STORMWATER MANAGEMENT REPORT

16 Fencourt Avenue
Randolph, MA

Prepared For:
Taj Estates of Randolph II, LLC
16 Fencourt Avenue
Randolph, MA 02368

Prepared By:

HARDY + MAN DESIGN GROUP, PC
CIVIL ENGINEERING & LAND DEVELOPMENT CONSULTING

Hardy + Man Design Group, PC
1285 Washington Street
Weymouth, MA 02189

September 16, 2022
Revised May 25, 2023

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Existing Site Conditions

The existing Lot is a 7.1± acres parcel of land located at Fencourt Avenue between the Union Street and Center Street. The parcel is currently containing an old office building which will be demolished. The existing parking spaces and paved roadways will be removed and redesigned.

The topography of the site slopes from the North edge of the lot towards multiple directions. The high point of the site is at elevation 142.5 (NAVD 88). The elevation drops to 133 at the entrance of the site and the boundary of the wetlands to the rear of the site. Please reference to the existing condition watershed map for the stormwater routes.

According to soil report information and multiple on-site soil test pits results, the type of soil for infiltration is Loamy Sand/Coarse Sand, infiltration rate of 2.41 in/hr is uses for stormwater analysis.

Methodology

This hydrologic analysis will utilize TR-55/TR-20 methodology and the analysis shall be performed for the 2, 10, 25 and 100-year design storms under pre-development and post-development conditions. The specified design storms shall be defined as a 24-hour storm using the most recent rainfall distribution recommended by the National Oceanic and Atmospheric Administration Atlas 14, as amended. See table below for the rainfall distribution used for this analysis.

	1-yr	2-yr	10-yr	25-yr	100-yr
Rainfall (inch)	2.80	3.20	4.70	5.50	6.70

Proposed Conditions

The applicant proposes the construction of three buildings, including one mix-use building with ground floor daycare center and upper floor residential units, two residential buildings. Appropriate roadway and parking lot will be constructed.

The proposed gross impervious coverage on the site will increase from 64,489 SF to 148,455 SF, resulting in 83,966 SF of new impervious area.

The proposed impervious areas consist of the buildings, parking areas, walkway, and drive aisles. Runoff from the proposed impervious areas will be collected and routed to a series of Catch Basins along the roadway and routed to (4) separate Infiltration Systems composed of 9,130 R-Tank SD systems. The proposed infiltration systems are proposing to provide treatment to the stormwater with appropriate pre-treatment process/structures.

The R-Tank systems and surrounding stone will provide a total 30,327 cubic feet of storage and were designed to decrease the existing peak flowrates and runoff volume for the 2-year, 10-year, 25-year, and 100-year rainfall events.

The following table depicts the peak runoff for the existing and proposed conditions for the four different storm events.

Peak Discharge Rates (cfs)

Pre-Development Runoffs:

Design Points	2-year	10-year	25-year	100-year
Area #1 (To Fencourt Ave)	**1.27**	**2.87**	**3.81**	**5.29**
Area #2 (To Wetland)	**0.05**	**0.88**	**1.86**	**3.96**
Area #3 (To 12" RCP)	**0.00**	**0.14**	**0.39**	**1.00**
Total	**1.32**	**3.89**	**6.06**	**10.25**

Post-Development Runoffs:

Note: The post-development discharge rates were taken from HydroCAD report hydrograph routing using the primary (cfs) excluded soil exfiltration (discarded).

Design Points	Discharge Areas	2-Year	10-Year	25-Year	100-Year
Area #1 (To Fencourt Ave)	Infiltration System 1	0.00	0.13	0.51	1.07
	Subcatchment 7S	0.01	0.12	0.23	0.41
Area #2 (To Wetland)	Infiltration System 2	0.00	0.00	0.05	0.48
	Infiltration System 3	0.00	0.48	0.82	1.39
	Infiltration System 4	0.00	0.36	0.74	1.28
	Subcatchment 6S	0.01	0.22	0.59	1.57
Area #3 (To 12" RCP)	Subcatchment 5S	0.00	0.01	0.02	0.07
Total		**0.02**	**1.32**	**2.96**	**6.27**

Comparison at Design Points:

Design Points	Comparison	2-Year	10-Year	25-Year	100-Year
Area #1 (To Fencourt Ave)	Existing Conditions	1.27	2.87	3.81	5.29
	Proposed Conditions	0.01	0.25	0.74	1.48
Area #2 (To Wetland)	Existing Conditions	0.05	0.88	1.86	3.96
	Proposed Conditions	0.01	1.06	2.20	4.72
Area #3 (To 12" RCP)	Existing Conditions	0.00	0.14	0.39	1.00
	Proposed Conditions	0.00	0.01	0.02	0.07

Comparison Pre-Development and Post-Development Rates of Runoffs:

	2-year	10-year	25-year	100-year
Existing Conditions	**1.32**	**3.89**	**6.06**	**10.25**
Proposed Conditions	**0.02**	**1.32**	**2.96**	**6.27**

Erosion and Sedimentation Control Measures

Erosion control measures to be employed include a staked "Filter Sock" erosion control barrier as depicted in the site plan. The barrier shall be inspected daily and be kept in place until such time that disturbed areas are re-vegetated or paved and are no longer a potential source of siltation.

TSS Removal Calculation

TSS removal rate for Catch Basin = 25%

TSS removal rate for Stormceptor 450i = 80%

Typical Treatment Chain

BMP For Infiltration System #1, #2, #3, #4	Removal Rate	Remaining TSS	Total Removal Effectiveness
Catch Basin	**25%**	**75%**	**25%**
Stormceptor 450i	**80%**	**15%**	**60%**
Infiltration System	**80% (with Above Pre-treatment)**	**3%**	**97%**

Conclusion

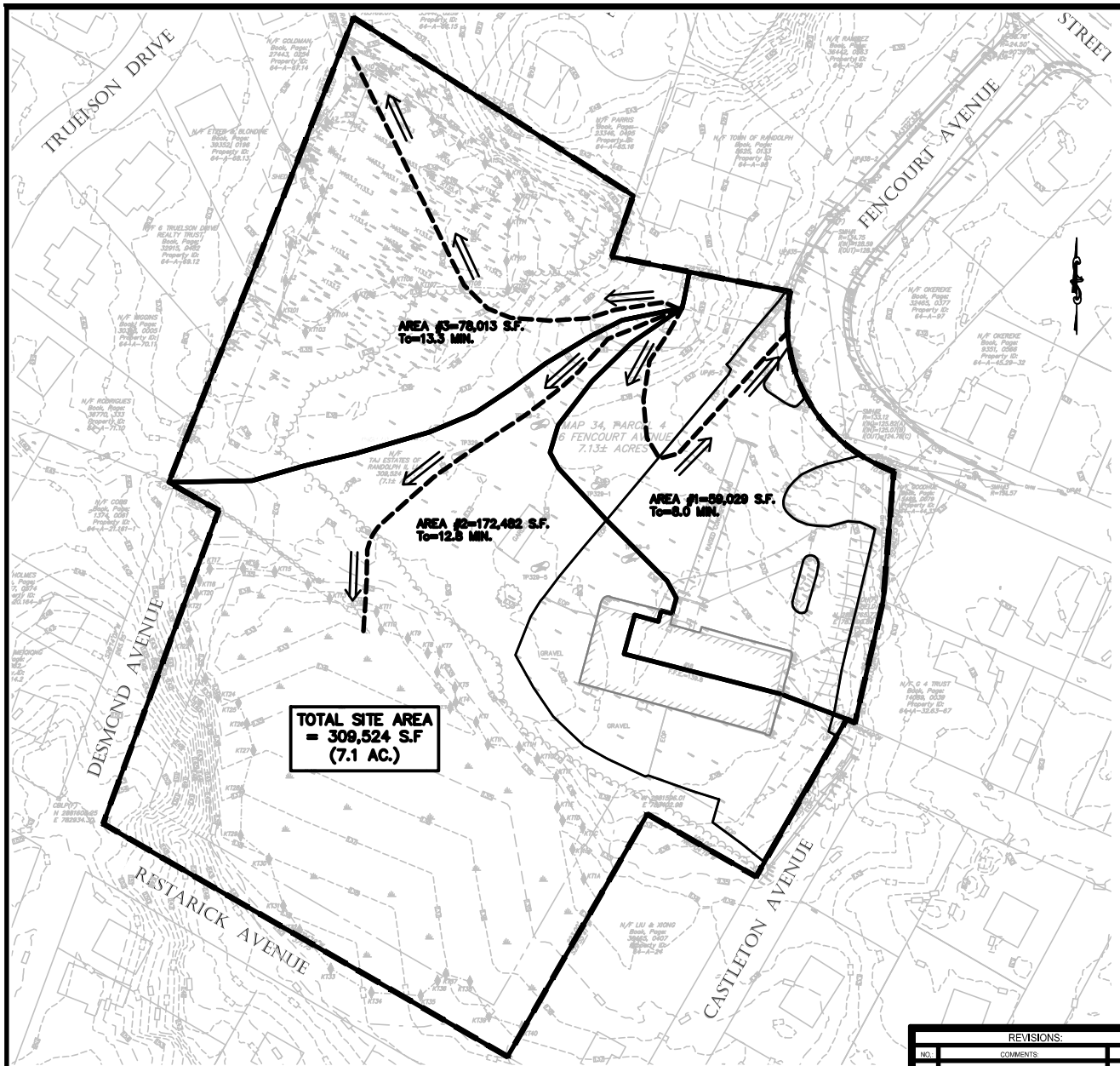
The stormwater management system will reduce the stormwater runoff flowrate by providing on-site infiltration systems. This R-Tank systems have been sized to decrease existing peak flowrates for the 2-year, 10-year, 25-year, and 100-year rainfall events.

During construction, the proposed erosion control measures protect sedimentation from construction activities from migrating from the site onto the public street and abutting properties.

The proposed stormwater management and erosion control design of the proposed development will meet the Town of Randolph Stormwater Regulations.

Pre-Development Calculations

2, 10, 25, and 100-Year Storms



PRE-DEVELOPMENT WATERSHEDS	
	AREA (S.F.)
BUILDING/ROOF	9,908
BITUMINOUS AND CONCRETE PAVEMENT	54,581
GRASS/OPEN SPACE	245,035
TOTAL LOT AREA	309,524 S.F. (7.10 AC.)

PRE-DEVELOPMENT WATERSHEDS - AREAS			
	IMPERVIOUS	GRASS/OPEN SPACE	TOTAL
AREA #1	36,006	23,023	59,029 S.F.
AREA #2	28,483	143,999	172,482 S.F.
AREA #3	0	78,013	78,013 S.F.
TOTAL AREA	64,489 S.F.	245,035 S.F.	309,524 S.F.

REVISIONS:

NO.	COMMENTS:	DATE:

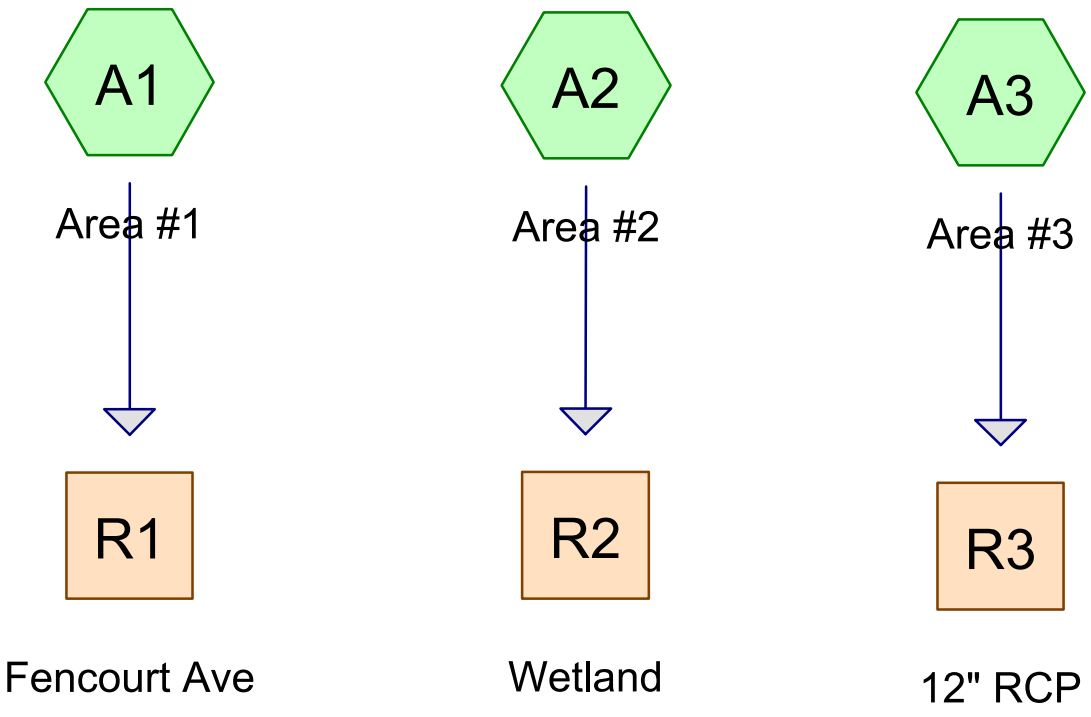
EXISTING WATERSHED MAP
16 Fencourt Ave
RANDOLPH, MASSACHUSETTS

HARDY - MAN DESIGN GROUP, PC
CIVIL ENGINEERING & LAND DEVELOPMENT CONSULTING
1285 WASHINGTON STREET
WEYMOUTH, MA
(781) 335-1464

DRAWN BY: JKY
DESIGNED BY: CYM
CHECKED BY: CYM
DATE: 9-09-2022
LATEST REVISION:
SCALE: 1" = 40'

PREPARED FOR:
PERMITTING

SHEET
EW-1



Subcat Reach Pond Link

Routing Diagram for 16 Fencourt Avenue-existing 2yr storm
Prepared by {enter your company name here}, Printed 9/9/2022

Time span=0.00-40.00 hrs, dt=0.02 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A1: Area #1 Runoff Area=59,029 sf 61.00% Impervious Runoff Depth=0.93"
Flow Length=272' Tc=8.0 min CN=72 Runoff=1.27 cfs 0.105 af

Subcatchment A2: Area #2 Runoff Area=172,482 sf 16.51% Impervious Runoff Depth=0.09"
Flow Length=384' Tc=12.8 min UI Adjusted CN=48 Runoff=0.05 cfs 0.030 af

Subcatchment A3: Area #3 Runoff Area=78,013 sf 0.00% Impervious Runoff Depth=0.02"
Flow Length=384' Slope=0.0250 '/' Tc=13.3 min CN=43 Runoff=0.00 cfs 0.003 af

Reach R1: Fencourt Ave Inflow=1.27 cfs 0.105 af
Outflow=1.27 cfs 0.105 af

Reach R2: Wetland Inflow=0.05 cfs 0.030 af
Outflow=0.05 cfs 0.030 af

Reach R3: 12" RCP Inflow=0.00 cfs 0.003 af
Outflow=0.00 cfs 0.003 af

Total Runoff Area = 7.106 ac Runoff Volume = 0.138 af Average Runoff Depth = 0.23"
79.17% Pervious = 5.625 ac 20.83% Impervious = 1.480 ac

Summary for Subcatchment A1: Area #1

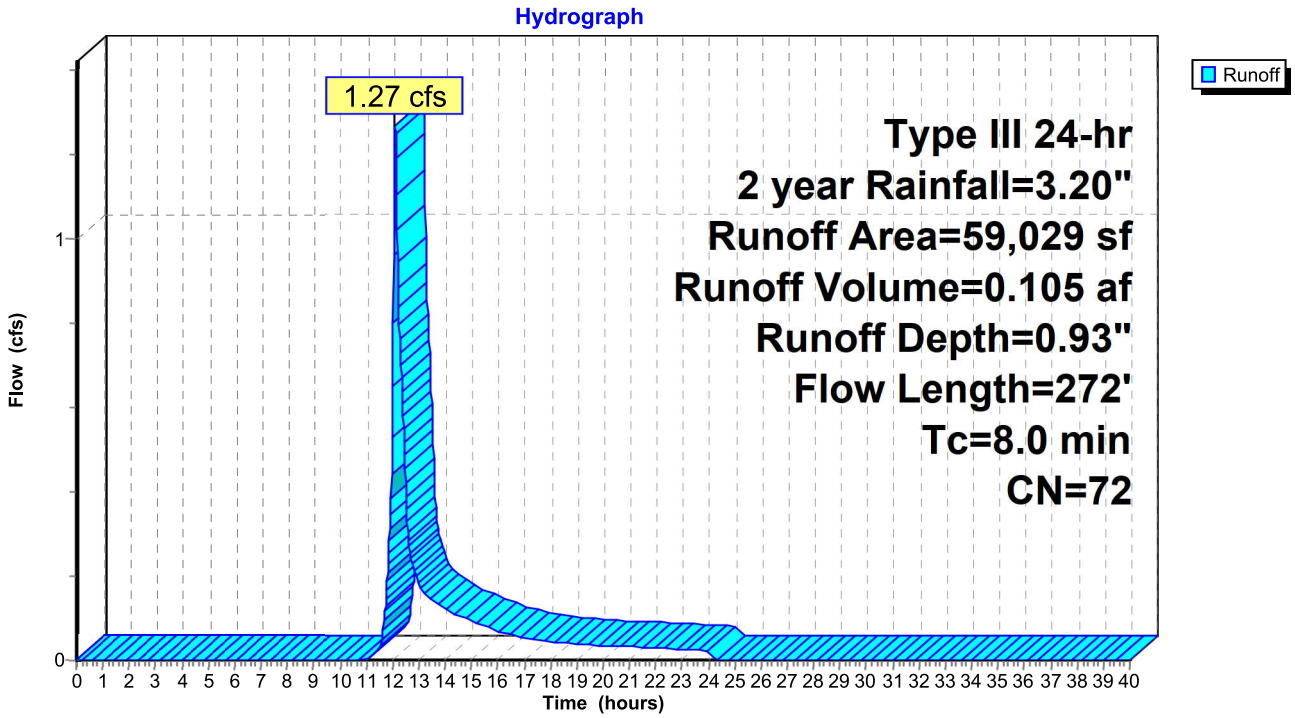
Runoff = 1.27 cfs @ 12.13 hrs, Volume= 0.105 af, Depth= 0.93"
Routed to Reach R1 : Fencourt Ave

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (sf)	CN	Description
36,006	98	Unconnected pavement, HSG A
23,023	32	Woods/grass comb., Good, HSG A
59,029	72	Weighted Average
23,023		39.00% Pervious Area
36,006		61.00% Impervious Area
36,006		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0500	0.25		**Sheet Flow, Grass** Grass: Short n= 0.150 P2= 3.20"
1.2	172	0.0140	2.40		**Shallow Concentrated Flow, Paved** Paved Kv= 20.3 fps
8.0	272	Total			

Subcatchment A1: Area #1



Summary for Subcatchment A2: Area #2

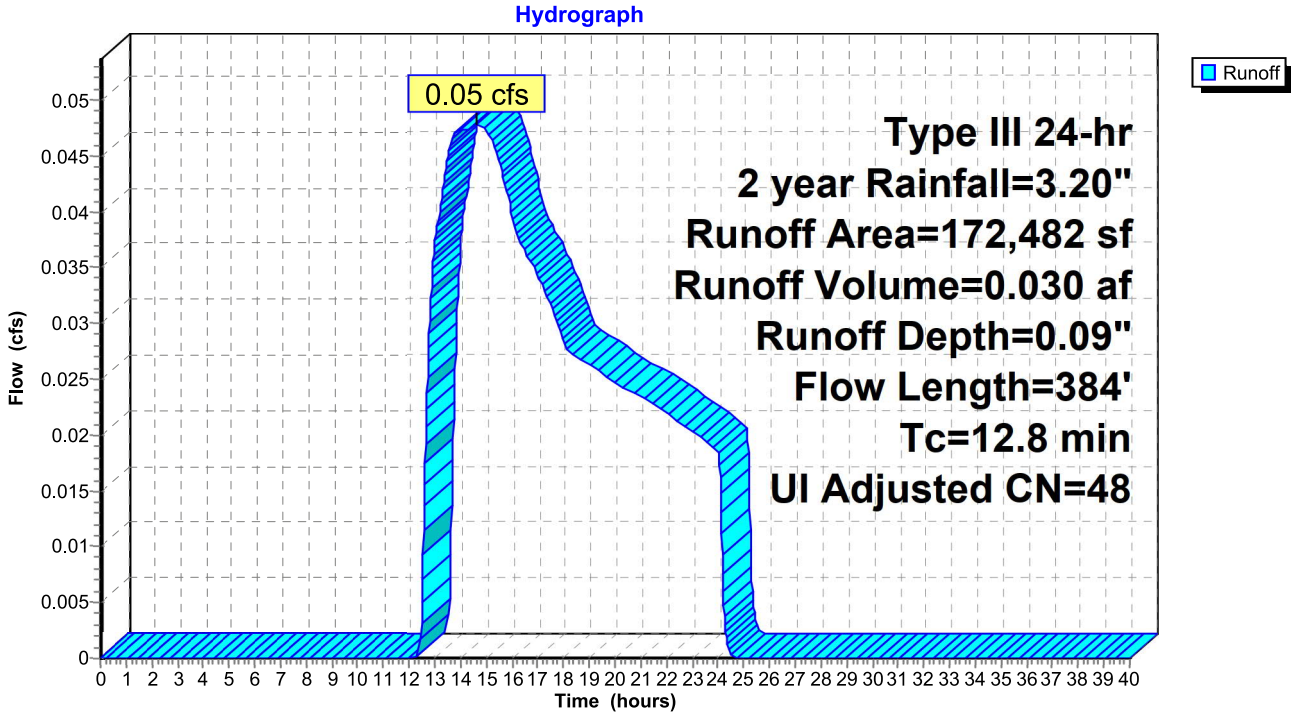
Runoff = 0.05 cfs @ 14.65 hrs, Volume= 0.030 af, Depth= 0.09"
Routed to Reach R2 : Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (sf)	CN	Adj	Description
143,999	43		Woods/grass comb., Fair, HSG A
28,483	98		Unconnected pavement, HSG A
172,482	52	48	Weighted Average, UI Adjusted
143,999			83.49% Pervious Area
28,483			16.51% Impervious Area
28,483			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0300	0.20		**Sheet Flow, Grass** Grass: Short n= 0.150 P2= 3.20"
4.5	284	0.0230	1.06		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
12.8	384	Total			

Subcatchment A2: Area #2



Summary for Subcatchment A3: Area #3

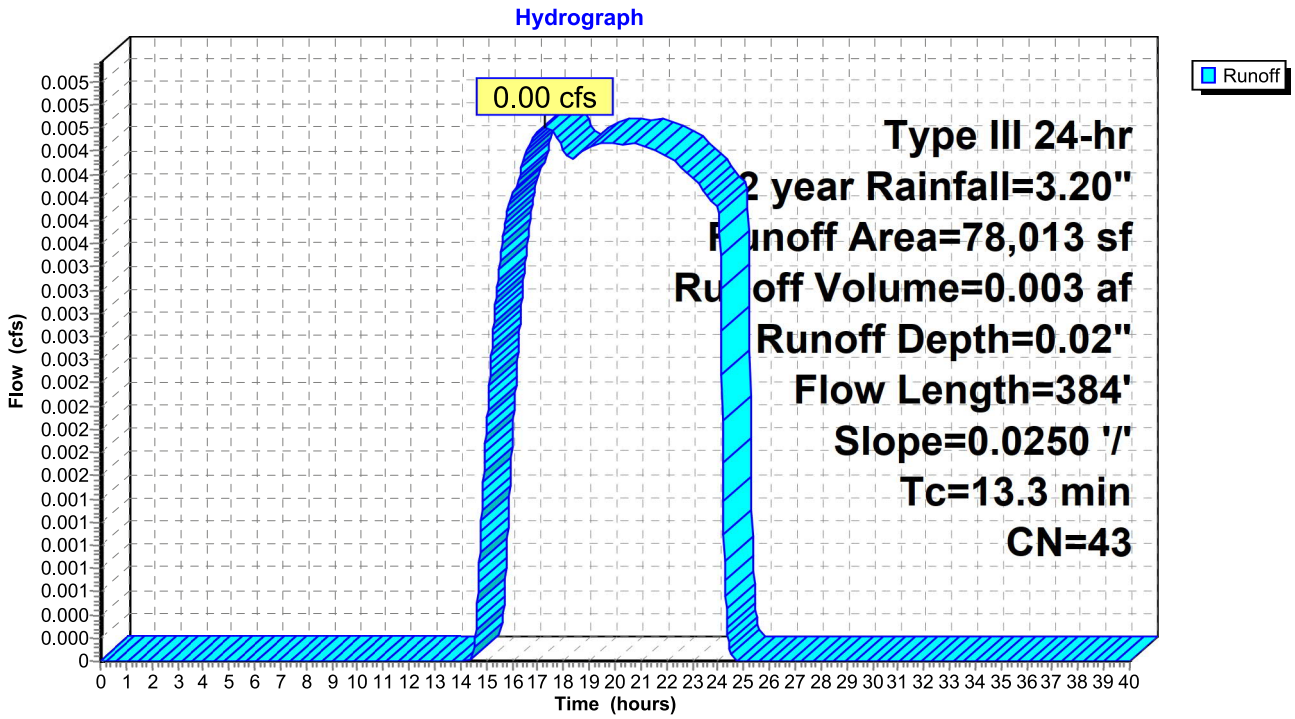
Runoff = 0.00 cfs @ 17.29 hrs, Volume= 0.003 af, Depth= 0.02"
Routed to Reach R3 : 12" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (sf)	CN	Description
78,013	43	Woods/grass comb., Fair, HSG A
78,013		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	100	0.0250	0.19		**Sheet Flow, Grass** Grass: Short n= 0.150 P2= 3.20"
4.3	284	0.0250	1.11		**Shallow Concentrated Flow, Weed and Marsh** Short Grass Pasture Kv= 7.0 fps
13.3	384	Total			

Subcatchment A3: Area #3



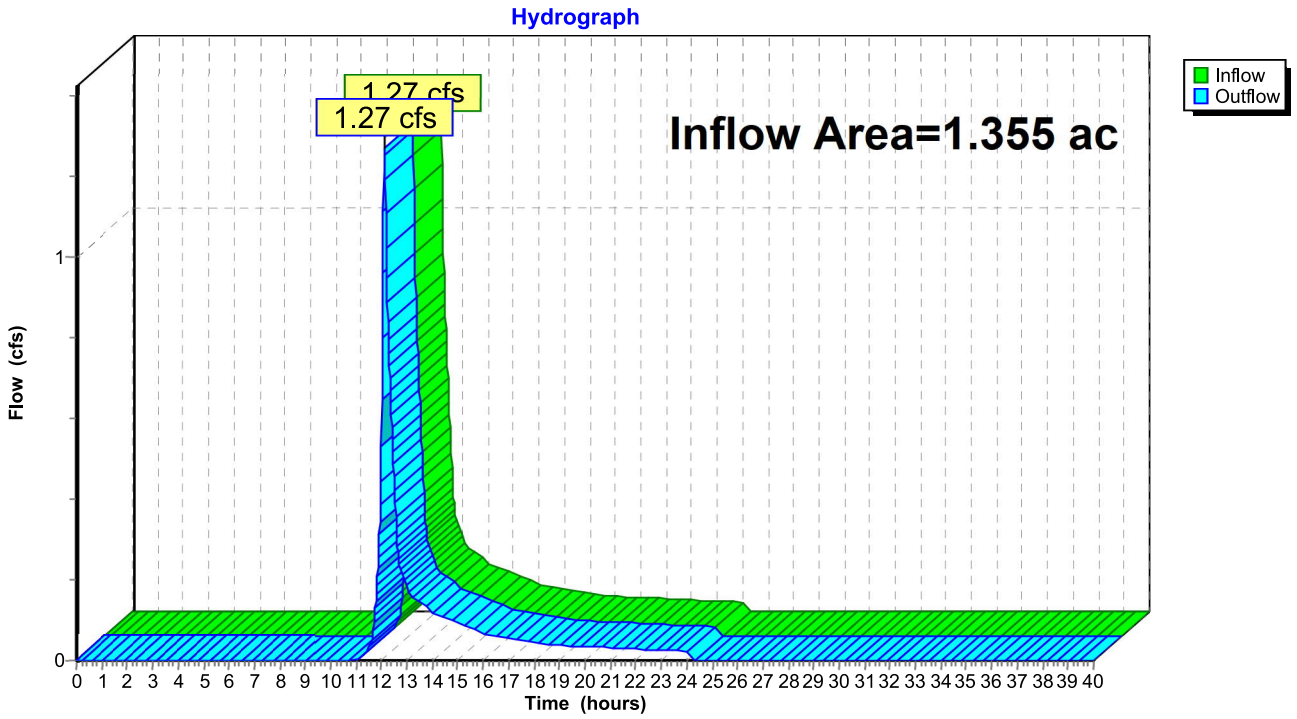
Summary for Reach R1: Fencourt Ave

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

Inflow Area = 1.355 ac, 61.00% Impervious, Inflow Depth = 0.93" for 2 year event
Inflow = 1.27 cfs @ 12.13 hrs, Volume= 0.105 af
Outflow = 1.27 cfs @ 12.13 hrs, Volume= 0.105 af, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node T

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs

Reach R1: Fencourt Ave



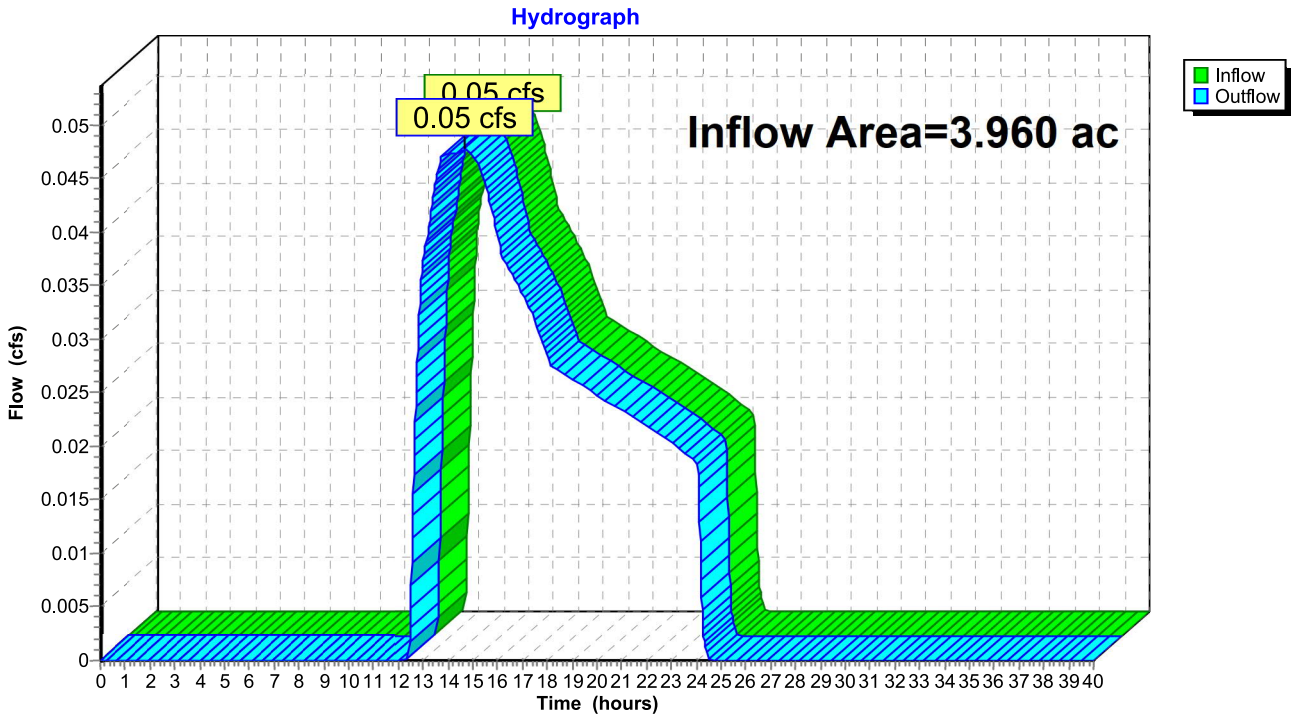
Summary for Reach R2: Wetland

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

Inflow Area = 3.960 ac, 16.51% Impervious, Inflow Depth = 0.09" for 2 year event
Inflow = 0.05 cfs @ 14.65 hrs, Volume= 0.030 af
Outflow = 0.05 cfs @ 14.65 hrs, Volume= 0.030 af, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node T

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs

Reach R2: Wetland

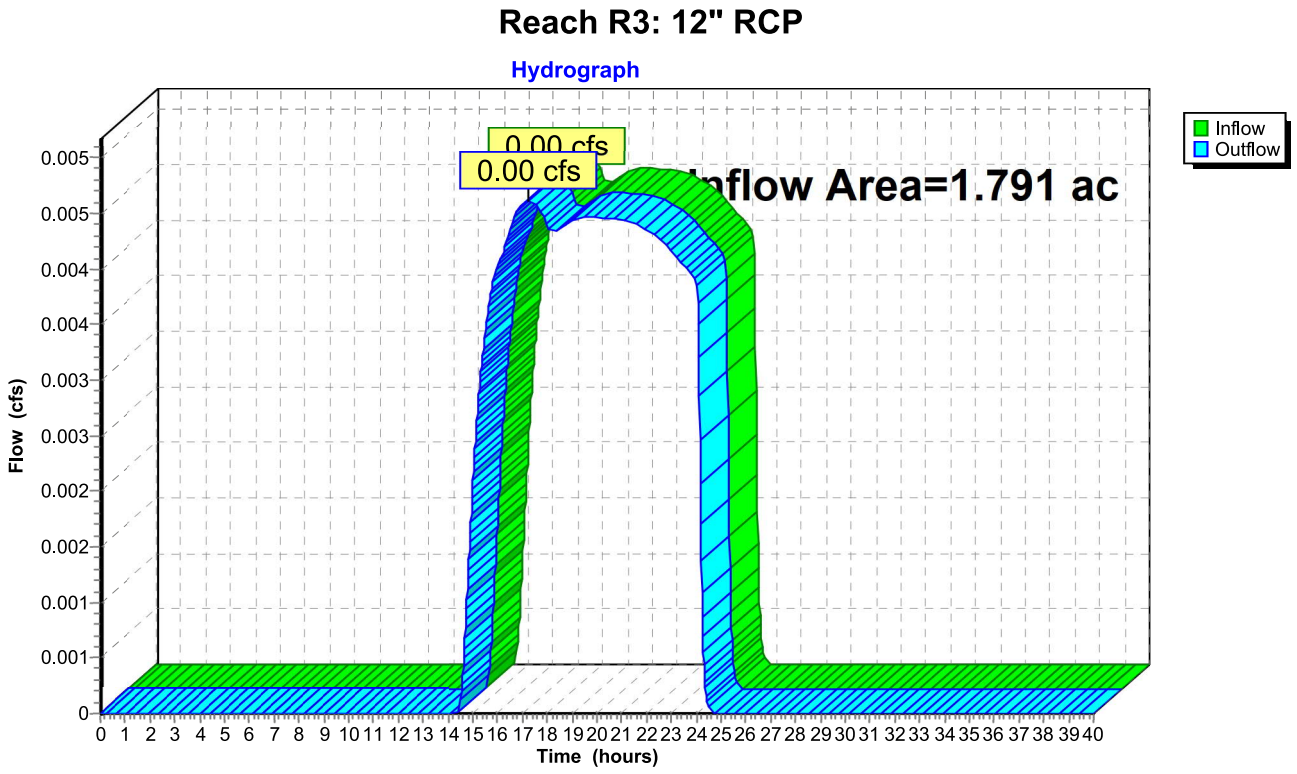


Summary for Reach R3: 12" RCP

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

Inflow Area = 1.791 ac, 0.00% Impervious, Inflow Depth = 0.02" for 2 year event
Inflow = 0.00 cfs @ 17.29 hrs, Volume= 0.003 af
Outflow = 0.00 cfs @ 17.29 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node T

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs



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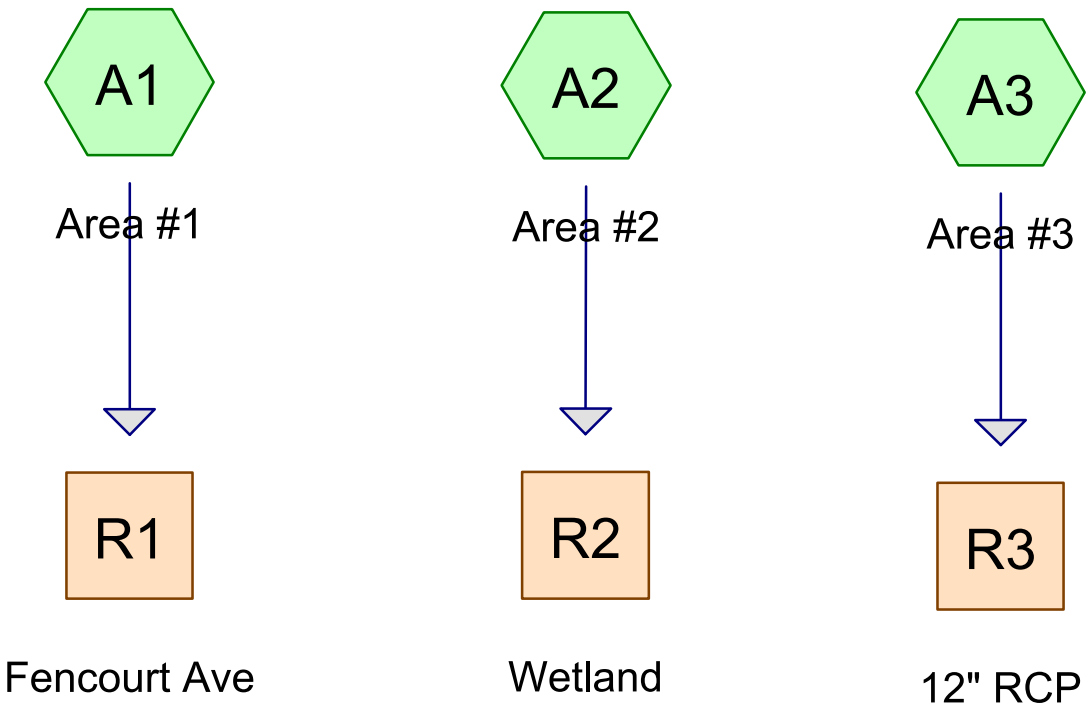


Subcat Reach Pond Link

Routing Diagram for 16 Fencourt Avenue-existing 10yr storm
Prepared by {enter your company name here}, Printed 9/9/2022

Time span=0.00-40.00 hrs, dt=0.02 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A1: Area #1 Runoff Area=59,029 sf 61.00% Impervious Runoff Depth=1.97"
Flow Length=272' Tc=8.0 min CN=72 Runoff=2.87 cfs 0.222 af

Subcatchment A2: Area #2 Runoff Area=172,482 sf 16.51% Impervious Runoff Depth=0.48"
Flow Length=384' Tc=12.8 min UI Adjusted CN=48 Runoff=0.88 cfs 0.158 af

Subcatchment A3: Area #3 Runoff Area=78,013 sf 0.00% Impervious Runoff Depth=0.27"
Flow Length=384' Slope=0.0250 '/' Tc=13.3 min CN=43 Runoff=0.14 cfs 0.041 af

Reach R1: Fencourt Ave Inflow=2.87 cfs 0.222 af
Outflow=2.87 cfs 0.222 af

Reach R2: Wetland Inflow=0.88 cfs 0.158 af
Outflow=0.88 cfs 0.158 af

Reach R3: 12" RCP Inflow=0.14 cfs 0.041 af
Outflow=0.14 cfs 0.041 af

Total Runoff Area = 7.106 ac Runoff Volume = 0.422 af Average Runoff Depth = 0.71"
79.17% Pervious = 5.625 ac 20.83% Impervious = 1.480 ac

Summary for Subcatchment A1: Area #1

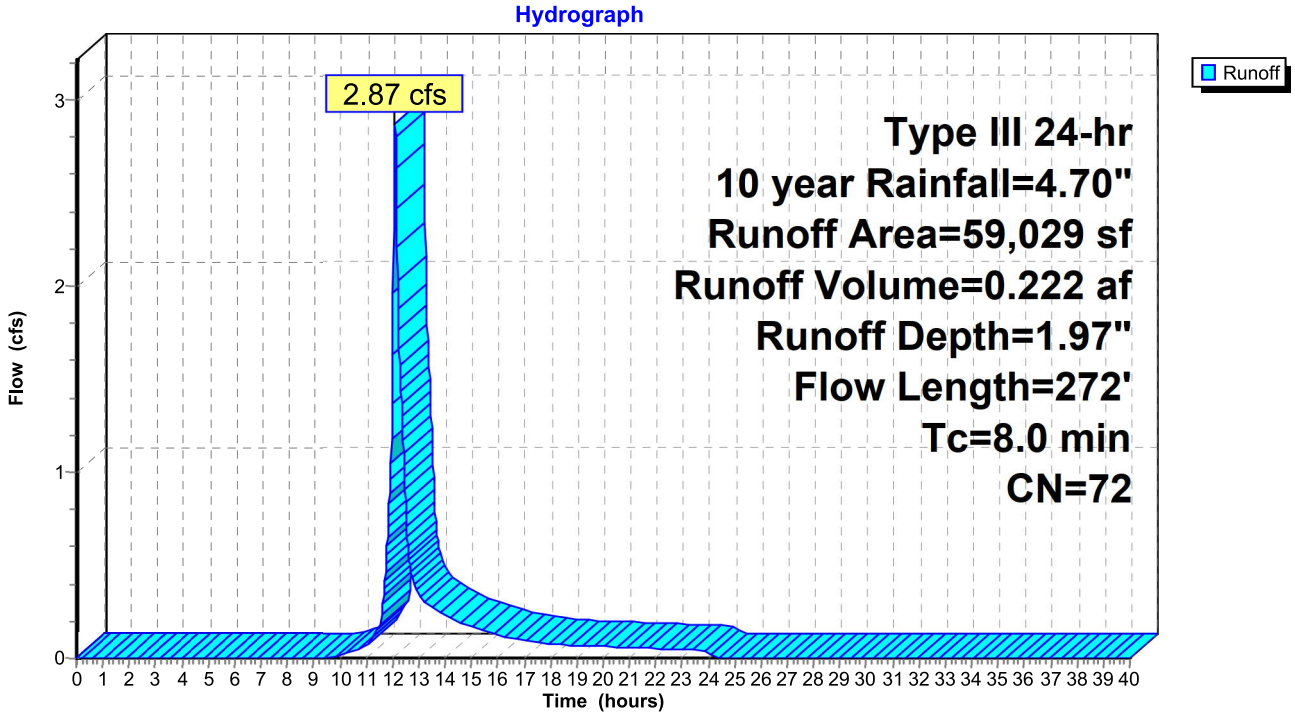
Runoff = 2.87 cfs @ 12.12 hrs, Volume= 0.222 af, Depth= 1.97"
Routed to Reach R1 : Fencourt Ave

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 10 year Rainfall=4.70"

Area (sf)	CN	Description
36,006	98	Unconnected pavement, HSG A
23,023	32	Woods/grass comb., Good, HSG A
59,029	72	Weighted Average
23,023		39.00% Pervious Area
36,006		61.00% Impervious Area
36,006		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0500	0.25		**Sheet Flow, Grass** Grass: Short n= 0.150 P2= 3.20"
1.2	172	0.0140	2.40		**Shallow Concentrated Flow, Paved** Paved Kv= 20.3 fps
8.0	272	Total			

Subcatchment A1: Area #1



Summary for Subcatchment A2: Area #2

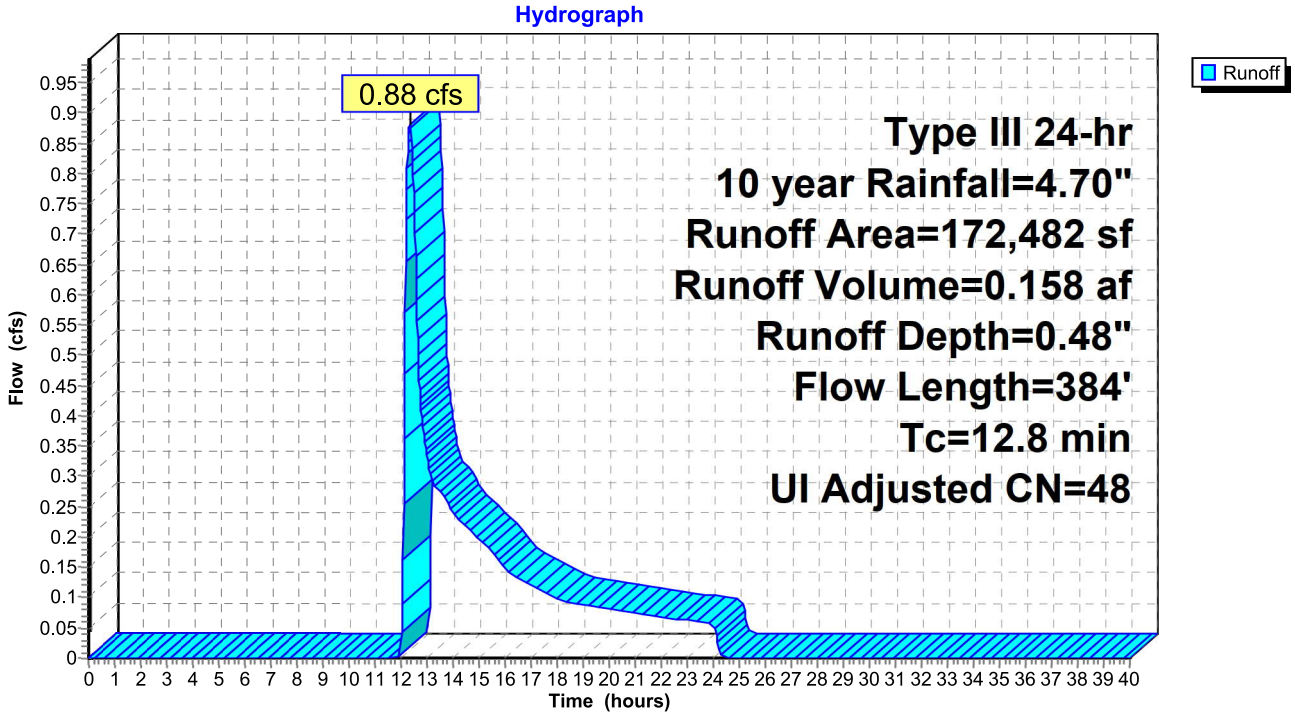
Runoff = 0.88 cfs @ 12.37 hrs, Volume= 0.158 af, Depth= 0.48"
Routed to Reach R2 : Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 10 year Rainfall=4.70"

Area (sf)	CN	Adj	Description
143,999	43		Woods/grass comb., Fair, HSG A
28,483	98		Unconnected pavement, HSG A
172,482	52	48	Weighted Average, UI Adjusted
143,999			83.49% Pervious Area
28,483			16.51% Impervious Area
28,483			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0300	0.20		**Sheet Flow, Grass** Grass: Short n= 0.150 P2= 3.20"
4.5	284	0.0230	1.06		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
12.8	384	Total			

Subcatchment A2: Area #2



Summary for Subcatchment A3: Area #3

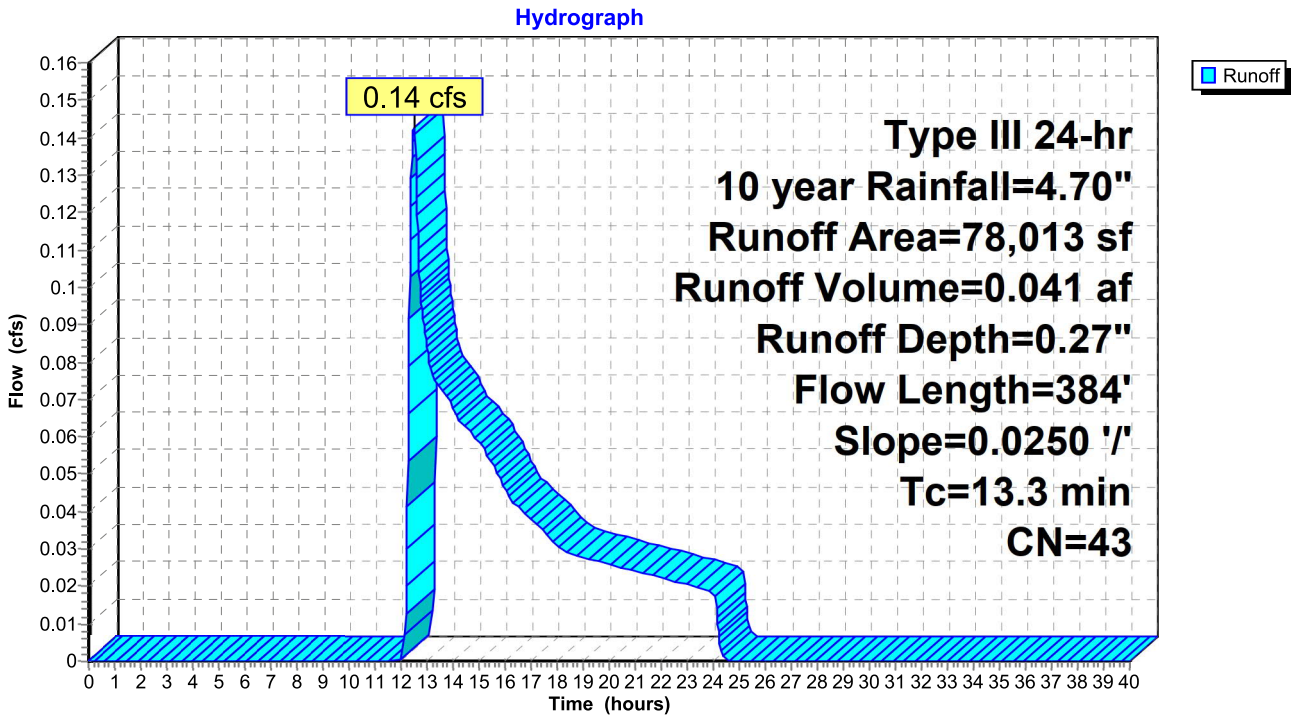
Runoff = 0.14 cfs @ 12.51 hrs, Volume= 0.041 af, Depth= 0.27"
Routed to Reach R3 : 12" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 10 year Rainfall=4.70"

Area (sf)	CN	Description
78,013	43	Woods/grass comb., Fair, HSG A
78,013		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	100	0.0250	0.19		**Sheet Flow, Grass** Grass: Short n= 0.150 P2= 3.20"
4.3	284	0.0250	1.11		**Shallow Concentrated Flow, Weed and Marsh** Short Grass Pasture Kv= 7.0 fps
13.3	384	Total			

Subcatchment A3: Area #3



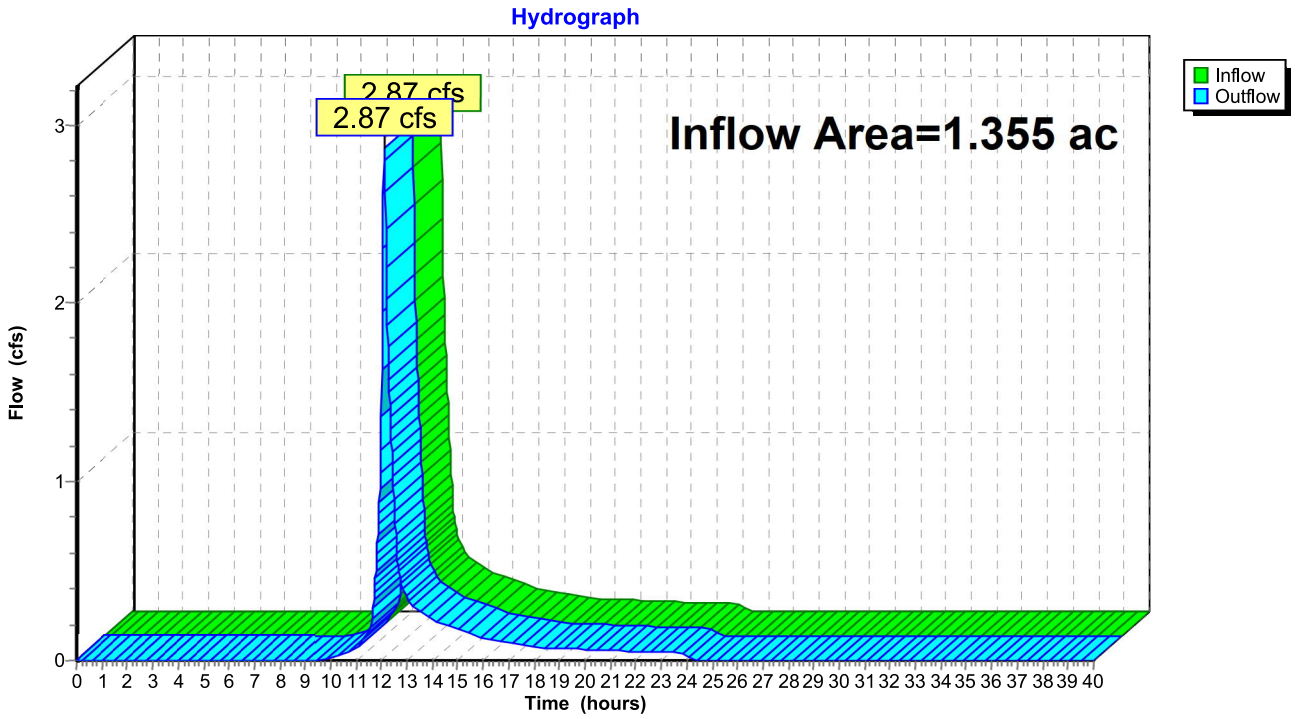
Summary for Reach R1: Fencourt Ave

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

Inflow Area = 1.355 ac, 61.00% Impervious, Inflow Depth = 1.97" for 10 year event
Inflow = 2.87 cfs @ 12.12 hrs, Volume= 0.222 af
Outflow = 2.87 cfs @ 12.12 hrs, Volume= 0.222 af, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node T

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs

Reach R1: Fencourt Ave



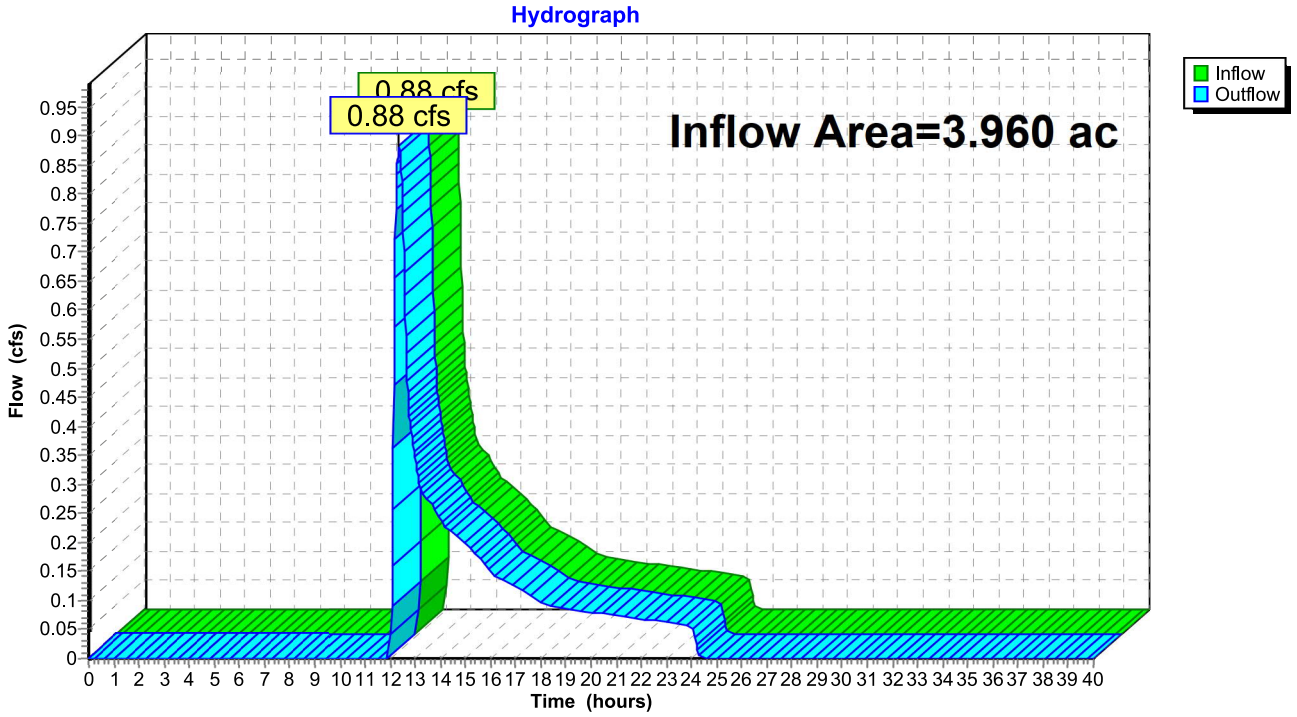
Summary for Reach R2: Wetland

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

Inflow Area = 3.960 ac, 16.51% Impervious, Inflow Depth = 0.48" for 10 year event
Inflow = 0.88 cfs @ 12.37 hrs, Volume= 0.158 af
Outflow = 0.88 cfs @ 12.37 hrs, Volume= 0.158 af, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node T

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs

Reach R2: Wetland



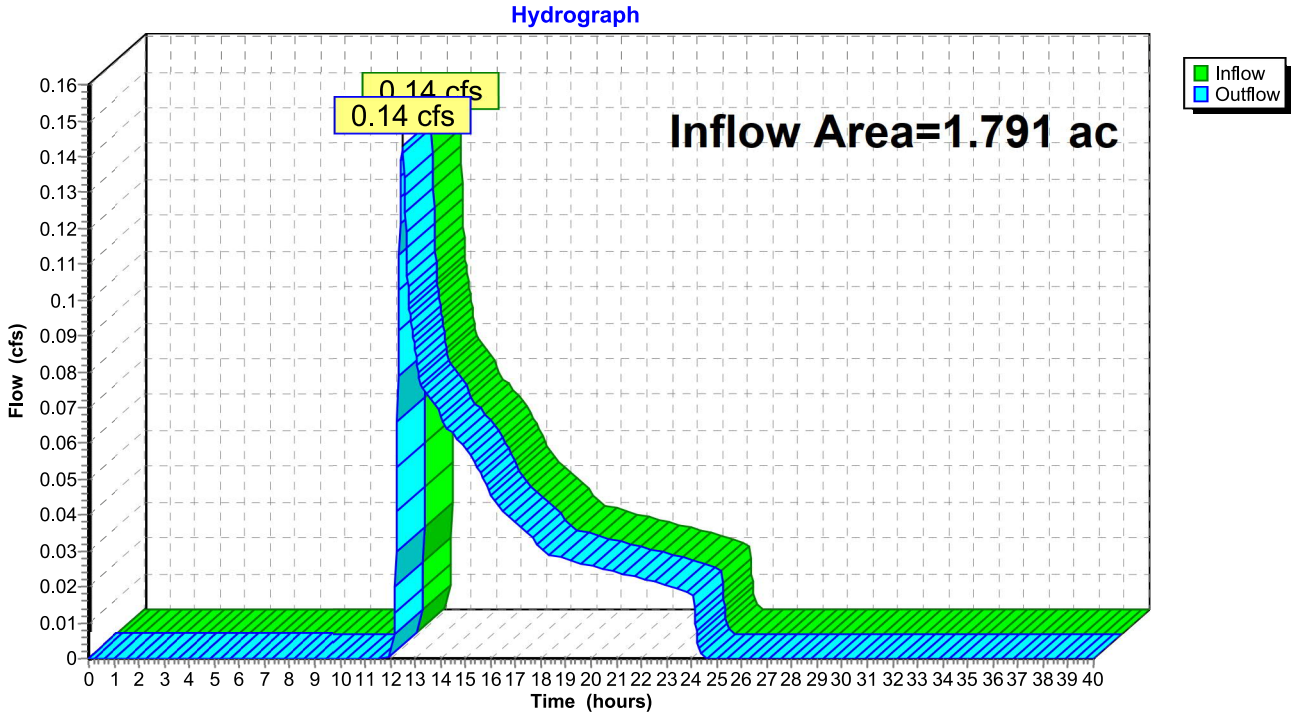
Summary for Reach R3: 12" RCP

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

Inflow Area = 1.791 ac, 0.00% Impervious, Inflow Depth = 0.27" for 10 year event
Inflow = 0.14 cfs @ 12.51 hrs, Volume= 0.041 af
Outflow = 0.14 cfs @ 12.51 hrs, Volume= 0.041 af, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node T

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs

Reach R3: 12" RCP



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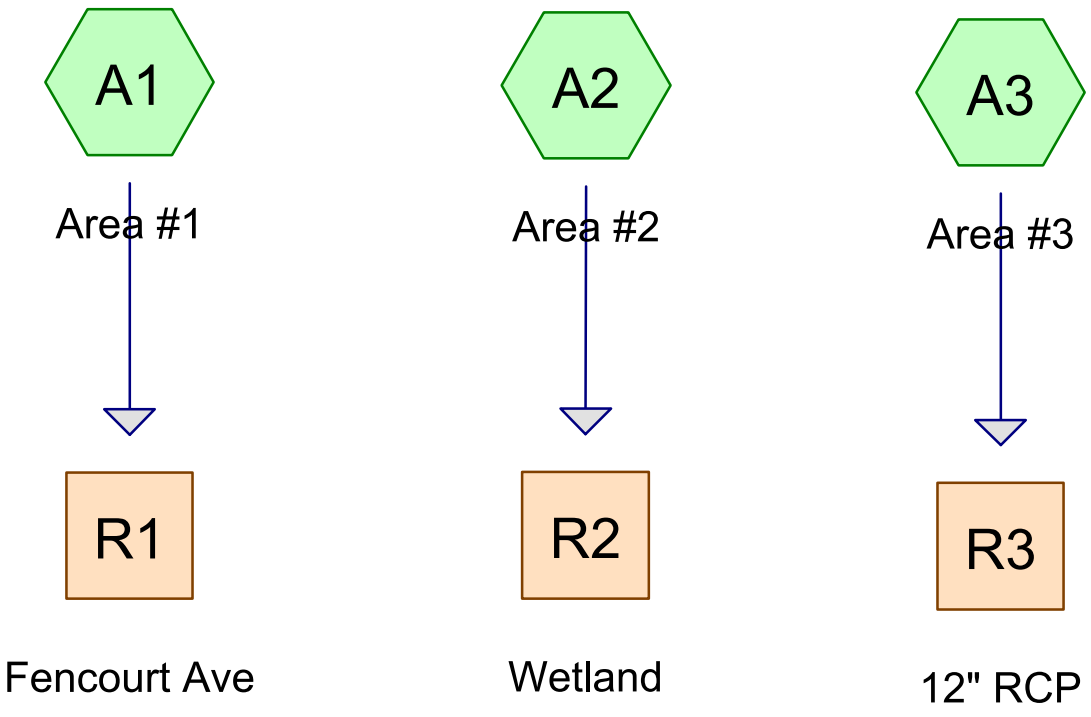
Current Event



Subcat Reach Pond Link

Routing Diagram for 16 Fencourt Avenue-existing 25yr storm
Prepared by {enter your company name here}, Printed 9/9/2022

Time span=0.00-40.00 hrs, dt=0.02 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A1: Area #1 Runoff Area=59,029 sf 61.00% Impervious Runoff Depth=2.59"
Flow Length=272' Tc=8.0 min CN=72 Runoff=3.81 cfs 0.292 af

Subcatchment A2: Area #2 Runoff Area=172,482 sf 16.51% Impervious Runoff Depth=0.78"
Flow Length=384' Tc=12.8 min UI Adjusted CN=48 Runoff=1.86 cfs 0.259 af

Subcatchment A3: Area #3 Runoff Area=78,013 sf 0.00% Impervious Runoff Depth=0.50"
Flow Length=384' Slope=0.0250 '/' Tc=13.3 min CN=43 Runoff=0.39 cfs 0.075 af

Reach R1: Fencourt Ave Inflow=3.81 cfs 0.292 af
Outflow=3.81 cfs 0.292 af

Reach R2: Wetland Inflow=1.86 cfs 0.259 af
Outflow=1.86 cfs 0.259 af

Reach R3: 12" RCP Inflow=0.39 cfs 0.075 af
Outflow=0.39 cfs 0.075 af

Total Runoff Area = 7.106 ac Runoff Volume = 0.626 af Average Runoff Depth = 1.06"
79.17% Pervious = 5.625 ac 20.83% Impervious = 1.480 ac

Summary for Subcatchment A1: Area #1

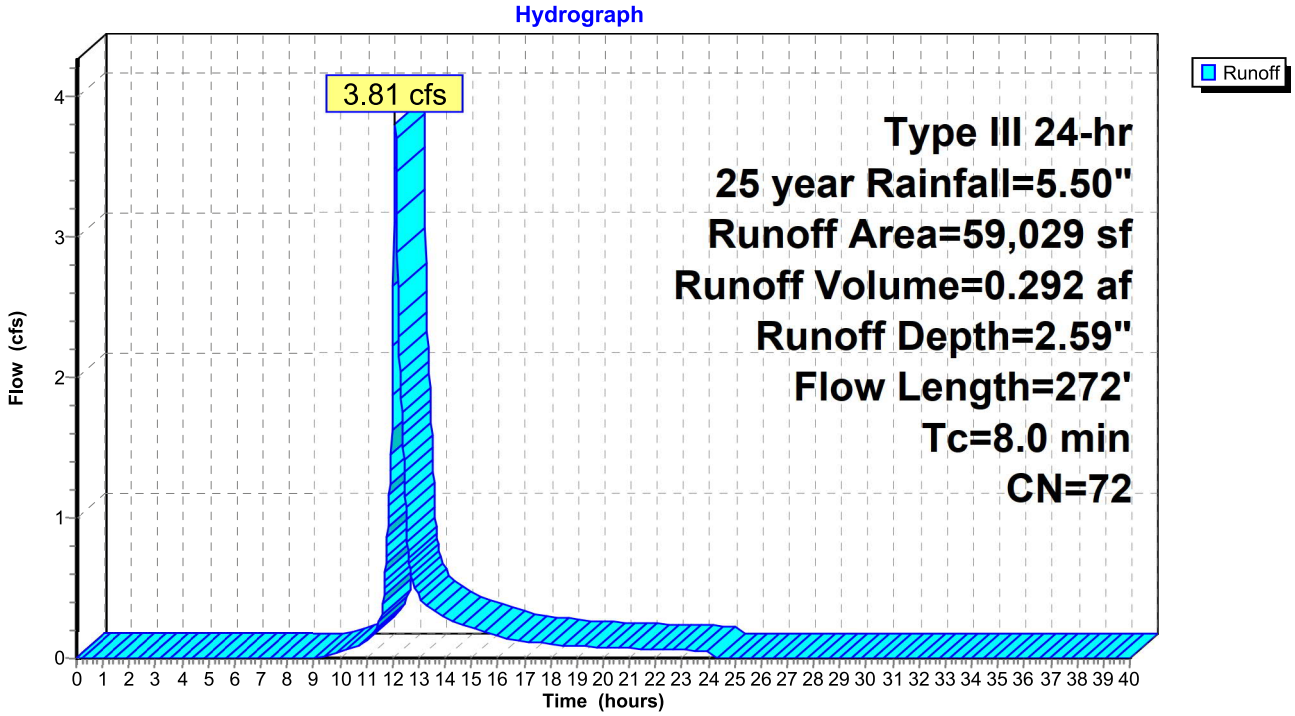
Runoff = 3.81 cfs @ 12.12 hrs, Volume= 0.292 af, Depth= 2.59"
Routed to Reach R1 : Fencourt Ave

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 25 year Rainfall=5.50"

Area (sf)	CN	Description
36,006	98	Unconnected pavement, HSG A
23,023	32	Woods/grass comb., Good, HSG A
59,029	72	Weighted Average
23,023		39.00% Pervious Area
36,006		61.00% Impervious Area
36,006		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0500	0.25		**Sheet Flow, Grass** Grass: Short n= 0.150 P2= 3.20"
1.2	172	0.0140	2.40		**Shallow Concentrated Flow, Paved** Paved Kv= 20.3 fps
8.0	272	Total			

Subcatchment A1: Area #1



Summary for Subcatchment A2: Area #2

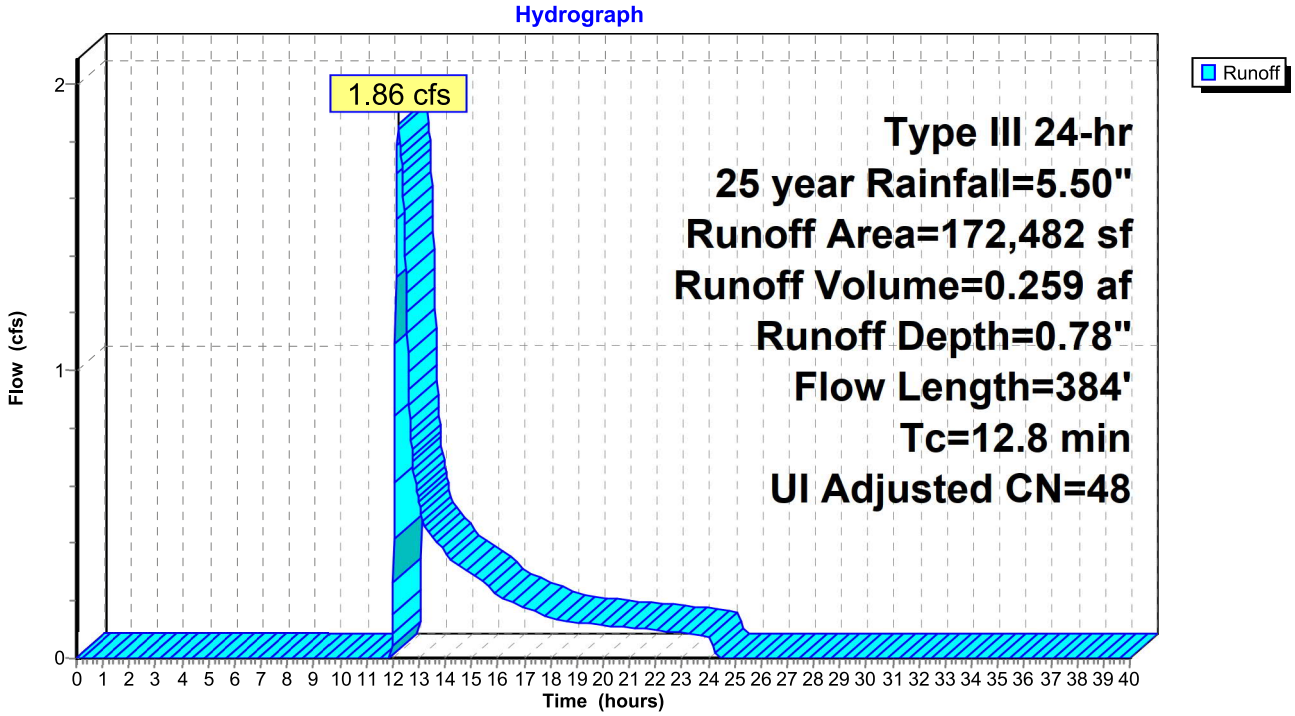
Runoff = 1.86 cfs @ 12.24 hrs, Volume= 0.259 af, Depth= 0.78"
Routed to Reach R2 : Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 25 year Rainfall=5.50"

Area (sf)	CN	Adj	Description
143,999	43		Woods/grass comb., Fair, HSG A
28,483	98		Unconnected pavement, HSG A
172,482	52	48	Weighted Average, UI Adjusted
143,999			83.49% Pervious Area
28,483			16.51% Impervious Area
28,483			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0300	0.20		**Sheet Flow, Grass** Grass: Short n= 0.150 P2= 3.20"
4.5	284	0.0230	1.06		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
12.8	384	Total			

Subcatchment A2: Area #2



Summary for Subcatchment A3: Area #3

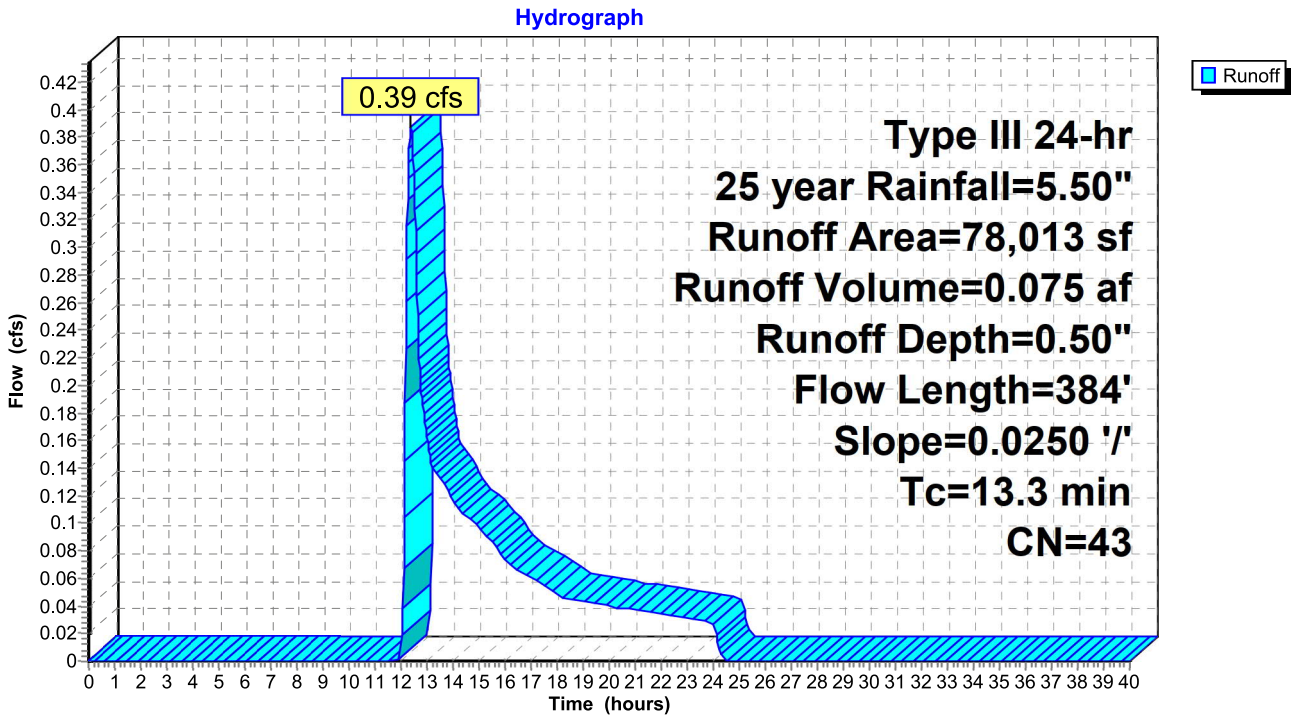
Runoff = 0.39 cfs @ 12.41 hrs, Volume= 0.075 af, Depth= 0.50"
Routed to Reach R3 : 12" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 25 year Rainfall=5.50"

Area (sf)	CN	Description
78,013	43	Woods/grass comb., Fair, HSG A
78,013		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	100	0.0250	0.19		**Sheet Flow, Grass** Grass: Short n= 0.150 P2= 3.20"
4.3	284	0.0250	1.11		**Shallow Concentrated Flow, Weed and Marsh** Short Grass Pasture Kv= 7.0 fps
13.3	384	Total			

Subcatchment A3: Area #3



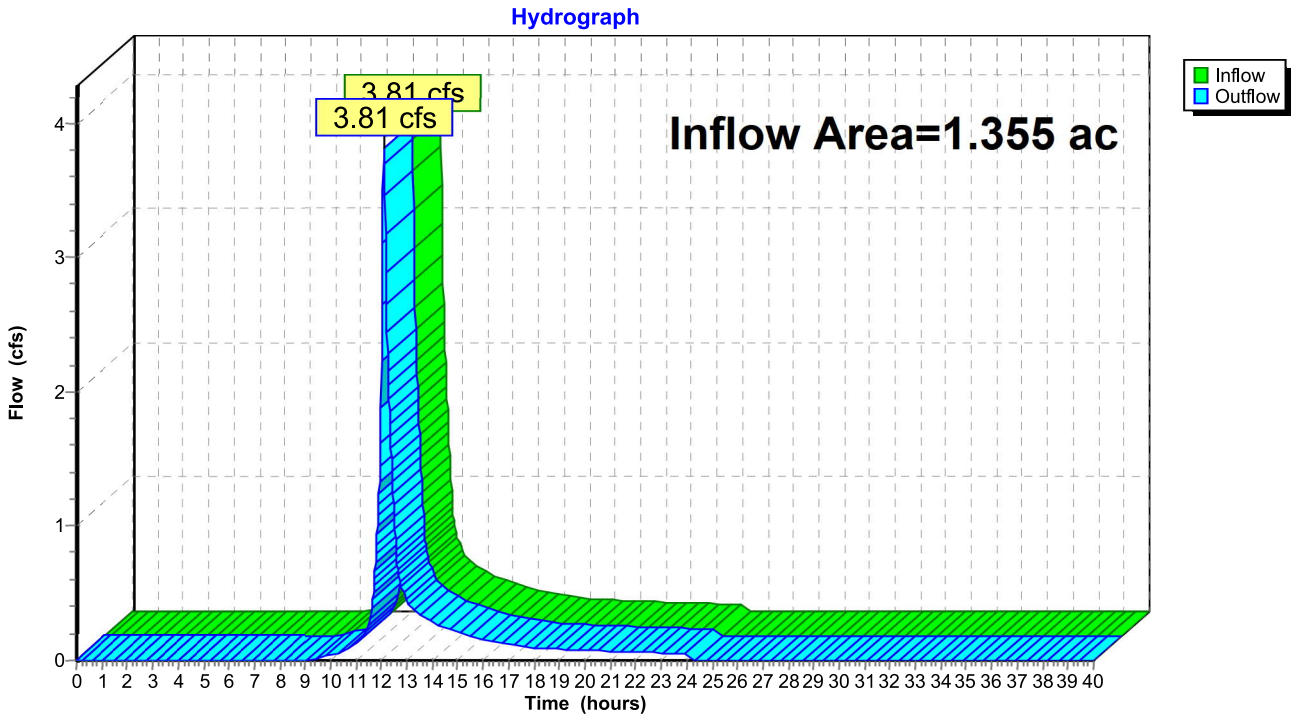
Summary for Reach R1: Fencourt Ave

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

Inflow Area = 1.355 ac, 61.00% Impervious, Inflow Depth = 2.59" for 25 year event
Inflow = 3.81 cfs @ 12.12 hrs, Volume= 0.292 af
Outflow = 3.81 cfs @ 12.12 hrs, Volume= 0.292 af, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node T

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs

Reach R1: Fencourt Ave



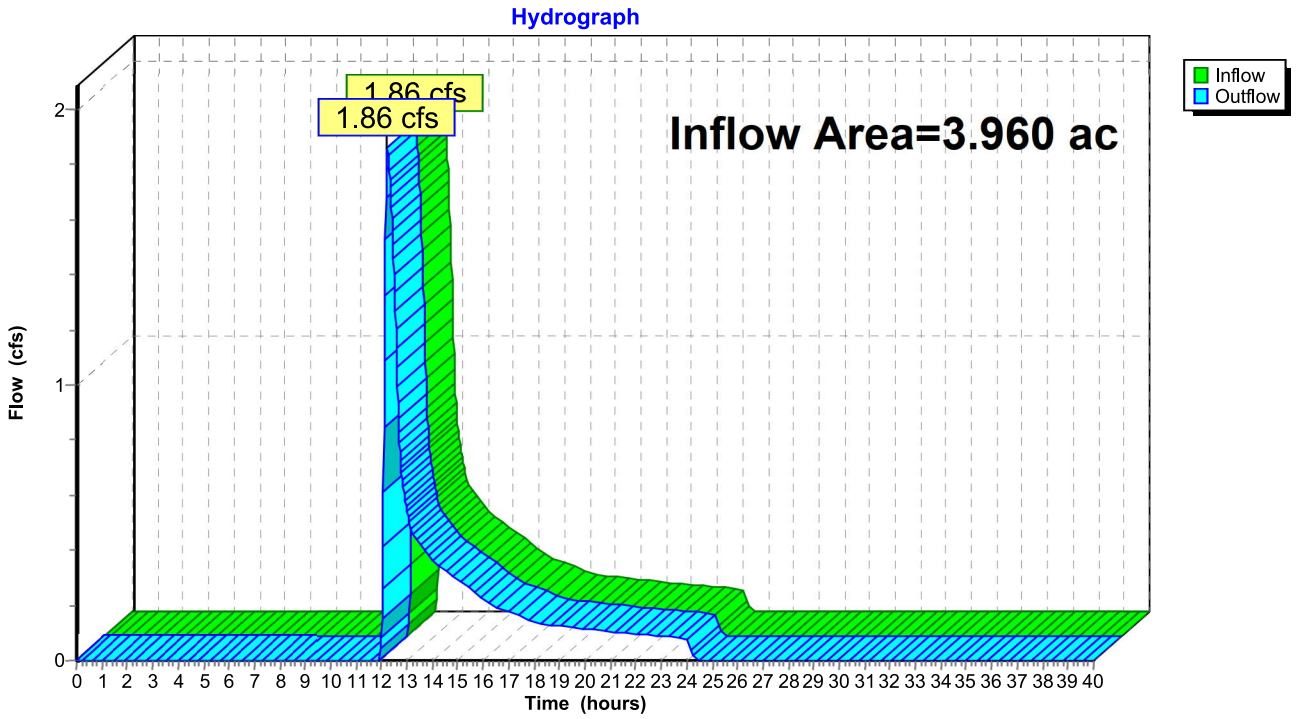
Summary for Reach R2: Wetland

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

Inflow Area = 3.960 ac, 16.51% Impervious, Inflow Depth = 0.78" for 25 year event
Inflow = 1.86 cfs @ 12.24 hrs, Volume= 0.259 af
Outflow = 1.86 cfs @ 12.24 hrs, Volume= 0.259 af, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node T

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs

Reach R2: Wetland



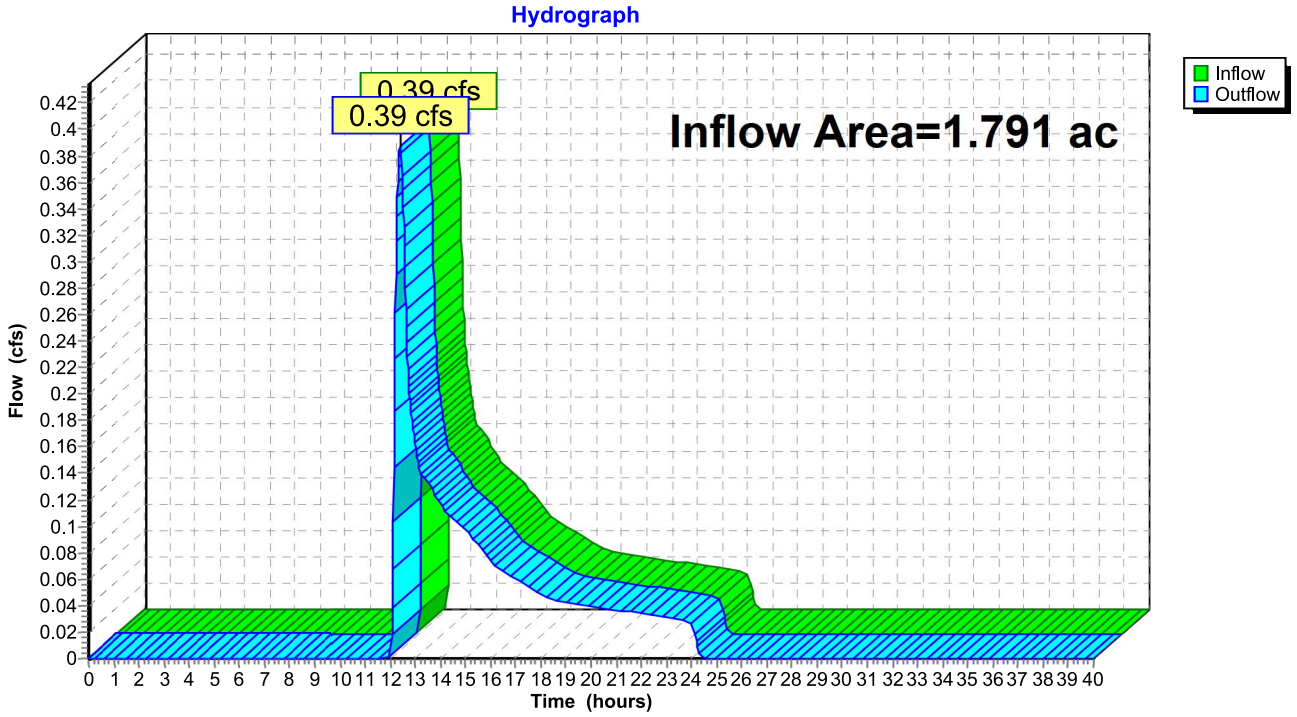
Summary for Reach R3: 12" RCP

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

Inflow Area = 1.791 ac, 0.00% Impervious, Inflow Depth = 0.50" for 25 year event
Inflow = 0.39 cfs @ 12.41 hrs, Volume= 0.075 af
Outflow = 0.39 cfs @ 12.41 hrs, Volume= 0.075 af, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node T

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs

Reach R3: 12" RCP



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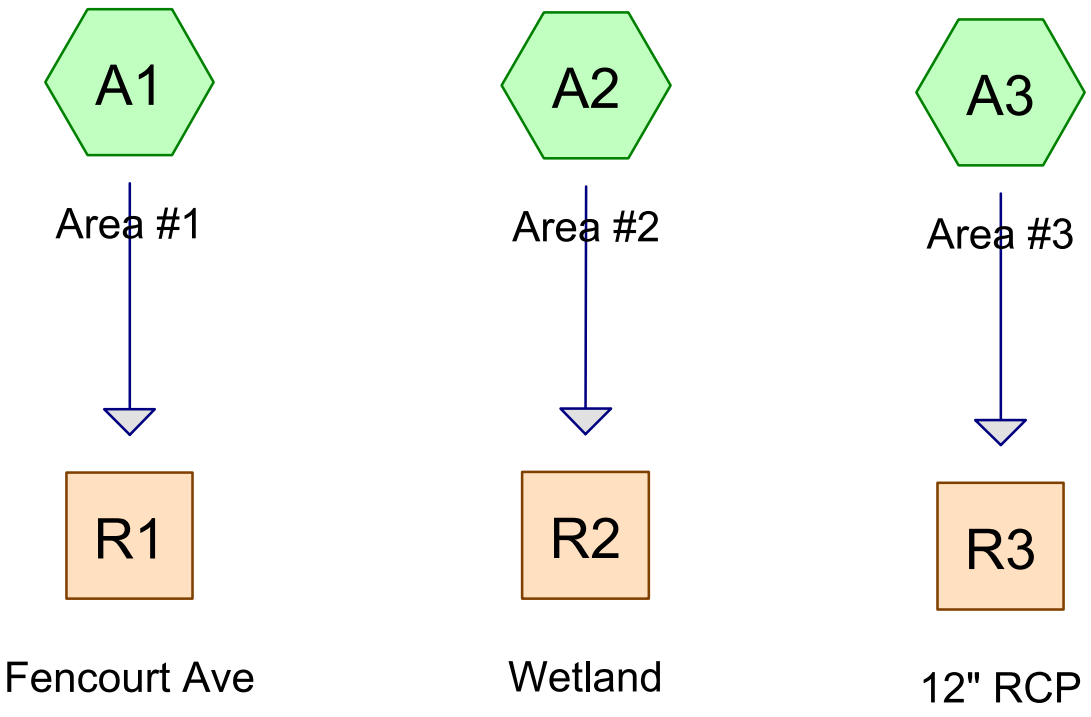


Subcat Reach Pond Link

Routing Diagram for 16 Fencourt Avenue-existing 100yr storm
Prepared by {enter your company name here}, Printed 9/9/2022

Time span=0.00-40.00 hrs, dt=0.02 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A1: Area #1 Runoff Area=59,029 sf 61.00% Impervious Runoff Depth=3.57"
Flow Length=272' Tc=8.0 min CN=72 Runoff=5.29 cfs 0.404 af

Subcatchment A2: Area #2 Runoff Area=172,482 sf 16.51% Impervious Runoff Depth=1.34"
Flow Length=384' Tc=12.8 min UI Adjusted CN=48 Runoff=3.96 cfs 0.441 af

Subcatchment A3: Area #3 Runoff Area=78,013 sf 0.00% Impervious Runoff Depth=0.95"
Flow Length=384' Slope=0.0250 '/' Tc=13.3 min CN=43 Runoff=1.00 cfs 0.141 af

Reach R1: Fencourt Ave Inflow=5.29 cfs 0.404 af
Outflow=5.29 cfs 0.404 af

Reach R2: Wetland Inflow=3.96 cfs 0.441 af
Outflow=3.96 cfs 0.441 af

Reach R3: 12" RCP Inflow=1.00 cfs 0.141 af
Outflow=1.00 cfs 0.141 af

Total Runoff Area = 7.106 ac Runoff Volume = 0.986 af Average Runoff Depth = 1.67"
79.17% Pervious = 5.625 ac 20.83% Impervious = 1.480 ac

Summary for Subcatchment A1: Area #1

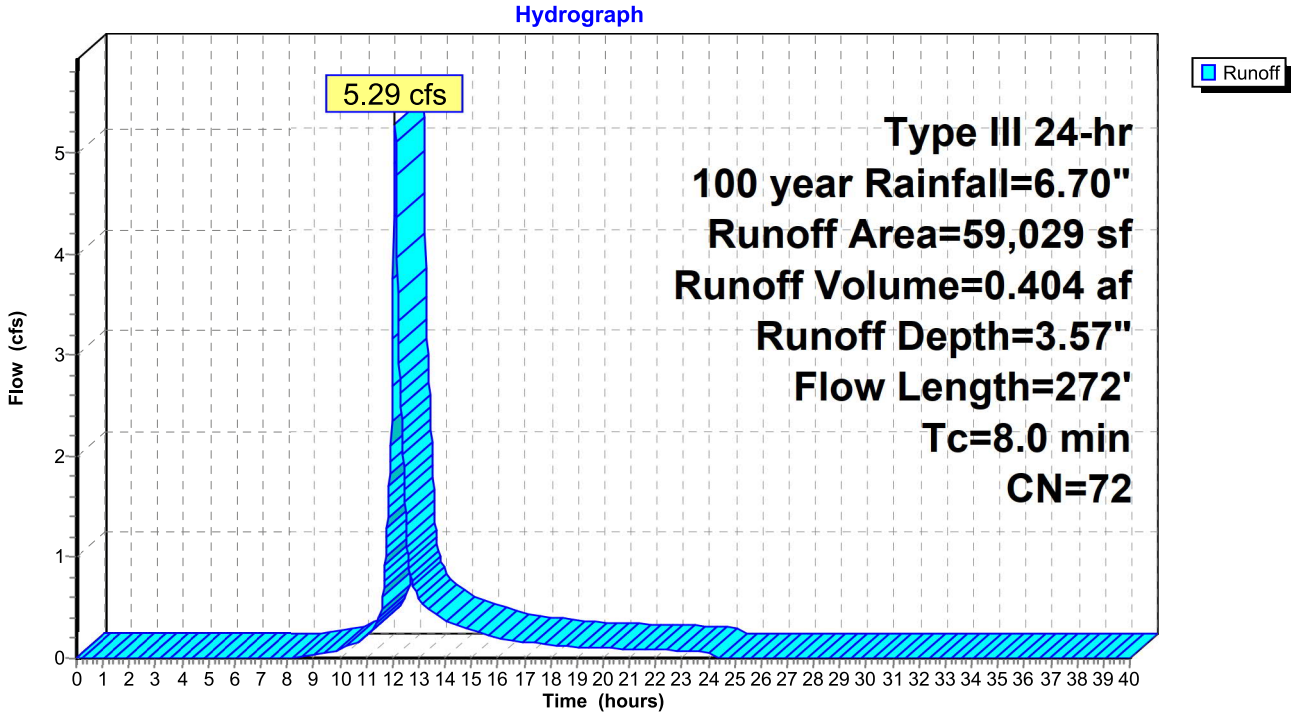
Runoff = 5.29 cfs @ 12.12 hrs, Volume= 0.404 af, Depth= 3.57"
Routed to Reach R1 : Fencourt Ave

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 100 year Rainfall=6.70"

Area (sf)	CN	Description
36,006	98	Unconnected pavement, HSG A
23,023	32	Woods/grass comb., Good, HSG A
59,029	72	Weighted Average
23,023		39.00% Pervious Area
36,006		61.00% Impervious Area
36,006		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0500	0.25		**Sheet Flow, Grass** Grass: Short n= 0.150 P2= 3.20"
1.2	172	0.0140	2.40		**Shallow Concentrated Flow, Paved** Paved Kv= 20.3 fps
8.0	272	Total			

Subcatchment A1: Area #1



Summary for Subcatchment A2: Area #2

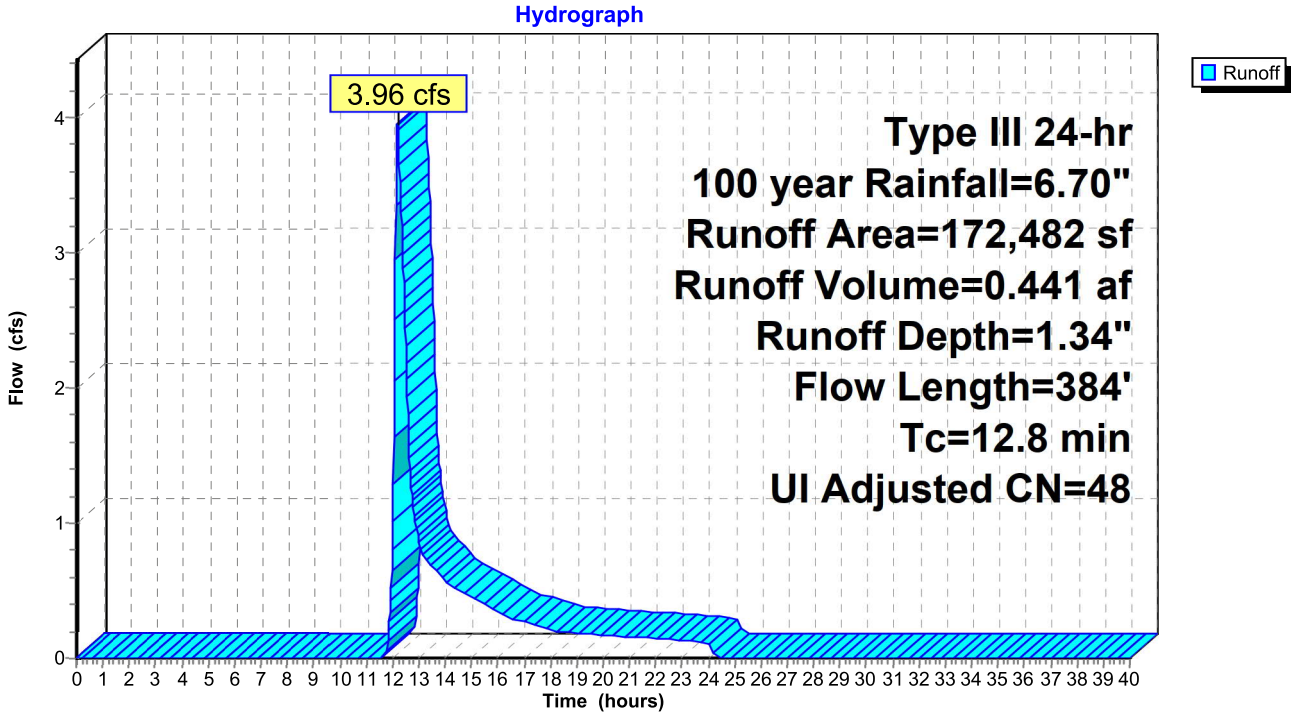
Runoff = 3.96 cfs @ 12.21 hrs, Volume= 0.441 af, Depth= 1.34"
Routed to Reach R2 : Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 100 year Rainfall=6.70"

Area (sf)	CN	Adj	Description
143,999	43		Woods/grass comb., Fair, HSG A
28,483	98		Unconnected pavement, HSG A
172,482	52	48	Weighted Average, UI Adjusted
143,999			83.49% Pervious Area
28,483			16.51% Impervious Area
28,483			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	100	0.0300	0.20		**Sheet Flow, Grass** Grass: Short n= 0.150 P2= 3.20"
4.5	284	0.0230	1.06		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
12.8	384	Total			

Subcatchment A2: Area #2



Summary for Subcatchment A3: Area #3

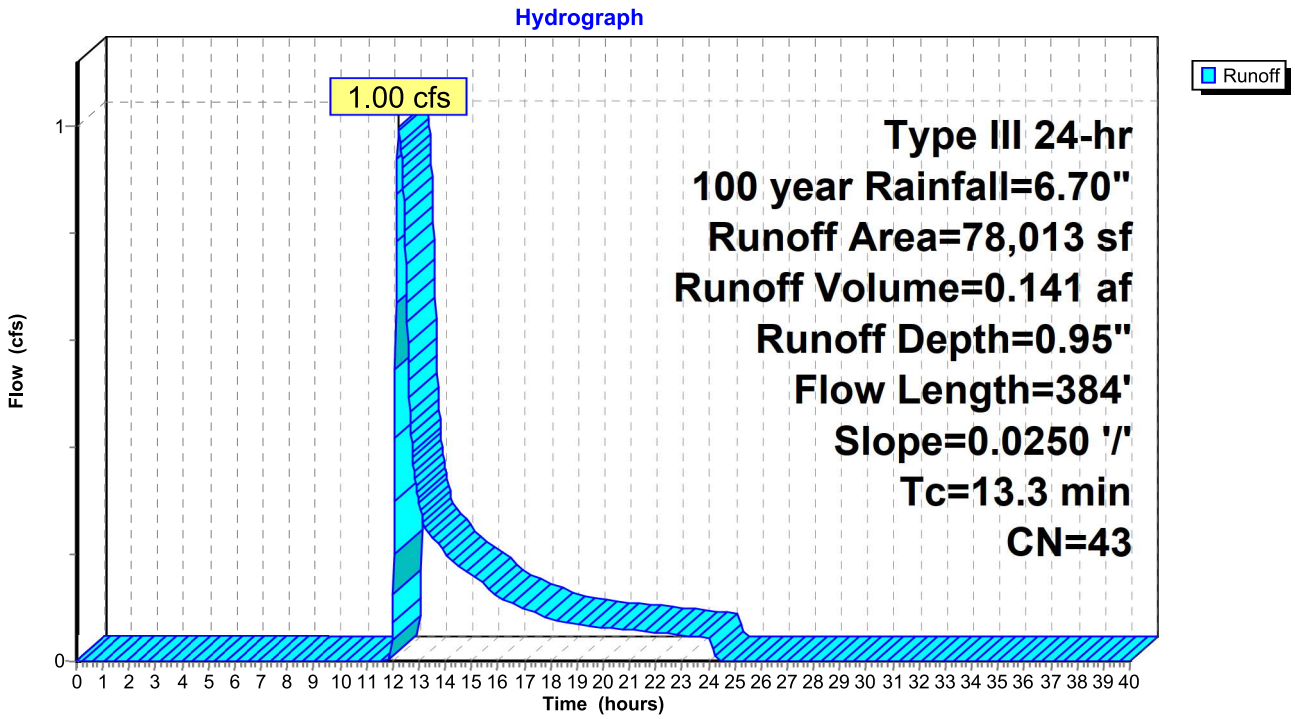
Runoff = 1.00 cfs @ 12.26 hrs, Volume= 0.141 af, Depth= 0.95"
Routed to Reach R3 : 12" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 100 year Rainfall=6.70"

Area (sf)	CN	Description
78,013	43	Woods/grass comb., Fair, HSG A
78,013		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	100	0.0250	0.19		**Sheet Flow, Grass** Grass: Short n= 0.150 P2= 3.20"
4.3	284	0.0250	1.11		**Shallow Concentrated Flow, Weed and Marsh** Short Grass Pasture Kv= 7.0 fps
13.3	384	Total			

Subcatchment A3: Area #3



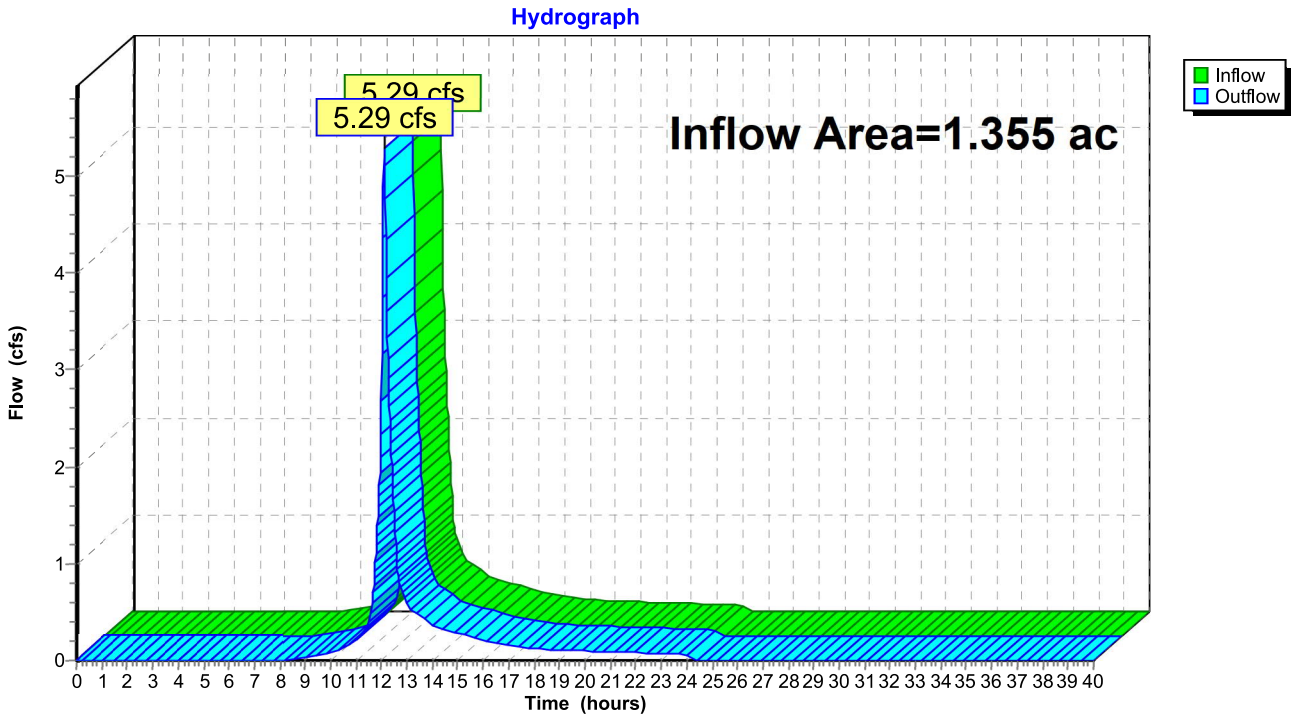
Summary for Reach R1: Fencourt Ave

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

Inflow Area = 1.355 ac, 61.00% Impervious, Inflow Depth = 3.57" for 100 year event
Inflow = 5.29 cfs @ 12.12 hrs, Volume= 0.404 af
Outflow = 5.29 cfs @ 12.12 hrs, Volume= 0.404 af, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node T

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs

Reach R1: Fencourt Ave



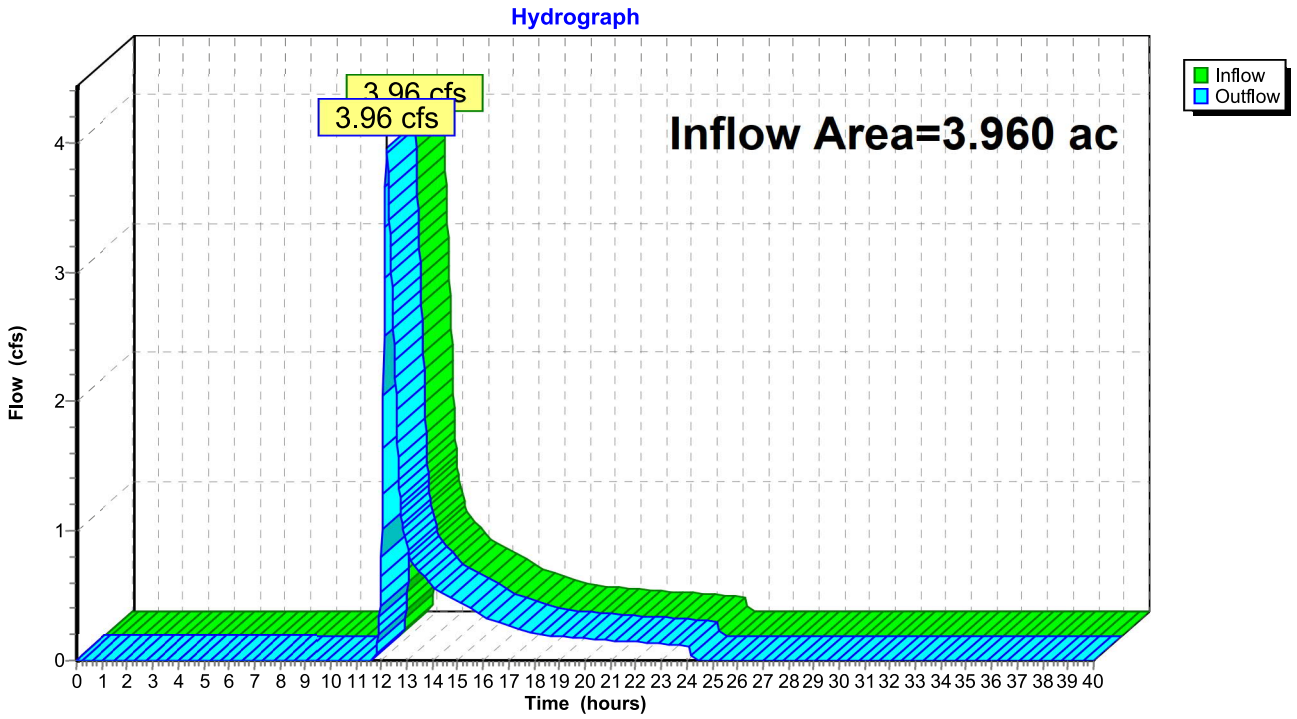
Summary for Reach R2: Wetland

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

Inflow Area = 3.960 ac, 16.51% Impervious, Inflow Depth = 1.34" for 100 year event
Inflow = 3.96 cfs @ 12.21 hrs, Volume= 0.441 af
Outflow = 3.96 cfs @ 12.21 hrs, Volume= 0.441 af, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node T

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs

Reach R2: Wetland

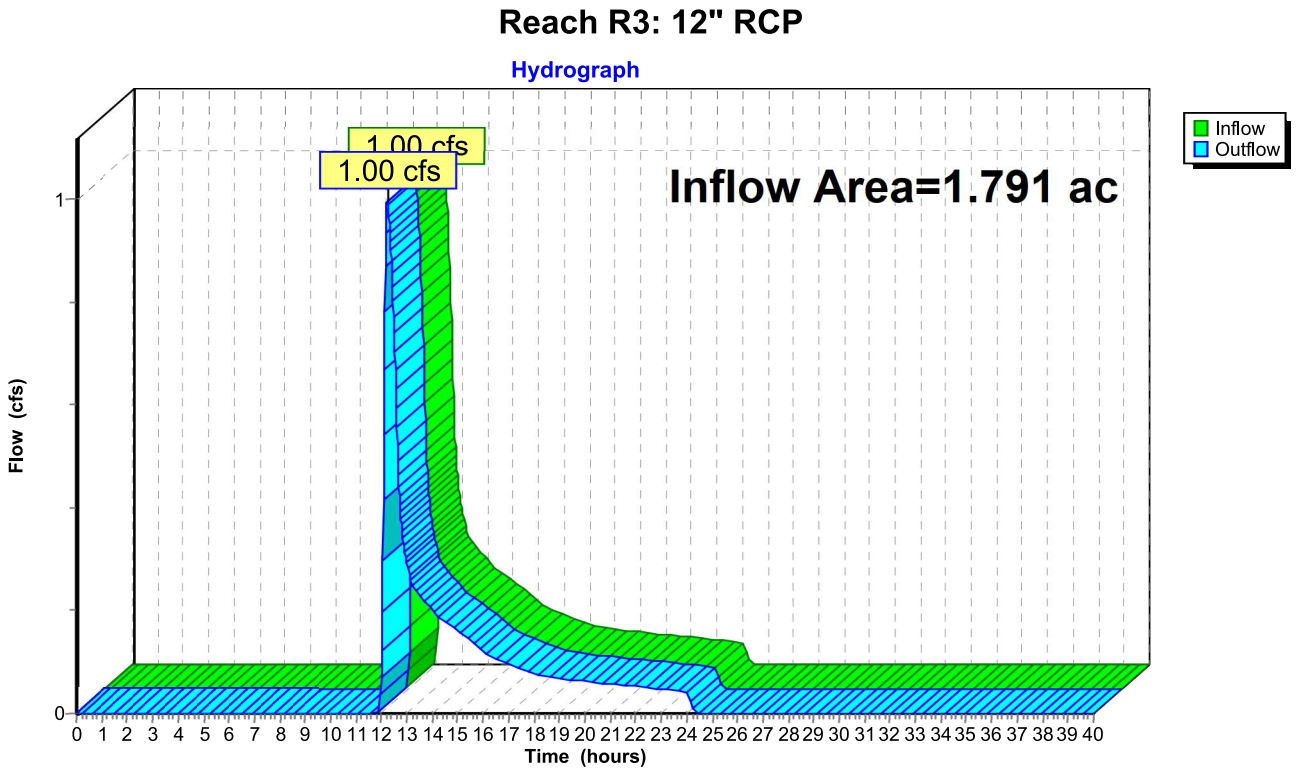


Summary for Reach R3: 12" RCP

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

Inflow Area = 1.791 ac, 0.00% Impervious, Inflow Depth = 0.95" for 100 year event
Inflow = 1.00 cfs @ 12.26 hrs, Volume= 0.141 af
Outflow = 1.00 cfs @ 12.26 hrs, Volume= 0.141 af, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node T

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs



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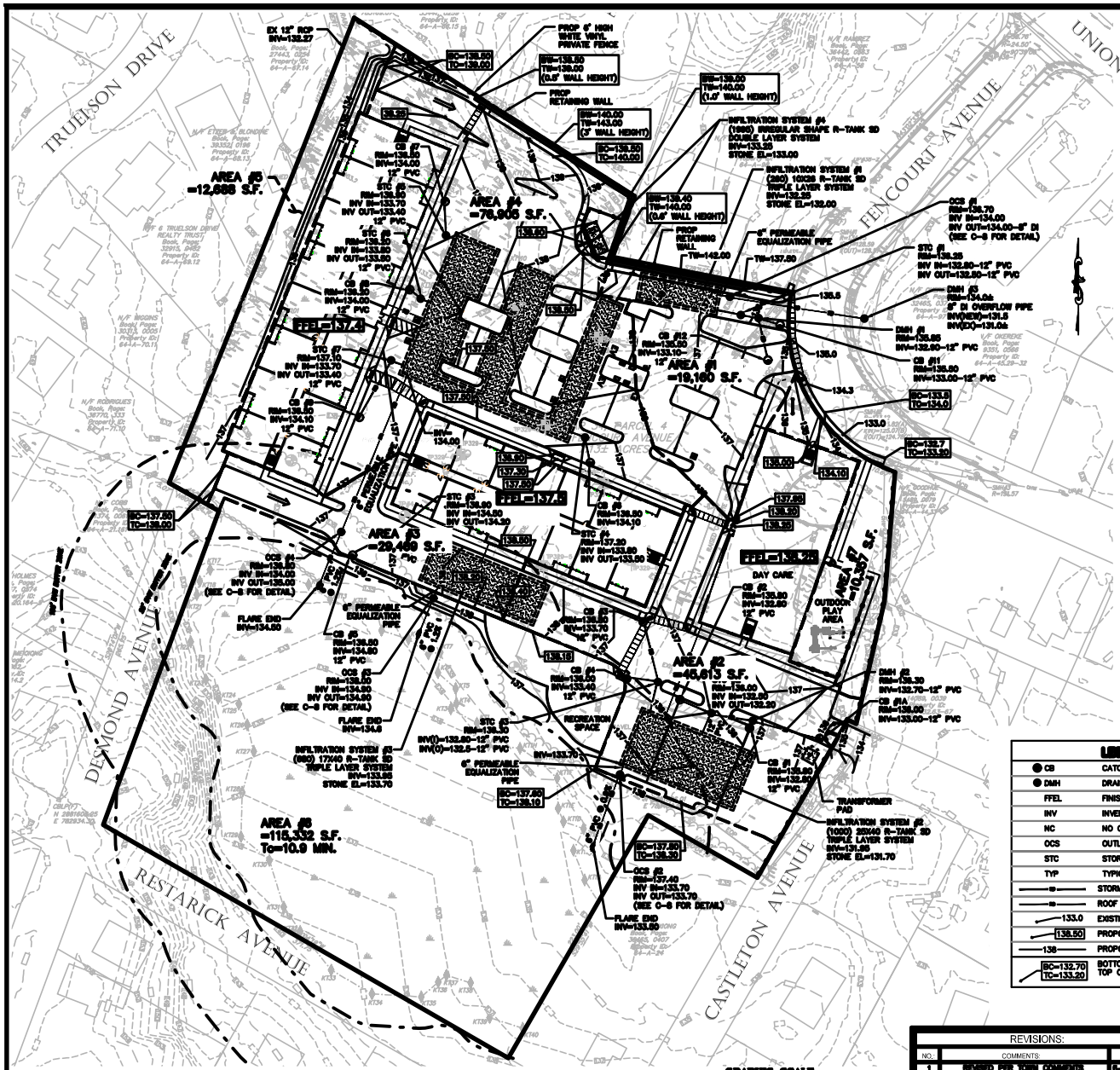
Post-Development Calculations

2, 10, 25, and 100-Year Storms



POST–DEVELOPMENT WATERSHEDS

	AREA (S.F.)
AREA #1 (TO FENCOURT AVE)	19,160
AREA #2 (TO WETLAND)	45,613
AREA #3 (TO WETLAND)	29,469
AREA #4 (TO WETLAND)	76,905
AREA #5 (TO EX. 12" RCP)	12,688
AREA #6 (TO WETLAND)	115,332
AREA #7 (TO FENCOURT AVE)	10,357
TOTAL LOT AREA	309,524 S.F.

LEGEND

CB	CATCH BASIN
DMH	DRAIN MANHOLE
FFEL	FINISHED FLOOR ELEVATION
INV	INVERT
NC	NO CURB
OCS	OUTLET CONTROL STRUCTURE
STC	STORMCEPTOR
TYP	TYPICAL
	STORM DRAIN PIPE
	ROOF DRAIN PIPE
133.0	EXISTING SPOT ELEVATION
138.50	PROPOSED SPOT ELEVATION
138	PROPOSED CONTOUR
BC=132.70 TC=133.20	BOTTOM OF CURB TOP OF CURB

STORMWATER SYSTEM ELEVATIONS

	SYSTEM #1	SYSTEM #2	SYSTEM #3	SYSTEM #4
MIN. GROUND ELEVATION	137.0±	136.0±	137.5±	136.7±
TOP OF STONE	134.98	134.68	135.98	135.26
TOP OF CHAMBER	134.48	134.18	135.48	134.76
BOTTOM OF CHAMBER	132.25	131.95	133.95	133.25
BOTTOM OF STONE	132.00	131.70	133.70	133.00
OVERFLOW OUTLET	134.20	134.50	134.90	135.00
EST. GWT	N/A	N/A	131.7	131.0

GRAPHIC SCALE
(IN FEET)
1 inch = 40 ft.

REVISIONS:		
NO.	COMMENTS:	DATE:
1	REVISED PER TOWN COMMENTS	5-25-2023

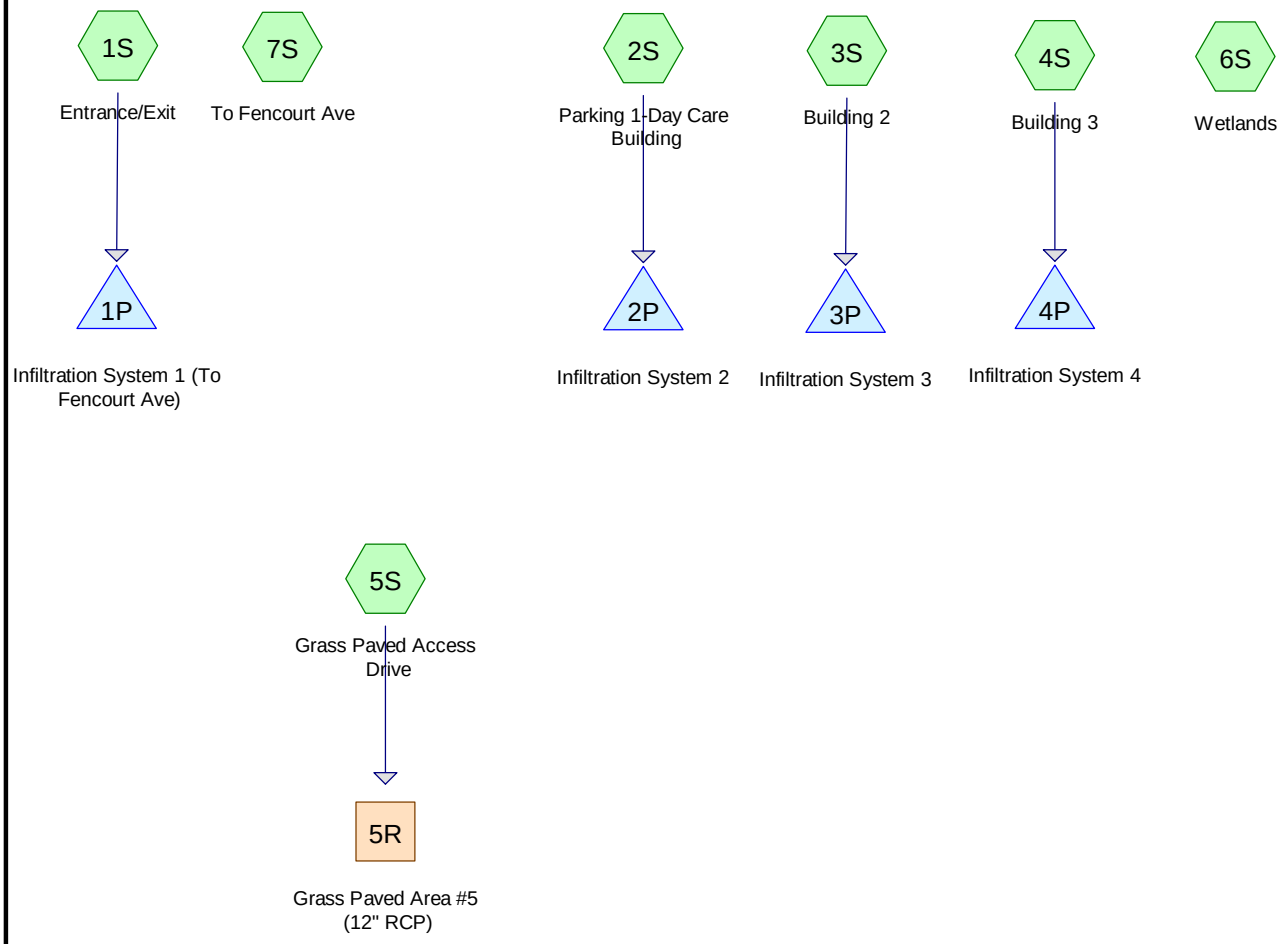
GRADING AND DRAINAGE PLAN
16 Fencourt Ave
RANDOLPH, MASSACHUSETTS

DRAWN BY: JKY
DESIGNED BY: CYM
CHECKED BY: CYM
DATE: 9-06-2022
LATEST REVISION: 5-25-2023
SCALE: 1" = 40'

PREPARED FOR:
PERMITTING

HARDY + MAN DESIGN GROUP, PC
CIVIL ENGINEERING & LAND DEVELOPMENT CONSULTING
1285 WASHINGTON STREET
WEYMOUTH, MA
(781) 335-1464

SHEET
PW-1



Routing Diagram for 16 Fencourt Avenue-Proposed 2yr storm-2023-05-25

Prepared by {enter your company name here}, Printed 5/29/2023

Time span=0.00-40.00 hrs, dt=0.02 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Entrance/Exit Runoff Area=19,160 sf 78.76% Impervious Runoff Depth=1.76"
Tc=6.0 min CN=85 Runoff=0.91 cfs 0.064 af

Subcatchment 2S: Parking 1-Day Care Building Runoff Area=45,613 sf 82.36% Impervious Runoff Depth=2.00"
Tc=6.0 min CN=88 Runoff=2.44 cfs 0.174 af

Subcatchment 3S: Building 2 Runoff Area=29,469 sf 96.22% Impervious Runoff Depth=2.75"
Tc=6.0 min CN=96 Runoff=2.03 cfs 0.155 af

Subcatchment 4S: Building 3 Runoff Area=76,905 sf 86.15% Impervious Runoff Depth=2.17"
Tc=6.0 min CN=90 Runoff=4.43 cfs 0.319 af

Subcatchment 5S: Grass Paved Access Drive Runoff Area=12,688 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=360' Tc=28.3 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 6S: Wetlands Runoff Area=115,332 sf 0.00% Impervious Runoff Depth=0.02"
Flow Length=230' Tc=10.9 min CN=43 Runoff=0.01 cfs 0.005 af

Subcatchment 7S: To Fencourt Ave Runoff Area=10,357 sf 11.49% Impervious Runoff Depth=0.17"
Tc=6.0 min UI Adjusted CN=52 Runoff=0.01 cfs 0.003 af

Reach 5R: Grass Paved Area #5 (12" RCP) Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Pond 1P: Infiltration System 1 (To Fencourt Ave) Peak Elev=133.21' Storage=0.025 af Inflow=0.91 cfs 0.064 af
Discarded=0.08 cfs 0.064 af Primary=0.00 cfs 0.000 af Outflow=0.08 cfs 0.064 af

Pond 2P: Infiltration System 2 Peak Elev=132.57' Storage=0.062 af Inflow=2.44 cfs 0.174 af
Discarded=0.27 cfs 0.174 af Primary=0.00 cfs 0.000 af Outflow=0.27 cfs 0.174 af

Pond 3P: Infiltration System 3 Peak Elev=134.79' Storage=0.056 af Inflow=2.03 cfs 0.155 af
Discarded=0.19 cfs 0.155 af Primary=0.00 cfs 0.000 af Outflow=0.19 cfs 0.155 af

Pond 4P: Infiltration System 4 Peak Elev=133.79' Storage=0.109 af Inflow=4.43 cfs 0.319 af
Discarded=0.51 cfs 0.319 af Primary=0.00 cfs 0.000 af Outflow=0.51 cfs 0.319 af

Total Runoff Area = 7.106 ac Runoff Volume = 0.721 af Average Runoff Depth = 1.22"
52.04% Pervious = 3.698 ac 47.96% Impervious = 3.408 ac

Summary for Subcatchment 1S: Entrance/Exit

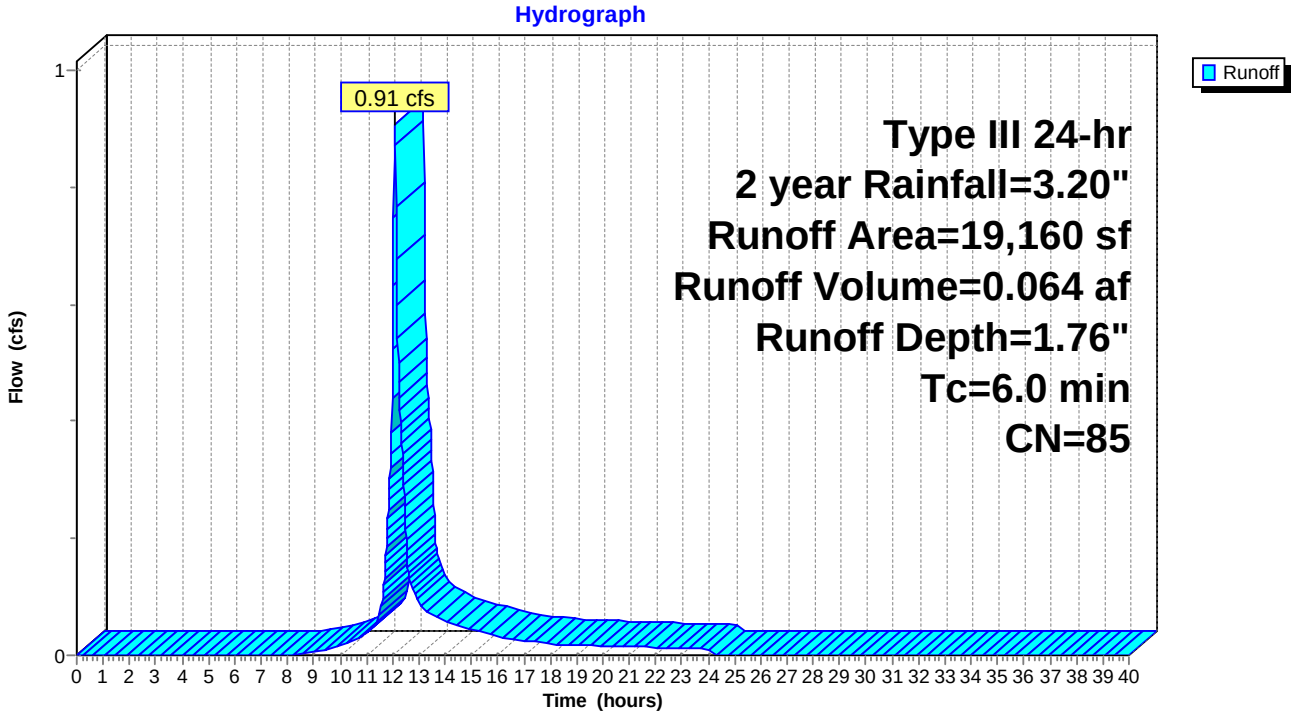
Runoff = 0.91 cfs @ 12.09 hrs, Volume= 0.064 af, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (sf)	CN	Description
15,090	98	Paved parking, HSG A
4,070	39	>75% Grass cover, Good, HSG A
19,160	85	Weighted Average
4,070		21.24% Pervious Area
15,090		78.76% Impervious Area

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

Subcatchment 1S: Entrance/Exit



Summary for Subcatchment 2S: Parking 1-Day Care Building

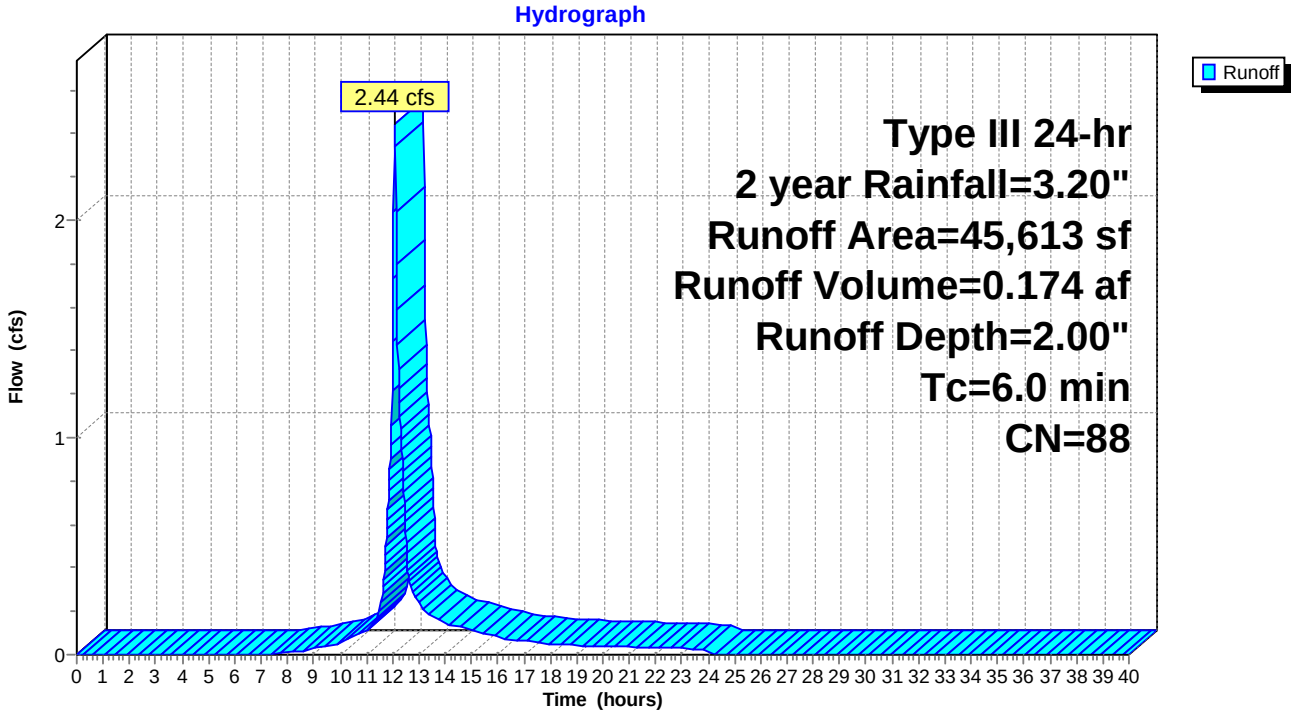
Runoff = 2.44 cfs @ 12.09 hrs, Volume= 0.174 af, Depth= 2.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 2 year Rainfall=3.20"

	Area (sf)	CN	Description
	24,731	98	Paved parking, HSG A
	8,047	39	>75% Grass cover, Good, HSG A
*	12,835	98	Daycare Building, HSG A
	45,613	88	Weighted Average
	8,047		17.64% Pervious Area
	37,566		82.36% Impervious Area

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

Subcatchment 2S: Parking 1-Day Care Building



Summary for Subcatchment 3S: Building 2

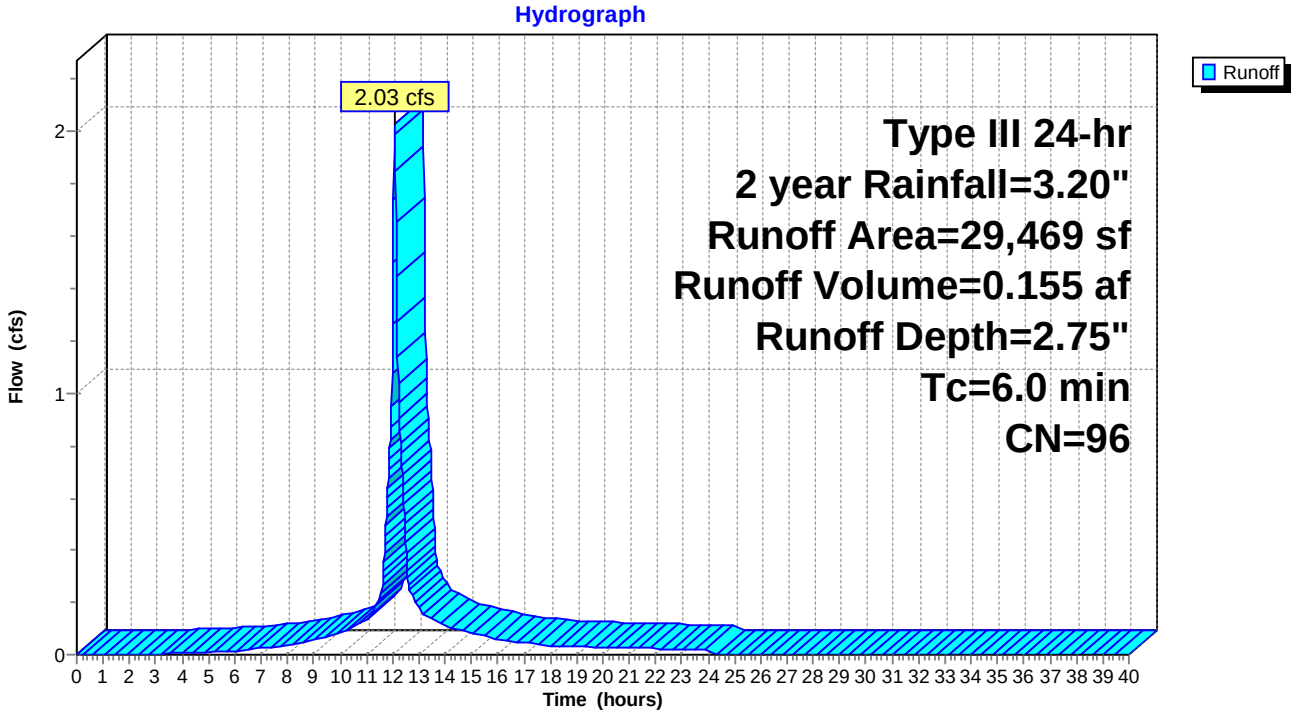
Runoff = 2.03 cfs @ 12.08 hrs, Volume= 0.155 af, Depth= 2.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 2 year Rainfall=3.20"

	Area (sf)	CN	Description
	11,219	98	Paved parking, HSG A
*	17,137	98	Building #2, HSG A
	1,113	39	>75% Grass cover, Good, HSG A
	29,469	96	Weighted Average
	1,113		3.78% Pervious Area
	28,356		96.22% Impervious Area

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

Subcatchment 3S: Building 2



Summary for Subcatchment 4S: Building 3

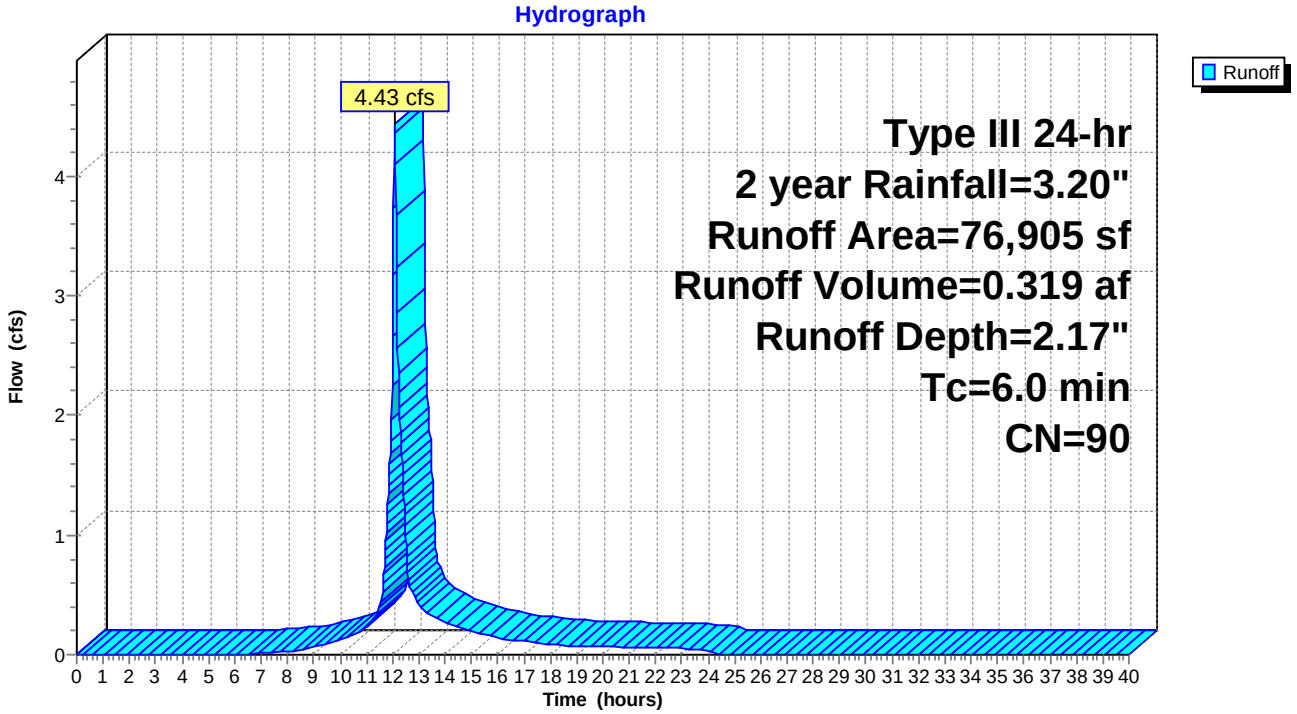
Runoff = 4.43 cfs @ 12.09 hrs, Volume= 0.319 af, Depth= 2.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 2 year Rainfall=3.20"

	Area (sf)	CN	Description
	43,449	98	Paved parking, HSG A
*	22,804	98	Building 3, HSG A
	10,652	39	>75% Grass cover, Good, HSG A
	76,905	90	Weighted Average
	10,652		13.85% Pervious Area
	66,253		86.15% Impervious Area

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

Subcatchment 4S: Building 3



Summary for Subcatchment 5S: Grass Paved Access Drive

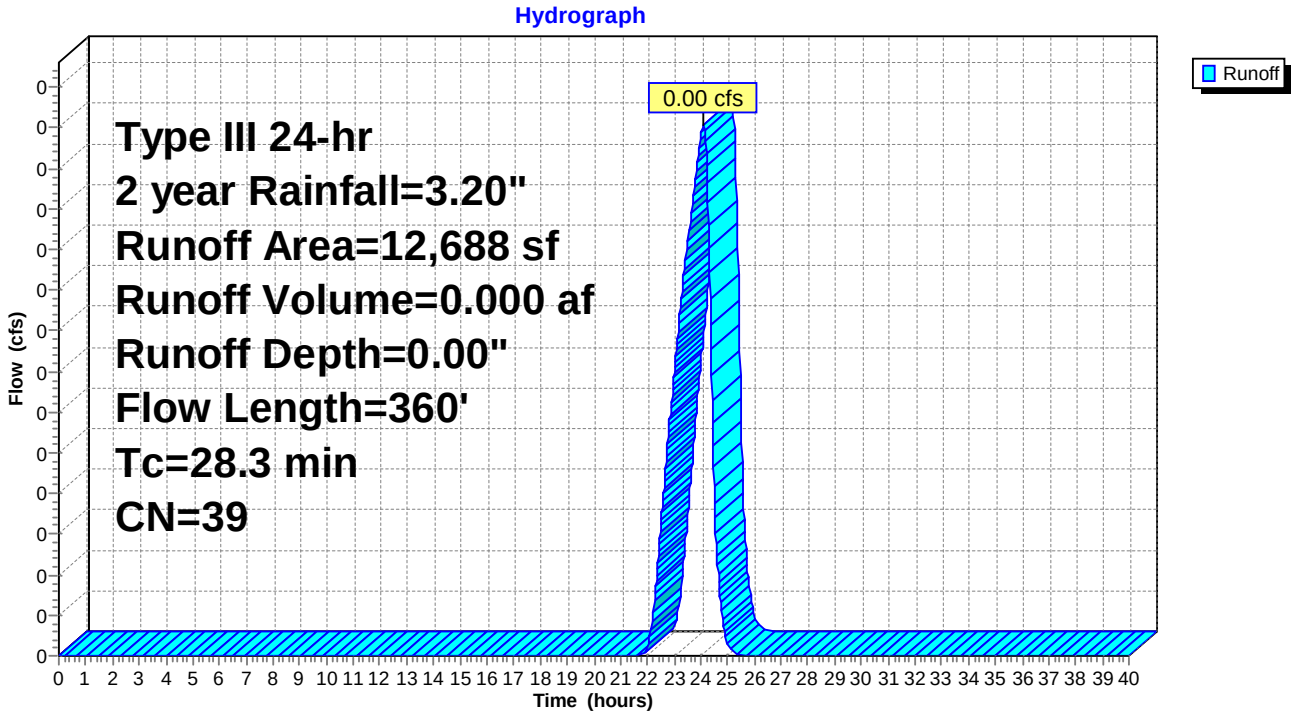
Runoff = 0.00 cfs @ 24.10 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (sf)	CN	Description
12,688	39	>75% Grass cover, Good, HSG A
12,688		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.6	100	0.0250	0.08		**Sheet Flow, Wood** Woods: Light underbrush n= 0.400 P2= 3.20"
8.7	260	0.0100	0.50		**Shallow Concentrated Flow, Wood** Woodland Kv= 5.0 fps
28.3	360	Total			

Subcatchment 5S: Grass Paved Access Drive



Summary for Subcatchment 6S: Wetlands

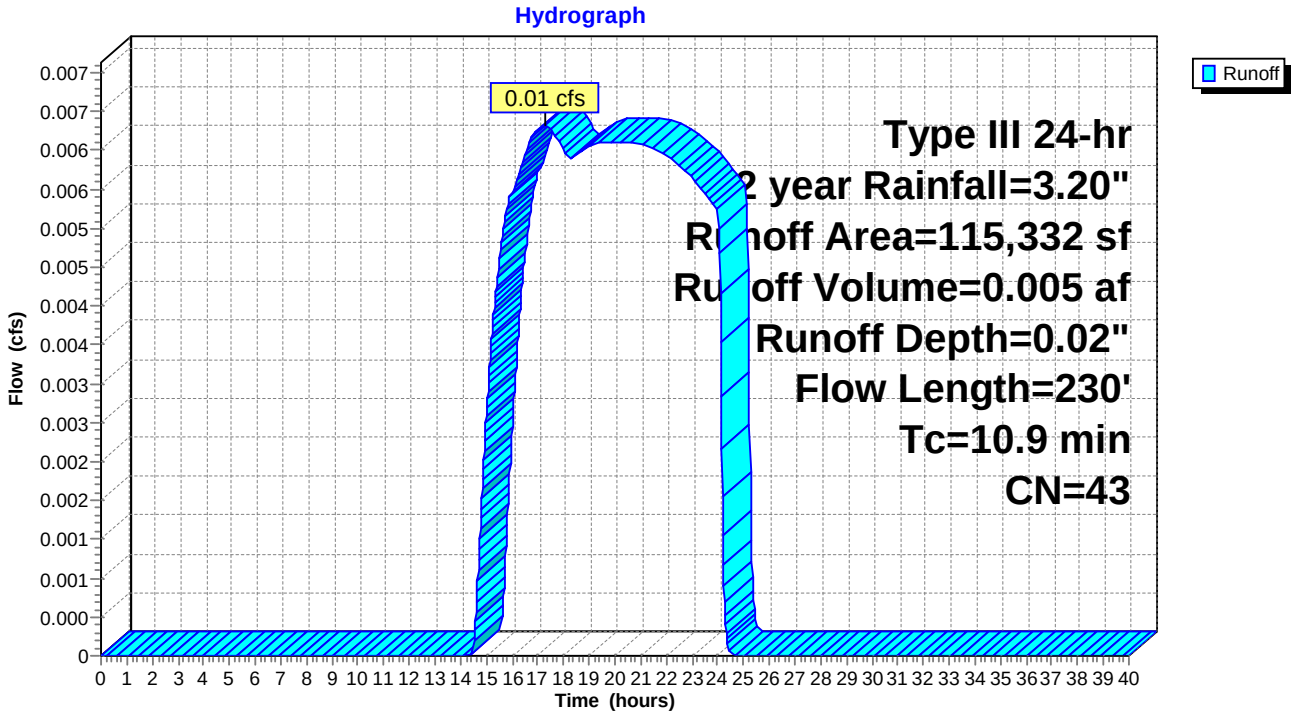
Runoff = 0.01 cfs @ 17.26 hrs, Volume= 0.005 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (sf)	CN	Description
115,332	43	Woods/grass comb., Fair, HSG A
115,332		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	100	0.1650	0.18		**Sheet Flow, Wood/Grass** Woods: Light underbrush n= 0.400 P2= 3.20"
1.7	130	0.0346	1.30		**Shallow Concentrated Flow, Wetland** Short Grass Pasture Kv= 7.0 fps
10.9	230	Total			

Subcatchment 6S: Wetlands



Summary for Subcatchment 7S: To Fencourt Ave

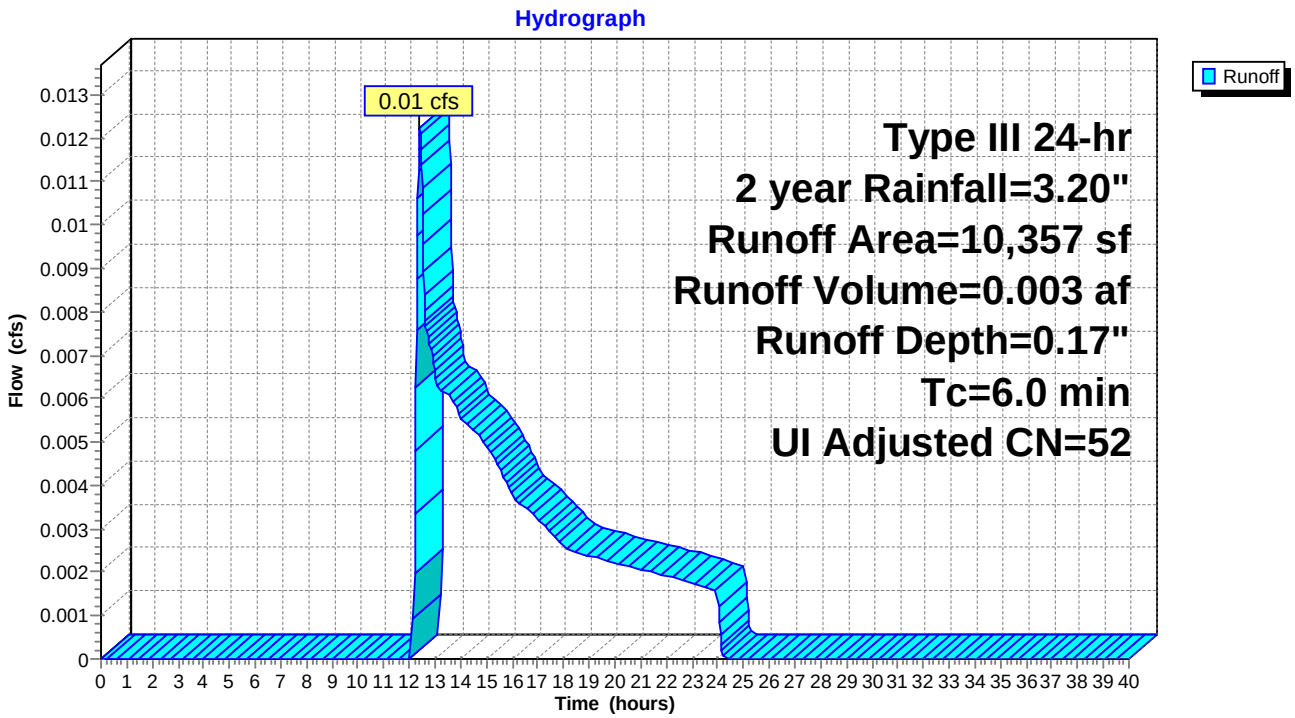
Runoff = 0.01 cfs @ 12.41 hrs, Volume= 0.003 af, Depth= 0.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 2 year Rainfall=3.20"

	Area (sf)	CN	Adj	Description
	1,190	98		Unconnected pavement, HSG A
	5,872	49		50-75% Grass cover, Fair, HSG A
*	3,295	49		Playground area
	10,357	55	52	Weighted Average, UI Adjusted
	9,167			88.51% Pervious Area
	1,190			11.49% Impervious Area
	1,190			100.00% Unconnected

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

Subcatchment 7S: To Fencourt Ave



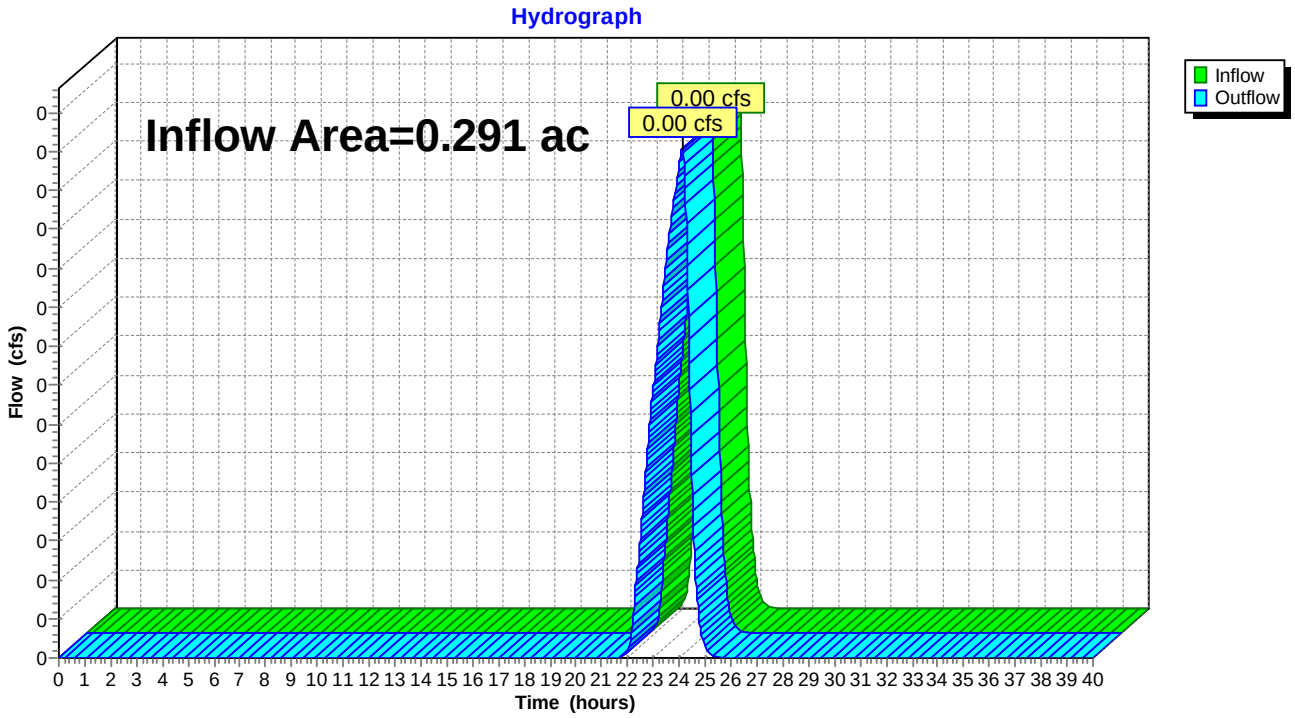
Summary for Reach 5R: Grass Paved Area #5 (12" RCP)

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

Inflow Area = 0.291 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2 year event
Inflow = 0.00 cfs @ 24.10 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 24.10 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs

Reach 5R: Grass Paved Area #5 (12" RCP)



Summary for Pond 1P: Infiltration System 1 (To Fencourt Ave)

Inflow Area = 0.440 ac, 78.76% Impervious, Inflow Depth = 1.76" for 2 year event
Inflow = 0.91 cfs @ 12.09 hrs, Volume= 0.064 af
Outflow = 0.08 cfs @ 11.62 hrs, Volume= 0.064 af, Atten= 91%, Lag= 0.0 min
Discarded = 0.08 cfs @ 11.62 hrs, Volume= 0.064 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Peak Elev= 133.21' @ 13.22 hrs Surf.Area= 0.032 ac Storage= 0.025 af

Plug-Flow detention time= 123.3 min calculated for 0.064 af (100% of inflow)
Center-of-Mass det. time= 123.3 min (949.3 - 826.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	132.00'	0.022 af	**21.62'W x 64.99'L x 2.98'H Field A** 0.096 af Overall - 0.041 af Embedded = 0.055 af x 40.0% Voids
#2A	132.25'	0.039 af	**ACF R-Tank SD 3** x 260 Inside #1 Inside= 15.7"W x 26.8"H => 2.78 sf x 2.35'L = 6.5 cf Outside= 15.7"W x 26.8"H => 2.93 sf x 2.35'L = 6.9 cf 260 Chambers in 10 Rows
		0.061 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	132.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	134.20'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	134.20'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	134.20'	**3.0" Vert. Orifice/Grate** C= 0.600
#5	Primary	134.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#6	Primary	134.00'	**4.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.08 cfs @ 11.62 hrs HW=132.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=132.00' (Free Discharge)
├**2=Orifice/Grate** (Controls 0.00 cfs)
├**3=Orifice/Grate** (Controls 0.00 cfs)
├**4=Orifice/Grate** (Controls 0.00 cfs)
├**5=Orifice/Grate** (Controls 0.00 cfs)
└**6=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: Infiltration System 1 (To Fencourt Ave) - Chamber Wizard Field A

Chamber Model = ACF R-Tank SD 3 (ACF Environmental R-Tank SD)
Inside= 15.7"W x 26.8"H => 2.78 sf x 2.35'L = 6.5 cf
Outside= 15.7"W x 26.8"H => 2.93 sf x 2.35'L = 6.9 cf

15.7" Wide + 6.0" Spacing = 21.7" C-C Row Spacing

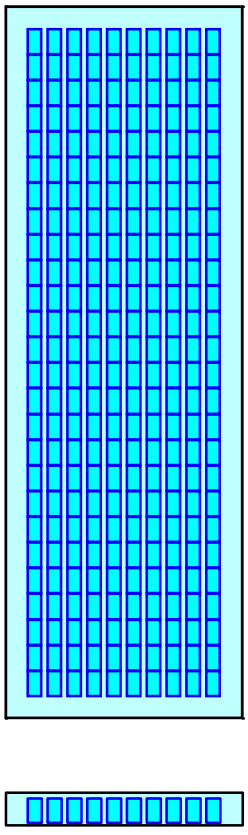
26 Chambers/Row x 2.35' Long = 60.99' Row Length +24.0" End Stone x 2 = 64.99' Base Length
10 Rows x 15.7" Wide + 6.0" Spacing x 9 + 24.0" Side Stone x 2 = 21.62' Base Width
3.0" Base + 26.8" Chamber Height + 6.0" Cover = 2.98' Field Height

260 Chambers x 6.5 cf = 1,696.4 cf Chamber Storage
260 Chambers x 6.9 cf = 1,785.7 cf Displacement

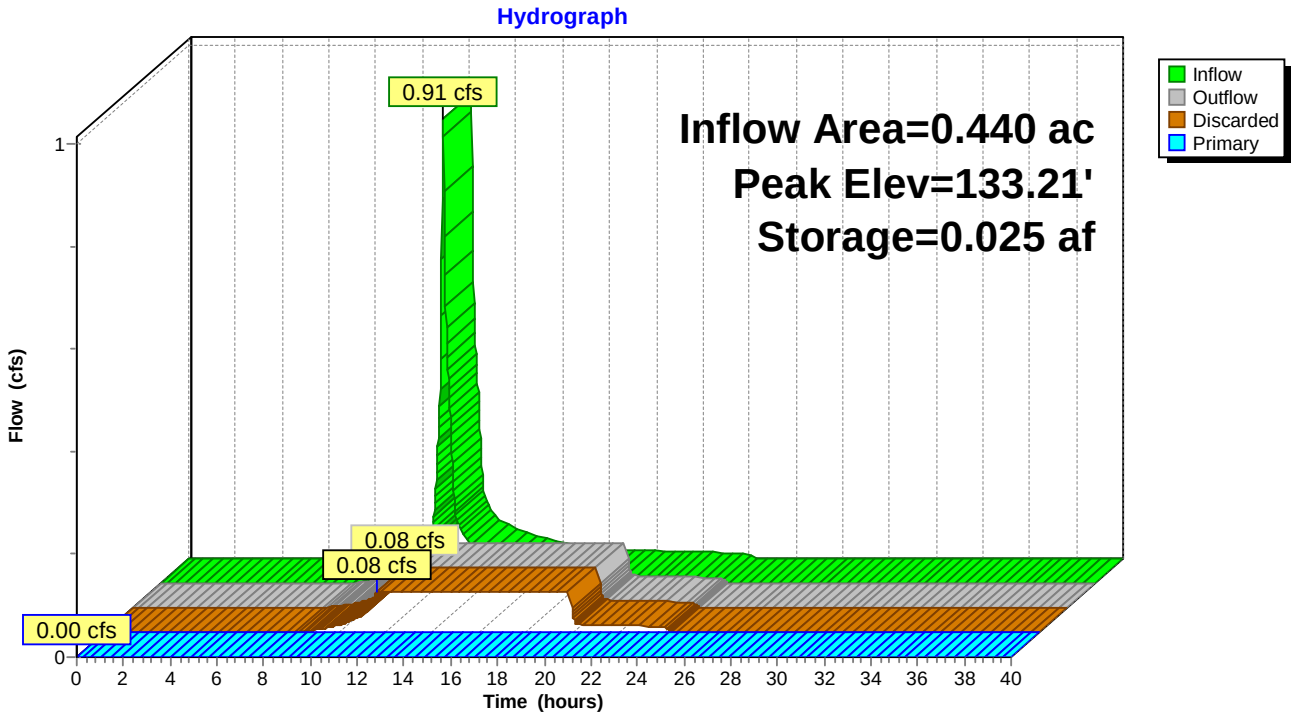
4,189.2 cf Field - 1,785.7 cf Chambers = 2,403.5 cf Stone x 40.0% Voids = 961.4 cf Stone Storage

Chamber Storage + Stone Storage = 2,657.8 cf = 0.061 af
Overall Storage Efficiency = 63.4%
Overall System Size = 64.99' x 21.62' x 2.98'

260 Chambers
155.2 cy Field
89.0 cy Stone



Pond 1P: Infiltration System 1 (To Fencourt Ave)



Stage-Area-Storage for Pond 1P: Infiltration System 1 (To Fencourt Ave)

Elevation (feet)	Surface (acres)	Storage (acre-feet)
132.00	**0.032**	0.000
132.05	0.032	0.001
132.10	0.032	0.001
132.15	0.032	0.002
132.20	0.032	0.003
132.25	0.032	0.003
132.30	0.032	0.004
132.35	0.032	0.006
132.40	0.032	0.007
132.45	0.032	0.008
132.50	0.032	0.009
132.55	0.032	0.010
132.60	0.032	0.011
132.65	0.032	0.012
132.70	0.032	0.014
132.75	0.032	0.015
132.80	0.032	0.016
132.85	0.032	0.017
132.90	0.032	0.018
132.95	0.032	0.019
133.00	0.032	0.020
133.05	0.032	0.022
133.10	0.032	0.023
133.15	0.032	0.024
133.20	0.032	0.025
133.25	0.032	0.026
133.30	0.032	0.027
133.35	0.032	0.029
133.40	0.032	0.030
133.45	0.032	0.031
133.50	0.032	0.032
133.55	0.032	0.033
133.60	0.032	0.034
133.65	0.032	0.035
133.70	0.032	0.037
133.75	0.032	0.038
133.80	0.032	0.039
133.85	0.032	0.040
133.90	0.032	0.041
133.95	0.032	0.042
134.00	0.032	0.043
134.05	0.032	0.045
134.10	0.032	0.046
134.15	0.032	0.047
134.20	0.032	0.048
134.25	0.032	0.049
134.30	0.032	0.050
134.35	0.032	0.052
134.40	0.032	0.053
134.45	0.032	0.054
134.50	0.032	0.055
134.55	0.032	0.055
134.60	0.032	0.056
134.65	0.032	0.057
134.70	0.032	0.057
134.75	0.032	0.058
134.80	0.032	0.059
134.85	0.032	0.059
134.90	0.032	0.060
134.95	0.032	**0.061**

Summary for Pond 2P: Infiltration System 2

Inflow Area = 1.047 ac, 82.36% Impervious, Inflow Depth = 2.00" for 2 year event
Inflow = 2.44 cfs @ 12.09 hrs, Volume= 0.174 af
Outflow = 0.27 cfs @ 11.66 hrs, Volume= 0.174 af, Atten= 89%, Lag= 0.0 min
Discarded = 0.27 cfs @ 11.66 hrs, Volume= 0.174 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Peak Elev= 132.57' @ 12.87 hrs Surf.Area= 0.110 ac Storage= 0.062 af

Plug-Flow detention time= 78.9 min calculated for 0.174 af (100% of inflow)
Center-of-Mass det. time= 78.9 min (893.9 - 815.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	131.70'	0.068 af	**48.81'W x 97.83'L x 2.98'H Field A** 0.327 af Overall - 0.158 af Embedded = 0.169 af x 40.0% Voids
#2A	131.95'	0.150 af	**ACF R-Tank SD 3** x 1000 Inside #1 Inside= 15.7"W x 26.8"H => 2.78 sf x 2.35'L = 6.5 cf Outside= 15.7"W x 26.8"H => 2.93 sf x 2.35'L = 6.9 cf 1000 Chambers in 25 Rows
		0.217 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	131.70'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	133.70'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	133.70'	**4.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.27 cfs @ 11.66 hrs HW=131.73' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.27 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=131.70' (Free Discharge)
├**2=Orifice/Grate** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 2P: Infiltration System 2 - Chamber Wizard Field A

Chamber Model = ACF R-Tank SD 3 (ACF Environmental R-Tank SD)
Inside= 15.7"W x 26.8"H => 2.78 sf x 2.35'L = 6.5 cf
Outside= 15.7"W x 26.8"H => 2.93 sf x 2.35'L = 6.9 cf

15.7" Wide + 6.0" Spacing = 21.7" C-C Row Spacing

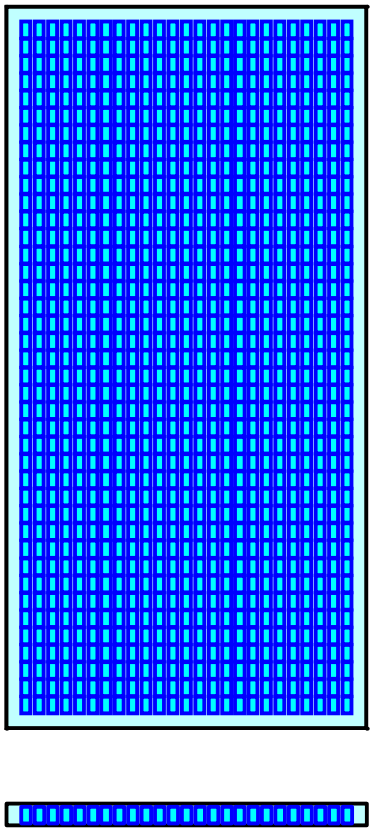
40 Chambers/Row x 2.35' Long = 93.83' Row Length +24.0" End Stone x 2 = 97.83' Base Length
25 Rows x 15.7" Wide + 6.0" Spacing x 24 + 24.0" Side Stone x 2 = 48.81' Base Width
3.0" Base + 26.8" Chamber Height + 6.0" Cover = 2.98' Field Height

1,000 Chambers x 6.5 cf = 6,524.6 cf Chamber Storage
1,000 Chambers x 6.9 cf = 6,868.0 cf Displacement

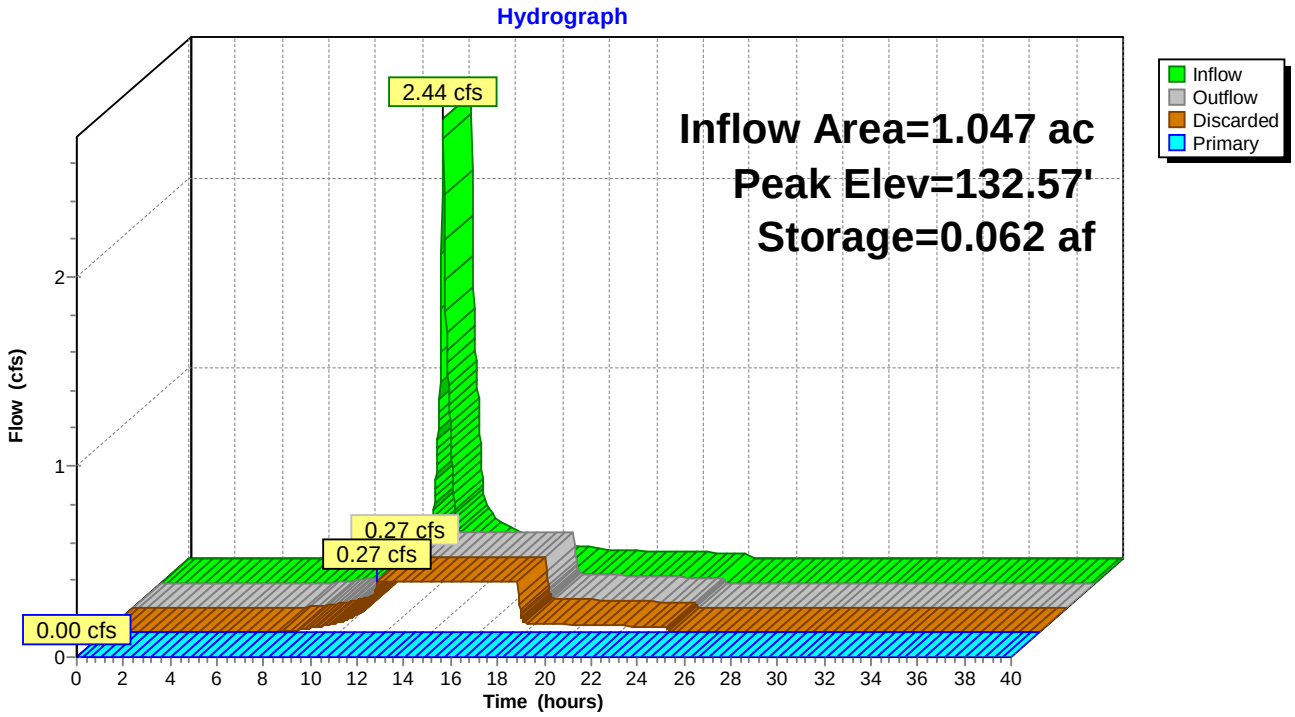
14,234.2 cf Field - 6,868.0 cf Chambers = 7,366.2 cf Stone x 40.0% Voids = 2,946.5 cf Stone Storage

Chamber Storage + Stone Storage = 9,471.1 cf = 0.217 af
Overall Storage Efficiency = 66.5%
Overall System Size = 97.83' x 48.81' x 2.98'

1,000 Chambers
527.2 cy Field
272.8 cy Stone



Pond 2P: Infiltration System 2



Stage-Area-Storage for Pond 2P: Infiltration System 2

Elevation (feet)	Surface (acres)	Storage (acre-feet)
131.70	**0.110**	0.000
131.75	0.110	0.002
131.80	0.110	0.004
131.85	0.110	0.007
131.90	0.110	0.009
131.95	0.110	0.011
132.00	0.110	0.015
132.05	0.110	0.019
132.10	0.110	0.023
132.15	0.110	0.028
132.20	0.110	0.032
132.25	0.110	0.036
132.30	0.110	0.040
132.35	0.110	0.044
132.40	0.110	0.048
132.45	0.110	0.052
132.50	0.110	0.056
132.55	0.110	0.061
132.60	0.110	0.065
132.65	0.110	0.069
132.70	0.110	0.073
132.75	0.110	0.077
132.80	0.110	0.081
132.85	0.110	0.085
132.90	0.110	0.090
132.95	0.110	0.094
133.00	0.110	0.098
133.05	0.110	0.102
133.10	0.110	0.106
133.15	0.110	0.110
133.20	0.110	0.114
133.25	0.110	0.118
133.30	0.110	0.123
133.35	0.110	0.127
133.40	0.110	0.131
133.45	0.110	0.135
133.50	0.110	0.139
133.55	0.110	0.143
133.60	0.110	0.147
133.65	0.110	0.152
133.70	0.110	0.156
133.75	0.110	0.160
133.80	0.110	0.164
133.85	0.110	0.168
133.90	0.110	0.172
133.95	0.110	0.176
134.00	0.110	0.181
134.05	0.110	0.185
134.10	0.110	0.189
134.15	0.110	0.193
134.20	0.110	0.196
134.25	0.110	0.199
134.30	0.110	0.201
134.35	0.110	0.203
134.40	0.110	0.205
134.45	0.110	0.207
134.50	0.110	0.209
134.55	0.110	0.212
134.60	0.110	0.214
134.65	0.110	**0.216**

Summary for Pond 3P: Infiltration System 3

Inflow Area = 0.677 ac, 96.22% Impervious, Inflow Depth = 2.75" for 2 year event
Inflow = 2.03 cfs @ 12.08 hrs, Volume= 0.155 af
Outflow = 0.19 cfs @ 11.42 hrs, Volume= 0.155 af, Atten= 91%, Lag= 0.0 min
Discarded = 0.19 cfs @ 11.42 hrs, Volume= 0.155 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Peak Elev= 134.79' @ 12.93 hrs Surf.Area= 0.077 ac Storage= 0.056 af

Plug-Flow detention time= 93.9 min calculated for 0.155 af (100% of inflow)
Center-of-Mass det. time= 93.8 min (867.9 - 774.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	133.70'	0.041 af	**34.31'W x 97.83'L x 2.26'H Field A** 0.174 af Overall - 0.073 af Embedded = 0.102 af x 40.0% Voids
#2A	133.95'	0.069 af	**ACF R-Tank SD 2** x 680 Inside #1 Inside= 15.7"W x 18.1"H => 1.88 sf x 2.35'L = 4.4 cf Outside= 15.7"W x 18.1"H => 1.98 sf x 2.35'L = 4.6 cf 680 Chambers in 17 Rows
		0.110 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	133.70'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	135.00'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	134.90'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.19 cfs @ 11.42 hrs HW=133.72' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=133.70' (Free Discharge)
├**2=Orifice/Grate** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 3P: Infiltration System 3 - Chamber Wizard Field A

Chamber Model = ACF R-Tank SD 2 (ACF Environmental R-Tank SD)
Inside= 15.7"W x 18.1"H => 1.88 sf x 2.35'L = 4.4 cf
Outside= 15.7"W x 18.1"H => 1.98 sf x 2.35'L = 4.6 cf

15.7" Wide + 6.0" Spacing = 21.7" C-C Row Spacing

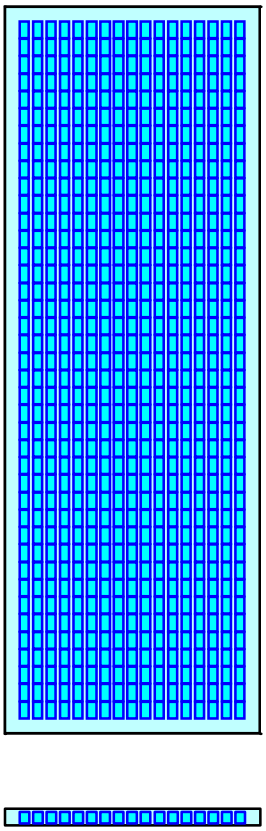
40 Chambers/Row x 2.35' Long = 93.83' Row Length +24.0" End Stone x 2 = 97.83' Base Length
17 Rows x 15.7" Wide + 6.0" Spacing x 16 + 24.0" Side Stone x 2 = 34.31' Base Width
3.0" Base + 18.1" Chamber Height + 6.0" Cover = 2.26' Field Height

680 Chambers x 4.4 cf = 3,001.3 cf Chamber Storage
680 Chambers x 4.6 cf = 3,159.3 cf Displacement

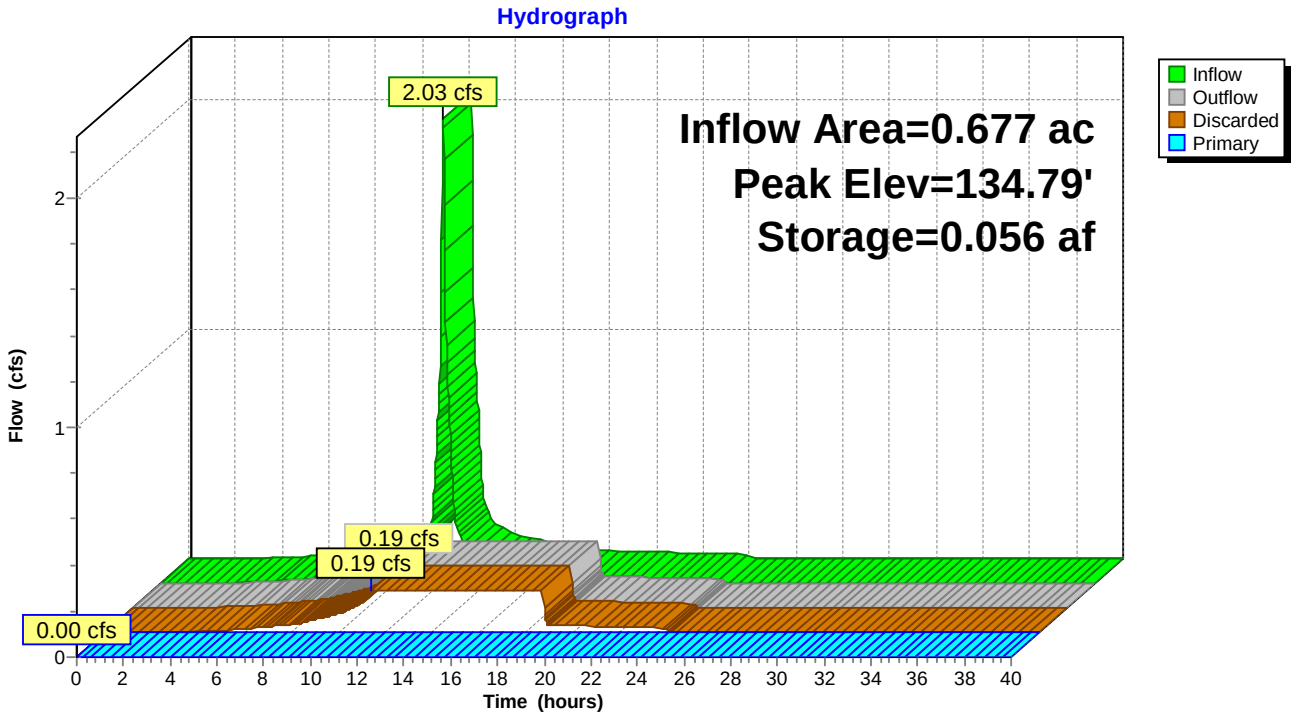
7,583.2 cf Field - 3,159.3 cf Chambers = 4,423.9 cf Stone x 40.0% Voids = 1,769.6 cf Stone Storage

Chamber Storage + Stone Storage = 4,770.9 cf = 0.110 af
Overall Storage Efficiency = 62.9%
Overall System Size = 97.83' x 34.31' x 2.26'

680 Chambers
280.9 cy Field
163.8 cy Stone



Pond 3P: Infiltration System 3



Stage-Area-Storage for Pond 3P: Infiltration System 3

Elevation (feet)	Surface (acres)	Storage (acre-feet)
133.70	**0.077**	0.000
133.75	0.077	0.002
133.80	0.077	0.003
133.85	0.077	0.005
133.90	0.077	0.006
133.95	0.077	0.008
134.00	0.077	0.011
134.05	0.077	0.013
134.10	0.077	0.016
134.15	0.077	0.019
134.20	0.077	0.022
134.25	0.077	0.025
134.30	0.077	0.028
134.35	0.077	0.031
134.40	0.077	0.033
134.45	0.077	0.036
134.50	0.077	0.039
134.55	0.077	0.042
134.60	0.077	0.045
134.65	0.077	0.048
134.70	0.077	0.051
134.75	0.077	0.054
134.80	0.077	0.056
134.85	0.077	0.059
134.90	0.077	0.062
134.95	0.077	0.065
135.00	0.077	0.068
135.05	0.077	0.071
135.10	0.077	0.074
135.15	0.077	0.076
135.20	0.077	0.079
135.25	0.077	0.082
135.30	0.077	0.085
135.35	0.077	0.088
135.40	0.077	0.091
135.45	0.077	0.094
135.50	0.077	0.095
135.55	0.077	0.097
135.60	0.077	0.098
135.65	0.077	0.100
135.70	0.077	0.102
135.75	0.077	0.103
135.80	0.077	0.105
135.85	0.077	0.106
135.90	0.077	0.108
135.95	0.077	**0.109**

Summary for Pond 4P: Infiltration System 4

Inflow Area = 1.765 ac, 86.15% Impervious, Inflow Depth = 2.17" for 2 year event
Inflow = 4.43 cfs @ 12.09 hrs, Volume= 0.319 af
Outflow = 0.51 cfs @ 11.66 hrs, Volume= 0.319 af, Atten= 88%, Lag= 0.0 min
Discarded = 0.51 cfs @ 11.66 hrs, Volume= 0.319 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Peak Elev= 133.79' @ 12.77 hrs Surf.Area= 0.212 ac Storage= 0.109 af

Plug-Flow detention time= 68.3 min calculated for 0.319 af (100% of inflow)
Center-of-Mass det. time= 68.3 min (875.2 - 806.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	133.00'	0.106 af	**66.93'W x 137.71'L x 2.26'H Field A** 0.478 af Overall - 0.213 af Embedded = 0.265 af x 40.0% Voids
#2A	133.25'	0.202 af	**ACF R-Tank SD 2** x 1995 Inside #1 Inside= 15.7"W x 18.1"H => 1.88 sf x 2.35'L = 4.4 cf Outside= 15.7"W x 18.1"H => 1.98 sf x 2.35'L = 4.6 cf 1995 Chambers in 35 Rows
		0.308 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	133.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	134.30'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	134.00'	**2.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	134.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.51 cfs @ 11.66 hrs HW=133.02' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.51 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=133.00' (Free Discharge)
├**2=Orifice/Grate** (Controls 0.00 cfs)
├**3=Orifice/Grate** (Controls 0.00 cfs)
└**4=Orifice/Grate** (Controls 0.00 cfs)

Pond 4P: Infiltration System 4 - Chamber Wizard Field A

Chamber Model = ACF R-Tank SD 2 (ACF Environmental R-Tank SD)
Inside= 15.7"W x 18.1"H => 1.88 sf x 2.35'L = 4.4 cf
Outside= 15.7"W x 18.1"H => 1.98 sf x 2.35'L = 4.6 cf

15.7" Wide + 6.0" Spacing = 21.7" C-C Row Spacing

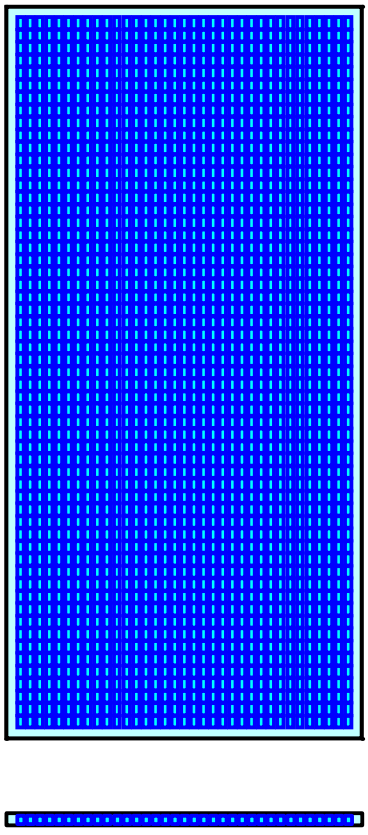
57 Chambers/Row x 2.35' Long = 133.71' Row Length +24.0" End Stone x 2 = 137.71' Base Length
35 Rows x 15.7" Wide + 6.0" Spacing x 34 + 24.0" Side Stone x 2 = 66.93' Base Width
3.0" Base + 18.1" Chamber Height + 6.0" Cover = 2.26' Field Height

1,995 Chambers x 4.4 cf = 8,805.3 cf Chamber Storage
1,995 Chambers x 4.6 cf = 9,268.8 cf Displacement

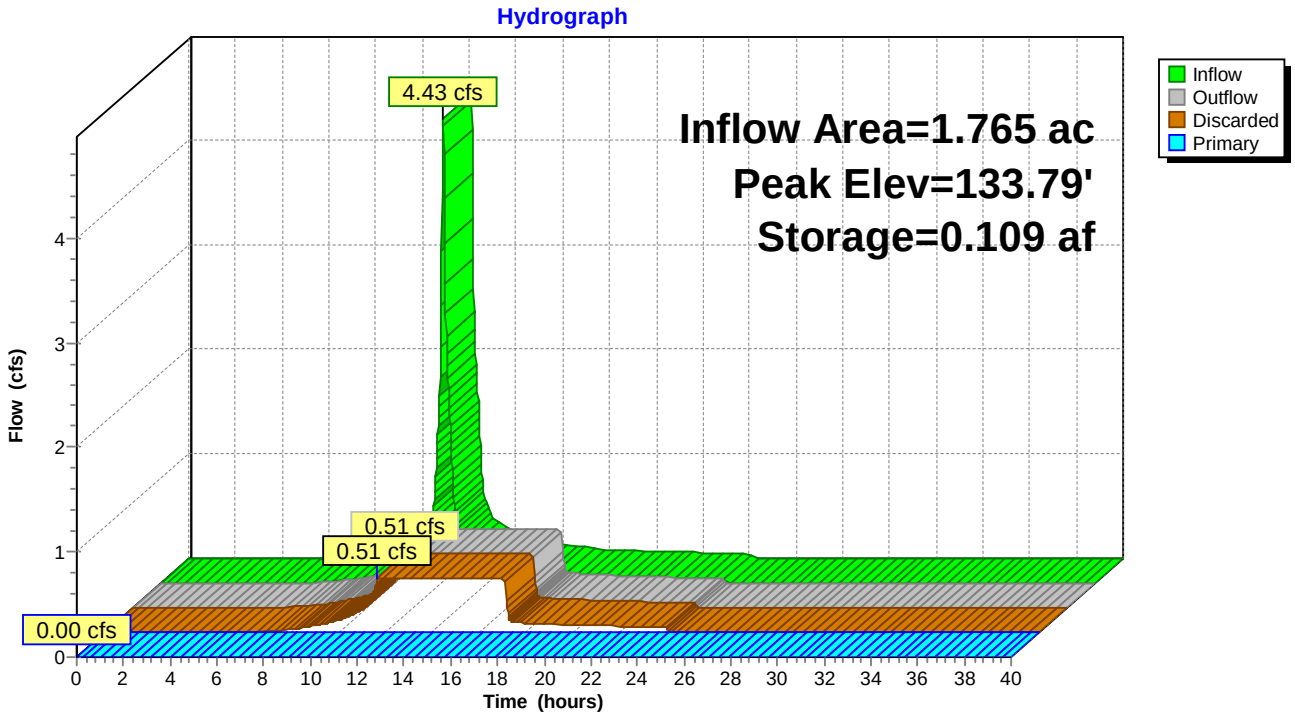
20,823.4 cf Field - 9,268.8 cf Chambers = 11,554.6 cf Stone x 40.0% Voids = 4,621.9 cf Stone Storage

Chamber Storage + Stone Storage = 13,427.2 cf = 0.308 af
Overall Storage Efficiency = 64.5%
Overall System Size = 137.71' x 66.93' x 2.26'

1,995 Chambers
771.2 cy Field
427.9 cy Stone



Pond 4P: Infiltration System 4



Stage-Area-Storage for Pond 4P: Infiltration System 4

Elevation (feet)	Surface (acres)	Storage (acre-feet)
133.00	**0.212**	0.000
133.05	0.212	0.004
133.10	0.212	0.008
133.15	0.212	0.013
133.20	0.212	0.017
133.25	0.212	0.021
133.30	0.212	0.029
133.35	0.212	0.037
133.40	0.212	0.045
133.45	0.212	0.054
133.50	0.212	0.062
133.55	0.212	0.070
133.60	0.212	0.078
133.65	0.212	0.086
133.70	0.212	0.094
133.75	0.212	0.102
133.80	0.212	0.110
133.85	0.212	0.118
133.90	0.212	0.127
133.95	0.212	0.135
134.00	0.212	0.143
134.05	0.212	0.151
134.10	0.212	0.159
134.15	0.212	0.167
134.20	0.212	0.175
134.25	0.212	0.183
134.30	0.212	0.191
134.35	0.212	0.200
134.40	0.212	0.208
134.45	0.212	0.216
134.50	0.212	0.224
134.55	0.212	0.232
134.60	0.212	0.240
134.65	0.212	0.248
134.70	0.212	0.256
134.75	0.212	0.264
134.80	0.212	0.269
134.85	0.212	0.274
134.90	0.212	0.278
134.95	0.212	0.282
135.00	0.212	0.286
135.05	0.212	0.291
135.10	0.212	0.295
135.15	0.212	0.299
135.20	0.212	0.303
135.25	0.212	**0.307**

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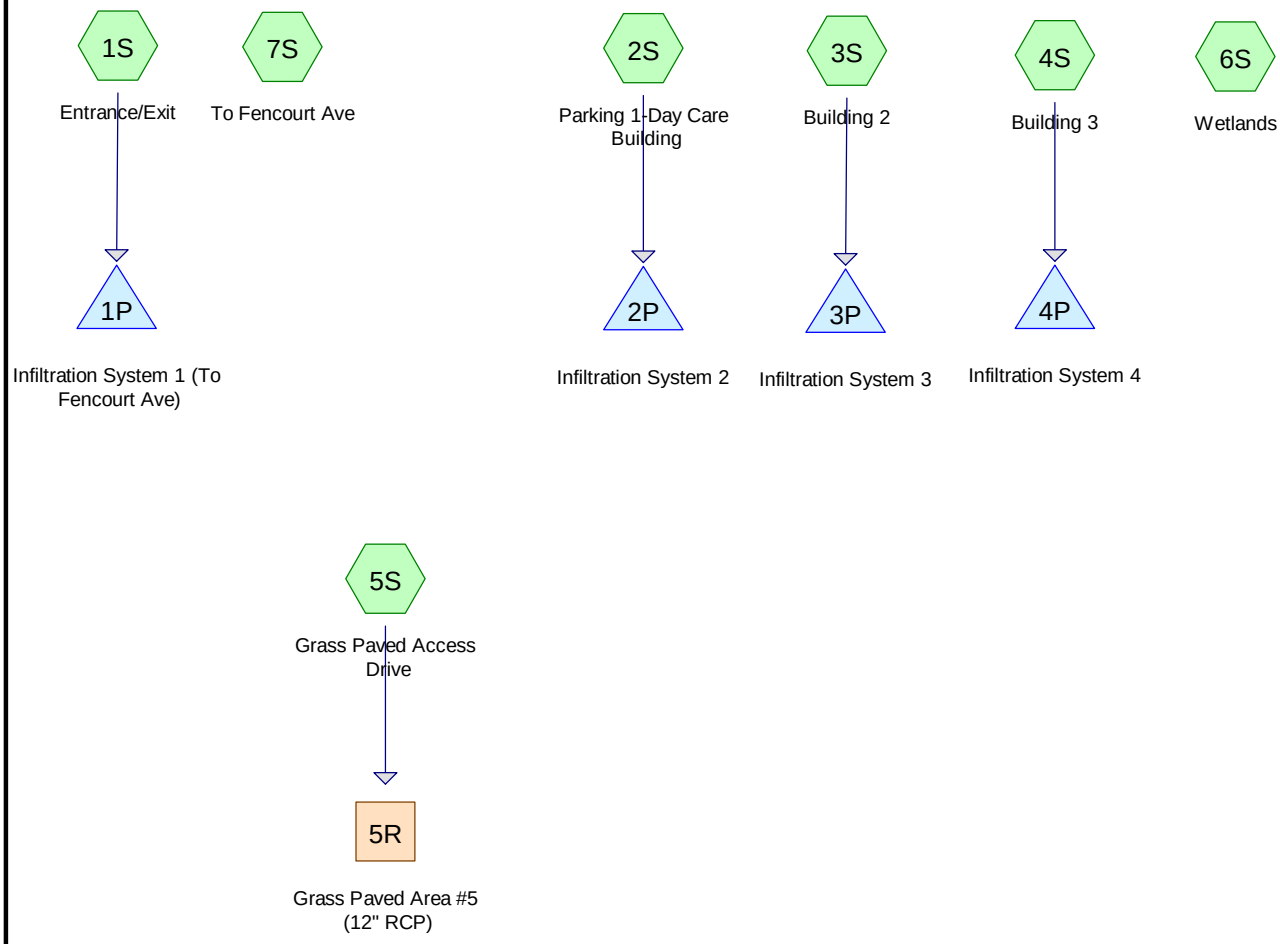
Current Event



Routing Diagram for 16 Fencourt Avenue-Proposed 10yr storm-2023-05-25
Prepared by {enter your company name here}, Printed 5/28/2023

Time span=0.00-40.00 hrs, dt=0.02 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Entrance/Exit Runoff Area=19,160 sf 78.76% Impervious Runoff Depth=3.09"
Tc=6.0 min CN=85 Runoff=1.58 cfs 0.113 af

Subcatchment 2S: Parking 1-Day Care Building Runoff Area=45,613 sf 82.36% Impervious Runoff Depth=3.38"
Tc=6.0 min CN=88 Runoff=4.07 cfs 0.295 af

Subcatchment 3S: Building 2 Runoff Area=29,469 sf 96.22% Impervious Runoff Depth=4.23"
Tc=6.0 min CN=96 Runoff=3.05 cfs 0.239 af

Subcatchment 4S: Building 3 Runoff Area=76,905 sf 86.15% Impervious Runoff Depth=3.59"
Tc=6.0 min CN=90 Runoff=7.18 cfs 0.528 af

Subcatchment 5S: Grass Paved Access Drive Runoff Area=12,688 sf 0.00% Impervious Runoff Depth=0.14"
Flow Length=360' Tc=28.3 min CN=39 Runoff=0.01 cfs 0.003 af

Subcatchment 6S: Wetlands Runoff Area=115,332 sf 0.00% Impervious Runoff Depth=0.27"
Flow Length=230' Tc=10.9 min CN=43 Runoff=0.22 cfs 0.061 af

Subcatchment 7S: To Fencourt Ave Runoff Area=10,357 sf 11.49% Impervious Runoff Depth=0.67"
Tc=6.0 min UI Adjusted CN=52 Runoff=0.12 cfs 0.013 af

Reach 5R: Grass Paved Area #5 (12" RCP) Inflow=0.01 cfs 0.003 af
Outflow=0.01 cfs 0.003 af

Pond 1P: Infiltration System 1 (To Fencourt Ave) Peak Elev=134.17' Storage=0.047 af Inflow=1.58 cfs 0.113 af
Discarded=0.08 cfs 0.102 af Primary=0.13 cfs 0.011 af Outflow=0.21 cfs 0.113 af

Pond 2P: Infiltration System 2 Peak Elev=133.36' Storage=0.128 af Inflow=4.07 cfs 0.295 af
Discarded=0.27 cfs 0.295 af Primary=0.00 cfs 0.000 af Outflow=0.27 cfs 0.295 af

Pond 3P: Infiltration System 3 Peak Elev=135.27' Storage=0.083 af Inflow=3.05 cfs 0.239 af
Discarded=0.19 cfs 0.207 af Primary=0.48 cfs 0.032 af Outflow=0.66 cfs 0.239 af

Pond 4P: Infiltration System 4 Peak Elev=134.35' Storage=0.200 af Inflow=7.18 cfs 0.528 af
Discarded=0.51 cfs 0.482 af Primary=0.36 cfs 0.046 af Outflow=0.87 cfs 0.528 af

Total Runoff Area = 7.106 ac Runoff Volume = 1.253 af Average Runoff Depth = 2.12"
52.04% Pervious = 3.698 ac 47.96% Impervious = 3.408 ac

Summary for Subcatchment 1S: Entrance/Exit

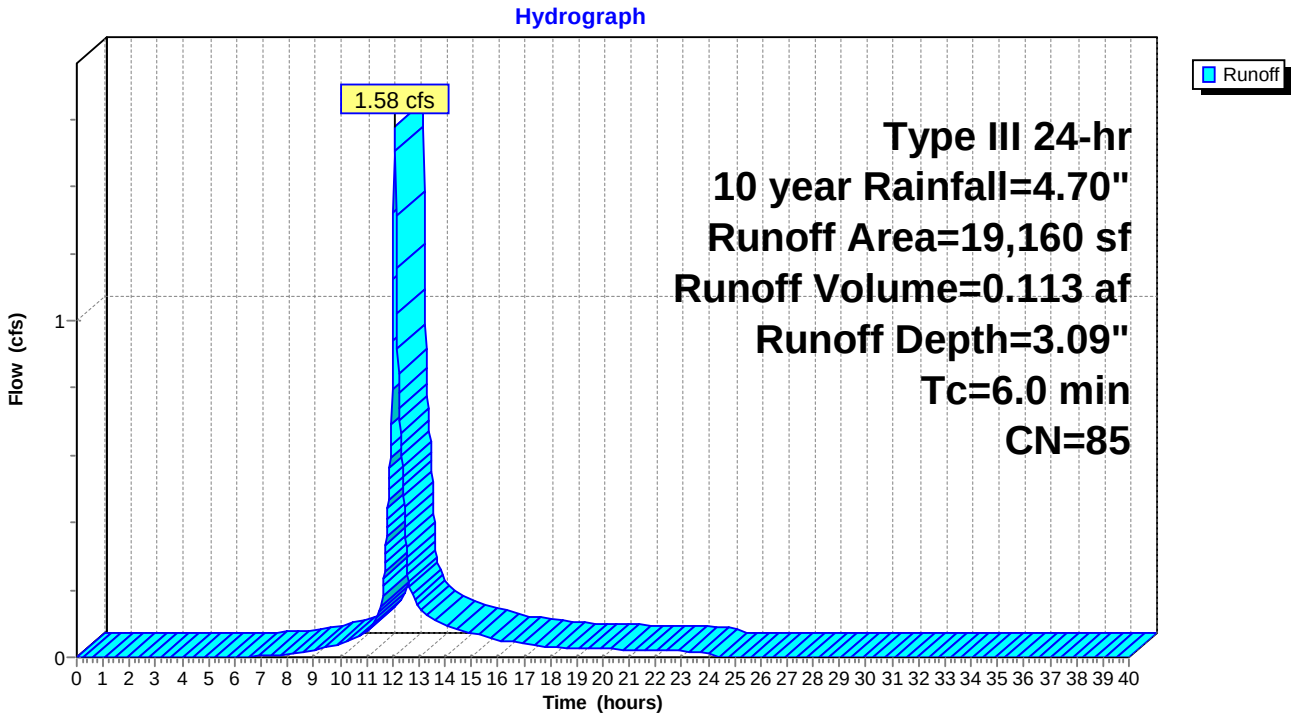
Runoff = 1.58 cfs @ 12.09 hrs, Volume= 0.113 af, Depth= 3.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 10 year Rainfall=4.70"

Area (sf)	CN	Description
15,090	98	Paved parking, HSG A
4,070	39	>75% Grass cover, Good, HSG A
19,160	85	Weighted Average
4,070		21.24% Pervious Area
15,090		78.76% Impervious Area

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

Subcatchment 1S: Entrance/Exit



Summary for Subcatchment 2S: Parking 1-Day Care Building

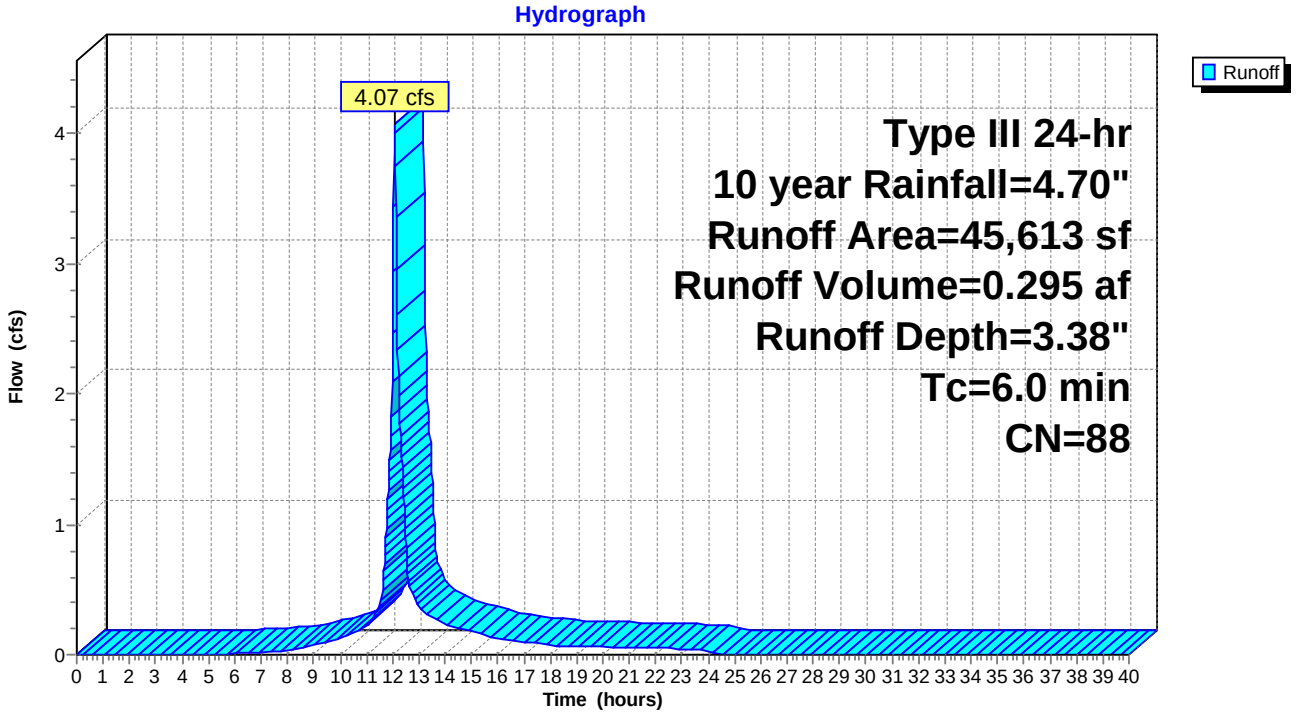
Runoff = 4.07 cfs @ 12.09 hrs, Volume= 0.295 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 10 year Rainfall=4.70"

	Area (sf)	CN	Description
	24,731	98	Paved parking, HSG A
	8,047	39	>75% Grass cover, Good, HSG A
*	12,835	98	Daycare Building, HSG A
	45,613	88	Weighted Average
	8,047		17.64% Pervious Area
	37,566		82.36% Impervious Area

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

Subcatchment 2S: Parking 1-Day Care Building



Summary for Subcatchment 3S: Building 2

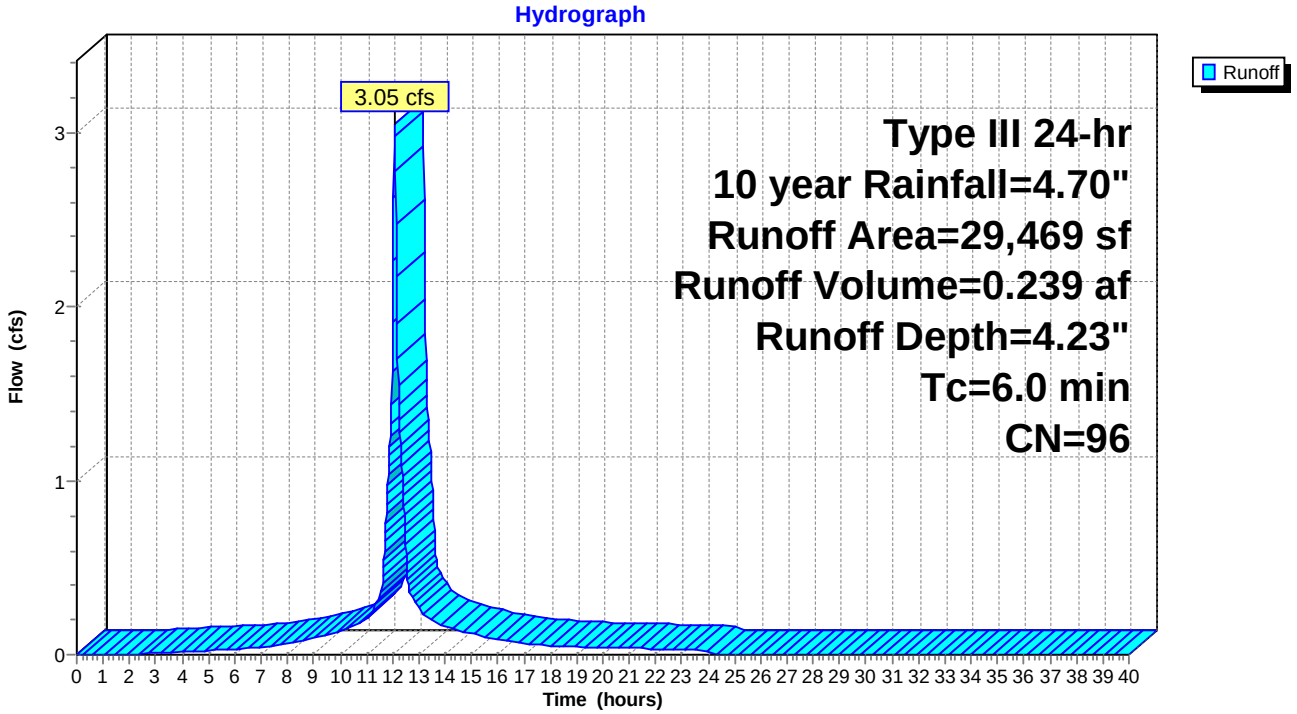
Runoff = 3.05 cfs @ 12.08 hrs, Volume= 0.239 af, Depth= 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 10 year Rainfall=4.70"

	Area (sf)	CN	Description
	11,219	98	Paved parking, HSG A
*	17,137	98	Building #2, HSG A
	1,113	39	>75% Grass cover, Good, HSG A
	29,469	96	Weighted Average
	1,113		3.78% Pervious Area
	28,356		96.22% Impervious Area

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

Subcatchment 3S: Building 2



Summary for Subcatchment 4S: Building 3

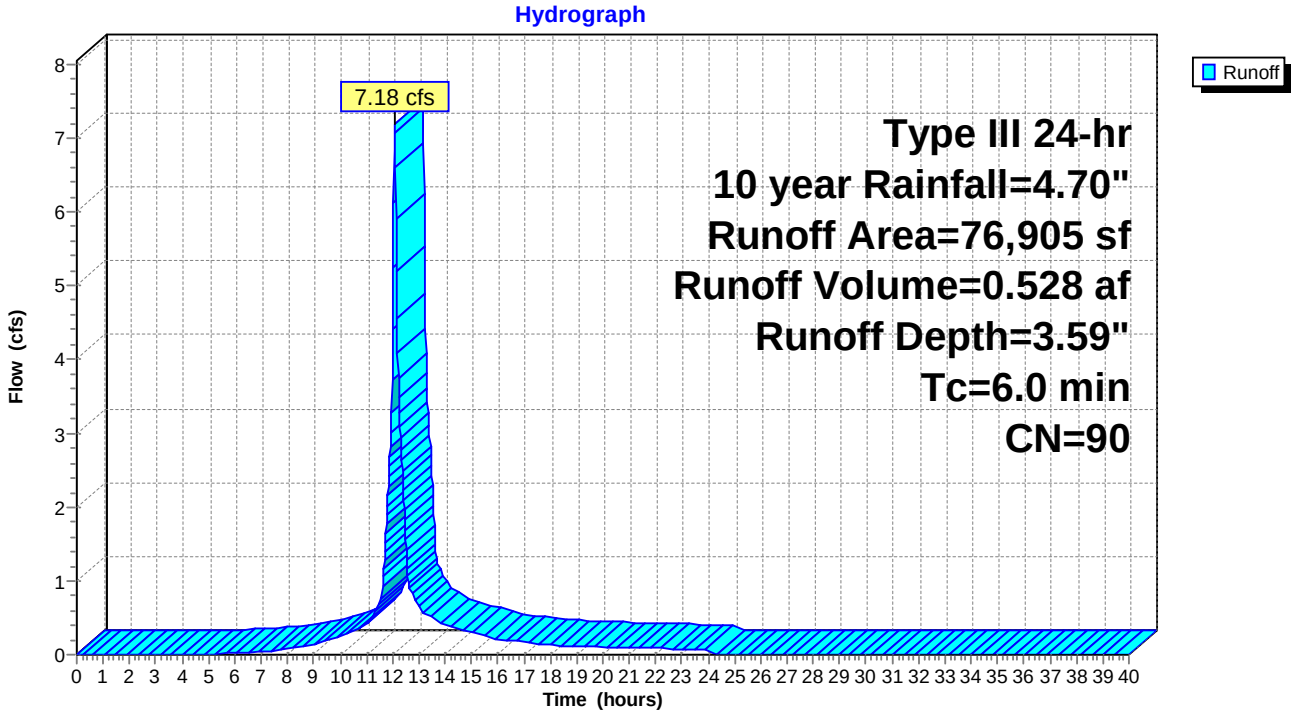
Runoff = 7.18 cfs @ 12.09 hrs, Volume= 0.528 af, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 10 year Rainfall=4.70"

	Area (sf)	CN	Description
	43,449	98	Paved parking, HSG A
*	22,804	98	Building 3, HSG A
	10,652	39	>75% Grass cover, Good, HSG A
	76,905	90	Weighted Average
	10,652		13.85% Pervious Area
	66,253		86.15% Impervious Area

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

Subcatchment 4S: Building 3



Summary for Subcatchment 5S: Grass Paved Access Drive

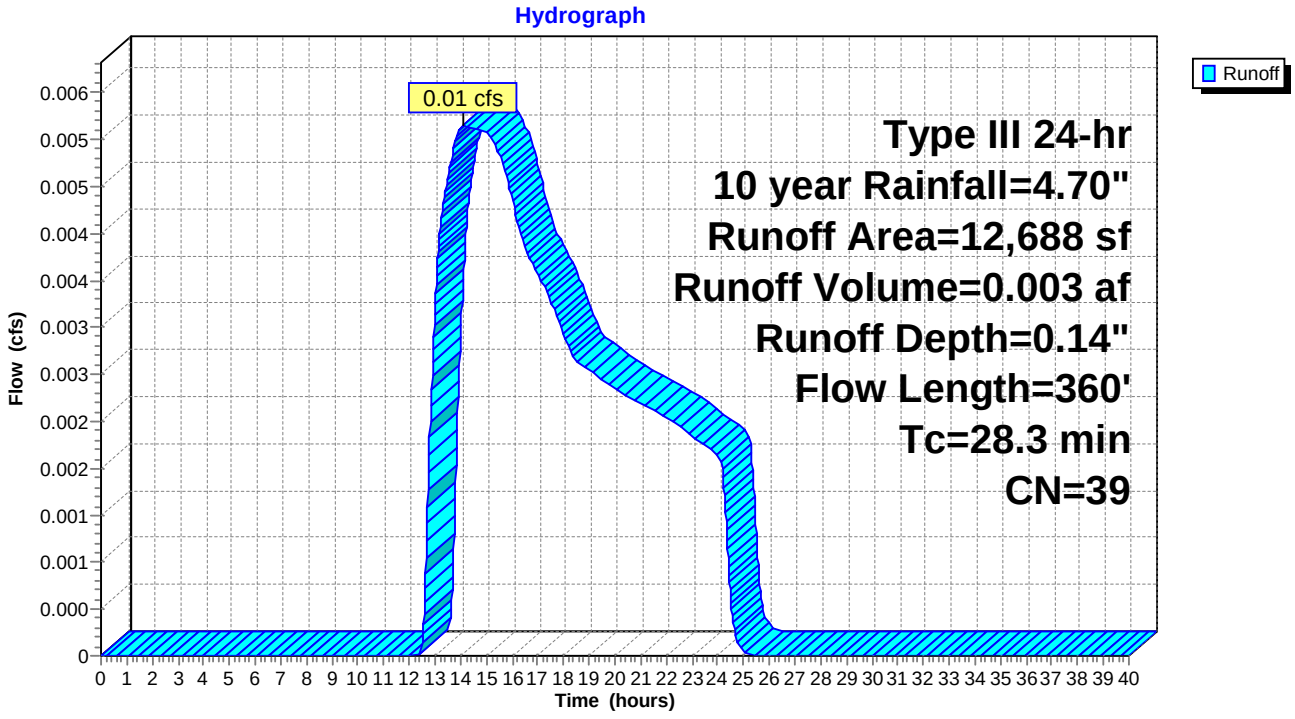
Runoff = 0.01 cfs @ 14.12 hrs, Volume= 0.003 af, Depth= 0.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 10 year Rainfall=4.70"

Area (sf)	CN	Description
12,688	39	>75% Grass cover, Good, HSG A
12,688		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.6	100	0.0250	0.08		**Sheet Flow, Wood** Woods: Light underbrush n= 0.400 P2= 3.20"
8.7	260	0.0100	0.50		**Shallow Concentrated Flow, Wood** Woodland Kv= 5.0 fps
28.3	360	Total			

Subcatchment 5S: Grass Paved Access Drive



Summary for Subcatchment 6S: Wetlands

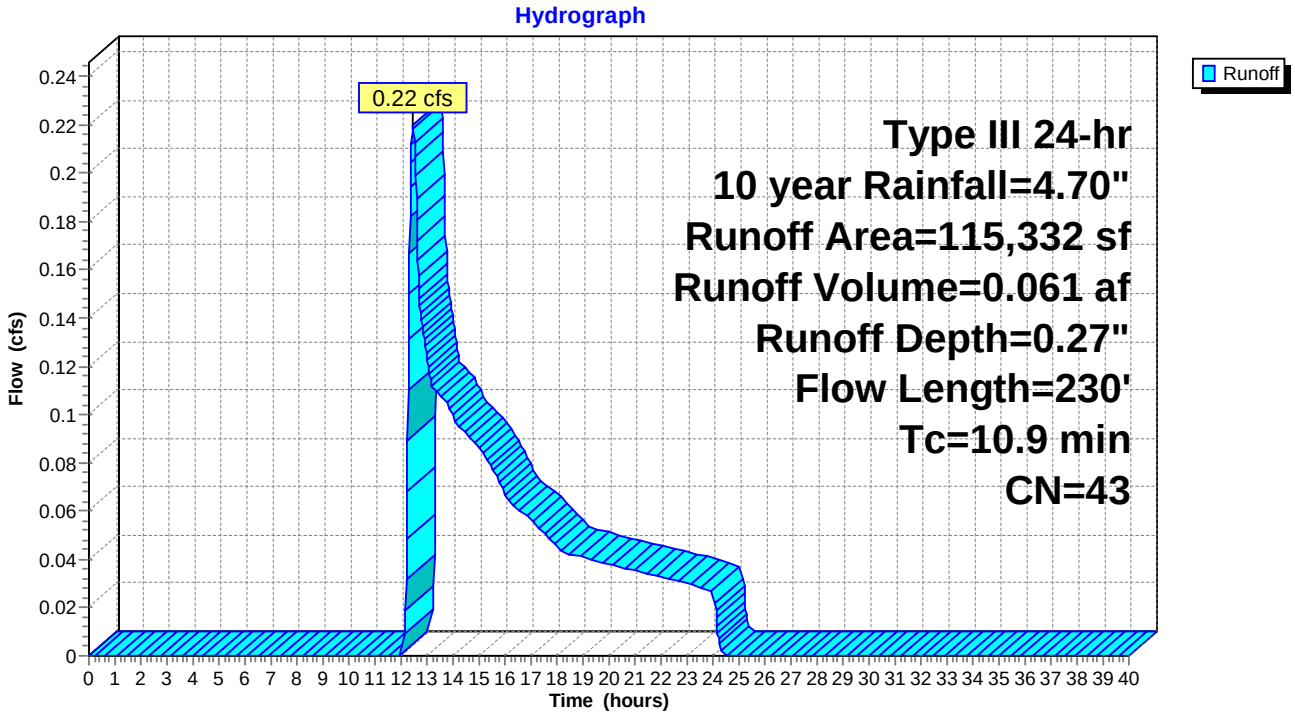
Runoff = 0.22 cfs @ 12.47 hrs, Volume= 0.061 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 10 year Rainfall=4.70"

Area (sf)	CN	Description
115,332	43	Woods/grass comb., Fair, HSG A
115,332		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	100	0.1650	0.18		**Sheet Flow, Wood/Grass** Woods: Light underbrush n= 0.400 P2= 3.20"
1.7	130	0.0346	1.30		**Shallow Concentrated Flow, Wetland** Short Grass Pasture Kv= 7.0 fps
10.9	230	Total			

Subcatchment 6S: Wetlands



Summary for Subcatchment 7S: To Fencourt Ave

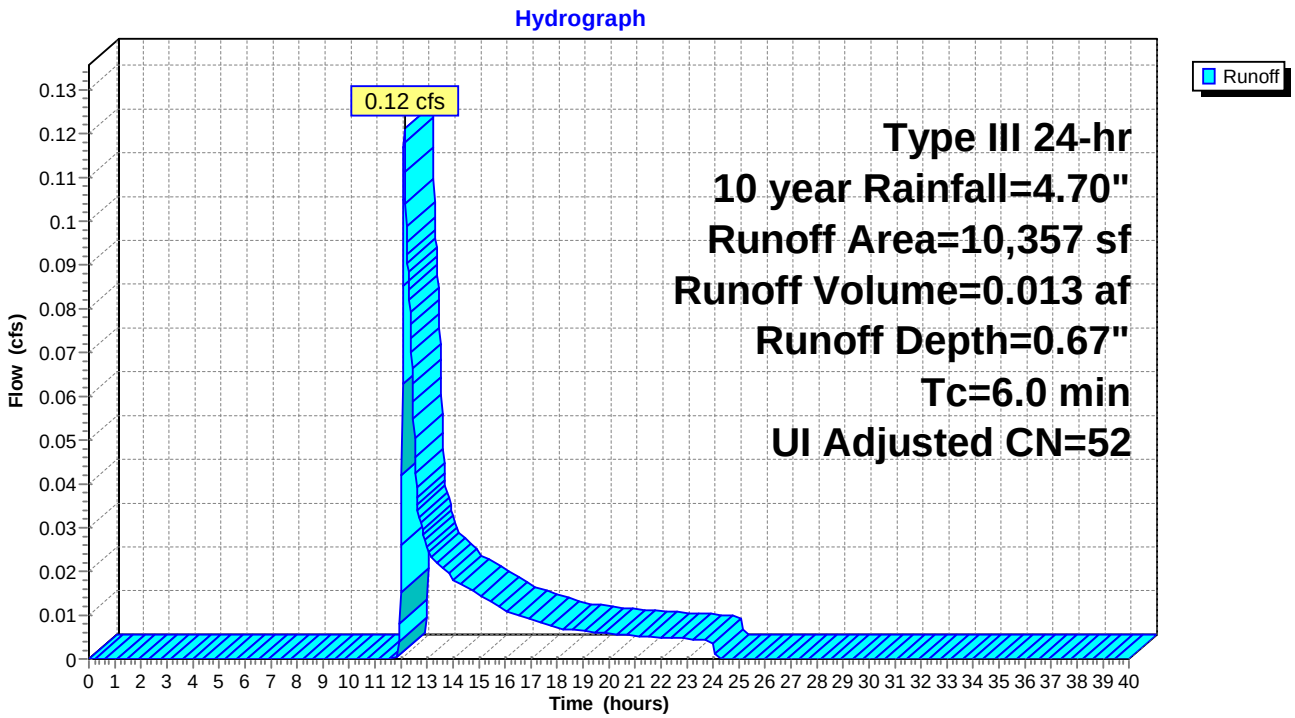
Runoff = 0.12 cfs @ 12.12 hrs, Volume= 0.013 af, Depth= 0.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 10 year Rainfall=4.70"

	Area (sf)	CN	Adj	Description
	1,190	98		Unconnected pavement, HSG A
	5,872	49		50-75% Grass cover, Fair, HSG A
*	3,295	49		Playground area
	10,357	55	52	Weighted Average, UI Adjusted
	9,167			88.51% Pervious Area
	1,190			11.49% Impervious Area
	1,190			100.00% Unconnected

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

Subcatchment 7S: To Fencourt Ave



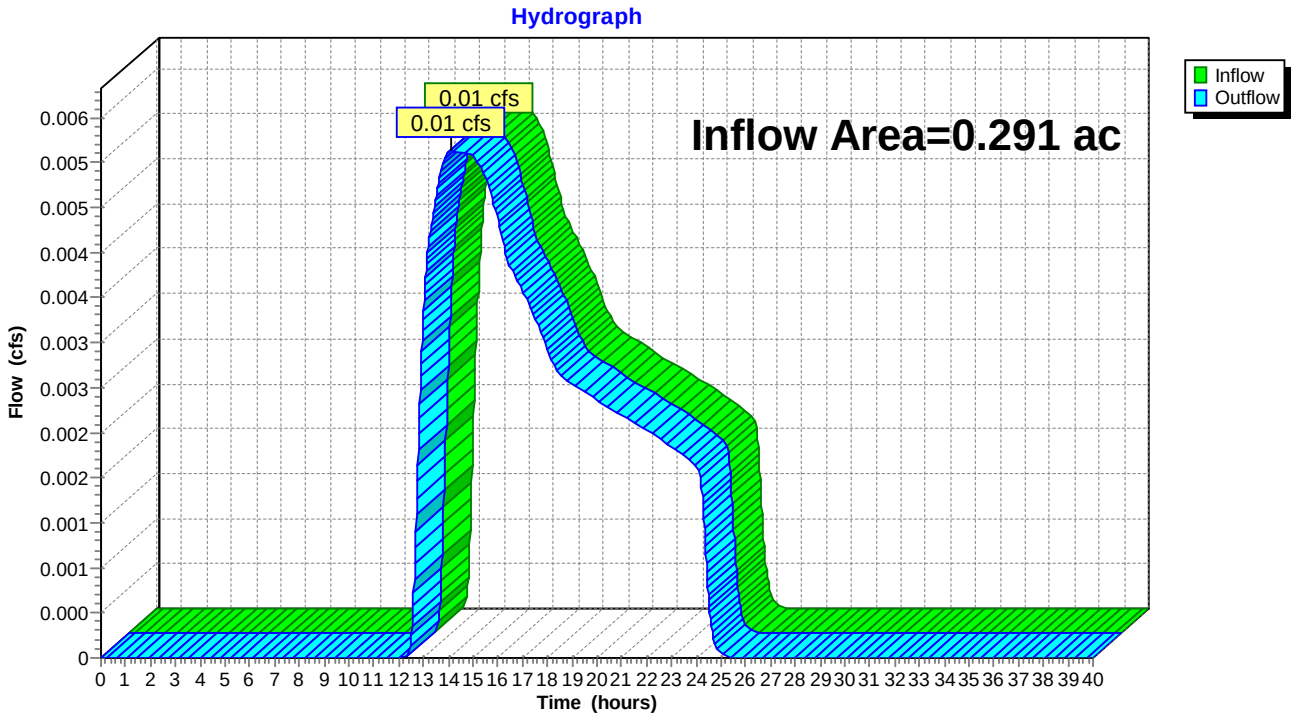
Summary for Reach 5R: Grass Paved Area #5 (12" RCP)

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

Inflow Area = 0.291 ac, 0.00% Impervious, Inflow Depth = 0.14" for 10 year event
Inflow = 0.01 cfs @ 14.12 hrs, Volume= 0.003 af
Outflow = 0.01 cfs @ 14.12 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs

Reach 5R: Grass Paved Area #5 (12" RCP)



Summary for Pond 1P: Infiltration System 1 (To Fencourt Ave)

Inflow Area = 0.440 ac, 78.76% Impervious, Inflow Depth = 3.09" for 10 year event
Inflow = 1.58 cfs @ 12.09 hrs, Volume= 0.113 af
Outflow = 0.21 cfs @ 12.66 hrs, Volume= 0.113 af, Atten= 87%, Lag= 34.4 min
Discarded = 0.08 cfs @ 11.10 hrs, Volume= 0.102 af
Primary = 0.13 cfs @ 12.66 hrs, Volume= 0.011 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Peak Elev= 134.17' @ 12.66 hrs Surf.Area= 0.032 ac Storage= 0.047 af

Plug-Flow detention time= 214.2 min calculated for 0.113 af (100% of inflow)
Center-of-Mass det. time= 214.2 min (1,024.1 - 810.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	132.00'	0.022 af	**21.62'W x 64.99'L x 2.98'H Field A** 0.096 af Overall - 0.041 af Embedded = 0.055 af x 40.0% Voids
#2A	132.25'	0.039 af	**ACF R-Tank SD 3** x 260 Inside #1 Inside= 15.7"W x 26.8"H => 2.78 sf x 2.35'L = 6.5 cf Outside= 15.7"W x 26.8"H => 2.93 sf x 2.35'L = 6.9 cf 260 Chambers in 10 Rows
		0.061 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	132.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	134.20'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	134.20'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	134.20'	**3.0" Vert. Orifice/Grate** C= 0.600
#5	Primary	134.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#6	Primary	134.00'	**4.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.08 cfs @ 11.10 hrs HW=132.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.13 cfs @ 12.66 hrs HW=134.17' (Free Discharge)
├**2=Orifice/Grate** (Controls 0.00 cfs)
├**3=Orifice/Grate** (Controls 0.00 cfs)
├**4=Orifice/Grate** (Controls 0.00 cfs)
├**5=Orifice/Grate** (Orifice Controls 0.06 cfs @ 1.41 fps)
└**6=Orifice/Grate** (Orifice Controls 0.06 cfs @ 1.41 fps)

Pond 1P: Infiltration System 1 (To Fencourt Ave) - Chamber Wizard Field A

Chamber Model = ACF R-Tank SD 3 (ACF Environmental R-Tank SD)
Inside= 15.7"W x 26.8"H => 2.78 sf x 2.35'L = 6.5 cf
Outside= 15.7"W x 26.8"H => 2.93 sf x 2.35'L = 6.9 cf

15.7" Wide + 6.0" Spacing = 21.7" C-C Row Spacing

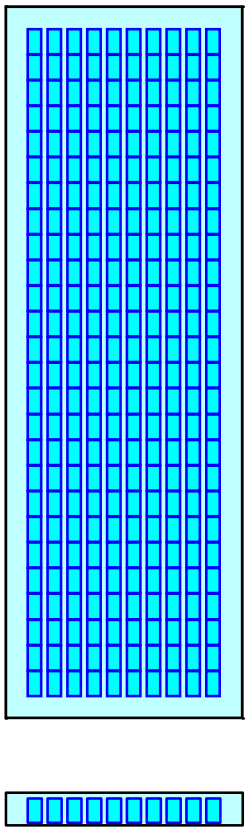
26 Chambers/Row x 2.35' Long = 60.99' Row Length +24.0" End Stone x 2 = 64.99' Base Length
10 Rows x 15.7" Wide + 6.0" Spacing x 9 + 24.0" Side Stone x 2 = 21.62' Base Width
3.0" Base + 26.8" Chamber Height + 6.0" Cover = 2.98' Field Height

260 Chambers x 6.5 cf = 1,696.4 cf Chamber Storage
260 Chambers x 6.9 cf = 1,785.7 cf Displacement

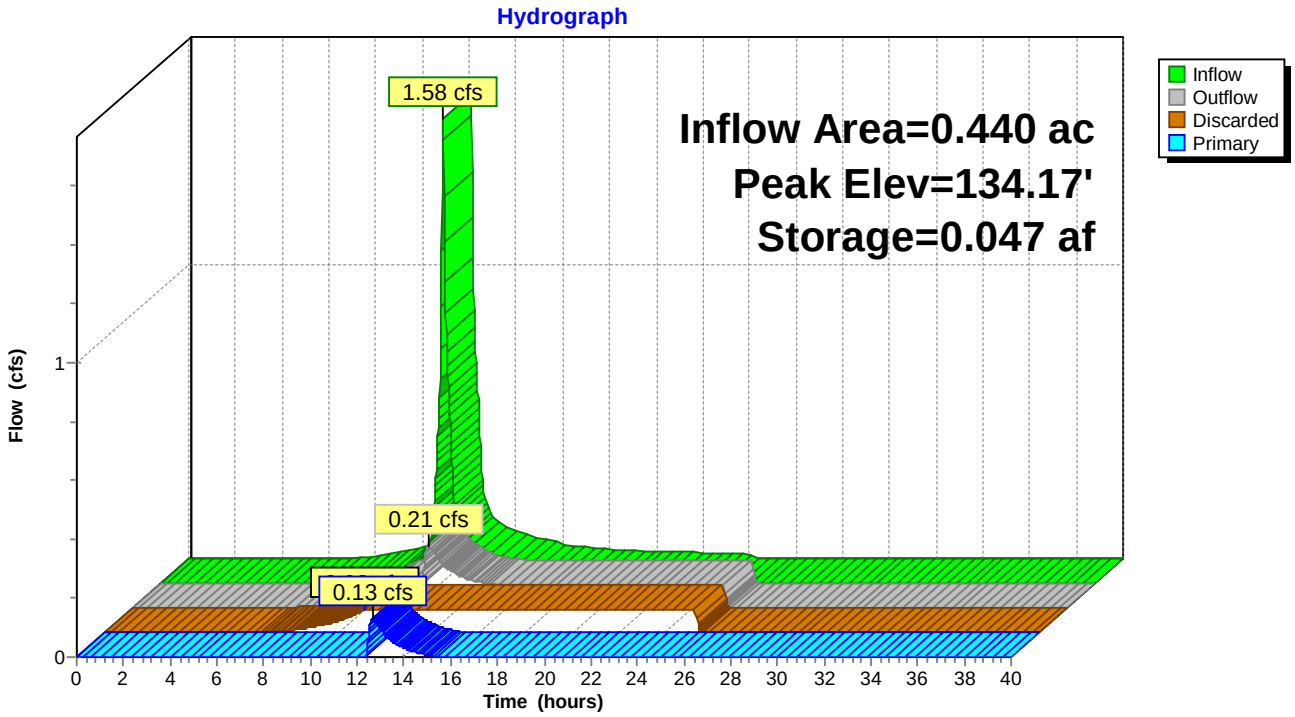
4,189.2 cf Field - 1,785.7 cf Chambers = 2,403.5 cf Stone x 40.0% Voids = 961.4 cf Stone Storage

Chamber Storage + Stone Storage = 2,657.8 cf = 0.061 af
Overall Storage Efficiency = 63.4%
Overall System Size = 64.99' x 21.62' x 2.98'

260 Chambers
155.2 cy Field
89.0 cy Stone



Pond 1P: Infiltration System 1 (To Fencourt Ave)



Summary for Pond 2P: Infiltration System 2

Inflow Area = 1.047 ac, 82.36% Impervious, Inflow Depth = 3.38" for 10 year event
Inflow = 4.07 cfs @ 12.09 hrs, Volume= 0.295 af
Outflow = 0.27 cfs @ 11.26 hrs, Volume= 0.295 af, Atten= 93%, Lag= 0.0 min
Discarded = 0.27 cfs @ 11.26 hrs, Volume= 0.295 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Peak Elev= 133.36' @ 13.70 hrs Surf.Area= 0.110 ac Storage= 0.128 af

Plug-Flow detention time= 182.2 min calculated for 0.295 af (100% of inflow)
Center-of-Mass det. time= 182.1 min (982.3 - 800.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	131.70'	0.068 af	**48.81'W x 97.83'L x 2.98'H Field A** 0.327 af Overall - 0.158 af Embedded = 0.169 af x 40.0% Voids
#2A	131.95'	0.150 af	**ACF R-Tank SD 3** x 1000 Inside #1 Inside= 15.7"W x 26.8"H => 2.78 sf x 2.35'L = 6.5 cf Outside= 15.7"W x 26.8"H => 2.93 sf x 2.35'L = 6.9 cf 1000 Chambers in 25 Rows
		0.217 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	131.70'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	133.70'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	133.70'	**4.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.27 cfs @ 11.26 hrs HW=131.73' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.27 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=131.70' (Free Discharge)
├**2=Orifice/Grate** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 2P: Infiltration System 2 - Chamber Wizard Field A

Chamber Model = ACF R-Tank SD 3 (ACF Environmental R-Tank SD)
Inside= 15.7"W x 26.8"H => 2.78 sf x 2.35'L = 6.5 cf
Outside= 15.7"W x 26.8"H => 2.93 sf x 2.35'L = 6.9 cf

15.7" Wide + 6.0" Spacing = 21.7" C-C Row Spacing

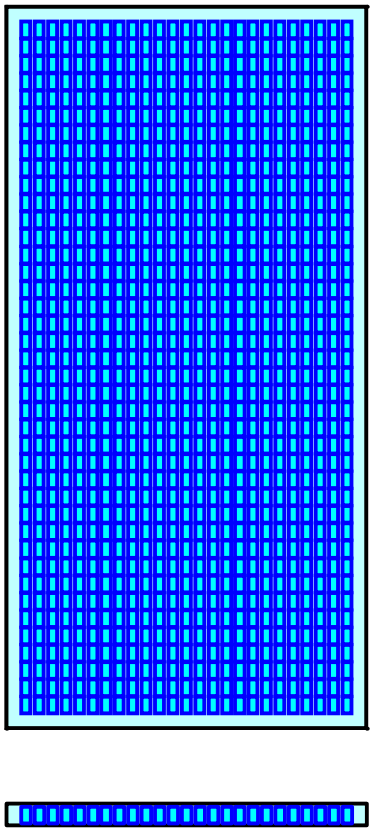
40 Chambers/Row x 2.35' Long = 93.83' Row Length +24.0" End Stone x 2 = 97.83' Base Length
25 Rows x 15.7" Wide + 6.0" Spacing x 24 + 24.0" Side Stone x 2 = 48.81' Base Width
3.0" Base + 26.8" Chamber Height + 6.0" Cover = 2.98' Field Height

1,000 Chambers x 6.5 cf = 6,524.6 cf Chamber Storage
1,000 Chambers x 6.9 cf = 6,868.0 cf Displacement

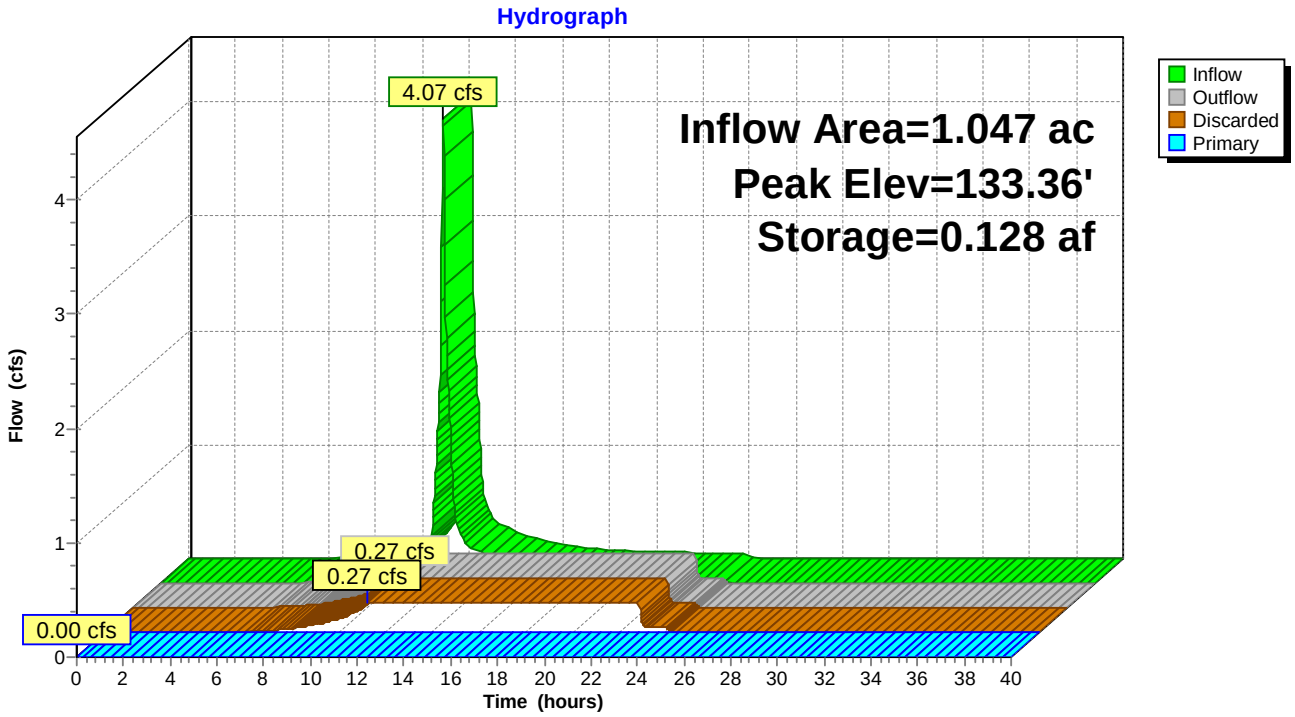
14,234.2 cf Field - 6,868.0 cf Chambers = 7,366.2 cf Stone x 40.0% Voids = 2,946.5 cf Stone Storage

Chamber Storage + Stone Storage = 9,471.1 cf = 0.217 af
Overall Storage Efficiency = 66.5%
Overall System Size = 97.83' x 48.81' x 2.98'

1,000 Chambers
527.2 cy Field
272.8 cy Stone



Pond 2P: Infiltration System 2



Summary for Pond 3P: Infiltration System 3

Inflow Area = 0.677 ac, 96.22% Impervious, Inflow Depth = 4.23" for 10 year event
Inflow = 3.05 cfs @ 12.08 hrs, Volume= 0.239 af
Outflow = 0.66 cfs @ 12.49 hrs, Volume= 0.239 af, Atten= 78%, Lag= 24.3 min
Discarded = 0.19 cfs @ 10.78 hrs, Volume= 0.207 af
Primary = 0.48 cfs @ 12.49 hrs, Volume= 0.032 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Peak Elev= 135.27' @ 12.49 hrs Surf.Area= 0.077 ac Storage= 0.083 af

Plug-Flow detention time= 109.3 min calculated for 0.239 af (100% of inflow)
Center-of-Mass det. time= 109.2 min (873.1 - 763.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	133.70'	0.041 af	**34.31'W x 97.83'L x 2.26'H Field A** 0.174 af Overall - 0.073 af Embedded = 0.102 af x 40.0% Voids
#2A	133.95'	0.069 af	**ACF R-Tank SD 2** x 680 Inside #1 Inside= 15.7"W x 18.1"H => 1.88 sf x 2.35'L = 4.4 cf Outside= 15.7"W x 18.1"H => 1.98 sf x 2.35'L = 4.6 cf 680 Chambers in 17 Rows
		0.110 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	133.70'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	135.00'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	134.90'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.19 cfs @ 10.78 hrs HW=133.72' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.48 cfs @ 12.49 hrs HW=135.26' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.16 cfs @ 1.75 fps)
└**3=Orifice/Grate** (Orifice Controls 0.32 cfs @ 2.06 fps)

Pond 3P: Infiltration System 3 - Chamber Wizard Field A

Chamber Model = ACF R-Tank SD 2 (ACF Environmental R-Tank SD)
Inside= 15.7"W x 18.1"H => 1.88 sf x 2.35'L = 4.4 cf
Outside= 15.7"W x 18.1"H => 1.98 sf x 2.35'L = 4.6 cf

15.7" Wide + 6.0" Spacing = 21.7" C-C Row Spacing

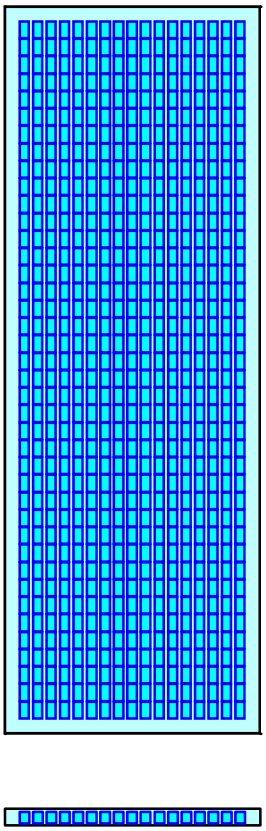
40 Chambers/Row x 2.35' Long = 93.83' Row Length +24.0" End Stone x 2 = 97.83' Base Length
17 Rows x 15.7" Wide + 6.0" Spacing x 16 + 24.0" Side Stone x 2 = 34.31' Base Width
3.0" Base + 18.1" Chamber Height + 6.0" Cover = 2.26' Field Height

680 Chambers x 4.4 cf = 3,001.3 cf Chamber Storage
680 Chambers x 4.6 cf = 3,159.3 cf Displacement

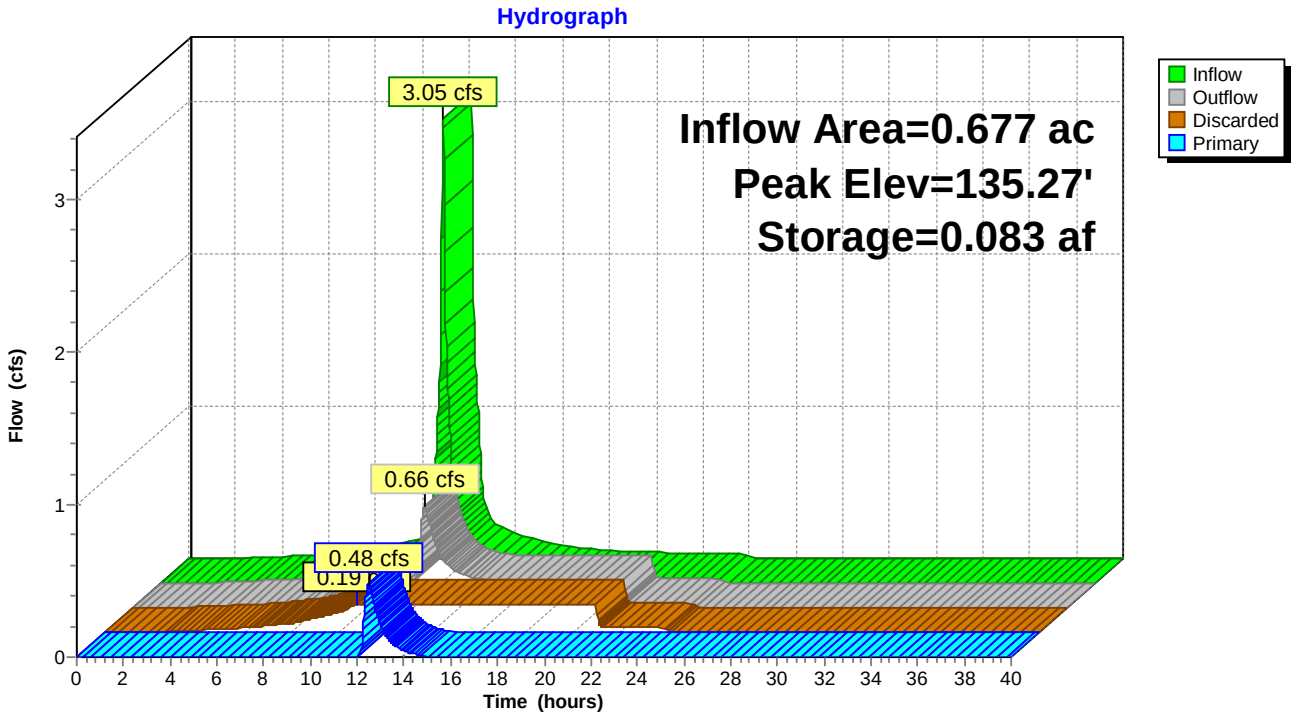
7,583.2 cf Field - 3,159.3 cf Chambers = 4,423.9 cf Stone x 40.0% Voids = 1,769.6 cf Stone Storage

Chamber Storage + Stone Storage = 4,770.9 cf = 0.110 af
Overall Storage Efficiency = 62.9%
Overall System Size = 97.83' x 34.31' x 2.26'

680 Chambers
280.9 cy Field
163.8 cy Stone



Pond 3P: Infiltration System 3



Summary for Pond 4P: Infiltration System 4

Inflow Area = 1.765 ac, 86.15% Impervious, Inflow Depth = 3.59" for 10 year event
Inflow = 7.18 cfs @ 12.09 hrs, Volume= 0.528 af
Outflow = 0.87 cfs @ 12.69 hrs, Volume= 0.528 af, Atten= 88%, Lag= 36.1 min
Discarded = 0.51 cfs @ 11.28 hrs, Volume= 0.482 af
Primary = 0.36 cfs @ 12.69 hrs, Volume= 0.046 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Peak Elev= 134.35' @ 12.69 hrs Surf.Area= 0.212 ac Storage= 0.200 af

Plug-Flow detention time= 112.7 min calculated for 0.528 af (100% of inflow)
Center-of-Mass det. time= 112.7 min (905.5 - 792.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	133.00'	0.106 af	**66.93'W x 137.71'L x 2.26'H Field A** 0.478 af Overall - 0.213 af Embedded = 0.265 af x 40.0% Voids
#2A	133.25'	0.202 af	**ACF R-Tank SD 2** x 1995 Inside #1 Inside= 15.7"W x 18.1"H => 1.88 sf x 2.35'L = 4.4 cf Outside= 15.7"W x 18.1"H => 1.98 sf x 2.35'L = 4.6 cf 1995 Chambers in 35 Rows
		0.308 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	133.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	134.30'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	134.00'	**2.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	134.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.51 cfs @ 11.28 hrs HW=133.02' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.51 cfs)

Primary OutFlow Max=0.36 cfs @ 12.69 hrs HW=134.35' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.01 cfs @ 0.76 fps)
├**3=Orifice/Grate** (Orifice Controls 0.05 cfs @ 2.49 fps)
└**4=Orifice/Grate** (Orifice Controls 0.30 cfs @ 2.01 fps)

Pond 4P: Infiltration System 4 - Chamber Wizard Field A

Chamber Model = ACF R-Tank SD 2 (ACF Environmental R-Tank SD)
Inside= 15.7"W x 18.1"H => 1.88 sf x 2.35'L = 4.4 cf
Outside= 15.7"W x 18.1"H => 1.98 sf x 2.35'L = 4.6 cf

15.7" Wide + 6.0" Spacing = 21.7" C-C Row Spacing

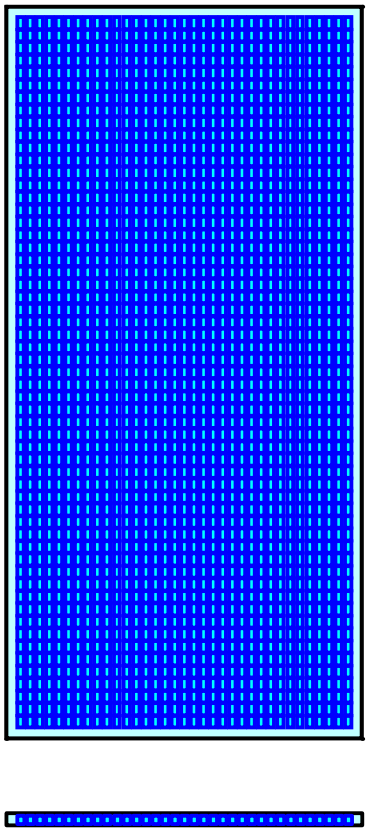
57 Chambers/Row x 2.35' Long = 133.71' Row Length +24.0" End Stone x 2 = 137.71' Base Length
35 Rows x 15.7" Wide + 6.0" Spacing x 34 + 24.0" Side Stone x 2 = 66.93' Base Width
3.0" Base + 18.1" Chamber Height + 6.0" Cover = 2.26' Field Height

1,995 Chambers x 4.4 cf = 8,805.3 cf Chamber Storage
1,995 Chambers x 4.6 cf = 9,268.8 cf Displacement

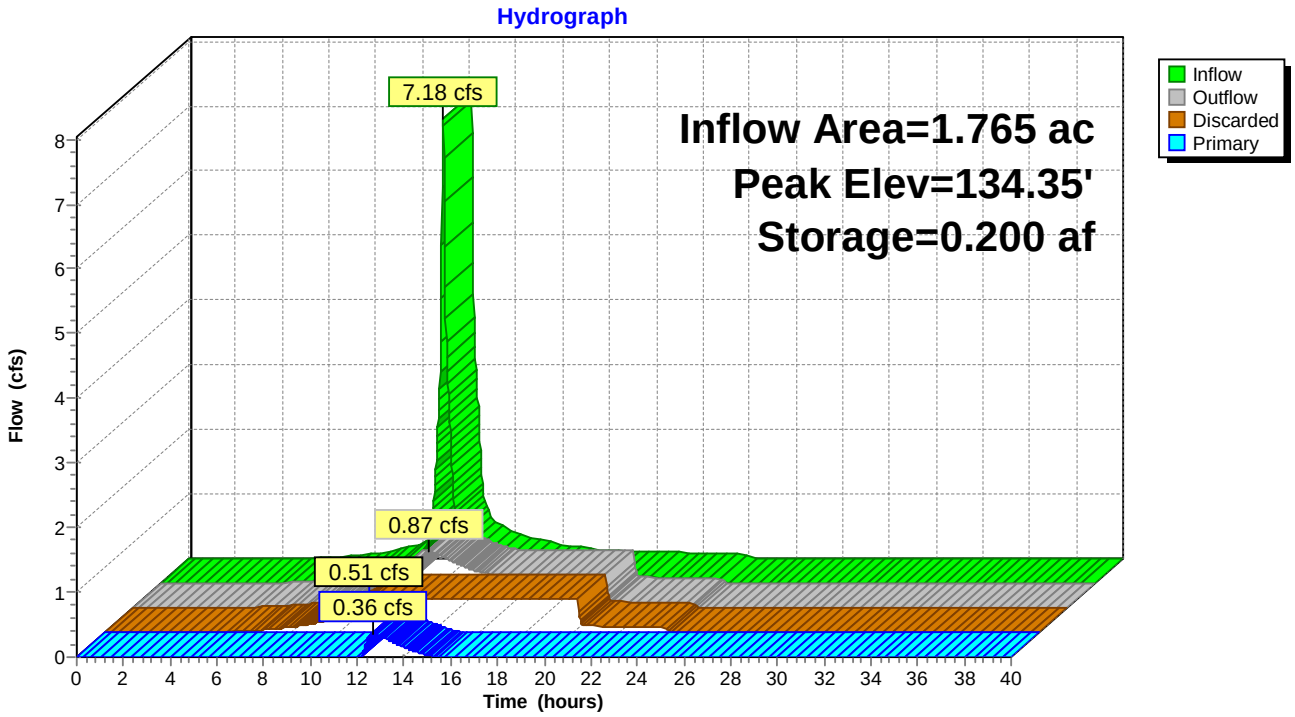
20,823.4 cf Field - 9,268.8 cf Chambers = 11,554.6 cf Stone x 40.0% Voids = 4,621.9 cf Stone Storage

Chamber Storage + Stone Storage = 13,427.2 cf = 0.308 af
Overall Storage Efficiency = 64.5%
Overall System Size = 137.71' x 66.93' x 2.26'

1,995 Chambers
771.2 cy Field
427.9 cy Stone



Pond 4P: Infiltration System 4



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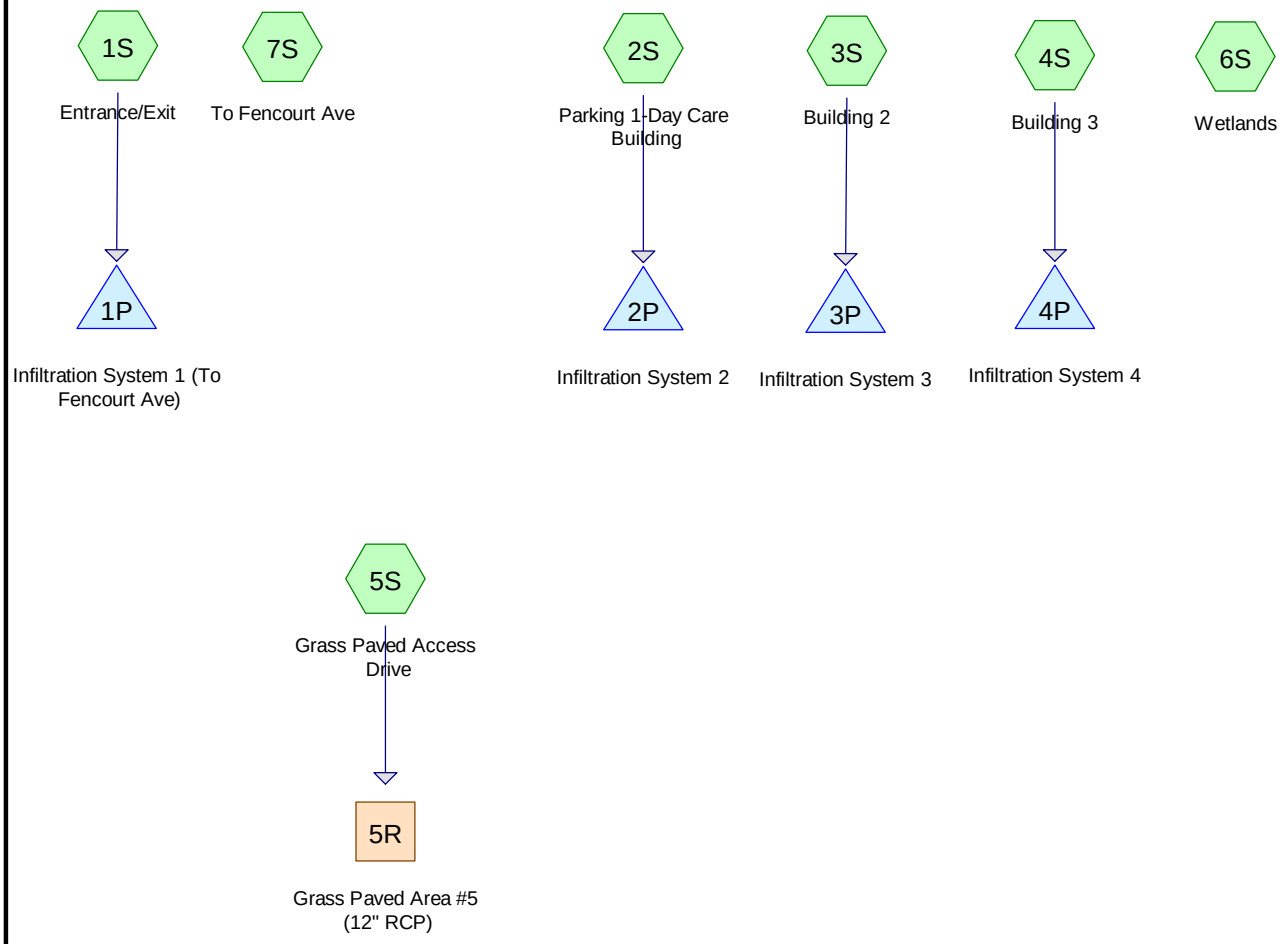


Routing Diagram for 16 Fencourt Avenue-Proposed 25yr storm-2023-05-25

Prepared by {enter your company name here}, Printed 5/28/2023

Time span=0.00-40.00 hrs, dt=0.02 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Entrance/Exit Runoff Area=19,160 sf 78.76% Impervious Runoff Depth=3.83"
Tc=6.0 min CN=85 Runoff=1.95 cfs 0.140 af

Subcatchment 2S: Parking 1-Day Care Building Runoff Area=45,613 sf 82.36% Impervious Runoff Depth=4.15"
Tc=6.0 min CN=88 Runoff=4.94 cfs 0.362 af

Subcatchment 3S: Building 2 Runoff Area=29,469 sf 96.22% Impervious Runoff Depth=5.03"
Tc=6.0 min CN=96 Runoff=3.59 cfs 0.284 af

Subcatchment 4S: Building 3 Runoff Area=76,905 sf 86.15% Impervious Runoff Depth=4.36"
Tc=6.0 min CN=90 Runoff=8.64 cfs 0.641 af

Subcatchment 5S: Grass Paved Access Drive Runoff Area=12,688 sf 0.00% Impervious Runoff Depth=0.31"
Flow Length=360' Tc=28.3 min CN=39 Runoff=0.02 cfs 0.008 af

Subcatchment 6S: Wetlands Runoff Area=115,332 sf 0.00% Impervious Runoff Depth=0.50"
Flow Length=230' Tc=10.9 min CN=43 Runoff=0.59 cfs 0.111 af

Subcatchment 7S: To Fencourt Ave Runoff Area=10,357 sf 11.49% Impervious Runoff Depth=1.04"
Tc=6.0 min UI Adjusted CN=52 Runoff=0.23 cfs 0.021 af

Reach 5R: Grass Paved Area #5 (12" RCP) Inflow=0.02 cfs 0.008 af
Outflow=0.02 cfs 0.008 af

Pond 1P: Infiltration System 1 (To Fencourt Ave) Peak Elev=134.36' Storage=0.052 af Inflow=1.95 cfs 0.140 af
Discarded=0.08 cfs 0.110 af Primary=0.51 cfs 0.030 af Outflow=0.59 cfs 0.140 af

Pond 2P: Infiltration System 2 Peak Elev=133.81' Storage=0.164 af Inflow=4.94 cfs 0.362 af
Discarded=0.27 cfs 0.355 af Primary=0.05 cfs 0.007 af Outflow=0.32 cfs 0.362 af

Pond 3P: Infiltration System 3 Peak Elev=135.44' Storage=0.093 af Inflow=3.59 cfs 0.284 af
Discarded=0.19 cfs 0.224 af Primary=0.82 cfs 0.059 af Outflow=1.01 cfs 0.284 af

Pond 4P: Infiltration System 4 Peak Elev=134.61' Storage=0.241 af Inflow=8.64 cfs 0.641 af
Discarded=0.51 cfs 0.533 af Primary=0.74 cfs 0.108 af Outflow=1.26 cfs 0.641 af

Total Runoff Area = 7.106 ac Runoff Volume = 1.567 af Average Runoff Depth = 2.65"
52.04% Pervious = 3.698 ac 47.96% Impervious = 3.408 ac

Summary for Subcatchment 1S: Entrance/Exit

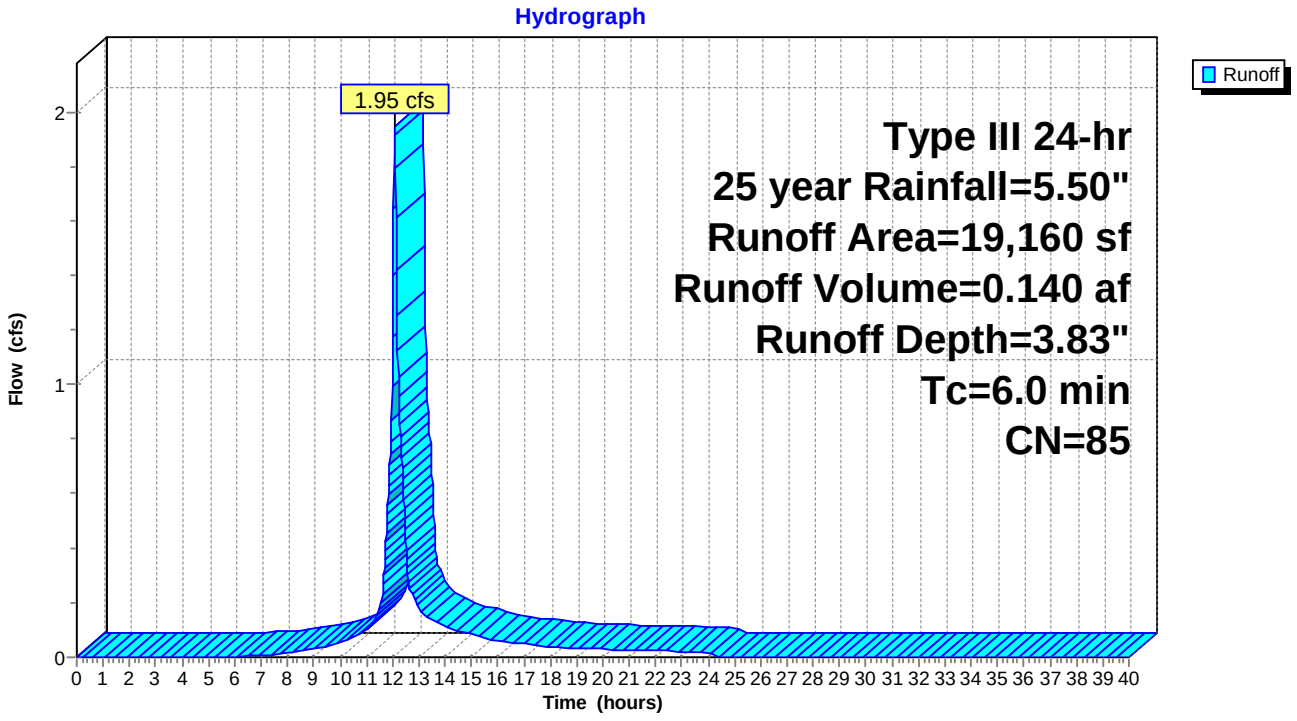
Runoff = 1.95 cfs @ 12.09 hrs, Volume= 0.140 af, Depth= 3.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 25 year Rainfall=5.50"

Area (sf)	CN	Description
15,090	98	Paved parking, HSG A
4,070	39	>75% Grass cover, Good, HSG A
19,160	85	Weighted Average
4,070		21.24% Pervious Area
15,090		78.76% Impervious Area

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

Subcatchment 1S: Entrance/Exit



Summary for Subcatchment 2S: Parking 1-Day Care Building

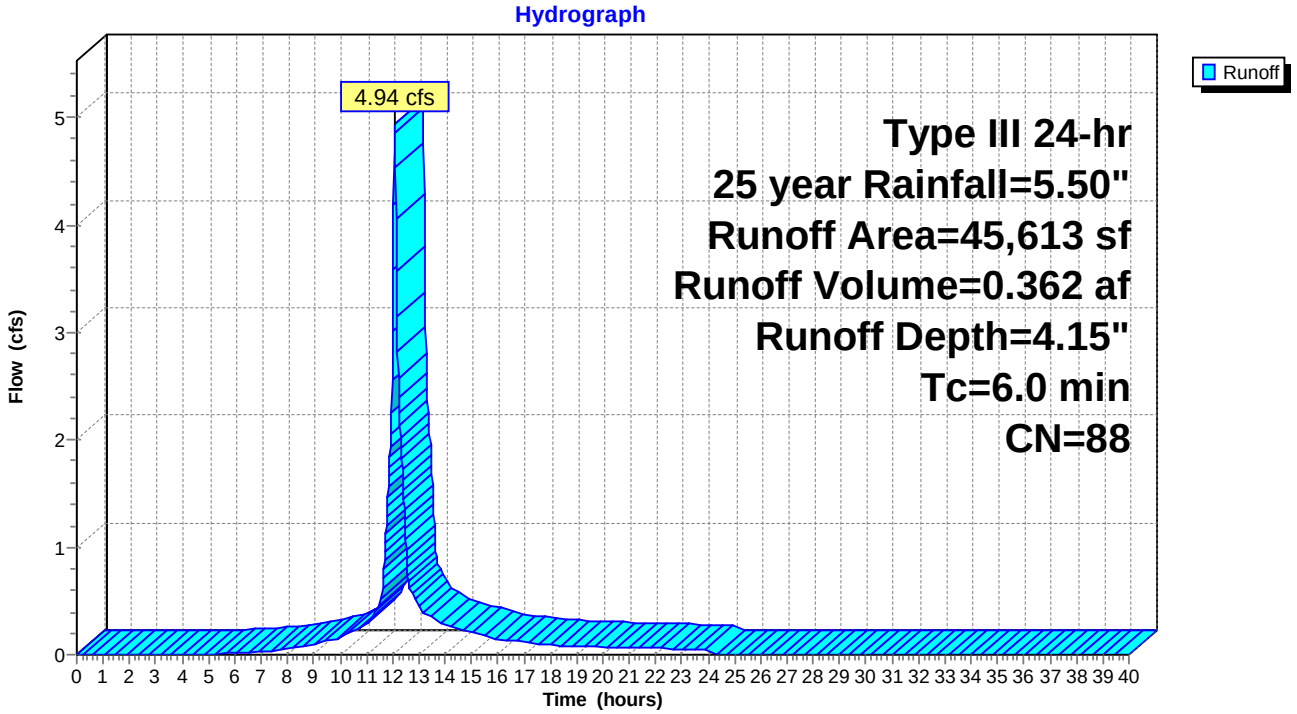
Runoff = 4.94 cfs @ 12.09 hrs, Volume= 0.362 af, Depth= 4.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 25 year Rainfall=5.50"

	Area (sf)	CN	Description
	24,731	98	Paved parking, HSG A
	8,047	39	>75% Grass cover, Good, HSG A
*	12,835	98	Daycare Building, HSG A
	45,613	88	Weighted Average
	8,047		17.64% Pervious Area
	37,566		82.36% Impervious Area

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

Subcatchment 2S: Parking 1-Day Care Building



Summary for Subcatchment 3S: Building 2

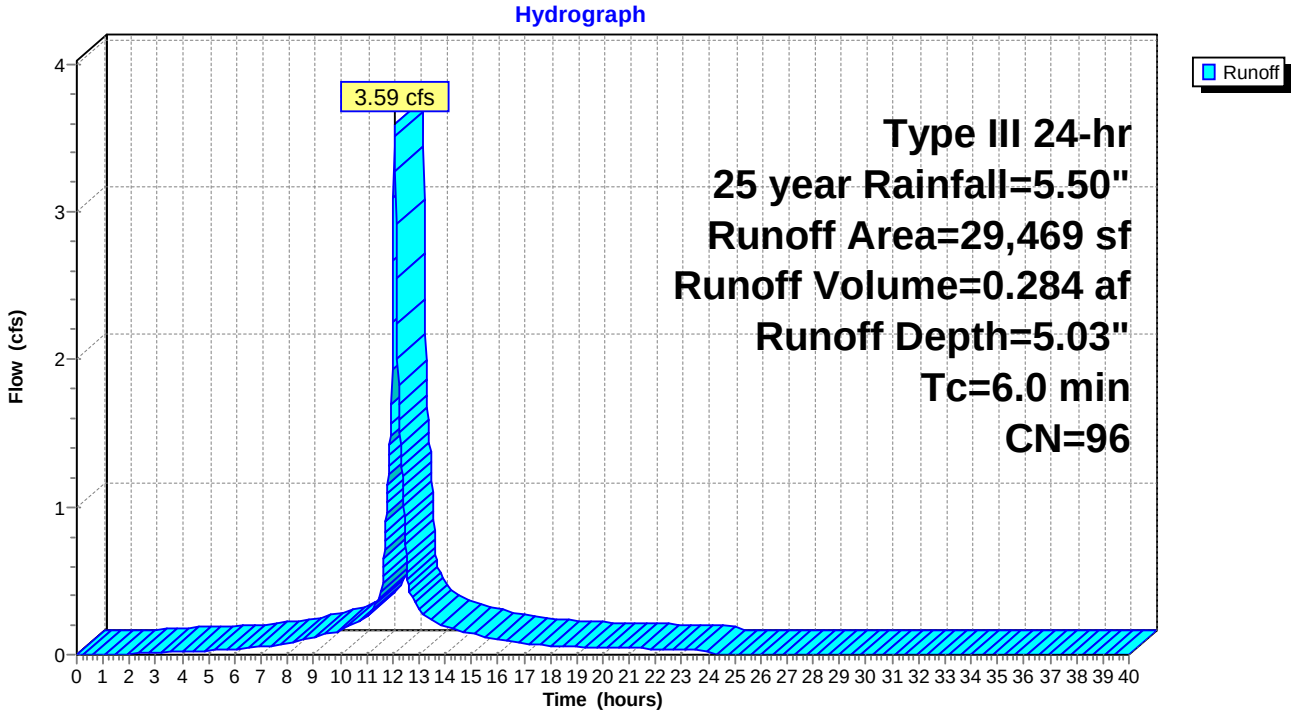
Runoff = 3.59 cfs @ 12.08 hrs, Volume= 0.284 af, Depth= 5.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 25 year Rainfall=5.50"

	Area (sf)	CN	Description
	11,219	98	Paved parking, HSG A
*	17,137	98	Building #2, HSG A
	1,113	39	>75% Grass cover, Good, HSG A
	29,469	96	Weighted Average
	1,113		3.78% Pervious Area
	28,356		96.22% Impervious Area

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

Subcatchment 3S: Building 2



Summary for Subcatchment 4S: Building 3

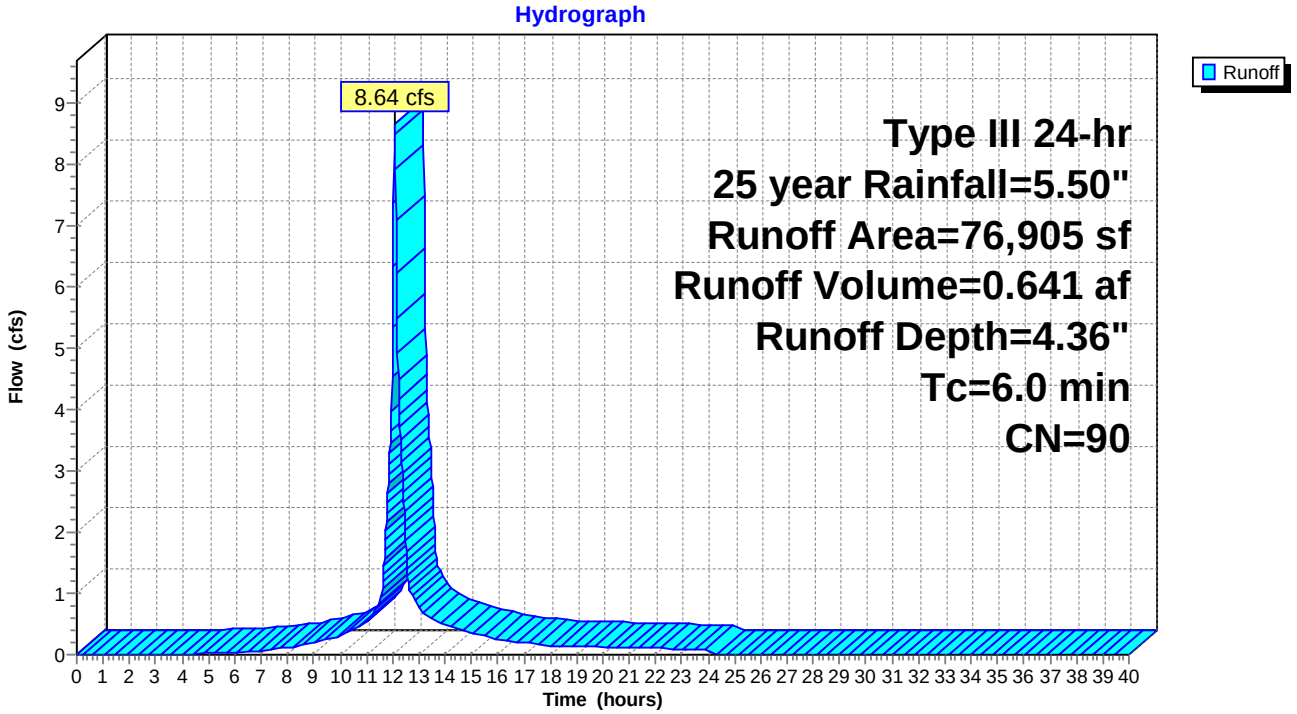
Runoff = 8.64 cfs @ 12.08 hrs, Volume= 0.641 af, Depth= 4.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 25 year Rainfall=5.50"

	Area (sf)	CN	Description
	43,449	98	Paved parking, HSG A
*	22,804	98	Building 3, HSG A
	10,652	39	>75% Grass cover, Good, HSG A
	76,905	90	Weighted Average
	10,652		13.85% Pervious Area
	66,253		86.15% Impervious Area

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

Subcatchment 4S: Building 3



Summary for Subcatchment 5S: Grass Paved Access Drive

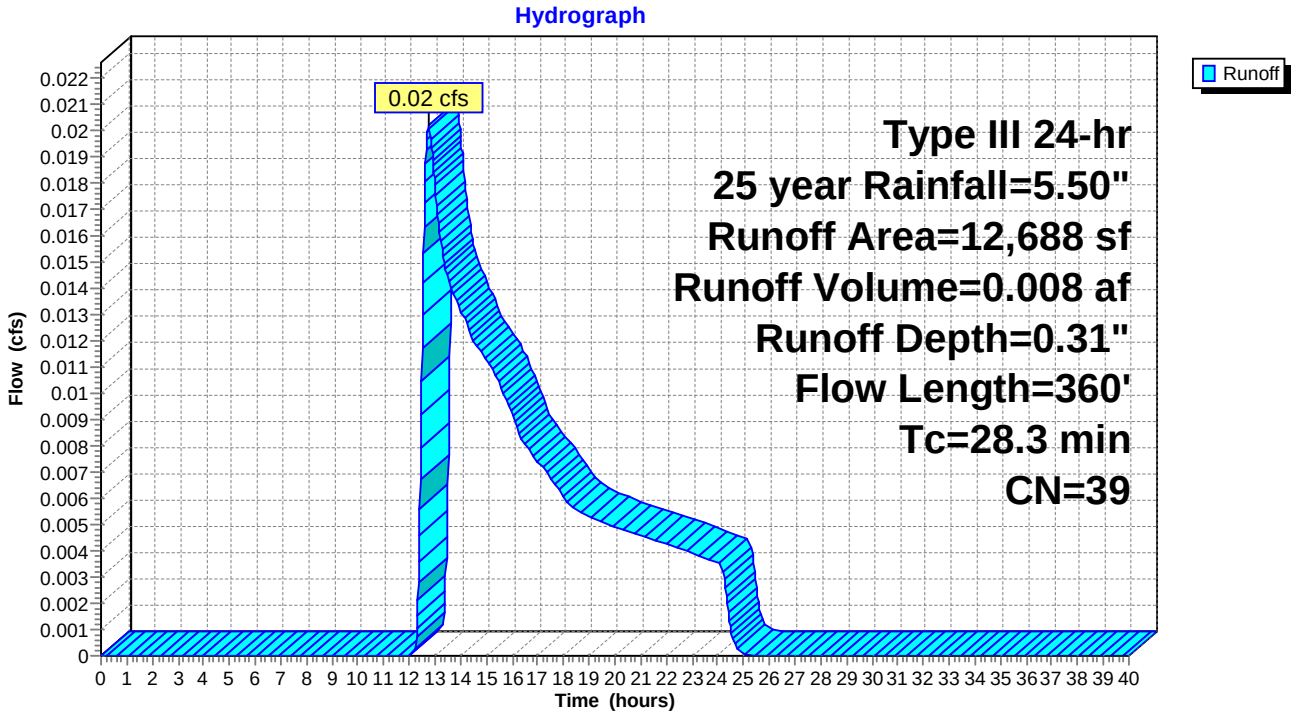
Runoff = 0.02 cfs @ 12.74 hrs, Volume= 0.008 af, Depth= 0.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 25 year Rainfall=5.50"

Area (sf)	CN	Description
12,688	39	>75% Grass cover, Good, HSG A
12,688		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.6	100	0.0250	0.08		**Sheet Flow, Wood** Woods: Light underbrush n= 0.400 P2= 3.20"
8.7	260	0.0100	0.50		**Shallow Concentrated Flow, Wood** Woodland Kv= 5.0 fps
28.3	360	Total			

Subcatchment 5S: Grass Paved Access Drive



Summary for Subcatchment 6S: Wetlands

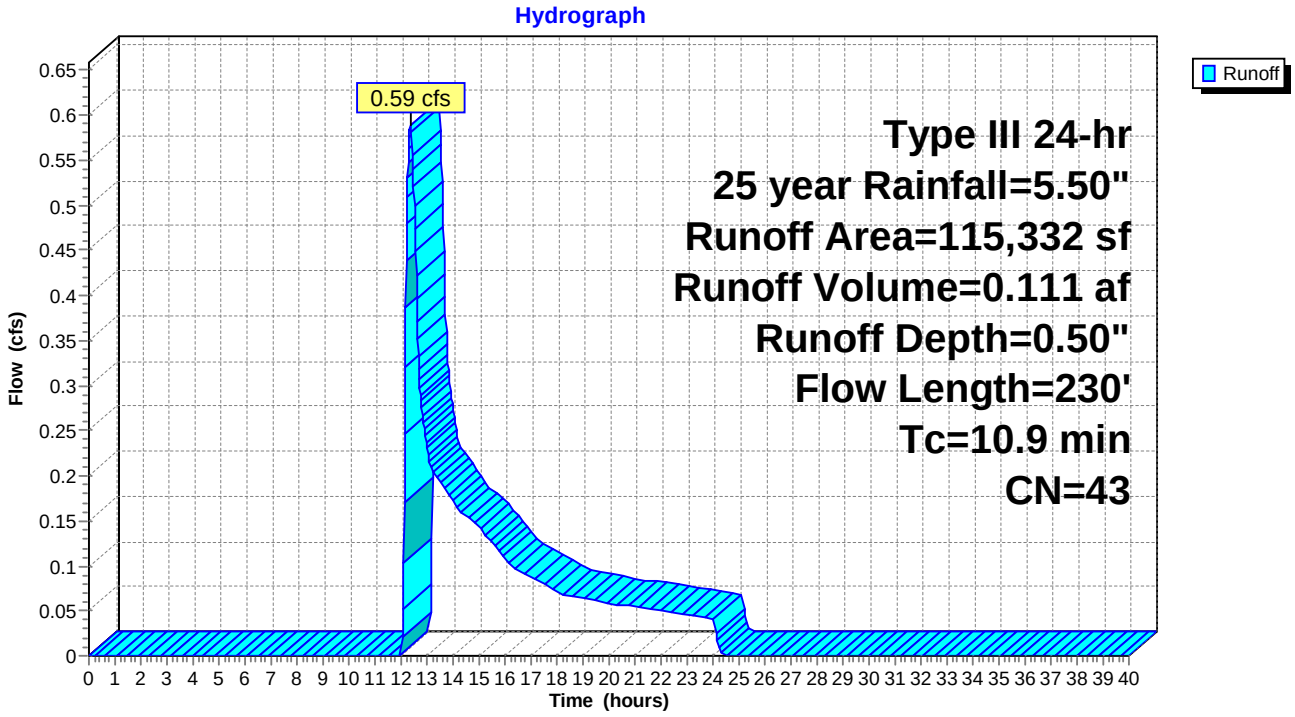
Runoff = 0.59 cfs @ 12.37 hrs, Volume= 0.111 af, Depth= 0.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 25 year Rainfall=5.50"

Area (sf)	CN	Description
115,332	43	Woods/grass comb., Fair, HSG A
115,332		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	100	0.1650	0.18		**Sheet Flow, Wood/Grass** Woods: Light underbrush n= 0.400 P2= 3.20"
1.7	130	0.0346	1.30		**Shallow Concentrated Flow, Wetland** Short Grass Pasture Kv= 7.0 fps
10.9	230	Total			

Subcatchment 6S: Wetlands



Summary for Subcatchment 7S: To Fencourt Ave

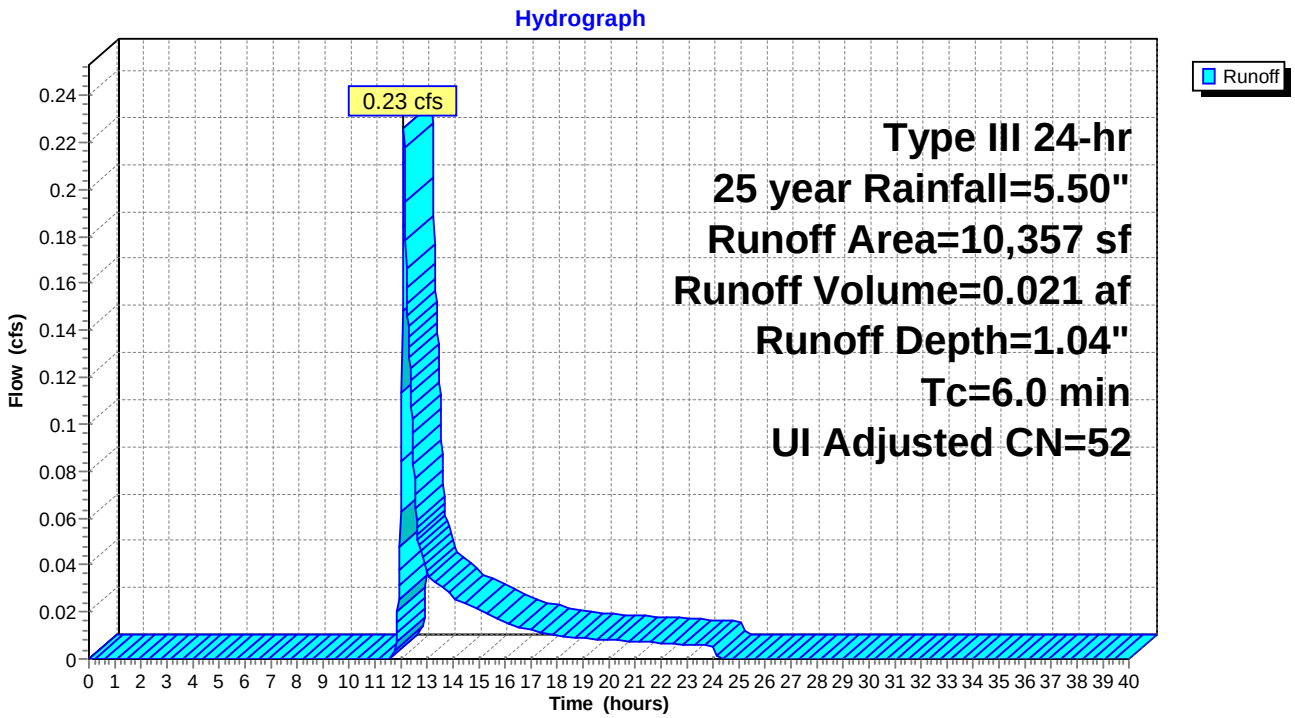
Runoff = 0.23 cfs @ 12.11 hrs, Volume= 0.021 af, Depth= 1.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 25 year Rainfall=5.50"

	Area (sf)	CN	Adj	Description
	1,190	98		Unconnected pavement, HSG A
	5,872	49		50-75% Grass cover, Fair, HSG A
*	3,295	49		Playground area
	10,357	55	52	Weighted Average, UI Adjusted
	9,167			88.51% Pervious Area
	1,190			11.49% Impervious Area
	1,190			100.00% Unconnected

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

Subcatchment 7S: To Fencourt Ave



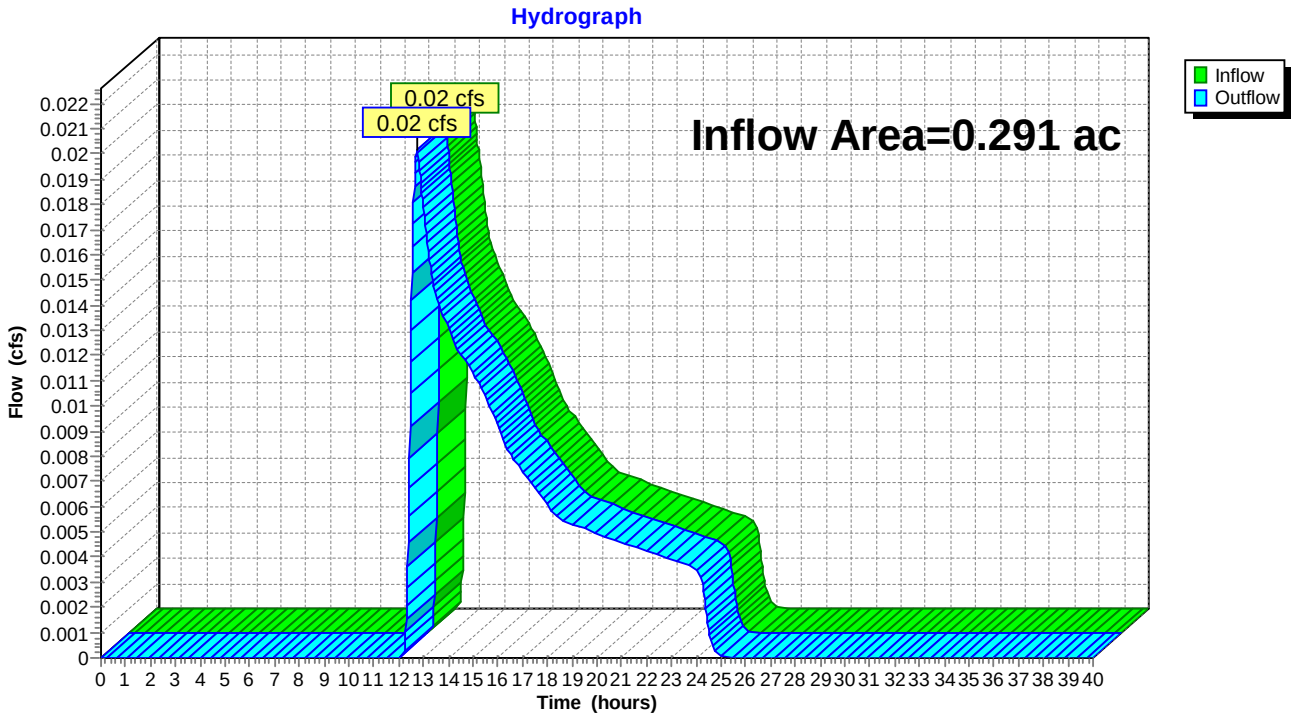
Summary for Reach 5R: Grass Paved Area #5 (12" RCP)

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

Inflow Area = 0.291 ac, 0.00% Impervious, Inflow Depth = 0.31" for 25 year event
Inflow = 0.02 cfs @ 12.74 hrs, Volume= 0.008 af
Outflow = 0.02 cfs @ 12.74 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs

Reach 5R: Grass Paved Area #5 (12" RCP)



Summary for Pond 1P: Infiltration System 1 (To Fencourt Ave)

Inflow Area = 0.440 ac, 78.76% Impervious, Inflow Depth = 3.83" for 25 year event
Inflow = 1.95 cfs @ 12.09 hrs, Volume= 0.140 af
Outflow = 0.59 cfs @ 12.42 hrs, Volume= 0.140 af, Atten= 70%, Lag= 19.8 min
Discarded = 0.08 cfs @ 10.62 hrs, Volume= 0.110 af
Primary = 0.51 cfs @ 12.42 hrs, Volume= 0.030 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Peak Elev= 134.36' @ 12.42 hrs Surf.Area= 0.032 ac Storage= 0.052 af

Plug-Flow detention time= 191.0 min calculated for 0.140 af (100% of inflow)
Center-of-Mass det. time= 190.9 min (994.8 - 803.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	132.00'	0.022 af	**21.62'W x 64.99'L x 2.98'H Field A** 0.096 af Overall - 0.041 af Embedded = 0.055 af x 40.0% Voids
#2A	132.25'	0.039 af	**ACF R-Tank SD 3** x 260 Inside #1 Inside= 15.7"W x 26.8"H => 2.78 sf x 2.35'L = 6.5 cf Outside= 15.7"W x 26.8"H => 2.93 sf x 2.35'L = 6.9 cf 260 Chambers in 10 Rows
		0.061 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	132.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	134.20'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	134.20'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	134.20'	**3.0" Vert. Orifice/Grate** C= 0.600
#5	Primary	134.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#6	Primary	134.00'	**4.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.08 cfs @ 10.62 hrs HW=132.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.51 cfs @ 12.42 hrs HW=134.36' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.05 cfs @ 1.37 fps)
├**3=Orifice/Grate** (Orifice Controls 0.05 cfs @ 1.37 fps)
├**4=Orifice/Grate** (Orifice Controls 0.05 cfs @ 1.37 fps)
├**5=Orifice/Grate** (Orifice Controls 0.19 cfs @ 2.13 fps)
└**6=Orifice/Grate** (Orifice Controls 0.19 cfs @ 2.13 fps)

Pond 1P: Infiltration System 1 (To Fencourt Ave) - Chamber Wizard Field A

Chamber Model = ACF R-Tank SD 3 (ACF Environmental R-Tank SD)
Inside= 15.7"W x 26.8"H => 2.78 sf x 2.35'L = 6.5 cf
Outside= 15.7"W x 26.8"H => 2.93 sf x 2.35'L = 6.9 cf

15.7" Wide + 6.0" Spacing = 21.7" C-C Row Spacing

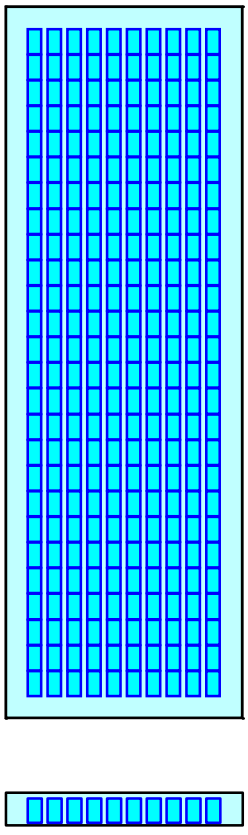
26 Chambers/Row x 2.35' Long = 60.99' Row Length +24.0" End Stone x 2 = 64.99' Base Length
10 Rows x 15.7" Wide + 6.0" Spacing x 9 + 24.0" Side Stone x 2 = 21.62' Base Width
3.0" Base + 26.8" Chamber Height + 6.0" Cover = 2.98' Field Height

260 Chambers x 6.5 cf = 1,696.4 cf Chamber Storage
260 Chambers x 6.9 cf = 1,785.7 cf Displacement

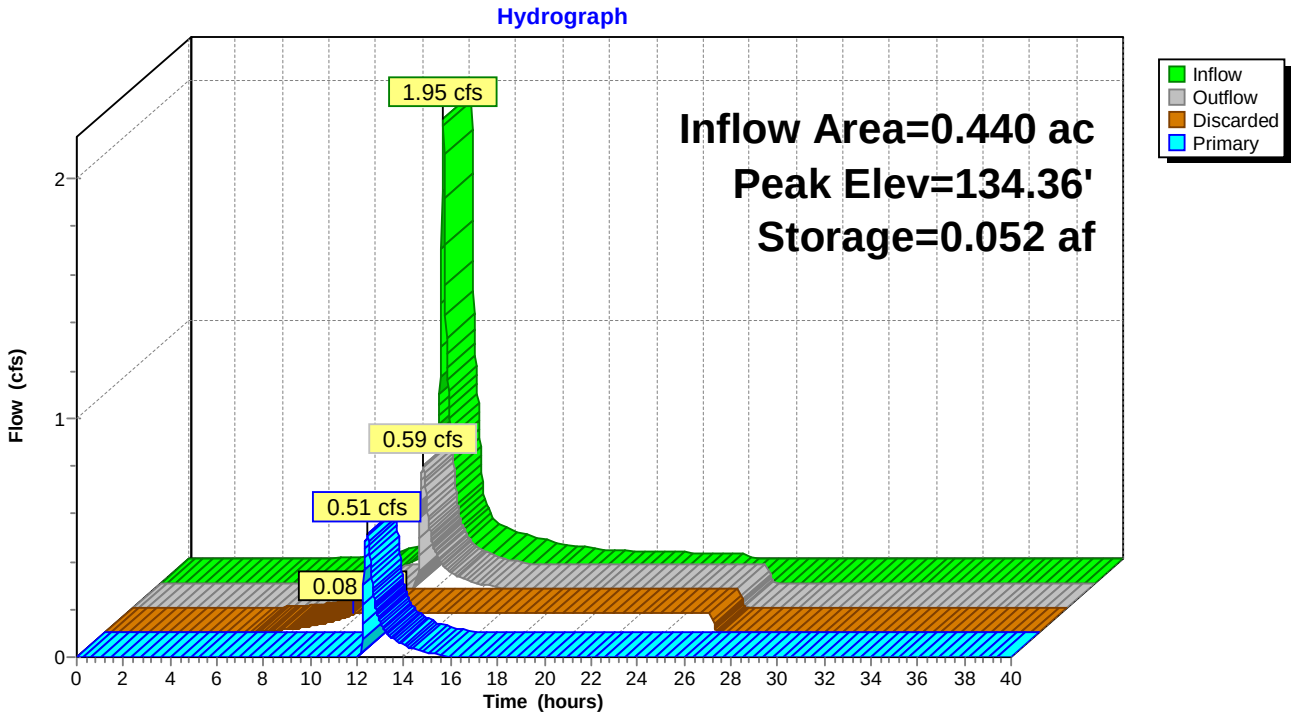
4,189.2 cf Field - 1,785.7 cf Chambers = 2,403.5 cf Stone x 40.0% Voids = 961.4 cf Stone Storage

Chamber Storage + Stone Storage = 2,657.8 cf = 0.061 af
Overall Storage Efficiency = 63.4%
Overall System Size = 64.99' x 21.62' x 2.98'

260 Chambers
155.2 cy Field
89.0 cy Stone



Pond 1P: Infiltration System 1 (To Fencourt Ave)



Summary for Pond 2P: Infiltration System 2

Inflow Area = 1.047 ac, 82.36% Impervious, Inflow Depth = 4.15" for 25 year event
Inflow = 4.94 cfs @ 12.09 hrs, Volume= 0.362 af
Outflow = 0.32 cfs @ 13.68 hrs, Volume= 0.362 af, Atten= 94%, Lag= 95.8 min
Discarded = 0.27 cfs @ 10.96 hrs, Volume= 0.355 af
Primary = 0.05 cfs @ 13.68 hrs, Volume= 0.007 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Peak Elev= 133.81' @ 13.68 hrs Surf.Area= 0.110 ac Storage= 0.164 af

Plug-Flow detention time= 233.9 min calculated for 0.362 af (100% of inflow)
Center-of-Mass det. time= 233.9 min (1,028.4 - 794.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	131.70'	0.068 af	**48.81'W x 97.83'L x 2.98'H Field A** 0.327 af Overall - 0.158 af Embedded = 0.169 af x 40.0% Voids
#2A	131.95'	0.150 af	**ACF R-Tank SD 3** x 1000 Inside #1 Inside= 15.7"W x 26.8"H => 2.78 sf x 2.35'L = 6.5 cf Outside= 15.7"W x 26.8"H => 2.93 sf x 2.35'L = 6.9 cf 1000 Chambers in 25 Rows
		0.217 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	131.70'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	133.70'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	133.70'	**4.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.27 cfs @ 10.96 hrs HW=131.73' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.27 cfs)

Primary OutFlow Max=0.05 cfs @ 13.68 hrs HW=133.81' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.03 cfs @ 1.11 fps)
└**3=Orifice/Grate** (Orifice Controls 0.03 cfs @ 1.11 fps)

Pond 2P: Infiltration System 2 - Chamber Wizard Field A

Chamber Model = ACF R-Tank SD 3 (ACF Environmental R-Tank SD)
Inside= 15.7"W x 26.8"H => 2.78 sf x 2.35'L = 6.5 cf
Outside= 15.7"W x 26.8"H => 2.93 sf x 2.35'L = 6.9 cf

15.7" Wide + 6.0" Spacing = 21.7" C-C Row Spacing

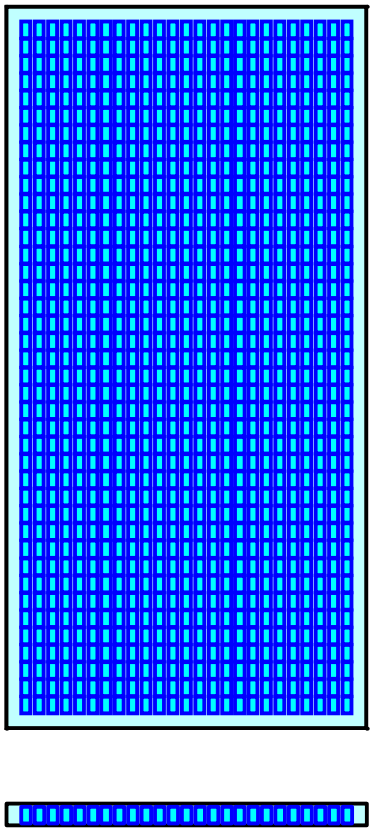
40 Chambers/Row x 2.35' Long = 93.83' Row Length +24.0" End Stone x 2 = 97.83' Base Length
25 Rows x 15.7" Wide + 6.0" Spacing x 24 + 24.0" Side Stone x 2 = 48.81' Base Width
3.0" Base + 26.8" Chamber Height + 6.0" Cover = 2.98' Field Height

1,000 Chambers x 6.5 cf = 6,524.6 cf Chamber Storage
1,000 Chambers x 6.9 cf = 6,868.0 cf Displacement

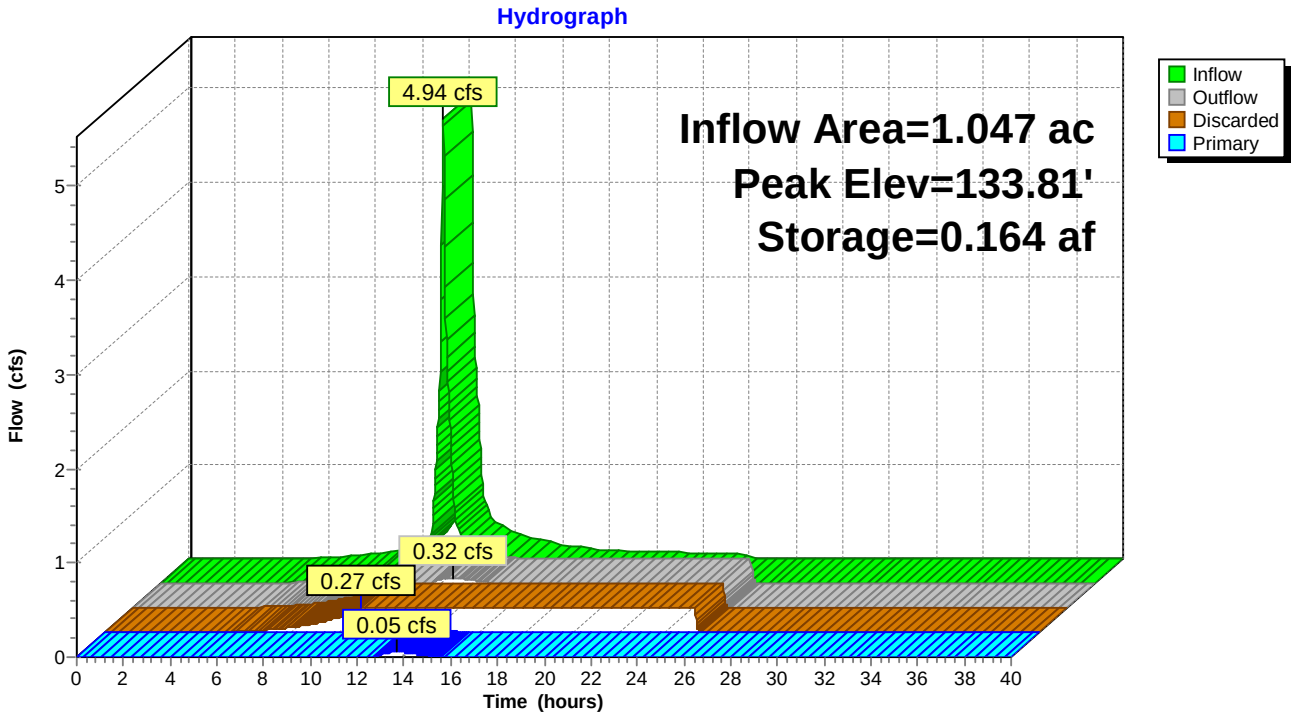
14,234.2 cf Field - 6,868.0 cf Chambers = 7,366.2 cf Stone x 40.0% Voids = 2,946.5 cf Stone Storage

Chamber Storage + Stone Storage = 9,471.1 cf = 0.217 af
Overall Storage Efficiency = 66.5%
Overall System Size = 97.83' x 48.81' x 2.98'

1,000 Chambers
527.2 cy Field
272.8 cy Stone



Pond 2P: Infiltration System 2



Summary for Pond 3P: Infiltration System 3

Inflow Area = 0.677 ac, 96.22% Impervious, Inflow Depth = 5.03" for 25 year event
Inflow = 3.59 cfs @ 12.08 hrs, Volume= 0.284 af
Outflow = 1.01 cfs @ 12.42 hrs, Volume= 0.284 af, Atten= 72%, Lag= 20.1 min
Discarded = 0.19 cfs @ 10.38 hrs, Volume= 0.224 af
Primary = 0.82 cfs @ 12.42 hrs, Volume= 0.059 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Peak Elev= 135.44' @ 12.42 hrs Surf.Area= 0.077 ac Storage= 0.093 af

Plug-Flow detention time= 103.0 min calculated for 0.284 af (100% of inflow)
Center-of-Mass det. time= 103.0 min (863.2 - 760.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	133.70'	0.041 af	**34.31'W x 97.83'L x 2.26'H Field A** 0.174 af Overall - 0.073 af Embedded = 0.102 af x 40.0% Voids
#2A	133.95'	0.069 af	**ACF R-Tank SD 2** x 680 Inside #1 Inside= 15.7"W x 18.1"H => 1.88 sf x 2.35'L = 4.4 cf Outside= 15.7"W x 18.1"H => 1.98 sf x 2.35'L = 4.6 cf 680 Chambers in 17 Rows
		0.110 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	133.70'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	135.00'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	134.90'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.19 cfs @ 10.38 hrs HW=133.72' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.82 cfs @ 12.42 hrs HW=135.44' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.32 cfs @ 2.31 fps)
└**3=Orifice/Grate** (Orifice Controls 0.51 cfs @ 2.59 fps)

Pond 3P: Infiltration System 3 - Chamber Wizard Field A

Chamber Model = ACF R-Tank SD 2 (ACF Environmental R-Tank SD)
Inside= 15.7"W x 18.1"H => 1.88 sf x 2.35'L = 4.4 cf
Outside= 15.7"W x 18.1"H => 1.98 sf x 2.35'L = 4.6 cf

15.7" Wide + 6.0" Spacing = 21.7" C-C Row Spacing

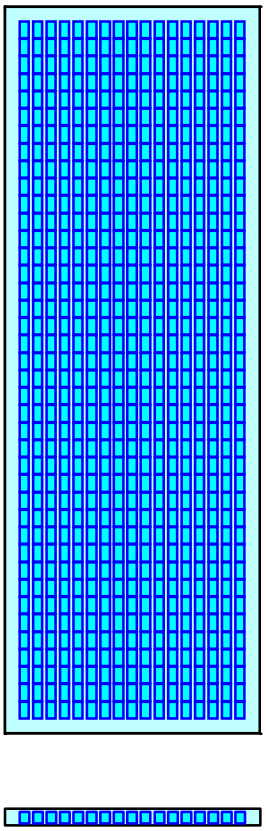
40 Chambers/Row x 2.35' Long = 93.83' Row Length +24.0" End Stone x 2 = 97.83' Base Length
17 Rows x 15.7" Wide + 6.0" Spacing x 16 + 24.0" Side Stone x 2 = 34.31' Base Width
3.0" Base + 18.1" Chamber Height + 6.0" Cover = 2.26' Field Height

680 Chambers x 4.4 cf = 3,001.3 cf Chamber Storage
680 Chambers x 4.6 cf = 3,159.3 cf Displacement

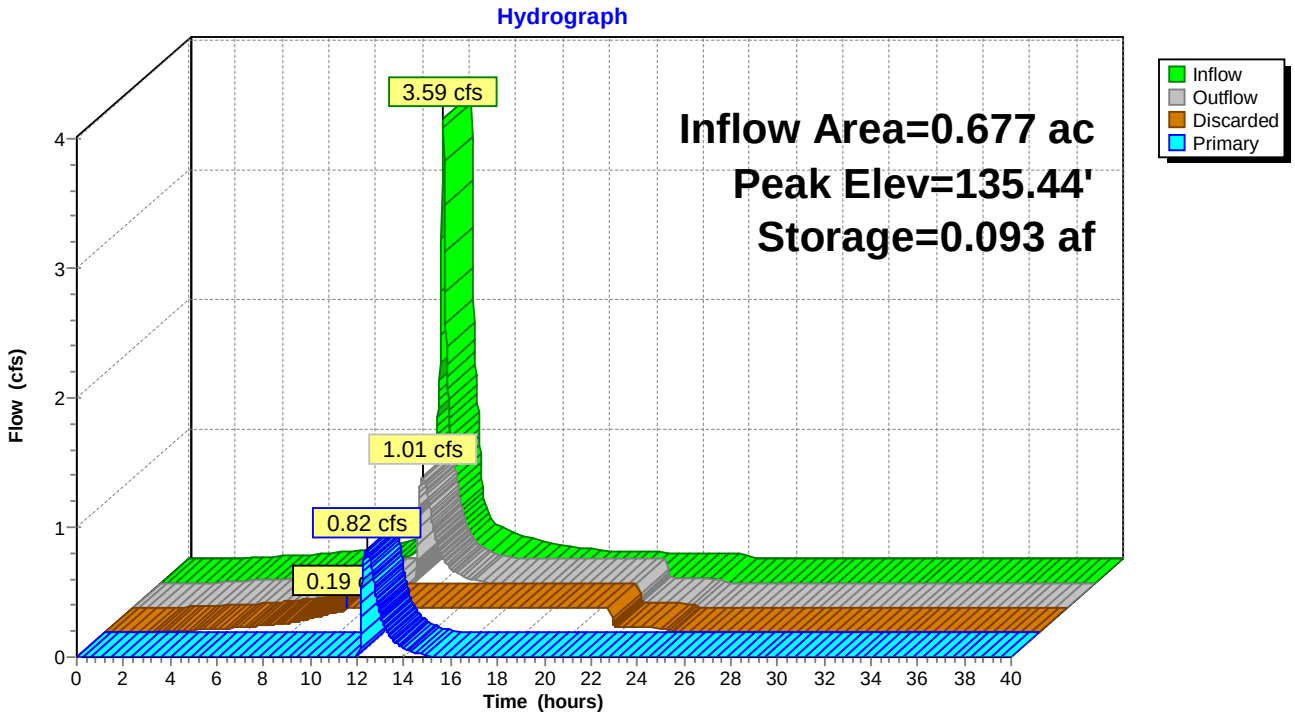
7,583.2 cf Field - 3,159.3 cf Chambers = 4,423.9 cf Stone x 40.0% Voids = 1,769.6 cf Stone Storage

Chamber Storage + Stone Storage = 4,770.9 cf = 0.110 af
Overall Storage Efficiency = 62.9%
Overall System Size = 97.83' x 34.31' x 2.26'

680 Chambers
280.9 cy Field
163.8 cy Stone



Pond 3P: Infiltration System 3



Summary for Pond 4P: Infiltration System 4

Inflow Area = 1.765 ac, 86.15% Impervious, Inflow Depth = 4.36" for 25 year event
Inflow = 8.64 cfs @ 12.08 hrs, Volume= 0.641 af
Outflow = 1.26 cfs @ 12.59 hrs, Volume= 0.641 af, Atten= 85%, Lag= 30.1 min
Discarded = 0.51 cfs @ 11.02 hrs, Volume= 0.533 af
Primary = 0.74 cfs @ 12.59 hrs, Volume= 0.108 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Peak Elev= 134.61' @ 12.59 hrs Surf.Area= 0.212 ac Storage= 0.241 af

Plug-Flow detention time= 111.9 min calculated for 0.641 af (100% of inflow)
Center-of-Mass det. time= 111.9 min (899.5 - 787.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	133.00'	0.106 af	**66.93'W x 137.71'L x 2.26'H Field A** 0.478 af Overall - 0.213 af Embedded = 0.265 af x 40.0% Voids
#2A	133.25'	0.202 af	**ACF R-Tank SD 2** x 1995 Inside #1 Inside= 15.7"W x 18.1"H => 1.88 sf x 2.35'L = 4.4 cf Outside= 15.7"W x 18.1"H => 1.98 sf x 2.35'L = 4.6 cf 1995 Chambers in 35 Rows
		0.308 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	133.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	134.30'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	134.00'	**2.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	134.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.51 cfs @ 11.02 hrs HW=133.02' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.51 cfs)

Primary OutFlow Max=0.74 cfs @ 12.59 hrs HW=134.61' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.10 cfs @ 2.05 fps)
├**3=Orifice/Grate** (Orifice Controls 0.08 cfs @ 3.48 fps)
└**4=Orifice/Grate** (Orifice Controls 0.56 cfs @ 2.87 fps)

Pond 4P: Infiltration System 4 - Chamber Wizard Field A

Chamber Model = ACF R-Tank SD 2 (ACF Environmental R-Tank SD)
Inside= 15.7"W x 18.1"H => 1.88 sf x 2.35'L = 4.4 cf
Outside= 15.7"W x 18.1"H => 1.98 sf x 2.35'L = 4.6 cf

15.7" Wide + 6.0" Spacing = 21.7" C-C Row Spacing

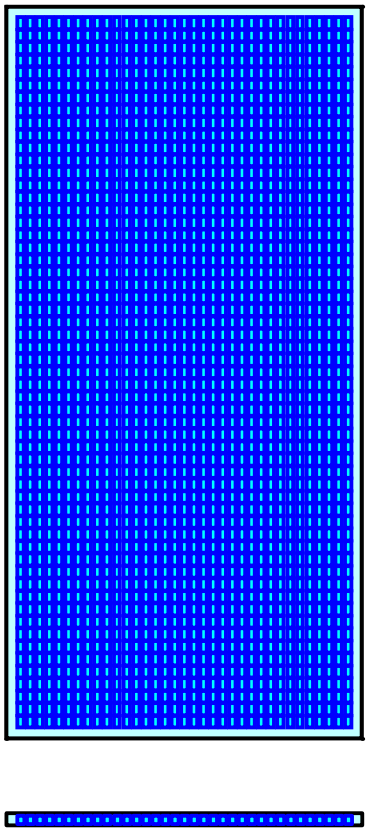
57 Chambers/Row x 2.35' Long = 133.71' Row Length +24.0" End Stone x 2 = 137.71' Base Length
35 Rows x 15.7" Wide + 6.0" Spacing x 34 + 24.0" Side Stone x 2 = 66.93' Base Width
3.0" Base + 18.1" Chamber Height + 6.0" Cover = 2.26' Field Height

1,995 Chambers x 4.4 cf = 8,805.3 cf Chamber Storage
1,995 Chambers x 4.6 cf = 9,268.8 cf Displacement

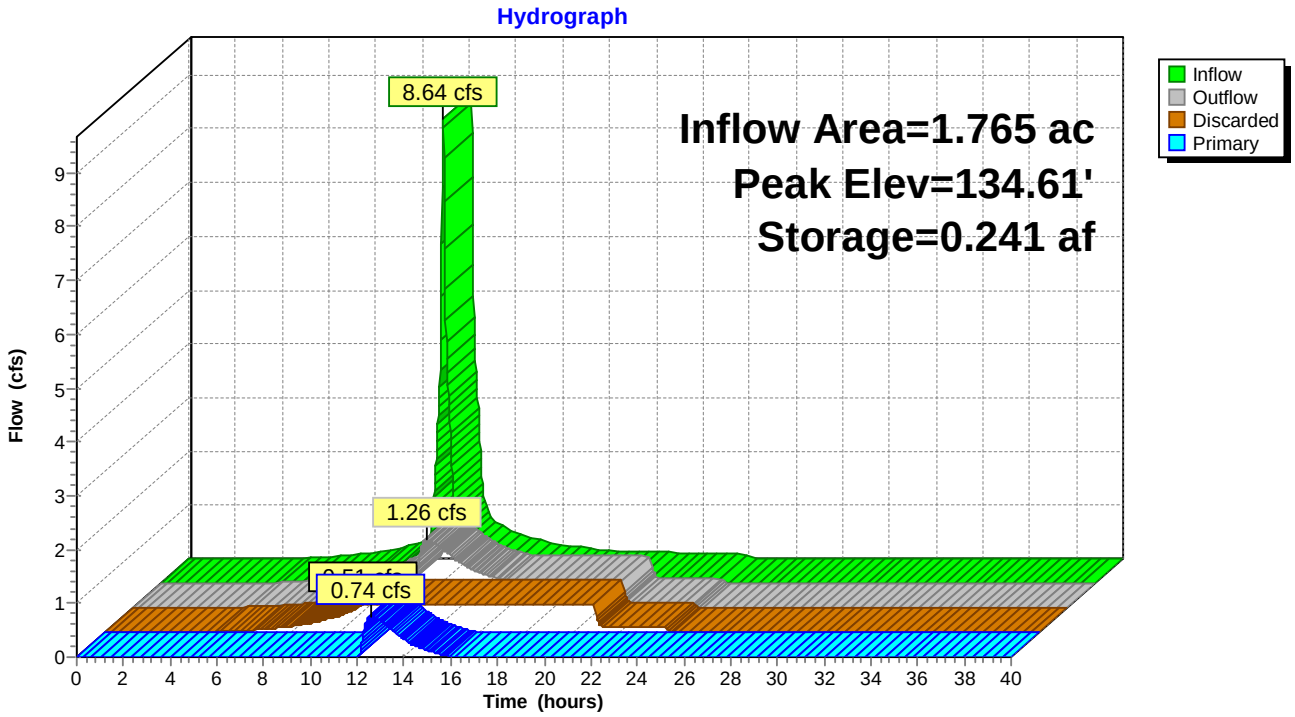
20,823.4 cf Field - 9,268.8 cf Chambers = 11,554.6 cf Stone x 40.0% Voids = 4,621.9 cf Stone Storage

Chamber Storage + Stone Storage = 13,427.2 cf = 0.308 af
Overall Storage Efficiency = 64.5%
Overall System Size = 137.71' x 66.93' x 2.26'

1,995 Chambers
771.2 cy Field
427.9 cy Stone



Pond 4P: Infiltration System 4



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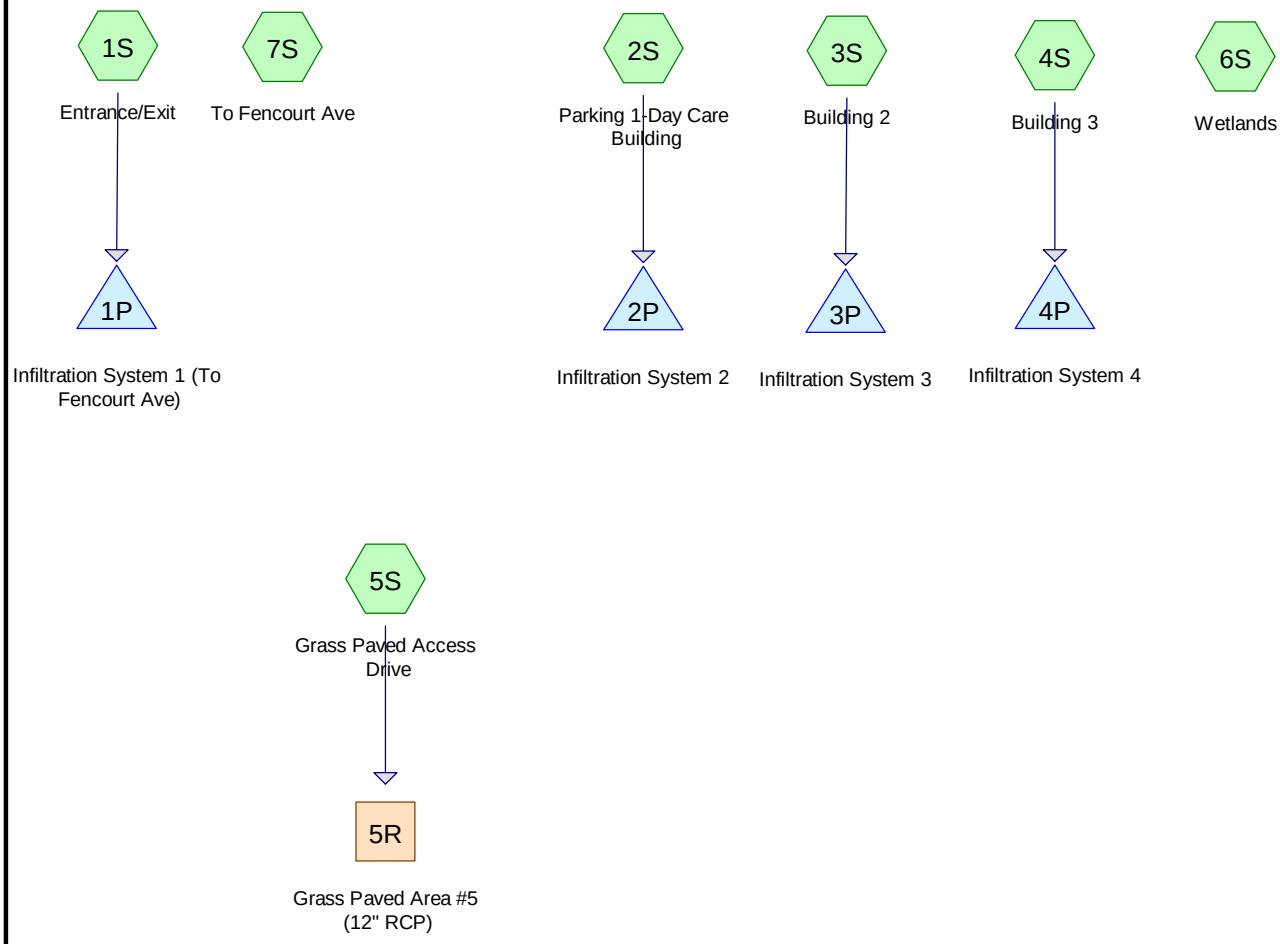
Current Event



Routing Diagram for 16 Fencourt Avenue-Proposed 100yr storm-2023-05-25

Prepared by {enter your company name here}, Printed 5/28/2023

Time span=0.00-40.00 hrs, dt=0.02 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Entrance/Exit Runoff Area=19,160 sf 78.76% Impervious Runoff Depth=4.97"
Tc=6.0 min CN=85 Runoff=2.49 cfs 0.182 af

Subcatchment 2S: Parking 1-Day Care Building Runoff Area=45,613 sf 82.36% Impervious Runoff Depth=5.30"
Tc=6.0 min CN=88 Runoff=6.23 cfs 0.463 af

Subcatchment 3S: Building 2 Runoff Area=29,469 sf 96.22% Impervious Runoff Depth=6.22"
Tc=6.0 min CN=96 Runoff=4.40 cfs 0.351 af

Subcatchment 4S: Building 3 Runoff Area=76,905 sf 86.15% Impervious Runoff Depth=5.53"
Tc=6.0 min CN=90 Runoff=10.81 cfs 0.814 af

Subcatchment 5S: Grass Paved Access Drive Runoff Area=12,688 sf 0.00% Impervious Runoff Depth=0.66"
Flow Length=360' Tc=28.3 min CN=39 Runoff=0.07 cfs 0.016 af

Subcatchment 6S: Wetlands Runoff Area=115,332 sf 0.00% Impervious Runoff Depth=0.95"
Flow Length=230' Tc=10.9 min CN=43 Runoff=1.57 cfs 0.209 af

Subcatchment 7S: To Fencourt Ave Runoff Area=10,357 sf 11.49% Impervious Runoff Depth=1.67"
Tc=6.0 min UI Adjusted CN=52 Runoff=0.41 cfs 0.033 af

Reach 5R: Grass Paved Area #5 (12" RCP) Inflow=0.07 cfs 0.016 af
Outflow=0.07 cfs 0.016 af

Pond 1P: Infiltration System 1 (To Fencourt Ave) Peak Elev=134.72' Storage=0.058 af Inflow=2.49 cfs 0.182 af
Discarded=0.08 cfs 0.121 af Primary=1.07 cfs 0.061 af Outflow=1.15 cfs 0.182 af

Pond 2P: Infiltration System 2 Peak Elev=134.20' Storage=0.196 af Inflow=6.23 cfs 0.463 af
Discarded=0.27 cfs 0.390 af Primary=0.48 cfs 0.072 af Outflow=0.75 cfs 0.463 af

Pond 3P: Infiltration System 3 Peak Elev=135.93' Storage=0.109 af Inflow=4.40 cfs 0.351 af
Discarded=0.19 cfs 0.247 af Primary=1.39 cfs 0.104 af Outflow=1.58 cfs 0.351 af

Pond 4P: Infiltration System 4 Peak Elev=135.26' Storage=0.308 af Inflow=10.81 cfs 0.814 af
Discarded=0.51 cfs 0.599 af Primary=1.28 cfs 0.215 af Outflow=1.79 cfs 0.814 af

Total Runoff Area = 7.106 ac Runoff Volume = 2.067 af Average Runoff Depth = 3.49"
52.04% Pervious = 3.698 ac 47.96% Impervious = 3.408 ac

Summary for Subcatchment 1S: Entrance/Exit

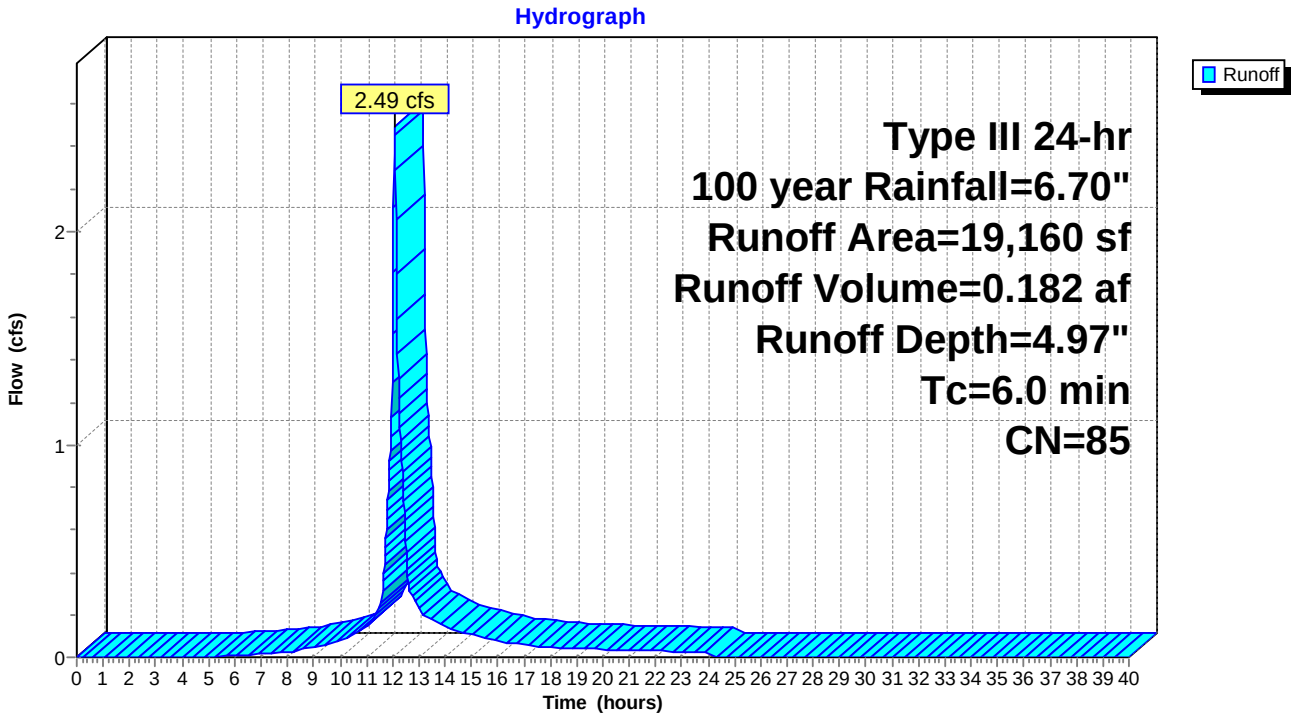
Runoff = 2.49 cfs @ 12.09 hrs, Volume= 0.182 af, Depth= 4.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 100 year Rainfall=6.70"

Area (sf)	CN	Description
15,090	98	Paved parking, HSG A
4,070	39	>75% Grass cover, Good, HSG A
19,160	85	Weighted Average
4,070		21.24% Pervious Area
15,090		78.76% Impervious Area

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

Subcatchment 1S: Entrance/Exit



Summary for Subcatchment 2S: Parking 1-Day Care Building

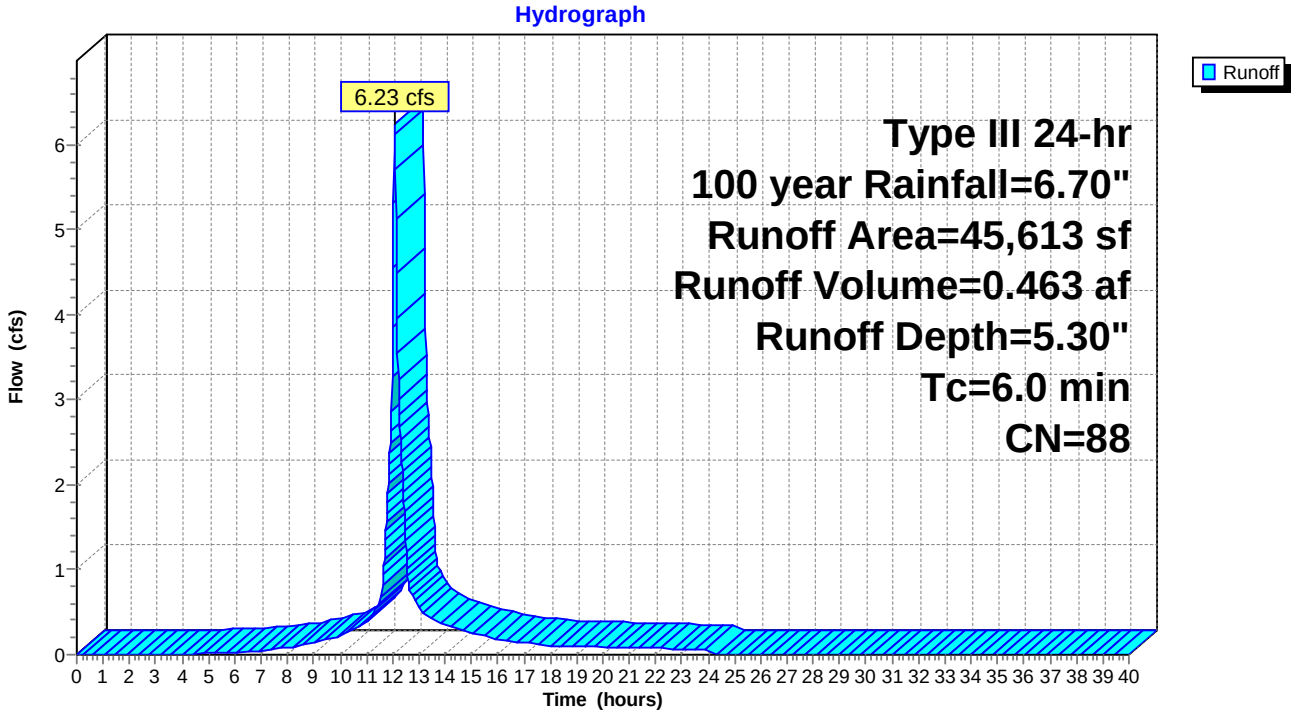
Runoff = 6.23 cfs @ 12.08 hrs, Volume= 0.463 af, Depth= 5.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 100 year Rainfall=6.70"

	Area (sf)	CN	Description
	24,731	98	Paved parking, HSG A
	8,047	39	>75% Grass cover, Good, HSG A
*	12,835	98	Daycare Building, HSG A
	45,613	88	Weighted Average
	8,047		17.64% Pervious Area
	37,566		82.36% Impervious Area

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

Subcatchment 2S: Parking 1-Day Care Building



Summary for Subcatchment 3S: Building 2

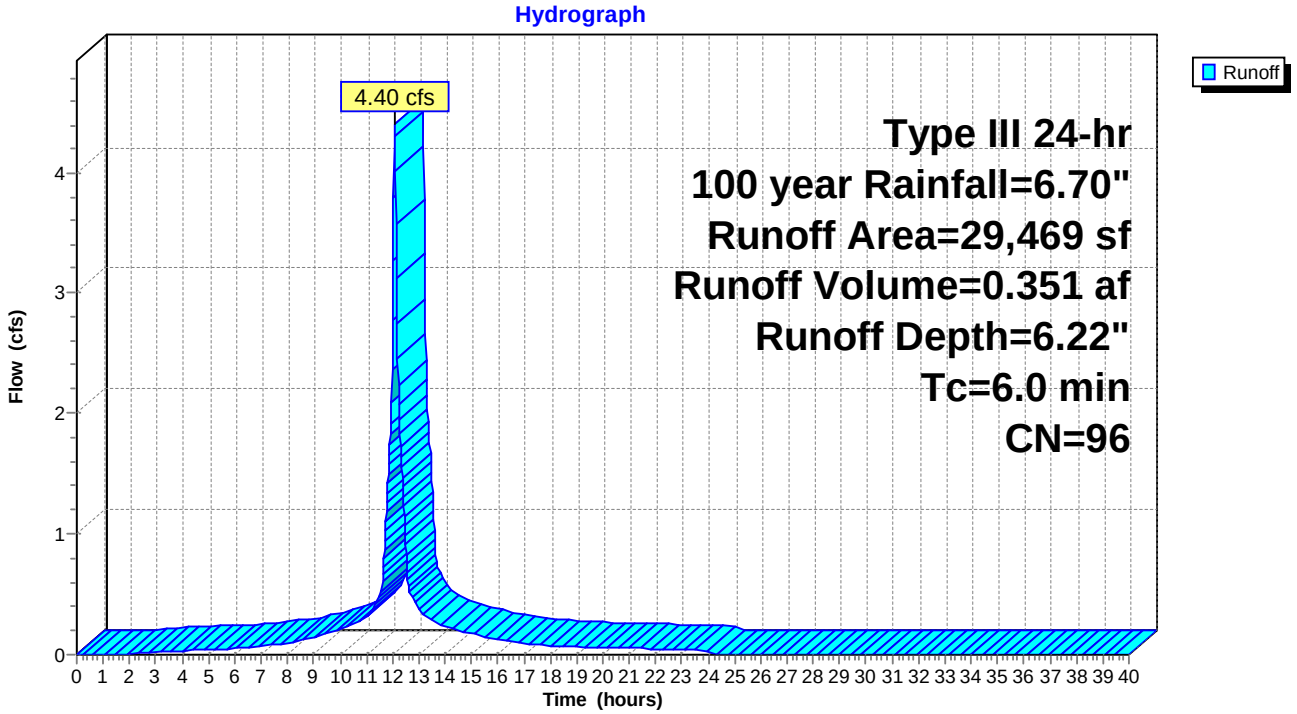
Runoff = 4.40 cfs @ 12.08 hrs, Volume= 0.351 af, Depth= 6.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 100 year Rainfall=6.70"

	Area (sf)	CN	Description
	11,219	98	Paved parking, HSG A
*	17,137	98	Building #2, HSG A
	1,113	39	>75% Grass cover, Good, HSG A
	29,469	96	Weighted Average
	1,113		3.78% Pervious Area
	28,356		96.22% Impervious Area

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

Subcatchment 3S: Building 2



Summary for Subcatchment 4S: Building 3

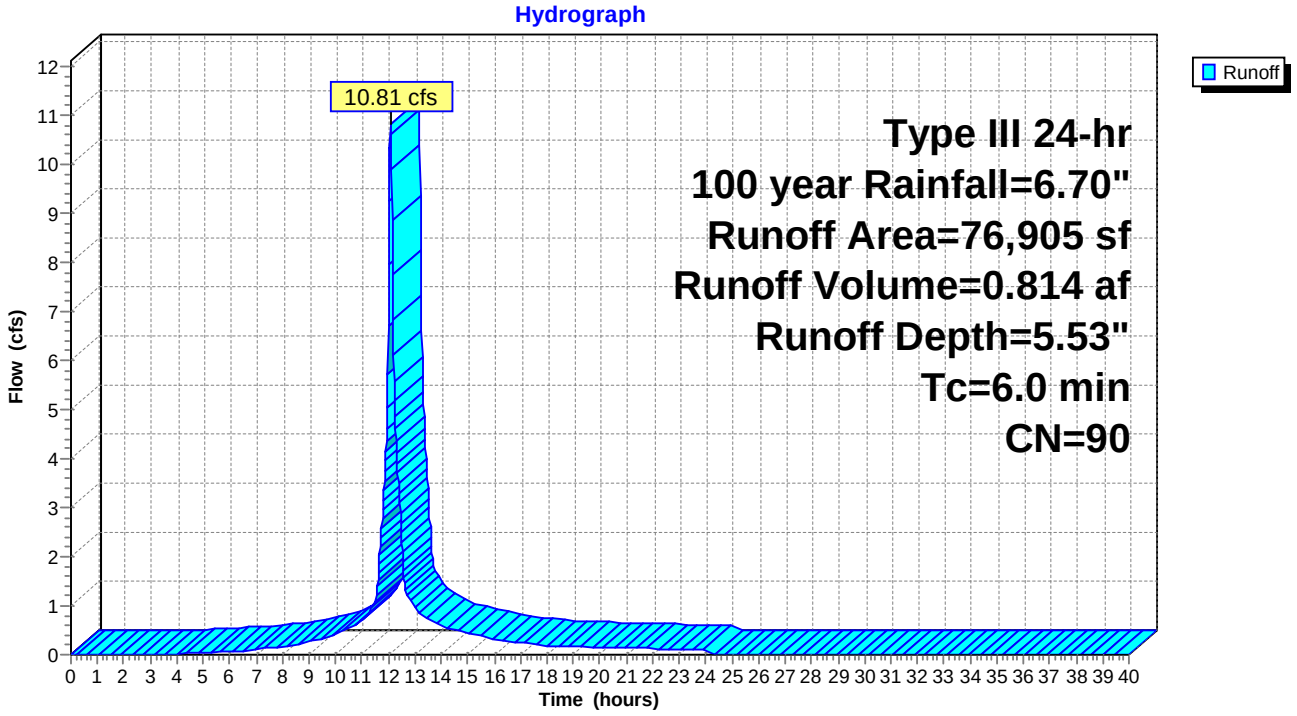
Runoff = 10.81 cfs @ 12.08 hrs, Volume= 0.814 af, Depth= 5.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 100 year Rainfall=6.70"

	Area (sf)	CN	Description
	43,449	98	Paved parking, HSG A
*	22,804	98	Building 3, HSG A
	10,652	39	>75% Grass cover, Good, HSG A
	76,905	90	Weighted Average
	10,652		13.85% Pervious Area
	66,253		86.15% Impervious Area

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

Subcatchment 4S: Building 3



Summary for Subcatchment 5S: Grass Paved Access Drive

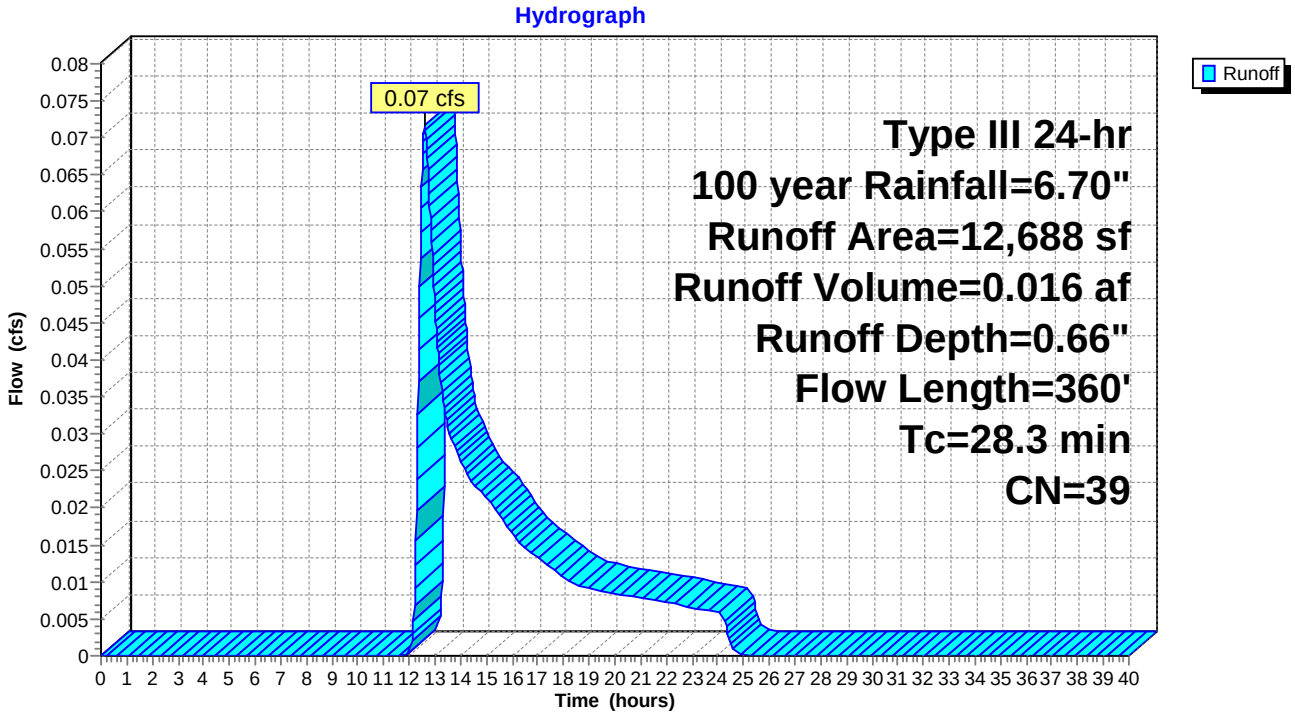
Runoff = 0.07 cfs @ 12.61 hrs, Volume= 0.016 af, Depth= 0.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 100 year Rainfall=6.70"

Area (sf)	CN	Description
12,688	39	>75% Grass cover, Good, HSG A
12,688		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.6	100	0.0250	0.08		**Sheet Flow, Wood** Woods: Light underbrush n= 0.400 P2= 3.20"
8.7	260	0.0100	0.50		**Shallow Concentrated Flow, Wood** Woodland Kv= 5.0 fps
28.3	360	Total			

Subcatchment 5S: Grass Paved Access Drive



Summary for Subcatchment 6S: Wetlands

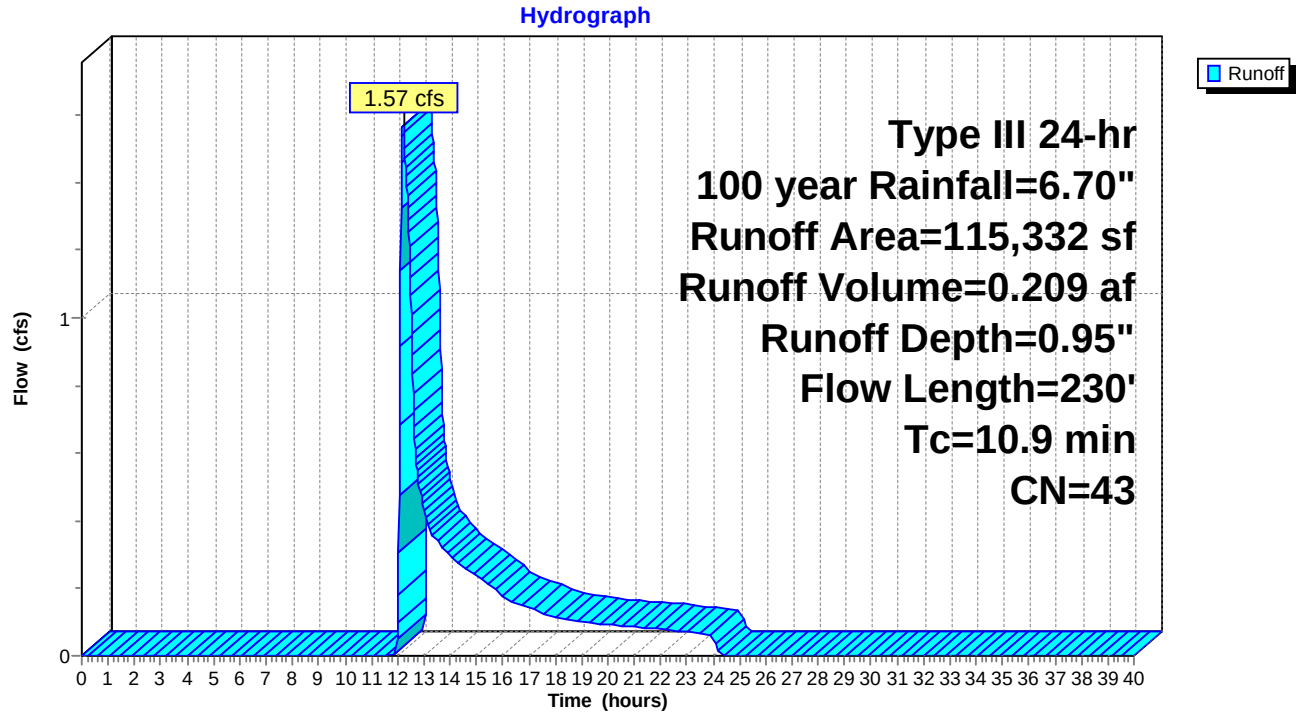
Runoff = 1.57 cfs @ 12.21 hrs, Volume= 0.209 af, Depth= 0.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 100 year Rainfall=6.70"

Area (sf)	CN	Description
115,332	43	Woods/grass comb., Fair, HSG A
115,332		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	100	0.1650	0.18		**Sheet Flow, Wood/Grass** Woods: Light underbrush n= 0.400 P2= 3.20"
1.7	130	0.0346	1.30		**Shallow Concentrated Flow, Wetland** Short Grass Pasture Kv= 7.0 fps
10.9	230	Total			

Subcatchment 6S: Wetlands



Summary for Subcatchment 7S: To Fencourt Ave

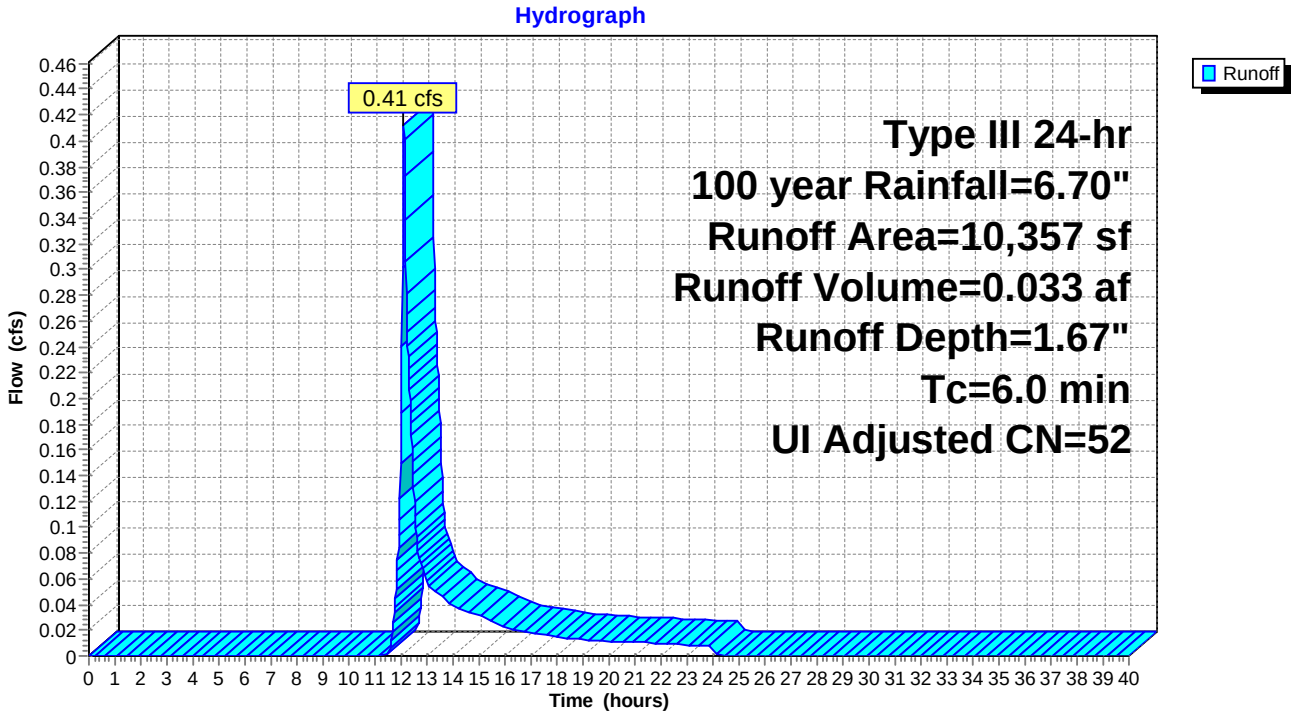
Runoff = 0.41 cfs @ 12.10 hrs, Volume= 0.033 af, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Type III 24-hr 100 year Rainfall=6.70"

	Area (sf)	CN	Adj	Description
	1,190	98		Unconnected pavement, HSG A
	5,872	49		50-75% Grass cover, Fair, HSG A
*	3,295	49		Playground area
	10,357	55	52	Weighted Average, UI Adjusted
	9,167			88.51% Pervious Area
	1,190			11.49% Impervious Area
	1,190			100.00% Unconnected

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

Subcatchment 7S: To Fencourt Ave



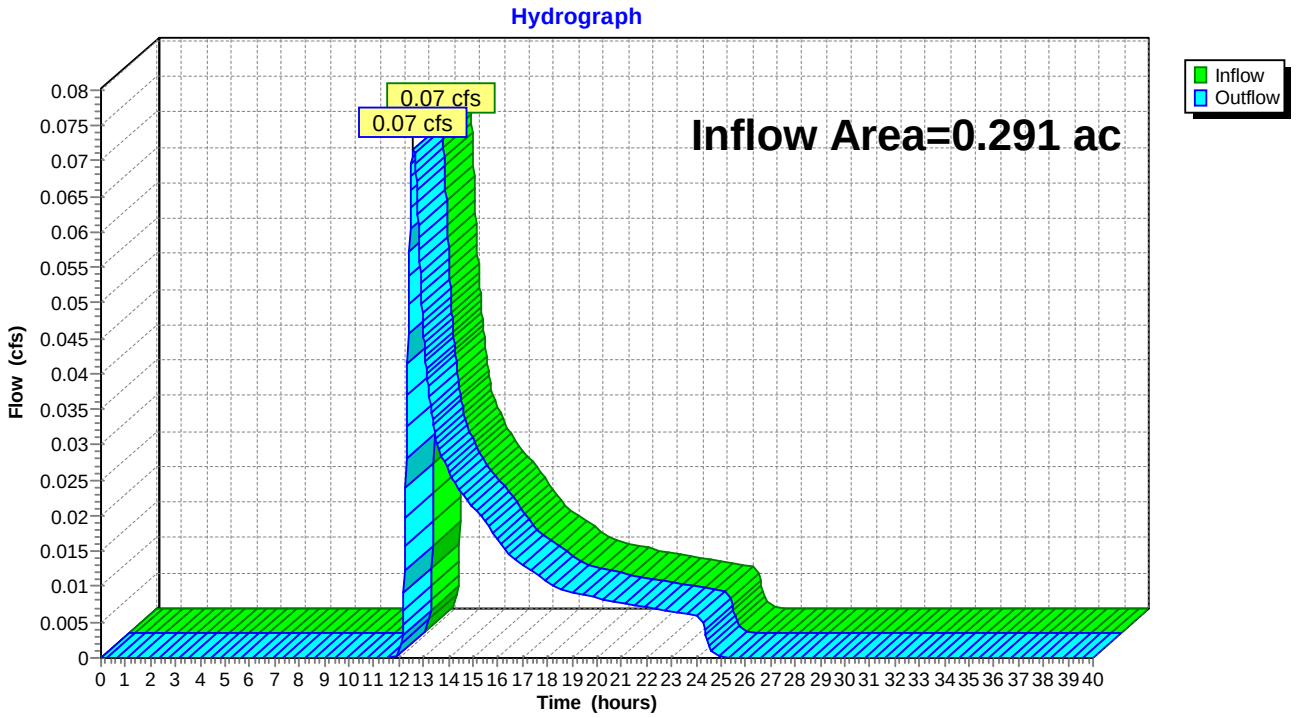
Summary for Reach 5R: Grass Paved Area #5 (12" RCP)

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

Inflow Area = 0.291 ac, 0.00% Impervious, Inflow Depth = 0.66" for 100 year event
Inflow = 0.07 cfs @ 12.61 hrs, Volume= 0.016 af
Outflow = 0.07 cfs @ 12.61 hrs, Volume= 0.016 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs

Reach 5R: Grass Paved Area #5 (12" RCP)



Summary for Pond 1P: Infiltration System 1 (To Fencourt Ave)

Inflow Area = 0.440 ac, 78.76% Impervious, Inflow Depth = 4.97" for 100 year event
Inflow = 2.49 cfs @ 12.09 hrs, Volume= 0.182 af
Outflow = 1.15 cfs @ 12.26 hrs, Volume= 0.182 af, Atten= 54%, Lag= 10.5 min
Discarded = 0.08 cfs @ 10.04 hrs, Volume= 0.121 af
Primary = 1.07 cfs @ 12.26 hrs, Volume= 0.061 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Peak Elev= 134.72' @ 12.26 hrs Surf.Area= 0.032 ac Storage= 0.058 af

Plug-Flow detention time= 166.1 min calculated for 0.182 af (100% of inflow)
Center-of-Mass det. time= 166.0 min (962.7 - 796.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	132.00'	0.022 af	**21.62'W x 64.99'L x 2.98'H Field A** 0.096 af Overall - 0.041 af Embedded = 0.055 af x 40.0% Voids
#2A	132.25'	0.039 af	**ACF R-Tank SD 3** x 260 Inside #1 Inside= 15.7"W x 26.8"H => 2.78 sf x 2.35'L = 6.5 cf Outside= 15.7"W x 26.8"H => 2.93 sf x 2.35'L = 6.9 cf 260 Chambers in 10 Rows
		0.061 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	132.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	134.20'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	134.20'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	134.20'	**3.0" Vert. Orifice/Grate** C= 0.600
#5	Primary	134.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#6	Primary	134.00'	**4.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.08 cfs @ 10.04 hrs HW=132.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=1.07 cfs @ 12.26 hrs HW=134.72' (Free Discharge)
├─**2=Orifice/Grate** (Orifice Controls 0.15 cfs @ 3.02 fps)
├─**3=Orifice/Grate** (Orifice Controls 0.15 cfs @ 3.02 fps)
├─**4=Orifice/Grate** (Orifice Controls 0.15 cfs @ 3.02 fps)
├─**5=Orifice/Grate** (Orifice Controls 0.31 cfs @ 3.58 fps)
└─**6=Orifice/Grate** (Orifice Controls 0.31 cfs @ 3.58 fps)

Pond 1P: Infiltration System 1 (To Fencourt Ave) - Chamber Wizard Field A

Chamber Model = ACF R-Tank SD 3 (ACF Environmental R-Tank SD)
Inside= 15.7"W x 26.8"H => 2.78 sf x 2.35'L = 6.5 cf
Outside= 15.7"W x 26.8"H => 2.93 sf x 2.35'L = 6.9 cf

15.7" Wide + 6.0" Spacing = 21.7" C-C Row Spacing

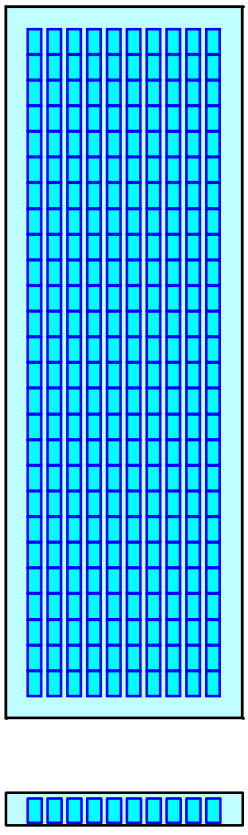
26 Chambers/Row x 2.35' Long = 60.99' Row Length +24.0" End Stone x 2 = 64.99' Base Length
10 Rows x 15.7" Wide + 6.0" Spacing x 9 + 24.0" Side Stone x 2 = 21.62' Base Width
3.0" Base + 26.8" Chamber Height + 6.0" Cover = 2.98' Field Height

260 Chambers x 6.5 cf = 1,696.4 cf Chamber Storage
260 Chambers x 6.9 cf = 1,785.7 cf Displacement

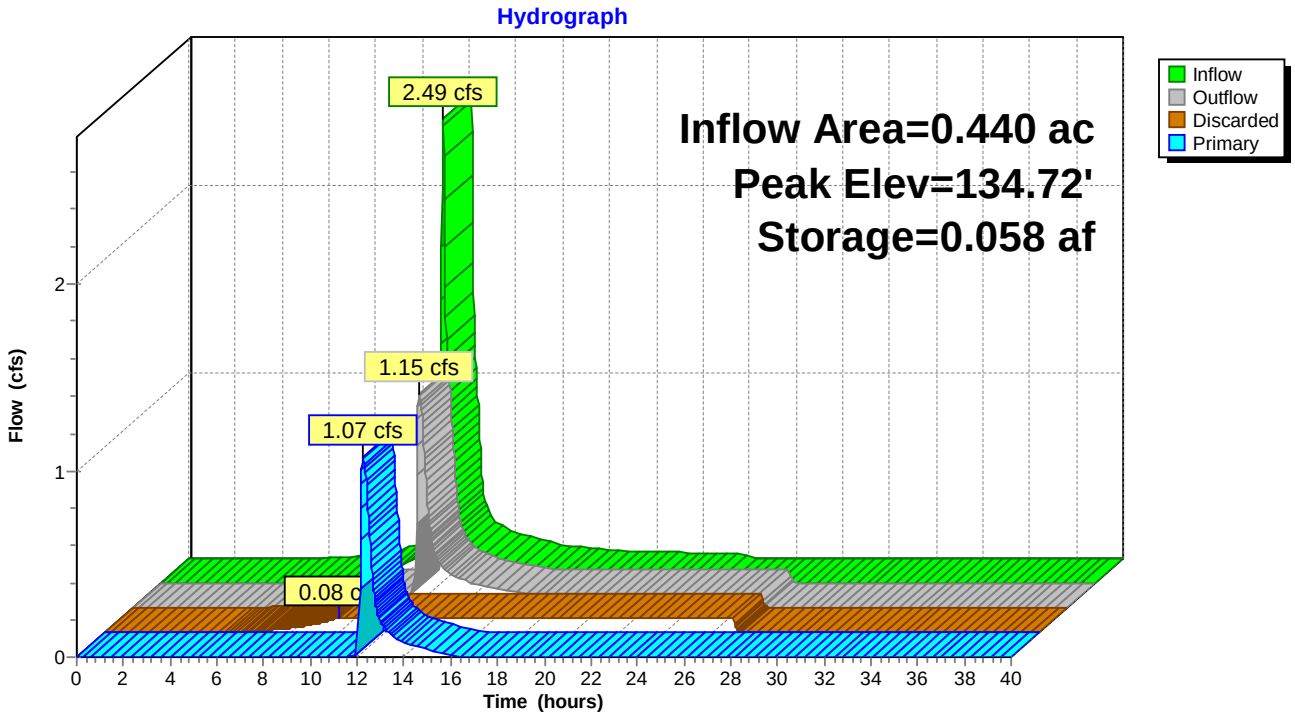
4,189.2 cf Field - 1,785.7 cf Chambers = 2,403.5 cf Stone x 40.0% Voids = 961.4 cf Stone Storage

Chamber Storage + Stone Storage = 2,657.8 cf = 0.061 af
Overall Storage Efficiency = 63.4%
Overall System Size = 64.99' x 21.62' x 2.98'

260 Chambers
155.2 cy Field
89.0 cy Stone



Pond 1P: Infiltration System 1 (To Fencourt Ave)



Summary for Pond 2P: Infiltration System 2

Inflow Area = 1.047 ac, 82.36% Impervious, Inflow Depth = 5.30" for 100 year event
Inflow = 6.23 cfs @ 12.08 hrs, Volume= 0.463 af
Outflow = 0.75 cfs @ 12.68 hrs, Volume= 0.463 af, Atten= 88%, Lag= 36.0 min
Discarded = 0.27 cfs @ 10.40 hrs, Volume= 0.390 af
Primary = 0.48 cfs @ 12.68 hrs, Volume= 0.072 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Peak Elev= 134.20' @ 12.68 hrs Surf.Area= 0.110 ac Storage= 0.196 af

Plug-Flow detention time= 214.2 min calculated for 0.462 af (100% of inflow)
Center-of-Mass det. time= 214.1 min (1,001.9 - 787.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	131.70'	0.068 af	**48.81'W x 97.83'L x 2.98'H Field A** 0.327 af Overall - 0.158 af Embedded = 0.169 af x 40.0% Voids
#2A	131.95'	0.150 af	**ACF R-Tank SD 3** x 1000 Inside #1 Inside= 15.7"W x 26.8"H => 2.78 sf x 2.35'L = 6.5 cf Outside= 15.7"W x 26.8"H => 2.93 sf x 2.35'L = 6.9 cf 1000 Chambers in 25 Rows
		0.217 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	131.70'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	133.70'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	133.70'	**4.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.27 cfs @ 10.40 hrs HW=131.73' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.27 cfs)

Primary OutFlow Max=0.48 cfs @ 12.68 hrs HW=134.20' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.24 cfs @ 2.76 fps)
└**3=Orifice/Grate** (Orifice Controls 0.24 cfs @ 2.76 fps)

Pond 2P: Infiltration System 2 - Chamber Wizard Field A

Chamber Model = ACF R-Tank SD 3 (ACF Environmental R-Tank SD)
Inside= 15.7"W x 26.8"H => 2.78 sf x 2.35'L = 6.5 cf
Outside= 15.7"W x 26.8"H => 2.93 sf x 2.35'L = 6.9 cf

15.7" Wide + 6.0" Spacing = 21.7" C-C Row Spacing

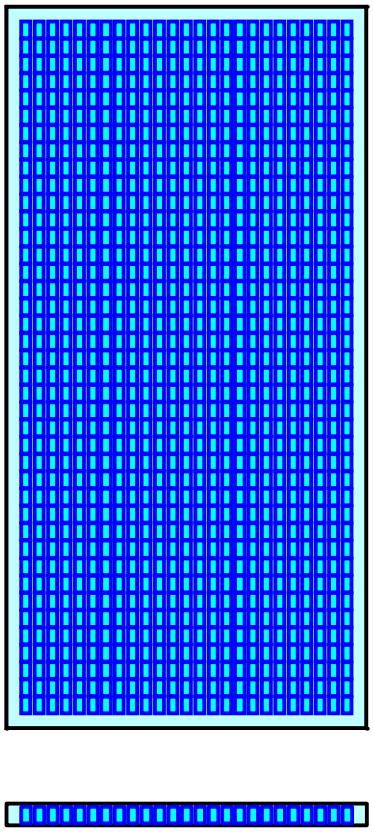
40 Chambers/Row x 2.35' Long = 93.83' Row Length +24.0" End Stone x 2 = 97.83' Base Length
25 Rows x 15.7" Wide + 6.0" Spacing x 24 + 24.0" Side Stone x 2 = 48.81' Base Width
3.0" Base + 26.8" Chamber Height + 6.0" Cover = 2.98' Field Height

1,000 Chambers x 6.5 cf = 6,524.6 cf Chamber Storage
1,000 Chambers x 6.9 cf = 6,868.0 cf Displacement

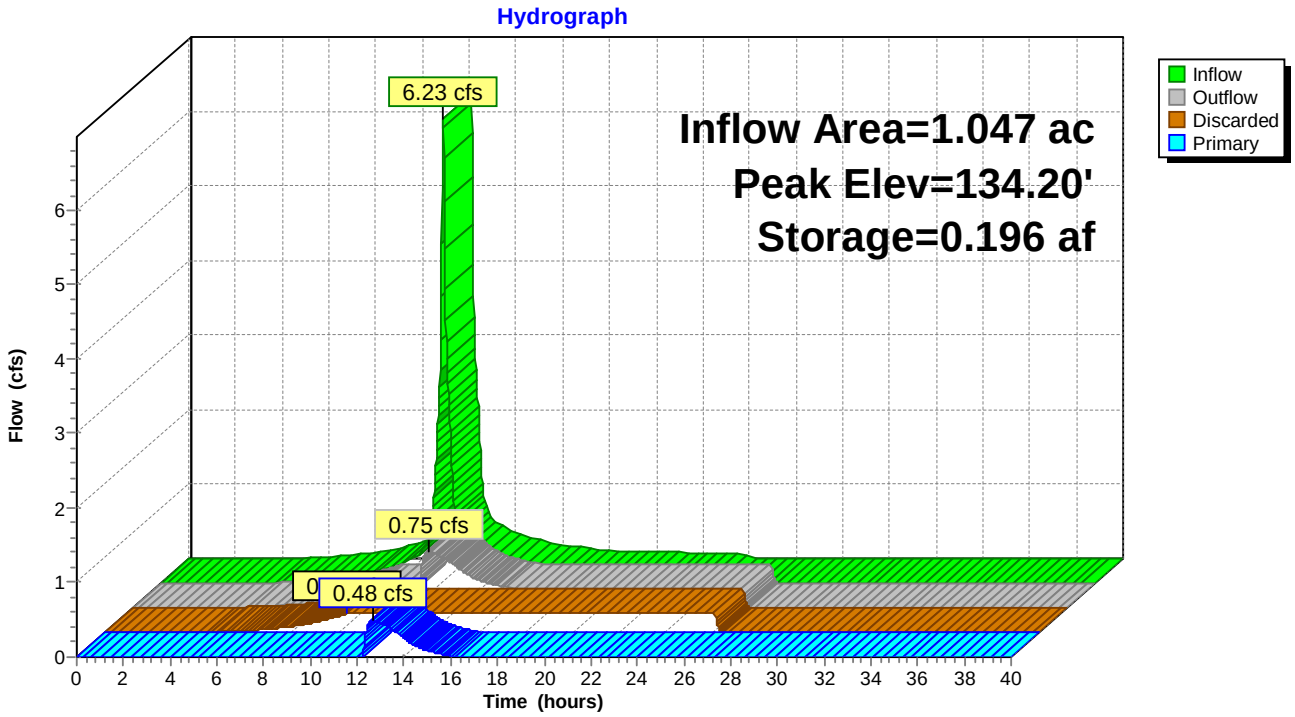
14,234.2 cf Field - 6,868.0 cf Chambers = 7,366.2 cf Stone x 40.0% Voids = 2,946.5 cf Stone Storage

Chamber Storage + Stone Storage = 9,471.1 cf = 0.217 af
Overall Storage Efficiency = 66.5%
Overall System Size = 97.83' x 48.81' x 2.98'

1,000 Chambers
527.2 cy Field
272.8 cy Stone



Pond 2P: Infiltration System 2



Summary for Pond 3P: Infiltration System 3

Inflow Area = 0.677 ac, 96.22% Impervious, Inflow Depth = 6.22" for 100 year event
Inflow = 4.40 cfs @ 12.08 hrs, Volume= 0.351 af
Outflow = 1.58 cfs @ 12.34 hrs, Volume= 0.351 af, Atten= 64%, Lag= 15.1 min
Discarded = 0.19 cfs @ 9.76 hrs, Volume= 0.247 af
Primary = 1.39 cfs @ 12.34 hrs, Volume= 0.104 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Peak Elev= 135.93' @ 12.34 hrs Surf.Area= 0.077 ac Storage= 0.109 af

Plug-Flow detention time= 96.4 min calculated for 0.351 af (100% of inflow)
Center-of-Mass det. time= 96.3 min (852.2 - 755.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	133.70'	0.041 af	**34.31'W x 97.83'L x 2.26'H Field A** 0.174 af Overall - 0.073 af Embedded = 0.102 af x 40.0% Voids
#2A	133.95'	0.069 af	**ACF R-Tank SD 2** x 680 Inside #1 Inside= 15.7"W x 18.1"H => 1.88 sf x 2.35'L = 4.4 cf Outside= 15.7"W x 18.1"H => 1.98 sf x 2.35'L = 4.6 cf 680 Chambers in 17 Rows
		0.110 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	133.70'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	135.00'	**5.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	134.90'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.19 cfs @ 9.76 hrs HW=133.72' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=1.39 cfs @ 12.34 hrs HW=135.93' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.56 cfs @ 4.09 fps)
└**3=Orifice/Grate** (Orifice Controls 0.83 cfs @ 4.25 fps)

Pond 3P: Infiltration System 3 - Chamber Wizard Field A

Chamber Model = ACF R-Tank SD 2 (ACF Environmental R-Tank SD)
Inside= 15.7"W x 18.1"H => 1.88 sf x 2.35'L = 4.4 cf
Outside= 15.7"W x 18.1"H => 1.98 sf x 2.35'L = 4.6 cf

15.7" Wide + 6.0" Spacing = 21.7" C-C Row Spacing

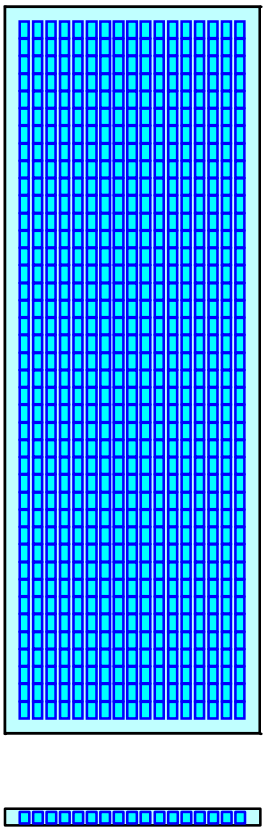
40 Chambers/Row x 2.35' Long = 93.83' Row Length +24.0" End Stone x 2 = 97.83' Base Length
17 Rows x 15.7" Wide + 6.0" Spacing x 16 + 24.0" Side Stone x 2 = 34.31' Base Width
3.0" Base + 18.1" Chamber Height + 6.0" Cover = 2.26' Field Height

680 Chambers x 4.4 cf = 3,001.3 cf Chamber Storage
680 Chambers x 4.6 cf = 3,159.3 cf Displacement

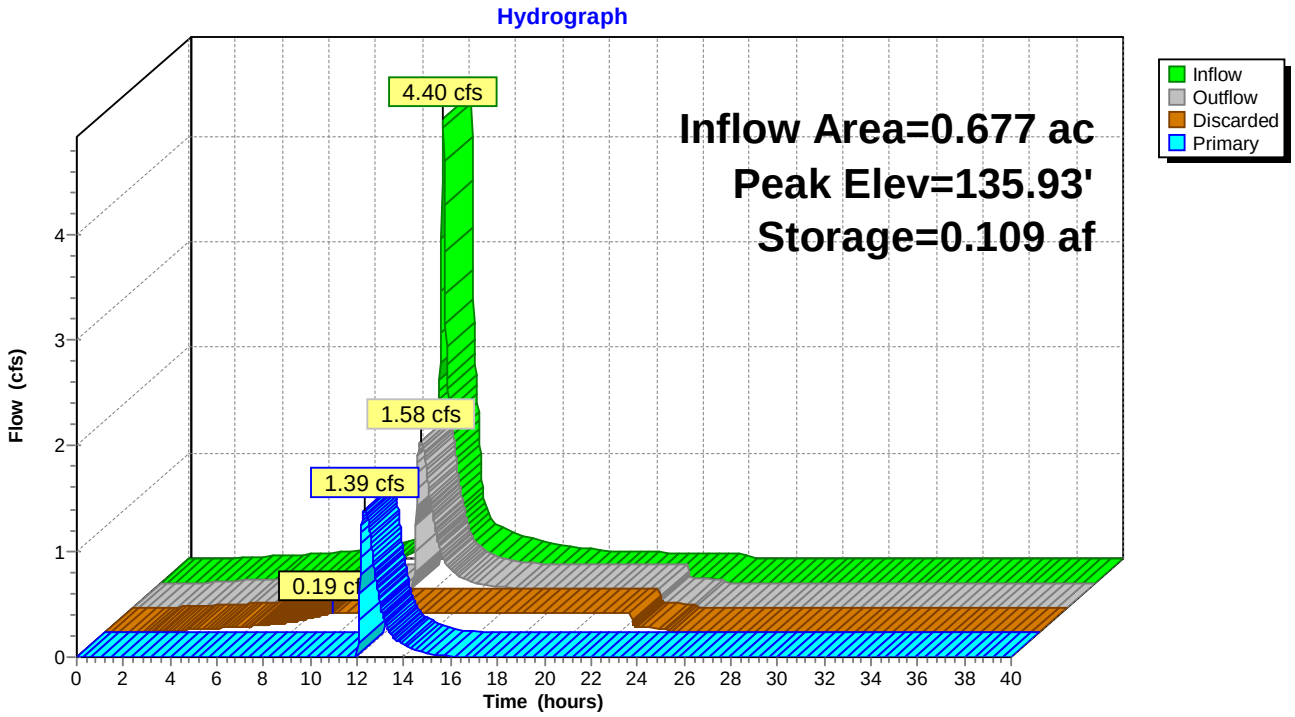
7,583.2 cf Field - 3,159.3 cf Chambers = 4,423.9 cf Stone x 40.0% Voids = 1,769.6 cf Stone Storage

Chamber Storage + Stone Storage = 4,770.9 cf = 0.110 af
Overall Storage Efficiency = 62.9%
Overall System Size = 97.83' x 34.31' x 2.26'

680 Chambers
280.9 cy Field
163.8 cy Stone



Pond 3P: Infiltration System 3



Summary for Pond 4P: Infiltration System 4

Inflow Area = 1.765 ac, 86.15% Impervious, Inflow Depth = 5.53" for 100 year event
Inflow = 10.81 cfs @ 12.08 hrs, Volume= 0.814 af
Outflow = 1.79 cfs @ 12.55 hrs, Volume= 0.814 af, Atten= 83%, Lag= 28.1 min
Discarded = 0.51 cfs @ 10.46 hrs, Volume= 0.599 af
Primary = 1.28 cfs @ 12.55 hrs, Volume= 0.215 af

Routing by Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.02 hrs
Peak Elev= 135.26' @ 12.55 hrs Surf.Area= 0.212 ac Storage= 0.308 af

Plug-Flow detention time= 111.2 min calculated for 0.813 af (100% of inflow)
Center-of-Mass det. time= 111.2 min (892.4 - 781.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	133.00'	0.106 af	**66.93'W x 137.71'L x 2.26'H Field A** 0.478 af Overall - 0.213 af Embedded = 0.265 af x 40.0% Voids
#2A	133.25'	0.202 af	**ACF R-Tank SD 2** x 1995 Inside #1 Inside= 15.7"W x 18.1"H => 1.88 sf x 2.35'L = 4.4 cf Outside= 15.7"W x 18.1"H => 1.98 sf x 2.35'L = 4.6 cf 1995 Chambers in 35 Rows
		0.308 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	133.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	134.30'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	134.00'	**2.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	134.00'	**6.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.51 cfs @ 10.46 hrs HW=133.02' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.51 cfs)

Primary OutFlow Max=1.28 cfs @ 12.55 hrs HW=135.26' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.22 cfs @ 4.39 fps)
├**3=Orifice/Grate** (Orifice Controls 0.11 cfs @ 5.22 fps)
└**4=Orifice/Grate** (Orifice Controls 0.95 cfs @ 4.83 fps)

Pond 4P: Infiltration System 4 - Chamber Wizard Field A

Chamber Model = ACF R-Tank SD 2 (ACF Environmental R-Tank SD)
Inside= 15.7"W x 18.1"H => 1.88 sf x 2.35'L = 4.4 cf
Outside= 15.7"W x 18.1"H => 1.98 sf x 2.35'L = 4.6 cf

15.7" Wide + 6.0" Spacing = 21.7" C-C Row Spacing

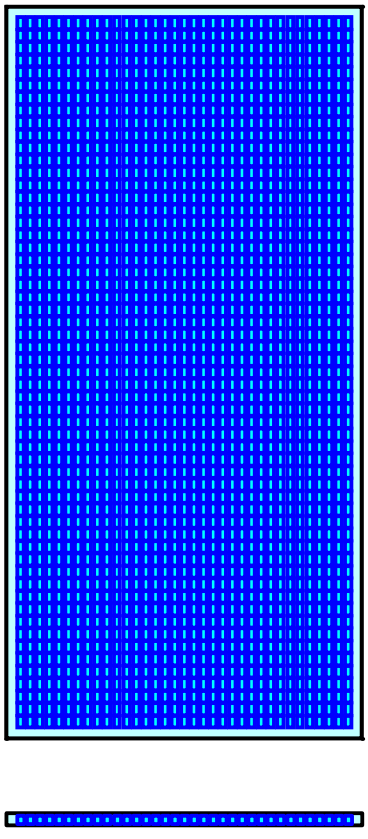
57 Chambers/Row x 2.35' Long = 133.71' Row Length +24.0" End Stone x 2 = 137.71' Base Length
35 Rows x 15.7" Wide + 6.0" Spacing x 34 + 24.0" Side Stone x 2 = 66.93' Base Width
3.0" Base + 18.1" Chamber Height + 6.0" Cover = 2.26' Field Height

1,995 Chambers x 4.4 cf = 8,805.3 cf Chamber Storage
1,995 Chambers x 4.6 cf = 9,268.8 cf Displacement

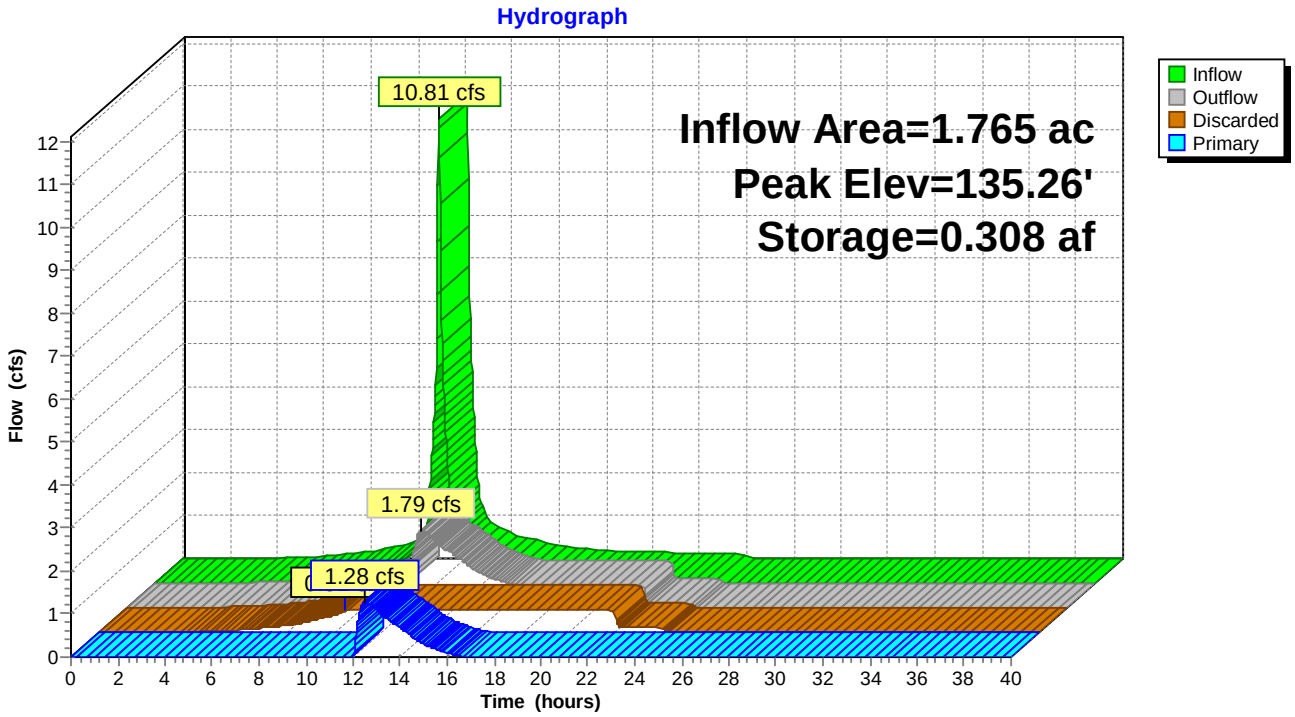
20,823.4 cf Field - 9,268.8 cf Chambers = 11,554.6 cf Stone x 40.0% Voids = 4,621.9 cf Stone Storage

Chamber Storage + Stone Storage = 13,427.2 cf = 0.308 af
Overall Storage Efficiency = 64.5%
Overall System Size = 137.71' x 66.93' x 2.26'

1,995 Chambers
771.2 cy Field
427.9 cy Stone



Pond 4P: Infiltration System 4



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Infiltration Structure Sizing Calculations

Volume of Infiltration System

The volume of the infiltration system is shown in the table below. The numbers were calculated by the following formulas:

Chamber Storage = Number of Chambers x 6.5 cf for triple layer, 4.4 cf for double layer

Chamber Displacement = Number of Chambers x 6.9 cf for triple layer, 4.6 cf for double layer

Field Area = System Length x System Width

Field Volume = Field Area x Field Hight

Stone Storage = (Field Volume – Chamber Displacement) x 40% Stone Voids

System Storage = Chamber Storage + Stone Storage

System #1, #2 are triple layer systems

System #3, #4 are double layer systems

INFILTRATION SYSTEM VOLUME CALCULATIONS					
	System 1	System 2	System 3	System 4	Total
No. Chambers	260x3	1000x3	680x2	1995x2	9,130
Field Dimension (ft x ft x ft)	64.99 x 21.62x2.98	97.83 x 48.81x2.98	97.83x 34.31x2.26	- - -	- - -
Field Area (sf)	1,405.1	4,775.1	3,356.5	10,459.5	19,996.2
Field Volume (cf)	4,189.2	14,234.2	7,583.2	23,638.5	49,645.1
Chamber Storage (cf)	1,696.4	6,524.6	3,001.3	8,805.3	20,027.6
Chamber Displacement (cf)	1,785.7	6,868.0	3,159.3	9,268.8	21,081.8
Stone Storage (cf)	961.4	2,946.5	1,769.6	4,621.9	11,455.8
System Storage (cf)	2,657.8	9,471.1	4,770.9	13,427.2	30,327

Massachusetts Stormwater Standards - Required Recharge Volume

Rv = F x Impervious Area

Where:

Rv = Required Recharged Volume

F = Target Depth Factor, for Type A Soils = 0.6”

Total Impervious Area on-site = 148,455 sf

Wv = 0.6” x 1 ft/12 inches x 148,455 sf = 7,423 cf

Infiltration System Storage Volume (Reference to HydroCAD Analysis 2-Year Storm Stage-Area-Storage Table):

Infiltration System #1 (Orifice at 134.00): 0.043 af x 43,560 sf = 1,873.1 cf

Infiltration System #2 (Orifice at 133.70): 0.156 af x 43,560 sf = 6,795.4 cf

Infiltration System #3 (Orifice at 134.90): 0.062 af x 43,560 sf = 2,700.7 cf

Infiltration System #4 (Orifice at 134.00): 0.143 af x 43,560 sf = 6,229.1 cf

Total Volume: 1,873.1 cf + 6,795.4 cf + 2,700.7 cf + 6,229.1 cf

= 17,598.3 cf > 7,423 cf

Massachusetts Stormwater Standards – Water Quality Volume I

Wv = f x Impervious Area

Where:

Wv = Required Recharged Volume

f = 1 Inch of Runoff

Total Impervious Area on-site = 148,455 sf

Wv = 1" x 1 ft/12 inches x 148,455 sf = 12,371.3 cf < 17,598.3 cf

Time to Infiltrate – Static Method

Time to Infiltrate = Rv / (K x Bottom of Stone Area x n)

Where

Rv=Required Recharged Volume

K=Rawls Rate (per Table 2.3.3 in the Mass Stormwater Handbook) = 2.41 in/hr for Loamy Sand

n=stone voids = 0.40

Retention System #1

Bottom of Stone Area Infiltration Area 1= 1,405 sf

Time to Infiltrate= 2,685 cf / (2.41 in/hr x 1 ft/12 inches x 1,405 sf x 0.40) = 23.8 hours

23.8 hours < 72 hours: Meets Standard

Retention System #2

Bottom of Stone Area Infiltration Area 2= 4,775 sf

Time to Infiltrate= 9,471 cf / (2.41 in/hr x 1 ft/12 inches x 4,775 sf x 0.40) = 24.7 hours

24.7 hours < 72 hours: Meets Standard

Retention System #3

Bottom of Stone Area Infiltration Area 3= 3,357 sf

Time to Infiltrate= 4,771cf / (2.41 in/hr x 1 ft/12 inches x 3,357 sf x 0.40) = 17.7 hours

17.7 hours < 72 hours: Meets Standard

Retention System #4

Bottom of Stone Area Infiltration Area 4= 10,460 sf

Time to Infiltrate= 13,427 cf / (2.41 in/hr x 1 ft/12 inches x 10,460 sf x 0.40) = 16 hours

16 hours < 72 hours: Meets Standard

Stormwater Operation and Maintenance Plan

16 Fencourt Avenue
Randolph, MA
July 8, 2022

Stormwater Management System Owner:

TAJ ESTATES OF RANDOLPH II LLC

The following Operation and Maintenance Plan is intended as a guide for maintaining the structural and non-structural BMP's post-construction. In order to document maintenance activities, the attached maintenance log should be kept on site. A minimum of two years' worth of records should be up to date and available for review and inspection, if requested by Town officials. The transfer of ownership (e.g. from developer to condo association) also includes the transfer of the maintenance obligation to the new owners. In order to ensure the proposed stormwater management system continues to function as designed and to prevent any adverse impacts down-gradient, proper maintenance is required.

Operation and Maintenance Plan During Construction

All erosion and sediment control measures must be in place prior to any disturbance.

Inlet Protection: Catch basins shall be protected from siltation during construction through the use of siltation fabric. The siltation fabric must be installed under the catch basin grates and the grates must be secured to prevent untreated seepage. The fabric should be inspected daily and immediately after a rainstorm. Sediment deposits must be removed promptly, and fabric must be repaired as necessary.

Perimeter Silt Protection: A "Silt Sock" (or approved equal) perimeter fence must be installed around the perimeter of work limits and material stockpiles. Installation shall be in accordance with manufacturer specifications and attached details. Silt fence shall be inspected daily. Trapped sediments shall be removed and repairs shall be made promptly.

Stabilized Construction Entrance: A stabilized construction entrance must be installed at the entrance to the construction site. Entrance shall be made of 1 ½" crushed stone for a depth of four inches. Construction entrance shall be inspected daily and repairs shall be made promptly.

Stormwater Operation and Maintenance Plan

16 Fencourt Avenue
Randolph, MA
July 8, 2022

Stormwater Management System Owner:

TAJ ESTATES OF RANDOLPH II LLC

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Operation and Maintenance Activities Post-Construction

General Housekeeping: Paved areas should be kept clear of debris or leaf buildup to prevent clogging of the catch basins. All chemical and hazardous materials shall be store in secured designated locations with spill protection.

Catch Basins and Deep Sump Drain Manhole Inspection and Cleaning: Catch basins and deep sump drain manhole shall be inspected at least four (4) times per year and cleaned a minimum of two (2) times per year. Inspections should include the frame and grate, outlet pipe, hood and overall structure. Cleaning of all structures shall be conducted in the early spring (after winter sanding and before spring rains), if there are 18-inches of accumulated sediments or if a noticeable hydrocarbon sheen is present. The sumps shall be cleaned utilizing a vacuum or clamshell type device.

R-Tank System Inspection and Cleaning: The subsurface infiltration basin does not require regular maintenance if pretreatment devices (catch basins, trench drains, and deep sump drain manholes) are properly maintained. The system has inspection ports that should be inspected when the other on-site stormwater devices are inspected. If sediment build-up within the retention system is found during inspection, the sediment shall be removed by vacuumed method through the inspection ports. Maintenance introduction sheet has been provided in the package.

Stormceptor Inspection and Cleaning: Inspect 2 times a year. Inspection and pump out as necessary per manufacturer's recommendation.

Drainage Outfall Inspection and Cleaning: Inspect 2 times a year. Trash debris removed & restore rip rap as necessary.

Snow and Ice: During winter snow season, snow shall be mechanically removed. Snow shall be stockpile at the landscape areas on-site where it can naturally melt. Snow melt runoff can then be slowly infiltrated into the ground or treated by the stormwater management system. If excessive snow encountered, the excessive snow shall be removed by a private contractor for off-site disposal. At no time snow shall be pushed off site to the public right of way of abutting lands.

O & M Budget: The annual overall O & M budget to maintain the BMP's to protect our water resources is set at $5,000 which include the maintenance and clean-out of the above BMP's. This budget is to be annually review and update to ensure the long-term performance of the system.

Long Term Operation and Maintenance Log
16 Fencourt Avenue, Randolph, MA

Driveway/Parking Lot/Street Sweeping

December-February	March-May	June-August	September-November
☐	☐	☐	☐
By: _____	By: _____	By: _____	By: _____

Comments: _____

Trench/Catch Basin Cleaning

January-February	March-April	June-July	November-December
☐	☐	☐	☐
By: _____	By: _____	By: _____	By: _____

Comments: _____

Deep Sump Manhole Inspection/Pump Out

March/April	Nov	
☐	☐	
By: _____	By: _____	
Pump Out: Yes No	Pump Out: Yes No	Comments: _____

Infiltration System Inspection/Flushing

March/April	Nov	
☐	☐	
By: _____	By: _____	
Flush Out: Yes No	Flush Out: Yes No	Comments: _____

Stormceptor System Inspection/Flushing

March/April	Nov	
☐	☐	
By: _____	By: _____	
Flush Out: Yes No	Flush Out: Yes No	Comments: _____

Note: O & M Log and maintenance record to be kept in management office and retain for miniumum 2 years and shall be made available for Town inspection when necessay.

TSS Removal Calculation Worksheet

Proj. No.: 16 Fencourt Ave
Date: 5/25/2023

Location: 16 Fencourt Avenue, Randolph, MA
System # System #1, #2, #3, #4

Computed by: SL

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BxC)	E Remaining Load (C-D)
Catch Basin	25	1.00	0.25	0.75
Stormceptor 450I	80	0.75	0.60	0.15
Infiltration System	80	0.15	0.12	0.03

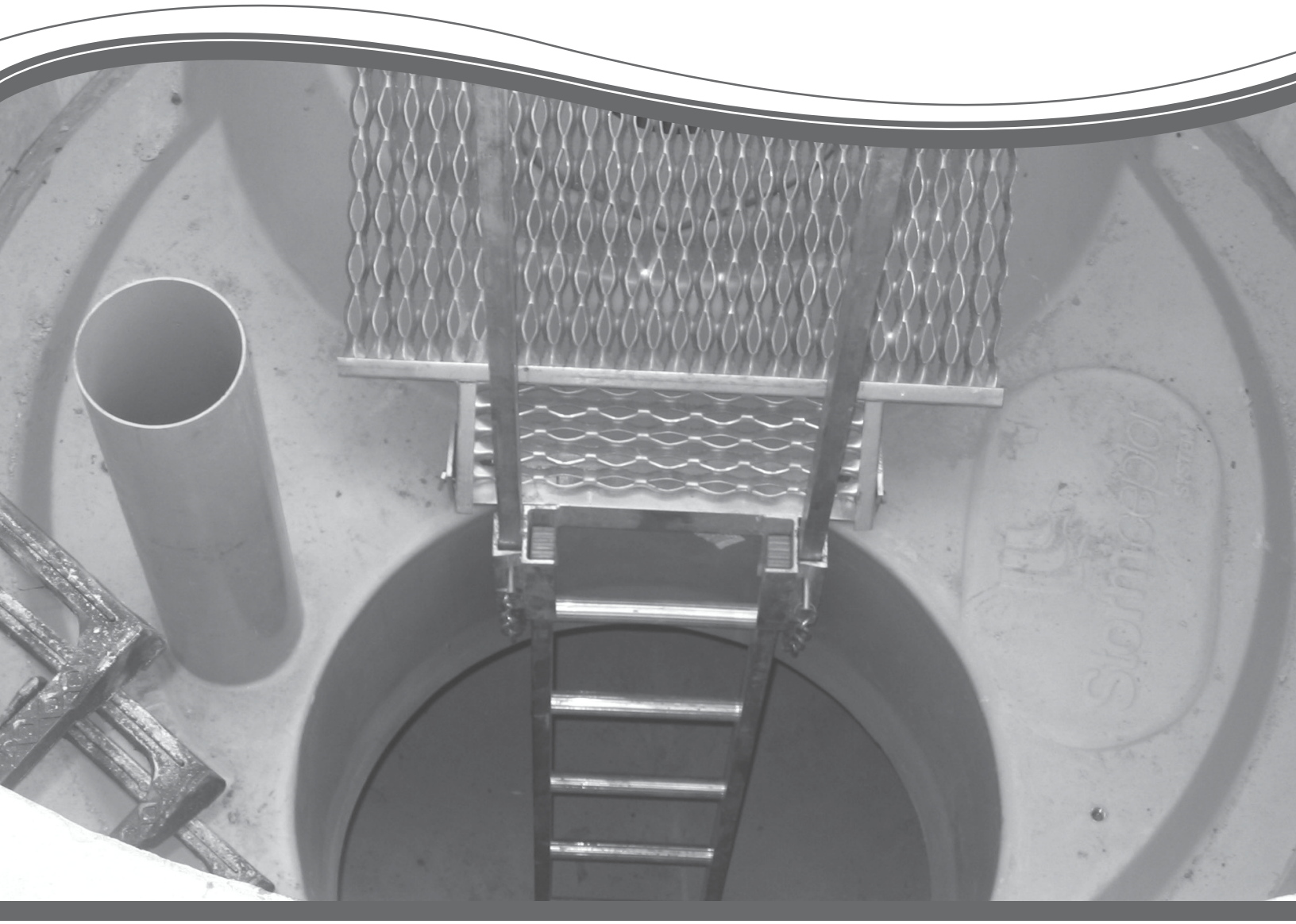
Total TSS Removal= 97%

Notes:

*Starting TSS Load for first BMP= 1.00. TSS load for subsequent BMP's is equal to the Remaining Load (E) from the previous BMP.

CONTECH®
ENGINEERED SOLUTIONS

Stormceptor® STC
Operation and Maintenance Guide



Stormceptor® STC

Stormceptor Design Notes

- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.

Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences			
Inlet Pipe Configuration	STC 450i	STC 900 to STC 7200	STC 11000 to STC 16000
Single inlet pipe	3 in. (75 mm)	1 in. (25 mm)	3 in. (75 mm)
Multiple inlet pipes	3 in. (75 mm)	3 in. (75 mm)	Only one inlet pipe.

Maximum inlet and outlet pipe diameters:

Inlet/Outlet Configuration	Inlet Unit STC 450i	In-Line Unit STC 900 to STC 7200	Series* STC 11000 to STC 16000
Straight Through	24 inch (600 mm)	42 inch (1050 mm)	60 inch (1500 mm)
Bend (90 degrees)	18 inch (450 mm)	33 inch (825 mm)	33 inch (825 mm)

- The inlet and in-line Stormceptor units can accommodate turns to a maximum of 90 degrees.
- Minimum distance from top of grade to crown is 2 feet (0.6 m)
- Submerged conditions. A unit is submerged when the standing water elevation at the proposed location of the Stormceptor unit is greater than the outlet invert elevation during zero flow conditions. In these cases, please contact your local Stormceptor representative and provide the following information:
- Top of grade elevation
- Stormceptor inlet and outlet pipe diameters and invert elevations
- Standing water elevation
- Stormceptor head loss, K = 1.3 (for submerged condition, K = 4)

Stormceptor® STC

OPERATION AND MAINTENANCE GUIDE
Table of Content

1. About Stormceptor

The Stormceptor® STC (Standard Treatment Cell) was developed by Imbrium™ Systems to address the growing need to remove and isolate pollution from the storm drain system before it enters the environment. The Stormceptor STC targets hydrocarbons and total suspended solids (TSS) in stormwater runoff. It improves water quality by removing contaminants through the gravitational settling of fine sediments and floatation of hydrocarbons while preventing the re-suspension or scour of previously captured pollutants.

The development of the Stormceptor STC revolutionized stormwater treatment, and created an entirely new category of environmental technology. Protecting thousands of waterways around the world, the Stormceptor System has set the standard for effective stormwater treatment.

1.1. Patent Information

The Stormceptor technology is protected by the following patents:

- Australia Patent No. 693,164 • 693,164 • 707,133 • 729,096 • 779401
- Austrian Patent No. 289647
- Canadian Patent No 2,009,208 •2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 (Pending)
- China Patent No 1168439
- Denmark DK 711879
- German DE 69534021
- Indonesian Patent No 16688
- Japan Patent No 9-11476 (Pending)
- Korea 10-2000-0026101 (Pending)
- Malaysia Patent No PI9701737 (Pending)
- New Zealand Patent No 314646
- United States Patent No 4,985,148 • 5,498,331 • 5,725,760 • 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690
- Stormceptor OSR Patent Pending • Stormceptor LCS Patent Pending

2. Stormceptor Design Overview

2.1. Design Philosophy

The patented Stormceptor System has been designed to focus on the environmental objective of providing long-term pollution control. The unique and innovative Stormceptor design allows for continuous positive treatment of runoff during all rainfall events, while ensuring that all captured pollutants are retained within the system, even during intense storm events.

An integral part of the Stormceptor design is PCSWMM for Stormceptor - sizing software developed in conjunction with Computational Hydraulics Inc. (CHI) and internationally acclaimed expert, Dr. Bill James. Using local historical rainfall data and continuous simulation modeling, this software allows a Stormceptor unit to be designed for each individual site and the corresponding water quality objectives.

By using PCSWMM for Stormceptor, the Stormceptor System can be designed to remove a wide range of particles (typically from 20 to 2,000 microns), and can also be customized to remove a specific particle size distribution (PSD). The specified PSD should accurately reflect what is in the stormwater runoff to ensure the device is achieving the desired water quality objective. Since stormwater runoff contains small particles (less than 75 microns), it is important to design a treatment system to remove smaller particles in addition to coarse particles.

2.2. Benefits

The Stormceptor System removes free oil and suspended solids from stormwater, preventing spills and non-point source pollution from entering downstream lakes and rivers. The key benefits, capabilities and applications of the Stormceptor System are as follows:

- Provides continuous positive treatment during all rainfall events
- Can be designed to remove over 80% of the annual sediment load
- Removes a wide range of particles
- Can be designed to remove a specific particle size distribution (PSD)
- Captures free oil from stormwater
- Prevents scouring or re-suspension of trapped pollutants
- Pre-treatment to reduce maintenance costs for downstream treatment measures (ponds, swales, detention basins, filters)
- Groundwater recharge protection
- Spills capture and mitigation
- Simple to design and specify
- Designed to your local watershed conditions
- Small footprint to allow for easy retrofit installations
- Easy to maintain (vacuum truck)
- Multiple inlets can connect to a single unit
- Suitable as a bend structure
- Pre-engineered for traffic loading (minimum AASHTO HS-20)
- Minimal elevation drop between inlet and outlet pipes
- Small head loss
- Additional protection provided by an 18" (457 mm) fiberglass skirt below the top of the insert, for the containment of hydrocarbons in the event of a spill.

2.3. Environmental Benefit

Freshwater resources are vital to the health and welfare of their surrounding communities. There is increasing public awareness, government regulations and corporate commitment to reducing the pollution entering our waterways. A major source of this pollution originates from stormwater runoff from urban areas. Rainfall runoff carries oils, sediment and other contaminants from roads and parking lots discharging directly into our streams, lakes and coastal waterways.

The Stormceptor System is designed to isolate contaminants from getting into the natural environment. The Stormceptor technology provides protection for the environment from spills that occur at service stations and vehicle accident sites, while also removing contaminated sediment in runoff that washes from roads and parking lots.

3. Key Operation Features

3.1. Scour Prevention

A key feature of the Stormceptor System is its patented scour prevention technology. This innovation ensures pollutants are captured and retained during all rainfall events, even extreme storms. The Stormceptor System provides continuous positive treatment for all rainfall events, including intense storms. Stormceptor slows incoming runoff, controlling and reducing velocities in the lower chamber to create a non-turbulent environment that promotes free oils and floatable debris to rise and sediment to settle.

The patented scour prevention technology, the fiberglass insert, regulates flows into the lower chamber through a combination of a weir and orifice while diverting high energy flows away through the upper chamber to prevent scouring. Laboratory testing demonstrated no scouring when tested up to 125% of the unit's operating rate, with the unit loaded to 100% sediment capacity (NJDEP, 2005). Second, the depth of the lower chamber ensures the sediment storage zone is adequately separated from the path of flow in the lower chamber to prevent scouring.

3.2. Operational Hydraulic Loading Rate

Designers and regulators need to evaluate the treatment capacity and performance of manufactured stormwater treatment systems. A commonly used parameter is the "operational hydraulic loading rate" which originated as a design methodology for wastewater treatment devices.

Operational hydraulic loading rate may be calculated by dividing the flow rate into a device by its settling area. This represents the critical settling velocity that is the prime determinant to quantify the influent particle size and density captured by the device. PCSWMM for Stormceptor uses a similar parameter that is calculated by dividing the hydraulic detention time in the device by the fall distance of the sediment.

$$v_{SC} = \frac{H}{6_H} = \frac{Q}{A_S}$$

Where:

v_{SC} = critical settling velocity, ft/s (m/s)

H = tank depth, ft (m)

$Ø_H$ = hydraulic detention time, ft/s (m/s)

Q = volumetric flow rate, ft3/s (m3/s)

A_S = surface area, ft^2 (m^2)

(Tchobanoglous, G. and Schroeder, E.D. 1987. Water Quality. Addison Wesley.)

Unlike designing typical wastewater devices, stormwater systems are designed for highly variable flow rates including intense peak flows. PCSWMM for Stormceptor incorporates all of the flows into its calculations, ensuring that the operational hydraulic loading rate is considered not only for one flow rate, but for all flows including extreme events.

3.3. Double Wall Containment

The Stormceptor System was conceived as a pollution identifier to assist with identifying illicit discharges. The fiberglass insert has a continuous skirt that lines the concrete barrel wall for a depth of 18 inches (457 mm) that provides double wall containment for hydrocarbons storage. This protective barrier ensures that toxic floatables do not migrate through the concrete wall into the surrounding soils.

4. Stormceptor Product Line

4.1. Stormceptor Models

A summary of Stormceptor models and capacities are listed in Table 1.

Table 1. Stormceptor Models

Stormceptor Model	Total Storage Volume U.S. Gal (L)	Hydrocarbon Storage Capacity U.S. Gal (L)	Maximum Sediment Capacity ft^3 (L)
STC 450i	470 (1,780)	86 (330)	46 (1,302)
STC 900	952 (3,600)	251 (950)	89 (2,520)
STC 1200	1,234 (4,670)	251 (950)	127 (3,596)
STC 1800	1,833 (6,940)	251 (950)	207 (5,861)
STC 2400	2,462 (9,320)	840 (3,180)	205 (5,805)
STC 3600	3,715 (1,406)	840 (3,180)	373 (10,562)
STC 4800	5,059 (1,950)	909 (3,440)	543 (15,376)
STC 6000	6,136 (23,230)	909 (3,440)	687 (19,453)
STC 7200	7,420 (28,090)	1,059 (4,010)	839 (23,757)
STC 11000	11,194 (42,370)	2,797 (10, 590)	1,086 (30,752)
STC 13000	13,348 (50,530)	2,797 (10, 590)	1,374 (38,907)
STC 16000	15,918 (60,260)	3,055 (11, 560)	1,677 (47,487)

NOTE: Storage volumes may vary slightly from region to region. For detailed information, contact your local Stormceptor representative.

4.2. Inline Stormceptor

The Inline Stormceptor, Figure 1, is the standard design for most stormwater treatment applications. The patented Stormceptor design allows the Inline unit to maintain continuous positive treatment of total suspended solids (TSS) year-round, regardless of flow rate. The Inline Stormceptor is composed of a precast concrete tank with a fiberglass insert situated at the invert of the storm sewer pipe, creating an upper chamber above the insert and a lower chamber below the insert.

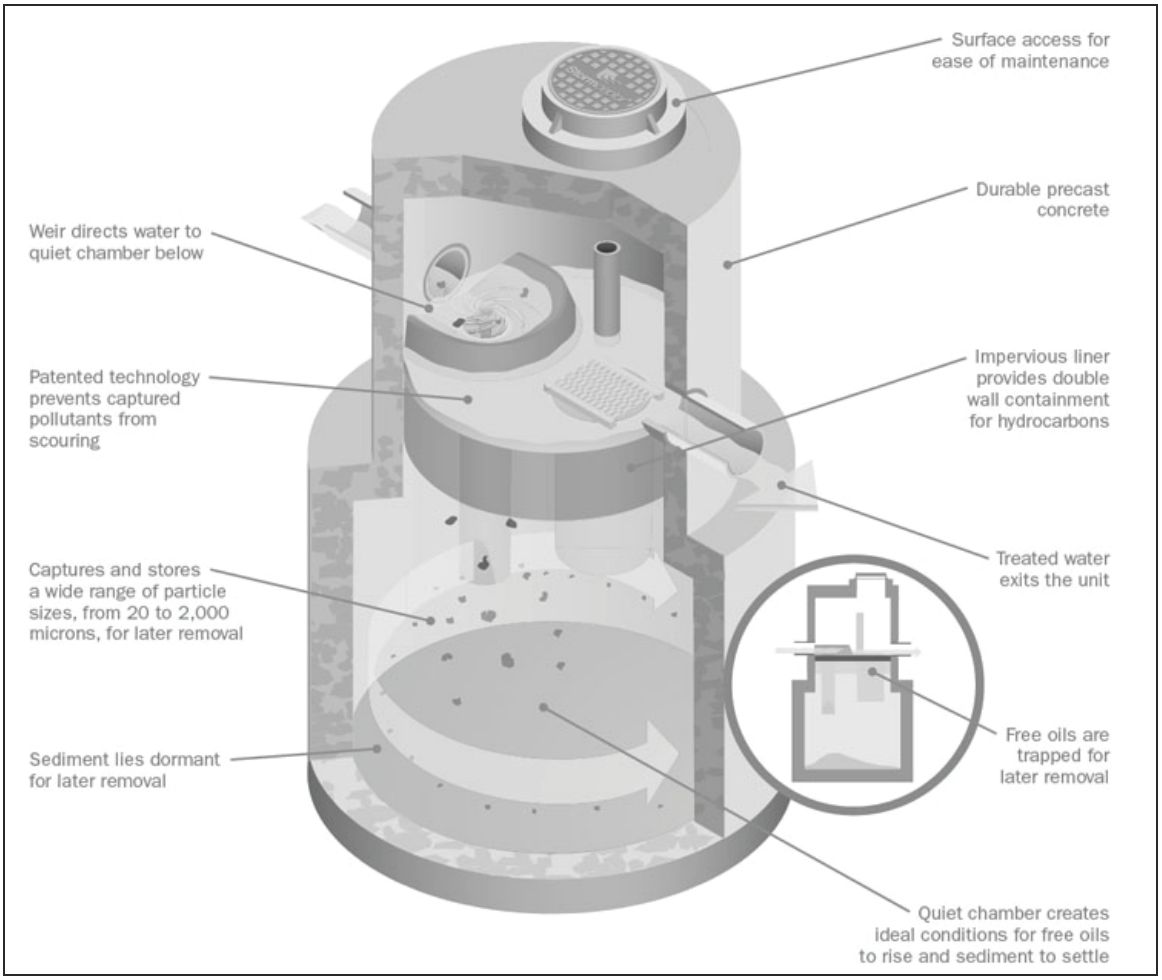


Figure 1. Inline Stormceptor

Operation

As water flows into the Stormceptor unit, it is slowed and directed to the lower chamber by a weir and drop tee. The stormwater enters the lower chamber, a non-turbulent environment, allowing free oils to rise and sediment to settle. The oil is captured underneath the fiberglass insert and shielded from exposure to the concrete walls by a fiberglass skirt. After the pollutants separate, treated water continues up a riser pipe, and exits the lower chamber on the downstream side of the weir before leaving the unit. During high flow events, the Stormceptor System's patented scour prevention technology ensures continuous pollutant removal and prevents re-suspension of previously captured pollutants.

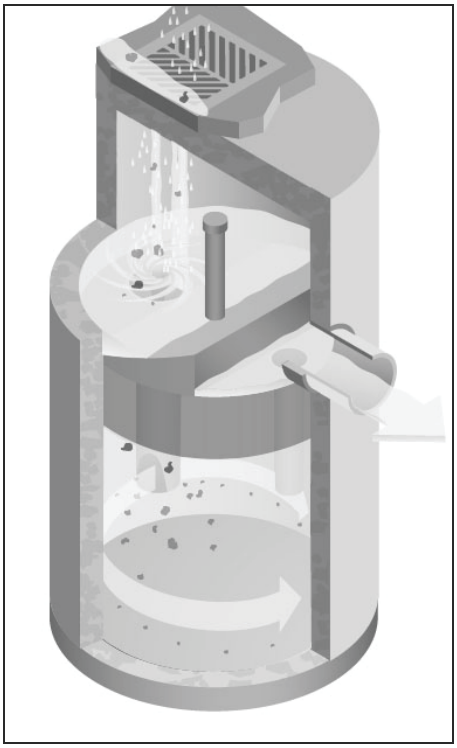


Figure 2. Inlet Stormceptor

4.3. Inlet Stormceptor

The Inlet Stormceptor System, Figure 2, was designed to provide protection for parking lots, loading bays, gas stations and other spill-prone areas. The Inlet Stormceptor is designed to remove sediment from stormwater introduced through a grated inlet, a storm sewer pipe, or both.

The Inlet Stormceptor design operates in the same manner as the Inline unit, providing continuous positive treatment, and ensuring that captured material is not re-suspended.

4.4. Series Stormceptor

Designed to treat larger drainage areas, the Series Stormceptor System, Figure 3, consists of two adjacent Stormceptor models that function in parallel. This design eliminates the need for additional structures and piping to reduce installation costs.

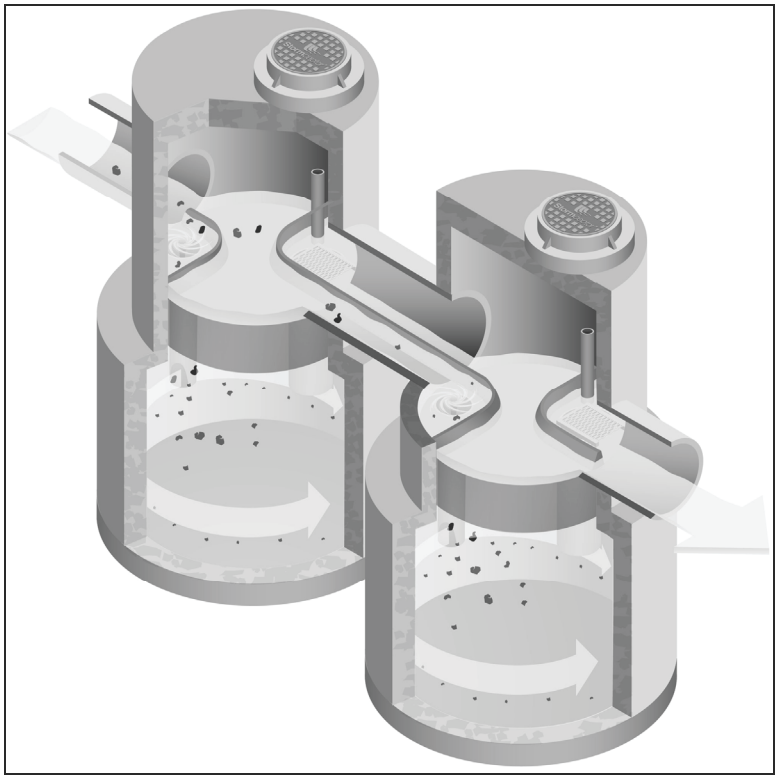


Figure 3. Series System

The Series Stormceptor design operates in the same manner as the Inline unit, providing continuous positive treatment, and ensuring that captured material is not re-suspended.

5. Sizing the Stormceptor System

The Stormceptor System is a versatile product that can be used for many different aspects of water quality improvement. While addressing these needs, there are conditions that the designer needs to be aware of in order to size the Stormceptor model to meet the demands of each individual site in an efficient and cost-effective manner.

PCSWMM for Stormceptor is the support tool used for identifying the appropriate Stormceptor model. In order to size a unit, it is recommended the user follow the seven design steps in the program. The steps are as follows:

STEP 1 – Project Details

The first step prior to sizing the Stormceptor System is to clearly identify the water quality objective for the development. It is recommended that a level of annual sediment (TSS) removal be identified and defined by a particle size distribution.

STEP 2 – Site Details

Identify the site development by the drainage area and the level of imperviousness. It is recommended that imperviousness be calculated based on the actual area of imperviousness based on paved surfaces, sidewalks and rooftops.

STEP 3 – Upstream Attenuation

The Stormceptor System is designed as a water quality device and is sometimes used in conjunction with onsite water quantity control devices such as ponds or underground detention systems. When possible, a greater benefit is typically achieved when installing a Stormceptor unit upstream of a detention facility. By placing the Stormceptor unit upstream of a detention structure, a benefit of less maintenance of the detention facility is realized.

STEP 4 – Particle Size Distribution

It is critical that the PSD be defined as part of the water quality objective. PSD is critical for the design of treatment system for a unit process of gravity settling and governs the size of a treatment system. A range of particle sizes has been provided and it is recommended that clays and silt-sized particles be considered in addition to sand and gravel-sized particles. Options and sample PSDs are provided in PCSWMM for Stormceptor. The default particle size distribution is the Fine Distribution, Table 2, option.

Table 2. Fine Distribution

Particle Size	Distribution	Specific Gravity
20	20%	1.3
60	20%	1.8
150	20%	2.2
400	20%	2.65
2000	20%	2.65

If the objective is the long-term removal of 80% of the total suspended solids on a given site, the PSD should be representative of the expected sediment on the site. For example, a system designed to remove 80% of coarse particles (greater than 75 microns) would provide relatively poor removal efficiency of finer particles that may be naturally prevalent in runoff from the site.

Since the small particle fraction contributes a disproportionately large amount of the total available particle surface area for pollutant adsorption, a system designed primarily for coarse particle capture will compromise water quality objectives.

STEP 5 – Rainfall Records

Local historical rainfall has been acquired from the U.S. National Oceanic and Atmospheric Administration, Environment Canada and regulatory agencies across North America. The rainfall data provided with PCSMM for Stormceptor provides an accurate estimation of small storm hydrology by modeling actual historical storm events including duration, intensities and peaks.

STEP 6 – Summary

At this point, the program may be executed to predict the level of TSS removal from the site. Once the simulation has completed, a table shall be generated identifying the TSS removal of each Stormceptor unit.

STEP 7 – Sizing Summary

Performance estimates of all Stormceptor units for the given site parameters will be displayed in a tabular format. The unit that meets the water quality objective, identified in Step 1, will be highlighted.

5.1. PCSWMM for Stormceptor

The Stormceptor System has been developed in conjunction with PCSWMM for Stormceptor as a technological solution to achieve water quality goals. Together, these two innovations model, simulate, predict and calculate the water quality objectives desired by a design engineer for TSS removal.

PCSWMM for Stormceptor is a proprietary sizing program which uses site specific inputs to a computer model to simulate sediment accumulation, hydrology and long-term total suspended solids removal. The model has been calibrated to field monitoring results from Stormceptor units that have been monitored in North America. The sizing methodology can be described by three processes:

1. Determination of real time hydrology
2. Buildup and wash off of TSS from impervious land areas
3. TSS transport through the Stormceptor (settling and discharge). The use of a calibrated model is the preferred method for sizing stormwater quality structures for the following reasons:
    - » The hydrology of the local area is properly and accurately incorporated in the sizing (distribution of flows, flow rate ranges and peaks, back-to-back storms, inter-event times)
    - » The distribution of TSS with the hydrology is properly and accurately considered in the sizing
    - » Particle size distribution is properly considered in the sizing
    - » The sizing can be optimized for TSS removal
    - » The cost benefit of alternate TSS removal criteria can be easily assessed
    - » The program assesses the performance of all Stormceptor models. Sizing may be selected based on a specific water quality outcome or based on the Maximum Extent Practicable

For more information regarding PCSWMM for Stormceptor, contact your local Stormceptor representative, or visit www.imbriumsystems.com to download a free copy of the program.

5.2. Sediment Loading Characteristics

The way in which sediment is transferred to stormwater can have a considerable effect on which type of system is implemented. On typical impervious surfaces (e.g. parking lots) sediment will build over time and wash off with the next rainfall. When rainfall patterns are examined, a short intense storm will have a higher concentration of sediment than a long slow drizzle. Together with rainfall data representing the site's typical rainfall patterns, sediment loading characteristics play a part in the correct sizing of a stormwater quality device.

Typical Sites

For standard site design of the Stormceptor System, PCSWMM for Stormceptor is utilized to accurately assess the unit's performance. As an integral part of the product's design, the program can be used to meet local requirements for total suspended solid removal. Typical installations of manufactured stormwater treatment devices would occur on areas such as paved parking lots or paved roads. These are considered "stable" surfaces which have non – erodible surfaces.

Unstable Sites

While standard sites consist of stable concrete or asphalt surfaces, sites such as gravel parking lots, or maintenance yards with stockpiles of sediment would be classified as "unstable". These types of sites do not exhibit first flush characteristics, are highly erodible and exhibit atypical sediment loading characteristics and must therefore be sized more carefully. Contact your local Stormceptor representative for assistance in selecting a proper unit sized for such unstable sites.

6. Spill Controls

When considering the removal of total petroleum hydrocarbons (TPH) from a storm sewer system there are two functions of the system: oil removal, and spill capture.

'Oil Removal' describes the capture of the minute volumes of free oil mobilized from impervious surfaces. In this instance relatively low concentrations, volumes and flow rates are considered. While the Stormceptor unit will still provide an appreciable oil removal function during higher flow events and/or with higher TPH concentrations, desired effluent limits may be exceeded under these conditions.

'Spill Capture' describes a manner of TPH removal more appropriate to recovery of a relatively high volume of a single phase deleterious liquid that is introduced to the storm sewer system over a relatively short duration. The two design criteria involved when considering this manner of introduction are overall volume and the specific gravity of the material. A standard Stormceptor unit will be able to capture and retain a maximum spill volume and a minimum specific gravity.

For spill characteristics that fall outside these limits, unit modifications are required. Contact your local Stormceptor Representative for more information.

One of the key features of the Stormceptor technology is its ability to capture and retain spills. While the standard Stormceptor System provides excellent protection for spill control, there are additional options to enhance spill protection if desired.

6.1. Oil Level Alarm

The oil level alarm is an electronic monitoring system designed to trigger a visual and audible alarm when a pre-set level of oil is reached within the lower chamber. As a standard, the oil

level alarm is designed to trigger at approximately 85% of the unit's available depth level for oil capture. The feature acts as a safeguard against spills caused by exceeding the oil storage capacity of the separator and eliminates the need for manual oil level inspection.

The oil level alarm installed on the Stormceptor insert is illustrated in Figure 4.

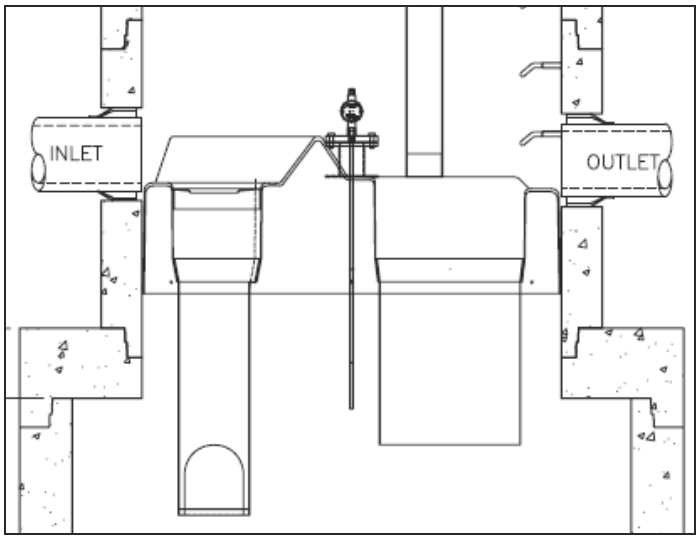


Figure 4. Oil level alarm

6.2. Increased Volume Storage Capacity

The Stormceptor unit may be modified to store a greater spill volume than is typically available. Under such a scenario, instead of installing a larger than required unit, modifications can be made to the recommended Stormceptor model to accommodate larger volumes. Contact your local Stormceptor representative for additional information and assistance for modifications.

7. Stormceptor Options

The Stormceptor System allows flexibility to incorporate to existing and new storm drainage infrastructure. The following section identifies considerations that should be reviewed when installing the system into a drainage network. For conditions that fall outside of the recommendations in this section, please contact your local Stormceptor representative for further guidance.

7.1. Installation Depth Minimum Cover

The minimum distance from the top of grade to the crown of the inlet pipe is 24 inches (600 mm). For situations that have a lower minimum distance, contact your local Stormceptor representative.

7.2. Maximum Inlet and Outlet Pipe Diameters

Maximum inlet and outlet pipe diameters are illustrated in Figure 5. Contact your local Stormceptor representative for larger pipe diameters

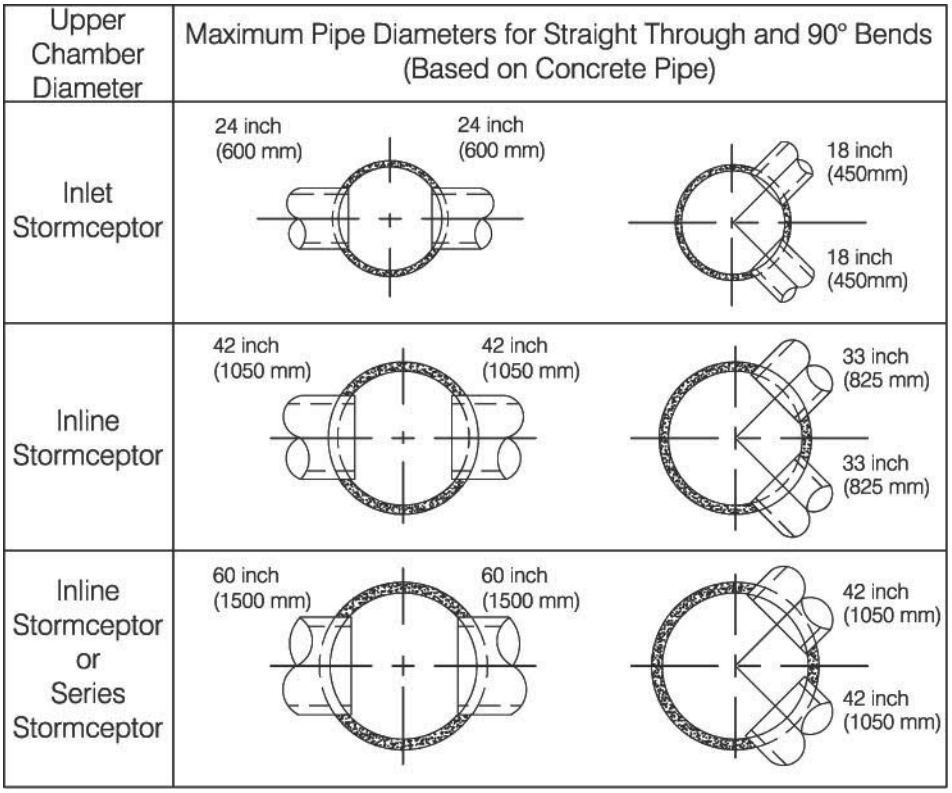


Figure 5. Maximum pipe diameters for straight through and bend applications

*The bend should only be incorporated into the second structure (downstream structure) of the Series Stormceptor System

7.3. Bends

The Stormceptor System can be used to change horizontal alignment in the storm drain network up to a maximum of 90 degrees. Figure 6 illustrates the typical bend situations of the Stormceptor System. Bends should only be applied to the second structure (downstream structure) of the Series Stormceptor System.

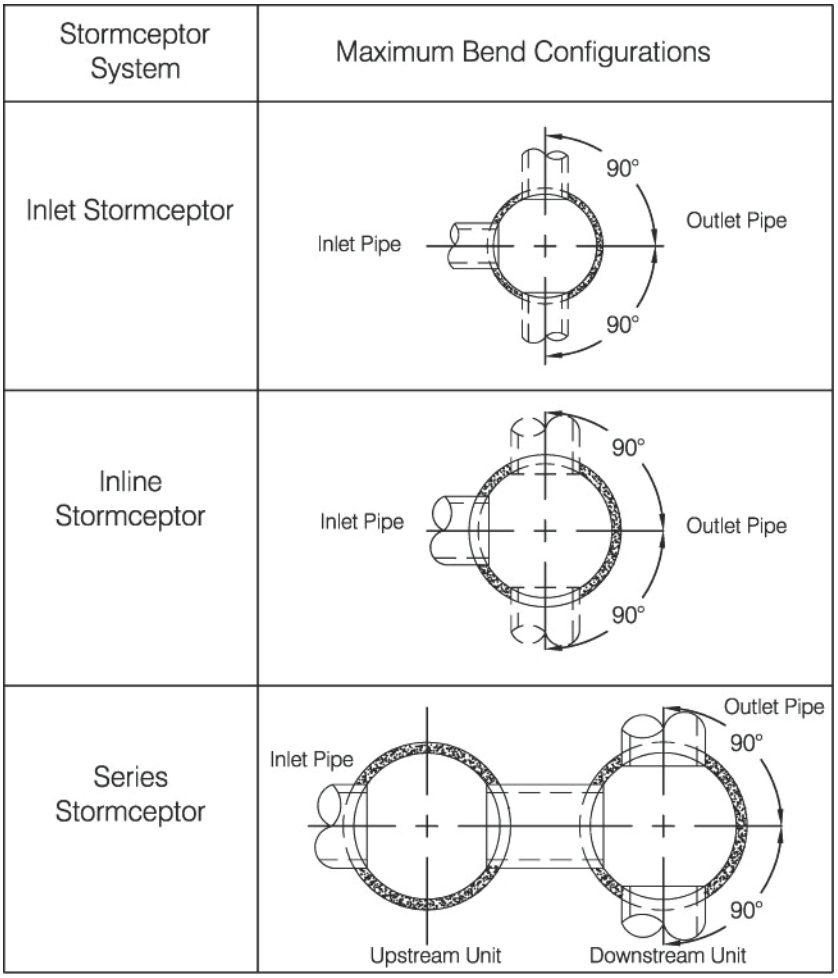


Figure 6. Maximum bend angles

7.4. Multiple Inlet Pipes

The Inlet and Inline Stormceptor System can accommodate two or more inlet pipes. The maximum number of inlet pipes that can be accommodated into a Stormceptor unit is a function of the number, alignment and diameter of the pipes and its effects on the structural integrity of the precast concrete. When multiple inlet pipes are used for new developments, each inlet pipe shall have an invert elevation 3 inches (75 mm) higher than the outlet pipe invert elevation.

7.5. Inlet/Outlet Pipe Invert Elevations

Recommended inlet and outlet pipe invert differences are listed in Table 3.

Table 3. Recommended Drops Between Inlet and Outlet Pipe Inverts

Number of Inlet Pipes	Inlet System	In-Line System	Series System
1	3 inches (75 mm)	1 inch (25 mm)	3 inches (75 mm)
>1	3 inches (75 mm)	3 inches (75 mm)	Not Applicable

7.6. Shallow Stormceptor

In cases where there may be restrictions to the depth of burial of storm sewer systems. In this situation, for selected Stormceptor models, the lower chamber components may be increased in diameter to reduce the overall depth of excavation required.

7.7. Customized Live Load

The Stormceptor system is typically designed for local highway truck loading (AASHTO HS- 20). When the project requires live loads greater than HS-20, the Stormceptor System may be customized structurally for a pre-specified live load. Contact your local Stormceptor representative for customized loading conditions.

7.8. Pre-treatment

The Stormceptor System may be sized to remove sediment and for spills control in conjunction with other stormwater BMPs to meet the water quality objective. For pretreatment applications, the Stormceptor System should be the first unit in a treatment train. The benefits of pre-treatment include the extension of the operational life (extension of maintenance frequency) of large stormwater management facilities, prevention of spills and lower total life- cycle maintenance cost.

7.9. Head loss

The head loss through the Stormceptor System is similar to a 60 degree bend at a manhole. The K value for calculating minor losses is approximately 1.3 (minor loss = k*1.3v2/2g).

However, when a Submerged modification is applied to a Stormceptor unit, the corresponding K value is 4.

7.10. Submerged

The Submerged modification, Figure 7, allows the Stormceptor System to operate in submerged or partially submerged storm sewers. This configuration can be installed on all models of the Stormceptor System by modifying the fiberglass insert. A customized weir height and a secondary drop tee are added.

Submerged instances are defined as standing water in the storm drain system during zero flow conditions. In these instances, the following information is necessary for the proper design and application of submerged modifications:

- Stormceptor top of grade elevation
- Stormceptor outlet pipe invert elevation
- Standing water elevation

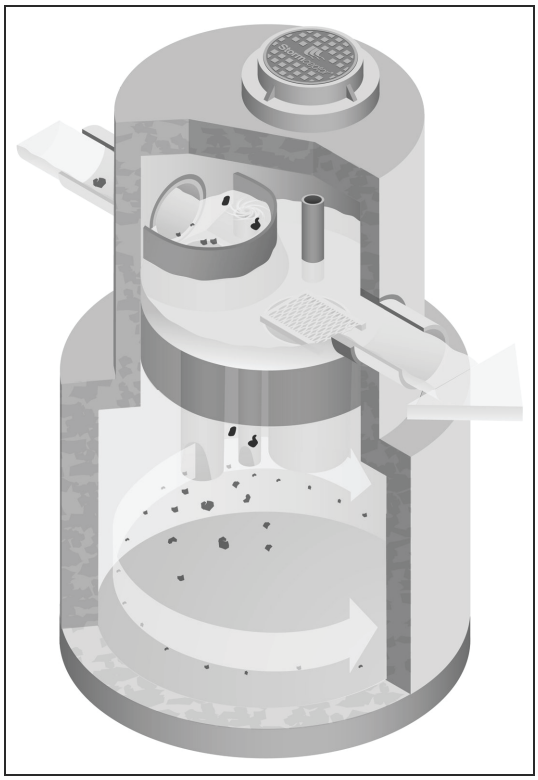


Figure 7. Submerged Stormceptor

8. Comparing Technologies

Designers have many choices available to achieve water quality goals in the treatment of stormwater runoff. Since many alternatives are available for use in stormwater quality treatment it is important to consider how to make an appropriate comparison between "approved alternatives". The following is a guide to assist with the accurate comparison of differing technologies and performance claims.

8.1. Particle Size Distribution (PSD)

The most sensitive parameter to the design of a stormwater quality device is the selection of the design particle size. While it is recommended that the actual particle size distribution (PSD) for sites be measured prior to sizing, alternative values for particle size should be selected to represent what is likely to occur naturally on the site. A reasonable estimate of a particle size distribution likely to be found on parking lots or other impervious surfaces should consist of a wide range of particles such as 20 microns to 2,000 microns (Ontario MOE, 1994).

There is no absolute right particle size distribution or specific gravity and the user is cautioned to review the site location, characteristics, material handling practices and regulatory requirements when selecting a particle size distribution. When comparing technologies, designs using different PSDs will result in incomparable TSS removal efficiencies. The PSD of the TSS removed needs to be standard between two products to allow for an accurate comparison.

8.2. Scour Prevention

In order to accurately predict the performance of a manufactured treatment device, there must be confidence that it will perform under all conditions. Since rainfall patterns cannot be predicted, stormwater quality devices placed in storm sewer systems must be able to withstand extreme events, and ensure that all pollutants previously captured are retained in the system.

In order to have confidence in a system's performance under extreme conditions, independent validation of scour prevention is essential when examining different technologies. Lack of independent verification of scour prevention should make a designer wary of accepting any product's performance claims.

8.3. Hydraulics

Full scale laboratory testing has been used to confirm the hydraulics of the Stormceptor System. Results of lab testing have been used to physically design the Stormceptor System and the sewer pipes entering and leaving the unit. Key benefits of Stormceptor are:

- Low head loss (typical k value of 1.3)
- Minimal inlet/outlet invert elevation drop across the structure
- Use as a bend structure
- Accommodates multiple inlets

The adaptability of the treatment device to the storm sewer design infrastructure can affect the overall performance and cost of the site.

8.4. Hydrology

Stormwater quality treatment technologies need to perform under varying climatic conditions. These can vary from long low intensity rainfall to short duration, high intensity storms. Since a treatment device is expected to perform under all these conditions, it makes sense that any system's design should accommodate those conditions as well.

Long-term continuous simulation evaluates the performance of a technology under the varying conditions expected in the climate of the subject site. Single, peak event design does not provide this information and is not equivalent to long-term simulation. Designers should request long-term simulation performance to ensure the technology can meet the long-term water quality objective.

9. Testing

The Stormceptor System has been the most widely monitored stormwater treatment technology in the world. Performance verification and monitoring programs are completed to the strictest standards and integrity. Since its introduction in 1990, numerous independent field tests and studies detailing the effectiveness of the Stormceptor System have been completed.

- Coventry University, UK – 97% removal of oil, 83% removal of sand and 73% removal of peat
- National Water Research Institute, Canada, - scaled testing for the development of the Stormceptor System identifying both TSS removal and scour prevention.
- New Jersey TARP Program – full scale testing of an STC 900 demonstrating 75% TSS removal of particles from 1 to 1000 microns. Scour testing completed demonstrated that the system does not scour. The New Jersey Department of Environmental Protection was followed.
- City of Indianapolis – full scale testing of an STC 900 demonstrating over 80% TSS removal of particles from 50 microns to 300 microns at 130% of the unit's operating rate. Scour testing completed demonstrated that the system does not scour.
- Westwood Massachusetts (1997), demonstrated >80% TSS removal
- Como Park (1997), demonstrated 76% TSS removal
- Ontario MOE SWAMP Program – 57% removal of 1 to 25 micron particles
- Laval Quebec – 50% removal of 1 to 25 micron particles

10. Installation

The installation of the concrete Stormceptor should conform in general to state highway, or local specifications for the installation of manholes. Selected sections of a general specification that are applicable are summarized in the following sections.

10.1. Excavation

Excavation for the installation of the Stormceptor should conform to state highway, or local specifications. Topsoil removed during the excavation for the Stormceptor should be stockpiled in designated areas and should not be mixed with subsoil or other materials.

Topsoil stockpiles and the general site preparation for the installation of the Stormceptor should conform to state highway or local specifications.

The Stormceptor should not be installed on frozen ground. Excavation should extend a minimum of 12 inches (300 mm) from the precast concrete surfaces plus an allowance for shoring and bracing where required. If the bottom of the excavation provides an unsuitable foundation additional excavation may be required.

In areas with a high water table, continuous dewatering may be required to ensure that the excavation is stable and free of water.

10.2. Backfilling

Backfill material should conform to state highway or local specifications. Backfill material should be placed in uniform layers not exceeding 12 inches (300mm) in depth and compacted to state highway or local specifications.

11. Stormceptor Construction Sequence

The concrete Stormceptor is installed in sections in the following sequence:

1. Aggregate base
2. Base slab
3. Lower chamber sections
4. Upper chamber section with fiberglass insert
5. Connect inlet and outlet pipes
6. Assembly of fiberglass insert components (drop tee, riser pipe, oil cleanout port and orifice plate
7. Remainder of upper chamber
8. Frame and access cover

The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

Adjustment of the Stormceptor can be performed by lifting the upper sections free of the excavated area, re-leveling the base and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary. Once the Stormceptor has been constructed, any lift holes must be plugged with mortar.

12. Maintenance

12.1. Health and Safety

The Stormceptor System has been designed considering safety first. It is recommended that confined space entry protocols be followed if entry to the unit is required. In addition, the fiberglass insert has the following health and safety features:

- Designed to withstand the weight of personnel
- A safety grate is located over the 24 inch (600 mm) riser pipe opening
- Ladder rungs can be provided for entry into the unit, if required

12.2. Maintenance Procedures

Maintenance of the Stormceptor system is performed using vacuum trucks. No entry into the unit is required for maintenance (in most cases). The vacuum service industry is a well- established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean a Stormceptor will vary based on the size of unit and transportation distances.

The need for maintenance can be determined easily by inspecting the unit from the surface. The depth of oil in the unit can be determined by inserting a dipstick in the oil inspection/cleanout port.

Similarly, the depth of sediment can be measured from the surface without entry into the Stormceptor via a dipstick tube equipped with a ball valve. This tube would be inserted through the riser pipe. Maintenance should be performed once the sediment depth exceeds the guideline values provided in the Table 4.

Table 4. Sediment Depths Indicating Required Servicing*

Particle Size	Specific Gravity
Model	Sediment Depth inches (mm)
450i	8 (200)
900	8 (200)
1200	10 (250)
1800	15 (381)
2400	12 (300)
3600	17 (430)
4800	15 (380)
6000	18 (460)
7200	15 (381)
11000	17 (380)
13000	20 (500)
16000	17 (380)
* based on 15% of the Stormceptor unit's total storage	

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

Oil is removed through the oil inspection/cleanout port and sediment is removed through the riser pipe. Alternatively oil could be removed from the 24 inches (600 mm) opening if water is removed from the lower chamber to lower the oil level below the drop pipes.

The following procedures should be taken when cleaning out Stormceptor:

1. Check for oil through the oil cleanout port
2. Remove any oil separately using a small portable pump
3. Decant the water from the unit to the sanitary sewer, if permitted by the local regulating authority, or into a separate containment tank
4. Remove the sludge from the bottom of the unit using the vacuum truck
5. Re-fill Stormceptor with water where required by the local jurisdiction

12.3. Submerged Stormceptor

Careful attention should be paid to maintenance of the Submerged Stormceptor System. In cases where the storm drain system is submerged, there is a requirement to plug both the inlet and outlet pipes to economically clean out the unit.

12.4. Hydrocarbon Spills

The Stormceptor is often installed in areas where the potential for spills is great. The Stormceptor System should be cleaned immediately after a spill occurs by a licensed liquid waste hauler.

12.5. Disposal

Requirements for the disposal of material from the Stormceptor System are similar to that of any other stormwater Best Management Practice (BMP) where permitted. Disposal options for the sediment may range from disposal in a sanitary trunk sewer upstream of a sewage treatment plant, to disposal in a sanitary landfill site. Petroleum waste products collected in the Stormceptor (free oil/chemical/fuel spills) should be removed by a licensed waste management company.

12.6. Oil Sheens

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a rainbow or sheen can be seen at very small oil concentrations (<10 mg/L). Stormceptor will remove over 98% of all free oil spills from storm sewer systems for dry weather or frequently occurring runoff events.

The appearance of a sheen at the outlet with high influent oil concentrations does not mean the unit is not working to this level of removal. In addition, if the influent oil is emulsified the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified conditions.

SUPPORT

Drawings and specifications are available at www.ContechES.com.

Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, and earth stabilization products. For information, visit www.ContechES.com or call 800.338.1122

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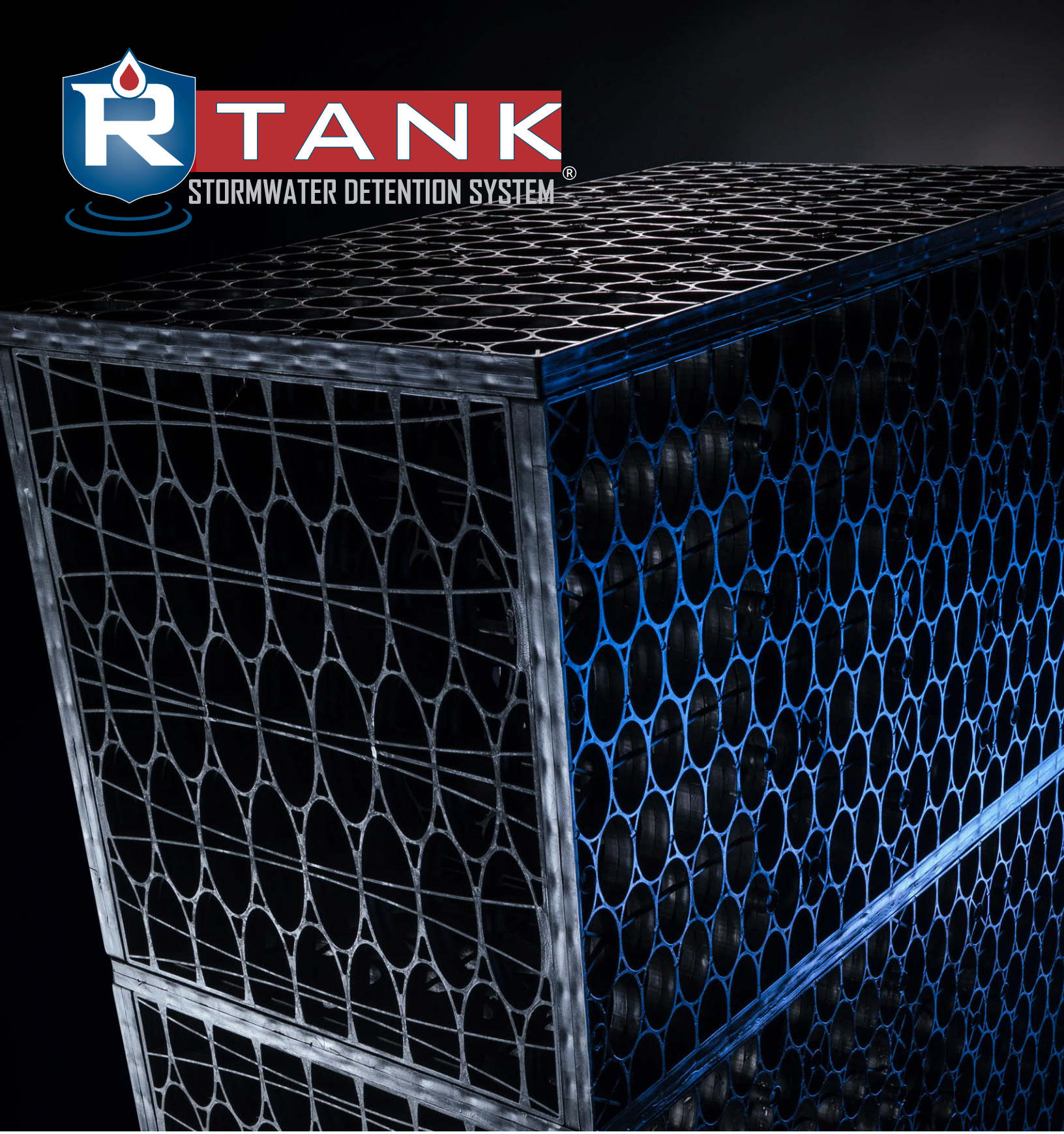
www.ContechES.com

RTANK®

STORMWATER DETENTION SYSTEM



LD HD SD UD XD

LET'S GET IT DONE®

ACF ENVIRONMENTAL

STORMWATER MANAGEMENT

IS YOUR STORMWATER SYSTEM TAKING UP TOO MUCH SPACE?

Reduce the size with the R-Tank System, an efficient and versatile underground stormwater storage system. This system will reduce your underground stormwater storage system footprint to resolve a utility conflict or free up space for a future expansion.

It will also provide additional options for vehicular loading and cover depths, and deliver greater installation versatility.

DOES YOUR PROJECT REQUIRE A UNIQUE SOLUTION DUE TO DEPTH OR TRAFFIC LOADS?

With five different module configurations, R-Tank provides system height options from 2" to over 7' deep. It also delivers support for HS-20 and HS-25 traffic, with cover depths from 6" to over 16'.

With an unlimited array of system footprints and configurations, R-Tank solves tough stormwater problems by adapting to the needs of your site - whether your're designing a project at the beach with minimal depth over a water table or a deep system in the hills.

R TANK®

R-TANK®

BENEFITS

HIGH CAPACITY
- 95% void internal area

STRENGTH
- Easily supports traffic loading from parking lots and roads
- Module options for HS-20 and HS-25 rating with cover depths from 6 inches to 16 feet

DESIGN & CONSTRUCTION VERSATILITY
- Modules can be combined into various shapes efficiently and effectively use space
- Varied height from 2 inches to 7 feet

INCREASED INFILTRATION AND EXILFILTRATION
- Outer shell is 90% open
- Increases groundwater recharge, reducing post-construction discharge volumes

EASY TO TRANSPORT
- Can be supplied unassembled for reduced delivery costs

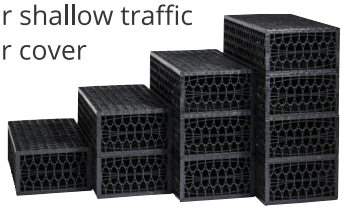
LIGHTWEIGHT AND QUICK TO INSTALL
- Installed by hand; no cranes required
- Reduces site access delays

RECYCLED CONTENT
- Manufactured with recycled polypropylene

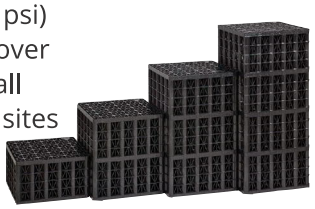
R-TANK LD®
- Light Duty module (30 psi)
- Ideal for applications in green space
- Not rated for vehicular traffic
- 12” Minimum cover, 36” maximum cover
- Four internal plates

R-TANK HD®
- Heavy Duty module (33.4 psi)
- Standard module for HS-20 traffic applications
- 20” Minimum cover,
- 84” Maximum cover
- Five internal plates

R-TANK SD®
- Super Duty module (42.9 psi)
- Higher safety factors for shallow traffic applications and deeper cover
- 18” Minimum cover,
- 120” Maximum cover
- Five internal plates



R-TANK UD®
- Ultra Duty module (134.2 psi)
- Traffic loads with 12” of cover
- Available from 14” – 66” tall
- Ideal for high water table sites



R-TANK XD®
- Extreme Duty module (240.2 psi)
- Traffic loads with 6” cover
- 16.5’ maximum cover
- Available from 2” - 10’ tall
- 90% void

DESIGN CONSIDERATIONS

Many factors will influence the design of the R-Tank® system. While this list is not intended to be all-inclusive, the following design considerations are worth highlighting:

1. PRE-TREATMENT

Removing pollutants from runoff before they enter an underground detention system is the smart way to design & build a system. Trash Guard Plus® (see page 6) is a great tool for this. Be sure the system you select will remove, heavy sediments, gross pollutants (trash) and biodegradable debris.

2. BACKFILL MATERIALS

Backfill materials should be stone (<1.5" in diameter) or soil (GW, GP SW or SP per the Unified Soil Classification System). Material must be free from lumps, debris and sharp objects that could cut the geotextile. See the R-Tank® narrative specification section 2.03 for additional information.

3. RUNOFF REDUCTION

Most designs incorporate an outlet to drain the system at a controlled rate and/or an overflow to prevent flooding in extreme events. Any infiltration that can be achieved on the site should also be taken advantage of. Consider raising the invert of your outlet or creating a sump to capture and infiltrate the water quality volume whenever possible.

4. WATER TABLE

While installing R-Tank® below the water table is manageable, a stable base must be created to account for the system's ability to drain water out or limit its ability to enter the system. If a liner is used to prevent ground water from entering, measures must be taken to prevent the system from floating.

5. CONSTRUCTION LOADS

Construction loads are often the heaviest loads the system will experience. Care must be taken during backfilling and compaction (see specification section 3.05), and post-installation construction traffic should be routed around the system (Install Guide step 12).

6. LATERAL LOADS

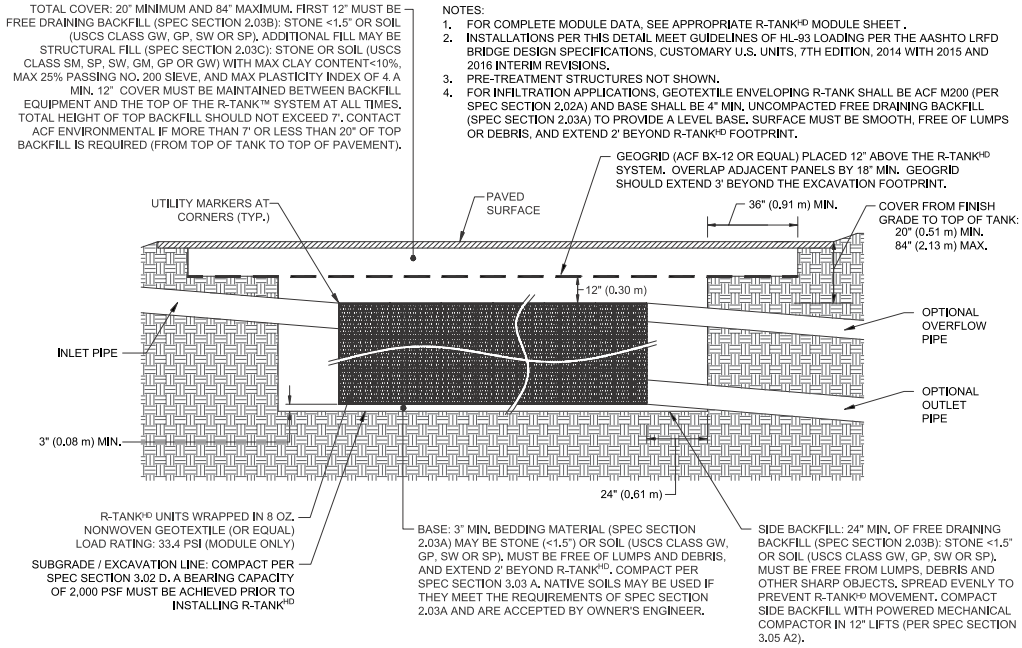
As systems get deeper, the loads acting on the sides of the tank increase. While vertical loads often control the design, lateral loads should also be considered.

7. R-TANK MODULES

Selecting the right module for your application is critical. See page 3 and the specs on the back of this brochure, for details. Our team is also here to help!

8. LOAD MODELING

A safety factor of >1.75 is required when designing an R-Tank System using the AASHTO LRFD Bridge Design Specifications. It is also necessary to run your own loading model with specific site requirements. Example models can be found in our Tech Note on loading capabilities, and minimum cover requirements can be found in the specs on the back of this brochure.



LOW IMPACT DESIGN & GREEN INFRASTRUCTURE

As much of the nation's Gray Infrastructure continues to decay, new concepts for rebuilding it are emerging through Green Infrastructure (GI) and Low Impact Development (LID). This type of reconstruction moves beyond traditional systems that do one thing well, to systems that accomplish multiple objectives simultaneously.

ACF Environmental has several technologies that dovetail with the goals of LID and GI and can play a significant role in the redevelopment process.

R-TANK®

SPACE EFFICIENT SUBSURFACE STORAGE

Pipe and stone are used in traditional systems to move and store runoff. R-Tank accomplishes the same purpose with several additional benefits.

- Stores and moves runoff
- Moves water slowly, increasing time of concentration
- Open system encourages infiltration
- Fully accessible for maintenance
- Stores 138% more water than stone
- Maximizes storage potential of GI practices
- Easily handles traffic loads
- Ships flat to reduce site disturbance

PERMEABLE PAVEMENTS

RUNOFF REDUCTION TECHNIQUES

Traditional pavements move vehicles efficiently, but are easily damaged by stormwater. ACF Environmental specializes in permeable pavements that handle traffic loads, while providing surface infiltration rates 10x higher than traditional pervious pavements, helping reduce the expense of long-term maintenance.

- Handles all vehicular loads
- Drains ten times faster than competing pervious pavements
- Reduces long-term maintenance costs
- Encourages infiltration
- Pair with R-Tank® to maximize water storage and transport

FOCALPOINT

VEGETATED/ BIOLOGICAL TREATMENT SYSTEM

Traditional landscaping adds aesthetic value to projects, but has more potential. Many developers turn to bioretention, but are forced to surrender massive land areas and dedicate significant future funds to maintenance. FocalPoint reduces the space requirements and maintenance costs of bioretention by up to 90% while providing similar pollutant removal.

- Adds aesthetic value to properties
- Cleans runoff to improve water quality
- Reduces space requirements and maintenance costs of traditional bioretention systems
- Encourages infiltration to reduce volume of water discharged
- Pairs with R-Tank® to maximize water storage and transport

R-Tank maximizes the storage capabilities of bioretention and permeable pavement systems.

MAINTENANCE

DESIGNING AN R-TANK SYSTEM WITH LONGEVITY & MAINTENANCE IN MIND IS A THREE-STEP PROCESS:

1. PREVENT

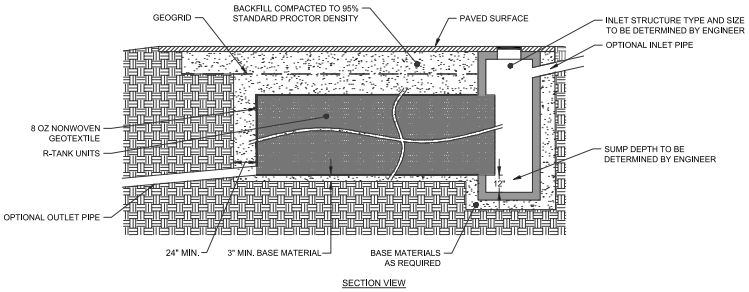
Keep debris and sediment out of the system by pre-treating runoff with the Trash Guard Plus® unit (see below). For a more centralized approach, you could consider having the R-Tank units penetrate the connecting structure, which allows the use of the R-Tank® as its own trash screen. This works best with a structure that includes a sump (see Inlet Connection drawing below).

2. ISOLATE

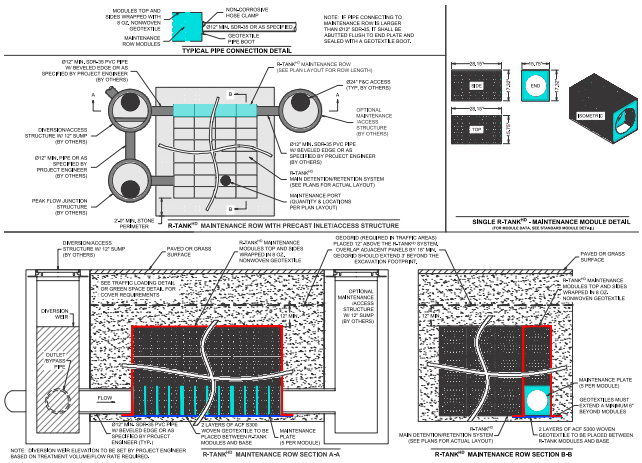
Trap solid pollutants inside the maintenance row (see Maintenance Row drawing below) where they can be easily removed, using the Maintenance Modules (available in LD, HD, and UD only). These modules are wrapped in geotextile to retain solids and are fully accessible by conventional jet-vac systems to remove captured pollutants.

3. PROTECT

Ensure a long system life by including maintenance ports to remove any pollutants that evade the pre-treatment system and maintenance row. Maintenance ports should be specified within 10’ of inlet and outlet connections, and roughly 50’ on center (see detail on page 7).



INLET CONNECTION



MAINTENANCE ROW

MAINTENANCE PREVENTION

TRASH GUARD PLUS ®

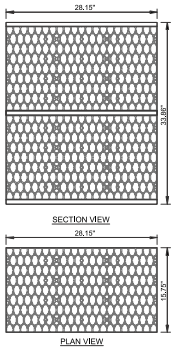
Trash Guard Plus® is a patented stormwater pretreatment device that captures debris, sediment and floatables. Easy to install and maintain, it is a fraction of the cost of other pretreatment devices.

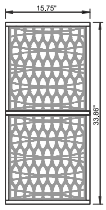
BENEFITS

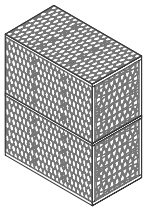
- Simple retrofit to existing catch basins
- Installs without heavy equipment
- Quick and easy assembly
- Adjusts to irregular catch basin bottoms and/or walls
- Eliminates stormwater trash at public parks, beaches, and waterways
- Removes harmful nutrients and regulated metals

TYPICAL DESIGN

MODULE DRAWING - DOUBLE



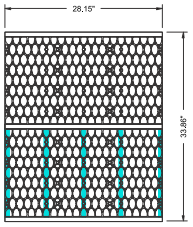


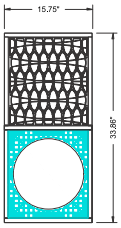

ISOMETRIC VIEW

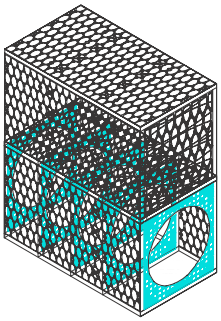
MODULE DATA

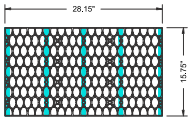
GEOMETRY: LENGTH = 28.15 IN. (715 MM) WIDTH = 15.75 IN. (400 MM) HEIGHT = 33.86 IN. (860 MM) TANK VOLUME = 8.69 CF STORAGE VOLUME = 8.25 CF VOID INTERNAL VOLUME: 95% VOID SURFACE AREA: 90%	**LOAD RATING:** 33.4 PSI, (MODULE ONLY) HS25, (WITH ACF COVER SYSTEM) **MATERIAL:** 100% RECYCLED POLYPROPYLENE **SMALL PLATES PER SEGMENT/TOTAL:** 5/10

MAINTENANCE MODULE - DOUBLE





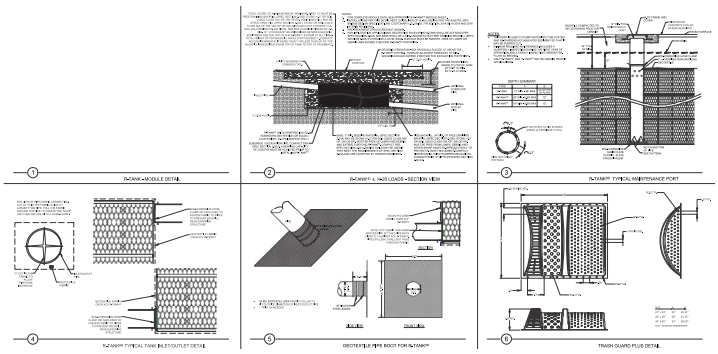

ISOMETRIC



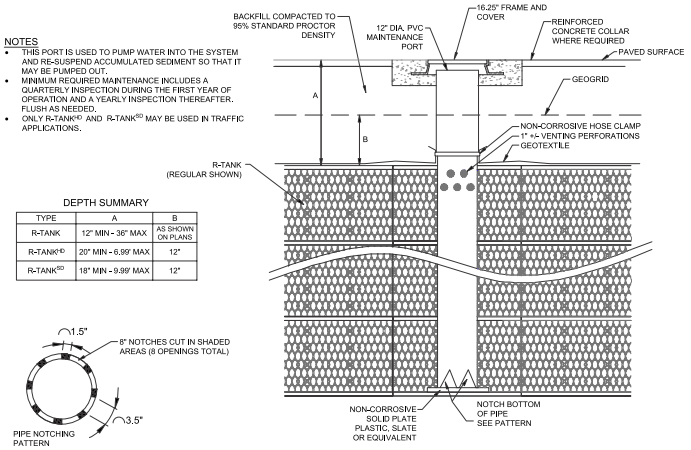
MODULE DATA

GEOMETRY: LENGTH = 28.15 IN. (715 MM) WIDTH = 15.75 IN. (400 MM) HEIGHT = 33.86 IN. (860 MM) TANK VOLUME = 8.69 CF STORAGE VOLUME = 8.25 CF VOID INTERNAL VOLUME: 95% VOID SURFACE AREA: 90%	**LOAD RATING:** 33.4 PSI, (MODULE ONLY) HS20, (WITH ACF COVER SYSTEM) **MATERIAL:** 100% RECYCLED POLYPROPYLENE **SMALL PLATES PER SEGMENT/TOTAL:** 5/10

COMPOSITE DETAILS



MAINTENANCE PORT



SELECTING THE RIGHT R-TANK MODULE

Cover Depth (inches)*	LD	HD	SD	UD	XD
Min. 6"	Green Space - No Traffic	Green Space - No Traffic	Green Space - No Traffic	Green Space - No Traffic	HS-20
12"	Green Space - No Traffic	Green Space - No Traffic	Green Space - No Traffic	HS-20**	HS-20
14"	Green Space - No Traffic	Green Space - No Traffic	Green Space - No Traffic	HS-20	HS-20
18"	Green Space - No Traffic	Green Space - No Traffic	HS-20	HS-20	HS-20
20"	Green Space - No Traffic	HS-20	HS-20	HS-20	HS-20
24"	Green Space - No Traffic	HS-20	HS-20	HS-20	HS-20
36"	Green Space - No Traffic	HS-20	HS-20	HS-20	HS-20
48"		HS-20	HS-20	HS-20	HS-20
60"		HS-20	HS-20	HS-20	HS-20
72"		HS-20	HS-20		HS-20
84"			HS-20		HS-20
120"			HS-20		HS-20
160"					HS-20
Max. 200"					HS-20

HS-20 designation based on AASHTO LRFD Bridge Design Spec for single lane traffic. HS-25 loading is available. Call ACF for details.
*Cover depth is measured from top of module to finished grade or top of pavement
**The UD module requires STONE backfill (not soil) on sides at this depth

R-TANK SPECIFICATIONS

LD HD

DIMENSIONS & CAPACITY

Module (Segments)	Width (inch)	Length (inch)	Height (in/ft)	Volume (cf)	Capacity (cf)	Weight* (lbs)
Mini	15.75	28.15	9.45”/0.79’	2.42	2.30	10.1/10.9
Single(1)	15.75	28.15	17.32”/1.44’	4.44	4.22	15.7/17.3
Single + Mini(1.5)	15.75	28.15	25.98”/2.17’	6.67	6.33	23.6/25.9
Double (2)	15.75	28.15	33.86”/2.82’	8.69	8.25	29.1/32.3
Double + Mini(2.5)	15.75	28.15	42.52”/3.54’	10.91	10.36	37.0/41.0
Triple (3)	15.75	28.15	50.39”/4.20’	12.93	12.28	42.5/47.4
Triple + Mini(3.5)	15.75	28.15	59.06”/4.92’	15.15	14.39	50.4/56.0
Quad(4)	15.75	28.15	66.93”/5.58’	17.17	16.31	55.9/62.4
Quad + Mini(4.5)	15.75	28.15	75.59”/6.30’	19.39	18.42	63.8/71.0
Pent(5)	15.75	28.15	83.46”/6.96’	21.41	20.34	69.3/77.4

*Weights shown are for LD/HD modules.

SD

DIMENSIONS & CAPACITY

Module (Segments)	Width (inch)	Length (inch)	Height (in/ft)	Volume (cf)	Capacity (cf)	Weight (lbs)
Single (1)	15.75	28.15	9.45”/0.79’	2.42	2.30	10.95
Double (2)	15.75	28.15	18.12”/1.51’	4.64	4.41	19.58
Triple (3)	15.75	28.15	26.79”/2.23’	6.86	6.52	28.21
Quad (4)	15.75	28.15	35.46”/2.96’	9.08	8.63	36.84
Pent (5)	15.75	28.15	44.13”/3.68’	11.30	10.74	45.47
Hex (6)	15.75	28.15	52.80”/4.40’	13.52	12.84	54.10
Septa (7)	15.75	28.15	61.47”/5.12’	15.74	14.95	62.73
Octo (8)	15.75	28.15	70.14”/5.85’	17.96	17.06	71.36
Nono (9)	15.75	28.15	78.81”/6.57’	20.18	19.17	79.99
Decka (10)	15.75	28.15	87.48”/7.29’	22.40	21.28	88.62

UD

DIMENSIONS & CAPACITY

Module (Segments)	Width (inch)	Length (inch)	Height (in/ft)	Volume (cf)	Capacity (cf)	Weight (lbs)
Single (1)	23.62	23.62	14.17”/1.18’	4.57	4.35	21.2
Double (2)	23.62	23.62	27.17”/2.26’	8.77	8.33	39.0
Triple (3)	23.62	23.62	40.16”/3.35’	12.97	12.32	56.8
Quad (4)	23.62	23.62	53.15”/4.43’	17.16	16.30	74.6
Pent (5)	23.62	23.62	66.14”/5.5’	21.35	20.29	92.4

XD

DIMENSIONS & CAPACITY

Module (Segments)	Width (inch)	Length (inch)	Height (inch)	Volume (cf)	Capacity (cf)	Weight (lbs)
Single (1)	19.68	23.62	1.97	0.53	0.48	4
Double (2)	19.68	23.62	3.94	1.06	0.95	8
Triple (3)	19.68	23.62	5.91	1.59	1.43	12
Quad (4)	19.68	23.62	7.87	2.12	1.91	16
Pent (5)	19.68	23.62	9.84	2.65	2.38	20

Note: XD modules may be stacked up to 10’ tall (60 layers).

SPECIFICATIONS

Item	Description	LD	HD	SD	UD	XD
Void Area	Volume available for water storage	95%	95%	95%	95%	90%
Surface Area Void	% of exterior available for infiltration	90%	90%	90%	90%	90%
Compressive Strength	ASTM D 2412/ ASTM F 2318	30.0 psi	33.4 psi	42.9 psi	134.2 psi	240.2 psi
Unit Weight	Weight of plastic per cubic foot of tank	3.29 lbs/cf	3.62 lbs/cf	3.96 lbs/cf	4.33 lbs/cf	7.55 lbs/cf
Rib Thickness	Thickness of load-bearing members	0.18”	0.18”	0.18”	-	-
Service Temperature	Safe temperature range for use	-14 - 167º F	-14 - 167º F	-14 - 167º F	-14 - 167º F	-14 - 167º F
Recycled Content	Use of recycled polypropylene	100%	100%	100%	100%	100%
Minimum Cover	Cover required for HS-20 loading	Not traffic rated	20”	18”	12” - 14”	6”
	Cover required for HS-25 loading	Not traffic rated	24”	18”	15” - 17”	6”
Maximum Cover	Maximum allowable cover depth	36”	6.99’	9.99’	5.0’	16.7’

STORMWATER DESIGN (English Units)

Project Name: 16 Fencourt Avenue, Randolph
System #1

Design Storm Event = 24hrs -10yr storm, 4.70 in/hr

Pavement thickness (ft) = 1

Pipe Thickness (inches) = 1

Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T_c Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	Pipe Capacity Check (Column 13 vs. Column 17)	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*8a*	*9*	*10*	*11*	*12*	*13*	*14*	*14a*	*15*	*16*	*17*	*17a*	*17b*	*18*	*19*	*20*	*21*
N	CB #11	SC #1	Parking	0.20	0.90	0.18	0.18	6.0	6.0	4.70	0.76	0.00	0.76	12	0.012	0.0054	3.60	2.83	VELOCITY OK	ADEQUATE PIPE CAPACITY	37.23	0.20	133.00	132.80
N	CB #12	SC #1	Parking	0.20	0.90	0.18	0.18	6.0	6.0	4.70	0.76	0.00	0.76	12	0.012	0.0040	3.11	2.44	VELOCITY OK	ADEQUATE PIPE CAPACITY	49.92	0.20	133.00	132.80
N	SC #1	System#1	Parking	0.40	0.90	0.36	0.36	6.0	6.3	4.70	1.52	0.00	1.52	12	0.012	0.0069	4.08	3.20	VELOCITY OK	ADEQUATE PIPE CAPACITY	29.06	0.20	132.50	132.30

STORMWATER DESIGN (English Units)

Project Name: 16 Fencourt Avenue, Randolph
System #2

Design Storm Event = 24hrs -10yr storm, 4.70 in/hr

Pavement thickness (ft) = 1

Pipe Thickness (inches) = 1

Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T_c Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	Pipe Capacity Check (Column 13 vs. Column 17)	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*8a*	*9*	*10*	*11*	*12*	*13*	*14*	*14a*	*15*	*16*	*17*	*17a*	*17b*	*18*	*19*	*20*	*21*
SE	CB #1	SC #2	Parking	0.26	0.90	0.23	0.23	6.0	6.0	4.70	0.99	0.00	0.99	12	0.012	0.0191	6.80	5.33	VELOCITY OK	ADEQUATE PIPE CAPACITY	31.35	0.60	133.10	132.50
SE	CB #2	SC #2	Parking	0.26	0.90	0.23	0.23	6.0	6.0	4.70	0.99	0.00	0.99	12	0.012	0.0217	7.23	5.68	VELOCITY OK	ADEQUATE PIPE CAPACITY	23.07	0.50	133.00	132.50
SE	SC #2	System#2	Parking	0.52	0.90	0.47	0.47	6.0	6.1	4.70	1.98	0.00	1.98	12	0.012	0.0185	6.67	5.24	VELOCITY OK	ADEQUATE PIPE CAPACITY	10.84	0.20	132.20	132.00
SE	CB #3	SC #3	Parking	0.26	0.90	0.23	0.23	6.0	6.0	4.70	0.99	0.00	0.99	12	0.012	0.0194	6.84	5.37	VELOCITY OK	ADEQUATE PIPE CAPACITY	46.43	0.90	133.70	132.80
SE	CB #4	SC #2	Parking	0.26	0.90	0.23	0.23	6.0	6.0	4.70	0.99	0.00	0.99	12	0.012	0.0206	7.05	5.53	VELOCITY OK	ADEQUATE PIPE CAPACITY	29.14	0.60	133.40	132.80
SE	SC #3	System#2	Parking	0.52	0.90	0.47	0.47	6.0	6.1	4.70	1.98	0.00	1.98	12	0.012	0.0212	7.15	5.61	VELOCITY OK	ADEQUATE PIPE CAPACITY	23.61	0.50	133.50	133.00

STORMWATER DESIGN (English Units)

Project Name: 16 Fencourt Avenue, Randolph
System #3

Design Storm Event = 24hrs -10yr storm, 4.70 in/hr

Pavement thickness (ft) = 1

Pipe Thickness (inches) = 1

Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T_c Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	]	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*8a*	*9*	*10*	*11*	*12*	*13*	*14*	*14a*	*15*	*16*	*17*	*17a*	*17b*	*18*	*19*	*20*	*21*
S	CB #5	SC #3	Parking	0.63	0.90	0.57	0.57	6.0	6.0	4.70	2.40	0.00	2.40	12	0.012	0.0077	4.30	3.37	VELOCITY OK	ADEQUATE PIPE CAPACITY	39.18	0.30	134.80	134.50
SE	SC #3	System#3	Parking	0.63	0.90	0.57	0.57	6.0	6.0	4.70	2.40	0.00	2.40	12	0.012	0.0061	3.82	3.00	VELOCITY OK	ADEQUATE PIPE CAPACITY	33.05	0.20	134.20	134.00

STORMWATER DESIGN (English Units)

Project Name: 16 Fencourt Avenue, Randolph
System #4

Design Storm Event = 24hrs -10yr storm, 4.70 in/hr

Pavement thickness (ft) = 1

Pipe Thickness (inches) = 1

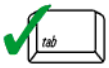
Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T_c Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	]	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*8a*	*9*	*10*	*11*	*12*	*13*	*14*	*14a*	*15*	*16*	*17*	*17a*	*17b*	*18*	*19*	*20*	*21*
MIDDLE	CB #6	SC #4	Parking	0.21	0.90	0.19	0.19	6.0	6.0	4.70	0.80	0.00	0.80	12	0.012	0.0176	6.52	5.11	VELOCITY OK	ADEQUATE PIPE CAPACITY	17.06	0.30	134.10	133.80
MIDDLE	SC #4	System#4	Parking	0.21	0.90	0.19	0.19	6.0	6.0	4.70	0.80	0.00	0.80	12	0.012	0.0180	6.59	5.18	VELOCITY OK	ADEQUATE PIPE CAPACITY	11.10	0.20	133.50	133.30
MIDDLE	CB #7	SC #5	Parking	0.28	0.90	0.25	0.25	6.0	6.0	4.70	1.07	0.00	1.07	12	0.012	0.0124	5.47	4.29	VELOCITY OK	ADEQUATE PIPE CAPACITY	24.19	0.30	134.00	133.70
MIDDLE	SC #5	System#4	Parking	0.28	0.90	0.25	0.25	6.0	6.0	4.70	1.07	0.00	1.07	12	0.012	0.0153	6.07	4.76	VELOCITY OK	ADEQUATE PIPE CAPACITY	6.55	0.10	133.40	133.30
MIDDLE	CB #8	SC #6	Parking	0.22	0.90	0.20	0.20	6.0	6.0	4.70	0.84	0.00	0.84	12	0.012	0.0247	7.72	6.05	VELOCITY OK	ADEQUATE PIPE CAPACITY	8.11	0.20	134.00	133.80
MIDDLE	SC #6	System#4	Parking	0.22	0.90	0.20	0.20	6.0	6.0	4.70	0.84	0.00	0.84	12	0.012	0.0305	8.59	6.74	VELOCITY OK	ADEQUATE PIPE CAPACITY	6.55	0.20	133.50	133.30
MIDDLE	CB #9	SC #7	Parking	0.22	0.90	0.20	0.20	6.0	6.0	4.70	0.84	0.00	0.84	12	0.012	0.0103	4.99	3.92	VELOCITY OK	ADEQUATE PIPE CAPACITY	38.72	0.40	134.10	133.70
MIDDLE	SC #7	System#4	Parking	0.22	0.90	0.20	0.20	6.0	6.0	4.70	0.84	0.00	0.84	12	0.012	0.0153	6.07	4.76	VELOCITY OK	ADEQUATE PIPE CAPACITY	6.55	0.10	133.40	133.30

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

09/19/2022

Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

- ☐ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☐ Static ☒ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas Not Applicable - The Site is not within critical area.

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

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

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

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

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

Town of Randolph

TOD District Design Review Committee

Illicit Discharge Statement

I, as Owner Representative, certify that:

1) The existing buildings located 16 Fencourt Avenue, Randolph, MA Massachusetts is to be demolished under the proposed site redevelopment. During the building demolition process, any illicit discharge, if exists, will be removed as part of the demolition process.
2) The plan accompanied the Special Permit application submittal clearly identifies the following:
    - The location of all on-site systems for conveying wastewater and stormwater.
    - The location of any measures taken to prevent the entry of illicit discharges int the Town of Randolph storm drain system.
    - There is no connects between the wastewater management and the Town of Randolph storm drain system.

Property Owner:
Taj Estates of Randolph II LLC
16 Fencourt Avenue
Randolph, MA

Signature:

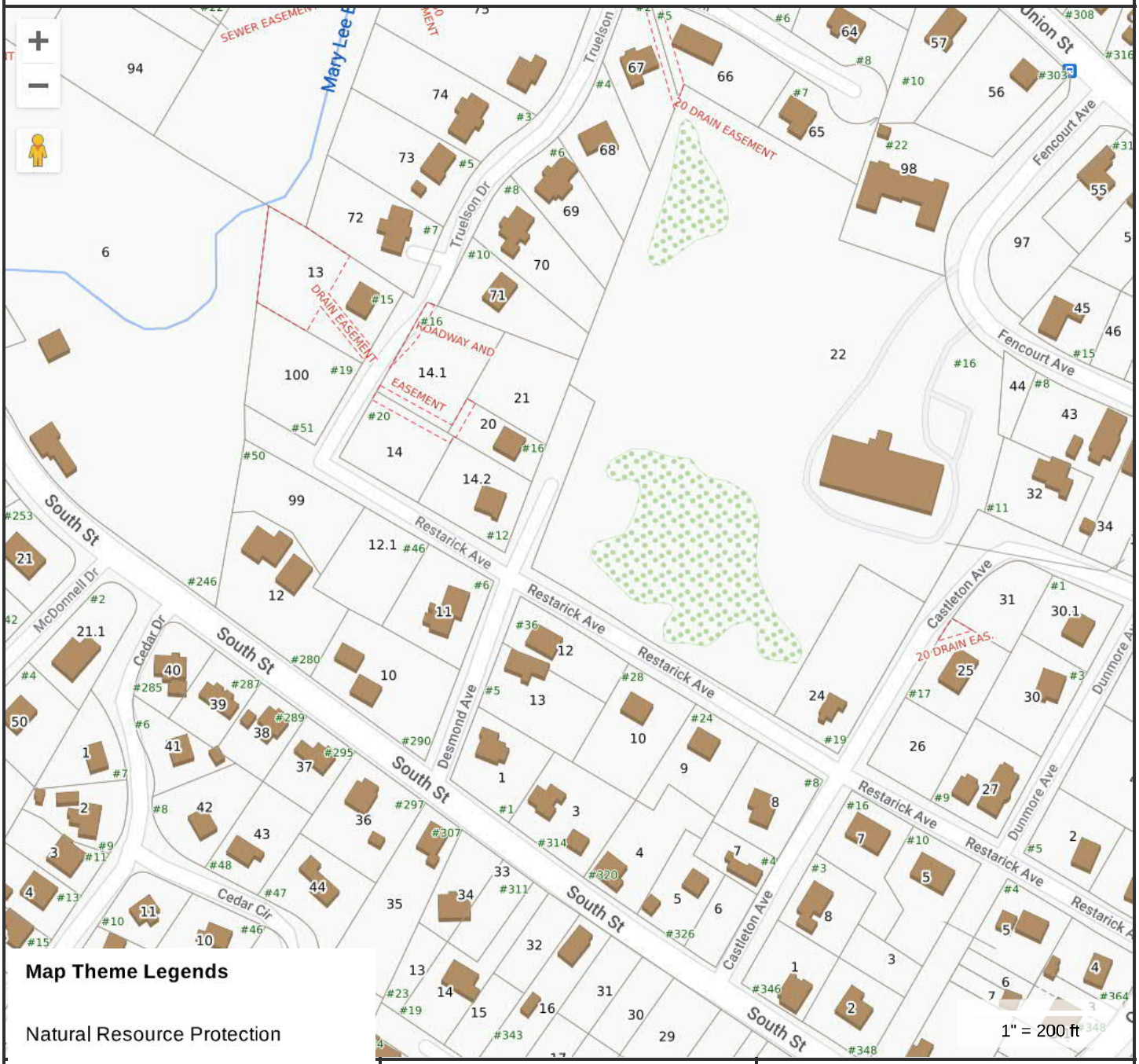
09/19/2022

_____

Chi Y. Man, PE
Hardy + Man Design Group, PC

HARDY+MAN DESIGN GROUP, PC
CIVIL ENGINEERING & LAND DEVELOPMENT CONSULTING

16 Fencourt Avenue - Critical Area Map



Map Theme Legends

Natural Resource Protection

- NHESP Certified Vernal Pools
- NHESP Potential Vernal Pools
- NHESP Priority Habitats of Rare Species
- NHESP Estimated Habitats of Rare Wildlife
- Areas of Critical Environmental Concern

Massachusetts DCR, Natural Heritage and Endangered Species Program

1" = 200 ft

MAP FOR REFERENCE ONLY
NOT A LEGAL DOCUMENT

Town of Randolph, MA makes no claims and no warranties, expressed or implied, concerning the validity or accuracy of the GIS data presented on this map.

Geometry updated 11/29/2021
Data updated on a daily basis

Print map scale is approximate. Critical layout or measurement activities should not be done using this resource.