DRAINAGE ANALYSIS

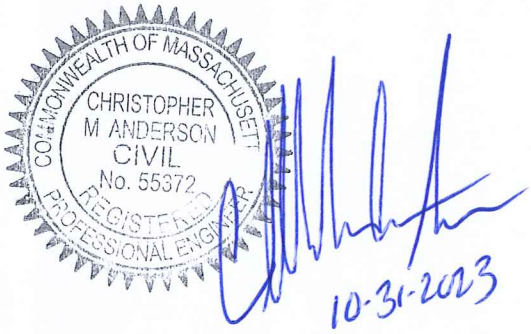
for

Commercial Building
w/Contractor's Yard

65 White Pond Road
Stow, Massachusetts

June 19, 2023

Revised Through October 31, 2023



Prepared for: ***Bransfield Tree Company, LLC***
65 White Pond Road
Stow, MA 01775
978-760-1882

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DRAINAGE NARRATIVE

1.0 NARRATIVE

Revised Through October 31, 2023

1.1 INTRODUCTION

On behalf of our client, Bransfield Tree Company, LLC, (Applicant), Hannigan Engineering, Inc. has prepared this Drainage Analysis and Report as part of the submittal package for an Amendment to a Site Plan Review from the Town of Stow. The project consists of a new industrial building and associated parking lot, along with the construction of a outdoor storage/contractor's yard areas at the rear the property at 65 & 63 White Pond Road in Stow, Massachusetts (Map 29, Parcel 72 &73).

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 Sevice (SCS) methods were utilized for this analysis in order to establish land use and run-off characteristics in the determination of pre- and post-developement 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.

Areas of the property were recently cleared and regraded. The stormwater review was performed based on conditions of the site prior to vegetative clearing and regrading. Prior to this, the majority of the runoff from the site flowed overland to the wetland areas adjacent to the Assabet Brook and ultimately to the brook itself. As such the Brook has been determined to be Design Point #1 (DP#1). For the purposes of this review and design, the drainage patterns prior to the commencement of earth disturbing activities on the property were utilized to ensure a full review of current and future impacts upon the property. The proposed design utilizes a series of conveyance structures as well as an infiltration basin to capture, treat, and dispose of runoff from the developed areas of the site.

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

Using SCS publications and other texts on surface water hydrology, in conjunction with drainage software *HydroCAD* developed by Applied Microcomputer Systems[5], 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 (Tc), 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 Tc's than other more general methods.

1.3 SITE DESCRIPTION

The Project is located at 65 Whites Pond Road on approximately 10.3 acres of land. The site historically contained an existing single-family home with various detached accessory structures and lawn area, with much the land being woodland. Recently, the dwelling has been removed, areas of woodland have been cleared, and the land has been regraded. Historically, the land generally sloped towaqrds the south western portion of the property towards Assabet Brook. The land currently maintains this drainage pattern.

The jurisdictional areas on the project were reviewed in March of 2023 and include the Annual Highwater Mark (AHW) of Assabet Brook, providing a corresponding Riverfront Area for the project, as well as the Bordering Vegetated Wetland (BVW) associated with the brook. Per the FEMA Firm Panel 25017-C0361F, dated July 7, 2014, a flood hazard area associated with the brook extends onto the property. This is an unnumbered Zone A with no established flood plain elevation. The flood plain has been graphically depicted on the site plans.

The proposed construction at the front of the site has been modified in location and orientation, but essentially maintains its original purpose and intent. The building will consist of a 4,958 square foot industrial structure with a footprint of 4,000 square feet with a 958 square foot mezzanine area. Access to the site will be provided by a new paved driveway along Whites Pond Road. This driveway will provide a loop around the entire building and provide access to parking spaces for employees and visitors. Along the rear of the building will be several overhead doors for vehicles to enter the structure. The area immediately behind the building will be utlized for the storage or equipment, vehicles and matierals.

The remaining areas around the property are intended to be utilized as outdoor storage/contractor's yard areas which will be leased to local contractors. These areas will be graded and topped with a mix of regrind pavement and gravel for stabilization. As part of the construction of the yard area, and to provide compliance with stormwater management regulations, a landscape berm will be constructed along the northerly portion of the site to direct runoff to the stormwater system. This system will include a stone lined drainage swale to capture the runoff from the storage yard area and direct it towards an infiltration basin located along the southerly property line. The combination of the berm and swale will create a barrier to ensure that no runoff from the yard area leaves the development without first going through the stormwater system.

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 originally overland flowed the Assabet Brook that runs along the southerly limits of the property. As such the Brook has been determined to be Design Point #1 (DP#1). The proposed work continues to utilize the same drainage pattern towards Assabet Brook. For the purposes of this review and design, the drainage patterns prior to the commencement of earth disturbing activities on the property were utilized to ensure a full review of current and future impacts upon the property

1.4 SOIL CHARACTERISTICS

Soil types for this analysis were based upon review of soils information contained in the SCS publication *Soil Report for Middlesex County, Massachusetts.* 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.

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

Soil Designation	Name	Hydrological Group
36A	Saco Mucky Silt Loam	B/D
254B	Merrimac Fine Sandy Loam	A
260B	Sudburry Fine Sandy Loam	B
656	Udorthents-Urban Land Complex	NA

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:

Land Use	Hydrologic Soil Group	Curve #
Grass Cover (good)	A	39
Woods (Good)	A	30
Gravel Surface	A	76
Grass Cover (good)	B	61
Woods (Good)	B	55
Water Surface (imp)	B	98
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:

Storm Frequency (years)	Rainfall (inches)
2	3.00
10	4.50
25	5.30
100	6.50

Prior to the clearing and regrading performed, the majority of the runoff from the site flowed overland to the wetland areas adjacent to the Assabet Brook and ultimately to the brook itself. Under proposed conditions, the project area associated with the building and paved parking areas will be directed to hooded, deep-sump catchbasins for initial treatment. These catchbasins will then direct the runoff through a trunkline which discharges to the proposed infiltration basin. The outlet of this trunkline will discharge to a sediment forebay for additional treatment prior to entering the infiltration basin.

The proposed stormwater system relies on a series of swales and berms around the contractor yard area to collect runoff and direct it towards an infiltration basin. The infiltration basin will be constructed with a sand bottom and covered with a layer of peastone, to aid in the infiltration to the underlying soils. The layer of peastone is intended to provide a more durable surface that is traversable for maintenance purposes. The basin will also be fitted with an emergency spillway. Based on the calculations, the emergency spillway will not experience flow in any storm event.

1.7 THE PROPOSED DRAINAGE SYSTEM

Changes in land use within a proposed development project may cause increases in peak rates of runoff to specific Design Points. These changes may include transformation of woodland and/or undisturbed areas to lawn, landscape and/or impervious areas. On this particular project, these transformed areas consist of building rooftop, access drives, parking areas, loading areas, etc. Additionally, areas of landscape around the property as well as sidewalks adjacent to the building provide additional areas where alterations in land use will occur. These changes will result in increases in peak rates of runoff which must be mitigated with an appropriately designed site, including proper grading to direct stormwater flows to the storm drainage system.

Under proposed conditions, the project area associated with the building and paved parking areas will be directed to hooded, deep-sump catchbasins for initial treatment. These catchbasins will then direct the runoff through a trunkline which discharges to the proposed infiltration basin. The outlet of this trunkline will discharge to a sediment forebay for additional treatment prior to entering the infiltration basin.

The proposed stormwater system relies on a series of swales and berms around the contractor yard area to collect runoff and direct it towards an infiltration basin. The infiltration basin will be constructed with a sand bottom and covered with a layer of peastone, to aid in the infiltration to the underlying soils. The layer of peastone is intended to provide a more durable surface that is traversable for maintenance purposes. The basin will also be fitted with an emergency spillway. Based on the calculations, the emergency spillway will not experience flow in any storm event.

The proposed drainage system has been designed to mitigate increases in peak rate of runoff at all design points during the 2-,10-, 25- and 100-year storm events, using SCS methods. The drainage pipe network on this project was designed to accommodate the 25-year storm event. The overall hydrologic impact of development was evaluated using the 100-year storm event as recommended by various engineering publications. The catchbasins on the project will contain a deep sump (48-inch below the level of the outlet pipe), along with a hood to contain the majority of the roadway debris and sediment within the basin itself. The catchbasins will discharge the stormwater directly to the drainage trunk lines.

1.8 CONCLUSIONS

As stated above, a single Design Point has been established throughout the project area as the Assabet Brook along the southerly limits of the property. 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 series of catchbasins and ultimately be directed to an infiltration basin features. 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-	2.07	4.70	6.69	10.36
	Post-	1.75	4.24	6.13	9.54

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. This drainage design assures that adverse impacts to abutting properties relative to increases in peak rates of runoff will not occur due to the proposed development upon the completion of construction and are mitigated to the maximum extent practicable. 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) The stormwater system is designed to capture and detain frequent storms allowing for accumulating pollutants to settle and filter prior to release.

B) Attenuation of the 2-, 10-, 25-, 50- and 100-year storm events has mitigated increases in peak rates of runoff.

C) On-site roadway and pavement areas are directed to standard catch basins with deep sumps for collection of debris and sediments prior to discharge.

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

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

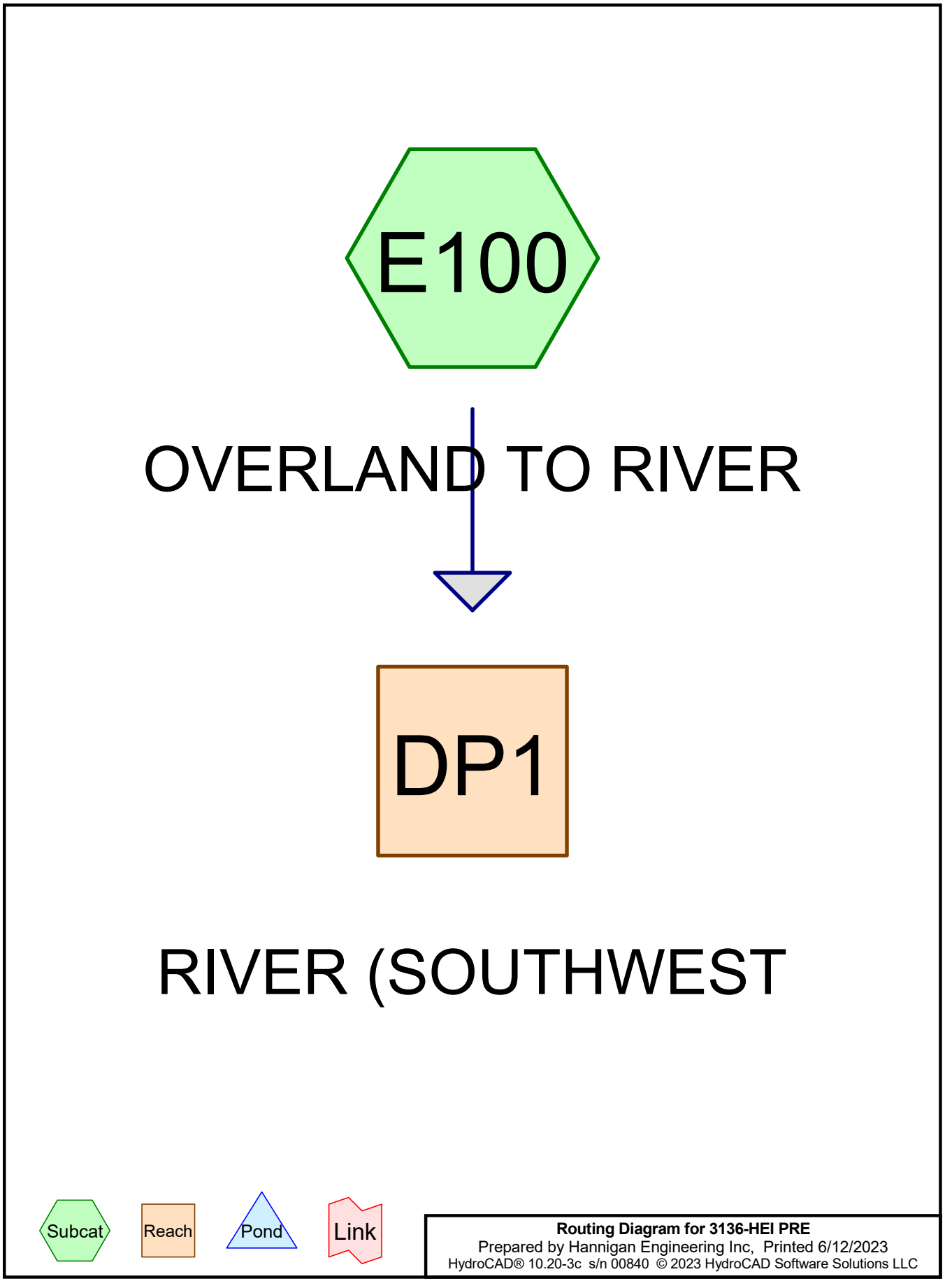
[3]"Handbook of Hydraulics" - 6th ed., E.F. Brater & H. Williams (1976)

[4]"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)

[5] "HydroCAD" Drainage software developed by Applied Microcomputer, Page Hill Road, Chocorua, NH

2.0
HYDROLOGICAL CALCULATIONS

2.1
PRE-DEVELOPMENT CALCULATIONS



Routing Diagram for 3136-HEI PRE
Prepared by Hannigan Engineering Inc, Printed 6/12/2023

Project Notes

Rainfall events imported from "TP-40-Rain.txt" for 444 MA Middlesex

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.10	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.50	2
3	25-Year	Type III 24-hr		Default	24.00	1	5.30	2
4	100-Year	Type III 24-hr		Default	24.00	1	6.50	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.501	39	>75% Grass cover, Good, HSG A (E100)
0.154	61	>75% Grass cover, Good, HSG B (E100)
0.611	98	Paved parking, HSG A (E100)
0.061	98	Paved parking, HSG B (E100)
0.219	98	Water Surface, HSG B (E100)
5.498	30	Woods, Good, HSG A (E100)
3.966	55	Woods, Good, HSG B (E100)
13.010	**44**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
8.610	HSG A	E100
4.400	HSG B	E100
0.000	HSG C	
0.000	HSG D	
0.000	Other	
13.010		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
2.501	0.154	0.000	0.000	0.000	2.656	>75% Grass cover, Good	E100
0.611	0.061	0.000	0.000	0.000	0.672	Paved parking	E100
0.000	0.219	0.000	0.000	0.000	0.219	Water Surface	E100
5.498	3.966	0.000	0.000	0.000	9.463	Woods, Good	E100
8.610	**4.400**	**0.000**	**0.000**	**0.000**	**13.010**	**TOTAL AREA**	

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

Subcatchment E100: OVERLAND TO RIVER Runoff Area=566,699 sf 6.85% Impervious Runoff Depth=0.27"
Flow Length=1,386' Tc=16.2 min CN=WQ Runoff=2.07 cfs 0.292 af

Reach DP1: RIVER (SOUTHWEST Inflow=2.07 cfs 0.292 af
Outflow=2.07 cfs 0.292 af

Total Runoff Area = 13.010 ac Runoff Volume = 0.292 af Average Runoff Depth = 0.27"
93.15% Pervious = 12.119 ac 6.85% Impervious = 0.891 ac

Summary for Subcatchment E100: OVERLAND TO RIVER

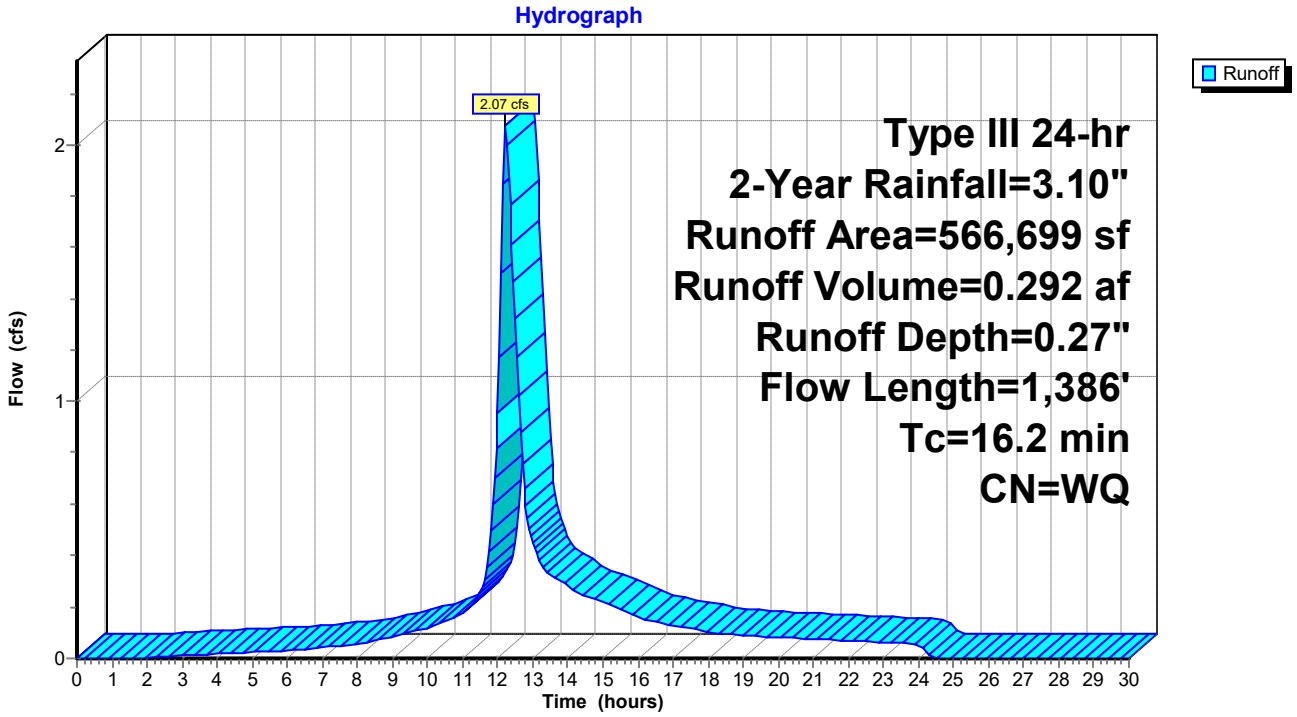
Runoff = 2.07 cfs @ 12.23 hrs, Volume= 0.292 af, Depth= 0.27"
Routed to Reach DP1 : RIVER (SOUTHWEST

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
108,958	39	>75% Grass cover, Good, HSG A
239,474	30	Woods, Good, HSG A
26,616	98	Paved parking, HSG A
6,716	61	>75% Grass cover, Good, HSG B
172,740	55	Woods, Good, HSG B
2,673	98	Paved parking, HSG B
9,522	98	Water Surface, HSG B
566,699		Weighted Average
527,888		93.15% Pervious Area
38,811		6.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	16	0.0200	0.94		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
3.8	34	0.0250	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.7	102	0.0250	2.55		**Shallow Concentrated Flow, GRASS** Unpaved Kv= 16.1 fps
1.8	321	0.0350	3.01		**Shallow Concentrated Flow, GRASS** Unpaved Kv= 16.1 fps
9.6	913	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.2	1,386	Total			

Subcatchment E100: OVERLAND TO RIVER



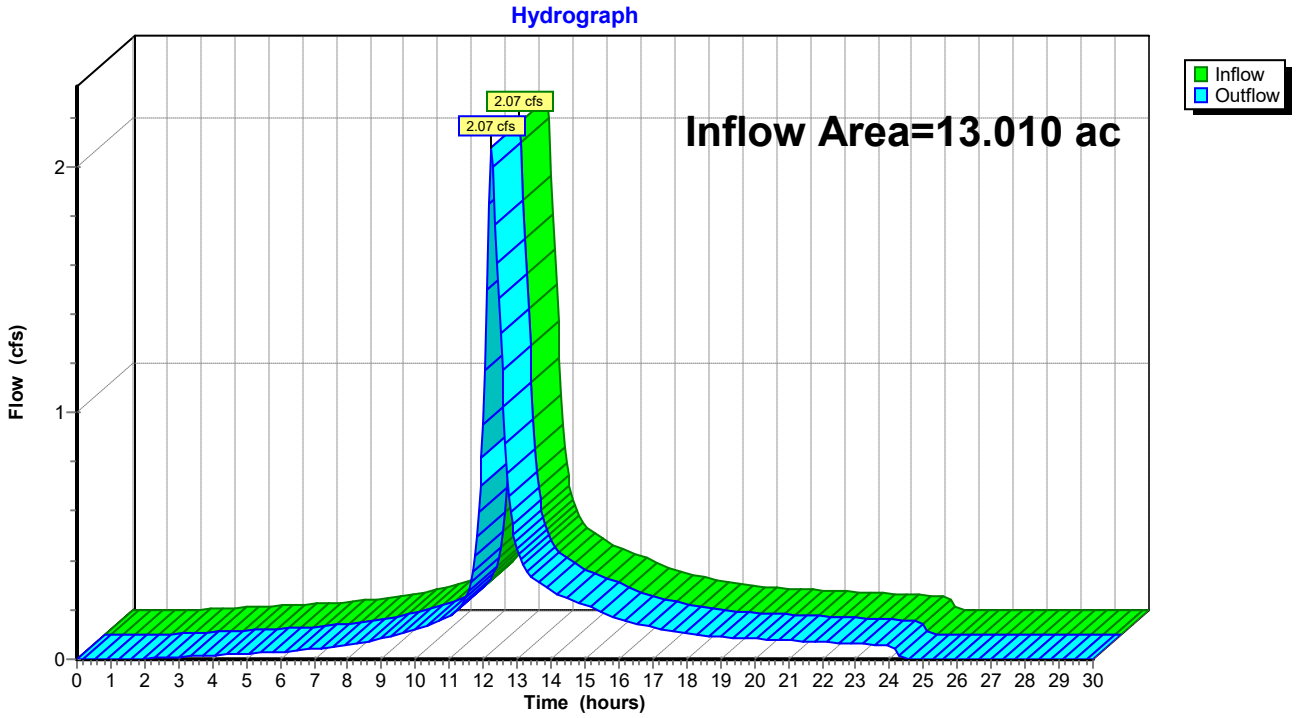
Summary for Reach DP1: RIVER (SOUTHWEST

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 13.010 ac, 6.85% Impervious, Inflow Depth = 0.27" for 2-Year event
Inflow = 2.07 cfs @ 12.23 hrs, Volume= 0.292 af
Outflow = 2.07 cfs @ 12.23 hrs, Volume= 0.292 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 DP1: RIVER (SOUTHWEST



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

Subcatchment E100: OVERLAND TO RIVER Runoff Area=566,699 sf 6.85% Impervious Runoff Depth=0.55"
Flow Length=1,386' Tc=16.2 min CN=WQ Runoff=4.70 cfs 0.599 af

Reach DP1: RIVER (SOUTHWEST Inflow=4.70 cfs 0.599 af
Outflow=4.70 cfs 0.599 af

Total Runoff Area = 13.010 ac Runoff Volume = 0.599 af Average Runoff Depth = 0.55"
93.15% Pervious = 12.119 ac 6.85% Impervious = 0.891 ac

Summary for Subcatchment E100: OVERLAND TO RIVER

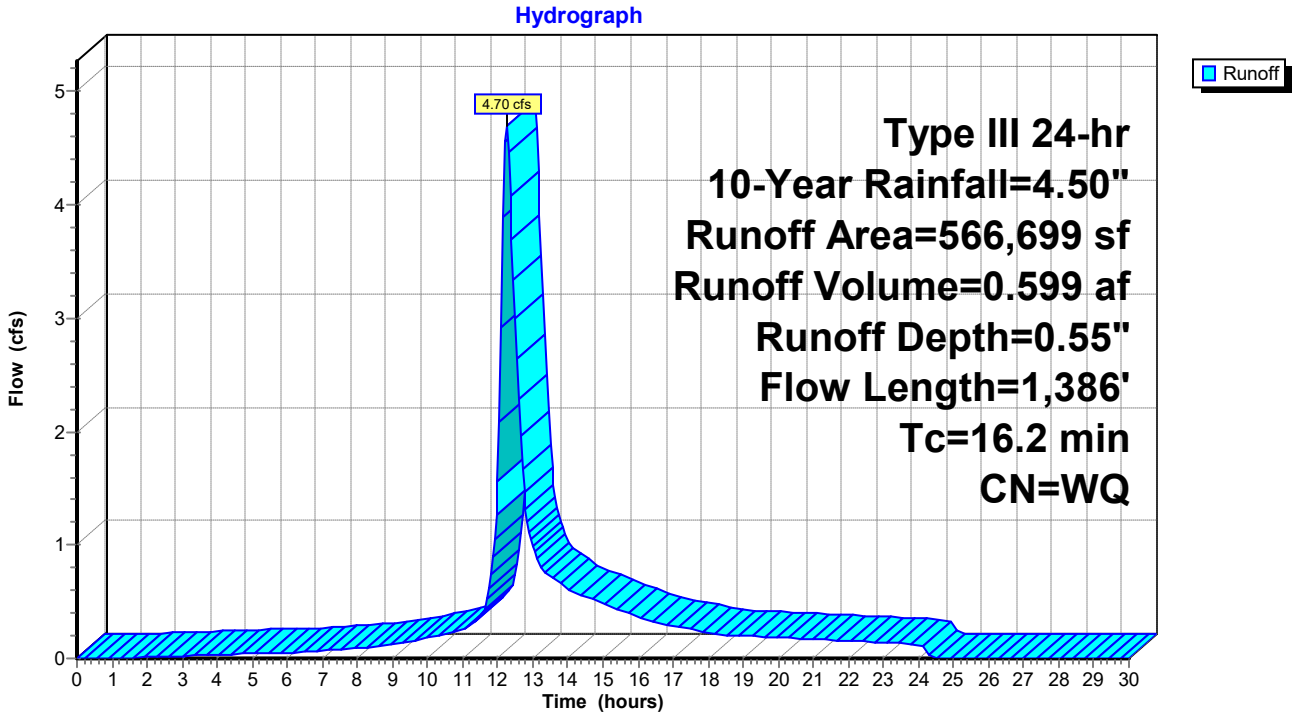
Runoff = 4.70 cfs @ 12.24 hrs, Volume= 0.599 af, Depth= 0.55"
Routed to Reach DP1 : RIVER (SOUTHWEST

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

Area (sf)	CN	Description
108,958	39	>75% Grass cover, Good, HSG A
239,474	30	Woods, Good, HSG A
26,616	98	Paved parking, HSG A
6,716	61	>75% Grass cover, Good, HSG B
172,740	55	Woods, Good, HSG B
2,673	98	Paved parking, HSG B
9,522	98	Water Surface, HSG B
566,699		Weighted Average
527,888		93.15% Pervious Area
38,811		6.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	16	0.0200	0.94		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
3.8	34	0.0250	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.7	102	0.0250	2.55		**Shallow Concentrated Flow, GRASS** Unpaved Kv= 16.1 fps
1.8	321	0.0350	3.01		**Shallow Concentrated Flow, GRASS** Unpaved Kv= 16.1 fps
9.6	913	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.2	1,386	Total			

Subcatchment E100: OVERLAND TO RIVER



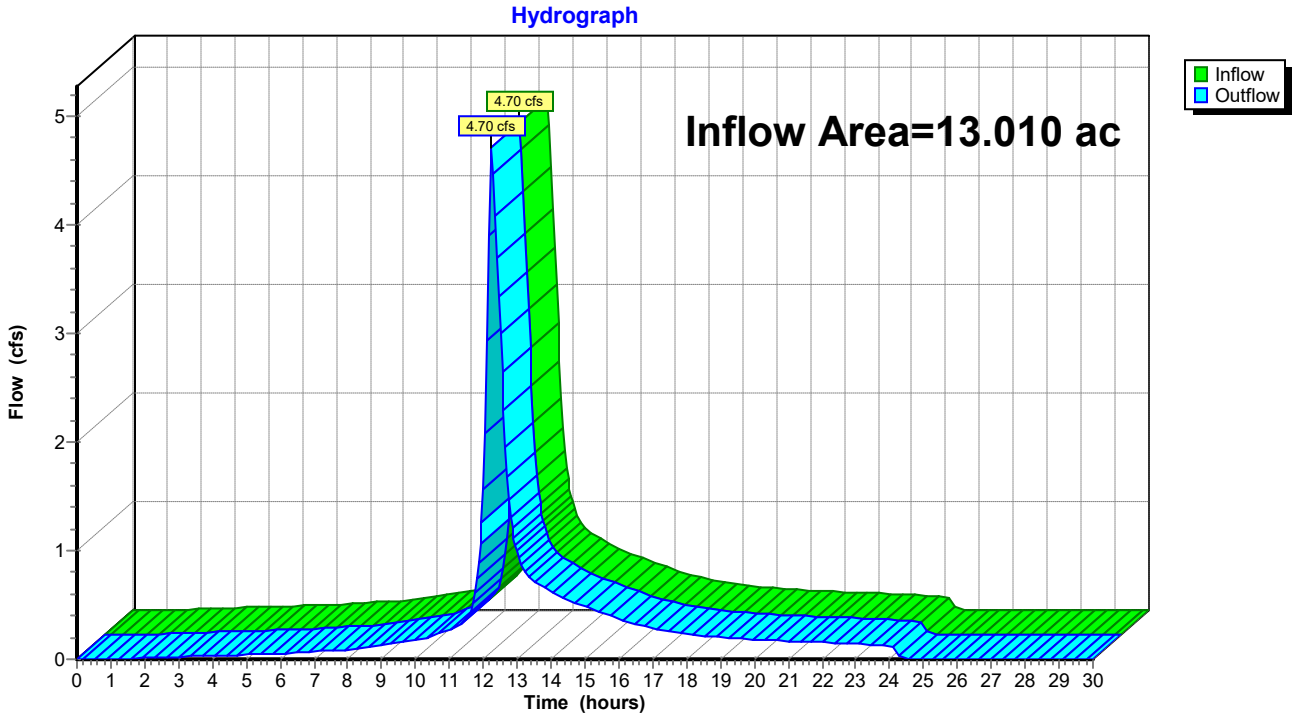
Summary for Reach DP1: RIVER (SOUTHWEST

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 13.010 ac, 6.85% Impervious, Inflow Depth = 0.55" for 10-Year event
Inflow = 4.70 cfs @ 12.24 hrs, Volume= 0.599 af
Outflow = 4.70 cfs @ 12.24 hrs, Volume= 0.599 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 DP1: RIVER (SOUTHWEST



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

Subcatchment E100: OVERLAND TO RIVER Runoff Area=566,699 sf 6.85% Impervious Runoff Depth=0.77"
Flow Length=1,386' Tc=16.2 min CN=WQ Runoff=6.69 cfs 0.833 af

Reach DP1: RIVER (SOUTHWEST Inflow=6.69 cfs 0.833 af
Outflow=6.69 cfs 0.833 af

Total Runoff Area = 13.010 ac Runoff Volume = 0.833 af Average Runoff Depth = 0.77"
93.15% Pervious = 12.119 ac 6.85% Impervious = 0.891 ac

Summary for Subcatchment E100: OVERLAND TO RIVER

Runoff = 6.69 cfs @ 12.24 hrs, Volume= 0.833 af, Depth= 0.77"
Routed to Reach DP1 : RIVER (SOUTHWEST

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

Area (sf)	CN	Description
108,958	39	>75% Grass cover, Good, HSG A
239,474	30	Woods, Good, HSG A
26,616	98	Paved parking, HSG A
6,716	61	>75% Grass cover, Good, HSG B
172,740	55	Woods, Good, HSG B
2,673	98	Paved parking, HSG B
9,522	98	Water Surface, HSG B
566,699		Weighted Average
527,888		93.15% Pervious Area
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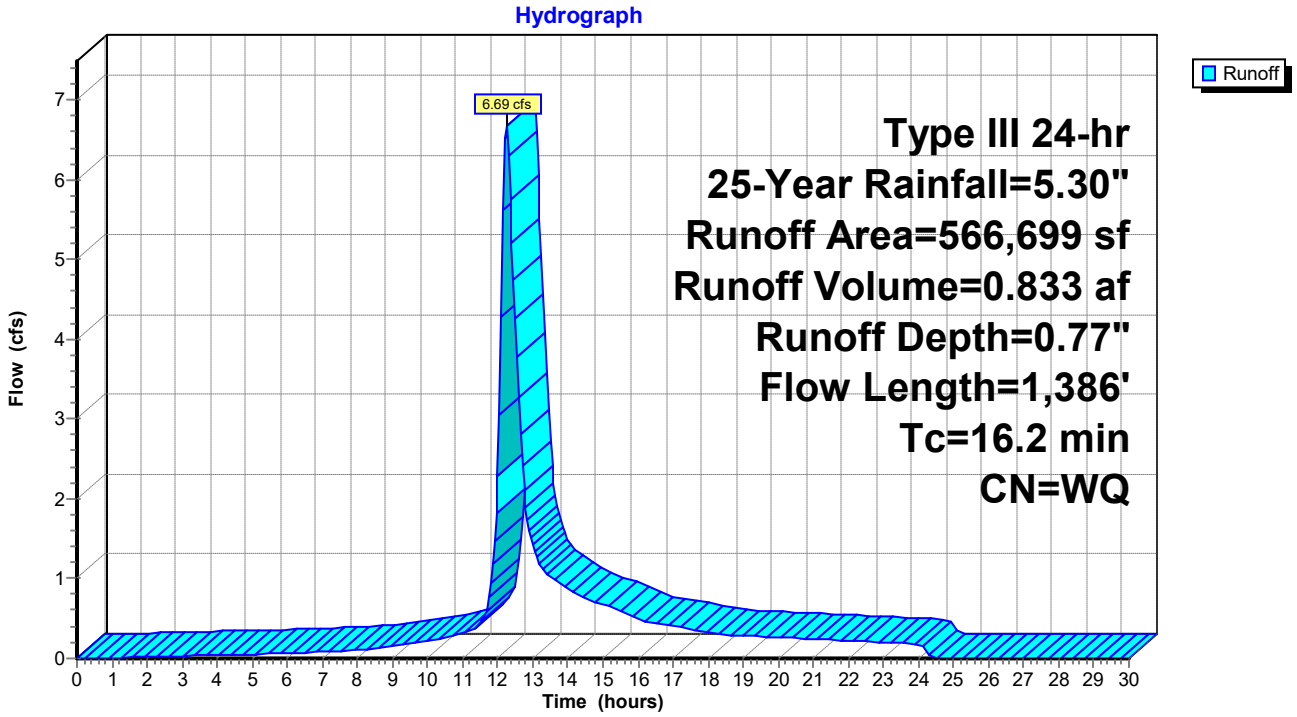
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	16	0.0200	0.94		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
3.8	34	0.0250	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.7	102	0.0250	2.55		**Shallow Concentrated Flow, GRASS** Unpaved Kv= 16.1 fps
1.8	321	0.0350	3.01		**Shallow Concentrated Flow, GRASS** Unpaved Kv= 16.1 fps
9.6	913	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.2	1,386	Total			

Subcatchment E100: OVERLAND TO RIVER



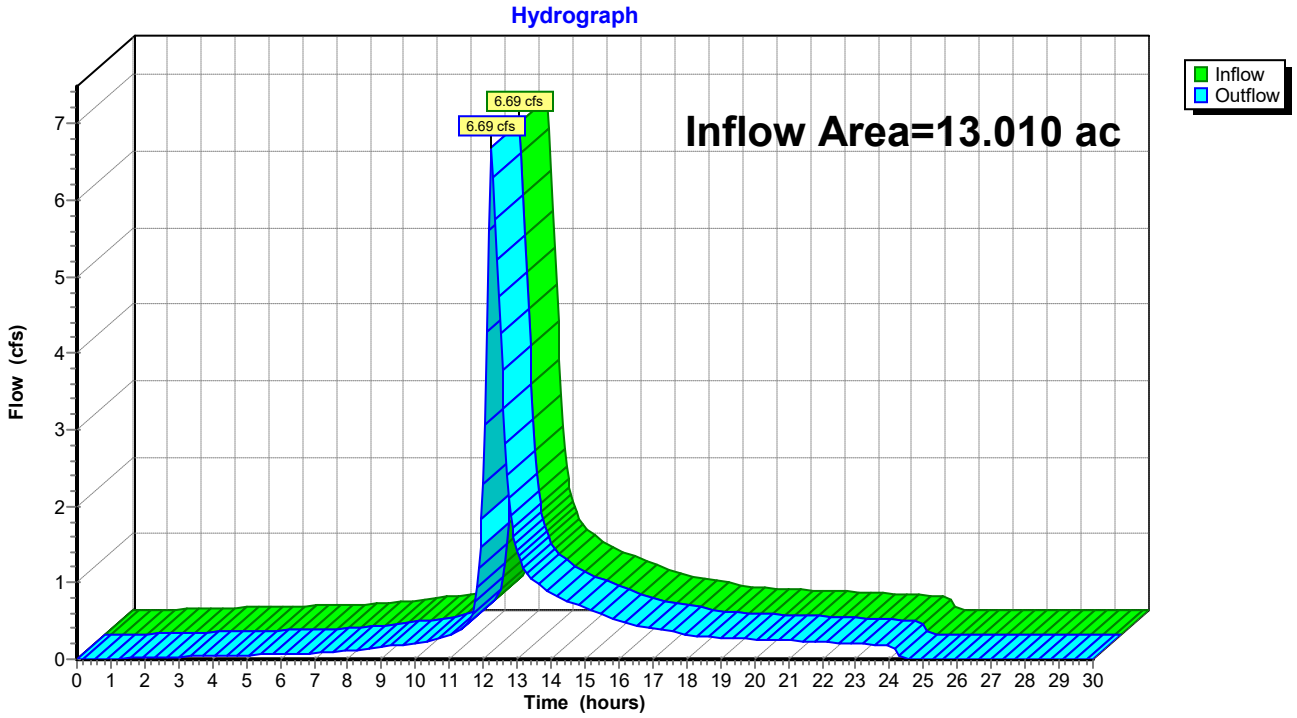
Summary for Reach DP1: RIVER (SOUTHWEST

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 13.010 ac, 6.85% Impervious, Inflow Depth = 0.77" for 25-Year event
Inflow = 6.69 cfs @ 12.24 hrs, Volume= 0.833 af
Outflow = 6.69 cfs @ 12.24 hrs, Volume= 0.833 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 DP1: RIVER (SOUTHWEST



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

Subcatchment E100: OVERLAND TO RIVER Runoff Area=566,699 sf 6.85% Impervious Runoff Depth=1.18"
Flow Length=1,386' Tc=16.2 min CN=WQ Runoff=10.36 cfs 1.280 af

Reach DP1: RIVER (SOUTHWEST Inflow=10.36 cfs 1.280 af
Outflow=10.36 cfs 1.280 af

Total Runoff Area = 13.010 ac Runoff Volume = 1.280 af Average Runoff Depth = 1.18"
93.15% Pervious = 12.119 ac 6.85% Impervious = 0.891 ac

Summary for Subcatchment E100: OVERLAND TO RIVER

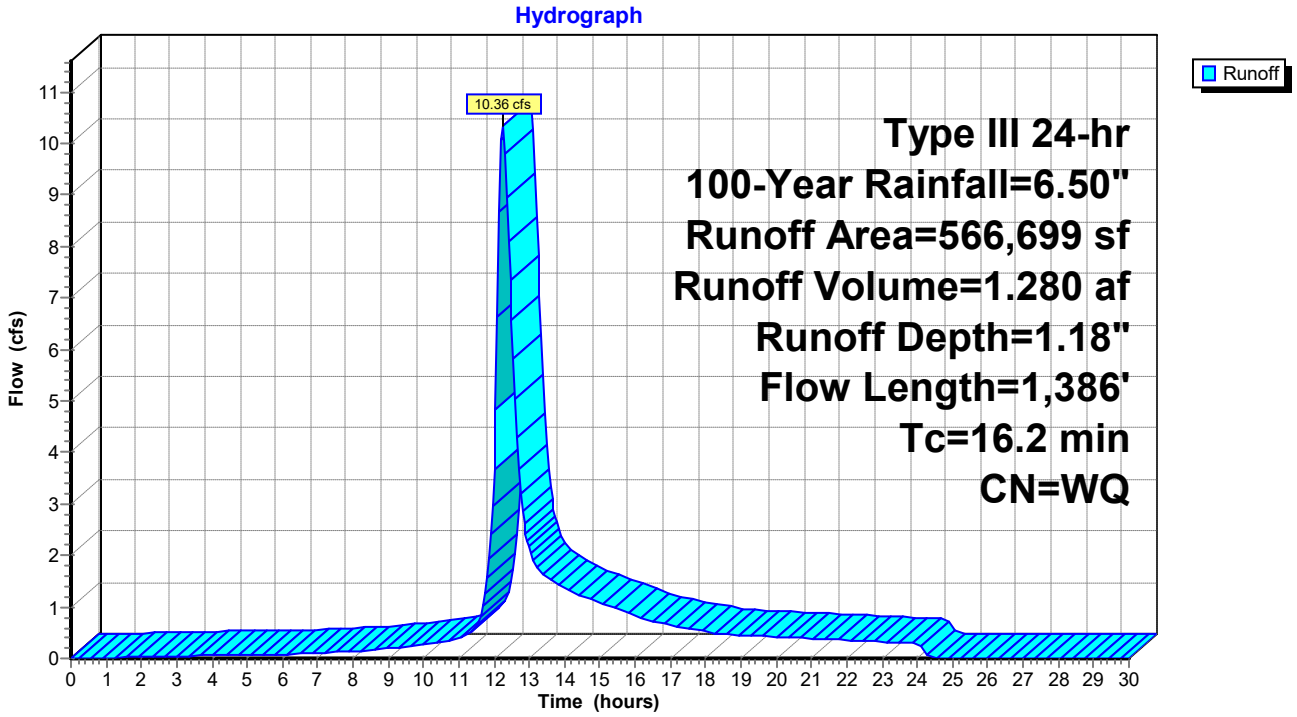
Runoff = 10.36 cfs @ 12.24 hrs, Volume= 1.280 af, Depth= 1.18"
Routed to Reach DP1 : RIVER (SOUTHWEST

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

Area (sf)	CN	Description
108,958	39	>75% Grass cover, Good, HSG A
239,474	30	Woods, Good, HSG A
26,616	98	Paved parking, HSG A
6,716	61	>75% Grass cover, Good, HSG B
172,740	55	Woods, Good, HSG B
2,673	98	Paved parking, HSG B
9,522	98	Water Surface, HSG B
566,699		Weighted Average
527,888		93.15% Pervious Area
38,811		6.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	16	0.0200	0.94		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
3.8	34	0.0250	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.7	102	0.0250	2.55		**Shallow Concentrated Flow, GRASS** Unpaved Kv= 16.1 fps
1.8	321	0.0350	3.01		**Shallow Concentrated Flow, GRASS** Unpaved Kv= 16.1 fps
9.6	913	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.2	1,386	Total			

Subcatchment E100: OVERLAND TO RIVER



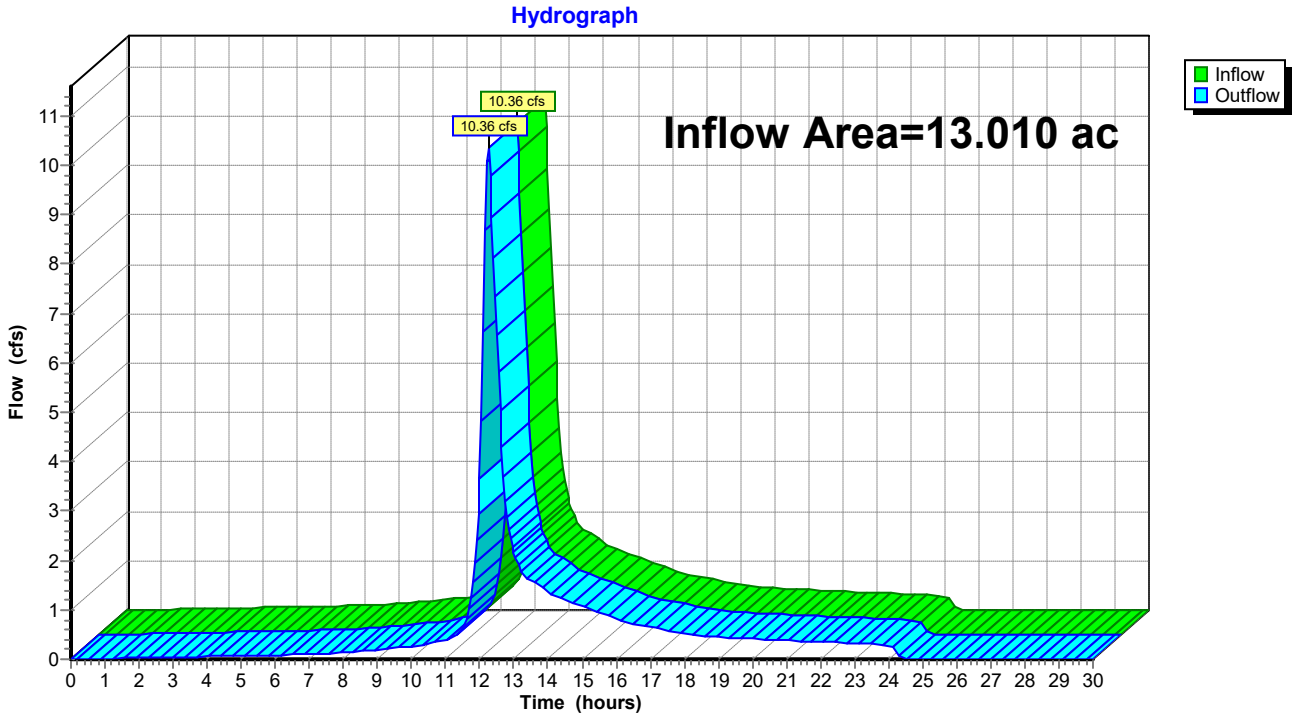
Summary for Reach DP1: RIVER (SOUTHWEST

[40] Hint: Not Described (Outflow=Inflow)

