

**DRAINAGE & STORMWATER  
MANAGEMENT REPORT**

*Prepared for*

**PROPOSED RESIDENTIAL DEVELOPMENT  
COLONEL LEDYARD HIGHWAY (CT ROUTE 117)  
& IRON STREET (CT ROUTE  
LEDYARD, CT**

**January 2026**

*Prepared for*

**Ledyard Center, LLC**

*Prepared by*

**Killingly Engineering Associates**  
*Civil Engineering & Surveying*



Normand Thibeault Jr., P.E.  
CT License #22834

## ***Introduction***

Ledyard Center, LLC has submitted a proposal to the Town of Ledyard to develop approximately 3 acres of a 41-acre parcel of land to permit construction of a 36-unit residential development. The property is currently vacant and wooded. The property generally slopes down gradient to the east. The design utilizes the same methodology for the site development but incorporates pre-treatment of stormwater runoff which will be retained on site.

## ***Summary***

According to the USDA-SCS Soil Survey, the bulk of the soils on site consist predominantly of Woodbridge soils. Canton and Charlton soils typically demonstrate infiltration rates of 4-6 inches per hour and are associated with Hydrologic Soil Group "C". The project will maintain the existing drainage patterns for post development conditions. During construction, the area of disturbance will be isolated with temporary construction fencing and the site will be surrounded with silt fence or staked haybales.

The calculations utilized HydroCAD Stormwater Modeling System, a computer model, to analyze pre-and post-development drainage conditions. The model used the NOAA Type D 24-hour rainfall to calculate the runoff. The 2, 10 and 100-year frequency storms were analyzed to evaluate peak runoff for pre-and post-construction conditions. Tables 1-3 summarize our findings for pre and post construction conditions:

**Table 1. Existing & Proposed Peak Flows to Wetlands**

Design Storm	Depth (in)	Existing peak	Proposed peak	Difference
2-Year	3.46	2.90 CFS	2.48 CFS	-0.42 CFS
10-Year	5.11	6.59 CFS	4.45 CFS	-2.14 CFS
100-Year	7.74	13.31 CFS	8.61 CFS	-4.70 CFS

As shown by the computations, the post development peak runoff rates are reduced from pre-construction rates for all design storms. It is important to note that much of the runoff will be via sheet flow and will be maintained on site; they will not detrimentally impact any adjacent properties. A Water Quality Volume (WQV) computation is included in this report, and the proposed stormwater basin will serve to exceed that requirement for the first 1.3" of rainfall per the State of Connecticut Stormwater Quality Manual. The required WQV for the site is 1,578 cubic feet and the stormwater basin provides 2,153 cubic feet below the low-level outlet from the basin.

## **HYDROCAD CALCULATIONS**

## **EXISTING CONDITIONS**

## **PROPOSED CONDITIONS**



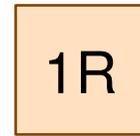
Drainage Area 1



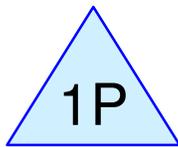
Drainage Area 2



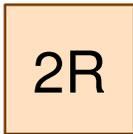
Drainage Area 3



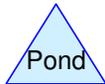
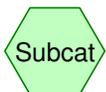
Grassed Swale



Stormwater Pond



Peak Flow



**Routing Diagram for Proposed Conditions**  
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### Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NOAA 24-hr	D	Default	24.00	1	3.46	2
2	10-Year	NOAA 24-hr	D	Default	24.00	1	5.11	2
3	100-Year	NOAA 24-hr	D	Default	24.00	1	7.74	2

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### Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.843	74	>75% Grass cover, Good, HSG C (1S, 2S, 3S)
0.545	98	Paved parking & roof, HSG C (1S)
0.650	98	Paved parking/roof, HSG C (3S)
<b>3.038</b>	<b>83</b>	<b>TOTAL AREA</b>

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### Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
3.038	HSG C	1S, 2S, 3S
0.000	HSG D	
0.000	Other	
<b>3.038</b>		<b>TOTAL AREA</b>

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### Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	1.843	0.000	0.000	1.843	>75% Grass cover, Good	1S, 2S, 3S
0.000	0.000	0.545	0.000	0.000	0.545	Paved parking & roof	1S
0.000	0.000	0.650	0.000	0.000	0.650	Paved parking/roof	3S
<b>0.000</b>	<b>0.000</b>	<b>3.038</b>	<b>0.000</b>	<b>0.000</b>	<b>3.038</b>	<b>TOTAL AREA</b>	

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### Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	1P	271.00	270.00	32.0	0.0313	0.012	0.0	4.0	0.0	

**Proposed Conditions**

NOAA 24-hr D 2-Year Rainfall=3.46"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1S: Drainage Area 1** Runoff Area=58,942 sf 40.24% Impervious Runoff Depth>1.74"  
Flow Length=203' Tc=11.2 min CN=84 Runoff=2.46 cfs 0.196 af

**Subcatchment 2S: Drainage Area 2** Runoff Area=19,528 sf 0.00% Impervious Runoff Depth>1.08"  
Flow Length=192' Slope=0.0680 '/' Tc=14.4 min CN=74 Runoff=0.46 cfs 0.040 af

**Subcatchment 3S: Drainage Area 3** Runoff Area=53,855 sf 52.59% Impervious Runoff Depth>1.98"  
Flow Length=320' Slope=0.0190 '/' Tc=7.3 min CN=87 Runoff=2.89 cfs 0.204 af

**Reach 1R: Grassed Swale** Avg. Flow Depth=0.20' Max Vel=3.19 fps Inflow=2.89 cfs 0.204 af  
n=0.035 L=200.0' S=0.0550 '/' Capacity=47.47 cfs Outflow=2.71 cfs 0.204 af

**Reach 2R: Peak Flow** Inflow=2.46 cfs 0.275 af  
Outflow=2.46 cfs 0.275 af

**Pond 1P: Stormwater Pond** Peak Elev=271.39' Storage=7,744 cf Inflow=3.12 cfs 0.244 af  
Primary=0.16 cfs 0.079 af Secondary=0.00 cfs 0.000 af Outflow=0.16 cfs 0.079 af

**Total Runoff Area = 3.038 ac Runoff Volume = 0.441 af Average Runoff Depth = 1.74"**  
**60.67% Pervious = 1.843 ac 39.33% Impervious = 1.195 ac**

**Proposed Conditions**

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NOAA 24-hr D 2-Year Rainfall=3.46"

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**Summary for Subcatchment 1S: Drainage Area 1**

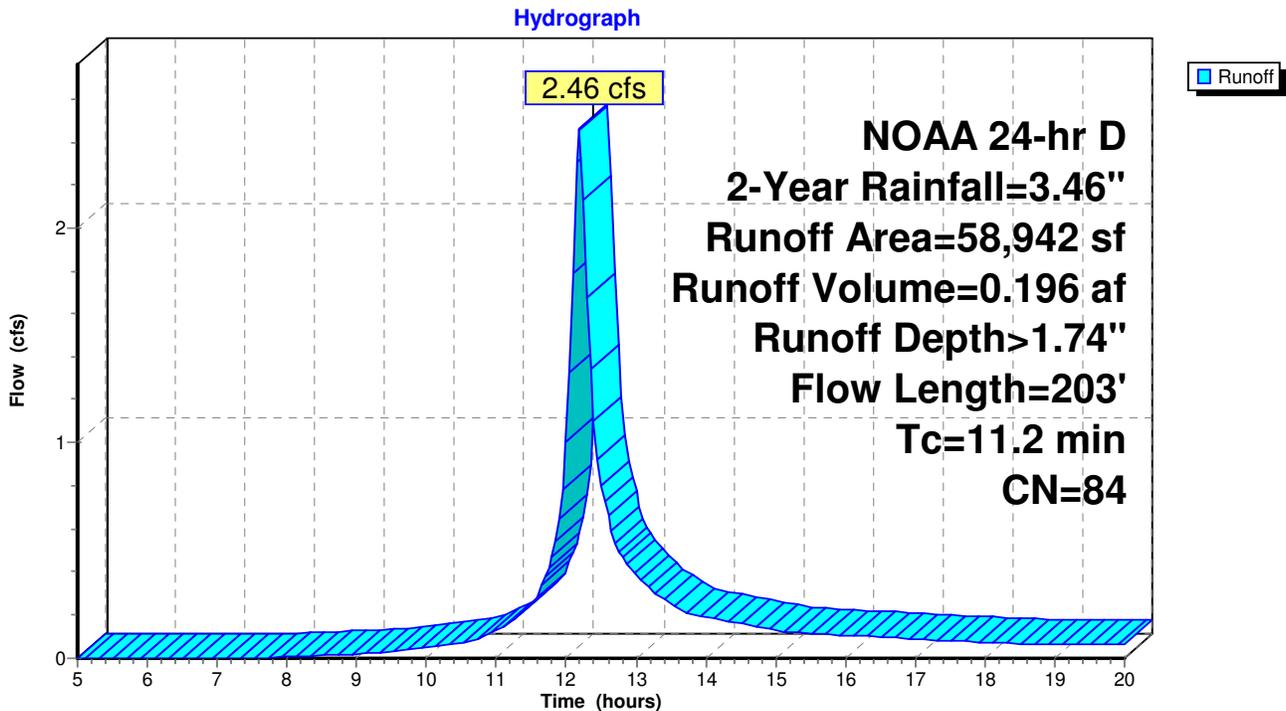
Runoff = 2.46 cfs @ 12.19 hrs, Volume= 0.196 af, Depth> 1.74"  
 Routed to Reach 2R : Peak Flow

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 NOAA 24-hr D 2-Year Rainfall=3.46"

	Area (sf)	CN	Description
*	23,721	98	Paved parking & roof, HSG C
	35,221	74	>75% Grass cover, Good, HSG C
	58,942	84	Weighted Average
	35,221		59.76% Pervious Area
	23,721		40.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	73	0.0410	1.76		<b>Sheet Flow, Tc-DA1a</b> Smooth surfaces n= 0.011 P2= 3.36"
10.5	130	0.0690	0.21		<b>Sheet Flow, Tc-AD1b</b> Grass: Dense n= 0.240 P2= 3.36"
11.2	203	Total			

**Subcatchment 1S: Drainage Area 1**



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NOAA 24-hr D 2-Year Rainfall=3.46"

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## Summary for Subcatchment 2S: Drainage Area 2

Runoff = 0.46 cfs @ 12.24 hrs, Volume= 0.040 af, Depth> 1.08"  
Routed to Pond 1P : Stormwater Pond

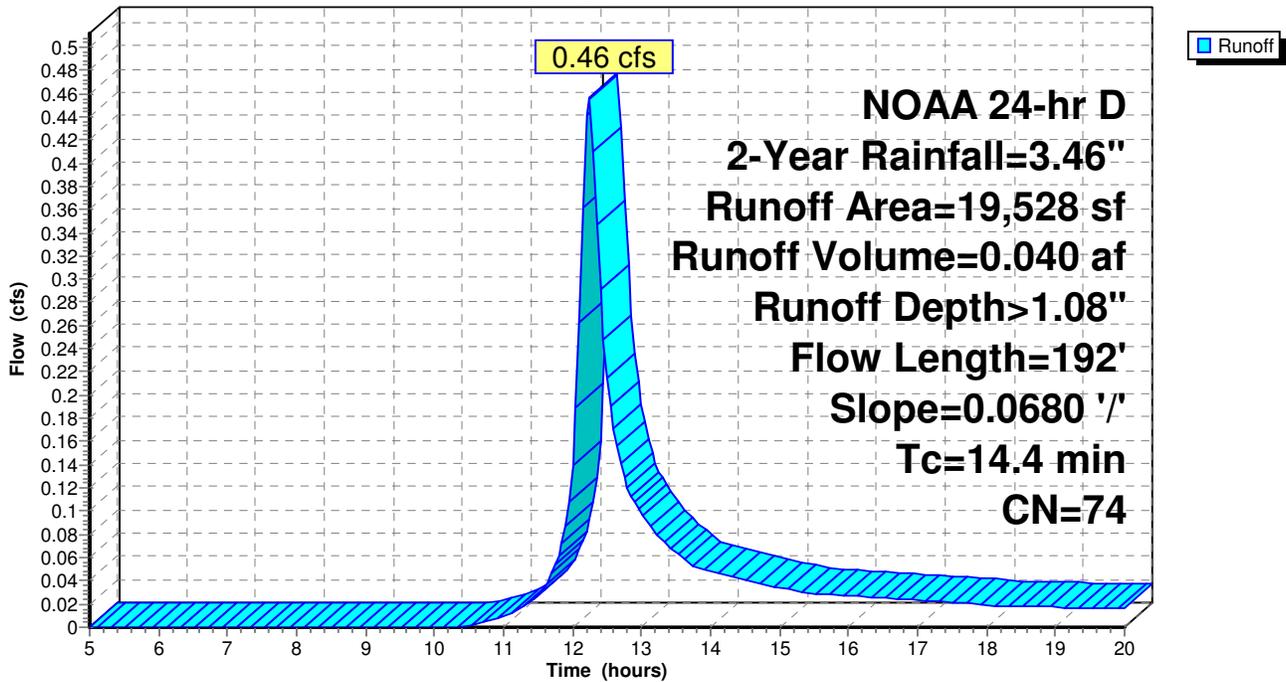
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
NOAA 24-hr D 2-Year Rainfall=3.46"

Area (sf)	CN	Description
19,528	74	>75% Grass cover, Good, HSG C
19,528		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.4	192	0.0680	0.22		Sheet Flow, Tc-DA2 Grass: Dense n= 0.240 P2= 3.36"

## Subcatchment 2S: Drainage Area 2

Hydrograph



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NOAA 24-hr D 2-Year Rainfall=3.46"

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**Summary for Subcatchment 3S: Drainage Area 3**

Runoff = 2.89 cfs @ 12.14 hrs, Volume= 0.204 af, Depth> 1.98"  
 Routed to Reach 1R : Grassed Swale

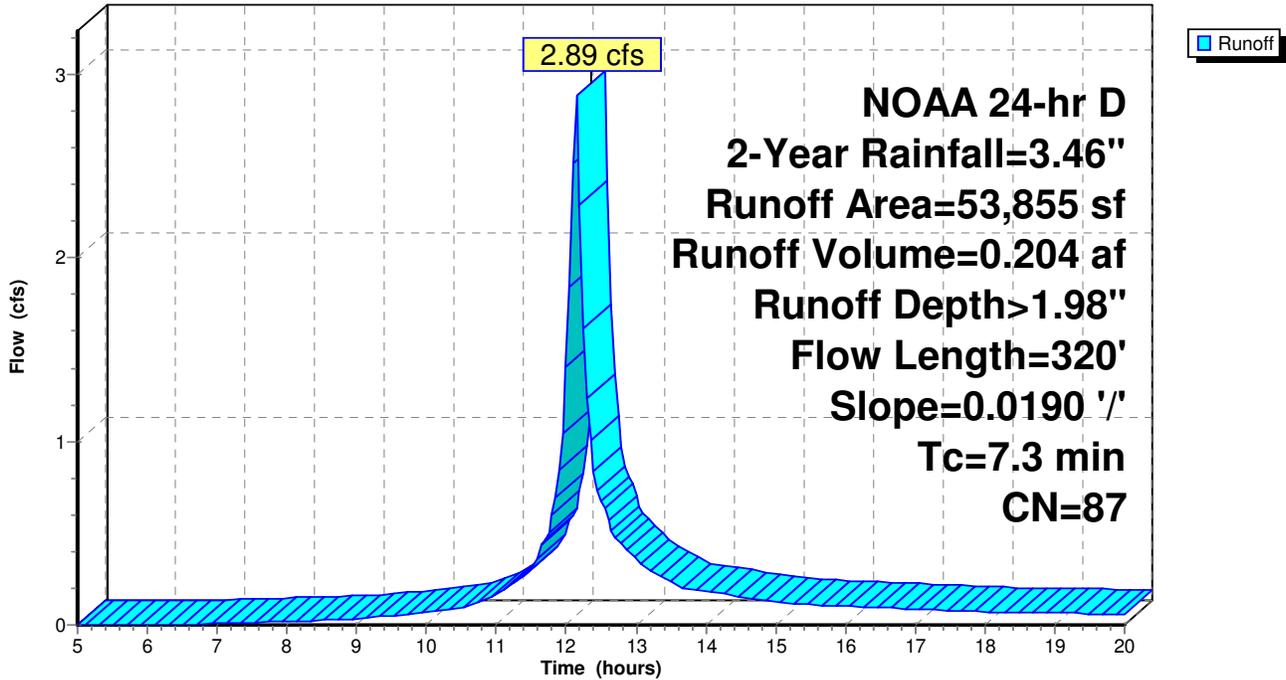
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 NOAA 24-hr D 2-Year Rainfall=3.46"

	Area (sf)	CN	Description
*	28,324	98	Paved parking/roof, HSG C
	25,531	74	>75% Grass cover, Good, HSG C
	53,855	87	Weighted Average
	25,531		47.41% Pervious Area
	28,324		52.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	320	0.0190	0.73		Lag/CN Method, Tc-DA3

**Subcatchment 3S: Drainage Area 3**

Hydrograph



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## Summary for Reach 1R: Grassed Swale

Inflow Area = 1.236 ac, 52.59% Impervious, Inflow Depth > 1.98" for 2-Year event  
Inflow = 2.89 cfs @ 12.14 hrs, Volume= 0.204 af  
Outflow = 2.71 cfs @ 12.17 hrs, Volume= 0.204 af, Atten= 6%, Lag= 1.6 min  
Routed to Pond 1P : Stormwater Pond

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Max. Velocity= 3.19 fps, Min. Travel Time= 1.0 min  
Avg. Velocity = 0.94 fps, Avg. Travel Time= 3.5 min

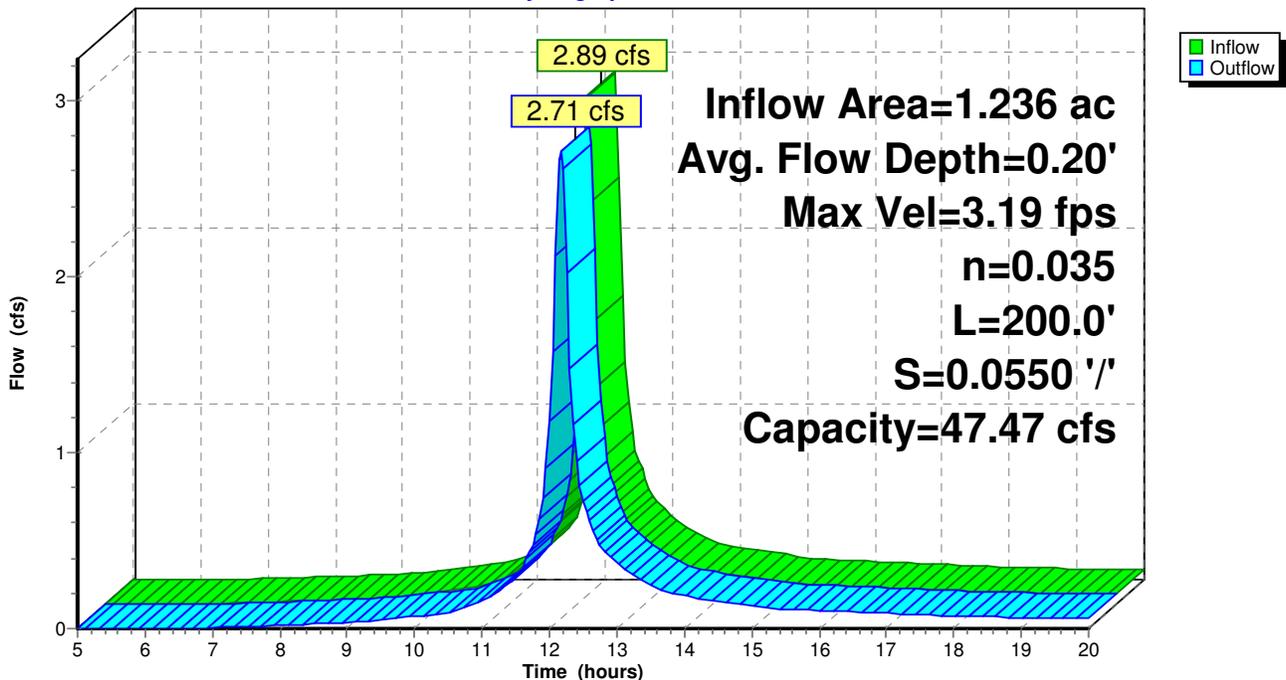
Peak Storage= 178 cf @ 12.15 hrs  
Average Depth at Peak Storage= 0.20' , Surface Width= 4.81'  
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 47.47 cfs

4.00' x 1.00' deep channel, n= 0.035  
Side Slope Z-value= 2.0 '/' Top Width= 8.00'  
Length= 200.0' Slope= 0.0550 '/'  
Inlet Invert= 286.00', Outlet Invert= 275.00'



## Reach 1R: Grassed Swale

Hydrograph



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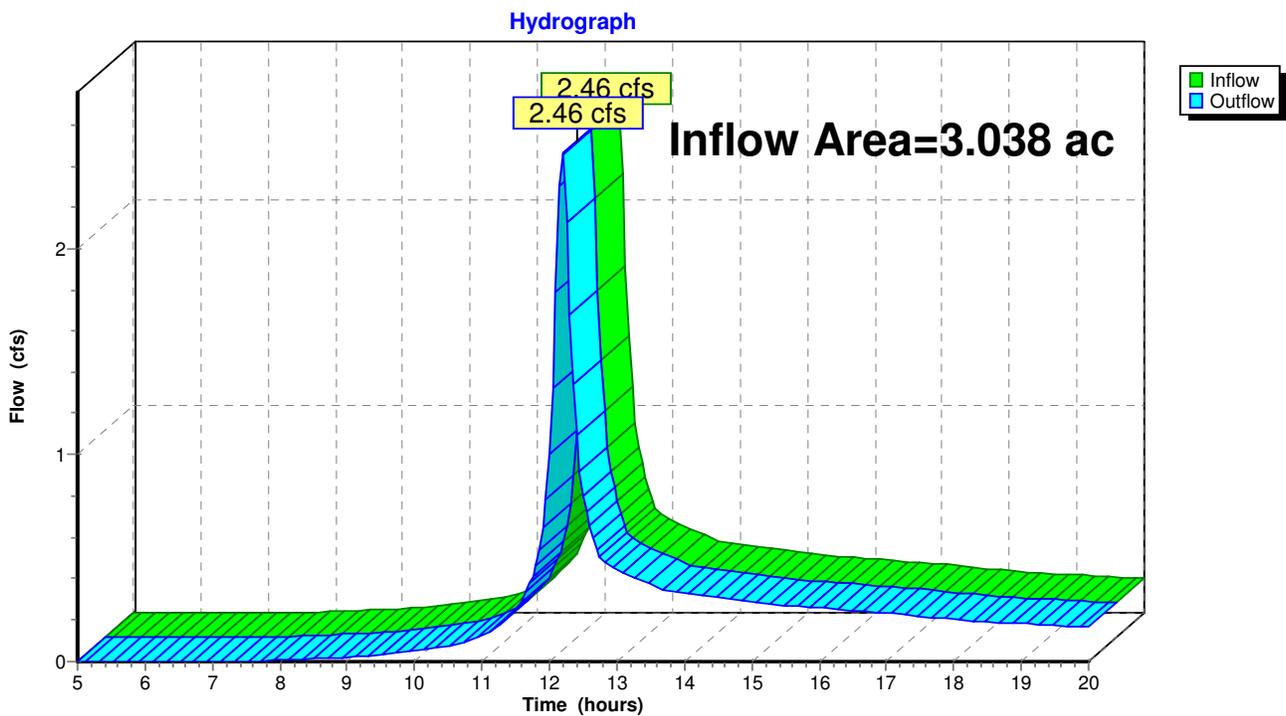
## Summary for Reach 2R: Peak Flow

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

Inflow Area = 3.038 ac, 39.33% Impervious, Inflow Depth > 1.09" for 2-Year event  
Inflow = 2.46 cfs @ 12.19 hrs, Volume= 0.275 af  
Outflow = 2.46 cfs @ 12.19 hrs, Volume= 0.275 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Reach 2R: Peak Flow



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NOAA 24-hr D 2-Year Rainfall=3.46"

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**Summary for Pond 1P: Stormwater Pond**

Inflow Area = 1.685 ac, 38.60% Impervious, Inflow Depth > 1.74" for 2-Year event  
 Inflow = 3.12 cfs @ 12.18 hrs, Volume= 0.244 af  
 Outflow = 0.16 cfs @ 15.08 hrs, Volume= 0.079 af, Atten= 95%, Lag= 173.9 min  
 Primary = 0.16 cfs @ 15.08 hrs, Volume= 0.079 af  
 Routed to Reach 2R : Peak Flow  
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af  
 Routed to Reach 2R : Peak Flow

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 271.39' @ 15.08 hrs Surf.Area= 4,450 sf Storage= 7,744 cf

Plug-Flow detention time= 295.2 min calculated for 0.079 af (32% of inflow)  
 Center-of-Mass det. time= 190.7 min ( 983.4 - 792.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	269.00'	21,394 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
269.00	710	0	0
270.00	3,595	2,153	2,153
272.00	4,825	8,420	10,573
273.00	5,426	5,126	15,698
274.00	5,965	5,696	21,394

Device	Routing	Invert	Outlet Devices
#1	Primary	271.00'	<b>4.0" Round Culvert</b> L= 32.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 271.00' / 270.00' S= 0.0313 '/' Cc= 0.900 n= 0.012, Flow Area= 0.09 sf
#2	Secondary	273.00'	<b>25.0' long + 2.0 '/' SideZ x 12.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

**Primary OutFlow** Max=0.16 cfs @ 15.08 hrs HW=271.39' (Free Discharge)  
 ↑1=Culvert (Inlet Controls 0.16 cfs @ 1.80 fps)

**Secondary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=269.00' (Free Discharge)  
 ↑2=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

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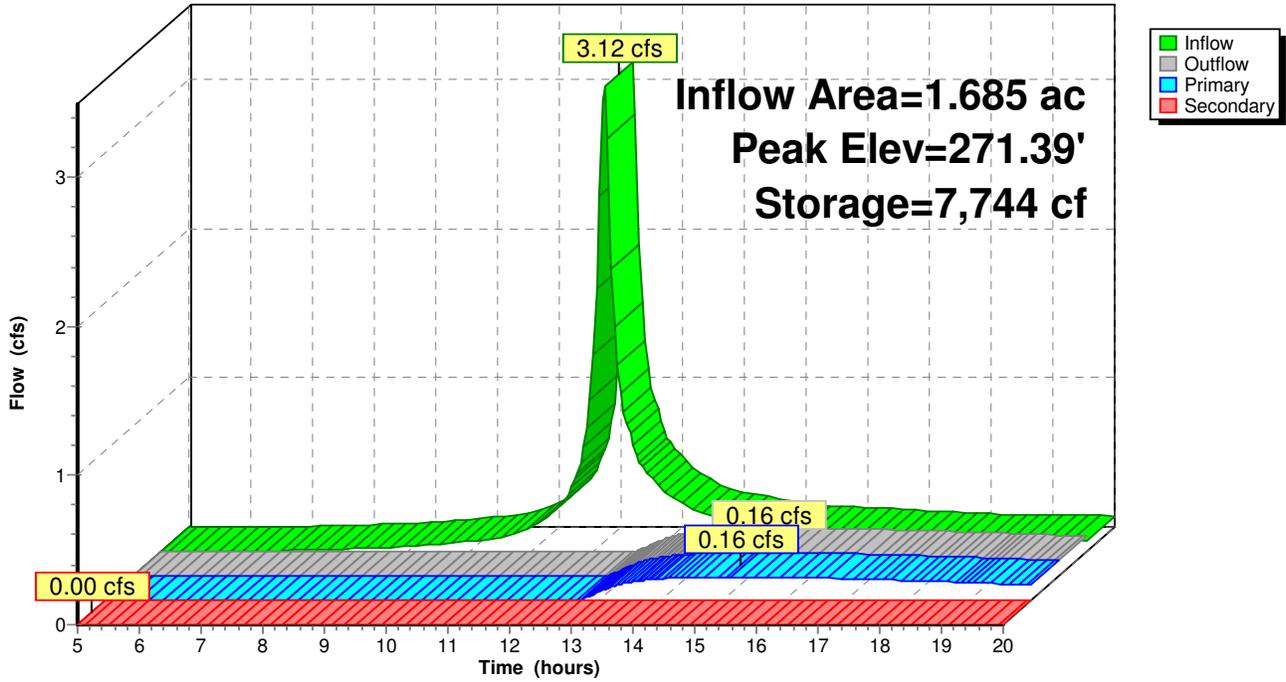
NOAA 24-hr D 2-Year Rainfall=3.46"

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**Pond 1P: Stormwater Pond**

Hydrograph



**Proposed Conditions**

NOAA 24-hr D 10-Year Rainfall=5.11"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1S: Drainage Area 1** Runoff Area=58,942 sf 40.24% Impervious Runoff Depth>3.12"  
Flow Length=203' Tc=11.2 min CN=84 Runoff=4.31 cfs 0.351 af

**Subcatchment 2S: Drainage Area 2** Runoff Area=19,528 sf 0.00% Impervious Runoff Depth>2.23"  
Flow Length=192' Slope=0.0680 '/' Tc=14.4 min CN=74 Runoff=0.95 cfs 0.083 af

**Subcatchment 3S: Drainage Area 3** Runoff Area=53,855 sf 52.59% Impervious Runoff Depth>3.41"  
Flow Length=320' Slope=0.0190 '/' Tc=7.3 min CN=87 Runoff=4.83 cfs 0.351 af

**Reach 1R: Grassed Swale** Avg. Flow Depth=0.27' Max Vel=3.83 fps Inflow=4.83 cfs 0.351 af  
n=0.035 L=200.0' S=0.0550 '/' Capacity=47.47 cfs Outflow=4.58 cfs 0.351 af

**Reach 2R: Peak Flow** Inflow=4.45 cfs 0.564 af  
Outflow=4.45 cfs 0.564 af

**Pond 1P: Stormwater Pond** Peak Elev=272.39' Storage=12,504 cf Inflow=5.42 cfs 0.434 af  
Primary=0.37 cfs 0.213 af Secondary=0.00 cfs 0.000 af Outflow=0.37 cfs 0.213 af

**Total Runoff Area = 3.038 ac Runoff Volume = 0.786 af Average Runoff Depth = 3.10"**  
**60.67% Pervious = 1.843 ac 39.33% Impervious = 1.195 ac**

**Proposed Conditions**

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NOAA 24-hr D 10-Year Rainfall=5.11"

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**Summary for Subcatchment 1S: Drainage Area 1**

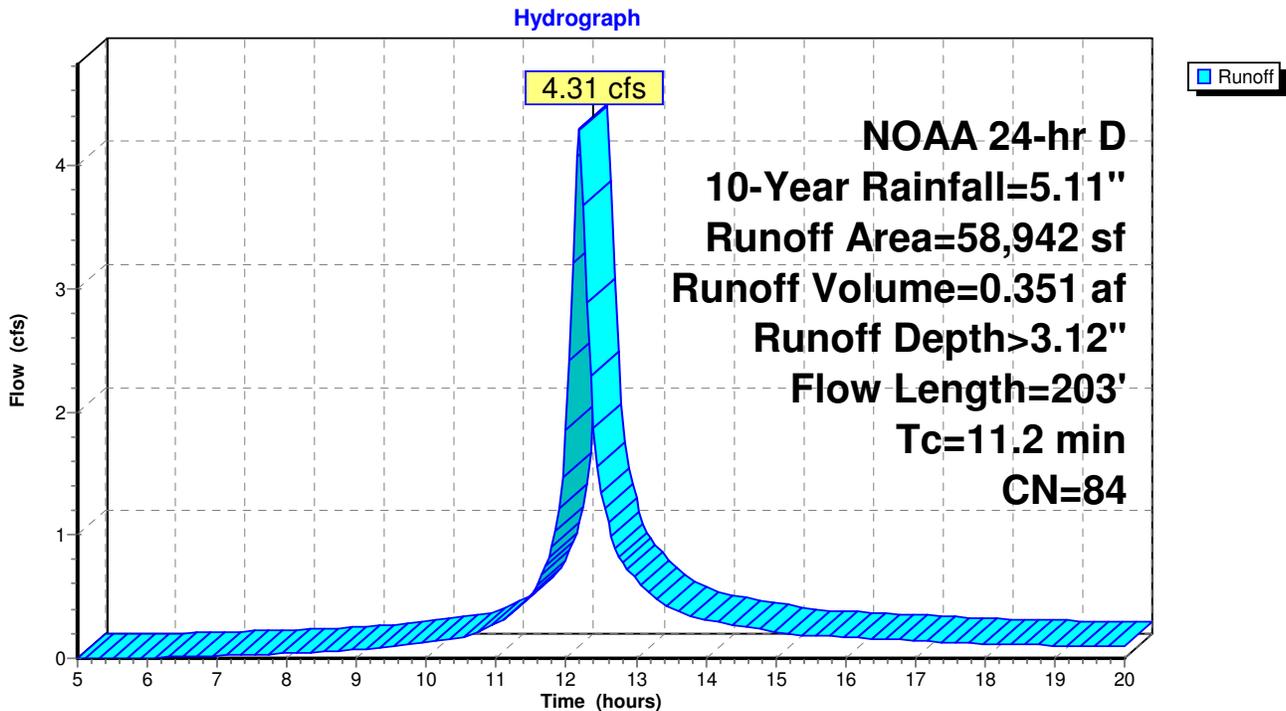
Runoff = 4.31 cfs @ 12.19 hrs, Volume= 0.351 af, Depth> 3.12"  
 Routed to Reach 2R : Peak Flow

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 NOAA 24-hr D 10-Year Rainfall=5.11"

	Area (sf)	CN	Description
*	23,721	98	Paved parking & roof, HSG C
	35,221	74	>75% Grass cover, Good, HSG C
	58,942	84	Weighted Average
	35,221		59.76% Pervious Area
	23,721		40.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	73	0.0410	1.76		<b>Sheet Flow, Tc-DA1a</b> Smooth surfaces n= 0.011 P2= 3.36"
10.5	130	0.0690	0.21		<b>Sheet Flow, Tc-AD1b</b> Grass: Dense n= 0.240 P2= 3.36"
11.2	203	Total			

**Subcatchment 1S: Drainage Area 1**



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NOAA 24-hr D 10-Year Rainfall=5.11"

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### Summary for Subcatchment 2S: Drainage Area 2

Runoff = 0.95 cfs @ 12.23 hrs, Volume= 0.083 af, Depth> 2.23"  
Routed to Pond 1P : Stormwater Pond

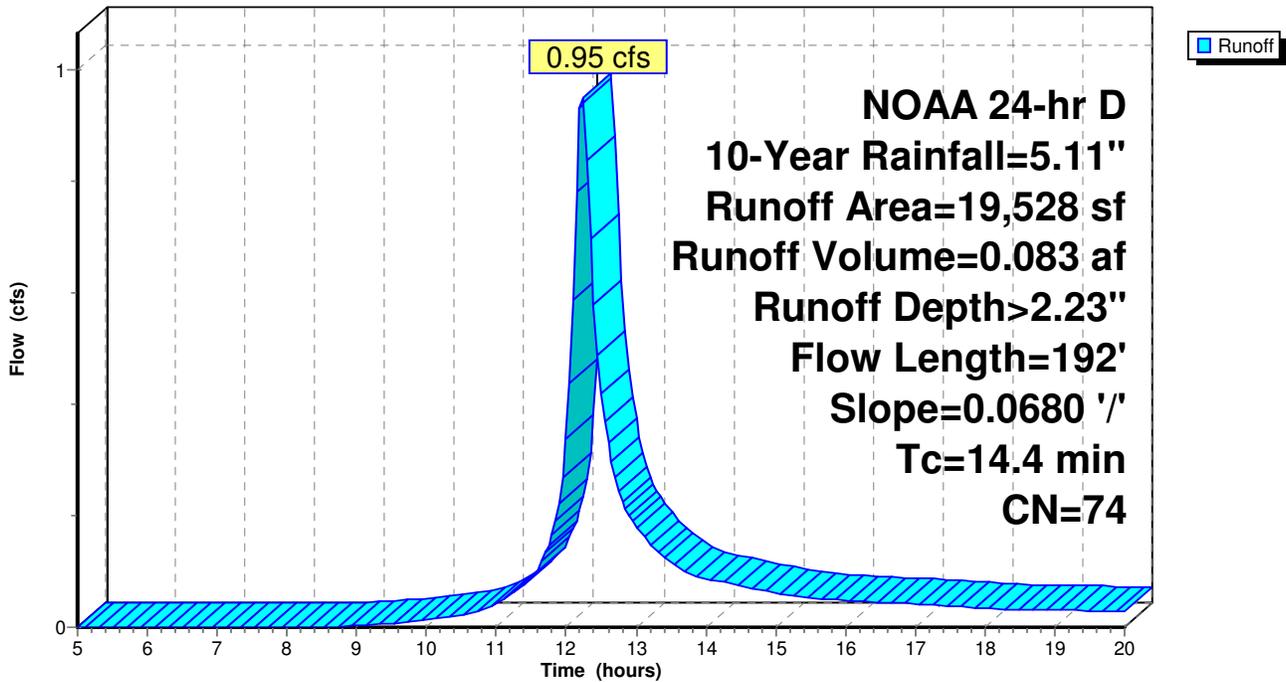
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
NOAA 24-hr D 10-Year Rainfall=5.11"

Area (sf)	CN	Description
19,528	74	>75% Grass cover, Good, HSG C
19,528		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.4	192	0.0680	0.22		<b>Sheet Flow, Tc-DA2</b> Grass: Dense n= 0.240 P2= 3.36"

### Subcatchment 2S: Drainage Area 2

Hydrograph



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NOAA 24-hr D 10-Year Rainfall=5.11"

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**Summary for Subcatchment 3S: Drainage Area 3**

Runoff = 4.83 cfs @ 12.14 hrs, Volume= 0.351 af, Depth> 3.41"  
 Routed to Reach 1R : Grassed Swale

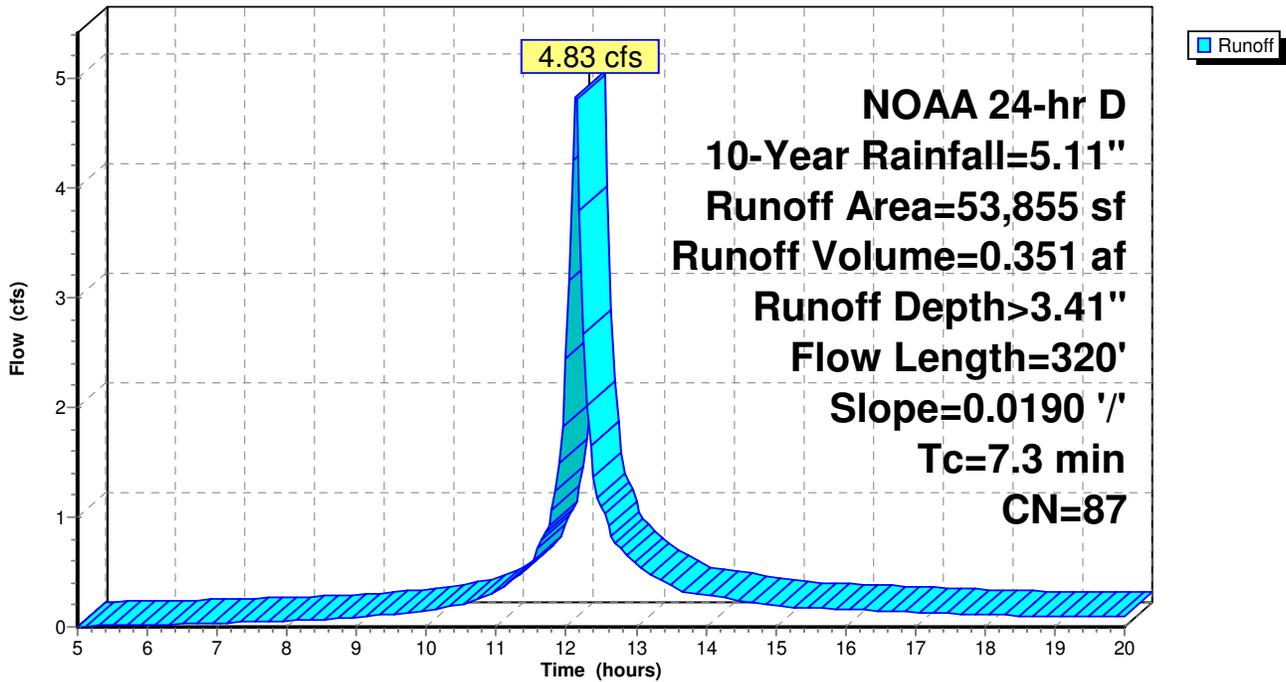
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 NOAA 24-hr D 10-Year Rainfall=5.11"

	Area (sf)	CN	Description
*	28,324	98	Paved parking/roof, HSG C
	25,531	74	>75% Grass cover, Good, HSG C
	53,855	87	Weighted Average
	25,531		47.41% Pervious Area
	28,324		52.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	320	0.0190	0.73		Lag/CN Method, Tc-DA3

**Subcatchment 3S: Drainage Area 3**

Hydrograph



## Proposed Conditions

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NOAA 24-hr D 10-Year Rainfall=5.11"

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### Summary for Reach 1R: Grassed Swale

[82] Warning: Early inflow requires earlier time span

Inflow Area = 1.236 ac, 52.59% Impervious, Inflow Depth > 3.41" for 10-Year event  
Inflow = 4.83 cfs @ 12.14 hrs, Volume= 0.351 af  
Outflow = 4.58 cfs @ 12.16 hrs, Volume= 0.351 af, Atten= 5%, Lag= 1.2 min  
Routed to Pond 1P : Stormwater Pond

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Max. Velocity= 3.83 fps, Min. Travel Time= 0.9 min  
Avg. Velocity = 1.12 fps, Avg. Travel Time= 3.0 min

Peak Storage= 249 cf @ 12.15 hrs  
Average Depth at Peak Storage= 0.27' , Surface Width= 5.10'  
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 47.47 cfs

4.00' x 1.00' deep channel, n= 0.035  
Side Slope Z-value= 2.0 '/' Top Width= 8.00'  
Length= 200.0' Slope= 0.0550 '/'  
Inlet Invert= 286.00', Outlet Invert= 275.00'



**Proposed Conditions**

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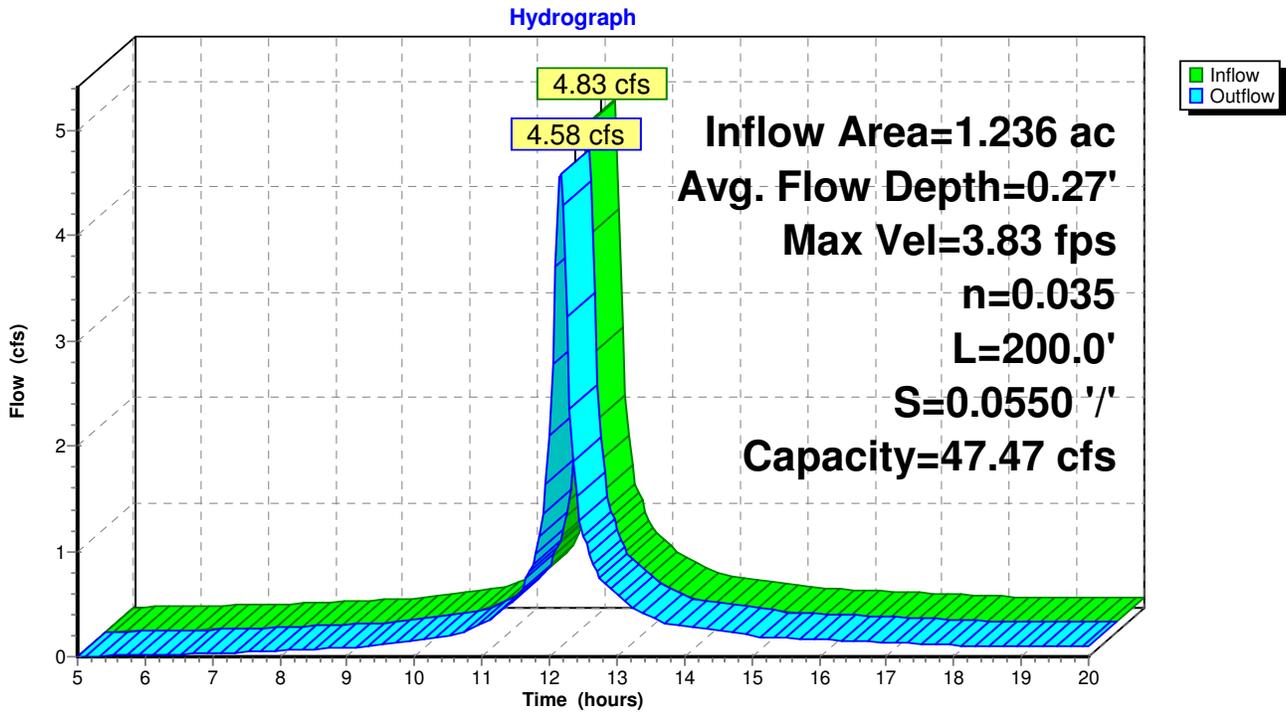
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NOAA 24-hr D 10-Year Rainfall=5.11"

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**Reach 1R: Grassed Swale**



# Proposed Conditions

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NOAA 24-hr D 10-Year Rainfall=5.11"

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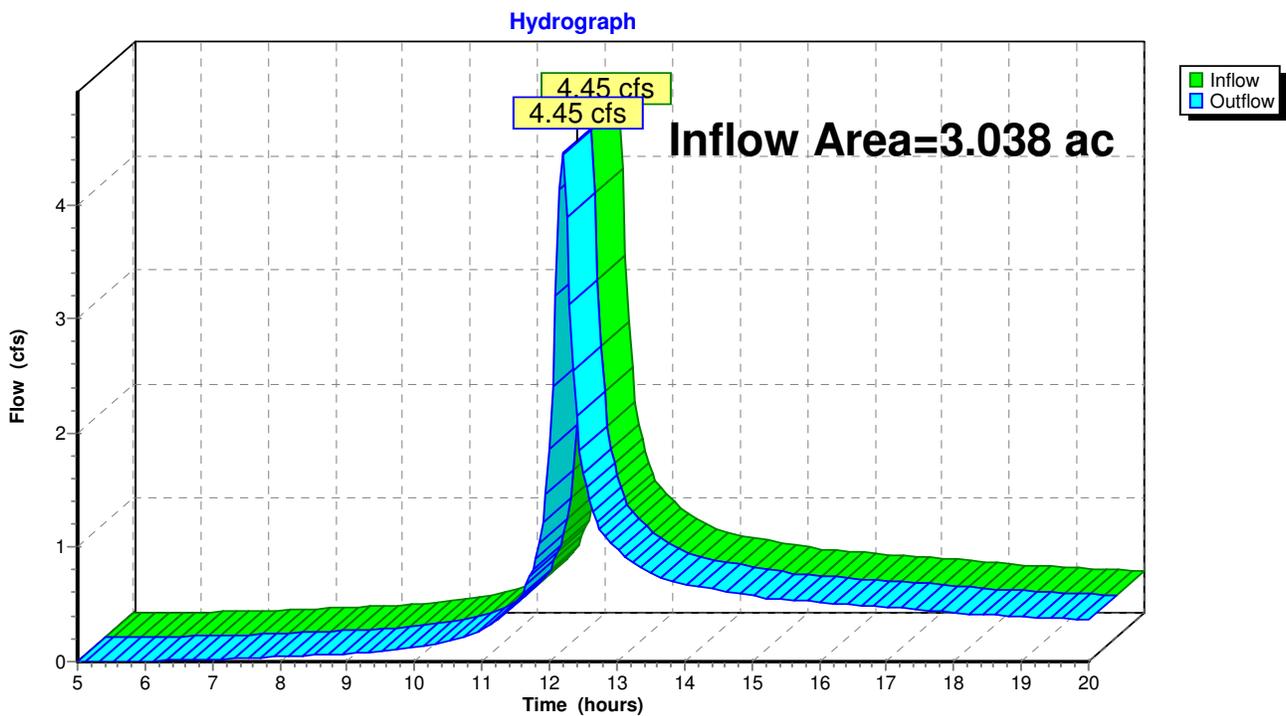
## Summary for Reach 2R: Peak Flow

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

Inflow Area = 3.038 ac, 39.33% Impervious, Inflow Depth > 2.23" for 10-Year event  
Inflow = 4.45 cfs @ 12.19 hrs, Volume= 0.564 af  
Outflow = 4.45 cfs @ 12.19 hrs, Volume= 0.564 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Reach 2R: Peak Flow



**Proposed Conditions**

NOAA 24-hr D 10-Year Rainfall=5.11"

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**Summary for Pond 1P: Stormwater Pond**

Inflow Area = 1.685 ac, 38.60% Impervious, Inflow Depth > 3.09" for 10-Year event  
 Inflow = 5.42 cfs @ 12.17 hrs, Volume= 0.434 af  
 Outflow = 0.37 cfs @ 14.10 hrs, Volume= 0.213 af, Atten= 93%, Lag= 116.0 min  
 Primary = 0.37 cfs @ 14.10 hrs, Volume= 0.213 af  
 Routed to Reach 2R : Peak Flow  
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af  
 Routed to Reach 2R : Peak Flow

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 272.39' @ 14.10 hrs Surf.Area= 5,060 sf Storage= 12,504 cf

Plug-Flow detention time= 268.1 min calculated for 0.212 af (49% of inflow)  
 Center-of-Mass det. time= 179.2 min ( 958.0 - 778.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	269.00'	21,394 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
269.00	710	0	0
270.00	3,595	2,153	2,153
272.00	4,825	8,420	10,573
273.00	5,426	5,126	15,698
274.00	5,965	5,696	21,394

Device	Routing	Invert	Outlet Devices
#1	Primary	271.00'	<b>4.0" Round Culvert</b> L= 32.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 271.00' / 270.00' S= 0.0313 '/' Cc= 0.900 n= 0.012, Flow Area= 0.09 sf
#2	Secondary	273.00'	<b>25.0' long + 2.0 '/' SideZ x 12.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

**Primary OutFlow** Max=0.37 cfs @ 14.10 hrs HW=272.39' (Free Discharge)  
 ↑1=Culvert (Inlet Controls 0.37 cfs @ 4.21 fps)

**Secondary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=269.00' (Free Discharge)  
 ↑2=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

**Proposed Conditions**

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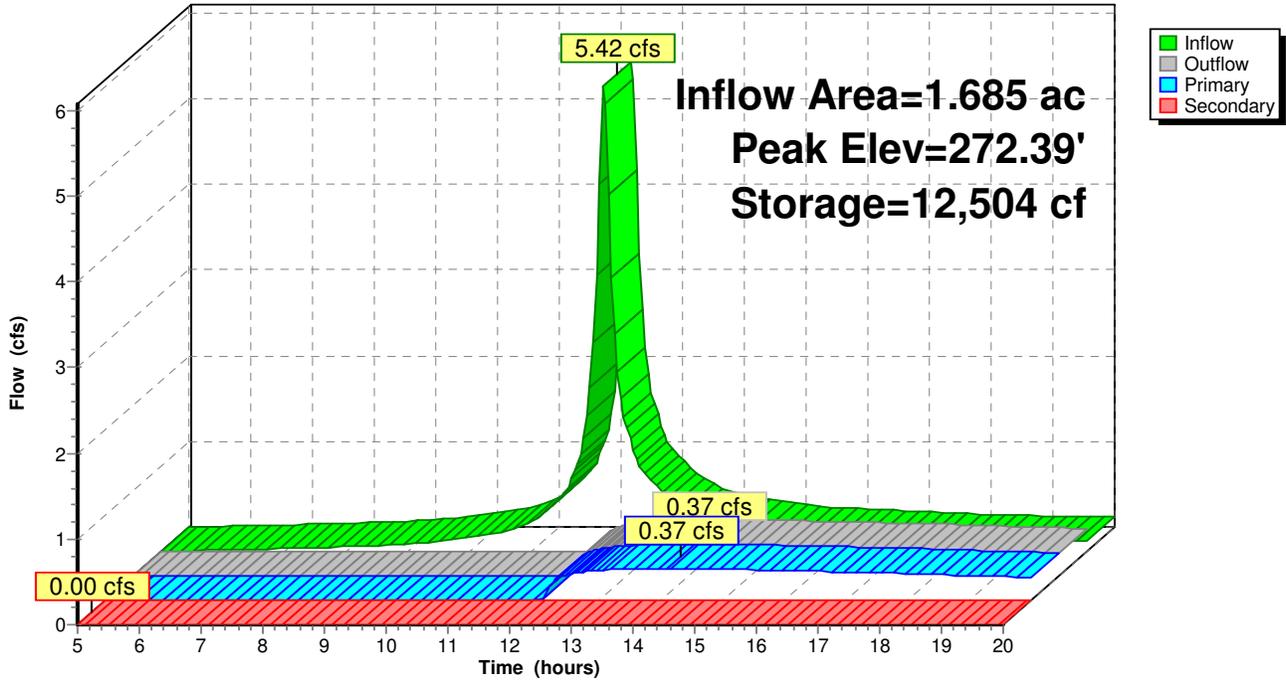
NOAA 24-hr D 10-Year Rainfall=5.11"

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**Pond 1P: Stormwater Pond**

Hydrograph



**Proposed Conditions**

NOAA 24-hr D 100-Year Rainfall=7.74"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1S: Drainage Area 1** Runoff Area=58,942 sf 40.24% Impervious Runoff Depth>5.43"  
Flow Length=203' Tc=11.2 min CN=84 Runoff=7.28 cfs 0.613 af

**Subcatchment 2S: Drainage Area 2** Runoff Area=19,528 sf 0.00% Impervious Runoff Depth>4.31"  
Flow Length=192' Slope=0.0680 '/' Tc=14.4 min CN=74 Runoff=1.83 cfs 0.161 af

**Subcatchment 3S: Drainage Area 3** Runoff Area=53,855 sf 52.59% Impervious Runoff Depth>5.77"  
Flow Length=320' Slope=0.0190 '/' Tc=7.3 min CN=87 Runoff=7.91 cfs 0.594 af

**Reach 1R: Grassed Swale** Avg. Flow Depth=0.37' Max Vel=4.53 fps Inflow=7.91 cfs 0.594 af  
n=0.035 L=200.0' S=0.0550 '/' Capacity=47.47 cfs Outflow=7.58 cfs 0.593 af

**Reach 2R: Peak Flow** Inflow=8.61 cfs 1.070 af  
Outflow=8.61 cfs 1.070 af

**Pond 1P: Stormwater Pond** Peak Elev=273.16' Storage=16,552 cf Inflow=9.18 cfs 0.754 af  
Primary=0.47 cfs 0.290 af Secondary=4.02 cfs 0.167 af Outflow=4.49 cfs 0.457 af

**Total Runoff Area = 3.038 ac Runoff Volume = 1.368 af Average Runoff Depth = 5.40"**  
**60.67% Pervious = 1.843 ac 39.33% Impervious = 1.195 ac**

**Proposed Conditions**

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NOAA 24-hr D 100-Year Rainfall=7.74"

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**Summary for Subcatchment 1S: Drainage Area 1**

Runoff = 7.28 cfs @ 12.19 hrs, Volume= 0.613 af, Depth> 5.43"  
 Routed to Reach 2R : Peak Flow

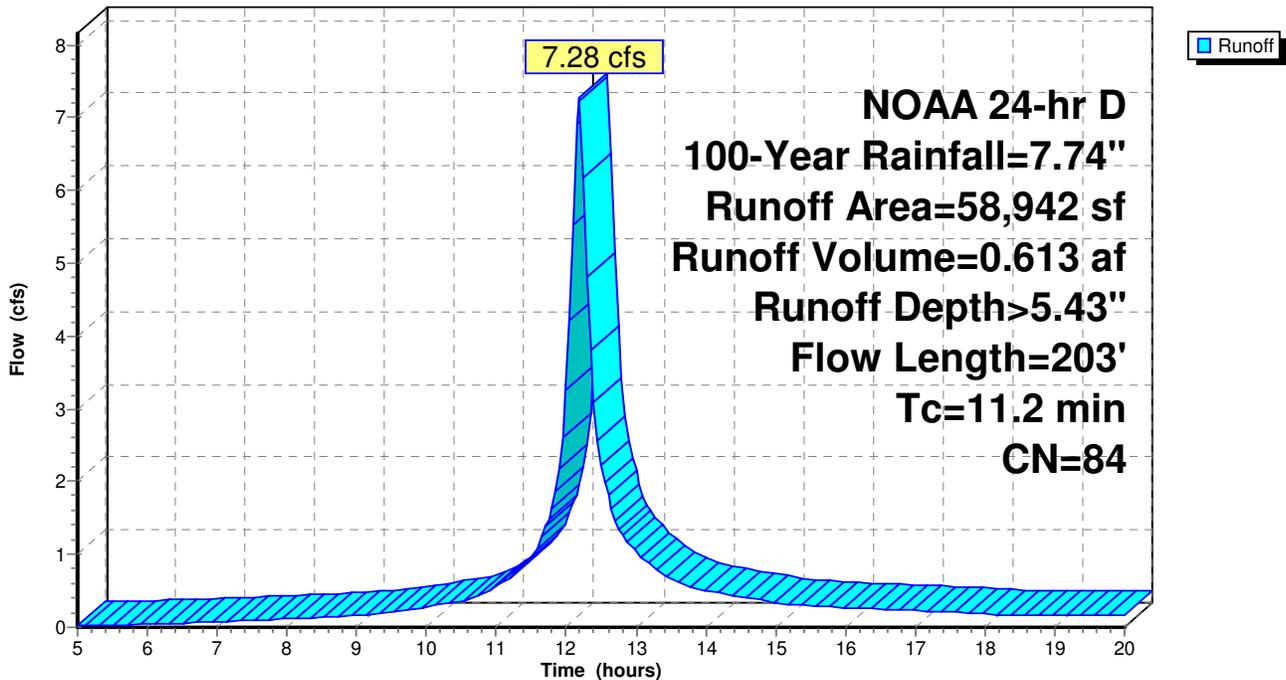
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 NOAA 24-hr D 100-Year Rainfall=7.74"

	Area (sf)	CN	Description
*	23,721	98	Paved parking & roof, HSG C
	35,221	74	>75% Grass cover, Good, HSG C
	58,942	84	Weighted Average
	35,221		59.76% Pervious Area
	23,721		40.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	73	0.0410	1.76		<b>Sheet Flow, Tc-DA1a</b> Smooth surfaces n= 0.011 P2= 3.36"
10.5	130	0.0690	0.21		<b>Sheet Flow, Tc-AD1b</b> Grass: Dense n= 0.240 P2= 3.36"
11.2	203	Total			

**Subcatchment 1S: Drainage Area 1**

Hydrograph



### Proposed Conditions

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### Summary for Subcatchment 2S: Drainage Area 2

Runoff = 1.83 cfs @ 12.22 hrs, Volume= 0.161 af, Depth> 4.31"  
Routed to Pond 1P : Stormwater Pond

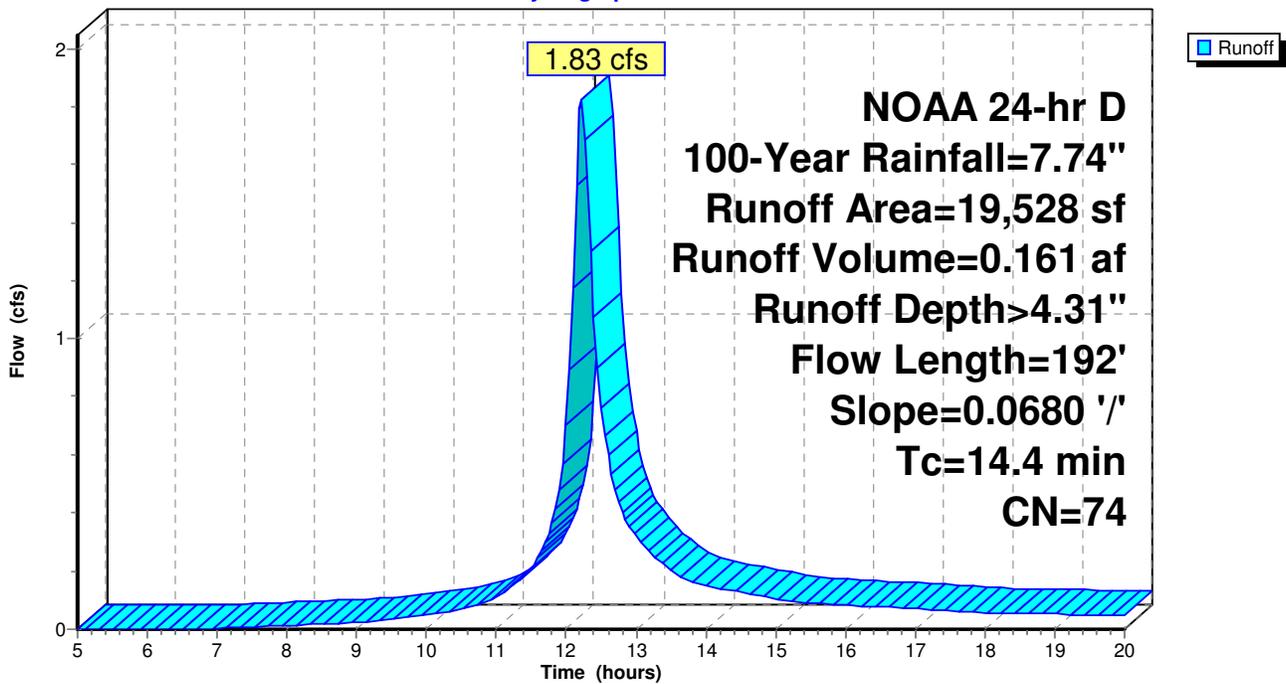
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
NOAA 24-hr D 100-Year Rainfall=7.74"

Area (sf)	CN	Description
19,528	74	>75% Grass cover, Good, HSG C
19,528		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.4	192	0.0680	0.22		<b>Sheet Flow, Tc-DA2</b> Grass: Dense n= 0.240 P2= 3.36"

### Subcatchment 2S: Drainage Area 2

Hydrograph



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**Summary for Subcatchment 3S: Drainage Area 3**

Runoff = 7.91 cfs @ 12.14 hrs, Volume= 0.594 af, Depth> 5.77"  
 Routed to Reach 1R : Grassed Swale

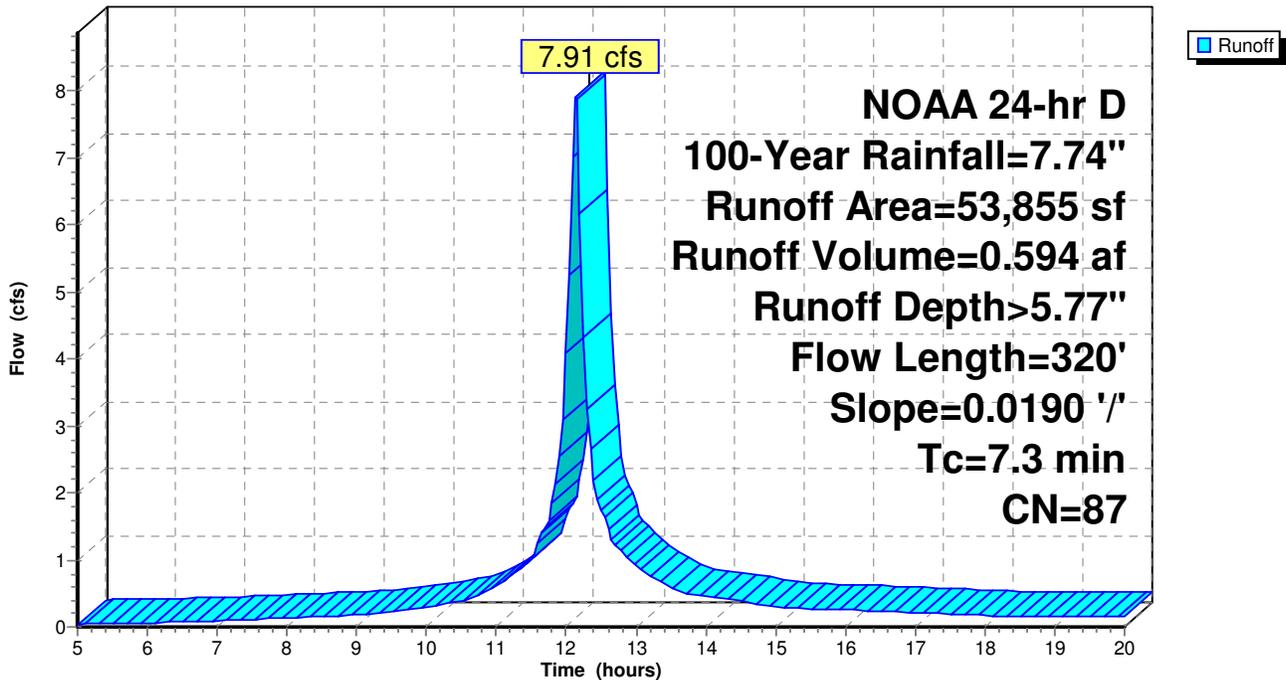
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 NOAA 24-hr D 100-Year Rainfall=7.74"

	Area (sf)	CN	Description
*	28,324	98	Paved parking/roof, HSG C
	25,531	74	>75% Grass cover, Good, HSG C
	53,855	87	Weighted Average
	25,531		47.41% Pervious Area
	28,324		52.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	320	0.0190	0.73		Lag/CN Method, Tc-DA3

**Subcatchment 3S: Drainage Area 3**

Hydrograph



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### Summary for Reach 1R: Grassed Swale

[82] Warning: Early inflow requires earlier time span

Inflow Area = 1.236 ac, 52.59% Impervious, Inflow Depth > 5.77" for 100-Year event  
Inflow = 7.91 cfs @ 12.14 hrs, Volume= 0.594 af  
Outflow = 7.58 cfs @ 12.16 hrs, Volume= 0.593 af, Atten= 4%, Lag= 1.0 min  
Routed to Pond 1P : Stormwater Pond

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Max. Velocity= 4.53 fps, Min. Travel Time= 0.7 min  
Avg. Velocity = 1.39 fps, Avg. Travel Time= 2.4 min

Peak Storage= 346 cf @ 12.15 hrs  
Average Depth at Peak Storage= 0.37' , Surface Width= 5.46'  
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 47.47 cfs

4.00' x 1.00' deep channel, n= 0.035  
Side Slope Z-value= 2.0 '/' Top Width= 8.00'  
Length= 200.0' Slope= 0.0550 '/'  
Inlet Invert= 286.00', Outlet Invert= 275.00'



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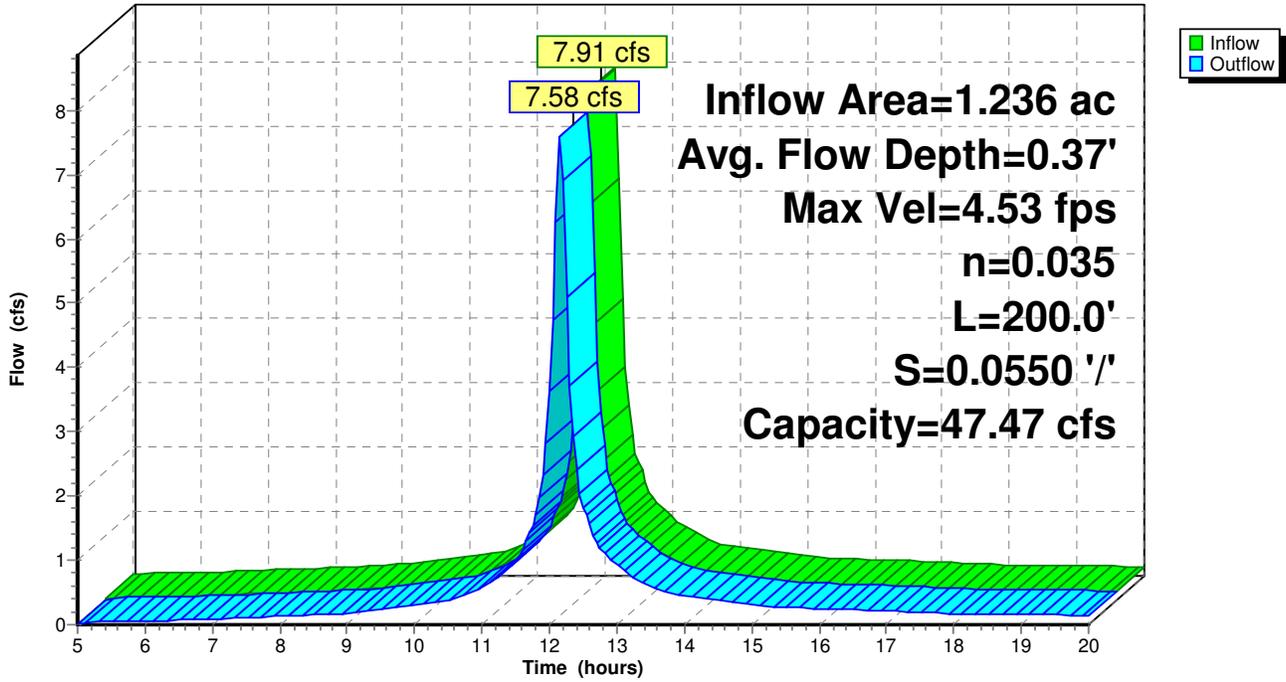
NOAA 24-hr D 100-Year Rainfall=7.74"

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**Reach 1R: Grassed Swale**

Hydrograph



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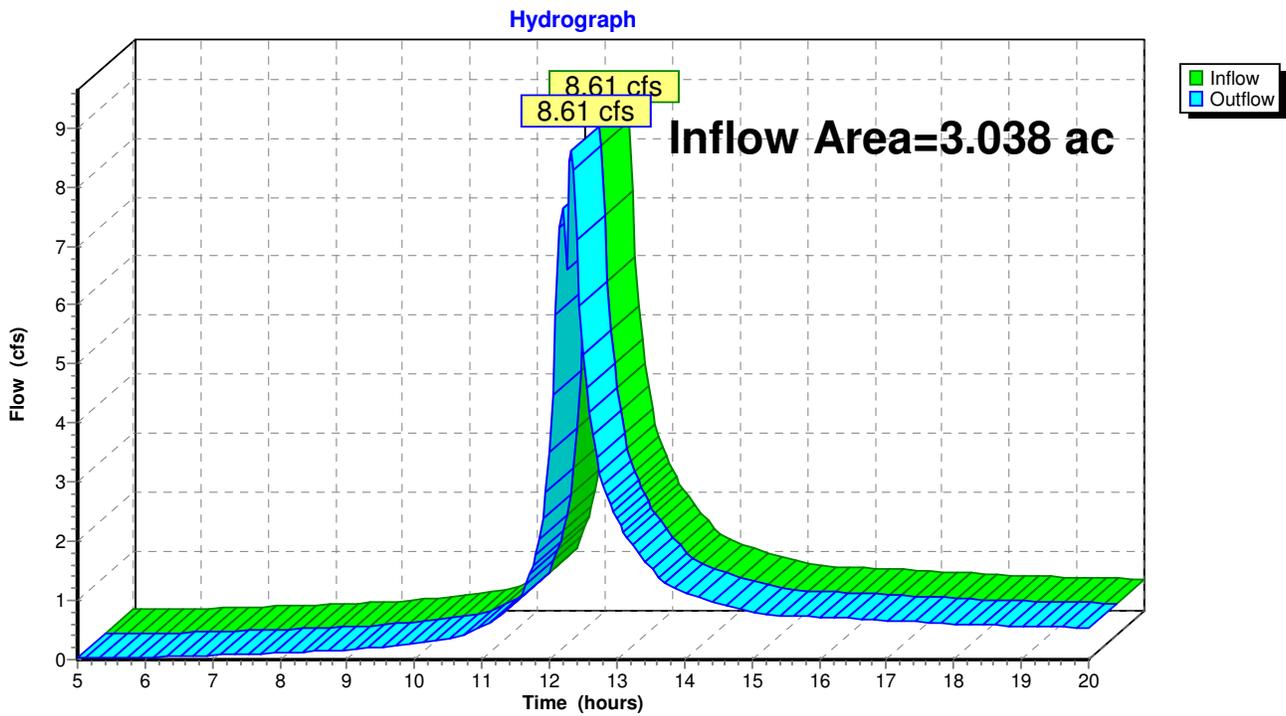
## Summary for Reach 2R: Peak Flow

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

Inflow Area = 3.038 ac, 39.33% Impervious, Inflow Depth > 4.23" for 100-Year event  
Inflow = 8.61 cfs @ 12.32 hrs, Volume= 1.070 af  
Outflow = 8.61 cfs @ 12.32 hrs, Volume= 1.070 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Reach 2R: Peak Flow



# Proposed Conditions

NOAA 24-hr D 100-Year Rainfall=7.74"

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## Summary for Pond 1P: Stormwater Pond

Inflow Area = 1.685 ac, 38.60% Impervious, Inflow Depth > 5.37" for 100-Year event  
 Inflow = 9.18 cfs @ 12.17 hrs, Volume= 0.754 af  
 Outflow = 4.49 cfs @ 12.36 hrs, Volume= 0.457 af, Atten= 51%, Lag= 11.5 min  
 Primary = 0.47 cfs @ 12.36 hrs, Volume= 0.290 af  
     Routed to Reach 2R : Peak Flow  
 Secondary = 4.02 cfs @ 12.36 hrs, Volume= 0.167 af  
     Routed to Reach 2R : Peak Flow

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 273.16' @ 12.36 hrs Surf.Area= 5,510 sf Storage= 16,552 cf

Plug-Flow detention time= 197.3 min calculated for 0.457 af (61% of inflow)  
 Center-of-Mass det. time= 118.2 min ( 884.7 - 766.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	269.00'	21,394 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
269.00	710	0	0
270.00	3,595	2,153	2,153
272.00	4,825	8,420	10,573
273.00	5,426	5,126	15,698
274.00	5,965	5,696	21,394

Device	Routing	Invert	Outlet Devices
#1	Primary	271.00'	<b>4.0" Round Culvert</b> L= 32.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 271.00' / 270.00' S= 0.0313 '/' Cc= 0.900 n= 0.012, Flow Area= 0.09 sf
#2	Secondary	273.00'	<b>25.0' long + 2.0 '/' SideZ x 12.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

**Primary OutFlow** Max=0.47 cfs @ 12.36 hrs HW=273.15' (Free Discharge)  
 ↑1=Culvert (Inlet Controls 0.47 cfs @ 5.36 fps)

**Secondary OutFlow** Max=3.92 cfs @ 12.36 hrs HW=273.15' (Free Discharge)  
 ↑2=Broad-Crested Rectangular Weir (Weir Controls 3.92 cfs @ 1.01 fps)

**Proposed Conditions**

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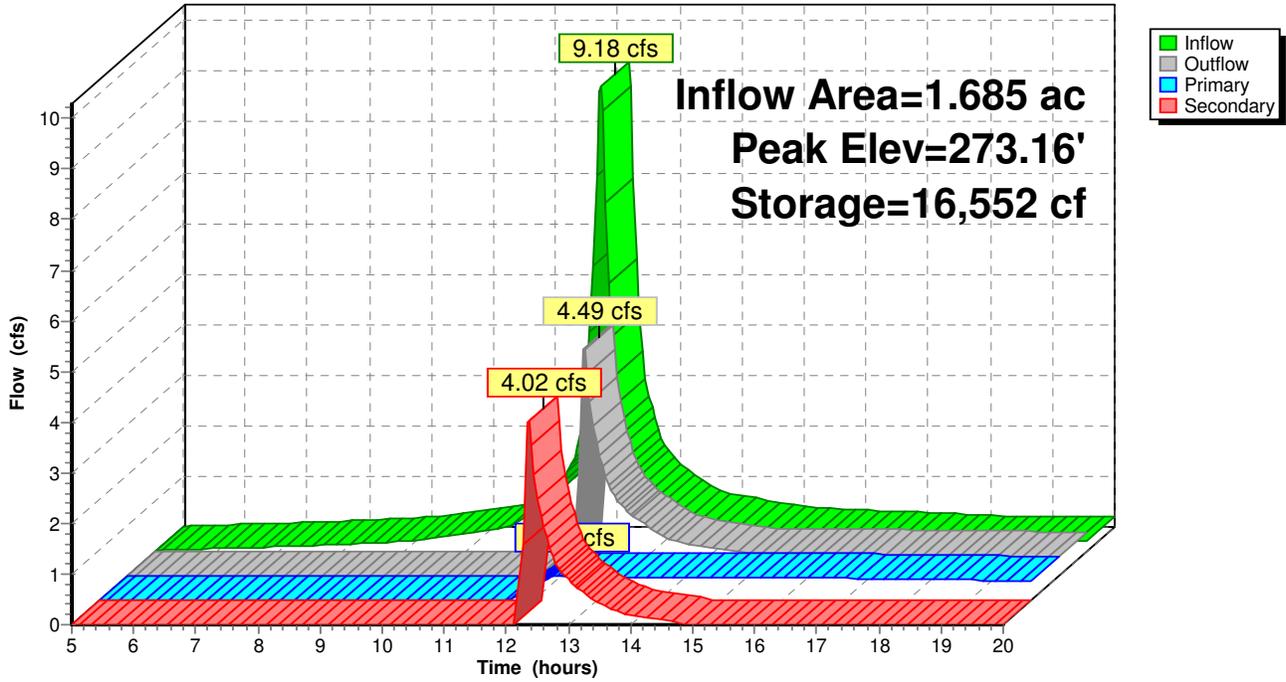
NOAA 24-hr D 100-Year Rainfall=7.74"

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**Pond 1P: Stormwater Pond**

Hydrograph



**SUPPORTING DOCUMENTATION**

**NOAA Point Precipitation Estimates  
Web Soil Survey**



**POINT PRECIPITATION FREQUENCY ESTIMATES**

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

NOAA, National Weather Service, Silver Spring, Maryland

[PF\\_tabular](#) | [PF\\_graphical](#) | [Maps & aeriels](#)

**PF tabular**

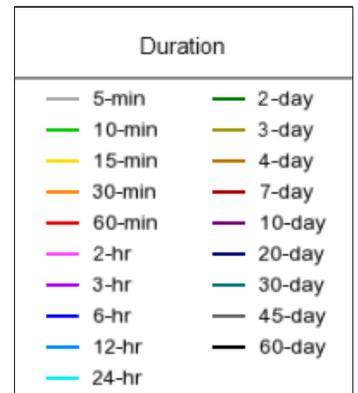
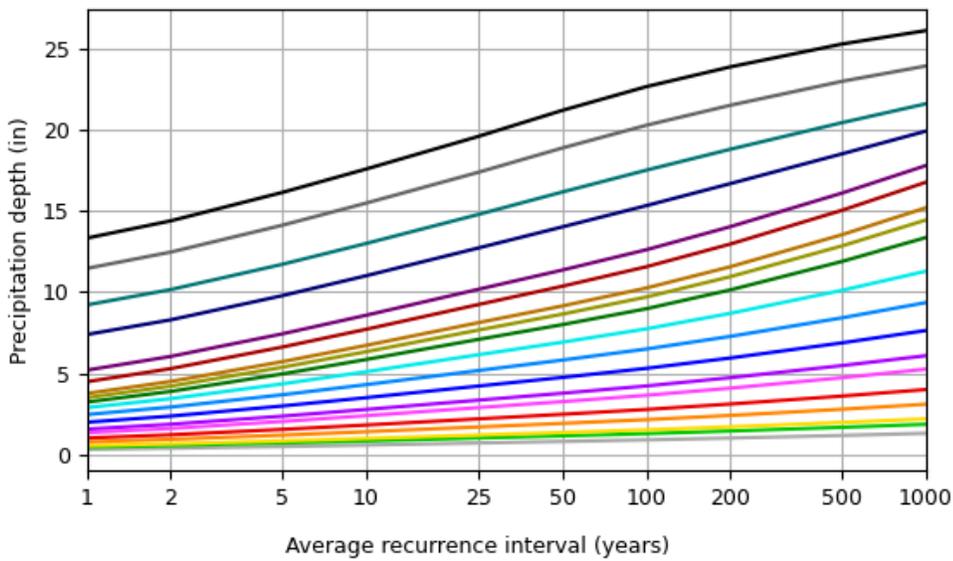
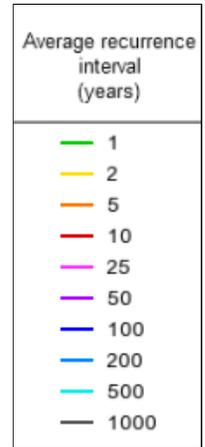
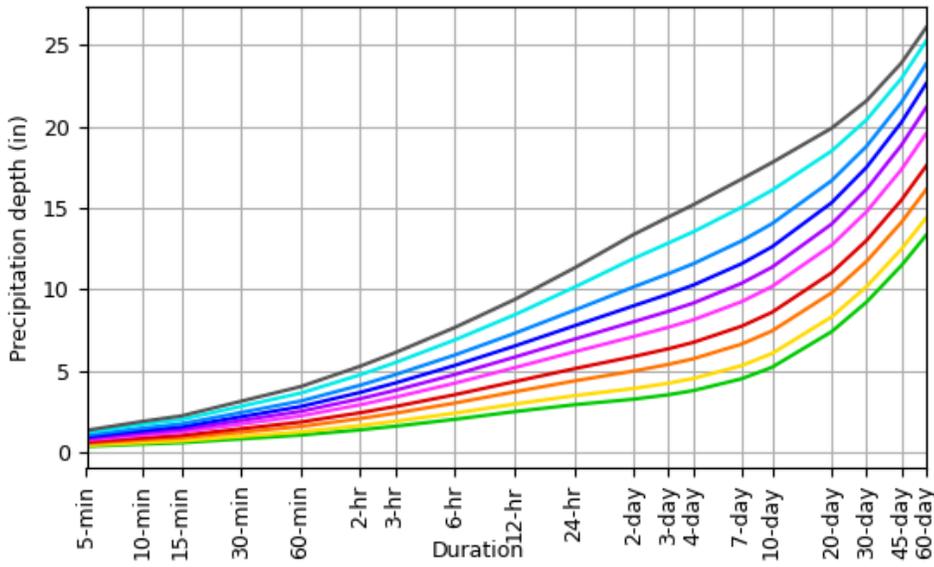
<b>PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)<sup>1</sup></b>										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.341 (0.265-0.437)	0.408 (0.316-0.523)	0.517 (0.399-0.664)	0.608 (0.467-0.782)	0.732 (0.545-0.973)	0.826 (0.603-1.11)	0.924 (0.656-1.28)	1.04 (0.697-1.45)	1.20 (0.775-1.72)	1.33 (0.841-1.93)
10-min	0.483 (0.375-0.619)	0.578 (0.448-0.740)	0.733 (0.566-0.942)	0.861 (0.661-1.11)	1.04 (0.772-1.38)	1.17 (0.854-1.58)	1.31 (0.930-1.82)	1.47 (0.988-2.06)	1.70 (1.10-2.43)	1.88 (1.19-2.74)
15-min	0.569 (0.441-0.728)	0.680 (0.527-0.871)	0.862 (0.665-1.11)	1.01 (0.777-1.30)	1.22 (0.909-1.62)	1.38 (1.00-1.86)	1.54 (1.09-2.14)	1.73 (1.16-2.42)	2.00 (1.29-2.86)	2.22 (1.40-3.22)
30-min	0.802 (0.622-1.03)	0.959 (0.743-1.23)	1.22 (0.937-1.56)	1.43 (1.10-1.84)	1.72 (1.28-2.28)	1.94 (1.41-2.61)	2.17 (1.54-3.00)	2.43 (1.63-3.40)	2.80 (1.82-4.02)	3.12 (1.97-4.53)
60-min	1.04 (0.804-1.33)	1.24 (0.958-1.58)	1.57 (1.21-2.01)	1.84 (1.41-2.37)	2.21 (1.65-2.94)	2.50 (1.82-3.37)	2.79 (1.98-3.87)	3.13 (2.10-4.38)	3.62 (2.34-5.18)	4.02 (2.54-5.84)
2-hr	1.36 (1.06-1.73)	1.62 (1.27-2.06)	2.05 (1.60-2.61)	2.41 (1.87-3.08)	2.90 (2.18-3.83)	3.27 (2.41-4.38)	3.66 (2.62-5.04)	4.10 (2.78-5.70)	4.74 (3.09-6.75)	5.27 (3.35-7.60)
3-hr	1.58 (1.24-2.00)	1.88 (1.48-2.38)	2.38 (1.86-3.02)	2.79 (2.17-3.55)	3.36 (2.53-4.41)	3.79 (2.80-5.04)	4.24 (3.04-5.80)	4.75 (3.22-6.56)	5.49 (3.58-7.77)	6.10 (3.89-8.76)
6-hr	2.01 (1.59-2.51)	2.38 (1.89-2.99)	3.00 (2.37-3.77)	3.52 (2.76-4.43)	4.23 (3.21-5.50)	4.76 (3.54-6.28)	5.32 (3.84-7.22)	5.96 (4.07-8.17)	6.88 (4.52-9.68)	7.65 (4.90-10.9)
12-hr	2.48 (1.98-3.07)	2.94 (2.35-3.65)	3.69 (2.94-4.59)	4.32 (3.42-5.39)	5.18 (3.97-6.68)	5.82 (4.37-7.63)	6.50 (4.74-8.76)	7.28 (5.00-9.91)	8.42 (5.56-11.7)	9.36 (6.03-13.2)
24-hr	2.90 (2.34-3.56)	3.46 (2.79-4.25)	4.36 (3.50-5.37)	5.11 (4.08-6.33)	6.15 (4.75-7.87)	6.92 (5.24-9.00)	7.74 (5.69-10.4)	8.70 (6.01-11.7)	10.1 (6.70-14.0)	11.3 (7.30-15.9)
2-day	3.24 (2.64-3.95)	3.90 (3.18-4.75)	4.97 (4.03-6.07)	5.86 (4.73-7.19)	7.09 (5.53-9.01)	8.00 (6.11-10.3)	8.98 (6.66-12.0)	10.1 (7.04-13.6)	11.9 (7.92-16.3)	13.4 (8.68-18.6)
3-day	3.52 (2.88-4.26)	4.22 (3.46-5.12)	5.38 (4.39-6.54)	6.34 (5.14-7.73)	7.66 (6.00-9.68)	8.65 (6.63-11.1)	9.70 (7.22-12.9)	11.0 (7.64-14.6)	12.8 (8.58-17.6)	14.4 (9.41-20.0)
4-day	3.77 (3.10-4.55)	4.52 (3.71-5.45)	5.73 (4.69-6.93)	6.73 (5.48-8.18)	8.12 (6.38-10.2)	9.15 (7.04-11.7)	10.3 (7.66-13.5)	11.6 (8.08-15.4)	13.5 (9.06-18.4)	15.2 (9.92-21.0)
7-day	4.49 (3.72-5.38)	5.30 (4.39-6.35)	6.62 (5.46-7.95)	7.72 (6.32-9.31)	9.23 (7.30-11.5)	10.4 (8.01-13.1)	11.6 (8.66-15.1)	13.0 (9.11-17.1)	15.0 (10.1-20.4)	16.8 (11.0-23.0)
10-day	5.20 (4.33-6.20)	6.05 (5.03-7.21)	7.44 (6.16-8.88)	8.59 (7.07-10.3)	10.2 (8.07-12.6)	11.4 (8.80-14.3)	12.6 (9.45-16.3)	14.0 (9.90-18.4)	16.1 (10.9-21.7)	17.8 (11.7-24.3)
20-day	7.39 (6.22-8.72)	8.30 (6.97-9.80)	9.78 (8.18-11.6)	11.0 (9.15-13.1)	12.7 (10.1-15.5)	14.0 (10.9-17.4)	15.3 (11.5-19.4)	16.7 (11.9-21.7)	18.5 (12.6-24.7)	19.9 (13.1-27.0)
30-day	9.21 (7.79-10.8)	10.2 (8.58-11.9)	11.7 (9.85-13.8)	13.0 (10.9-15.4)	14.8 (11.8-17.9)	16.2 (12.6-19.8)	17.5 (13.1-21.9)	18.8 (13.4-24.3)	20.4 (13.9-27.1)	21.6 (14.3-29.2)
45-day	11.5 (9.74-13.4)	12.5 (10.6-14.5)	14.1 (11.9-16.5)	15.5 (13.0-18.2)	17.4 (14.0-20.9)	18.9 (14.8-22.9)	20.3 (15.2-25.1)	21.5 (15.4-27.6)	23.0 (15.8-30.3)	23.9 (15.9-32.2)
60-day	13.3 (11.4-15.5)	14.4 (12.3-16.7)	16.1 (13.7-18.8)	17.6 (14.8-20.6)	19.6 (15.8-23.4)	21.2 (16.6-25.6)	22.6 (17.0-27.9)	23.8 (17.2-30.5)	25.2 (17.4-33.2)	26.1 (17.5-35.0)

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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**PF graphical**

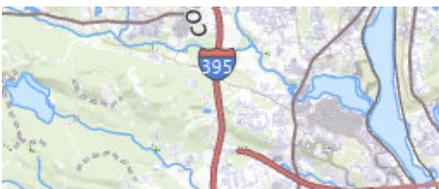
PDS-based depth-duration-frequency (DDF) curves  
 Latitude: 41.4420°, Longitude: -72.0164°



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**Maps & aerials**

**Small scale terrain**





+  
-



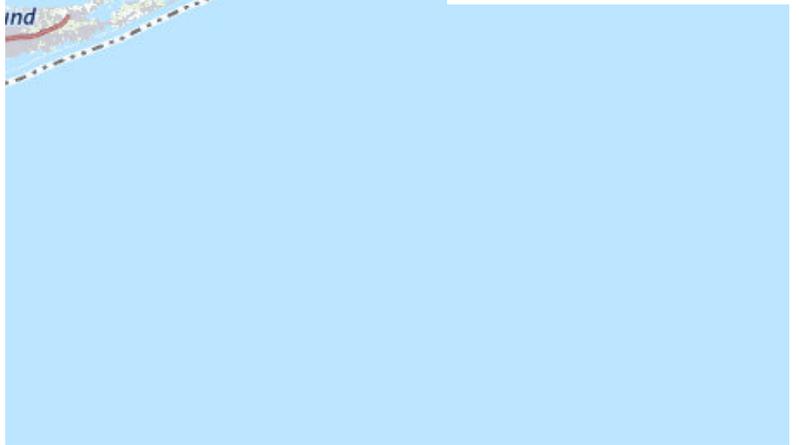
Scale terrain

+  
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+  
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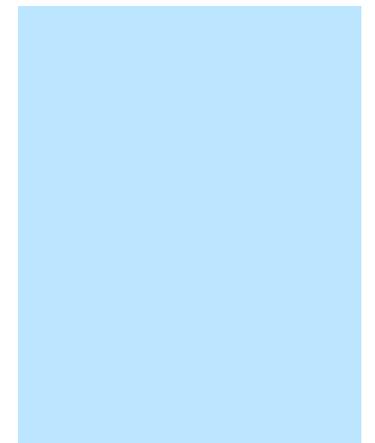




setts



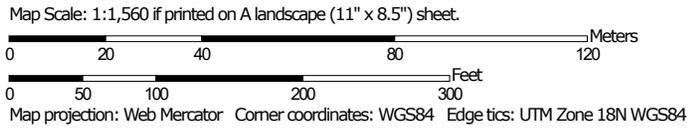
Vantucket  
Sound



Soil Map—State of Connecticut, Eastern Part  
(740 Colonel Ledyard)



Soil Map may not be valid at this scale.



## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

### Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

### Water Features



Streams and Canals

### Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

### Background



Aerial Photography

## MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: State of Connecticut, Eastern Part  
Survey Area Data: Version 6, Sep 16, 2025

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

Date(s) aerial images were photographed: Jun 14, 2022—Oct 6, 2022

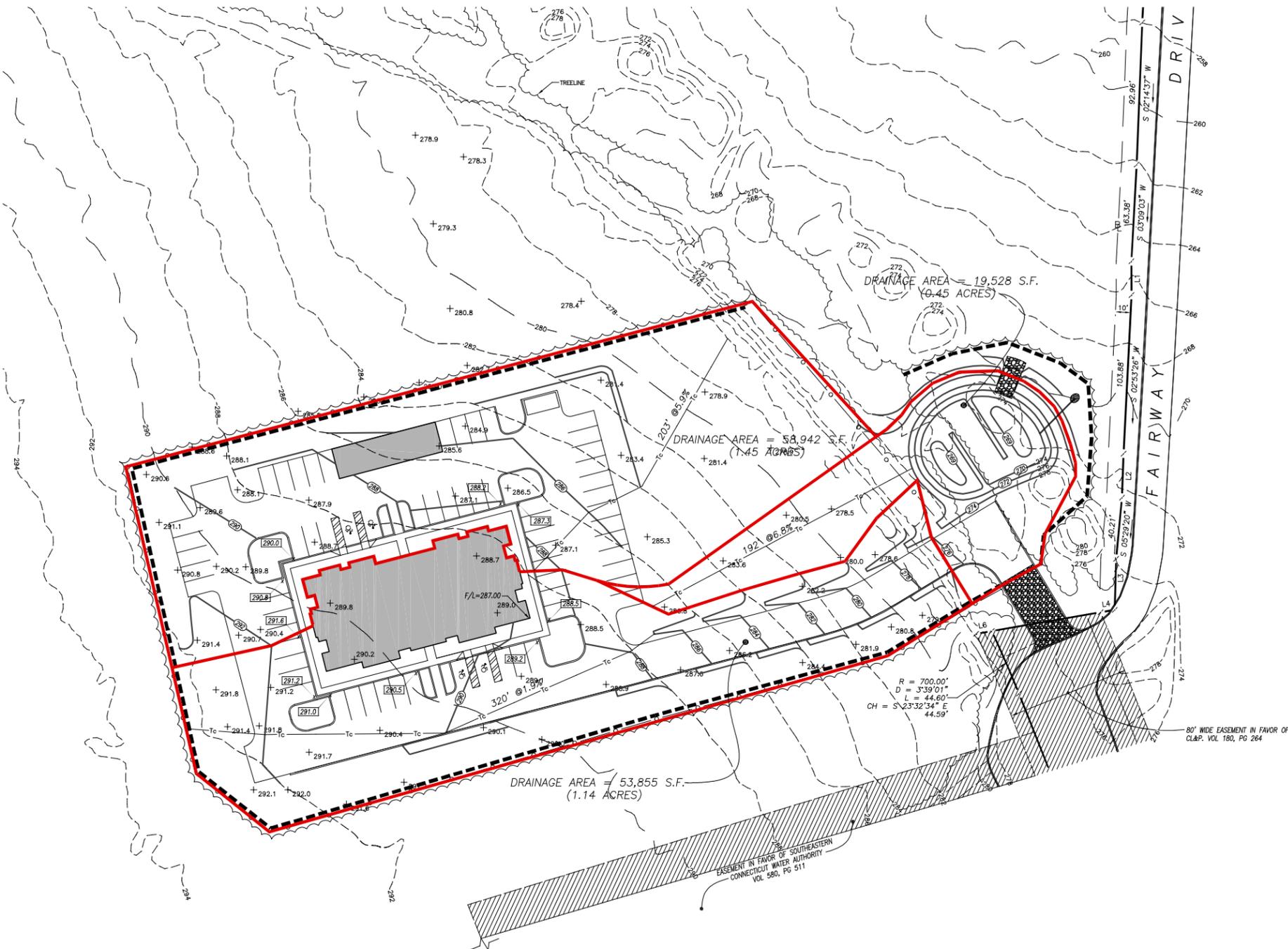
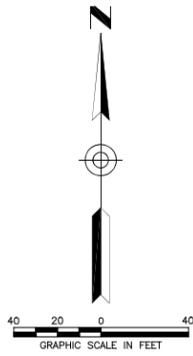
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
46B	Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony	3.4	60.4%
47C	Woodbridge fine sandy loam, 3 to 15 percent slopes, extremely stony	2.2	39.4%
85B	Paxton and Montauk fine sandy loams, 3 to 8 percent slopes, very stony	0.0	0.2%
<b>Totals for Area of Interest</b>		<b>5.6</b>	<b>100.0%</b>

## **DRAINAGE AREA PLANS**





K:\2023\085\23038\Drawings\2024 - Building - VP-DRAINAGE.dwg Mar 02, 2026 - 2:28 PM

**LEGEND**

- F.F. FINISHED FLOOR
- - - 100 - - - EXISTING CONTOURS
- (100) PROPOSED CONTOURS
- - - - - BUILDING SETBACK LINE
- - - - - SILT FENCE

DATE	DESCRIPTION

**PROPOSED DRAINAGE AREA PLAN**  
 PREPARED FOR  
**LEDYARD CENTER, LLC**  
 COLONEL LEDYARD HIGHWAY (RTE 117) & IRON STREET (RTE 214)  
 LEDYARD, CONNECTICUT



**Killingly Engineering Associates**  
Civil Engineering & Surveying

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Killingly, Connecticut 06241  
(860) 779-7299  
www.killinglyengineering.com

DATE: 1/17/2026	DRAWN: RGS
SCALE: 1" = 40'	DESIGN: NET
SHEET: 2 OF 2	CHK BY: --
DWG. No: CLIENT FILE	JOB No: 23038