GRADY CONSULTING, L.L.C.

Civil Engineers ♦ Land Surveyors ♦ Landscape Architects

STORMWATER REPORT

8 Franklin Rodgers Rd.
Hingham, Massachusetts

Prepared for:

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8 Franklin Rodgers Rd.
Hingham, MA 02043

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SUMMARY

This Stormwater Report has been prepared to document compliance with Stormwater Management Standards for the development of a single family house lot. The applicant is proposing to build a single family home with associated grading, driveway, and stormwater controls. Currently the site consists of a paved driveway, wooded areas, and an existing building.

Currently the site consists of approximately 8,234 sf of impervious area. The development of the site will increase the impervious area by 4,301 sf to 12,535 sf. The proposed drainage consists of a catch basin which is routed to an underground crushed stone bed to capture and infiltrate driveway and roof runoff. The soils on site are classified as A and the entire recharge volume is proposed to be infiltrated. The design as proposed reduces peak runoff and improves stormwater quality and treatment.

This analysis is divided into the following sections:

Section I Compliance with Massachusetts Stormwater Management Regulations
Section II Overall Site Analysis
Section III Operation and Maintenance Plan

Pre Development -
Catchment Existing Area 1 (Subcat PRE 1) consists of existing stormwater runoff towards the north of the lot (Design point 1 – DP1). It consists of roof runoff, and runoff from wooded and grassed areas.

Catchment Existing Area 2 (Subcat PRE 2) consists of existing stormwater runoff towards the wetland line towards the east (Design point 2 – DP2). This includes roof, pavement, wooded and grassed areas.

Post Development -
Catchment Post Area 1 (Subcat POST 1) consists of existing grassed and wooded areas, and proposed pool and cabana roof, which runoff overland off-site towards the north (DP-1) and do not contribute to the proposed stormwater bmps.

Catchment Post Area 2 (Subcat POST 2) consists of the existing driveway, grassed, and wooded areas that runoff towards the wetland at the east out to DP 2.

Catchment Post Area 3 (Subcat POST 2A) consists of roof, proposed driveway, and grassed areas runoff which flow overland towards the proposed catch basin, which is routed to the subsurface crushed stone bed.

The calculations have been performed for the 2, 10, 25, and 100-year 24 hour storm event, using HydroCAD 10.00 Stormwater Modeling computer program. This computer program is based upon the TR-55 computer models and uses the SCS Curvilinear Unit rainfall distribution. The closed drainage system calculation were performed using the HydroCAD Stormwater Modeling program.

SUMMARY OF STORMWATER FLOWS
(cfs)

DP-1 PRE-DEVELOPMENT CONDITIONS

Event	Outflow
2-Year	0.00
10-Year	0.03
25-Year	0.11
100-Year	0.42

DP-2 PRE-DEVELOPMENT CONDITIONS

Event	Outflow
2-Year	0.00
10-Year	0.11
25-Year	0.36
100-Year	1.30

DP-1 POST-DEVELOPMENT CONDITIONS

Event	Outflow
2-Year	0.00
10-Year	0.03
25-Year	0.11
100-Year	0.40

DP-2 POST-DEVELOPMENT CONDITIONS

Event	Outflow
2-Year	0.00
10-Year	0.02
25-Year	0.12
100-Year	1.15

Section I

Compliance with Massachusetts Stormwater Management Regulations

STANDARD 1. NO NEW STORMWATER CONVEYANCES
The proposed re-development proposes no new stormwater conveyances that discharge untreated stormwater off-site or cause down gradient erosion.

STANDARD 2. PEAK RATE ATTENUATION
The overall site analysis demonstrates that the stormwater management system has been designed so that the post-development peak discharge rates do not exceed the pre-development discharge rate.

STANDARD 3. STORMWATER RECHARGE
Based on Plymouth County Soil Survey, the consist of Hydrologic Soils Group "Type A", loamy sand for the majority of the site.

Total proposed impervious – 4,301 sf
HSG "A" Target Depth Factor =0.60
Total required recharge = 0.60" * 1'/12" * 4,301 sf = 215 CF

Total Provided Recharge (Subsurface Infiltration Basin) = 1,980 CF

Drawdown calculations

Subsurface Infiltration Basin
Bottom area = 3,300 sf
Infiltration rate = 2.47 in/hr
Storage volume = 1,980 cf

$$\boldsymbol{Drawdown_{G1} = \frac{1,980\ cf}{2.47\ {}^{in}/_{hr} * 3,300\ sf * 1'/12"} = 2.9\ hr < 72\ hrs}$$

STANDARD 4. WATER QUALITY

TSS Removal

The proposed work meets the requirement for removal of total suspended solids (TSS). See TSS Removal Worksheet

Long-Term Pollution Prevention Plan

The long-term pollution prevention plan will be combined with the Operation and Maintenance Plan required by Standard 9.

WATER QUALITY TREATMENT VOLUME

V_{WQ} = (D_{WQ}/12 inches/foot) * (A_{IMP} * 43,560 square feet/acre)

V_{WQ} = *Required Water Quality Volume* (in cubic feet)
D_{WQ} = Water Quality Depth: one-inch for discharges within a Zone II or Interim Wellhead Protection Area, to or near another critical area, runoff from a LUHPPL, or exfiltration to soils with infiltration rate greater than 2.4 inches/hour or greater; ½-inch for discharges near or to other areas.
A_{IMP} = Impervious Area (in acres)

Total proposed driveway impervious – 410 SF
Req Recharge depth – 1”
Total water quality volume = 1” * 1’/12” * 410 sf = 34 CF

Total Provided WQv (Subsurface infiltration) = 1,980 CF

STANDARD 5 LAND USES WITH HIGHER POTENTIAL POLLUTANT LOADS

The land use is not considered a higher potential pollutant load.

STANDARD 6. CRITICAL AREAS

The project does not lie in any critical areas..

STANDARD 7. REDEVELOPMENT PROJECT

“A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.”

This project is not a redevelopment project.

STANDARD 8. CONSTRUCTION PERIOD CONTROLS

A plan to control construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

The proposed project will not disturb more than one acre of land and is not required to obtain coverage under the NPDES Construction General Permit issued by EPA and will not require a Stormwater Pollution Plan (see attached O&M Plan during construction)

STANDARD 9. LONG-TERM OPERATION AND MAINTENANCE (O&M) PLAN

A Long -Term Operation and Maintenance (O&M) Plan shall be developed and implemented to ensure that stormwater management systems function as designed.

The Long-Term Operation and Maintenance Plan shall at a minimum include:

1. *Stormwater management system(s) owners;*
2. *The party or parties responsible for operation and maintenance, including how future property owners will be notified of the presence of the stormwater management system and the requirement for proper operation and maintenance;*
3. *The routine and non-routine maintenance tasks to be undertaken after construction is complete and a schedule for implementing those tasks;*
4. *A plan that is drawn to scale and shows the location of all stormwater BMPs in each treatment train along with the discharge point;*
5. *A description and delineation of public safety features; and*
6. *An estimated operations and maintenance budget.*

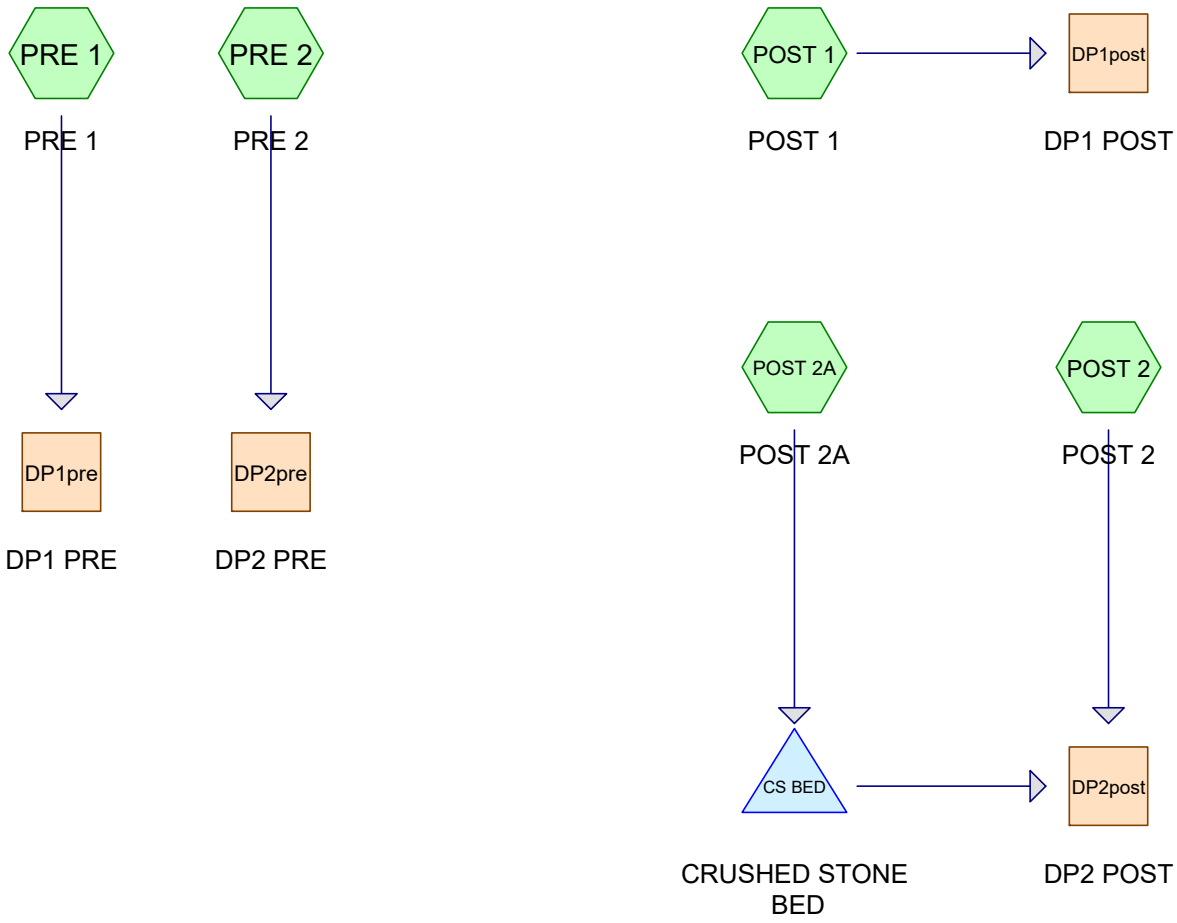
(see attached O&M Plan post construction)

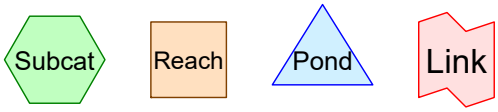
STANDARD 10. ILLICIT DISCHARGES PROHIBITED

"All illicit discharges to the stormwater management system are prohibited."

Section II

Overall Site Analysis





Routing Diagram for 8 Franklin Rodgers
Prepared by Grady Consulting LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
48,939	39	>75% Grass cover, Good, HSG A (POST 1, POST 2, POST 2A, PRE 1, PRE 2)
8,133	98	Paved parking, HSG A (POST 2, PRE 2)
7,738	98	Roofs, HSG A (POST 1, POST 2A, PRE 1)
3,773	98	Unconnected pavement, HSG A (POST 2A)
1,125	98	Unconnected roofs, HSG A (PRE 2)
50,292	30	Woods, Good, HSG A (POST 1, POST 2, PRE 1, PRE 2)
120,000	**45**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
120,000	HSG A	POST 1, POST 2, POST 2A, PRE 1, PRE 2
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
120,000		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
48,939	0	0	0	0	48,939	>75% Grass cover, Good	
8,133	0	0	0	0	8,133	Paved parking	
7,738	0	0	0	0	7,738	Roofs	
3,773	0	0	0	0	3,773	Unconnected pavement	
1,125	0	0	0	0	1,125	Unconnected roofs	
50,292	0	0	0	0	50,292	Woods, Good	
120,000	**0**	**0**	**0**	**0**	**120,000**	**TOTAL AREA**	

Time span=5.00-24.00 hrs, dt=0.05 hrs, 381 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 POST 1: POST 1 Runoff Area=14,181 sf 10.97% Impervious Runoff Depth>0.03"
Flow Length=215' Tc=20.9 min CN=43 Runoff=0.00 cfs 40 cf

Subcatchment POST 2: POST 2 Runoff Area=34,975 sf 6.82% Impervious Runoff Depth>0.00"
Flow Length=192' Tc=17.4 min CN=38 Runoff=0.00 cfs 1 cf

Subcatchment POST 2A: POST 2A Runoff Area=10,844 sf 79.25% Impervious Runoff Depth>1.96"
Tc=5.0 min CN=86 Runoff=0.57 cfs 1,776 cf

Subcatchment PRE 1: PRE 1 Runoff Area=16,401 sf 8.30% Impervious Runoff Depth>0.02"
Flow Length=215' Tc=20.9 min CN=42 Runoff=0.00 cfs 32 cf

Subcatchment PRE 2: PRE 2 Runoff Area=43,599 sf 15.76% Impervious Runoff Depth>0.03"
Flow Length=192' Tc=17.4 min UI Adjusted CN=43 Runoff=0.00 cfs 125 cf

Reach DP1post: DP1 POST Inflow=0.00 cfs 40 cf
Outflow=0.00 cfs 40 cf

Reach DP1pre: DP1 PRE Inflow=0.00 cfs 32 cf
Outflow=0.00 cfs 32 cf

Reach DP2post: DP2 POST Inflow=0.00 cfs 1 cf
Outflow=0.00 cfs 1 cf

Reach DP2pre: DP2 PRE Inflow=0.00 cfs 125 cf
Outflow=0.00 cfs 125 cf

Pond CS BED: CRUSHED STONE BED Peak Elev=47.24' Storage=312 cf Inflow=0.57 cfs 1,776 cf
Discarded=0.19 cfs 1,774 cf Primary=0.00 cfs 0 cf Outflow=0.19 cfs 1,774 cf

Total Runoff Area = 120,000 sf Runoff Volume = 1,974 cf Average Runoff Depth = 0.20"
82.69% Pervious = 99,231 sf 17.31% Impervious = 20,769 sf

Summary for Subcatchment POST 1: POST 1

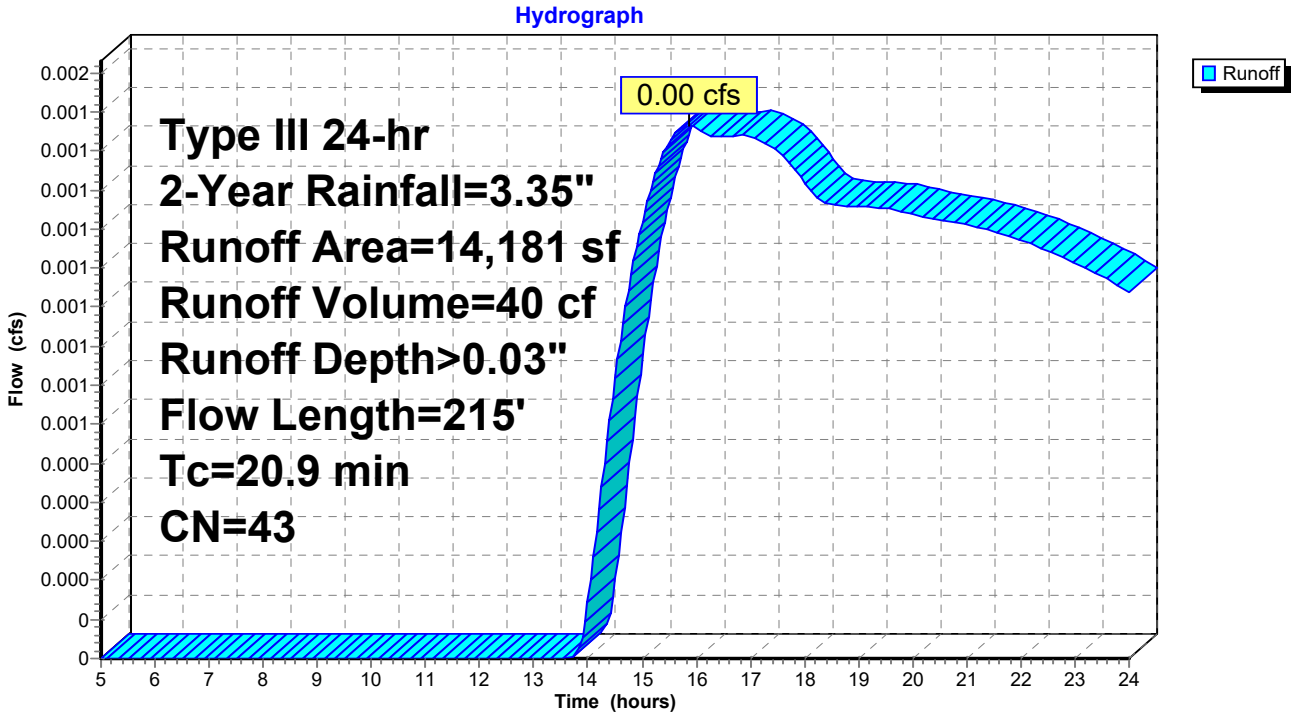
Runoff = 0.00 cfs @ 15.88 hrs, Volume= 40 cf, Depth> 0.03"
Routed to Reach DP1post : DP1 POST

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.35"

Area (sf)	CN	Description
8,653	39	>75% Grass cover, Good, HSG A
3,972	30	Woods, Good, HSG A
1,556	98	Roofs, HSG A
14,181	43	Weighted Average
12,625		89.03% Pervious Area
1,556		10.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.9	26	0.0040	0.03		**Sheet Flow, GRASS** Grass: Bermuda n= 0.410 P2= 3.35"
4.6	25	0.0586	0.09		**Sheet Flow, GRASS** Grass: Bermuda n= 0.410 P2= 3.35"
0.2	25	0.0586	1.69		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
0.4	40	0.0500	1.57		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
0.2	22	0.0450	1.48		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
1.6	77	0.0259	0.80		**Shallow Concentrated Flow, GRASS** Woodland Kv= 5.0 fps
20.9	215	Total			

Subcatchment POST 1: POST 1



Summary for Subcatchment POST 2: POST 2

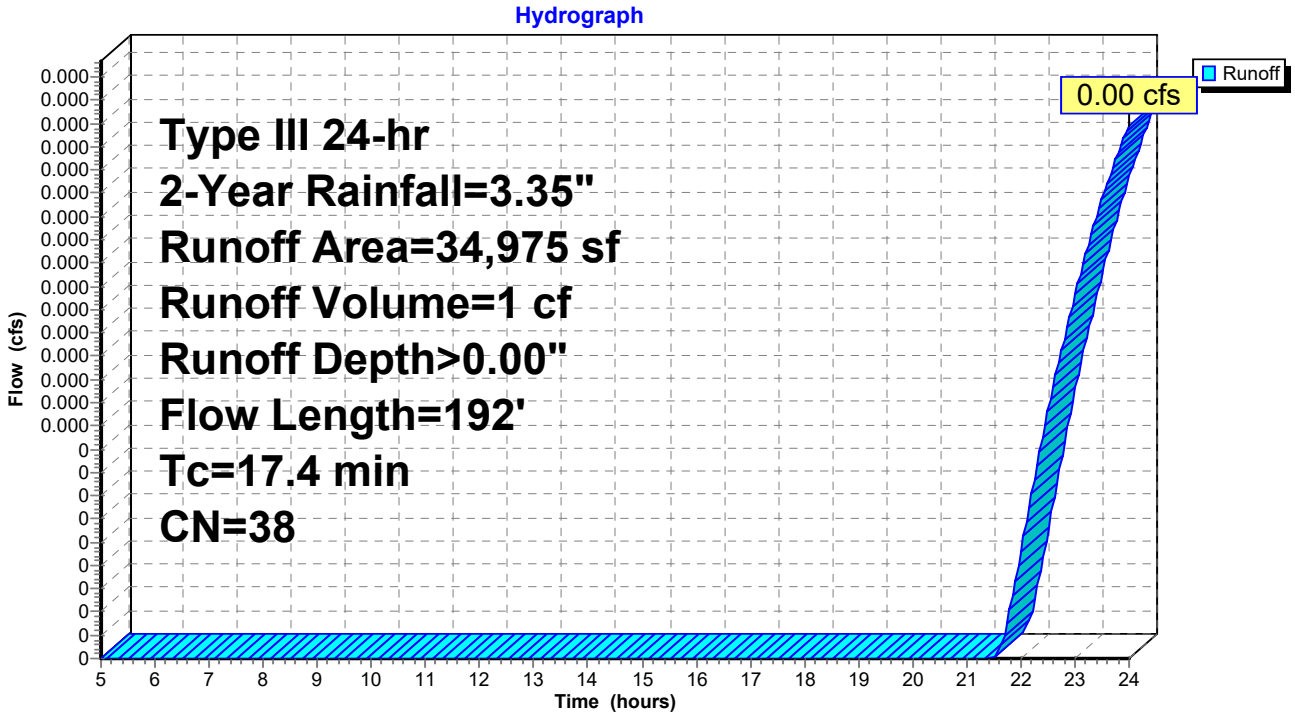
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 1 cf, Depth> 0.00"
Routed to Reach DP2post : DP2 POST

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.35"

Area (sf)	CN	Description
11,416	39	>75% Grass cover, Good, HSG A
21,174	30	Woods, Good, HSG A
2,385	98	Paved parking, HSG A
34,975	38	Weighted Average
32,590		93.18% Pervious Area
2,385		6.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	50	0.0125	0.06		**Sheet Flow, WOODS** Woods: Light underbrush n= 0.400 P2= 3.35"
0.9	32	0.0157	0.63		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
0.7	38	0.0288	0.85		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
1.0	45	0.0243	0.78		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
0.3	27	0.0667	1.29		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
17.4	192	Total			

Subcatchment POST 2: POST 2



Summary for Subcatchment POST 2A: POST 2A

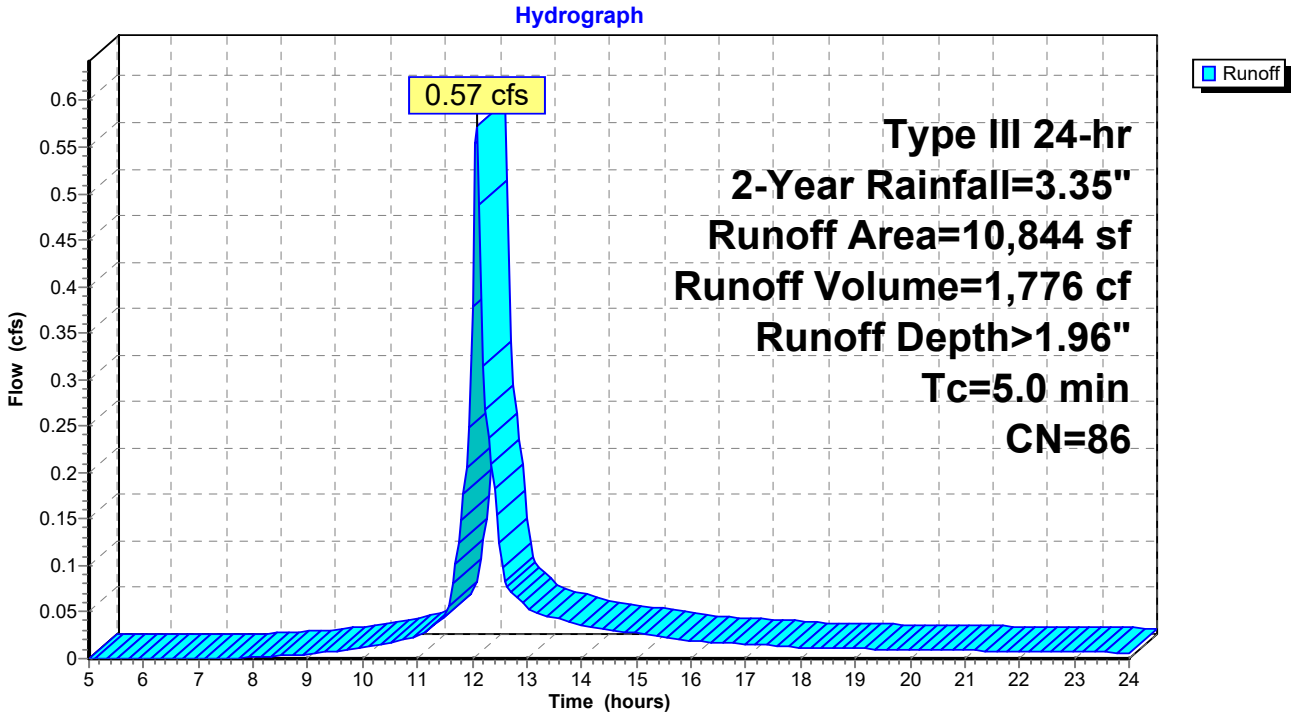
Runoff = 0.57 cfs @ 12.08 hrs, Volume= 1,776 cf, Depth> 1.96"
Routed to Pond CS BED : CRUSHED STONE BED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.35"

Area (sf)	CN	Description
2,250	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
4,821	98	Roofs, HSG A
3,773	98	Unconnected pavement, HSG A
10,844	86	Weighted Average
2,250		20.75% Pervious Area
8,594		79.25% Impervious Area
3,773		43.90% Unconnected

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

Subcatchment POST 2A: POST 2A



Summary for Subcatchment PRE 1: PRE 1

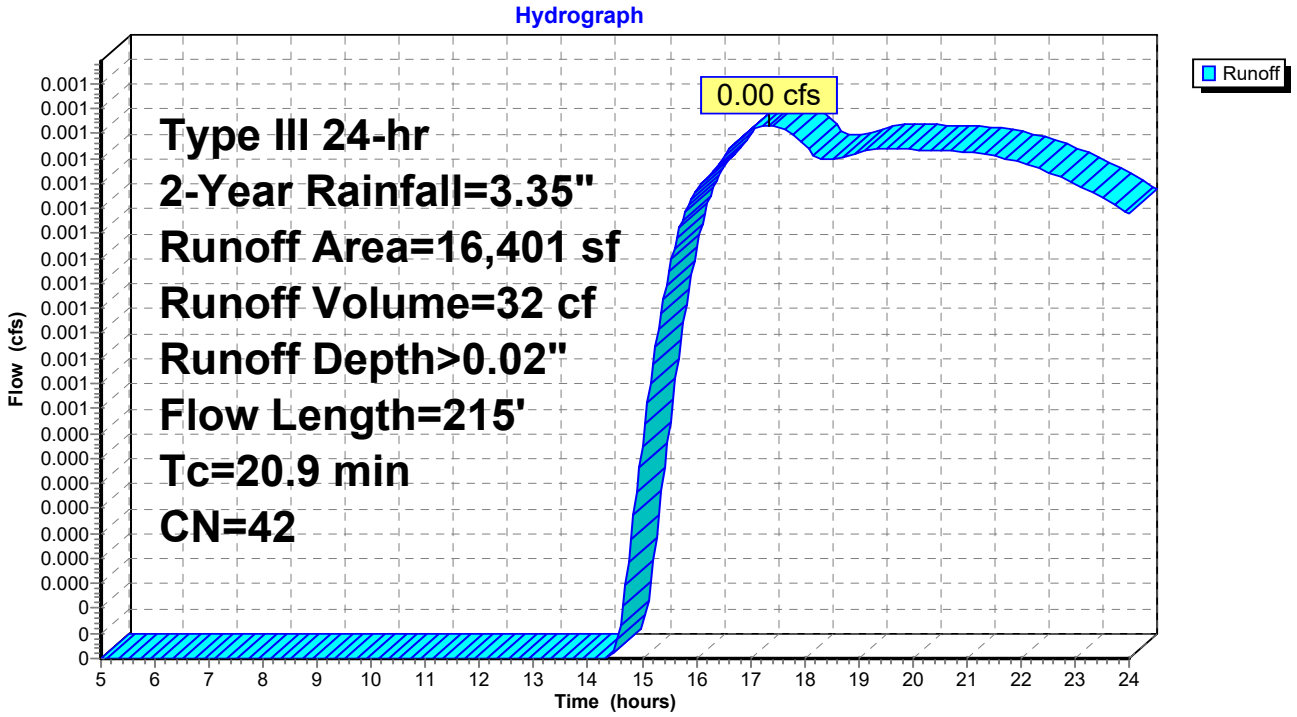
Runoff = 0.00 cfs @ 17.34 hrs, Volume= 32 cf, Depth> 0.02"
Routed to Reach DP1pre : DP1 PRE