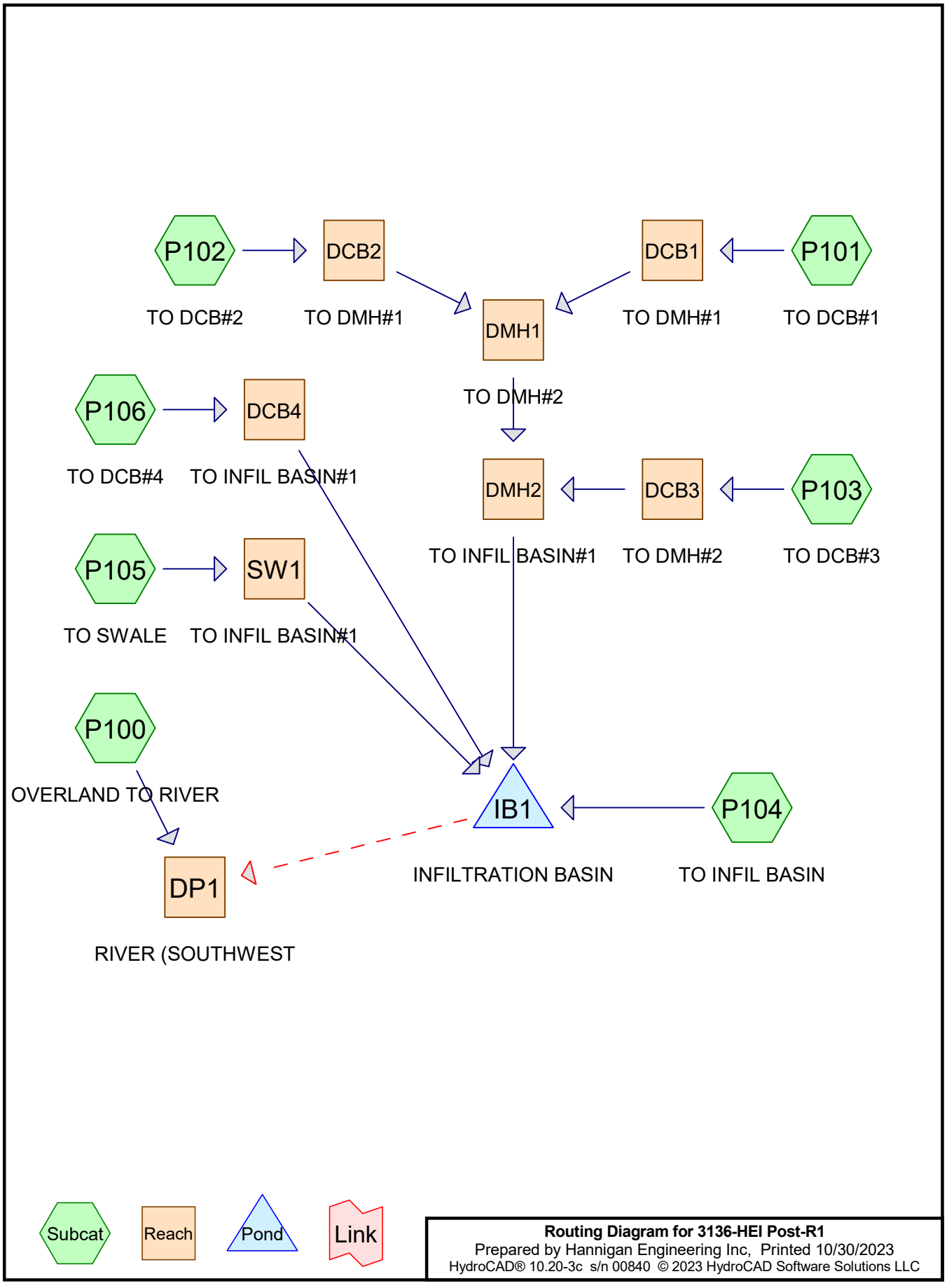
Inflow Area = 13.010 ac, 6.85% Impervious, Inflow Depth = 1.18" for 100-Year event
Inflow = 10.36 cfs @ 12.24 hrs, Volume= 1.280 af
Outflow = 10.36 cfs @ 12.24 hrs, Volume= 1.280 af, Atten= 0%, Lag= 0.0 min

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

Reach DP1: RIVER (SOUTHWEST



2.2
POST DEVELOPMENT CALCULATIONS



Routing Diagram for 3136-HEI Post-R1
Prepared by Hannigan Engineering Inc, Printed 10/30/2023

Project Notes

Rainfall events imported from "TP-40-Rain.txt" for 444 MA Middlesex

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.10	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.50	2
3	25-Year	Type III 24-hr		Default	24.00	1	5.30	2
4	100-Year	Type III 24-hr		Default	24.00	1	6.50	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.217	39	>75% Grass cover, Good, HSG A (P100, P101, P102, P103, P104)
0.154	61	>75% Grass cover, Good, HSG B (P100)
0.305	76	Gravel roads, HSG A (P102, P104)
2.459	96	Gravel surface, HSG A (P101, P102, P104, P105, P106)
1.513	98	Paved parking, HSG A (P100, P101, P102, P103, P104, P105, P106)
0.061	98	Paved parking, HSG B (P100)
0.219	98	Water Surface, HSG B (P100)
2.116	30	Woods, Good, HSG A (P100)
3.966	55	Woods, Good, HSG B (P100)
13.010	**62**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
8.610	HSG A	P100, P101, P102, P103, P104, P105, P106
4.400	HSG B	P100
0.000	HSG C	
0.000	HSG D	
0.000	Other	
13.010		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
2.217	0.154	0.000	0.000	0.000	2.371	>75% Grass cover, Good	P100, P101, P102, P103, P104
0.305	0.000	0.000	0.000	0.000	0.305	Gravel roads	P102, P104
2.459	0.000	0.000	0.000	0.000	2.459	Gravel surface	P101, P102, P104, P105, P106
1.513	0.061	0.000	0.000	0.000	1.574	Paved parking	P100, P101, P102, P103, P104, P105, P106
0.000	0.219	0.000	0.000	0.000	0.219	Water Surface	P100
2.116	3.966	0.000	0.000	0.000	6.082	Woods, Good	P100
8.610	**4.400**	**0.000**	**0.000**	**0.000**	**13.010**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	DCB1	206.65	205.60	104.0	0.0101	0.013	0.0	12.0	0.0	TO DMH#1
2	DCB2	206.65	205.60	16.0	0.0656	0.013	0.0	12.0	0.0	TO DMH#1
3	DCB3	206.50	204.40	74.0	0.0284	0.013	0.0	12.0	0.0	TO DMH#2
4	DCB4	205.20	202.50	210.0	0.0129	0.011	0.0	15.0	0.0	TO INFIL BASIN#1
5	DMH1	205.50	204.60	92.0	0.0098	0.013	0.0	12.0	0.0	TO DMH#2
6	DMH2	204.60	202.50	130.0	0.0162	0.013	0.0	12.0	0.0	TO INFIL BASIN#1

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

Subcatchment P100: OVERLAND TO RIVER Runoff Area=373,692 sf 8.68% Impervious Runoff Depth=0.36"
Flow Length=1,386' Tc=16.2 min CN=WQ Runoff=1.75 cfs 0.256 af

Subcatchment P101: TO DCB#1 Runoff Area=10,350 sf 70.45% Impervious Runoff Depth=2.12"
Flow Length=125' Tc=5.0 min CN=WQ Runoff=0.53 cfs 0.042 af

Subcatchment P102: TO DCB#2 Runoff Area=9,735 sf 77.81% Impervious Runoff Depth=2.49"
Flow Length=120' Tc=5.0 min CN=WQ Runoff=0.59 cfs 0.046 af

Subcatchment P103: TO DCB#3 Runoff Area=16,853 sf 81.69% Impervious Runoff Depth=2.34"
Flow Length=156' Tc=5.0 min CN=WQ Runoff=0.96 cfs 0.076 af

Subcatchment P104: TO INFIL BASIN Runoff Area=46,544 sf 10.77% Impervious Runoff Depth=1.09"
Flow Length=145' Tc=5.0 min CN=WQ Runoff=1.27 cfs 0.097 af

Subcatchment P105: TO SWALE Runoff Area=44,672 sf 0.87% Impervious Runoff Depth=2.65"
Flow Length=265' Tc=5.0 min CN=WQ Runoff=2.99 cfs 0.227 af

Subcatchment P106: TO DCB#4 Runoff Area=64,868 sf 17.93% Impervious Runoff Depth=2.69"
Flow Length=302' Slope=0.0050 '/' Tc=5.0 min CN=WQ Runoff=4.37 cfs 0.334 af

Reach DCB1: TO DMH#1 Avg. Flow Depth=0.26' Max Vel=3.24 fps Inflow=0.53 cfs 0.042 af
12.0" Round Pipe n=0.013 L=104.0' S=0.0101 '/' Capacity=3.58 cfs Outflow=0.52 cfs 0.042 af

Reach DCB2: TO DMH#1 Avg. Flow Depth=0.17' Max Vel=6.48 fps Inflow=0.59 cfs 0.046 af
12.0" Round Pipe n=0.013 L=16.0' S=0.0656 '/' Capacity=9.13 cfs Outflow=0.59 cfs 0.046 af

Reach DCB3: TO DMH#2 Avg. Flow Depth=0.27' Max Vel=5.53 fps Inflow=0.96 cfs 0.076 af
12.0" Round Pipe n=0.013 L=74.0' S=0.0284 '/' Capacity=6.00 cfs Outflow=0.94 cfs 0.076 af

Reach DCB4: TO INFIL BASIN#1 Avg. Flow Depth=0.63' Max Vel=7.03 fps Inflow=4.37 cfs 0.334 af
15.0" Round Pipe n=0.011 L=210.0' S=0.0129 '/' Capacity=8.66 cfs Outflow=4.26 cfs 0.334 af

Reach DMH1: TO DMH#2 Avg. Flow Depth=0.38' Max Vel=3.96 fps Inflow=1.10 cfs 0.088 af
12.0" Round Pipe n=0.013 L=92.0' S=0.0098 '/' Capacity=3.52 cfs Outflow=1.09 cfs 0.088 af

Reach DMH2: TO INFIL BASIN#1 Avg. Flow Depth=0.47' Max Vel=5.60 fps Inflow=2.02 cfs 0.164 af
12.0" Round Pipe n=0.013 L=130.0' S=0.0162 '/' Capacity=4.53 cfs Outflow=1.99 cfs 0.164 af

Reach DP1: RIVER (SOUTHWEST Inflow=1.75 cfs 0.256 af
Outflow=1.75 cfs 0.256 af

Reach SW1: TO INFIL BASIN#1 Avg. Flow Depth=0.32' Max Vel=1.79 fps Inflow=2.99 cfs 0.227 af
n=0.040 L=255.0' S=0.0137 '/' Capacity=98.37 cfs Outflow=2.78 cfs 0.227 af

Pond IB1: INFILTRATION BASIN Peak Elev=204.61' Storage=11,458 cf Inflow=9.97 cfs 0.821 af
Discarded=1.82 cfs 0.821 af Secondary=0.00 cfs 0.000 af Outflow=1.82 cfs 0.821 af

Total Runoff Area = 13.010 ac Runoff Volume = 1.078 af Average Runoff Depth = 0.99"
86.22% Pervious = 11.217 ac 13.78% Impervious = 1.793 ac

Summary for Subcatchment P100: OVERLAND TO RIVER

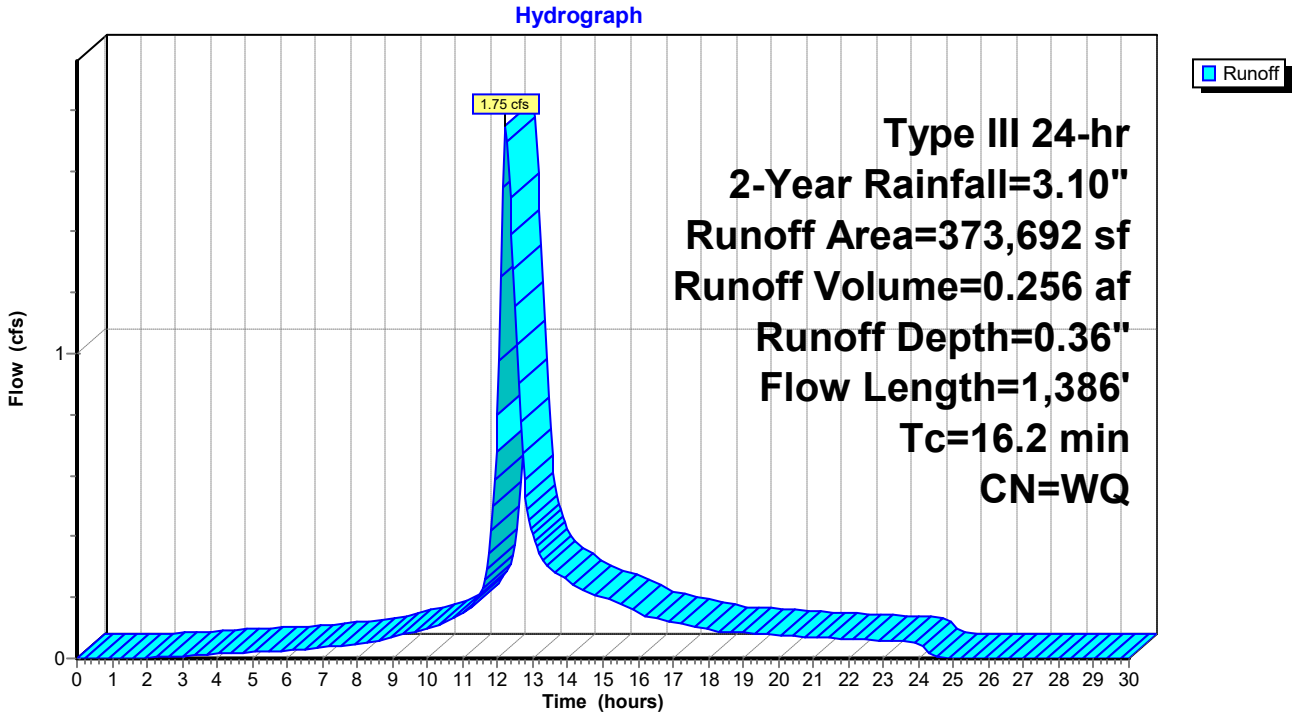
Runoff = 1.75 cfs @ 12.23 hrs, Volume= 0.256 af, Depth= 0.36"
Routed to Reach DP1 : RIVER (SOUTHWEST

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
69,627	39	>75% Grass cover, Good, HSG A
92,181	30	Woods, Good, HSG A
20,233	98	Paved parking, HSG A
6,716	61	>75% Grass cover, Good, HSG B
172,740	55	Woods, Good, HSG B
2,673	98	Paved parking, HSG B
9,522	98	Water Surface, HSG B
373,692		Weighted Average
341,264		91.32% Pervious Area
32,428		8.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	16	0.0200	0.94		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
3.8	34	0.0250	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.7	102	0.0250	2.55		**Shallow Concentrated Flow, GRASS** Unpaved Kv= 16.1 fps
1.8	321	0.0350	3.01		**Shallow Concentrated Flow, GRASS** Unpaved Kv= 16.1 fps
9.6	913	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.2	1,386	Total			

Subcatchment P100: OVERLAND TO RIVER



Summary for Subcatchment P101: TO DCB#1

[49] Hint: Tc<2dt may require smaller dt

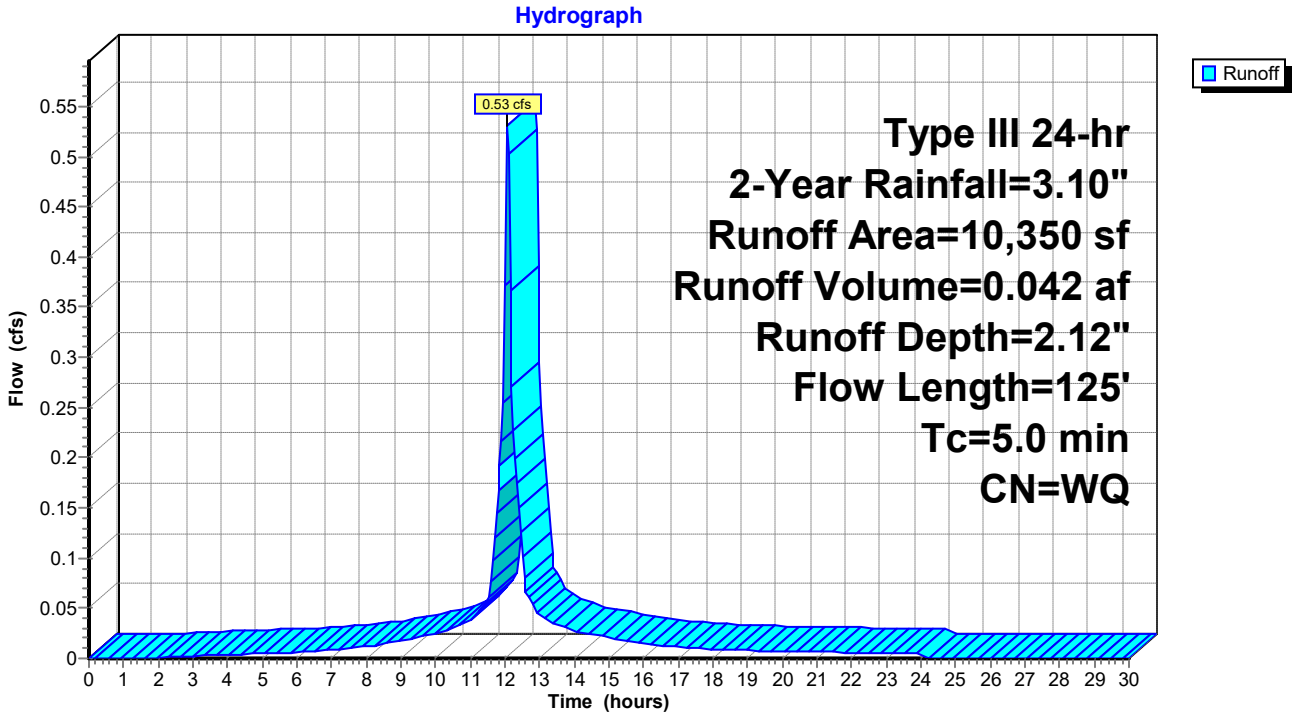
Runoff = 0.53 cfs @ 12.07 hrs, Volume= 0.042 af, Depth= 2.12"
Routed to Reach DCB1 : TO DMH#1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
2,688	39	>75% Grass cover, Good, HSG A
7,292	98	Paved parking, HSG A
370	96	Gravel surface, HSG A
10,350		Weighted Average
3,058		29.55% Pervious Area
7,292		70.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	25	0.0830	1.81		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.1	25	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.5	75	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.8	125	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P101: TO DCB#1



Summary for Subcatchment P102: TO DCB#2

[49] Hint: Tc<2dt may require smaller dt

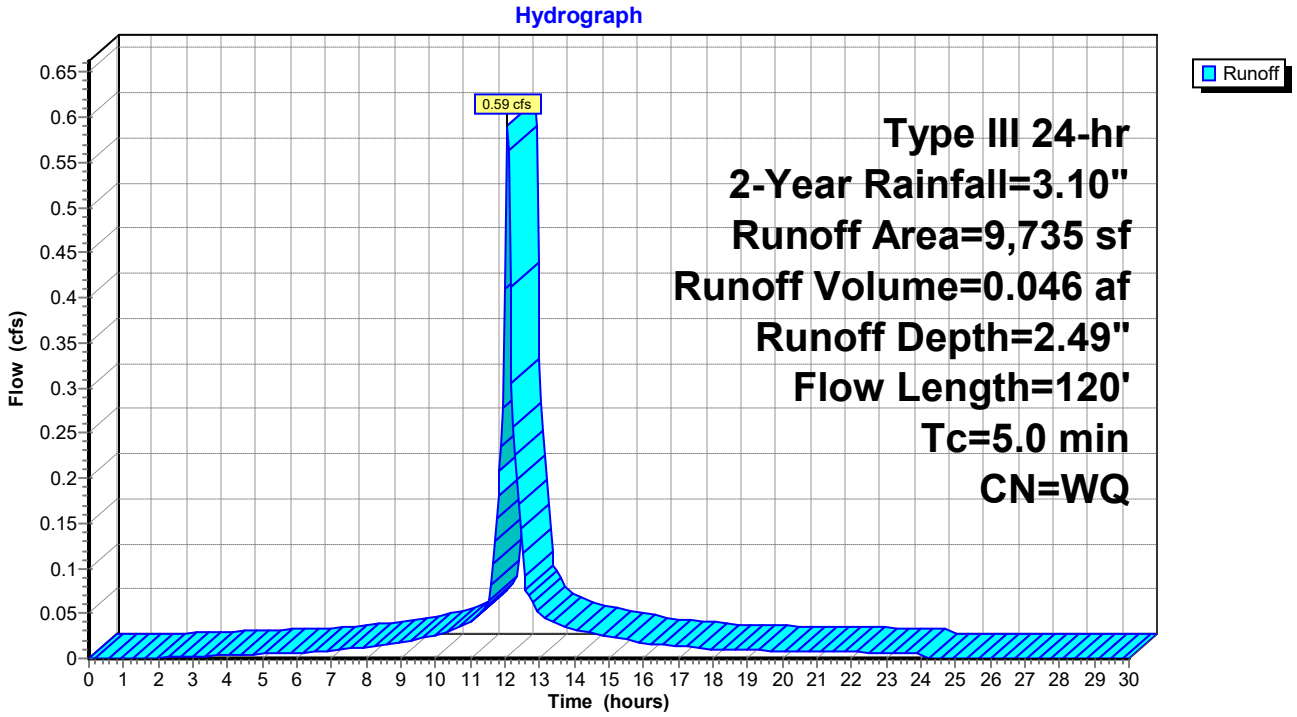
Runoff = 0.59 cfs @ 12.07 hrs, Volume= 0.046 af, Depth= 2.49"
Routed to Reach DCB2 : TO DMH#1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
272	39	>75% Grass cover, Good, HSG A
7,575	98	Paved parking, HSG A
327	96	Gravel surface, HSG A
1,561	76	Gravel roads, HSG A
9,735		Weighted Average
2,160		22.19% Pervious Area
7,575		77.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	21	0.0350	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.5	29	0.0200	1.06		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.4	70	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.2	120	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P102: TO DCB#2



Summary for Subcatchment P103: TO DCB#3

[49] Hint: Tc<2dt may require smaller dt

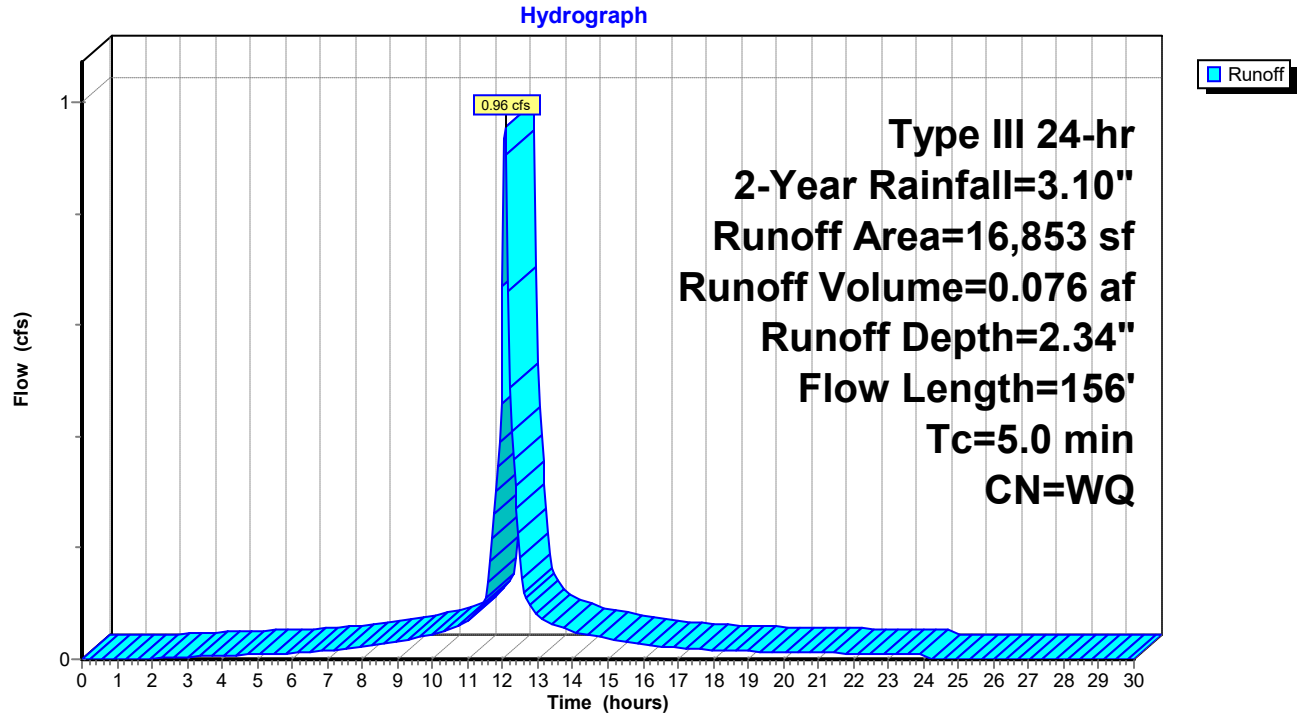
Runoff = 0.96 cfs @ 12.07 hrs, Volume= 0.076 af, Depth= 2.34"
Routed to Reach DCB3 : TO DMH#2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,086	39	>75% Grass cover, Good, HSG A
13,767	98	Paved parking, HSG A
16,853		Weighted Average
3,086		18.31% Pervious Area
13,767		81.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	21	0.0350	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.5	29	0.0200	1.06		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.6	106	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.4	156	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P103: TO DCB#3



Summary for Subcatchment P104: TO INFIL BASIN

[49] Hint: Tc<2dt may require smaller dt

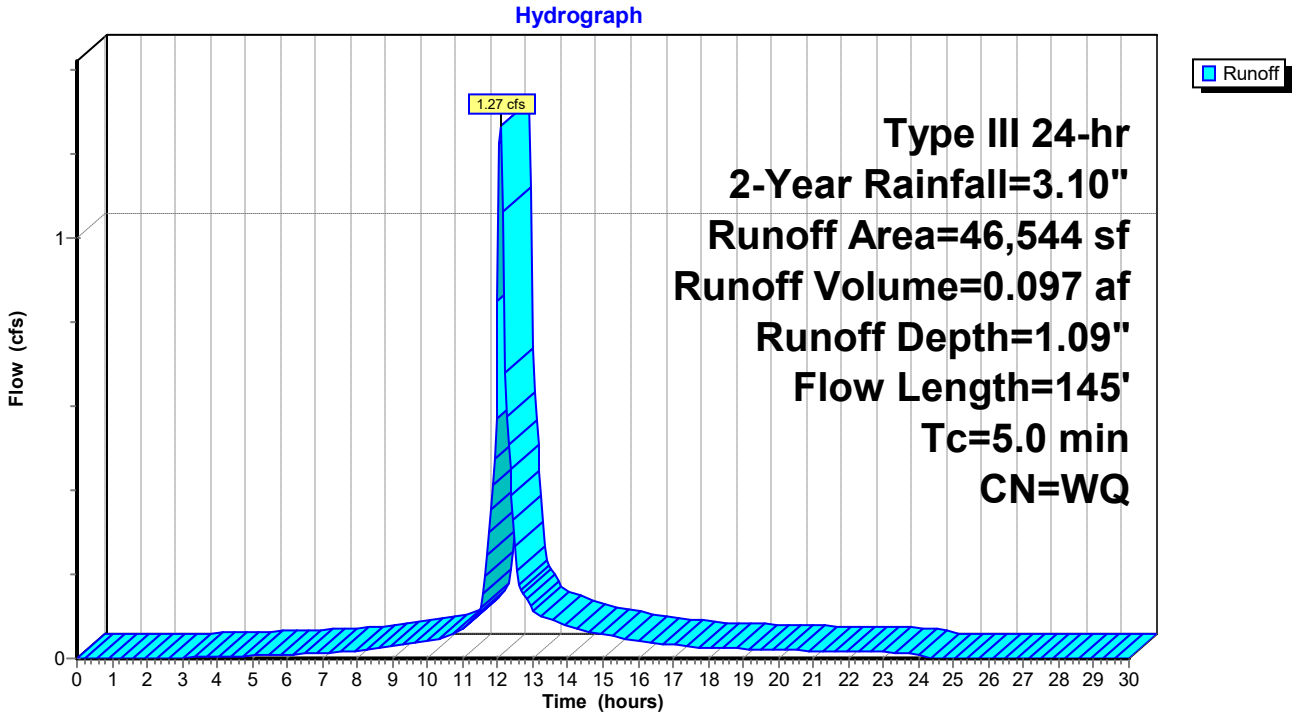
Runoff = 1.27 cfs @ 12.07 hrs, Volume= 0.097 af, Depth= 1.09"
Routed to Pond IB1 : INFILTRATION BASIN

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
20,908	39	>75% Grass cover, Good, HSG A
8,891	96	Gravel surface, HSG A
11,733	76	Gravel roads, HSG A
5,012	98	Paved parking, HSG A
46,544		Weighted Average
41,532		89.23% Pervious Area
5,012		10.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.18		**Sheet Flow, gravel**
					Smooth surfaces n= 0.011 P2= 3.10"
0.5	67	0.0200	2.28		**Shallow Concentrated Flow, gravel**
					Unpaved Kv= 16.1 fps
0.1	28	0.3300	9.25		**Shallow Concentrated Flow,**
					Unpaved Kv= 16.1 fps
1.3	145	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P104: TO INFIL BASIN



Summary for Subcatchment P105: TO SWALE

[49] Hint: Tc<2dt may require smaller dt

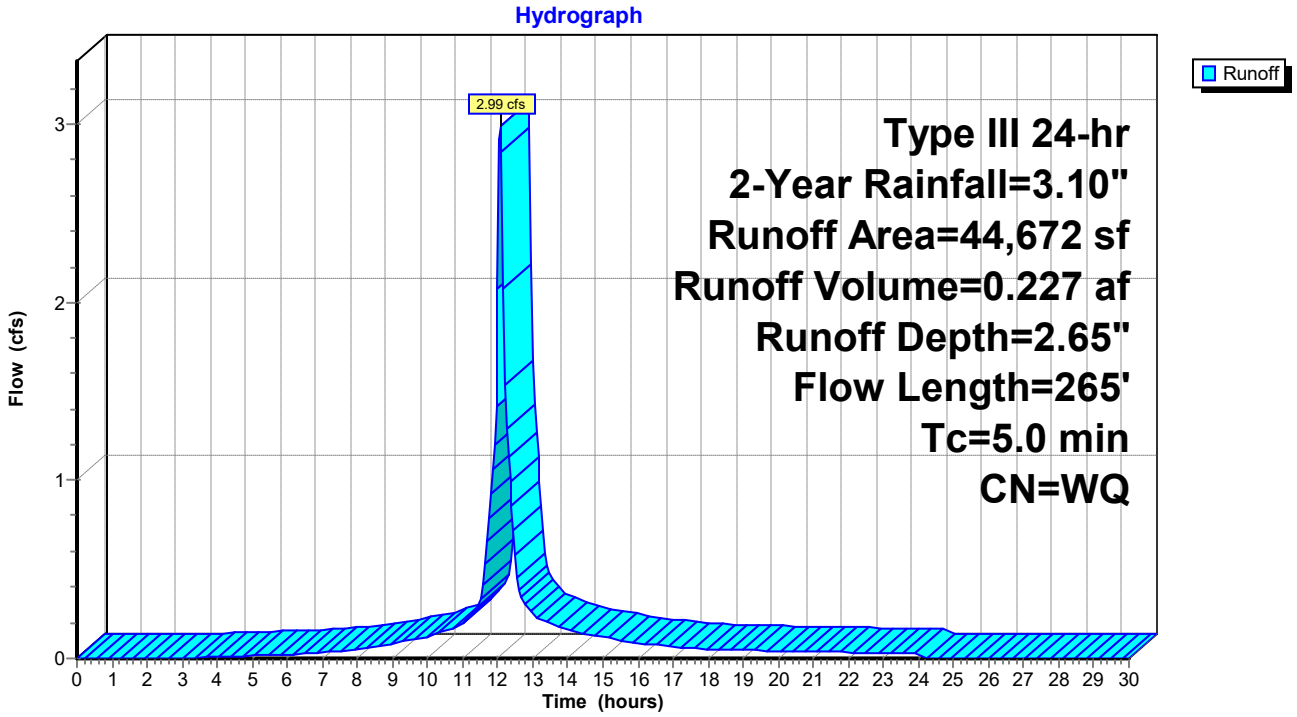
Runoff = 2.99 cfs @ 12.07 hrs, Volume= 0.227 af, Depth= 2.65"
Routed to Reach SW1 : TO INFIL BASIN#1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
387	98	Paved parking, HSG A
7,218	96	Gravel surface, HSG A
37,067	96	Gravel surface, HSG A
44,672		Weighted Average
44,285		99.13% Pervious Area
387		0.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	22	0.5000	3.62		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.7	23	0.0050	0.58		**Sheet Flow, gravel** Smooth surfaces n= 0.011 P2= 3.10"
3.2	220	0.0050	1.14		**Shallow Concentrated Flow, GRAVEL** Unpaved Kv= 16.1 fps
4.0	265	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P105: TO SWALE



Summary for Subcatchment P106: TO DCB#4

[49] Hint: Tc<2dt may require smaller dt

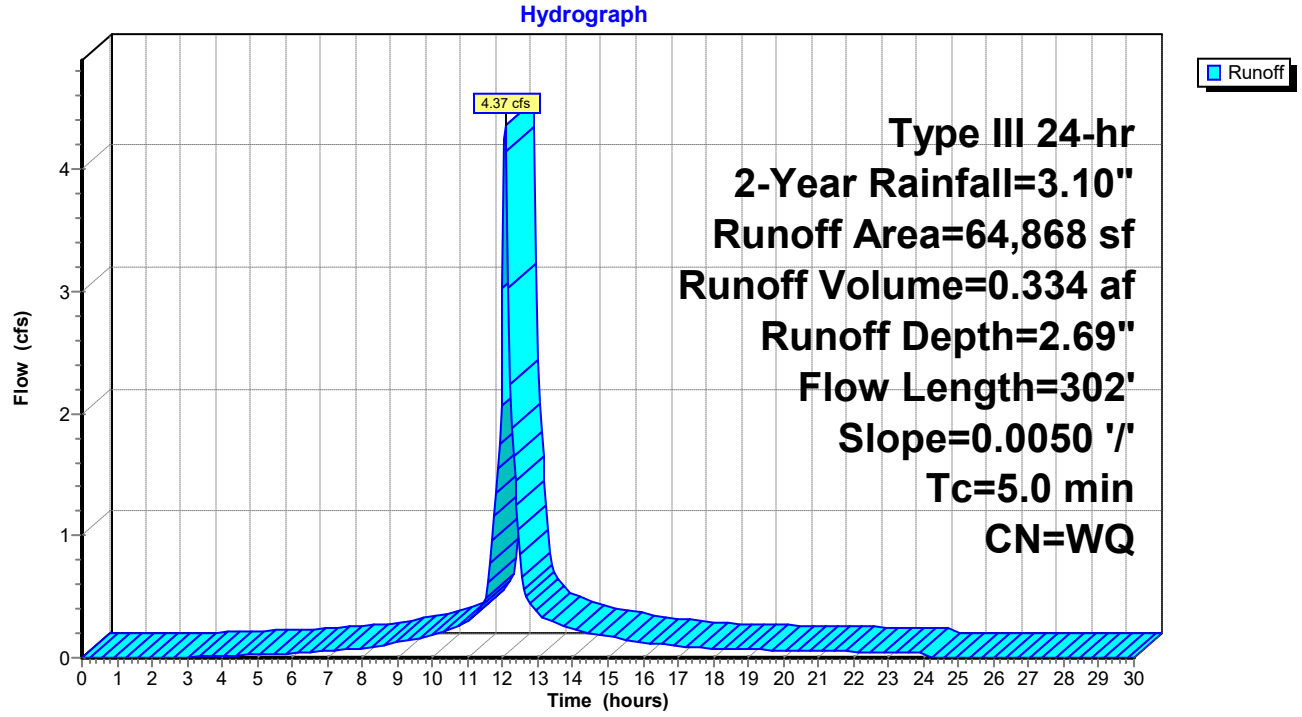
Runoff = 4.37 cfs @ 12.07 hrs, Volume= 0.334 af, Depth= 2.69"
Routed to Reach DCB4 : TO INFIL BASIN#1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
11,628	98	Paved parking, HSG A
6,496	96	Gravel surface, HSG A
46,744	96	Gravel surface, HSG A
64,868		Weighted Average
53,240		82.07% Pervious Area
11,628		17.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	50	0.0050	0.68		**Sheet Flow, GRAVEL** Smooth surfaces n= 0.011 P2= 3.10"
3.7	252	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
4.9	302	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P106: TO DCB#4



Summary for Reach DCB1: TO DMH#1

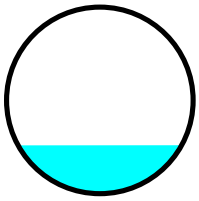
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.238 ac, 70.45% Impervious, Inflow Depth = 2.12" for 2-Year event
Inflow = 0.53 cfs @ 12.07 hrs, Volume= 0.042 af
Outflow = 0.52 cfs @ 12.09 hrs, Volume= 0.042 af, Atten= 3%, Lag= 1.1 min
Routed to Reach DMH1 : TO DMH#2

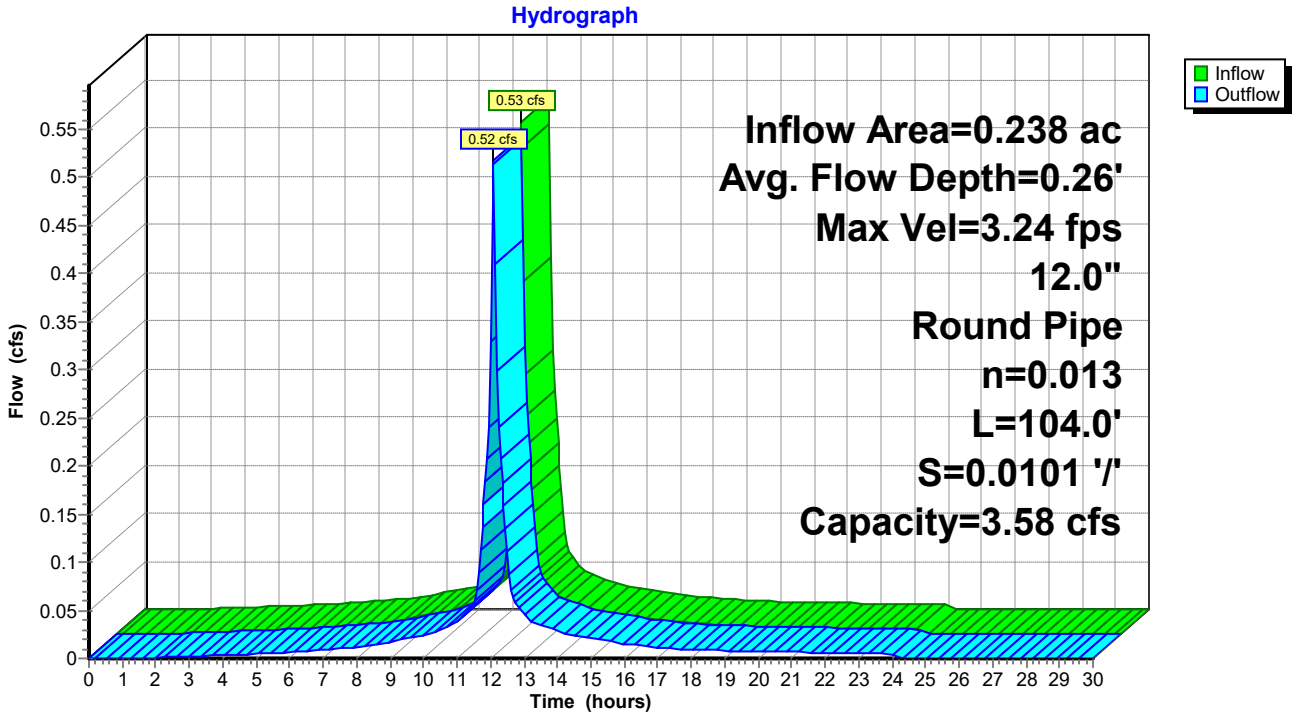
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.24 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.06 fps, Avg. Travel Time= 1.6 min

Peak Storage= 17 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.26' , Surface Width= 0.88'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.58 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 104.0' Slope= 0.0101 '/'
Inlet Invert= 206.65', Outlet Invert= 205.60'



Reach DCB1: TO DMH#1



Summary for Reach DCB2: TO DMH#1

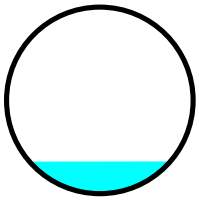
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.223 ac, 77.81% Impervious, Inflow Depth = 2.49" for 2-Year event
Inflow = 0.59 cfs @ 12.07 hrs, Volume= 0.046 af
Outflow = 0.59 cfs @ 12.07 hrs, Volume= 0.046 af, Atten= 0%, Lag= 0.1 min
Routed to Reach DMH1 : TO DMH#2

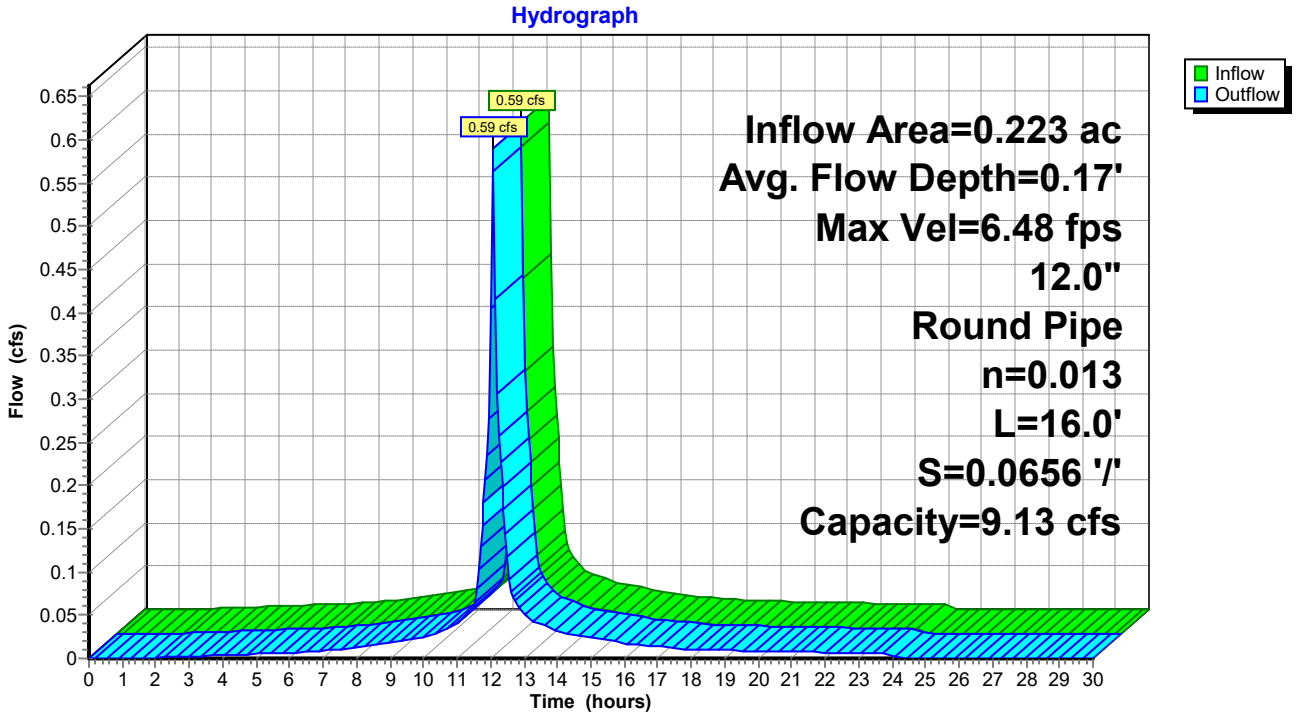
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.48 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.13 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.17' , Surface Width= 0.76'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.13 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 16.0' Slope= 0.0656 '/'
Inlet Invert= 206.65', Outlet Invert= 205.60'



