STORMWATER ANALYSIS & CALCULATIONS REPORT

for

280 & 0 OLD FALMOUTH ROAD BARNSTABLE, MASSACHUSETTS

8-15-16

Prepared for:

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TABLE OF CONTENTS

CALCULATION METHODS

- TR 20 SCS Unit Hydrograph Procedure
- Runoff Curve Numbers
- Time of Concentration by TR55 Methodology
- Reach and Pond Rating by the Storage-Indication Method
- Manning Equation

SOURCE OF DATA

- Technical Report No. 20
- Technical Report No. 55
- Technical Paper No. 40
- Field Survey by Meridian Associates, Inc.
- Soil Testing by Meridian Associates, Inc.
- Massachusetts Stormwater Handbook February 2008

REPORT SUMMARY:

Calculation Objective

The purpose of this drainage analysis is to design a stormwater management system that will not increase peak rates and volumes of stormwater runoff that will flow offsite from pre to post development at the selected design points during the 2, 10, and 100-year design storm events.

The following analysis is separated into existing conditions and proposed conditions for ease of comparison. Drainage maps have been incorporated into this report to depict existing and proposed watershed areas and subcatchments for the site.

This stormwater management hydrological study has been prepared in accordance with the Performance Standards set forth in the Massachusetts DEP Stormwater Regulations, the Town of Barnstable Zoning Regulations, and the Cape Cod Regional Policy Plan. Subsequently, the following stormwater management report meets the DEP regulations.

Classification of Soils:

The drainage class of the various soil types on the locus property has been categorized by applying the information provided by the soil maps prepared by the United States Department of Agriculture, National Resource Conservation Service (hereon referred to as the USDA NRCS). Based upon the USDA NRCS Soil Maps, six (6) soil groups exist within the subcatchment areas that are used throughout this drainage analysis. The six different soil types are as follows:

- Carver loamy coarse sand; 0-3% slopes, Hydrological Soil Group A.
- Carver loamy coarse sand; 3-8% slopes, Hydrological Soil Group A.
- Carver coarse sand; 15-35% slopes, Hydrological Soil Group A.
- Merrimac fine sandy loam; 0-3% Slopes, Hydrological Soil Group A.
- Merrimac fine sandy loam; 3-8% Slopes, Hydrological Soil Group A.
- Pipestone loamy coarse sand; 0-3% Slopes, Hydrological Soil Group A.

Carver Loamy Coarse Sand

This unit consists of very deep, nearly level to gently sloping, excessively drained soil generally in broad areas on outwash plains but is also in areas of sandy glacial lake deposits. Seasonal high groundwater is typically found at depths of more than 80" below the existing grade. Parent material is generally loose sandy glaciofluvial deposits. The permeability of this soil is very rapid in the subsoil and substratum.

Carver Coarse Sand

This unit consists of very deep, moderately steep to steep, excessively drained soil generally found on hills and ridges in areas of ice-contact deposits and on the side slopes of swales on outwash plains. Seasonal high groundwater is typically found at depths of more than 80" below the existing grade. Parent material is generally sandy glaciofluvial deposits and loose sandy glaciofluvial deposits. The permeability of this soil is very rapid in the subsoil and substratum.

Merrimac Fine Sandy Loam

This unit consists of very deep, nearly level to gently sloping, well-drained soil mainly in broad areas on outwash plains but is also on glacial lake plains. Seasonal high groundwater is typically found at depths of more than 80" below the existing grade. Parent material is generally loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss. The permeability of this soil moderately rapid in the subsoil and rapid in the substratum.

Pipestone loamy Coarse Sand

This unit consists of very deep, nearly level, poorly-drained soil in depressions, at the base of swales, and in low areas bordering streams, ponds, and swamps. Seasonal high groundwater is typically found at depths of 6-18" below the existing grade. Parent material is generally loose sandy glaciofluvial deposits. The permeability of this soil rapid throughout.

(Soil descriptions extracted from NRCS website and Barnstable County Soil Survey)

Onsite soil testing was conducted by Andrew Rodriguez (Certified Soil Evaluator #13890), Meridian Associates, Inc., on April 22, 2016 in the areas depicted on the attached plan. Fill/Human transported material (HTM) was found in each test pit at varying depths. The testing revealed that ground water ranged from 24" to 132" below the existing surface throughout the test pits. The water observed appears to be perched due to the nature of the HTM which contained wood and other organic materials in the upper elevations of the test pits. Below the HTM, soil testing revealed that the parent material consisted of sand (Hydrological Soil Group A). Due to the current use of the site, soils on portions of the site were modeled as a Hydrologic Soil Group C to more accurately model the existing drainage characteristics of the site.

Selection of Storm Events

The storm event rainfall frequencies have been selected based upon the Massachusetts Stormwater Guidelines requirements. Storm event rainfall data has been compiled from Technical Release No. 55, Urban Hydrology for Small Watersheds, 2nd Edition, prepared by the U.S. Soil Conservation Service. Rainfall frequency data has been provided as follows:

Frequency (Years)	Rainfall [24 hour event (inches)]
2	3.6
10	4.8
100	7.1

Existing Site Overview

The project area is comprised of mostly dirt/fill/human transported material (HTM) and landscaping material stock piled (Cape Resources Company). The western portion of the site consists mostly of wooded land. The majority of the site included within the drainage analysis currently slopes east-southeasterly towards man-made on-site depressions and Old Falmouth Road. The stormwater runoff patterns established within the pre-development conditions are based on existing topography which indicates that the runoff flows to two (2) design points which are listed below:

- Design Point #1 **(DP1)** is the man-made depression at the eastern edge of the locus property;

- Design Point #2 **(DP2)** is the man-made depression at the south easterly edge of the locus property;

The existing site has been broken into two (2) subcatchments as depicted on the Pre-Development Drainage Plan. The following summarizes the various hydraulic conditions and areas comprising the pre-hydrologic model:

- **Subcatchment SC1** – This is denoted as SC1 on the accompanying Pre-Development Drainage Plan. The subcatchment area consists mostly of dirt/fill/HTM, with areas of brush, wooded land, and impervious surfaces. Stormwater runoff generated in this subcatchment flows easterly to a man-made depression **(DP1)**.

- **Subcatchment SC2** – This is denoted as SC2 on the accompanying Pre-Development Drainage Plan. The subcatchment area consists mostly of dirt/fill/HTM and wooded land with areas of brush, grass, and impervious surfaces. Stormwater runoff generated in this subcatchment flows easterly-southeasterly to a man-made depression **(DP2)**.

Proposed Site Overview

The proposed project is comprised of the development of a ground-mounted solar photovoltaic facility, the construction of a gravel access road, two infiltration basins with sediment forebays, riprap level spreaders, riprap slopes, concrete equipment pads, new utility poles and risers, fencing, gates, grass channels and associated seeding and stabilization. The existing runoff patterns will be maintained with the proposed grading. The proposed solar facility will be installed using either a screw or post system which minimizes impact on the existing topography.

A drainage system has been designed and incorporated into the existing topography in order to manage stormwater runoff in an appropriate and responsible manner. More specifically, peak rates and volumes of stormwater runoff in the proposed conditions will not result in an increase in the 2, 10, and 100-year storm events at the selected design points. These decreases in runoff occur prior to discharging into the proposed drainage system due to the change in ground cover from compacted exposed dirt/fill/HTM to a low growth seed mixture. The proposed system has been designed to contain the 100-year storm volume along with freeboard and additional emergency storage.

The proposed site has been broken into two (2) subcatchments as depicted on the Post-Development Drainage Plan. The following summarizes the various hydraulic conditions and areas comprising the post-hydrologic model.

- **Subcatchment SC100** – This is denoted as SC100 on the accompanying Post-Development Drainage Plan. The subcatchment area consists of wooded land, brush, a proposed concrete pad, a portion of the proposed gravel access drive and "Solar Farm Seed Mix" grassed areas. Stormwater runoff generated in this subcatchment flows easterly to a Proposed Infiltration Basin 100 **(PIB100)**. A portion of the subcatchment area flows through a grass channel prior to discharging to said Proposed Infiltration Basin 100 **(PIB100)**.

- **Subcatchment SC200** – This is denoted as SC200 on the accompanying Post-Development Drainage Plan. The subcatchment area consists of wooded land, brush, a proposed concrete pad, a portion of the proposed gravel access drive and "Solar Farm Seed Mix" grassed areas. Stormwater runoff generated in this subcatchment flows easterly-southeasterly to a Proposed Infiltration Basin 200 **(PIB200)**. A portion of the subcatchment area flows through a grass channel prior to discharging to said Proposed Infiltration Basin 200 **(PIB200)**.

Proposed Stormwater Mitigation

The majority of the existing stormwater runoff generated in the project area flows to two (2) man-made temporary basins onsite, had no outlets, and did not discharge offsite. The proposed drainage systems for DP1 and DP2 have been designed to completely store the 100-year storm event volume prior to factoring in the exfiltration rates of the parent sand

material. The design proposes to remove all of the fill/HTM within the footprint of the basins down to the parent sand material and replacing the fill/HTM with clean granular sand.

Proposed Infiltration Basin 1 (PIB1) consists of a grassed base to replicate the function of the existing man-made depression in this area and a stone sedimentation forebay berm. A grassed outlet weir will disperse any stormwater to a smaller overflow basin.

Proposed Infiltration Basin 2 (PIB2) consists of a grassed base to replicate the function of the existing man-made depression in this area and a stone sedimentation forebay berm. A grassed outlet weir will disperse any stormwater to a smaller overflow basin.

The following Tables summarize the peak flows and volumes resulting from the stormwater analysis described in this report.

Summary of Flows at Design Point 1

Storm Event	Existing Conditions (Pre)		Proposed Conditions (Post)	
	Peak Flow (CFS)	Volume (AF)	Peak Flow (CFS)	Volume (AF)
2-Year (3.00 in./hr.)	13.85	1.31	7.56	0.79
10-Year (4.50 in./hr.)	21.83	2.06	14.08	1.39
100-Year (6.50 in./hr.)	37.66	3.59	28.45	2.73

Summary of Flows at Design Point 2

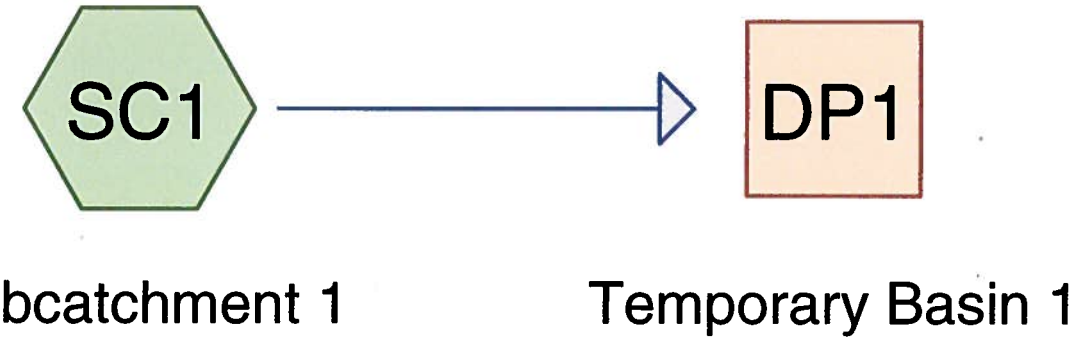
Storm Event	Existing Conditions (Pre)		Proposed Conditions (Post)	
	Peak Flow (CFS)	Volume (AF)	Peak Flow (CFS)	Volume (AF)
2-Year (3.00 in./hr.)	6.61	1.28	2.86	0.72
10-Year (4.50 in./hr.)	13.80	2.42	8.06	1.59
100-Year (6.50 in./hr.)	30.33	5.06	21.98	3.78

* CFS – Cubic Feet Per Second
* AF – Acre Feet

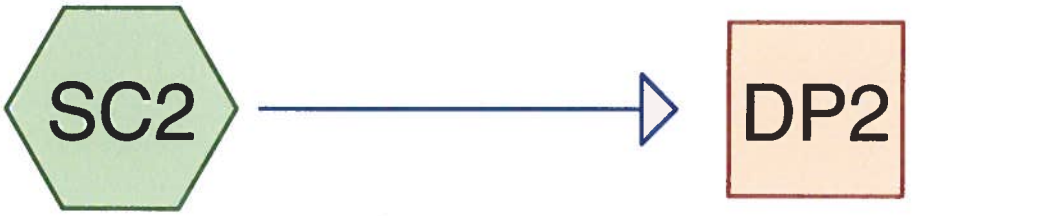
Conclusion

The calculations demonstrate that the proposed development will not result in an increase in the peak rate or volume of stormwater runoff for the 2-year, 10-year, or 100-year 24-hour storm events at the two (2) selected design points.

EXISTING CONDITIONS
WATERSHED ROUTING DIAGRAM



Subcatchment 1 Temporary Basin 1



Subcatchment 2 Temporary Basin 2

Subcat Reach Pond Link

Routing Diagram for 5834_PRE-DEV - C SOILS
Prepared by Meridian Associates, Inc., Printed 8/12/2016

EXISTING CONDITIONS
2-YEAR DESIGN

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 SC1: Subcatchment 1 Runoff Area=382,940 sf 0.31% Impervious Runoff Depth=1.79"
Flow Length=1,030' Tc=15.0 min CN=81 Runoff=13.85 cfs 1.31 af

Subcatchment SC2: Subcatchment 2 Runoff Area=831,551 sf 2.67% Impervious Runoff Depth=0.81"
Flow Length=1,800' Tc=51.0 min CN=65 Runoff=6.61 cfs 1.28 af

Reach DP1: Temporary Basin 1 Inflow=13.85 cfs 1.31 af
Outflow=13.85 cfs 1.31 af

Reach DP2: Temporary Basin 2 Inflow=6.61 cfs 1.28 af
Outflow=6.61 cfs 1.28 af

Total Runoff Area = 27.881 ac Runoff Volume = 2.59 af Average Runoff Depth = 1.12"
98.07% Pervious = 27.343 ac 1.93% Impervious = 0.538 ac

Summary for Subcatchment SC1: Subcatchment 1

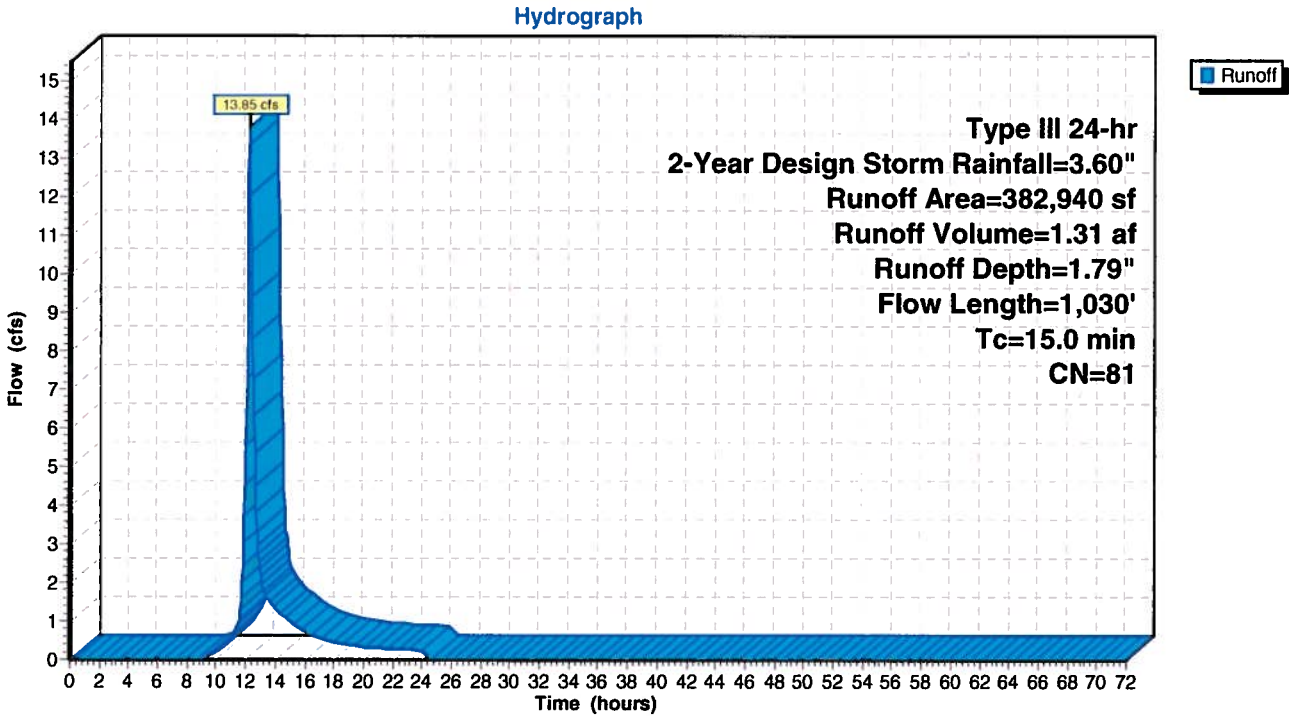
Runoff = 13.85 cfs @ 12.21 hrs, Volume= 1.31 af, Depth= 1.79"

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=3.60"

Area (sf)	CN	Description
9,397	30	Woods, Good, HSG A
294,789	87	Dirt roads, HSG C
77,554	65	Brush, Good, HSG C
1,200	98	Unconnected roofs, HSG C
382,940	81	Weighted Average
381,740		99.69% Pervious Area
1,200		0.31% Impervious Area
1,200		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0624	0.10		**Sheet Flow, Sheet Flow (Segment 1)** Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	133	0.0886	1.49		**Shallow Concentrated Flow, SCF (Segment 2)** Woodland Kv= 5.0 fps
0.4	103	0.0854	4.70		**Shallow Concentrated Flow, SCF (Segment 3)** Unpaved Kv= 16.1 fps
5.2	744	0.0217	2.37		**Shallow Concentrated Flow, SCF (Segment 4)** Unpaved Kv= 16.1 fps
15.0	1,030	Total			

Subcatchment SC1: Subcatchment 1



Summary for Subcatchment SC2: Subcatchment 2

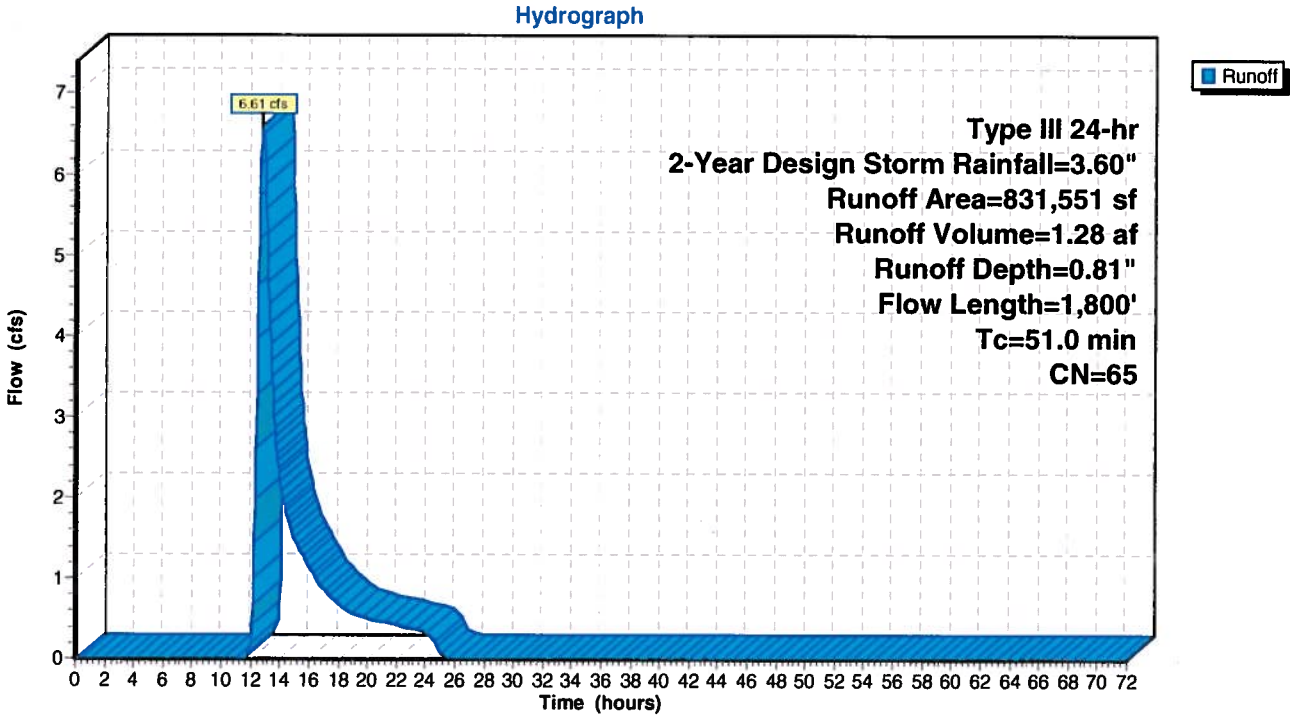
Runoff = 6.61 cfs @ 12.80 hrs, Volume= 1.28 af, Depth= 0.81"

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=3.60"

	Area (sf)	CN	Description
	303,440	30	Woods, Good, HSG A
	472,718	87	Dirt roads, HSG C
	12,958	65	Brush, Good, HSG C
	20,210	39	>75% Grass cover, Good, HSG A
	4,237	98	Unconnected roofs, HSG C
*	17,988	98	Bituminous Concrete, HSG A
	831,551	65	Weighted Average
	809,326		97.33% Pervious Area
	22,225		2.67% Impervious Area
	4,237		19.06% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0742	0.11		**Sheet Flow, Sheet Flow (Segment 1)** Woods: Light underbrush n= 0.400 P2= 3.10"
1.2	97	0.0722	1.34		**Shallow Concentrated Flow, SCF (Segment 2)** Woodland Kv= 5.0 fps
30.8	851	0.0085	0.46		**Shallow Concentrated Flow, SCF (Segment 3)** Woodland Kv= 5.0 fps
11.5	774	0.0258	1.12		**Shallow Concentrated Flow, SCF (Segment 4)** Short Grass Pasture Kv= 7.0 fps
0.1	28	0.0410	3.26		**Shallow Concentrated Flow, SCF (Segment 5)** Unpaved Kv= 16.1 fps
51.0	1,800	Total			

Subcatchment SC2: Subcatchment 2



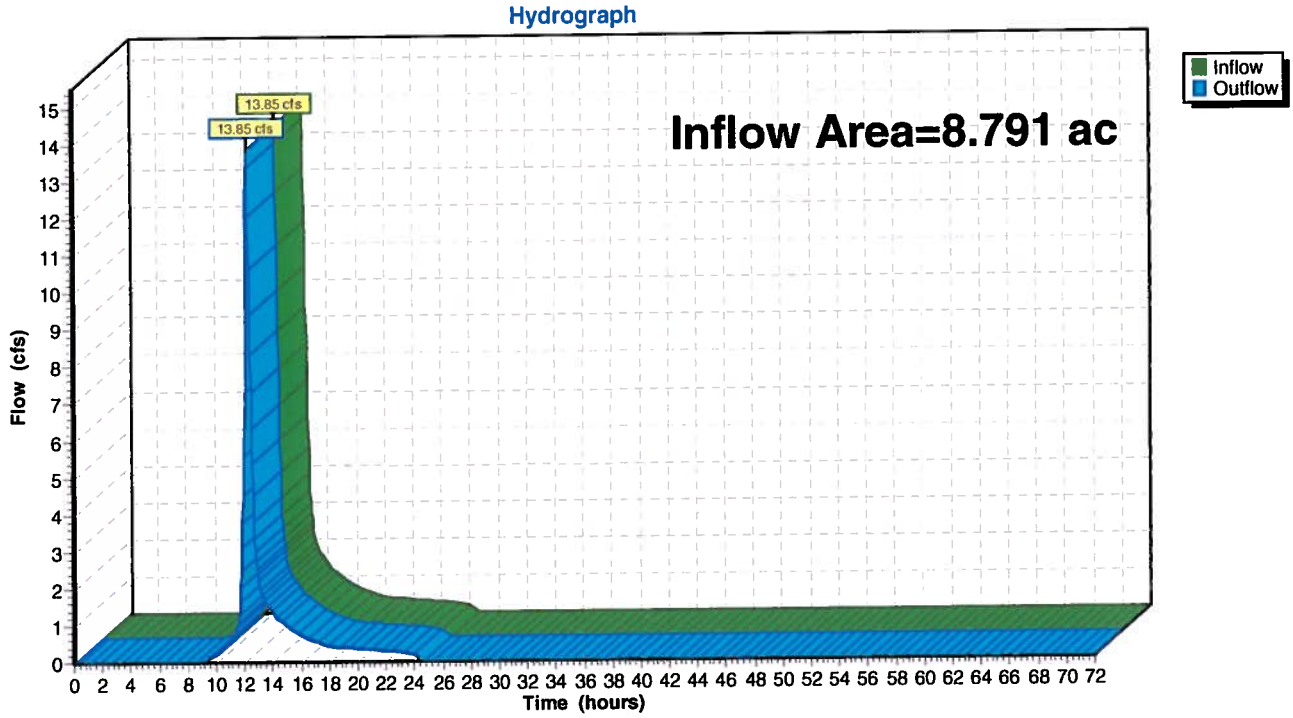
Summary for Reach DP1: Temporary Basin 1

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

Inflow Area = 8.791 ac, 0.31% Impervious, Inflow Depth = 1.79" for 2-Year Design Storm event
Inflow = 13.85 cfs @ 12.21 hrs, Volume= 1.31 af
Outflow = 13.85 cfs @ 12.21 hrs, Volume= 1.31 af, Atten= 0%, Lag= 0.0 min

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

Reach DP1: Temporary Basin 1



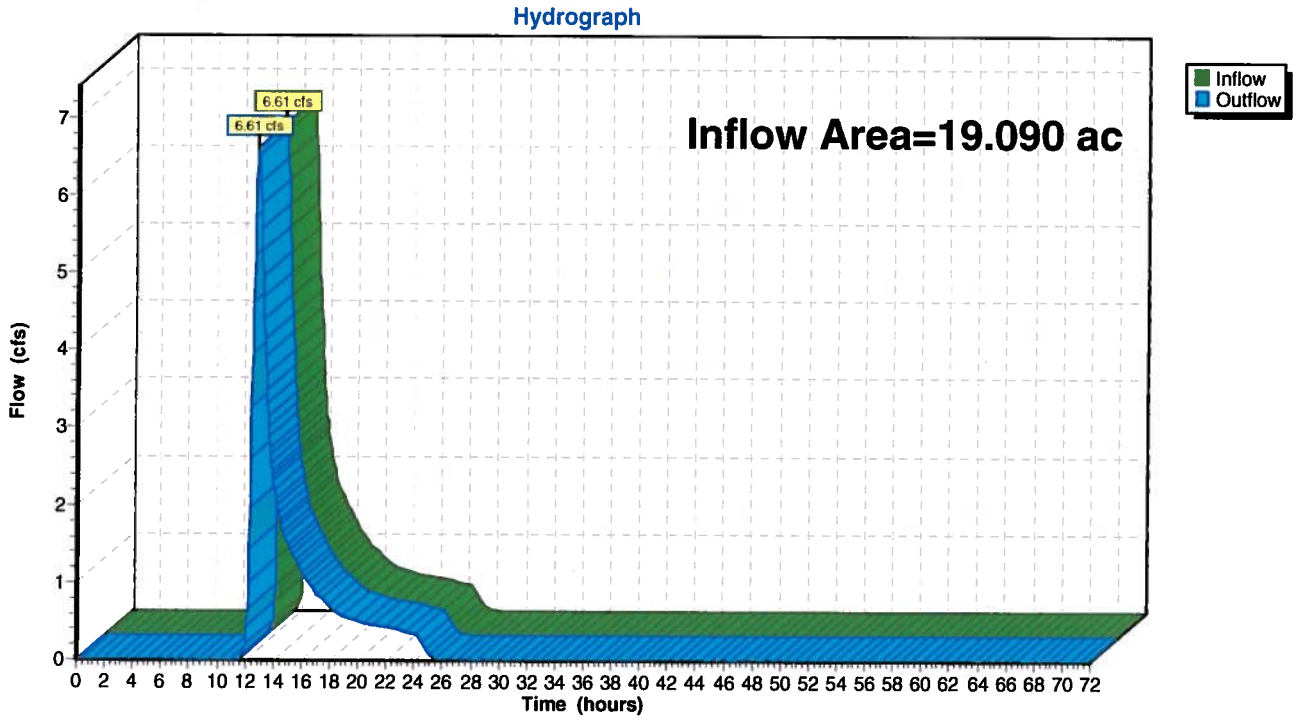
Summary for Reach DP2: Temporary Basin 2

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

Inflow Area = 19.090 ac, 2.67% Impervious, Inflow Depth = 0.81" for 2-Year Design Storm event
Inflow = 6.61 cfs @ 12.80 hrs, Volume= 1.28 af
Outflow = 6.61 cfs @ 12.80 hrs, Volume= 1.28 af, Atten= 0%, Lag= 0.0 min

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

Reach DP2: Temporary Basin 2



EXISTING CONDITIONS
10-YEAR DESIGN STORM

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 SC1: Subcatchment 1 Runoff Area=382,940 sf 0.31% Impervious Runoff Depth=2.81"
Flow Length=1,030' Tc=15.0 min CN=81 Runoff=21.83 cfs 2.06 af

Subcatchment SC2: Subcatchment 2 Runoff Area=831,551 sf 2.67% Impervious Runoff Depth=1.52"
Flow Length=1,800' Tc=51.0 min CN=65 Runoff=13.80 cfs 2.42 af

Reach DP1: Temporary Basin 1 Inflow=21.83 cfs 2.06 af
Outflow=21.83 cfs 2.06 af

Reach DP2: Temporary Basin 2 Inflow=13.80 cfs 2.42 af
Outflow=13.80 cfs 2.42 af

Total Runoff Area = 27.881 ac Runoff Volume = 4.48 af Average Runoff Depth = 1.93"
98.07% Pervious = 27.343 ac 1.93% Impervious = 0.538 ac

Summary for Subcatchment SC1: Subcatchment 1

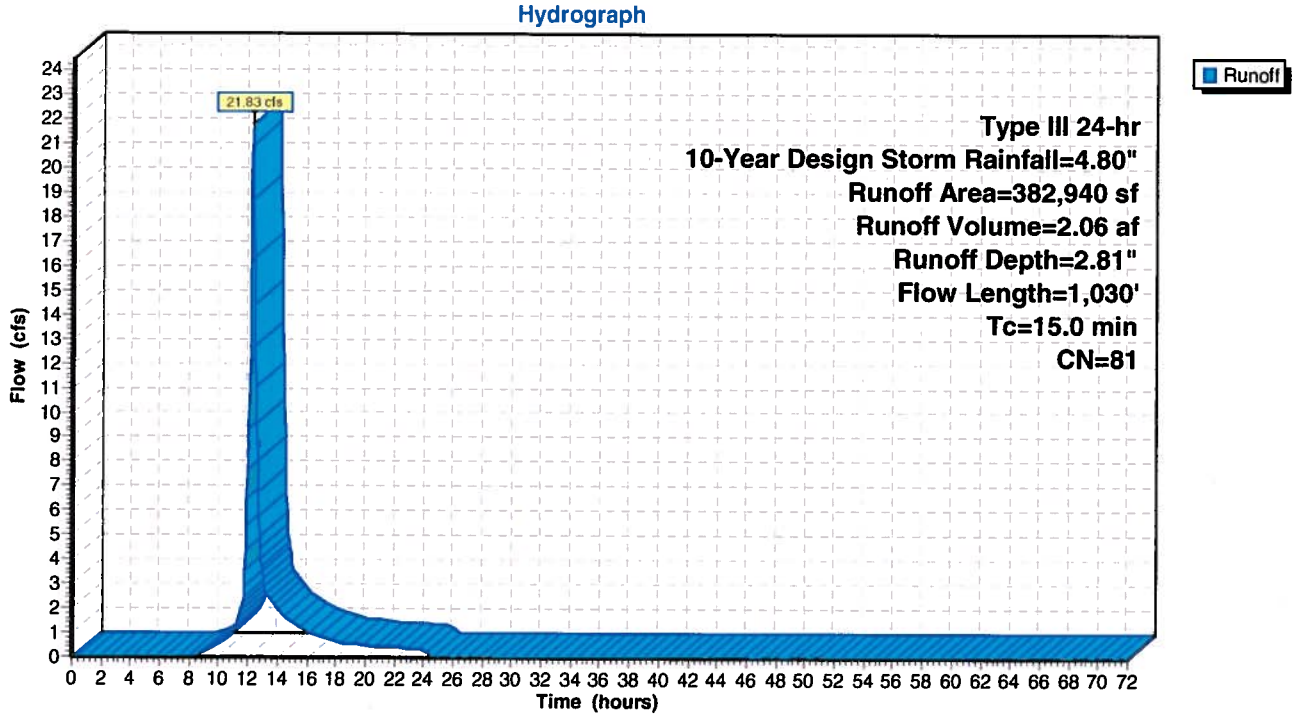
Runoff = 21.83 cfs @ 12.21 hrs, Volume= 2.06 af, Depth= 2.81"

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=4.80"

Area (sf)	CN	Description
9,397	30	Woods, Good, HSG A
294,789	87	Dirt roads, HSG C
77,554	65	Brush, Good, HSG C
1,200	98	Unconnected roofs, HSG C
382,940	81	Weighted Average
381,740		99.69% Pervious Area
1,200		0.31% Impervious Area
1,200		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0624	0.10		**Sheet Flow, Sheet Flow (Segment 1)** Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	133	0.0886	1.49		**Shallow Concentrated Flow, SCF (Segment 2)** Woodland Kv= 5.0 fps
0.4	103	0.0854	4.70		**Shallow Concentrated Flow, SCF (Segment 3)** Unpaved Kv= 16.1 fps
5.2	744	0.0217	2.37		**Shallow Concentrated Flow, SCF (Segment 4)** Unpaved Kv= 16.1 fps
15.0	1,030	Total			

Subcatchment SC1: Subcatchment 1



Summary for Subcatchment SC2: Subcatchment 2

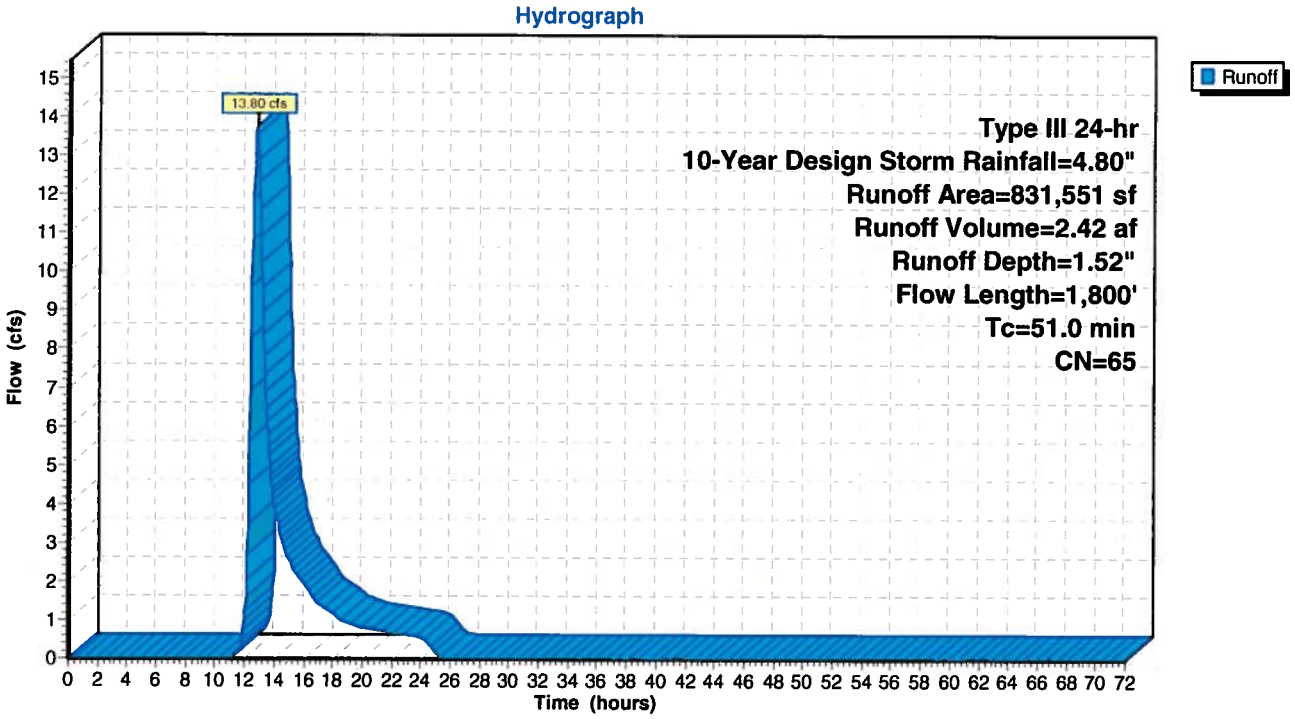
Runoff = 13.80 cfs @ 12.75 hrs, Volume= 2.42 af, Depth= 1.52"

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=4.80"

	Area (sf)	CN	Description
	303,440	30	Woods, Good, HSG A
	472,718	87	Dirt roads, HSG C
	12,958	65	Brush, Good, HSG C
	20,210	39	>75% Grass cover, Good, HSG A
	4,237	98	Unconnected roofs, HSG C
*	17,988	98	Bituminous Concrete, HSG A
	831,551	65	Weighted Average
	809,326		97.33% Pervious Area
	22,225		2.67% Impervious Area
	4,237		19.06% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0742	0.11		**Sheet Flow, Sheet Flow (Segment 1)** Woods: Light underbrush n= 0.400 P2= 3.10"
1.2	97	0.0722	1.34		**Shallow Concentrated Flow, SCF (Segment 2)** Woodland Kv= 5.0 fps
30.8	851	0.0085	0.46		**Shallow Concentrated Flow, SCF (Segment 3)** Woodland Kv= 5.0 fps
11.5	774	0.0258	1.12		**Shallow Concentrated Flow, SCF (Segment 4)** Short Grass Pasture Kv= 7.0 fps
0.1	28	0.0410	3.26		**Shallow Concentrated Flow, SCF (Segment 5)** Unpaved Kv= 16.1 fps
51.0	1,800	Total			

Subcatchment SC2: Subcatchment 2



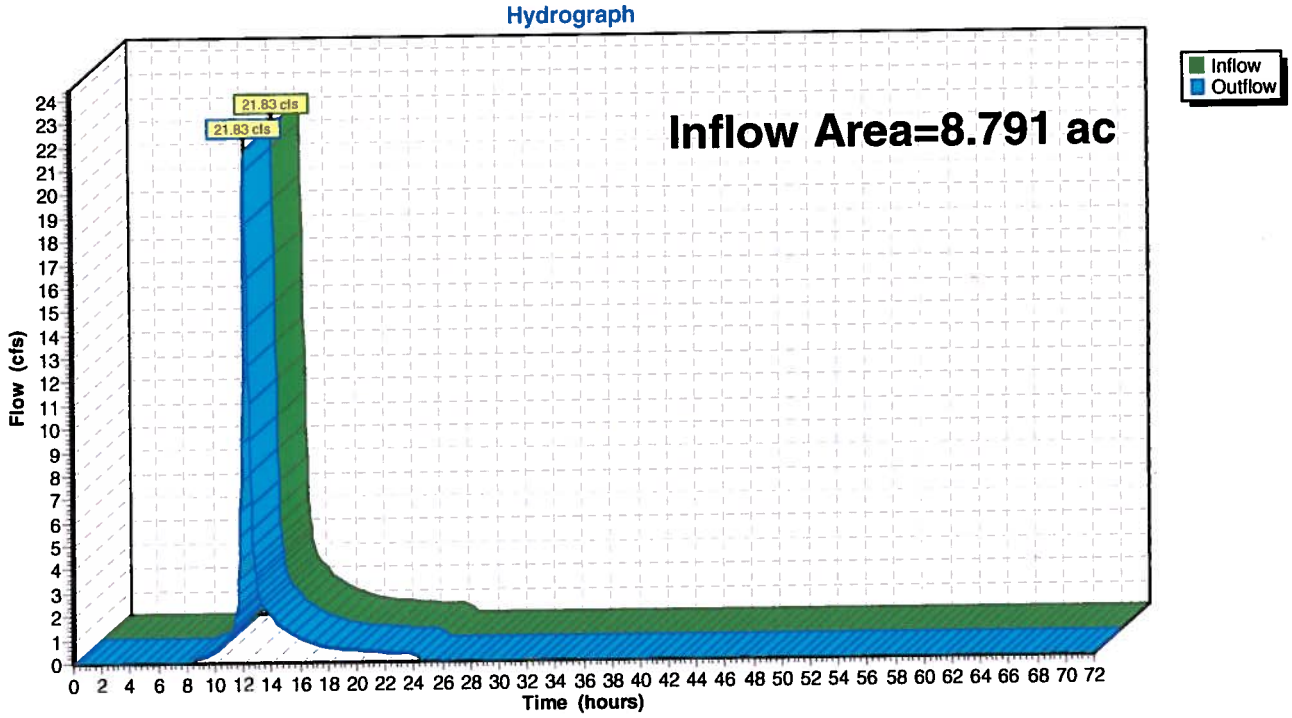
Summary for Reach DP1: Temporary Basin 1

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

Inflow Area = 8.791 ac, 0.31% Impervious, Inflow Depth = 2.81" for 10-Year Design Storm event
Inflow = 21.83 cfs @ 12.21 hrs, Volume= 2.06 af
Outflow = 21.83 cfs @ 12.21 hrs, Volume= 2.06 af, Atten= 0%, Lag= 0.0 min

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

Reach DP1: Temporary Basin 1



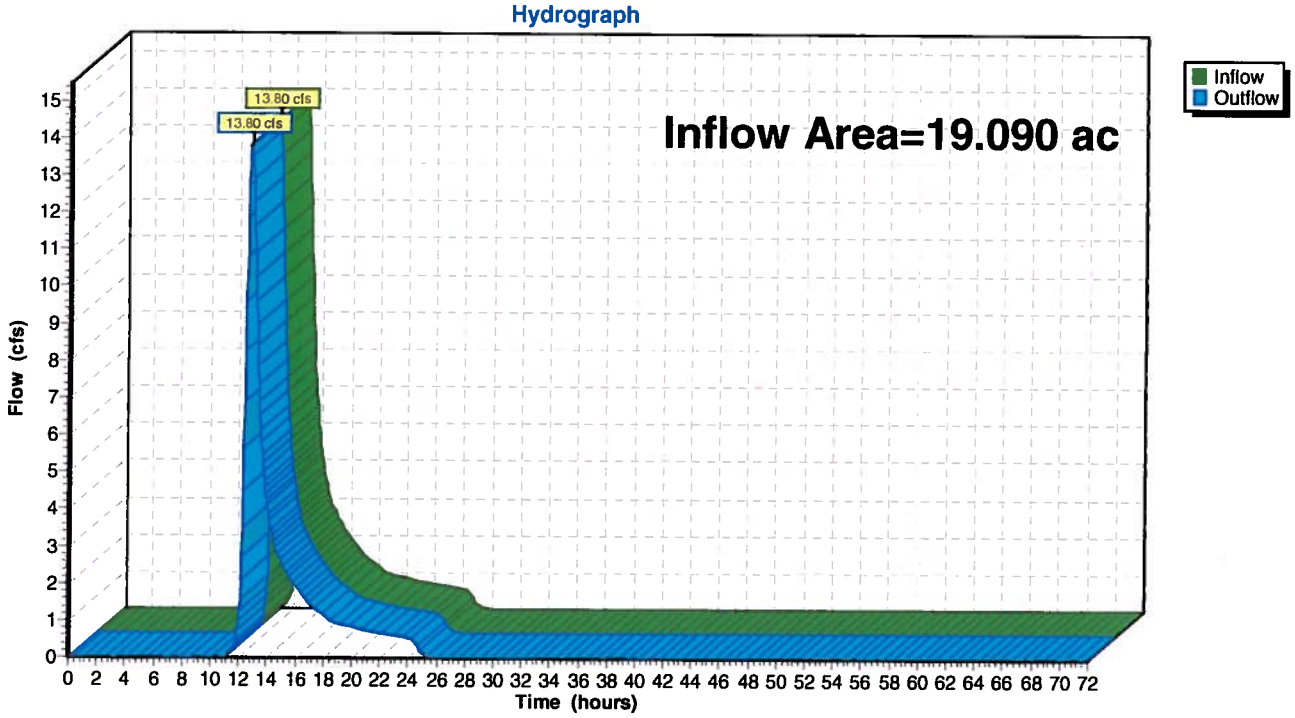
Summary for Reach DP2: Temporary Basin 2

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

Inflow Area = 19.090 ac, 2.67% Impervious, Inflow Depth = 1.52" for 10-Year Design Storm event
Inflow = 13.80 cfs @ 12.75 hrs, Volume= 2.42 af
Outflow = 13.80 cfs @ 12.75 hrs, Volume= 2.42 af, Atten= 0%, Lag= 0.0 min

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

Reach DP2: Temporary Basin 2



EXISTING CONDITIONS
100-YEAR DESIGN STORM

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 SC1: Subcatchment 1 Runoff Area=382,940 sf 0.31% Impervious Runoff Depth=4.90"
Flow Length=1,030' Tc=15.0 min CN=81 Runoff=37.66 cfs 3.59 af

Subcatchment SC2: Subcatchment 2 Runoff Area=831,551 sf 2.67% Impervious Runoff Depth=3.18"
Flow Length=1,800' Tc=51.0 min CN=65 Runoff=30.33 cfs 5.06 af

Reach DP1: Temporary Basin 1 Inflow=37.66 cfs 3.59 af
Outflow=37.66 cfs 3.59 af

Reach DP2: Temporary Basin 2 Inflow=30.33 cfs 5.06 af
Outflow=30.33 cfs 5.06 af

Total Runoff Area = 27.881 ac Runoff Volume = 8.65 af Average Runoff Depth = 3.72"
98.07% Pervious = 27.343 ac 1.93% Impervious = 0.538 ac

Summary for Subcatchment SC1: Subcatchment 1

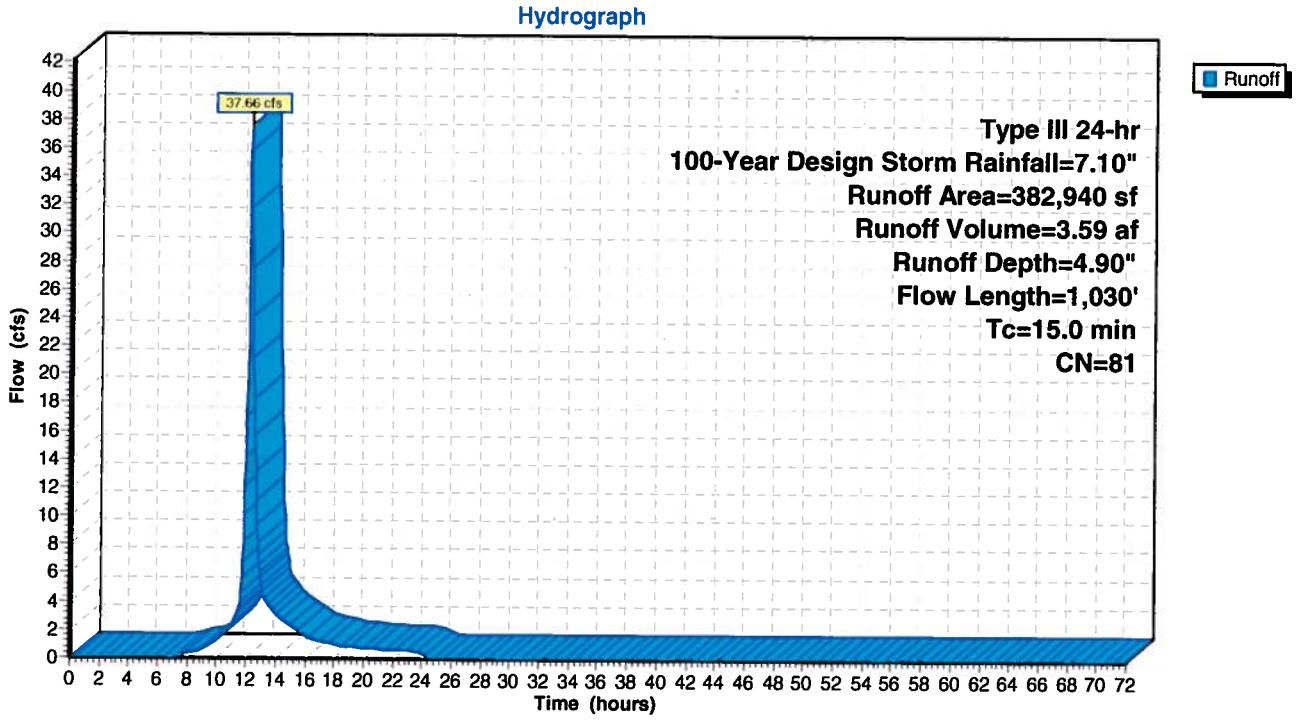
Runoff = 37.66 cfs @ 12.20 hrs, Volume= 3.59 af, Depth= 4.90"

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=7.10"

Area (sf)	CN	Description
9,397	30	Woods, Good, HSG A
294,789	87	Dirt roads, HSG C
77,554	65	Brush, Good, HSG C
1,200	98	Unconnected roofs, HSG C
382,940	81	Weighted Average
381,740		99.69% Pervious Area
1,200		0.31% Impervious Area
1,200		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0624	0.10		**Sheet Flow, Sheet Flow (Segment 1)** Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	133	0.0886	1.49		**Shallow Concentrated Flow, SCF (Segment 2)** Woodland Kv= 5.0 fps
0.4	103	0.0854	4.70		**Shallow Concentrated Flow, SCF (Segment 3)** Unpaved Kv= 16.1 fps
5.2	744	0.0217	2.37		**Shallow Concentrated Flow, SCF (Segment 4)** Unpaved Kv= 16.1 fps
15.0	1,030	Total			

Subcatchment SC1: Subcatchment 1



Summary for Subcatchment SC2: Subcatchment 2

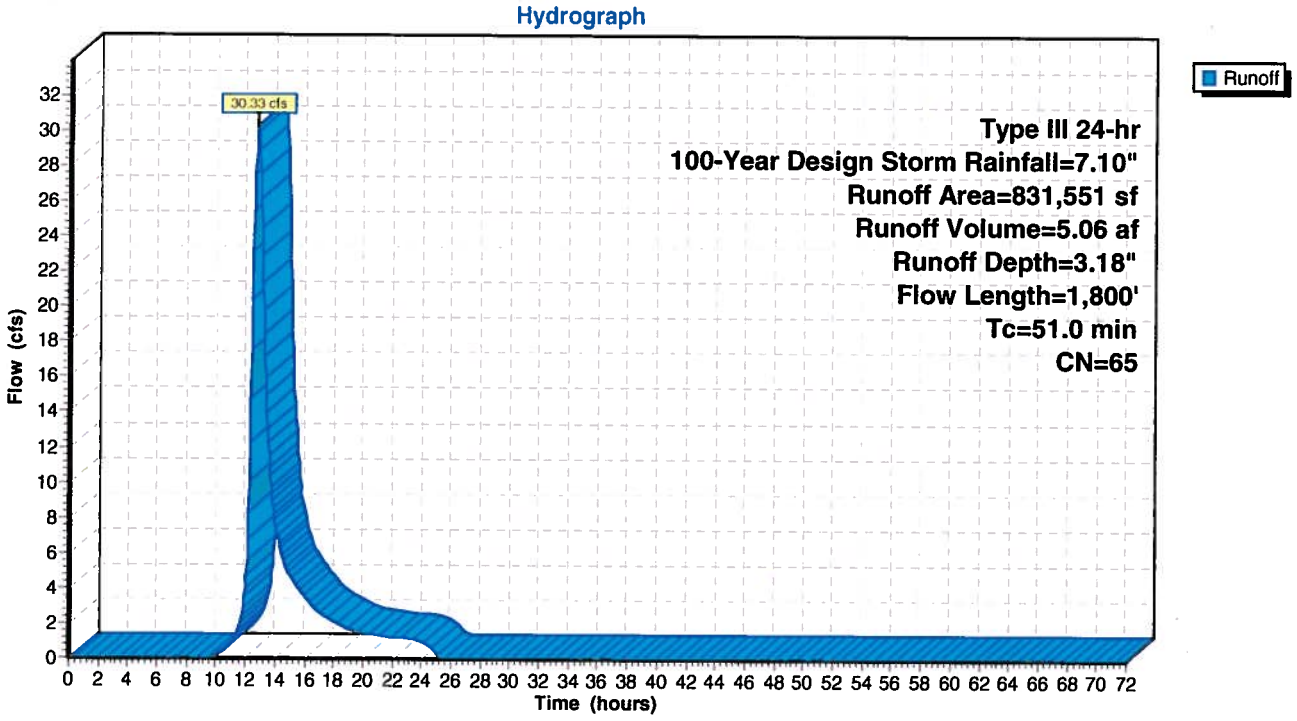
Runoff = 30.33 cfs @ 12.72 hrs, Volume= 5.06 af, Depth= 3.18"

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=7.10"

	Area (sf)	CN	Description
	303,440	30	Woods, Good, HSG A
	472,718	87	Dirt roads, HSG C
	12,958	65	Brush, Good, HSG C
	20,210	39	>75% Grass cover, Good, HSG A
	4,237	98	Unconnected roofs, HSG C
*	17,988	98	Bituminous Concrete, HSG A
	831,551	65	Weighted Average
	809,326		97.33% Pervious Area
	22,225		2.67% Impervious Area
	4,237		19.06% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0742	0.11		**Sheet Flow, Sheet Flow (Segment 1)** Woods: Light underbrush n= 0.400 P2= 3.10"
1.2	97	0.0722	1.34		**Shallow Concentrated Flow, SCF (Segment 2)** Woodland Kv= 5.0 fps
30.8	851	0.0085	0.46		**Shallow Concentrated Flow, SCF (Segment 3)** Woodland Kv= 5.0 fps
11.5	774	0.0258	1.12		**Shallow Concentrated Flow, SCF (Segment 4)** Short Grass Pasture Kv= 7.0 fps
0.1	28	0.0410	3.26		**Shallow Concentrated Flow, SCF (Segment 5)** Unpaved Kv= 16.1 fps
51.0	1,800	Total			

Subcatchment SC2: Subcatchment 2



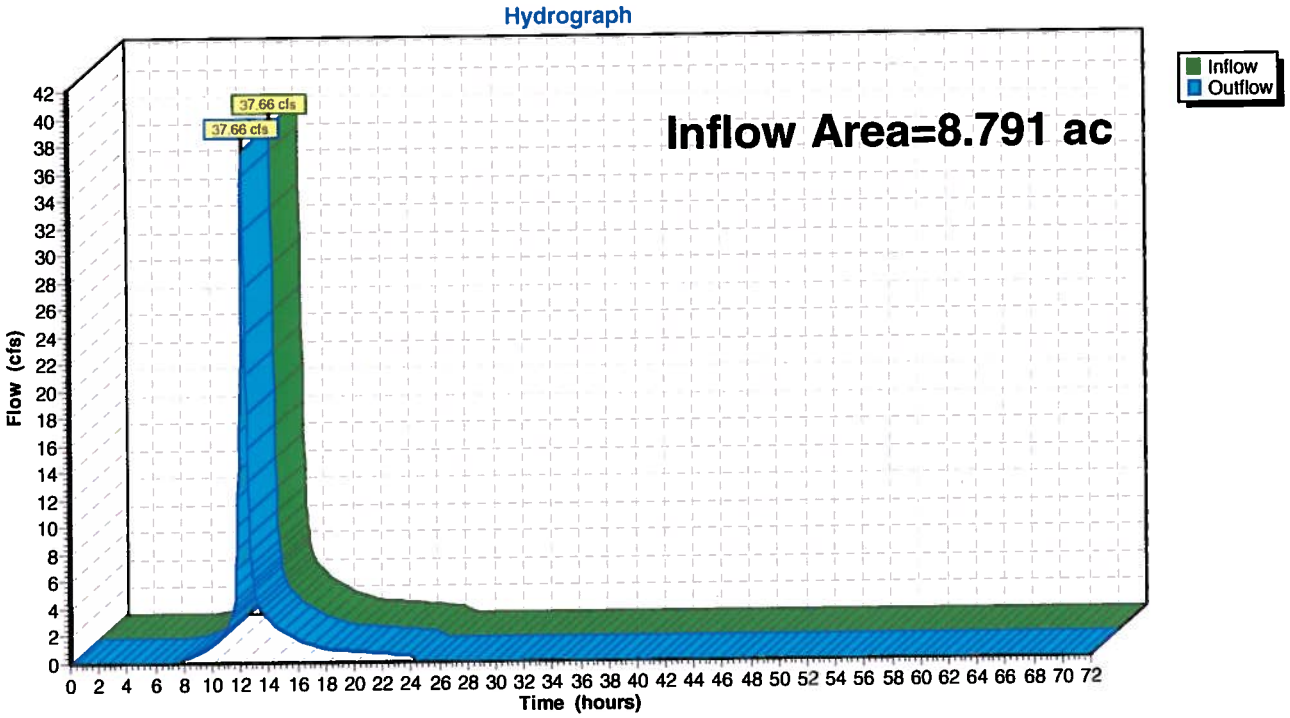
Summary for Reach DP1: Temporary Basin 1

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

Inflow Area = 8.791 ac, 0.31% Impervious, Inflow Depth = 4.90" for 100-Year Design Storm event
Inflow = 37.66 cfs @ 12.20 hrs, Volume= 3.59 af
Outflow = 37.66 cfs @ 12.20 hrs, Volume= 3.59 af, Atten= 0%, Lag= 0.0 min

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

Reach DP1: Temporary Basin 1



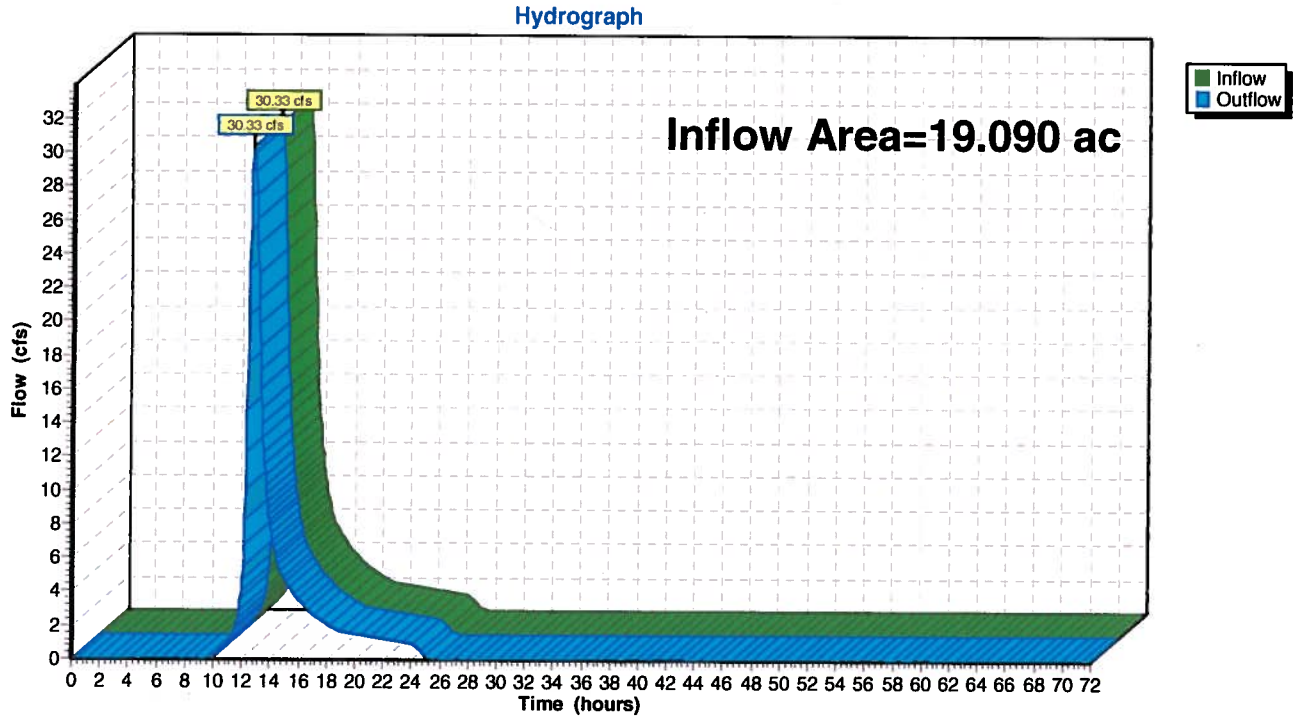
Summary for Reach DP2: Temporary Basin 2

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

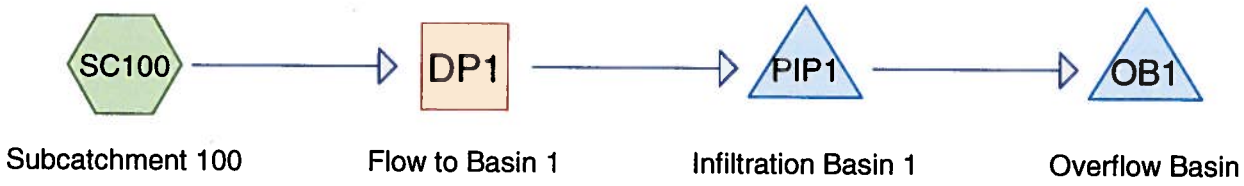
Inflow Area = 19.090 ac, 2.67% Impervious, Inflow Depth = 3.18" for 100-Year Design Storm event
Inflow = 30.33 cfs @ 12.72 hrs, Volume= 5.06 af
Outflow = 30.33 cfs @ 12.72 hrs, Volume= 5.06 af, Atten= 0%, Lag= 0.0 min

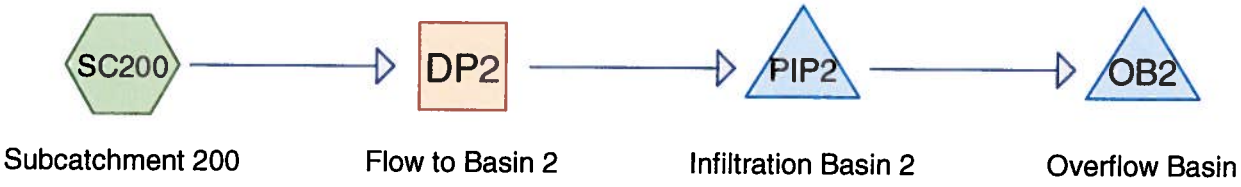
Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

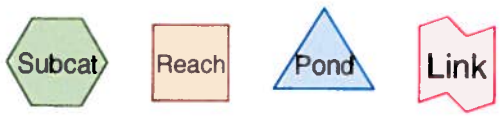
Reach DP2: Temporary Basin 2



PROPOSED CONDITIONS
WATERSHED ROUTING DIAGRAM







Routing Diagram for 5834_POST-DEV - C SOILS realigned rd
Prepared by Meridian Associates, Inc., Printed 8/12/2016

PROPOSED CONDITIONS
2-YEAR DESIGN STORM

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 SC100: Subcatchment 100 Runoff Area=384,969 sf 0.00% Impervious Runoff Depth=1.07"
Flow Length=1,022' Tc=15.6 min CN=70 Runoff=7.56 cfs 0.79 af

Subcatchment SC200: Subcatchment 200 Runoff Area=829,522 sf 1.39% Impervious Runoff Depth=0.45"
Flow Length=1,800' Tc=50.1 min CN=57 Runoff=2.86 cfs 0.72 af

Reach DP1: Flow to Basin 1 Inflow=7.56 cfs 0.79 af
Outflow=7.56 cfs 0.79 af

Reach DP2: Flow to Basin 2 Inflow=2.86 cfs 0.72 af
Outflow=2.86 cfs 0.72 af

Pond OB1: Overflow Basin Peak Elev=44.00' Storage=0 cf Inflow=0.00 cfs 0.00 af
Outflow=0.00 cfs 0.00 af

Pond OB2: Overflow Basin Peak Elev=41.00' Storage=0 cf Inflow=0.00 cfs 0.00 af
Outflow=0.00 cfs 0.00 af

Pond PIP1: Infiltration Basin 1 Peak Elev=44.27' Storage=8,167 cf Inflow=7.56 cfs 0.79 af
Discarded=2.27 cfs 0.79 af Primary=0.00 cfs 0.00 af Outflow=2.27 cfs 0.79 af

Pond PIP2: Infiltration Basin 2 Peak Elev=40.57' Storage=906 cf Inflow=2.86 cfs 0.72 af
Discarded=2.51 cfs 0.72 af Primary=0.00 cfs 0.00 af Outflow=2.51 cfs 0.72 af

Total Runoff Area = 27.881 ac Runoff Volume = 1.51 af Average Runoff Depth = 0.65"
99.05% Pervious = 27.617 ac 0.95% Impervious = 0.264 ac

Summary for Subcatchment SC100: Subcatchment 100

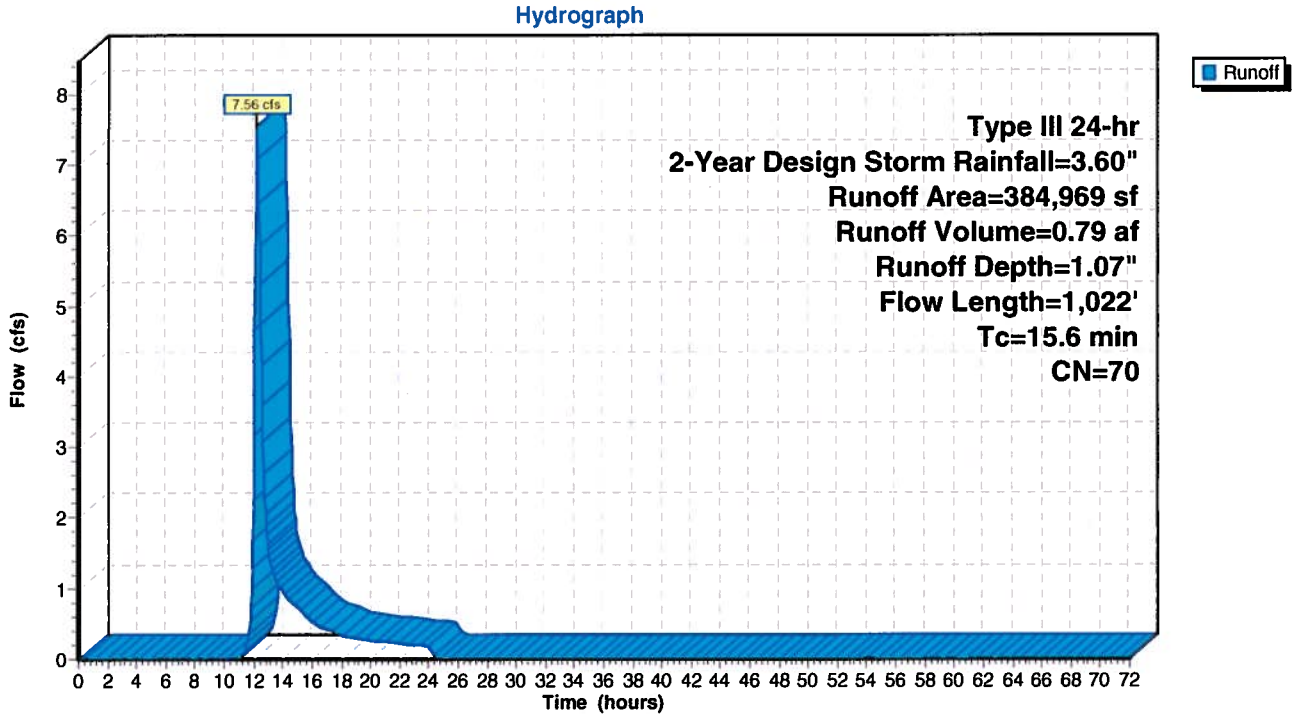
Runoff = 7.56 cfs @ 12.24 hrs, Volume= 0.79 af, Depth= 1.07"

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=3.60"

	Area (sf)	CN	Description
	9,397	30	Woods, Good, HSG A
	0	87	Dirt roads, HSG C
	77,025	65	Brush, Good, HSG C
*	0	30	Proposed Meadow, non-grazed, HSG A
*	275,679	71	Proposed Meadow, non-grazed, HSG C
*	0	98	Proposed Concrete Pad
*	22,868	89	Proposed Gravel Roads, HSG C
	384,969	70	Weighted Average
	384,969		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0624	0.10		**Sheet Flow, Sheet Flow (Segment 1)** Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	133	0.0886	1.49		**Shallow Concentrated Flow, SCF (Segment 2)** Woodland Kv= 5.0 fps
0.4	103	0.0854	4.70		**Shallow Concentrated Flow, SCF (Segment 3)** Unpaved Kv= 16.1 fps
4.7	668	0.0217	2.37		**Shallow Concentrated Flow, SCF (Segment 4)** Unpaved Kv= 16.1 fps
1.1	68	0.0217	1.03		**Shallow Concentrated Flow, SCF (Segment 4)** Short Grass Pasture Kv= 7.0 fps
15.6	1,022	Total			

Subcatchment SC100: Subcatchment 100



Summary for Subcatchment SC200: Subcatchment 200

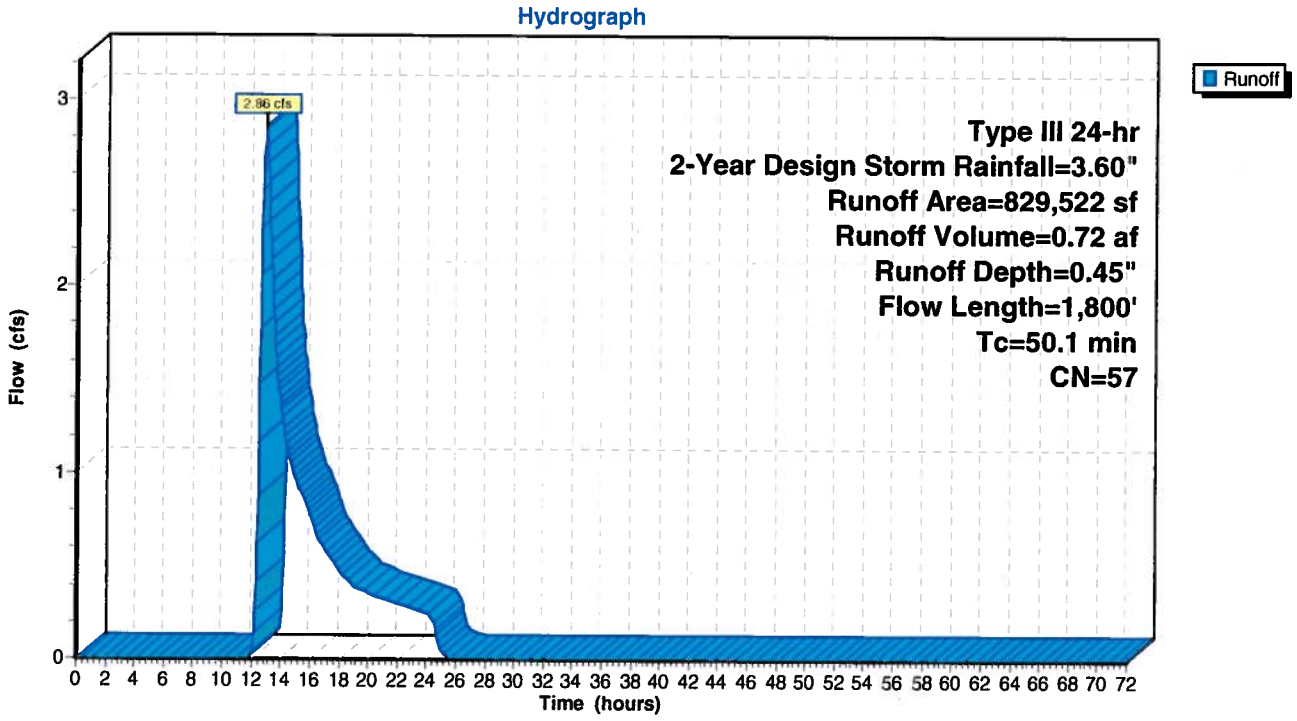
Runoff = 2.86 cfs @ 12.88 hrs, Volume= 0.72 af, Depth= 0.45"

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=3.60"

	Area (sf)	CN	Description
	216,049	30	Woods, Good, HSG A
	3,161	87	Dirt roads, HSG C
	8,886	65	Brush, Good, HSG C
	17,360	39	>75% Grass cover, Good, HSG A
*	10,510	98	Bituminous Concrete Sidewalk, HSG A
*	69,245	30	Proposed Meadow, non-grazed, HSG A
*	463,342	71	Proposed Meadow, non-grazed, HSG C
*	1,000	98	Proposed Concrete Pad
*	0	98	Proposed Concrete Pad
*	0	98	Proposed Concrete Pad
*	18,144	76	Proposed Gravel Roads, HSG A
*	21,825	89	Proposed Gravel Roads, HSG C
	829,522	57	Weighted Average
	818,012		98.61% Pervious Area
	11,510		1.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0742	0.11		**Sheet Flow, Sheet Flow (Segment 1)** Woods: Light underbrush n= 0.400 P2= 3.10"
1.2	97	0.0722	1.34		**Shallow Concentrated Flow, SCF (Segment 2)** Woodland Kv= 5.0 fps
2.8	109	0.0085	0.65		**Shallow Concentrated Flow, SCF (Segment 3)** Short Grass Pasture Kv= 7.0 fps
26.8	742	0.0085	0.46		**Shallow Concentrated Flow, SCF (Segment 3)** Woodland Kv= 5.0 fps
11.9	802	0.0258	1.12		**Shallow Concentrated Flow, SCF (Segment 4)** Short Grass Pasture Kv= 7.0 fps
50.1	1,800	Total			

Subcatchment SC200: Subcatchment 200



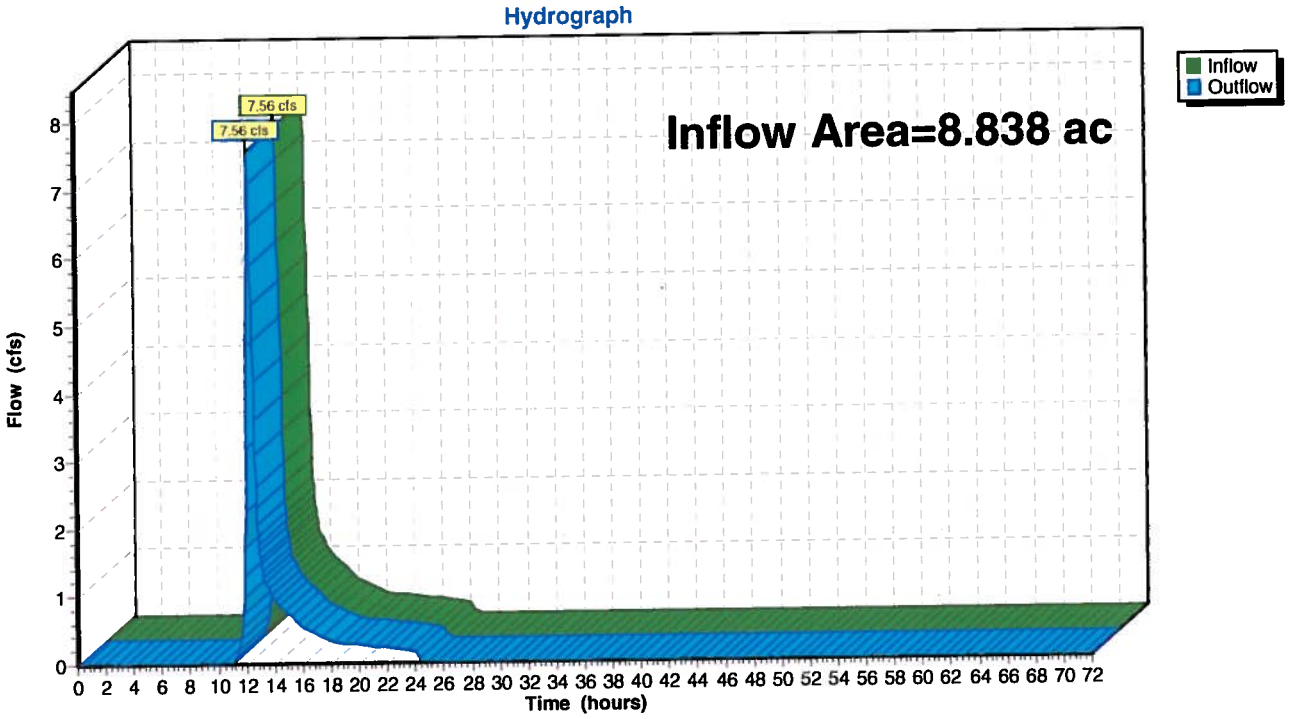
Summary for Reach DP1: Flow to Basin 1

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

Inflow Area = 8.838 ac, 0.00% Impervious, Inflow Depth = 1.07" for 2-Year Design Storm event
Inflow = 7.56 cfs @ 12.24 hrs, Volume= 0.79 af
Outflow = 7.56 cfs @ 12.24 hrs, Volume= 0.79 af, Atten= 0%, Lag= 0.0 min

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

Reach DP1: Flow to Basin 1



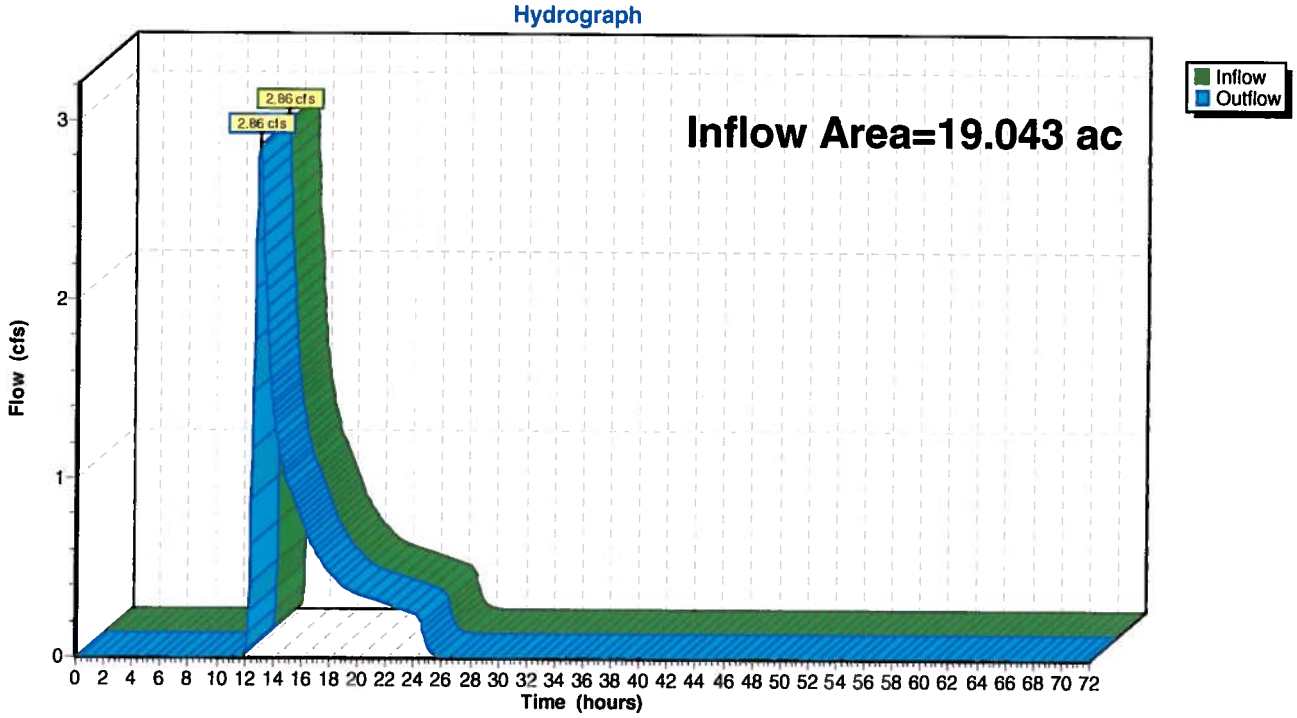
Summary for Reach DP2: Flow to Basin 2

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

Inflow Area = 19.043 ac, 1.39% Impervious, Inflow Depth = 0.45" for 2-Year Design Storm event
Inflow = 2.86 cfs @ 12.88 hrs, Volume= 0.72 af
Outflow = 2.86 cfs @ 12.88 hrs, Volume= 0.72 af, Atten= 0%, Lag= 0.0 min

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

Reach DP2: Flow to Basin 2



Summary for Pond OB1: Overflow Basin

Inflow Area = 8.838 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year Design Storm event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

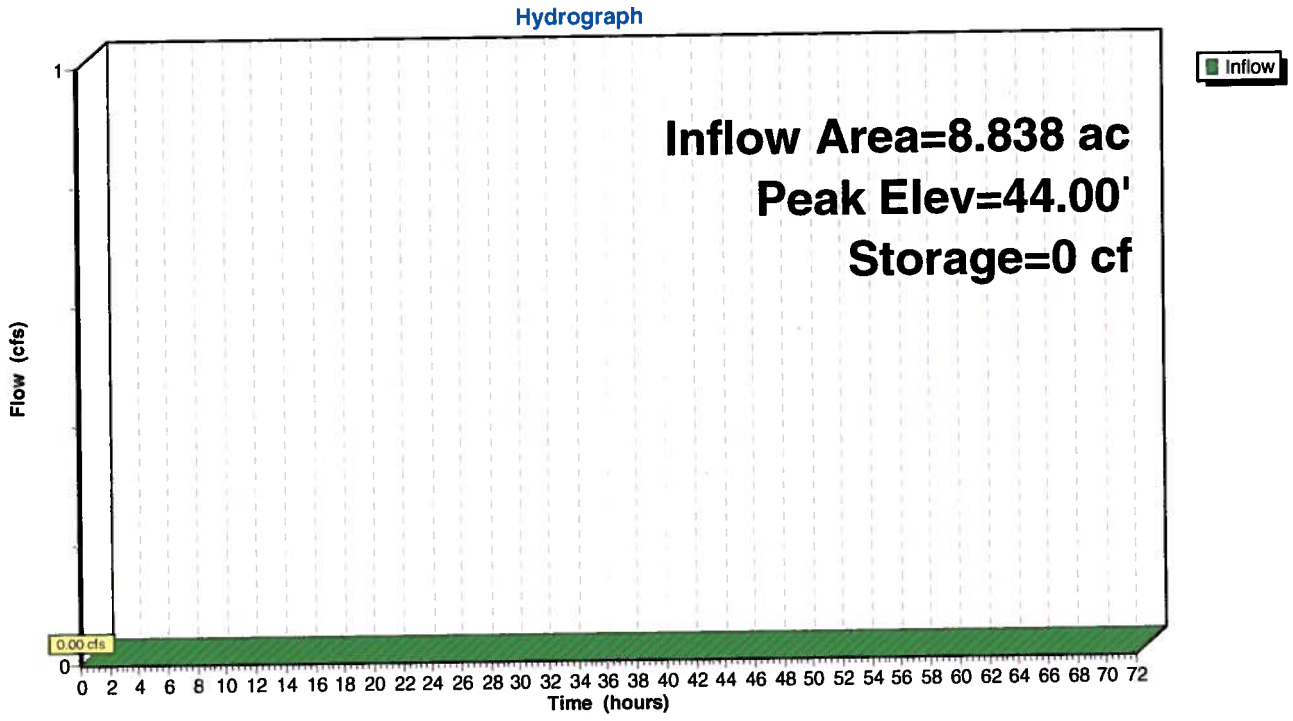
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 44.00' @ 0.00 hrs Surf.Area= 845 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	44.00'	4,123 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)
44.00	845	137.0	0	0	845
45.00	1,280	155.0	1,055	1,055	1,288
46.00	1,775	174.0	1,521	2,576	1,812
47.00	1,330	193.0	1,547	4,123	2,396

Pond OB1: Overflow Basin



Summary for Pond OB2: Overflow Basin

Inflow Area = 19.043 ac, 1.39% Impervious, Inflow Depth = 0.00" for 2-Year Design Storm event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

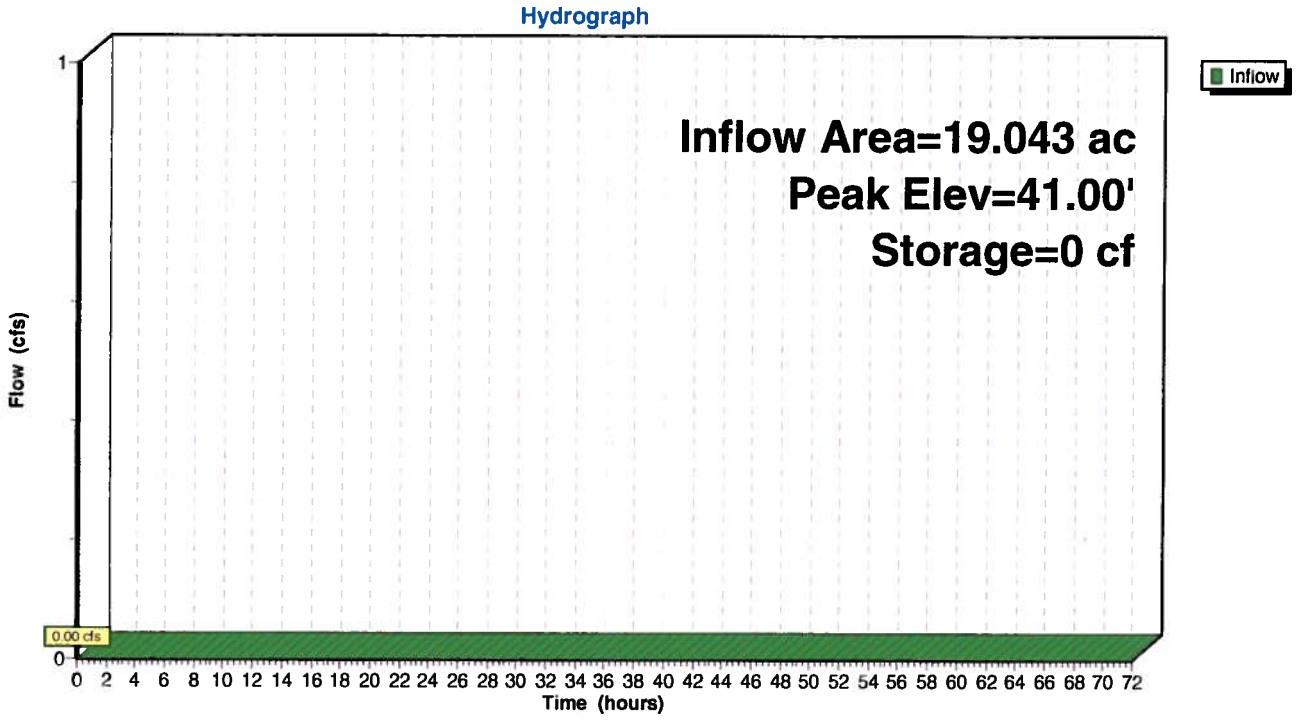
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 41.00' @ 0.00 hrs Surf.Area= 210 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	41.00'	1,635 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)
41.00	210	58.0	0	0	210
42.00	400	77.0	300	300	425
43.00	660	95.0	525	825	686
44.00	970	114.0	810	1,635	1,019

Pond OB2: Overflow Basin



Summary for Pond PIP1: Infiltration Basin 1

Inflow Area = 8.838 ac, 0.00% Impervious, Inflow Depth = 1.07" for 2-Year Design Storm event
Inflow = 7.56 cfs @ 12.24 hrs, Volume= 0.79 af
Outflow = 2.27 cfs @ 12.76 hrs, Volume= 0.79 af, Atten= 70%, Lag= 31.2 min
Discarded = 2.27 cfs @ 12.76 hrs, Volume= 0.79 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 44.27' @ 12.76 hrs Surf.Area= 11,882 sf Storage= 8,167 cf

Plug-Flow detention time= 26.3 min calculated for 0.79 af (100% of inflow)
Center-of-Mass det. time= 26.2 min (902.5 - 876.3)

Volume	Invert	Avail.Storage	Storage Description
#1	43.50'	74,849 cf	**Infiltration Basin #1 (Irregular)** Listed below (Recalc)

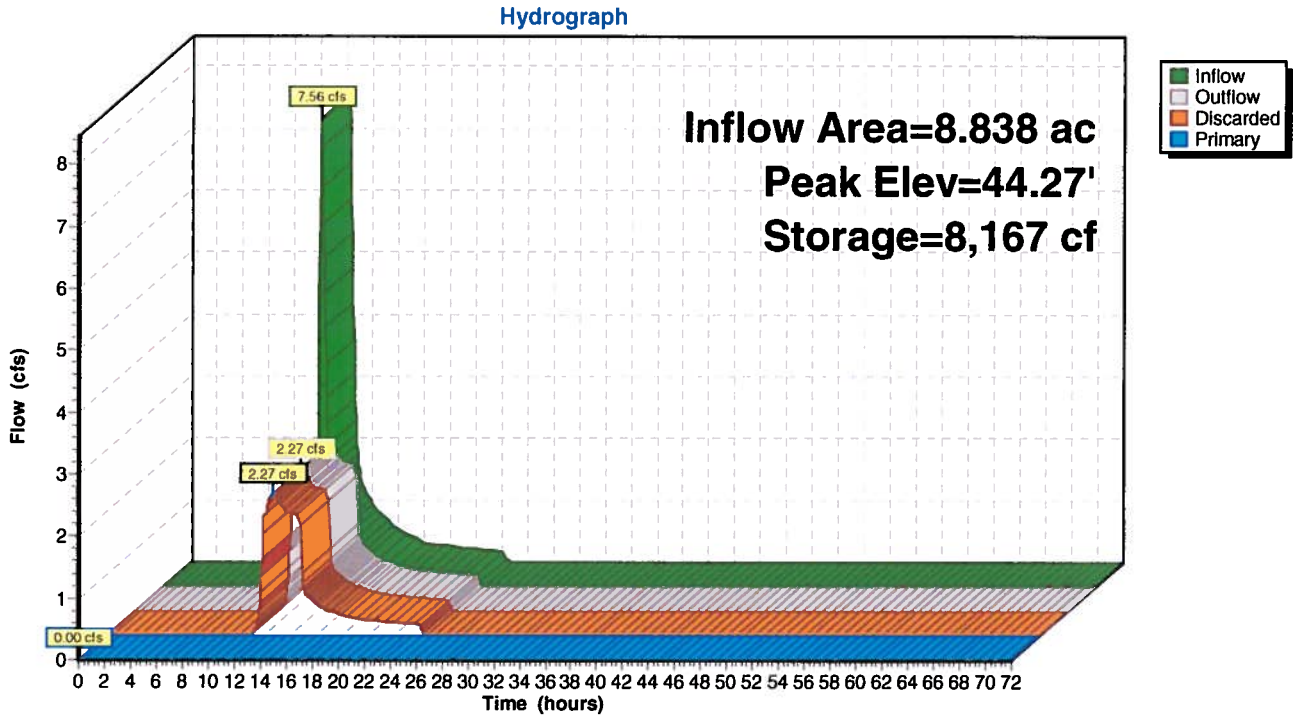
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
43.50	10,000	547.0	0	0	10,000
44.00	10,500	554.0	5,124	5,124	10,672
45.00	16,000	611.0	13,154	18,278	15,989
46.00	17,900	630.0	16,941	35,219	17,965
47.00	19,800	648.0	18,842	54,061	19,904
48.00	21,790	667.0	20,787	74,849	21,998

Device	Routing	Invert	Outlet Devices
#1	Primary	47.00'	**10.0' long x 10.0' 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) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Discarded	43.50'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=2.27 cfs @ 12.76 hrs HW=44.27' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 2.27 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=43.50' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond PIP1: Infiltration Basin 1



Summary for Pond PIP2: Infiltration Basin 2

Inflow Area = 19.043 ac, 1.39% Impervious, Inflow Depth = 0.45" for 2-Year Design Storm event
Inflow = 2.86 cfs @ 12.88 hrs, Volume= 0.72 af
Outflow = 2.51 cfs @ 13.12 hrs, Volume= 0.72 af, Atten= 12%, Lag= 14.7 min
Discarded = 2.51 cfs @ 13.12 hrs, Volume= 0.72 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 40.57' @ 13.12 hrs Surf.Area= 13,110 sf Storage= 906 cf

Plug-Flow detention time= 4.2 min calculated for 0.72 af (100% of inflow)
Center-of-Mass det. time= 4.2 min (966.2 - 962.1)

Volume	Invert	Avail.Storage	Storage Description
#1	40.50'	97,330 cf	**Infiltration Basin #2 (Irregular)** Listed below (Recalc)

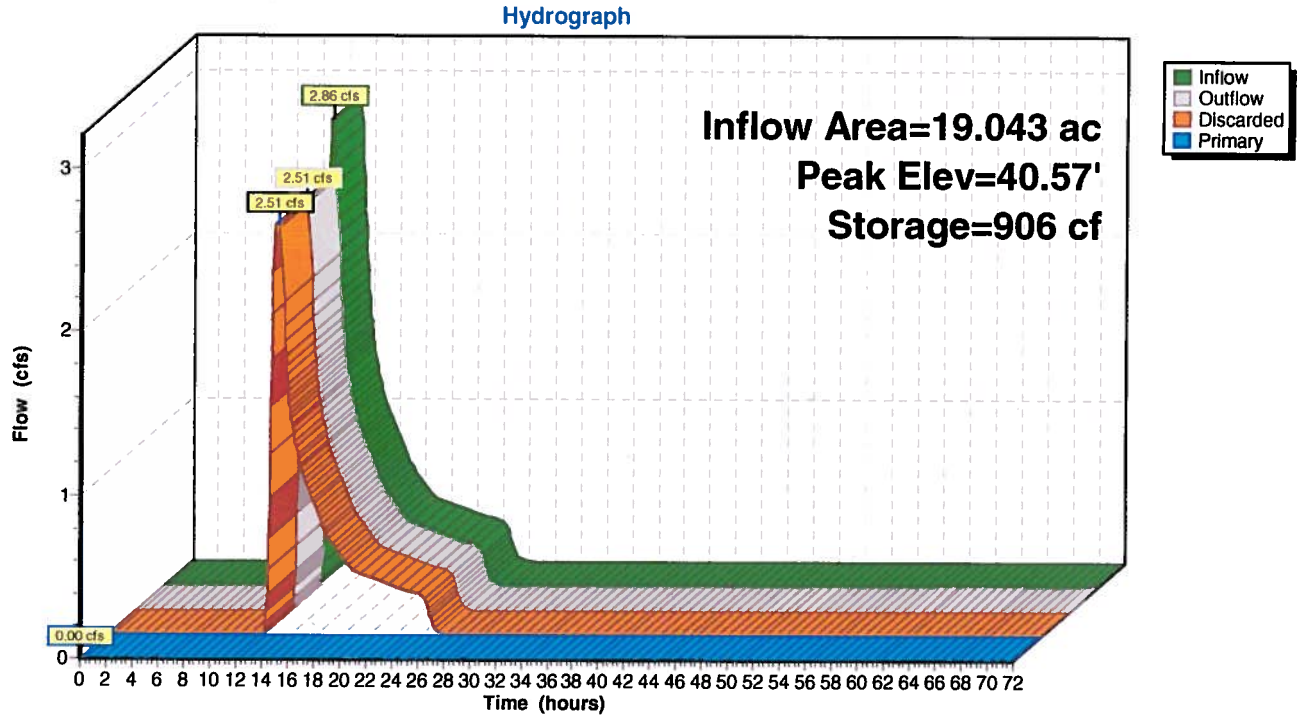
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
40.50	13,000	771.0	0	0	13,000
41.00	13,800	778.0	6,699	6,699	13,946
42.00	20,650	839.0	17,110	23,809	21,837
43.00	23,200	858.0	21,913	45,722	24,539
44.00	25,800	876.0	24,488	70,210	27,170
45.00	28,460	896.0	27,119	97,330	30,126

Device	Routing	Invert	Outlet Devices
#1	Discarded	40.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	44.00'	**10.0' long x 10.0' 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) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=2.51 cfs @ 13.12 hrs HW=40.57' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 2.51 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=40.50' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond PIP2: Infiltration Basin 2



PROPOSED CONDITIONS
10-YEAR DESIGN STORM

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 SC100: Subcatchment 100 Runoff Area=384,969 sf 0.00% Impervious Runoff Depth=1.89"
Flow Length=1,022' Tc=15.6 min CN=70 Runoff=14.08 cfs 1.39 af

Subcatchment SC200: Subcatchment 200 Runoff Area=829,522 sf 1.39% Impervious Runoff Depth=1.00"
Flow Length=1,800' Tc=50.1 min CN=57 Runoff=8.06 cfs 1.59 af

Reach DP1: Flow to Basin 1 Inflow=14.08 cfs 1.39 af
Outflow=14.08 cfs 1.39 af

Reach DP2: Flow to Basin 2 Inflow=8.06 cfs 1.59 af
Outflow=8.06 cfs 1.59 af

Pond OB1: Overflow Basin Peak Elev=44.00' Storage=0 cf Inflow=0.00 cfs 0.00 af
Outflow=0.00 cfs 0.00 af

Pond OB2: Overflow Basin Peak Elev=41.00' Storage=0 cf Inflow=0.00 cfs 0.00 af
Outflow=0.00 cfs 0.00 af

Pond PIP1: Infiltration Basin 1 Peak Elev=45.05' Storage=19,050 cf Inflow=14.08 cfs 1.39 af
Discarded=3.08 cfs 1.39 af Primary=0.00 cfs 0.00 af Outflow=3.08 cfs 1.39 af

Pond PIP2: Infiltration Basin 2 Peak Elev=41.51' Storage=14,569 cf Inflow=8.06 cfs 1.59 af
Discarded=3.28 cfs 1.59 af Primary=0.00 cfs 0.00 af Outflow=3.28 cfs 1.59 af

Total Runoff Area = 27.881 ac Runoff Volume = 2.98 af Average Runoff Depth = 1.28"
99.05% Pervious = 27.617 ac 0.95% Impervious = 0.264 ac

Summary for Subcatchment SC100: Subcatchment 100

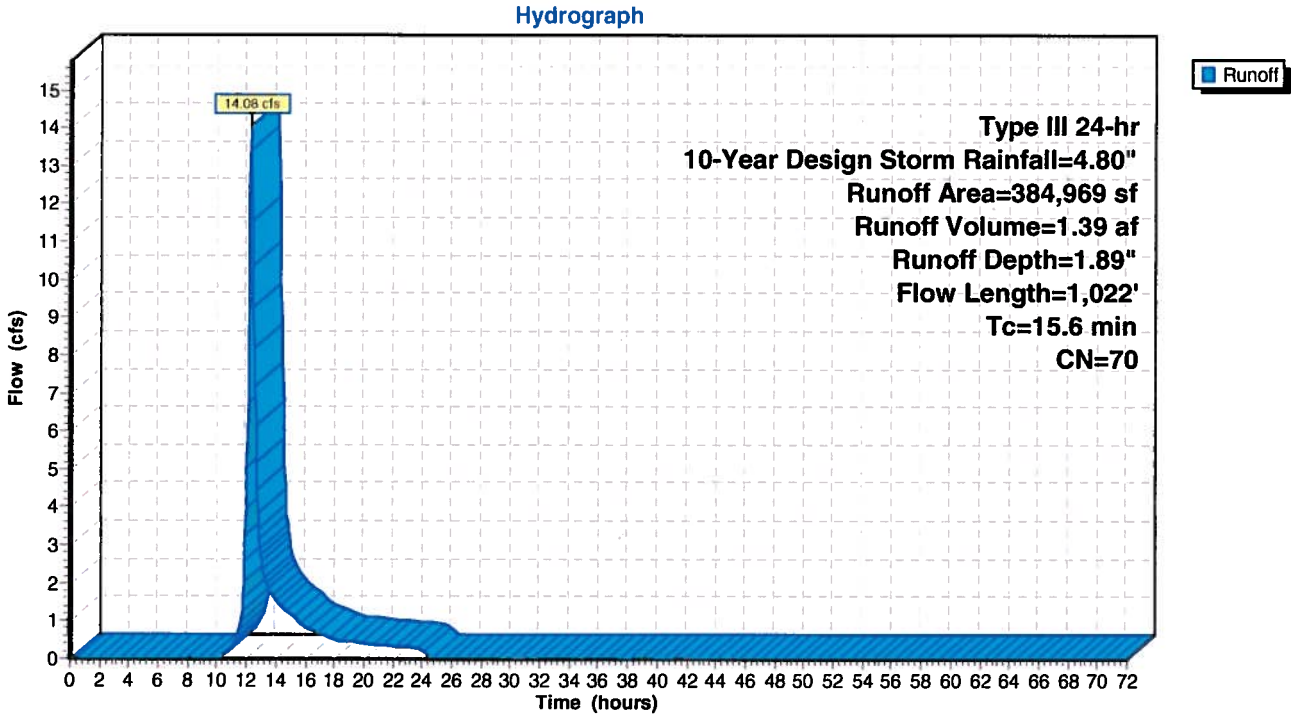
Runoff = 14.08 cfs @ 12.23 hrs, Volume= 1.39 af, Depth= 1.89"

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=4.80"

	Area (sf)	CN	Description
	9,397	30	Woods, Good, HSG A
	0	87	Dirt roads, HSG C
	77,025	65	Brush, Good, HSG C
*	0	30	Proposed Meadow, non-grazed, HSG A
*	275,679	71	Proposed Meadow, non-grazed, HSG C
*	0	98	Proposed Concrete Pad
*	22,868	89	Proposed Gravel Roads, HSG C
	384,969	70	Weighted Average
	384,969		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0624	0.10		**Sheet Flow, Sheet Flow (Segment 1)** Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	133	0.0886	1.49		**Shallow Concentrated Flow, SCF (Segment 2)** Woodland Kv= 5.0 fps
0.4	103	0.0854	4.70		**Shallow Concentrated Flow, SCF (Segment 3)** Unpaved Kv= 16.1 fps
4.7	668	0.0217	2.37		**Shallow Concentrated Flow, SCF (Segment 4)** Unpaved Kv= 16.1 fps
1.1	68	0.0217	1.03		**Shallow Concentrated Flow, SCF (Segment 4)** Short Grass Pasture Kv= 7.0 fps
15.6	1,022	Total			

Subcatchment SC100: Subcatchment 100



Summary for Subcatchment SC200: Subcatchment 200

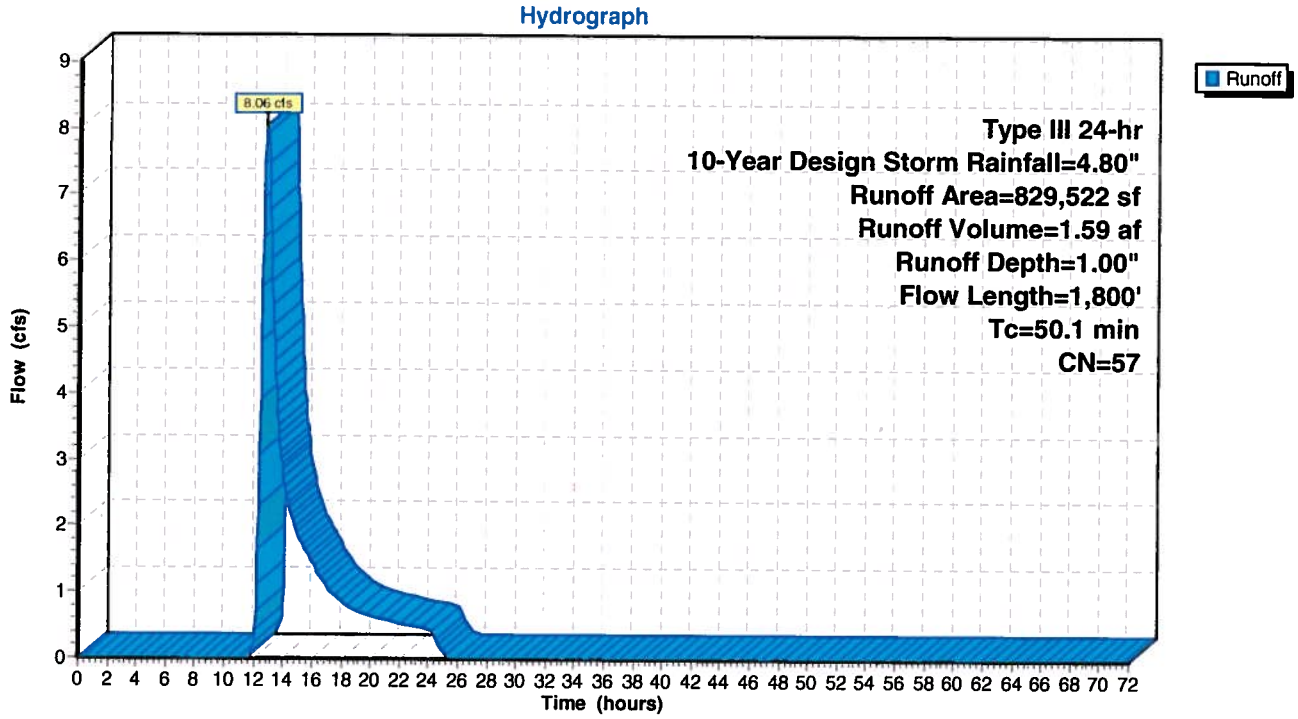
Runoff = 8.06 cfs @ 12.79 hrs, Volume= 1.59 af, Depth= 1.00"

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=4.80"

	Area (sf)	CN	Description
	216,049	30	Woods, Good, HSG A
	3,161	87	Dirt roads, HSG C
	8,886	65	Brush, Good, HSG C
	17,360	39	>75% Grass cover, Good, HSG A
*	10,510	98	Bituminous Concrete Sidewalk, HSG A
*	69,245	30	Proposed Meadow, non-grazed, HSG A
*	463,342	71	Proposed Meadow, non-grazed, HSG C
*	1,000	98	Proposed Concrete Pad
*	0	98	Proposed Concrete Pad
*	0	98	Proposed Concrete Pad
*	18,144	76	Proposed Gravel Roads, HSG A
*	21,825	89	Proposed Gravel Roads, HSG C
	829,522	57	Weighted Average
	818,012		98.61% Pervious Area
	11,510		1.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0742	0.11		**Sheet Flow, Sheet Flow (Segment 1)** Woods: Light underbrush n= 0.400 P2= 3.10"
1.2	97	0.0722	1.34		**Shallow Concentrated Flow, SCF (Segment 2)** Woodland Kv= 5.0 fps
2.8	109	0.0085	0.65		**Shallow Concentrated Flow, SCF (Segment 3)** Short Grass Pasture Kv= 7.0 fps
26.8	742	0.0085	0.46		**Shallow Concentrated Flow, SCF (Segment 3)** Woodland Kv= 5.0 fps
11.9	802	0.0258	1.12		**Shallow Concentrated Flow, SCF (Segment 4)** Short Grass Pasture Kv= 7.0 fps
50.1	1,800	Total			

Subcatchment SC200: Subcatchment 200



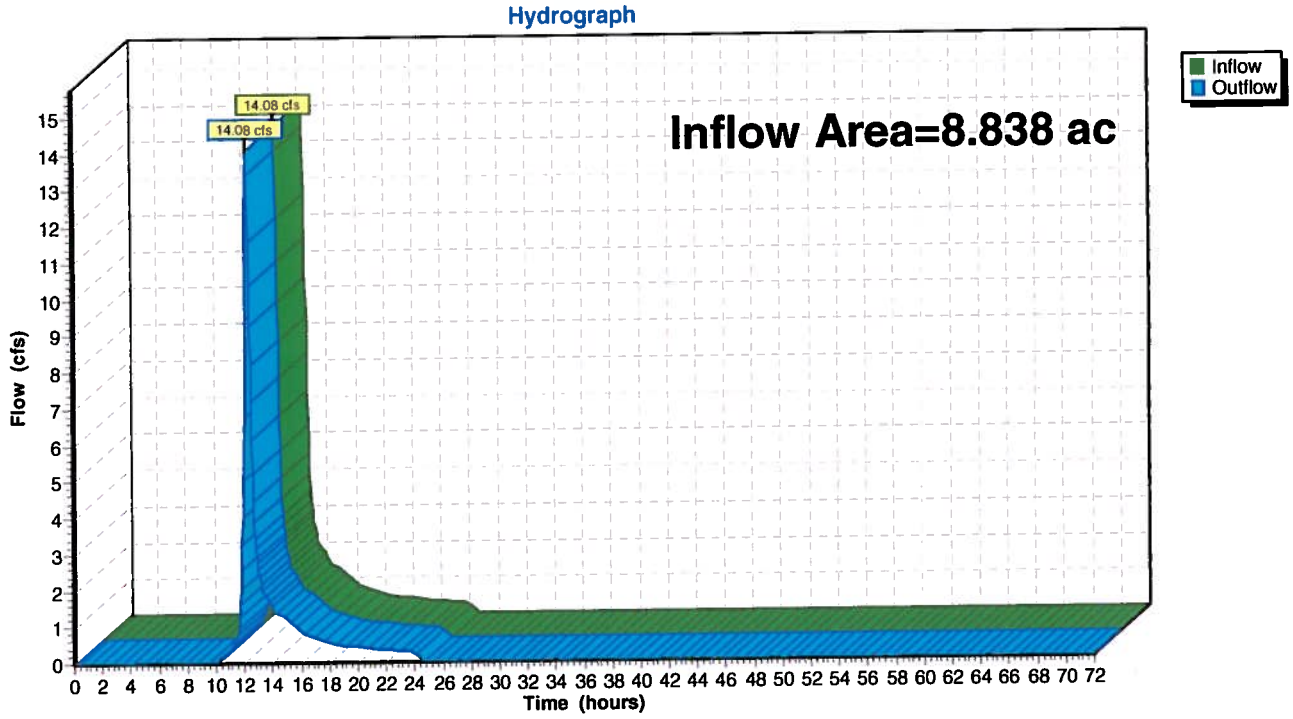
Summary for Reach DP1: Flow to Basin 1

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

Inflow Area = 8.838 ac, 0.00% Impervious, Inflow Depth = 1.89" for 10-Year Design Storm event
Inflow = 14.08 cfs @ 12.23 hrs, Volume= 1.39 af
Outflow = 14.08 cfs @ 12.23 hrs, Volume= 1.39 af, Atten= 0%, Lag= 0.0 min

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

Reach DP1: Flow to Basin 1



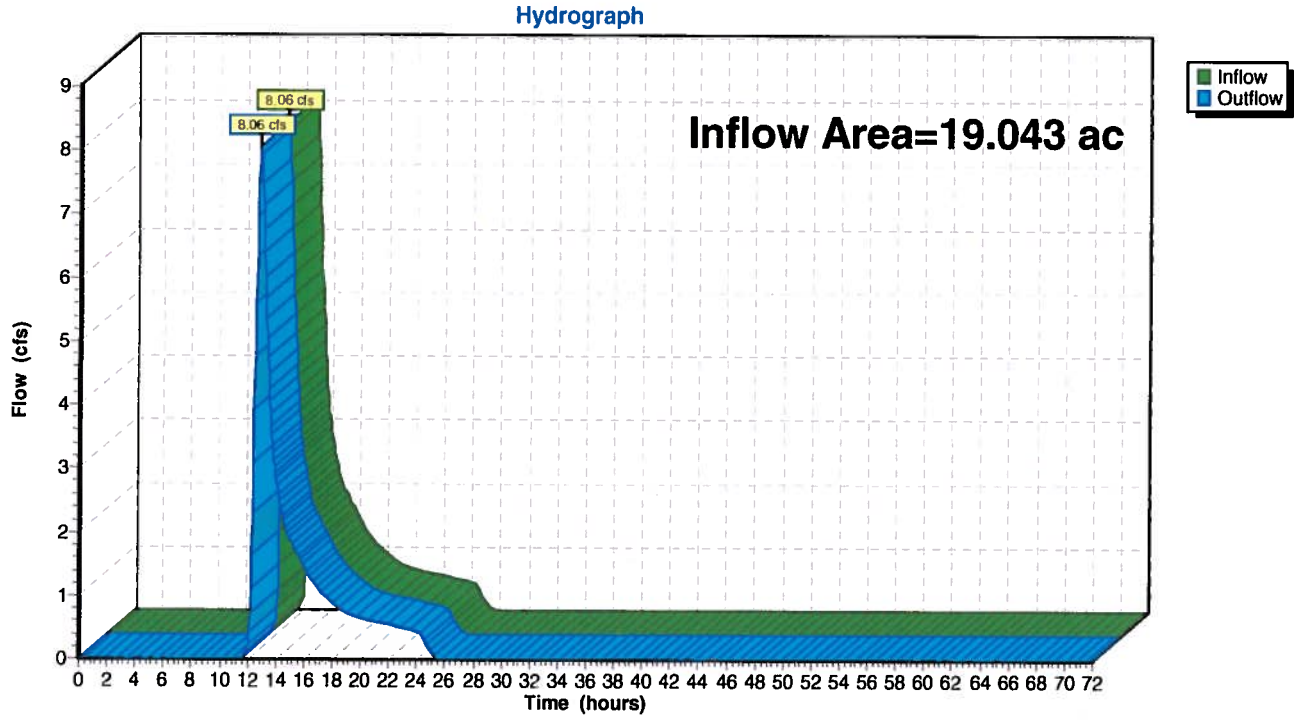
Summary for Reach DP2: Flow to Basin 2

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

Inflow Area = 19.043 ac, 1.39% Impervious, Inflow Depth = 1.00" for 10-Year Design Storm event
Inflow = 8.06 cfs @ 12.79 hrs, Volume= 1.59 af
Outflow = 8.06 cfs @ 12.79 hrs, Volume= 1.59 af, Atten= 0%, Lag= 0.0 min

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

Reach DP2: Flow to Basin 2



Summary for Pond OB1: Overflow Basin

Inflow Area = 8.838 ac, 0.00% Impervious, Inflow Depth = 0.00" for 10-Year Design Storm event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

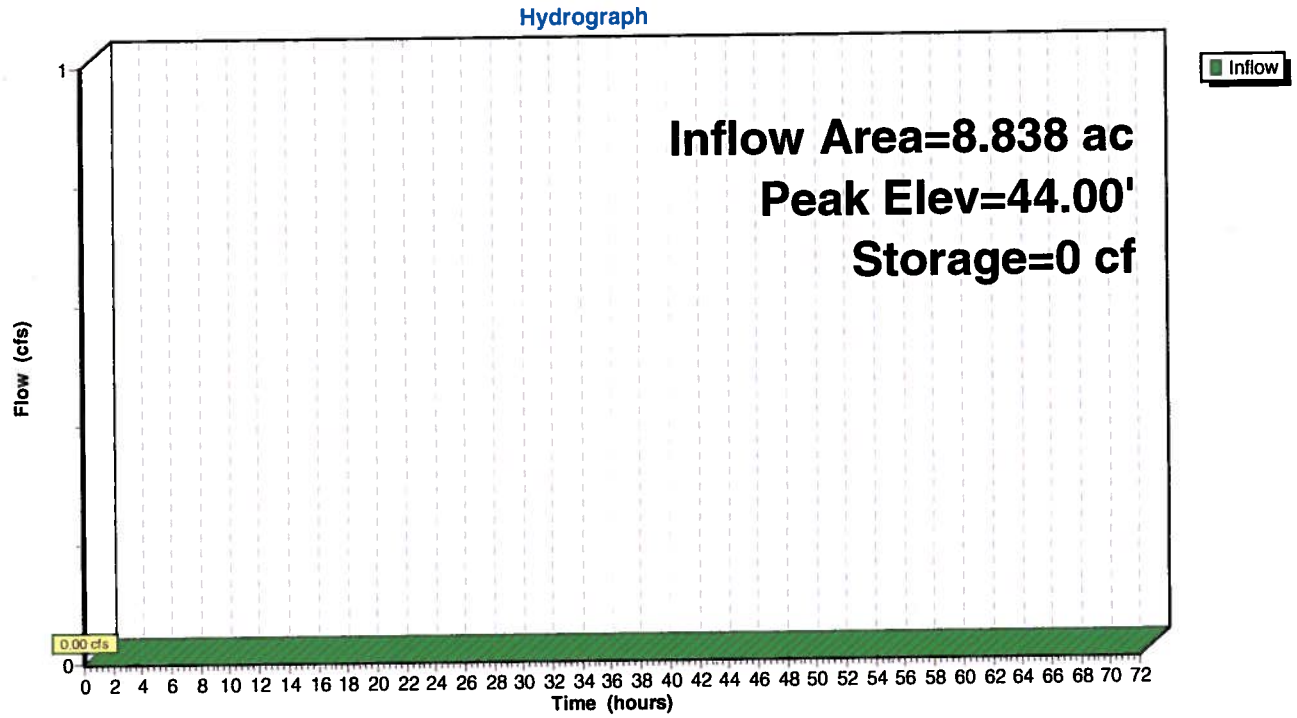
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 44.00' @ 0.00 hrs Surf.Area= 845 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	44.00'	4,123 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)
44.00	845	137.0	0	0	845
45.00	1,280	155.0	1,055	1,055	1,288
46.00	1,775	174.0	1,521	2,576	1,812
47.00	1,330	193.0	1,547	4,123	2,396

Pond OB1: Overflow Basin



Summary for Pond OB2: Overflow Basin

Inflow Area = 19.043 ac, 1.39% Impervious, Inflow Depth = 0.00" for 10-Year Design Storm event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

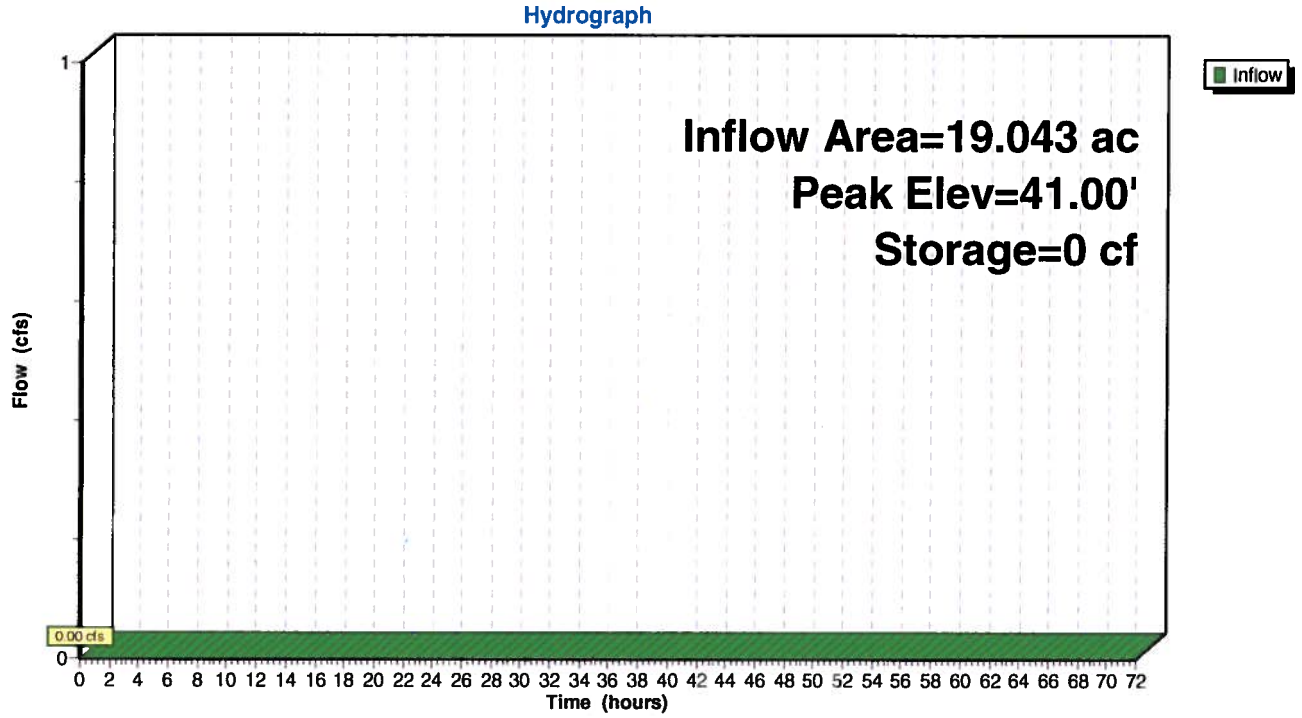
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 41.00' @ 0.00 hrs Surf.Area= 210 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	41.00'	1,635 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)
41.00	210	58.0	0	0	210
42.00	400	77.0	300	300	425
43.00	660	95.0	525	825	686
44.00	970	114.0	810	1,635	1,019

Pond OB2: Overflow Basin



Summary for Pond PIP1: Infiltration Basin 1

Inflow Area = 8.838 ac, 0.00% Impervious, Inflow Depth = 1.89" for 10-Year Design Storm event
Inflow = 14.08 cfs @ 12.23 hrs, Volume= 1.39 af
Outflow = 3.08 cfs @ 12.86 hrs, Volume= 1.39 af, Atten= 78%, Lag= 38.4 min
Discarded = 3.08 cfs @ 12.86 hrs, Volume= 1.39 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 45.05' @ 12.86 hrs Surf.Area= 16,089 sf Storage= 19,050 cf

Plug-Flow detention time= 55.4 min calculated for 1.39 af (100% of inflow)
Center-of-Mass det. time= 55.4 min (914.2 - 858.8)

Volume	Invert	Avail.Storage	Storage Description
#1	43.50'	74,849 cf	**Infiltration Basin #1 (Irregular)** Listed below (Recalc)

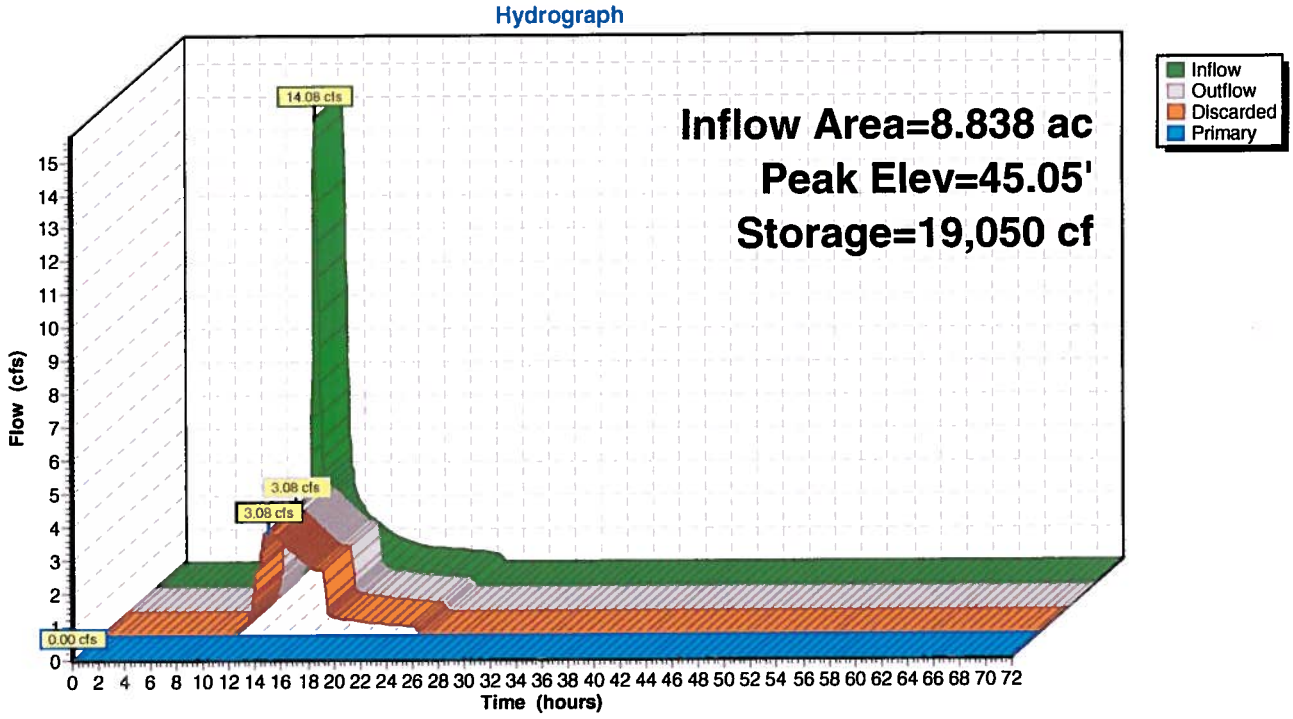
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
43.50	10,000	547.0	0	0	10,000
44.00	10,500	554.0	5,124	5,124	10,672
45.00	16,000	611.0	13,154	18,278	15,989
46.00	17,900	630.0	16,941	35,219	17,965
47.00	19,800	648.0	18,842	54,061	19,904
48.00	21,790	667.0	20,787	74,849	21,998

Device	Routing	Invert	Outlet Devices
#1	Primary	47.00'	**10.0' long x 10.0' 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) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Discarded	43.50'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=3.08 cfs @ 12.86 hrs HW=45.05' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 3.08 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=43.50' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond PIP1: Infiltration Basin 1



Summary for Pond PIP2: Infiltration Basin 2

Inflow Area = 19.043 ac, 1.39% Impervious, Inflow Depth = 1.00" for 10-Year Design Storm event
Inflow = 8.06 cfs @ 12.79 hrs, Volume= 1.59 af
Outflow = 3.28 cfs @ 13.74 hrs, Volume= 1.59 af, Atten= 59%, Lag= 56.8 min
Discarded = 3.28 cfs @ 13.74 hrs, Volume= 1.59 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 41.51' @ 13.74 hrs Surf.Area= 17,122 sf Storage= 14,569 cf

Plug-Flow detention time= 38.5 min calculated for 1.59 af (100% of inflow)
Center-of-Mass det. time= 38.5 min (968.3 - 929.8)

Volume	Invert	Avail.Storage	Storage Description
#1	40.50'	97,330 cf	**Infiltration Basin #2 (Irregular)** Listed below (Recalc)

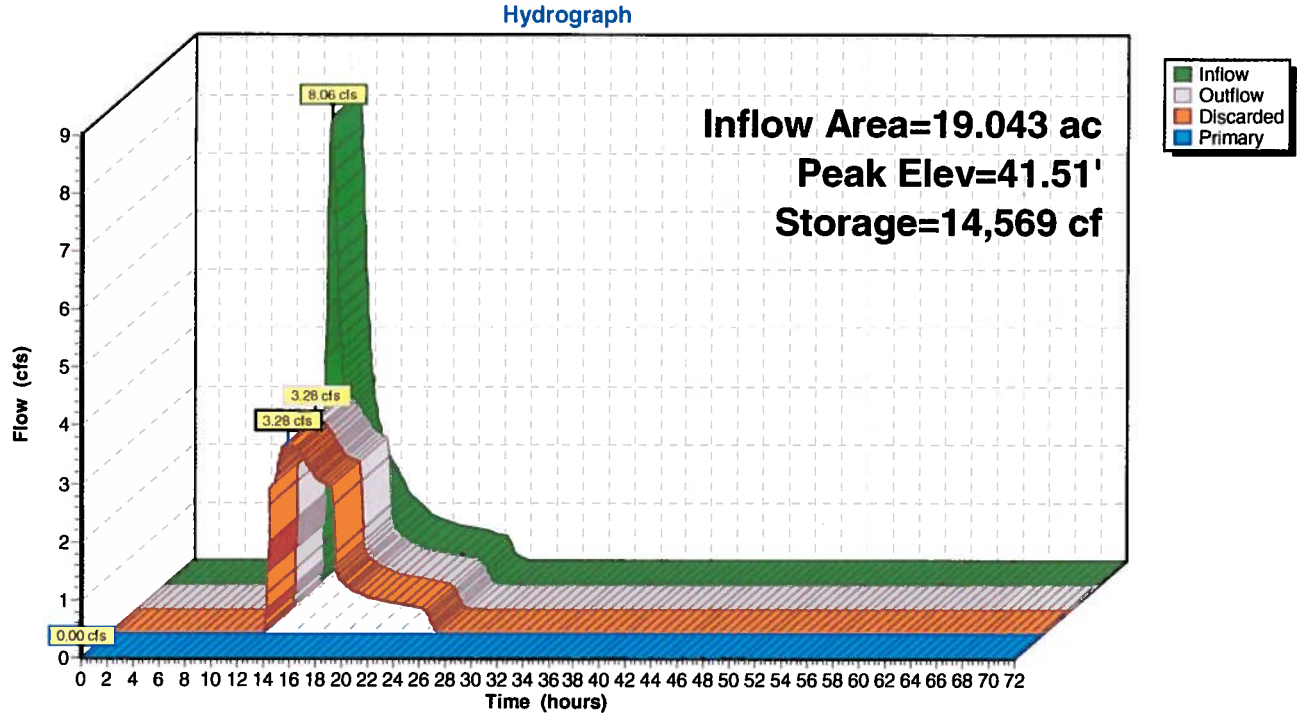
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
40.50	13,000	771.0	0	0	13,000
41.00	13,800	778.0	6,699	6,699	13,946
42.00	20,650	839.0	17,110	23,809	21,837
43.00	23,200	858.0	21,913	45,722	24,539
44.00	25,800	876.0	24,488	70,210	27,170
45.00	28,460	896.0	27,119	97,330	30,126

Device	Routing	Invert	Outlet Devices
#1	Discarded	40.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	44.00'	**10.0' long x 10.0' 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) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=3.28 cfs @ 13.74 hrs HW=41.51' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 3.28 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=40.50' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond PIP2: Infiltration Basin 2



PROPOSED CONDITIONS
100-YEAR DESIGN STORM

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 SC100: Subcatchment 100 Runoff Area=384,969 sf 0.00% Impervious Runoff Depth=3.70"
Flow Length=1,022' Tc=15.6 min CN=70 Runoff=28.45 cfs 2.73 af

Subcatchment SC200: Subcatchment 200 Runoff Area=829,522 sf 1.39% Impervious Runoff Depth=2.38"
Flow Length=1,800' Tc=50.1 min CN=57 Runoff=21.98 cfs 3.78 af

Reach DP1: Flow to Basin 1 Inflow=28.45 cfs 2.73 af
Outflow=28.45 cfs 2.73 af

Reach DP2: Flow to Basin 2 Inflow=21.98 cfs 3.78 af
Outflow=21.98 cfs 3.78 af

Pond OB1: Overflow Basin Peak Elev=44.00' Storage=0 cf Inflow=0.00 cfs 0.00 af
Outflow=0.00 cfs 0.00 af

Pond OB2: Overflow Basin Peak Elev=41.00' Storage=0 cf Inflow=0.00 cfs 0.00 af
Outflow=0.00 cfs 0.00 af

Pond PIP1: Infiltration Basin 1 Peak Elev=46.69' Storage=47,957 cf Inflow=28.45 cfs 2.73 af
Discarded=3.67 cfs 2.73 af Primary=0.00 cfs 0.00 af Outflow=3.67 cfs 2.73 af

Pond PIP2: Infiltration Basin 2 Peak Elev=43.70' Storage=62,493 cf Inflow=21.98 cfs 3.78 af
Discarded=4.78 cfs 3.78 af Primary=0.00 cfs 0.00 af Outflow=4.78 cfs 3.78 af

Total Runoff Area = 27.881 ac Runoff Volume = 6.50 af Average Runoff Depth = 2.80"
99.05% Pervious = 27.617 ac 0.95% Impervious = 0.264 ac

Summary for Subcatchment SC100: Subcatchment 100

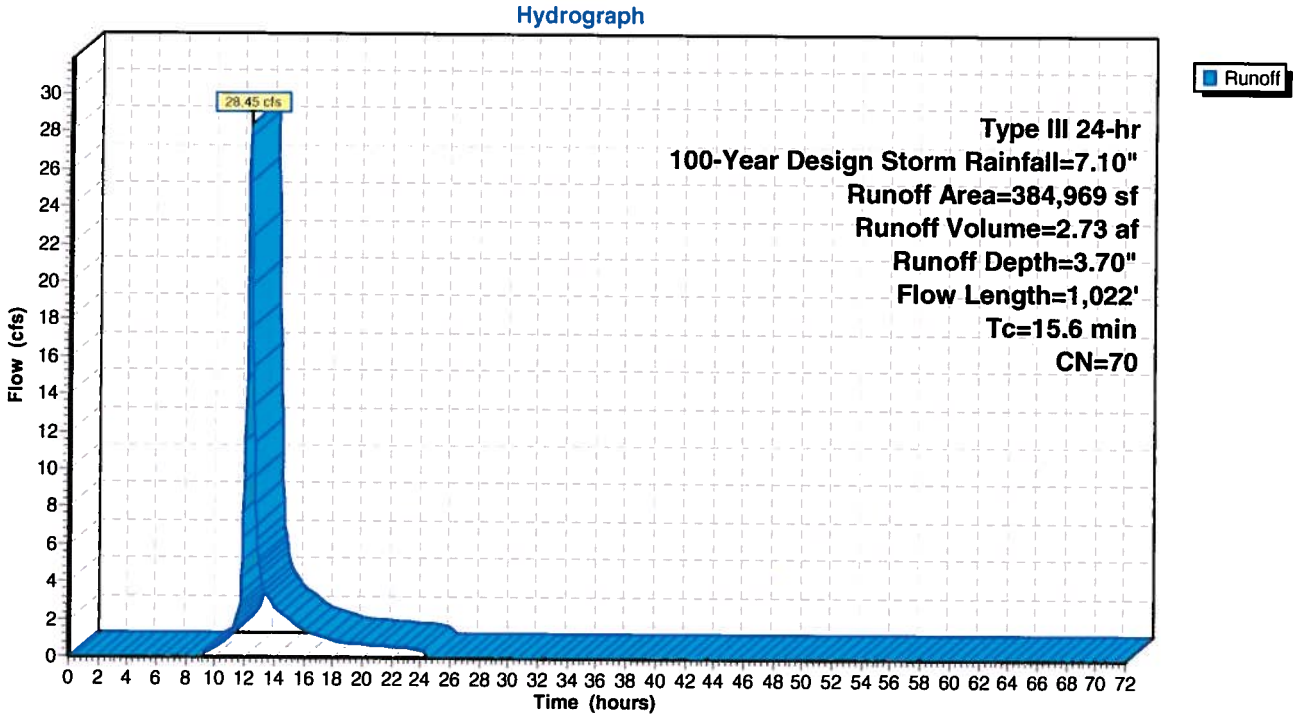
Runoff = 28.45 cfs @ 12.22 hrs, Volume= 2.73 af, Depth= 3.70"

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=7.10"

	Area (sf)	CN	Description
	9,397	30	Woods, Good, HSG A
	0	87	Dirt roads, HSG C
	77,025	65	Brush, Good, HSG C
*	0	30	Proposed Meadow, non-grazed, HSG A
*	275,679	71	Proposed Meadow, non-grazed, HSG C
*	0	98	Proposed Concrete Pad
*	22,868	89	Proposed Gravel Roads, HSG C
	384,969	70	Weighted Average
	384,969		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0624	0.10		**Sheet Flow, Sheet Flow (Segment 1)** Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	133	0.0886	1.49		**Shallow Concentrated Flow, SCF (Segment 2)** Woodland Kv= 5.0 fps
0.4	103	0.0854	4.70		**Shallow Concentrated Flow, SCF (Segment 3)** Unpaved Kv= 16.1 fps
4.7	668	0.0217	2.37		**Shallow Concentrated Flow, SCF (Segment 4)** Unpaved Kv= 16.1 fps
1.1	68	0.0217	1.03		**Shallow Concentrated Flow, SCF (Segment 4)** Short Grass Pasture Kv= 7.0 fps
15.6	1,022	Total			

Subcatchment SC100: Subcatchment 100



Summary for Subcatchment SC200: Subcatchment 200

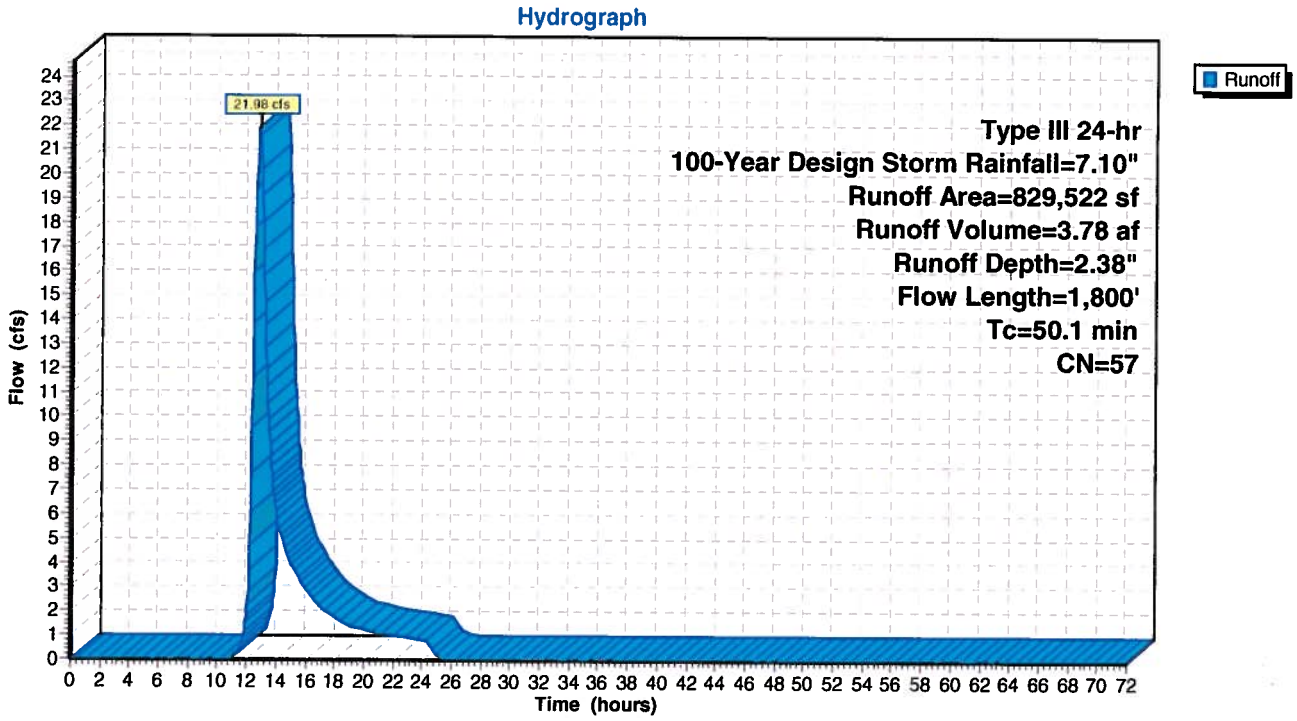
Runoff = 21.98 cfs @ 12.74 hrs, Volume= 3.78 af, Depth= 2.38"

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=7.10"

	Area (sf)	CN	Description
	216,049	30	Woods, Good, HSG A
	3,161	87	Dirt roads, HSG C
	8,886	65	Brush, Good, HSG C
	17,360	39	>75% Grass cover, Good, HSG A
*	10,510	98	Bituminous Concrete Sidewalk, HSG A
*	69,245	30	Proposed Meadow, non-grazed, HSG A
*	463,342	71	Proposed Meadow, non-grazed, HSG C
*	1,000	98	Proposed Concrete Pad
*	0	98	Proposed Concrete Pad
*	0	98	Proposed Concrete Pad
*	18,144	76	Proposed Gravel Roads, HSG A
*	21,825	89	Proposed Gravel Roads, HSG C
	829,522	57	Weighted Average
	818,012		98.61% Pervious Area
	11,510		1.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0742	0.11		**Sheet Flow, Sheet Flow (Segment 1)** Woods: Light underbrush n= 0.400 P2= 3.10"
1.2	97	0.0722	1.34		**Shallow Concentrated Flow, SCF (Segment 2)** Woodland Kv= 5.0 fps
2.8	109	0.0085	0.65		**Shallow Concentrated Flow, SCF (Segment 3)** Short Grass Pasture Kv= 7.0 fps
26.8	742	0.0085	0.46		**Shallow Concentrated Flow, SCF (Segment 3)** Woodland Kv= 5.0 fps
11.9	802	0.0258	1.12		**Shallow Concentrated Flow, SCF (Segment 4)** Short Grass Pasture Kv= 7.0 fps
50.1	1,800	Total			

Subcatchment SC200: Subcatchment 200



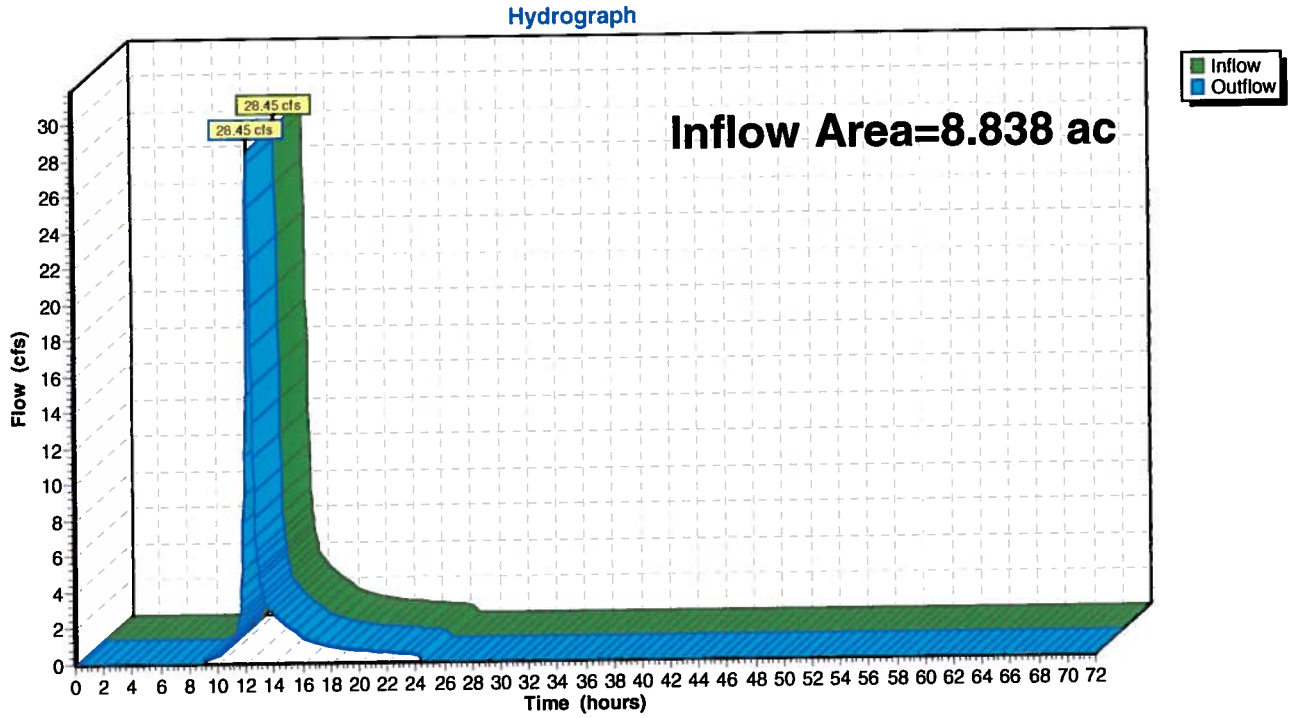
Summary for Reach DP1: Flow to Basin 1

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

Inflow Area = 8.838 ac, 0.00% Impervious, Inflow Depth = 3.70" for 100-Year Design Storm event
Inflow = 28.45 cfs @ 12.22 hrs, Volume= 2.73 af
Outflow = 28.45 cfs @ 12.22 hrs, Volume= 2.73 af, Atten= 0%, Lag= 0.0 min

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

Reach DP1: Flow to Basin 1



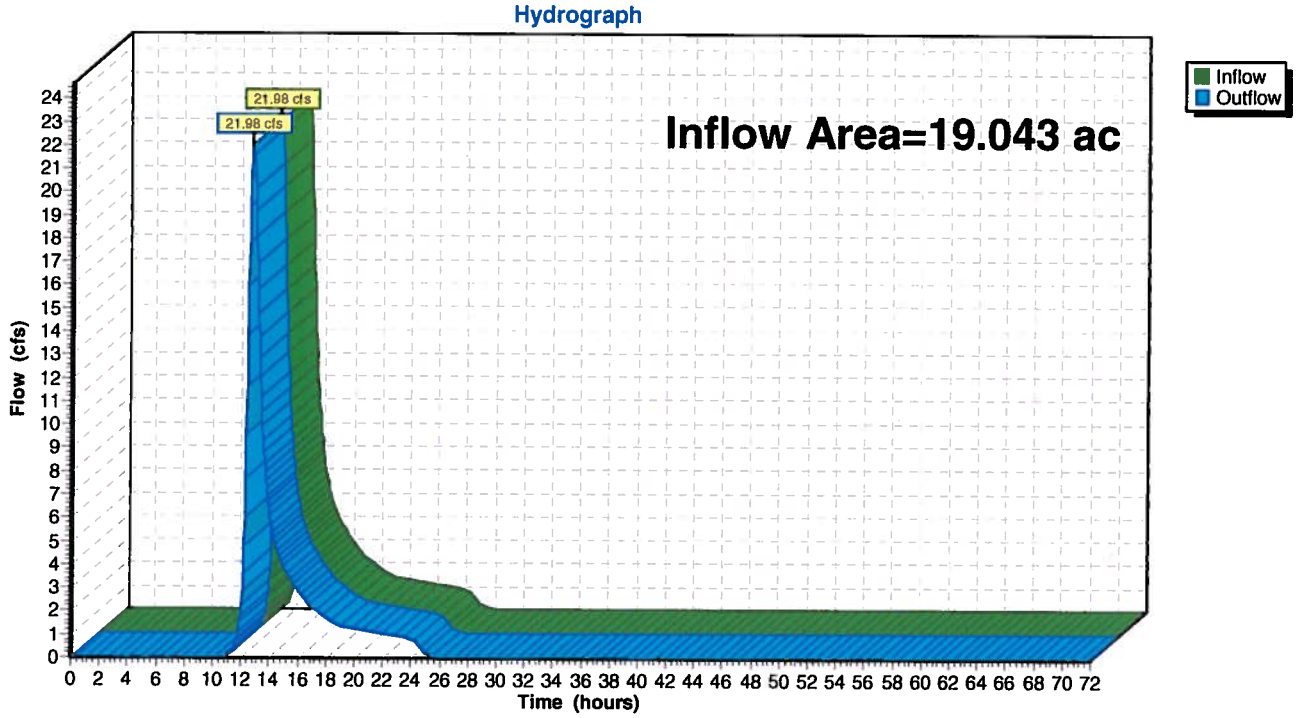
Summary for Reach DP2: Flow to Basin 2

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

Inflow Area = 19.043 ac, 1.39% Impervious, Inflow Depth = 2.38" for 100-Year Design Storm event
Inflow = 21.98 cfs @ 12.74 hrs, Volume= 3.78 af
Outflow = 21.98 cfs @ 12.74 hrs, Volume= 3.78 af, Atten= 0%, Lag= 0.0 min

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

Reach DP2: Flow to Basin 2



Summary for Pond OB1: Overflow Basin

Inflow Area = 8.838 ac, 0.00% Impervious, Inflow Depth = 0.00" for 100-Year Design Storm event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

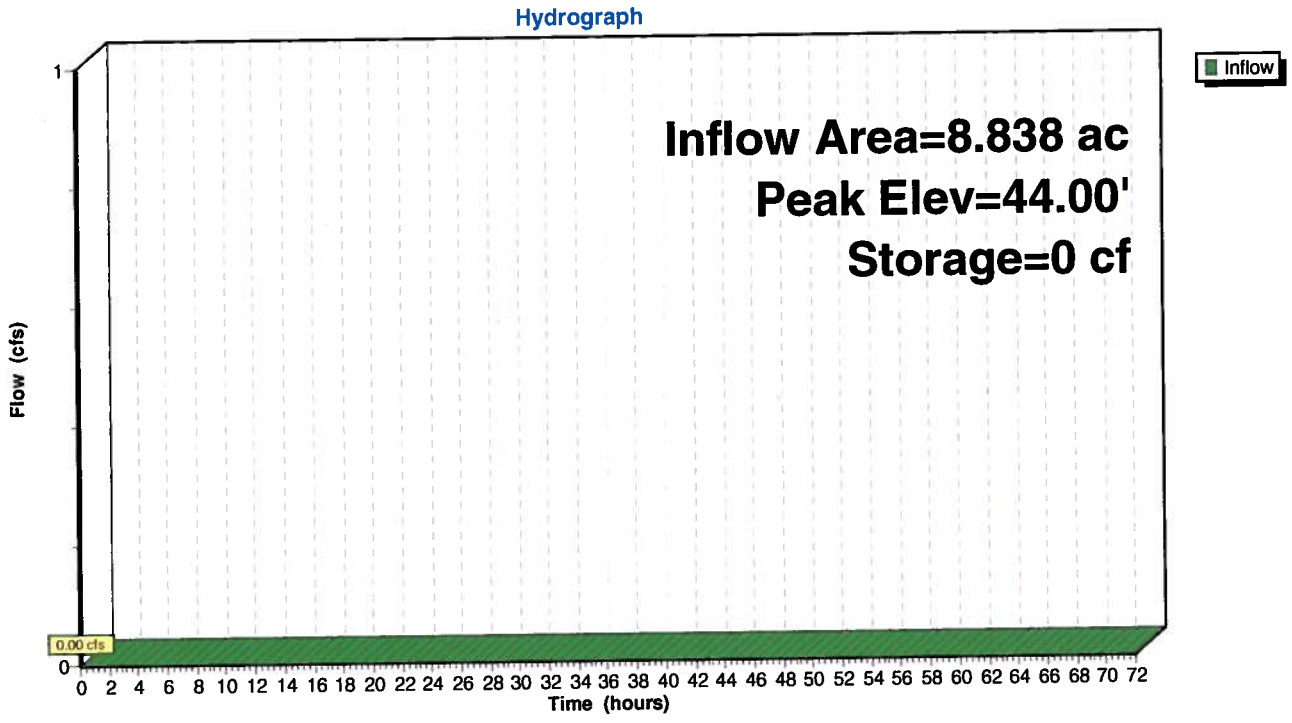
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 44.00' @ 0.00 hrs Surf.Area= 845 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	44.00'	4,123 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)
44.00	845	137.0	0	0	845
45.00	1,280	155.0	1,055	1,055	1,288
46.00	1,775	174.0	1,521	2,576	1,812
47.00	1,330	193.0	1,547	4,123	2,396

Pond OB1: Overflow Basin



Summary for Pond OB2: Overflow Basin

Inflow Area = 19.043 ac, 1.39% Impervious, Inflow Depth = 0.00" for 100-Year Design Storm event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

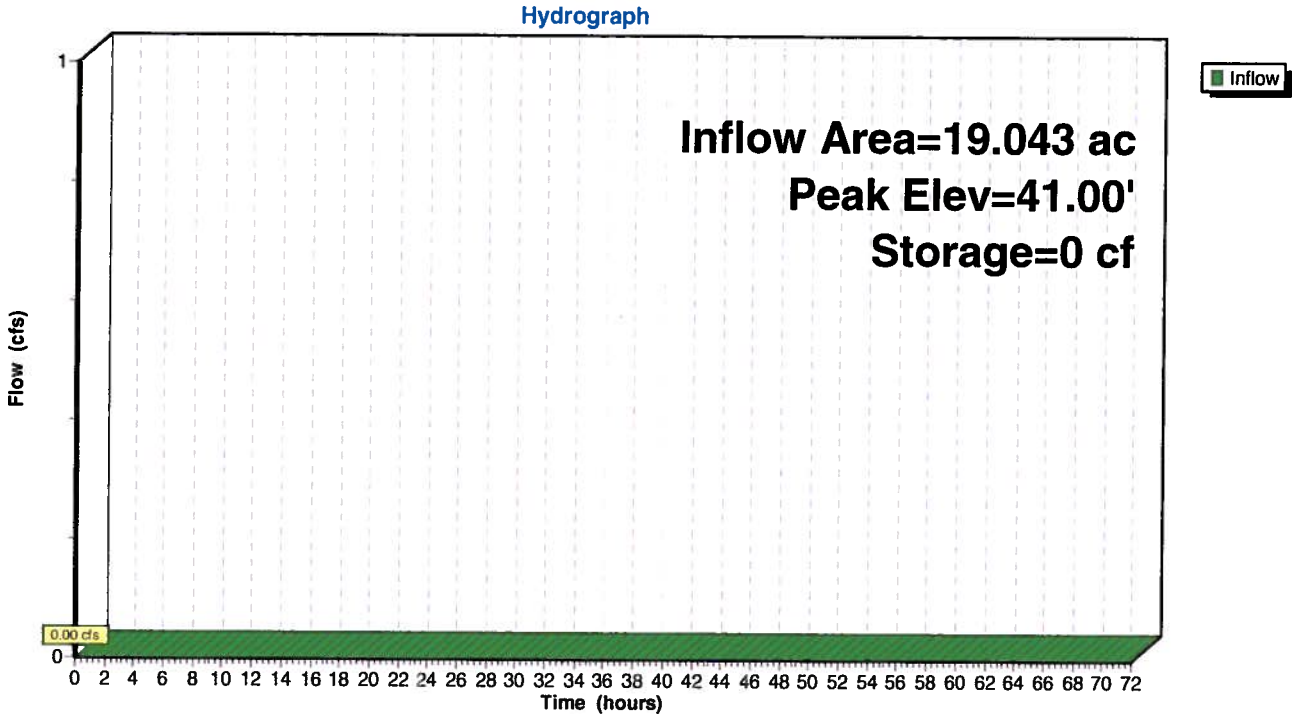
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 41.00' @ 0.00 hrs Surf.Area= 210 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	41.00'	1,635 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)
41.00	210	58.0	0	0	210
42.00	400	77.0	300	300	425
43.00	660	95.0	525	825	686
44.00	970	114.0	810	1,635	1,019

Pond OB2: Overflow Basin



Summary for Pond PIP1: Infiltration Basin 1

Inflow Area = 8.838 ac, 0.00% Impervious, Inflow Depth = 3.70" for 100-Year Design Storm event
Inflow = 28.45 cfs @ 12.22 hrs, Volume= 2.73 af
Outflow = 3.67 cfs @ 13.24 hrs, Volume= 2.73 af, Atten= 87%, Lag= 61.1 min
Discarded = 3.67 cfs @ 13.24 hrs, Volume= 2.73 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 46.69' @ 13.24 hrs Surf.Area= 19,195 sf Storage= 47,957 cf

Plug-Flow detention time= 127.8 min calculated for 2.73 af (100% of inflow)
Center-of-Mass det. time= 127.8 min (966.9 - 839.1)

Volume	Invert	Avail.Storage	Storage Description
#1	43.50'	74,849 cf	**Infiltration Basin #1 (Irregular)** Listed below (Recalc)

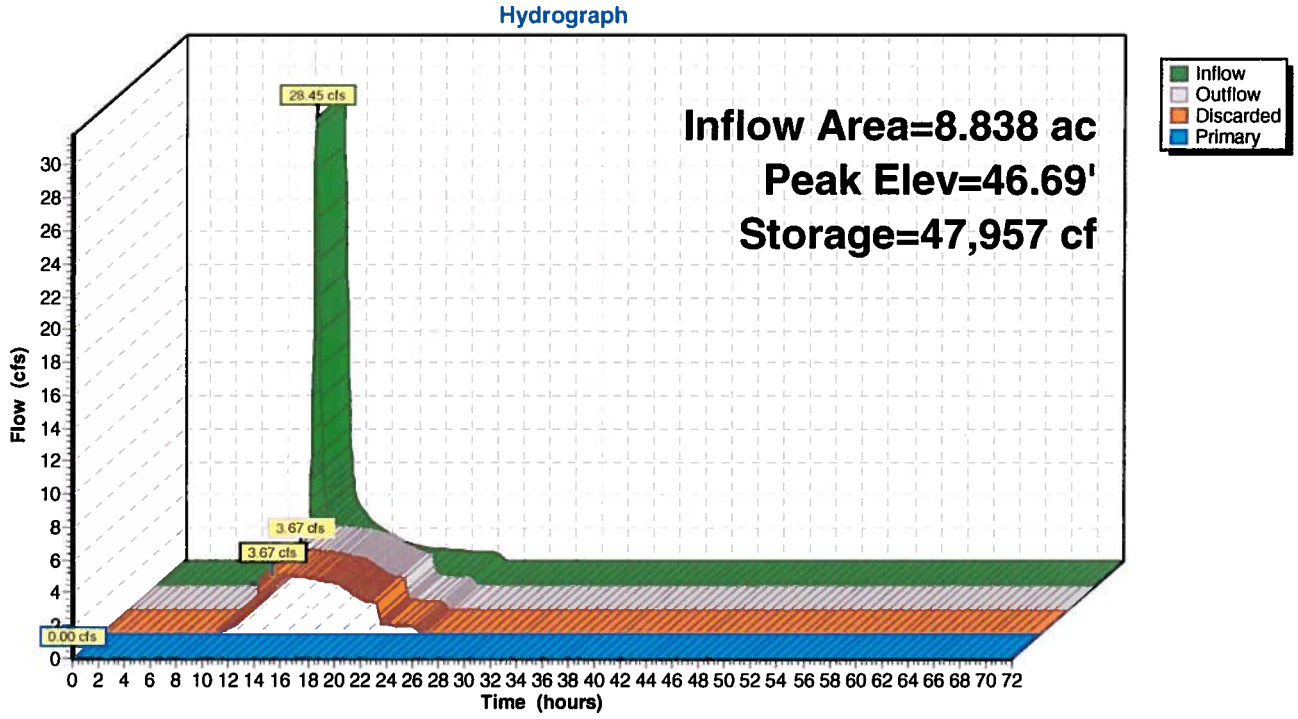
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
43.50	10,000	547.0	0	0	10,000
44.00	10,500	554.0	5,124	5,124	10,672
45.00	16,000	611.0	13,154	18,278	15,989
46.00	17,900	630.0	16,941	35,219	17,965
47.00	19,800	648.0	18,842	54,061	19,904
48.00	21,790	667.0	20,787	74,849	21,998

Device	Routing	Invert	Outlet Devices
#1	Primary	47.00'	**10.0' long x 10.0' 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) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#2	Discarded	43.50'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=3.67 cfs @ 13.24 hrs HW=46.69' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 3.67 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=43.50' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond PIP1: Infiltration Basin 1



Summary for Pond PIP2: Infiltration Basin 2

Inflow Area = 19.043 ac, 1.39% Impervious, Inflow Depth = 2.38" for 100-Year Design Storm event
Inflow = 21.98 cfs @ 12.74 hrs, Volume= 3.78 af
Outflow = 4.78 cfs @ 14.42 hrs, Volume= 3.78 af, Atten= 78%, Lag= 101.2 min
Discarded = 4.78 cfs @ 14.42 hrs, Volume= 3.78 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.00 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 43.70' @ 14.42 hrs Surf.Area= 24,995 sf Storage= 62,493 cf

Plug-Flow detention time= 139.0 min calculated for 3.77 af (100% of inflow)
Center-of-Mass det. time= 138.9 min (1,039.8 - 900.9)

Volume	Invert	Avail.Storage	Storage Description
#1	40.50'	97,330 cf	**Infiltration Basin #2 (Irregular)** Listed below (Recalc)

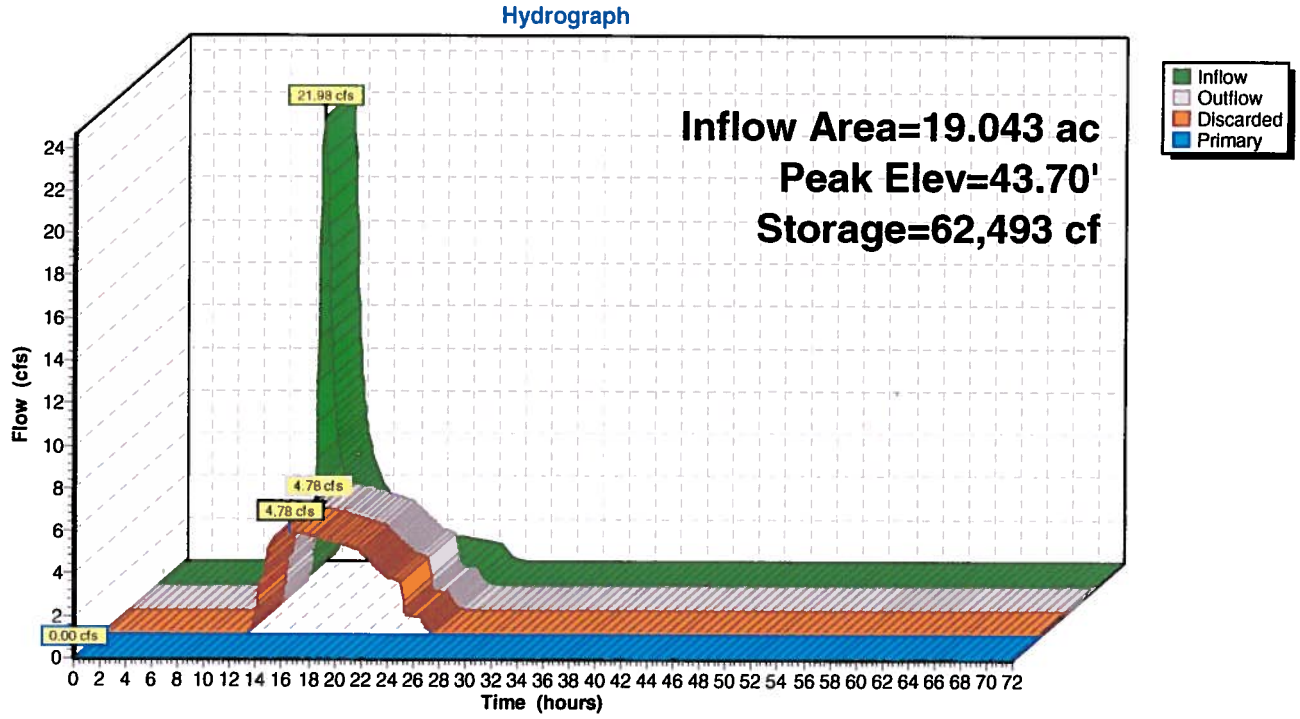
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
40.50	13,000	771.0	0	0	13,000
41.00	13,800	778.0	6,699	6,699	13,946
42.00	20,650	839.0	17,110	23,809	21,837
43.00	23,200	858.0	21,913	45,722	24,539
44.00	25,800	876.0	24,488	70,210	27,170
45.00	28,460	896.0	27,119	97,330	30,126

Device	Routing	Invert	Outlet Devices
#1	Discarded	40.50'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	44.00'	**10.0' long x 10.0' 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) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=4.78 cfs @ 14.42 hrs HW=43.70' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 4.78 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=40.50' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond PIP2: Infiltration Basin 2



APPENDIX

OPERATION & MAINTENANCE PROGRAM

OPERATION AND MAINTENANCE PROGRAM
for
A PROPOSED STORMWATER MANAGEMENT SYSTEM
located at
280 & 0 OLD FALMOUTH ROAD
BARNSTABLE, MASSACHUSETTS

Applicant:

LSDP 15, LLC
c/o Lake Street Development Partners
180 North Stetson Avenue, Suite 3500
Chicago, Illinois 60601

Prepared by:

Meridian Associates, Inc.
500 Cummings Center, Suite 5950
Beverly, Massachusetts 01915
(978) 299-0447

August 15, 2016

Project Name: LSDP 15, LLC Solar Development
280 & 0 Old Falmouth Road
Barnstable, Massachusetts 02648

Owner Name: EAC Organics Inc.
9289 Bonta Bridge Road
Jordan, New York 13080

Party Responsible for Maintenance During Construction:
LSDP 15, LLC
c/o Lake Street Development Partners
180 North Stetson Avenue, Suite 3500
Chicago, Illinois 60601

Party Responsible for Maintenance After Construction:
LSDP 15, LLC
c/o Lake Street Development Partners
180 North Stetson Avenue, Suite 3500
Chicago, Illinois 60601

Erosion and Sedimentation Control Measures during Construction Activities

FilterMitt™

FilterMitt™, or approved equal, shall be installed in accordance with the design plans. Repair any FilterMitt™ that have been torn, disturbed or are in poor condition. The line of FilterMitt™ shall be inspected and maintained on a weekly basis, after every major storm event (2-year or greater) during construction, and at least daily during prolonged rainfall events. Deposited sediments shall be removed when the volume of the deposition reaches approximately one-half the height of the FilterMitt™.

Temporary Sedimentation Basin

The Temporary Sedimentation Basin shall be checked weekly and after major storm events during construction for rilling, erosion, and debris removal. Avoid compaction of the parent material by working from the edge of the area proposed as the location of the Sedimentation Basin.

Gravel Access Road & Temporary Construction Parking Area

The gravel access road and temporary construction parking area shall be inspected weekly. The access road should be inspected for ruts, channelized drainage, gullying and sedimentation. Repairs to the road and parking areas shall be made with new clean stone, and shall be compacted into place. Large ruts may be filled with larger stone and set in place with dense grade material, then overlain by new crushed stone.

Stockpiles

All unused debris, soil, and other material shall be stockpiled in locations of relatively flat grades, away from any trees identified to be saved and upgradient of the haybales. Stockpile side slopes shall not be greater than 2:1. All stockpiles shall be surrounded by a row of haybales, and shall be placed outside the 100-foot buffer to any bordering vegetated wetland. Surrounding haybales shall be inspected and maintained on a daily basis.

Surface Stabilization

Once the forested areas have been cleared and grubbed, the entire area will be tilled. Following the installation of the array; areas of exposed soils will be seeded with the *Solar Farm Seed Mix* provided by Ersnt Conservation Seeds or the MA DOT Seed Mix for Slopes and Shoulders.

Construction Tracking Pad

A construction tracking pad shall be installed at the designated entrances/exit to the site, as shown on the Erosion & Sedimentation Control plans, to the site to reduce the amount of sediment transported off site. The construction tracking pad shall be inspected weekly.

Grass Channels

Grass Channels shall be checked weekly and after every major storm event during construction for rilling, gullying, erosions and debris removal.

Removal of Sediment and Erosion Controls

At the completion of construction activities and after receiving approval from the Town of Barnstable, all physical sediment and erosion controls shall be removed from the site. The areas where the controls have been removed shall be seeded and stabilized immediately upon removal.

Long-Term Inspection and Maintenance Measures after Construction

Erosion Control

Eroded sediments can adversely affect the performance of the stormwater management system. Eroding or barren areas should be immediately re-vegetated.

Infiltration Basins

Infiltration basins shall be checked bi-annually and after every major storm event for rilling, gullying, erosions and debris removal. Maintenance mowing shall occur at a minimum of twice per year.

Grass Channels

Grass Channels shall be checked bi-annually and after every major storm event for rilling, gullying, erosions and debris removal. Grass height shall not exceed 6" in height.

Gravel Access Road & Temporary Construction Parking Areas

The gravel access road and temporary construction parking areas shall be inspected on the same schedule as the infiltration basin. The access road should be inspected for ruts, channelized drainage, gullying and sedimentation. Repairs to the road and parking areas shall be made with new clean stone, and shall be compacted into place. Large ruts may be filled with larger stone and set in place with dense grade material, then overlain by new crushed stone.

Areas immediately Down-Slope of Rip-Rap

The areas immediately down-slope of the rip rap shall be inspected after major storm events, or at minimum twice per year. These locations will be subject to concentrated flows and therefore may be prone to erosion and the formation of "gulleys" or channels. If any "gulleys" or channels are observed, they should immediately be repaired by installing sod and reseeding with grass. These areas shall be reseeded until a stable groundcover is established.

Debris and Litter Removal

Trash may collect in the BMP's. All debris and litter shall be removed when necessary, and after each storm event. Sediment and debris collected from vacuuming and/or sweeping should be disposed of at a permitted waste disposal facility. Avoid disposing of this material on site, where it could be washed into the basins.

Seed Mix Grass Mowing

Grass shall be inspected annually and maintenance mowing shall occur as needed. All mowing to take place will be done with a mulch mower so grass clippings will not be an issue.

<u>Good Housekeeping Practices</u> (in accordance with Standard 10 of the Stormwater Management Handbook to prevent illicit discharges)

Requirements for routine inspection and maintenance of stormwater BMPs
See Inspection and Maintenance Measures after Construction.

Spill prevention and response plans
Spill Control Practices shall be in conformance with the guidelines set forth in the National Pollutant Discharge Elimination System (NPDES) Stormwater Pollution Prevention Plan (SWPPP).

Provisions for maintenance of lawns, gardens, and other landscaped areas
- Grass shall not be cut shorter than 2 to 3 inches and mulch clipping should be left on lawn as a natural fertilizer.
- The use of mulch shall be utilized where possible. Mulch helps retain water and prevents erosion.

Snow disposal and plowing plans relative to Stormwater Infiltration Areas
- Snow shall be plowed and stored on gravel, grass, or other permeable surfaces to allow filtration to occur.
- Once snow melts, all debris shall be extracted from surface and properly disposed of.
- Snow shall not be disposed of in any Stormwater Infiltration Basin or swale.

STORMWATER MANAGEMENT
CONSTRUCTION PHASE

INSPECTION SCHEDULE AND EVALUATION CHECKLIST

PROJECT LOCATION: 280 & 0 Old Falmouth Road, Barnstable, Massachusetts **WEATHER:** _____

Inspection Date	*Inspector*	*Area Inspected*	*Required Inspection Frequency if BMP*	*Comments*	*Recommendation*	*Follow-up Inspection Required (yes/no)*
		FilterMitt™	*Weekly and After Major Storm Events*			
		Construction Tracking Pad	*Weekly and After Major Storm Events*			
		Gravel Access Road and Temporary Parking Area	*Weekly and After Major Storm Events*			
		Temporary Sedimentation Basins	*Weekly and After Major Storm Events*			
		Grass Channels	*Weekly and After Major Storm Events*			

(1) Refer to the Massachusetts Stormwater Handbook, Volume Two: Stormwater Technical Handbook (February 2008) for recommendations regarding frequency for inspection and maintenance of specific BMP's.

(2) Inspections to be conducted by a qualified professional such as an environmental scientist or civil engineer.

Limited or no use of sodium chloride salts, fertilizers or pesticides recommended.

Other notes: (Include deviations from: Con. Comm. Order of Conditions, PB Approval, Construction Sequence and Approved Plan)

Stormwater Control Manager: _____

STORMWATER MANAGEMENT
AFTER CONSTRUCTION

INSPECTION SCHEDULE AND EVALUATION CHECKLIST

PROJECT LOCATION: 280 & 0 Old Falmouth Road, Barnstable, Massachusetts **WEATHER:**_____

Inspection Date	*Inspector*	*Area Inspected*	*Required Inspection Frequency if BMP*	*Comments*	*Recommendation*	*Follow-up Inspection Required (yes/no)*
		Infiltration Basin 1	*Bi-annually and After Major Storm Event*			
		Infiltration Basin 2	*Bi-annually and After Major Storm Event*			
		Gravel Access Road	*Bi-annually and After Major Storm Event*			
		Grass Channels	*Bi-annually and After Major Storm Event*			

(1) Refer to the Massachusetts Stormwater Handbook, Volume Two: Stormwater Technical Handbook (February 2008) for recommendations regarding frequency for inspection and maintenance of specific BMP's.
(2) Inspections to be conducted by a qualified professional such as an environmental scientist or civil engineer.

Limited or no use of sodium chloride salts, fertilizers or pesticides recommended.
Other notes: (Include deviations from: Con. Comm. Order of Conditions, PB Approval, Construction Sequence and Approved Plan)
Stormwater Control Manager: _____

STORMWATER MANAGEMENT STANDARDS

for

280 & 0 OLD FALMOUTH ROAD BARNSTABLE, MASSACHUSETTS

Prepared for:

LSDP 15, LLC
c/o Lake Street Development Partners
180 North Stetson Avenue, Suite 3500
Chicago, Illinois 60601

Prepared by:

Meridian Associates, Inc.
500 Cummings Center, Suite 5950
Beverly, Massachusetts 01915
(978) 299-0447

August 15, 2016

MERIDIAN ASSOCIATES

Stormwater Management Standards

Project Narrative:

This site is located at 280 and 0 Old Falmouth Road in Barnstable, Massachusetts. The project area is comprised of mostly dirt/fill/human transported material (HTM) and landscaping material stock piled (Cape Resources Company). The western portion of the site consists mostly of wooded land. The majority of the site included within the drainage analysis currently slopes east-southeasterly towards man-made on-site depressions and Old Falmouth Road.

The proposed project is comprised of the development of a ground-mounted solar photovoltaic facility, the construction of a gravel access road, two infiltration basins with sediment forebays, riprap level spreaders, riprap slopes, concrete equipment pads, new utility poles and risers, fencing, gates, and associated seeding and stabilization.

The existing runoff patterns will be maintained with the proposed grading. The proposed solar facility will be installed using either a screw or post system which minimizes impact on the existing topography.

Standard 1: No new stormwater conveyances may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

The proposed project does not discharge untreated stormwater directly to wetlands or waters of the Commonwealth. A wetland resource area was delineated to the north of the project area on the subject property. The proposed limit of work and post-development subcatchment areas are located outside of resource area buffer zones. Stormwater in Pre- and Post-Development conditions does not flow to this wetland resource area. The existing project topography directs the majority of the runoff from the proposed area easterly-southeasterly towards the proposed infiltration basins.

Standard 2: Peak Rate Attenuation - Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.

For the purpose of analyzing pre and post development stormwater peak rates of runoff, two (2) design points have been selected based on existing topographic conditions and were used for both the pre and the post calculations. Comparison values for pre and post development stormwater peak rates are given for the design points only.

The storm events used to calculate peak runoff rates for pre and post construction conditions have been selected based upon the Massachusetts Stormwater Guidelines requirements. Full detail of peak rate attenuation along with supplemental stormwater calculations utilizing HydroCAD as well as pre and post drainage site plans can be found in the appendix of this report. The details of this report show that the peak rates of runoff

for the 2-year, 10-year and 100 year events have been matched or reduced from pre to post conditions.

The hydrologic calculations from HydroCAD has been included in the "Stormwater Analysis & Calculations Report".

Proposed Design Point and Subcatchment Areas

This site currently slopes in two (2) general directions with varying grades. The existing stormwater runoff patterns are based on existing topography which indicates that the runoff flows to five design points:

- Design Point #1 **(DP1)** is the man-made depression at the eastern edge of the locus property;
- Design Point #2 **(DP2)** is the man-made depression at the south easterly edge of the locus property;

Summary of Flows at Design Point 1

Storm Event	Existing Conditions (Pre) Peak Flow (CFS)	Existing Conditions (Pre) Volume (AF)	Proposed Conditions (Post) Peak Flow (CFS)	Proposed Conditions (Post) Volume (AF)
2-Year (3.00 in./hr.)	13.85	1.31	7.56	0.79
10-Year (4.50 in./hr.)	21.83	2.06	14.08	1.39
100-Year (6.50 in./hr.)	37.66	3.59	28.45	2.73

Summary of Flows at Design Point 2

Storm Event	Existing Conditions (Pre) Peak Flow (CFS)	Existing Conditions (Pre) Volume (AF)	Proposed Conditions (Post) Peak Flow (CFS)	Proposed Conditions (Post) Volume (AF)
2-Year (3.00 in./hr.)	6.61	1.28	2.86	0.72
10-Year (4.50 in./hr.)	13.80	2.42	8.06	1.59
100-Year (6.50 in./hr.)	30.33	5.06	21.98	3.78

* CFS – Cubic Feet Per Second
* AF – Acre Feet

The tables above outline the results of the hydrologic model. As required by Standard #2, the project has adequately attenuated for potential increase in peak stormwater flows.

Standard 3: Recharge - Loss of annual recharge to groundwater shall be eliminated or minimized. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This standard is met when the stormwater management system is designed to infiltrate the required recharge volume in accordance with the Mass Stormwater Handbook.

Onsite soil testing was conducted by Andrew Rodriguez (Certified Soil Evaluator #13890), Meridian Associates, Inc., on April 22, 2016 in the areas depicted on the attached plan. Fill/Human transported material (HTM) was found in each test pit at varying depths. The testing revealed that ground water ranged from 24" to 132" below the existing surface throughout the test pits. The water observed appears to be perched due to the nature of the HTM which contained wood and other organic materials in the upper elevations of the test pits. Below the HTM, soil testing revealed that the parent material consisted of sand (Hydrological Soil Group A). Due to the current use of the site, soils on portions of the site were modeled as a Hydrologic Soil Group C to more accurately model the existing drainage characteristics of the site.

There will be a reduction in total impervious surfaces within the project area. The amount of groundwater recharge that would be required is negligible and the proposed stormwater management system (constructed infiltration basins) will promote groundwater recharge.

Standard 4: Water Quality – Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). The standard is met with pollution prevention plans, stormwater BMP's sized to capture required water quality volume, and pretreatment measures.

The proposed project results in a reduction of total impervious area. The project consists of removing roofed structures and bituminous concrete pads, in addition to the installation of a concrete equipment pad. Therefore, with the stormwater traveling over vegetated land cover, and a portion flowing through a grass channel prior to discharging to a riprap level spreader and then into the infiltration basins will accommodate for any minor TSS needed to be removed. The amount of TSS removal that would be required is negligible. Refer to the TSS Removal calculations and grass channel detail in the Appendix of the Stormwater Analysis and Calculations Report.

Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs) – Source control and pollution prevention shall be implemented in accordance with the Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.

Stormwater Standard 5 is not applicable to this project. The proposed development will not subject the site to higher potential pollutant loads as defined in the Massachusetts Department of Environmental Protection Wetlands and Water Quality Regulations.

LUHPPLs are identified in 310 CMR 22.20B(2) and C(2)(a)-(k) and (m) and CMR 22.21(2)(a)(1)-(8) and (b)(1)-(6), areas within a site that are the location of activities that are subject to an individual National Pollutant Discharge Elimination System (NPDES) permit or the NPDES Multi-sector General Permit; auto fueling facilities, exterior fleet storage areas, exterior vehicle service and equipment cleaning areas; marinas and boatyards; parking lots with high-intensity-use; confined disposal facilities and disposal sites.

Standard 6: Critical Areas – Stormwater discharges to critical areas require the use of specific source control and pollution prevention measures and specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas.

Stormwater Standard 6 is not applicable to this project given that proposed stormwater does not discharge near a critical area. Critical areas being Outstanding Resource Waters and Special Resource Waters as designated in 314 CMR 4.0, recharge areas for public water supplies as defined in 310 CMR 22.02, bathing beaches as defined in 105 CMR 445.000, cold-water fisheries and shellfish growing areas as defined in 314 CMR 9.02 and 310 CMR 10.04. The stormwater runoff generated from this project does not discharge Critical Areas therefore Standard #6 does not applies to this project.

Standard 7: Redevelopments – A redevelopment project is required to meet Standards 1-6 only to the maximum extent practicable. Remaining standards shall be met as well as the project shall improve the existing conditions.

Stormwater Standard 7 is not applicable to this project. Within the Stormwater Management Handbook (volume 1 chapter 1 page 20), the definition of a redevelopment project includes, "development, rehabilitation, expansion and phased projects on previously developed sites, provided the redevelopment results in no net increase in impervious area".

This project results in a reduction of impervious area in the proposed conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan shall be implemented.

An *Operation and Maintenance Program for Proposed Stormwater Management Systems* is included with this report. The program details the construction period operation and maintenance plan and sequencing for pollution prevention measures and erosion and sedimentation controls. Locations of erosion control measures for the project are depicted on the site plan set accompanying this report.

Standard 9: A long term Operation and Maintenance Plan shall be implemented.

An *Operation and Maintenance Program for a Proposed Stormwater Management System* is included with this report. The long term operation and maintenance section of

the program provides details and the schedule for routine and non-routine maintenance tasks to be implemented at the completion of the project.

Standard 10: Prohibition of Illicit Discharges – 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. Discharges to the stormwater management system from the following activities or facilities are permissible: 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 buildings without detergents. All other illicit discharges are prohibited.

There are no known illicit discharges anticipated through the completion of this project. During construction, and post construction, procedures are provided to dissipate the potential for illicit discharges to the drainage system. Post construction preventions of illicit discharges are described in the Operation and Maintenance Program under the Good Housekeeping Practices section of this report.

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CHECKLIST FOR STORMWATER REPORT

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

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 8[2]
- 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.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

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.

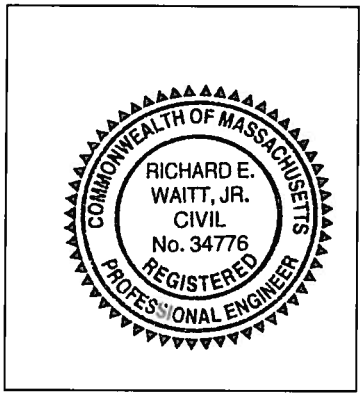
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



8-15-16

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): Low impact design srew & post racking system

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 Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☐ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

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

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☐ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☐ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☐ The BMP is sized (and calculations provided) based on:

- ☐ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

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

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

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

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

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

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

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☐ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

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

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

USDA NATURAL RESOURCE CONSERVATION SERVICE

NATIONAL COOPERATIVE SOIL SURVEY

Hydrologic Soil Group—Barnstable County, Massachusetts

Map Scale: 1:3,930 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

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

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: http://websoilsurvey.nrcs.usda.gov
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: Barnstable County, Massachusetts
Survey Area Data: Version 12, Sep 28, 2015

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

Date(s) aerial images were photographed: Mar 30, 2011—Oct 8, 2011

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.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Barnstable County, Massachusetts (MA001)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
38A	Pipestone loamy coarse sand, 0 to 3 percent slopes	A/D	1.5	2.5%
252D	Carver coarse sand, 15 to 35 percent slopes	A	5.0	8.2%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	A	22.5	36.9%
259A	Carver loamy coarse sand, 0 to 3 percent slopes	A	2.9	4.7%
259B	Carver loamy coarse sand, 3 to 8 percent slopes	A	25.2	41.4%
600	Pits, sand and gravel		0.2	0.3%
665	Udipsamments, smoothed		3.6	6.0%
Totals for Area of Interest			**60.9**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

FEDERAL EMERGENCY MANAGEMENT AGENCY

FLOOD INSURANCE RATE MAP

MAP SCALE 1" = 500'

250 0 500 1000

FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0542J

FIRM

FLOOD INSURANCE RATE MAP

BARNSTABLE COUNTY, MASSACHUSETTS (ALL JURISDICTIONS)

PANEL 542 OF 875

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BARNSTABLE, TOWN OF	250001	0542	J

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
25001C0542J

EFFECTIVE DATE
JULY 16, 2014

Federal Emergency Management Agency

NITROGEN LOADING CALCULATIONS

MERIDIAN ASSOCIATES

Nitrogen Loading

Existing Use:

This site is located at 280 and 0 Old Falmouth Road in Barnstable, Massachusetts. The project area is comprised of mostly dirt/fill/human transported material (HTM) and landscaping material stock piles (Cape Resources Company).

Lot size: 36.32 acres (1,582,099± ft2)
Roof Area: 5,324± ft2
Impervious Pavement Area; 7,478± ft2
Dirt/Gravel Roads: 96,956± ft2
Pervious area: 1,472,341± ft2
Wastewater flow (Title V =75 GPD/1,000 sf, office use. Office bldg. =1,088 sf): 82 GPD
Landfill area =11± acres (479,160± ft2)

Wastewater
[82 Gal/day] [3.785 L/Gal] = 310.4 L/day
[310.4 L/day] [35 mg/L] = 10,864 mg/day

Roof, Gravel Roads, Impervious
[109,758 ft2] [40 in/yr] [1 ft/12 in] [28.32 L/ft3] [1 yr/365 day] = 28,386.7 L/day
[28,386.7 L/day] [0.75 mg/L] = 21,290 mg/day

Pervious Area
[1,472,341 ft2] [1.5 ft/yr] [28.32 L/ft3] [1 yr/365 days] = 171,356.3 L/day

Wood Waste Landfill*
[479,160 ft2] [40 in/yr] [1 ft/12 in] [28.32 L/ft3] [1 yr/365 days] [7.7 mg/L*] = 954,224.2 mg/day

Nitrogen load
[10,864 + 21,290 + 954,224.2] = [986,378.2 mg]
[310.4 + 28,386.7 + 171,356.3] = [200,053.4 L]
= 4.93 PPM

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www.meridianassoc.com

Total Site Proposed Use Prior to Mitigation:

The proposed project is comprised of the development of a ground-mounted solar photovoltaic facility.

Lot size: 36.32 acres (1,582,099± ft2)
Roof Area: 0 ft2
Impervious Pavement Area (slab): 1,000± ft2
Dirt/Gravel Roads: 62,835± ft2
Pervious area: 1,518,264± ft2
Wastewater flow: 0
Landfill area =11± acres (479,160± ft2)
Landfill removed at basins = 39,700 ft2
Solar panel array = 292,688 ft2

Wastewater
0

Roof, Gravel Roads, Impervious
[63,835 ft2] [40 in/yr] [1 ft/12 in] [28.32 L/ft3] [1 yr/365 day] = 16,509.6 L/day
[16,509.6 L/day] [0.75 mg/L] = 12,382.2 mg/day

Array
[292,688 ft2] [40 in/yr] [1 ft/12 in] [28.32 L/ft3] [1 yr/365 day] [0.75 mg/L] = 56,773.4 mg/day

Wood Waste Landfill*
[439,460 ft2] [40 in/yr] [1 ft/12 in] [28.32 L/ft3]] [1 yr/365 day] [7.7 mg/L*] = 875,163.5 mg/day

Pervious Area
[1,518,264 ft2] [1.5 ft/yr] [28.32 L/ft3] [1 yr/365 days] = 176,701 L/day

Nitrogen Load
[12,382.2 +56,773.4 +875,163.5] = [944,319.1 mg]
[16,509.6 + 176,701] = [192,310.6 L]
= 4.91 PPM

*Reference: "Massachusetts Estuaries Project, Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for the Herring River Embayment System, Harwich, Massachusetts", Final report-March 2013, see page 45 for buried wood waste nitrogen load.

Total Proposed Use with Mitigation:

The proposed project is comprised of the development of a ground-mounted solar photovoltaic facility.

Lot size: 36.32 acres (1,582,099± ft2)
Roof Area: 0 ft2
Impervious Pavement Area (slab): 1,000± ft2
Dirt/Gravel Roads: 62,835± ft2
Pervious area: 1,518,264± ft2
Wastewater flow: 0
Landfill area =11± acres (479,160± ft2)
Landfill removed at basins = 39,700 ft2
Solar panel array = 292,688 ft2

Wastewater
0

Roof, Gravel Roads, Impervious
[63,835 ft2] [40 in/yr] [1 ft/12 in] [28.32 L/ft3] [1 yr/365 day] = 16,509.6 L/day
[16,509.6 L/day] [0.75 mg/L] = 12,382.2 mg/day

Array
[292,688 ft2] [40 in/yr] [1 ft/12 in] [28.32 L/ft3] [1 yr/365 day] [0.75 mg/L] = 56,773.4 mg/day

Wood Waste Landfill*
[439,460 ft2] [40 in/yr] [1 ft/12 in] [28.32 L/ft3]] [1 yr/365 day] [7.7 mg/L*] = 875,163.5 mg/day

Pervious Area
[1,136,916 ft2] [1.5 ft/yr] [28.32 L/ft3] [1 yr/365 days] = 132,317 L/day **[TO BASINS]**
[367,646 ft2] [1.5 ft/yr] [28.32 L/ft3] [1 yr/365 days] = 42,788 L/day **[OFFSITE FLOW]**

Nitrogen Load Flowing to Offsite Areas
[0 + 0 + 0] = [0 mg]
[0 + 42,788] = [42,788 L]
= 0.00 PPM

Nitrogen Load Flowing to Infiltration Basins
[12,382.2 +56,773.4 +875,163.5] = [944,319.1 mg]
[16,509.6 + 132,317] = [148,826.6 L]
= 6.34 PPM

6.34 PPM x 50% Nitrogen Removal Efficiency = 3.17 PPM < 4.93 PPM [35.7% REDUCTION]

*Reference: "Massachusetts Estuaries Project, Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for the Herring River Embayment System, Harwich, Massachusetts", Final report-March 2013, see page 45 for buried wood waste nitrogen load.

TSS REMOVAL CALCULATIONS

MERIDIAN ASSOCIATES

TSS Removal

Infiltration basin provides 80% TSS removal with grass channel and sediment forebay for pretreatment.
Minimum forebay size = (0.1"/12 per ft) x (area of impervious surface, sf)
Assume onsite gravel road, dirt roads and equipment slabs are the impervious surface

Infiltration Basin 1:

Impervious surface = 22,868 sf
Forebay required = (0.1/12) x (22,868) = 190.6 cf
Volume provided = 2,803 cf

Check forebay for 1/2 inch WQV:
Required WQV = (0.5/12) x (22,868) = 953 cf < 2,803 cf provided

Infiltration Basin 2:

Onsite Impervious surface = 44,130 sf
Forebay required= (0.1/12) x (44,130) = 368 cf
Volume provided = 3,149 cf

Check forebay for 1/2 inch WQV:
Required WQV = (0.5/12) x (44,130) = 1,839 cf < 3,149 cf provided

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INSTRUCTIONS:

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: 280 & 0 Old Falmouth Road

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Grass Channel	0.50	1.00	0.50	0.50
Sediment Forebay	0.25	0.50	0.13	0.38
Infiltration Basin	0.80	0.38	0.30	0.08
	0.00	0.08	0.00	0.08
	0.00	0.08	0.00	0.08

Total TSS Removal = 93%

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

Project: 5834

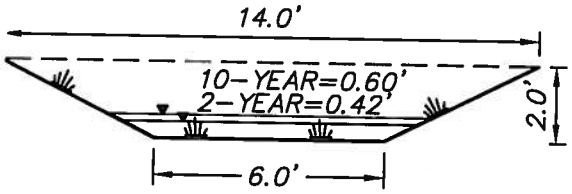
Prepared By: Meridian Associates, Inc.

Date: 8/12/2016

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

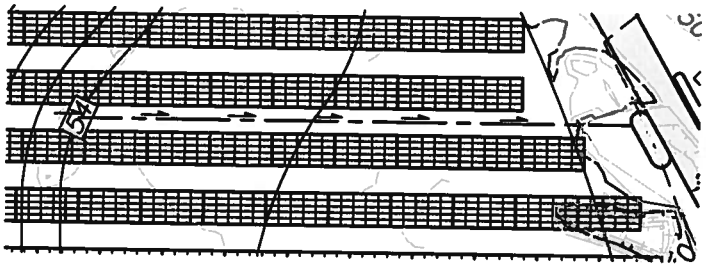


PROPOSED GRASS CHANNEL 100 SECTION VIEW:

(1"=5')

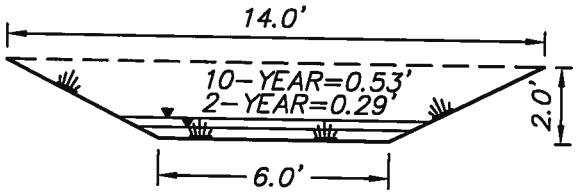
NOTE:

THE WATER LEVELS DEPICTED HEREON ARE BASED UPON THE ENTIRETY OF SUBCATCHMENT 100 FLOWING INTO THE GRASS CHANNEL. THE TRIBUTARY AREA FLOWING TO THE GRASS CHANNEL IS MUCH SMALLER AND WILL RESULT IN LOWER PEAK WATER LEVELS.



PROPOSED GRASS CHANNEL 100 PROFILE VIEW:

(1"=100')

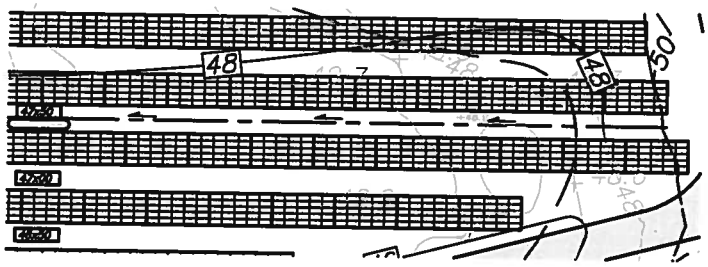


PROPOSED GRASS CHANNEL 200B SECTION VIEW:

(1"=5')

NOTE:

THE WATER LEVELS DEPICTED HEREON ARE BASED UPON THE ENTIRETY OF SUBCATCHMENT 200 FLOWING INTO THE GRASS CHANNEL. THE TRIBUTARY AREA FLOWING TO THE GRASS CHANNEL IS MUCH SMALLER AND WILL RESULT IN LOWER PEAK WATER LEVELS.



PROPOSED GRASS CHANNEL 200B PROFILE VIEW:

(1"=100')

SCALE: AS NOTED

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