

**Storm Drainage Report
Proposed Affordable Housing Development
Clark Lane
Waterford, Connecticut**

Prepared for

Kingstown Properties LLC

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Prepared by:

Provost & Rovero, Inc.

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Section 1

Executive Summary

PROJECT NARRATIVE

This proposal involves the construction of 47 detached affordable housing units on a 16.166 acre parcel located on the easterly side of Clark Lane in Waterford, Connecticut. The project will be accessed by a private road system which intersects Clark Lane at the northerly and southerly limits of the project. All units will be served by public water and sewer utilities. The project is located in the watershed of the Fenger Brook headwaters which is a tributary within the Jordan Brook watershed. The subject property is comprised primarily of hydrologic group C soils of the Montauk series. The property generally slopes and drains from west to east and Fenger Brook flows off the property near its southeasterly corner. The southeasterly portion of the subject property includes a wetland system which extends approximately 500' up gradient of the Fenger Brook watercourse. Because of the environmental sensitivity of the overall Jordan Brook watershed, the project has been designed to provide a minimum 50' undisturbed buffer to the delineated wetland edge. The only exception to this buffer is the discharge from the stormwater treatment and management system which will discharge fully renovated and treated stormwater near the wetland edge. Stormwater management and treatment will be accomplished by means of a system which includes catch basin sumps, a hydrodynamic separator, a bioretention basin and a stormwater detention basin.

HYDROLOGIC ANALYSIS

This project includes a stormwater detention basin to mitigate increases in peak flow rates resulting from the proposed development. A hydrologic analysis point was chosen where Fenger Brook leaves the subject property near its southeasterly corner. The overall watershed at this point is approximately 102 acres. The hydrologic analysis was completed with HydroCAD software utilizing TR-55 and TR-20 methodology. The following is a summary of existing and proposed peak flow rates at the analysis point:

<u>Storm Event</u>	<u>Existing Peak Flow (cfs)</u>	<u>Proposed Peak Flow (cfs)</u>
2 year	47.88	41.18
5 year	81.00	70.03
10 year	102.16	88.62
25 year	131.32	122.95
50 year	153.86	151.05
100 year	184.45	184.22

The following is a summary of proposed peak flow rates at the detention basin discharge:

<u>Storm Event</u>	<u>Proposed Peak Flow (cfs)</u>
2 year	2.93
5 year	3.69
10 year	6.61
25 year	15.15
50 year	22.04
100 year	28.85

The detention basin outlet is equipped with a riprap lined plunge pool and concrete weir level spreader. The discharge from the detention basin during a 100 year storm was analyzed to ensure that the level spreader would not result in erosive flow velocities. The 100 year detention basin discharge is 28.85 cfs which will result in a flow velocity from the level spreader of 1.78 ft/sec.

Per the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control, the allowable velocity for sandy loam soils consistent with those observed on site is 2.5 ft/sec. Based on this analysis, downstream erosion of native soils is not anticipated as a result of the detention basin discharge.

Detailed hydrologic calculations are presented in Section 4.

WATER QUALITY DESIGN

This project incorporates multiple stacked stormwater treatment measures to mitigate any potential impacts to stormwater quality. The stormwater quality treatment system has also been sized to fully renovate and treat off-site stormwater runoff from Clark Lane which currently discharges onto the subject property. The system has primarily been designed to address loading of the following pollutants: total nitrogen, total phosphorus, total suspended solids (sediment) and heavy metals. The control of sediment transport is important in mitigating all of the pollutants due to the tendency of these pollutants to adhere to sediment. Bacteriological pollutant loading is not considered a primary concern for this project because of the use of sanitary sewers to dispose of all wastewater. The following measures are incorporated into the stormwater treatment system:

- Catch basins equipped with sumps for retention of solids.
- Stormceptor hydrodynamic separator – designed to capture 80% of total suspended solids (TSS) annually for sediment gradation consistent with road sand. Suspended solids are a primary source of potential pollution including nitrogen, phosphorus and heavy metals. Field testing of in place Stormceptor units has indicated removal efficiencies of approximately 65% for total nitrogen and 30% for total phosphorus.
- Bioretention basin – design per 2008 New Hampshire Stormwater Manual (“NH Manual”) and 2004 Connecticut Stormwater Quality Manual (“CT Manual”) to treat the water quality volume (WQV) from the proposed project and Clark Lane. The NH Manual indicates a 90% removal efficiency for total suspended solids, a 65% removal efficiency for total nitrogen and a 65% removal efficiency for total phosphorus. The bioretention basin has been designed as an off-line system through the use of a flow diversion structure. The diversion structure has been designed to minimize flow rates through the basin above the water quality flow (WQF) even during large storm events.
- Wet bottom detention basin – based on test pits within the detention basin, a permanent hydric soil regime is anticipated. Initial seeding and natural colonization of wetland species will facilitate additional vegetative stormwater renovation.

While the overall performance of the proposed stormwater treatment train cannot be exactly quantified, the stacking of different measures will significantly increase discharged water quality versus reliance on a single treatment measure. The stacking of different measures is encouraged in Section 6.4 of the CT Manual. While the NH Manual conservatively allows a designer to only account for the most effective measure within the treatment train, accounting for the removal efficiencies of just the Stormceptor and bioretention basin would result in the following estimated removal efficiencies for any discharges into the receiving environment:

Total Suspended Solids: 98% removal

Total Nitrogen: 88% removal

Total Phosphorus: 75% removal

Design calculations for specific water quality treatment systems are presented in Section 3.

STORM SEWER DESIGN

Storm sewers will be constructed of smooth interior wall HDPE pipe. The hydrologic analysis for storm sewer design was completed with the Rational Method for a 10 year design storm utilizing IDF information from the Connecticut DOT Drainage Manual.

Storm sewer design calculations are presented in Section 2.

TEMPORARY EROSION AND SEDIMENTATION CONTROL DESIGN

The total disturbed area proposed for this project is approximately 8 acres. A temporary sediment basin has been designed to accommodate this site disturbance with an assumed project duration of 18 months based on sediment loading capacity. The sediment basin has been designed to allow reconfiguring into both the permanent bioretention basin and detention basin. The bioretention basin reconfiguration will require the placement of fill in the bottom of the basin and the installation of the underdrain and sand/compost filter system as well as permanent stabilization with the selected seed mix and wetland plantings. The detention basin reconfiguration will only require minor modifications to the outlet structure, provisions for which can be incorporated into the initial sediment basin construction.

The sediment basin has been designed in accordance with the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control. Storm routing and design of the outlet control system were accomplished with TR-55 and TR-20 methodology utilizing HydroCAD software. Design calculations for the sediment basin are presented in Section 5.

Because the sediment basin will serve the majority of the disturbed site area, isolated perimeter site areas which cannot drain to the sediment basin can be suitably protected with non-engineered erosion and sediment controls such as silt fence, staked hay bales, wood chip berms, temporary seeding and management of site grades to prevent concentrated flows.

Section 2

Storm Sewer Design Calculations

Name	Area (Acres)	Runoff Coef.	Tc (min)	Compound Tc (min)	Rainfall Intensity (in/hr)	Discharge (cfs)
FES 102	0.00	0.00	0.00	26.06	3.11	0.00
DMH 103	0.00	0.50	0.00	25.99	3.12	0.00
SC 104	0.16	0.85	5.00	25.73	3.14	0.80
CB 107	0.25	0.70	5.00	25.59	3.15	1.04
CB 108	0.03	0.85	5.00	25.34	3.17	0.13
CB 111	0.92	0.65	12.90	24.66	3.23	2.60
DMH 113	0.00	0.50	0.00	24.19	3.26	0.00
DMH 116	0.00	0.50	0.00	23.24	3.34	0.00
CB 117	0.72	0.65	12.70	21.33	3.49	2.04
CB 119	0.20	0.70	7.70	10.34	4.74	0.73
CB 121	0.15	0.80	6.20	9.47	4.93	0.67
CB 122	0.35	0.55	9.30	9.30	4.97	0.96
CB 120	0.61	0.55	9.00	9.00	5.04	1.70
CB 118	2.71	0.40	21.20	21.20	3.50	3.79
DMH 114	0.00	0.50	0.00	19.17	3.67	0.00
DMH 115	2.66	0.65	19.10	19.10	3.67	6.34
CB 112	3.25	0.38	14.70	14.70	4.05	5.00
CB 109	0.09	0.85	5.00	5.22	5.95	0.47
CB 110	0.09	0.85	5.00	5.00	6.00	0.46
CB 105	0.14	0.75	6.00	6.00	5.76	0.63
CB 106	0.14	0.70	5.00	5.00	6.00	0.58

Upstream Node	Downstream Node	Diameter (in)	Material	Manning's n	Length (ft)	Upstream Invert (ft)	Downstream Invert (ft)	Upstream Rim Elev (ft)	Upstream HGL (ft)	Downstream Rim Elev (ft)	Downstream HGL (ft)	Slope (%)	Total Flow (cfs)	Peak Time (min)	Upstream Velocity (fps)	Downstream Velocity (fps)
DMH 103	FES 102	36.00	CPP	0.012	51.99	91.00	90.00	104.00	91.92	95.00	90.92	1.92	20.54	26.06	11.17	11.17
SC 104	DMH 103	24.00	CPP	0.012	112.28	96.30	95.70	103.80	98.34	104.00	97.33	0.53	20.67	25.99	6.58	7.54
CB 107	SC 104	24.00	CPP	0.012	54.60	96.60	96.30	104.54	99.09	103.80	98.74	0.55	19.68	25.73	6.26	6.26
CB 108	CB 107	24.00	CPP	0.012	97.05	97.10	96.60	106.53	100.23	104.54	99.64	0.52	19.26	25.59	6.13	6.13
CB 111	CB 108	24.00	CPP	0.012	255.02	98.30	97.10	104.55	102.21	106.53	100.68	0.47	19.01	25.34	6.05	6.05
DMH 113	CB 111	24.00	CPP	0.012	125.07	98.90	98.30	105.84	102.75	104.55	102.39	0.48	13.25	24.66	4.22	4.22
DMH 116	DMH 113	24.00	CPP	0.012	145.11	99.60	98.90	107.52	103.02	105.84	102.87	0.48	7.79	24.19	2.48	2.48
CB 117	DMH 116	24.00	CPP	0.012	296.95	101.00	99.60	104.69	103.36	107.52	103.03	0.47	8.14	23.24	2.59	2.59
CB 119	CB 117	15.00	CPP	0.012	196.76	104.50	101.00	108.35	105.28	104.69	103.40	1.78	3.72	21.33	4.62	3.03
CB 121	CB 119	15.00	CPP	0.012	133.41	108.00	104.50	111.33	108.49	108.35	105.37	2.62	1.53	10.34	3.43	1.68
CB 122	CB 121	15.00	CPP	0.012	24.00	108.20	108.00	111.33	108.58	111.33	108.58	0.83	0.96	9.47	2.99	1.71
CB 120	CB 119	15.00	CPP	0.012	24.00	104.70	104.50	108.35	105.37	108.35	105.37	0.83	1.64	10.34	2.53	1.80
CB 118	CB 117	15.00	CPP	0.012	24.00	101.20	101.00	104.69	103.47	104.69	103.40	0.83	3.79	21.33	3.09	3.09
DMH 114	DMH 113	15.00	CPP	0.012	86.04	104.00	101.90	108.00	104.68	105.84	102.58	2.44	6.33	24.19	9.25	9.25
DMH 115	DMH 114	15.00	CPP	0.012	24.29	108.98	104.00	112.00	110.00	108.00	105.03	20.50	6.34	19.17	5.94	5.85
CB 112	CB 111	15.00	CPP	0.012	24.00	100.65	100.55	104.55	102.51	104.55	102.39	0.42	5.00	24.66	4.07	4.07
CB 109	CB 108	15.00	CPP	0.012	50.05	103.25	103.00	107.15	103.62	106.53	103.37	0.50	0.92	25.34	3.09	3.09
CB 110	CB 109	15.00	CPP	0.012	24.00	103.50	103.25	107.15	103.77	107.15	103.68	1.04	0.46	5.22	2.44	1.26
CB 105	SC 104	24.00	CPP	0.012	41.32	98.70	96.30	102.82	99.08	103.80	98.74	5.81	1.19	25.73	2.90	0.38
CB 106	CB 105	24.00	CPP	0.012	24.00	98.90	98.70	102.82	99.16	102.82	99.11	0.83	0.58	6.00	2.40	1.26

Section 3

Water Quality Design Calculations

Detailed Stormceptor Sizing Report – Clark Lane

Project Information & Location			
Project Name	Clark Lane	Project Number	213009
City	Waterford	State/ Province	Connecticut
Country	United States of America	Date	5/15/2022
Designer Information		EOR Information (optional)	
Name	David Held	Name	
Company	Provost & Rovero, Inc.	Company	
Phone #	860-230-0856	Phone #	
Email	dheld@prorovinc.com	Email	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	Clark Lane
Recommended Stormceptor Model	STC 4800
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	81
PSD	OK-110
Rainfall Station	BRIDGEPORT SIKORSKY AP

The recommended Stormceptor model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	% TSS Removal Provided
STC 450i	59
STC 900	70
STC 1200	70
STC 1800	71
STC 2400	76
STC 3600	77
STC 4800	81
STC 6000	81
STC 7200	84
STC 11000	88
STC 13000	88
STC 16000	90

Stormceptor

The Stormceptor oil and sediment separator is sized to treat stormwater runoff by removing pollutants through gravity separation and flotation. Stormceptor's patented design generates positive TSS removal for each rainfall event, including large storms. Significant levels of pollutants such as heavy metals, free oils and nutrients are prevented from entering natural water resources and the re-suspension of previously captured sediment (scour) does not occur. Stormceptor provides a high level of TSS removal for small frequent storm events that represent the majority of annual rainfall volume and pollutant load. Positive treatment continues for large infrequent events, however, such events have little impact on the average annual TSS removal as they represent a small percentage of the total runoff volume and pollutant load.

Design Methodology

Stormceptor is sized using PCSWMM for Stormceptor, a continuous simulation model based on US EPA SWMM. The program calculates hydrology using local historical rainfall data and specified site parameters. With US EPA SWMM's precision, every Stormceptor unit is designed to achieve a defined water quality objective. The TSS removal data presented follows US EPA guidelines to reduce the average annual TSS load. The Stormceptor's unit process for TSS removal is settling. The settling model calculates TSS removal by analyzing:

- Site parameters
- Continuous historical rainfall data, including duration, distribution, peaks & inter-event dry periods
- Particle size distribution, and associated settling velocities (Stokes Law, corrected for drag)
- TSS load
- Detention time of the system

Hydrology Analysis			
PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of Stormceptor are based on the average annual removal of TSS for the selected site parameters. The Stormceptor is engineered to capture sediment particles by treating the required average annual runoff volume, ensuring positive removal efficiency is maintained during each rainfall event, and preventing negative removal efficiency (scour). Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.			

Rainfall Station			
State/Province	Connecticut	Total Number of Rainfall Events	7592
Rainfall Station Name	BRIDGEPORT SIKORSKY AP	Total Rainfall (in)	2372.0
Station ID #	0806	Average Annual Rainfall (in)	40.9
Coordinates	41°9'30"N, 73°7'44"W	Total Evaporation (in)	87.8
Elevation (ft)	5	Total Infiltration (in)	1437.7
Years of Rainfall Data	58	Total Rainfall that is Runoff (in)	846.5

Notes	
• Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules. • Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed. • For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.	

Drainage Area		Up Stream Storage	
Total Area (acres)	13.74	Storage (ac-ft)	Discharge (cfs)
Imperviousness %	38.5	0.000	0.000
Water Quality Objective		Up Stream Flow Diversion	
TSS Removal (%)	80.0	Max. Flow to Stormceptor (cfs)	
Runoff Volume Capture (%)		Design Details	
Oil Spill Capture Volume (Gal)		Stormceptor Inlet Invert Elev (ft)	96.30
Peak Conveyed Flow Rate (CFS)		Stormceptor Outlet Invert Elev (ft)	96.30
Water Quality Flow Rate (CFS)		Stormceptor Rim Elev (ft)	
		Normal Water Level Elevation (ft)	
		Pipe Diameter (in)	24
		Pipe Material	HDPE - plastic
		Multiple Inlets (Y/N)	Yes
		Grate Inlet (Y/N)	No

Particle Size Distribution (PSD)		
Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor design.		
OK-110		
Particle Diameter (microns)	Distribution %	Specific Gravity
1.0	0.0	2.65
53.0	3.0	2.65
75.0	15.0	2.65
88.0	25.0	2.65
106.0	41.0	2.65
125.0	15.0	2.65
150.0	1.0	2.65
212.0	0.0	2.65

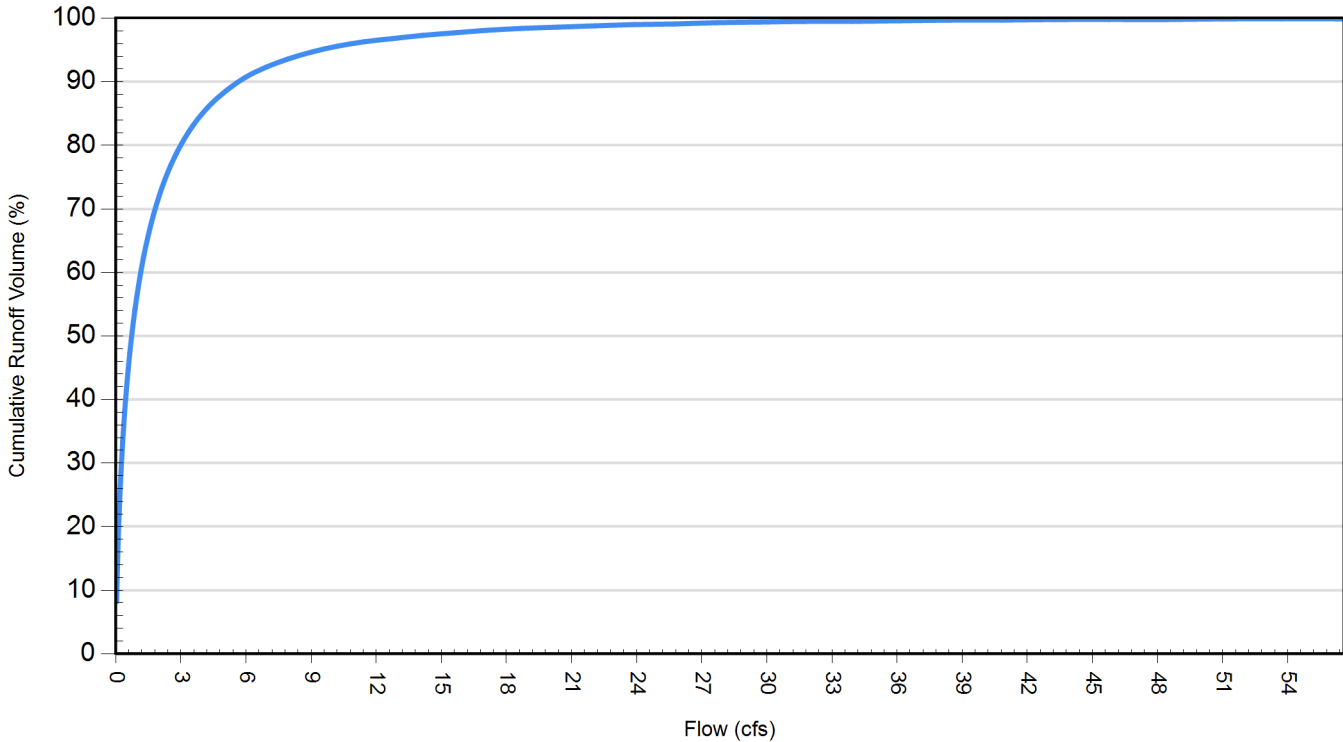
Site Name		Clark Lane	
Site Details			
Drainage Area		Infiltration Parameters	
Total Area (acres)	13.74	Horton's equation is used to estimate infiltration	
Imperviousness %	38.5	Max. Infiltration Rate (in/hr)	2.44
Surface Characteristics		Min. Infiltration Rate (in/hr)	0.4
Width (ft)	1547.00	Decay Rate (1/sec)	0.00055
Slope %	2	Regeneration Rate (1/sec)	0.01
Impervious Depression Storage (in)	0.02	Evaporation	
Pervious Depression Storage (in)	0.2	Daily Evaporation Rate (in/day)	0.1
Impervious Manning's n	0.015	Dry Weather Flow	
Pervious Manning's n	0.25	Dry Weather Flow (cfs)	0
Maintenance Frequency		Winter Months	
Maintenance Frequency (months) >	12	Winter Infiltration	0
TSS Loading Parameters			
TSS Loading Function			
Buildup/Wash-off Parameters		TSS Availability Parameters	
Target Event Mean Conc. (EMC) mg/L		Availability Constant A	
Exponential Buildup Power		Availability Factor B	
Exponential Washoff Exponent		Availability Exponent C	
		Min. Particle Size Affected by Availability (micron)	

Cumulative Runoff Volume by Runoff Rate			
Runoff Rate (cfs)	Runoff Volume (ft³)	Volume Over (ft³)	Cumulative Runoff Volume (%)
0.035	3542487	39932370	8.2
0.141	9164891	34302280	21.1
0.318	14570120	28888310	33.5
0.565	19383870	24080850	44.6
0.883	23548900	19906010	54.2
1.271	27064450	16405460	62.3
1.730	29997260	13467140	69.0
2.260	32409850	11051820	74.6
2.860	34426600	9037395	79.2
3.531	36079020	7385202	83.0
4.273	37425120	6034767	86.1
5.085	38522150	4939094	88.6
5.968	39401380	4058374	90.7
6.922	40115140	3345436	92.3
7.946	40684690	2775470	93.6
9.041	41148840	2310718	94.7
10.206	41525630	1933773	95.6
11.442	41831030	1628381	96.3
12.749	42082410	1376671	96.8
14.126	42294880	1164317	97.3
15.574	42472560	986484	97.7
17.092	42621690	837396	98.1
18.681	42748810	710346	98.4
20.341	42851960	607109	98.6
22.072	42937830	521210	98.8
23.873	43013870	445008	99.0
25.744	43078770	380114	99.1
27.687	43134350	324578	99.3
29.700	43182370	276615	99.4
31.783	43222220	236770	99.5
33.937	43257010	201963	99.5
36.162	43285180	173804	99.6
38.458	43309860	149113	99.7
40.824	43332990	125978	99.7
43.261	43353620	105317	99.8
45.768	43371190	87741	99.8
48.346	43386000	72897	99.8

50.994	43399360	59516	99.9
53.714	43411060	47816	99.9
56.504	43418970	39897	99.9

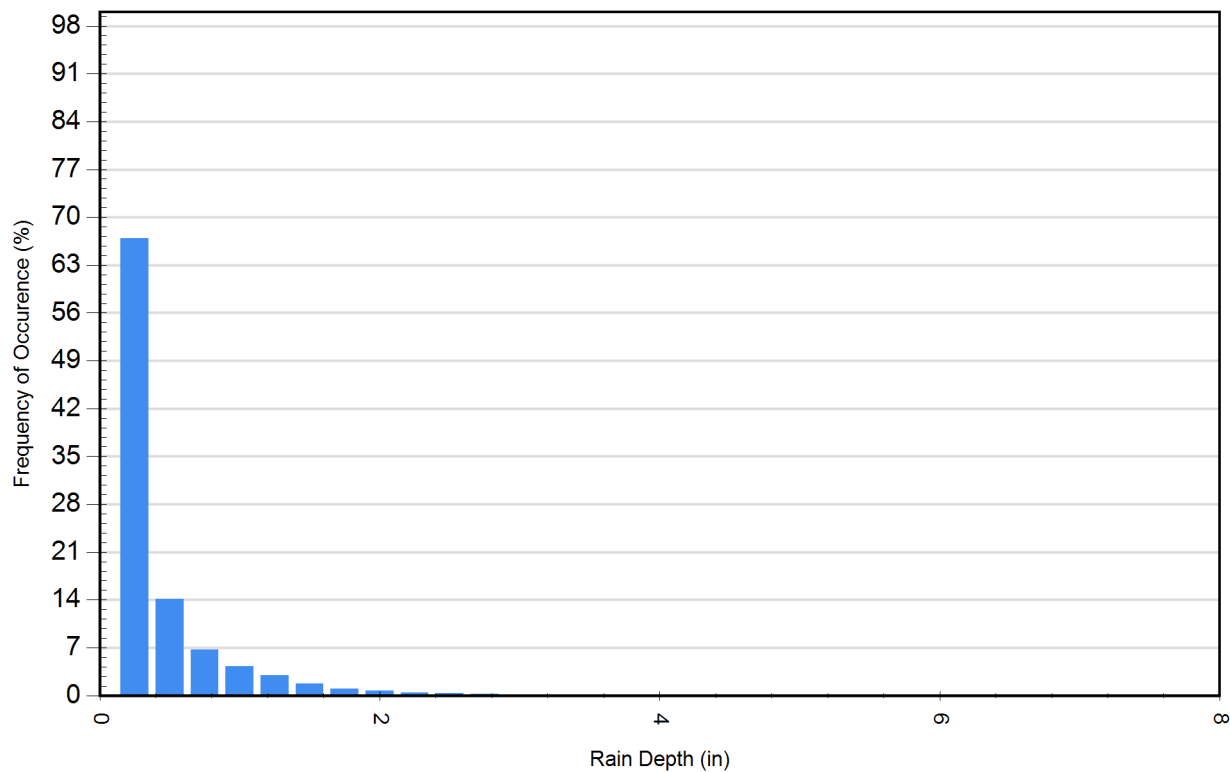
Cumulative Runoff Volume by Runoff Rate

For area: 13.74(ac), imperviousness: 38.5%, rainfall station: BRIDGEPORT SIKORSKY AP



Rainfall Event Analysis				
Rainfall Depth (in)	No. of Events	Percentage of Total Events (%)	Total Volume (in)	Percentage of Annual Volume (%)
0.25	5078	66.9	361	15.2
0.50	1071	14.1	394	16.6
0.75	510	6.7	314	13.2
1.00	324	4.3	285	12.0
1.25	224	3.0	251	10.6
1.50	132	1.7	182	7.7
1.75	73	1.0	118	5.0
2.00	54	0.7	101	4.2
2.25	32	0.4	68	2.9
2.50	26	0.3	61	2.6
2.75	18	0.2	47	2.0
3.00	10	0.1	29	1.2
3.25	8	0.1	25	1.0
3.50	8	0.1	27	1.2
3.75	8	0.1	29	1.2
4.00	3	0.0	12	0.5
4.25	2	0.0	8	0.3
4.50	2	0.0	9	0.4
4.75	2	0.0	9	0.4
5.00	0	0.0	0	0.0
5.25	1	0.0	5	0.2
5.50	2	0.0	11	0.4
5.75	0	0.0	0	0.0
6.00	1	0.0	6	0.2
6.25	0	0.0	0	0.0
6.50	2	0.0	13	0.5
6.75	0	0.0	0	0.0
7.00	0	0.0	0	0.0
7.25	1	0.0	7	0.3
7.50	0	0.0	0	0.0
7.75	0	0.0	0	0.0

Frequency of Occurrence by Rainfall Depths



For Stormceptor Specifications and Drawings Please Visit:
<https://www.conteches.com/technical-guides/search?filter=1WBC005EYX>

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Job: 213009 - Clark Lane

Sheet No. 1 of

Calculated by: DJH Date: 3/5/22

Checked by: Date:

Scale:

Water Quality Design

Determine Water Quality Volume

$$WQV = (1") (R) (A) / 12$$

$$A = 13.736 \text{ ac}$$

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

$$I = 5.294 \text{ ac} / 13.736 \text{ ac} = 38.5\%$$

$$R = 0.05 + 0.009(38.5) = 0.40$$

$$WQV = (1") (0.40) (13.736 \text{ ac}) / 12 = 0.458 \text{ ac} \cdot \text{ft} = 19,945 \text{ ft}^3$$

Retention Basin Volume:

Elevation	Area (ft ²)	Volume (ft ³)
95	8075	20043
97	11968	

Basin will retain WQV

Determine WQF

$T_c = 26$ minutes (from storm sewer design)

$$P = 1"$$

$$Q = (0.458 \text{ ac} \cdot \text{ft} / 13.736 \text{ ac}) (12) = 0.400"$$

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

$$CN = \frac{1000}{10 + 5(1) + 10(0.4) - 10(0.4^2 + 1.25(0.4)(1))^{1/2}} = 92$$

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Job: 213009 - Clark Lane

Sheet No. 2 of

Calculated by: DJH Date: 3/9/22

Checked by: Date:

Scale:

From Table 4-1, $I_a = 0.174$

From Exhibit 4-111, $q_u = 400 \text{ csm/in}$

$$WQF = q_u A_Q$$

$$WQF = (400 \text{ cfs/mi}^2/\text{inch}) (13.736 \text{ ac}/640 \text{ ac/mi}^2) (0.4 \text{ in})$$

$$WQF = 3.43 \text{ cfs}$$



Water Quality Flow Calculation

The water quality flow (WQF) is the peak flow rate associated with the water quality design storm. This section describes the recommended procedure for calculating the water quality flow (WQF) for the design of:

- Grass drainage channels (not water quality swales, which should be designed based on water quality volume - WQV)
- Pre-manufactured stormwater treatment devices (e.g., hydrodynamic separators, catch basin inserts, and media filters)
- Flow diversion structures for off-line stormwater treatment practices

The WQF should be calculated using the WQV described in Chapter Seven. This WQV, converted to watershed inches, should be substituted for the runoff depth (Q) in the Natural Resources Conservation Service (formerly Soil Conservation Service), TR-55 Graphical Peak Discharge Method. The procedure is based on the approach described in Claytor and Schueler, 1996.