Reach DCB2: TO DMH#1



Summary for Reach DCB3: TO DMH#2

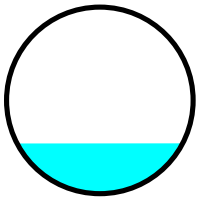
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.387 ac, 81.69% Impervious, Inflow Depth = 2.34" for 2-Year event
Inflow = 0.96 cfs @ 12.07 hrs, Volume= 0.076 af
Outflow = 0.94 cfs @ 12.08 hrs, Volume= 0.076 af, Atten= 2%, Lag= 0.5 min
Routed to Reach DMH2 : TO INFIL BASIN#1

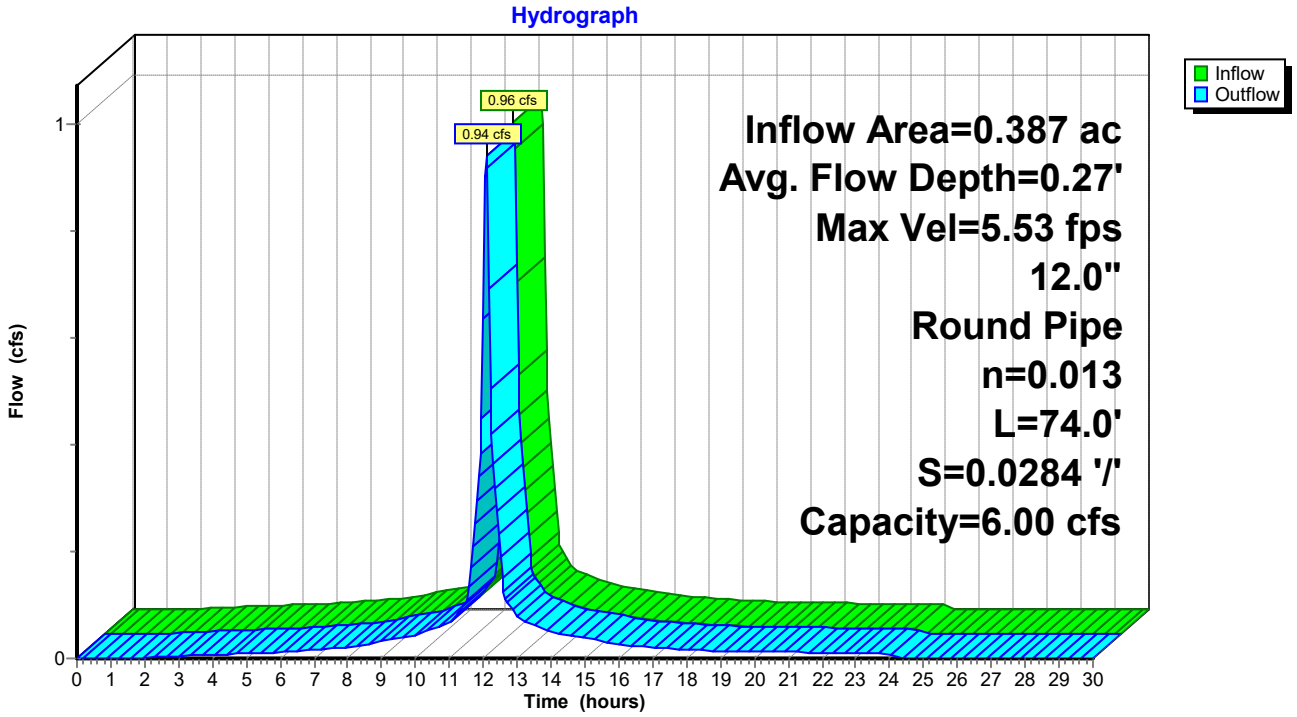
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.53 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.82 fps, Avg. Travel Time= 0.7 min

Peak Storage= 13 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.27' , Surface Width= 0.89'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.00 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 74.0' Slope= 0.0284 '/'
Inlet Invert= 206.50', Outlet Invert= 204.40'



Reach DCB3: TO DMH#2



Summary for Reach DCB4: TO INFIL BASIN#1

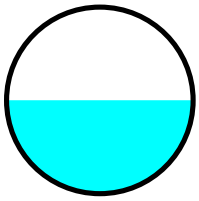
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 1.489 ac, 17.93% Impervious, Inflow Depth = 2.69" for 2-Year event
Inflow = 4.37 cfs @ 12.07 hrs, Volume= 0.334 af
Outflow = 4.26 cfs @ 12.09 hrs, Volume= 0.334 af, Atten= 2%, Lag= 1.1 min
Routed to Pond IB1 : INFILTRATION BASIN

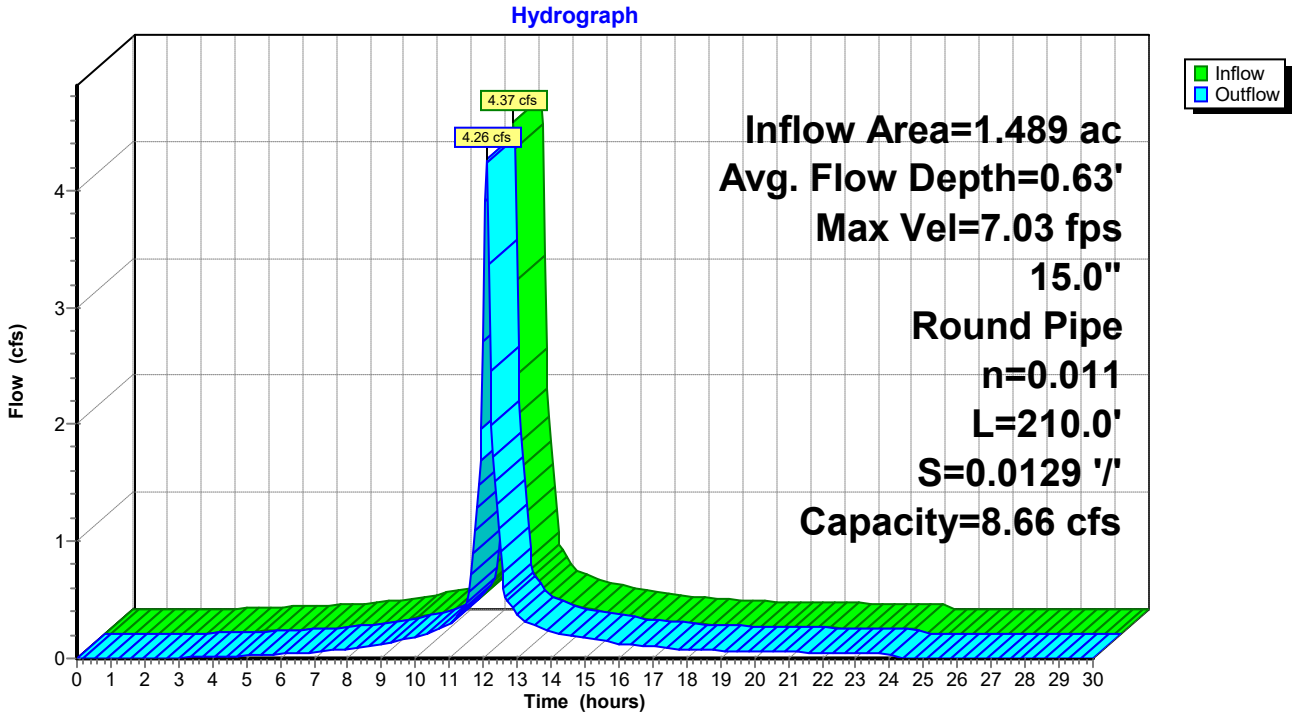
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.03 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.27 fps, Avg. Travel Time= 1.5 min

Peak Storage= 129 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.63' , Surface Width= 1.25'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 8.66 cfs

15.0" Round Pipe
n= 0.011 Concrete pipe, straight & clean
Length= 210.0' Slope= 0.0129 '/'
Inlet Invert= 205.20', Outlet Invert= 202.50'



Reach DCB4: TO INFIL BASIN#1



Summary for Reach DMH1: TO DMH#2

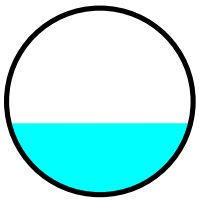
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach DCB1 OUTLET depth by 0.03' @ 12.10 hrs
[62] Hint: Exceeded Reach DCB2 OUTLET depth by 0.11' @ 12.10 hrs

Inflow Area = 0.461 ac, 74.02% Impervious, Inflow Depth = 2.30" for 2-Year event
Inflow = 1.10 cfs @ 12.08 hrs, Volume= 0.088 af
Outflow = 1.09 cfs @ 12.09 hrs, Volume= 0.088 af, Atten= 1%, Lag= 0.7 min
Routed to Reach DMH2 : TO INFIL BASIN#1

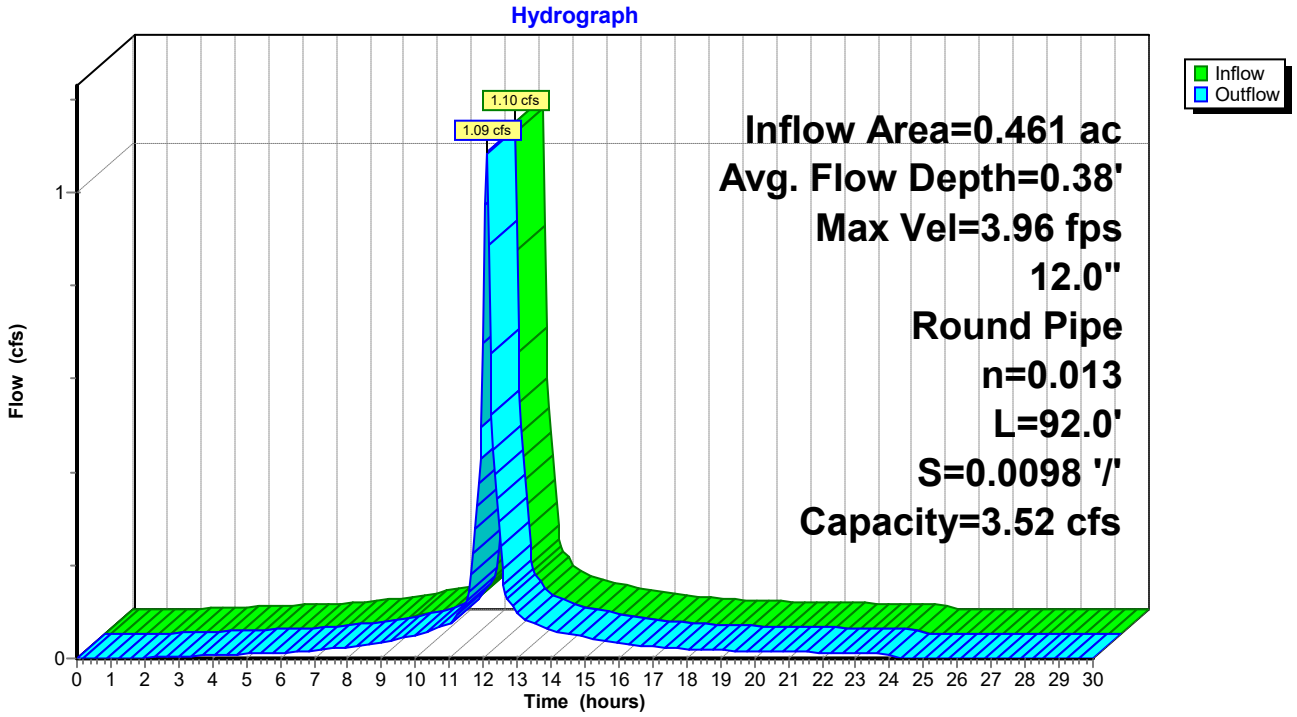
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.96 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.30 fps, Avg. Travel Time= 1.2 min

Peak Storage= 26 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.38' , Surface Width= 0.97'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.52 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 92.0' Slope= 0.0098 '/'
Inlet Invert= 205.50', Outlet Invert= 204.60'



Reach DMH1: TO DMH#2



Summary for Reach DMH2: TO INFIL BASIN#1

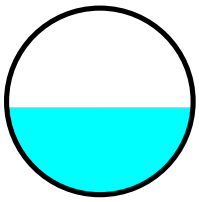
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach DCB3 OUTLET depth by 0.40' @ 12.10 hrs
[62] Hint: Exceeded Reach DMH1 OUTLET depth by 0.09' @ 12.10 hrs

Inflow Area = 0.848 ac, 77.52% Impervious, Inflow Depth = 2.32" for 2-Year event
Inflow = 2.02 cfs @ 12.09 hrs, Volume= 0.164 af
Outflow = 1.99 cfs @ 12.10 hrs, Volume= 0.164 af, Atten= 1%, Lag= 0.6 min
Routed to Pond IB1 : INFILTRATION BASIN

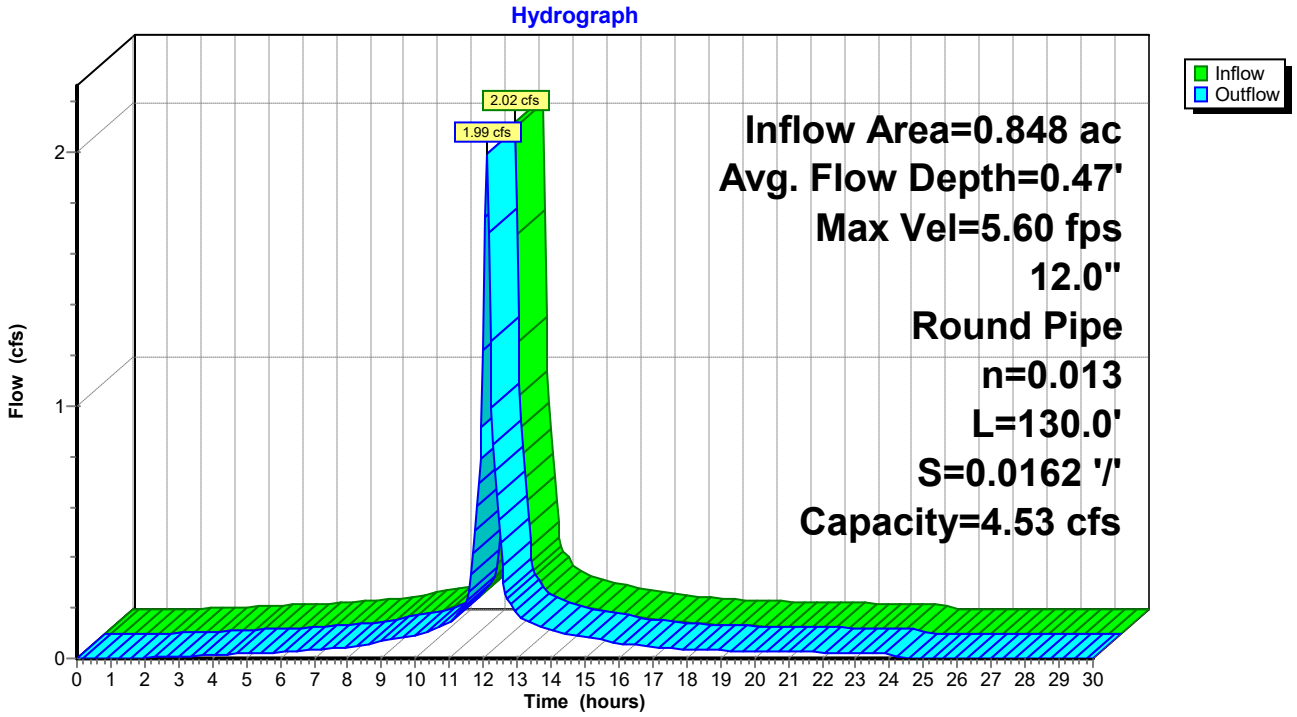
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.60 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.87 fps, Avg. Travel Time= 1.2 min

Peak Storage= 47 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.47' , Surface Width= 1.00'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 4.53 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 130.0' Slope= 0.0162 '/'
Inlet Invert= 204.60', Outlet Invert= 202.50'



Reach DMH2: TO INFIL BASIN#1



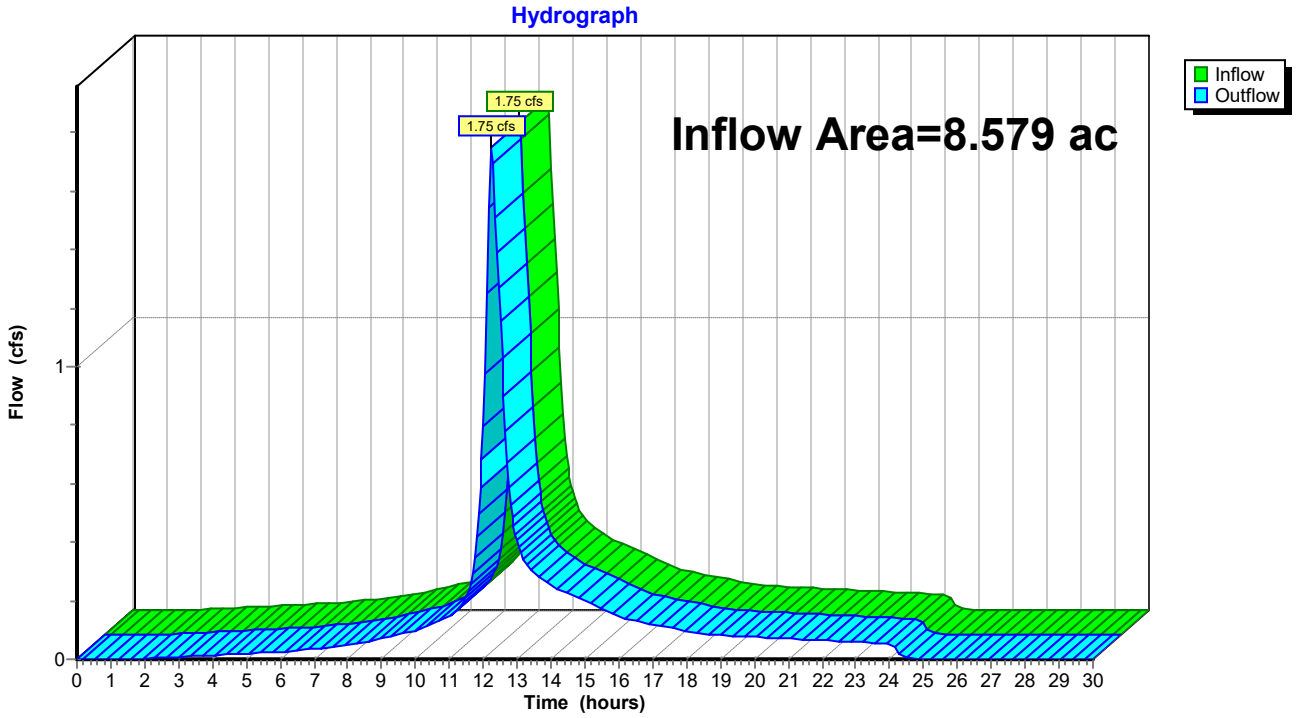
Summary for Reach DP1: RIVER (SOUTHWEST

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 8.579 ac, 8.68% Impervious, Inflow Depth = 0.36" for 2-Year event
Inflow = 1.75 cfs @ 12.23 hrs, Volume= 0.256 af
Outflow = 1.75 cfs @ 12.23 hrs, Volume= 0.256 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 DP1: RIVER (SOUTHWEST



Summary for Reach SW1: TO INFIL BASIN#1

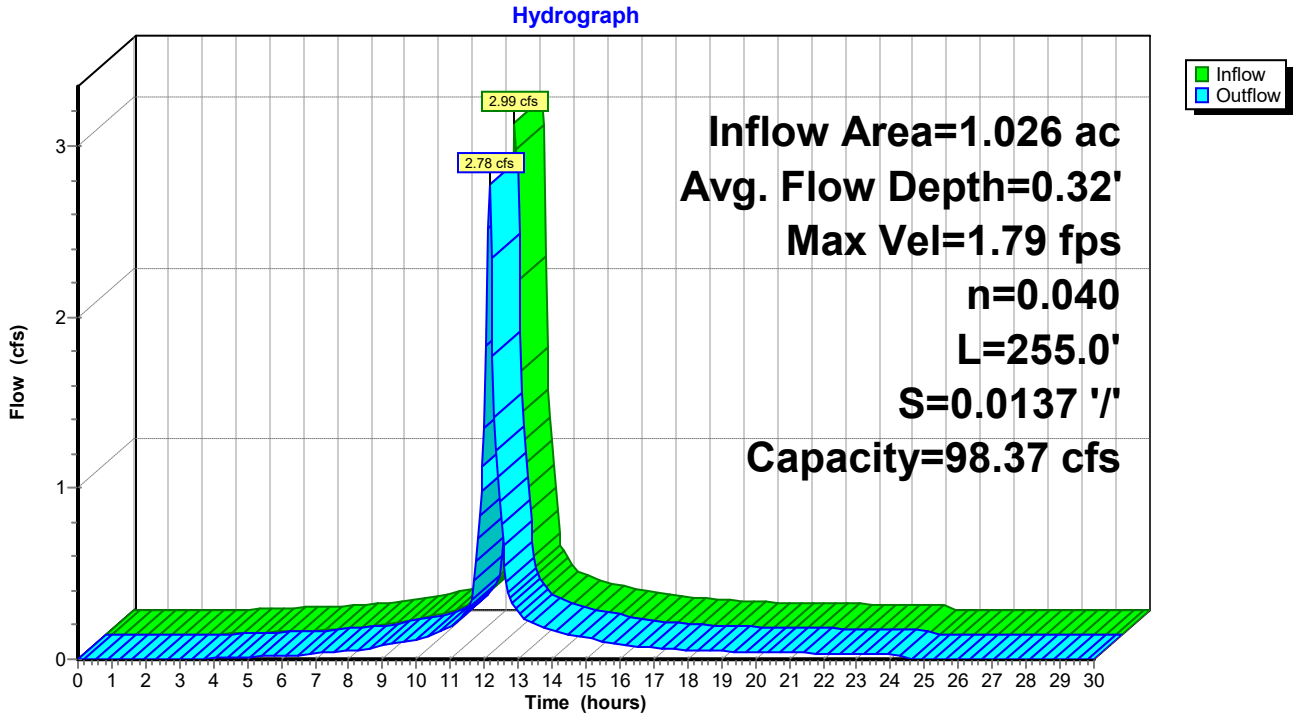
Inflow Area = 1.026 ac, 0.87% Impervious, Inflow Depth = 2.65" for 2-Year event
Inflow = 2.99 cfs @ 12.07 hrs, Volume= 0.227 af
Outflow = 2.78 cfs @ 12.14 hrs, Volume= 0.227 af, Atten= 7%, Lag= 4.4 min
Routed to Pond IB1 : INFILTRATION BASIN

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.79 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 0.48 fps, Avg. Travel Time= 8.8 min

Peak Storage= 406 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.32' , Surface Width= 5.93'
Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 98.37 cfs

4.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 255.0' Slope= 0.0137 '/'
Inlet Invert= 208.00', Outlet Invert= 204.50'

‡



Summary for Pond IB1: INFILTRATION BASIN

[62] Hint: Exceeded Reach DCB4 OUTLET depth by 1.90' @ 12.65 hrs
[62] Hint: Exceeded Reach DMH2 OUTLET depth by 1.94' @ 12.65 hrs
[61] Hint: Exceeded Reach SW1 outlet invert by 0.11' @ 12.55 hrs

Inflow Area = 4.431 ac, 23.66% Impervious, Inflow Depth = 2.22" for 2-Year event
Inflow = 9.97 cfs @ 12.10 hrs, Volume= 0.821 af
Outflow = 1.82 cfs @ 12.57 hrs, Volume= 0.821 af, Atten= 82%, Lag= 28.3 min
Discarded = 1.82 cfs @ 12.57 hrs, Volume= 0.821 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach DP1 : RIVER (SOUTHWEST

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 204.61' @ 12.57 hrs Surf.Area= 7,239 sf Storage= 11,458 cf

Plug-Flow detention time= 52.0 min calculated for 0.820 af (100% of inflow)
Center-of-Mass det. time= 51.9 min (826.6 - 774.7)

Volume	Invert	Avail.Storage	Storage Description
#1	202.50'	64,106 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

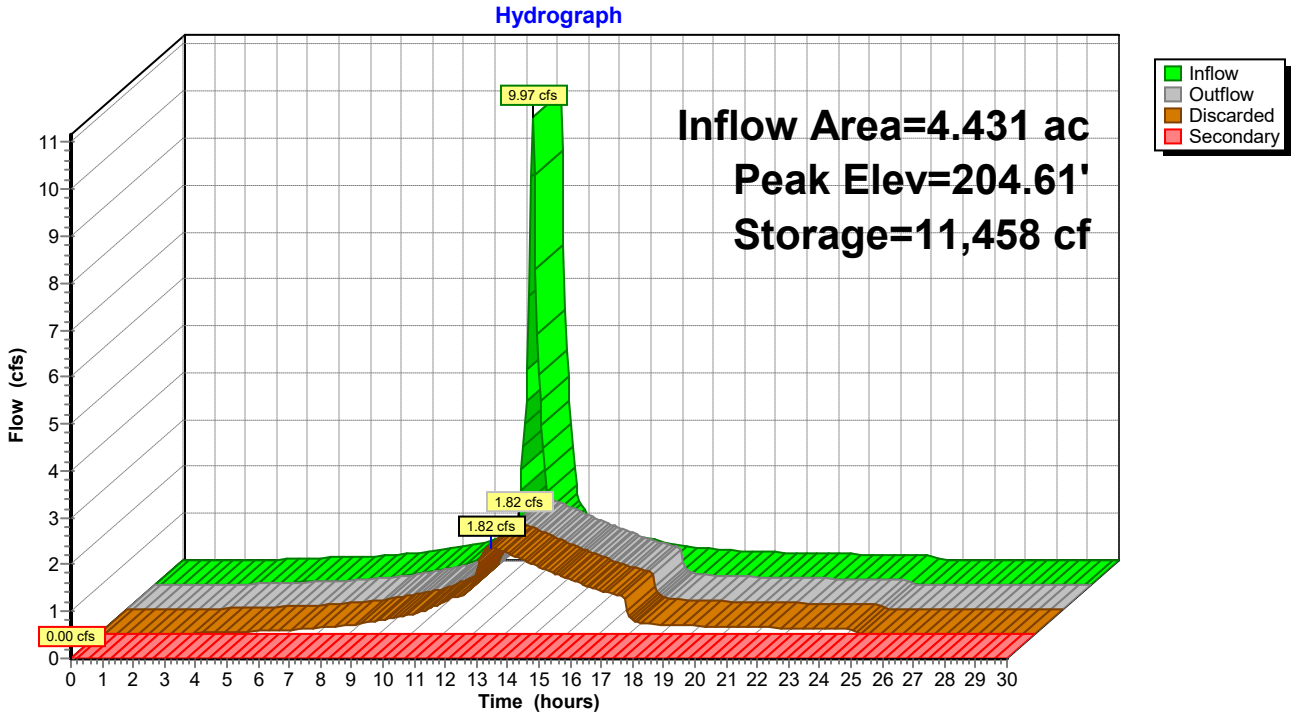
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
202.50	3,998	0	0
203.00	4,458	2,114	2,114
204.00	6,067	5,263	7,377
206.00	9,887	15,954	23,331
208.00	15,259	25,146	48,477
209.00	16,000	15,630	64,106

Device	Routing	Invert	Outlet Devices
#1	Discarded	202.50'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 197.70'
#2	Secondary	208.00'	**10.0' long + 3.0 '/' SideZ x 10.0' breadth Broad-Crested Rectangular Weir**
			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

Discarded OutFlow Max=1.82 cfs @ 12.57 hrs HW=204.61' (Free Discharge)
1=Exfiltration (Controls 1.82 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=202.50' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond IB1: INFILTRATION BASIN



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

Subcatchment P100: OVERLAND TO RIVER Runoff Area=373,692 sf 8.68% Impervious Runoff Depth=0.75"
Flow Length=1,386' Tc=16.2 min CN=WQ Runoff=4.24 cfs 0.538 af

Subcatchment P101: TO DCB#1 Runoff Area=10,350 sf 70.45% Impervious Runoff Depth=3.18"
Flow Length=125' Tc=5.0 min CN=WQ Runoff=0.78 cfs 0.063 af

Subcatchment P102: TO DCB#2 Runoff Area=9,735 sf 77.81% Impervious Runoff Depth=3.80"
Flow Length=120' Tc=5.0 min CN=WQ Runoff=0.89 cfs 0.071 af

Subcatchment P103: TO DCB#3 Runoff Area=16,853 sf 81.69% Impervious Runoff Depth=3.50"
Flow Length=156' Tc=5.0 min CN=WQ Runoff=1.40 cfs 0.113 af

Subcatchment P104: TO INFIL BASIN Runoff Area=46,544 sf 10.77% Impervious Runoff Depth=1.82"
Flow Length=145' Tc=5.0 min CN=WQ Runoff=2.07 cfs 0.162 af

Subcatchment P105: TO SWALE Runoff Area=44,672 sf 0.87% Impervious Runoff Depth=4.04"
Flow Length=265' Tc=5.0 min CN=WQ Runoff=4.45 cfs 0.345 af

Subcatchment P106: TO DCB#4 Runoff Area=64,868 sf 17.93% Impervious Runoff Depth=4.08"
Flow Length=302' Slope=0.0050 '/' Tc=5.0 min CN=WQ Runoff=6.48 cfs 0.506 af

Reach DCB1: TO DMH#1 Avg. Flow Depth=0.32' Max Vel=3.61 fps Inflow=0.78 cfs 0.063 af
12.0" Round Pipe n=0.013 L=104.0' S=0.0101 '/' Capacity=3.58 cfs Outflow=0.76 cfs 0.063 af

Reach DCB2: TO DMH#1 Avg. Flow Depth=0.21' Max Vel=7.32 fps Inflow=0.89 cfs 0.071 af
12.0" Round Pipe n=0.013 L=16.0' S=0.0656 '/' Capacity=9.13 cfs Outflow=0.89 cfs 0.071 af

Reach DCB3: TO DMH#2 Avg. Flow Depth=0.33' Max Vel=6.17 fps Inflow=1.40 cfs 0.113 af
12.0" Round Pipe n=0.013 L=74.0' S=0.0284 '/' Capacity=6.00 cfs Outflow=1.38 cfs 0.113 af

Reach DCB4: TO INFIL BASIN#1 Avg. Flow Depth=0.80' Max Vel=7.70 fps Inflow=6.48 cfs 0.506 af
15.0" Round Pipe n=0.011 L=210.0' S=0.0129 '/' Capacity=8.66 cfs Outflow=6.33 cfs 0.506 af

Reach DMH1: TO DMH#2 Avg. Flow Depth=0.48' Max Vel=4.39 fps Inflow=1.64 cfs 0.134 af
12.0" Round Pipe n=0.013 L=92.0' S=0.0098 '/' Capacity=3.52 cfs Outflow=1.62 cfs 0.134 af

Reach DMH2: TO INFIL BASIN#1 Avg. Flow Depth=0.59' Max Vel=6.16 fps Inflow=2.99 cfs 0.247 af
12.0" Round Pipe n=0.013 L=130.0' S=0.0162 '/' Capacity=4.53 cfs Outflow=2.95 cfs 0.247 af

Reach DP1: RIVER (SOUTHWEST Inflow=4.24 cfs 0.538 af
Outflow=4.24 cfs 0.538 af

Reach SW1: TO INFIL BASIN#1 Avg. Flow Depth=0.40' Max Vel=2.04 fps Inflow=4.45 cfs 0.345 af
n=0.040 L=255.0' S=0.0137 '/' Capacity=98.37 cfs Outflow=4.12 cfs 0.345 af

Pond IB1: INFILTRATION BASIN Peak Elev=205.56' Storage=19,146 cf Inflow=15.08 cfs 1.259 af
Discarded=2.44 cfs 1.259 af Secondary=0.00 cfs 0.000 af Outflow=2.44 cfs 1.259 af

Total Runoff Area = 13.010 ac Runoff Volume = 1.798 af Average Runoff Depth = 1.66"
86.22% Pervious = 11.217 ac 13.78% Impervious = 1.793 ac

Summary for Subcatchment P100: OVERLAND TO RIVER

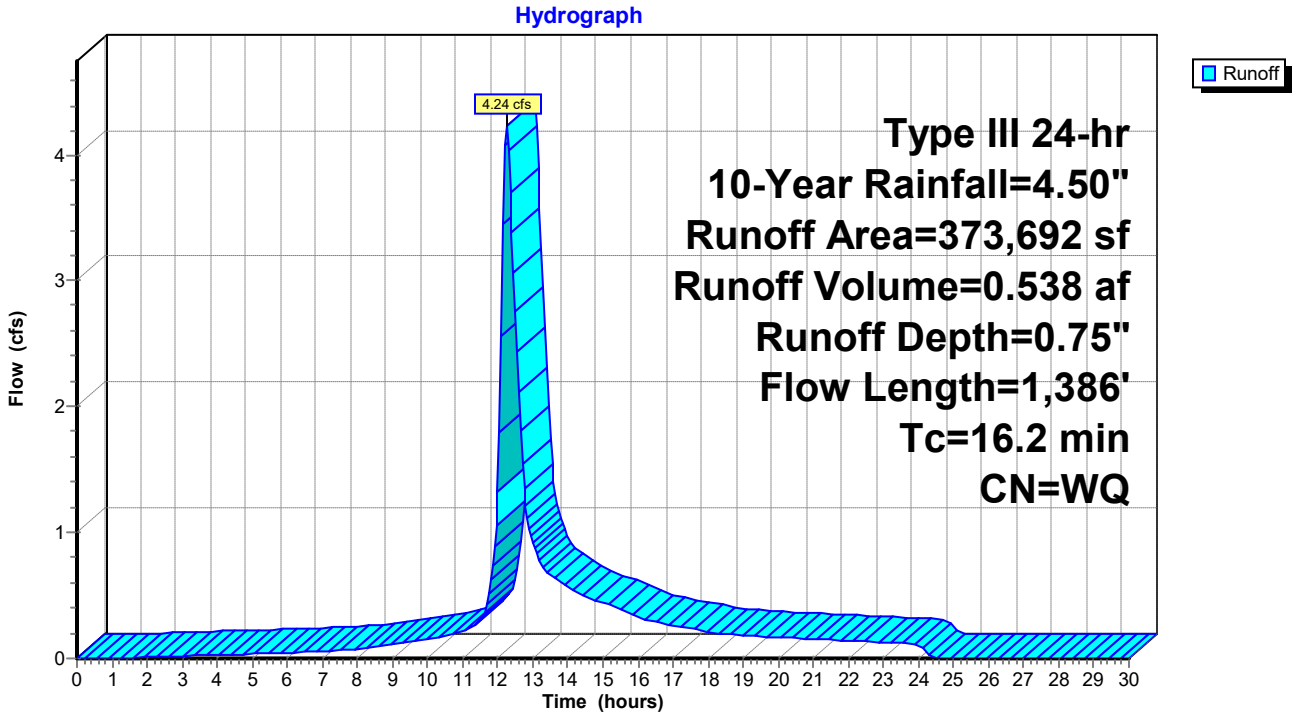
Runoff = 4.24 cfs @ 12.25 hrs, Volume= 0.538 af, Depth= 0.75"
Routed to Reach DP1 : RIVER (SOUTHWEST

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

Area (sf)	CN	Description
69,627	39	>75% Grass cover, Good, HSG A
92,181	30	Woods, Good, HSG A
20,233	98	Paved parking, HSG A
6,716	61	>75% Grass cover, Good, HSG B
172,740	55	Woods, Good, HSG B
2,673	98	Paved parking, HSG B
9,522	98	Water Surface, HSG B
373,692		Weighted Average
341,264		91.32% Pervious Area
32,428		8.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	16	0.0200	0.94		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
3.8	34	0.0250	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.7	102	0.0250	2.55		**Shallow Concentrated Flow, GRASS** Unpaved Kv= 16.1 fps
1.8	321	0.0350	3.01		**Shallow Concentrated Flow, GRASS** Unpaved Kv= 16.1 fps
9.6	913	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.2	1,386	Total			

Subcatchment P100: OVERLAND TO RIVER



Summary for Subcatchment P101: TO DCB#1

[49] Hint: Tc<2dt may require smaller dt

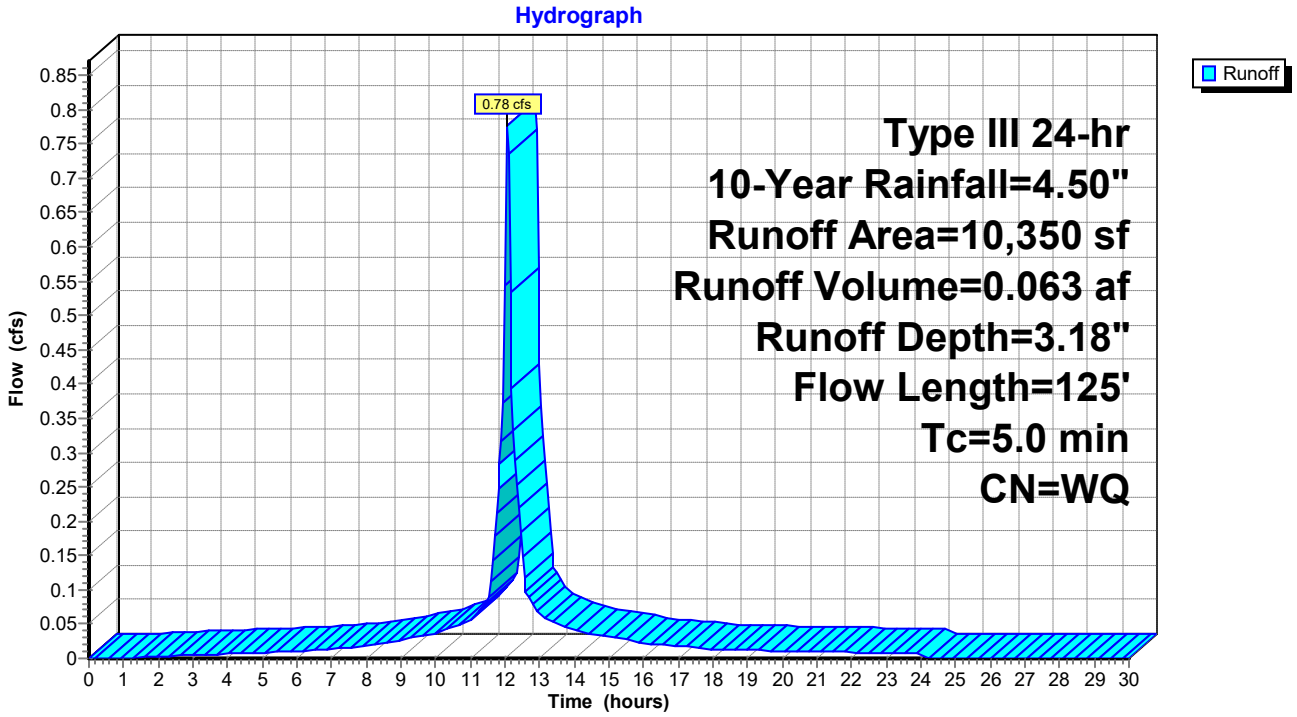
Runoff = 0.78 cfs @ 12.07 hrs, Volume= 0.063 af, Depth= 3.18"
Routed to Reach DCB1 : TO DMH#1

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

Area (sf)	CN	Description
2,688	39	>75% Grass cover, Good, HSG A
7,292	98	Paved parking, HSG A
370	96	Gravel surface, HSG A
10,350		Weighted Average
3,058		29.55% Pervious Area
7,292		70.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	25	0.0830	1.81		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.1	25	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.5	75	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.8	125	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P101: TO DCB#1



Summary for Subcatchment P102: TO DCB#2

[49] Hint: Tc<2dt may require smaller dt

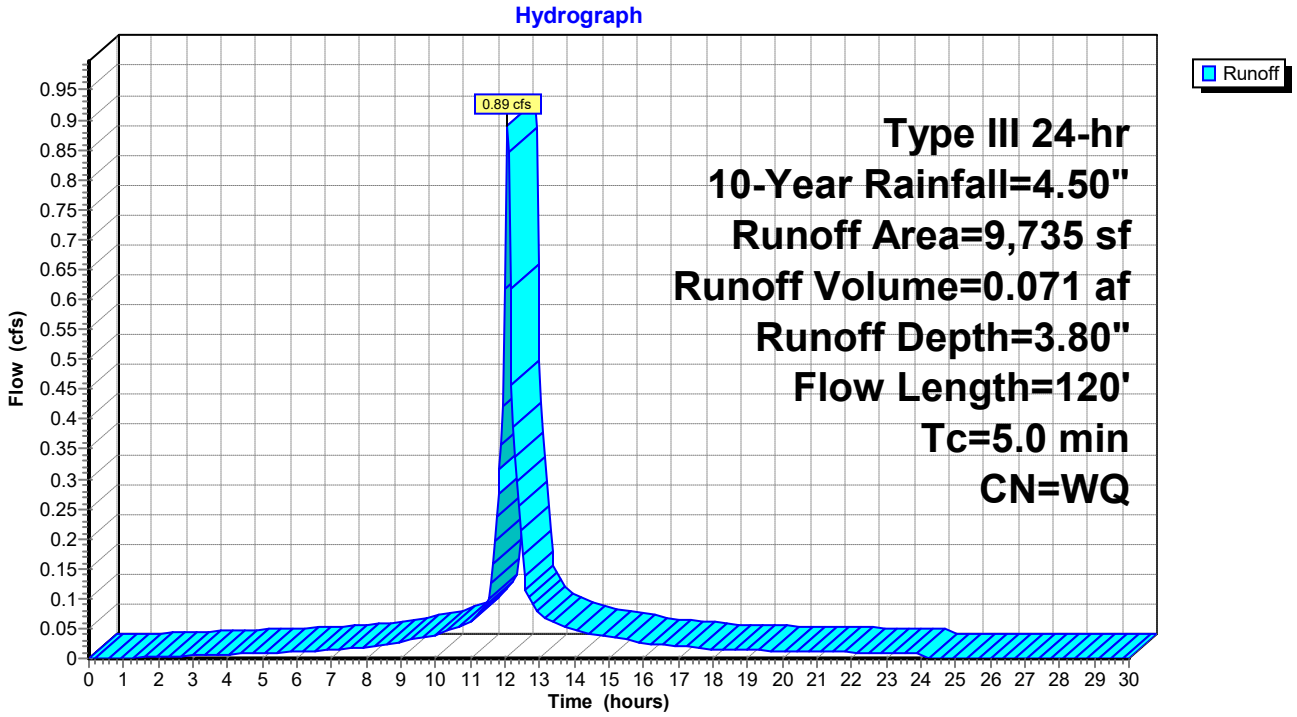
Runoff = 0.89 cfs @ 12.07 hrs, Volume= 0.071 af, Depth= 3.80"
Routed to Reach DCB2 : TO DMH#1

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

Area (sf)	CN	Description
272	39	>75% Grass cover, Good, HSG A
7,575	98	Paved parking, HSG A
327	96	Gravel surface, HSG A
1,561	76	Gravel roads, HSG A
9,735		Weighted Average
2,160		22.19% Pervious Area
7,575		77.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	21	0.0350	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.5	29	0.0200	1.06		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.4	70	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.2	120	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P102: TO DCB#2



Summary for Subcatchment P103: TO DCB#3

[49] Hint: Tc<2dt may require smaller dt

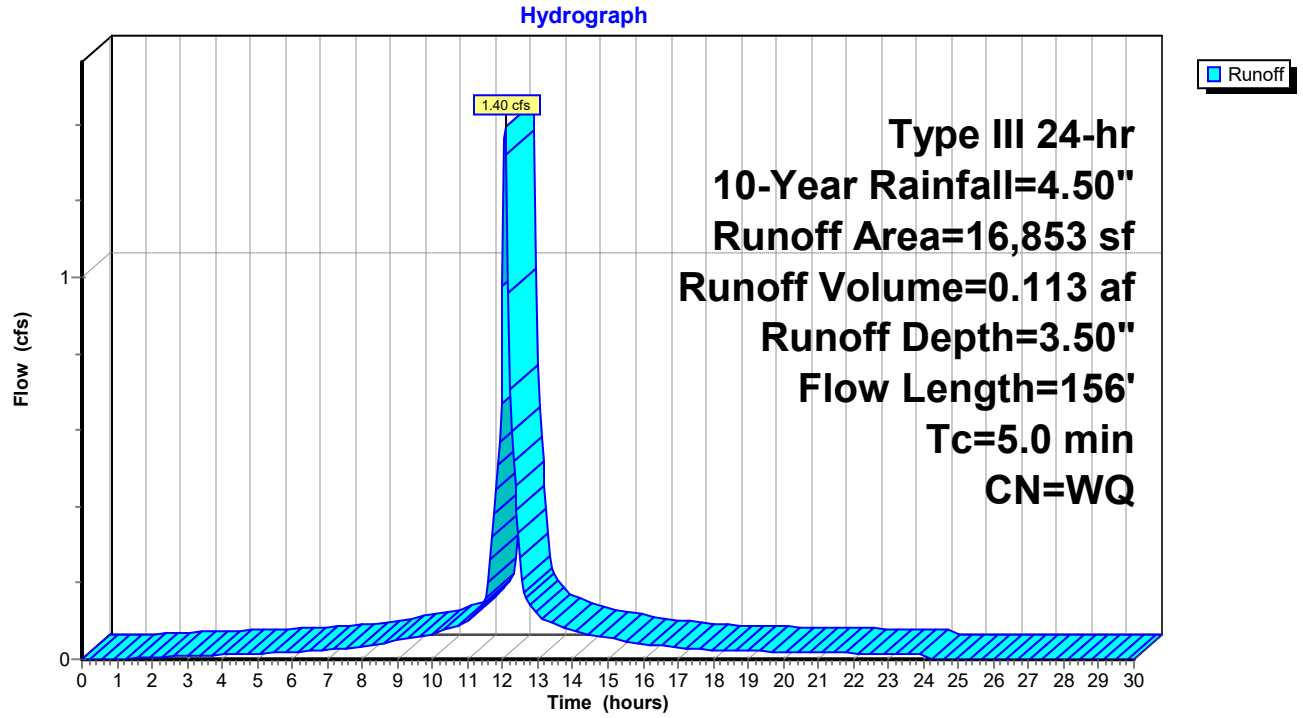
Runoff = 1.40 cfs @ 12.07 hrs, Volume= 0.113 af, Depth= 3.50"
Routed to Reach DCB3 : TO DMH#2