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.35"

Area (sf)	CN	Description
11,068	39	>75% Grass cover, Good, HSG A
3,972	30	Woods, Good, HSG A
1,361	98	Roofs, HSG A
16,401	42	Weighted Average
15,040		91.70% Pervious Area
1,361		8.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.9	26	0.0040	0.03		**Sheet Flow, GRASS** Grass: Bermuda n= 0.410 P2= 3.35"
4.6	25	0.0586	0.09		**Sheet Flow, GRASS** Grass: Bermuda n= 0.410 P2= 3.35"
0.2	25	0.0586	1.69		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
0.4	40	0.0500	1.57		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
0.2	22	0.0450	1.48		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
1.6	77	0.0259	0.80		**Shallow Concentrated Flow, GRASS** Woodland Kv= 5.0 fps
20.9	215	Total			

Subcatchment PRE 1: PRE 1



Summary for Subcatchment PRE 2: PRE 2

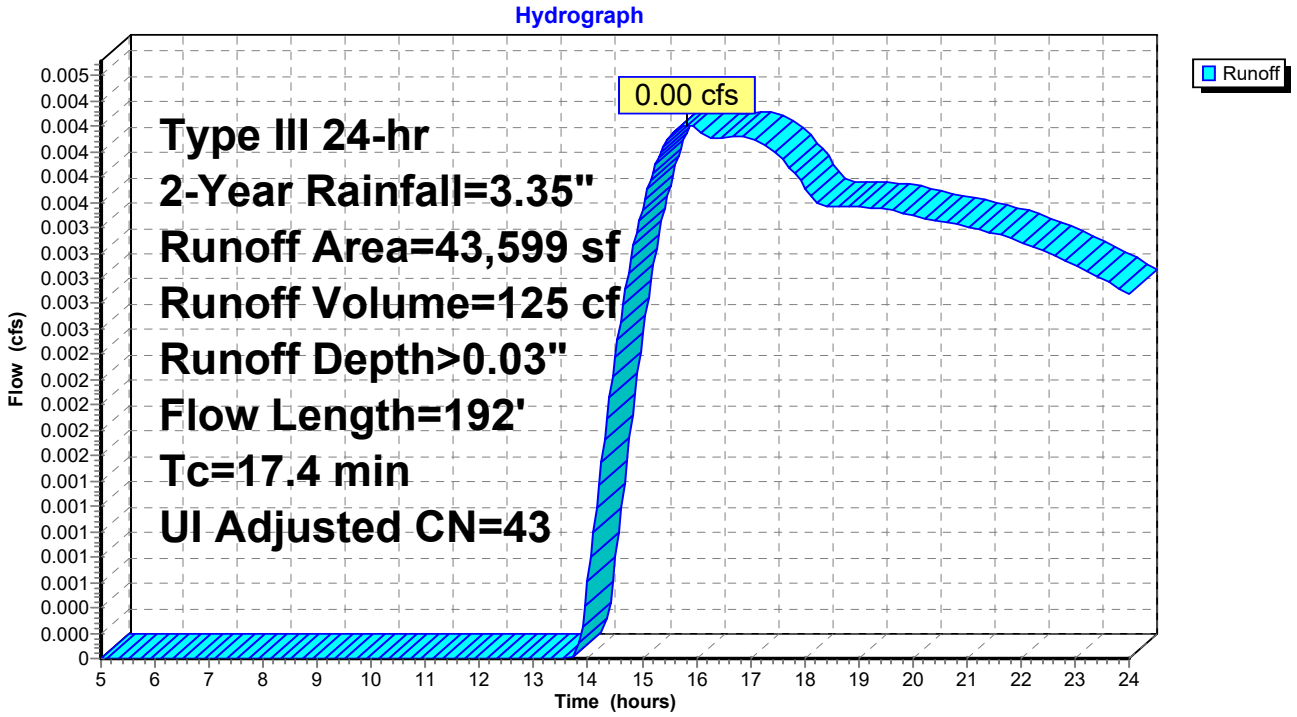
Runoff = 0.00 cfs @ 15.83 hrs, Volume= 125 cf, Depth> 0.03"
Routed to Reach DP2pre : DP2 PRE

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.35"

Area (sf)	CN	Adj	Description
15,552	39		>75% Grass cover, Good, HSG A
21,174	30		Woods, Good, HSG A
5,748	98		Paved parking, HSG A
1,125	98		Unconnected roofs, HSG A
43,599	44	43	Weighted Average, UI Adjusted
36,726			84.24% Pervious Area
6,873			15.76% Impervious Area
1,125			16.37% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	50	0.0125	0.06		**Sheet Flow, WOODS** Woods: Light underbrush n= 0.400 P2= 3.35"
0.9	32	0.0157	0.63		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
0.7	38	0.0288	0.85		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
1.0	45	0.0243	0.78		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
0.3	27	0.0667	1.29		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
17.4	192	Total			

Subcatchment PRE 2: PRE 2

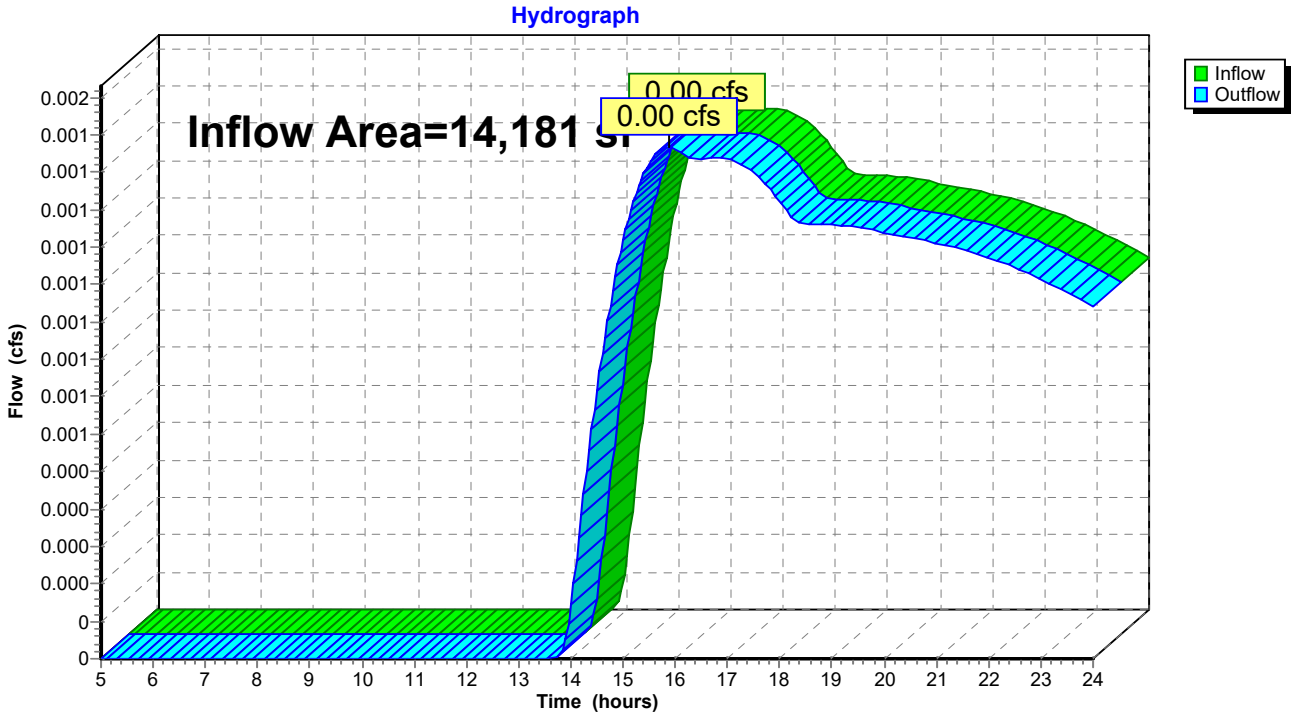


Summary for Reach DP1post: DP1 POST

Inflow Area = 14,181 sf, 10.97% Impervious, Inflow Depth > 0.03" for 2-Year event
Inflow = 0.00 cfs @ 15.88 hrs, Volume= 40 cf
Outflow = 0.00 cfs @ 15.88 hrs, Volume= 40 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

Reach DP1post: DP1 POST

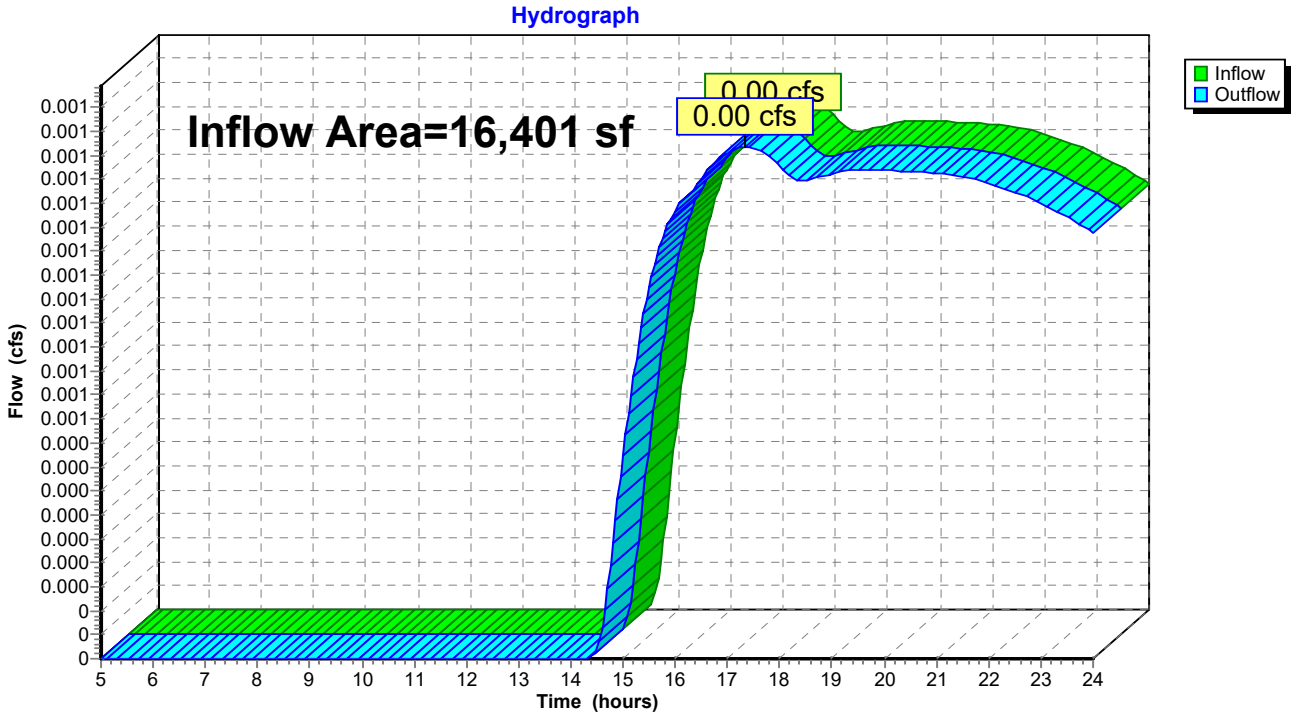


Summary for Reach DP1pre: DP1 PRE

Inflow Area = 16,401 sf, 8.30% Impervious, Inflow Depth > 0.02" for 2-Year event
Inflow = 0.00 cfs @ 17.34 hrs, Volume= 32 cf
Outflow = 0.00 cfs @ 17.34 hrs, Volume= 32 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

Reach DP1pre: DP1 PRE

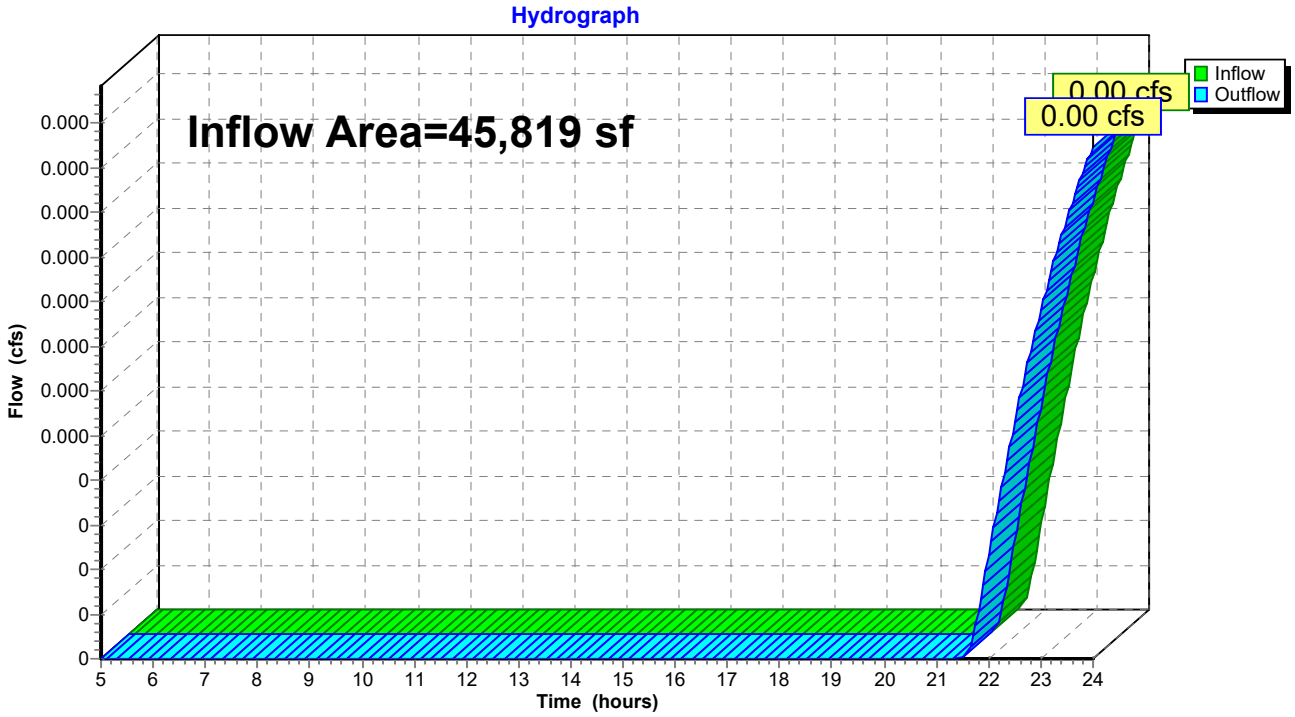


Summary for Reach DP2post: DP2 POST

Inflow Area = 45,819 sf, 23.96% Impervious, Inflow Depth > 0.00" for 2-Year event
Inflow = 0.00 cfs @ 24.00 hrs, Volume= 1 cf
Outflow = 0.00 cfs @ 24.00 hrs, Volume= 1 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

Reach DP2post: DP2 POST

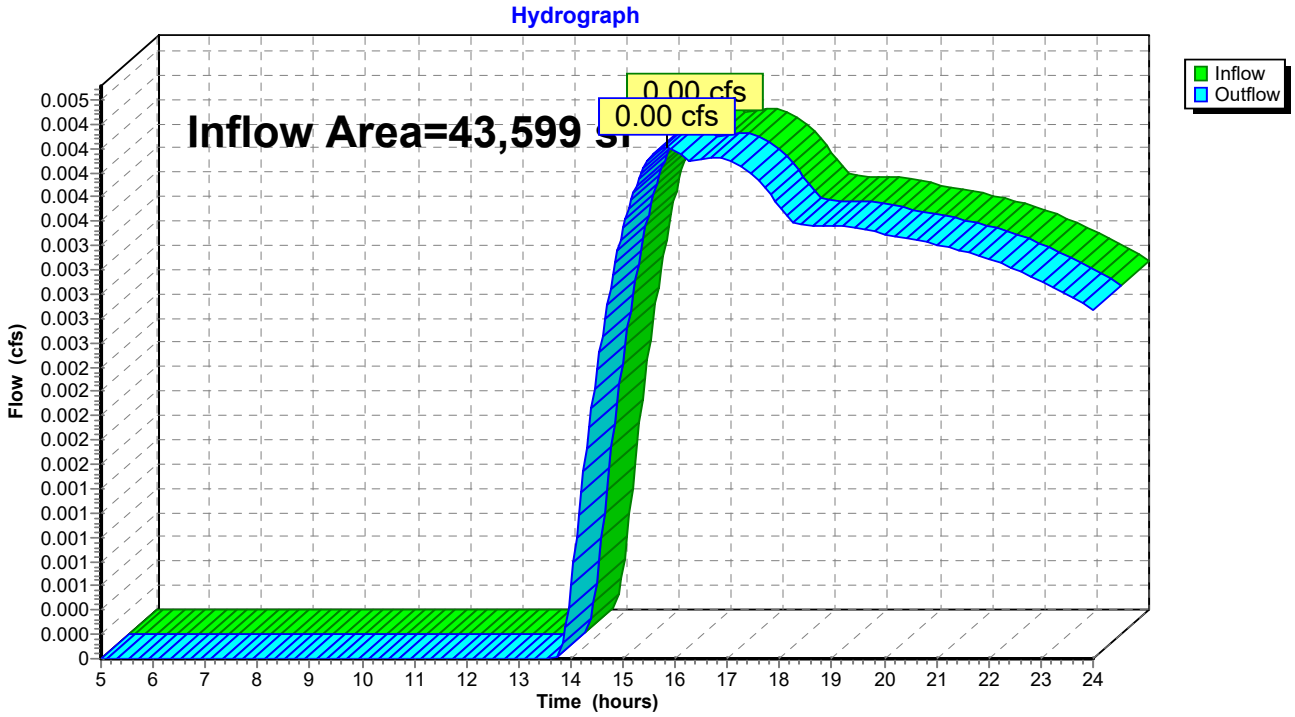


Summary for Reach DP2pre: DP2 PRE

Inflow Area = 43,599 sf, 15.76% Impervious, Inflow Depth > 0.03" for 2-Year event
Inflow = 0.00 cfs @ 15.83 hrs, Volume= 125 cf
Outflow = 0.00 cfs @ 15.83 hrs, Volume= 125 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

Reach DP2pre: DP2 PRE



Summary for Pond CS BED: CRUSHED STONE BED

Inflow Area = 10,844 sf, 79.25% Impervious, Inflow Depth > 1.96" for 2-Year event
Inflow = 0.57 cfs @ 12.08 hrs, Volume= 1,776 cf
Outflow = 0.19 cfs @ 11.95 hrs, Volume= 1,774 cf, Atten= 67%, Lag= 0.0 min
Discarded = 0.19 cfs @ 11.95 hrs, Volume= 1,774 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Routed to Reach DP2post : DP2 POST

Routing by Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 47.24' @ 12.39 hrs Surf.Area= 3,300 sf Storage= 312 cf

Plug-Flow detention time= 10.4 min calculated for 1,769 cf (100% of inflow)
Center-of-Mass det. time= 9.8 min (829.0 - 819.2)

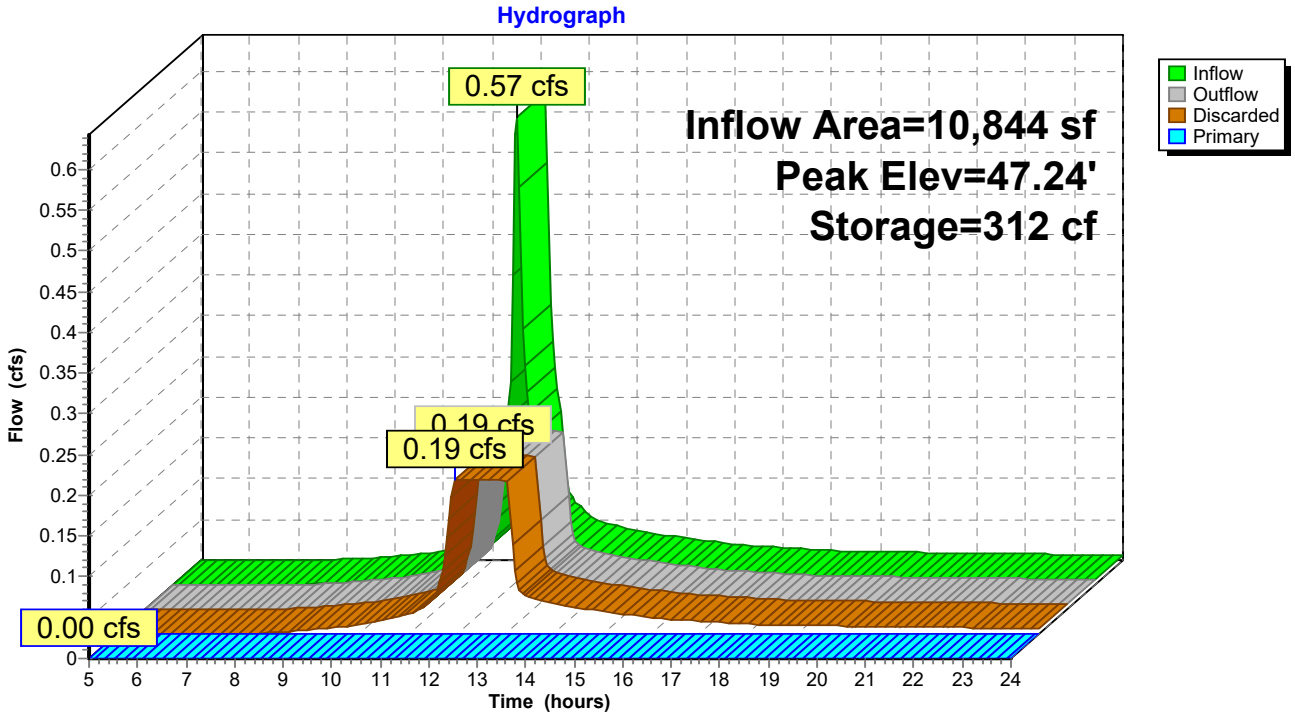
Volume	Invert	Avail.Storage	Storage Description
#1	47.00'	1,980 cf	**60.00'W x 55.00'L x 1.50'H Prismatoid** 4,950 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	47.00'	**2.470 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	48.50'	**24.0" W x 24.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.19 cfs @ 11.95 hrs HW=47.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=47.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond CS BED: CRUSHED STONE BED



Stage-Discharge for Pond CS BED: CRUSHED STONE BED

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
47.00	0.00	**0.00**	0.00
47.05	0.19	**0.19**	0.00
47.10	0.19	0.19	0.00
47.15	0.19	0.19	0.00
47.20	0.19	0.19	0.00
47.25	0.19	0.19	0.00
47.30	0.19	0.19	0.00
47.35	0.19	0.19	0.00
47.40	0.19	0.19	0.00
47.45	0.19	0.19	0.00
47.50	0.19	0.19	0.00
47.55	0.19	0.19	0.00
47.60	0.19	0.19	0.00
47.65	0.19	0.19	0.00
47.70	0.19	0.19	0.00
47.75	0.19	0.19	0.00
47.80	0.19	0.19	0.00
47.85	0.19	0.19	0.00
47.90	0.19	0.19	0.00
47.95	0.19	0.19	0.00
48.00	0.19	0.19	0.00
48.05	0.19	0.19	0.00
48.10	0.19	0.19	0.00
48.15	0.19	0.19	0.00
48.20	0.19	0.19	0.00
48.25	0.19	0.19	0.00
48.30	0.19	0.19	0.00
48.35	0.19	0.19	0.00
48.40	0.19	0.19	0.00
48.45	0.19	0.19	0.00
48.50	0.19	0.19	0.00
48.55	0.26	0.19	0.07
48.60	0.39	0.19	0.20
48.65	0.56	0.19	0.37
48.70	0.76	0.19	0.57
48.75	0.99	0.19	0.80
48.80	1.24	0.19	1.05
48.85	1.52	0.19	1.33
48.90	1.81	0.19	1.62
48.95	2.13	0.19	1.94
49.00	2.46	0.19	2.27
49.05	2.81	0.19	2.62
49.10	3.17	0.19	2.98
49.15	3.55	0.19	3.36
49.20	3.95	0.19	3.76
49.25	4.36	0.19	4.17
49.30	4.78	0.19	4.59
49.35	5.22	0.19	5.03
49.40	5.67	0.19	5.48
49.45	6.13	0.19	5.94
49.50	6.61	0.19	6.42
49.55	7.10	0.19	6.91
49.60	7.60	0.19	7.41
49.65	8.11	0.19	7.92
49.70	8.63	0.19	8.44
49.75	9.16	0.19	8.97
49.80	9.70	0.19	9.52
49.85	10.26	0.19	10.07
49.90	10.82	0.19	10.63
49.95	11.40	0.19	11.21
50.00	11.98	0.19	11.79
50.05	12.58	0.19	12.39
50.10	13.18	0.19	12.99
50.15	13.80	0.19	13.61
50.20	14.42	0.19	14.23
50.25	15.05	0.19	14.86
50.30	15.69	0.19	15.50
50.35	16.34	0.19	16.15
50.40	17.00	0.19	16.81
50.45	17.67	0.19	17.48
50.50	**18.35**	0.19	**18.16**

Stage-Area-Storage for Pond CS BED: CRUSHED STONE BED

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
47.00	**3,300**	0
47.05	3,300	66
47.10	3,300	132
47.15	3,300	198
47.20	3,300	264
47.25	3,300	330
47.30	3,300	396
47.35	3,300	462
47.40	3,300	528
47.45	3,300	594
47.50	3,300	660
47.55	3,300	726
47.60	3,300	792
47.65	3,300	858
47.70	3,300	924
47.75	3,300	990
47.80	3,300	1,056
47.85	3,300	1,122
47.90	3,300	1,188
47.95	3,300	1,254
48.00	3,300	1,320
48.05	3,300	1,386
48.10	3,300	1,452
48.15	3,300	1,518
48.20	3,300	1,584
48.25	3,300	1,650
48.30	3,300	1,716
48.35	3,300	1,782
48.40	3,300	1,848
48.45	3,300	1,914
48.50	3,300	**1,980**
48.55	3,300	1,980
48.60	3,300	1,980
48.65	3,300	1,980
48.70	3,300	1,980
48.75	3,300	1,980
48.80	3,300	1,980
48.85	3,300	1,980
48.90	3,300	1,980
48.95	3,300	1,980
49.00	3,300	1,980
49.05	3,300	1,980
49.10	3,300	1,980
49.15	3,300	1,980
49.20	3,300	1,980
49.25	3,300	1,980
49.30	3,300	1,980
49.35	3,300	1,980
49.40	3,300	1,980
49.45	3,300	1,980
49.50	3,300	1,980
49.55	3,300	1,980
49.60	3,300	1,980
49.65	3,300	1,980
49.70	3,300	1,980
49.75	3,300	1,980
49.80	3,300	1,980
49.85	3,300	1,980
49.90	3,300	1,980
49.95	3,300	1,980
50.00	3,300	1,980
50.05	3,300	1,980
50.10	3,300	1,980
50.15	3,300	1,980
50.20	3,300	1,980
50.25	3,300	1,980
50.30	3,300	1,980
50.35	3,300	1,980
50.40	3,300	1,980
50.45	3,300	1,980
50.50	3,300	1,980

Time span=5.00-24.00 hrs, dt=0.05 hrs, 381 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 POST 1: POST 1 Runoff Area=14,181 sf 10.97% Impervious Runoff Depth>0.34"
Flow Length=215' Tc=20.9 min CN=43 Runoff=0.03 cfs 397 cf

Subcatchment POST 2: POST 2 Runoff Area=34,975 sf 6.82% Impervious Runoff Depth>0.16"
Flow Length=192' Tc=17.4 min CN=38 Runoff=0.02 cfs 455 cf

Subcatchment POST 2A: POST 2A Runoff Area=10,844 sf 79.25% Impervious Runoff Depth>3.42"
Tc=5.0 min CN=86 Runoff=0.99 cfs 3,089 cf

Subcatchment PRE 1: PRE 1 Runoff Area=16,401 sf 8.30% Impervious Runoff Depth>0.30"
Flow Length=215' Tc=20.9 min CN=42 Runoff=0.03 cfs 405 cf

Subcatchment PRE 2: PRE 2 Runoff Area=43,599 sf 15.76% Impervious Runoff Depth>0.34"
Flow Length=192' Tc=17.4 min UI Adjusted CN=43 Runoff=0.11 cfs 1,224 cf

