

STORMWATER MANAGEMENT REPORT

Harmony Village

**218-220 Main Street
Medway, Massachusetts**

Prepared for:

Harmony Village LLC

5 Exchange Street, Suite 4

Milford, MA 01757

Prepared by:

MERIDIAN ASSOCIATES, INC.

69 Milk Street, Suite 302

Westborough, Massachusetts 01581

November 12, 2020



11/12/20



TABLE OF CONTENTS

Report Summary:

- * Calculation Objectives
- * Calculation Methods
- * Sources of Data
- * Soil Descriptions
- * Selection of Storm Events
- * Existing Conditions Overview
- * Proposed Conditions Overview
- * Summary of Peak Stormwater Runoff Rates
- * Erosion Control Discussion
- * Conclusion

Soils Information:

- * NRCS Information
- * Test Pit Location Sketch
- * Test Pit Log

Hydrological Analysis:

- * Existing Conditions Subcatchment Area Plan
- * Existing Conditions HydroCAD Analysis
- * Proposed Conditions Subcatchment Area Plan
- * Proposed Conditions HydroCAD Analysis

Water Quality:

- * Recharge, Water Quality and TSS Removal Calcs.
- * Infiltration BMP Drawdown Calcs.
- * Mounding Analysis

Checklist for Stormwater Report:

- * Checklist for Stormwater Report

REPORT SUMMARY:

Calculation Objectives:

The objective of these calculations is to demonstrate design compliance of the proposed development at 218-220 Main Street in Medway, Massachusetts for water quantity and water quality objectives of the DEP's Stormwater Management Regulations, the Massachusetts Stormwater Handbook, and Medway's Stormwater Management and Land Disturbance Bylaw. Portions of the Project can be considered as redevelopment. The proposed development will fully comply with the ten (10) standards of the MADEP Stormwater Regulations as well as Medway's Stormwater Management and Land Disturbance Bylaw.

Subcatchment Area Plans have been incorporated into this report to depict existing and proposed watershed areas.

Calculation Methods:

- TR55/TR20 methodology utilizing HydroCAD software by Applied Microcomputer Systems.
- MADEP Stormwater Management Handbook for Water Quality Calculations / TSS Removal.

Sources of Data:

- Technical Report No. 20 & No. 55
- Technical Paper No. 40
- NOAA Atlas 14, September 2015
- Existing Conditions Field Survey by Meridian Associates, Inc. in July 2019
- Web Soil Survey of Norfolk County Massachusetts by the USDA Natural Resources Conservation Service (NRCS)
- Soil Testing performed by Janice Weldon, SE of Meridian Associates, Inc. on April 27, 2020
- "Stormwater Management – Stormwater Policy Handbook and Stormwater Technical Handbook" by the Massachusetts DEP – February 2008

Soil Descriptions:

Existing soil conditions have been characterized by the Norfolk County Soil Survey Report. The soils have been assigned a Hydrologic Soil Grouping (HSG) by NRCS. According to NRCS, the site consists of the following soils:

Hydrologic Soil Group (HSG) Rating	NRCS Soil Map Unit Name
B	Charlton-Hollis-Rock outcrop complex, 8-15% slopes
B	Canton fine sandy loam, 0-8% slopes, extremely stony

As required by Volume 3: Documenting Compliance with the Massachusetts Stormwater Management Standards, an on-site soil evaluation was undertaken on April 27, 2020 to confirm the NRCS soil survey by Janice Weldon, a licensed soil evaluator with MAI.

The observed soil type was documented, mapped and is included in this report. The observed soils were found to be primarily sand and loamy sand, with an Estimated Seasonal High Groundwater elevation varying from 226.0 to 233.5. This variation is likely due to the presence of ledge.

Due to the soil type, design of the infiltration chambers, as well as dewatering and mounding calculations are based on a loamy sand Rawls Infiltration rate of 2.41 in/hr, as the chambers will be draining into this layer. The detention basin was modelled with a more conservative Rawls Infiltration rate of 1.02 in/hr since the basin will dewater into the sandy loam. Mounding and dewatering calculations were also performed with this lower Rawls Rate.

Selection of Storm Events:

The storm events have been compiled from the National Oceanic and Atmospheric Administration (NOAA)'s Atlas 14. The 2-year, 10-year, and 100-year storm events have been utilized for hydrology calculations. The rainfall data for the Type III, 24-hour storm events follow:

<u>Frequency (Years)</u>	<u>Rainfall (Inches/Hour)</u>
2	3.37
10	5.26
100	8.26

Existing Conditions Overview:

The Site is a 1.22 acre parcel located on Main Street in southern Medway. There are currently two single family homes on the site as well as a shed and a pool. Stormwater on the site drains naturally to the abutting property to the west or overland to the municipal storm drain system on Main Street. Some of the runoff which drains to Main Street is captured in a manmade pond and/or a natural depression, however there are no true stormwater management devices on the property.

Existing conditions on the site have been modelled using four subcatchment areas. A summary of existing subcatchments and natural drainage devices can be found below.

<u>Description</u>	<u>Comments</u>
SC-E1 (DP-1)	Developed area of site, flows directly overland to Main Street
SC-E2 (DP-1)	Existing pervious area, flows to man-made pond
SC-E3 (DP-1)	Overland flow to existing depression
SC-E4 (DP-2)	Overland flow to western abutters
EP-1	Man-made lined pond, no exfiltration
EP-2	Existing depression in southwest corner of site
DP-1	Main Street municipal storm drain system
DP-2	224 Main Street (Western abutters)

Proposed Conditions Overview:

New Generation Custom Homes is proposing to construct four additional residential units in the form of one quadplex. The driveway will be extended to service the new building. The existing pool and shed will be demolished. Development will add approximately 11,100 sf of new impervious to the site in the form of driveways and the building.

Increases in stormwater runoff rates and volumes will be mitigated through the installation of two subsurface infiltration systems which will serve as drywells for all three buildings on site. The drywells have been sized to contain the 100-year storm event, and roof drains on all buildings will be fitted with overflows to allow for bypass in larger storm events. Stormwater from driveways and yards will be directed to a detention basin via deep sump catch basins and a CDS treatment unit.

The following is a summary of post-development subcatchment watershed areas from the site:

<u>Description</u>	<u>Comments</u>
SC P-1 (DP-2)	Overland flow to 244 Main Street
SC P-2 (DP-1)	Proposed development driveways and central yard area to PP-1
SC P-3 (DP-1)	Overland flow directly to PP-1
SC P-4 (DP-1)	Overland flow to Main Street
P-Ex	Existing buildings
P-D	Proposed four-unit development
PP-1	Proposed Detention Basin
DW-1	Proposed drywell to serve existing buildings
DW-2	Proposed drywell to serve proposed building
DP-1	Main Street municipal storm drain system
DP-2	224 Main Street (Western Abutters)

Summary of Flows at Design Point 1

<u>Storm Event</u>	<u>Existing Conditions (Pre)</u>		<u>Proposed Conditions (Post)</u>	
	<u>Peak Flow (CFS)</u>	<u>Runoff Volume (CF)</u>	<u>Peak Flow (CFS)</u>	<u>Runoff Volume (CF)</u>
2-Year (3.37 in./hr.)	0.47	2,529	0.11	509
10-Year (5.26 in./hr.)	1.28	6,196	0.35	1,328
100-Year (8.26 in./hr.)	2.78	13,201	0.88	5,709

Summary of Flows at Design Point 2

<u>Storm Event</u>	<u>Existing Conditions (Pre)</u>		<u>Proposed Conditions (Post)</u>	
	<u>Peak Flow (CFS)</u>	<u>Runoff Volume (CF)</u>	<u>Peak Flow (CFS)</u>	<u>Runoff Volume (CF)</u>
2-Year (3.37 in./hr.)	0.24	1,890	0.24	1,381
10-Year (5.26 in./hr.)	0.97	5,722	0.97	4,093
100-Year (8.26 in./hr.)	2.53	13,996	2.50	9,762

Erosion Control Discussion:

The project is subject to the NPDES Construction General Permit requirements, so a comprehensive Stormwater Pollution Prevention Plan (SWPPP) will be required prior to construction. Erosion control measures have been depicted on the plans and are further outlined in the Operation and Maintenance Plan found in this Report. Inlet protection shall be provided on all catch basins and storm drain inlets within the limit of work. In addition, the Project area will be surrounded by a compost sock or sediment control barrier for the duration of construction. An Operation and Maintenance Exhibit is also included as part of this submission.

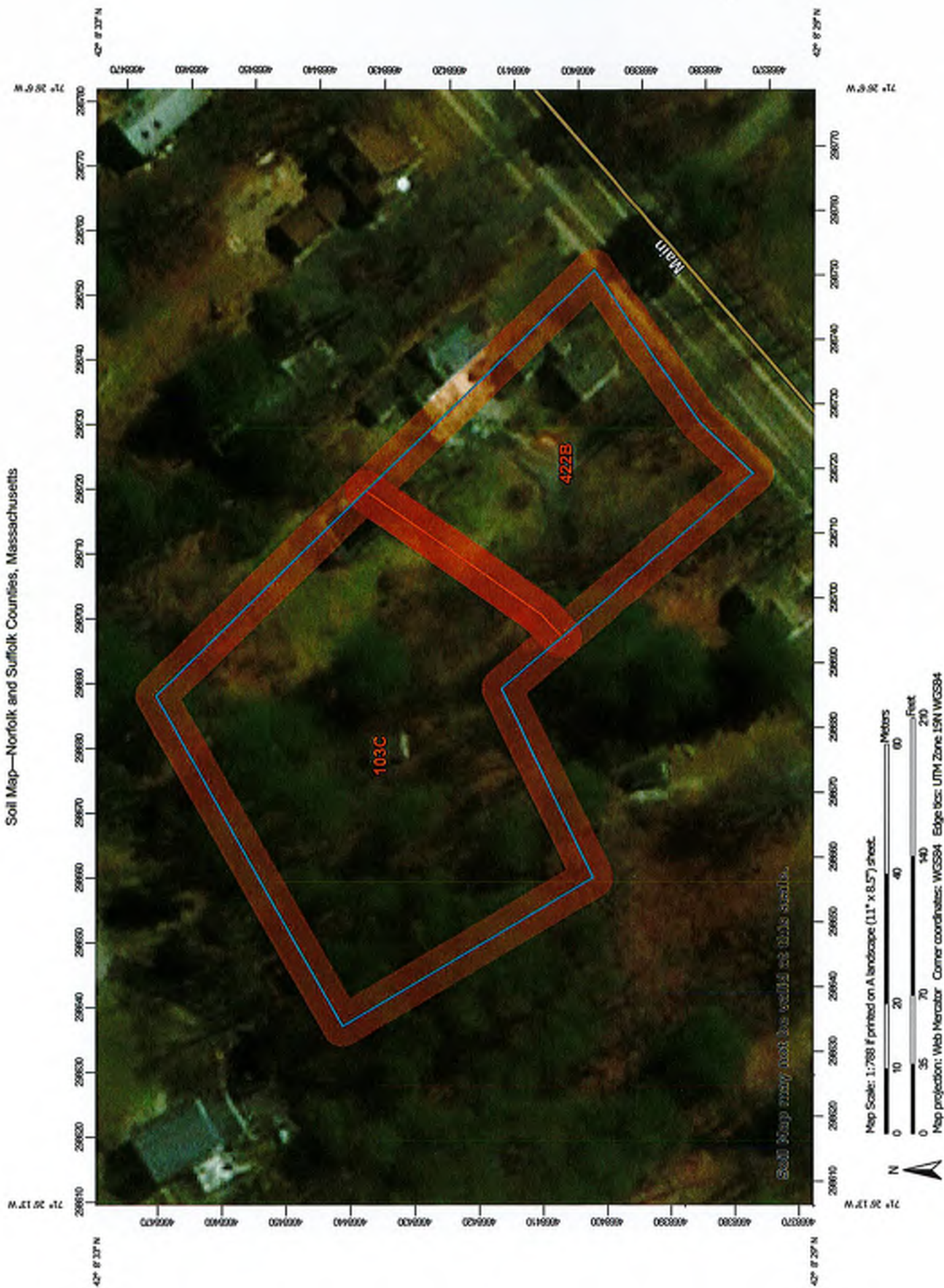
Conclusion:

The calculations performed for all design storm events indicate that neither peak flow rates nor volumes will exceed those of existing conditions with implementation of the stormwater management system as proposed for the 2, 10 and 100-year storm events.

An Operation and Maintenance Plan for stormwater systems is included herein.

With implementation of the stormwater management system as designed, full compliance with the MADEP Stormwater Management regulations as well as the Town of Medway Stormwater Management and Land Disturbance Bylaw.

SOILS INFORMATION



MAP LEGEND

	Area of Interest (AOI)
	Area of Interest (AOI)
	Soils
	Soils
	Soil Map Unit Polygons
	Soil Map Unit Lines
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points
	Soil Map Unit Points

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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

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

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Date: Version 14, Sep 12, 2018

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

Date(s) aerial images were photographed: May 14, 2010—Apr 1, 2017

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
103C	Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes	0.8	65.7%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	0.4	34.3%
Totals for Area of Interest		1.2	100.0%



April 27, 2020

Soil Testing Summary

**New Generation Homes Multifamily
Development
218-220 Main Street, Medway, MA**

The following test pits were evaluated on this date by Soil Evaluator Janice Weldon

TP-1

Surface elevation (existing)=228.5
0-10" Ap Sandy Loam
10"-24" Bw Fine Sandy Loam
24"-41" C1 Stony Fine Loamy Sand
41"-90"+ C2 Extremely Stony Loamy Sand
Roots to 36"
ESHW Elev. 226.0
Refusal at Elev. 221.0

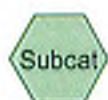
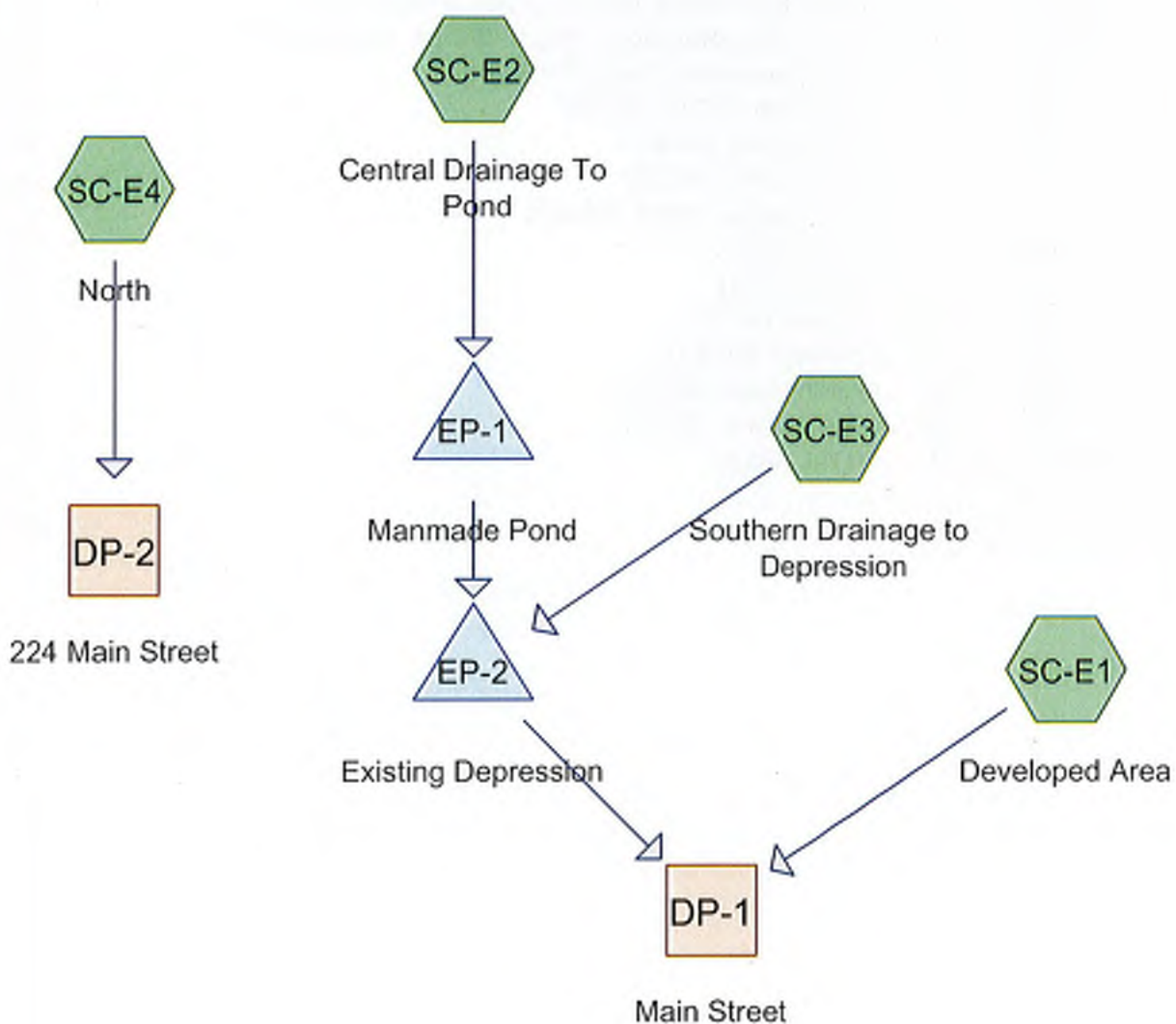
TP-2

Surface Elevation (existing) = 235.5
0-10" Ap, Fine Sandy Loam
10"-14" Bw1, Stony Fine Sandy Loam
14"-31" Bw2, Stony Fine Loamy Sand
31"-46" C1, Stony Fine Sand
46"-81" C2, Extremely Stony Sand
ESHW Elev. 232.7
Refusal at Elev. 228.75

TP-3

Surface elevation (existing) = 239.0
0-10" Ap, Fine Sandy Loam
10"-27" Fill (10"-48" on south pit face)
27"-57" Bw Stony Fine Sandy Loam
57"-93"+ C, Fine Loamy Sand
Cobbles beginning at 10"
Large rocks and boulders at 57"
Roots to 60"
ESHW Elev. 233.5
Refusal at Elev. 231.3

HYDROLOGICAL ANALYSIS



Routing Diagram for 8521_Existing_Inc Off Prop Flow
 Prepared by Meridian Associates, Inc., Printed 10/28/2020
 HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

8521_Existing_Inc Off Prop Flow

Prepared by Meridian Associates, Inc.

Printed 10/28/2020

HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

Page 2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
65,007	60	Woods, Fair, HSG B (SC-E1, SC-E2, SC-E3, SC-E4)
18,456	61	>75% Grass cover, Good, HSG B (SC-E1, SC-E3, SC-E4)
119	79	<50% Grass cover, Poor, HSG B (SC-E2)
366	82	Gravel path (SC-E1, SC-E4)
1,671	98	218 and patio (SC-E1)
1,126	98	220 and patio (SC-E1)
347	98	Paved parking, HSG B (SC-E2)
1,165	98	Pool (SC-E1)
196	98	Shed (SC-E4)
1,774	98	concrete (SC-E1)
1,499	98	pavement (SC-E1)
298	98	retaining walls (SC-E1)
27	98	stone walkway (SC-E1)
92,051	64	TOTAL AREA

8521_Existing_Inc Off Prop Flow

Prepared by Meridian Associates, Inc.

Printed 10/28/2020

HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

Page 3

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
83,929	HSG B	SC-E1, SC-E2, SC-E3, SC-E4
0	HSG C	
0	HSG D	
8,122	Other	SC-E1, SC-E4
92,051		TOTAL AREA

8521_Existing_Inc Off Prop Flow

Prepared by Meridian Associates, Inc.

Printed 10/28/2020

HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

Page 4

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
0	0	0	0	1,671	1,671	218 and patio
0	0	0	0	1,126	1,126	220 and patio
0	0	0	0	366	366	Gravel path
0	0	0	0	1,165	1,165	Pool
0	0	0	0	196	196	Shed
0	0	0	0	1,774	1,774	concrete
0	0	0	0	1,499	1,499	pavement
0	0	0	0	298	298	retaining walls
0	0	0	0	27	27	stone walkway
0	119	0	0	0	119	<50% Grass cover, Poor
0	18,456	0	0	0	18,456	>75% Grass cover, Good
0	347	0	0	0	347	Paved parking
0	65,007	0	0	0	65,007	Woods, Fair
0	83,929	0	0	8,122	92,051	TOTAL AREA

8521_Existing_Inc Off Prop Flow

Type III 24-hr 2-Year Design Storm Rainfall=3.37"

Prepared by Meridian Associates, Inc.

Printed 10/28/2020

HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

Page 5

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points

Runoff by SCS TR-20 method, UH=SCS

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

Subcatchment SC-E1: Developed Area Runoff Area=34,607 sf 21.85% Impervious Runoff Depth=0.88"
Flow Length=936' Tc=21.5 min CN=69 Runoff=0.47 cfs 2,529 cf

Subcatchment SC-E2: Central Drainage To Runoff Area=6,523 sf 5.32% Impervious Runoff Depth=0.56"
Flow Length=109' Tc=6.9 min CN=62 Runoff=0.07 cfs 302 cf

Subcatchment SC-E3: Southern Drainage to Runoff Area=3,338 sf 0.00% Impervious Runoff Depth=0.52"
Tc=6.0 min CN=61 Runoff=0.03 cfs 143 cf

Subcatchment SC-E4: North Runoff Area=47,583 sf 0.41% Impervious Runoff Depth=0.48"
Flow Length=932' Tc=29.6 min CN=60 Runoff=0.24 cfs 1,890 cf

Reach DP-1: Main Street Inflow=0.47 cfs 2,529 cf
Outflow=0.47 cfs 2,529 cf

Reach DP-2: 224 Main Street Inflow=0.24 cfs 1,890 cf
Outflow=0.24 cfs 1,890 cf

Pond EP-1: Manmade Pond Peak Elev=228.25' Storage=302 cf Inflow=0.07 cfs 302 cf
Outflow=0.00 cfs 0 cf

Pond EP-2: Existing Depression Peak Elev=227.02' Storage=14 cf Inflow=0.03 cfs 143 cf
Discarded=0.02 cfs 143 cf Primary=0.00 cfs 0 cf Outflow=0.02 cfs 143 cf

Total Runoff Area = 92,051 sf Runoff Volume = 4,865 cf Average Runoff Depth = 0.63"
91.20% Pervious = 83,948 sf 8.80% Impervious = 8,103 sf

Summary for Subcatchment SC-E1: Developed Area

Runoff = 0.47 cfs @ 12.34 hrs, Volume= 2,529 cf, Depth= 0.88"

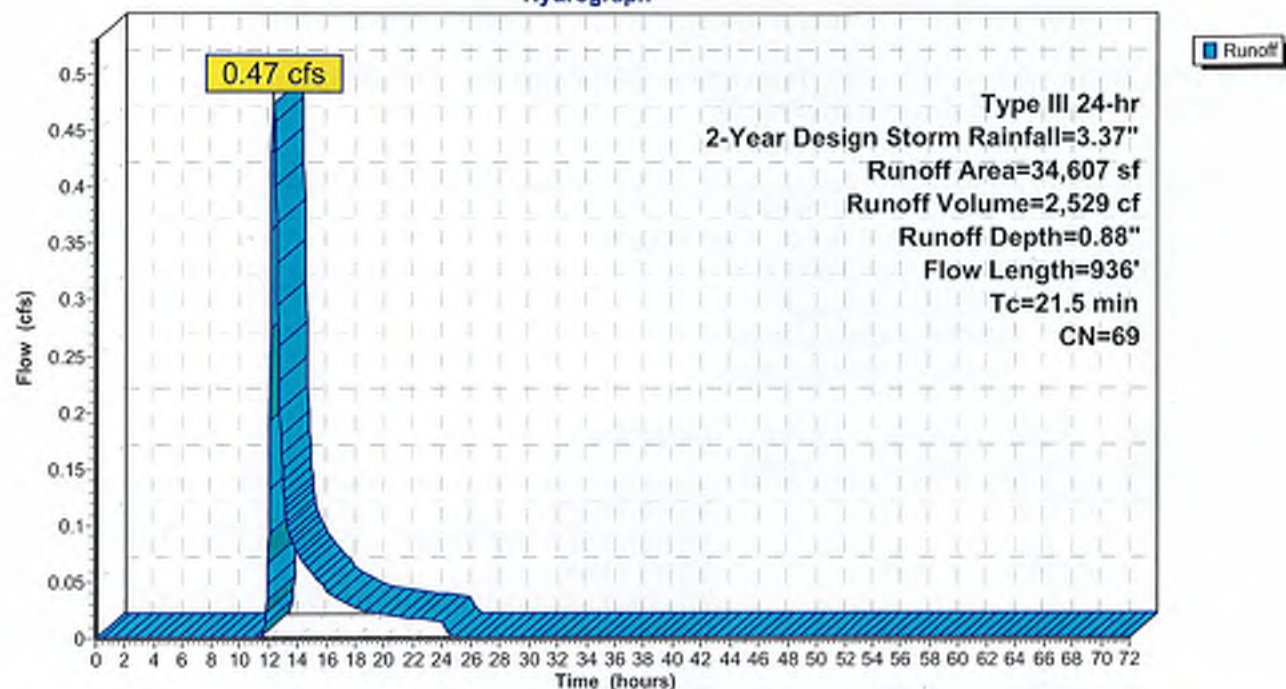
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Design Storm Rainfall=3.37"

	Area (sf)	CN	Description
*	1,165	98	Pool
*	1,671	98	218 and patio
*	1,126	98	220 and patio
*	1,774	98	concrete
*	27	98	stone walkway
*	298	98	retaining walls
*	1,499	98	pavement
	10,828	60	Woods, Fair, HSG B
*	197	82	Gravel path
	16,022	61	>75% Grass cover, Good, HSG B
	34,607	69	Weighted Average
	27,047		78.15% Pervious Area
	7,560		21.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	50	0.0460	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
9.6	625	0.0470	1.08		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.8	31	0.0150	0.61		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.1	66	0.0200	0.99		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.0	10	0.3100	3.90		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.6	59	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.4	95	0.0400	4.06		Shallow Concentrated Flow, Paved Kv= 20.3 fps
21.5	936	Total			

Subcatchment SC-E1: Developed Area

Hydrograph



Summary for Subcatchment SC-E2: Central Drainage To Pond

Runoff = 0.07 cfs @ 12.13 hrs, Volume= 302 cf, Depth= 0.56"

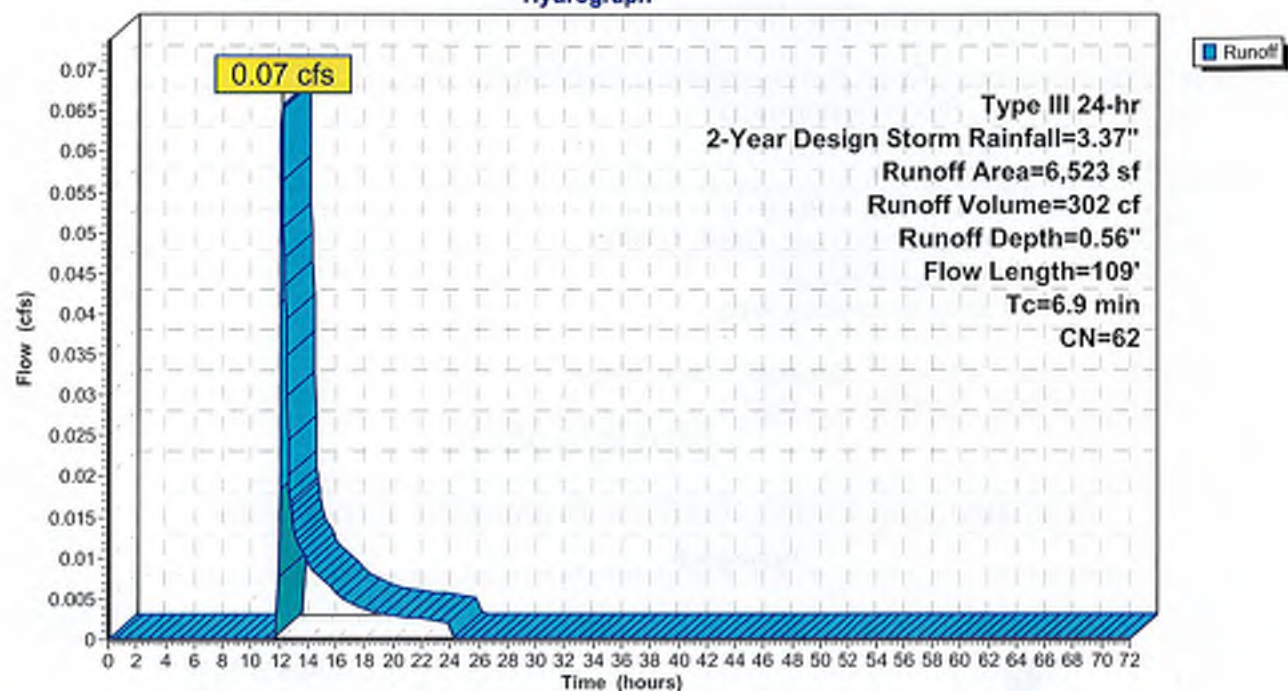
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Design Storm Rainfall=3.37"

Area (sf)	CN	Description
347	98	Paved parking, HSG B
119	79	<50% Grass cover, Poor, HSG B
6,057	60	Woods, Fair, HSG B
6,523	62	Weighted Average
6,176		94.68% Pervious Area
347		5.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	20	0.0900	0.10		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
1.7	9	0.1000	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	4	0.1400	0.19		Sheet Flow, Grass: Short n= 0.150 P2= 3.10"
1.0	9	0.0500	0.15		Sheet Flow, Grass: Short n= 0.150 P2= 3.10"
0.1	7	0.0540	1.18		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.10"
0.0	12	0.0700	5.37		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.0	3	0.0800	1.98		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.5	45	0.0800	1.41		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
6.9	109	Total			

Subcatchment SC-E2: Central Drainage To Pond

Hydrograph



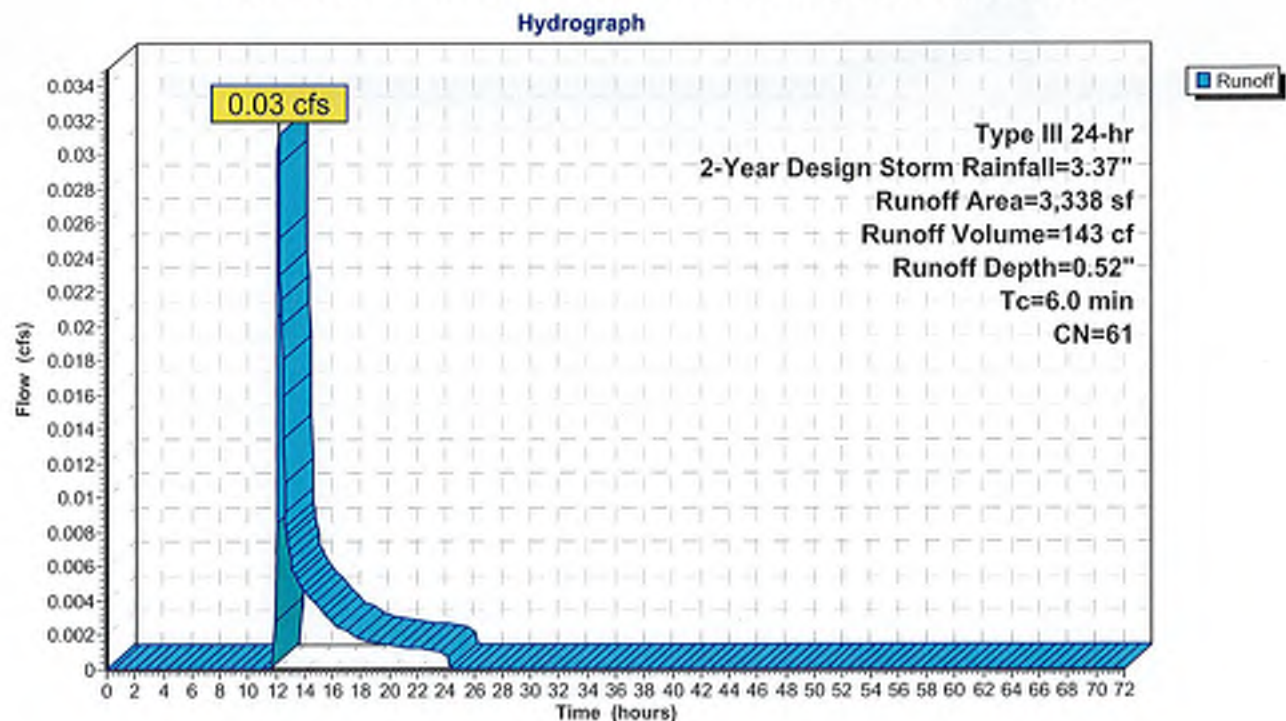
Summary for Subcatchment SC-E3: Southern Drainage to Depression

Runoff = 0.03 cfs @ 12.12 hrs, Volume= 143 cf, Depth= 0.52"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Design Storm Rainfall=3.37"

Area (sf)	CN	Description
1,000	60	Woods, Fair, HSG B
2,338	61	>75% Grass cover, Good, HSG B
3,338	61	Weighted Average
3,338		100.00% Pervious Area

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

Subcatchment SC-E3: Southern Drainage to Depression

Summary for Subcatchment SC-E4: North

Runoff = 0.24 cfs @ 12.55 hrs, Volume= 1,890 cf, Depth= 0.48"

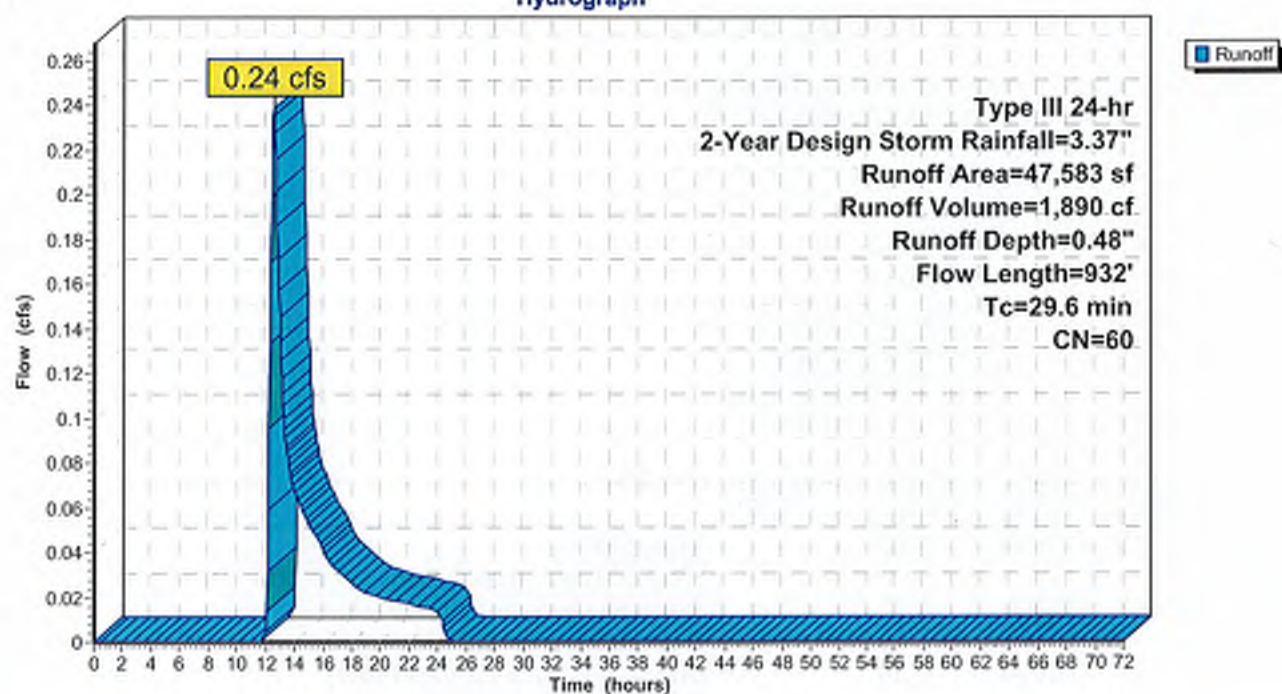
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Design Storm Rainfall=3.37"

	Area (sf)	CN	Description
*	196	98	Shed
	96	61	>75% Grass cover, Good, HSG B
*	169	82	Gravel path
	47,122	60	Woods, Fair, HSG B
	47,583	60	Weighted Average
	47,387		99.59% Pervious Area
	196		0.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
10.2	687	0.0500	1.12		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.5	22	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.0	53	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.4	61	0.3200	2.83		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.0	59	0.0400	1.00		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
29.6	932	Total			

Subcatchment SC-E4: North

Hydrograph



Summary for Reach DP-1: Main Street

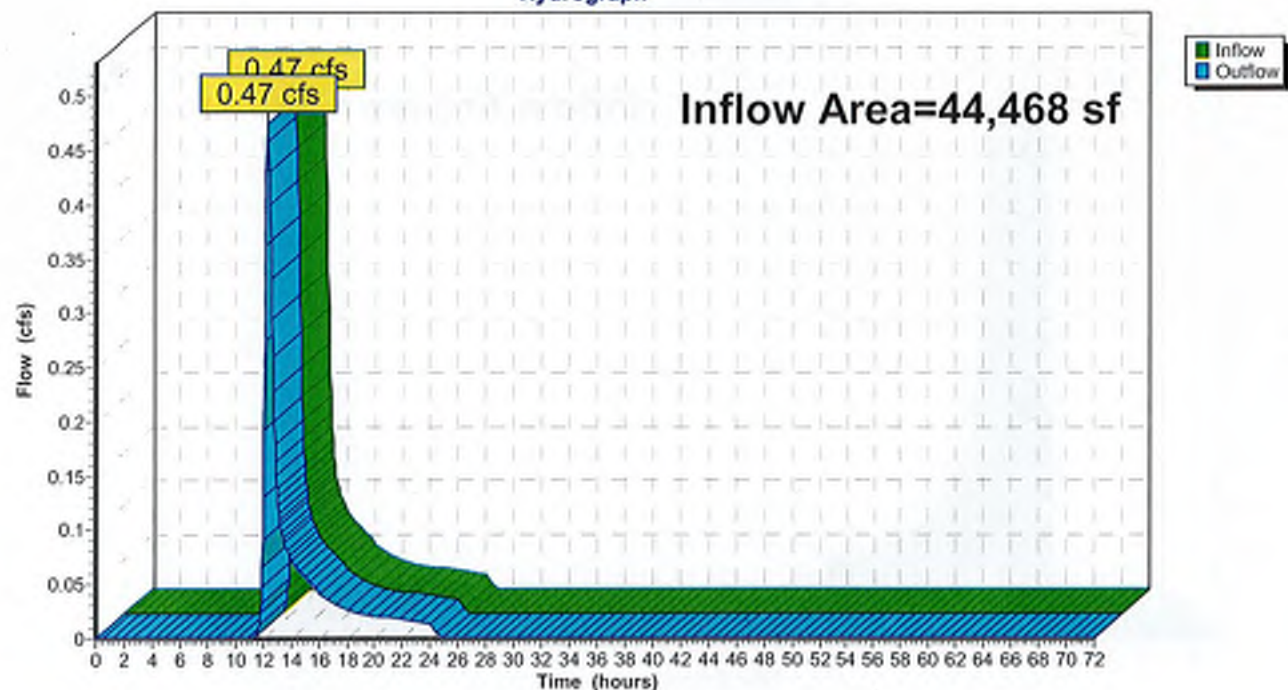
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 44,468 sf, 17.78% Impervious, Inflow Depth = 0.68" for 2-Year Design Storm event
Inflow = 0.47 cfs @ 12.34 hrs, Volume= 2,529 cf
Outflow = 0.47 cfs @ 12.34 hrs, Volume= 2,529 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-1: Main Street

Hydrograph



Summary for Reach DP-2: 224 Main Street

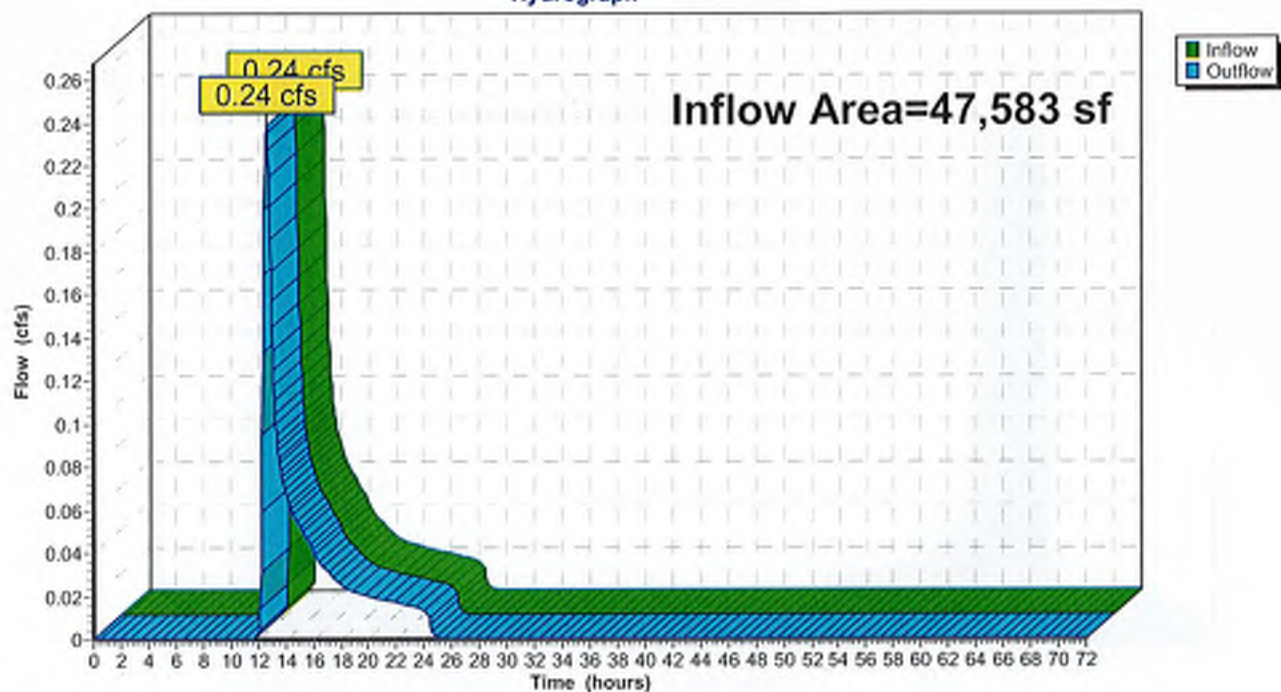
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 47,583 sf, 0.41% Impervious, Inflow Depth = 0.48" for 2-Year Design Storm event
Inflow = 0.24 cfs @ 12.55 hrs, Volume= 1,890 cf
Outflow = 0.24 cfs @ 12.55 hrs, Volume= 1,890 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-2: 224 Main Street

Hydrograph



Summary for Pond EP-1: Manmade Pond

Inflow Area = 6,523 sf, 5.32% Impervious, Inflow Depth = 0.56" for 2-Year Design Storm event
 Inflow = 0.07 cfs @ 12.13 hrs, Volume= 302 cf
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2

Starting Elev= 127.00' Surf.Area= 0 sf Storage= 0 cf

Peak Elev= 228.25' @ 24.45 hrs Surf.Area= 290 sf Storage= 302 cf

Flood Elev= 228.50' Surf.Area= 311 sf Storage= 379 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)

Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	227.00'	379 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
227.00	198	50.1	0	0	198
228.50	311	62.7	379	379	339

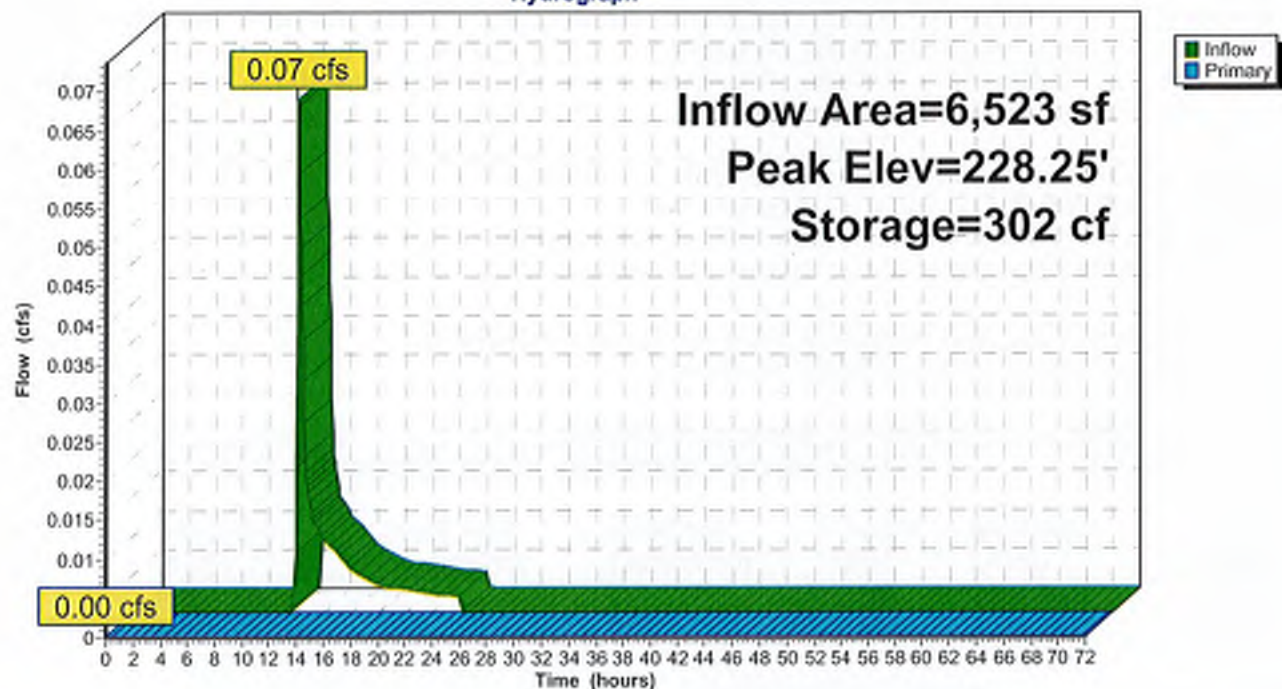
Device	Routing	Invert	Outlet Devices
#1	Primary	228.49'	2.7' long x 18.8' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=227.00' (Free Discharge)

↑1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond EP-1: Manmade Pond

Hydrograph



Summary for Pond EP-2: Existing Depression

[58] Hint: Peaked 99.02' above defined flood level

Inflow Area = 9,861 sf, 3.52% Impervious, Inflow Depth = 0.17" for 2-Year Design Storm event
 Inflow = 0.03 cfs @ 12.12 hrs, Volume= 143 cf
 Outflow = 0.02 cfs @ 12.45 hrs, Volume= 143 cf, Atten= 49%, Lag= 19.5 min
 Discarded = 0.02 cfs @ 12.45 hrs, Volume= 143 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Peak Elev= 227.02' @ 12.45 hrs Surf.Area= 681 sf Storage= 14 cf

Flood Elev= 128.00' Surf.Area= 0 sf Storage= 0 cf

Plug-Flow detention time= 8.4 min calculated for 143 cf (100% of inflow)

Center-of-Mass det. time= 8.4 min (916.8 - 908.4)

Volume	Invert	Avail.Storage	Storage Description
#1	227.00'	1,285 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
227.00	659	112.5	0	0	659
228.00	2,038	207.9	1,285	1,285	3,097

Device	Routing	Invert	Outlet Devices
#1	Primary	227.90'	83.7' long x 2.7' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.46 2.59 2.63 2.63 2.64 2.65 2.66 2.72 2.72 2.74 2.86 3.00 3.10 3.22 3.32
#2	Discarded	227.00'	1.020 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'

Discarded OutFlow Max=0.02 cfs @ 12.45 hrs HW=227.02' (Free Discharge)

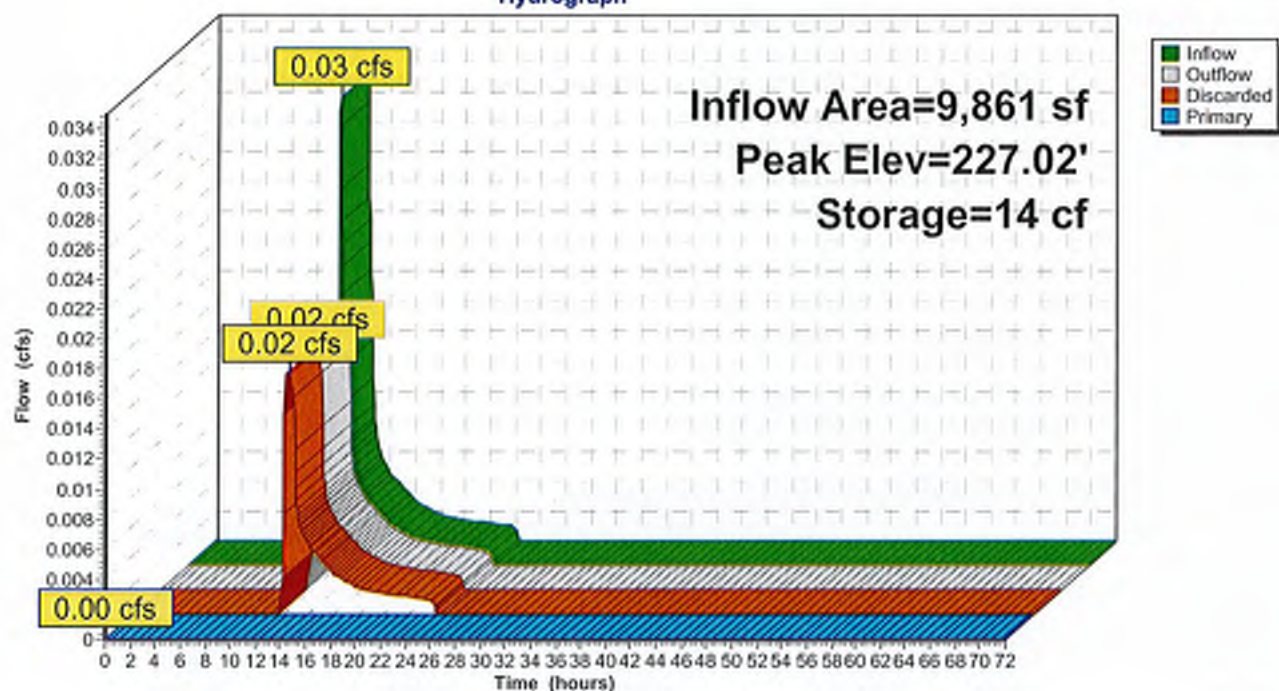
↑2=Exfiltration (Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=227.00' (Free Discharge)

↑1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond EP-2: Existing Depression

Hydrograph



8521_Existing_Inc Off Prop Flow

Type III 24-hr 10-Year Design Storm Rainfall=5.26"

Prepared by Meridian Associates, Inc.

Printed 10/28/2020

HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

Page 19

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points

Runoff by SCS TR-20 method, UH=SCS

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

Subcatchment SC-E1: Developed AreaRunoff Area=34,607 sf 21.85% Impervious Runoff Depth=2.15"
Flow Length=936' Tc=21.5 min CN=69 Runoff=1.28 cfs 6,196 cf**Subcatchment SC-E2: Central Drainage To**Runoff Area=6,523 sf 5.32% Impervious Runoff Depth=1.60"
Flow Length=109' Tc=6.9 min CN=62 Runoff=0.25 cfs 870 cf**Subcatchment SC-E3: Southern Drainage to**Runoff Area=3,338 sf 0.00% Impervious Runoff Depth=1.53"
Tc=6.0 min CN=61 Runoff=0.12 cfs 425 cf**Subcatchment SC-E4: North**Runoff Area=47,583 sf 0.41% Impervious Runoff Depth=1.46"
Flow Length=932' Tc=29.6 min CN=60 Runoff=0.97 cfs 5,771 cf**Reach DP-1: Main Street**Inflow=1.28 cfs 6,196 cf
Outflow=1.28 cfs 6,196 cf**Reach DP-2: 224 Main Street**Inflow=0.97 cfs 5,771 cf
Outflow=0.97 cfs 5,771 cf**Pond EP-1: Manmade Pond**Peak Elev=228.54' Storage=379 cf Inflow=0.25 cfs 870 cf
Outflow=0.08 cfs 695 cf**Pond EP-2: Existing Depression**Peak Elev=227.45' Storage=413 cf Inflow=0.12 cfs 1,120 cf
Discarded=0.03 cfs 1,120 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 1,120 cf**Total Runoff Area = 92,051 sf Runoff Volume = 13,263 cf Average Runoff Depth = 1.73"**
91.20% Pervious = 83,948 sf 8.80% Impervious = 8,103 sf

Summary for Subcatchment SC-E1: Developed Area

Runoff = 1.28 cfs @ 12.31 hrs, Volume= 6,196 cf, Depth= 2.15"

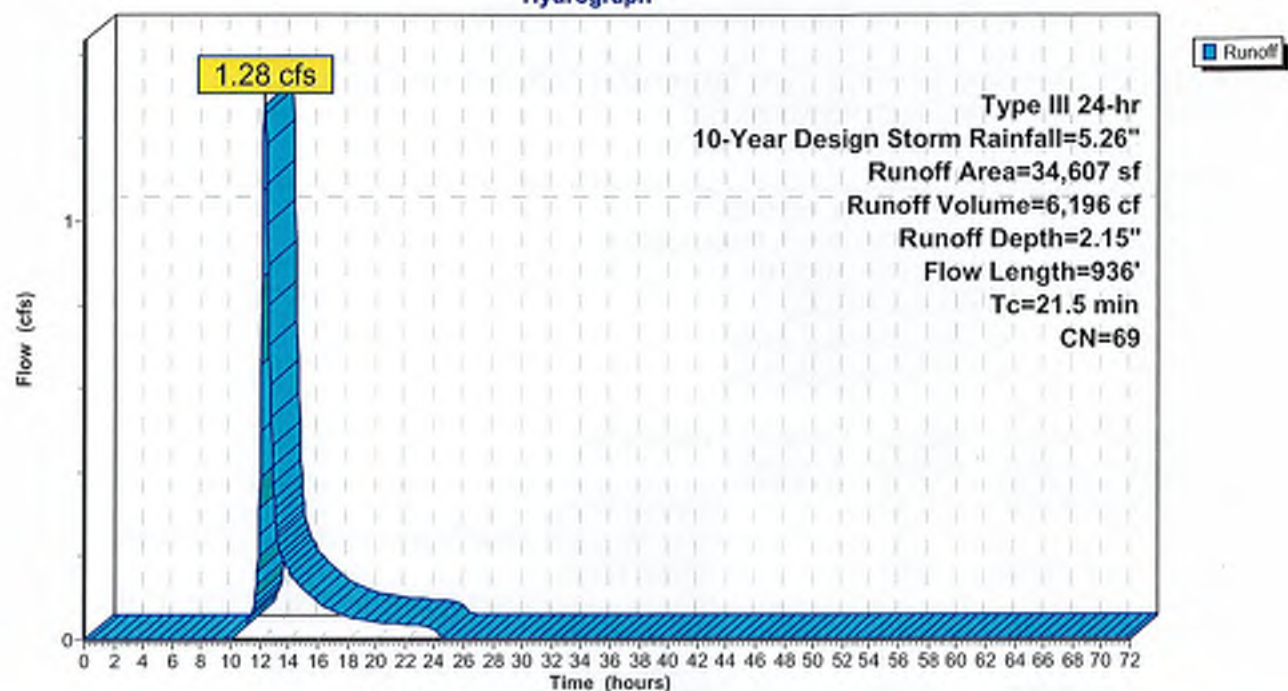
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Design Storm Rainfall=5.26"

	Area (sf)	CN	Description
*	1,165	98	Pool
*	1,671	98	218 and patio
*	1,126	98	220 and patio
*	1,774	98	concrete
*	27	98	stone walkway
*	298	98	retaining walls
*	1,499	98	pavement
	10,828	60	Woods, Fair, HSG B
*	197	82	Gravel path
	16,022	61	>75% Grass cover, Good, HSG B
	34,607	69	Weighted Average
	27,047		78.15% Pervious Area
	7,560		21.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	50	0.0460	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
9.6	625	0.0470	1.08		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.8	31	0.0150	0.61		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.1	66	0.0200	0.99		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.0	10	0.3100	3.90		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.6	59	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.4	95	0.0400	4.06		Shallow Concentrated Flow, Paved Kv= 20.3 fps
21.5	936	Total			

Subcatchment SC-E1: Developed Area

Hydrograph



Summary for Subcatchment SC-E2: Central Drainage To Pond

Runoff = 0.25 cfs @ 12.11 hrs, Volume= 870 cf, Depth= 1.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

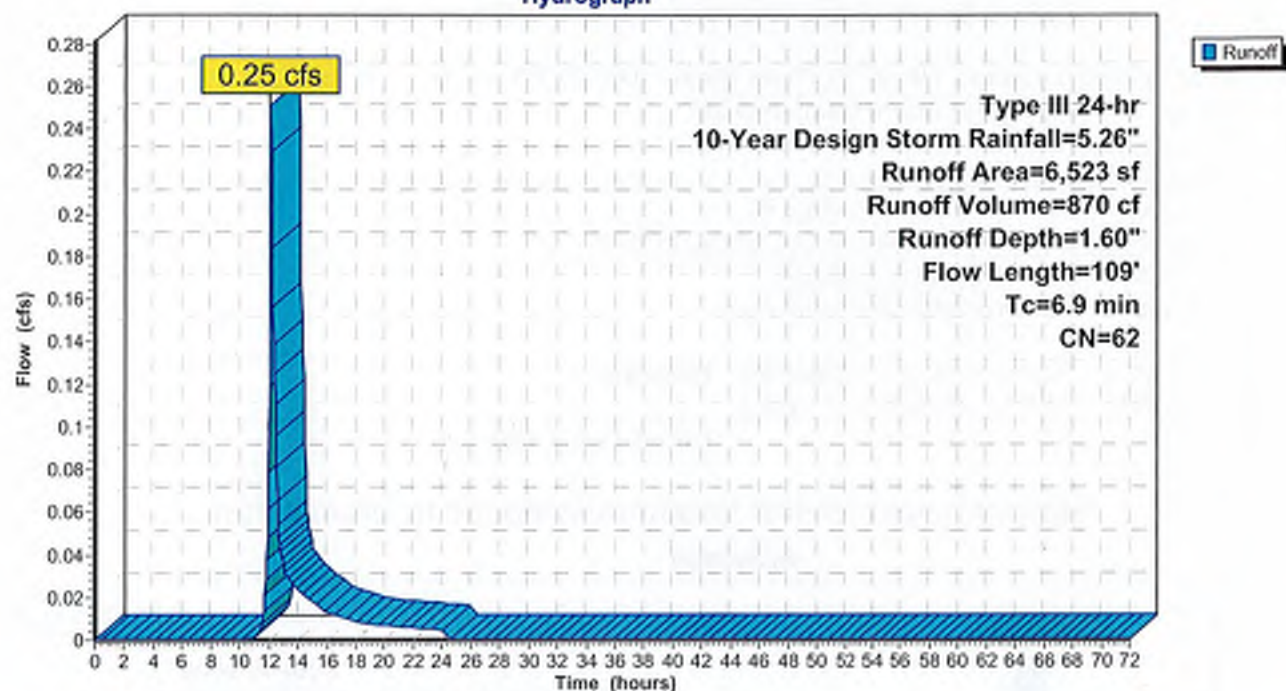
Type III 24-hr 10-Year Design Storm Rainfall=5.26"

Area (sf)	CN	Description
347	98	Paved parking, HSG B
119	79	<50% Grass cover, Poor, HSG B
6,057	60	Woods, Fair, HSG B
6,523	62	Weighted Average
6,176		94.68% Pervious Area
347		5.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	20	0.0900	0.10		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
1.7	9	0.1000	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	4	0.1400	0.19		Sheet Flow, Grass: Short n= 0.150 P2= 3.10"
1.0	9	0.0500	0.15		Sheet Flow, Grass: Short n= 0.150 P2= 3.10"
0.1	7	0.0540	1.18		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.10"
0.0	12	0.0700	5.37		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.0	3	0.0800	1.98		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.5	45	0.0800	1.41		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
6.9	109	Total			

Subcatchment SC-E2: Central Drainage To Pond

Hydrograph



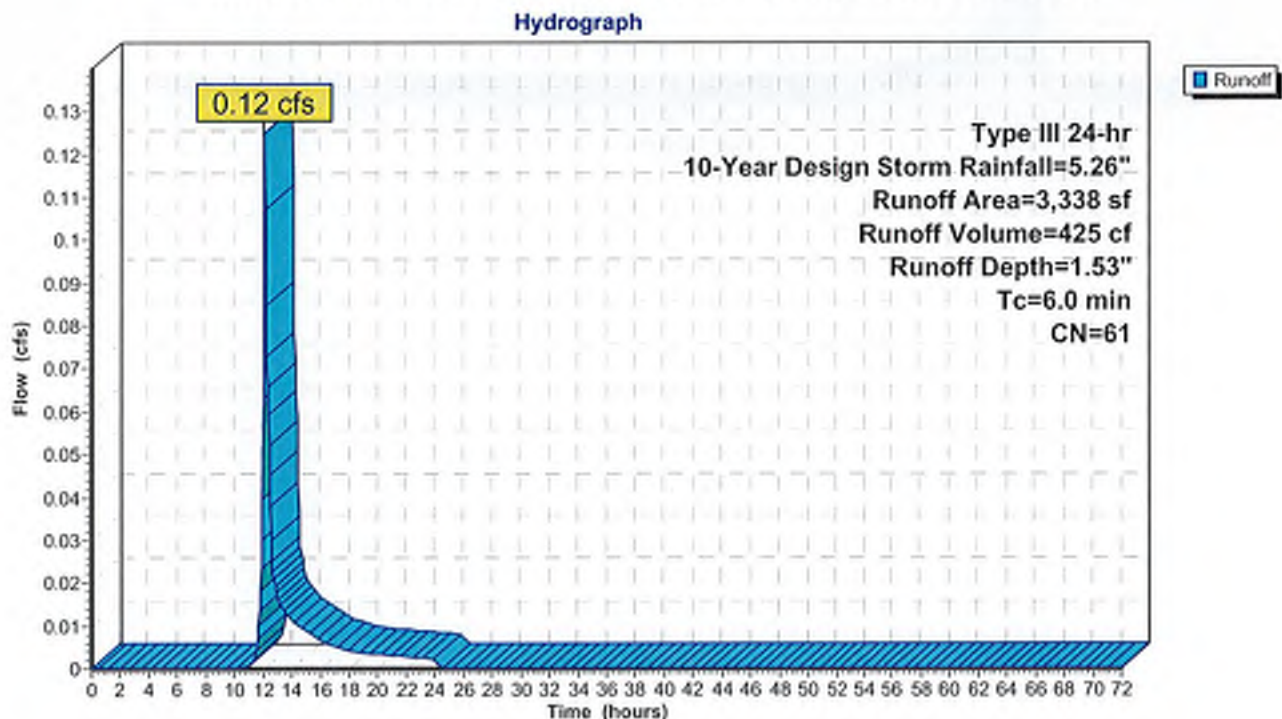
Summary for Subcatchment SC-E3: Southern Drainage to Depression

Runoff = 0.12 cfs @ 12.10 hrs, Volume= 425 cf, Depth= 1.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-Year Design Storm Rainfall=5.26"

Area (sf)	CN	Description
1,000	60	Woods, Fair, HSG B
2,338	61	>75% Grass cover, Good, HSG B
3,338	61	Weighted Average
3,338		100.00% Pervious Area

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

Subcatchment SC-E3: Southern Drainage to Depression

Summary for Subcatchment SC-E4: North

Runoff = 0.97 cfs @ 12.46 hrs, Volume= 5,771 cf, Depth= 1.46"

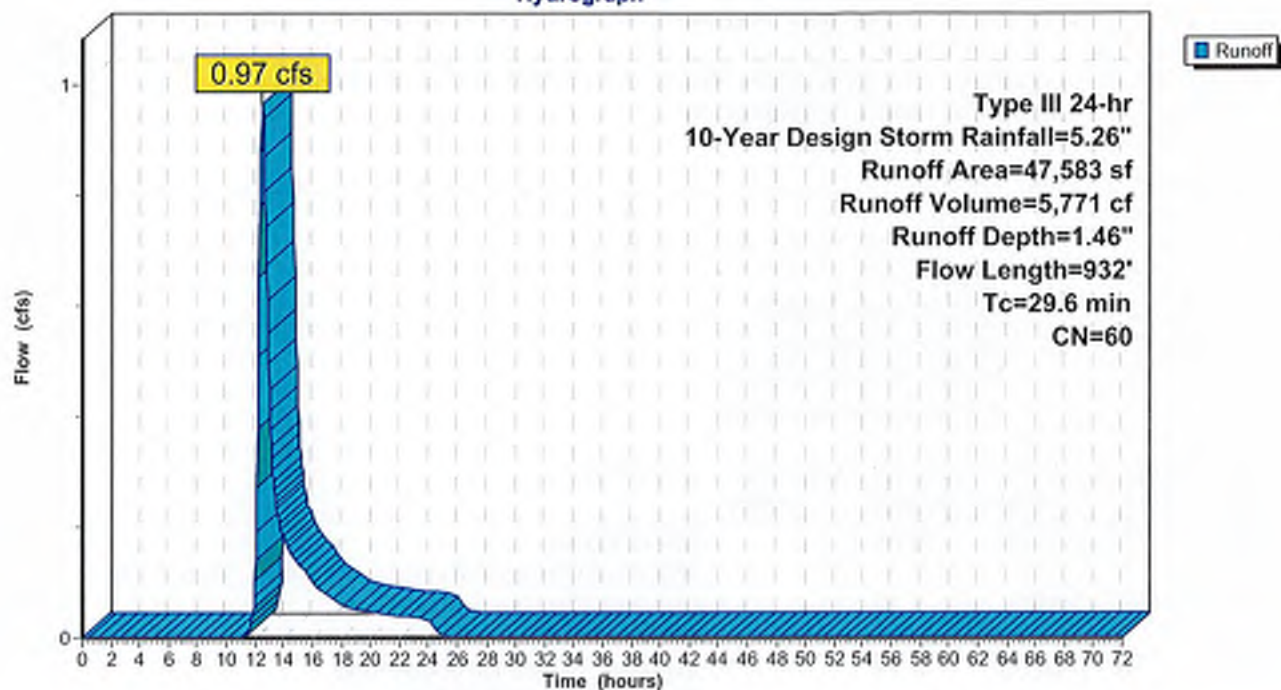
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Design Storm Rainfall=5.26"

Area (sf)	CN	Description
* 196	98	Shed
96	61	>75% Grass cover, Good, HSG B
* 169	82	Gravel path
47,122	60	Woods, Fair, HSG B
47,583	60	Weighted Average
47,387		99.59% Pervious Area
196		0.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
10.2	687	0.0500	1.12		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.5	22	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.0	53	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.4	61	0.3200	2.83		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.0	59	0.0400	1.00		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
29.6	932	Total			

Subcatchment SC-E4: North

Hydrograph



Summary for Reach DP-1: Main Street

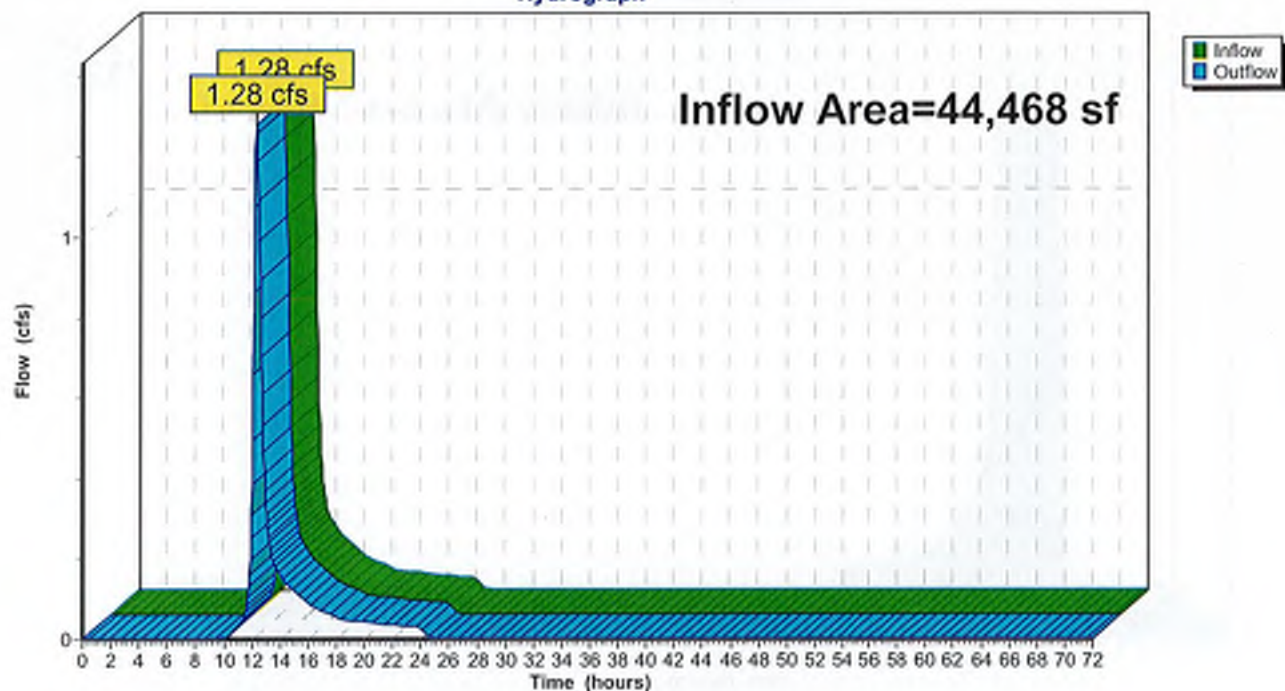
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 44,468 sf, 17.78% Impervious, Inflow Depth = 1.67" for 10-Year Design Storm event
Inflow = 1.28 cfs @ 12.31 hrs, Volume= 6,196 cf
Outflow = 1.28 cfs @ 12.31 hrs, Volume= 6,196 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-1: Main Street

Hydrograph

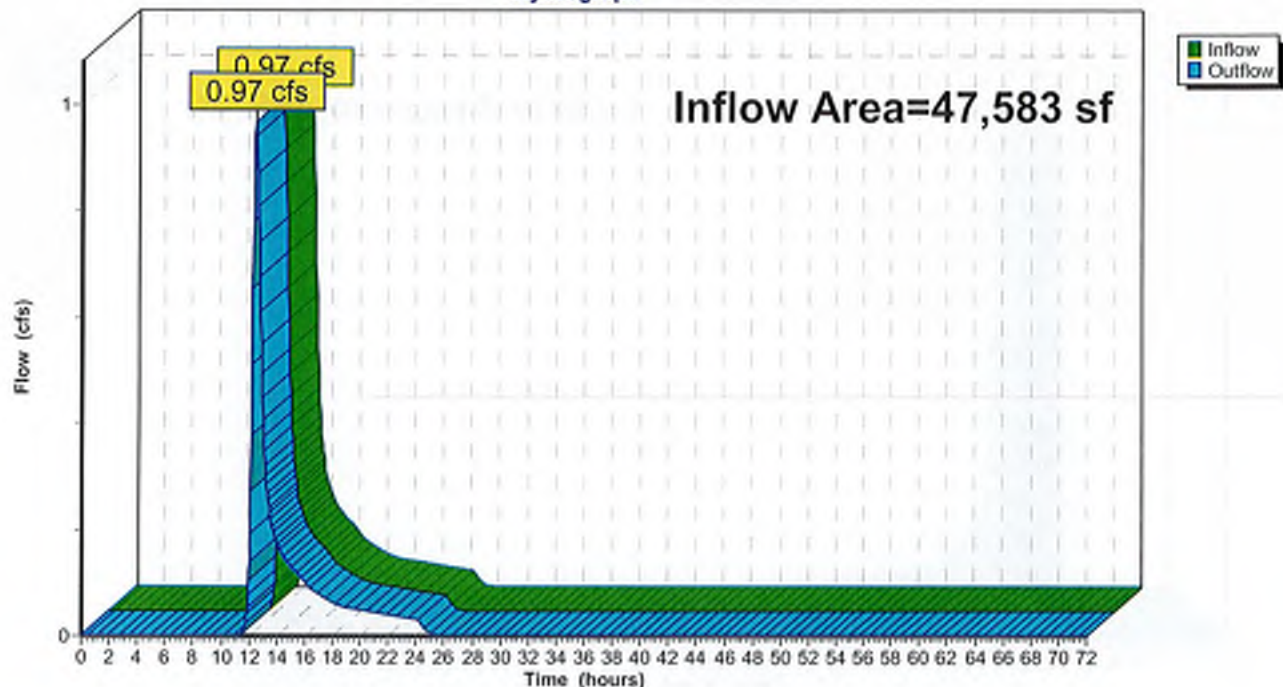


Summary for Reach DP-2: 224 Main Street

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

Inflow Area = 47,583 sf, 0.41% Impervious, Inflow Depth = 1.46" for 10-Year Design Storm event
Inflow = 0.97 cfs @ 12.46 hrs, Volume= 5,771 cf
Outflow = 0.97 cfs @ 12.46 hrs, Volume= 5,771 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-2: 224 Main Street**Hydrograph**

Summary for Pond EP-1: Manmade Pond

[93] Warning: Storage range exceeded by 0.04'

[58] Hint: Peaked 0.04' above defined flood level

Inflow Area = 6,523 sf, 5.32% Impervious, Inflow Depth = 1.60" for 10-Year Design Storm event
 Inflow = 0.25 cfs @ 12.11 hrs, Volume= 870 cf
 Outflow = 0.08 cfs @ 12.62 hrs, Volume= 695 cf, Atten= 67%, Lag= 30.6 min
 Primary = 0.08 cfs @ 12.62 hrs, Volume= 695 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2

Starting Elev= 127.00' Surf.Area= 0 sf Storage= 0 cf

Peak Elev= 228.54' @ 12.60 hrs Surf.Area= 311 sf Storage= 379 cf

Flood Elev= 228.50' Surf.Area= 311 sf Storage= 379 cf

Plug-Flow detention time= 156.9 min calculated for 695 cf (80% of inflow)

Center-of-Mass det. time= 73.8 min (940.5 - 866.8)

Volume	Invert	Avail.Storage	Storage Description
#1	227.00'	379 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
227.00	198	50.1	0	0	198
228.50	311	62.7	379	379	339

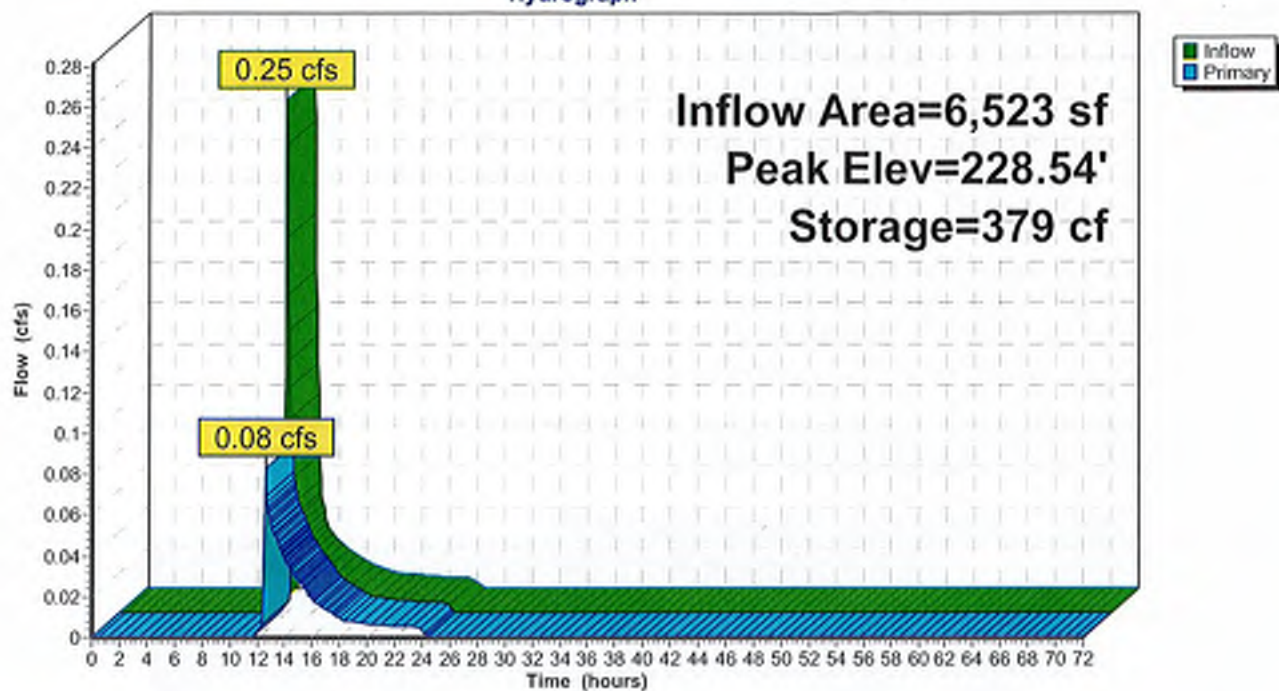
Device	Routing	Invert	Outlet Devices
#1	Primary	228.49'	2.7' long x 18.8' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.07 cfs @ 12.62 hrs HW=228.54' (Free Discharge)

↑1=Broad-Crested Rectangular Weir (Weir Controls 0.07 cfs @ 0.58 fps)

Pond EP-1: Manmade Pond

Hydrograph



Summary for Pond EP-2: Existing Depression

[58] Hint: Peaked 99.45' above defined flood level

Inflow Area = 9,861 sf, 3.52% Impervious, Inflow Depth = 1.36" for 10-Year Design Storm event
 Inflow = 0.12 cfs @ 12.10 hrs, Volume= 1,120 cf
 Outflow = 0.03 cfs @ 15.71 hrs, Volume= 1,120 cf, Atten= 77%, Lag= 216.5 min
 Discarded = 0.03 cfs @ 15.71 hrs, Volume= 1,120 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Peak Elev= 227.45' @ 15.71 hrs Surf.Area= 1,190 sf Storage= 413 cf
 Flood Elev= 128.00' Surf.Area= 0 sf Storage= 0 cf

Plug-Flow detention time= 172.5 min calculated for 1,119 cf (100% of inflow)
 Center-of-Mass det. time= 172.4 min (1,085.7 - 913.3)

Volume	Invert	Avail. Storage	Storage Description
#1	227.00'	1,285 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
227.00	659	112.5	0	0	659
228.00	2,038	207.9	1,285	1,285	3,097

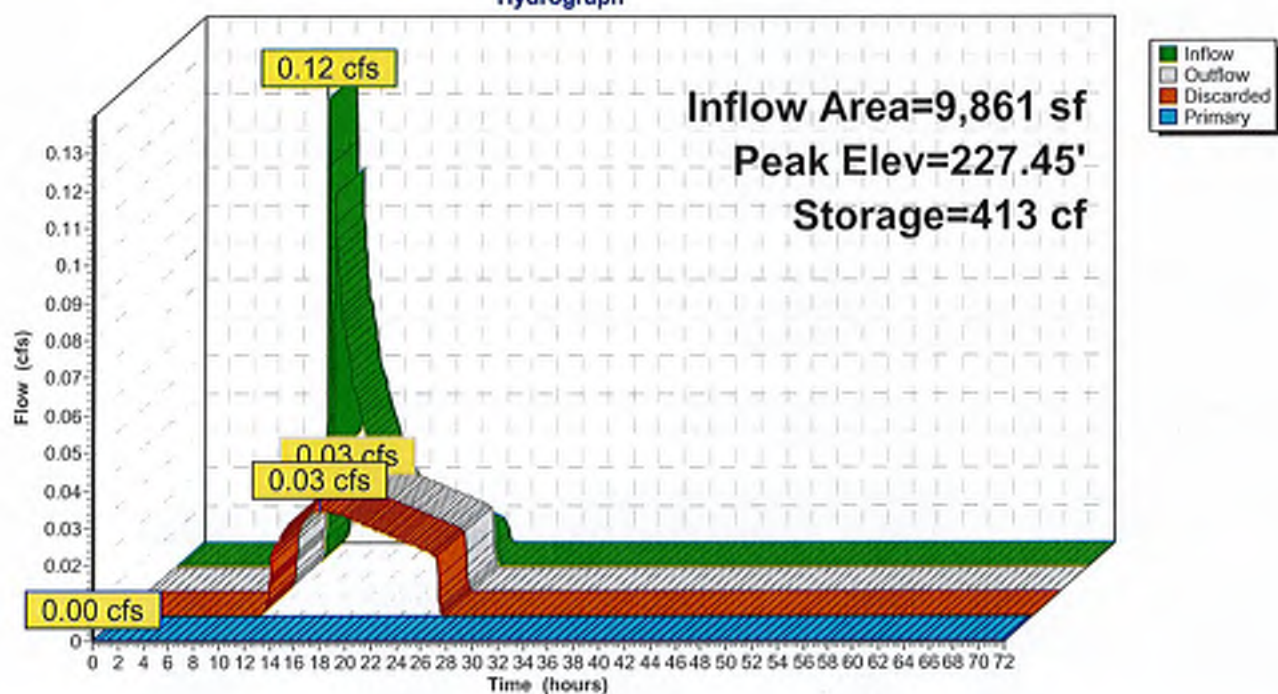
Device	Routing	Invert	Outlet Devices
#1	Primary	227.90'	83.7' long x 2.7' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.46 2.59 2.63 2.63 2.64 2.65 2.66 2.72 2.72 2.74 2.86 3.00 3.10 3.22 3.32
#2	Discarded	227.00'	1.020 In/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'

Discarded OutFlow Max=0.03 cfs @ 15.71 hrs HW=227.45' (Free Discharge)
 ↑ **2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=227.00' (Free Discharge)
 ↑ **1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond EP-2: Existing Depression

Hydrograph



8521_Existing_Inc Off Prop Flow

Type III 24-hr 100-Year Design Storm Rainfall=8.26"

Prepared by Meridian Associates, Inc.

Printed 10/28/2020

HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

Page 33

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points

Runoff by SCS TR-20 method, UH=SCS

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

Subcatchment SC-E1: Developed Area Runoff Area=34,607 sf 21.85% Impervious Runoff Depth=4.57"
Flow Length=936' Tc=21.5 min CN=69 Runoff=2.78 cfs 13,184 cf

Subcatchment SC-E2: Central Drainage To Runoff Area=6,523 sf 5.32% Impervious Runoff Depth=3.76"
Flow Length=109' Tc=6.9 min CN=62 Runoff=0.63 cfs 2,043 cf

Subcatchment SC-E3: Southern Drainage to Runoff Area=3,338 sf 0.00% Impervious Runoff Depth=3.64"
Tc=6.0 min CN=61 Runoff=0.32 cfs 1,014 cf

Subcatchment SC-E4: North Runoff Area=47,583 sf 0.41% Impervious Runoff Depth=3.53"
Flow Length=932' Tc=29.6 min CN=60 Runoff=2.53 cfs 13,996 cf

Reach DP-1: Main Street Inflow=2.78 cfs 13,201 cf
Outflow=2.78 cfs 13,201 cf

Reach DP-2: 224 Main Street Inflow=2.53 cfs 13,996 cf
Outflow=2.53 cfs 13,996 cf

Pond EP-1: Manmade Pond Peak Elev=228.68' Storage=379 cf Inflow=0.63 cfs 2,043 cf
Outflow=0.59 cfs 1,048 cf

Pond EP-2: Existing Depression Peak Elev=227.90' Storage=1,092 cf Inflow=0.91 cfs 2,062 cf
Discarded=0.04 cfs 2,045 cf Primary=0.02 cfs 17 cf Outflow=0.06 cfs 2,062 cf

Total Runoff Area = 92,051 sf Runoff Volume = 30,236 cf Average Runoff Depth = 3.94"
91.20% Pervious = 83,948 sf 8.80% Impervious = 8,103 sf

Summary for Subcatchment SC-E1: Developed Area

Runoff = 2.78 cfs @ 12.30 hrs, Volume= 13,184 cf, Depth= 4.57"

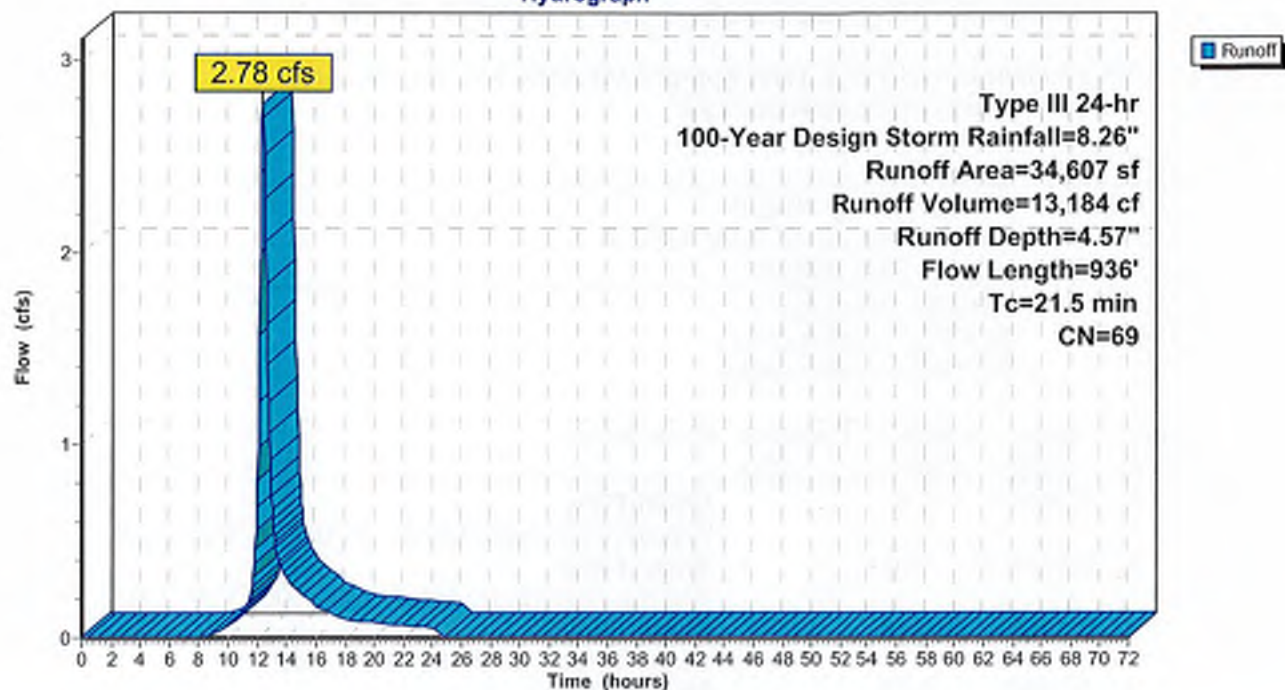
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Design Storm Rainfall=8.26"

	Area (sf)	CN	Description
*	1,165	98	Pool
*	1,671	98	218 and patio
*	1,126	98	220 and patio
*	1,774	98	concrete
*	27	98	stone walkway
*	298	98	retaining walls
*	1,499	98	pavement
	10,828	60	Woods, Fair, HSG B
*	197	82	Gravel path
	16,022	61	>75% Grass cover, Good, HSG B
	34,607	69	Weighted Average
	27,047		78.15% Pervious Area
	7,560		21.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	50	0.0460	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
9.6	625	0.0470	1.08		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.8	31	0.0150	0.61		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.1	66	0.0200	0.99		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.0	10	0.3100	3.90		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.6	59	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.4	95	0.0400	4.06		Shallow Concentrated Flow, Paved Kv= 20.3 fps
21.5	936	Total			

Subcatchment SC-E1: Developed Area

Hydrograph



Summary for Subcatchment SC-E2: Central Drainage To Pond

Runoff = 0.63 cfs @ 12.11 hrs, Volume= 2,043 cf, Depth= 3.76"

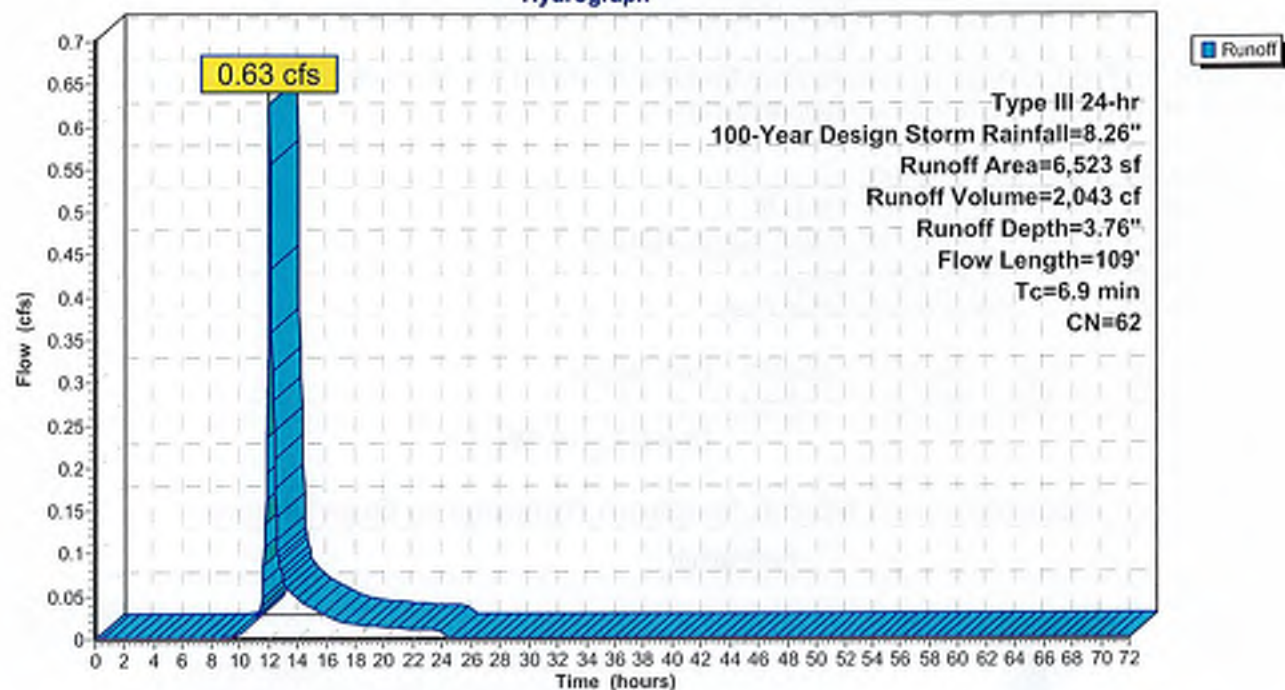
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Design Storm Rainfall=8.26"

Area (sf)	CN	Description
347	98	Paved parking, HSG B
119	79	<50% Grass cover, Poor, HSG B
6,057	60	Woods, Fair, HSG B
6,523	62	Weighted Average
6,176		94.68% Pervious Area
347		5.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	20	0.0900	0.10		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
1.7	9	0.1000	0.09		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	4	0.1400	0.19		Sheet Flow, Grass: Short n= 0.150 P2= 3.10"
1.0	9	0.0500	0.15		Sheet Flow, Grass: Short n= 0.150 P2= 3.10"
0.1	7	0.0540	1.18		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.10"
0.0	12	0.0700	5.37		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.0	3	0.0800	1.98		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.5	45	0.0800	1.41		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
6.9	109	Total			

Subcatchment SC-E2: Central Drainage To Pond

Hydrograph



Summary for Subcatchment SC-E3: Southern Drainage to Depression

Runoff = 0.32 cfs @ 12.10 hrs, Volume= 1,014 cf, Depth= 3.64"

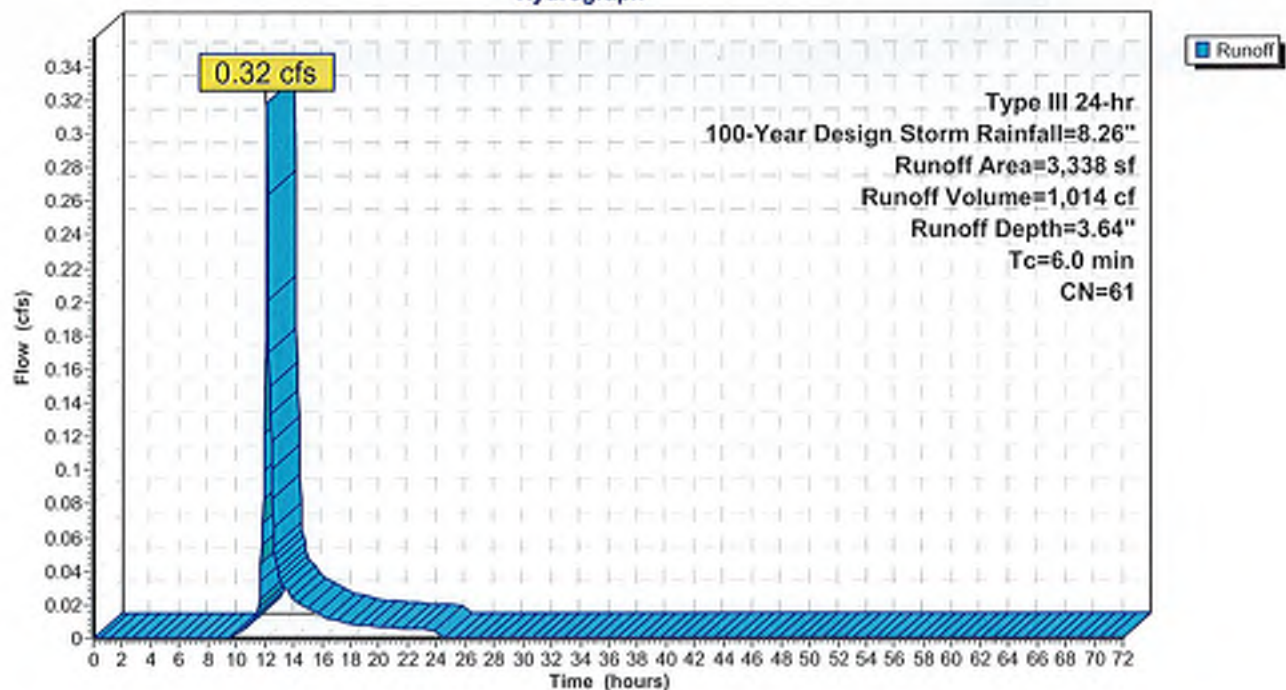
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Design Storm Rainfall=8.26"

Area (sf)	CN	Description
1,000	60	Woods, Fair, HSG B
2,338	61	>75% Grass cover, Good, HSG B
3,338	61	Weighted Average
3,338		100.00% Pervious Area

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

Subcatchment SC-E3: Southern Drainage to Depression

Hydrograph



Summary for Subcatchment SC-E4: North

Runoff = 2.53 cfs @ 12.43 hrs, Volume= 13,996 cf, Depth= 3.53"

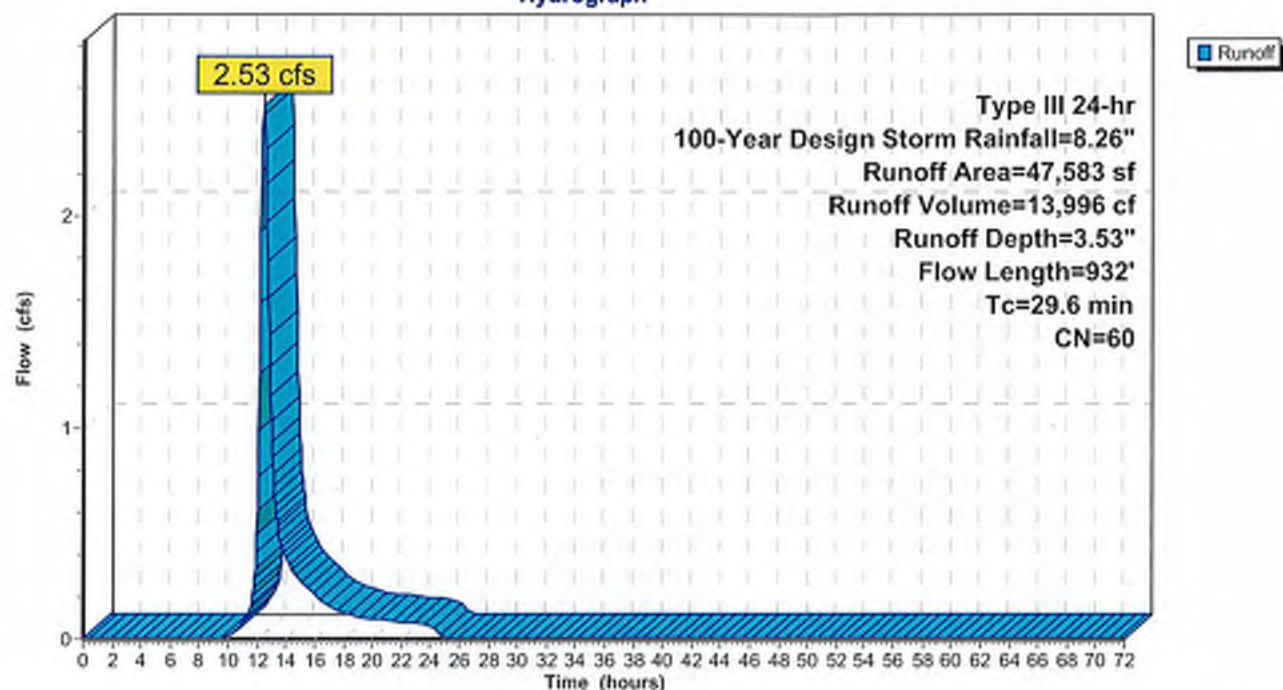
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Design Storm Rainfall=8.26"

Area (sf)	CN	Description
* 196	98	Shed
96	61	>75% Grass cover, Good, HSG B
* 169	82	Gravel path
47,122	60	Woods, Fair, HSG B
47,583	60	Weighted Average
47,387		99.59% Pervious Area
196		0.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.10"
10.2	687	0.0500	1.12		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.5	22	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.0	53	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.4	61	0.3200	2.83		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.0	59	0.0400	1.00		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
29.6	932	Total			

Subcatchment SC-E4: North

Hydrograph



Summary for Reach DP-1: Main Street

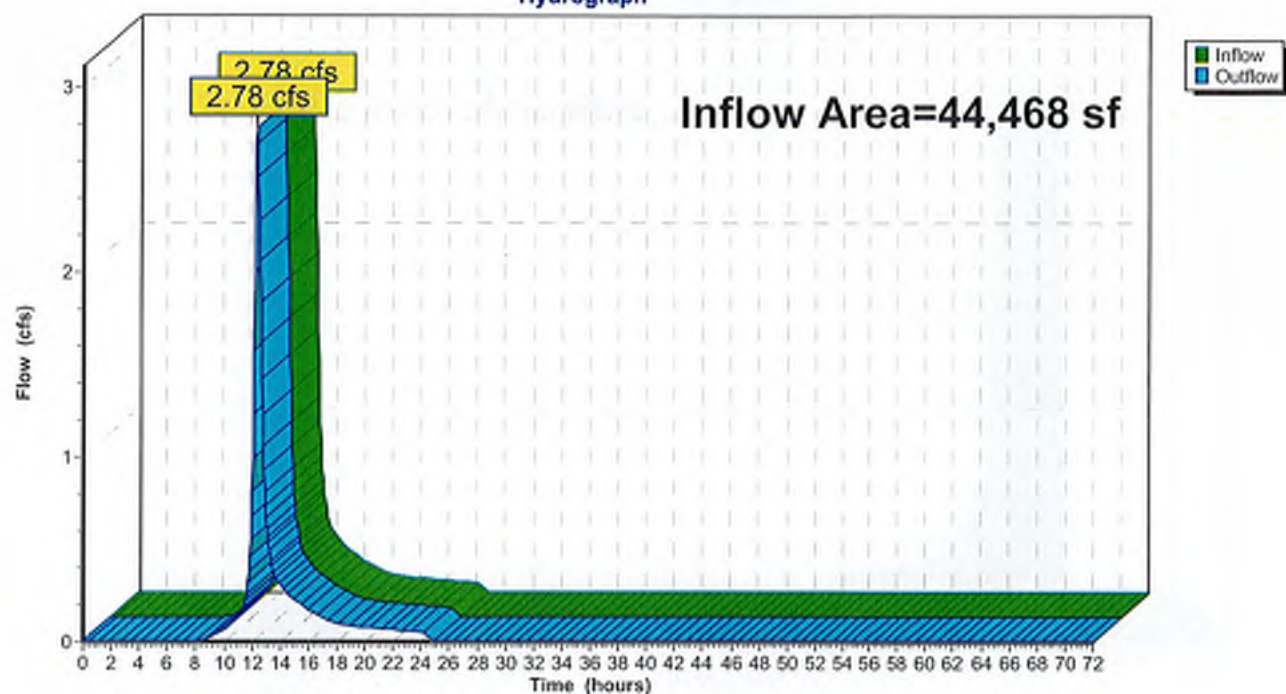
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 44,468 sf, 17.78% Impervious, Inflow Depth = 3.56" for 100-Year Design Storm event
Inflow = 2.78 cfs @ 12.30 hrs, Volume= 13,201 cf
Outflow = 2.78 cfs @ 12.30 hrs, Volume= 13,201 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-1: Main Street

Hydrograph



Summary for Reach DP-2: 224 Main Street

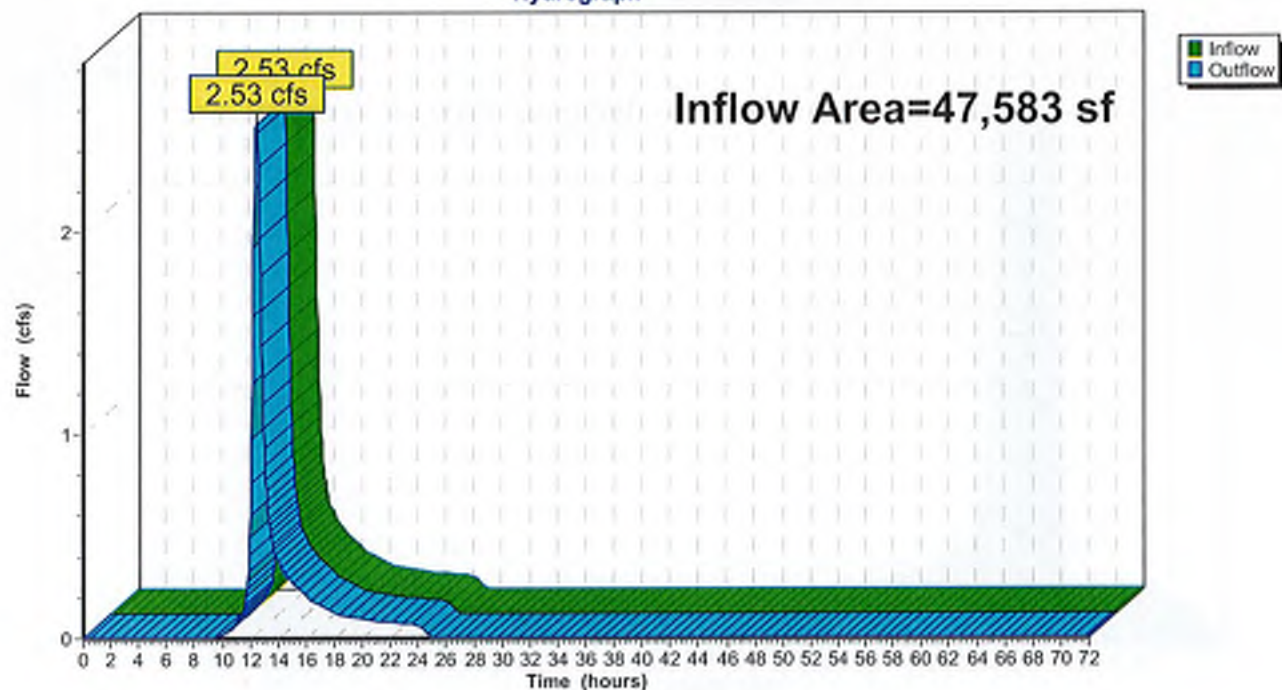
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 47,583 sf, 0.41% Impervious, Inflow Depth = 3.53" for 100-Year Design Storm event
Inflow = 2.53 cfs @ 12.43 hrs, Volume= 13,996 cf
Outflow = 2.53 cfs @ 12.43 hrs, Volume= 13,996 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-2: 224 Main Street

Hydrograph



Summary for Pond EP-1: Manmade Pond

[93] Warning: Storage range exceeded by 0.18'

[58] Hint: Peaked 0.18' above defined flood level

Inflow Area = 6,523 sf, 5.32% Impervious, Inflow Depth = 3.76" for 100-Year Design Storm event
 Inflow = 0.63 cfs @ 12.11 hrs, Volume= 2,043 cf
 Outflow = 0.59 cfs @ 12.11 hrs, Volume= 1,048 cf, Atten= 6%, Lag= 0.0 min
 Primary = 0.59 cfs @ 12.11 hrs, Volume= 1,048 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2

Starting Elev= 127.00' Surf.Area= 0 sf Storage= 0 cf

Peak Elev= 228.68' @ 12.11 hrs Surf.Area= 311 sf Storage= 379 cf

Flood Elev= 228.50' Surf.Area= 311 sf Storage= 379 cf

Plug-Flow detention time= 125.0 min calculated for 1,047 cf (51% of inflow)

Center-of-Mass det. time= 5.5 min (846.5 - 841.0)

Volume	Invert	Avail.Storage	Storage Description
#1	227.00'	379 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
227.00	198	50.1	0	0	198
228.50	311	62.7	379	379	339

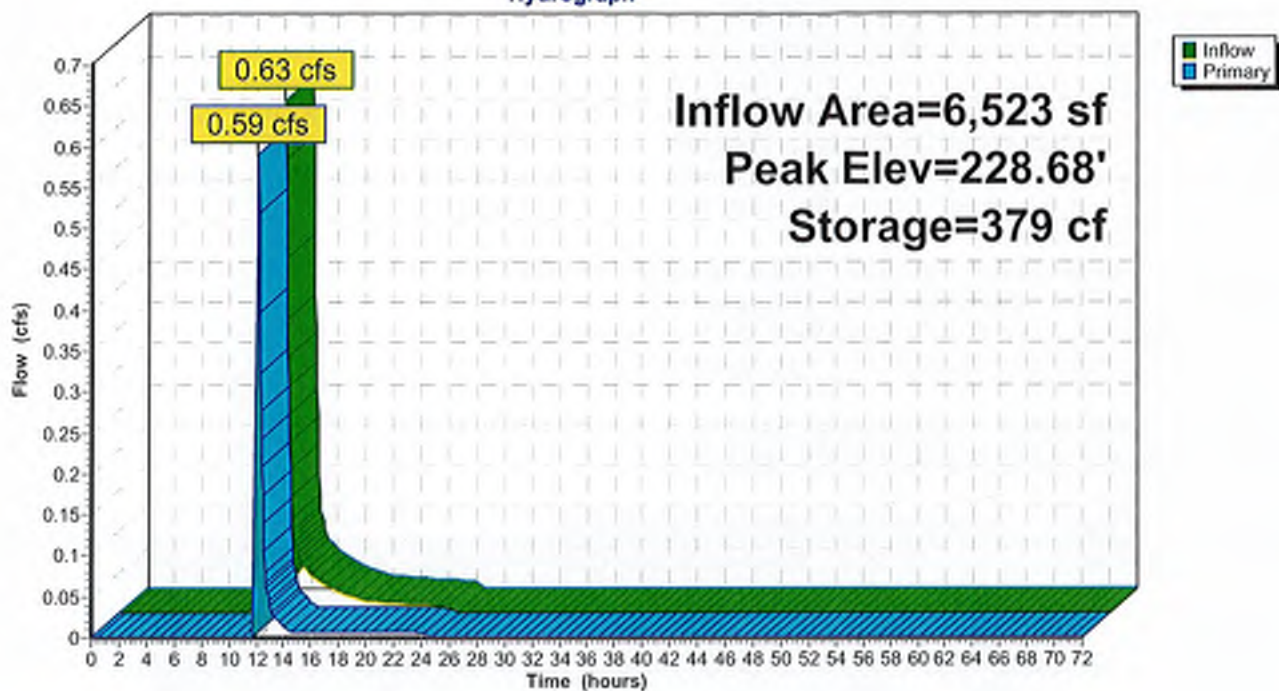
Device	Routing	Invert	Outlet Devices
#1	Primary	228.49'	2.7' long x 18.8' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.58 cfs @ 12.11 hrs HW=228.68' (Free Discharge)

↑1=Broad-Crested Rectangular Weir (Weir Controls 0.58 cfs @ 1.16 fps)

Pond EP-1: Manmade Pond

Hydrograph



Summary for Pond EP-2: Existing Depression

[58] Hint: Peaked 99.90' above defined flood level

Inflow Area = 9,861 sf, 3.52% Impervious, Inflow Depth = 2.51" for 100-Year Design Storm event
 Inflow = 0.91 cfs @ 12.10 hrs, Volume= 2,062 cf
 Outflow = 0.06 cfs @ 13.16 hrs, Volume= 2,062 cf, Atten= 93%, Lag= 63.8 min
 Discarded = 0.04 cfs @ 13.16 hrs, Volume= 2,045 cf
 Primary = 0.02 cfs @ 13.16 hrs, Volume= 17 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Peak Elev= 227.90' @ 13.16 hrs Surf.Area= 1,867 sf Storage= 1,092 cf
 Flood Elev= 128.00' Surf.Area= 0 sf Storage= 0 cf

Plug-Flow detention time= 294.3 min calculated for 2,060 cf (100% of inflow)
 Center-of-Mass det. time= 294.3 min (1,138.7 - 844.4)

Volume	Invert	Avail.Storage	Storage Description
#1	227.00'	1,285 cf	Custom Stage Data (Irregular) Listed below (Recalc)

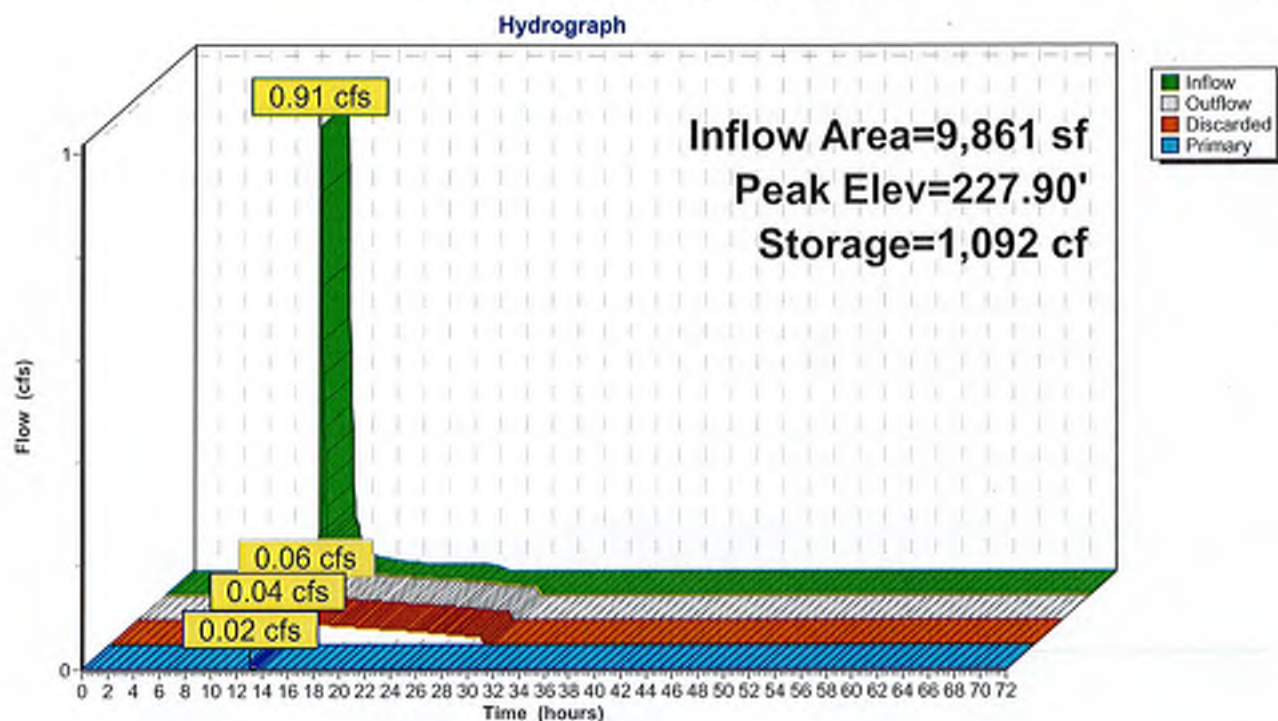
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
227.00	659	112.5	0	0	659
228.00	2,038	207.9	1,285	1,285	3,097

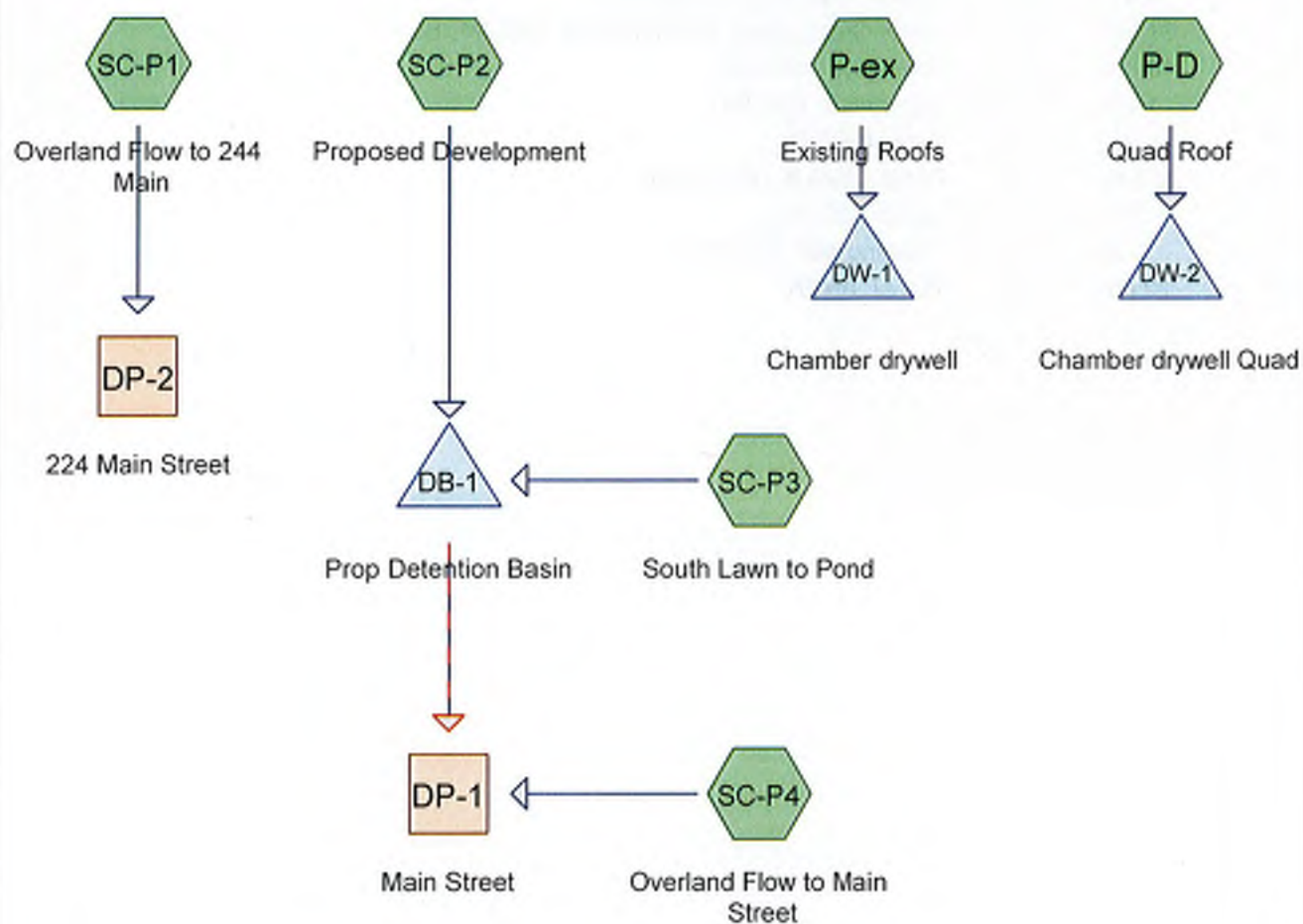
Device	Routing	Invert	Outlet Devices
#1	Primary	227.90'	83.7' long x 2.7' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.46 2.59 2.63 2.63 2.64 2.65 2.66 2.72 2.72 2.74 2.86 3.00 3.10 3.22 3.32
#2	Discarded	227.00'	1.020 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'

Discarded OutFlow Max=0.04 cfs @ 13.16 hrs HW=227.90' (Free Discharge)
 ↳ **2=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 13.16 hrs HW=227.90' (Free Discharge)
 ↳ **1=Broad-Crested Rectangular Weir** (Weir Controls 0.00 cfs @ 0.07 fps)

Pond EP-2: Existing Depression





Routing Diagram for 8521_Proposed_Quad-DG

Prepared by Microsoft, Printed 11/12/2020

HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
10,692	60	Woodlands (SC-P2)
2,054	60	Woods (SC-P4)
24,311	60	Woods, Fair, HSG B (SC-P1)
34,598	61	>75% Grass cover, Good, HSG B (SC-P1, SC-P2, SC-P3, SC-P4)
8,886	98	Driveways (SC-P2)
1,195	98	Impervious (SC-P4)
210	98	Patio (SC-P2)
9,065	98	Roofs, HSG B (P-D, P-ex)
979	98	patios (SC-P1)
61	98	retaining wall (SC-P2)
92,051	69	TOTAL AREA

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
67,974	HSG B	P-D, P-ex, SC-P1, SC-P2, SC-P3, SC-P4
0	HSG C	
0	HSG D	
24,077	Other	SC-P1, SC-P2, SC-P4
92,051		TOTAL AREA

8521_Proposed_Quad-DG

Prepared by Microsoft

Printed 11/12/2020

HydroCAD® 10.00 s/n 00814 © 2011 HydroCAD Software Solutions LLC

Page 4

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
0	34,598	0	0	0	34,598	>75% Grass cover, Good
0	0	0	0	8,886	8,886	Driveways
0	0	0	0	1,195	1,195	Impervious
0	0	0	0	210	210	Patio
0	9,065	0	0	0	9,065	Roofs
0	0	0	0	10,692	10,692	Woodlands
0	0	0	0	2,054	2,054	Woods
0	24,311	0	0	0	24,311	Woods, Fair
0	0	0	0	979	979	patios
0	0	0	0	61	61	retaining wall
0	67,974	0	0	24,077	92,051	TOTAL AREA

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points

Runoff by SCS TR-20 method, UH=SCS

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

Subcatchment P-D: Quad Roof Runoff Area=6,891 sf 100.00% Impervious Runoff Depth=3.14"
Tc=6.0 min CN=98 Runoff=0.51 cfs 1,801 cf

Subcatchment P-ex: Existing Roofs Runoff Area=2,174 sf 100.00% Impervious Runoff Depth=3.14"
Tc=6.0 min CN=98 Runoff=0.16 cfs 568 cf

Subcatchment SC-P1: Overland Flow to 244 Runoff Area=32,145 sf 3.05% Impervious Runoff Depth=0.52"
Flow Length=310' Tc=12.4 min CN=61 Runoff=0.24 cfs 1,381 cf

Subcatchment SC-P2: Proposed Runoff Area=32,876 sf 27.85% Impervious Runoff Depth=0.98"
Flow Length=280' Tc=10.7 min CN=71 Runoff=0.68 cfs 2,690 cf

Subcatchment SC-P3: South Lawn to Pond Runoff Area=9,610 sf 0.00% Impervious Runoff Depth=0.52"
Tc=6.0 min CN=61 Runoff=0.09 cfs 413 cf

Subcatchment SC-P4: Overland Flow to Runoff Area=8,355 sf 14.30% Impervious Runoff Depth=0.73"
Flow Length=250' Tc=11.2 min CN=66 Runoff=0.11 cfs 509 cf

Reach DP-1: Main Street Inflow=0.11 cfs 509 cf
Outflow=0.11 cfs 509 cf

Reach DP-2: 224 Main Street Inflow=0.24 cfs 1,381 cf
Outflow=0.24 cfs 1,381 cf

Pond DB-1: Prop Detention Basin Peak Elev=228.56' Storage=1,030 cf Inflow=0.76 cfs 3,103 cf
Discarded=0.11 cfs 3,103 cf Primary=0.00 cfs 0 cf Secondary=0.00 cfs 0 cf Outflow=0.11 cfs 3,103 cf

Pond DW-1: Chamber drywell Peak Elev=229.82' Storage=162 cf Inflow=0.16 cfs 568 cf
Outflow=0.02 cfs 568 cf

Pond DW-2: Chamber drywell Quad Peak Elev=235.31' Storage=463 cf Inflow=0.51 cfs 1,801 cf
Outflow=0.09 cfs 1,801 cf

Total Runoff Area = 92,051 sf Runoff Volume = 7,362 cf Average Runoff Depth = 0.96"
77.84% Pervious = 71,655 sf 22.16% Impervious = 20,396 sf

Summary for Subcatchment P-D: Quad Roof

Runoff = 0.51 cfs @ 12.09 hrs, Volume= 1,801 cf, Depth= 3.14"

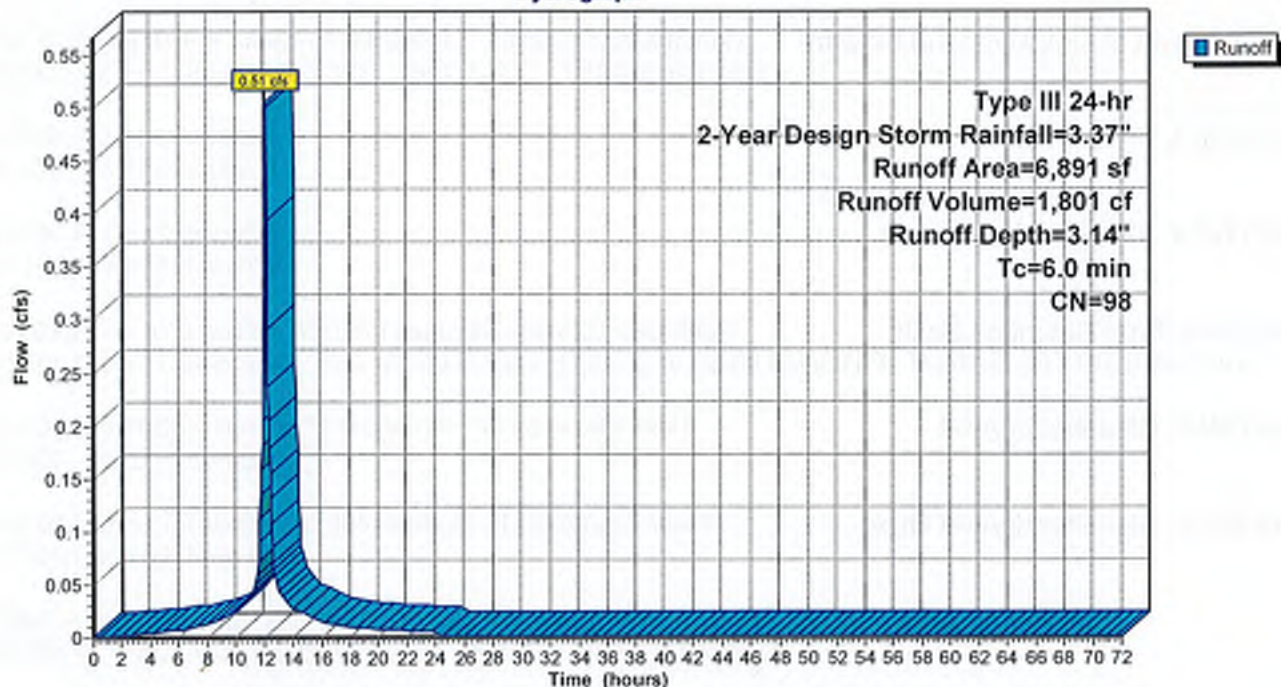
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Design Storm Rainfall=3.37"

Area (sf)	CN	Description
6,891	98	Roofs, HSG B
6,891		100.00% Impervious Area

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

Subcatchment P-D: Quad Roof

Hydrograph



Summary for Subcatchment P-ex: Existing Roofs

Runoff = 0.16 cfs @ 12.09 hrs, Volume= 568 cf, Depth= 3.14"

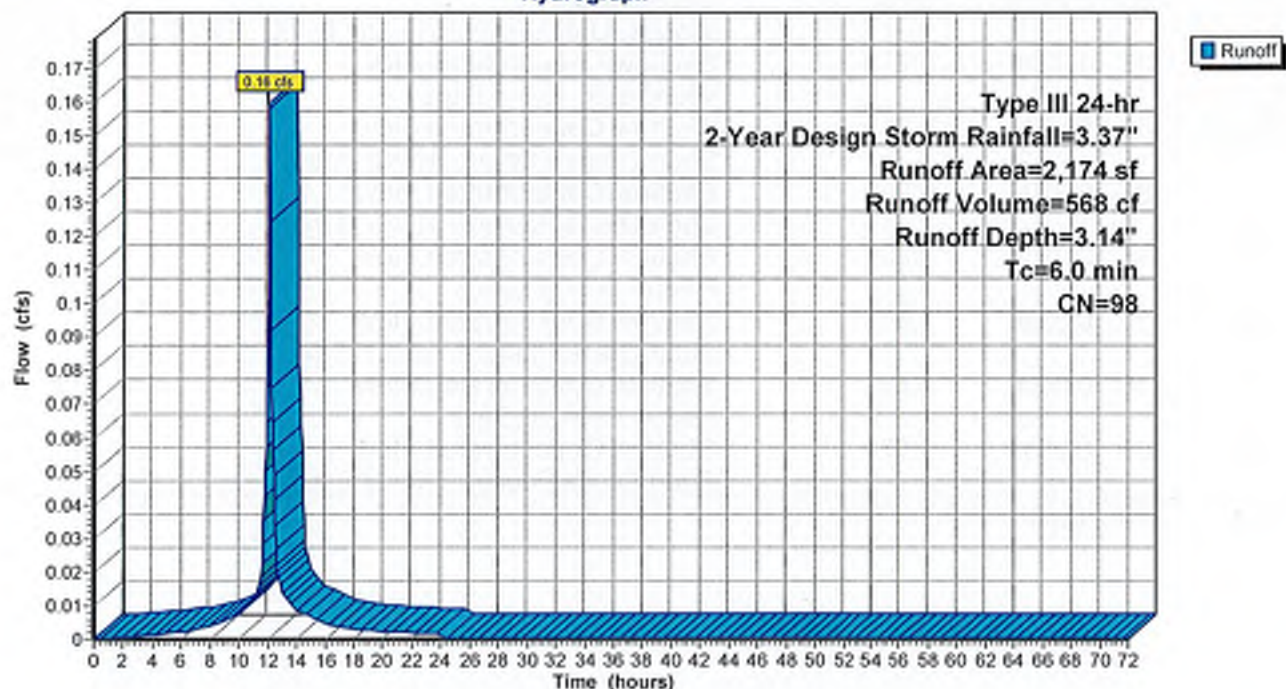
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Design Storm Rainfall=3.37"

Area (sf)	CN	Description
2,174	98	Roofs, HSG B
2,174		100.00% Impervious Area

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

Subcatchment P-ex: Existing Roofs

Hydrograph



Summary for Subcatchment SC-P1: Overland Flow to 244 Main

Runoff = 0.24 cfs @ 12.23 hrs, Volume= 1,381 cf, Depth= 0.52"

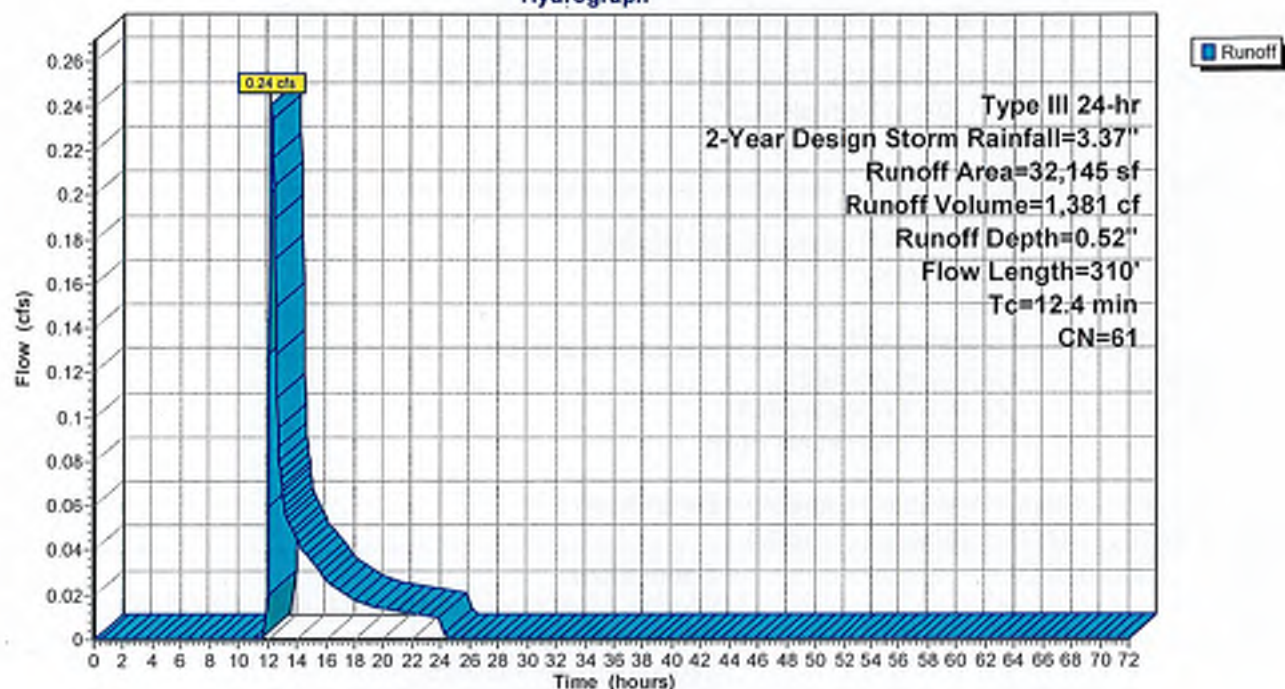
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Design Storm Rainfall=3.37"

Area (sf)	CN	Description
6,855	61	>75% Grass cover, Good, HSG B
24,311	60	Woods, Fair, HSG B
* 979	98	patios
32,145	61	Weighted Average
31,166		96.95% Pervious Area
979		3.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	50	0.0460	0.10		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.37"
0.8	36	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.7	50	0.0300	1.21		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
1.4	81	0.0200	0.99		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.1	15	0.0360	3.85		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.3	25	0.0360	1.33		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.1	15	0.0500	4.54		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.4	38	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
12.4	310	Total			

Subcatchment SC-P1: Overland Flow to 244 Main

Hydrograph



Summary for Subcatchment SC-P2: Proposed Development

Runoff = 0.68 cfs @ 12.17 hrs, Volume= 2,690 cf, Depth= 0.98"

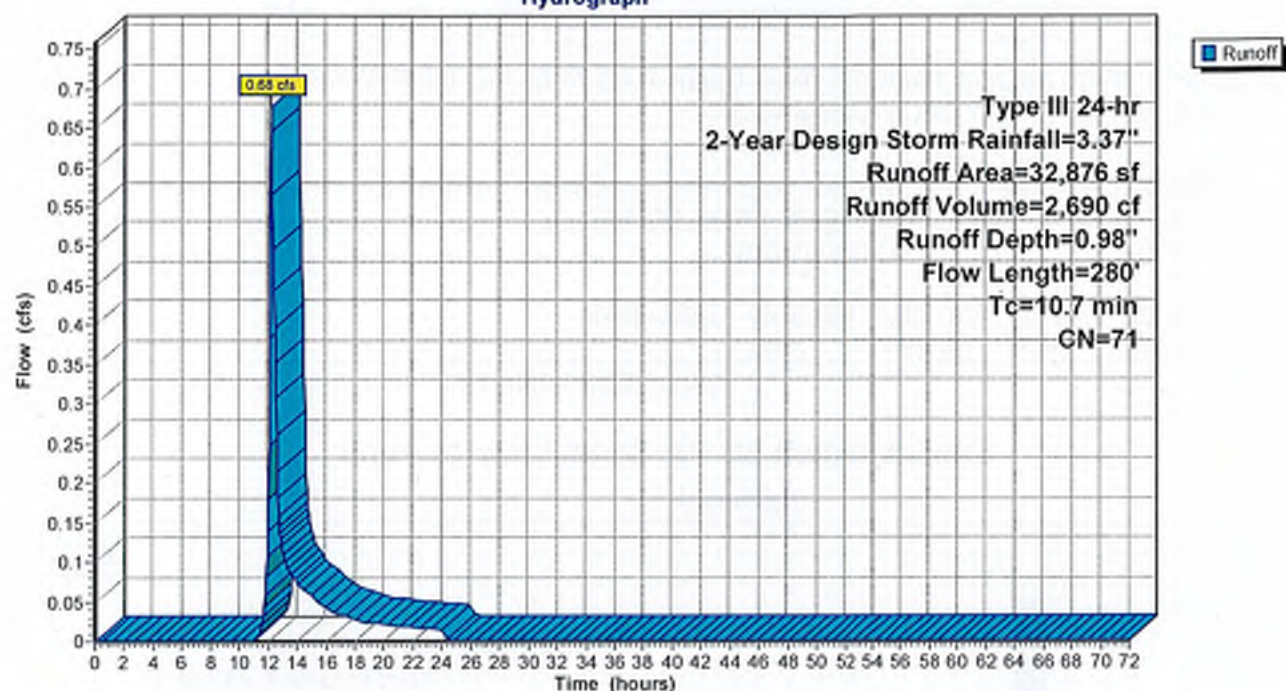
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Design Storm Rainfall=3.37"

	Area (sf)	CN	Description
*	8,886	98	Driveways
	13,027	61	>75% Grass cover, Good, HSG B
*	10,692	60	Woodlands
*	210	98	Patio
*	61	98	retaining wall
	32,876	71	Weighted Average
	23,719		72.15% Pervious Area
	9,157		27.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0520	0.10		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.37"
0.8	50	0.0480	1.10		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.1	13	0.0800	1.98		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
1.0	71	0.0300	1.21		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.1	19	0.1600	2.80		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.2	15	0.0400	1.40		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.3	62	0.0400	4.06		Shallow Concentrated Flow, Paved Kv= 20.3 fps
10.7	280	Total			

Subcatchment SC-P2: Proposed Development

Hydrograph



Summary for Subcatchment SC-P3: South Lawn to Pond

Runoff = 0.09 cfs @ 12.12 hrs, Volume= 413 cf, Depth= 0.52"

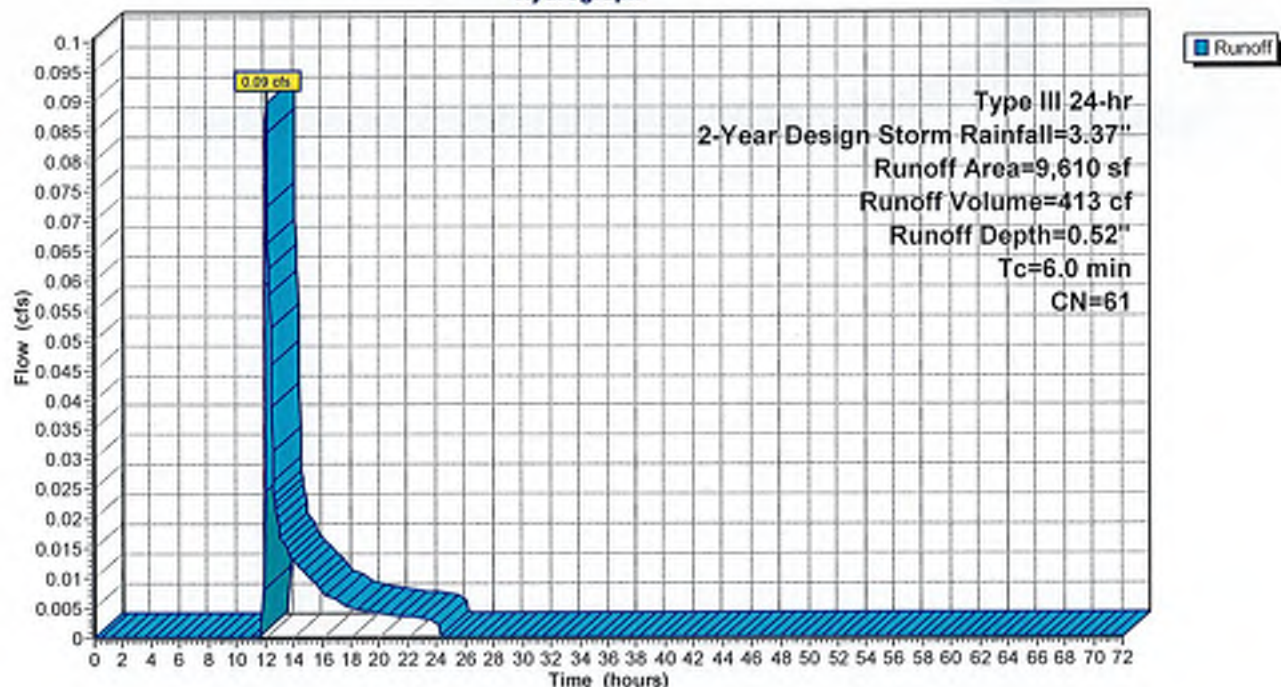
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Design Storm Rainfall=3.37"

Area (sf)	CN	Description
9,610	61	>75% Grass cover, Good, HSG B
9,610		100.00% Pervious Area

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

Subcatchment SC-P3: South Lawn to Pond

Hydrograph



Summary for Subcatchment SC-P4: Overland Flow to Main Street

Runoff = 0.11 cfs @ 12.19 hrs, Volume= 509 cf, Depth= 0.73"

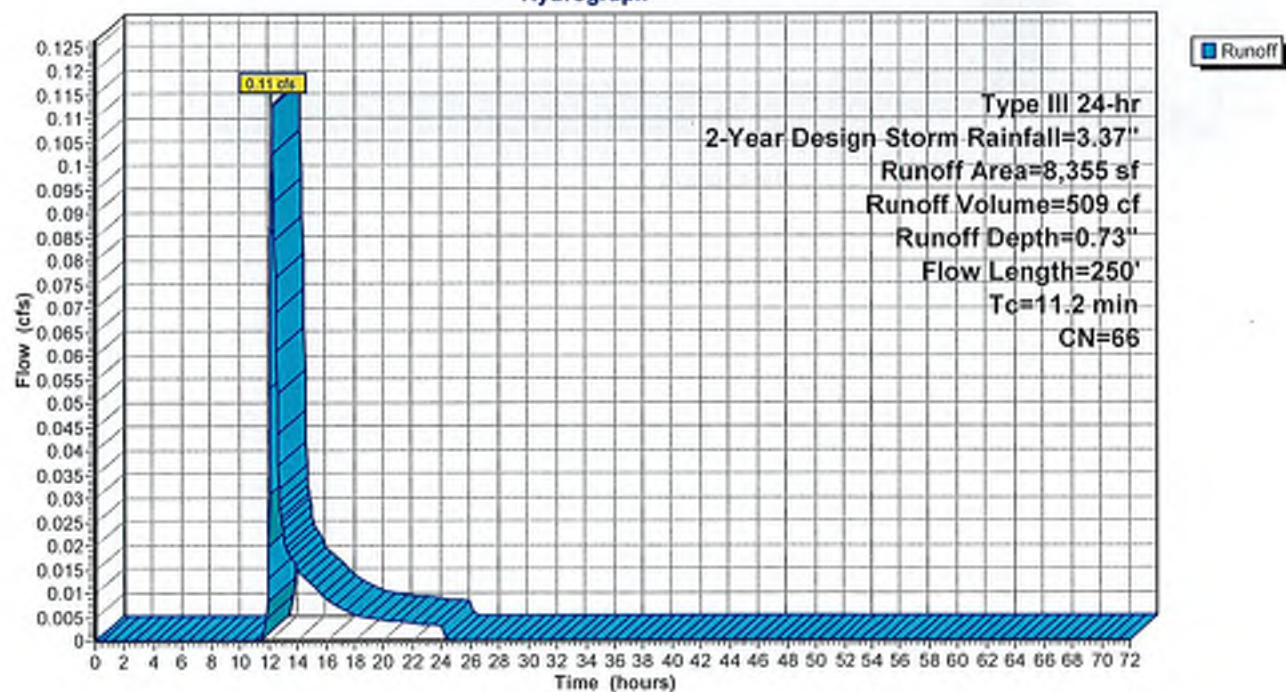
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Design Storm Rainfall=3.37"

Area (sf)	CN	Description
* 1,195	98	Impervious
5,106	61	>75% Grass cover, Good, HSG B
* 2,054	60	Woods
8,355	66	Weighted Average
7,160		85.70% Pervious Area
1,195		14.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0500	0.10		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.37"
2.9	200	0.0530	1.15		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
11.2	250	Total			

Subcatchment SC-P4: Overland Flow to Main Street

Hydrograph



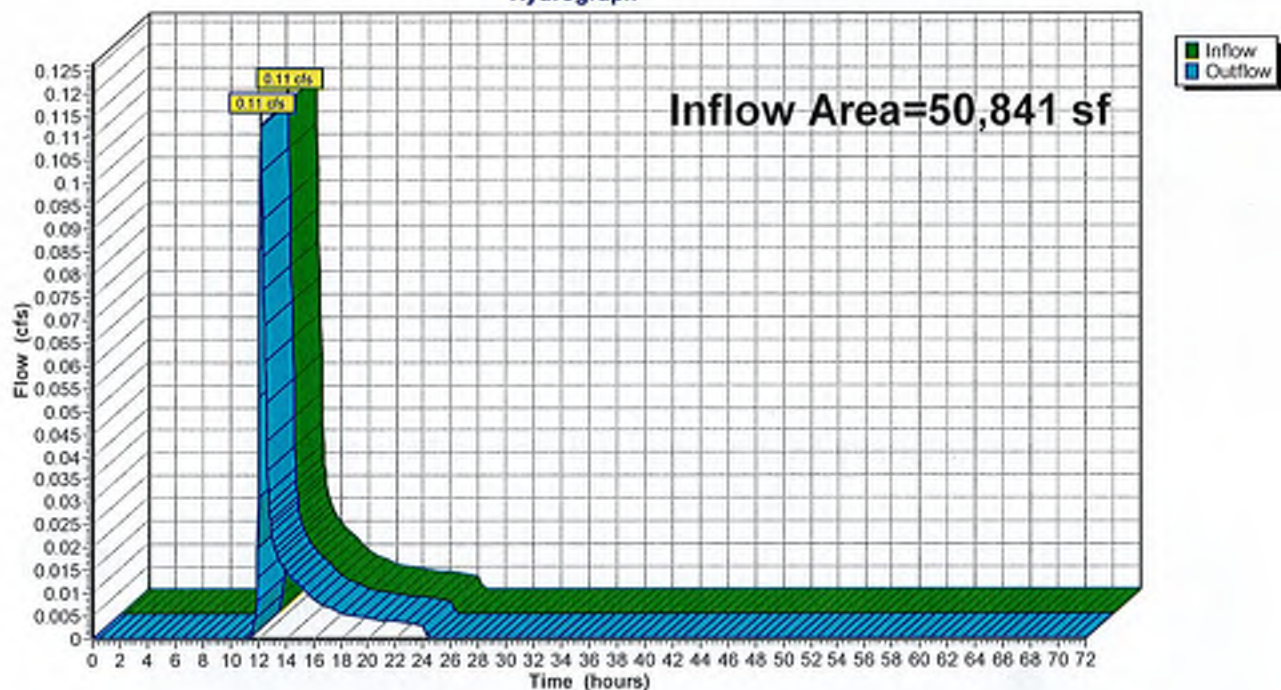
Summary for Reach DP-1: Main Street

Inflow Area = 50,841 sf, 20.36% Impervious, Inflow Depth = 0.12" for 2-Year Design Storm event
Inflow = 0.11 cfs @ 12.19 hrs, Volume= 509 cf
Outflow = 0.11 cfs @ 12.19 hrs, Volume= 509 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-1: Main Street

Hydrograph



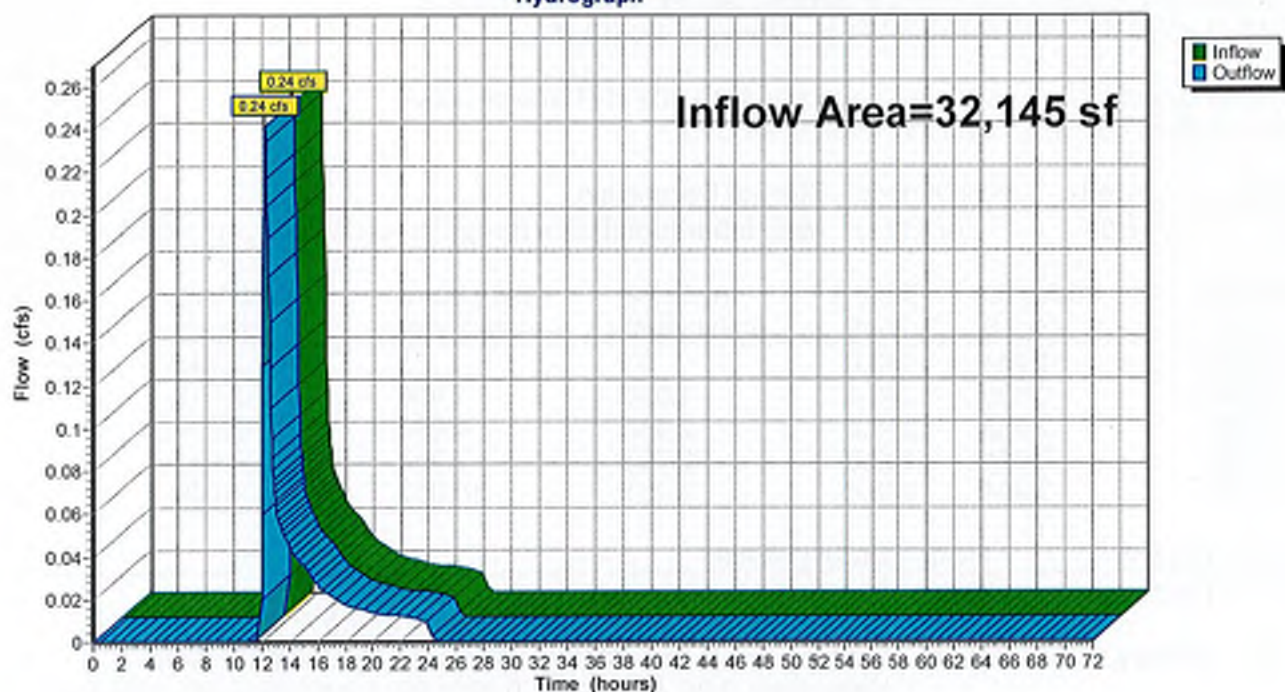
Summary for Reach DP-2: 224 Main Street

Inflow Area = 32,145 sf, 3.05% Impervious, Inflow Depth = 0.52" for 2-Year Design Storm event
Inflow = 0.24 cfs @ 12.23 hrs, Volume= 1,381 cf
Outflow = 0.24 cfs @ 12.23 hrs, Volume= 1,381 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-2: 224 Main Street

Hydrograph



Summary for Pond DB-1: Prop Detention Basin

Inflow Area = 42,486 sf, 21.55% Impervious, Inflow Depth = 0.88" for 2-Year Design Storm event
 Inflow = 0.76 cfs @ 12.16 hrs, Volume= 3,103 cf
 Outflow = 0.11 cfs @ 13.24 hrs, Volume= 3,103 cf, Atten= 86%, Lag= 64.7 min
 Discarded = 0.11 cfs @ 13.24 hrs, Volume= 3,103 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 228.56' @ 13.24 hrs Surf.Area= 1,957 sf Storage= 1,030 cf
 Flood Elev= 232.00' Surf.Area= 3,494 sf Storage= 10,313 cf

Plug-Flow detention time= 90.3 min calculated for 3,101 cf (100% of inflow)
 Center-of-Mass det. time= 90.2 min (967.9 - 877.6)

Volume	Invert	Avail. Storage	Storage Description		
#1	228.00'	10,313 cf	Main Infiltration Basin (Irregular) Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
228.00	1,744	183.8	0	0	1,744
229.00	2,135	201.4	1,936	1,936	2,317
230.00	2,558	218.0	2,343	4,280	2,909
231.00	3,014	233.8	2,783	7,062	3,521
232.00	3,494	246.4	3,251	10,313	4,059

Device	Routing	Invert	Outlet Devices
#1	Discarded	228.00'	2.410 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'
#2	Primary	231.00'	8.0' long x 8.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#3	Secondary	231.20'	24.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

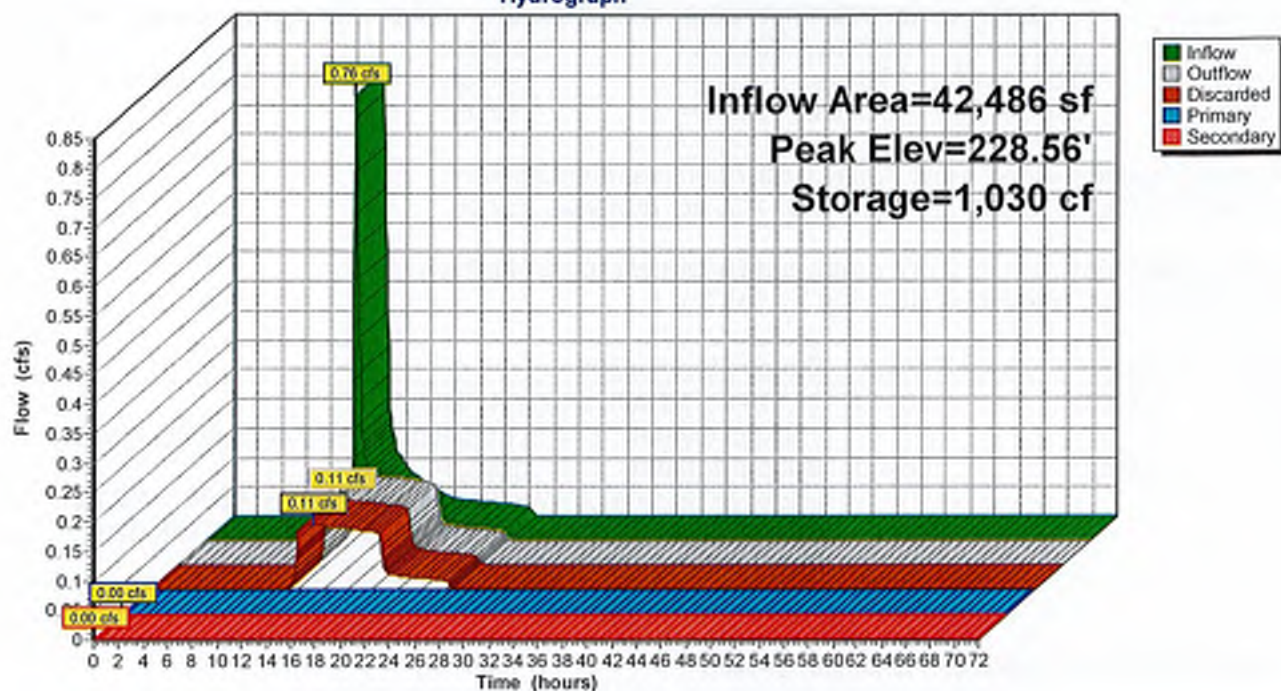
Discarded OutFlow Max=0.11 cfs @ 13.24 hrs HW=228.56' (Free Discharge)
 ↳1=Exfiltration (Controls 0.11 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=228.00' (Free Discharge)
 ↳2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=228.00' (Free Discharge)
 ↳3=Orifice/Grate (Controls 0.00 cfs)

Pond DB-1: Prop Detention Basin

Hydrograph



Summary for Pond DW-1: Chamber drywell

Inflow Area = 2,174 sf, 100.00% Impervious, Inflow Depth = 3.14" for 2-Year Design Storm event
 Inflow = 0.16 cfs @ 12.09 hrs, Volume = 568 cf
 Outflow = 0.02 cfs @ 11.70 hrs, Volume = 568 cf, Atten = 85%, Lag = 0.0 min
 Discarded = 0.02 cfs @ 11.70 hrs, Volume = 568 cf

Routing by Stor-Ind method, Time Span = 0.00-72.00 hrs, dt = 0.05 hrs
 Peak Elev = 229.82' @ 12.58 hrs Surf.Area = 430 sf Storage = 162 cf

Plug-Flow detention time = 40.4 min calculated for 568 cf (100% of inflow)
 Center-of-Mass det. time = 40.4 min (795.7 - 755.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	229.10'	391 cf	11.17'W x 38.50'L x 3.54'H Field A 1,523 cf Overall - 544 cf Embedded = 979 cf x 40.0% Voids
#2A	229.60'	544 cf	Cultec R-330XL x 10 Inside #1 Effective Size = 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size = 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment = +1.50' x 7.45 sf x 2 rows
		935 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	229.10'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max = 0.02 cfs @ 11.70 hrs HW = 229.14' (Free Discharge)
 ↑ 1 = Exfiltration (Exfiltration Controls 0.02 cfs)

Pond DW-1: Chamber drywell - Chamber Wizard Field A**Chamber Model = Cultec R-330XL**

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 2 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

5 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 36.50' Row Length +12.0" End Stone x 2 = 38.50' Base Length

2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.17' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

10 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 2 Rows = 543.9 cf Chamber Storage

1,522.6 cf Field - 543.9 cf Chambers = 978.7 cf Stone x 40.0% Voids = 391.5 cf Stone Storage

Stone + Chamber Storage = 935.4 cf = 0.021 af

Overall Storage Efficiency = 61.4%

10 Chambers

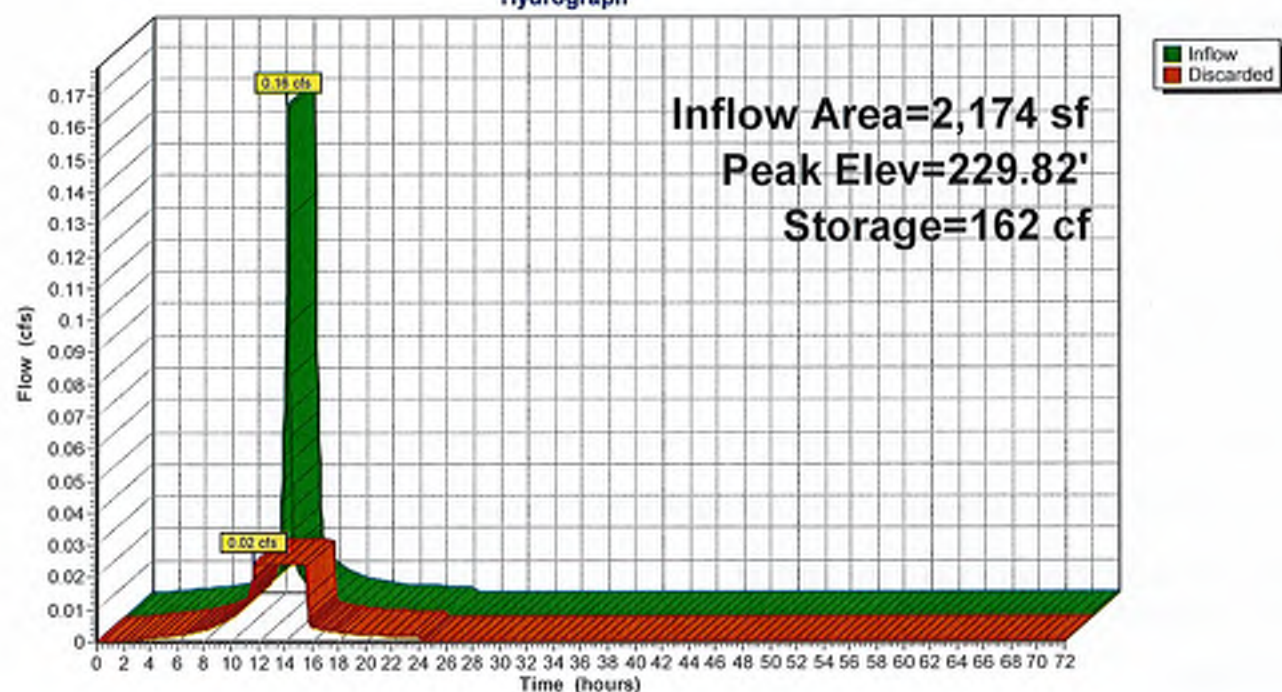
56.4 cy Field

36.2 cy Stone



Pond DW-1: Chamber drywell

Hydrograph



Summary for Pond DW-2: Chamber drywell Quad

Inflow Area = 6,891 sf, 100.00% Impervious, Inflow Depth = 3.14" for 2-Year Design Storm event
 Inflow = 0.51 cfs @ 12.09 hrs, Volume= 1,801 cf
 Outflow = 0.09 cfs @ 11.70 hrs, Volume= 1,801 cf, Atten= 82%, Lag= 0.0 min
 Discarded = 0.09 cfs @ 11.70 hrs, Volume= 1,801 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Peak Elev= 235.31' @ 12.54 hrs Surf.Area= 1,600 sf Storage= 463 cf

Plug-Flow detention time= 28.6 min calculated for 1,800 cf (100% of inflow)
 Center-of-Mass det. time= 28.6 min (783.9 - 755.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	234.70'	995 cf	40.00'W x 40.00'L x 2.04'H Field A 3,267 cf Overall - 778 cf Embedded = 2,489 cf x 40.0% Voids
#2A	235.20'	778 cf	Cultec C-100 x 55 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 11 rows
		1,774 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	234.70'	2,410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.09 cfs @ 11.70 hrs HW=234.72' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Pond DW-2: Chamber drywell Quad - Chamber Wizard Field A**Chamber Model = Cultec C-100**

Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 11 rows

36.0" Wide + 6.0" Spacing = 42.0" C-C Row Spacing

5 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 38.00' Row Length +12.0" End Stone x 2 = 40.00' Base Length

11 Rows x 36.0" Wide + 6.0" Spacing x 10 + 12.0" Side Stone x 2 = 40.00' Base Width

6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

55 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 11 Rows = 778.1 cf Chamber Storage

3,266.7 cf Field - 778.1 cf Chambers = 2,488.6 cf Stone x 40.0% Voids = 995.4 cf Stone Storage

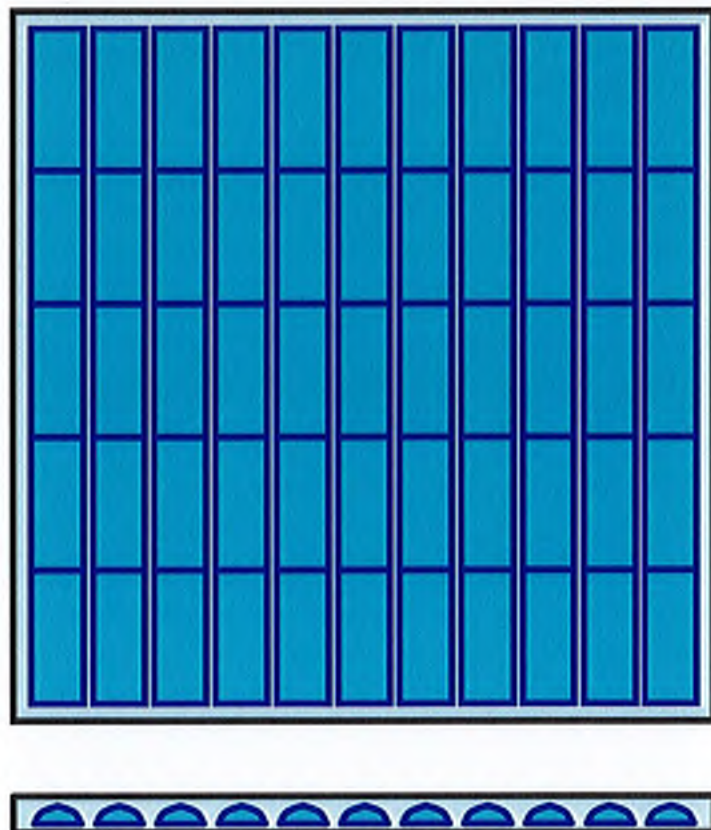
Stone + Chamber Storage = 1,773.5 cf = 0.041 af

Overall Storage Efficiency = 54.3%

55 Chambers

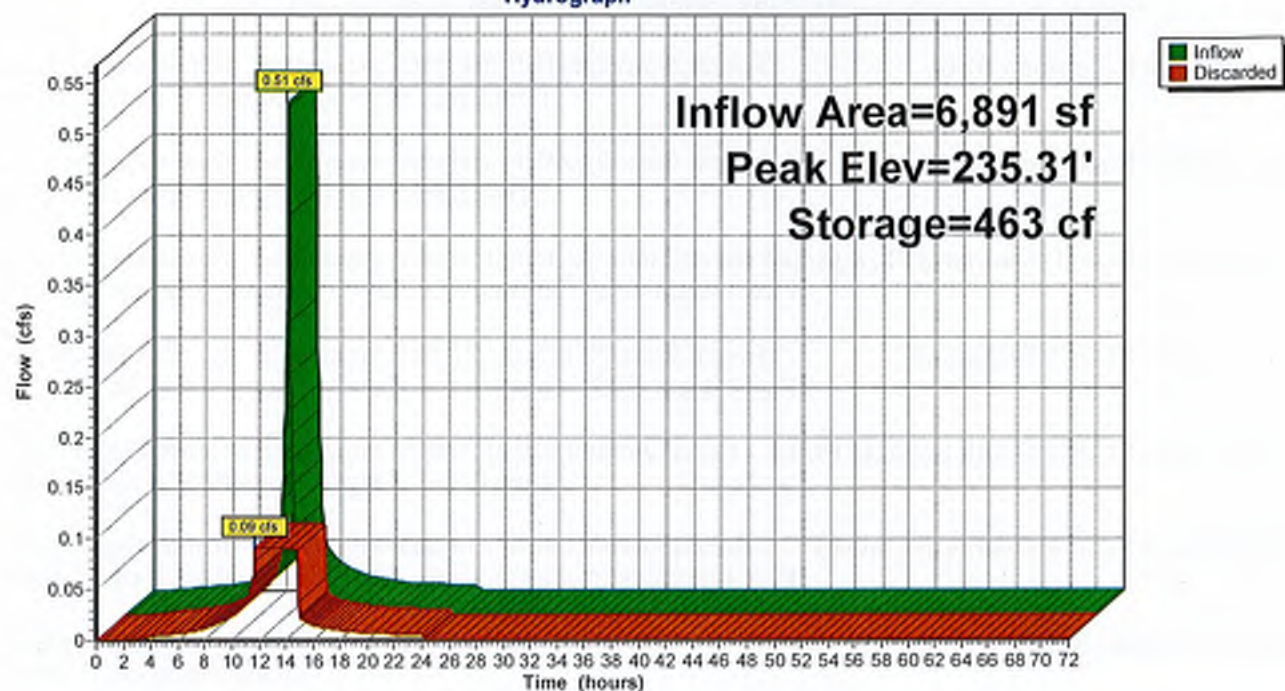
121.0 cy Field

92.2 cy Stone



Pond DW-2: Chamber drywell Quad

Hydrograph



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points

Runoff by SCS TR-20 method, UH=SCS

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

Subcatchment P-D: Quad Roof Runoff Area=6,891 sf 100.00% Impervious Runoff Depth=5.02"
Tc=6.0 min CN=98 Runoff=0.80 cfs 2,884 cf

Subcatchment P-ex: Existing Roofs Runoff Area=2,174 sf 100.00% Impervious Runoff Depth=5.02"
Tc=6.0 min CN=98 Runoff=0.25 cfs 910 cf

Subcatchment SC-P1: Overland Flow to 244 Runoff Area=32,145 sf 3.05% Impervious Runoff Depth=1.53"
Flow Length=310' Tc=12.4 min CN=61 Runoff=0.97 cfs 4,093 cf

Subcatchment SC-P2: Proposed Runoff Area=32,876 sf 27.85% Impervious Runoff Depth=2.31"
Flow Length=280' Tc=10.7 min CN=71 Runoff=1.72 cfs 6,342 cf

Subcatchment SC-P3: South Lawn to Pond Runoff Area=9,610 sf 0.00% Impervious Runoff Depth=1.53"
Tc=6.0 min CN=61 Runoff=0.36 cfs 1,224 cf

Subcatchment SC-P4: Overland Flow to Runoff Area=8,355 sf 14.30% Impervious Runoff Depth=1.91"
Flow Length=250' Tc=11.2 min CN=66 Runoff=0.35 cfs 1,328 cf

Reach DP-1: Main Street Inflow=0.35 cfs 1,328 cf
Outflow=0.35 cfs 1,328 cf

Reach DP-2: 224 Main Street Inflow=0.97 cfs 4,093 cf
Outflow=0.97 cfs 4,093 cf

Pond DB-1: Prop Detention Basin Peak Elev=229.79' Storage=3,746 cf Inflow=2.02 cfs 7,566 cf
Discarded=0.14 cfs 7,566 cf Primary=0.00 cfs 0 cf Secondary=0.00 cfs 0 cf Outflow=0.14 cfs 7,566 cf

Pond DW-1: Chamber drywell Peak Elev=230.25' Storage=310 cf Inflow=0.25 cfs 910 cf
Outflow=0.02 cfs 910 cf

Pond DW-2: Chamber drywell Quad Peak Elev=235.67' Storage=908 cf Inflow=0.80 cfs 2,884 cf
Outflow=0.09 cfs 2,884 cf

Total Runoff Area = 92,051 sf Runoff Volume = 16,781 cf Average Runoff Depth = 2.19"
77.84% Pervious = 71,655 sf 22.16% Impervious = 20,396 sf

Summary for Subcatchment P-D: Quad Roof

Runoff = 0.80 cfs @ 12.09 hrs, Volume= 2,884 cf, Depth= 5.02"

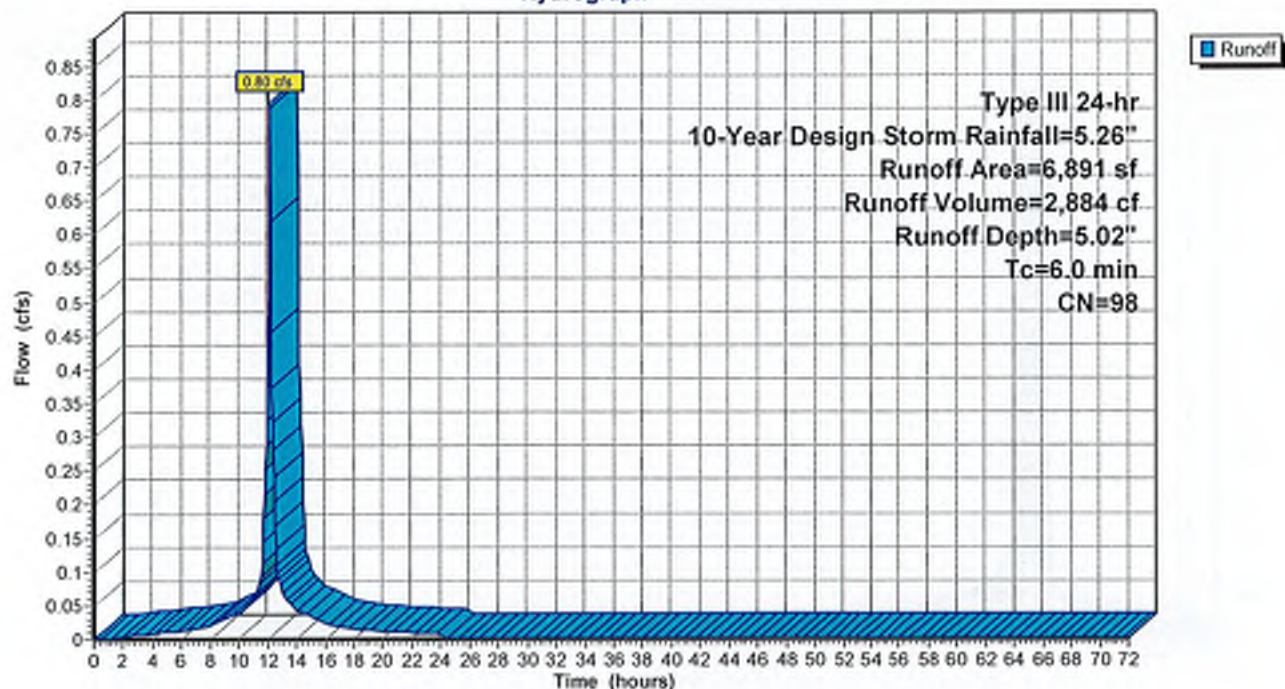
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Design Storm Rainfall=5.26"

Area (sf)	CN	Description
6,891	98	Roofs, HSG B
6,891		100.00% Impervious Area

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

Subcatchment P-D: Quad Roof

Hydrograph



Summary for Subcatchment P-ex: Existing Roofs

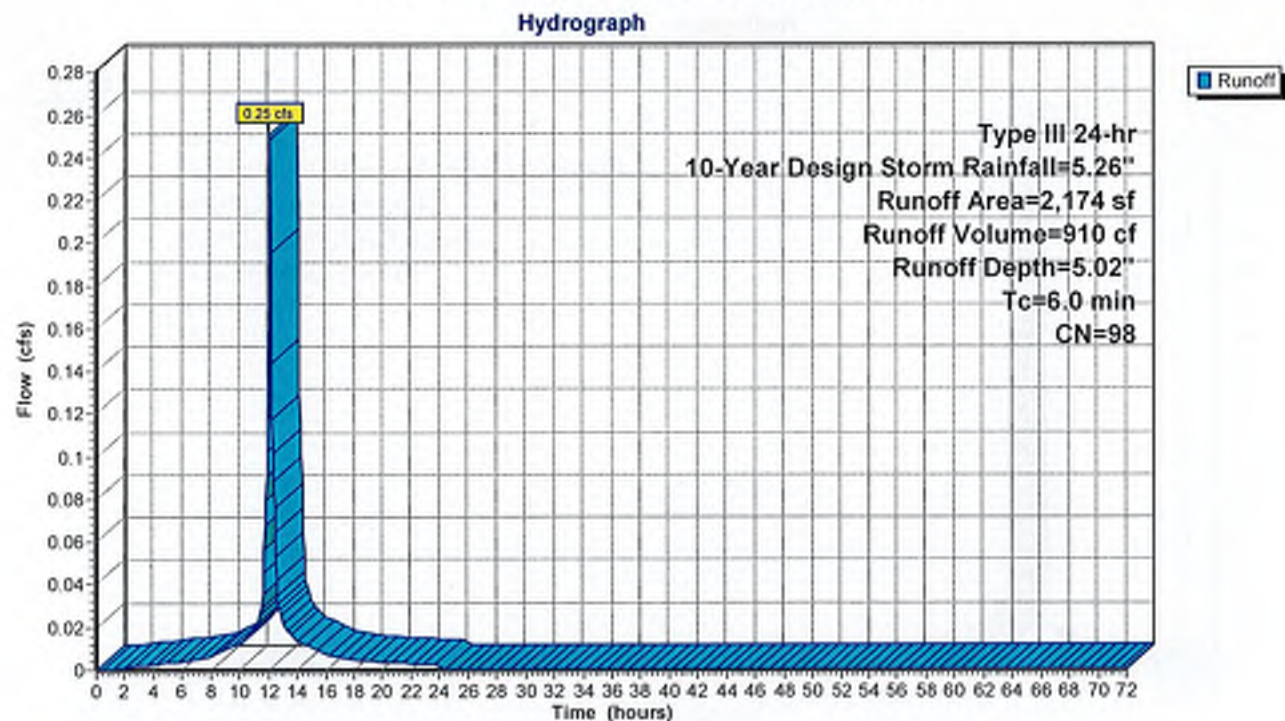
Runoff = 0.25 cfs @ 12.09 hrs, Volume= 910 cf, Depth= 5.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Design Storm Rainfall=5.26"

Area (sf)	CN	Description
2,174	98	Roofs, HSG B
2,174		100.00% Impervious Area

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

Subcatchment P-ex: Existing Roofs



Summary for Subcatchment SC-P1: Overland Flow to 244 Main

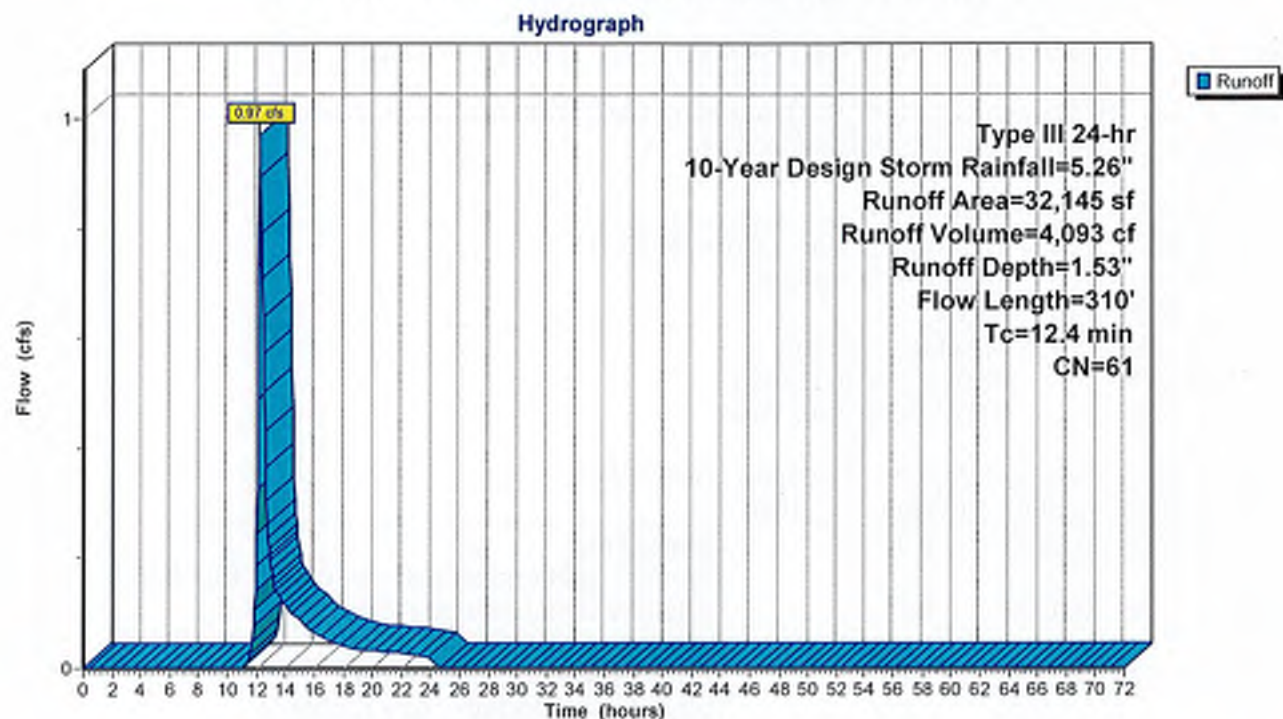
Runoff = 0.97 cfs @ 12.19 hrs, Volume= 4,093 cf, Depth= 1.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Design Storm Rainfall=5.26"

Area (sf)	CN	Description
6,855	61	>75% Grass cover, Good, HSG B
24,311	60	Woods, Fair, HSG B
* 979	98	patios
32,145	61	Weighted Average
31,166		96.95% Pervious Area
979		3.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	50	0.0460	0.10		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.37"
0.8	36	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.7	50	0.0300	1.21		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
1.4	81	0.0200	0.99		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.1	15	0.0360	3.85		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.3	25	0.0360	1.33		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.1	15	0.0500	4.54		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.4	38	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
12.4	310	Total			

Subcatchment SC-P1: Overland Flow to 244 Main



Summary for Subcatchment SC-P2: Proposed Development

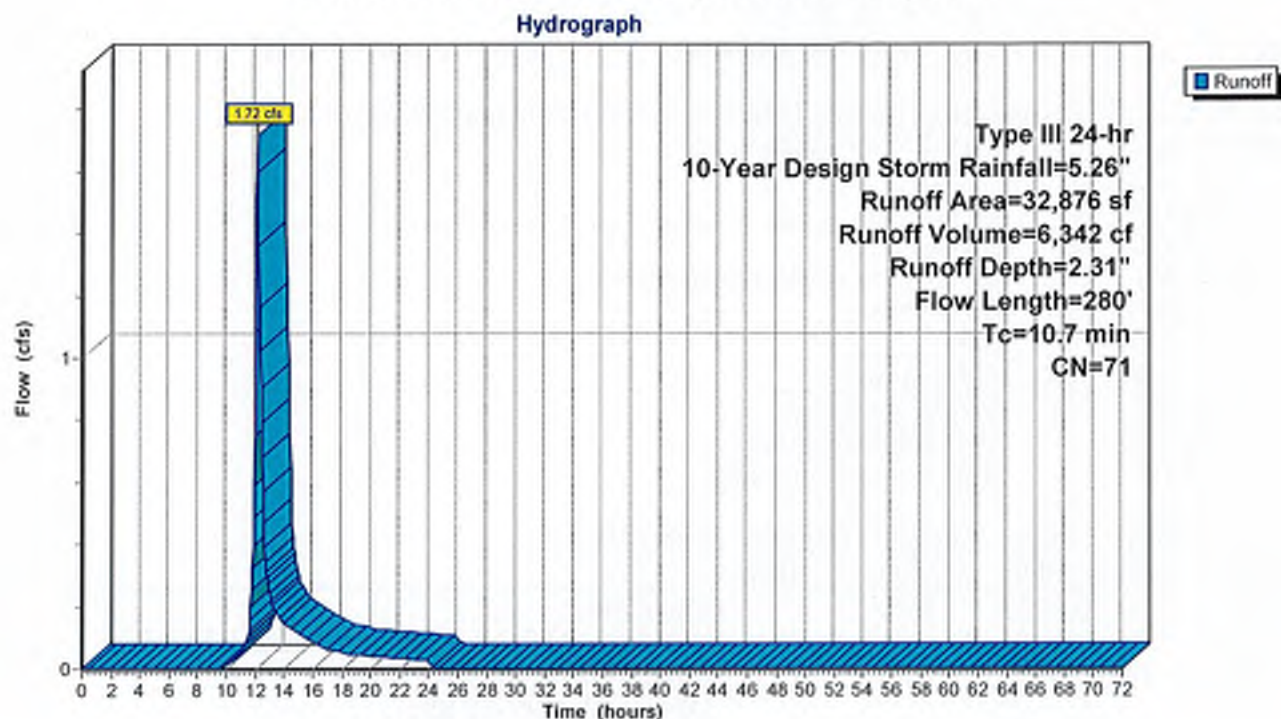
Runoff = 1.72 cfs @ 12.16 hrs, Volume= 6,342 cf, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Design Storm Rainfall=5.26"

	Area (sf)	CN	Description
*	8,886	98	Driveways
	13,027	61	>75% Grass cover, Good, HSG B
*	10,692	60	Woodlands
*	210	98	Patio
*	61	98	retaining wall
	32,876	71	Weighted Average
	23,719		72.15% Pervious Area
	9,157		27.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0520	0.10		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.37"
0.8	50	0.0480	1.10		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.1	13	0.0800	1.98		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
1.0	71	0.0300	1.21		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.1	19	0.1600	2.80		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.2	15	0.0400	1.40		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.3	62	0.0400	4.06		Shallow Concentrated Flow, Paved Kv= 20.3 fps
10.7	280	Total			

Subcatchment SC-P2: Proposed Development



Summary for Subcatchment SC-P3: South Lawn to Pond

Runoff = 0.36 cfs @ 12.10 hrs, Volume= 1,224 cf, Depth= 1.53"

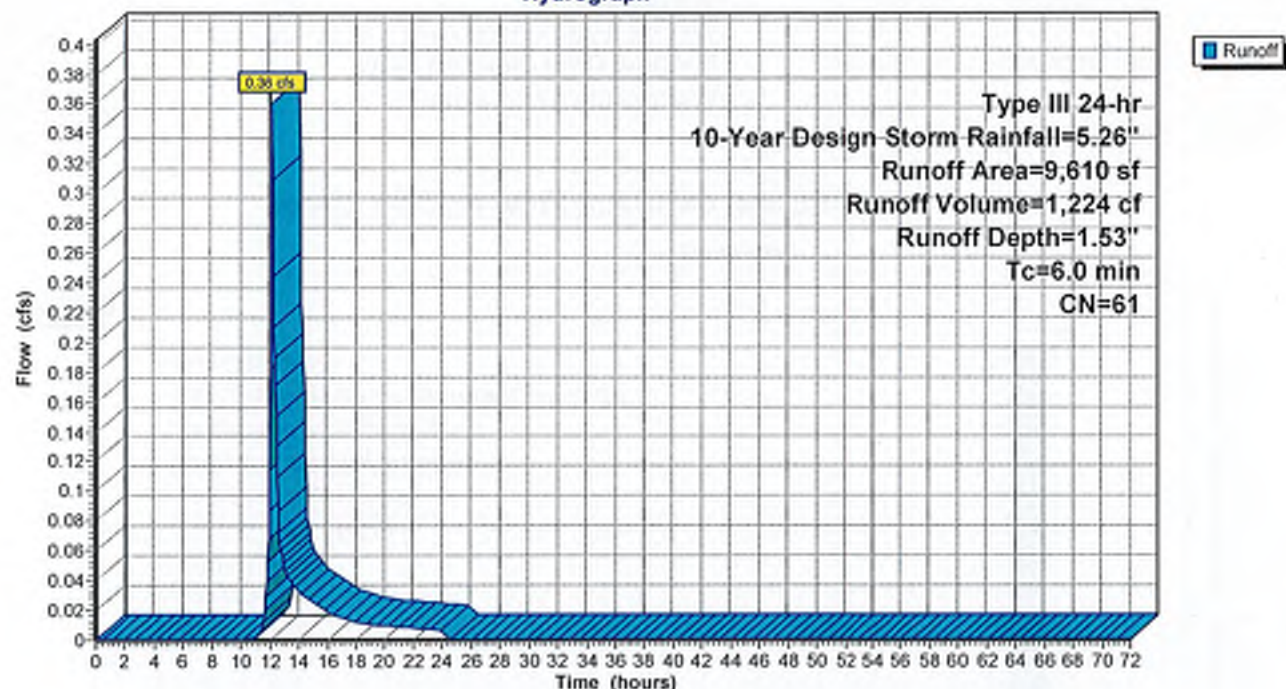
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Design Storm Rainfall=5.26"

Area (sf)	CN	Description
9,610	61	>75% Grass cover, Good, HSG B
9,610		100.00% Pervious Area

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

Subcatchment SC-P3: South Lawn to Pond

Hydrograph



Summary for Subcatchment SC-P4: Overland Flow to Main Street

Runoff = 0.35 cfs @ 12.17 hrs, Volume= 1,328 cf, Depth= 1.91"

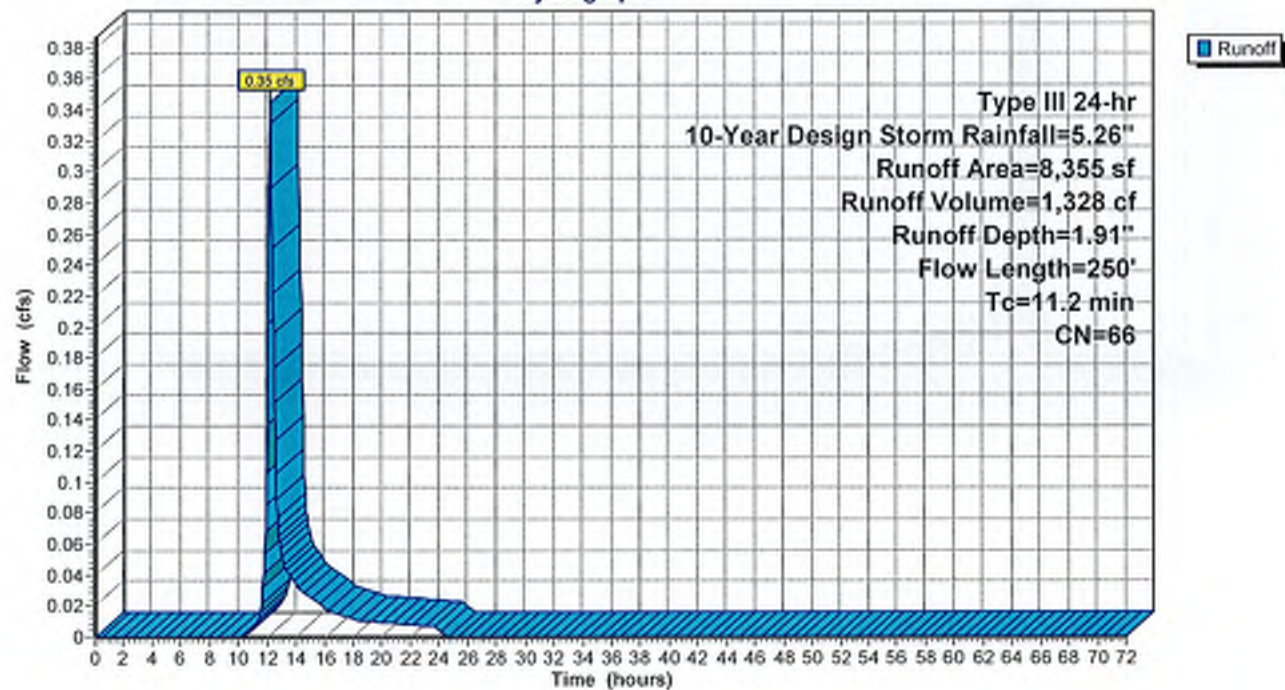
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Design Storm Rainfall=5.26"

Area (sf)	CN	Description
* 1,195	98	Impervious
5,106	61	>75% Grass cover, Good, HSG B
* 2,054	60	Woods
8,355	66	Weighted Average
7,160		85.70% Pervious Area
1,195		14.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0500	0.10		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.37"
2.9	200	0.0530	1.15		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
11.2	250	Total			

Subcatchment SC-P4: Overland Flow to Main Street

Hydrograph



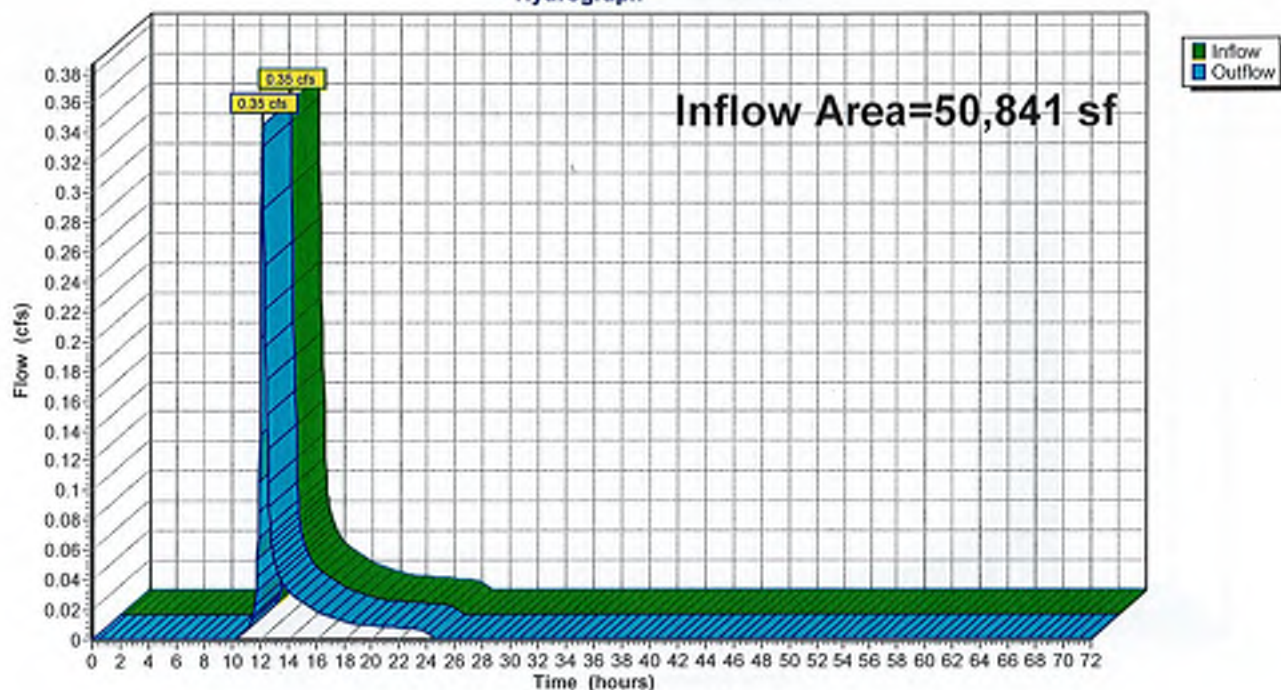
Summary for Reach DP-1: Main Street

Inflow Area = 50,841 sf, 20.36% Impervious, Inflow Depth = 0.31" for 10-Year Design Storm event
Inflow = 0.35 cfs @ 12.17 hrs, Volume= 1,328 cf
Outflow = 0.35 cfs @ 12.17 hrs, Volume= 1,328 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-1: Main Street

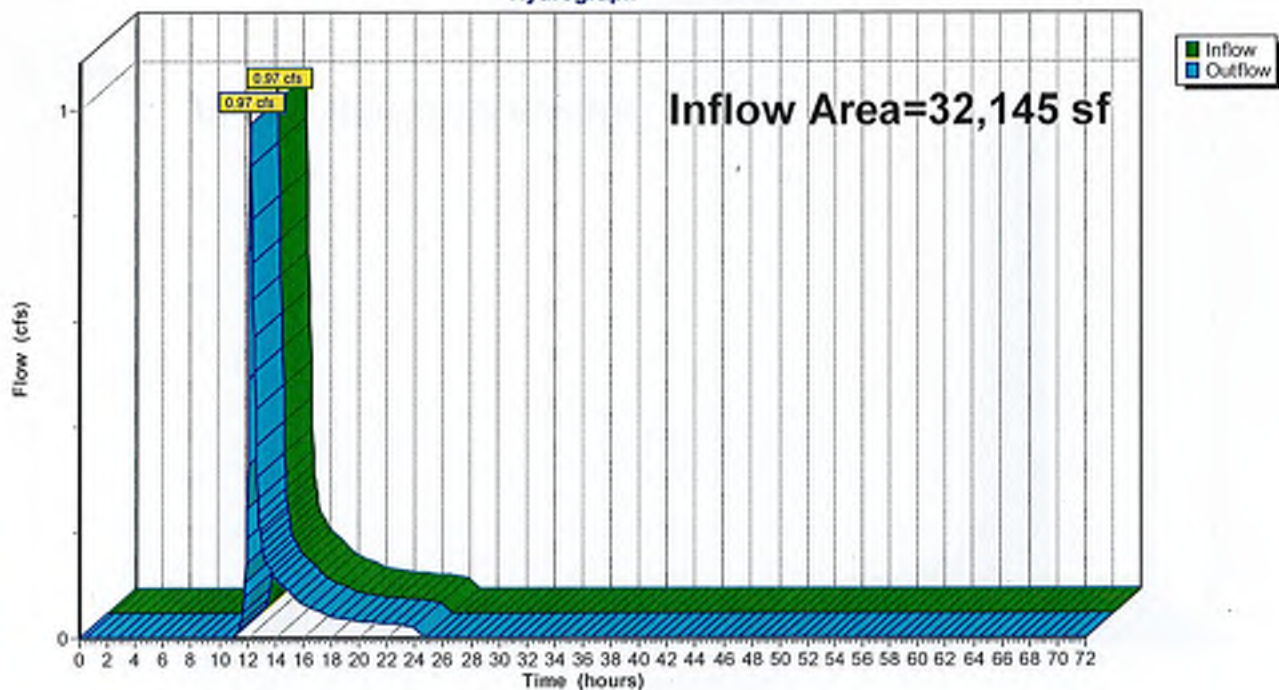
Hydrograph



Summary for Reach DP-2: 224 Main Street

Inflow Area = 32,145 sf, 3.05% Impervious, Inflow Depth = 1.53" for 10-Year Design Storm event
Inflow = 0.97 cfs @ 12.19 hrs, Volume= 4,093 cf
Outflow = 0.97 cfs @ 12.19 hrs, Volume= 4,093 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-2: 224 Main Street**Hydrograph**

Summary for Pond DB-1: Prop Detention Basin

Inflow Area = 42,486 sf, 21.55% Impervious, Inflow Depth = 2.14" for 10-Year Design Storm event
 Inflow = 2.02 cfs @ 12.15 hrs, Volume= 7,566 cf
 Outflow = 0.14 cfs @ 15.01 hrs, Volume= 7,566 cf, Atten= 93%, Lag= 171.6 min
 Discarded = 0.14 cfs @ 15.01 hrs, Volume= 7,566 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2

Peak Elev= 229.79' @ 15.01 hrs Surf.Area= 2,465 sf Storage= 3,746 cf

Flood Elev= 232.00' Surf.Area= 3,494 sf Storage= 10,313 cf

Plug-Flow detention time= 304.6 min calculated for 7,566 cf (100% of inflow)

Center-of-Mass det. time= 304.5 min (1,154.9 - 850.4)

Volume	Invert	Avail.Storage	Storage Description
#1	228.00'	10,313 cf	Main Infiltration Basin (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
228.00	1,744	183.8	0	0	1,744
229.00	2,135	201.4	1,936	1,936	2,317
230.00	2,558	218.0	2,343	4,280	2,909
231.00	3,014	233.8	2,783	7,062	3,521
232.00	3,494	246.4	3,251	10,313	4,059

Device	Routing	Invert	Outlet Devices
#1	Discarded	228.00'	2.410 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'
#2	Primary	231.00'	8.0' long x 8.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#3	Secondary	231.20'	24.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.14 cfs @ 15.01 hrs HW=229.79' (Free Discharge)

↑1=Exfiltration (Controls 0.14 cfs)

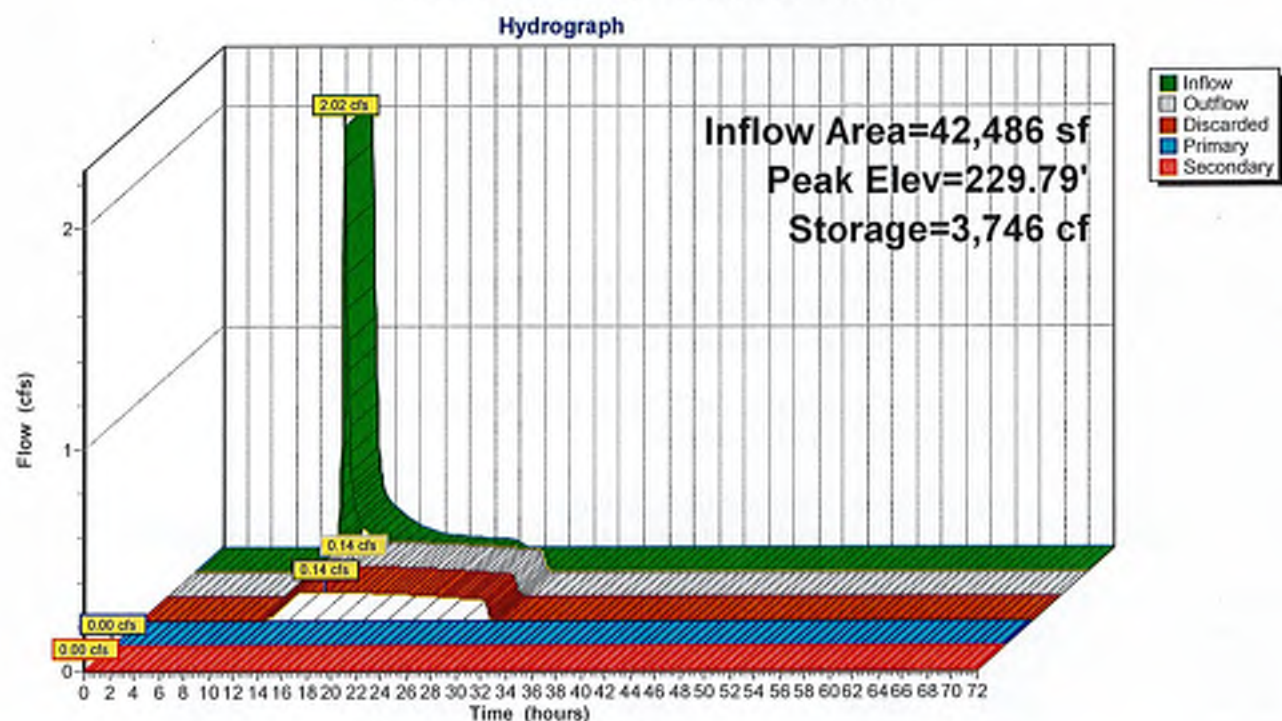
Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=228.00' (Free Discharge)

↑2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=228.00' (Free Discharge)

↑3=Orifice/Grate (Controls 0.00 cfs)

Pond DB-1: Prop Detention Basin



Summary for Pond DW-1: Chamber drywell

Inflow Area = 2,174 sf, 100.00% Impervious, Inflow Depth = 5.02" for 10-Year Design Storm event
 Inflow = 0.25 cfs @ 12.09 hrs, Volume= 910 cf
 Outflow = 0.02 cfs @ 11.40 hrs, Volume= 910 cf, Atten= 90%, Lag= 0.0 min
 Discarded = 0.02 cfs @ 11.40 hrs, Volume= 910 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Peak Elev= 230.25' @ 12.90 hrs Surf.Area= 430 sf Storage= 310 cf

Plug-Flow detention time= 88.2 min calculated for 909 cf (100% of inflow)
 Center-of-Mass det. time= 88.1 min (835.3 - 747.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	229.10'	391 cf	11.17'W x 38.50'L x 3.54'H Field A 1,523 cf Overall - 544 cf Embedded = 979 cf x 40.0% Voids
#2A	229.60'	544 cf	Cultec R-330XL x 10 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 2 rows
		935 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	229.10'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.02 cfs @ 11.40 hrs HW=229.14' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.02 cfs)

Pond DW-1: Chamber drywell - Chamber Wizard Field A**Chamber Model = Cultec R-330XL**

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 2 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

5 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 36.50' Row Length +12.0" End Stone x 2 = 38.50' Base Length

2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.17' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

10 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 2 Rows = 543.9 cf Chamber Storage

1,522.6 cf Field - 543.9 cf Chambers = 978.7 cf Stone x 40.0% Voids = 391.5 cf Stone Storage

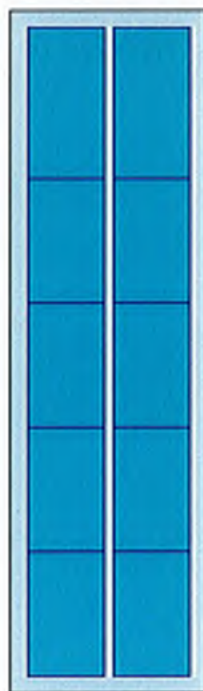
Stone + Chamber Storage = 935.4 cf = 0.021 af

Overall Storage Efficiency = 61.4%

10 Chambers

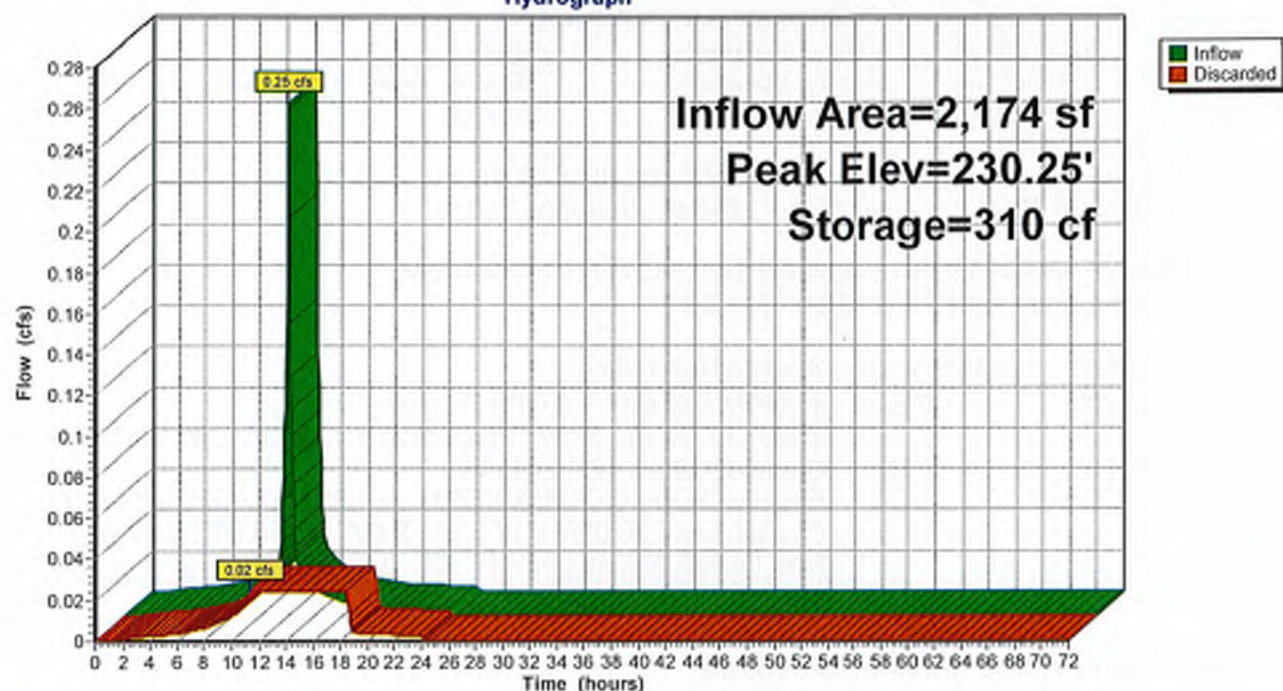
56.4 cy Field

36.2 cy Stone



Pond DW-1: Chamber drywell

Hydrograph



Summary for Pond DW-2: Chamber drywell Quad

Inflow Area = 6,891 sf, 100.00% Impervious, Inflow Depth = 5.02" for 10-Year Design Storm event
 Inflow = 0.80 cfs @ 12.09 hrs, Volume = 2,884 cf
 Outflow = 0.09 cfs @ 11.55 hrs, Volume = 2,884 cf, Atten = 89%, Lag = 0.0 min
 Discarded = 0.09 cfs @ 11.55 hrs, Volume = 2,884 cf

Routing by Stor-Ind method, Time Span = 0.00-72.00 hrs, dt = 0.05 hrs
 Peak Elev = 235.67' @ 12.73 hrs Surf. Area = 1,600 sf Storage = 908 cf

Plug-Flow detention time = 64.9 min calculated for 2,882 cf (100% of inflow)
 Center-of-Mass det. time = 64.8 min (812.0 - 747.2)

Volume	Invert	Avail. Storage	Storage Description
#1A	234.70'	995 cf	40.00'W x 40.00'L x 2.04'H Field A 3,267 cf Overall - 778 cf Embedded = 2,489 cf x 40.0% Voids
#2A	235.20'	778 cf	Cultec C-100 x 55 Inside #1 Effective Size = 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size = 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment = +0.50' x 1.86 sf x 11 rows
		1,774 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	234.70'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max = 0.09 cfs @ 11.55 hrs HW = 234.72' (Free Discharge)
 ↑ 1 = Exfiltration (Exfiltration Controls 0.09 cfs)

Pond DW-2: Chamber drywell Quad - Chamber Wizard Field A**Chamber Model = Cultec C-100**

Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 11 rows

36.0" Wide + 6.0" Spacing = 42.0" C-C Row Spacing

5 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 38.00' Row Length +12.0" End Stone x 2 = 40.00' Base Length

11 Rows x 36.0" Wide + 6.0" Spacing x 10 + 12.0" Side Stone x 2 = 40.00' Base Width

6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

55 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 11 Rows = 778.1 cf Chamber Storage

3,266.7 cf Field - 778.1 cf Chambers = 2,488.6 cf Stone x 40.0% Voids = 995.4 cf Stone Storage

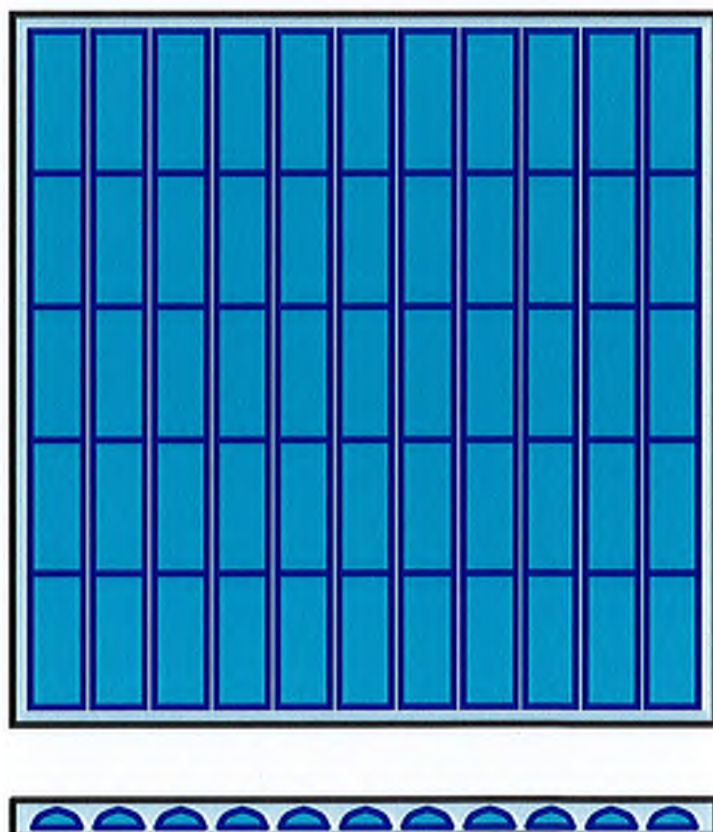
Stone + Chamber Storage = 1,773.5 cf = 0.041 af

Overall Storage Efficiency = 54.3%

55 Chambers

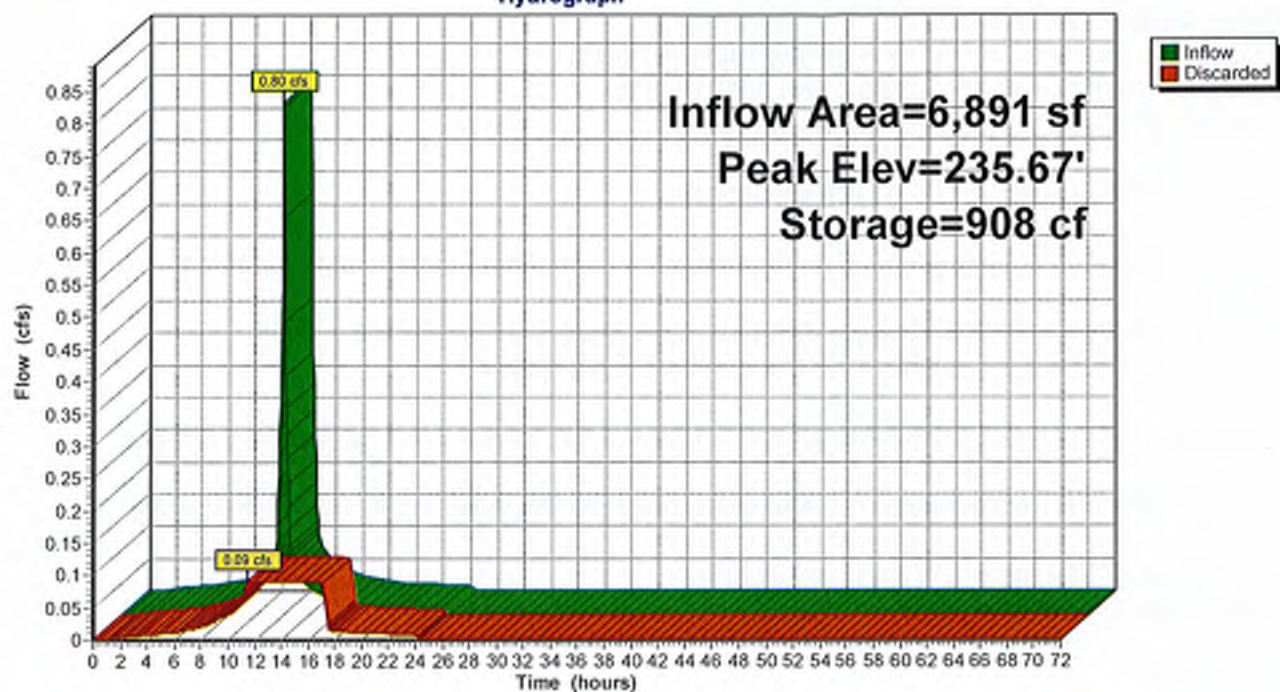
121.0 cy Field

92.2 cy Stone



Pond DW-2: Chamber drywell Quad

Hydrograph



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points

Runoff by SCS TR-20 method, UH=SCS

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

Subcatchment P-D: Quad RoofRunoff Area=6,891 sf 100.00% Impervious Runoff Depth=8.02"
Tc=6.0 min CN=98 Runoff=1.25 cfs 4,606 cf**Subcatchment P-ex: Existing Roofs**Runoff Area=2,174 sf 100.00% Impervious Runoff Depth=8.02"
Tc=6.0 min CN=98 Runoff=0.40 cfs 1,453 cf**Subcatchment SC-P1: Dverland Flow to 244**Runoff Area=32,145 sf 3.05% Impervious Runoff Depth=3.64"
Flow Length=310' Tc=12.4 min CN=61 Runoff=2.50 cfs 9,762 cf**Subcatchment SC-P2: Proposed**Runoff Area=32,876 sf 27.85% Impervious Runoff Depth=4.81"
Flow Length=280' Tc=10.7 min CN=71 Runoff=3.60 cfs 13,166 cf**Subcatchment SC-P3: South Lawn to Pond**Runoff Area=9,610 sf 0.00% Impervious Runoff Depth=3.64"
Tc=6.0 min CN=61 Runoff=0.92 cfs 2,918 cf**Subcatchment SC-P4: Dverland Flow to**Runoff Area=8,355 sf 14.30% Impervious Runoff Depth=4.22"
Flow Length=250' Tc=11.2 min CN=66 Runoff=0.79 cfs 2,939 cf**Reach DP-1: Main Street**Inflow=0.88 cfs 5,709 cf
Outflow=0.88 cfs 5,709 cf**Reach DP-2: 224 Main Street**Inflow=2.50 cfs 9,762 cf
Outflow=2.50 cfs 9,762 cf**Pond DB-1: Prop Detention Basin**Peak Elev=231.11' Storage=7,394 cf Inflow=4.37 cfs 16,085 cf
Discarded=0.17 cfs 13,314 cf Primary=0.71 cfs 2,770 cf Secondary=0.00 cfs 0 cf Outflow=0.88 cfs 16,084 cf**Pond DW-1: Chamber drywell**Peak Elev=231.13' Storage=593 cf Inflow=0.40 cfs 1,453 cf
Outflow=0.02 cfs 1,453 cf**Pond DW-2: Chamber drywell Quad**Peak Elev=236.69' Storage=1,739 cf Inflow=1.25 cfs 4,606 cf
Outflow=0.09 cfs 4,606 cfTotal Runoff Area = 92,051 sf Runoff Volume = 34,844 cf Average Runoff Depth = 4.54"
77.84% Pervious = 71,655 sf 22.16% Impervious = 20,396 sf

Summary for Subcatchment P-D: Quad Roof

Runoff = 1.25 cfs @ 12.09 hrs, Volume= 4,606 cf, Depth= 8.02"

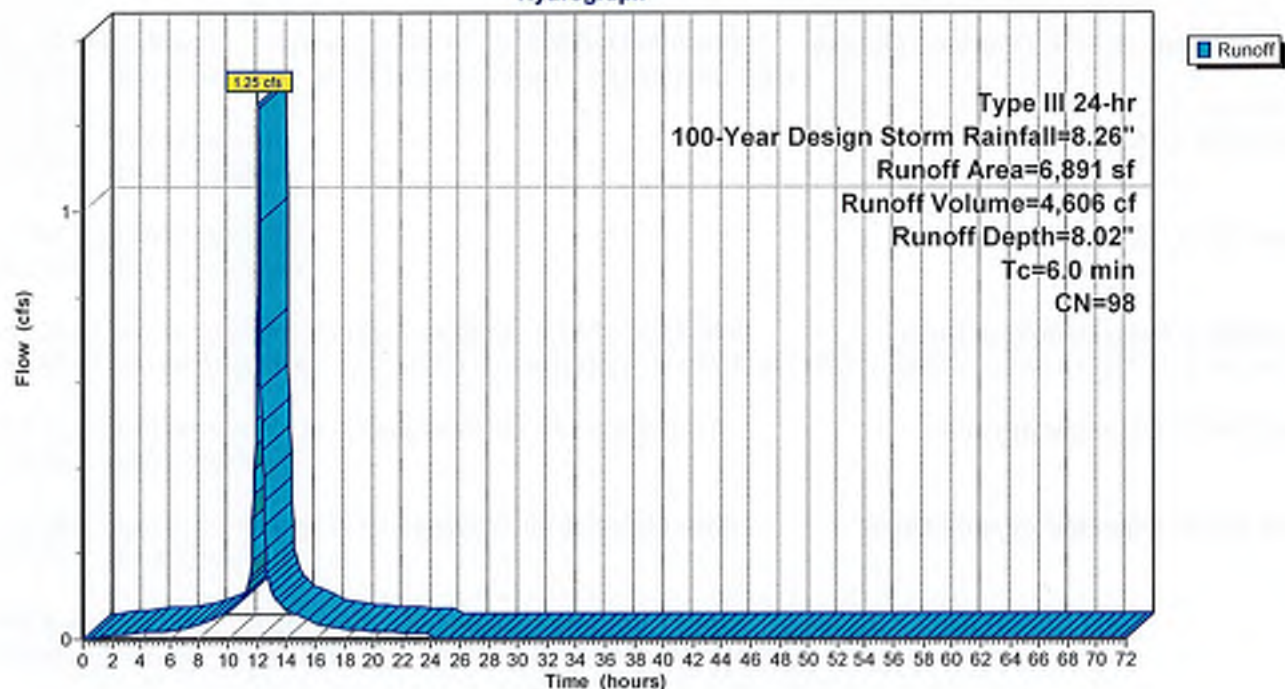
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Design Storm Rainfall=8.26"

Area (sf)	CN	Description
6,891	98	Roofs, HSG B
6,891		100.00% Impervious Area

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

Subcatchment P-D: Quad Roof

Hydrograph



Summary for Subcatchment P-ex: Existing Roofs

Runoff = 0.40 cfs @ 12.09 hrs, Volume= 1,453 cf, Depth= 8.02"

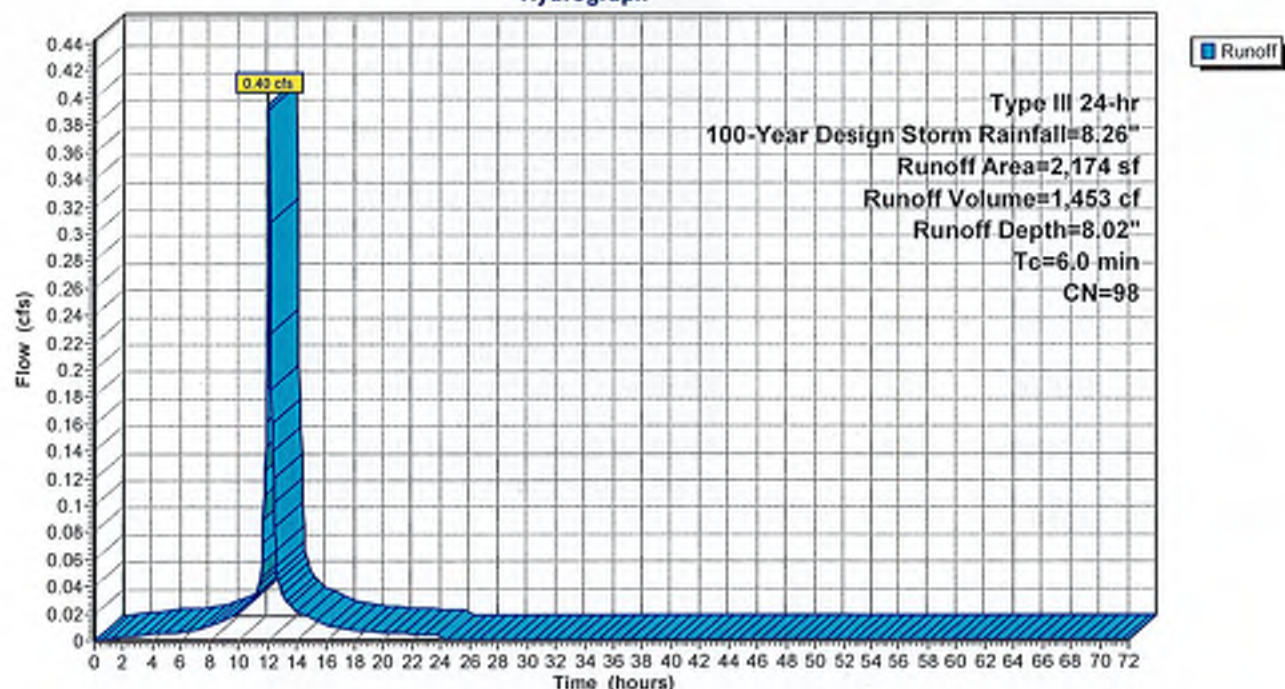
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Design Storm Rainfall=8.26"

Area (sf)	CN	Description
2,174	98	Roofs, HSG B
2,174		100.00% Impervious Area

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

Subcatchment P-ex: Existing Roofs

Hydrograph



Summary for Subcatchment SC-P1: Overland Flow to 244 Main

Runoff = 2.50 cfs @ 12.18 hrs, Volume= 9,762 cf, Depth= 3.64"

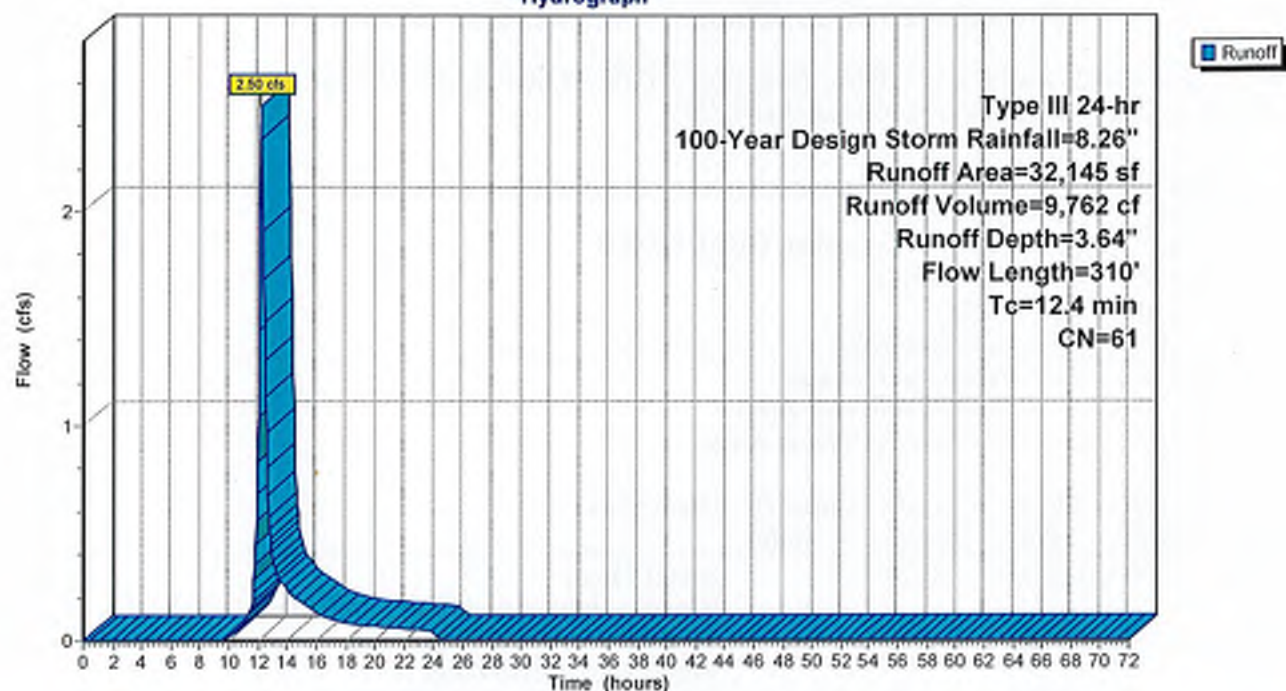
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Design Storm Rainfall=8.26"

Area (sf)	CN	Description
6,855	61	>75% Grass cover, Good, HSG B
24,311	60	Woods, Fair, HSG B
* 979	98	patios
32,145	61	Weighted Average
31,166		96.95% Pervious Area
979		3.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	50	0.0460	0.10		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.37"
0.8	36	0.0200	0.71		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.7	50	0.0300	1.21		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
1.4	81	0.0200	0.99		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.1	15	0.0360	3.85		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.3	25	0.0360	1.33		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.1	15	0.0500	4.54		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.4	38	0.0500	1.57		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
12.4	310	Total			

Subcatchment SC-P1: Overland Flow to 244 Main

Hydrograph



Summary for Subcatchment SC-P2: Proposed Development

Runoff = 3.60 cfs @ 12.15 hrs, Volume= 13,166 cf, Depth= 4.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

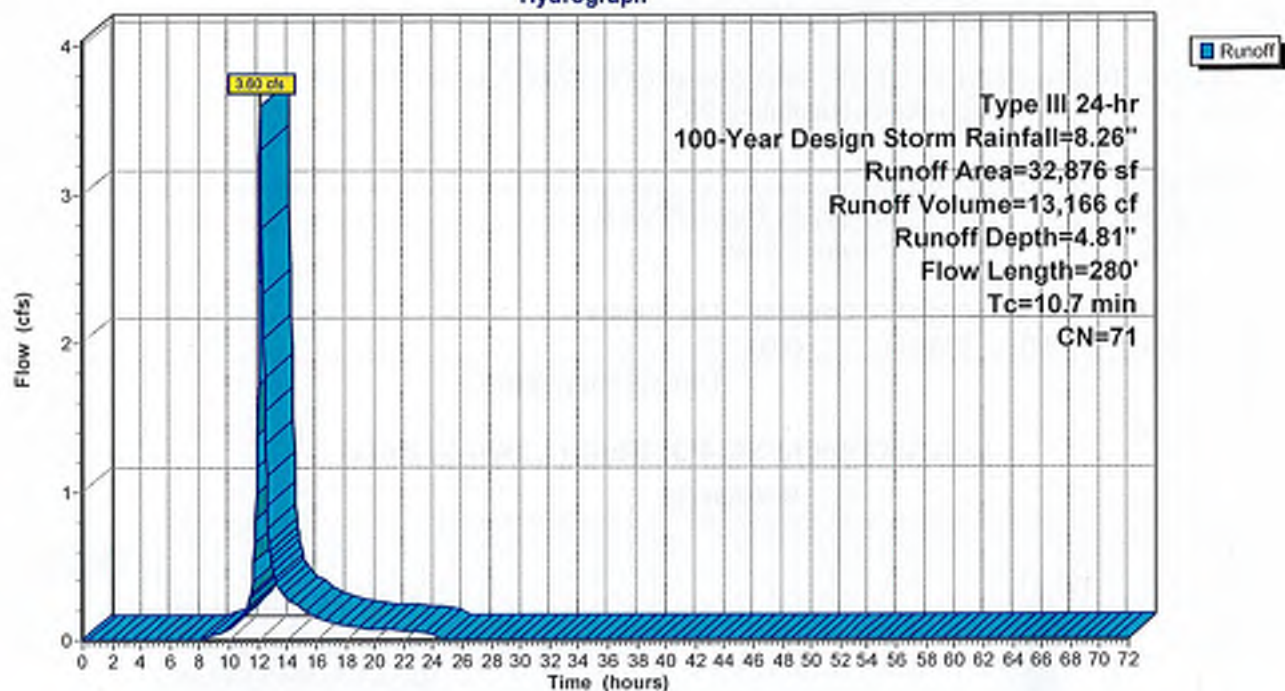
Type III 24-hr 100-Year Design Storm Rainfall=8.26"

	Area (sf)	CN	Description
*	8,886	98	Driveways
	13,027	61	>75% Grass cover, Good, HSG B
*	10,692	60	Woodlands
*	210	98	Patio
*	61	98	retaining wall
	32,876	71	Weighted Average
	23,719		72.15% Pervious Area
	9,157		27.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0520	0.10		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.37"
0.8	50	0.0480	1.10		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.1	13	0.0800	1.98		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
1.0	71	0.0300	1.21		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.1	19	0.1600	2.80		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.2	15	0.0400	1.40		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.3	62	0.0400	4.06		Shallow Concentrated Flow, Paved Kv= 20.3 fps
10.7	280	Total			

Subcatchment SC-P2: Proposed Development

Hydrograph



Summary for Subcatchment SC-P3: South Lawn to Pond

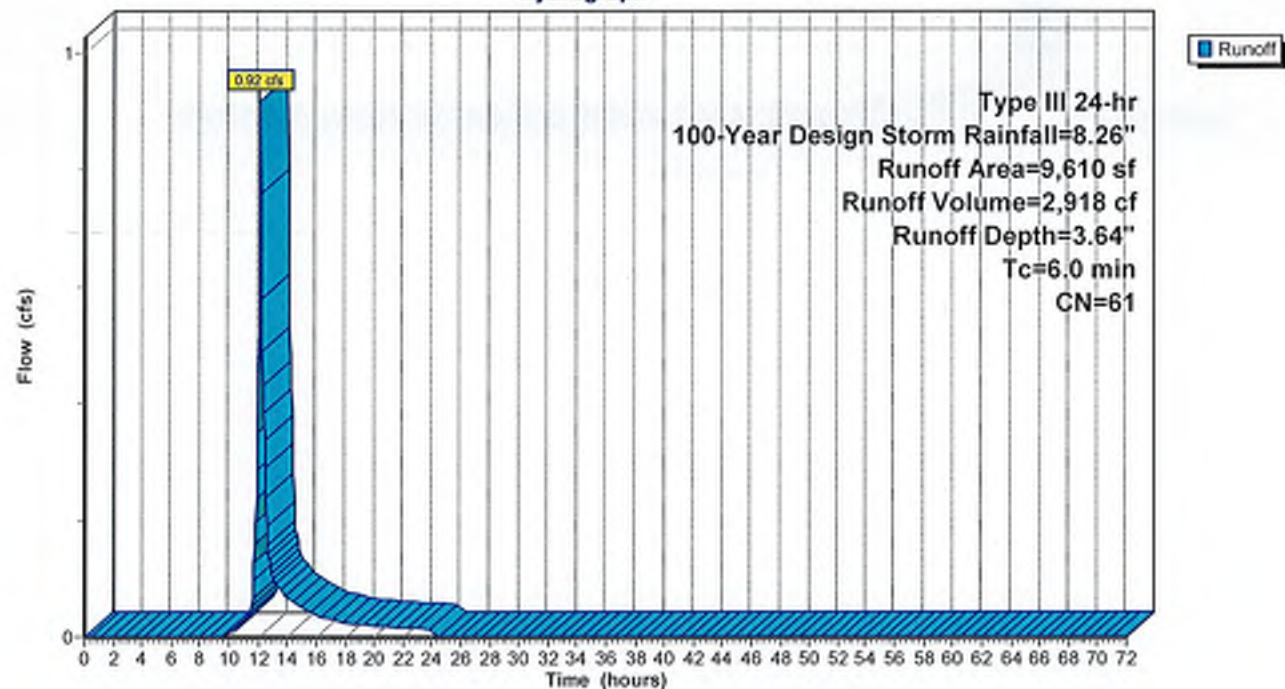
Runoff = 0.92 cfs @ 12.10 hrs, Volume= 2,918 cf, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Type III 24-hr 100-Year Design Storm Rainfall=8.26"

Area (sf)	CN	Description
9,610	61	>75% Grass cover, Good, HSG B
9,610		100.00% Pervious Area

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

Subcatchment SC-P3: South Lawn to Pond**Hydrograph**

Summary for Subcatchment SC-P4: Overland Flow to Main Street

Runoff = 0.79 cfs @ 12.16 hrs, Volume= 2,939 cf, Depth= 4.22"

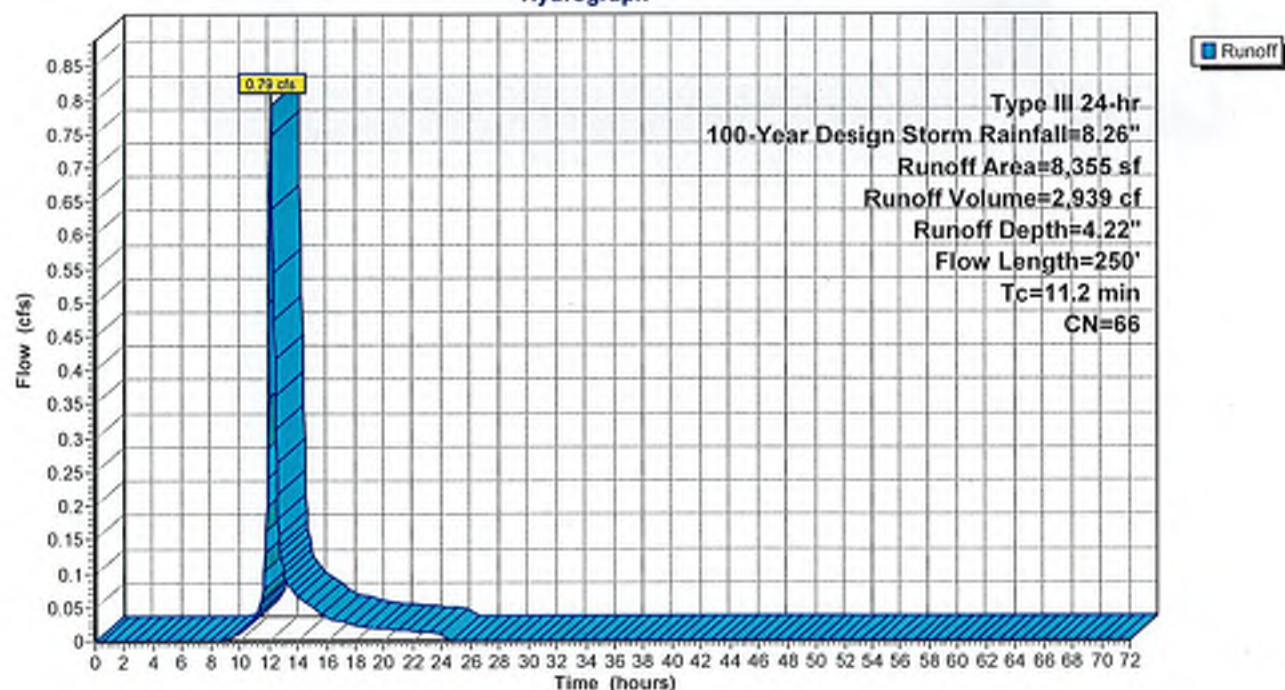
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Design Storm Rainfall=8.26"

Area (sf)	CN	Description
* 1,195	98	Impervious
5,106	61	>75% Grass cover, Good, HSG B
* 2,054	60	Woods
8,355	66	Weighted Average
7,160		85.70% Pervious Area
1,195		14.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0500	0.10		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.37"
2.9	200	0.0530	1.15		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
11.2	250	Total			

Subcatchment SC-P4: Overland Flow to Main Street

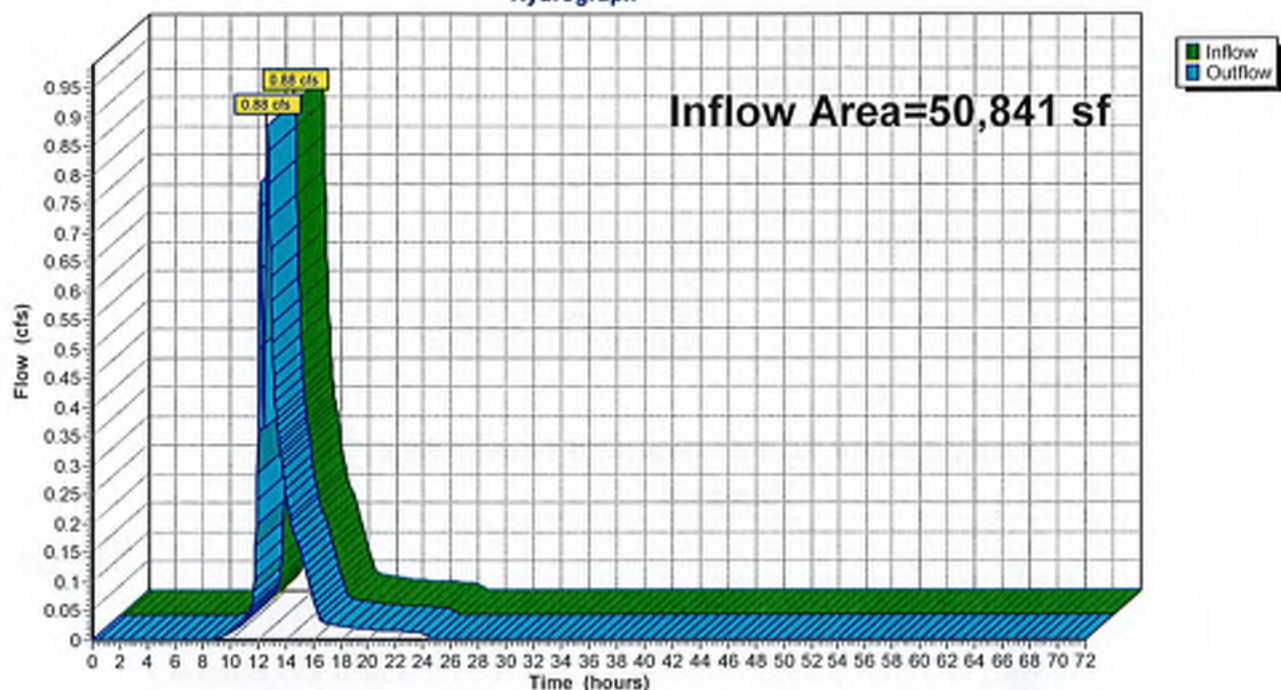
Hydrograph



Summary for Reach DP-1: Main Street

Inflow Area = 50,841 sf, 20.36% Impervious, Inflow Depth = 1.35" for 100-Year Design Storm event
Inflow = 0.88 cfs @ 12.65 hrs, Volume= 5,709 cf
Outflow = 0.88 cfs @ 12.65 hrs, Volume= 5,709 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-1: Main Street**Hydrograph**

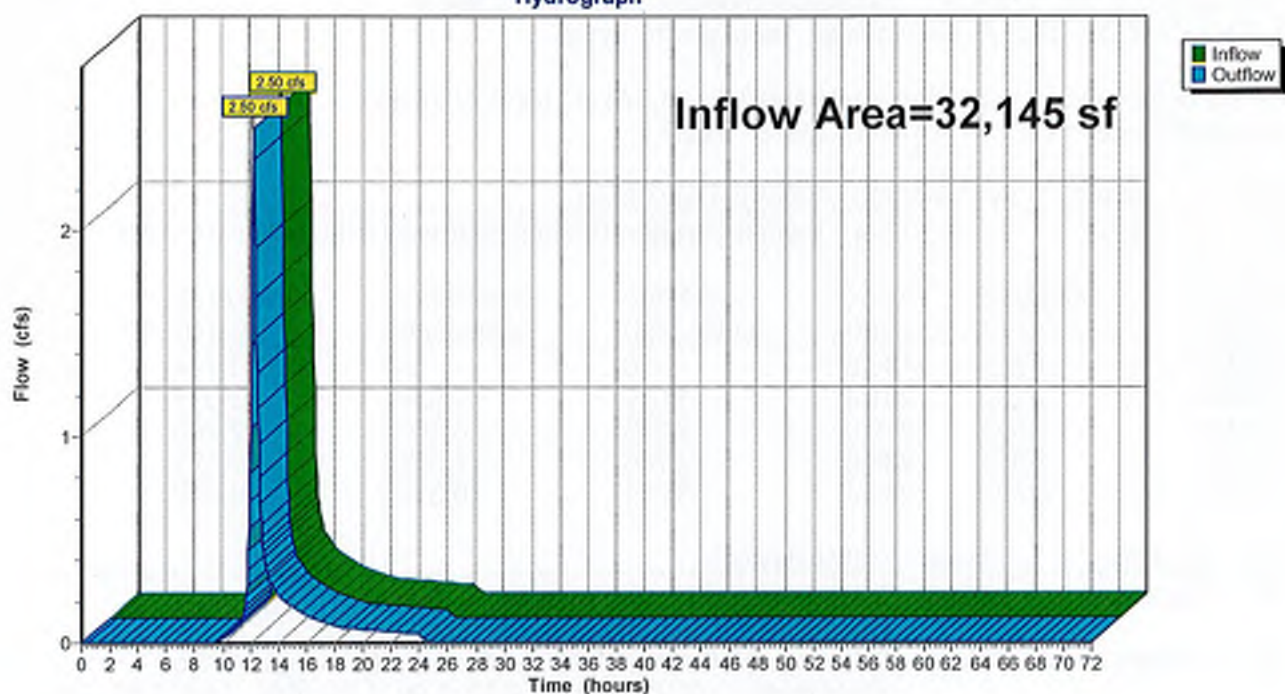
Summary for Reach DP-2: 224 Main Street

Inflow Area = 32,145 sf, 3.05% Impervious, Inflow Depth = 3.64" for 100-Year Design Storm event
Inflow = 2.50 cfs @ 12.18 hrs, Volume= 9,762 cf
Outflow = 2.50 cfs @ 12.18 hrs, Volume= 9,762 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-2: 224 Main Street

Hydrograph



Summary for Pond DB-1: Prop Detention Basin

Inflow Area = 42,486 sf, 21.55% Impervious, Inflow Depth = 4.54" for 100-Year Design Storm event
 Inflow = 4.37 cfs @ 12.14 hrs, Volume= 16,085 cf
 Outflow = 0.88 cfs @ 12.66 hrs, Volume= 16,084 cf, Atten= 80%, Lag= 31.5 min
 Discarded = 0.17 cfs @ 12.66 hrs, Volume= 13,314 cf
 Primary = 0.71 cfs @ 12.66 hrs, Volume= 2,770 cf
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 231.11' @ 12.66 hrs Surf.Area= 3,065 sf Storage= 7,394 cf
 Flood Elev= 232.00' Surf.Area= 3,494 sf Storage= 10,313 cf

Plug-Flow detention time= 401.6 min calculated for 16,073 cf (100% of inflow)
 Center-of-Mass det. time= 401.8 min (1,230.5 - 828.7)

Volume	Invert	Avail. Storage	Storage Description
#1	228.00'	10,313 cf	Main Infiltration Basin (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
228.00	1,744	183.8	0	0	1,744
229.00	2,135	201.4	1,936	1,936	2,317
230.00	2,558	218.0	2,343	4,280	2,909
231.00	3,014	233.8	2,783	7,062	3,521
232.00	3,494	246.4	3,251	10,313	4,059

Device	Routing	Invert	Outlet Devices
#1	Discarded	228.00'	2.410 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'
#2	Primary	231.00'	8.0' long x 8.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.86 2.64 2.84 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
#3	Secondary	231.20'	24.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

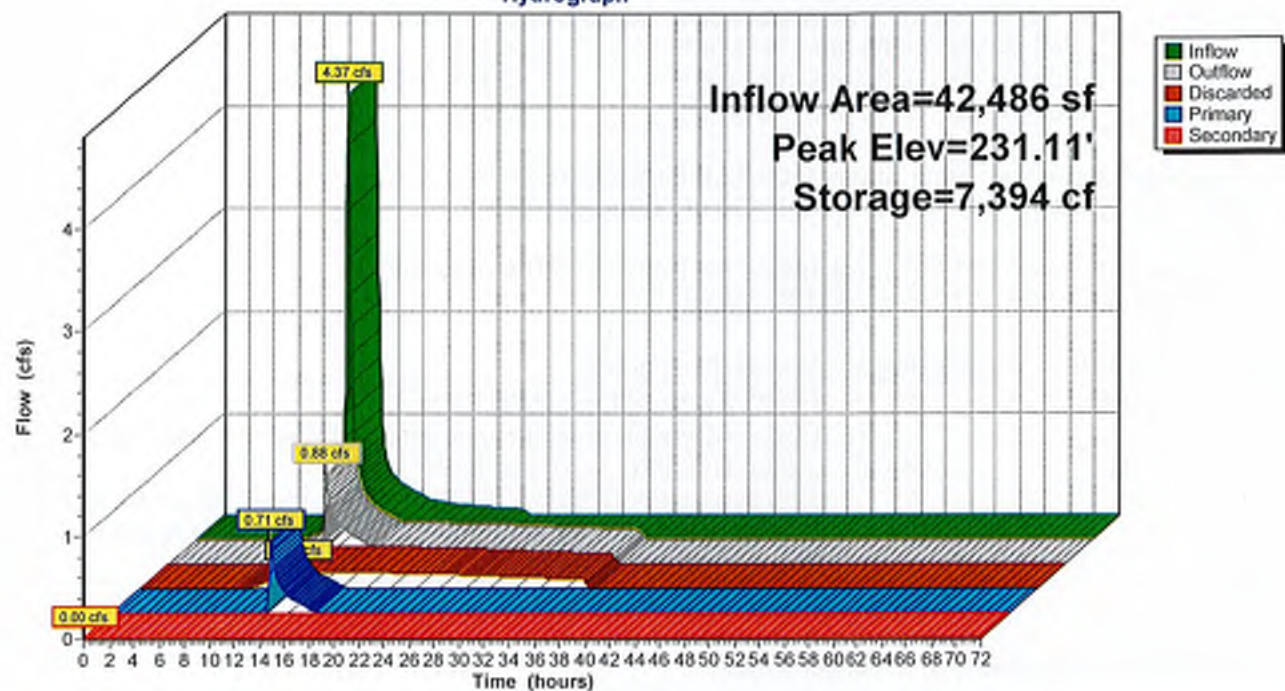
Discarded OutFlow Max=0.17 cfs @ 12.66 hrs HW=231.11' (Free Discharge)
 ↳1=Exfiltration (Controls 0.17 cfs)

Primary OutFlow Max=0.69 cfs @ 12.66 hrs HW=231.11' (Free Discharge)
 ↳2=Broad-Crested Rectangular Weir (Weir Controls 0.69 cfs @ 0.80 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=228.00' (Free Discharge)
 ↳3=Orifice/Grate (Controls 0.00 cfs)

Pond DB-1: Prop Detention Basin

Hydrograph



Summary for Pond DW-1: Chamber drywell

Inflow Area = 2,174 sf, 100.00% Impervious, Inflow Depth = 8.02" for 100-Year Design Storm event
 Inflow = 0.40 cfs @ 12.09 hrs, Volume = 1,453 cf
 Outflow = 0.02 cfs @ 10.60 hrs, Volume = 1,453 cf, Atten = 94%, Lag = 0.0 min
 Discarded = 0.02 cfs @ 10.60 hrs, Volume = 1,453 cf

Routing by Stor-Ind method, Time Span = 0.00-72.00 hrs, dt = 0.05 hrs
 Peak Elev = 231.13' @ 13.73 hrs Surf.Area = 430 sf Storage = 593 cf

Plug-Flow detention time = 191.2 min calculated for 1,452 cf (100% of inflow)

Center-of-Mass det. time = 191.1 min (931.9 - 740.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	229.10'	391 cf	11.17'W x 38.50'L x 3.54'H Field A 1,523 cf Overall - 544 cf Embedded = 979 cf x 40.0% Voids
#2A	229.60'	544 cf	Cultec R-330XL x 10 Inside #1 Effective Size = 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size = 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment = +1.50' x 7.45 sf x 2 rows
		935 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	229.10'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max = 0.02 cfs @ 10.60 hrs HW = 229.14' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Pond DW-1: Chamber drywell - Chamber Wizard Field A**Chamber Model = Cultec R-330XL**

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 2 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

5 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 36.50' Row Length +12.0" End Stone x 2 = 38.50' Base Length

2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.17' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

10 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 2 Rows = 543.9 cf Chamber Storage

1,522.6 cf Field - 543.9 cf Chambers = 978.7 cf Stone x 40.0% Voids = 391.5 cf Stone Storage

Stone + Chamber Storage = 935.4 cf = 0.021 af

Overall Storage Efficiency = 61.4%

10 Chambers

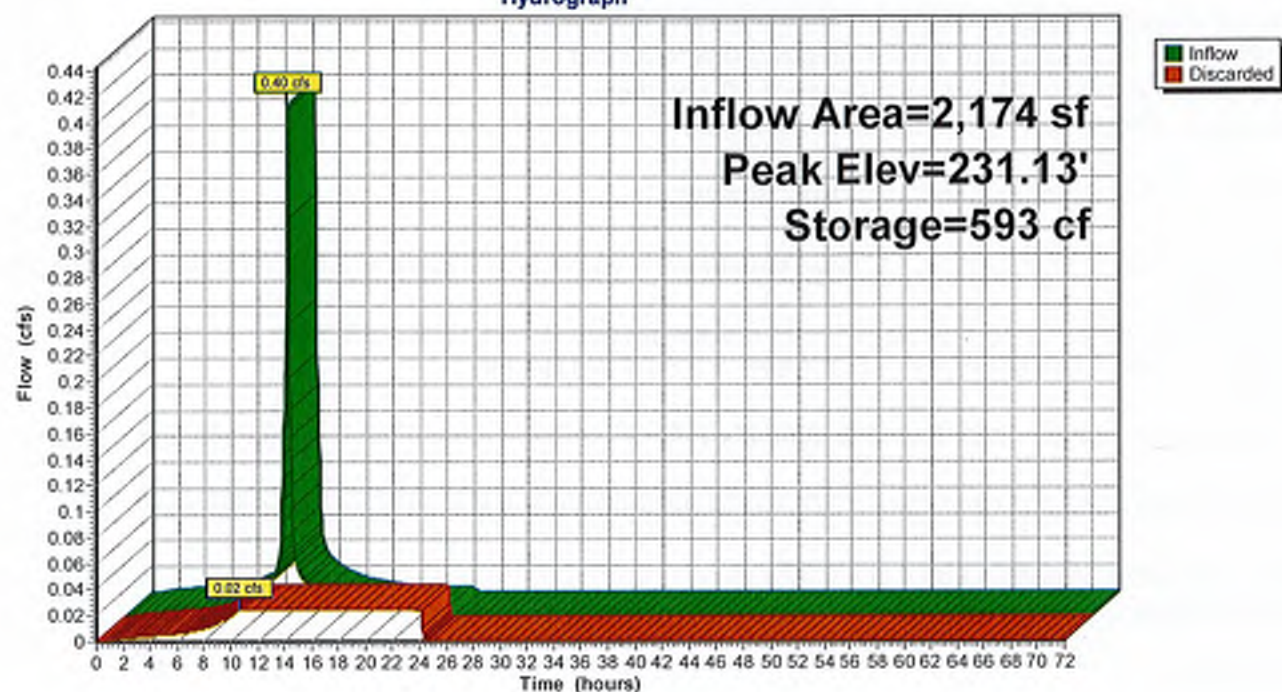
56.4 cy Field

36.2 cy Stone



Pond DW-1: Chamber drywell

Hydrograph



Summary for Pond DW-2: Chamber drywell Quad

Inflow Area = 6,891 sf, 100.00% Impervious, Inflow Depth = 8.02" for 100-Year Design Storm event
 Inflow = 1.25 cfs @ 12.09 hrs, Volume= 4,606 cf
 Outflow = 0.09 cfs @ 10.95 hrs, Volume= 4,606 cf, Atten= 93%, Lag= 0.0 min
 Discarded = 0.09 cfs @ 10.95 hrs, Volume= 4,606 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Peak Elev= 236.69' @ 13.31 hrs Surf.Area= 1,600 sf Storage= 1,739 cf

Plug-Flow detention time= 142.9 min calculated for 4,602 cf (100% of inflow)
 Center-of-Mass det. time= 142.8 min (883.6 - 740.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	234.70'	995 cf	40.00'W x 40.00'L x 2.04'H Field A 3,267 cf Overall - 778 cf Embedded = 2,489 cf x 40.0% Voids
#2A	235.20'	778 cf	Cultec C-100 x 55 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 11 rows
		1,774 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	234.70'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.09 cfs @ 10.95 hrs HW=234.72' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.09 cfs)

Pond DW-2: Chamber drywell Quad - Chamber Wizard Field A**Chamber Model = Cultec C-100**

Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 11 rows

36.0" Wide + 6.0" Spacing = 42.0" C-C Row Spacing

5 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 38.00' Row Length +12.0" End Stone x 2 = 40.00' Base Length

11 Rows x 36.0" Wide + 6.0" Spacing x 10 + 12.0" Side Stone x 2 = 40.00' Base Width

6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

55 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 11 Rows = 778.1 cf Chamber Storage

3,266.7 cf Field - 778.1 cf Chambers = 2,488.6 cf Stone x 40.0% Voids = 995.4 cf Stone Storage

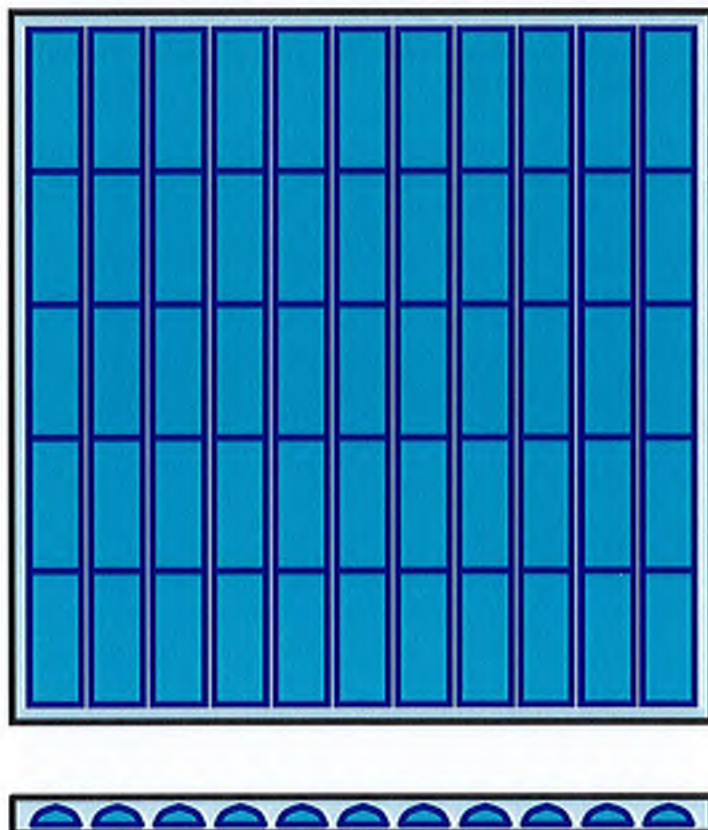
Stone + Chamber Storage = 1,773.5 cf = 0.041 af

Overall Storage Efficiency = 54.3%

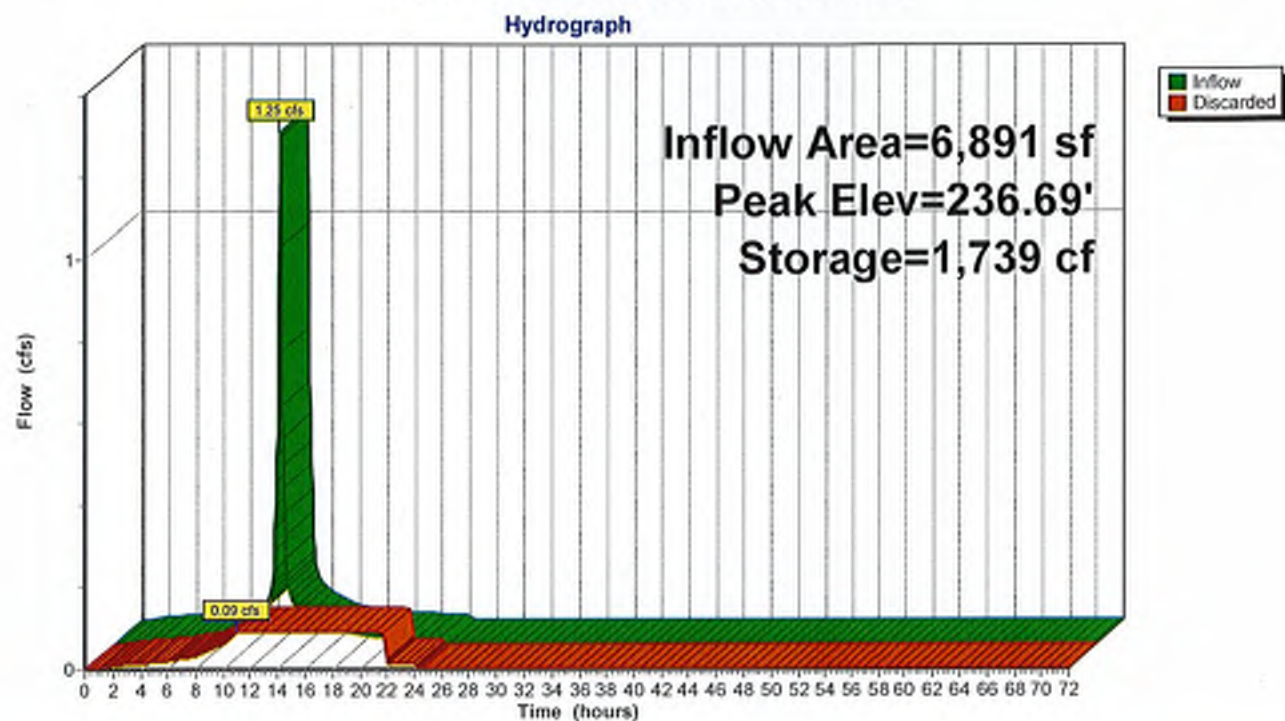
55 Chambers

121.0 cy Field

92.2 cy Stone



Pond DW-2: Chamber drywell Quad



WATER QUALITY

MASSACHUSETTS STORMWATER MANAGEMENT STANDARDS

Standard #1: No New Untreated Discharges

Developmental Measures:

The proposed development on this site includes the construction of four new housing units in the form of one new building. A driveway will also be constructed to serve the new building. The two existing single-family homes on the property will remain, however the existing driveway will be reconstructed as part of the proposed driveway. The existing pool and shed will be removed.

To account for increased impervious from the new development, several stormwater management devices are proposed. Two subsurface infiltration systems are proposed to serve all three buildings (two existing and one proposed) on the site. These chambers will serve as drywells and are sized to infiltrate storms up to and including the 100-year storm event. Downspouts on all structures shall be fitted with overflows for larger storm events. Runoff from the remainder of the developed site shall be routed to a detention basin via deep sump catch basins and CDS treatment unit. The detention basin is sized to contain the 100-year storm, however the rim elevation of the upstream catchbasins have been set such that additional flow can backwater into the catchbasins and flow overland to the municipal system on Main Street.

Standard #2: Peak Rate Attenuation

SUMMARY OF COMPUTATIONS

DEP Stormwater Management Regulations as well as Medway's Stormwater and Land Disturbance Bylaw both stipulate that no increase in the rate nor volume of stormwater runoff is allowed between existing and proposed conditions on a site. The following table shows peak flow rates and runoff volumes for this site and demonstrate that no increase for either parameter is seen.

Design Point	2 Yr.		10 Yr.		100 Yr.	
Peak Flow (cfs)						
DP-1	0.47	0.11	1.28	0.35	2.78	0.88
OP-2	0.24	0.24	0.97	0.97	2.53	2.50

Design Point	2 Yr.		10 Yr.		100 Yr.	
Runoff Volume (cf)						
DP-1	2,529	509	6,196	1,328	13,201	5,709
DP-2	1,890	1,381	5,772	4,093	13,996	9,762

	Existing
	Proposed

Standard #3: Recharge Calculations

Based on the DEP Stormwater Handbook, a "Rawls" infiltration rate has been utilized for and Subsurface Infiltration Chamber Design. The NRCS Hydrologic Soil Group rating for site hydrology is "B" based on NRCS soil maps. On-site soil testing performed in April of 2020 revealed a layer of sandy loam underlain by loamy sand. As such, the chamber systems, which will be placed below existing grade in the loamy sand layer, were designed based on a Rawls Infiltration rate of 2.41 in/hr. This is consistent with HSG Type "A" soils. The detention basin, which will be constructed above existing grade and will therefore dewater into the sandy loam layer, was designed based on a Rawls Infiltration rate of 1.02 in/hr. This is consistent with Type "B" soils found at the surface across the site. Mounding and dewatering calculations were performed for each component consistent with the Rawls Rates noted above. NRCS data and test pit information supporting this can be found in the "Soils Information" section of this report.

The Required Recharge Volume (Rv):

This project is required to meet this Standard to the maximum extent practicable, but fully complies as designed. There are currently approximately 10,473 sf of impervious areas on the site. Under proposed conditions, the amount of impervious area would increase to 20,396 sf.

Total impervious on site = 20,396 sf

$R_v = F * \text{Impervious Area}$

F = Target Depth Factor associated with Hydrological Soil Group; HSG = 0.35 inches

$R_v = [(0.35 \text{ in})(20,396 \text{ sf})]/(12 \text{ in/ft}) = 594.9 \text{ ft}^3$

Recharge volume provided by DB-1 : 10,313 ft³

Therefore, the total recharge volume provided is 10,313 ft³ > 594.95 ft³ required. OKAY

Drawdown Within 72 Hours

$$Time_{drawdown} = \frac{R_v}{(K)(\text{Bottom Area})(n)}$$

Rv = Storage Volume (recharge volume provided)%

K = Saturated Hydraulic Conductivity (1.02 in/hr for PP-1, 2.41 in/hr for dry wells)

Bottom Area = Bottom Area of Recharge Structure

n = porosity of the stone; if applicable

DB-1

$Time_{drawdown} \text{ SIS} = 10,313 \text{ cu.ft} / (2.41 \text{ in/hr} * 1/12 \text{ ft/in} * 3,494 \text{ sq.ft.}) = 14.7 \text{ hrs} < 72 \text{ hrs}$

DW-1

$Time_{drawdown} \text{ SIS} = 593 \text{ cu.ft} / (2.41 \text{ in/hr} * 1/12 \text{ ft/in} * 430 \text{ sq.ft.}) = 6.9 \text{ hrs} < 72 \text{ hrs}$

DW-2

$Time_{drawdown} \text{ SIS} = 1,739 \text{ cu.ft} / (2.41 \text{ in/hr} * 1/12 \text{ ft/in} * 1,600 \text{ sq.ft.}) = 5.4 \text{ hrs} < 72 \text{ hrs}$

Standard #4: Water Quality Volume Calculations

The Water Quality Treatment Volume (V_{WQ}):

$$V_{WQ} = (D_{WQ}/12 \text{ inches/foot}) * (A_{IMP})$$

$D_{WQ} = 1 \text{ inch}$ (required water quality volume)

$A_{IMP} = 11,331 \text{ sf}$ (does not include building roofs)

$$V_{WQ}(\text{Proposed}) = (1 \text{ inch}/12 \text{ inches/foot}) * (11,331 \text{ sf}) = \boxed{944 \text{ ft}^3}$$

➔ 7,062 ft^3 provided by detention basin DB-1 (below 231.0)

TSS Removal Rate

Using deep sump catch basins, a CDS treatment unit, and a detention basin, a TSS removal efficiency of 95% is achieved. See attached TSS calculation worksheet.

Standard #5: Land Uses with Higher Potential Pollutant Loads

This project does not have a land use with a higher potential pollutant loads.

Standard #6: Critical Areas

This project does not discharge to a Zone II, Interim Wellhead Protection Areas or directly to a Cold-Water Fisheries.

Standard #7: Redevelopment

While part of the Project could qualify as "redevelopment," the calculations for Standards 2-6 demonstrate full compliance with Massachusetts Stormwater Regulations and Medway's Stormwater Management and Land Disturbance Bylaw.

Standard #8: Construction Period Controls

Upon completion of the project, the site will have disturbed approximately 1.15 acres, therefore a NPDES Construction General Permit is required and will be completed prior to construction.

Standard #9: Operation And Maintenance Plan

A Long -Term Operation and Maintenance (O&M) Plan has been developed and is attached to this report.

Standard #10: Illicit Discharges To Drainage System

An Illicit Discharge Compliance Statement has not been incorporated into the Operation and Maintenance (O&M) plan, however one will be completed prior to construction.

INSTRUCTIONS:

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Non-automated: Mar. 4, 2008

Location: IF-1

A	B	C	D	E
BMP ¹	TSS Removal Rate ¹	Starting TSS Load*	Removed (B*C)	Remaining Load (C-D)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
CDS Unit	0.65	0.75	0.49	0.26
Infiltration System	0.80	0.26	0.21	0.05

Separate Form Needs to be Completed for Each Outlet or BMP Train

Total TSS Removal =

95%

Project:

218-222 Main Street, Medway

Prepared By:

Meridian Associates, Inc.

*Equals remaining load from previous BMP (E)

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 (hi0), 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 are 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

4.8200	R	Recharge (infiltration) rate (feet/day)
0.150	Sy	Specific yield, Sy (dimensionless, between 0 and 1)
48.20	K	Horizontal hydraulic conductivity, Kh (feet/day)*
27.500	x	1/2 length of basin (x direction, in feet)
14.750	y	1/2 width of basin (y direction, in feet)
0.230	t	duration of infiltration period (days)
3.950	hi(0)	initial thickness of saturated zone (feet)

Conversion Table

inch/hour feet/day

0.67 1.33

2.00 4.00

hours days

36 1.50

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).

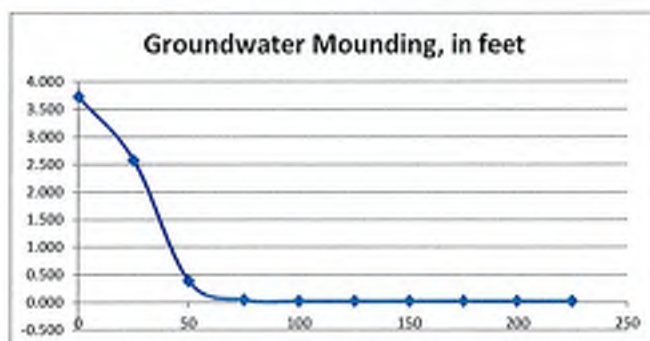
7.669	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
3.713	Δh(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground-water Mounding, in feet

3.713	0
2.567	25
0.371	50
0.027	75
0.003	100
0.002	125
0.002	150
0.002	175
0.002	200
0.002	225



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.

PHOSPHORUS REMOVAL

From MA MS4 General Permit Appendix F Attachment 3: Method to determine the phosphorus load reduction for a BMP with known storage volume when both pervious and impervious drainage areas are present.

For DB-1:

Impervious area (IA) = 11,331 SF = 0.26 Ac.

Pervious Area (PA) = 31,155 SF = 0.7115 Ac.

DB-1 Volume (below 231.0) = 7,062 CF

Depth of runoff treated from IA for 50% reduction = 0.2 in.

DB-1 Volume is converted to inches of runoff from the contributing IA:

DB-1 Vol = (7,062 SF/0.26 Ac.) x (12 in/ft / 43,560 SF/Ac) = 7.48 in.

Volume of runoff from PA:

(0.715 Ac. x 0.2 in.) x 3,630 cf/Ac-in. = 519 CF

Portion of DB-1 Vol available to treat runoff from IA:

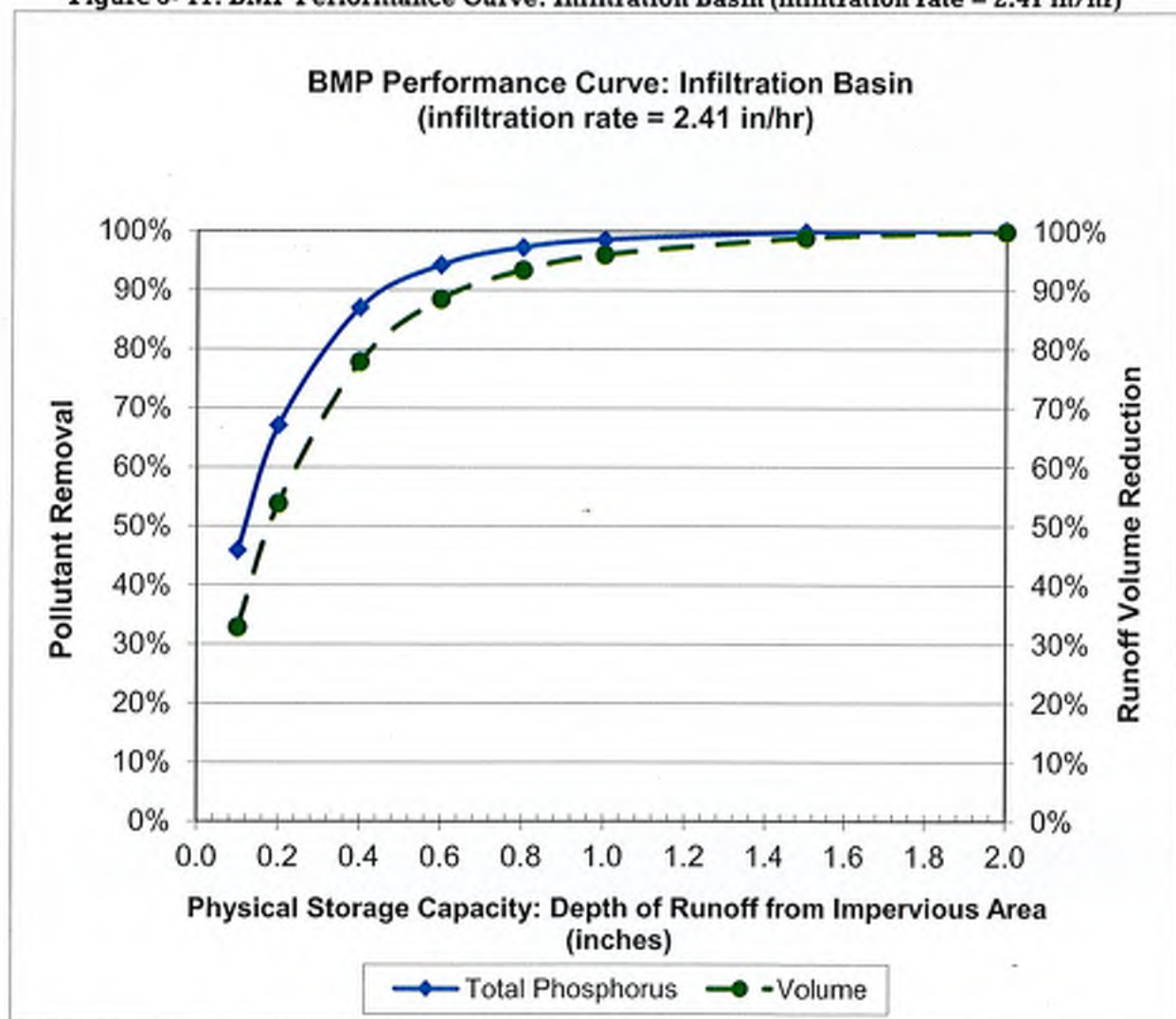
7,062 CF – 519 CF = 6,543 CF

(6543 CF/0.26 Ac.) x (12 in/ft x 1 Ac./43,560 SF) = 6.93 in.

Per Table 3-14 (attached), any treatment depth of 2 inches or greater will yield 100% phosphorous removal.

Table 3- 14: Infiltration Basin (2.41 in/hr) BMP Performance Table

Infiltration Basin (2.41 in/hr) BMP Performance Table: Long-Term Phosphorus Load Reduction								
BMP Capacity: Depth of Runoff Treated from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	32.8%	53.8%	77.8%	88.4%	93.4%	96.0%	98.8%	99.8%
Cumulative Phosphorus Load Reduction	46%	67%	87%	94%	97%	98%	100%	100%

Figure 3- 11: BMP Performance Curve: Infiltration Basin (infiltration rate = 2.41 in/hr)

OPERATION & MAINTENANCE PLAN

Stormwater Management Operation and Maintenance Plan
Multifamily Development
218-220 Main Street, Medway, Massachusetts

June 10, 2020
Revised November 12, 2020

In accordance with Standard 9 of the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Handbook, the attached on-site maintenance program for the proposed stormwater management system has been developed to ensure the Best Management Practices (BMP's) in place will remain functioning as designed. The Plan contains both construction period operations and maintenance as well as post construction responsibilities that shall "run" with the property if ownership is transferred.

All stormwater management-related records shall be retained for a minimum of three (3) years. These records shall be available for inspection during normal business hours upon request by City or MassDEP personnel.

Owner/Operator:

Harmony Village LLC
218 Main Street
Medway, MA 02053

Construction Period Operation and Maintenance

Erosion Control Barrier:

Compost filter socks ("Filtrex Sox"), or approved equal, shall be installed where indicated on the plans and in other appropriate locations where warranted. These barriers shall be installed prior to the commencement of any work on site and in accordance with the construction plans. A supply of erosion control barrier materials shall be kept on site to replace and/or repair barriers that are damaged or degraded. The barriers shall be observed and maintained as necessary on a weekly basis and after every rainfall event of 0.25 inches or more during construction.

Deep Sump Catch Basin Protection:

Temporary catch basin protection barriers consisting of compost filter socks and a Silt Sack will be placed around and in all constructed inlets to prevent inflow of sediment into the constructed drainage systems. The barriers shall remain in place until a permanent cover is established or diversions away from the catch basin are constructed. The barrier shall be observed and maintained as necessary on a weekly basis and after every rainfall event of 0.25 inches or more. If inspection identifies the presence of hydrocarbons, these materials shall be immediately removed and disposed of in accordance with applicable local, state and federal guidelines and regulations.

Diversions:

Temporary diversion swales and mounds will be constructed to divert stormwater away from areas under construction to limit sediment transport. These diversions will be relocated as construction progresses. Compost filter socks shall be installed in the centerline of swales where necessary to reduce storm velocities and soil erosion.

Sediment Traps:

Temporary sediment traps shall be utilized to limit sediment transport off-site. These traps will be sized according to Massachusetts DEP and US EPA guidelines and will be relocated as construction progresses. No sediment shall be allowed to enter the infiltration components of the stormwater system.

Surface Stabilization:

The surface of all disturbed areas shall be stabilized during and after construction. Temporary measures shall be taken during construction to prevent erosion and siltation. All finished surfaces shall be stabilized with finish materials or permanent vegetative cover. Some or all of the following measures will be utilized on this project as conditions may warrant.

- Temporary Seeding
- Temporary Mulching
- Permanent Seeding
- Placement of Sod
- Hydroseeding
- Placement of Hay
- Placement of Jute Netting

Subsurface Storage Facilities:

Construction activity above and around the proposed location of the subsurface storage facilities shall be limited to prevent compaction of the existing soil. Care shall be taken to redirect stormwater runoff from this area to prevent ponding. Installation of this system shall occur under dry weather conditions and system shall be backfilled immediately to prohibit the introduction of fines or other material that would compromise the functionality of this system.

Spill Control:

A contingency plan to address the spillage/release of petroleum products and any hazardous materials will be implemented for the site during construction. The plan will include the following measures:

- Equipment necessary to quickly attend to inadvertent spills or leaks shall be maintained on-site in a secure but accessible location. Such equipment will include, but not be limited to, the following: urethane drain cover seals (mats), a spill containment kit which includes sand and shovels, suitable absorbent materials,

storage containers, safety goggles, chemically resistant gloves and overshoe boots, water and chemical fire extinguishers, and first aid equipment.

- Spills or leaks will be treated properly according to material type, volume of spillage and location of spill. Mitigation will include preventing further spillage, containing the spilled material in the smallest practical area, removing spilled material in a safe and environmentally friendly manner, and remediating any damage to the environment.
- The contractor shall be familiar with the reporting requirements of the Massachusetts Contingency Plan (310 CMR 40.00) as issued by the Massachusetts Department of Environmental Protection (DEP); specifically Subpart C Notification of Releases and Threats of Release of Oil and Hazardous Materials and Subpart D Preliminary Response Activities and Risk Reduction Measures.
- For any large spills, Massachusetts DEP Hazardous Waste Incident Response Group will be notified immediately at (617) 792-7653 and an emergency response contractor will be called in.

Long-Term Operation and Maintenance

General House Keeping:

The site should generally be kept clean and free of debris such as leaves, limbs, trash, construction materials, etc. Maintenance of lawns, gardens and other landscaped areas should be done regularly and any clippings composted or disposed of as appropriate and recommended by Medway DPW. Pet waste should be picked up and disposed of in trash.

Deep Sump Hooded Catch Basins:

Deep Sump Drain Basins shall be inspected at least four times per year. Accumulated sediment in drain basins shall be removed when sediment accumulates to 24 inches below the invert of the outlet pipe of the drain basins; but should be removed during late winter / early spring at a minimum. Sediment shall be transported off site and disposed of in accordance with applicable local, state and federal guidelines and regulations. Care shall be taken to not dislodge the hood/tees on the outlet pipes. If dislodged, the hood/tee shall be immediately reinstalled and secured.

CDS® Treatment Units:

CDS treatment units shall be inspected a minimum of four times per year until the site reaches "equilibrium"; after which time annual inspections are typically sufficient. Accumulated sediment shall be removed via a vacuum truck when it reaches a depth of 1.5 feet. Any accumulated hydrocarbons shall be removed via the inspection / cleanout port. Refer to spill control section below in the event of any hazardous material spill. Transport and dispose of sediment and hydrocarbons off site in accordance with applicable local, state and federal guidelines and regulations. See the attached CDS Inspection and Maintenance Guide/Log as provided by Contech Construction Products, Inc.

Subsurface Storage Facilities:

The subsurface storage system inspections should include inspections following the first several rainfall events or first few months after construction, after all major storms (2-year), and on regular bi-annual scheduled dates, to ascertain whether captured runoff dissipates within 72 hours following the event. Pooled water inside the system (as visible from the observation port) after several days often indicates that the bottom of the system is clogged. If the water does not drain, then a qualified professional should be retained to determine the cause of apparent infiltration failure and recommend corrective action. Such corrective action should be immediately implemented by the owner. The system should receive little or no sediment. If any significant sediment is observed in the observation ports or drain manhole, then the system can be cleaned based on manufacturer recommendations and the source of the sediment eliminated.

Storage/Recharge Basin, Weir/Spillway, Flared End Inlets:

The open storage/recharge basin and flared end inlet shall be inspected annually to ensure basin is operating properly. Inlet and outlets shall be examined for clogging. Sediment accumulation shall be removed from inlets and rip-rap areas as required to maintain free flow. Sediment accumulation shall be removed from the basin at least once every five (5) years or when it accumulates over twelve (12) inches above bottom.

Vegetation on the side slopes and basin bottom shall be mowed and any woody growth shall be removed on a regular basis so that trees and large scrub brush does not grow in the basin.

Storing Materials and Waste Products:

General storage of materials and waste products should be kept inside and/or under cover (garage, basement, carport, etc.).

Vehicle Washing:

Vehicle washing should be done sparing as allowed by Medway water regulations. Washing products used should be safe for the environment.

Snow Removal:

Snow that is removed from paved surfaces shall not be stored over catch basins or in the recharge basin. In the event that snow storage areas are depleted, snow is to be transported off-site.

De-icing:

The use of Sodium Chloride ("rock salt") for de-icing of paved surfaces is not permitted. The use of Calcium Chloride is allowed but will be limited. Sand will be the primary icing control agent.

Fertilizer:

Slow release organic fertilizers will be used in landscape areas to limit nutrient transport to groundwater and any offsite wetland areas. Application will be limited to 3 lbs. per 1000 square feet of lawn area.

Waste Management:

Solid waste will be contained within dumpsters for pick up by a privately contracted waste hauler. Waste deposition in these dumpsters will be consistent with state and local permits. The covers of the dumpster and doors of the dumpster enclosure will be kept closed to limit rainwater and pest intrusion.

Spill Control:

A contingency plan to address the spillage/release of petroleum products and any hazardous materials will be implemented for the facility. The plan will include the following measures:

- Spills or leaks will be treated properly according to material type, volume of spillage and location of spill. Mitigation will include preventing further spillage, containing the spilled material in the smallest practical area, removing spilled material in a safe and environmentally friendly manner, and remediating any damage to the environment.
- The catch basins have a specific internal storage capacity that will be available in the event of any hazardous material spill. However, for added security, urethane drain cover seals ("mats") will be kept on-site to be placed over the grate of the catch basin to assist with the prevention of flow from entering the drainage system in the event of a spill. These should be kept in an easily accessible on-site location.
- The owner shall be familiar with the reporting requirements of the Massachusetts Contingency Plan (310 CMR 40.00) as issued by the Massachusetts Department of Environmental Protection (DEP); specifically Subpart C Notification of Releases and Threats of Release of Oil and Hazardous Materials and Subpart D Preliminary Response Activities and Risk Reduction Measures.
- For any large spills, Massachusetts DEP Hazardous Waste Incident Response Group will be notified immediately at (617) 792-7653 and an emergency response contractor will be called in.

Prohibition of Illicit Discharges

All illicit discharges to the stormwater management system are prohibited. Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater.

An Illicit discharge does not include allowable non-stormwater discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands,

dechlorinated water from swimming pools, water used for street washing and water used to clean residential building without detergents.

Long-Term Operation and Maintenance Budget

Consistent with Standard 9 of the Massachusetts Department of Environmental Protection Stormwater Handbook (February 2008) the approximate cost of inspections and maintenance based on the abovementioned post-construction activities and frequencies is as follows;

- **Deep Sump Catch Basins & Trench Drain/Manhole** - inspection/cleaning - \$2,000 per year based on quarterly inspections and sediment removal from the three (3) deep sump catch basins/inlets and one drain/manhole.
- **Stormwater Quality Units (CDS)** – inspection/cleaning - \$500.00 per year based on quarterly inspections (or per manufacturer's guidelines) and sediment removal for one unit
- **Subsurface Storage Chambers** - \$1,000 per year based on bi-annual inspections. Any necessary maintenance costs to be determined based on observations.
- **Storage/Recharge Basin** – inspection/cleaning - \$500 per year/cleaning - \$500 (as required based upon yearly inspection).

Additional costs may be incurred if it is determined during routine inspections of the BMP's that further corrective actions are necessary.

Inspection Report

Operation and Maintenance Log

General Information			
Project Name	Harmony Village		
MAI Project No.	8521	Location	218-220 Main Street Medway, MA 02053
Date of Inspection		Start/End Time	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Inspector's Qualifications			
Describe present phase of construction			
Type of Inspection: <input type="checkbox"/> Regular <input type="checkbox"/> Pre-storm event <input type="checkbox"/> During storm event <input type="checkbox"/> Post-storm event			
Weather Information			
Has there been a storm event since the last inspection? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, provide: Storm Start Date & Time: Storm Duration (hrs): Approximate Amount of Precipitation (in):			
Weather at time of this inspection? <input type="checkbox"/> Clear <input type="checkbox"/> Cloudy <input type="checkbox"/> Rain <input type="checkbox"/> Sleet <input type="checkbox"/> Fog <input type="checkbox"/> Snowing <input type="checkbox"/> High Winds <input type="checkbox"/> Other: Temperature:			
Have any discharges occurred since the last inspection? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, describe:			
Are there any discharges at the time of inspection? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, describe:			

Site-specific BMPs

- Number the structural and non-structural BMPs identified in your O&M Plan on your site map and list them below (add as many BMPs as necessary). Carry a copy of the numbered site map with you during your inspections. This list will ensure that you are inspecting all required BMPs at your site.
- Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.

	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed and Notes
1		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
2		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
3		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
4		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
5		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
6		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
7		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
8		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
9		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
10		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

Overall Site Issues

Below are some general site issues that should be assessed during inspections. Customize this list as needed for conditions at your site.

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
3	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
4	Are discharge points and receiving waters free of any sediment deposits?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
5	Are storm drain inlets properly protected?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
6	Is the construction exit preventing sediment from being tracked into	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
	the street?			
7	Is trash/litter from work areas collected and placed in covered dumpsters?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
8	Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
9	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
10	Are materials that are potential stormwater contaminants stored inside or under cover?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
11	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
12	(Other)	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

Non-Compliance

Describe any incidents of non-compliance not described above:

MADEP STORMWATER MANAGEMENT CHECKLIST



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



Please See Stamp to Left - 11/12/2020

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): _____

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 proprietary 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.