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

Area (sf)	CN	Description
3,086	39	>75% Grass cover, Good, HSG A
13,767	98	Paved parking, HSG A
16,853		Weighted Average
3,086		18.31% Pervious Area
13,767		81.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	21	0.0350	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.5	29	0.0200	1.06		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.6	106	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.4	156	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P103: TO DCB#3



Summary for Subcatchment P104: TO INFIL BASIN

[49] Hint: Tc<2dt may require smaller dt

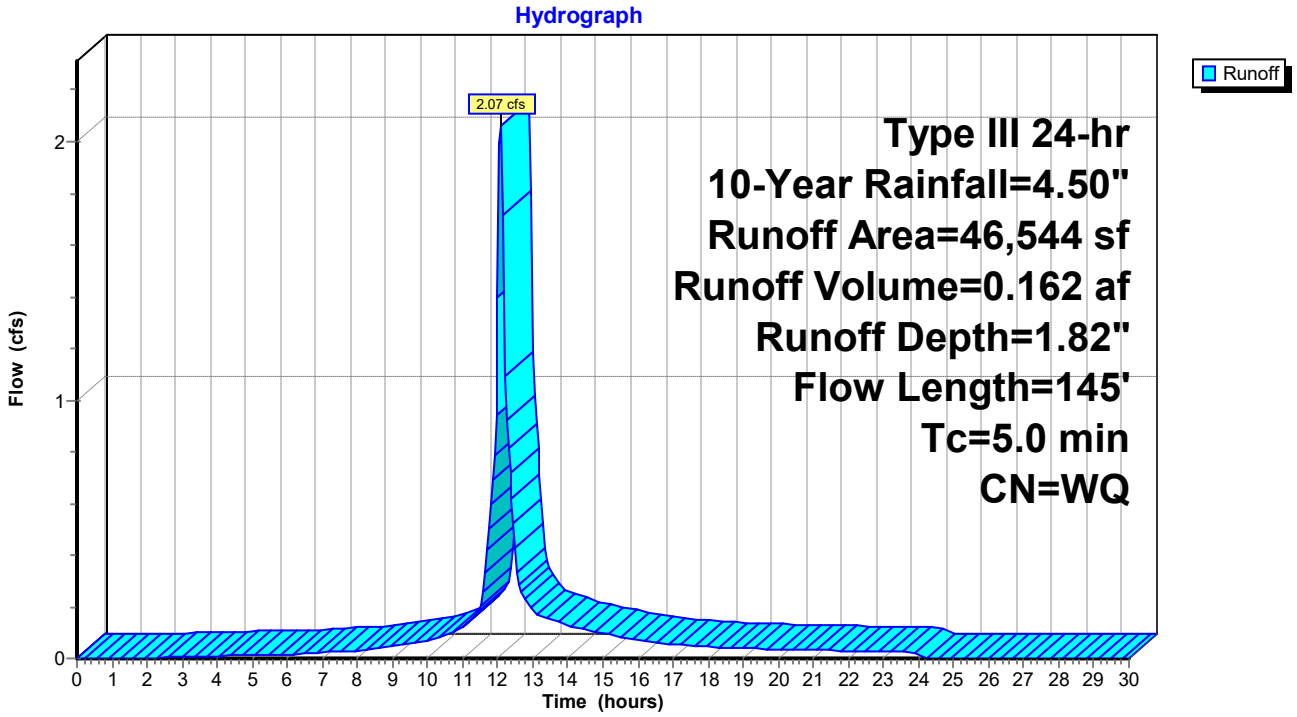
Runoff = 2.07 cfs @ 12.07 hrs, Volume= 0.162 af, Depth= 1.82"
Routed to Pond IB1 : INFILTRATION BASIN

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

Area (sf)	CN	Description
20,908	39	>75% Grass cover, Good, HSG A
8,891	96	Gravel surface, HSG A
11,733	76	Gravel roads, HSG A
5,012	98	Paved parking, HSG A
46,544		Weighted Average
41,532		89.23% Pervious Area
5,012		10.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.18		**Sheet Flow, gravel** Smooth surfaces n= 0.011 P2= 3.10"
0.5	67	0.0200	2.28		**Shallow Concentrated Flow, gravel** Unpaved Kv= 16.1 fps
0.1	28	0.3300	9.25		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.3	145	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P104: TO INFIL BASIN



Summary for Subcatchment P105: TO SWALE

[49] Hint: Tc<2dt may require smaller dt

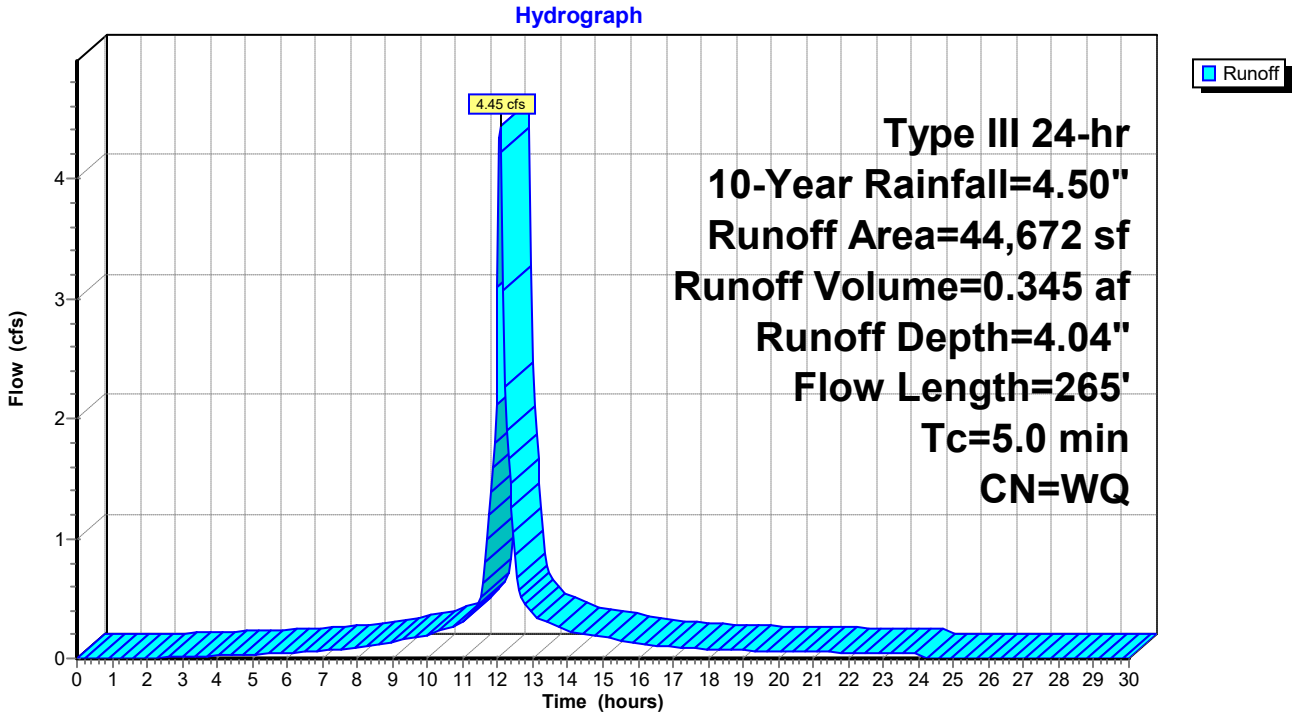
Runoff = 4.45 cfs @ 12.07 hrs, Volume= 0.345 af, Depth= 4.04"
Routed to Reach SW1 : TO INFIL BASIN#1

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

Area (sf)	CN	Description
387	98	Paved parking, HSG A
7,218	96	Gravel surface, HSG A
37,067	96	Gravel surface, HSG A
44,672		Weighted Average
44,285		99.13% Pervious Area
387		0.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	22	0.5000	3.62		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.7	23	0.0050	0.58		**Sheet Flow, gravel** Smooth surfaces n= 0.011 P2= 3.10"
3.2	220	0.0050	1.14		**Shallow Concentrated Flow, GRAVEL** Unpaved Kv= 16.1 fps
4.0	265	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P105: TO SWALE



Summary for Subcatchment P106: TO DCB#4

[49] Hint: Tc<2dt may require smaller dt

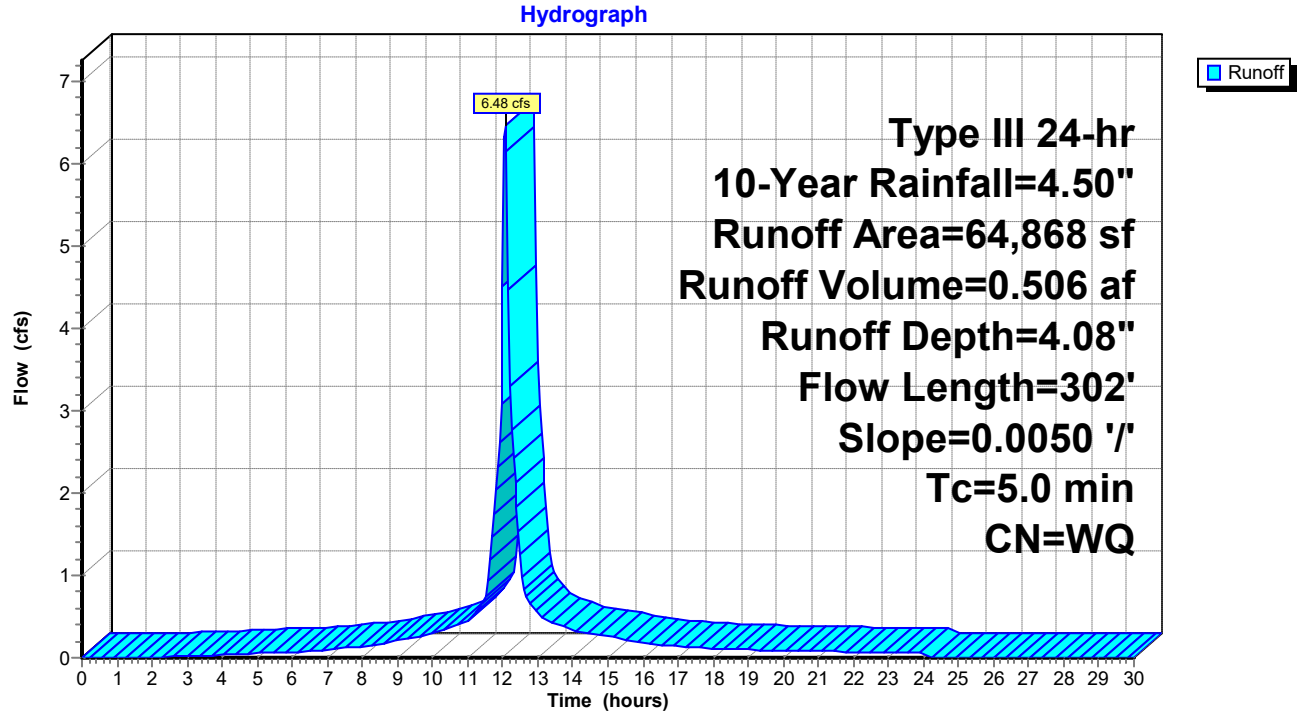
Runoff = 6.48 cfs @ 12.07 hrs, Volume= 0.506 af, Depth= 4.08"
Routed to Reach DCB4 : TO INFIL BASIN#1

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

Area (sf)	CN	Description
11,628	98	Paved parking, HSG A
6,496	96	Gravel surface, HSG A
46,744	96	Gravel surface, HSG A
64,868		Weighted Average
53,240		82.07% Pervious Area
11,628		17.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	50	0.0050	0.68		**Sheet Flow, GRAVEL** Smooth surfaces n= 0.011 P2= 3.10"
3.7	252	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
4.9	302	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P106: TO DCB#4



Summary for Reach DCB1: TO DMH#1

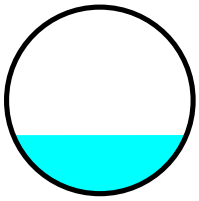
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.238 ac, 70.45% Impervious, Inflow Depth = 3.18" for 10-Year event
Inflow = 0.78 cfs @ 12.07 hrs, Volume= 0.063 af
Outflow = 0.76 cfs @ 12.09 hrs, Volume= 0.063 af, Atten= 2%, Lag= 1.0 min
Routed to Reach DMH1 : TO DMH#2

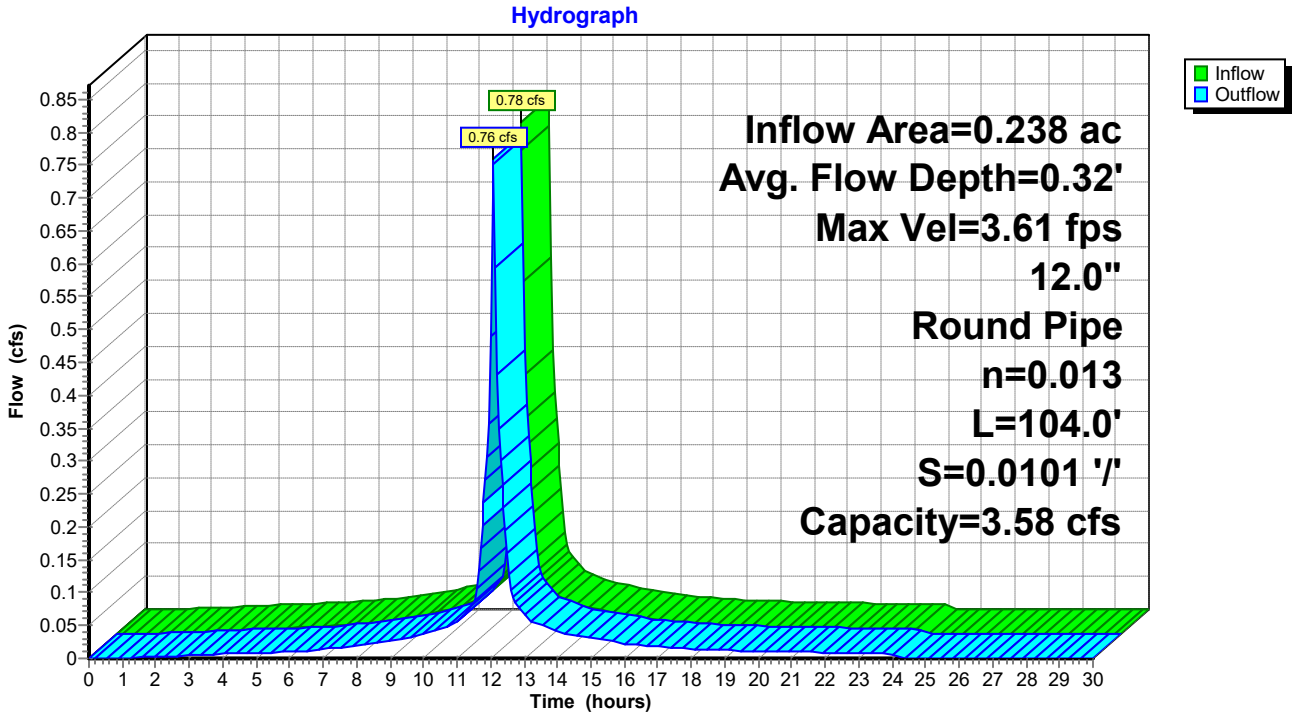
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.61 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.20 fps, Avg. Travel Time= 1.4 min

Peak Storage= 22 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.32' , Surface Width= 0.93'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.58 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 104.0' Slope= 0.0101 '/'
Inlet Invert= 206.65', Outlet Invert= 205.60'



Reach DCB1: TO DMH#1



Summary for Reach DCB2: TO DMH#1

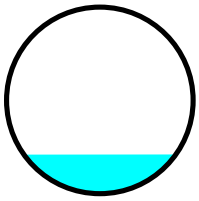
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.223 ac, 77.81% Impervious, Inflow Depth = 3.80" for 10-Year event
Inflow = 0.89 cfs @ 12.07 hrs, Volume= 0.071 af
Outflow = 0.89 cfs @ 12.07 hrs, Volume= 0.071 af, Atten= 0%, Lag= 0.1 min
Routed to Reach DMH1 : TO DMH#2

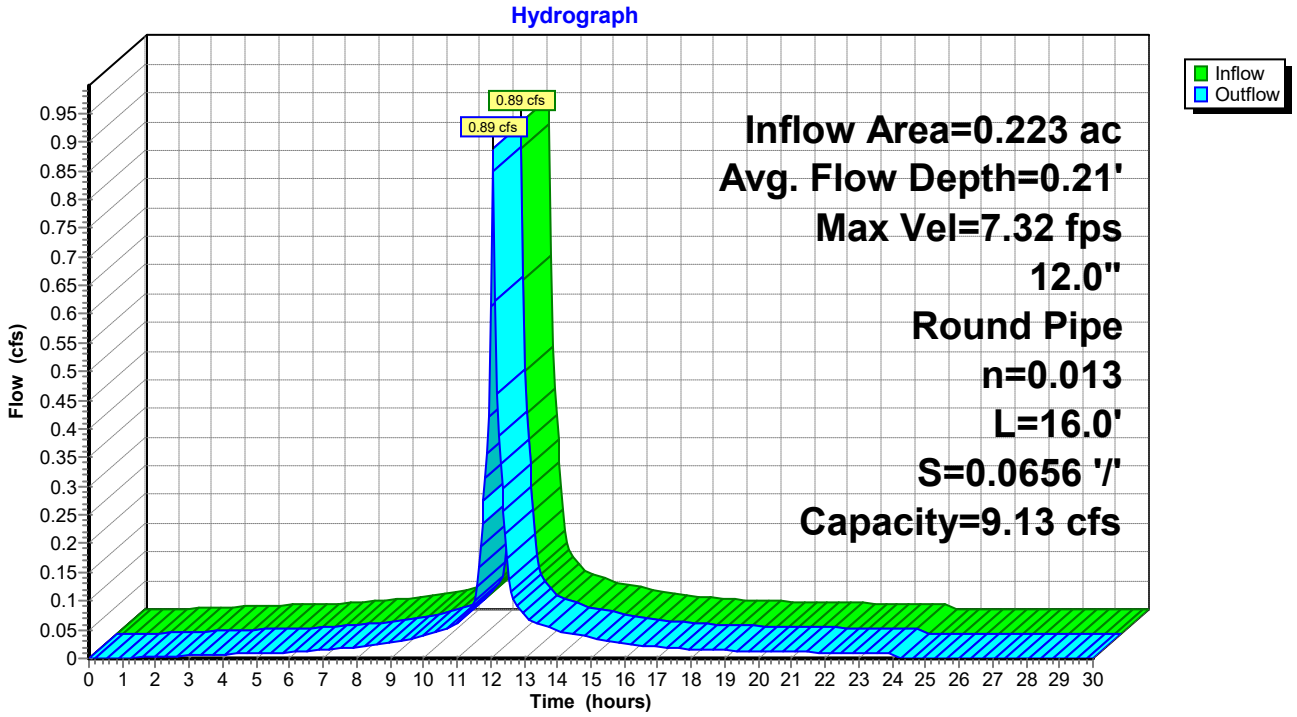
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.32 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.40 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.21' , Surface Width= 0.82'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.13 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 16.0' Slope= 0.0656 '/'
Inlet Invert= 206.65', Outlet Invert= 205.60'



Reach DCB2: TO DMH#1



Summary for Reach DCB3: TO DMH#2

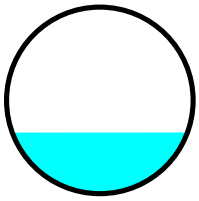
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.387 ac, 81.69% Impervious, Inflow Depth = 3.50" for 10-Year event
Inflow = 1.40 cfs @ 12.07 hrs, Volume= 0.113 af
Outflow = 1.38 cfs @ 12.08 hrs, Volume= 0.113 af, Atten= 2%, Lag= 0.4 min
Routed to Reach DMH2 : TO INFIL BASIN#1

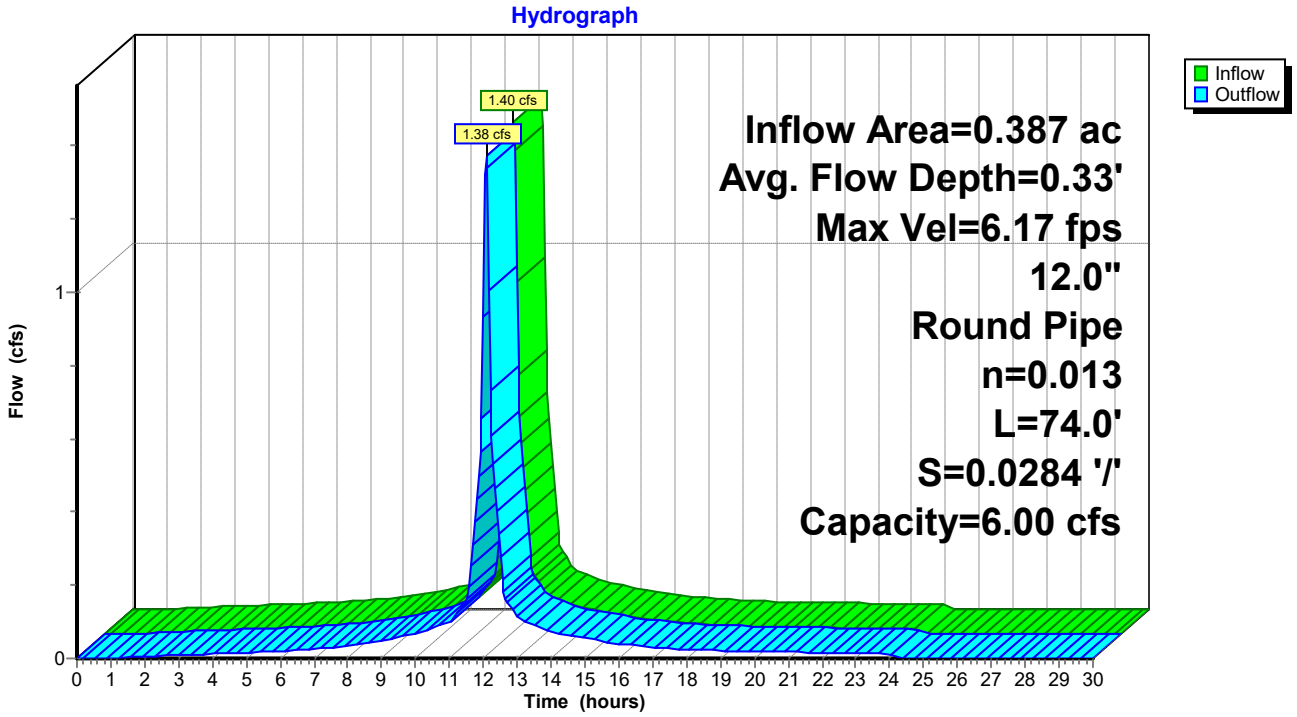
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.17 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.06 fps, Avg. Travel Time= 0.6 min

Peak Storage= 17 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.33' , Surface Width= 0.94'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.00 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 74.0' Slope= 0.0284 '/'
Inlet Invert= 206.50', Outlet Invert= 204.40'



Reach DCB3: TO DMH#2



Summary for Reach DCB4: TO INFIL BASIN#1

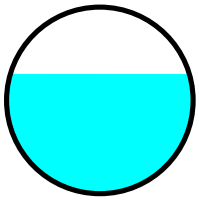
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 1.489 ac, 17.93% Impervious, Inflow Depth = 4.08" for 10-Year event
Inflow = 6.48 cfs @ 12.07 hrs, Volume= 0.506 af
Outflow = 6.33 cfs @ 12.09 hrs, Volume= 0.506 af, Atten= 2%, Lag= 1.0 min
Routed to Pond IB1 : INFILTRATION BASIN

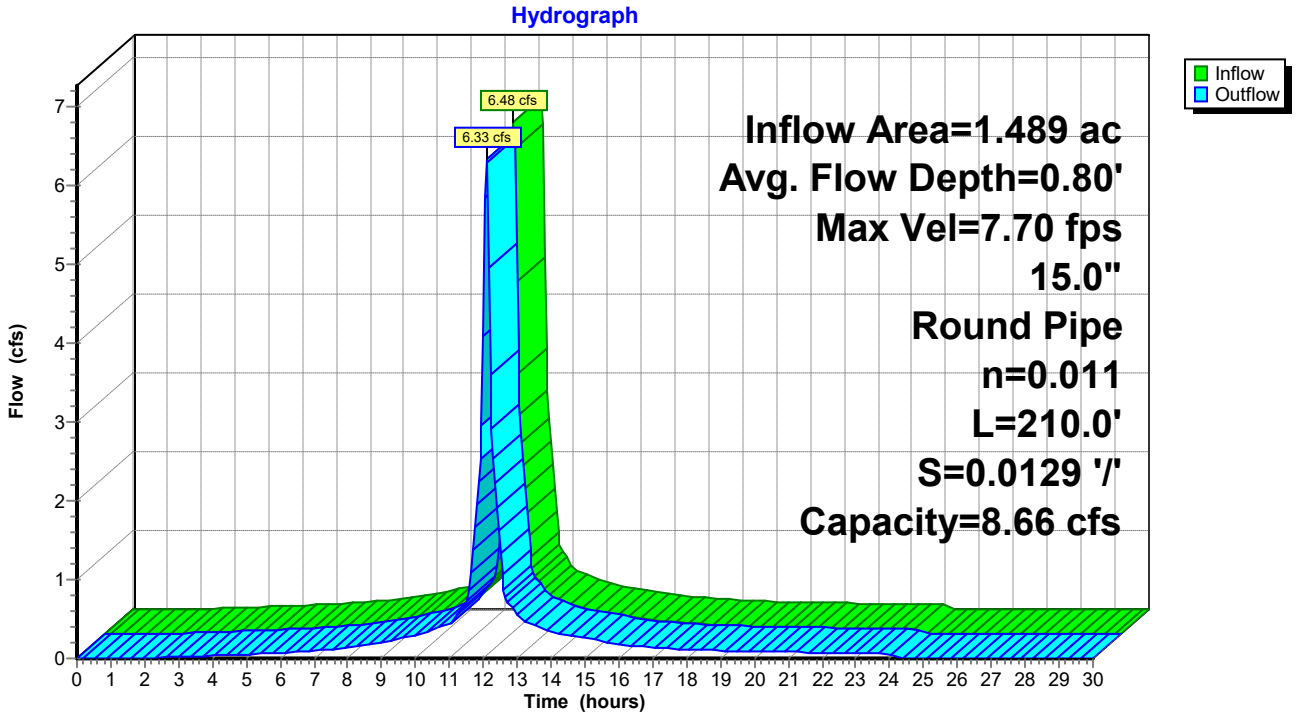
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.70 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.58 fps, Avg. Travel Time= 1.4 min

Peak Storage= 175 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.80' , Surface Width= 1.20'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 8.66 cfs

15.0" Round Pipe
n= 0.011 Concrete pipe, straight & clean
Length= 210.0' Slope= 0.0129 '/'
Inlet Invert= 205.20', Outlet Invert= 202.50'



Reach DCB4: TO INFIL BASIN#1



Summary for Reach DMH1: TO DMH#2

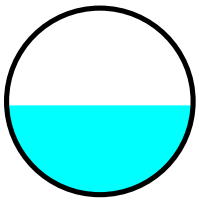
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach DCB1 OUTLET depth by 0.06' @ 12.10 hrs
[62] Hint: Exceeded Reach DCB2 OUTLET depth by 0.17' @ 12.10 hrs

Inflow Area = 0.461 ac, 74.02% Impervious, Inflow Depth = 3.48" for 10-Year event
Inflow = 1.64 cfs @ 12.08 hrs, Volume= 0.134 af
Outflow = 1.62 cfs @ 12.09 hrs, Volume= 0.134 af, Atten= 1%, Lag= 0.7 min
Routed to Reach DMH2 : TO INFIL BASIN#1

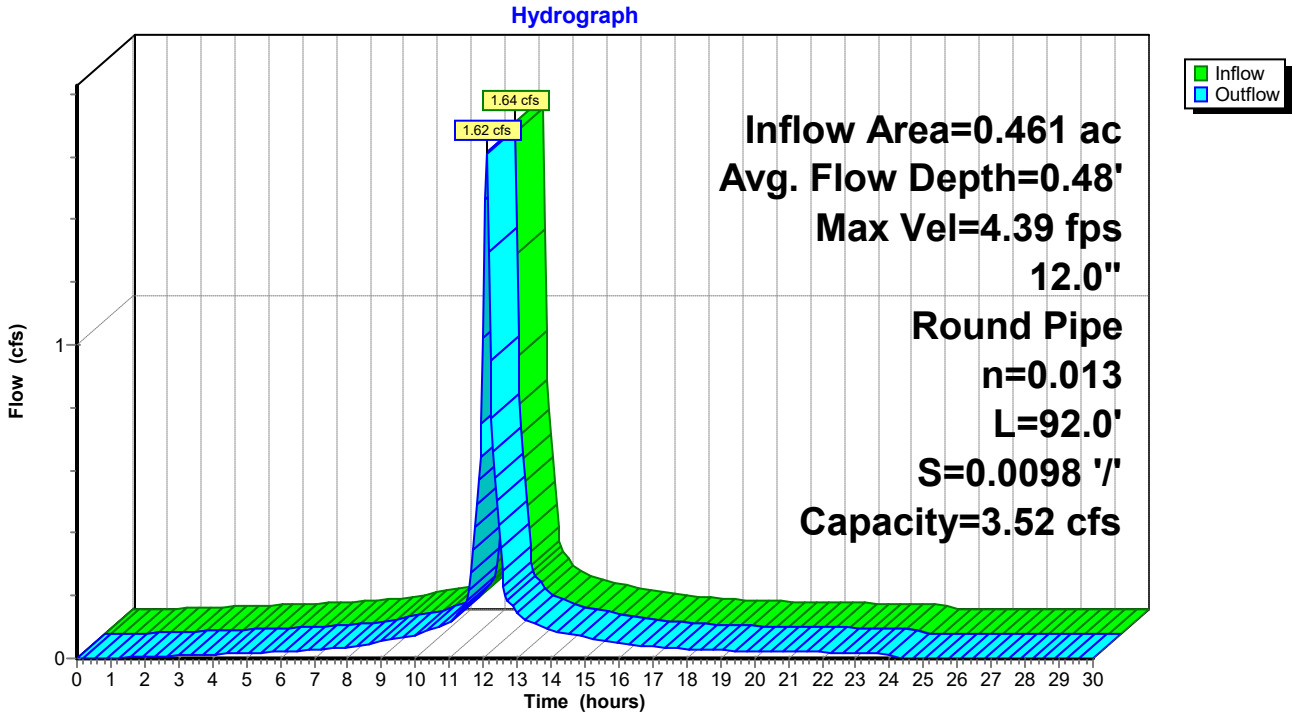
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.39 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.48 fps, Avg. Travel Time= 1.0 min

Peak Storage= 34 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.48' , Surface Width= 1.00'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.52 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 92.0' Slope= 0.0098 '/'
Inlet Invert= 205.50', Outlet Invert= 204.60'



Reach DMH1: TO DMH#2



Summary for Reach DMH2: TO INFIL BASIN#1

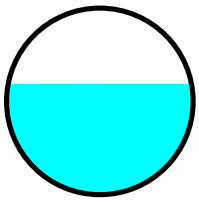
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach DCB3 OUTLET depth by 0.47' @ 12.10 hrs
[62] Hint: Exceeded Reach DMH1 OUTLET depth by 0.12' @ 12.10 hrs

Inflow Area = 0.848 ac, 77.52% Impervious, Inflow Depth = 3.49" for 10-Year event
Inflow = 2.99 cfs @ 12.09 hrs, Volume= 0.247 af
Outflow = 2.95 cfs @ 12.10 hrs, Volume= 0.247 af, Atten= 1%, Lag= 0.6 min
Routed to Pond IB1 : INFILTRATION BASIN

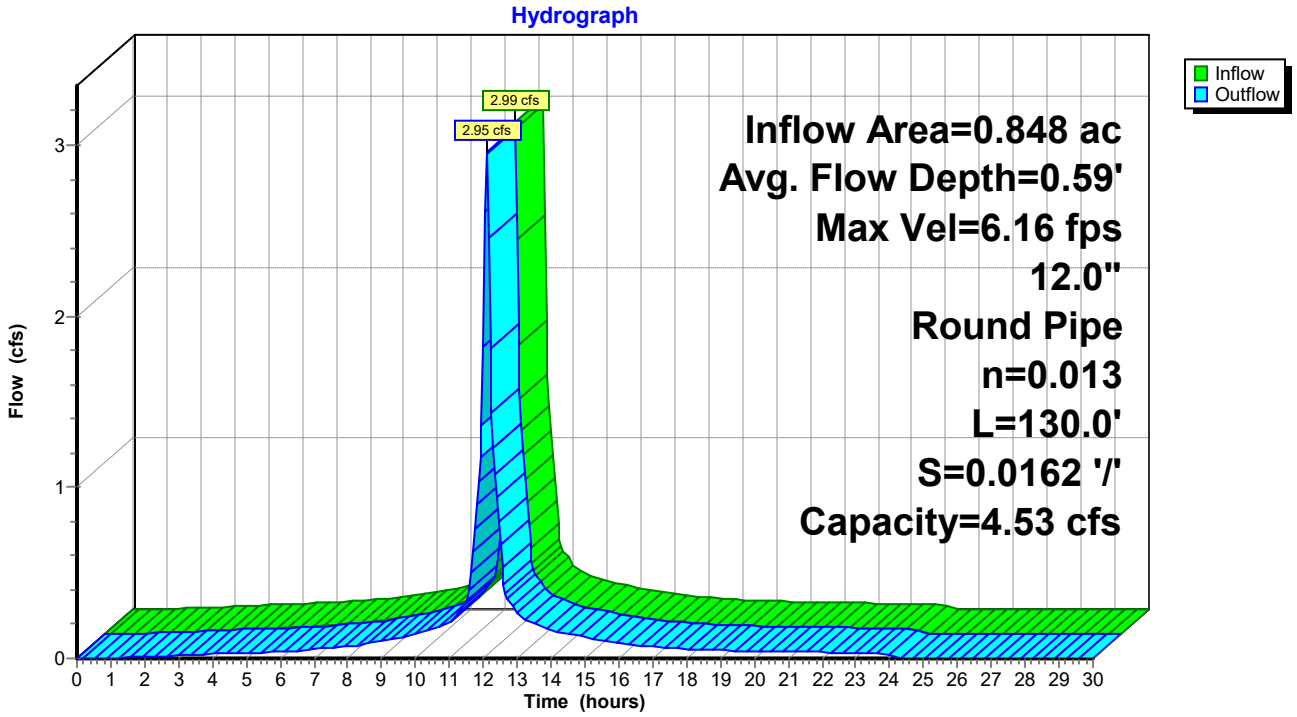
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.16 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.11 fps, Avg. Travel Time= 1.0 min

Peak Storage= 63 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.59' , Surface Width= 0.98'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 4.53 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 130.0' Slope= 0.0162 '/'
Inlet Invert= 204.60', Outlet Invert= 202.50'



Reach DMH2: TO INFIL BASIN#1



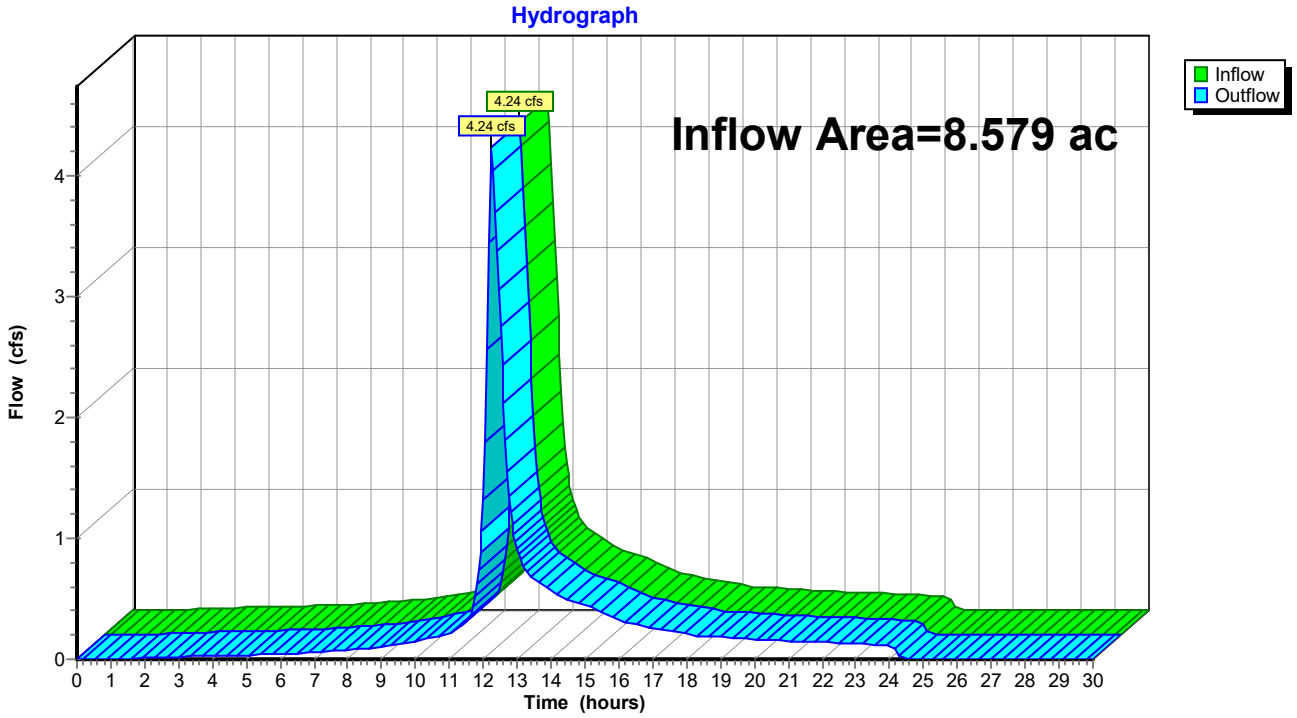
Summary for Reach DP1: RIVER (SOUTHWEST

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 8.579 ac, 8.68% Impervious, Inflow Depth = 0.75" for 10-Year event
Inflow = 4.24 cfs @ 12.25 hrs, Volume= 0.538 af
Outflow = 4.24 cfs @ 12.25 hrs, Volume= 0.538 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 DP1: RIVER (SOUTHWEST



Summary for Reach SW1: TO INFIL BASIN#1

Inflow Area = 1.026 ac, 0.87% Impervious, Inflow Depth = 4.04" for 10-Year event
Inflow = 4.45 cfs @ 12.07 hrs, Volume= 0.345 af
Outflow = 4.12 cfs @ 12.14 hrs, Volume= 0.345 af, Atten= 7%, Lag= 3.9 min
Routed to Pond IB1 : INFILTRATION BASIN

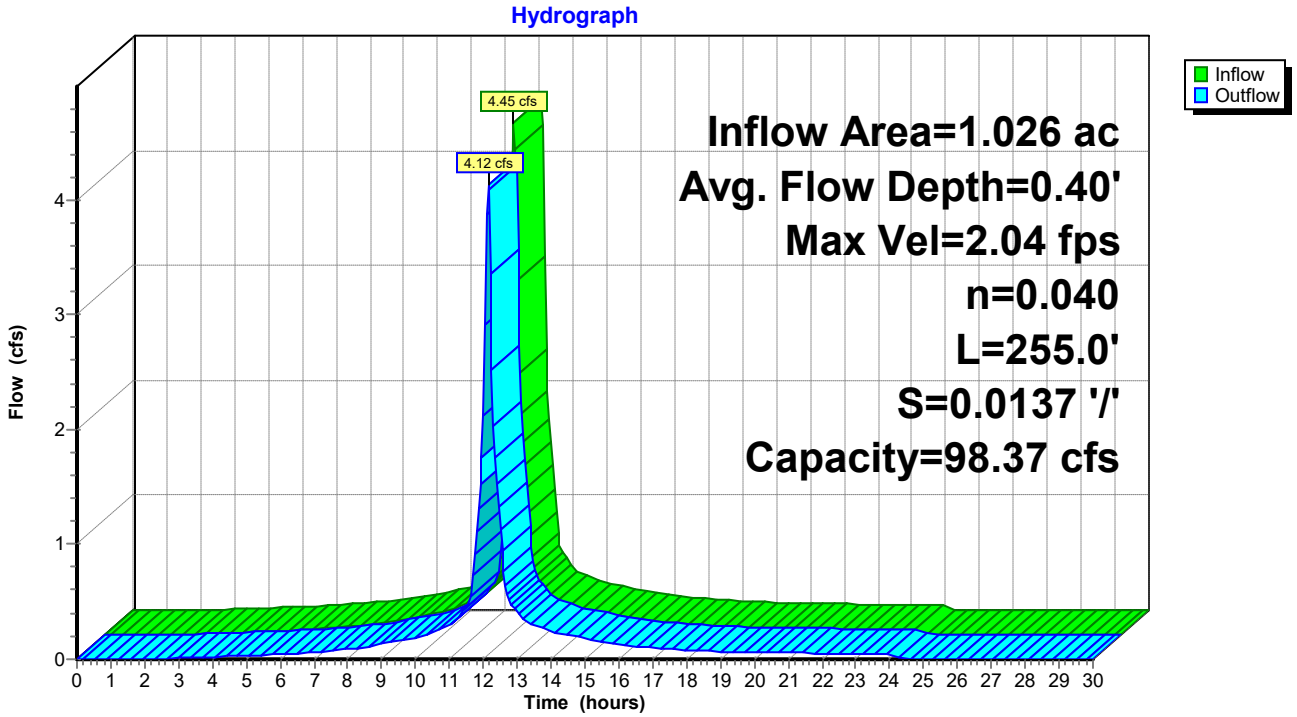
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.04 fps, Min. Travel Time= 2.1 min
Avg. Velocity = 0.55 fps, Avg. Travel Time= 7.8 min

Peak Storage= 536 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.40' , Surface Width= 6.42'
Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 98.37 cfs

4.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 255.0' Slope= 0.0137 '/'
Inlet Invert= 208.00', Outlet Invert= 204.50'

‡

Reach SW1: TO INFIL BASIN#1



Summary for Pond IB1: INFILTRATION BASIN

[63] Warning: Exceeded Reach DCB4 INLET depth by 0.10' @ 12.65 hrs
[63] Warning: Exceeded Reach DMH2 INLET depth by 0.76' @ 12.65 hrs
[62] Hint: Exceeded Reach SW1 OUTLET depth by 0.93' @ 12.65 hrs

Inflow Area = 4.431 ac, 23.66% Impervious, Inflow Depth = 3.41" for 10-Year event
Inflow = 15.08 cfs @ 12.10 hrs, Volume= 1.259 af
Outflow = 2.44 cfs @ 12.60 hrs, Volume= 1.259 af, Atten= 84%, Lag= 29.9 min
Discarded = 2.44 cfs @ 12.60 hrs, Volume= 1.259 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach DP1 : RIVER (SOUTHWEST

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 205.56' @ 12.60 hrs Surf.Area= 9,043 sf Storage= 19,146 cf

Plug-Flow detention time= 71.1 min calculated for 1.257 af (100% of inflow)
Center-of-Mass det. time= 71.0 min (837.9 - 766.9)

Volume	Invert	Avail.Storage	Storage Description
#1	202.50'	64,106 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

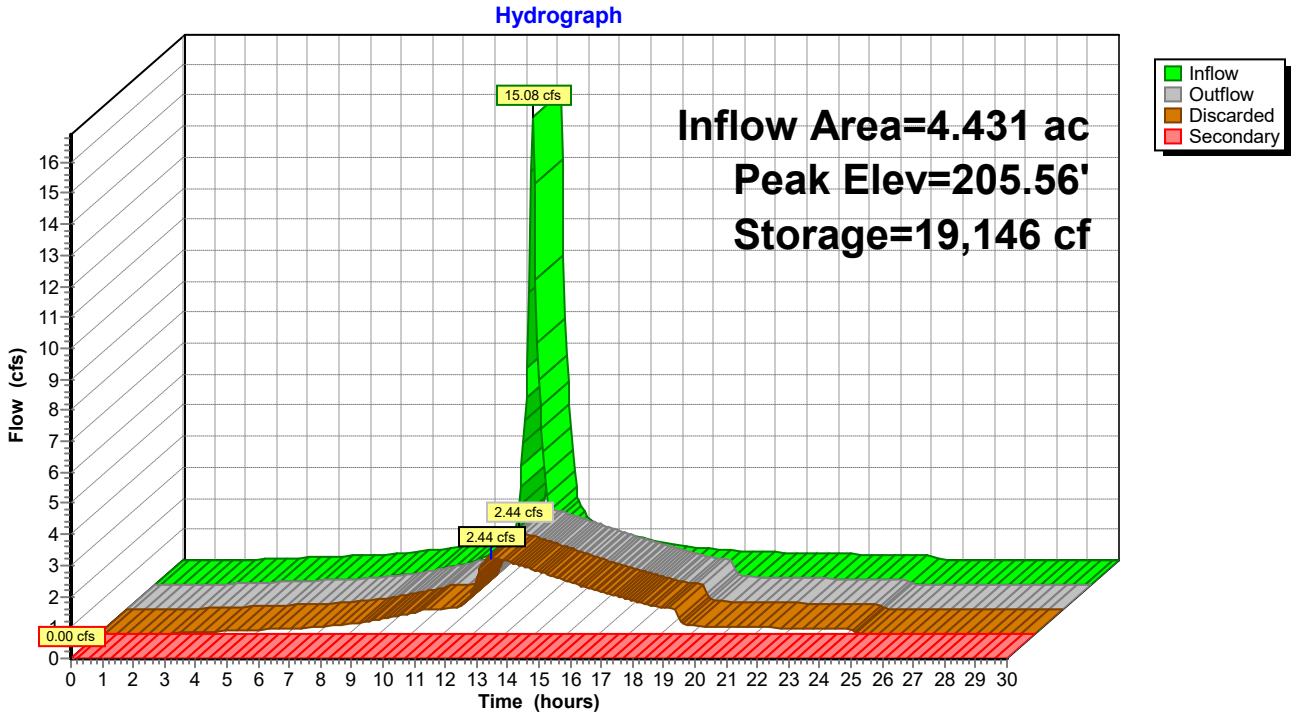
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
202.50	3,998	0	0
203.00	4,458	2,114	2,114
204.00	6,067	5,263	7,377
206.00	9,887	15,954	23,331
208.00	15,259	25,146	48,477
209.00	16,000	15,630	64,106

Device	Routing	Invert	Outlet Devices
#1	Discarded	202.50'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 197.70'
#2	Secondary	208.00'	**10.0' long + 3.0 '/' SideZ x 10.0' breadth Broad-Crested Rectangular Weir**
			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

Discarded OutFlow Max=2.44 cfs @ 12.60 hrs HW=205.56' (Free Discharge)
1=Exfiltration (Controls 2.44 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=202.50' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond IB1: INFILTRATION BASIN



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

Subcatchment P100: OVERLAND TO RIVER Runoff Area=373,692 sf 8.68% Impervious Runoff Depth=1.04"
Flow Length=1,386' Tc=16.2 min CN=WQ Runoff=6.13 cfs 0.747 af

Subcatchment P101: TO DCB#1 Runoff Area=10,350 sf 70.45% Impervious Runoff Depth=3.81"
Flow Length=125' Tc=5.0 min CN=WQ Runoff=0.92 cfs 0.075 af

Subcatchment P102: TO DCB#2 Runoff Area=9,735 sf 77.81% Impervious Runoff Depth=4.56"
Flow Length=120' Tc=5.0 min CN=WQ Runoff=1.06 cfs 0.085 af

Subcatchment P103: TO DCB#3 Runoff Area=16,853 sf 81.69% Impervious Runoff Depth=4.18"
Flow Length=156' Tc=5.0 min CN=WQ Runoff=1.65 cfs 0.135 af

Subcatchment P104: TO INFIL BASIN Runoff Area=46,544 sf 10.77% Impervious Runoff Depth=2.29"
Flow Length=145' Tc=5.0 min CN=WQ Runoff=2.53 cfs 0.204 af

Subcatchment P105: TO SWALE Runoff Area=44,672 sf 0.87% Impervious Runoff Depth=4.83"
Flow Length=265' Tc=5.0 min CN=WQ Runoff=5.28 cfs 0.413 af

Subcatchment P106: TO DCB#4 Runoff Area=64,868 sf 17.93% Impervious Runoff Depth=4.87"
Flow Length=302' Slope=0.0050 '/' Tc=5.0 min CN=WQ Runoff=7.68 cfs 0.605 af

Reach DCB1: TO DMH#1 Avg. Flow Depth=0.34' Max Vel=3.78 fps Inflow=0.92 cfs 0.075 af
12.0" Round Pipe n=0.013 L=104.0' S=0.0101 '/' Capacity=3.58 cfs Outflow=0.90 cfs 0.075 af

Reach DCB2: TO DMH#1 Avg. Flow Depth=0.23' Max Vel=7.71 fps Inflow=1.06 cfs 0.085 af
12.0" Round Pipe n=0.013 L=16.0' S=0.0656 '/' Capacity=9.13 cfs Outflow=1.06 cfs 0.085 af

Reach DCB3: TO DMH#2 Avg. Flow Depth=0.36' Max Vel=6.46 fps Inflow=1.65 cfs 0.135 af
12.0" Round Pipe n=0.013 L=74.0' S=0.0284 '/' Capacity=6.00 cfs Outflow=1.62 cfs 0.135 af

Reach DCB4: TO INFIL BASIN#1 Avg. Flow Depth=0.91' Max Vel=7.94 fps Inflow=7.68 cfs 0.605 af
15.0" Round Pipe n=0.011 L=210.0' S=0.0129 '/' Capacity=8.66 cfs Outflow=7.50 cfs 0.605 af

Reach DMH1: TO DMH#2 Avg. Flow Depth=0.53' Max Vel=4.59 fps Inflow=1.94 cfs 0.160 af
12.0" Round Pipe n=0.013 L=92.0' S=0.0098 '/' Capacity=3.52 cfs Outflow=1.92 cfs 0.160 af

Reach DMH2: TO INFIL BASIN#1 Avg. Flow Depth=0.67' Max Vel=6.38 fps Inflow=3.54 cfs 0.295 af
12.0" Round Pipe n=0.013 L=130.0' S=0.0162 '/' Capacity=4.53 cfs Outflow=3.50 cfs 0.295 af

Reach DP1: RIVER (SOUTHWEST Inflow=6.13 cfs 0.747 af
Outflow=6.13 cfs 0.747 af

Reach SW1: TO INFIL BASIN#1 Avg. Flow Depth=0.44' Max Vel=2.15 fps Inflow=5.28 cfs 0.413 af
n=0.040 L=255.0' S=0.0137 '/' Capacity=98.37 cfs Outflow=4.88 cfs 0.413 af

Pond IB1: INFILTRATION BASIN Peak Elev=206.05' Storage=23,874 cf Inflow=18.01 cfs 1.517 af
Discarded=2.79 cfs 1.517 af Secondary=0.00 cfs 0.000 af Outflow=2.79 cfs 1.517 af

Total Runoff Area = 13.010 ac Runoff Volume = 2.263 af Average Runoff Depth = 2.09"
86.22% Pervious = 11.217 ac 13.78% Impervious = 1.793 ac

Summary for Subcatchment P100: OVERLAND TO RIVER

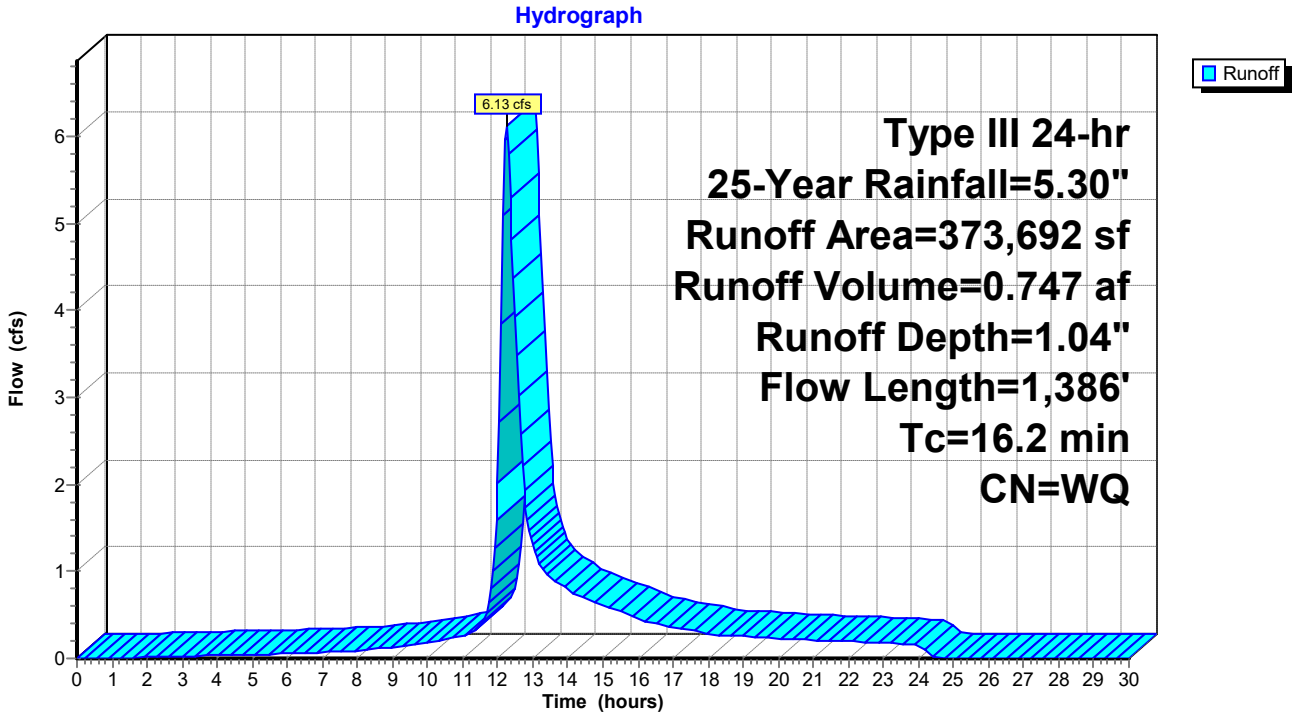
Runoff = 6.13 cfs @ 12.24 hrs, Volume= 0.747 af, Depth= 1.04"
Routed to Reach DP1 : RIVER (SOUTHWEST

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

Area (sf)	CN	Description
69,627	39	>75% Grass cover, Good, HSG A
92,181	30	Woods, Good, HSG A
20,233	98	Paved parking, HSG A
6,716	61	>75% Grass cover, Good, HSG B
172,740	55	Woods, Good, HSG B
2,673	98	Paved parking, HSG B
9,522	98	Water Surface, HSG B
373,692		Weighted Average
341,264		91.32% Pervious Area
32,428		8.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	16	0.0200	0.94		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
3.8	34	0.0250	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.7	102	0.0250	2.55		**Shallow Concentrated Flow, GRASS** Unpaved Kv= 16.1 fps
1.8	321	0.0350	3.01		**Shallow Concentrated Flow, GRASS** Unpaved Kv= 16.1 fps
9.6	913	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.2	1,386	Total			

Subcatchment P100: OVERLAND TO RIVER



Summary for Subcatchment P101: TO DCB#1

[49] Hint: Tc<2dt may require smaller dt

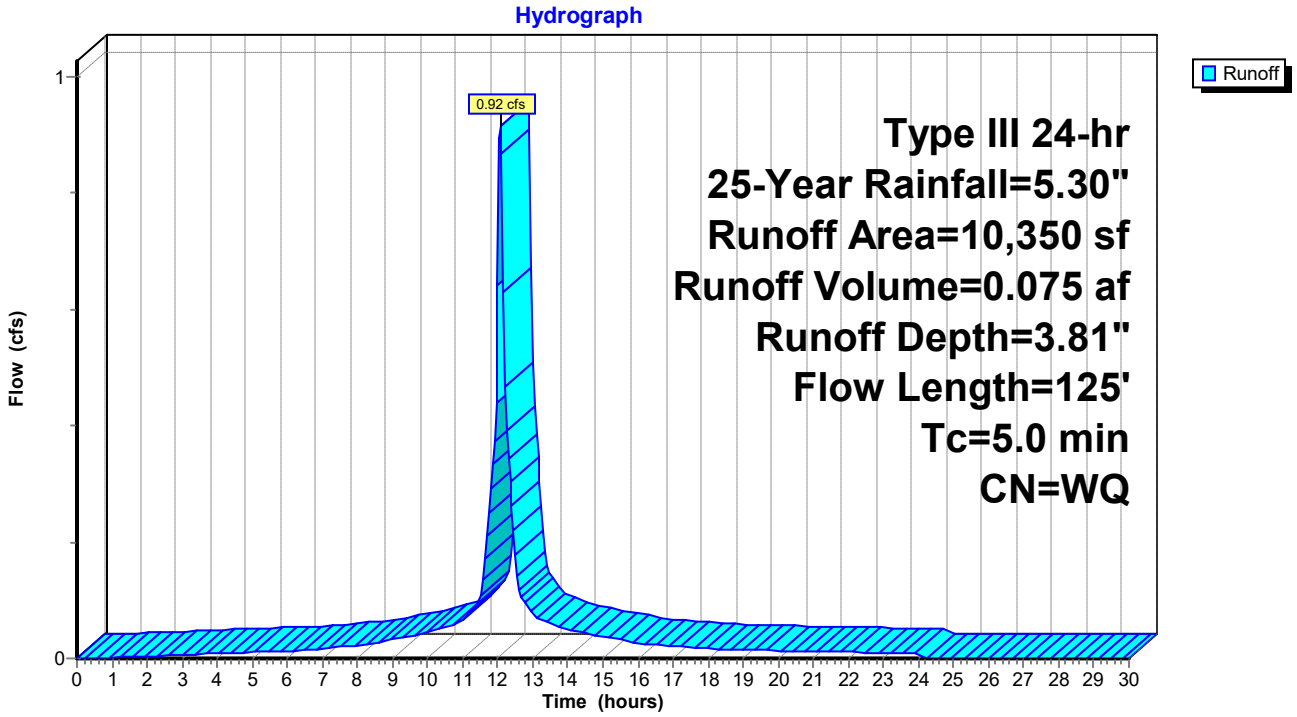
Runoff = 0.92 cfs @ 12.07 hrs, Volume= 0.075 af, Depth= 3.81"
Routed to Reach DCB1 : TO DMH#1

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

Area (sf)	CN	Description
2,688	39	>75% Grass cover, Good, HSG A
7,292	98	Paved parking, HSG A
370	96	Gravel surface, HSG A
10,350		Weighted Average
3,058		29.55% Pervious Area
7,292		70.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	25	0.0830	1.81		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.1	25	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.5	75	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.8	125	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P101: TO DCB#1



Summary for Subcatchment P102: TO DCB#2

[49] Hint: Tc<2dt may require smaller dt

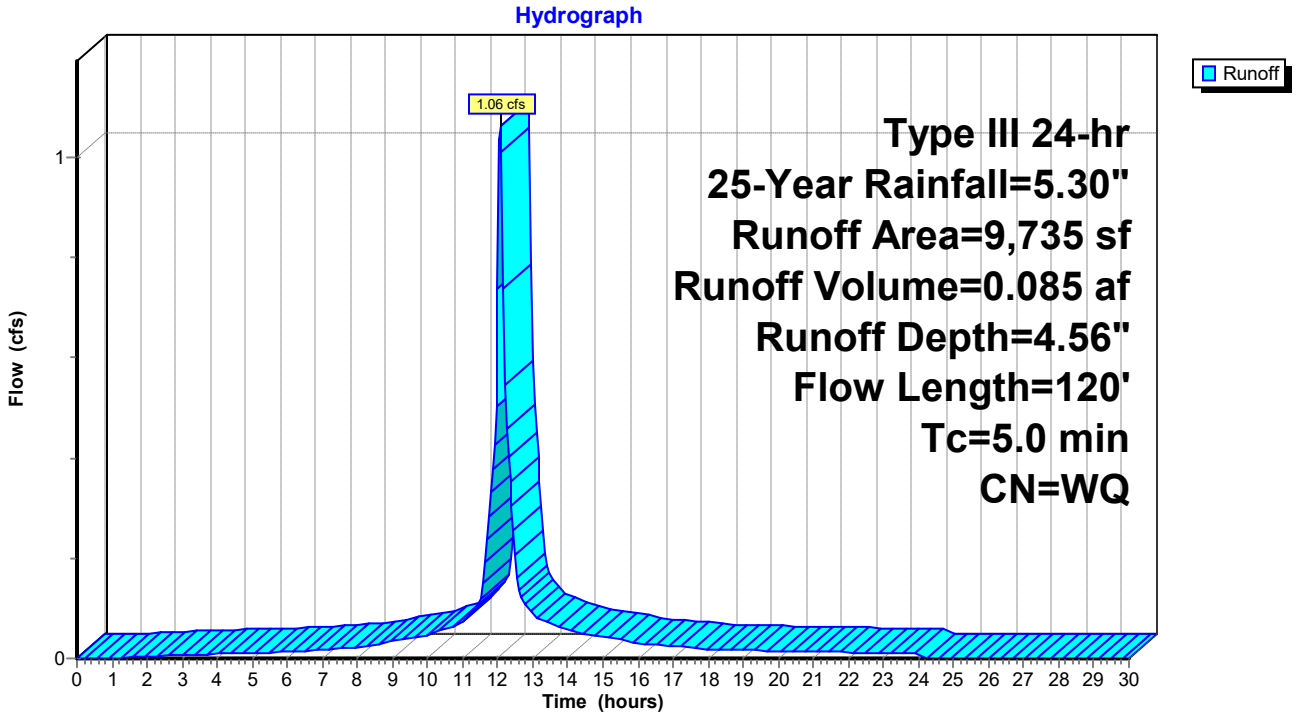
Runoff = 1.06 cfs @ 12.07 hrs, Volume= 0.085 af, Depth= 4.56"
Routed to Reach DCB2 : TO DMH#1

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

Area (sf)	CN	Description
272	39	>75% Grass cover, Good, HSG A
7,575	98	Paved parking, HSG A
327	96	Gravel surface, HSG A
1,561	76	Gravel roads, HSG A
9,735		Weighted Average
2,160		22.19% Pervious Area
7,575		77.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	21	0.0350	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.5	29	0.0200	1.06		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.4	70	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.2	120	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P102: TO DCB#2



Summary for Subcatchment P103: TO DCB#3

[49] Hint: Tc<2dt may require smaller dt

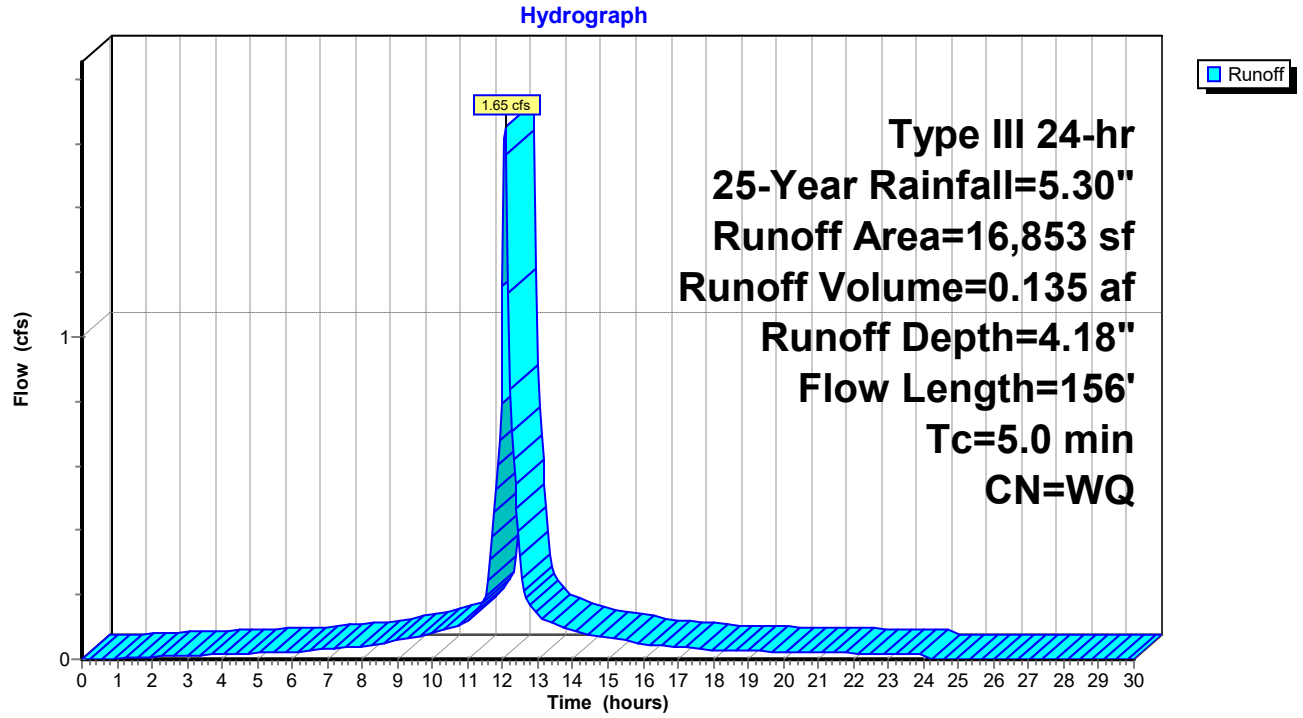
Runoff = 1.65 cfs @ 12.07 hrs, Volume= 0.135 af, Depth= 4.18"
Routed to Reach DCB3 : TO DMH#2

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

Area (sf)	CN	Description
3,086	39	>75% Grass cover, Good, HSG A
13,767	98	Paved parking, HSG A
16,853		Weighted Average
3,086		18.31% Pervious Area
13,767		81.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	21	0.0350	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.5	29	0.0200	1.06		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.6	106	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.4	156	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P103: TO DCB#3



Summary for Subcatchment P104: TO INFIL BASIN

[49] Hint: Tc<2dt may require smaller dt

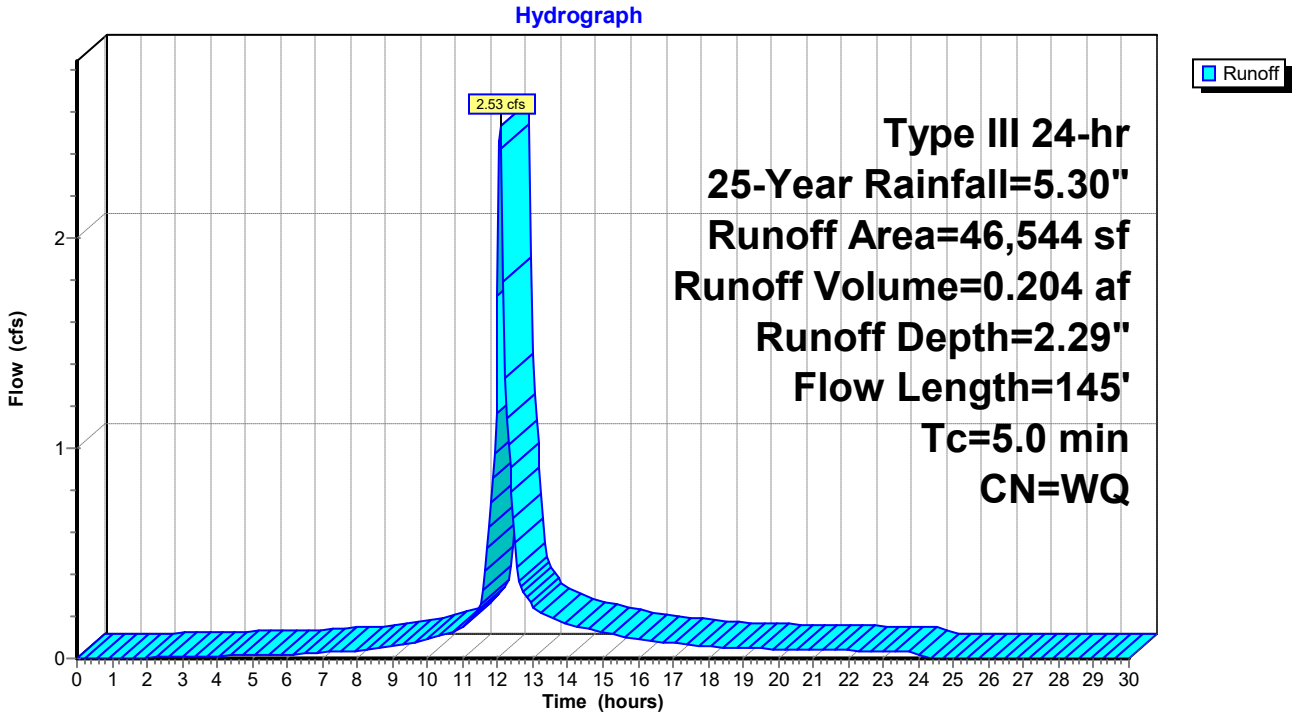
Runoff = 2.53 cfs @ 12.07 hrs, Volume= 0.204 af, Depth= 2.29"
Routed to Pond IB1 : INFILTRATION BASIN

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

Area (sf)	CN	Description
20,908	39	>75% Grass cover, Good, HSG A
8,891	96	Gravel surface, HSG A
11,733	76	Gravel roads, HSG A
5,012	98	Paved parking, HSG A
46,544		Weighted Average
41,532		89.23% Pervious Area
5,012		10.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.18		**Sheet Flow, gravel**
					Smooth surfaces n= 0.011 P2= 3.10"
0.5	67	0.0200	2.28		**Shallow Concentrated Flow, gravel**
					Unpaved Kv= 16.1 fps
0.1	28	0.3300	9.25		**Shallow Concentrated Flow,**
					Unpaved Kv= 16.1 fps
1.3	145	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P104: TO INFIL BASIN



Summary for Subcatchment P105: TO SWALE

[49] Hint: Tc<2dt may require smaller dt

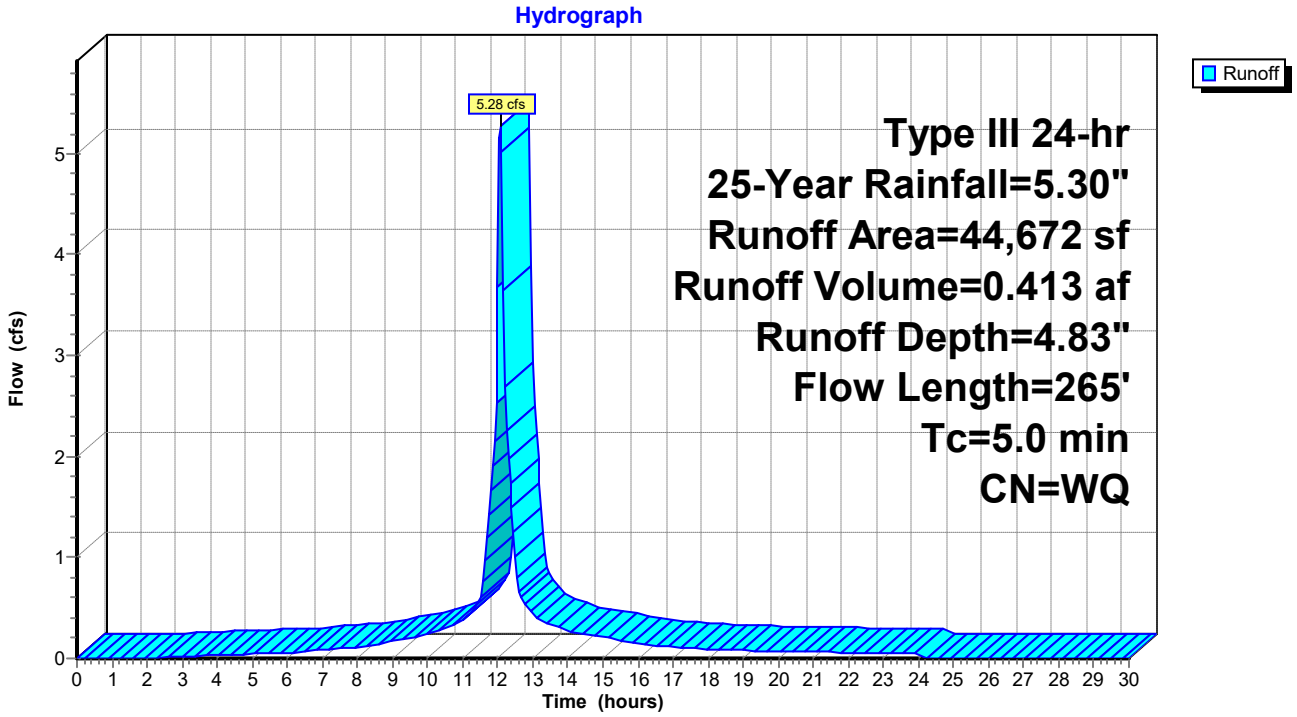
Runoff = 5.28 cfs @ 12.07 hrs, Volume= 0.413 af, Depth= 4.83"
Routed to Reach SW1 : TO INFIL BASIN#1

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

Area (sf)	CN	Description
387	98	Paved parking, HSG A
7,218	96	Gravel surface, HSG A
37,067	96	Gravel surface, HSG A
44,672		Weighted Average
44,285		99.13% Pervious Area
387		0.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	22	0.5000	3.62		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.7	23	0.0050	0.58		**Sheet Flow, gravel** Smooth surfaces n= 0.011 P2= 3.10"
3.2	220	0.0050	1.14		**Shallow Concentrated Flow, GRAVEL** Unpaved Kv= 16.1 fps
4.0	265	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P105: TO SWALE



Summary for Subcatchment P106: TO DCB#4

[49] Hint: Tc<2dt may require smaller dt

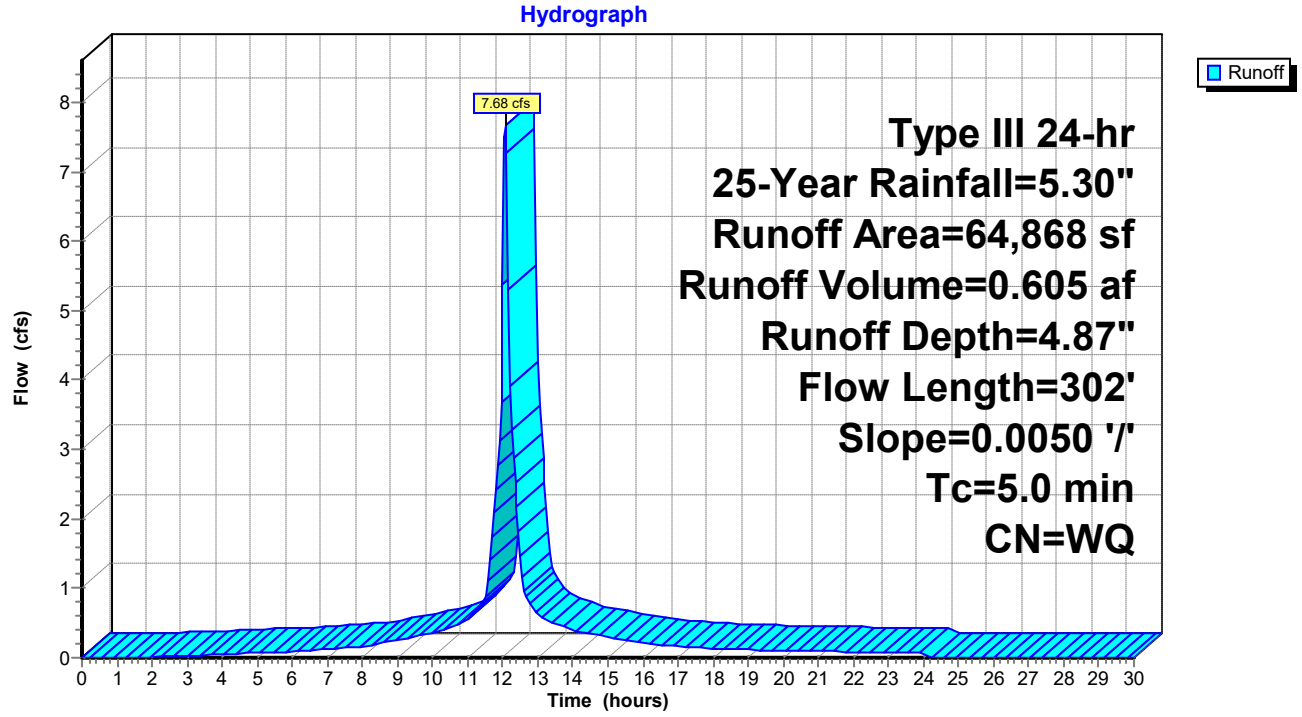
Runoff = 7.68 cfs @ 12.07 hrs, Volume= 0.605 af, Depth= 4.87"
Routed to Reach DCB4 : TO INFIL BASIN#1

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

Area (sf)	CN	Description
11,628	98	Paved parking, HSG A
6,496	96	Gravel surface, HSG A
46,744	96	Gravel surface, HSG A
64,868		Weighted Average
53,240		82.07% Pervious Area
11,628		17.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	50	0.0050	0.68		**Sheet Flow, GRAVEL** Smooth surfaces n= 0.011 P2= 3.10"
3.7	252	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
4.9	302	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P106: TO DCB#4



Summary for Reach DCB1: TO DMH#1

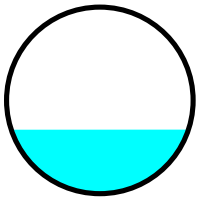
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.238 ac, 70.45% Impervious, Inflow Depth = 3.81" for 25-Year event
Inflow = 0.92 cfs @ 12.07 hrs, Volume= 0.075 af
Outflow = 0.90 cfs @ 12.09 hrs, Volume= 0.075 af, Atten= 2%, Lag= 1.0 min
Routed to Reach DMH1 : TO DMH#2

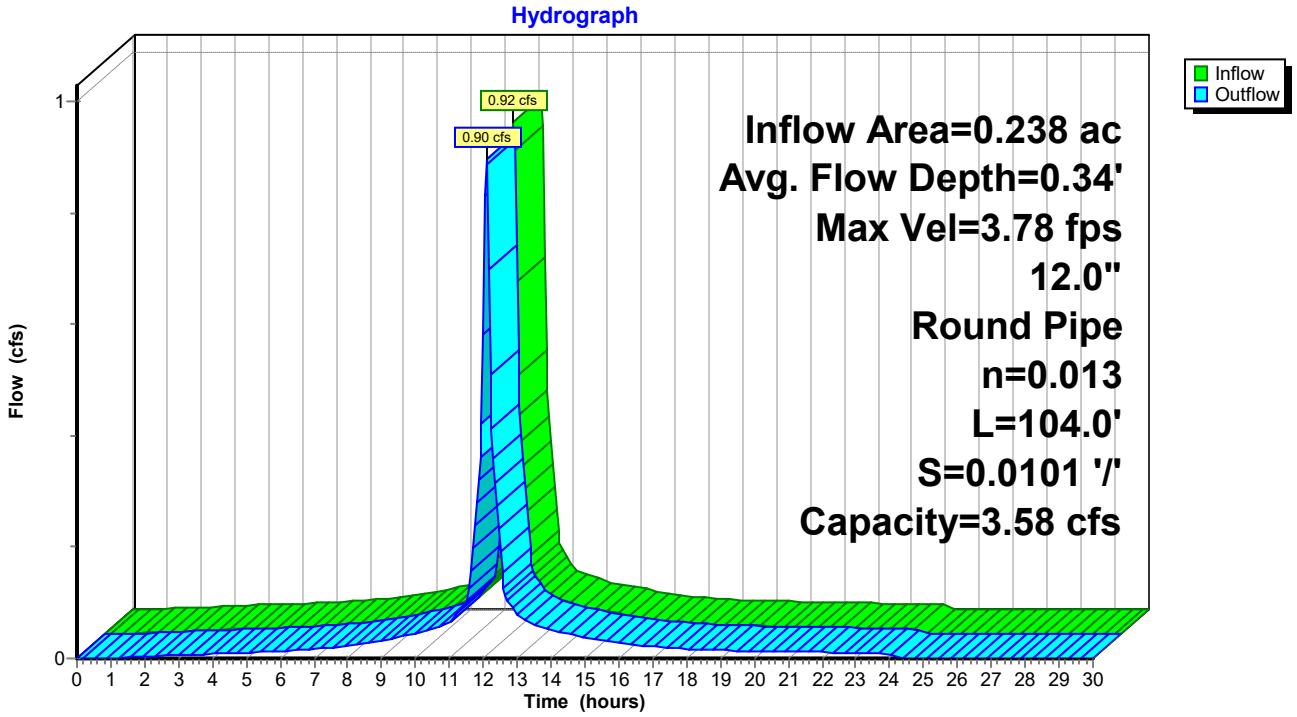
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.78 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.27 fps, Avg. Travel Time= 1.4 min

Peak Storage= 25 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.34' , Surface Width= 0.95'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.58 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 104.0' Slope= 0.0101 '/'
Inlet Invert= 206.65', Outlet Invert= 205.60'



Reach DCB1: TO DMH#1



Summary for Reach DCB2: TO DMH#1

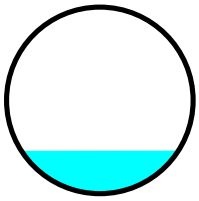
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.223 ac, 77.81% Impervious, Inflow Depth = 4.56" for 25-Year event
Inflow = 1.06 cfs @ 12.07 hrs, Volume= 0.085 af
Outflow = 1.06 cfs @ 12.07 hrs, Volume= 0.085 af, Atten= 0%, Lag= 0.1 min
Routed to Reach DMH1 : TO DMH#2

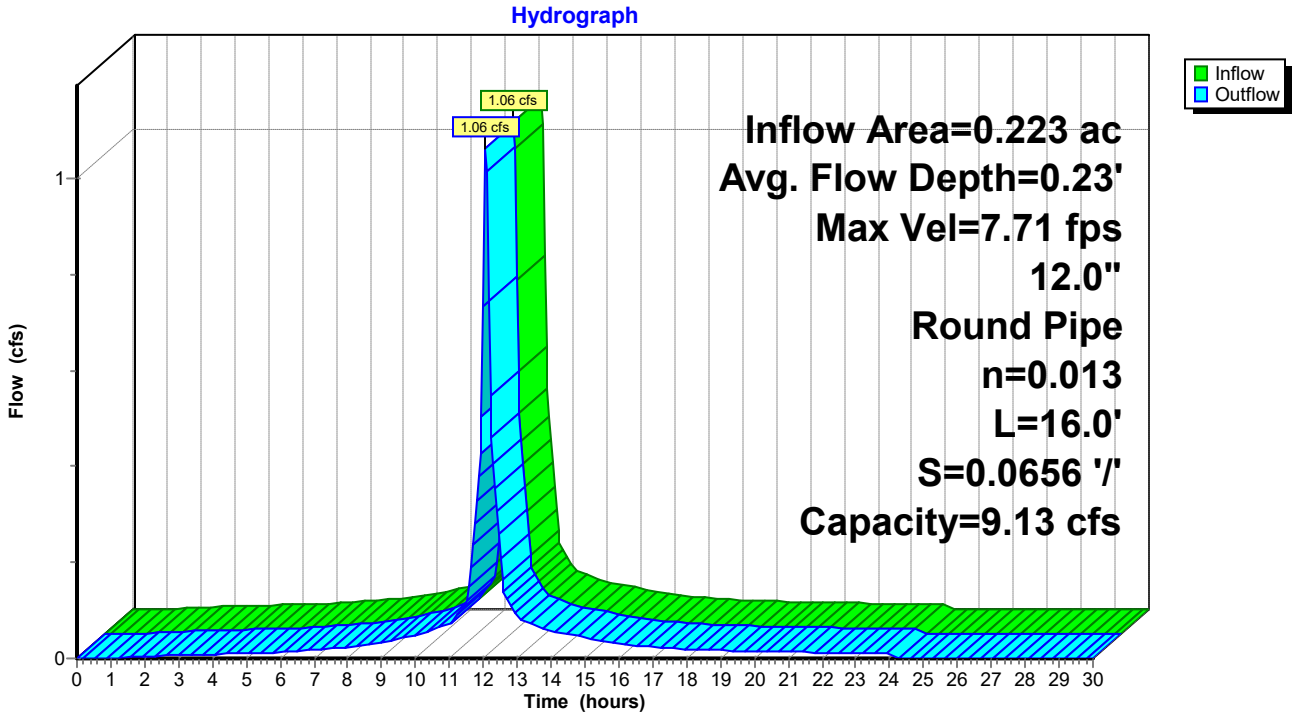
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.71 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.53 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.23' , Surface Width= 0.84'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.13 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 16.0' Slope= 0.0656 '/'
Inlet Invert= 206.65', Outlet Invert= 205.60'



Reach DCB2: TO DMH#1



Summary for Reach DCB3: TO DMH#2

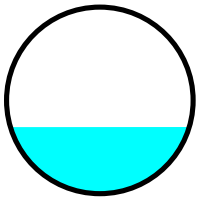
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.387 ac, 81.69% Impervious, Inflow Depth = 4.18" for 25-Year event
Inflow = 1.65 cfs @ 12.07 hrs, Volume= 0.135 af
Outflow = 1.62 cfs @ 12.08 hrs, Volume= 0.135 af, Atten= 2%, Lag= 0.4 min
Routed to Reach DMH2 : TO INFIL BASIN#1

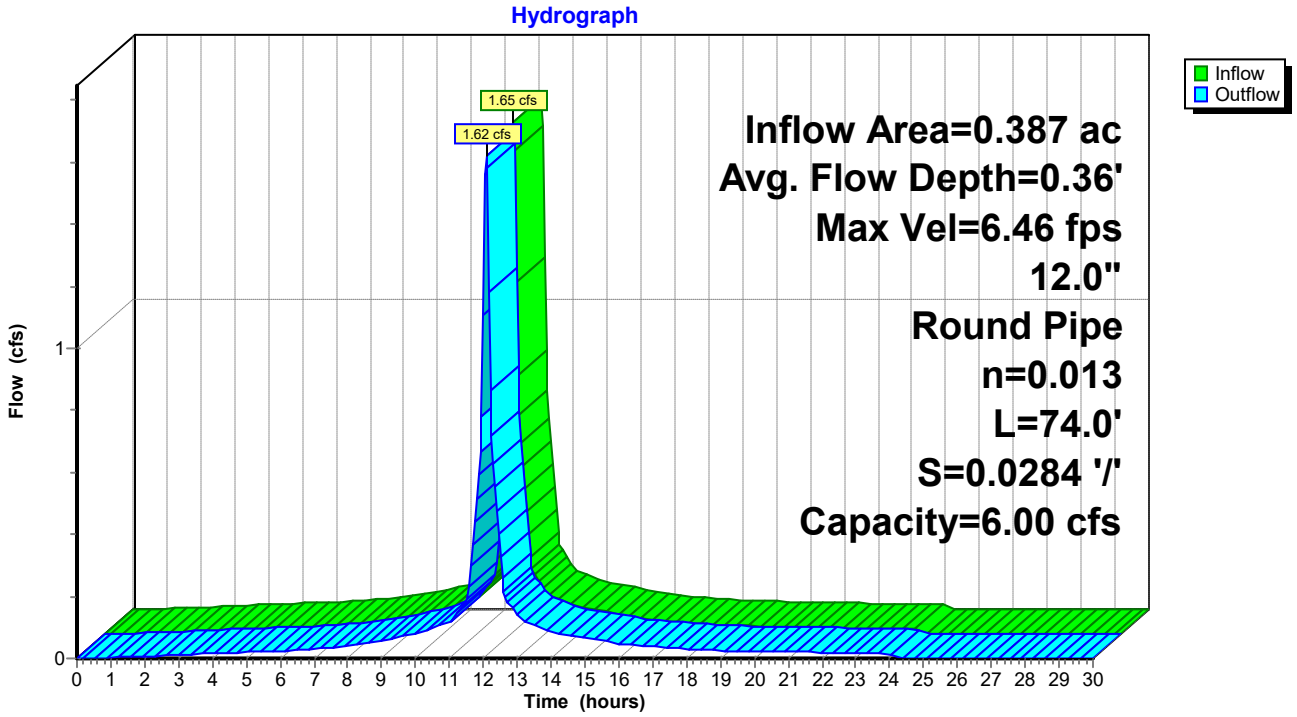
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.46 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.17 fps, Avg. Travel Time= 0.6 min

Peak Storage= 19 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.36' , Surface Width= 0.96'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.00 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 74.0' Slope= 0.0284 '/'
Inlet Invert= 206.50', Outlet Invert= 204.40'



Reach DCB3: TO DMH#2



Summary for Reach DCB4: TO INFIL BASIN#1

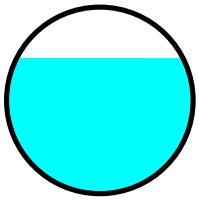
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 1.489 ac, 17.93% Impervious, Inflow Depth = 4.87" for 25-Year event
Inflow = 7.68 cfs @ 12.07 hrs, Volume= 0.605 af
Outflow = 7.50 cfs @ 12.09 hrs, Volume= 0.605 af, Atten= 2%, Lag= 1.0 min
Routed to Pond IB1 : INFILTRATION BASIN

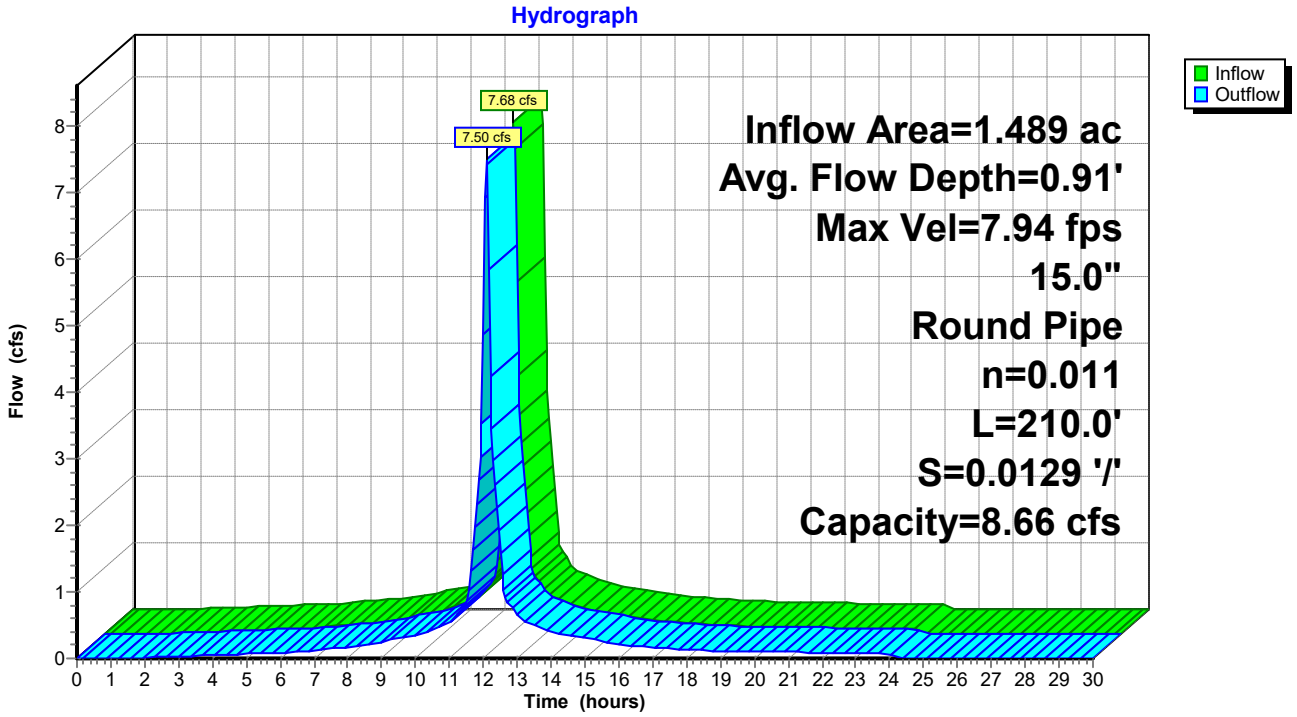
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.94 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.73 fps, Avg. Travel Time= 1.3 min

Peak Storage= 201 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.91' , Surface Width= 1.11'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 8.66 cfs

15.0" Round Pipe
n= 0.011 Concrete pipe, straight & clean
Length= 210.0' Slope= 0.0129 '/'
Inlet Invert= 205.20', Outlet Invert= 202.50'



Reach DCB4: TO INFIL BASIN#1



Summary for Reach DMH1: TO DMH#2

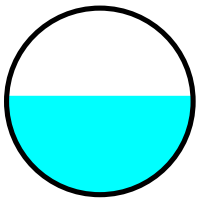
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach DCB1 OUTLET depth by 0.09' @ 12.10 hrs
[62] Hint: Exceeded Reach DCB2 OUTLET depth by 0.20' @ 12.10 hrs

Inflow Area = 0.461 ac, 74.02% Impervious, Inflow Depth = 4.17" for 25-Year event
Inflow = 1.94 cfs @ 12.08 hrs, Volume= 0.160 af
Outflow = 1.92 cfs @ 12.09 hrs, Volume= 0.160 af, Atten= 1%, Lag= 0.7 min
Routed to Reach DMH2 : TO INFIL BASIN#1

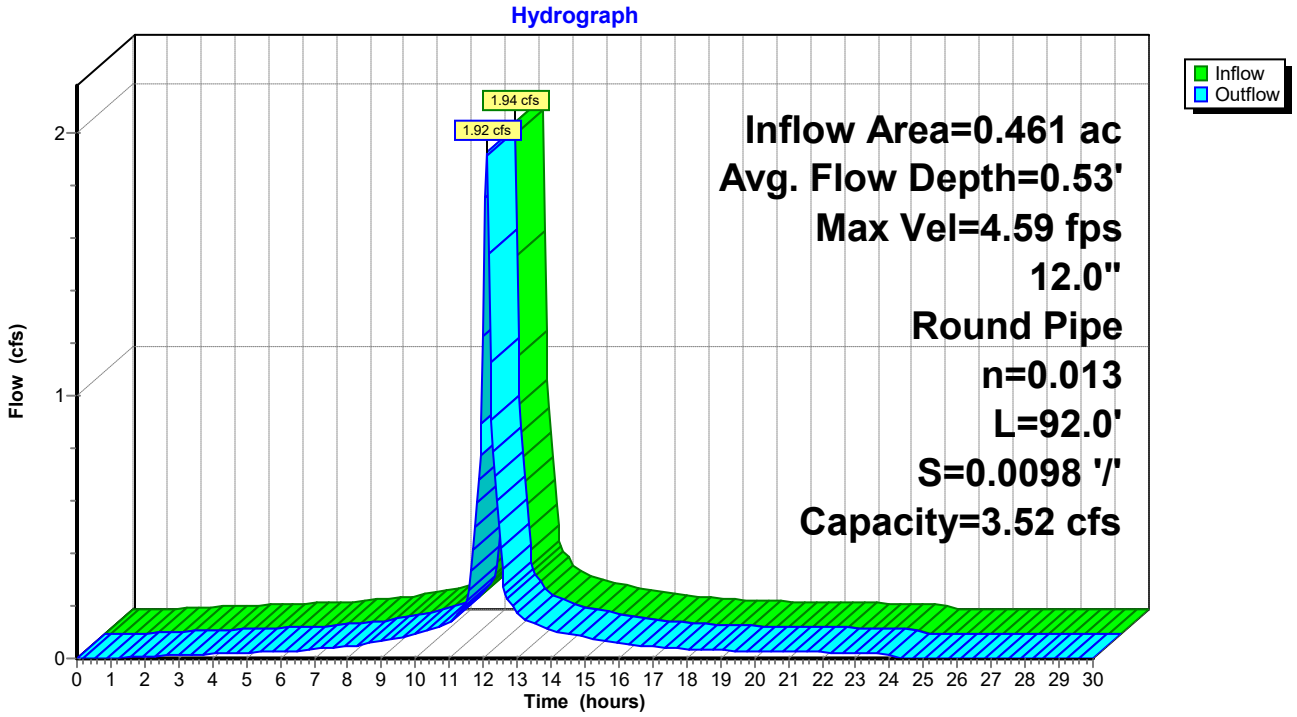
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.59 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.56 fps, Avg. Travel Time= 1.0 min

Peak Storage= 39 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.53' , Surface Width= 1.00'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.52 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 92.0' Slope= 0.0098 '/'
Inlet Invert= 205.50', Outlet Invert= 204.60'



Reach DMH1: TO DMH#2



Summary for Reach DMH2: TO INFIL BASIN#1

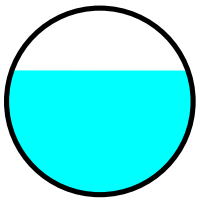
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach DCB3 OUTLET depth by 0.51' @ 12.10 hrs
[62] Hint: Exceeded Reach DMH1 OUTLET depth by 0.14' @ 12.10 hrs

Inflow Area = 0.848 ac, 77.52% Impervious, Inflow Depth = 4.18" for 25-Year event
Inflow = 3.54 cfs @ 12.08 hrs, Volume= 0.295 af
Outflow = 3.50 cfs @ 12.09 hrs, Volume= 0.295 af, Atten= 1%, Lag= 0.6 min
Routed to Pond IB1 : INFILTRATION BASIN

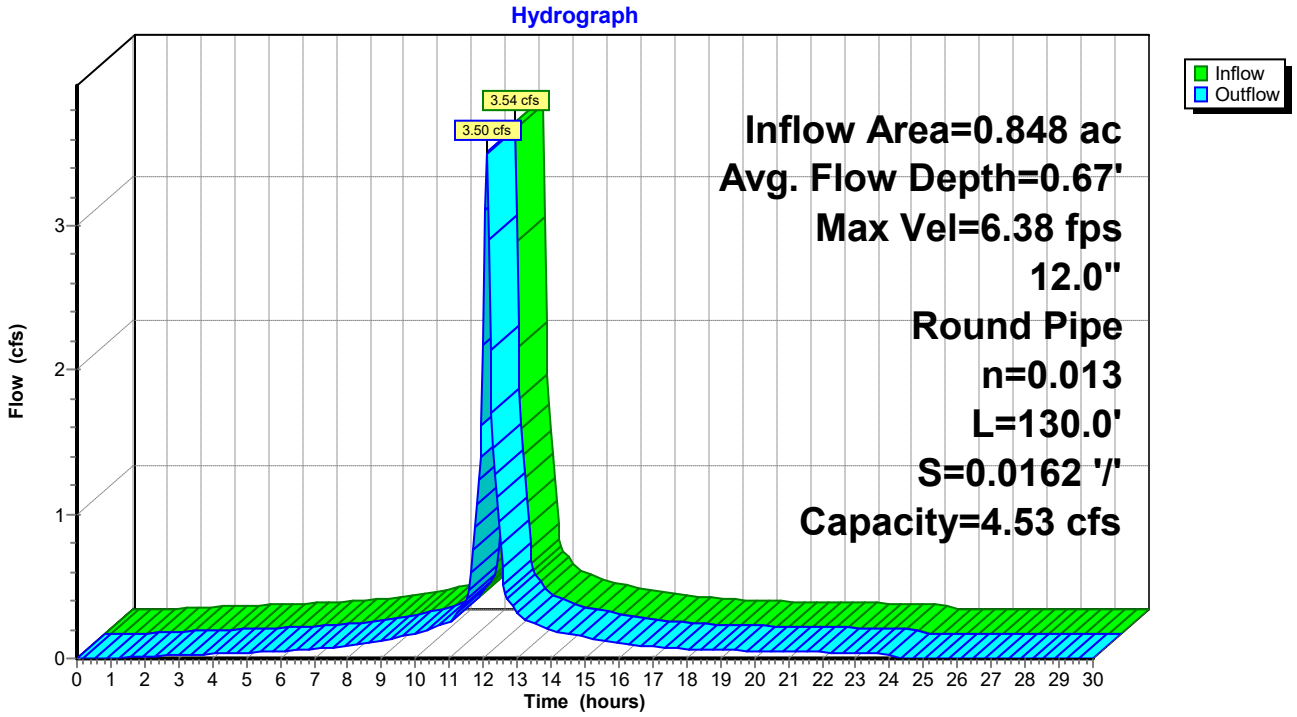
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.38 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.22 fps, Avg. Travel Time= 1.0 min

Peak Storage= 72 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.67' , Surface Width= 0.94'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 4.53 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 130.0' Slope= 0.0162 '/'
Inlet Invert= 204.60', Outlet Invert= 202.50'



Reach DMH2: TO INFIL BASIN#1



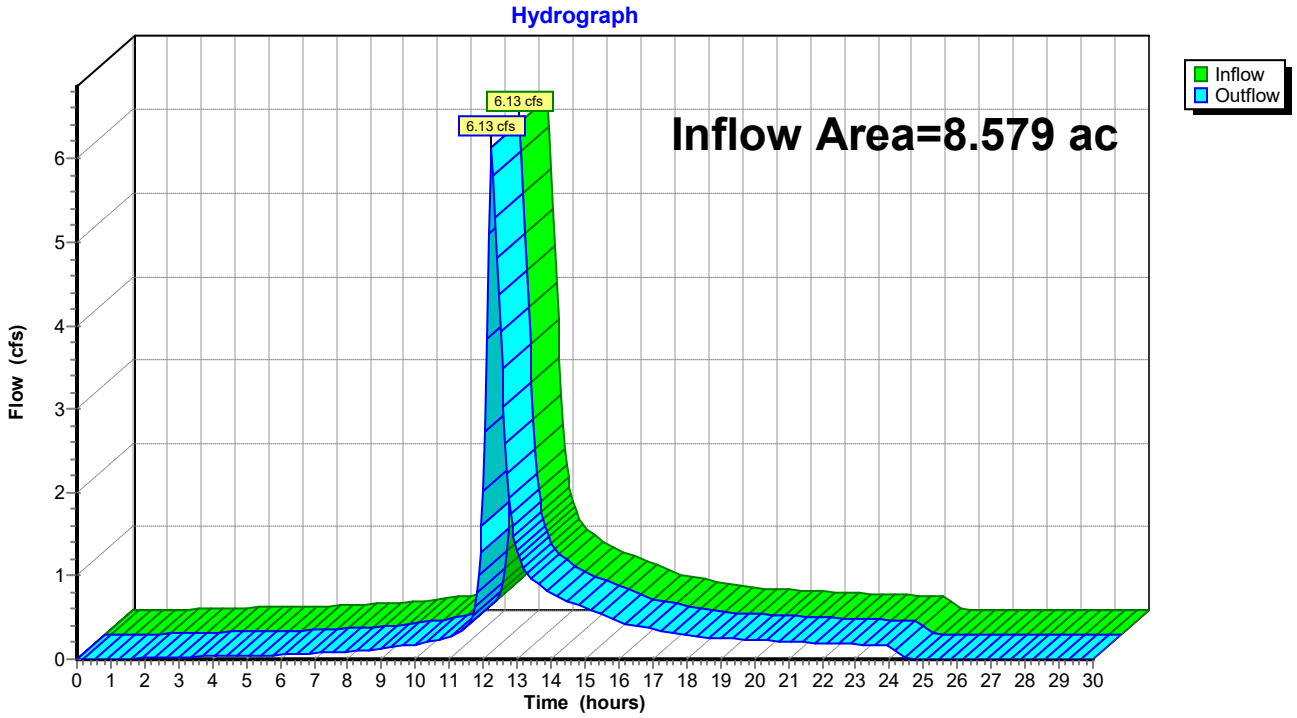
Summary for Reach DP1: RIVER (SOUTHWEST

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 8.579 ac, 8.68% Impervious, Inflow Depth = 1.04" for 25-Year event
Inflow = 6.13 cfs @ 12.24 hrs, Volume= 0.747 af
Outflow = 6.13 cfs @ 12.24 hrs, Volume= 0.747 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 DP1: RIVER (SOUTHWEST



Summary for Reach SW1: TO INFIL BASIN#1

Inflow Area = 1.026 ac, 0.87% Impervious, Inflow Depth = 4.83" for 25-Year event
Inflow = 5.28 cfs @ 12.07 hrs, Volume= 0.413 af
Outflow = 4.88 cfs @ 12.13 hrs, Volume= 0.413 af, Atten= 7%, Lag= 3.7 min
Routed to Pond IB1 : INFILTRATION BASIN

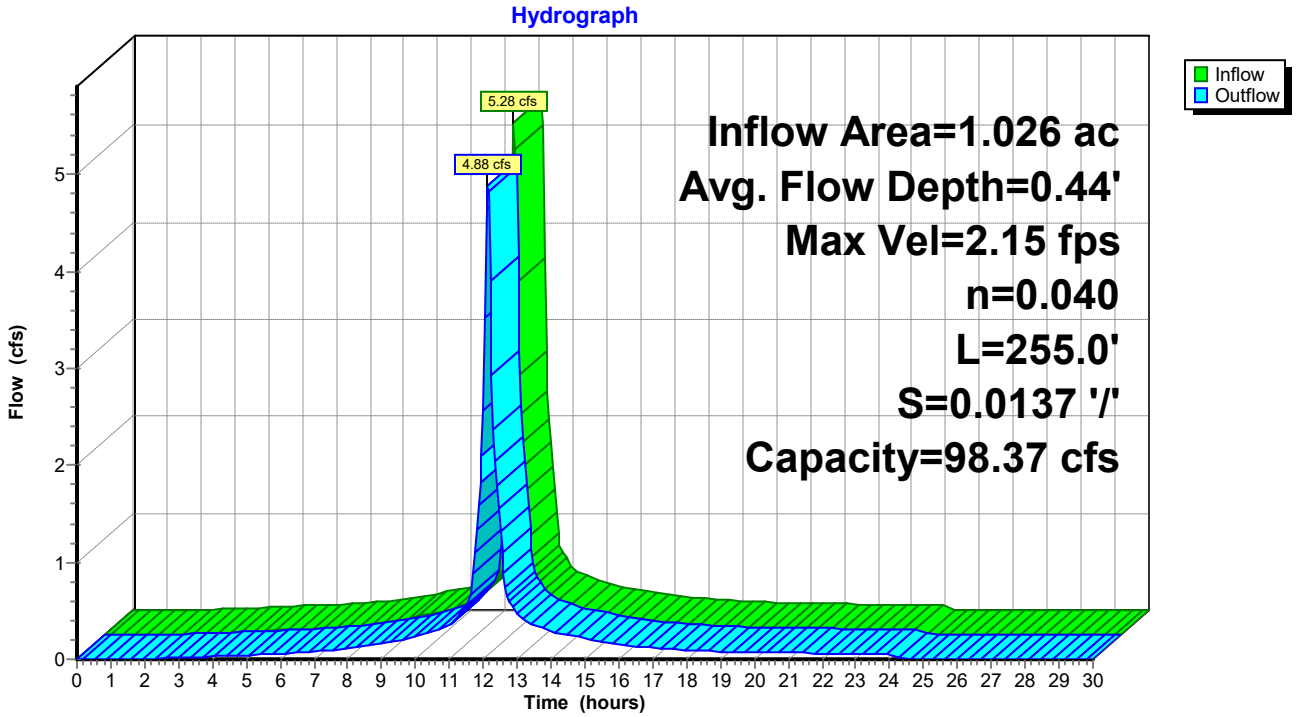
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.15 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 0.58 fps, Avg. Travel Time= 7.3 min

Peak Storage= 604 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.44' , Surface Width= 6.66'
Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 98.37 cfs

4.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 255.0' Slope= 0.0137 '/'
Inlet Invert= 208.00', Outlet Invert= 204.50'

‡

Reach SW1: TO INFIL BASIN#1



Summary for Pond IB1: INFILTRATION BASIN

[63] Warning: Exceeded Reach DCB4 INLET depth by 0.58' @ 12.65 hrs
[63] Warning: Exceeded Reach DMH2 INLET depth by 1.24' @ 12.65 hrs
[62] Hint: Exceeded Reach SW1 OUTLET depth by 1.41' @ 12.65 hrs

Inflow Area = 4.431 ac, 23.66% Impervious, Inflow Depth = 4.11" for 25-Year event
Inflow = 18.01 cfs @ 12.10 hrs, Volume= 1.517 af
Outflow = 2.79 cfs @ 12.61 hrs, Volume= 1.517 af, Atten= 85%, Lag= 30.7 min
Discarded = 2.79 cfs @ 12.61 hrs, Volume= 1.517 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach DP1 : RIVER (SOUTHWEST

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 206.05' @ 12.61 hrs Surf.Area= 10,034 sf Storage= 23,874 cf

Plug-Flow detention time= 81.0 min calculated for 1.514 af (100% of inflow)
Center-of-Mass det. time= 80.9 min (844.9 - 764.1)

Volume	Invert	Avail.Storage	Storage Description
#1	202.50'	64,106 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

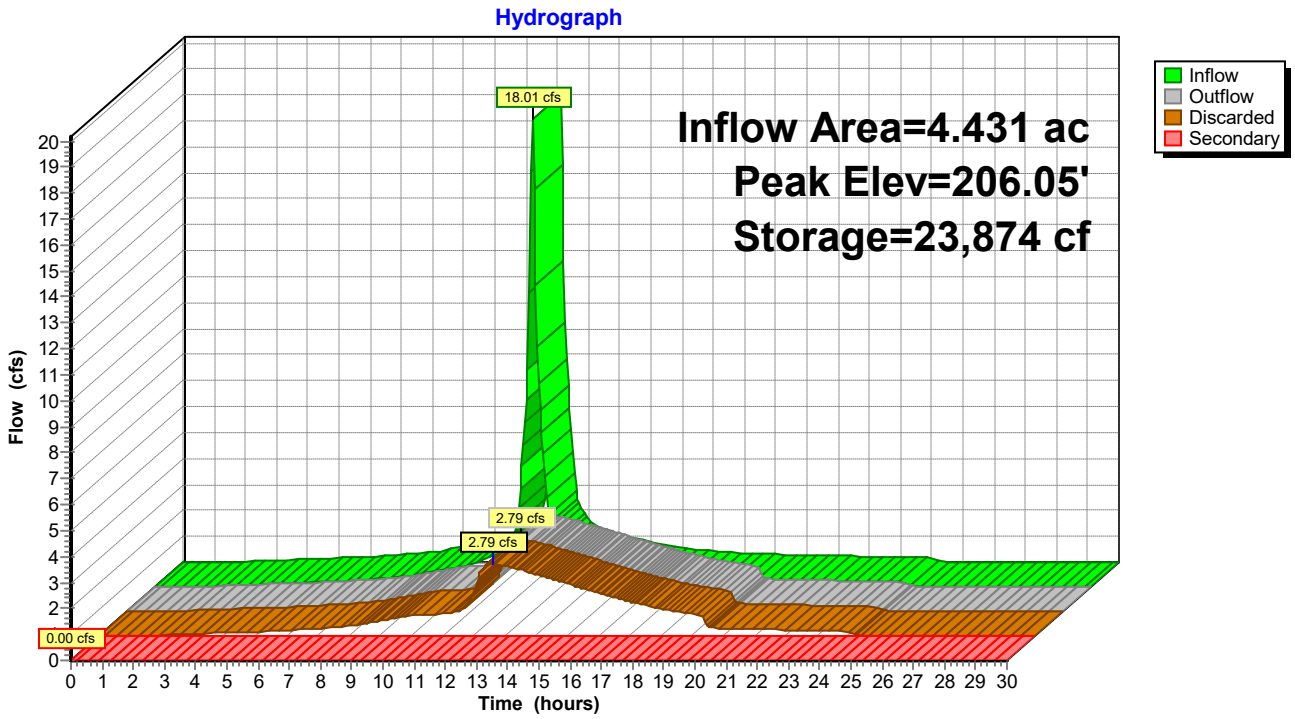
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
202.50	3,998	0	0
203.00	4,458	2,114	2,114
204.00	6,067	5,263	7,377
206.00	9,887	15,954	23,331
208.00	15,259	25,146	48,477
209.00	16,000	15,630	64,106

Device	Routing	Invert	Outlet Devices
#1	Discarded	202.50'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 197.70'
#2	Secondary	208.00'	**10.0' long + 3.0 '/' SideZ x 10.0' breadth Broad-Crested Rectangular Weir** 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

Discarded OutFlow Max=2.79 cfs @ 12.61 hrs HW=206.05' (Free Discharge)
1=Exfiltration (Controls 2.79 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=202.50' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond IB1: INFILTRATION BASIN



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

Subcatchment P100: OVERLAND TO RIVER Runoff Area=373,692 sf 8.68% Impervious Runoff Depth=1.57"
Flow Length=1,386' Tc=16.2 min CN=WQ Runoff=9.54 cfs 1.121 af

Subcatchment P101: TO DCB#1 Runoff Area=10,350 sf 70.45% Impervious Runoff Depth=4.78"
Flow Length=125' Tc=5.0 min CN=WQ Runoff=1.13 cfs 0.095 af

Subcatchment P102: TO DCB#2 Runoff Area=9,735 sf 77.81% Impervious Runoff Depth=5.70"
Flow Length=120' Tc=5.0 min CN=WQ Runoff=1.32 cfs 0.106 af

Subcatchment P103: TO DCB#3 Runoff Area=16,853 sf 81.69% Impervious Runoff Depth=5.22"
Flow Length=156' Tc=5.0 min CN=WQ Runoff=2.04 cfs 0.168 af

Subcatchment P104: TO INFIL BASIN Runoff Area=46,544 sf 10.77% Impervious Runoff Depth=3.06"
Flow Length=145' Tc=5.0 min CN=WQ Runoff=3.29 cfs 0.272 af

Subcatchment P105: TO SWALE Runoff Area=44,672 sf 0.87% Impervious Runoff Depth=6.03"
Flow Length=265' Tc=5.0 min CN=WQ Runoff=6.51 cfs 0.515 af

Subcatchment P106: TO DCB#4 Runoff Area=64,868 sf 17.93% Impervious Runoff Depth=6.07"
Flow Length=302' Slope=0.0050 '/' Tc=5.0 min CN=WQ Runoff=9.47 cfs 0.753 af

Reach DCB1: TO DMH#1 Avg. Flow Depth=0.39' Max Vel=4.01 fps Inflow=1.13 cfs 0.095 af
12.0" Round Pipe n=0.013 L=104.0' S=0.0101 '/' Capacity=3.58 cfs Outflow=1.11 cfs 0.095 af

Reach DCB2: TO DMH#1 Avg. Flow Depth=0.26' Max Vel=8.21 fps Inflow=1.32 cfs 0.106 af
12.0" Round Pipe n=0.013 L=16.0' S=0.0656 '/' Capacity=9.13 cfs Outflow=1.32 cfs 0.106 af

Reach DCB3: TO DMH#2 Avg. Flow Depth=0.40' Max Vel=6.84 fps Inflow=2.04 cfs 0.168 af
12.0" Round Pipe n=0.013 L=74.0' S=0.0284 '/' Capacity=6.00 cfs Outflow=2.01 cfs 0.168 af

Reach DCB4: TO INFIL BASIN#1 Avg. Flow Depth=1.13' Max Vel=8.03 fps Inflow=9.47 cfs 0.753 af
15.0" Round Pipe n=0.011 L=210.0' S=0.0129 '/' Capacity=8.66 cfs Outflow=9.23 cfs 0.753 af

Reach DMH1: TO DMH#2 Avg. Flow Depth=0.61' Max Vel=4.82 fps Inflow=2.41 cfs 0.201 af
12.0" Round Pipe n=0.013 L=92.0' S=0.0098 '/' Capacity=3.52 cfs Outflow=2.39 cfs 0.201 af

Reach DMH2: TO INFIL BASIN#1 Avg. Flow Depth=0.79' Max Vel=6.57 fps Inflow=4.39 cfs 0.369 af
12.0" Round Pipe n=0.013 L=130.0' S=0.0162 '/' Capacity=4.53 cfs Outflow=4.34 cfs 0.369 af

Reach DP1: RIVER (SOUTHWEST Inflow=9.54 cfs 1.121 af
Outflow=9.54 cfs 1.121 af

Reach SW1: TO INFIL BASIN#1 Avg. Flow Depth=0.50' Max Vel=2.30 fps Inflow=6.51 cfs 0.515 af
n=0.040 L=255.0' S=0.0137 '/' Capacity=98.37 cfs Outflow=6.02 cfs 0.515 af

Pond IB1: INFILTRATION BASIN Peak Elev=206.73' Storage=31,271 cf Inflow=22.51 cfs 1.910 af
Discarded=3.37 cfs 1.910 af Secondary=0.00 cfs 0.000 af Outflow=3.37 cfs 1.910 af

Total Runoff Area = 13.010 ac Runoff Volume = 3.031 af Average Runoff Depth = 2.80"
86.22% Pervious = 11.217 ac 13.78% Impervious = 1.793 ac

Summary for Subcatchment P100: OVERLAND TO RIVER

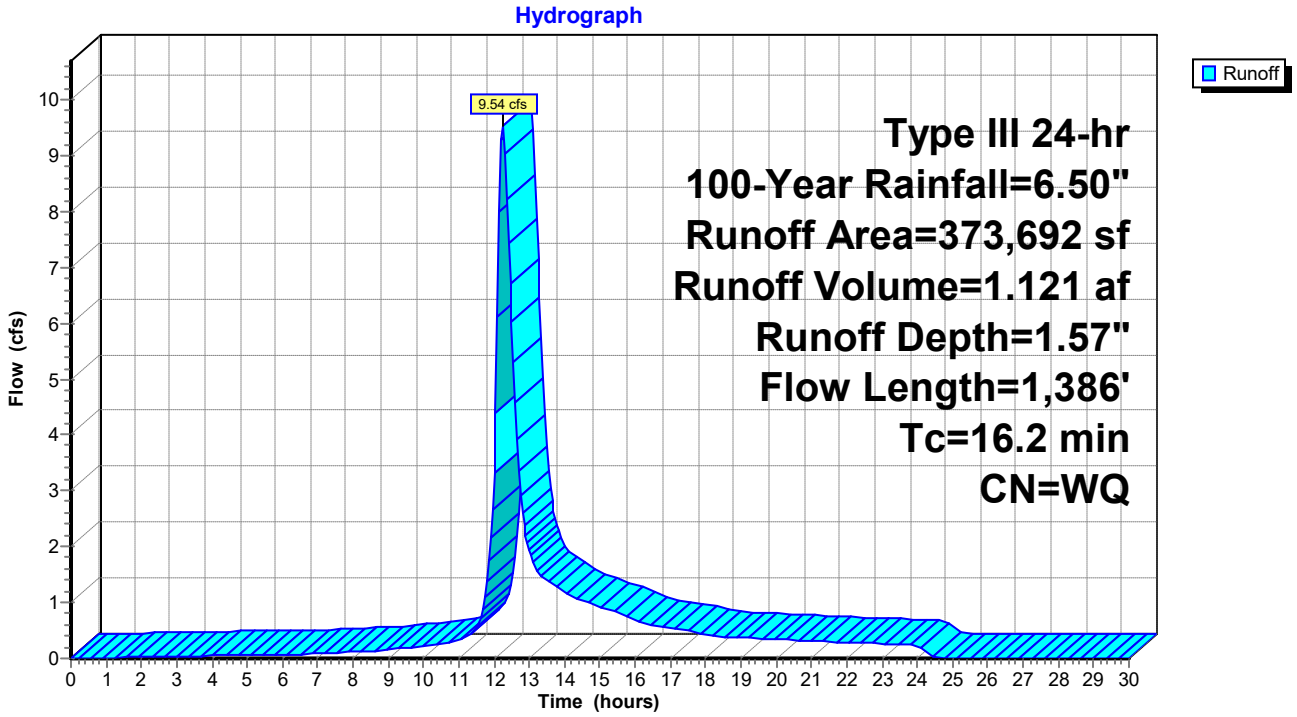
Runoff = 9.54 cfs @ 12.24 hrs, Volume= 1.121 af, Depth= 1.57"
Routed to Reach DP1 : RIVER (SOUTHWEST

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

Area (sf)	CN	Description
69,627	39	>75% Grass cover, Good, HSG A
92,181	30	Woods, Good, HSG A
20,233	98	Paved parking, HSG A
6,716	61	>75% Grass cover, Good, HSG B
172,740	55	Woods, Good, HSG B
2,673	98	Paved parking, HSG B
9,522	98	Water Surface, HSG B
373,692		Weighted Average
341,264		91.32% Pervious Area
32,428		8.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	16	0.0200	0.94		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
3.8	34	0.0250	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.7	102	0.0250	2.55		**Shallow Concentrated Flow, GRASS** Unpaved Kv= 16.1 fps
1.8	321	0.0350	3.01		**Shallow Concentrated Flow, GRASS** Unpaved Kv= 16.1 fps
9.6	913	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.2	1,386	Total			

Subcatchment P100: OVERLAND TO RIVER



Summary for Subcatchment P101: TO DCB#1

[49] Hint: Tc<2dt may require smaller dt

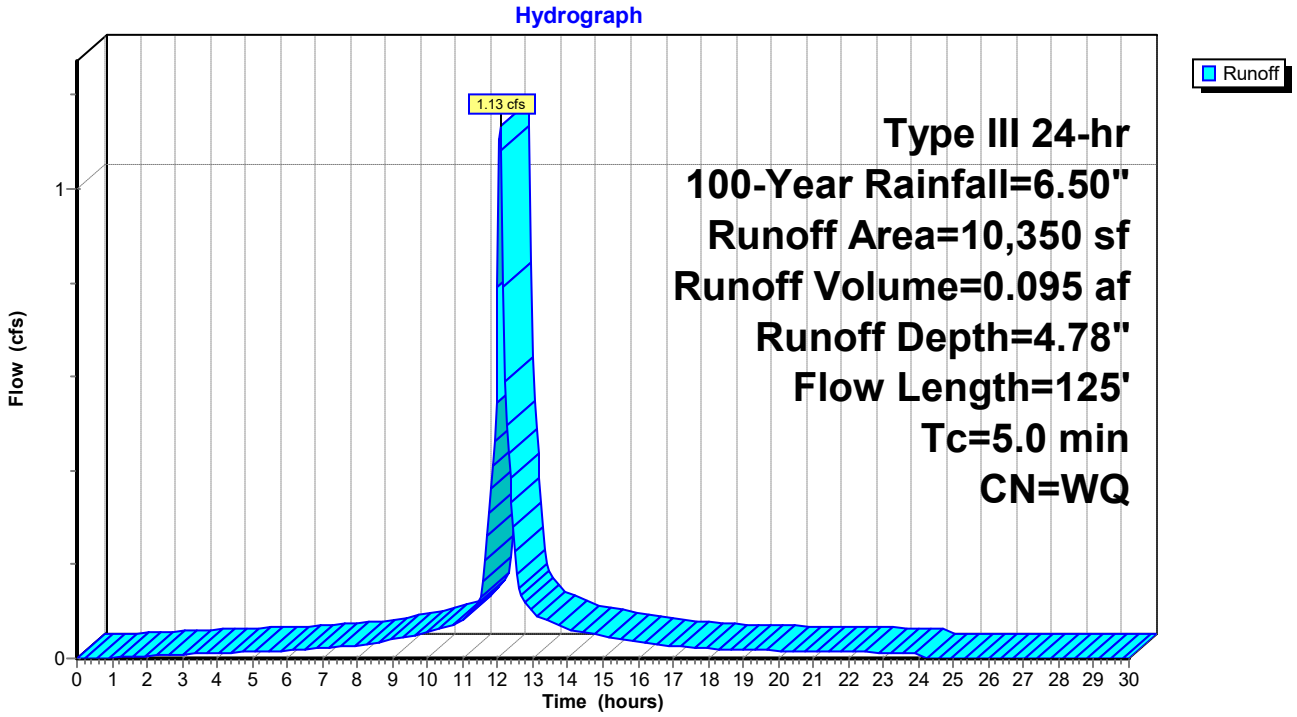
Runoff = 1.13 cfs @ 12.07 hrs, Volume= 0.095 af, Depth= 4.78"
Routed to Reach DCB1 : TO DMH#1

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

Area (sf)	CN	Description
2,688	39	>75% Grass cover, Good, HSG A
7,292	98	Paved parking, HSG A
370	96	Gravel surface, HSG A
10,350		Weighted Average
3,058		29.55% Pervious Area
7,292		70.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	25	0.0830	1.81		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.1	25	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.5	75	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.8	125	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P101: TO DCB#1



Summary for Subcatchment P102: TO DCB#2

[49] Hint: Tc<2dt may require smaller dt

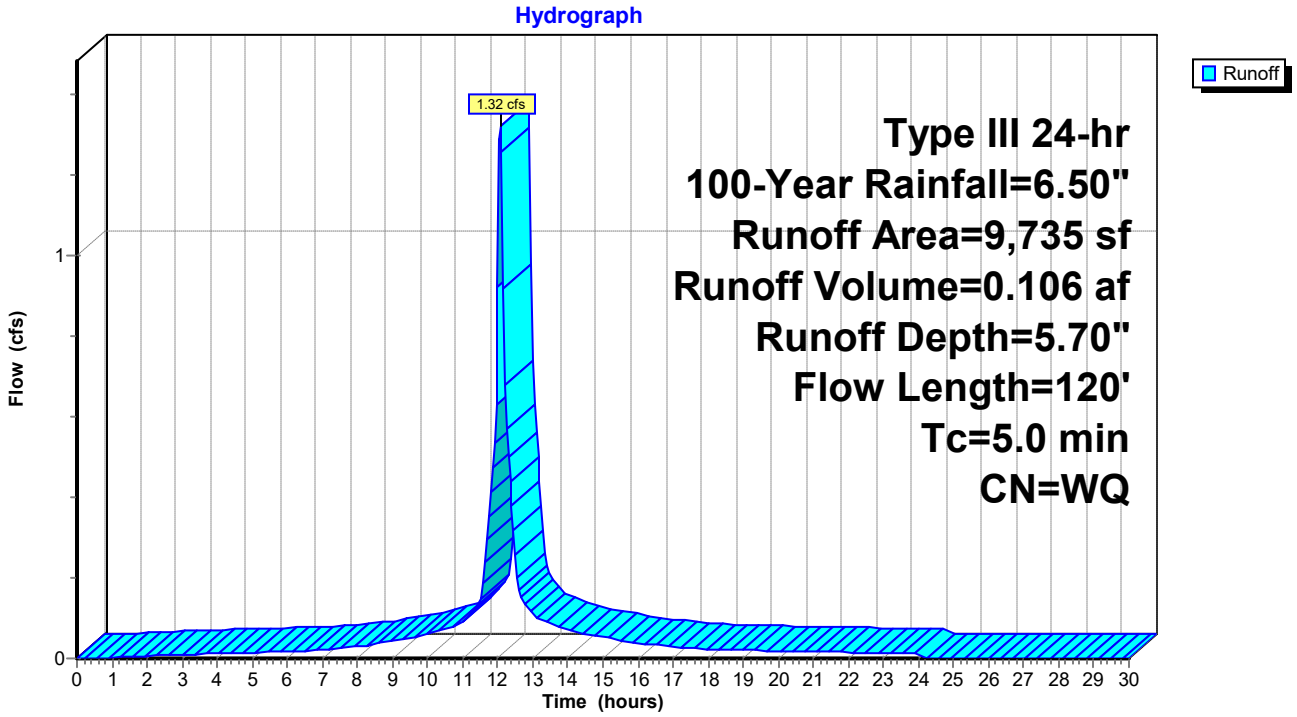
Runoff = 1.32 cfs @ 12.07 hrs, Volume= 0.106 af, Depth= 5.70"
Routed to Reach DCB2 : TO DMH#1

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

Area (sf)	CN	Description
272	39	>75% Grass cover, Good, HSG A
7,575	98	Paved parking, HSG A
327	96	Gravel surface, HSG A
1,561	76	Gravel roads, HSG A
9,735		Weighted Average
2,160		22.19% Pervious Area
7,575		77.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	21	0.0350	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.5	29	0.0200	1.06		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.4	70	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.2	120	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P102: TO DCB#2



Summary for Subcatchment P103: TO DCB#3

[49] Hint: Tc<2dt may require smaller dt

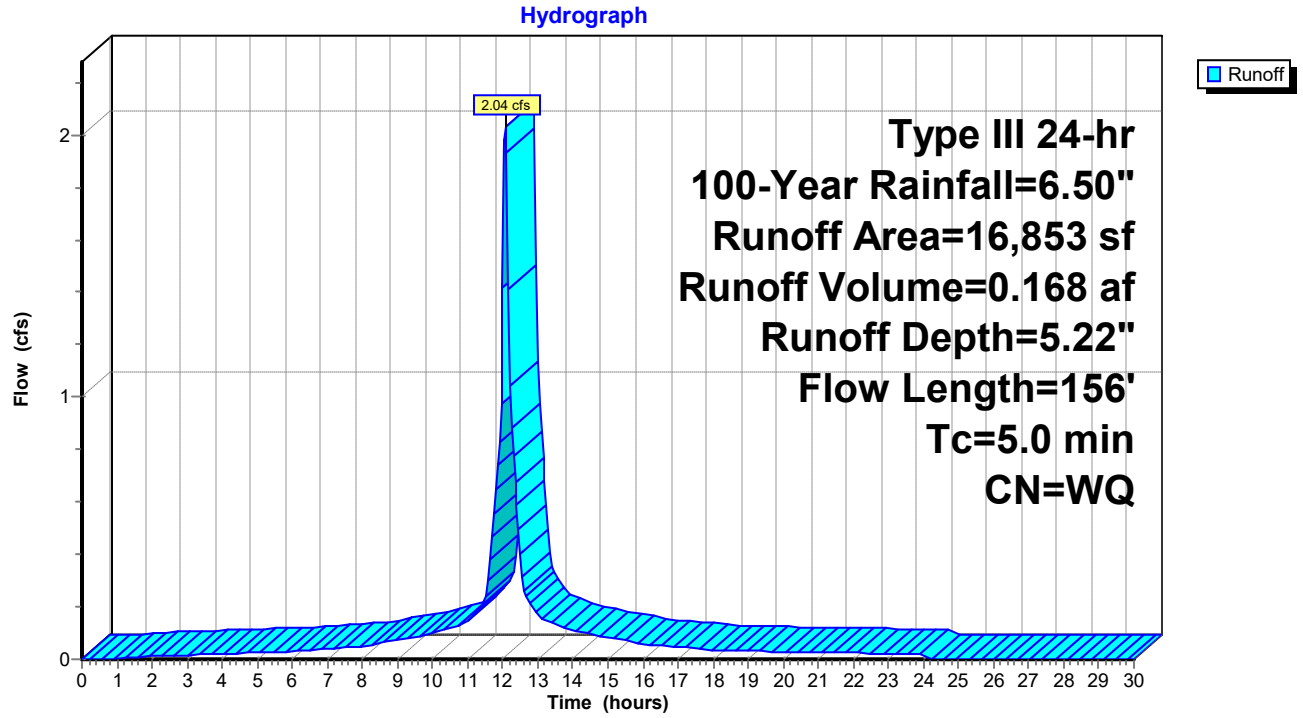
Runoff = 2.04 cfs @ 12.07 hrs, Volume= 0.168 af, Depth= 5.22"
Routed to Reach DCB3 : TO DMH#2

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

Area (sf)	CN	Description
3,086	39	>75% Grass cover, Good, HSG A
13,767	98	Paved parking, HSG A
16,853		Weighted Average
3,086		18.31% Pervious Area
13,767		81.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.3	21	0.0350	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
0.5	29	0.0200	1.06		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.6	106	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.4	156	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P103: TO DCB#3



Summary for Subcatchment P104: TO INFIL BASIN

[49] Hint: Tc<2dt may require smaller dt

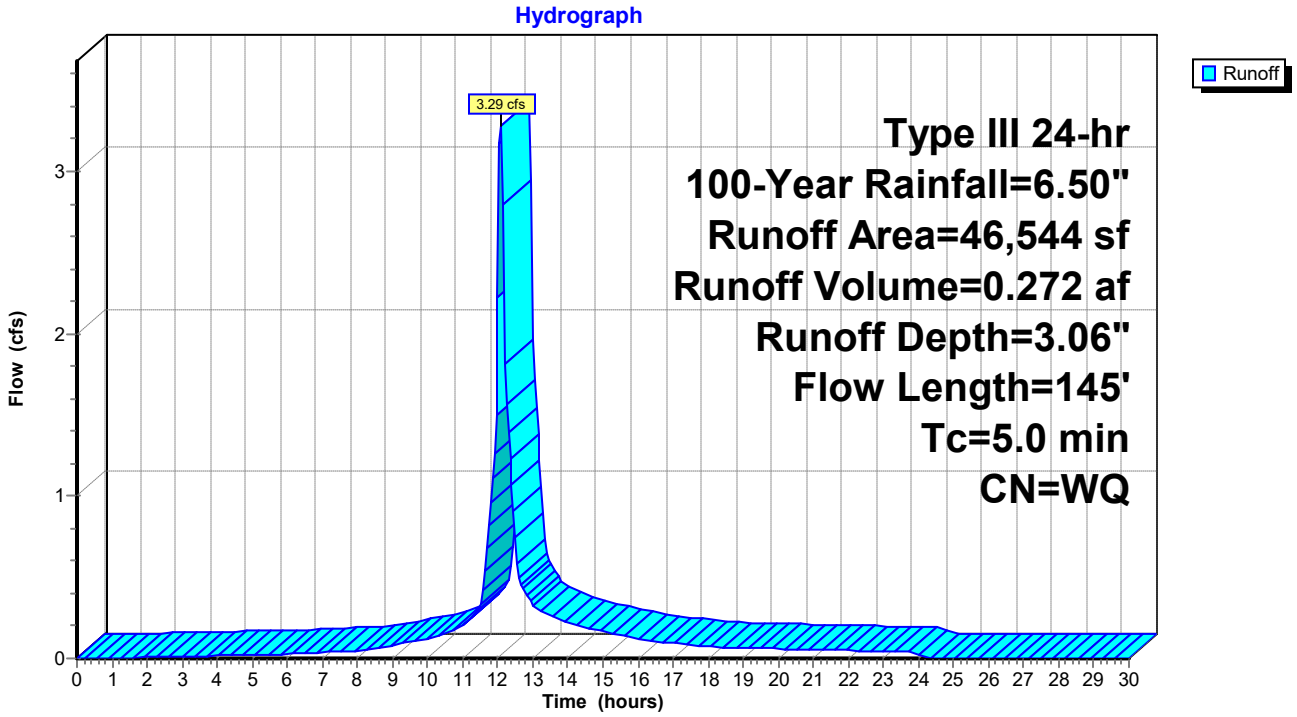
Runoff = 3.29 cfs @ 12.08 hrs, Volume= 0.272 af, Depth= 3.06"
Routed to Pond IB1 : INFILTRATION BASIN

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

Area (sf)	CN	Description
20,908	39	>75% Grass cover, Good, HSG A
8,891	96	Gravel surface, HSG A
11,733	76	Gravel roads, HSG A
5,012	98	Paved parking, HSG A
46,544		Weighted Average
41,532		89.23% Pervious Area
5,012		10.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.18		**Sheet Flow, gravel**
					Smooth surfaces n= 0.011 P2= 3.10"
0.5	67	0.0200	2.28		**Shallow Concentrated Flow, gravel**
					Unpaved Kv= 16.1 fps
0.1	28	0.3300	9.25		**Shallow Concentrated Flow,**
					Unpaved Kv= 16.1 fps
1.3	145	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P104: TO INFIL BASIN



Summary for Subcatchment P105: TO SWALE

[49] Hint: Tc<2dt may require smaller dt

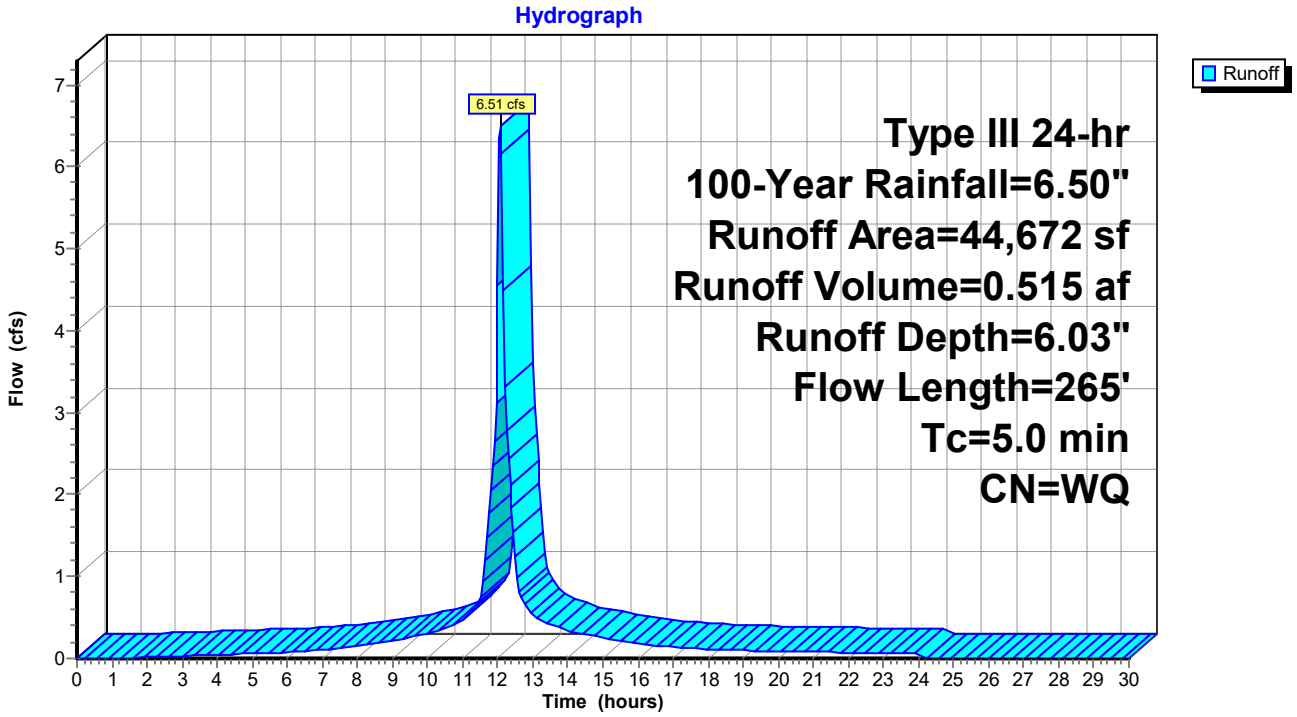
Runoff = 6.51 cfs @ 12.07 hrs, Volume= 0.515 af, Depth= 6.03"
Routed to Reach SW1 : TO INFIL BASIN#1

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

Area (sf)	CN	Description
387	98	Paved parking, HSG A
7,218	96	Gravel surface, HSG A
37,067	96	Gravel surface, HSG A
44,672		Weighted Average
44,285		99.13% Pervious Area
387		0.87% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	22	0.5000	3.62		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.7	23	0.0050	0.58		**Sheet Flow, gravel** Smooth surfaces n= 0.011 P2= 3.10"
3.2	220	0.0050	1.14		**Shallow Concentrated Flow, GRAVEL** Unpaved Kv= 16.1 fps
4.0	265	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P105: TO SWALE



Summary for Subcatchment P106: TO DCB#4

[49] Hint: Tc<2dt may require smaller dt

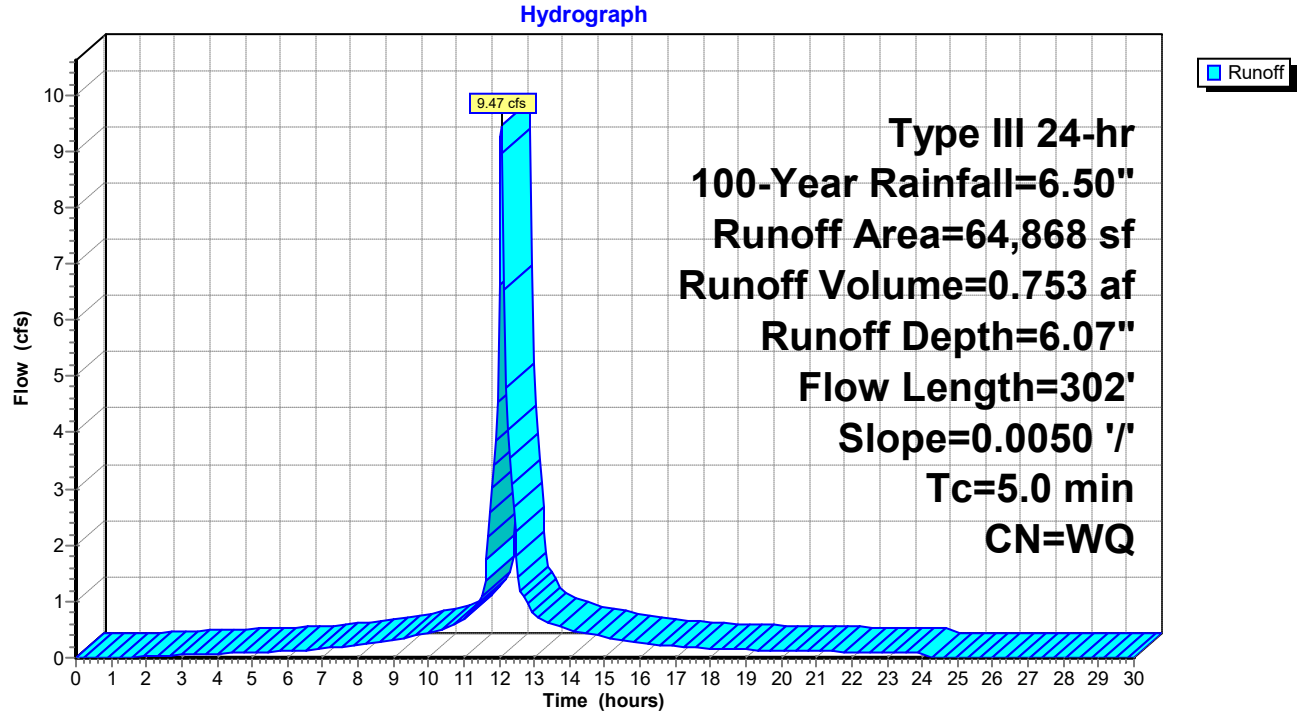
Runoff = 9.47 cfs @ 12.07 hrs, Volume= 0.753 af, Depth= 6.07"
Routed to Reach DCB4 : TO INFIL BASIN#1

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

Area (sf)	CN	Description
11,628	98	Paved parking, HSG A
6,496	96	Gravel surface, HSG A
46,744	96	Gravel surface, HSG A
64,868		Weighted Average
53,240		82.07% Pervious Area
11,628		17.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	50	0.0050	0.68		**Sheet Flow, GRAVEL** Smooth surfaces n= 0.011 P2= 3.10"
3.7	252	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
4.9	302	Total, Increased to minimum Tc = 5.0 min			

Subcatchment P106: TO DCB#4



Summary for Reach DCB1: TO DMH#1

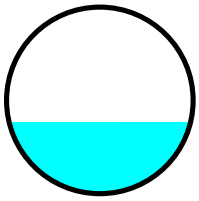
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.238 ac, 70.45% Impervious, Inflow Depth = 4.78" for 100-Year event
Inflow = 1.13 cfs @ 12.07 hrs, Volume= 0.095 af
Outflow = 1.11 cfs @ 12.09 hrs, Volume= 0.095 af, Atten= 2%, Lag= 0.9 min
Routed to Reach DMH1 : TO DMH#2

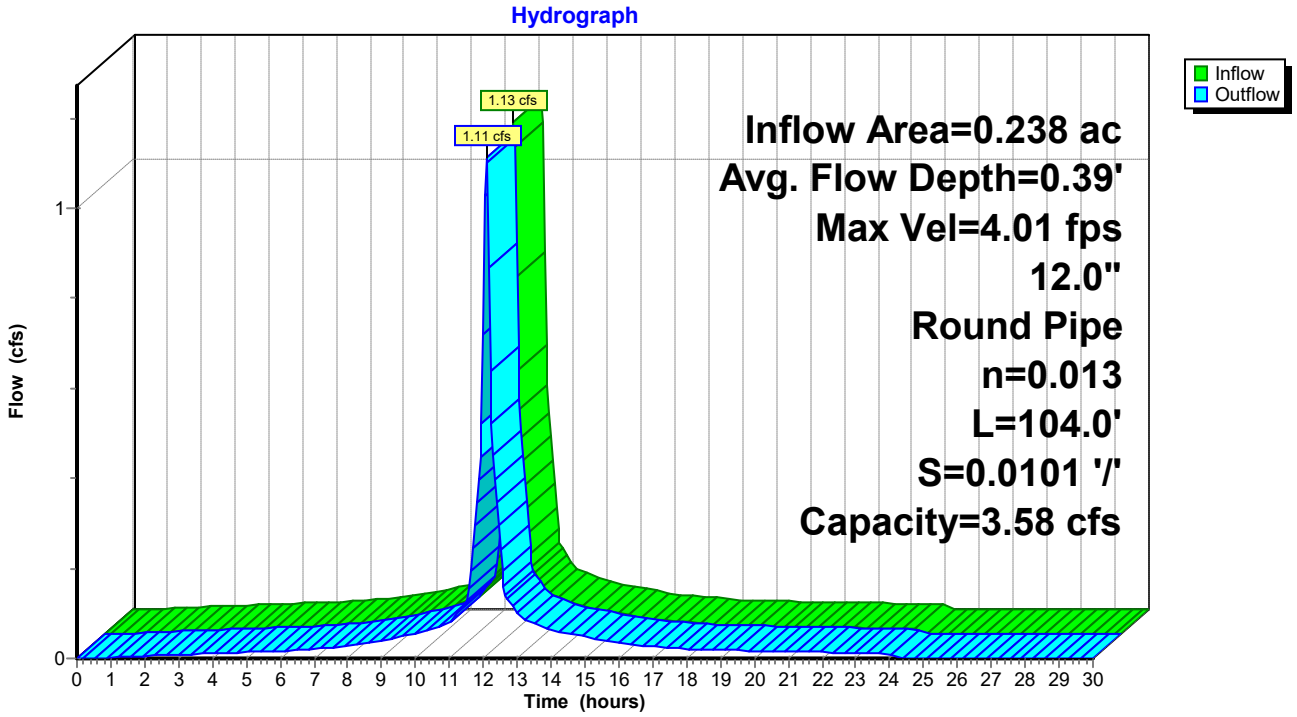
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.01 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.36 fps, Avg. Travel Time= 1.3 min

Peak Storage= 29 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.39' , Surface Width= 0.97'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.58 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 104.0' Slope= 0.0101 '/'
Inlet Invert= 206.65', Outlet Invert= 205.60'



Reach DCB1: TO DMH#1



Summary for Reach DCB2: TO DMH#1

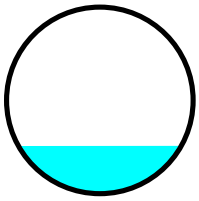
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.223 ac, 77.81% Impervious, Inflow Depth = 5.70" for 100-Year event
Inflow = 1.32 cfs @ 12.07 hrs, Volume= 0.106 af
Outflow = 1.32 cfs @ 12.07 hrs, Volume= 0.106 af, Atten= 0%, Lag= 0.1 min
Routed to Reach DMH1 : TO DMH#2

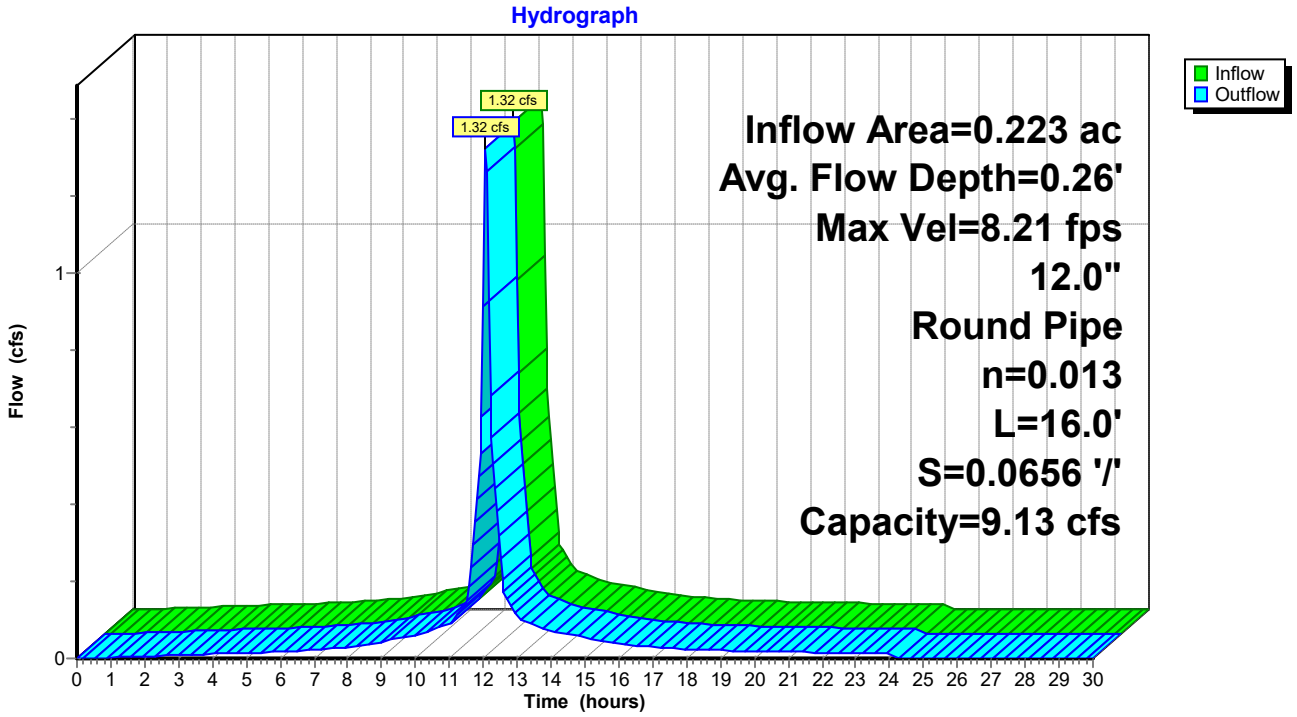
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.21 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.70 fps, Avg. Travel Time= 0.1 min

Peak Storage= 3 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.26' , Surface Width= 0.87'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.13 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 16.0' Slope= 0.0656 '/'
Inlet Invert= 206.65', Outlet Invert= 205.60'



Reach DCB2: TO DMH#1



Summary for Reach DCB3: TO DMH#2

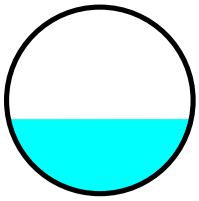
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.387 ac, 81.69% Impervious, Inflow Depth = 5.22" for 100-Year event
Inflow = 2.04 cfs @ 12.07 hrs, Volume= 0.168 af
Outflow = 2.01 cfs @ 12.08 hrs, Volume= 0.168 af, Atten= 1%, Lag= 0.4 min
Routed to Reach DMH2 : TO INFIL BASIN#1

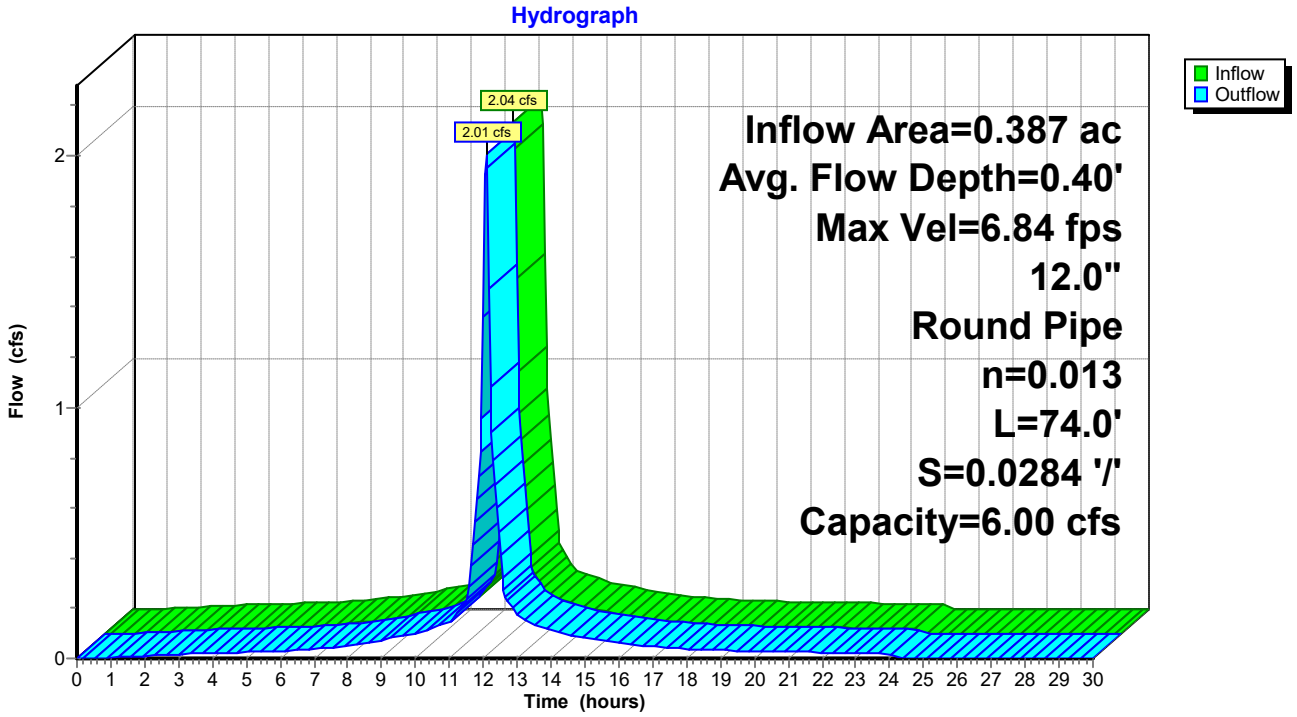
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.84 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.32 fps, Avg. Travel Time= 0.5 min

Peak Storage= 22 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.40' , Surface Width= 0.98'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.00 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 74.0' Slope= 0.0284 '/'
Inlet Invert= 206.50', Outlet Invert= 204.40'



Reach DCB3: TO DMH#2



Summary for Reach DCB4: TO INFIL BASIN#1

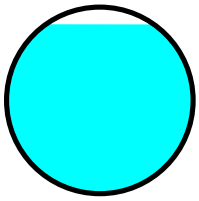
[52] Hint: Inlet/Outlet conditions not evaluated
[55] Hint: Peak inflow is 109% of Manning's capacity

Inflow Area = 1.489 ac, 17.93% Impervious, Inflow Depth = 6.07" for 100-Year event
Inflow = 9.47 cfs @ 12.07 hrs, Volume= 0.753 af
Outflow = 9.23 cfs @ 12.09 hrs, Volume= 0.753 af, Atten= 3%, Lag= 1.0 min
Routed to Pond IB1 : INFILTRATION BASIN

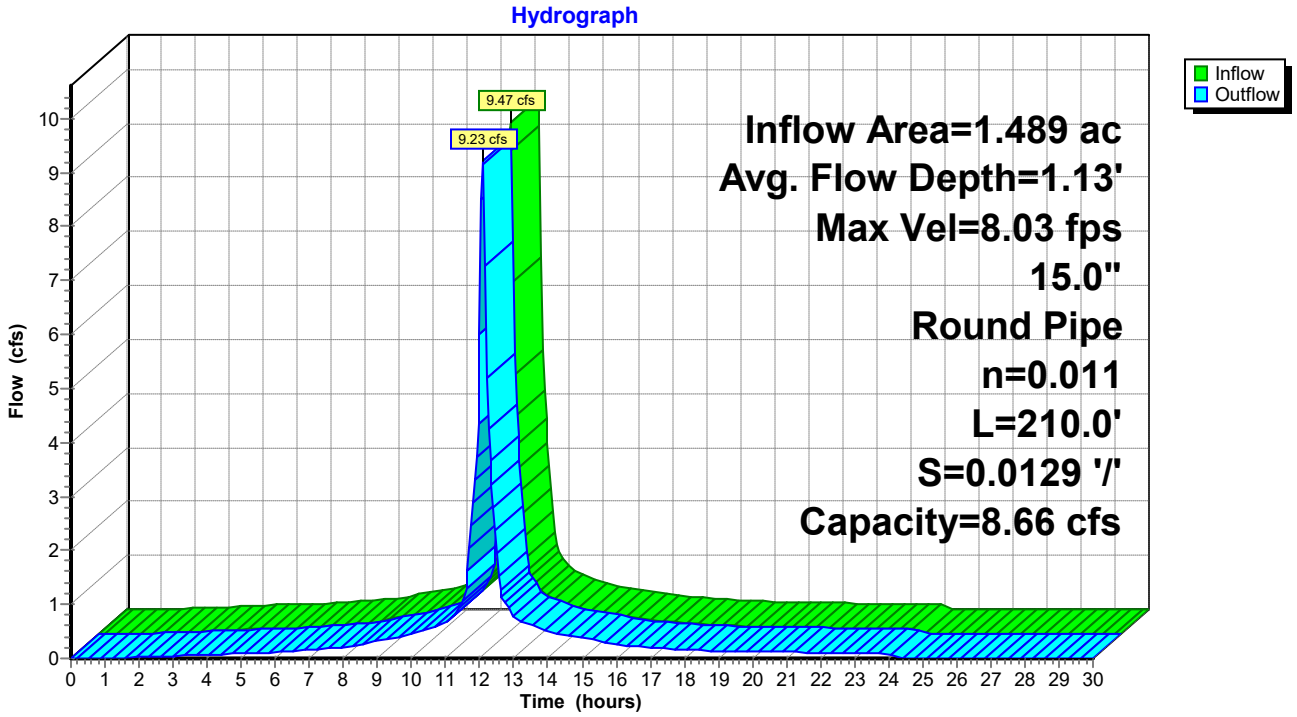
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.03 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.92 fps, Avg. Travel Time= 1.2 min

Peak Storage= 247 cf @ 12.08 hrs
Average Depth at Peak Storage= 1.13' , Surface Width= 0.73'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 8.66 cfs

15.0" Round Pipe
n= 0.011 Concrete pipe, straight & clean
Length= 210.0' Slope= 0.0129 '/'
Inlet Invert= 205.20', Outlet Invert= 202.50'



Reach DCB4: TO INFIL BASIN#1



Summary for Reach DMH1: TO DMH#2

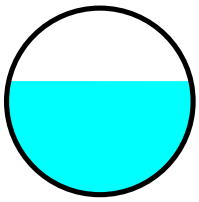
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach DCB1 OUTLET depth by 0.12' @ 12.10 hrs
[62] Hint: Exceeded Reach DCB2 OUTLET depth by 0.25' @ 12.10 hrs

Inflow Area = 0.461 ac, 74.02% Impervious, Inflow Depth = 5.23" for 100-Year event
Inflow = 2.41 cfs @ 12.08 hrs, Volume= 0.201 af
Outflow = 2.39 cfs @ 12.09 hrs, Volume= 0.201 af, Atten= 1%, Lag= 0.6 min
Routed to Reach DMH2 : TO INFIL BASIN#1

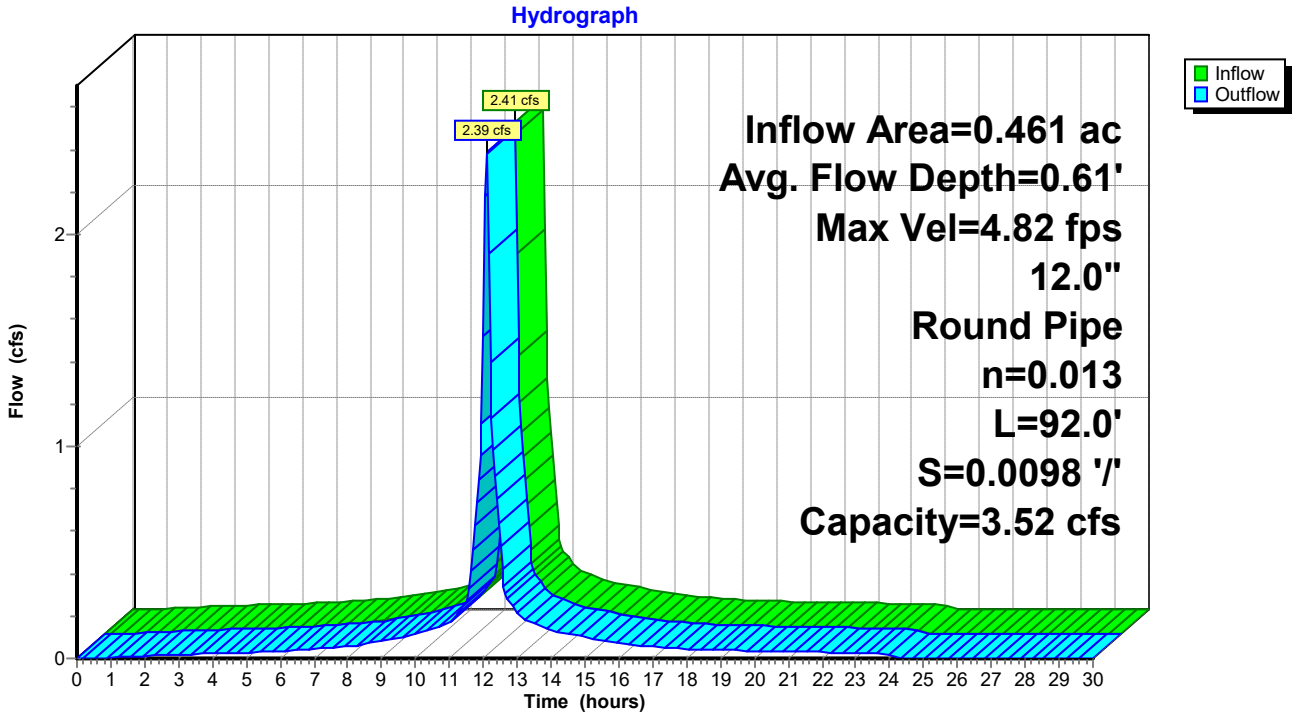
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.82 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.67 fps, Avg. Travel Time= 0.9 min

Peak Storage= 46 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.61' , Surface Width= 0.98'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.52 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 92.0' Slope= 0.0098 '/'
Inlet Invert= 205.50', Outlet Invert= 204.60'



Reach DMH1: TO DMH#2



Summary for Reach DMH2: TO INFIL BASIN#1

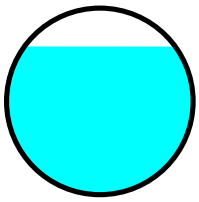
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach DCB3 OUTLET depth by 0.60' @ 12.10 hrs
[62] Hint: Exceeded Reach DMH1 OUTLET depth by 0.19' @ 12.10 hrs

Inflow Area = 0.848 ac, 77.52% Impervious, Inflow Depth = 5.23" for 100-Year event
Inflow = 4.39 cfs @ 12.08 hrs, Volume= 0.369 af
Outflow = 4.34 cfs @ 12.09 hrs, Volume= 0.369 af, Atten= 1%, Lag= 0.6 min
Routed to Pond IB1 : INFILTRATION BASIN

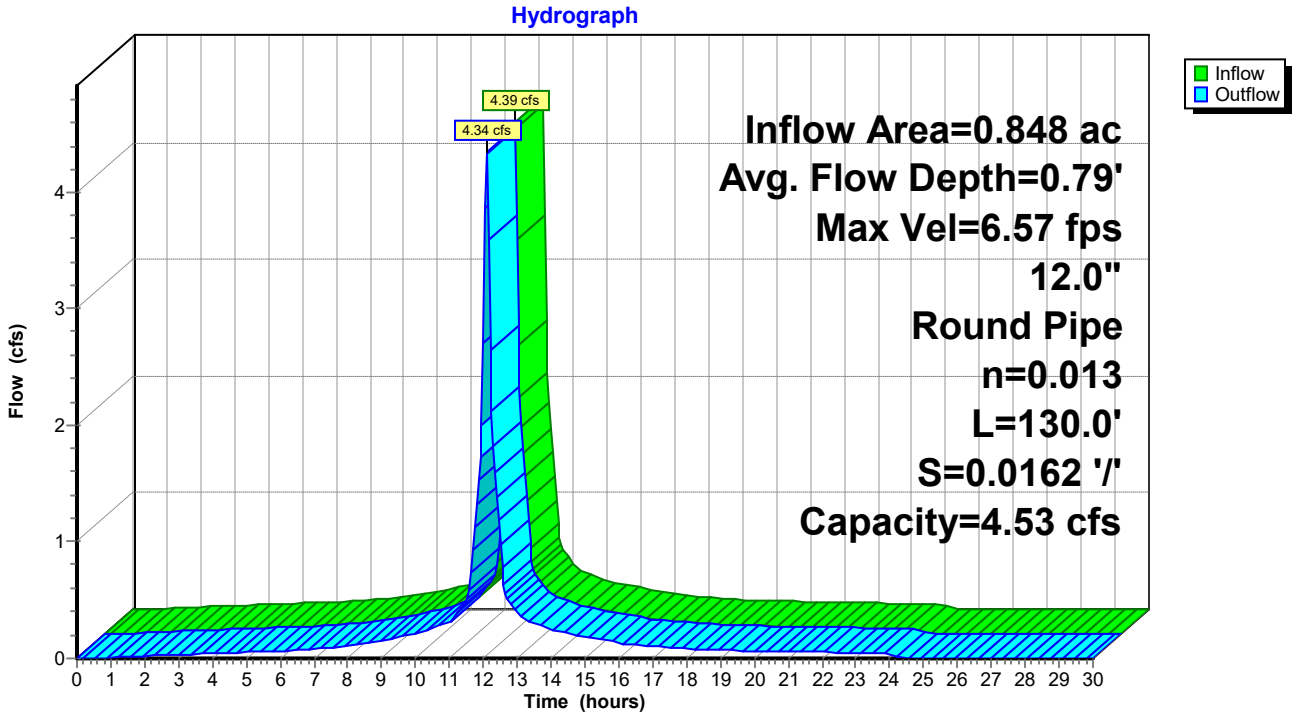
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.57 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.38 fps, Avg. Travel Time= 0.9 min

Peak Storage= 87 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.79' , Surface Width= 0.81'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 4.53 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 130.0' Slope= 0.0162 '/'
Inlet Invert= 204.60', Outlet Invert= 202.50'



Reach DMH2: TO INFIL BASIN#1



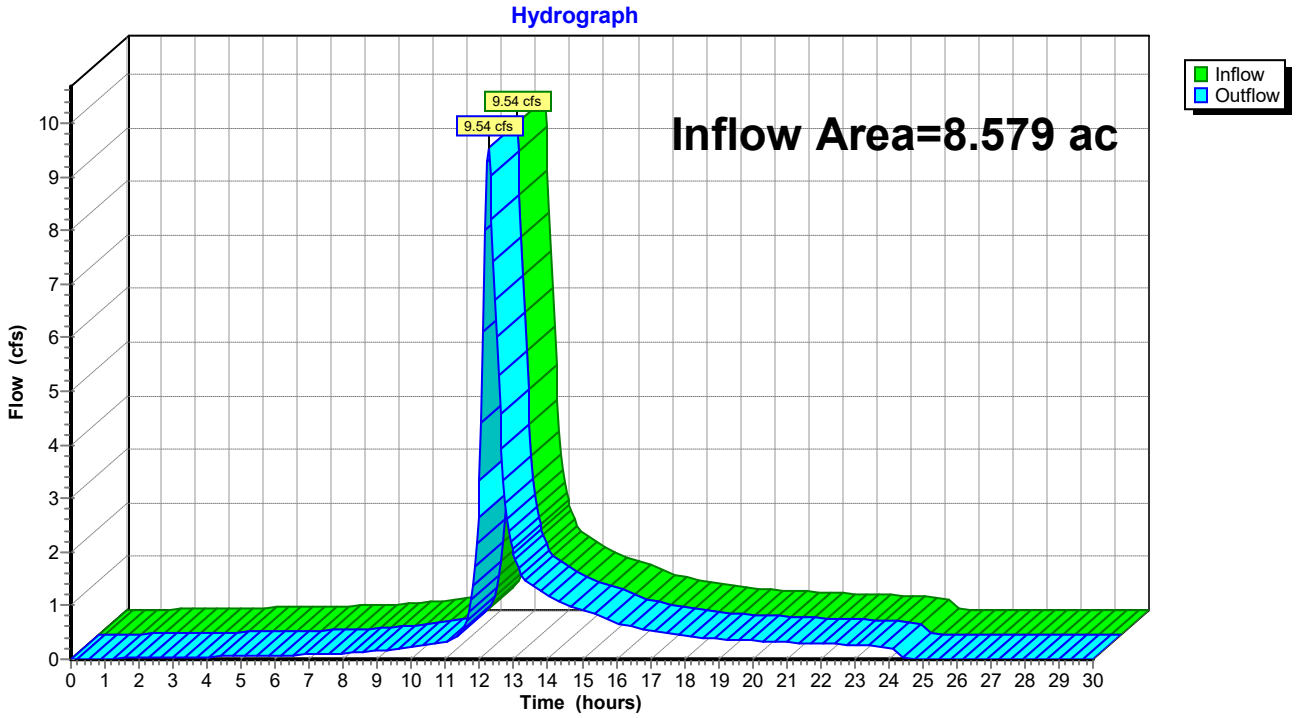
Summary for Reach DP1: RIVER (SOUTHWEST

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 8.579 ac, 8.68% Impervious, Inflow Depth = 1.57" for 100-Year event
Inflow = 9.54 cfs @ 12.24 hrs, Volume= 1.121 af
Outflow = 9.54 cfs @ 12.24 hrs, Volume= 1.121 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 DP1: RIVER (SOUTHWEST



Summary for Reach SW1: TO INFIL BASIN#1

Inflow Area = 1.026 ac, 0.87% Impervious, Inflow Depth = 6.03" for 100-Year event
Inflow = 6.51 cfs @ 12.07 hrs, Volume= 0.515 af
Outflow = 6.02 cfs @ 12.13 hrs, Volume= 0.515 af, Atten= 8%, Lag= 3.5 min
Routed to Pond IB1 : INFILTRATION BASIN

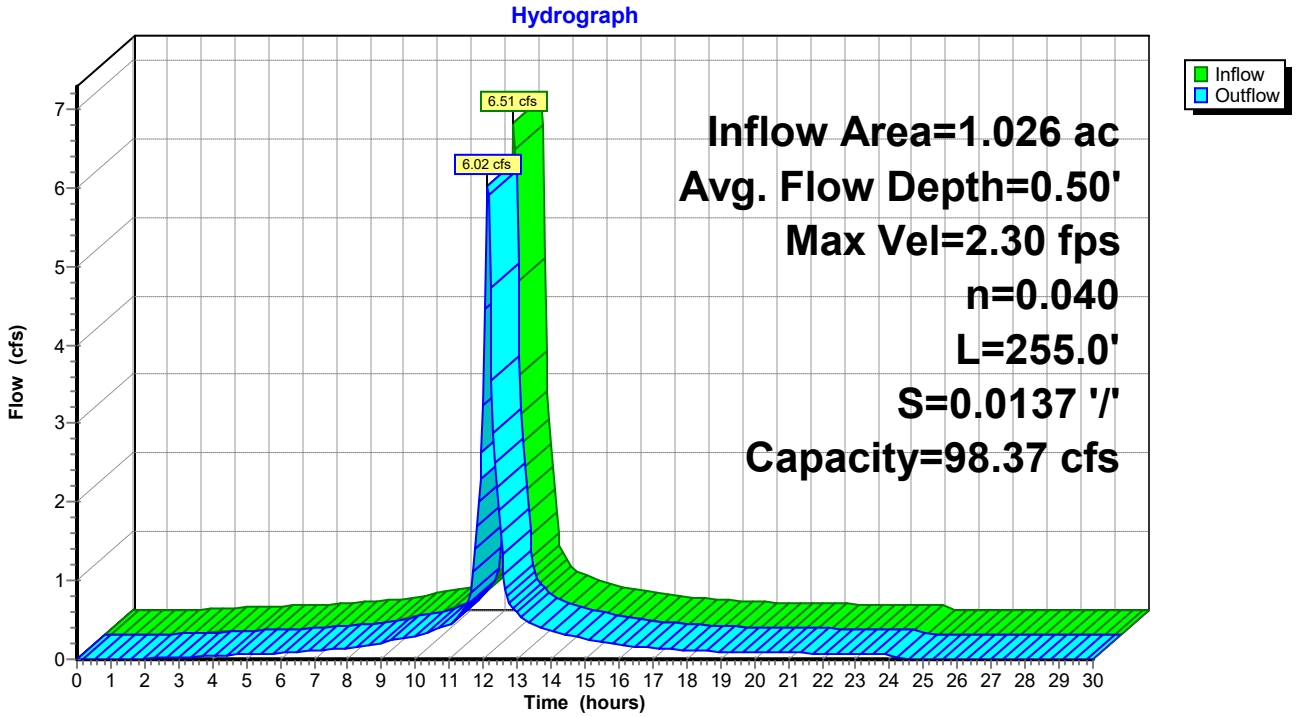
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.30 fps, Min. Travel Time= 1.8 min
Avg. Velocity = 0.62 fps, Avg. Travel Time= 6.8 min

Peak Storage= 700 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.50' , Surface Width= 7.00'
Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 98.37 cfs

4.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 255.0' Slope= 0.0137 '/'
Inlet Invert= 208.00', Outlet Invert= 204.50'

‡

Reach SW1: TO INFIL BASIN#1



Summary for Pond IB1: INFILTRATION BASIN

[63] Warning: Exceeded Reach DCB4 INLET depth by 1.23' @ 12.70 hrs
[63] Warning: Exceeded Reach DMH2 INLET depth by 1.89' @ 12.70 hrs
[62] Hint: Exceeded Reach SW1 OUTLET depth by 2.07' @ 12.70 hrs
[64] Warning: Exceeded Reach SW1 outlet bank by 0.23' @ 12.62 hrs

Inflow Area = 4.431 ac, 23.66% Impervious, Inflow Depth = 5.17" for 100-Year event
Inflow = 22.51 cfs @ 12.10 hrs, Volume= 1.910 af
Outflow = 3.37 cfs @ 12.62 hrs, Volume= 1.910 af, Atten= 85%, Lag= 31.1 min
Discarded = 3.37 cfs @ 12.62 hrs, Volume= 1.910 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach DP1 : RIVER (SOUTHWEST

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 206.73' @ 12.62 hrs Surf.Area= 11,849 sf Storage= 31,271 cf

Plug-Flow detention time= 93.7 min calculated for 1.906 af (100% of inflow)
Center-of-Mass det. time= 93.5 min (854.4 - 760.9)

Volume	Invert	Avail.Storage	Storage Description
#1	202.50'	64,106 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

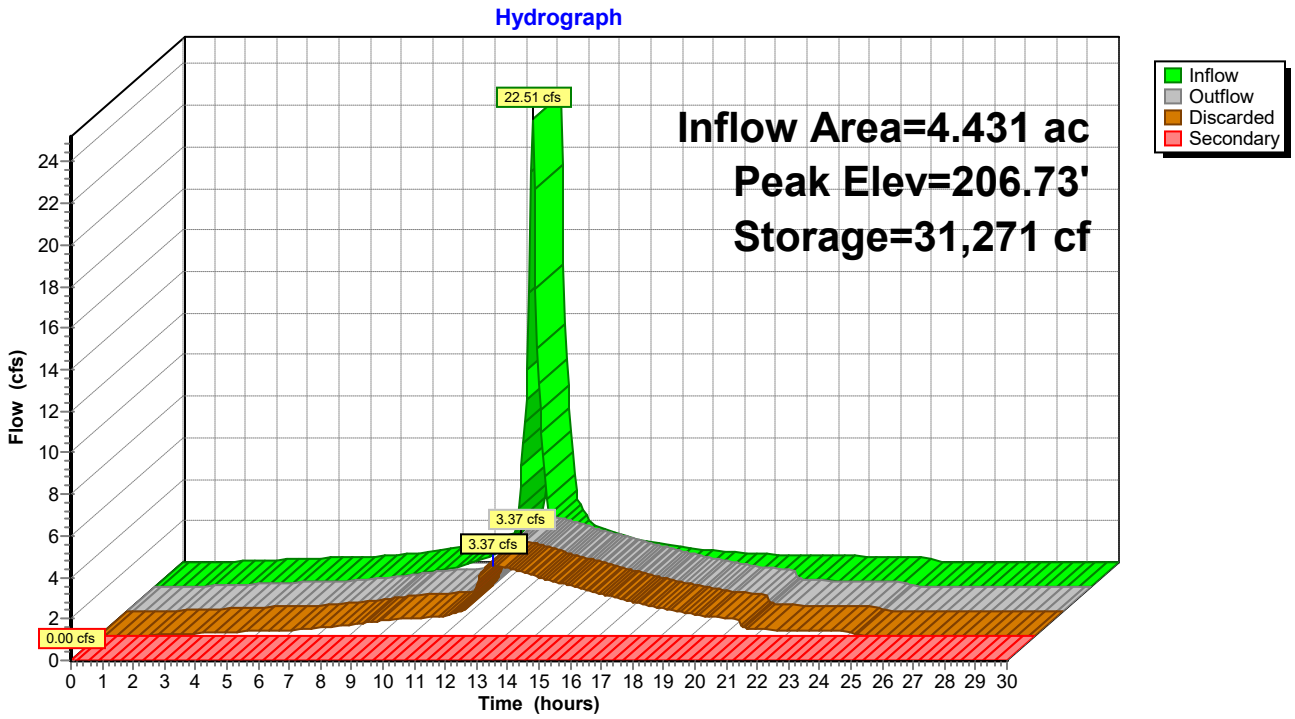
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
202.50	3,998	0	0
203.00	4,458	2,114	2,114
204.00	6,067	5,263	7,377
206.00	9,887	15,954	23,331
208.00	15,259	25,146	48,477
209.00	16,000	15,630	64,106

Device	Routing	Invert	Outlet Devices
#1	Discarded	202.50'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 197.70'
#2	Secondary	208.00'	**10.0' long + 3.0 '/' SideZ x 10.0' breadth Broad-Crested Rectangular Weir** 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

Discarded OutFlow Max=3.37 cfs @ 12.62 hrs HW=206.73' (Free Discharge)
↑—**1=Exfiltration** (Controls 3.37 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=202.50' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond IB1: INFILTRATION BASIN



3.0
STORMWATER MANAGEMENT FORMS

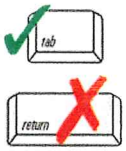
Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

EXCLUDING MUNICIPAL DRAINAGE SYTEM

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

EXCLUDING MUNICIPAL DRAINAGE SYTEM

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.

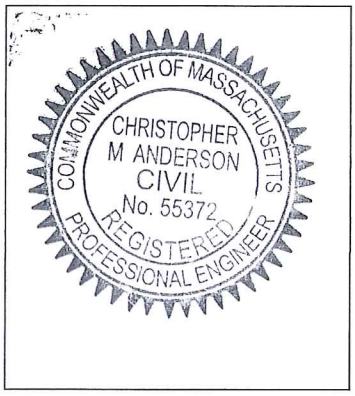
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



10-31-2023

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

EXCLUDING MUNICIPAL DRAINAGE SYTEM

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): Deep-Sump Catchbasin, Infiltration Basin, Sediment Forebays

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

EXCLUDING MUNICIPAL DRAINAGE SYTEM

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 no exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

☒ Recharge BMPs have been sized to infiltrate the Required Recharge V olume.

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

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

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

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

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

Checklist for Stormwater Report

EXCLUDING MUNICIPAL DRAINAGE SYTEM

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

EXCLUDING MUNICIPAL DRAINAGE SYTEM

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs) (*NOT APPLICABLE*)

☐ 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 (NOT APPLICABLE)

☐ 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

EXCLUDING MUNICIPAL DRAINAGE SYTEM

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable (NOT APPLICABLE)

☐ *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 (NOT APPLICABLE)

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.

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

Checklist for Stormwater Report

EXCLUDING MUNICIPAL DRAINAGE SYTEM

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

65 Whites Pond Road, Stow, Massachusetts

June 14, 2023

Revised Through October 31, 2023

Standard 1: No Untreated Discharges or Erosion to Wetlands

The drainage from the site originally overland flowed the Assabet Brook that runs along the southerly limits of the property. As such the Brook has been determined to be Design Point #1 (DP#1) It is noted that within the last few years work has been performed within the property including movement of earth and removal of trees. The proposed work continues to utilize the same drainage pattern towards Assabet Brook. For the purposes of this review and design, the drainage patterns prior to the commencement of earth disturbing activities on the property were utilized to ensure a full review of current and future impacts upon the property. The proposed design utilizes a series of conveyance structures as well as an infiltration basin to capture runoff from the developed area. Upon the completion of construction, based on the hydrological calculations, the proposed basin will not experience a discharge up to and including the 100-year storm event. This insures that there are no untreated discharges nor erosion to the wetlands, as such compliance with Standard 1 is achieved.

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) to IB#1

Qmax=4.33 cfs (100-Year) Sp=12/12 ➔1.25 ft

L=1.8(4.33-5)/(1.0^1.5) + 10 ➔ -1.2 + 10 = 8.8 ➔ 10 feet (minimum)

W2=3(1.0) +0.7(10) ➔ 3.0+ 7 = 10.0 ➔ 10.0 feet

Provide an apron 10-feet long with a terminus width of 12 feet wide.

FE#1 discharges into Sediment Forebay #1, with a Width of approximately 12ft and length of 12ft

For 15-inch HDPE pipe (FE#2) to IB#1

Qmax=9.23 cfs (100-Year) Sp=15/12 ➔1.25 ft

L=1.8(9.23-5)/(1.25^1.5) + 10 ➔ 5.45 + 10 = 15.45 ➔ 16 feet

W2=3(1.25) +0.7(16) ➔ 3.75+ 11.2 = 14.95 ➔ 15.0 feet

Provide an apron 16-feet long with a terminus width of 15 feet wide.

FE#1 discharges into Sediment Forebay #1, with a Width of approximately 38ft and length of 16ft

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-	2.07	4.70	6.69	10.36
	Post-	1.75	4.24	6.13	9.54

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 . Compliance has been achieved.

Standard 3: Stormwater Recharge

Impervious Area Proposed: (This area includes all proposed buildings, driveways, etc.)

The soils within the reviewed project area classified as HSG A:
Existing Impervious HSG-A: 26,616 s.f.
Proposed Impervious HSG-A: 186,306 s.f.*
Net New Impervious HSG-A: 159,690 s.f.

**impervious calculations include gravel/regrind surface areas*

Existing Impervious HSG-B: 2,673 s.f.
Proposed Impervious HSG-B: 2,673 s.f.
Net New Impervious HSG-B: +00 s.f.

Total New Impervious area = +159,690 s.f.
Total Project Impervious = 168,548 s.f.

Required Recharge Volume:

Net Increase HSG Soil A

Net New Impervious HSG A= 159,690 s.f.
HSG A: 159,690 s.f. x (0.6 in/12) = 7,985 c.f.

Required Recharge Volume = 7,985 c.f.

Capture Rate:

Total Impervious to Infil Basin#1	166,048 sf
Net Captured Impervious	**166,048 sf**

Capture Rate = 166,048 s.f. / 168,548 s.f. = 98.5%

Compliance is provided, Capture rate in excess of 65%

Recharge Provided:
Total Volume Required: 7,985 c.f.

Infil Basin#1: 27,791 c.f. of Infiltration Volume provided *
27,791 c.f. of infiltration volume provided
**Recharge volume based on 1-Year Storm event infiltration volume.*

Required Recharge Volume = 7,985 c.f.
Provided Recharge Volume = 27,791 c.f.

Compliance is provided

Storage Volume Provided:

Volume below lowest outlet within detention facility, unless otherwise noted.

Infiltration Basin#1: 31,271 c.f. of storage volume provided. (100-year storage)

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)

Infiltration Basin #1: 31,271 c.f. of storage volume provided.
Time = 31,271 c.f. / (8.27 in/hr x (1 ft/ 12 in) x 3,998 s.f.) = **11.35 hrs**

Compliance is provided

Groundwater Offset Review:

Infiltration Basin #1

Deep #4 Review

Elevation of Test Area	= 207.8	
Presumed ESHWT	= 197.8	*ESHWT not observed (Bottom of Excavation @10')*
Bottom of Basin	= 202.5	
Offset to Groundwater	= 4.7 ft	*<4ft, No Mounding analysis req'd*

Compliance provided offset greater than 4.0 feet

Deep #5 Review

Elevation of Test Area	= 207.5	
Presumed ESHWT	= 197.5	*ESHWT not observed (Bottom of Excavation @10')*
Bottom of Basin	= 202.5	
Offset to Groundwater	= 5.0 ft	*<4ft, No Mounding analysis req'd*

Compliance provided offset greater than 4.0 feet

Standard 4: Water Quality

Water Quality Volume (WQV) = Water Quality Depth x Impervious Area

Water Quality Depth = 1 inch
WQV = [(1 inch) / 12 inches/foot] x (168,548 s.f.) = 14,045 cf

The project has been designed to incorporate a series of structural Best Management Practices (BMPs) in order to achieve the appropriate level of Water Quality Treatment. Runoff from within the development will be captured via deep-sump catchbasin which will direct runoff towards one of several drainage trunklines. These trunklines will then direct runoff towards the proposed infiltration basin which will be fitted with a sediment forebay designed to accommodate the anticipated impervious areas. Additionally the collection swale that runs along the westerly perimeter around the site will be lined with a stone bottom with checkdams provided every 50-feet in order to reduce stormwater velocity and allow for sediment drop-out along its length. Prior to reach the infiltration basin the swale will also discharge into a sediment forebay for additional treatment. The treatment trains have been designed to provide in excess of the required 80% TSS removal with a total treatment volume of approximately 27,791 c.f. based on the infiltration volume during the 1-year storm event. Reference is made to the provided TSS Removal Forms for each specific discharge point.

Forebay Sizing

Forebay #1:

Contributing Impervious Area	=	95,760 square feet +/-	
Water Quality Inlet Sizing	=	0.1" volume over contributing area	
	=	0.1"/12 x 95,760 square feet	
	=	798 ft^3	(Required Volume)
Volume Provided within Forebay #1:			
	=	839 ft^3	(Provided Volume)

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.

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: INFITLRATION BASIN#1

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Catchbasin	0.25	1.00	0.25	0.75
INFILTRAITON BASIN WITH SEDIMENT FOREBAY	0.80	0.75	0.60	0.15

Total TSS Removal = 85%

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

Project: MONEYBROOK FARM

Prepared By: Hannigan Engineering, Inc.

Date: 6/14/2023

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

Summary for Pond IB1: INFILTRATION BASIN

[62] Hint: Exceeded Reach DCB4 OUTLET depth by 1.47' @ 12.60 hrs
[62] Hint: Exceeded Reach DMH2 OUTLET depth by 1.51' @ 12.60 hrs

Inflow Area = 4.431 ac, 23.66% Impervious, Inflow Depth = 1.73" for 1-Year event
Inflow = 7.79 cfs @ 12.10 hrs, Volume= 0.638 af
Outflow = 1.55 cfs @ 12.56 hrs, Volume= 0.638 af, Atten= 80%, Lag= 27.4 min
Discarded = 1.55 cfs @ 12.56 hrs, Volume= 0.638 af <=Recharge Volume
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach DP1 : RIVER (SOUTHWEST

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 204.17' @ 12.56 hrs Surf.Area= 6,385 sf Storage= 8,412 cf

Plug-Flow detention time= 42.5 min calculated for 0.637 af (100% of inflow)
Center-of-Mass det. time= 42.4 min (822.9 - 780.5)

Volume	Invert	Avail.Storage	Storage Description
#1	202.50'	64,106 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
202.50	3,998	0	0
203.00	4,458	2,114	2,114
204.00	6,067	5,263	7,377
206.00	9,887	15,954	23,331
208.00	15,259	25,146	48,477
209.00	16,000	15,630	64,106

Device	Routing	Invert	Outlet Devices
#1	Discarded	202.50'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 197.70'
#2	Secondary	208.00'	**10.0' long + 3.0 '/' SideZ x 10.0' breadth Broad-Crested Rectangular Weir** 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

Discarded OutFlow Max=1.55 cfs @ 12.56 hrs HW=204.17' (Free Discharge)
↑└**1=Exfiltration** (Controls 1.55 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=202.50' (Free Discharge)
↑└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond IB1: INFILTRATION BASIN

[63] Warning: Exceeded Reach DCB4 INLET depth by 1.23' @ 12.70 hrs
[63] Warning: Exceeded Reach DMH2 INLET depth by 1.89' @ 12.70 hrs
[62] Hint: Exceeded Reach SW1 OUTLET depth by 2.07' @ 12.70 hrs
[64] Warning: Exceeded Reach SW1 outlet bank by 0.23' @ 12.62 hrs

Inflow Area = 4.431 ac, 23.66% Impervious, Inflow Depth = 5.17" for 100-Year event
Inflow = 22.51 cfs @ 12.10 hrs, Volume= 1.910 af
Outflow = 3.37 cfs @ 12.62 hrs, Volume= 1.910 af, Atten= 85%, Lag= 31.1 min
Discarded = 3.37 cfs @ 12.62 hrs, Volume= 1.910 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach DP1 : RIVER (SOUTHWEST

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 206.73' @ 12.62 hrs Surf.Area= 11,849 sf Storage= 31,271 cf <=Drawdown/Storage Volume

Plug-Flow detention time= 93.7 min calculated for 1.906 af (100% of inflow)
Center-of-Mass det. time= 93.5 min (854.4 - 760.9)

Volume	Invert	Avail.Storage	Storage Description
#1	202.50'	64,106 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
202.50	3,998	0	0
203.00	4,458	2,114	2,114
204.00	6,067	5,263	7,377
206.00	9,887	15,954	23,331
208.00	15,259	25,146	48,477
209.00	16,000	15,630	64,106

Device	Routing	Invert	Outlet Devices
#1	Discarded	202.50'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 197.70'
#2	Secondary	208.00'	**10.0' long + 3.0 '/' SideZ x 10.0' breadth Broad-Crested Rectangular Weir**
			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

Discarded OutFlow Max=3.37 cfs @ 12.62 hrs HW=206.73' (Free Discharge)
↑**1=Exfiltration** (Controls 3.37 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=202.50' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

3.1
OPERATION AND MAINTENANCE

STORMWATER OPERATION, MAINTENANCE AND POLLUTION PREVENTION PLAN

Money Brook Farm
#65 Whites Pond Road
Stow, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:
Money Brook Farm, LLC
6 Sandy Brook Drive
Stow, MA 01775
978-760-1882

RESPONSIBLE PARTY POST CONSTRUCTION:
Money Brook Farm, LLC
6 Sandy Brook Drive
Stow, MA 01775
978-760-1882

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 (Volume1: 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. Roads and parking lots shall be swept at least twice per year and on a more frequent basis depending on sanding operations. All resulting sweepings shall be collected and properly disposed of off-site in accordance with MADEP and other applicable requirements.

3. Accumulated sediment shall be removed a minimum of one time per year by means of a clamshell bucket or equivalent from the bottom of the deep sump catch basins and manhole. Disposal of accumulated sediment and pollutants must be in accordance with local, state, and federal guidelines and requirements.

4. All resulting sweepings or sediment removed from catch basins, and manhole connections shall be collected and properly disposed of off-site in accordance with MADEP and other applicable requirements.

5. Reference to this Operation and Maintenance Plan will be made within the chain of title by reference or recorded within the initial deed transfer if this is to occur prior to construction. This Plan shall be followed by subsequent landowners as required and amended by the Massachusetts Department of Environmental Protection's Stormwater Management Regulations.

6. It shall be the responsibility of the land owner to ensure that the Operation and Maintenance of all stormwater structures is performed as outlined in the provided Maintenance Schedule and to provide full funding of the required tasks.

7. **Maintenance Schedule**

Structure Type	Inspection	Maintenance	Task	Cost Estimate	Owner
Deep Sump Catchbasin	Quarterly and at the end of the foliage and snow removal seasons	Quarterly, or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe	Clean/Remove Debris and Sediment	$1,000* *($1,000/Year)*	Land Owner
Rip/Rap Aprons	Every 2 Years	Every 10 Years	Clean/Add Stone	$500* *($50/Year)*	Land Owner
Infiltration Basin	Monthly (May-Oct)	Monthly (May-Oct)	Mow Grass Areas	$600* *($600/Year)*	Land Owner
Outfall Structures	Every 2 Years	Every 10 Years	Clean/Add stone	$50* *($50/Year)*	Land Owner
	Total Annual Estimated Cost			$1,700/Year	Land Owner

NOTES:

*Cost estimate per RS Means: Site work & Landscape Cost Data, Includes Mobilization, Material and Installation costs for work

LONG TERM POLLUTION PREVENTION PLAN

1. Access drives to the site shall be swept on an annual basis with a commercial cleaning unit. Any sediment removed shall be disposed of in accordance with applicable local and state requirements.

2. Trash and other debris shall be removed from the drives 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.

3. 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.

4. 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

5. Grass shall be maintained at a minimum blade height of two to three inches and only 1/3 of the plant height shall be removed at a time.

6. The use of pesticides will be kept at a level consistent with typical residential use. Where possible mechanical methods (i.e. pest traps) or biological methods (i.e. beneficial insects) of pest control shall be implemented.

7. Herbicide treatment shall be performed by ***licensed applicator only***, and be consistent with recommend treatment rates per State requirements or Manufacturer specifications, whichever be more stringent.

8. Pet waste shall be disposed of in accordance with local regulations. Pet waste shall not be disposed of in a storm drain or catch basin.

9. All chemically based materials (i.e. pesticides, herbicides, de-icing chemicals, etc…) shall be stored within an enclosed shelter and not exposed to the weather. All such materials shall also be stored per the manufacturer requirements or recommendations.

10. Vehicles shall be stored in designated or within sheltered areas, including carports and/or garages. All carports and vehicle storage areas shall have an appropriate Spill Response Kit provided, in the case of spillage.

11. All Vehicles or equipment shall be maintained and in good working order, to ensure there are no significant leaks on a regular basis. In the even of minor/periodic leaking appropriate containment features shall be provided for, including and not limited to capture trays and/or buckets.

12. The industrial holding tank shall be inspected on a regular basis and pumped as necessary per the requirements of 314 CMR 18.000.

13. There shall be no outdoor washing or rinsing of vehicles or equipment permissible on the property.

Inspection Log

Money Brook Farm
#65 Whites Pond Road, Stow, Massachusetts

DATE	ACTION	RESULT	PERFORMED BY

Maintenance Log

Money Brook Farm
#65 Whites Pond Road, Stow, Massachusetts

DATE	ACTION	PERFORMED BY

3.2
SOIL EVALUATION LOGS

Commonwealth of Massachusetts
City/Town of

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

Stow Board of Health
JUN 06 2016
RECEIVED

A. Facility Information

Harold J. Hanson
Owner Name

65 White Pond Road — OOR-29 000073
Street Address — Map/Lot #

Stow — MA — 01775
City — State — Zip Code

B. Site Information

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

2. Soil Survey Available? ☒ Yes ☐ No If yes: Web Soil Survey (Source) — 254B (Soil Map Unit)

Merrimac fine sandy loam (Soil Name) — N/A (Soil Limitations)

Loamy glaciofluvial deposits over sandy and gravelly glaciofluvial deposits (Geologic/Parent Material) — Kames, eskers, moraines, outwash terraces (Landform)

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

4. Flood Rate Insurance Map

Above the 500-year flood boundary? ☒ Yes ☐ No Within the 100-year flood boundary? ☐ Yes ☐ No
If Yes, continue to #5.

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No MassGIS Wetland Data Layer: — (Wetland Type)

7. Current Water Resource Conditions (USGS): 05/2016 (Month/Year) Range: ☐ Above Normal ☐ Normal ☒ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of

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

C. On-Site Review (continued)

Deep Observation Hole Number: TP-1

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-6	Ap	10YR3/2	-	-	-	SL	-	-	M	F	
6-18	Bw	10YR5/6	-	-	-	LS	-	-	M	F	
18-36	C1	10YR 4/4	-	-	-	Sand	10%	-	SG	Loose	
36-120	C2	10YR 5/3	-	-	-	Sand	-	-	SG	Loose	

Additional Notes:

No GW
No redox
No weeping

Commonwealth of Massachusetts
City/Town of

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

C. On-Site Review (continued)

Deep Observation Hole Number: TP-2

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-9	A_p	10YR 3/2	-	-	-	SL	-	-	M	F	
9-26	B	10YR 5/6	-	-	-	LS	-	-	M	F	
26-44	C_1	10YR 4/4	-	-	-	Sand	10%	-	SG	Loose	
44-120	C_2	10YR 5/2	-	-	-	Sand	-	-	SG	Loose	

Additional Notes:

No GW
No redox
No weeping

Commonwealth of Massachusetts
City/Town of

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

C. On-Site Review (continued)

Deep Observation Hole Number: TP-3

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-9	Ap	10YR 3/2	-	-	-	SL	-	-	M	F	
9-27	Bw	10 YR 5/6	-	-	-	LS	-	-	M	F	
27-36	C1	10 YR 4/4	-	-	-	Sand	10%	-	SG	Loose	
36-120	C2	10YR 5/2	-	-	-	Sand	-	-	SG	Loose	

Additional Notes:

No GW
No Weeping
No redox

Commonwealth of Massachusetts
City/Town of

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

C. On-Site Review (continued)

Deep Observation Hole Number: TP-4

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-36	Fill	-	-	-	-	—	-	-	—	—	
36-120	C	10 YR 5/2	-	-	-	Sand	-	-	SG	Loose	

Additional Notes:

No GW
No Weeping
No Redox

Commonwealth of Massachusetts
City/Town of

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

C. On-Site Review (continued)

Deep Observation Hole Number: TP-5

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-32	Fill	-	-	-	-	-	-	-	-	-	
32-60	Bw	10YR 5/6	-	-	-	LS	-	-	M	F	
60-120	C	10YR 5/2	-	-	-	Sand	10%	-	SG	Loose	

Additional Notes:

No GW

No Weeping

No redox

Commonwealth of Massachusetts
City/Town of

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

C. On-Site Review (continued)

Deep Observation Hole Number: TP-6

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-9	Ap	10YR 3/2	-	-	-	SL	-	-	M	FR	
9-26	Bw	10YR 5/6	-	-	-	LS	-	-	M	FR	
26-41	C1	10YR 7/3	-	-	-	Fine Sand	-	-	SG	Loose	
41-120	C2	10YR 6/2	-	-	-	Sand	-	-	SG	Loose	

Additional Notes:

No GW
No Weeping
No Redox

Commonwealth of Massachusetts
City/Town of

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

C. On-Site Review (continued)

Deep Observation Hole Number: TP-7

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-9	A_p	10YR 3/2	-	-	-	SL	-	-	M	F	
9-24	Bw	10YR 5/6	-	-	-	LS	-	-	M	F	
24-40	C_1	10YR 4/4	-	-	-	Sand	10%	-	SG	Loose	
40-120	C_2	10YR 5/2				Sand	-	-	SG	Loose	

Additional Notes:

No GW
No Weeping
No Redox

Commonwealth of Massachusetts
City/Town of

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

F. Board of Health Witness

Kalene Gendron
Name of Board of Health Witness

Nashoba Associated
Board of Health

G. Soil Evaluator Certification

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

Daniel Carr
Signature of Soil Evaluator

5/31/2016
Date

Daniel Carr / SE 13801
Typed or Printed Name of Soil Evaluator/ License #

7/1/2018
Expiration Date of License

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

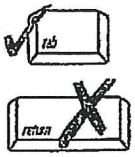
Commonwealth of Massachusetts
City/Town of

Percolation Test

Form 12

Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

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



A. Site Information

Harold J. Hanson
Owner Name

65 White Pond Road
Street Address or Lot #

Stow | MA | 01775
City/Town | State | Zip Code

Contact Person (if different from Owner) | Telephone Number

B. Test Results

	Date 5/31/16 Time	Date 5/31/16 Time
Observation Hole #	PT-1	PT-2 | PT-3
Depth of Perc	48"	54" | 58"
Start Pre-Soak	11:25	11:45 | 12:05
End Pre-Soak	11:40	12:00 | 12:20
Time at 12"	Unable	Unable | Unable
Time at 9"	to	to | to
Time at 6"	Presoak	Presoak | Presoak
Time (9"-6")		
Rate (Min./Inch)	<2mpi	<2mpi | <2mpi
Test Passed:	☑	☑ | ☑
Test Failed:	☐	☐ | ☐

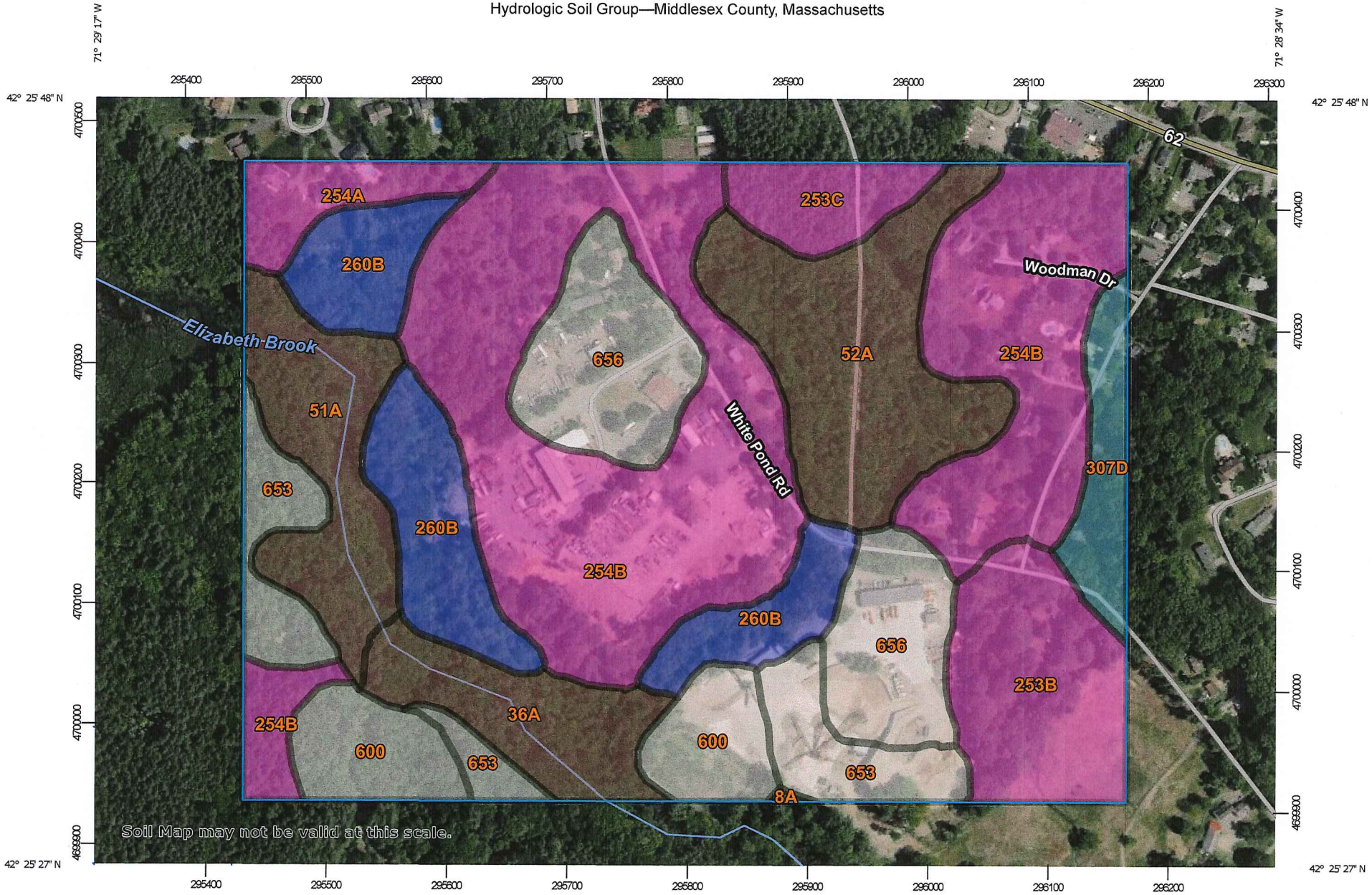
Dan Carr
Test Performed By:

Kaleb Gordon
Board of Health Witness

Comments:

FIGURE 1
LOCUS MAP AND SOILS MAP

Hydrologic Soil Group—Middlesex County, Massachusetts



Map Scale: 1:4,490 if printed on A landscape (11" x 8.5") sheet.

N

0 50 100 200 300 Meters

0 200 400 800 1200 Feet

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

MAP LEGEND

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

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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: Middlesex County, Massachusetts
Survey Area Data: Version 22, Sep 9, 2022

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

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

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8A	Limerick silt loam, 0 to 3 percent slopes, frequently flooded	B/D	0.1	0.1%
36A	Saco mucky silt loam, frequently ponded, 0 to 1 percent slopes, frequently flooded	B/D	4.7	4.8%
51A	Swansea muck, 0 to 1 percent slopes	B/D	6.3	6.5%
52A	Freetown muck, 0 to 1 percent slopes	B/D	9.9	10.3%
253B	Hinckley loamy sand, 3 to 8 percent slopes	A	6.6	6.9%
253C	Hinckley loamy sand, 8 to 15 percent slopes	A	2.5	2.5%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	A	2.4	2.5%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	31.5	32.7%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	B	9.4	9.7%
307D	Paxton fine sandy loam, 15 to 25 percent slopes, extremely stony	C	2.7	2.8%
600	Pits, gravel		5.2	5.4%
653	Udorthents, sandy		6.0	6.2%
656	Udorthents-Urban land complex		9.4	9.7%
Totals for Area of Interest			**96.5**	**100.0%**

Description

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

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

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

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

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

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

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

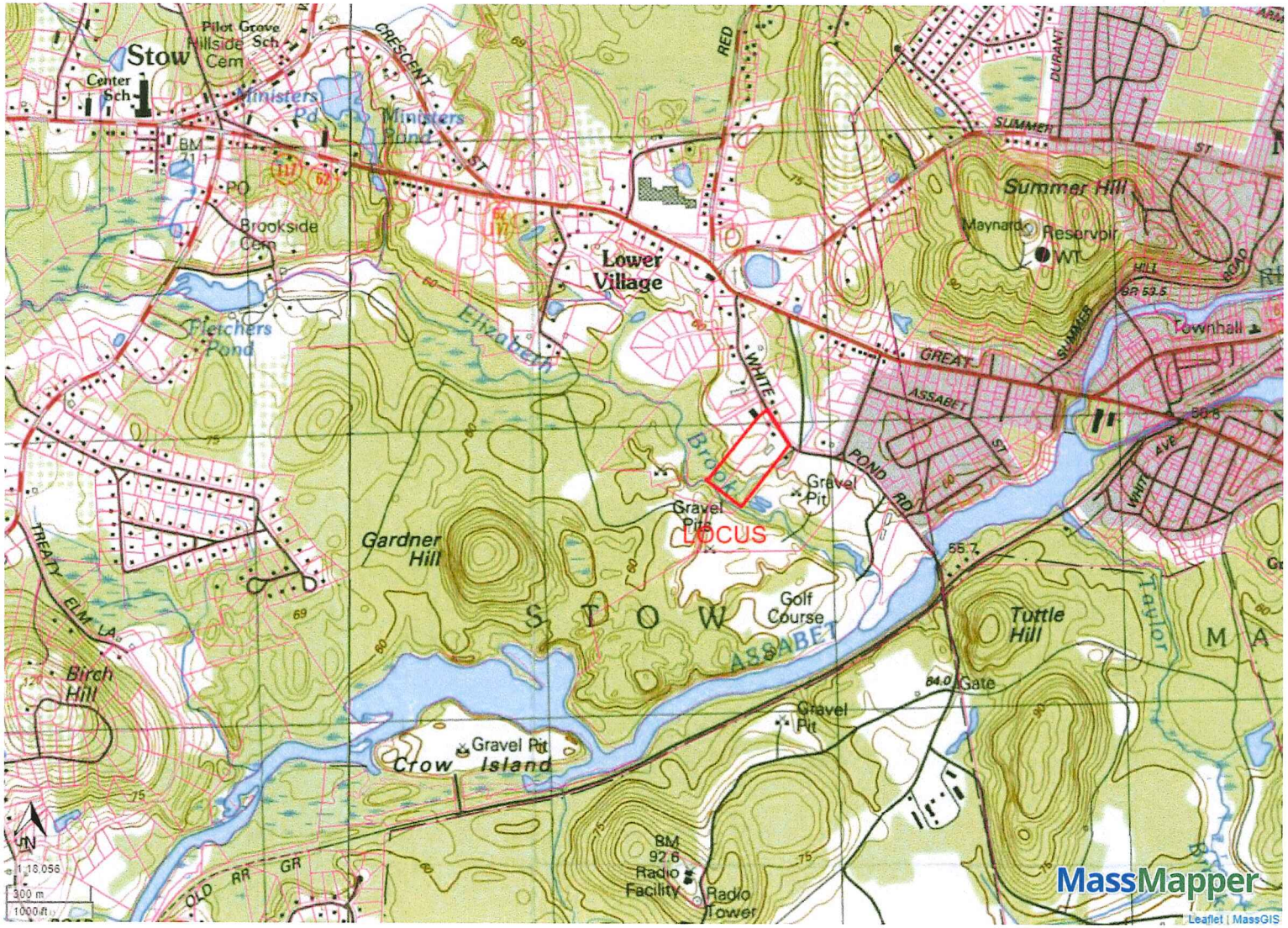
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

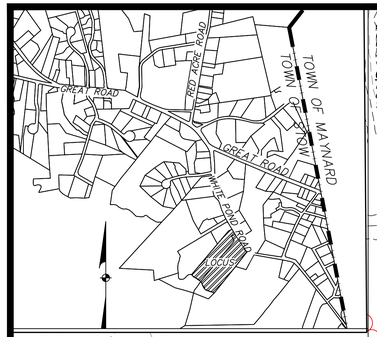
65 & 63 White Pond Road, Stow, MA



Property Tax Parcels

USGS Topographic Maps

FIGURE 2
PRE-DEVELOMPENT WATERSHED MAP



LOCUS MAP SCALE: 1" = 1200'

APPLICANT
BRANSFIELD TREE COMPANY
65 WHITE POND ROAD
STOW, MA 01775

OWNER
MONEY BROOK FARM, LLC
65 WHITE POND ROAD
STOW, MA 01775

PARKING CALCULATIONS
INDUSTRIAL USE (CONTRACTOR YARD)
1 SPACE PER 800 SF

4,000 SF / 800 SF = 5 SPACES
TOTAL SPACES REQUIRED = 5 SPACES
TOTAL SPACES PROVIDED = 24 SPACES

N/F
RONALD JAGIELLO
& KATHERINE JAGIELLO
TRUSTEES OF THE
J & K TRUST
BK. 21520-468
PLAN NO. 979 OF 1980
PARCEL A

N/F
BENJAMIN H. POULSON
& MARTIN E. WRIGHT, JR.
BK. 14360-79
PLAN NO. 1166 OF 1978
PARCEL X

N/F
MONEY BROOK FARM LLC
BK. 68258-348
PARCEL 1
PLAN NO. 1090 OF 1954

N/F
MONEY BROOK FARM LLC
BK. 68258-348
PARCEL 2

N/F
THE STOW CONSERVATION
COMMISSION
BK. 12215-518
PLAN NO. 605 OF 1972

N/F
TOWN OF STOW
CONSERVATION COMMISSION
BK. 72273-571
PLAN NO. 154 OF 2019
PARCEL A

N/F
J. MELONE & SONS, INC.
BK. 10389-234

N/F
J. MELONE & SONS, INC.
BK. 10235-58
PLAN NO. 154 OF 2019
LOT 1

N54°42'24"E 67.00'

N52°21'18"E ±940'

S22°55'36"E 290.78'

S50°51'46"W ±874'

WALTZ POND ROAD

SECONDARY DISTRICT
COMMERCIAL DISTRICT

APPROXIMATE ZONING
SECONDARY
RESIDENTIAL

TBM NAIL SET
IN UP-9
ELEV= 208.72'

UP-8/8
UP-9
UP-10
UP-10

E100

100FT RIVERFRONT AREA
200FT RIVERFRONT AREA
FLOOD PLAIN (ZONE A)
(DIGITIZED PER MASS GIS)
WETLAND LOCATION PER PLAN
BY STAMSKI & MCNARY DATED
JUNE 20, 2022.
BANK
BVW (CARON)
EXISTING STREAM
AHW (CARON)
(SEPT 23, 2022)

CEC-B-1 through CEC-B-20
CEC-A-1 through CEC-A-4
A-1 through A-20
OA-17 (C) through OA-21 (C)
AHW-1 through AHW-20

200'
190'
180'
210'

PROJECT INFORMATION

LAND INFORMATION

MAP/PARCEL:	29/72; 29/73
DEED BOOK/PAGE:	68258-348
COMBINED FRONTAGE:	459.44 FT
COMBINED AREA:	10.33 ACRES±

ZONING INFORMATION

ZONING DISTRICT: COMMERCIAL

DIMENSIONAL REQUIREMENTS:	REQUIRED	PROVIDED
MINIMUM AREA:	40,000 SF	10.33 AC±
MINIMUM FRONTAGE:	150 FEET	459.44 FT
MAXIMUM HEIGHT:	N/A	28.16 FT
MINIMUM SETBACKS:		
FRONT YARD:	50 FT	80.76FT
SIDE YARD:	25 FT*	172.64FT
REAR YARD:	25 FT*	800FT±
MINIMUM OPEN SPACE	30%	55%
FLOOR AREA RATIO	0.30	0.011

*50FT WHEN ABUTTING A RESIDENTIAL DISTRICT

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 SEPTEMBER OF 2022. VERTICAL DATUM BASED ON NAVD88.
2. AREAS SUBJECT TO PROTECTION UNDER THE WETLANDS PROTECTION ACT HAVE BEEN FIELD LOCATED IN SEPTEMBER 2022. 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 STOW 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 PROPERTY IS PARTLY WITHIN A 100 YEAR FLOOD PLAIN. THE AREA PROPOSED FOR DEVELOPMENT IS NOT WITHIN A 100 YEAR FLOOD PLAIN PER F.E.M.A. FIRM PANEL #25017C-0361F, DATED: JULY 7, 2014. 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 STOW.

HANNIGAN ENGINEERING, INC.
CIVIL ENGINEERS & LAND SURVEYORS

8 MONUMENT SQUARE (978) 534-1234 (T)
LEOMINSTER, MASSACHUSETTS 01453 (978) 534-6060 (F)
www.hanniganengineering.com

EXISTING WATERSHED PLAN IN STOW, MASSACHUSETTS

PREPARED FOR:
JONATHAN BRANSFIELD
MONEY BROOK FARM, LLC
65 WHITE POND ROAD
STOW, MASSACHUSETTS 01775
TEL: (978) 760-1882

GRAPHIC SCALE: 1"=40'
0 10 20 30 40 50 75 100 150 FEET
0 5 10 15 20 30 40 50 METERS

CALC: CMA/WDH	DRWN: CMA/WDH	SCALE: 1"=40'
CHKD: WDH	APPD: WDH	DATE: JUN 16,2023
SRV: JHG/HCM	FB: 78-62	JOB NO: 3136
TAB: (2) SDP	SHEET 1 OF 2	PLAN NO: D-1-22

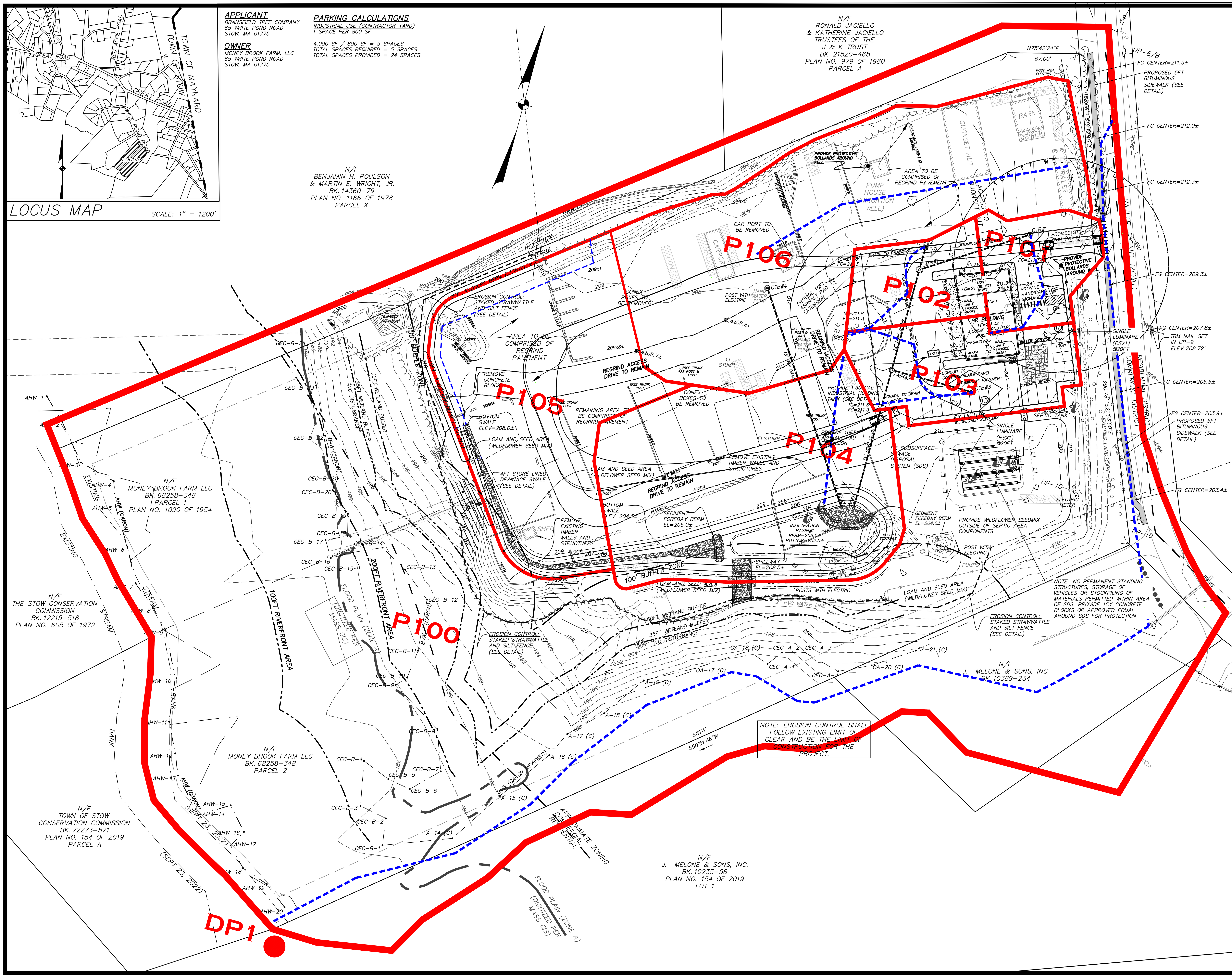
FIGURE 3
POST-DEVELOMPENT WATERSHED MAP

APPLICANT
BRANSFIELD TREE COMPANY
65 WHITE POND ROAD
STOW, MA 01775

OWNER
MONEY BROOK FARM, LLC
65 WHITE POND ROAD
STOW, MA 01775

PARKING CALCULATIONS
INDUSTRIAL USE (CONTRACTOR YARD)
1 SPACE PER 800 SF

4,000 SF / 800 SF = 5 SPACES
TOTAL SPACES REQUIRED = 5 SPACES
TOTAL SPACES PROVIDED = 24 SPACES


TOWN OF MAYNARD
GREAT ROAD
RED ACRE ROAD
WHITE POND ROAD
LOCUS
LOCUS MAP SCALE: 1" = 1200'
P100
P101
P102
P103
P104
P105
P106
DP1
N/F RONALD JAGIELLO & KATHERINE JAGIELLO TRUSTEES OF THE J & K TRUST BK. 21520-468 PLAN NO. 979 OF 1980 PARCEL A
N/F BENJAMIN H. POULSON & MARTIN E. WRIGHT, JR. BK. 14360-79 PLAN NO. 1166 OF 1978 PARCEL X
N/F MONEY BROOK FARM LLC BK. 68258-348 PARCEL 1 PLAN NO. 1090 OF 1954
N/F THE STOW CONSERVATION COMMISSION BK. 12215-518 PLAN NO. 605 OF 1972
N/F MONEY BROOK FARM LLC BK. 68258-348 PARCEL 2
N/F TOWN OF STOW CONSERVATION COMMISSION BK. 72273-571 PLAN NO. 154 OF 2019 PARCEL A
N/F J. MELONE & SONS, INC. BK. 10235-58 PLAN NO. 154 OF 2019 LOT 1
N/F J. MELONE & SONS, INC. BK. 10389-234
WHITE POND ROAD
100FT RIVERFRONT AREA
200FT RIVERFRONT AREA
50FT WETLAND BUFFER
35FT WETLAND BUFFER NO DISTURBANCE
100' BUFFER ZONE
FLOOD PLAIN (ZONE A) (DIGITIZED PER MASS GIS)
APPROXIMATE ZONING COMMERCIAL RESIDENTIAL
COMMERCIAL DISTRICT
RESIDENTIAL DISTRICT
N75°42'24"E 67.00'
S50°51'46"W ±874'
BARN
QUONSET HUT
PUMP HOUSE
PR BUILDING
AREA TO BE COMPRISED OF REGRIND PAVEMENT
REGRIND ACCESS DRIVE TO REMAIN
EROSION CONTROL: STAKED STRAWWATTLE AND SILT FENCE (SEE DETAIL)
INFILTRATION BASIN
SPILLWAY EL=208.5±
PR SUBSURFACE SEWAGE DISPOSAL SYSTEM (SDS)
LOAM AND SEED AREA (WILDFLOWER SEED MIX)
4FT STONE LINED DRAINAGE SWALE (SEE DETAIL)
NOTE: EROSION CONTROL SHALL FOLLOW EXISTING LIMIT OF CLEAR AND BE THE LIMIT OF CONSTRUCTION FOR THE PROJECT.
NOTE: NO PERMANENT STANDING STRUCTURES, STORAGE OF VEHICLES OR STOCKPILING OF MATERIALS PERMITTED WITHIN AREA OF SDS. PROVIDE 1CY CONCRETE BLOCKS OR APPROVED EQUAL AROUND SDS FOR PROTECTION
PROPOSED 5FT BITUMINOUS SIDEWALK (SEE DETAIL)
TBM NAIL SET IN UP-9 ELEV. 208.72'

PROJECT INFORMATION

LAND INFORMATION

MAP/PARCEL:	29/72; 29/73
DEED BOOK/PAGE:	68258-348
COMBINED FRONTAGE:	459.44 FT
COMBINED AREA:	10.33 ACRES±

ZONING INFORMATION

ZONING DISTRICT: COMMERCIAL

DIMENSIONAL REQUIREMENTS:	REQUIRED	PROVIDED
MINIMUM AREA:	40,000 SF	10.33 AC±
MINIMUM FRONTAGE:	150 FEET	459.44 FT
MAXIMUM HEIGHT:	N/A	28.16 FT
MINIMUM SETBACKS:		
FRONT YARD:	50 FT	80.76FT
SIDE YARD:	25 FT*	172.64FT
REAR YARD:	25 FT*	800FT±
MINIMUM OPEN SPACE	30%	55%
FLOOR AREA RATIO	0.30	0.011

*50FT WHEN ABUTTING A RESIDENTIAL DISTRICT

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 SEPTEMBER OF 2022. VERTICAL DATUM BASED ON NAVD88.
2. AREAS SUBJECT TO PROTECTION UNDER THE WETLANDS PROTECTION ACT HAVE BEEN FIELD LOCATED IN SEPTEMBER 2022. 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 STOW 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 PROPERTY IS PARTLY WITHIN A 100 YEAR FLOOD PLAIN. THE AREA PROPOSED FOR DEVELOPMENT IS NOT WITHIN A 100 YEAR FLOOD PLAIN PER F.E.M.A. FIRM PANEL #25017C-0361F, DATED: JULY 7, 2014. 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 STOW.

HANNIGAN ENGINEERING, INC.
CIVIL ENGINEERS & LAND SURVEYORS

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(978) 534-6060 (F)

PROPOSED WATERSHED PLAN IN STOW, MASSACHUSETTS

PREPARED FOR:
JONATHAN BRANSFIELD
MONEY BROOK FARM, LLC
65 WHITE POND ROAD
STOW, MASSACHUSETTS 01775
TEL: (978) 760-1882

GRAPHIC SCALE: 1"=40'

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