsite systems.
2. Reseed any bare areas as soon as they occur. Erosion control measures shall be installed in these areas to prevent deposits of sediment from entering the drainage system
3. Grass shall be maintained at a minimum blade height of four to six inches and not allowed to exceed 18 inches in total height. Only 1/3 of the plant height shall be removed at a time.

## SEEDING OPERATION AND MAINTENANCE

1. Grass shall be maintained at a minimum blade height of four to six inches and not allowed to exceed 18 inches in total height. Only 1/3 of the plant height shall be removed at a time.
2. No Herbicides or pesticides will be used on this project.

### Inspection Log

ZP Battery Devco, LLC  
#1355 Main Street, Leicester, Massachusetts

<u>DATE</u>	<u>ACTION</u>	<u>RESULT</u>	<u>PERFORMED BY</u>

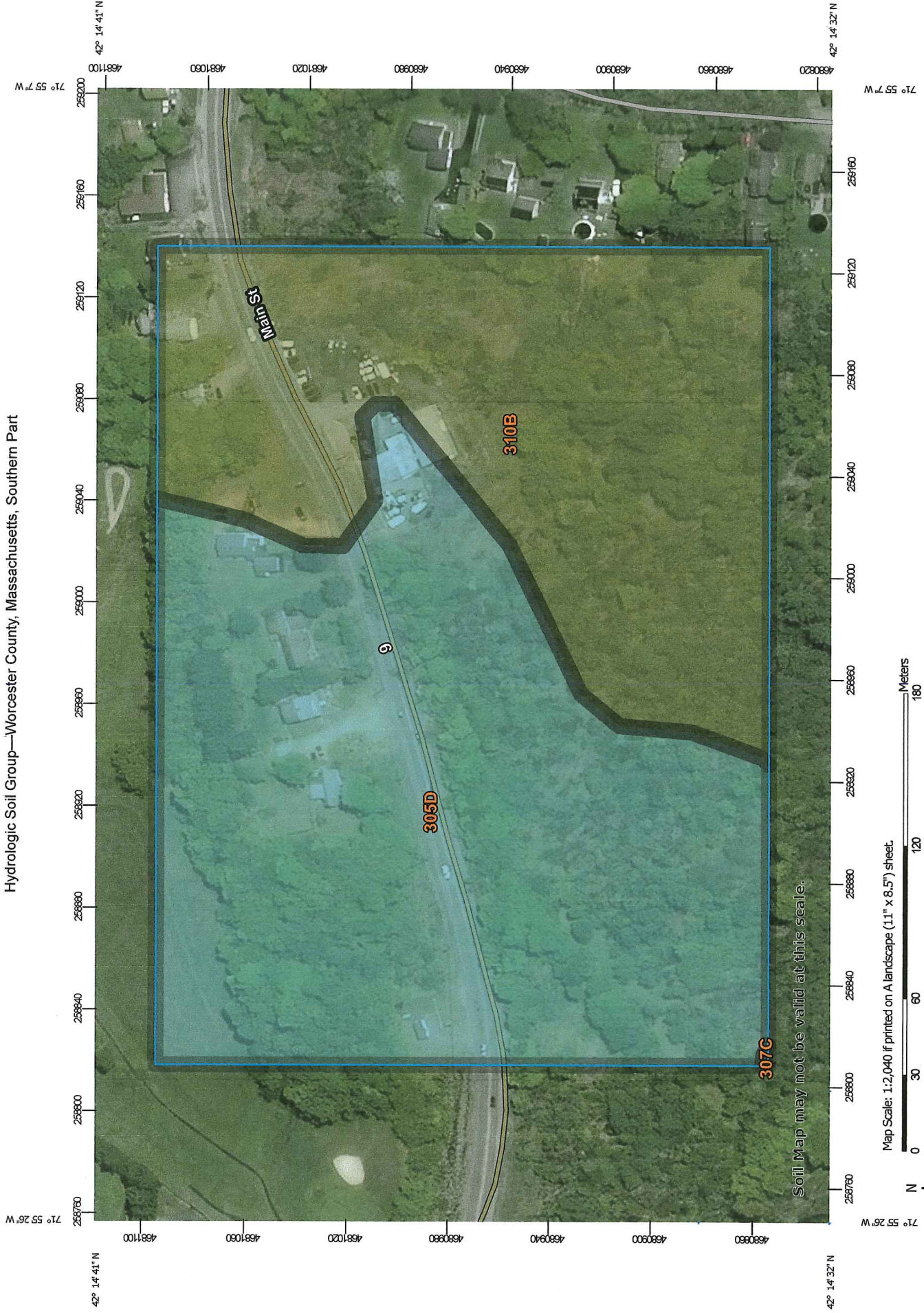


Maintenance Log  
ZP Battery Devco, LLC  
#1355 Main Street, Leicester, Massachusetts

<u>DATE</u>	<u>ACTION</u>	<u>PERFORMED</u> <u>BY</u>

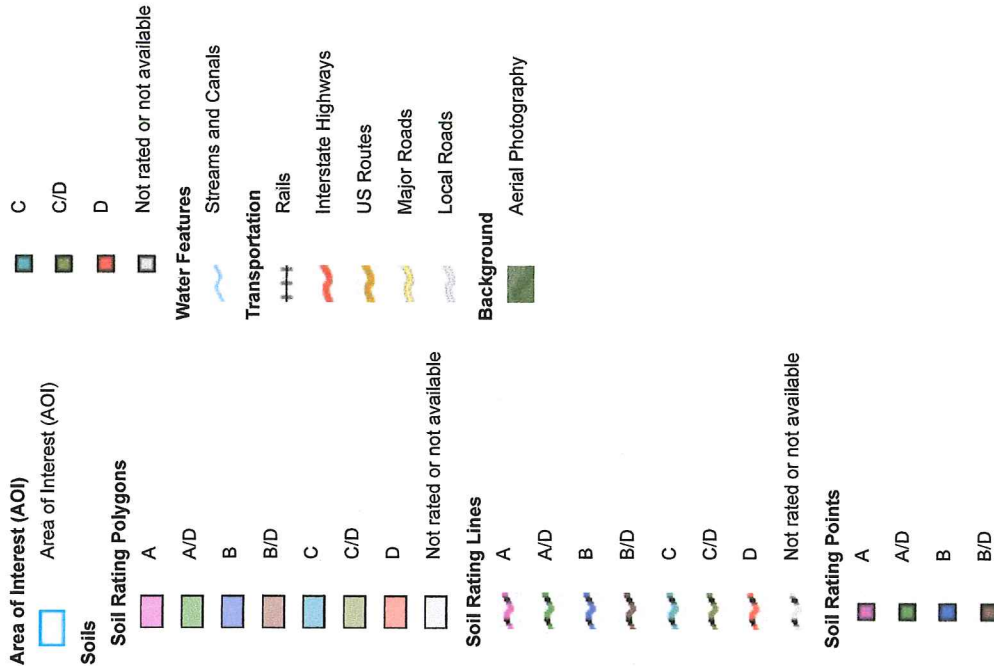


**FIGURE 1**  
**LOCUS MAP AND SOILS MAP**





## MAP LEGEND



## MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service  
Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Worcester County, Massachusetts, Southern Part

Survey Area Data: Version 13, Jun 11, 2020

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

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

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

## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
305D	Paxton fine sandy loam, 15 to 25 percent slopes	C	11.3	58.6%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	C	0.0	0.0%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	C/D	7.9	41.4%
<b>Totals for Area of Interest</b>			<b>19.2</b>	<b>100.0%</b>

## 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

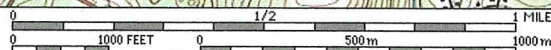
*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher





MN TN  
16°





**FIGURE 2**  
**PRE-DEVELOPMENT WATERSHED MAP**

PROJECT INFORMATION

LAND INFORMATION  
MAP PARCEL: 26B/A1  
DEED BOOK-PAGE: 65218/149  
EXISTING FRONTAGE: 794.29'  
EXISTING AREA: 5.44 ACRES

ZONING INFORMATION  
ZONING DISTRICT: HIGHWAY BUSINESS-INDUSTRIAL 1 (HB-1)  
DIMENSIONAL REQUIREMENTS:  
MINIMUM AREA: 60,000 S.F.  
MINIMUM FRONTAGE: 200'  
MAXIMUM HEIGHT: 55'  
MINIMUM SETBACKS:  
FRONT YARD: 50'  
SIDE YARD: 50'  
REAR YARD: 50'

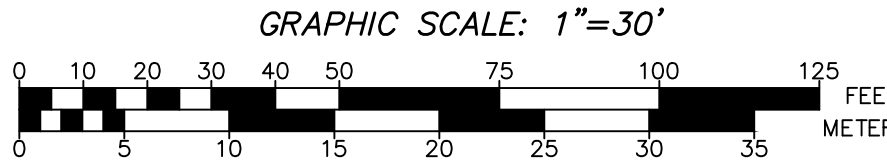
- GENERAL NOTES:
1. PROPERTY LINE INFORMATION BASED DEEDS AND PLANS OF RECORD. NO CERTIFICATION OF PROPERTY LINES SHOWN ON THIS PLAN IS INTENDED OR IMPLIED BY HANNIGAN ENGINEERING, INC. TOPOGRAPHIC INFORMATION IS THE RESULT OF AN ON-THE-GROUND TOPOGRAPHIC SURVEY BY HANNIGAN ENGINEERING, INC. IN JULY OF 2021.
  2. AREAS SUBJECT TO PROTECTION UNDER THE WETLANDS PROTECTION ACT HAVE BEEN DELINEATED BY CARON ENVIRONMENTAL CONSULTING ON MARCH 26, 2021. THESE AREAS ARE DEPICTED ON THE PLANS BASED ON FIELD SURVEY LOCATION DURING THE TOPOGRAPHIC SURVEY.
  3. LOCATION OF ALL UTILITIES ARE APPROXIMATE AS SHOWN AND BASED UPON VISIBLE STRUCTURES AT THE TIME OF THE FIELD SURVEY. LOCATION OF EXISTING UTILITIES AND SUBSURFACE STRUCTURES, WHETHER OR NOT SHOWN ON THESE PLANS, SHALL BE DETERMINED BY THE CONTRACTOR, MARKED IN THE FIELD, AND REVIEWED BY THE ENGINEER PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. THE CONTRACTOR SHALL BE AWARE OF THE OBLIGATION TO ALL UTILITY COMPANIES AND AGENCY AS WELL AS DIG-SAFE PRIOR TO EXCAVATION. (SEE NOTE)
  4. NOTIFICATION REQUIREMENTS SHOWN ON THIS PLAN SHALL NOT RELIEVE THE CONTRACTOR OF ANY OTHER REQUIREMENTS WHICH MAY EXIST UNDER LOCAL, STATE, OR FEDERAL JURISDICTION TO WHICH THE CONTRACTOR IS OBLIGATED.
  5. RELOCATION OF AND/OR CONNECTION TO EXISTING UTILITIES SHALL BE PERFORMED IN ACCORDANCE WITH PROVISIONS OF THE APPROPRIATE UTILITY COMPANY AND/OR REGULATORY AGENCY.
  6. UNLESS OTHERWISE SPECIFIED, ALL MATERIALS AND WORKMANSHIP SHALL CONFORM WITH THE REQUIREMENTS OF THE TOWN OF LEICESTER AND THE MASS DOT SPECIFICATIONS OF HIGHWAYS AND BRIDGES.
  7. ALL SLOPES UNLESS OTHERWISE SPECIFIED, SHALL BE LOAMED AND SEEDED FOR STABILIZATION.
  8. ANY DEVIATIONS IN DESIGN AS SHOWN SHALL REQUIRE A REVIEW AND APPROVAL OF THE DESIGN ENGINEER OR FIRM. CHANGES MADE IN THE FIELD MADE WITHOUT AUTHORIZATION SHALL BE SUBJECT TO REVIEW BY THE ENGINEER AND APPROPRIATE APPROVING AUTHORITY. EXPENSES INCURRED TO BRING THE UNAUTHORIZED CHANGES TO ACCEPTABLE CONFORMANCE SHALL BE BORNE BY THE COMPANY OR CONTRACTOR MAKING THE UNAUTHORIZED CHANGE.
  9. ANY MATERIALS DISCOVERED ON-SITE WHICH ARE NOT SUITABLE FOR USE IN THE PROJECT AS SHOWN ON THIS PLAN SHALL BE REMOVED AND HAULED OFF-SITE TO AN APPROPRIATELY LICENSED FACILITY.
  10. PLANS TO BE REVIEWED BY APPLICABLE UTILITY AGENCIES FOR COMPLIANCE WITH REGULATIONS. FINAL LOCATION IS SUBJECT TO CHANGE.
  11. APPLICANT SHOULD BE AWARE OF OBLIGATIONS TO COMPLY WITH CHAPTER 131, SECTION 40 OF THE MASSACHUSETTS GENERAL LAWS, OTHERWISE KNOWN AS THE WETLANDS PROTECTION ACT, AND THE ASSOCIATED REGULATIONS (310 CMR 10.00).
  12. STOCKPILING OF MATERIAL SHALL NOT BE PERMITTED WITHIN ANY AREAS SUBJECT TO PROTECTION UNDER THE WETLANDS PROTECTION ACT WITHOUT PRIOR APPROVAL BY THE LOCAL CONSERVATION COMMISSION. STOCKPILES SHALL BE PLACED IN A SUITABLE LOCATION AND SURROUNDED BY A ROW OF STAKED HAY BALES FOR EROSION CONTROL.
  13. AREAS OF FILL TO BE COMPACTED TO A MINIMUM 95% DRY DENSITY IN AREAS WITHIN ROADWAYS AND UTILITY EASEMENTS. OTHER AREAS OF FILL TO BE COMPACTED TO A MINIMUM 90% DRY DENSITY. ALL FILL MATERIALS ARE TO BE CLEAN FILL, FREE OF DELETERIOUS MATERIALS AND DEBRIS.
  14. ALL SIDEWALKS AND RAMPS TO CONFORM TO REQUIREMENTS OF THE AMERICANS WITH DISABILITIES ACT (ADA), AS REQUIRED. SEE ARCHITECTURAL PLANS FOR CONFORMANCE REQUIREMENTS FOR PROPOSED BUILDINGS.
  15. THE AREA PROPOSED FOR DEVELOPMENT IS NOT WITHIN A 100 YEAR FLOOD PLAIN PER F.E.M.A. FIRM PANEL #250313 0781 E, DATED: JULY 4, 2011. COMPLIANCE WITH APPLICABLE REGULATIONS IS REQUIRED.
  16. ALL REINFORCED CONCRETE PIPE TO BE CLASS III UNLESS OTHERWISE NOTED.
  17. PRE-CONSTRUCTION CONFERENCE SHALL BE HELD PRIOR TO THE COMMENCEMENT OF CONSTRUCTION.
  18. ALL UTILITIES ARE TO BE INSTALLED BY A LICENSED UTILITY CONTRACTOR LICENSED BY THE TOWN OF LEICESTER.

HANNIGAN  
ENGINEERING, INC.  
CIVIL ENGINEERS & LAND SURVEYORS

B MONUMENT SQUARE (978) 534-1234 (T)  
LEOMINSTER, MASSACHUSETTS 01453 (978) 534-6060 (F)  
WWW.HANNIGANENGINEERING.COM

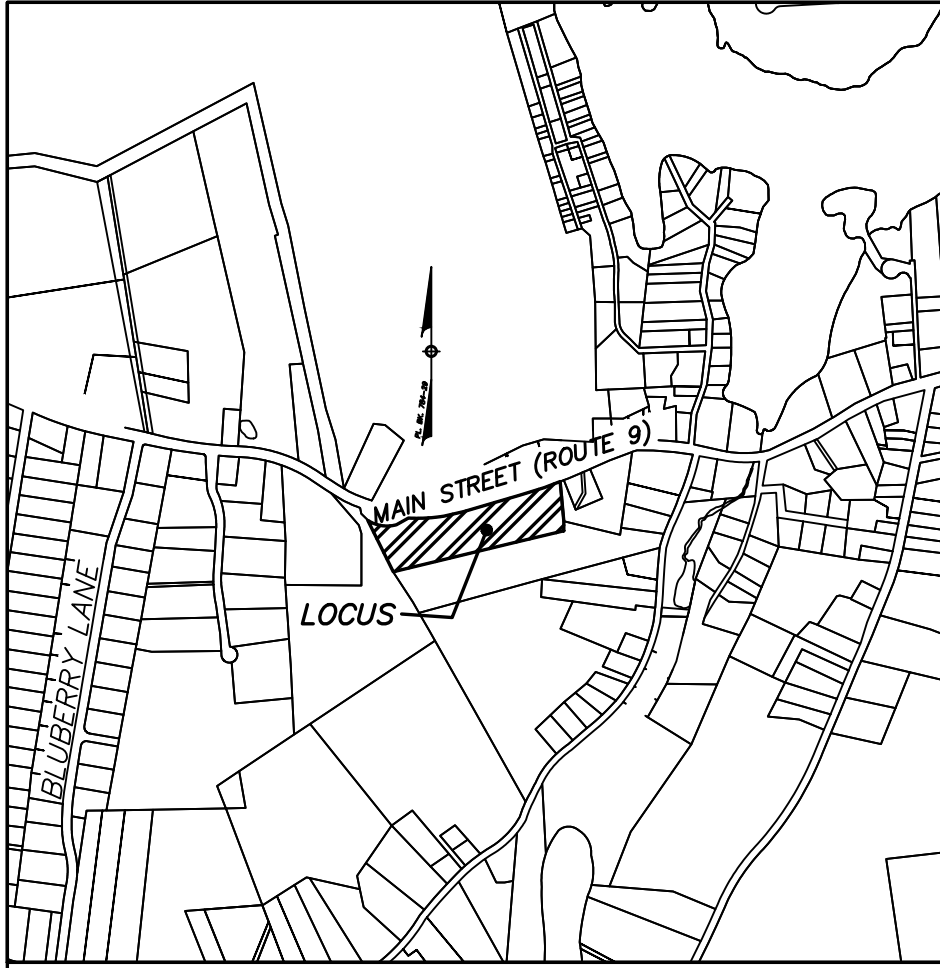
EXISTING WATERSHED  
IN  
LEICESTER, MASSACHUSETTS

PREPARED FOR:  
ZP BATTERY DEVCO, LLC  
BRENDAN GOVE  
10 E WORCESTER STREET SUITE 3A  
WORCESTER, MASSACHUSETTS 01604  
TEL:

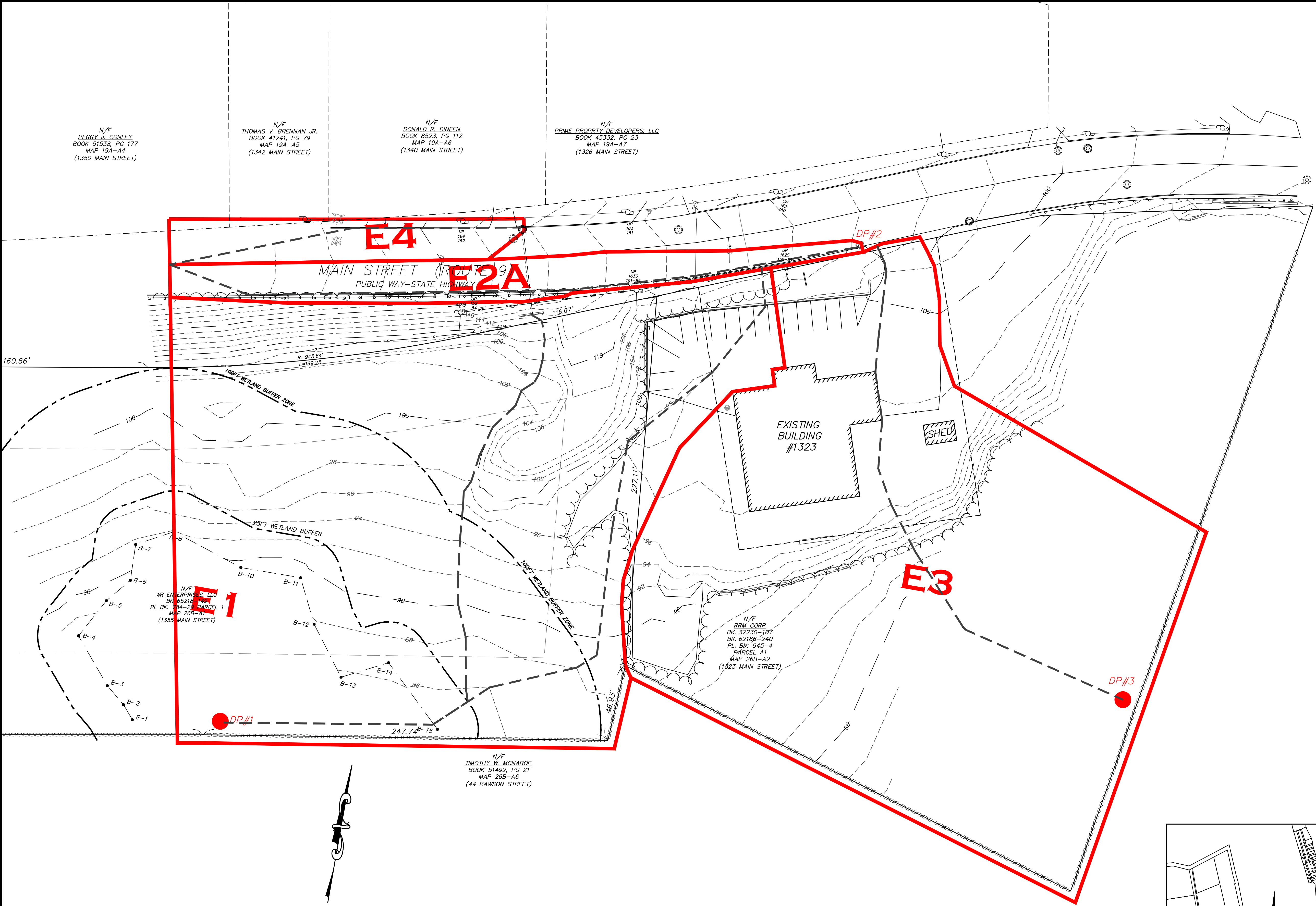


CALC: CMA	DRWN: CMA	SCALE: 1"=30'
CHKD: WDH	APPD: WDH	DATE: SEP 21, 2021
SRV: JEF	FB: 71-22	JOB NO: 3010
TAB: WS	SHEET 1 OF 2	PLAN NO: C-17-38

APPLICANT:  
ZP BATTERY DEVCO, LLC  
BRENDAN GOVE  
10 E. WORCESTER STREET, SUIT 3A  
WORCESTER, MASSACHUSETTS 01604  
OWNER:  
WR ENTERPRISES, LLC  
1323 MAIN STREET  
LEICESTER, MASSACHUSETTS 01524



LOCUS PLAN SCALE: 1":1000'





**FIGURE 3**  
**POST-DEVELOPMENT WATERSHED MAP**



PROJECT INFORMATION

LAND INFORMATION  
MAP PARCEL: 26B/A1  
DEED BOOK-PAGE: 65218/149  
EXISTING FRONTAGE: 794.29'  
EXISTING AREA: 5.44 ACRES

ZONING INFORMATION  
ZONING DISTRICT: HIGHWAY BUSINESS-INDUSTRIAL 1 (HB-1)  
DIMENSIONAL REQUIREMENTS:  
MINIMUM AREA: 60,000 S.F.  
MINIMUM FRONTAGE: 200'  
MAXIMUM HEIGHT: 55'  
MINIMUM SETBACKS:  
FRONT YARD: 50'  
SIDE YARD: 50'  
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PROPOSED WATERSHED PLAN  
IN  
LEICESTER, MASSACHUSETTS

PREPARED FOR:  
ZP BATTERY DEVCO, LLC  
BRENDAN GOVE  
10 E WORCESTER STREET SUITE 3A  
WORCESTER, MASSACHUSETTS 01604  
TEL:

GRAPHIC SCALE: 1"=30'  
0 10 20 30 40 50 75 100 125 FEET  
0 5 10 15 20 25 30 35 METERS

CALC: CMA	DRWN: CMA	SCALE: 1"=30'
CHKD: WDH	APPD: WDH	DATE: SEP 21, 2021
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WORCESTER, MASSACHUSETTS 01604  
OWNER:  
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1323 MAIN STREET  
LEICESTER, MASSACHUSETTS 01524



LOCUS PLAN SCALE: 1":1000'