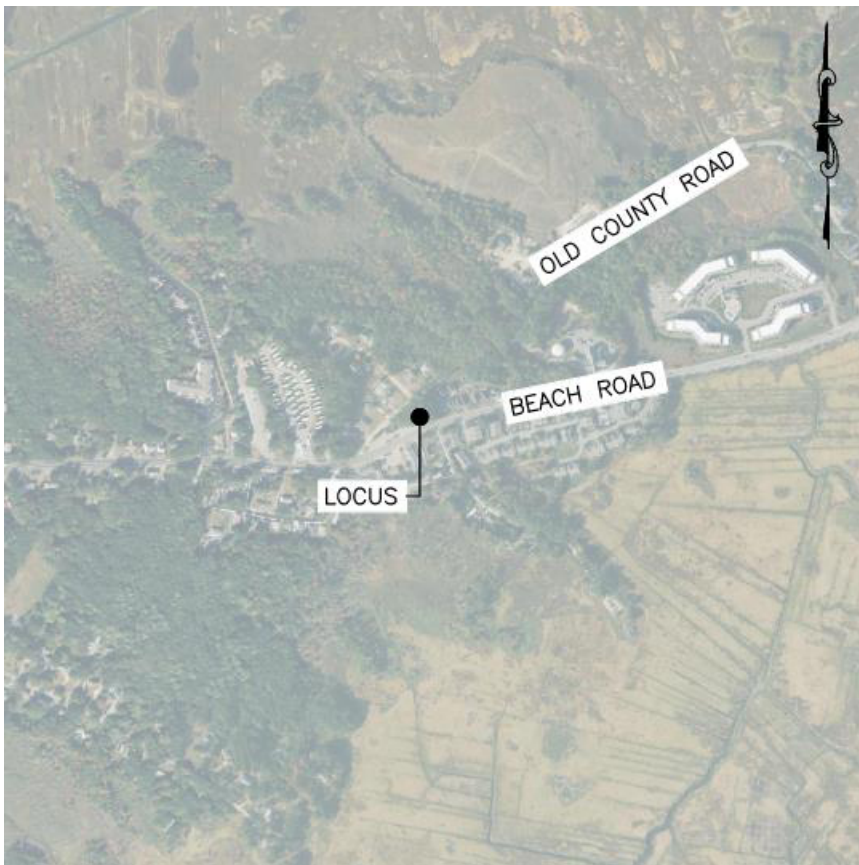


DRAINAGE REPORT

**159 Beach Road
Salisbury, Massachusetts**

CIVIL DESIGN Consultants, Inc.

Survey - Design - Permitting - Construction Administration
344 North Main Street
Andover, MA 01810-2611 Tel: (978) 416-0920



OWNER:

**Edward Foote Jr. & Joanne F. Blais
123 Central Street
Salisbury, MA 01952**

APPLICANT:

**Larkin Real Estate Group, Inc
383 Main Street
Medfield, MA 02052**

SUBMITTED TO:

**Salisbury Planning Board
5 Beach Road
Salisbury, MA 01952**

ISSUED:

**June 14, 2022
Revised: December 27, 2022**

DRAINAGE REPORT

Drainage Narrative

TAB 1

Existing Conditions

TAB 2

- 2-Yr Storm Event
- 10-Yr Storm Event
- 25-Yr Storm Event
- 50-Yr Storm Event
- 100-Yr Storm Event

Proposed Conditions

TAB 3

- 2-Yr Storm Event
- 10-Yr Storm Event
- 25-Yr Storm Event
- 50-Yr Storm Event
- 100-Yr Storm Event

Supplemental Information

TAB 4

- Check List for Stormwater Report
- Stormwater Management Calculations
- Groundwater Mounding Analysis
- Operations and Maintenance Plan
- NRCS Soil Map
- Soil Logs
- Existing Watershed Plan
- Proposed Watershed Plan

DRAINAGE REPORT

159 Beach Road

Salisbury, Massachusetts

TAB 1

DRAINAGE REPORT

159 Beach Road
Salisbury, Massachusetts

PROJECT DESCRIPTION

The applicant proposes to re-develop 159 Beach Road in Salisbury, MA into a 19-unit residential development, with 9 duplexes and a single-family dwelling. The parcel totals approximately 30,310-SF and contains an existing ice cream stand with paved parking and associated appurtenances. The project consists of construction of 19 units, consisting of 9 duplex dwellings and one single-family dwelling, along with associated infrastructure including driveways, landscaping, drainage facilities, and utilities. Project plans entitled *Site Development Plans for 159 Beach Road*, last revised December 27, 2022, have been prepared by this office and provided for your review. These plans illustrate the proposal in detail including zoning, easements, construction details, and provisions for utilities. Drainage will be collected and routed through best management practices sized to address the MADEP Stormwater Management Standards.

SITE DESCRIPTION

The total lot area of the project site is approximately 30,310-SF and provides frontage on Beach Road and Old County Road. The site is generally flat, with an elevation ranging between 10-FT and 14-FT across the site.

According to the Natural Resource Conservation Service Soil Survey for Middlesex County, Massachusetts soils on the site are mapped as containing Wareham Loamy Sand and Windsor Loamy Sand, both in Hydrologic Soil Group A.

SURFACE DRAINAGE

Pre-Development Condition

The pre-development condition consists of two watershed areas contributing to two design points. Design Point #1 (DP-1) receives runoff from drainage area EWA-1 and consists of overland flow to the south towards Beach Road. Design Point #2 (DP-2) receives runoff from drainage area EWA-2 and consists of overland flow to the north and east, towards the abutting properties along Old County Road and Beach Road. Contributing areas to the Design Points are detailed in the following Table 1.

TABLE 1: EXISTING WATERSHED DESIGN POINT DETAILS

DESIGN POINT	AREA NAME	AREA (SF)	T _c (min.)	CN
DP-1	EWA-1	15,898	14.4	73
DP-2	EWA-2	14,413	16.0	30

Post-Development Condition

The proposed project includes the construction of 9 duplex dwellings and one single-family dwelling. Other components include construction of a new driveways along with landscaping, drainage, utilities, and associated appurtenances. The development is less than one acre, therefore, the system has been designed to meet the requirements of the Town of Salisbury Planning Board Rules and Regulations Section III.c.5 – Drainage.

Drainage will be routed through porous pavement sections and an infiltration trench sized to capture and infiltrate runoff from roofs and driveways for up to and including the 100-year storm event. The drainage design results in all impervious area being captured and treated. This provides a net benefit compared to the existing condition, which had approximately 10,000-SF of untreated impervious area.

DRAINAGE REPORT

159 Beach Road
Salisbury, Massachusetts

The proposed construction results in five watersheds discharging to two Design Points. DP-1 receives flow from PWA-1, which consists of overland flow towards Beach Road. DP-2 receives flow from PWA-2A, PWA-2B, PWA-2C, and PWA-2D. PWA-2A consists of overland flow towards an infiltration trench. The design points are summarized in Table 2 below.

TABLE 2: PROPOSED WATERSHED DESIGN POINT DETAILS

DESIGN POINT	AREA NAME	AREA (SF)	Tc (min.)	CN
DP-1	PWA-1	5,086	6.0	39
DP-2	PWA-2A	1,799	6.0	88
	PWA-2B	7,611	6.0	87
	PWA-2C	12,527	6.0	89
	PWA-2D	3,384	6.0	39

Peak Discharge Comparison

As illustrated in the following tables, the impact of the proposed improvements has been mitigated through the use of infiltration trenches for up to and including the 100-year, 24-hour storm event.

Design Point #1

Peak Flow:

	2-YR (3.1-IN)	10-YR (4.5-IN)	25-YR (5.3-IN)	50-YR (5.9-IN)	100-YR (6.5-IN)
	CFS	CFS	CFS	CFS	CFS
Pre-Development	0.3	0.6	0.8	1.0	1.1
Post-Development	0.0	0.0	0.0	0.0	0.0

Design Point #2

Peak Flow:

	2-YR (3.1-IN)	10-YR (4.5-IN)	25-YR (5.3-IN)	50-YR (5.9-IN)	100-YR (6.5-IN)
	CFS	CFS	CFS	CFS	CFS
Pre-Development	0.0	0.0	0.0	0.0	0.0
Post-Development	0.0	0.0	0.0	0.0	0.0

DRAINAGE REPORT

159 Beach Road
Salisbury, Massachusetts

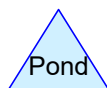
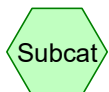
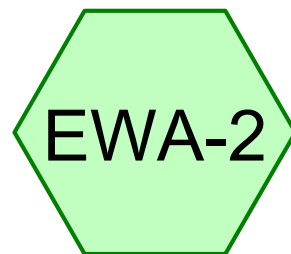
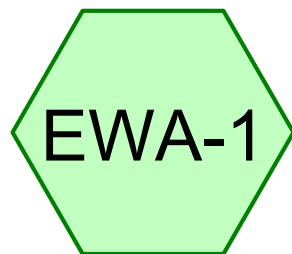
METHODOLOGY

Drainage calculations were performed using the computer program HydroCAD by HydroCAD Software Solutions, LLC based upon Technical Release 20 (TR-20), developed by the NRCS, formerly the Soils Conservation Service. Drainage calculations were prepared for the 2-YR, 10-YR, 25-YR, 50-YR, and 100-YR Type III 24-hour storm events. Rainfall data corresponds with National Weather Service Technical Paper 40 (TP-40) used in Technical Release 55 (TR-55). Curve numbers were generated using the information provided in TR-55 and the SCS Soils Survey.

DRAINAGE REPORT

159 Beach Road
Salisbury, Massachusetts

TAB 2



Project Notes

Rainfall events imported from "19-6813 Pre-Development.hcp"

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEWA-1:

Runoff Area=15,898 sf 62.93% Impervious Runoff Depth=0.92"

Flow Length=130' Slope=0.0200 '/' Tc=14.4 min CN=73 Runoff=0.3 cfs 0.028 af

SubcatchmentEWA-2:

Runoff Area=14,413 sf 0.00% Impervious Runoff Depth=0.00"

Flow Length=200' Slope=0.0200 '/' Tc=16.0 min CN=30 Runoff=0.0 cfs 0.000 af

Total Runoff Area = 0.696 ac Runoff Volume = 0.028 af Average Runoff Depth = 0.48"
67.00% Pervious = 0.466 ac 33.00% Impervious = 0.230 ac

Summary for Subcatchment EWA-1:

Runoff = 0.3 cfs @ 12.22 hrs, Volume= 0.028 af, Depth= 0.92"

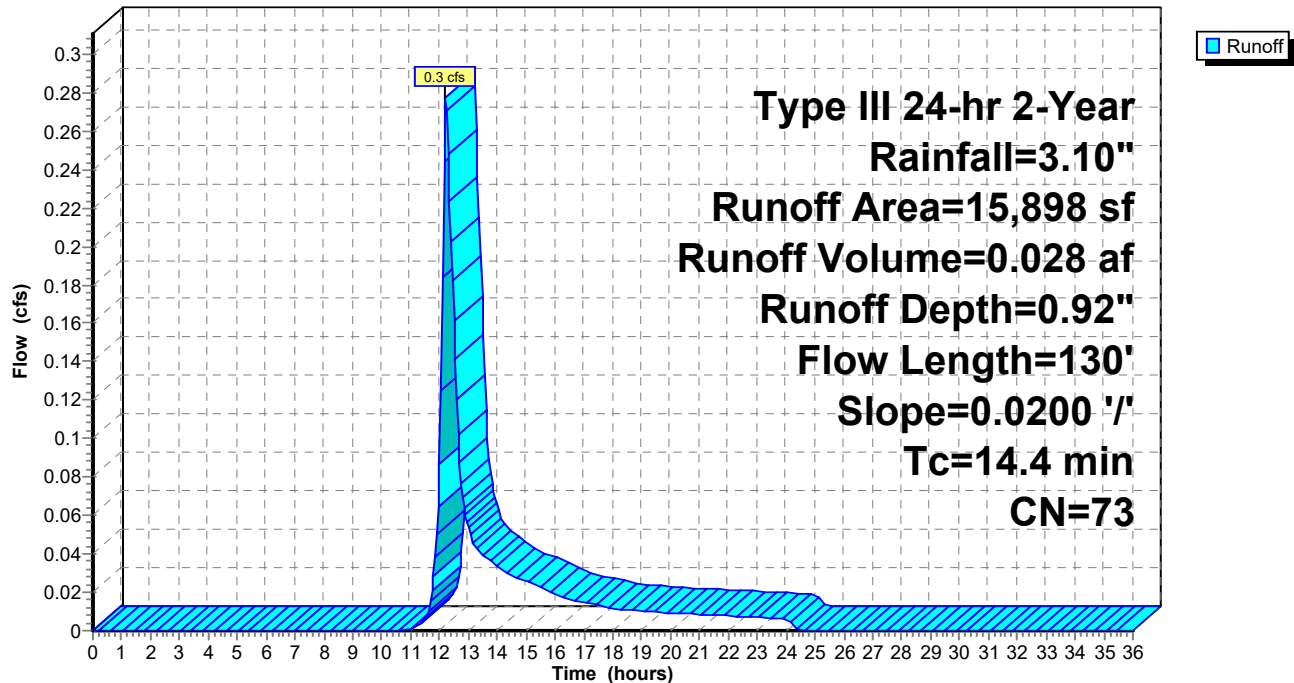
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
1,234	39	>75% Grass cover, Good, HSG A
1,869	98	Roofs, HSG A
8,135	98	Paved parking, HSG A
4,660	30	Woods, Good, HSG A
15,898	73	Weighted Average
5,894		37.07% Pervious Area
10,004		62.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
1.9	80	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
14.4	130	Total			

Subcatchment EWA-1:

Hydrograph



Summary for Subcatchment EWA-2:

[45] Hint: Runoff=Zero

Runoff = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

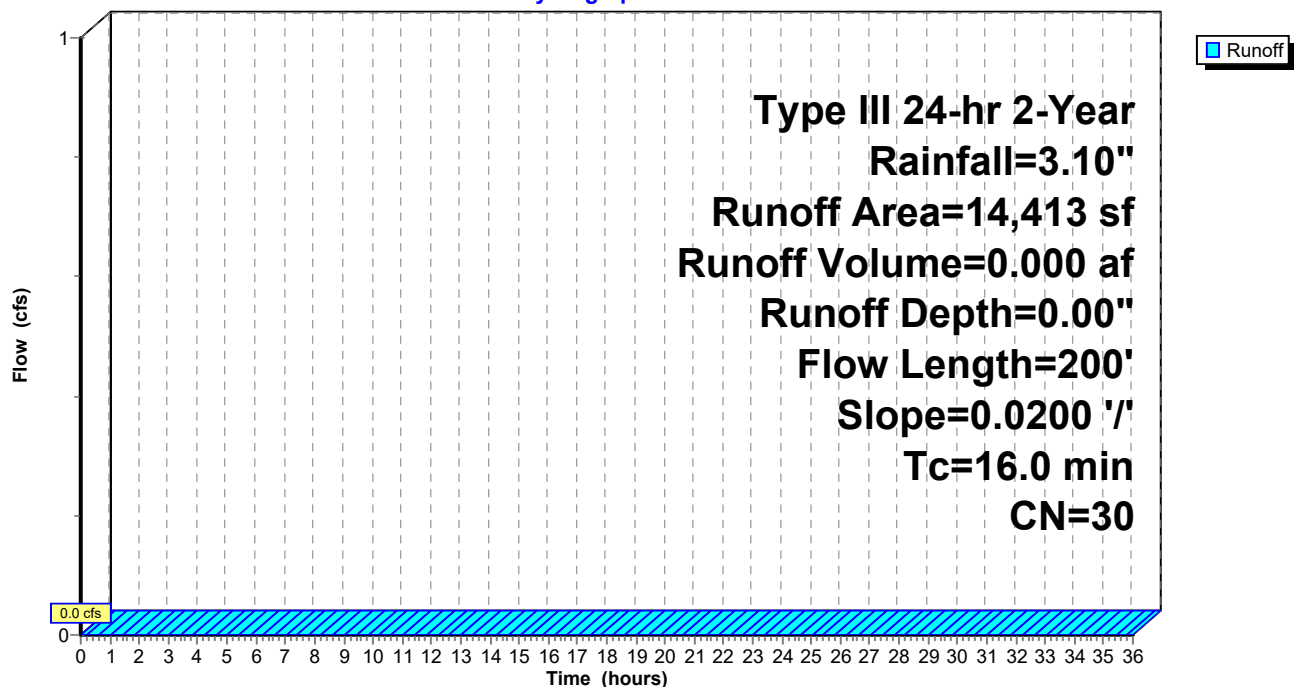
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
299	39	>75% Grass cover, Good, HSG A
0	98	Roofs, HSG A
0	98	Paved parking, HSG A
14,114	30	Woods, Good, HSG A
14,413	30	Weighted Average
14,413		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		Sheet Flow,
					Woods: Light underbrush n= 0.400 P2= 3.10"
3.5	150	0.0200	0.71		Shallow Concentrated Flow,
					Woodland Kv= 5.0 fps
16.0	200	Total			

Subcatchment EWA-2:

Hydrograph



Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEWA-1:

Runoff Area=15,898 sf 62.93% Impervious Runoff Depth=1.90"

Flow Length=130' Slope=0.0200 '/' Tc=14.4 min CN=73 Runoff=0.6 cfs 0.058 af

SubcatchmentEWA-2:

Runoff Area=14,413 sf 0.00% Impervious Runoff Depth=0.00"

Flow Length=200' Slope=0.0200 '/' Tc=16.0 min CN=30 Runoff=0.0 cfs 0.000 af

Total Runoff Area = 0.696 ac Runoff Volume = 0.058 af Average Runoff Depth = 0.99"
67.00% Pervious = 0.466 ac 33.00% Impervious = 0.230 ac

Summary for Subcatchment EWA-1:

Runoff = 0.6 cfs @ 12.21 hrs, Volume= 0.058 af, Depth= 1.90"

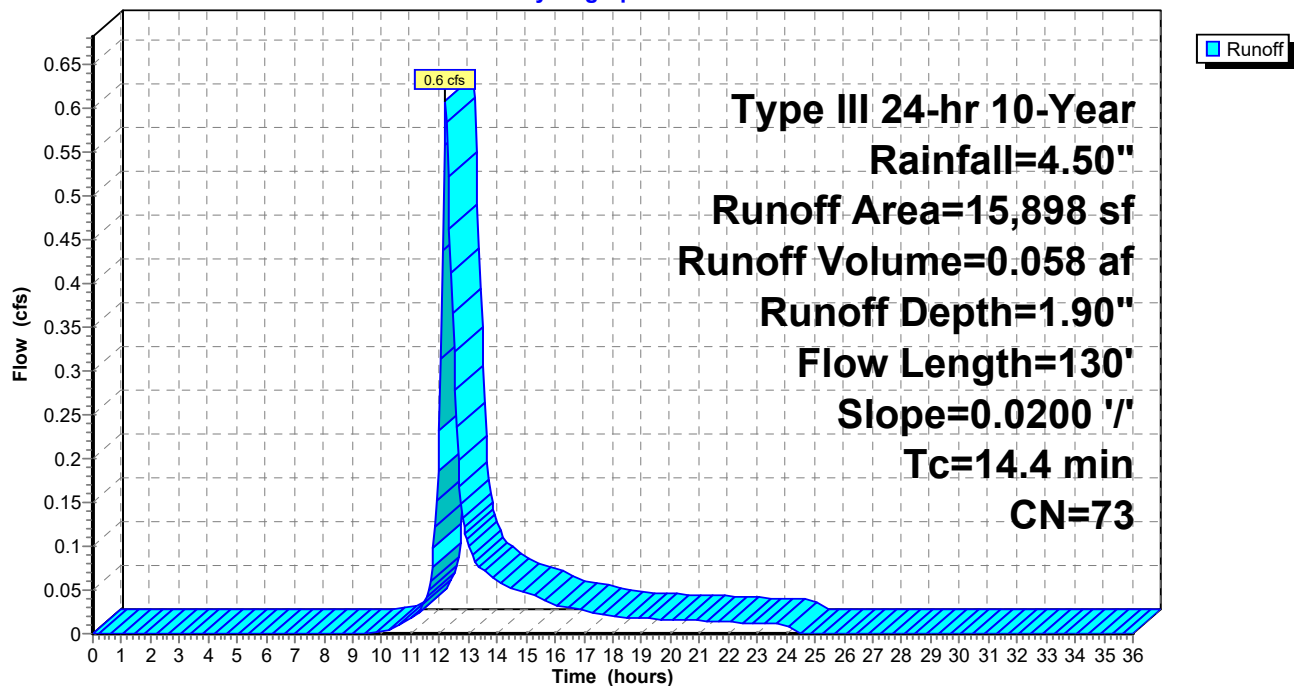
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,234	39	>75% Grass cover, Good, HSG A
1,869	98	Roofs, HSG A
8,135	98	Paved parking, HSG A
4,660	30	Woods, Good, HSG A
15,898	73	Weighted Average
5,894		37.07% Pervious Area
10,004		62.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
1.9	80	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
14.4	130	Total			

Subcatchment EWA-1:

Hydrograph



Summary for Subcatchment EWA-2:

[45] Hint: Runoff=Zero

Runoff = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

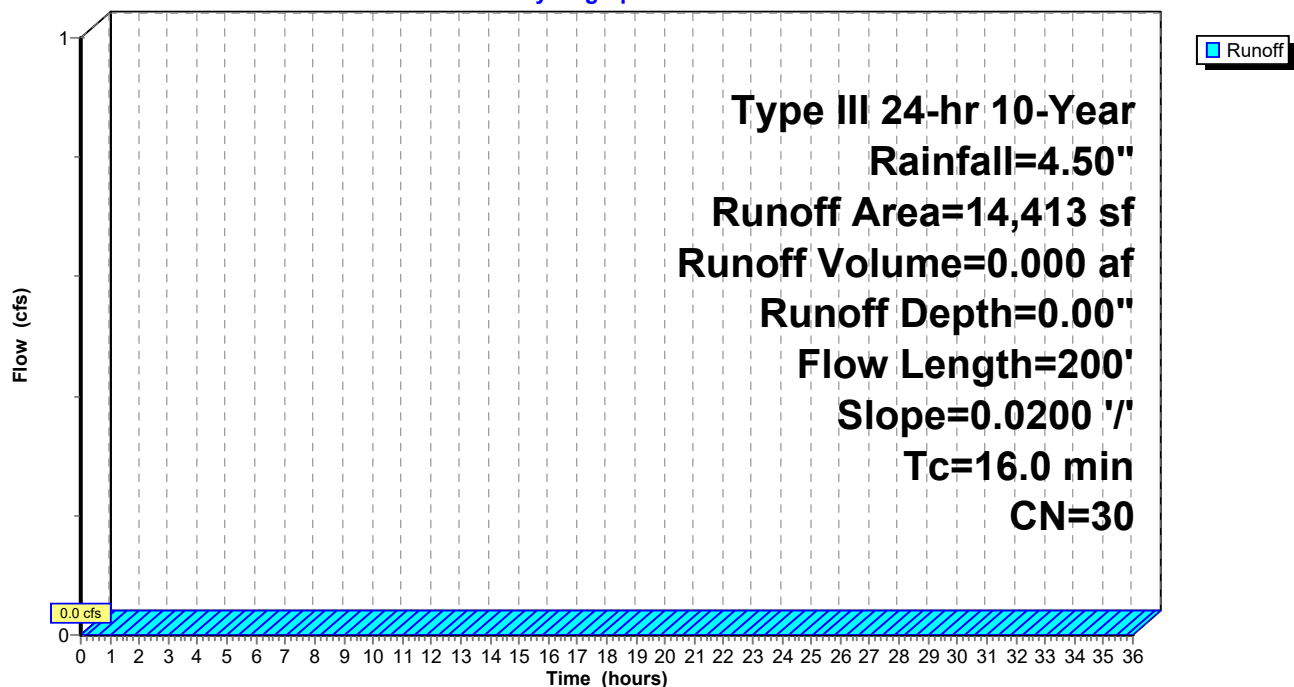
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
299	39	>75% Grass cover, Good, HSG A
0	98	Roofs, HSG A
0	98	Paved parking, HSG A
14,114	30	Woods, Good, HSG A
14,413	30	Weighted Average
14,413		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
3.5	150	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
16.0	200	Total			

Subcatchment EWA-2:

Hydrograph



Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEWA-1:

Runoff Area=15,898 sf 62.93% Impervious Runoff Depth=2.52"

Flow Length=130' Slope=0.0200 '/' Tc=14.4 min CN=73 Runoff=0.8 cfs 0.077 af

SubcatchmentEWA-2:

Runoff Area=14,413 sf 0.00% Impervious Runoff Depth=0.02"

Flow Length=200' Slope=0.0200 '/' Tc=16.0 min CN=30 Runoff=0.0 cfs 0.000 af

Total Runoff Area = 0.696 ac Runoff Volume = 0.077 af Average Runoff Depth = 1.33"
67.00% Pervious = 0.466 ac 33.00% Impervious = 0.230 ac

Summary for Subcatchment EWA-1:

Runoff = 0.8 cfs @ 12.21 hrs, Volume= 0.077 af, Depth= 2.52"

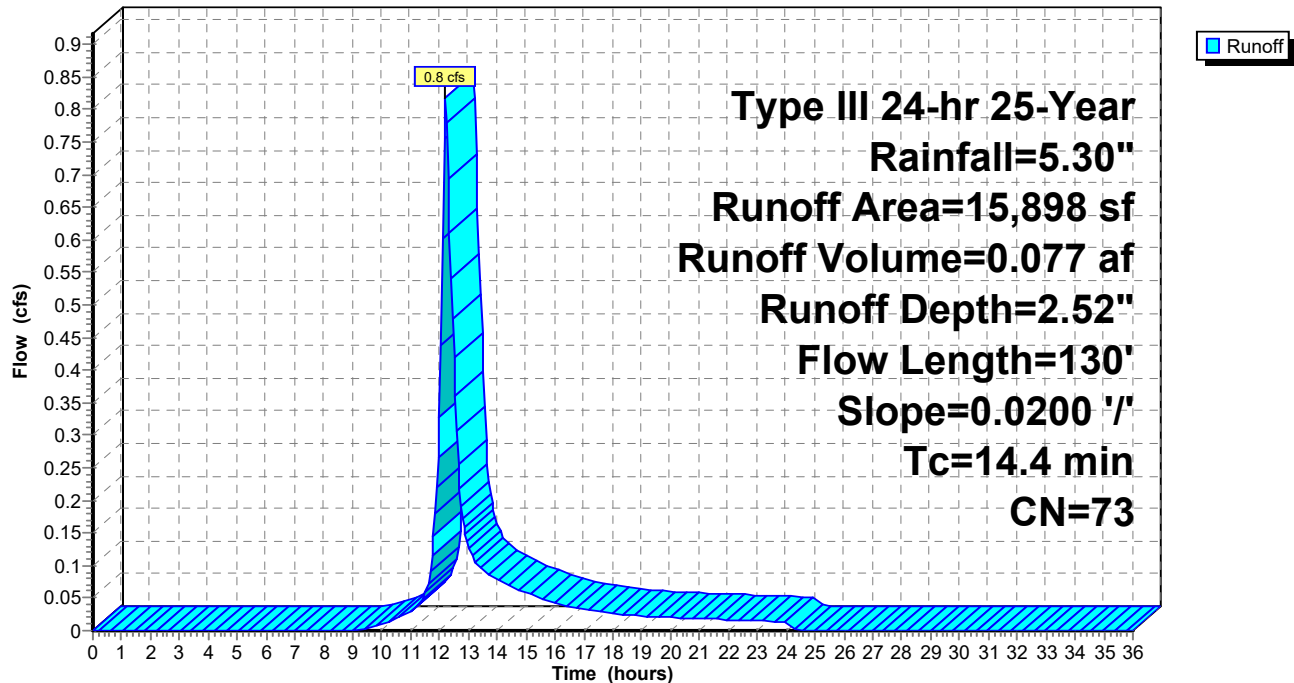
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
1,234	39	>75% Grass cover, Good, HSG A
1,869	98	Roofs, HSG A
8,135	98	Paved parking, HSG A
4,660	30	Woods, Good, HSG A
15,898	73	Weighted Average
5,894		37.07% Pervious Area
10,004		62.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
1.9	80	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
14.4	130	Total			

Subcatchment EWA-1:

Hydrograph



Summary for Subcatchment EWA-2:

Runoff = 0.0 cfs @ 22.16 hrs, Volume= 0.000 af, Depth= 0.02"

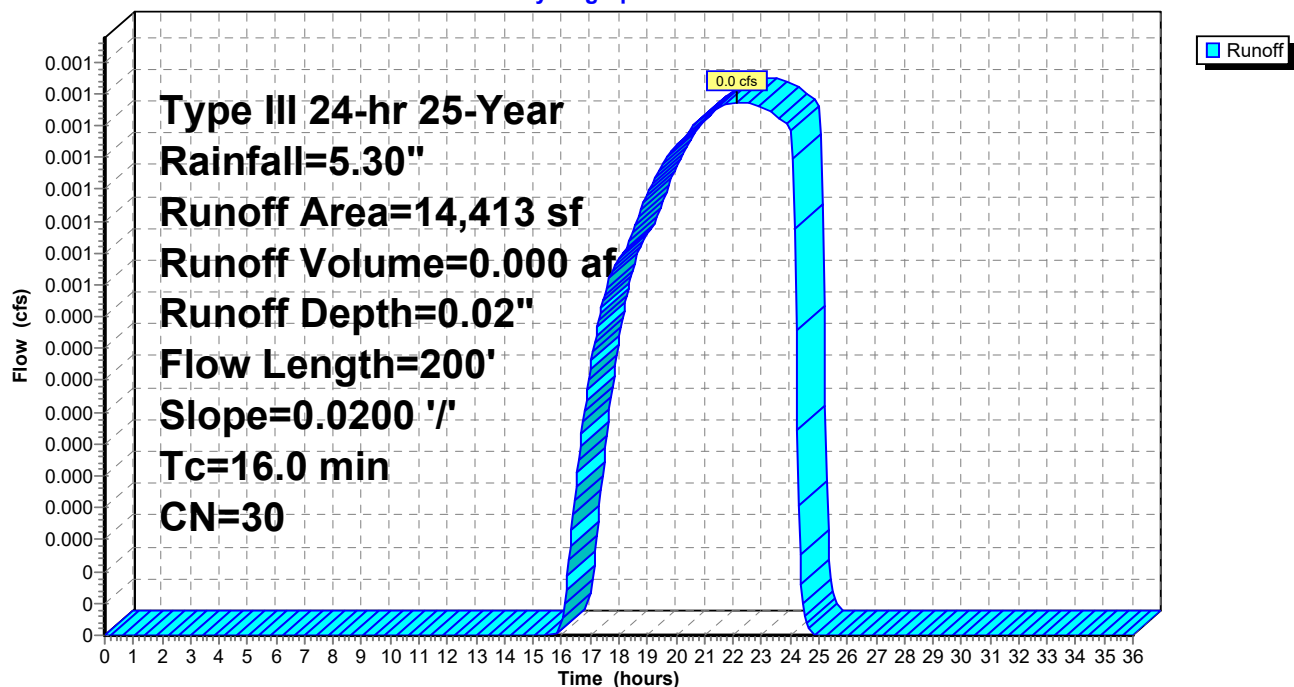
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
299	39	>75% Grass cover, Good, HSG A
0	98	Roofs, HSG A
0	98	Paved parking, HSG A
14,114	30	Woods, Good, HSG A
14,413	30	Weighted Average
14,413		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
3.5	150	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
16.0	200	Total			

Subcatchment EWA-2:

Hydrograph



Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEWA-1:

Runoff Area=15,898 sf 62.93% Impervious Runoff Depth=3.01"

Flow Length=130' Slope=0.0200 '/' Tc=14.4 min CN=73 Runoff=1.0 cfs 0.091 af

SubcatchmentEWA-2:

Runoff Area=14,413 sf 0.00% Impervious Runoff Depth=0.06"

Flow Length=200' Slope=0.0200 '/' Tc=16.0 min CN=30 Runoff=0.0 cfs 0.002 af

Total Runoff Area = 0.696 ac Runoff Volume = 0.093 af Average Runoff Depth = 1.61"
67.00% Pervious = 0.466 ac 33.00% Impervious = 0.230 ac

Summary for Subcatchment EWA-1:

Runoff = 1.0 cfs @ 12.20 hrs, Volume= 0.091 af, Depth= 3.01"

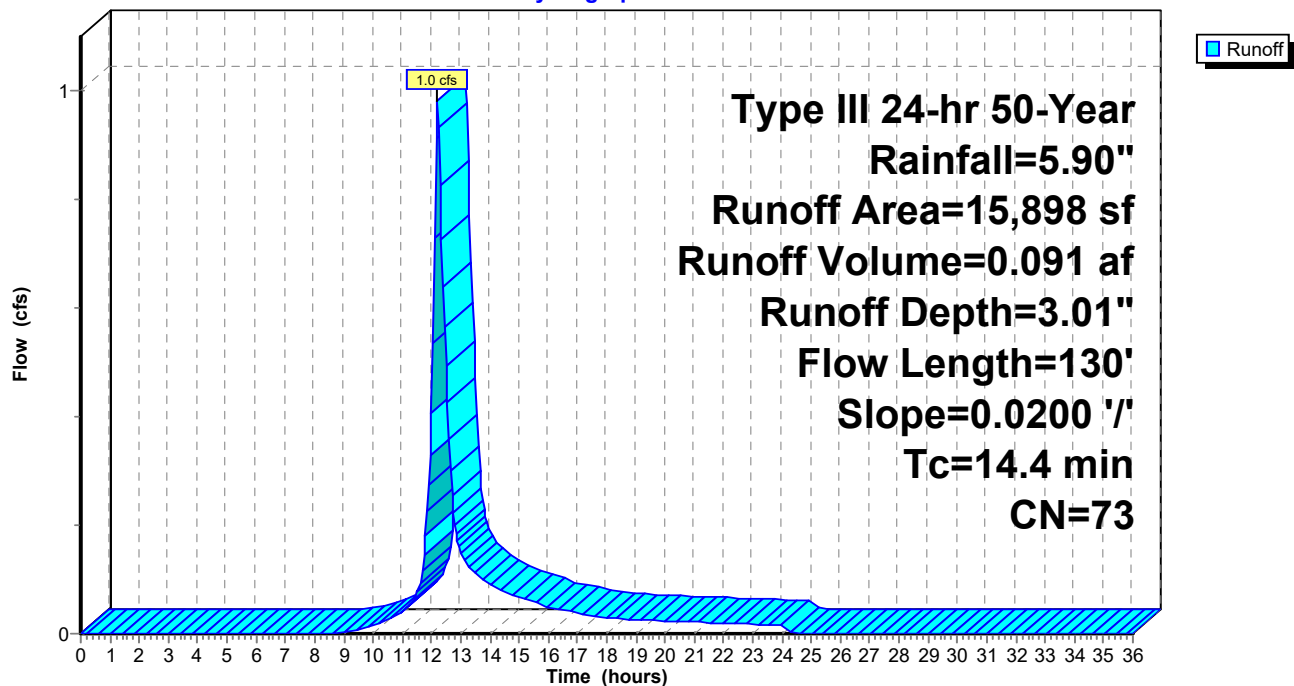
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-Year Rainfall=5.90"

Area (sf)	CN	Description
1,234	39	>75% Grass cover, Good, HSG A
1,869	98	Roofs, HSG A
8,135	98	Paved parking, HSG A
4,660	30	Woods, Good, HSG A
15,898	73	Weighted Average
5,894		37.07% Pervious Area
10,004		62.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
1.9	80	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
14.4	130	Total			

Subcatchment EWA-1:

Hydrograph



Summary for Subcatchment EWA-2:

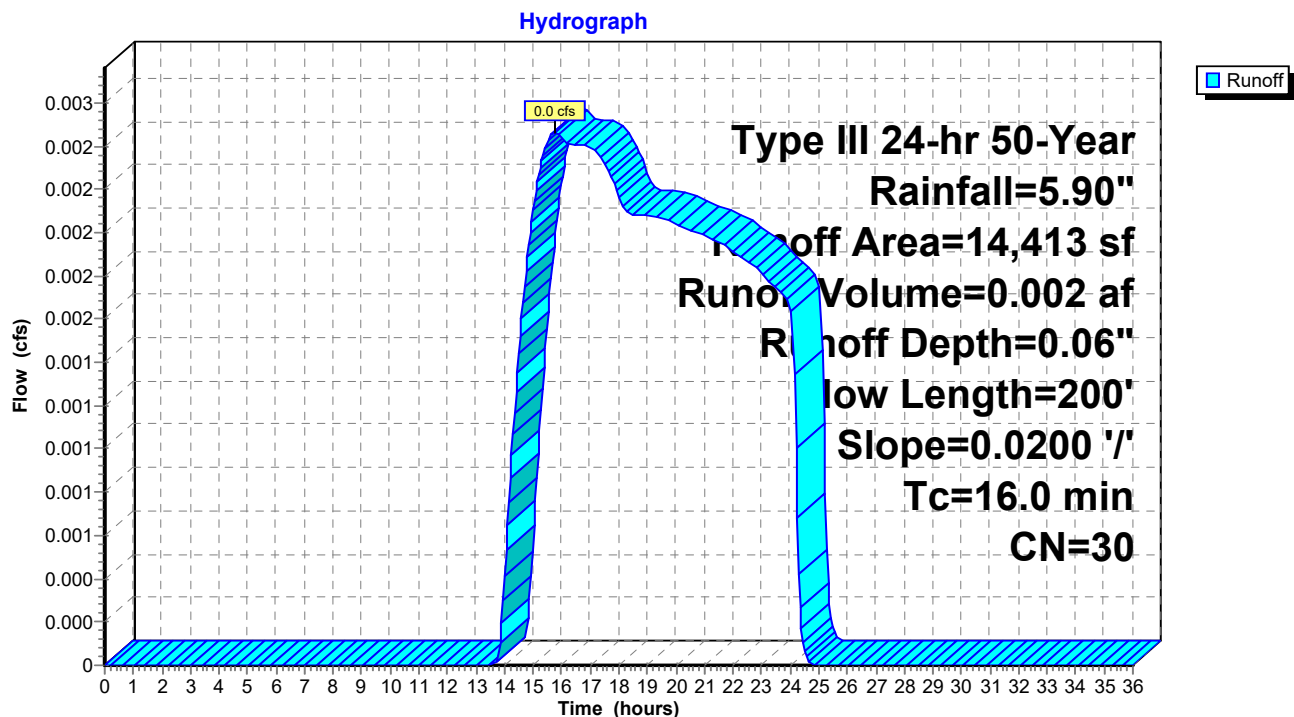
Runoff = 0.0 cfs @ 15.79 hrs, Volume= 0.002 af, Depth= 0.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Type III 24-hr 50-Year Rainfall=5.90"

Area (sf)	CN	Description
299	39	>75% Grass cover, Good, HSG A
0	98	Roofs, HSG A
0	98	Paved parking, HSG A
14,114	30	Woods, Good, HSG A
14,413	30	Weighted Average
14,413		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
3.5	150	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
16.0	200	Total			

Subcatchment EWA-2:

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEWA-1:

Runoff Area=15,898 sf 62.93% Impervious Runoff Depth=3.51"

Flow Length=130' Slope=0.0200 '/' Tc=14.4 min CN=73 Runoff=1.1 cfs 0.107 af

SubcatchmentEWA-2:

Runoff Area=14,413 sf 0.00% Impervious Runoff Depth=0.13"

Flow Length=200' Slope=0.0200 '/' Tc=16.0 min CN=30 Runoff=0.0 cfs 0.004 af

Total Runoff Area = 0.696 ac Runoff Volume = 0.110 af Average Runoff Depth = 1.90"
67.00% Pervious = 0.466 ac 33.00% Impervious = 0.230 ac

Summary for Subcatchment EWA-1:

Runoff = 1.1 cfs @ 12.20 hrs, Volume= 0.107 af, Depth= 3.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

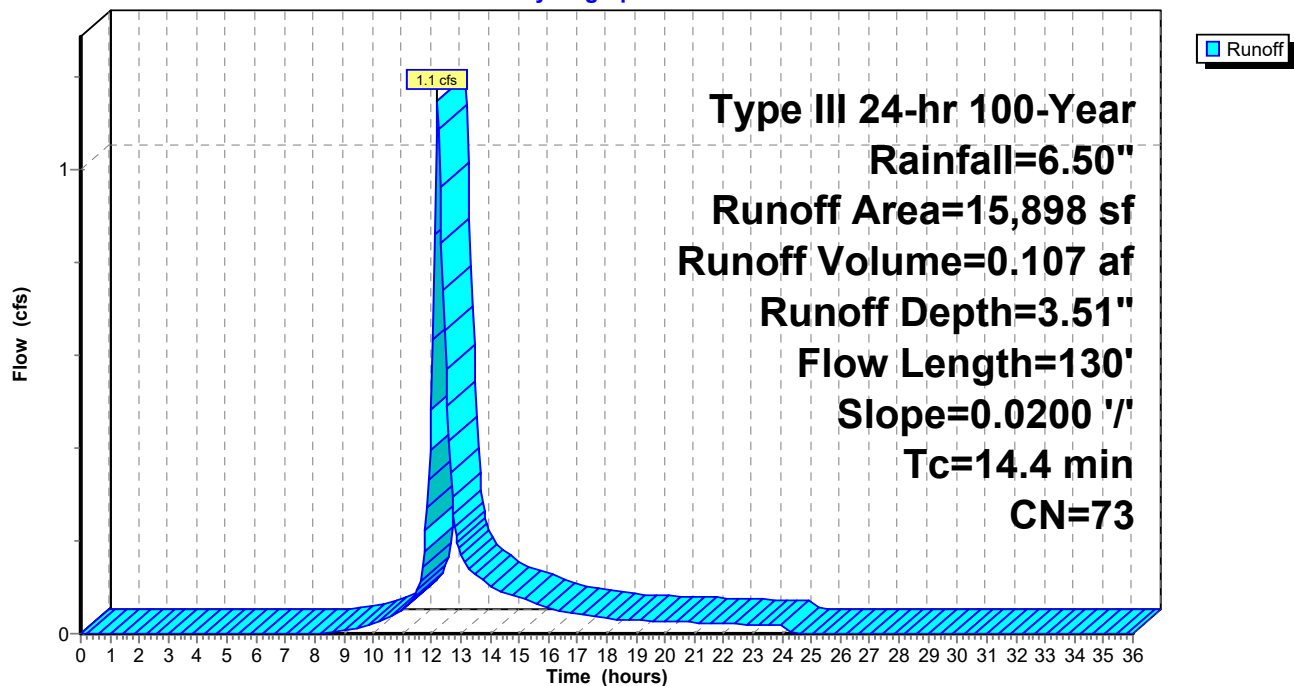
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
1,234	39	>75% Grass cover, Good, HSG A
1,869	98	Roofs, HSG A
8,135	98	Paved parking, HSG A
4,660	30	Woods, Good, HSG A
15,898	73	Weighted Average
5,894		37.07% Pervious Area
10,004		62.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
1.9	80	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
14.4	130	Total			

Subcatchment EWA-1:

Hydrograph



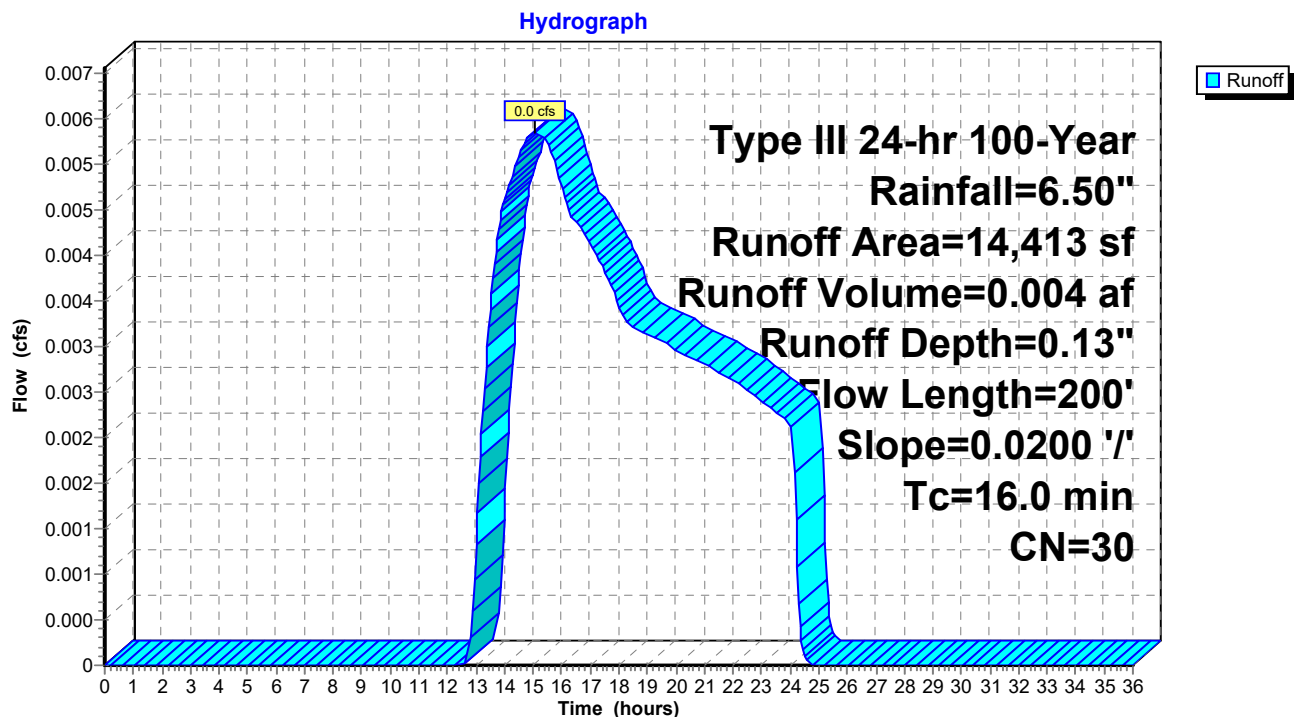
Summary for Subcatchment EWA-2:

Runoff = 0.0 cfs @ 15.06 hrs, Volume= 0.004 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
299	39	>75% Grass cover, Good, HSG A
0	98	Roofs, HSG A
0	98	Paved parking, HSG A
14,114	30	Woods, Good, HSG A
14,413	30	Weighted Average
14,413		100.00% Pervious Area

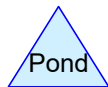
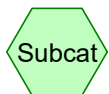
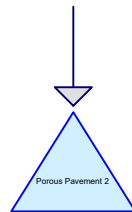
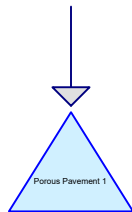
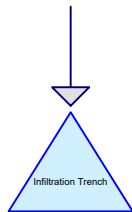
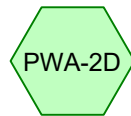
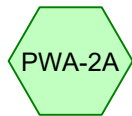
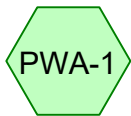
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
3.5	150	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
16.0	200	Total			

Subcatchment EWA-2:

DRAINAGE REPORT

159 Beach Road
Salisbury, Massachusetts

TAB 3



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

Printed 12/27/2022

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.281	39	>75% Grass cover, Good, HSG A (PWA-1, PWA-2A, PWA-2B, PWA-2C, PWA-2D)
0.146	98	Paved parking, HSG A (PWA-2A, PWA-2B, PWA-2C)
0.271	98	Roofs, HSG A (PWA-2A, PWA-2B, PWA-2C)
0.698	74	TOTAL AREA

21-10254 - Post-R3*Type III 24-hr 2-Year Rainfall=3.10"*

Prepared by Civil Design Consultants, Inc.

Printed 12/27/2022

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Page 3

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPWA-1: Runoff Area=5,086 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.0 cfs 0.000 af

SubcatchmentPWA-2A: Runoff Area=1,799 sf 83.10% Impervious Runoff Depth=1.91"
Tc=6.0 min CN=88 Runoff=0.1 cfs 0.007 af

SubcatchmentPWA-2B: Runoff Area=7,611 sf 81.01% Impervious Runoff Depth=1.83"
Tc=6.0 min CN=87 Runoff=0.4 cfs 0.027 af

SubcatchmentPWA-2C: Runoff Area=12,526 sf 83.91% Impervious Runoff Depth=1.99"
Tc=6.0 min CN=89 Runoff=0.7 cfs 0.048 af

SubcatchmentPWA-2D: Runoff Area=3,384 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.0 cfs 0.000 af

Pond Infiltration Trench: Peak Elev=10.45' Storage=46 cf Inflow=0.1 cfs 0.007 af
Outflow=0.0 cfs 0.007 af

Pond Porous Pavement 1: Peak Elev=9.50' Storage=8 cf Inflow=0.4 cfs 0.027 af
Outflow=0.4 cfs 0.027 af

Pond Porous Pavement 2: Peak Elev=9.50' Storage=14 cf Inflow=0.7 cfs 0.048 af
Outflow=0.7 cfs 0.048 af

Total Runoff Area = 0.698 ac Runoff Volume = 0.081 af Average Runoff Depth = 1.39"
40.24% Pervious = 0.281 ac 59.76% Impervious = 0.417 ac

21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 2-Year Rainfall=3.10"

Printed 12/27/2022

Page 4

Summary for Subcatchment PWA-1:

[45] Hint: Runoff=Zero

Runoff = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

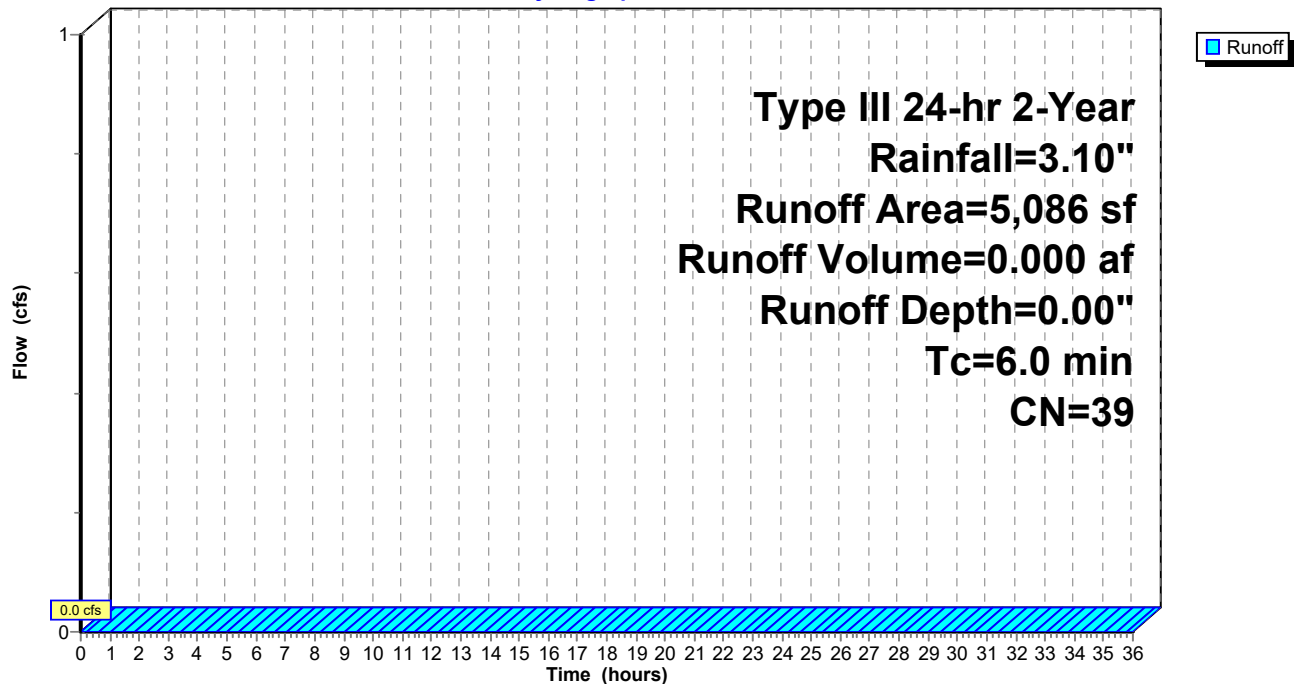
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
5,086	39	>75% Grass cover, Good, HSG A
0	98	Roofs, HSG A
0	98	Paved parking, HSG A
0	30	Woods, Good, HSG A
5,086	39	Weighted Average
5,086		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-1:

Hydrograph



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 2-Year Rainfall=3.10"

Printed 12/27/2022

Page 5

Summary for Subcatchment PWA-2A:

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.007 af, Depth= 1.91"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

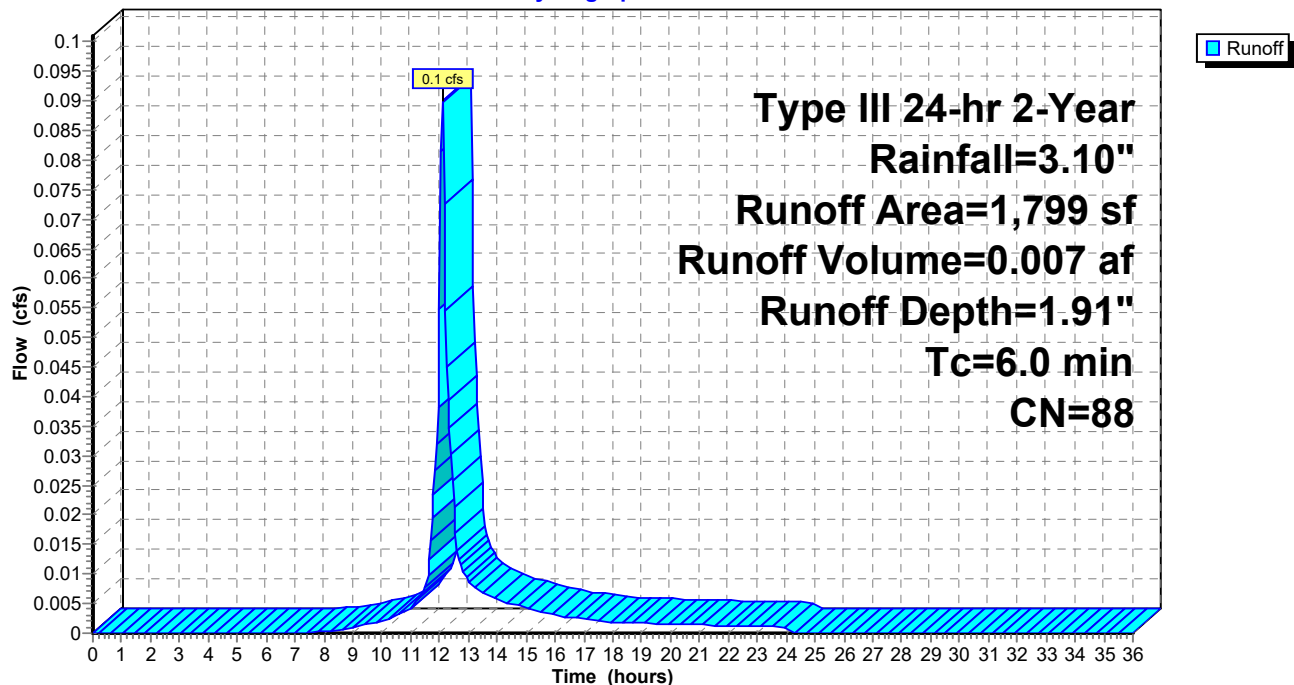
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
828	98	Roofs, HSG A
667	98	Paved parking, HSG A
304	39	>75% Grass cover, Good, HSG A
1,799	88	Weighted Average
304		16.90% Pervious Area
1,495		83.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-2A:

Hydrograph



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 2-Year Rainfall=3.10"

Printed 12/27/2022

Page 6

Summary for Subcatchment PWA-2B:

Runoff = 0.4 cfs @ 12.09 hrs, Volume= 0.027 af, Depth= 1.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

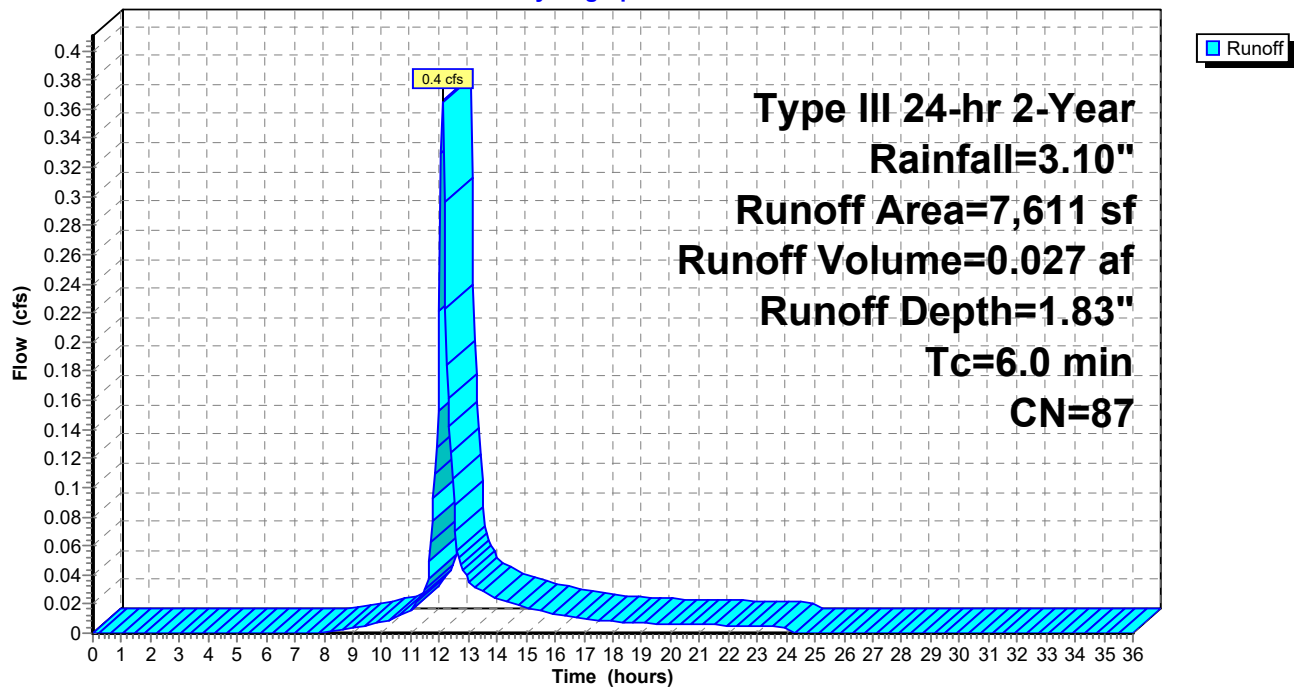
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,936	98	Roofs, HSG A
2,230	98	Paved parking, HSG A
1,445	39	>75% Grass cover, Good, HSG A
7,611	87	Weighted Average
1,445		18.99% Pervious Area
6,166		81.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-2B:

Hydrograph



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 2-Year Rainfall=3.10"

Printed 12/27/2022

Page 7

Summary for Subcatchment PWA-2C:

Runoff = 0.7 cfs @ 12.09 hrs, Volume= 0.048 af, Depth= 1.99"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

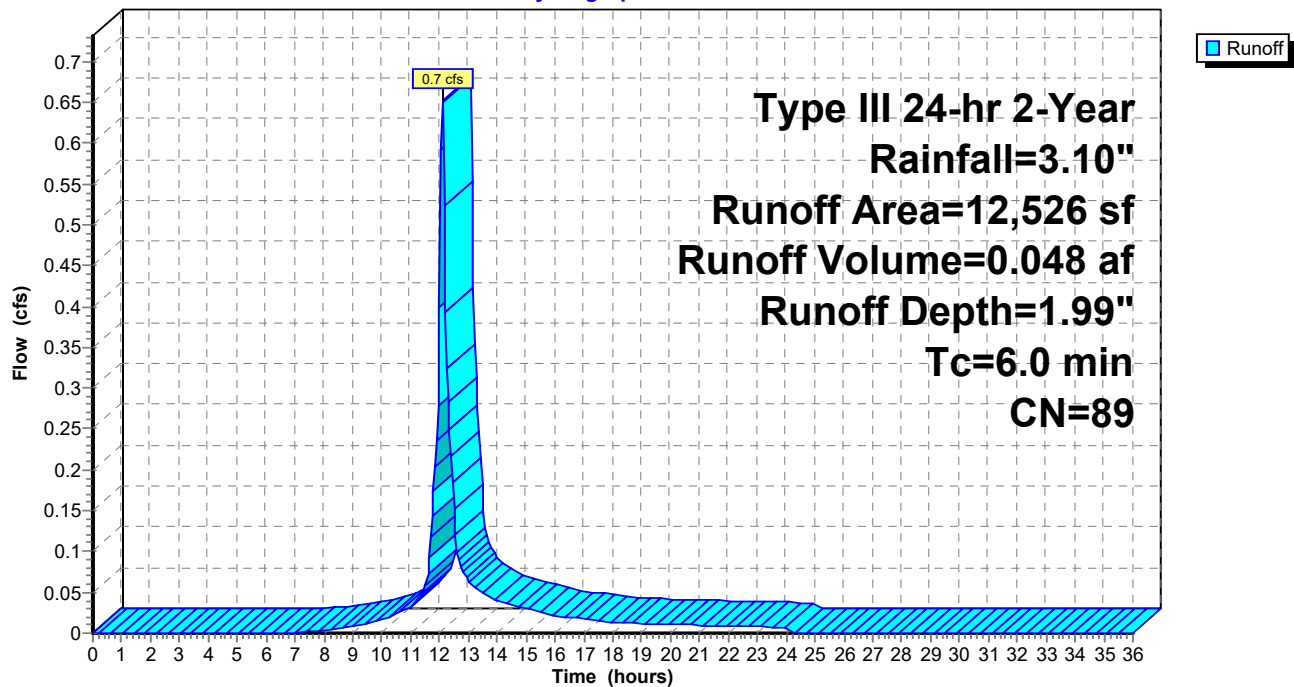
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
7,056	98	Roofs, HSG A
3,454	98	Paved parking, HSG A
2,016	39	>75% Grass cover, Good, HSG A
12,526	89	Weighted Average
2,016		16.09% Pervious Area
10,510		83.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-2C:

Hydrograph



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 2-Year Rainfall=3.10"

Printed 12/27/2022

Page 8

Summary for Subcatchment PWA-2D:

[45] Hint: Runoff=Zero

Runoff = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

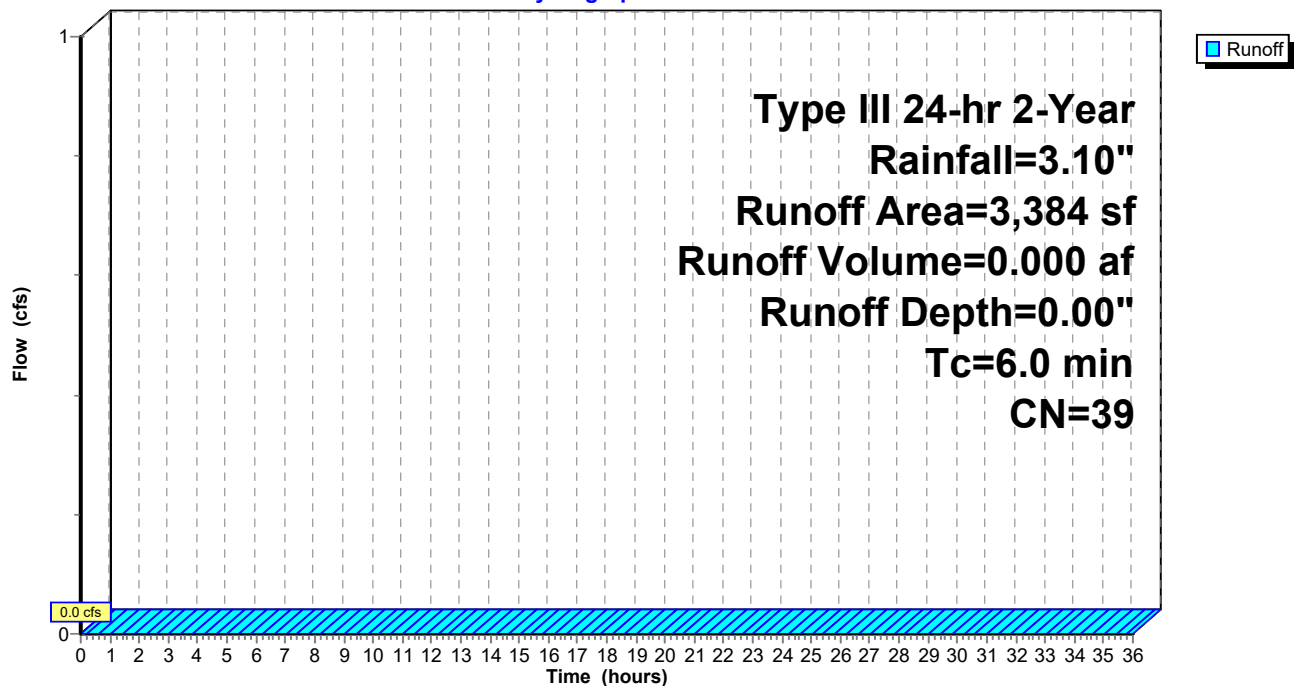
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
3,384	39	>75% Grass cover, Good, HSG A
0	98	Roofs, HSG A
0	98	Paved parking, HSG A
0	30	Woods, Good, HSG A
3,384	39	Weighted Average
3,384		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-2D:

Hydrograph



21-10254 - Post-R3

Type III 24-hr 2-Year Rainfall=3.10"

Prepared by Civil Design Consultants, Inc.

Printed 12/27/2022

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Page 9

Summary for Pond Infiltration Trench:

Inflow Area = 0.041 ac, 83.10% Impervious, Inflow Depth = 1.91" for 2-Year event
 Inflow = 0.1 cfs @ 12.09 hrs, Volume= 0.007 af
 Outflow = 0.0 cfs @ 12.35 hrs, Volume= 0.007 af, Atten= 62%, Lag= 15.8 min
 Discarded = 0.0 cfs @ 12.35 hrs, Volume= 0.007 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 10.45' @ 12.35 hrs Surf.Area= 122 sf Storage= 46 cf

Plug-Flow detention time= 7.8 min calculated for 0.007 af (100% of inflow)
 Center-of-Mass det. time= 7.8 min (824.2 - 816.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	9.50'	172 cf	3.04'W x 40.00'L x 3.88'H Field A 472 cf Overall - 42 cf Embedded = 430 cf x 40.0% Voids
#2A	11.17'	32 cf	ADS N-12 12 x 2 Inside #1 Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf
204 cf			Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	9.50'	8.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 7.50'

Discarded OutFlow Max=0.0 cfs @ 12.35 hrs HW=10.45' (Free Discharge)
 ↑1=Exfiltration (Controls 0.0 cfs)

21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 2-Year Rainfall=3.10"

Printed 12/27/2022

Page 10

Pond Infiltration Trench: - Chamber Wizard Field A**Chamber Model = ADS N-12 12**

Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf

Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf

14.5" Wide + 0.0" Spacing = 14.5" C-C

2 Chambers/Row x 20.00' Long = 40.00' Base Length

1 Rows x 14.5" Wide + 11.0" Side Stone x 2 = 3.04' Base Width

20.0" Base + 14.5" Chamber Height + 12.0" Cover = 3.88' Field Height

2 Chambers x 16.2 cf = 32.4 cf Chamber Storage

2 Chambers x 20.9 cf = 41.9 cf Displacement

471.6 cf Field - 41.9 cf Chambers = 429.8 cf Stone x 40.0% Voids = 171.9 cf Stone Storage

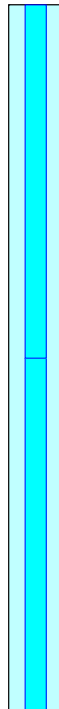
Stone + Chamber Storage = 204.3 cf = 0.005 af

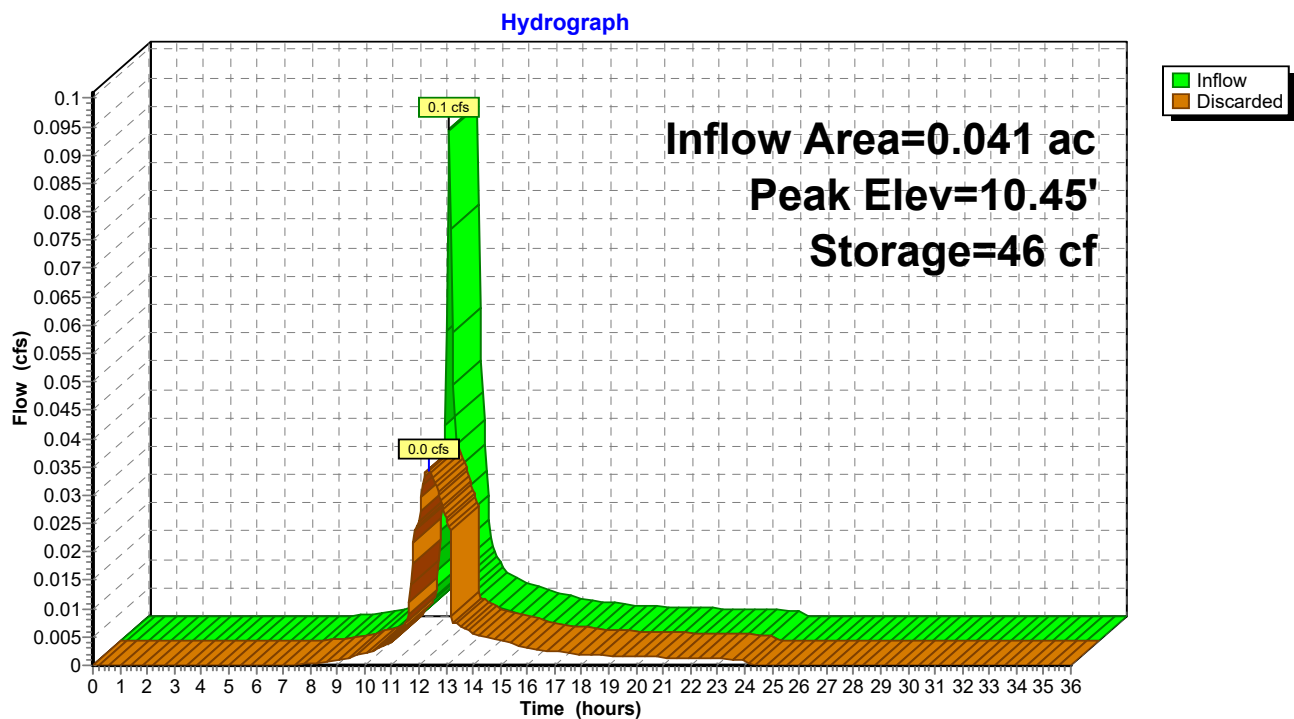
2 Chambers @ \$ 0.00 /ea = \$ 0.00

17.5 cy Field Excavation @ \$ 0.00 /cy = \$ 0.00

15.9 cy Stone @ \$ 0.00 /cy = \$ 0.00

Total Cost = \$ 0.00



Pond Infiltration Trench:

21-10254 - Post-R3

Type III 24-hr 2-Year Rainfall=3.10"

Prepared by Civil Design Consultants, Inc.

Printed 12/27/2022

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Page 12

Summary for Pond Porous Pavement 1:

Inflow Area = 0.175 ac, 81.01% Impervious, Inflow Depth = 1.83" for 2-Year event
 Inflow = 0.4 cfs @ 12.09 hrs, Volume= 0.027 af
 Outflow = 0.4 cfs @ 12.10 hrs, Volume= 0.027 af, Atten= 0%, Lag= 0.4 min
 Discarded = 0.4 cfs @ 12.10 hrs, Volume= 0.027 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 9.50' @ 12.10 hrs Surf.Area= 2,712 sf Storage= 8 cf

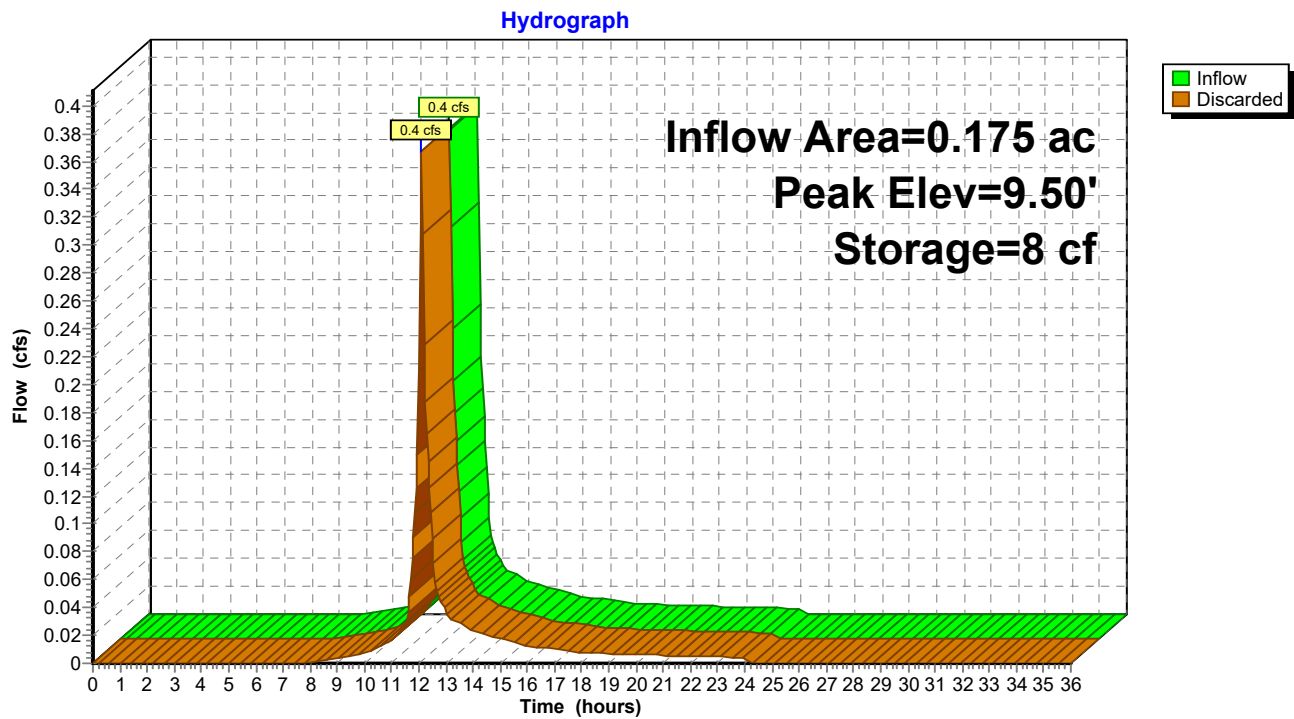
Plug-Flow detention time= 0.3 min calculated for 0.027 af (100% of inflow)
 Center-of-Mass det. time= 0.3 min (820.6 - 820.2)

Volume	Invert	Avail.Storage	Storage Description	
#1	9.49'	2,086 cf	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
9.49	2,712	0.0	0	0
9.50	2,712	40.0	11	11
10.25	2,712	40.0	814	824
10.26	2,712	30.0	8	833
11.25	2,712	30.0	805	1,638
11.26	2,712	40.0	11	1,649
11.58	2,712	40.0	347	1,996
11.59	2,712	10.0	3	1,999
11.91	2,712	10.0	87	2,086

Device	Routing	Invert	Outlet Devices
#1	Discarded	9.49'	8.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 7.50'

Discarded OutFlow Max=0.5 cfs @ 12.10 hrs HW=9.50' (Free Discharge)

↑ **1=Exfiltration** (Controls 0.5 cfs)

Pond Porous Pavement 1:

21-10254 - Post-R3

Type III 24-hr 2-Year Rainfall=3.10"

Prepared by Civil Design Consultants, Inc.

Printed 12/27/2022

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Page 14

Summary for Pond Porous Pavement 2:

Inflow Area = 0.288 ac, 83.91% Impervious, Inflow Depth = 1.99" for 2-Year event
 Inflow = 0.7 cfs @ 12.09 hrs, Volume= 0.048 af
 Outflow = 0.7 cfs @ 12.10 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.4 min
 Discarded = 0.7 cfs @ 12.10 hrs, Volume= 0.048 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 9.50' @ 12.10 hrs Surf.Area= 3,973 sf Storage= 14 cf

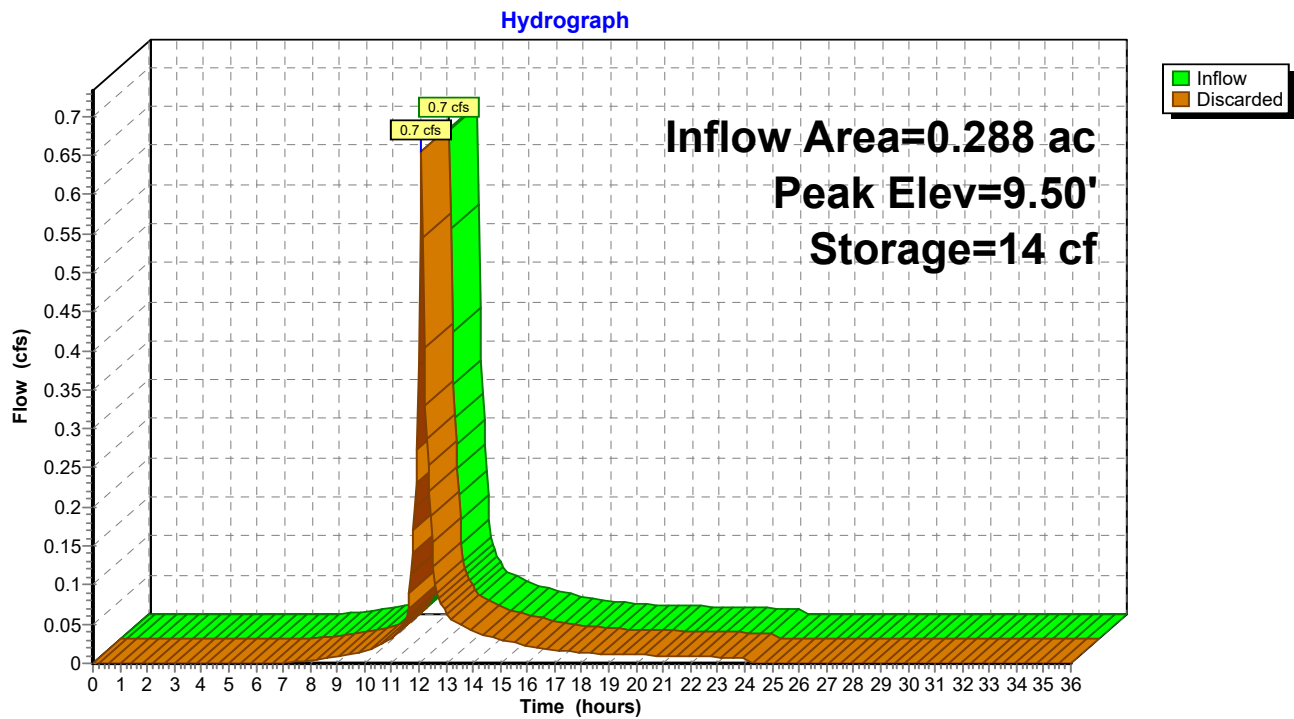
Plug-Flow detention time= 0.3 min calculated for 0.048 af (100% of inflow)
 Center-of-Mass det. time= 0.3 min (812.7 - 812.3)

Volume	Invert	Avail.Storage	Storage Description	
#1	9.49'	3,055 cf	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
9.49	3,973	0.0	0	0
9.50	3,973	40.0	16	16
10.25	3,973	40.0	1,192	1,208
10.26	3,973	30.0	12	1,220
11.25	3,973	30.0	1,180	2,400
11.26	3,973	40.0	16	2,416
11.58	3,973	40.0	509	2,924
11.59	3,973	10.0	4	2,928
11.91	3,973	10.0	127	3,055

Device	Routing	Invert	Outlet Devices
#1	Discarded	9.49'	8.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 7.50'

Discarded OutFlow Max=0.8 cfs @ 12.10 hrs HW=9.50' (Free Discharge)

↑ **1=Exfiltration** (Controls 0.8 cfs)

Pond Porous Pavement 2:

21-10254 - Post-R3*Type III 24-hr 10-Year Rainfall=4.50"*

Prepared by Civil Design Consultants, Inc.

Printed 12/27/2022

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Page 16

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPWA-1: Runoff Area=5,086 sf 0.00% Impervious Runoff Depth=0.11"
Tc=6.0 min CN=39 Runoff=0.0 cfs 0.001 af

SubcatchmentPWA-2A: Runoff Area=1,799 sf 83.10% Impervious Runoff Depth=3.20"
Tc=6.0 min CN=88 Runoff=0.1 cfs 0.011 af

SubcatchmentPWA-2B: Runoff Area=7,611 sf 81.01% Impervious Runoff Depth=3.10"
Tc=6.0 min CN=87 Runoff=0.6 cfs 0.045 af

SubcatchmentPWA-2C: Runoff Area=12,526 sf 83.91% Impervious Runoff Depth=3.30"
Tc=6.0 min CN=89 Runoff=1.1 cfs 0.079 af

SubcatchmentPWA-2D: Runoff Area=3,384 sf 0.00% Impervious Runoff Depth=0.11"
Tc=6.0 min CN=39 Runoff=0.0 cfs 0.001 af

Pond Infiltration Trench: Peak Elev=11.56' Storage=103 cf Inflow=0.1 cfs 0.011 af
Outflow=0.0 cfs 0.011 af

Pond Porous Pavement 1: Peak Elev=9.52' Storage=28 cf Inflow=0.6 cfs 0.045 af
Outflow=0.5 cfs 0.045 af

Pond Porous Pavement 2: Peak Elev=9.56' Storage=108 cf Inflow=1.1 cfs 0.079 af
Outflow=0.8 cfs 0.079 af

Total Runoff Area = 0.698 ac Runoff Volume = 0.137 af Average Runoff Depth = 2.35"
40.24% Pervious = 0.281 ac 59.76% Impervious = 0.417 ac

21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 10-Year Rainfall=4.50"

Printed 12/27/2022

Page 17

Summary for Subcatchment PWA-1:

Runoff = 0.0 cfs @ 14.71 hrs, Volume= 0.001 af, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

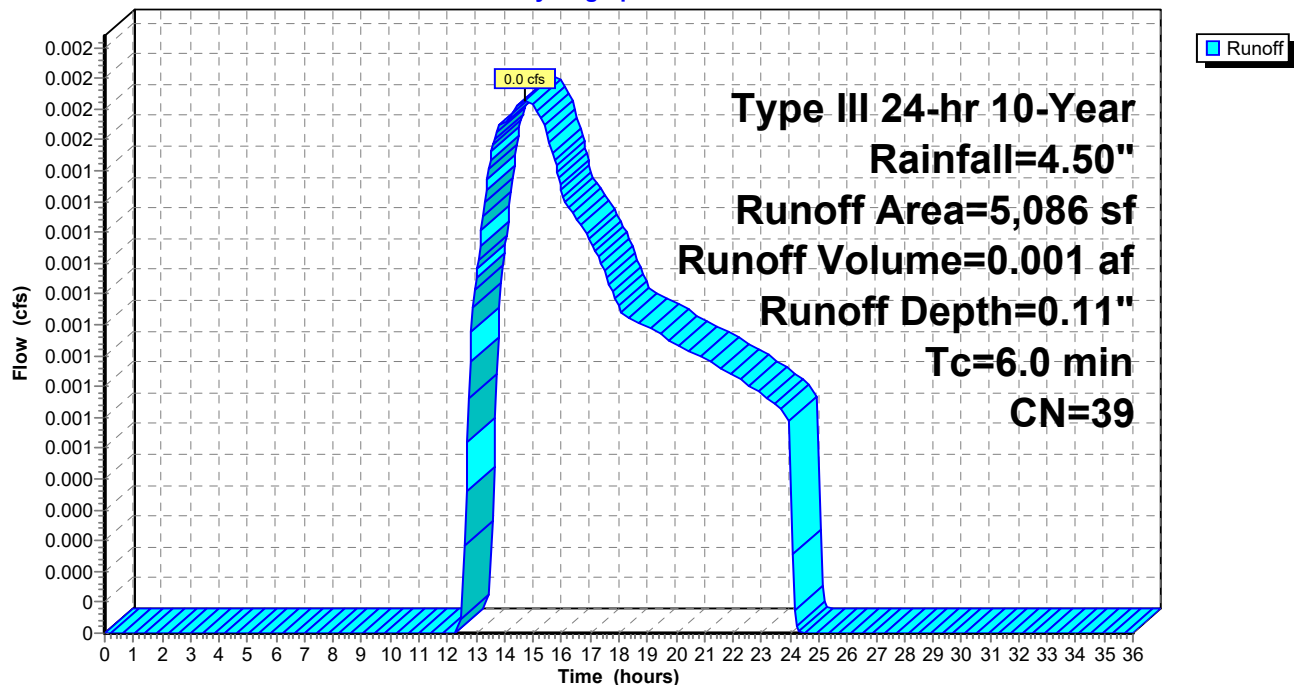
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
5,086	39	>75% Grass cover, Good, HSG A
0	98	Roofs, HSG A
0	98	Paved parking, HSG A
0	30	Woods, Good, HSG A
5,086	39	Weighted Average
5,086		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-1:

Hydrograph



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 10-Year Rainfall=4.50"

Printed 12/27/2022

Page 18

Summary for Subcatchment PWA-2A:

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.011 af, Depth= 3.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

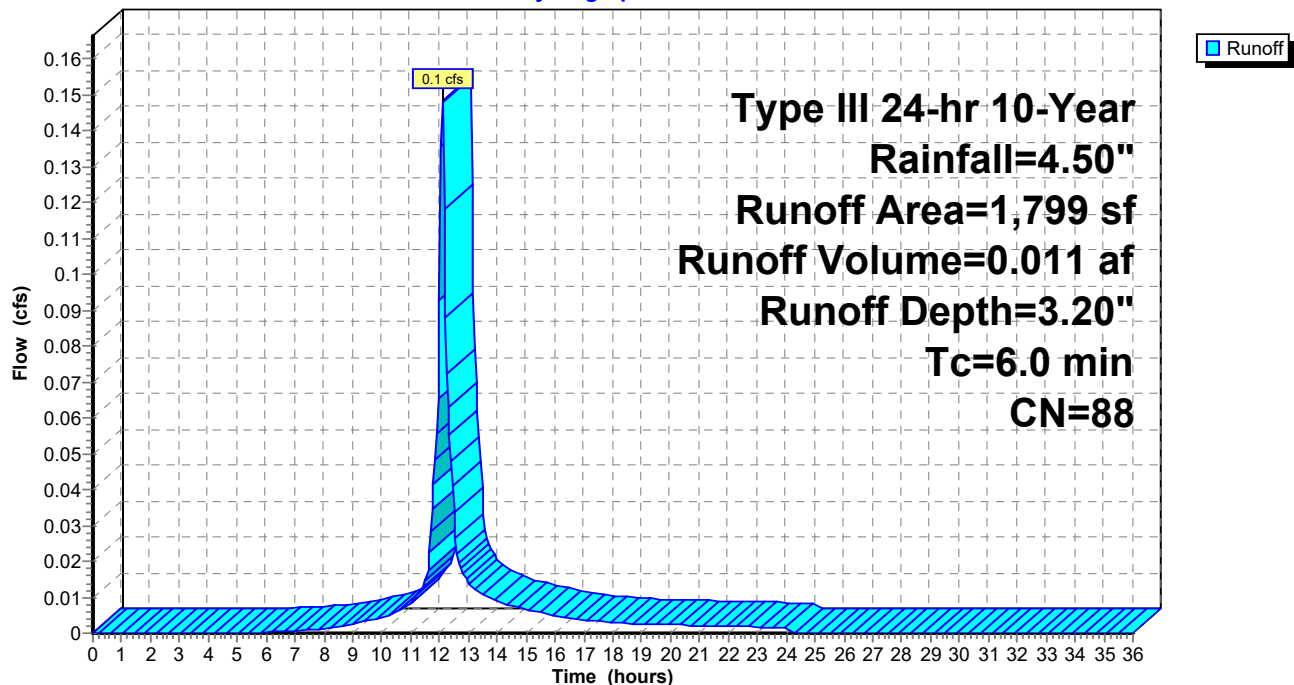
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
828	98	Roofs, HSG A
667	98	Paved parking, HSG A
304	39	>75% Grass cover, Good, HSG A
1,799	88	Weighted Average
304		16.90% Pervious Area
1,495		83.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-2A:

Hydrograph



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 10-Year Rainfall=4.50"

Printed 12/27/2022

Page 19

Summary for Subcatchment PWA-2B:

Runoff = 0.6 cfs @ 12.09 hrs, Volume= 0.045 af, Depth= 3.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

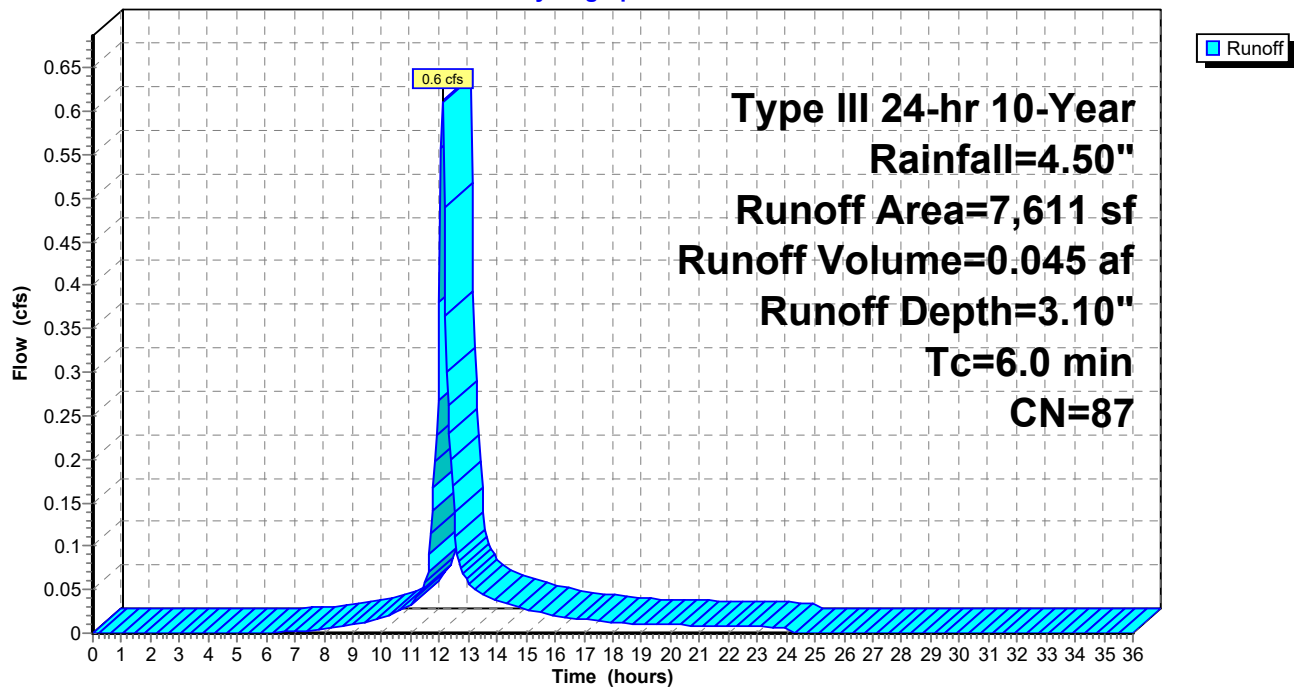
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,936	98	Roofs, HSG A
2,230	98	Paved parking, HSG A
1,445	39	>75% Grass cover, Good, HSG A
7,611	87	Weighted Average
1,445		18.99% Pervious Area
6,166		81.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-2B:

Hydrograph



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 10-Year Rainfall=4.50"

Printed 12/27/2022

Page 20

Summary for Subcatchment PWA-2C:

Runoff = 1.1 cfs @ 12.09 hrs, Volume= 0.079 af, Depth= 3.30"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

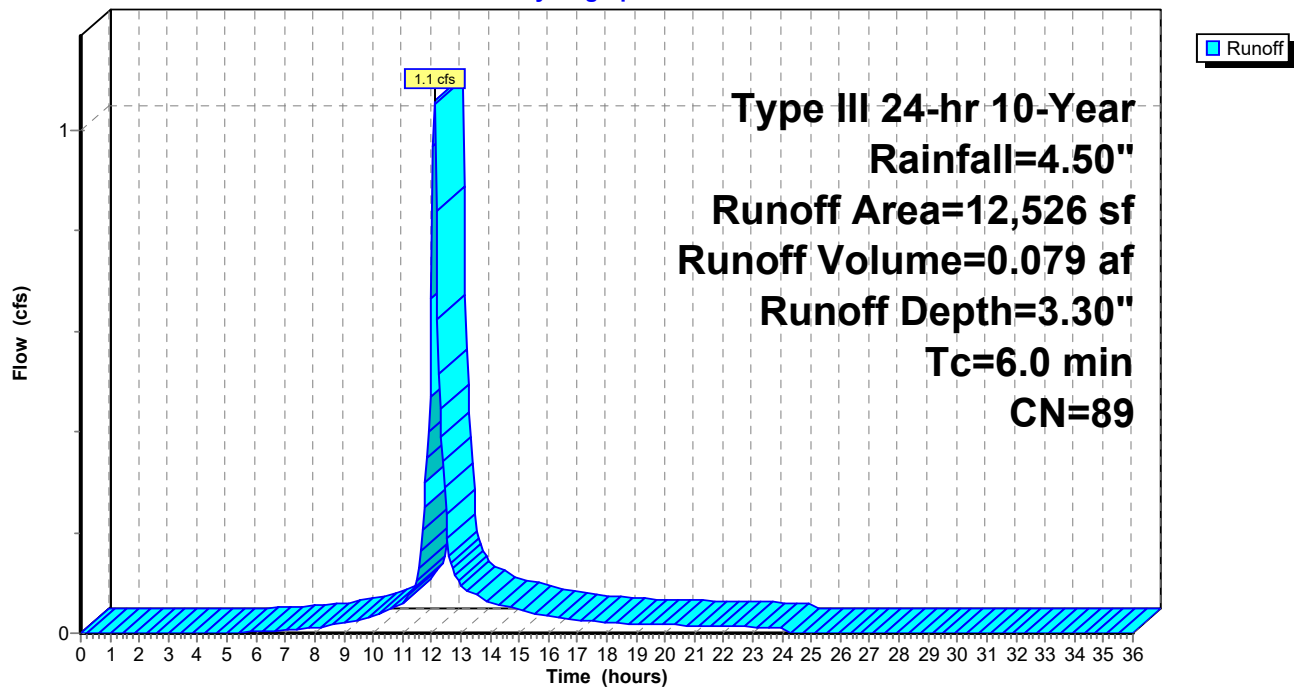
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
7,056	98	Roofs, HSG A
3,454	98	Paved parking, HSG A
2,016	39	>75% Grass cover, Good, HSG A
12,526	89	Weighted Average
2,016		16.09% Pervious Area
10,510		83.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-2C:

Hydrograph



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 10-Year Rainfall=4.50"

Printed 12/27/2022

Page 21

Summary for Subcatchment PWA-2D:

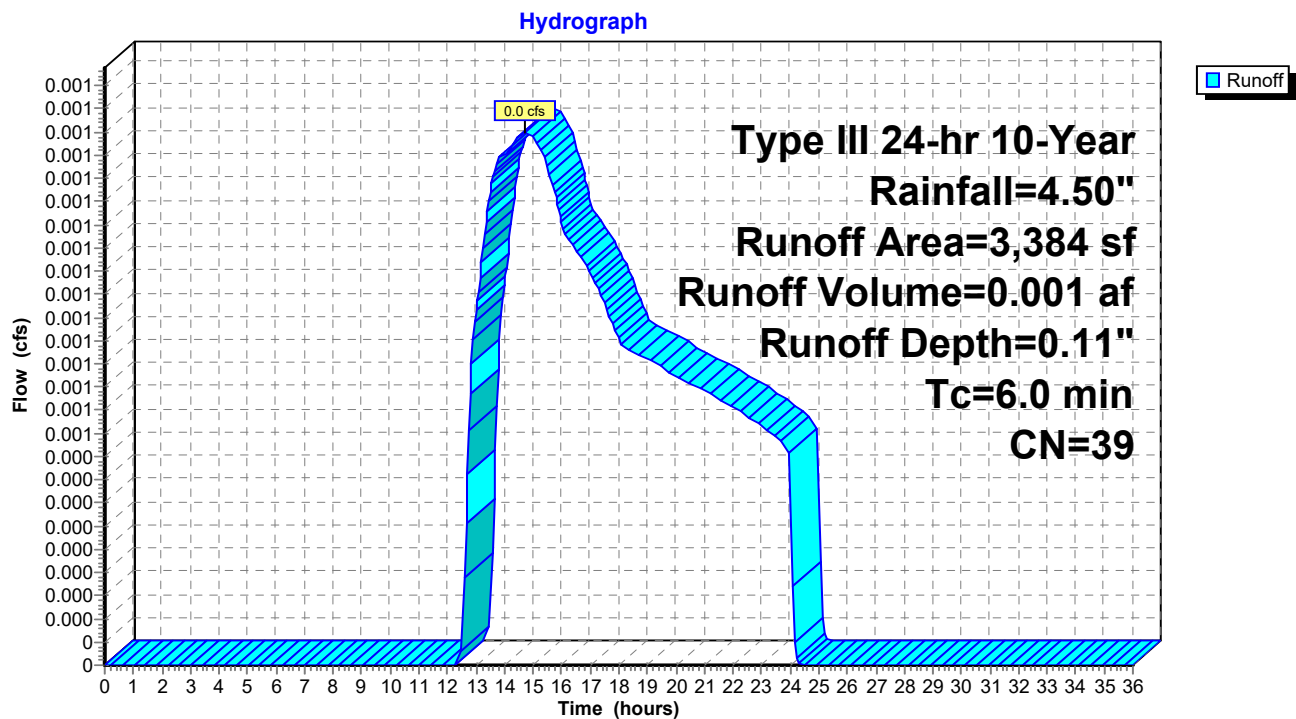
Runoff = 0.0 cfs @ 14.71 hrs, Volume= 0.001 af, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
3,384	39	>75% Grass cover, Good, HSG A
0	98	Roofs, HSG A
0	98	Paved parking, HSG A
0	30	Woods, Good, HSG A
3,384	39	Weighted Average
3,384		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-2D:

21-10254 - Post-R3

Type III 24-hr 10-Year Rainfall=4.50"

Prepared by Civil Design Consultants, Inc.

Printed 12/27/2022

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Page 22

Summary for Pond Infiltration Trench:

Inflow Area = 0.041 ac, 83.10% Impervious, Inflow Depth = 3.20" for 10-Year event
 Inflow = 0.1 cfs @ 12.09 hrs, Volume= 0.011 af
 Outflow = 0.0 cfs @ 12.41 hrs, Volume= 0.011 af, Atten= 68%, Lag= 19.0 min
 Discarded = 0.0 cfs @ 12.41 hrs, Volume= 0.011 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 11.56' @ 12.41 hrs Surf.Area= 122 sf Storage= 103 cf

Plug-Flow detention time= 14.3 min calculated for 0.011 af (100% of inflow)
 Center-of-Mass det. time= 14.3 min (816.1 - 801.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	9.50'	172 cf	3.04'W x 40.00'L x 3.88'H Field A 472 cf Overall - 42 cf Embedded = 430 cf x 40.0% Voids
#2A	11.17'	32 cf	ADS N-12 12 x 2 Inside #1 Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf
		204 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	9.50'	8.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 7.50'

Discarded OutFlow Max=0.0 cfs @ 12.41 hrs HW=11.56' (Free Discharge)
 ↑1=Exfiltration (Controls 0.0 cfs)

21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 10-Year Rainfall=4.50"

Printed 12/27/2022

Page 23

Pond Infiltration Trench: - Chamber Wizard Field A**Chamber Model = ADS N-12 12**

Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf

Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf

14.5" Wide + 0.0" Spacing = 14.5" C-C

2 Chambers/Row x 20.00' Long = 40.00' Base Length

1 Rows x 14.5" Wide + 11.0" Side Stone x 2 = 3.04' Base Width

20.0" Base + 14.5" Chamber Height + 12.0" Cover = 3.88' Field Height

2 Chambers x 16.2 cf = 32.4 cf Chamber Storage

2 Chambers x 20.9 cf = 41.9 cf Displacement

471.6 cf Field - 41.9 cf Chambers = 429.8 cf Stone x 40.0% Voids = 171.9 cf Stone Storage

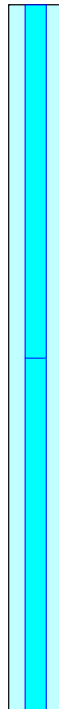
Stone + Chamber Storage = 204.3 cf = 0.005 af

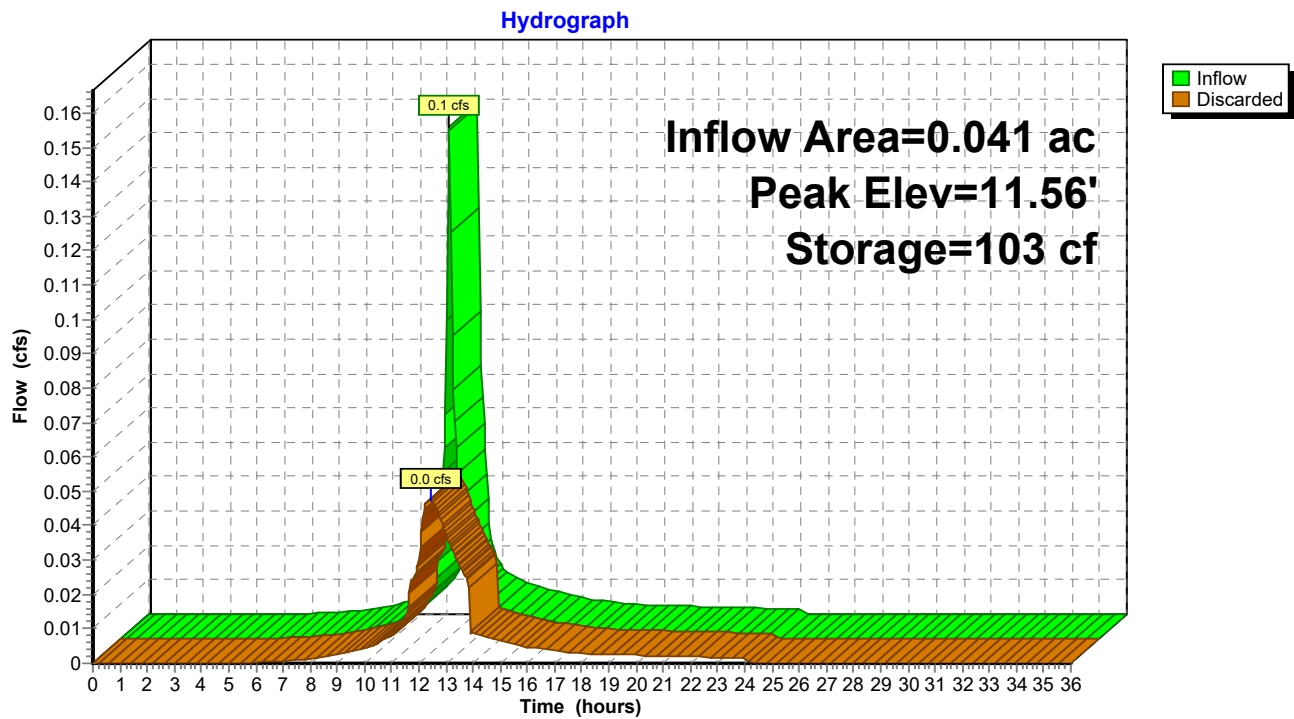
2 Chambers @ \$ 0.00 /ea = \$ 0.00

17.5 cy Field Excavation @ \$ 0.00 /cy = \$ 0.00

15.9 cy Stone @ \$ 0.00 /cy = \$ 0.00

Total Cost = \$ 0.00



Pond Infiltration Trench:

21-10254 - Post-R3

Type III 24-hr 10-Year Rainfall=4.50"

Prepared by Civil Design Consultants, Inc.

Printed 12/27/2022

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Page 25

Summary for Pond Porous Pavement 1:

Inflow Area = 0.175 ac, 81.01% Impervious, Inflow Depth = 3.10" for 10-Year event
 Inflow = 0.6 cfs @ 12.09 hrs, Volume= 0.045 af
 Outflow = 0.5 cfs @ 12.15 hrs, Volume= 0.045 af, Atten= 14%, Lag= 3.6 min
 Discarded = 0.5 cfs @ 12.15 hrs, Volume= 0.045 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 9.52' @ 12.14 hrs Surf.Area= 2,712 sf Storage= 28 cf

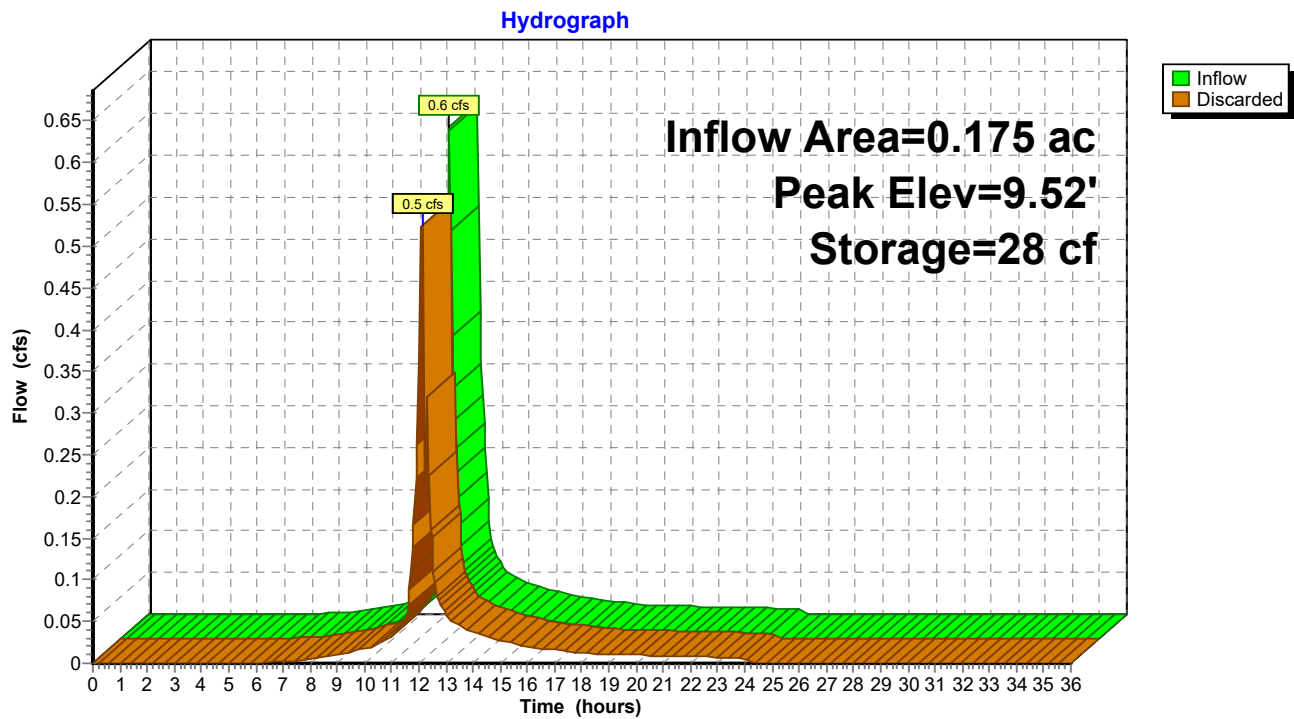
Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 0.4 min (805.6 - 805.2)

Volume	Invert	Avail.Storage	Storage Description	
#1	9.49'	2,086 cf	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
9.49	2,712	0.0	0	0
9.50	2,712	40.0	11	11
10.25	2,712	40.0	814	824
10.26	2,712	30.0	8	833
11.25	2,712	30.0	805	1,638
11.26	2,712	40.0	11	1,649
11.58	2,712	40.0	347	1,996
11.59	2,712	10.0	3	1,999
11.91	2,712	10.0	87	2,086

Device	Routing	Invert	Outlet Devices
#1	Discarded	9.49'	8.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 7.50'

Discarded OutFlow Max=0.5 cfs @ 12.15 hrs HW=9.52' (Free Discharge)

↑ **1=Exfiltration** (Controls 0.5 cfs)

Pond Porous Pavement 1:

21-10254 - Post-R3

Type III 24-hr 10-Year Rainfall=4.50"

Prepared by Civil Design Consultants, Inc.

Printed 12/27/2022

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Page 27

Summary for Pond Porous Pavement 2:

[85] Warning: Oscillations may require Finer Routing>1

Inflow Area = 0.288 ac, 83.91% Impervious, Inflow Depth = 3.30" for 10-Year event
 Inflow = 1.1 cfs @ 12.09 hrs, Volume= 0.079 af
 Outflow = 0.8 cfs @ 12.16 hrs, Volume= 0.079 af, Atten= 26%, Lag= 4.4 min
 Discarded = 0.8 cfs @ 12.16 hrs, Volume= 0.079 af

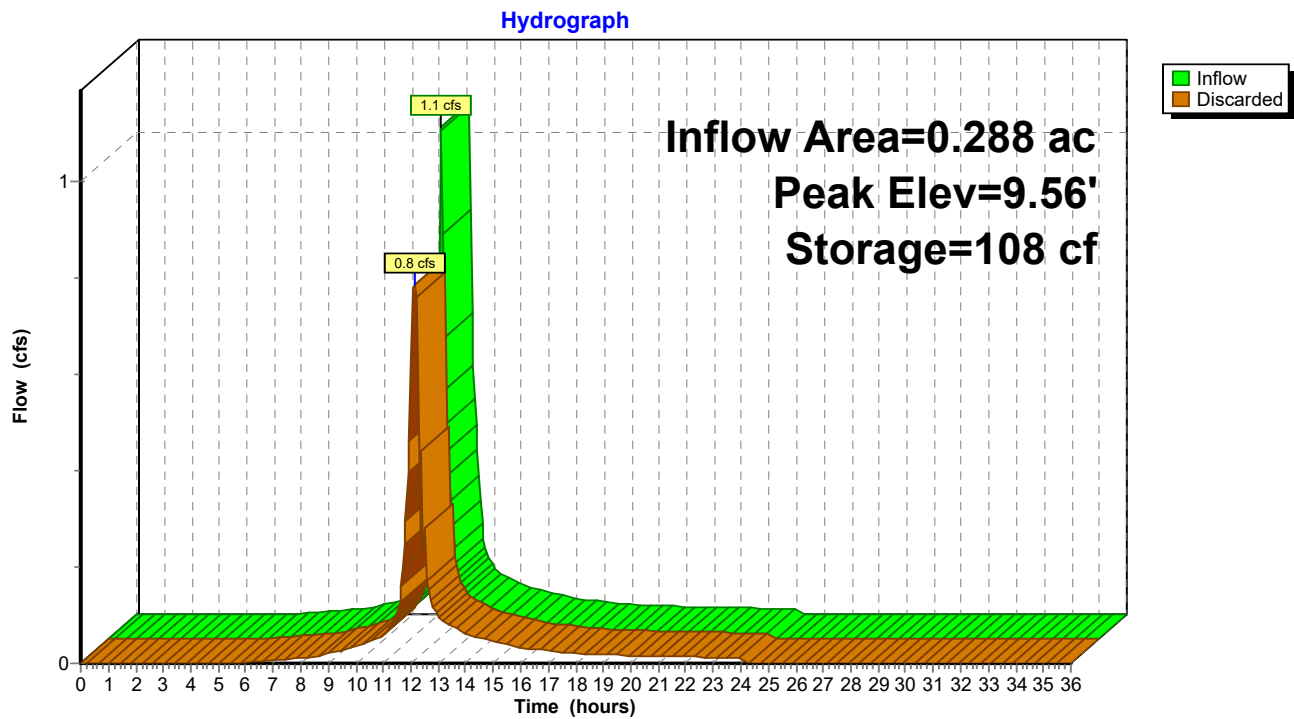
Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 9.56' @ 12.16 hrs Surf.Area= 3,973 sf Storage= 108 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 0.6 min (798.7 - 798.1)

Volume	Invert	Avail.Storage	Storage Description	
#1	9.49'	3,055 cf	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
9.49	3,973	0.0	0	0
9.50	3,973	40.0	16	16
10.25	3,973	40.0	1,192	1,208
10.26	3,973	30.0	12	1,220
11.25	3,973	30.0	1,180	2,400
11.26	3,973	40.0	16	2,416
11.58	3,973	40.0	509	2,924
11.59	3,973	10.0	4	2,928
11.91	3,973	10.0	127	3,055

Device	Routing	Invert	Outlet Devices
#1	Discarded	9.49'	8.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 7.50'

Discarded OutFlow Max=0.8 cfs @ 12.16 hrs HW=9.56' (Free Discharge)↑**1=Exfiltration** (Controls 0.8 cfs)

Pond Porous Pavement 2:

21-10254 - Post-R3*Type III 24-hr 25-Year Rainfall=5.30"*

Prepared by Civil Design Consultants, Inc.

Printed 12/27/2022

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Page 29

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPWA-1: Runoff Area=5,086 sf 0.00% Impervious Runoff Depth=0.26"
Tc=6.0 min CN=39 Runoff=0.0 cfs 0.003 af

SubcatchmentPWA-2A: Runoff Area=1,799 sf 83.10% Impervious Runoff Depth=3.95"
Tc=6.0 min CN=88 Runoff=0.2 cfs 0.014 af

SubcatchmentPWA-2B: Runoff Area=7,611 sf 81.01% Impervious Runoff Depth=3.85"
Tc=6.0 min CN=87 Runoff=0.8 cfs 0.056 af

SubcatchmentPWA-2C: Runoff Area=12,526 sf 83.91% Impervious Runoff Depth=4.06"
Tc=6.0 min CN=89 Runoff=1.3 cfs 0.097 af

SubcatchmentPWA-2D: Runoff Area=3,384 sf 0.00% Impervious Runoff Depth=0.26"
Tc=6.0 min CN=39 Runoff=0.0 cfs 0.002 af

Pond Infiltration Trench: Peak Elev=12.07' Storage=140 cf Inflow=0.2 cfs 0.014 af
Outflow=0.1 cfs 0.014 af

Pond Porous Pavement 1: Peak Elev=9.57' Storage=87 cf Inflow=0.8 cfs 0.056 af
Outflow=0.5 cfs 0.056 af

Pond Porous Pavement 2: Peak Elev=9.63' Storage=219 cf Inflow=1.3 cfs 0.097 af
Outflow=0.8 cfs 0.097 af

Total Runoff Area = 0.698 ac Runoff Volume = 0.171 af Average Runoff Depth = 2.94"
40.24% Pervious = 0.281 ac 59.76% Impervious = 0.417 ac

21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 25-Year Rainfall=5.30"

Printed 12/27/2022

Page 30

Summary for Subcatchment PWA-1:

Runoff = 0.0 cfs @ 12.43 hrs, Volume= 0.003 af, Depth= 0.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

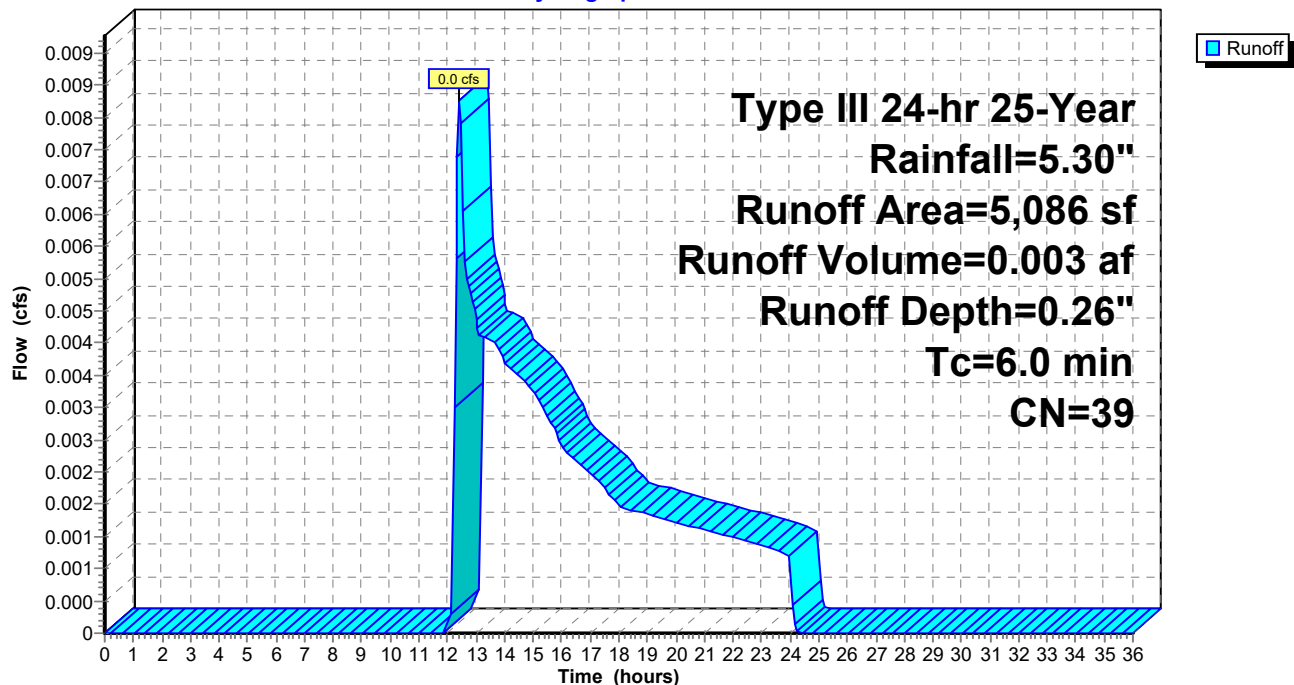
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
5,086	39	>75% Grass cover, Good, HSG A
0	98	Roofs, HSG A
0	98	Paved parking, HSG A
0	30	Woods, Good, HSG A
5,086	39	Weighted Average
5,086		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-1:

Hydrograph



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 25-Year Rainfall=5.30"

Printed 12/27/2022

Page 31

Summary for Subcatchment PWA-2A:

Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.014 af, Depth= 3.95"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

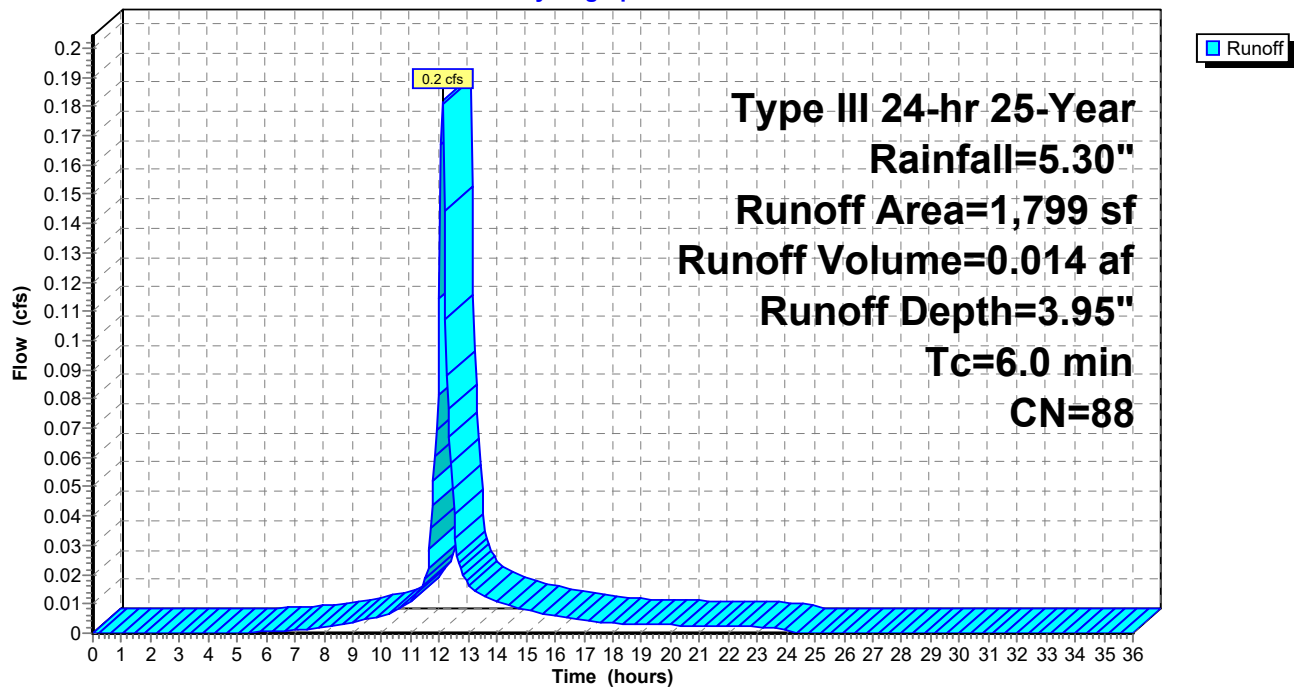
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
828	98	Roofs, HSG A
667	98	Paved parking, HSG A
304	39	>75% Grass cover, Good, HSG A
1,799	88	Weighted Average
304		16.90% Pervious Area
1,495		83.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-2A:

Hydrograph



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 25-Year Rainfall=5.30"

Printed 12/27/2022

Page 32

Summary for Subcatchment PWA-2B:

Runoff = 0.8 cfs @ 12.09 hrs, Volume= 0.056 af, Depth= 3.85"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

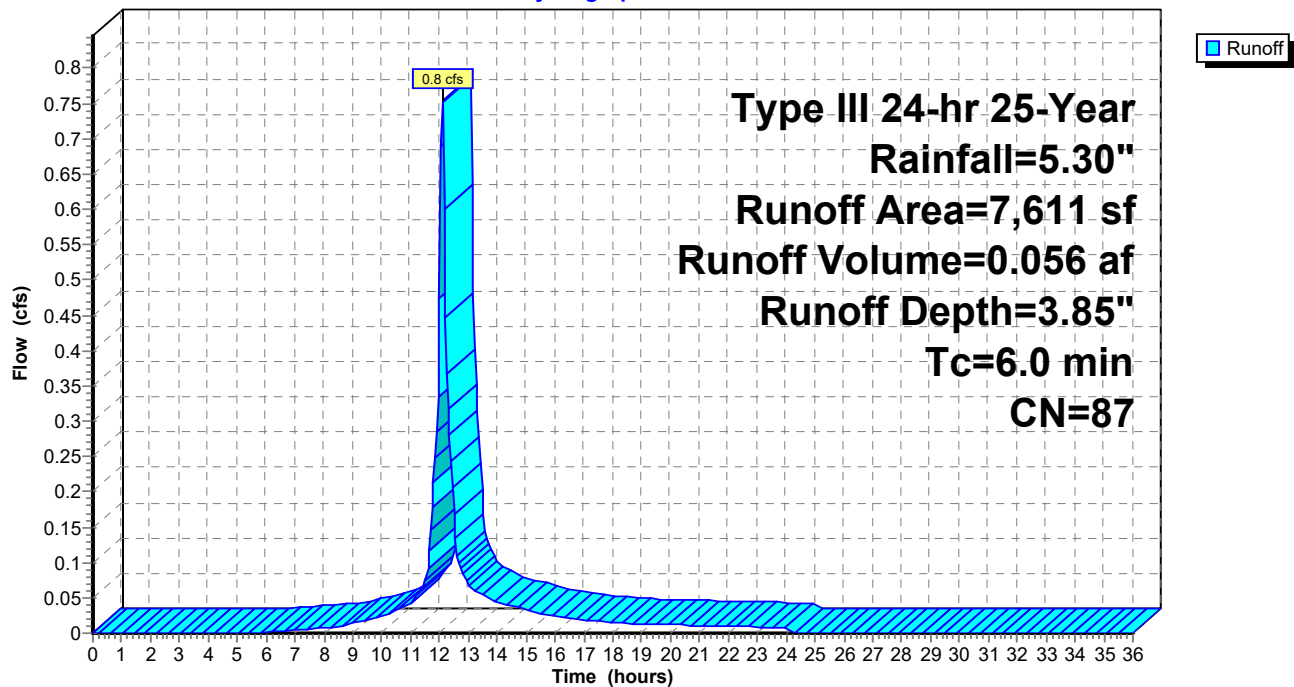
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
3,936	98	Roofs, HSG A
2,230	98	Paved parking, HSG A
1,445	39	>75% Grass cover, Good, HSG A
7,611	87	Weighted Average
1,445		18.99% Pervious Area
6,166		81.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-2B:

Hydrograph



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 25-Year Rainfall=5.30"

Printed 12/27/2022

Page 33

Summary for Subcatchment PWA-2C:

Runoff = 1.3 cfs @ 12.09 hrs, Volume= 0.097 af, Depth= 4.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

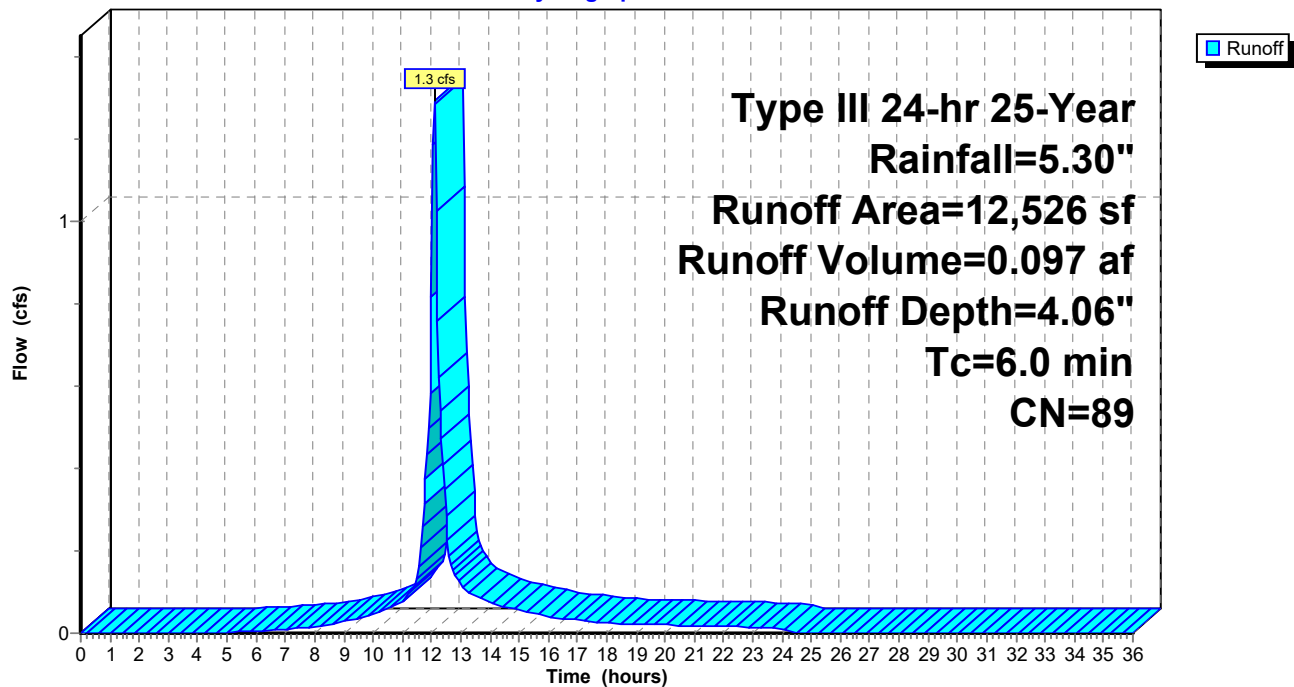
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
7,056	98	Roofs, HSG A
3,454	98	Paved parking, HSG A
2,016	39	>75% Grass cover, Good, HSG A
12,526	89	Weighted Average
2,016		16.09% Pervious Area
10,510		83.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-2C:

Hydrograph



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 25-Year Rainfall=5.30"

Printed 12/27/2022

Page 34

Summary for Subcatchment PWA-2D:

Runoff = 0.0 cfs @ 12.43 hrs, Volume= 0.002 af, Depth= 0.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

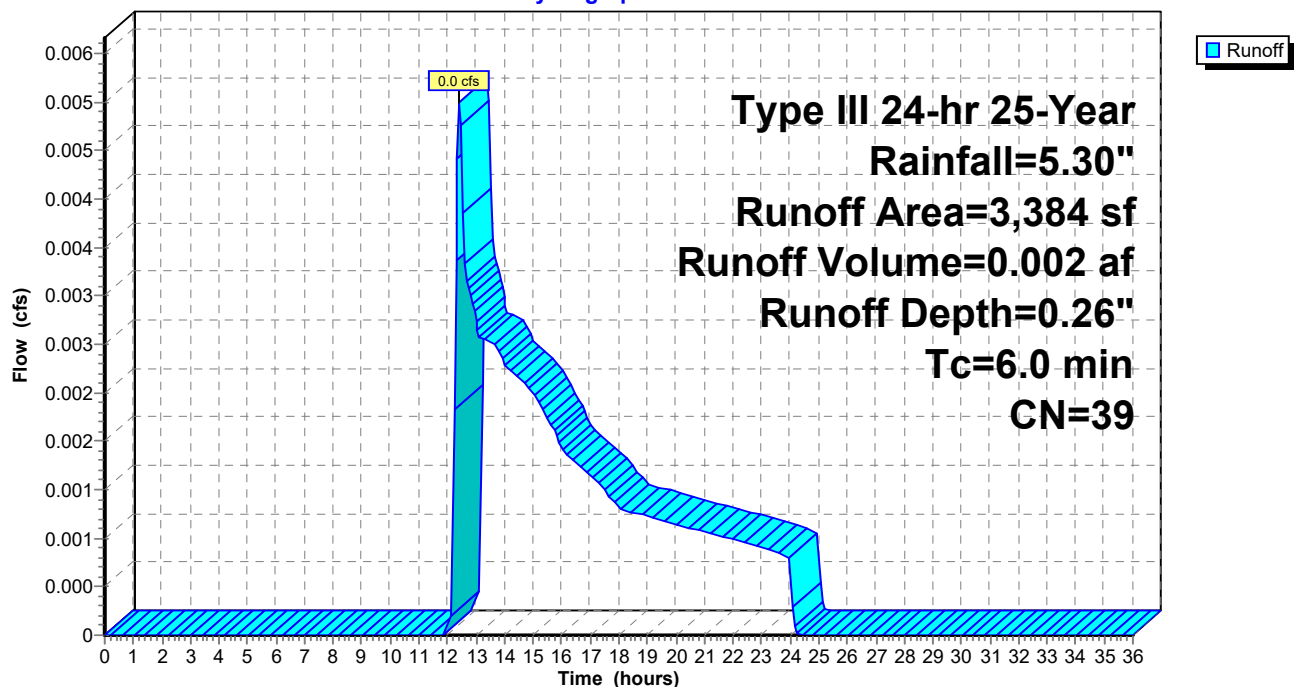
Type III 24-hr 25-Year Rainfall=5.30"

Area (sf)	CN	Description
3,384	39	>75% Grass cover, Good, HSG A
0	98	Roofs, HSG A
0	98	Paved parking, HSG A
0	30	Woods, Good, HSG A
3,384	39	Weighted Average
3,384		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-2D:

Hydrograph



21-10254 - Post-R3

Type III 24-hr 25-Year Rainfall=5.30"

Prepared by Civil Design Consultants, Inc.

Printed 12/27/2022

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Page 35

Summary for Pond Infiltration Trench:

Inflow Area = 0.041 ac, 83.10% Impervious, Inflow Depth = 3.95" for 25-Year event
 Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.014 af
 Outflow = 0.1 cfs @ 12.43 hrs, Volume= 0.014 af, Atten= 71%, Lag= 20.3 min
 Discarded = 0.1 cfs @ 12.43 hrs, Volume= 0.014 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 12.07' @ 12.43 hrs Surf.Area= 122 sf Storage= 140 cf

Plug-Flow detention time= 17.7 min calculated for 0.014 af (100% of inflow)
 Center-of-Mass det. time= 17.7 min (813.5 - 795.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	9.50'	172 cf	3.04'W x 40.00'L x 3.88'H Field A 472 cf Overall - 42 cf Embedded = 430 cf x 40.0% Voids
#2A	11.17'	32 cf	ADS N-12 12 x 2 Inside #1 Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf
		204 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	9.50'	8.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 7.50'

Discarded OutFlow Max=0.1 cfs @ 12.43 hrs HW=12.07' (Free Discharge)
 ↑1=Exfiltration (Controls 0.1 cfs)

21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 25-Year Rainfall=5.30"

Printed 12/27/2022

Page 36

Pond Infiltration Trench: - Chamber Wizard Field A**Chamber Model = ADS N-12 12**

Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf

Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf

14.5" Wide + 0.0" Spacing = 14.5" C-C

2 Chambers/Row x 20.00' Long = 40.00' Base Length

1 Rows x 14.5" Wide + 11.0" Side Stone x 2 = 3.04' Base Width

20.0" Base + 14.5" Chamber Height + 12.0" Cover = 3.88' Field Height

2 Chambers x 16.2 cf = 32.4 cf Chamber Storage

2 Chambers x 20.9 cf = 41.9 cf Displacement

471.6 cf Field - 41.9 cf Chambers = 429.8 cf Stone x 40.0% Voids = 171.9 cf Stone Storage

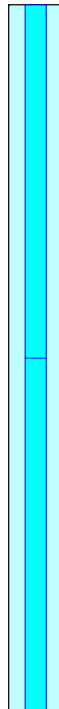
Stone + Chamber Storage = 204.3 cf = 0.005 af

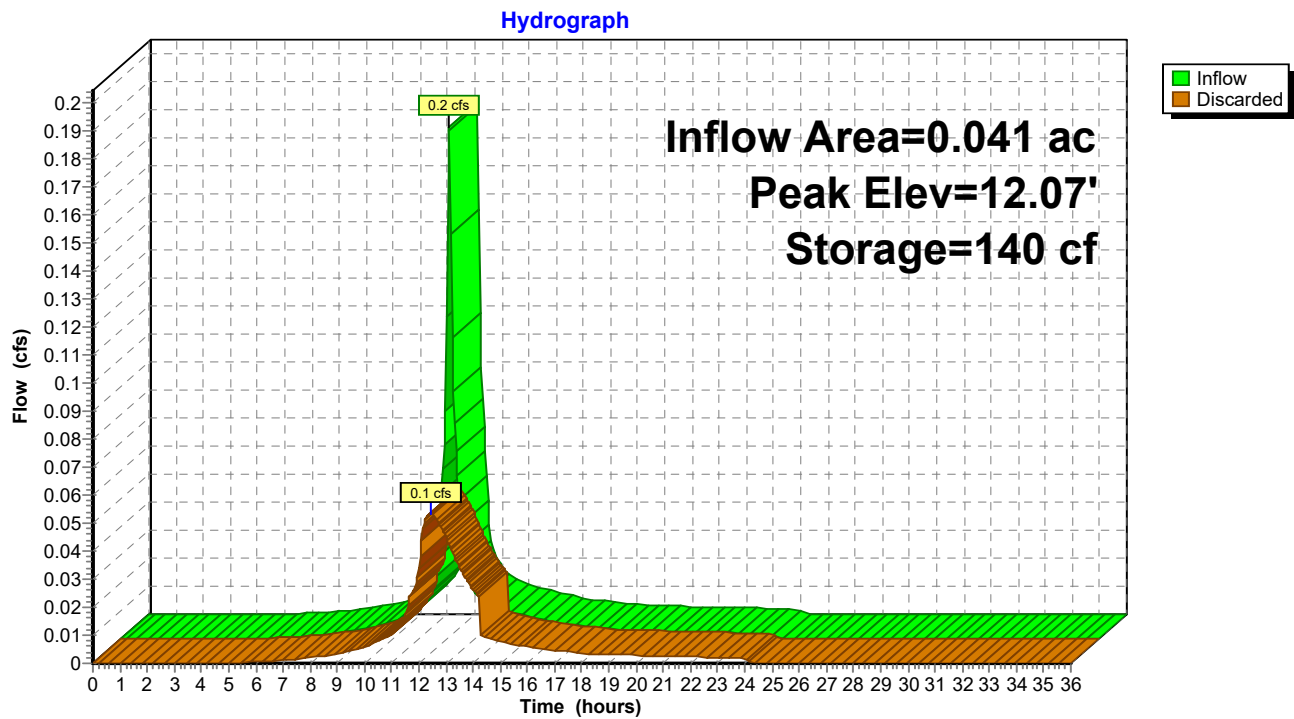
2 Chambers @ \$ 0.00 /ea = \$ 0.00

17.5 cy Field Excavation @ \$ 0.00 /cy = \$ 0.00

15.9 cy Stone @ \$ 0.00 /cy = \$ 0.00

Total Cost = \$ 0.00



Pond Infiltration Trench:

21-10254 - Post-R3

Type III 24-hr 25-Year Rainfall=5.30"

Prepared by Civil Design Consultants, Inc.

Printed 12/27/2022

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Page 38

Summary for Pond Porous Pavement 1:

Inflow Area = 0.175 ac, 81.01% Impervious, Inflow Depth = 3.85" for 25-Year event
 Inflow = 0.8 cfs @ 12.09 hrs, Volume= 0.056 af
 Outflow = 0.5 cfs @ 12.17 hrs, Volume= 0.056 af, Atten= 28%, Lag= 4.8 min
 Discarded = 0.5 cfs @ 12.17 hrs, Volume= 0.056 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 9.57' @ 12.17 hrs Surf.Area= 2,712 sf Storage= 87 cf

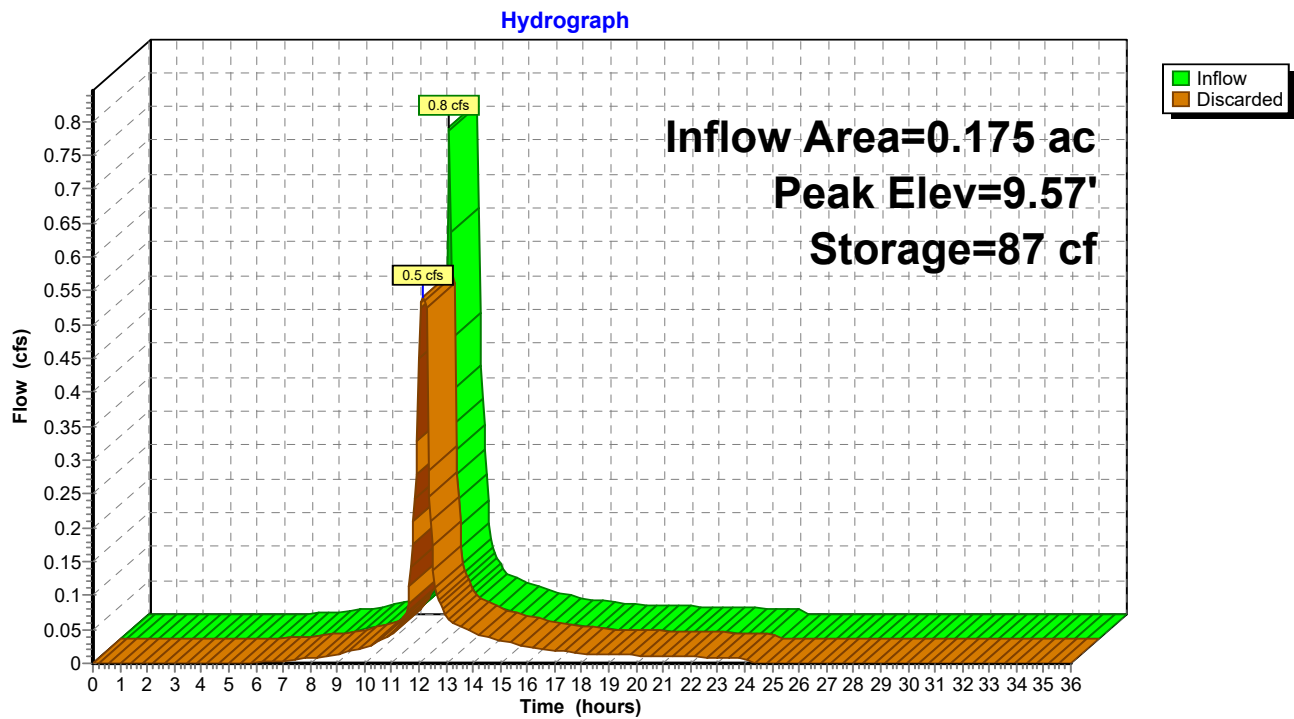
Plug-Flow detention time= 0.7 min calculated for 0.056 af (100% of inflow)
 Center-of-Mass det. time= 0.7 min (799.8 - 799.1)

Volume	Invert	Avail.Storage	Storage Description	
#1	9.49'	2,086 cf	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
9.49	2,712	0.0	0	0
9.50	2,712	40.0	11	11
10.25	2,712	40.0	814	824
10.26	2,712	30.0	8	833
11.25	2,712	30.0	805	1,638
11.26	2,712	40.0	11	1,649
11.58	2,712	40.0	347	1,996
11.59	2,712	10.0	3	1,999
11.91	2,712	10.0	87	2,086

Device	Routing	Invert	Outlet Devices
#1	Discarded	9.49'	8.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 7.50'

Discarded OutFlow Max=0.5 cfs @ 12.17 hrs HW=9.57' (Free Discharge)

↑ **1=Exfiltration** (Controls 0.5 cfs)

Pond Porous Pavement 1:

21-10254 - Post-R3

Type III 24-hr 25-Year Rainfall=5.30"

Prepared by Civil Design Consultants, Inc.

Printed 12/27/2022

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Page 40

Summary for Pond Porous Pavement 2:

Inflow Area = 0.288 ac, 83.91% Impervious, Inflow Depth = 4.06" for 25-Year event
 Inflow = 1.3 cfs @ 12.09 hrs, Volume= 0.097 af
 Outflow = 0.8 cfs @ 12.19 hrs, Volume= 0.097 af, Atten= 37%, Lag= 6.4 min
 Discarded = 0.8 cfs @ 12.19 hrs, Volume= 0.097 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 9.63' @ 12.19 hrs Surf.Area= 3,973 sf Storage= 219 cf

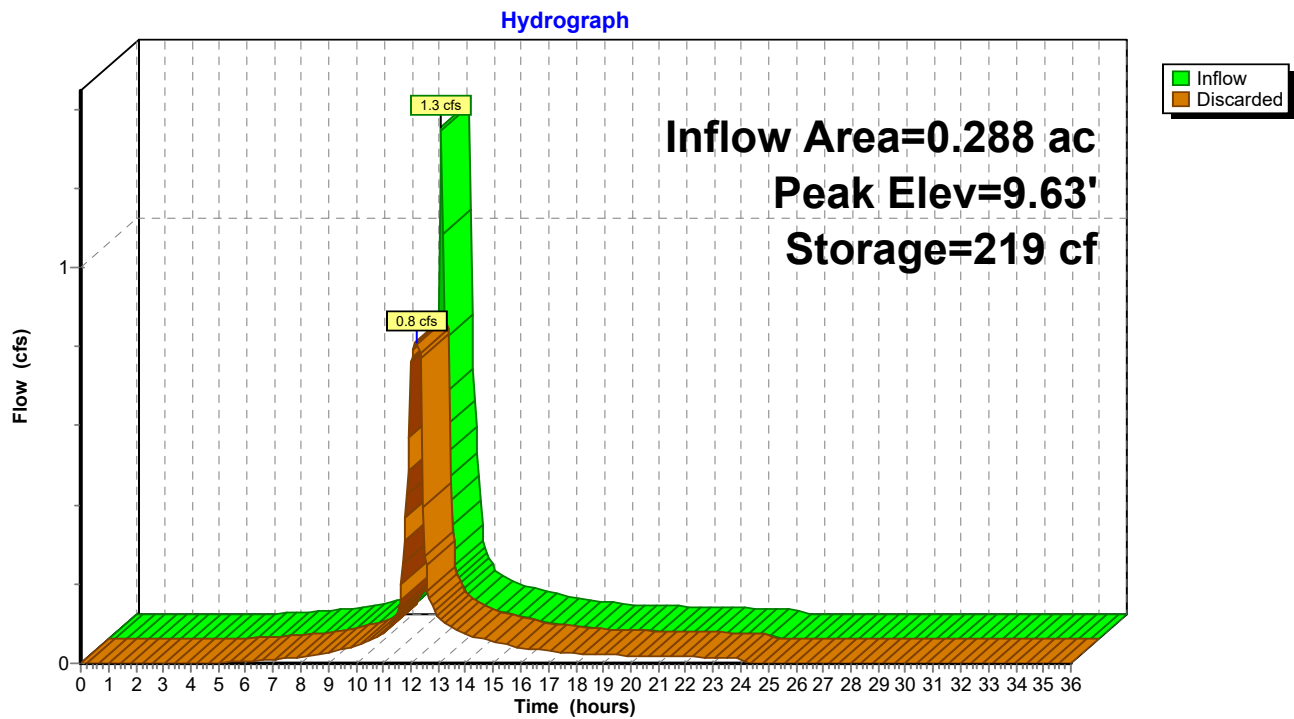
Plug-Flow detention time= 1.1 min calculated for 0.097 af (100% of inflow)
 Center-of-Mass det. time= 1.1 min (793.4 - 792.4)

Volume	Invert	Avail.Storage	Storage Description	
#1	9.49'	3,055 cf	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
9.49	3,973	0.0	0	0
9.50	3,973	40.0	16	16
10.25	3,973	40.0	1,192	1,208
10.26	3,973	30.0	12	1,220
11.25	3,973	30.0	1,180	2,400
11.26	3,973	40.0	16	2,416
11.58	3,973	40.0	509	2,924
11.59	3,973	10.0	4	2,928
11.91	3,973	10.0	127	3,055

Device	Routing	Invert	Outlet Devices
#1	Discarded	9.49'	8.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 7.50'

Discarded OutFlow Max=0.8 cfs @ 12.19 hrs HW=9.63' (Free Discharge)

↑ **1=Exfiltration** (Controls 0.8 cfs)

Pond Porous Pavement 2:

21-10254 - Post-R3*Type III 24-hr 50-Year Rainfall=5.90"*

Prepared by Civil Design Consultants, Inc.

Printed 12/27/2022

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Page 42

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPWA-1: Runoff Area=5,086 sf 0.00% Impervious Runoff Depth=0.42"
Tc=6.0 min CN=39 Runoff=0.0 cfs 0.004 af

SubcatchmentPWA-2A: Runoff Area=1,799 sf 83.10% Impervious Runoff Depth=4.53"
Tc=6.0 min CN=88 Runoff=0.2 cfs 0.016 af

SubcatchmentPWA-2B: Runoff Area=7,611 sf 81.01% Impervious Runoff Depth=4.42"
Tc=6.0 min CN=87 Runoff=0.9 cfs 0.064 af

SubcatchmentPWA-2C: Runoff Area=12,526 sf 83.91% Impervious Runoff Depth=4.64"
Tc=6.0 min CN=89 Runoff=1.5 cfs 0.111 af

SubcatchmentPWA-2D: Runoff Area=3,384 sf 0.00% Impervious Runoff Depth=0.42"
Tc=6.0 min CN=39 Runoff=0.0 cfs 0.003 af

Pond Infiltration Trench: Peak Elev=12.60' Storage=166 cf Inflow=0.2 cfs 0.016 af
Outflow=0.1 cfs 0.016 af

Pond Porous Pavement 1: Peak Elev=9.62' Storage=136 cf Inflow=0.9 cfs 0.064 af
Outflow=0.6 cfs 0.064 af

Pond Porous Pavement 2: Peak Elev=9.69' Storage=325 cf Inflow=1.5 cfs 0.111 af
Outflow=0.8 cfs 0.111 af

Total Runoff Area = 0.698 ac Runoff Volume = 0.198 af Average Runoff Depth = 3.40"
40.24% Pervious = 0.281 ac 59.76% Impervious = 0.417 ac

21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 50-Year Rainfall=5.90"

Printed 12/27/2022

Page 43

Summary for Subcatchment PWA-1:

Runoff = 0.0 cfs @ 12.36 hrs, Volume= 0.004 af, Depth= 0.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

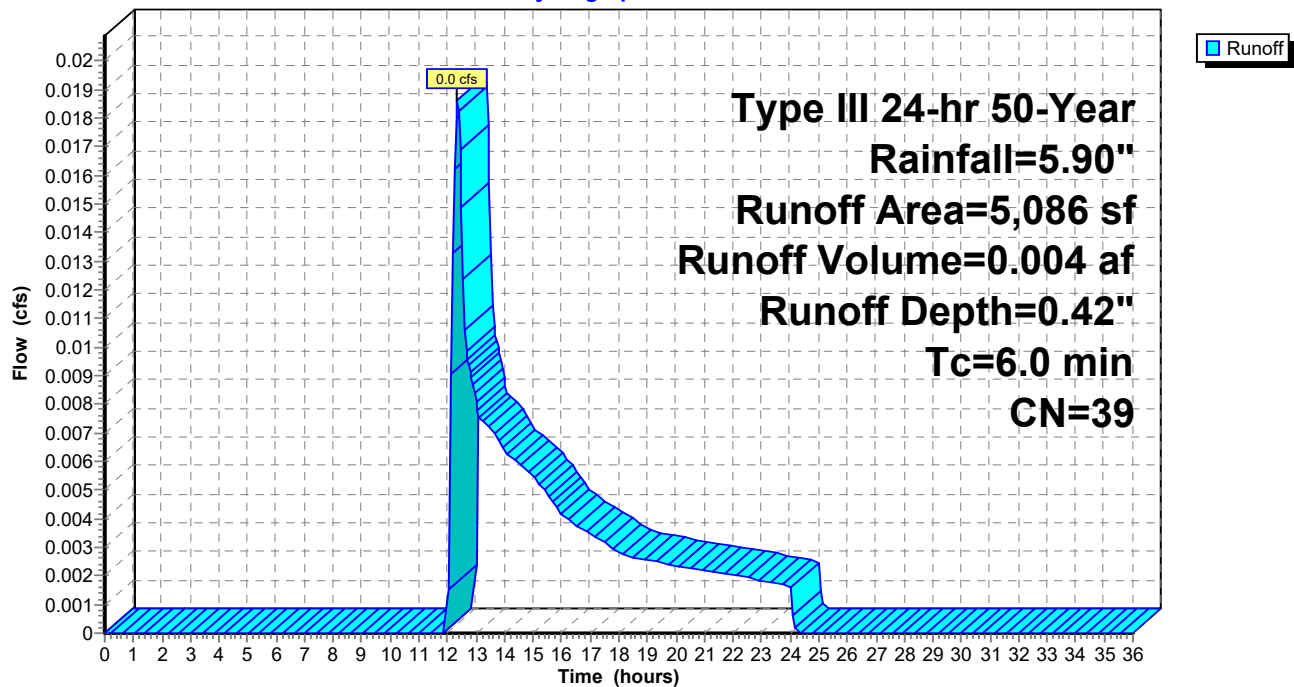
Type III 24-hr 50-Year Rainfall=5.90"

Area (sf)	CN	Description
5,086	39	>75% Grass cover, Good, HSG A
0	98	Roofs, HSG A
0	98	Paved parking, HSG A
0	30	Woods, Good, HSG A
5,086	39	Weighted Average
5,086		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-1:

Hydrograph



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 50-Year Rainfall=5.90"

Printed 12/27/2022

Page 44

Summary for Subcatchment PWA-2A:

Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.016 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

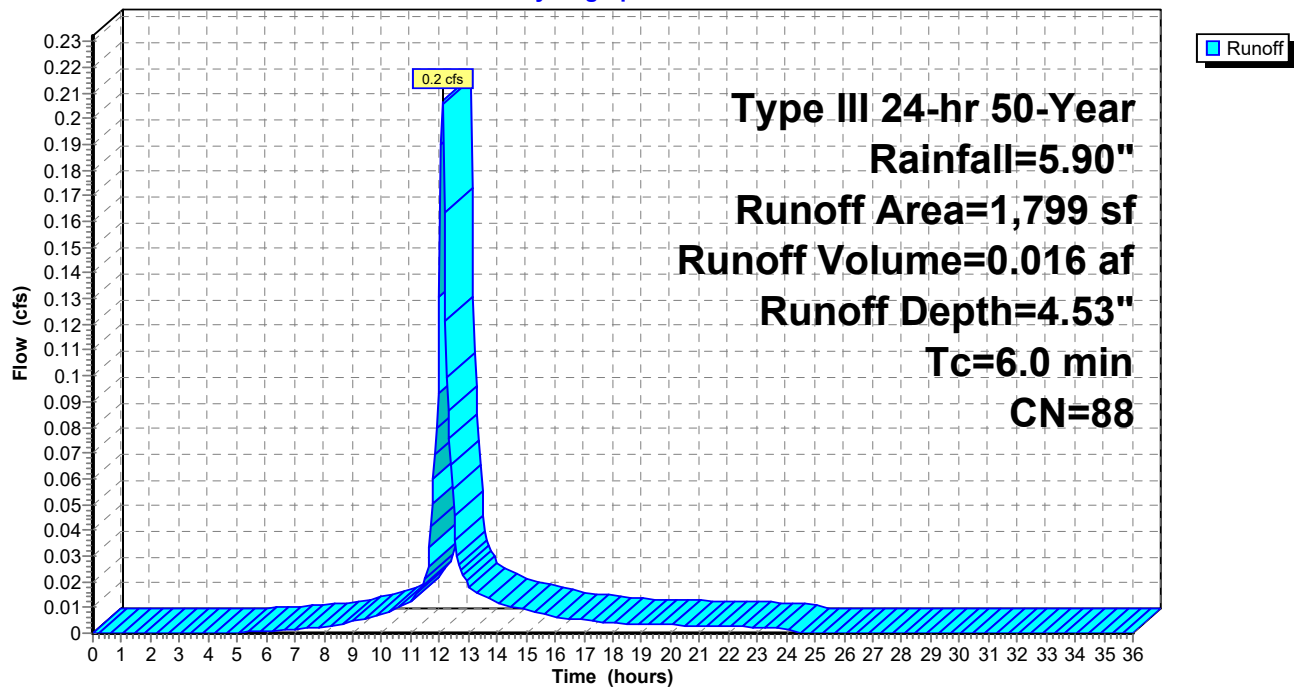
Type III 24-hr 50-Year Rainfall=5.90"

Area (sf)	CN	Description
828	98	Roofs, HSG A
667	98	Paved parking, HSG A
304	39	>75% Grass cover, Good, HSG A
1,799	88	Weighted Average
304		16.90% Pervious Area
1,495		83.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-2A:

Hydrograph



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 50-Year Rainfall=5.90"

Printed 12/27/2022

Page 45

Summary for Subcatchment PWA-2B:

Runoff = 0.9 cfs @ 12.09 hrs, Volume= 0.064 af, Depth= 4.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

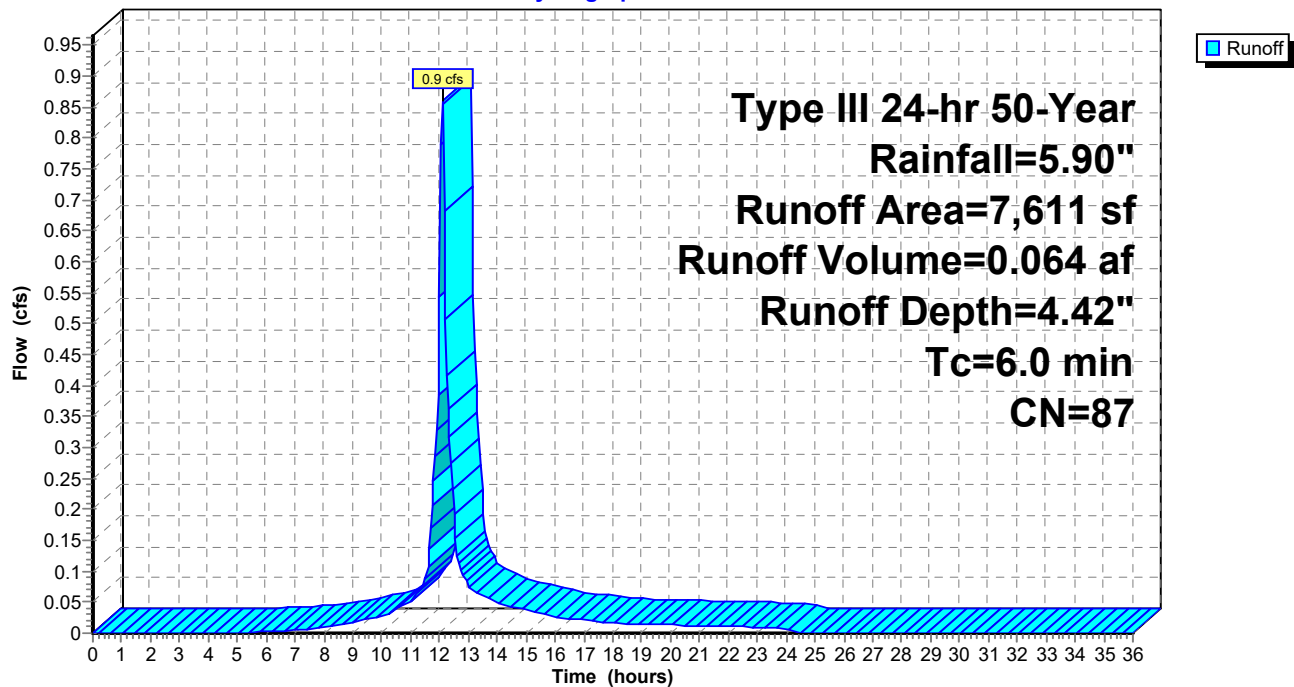
Type III 24-hr 50-Year Rainfall=5.90"

Area (sf)	CN	Description
3,936	98	Roofs, HSG A
2,230	98	Paved parking, HSG A
1,445	39	>75% Grass cover, Good, HSG A
7,611	87	Weighted Average
1,445		18.99% Pervious Area
6,166		81.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-2B:

Hydrograph



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 50-Year Rainfall=5.90"

Printed 12/27/2022

Page 46

Summary for Subcatchment PWA-2C:

Runoff = 1.5 cfs @ 12.09 hrs, Volume= 0.111 af, Depth= 4.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

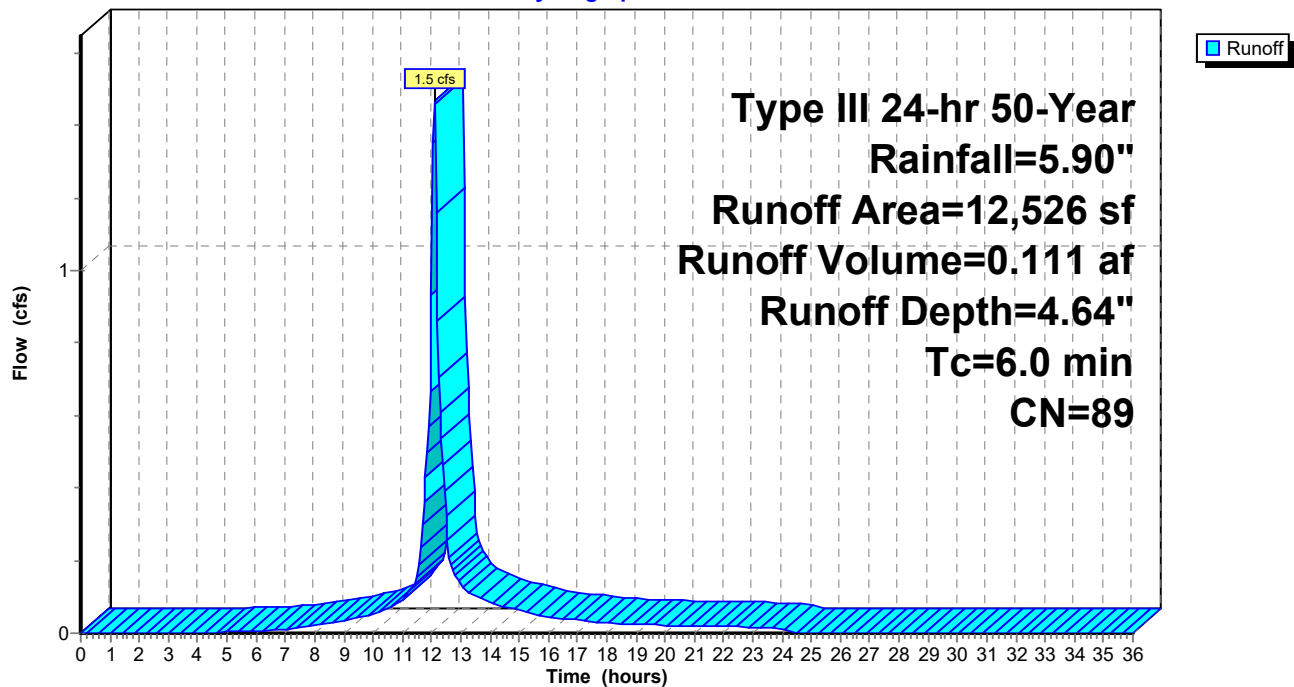
Type III 24-hr 50-Year Rainfall=5.90"

Area (sf)	CN	Description
7,056	98	Roofs, HSG A
3,454	98	Paved parking, HSG A
2,016	39	>75% Grass cover, Good, HSG A
12,526	89	Weighted Average
2,016		16.09% Pervious Area
10,510		83.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-2C:

Hydrograph



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 50-Year Rainfall=5.90"

Printed 12/27/2022

Page 47

Summary for Subcatchment PWA-2D:

Runoff = 0.0 cfs @ 12.36 hrs, Volume= 0.003 af, Depth= 0.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

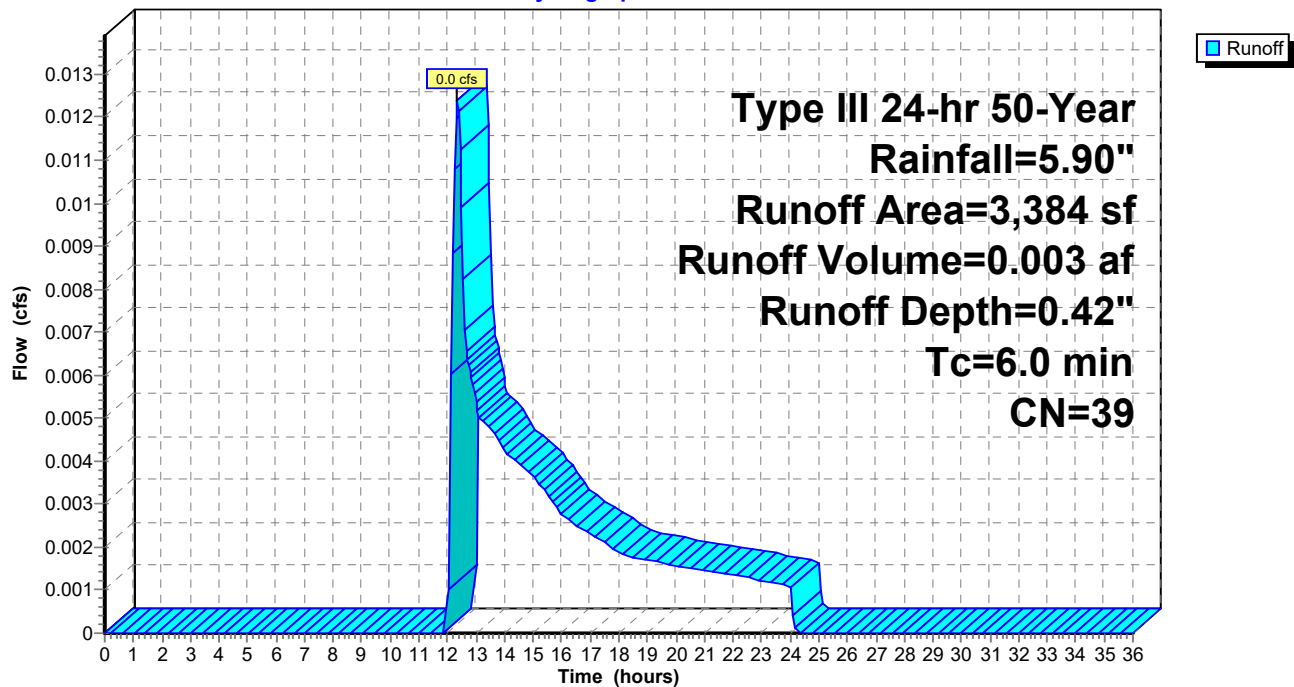
Type III 24-hr 50-Year Rainfall=5.90"

Area (sf)	CN	Description
3,384	39	>75% Grass cover, Good, HSG A
0	98	Roofs, HSG A
0	98	Paved parking, HSG A
0	30	Woods, Good, HSG A
3,384	39	Weighted Average
3,384		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-2D:

Hydrograph



21-10254 - Post-R3

Type III 24-hr 50-Year Rainfall=5.90"

Prepared by Civil Design Consultants, Inc.

Printed 12/27/2022

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Page 48

Summary for Pond Infiltration Trench:

Inflow Area = 0.041 ac, 83.10% Impervious, Inflow Depth = 4.53" for 50-Year event
 Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.016 af
 Outflow = 0.1 cfs @ 12.43 hrs, Volume= 0.016 af, Atten= 71%, Lag= 20.6 min
 Discarded = 0.1 cfs @ 12.43 hrs, Volume= 0.016 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 12.60' @ 12.43 hrs Surf.Area= 122 sf Storage= 166 cf

Plug-Flow detention time= 19.9 min calculated for 0.016 af (100% of inflow)
 Center-of-Mass det. time= 19.9 min (811.9 - 792.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	9.50'	172 cf	3.04'W x 40.00'L x 3.88'H Field A 472 cf Overall - 42 cf Embedded = 430 cf x 40.0% Voids
#2A	11.17'	32 cf	ADS N-12 12 x 2 Inside #1 Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf
		204 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	9.50'	8.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 7.50'

Discarded OutFlow Max=0.1 cfs @ 12.43 hrs HW=12.59' (Free Discharge)
 ↑1=Exfiltration (Controls 0.1 cfs)

21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 50-Year Rainfall=5.90"

Printed 12/27/2022

Page 49

Pond Infiltration Trench: - Chamber Wizard Field A**Chamber Model = ADS N-12 12**

Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf

Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf

14.5" Wide + 0.0" Spacing = 14.5" C-C

2 Chambers/Row x 20.00' Long = 40.00' Base Length

1 Rows x 14.5" Wide + 11.0" Side Stone x 2 = 3.04' Base Width

20.0" Base + 14.5" Chamber Height + 12.0" Cover = 3.88' Field Height

2 Chambers x 16.2 cf = 32.4 cf Chamber Storage

2 Chambers x 20.9 cf = 41.9 cf Displacement

471.6 cf Field - 41.9 cf Chambers = 429.8 cf Stone x 40.0% Voids = 171.9 cf Stone Storage

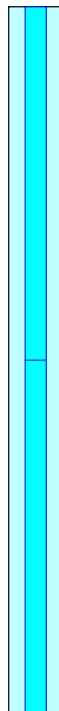
Stone + Chamber Storage = 204.3 cf = 0.005 af

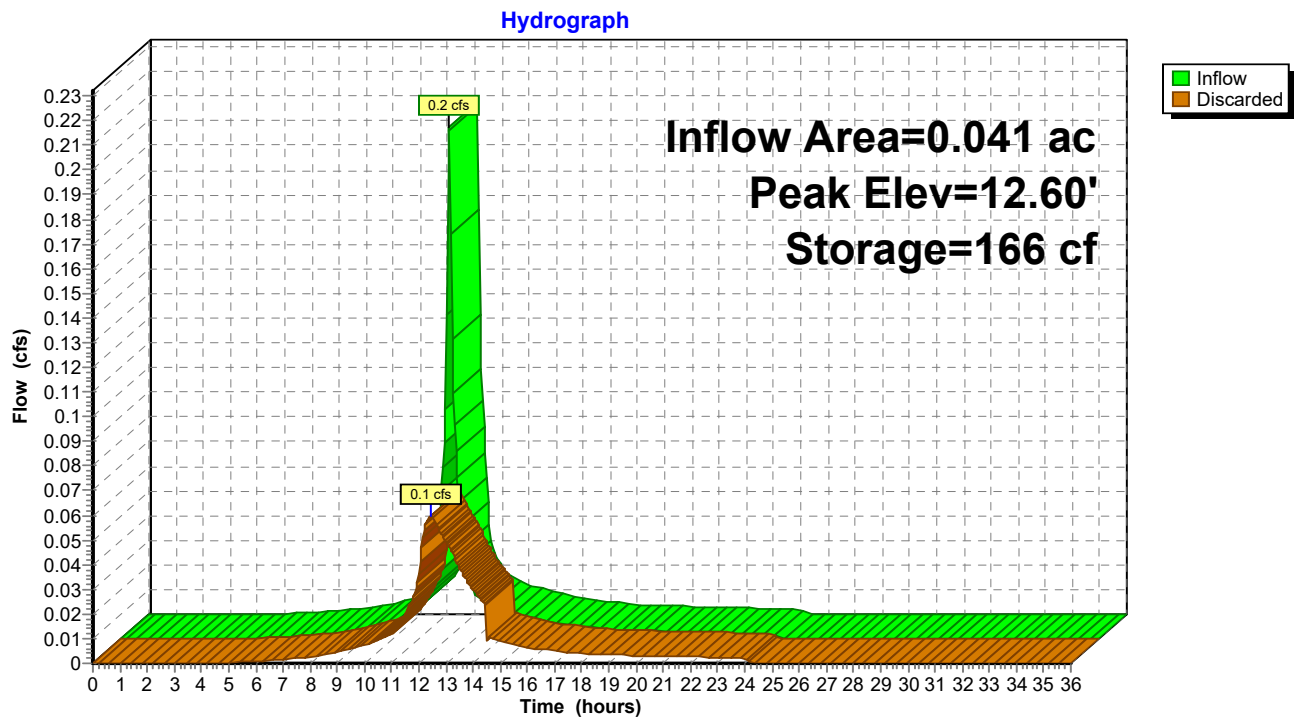
2 Chambers @ \$ 0.00 /ea = \$ 0.00

17.5 cy Field Excavation @ \$ 0.00 /cy = \$ 0.00

15.9 cy Stone @ \$ 0.00 /cy = \$ 0.00

Total Cost = \$ 0.00



Pond Infiltration Trench:

21-10254 - Post-R3

Type III 24-hr 50-Year Rainfall=5.90"

Prepared by Civil Design Consultants, Inc.

Printed 12/27/2022

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Page 51

Summary for Pond Porous Pavement 1:

[85] Warning: Oscillations may require Finer Routing>1

Inflow Area = 0.175 ac, 81.01% Impervious, Inflow Depth = 4.42" for 50-Year event
 Inflow = 0.9 cfs @ 12.09 hrs, Volume= 0.064 af
 Outflow = 0.6 cfs @ 12.19 hrs, Volume= 0.064 af, Atten= 36%, Lag= 6.1 min
 Discarded = 0.6 cfs @ 12.19 hrs, Volume= 0.064 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 9.62' @ 12.19 hrs Surf.Area= 2,712 sf Storage= 136 cf

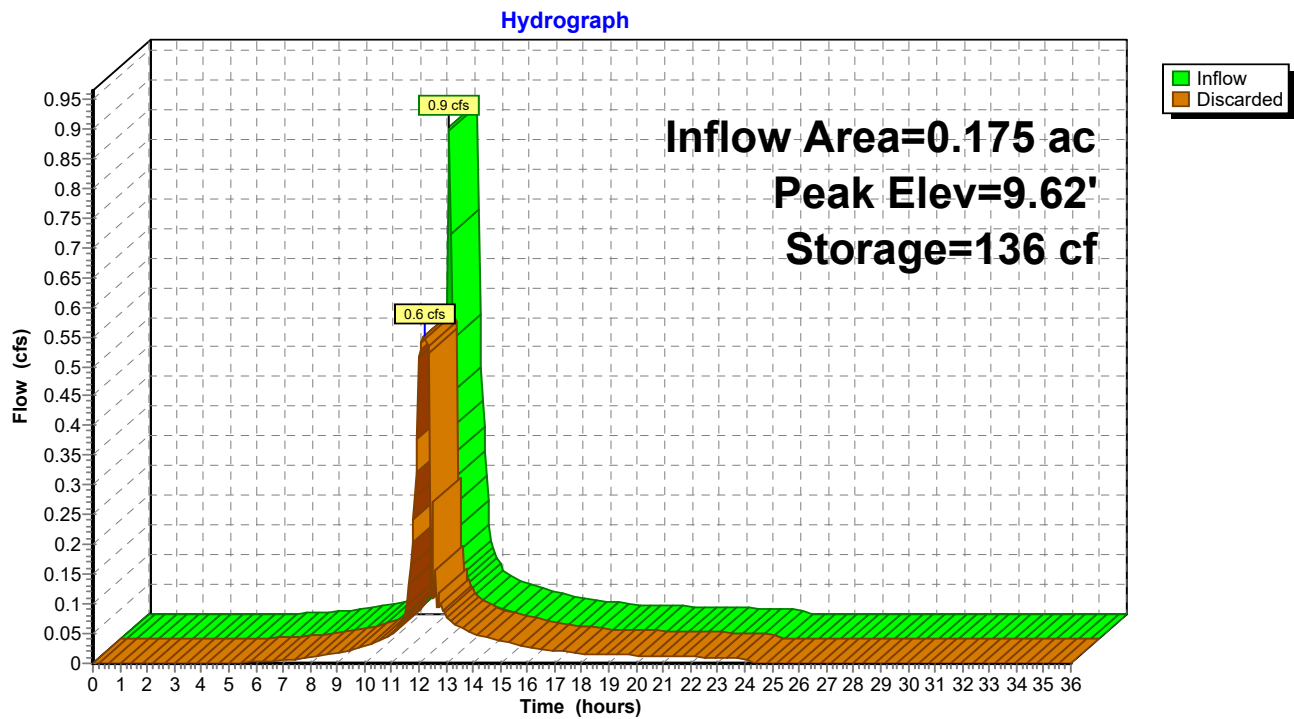
Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 1.0 min (796.2 - 795.2)

Volume	Invert	Avail.Storage	Storage Description	
#1	9.49'	2,086 cf	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
9.49	2,712	0.0	0	0
9.50	2,712	40.0	11	11
10.25	2,712	40.0	814	824
10.26	2,712	30.0	8	833
11.25	2,712	30.0	805	1,638
11.26	2,712	40.0	11	1,649
11.58	2,712	40.0	347	1,996
11.59	2,712	10.0	3	1,999
11.91	2,712	10.0	87	2,086

Device	Routing	Invert	Outlet Devices
#1	Discarded	9.49'	8.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 7.50'

Discarded OutFlow Max=0.6 cfs @ 12.19 hrs HW=9.61' (Free Discharge)

↑**1=Exfiltration** (Controls 0.6 cfs)

Pond Porous Pavement 1:

21-10254 - Post-R3

Type III 24-hr 50-Year Rainfall=5.90"

Prepared by Civil Design Consultants, Inc.

Printed 12/27/2022

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Page 53

Summary for Pond Porous Pavement 2:

[85] Warning: Oscillations may require Finer Routing>1

Inflow Area = 0.288 ac, 83.91% Impervious, Inflow Depth = 4.64" for 50-Year event
 Inflow = 1.5 cfs @ 12.09 hrs, Volume= 0.111 af
 Outflow = 0.8 cfs @ 12.21 hrs, Volume= 0.111 af, Atten= 43%, Lag= 7.5 min
 Discarded = 0.8 cfs @ 12.21 hrs, Volume= 0.111 af

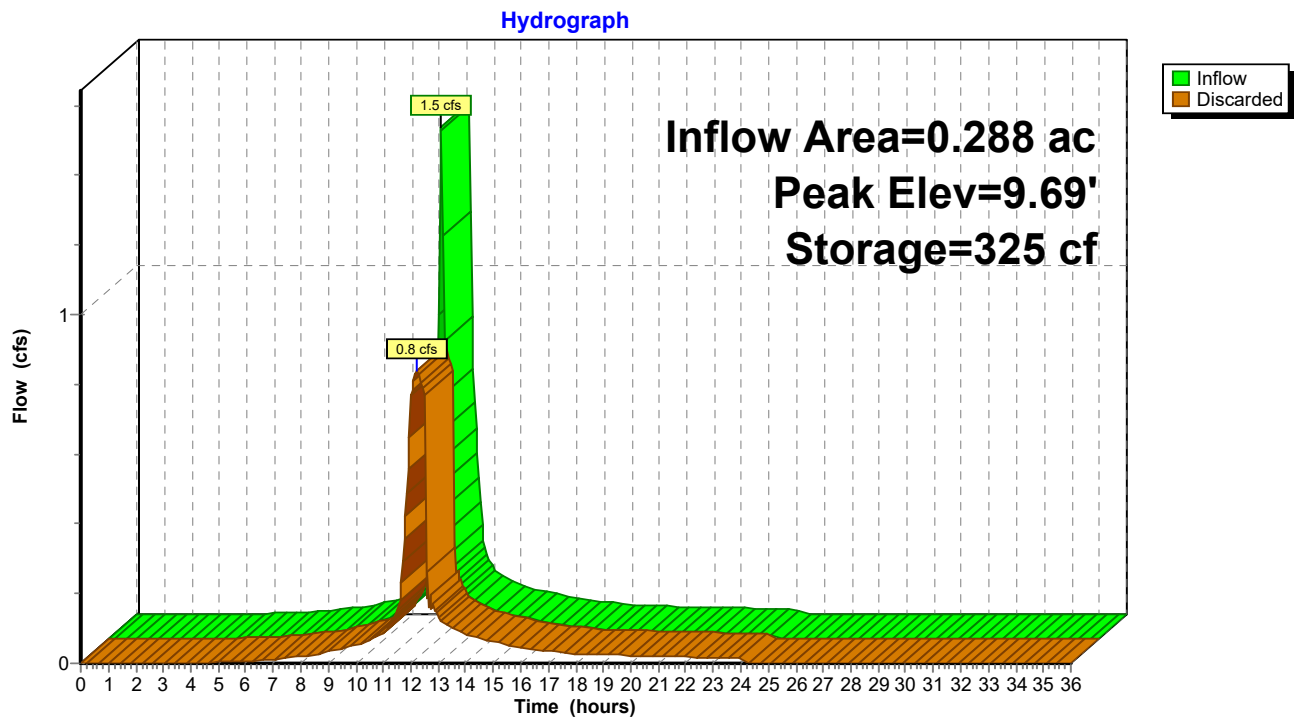
Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 9.69' @ 12.21 hrs Surf.Area= 3,973 sf Storage= 325 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 1.5 min (790.3 - 788.7)

Volume	Invert	Avail.Storage	Storage Description	
#1	9.49'	3,055 cf	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
9.49	3,973	0.0	0	0
9.50	3,973	40.0	16	16
10.25	3,973	40.0	1,192	1,208
10.26	3,973	30.0	12	1,220
11.25	3,973	30.0	1,180	2,400
11.26	3,973	40.0	16	2,416
11.58	3,973	40.0	509	2,924
11.59	3,973	10.0	4	2,928
11.91	3,973	10.0	127	3,055

Device	Routing	Invert	Outlet Devices
#1	Discarded	9.49'	8.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 7.50'

Discarded OutFlow Max=0.8 cfs @ 12.21 hrs HW=9.69' (Free Discharge)↑**1=Exfiltration** (Controls 0.8 cfs)

Pond Porous Pavement 2:

21-10254 - Post-R3*Type III 24-hr 100-Year Rainfall=6.50"*

Prepared by Civil Design Consultants, Inc.

Printed 12/27/2022

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Page 55

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPWA-1: Runoff Area=5,086 sf 0.00% Impervious Runoff Depth=0.60"
Tc=6.0 min CN=39 Runoff=0.0 cfs 0.006 af

SubcatchmentPWA-2A: Runoff Area=1,799 sf 83.10% Impervious Runoff Depth=5.11"
Tc=6.0 min CN=88 Runoff=0.2 cfs 0.018 af

SubcatchmentPWA-2B: Runoff Area=7,611 sf 81.01% Impervious Runoff Depth=5.00"
Tc=6.0 min CN=87 Runoff=1.0 cfs 0.073 af

SubcatchmentPWA-2C: Runoff Area=12,526 sf 83.91% Impervious Runoff Depth=5.22"
Tc=6.0 min CN=89 Runoff=1.6 cfs 0.125 af

SubcatchmentPWA-2D: Runoff Area=3,384 sf 0.00% Impervious Runoff Depth=0.60"
Tc=6.0 min CN=39 Runoff=0.0 cfs 0.004 af

Pond Infiltration Trench: Peak Elev=13.14' Storage=193 cf Inflow=0.2 cfs 0.018 af
Outflow=0.1 cfs 0.018 af

Pond Porous Pavement 1: Peak Elev=9.67' Storage=200 cf Inflow=1.0 cfs 0.073 af
Outflow=0.6 cfs 0.073 af

Pond Porous Pavement 2: Peak Elev=9.76' Storage=432 cf Inflow=1.6 cfs 0.125 af
Outflow=0.9 cfs 0.125 af

Total Runoff Area = 0.698 ac Runoff Volume = 0.225 af Average Runoff Depth = 3.87"
40.24% Pervious = 0.281 ac 59.76% Impervious = 0.417 ac

21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 100-Year Rainfall=6.50"

Printed 12/27/2022

Page 56

Summary for Subcatchment PWA-1:

Runoff = 0.0 cfs @ 12.29 hrs, Volume= 0.006 af, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

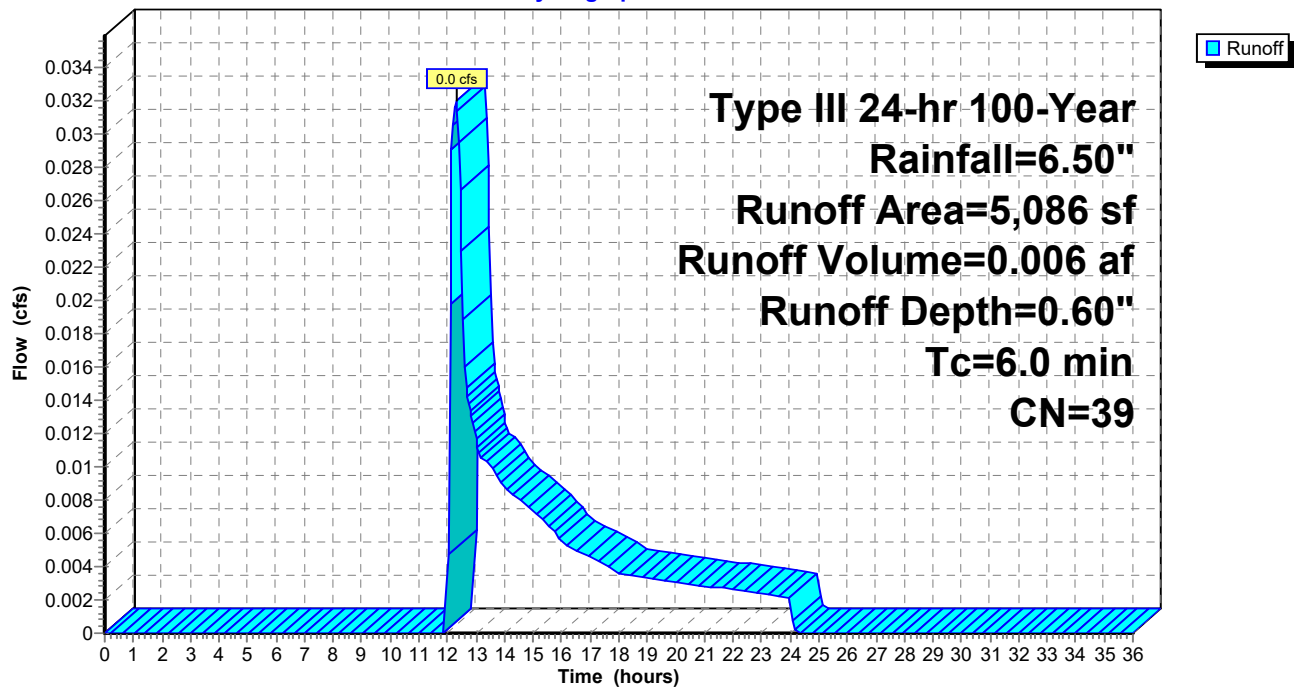
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
5,086	39	>75% Grass cover, Good, HSG A
0	98	Roofs, HSG A
0	98	Paved parking, HSG A
0	30	Woods, Good, HSG A
5,086	39	Weighted Average
5,086		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-1:

Hydrograph



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 100-Year Rainfall=6.50"

Printed 12/27/2022

Page 57

Summary for Subcatchment PWA-2A:

Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.018 af, Depth= 5.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

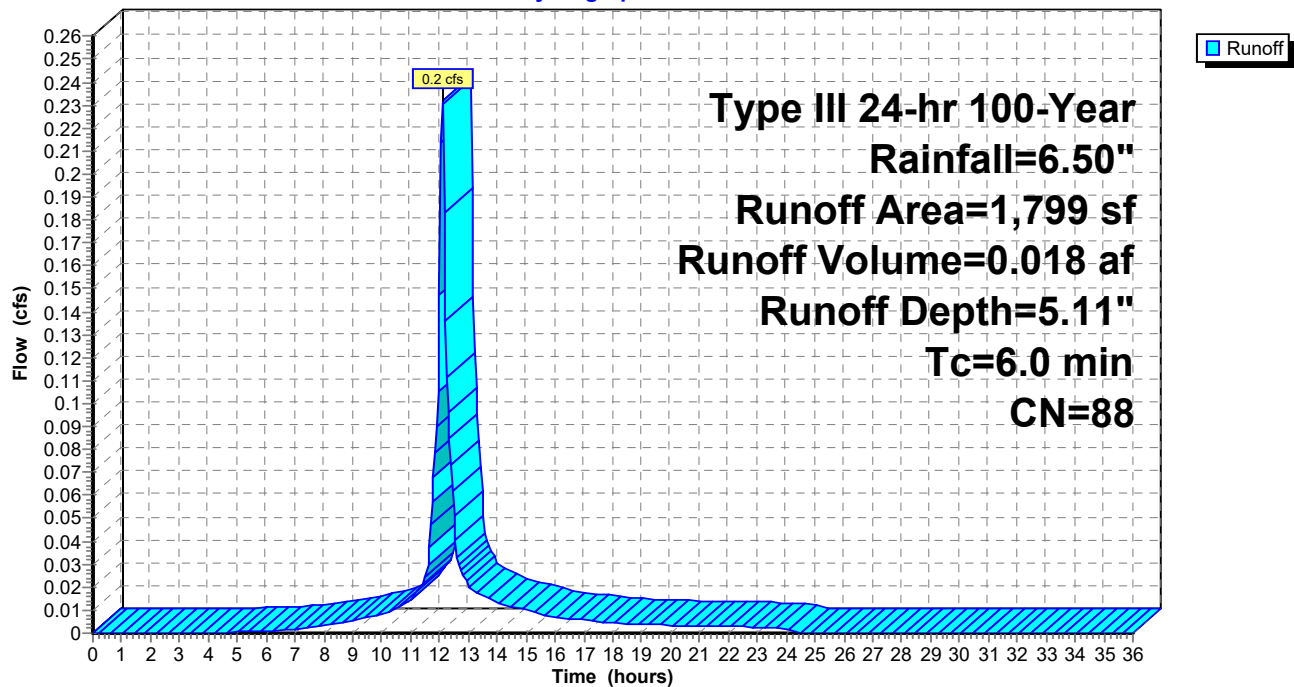
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
828	98	Roofs, HSG A
667	98	Paved parking, HSG A
304	39	>75% Grass cover, Good, HSG A
1,799	88	Weighted Average
304		16.90% Pervious Area
1,495		83.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-2A:

Hydrograph



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 100-Year Rainfall=6.50"

Printed 12/27/2022

Page 58

Summary for Subcatchment PWA-2B:

Runoff = 1.0 cfs @ 12.09 hrs, Volume= 0.073 af, Depth= 5.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

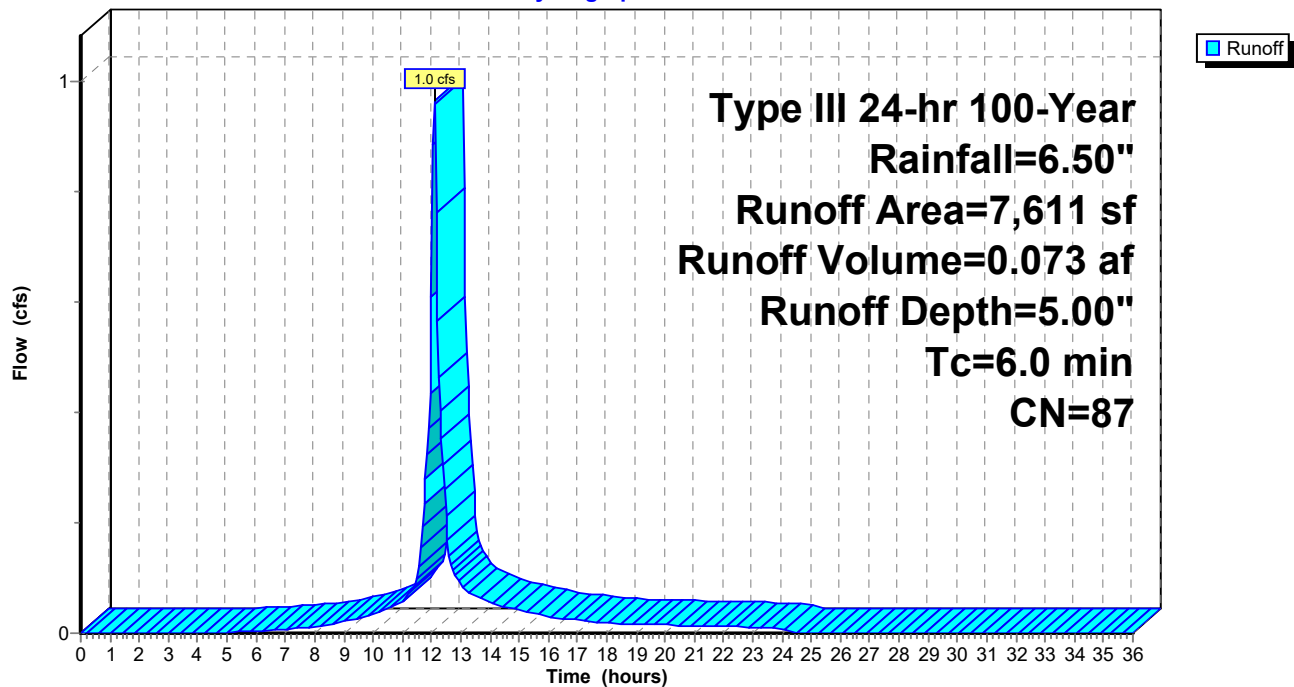
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
3,936	98	Roofs, HSG A
2,230	98	Paved parking, HSG A
1,445	39	>75% Grass cover, Good, HSG A
7,611	87	Weighted Average
1,445		18.99% Pervious Area
6,166		81.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-2B:

Hydrograph



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 100-Year Rainfall=6.50"

Printed 12/27/2022

Page 59

Summary for Subcatchment PWA-2C:

Runoff = 1.6 cfs @ 12.09 hrs, Volume= 0.125 af, Depth= 5.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

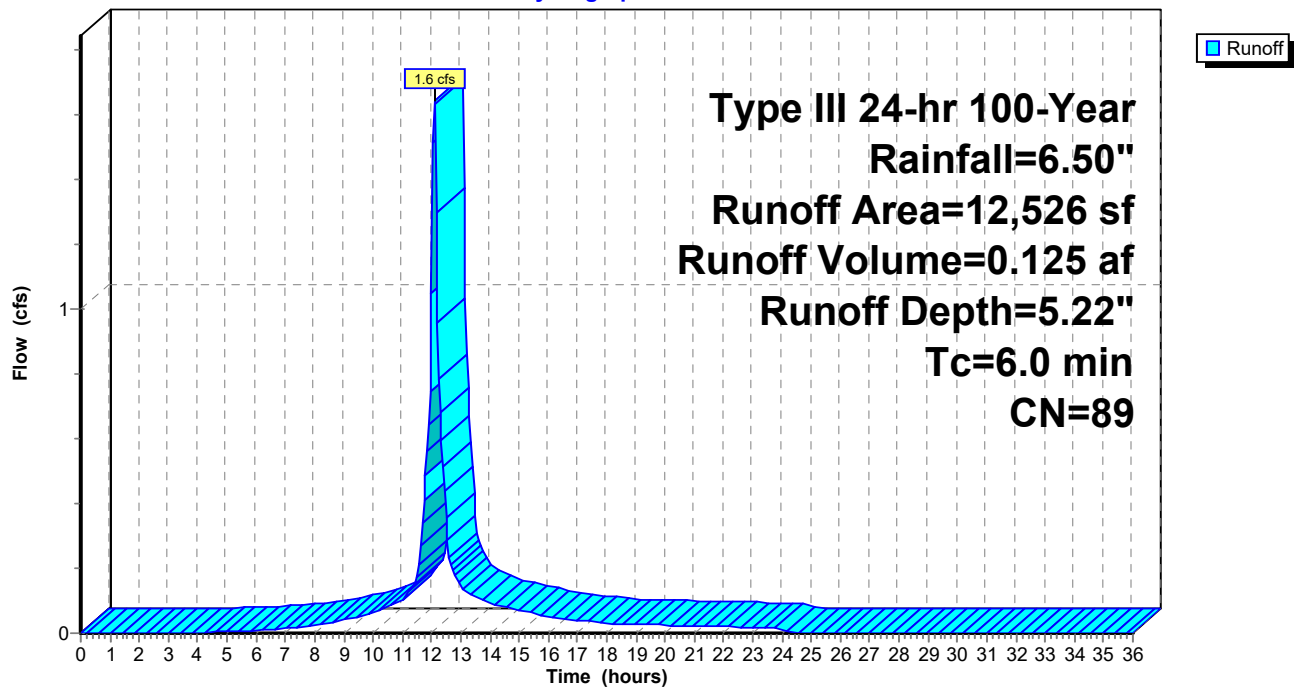
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
7,056	98	Roofs, HSG A
3,454	98	Paved parking, HSG A
2,016	39	>75% Grass cover, Good, HSG A
12,526	89	Weighted Average
2,016		16.09% Pervious Area
10,510		83.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-2C:

Hydrograph



21-10254 - Post-R3

Prepared by Civil Design Consultants, Inc.

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Type III 24-hr 100-Year Rainfall=6.50"

Printed 12/27/2022

Page 60

Summary for Subcatchment PWA-2D:

Runoff = 0.0 cfs @ 12.29 hrs, Volume= 0.004 af, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

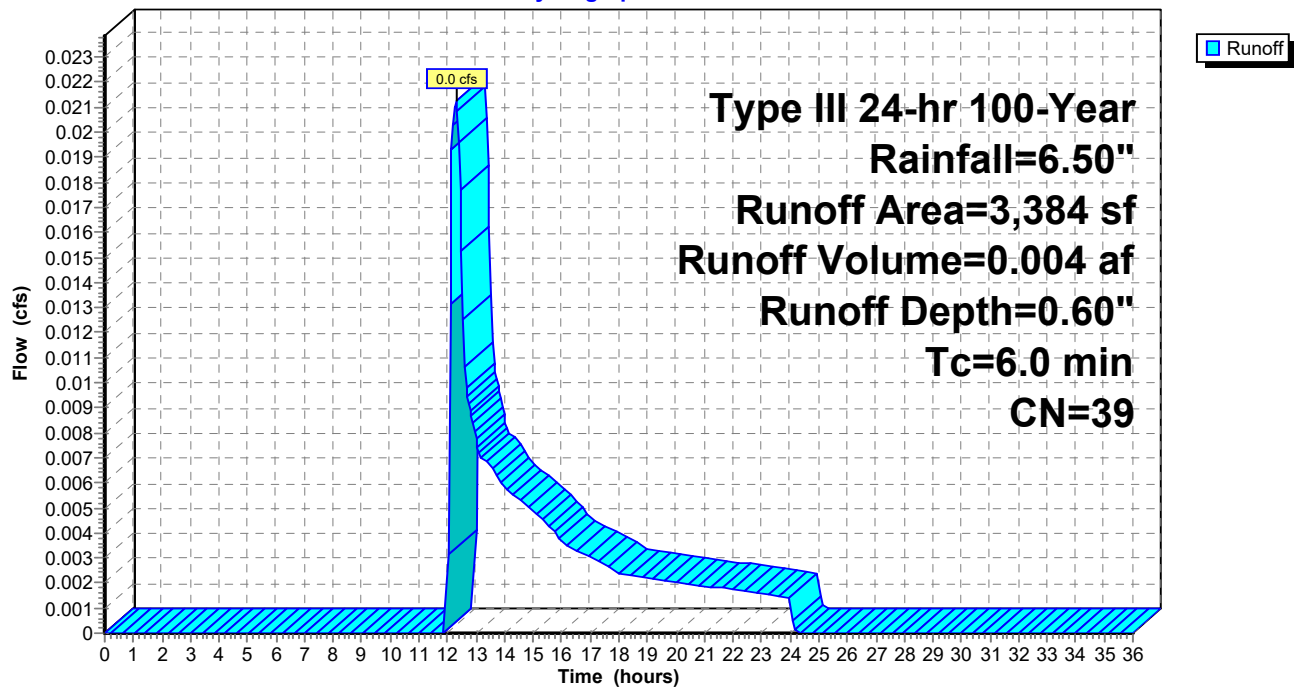
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
3,384	39	>75% Grass cover, Good, HSG A
0	98	Roofs, HSG A
0	98	Paved parking, HSG A
0	30	Woods, Good, HSG A
3,384	39	Weighted Average
3,384		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, 6

Subcatchment PWA-2D:

Hydrograph



21-10254 - Post-R3

Type III 24-hr 100-Year Rainfall=6.50"

Prepared by Civil Design Consultants, Inc.

Printed 12/27/2022

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Page 61

Summary for Pond Infiltration Trench:

Inflow Area = 0.041 ac, 83.10% Impervious, Inflow Depth = 5.11" for 100-Year event
 Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.018 af
 Outflow = 0.1 cfs @ 12.43 hrs, Volume= 0.018 af, Atten= 72%, Lag= 20.7 min
 Discarded = 0.1 cfs @ 12.43 hrs, Volume= 0.018 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 13.14' @ 12.43 hrs Surf.Area= 122 sf Storage= 193 cf

Plug-Flow detention time= 21.7 min calculated for 0.018 af (100% of inflow)
 Center-of-Mass det. time= 21.6 min (810.4 - 788.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	9.50'	172 cf	3.04'W x 40.00'L x 3.88'H Field A 472 cf Overall - 42 cf Embedded = 430 cf x 40.0% Voids
#2A	11.17'	32 cf	ADS N-12 12 x 2 Inside #1 Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf
		204 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	9.50'	8.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 7.50'

Discarded OutFlow Max=0.1 cfs @ 12.43 hrs HW=13.14' (Free Discharge)
 ↑1=Exfiltration (Controls 0.1 cfs)

21-10254 - Post-R3*Type III 24-hr 100-Year Rainfall=6.50"*

Prepared by Civil Design Consultants, Inc.

Printed 12/27/2022

HydroCAD® 9.10 s/n 06435 © 2011 HydroCAD Software Solutions LLC

Page 62

Pond Infiltration Trench: - Chamber Wizard Field A**Chamber Model = ADS N-12 12**

Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf

Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf

14.5" Wide + 0.0" Spacing = 14.5" C-C

2 Chambers/Row x 20.00' Long = 40.00' Base Length

1 Rows x 14.5" Wide + 11.0" Side Stone x 2 = 3.04' Base Width

20.0" Base + 14.5" Chamber Height + 12.0" Cover = 3.88' Field Height

2 Chambers x 16.2 cf = 32.4 cf Chamber Storage

2 Chambers x 20.9 cf = 41.9 cf Displacement

471.6 cf Field - 41.9 cf Chambers = 429.8 cf Stone x 40.0% Voids = 171.9 cf Stone Storage

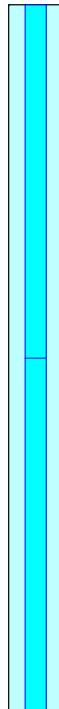
Stone + Chamber Storage = 204.3 cf = 0.005 af

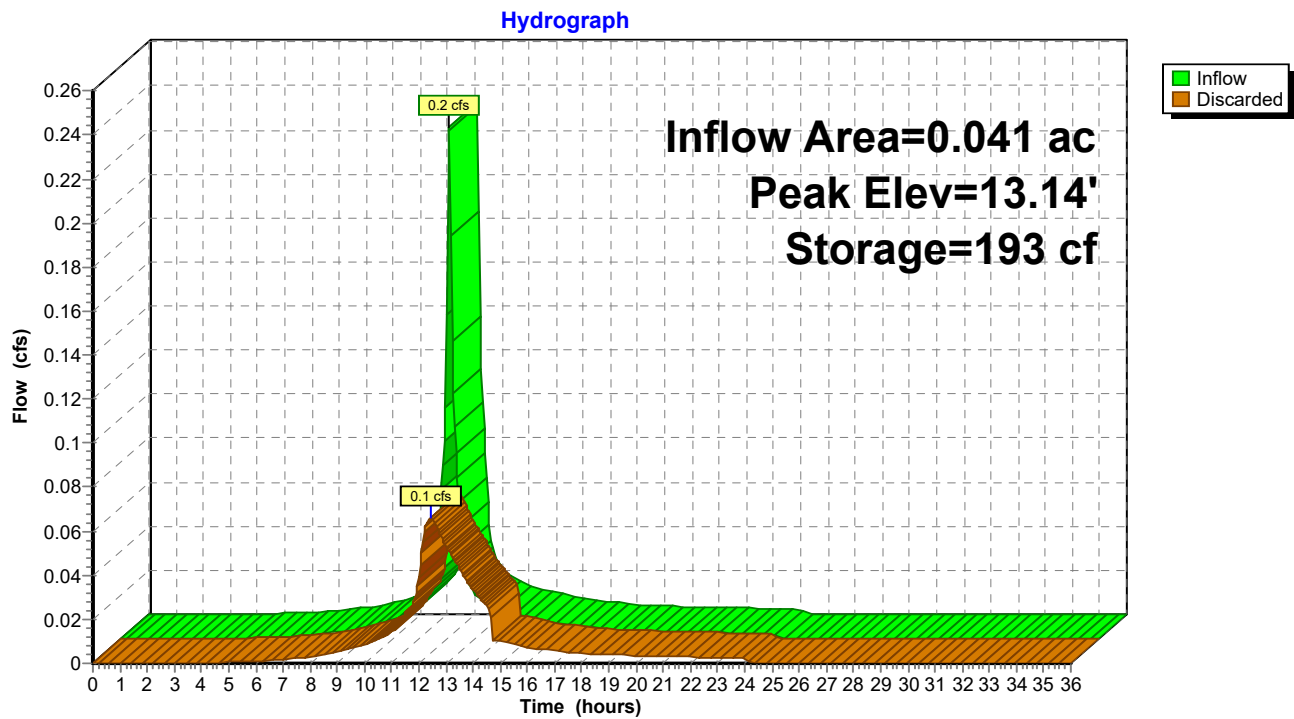
2 Chambers @ \$ 0.00 /ea = \$ 0.00

17.5 cy Field Excavation @ \$ 0.00 /cy = \$ 0.00

15.9 cy Stone @ \$ 0.00 /cy = \$ 0.00

Total Cost = \$ 0.00



Pond Infiltration Trench:

Summary for Pond Porous Pavement 1:

[85] Warning: Oscillations may require Finer Routing>1

Inflow Area = 0.175 ac, 81.01% Impervious, Inflow Depth = 5.00" for 100-Year event
 Inflow = 1.0 cfs @ 12.09 hrs, Volume= 0.073 af
 Outflow = 0.6 cfs @ 12.21 hrs, Volume= 0.073 af, Atten= 41%, Lag= 7.2 min
 Discarded = 0.6 cfs @ 12.21 hrs, Volume= 0.073 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 9.67' @ 12.21 hrs Surf.Area= 2,712 sf Storage= 200 cf

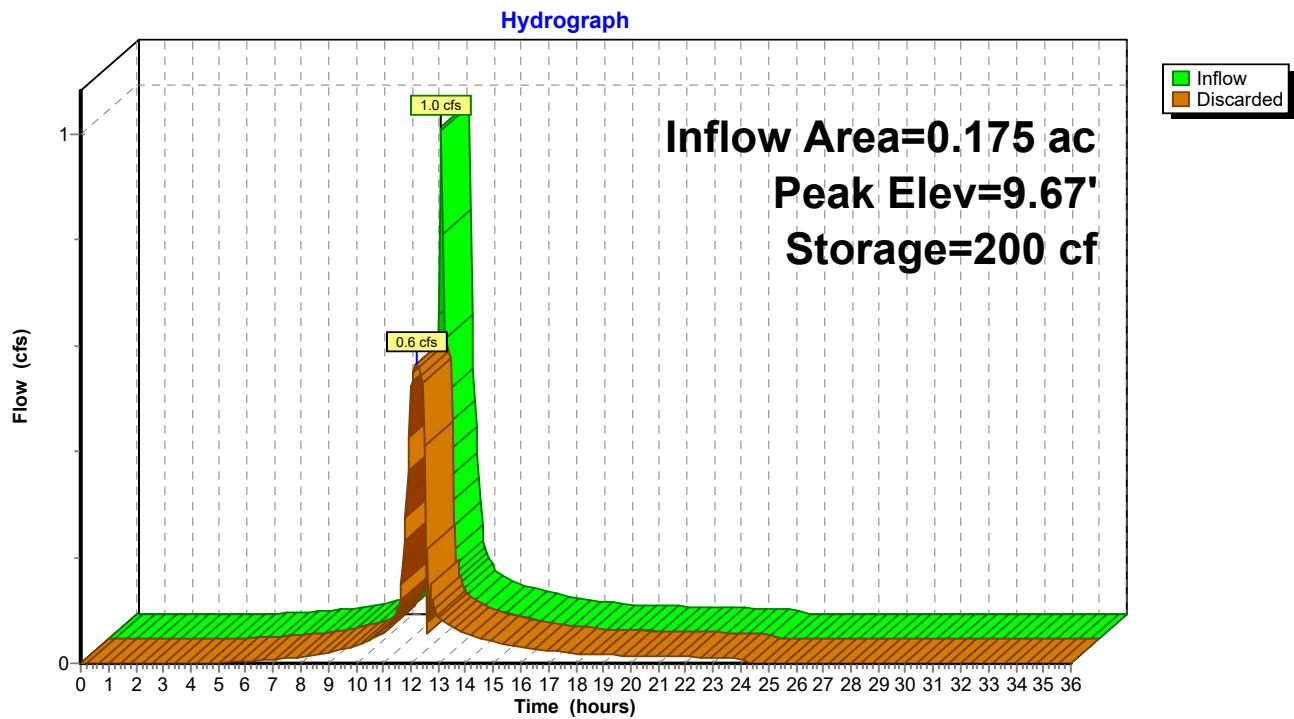
Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 1.4 min (793.3 - 791.9)

Volume	Invert	Avail.Storage	Storage Description	
#1	9.49'	2,086 cf	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
9.49	2,712	0.0	0	0
9.50	2,712	40.0	11	11
10.25	2,712	40.0	814	824
10.26	2,712	30.0	8	833
11.25	2,712	30.0	805	1,638
11.26	2,712	40.0	11	1,649
11.58	2,712	40.0	347	1,996
11.59	2,712	10.0	3	1,999
11.91	2,712	10.0	87	2,086

Device	Routing	Invert	Outlet Devices
#1	Discarded	9.49'	8.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 7.50'

Discarded OutFlow Max=0.6 cfs @ 12.21 hrs HW=9.67' (Free Discharge)

↑**1=Exfiltration** (Controls 0.6 cfs)

Pond Porous Pavement 1:

Summary for Pond Porous Pavement 2:

[85] Warning: Oscillations may require Finer Routing>1

Inflow Area = 0.288 ac, 83.91% Impervious, Inflow Depth = 5.22" for 100-Year event
 Inflow = 1.6 cfs @ 12.09 hrs, Volume= 0.125 af
 Outflow = 0.9 cfs @ 12.23 hrs, Volume= 0.125 af, Atten= 47%, Lag= 8.4 min
 Discarded = 0.9 cfs @ 12.23 hrs, Volume= 0.125 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 9.76' @ 12.23 hrs Surf.Area= 3,973 sf Storage= 432 cf

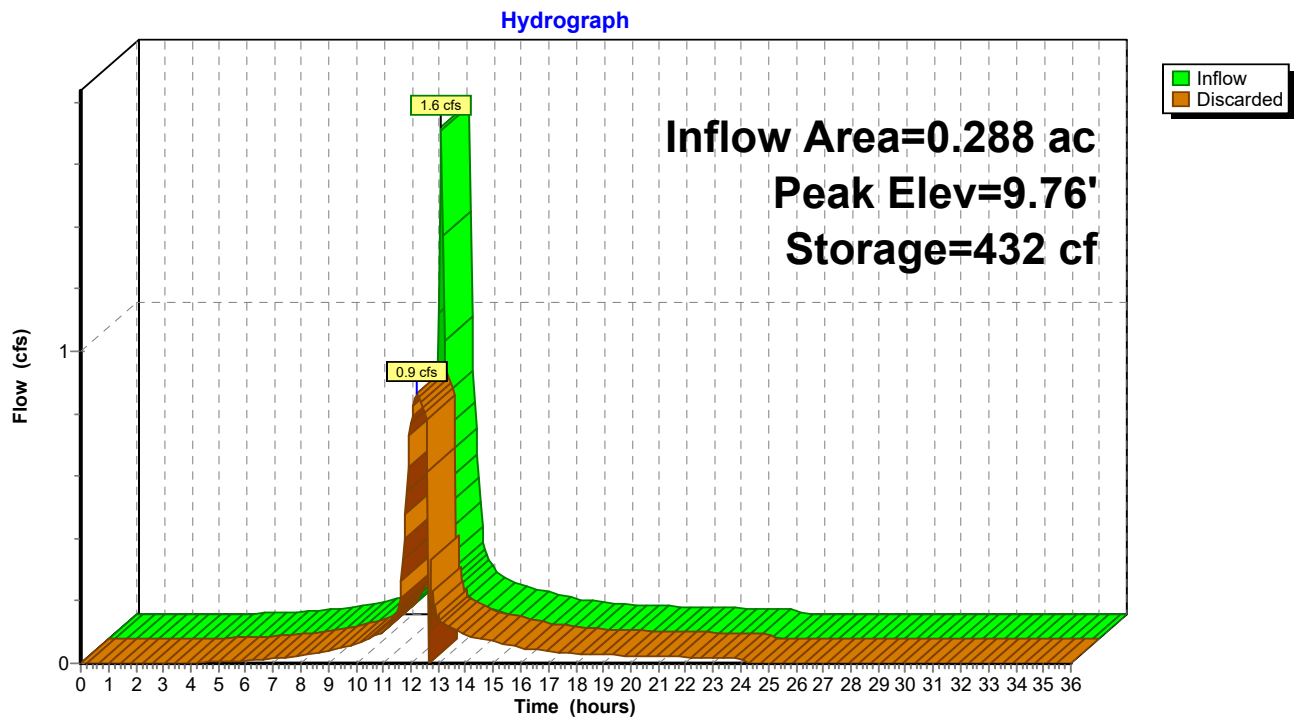
Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 2.0 min (787.6 - 785.6)

Volume	Invert	Avail.Storage	Storage Description	
#1	9.49'	3,055 cf	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
9.49	3,973	0.0	0	0
9.50	3,973	40.0	16	16
10.25	3,973	40.0	1,192	1,208
10.26	3,973	30.0	12	1,220
11.25	3,973	30.0	1,180	2,400
11.26	3,973	40.0	16	2,416
11.58	3,973	40.0	509	2,924
11.59	3,973	10.0	4	2,928
11.91	3,973	10.0	127	3,055

Device	Routing	Invert	Outlet Devices
#1	Discarded	9.49'	8.270 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 7.50'

Discarded OutFlow Max=0.9 cfs @ 12.23 hrs HW=9.76' (Free Discharge)

↑**1=Exfiltration** (Controls 0.9 cfs)

Pond Porous Pavement 2:

DRAINAGE REPORT

159 Beach Road

Salisbury, Massachusetts

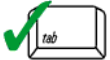
TAB 4



Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.¹ This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8²
- Operation and Maintenance Plan required by Standard 9

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

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

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

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

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



Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

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

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

- ☐ New development
- ☒ Redevelopment
- ☐ Mix of New Development and Redevelopment



Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☒ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
 - ☐ Credit 1
 - ☐ Credit 2
 - ☐ Credit 3
- ☒ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☒ Other (describe): Infiltration trench and porous pavement

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.



Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

- ☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- ☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- ☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

- ☒ Soil Analysis provided.
- ☒ Required Recharge Volume calculation provided.
- ☐ Required Recharge volume reduced through use of the LID site Design Credits.
- ☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.
 - ☒ Static
 - ☐ Simple Dynamic
 - ☐ Dynamic Field¹
- ☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.
- ☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- ☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- ☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
 - ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
 - ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
 - ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
 - ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- ☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- ☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

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



Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

- ☒ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- ☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
 - Provisions for storing materials and waste products inside or under cover;
 - Vehicle washing controls;
 - Requirements for routine inspections and maintenance of stormwater BMPs;
 - Spill prevention and response plans;
 - Provisions for maintenance of lawns, gardens, and other landscaped areas;
 - Requirements for storage and use of fertilizers, herbicides, and pesticides;
 - Pet waste management provisions;
 - Provisions for operation and management of septic systems;
 - Provisions for solid waste management;
 - Snow disposal and plowing plans relative to Wetland Resource Areas;
 - Winter Road Salt and/or Sand Use and Storage restrictions;
 - Street sweeping schedules;
 - Provisions for prevention of illicit discharges to the stormwater management system;
 - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
 - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
 - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- ☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
 - ☒ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
 - ☐ is within the Zone II or Interim Wellhead Protection Area
 - ☐ is near or to other critical areas
 - ☒ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
 - ☐ involves runoff from land uses with higher potential pollutant loads.
 - ☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.
 - ☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.



Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

- ☒ The BMP is sized (and calculations provided) based on:
 - ☒ The ½" or 1" Water Quality Volume or
 - ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- ☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- ☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

- ☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- ☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- ☐ The NPDES Multi-Sector General Permit does **not** cover the land use.
- ☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- ☐ All exposure has been eliminated.
- ☐ All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- ☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- ☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- ☐ Critical areas and BMPs are identified in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

- ☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
 - ☐ Limited Project
 - ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
 - ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
 - ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
 - ☐ Bike Path and/or Foot Path
- ☒ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.
- ☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- ☒ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
 - Construction Period Operation and Maintenance Plan;
 - Names of Persons or Entity Responsible for Plan Compliance;
 - Construction Period Pollution Prevention Measures;
 - Erosion and Sedimentation Control Plan Drawings;
 - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
 - Vegetation Planning;
 - Site Development Plan;
 - Construction Sequencing Plan;
 - Sequencing of Erosion and Sedimentation Controls;
 - Operation and Maintenance of Erosion and Sedimentation Controls;
 - Inspection Schedule;
 - Maintenance Schedule;
 - Inspection and Maintenance Log Form.
- ☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

- ☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- ☐ The project is **not** covered by a NPDES Construction General Permit.
- ☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- ☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

- ☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - ☒ Name of the stormwater management system owners;
 - ☒ Party responsible for operation and maintenance;
 - ☒ Schedule for implementation of routine and non-routine maintenance tasks;
 - ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
 - ☒ Description and delineation of public safety features;
 - ☒ Estimated operation and maintenance budget; and
 - ☒ Operation and Maintenance Log Form.
- ☐ The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
 - ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
 - ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

- ☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- ☐ An Illicit Discharge Compliance Statement is attached;
- ☒ NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

Project: 159 Beach Road
Location: Salisbury, MA
Client: Larkin Real Estate Group, Inc.

Project Number: 21-10254
Prepared By: William Hall, P.E.
Date: December 27, 2022

STORMWATER MANAGEMENT STANDARDS CALCULATIONS

Standard 1: Velocity & Rip-Rap Apron Sizing and Gradation Calculations

- Not Applicable, no outlets proposed.

Conclusion: No stormwater discharges are proposed, the Stormwater Management System conforms to Standard 1.

Standard 2: Peak Discharge Summary (CFS)

	2-Year (3.1-IN)	10-Year (4.5-IN)	25-Year (5.3-IN)	50-Year (5.9-IN)	100-Year (6.5-IN)
Design Point 1					
Pre-Development Conditions:	0.3	0.6	0.8	1.0	1.1
Post Development Conditions:	0.0	0.0	0.0	0.0	0.0

	2-Year (3.1-IN)	10-Year (4.5-IN)	25-Year (5.3-IN)	50-Year (5.9-IN)	100-Year (6.5-IN)
Design Point 2					
Pre-Development Conditions:	0.0	0.0	0.0	0.0	0.0
Post Development Conditions:	0.0	0.0	0.0	0.0	0.0

Conclusion: The Stormwater Management System conforms to Standard 2.

Standard 3: Recharge Calculations (Static Method)

Porous Pavement 1

Hydrologic Soils Group:	A	B	C	D	
Total Proposed Impervious Area:	0.14	0.00	0.00	0.00	0.14
Target Factor:	0.60	0.35	0.25	0.10	
Required Recharge Volume:	305	0	0	0	305 CF

Volume Provided: 2,080 CF

Determine Drawdown Time

Saturated Hydraulic Conductivity (Rawls Rate): 8.27 IN/HR
Bottom Area of Infiltration Basin: 2,712 SF
Drawdown Time: 1.1 HRS

Porous Pavement 2

Hydrologic Soils Group:	A	B	C	D	
Total Proposed Impervious Area:	0.24	0.00	0.00	0.00	0.24
Target Factor:	0.60	0.35	0.25	0.10	
Required Recharge Volume:	523	0	0	0	523 CF

Volume Provided: 3,047 CF

Determine Drawdown Time

Saturated Hydraulic Conductivity (Rawls Rate):	8.27 IN/HR
Bottom Area of Infiltration Basin:	3,973 SF
Drawdown Time:	1.1 HRS

Infiltration Trench

Hydrologic Soils Group:	A	B	C	D	
Total Proposed Impervious Area:	0.03	0.00	0.00	0.00	0.03
Target Factor:	0.60	0.35	0.25	0.10	
Required Recharge Volume:	75	0	0	0	75 CF

Volume Provided: 201 CF

Determine Drawdown Time

Saturated Hydraulic Conductivity (Rawls Rate):	8.27 IN/HR
Bottom Area of Infiltration Basin:	122 SF
Drawdown Time:	2.4 HRS

Conclusion: The volume provided exceeds the minimum recharge volume required. In addition, the BMPs drain within 72-HRS to comply with DEP regulations. The Stormwater Management System conforms to Standard 3.

Standard 4: Water Quality Volume Calculations

Porous Pavement 1

Water Quality Depth:	1.0 IN
Total Proposed Impervious Area:	0.14 Acres
Required Water Quality Volume:	508 CF
Provided Water Quality Volume:	824 CF

Porous Pavement 2

Water Quality Depth:	1.0 IN
Total Proposed Impervious Area:	0.24 Acres
Required Water Quality Volume:	871 CF
Provided Water Quality Volume:	1,208 CF

Infiltration Trench

Water Quality Depth:	1.0 IN
Total Proposed Impervious Area:	0.03 Acres
Required Water Quality Volume:	125 CF
Provided Water Quality Volume:	201 CF

TSS Removal Rate Calculations

Treatment Provided From Pervious Pavement Systems 1 & 2

	TSS Removal Rate	Starting TSS Load	Amount Removed	Remaining Load
Street Sweeping:	5%	1.00	0.05	0.95
Pervious Pavement System:	80%	0.95	0.76	0.19
TSS Removed through Pervious Pavement:				81.0%

Treatment Provided From Infiltration Trench

	TSS Removal Rate	Starting TSS Load	Amount Removed	Remaining Load
Infiltration Trench with Filter Strip:	80%	1.00	0.80	0.20
TSS Removed through Infiltration Trench:				80.0%

Conclusion: The volume provided by the storage course of the pavers exceeds the Water Quality Volume, therefore the TSS Removal Rate meets 80%. The Stormwater Management System conforms to Standard 4.

Standard 5: Land Uses With Higher Potential Pollutant Loads

Conclusion: The proposed use is not considered a Land Use with Higher Potential Pollutant Loads. This Standard is NOT Applicable.

Standard 6: Critical Areas

Conclusion: The proposal is not located within a Critical Area. This Standard is NOT Applicable.

Standard 7: Redevelopment


Conclusion: The development does meet the criteria for Redevelopment. All standards have been met through the use of porous pavers.

Standard 8: Construction Period Controls

Conclusion: The project is not covered by a NPDES Construction General Permit. An erosion and sedimentation control plan has been submitted to address construction period pollution prevention measures and to reduce the potential for erosion and sedimentation. The Stormwater Management System Conforms to Standard 8.

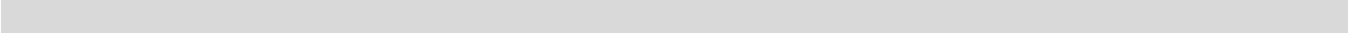
Standard 9: Operations and Maintenance Plan

Conclusion: An Operations and Maintenance Plan has been prepared and provided with this summary. The Stormwater Management System Conforms to Standard 9.



Standard 10: Illicit Discharges to Drainage System

Conclusion: All off-site discharges are comprised entirely of stormwater. The Stormwater Management System Conforms to Standard 10.



Porous Pavement 1 Mounding

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness is calculated.

Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. **The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed** otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

Input Values		use consistent units (e.g. feet & days or inches & hours)	Conversion Table		
			inch/hour	feet/day	
0.7670	R	Recharge (infiltration) rate (feet/day)	0.67	1.33	
0.350	Sy	Specific yield, Sy (dimensionless, between 0 and 1)			
165.40	K	Horizontal hydraulic conductivity, Kh (feet/day)*	2.00	4.00	In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).
40.000	x	1/2 length of basin (x direction, in feet)			
17.000	y	1/2 width of basin (y direction, in feet)	hours	days	
0.046	t	duration of infiltration period (days)	36	1.50	
2.500	hi(0)	initial thickness of saturated zone (feet)			
2.597	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)			
0.097	Δh(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)			

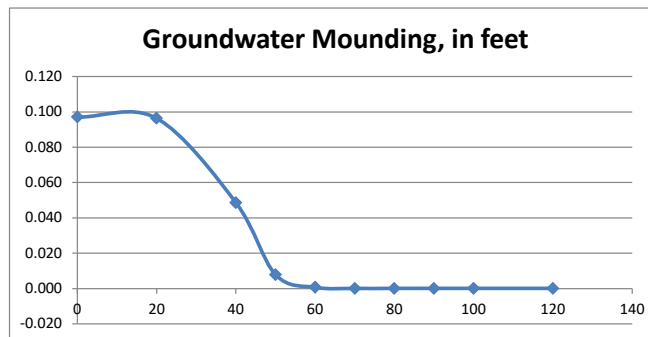
Ground-water Mounding, in feet

Distance from center of basin in x direction, in feet

0.097	0
0.096	20
0.049	40
0.008	50
0.001	60
0.000	70
0.000	80
0.000	90
0.000	100
0.000	120



Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

Porous Pavement 2 Mounding

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness is calculated.

Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. **The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed** otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

Input Values		use consistent units (e.g. feet & days or inches & hours)	Conversion Table		
			inch/hour	feet/day	
0.7670	R	Recharge (infiltration) rate (feet/day)	0.67	1.33	
0.350	Sy	Specific yield, Sy (dimensionless, between 0 and 1)			
165.40	K	Horizontal hydraulic conductivity, Kh (feet/day)*	2.00	4.00	In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).
57.500	x	1/2 length of basin (x direction, in feet)			
17.250	y	1/2 width of basin (y direction, in feet)	hours	days	
0.046	t	duration of infiltration period (days)	36	1.50	
2.500	hi(0)	initial thickness of saturated zone (feet)			
2.597	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)			
0.097	Δh(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)			

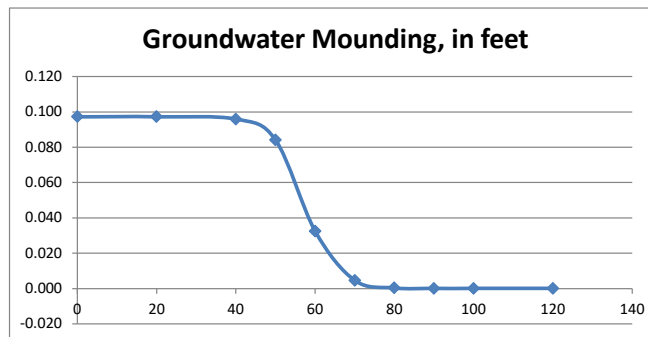
Ground-water Mounding, in feet

Distance from center of basin in x direction, in feet

0.097	0
0.097	20
0.096	40
0.084	50
0.033	60
0.005	70
0.000	80
0.000	90
0.000	100
0.000	120



Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

OPERATIONS AND MAINTENANCE PLAN

December 27, 2022

This Operations and Maintenance (O&M) Plan has been prepared in accordance with the Stormwater Management Policy issued by the Department of Environmental Protection (DEP) for 159 Beach Road in Salisbury, MA.

Upon a period beginning twelve months after the completion of the project, the porous pavers shall be inspected annually. Maintenance and inspection shall be performed as indicated below:

Visual Inspection

The surface must be inspected annually for signs of degradation and clogging of the infiltration trenches and porous pavement. Regularly monitor the surface after storm events to make sure that the surface drains properly. Puddling could be an indication of clogging of the drainage system. Trenches shall be weeded and mowed as required to control vegetation.

Porous Pavement

Frequent cleaning and maintenance of porous pavement is critical to maintain proper function of the system. No winter sanding of porous pavements is permitted. It is also recommended to minimize application of salt for ice control and to never reseal or repave with impermeable materials. The porous pavement should be inspected annually for deterioration or spalling. For porous asphalt and concrete, the surface should be cleaned a minimum of twice per year using a vacuum sweeper (Note power washing may be required beforehand to dislodge trapped particles). Major clogging may necessitate replacement of pavement surface, and possibly filter course and sub-base course. It is advised to post signage indicating porous pavement areas.

Infiltration Trench

Infiltration systems are prone to clogging and failure, so it is imperative to develop and implement aggressive maintenance plans and schedules. Installing the required pretreatment BMPs will significantly reduce maintenance requirements. Inspections and preventive maintenance must be performed at least twice a year. Drainage pipes shall be inspected and cleaned of sediment at least every five (5) years, or in accordance to manufacture's specifications, or as required to maintain adequate functionality of the stormwater conveyance system. All sediments shall be properly handled and disposed of in accordance with local, state and federal guidelines and regulations.

Snow Storage / Removal

Snow plowed from the proposed driveway will be placed or disposed of in accordance with the policy developed by DEP. Under no circumstances shall snow plowed or removed from the road be stockpiled within the Town right-of-way. If conditions arise where snow storage areas are at capacity the Operator is required to remove and dispose of snow off site in conformance with all local, state and federal regulations.

Property Applicant / Responsible Party:

Larkin Real Estate Group, Inc.
383 Main Street
Medfield, MA 02052

Construction Period Pollution Prevention Plan:

See Sheet C-5 for construction period erosion and sedimentation control measure.

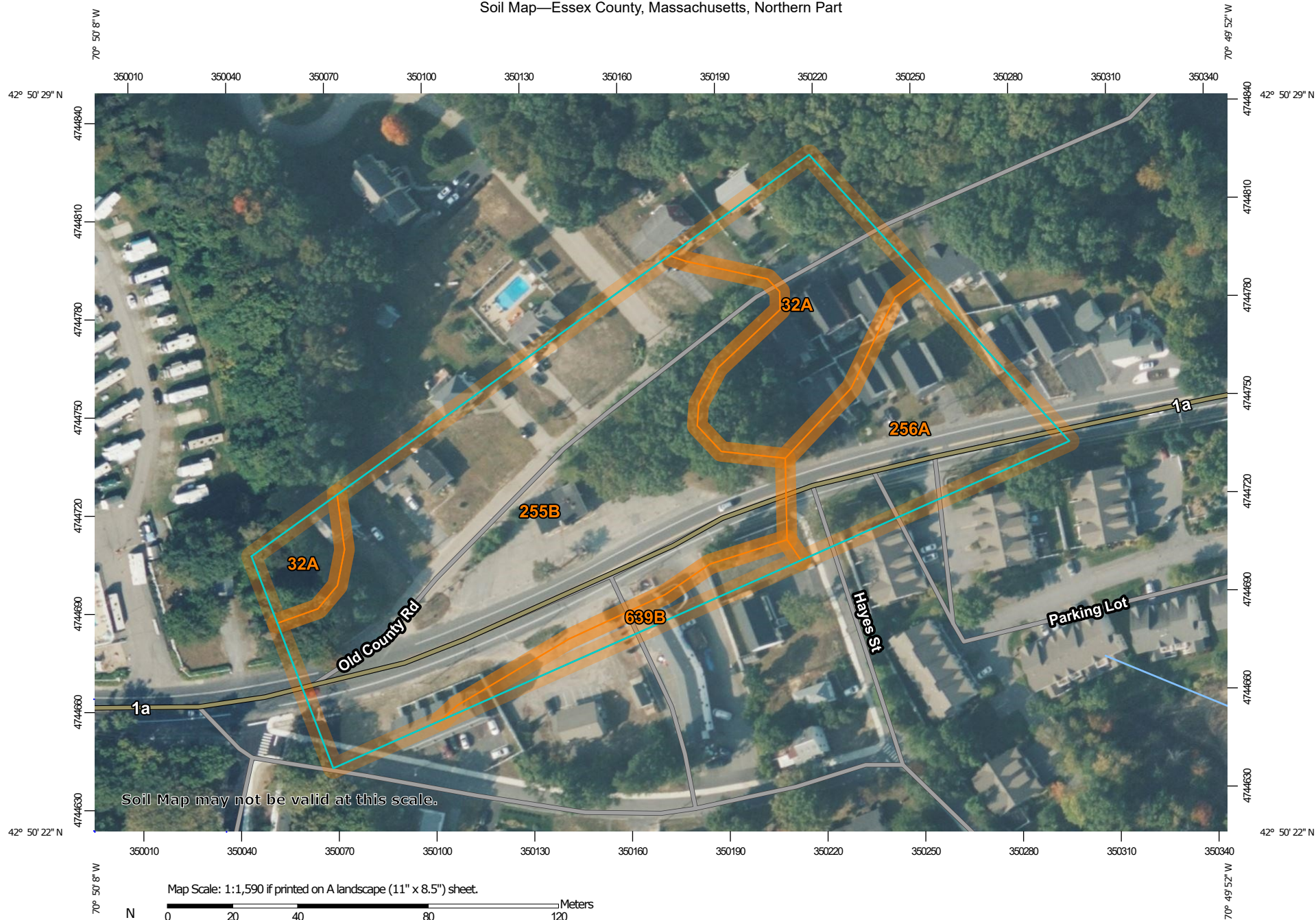
System Map:

See Sheet C-3 for the location of all stormwater management facilities.

Estimated Operations and Maintenance Budget

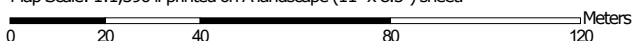
All maintenance will be performed as required. An annual budget of \$2,500 a year should be specified for operations and maintenance of the obligations.

Soil Map—Essex County, Massachusetts, Northern Part



Soil Map may not be valid at this scale.

Map Scale: 1:1,590 if printed on A landscape (11" x 8.5") sheet.



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



**Natural Resources
Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

5/31/2022
Page 1 of 3

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 1:15,800.

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: Essex County, Massachusetts, Northern Part

Survey Area Data: Version 17, Sep 2, 2021

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

Date(s) aerial images were photographed: May 22, 2020—Sep 25, 2020

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
32A	Wareham loamy sand, 0 to 3 percent slopes	1.0	20.2%
255B	Windsor loamy sand, 3 to 8 percent slopes	3.0	58.5%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	0.9	17.5%
639B	Urban land-Hooksan complex, 0 to 8 percent slopes	0.2	3.7%
Totals for Area of Interest		5.2	100.0%



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

A. Facility Information

Larkin

Owner Name

159 Beach Road

Street Address

Salisbury

City

MA

State

Map/Lot #

Zip Code

B. Site Information

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

Test pits for drainage purposes only

2. Soil Survey Available? ☒ Yes ☐ No If yes:

Web Soil Survey 32A/255B

Source

Soil Map Unit

Wareham and Windsor loamy sand

Soil Name

Soil Limitations

Soil Parent material

Landform

3. Surficial Geological Report Available? ☐ Yes ☐ No

If yes:

Year Published/Source

Map Unit

Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? ☐ Yes ☐ No

5. Within a velocity zone? ☐ Yes ☐ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No

If yes, MassGIS Wetland Data Layer:

Wetland Type

7. Current Water Resource Conditions (USGS):

Month/Day/ Year

Range: ☐ Above Normal

☐ Normal

☐ Below Normal

8. Other references reviewed:



Commonwealth of Massachusetts
City/Town of Salisbury

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

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-1 1/28/22
 Hole # Date Time Weather Latitude Longitude:

1. Land Use Commercial
 (e.g., woodland, agricultural field, vacant lot, etc.) Vegetation Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)

Description of Location: _____

2. Soil Parent Material: _____
 Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands _____ feet
 Property Line >10 feet Drinking Water Well _____ feet Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-8	A	Sandy Loam	10YR3/2	_____	_____	_____	_____	_____	Massive	Friable	
8-18	B	Loamy Sand	10YR5/6	_____	_____	_____	_____	_____	Massive	Friable	
18-90	C	Sand	10YR7/6	78"	High Chroma	>5	_____	_____	Single Grain	Loose	

Additional Notes:



Commonwealth of Massachusetts
City/Town of Salisbury

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

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-2 1/28/22
Hole # Date Time Weather Latitude Longitude:

1. Land Use: Commercial
(e.g., woodland, agricultural field, vacant lot, etc.) Vegetation Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)

Description of Location: _____

2. Soil Parent Material: _____ Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands _____ feet
Property Line >10 feet Drinking Water Well _____ feet Other _____ feet

4. Unsuitable

Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 102" Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-78	Fill										
78-102	C	Sand	10YR7/6	84"	H.C.	>5			S.G.	Loose	

Additional Notes:



Commonwealth of Massachusetts
City/Town of Salisbury

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

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-3 1/28/22
Hole # Date Time Weather Latitude Longitude:

1. Land Use Commercial
(e.g., woodland, agricultural field, vacant lot, etc.) Vegetation Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)

Description of Location: _____

2. Soil Parent Material: _____
Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands _____ feet
Property Line >10 feet Drinking Water Well _____ feet Other _____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 96" Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-72	Fill										
72-102	C	Sand	10YR7/6	78"	H.C.	>5			S.G.	Loose	

Additional Notes:



Commonwealth of Massachusetts
City/Town of Salisbury

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

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-4 1/28/22
Hole # Date Time Weather Latitude Longitude:

1. Land Use: Commercial
(e.g., woodland, agricultural field, vacant lot, etc.) Vegetation Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)

Description of Location: _____

2. Soil Parent Material: _____ Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands _____ feet
Property Line >10 feet Drinking Water Well _____ feet Other _____ feet

4. Unsuitable

Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 84" Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-60	Fill										
60-96	C	Sand	10YR7/6	66"	H.C.	>5			S.G.	Loose	

Additional Notes:



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

F. Certification

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

Signature of Soil Evaluator

William Hall, P.E., S.E. 13592

Typed or Printed Name of Soil Evaluator / License #

1/28/22

Date

6/30/24

Expiration Date of License

Name of Approving Authority Witness

Approving Authority

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

Field Diagrams: Use this area for field diagrams: