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City of Grove City
11-27-18

DRAINAGE CALCULATIONS FOR PROPOSED AUTOZONE STORE NO. 6121

2682 LONDON-GROVEPORT ROAD
GROVE CITY, OHIO

NOVEMBER 26, 2018

PRISM ENGINEERING & DESIGN GROUP, LLC
2309 WATTERSON TRAIL, SUITE 200
LOUISVILLE, KENTUCKY 40299
(502) 491-8891



**SUMMARY OF DRAINAGE DESIGN
FOR AUTOZONE STORE NO. 6121
GROVE CITY, OHIO
NOVEMBER 26, 2018**

GENERAL INFORMATION

The subject site is located on the northern side of London-Groveport Road and the eastern side of Summit Drive, just east of Interstate 71, in Grove City, Ohio. AutoZone Store Development proposes to construct a new 7,381 sq. ft. building and related site improvements on the existing 1.356 acre parcel.

CRITICAL STORM

As shown in the attached critical storm calculations, we have determined the critical storm to be the 25-year storm event for this site, based on the proposed development area. Therefore, the proposed stormwater discharge from the site will be limited to the existing 1-year runoff rate for the proposed conditions for the 1, 2, 5, 10 and 25-year events. The proposed 50 and 100-year events will be limited to the existing peak flowrates for the 50 and 100-year events, respectively.

EXISTING CONDITIONS

The subject site generally slopes away from London-Groveport Road, with stormwater draining from South to North. Stormwater is ultimately captured by the existing storm sewer system serving the Summit Apartments site. An existing storm sewer inlet is located at the northern side of the site for discharge from the subject parcel.

The existing parcel includes existing improvements that will remain on the site. Along the western side of the parcel, a portion of Summit Drive is located on the site, as well as the existing sidewalk along the eastern side of Summit Drive. These existing improvements are served by existing the existing storm sewer system and the existing drainage patterns will remain unchanged. In addition, the existing bike path along London Groveport Road will remain in place. The existing bike path slopes away from the subject site, allowing stormwater to drain into the existing storm sewer system along London-Groveport Road.

For the purposes of the drainage calculations for the proposed AutoZone site, the existing site improvements along the western and southern portions of the parcel are excluded, as they already exist at the site. In addition, the existing grassed areas along the northern and eastern perimeter of the parcel (existing utility easement areas) are also excluded from the calculations, as these areas currently discharge stormwater to the existing storm sewer system and these areas will remain as grass.

With these existing areas excluded from the calculations for the proposed site improvements, the calculations are based on a development area of 33,633 sq. ft. (0.77 ac.). The existing site analysis was performed using a SCS curve number of 77. Prior to development on the adjacent parcels, the existing site was used as cropland. Using HydroCAD software, the following existing runoff rates were calculated using a Huff Distribution, 2nd Quartile – 12-hour storm event. The existing peak runoff rates are shown in the following table.

Pre-Developed Peak Runoff from Development Area	
Frequency (yr)	Flowrate (cfs)
1	0.07 cfs
2	0.11 cfs
5	0.18 cfs
10	0.23 cfs
25	0.32 cfs
50	0.40 cfs
100	0.49 cfs

PROPOSED CONDITIONS

As part of this project, AutoZone proposes to construct a 7,381 sq. ft. building and related site improvements, with an on-site stormwater detention system. The detention system will discharge to the existing storm sewer located on site. For the purposes of these calculations, the development area of 33,633 sq. ft. (0.77 ac) was used for the design. HydroCAD software used for the calculations with a Huff Distribution 2nd Quartile 12-hour storm event.

The proposed conditions for the development area consist of 27,711 sq. ft. of impervious area and 4,559 sq. ft. of pervious area directed to the on-site stormwater detention system, as well as 1,363 sq. ft. of impervious area that directly discharges from the site. An underground detention system is proposed for the project, utilizing a Stormtech system. The Stormtech system is detailed within the site construction drawings.

Based on the HydroCAD modeling (attached), the proposed stormwater discharge from the site is shown in the table below:

Post Construction Peak Runoff from Development Area	
Frequency (yr)	Flowrate (cfs)
1	0.04 cfs
2	0.05 cfs
5	0.05 cfs
10	0.06 cfs
25	0.07 cfs
50	0.24 cfs
100	0.41 cfs

As can be seen in the table above, the proposed peak flowrate from the site is limited to the 1-year predeveloped flowrate for the proposed 1, 2, 5, 10 and 25-year storm events. The proposed 50 and 100-year events are discharged at rates less than existing conditions.

STORM SEWER DESIGN

The design of the proposed storm sewer system for the site is shown on the site construction drawings (Sheet C1.2).

CRITICAL STORM DETERMINATION and HydroCAD REPORTS

EXISTING CONDITIONS
PROPOSED CONDITIONS
DETENTION BASIN CALCULATIONS

AUTOZONE STORE NO. 6121
CRITICAL STORM DETERMINATION

EXISTING PRE-DEVELOPMENT CONDITIONS:

SITE AREA = 48,114 SF
(Area excludes existing Summit Drive and related improvements)

EXISTING CN = 77
(Previous cropland prior to adjacent development)

PROPOSED POST-DEVELOPMENT CONDITIONS:

AREA = 48,114 SF
(Area excludes existing Summit Drive and related improvements)

PROPOSED CN = 74 for 19,040 SF
PROPOSED CN = 98 for 29,074 SF

EXISTING 1-YEAR RUNOFF VOLUME = 0.045 AC-FT

PROPOSED 1-YEAR RUNOFF VOLUME = 0.100 AC-FT

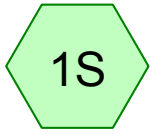
% INCREASE = $\frac{0.100-0.045}{0.045}$

% INCREASE = 122%

THEREFORE, BASED ON THE CRITICAL STORM METHOD, THE CRITICAL STORM FOR THE SITE DEVELOPMENT AREA IS THE 25-YEAR STORM.

AS A RESULT, THE DISCHARGE FROM THE PROPOSED DETENTION SYSTEM WILL BE LIMITED TO THE PRE-DEVELOPMENT 1-YEAR PEAK RATE FOR THE 1, 2, 5, 10 AND 25-YEAR POST-DEVELOPMENT PEAK RATES.

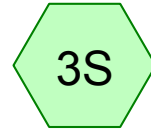
THE POST-DEVELOPMENT PEAK RATES FOR THE 50 AND 100-YEAR CONDITIONS WILL BE LIMITED TO THE PRE-DEVELOPMENT PEAK RATES FOR THE 50 AND 100-YEAR STORM EVENTS, RESPECTIVELY.



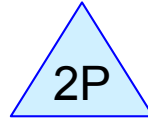
Existing Conditions



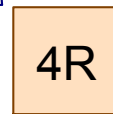
Proposed - To Detention



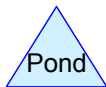
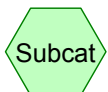
Proposed - Detention Bypass



Stormtech



Proposed Flow From Site



Detention Design - 740 11.23.18

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AutoZone Store No. 6121 Grove City OH

Huff 0-10sm 2Q 12.00 hrs 1yr-12hr Rainfall=1.88"

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Summary for Subcatchment 1S: Existing Conditions

Runoff = 0.07 cfs @ 5.62 hrs, Volume= 0.025 af, Depth= 0.39"

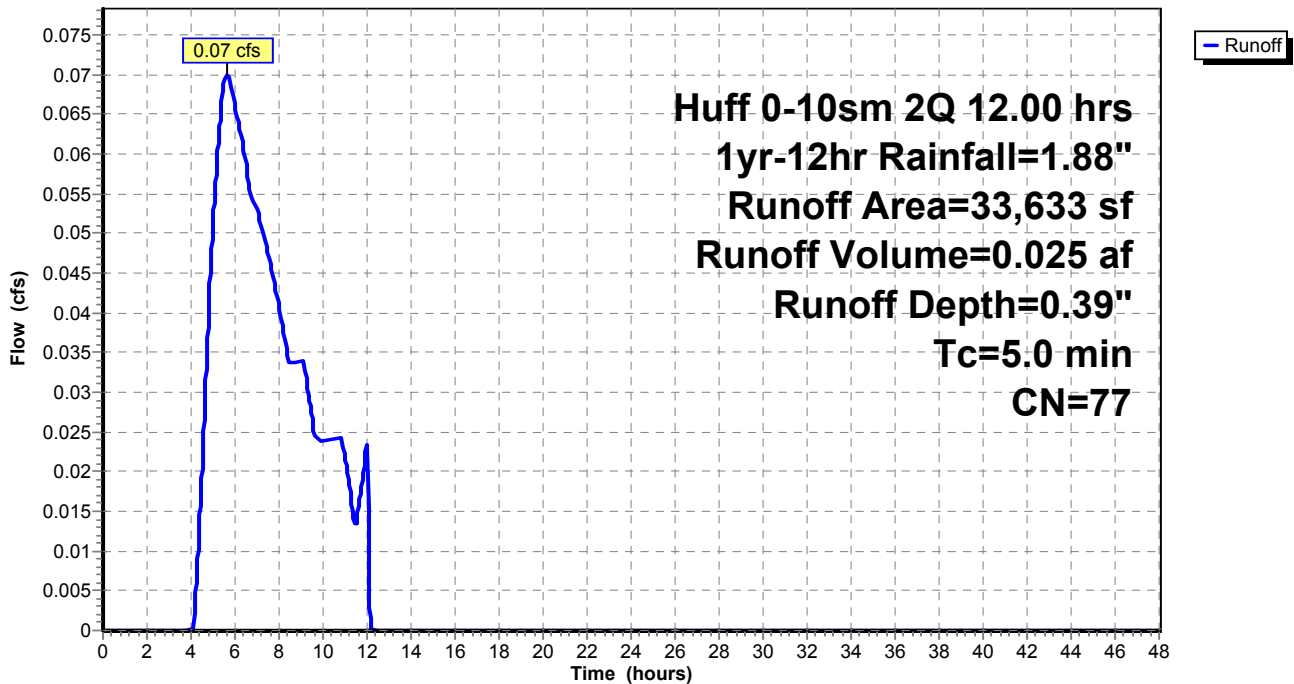
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Huff 0-10sm 2Q 12.00 hrs 1yr-12hr Rainfall=1.88"

Area (sf)	CN	Description
* 33,633	77	Previous Farm Land
33,633		100.00% Pervious Area

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

Subcatchment 1S: Existing Conditions

Hydrograph



Detention Design - 740 11.23.18

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Huff 0-10sm 2Q 12.00 hrs 1yr-12hr Rainfall=1.88"

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Summary for Subcatchment 2S: Proposed - To Detention

Runoff = 0.23 cfs @ 4.94 hrs, Volume= 0.085 af, Depth= 1.37"

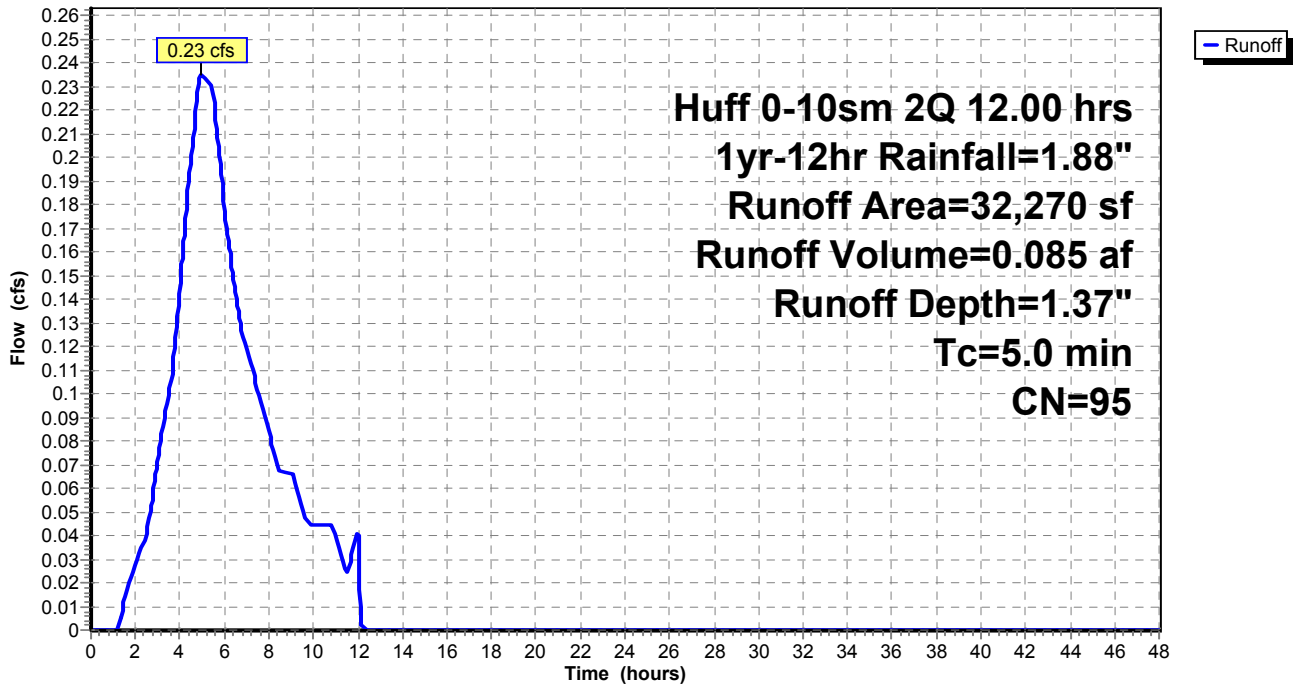
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
 Huff 0-10sm 2Q 12.00 hrs 1yr-12hr Rainfall=1.88"

	Area (sf)	CN	Description
*	4,559	74	HSG C Grass
*	27,711	98	HSG C Impervious
	32,270	95	Weighted Average
	4,559		14.13% Pervious Area
	27,711		85.87% Impervious Area