Reach DP1post: DP1 POST Inflow=0.03 cfs 397 cf
Outflow=0.03 cfs 397 cf

Reach DP1pre: DP1 PRE Inflow=0.03 cfs 405 cf
Outflow=0.03 cfs 405 cf

Reach DP2post: DP2 POST Inflow=0.02 cfs 455 cf
Outflow=0.02 cfs 455 cf

Reach DP2pre: DP2 PRE Inflow=0.11 cfs 1,224 cf
Outflow=0.11 cfs 1,224 cf

Pond CS BED: CRUSHED STONE BED Peak Elev=47.63' Storage=828 cf Inflow=0.99 cfs 3,089 cf
Discarded=0.19 cfs 3,087 cf Primary=0.00 cfs 0 cf Outflow=0.19 cfs 3,087 cf

Total Runoff Area = 120,000 sf Runoff Volume = 5,570 cf Average Runoff Depth = 0.56"
82.69% Pervious = 99,231 sf 17.31% Impervious = 20,769 sf

Summary for Subcatchment POST 1: POST 1

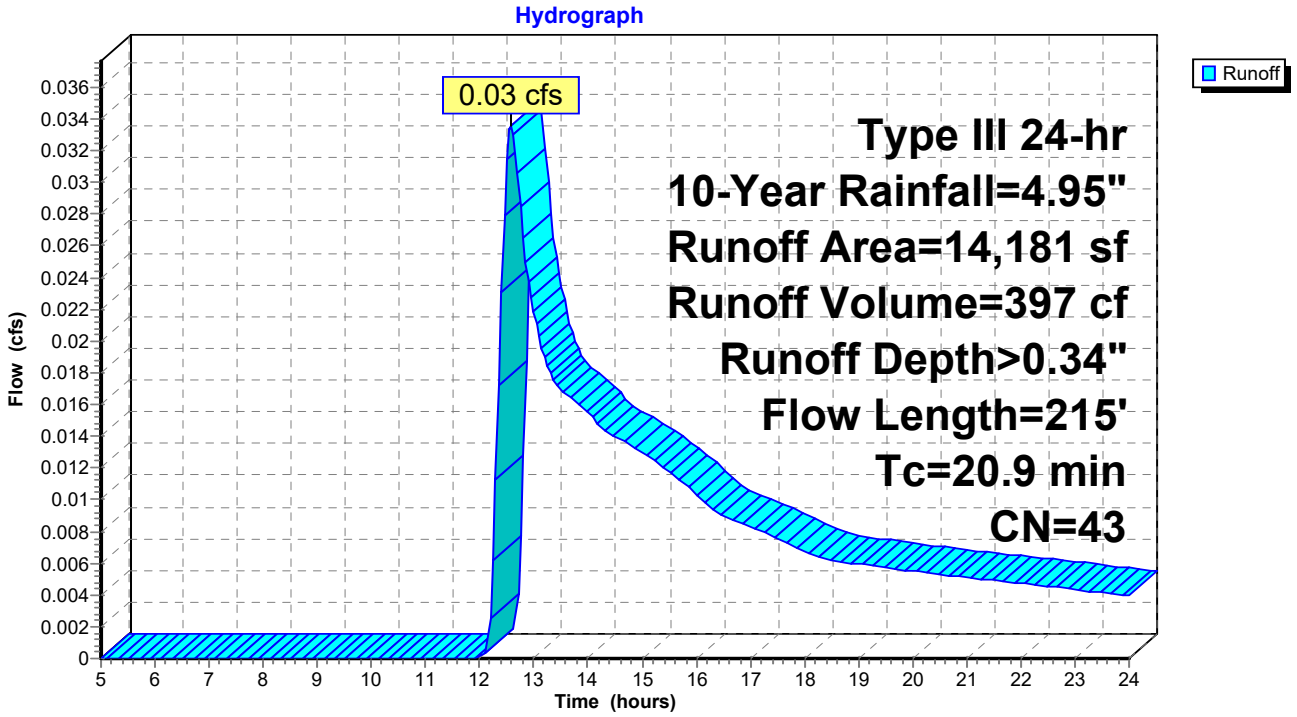
Runoff = 0.03 cfs @ 12.58 hrs, Volume= 397 cf, Depth> 0.34"
Routed to Reach DP1post : DP1 POST

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
8,653	39	>75% Grass cover, Good, HSG A
3,972	30	Woods, Good, HSG A
1,556	98	Roofs, HSG A
14,181	43	Weighted Average
12,625		89.03% Pervious Area
1,556		10.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.9	26	0.0040	0.03		**Sheet Flow, GRASS** Grass: Bermuda n= 0.410 P2= 3.35"
4.6	25	0.0586	0.09		**Sheet Flow, GRASS** Grass: Bermuda n= 0.410 P2= 3.35"
0.2	25	0.0586	1.69		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
0.4	40	0.0500	1.57		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
0.2	22	0.0450	1.48		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
1.6	77	0.0259	0.80		**Shallow Concentrated Flow, GRASS** Woodland Kv= 5.0 fps
20.9	215	Total			

Subcatchment POST 1: POST 1



Summary for Subcatchment POST 2: POST 2

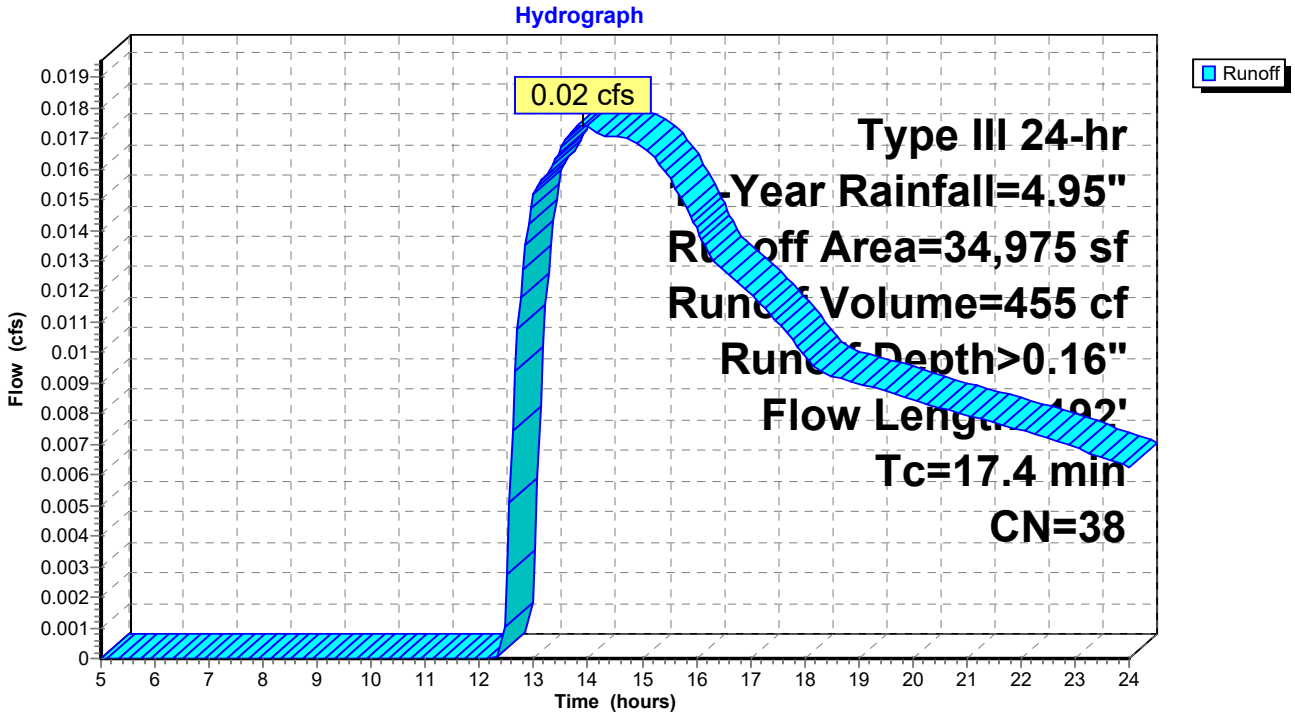
Runoff = 0.02 cfs @ 13.90 hrs, Volume= 455 cf, Depth> 0.16"
Routed to Reach DP2post : DP2 POST

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
11,416	39	>75% Grass cover, Good, HSG A
21,174	30	Woods, Good, HSG A
2,385	98	Paved parking, HSG A
34,975	38	Weighted Average
32,590		93.18% Pervious Area
2,385		6.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	50	0.0125	0.06		**Sheet Flow, WOODS** Woods: Light underbrush n= 0.400 P2= 3.35"
0.9	32	0.0157	0.63		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
0.7	38	0.0288	0.85		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
1.0	45	0.0243	0.78		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
0.3	27	0.0667	1.29		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
17.4	192	Total			

Subcatchment POST 2: POST 2



Summary for Subcatchment POST 2A: POST 2A

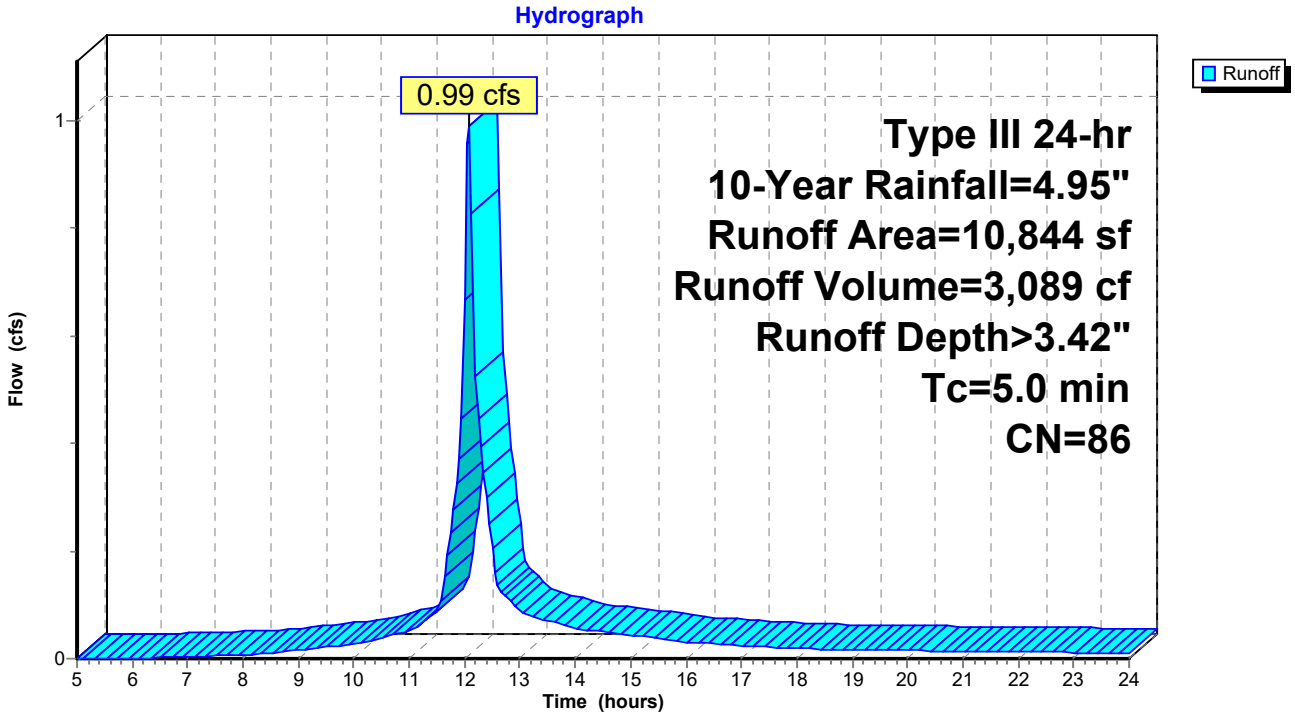
Runoff = 0.99 cfs @ 12.07 hrs, Volume= 3,089 cf, Depth> 3.42"
Routed to Pond CS BED : CRUSHED STONE BED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
2,250	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
4,821	98	Roofs, HSG A
3,773	98	Unconnected pavement, HSG A
10,844	86	Weighted Average
2,250		20.75% Pervious Area
8,594		79.25% Impervious Area
3,773		43.90% Unconnected

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

Subcatchment POST 2A: POST 2A



Summary for Subcatchment PRE 1: PRE 1

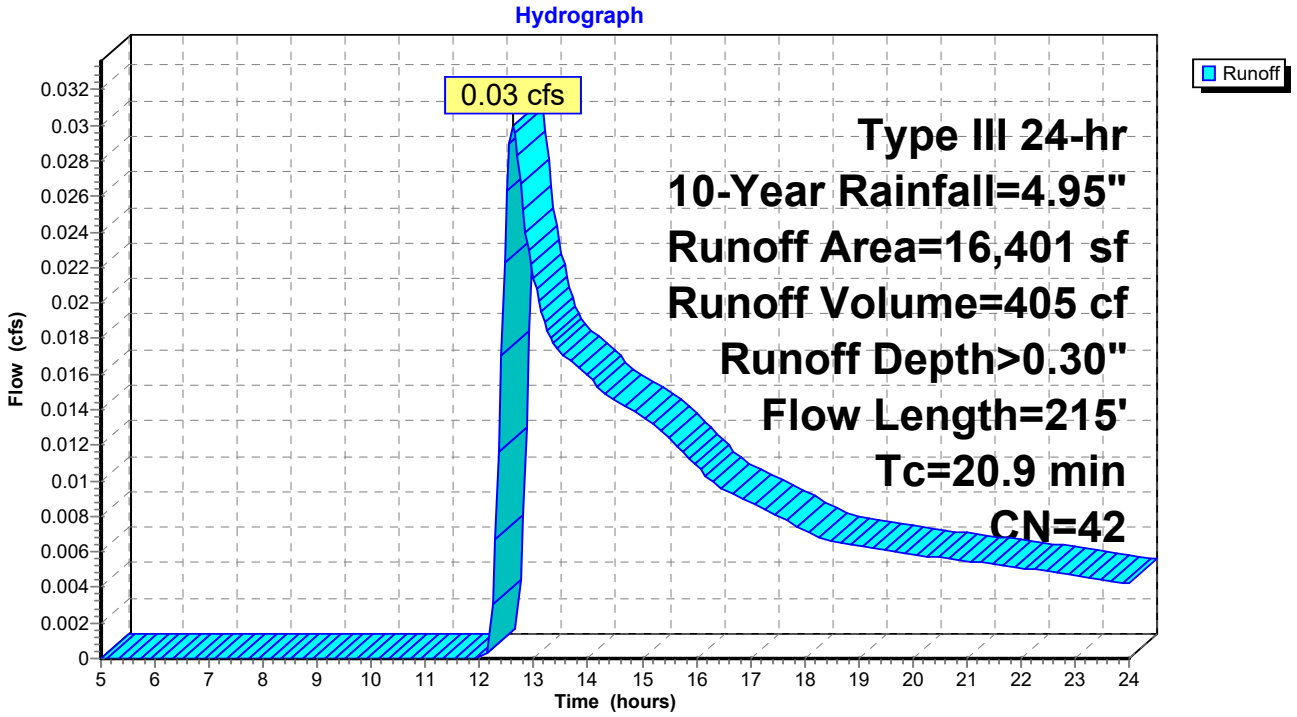
Runoff = 0.03 cfs @ 12.61 hrs, Volume= 405 cf, Depth> 0.30"
Routed to Reach DP1pre : DP1 PRE

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Description
11,068	39	>75% Grass cover, Good, HSG A
3,972	30	Woods, Good, HSG A
1,361	98	Roofs, HSG A
16,401	42	Weighted Average
15,040		91.70% Pervious Area
1,361		8.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.9	26	0.0040	0.03		**Sheet Flow, GRASS** Grass: Bermuda n= 0.410 P2= 3.35"
4.6	25	0.0586	0.09		**Sheet Flow, GRASS** Grass: Bermuda n= 0.410 P2= 3.35"
0.2	25	0.0586	1.69		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
0.4	40	0.0500	1.57		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
0.2	22	0.0450	1.48		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
1.6	77	0.0259	0.80		**Shallow Concentrated Flow, GRASS** Woodland Kv= 5.0 fps
20.9	215	Total			

Subcatchment PRE 1: PRE 1



Summary for Subcatchment PRE 2: PRE 2

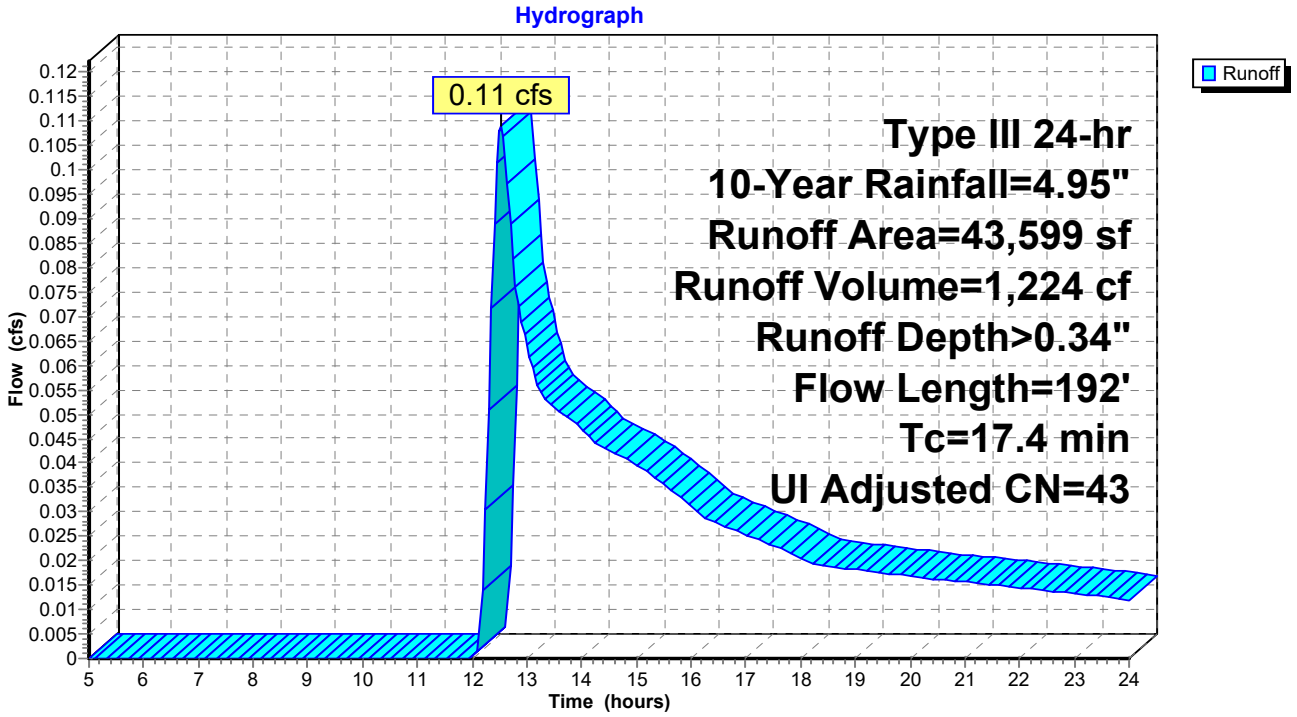
Runoff = 0.11 cfs @ 12.53 hrs, Volume= 1,224 cf, Depth> 0.34"
Routed to Reach DP2pre : DP2 PRE

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.95"

Area (sf)	CN	Adj	Description
15,552	39		>75% Grass cover, Good, HSG A
21,174	30		Woods, Good, HSG A
5,748	98		Paved parking, HSG A
1,125	98		Unconnected roofs, HSG A
43,599	44	43	Weighted Average, UI Adjusted
36,726			84.24% Pervious Area
6,873			15.76% Impervious Area
1,125			16.37% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	50	0.0125	0.06		**Sheet Flow, WOODS** Woods: Light underbrush n= 0.400 P2= 3.35"
0.9	32	0.0157	0.63		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
0.7	38	0.0288	0.85		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
1.0	45	0.0243	0.78		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
0.3	27	0.0667	1.29		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
17.4	192	Total			

Subcatchment PRE 2: PRE 2

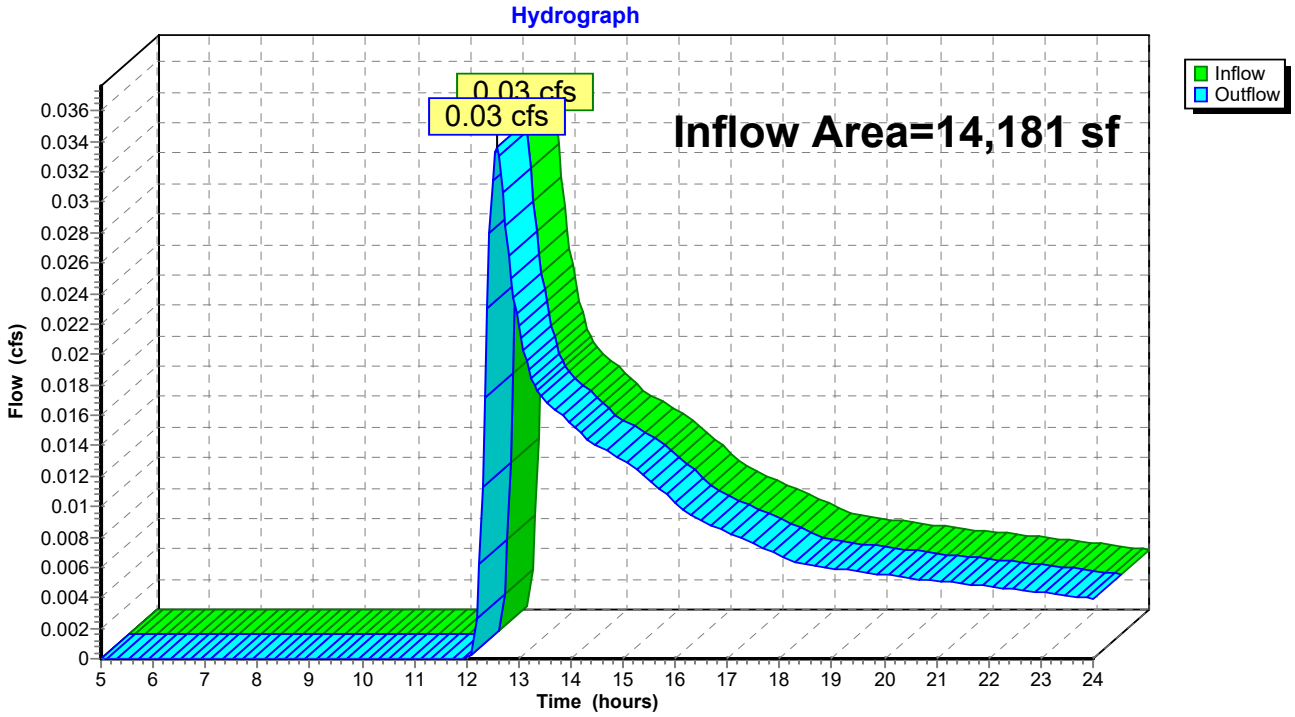


Summary for Reach DP1post: DP1 POST

Inflow Area = 14,181 sf, 10.97% Impervious, Inflow Depth > 0.34" for 10-Year event
Inflow = 0.03 cfs @ 12.58 hrs, Volume= 397 cf
Outflow = 0.03 cfs @ 12.58 hrs, Volume= 397 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

Reach DP1post: DP1 POST

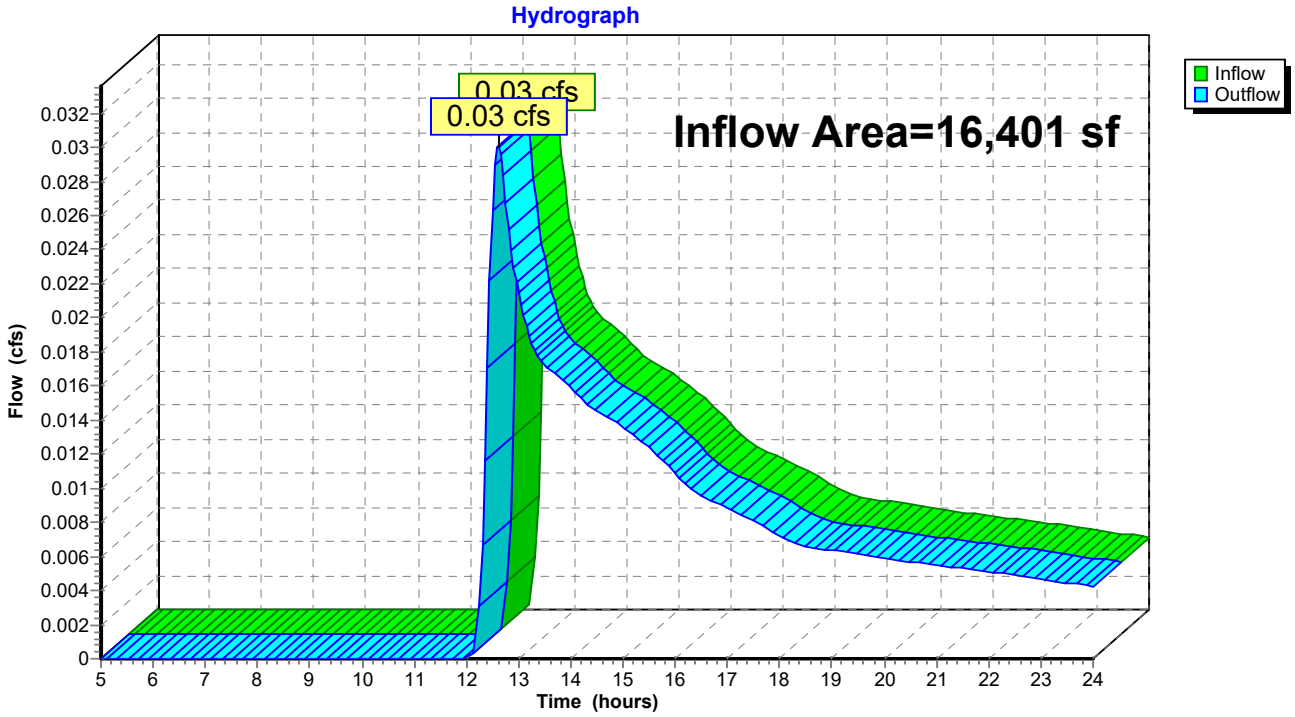


Summary for Reach DP1pre: DP1 PRE

Inflow Area = 16,401 sf, 8.30% Impervious, Inflow Depth > 0.30" for 10-Year event
Inflow = 0.03 cfs @ 12.61 hrs, Volume= 405 cf
Outflow = 0.03 cfs @ 12.61 hrs, Volume= 405 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

Reach DP1pre: DP1 PRE

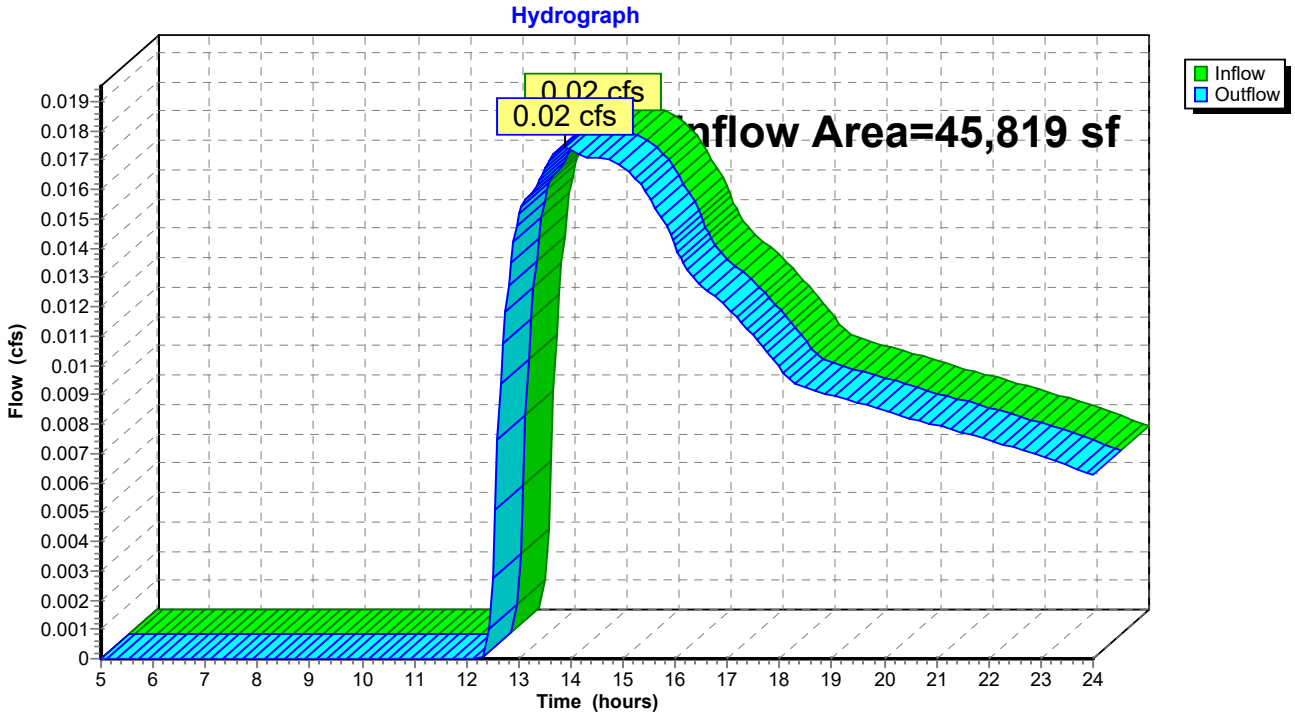


Summary for Reach DP2post: DP2 POST

Inflow Area = 45,819 sf, 23.96% Impervious, Inflow Depth > 0.12" for 10-Year event
Inflow = 0.02 cfs @ 13.90 hrs, Volume= 455 cf
Outflow = 0.02 cfs @ 13.90 hrs, Volume= 455 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

Reach DP2post: DP2 POST

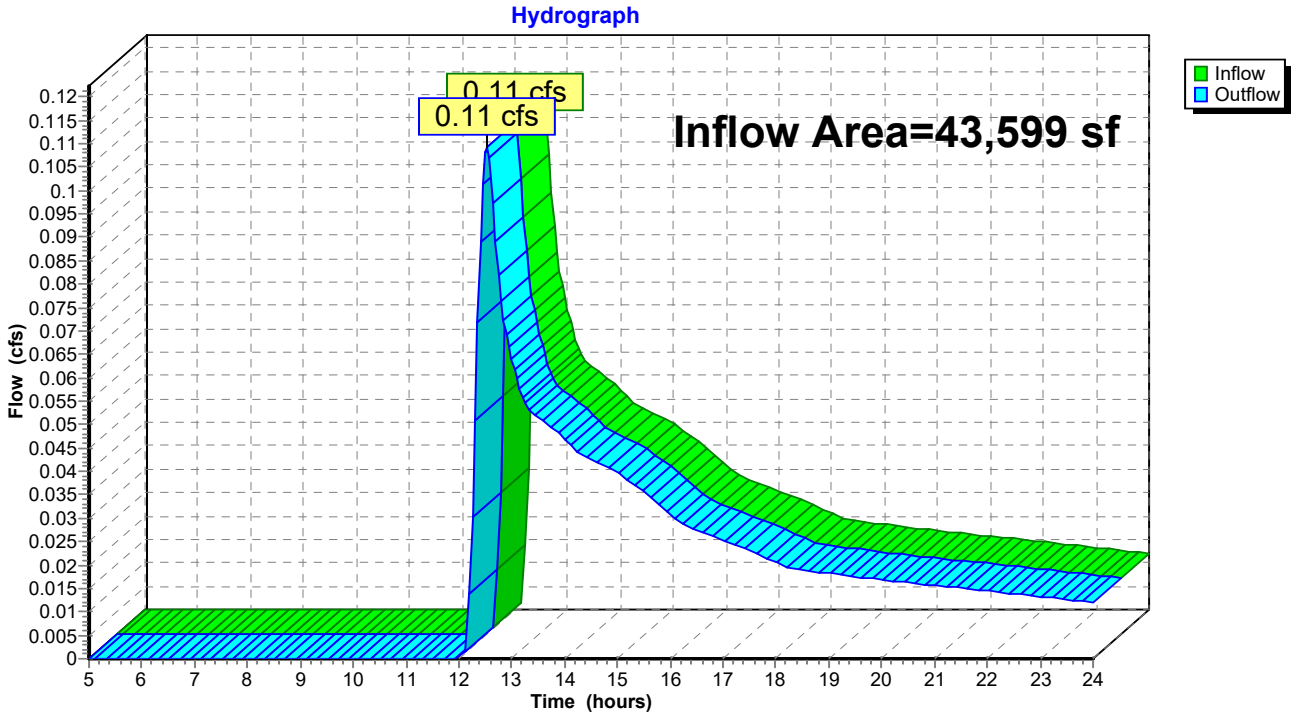


Summary for Reach DP2pre: DP2 PRE

Inflow Area = 43,599 sf, 15.76% Impervious, Inflow Depth > 0.34" for 10-Year event
Inflow = 0.11 cfs @ 12.53 hrs, Volume= 1,224 cf
Outflow = 0.11 cfs @ 12.53 hrs, Volume= 1,224 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

Reach DP2pre: DP2 PRE



Summary for Pond CS BED: CRUSHED STONE BED

Inflow Area = 10,844 sf, 79.25% Impervious, Inflow Depth > 3.42" for 10-Year event
Inflow = 0.99 cfs @ 12.07 hrs, Volume= 3,089 cf
Outflow = 0.19 cfs @ 11.80 hrs, Volume= 3,087 cf, Atten= 81%, Lag= 0.0 min
Discarded = 0.19 cfs @ 11.80 hrs, Volume= 3,087 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Routed to Reach DP2post : DP2 POST

Routing by Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 47.63' @ 12.52 hrs Surf.Area= 3,300 sf Storage= 828 cf

Plug-Flow detention time= 27.2 min calculated for 3,078 cf (100% of inflow)
Center-of-Mass det. time= 26.7 min (830.2 - 803.5)

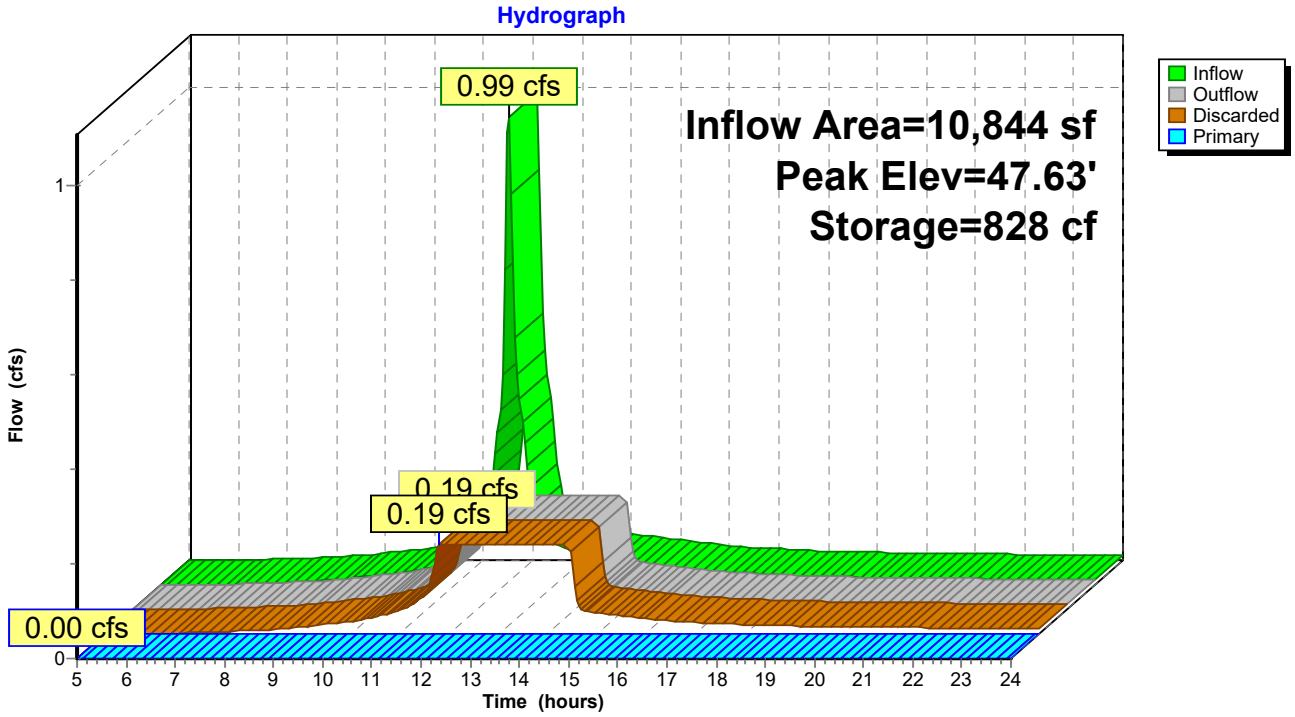
Volume	Invert	Avail.Storage	Storage Description
#1	47.00'	1,980 cf	**60.00'W x 55.00'L x 1.50'H Prismatoid** 4,950 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	47.00'	**2.470 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	48.50'	**24.0" W x 24.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.19 cfs @ 11.80 hrs HW=47.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=47.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond CS BED: CRUSHED STONE BED



Stage-Discharge for Pond CS BED: CRUSHED STONE BED

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
47.00	0.00	**0.00**	0.00
47.05	0.19	**0.19**	0.00
47.10	0.19	0.19	0.00
47.15	0.19	0.19	0.00
47.20	0.19	0.19	0.00
47.25	0.19	0.19	0.00
47.30	0.19	0.19	0.00
47.35	0.19	0.19	0.00
47.40	0.19	0.19	0.00
47.45	0.19	0.19	0.00
47.50	0.19	0.19	0.00
47.55	0.19	0.19	0.00
47.60	0.19	0.19	0.00
47.65	0.19	0.19	0.00
47.70	0.19	0.19	0.00
47.75	0.19	0.19	0.00
47.80	0.19	0.19	0.00
47.85	0.19	0.19	0.00
47.90	0.19	0.19	0.00
47.95	0.19	0.19	0.00
48.00	0.19	0.19	0.00
48.05	0.19	0.19	0.00
48.10	0.19	0.19	0.00
48.15	0.19	0.19	0.00
48.20	0.19	0.19	0.00
48.25	0.19	0.19	0.00
48.30	0.19	0.19	0.00
48.35	0.19	0.19	0.00
48.40	0.19	0.19	0.00
48.45	0.19	0.19	0.00
48.50	0.19	0.19	0.00
48.55	0.26	0.19	0.07
48.60	0.39	0.19	0.20
48.65	0.56	0.19	0.37
48.70	0.76	0.19	0.57
48.75	0.99	0.19	0.80
48.80	1.24	0.19	1.05
48.85	1.52	0.19	1.33
48.90	1.81	0.19	1.62
48.95	2.13	0.19	1.94
49.00	2.46	0.19	2.27
49.05	2.81	0.19	2.62
49.10	3.17	0.19	2.98
49.15	3.55	0.19	3.36
49.20	3.95	0.19	3.76
49.25	4.36	0.19	4.17
49.30	4.78	0.19	4.59
49.35	5.22	0.19	5.03
49.40	5.67	0.19	5.48
49.45	6.13	0.19	5.94
49.50	6.61	0.19	6.42
49.55	7.10	0.19	6.91
49.60	7.60	0.19	7.41
49.65	8.11	0.19	7.92
49.70	8.63	0.19	8.44
49.75	9.16	0.19	8.97
49.80	9.70	0.19	9.52
49.85	10.26	0.19	10.07
49.90	10.82	0.19	10.63
49.95	11.40	0.19	11.21
50.00	11.98	0.19	11.79
50.05	12.58	0.19	12.39
50.10	13.18	0.19	12.99
50.15	13.80	0.19	13.61
50.20	14.42	0.19	14.23
50.25	15.05	0.19	14.86
50.30	15.69	0.19	15.50
50.35	16.34	0.19	16.15
50.40	17.00	0.19	16.81
50.45	17.67	0.19	17.48
50.50	**18.35**	0.19	**18.16**

Stage-Area-Storage for Pond CS BED: CRUSHED STONE BED

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
47.00	**3,300**	0
47.05	3,300	66
47.10	3,300	132
47.15	3,300	198
47.20	3,300	264
47.25	3,300	330
47.30	3,300	396
47.35	3,300	462
47.40	3,300	528
47.45	3,300	594
47.50	3,300	660
47.55	3,300	726
47.60	3,300	792
47.65	3,300	858
47.70	3,300	924
47.75	3,300	990
47.80	3,300	1,056
47.85	3,300	1,122
47.90	3,300	1,188
47.95	3,300	1,254
48.00	3,300	1,320
48.05	3,300	1,386
48.10	3,300	1,452
48.15	3,300	1,518
48.20	3,300	1,584
48.25	3,300	1,650
48.30	3,300	1,716
48.35	3,300	1,782
48.40	3,300	1,848
48.45	3,300	1,914
48.50	3,300	**1,980**
48.55	3,300	1,980
48.60	3,300	1,980
48.65	3,300	1,980
48.70	3,300	1,980
48.75	3,300	1,980
48.80	3,300	1,980
48.85	3,300	1,980
48.90	3,300	1,980
48.95	3,300	1,980
49.00	3,300	1,980
49.05	3,300	1,980
49.10	3,300	1,980
49.15	3,300	1,980
49.20	3,300	1,980
49.25	3,300	1,980
49.30	3,300	1,980
49.35	3,300	1,980
49.40	3,300	1,980
49.45	3,300	1,980
49.50	3,300	1,980
49.55	3,300	1,980
49.60	3,300	1,980
49.65	3,300	1,980
49.70	3,300	1,980
49.75	3,300	1,980
49.80	3,300	1,980
49.85	3,300	1,980
49.90	3,300	1,980
49.95	3,300	1,980
50.00	3,300	1,980
50.05	3,300	1,980
50.10	3,300	1,980
50.15	3,300	1,980
50.20	3,300	1,980
50.25	3,300	1,980
50.30	3,300	1,980
50.35	3,300	1,980
50.40	3,300	1,980
50.45	3,300	1,980
50.50	3,300	1,980

Time span=5.00-24.00 hrs, dt=0.05 hrs, 381 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 POST 1: POST 1 Runoff Area=14,181 sf 10.97% Impervious Runoff Depth>0.74"
Flow Length=215' Tc=20.9 min CN=43 Runoff=0.11 cfs 874 cf

Subcatchment POST 2: POST 2 Runoff Area=34,975 sf 6.82% Impervious Runoff Depth>0.44"
Flow Length=192' Tc=17.4 min CN=38 Runoff=0.12 cfs 1,287 cf

Subcatchment POST 2A: POST 2A Runoff Area=10,844 sf 79.25% Impervious Runoff Depth>4.59"
Tc=5.0 min CN=86 Runoff=1.31 cfs 4,145 cf

Subcatchment PRE 1: PRE 1 Runoff Area=16,401 sf 8.30% Impervious Runoff Depth>0.68"
Flow Length=215' Tc=20.9 min CN=42 Runoff=0.11 cfs 924 cf

Subcatchment PRE 2: PRE 2 Runoff Area=43,599 sf 15.76% Impervious Runoff Depth>0.74"
Flow Length=192' Tc=17.4 min UI Adjusted CN=43 Runoff=0.36 cfs 2,691 cf

Reach DP1post: DP1 POST Inflow=0.11 cfs 874 cf
Outflow=0.11 cfs 874 cf

Reach DP1pre: DP1 PRE Inflow=0.11 cfs 924 cf
Outflow=0.11 cfs 924 cf

Reach DP2post: DP2 POST Inflow=0.12 cfs 1,287 cf
Outflow=0.12 cfs 1,287 cf

Reach DP2pre: DP2 PRE Inflow=0.36 cfs 2,691 cf
Outflow=0.36 cfs 2,691 cf

Pond CS BED: CRUSHED STONE BED Peak Elev=47.97' Storage=1,284 cf Inflow=1.31 cfs 4,145 cf
Discarded=0.19 cfs 4,142 cf Primary=0.00 cfs 0 cf Outflow=0.19 cfs 4,142 cf

Total Runoff Area = 120,000 sf Runoff Volume = 9,922 cf Average Runoff Depth = 0.99"
82.69% Pervious = 99,231 sf 17.31% Impervious = 20,769 sf

Summary for Subcatchment POST 1: POST 1

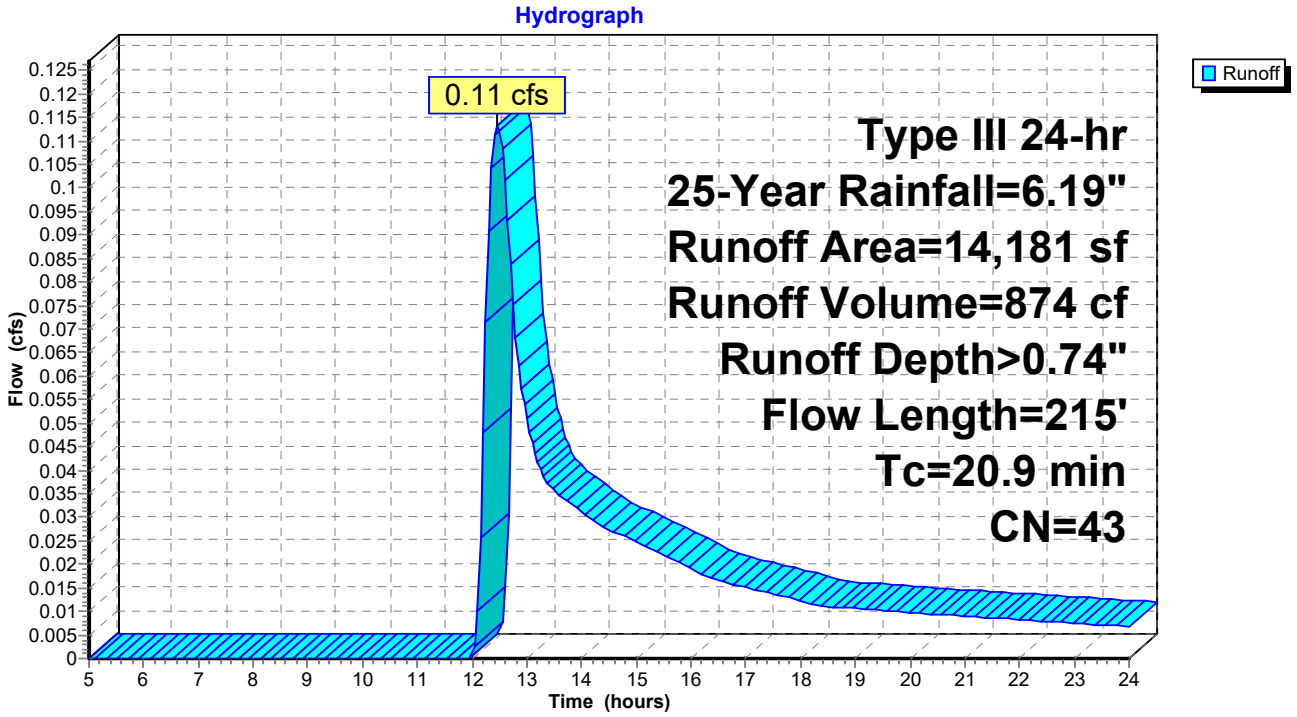
Runoff = 0.11 cfs @ 12.46 hrs, Volume= 874 cf, Depth> 0.74"
Routed to Reach DP1post : DP1 POST

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.19"

Area (sf)	CN	Description
8,653	39	>75% Grass cover, Good, HSG A
3,972	30	Woods, Good, HSG A
1,556	98	Roofs, HSG A
14,181	43	Weighted Average
12,625		89.03% Pervious Area
1,556		10.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.9	26	0.0040	0.03		**Sheet Flow, GRASS** Grass: Bermuda n= 0.410 P2= 3.35"
4.6	25	0.0586	0.09		**Sheet Flow, GRASS** Grass: Bermuda n= 0.410 P2= 3.35"
0.2	25	0.0586	1.69		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
0.4	40	0.0500	1.57		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
0.2	22	0.0450	1.48		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
1.6	77	0.0259	0.80		**Shallow Concentrated Flow, GRASS** Woodland Kv= 5.0 fps
20.9	215	Total			

Subcatchment POST 1: POST 1



Summary for Subcatchment POST 2: POST 2

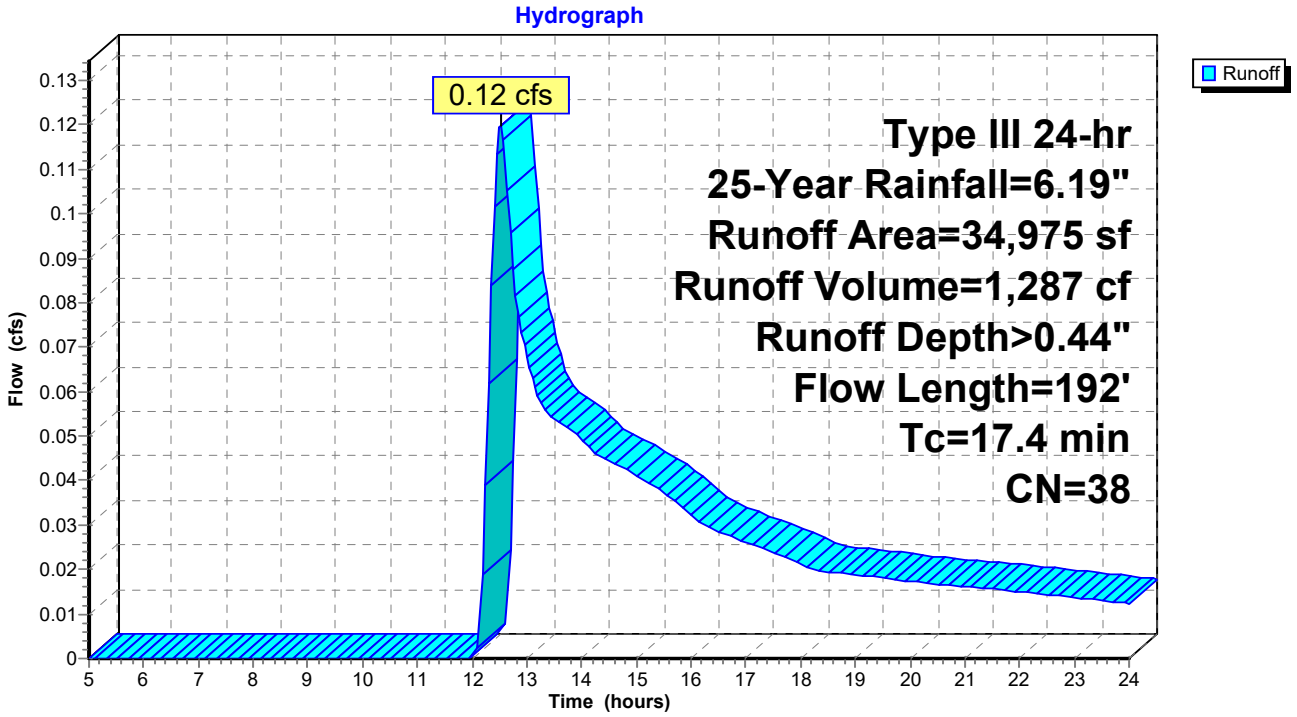
Runoff = 0.12 cfs @ 12.52 hrs, Volume= 1,287 cf, Depth> 0.44"
Routed to Reach DP2post : DP2 POST

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.19"

Area (sf)	CN	Description
11,416	39	>75% Grass cover, Good, HSG A
21,174	30	Woods, Good, HSG A
2,385	98	Paved parking, HSG A
34,975	38	Weighted Average
32,590		93.18% Pervious Area
2,385		6.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	50	0.0125	0.06		**Sheet Flow, WOODS** Woods: Light underbrush n= 0.400 P2= 3.35"
0.9	32	0.0157	0.63		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
0.7	38	0.0288	0.85		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
1.0	45	0.0243	0.78		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
0.3	27	0.0667	1.29		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
17.4	192	Total			

Subcatchment POST 2: POST 2



Summary for Subcatchment POST 2A: POST 2A

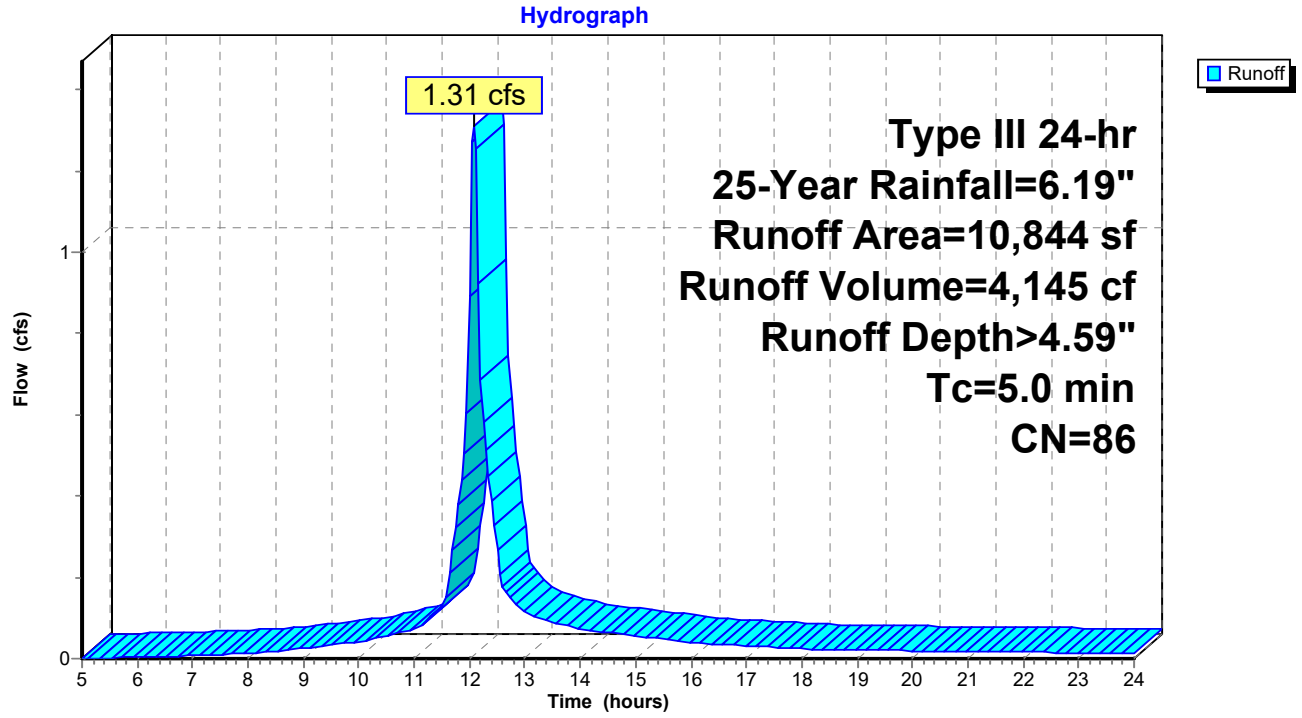
Runoff = 1.31 cfs @ 12.07 hrs, Volume= 4,145 cf, Depth> 4.59"
Routed to Pond CS BED : CRUSHED STONE BED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.19"

Area (sf)	CN	Description
2,250	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
4,821	98	Roofs, HSG A
3,773	98	Unconnected pavement, HSG A
10,844	86	Weighted Average
2,250		20.75% Pervious Area
8,594		79.25% Impervious Area
3,773		43.90% Unconnected

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

Subcatchment POST 2A: POST 2A



Summary for Subcatchment PRE 1: PRE 1

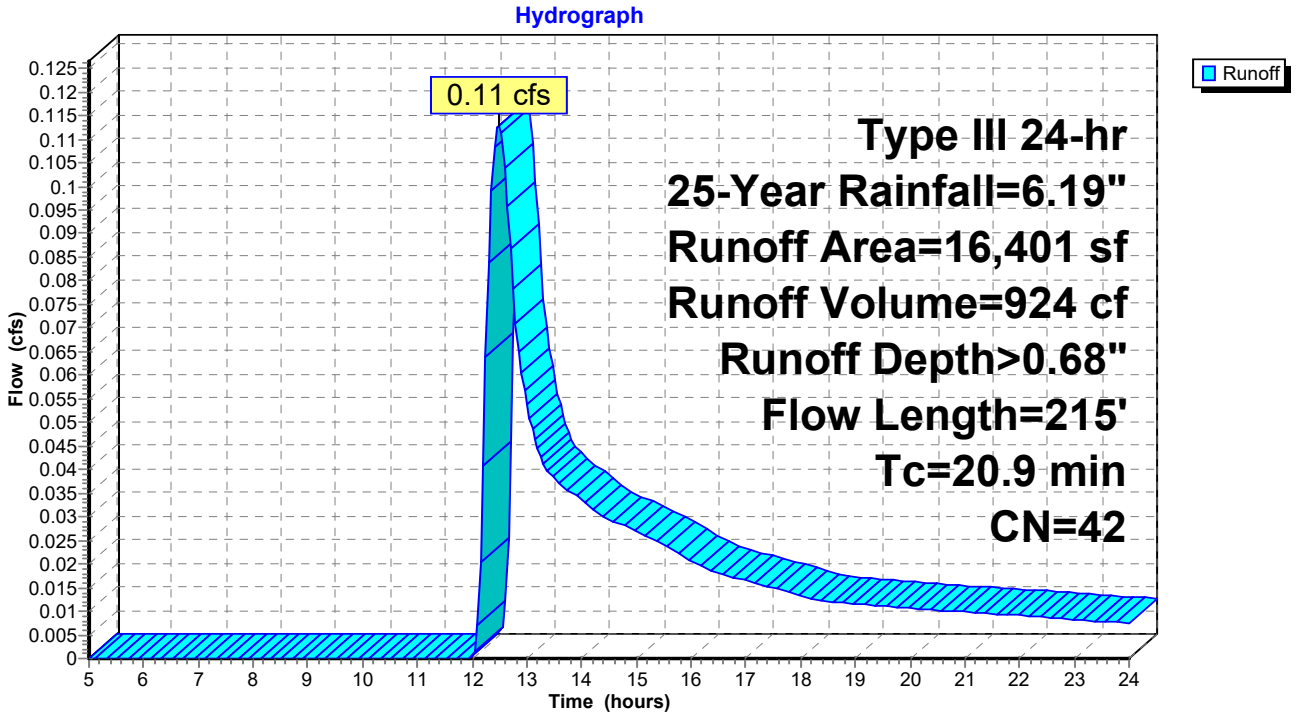
Runoff = 0.11 cfs @ 12.48 hrs, Volume= 924 cf, Depth> 0.68"
Routed to Reach DP1pre : DP1 PRE

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.19"

Area (sf)	CN	Description
11,068	39	>75% Grass cover, Good, HSG A
3,972	30	Woods, Good, HSG A
1,361	98	Roofs, HSG A
16,401	42	Weighted Average
15,040		91.70% Pervious Area
1,361		8.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.9	26	0.0040	0.03		**Sheet Flow, GRASS** Grass: Bermuda n= 0.410 P2= 3.35"
4.6	25	0.0586	0.09		**Sheet Flow, GRASS** Grass: Bermuda n= 0.410 P2= 3.35"
0.2	25	0.0586	1.69		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
0.4	40	0.0500	1.57		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
0.2	22	0.0450	1.48		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
1.6	77	0.0259	0.80		**Shallow Concentrated Flow, GRASS** Woodland Kv= 5.0 fps
20.9	215	Total			

Subcatchment PRE 1: PRE 1



Summary for Subcatchment PRE 2: PRE 2

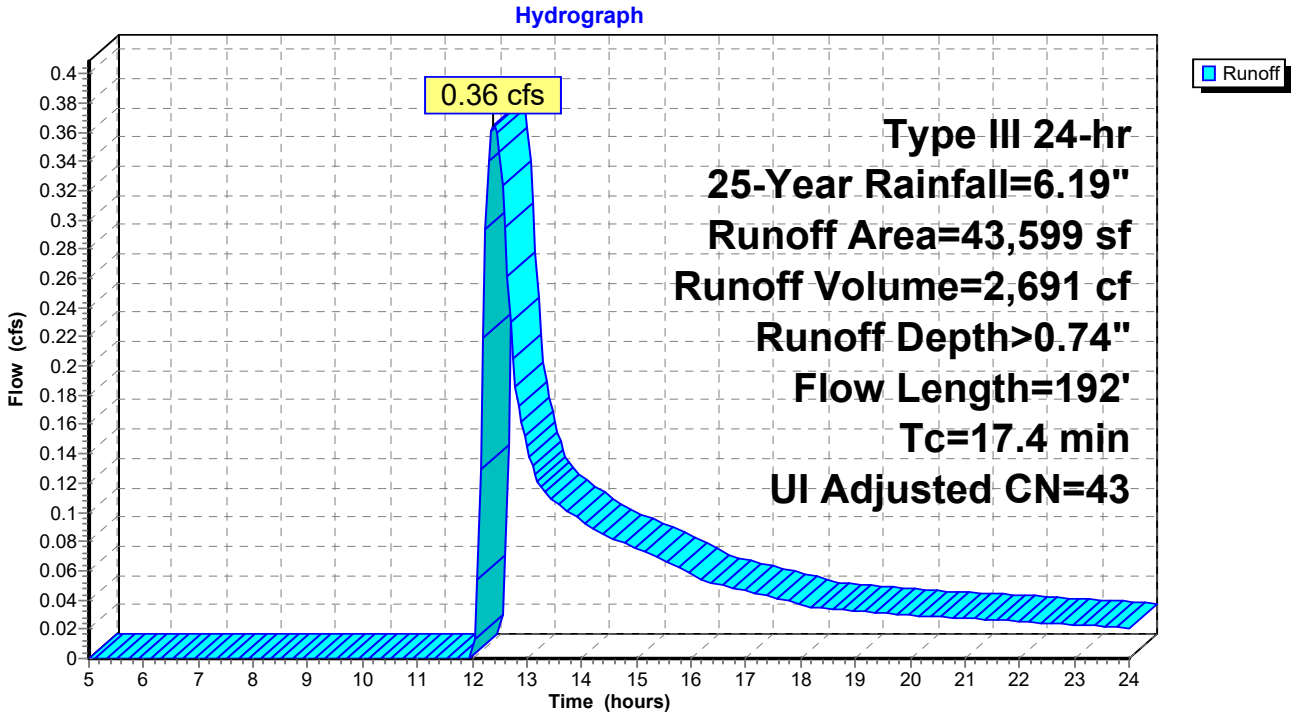
Runoff = 0.36 cfs @ 12.40 hrs, Volume= 2,691 cf, Depth> 0.74"
Routed to Reach DP2pre : DP2 PRE

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.19"

Area (sf)	CN	Adj	Description
15,552	39		>75% Grass cover, Good, HSG A
21,174	30		Woods, Good, HSG A
5,748	98		Paved parking, HSG A
1,125	98		Unconnected roofs, HSG A
43,599	44	43	Weighted Average, UI Adjusted
36,726			84.24% Pervious Area
6,873			15.76% Impervious Area
1,125			16.37% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	50	0.0125	0.06		**Sheet Flow, WOODS** Woods: Light underbrush n= 0.400 P2= 3.35"
0.9	32	0.0157	0.63		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
0.7	38	0.0288	0.85		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
1.0	45	0.0243	0.78		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
0.3	27	0.0667	1.29		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
17.4	192	Total			

Subcatchment PRE 2: PRE 2

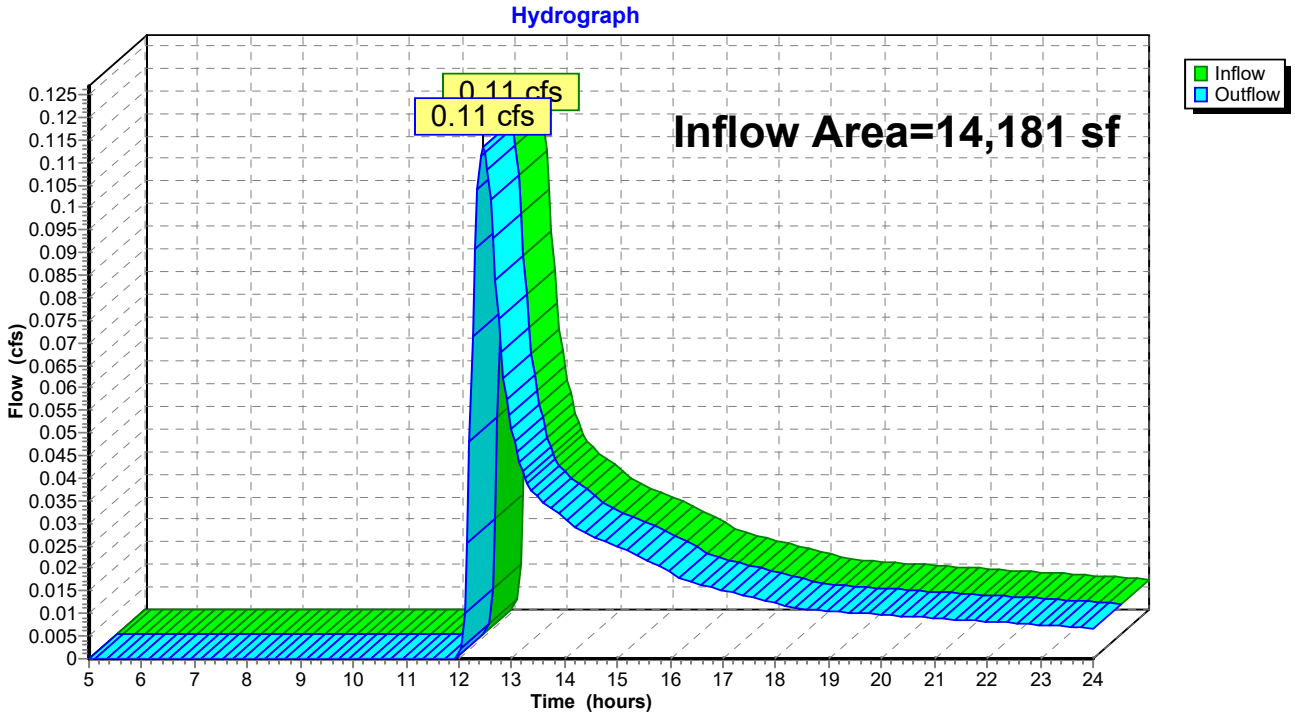


Summary for Reach DP1post: DP1 POST

Inflow Area = 14,181 sf, 10.97% Impervious, Inflow Depth > 0.74" for 25-Year event
Inflow = 0.11 cfs @ 12.46 hrs, Volume= 874 cf
Outflow = 0.11 cfs @ 12.46 hrs, Volume= 874 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

Reach DP1post: DP1 POST

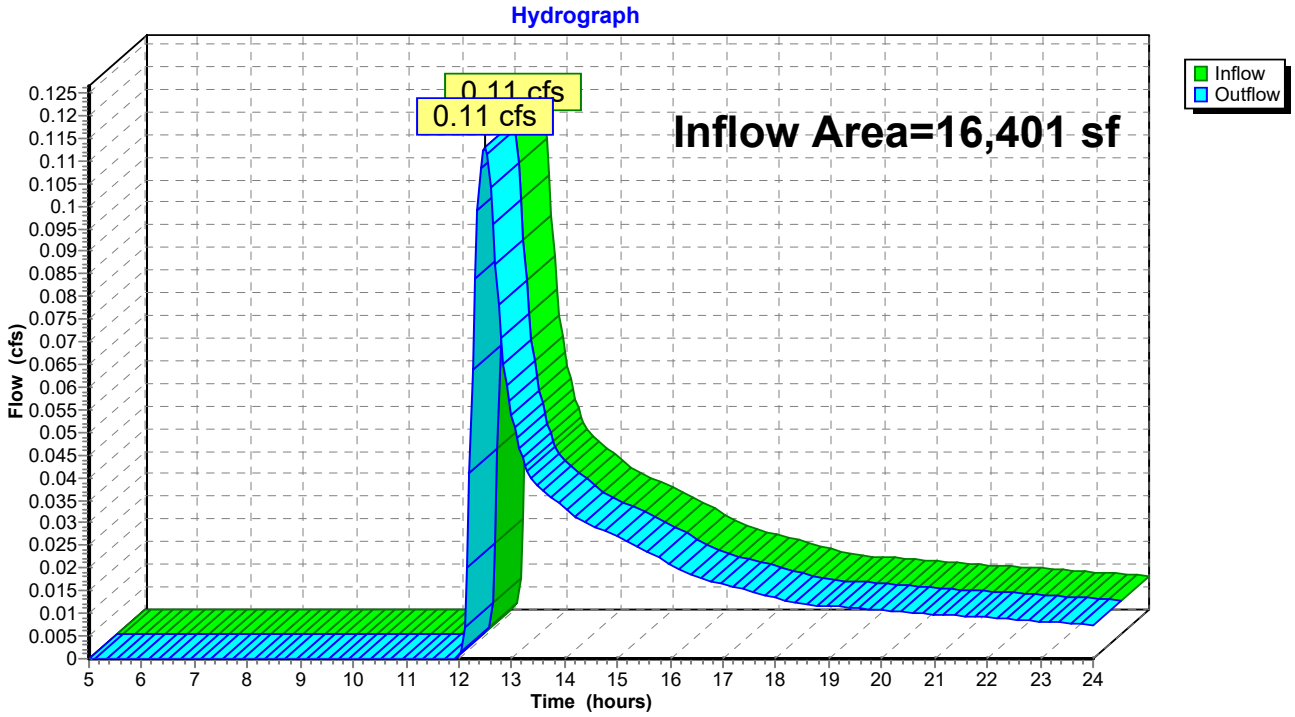


Summary for Reach DP1pre: DP1 PRE

Inflow Area = 16,401 sf, 8.30% Impervious, Inflow Depth > 0.68" for 25-Year event
Inflow = 0.11 cfs @ 12.48 hrs, Volume= 924 cf
Outflow = 0.11 cfs @ 12.48 hrs, Volume= 924 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

Reach DP1pre: DP1 PRE

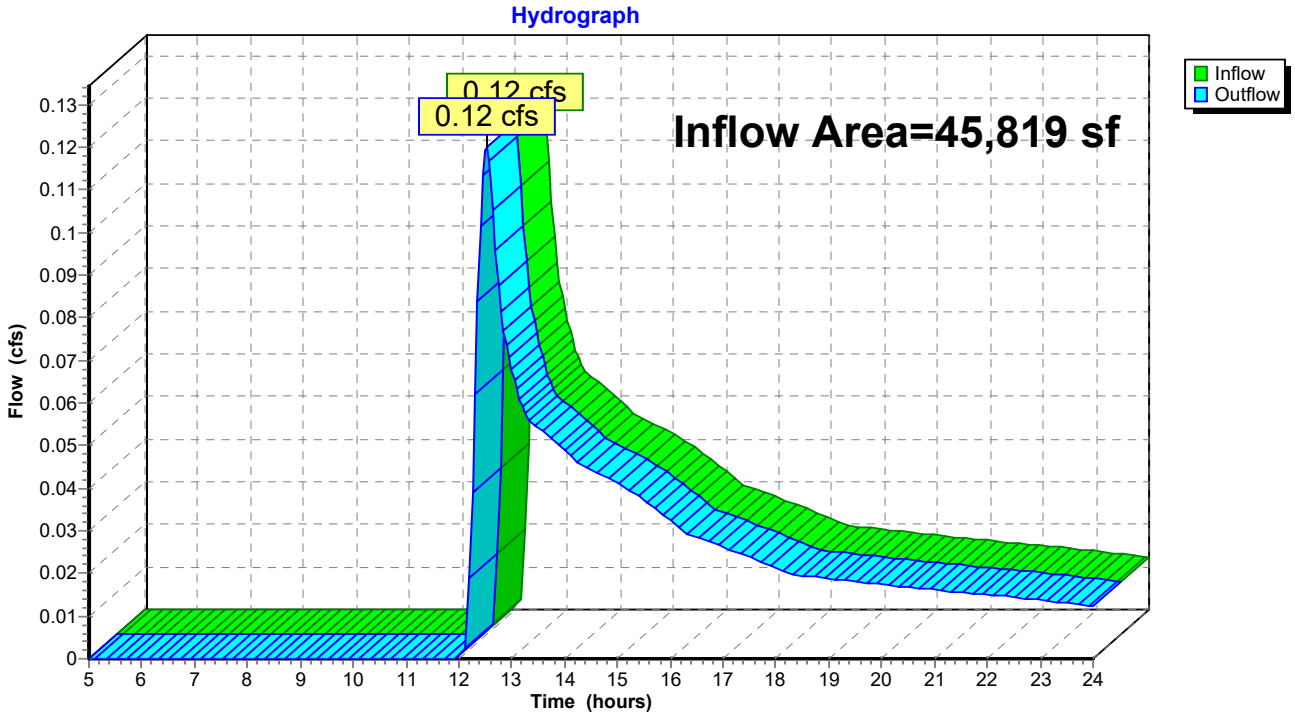


Summary for Reach DP2post: DP2 POST

Inflow Area = 45,819 sf, 23.96% Impervious, Inflow Depth > 0.34" for 25-Year event
Inflow = 0.12 cfs @ 12.52 hrs, Volume= 1,287 cf
Outflow = 0.12 cfs @ 12.52 hrs, Volume= 1,287 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

Reach DP2post: DP2 POST

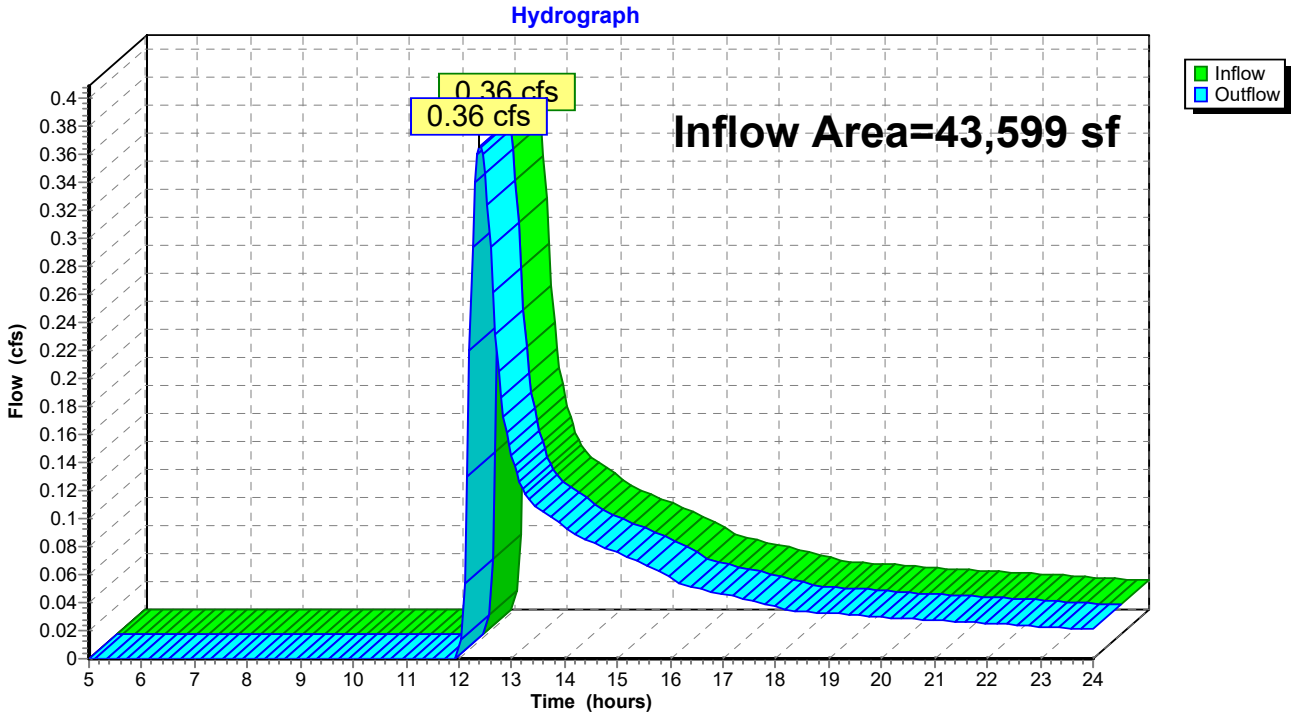


Summary for Reach DP2pre: DP2 PRE

Inflow Area = 43,599 sf, 15.76% Impervious, Inflow Depth > 0.74" for 25-Year event
Inflow = 0.36 cfs @ 12.40 hrs, Volume= 2,691 cf
Outflow = 0.36 cfs @ 12.40 hrs, Volume= 2,691 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

Reach DP2pre: DP2 PRE



Summary for Pond CS BED: CRUSHED STONE BED

Inflow Area = 10,844 sf, 79.25% Impervious, Inflow Depth > 4.59" for 25-Year event
Inflow = 1.31 cfs @ 12.07 hrs, Volume= 4,145 cf
Outflow = 0.19 cfs @ 11.70 hrs, Volume= 4,142 cf, Atten= 86%, Lag= 0.0 min
Discarded = 0.19 cfs @ 11.70 hrs, Volume= 4,142 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Routed to Reach DP2post : DP2 POST

Routing by Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 47.97' @ 12.58 hrs Surf.Area= 3,300 sf Storage= 1,284 cf

Plug-Flow detention time= 45.4 min calculated for 4,142 cf (100% of inflow)
Center-of-Mass det. time= 44.9 min (840.2 - 795.3)

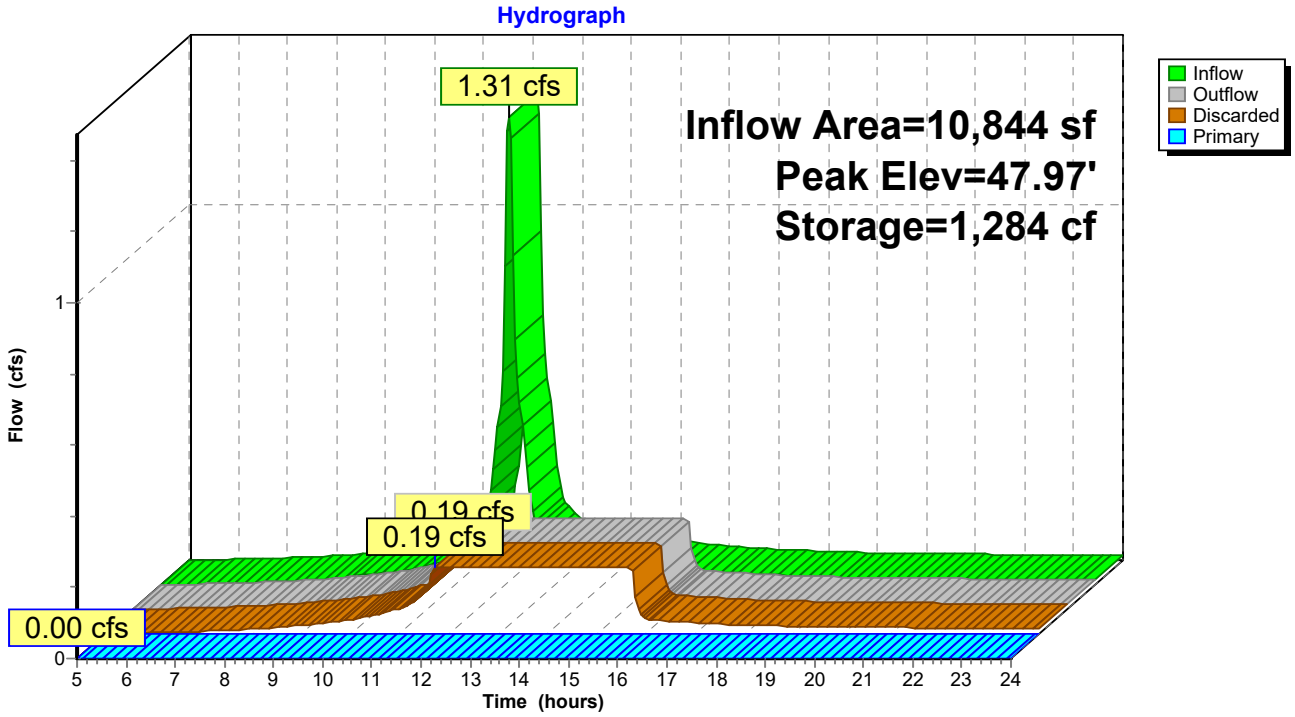
Volume	Invert	Avail.Storage	Storage Description
#1	47.00'	1,980 cf	**60.00'W x 55.00'L x 1.50'H Prismatoid** 4,950 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	47.00'	**2.470 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	48.50'	**24.0" W x 24.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.19 cfs @ 11.70 hrs HW=47.04' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=47.00' (Free Discharge)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Pond CS BED: CRUSHED STONE BED



Stage-Discharge for Pond CS BED: CRUSHED STONE BED

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
47.00	0.00	**0.00**	0.00
47.05	0.19	**0.19**	0.00
47.10	0.19	0.19	0.00
47.15	0.19	0.19	0.00
47.20	0.19	0.19	0.00
47.25	0.19	0.19	0.00
47.30	0.19	0.19	0.00
47.35	0.19	0.19	0.00
47.40	0.19	0.19	0.00
47.45	0.19	0.19	0.00
47.50	0.19	0.19	0.00
47.55	0.19	0.19	0.00
47.60	0.19	0.19	0.00
47.65	0.19	0.19	0.00
47.70	0.19	0.19	0.00
47.75	0.19	0.19	0.00
47.80	0.19	0.19	0.00
47.85	0.19	0.19	0.00
47.90	0.19	0.19	0.00
47.95	0.19	0.19	0.00
48.00	0.19	0.19	0.00
48.05	0.19	0.19	0.00
48.10	0.19	0.19	0.00
48.15	0.19	0.19	0.00
48.20	0.19	0.19	0.00
48.25	0.19	0.19	0.00
48.30	0.19	0.19	0.00
48.35	0.19	0.19	0.00
48.40	0.19	0.19	0.00
48.45	0.19	0.19	0.00
48.50	0.19	0.19	0.00
48.55	0.26	0.19	0.07
48.60	0.39	0.19	0.20
48.65	0.56	0.19	0.37
48.70	0.76	0.19	0.57
48.75	0.99	0.19	0.80
48.80	1.24	0.19	1.05
48.85	1.52	0.19	1.33
48.90	1.81	0.19	1.62
48.95	2.13	0.19	1.94
49.00	2.46	0.19	2.27
49.05	2.81	0.19	2.62
49.10	3.17	0.19	2.98
49.15	3.55	0.19	3.36
49.20	3.95	0.19	3.76
49.25	4.36	0.19	4.17
49.30	4.78	0.19	4.59
49.35	5.22	0.19	5.03
49.40	5.67	0.19	5.48
49.45	6.13	0.19	5.94
49.50	6.61	0.19	6.42
49.55	7.10	0.19	6.91
49.60	7.60	0.19	7.41
49.65	8.11	0.19	7.92
49.70	8.63	0.19	8.44
49.75	9.16	0.19	8.97
49.80	9.70	0.19	9.52
49.85	10.26	0.19	10.07
49.90	10.82	0.19	10.63
49.95	11.40	0.19	11.21
50.00	11.98	0.19	11.79
50.05	12.58	0.19	12.39
50.10	13.18	0.19	12.99
50.15	13.80	0.19	13.61
50.20	14.42	0.19	14.23
50.25	15.05	0.19	14.86
50.30	15.69	0.19	15.50
50.35	16.34	0.19	16.15
50.40	17.00	0.19	16.81
50.45	17.67	0.19	17.48
50.50	**18.35**	0.19	**18.16**

Stage-Area-Storage for Pond CS BED: CRUSHED STONE BED

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
47.00	**3,300**	0
47.05	3,300	66
47.10	3,300	132
47.15	3,300	198
47.20	3,300	264
47.25	3,300	330
47.30	3,300	396
47.35	3,300	462
47.40	3,300	528
47.45	3,300	594
47.50	3,300	660
47.55	3,300	726
47.60	3,300	792
47.65	3,300	858
47.70	3,300	924
47.75	3,300	990
47.80	3,300	1,056
47.85	3,300	1,122
47.90	3,300	1,188
47.95	3,300	1,254
48.00	3,300	1,320
48.05	3,300	1,386
48.10	3,300	1,452
48.15	3,300	1,518
48.20	3,300	1,584
48.25	3,300	1,650
48.30	3,300	1,716
48.35	3,300	1,782
48.40	3,300	1,848
48.45	3,300	1,914
48.50	3,300	**1,980**
48.55	3,300	1,980
48.60	3,300	1,980
48.65	3,300	1,980
48.70	3,300	1,980
48.75	3,300	1,980
48.80	3,300	1,980
48.85	3,300	1,980
48.90	3,300	1,980
48.95	3,300	1,980
49.00	3,300	1,980
49.05	3,300	1,980
49.10	3,300	1,980
49.15	3,300	1,980
49.20	3,300	1,980
49.25	3,300	1,980
49.30	3,300	1,980
49.35	3,300	1,980
49.40	3,300	1,980
49.45	3,300	1,980
49.50	3,300	1,980
49.55	3,300	1,980
49.60	3,300	1,980
49.65	3,300	1,980
49.70	3,300	1,980
49.75	3,300	1,980
49.80	3,300	1,980
49.85	3,300	1,980
49.90	3,300	1,980
49.95	3,300	1,980
50.00	3,300	1,980
50.05	3,300	1,980
50.10	3,300	1,980
50.15	3,300	1,980
50.20	3,300	1,980
50.25	3,300	1,980
50.30	3,300	1,980
50.35	3,300	1,980
50.40	3,300	1,980
50.45	3,300	1,980
50.50	3,300	1,980

Time span=5.00-24.00 hrs, dt=0.05 hrs, 381 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 POST 1: POST 1 Runoff Area=14,181 sf 10.97% Impervious Runoff Depth>1.87"
Flow Length=215' Tc=20.9 min CN=43 Runoff=0.40 cfs 2,213 cf

Subcatchment POST 2: POST 2 Runoff Area=34,975 sf 6.82% Impervious Runoff Depth>1.34"
Flow Length=192' Tc=17.4 min CN=38 Runoff=0.63 cfs 3,912 cf

Subcatchment POST 2A: POST 2A Runoff Area=10,844 sf 79.25% Impervious Runoff Depth>6.97"
Tc=5.0 min CN=86 Runoff=1.96 cfs 6,303 cf

Subcatchment PRE 1: PRE 1 Runoff Area=16,401 sf 8.30% Impervious Runoff Depth>1.76"
Flow Length=215' Tc=20.9 min CN=42 Runoff=0.42 cfs 2,411 cf

Subcatchment PRE 2: PRE 2 Runoff Area=43,599 sf 15.76% Impervious Runoff Depth>1.88"
Flow Length=192' Tc=17.4 min UI Adjusted CN=43 Runoff=1.30 cfs 6,813 cf

Reach DP1post: DP1 POST Inflow=0.40 cfs 2,213 cf
Outflow=0.40 cfs 2,213 cf

Reach DP1pre: DP1 PRE Inflow=0.42 cfs 2,411 cf
Outflow=0.42 cfs 2,411 cf

Reach DP2post: DP2 POST Inflow=1.15 cfs 4,211 cf
Outflow=1.15 cfs 4,211 cf

Reach DP2pre: DP2 PRE Inflow=1.30 cfs 6,813 cf
Outflow=1.30 cfs 6,813 cf

Pond CS BED: CRUSHED STONE BED Peak Elev=48.70' Storage=1,980 cf Inflow=1.96 cfs 6,303 cf
Discarded=0.19 cfs 5,999 cf Primary=0.53 cfs 300 cf Outflow=0.72 cfs 6,298 cf

Total Runoff Area = 120,000 sf Runoff Volume = 21,651 cf Average Runoff Depth = 2.17"
82.69% Pervious = 99,231 sf 17.31% Impervious = 20,769 sf

Summary for Subcatchment POST 1: POST 1

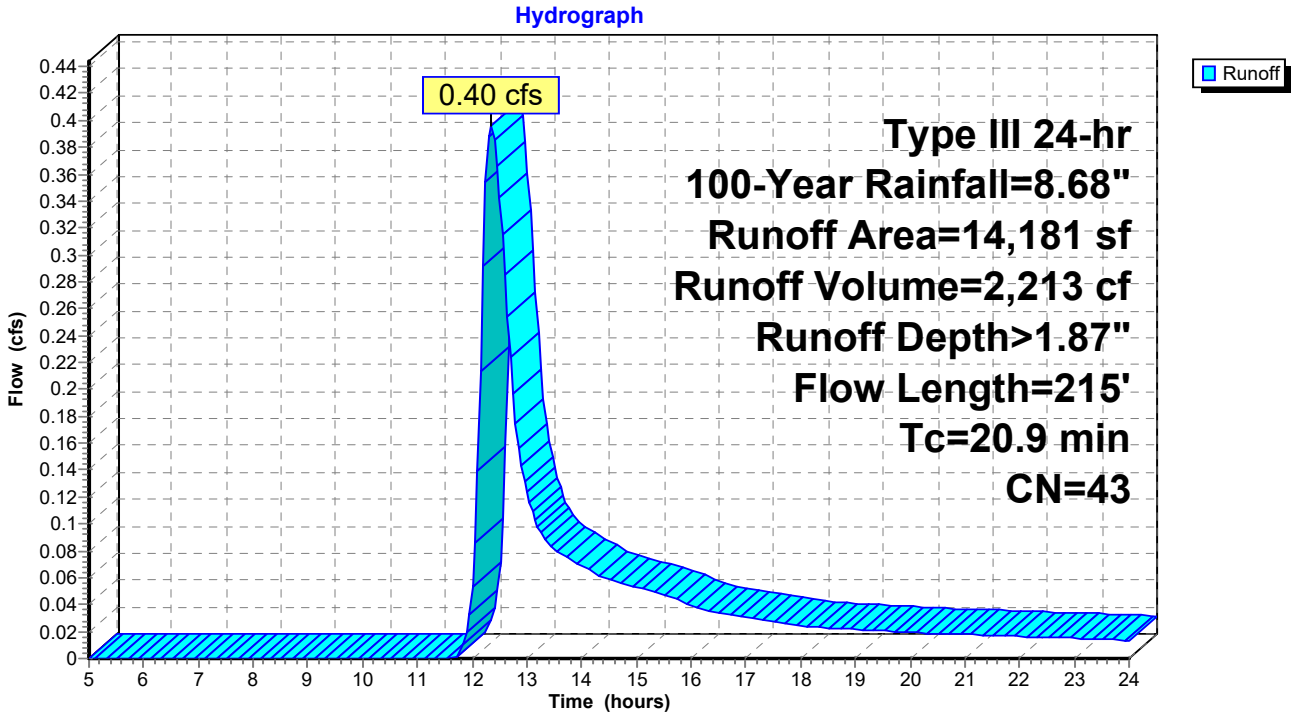
Runoff = 0.40 cfs @ 12.35 hrs, Volume= 2,213 cf, Depth> 1.87"
Routed to Reach DP1post : DP1 POST

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.68"

Area (sf)	CN	Description
8,653	39	>75% Grass cover, Good, HSG A
3,972	30	Woods, Good, HSG A
1,556	98	Roofs, HSG A
14,181	43	Weighted Average
12,625		89.03% Pervious Area
1,556		10.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.9	26	0.0040	0.03		**Sheet Flow, GRASS** Grass: Bermuda n= 0.410 P2= 3.35"
4.6	25	0.0586	0.09		**Sheet Flow, GRASS** Grass: Bermuda n= 0.410 P2= 3.35"
0.2	25	0.0586	1.69		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
0.4	40	0.0500	1.57		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
0.2	22	0.0450	1.48		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
1.6	77	0.0259	0.80		**Shallow Concentrated Flow, GRASS** Woodland Kv= 5.0 fps
20.9	215	Total			

Subcatchment POST 1: POST 1



Summary for Subcatchment POST 2: POST 2

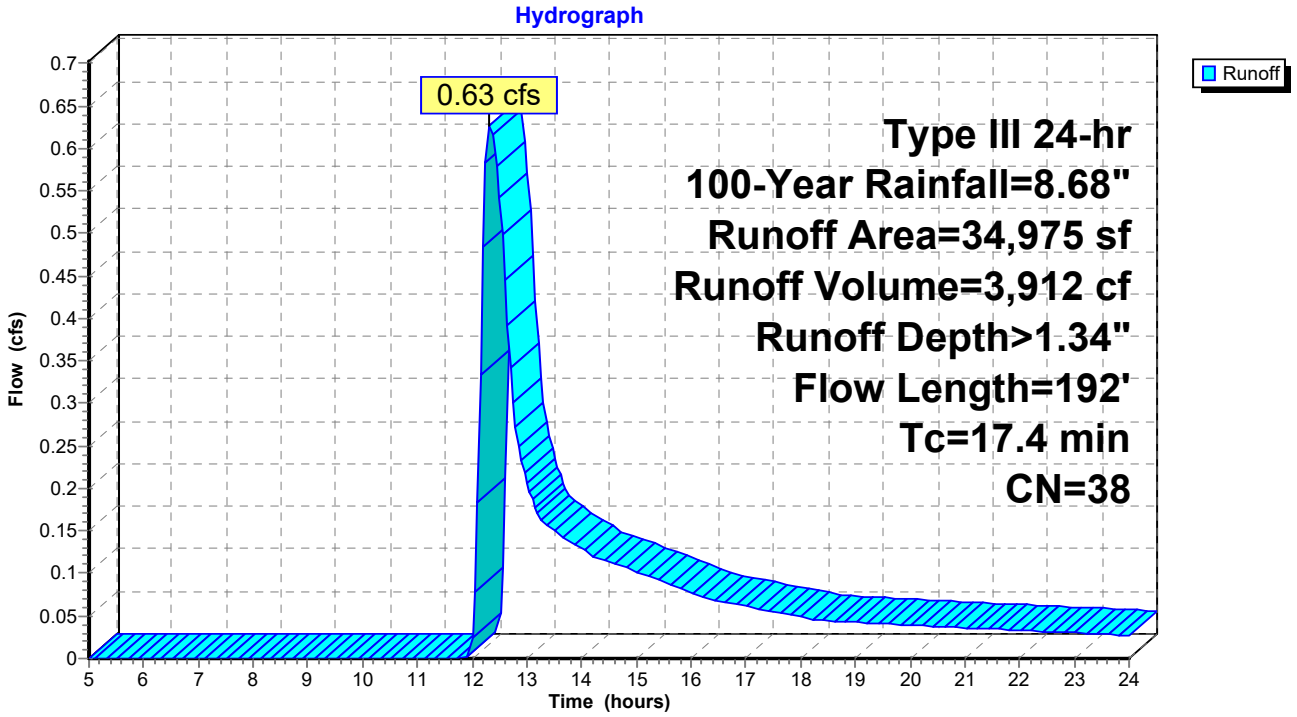
Runoff = 0.63 cfs @ 12.33 hrs, Volume= 3,912 cf, Depth> 1.34"
Routed to Reach DP2post : DP2 POST

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.68"

Area (sf)	CN	Description
11,416	39	>75% Grass cover, Good, HSG A
21,174	30	Woods, Good, HSG A
2,385	98	Paved parking, HSG A
34,975	38	Weighted Average
32,590		93.18% Pervious Area
2,385		6.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	50	0.0125	0.06		**Sheet Flow, WOODS** Woods: Light underbrush n= 0.400 P2= 3.35"
0.9	32	0.0157	0.63		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
0.7	38	0.0288	0.85		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
1.0	45	0.0243	0.78		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
0.3	27	0.0667	1.29		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
17.4	192	Total			

Subcatchment POST 2: POST 2



Summary for Subcatchment POST 2A: POST 2A

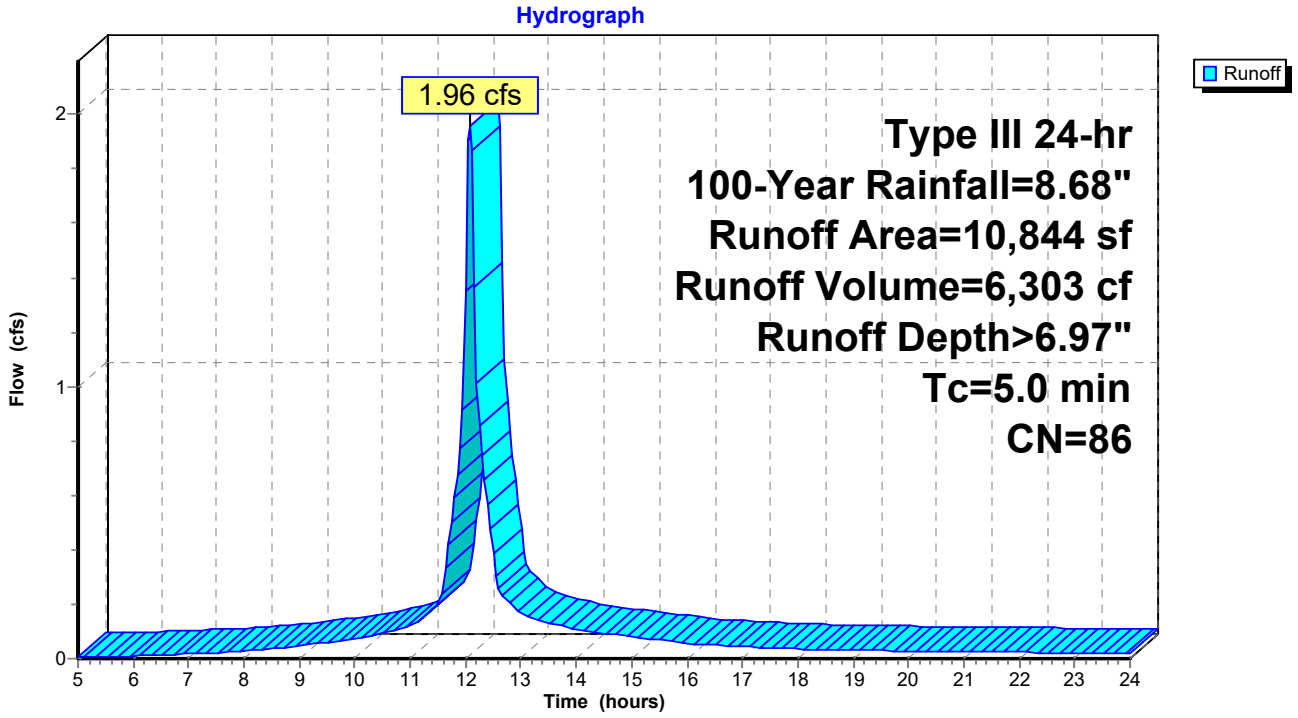
Runoff = 1.96 cfs @ 12.07 hrs, Volume= 6,303 cf, Depth> 6.97"
Routed to Pond CS BED : CRUSHED STONE BED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.68"

Area (sf)	CN	Description
2,250	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
4,821	98	Roofs, HSG A
3,773	98	Unconnected pavement, HSG A
10,844	86	Weighted Average
2,250		20.75% Pervious Area
8,594		79.25% Impervious Area
3,773		43.90% Unconnected

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

Subcatchment POST 2A: POST 2A



Summary for Subcatchment PRE 1: PRE 1

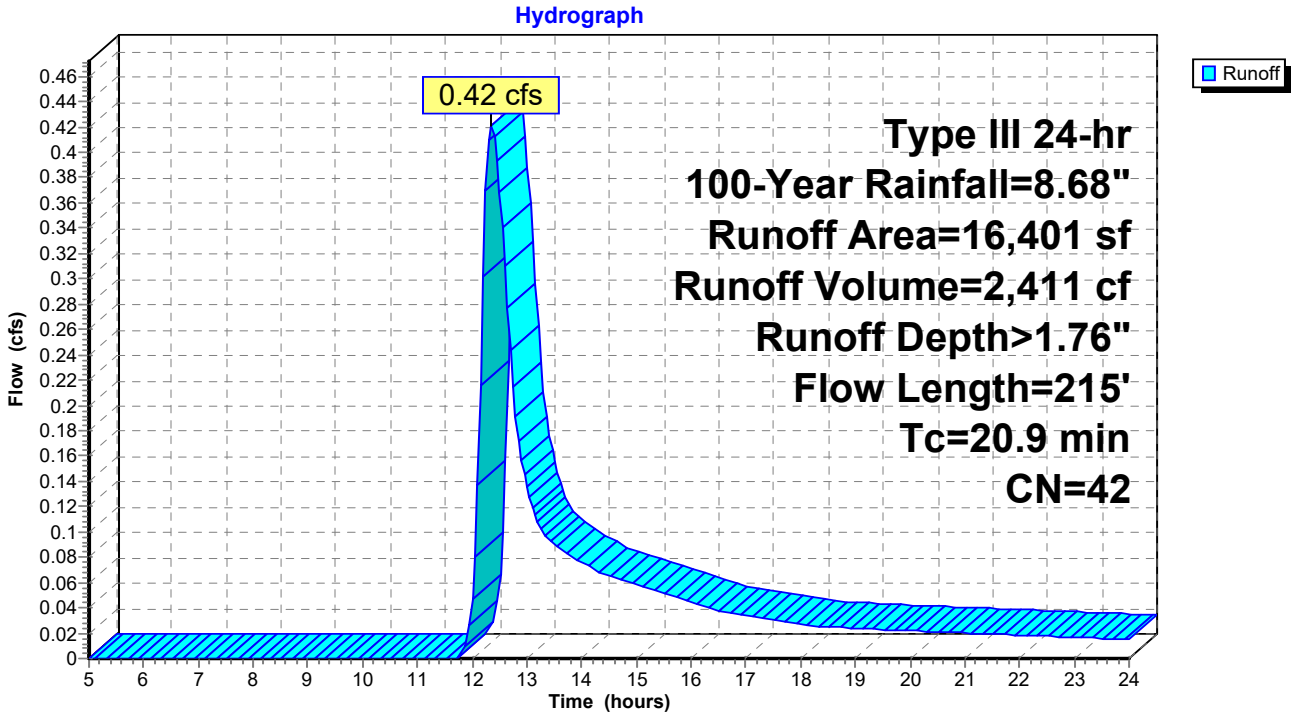
Runoff = 0.42 cfs @ 12.35 hrs, Volume= 2,411 cf, Depth> 1.76"
Routed to Reach DP1pre : DP1 PRE

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.68"

Area (sf)	CN	Description
11,068	39	>75% Grass cover, Good, HSG A
3,972	30	Woods, Good, HSG A
1,361	98	Roofs, HSG A
16,401	42	Weighted Average
15,040		91.70% Pervious Area
1,361		8.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.9	26	0.0040	0.03		**Sheet Flow, GRASS** Grass: Bermuda n= 0.410 P2= 3.35"
4.6	25	0.0586	0.09		**Sheet Flow, GRASS** Grass: Bermuda n= 0.410 P2= 3.35"
0.2	25	0.0586	1.69		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
0.4	40	0.0500	1.57		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
0.2	22	0.0450	1.48		**Shallow Concentrated Flow, GRASS** Short Grass Pasture Kv= 7.0 fps
1.6	77	0.0259	0.80		**Shallow Concentrated Flow, GRASS** Woodland Kv= 5.0 fps
20.9	215	Total			

Subcatchment PRE 1: PRE 1



Summary for Subcatchment PRE 2: PRE 2

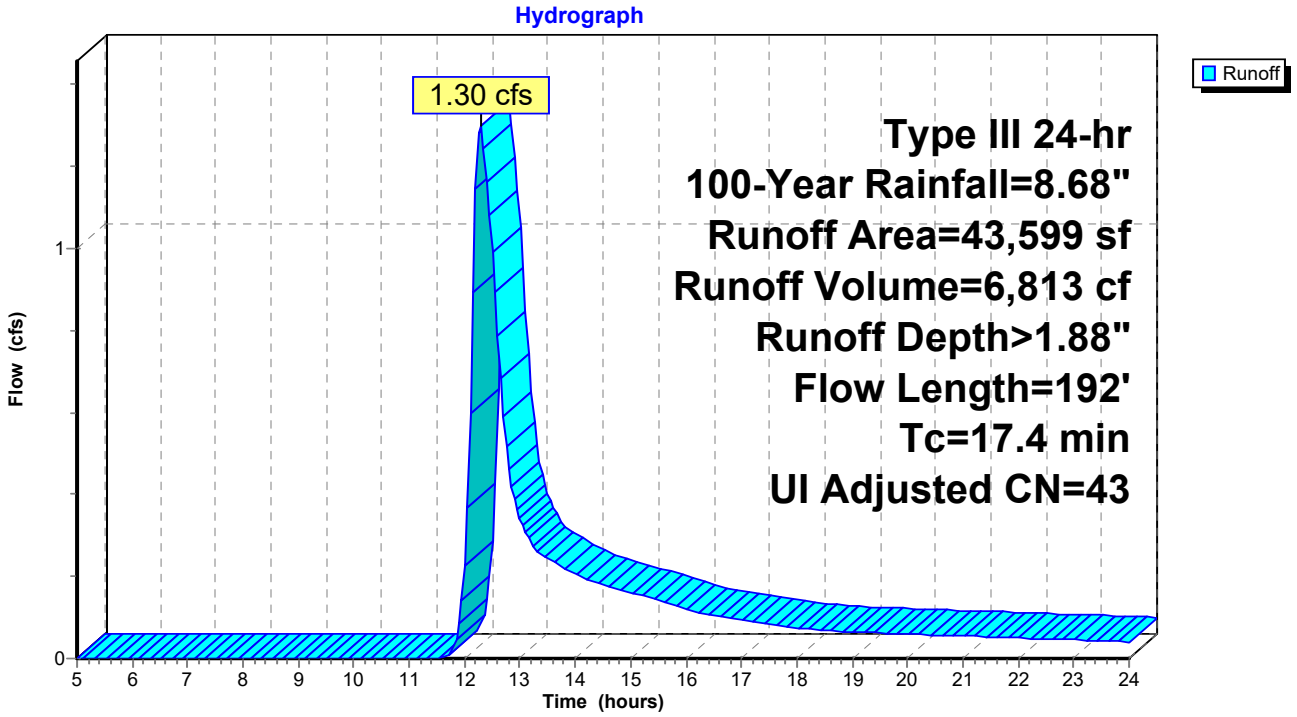
Runoff = 1.30 cfs @ 12.29 hrs, Volume= 6,813 cf, Depth> 1.88"
Routed to Reach DP2pre : DP2 PRE

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.68"

Area (sf)	CN	Adj	Description
15,552	39		>75% Grass cover, Good, HSG A
21,174	30		Woods, Good, HSG A
5,748	98		Paved parking, HSG A
1,125	98		Unconnected roofs, HSG A
43,599	44	43	Weighted Average, UI Adjusted
36,726			84.24% Pervious Area
6,873			15.76% Impervious Area
1,125			16.37% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	50	0.0125	0.06		**Sheet Flow, WOODS** Woods: Light underbrush n= 0.400 P2= 3.35"
0.9	32	0.0157	0.63		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
0.7	38	0.0288	0.85		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
1.0	45	0.0243	0.78		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
0.3	27	0.0667	1.29		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
17.4	192	Total			

Subcatchment PRE 2: PRE 2

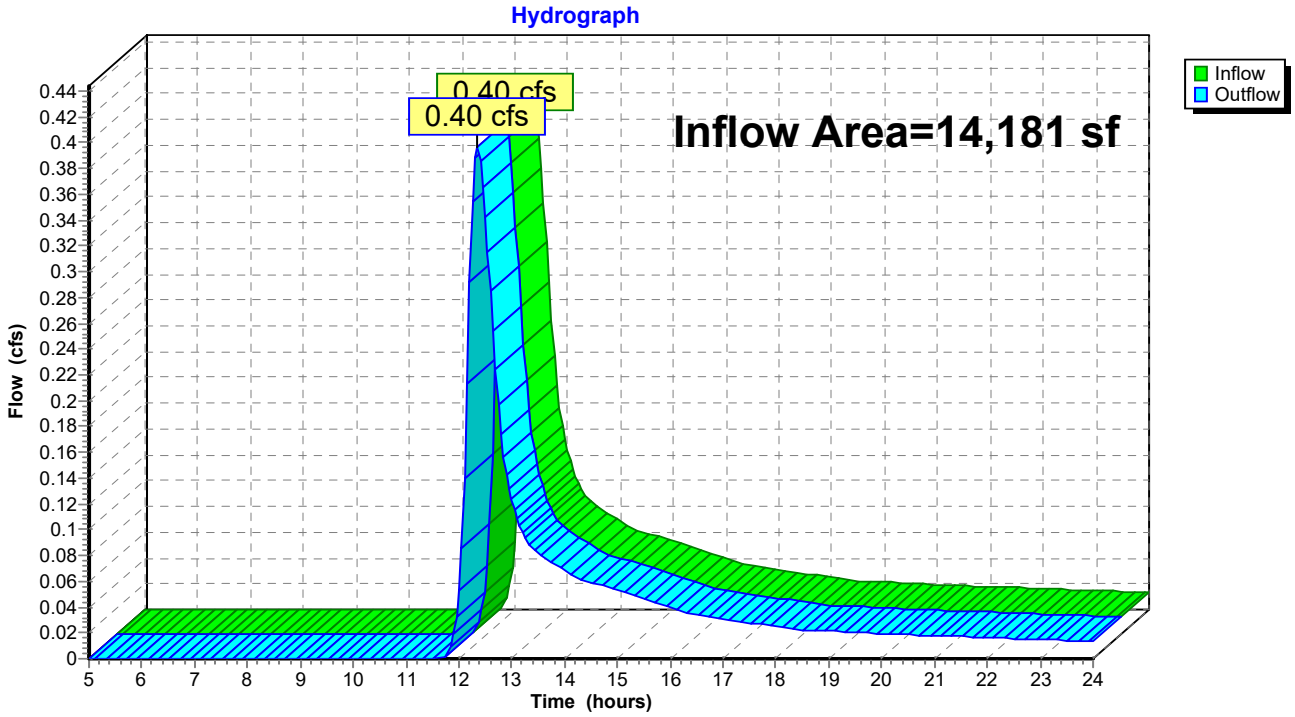


Summary for Reach DP1post: DP1 POST

Inflow Area = 14,181 sf, 10.97% Impervious, Inflow Depth > 1.87" for 100-Year event
Inflow = 0.40 cfs @ 12.35 hrs, Volume= 2,213 cf
Outflow = 0.40 cfs @ 12.35 hrs, Volume= 2,213 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

Reach DP1post: DP1 POST

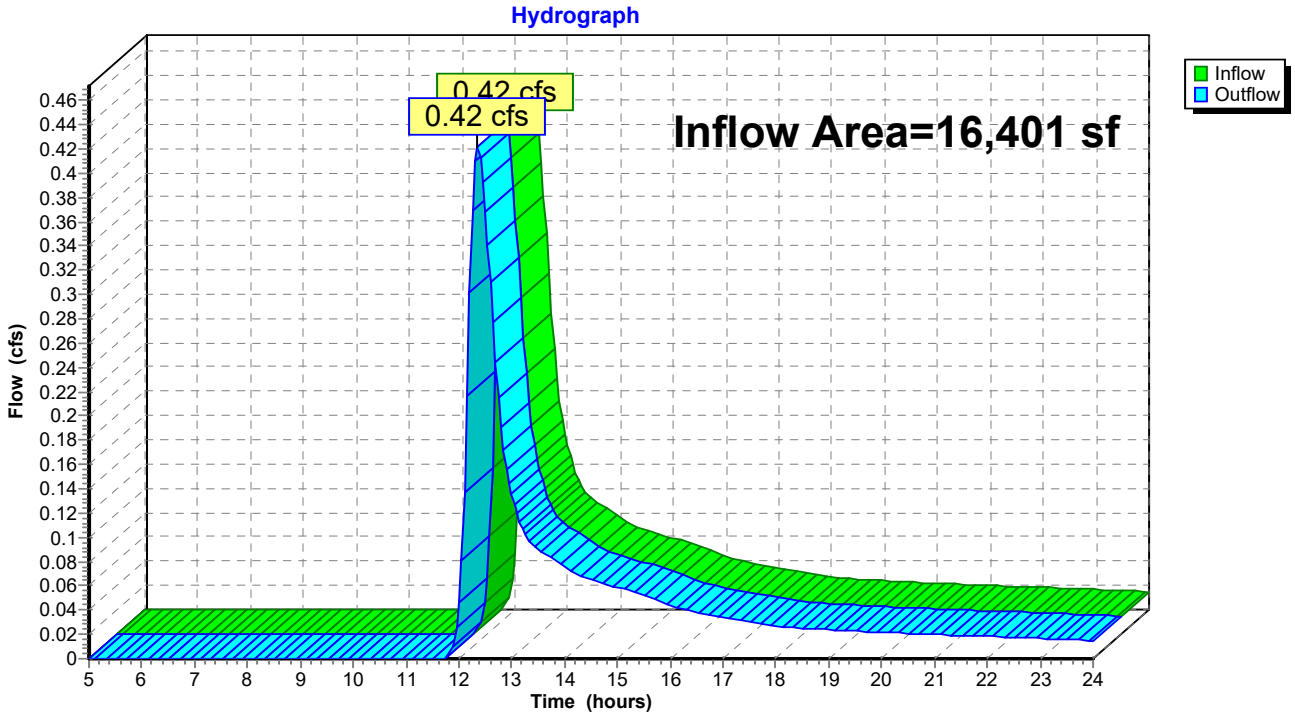


Summary for Reach DP1pre: DP1 PRE

Inflow Area = 16,401 sf, 8.30% Impervious, Inflow Depth > 1.76" for 100-Year event
Inflow = 0.42 cfs @ 12.35 hrs, Volume= 2,411 cf
Outflow = 0.42 cfs @ 12.35 hrs, Volume= 2,411 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

Reach DP1pre: DP1 PRE

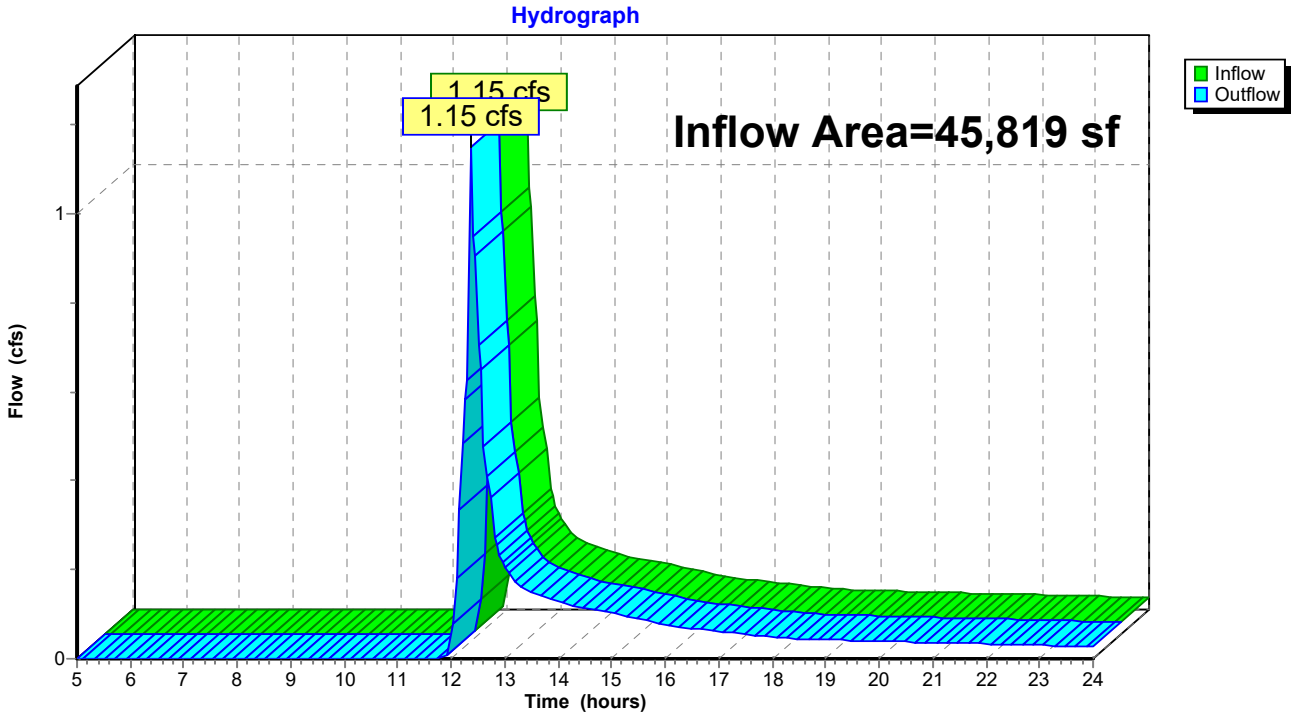


Summary for Reach DP2post: DP2 POST

Inflow Area = 45,819 sf, 23.96% Impervious, Inflow Depth > 1.10" for 100-Year event
Inflow = 1.15 cfs @ 12.36 hrs, Volume= 4,211 cf
Outflow = 1.15 cfs @ 12.36 hrs, Volume= 4,211 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

Reach DP2post: DP2 POST

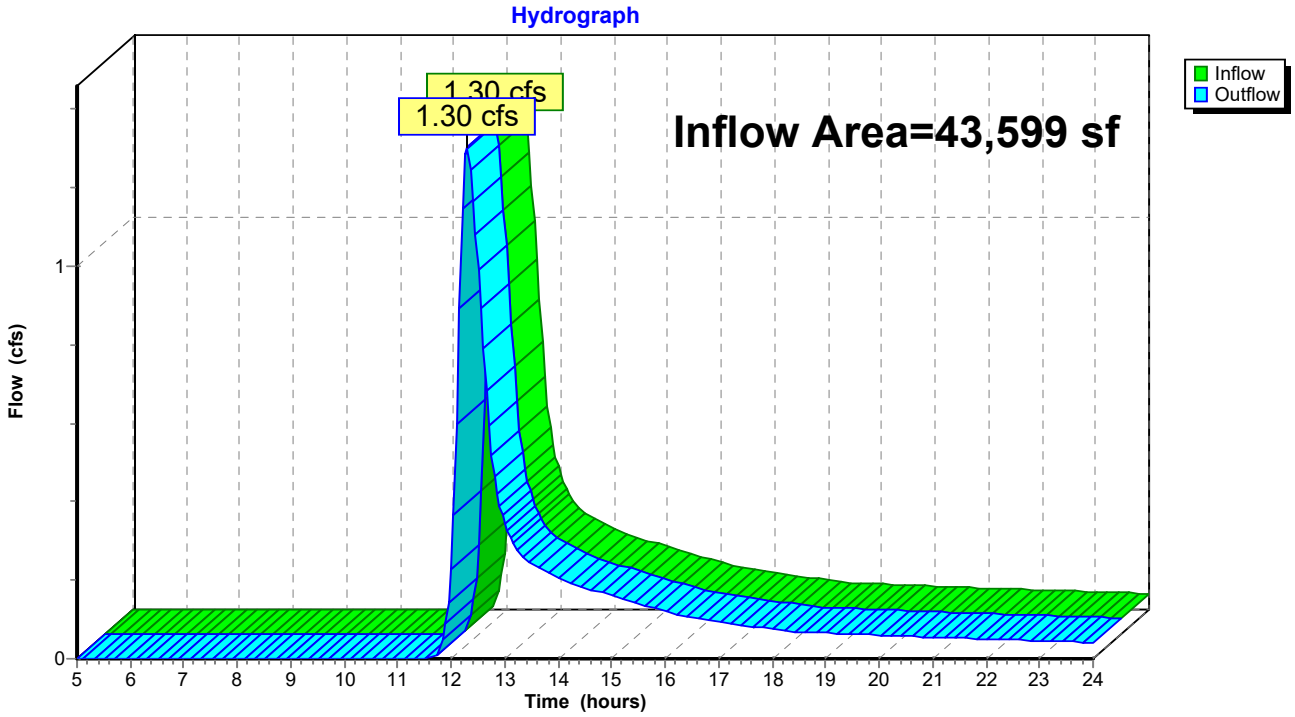


Summary for Reach DP2pre: DP2 PRE

Inflow Area = 43,599 sf, 15.76% Impervious, Inflow Depth > 1.88" for 100-Year event
Inflow = 1.30 cfs @ 12.29 hrs, Volume= 6,813 cf
Outflow = 1.30 cfs @ 12.29 hrs, Volume= 6,813 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

Reach DP2pre: DP2 PRE



Summary for Pond CS BED: CRUSHED STONE BED

Inflow Area = 10,844 sf, 79.25% Impervious, Inflow Depth > 6.97" for 100-Year event
Inflow = 1.96 cfs @ 12.07 hrs, Volume= 6,303 cf
Outflow = 0.72 cfs @ 12.36 hrs, Volume= 6,298 cf, Atten= 63%, Lag= 17.4 min
Discarded = 0.19 cfs @ 11.55 hrs, Volume= 5,999 cf
Primary = 0.53 cfs @ 12.36 hrs, Volume= 300 cf
Routed to Reach DP2post : DP2 POST

Routing by Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 48.70' @ 12.37 hrs Surf.Area= 3,300 sf Storage= 1,980 cf

Plug-Flow detention time= 73.9 min calculated for 6,282 cf (100% of inflow)
Center-of-Mass det. time= 73.2 min (858.0 - 784.8)

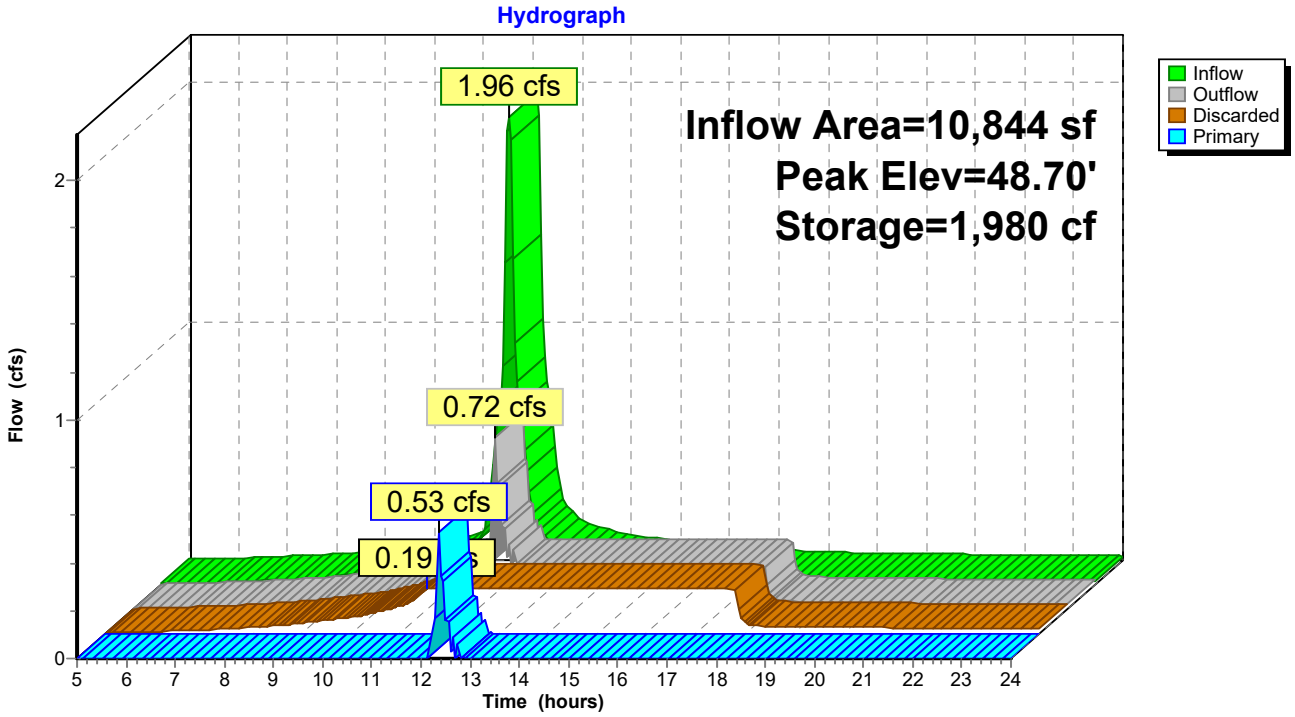
Volume	Invert	Avail.Storage	Storage Description
#1	47.00'	1,980 cf	**60.00'W x 55.00'L x 1.50'H Prismatoid** 4,950 cf Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	47.00'	**2.470 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	48.50'	**24.0" W x 24.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.19 cfs @ 11.55 hrs HW=47.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.46 cfs @ 12.36 hrs HW=48.67' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.46 cfs @ 1.33 fps)

Pond CS BED: CRUSHED STONE BED



Stage-Discharge for Pond CS BED: CRUSHED STONE BED

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
47.00	0.00	**0.00**	0.00
47.05	0.19	**0.19**	0.00
47.10	0.19	0.19	0.00
47.15	0.19	0.19	0.00
47.20	0.19	0.19	0.00
47.25	0.19	0.19	0.00
47.30	0.19	0.19	0.00
47.35	0.19	0.19	0.00
47.40	0.19	0.19	0.00
47.45	0.19	0.19	0.00
47.50	0.19	0.19	0.00
47.55	0.19	0.19	0.00
47.60	0.19	0.19	0.00
47.65	0.19	0.19	0.00
47.70	0.19	0.19	0.00
47.75	0.19	0.19	0.00
47.80	0.19	0.19	0.00
47.85	0.19	0.19	0.00
47.90	0.19	0.19	0.00
47.95	0.19	0.19	0.00
48.00	0.19	0.19	0.00
48.05	0.19	0.19	0.00
48.10	0.19	0.19	0.00
48.15	0.19	0.19	0.00
48.20	0.19	0.19	0.00
48.25	0.19	0.19	0.00
48.30	0.19	0.19	0.00
48.35	0.19	0.19	0.00
48.40	0.19	0.19	0.00
48.45	0.19	0.19	0.00
48.50	0.19	0.19	0.00
48.55	0.26	0.19	0.07
48.60	0.39	0.19	0.20
48.65	0.56	0.19	0.37
48.70	0.76	0.19	0.57
48.75	0.99	0.19	0.80
48.80	1.24	0.19	1.05
48.85	1.52	0.19	1.33
48.90	1.81	0.19	1.62
48.95	2.13	0.19	1.94
49.00	2.46	0.19	2.27
49.05	2.81	0.19	2.62
49.10	3.17	0.19	2.98
49.15	3.55	0.19	3.36
49.20	3.95	0.19	3.76
49.25	4.36	0.19	4.17
49.30	4.78	0.19	4.59
49.35	5.22	0.19	5.03
49.40	5.67	0.19	5.48
49.45	6.13	0.19	5.94
49.50	6.61	0.19	6.42
49.55	7.10	0.19	6.91
49.60	7.60	0.19	7.41
49.65	8.11	0.19	7.92
49.70	8.63	0.19	8.44
49.75	9.16	0.19	8.97
49.80	9.70	0.19	9.52
49.85	10.26	0.19	10.07
49.90	10.82	0.19	10.63
49.95	11.40	0.19	11.21
50.00	11.98	0.19	11.79
50.05	12.58	0.19	12.39
50.10	13.18	0.19	12.99
50.15	13.80	0.19	13.61
50.20	14.42	0.19	14.23
50.25	15.05	0.19	14.86
50.30	15.69	0.19	15.50
50.35	16.34	0.19	16.15
50.40	17.00	0.19	16.81
50.45	17.67	0.19	17.48
50.50	**18.35**	0.19	**18.16**

Stage-Area-Storage for Pond CS BED: CRUSHED STONE BED

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
47.00	**3,300**	0
47.05	3,300	66
47.10	3,300	132
47.15	3,300	198
47.20	3,300	264
47.25	3,300	330
47.30	3,300	396
47.35	3,300	462
47.40	3,300	528
47.45	3,300	594
47.50	3,300	660
47.55	3,300	726
47.60	3,300	792
47.65	3,300	858
47.70	3,300	924
47.75	3,300	990
47.80	3,300	1,056
47.85	3,300	1,122
47.90	3,300	1,188
47.95	3,300	1,254
48.00	3,300	1,320
48.05	3,300	1,386
48.10	3,300	1,452
48.15	3,300	1,518
48.20	3,300	1,584
48.25	3,300	1,650
48.30	3,300	1,716
48.35	3,300	1,782
48.40	3,300	1,848
48.45	3,300	1,914
48.50	3,300	**1,980**
48.55	3,300	1,980
48.60	3,300	1,980
48.65	3,300	1,980
48.70	3,300	1,980
48.75	3,300	1,980
48.80	3,300	1,980
48.85	3,300	1,980
48.90	3,300	1,980
48.95	3,300	1,980
49.00	3,300	1,980
49.05	3,300	1,980
49.10	3,300	1,980
49.15	3,300	1,980
49.20	3,300	1,980
49.25	3,300	1,980
49.30	3,300	1,980
49.35	3,300	1,980
49.40	3,300	1,980
49.45	3,300	1,980
49.50	3,300	1,980
49.55	3,300	1,980
49.60	3,300	1,980
49.65	3,300	1,980
49.70	3,300	1,980
49.75	3,300	1,980
49.80	3,300	1,980
49.85	3,300	1,980
49.90	3,300	1,980
49.95	3,300	1,980
50.00	3,300	1,980
50.05	3,300	1,980
50.10	3,300	1,980
50.15	3,300	1,980
50.20	3,300	1,980
50.25	3,300	1,980
50.30	3,300	1,980
50.35	3,300	1,980
50.40	3,300	1,980
50.45	3,300	1,980
50.50	3,300	1,980

Events for Subcatchment POST 1: POST 1

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Year	3.35	0.00	40	0.03
10-Year	4.95	0.03	397	0.34
25-Year	6.19	0.11	874	0.74
100-Year	**8.68**	**0.40**	**2,213**	**1.87**

Events for Subcatchment POST 2: POST 2

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Year	3.35	0.00	1	0.00
10-Year	4.95	0.02	455	0.16
25-Year	6.19	0.12	1,287	0.44
100-Year	**8.68**	**0.63**	**3,912**	**1.34**

Events for Subcatchment POST 2A: POST 2A

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Year	3.35	0.57	1,776	1.96
10-Year	4.95	0.99	3,089	3.42
25-Year	6.19	1.31	4,145	4.59
100-Year	**8.68**	**1.96**	**6,303**	**6.97**

Events for Subcatchment PRE 1: PRE 1

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Year	3.35	0.00	32	0.02
10-Year	4.95	0.03	405	0.30
25-Year	6.19	0.11	924	0.68
100-Year	**8.68**	**0.42**	**2,411**	**1.76**

Events for Subcatchment PRE 2: PRE 2

Event	Rainfall (inches)	Runoff (cfs)	Volume (cubic-feet)	Depth (inches)
2-Year	3.35	0.00	125	0.03
10-Year	4.95	0.11	1,224	0.34
25-Year	6.19	0.36	2,691	0.74
100-Year	**8.68**	**1.30**	**6,813**	**1.88**

Events for Reach DP1post: DP1 POST

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Year	0.00	0.00	**0.00**	**0**
10-Year	0.03	0.03	0.00	0
25-Year	0.11	0.11	0.00	0
100-Year	**0.40**	**0.40**	0.00	0

Events for Reach DP1pre: DP1 PRE

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Year	0.00	0.00	**0.00**	**0**
10-Year	0.03	0.03	0.00	0
25-Year	0.11	0.11	0.00	0
100-Year	**0.42**	**0.42**	0.00	0

Events for Reach DP2post: DP2 POST

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Year	0.00	0.00	**0.00**	**0**
10-Year	0.02	0.02	0.00	0
25-Year	0.12	0.12	0.00	0
100-Year	**1.15**	**1.15**	0.00	0

Events for Reach DP2pre: DP2 PRE

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Year	0.00	0.00	**0.00**	**0**
10-Year	0.11	0.11	0.00	0
25-Year	0.36	0.36	0.00	0
100-Year	**1.30**	**1.30**	0.00	0

Events for Pond CS BED: CRUSHED STONE BED

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Year	0.57	0.19	**0.19**	0.00	47.24	312
10-Year	0.99	0.19	0.19	0.00	47.63	828
25-Year	1.31	0.19	0.19	0.00	47.97	1,284
100-Year	**1.96**	**0.72**	0.19	**0.53**	**48.70**	**1,980**

Section III

OPERATION AND MAINTENANCE PLAN

OPERATION AND MAINTENANCE PLAN
DURING CONSTRUCTION
8 Franklin Rodgers Rd
Hingham, MA 02043

Owner: Lauren & Andy McEleny
8 Franklin Rodgers Road
Hingham, MA 02043

Party Responsible for Operation and Maintenance:

Lauren & Andy McEleny
8 Franklin Rodgers Road
Hingham, MA 02043

Source of Funding:

Operation and Maintenance of this stormwater management system will be the responsibility of the property owner to include its successor and/or assigns, as the same may appear on record with the appropriate register of deeds.

During Construction:

During periods of active construction the stormwater management system shall be inspected on a weekly basis and within 24 hours of a storm event of greater than ½". Maintenance tasks shall be performed monthly or after significant rainfall events of 1" of rain or greater. During construction, silt-laden runoff shall be prevented from entering the drainage system and off-site properties. Temporary swales shall be constructed as needed during construction to direct runoff to sediment traps. Subsurface systems shall not be placed in service until after the installation of base course pavement and vegetative stabilization of the areas contributing to the systems.

If dewatering operations are necessary, all water pumped from the dewatering shall be directed to a "dirt bag" pumped sediment removal system (or approved equal) as manufactured by ACF Environmental. The unit shall be placed on a crushed stone blanket. Disposal of such "dirt bag" shall occur when the device is full and can no longer effectively filter sediment or allow water to pass at a reasonable flow rate. Disposal of this unit shall be the responsibility of the contractor and shall be as directed by the owner in accordance with applicable local, state, and federal guidelines and regulations.

Stabilized construction entrances shall be placed at the entrances and shall consist of 1½" to 2" stone and be constructed as shown on the approved plans.

All erosion and sedimentation control measures shall be in place prior to the commencement of any site work or earthwork operations, shall be maintained during construction, and shall remain in place until all site work is complete and ground cover is established.

All exposed soils not to be paved shall be stabilized as soon as practical. Seed mixes shall only be applied during appropriate periods as recommended by the seed supplier, typically May 1 to October 15. Any exposed soils that can not be stabilized by vegetation during these dates shall be stabilized with hay bales, hay mulch, check dams, jute netting or other acceptable means.

Once each structure is in place, it should be maintained in accordance with the procedures described in the post-construction Operations and Maintenance Plan.

During dry periods where dust is created by construction activities the following control measures should be implemented.

- Sprinkling – The contractor may sprinkle the ground along haul roads and traffic areas until moist.
- Vegetative cover – Areas that are not expected to be disturbed regularly may be stabilized with vegetative cover.
- Mulch – Mulching can be used as a quick and effective means of dust control in recently disturbed areas.
- Spray on chemical soil treatments may be utilized. Application rates shall conform to manufacturers recommendations.

Inspections

The Owner shall be responsible to secure the services of a Professional Engineer to perform inspections as required. Inspections during periods of active construction shall be weekly and within 24 hours of a storm event of greater than ½ “. The Professional Engineer shall perform inspections to insure that the approved plan is being followed with particular attention to the Planning Board Approval and the Construction Sequencing. The Engineer shall be responsible for inspections during the construction of the stormwater management system. The Engineer shall prepare and submit to the Planning Board, the Inspection Schedule and Evaluation Checklist (see attached) and, if necessary, request the required maintenance and/or repair of the necessary items. This form shall be stamped by the Engineer and the Owner shall be notified that specific changes and/or repairs are necessary.

For additional information, refer to Performance, Standards and Guidelines for Stormwater Management in Massachusetts, published by the Department of Environmental Protection.

STORMWATER MANAGEMENT
BEST MANAGEMENT PRACTICES
INSPECTION SCHEDULE AND EVALUATION CHECKLIST – CONSTRUCTION PHASE

PROJECT LOCATION: 8 Franklin Rodgers Rd., Hingham
Latest Revision: 6/28/2024

Stormwater Control Manager: _____ **Stamp**

Best Management Practice	Inspection Frequency (1)	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning / Repair Needed yes/no List items	Date of Cleaning/Repair	Performed By	Water Level in Detention System
Silt sock & erosion control	After every major storm event							
Temporary Construction Entrance	Daily or as needed.							

(1) Refer to the Massachusetts Stormwater Management, Volume Two: Stormwater Technical Handbook for recommendations regarding frequency for inspection and maintenance of specific BMPs.

Limited or no use of sodium chloride salts, fertilizers or pesticides recommended. Slow release fertilizer recommended.
Other notes:(Include deviations from: Con Com Order of Conditions, PB Approval, Construction Sequence and Approved Plan)

OPERATION AND MAINTENANCE PLAN
POST CONSTRUCTION
8 Franklin Rodgers Road
Hingham, MA 02043

Owner: Lauren & Andy McEleny
8 Franklin Rodgers Road
Hingham, MA 02043

Party Responsible for Operation and Maintenance:

Lauren & Andy McEleny
8 Franklin Rodgers Road
Hingham, MA 02043

Source of Funding:
Operation and Maintenance of this stormwater management system will be the responsibility of the owner.

Post Construction Inspection and Maintenance:

Deep Sump Catch Basins
Deep sump catch basins shall become part of the roadway system and shall be inspected after every major storm event during construction and cleaned when sediment exceeds 24" depth. After construction when all slopes have been stabilized, basins shall be cleaned a minimum of 4 times per year or whenever the depth of deposits is greater than or equal to on half the depth from the bottom of the invert (2 ft). Disposal of the accumulated sediment shall be in accordance with applicable local, state, and federal guidelines and regulations.

Subsurface Drainage Systems
Inspect Inlets and access manholes twice per year. Remove any debris that might clog the system.

After construction, the systems should be inspected after any significant rainfall exceeding 1" of rainfall in 24 hours or major storm event. If the system is continuing to hold standing water after 72 hours, the owner should have it inspected and repaired.

The subsurface systems should be inspected twice per year and at least once per year by a drainage system professional to ensure that the system is operating as intended. The owner shall implement and pay for the inspector's recommendations.

Definition of Major Storm Event

For the purposes of this operation and maintenance plan a major storm event should be defined as a rainfall of such intensity or duration that causes observable movement of sediment on the roadway or site. It is the intent of this plan to prevent this sediment from entering the drainage system. Prior to stabilization of the site this may occur more frequently with less intense storms. As the site is stabilized with ground cover the movement of sediment will only occur during more severe storms. For additional information, refer to Performance Standards and Guidelines for Stormwater Management in Massachusetts, published by the Department of Environmental Protection.

STORMWATER MANAGEMENT
BEST MANAGEMENT PRACTICES

INSPECTION SCHEDULE AND EVALUATION CHECKLIST – POST CONSTRUCTION PHASE

PROJECT LOCATION: 8 Franklin Rodgers Road, Hingham
Latest Revision 6/28/2024

Best Management Practice	Inspection Frequency (1)	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/ Repair Needed yes/no List items	Date of Cleaning/ Repair	Performed By	Water Level in Drainage System
Deep Sump Hooded Catch Basins	4 times per year							
Subsurface structures	Twice a year							

(1) Refer to the Massachusetts Stormwater Management, Volume Two: Stormwater Technical Handbook for recommendations regarding frequency for inspection and maintenance of specific BMPs.
(2) records shall be kept for a minimum of three years.

Limited or no use of sodium chloride salts, fertilizers or pesticides recommended. Slow release fertilizer recommended.
Other notes:(Include deviations from: Con Com Order of Conditions, PB Approval, Construction Sequence and Approved Plan)

Stormwater Control Manager: _____ **Stamp**

Deep Sump Catch Basin

Description: Deep sump catch basins, also known as oil and grease or hooded catch basins, are underground retention systems designed to remove trash, debris, and coarse sediment from stormwater runoff, and serve as temporary spill containment devices for floatables such as oils and greases.

Ability to meet specific standards

Standard	Description
2 - Peak Flow	Provides no peak flow attenuation
3 - Recharge	Provides no groundwater recharge
4 - TSS Removal	25% TSS removal credit when used for pretreatment. Because of their limited effectiveness and storage capacity, deep sump catch basins receive credit for removing TSS only if they are used for pretreatment and designed as off-line systems.
5 - Higher Pollutant Loading	Recommended as pretreatment BMP. Although provides some spill control capability, a deep sump catch basin may not be used in place of an oil grit separator or sand filter for land uses that have the potential to generate runoff with high concentrations of oil and grease such as: high-intensity-use parking lots, gas stations, fleet storage areas, vehicle and/or equipment maintenance and service areas.
6 - Discharges near or to Critical Areas	May be used as pretreatment BMP. not an adequate spill control device for discharges near or to critical areas.
7 - Redevelopment	Highly suitable.

Advantages/Benefits:

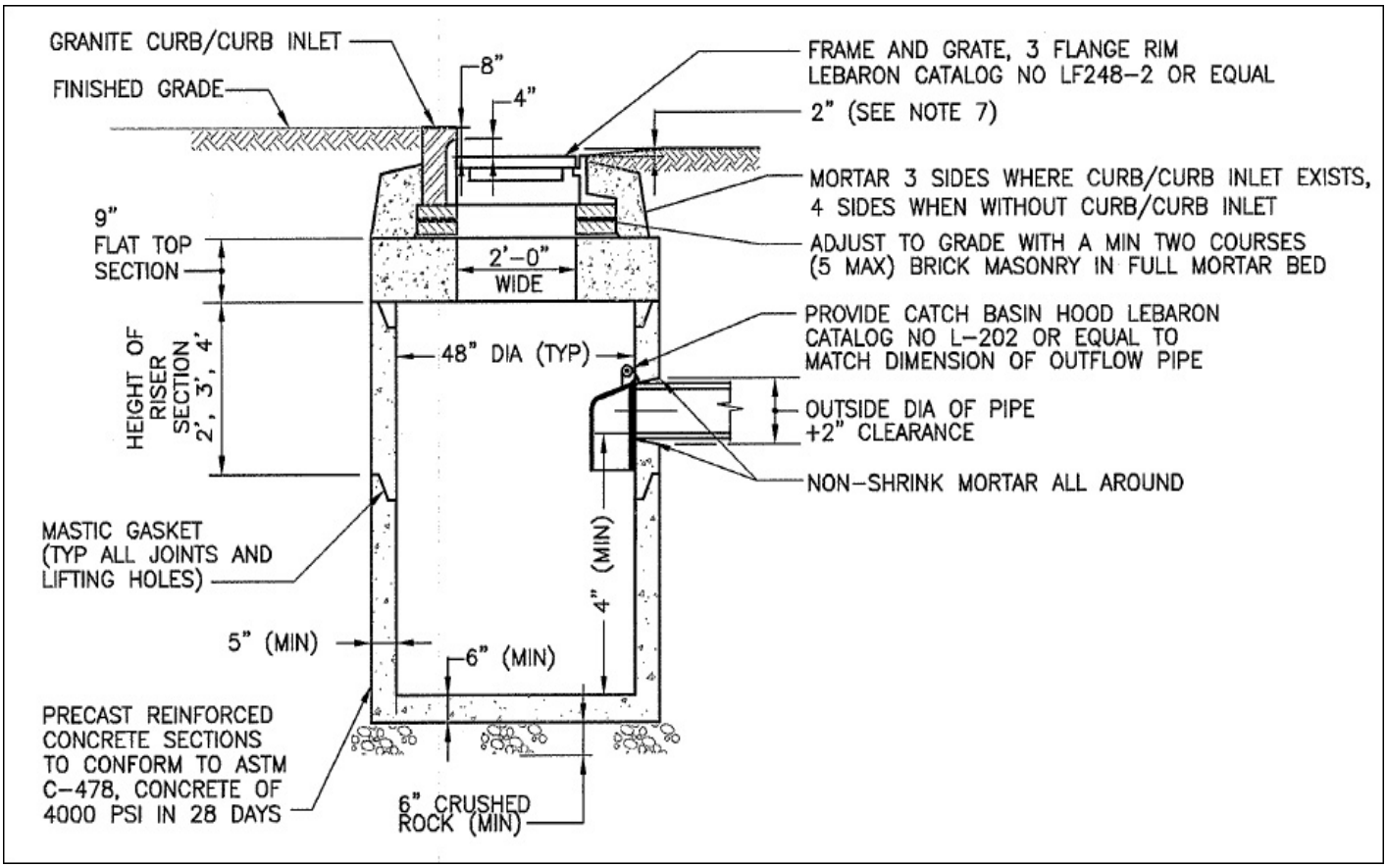
- Located underground, so limited lot size is not a deterrent.
- Compatible with subsurface storm drain systems.
- Can be used for retrofitting small urban lots where larger BMPs are not feasible.
- Provide pretreatment of runoff before it is delivered to other BMPs.
- Easily accessed for maintenance.
- Longevity is high with proper maintenance.

Disadvantages/Limitations:

- Limited pollutant removal.
- Expensive to install and maintain, resulting in high cost per unit area treated.
- No ability to control volume of stormwater
- Frequent maintenance is essential
- Requires proper disposal of trapped sediment and oil and grease
- Entrapment hazard for amphibians and other small animals

Pollutant Removal Efficiencies

- Total Suspended Solids (TSS) - 25% (for regulatory purposes)
- Nutrients (Nitrogen, phosphorus) - Insufficient data
- Metals (copper, lead, zinc, cadmium) - Insufficient data
- Pathogens (coliform, e coli) - Insufficient data



adapted from the University of New Hampshire

Maintenance

Activity	Frequency
Inspect units	Four times per year
Clean units	Four times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.

Special Features

All deep sump catch basins must include hoods. For MassHighway projects, consult the Stormwater Handbook for Highways and Bridges for hood requirements.

LID Alternative

Reduce Impervious Surface
Disconnect rooftop and non-rooftop runoff
Vegetated Filter Strip

Deep Sump Catch Basin

Suitable Applications

- Pretreatment
- Residential subdivisions
- Office
- Retail

Design Considerations

- The contributing drainage area to any deep sump catch basin should not exceed ¼ acre of impervious cover.
- Design and construct deep sump catch basins as off-line systems.
- Size the drainage area so that the flow rate does not exceed the capacity of the inlet grate.
- Divert excess flows to another BMP intended to meet the water quantity requirements (peak rate attenuation) or to a storm drain system. An off-line design enhances pollutant removal efficiency, because it prevents the resuspension of sediments in large storms.

Make the sump depth (distance from the bottom of the outlet pipe to the bottom of the basin) at least four feet times the diameter of the outlet pipe and more if the contributing drainage area has a high sediment load. The minimum sump depth is 4 feet. Double catch basins, those with 2 inlet grates, may require deeper sumps. Install the invert of the outlet pipe at least 4 feet from the bottom of the catch basin grate.

The inlet grate serves to prevent larger debris from entering the sump. To be effective, the grate must have a separation between the grates of one square inch or less. The inlet openings must not allow flows greater than 3 cfs to enter the deep sump catch basin. If the inlet grate is designed with a curb cut, the grate must reach the back of the curb cut to prevent bypassing. The inlet grate must be constructed of a durable material and fit tightly into the frame so it won't be dislodged by automobile traffic. The inlet grate must not be welded to the frame so that sediments may be easily removed. To facilitate maintenance, the inlet grate must be placed along the road shoulder or curb line rather than a traffic lane.

Note that within parking garages, the State Plumbing Code regulates inlet grates and other stormwater management controls. Inlet grates inside parking garages are currently required to have much smaller openings than those described herein.

To receive the 25% removal credit, hoods must be used in deep sump catch basins. Hoods also help contain oil spills. MassHighway may install catch basins without hoods provided they are designed, constructed, operated, and maintained in accordance with the Mass Highway Stormwater Handbook.

Install the weep hole above the outlet pipe. Never install the weep hole in the bottom of the catch basin barrel.

Site Constraints

A proponent may not be able to install a deep sump catch basin because of:

- Depth to bedrock;
- High groundwater;
- Presence of utilities; or
- Other site conditions that limit depth of excavation because of stability.

Maintenance

Regular maintenance is essential. Deep sump catch basins remain effective at removing pollutants only if they are cleaned out frequently. One study found that once 50% of the sump volume is filled, the catch basin is not able to retain additional sediments.

Inspect or clean deep sump basins at least four times per year and at the end of the foliage and snow-removal seasons. Sediments must also be removed four times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin. If handling runoff from land uses with higher potential pollutant loads or discharging runoff near or to a critical area, more frequent cleaning may be necessary.

Clamshell buckets are typically used to remove sediment in Massachusetts. However, vacuum trucks are preferable, because they remove more trapped sediment and supernatant than clamshells. Vacuuming is also a speedier process and is less likely to snap the cast iron hood within the deep sump catch basin.

Always consider the safety of the staff cleaning deep sump catch basins. Cleaning a deep sump catch basin within a road with active traffic or even within a parking lot is dangerous, and a police detail may be necessary to safeguard workers.

Although catch basin debris often contains concentrations of oil and hazardous materials such as petroleum hydrocarbons and metals, MassDEP classifies them as solid waste. Unless there is evidence that they have been contaminated by a spill or other means, MassDEP does not routinely require catch basin cleanings to be tested before disposal. Contaminated catch basin cleanings must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.000, and handled as hazardous waste.

In the absence of evidence of contamination, catch basin cleanings may be taken to a landfill or other facility permitted by MassDEP to accept solid waste, without any prior approval by MassDEP. However, some landfills require catch basin cleanings to be tested before they are accepted.

With prior MassDEP approval, catch basin cleanings may be used as grading and shaping materials at landfills undergoing closure (see Revised Guidelines for Determining Closure Activities at Inactive Unlined Landfill Sites) or as daily cover at active landfills. MassDEP also encourages the beneficial reuse of catch basin cleanings whenever possible. A Beneficial Reuse Determination is required for such use.

MassDEP regulations prohibit landfills from accepting materials that contain free-draining liquids. One way to remove liquids is to use a hydraulic lift truck during cleaning operations so that the material can be decanted at the site. After loading material from several catch basins into a truck, elevate the truck so that any free-draining liquid can flow back into the structure. If there is no free water in the truck, the material may be deemed to be sufficiently dry. Otherwise the catch basin cleanings must undergo a Paint Filter Liquids Test. Go to www. Mass.gov/dep/recycle/laws/cafacts.doc for information on all of the MassDEP requirements pertaining to the disposal of catch basin cleanings.

Subsurface Structures

Description: Subsurface structures are underground systems that capture runoff, and gradually infiltrate it into the groundwater through rock and gravel. There are a number of underground infiltration systems that can be installed to enhance groundwater recharge. The most common types include pre-cast concrete or plastic pits, chambers (manufactured pipes), perforated pipes, and galleys.

Ability to meet specific standards

Standard	Description
2 - Peak Flow	N/A
3 - Recharge	Provides groundwater recharge
4 - TSS Removal	80%
5 - Higher Pollutant Loading	May be used if 44% of TSS is removed with a pretreatment BMP prior to infiltration. Land uses with the potential to generate runoff with high concentrations of oil and grease require an oil grit separator or equivalent prior to discharge to the infiltration structure. Infiltration must be done in accordance with 314 CMR 5.00.
6 - Discharges near or to Critical Areas	Highly recommended
7 - Redevelopment	Suitable with pretreatment

Advantages/Benefits:

- Provides groundwater recharge
- Reduces downstream flooding
- Preserves the natural water balance of the site
- Can remove other pollutants besides TSS
- Can be installed on properties with limited space
- Useful in stormwater retrofit applications

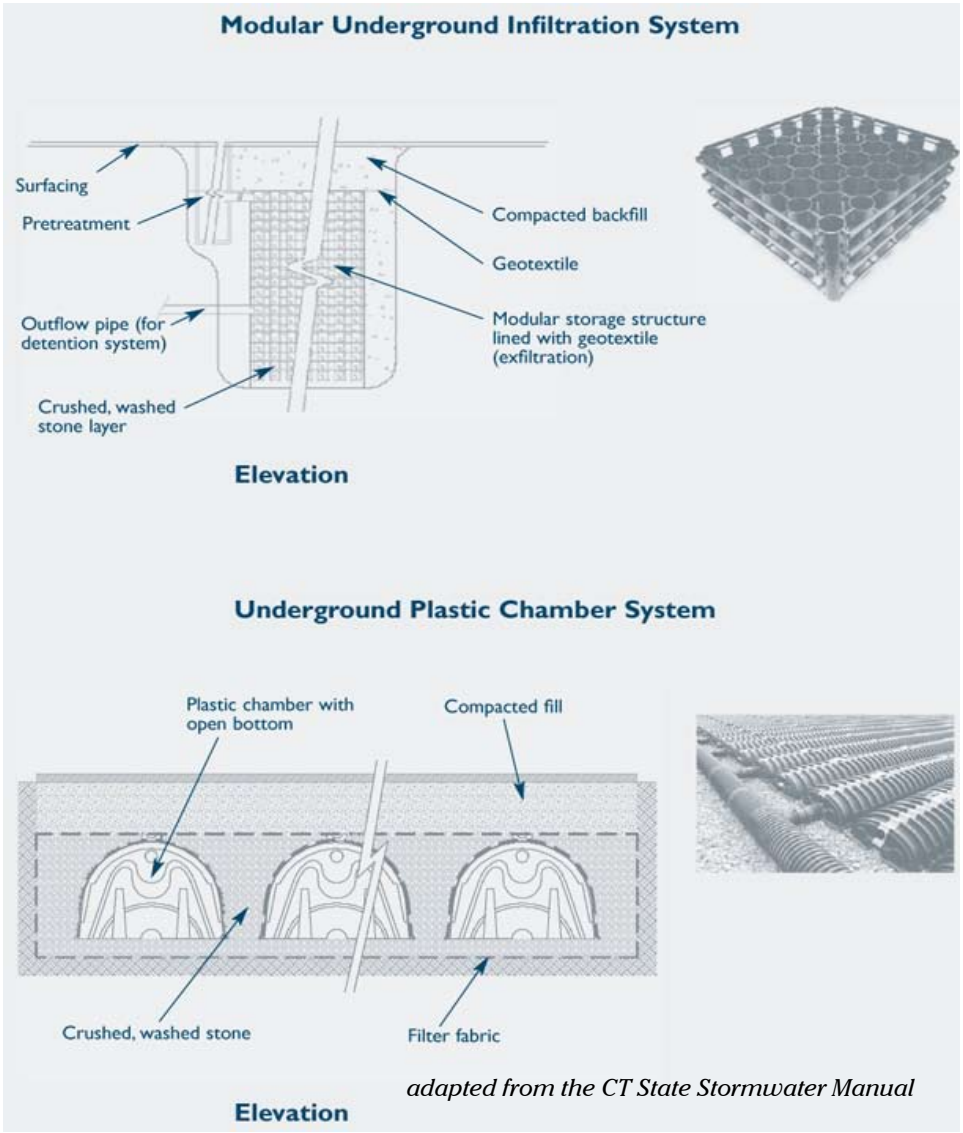
Disadvantages/Limitations:

- Limited data on field performance
- Susceptible to clogging by sediment
- Potential for mosquito breeding due to standing water if system fails

Pollutant Removal Efficiencies

• Total Suspended Solids (TSS)	80%
• Nutrients (Nitrogen, phosphorus)	Insufficient data
• Metals (copper, lead, zinc, cadmium)	Insufficient data
• Pathogens (coliform, e coli)	Insufficient data

Subsurface Structures



adapted from the CT State Stormwater Manual

There are different types of subsurface structures:

Infiltration Pit: A pre-cast concrete or plastic barrel with uniform perforations. The bottom of the pit should be closed with the lowest row of perforations at least 6 inches above the bottom, to serve as a sump. Infiltration pits typically include an observation well. The pits may be placed linearly, so that as the infiltrative surfaces in the first pit clog, the overflow moves to the second pit for exfiltration. Place an outlet near the top of the infiltration pit to accommodate emergency overflows. MassDEP provides recharge credit for storage below the emergency outflow invert. To make an infiltration pit, excavate the pit, wrap fabric around the barrel, place stone in the bottom of the pit, place the barrel in the pit, and then backfill stone around the barrel. Take a boring or dig an observation trench at the site of each proposed pit.

Chambers: These are typically manufactured pipes containing open bottoms and sometimes perforations. The chambers are placed atop a stone bed. Take the same number of borings or observation pits as for infiltration trenches. Do not confuse these systems with underground detention systems (UDS) that use similar chambers. UDS are designed to attenuate peak rates of runoff--not to recharge groundwater.

Perforated Pipes: In this system, pipes containing perforations are placed in a leaching bed, similar to a Title 5 soil absorption system (SAS). The pipes dose the leaching bed. Take the same number of borings or observation pits as for infiltration trenches. Perforated pipes by themselves do not constitute a stormwater recharge system and receive no credit pursuant to Stormwater Standard No. 3. Do not confuse recharge systems that use perforated pipes with perforated pipes installed to lower the water table or divert groundwater flows.

Galleys: Similar to infiltration pits. Some designs consist of concrete perforated rectangular vaults. Others are modular systems usually placed under parking lots. When the galley design consists of a single rectangular perforated vault, conduct one boring or observation trench per galley. When the galleys consist of interlocking modular units, take the same number of borings or observation pits as for infiltration trenches. Do not confuse these galleys with vaults storing water for purposes of underground detention, which do not contain perforations.

Applicability

Subsurface structures are constructed to store stormwater temporarily and let it percolate into the underlying soil. These structures are used for small drainage areas (typically less than 2 acres). They are feasible only where the soil is adequately permeable and the maximum water table and/or bedrock

elevation is sufficiently low. They can be used to control the quantity as well as quality of stormwater runoff, if properly designed and constructed. The structures serve as storage chambers for captured stormwater, while the soil matrix provides treatment.

Without adequate pretreatment, subsurface structures are not suitable for stormwater runoff from land uses or activities with the potential for high sediment or pollutant loads. Structural pretreatment BMPs for these systems include, but are not limited to, deep sump catch basins, proprietary separators, and oil/grit separators. They are suitable alternatives to traditional infiltration trenches and basins for space-limited sites. These systems can be installed beneath parking lots and other developed areas provided the systems can be accessed for routine maintenance.

Subsurface systems are highly prone to clogging. Pretreatment is always required unless the runoff is strictly from residential rooftops.

Effectiveness

Performance of subsurface systems varies by manufacturer and system design. Although there are limited field performance data, pollutant removal efficiency is expected to be similar to those of infiltration trenches and basins (i.e., up to 80% of TSS removal). MassDEP awards a TSS removal credit of 80% for systems designed in accordance with the specifications in this handbook.

Planning Considerations

Subsurface structures are excellent groundwater recharge alternatives where space is limited. Because infiltration systems discharge runoff to groundwater, they are inappropriate for use in areas with potentially higher pollutant loads (such as gas stations), unless adequate pretreatment is provided. In that event, oil grit separators, sand filters or equivalent BMPs must be used to remove sediment, floatables and grease prior to discharge to the subsurface structure.

Design

Unlike infiltration basins, widely accepted design standards and procedures for designing subsurface structures are not available. Generally, a subsurface structure is designed to store a ''capture volume'' of runoff for a specified period of ''storage time.'' The definition of capture volume differs depending on the purpose of the subsurface structure and the stormwater management program being used. Subsurface structures should infiltrate good quality runoff only. Pretreatment prior to infiltration is essential.
The composition, configuration and layout of subsurface structures varies considerably depending on the manufacturer. Follow the design criteria specified by vendors or system manufacturers. Install subsurface structures in areas that are easily accessible for routine and non-routine maintenance.

As with infiltration trenches and basins, install subsurface structures only in soils having suitable infiltration capacities as determined through field testing. Determine the infiltrative capacity of the underlying native soil through the soil evaluation set forth in Volume 3. Never use a standard septic system percolation test to determine soil permeability because this test tends to greatly overestimate the infiltration capacity of soils.

Subsurface structures are typically designed to function off-line. Place a flow bypass structure upgradient of the infiltration structure to convey high flows around the structure during large storms.

Design the subsurface structure so that it drains within 72 hours after the storm event and completely dewaters between storms. Use a minimum draining time of 6 hours to ensure adequate pollutant removal. Design all ports to be mosquito-proof, i.e., to inhibit or reduce the number of mosquitoes able to breed within the BMP.

The minimum acceptable field infiltration rate is 0.17 inches per hour. Subsurface structures must be sized in accordance with the procedures set forth in Volume 3. Manufactured structures must also be sized in accordance with the manufacturers' specifications. Design the system to totally exfiltrate within 72 hours.

Design the subsurface structure for live and dead loads appropriate for their location. Provide measures to dissipate inlet flow velocities and prevent channeling of the stone media. Generally, design the system so that inflow velocities are less than 2 feet per second (fps).
All of these devices must have an appropriate number of observation wells, to monitor the water surface elevation within the well, and to serve as a sampling port.

Each of these different types of structures, with the exception of perforated pipes in leaching fields similar to Title 5 systems, must have entry ports to allow worker access for maintenance, in accordance with OSHA requirements.

Construction

Stabilize the site prior to installing the subsurface structure. Do not allow runoff from any disturbed areas on the site to flow to the structure. Rope off the area where the subsurface structures are to be placed. Accomplish any required excavation with equipment placed just outside of this area. If the size of the area intended for exfiltration is too large to accommodate this approach, use trucks with low-pressure tires to minimize compaction. Do not allow any other vehicles within the area to be excavated. Keep the area above and immediately surrounding the subsurface structure roped off to all construction vehicles until the final top surface is installed (either paving or landscaping). This prevents additional compaction. When installing the final top surface, work from the edges to minimize compaction of the underlying soils.

Before installing the top surface, implement erosion and sediment controls to prevent sheet flow or wind blown sediment from entering the leach field. This includes, but is not limited to, minimizing land disturbances at any one time, placing stockpiles away from the area intended for infiltration, stabilizing any stockpiles through use of vegetation or tarps, and placing sediment fences around the perimeter of the infiltration field.

Provide an access port, man-way, and observation well to enable inspection of water levels within the system. Make the observation well pipe visible at grade (i.e., not buried).

Maintenance

Because subsurface structures are installed underground, they are extremely difficult to maintain. Inspect inlets at least twice a year. Remove any debris that might clog the system. Include mosquito controls in the Operation and Maintenance Plan.

Adapted from:
Connecticut Department of Environmental Conservation. Connecticut Stormwater Quality Manual. 2004.
MassHighway. Storm Water Handbook for Highways and Bridges. May 2004.

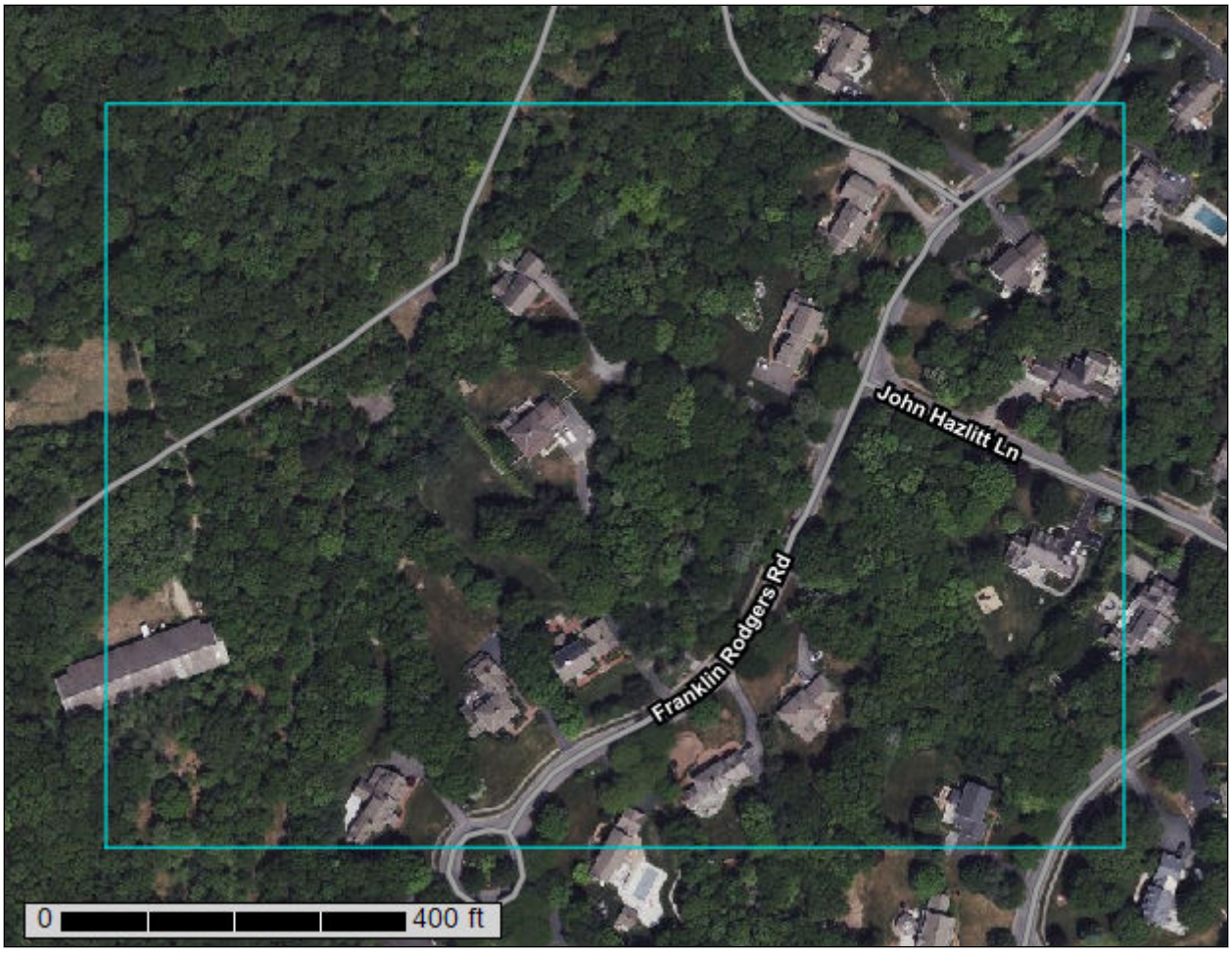
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Plymouth County, Massachusetts



June 27, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

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: Plymouth County, Massachusetts
Survey Area Data: Version 16, Sep 10, 2023

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
262B	Quonset sandy loam, 3 to 8 percent slopes	18.0	77.0%
262C	Quonset sandy loam, 8 to 15 percent slopes	5.2	22.2%
657A	Aquepts, 0 to 3 percent slopes	0.2	0.9%
Totals for Area of Interest		**23.4**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The

delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Plymouth County, Massachusetts

262B—Quonset sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: bqtk
Elevation: 0 to 400 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Quonset and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Quonset

Setting

Landform: Terraces, outwash plains, kames, eskers, deltas
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and gravelly glaciofluvial deposits

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
Oa - 1 to 2 inches: highly decomposed plant material
A - 2 to 4 inches: sandy loam
Bw1 - 4 to 7 inches: channery sandy loam
Bw2 - 7 to 14 inches: channery loamy sand
BC - 14 to 22 inches: very channery loamy sand
C - 22 to 65 inches: extremely channery sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Warwick

Percent of map unit: 8 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Deerfield

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Shoulder, footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Hinckley

Percent of map unit: 4 percent
Landform: Outwash deltas, terraces, kames, eskers
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Canton

Percent of map unit: 3 percent
Landform: Till plains, ridges, hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

262C—Quonset sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: bqtl
Elevation: 0 to 400 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Quonset and similar soils: 80 percent

Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Quonset

Setting

Landform: Terraces, outwash plains, kames, eskers, deltas
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Sandy and gravelly glaciofluvial deposits

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
Oa - 1 to 2 inches: highly decomposed plant material
A - 2 to 4 inches: sandy loam
Bw1 - 4 to 7 inches: channery sandy loam
Bw2 - 7 to 14 inches: channery loamy sand
BC - 14 to 22 inches: very channery loamy sand
C - 22 to 65 inches: extremely channery sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Warwick

Percent of map unit: 8 percent
Landform: Terraces, outwash plains, deltas
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Deerfield

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Shoulder, footslope
Landform position (three-dimensional): Tread

Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Hinckley

Percent of map unit: 4 percent
Landform: Outwash deltas, terraces, kames, eskers
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Canton

Percent of map unit: 3 percent
Landform: Till plains, ridges, hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

657A—Aquepts, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: bd0z
Elevation: 0 to 390 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Aquepts and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Aquepts

Setting

Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Coarse-loamy human transported material over sandy and gravelly glaciofluvial deposits

Typical profile

^A - 0 to 4 inches: very fine sandy loam
^BA - 4 to 17 inches: very fine sandy loam
^Cg - 17 to 42 inches: very fine sandy loam

2Oa - 42 to 47 inches: muck
3Cg - 47 to 65 inches: loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)
Depth to water table: About 0 to 4 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Available water supply, 0 to 60 inches: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D
Hydric soil rating: Yes

Minor Components

Udorthents, wet substratum

Percent of map unit: 10 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Udorthents, loamy

Percent of map unit: 10 percent
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf