

DRAINAGE REPORT

Prepared for:

Island Diversified, LLC

Project Location:

8 Mathes Terrace & 15 Madbury Road

Durham, NH 03861

Prepared on:

December 18, 2013

Prepared by:



MJS
ENGINEERING, PC

CIVIL/SITE CONSULTING ENVIRONMENTAL

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<u>Appendix Number</u>	<u>Date</u>	<u>Description</u>
A	12/18/13	Pre-Development Drainage Analysis and Plan
B	12/18/13	Post-Development Drainage Analysis and Plan
C	12/18/13	NRCS Soil Map
D	12/18/13	Rip Rap Calculations

Project Background / Purpose

Island Diversified, LLC is proposing to redevelop two adjacent parcels located at 15 Madbury Road and 8 Mathes Terrace in the Central Business District of Durham, New Hampshire. The proposal involves the removal of the existing buildings on site and the construction of a single multi-story building with commercial and residential occupancy as well as parking on the first floor of a portion of the building.

The two parcels that the site is comprised of are lots 12-5 & 12-6 located on Tax Map 2. These lots are located at the intersection of Madbury Road and Mathes Terrace, Lot 12-5 directly abuts Madbury Road and is 6,728 square feet (0.154 ac). Lot 12-6 is set back on Mathes Terrace and is 5,524 square feet (0.127 ac).

Soil Mapping

The soil mapping was determined by the NRCS USDA Strafford County Web Soil Survey. The soil found on site is Hollis Charlton, very rocky, fine sandy loam. This soil is a Hydrologic Soil Group C soil as modeled in the analysis. Refer to Appendix C for the NRCS Soil Map.

Drainage Analysis

Drainage conditions have been analyzed based on the runoff characteristics at two points of analysis (POA). This analysis utilizes HydroCAD modeling software. This program models the runoff based on the SCS TR-20 method and the time of concentration based on the SCS TR-55 method. This analysis compares the runoff rates for the 1 inch, 2, 10, 25, 50 and 100-year USDA/SCS Type III 24-hour storm events. The rainfall data used in the model is for the Town of Durham.

The two parcels identified as Lot 12-5 and Lot 12-6 total 0.154 and 0.127 acres, respectively. Each parcel has one building containing student housing. Also present are typical site amenities including parking areas, landscaping, and walkways. The Existing Conditions Plan depicts the existing development on the property.

Pre-Development Conditions

The enclosed Pre-Development Drainage Plan (Appendix A) depicts the contributing runoff areas that are generated from this property and from off-site areas that discharge stormwater runoff across this property. The watershed areas have been determined via inspection by our office as well as a topographical survey.

Pre-Development Drainage conditions have been analyzed based on the runoff characteristics at two points of analysis (POA). The back half of the property drains over Mathes Terrace to Pettee Brook to the south-west. The front half of the property drains toward Madbury Road. This runoff is collected in the Madbury Road closed drainage system or flows down Madbury Road. All runoff reaches Pettee Brook south of the parcel near the intersection with Pettee Brook Lane. From there Pettee Brook continues nearly a third of a mile to Beard's Creek. Beard's Creek continues for a half mile before reaching the Oyster River.

The cover types located on the lot are typical for the use and include pavement, woods, and grass, and landscape areas. The wooded, and grass areas are considered to be in good condition. The hydrologic analysis of the existing runoff conditions are provided in Appendix A.

Post-Development Conditions

The proposed site development is depicted on the Post Development Drainage Plan (Appendix B).

Subcatchment 1 of the Pre-Development has been divided into four subcatchments and Subcatchment 2 has been divided into three subcatchments in the Post-Development based on the proposed development of the site. The cover types are consistent with the Pre-Development.

The stormwater management design includes permeable pavers, a roof drain and gutter collection system, a drip strip, rain garden, and subsurface stormwater chamber system.

The permeable pavers provide stormwater treatment through filtration. The permeable paver system has underdrains with impermeable subgrade liners to maximize the capacity to store stormwater. The permeable pavers will be treating the runoff from the west side of the building. This runoff will then be routed through a manhole on its way to Pettee Brook. This design assumes a conservative infiltration rate through the pavement of 5 inches per hour after a 20-year period. It is expected that infiltration rates will exceed this estimate with implementation of a maintenance program which will include vacuum sweeping. The roof gutter system works as a means of collecting the roof runoff from the north side of the building and transporting it to the subsurface chamber system located within the parking garage. The rain garden will provide treatment by means of filtration through a subgrade which includes a soil filter bed and gravel. The rain garden will treat runoff that is from the east side of the building and portions of the north side of the building.

The hydrologic analysis of the proposed runoff conditions are provided in Appendix B.

Comparison of Pre- vs. Post-Conditions

The following table quantifies the peak rate of discharge and discharge volume leaving the parcel at POA 1 and 2 as shown on the Pre- and Post-Development Drainage Plans. The analysis has been run using the extreme rainfall quantities.

Table 1: Peak Rate of Runoff Comparison Table (cfs)

Condition	POA 1			POA 2		
	Pre	Post	Change	Pre	Post	Change
1 inch Storm	0.06	0.06	0.00	0.00	0.02	+0.02
2 Yr Storm	0.49	0.48	-0.01	0.15	0.11	-0.04
10 Yr Storm	0.80	0.78	-0.02	0.28	0.18	-0.10
25 Yr Storm	1.00	0.95	-0.05	0.36	0.21	-0.15
50 Yr Storm	1.13	1.06	-0.07	0.41	0.22	-0.19
100 Yr Storm	1.29	1.19	-0.10	0.48	0.24	-0.24

Table 2: Discharge Volume of Runoff Comparison Table (cubic feet)

	POA 1			POA 2		
Condition	Pre	Post	Change	Pre	Post	Change
1 inch storm	211	486	+275	35	93	+58
2 Yr Storm	1,526	2,112	+586	469	612	+143
10 Yr Storm	2,545	3,244	+699	855	1,002	+147
25 Yr Storm	3,200	3,957	+757	1,113	1,252	+139
50 Yr Storm	3,632	4,423	+791	1,285	1,417	+132
100 Yr Storm	4,179	5,011	+832	1,505	1,625	+120

There is a reduction or no change in the peak rate of runoff during all the design storm events at POA 1 and 2 except POA 2 in the 1-inch storm which is increased from 0.00 cfs to 0.02 cfs which is a negligible increase in runoff. The reduction in peak rate of discharge is attributed to the permeable pavers which in addition to treating runoff also provide peak flow attenuation. There is also flow attenuation provided by the subsurface chamber system and rain garden. The soils present on site are not conducive for infiltration best management practices and therefore discharge volume reduction is not possible on this site. Although infiltration is not expected or modeled in the analysis, minimal infiltration will occur below the rain garden.

Stormwater Treatment Practices

Stormwater treatment will be provided by permeable pavers, a rain garden, and a StormTech subsurface stormwater chamber system. The permeable pavers and rain garden filtrate stormwater through a subgrade consisting of stone and/or soil. The subsurface stormwater chamber system provides stormwater detention as well as cooling of roof runoff. The runoff going to the chamber system does not need to be previously treated due to the fact that it is comprised of only roof runoff. An oil hood (Snout) with a boom (Bioskirt) attached will be installed in a drain manhole that collects ancillary runoff from inside the parking garage. The Snout reduces pollutants such as floatables, trash, oil, and sediment. The Bio-skirt is used to reduce bacteria and allows for the absorption of oil and grease. A maintenance plan will be developed for the permanent erosion control structures and stormwater treatment systems.

Erosion & Sediment Control

Temporary and permanent practices are used to prevent and minimize erosion and sedimentation on site. The installation of Silt Soxx™ at the perimeter of construction areas will provide sediment retention during the construction phase of the development. Geosynthetic Sediment Traps (Silt Sacks™) will be installed in all catchbasins accepting runoff from the redevelopment of the lot. Rip rap is proposed in drainage structure outlet areas to prevent erosion (see Appendix D for sizing calculations).

A stabilized construction entrance and daily sweeping of Madbury Road and Mathes Terrace will minimize the transport of sediment from the site. A maintenance plan will be developed for the permanent erosion control structures and stormwater treatment systems.

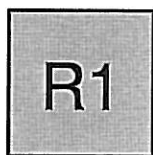
Conclusion

The enclosed comparative hydrologic model provides sufficient evidence that the proposed, permeable pavers, gutter system, rain garden, and subsurface chamber system will mitigate the typical increase in peak rate of discharge resulting from the increased impervious coverage. The use of erosion and sediment controls and proper construction practices will minimize the impact of this project.

APPENDIX A



Subcatchment 1



ROW



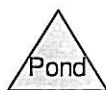
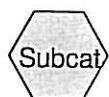
POA 1



Subcatchment 2



POA 2



Routing Diagram for 13-023 PRE

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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
5,661	74	>75% Grass cover, Good, HSG C (1, 2)
7,249	98	Paved parking, HSG C (1, 2)
1,373	73	Woods, Fair, HSG C (1, 2)
14,283	86	TOTAL AREA

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Type III 24-hr 1 Year Rainfall=2.50"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points

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

Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1: Subcatchment 1

Runoff Area=10,025 sf 59.64% Impervious Runoff Depth=1.38"

Tc=6.0 min CN=88 Runoff=0.37 cfs 1,154 cf

Subcatchment 2: Subcatchment 2

Runoff Area=4,258 sf 29.83% Impervious Runoff Depth=0.94"

Tc=6.0 min CN=81 Runoff=0.11 cfs 334 cf

Reach POA1: POA 1

Inflow=0.37 cfs 1,154 cf

Outflow=0.37 cfs 1,154 cf

Reach POA2: POA 2

Inflow=0.11 cfs 334 cf

Outflow=0.11 cfs 334 cf

Reach R1: ROWAvg. Flow Depth=0.04' Max Vel=1.29 fps Inflow=0.37 cfs 1,154 cf
n=0.013 L=75.0' S=0.0187 '/' Capacity=3.42 cfs Outflow=0.37 cfs 1,154 cf**Total Runoff Area = 14,283 sf Runoff Volume = 1,488 cf Average Runoff Depth = 1.25"**
49.25% Pervious = 7,034 sf 50.75% Impervious = 7,249 sf

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Type III 24-hr 2 Year Rainfall=3.01"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points

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

Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1: Subcatchment 1

Runoff Area=10,025 sf 59.64% Impervious Runoff Depth=1.83"

Tc=6.0 min CN=88 Runoff=0.49 cfs 1,526 cf

Subcatchment 2: Subcatchment 2

Runoff Area=4,258 sf 29.83% Impervious Runoff Depth=1.32"

Tc=6.0 min CN=81 Runoff=0.15 cfs 469 cf

Reach POA1: POA 1

Inflow=0.49 cfs 1,526 cf

Outflow=0.49 cfs 1,526 cf

Reach POA2: POA 2

Inflow=0.15 cfs 469 cf

Outflow=0.15 cfs 469 cf

Reach R1: ROWAvg. Flow Depth=0.04' Max Vel=1.41 fps Inflow=0.49 cfs 1,526 cf
n=0.013 L=75.0' S=0.0187 ' Capacity=3.42 cfs Outflow=0.49 cfs 1,526 cf**Total Runoff Area = 14,283 sf Runoff Volume = 1,995 cf Average Runoff Depth = 1.68"**
49.25% Pervious = 7,034 sf 50.75% Impervious = 7,249 sf

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Type III 24-hr 10 Year Rainfall=4.34"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points

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

Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1: Subcatchment 1

Runoff Area=10,025 sf 59.64% Impervious Runoff Depth=3.05"

Tc=6.0 min CN=88 Runoff=0.81 cfs 2,545 cf

Subcatchment 2: Subcatchment 2

Runoff Area=4,258 sf 29.83% Impervious Runoff Depth=2.41"

Tc=6.0 min CN=81 Runoff=0.28 cfs 855 cf

Reach POA1: POA 1

Inflow=0.80 cfs 2,545 cf

Outflow=0.80 cfs 2,545 cf

Reach POA2: POA 2

Inflow=0.28 cfs 855 cf

Outflow=0.28 cfs 855 cf

Reach R1: ROWAvg. Flow Depth=0.05' Max Vel=1.64 fps Inflow=0.81 cfs 2,545 cf
n=0.013 L=75.0' S=0.0187 '/' Capacity=3.42 cfs Outflow=0.80 cfs 2,545 cf**Total Runoff Area = 14,283 sf Runoff Volume = 3,400 cf Average Runoff Depth = 2.86"**
49.25% Pervious = 7,034 sf 50.75% Impervious = 7,249 sf

13-023 PRE*Type III 24-hr 25 Year Rainfall=5.17"*

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points

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

Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1: Subcatchment 1

Runoff Area=10,025 sf 59.64% Impervious Runoff Depth=3.83"

Tc=6.0 min CN=88 Runoff=1.01 cfs 3,200 cf

Subcatchment 2: Subcatchment 2

Runoff Area=4,258 sf 29.83% Impervious Runoff Depth=3.14"

Tc=6.0 min CN=81 Runoff=0.36 cfs 1,113 cf

Reach POA1: POA 1

Inflow=1.00 cfs 3,200 cf

Outflow=1.00 cfs 3,200 cf

Reach POA2: POA 2

Inflow=0.36 cfs 1,113 cf

Outflow=0.36 cfs 1,113 cf

Reach R1: ROWAvg. Flow Depth=0.06' Max Vel=1.76 fps Inflow=1.01 cfs 3,200 cf
n=0.013 L=75.0' S=0.0187 '/' Capacity=3.42 cfs Outflow=1.00 cfs 3,200 cf**Total Runoff Area = 14,283 sf Runoff Volume = 4,313 cf Average Runoff Depth = 3.62"**
49.25% Pervious = 7,034 sf 50.75% Impervious = 7,249 sf

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Type III 24-hr 50 Year Rainfall=5.71"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points

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

Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1: Subcatchment 1

Runoff Area=10,025 sf 59.64% Impervious Runoff Depth=4.35"

Tc=6.0 min CN=88 Runoff=1.14 cfs 3,632 cf

Subcatchment 2: Subcatchment 2

Runoff Area=4,258 sf 29.83% Impervious Runoff Depth=3.62"

Tc=6.0 min CN=81 Runoff=0.41 cfs 1,285 cf

Reach POA1: POA 1

Inflow=1.13 cfs 3,632 cf

Outflow=1.13 cfs 3,632 cf

Reach POA2: POA 2

Inflow=0.41 cfs 1,285 cf

Outflow=0.41 cfs 1,285 cf

Reach R1: ROWAvg. Flow Depth=0.06' Max Vel=1.83 fps Inflow=1.14 cfs 3,632 cf
n=0.013 L=75.0' S=0.0187 '/' Capacity=3.42 cfs Outflow=1.13 cfs 3,632 cf**Total Runoff Area = 14,283 sf Runoff Volume = 4,916 cf Average Runoff Depth = 4.13"**
49.25% Pervious = 7,034 sf 50.75% Impervious = 7,249 sf

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Type III 24-hr 100 Year Rainfall=6.39"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points

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

Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1: Subcatchment 1

Runoff Area=10,025 sf 59.64% Impervious Runoff Depth=5.00"

Tc=6.0 min CN=88 Runoff=1.30 cfs 4,179 cf

Subcatchment 2: Subcatchment 2

Runoff Area=4,258 sf 29.83% Impervious Runoff Depth=4.24"

Tc=6.0 min CN=81 Runoff=0.48 cfs 1,505 cf

Reach POA1: POA 1

Inflow=1.29 cfs 4,179 cf

Outflow=1.29 cfs 4,179 cf

Reach POA2: POA 2

Inflow=0.48 cfs 1,505 cf

Outflow=0.48 cfs 1,505 cf

Reach R1: ROWAvg. Flow Depth=0.06' Max Vel=1.90 fps Inflow=1.30 cfs 4,179 cf
n=0.013 L=75.0' S=0.0187 '/' Capacity=3.42 cfs Outflow=1.29 cfs 4,179 cf**Total Runoff Area = 14,283 sf Runoff Volume = 5,684 cf Average Runoff Depth = 4.78"**
49.25% Pervious = 7,034 sf 50.75% Impervious = 7,249 sf

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Type III 24-hr 2 Year Rainfall=3.01"

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Summary for Subcatchment 1: Subcatchment 1

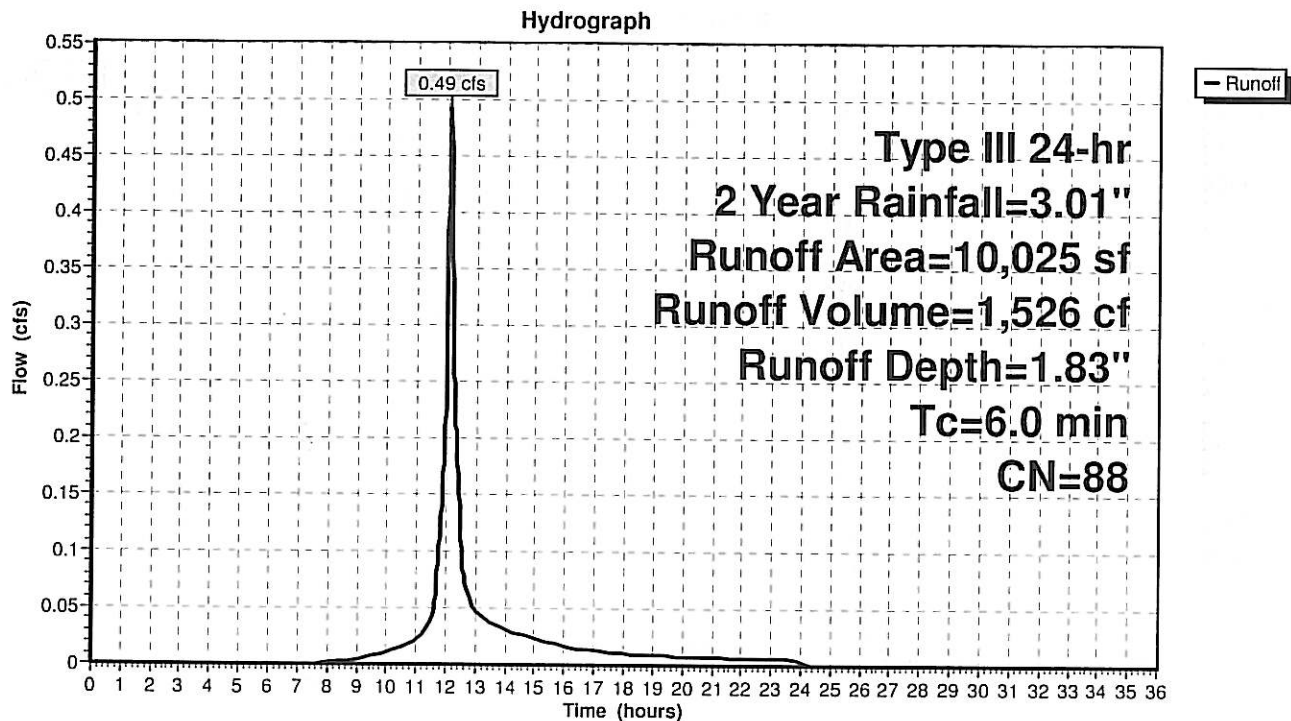
Runoff = 0.49 cfs @ 12.09 hrs, Volume= 1,526 cf, Depth= 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Type III 24-hr 2 Year Rainfall=3.01"

Area (sf)	CN	Description
5,979	98	Paved parking, HSG C
3,085	74	>75% Grass cover, Good, HSG C
961	73	Woods, Fair, HSG C
10,025	88	Weighted Average
4,046		40.36% Pervious Area
5,979		59.64% Impervious Area

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

Subcatchment 1: Subcatchment 1



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Type III 24-hr 2 Year Rainfall=3.01"

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Summary for Subcatchment 2: Subcatchment 2

Runoff = 0.15 cfs @ 12.09 hrs, Volume= 469 cf, Depth= 1.32"

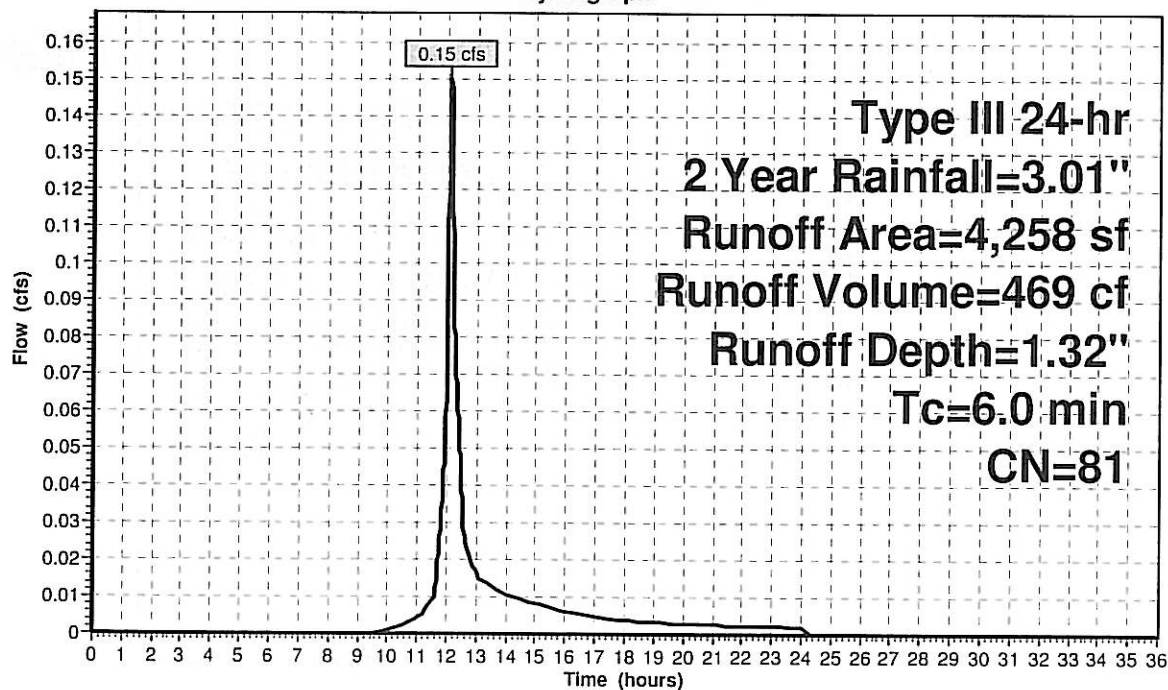
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Rainfall=3.01"

Area (sf)	CN	Description
1,270	98	Paved parking, HSG C
2,576	74	>75% Grass cover, Good, HSG C
412	73	Woods, Fair, HSG C
4,258	81	Weighted Average
2,988		70.17% Pervious Area
1,270		29.83% Impervious Area

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

Subcatchment 2: Subcatchment 2

Hydrograph



Summary for Reach POA1: POA 1

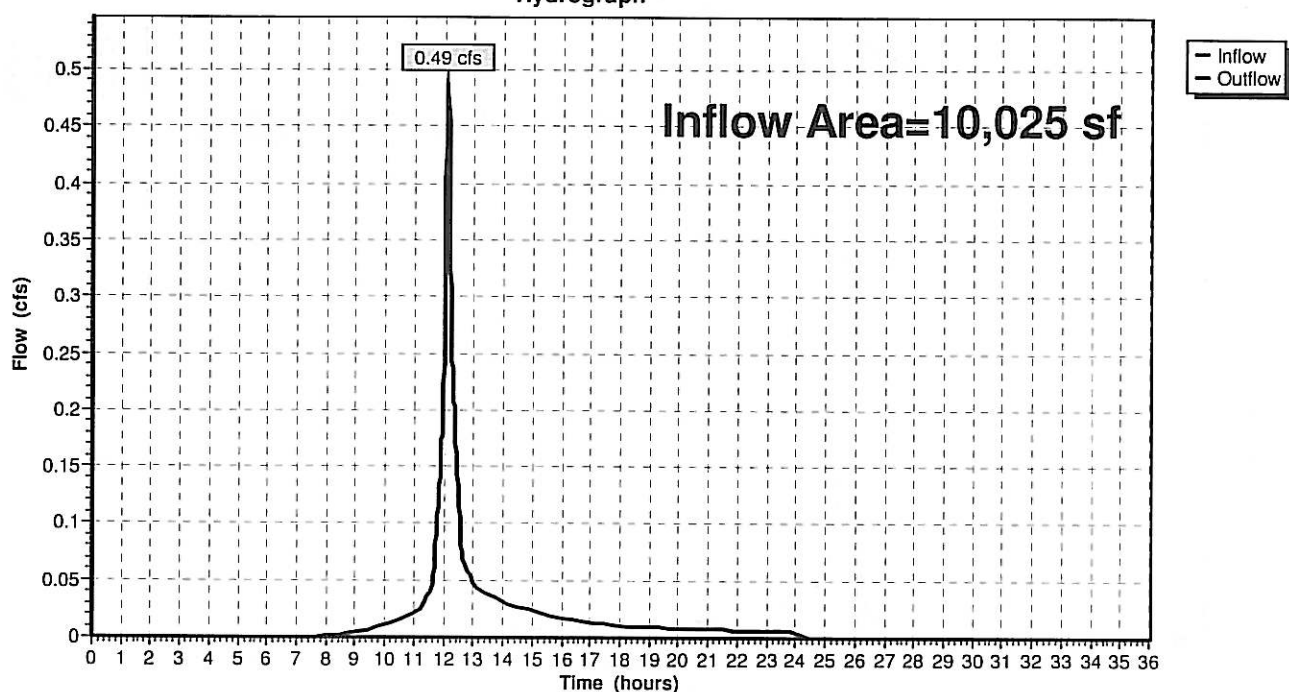
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10,025 sf, 59.64% Impervious, Inflow Depth = 1.83" for 2 Year event
Inflow = 0.49 cfs @ 12.10 hrs, Volume= 1,526 cf
Outflow = 0.49 cfs @ 12.10 hrs, Volume= 1,526 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach POA1: POA 1

Hydrograph



Summary for Reach POA2: POA 2

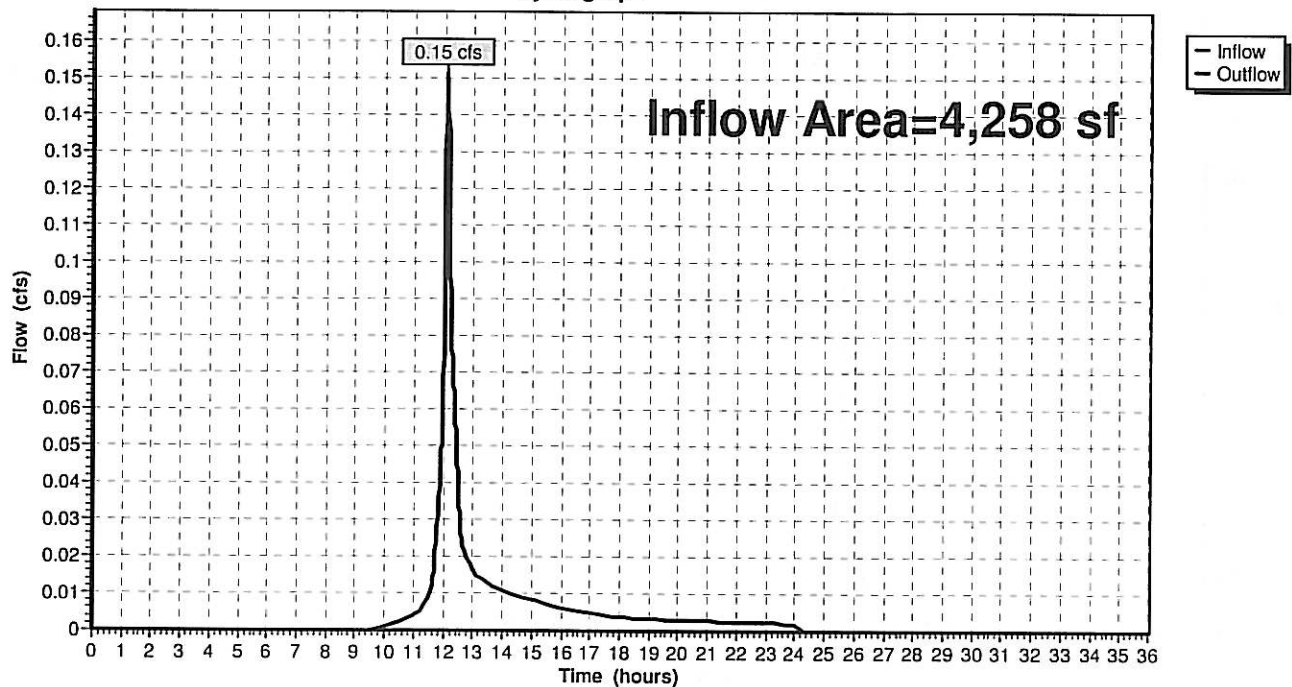
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4,258 sf, 29.83% Impervious, Inflow Depth = 1.32" for 2 Year event
Inflow = 0.15 cfs @ 12.09 hrs, Volume= 469 cf
Outflow = 0.15 cfs @ 12.09 hrs, Volume= 469 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach POA2: POA 2

Hydrograph



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Type III 24-hr 2 Year Rainfall=3.01"

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Summary for Reach R1: ROW

Inflow Area = 10,025 sf, 59.64% Impervious, Inflow Depth = 1.83" for 2 Year event
Inflow = 0.49 cfs @ 12.09 hrs, Volume= 1,526 cf
Outflow = 0.49 cfs @ 12.10 hrs, Volume= 1,526 cf, Atten= 1%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.41 fps, Min. Travel Time= 0.9 min

Avg. Velocity = 0.46 fps, Avg. Travel Time= 2.7 min

Peak Storage= 26 cf @ 12.10 hrs

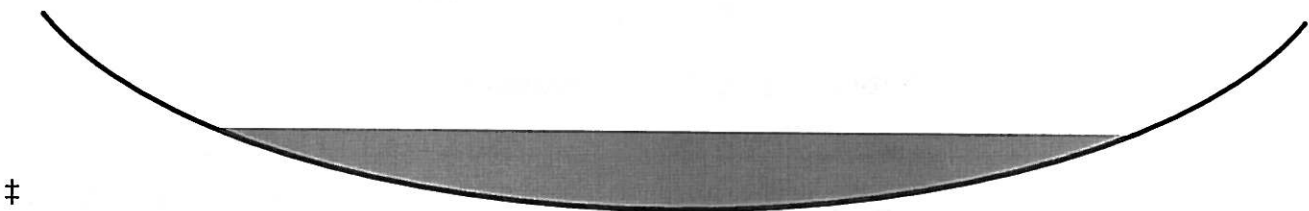
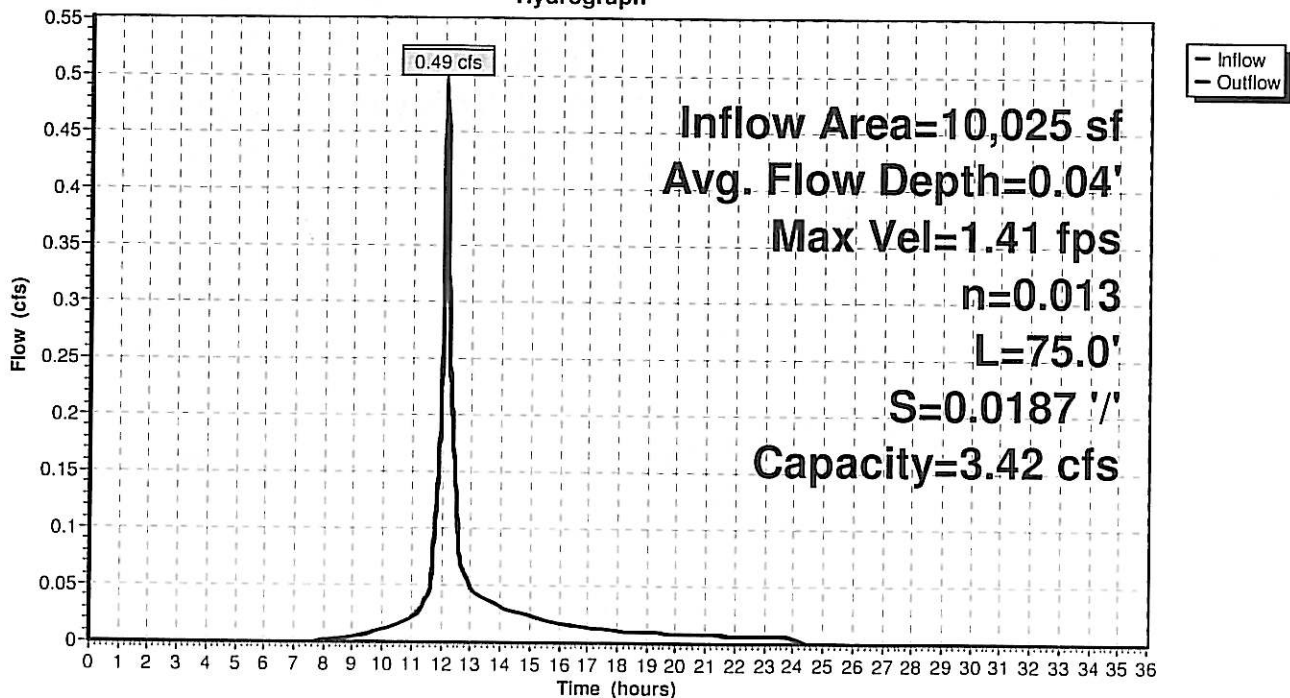
Average Depth at Peak Storage= 0.04'

Bank-Full Depth= 0.10' Flow Area= 1.3 sf, Capacity= 3.42 cfs

20.00' x 0.10' deep Parabolic Channel, n= 0.013 Asphalt, smooth

Length= 75.0' Slope= 0.0187 '/'

Inlet Invert= 47.50', Outlet Invert= 46.10'

**Reach R1: ROW****Hydrograph**

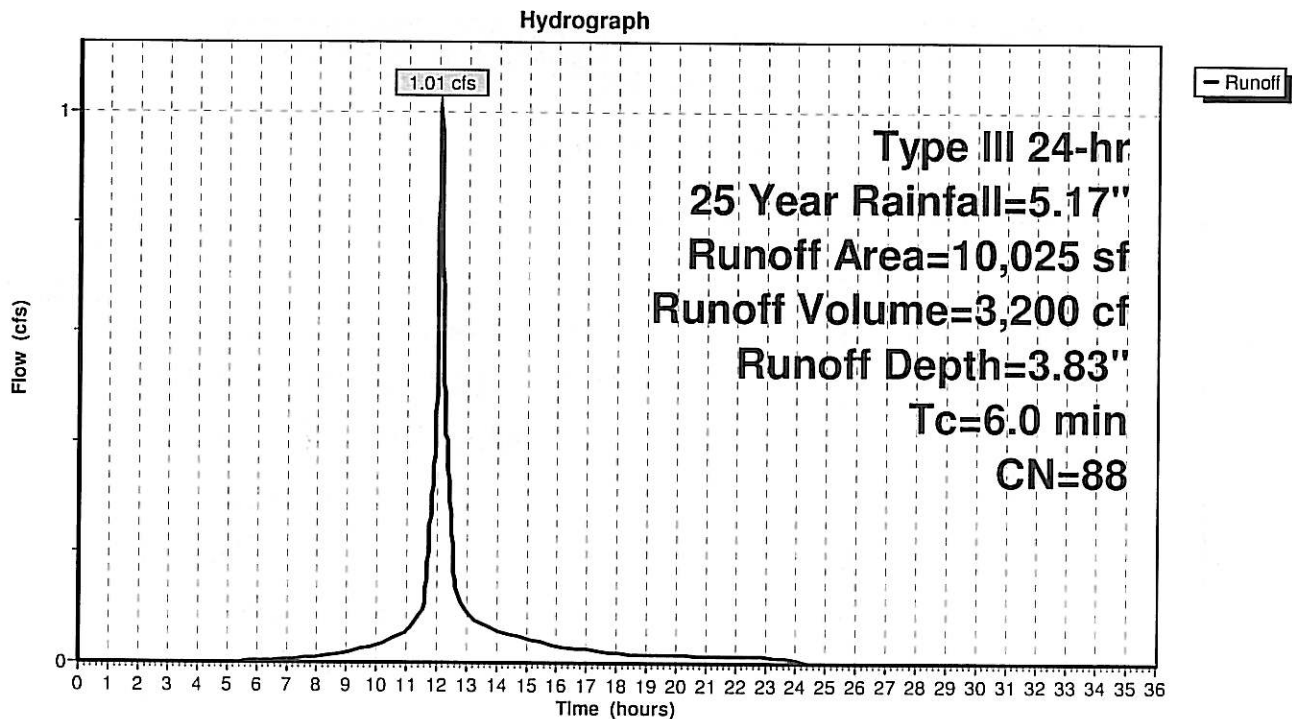
Summary for Subcatchment 1: Subcatchment 1

Runoff = 1.01 cfs @ 12.09 hrs, Volume= 3,200 cf, Depth= 3.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Rainfall=5.17"

Area (sf)	CN	Description
5,979	98	Paved parking, HSG C
3,085	74	>75% Grass cover, Good, HSG C
961	73	Woods, Fair, HSG C
10,025	88	Weighted Average
4,046		40.36% Pervious Area
5,979		59.64% Impervious Area

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

Subcatchment 1: Subcatchment 1

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Type III 24-hr 25 Year Rainfall=5.17"

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Summary for Subcatchment 2: Subcatchment 2

Runoff = 0.36 cfs @ 12.09 hrs, Volume= 1,113 cf, Depth= 3.14"

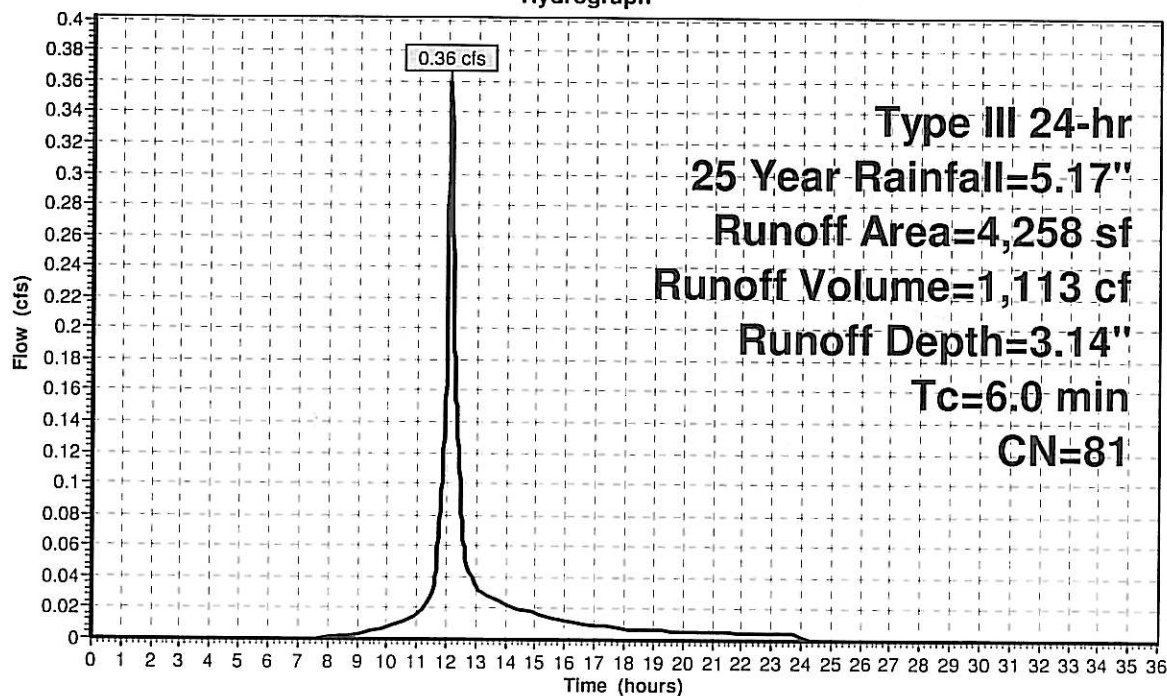
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Rainfall=5.17"

Area (sf)	CN	Description
1,270	98	Paved parking, HSG C
2,576	74	>75% Grass cover, Good, HSG C
412	73	Woods, Fair, HSG C
4,258	81	Weighted Average
2,988		70.17% Pervious Area
1,270		29.83% Impervious Area

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

Subcatchment 2: Subcatchment 2

Hydrograph

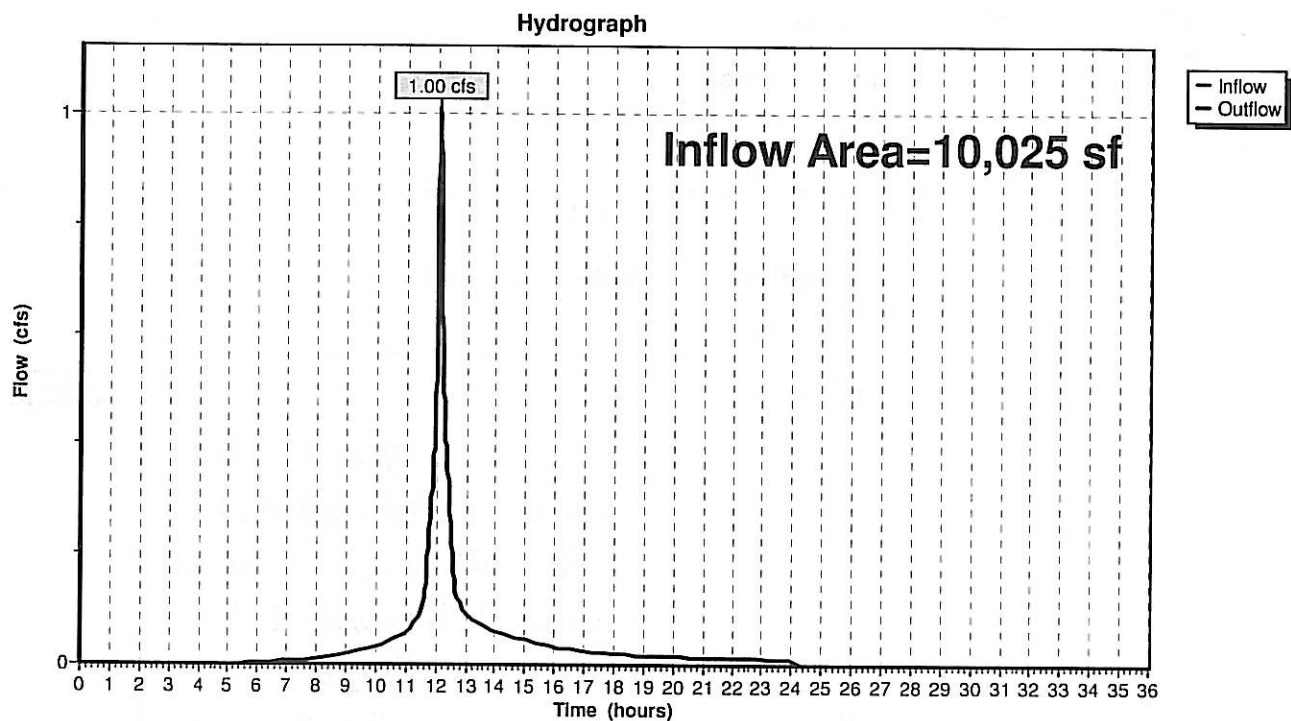


Summary for Reach POA1: POA 1

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

Inflow Area = 10,025 sf, 59.64% Impervious, Inflow Depth = 3.83" for 25 Year event
Inflow = 1.00 cfs @ 12.09 hrs, Volume= 3,200 cf
Outflow = 1.00 cfs @ 12.09 hrs, Volume= 3,200 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

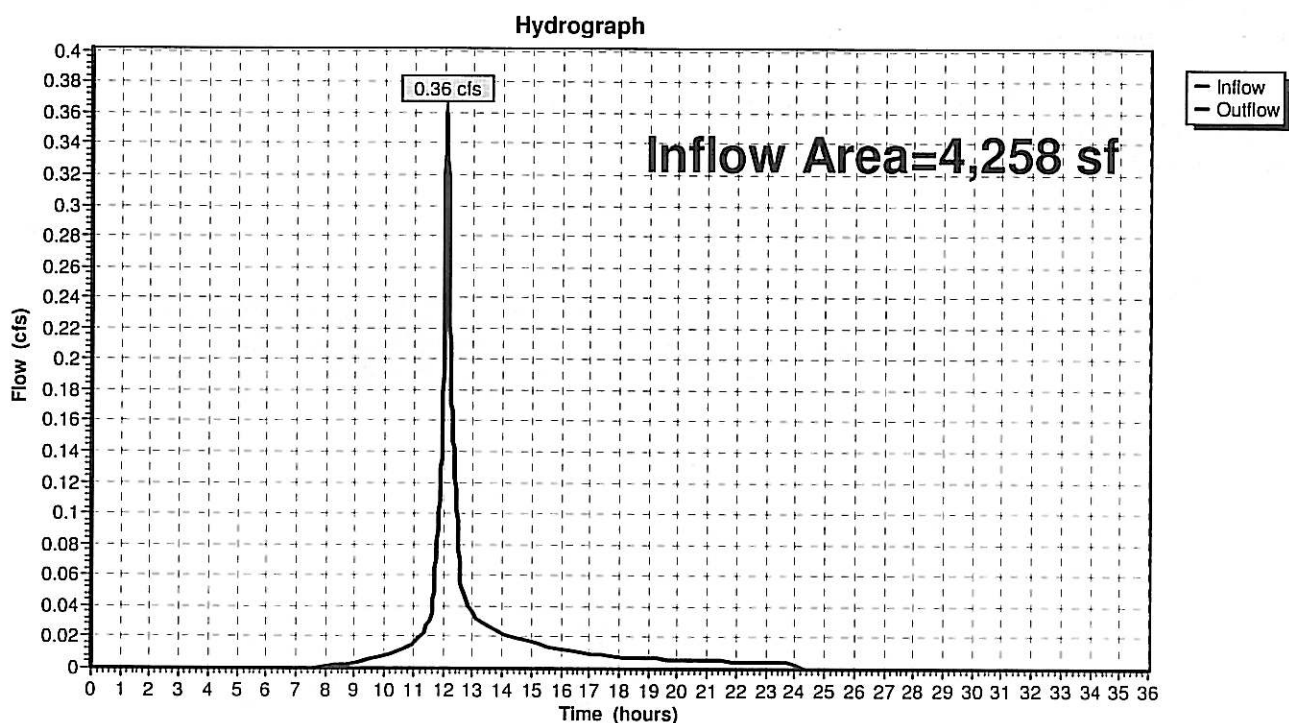
Reach POA1: POA 1

Summary for Reach POA2: POA 2

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

Inflow Area = 4,258 sf, 29.83% Impervious, Inflow Depth = 3.14" for 25 Year event
Inflow = 0.36 cfs @ 12.09 hrs, Volume= 1,113 cf
Outflow = 0.36 cfs @ 12.09 hrs, Volume= 1,113 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach POA2: POA 2

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Type III 24-hr 25 Year Rainfall=5.17"

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Summary for Reach R1: ROW

Inflow Area = 10,025 sf, 59.64% Impervious, Inflow Depth = 3.83" for 25 Year event
Inflow = 1.01 cfs @ 12.09 hrs, Volume= 3,200 cf
Outflow = 1.00 cfs @ 12.09 hrs, Volume= 3,200 cf, Atten= 1%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.76 fps, Min. Travel Time= 0.7 min

Avg. Velocity = 0.55 fps, Avg. Travel Time= 2.3 min

Peak Storage= 43 cf @ 12.09 hrs

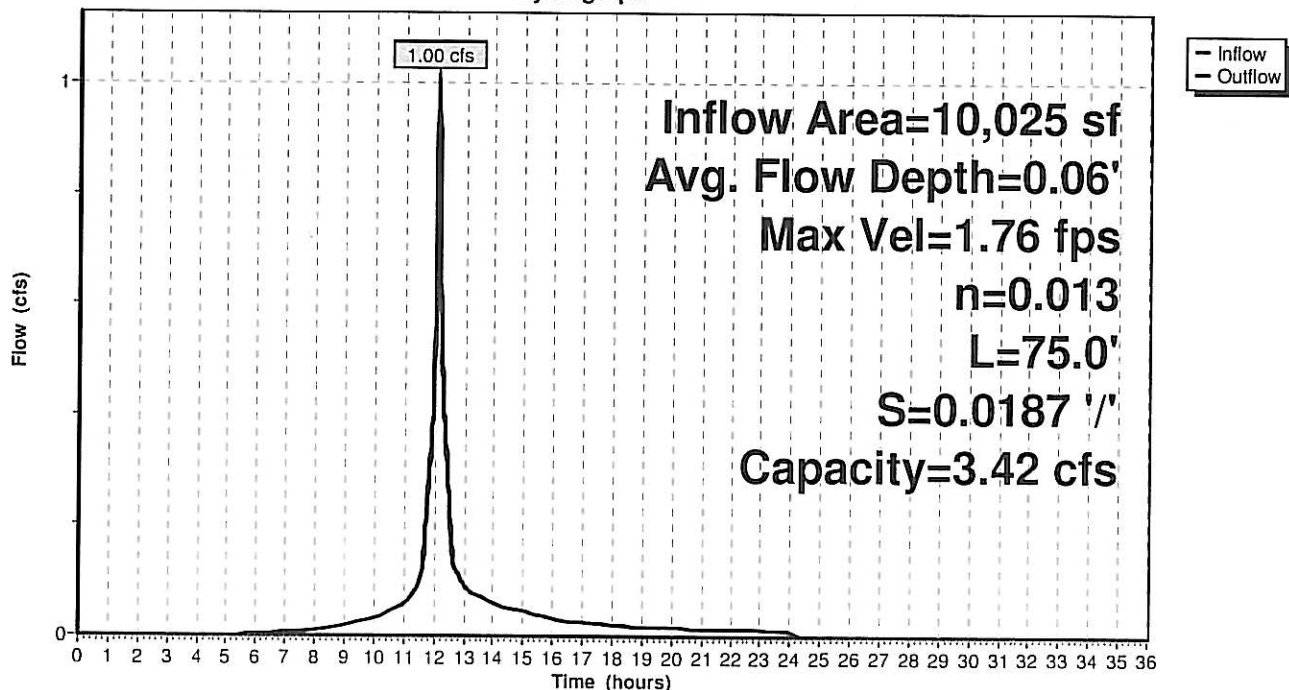
Average Depth at Peak Storage= 0.06'

Bank-Full Depth= 0.10' Flow Area= 1.3 sf, Capacity= 3.42 cfs

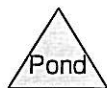
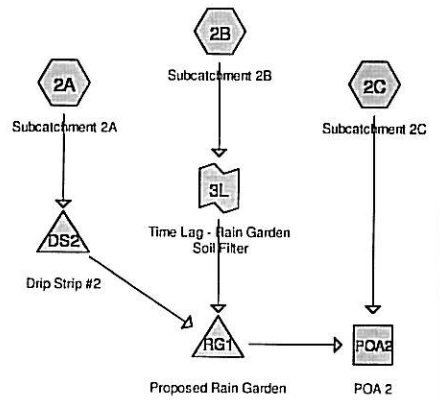
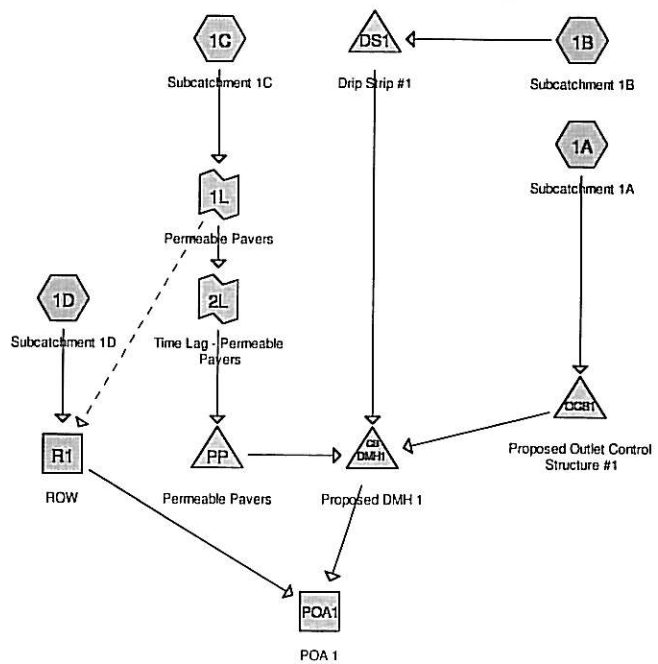
20.00' x 0.10' deep Parabolic Channel, n= 0.013 Asphalt, smooth

Length= 75.0' Slope= 0.0187 '/'

Inlet Invert= 47.50', Outlet Invert= 46.10'

**Reach R1: ROW****Hydrograph**

APPENDIX B



Routing Diagram for 13-023 POST

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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
2,328	74	>75% Grass cover, Good, HSG C (1B, 1C, 1D, 2A, 2B, 2C)
340	98	Drip Strip, HSG C (1B, 2A)
1,387	98	Paved parking, HSG C (1D)
468	98	Pervious Pavement, HSG C (1C)
685	98	Roofs & Concrete Pads, HSG C (1C)
8,627	98	Roofs, HSG C (1A, 1B, 2A, 2B, 2C)
448	73	Woods, Fair, HSG C (1B, 1C, 1D, 2A, 2B)
14,283	93	TOTAL AREA

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Type III 24-hr 1 inch Rainfall=1.00"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1A: Subcatchment 1A	Runoff Area=5,126 sf 100.00% Impervious Runoff Depth=0.79" Tc=6.0 min CN=98 Runoff=0.10 cfs 338 cf
Subcatchment 1B: Subcatchment 1B	Runoff Area=1,658 sf 84.74% Impervious Runoff Depth=0.50" Tc=6.0 min CN=94 Runoff=0.02 cfs 70 cf
Subcatchment 1C: Subcatchment 1C	Runoff Area=1,417 sf 81.37% Impervious Runoff Depth=0.50" Tc=6.0 min CN=94 Runoff=0.02 cfs 59 cf
Subcatchment 1D: Subcatchment 1D	Runoff Area=2,294 sf 60.46% Impervious Runoff Depth=0.25" Tc=6.0 min CN=88 Runoff=0.01 cfs 48 cf
Subcatchment 2A: Subcatchment 2A	Runoff Area=1,494 sf 74.90% Impervious Runoff Depth=0.40" Tc=6.0 min CN=92 Runoff=0.02 cfs 50 cf
Subcatchment 2B: Subcatchment 2B	Runoff Area=1,312 sf 62.27% Impervious Runoff Depth=0.28" Tc=6.0 min CN=89 Runoff=0.01 cfs 31 cf
Subcatchment 2C: Subcatchment 2C	Runoff Area=982 sf 50.92% Impervious Runoff Depth=0.20" Tc=6.0 min CN=86 Runoff=0.00 cfs 16 cf
Reach POA1: POA 1	Inflow=0.06 cfs 486 cf Outflow=0.06 cfs 486 cf
Reach POA2: POA 2	Inflow=0.02 cfs 93 cf Outflow=0.02 cfs 93 cf
Reach R1: ROW	Avg. Flow Depth=0.01' Max Vel=0.46 fps Inflow=0.01 cfs 48 cf n=0.013 L=75.0' S=0.0187 '/' Capacity=3.42 cfs Outflow=0.01 cfs 48 cf
Pond DMH1: Proposed DMH 1	Peak Elev=44.64' Inflow=0.05 cfs 438 cf 10.0" Round Culvert n=0.013 L=90.0' S=0.0050 '/' Outflow=0.05 cfs 438 cf
Pond DS1: Drip Strip #1	Peak Elev=49.80' Storage=33 cf Inflow=0.02 cfs 70 cf 4.0" Round Culvert n=0.010 L=8.0' S=0.4688 '/' Outflow=0.01 cfs 42 cf
Pond DS2: Drip Strip #2	Peak Elev=51.50' Storage=0 cf Inflow=0.02 cfs 50 cf 4.0" Round Culvert n=0.010 L=4.0' S=0.0625 '/' Outflow=0.02 cfs 50 cf
Pond OCS1: Proposed Outlet Control Structure #1	Peak Elev=46.48' Storage=69 cf Inflow=0.10 cfs 338 cf Outflow=0.05 cfs 337 cf
Pond PP: Permeable Pavers	Peak Elev=45.64' Storage=13 cf Inflow=0.02 cfs 59 cf Outflow=0.01 cfs 59 cf
Pond RG1: Proposed Rain Garden	Peak Elev=47.75' Storage=6 cf Inflow=0.02 cfs 81 cf Outflow=0.02 cfs 77 cf

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Type III 24-hr 1 inch Rainfall=1.00"

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Link 1L: Permeable Pavers

below 0.06 cfs Inflow=0.02 cfs 59 cf
Primary=0.02 cfs 59 cf Secondary=0.00 cfs 0 cf

Link 2L: Time Lag - Permeable Pavers

delayed by 336.0 min Inflow=0.02 cfs 59 cf
Primary=0.02 cfs 59 cf

Link 3L: Time Lag - Rain Garden Soil Filter

delayed by 165.0 min Inflow=0.01 cfs 31 cf
Primary=0.01 cfs 31 cf

Total Runoff Area = 14,283 sf Runoff Volume = 613 cf Average Runoff Depth = 0.51"
19.44% Pervious = 2,776 sf 80.56% Impervious = 11,507 sf

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Type III 24-hr 2 Year Rainfall=3.01"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1A: Subcatchment 1A	Runoff Area=5,126 sf 100.00% Impervious Runoff Depth=2.78" Tc=6.0 min CN=98 Runoff=0.34 cfs 1,187 cf
Subcatchment 1B: Subcatchment 1B	Runoff Area=1,658 sf 84.74% Impervious Runoff Depth=2.36" Tc=6.0 min CN=94 Runoff=0.10 cfs 326 cf
Subcatchment 1C: Subcatchment 1C	Runoff Area=1,417 sf 81.37% Impervious Runoff Depth=2.36" Tc=6.0 min CN=94 Runoff=0.09 cfs 279 cf
Subcatchment 1D: Subcatchment 1D	Runoff Area=2,294 sf 60.46% Impervious Runoff Depth=1.83" Tc=6.0 min CN=88 Runoff=0.11 cfs 349 cf
Subcatchment 2A: Subcatchment 2A	Runoff Area=1,494 sf 74.90% Impervious Runoff Depth=2.17" Tc=6.0 min CN=92 Runoff=0.09 cfs 270 cf
Subcatchment 2B: Subcatchment 2B	Runoff Area=1,312 sf 62.27% Impervious Runoff Depth=1.91" Tc=6.0 min CN=89 Runoff=0.07 cfs 209 cf
Subcatchment 2C: Subcatchment 2C	Runoff Area=982 sf 50.92% Impervious Runoff Depth=1.67" Tc=6.0 min CN=86 Runoff=0.04 cfs 137 cf
Reach POA1: POA 1	Inflow=0.48 cfs 2,112 cf Outflow=0.48 cfs 2,112 cf
Reach POA2: POA 2	Inflow=0.11 cfs 612 cf Outflow=0.11 cfs 612 cf
Reach R1: ROW	Avg. Flow Depth=0.02' Max Vel=0.95 fps Inflow=0.14 cfs 358 cf n=0.013 L=75.0' S=0.0187 '/' Capacity=3.42 cfs Outflow=0.14 cfs 358 cf
Pond DMH1: Proposed DMH 1	Peak Elev=44.87' Inflow=0.36 cfs 1,753 cf 10.0" Round Culvert n=0.013 L=90.0' S=0.0050 '/' Outflow=0.36 cfs 1,753 cf
Pond DS1: Drip Strip #1	Peak Elev=49.96' Storage=54 cf Inflow=0.10 cfs 326 cf 4.0" Round Culvert n=0.010 L=8.0' S=0.4688 '/' Outflow=0.09 cfs 298 cf
Pond DS2: Drip Strip #2	Peak Elev=51.50' Storage=0 cf Inflow=0.09 cfs 270 cf 4.0" Round Culvert n=0.010 L=4.0' S=0.0625 '/' Outflow=0.09 cfs 270 cf
Pond OCS1: Proposed Outlet Control Structure #1	Peak Elev=46.77' Storage=156 cf Inflow=0.34 cfs 1,187 cf Outflow=0.27 cfs 1,186 cf
Pond PP: Permeable Pavers	Peak Elev=45.73' Storage=32 cf Inflow=0.06 cfs 270 cf Outflow=0.05 cfs 269 cf
Pond RG1: Proposed Rain Garden	Peak Elev=48.39' Storage=19 cf Inflow=0.09 cfs 479 cf Outflow=0.07 cfs 475 cf

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Type III 24-hr 2 Year Rainfall=3.01"

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Link 1L: Permeable Pavers

below 0.06 cfs Inflow=0.09 cfs 279 cf
Primary=0.06 cfs 270 cf Secondary=0.03 cfs 9 cf

Link 2L: Time Lag - Permeable Pavers

delayed by 336.0 min Inflow=0.06 cfs 270 cf
Primary=0.06 cfs 270 cf

Link 3L: Time Lag - Rain Garden Soil Filter

delayed by 165.0 min Inflow=0.07 cfs 209 cf
Primary=0.07 cfs 209 cf

Total Runoff Area = 14,283 sf Runoff Volume = 2,756 cf Average Runoff Depth = 2.32"
19.44% Pervious = 2,776 sf 80.56% Impervious = 11,507 sf

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Type III 24-hr 10 Year Rainfall=4.34"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1A: Subcatchment 1A	Runoff Area=5,126 sf 100.00% Impervious Runoff Depth=4.10" Tc=6.0 min CN=98 Runoff=0.50 cfs 1,753 cf
Subcatchment 1B: Subcatchment 1B	Runoff Area=1,658 sf 84.74% Impervious Runoff Depth=3.66" Tc=6.0 min CN=94 Runoff=0.15 cfs 505 cf
Subcatchment 1C: Subcatchment 1C	Runoff Area=1,417 sf 81.37% Impervious Runoff Depth=3.66" Tc=6.0 min CN=94 Runoff=0.13 cfs 432 cf
Subcatchment 1D: Subcatchment 1D	Runoff Area=2,294 sf 60.46% Impervious Runoff Depth=3.05" Tc=6.0 min CN=88 Runoff=0.19 cfs 582 cf
Subcatchment 2A: Subcatchment 2A	Runoff Area=1,494 sf 74.90% Impervious Runoff Depth=3.45" Tc=6.0 min CN=92 Runoff=0.13 cfs 429 cf
Subcatchment 2B: Subcatchment 2B	Runoff Area=1,312 sf 62.27% Impervious Runoff Depth=3.14" Tc=6.0 min CN=89 Runoff=0.11 cfs 344 cf
Subcatchment 2C: Subcatchment 2C	Runoff Area=982 sf 50.92% Impervious Runoff Depth=2.86" Tc=6.0 min CN=86 Runoff=0.07 cfs 234 cf
Reach POA1: POA 1	Inflow=0.78 cfs 3,244 cf Outflow=0.78 cfs 3,244 cf
Reach POA2: POA 2	Inflow=0.18 cfs 1,003 cf Outflow=0.18 cfs 1,003 cf
Reach R1: ROW	Avg. Flow Depth=0.03' Max Vel=1.15 fps Inflow=0.26 cfs 619 cf n=0.013 L=75.0' S=0.0187 '/' Capacity=3.42 cfs Outflow=0.25 cfs 619 cf
Pond DMH1: Proposed DMH 1	Peak Elev=44.96' Inflow=0.54 cfs 2,625 cf 10.0" Round Culvert n=0.013 L=90.0' S=0.0050 '/' Outflow=0.54 cfs 2,625 cf
Pond DS1: Drip Strip #1	Peak Elev=50.03' Storage=62 cf Inflow=0.15 cfs 505 cf 4.0" Round Culvert n=0.010 L=8.0' S=0.4688 '/' Outflow=0.14 cfs 478 cf
Pond DS2: Drip Strip #2	Peak Elev=51.50' Storage=0 cf Inflow=0.13 cfs 429 cf 4.0" Round Culvert n=0.010 L=4.0' S=0.0625 '/' Outflow=0.13 cfs 429 cf
Pond OCS1: Proposed Outlet Control Structure #1	Peak Elev=46.87' Storage=198 cf Inflow=0.50 cfs 1,753 cf Outflow=0.40 cfs 1,753 cf
Pond PP: Permeable Pavers	Peak Elev=45.74' Storage=34 cf Inflow=0.06 cfs 395 cf Outflow=0.06 cfs 395 cf
Pond RG1: Proposed Rain Garden	Peak Elev=49.33' Storage=31 cf Inflow=0.14 cfs 773 cf Outflow=0.11 cfs 769 cf

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Type III 24-hr 10 Year Rainfall=4.34"

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Link 1L: Permeable Pavers

below 0.06 cfs Inflow=0.13 cfs 432 cf
Primary=0.06 cfs 395 cf Secondary=0.07 cfs 37 cf

Link 2L: Time Lag - Permeable Pavers

delayed by 336.0 min Inflow=0.06 cfs 395 cf
Primary=0.06 cfs 395 cf

Link 3L: Time Lag - Rain Garden Soil Filter

delayed by 165.0 min Inflow=0.11 cfs 344 cf
Primary=0.11 cfs 344 cf

Total Runoff Area = 14,283 sf Runoff Volume = 4,279 cf Average Runoff Depth = 3.60"
19.44% Pervious = 2,776 sf 80.56% Impervious = 11,507 sf

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Type III 24-hr 25 Year Rainfall=5.17"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1A: Subcatchment 1A	Runoff Area=5,126 sf 100.00% Impervious Runoff Depth=4.93" Tc=6.0 min CN=98 Runoff=0.60 cfs 2,107 cf
Subcatchment 1B: Subcatchment 1B	Runoff Area=1,658 sf 84.74% Impervious Runoff Depth=4.48" Tc=6.0 min CN=94 Runoff=0.19 cfs 618 cf
Subcatchment 1C: Subcatchment 1C	Runoff Area=1,417 sf 81.37% Impervious Runoff Depth=4.48" Tc=6.0 min CN=94 Runoff=0.16 cfs 529 cf
Subcatchment 1D: Subcatchment 1D	Runoff Area=2,294 sf 60.46% Impervious Runoff Depth=3.83" Tc=6.0 min CN=88 Runoff=0.23 cfs 732 cf
Subcatchment 2A: Subcatchment 2A	Runoff Area=1,494 sf 74.90% Impervious Runoff Depth=4.26" Tc=6.0 min CN=92 Runoff=0.16 cfs 530 cf
Subcatchment 2B: Subcatchment 2B	Runoff Area=1,312 sf 62.27% Impervious Runoff Depth=3.93" Tc=6.0 min CN=89 Runoff=0.13 cfs 430 cf
Subcatchment 2C: Subcatchment 2C	Runoff Area=982 sf 50.92% Impervious Runoff Depth=3.63" Tc=6.0 min CN=86 Runoff=0.09 cfs 297 cf
Reach POA1: POA 1	Inflow=0.95 cfs 3,957 cf Outflow=0.95 cfs 3,957 cf
Reach POA2: POA 2	Inflow=0.21 cfs 1,253 cf Outflow=0.21 cfs 1,253 cf
Reach R1: ROW	Avg. Flow Depth=0.03' Max Vel=1.24 fps Inflow=0.33 cfs 793 cf n=0.013 L=75.0' S=0.0187 '/' Capacity=3.42 cfs Outflow=0.32 cfs 793 cf
Pond DMH1: Proposed DMH 1	Peak Elev=45.01' Inflow=0.65 cfs 3,165 cf 10.0" Round Culvert n=0.013 L=90.0' S=0.0050 '/' Outflow=0.65 cfs 3,165 cf
Pond DS1: Drip Strip #1	Peak Elev=50.07' Storage=68 cf Inflow=0.19 cfs 618 cf 4.0" Round Culvert n=0.010 L=8.0' S=0.4688 '/' Outflow=0.17 cfs 590 cf
Pond DS2: Drip Strip #2	Peak Elev=51.50' Storage=0 cf Inflow=0.16 cfs 530 cf 4.0" Round Culvert n=0.010 L=4.0' S=0.0625 '/' Outflow=0.16 cfs 530 cf
Pond OCS1: Proposed Outlet Control Structure #1	Peak Elev=46.93' Storage=222 cf Inflow=0.60 cfs 2,107 cf Outflow=0.48 cfs 2,107 cf
Pond PP: Permeable Pavers	Peak Elev=45.74' Storage=34 cf Inflow=0.06 cfs 468 cf Outflow=0.06 cfs 467 cf
Pond RG1: Proposed Rain Garden	Peak Elev=49.61' Storage=43 cf Inflow=0.17 cfs 960 cf Outflow=0.12 cfs 956 cf

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Type III 24-hr 25 Year Rainfall=5.17"

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Link 1L: Permeable Pavers

below 0.06 cfs Inflow=0.16 cfs 529 cf
Primary=0.06 cfs 468 cf Secondary=0.10 cfs 60 cf

Link 2L: Time Lag - Permeable Pavers

delayed by 336.0 min Inflow=0.06 cfs 468 cf
Primary=0.06 cfs 468 cf

Link 3L: Time Lag - Rain Garden Soil Filter

delayed by 165.0 min Inflow=0.13 cfs 430 cf
Primary=0.13 cfs 430 cf

Total Runoff Area = 14,283 sf Runoff Volume = 5,243 cf Average Runoff Depth = 4.41"
19.44% Pervious = 2,776 sf 80.56% Impervious = 11,507 sf

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Type III 24-hr 50 Year Rainfall=5.71"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1A: Subcatchment 1A	Runoff Area=5,126 sf 100.00% Impervious Runoff Depth=5.47" Tc=6.0 min CN=98 Runoff=0.66 cfs 2,338 cf
Subcatchment 1B: Subcatchment 1B	Runoff Area=1,658 sf 84.74% Impervious Runoff Depth=5.01" Tc=6.0 min CN=94 Runoff=0.21 cfs 692 cf
Subcatchment 1C: Subcatchment 1C	Runoff Area=1,417 sf 81.37% Impervious Runoff Depth=5.01" Tc=6.0 min CN=94 Runoff=0.18 cfs 592 cf
Subcatchment 1D: Subcatchment 1D	Runoff Area=2,294 sf 60.46% Impervious Runoff Depth=4.35" Tc=6.0 min CN=88 Runoff=0.26 cfs 831 cf
Subcatchment 2A: Subcatchment 2A	Runoff Area=1,494 sf 74.90% Impervious Runoff Depth=4.78" Tc=6.0 min CN=92 Runoff=0.18 cfs 596 cf
Subcatchment 2B: Subcatchment 2B	Runoff Area=1,312 sf 62.27% Impervious Runoff Depth=4.45" Tc=6.0 min CN=89 Runoff=0.15 cfs 487 cf
Subcatchment 2C: Subcatchment 2C	Runoff Area=982 sf 50.92% Impervious Runoff Depth=4.13" Tc=6.0 min CN=86 Runoff=0.11 cfs 338 cf
Reach POA1: POA 1	Inflow=1.06 cfs 4,423 cf Outflow=1.06 cfs 4,423 cf
Reach POA2: POA 2	Inflow=0.22 cfs 1,417 cf Outflow=0.22 cfs 1,417 cf
Reach R1: ROW	Avg. Flow Depth=0.04' Max Vel=1.30 fps Inflow=0.38 cfs 910 cf n=0.013 L=75.0' S=0.0187 '/' Capacity=3.42 cfs Outflow=0.37 cfs 910 cf
Pond DMH1: Proposed DMH 1	Peak Elev=45.04' Inflow=0.71 cfs 3,513 cf 10.0" Round Culvert n=0.013 L=90.0' S=0.0050 '/' Outflow=0.71 cfs 3,513 cf
Pond DS1: Drip Strip #1	Peak Elev=50.10' Storage=71 cf Inflow=0.21 cfs 692 cf 4.0" Round Culvert n=0.010 L=8.0' S=0.4688 '/' Outflow=0.18 cfs 664 cf
Pond DS2: Drip Strip #2	Peak Elev=51.50' Storage=0 cf Inflow=0.18 cfs 596 cf 4.0" Round Culvert n=0.010 L=4.0' S=0.0625 '/' Outflow=0.18 cfs 596 cf
Pond OCS1: Proposed Outlet Control Structure #1	Peak Elev=46.97' Storage=239 cf Inflow=0.66 cfs 2,338 cf Outflow=0.53 cfs 2,337 cf
Pond PP: Permeable Pavers	Peak Elev=45.74' Storage=34 cf Inflow=0.06 cfs 513 cf Outflow=0.06 cfs 512 cf
Pond RG1: Proposed Rain Garden	Peak Elev=49.74' Storage=52 cf Inflow=0.18 cfs 1,083 cf Outflow=0.12 cfs 1,079 cf

13-023 POST*Type III 24-hr 50 Year Rainfall=5.71"*

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Link 1L: Permeable Pavers

below 0.06 cfs Inflow=0.18 cfs 592 cf
Primary=0.06 cfs 513 cf Secondary=0.12 cfs 79 cf

Link 2L: Time Lag - Permeable Pavers

delayed by 336.0 min Inflow=0.06 cfs 513 cf
Primary=0.06 cfs 513 cf

Link 3L: Time Lag - Rain Garden Soil Filter

delayed by 165.0 min Inflow=0.15 cfs 487 cf
Primary=0.15 cfs 487 cf

Total Runoff Area = 14,283 sf Runoff Volume = 5,873 cf Average Runoff Depth = 4.93"
19.44% Pervious = 2,776 sf 80.56% Impervious = 11,507 sf

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Type III 24-hr 100 Year Rainfall=6.39"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1A: Subcatchment 1A	Runoff Area=5,126 sf 100.00% Impervious Runoff Depth=6.15" Tc=6.0 min CN=98 Runoff=0.74 cfs 2,628 cf
Subcatchment 1B: Subcatchment 1B	Runoff Area=1,658 sf 84.74% Impervious Runoff Depth=5.68" Tc=6.0 min CN=94 Runoff=0.23 cfs 785 cf
Subcatchment 1C: Subcatchment 1C	Runoff Area=1,417 sf 81.37% Impervious Runoff Depth=5.68" Tc=6.0 min CN=94 Runoff=0.20 cfs 671 cf
Subcatchment 1D: Subcatchment 1D	Runoff Area=2,294 sf 60.46% Impervious Runoff Depth=5.00" Tc=6.0 min CN=88 Runoff=0.30 cfs 956 cf
Subcatchment 2A: Subcatchment 2A	Runoff Area=1,494 sf 74.90% Impervious Runoff Depth=5.45" Tc=6.0 min CN=92 Runoff=0.20 cfs 679 cf
Subcatchment 2B: Subcatchment 2B	Runoff Area=1,312 sf 62.27% Impervious Runoff Depth=5.11" Tc=6.0 min CN=89 Runoff=0.17 cfs 559 cf
Subcatchment 2C: Subcatchment 2C	Runoff Area=982 sf 50.92% Impervious Runoff Depth=4.78" Tc=6.0 min CN=86 Runoff=0.12 cfs 391 cf
Reach POA1: POA 1	Inflow=1.19 cfs 5,011 cf Outflow=1.19 cfs 5,011 cf
Reach POA2: POA 2	Inflow=0.24 cfs 1,625 cf Outflow=0.24 cfs 1,625 cf
Reach R1: ROW	Avg. Flow Depth=0.04' Max Vel=1.36 fps Inflow=0.44 cfs 1,060 cf n=0.013 L=75.0' S=0.0187 ' Capacity=3.42 cfs Outflow=0.43 cfs 1,060 cf
Pond DMH1: Proposed DMH 1	Peak Elev=45.07' Inflow=0.79 cfs 3,951 cf 10.0" Round Culvert n=0.013 L=90.0' S=0.0050 ' Outflow=0.79 cfs 3,951 cf
Pond DS1: Drip Strip #1	Peak Elev=50.15' Storage=76 cf Inflow=0.23 cfs 785 cf 4.0" Round Culvert n=0.010 L=8.0' S=0.4688 ' Outflow=0.20 cfs 757 cf
Pond DS2: Drip Strip #2	Peak Elev=51.50' Storage=0 cf Inflow=0.20 cfs 679 cf 4.0" Round Culvert n=0.010 L=4.0' S=0.0625 ' Outflow=0.20 cfs 679 cf
Pond OCS1: Proposed Outlet Control Structure #1	Peak Elev=47.02' Storage=261 cf Inflow=0.74 cfs 2,628 cf Outflow=0.58 cfs 2,627 cf
Pond PP: Permeable Pavers	Peak Elev=45.74' Storage=34 cf Inflow=0.06 cfs 567 cf Outflow=0.06 cfs 567 cf
Pond RG1: Proposed Rain Garden	Peak Elev=49.89' Storage=66 cf Inflow=0.21 cfs 1,238 cf Outflow=0.13 cfs 1,234 cf

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Type III 24-hr 100 Year Rainfall=6.39"

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Link 1L: Permeable Pavers

below 0.06 cfs Inflow=0.20 cfs 671 cf
Primary=0.06 cfs 567 cf Secondary=0.14 cfs 104 cf

Link 2L: Time Lag - Permeable Pavers

delayed by 336.0 min Inflow=0.06 cfs 567 cf
Primary=0.06 cfs 567 cf

Link 3L: Time Lag - Rain Garden Soil Filter

delayed by 165.0 min Inflow=0.17 cfs 559 cf
Primary=0.17 cfs 559 cf

Total Runoff Area = 14,283 sf Runoff Volume = 6,670 cf Average Runoff Depth = 5.60"
19.44% Pervious = 2,776 sf 80.56% Impervious = 11,507 sf

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Type III 24-hr 2 Year Rainfall=3.01"

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Summary for Subcatchment 1A: Subcatchment 1A

Runoff = 0.34 cfs @ 12.08 hrs, Volume= 1,187 cf, Depth= 2.78"

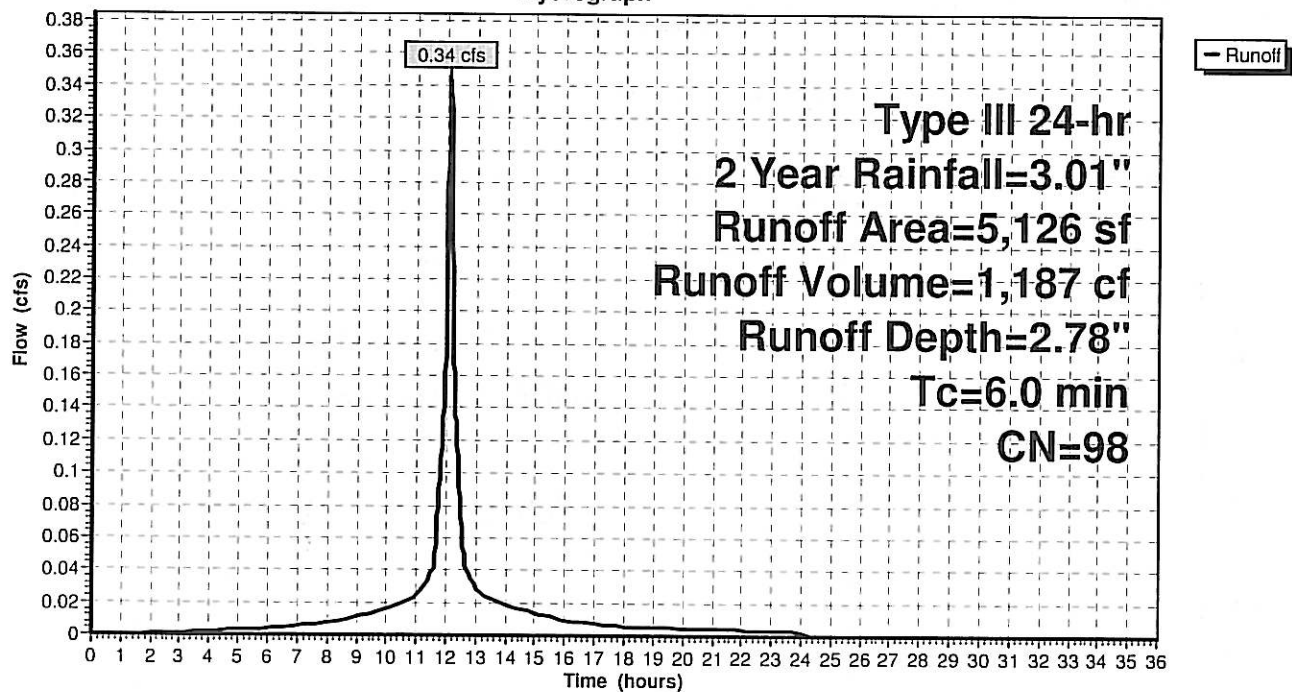
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Rainfall=3.01"

Area (sf)	CN	Description
5,126	98	Roofs, HSG C
5,126		100.00% Impervious Area

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

Subcatchment 1A: Subcatchment 1A

Hydrograph



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Type III 24-hr 2 Year Rainfall=3.01"

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Summary for Subcatchment 1B: Subcatchment 1B

Runoff = 0.10 cfs @ 12.08 hrs, Volume= 326 cf, Depth= 2.36"

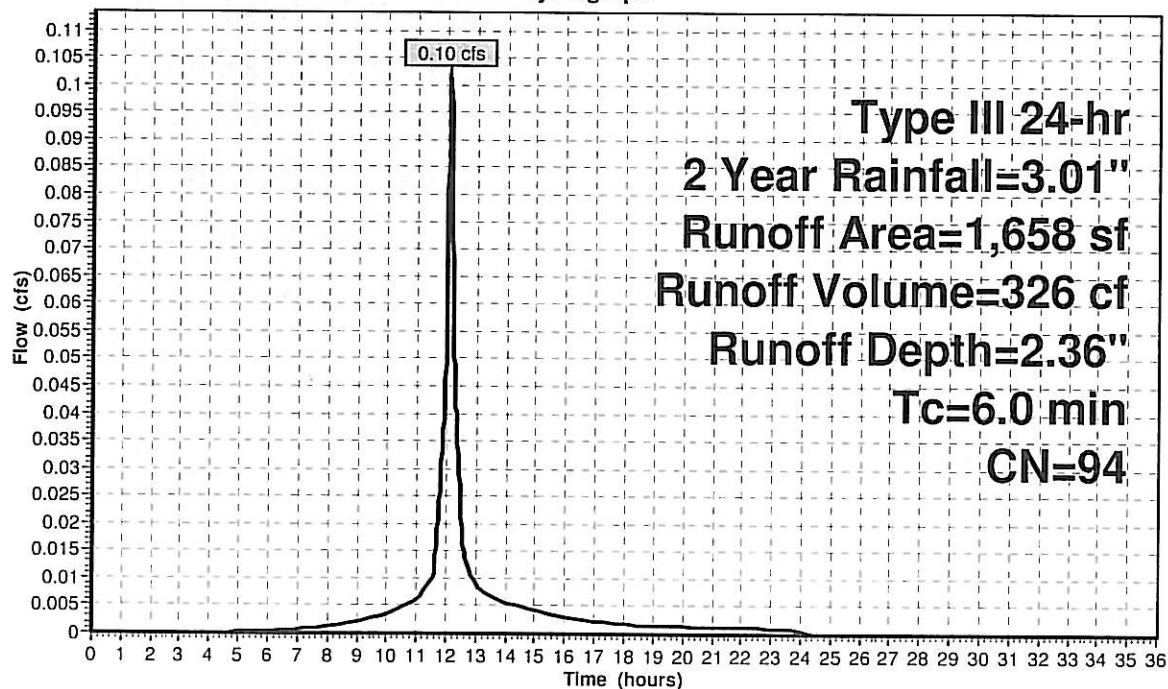
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Rainfall=3.01"

Area (sf)	CN	Description
1,216	98	Roofs, HSG C
114	74	>75% Grass cover, Good, HSG C
139	73	Woods, Fair, HSG C
* 189	98	Drip Strip, HSG C
1,658	94	Weighted Average
253		15.26% Pervious Area
1,405		84.74% Impervious Area

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

Subcatchment 1B: Subcatchment 1B

Hydrograph



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Type III 24-hr 2 Year Rainfall=3.01"

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Summary for Subcatchment 1C: Subcatchment 1C

Runoff = 0.09 cfs @ 12.08 hrs, Volume= 279 cf, Depth= 2.36"

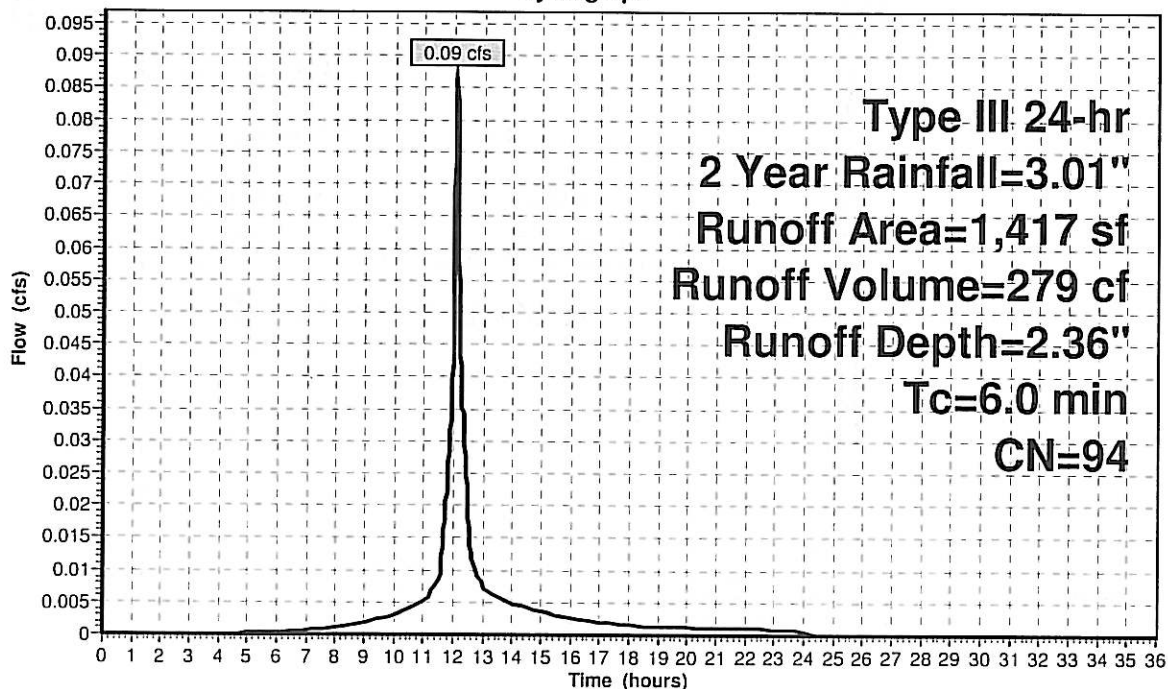
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Rainfall=3.01"

	Area (sf)	CN	Description
*	685	98	Roofs & Concrete Pads, HSG C
	235	74	>75% Grass cover, Good, HSG C
	29	73	Woods, Fair, HSG C
*	468	98	Pervious Pavement, HSG C
	1,417	94	Weighted Average
	264		18.63% Pervious Area
	1,153		81.37% Impervious Area

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

Subcatchment 1C: Subcatchment 1C

Hydrograph



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Type III 24-hr 2 Year Rainfall=3.01"

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Summary for Subcatchment 1D: Subcatchment 1D

Runoff = 0.11 cfs @ 12.09 hrs, Volume= 349 cf, Depth= 1.83"

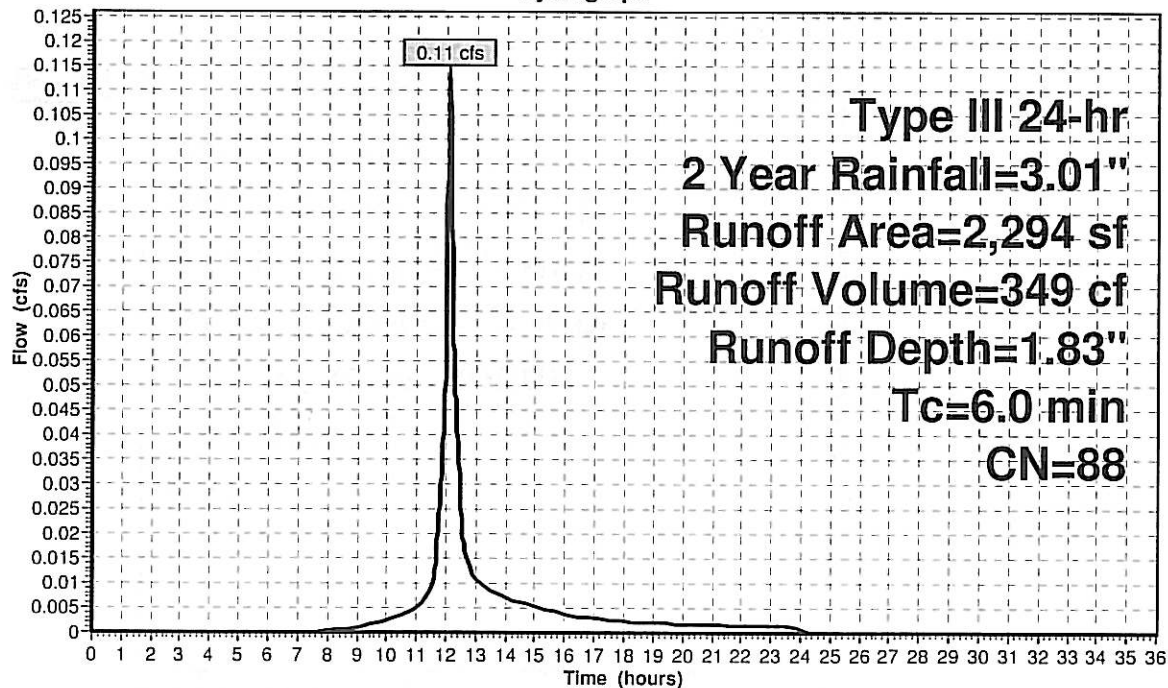
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Rainfall=3.01"

Area (sf)	CN	Description
1,387	98	Paved parking, HSG C
739	74	>75% Grass cover, Good, HSG C
168	73	Woods, Fair, HSG C
2,294	88	Weighted Average
907		39.54% Pervious Area
1,387		60.46% Impervious Area

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

Subcatchment 1D: Subcatchment 1D

Hydrograph



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Type III 24-hr 2 Year Rainfall=3.01"

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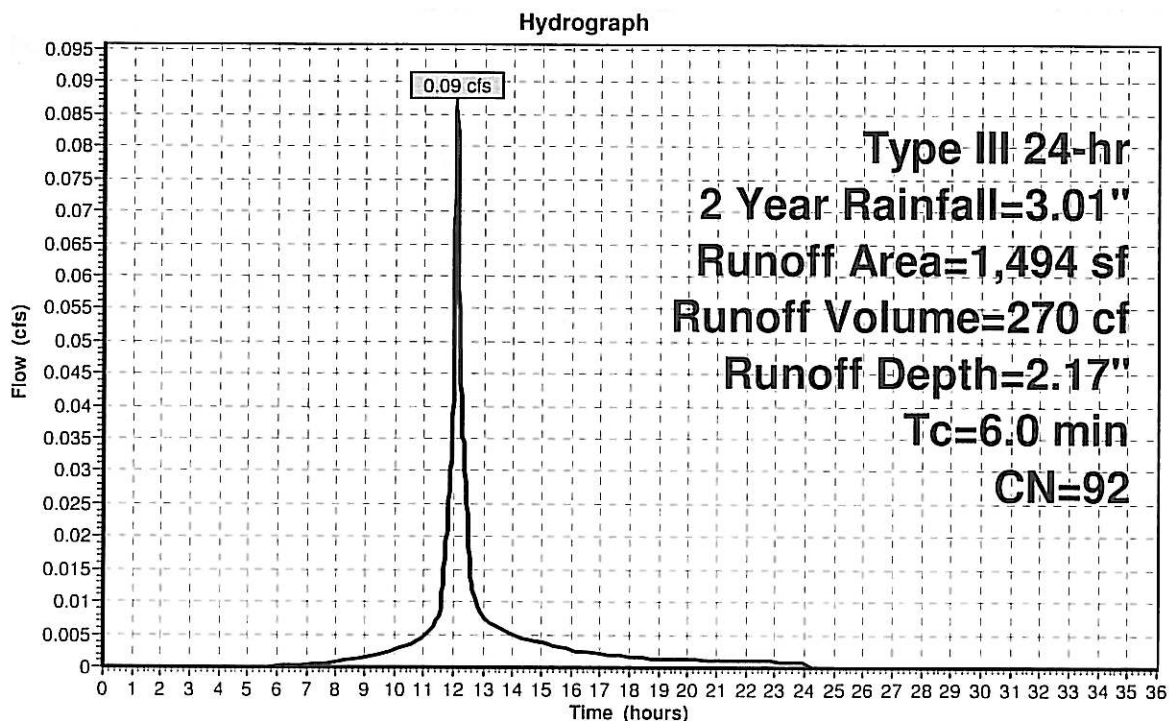
Summary for Subcatchment 2A: Subcatchment 2A

Runoff = 0.09 cfs @ 12.09 hrs, Volume= 270 cf, Depth= 2.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Rainfall=3.01"

Area (sf)	CN	Description
968	98	Roofs, HSG C
299	74	>75% Grass cover, Good, HSG C
76	73	Woods, Fair, HSG C
* 151	98	Drip Strip, HSG C
1,494	92	Weighted Average
375		25.10% Pervious Area
1,119		74.90% Impervious Area

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

Subcatchment 2A: Subcatchment 2A

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Type III 24-hr 2 Year Rainfall=3.01"

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Summary for Subcatchment 2B: Subcatchment 2B

Runoff = 0.07 cfs @ 12.09 hrs, Volume= 209 cf, Depth= 1.91"

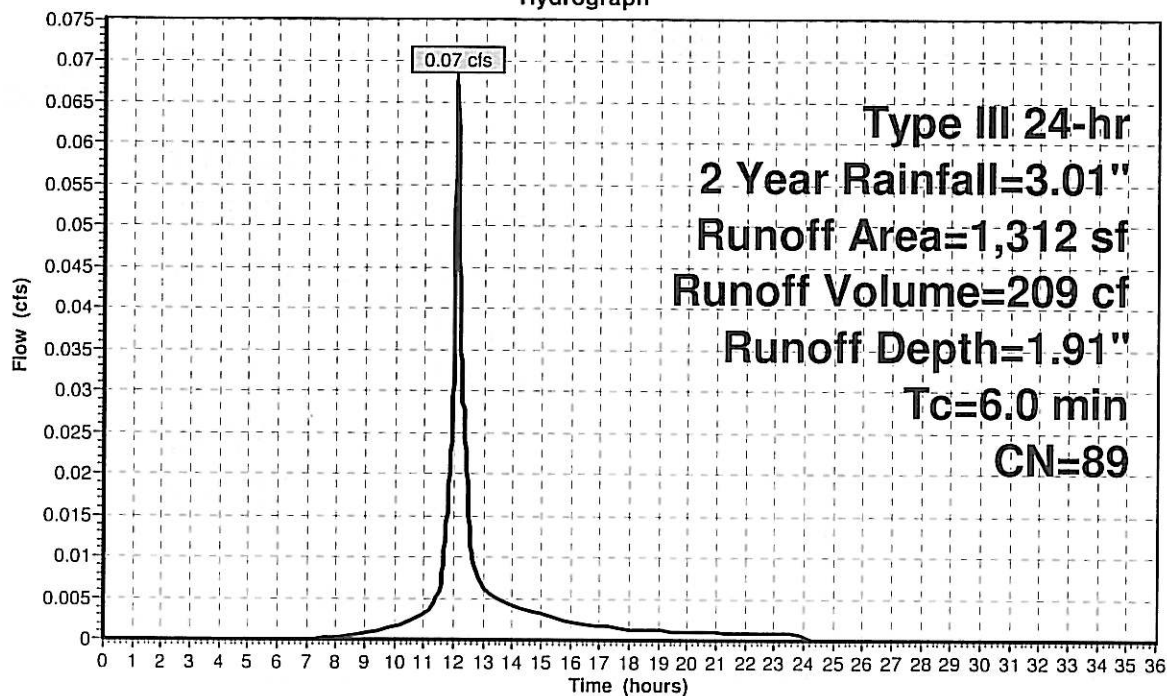
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Rainfall=3.01"

Area (sf)	CN	Description
817	98	Roofs, HSG C
459	74	>75% Grass cover, Good, HSG C
36	73	Woods, Fair, HSG C
1,312	89	Weighted Average
495		37.73% Pervious Area
817		62.27% Impervious Area

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

Subcatchment 2B: Subcatchment 2B

Hydrograph



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Type III 24-hr 2 Year Rainfall=3.01"

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Summary for Subcatchment 2C: Subcatchment 2C

Runoff = 0.04 cfs @ 12.09 hrs, Volume= 137 cf, Depth= 1.67"

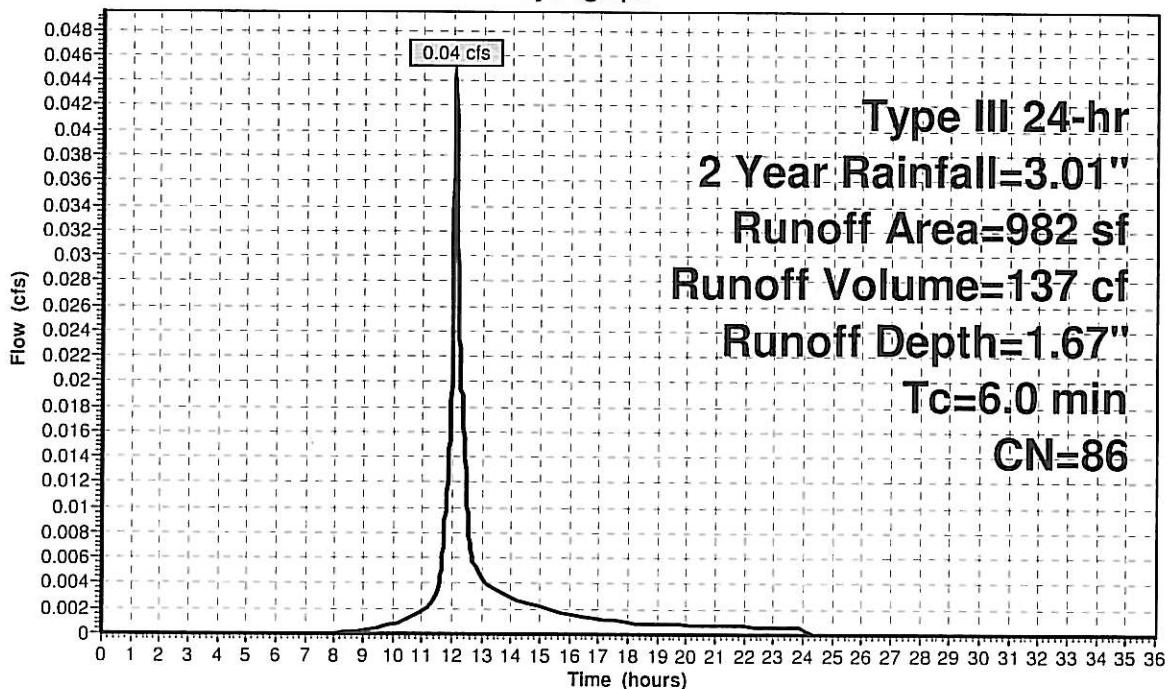
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 Year Rainfall=3.01"

Area (sf)	CN	Description
500	98	Roofs, HSG C
482	74	>75% Grass cover, Good, HSG C
982	86	Weighted Average
482		49.08% Pervious Area
500		50.92% Impervious Area

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

Subcatchment 2C: Subcatchment 2C

Hydrograph

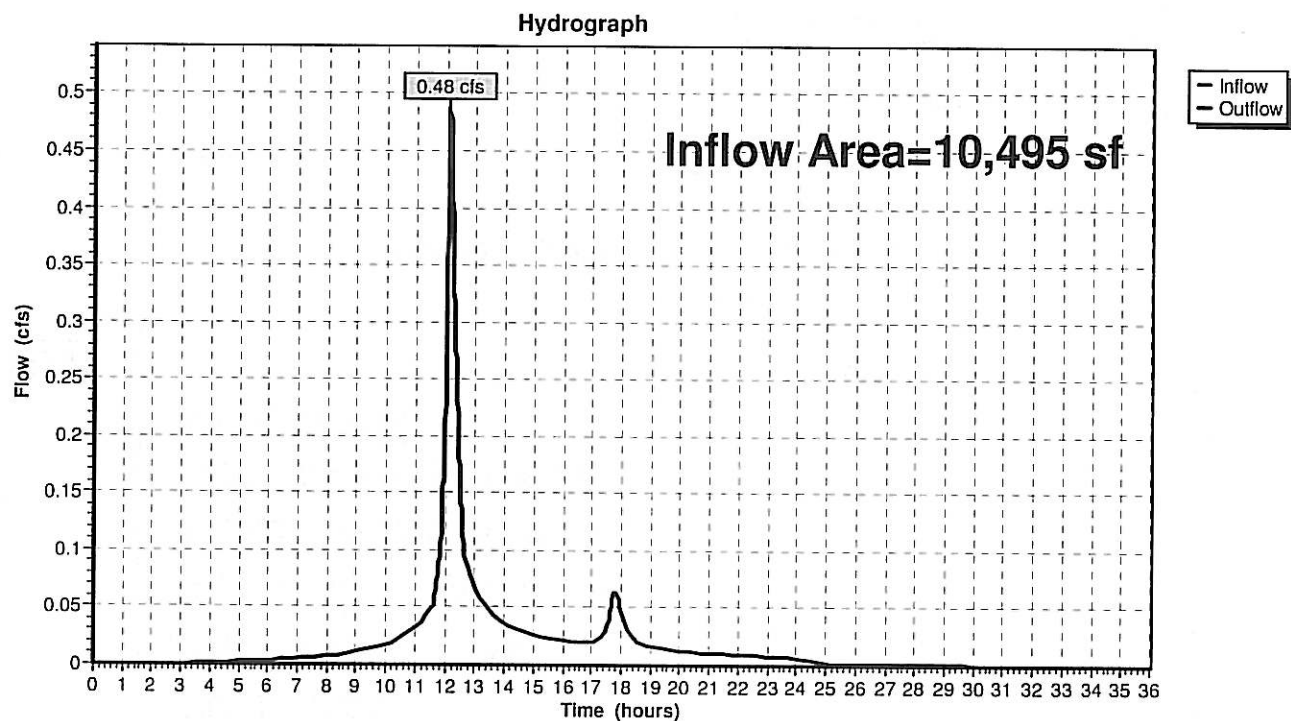


Summary for Reach POA1: POA 1

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

Inflow Area = 10,495 sf, 86.43% Impervious, Inflow Depth = 2.41" for 2 Year event
Inflow = 0.48 cfs @ 12.12 hrs, Volume= 2,112 cf
Outflow = 0.48 cfs @ 12.12 hrs, Volume= 2,112 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach POA1: POA 1

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Summary for Reach POA2: POA 2

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

Inflow Area = 3,788 sf, 64.31% Impervious, Inflow Depth = 1.94" for 2 Year event

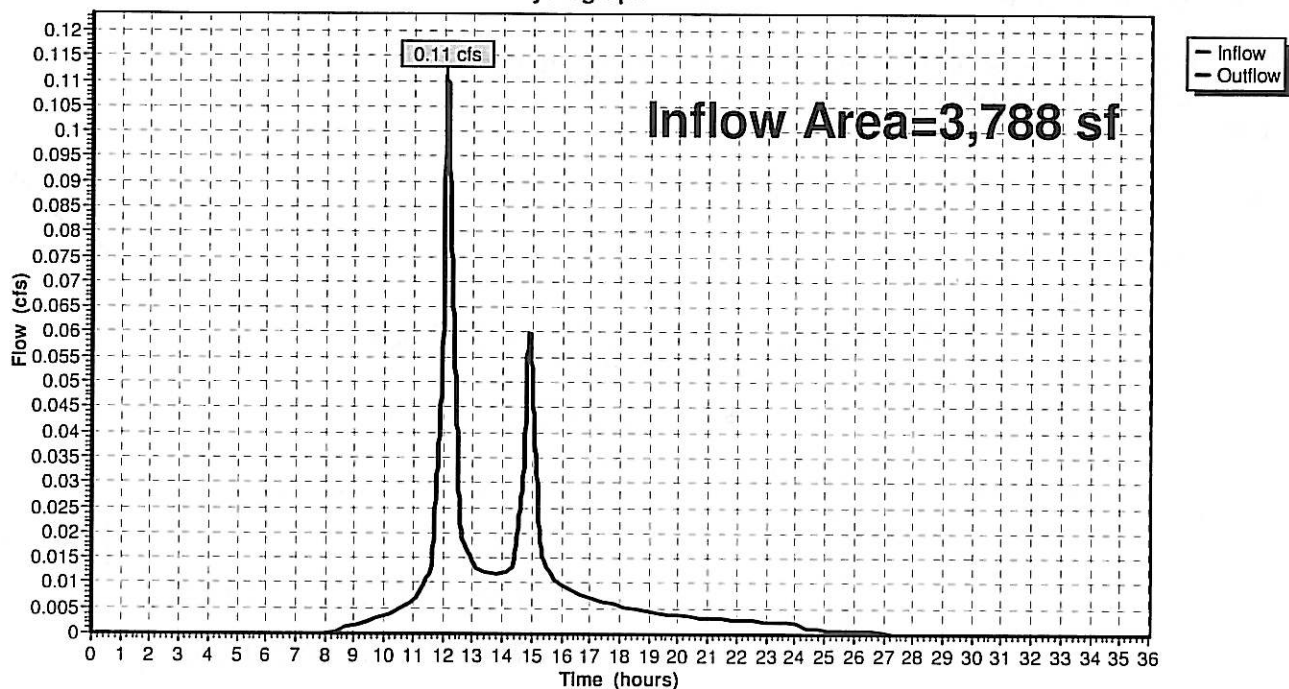
Inflow = 0.11 cfs @ 12.12 hrs, Volume= 612 cf

Outflow = 0.11 cfs @ 12.12 hrs, Volume= 612 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach POA2: POA 2

Hydrograph



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Summary for Reach R1: ROW

Inflow Area = 2,294 sf, 60.46% Impervious, Inflow Depth = 1.87" for 2 Year event
Inflow = 0.14 cfs @ 12.09 hrs, Volume= 358 cf
Outflow = 0.14 cfs @ 12.10 hrs, Volume= 358 cf, Atten= 2%, Lag= 0.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Max. Velocity= 0.95 fps, Min. Travel Time= 1.3 min

Avg. Velocity = 0.30 fps, Avg. Travel Time= 4.2 min

Peak Storage= 11 cf @ 12.10 hrs

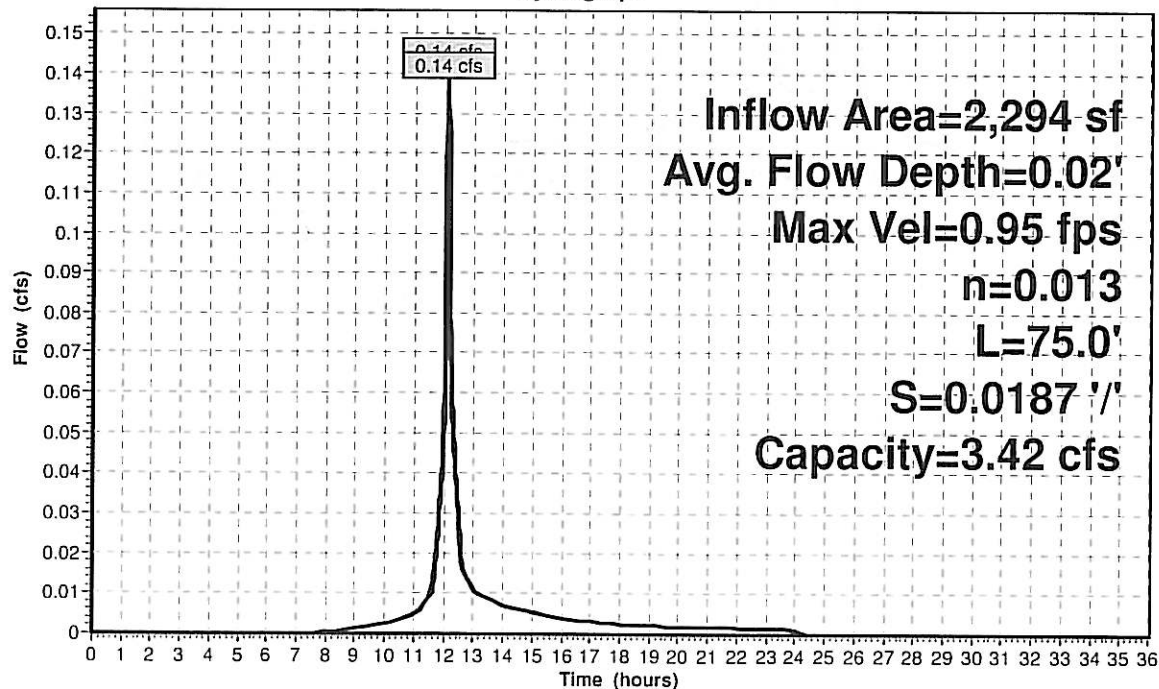
Average Depth at Peak Storage= 0.02'

Bank-Full Depth= 0.10' Flow Area= 1.3 sf, Capacity= 3.42 cfs

20.00' x 0.10' deep Parabolic Channel, n= 0.013 Asphalt, smooth

Length= 75.0' Slope= 0.0187 '/'

Inlet Invert= 47.50', Outlet Invert= 46.10'

**Reach R1: ROW****Hydrograph**

Summary for Pond DMH1: Proposed DMH 1

Inflow Area = 8,201 sf, 93.70% Impervious, Inflow Depth > 2.57" for 2 Year event
 Inflow = 0.36 cfs @ 12.14 hrs, Volume= 1,753 cf
 Outflow = 0.36 cfs @ 12.14 hrs, Volume= 1,753 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.36 cfs @ 12.14 hrs, Volume= 1,753 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Peak Elev= 44.87' @ 12.14 hrs

Flood Elev= 47.90'

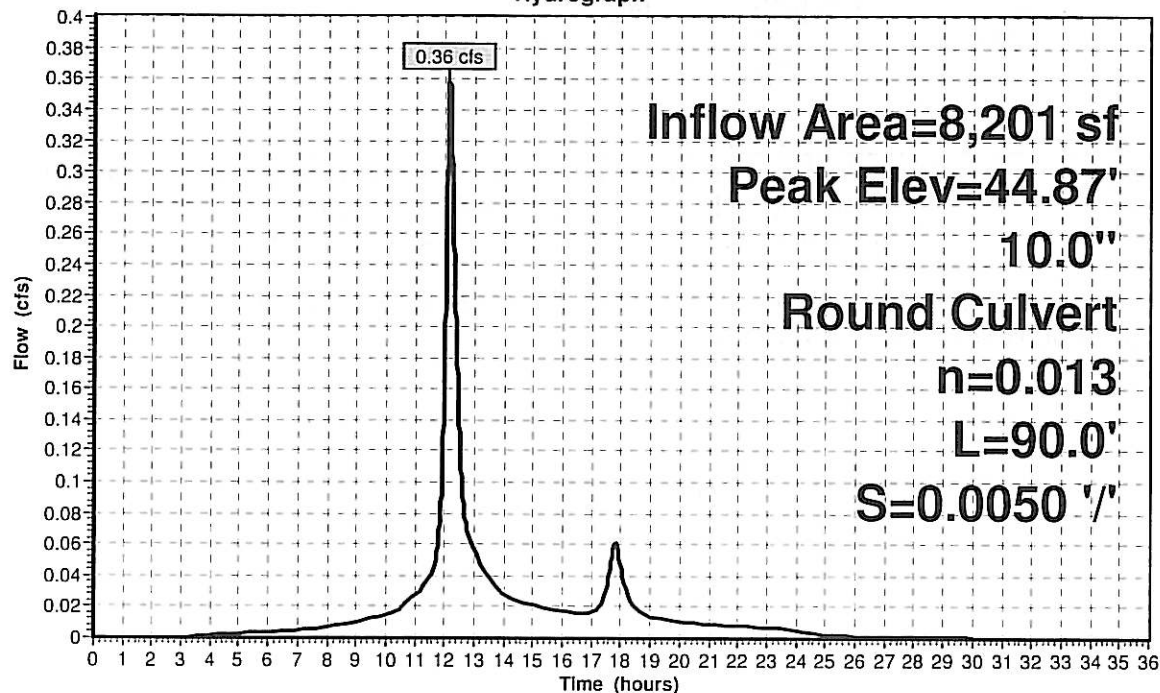
Device	Routing	Invert	Outlet Devices
#1	Primary	44.50'	10.0" Round Culvert L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 44.50' / 44.05' S= 0.0050 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf

Primary OutFlow Max=0.36 cfs @ 12.14 hrs HW=44.87' TW=0.00' (Dynamic Tailwater)

↑ **1=Culvert** (Barrel Controls 0.36 cfs @ 2.26 fps)

Pond DMH1: Proposed DMH 1

Hydrograph



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Type III 24-hr 2 Year Rainfall=3.01"

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Summary for Pond DS1: Drip Strip #1

Inflow Area = 1,658 sf, 84.74% Impervious, Inflow Depth = 2.36" for 2 Year event
 Inflow = 0.10 cfs @ 12.08 hrs, Volume= 326 cf
 Outflow = 0.09 cfs @ 12.13 hrs, Volume= 298 cf, Atten= 11%, Lag= 2.5 min
 Primary = 0.09 cfs @ 12.13 hrs, Volume= 298 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Peak Elev= 49.96' @ 12.13 hrs Surf.Area= 278 sf Storage= 54 cf

Plug-Flow detention time= 81.7 min calculated for 298 cf (91% of inflow)

Center-of-Mass det. time= 38.5 min (827.7 - 789.1)

Volume	Invert	Avail.Storage	Storage Description
#1	49.50'	331 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 834 cf Overall - 7 cf Embedded = 827 cf x 40.0% Voids
#2	49.75'	7 cf	4.0" Round Pipe Storage Inside #1 L= 84.0'
		338 cf	Total Available Storage

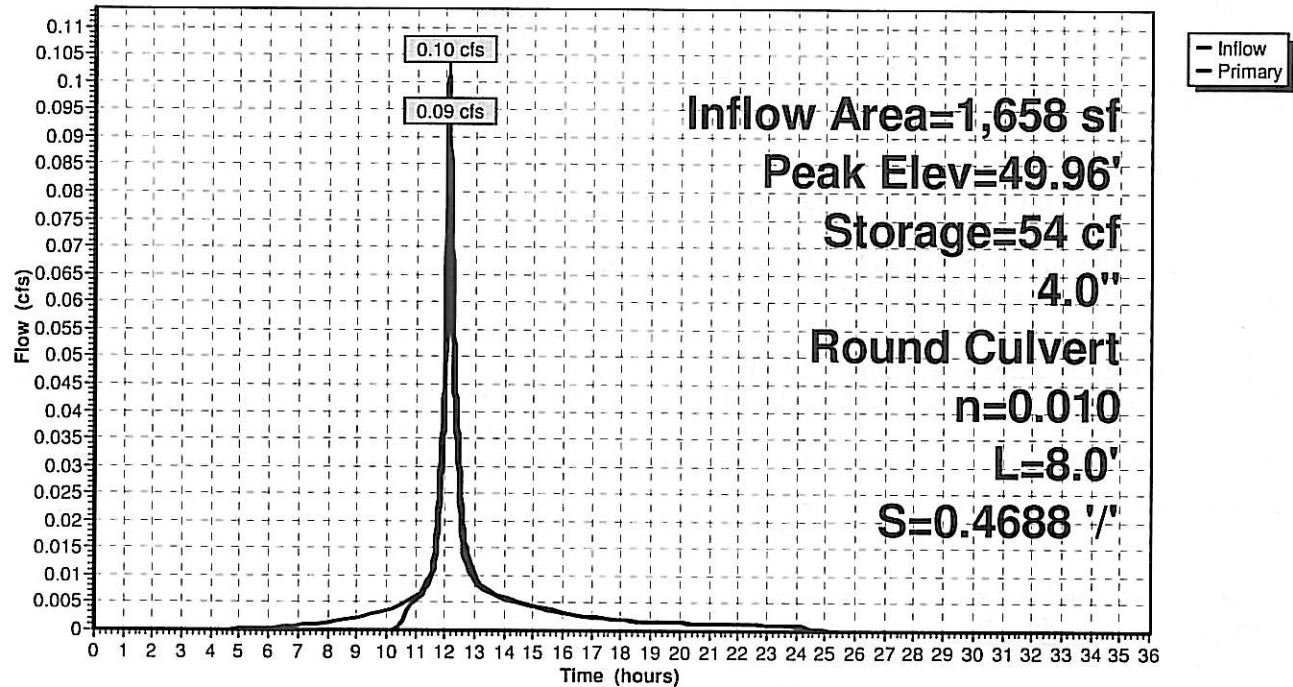
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
49.50	278	0	0
52.50	278	834	834

Device	Routing	Invert	Outlet Devices
#1	Primary	49.75'	4.0" Round Culvert L= 8.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 49.75' / 46.00' S= 0.4688 ' S= 0.4688 ' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf

Primary OutFlow Max=0.09 cfs @ 12.13 hrs HW=49.96' TW=44.87' (Dynamic Tailwater)↑ **1=Culvert** (Inlet Controls 0.09 cfs @ 1.56 fps)

Pond DS1: Drip Strip #1

Hydrograph



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Type III 24-hr 2 Year Rainfall=3.01"

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Summary for Pond DS2: Drip Strip #2

Inflow Area = 1,494 sf, 74.90% Impervious, Inflow Depth = 2.17" for 2 Year event
 Inflow = 0.09 cfs @ 12.09 hrs, Volume= 270 cf
 Outflow = 0.09 cfs @ 12.09 hrs, Volume= 270 cf, Atten= 0%, Lag= 0.0 min
 Primary = 0.09 cfs @ 12.09 hrs, Volume= 270 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Peak Elev= 51.50' @ 0.00 hrs Surf.Area= 220 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 0.0 min (800.0 - 800.0)

Volume	Invert	Avail.Storage	Storage Description
#1	51.50'	262 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 660 cf Overall - 5 cf Embedded = 655 cf x 40.0% Voids
#2	51.75'	5 cf	4.0" Round Pipe Storage Inside #1 L= 62.0'
		267 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
51.50	220	0	0
54.50	220	660	660

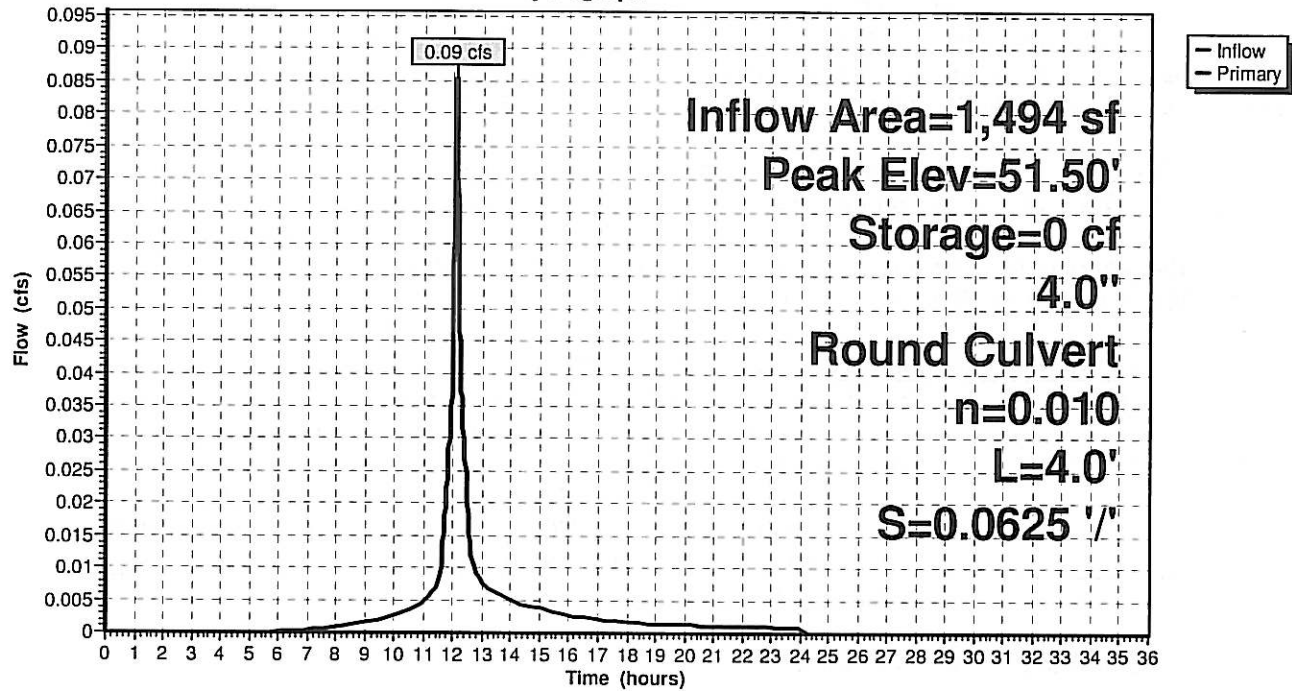
Device	Routing	Invert	Outlet Devices
#1	Primary	50.25'	4.0" Round Culvert L= 4.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 50.25' / 50.00' S= 0.0625 ' S= 0.0625 ' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=51.50' TW=48.20' (Dynamic Tailwater)

↑1=Culvert (Passes 0.00 cfs of 0.44 cfs potential flow)

Pond DS2: Drip Strip #2

Hydrograph



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Type III 24-hr 2 Year Rainfall=3.01"

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Summary for Pond OCS1: Proposed Outlet Control Structure #1

Inflow Area = 5,126 sf, 100.00% Impervious, Inflow Depth = 2.78" for 2 Year event
 Inflow = 0.34 cfs @ 12.08 hrs, Volume= 1,187 cf
 Outflow = 0.27 cfs @ 12.15 hrs, Volume= 1,186 cf, Atten= 22%, Lag= 3.7 min
 Primary = 0.27 cfs @ 12.15 hrs, Volume= 1,186 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 46.77' @ 12.15 hrs Surf.Area= 562 sf Storage= 156 cf

Plug-Flow detention time= 23.4 min calculated for 1,186 cf (100% of inflow)
 Center-of-Mass det. time= 23.2 min (781.0 - 757.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	46.17'	404 cf	18.17'W x 30.92'L x 2.33'H Field A 1,311 cf Overall - 299 cf Embedded = 1,011 cf x 40.0% Voids
#2A	46.67'	299 cf	ADS StormTech SC-310 x 20 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 5 rows
		704 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	44.78'	10.0" Round Culvert L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 44.78' / 44.50' S= 0.0056 ' S= 0.0056 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#2	Device 1	46.17'	2.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	46.50'	6.0" Vert. Orifice/Grate C= 0.600
#4	Device 1	47.30'	3.0' long x 1.25' rise Sharp-Crested Rectangular Weir 2 End Contraction(s) 0.6' Crest Height

Primary OutFlow Max=0.27 cfs @ 12.15 hrs HW=46.77' TW=44.87' (Dynamic Tailwater)

- ↑ 1=Culvert (Passes 0.27 cfs of 2.81 cfs potential flow)
- ↑ 2=Orifice/Grate (Orifice Controls 0.08 cfs @ 3.47 fps)
- ↑ 3=Orifice/Grate (Orifice Controls 0.19 cfs @ 1.78 fps)
- ↑ 4=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

13-023 POST

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Type III 24-hr 2 Year Rainfall=3.01"

Printed 12/18/2013

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Pond OCS1: Proposed Outlet Control Structure #1 - Chamber Wizard Field A**Chamber Model = ADS_StormTech SC-310**

Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf

Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

Row Length Adjustment= +0.44' x 2.07 sf x 5 rows

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

4 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 28.92' Row Length +12.0" End Stone x 2 = 30.92' Base Length

5 Rows x 34.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 18.17' Base Width

6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

20 Chambers x 14.7 cf +0.44' Row Adjustment x 2.07 sf x 5 Rows = 299.4 cf Chamber Storage

1,310.6 cf Field - 299.4 cf Chambers = 1,011.2 cf Stone x 40.0% Voids = 404.5 cf Stone Storage

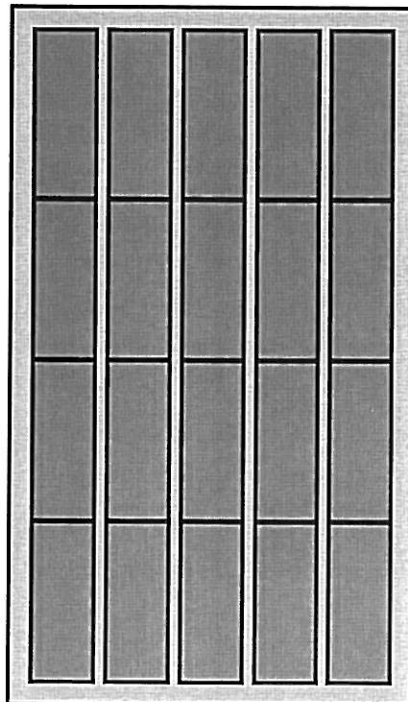
Chamber Storage + Stone Storage = 703.9 cf = 0.016 af

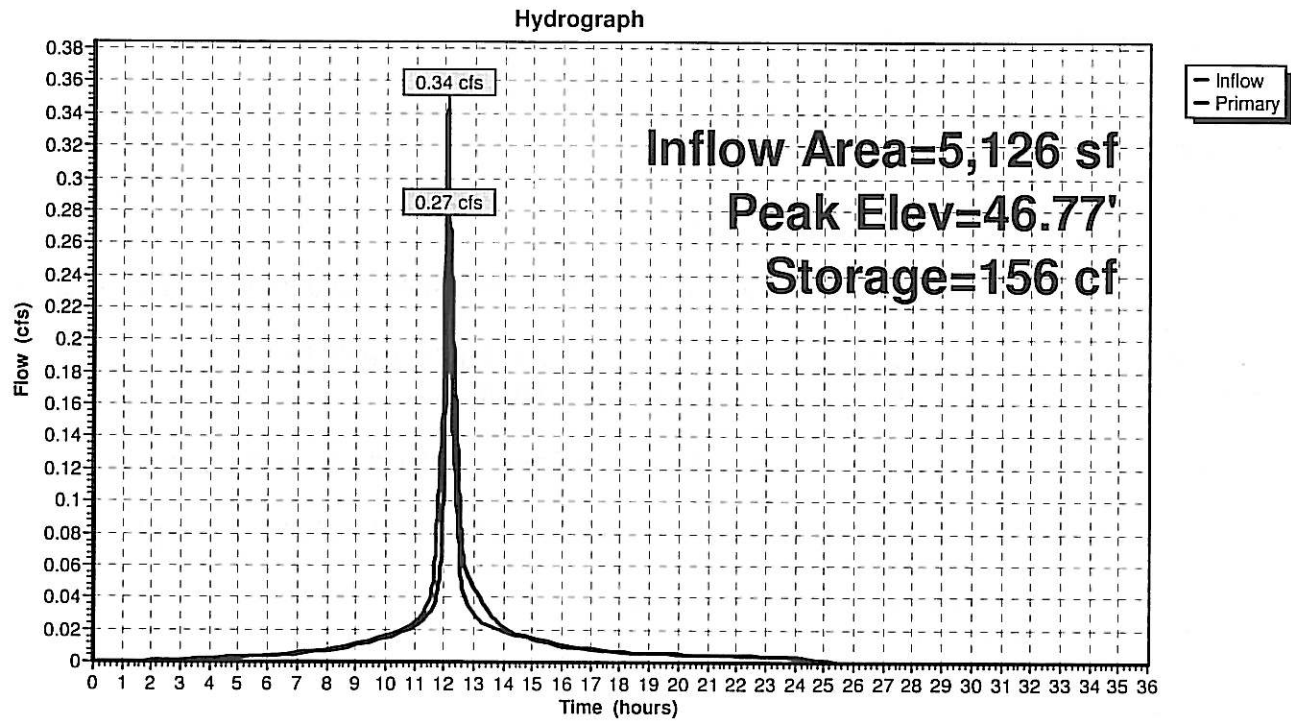
Overall Storage Efficiency = 53.7%

20 Chambers

48.5 cy Field

37.5 cy Stone



Pond OCS1: Proposed Outlet Control Structure #1

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Summary for Pond PP: Permeable Pavers

Inflow Area = 1,417 sf, 81.37% Impervious, Inflow Depth = 2.28" for 2 Year event
 Inflow = 0.06 cfs @ 17.62 hrs, Volume= 270 cf
 Outflow = 0.05 cfs @ 17.78 hrs, Volume= 269 cf, Atten= 9%, Lag= 9.7 min
 Primary = 0.05 cfs @ 17.78 hrs, Volume= 269 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 45.73' @ 17.78 hrs Surf.Area= 497 sf Storage= 32 cf

Plug-Flow detention time= 27.8 min calculated for 269 cf (100% of inflow)
 Center-of-Mass det. time= 26.4 min (1,153.7 - 1,127.2)

Volume	Invert	Avail.Storage	Storage Description			
#1	45.57'	315 cf	Custom Stage Data (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
45.57	497	93.0	0.0	0	0	497
47.07	497	93.0	40.0	298	298	637
47.24	497	93.0	20.0	17	315	652
47.50	497	93.0	0.0	0	315	676

Device	Routing	Invert	Outlet Devices
#1	Primary	45.57'	4.0" Round Culvert L= 3.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 45.57' / 45.51' S= 0.0200 ' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf
#2	Device 1	45.57'	0.2" Vert. Perforated Underdrain X 200.00 C= 0.600

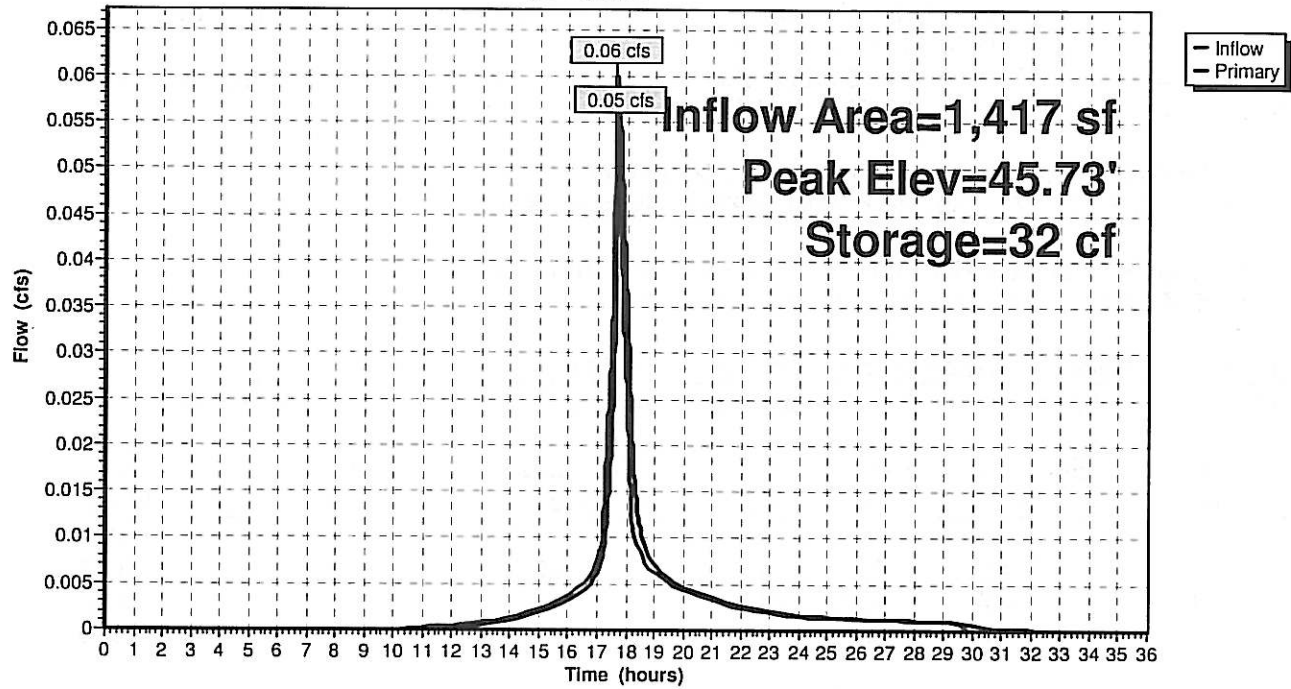
Primary OutFlow Max=0.05 cfs @ 17.78 hrs HW=45.73' TW=44.65' (Dynamic Tailwater)

↑ **1=Culvert** (Barrel Controls 0.05 cfs @ 1.89 fps)

↑ **2=Perforated Underdrain** (Passes 0.05 cfs of 0.08 cfs potential flow)

Pond PP: Permeable Pavers

Hydrograph



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Type III 24-hr 2 Year Rainfall=3.01"

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Summary for Pond RG1: Proposed Rain Garden

Inflow Area = 2,806 sf, 69.00% Impervious, Inflow Depth = 2.05" for 2 Year event
 Inflow = 0.09 cfs @ 12.09 hrs, Volume= 479 cf
 Outflow = 0.07 cfs @ 12.14 hrs, Volume= 475 cf, Atten= 18%, Lag= 3.4 min
 Primary = 0.07 cfs @ 12.14 hrs, Volume= 475 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 48.39' @ 12.14 hrs Surf.Area= 59 sf Storage= 19 cf

Plug-Flow detention time= 12.6 min calculated for 475 cf (99% of inflow)
 Center-of-Mass det. time= 6.8 min (884.6 - 877.8)

Volume	Invert	Avail.Storage	Storage Description			
#1	47.50'	144 cf	Custom Stage Data (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
47.50	59	29.0	0.0	0	0	59
48.25	59	29.0	40.0	18	18	81
49.25	59	29.0	20.0	12	30	110
49.50	59	29.0	40.0	6	35	117
50.00	110	38.0	100.0	42	77	168
50.50	158	47.0	100.0	67	144	232

Device	Routing	Invert	Outlet Devices													
#1	Primary	47.67'	8.0" Round Culvert L= 26.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 47.67' / 47.50' S= 0.0065 ' S= 0.0065 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf													
#2	Device 1	47.67'	0.2" Vert. Orifice/Grate X 80.00 C= 0.600													
#3	Device 1	50.00'	18 Inch Beehive Grate Head (feet) 0.00 0.10 0.15 0.17 0.18 0.19 0.20 0.25 0.26 0.35 0.50 0.75 1.00 1.25 1.50 1.75 2.00 Disch. (cfs) 0.000 0.500 0.900 1.100 1.000 1.100 1.200 1.400 1.700 2.000 2.300 2.900 3.400 3.800 4.100 4.500 4.800													

Primary OutFlow Max=0.07 cfs @ 12.14 hrs HW=48.39' TW=0.00' (Dynamic Tailwater)

- ↑ **1=Culvert** (Passes 0.07 cfs of 0.89 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 0.07 cfs @ 4.05 fps)
- ↑ **3=18 Inch Beehive Grate** (Controls 0.00 cfs)

APPENDIX C

Custom Soil Resource Report Soil Map



Map Scale: 1:689 if printed on A landscape (11" x 8.5") sheet.

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

APPENDIX D

PIPE OUTLET PROTECTION APRON DESIGN

And

d₅₀ RIPRAP SIZING

PROJECT NAME :	Island Diversified LLC Durham, NH		
LOCATION:	Rip Rap #1		
BY :	MS	CHECKED BY :	MJS
DATE :	12/18/2013	STORM:	25-Yr
		DATE :	12/18/2013

DOWNSTREAM CHANNEL (OR SPREADER) HYDRAULICS

Peak Discharge Required =	0.65	cfs
Channel Bottom Width =	3.0	Feet
Hydraulic Gradient =	0.330	Feet/Feet
Left Side Slope =	20.0	:1(h:v)
Right Side Slope =	20.0	:1(h:v)
Depth of Flow* =	0.090	Feet
Manning's "n" =	0.0728	Please refer to Figure 7-52 of HANDBOOK
Area =	0.43	Square Feet
Wetted Perimeter =	6.60	Feet
Hydraulic Radius =	0.07	Feet
Top Width =	6.60	Feet
Velocity =	1.90	Feet/Second
Peak Discharge Determined =	0.82	cfs

La AND W CALCULATIONS:

Culvert Diameter (Do) =	10.0	Inches	Assumes Channel Bottom at the Culvert Equals the Invert Outlet Elevation of the Pipe. If this is not the case, the calculations involving the Tailwater will have to be calculated by hand.
Tail Water Depth (TW)* =	0.09	Feet	
Length of Apron (La) =	7	Feet	
Width of Apron @ D.S End (W) =	10	Feet	
Width of D.S. Apron if Channel (W) =	6.6	Feet	

*If outletting to Flat Area use TW depth = 0.2 x Do

ROCK RIPRAP SIZE

d ₅₀ =	0.15	Feet or	1.80	Inches	USE
d ₅₀ = (0.02 x Q ^{4/3})/(Tw x Do)					4.0

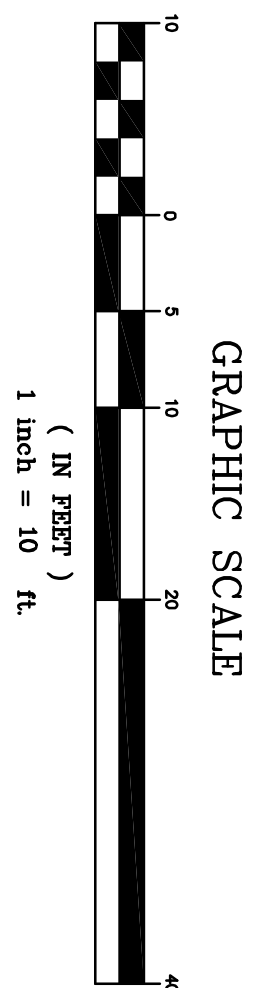
ROCK RIPRAP GRADATION (TABLE 7-24 OF NHDES HANDBOOK)

% of Weight Smaller Than The Given Size	Size of Stone in Inches		
100	6.0	to	8.0
85	5.2	to	7.2
50	4.0	to	6.0
15	1.2	to	2.0

Minimum Rock Riprap Blanket Thickness = 12.0 Inches
Minimum Six inch Sand/Gravel Bedding or Geotextile Fabric Required Under All Rock Riprap

FORMULAS USED (Reference NHDES HANDBOOK, Pages 7-114, 7-115)

Manning's Uniform Channel Flow - $Q = (A \times 1.486 \times R^{2/3} \times S^{1/2}) / n$
 Length of Apron (La) TW < Do/2 - $La = (1.8 \times Q / Do^{1.5}) + 7 \times Do$
 Length of Apron (La) TW >= Do/2 - $La = 3.0 \times Q / Do^{1.5} + 7 \times Do$
 Width of Apron @ D.S End TW < Do/2 - $W = 3 \times Do + La$
 Width of Apron @ D.S End TW >= Do/2 - $W = 3 \times Do + 0.4 \times La$
 Width of D.S. Apron if in Channel - Ch. BW + Sum of Side Slopes x Flow Depth
 Width of Apron @ Culvert - $Wc = 3 \times Do$



OA 1
2
R1

NO.	REVISIONS	DATE	INT.

DATE:	12/18/13
SCALE:	1"=10'
DESIGNED BY:	MS
DRAWN BY:	MS
APPROVED BY:	MJS
DWG FILE:	

PRE-DEVELOPMENT DRAINAGE PLAN
prepared for
ISLAND DIVERSIFIED LLC
(TAX MAP 2, LOT 12-5 & 12-6)
MATHES TERRACE DURHAM, NH



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PRE