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

$$CN = \frac{1000}{[10 + 5P + 10Q - 10(Q + 1.25Q)^{0.4}]}$$

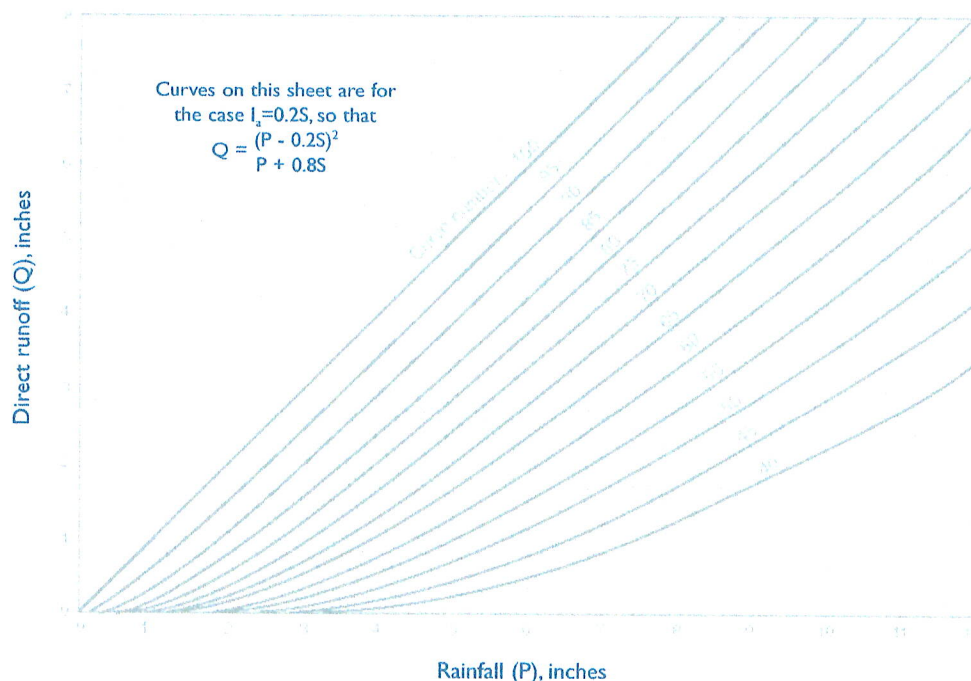
where: CN = Runoff Curve Number

P = design precipitation, inches
(1" for water quality storm)

Q = runoff depth (in watershed inches)

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

Figure 2-1 Solution of Runoff Equation



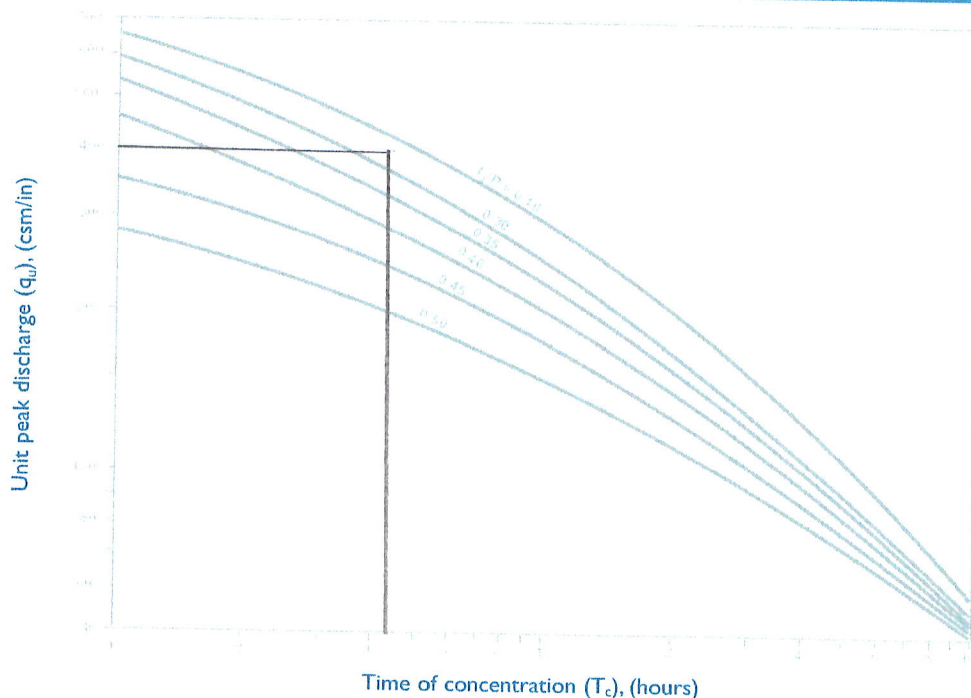
2. Compute the time of concentration (t_c) based on the methods described in Chapter 3 of TR-55. A minimum value of 0.167 hours (10 minutes) should be used. For sheet flow, the flow path should not be longer than 300 feet.
3. Using the computed CN, t_c , and drainage area (A) in acres, compute the peak discharge for the water quality storm (i.e., the water quality flow [WQF]), based on the procedures described in Chapter 4 of TR-55.
 - Read initial abstraction (I_a) from Table 4-1 in Chapter 4 of TR-55 (reproduced below); compute I_a/P

Table 4-1 I_a values for runoff curve numbers

Curve number	I_a (in)	Curve number	I_a (in)	Curve number	I_a (in)	Curve number	I_a (in)
40	3.000	55	1.636	70	0.857	85	0.353
41	2.878	56	1.571	71	0.817	86	0.326
42	2.762	57	1.509	72	0.778	87	0.299
43	2.651	58	1.448	73	0.740	88	0.273
44	2.545	59	1.390	74	0.703	89	0.247
45	2.444	60	1.333	75	0.667	90	0.222
46	2.348	61	1.279	76	0.632	91	0.198
47	2.255	62	1.226	77	0.597	92	0.174
48	2.167	63	1.175	78	0.564	93	0.151
49	2.082	64	1.125	79	0.532	94	0.128
50	2.000	65	1.077	80	0.500	95	0.105
51	1.922	66	1.030	81	0.469	96	0.083
52	1.846	67	0.985	82	0.439	97	0.062
53	1.774	68	0.941	83	0.410	98	0.041
54	1.704	69	0.899	84	0.381		

- Read the unit peak discharge (q_u) from Exhibit 4-III in Chapter 4 of TR-55 (reproduced below) for appropriate t_c

Exhibit 4-III Unit peak discharge (q_u) for NRCS (SCS) type III rainfall distribution





- *Substituting the water quality volume (WQV), converted to watershed inches, for runoff depth (Q), compute the water quality flow (WQF) from the following equation:*

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

where: WQV = water quality volume (cfs)

q_u = unit peak discharge (cfs/mi²/inch)

A = drainage area (mi²)

Q = runoff depth (in

watershed inches)

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

Other peak flow calculation methods may be used for determining the WQF, such as those recommended by manufacturers of proprietary treatment systems, provided that the WQF calculated by other methods is equal to or greater than the WQF calculated using the above NRCS Graphical Peak Discharge Method.

Flow Diversion Structures

Flow diversion structures, also called flow splitters, are designed to deliver flows up to the design water quality flow (WQF) or water quality volume (WQV) to off-line stormwater treatment practices. Flows in excess of the WQF or WQV are diverted around the treatment facility with minimal increase in head at the flow diversion structure to avoid surcharging the treatment facility under higher flow conditions. Flow diversion structures are typically manholes or vaults equipped with weirs, orifices, or pipes to bypass excess runoff. A number of design options exist. **Figures B-1 through B-3** show common examples of flow diversion structures for use upstream of stormwater treatment practices. Other equivalent designs that achieve the result of diverting flows in excess of the WQF or WQV around the treatment facility, including bypasses or overflows located inside the facility, are also acceptable.

The following general procedures are recommended for design of flow diversion structures:

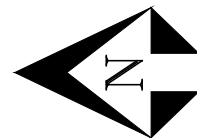
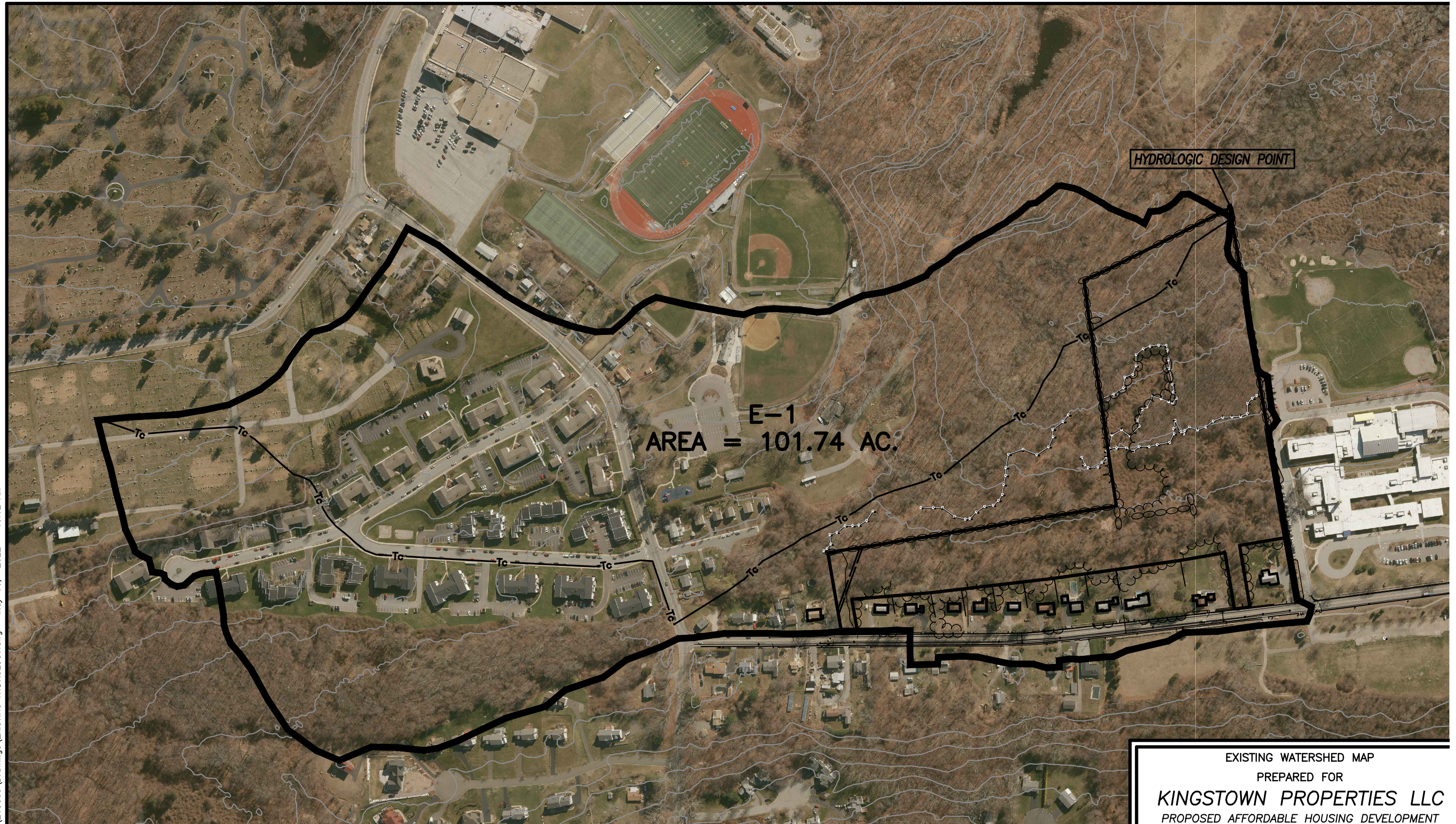
- *Locate the top of the weir or overflow structure at the maximum water surface elevation associated with the WQF, or the water surface elevation in the treatment practice when the entire WQV is being held, whichever is higher.*
- *Determine the diversion structure dimensions required to divert flows in excess of the WQF using standard equations for a rectangular sharp-crested weir, uniform flow in pipes or channels, or orifice depending on the type of diversion structure.*
- *Provide sufficient freeboard in the stormwater treatment practice and flow splitter to accommodate flow over the diversion structure.*
- *Limit the maximum head over the flow diversion structure to avoid surcharging the stormwater treatment practice under high flow conditions. Flow to the stormwater treatment practice at the 100-year water surface elevation should not increase the WQF by more than 10 percent.*
- *Design diversion structures to withstand the effects of freezing, frost in foundations, erosion, and flotation due to high water conditions. These structures should be designed to minimize clogging potential and to allow for ease of inspection and maintenance.*

Design Parameters

Section			
Shape:	Circular		
Material:	Concrete		
Diameter:	12.00	in	
Manning's n:	0.0130		
Number of Barrels:	1		
Inlet			
Inlet Type:	Square Edge with Headwall		
Ke:	0.50		
Inverts			
Inlet Invert Elevation:	95.400	ft	
Outlet Invert Elevation:	95.000	ft	
Length:	71.000	ft	
Slope:	0.56	%	
Culvert Calculation			
Discharge:	3.43	cfs	water quality flow (WGF)
Headwater Elevation:	96.826	ft	top of diversion weir
Tailwater Elevation:	2.000	ft	
Downstream Velocity:	5.14	ft/s	
Downstream Flow Depth:	0.792	ft	
Flow Control Type:	Inlet Control, Submerged		

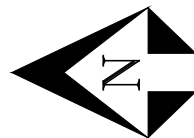
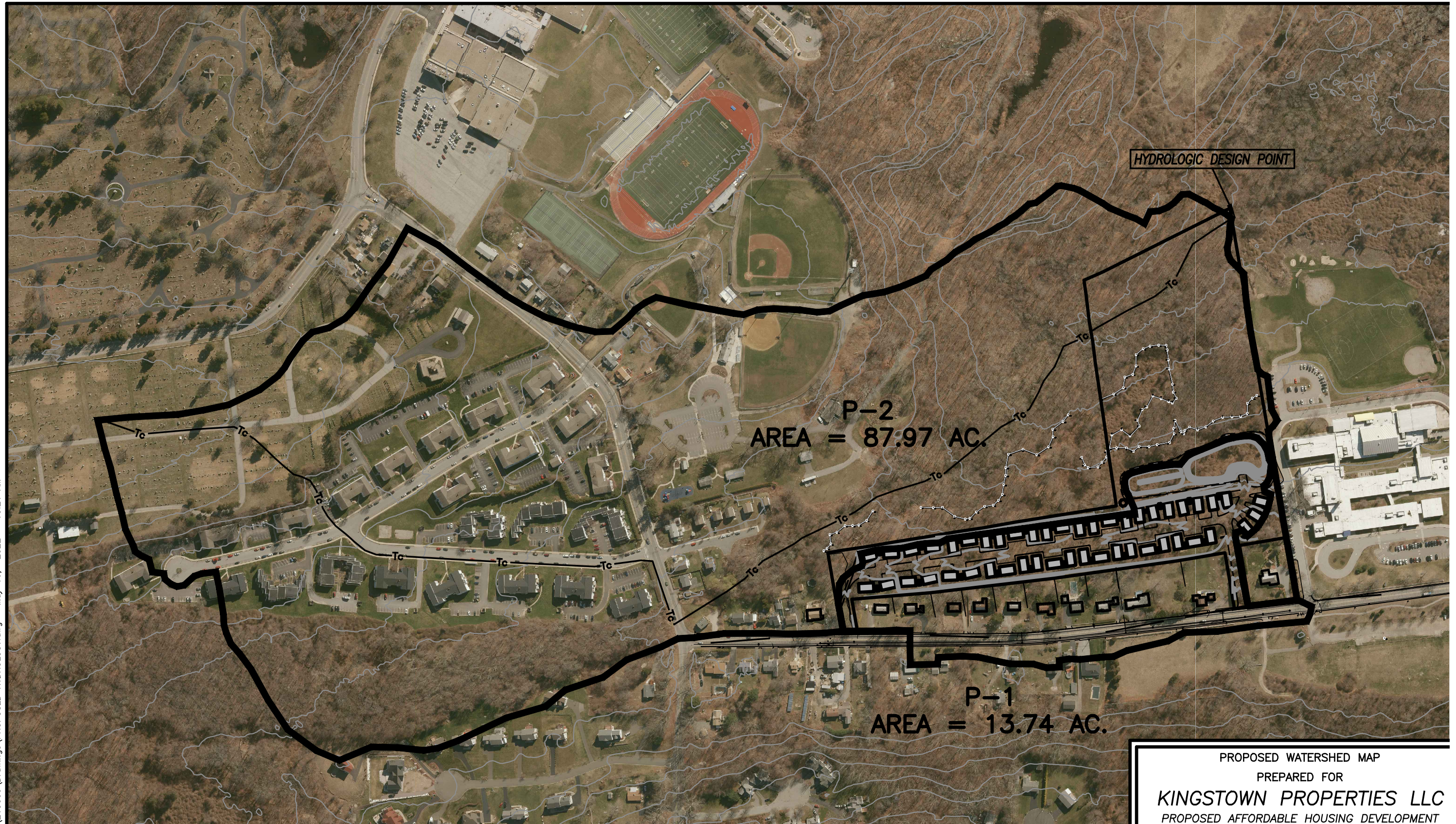
Section 4

Hydrologic Analysis Calculations



EXISTING WATERSHED MAP PREPARED FOR KINGSTOWN PROPERTIES LLC PROPOSED AFFORDABLE HOUSING DEVELOPMENT CLARK LANE WATERFORD, CONNECTICUT	
SCALE: 1" = 300'	DATE: 5/16/2022
JOB No: 213009	DRAWN BY: DJH
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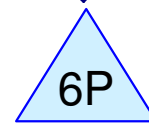
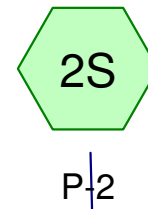
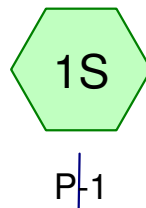
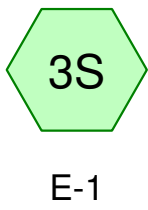
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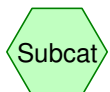
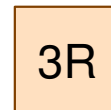
PROPOSED WATERSHED MAP
PREPARED FOR
KINGSTOWN PROPERTIES LLC
PROPOSED AFFORDABLE HOUSING DEVELOPMENT
CLARK LANE
WATERFORD, CONNECTICUT

SCALE: 1" = 300'	DATE: 5/16/2022
JOB No: 213009	DRAWN BY: DJH

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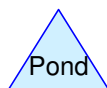
Detention Basin



Subcat



Reach



Pond



Link

Routing Diagram for 213009

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Project Notes

CarlsonStageIncrement|1.0000|

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
21.549	49	50-75% Grass cover, Fair HSG A (1S, 3S)
6.976	69	50-75% Grass cover, Fair HSG B (1S, 3S)
46.790	79	50-75% Grass cover, Fair HSG C (1S, 2S, 3S)
1.996	84	50-75% Grass cover, Fair HSG D (1S, 3S)
22.152	98	Paved parking HSG A (1S, 3S)
1.644	98	Paved parking HSG B (1S, 3S)
19.305	98	Paved parking HSG C (1S, 2S, 3S)
1.046	98	Paved parking HSG D (1S, 3S)
7.008	36	Woods, Fair HSG A (1S, 3S)
7.864	60	Woods, Fair HSG B (1S, 3S)
41.589	73	Woods, Fair HSG C (1S, 2S, 3S)
21.166	79	Woods, Fair HSG D (1S, 3S)
3.956	76	Woods/grass comb., Fair HSG C (1S, 2S, 3S)
0.402	82	Woods/grass comb., Fair HSG D (1S, 3S)
203.443	76	TOTAL AREA

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
50.709	HSG A	1S, 3S
16.484	HSG B	1S, 3S
111.640	HSG C	1S, 2S, 3S
24.610	HSG D	1S, 3S
0.000	Other	
203.443		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
21.549	6.976	46.790	1.996	0.000	77.311	50-75% Grass cover, Fair	1S, 2S, 3S
22.152	1.644	19.305	1.046	0.000	44.147	Paved parking	1S, 2S, 3S
7.008	7.864	41.589	21.166	0.000	77.627	Woods, Fair	1S, 2S, 3S
0.000	0.000	3.956	0.402	0.000	4.358	Woods/grass comb., Fair	1S, 2S, 3S
50.709	16.484	111.640	24.610	0.000	203.443	TOTAL AREA	

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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	6P	89.00	88.00	112.0	0.0089	0.012	24.0	0.0	0.0
2	6P	90.00	89.90	5.0	0.0200	0.012	10.0	0.0	0.0

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Type III 24-hr 2 year Rainfall=3.20"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Muskingum-Cunge method - Pond routing by Stor-Ind method

Subcatchment 1S: P-1

Runoff Area=87.970 ac 20.82% Impervious Runoff Depth>1.07"
Flow Length=4,420' Tc=68.3 min CN=75 Runoff=38.95 cfs 7.866 af

Subcatchment 2S: P-2

Runoff Area=13.736 ac 38.54% Impervious Runoff Depth>1.83"
Tc=26.0 min CN=86 Runoff=17.80 cfs 2.090 af

Subcatchment 3S: E-1

Runoff Area=101.737 ac 20.18% Impervious Runoff Depth>1.13"
Flow Length=4,420' Tc=68.3 min CN=76 Runoff=47.88 cfs 9.584 af

Reach 3R: Overland Flow

Avg. Flow Depth=0.15' Max Vel=0.42 fps Inflow=2.93 cfs 1.902 af
n=0.400 L=760.0' S=0.0368 '/' Capacity=35.52 cfs Outflow=2.93 cfs 1.873 af

Pond 6P: Detention Basin

Peak Elev=92.42' Storage=44,281 cf Inflow=17.80 cfs 2.090 af
Outflow=2.93 cfs 1.902 af

Link 2L: Design Point

Inflow=41.18 cfs 9.739 af
Primary=41.18 cfs 9.739 af

Total Runoff Area = 203.443 ac Runoff Volume = 19.540 af Average Runoff Depth = 1.15"
78.30% Pervious = 159.296 ac 21.70% Impervious = 44.147 ac

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Type III 24-hr 2 year Rainfall=3.20"

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Summary for Subcatchment 1S: P-1

CarlsonPlanXYPos|1171180.9301|691042.4469|

CarlsonSurface||

Runoff = 38.95 cfs @ 12.98 hrs, Volume= 7.866 af, Depth> 1.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (ac)	CN	Description
11.076	98	Paved parking HSG A
10.583	79	Woods, Fair HSG D
1.449	76	Woods/grass comb., Fair HSG C
0.201	82	Woods/grass comb., Fair HSG D
3.504	36	Woods, Fair HSG A
16.559	73	Woods, Fair HSG C
3.932	60	Woods, Fair HSG B
0.822	98	Paved parking HSG B
0.523	98	Paved parking HSG D
5.898	98	Paved parking HSG C
10.774	49	50-75% Grass cover, Fair HSG A
3.488	69	50-75% Grass cover, Fair HSG B
18.163	79	50-75% Grass cover, Fair HSG C
0.998	84	50-75% Grass cover, Fair HSG D
87.970	75	Weighted Average
69.651		79.18% Pervious Area
18.319		20.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	100	0.0200	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
3.6	980	0.0490	4.49		Shallow Concentrated Flow, Paved Kv= 20.3 fps
6.8	1,230		3.00		Direct Entry, pipe flow
43.6	2,110	0.0260	0.81		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
68.3	4,420	Total			

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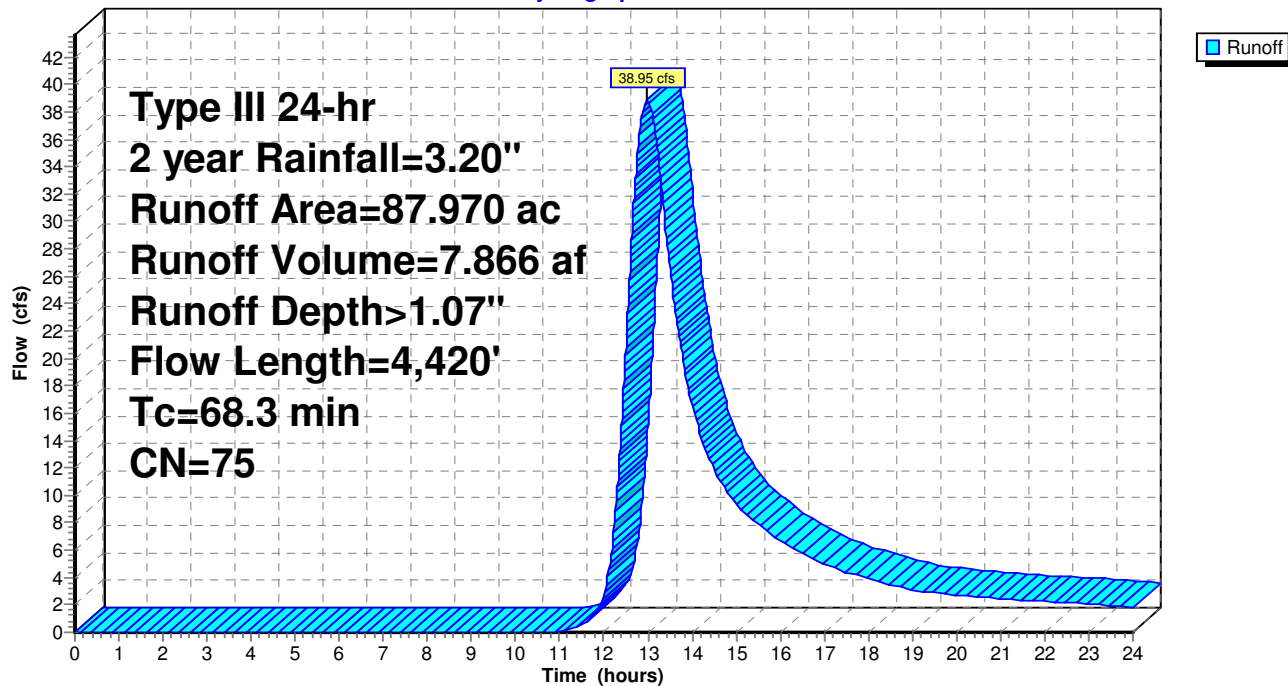
Type III 24-hr 2 year Rainfall=3.20"

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Subcatchment 1S: P-1

Hydrograph



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Type III 24-hr 2 year Rainfall=3.20"

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Summary for Subcatchment 2S: P-2

CarlsonPlanXYPos|1170813.5231|690121.8114|

CarlsonSurface||

Runoff = 17.80 cfs @ 12.36 hrs, Volume= 2.090 af, Depth> 1.83"

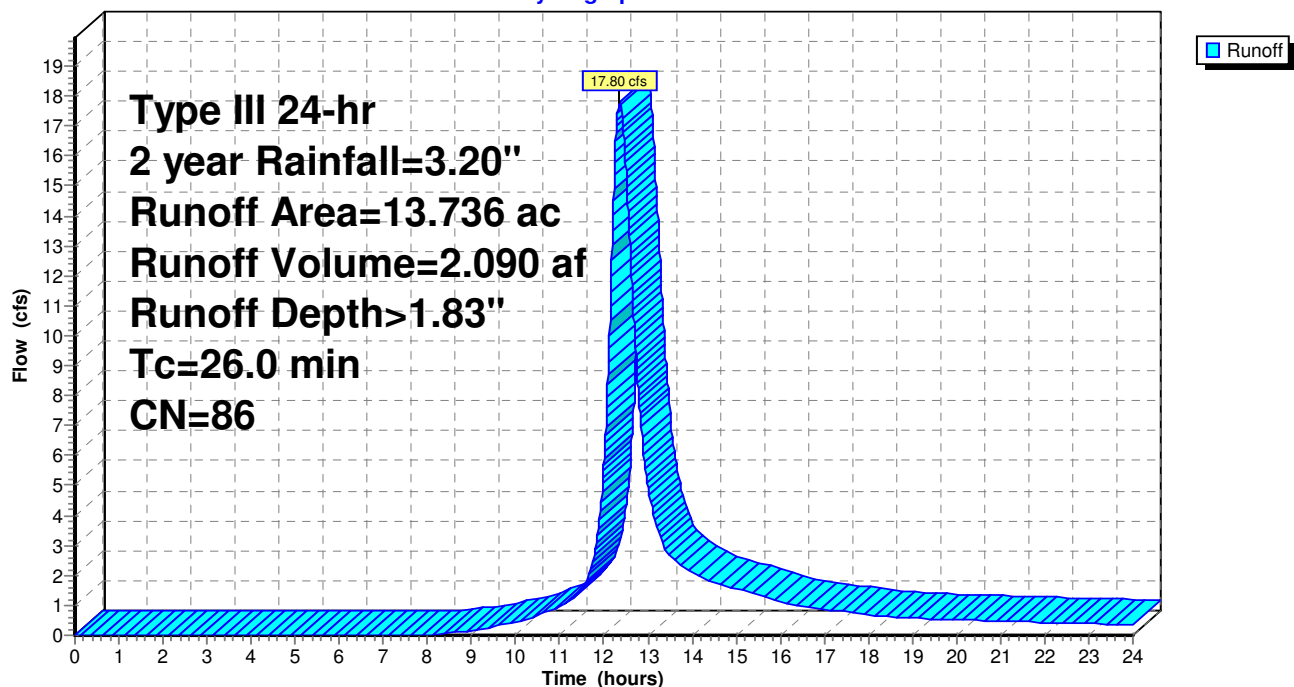
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (ac)	CN	Description
0.464	73	Woods, Fair HSG C
0.525	76	Woods/grass comb., Fair HSG C
5.294	98	Paved parking HSG C
7.453	79	50-75% Grass cover, Fair HSG C
13.736	86	Weighted Average
8.442		61.46% Pervious Area
5.294		38.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.0					Direct Entry, Storm sewer TC

Subcatchment 2S: P-2

Hydrograph



213009*Type III 24-hr 2 year Rainfall=3.20"*

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Summary for Subcatchment 3S: E-1

CarlsonPlanXYPos|1171180.9301|691042.4469|

CarlsonSurface||

Runoff = 47.88 cfs @ 12.98 hrs, Volume= 9.584 af, Depth> 1.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (ac)	CN	Description
11.076	98	Paved parking HSG A
10.583	79	Woods, Fair HSG D
1.982	76	Woods/grass comb., Fair HSG C
0.201	82	Woods/grass comb., Fair HSG D
3.504	36	Woods, Fair HSG A
24.566	73	Woods, Fair HSG C
3.932	60	Woods, Fair HSG B
0.822	98	Paved parking HSG B
0.523	98	Paved parking HSG D
8.113	98	Paved parking HSG C
10.775	49	50-75% Grass cover, Fair HSG A
3.488	69	50-75% Grass cover, Fair HSG B
21.174	79	50-75% Grass cover, Fair HSG C
0.998	84	50-75% Grass cover, Fair HSG D
101.737	76	Weighted Average
81.203		79.82% Pervious Area
20.534		20.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	100	0.0200	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
3.6	980	0.0490	4.49		Shallow Concentrated Flow, Paved Kv= 20.3 fps
6.8	1,230		3.00		Direct Entry, pipe flow
43.6	2,110	0.0260	0.81		Shallow Concentrated Flow, watercourse Woodland Kv= 5.0 fps
68.3	4,420	Total			

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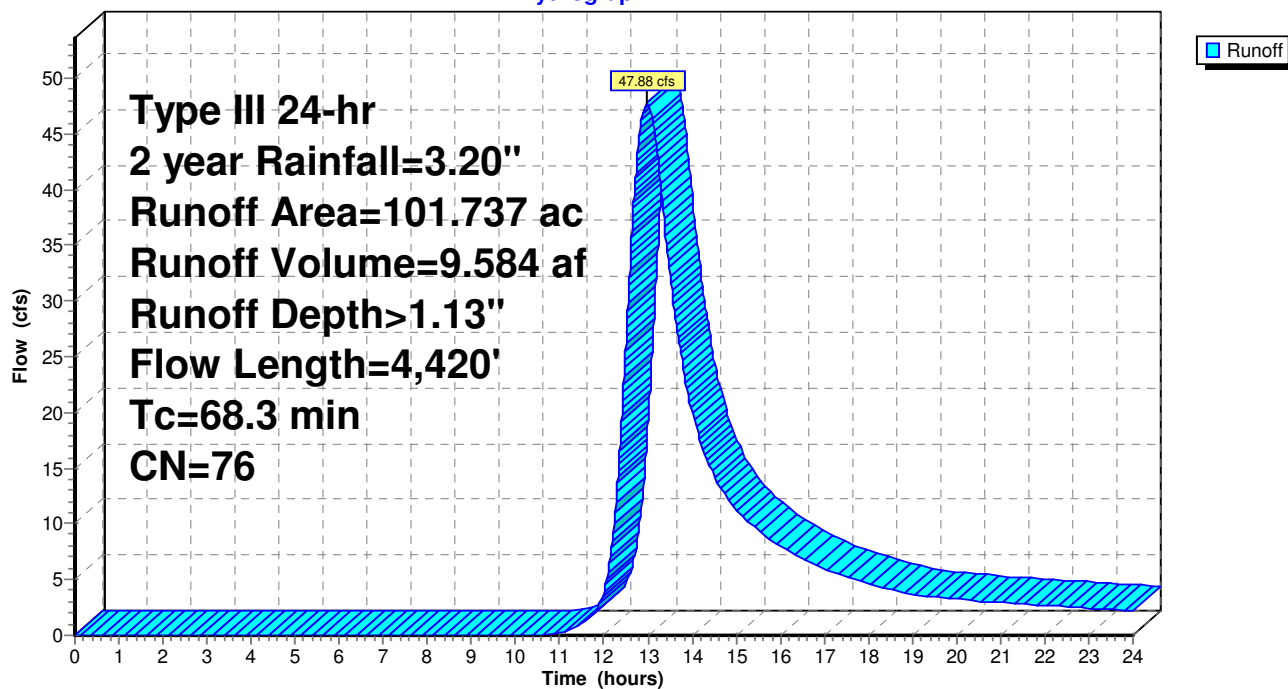
Type III 24-hr 2 year Rainfall=3.20"

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Subcatchment 3S: E-1

Hydrograph



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Type III 24-hr 2 year Rainfall=3.20"

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Summary for Reach 3R: Overland Flow

[79] Warning: Submerged Pond 6P Primary device # 1 OUTLET by 0.15'

Inflow Area = 13.736 ac, 38.54% Impervious, Inflow Depth > 1.66" for 2 year event
Inflow = 2.93 cfs @ 13.38 hrs, Volume= 1.902 af
Outflow = 2.93 cfs @ 13.93 hrs, Volume= 1.873 af, Atten= 0%, Lag= 32.8 min

Routing by Muskingum-Cunge method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Reference Flow= 2.20 cfs Estimated Depth= 0.19' Velocity= 0.23 fps
m= 1.662, c= 0.39 fps, dt= 0.6 min, dx= 760.0' / 55 = 13.8', K= 0.6 min, X= 0.389
Max. Velocity= 0.42 fps, Min. Travel Time= 30.3 min
Avg. Velocity= 0.34 fps, Avg. Travel Time= 37.5 min

Peak Storage= 5,746 cf @ 13.70 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 1.00' Flow Area= 51.0 sf, Capacity= 35.52 cfs

50.00' x 1.00' deep channel, n= 0.400
Side Slope Z-value= 1.0 '/' Top Width= 52.00'
Length= 760.0' Slope= 0.0368 '/'
Inlet Invert= 88.00', Outlet Invert= 60.00'



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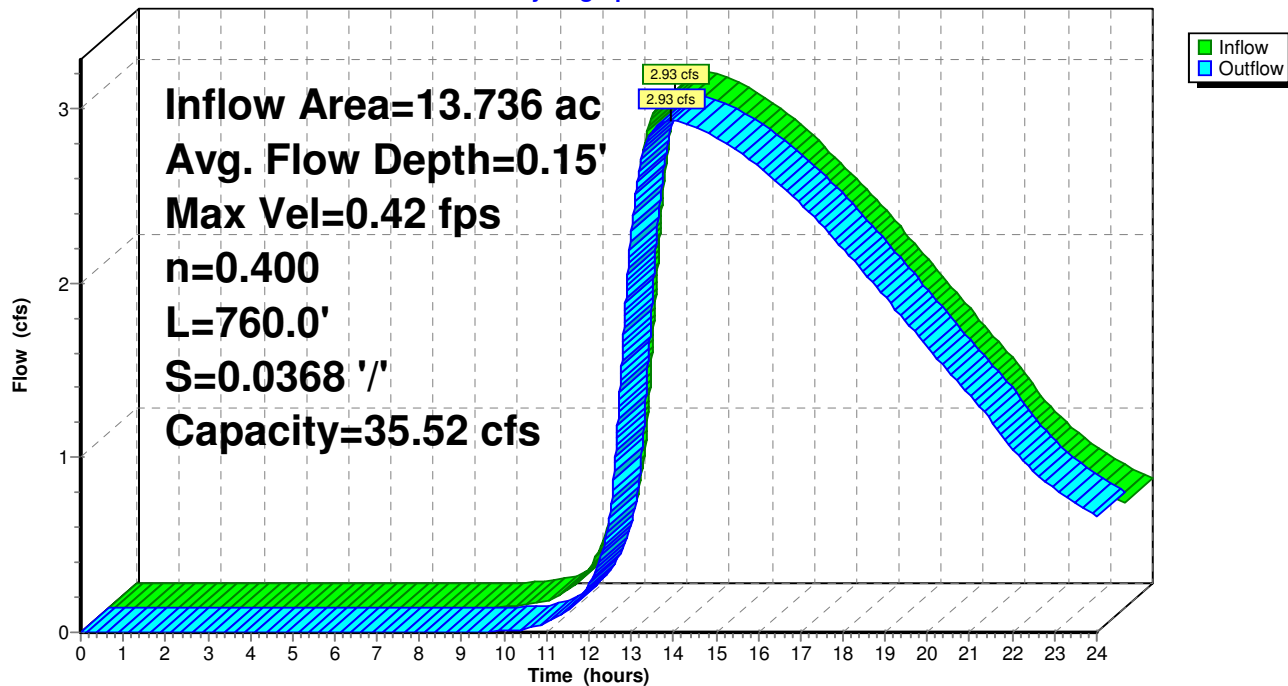
Type III 24-hr 2 year Rainfall=3.20"

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Reach 3R: Overland Flow

Hydrograph



Summary for Pond 6P: Detention Basin

Inflow Area = 13.736 ac, 38.54% Impervious, Inflow Depth > 1.83" for 2 year event
 Inflow = 17.80 cfs @ 12.36 hrs, Volume= 2.090 af
 Outflow = 2.93 cfs @ 13.38 hrs, Volume= 1.902 af, Atten= 84%, Lag= 61.5 min
 Primary = 2.93 cfs @ 13.38 hrs, Volume= 1.902 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 92.42' @ 13.38 hrs Surf.Area= 20,256 sf Storage= 44,281 cf

Plug-Flow detention time= 204.0 min calculated for 1.901 af (91% of inflow)
 Center-of-Mass det. time= 160.6 min (998.5 - 837.8)

Volume	Invert	Avail.Storage	Storage Description
#1	90.00'	127,579 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
90.00	16,410	0	0
92.00	19,568	35,978	35,978
94.00	22,870	42,438	78,416
95.00	24,576	23,723	102,139
96.00	26,304	25,440	127,579

Device	Routing	Invert	Outlet Devices
#1	Primary	89.00'	24.0" Round Culvert L= 112.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 89.00' / 88.00' S= 0.0089 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	90.00'	10.0" Round Culvert L= 5.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 90.00' / 89.90' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 0.55 sf
#3	Device 1	93.90'	30.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Primary	95.00'	20.0' long x 13.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.60 2.64 2.70 2.66 2.65 2.66 2.65 2.63

Primary OutFlow Max=2.93 cfs @ 13.38 hrs HW=92.42' (Free Discharge)

1=Culvert (Passes 2.93 cfs of 23.52 cfs potential flow)
 2=Culvert (Inlet Controls 2.93 cfs @ 5.38 fps)
 3=Orifice/Grate (Controls 0.00 cfs)
 4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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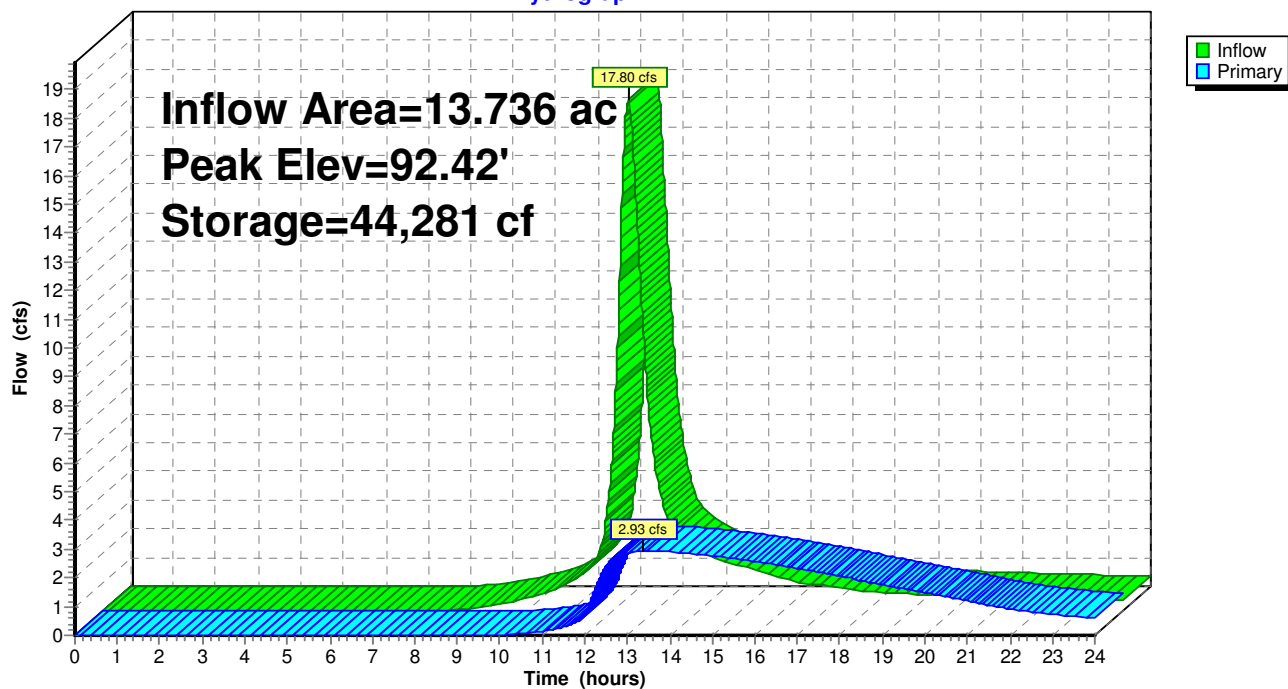
Type III 24-hr 2 year Rainfall=3.20"

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Pond 6P: Detention Basin

Hydrograph



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Type III 24-hr 2 year Rainfall=3.20"

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Summary for Link 2L: Design Point

Inflow Area = 101.706 ac, 23.22% Impervious, Inflow Depth > 1.15" for 2 year event

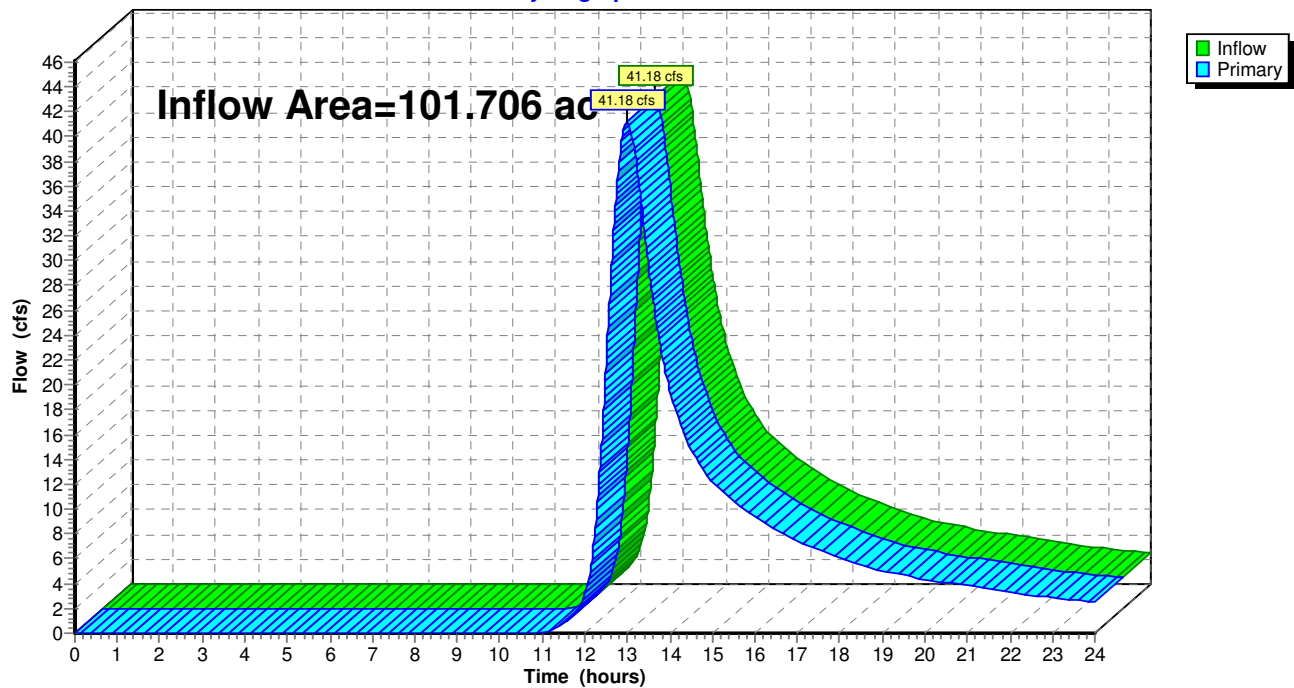
Inflow = 41.18 cfs @ 12.98 hrs, Volume= 9.739 af

Primary = 41.18 cfs @ 12.98 hrs, Volume= 9.739 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 2L: Design Point

Hydrograph



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Type III 24-hr 5 year Rainfall=4.20"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Muskingum-Cunge method - Pond routing by Stor-Ind method

Subcatchment 1S: P-1

Runoff Area=87.970 ac 20.82% Impervious Runoff Depth>1.79"
Flow Length=4,420' Tc=68.3 min CN=75 Runoff=67.00 cfs 13.101 af

Subcatchment 2S: P-2

Runoff Area=13.736 ac 38.54% Impervious Runoff Depth>2.71"
Tc=26.0 min CN=86 Runoff=26.38 cfs 3.108 af

Subcatchment 3S: E-1

Runoff Area=101.737 ac 20.18% Impervious Runoff Depth>1.86"
Flow Length=4,420' Tc=68.3 min CN=76 Runoff=81.00 cfs 15.781 af

Reach 3R: Overland Flow

Avg. Flow Depth=0.17' Max Vel=0.45 fps Inflow=3.69 cfs 2.800 af
n=0.400 L=760.0' S=0.0368 '/' Capacity=35.52 cfs Outflow=3.69 cfs 2.746 af

Pond 6P: Detention Basin

Peak Elev=93.59' Storage=69,188 cf Inflow=26.38 cfs 3.108 af
Outflow=3.69 cfs 2.800 af

Link 2L: Design Point

Inflow=70.03 cfs 15.846 af
Primary=70.03 cfs 15.846 af

Total Runoff Area = 203.443 ac Runoff Volume = 31.990 af Average Runoff Depth = 1.89"
78.30% Pervious = 159.296 ac 21.70% Impervious = 44.147 ac

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Type III 24-hr 5 year Rainfall=4.20"

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Summary for Subcatchment 1S: P-1

CarlsonPlanXYPos|1171180.9301|691042.4469|

CarlsonSurface||

Runoff = 67.00 cfs @ 12.97 hrs, Volume= 13.101 af, Depth> 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 5 year Rainfall=4.20"

Area (ac)	CN	Description
11.076	98	Paved parking HSG A
10.583	79	Woods, Fair HSG D
1.449	76	Woods/grass comb., Fair HSG C
0.201	82	Woods/grass comb., Fair HSG D
3.504	36	Woods, Fair HSG A
16.559	73	Woods, Fair HSG C
3.932	60	Woods, Fair HSG B
0.822	98	Paved parking HSG B
0.523	98	Paved parking HSG D
5.898	98	Paved parking HSG C
10.774	49	50-75% Grass cover, Fair HSG A
3.488	69	50-75% Grass cover, Fair HSG B
18.163	79	50-75% Grass cover, Fair HSG C
0.998	84	50-75% Grass cover, Fair HSG D
87.970	75	Weighted Average
69.651		79.18% Pervious Area
18.319		20.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	100	0.0200	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
3.6	980	0.0490	4.49		Shallow Concentrated Flow, Paved Kv= 20.3 fps
6.8	1,230		3.00		Direct Entry, pipe flow
43.6	2,110	0.0260	0.81		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
68.3	4,420	Total			

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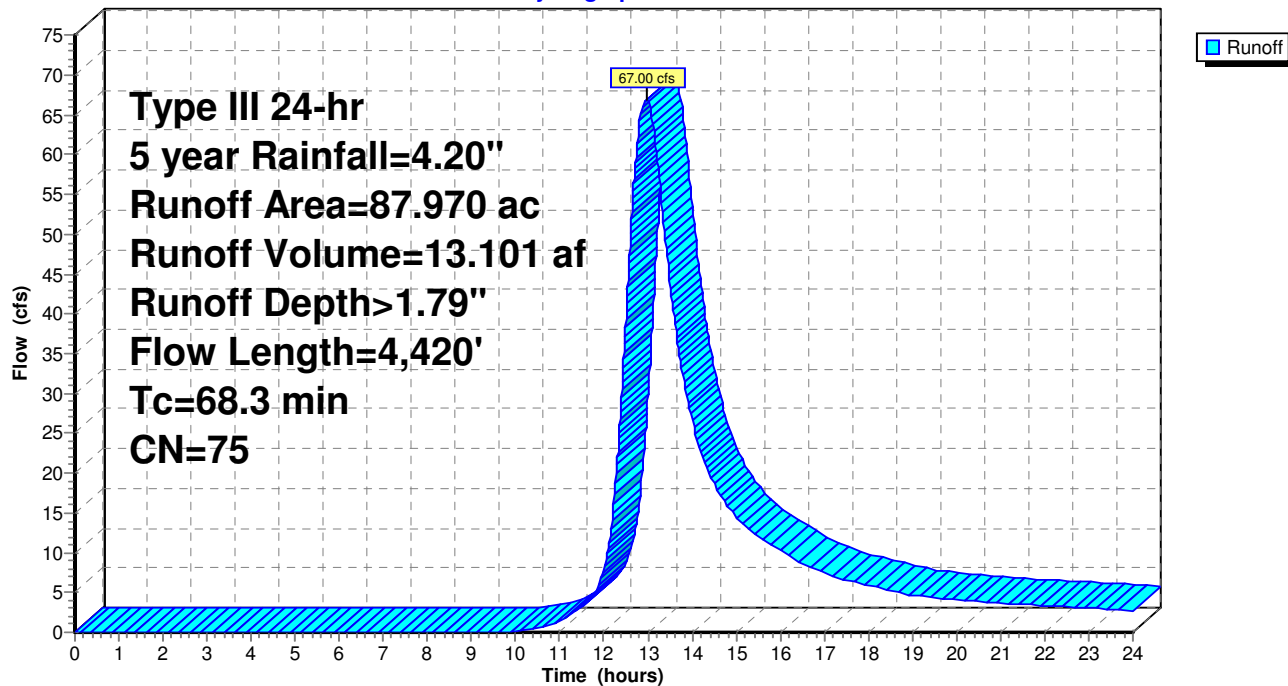
Type III 24-hr 5 year Rainfall=4.20"

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Subcatchment 1S: P-1

Hydrograph



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Type III 24-hr 5 year Rainfall=4.20"

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Summary for Subcatchment 2S: P-2

CarlsonPlanXYPos|1170813.5231|690121.8114|

CarlsonSurface||

Runoff = 26.38 cfs @ 12.34 hrs, Volume= 3.108 af, Depth> 2.71"

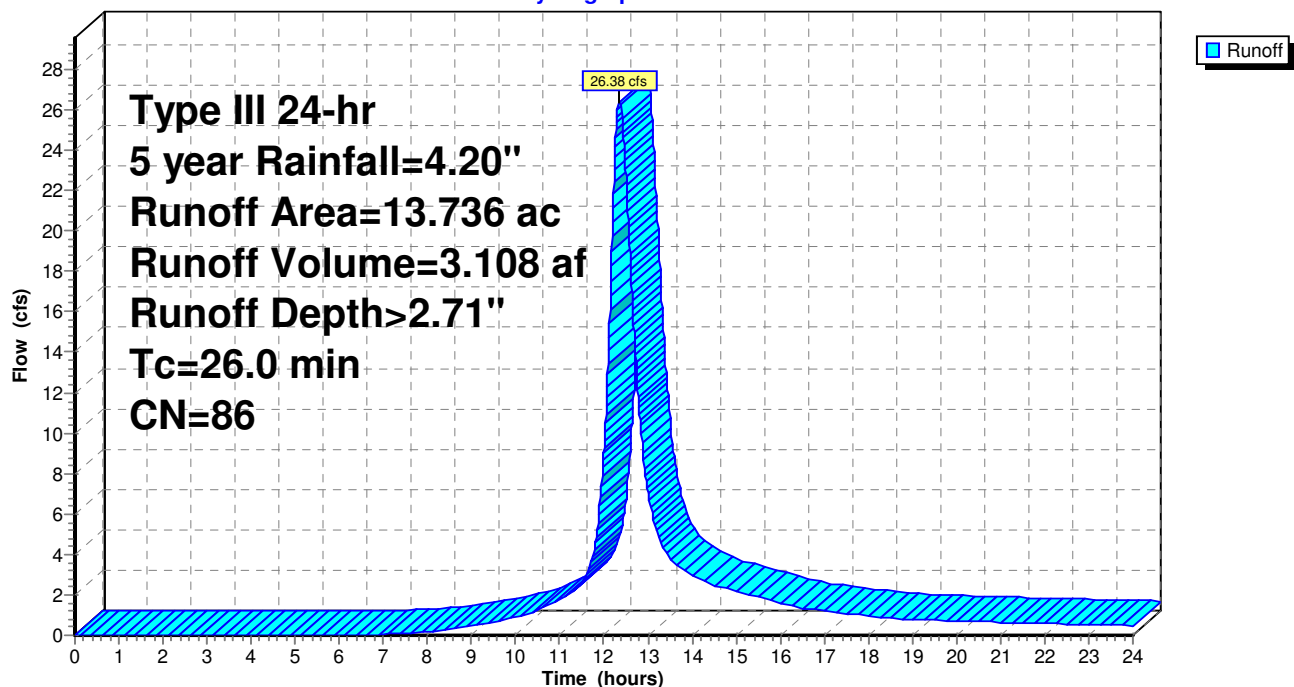
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 5 year Rainfall=4.20"

Area (ac)	CN	Description
0.464	73	Woods, Fair HSG C
0.525	76	Woods/grass comb., Fair HSG C
5.294	98	Paved parking HSG C
7.453	79	50-75% Grass cover, Fair HSG C
13.736	86	Weighted Average
8.442		61.46% Pervious Area
5.294		38.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.0					Direct Entry, Storm sewer TC

Subcatchment 2S: P-2

Hydrograph



Summary for Subcatchment 3S: E-1

CarlsonPlanXYPos|1171180.9301|691042.4469|

CarlsonSurface||

Runoff = 81.00 cfs @ 12.97 hrs, Volume= 15.781 af, Depth> 1.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 5 year Rainfall=4.20"

Area (ac)	CN	Description
11.076	98	Paved parking HSG A
10.583	79	Woods, Fair HSG D
1.982	76	Woods/grass comb., Fair HSG C
0.201	82	Woods/grass comb., Fair HSG D
3.504	36	Woods, Fair HSG A
24.566	73	Woods, Fair HSG C
3.932	60	Woods, Fair HSG B
0.822	98	Paved parking HSG B
0.523	98	Paved parking HSG D
8.113	98	Paved parking HSG C
10.775	49	50-75% Grass cover, Fair HSG A
3.488	69	50-75% Grass cover, Fair HSG B
21.174	79	50-75% Grass cover, Fair HSG C
0.998	84	50-75% Grass cover, Fair HSG D
101.737	76	Weighted Average
81.203		79.82% Pervious Area
20.534		20.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	100	0.0200	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
3.6	980	0.0490	4.49		Shallow Concentrated Flow, Paved Kv= 20.3 fps
6.8	1,230		3.00		Direct Entry, pipe flow
43.6	2,110	0.0260	0.81		Shallow Concentrated Flow, watercourse Woodland Kv= 5.0 fps
68.3	4,420	Total			

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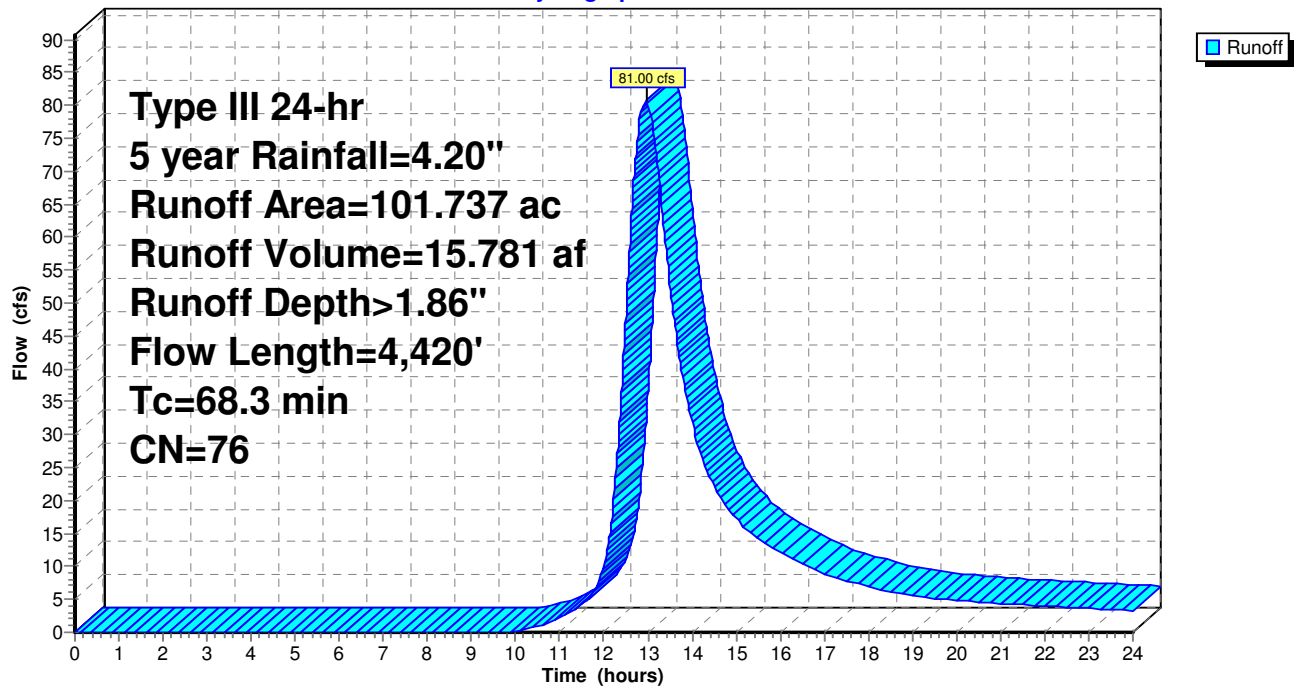
Type III 24-hr 5 year Rainfall=4.20"

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Subcatchment 3S: E-1

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Type III 24-hr 5 year Rainfall=4.20"

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Summary for Reach 3R: Overland Flow

[79] Warning: Submerged Pond 6P Primary device # 1 OUTLET by 0.17'

Inflow Area = 13.736 ac, 38.54% Impervious, Inflow Depth > 2.45" for 5 year event
Inflow = 3.69 cfs @ 13.53 hrs, Volume= 2.800 af
Outflow = 3.69 cfs @ 14.03 hrs, Volume= 2.746 af, Atten= 0%, Lag= 30.0 min

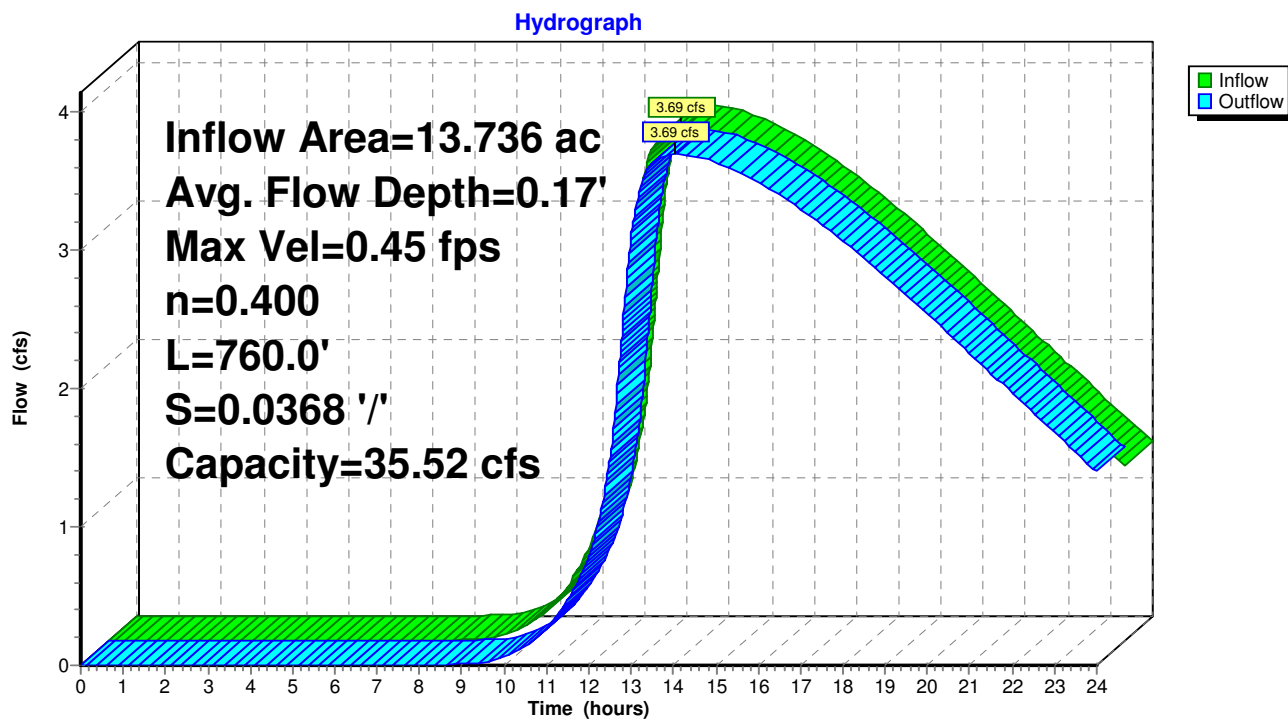
Routing by Muskingum-Cunge method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Reference Flow= 2.77 cfs Estimated Depth= 0.22' Velocity= 0.26 fps
m= 1.662, c= 0.42 fps, dt= 0.6 min, dx= 760.0' / 50 = 15.2', K= 0.6 min, X= 0.384
Max. Velocity= 0.45 fps, Min. Travel Time= 28.4 min
Avg. Velocity= 0.37 fps, Avg. Travel Time= 34.1 min

Peak Storage= 6,612 cf @ 13.82 hrs
Average Depth at Peak Storage= 0.17'
Bank-Full Depth= 1.00' Flow Area= 51.0 sf, Capacity= 35.52 cfs

50.00' x 1.00' deep channel, n= 0.400
Side Slope Z-value= 1.0 '/' Top Width= 52.00'
Length= 760.0' Slope= 0.0368 '/'
Inlet Invert= 88.00', Outlet Invert= 60.00'



Reach 3R: Overland Flow



Summary for Pond 6P: Detention Basin

Inflow Area = 13.736 ac, 38.54% Impervious, Inflow Depth > 2.71" for 5 year event
 Inflow = 26.38 cfs @ 12.34 hrs, Volume= 3.108 af
 Outflow = 3.69 cfs @ 13.53 hrs, Volume= 2.800 af, Atten= 86%, Lag= 71.4 min
 Primary = 3.69 cfs @ 13.53 hrs, Volume= 2.800 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 93.59' @ 13.53 hrs Surf.Area= 22,194 sf Storage= 69,188 cf

Plug-Flow detention time= 237.3 min calculated for 2.799 af (90% of inflow)
 Center-of-Mass det. time= 190.7 min (1,017.4 - 826.7)

Volume	Invert	Avail.Storage	Storage Description
#1	90.00'	127,579 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
90.00	16,410	0	0
92.00	19,568	35,978	35,978
94.00	22,870	42,438	78,416
95.00	24,576	23,723	102,139
96.00	26,304	25,440	127,579

Device	Routing	Invert	Outlet Devices
#1	Primary	89.00'	24.0" Round Culvert L= 112.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 89.00' / 88.00' S= 0.0089 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	90.00'	10.0" Round Culvert L= 5.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 90.00' / 89.90' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 0.55 sf
#3	Device 1	93.90'	30.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Primary	95.00'	20.0' long x 13.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.60 2.64 2.70 2.66 2.65 2.66 2.65 2.63

Primary OutFlow Max=3.69 cfs @ 13.53 hrs HW=93.59' (Free Discharge)

1=Culvert (Passes 3.69 cfs of 28.66 cfs potential flow)
 2=Culvert (Inlet Controls 3.69 cfs @ 6.77 fps)
 3=Orifice/Grate (Controls 0.00 cfs)
 4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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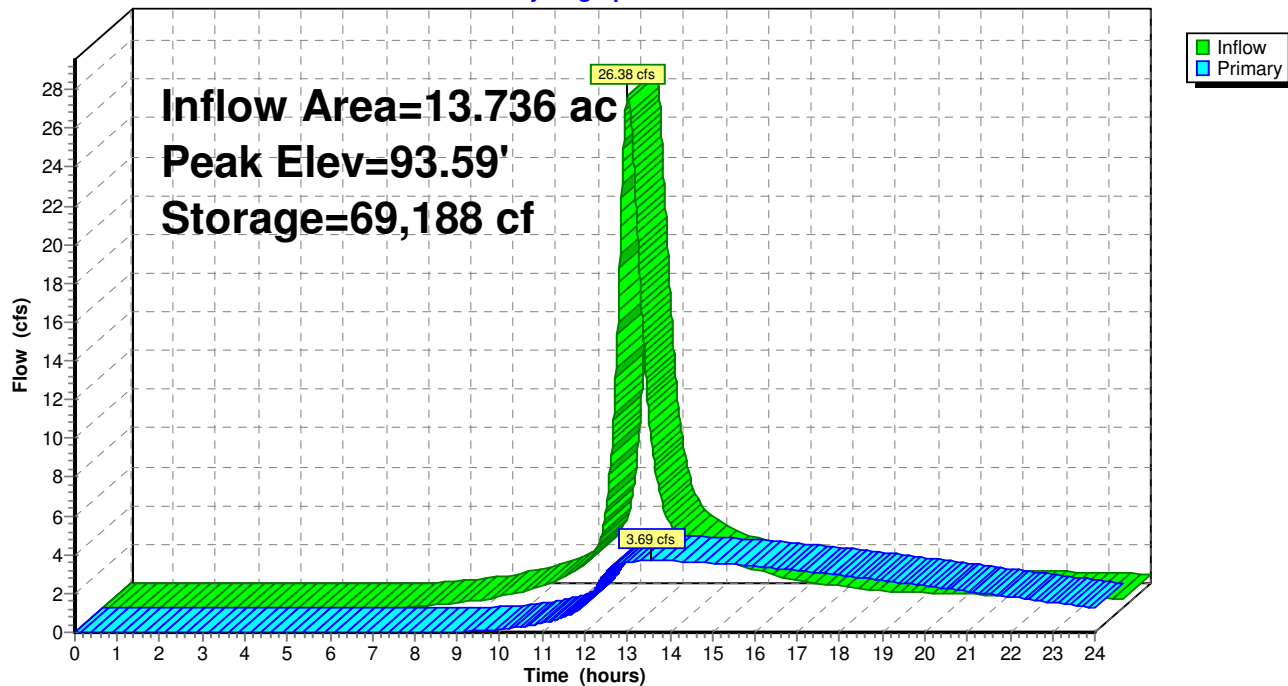
Type III 24-hr 5 year Rainfall=4.20"

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Pond 6P: Detention Basin

Hydrograph



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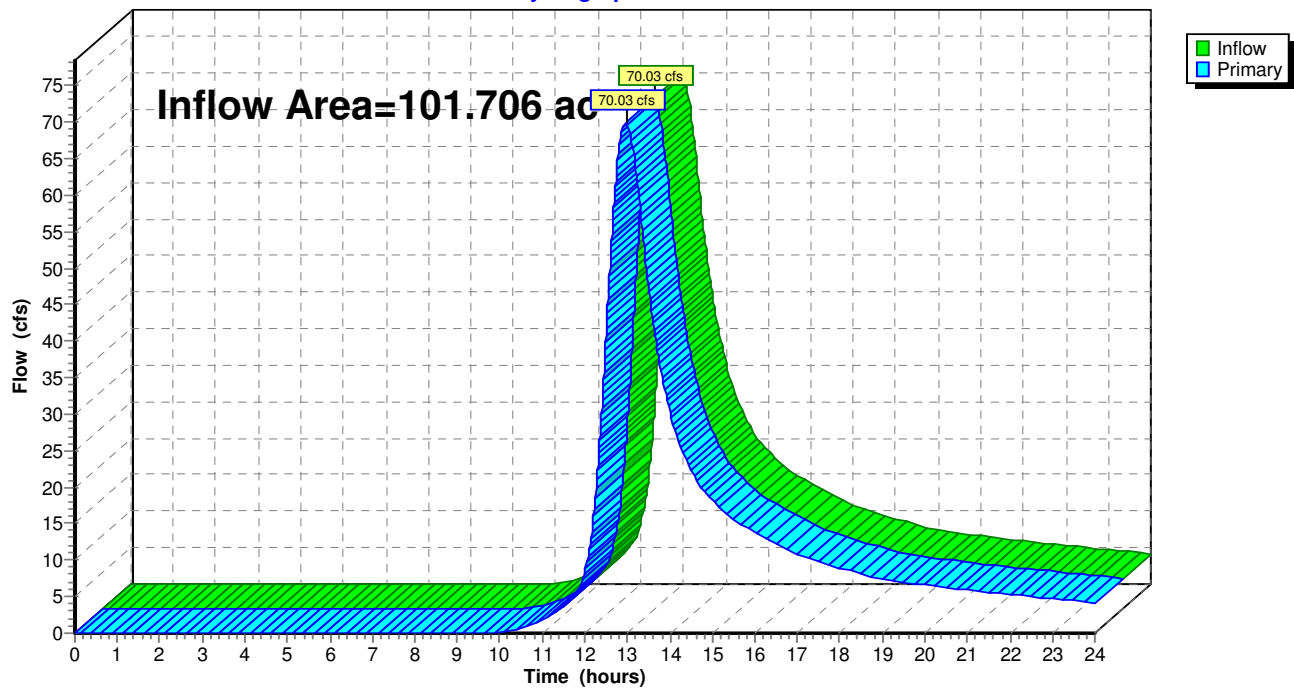
Summary for Link 2L: Design Point

Inflow Area = 101.706 ac, 23.22% Impervious, Inflow Depth > 1.87" for 5 year event
Inflow = 70.03 cfs @ 12.98 hrs, Volume= 15.846 af
Primary = 70.03 cfs @ 12.98 hrs, Volume= 15.846 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 2L: Design Point

Hydrograph



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Type III 24-hr 10 year Rainfall=4.80"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Muskingum-Cunge method - Pond routing by Stor-Ind method

Subcatchment 1S: P-1

Runoff Area=87.970 ac 20.82% Impervious Runoff Depth>2.25"
Flow Length=4,420' Tc=68.3 min CN=75 Runoff=85.03 cfs 16.501 af

Subcatchment 2S: P-2

Runoff Area=13.736 ac 38.54% Impervious Runoff Depth>3.27"
Tc=26.0 min CN=86 Runoff=31.60 cfs 3.738 af

Subcatchment 3S: E-1

Runoff Area=101.737 ac 20.18% Impervious Runoff Depth>2.33"
Flow Length=4,420' Tc=68.3 min CN=76 Runoff=102.16 cfs 19.787 af

Reach 3R: Overland Flow

Avg. Flow Depth=0.24' Max Vel=0.59 fps Inflow=6.61 cfs 3.335 af
n=0.400 L=760.0' S=0.0368 '/' Capacity=35.52 cfs Outflow=6.60 cfs 3.280 af

Pond 6P: Detention Basin

Peak Elev=94.12' Storage=81,118 cf Inflow=31.60 cfs 3.738 af
Outflow=6.61 cfs 3.335 af

Link 2L: Design Point

Inflow=88.62 cfs 19.782 af
Primary=88.62 cfs 19.782 af

Total Runoff Area = 203.443 ac Runoff Volume = 40.025 af Average Runoff Depth = 2.36"
78.30% Pervious = 159.296 ac 21.70% Impervious = 44.147 ac

Summary for Subcatchment 1S: P-1

CarlsonPlanXYPos|1171180.9301|691042.4469|

CarlsonSurface||

Runoff = 85.03 cfs @ 12.97 hrs, Volume= 16.501 af, Depth> 2.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 year Rainfall=4.80"

Area (ac)	CN	Description
11.076	98	Paved parking HSG A
10.583	79	Woods, Fair HSG D
1.449	76	Woods/grass comb., Fair HSG C
0.201	82	Woods/grass comb., Fair HSG D
3.504	36	Woods, Fair HSG A
16.559	73	Woods, Fair HSG C
3.932	60	Woods, Fair HSG B
0.822	98	Paved parking HSG B
0.523	98	Paved parking HSG D
5.898	98	Paved parking HSG C
10.774	49	50-75% Grass cover, Fair HSG A
3.488	69	50-75% Grass cover, Fair HSG B
18.163	79	50-75% Grass cover, Fair HSG C
0.998	84	50-75% Grass cover, Fair HSG D
87.970	75	Weighted Average
69.651		79.18% Pervious Area
18.319		20.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	100	0.0200	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
3.6	980	0.0490	4.49		Shallow Concentrated Flow, Paved Kv= 20.3 fps
6.8	1,230		3.00		Direct Entry, pipe flow
43.6	2,110	0.0260	0.81		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
68.3	4,420	Total			

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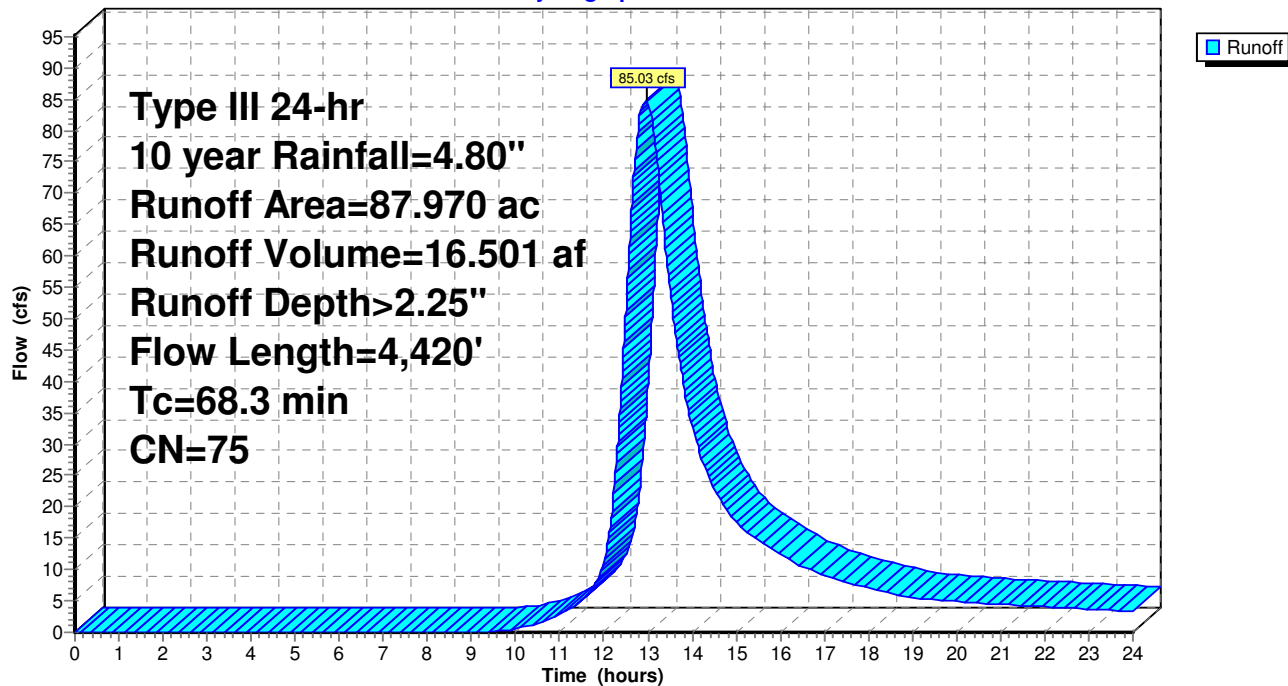
Type III 24-hr 10 year Rainfall=4.80"

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Subcatchment 1S: P-1

Hydrograph



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Type III 24-hr 10 year Rainfall=4.80"

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Summary for Subcatchment 2S: P-2

CarlsonPlanXYPos|1170813.5231|690121.8114|

CarlsonSurface||

Runoff = 31.60 cfs @ 12.34 hrs, Volume= 3.738 af, Depth> 3.27"

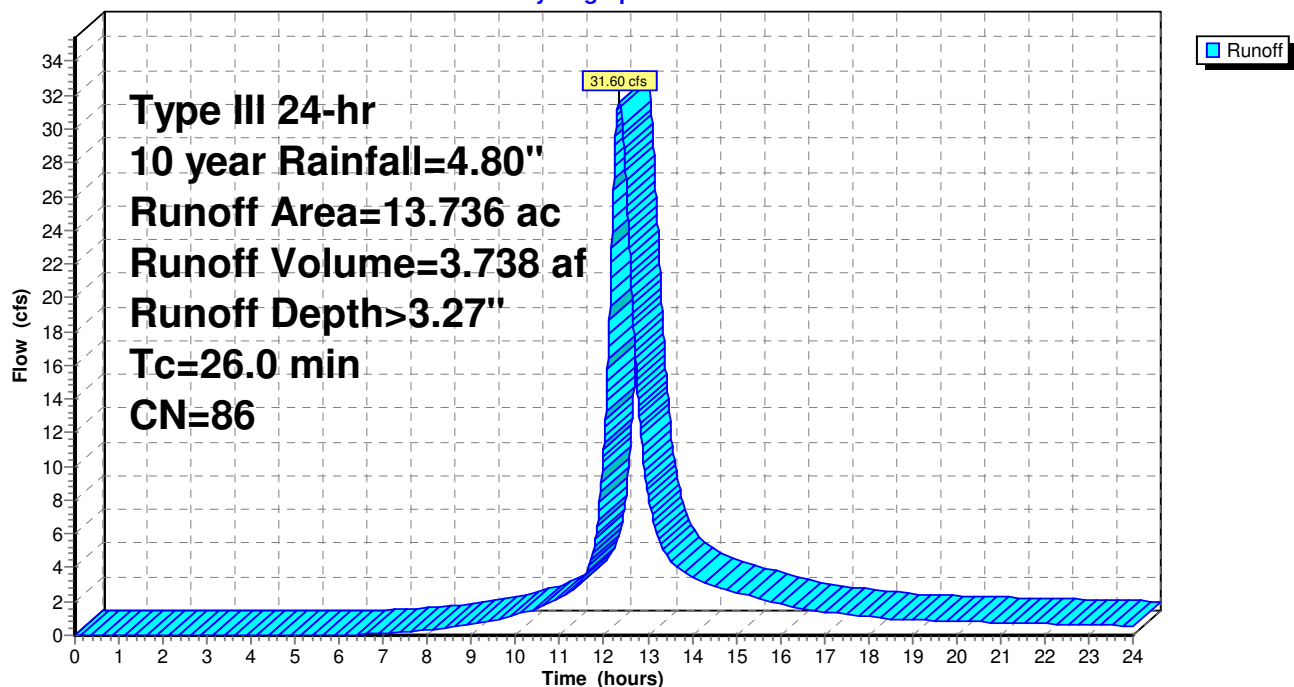
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 year Rainfall=4.80"

Area (ac)	CN	Description
0.464	73	Woods, Fair HSG C
0.525	76	Woods/grass comb., Fair HSG C
5.294	98	Paved parking HSG C
7.453	79	50-75% Grass cover, Fair HSG C
13.736	86	Weighted Average
8.442		61.46% Pervious Area
5.294		38.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.0					Direct Entry, Storm sewer TC

Subcatchment 2S: P-2

Hydrograph



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Type III 24-hr 10 year Rainfall=4.80"

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Summary for Subcatchment 3S: E-1

CarlsonPlanXYPos|1171180.9301|691042.4469|

CarlsonSurface||

Runoff = 102.16 cfs @ 12.97 hrs, Volume= 19.787 af, Depth> 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 year Rainfall=4.80"

Area (ac)	CN	Description
11.076	98	Paved parking HSG A
10.583	79	Woods, Fair HSG D
1.982	76	Woods/grass comb., Fair HSG C
0.201	82	Woods/grass comb., Fair HSG D
3.504	36	Woods, Fair HSG A
24.566	73	Woods, Fair HSG C
3.932	60	Woods, Fair HSG B
0.822	98	Paved parking HSG B
0.523	98	Paved parking HSG D
8.113	98	Paved parking HSG C
10.775	49	50-75% Grass cover, Fair HSG A
3.488	69	50-75% Grass cover, Fair HSG B
21.174	79	50-75% Grass cover, Fair HSG C
0.998	84	50-75% Grass cover, Fair HSG D
101.737	76	Weighted Average
81.203		79.82% Pervious Area
20.534		20.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	100	0.0200	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
3.6	980	0.0490	4.49		Shallow Concentrated Flow, Paved Kv= 20.3 fps
6.8	1,230		3.00		Direct Entry, pipe flow
43.6	2,110	0.0260	0.81		Shallow Concentrated Flow, watercourse Woodland Kv= 5.0 fps
68.3	4,420	Total			

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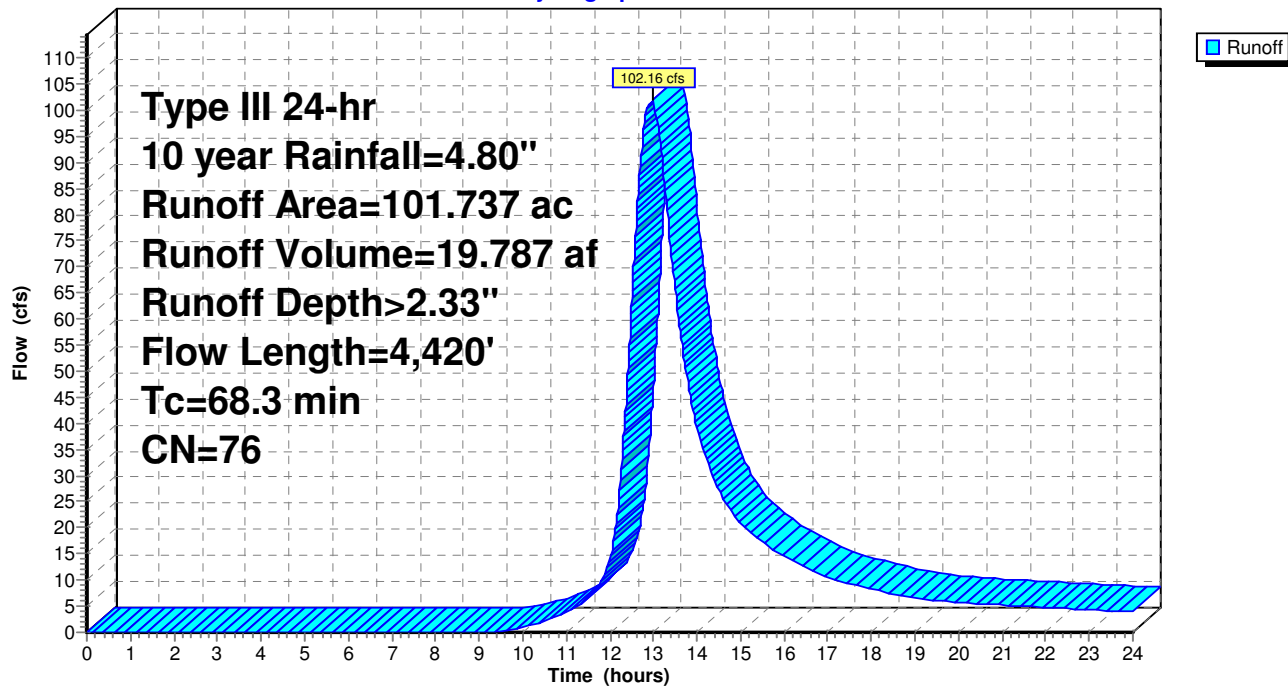
Type III 24-hr 10 year Rainfall=4.80"

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Subcatchment 3S: E-1

Hydrograph



Summary for Reach 3R: Overland Flow

[79] Warning: Submerged Pond 6P Primary device # 1 OUTLET by 0.24'

Inflow Area = 13.736 ac, 38.54% Impervious, Inflow Depth > 2.91" for 10 year event
Inflow = 6.61 cfs @ 13.14 hrs, Volume= 3.335 af
Outflow = 6.60 cfs @ 13.53 hrs, Volume= 3.280 af, Atten= 0%, Lag= 23.9 min

Routing by Muskingum-Cunge method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Reference Flow= 4.96 cfs Estimated Depth= 0.31' Velocity= 0.32 fps
m= 1.660, c= 0.53 fps, dt= 0.6 min, dx= 760.0' / 40 = 19.0', K= 0.6 min, X= 0.368
Max. Velocity= 0.59 fps, Min. Travel Time= 21.4 min
Avg. Velocity= 0.48 fps, Avg. Travel Time= 26.4 min

Peak Storage= 9,149 cf @ 13.37 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 1.00' Flow Area= 51.0 sf, Capacity= 35.52 cfs

50.00' x 1.00' deep channel, n= 0.400
Side Slope Z-value= 1.0 '/' Top Width= 52.00'
Length= 760.0' Slope= 0.0368 '/'
Inlet Invert= 88.00', Outlet Invert= 60.00'



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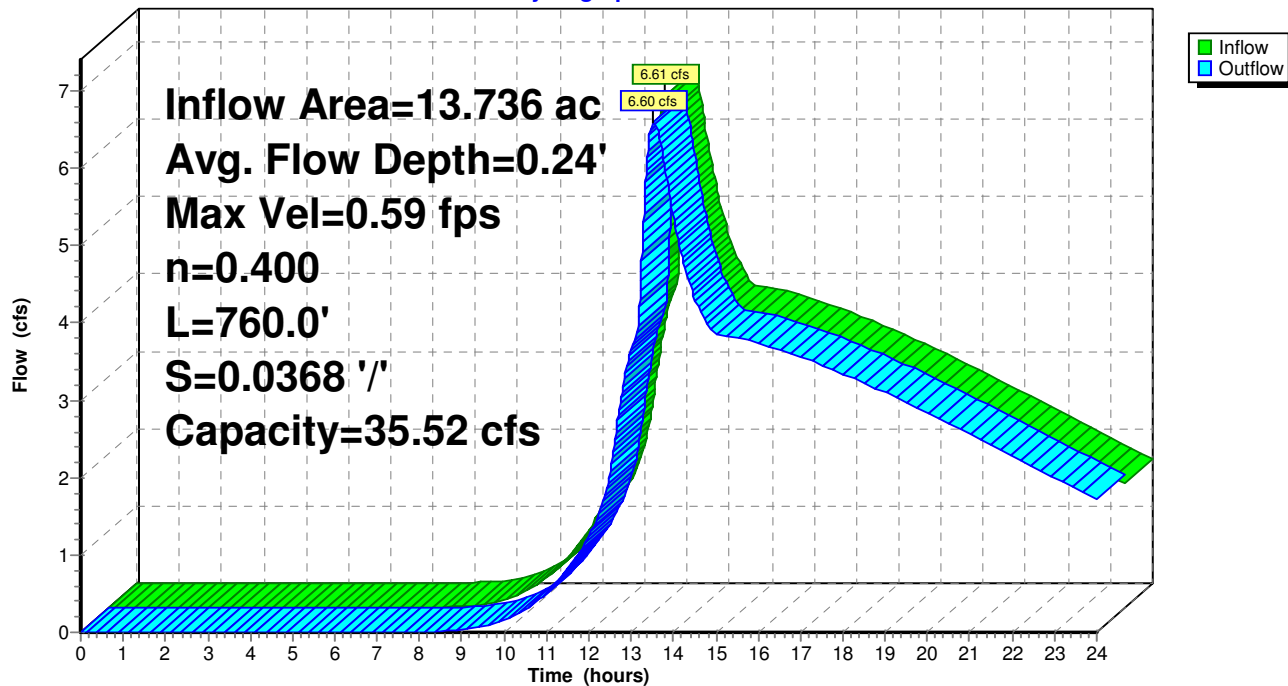
Type III 24-hr 10 year Rainfall=4.80"

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Reach 3R: Overland Flow

Hydrograph



Summary for Pond 6P: Detention Basin

Inflow Area = 13.736 ac, 38.54% Impervious, Inflow Depth > 3.27" for 10 year event
 Inflow = 31.60 cfs @ 12.34 hrs, Volume= 3.738 af
 Outflow = 6.61 cfs @ 13.14 hrs, Volume= 3.335 af, Atten= 79%, Lag= 47.6 min
 Primary = 6.61 cfs @ 13.14 hrs, Volume= 3.335 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 94.12' @ 13.14 hrs Surf.Area= 23,071 sf Storage= 81,118 cf

Plug-Flow detention time= 236.0 min calculated for 3.334 af (89% of inflow)
 Center-of-Mass det. time= 186.4 min (1,007.9 - 821.5)

Volume	Invert	Avail.Storage	Storage Description
#1	90.00'	127,579 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
90.00	16,410	0	0
92.00	19,568	35,978	35,978
94.00	22,870	42,438	78,416
95.00	24,576	23,723	102,139
96.00	26,304	25,440	127,579

Device	Routing	Invert	Outlet Devices
#1	Primary	89.00'	24.0" Round Culvert L= 112.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 89.00' / 88.00' S= 0.0089 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	90.00'	10.0" Round Culvert L= 5.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 90.00' / 89.90' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 0.55 sf
#3	Device 1	93.90'	30.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Primary	95.00'	20.0' long x 13.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.60 2.64 2.70 2.66 2.65 2.66 2.65 2.63

Primary OutFlow Max=6.60 cfs @ 13.14 hrs HW=94.12' (Free Discharge)

1=Culvert (Passes 6.60 cfs of 30.69 cfs potential flow)
 2=Culvert (Inlet Controls 3.99 cfs @ 7.31 fps)
 3=Orifice/Grate (Weir Controls 2.61 cfs @ 1.53 fps)
 4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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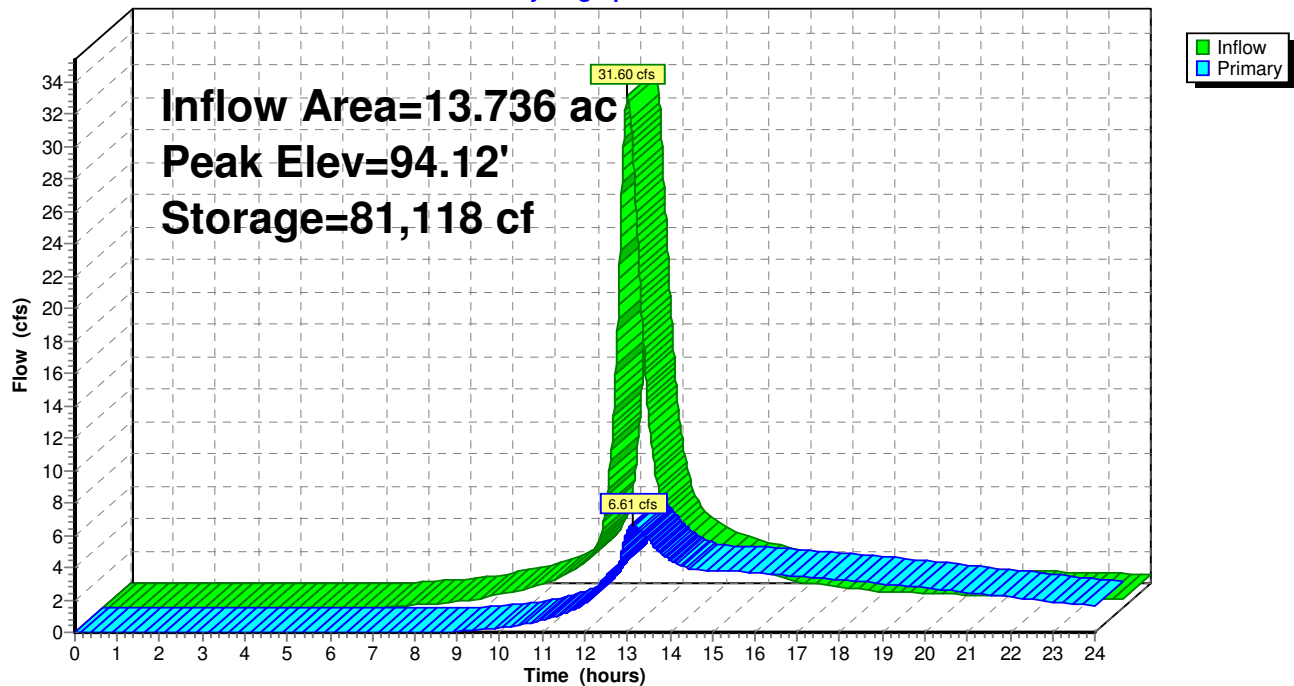
Type III 24-hr 10 year Rainfall=4.80"

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Pond 6P: Detention Basin

Hydrograph



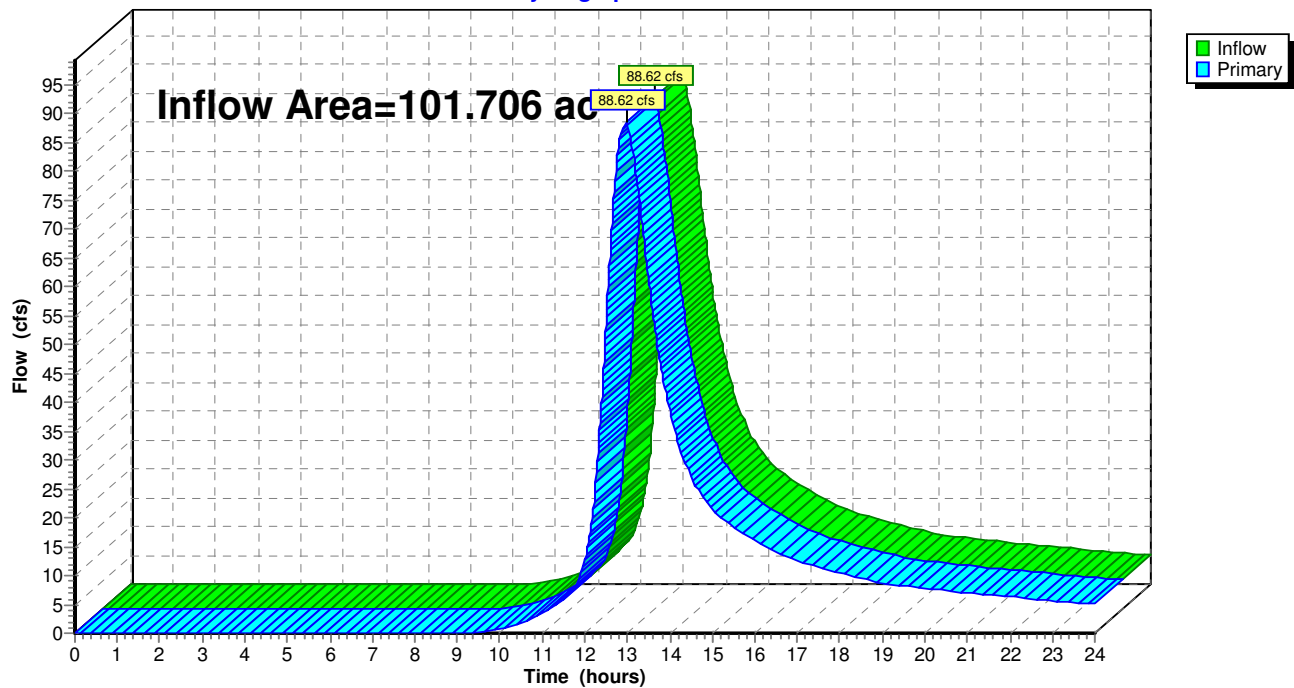
Summary for Link 2L: Design Point

Inflow Area = 101.706 ac, 23.22% Impervious, Inflow Depth > 2.33" for 10 year event

Inflow = 88.62 cfs @ 12.97 hrs, Volume= 19.782 af

Primary = 88.62 cfs @ 12.97 hrs, Volume= 19.782 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 2L: Design Point**Hydrograph**

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Type III 24-hr 25 year Rainfall=5.60"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Muskingum-Cunge method - Pond routing by Stor-Ind method

Subcatchment 1S: P-1

Runoff Area=87.970 ac 20.82% Impervious Runoff Depth>2.90"
Flow Length=4,420' Tc=68.3 min CN=75 Runoff=109.97 cfs 21.250 af

Subcatchment 2S: P-2

Runoff Area=13.736 ac 38.54% Impervious Runoff Depth>4.01"
Tc=26.0 min CN=86 Runoff=38.59 cfs 4.592 af

Subcatchment 3S: E-1

Runoff Area=101.737 ac 20.18% Impervious Runoff Depth>2.99"
Flow Length=4,420' Tc=68.3 min CN=76 Runoff=131.32 cfs 25.364 af

Reach 3R: Overland Flow

Avg. Flow Depth=0.39' Max Vel=0.87 fps Inflow=15.15 cfs 4.111 af
n=0.400 L=760.0' S=0.0368 '/' Capacity=35.52 cfs Outflow=15.07 cfs 4.067 af

Pond 6P: Detention Basin

Peak Elev=94.47' Storage=89,286 cf Inflow=38.59 cfs 4.592 af
Outflow=15.15 cfs 4.111 af

Link 2L: Design Point

Inflow=122.95 cfs 25.317 af
Primary=122.95 cfs 25.317 af

Total Runoff Area = 203.443 ac Runoff Volume = 51.206 af Average Runoff Depth = 3.02"
78.30% Pervious = 159.296 ac 21.70% Impervious = 44.147 ac

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Type III 24-hr 25 year Rainfall=5.60"

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Summary for Subcatchment 1S: P-1

CarlsonPlanXYPos|1171180.9301|691042.4469|

CarlsonSurface||

Runoff = 109.97 cfs @ 12.97 hrs, Volume= 21.250 af, Depth> 2.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 year Rainfall=5.60"

Area (ac)	CN	Description
11.076	98	Paved parking HSG A
10.583	79	Woods, Fair HSG D
1.449	76	Woods/grass comb., Fair HSG C
0.201	82	Woods/grass comb., Fair HSG D
3.504	36	Woods, Fair HSG A
16.559	73	Woods, Fair HSG C
3.932	60	Woods, Fair HSG B
0.822	98	Paved parking HSG B
0.523	98	Paved parking HSG D
5.898	98	Paved parking HSG C
10.774	49	50-75% Grass cover, Fair HSG A
3.488	69	50-75% Grass cover, Fair HSG B
18.163	79	50-75% Grass cover, Fair HSG C
0.998	84	50-75% Grass cover, Fair HSG D
87.970	75	Weighted Average
69.651		79.18% Pervious Area
18.319		20.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	100	0.0200	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
3.6	980	0.0490	4.49		Shallow Concentrated Flow, Paved Kv= 20.3 fps
6.8	1,230		3.00		Direct Entry, pipe flow
43.6	2,110	0.0260	0.81		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
68.3	4,420	Total			

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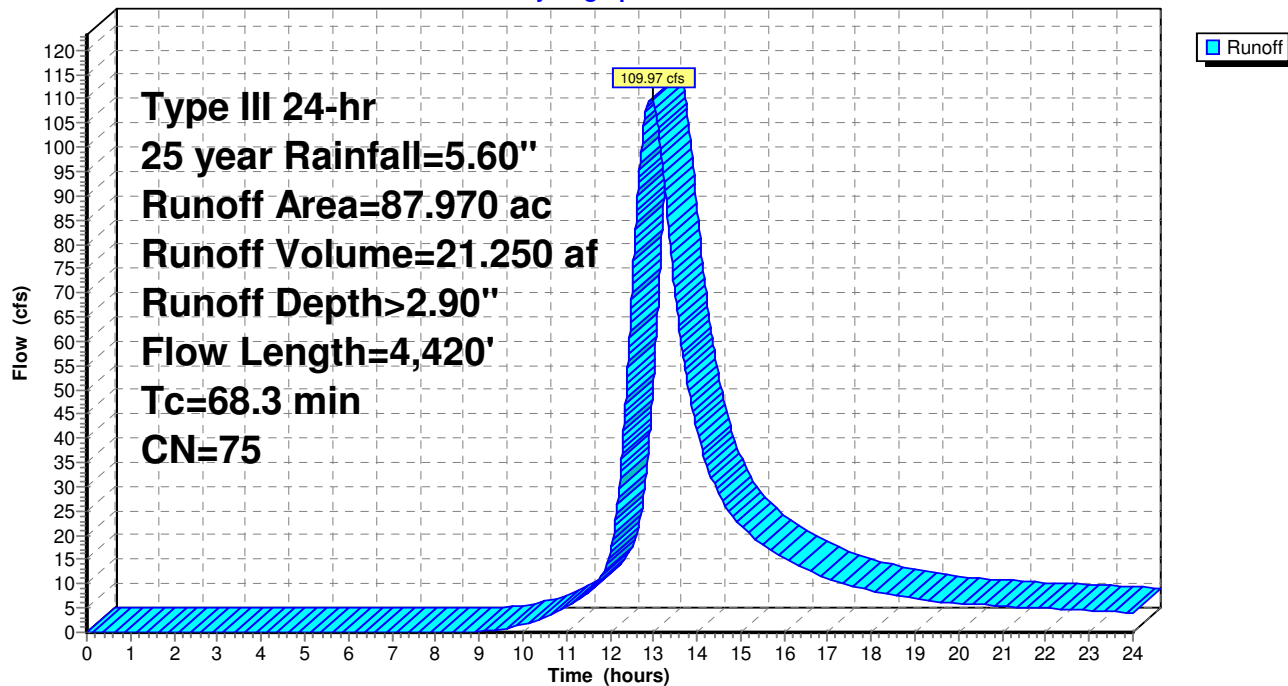
Type III 24-hr 25 year Rainfall=5.60"

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Subcatchment 1S: P-1

Hydrograph



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Type III 24-hr 25 year Rainfall=5.60"

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Summary for Subcatchment 2S: P-2

CarlsonPlanXYPos|1170813.5231|690121.8114|

CarlsonSurface||

Runoff = 38.59 cfs @ 12.34 hrs, Volume= 4.592 af, Depth> 4.01"

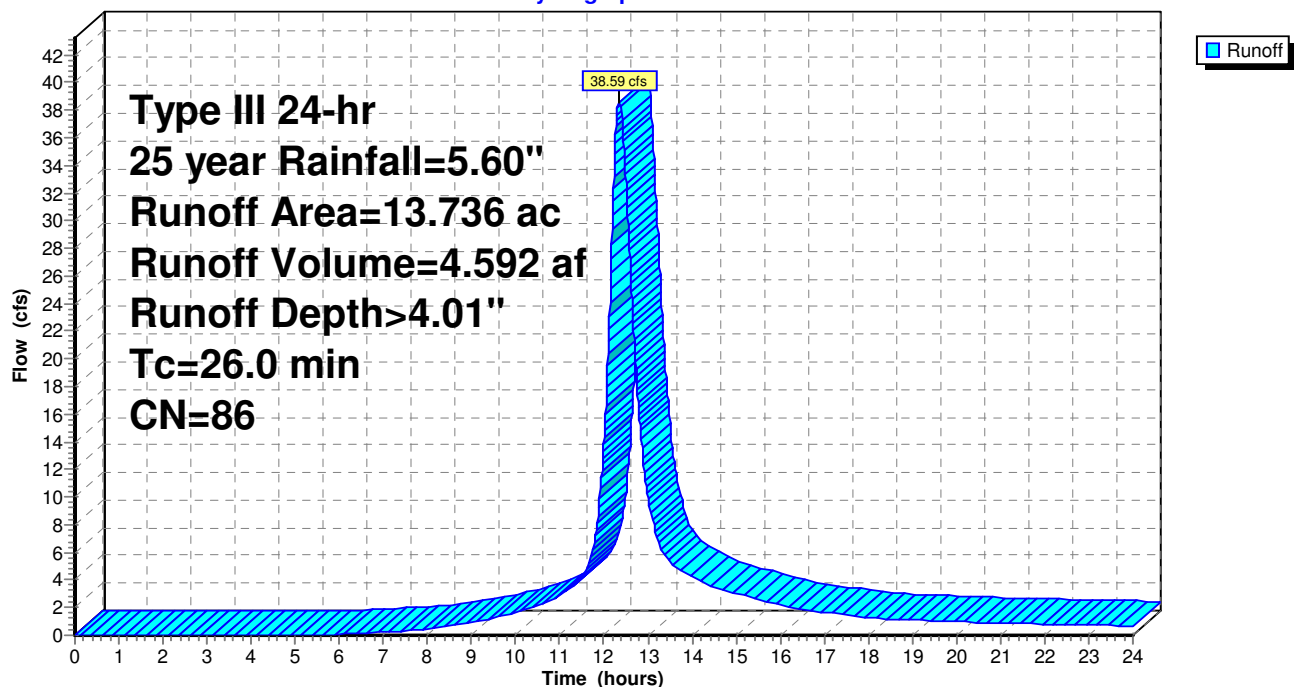
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 year Rainfall=5.60"

Area (ac)	CN	Description
0.464	73	Woods, Fair HSG C
0.525	76	Woods/grass comb., Fair HSG C
5.294	98	Paved parking HSG C
7.453	79	50-75% Grass cover, Fair HSG C
13.736	86	Weighted Average
8.442		61.46% Pervious Area
5.294		38.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.0					Direct Entry, Storm sewer TC

Subcatchment 2S: P-2

Hydrograph



213009*Type III 24-hr 25 year Rainfall=5.60"*

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Summary for Subcatchment 3S: E-1

CarlsonPlanXYPos|1171180.9301|691042.4469|

CarlsonSurface||

Runoff = 131.32 cfs @ 12.97 hrs, Volume= 25.364 af, Depth> 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 year Rainfall=5.60"

Area (ac)	CN	Description
11.076	98	Paved parking HSG A
10.583	79	Woods, Fair HSG D
1.982	76	Woods/grass comb., Fair HSG C
0.201	82	Woods/grass comb., Fair HSG D
3.504	36	Woods, Fair HSG A
24.566	73	Woods, Fair HSG C
3.932	60	Woods, Fair HSG B
0.822	98	Paved parking HSG B
0.523	98	Paved parking HSG D
8.113	98	Paved parking HSG C
10.775	49	50-75% Grass cover, Fair HSG A
3.488	69	50-75% Grass cover, Fair HSG B
21.174	79	50-75% Grass cover, Fair HSG C
0.998	84	50-75% Grass cover, Fair HSG D
101.737	76	Weighted Average
81.203		79.82% Pervious Area
20.534		20.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	100	0.0200	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
3.6	980	0.0490	4.49		Shallow Concentrated Flow, Paved Kv= 20.3 fps
6.8	1,230		3.00		Direct Entry, pipe flow
43.6	2,110	0.0260	0.81		Shallow Concentrated Flow, watercourse Woodland Kv= 5.0 fps
68.3	4,420	Total			

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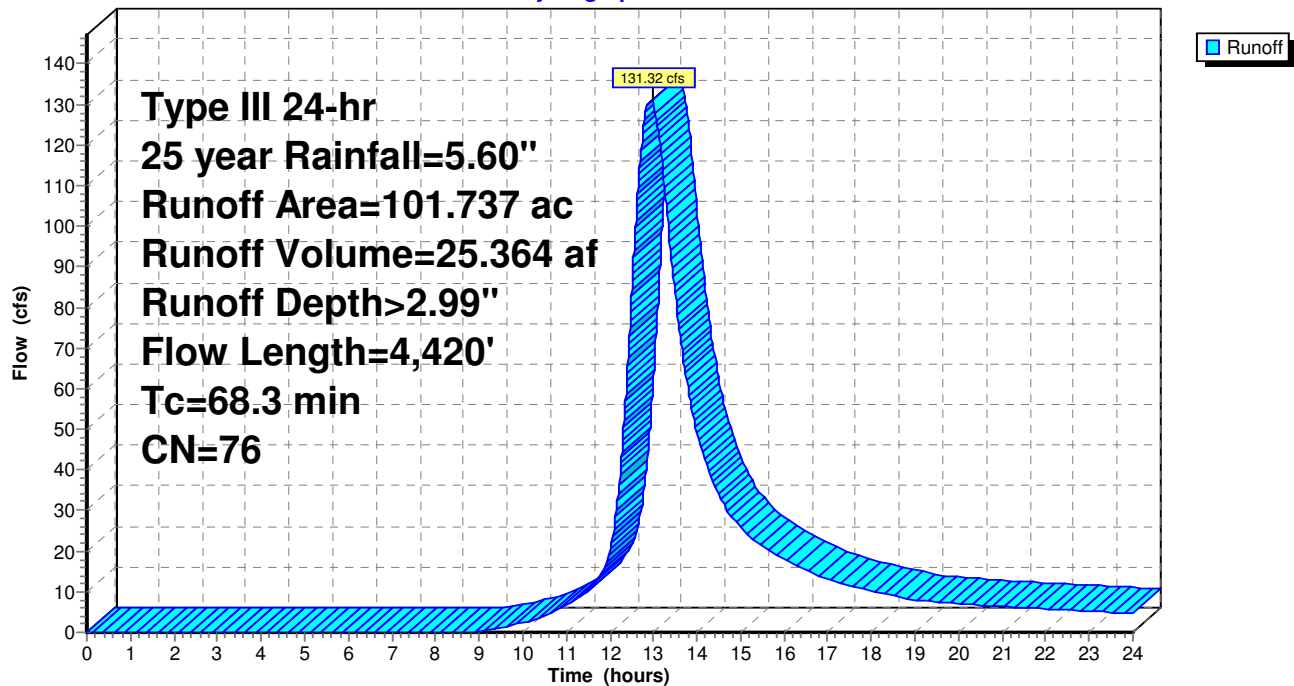
Type III 24-hr 25 year Rainfall=5.60"

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Subcatchment 3S: E-1

Hydrograph



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Type III 24-hr 25 year Rainfall=5.60"

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Summary for Reach 3R: Overland Flow

[79] Warning: Submerged Pond 6P Primary device # 1 OUTLET by 0.39'

Inflow Area = 13.736 ac, 38.54% Impervious, Inflow Depth > 3.59" for 25 year event
Inflow = 15.15 cfs @ 12.82 hrs, Volume= 4.111 af
Outflow = 15.07 cfs @ 13.11 hrs, Volume= 4.067 af, Atten= 1%, Lag= 17.4 min

Routing by Muskingum-Cunge method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Reference Flow= 11.37 cfs Estimated Depth= 0.50' Velocity= 0.45 fps
m= 1.655, c= 0.74 fps, dt= 0.6 min, dx= 760.0' / 29 = 26.2', K= 0.6 min, X= 0.342
Max. Velocity= 0.87 fps, Min. Travel Time= 14.5 min
Avg. Velocity= 0.69 fps, Avg. Travel Time= 18.4 min

Peak Storage= 14,961 cf @ 12.99 hrs
Average Depth at Peak Storage= 0.39'
Bank-Full Depth= 1.00' Flow Area= 51.0 sf, Capacity= 35.52 cfs

50.00' x 1.00' deep channel, n= 0.400
Side Slope Z-value= 1.0 '/' Top Width= 52.00'
Length= 760.0' Slope= 0.0368 '/'
Inlet Invert= 88.00', Outlet Invert= 60.00'



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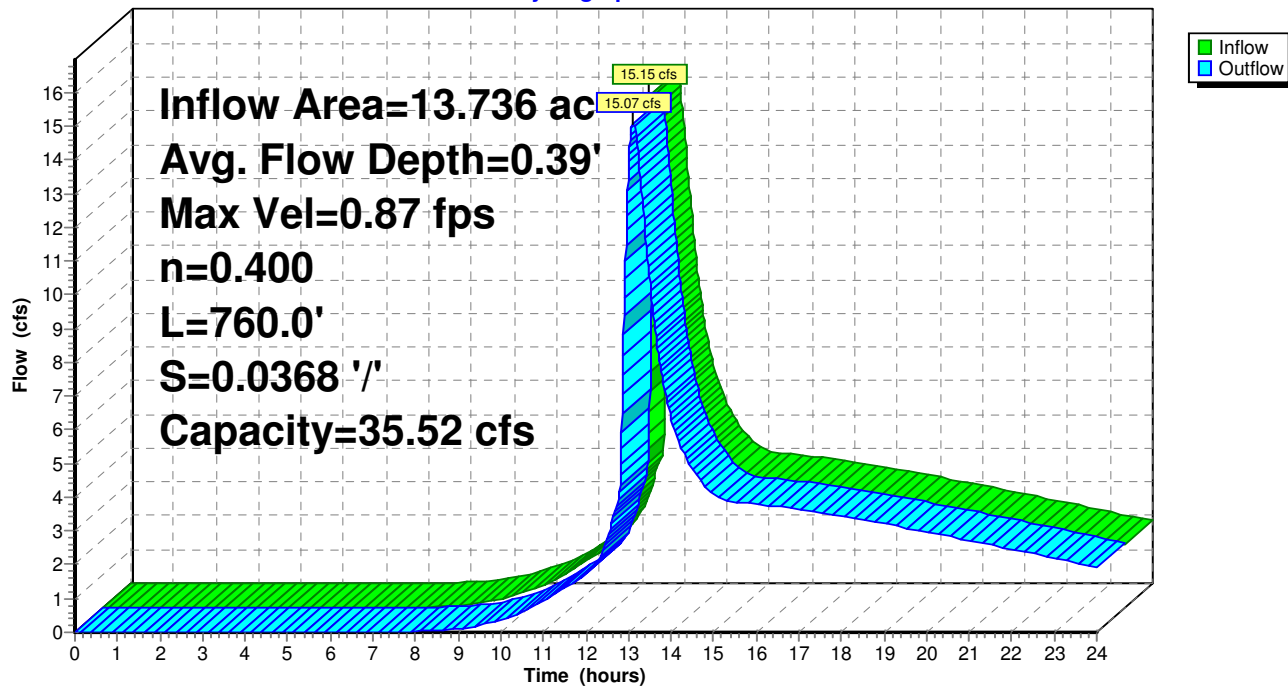
Type III 24-hr 25 year Rainfall=5.60"

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Reach 3R: Overland Flow

Hydrograph



Summary for Pond 6P: Detention Basin

Inflow Area = 13.736 ac, 38.54% Impervious, Inflow Depth > 4.01" for 25 year event
 Inflow = 38.59 cfs @ 12.34 hrs, Volume= 4.592 af
 Outflow = 15.15 cfs @ 12.82 hrs, Volume= 4.111 af, Atten= 61%, Lag= 28.7 min
 Primary = 15.15 cfs @ 12.82 hrs, Volume= 4.111 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 94.47' @ 12.82 hrs Surf.Area= 23,667 sf Storage= 89,286 cf

Plug-Flow detention time= 208.3 min calculated for 4.111 af (90% of inflow)
 Center-of-Mass det. time= 159.6 min (975.4 - 815.8)

Volume	Invert	Avail.Storage	Storage Description
#1	90.00'	127,579 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
90.00	16,410	0	0
92.00	19,568	35,978	35,978
94.00	22,870	42,438	78,416
95.00	24,576	23,723	102,139
96.00	26,304	25,440	127,579

Device	Routing	Invert	Outlet Devices
#1	Primary	89.00'	24.0" Round Culvert L= 112.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 89.00' / 88.00' S= 0.0089 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	90.00'	10.0" Round Culvert L= 5.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 90.00' / 89.90' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 0.55 sf
#3	Device 1	93.90'	30.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Primary	95.00'	20.0' long x 13.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.60 2.64 2.70 2.66 2.65 2.66 2.65 2.63

Primary OutFlow Max=15.14 cfs @ 12.82 hrs HW=94.47' (Free Discharge)

1=Culvert (Passes 15.14 cfs of 31.97 cfs potential flow)
 2=Culvert (Inlet Controls 4.17 cfs @ 7.65 fps)
 3=Orifice/Grate (Weir Controls 10.97 cfs @ 2.46 fps)
 4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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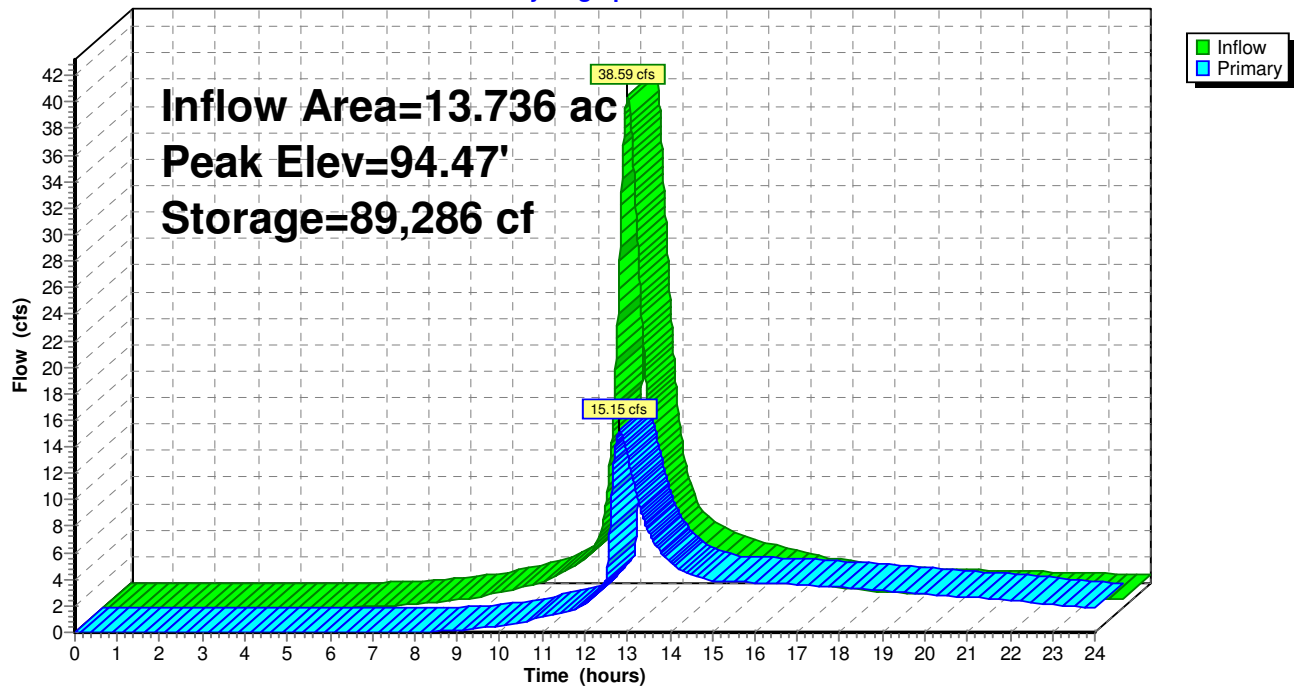
Type III 24-hr 25 year Rainfall=5.60"

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Pond 6P: Detention Basin

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Type III 24-hr 25 year Rainfall=5.60"

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Summary for Link 2L: Design Point

Inflow Area = 101.706 ac, 23.22% Impervious, Inflow Depth > 2.99" for 25 year event

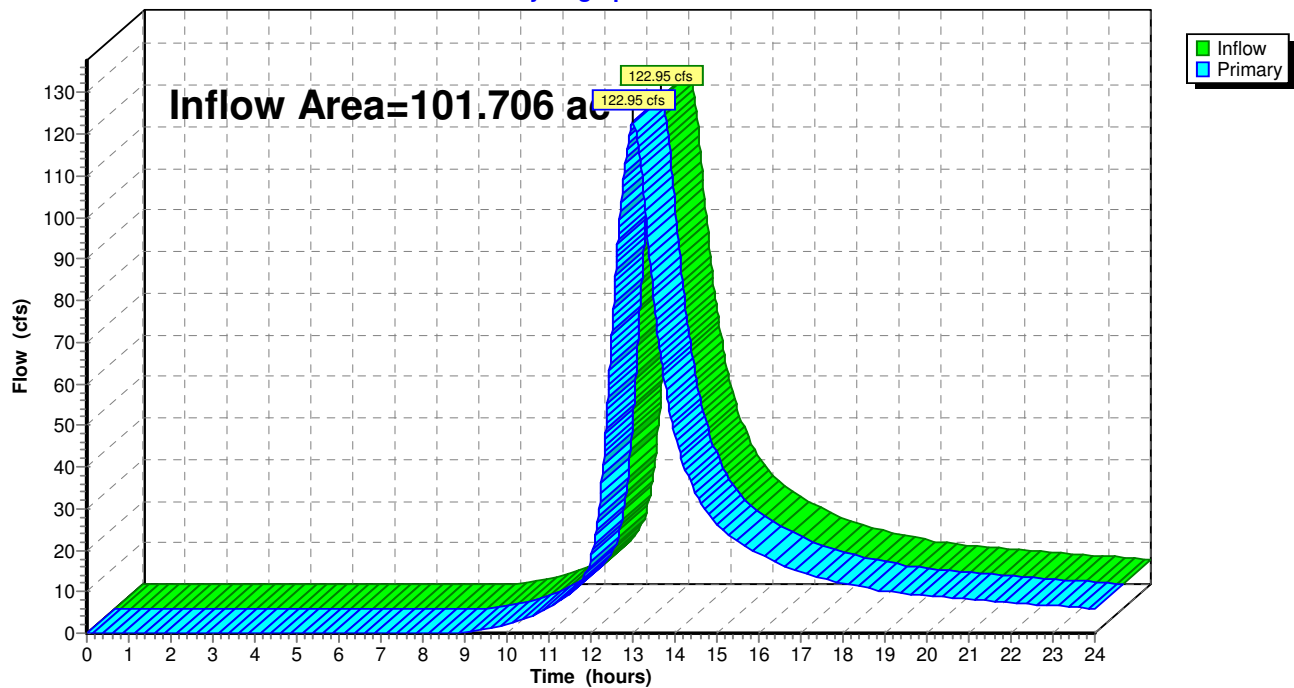
Inflow = 122.95 cfs @ 12.98 hrs, Volume= 25.317 af

Primary = 122.95 cfs @ 12.98 hrs, Volume= 25.317 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 2L: Design Point

Hydrograph



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Type III 24-hr 50 year Rainfall=6.20"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Muskingum-Cunge method - Pond routing by Stor-Ind method

Subcatchment 1S: P-1

Runoff Area=87.970 ac 20.82% Impervious Runoff Depth>3.40"
Flow Length=4,420' Tc=68.3 min CN=75 Runoff=129.20 cfs 24.937 af

Subcatchment 2S: P-2

Runoff Area=13.736 ac 38.54% Impervious Runoff Depth>4.58"
Tc=26.0 min CN=86 Runoff=43.83 cfs 5.242 af

Subcatchment 3S: E-1

Runoff Area=101.737 ac 20.18% Impervious Runoff Depth>3.50"
Flow Length=4,420' Tc=68.3 min CN=76 Runoff=153.86 cfs 29.683 af

Reach 3R: Overland Flow

Avg. Flow Depth=0.49' Max Vel=1.02 fps Inflow=22.04 cfs 4.703 af
n=0.400 L=760.0' S=0.0368 '/' Capacity=35.52 cfs Outflow=21.91 cfs 4.661 af

Pond 6P: Detention Basin

Peak Elev=94.68' Storage=94,408 cf Inflow=43.83 cfs 5.242 af
Outflow=22.04 cfs 4.703 af

Link 2L: Design Point

Inflow=151.05 cfs 29.598 af
Primary=151.05 cfs 29.598 af

Total Runoff Area = 203.443 ac Runoff Volume = 59.861 af Average Runoff Depth = 3.53"
78.30% Pervious = 159.296 ac 21.70% Impervious = 44.147 ac

Summary for Subcatchment 1S: P-1

CarlsonPlanXYPos|1171180.9301|691042.4469|

CarlsonSurface||

Runoff = 129.20 cfs @ 12.91 hrs, Volume= 24.937 af, Depth> 3.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 50 year Rainfall=6.20"

Area (ac)	CN	Description
11.076	98	Paved parking HSG A
10.583	79	Woods, Fair HSG D
1.449	76	Woods/grass comb., Fair HSG C
0.201	82	Woods/grass comb., Fair HSG D
3.504	36	Woods, Fair HSG A
16.559	73	Woods, Fair HSG C
3.932	60	Woods, Fair HSG B
0.822	98	Paved parking HSG B
0.523	98	Paved parking HSG D
5.898	98	Paved parking HSG C
10.774	49	50-75% Grass cover, Fair HSG A
3.488	69	50-75% Grass cover, Fair HSG B
18.163	79	50-75% Grass cover, Fair HSG C
0.998	84	50-75% Grass cover, Fair HSG D
87.970	75	Weighted Average
69.651		79.18% Pervious Area
18.319		20.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	100	0.0200	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
3.6	980	0.0490	4.49		Shallow Concentrated Flow, Paved Kv= 20.3 fps
6.8	1,230		3.00		Direct Entry, pipe flow
43.6	2,110	0.0260	0.81		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
68.3	4,420	Total			

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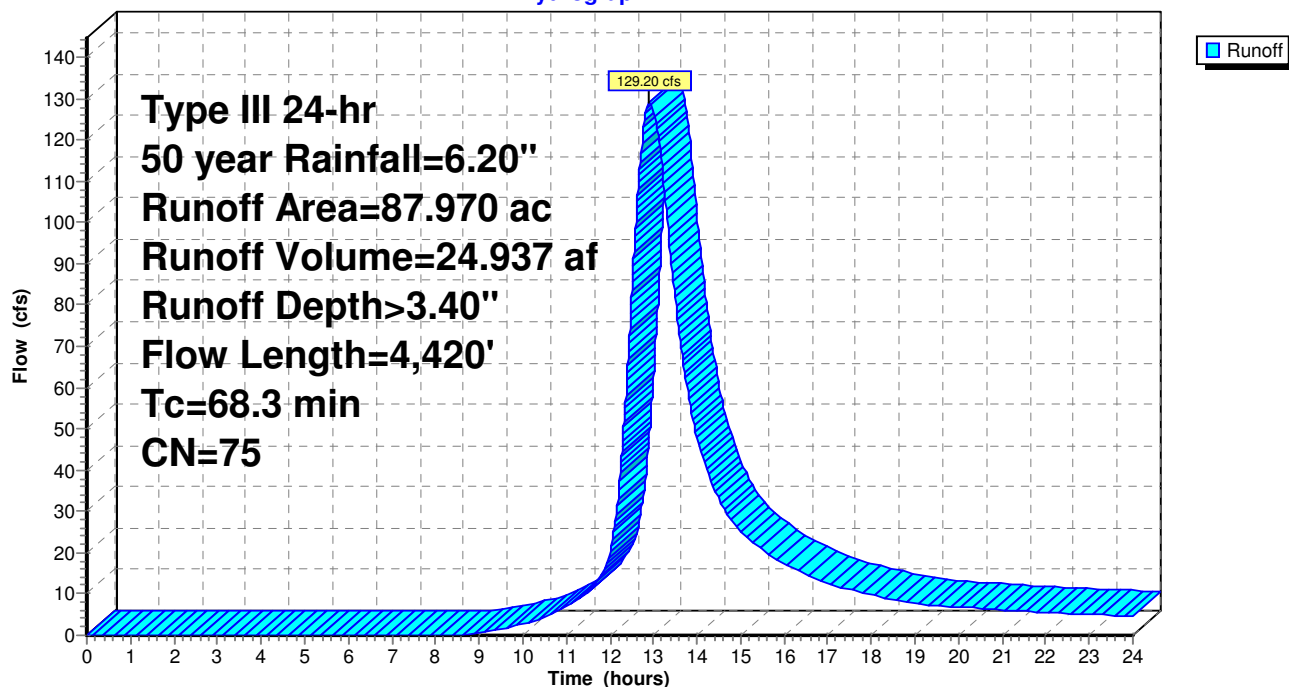
Type III 24-hr 50 year Rainfall=6.20"

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Subcatchment 1S: P-1

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Type III 24-hr 50 year Rainfall=6.20"

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Summary for Subcatchment 2S: P-2

CarlsonPlanXYPos|1170813.5231|690121.8114|

CarlsonSurface||

Runoff = 43.83 cfs @ 12.34 hrs, Volume= 5.242 af, Depth> 4.58"

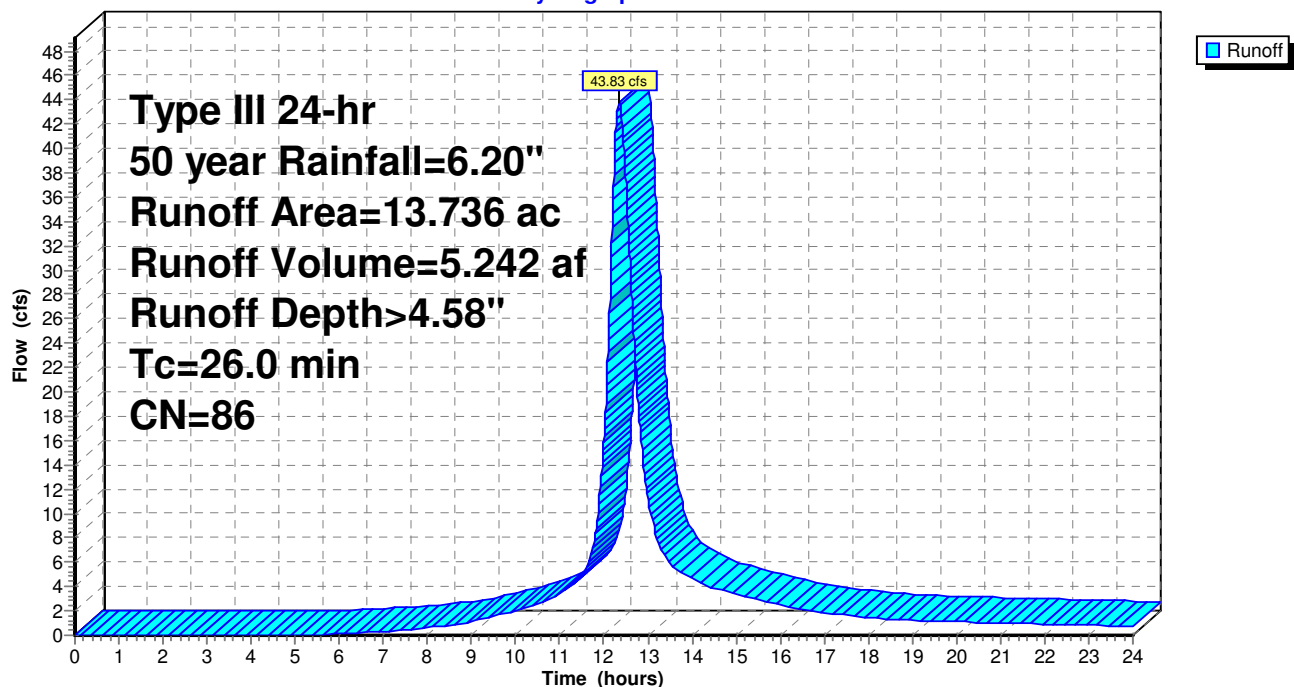
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 50 year Rainfall=6.20"

Area (ac)	CN	Description
0.464	73	Woods, Fair HSG C
0.525	76	Woods/grass comb., Fair HSG C
5.294	98	Paved parking HSG C
7.453	79	50-75% Grass cover, Fair HSG C
13.736	86	Weighted Average
8.442		61.46% Pervious Area
5.294		38.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.0					Direct Entry, Storm sewer TC

Subcatchment 2S: P-2

Hydrograph



Summary for Subcatchment 3S: E-1

CarlsonPlanXYPos|1171180.9301|691042.4469|

CarlsonSurface||

Runoff = 153.86 cfs @ 12.91 hrs, Volume= 29.683 af, Depth> 3.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 50 year Rainfall=6.20"

Area (ac)	CN	Description
11.076	98	Paved parking HSG A
10.583	79	Woods, Fair HSG D
1.982	76	Woods/grass comb., Fair HSG C
0.201	82	Woods/grass comb., Fair HSG D
3.504	36	Woods, Fair HSG A
24.566	73	Woods, Fair HSG C
3.932	60	Woods, Fair HSG B
0.822	98	Paved parking HSG B
0.523	98	Paved parking HSG D
8.113	98	Paved parking HSG C
10.775	49	50-75% Grass cover, Fair HSG A
3.488	69	50-75% Grass cover, Fair HSG B
21.174	79	50-75% Grass cover, Fair HSG C
0.998	84	50-75% Grass cover, Fair HSG D
101.737	76	Weighted Average
81.203		79.82% Pervious Area
20.534		20.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	100	0.0200	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
3.6	980	0.0490	4.49		Shallow Concentrated Flow, Paved Kv= 20.3 fps
6.8	1,230		3.00		Direct Entry, pipe flow
43.6	2,110	0.0260	0.81		Shallow Concentrated Flow, watercourse Woodland Kv= 5.0 fps
68.3	4,420	Total			

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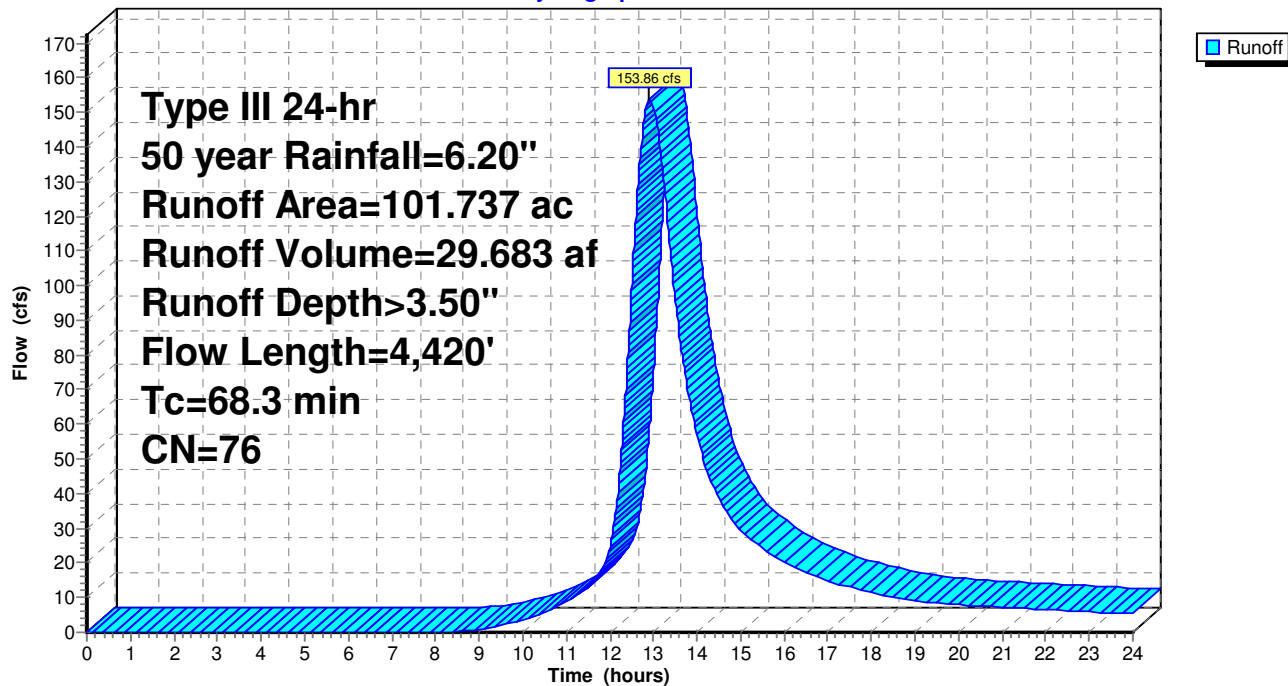
Type III 24-hr 50 year Rainfall=6.20"

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Subcatchment 3S: E-1

Hydrograph



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Type III 24-hr 50 year Rainfall=6.20"

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Summary for Reach 3R: Overland Flow

[79] Warning: Submerged Pond 6P Primary device # 1 OUTLET by 0.49'

Inflow Area = 13.736 ac, 38.54% Impervious, Inflow Depth > 4.11" for 50 year event
Inflow = 22.04 cfs @ 12.73 hrs, Volume= 4.703 af
Outflow = 21.91 cfs @ 12.98 hrs, Volume= 4.661 af, Atten= 1%, Lag= 15.0 min

Routing by Muskingum-Cunge method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Reference Flow= 16.53 cfs Estimated Depth= 0.63' Velocity= 0.52 fps
m= 1.652, c= 0.85 fps, dt= 0.6 min, dx= 760.0' / 25 = 30.4', K= 0.6 min, X= 0.329
Max. Velocity= 1.02 fps, Min. Travel Time= 12.4 min
Avg. Velocity= 0.80 fps, Avg. Travel Time= 15.7 min

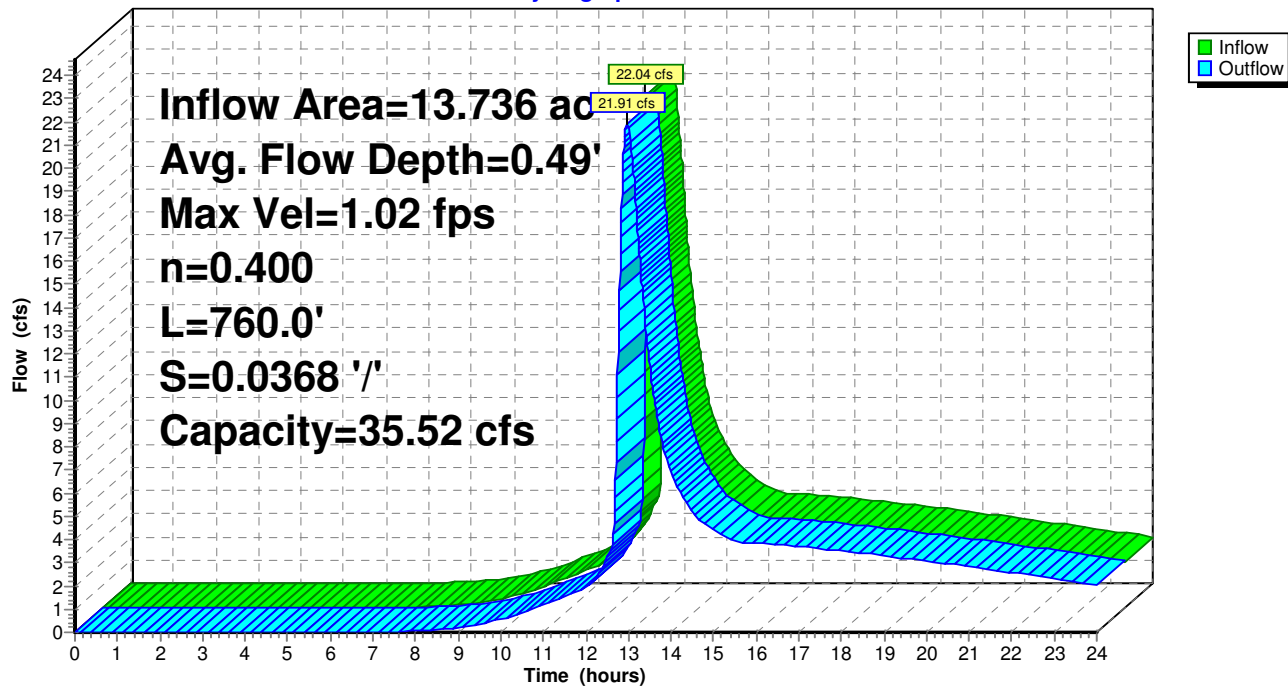
Peak Storage= 18,892 cf @ 12.87 hrs
Average Depth at Peak Storage= 0.49'
Bank-Full Depth= 1.00' Flow Area= 51.0 sf, Capacity= 35.52 cfs

50.00' x 1.00' deep channel, n= 0.400
Side Slope Z-value= 1.0 '/' Top Width= 52.00'
Length= 760.0' Slope= 0.0368 '/'
Inlet Invert= 88.00', Outlet Invert= 60.00'



Reach 3R: Overland Flow

Hydrograph



Summary for Pond 6P: Detention Basin

Inflow Area = 13.736 ac, 38.54% Impervious, Inflow Depth > 4.58" for 50 year event
 Inflow = 43.83 cfs @ 12.34 hrs, Volume= 5.242 af
 Outflow = 22.04 cfs @ 12.73 hrs, Volume= 4.703 af, Atten= 50%, Lag= 23.1 min
 Primary = 22.04 cfs @ 12.73 hrs, Volume= 4.703 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 94.68' @ 12.73 hrs Surf.Area= 24,033 sf Storage= 94,408 cf

Plug-Flow detention time= 191.4 min calculated for 4.701 af (90% of inflow)
 Center-of-Mass det. time= 143.4 min (955.6 - 812.2)

Volume	Invert	Avail.Storage	Storage Description
#1	90.00'	127,579 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
90.00	16,410	0	0
92.00	19,568	35,978	35,978
94.00	22,870	42,438	78,416
95.00	24,576	23,723	102,139
96.00	26,304	25,440	127,579

Device	Routing	Invert	Outlet Devices
#1	Primary	89.00'	24.0" Round Culvert L= 112.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 89.00' / 88.00' S= 0.0089 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	90.00'	10.0" Round Culvert L= 5.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 90.00' / 89.90' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 0.55 sf
#3	Device 1	93.90'	30.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Primary	95.00'	20.0' long x 13.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.60 2.64 2.70 2.66 2.65 2.66 2.65 2.63

Primary OutFlow Max=22.04 cfs @ 12.73 hrs HW=94.68' (Free Discharge)

1=Culvert (Passes 22.04 cfs of 32.73 cfs potential flow)
 2=Culvert (Inlet Controls 4.28 cfs @ 7.85 fps)
 3=Orifice/Grate (Weir Controls 17.75 cfs @ 2.89 fps)
 4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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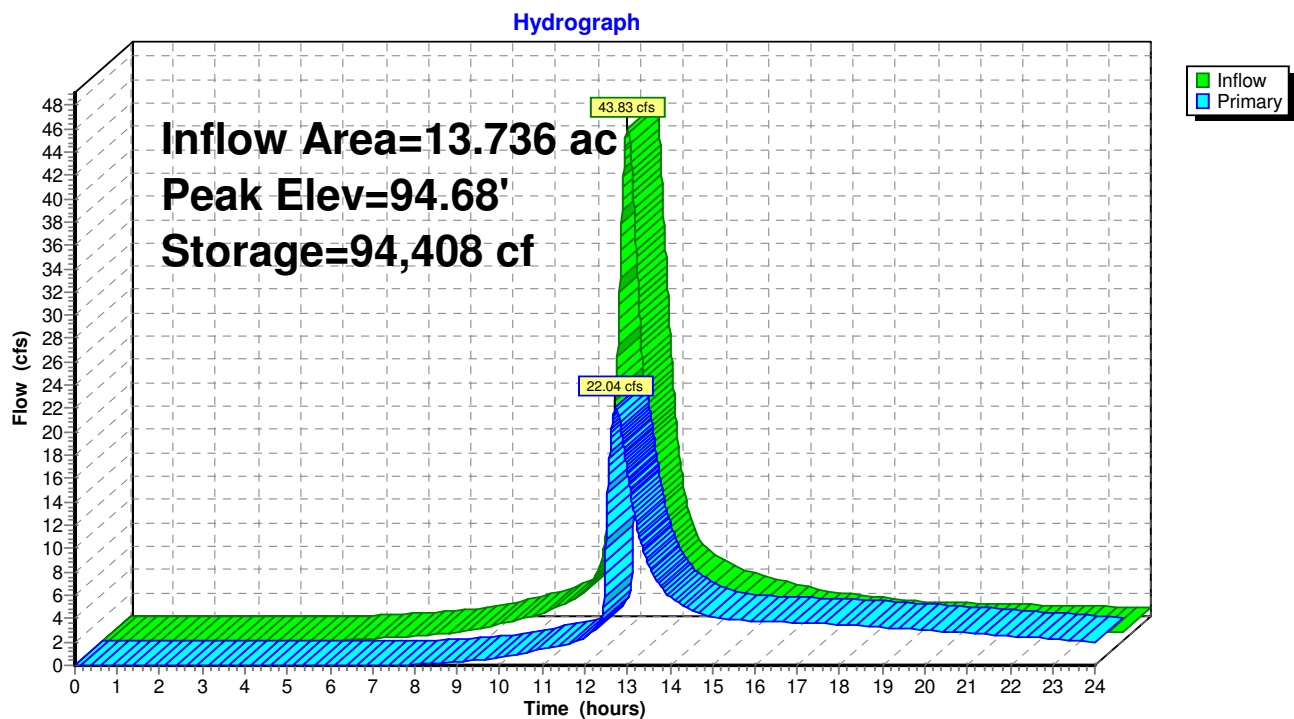
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Type III 24-hr 50 year Rainfall=6.20"

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Pond 6P: Detention Basin



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Type III 24-hr 50 year Rainfall=6.20"

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Summary for Link 2L: Design Point

Inflow Area = 101.706 ac, 23.22% Impervious, Inflow Depth > 3.49" for 50 year event

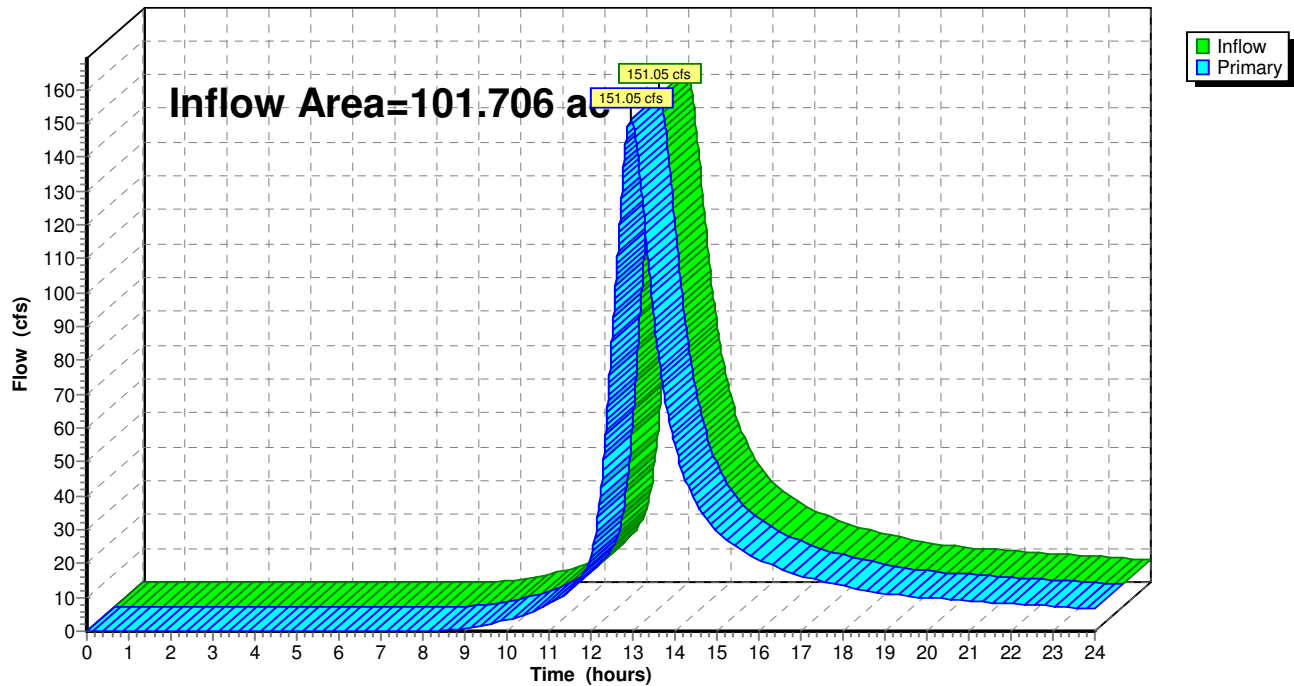
Inflow = 151.05 cfs @ 12.97 hrs, Volume= 29.598 af

Primary = 151.05 cfs @ 12.97 hrs, Volume= 29.598 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 2L: Design Point

Hydrograph



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Type III 24-hr 100 year Rainfall=7.00"

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Muskingum-Cunge method - Pond routing by Stor-Ind method

Subcatchment 1S: P-1

Runoff Area=87.970 ac 20.82% Impervious Runoff Depth>4.09"
Flow Length=4,420' Tc=68.3 min CN=75 Runoff=155.43 cfs 29.981 af

Subcatchment 2S: P-2

Runoff Area=13.736 ac 38.54% Impervious Runoff Depth>5.34"
Tc=26.0 min CN=86 Runoff=50.81 cfs 6.115 af

Subcatchment 3S: E-1

Runoff Area=101.737 ac 20.18% Impervious Runoff Depth>4.20"
Flow Length=4,420' Tc=68.3 min CN=76 Runoff=184.45 cfs 35.583 af

Reach 3R: Overland Flow

Avg. Flow Depth=0.60' Max Vel=1.16 fps Inflow=28.85 cfs 5.501 af
n=0.400 L=760.0' S=0.0368 '/' Capacity=35.52 cfs Outflow=28.79 cfs 5.460 af

Pond 6P: Detention Basin

Peak Elev=94.97' Storage=101,349 cf Inflow=50.81 cfs 6.115 af
Outflow=28.85 cfs 5.501 af

Link 2L: Design Point

Inflow=184.22 cfs 35.441 af
Primary=184.22 cfs 35.441 af

Total Runoff Area = 203.443 ac Runoff Volume = 71.679 af Average Runoff Depth = 4.23"
78.30% Pervious = 159.296 ac 21.70% Impervious = 44.147 ac

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Type III 24-hr 100 year Rainfall=7.00"

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Summary for Subcatchment 1S: P-1

CarlsonPlanXYPos|1171180.9301|691042.4469|

CarlsonSurface||

Runoff = 155.43 cfs @ 12.91 hrs, Volume= 29.981 af, Depth> 4.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 year Rainfall=7.00"

Area (ac)	CN	Description
11.076	98	Paved parking HSG A
10.583	79	Woods, Fair HSG D
1.449	76	Woods/grass comb., Fair HSG C
0.201	82	Woods/grass comb., Fair HSG D
3.504	36	Woods, Fair HSG A
16.559	73	Woods, Fair HSG C
3.932	60	Woods, Fair HSG B
0.822	98	Paved parking HSG B
0.523	98	Paved parking HSG D
5.898	98	Paved parking HSG C
10.774	49	50-75% Grass cover, Fair HSG A
3.488	69	50-75% Grass cover, Fair HSG B
18.163	79	50-75% Grass cover, Fair HSG C
0.998	84	50-75% Grass cover, Fair HSG D
87.970	75	Weighted Average
69.651		79.18% Pervious Area
18.319		20.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	100	0.0200	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
3.6	980	0.0490	4.49		Shallow Concentrated Flow, Paved Kv= 20.3 fps
6.8	1,230		3.00		Direct Entry, pipe flow
43.6	2,110	0.0260	0.81		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
68.3	4,420	Total			

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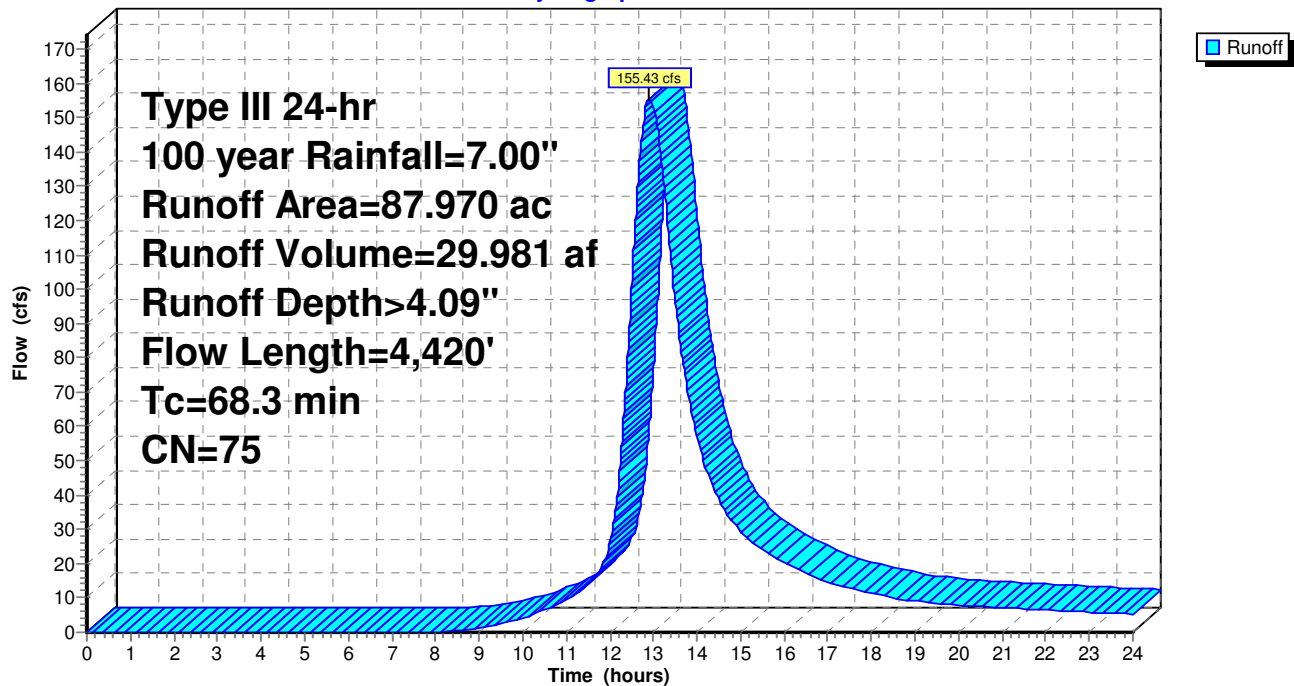
Type III 24-hr 100 year Rainfall=7.00"

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Subcatchment 1S: P-1

Hydrograph



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Type III 24-hr 100 year Rainfall=7.00"

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Summary for Subcatchment 2S: P-2

CarlsonPlanXYPos|1170813.5231|690121.8114|

CarlsonSurface||

Runoff = 50.81 cfs @ 12.34 hrs, Volume= 6.115 af, Depth> 5.34"

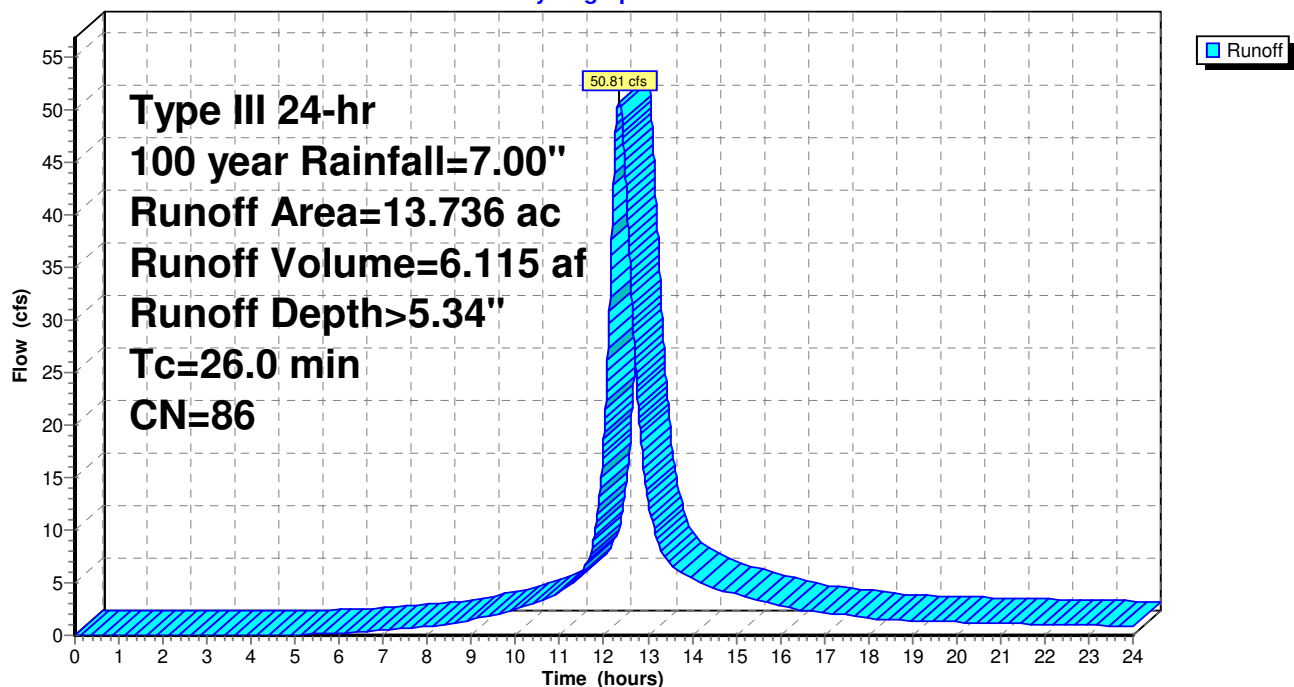
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 year Rainfall=7.00"

Area (ac)	CN	Description
0.464	73	Woods, Fair HSG C
0.525	76	Woods/grass comb., Fair HSG C
5.294	98	Paved parking HSG C
7.453	79	50-75% Grass cover, Fair HSG C
13.736	86	Weighted Average
8.442		61.46% Pervious Area
5.294		38.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.0					Direct Entry, Storm sewer TC

Subcatchment 2S: P-2

Hydrograph



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Type III 24-hr 100 year Rainfall=7.00"

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Summary for Subcatchment 3S: E-1

CarlsonPlanXYPos|1171180.9301|691042.4469|

CarlsonSurface||

Runoff = 184.45 cfs @ 12.90 hrs, Volume= 35.583 af, Depth> 4.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 year Rainfall=7.00"

Area (ac)	CN	Description
11.076	98	Paved parking HSG A
10.583	79	Woods, Fair HSG D
1.982	76	Woods/grass comb., Fair HSG C
0.201	82	Woods/grass comb., Fair HSG D
3.504	36	Woods, Fair HSG A
24.566	73	Woods, Fair HSG C
3.932	60	Woods, Fair HSG B
0.822	98	Paved parking HSG B
0.523	98	Paved parking HSG D
8.113	98	Paved parking HSG C
10.775	49	50-75% Grass cover, Fair HSG A
3.488	69	50-75% Grass cover, Fair HSG B
21.174	79	50-75% Grass cover, Fair HSG C
0.998	84	50-75% Grass cover, Fair HSG D
101.737	76	Weighted Average
81.203		79.82% Pervious Area
20.534		20.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	100	0.0200	0.12		Sheet Flow, Grass: Dense n= 0.240 P2= 3.20"
3.6	980	0.0490	4.49		Shallow Concentrated Flow, Paved Kv= 20.3 fps
6.8	1,230		3.00		Direct Entry, pipe flow
43.6	2,110	0.0260	0.81		Shallow Concentrated Flow, watercourse Woodland Kv= 5.0 fps
68.3	4,420	Total			

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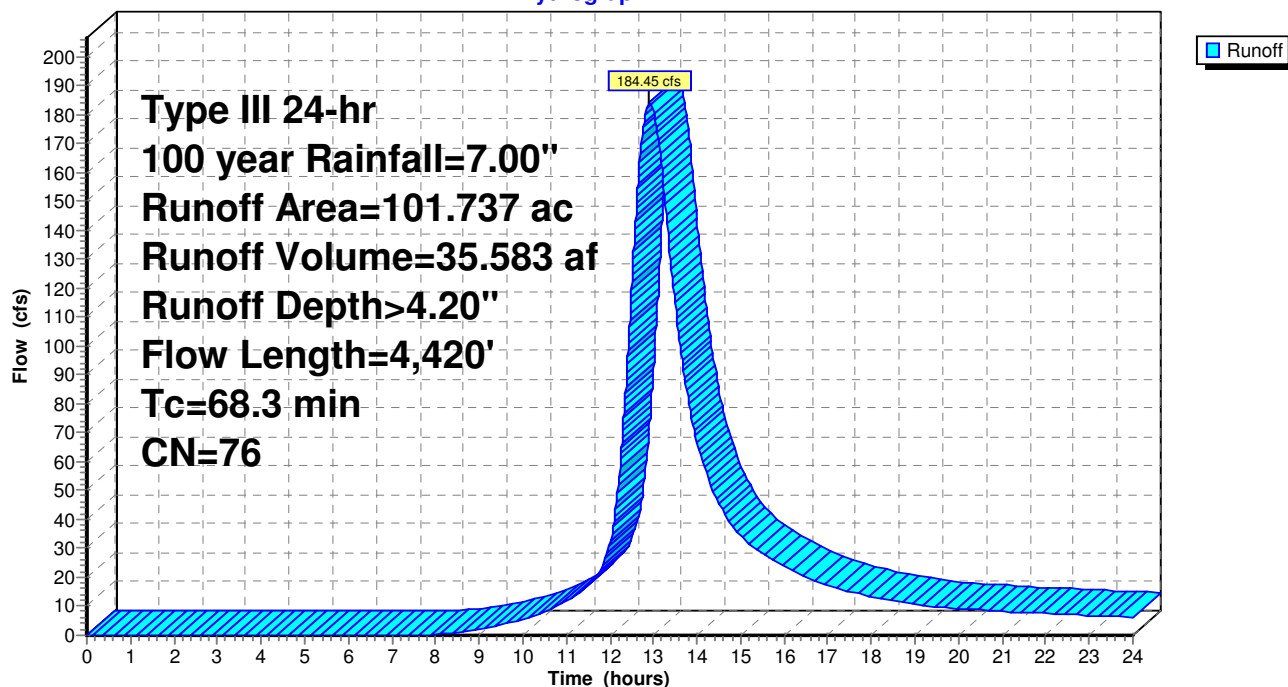
Type III 24-hr 100 year Rainfall=7.00"

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Subcatchment 3S: E-1

Hydrograph



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Type III 24-hr 100 year Rainfall=7.00"

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Summary for Reach 3R: Overland Flow

[79] Warning: Submerged Pond 6P Primary device # 1 OUTLET by 0.60'

Inflow Area = 13.736 ac, 38.54% Impervious, Inflow Depth > 4.81" for 100 year event
Inflow = 28.85 cfs @ 12.68 hrs, Volume= 5.501 af
Outflow = 28.79 cfs @ 12.90 hrs, Volume= 5.460 af, Atten= 0%, Lag= 13.4 min

Routing by Muskingum-Cunge method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Reference Flow= 21.63 cfs Estimated Depth= 0.74' Velocity= 0.57 fps
m= 1.650, c= 0.95 fps, dt= 0.6 min, dx= 760.0' / 22 = 34.5', K= 0.6 min, X= 0.323
Max. Velocity= 1.16 fps, Min. Travel Time= 10.9 min
Avg. Velocity= 0.90 fps, Avg. Travel Time= 14.1 min

Peak Storage= 22,894 cf @ 12.80 hrs
Average Depth at Peak Storage= 0.60'
Bank-Full Depth= 1.00' Flow Area= 51.0 sf, Capacity= 35.52 cfs

50.00' x 1.00' deep channel, n= 0.400
Side Slope Z-value= 1.0 '/' Top Width= 52.00'
Length= 760.0' Slope= 0.0368 '/'
Inlet Invert= 88.00', Outlet Invert= 60.00'



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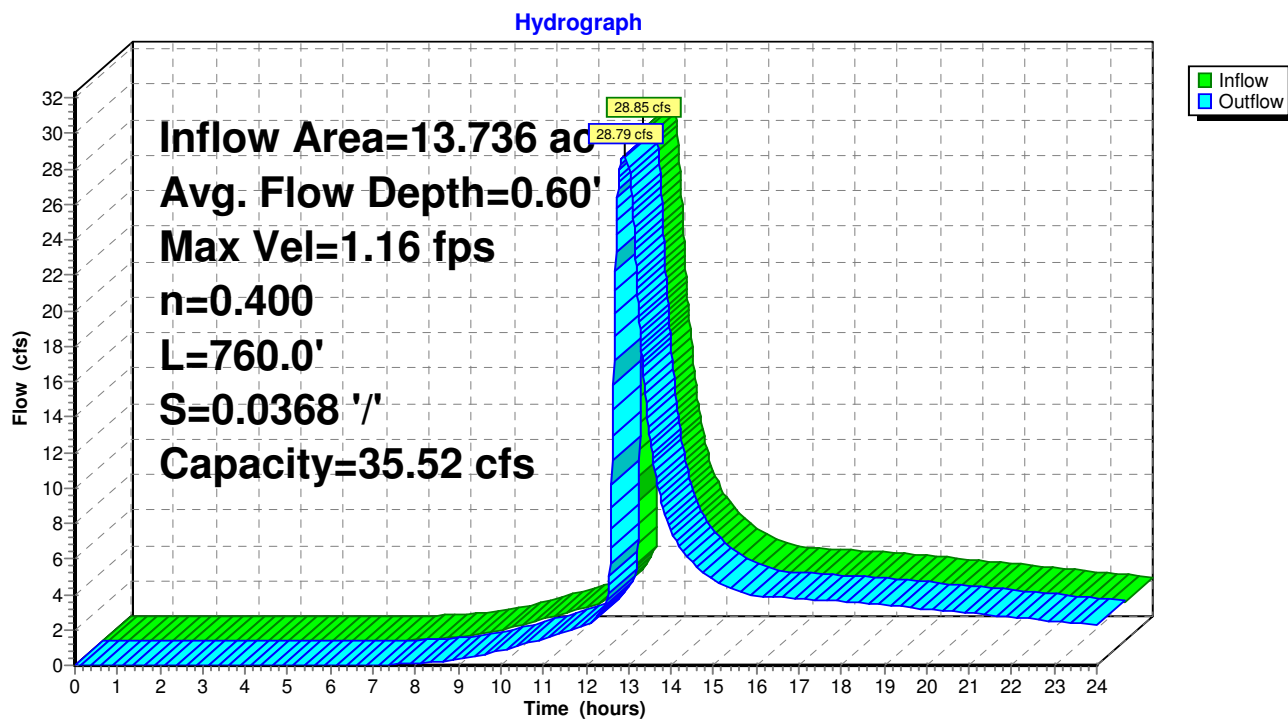
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Type III 24-hr 100 year Rainfall=7.00"

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Reach 3R: Overland Flow



Summary for Pond 6P: Detention Basin

Inflow Area = 13.736 ac, 38.54% Impervious, Inflow Depth > 5.34" for 100 year event
 Inflow = 50.81 cfs @ 12.34 hrs, Volume= 6.115 af
 Outflow = 28.85 cfs @ 12.68 hrs, Volume= 5.501 af, Atten= 43%, Lag= 20.2 min
 Primary = 28.85 cfs @ 12.68 hrs, Volume= 5.501 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 94.97' @ 12.68 hrs Surf.Area= 24,521 sf Storage= 101,349 cf

Plug-Flow detention time= 173.4 min calculated for 5.498 af (90% of inflow)
 Center-of-Mass det. time= 126.2 min (934.2 - 808.0)

Volume	Invert	Avail.Storage	Storage Description
#1	90.00'	127,579 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
90.00	16,410	0	0
92.00	19,568	35,978	35,978
94.00	22,870	42,438	78,416
95.00	24,576	23,723	102,139
96.00	26,304	25,440	127,579

Device	Routing	Invert	Outlet Devices
#1	Primary	89.00'	24.0" Round Culvert L= 112.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 89.00' / 88.00' S= 0.0089 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	90.00'	10.0" Round Culvert L= 5.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 90.00' / 89.90' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 0.55 sf
#3	Device 1	93.90'	30.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Primary	95.00'	20.0' long x 13.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.60 2.64 2.70 2.66 2.65 2.66 2.65 2.63

Primary OutFlow Max=28.85 cfs @ 12.68 hrs HW=94.97' (Free Discharge)

1=Culvert (Passes 28.85 cfs of 33.71 cfs potential flow)
 2=Culvert (Inlet Controls 4.42 cfs @ 8.11 fps)
 3=Orifice/Grate (Orifice Controls 24.42 cfs @ 4.98 fps)
 4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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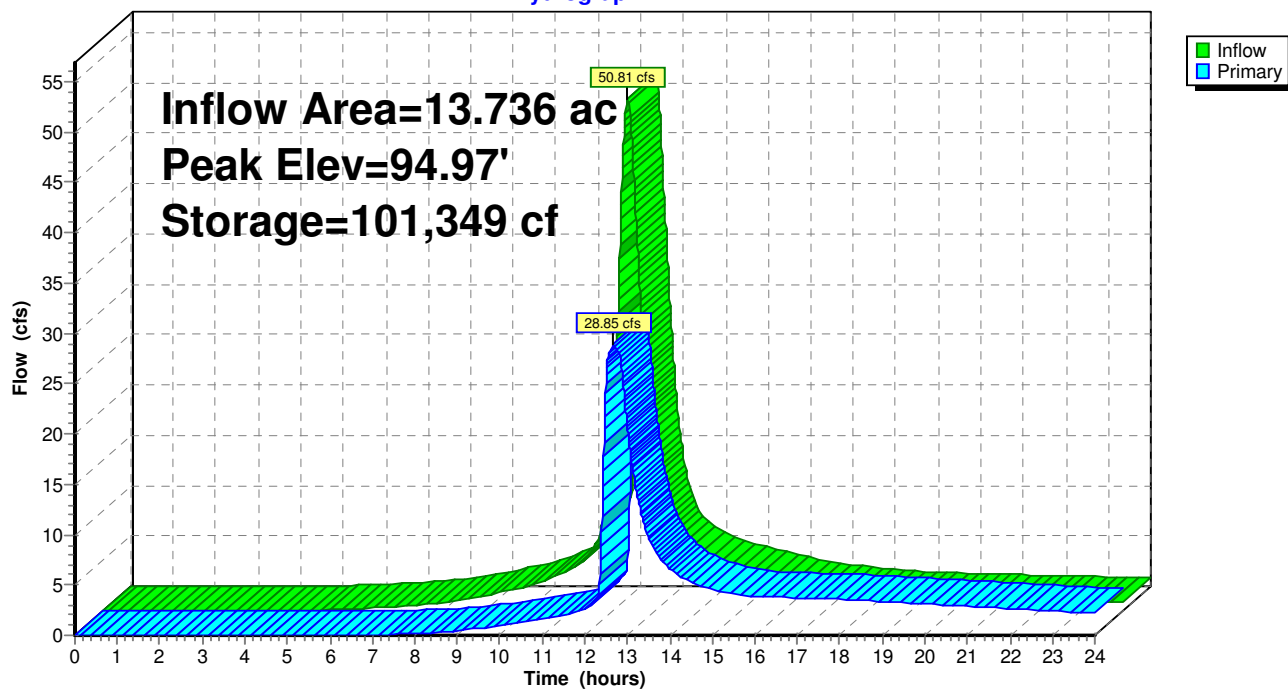
Type III 24-hr 100 year Rainfall=7.00"

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Pond 6P: Detention Basin

Hydrograph



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Type III 24-hr 100 year Rainfall=7.00"

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Summary for Link 2L: Design Point

Inflow Area = 101.706 ac, 23.22% Impervious, Inflow Depth > 4.18" for 100 year event

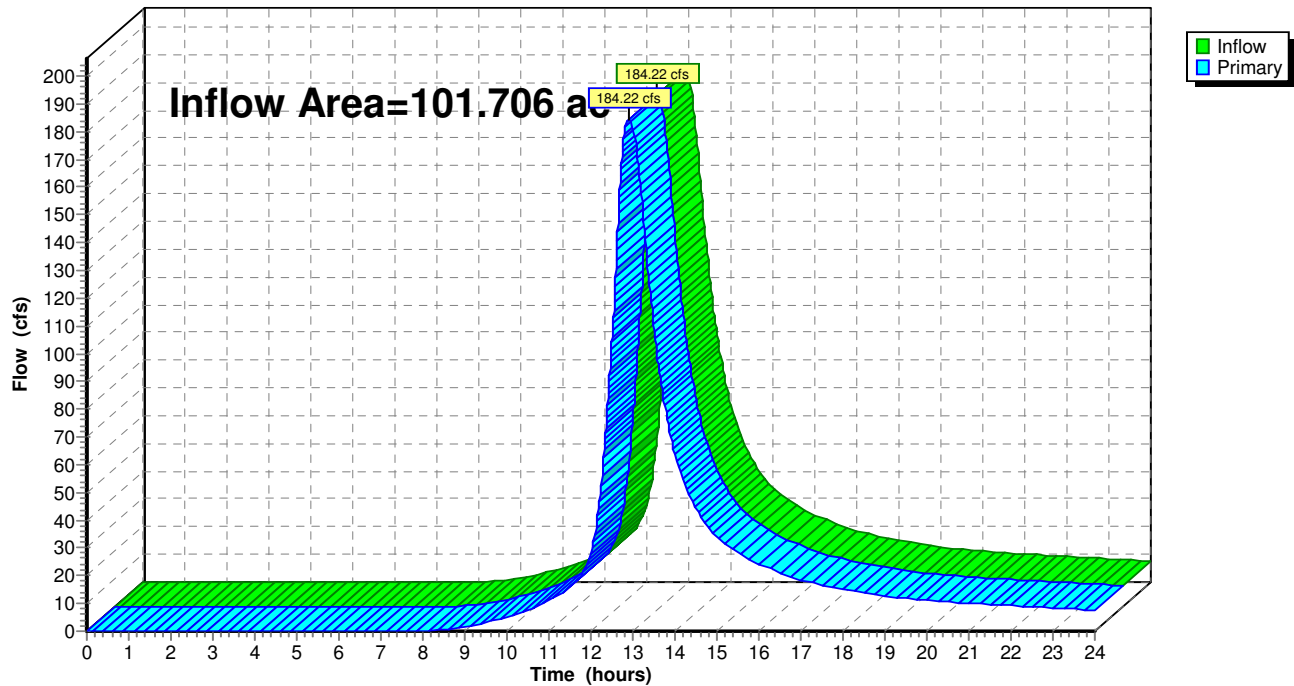
Inflow = 184.22 cfs @ 12.91 hrs, Volume= 35.441 af

Primary = 184.22 cfs @ 12.91 hrs, Volume= 35.441 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 2L: Design Point

Hydrograph



Section 5

Erosion and Sediment Control Design

Provost & Rovero, Inc.

P.O. Box 191, 57 East Main Street Plainfield, CT 06374

Telephone (860) 230-0856

Fax (860) 230-0860

Job: 213009 - Sediment Basin Design

Sheet No. 1 of

Calculated by: DTH Date: 7/30/22

Checked by: Date:

Scale:

Determine sediment volume

$$V = \frac{(DA)(A)(DR)(TE)(2,000 \text{ #/ton})}{\gamma (43,560 \text{ ft}^2/\text{ac})}$$

$$DA = 13.74 \text{ acres}$$

A: 8.0 acres construction site @ 50 ton/ac/yr
5.74 acres developed @ 1.0 ton/ac/yr

$$A_{avg} = 30 \text{ ton/ac/yr}$$

$$DR \text{ for silt/sand mix} = 0.50$$

$$TE = 0.80 \text{ (assume 80\% efficiency)}$$

$$\gamma = 85 \text{ #/ft}^3$$

$$V = \frac{(13.74 \text{ ac})(30 \text{ ton/ac/yr})(0.50)(0.80)(2,000 \text{ #/ton})}{(85 \text{ #/ft}^3)(43,560 \text{ ft}^2/\text{ac})} = 0.09 \text{ ac}\cdot\text{ft}/\text{yr}$$

Assume site will be disturbed for 18 months

$$\% \text{ Required sediment storage} = (0.09 \text{ ac}\cdot\text{ft}/\text{yr})(1.5 \text{ yrs}) = 0.14 \text{ ac}\cdot\text{ft} = 6,098 \text{ ft}^3$$

$$\text{Sediment storage elevation} = 90.40 \pm$$

Determine detention storage volume

$$Q_{10} = 34.10 \text{ cfs}$$

$$V_r = 4.082 \text{ ac}\cdot\text{ft} / 13.74 \text{ ac} = 0.30 \text{ ft} = 3.6 \text{ in}$$

$$Q_{10} / DA = 34.10 / 13.74 = 2.47$$

from Figure SB-13, $Q_0 / Q_i = 0.09$

$$\% Q_0 = (0.09)(34.10 \text{ cfs}) = 3.1 \text{ cfs}$$

Provost & Rovero, Inc.

P.O. Box 191, 57 East Main Street Plainfield, CT 06374

Telephone (860) 230-0856

Fax (860) 230-0860

Job: 213009 - Sediment Basin Design

Sheet No. 2 of

Calculated by: DJH Date: 7/30/22

Checked by: Date:

Scale:

$$\text{Release rate} = \frac{(3.1 \text{ cfs}) (640 \text{ ac/sm})}{13.74 \text{ ac}} = 144 \text{ csm}$$

$$\text{From Figure DB-6} \quad V_s = (2.0 \text{ in}) (13.74 \text{ ac}) (1 \text{ ft}/12 \text{ in}) = 2.29 \text{ ac}\cdot\text{ft}$$

$$\text{Total Storage Required} = 2.29 \text{ ac}\cdot\text{ft} + 0.14 \text{ ac}\cdot\text{ft} = 2.43 \text{ ac}\cdot\text{ft} = 105,851 \text{ ft}^3$$

Set principal spillway at elev. 95.20 (storage = 107,087 ft³)

Depth: The average depth shall be 4 feet or greater.

Width: The minimum width shall be:

$$W = 10 \sqrt{Q_5}$$

where: W = width in feet

Q_5 = peak discharge from a 5-year frequency storm in cfs.

When the downstream area is highly sensitive to sediment impacts, the minimum width shall be:

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

where: W = width in feet

Q_{25} = peak discharge from a 25-year frequency storm in cfs.

Figure SB-1 Determining Erosion Rates

Land Use	Ave. Annual Erosion
Wooded area	0.2 ton/ac/yr
Developed urban areas, grassed areas, pastures, hay fields, abandoned fields with good cover	1.0 ton/ac/yr
Clean tilled cropland (corn, vegetables, etc.)	10 ton/ac/yr
Construction Areas	50 ton/ac/yr

Source: USDA-SCS

Figure SB-2 Estimated Sediment Density

Soil Texture *	γ_2 Submerged (lbs/cu. ft.)
Clay	40-60
Silt	55-75
Clay-silt mixtures (equal parts)	40-65
Sand-silt mixtures (equal parts)	75-95
Clay-silt-sand mixtures (equal parts)	50-80
Sand	85-100
Gravel	85-125
Poorly sorted sand and gravel	95-130

* Use USDA soil data from county soil surveys or sieve analysis to determine soil texture.

Source: USDA-NRCS.

Length: The effective flow length shall be equal to at least two times the effective flow width. When site constraints prohibit the design of an adequate length, baffles

are required to provide for the creation of an adequate flow length. (see **Figure SB-7**)

Spillway Design

The outlets for the basin shall consist of a combination of principal and emergency spillways. These outlets must pass the peak runoff from the contributing drainage area for the design storm (see **Figure SB-5**). If, due to site conditions and basin geometry, a separate emergency spillway is not feasible, the principal spillway must pass the entire peak runoff expected from the design storm. However, an attempt to provide a separate emergency spillway should always be made (refer to "Emergency Spillway", **Figure SB-10**). Runoff computations shall be based upon the soil cover conditions which are expected to prevail during the life of the basin. Refer to standard engineering practices for calculations of the peak rate of runoff. Notably, the flow through the dewatering orifice cannot be utilized when calculating the design storm elevation because of its potential to become clogged; therefore, available spillway storage must begin at the principal spillway crest.

The spillways designed by the procedures contained in this manual will not necessarily result in any reduction in the peak rate of runoff. If a reduction in peak runoff is desired, the appropriate hydrographs and storm routings shall be generated to choose the basin and spillway sizes.

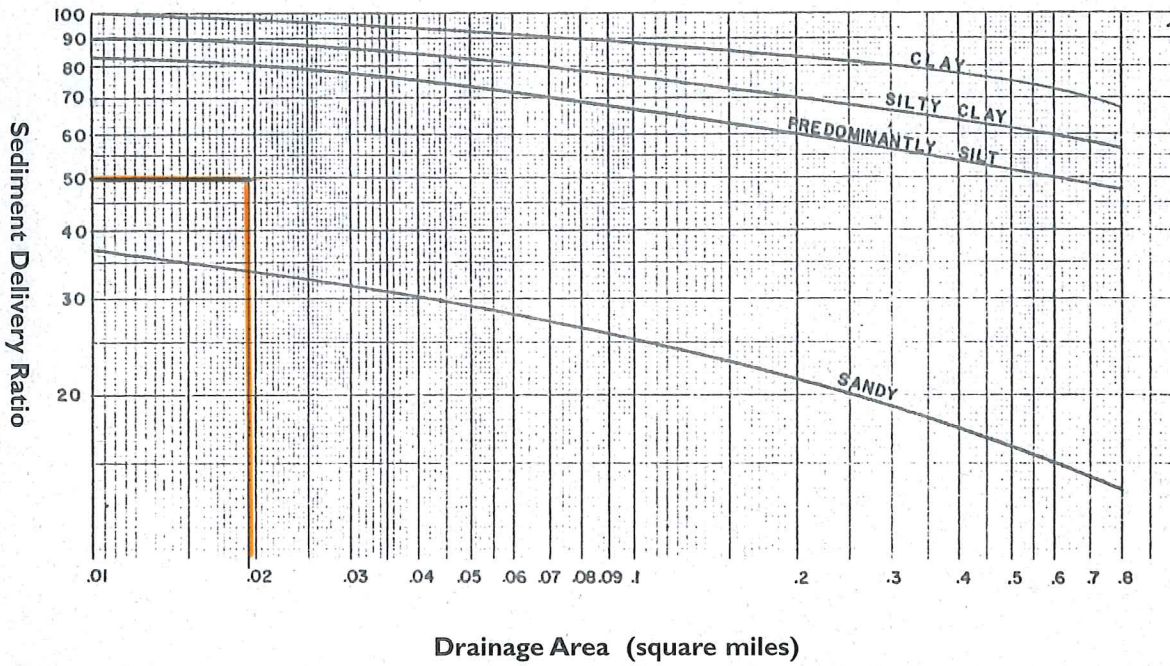
Principal Spillway

For maximum effectiveness, the principal spillway should consist of a vertical pipe or box of corrugated metal or reinforced concrete, with a minimum diameter of 15 inches, joined by a water tight connection to a horizontal pipe (barrel) extending through the embankment and outletting beyond the downstream toe of the fill. If the principal spillway is used in conjunction with a separate emergency spillway, then the principal spillway shall be designed to pass at least the peak flow expected from a 2-year storm. If no emergency spillway is used, the principal spillway shall be designed to pass the entire peak flow expected from the design storm.

Design Elevations: The crest of the principal spillway shall be set at the elevation corresponding to the storage volume required. If a principal spillway is used in conjunction with an emergency spillway, the principal spillway crest shall be a minimum of 1.0 foot below the crest of the emergency spillway. In addition, a minimum freeboard of 1.0 foot shall be provided between the design high water elevation (design depth through the emergency spillway) and the top of the embankment. If no emergency spillway is used, the crest of the principal spillway shall be a minimum of 3 feet below the top of the embankment; in addition, a minimum freeboard of 2.0 feet shall be provided between the design high water and the top of the embankment.

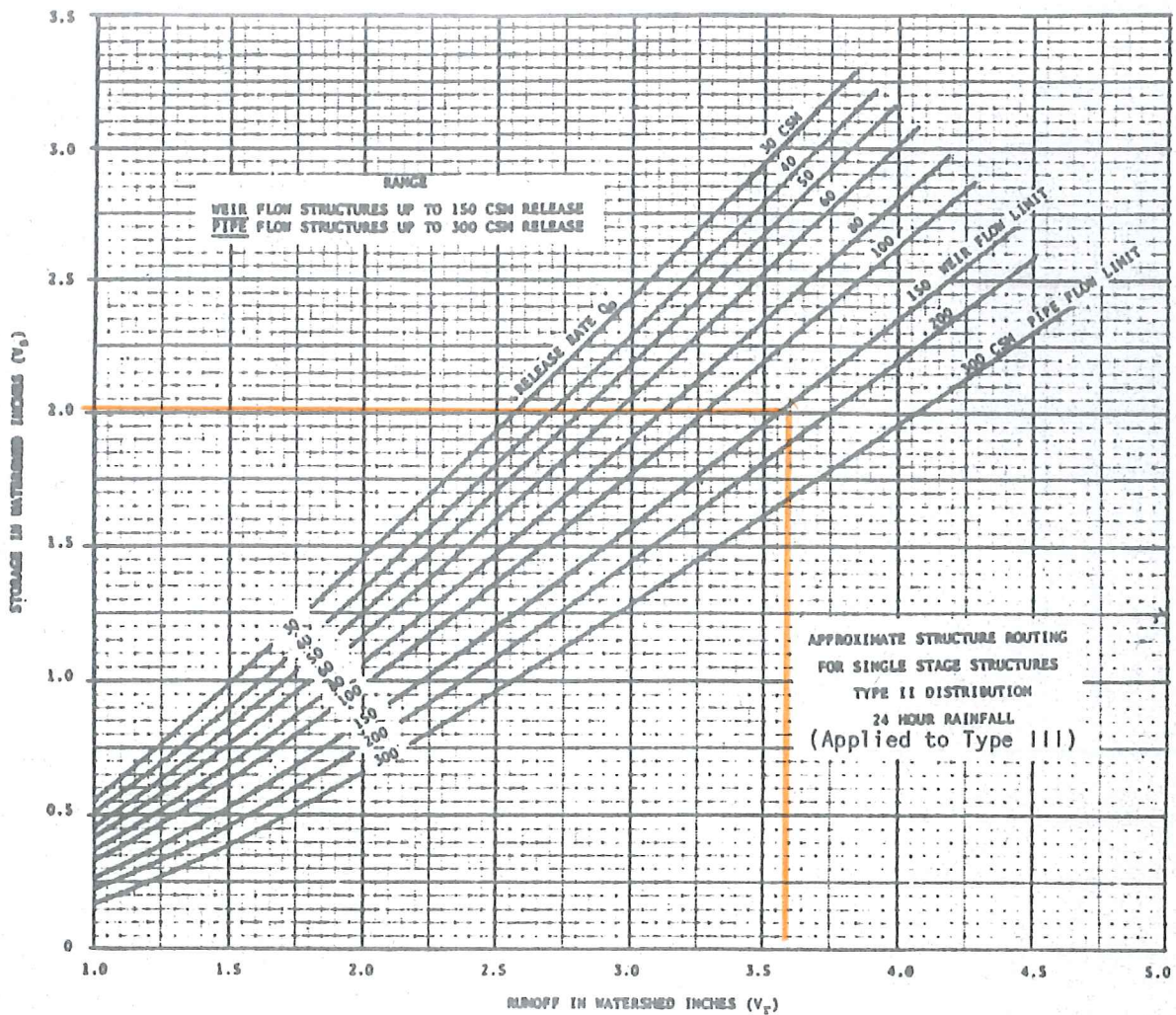
Anti-Vortex Device and Trash Rack: If a riser-type principal spillway is used, an anti-vortex device and trash rack shall be attached to the top of the riser to improve the flow characteristics and prevent blockage due to

Figure SB-12 Sediment Delivery Ration Vs. Drainage Area Graph

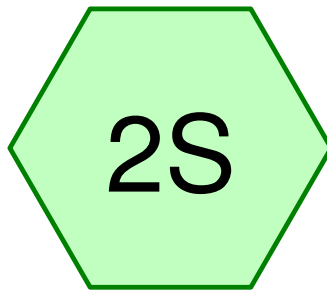


Source: USDA-NRCS

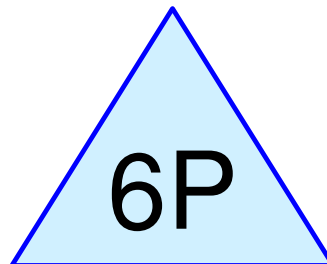
Figure DB-6 Structure Routing Graph



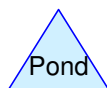
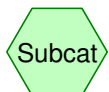
Source: USDA-NRCS



P-2



Sediment Basin



Routing Diagram for 213009 E&S

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Project Notes

CarlsonStageIncrement|1.0000|

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Page 3

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.321	79	50-75% Grass cover, Fair HSG C (2S)
8.000	91	Newly graded area, HSG C (2S)
2.430	98	Paved parking HSG C (2S)
0.464	73	Woods, Fair HSG C (2S)
0.525	76	Woods/grass comb., Fair HSG C (2S)
13.740	89	TOTAL AREA

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
13.740	HSG C	2S
0.000	HSG D	
0.000	Other	
13.740		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	2.321	0.000	0.000	2.321	50-75% Grass cover, Fair	2S
0.000	0.000	8.000	0.000	0.000	8.000	Newly graded area	2S
0.000	0.000	2.430	0.000	0.000	2.430	Paved parking	2S
0.000	0.000	0.464	0.000	0.000	0.464	Woods, Fair	2S
0.000	0.000	0.525	0.000	0.000	0.525	Woods/grass comb., Fair	2S
0.000	0.000	13.740	0.000	0.000	13.740	TOTAL AREA	

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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	6P	89.90	89.60	44.0	0.0068	0.012	24.0	0.0	0.0

213009 E&S*Type III 24-hr 2 year Rainfall=3.20"*

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Muskingum-Cunge method - Pond routing by Stor-Ind method

Subcatchment 2S: P-2

Runoff Area=13.740 ac 17.69% Impervious Runoff Depth>2.07"

Tc=26.0 min CN=89 Runoff=20.13 cfs 2.372 af

Pond 6P: Sediment Basin

Peak Elev=95.05' Storage=103,305 cf Inflow=20.13 cfs 2.372 af

Outflow=0.00 cfs 0.000 af

Total Runoff Area = 13.740 ac Runoff Volume = 2.372 af Average Runoff Depth = 2.07"
82.31% Pervious = 11.310 ac 17.69% Impervious = 2.430 ac

Summary for Subcatchment 2S: P-2

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CarlsonSurface||

Runoff = 20.13 cfs @ 12.34 hrs, Volume= 2.372 af, Depth> 2.07"

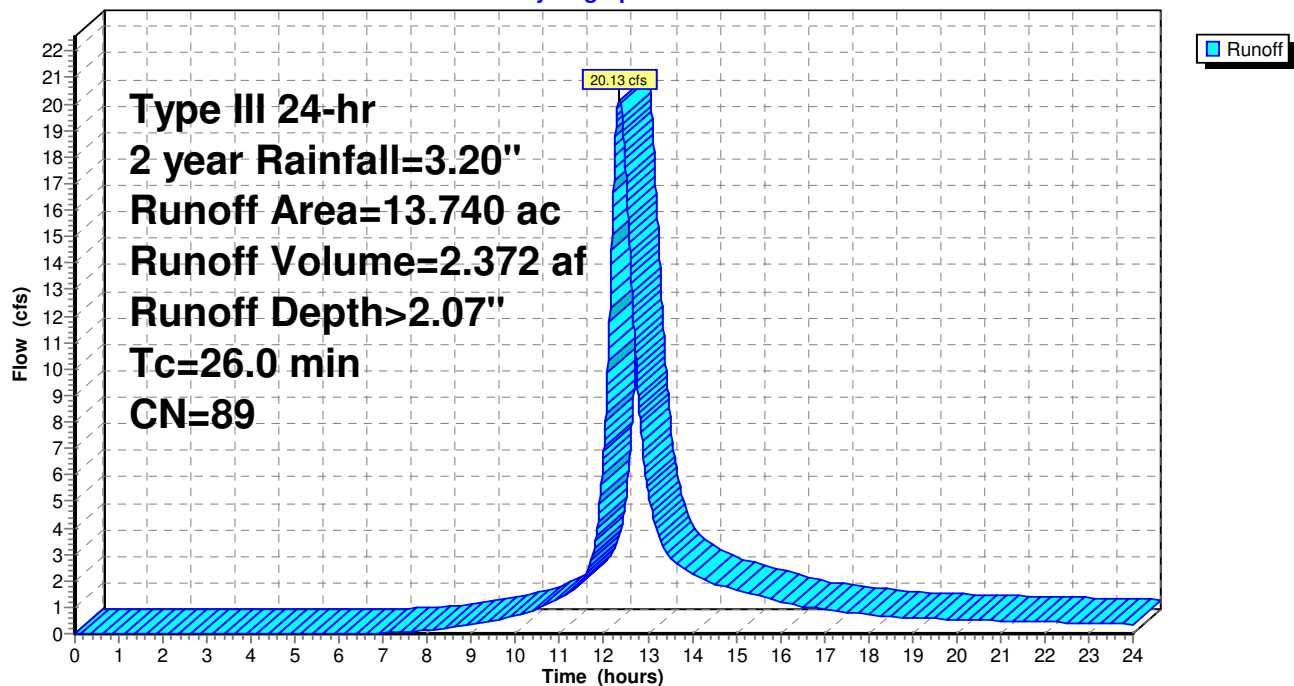
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (ac)	CN	Description
0.464	73	Woods, Fair HSG C
0.525	76	Woods/grass comb., Fair HSG C
2.430	98	Paved parking HSG C
2.321	79	50-75% Grass cover, Fair HSG C
8.000	91	Newly graded area, HSG C
13.740	89	Weighted Average
11.310		82.31% Pervious Area
2.430		17.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.0					Direct Entry, Storm sewer TC

Subcatchment 2S: P-2

Hydrograph



Summary for Pond 6P: Sediment Basin

Inflow Area = 13.740 ac, 17.69% Impervious, Inflow Depth > 2.07" for 2 year event
 Inflow = 20.13 cfs @ 12.34 hrs, Volume= 2.372 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 95.05' @ 24.00 hrs Surf.Area= 24,658 sf Storage= 103,305 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

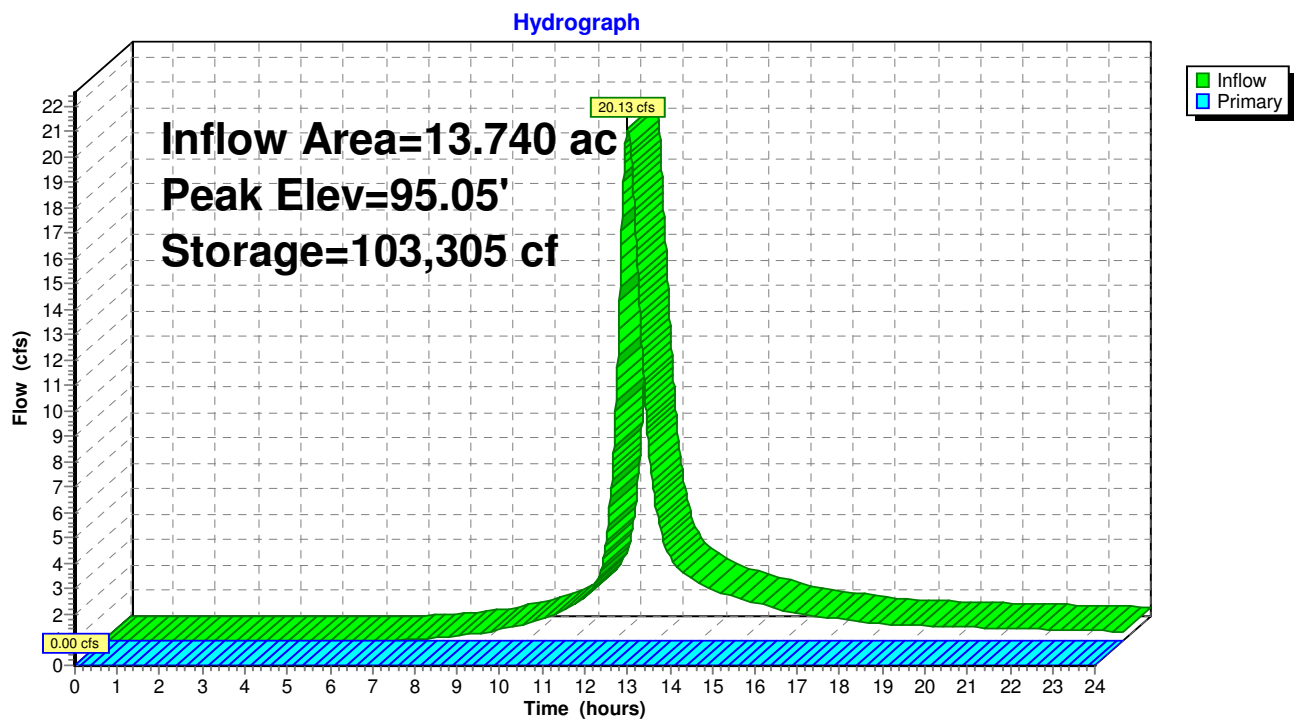
Volume	Invert	Avail.Storage	Storage Description
#1	90.00'	154,771 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
90.00	16,410	0	0
92.00	19,568	35,978	35,978
94.00	22,870	42,438	78,416
95.00	24,576	23,723	102,139
96.00	26,304	25,440	127,579
97.00	28,079	27,192	154,771

Device	Routing	Invert	Outlet Devices
#1	Primary	89.90'	24.0" Round Culvert L= 44.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 89.90' / 89.60' S= 0.0068 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	95.20'	30.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Primary	96.20'	20.0' long x 13.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.60 2.64 2.70 2.66 2.65 2.66 2.65 2.63

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=90.00' (Free Discharge)

1=Culvert (Passes 0.00 cfs of 0.05 cfs potential flow)
 2=Orifice/Grate (Controls 0.00 cfs)
 3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 6P: Sediment Basin



213009 E&S*Type III 24-hr 5 year Rainfall=4.20"*

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Muskingum-Cunge method - Pond routing by Stor-Ind method

Subcatchment 2S: P-2

Runoff Area=13.740 ac 17.69% Impervious Runoff Depth>3.00"

Tc=26.0 min CN=89 Runoff=28.85 cfs 3.432 af

Pond 6P: Sediment Basin

Peak Elev=95.40' Storage=112,036 cf Inflow=28.85 cfs 3.432 af

Outflow=2.26 cfs 0.933 af

Total Runoff Area = 13.740 ac Runoff Volume = 3.432 af Average Runoff Depth = 3.00"
82.31% Pervious = 11.310 ac 17.69% Impervious = 2.430 ac

Summary for Subcatchment 2S: P-2

CarlsonPlanXYPos|1170813.5231|690121.8114|

CarlsonSurface||

Runoff = 28.85 cfs @ 12.34 hrs, Volume= 3.432 af, Depth> 3.00"

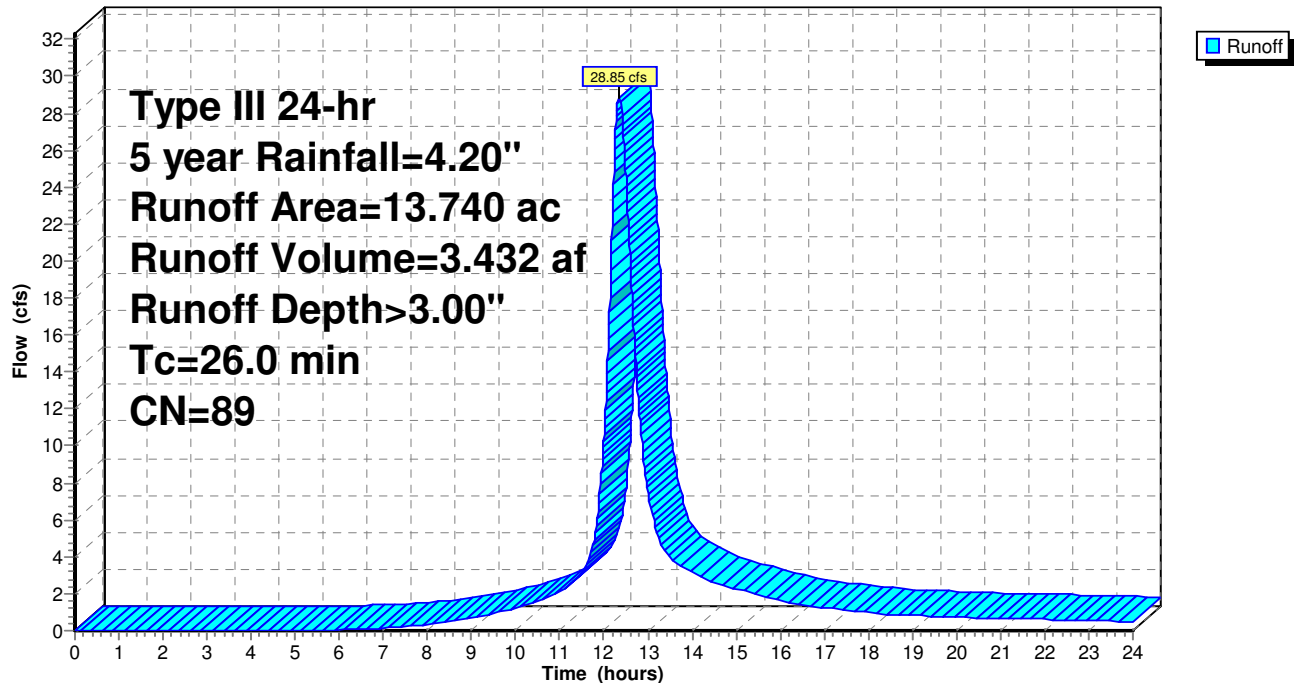
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 5 year Rainfall=4.20"

Area (ac)	CN	Description
0.464	73	Woods, Fair HSG C
0.525	76	Woods/grass comb., Fair HSG C
2.430	98	Paved parking HSG C
2.321	79	50-75% Grass cover, Fair HSG C
8.000	91	Newly graded area, HSG C
13.740	89	Weighted Average
11.310		82.31% Pervious Area
2.430		17.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.0					Direct Entry, Storm sewer TC

Subcatchment 2S: P-2

Hydrograph



Summary for Pond 6P: Sediment Basin

Inflow Area = 13.740 ac, 17.69% Impervious, Inflow Depth > 3.00" for 5 year event
 Inflow = 28.85 cfs @ 12.34 hrs, Volume= 3.432 af
 Outflow = 2.26 cfs @ 15.01 hrs, Volume= 0.933 af, Atten= 92%, Lag= 160.4 min
 Primary = 2.26 cfs @ 15.01 hrs, Volume= 0.933 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 95.40' @ 15.01 hrs Surf.Area= 25,262 sf Storage= 112,036 cf

Plug-Flow detention time= 393.3 min calculated for 0.932 af (27% of inflow)
 Center-of-Mass det. time= 249.3 min (1,065.6 - 816.3)

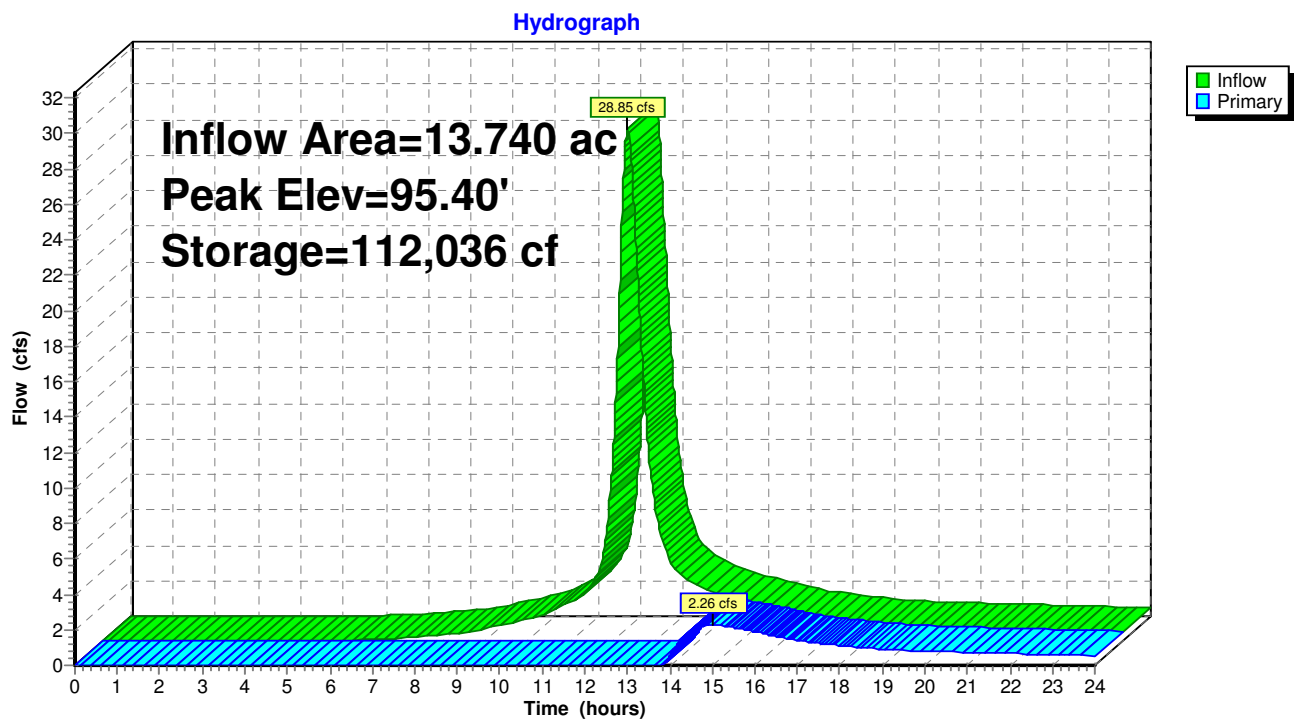
Volume	Invert	Avail.Storage	Storage Description
#1	90.00'	154,771 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
90.00	16,410	0	0
92.00	19,568	35,978	35,978
94.00	22,870	42,438	78,416
95.00	24,576	23,723	102,139
96.00	26,304	25,440	127,579
97.00	28,079	27,192	154,771

Device	Routing	Invert	Outlet Devices
#1	Primary	89.90'	24.0" Round Culvert L= 44.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 89.90' / 89.60' S= 0.0068 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	95.20'	30.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Primary	96.20'	20.0' long x 13.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.60 2.64 2.70 2.66 2.65 2.66 2.65 2.63

Primary OutFlow Max=2.25 cfs @ 15.01 hrs HW=95.40' (Free Discharge)

1=Culvert (Passes 2.25 cfs of 32.08 cfs potential flow)
 2=Orifice/Grate (Weir Controls 2.25 cfs @ 1.45 fps)
 3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 6P: Sediment Basin

213009 E&S*Type III 24-hr 10 year Rainfall=4.80"*

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Muskingum-Cunge method - Pond routing by Stor-Ind method

Subcatchment 2S: P-2

Runoff Area=13.740 ac 17.69% Impervious Runoff Depth>3.56"
Tc=26.0 min CN=89 Runoff=34.10 cfs 4.082 af

Pond 6P: Sediment Basin

Peak Elev=95.53' Storage=115,417 cf Inflow=34.10 cfs 4.082 af
Outflow=4.88 cfs 1.578 af

Total Runoff Area = 13.740 ac Runoff Volume = 4.082 af Average Runoff Depth = 3.56"
82.31% Pervious = 11.310 ac 17.69% Impervious = 2.430 ac

Summary for Subcatchment 2S: P-2

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CarlsonSurface||

Runoff = 34.10 cfs @ 12.34 hrs, Volume= 4.082 af, Depth> 3.56"

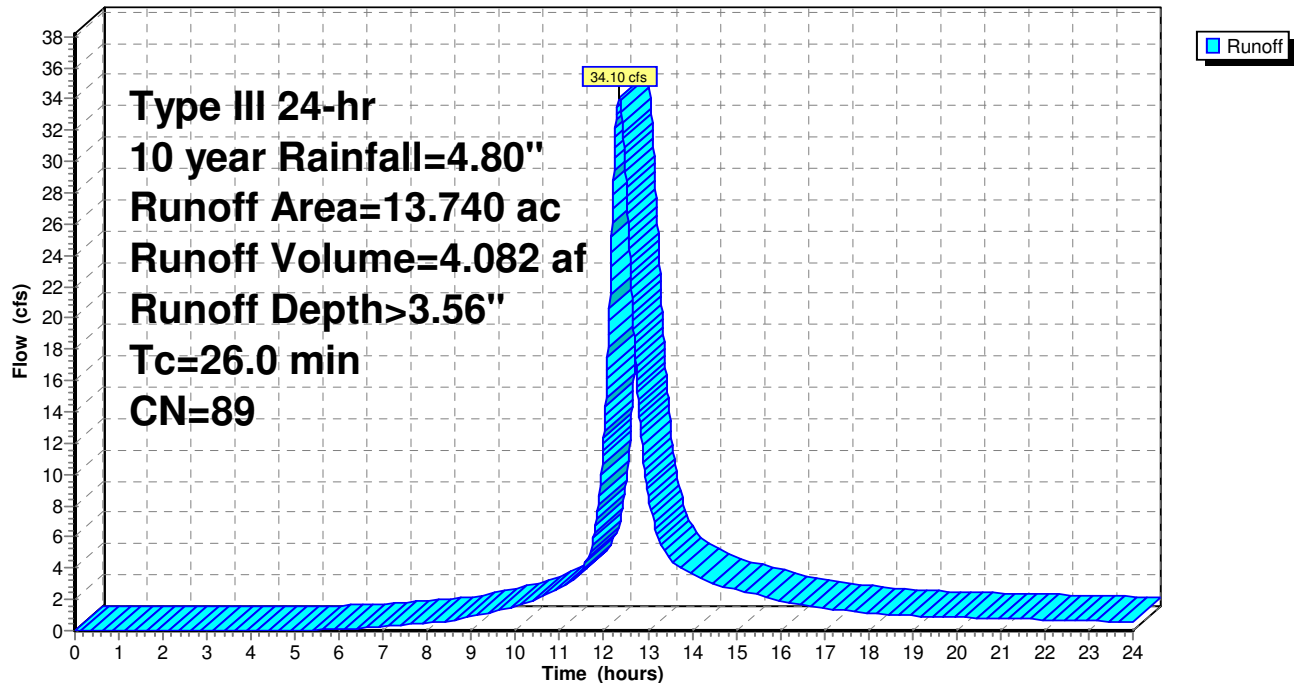
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 year Rainfall=4.80"

Area (ac)	CN	Description
0.464	73	Woods, Fair HSG C
0.525	76	Woods/grass comb., Fair HSG C
2.430	98	Paved parking HSG C
2.321	79	50-75% Grass cover, Fair HSG C
8.000	91	Newly graded area, HSG C
13.740	89	Weighted Average
11.310		82.31% Pervious Area
2.430		17.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.0					Direct Entry, Storm sewer TC

Subcatchment 2S: P-2

Hydrograph



Summary for Pond 6P: Sediment Basin

Inflow Area = 13.740 ac, 17.69% Impervious, Inflow Depth > 3.56" for 10 year event
 Inflow = 34.10 cfs @ 12.34 hrs, Volume= 4.082 af
 Outflow = 4.88 cfs @ 13.43 hrs, Volume= 1.578 af, Atten= 86%, Lag= 65.3 min
 Primary = 4.88 cfs @ 13.43 hrs, Volume= 1.578 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 95.53' @ 13.43 hrs Surf.Area= 25,493 sf Storage= 115,417 cf

Plug-Flow detention time= 302.9 min calculated for 1.578 af (39% of inflow)
 Center-of-Mass det. time= 177.2 min (988.7 - 811.5)

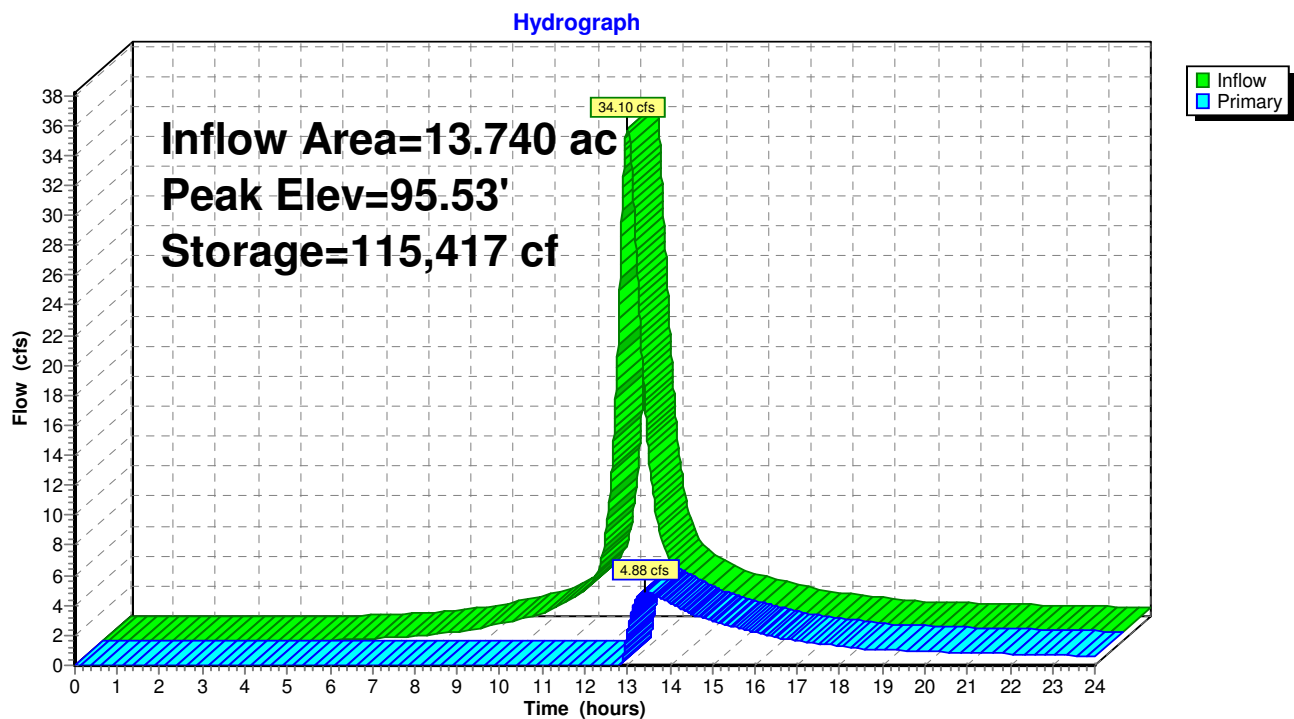
Volume	Invert	Avail.Storage	Storage Description
#1	90.00'	154,771 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
90.00	16,410	0	0
92.00	19,568	35,978	35,978
94.00	22,870	42,438	78,416
95.00	24,576	23,723	102,139
96.00	26,304	25,440	127,579
97.00	28,079	27,192	154,771

Device	Routing	Invert	Outlet Devices
#1	Primary	89.90'	24.0" Round Culvert L= 44.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 89.90' / 89.60' S= 0.0068 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	95.20'	30.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Primary	96.20'	20.0' long x 13.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.60 2.64 2.70 2.66 2.65 2.66 2.65 2.63

Primary OutFlow Max=4.88 cfs @ 13.43 hrs HW=95.53' (Free Discharge)

1=Culvert (Passes 4.88 cfs of 32.55 cfs potential flow)
 2=Orifice/Grate (Weir Controls 4.88 cfs @ 1.88 fps)
 3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 6P: Sediment Basin

213009 E&S*Type III 24-hr 25 year Rainfall=5.60"*

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Muskingum-Cunge method - Pond routing by Stor-Ind method

Subcatchment 2S: P-2

Runoff Area=13.740 ac 17.69% Impervious Runoff Depth=4.33"
Tc=26.0 min CN=89 Runoff=41.07 cfs 4.958 af

Pond 6P: Sediment Basin

Peak Elev=95.84' Storage=123,361 cf Inflow=41.07 cfs 4.958 af
Outflow=13.13 cfs 2.448 af

Total Runoff Area = 13.740 ac Runoff Volume = 4.958 af Average Runoff Depth = 4.33"
82.31% Pervious = 11.310 ac 17.69% Impervious = 2.430 ac

Summary for Subcatchment 2S: P-2

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CarlsonSurface||

Runoff = 41.07 cfs @ 12.34 hrs, Volume= 4.958 af, Depth> 4.33"

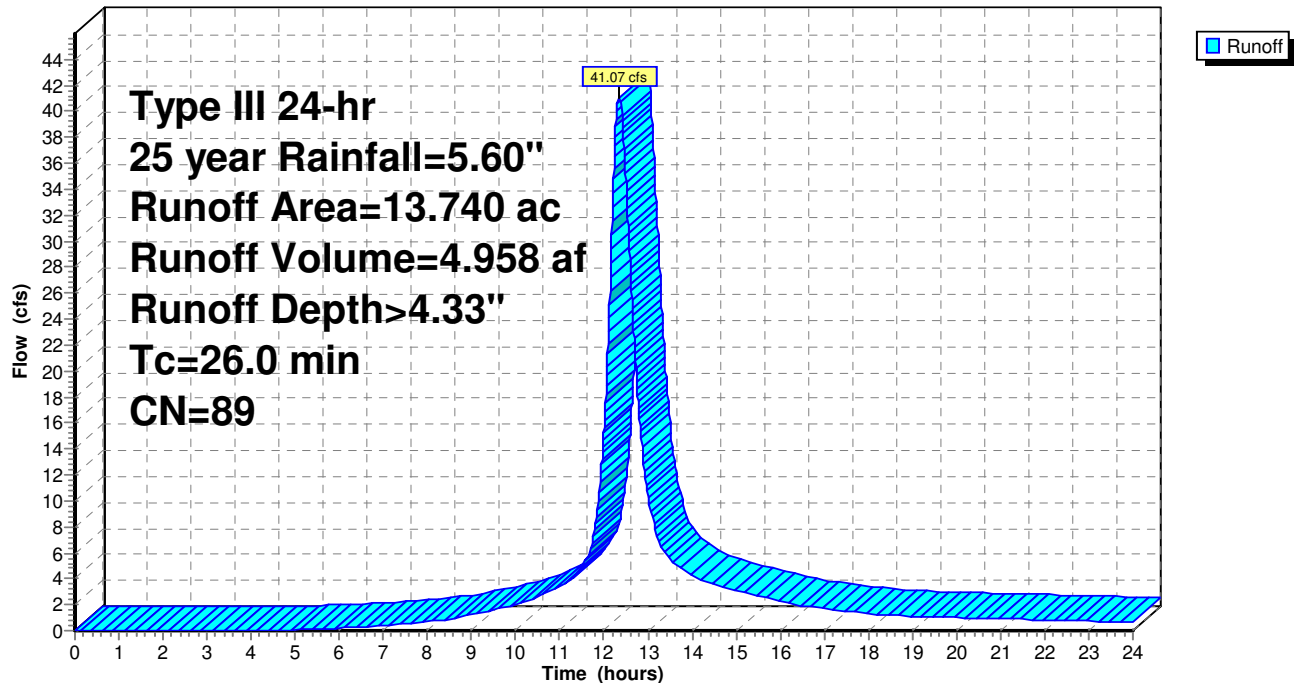
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 year Rainfall=5.60"

Area (ac)	CN	Description
0.464	73	Woods, Fair HSG C
0.525	76	Woods/grass comb., Fair HSG C
2.430	98	Paved parking HSG C
2.321	79	50-75% Grass cover, Fair HSG C
8.000	91	Newly graded area, HSG C
13.740	89	Weighted Average
11.310		82.31% Pervious Area
2.430		17.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.0					Direct Entry, Storm sewer TC

Subcatchment 2S: P-2

Hydrograph



Summary for Pond 6P: Sediment Basin

Inflow Area = 13.740 ac, 17.69% Impervious, Inflow Depth > 4.33" for 25 year event
 Inflow = 41.07 cfs @ 12.34 hrs, Volume= 4.958 af
 Outflow = 13.13 cfs @ 12.89 hrs, Volume= 2.448 af, Atten= 68%, Lag= 33.2 min
 Primary = 13.13 cfs @ 12.89 hrs, Volume= 2.448 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 95.84' @ 12.89 hrs Surf.Area= 26,025 sf Storage= 123,361 cf

Plug-Flow detention time= 244.7 min calculated for 2.447 af (49% of inflow)
 Center-of-Mass det. time= 132.0 min (938.2 - 806.2)

Volume	Invert	Avail.Storage	Storage Description
#1	90.00'	154,771 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
90.00	16,410	0	0
92.00	19,568	35,978	35,978
94.00	22,870	42,438	78,416
95.00	24,576	23,723	102,139
96.00	26,304	25,440	127,579
97.00	28,079	27,192	154,771

Device	Routing	Invert	Outlet Devices
#1	Primary	89.90'	24.0" Round Culvert L= 44.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 89.90' / 89.60' S= 0.0068 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	95.20'	30.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Primary	96.20'	20.0' long x 13.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.60 2.64 2.70 2.66 2.65 2.66 2.65 2.63

Primary OutFlow Max=13.11 cfs @ 12.89 hrs HW=95.84' (Free Discharge)

1=Culvert (Passes 13.11 cfs of 33.62 cfs potential flow)
 2=Orifice/Grate (Weir Controls 13.11 cfs @ 2.61 fps)
 3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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