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

Subcatchment 2S: Proposed - To Detention

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 1yr-12hr Rainfall=1.88"

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Summary for Subcatchment 3S: Proposed - Detention Bypass

Runoff = 0.01 cfs @ 4.90 hrs, Volume= 0.004 af, Depth= 1.66"

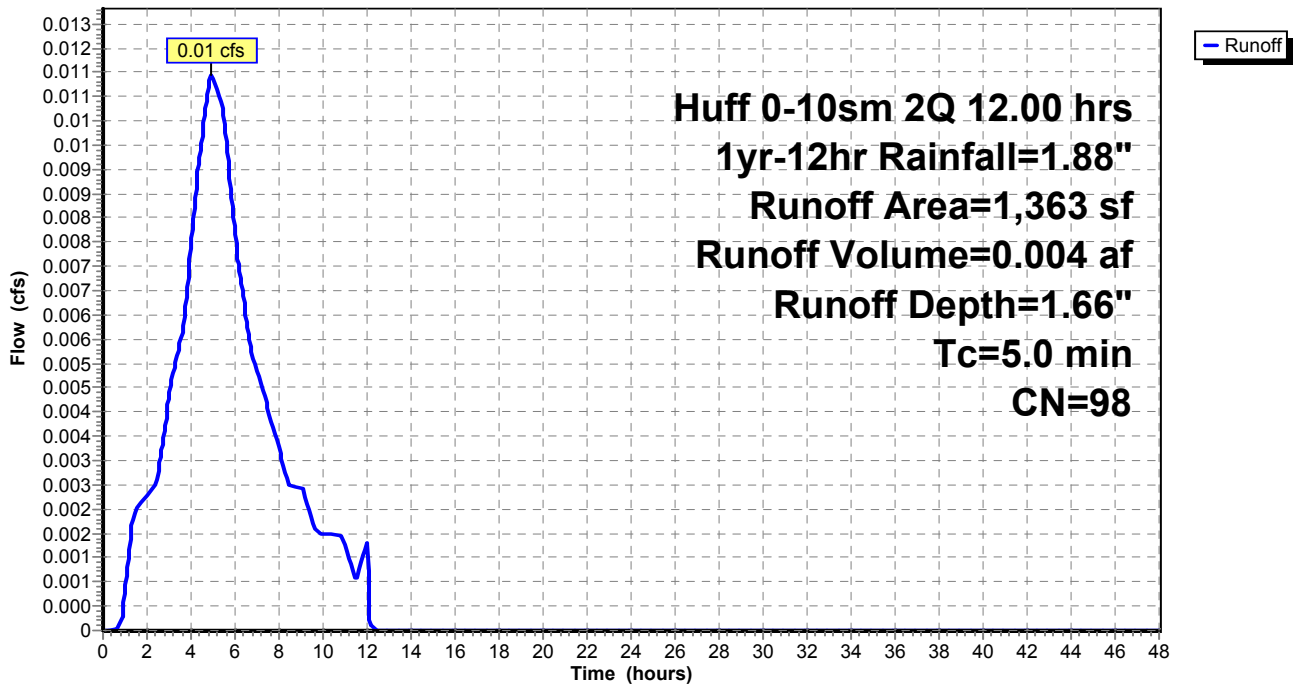
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Huff 0-10sm 2Q 12.00 hrs 1yr-12hr Rainfall=1.88"

Area (sf)	CN	Description
* 1,363	98	Dumpster and Adjacent Paved Areas
1,363		100.00% Impervious Area

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

Subcatchment 3S: Proposed - Detention Bypass

Hydrograph



Detention Design - 740 11.23.18

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Huff 0-10sm 2Q 12.00 hrs 1yr-12hr Rainfall=1.88"

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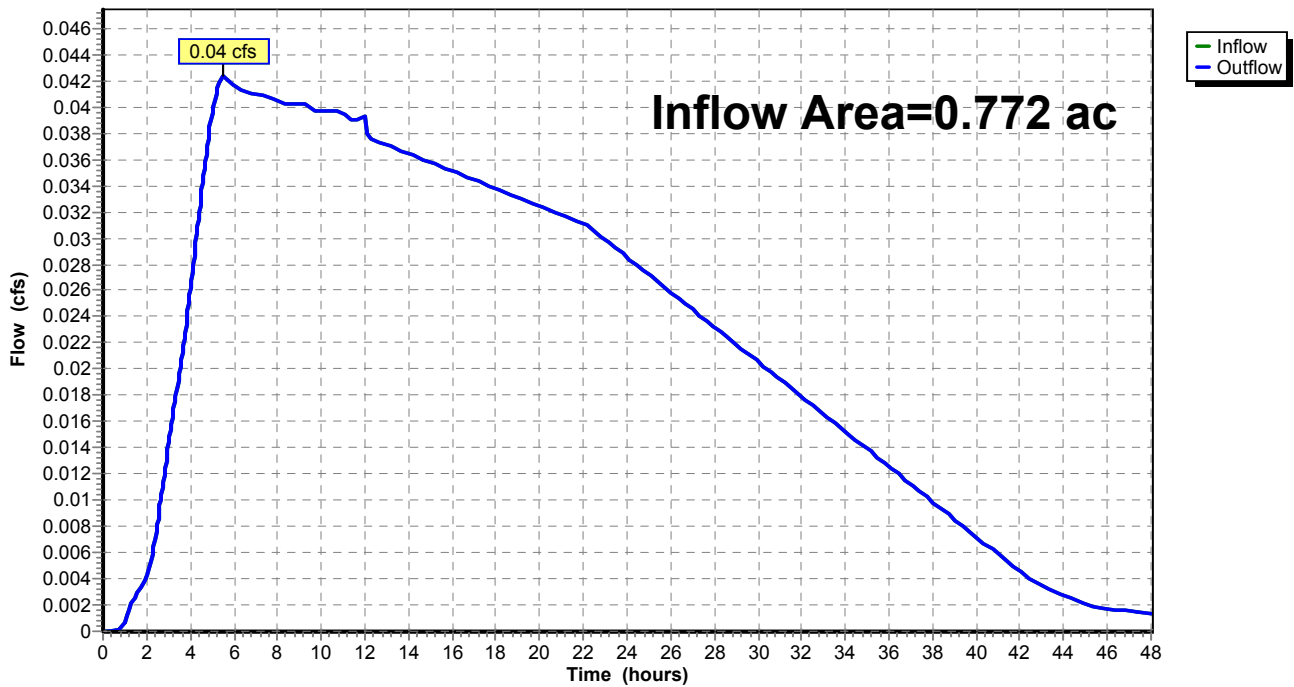
Summary for Reach 4R: Proposed Flow From Site

Inflow Area = 0.772 ac, 86.44% Impervious, Inflow Depth > 1.37" for 1yr-12hr event
Inflow = 0.04 cfs @ 5.50 hrs, Volume= 0.088 af
Outflow = 0.04 cfs @ 5.50 hrs, Volume= 0.088 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 4R: Proposed Flow From Site

Hydrograph



Detention Design - 740 11.23.18

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Huff 0-10sm 2Q 12.00 hrs 1yr-12hr Rainfall=1.88"

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Summary for Pond 2P: Stormtech

Inflow Area = 0.741 ac, 85.87% Impervious, Inflow Depth = 1.37" for 1yr-12hr event
Inflow = 0.23 cfs @ 4.94 hrs, Volume= 0.085 af
Outflow = 0.04 cfs @ 11.06 hrs, Volume= 0.084 af, Atten= 84%, Lag= 367.3 min
Primary = 0.04 cfs @ 11.06 hrs, Volume= 0.084 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs / 9
Peak Elev= 813.96' @ 11.06 hrs Surf.Area= 3,409 sf Storage= 2,629 cf

Plug-Flow detention time= 784.5 min calculated for 0.084 af (99% of inflow)
Center-of-Mass det. time= 780.7 min (1,147.2 - 366.5)

Volume	Invert	Avail.Storage	Storage Description
#1	812.50'	3,831 cf	25.25'W x 135.00'L x 4.00'H Stone Volume 13,635 cf Overall - 4,057 cf Embedded = 9,578 cf x 40.0% Voids
#2	813.50'	4,057 cf	StormTech SC-740 x 88 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 5 rows
		7,888 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	812.50'	1.1" Vert. Orifice/Grate C= 0.600
#2	Primary	816.00'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=0.04 cfs @ 11.06 hrs HW=813.96' (Free Discharge)

- 1=Orifice/Grate (Orifice Controls 0.04 cfs @ 5.73 fps)
- 2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Detention Design - 740 11.23.18

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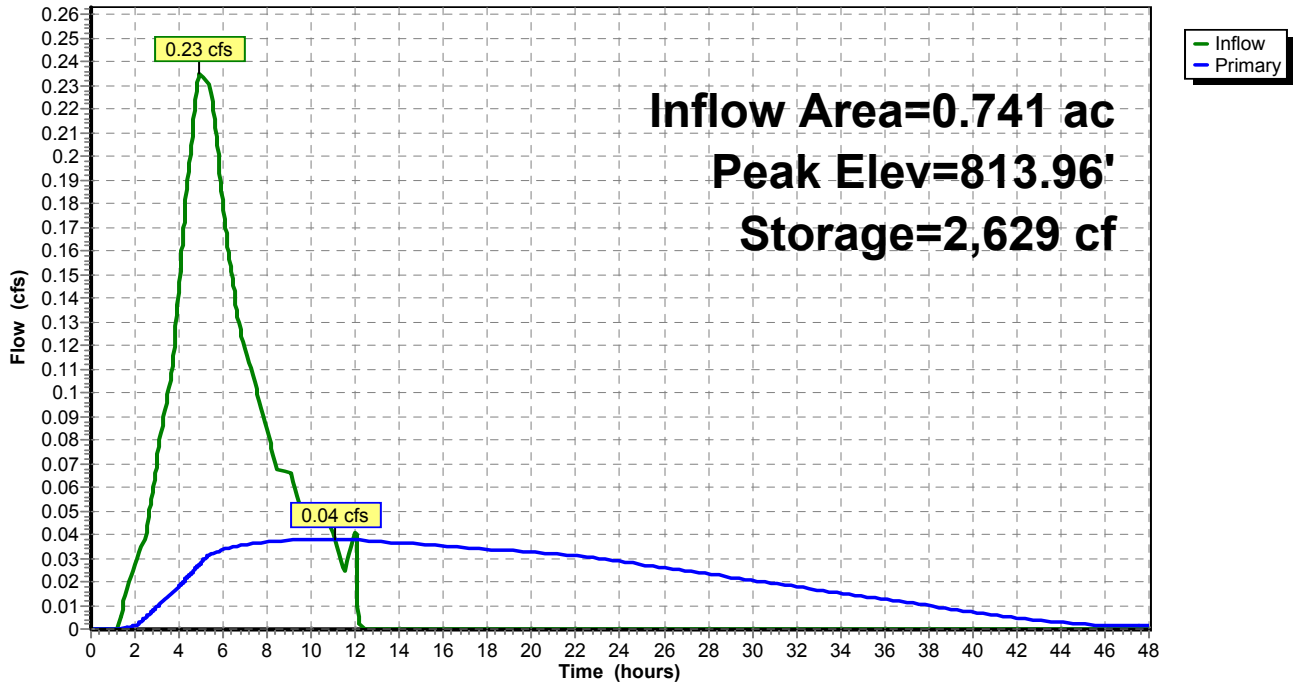
AutoZone Store No. 6121 Grove City OH
Huff 0-10sm 2Q 12.00 hrs 1yr-12hr Rainfall=1.88"

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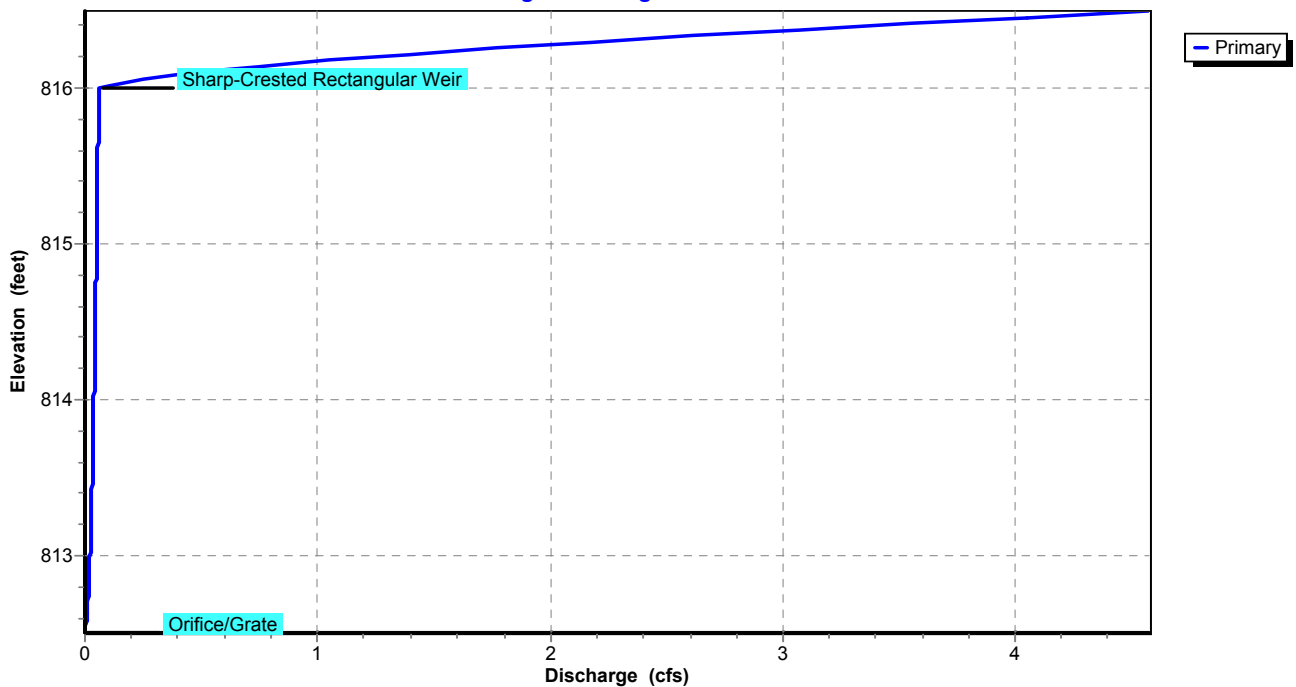
Pond 2P: Stormtech

Hydrograph



Pond 2P: Stormtech

Stage-Discharge



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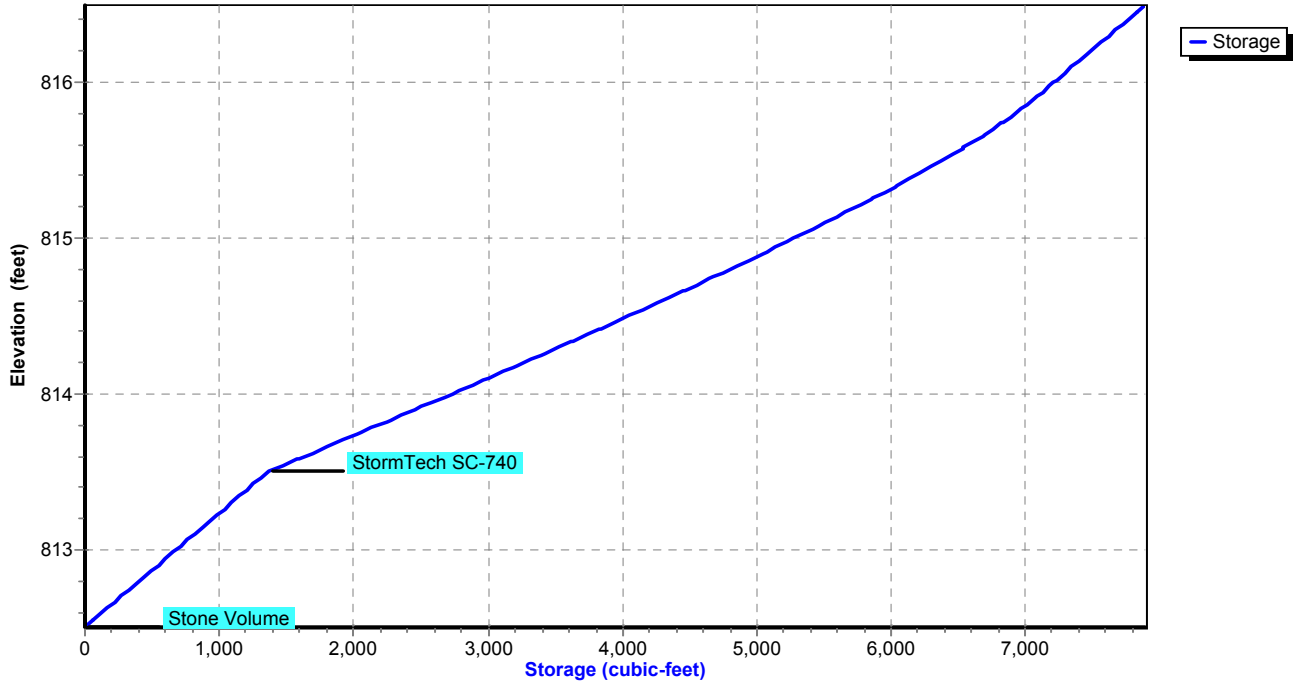
Huff 0-10sm 2Q 12.00 hrs 1yr-12hr Rainfall=1.88"

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Pond 2P: Stormtech

Stage-Area-Storage



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Huff 0-10sm 2Q 12.00 hrs 2yr-12hr Rainfall=2.25"

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Summary for Subcatchment 1S: Existing Conditions

Runoff = 0.11 cfs @ 5.51 hrs, Volume= 0.038 af, Depth= 0.59"

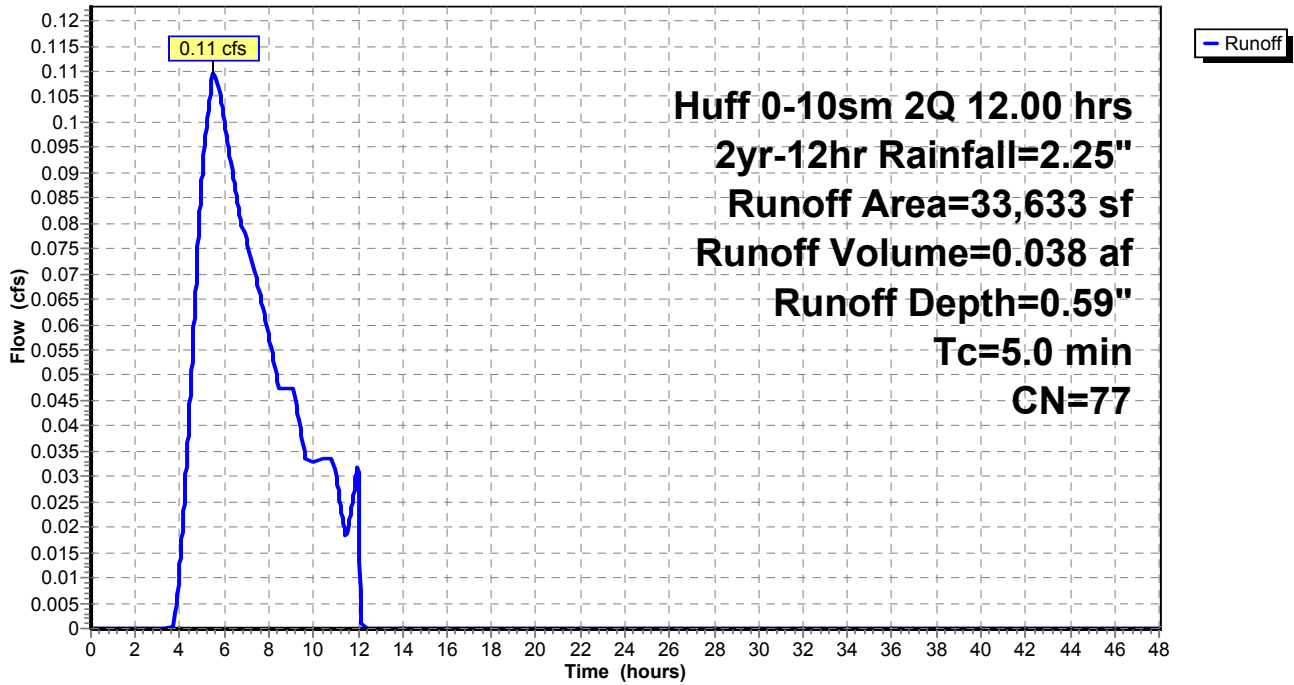
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
 Huff 0-10sm 2Q 12.00 hrs 2yr-12hr Rainfall=2.25"

Area (sf)	CN	Description
* 33,633	77	Previous Farm Land
33,633		100.00% Pervious Area

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

Subcatchment 1S: Existing Conditions

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 2yr-12hr Rainfall=2.25"

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Summary for Subcatchment 2S: Proposed - To Detention

Runoff = 0.29 cfs @ 4.92 hrs, Volume= 0.106 af, Depth= 1.72"

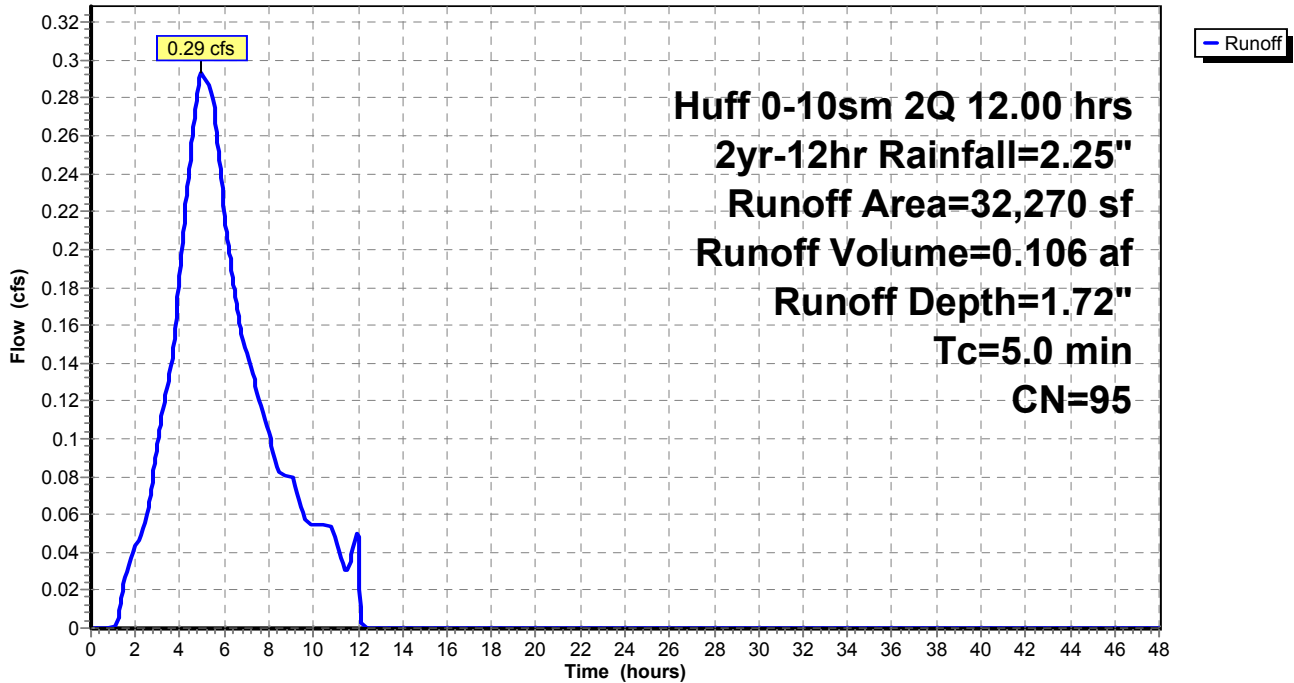
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
 Huff 0-10sm 2Q 12.00 hrs 2yr-12hr Rainfall=2.25"

	Area (sf)	CN	Description
*	4,559	74	HSG C Grass
*	27,711	98	HSG C Impervious
	32,270	95	Weighted Average
	4,559		14.13% Pervious Area
	27,711		85.87% Impervious Area

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

Subcatchment 2S: Proposed - To Detention

Hydrograph



Detention Design - 740 11.23.18

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Huff 0-10sm 2Q 12.00 hrs 2yr-12hr Rainfall=2.25"

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Summary for Subcatchment 3S: Proposed - Detention Bypass

Runoff = 0.01 cfs @ 4.89 hrs, Volume= 0.005 af, Depth= 2.02"

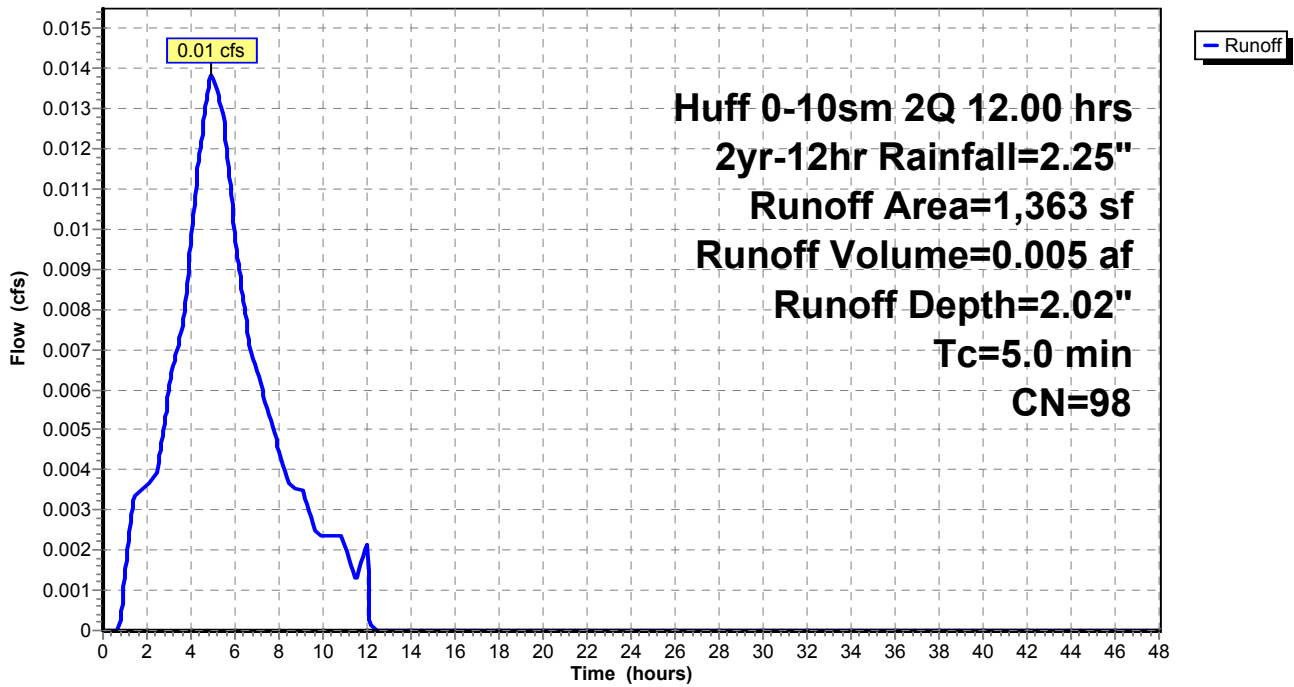
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
 Huff 0-10sm 2Q 12.00 hrs 2yr-12hr Rainfall=2.25"

Area (sf)	CN	Description
* 1,363	98	Dumpster and Adjacent Paved Areas
1,363		100.00% Impervious Area

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

Subcatchment 3S: Proposed - Detention Bypass

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 2yr-12hr Rainfall=2.25"

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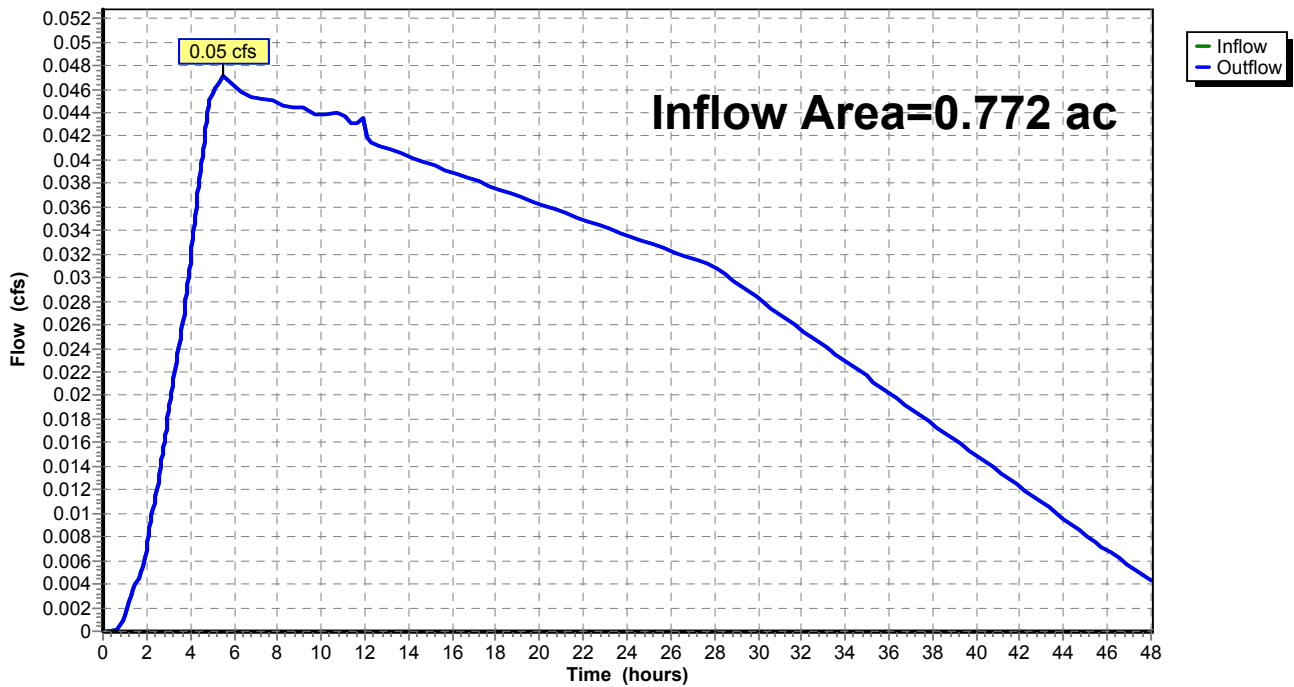
Summary for Reach 4R: Proposed Flow From Site

Inflow Area = 0.772 ac, 86.44% Impervious, Inflow Depth > 1.70" for 2yr-12hr event
Inflow = 0.05 cfs @ 5.50 hrs, Volume= 0.110 af
Outflow = 0.05 cfs @ 5.50 hrs, Volume= 0.110 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 4R: Proposed Flow From Site

Hydrograph



Detention Design - 740 11.23.18

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AutoZone Store No. 6121 Grove City OH
Huff 0-10sm 2Q 12.00 hrs 2yr-12hr Rainfall=2.25"

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Summary for Pond 2P: Stormtech

Inflow Area = 0.741 ac, 85.87% Impervious, Inflow Depth = 1.72" for 2yr-12hr event
Inflow = 0.29 cfs @ 4.92 hrs, Volume= 0.106 af
Outflow = 0.04 cfs @ 11.16 hrs, Volume= 0.104 af, Atten= 86%, Lag= 374.1 min
Primary = 0.04 cfs @ 11.16 hrs, Volume= 0.104 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs / 9
Peak Elev= 814.27' @ 11.16 hrs Surf.Area= 3,409 sf Storage= 3,441 cf

Plug-Flow detention time= 902.2 min calculated for 0.104 af (98% of inflow)
Center-of-Mass det. time= 895.5 min (1,256.8 - 361.2)

Volume	Invert	Avail.Storage	Storage Description
#1	812.50'	3,831 cf	25.25'W x 135.00'L x 4.00'H Stone Volume 13,635 cf Overall - 4,057 cf Embedded = 9,578 cf x 40.0% Voids
#2	813.50'	4,057 cf	StormTech SC-740 x 88 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 5 rows
		7,888 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	812.50'	1.1" Vert. Orifice/Grate C= 0.600
#2	Primary	816.00'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=0.04 cfs @ 11.16 hrs HW=814.27' (Free Discharge)

- 1=Orifice/Grate (Orifice Controls 0.04 cfs @ 6.32 fps)
- 2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Detention Design - 740 11.23.18

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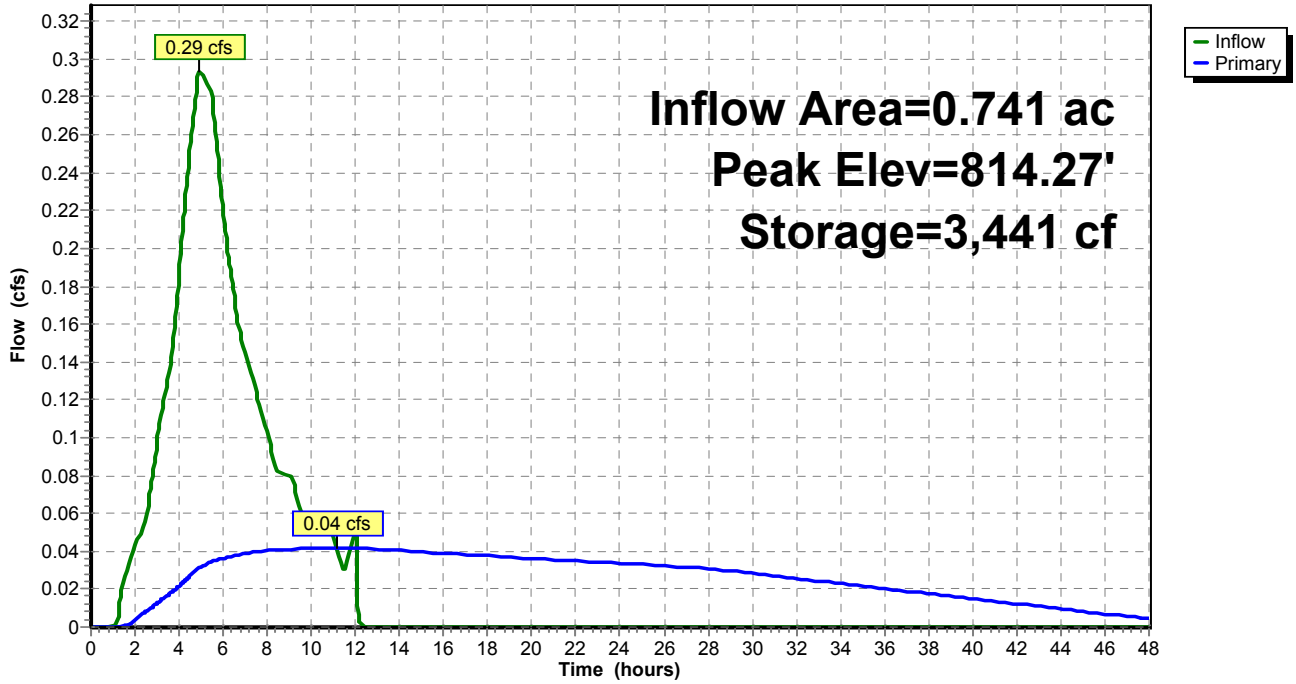
AutoZone Store No. 6121 Grove City OH
Huff 0-10sm 2Q 12.00 hrs 2yr-12hr Rainfall=2.25"

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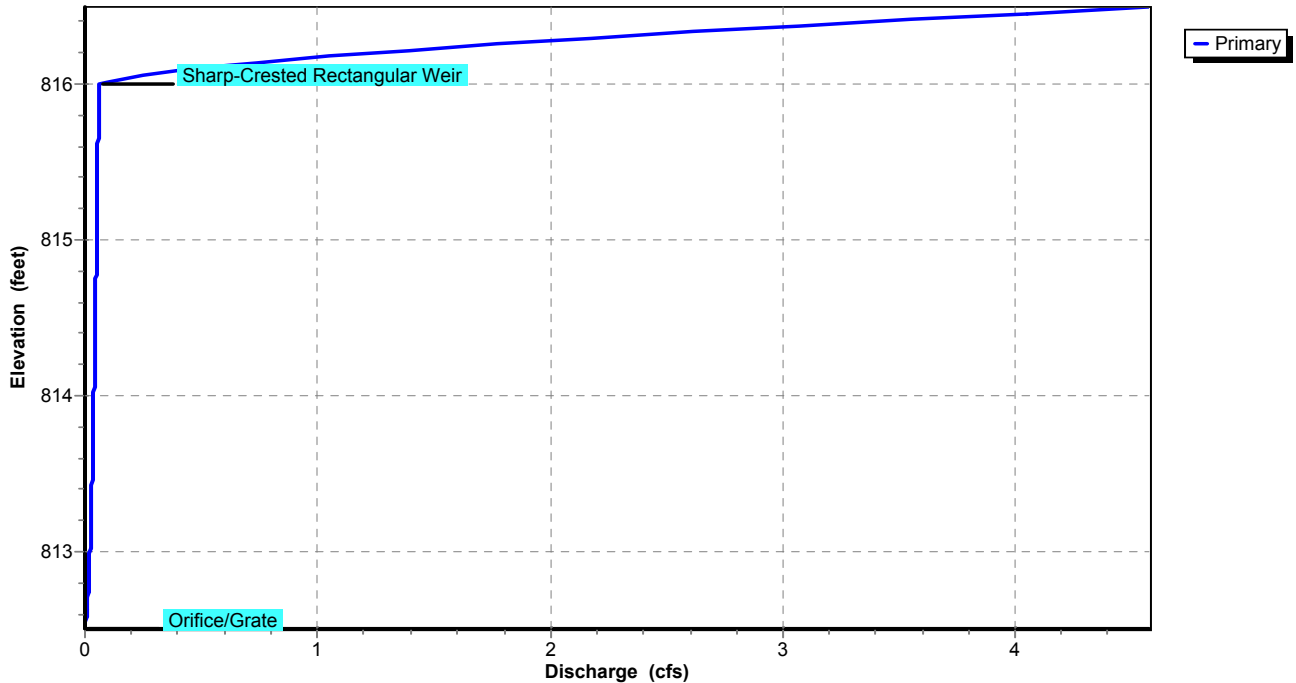
Pond 2P: Stormtech

Hydrograph



Pond 2P: Stormtech

Stage-Discharge



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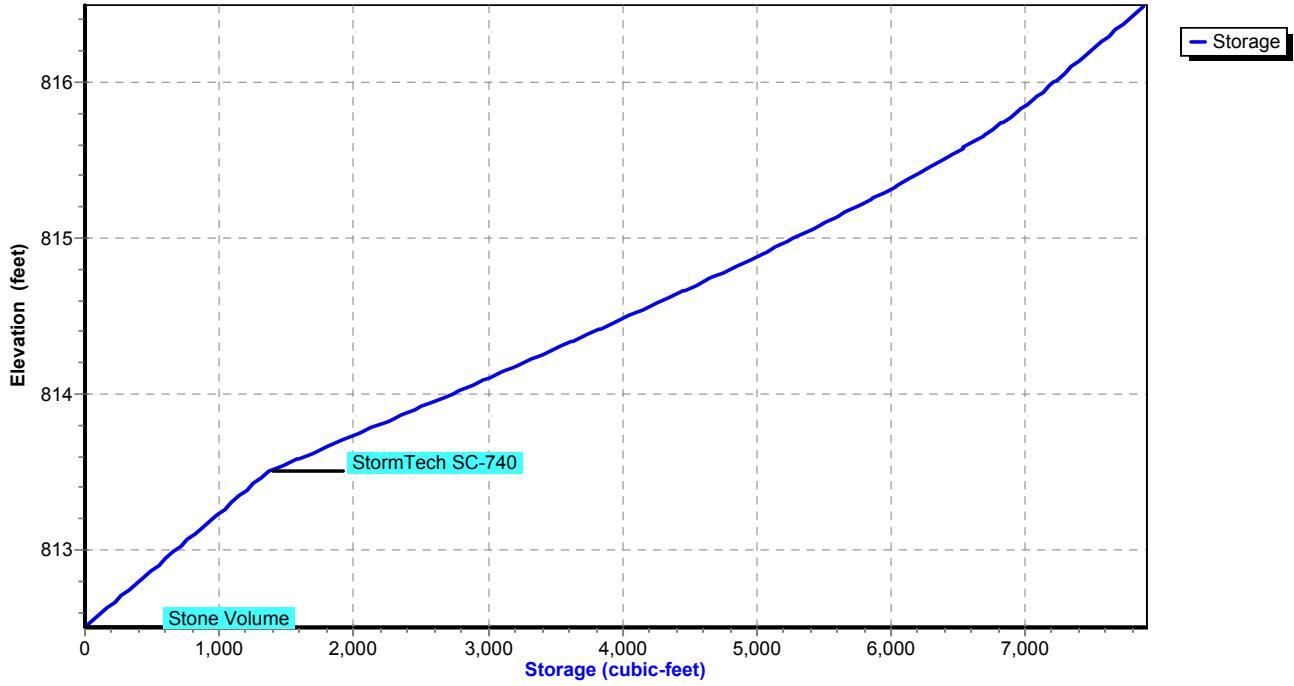
Huff 0-10sm 2Q 12.00 hrs 2yr-12hr Rainfall=2.25"

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Pond 2P: Stormtech

Stage-Area-Storage



Detention Design - 740 11.23.18

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Huff 0-10sm 2Q 12.00 hrs 5yr-12hr Rainfall=2.79"

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Summary for Subcatchment 1S: Existing Conditions

Runoff = 0.18 cfs @ 5.48 hrs, Volume= 0.060 af, Depth= 0.93"

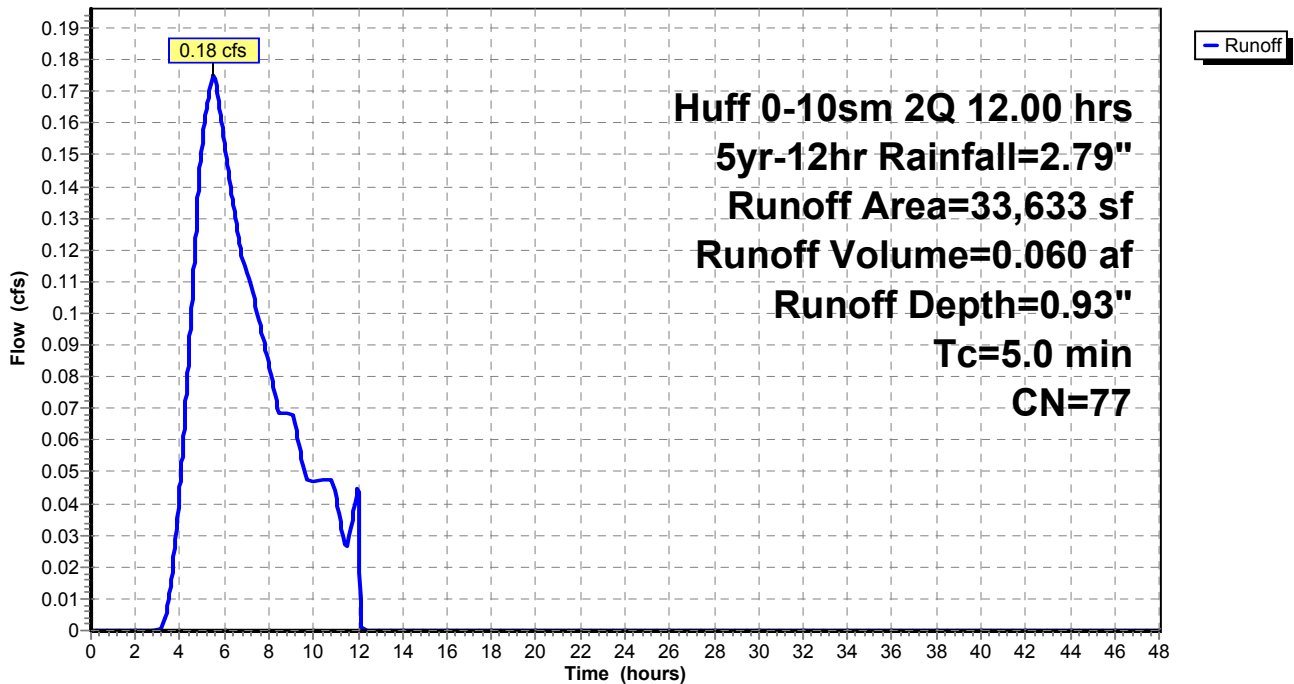
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Huff 0-10sm 2Q 12.00 hrs 5yr-12hr Rainfall=2.79"

Area (sf)	CN	Description
* 33,633	77	Previous Farm Land
33,633		100.00% Pervious Area

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

Subcatchment 1S: Existing Conditions

Hydrograph



Detention Design - 740 11.23.18

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AutoZone Store No. 6121 Grove City OH

Huff 0-10sm 2Q 12.00 hrs 5yr-12hr Rainfall=2.79"

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Summary for Subcatchment 2S: Proposed - To Detention

Runoff = 0.38 cfs @ 4.91 hrs, Volume= 0.139 af, Depth= 2.24"

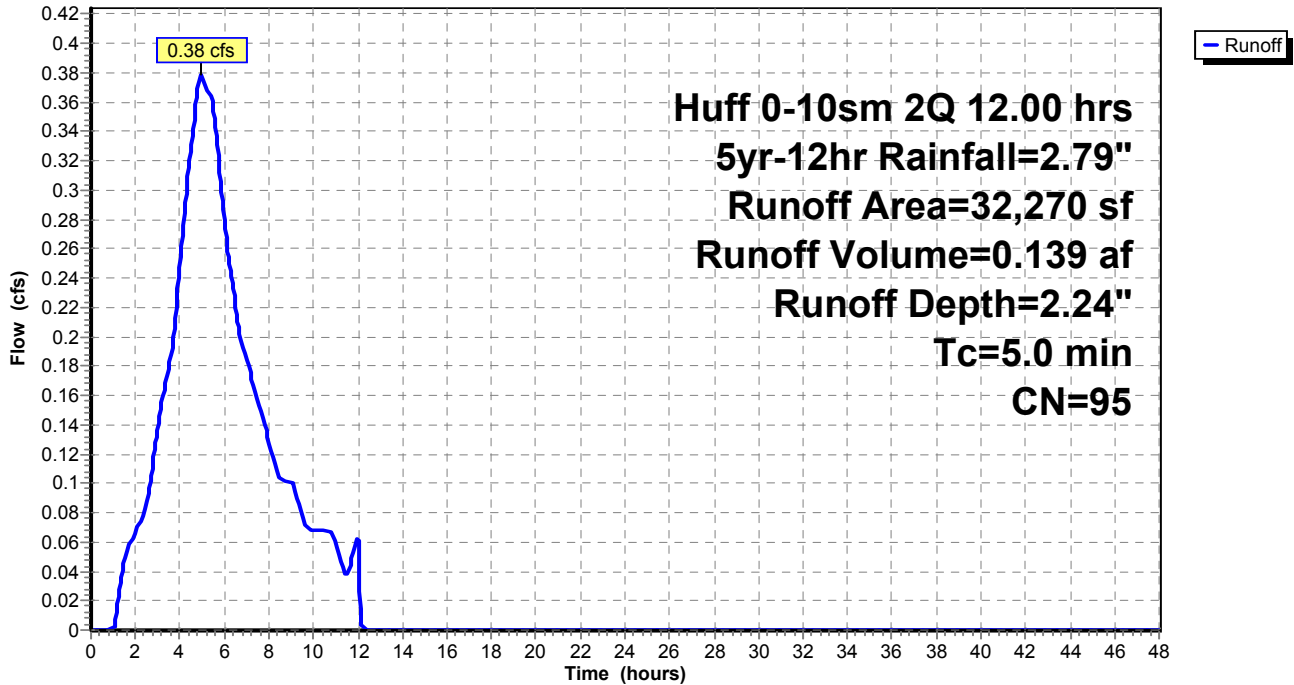
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
 Huff 0-10sm 2Q 12.00 hrs 5yr-12hr Rainfall=2.79"

	Area (sf)	CN	Description
*	4,559	74	HSG C Grass
*	27,711	98	HSG C Impervious
	32,270	95	Weighted Average
	4,559		14.13% Pervious Area
	27,711		85.87% Impervious Area

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

Subcatchment 2S: Proposed - To Detention

Hydrograph



Detention Design - 740 11.23.18

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Huff 0-10sm 2Q 12.00 hrs 5yr-12hr Rainfall=2.79"

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Summary for Subcatchment 3S: Proposed - Detention Bypass

Runoff = 0.02 cfs @ 4.89 hrs, Volume= 0.007 af, Depth= 2.56"

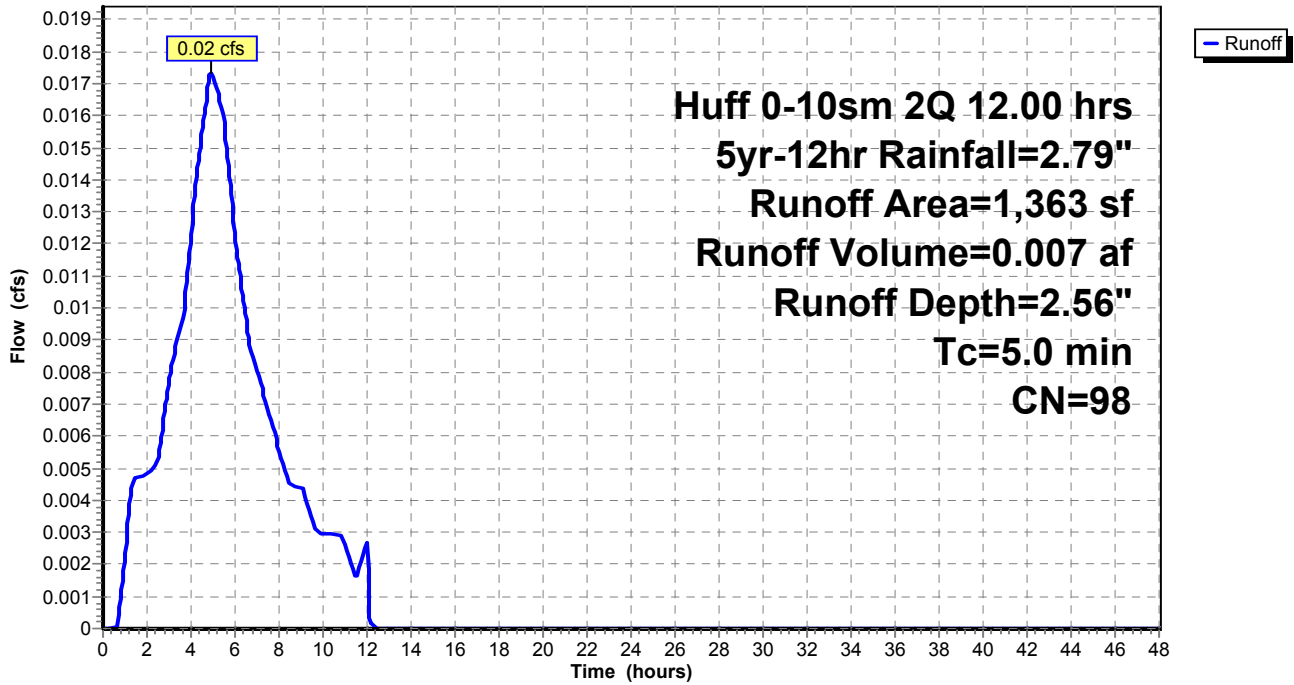
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
 Huff 0-10sm 2Q 12.00 hrs 5yr-12hr Rainfall=2.79"

Area (sf)	CN	Description
* 1,363	98	Dumpster and Adjacent Paved Areas
1,363		100.00% Impervious Area

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

Subcatchment 3S: Proposed - Detention Bypass

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 5yr-12hr Rainfall=2.79"

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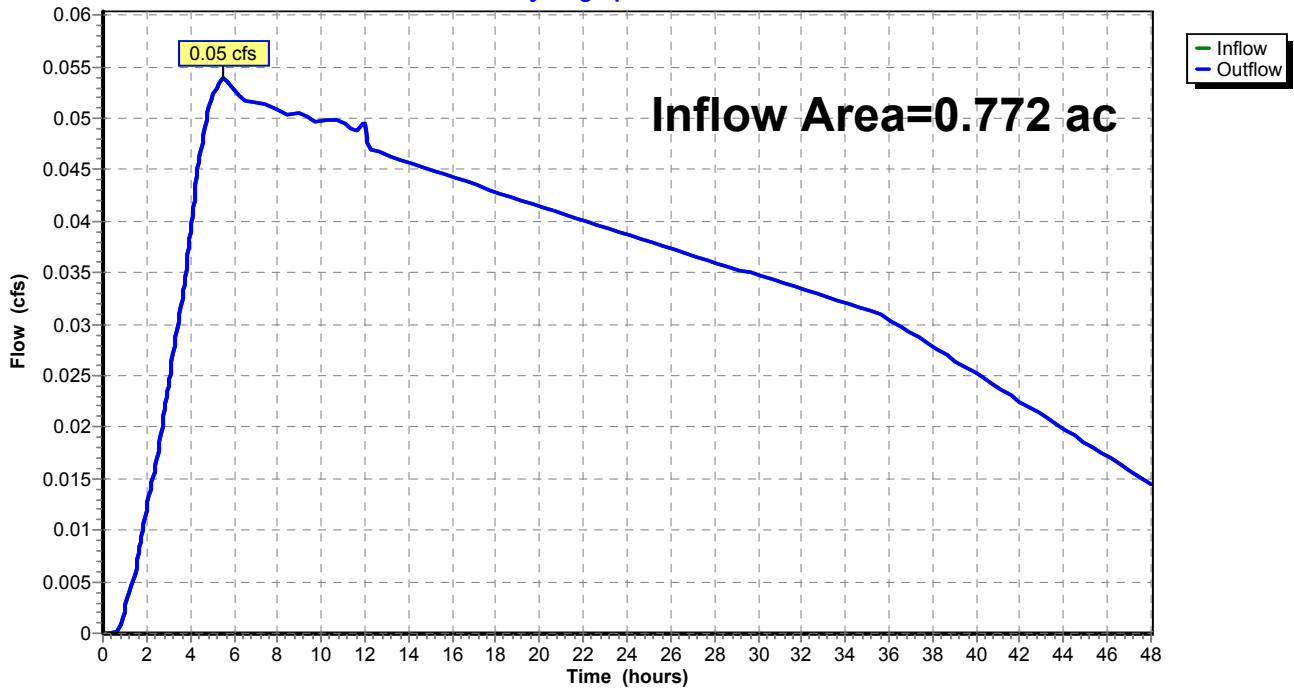
Summary for Reach 4R: Proposed Flow From Site

Inflow Area = 0.772 ac, 86.44% Impervious, Inflow Depth > 2.13" for 5yr-12hr event
Inflow = 0.05 cfs @ 5.49 hrs, Volume= 0.137 af
Outflow = 0.05 cfs @ 5.49 hrs, Volume= 0.137 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 4R: Proposed Flow From Site

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 5yr-12hr Rainfall=2.79"

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Summary for Pond 2P: Stormtech

Inflow Area = 0.741 ac, 85.87% Impervious, Inflow Depth = 2.24" for 5yr-12hr event
Inflow = 0.38 cfs @ 4.91 hrs, Volume= 0.139 af
Outflow = 0.05 cfs @ 12.05 hrs, Volume= 0.131 af, Atten= 88%, Lag= 428.7 min
Primary = 0.05 cfs @ 12.05 hrs, Volume= 0.131 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs / 9
Peak Elev= 814.74' @ 12.05 hrs Surf.Area= 3,409 sf Storage= 4,660 cf

Plug-Flow detention time= 1,018.4 min calculated for 0.131 af (94% of inflow)
Center-of-Mass det. time= 999.2 min (1,354.8 - 355.5)

Volume	Invert	Avail.Storage	Storage Description
#1	812.50'	3,831 cf	25.25'W x 135.00'L x 4.00'H Stone Volume 13,635 cf Overall - 4,057 cf Embedded = 9,578 cf x 40.0% Voids
#2	813.50'	4,057 cf	StormTech SC-740 x 88 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 5 rows
		7,888 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	812.50'	1.1" Vert. Orifice/Grate C= 0.600
#2	Primary	816.00'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=0.05 cfs @ 12.05 hrs HW=814.74' (Free Discharge)

- 1=Orifice/Grate (Orifice Controls 0.05 cfs @ 7.14 fps)
- 2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Detention Design - 740 11.23.18

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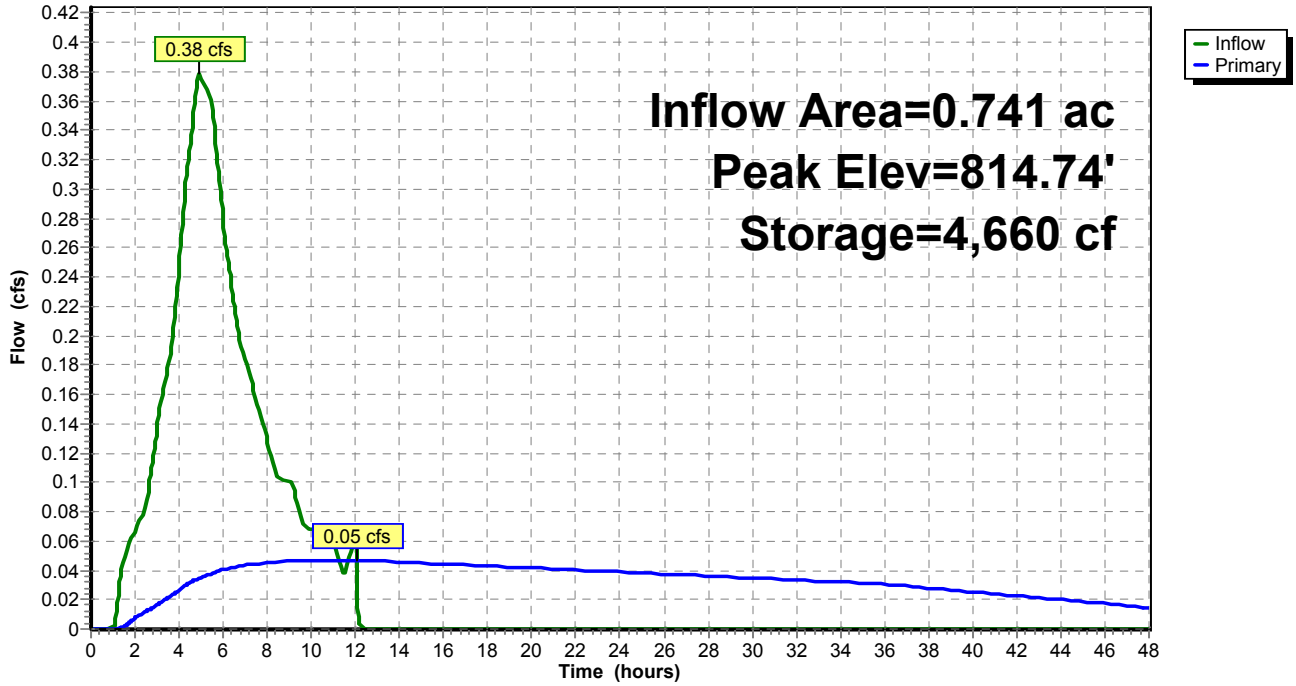
Huff 0-10sm 2Q 12.00 hrs 5yr-12hr Rainfall=2.79"

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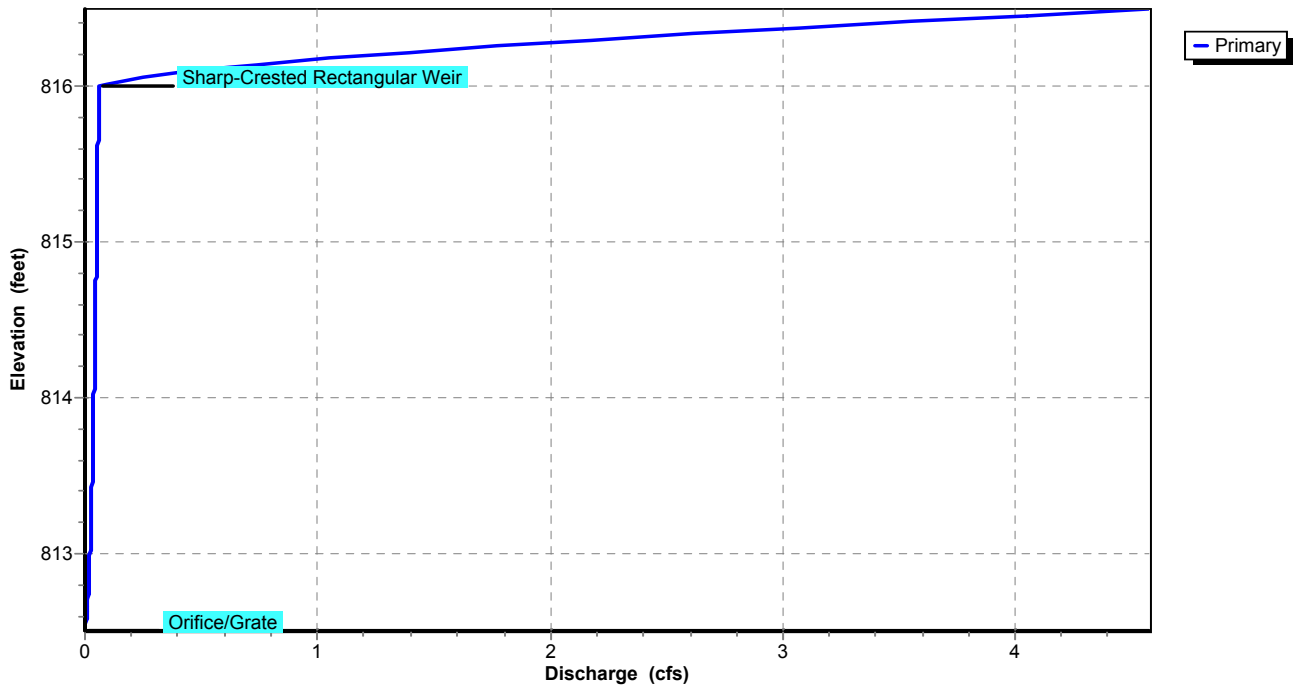
Pond 2P: Stormtech

Hydrograph



Pond 2P: Stormtech

Stage-Discharge



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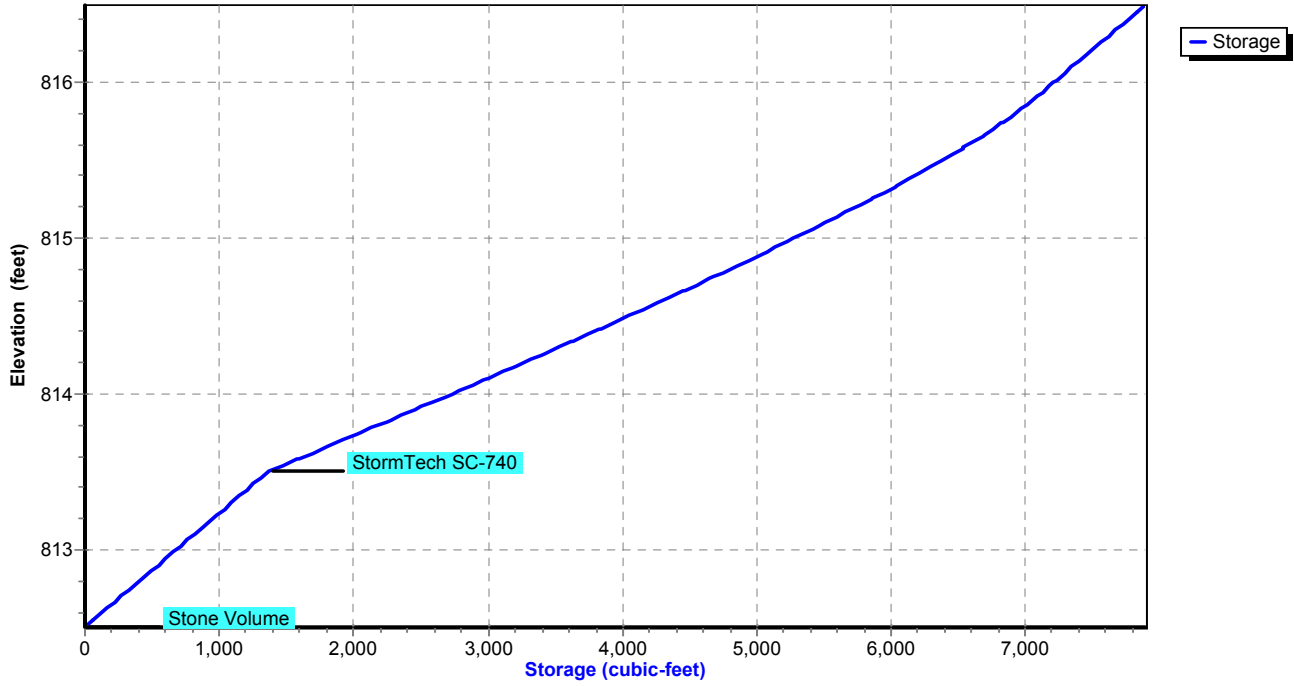
Huff 0-10sm 2Q 12.00 hrs 5yr-12hr Rainfall=2.79"

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Pond 2P: Stormtech

Stage-Area-Storage



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Huff 0-10sm 2Q 12.00 hrs 10yr-12hr Rainfall=3.24"

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Summary for Subcatchment 1S: Existing Conditions

Runoff = 0.23 cfs @ 5.47 hrs, Volume= 0.080 af, Depth= 1.24"

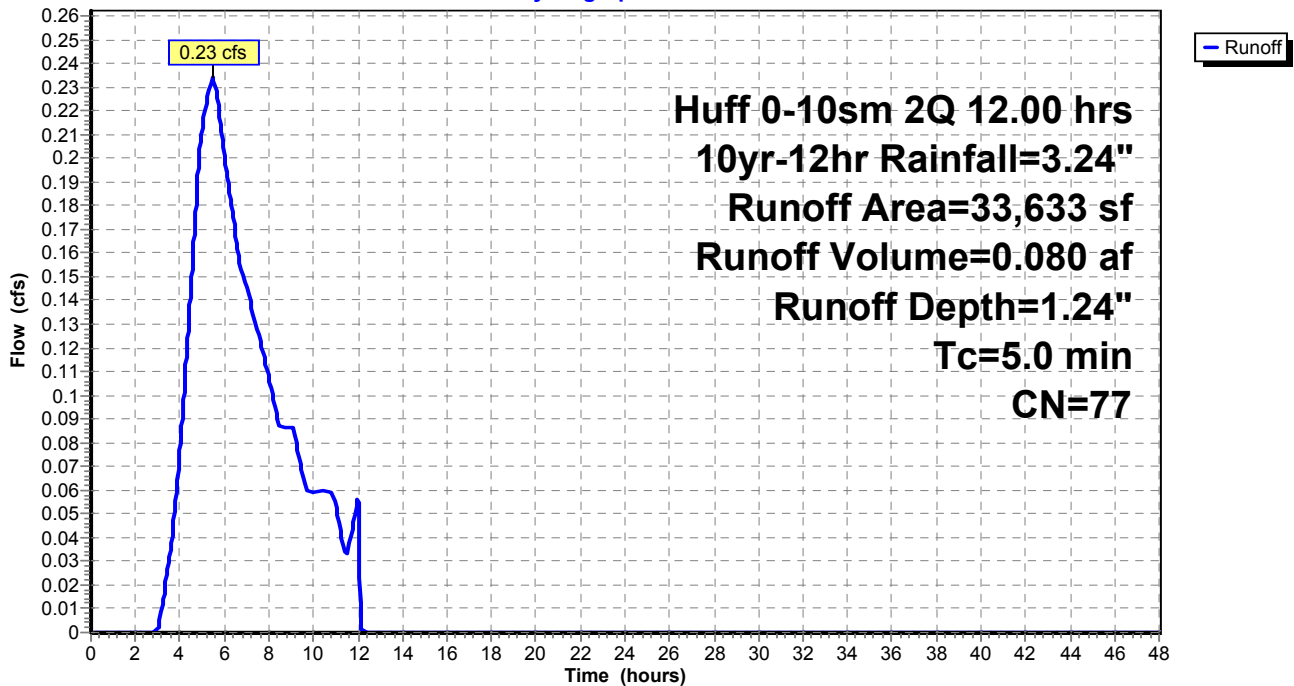
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
Huff 0-10sm 2Q 12.00 hrs 10yr-12hr Rainfall=3.24"

Area (sf)	CN	Description
* 33,633	77	Previous Farm Land
33,633		100.00% Pervious Area

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

Subcatchment 1S: Existing Conditions

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 10yr-12hr Rainfall=3.24"

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Summary for Subcatchment 2S: Proposed - To Detention

Runoff = 0.45 cfs @ 4.90 hrs, Volume= 0.166 af, Depth= 2.68"

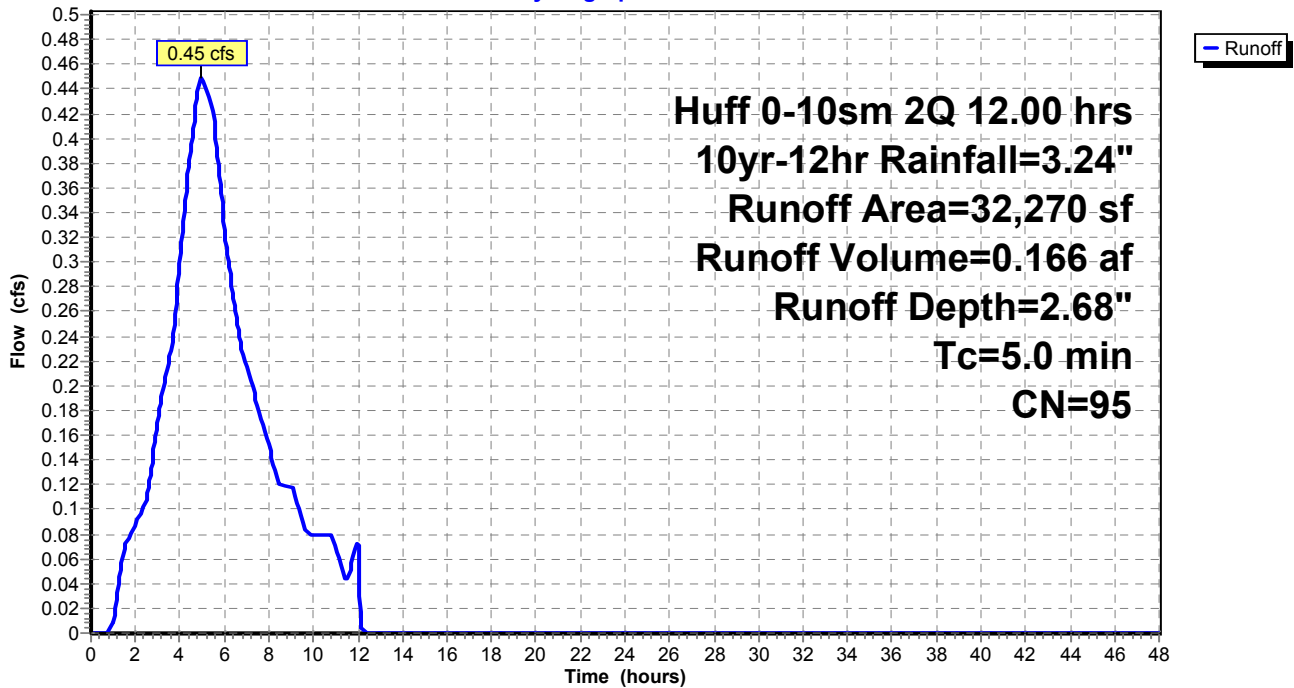
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
 Huff 0-10sm 2Q 12.00 hrs 10yr-12hr Rainfall=3.24"

	Area (sf)	CN	Description
*	4,559	74	HSG C Grass
*	27,711	98	HSG C Impervious
	32,270	95	Weighted Average
	4,559		14.13% Pervious Area
	27,711		85.87% Impervious Area

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

Subcatchment 2S: Proposed - To Detention

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 10yr-12hr Rainfall=3.24"

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Summary for Subcatchment 3S: Proposed - Detention Bypass

Runoff = 0.02 cfs @ 4.89 hrs, Volume= 0.008 af, Depth= 3.01"

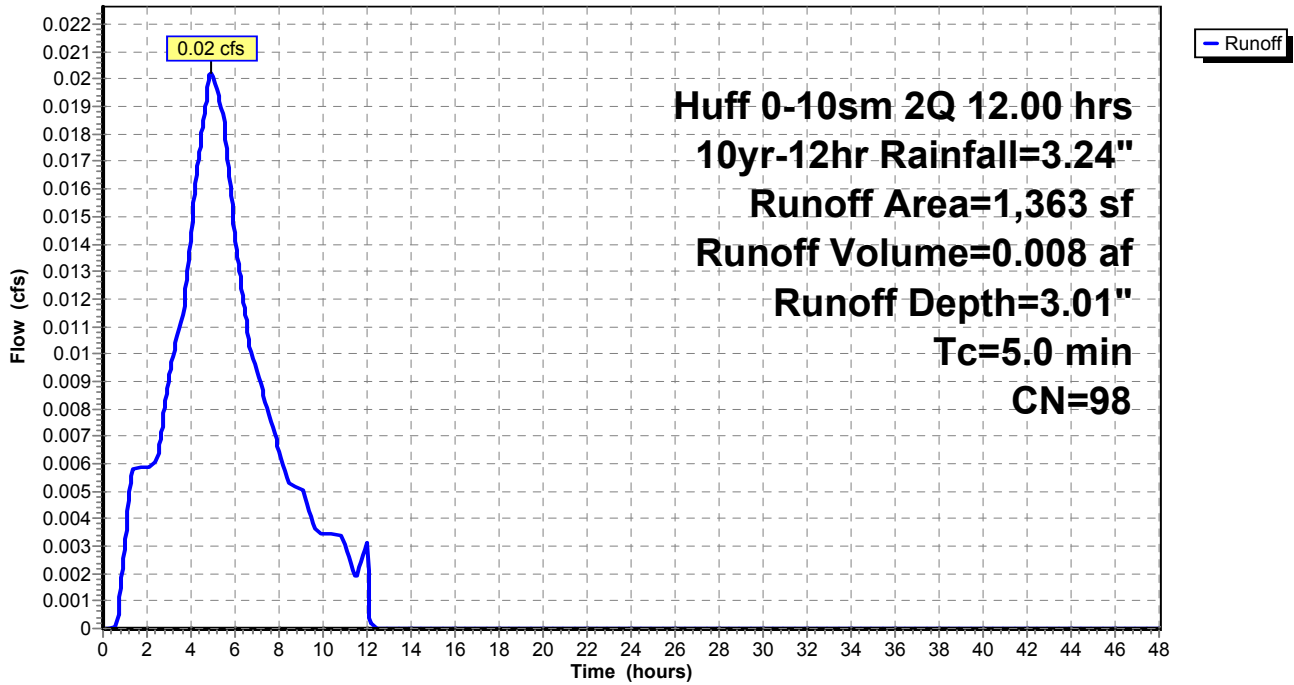
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
 Huff 0-10sm 2Q 12.00 hrs 10yr-12hr Rainfall=3.24"

Area (sf)	CN	Description
* 1,363	98	Dumpster and Adjacent Paved Areas
1,363		100.00% Impervious Area

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

Subcatchment 3S: Proposed - Detention Bypass

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 10yr-12hr Rainfall=3.24"

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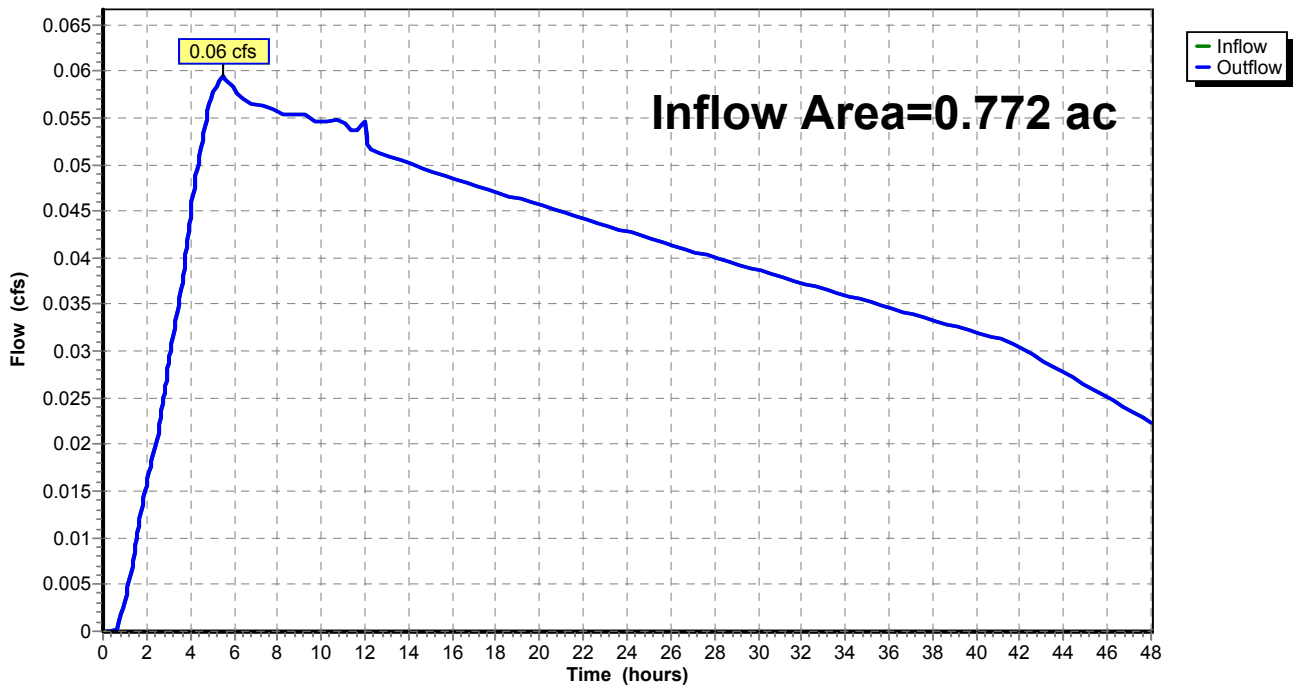
Summary for Reach 4R: Proposed Flow From Site

Inflow Area = 0.772 ac, 86.44% Impervious, Inflow Depth > 2.43" for 10yr-12hr event
Inflow = 0.06 cfs @ 5.49 hrs, Volume= 0.157 af
Outflow = 0.06 cfs @ 5.49 hrs, Volume= 0.157 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 4R: Proposed Flow From Site

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 10yr-12hr Rainfall=3.24"

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Summary for Pond 2P: Stormtech

Inflow Area = 0.741 ac, 85.87% Impervious, Inflow Depth = 2.68" for 10yr-12hr event
 Inflow = 0.45 cfs @ 4.90 hrs, Volume= 0.166 af
 Outflow = 0.05 cfs @ 12.06 hrs, Volume= 0.149 af, Atten= 89%, Lag= 429.2 min
 Primary = 0.05 cfs @ 12.06 hrs, Volume= 0.149 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs / 9
 Peak Elev= 815.19' @ 12.06 hrs Surf.Area= 3,409 sf Storage= 5,704 cf

Plug-Flow detention time= 1,075.1 min calculated for 0.149 af (90% of inflow)
 Center-of-Mass det. time= 1,043.1 min (1,395.1 - 351.9)

Volume	Invert	Avail.Storage	Storage Description
#1	812.50'	3,831 cf	25.25'W x 135.00'L x 4.00'H Stone Volume 13,635 cf Overall - 4,057 cf Embedded = 9,578 cf x 40.0% Voids
#2	813.50'	4,057 cf	StormTech SC-740 x 88 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 5 rows
		7,888 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	812.50'	1.1" Vert. Orifice/Grate C= 0.600
#2	Primary	816.00'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=0.05 cfs @ 12.06 hrs HW=815.19' (Free Discharge)

- 1=Orifice/Grate (Orifice Controls 0.05 cfs @ 7.82 fps)
- 2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

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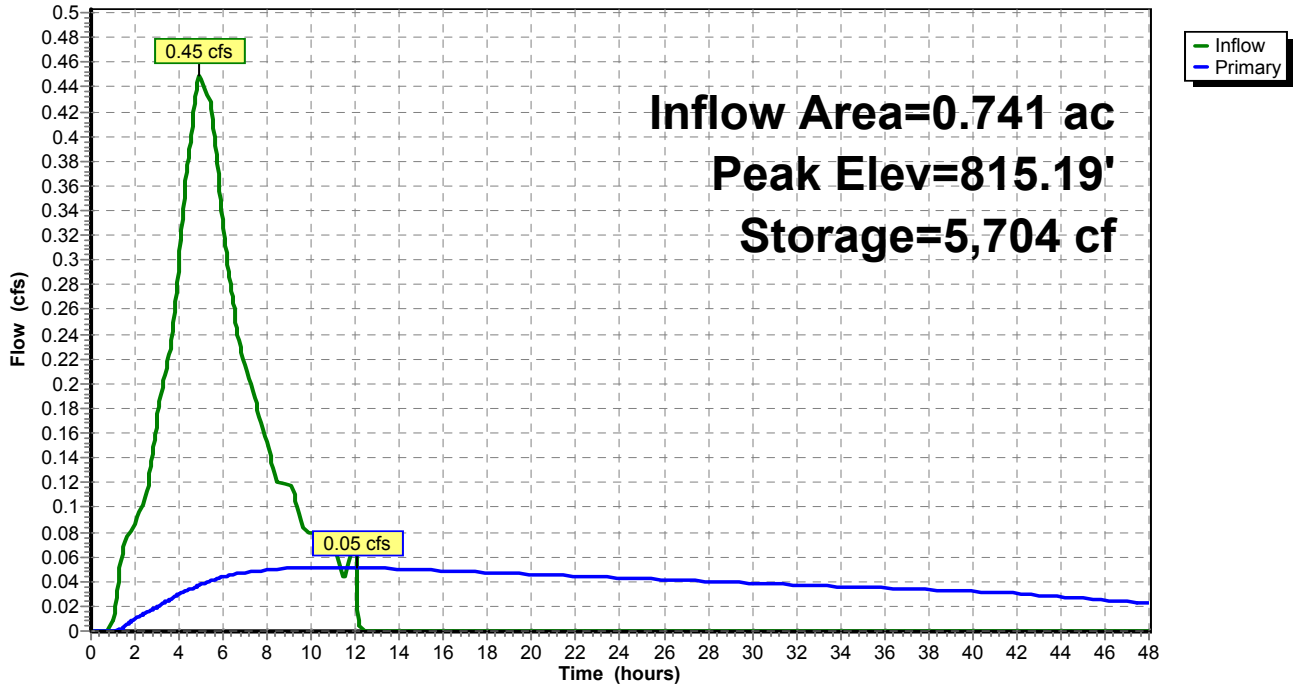
Huff 0-10sm 2Q 12.00 hrs 10yr-12hr Rainfall=3.24"

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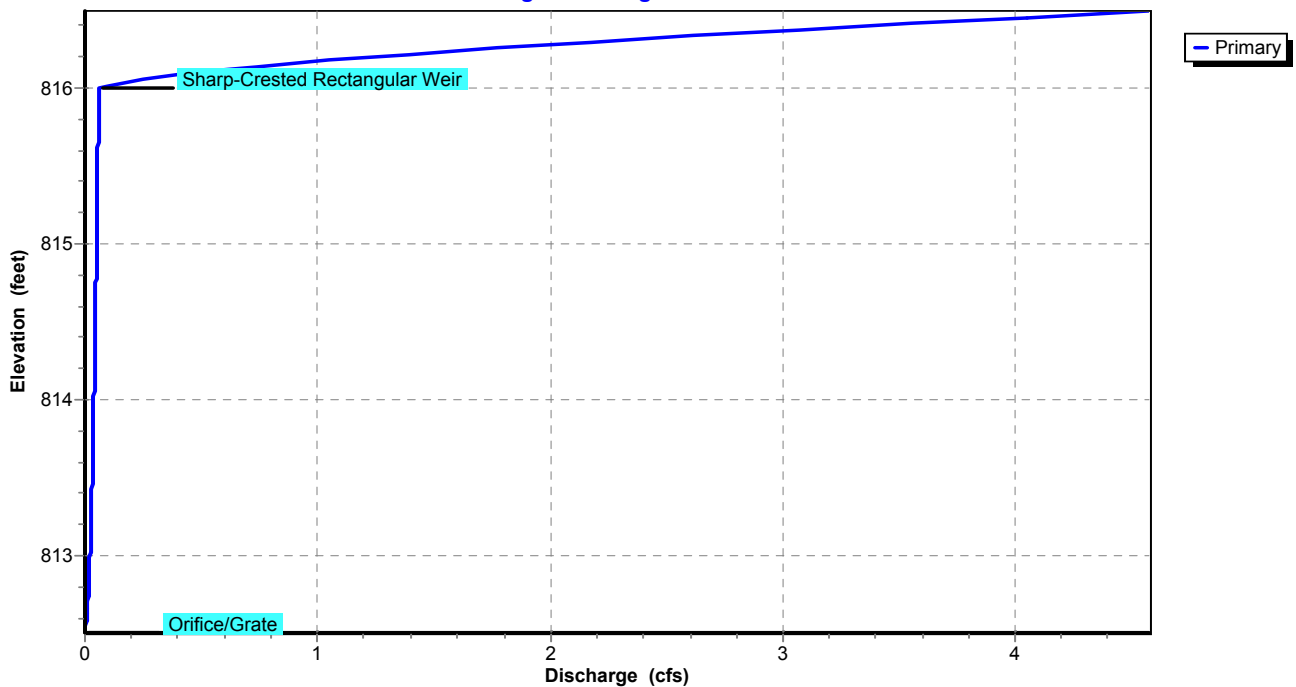
Pond 2P: Stormtech

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Pond 2P: Stormtech

Stage-Discharge



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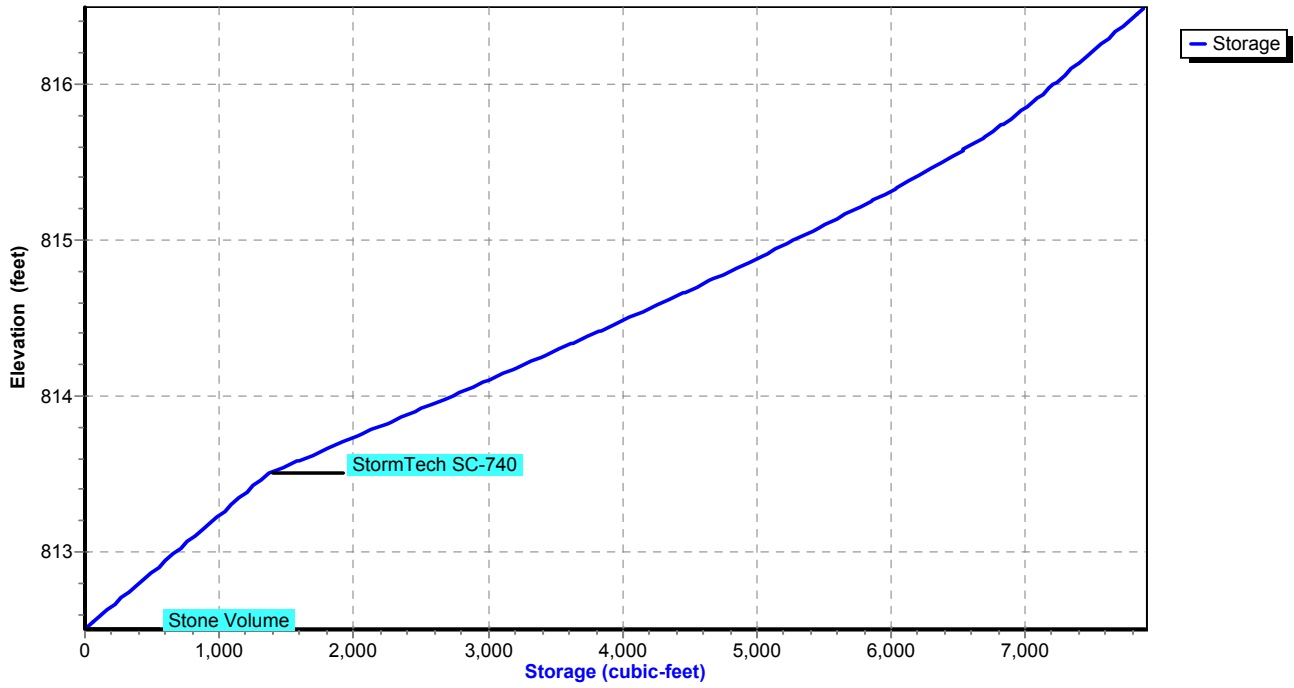
Huff 0-10sm 2Q 12.00 hrs 10yr-12hr Rainfall=3.24"

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Pond 2P: Stormtech

Stage-Area-Storage



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Huff 0-10sm 2Q 12.00 hrs 25yr-12hr Rainfall=3.88"

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Summary for Subcatchment 1S: Existing Conditions

Runoff = 0.32 cfs @ 5.45 hrs, Volume= 0.111 af, Depth= 1.72"

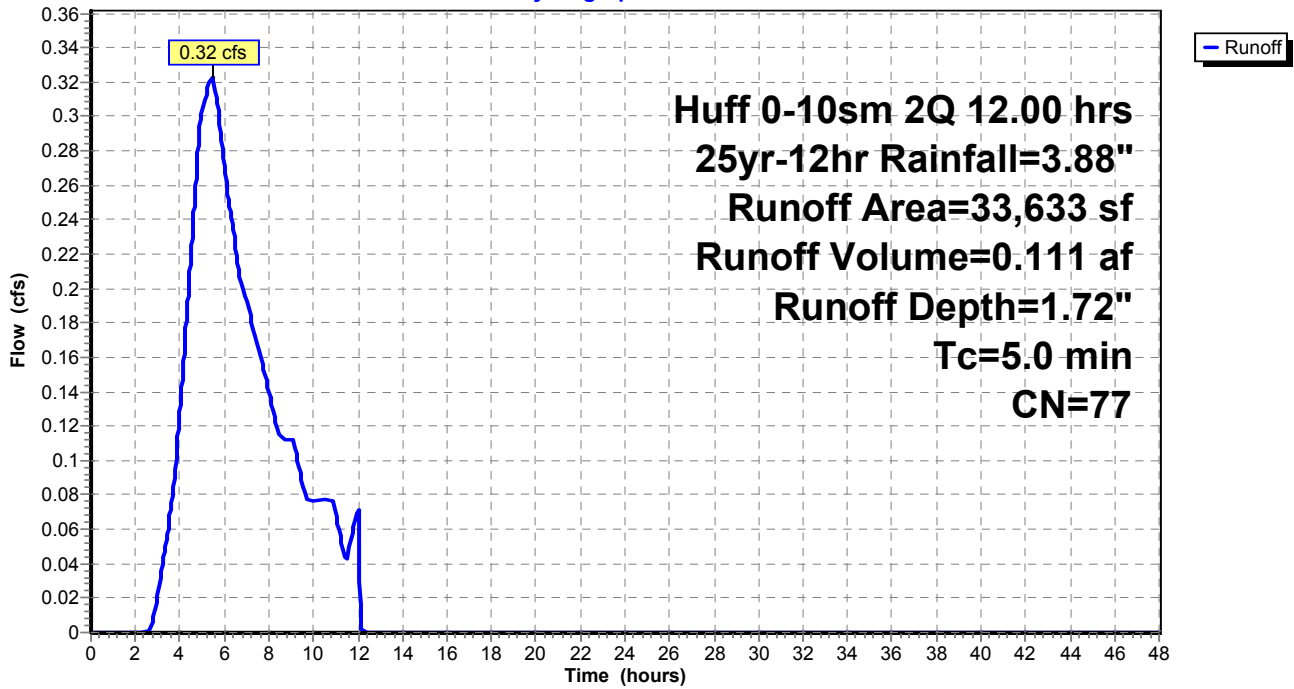
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
 Huff 0-10sm 2Q 12.00 hrs 25yr-12hr Rainfall=3.88"

Area (sf)	CN	Description
* 33,633	77	Previous Farm Land
33,633		100.00% Pervious Area

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

Subcatchment 1S: Existing Conditions

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 25yr-12hr Rainfall=3.88"

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Summary for Subcatchment 2S: Proposed - To Detention

Runoff = 0.55 cfs @ 4.90 hrs, Volume= 0.205 af, Depth= 3.31"

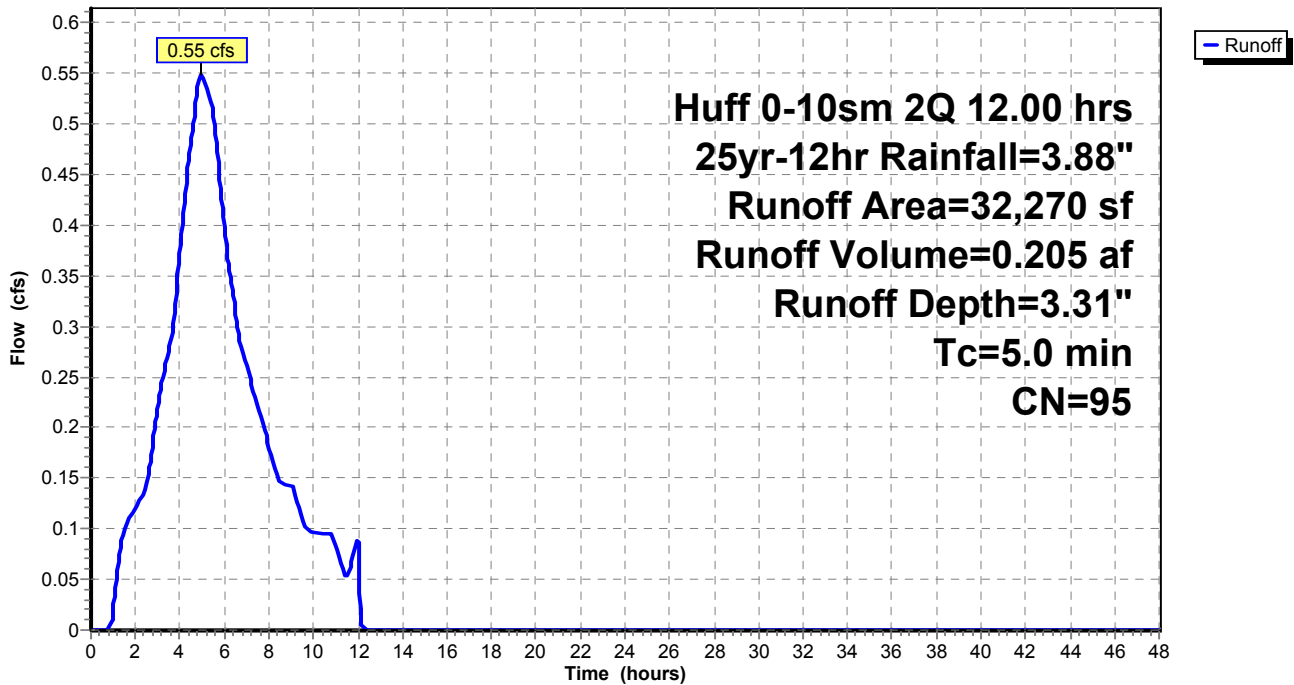
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
 Huff 0-10sm 2Q 12.00 hrs 25yr-12hr Rainfall=3.88"

	Area (sf)	CN	Description
*	4,559	74	HSG C Grass
*	27,711	98	HSG C Impervious
	32,270	95	Weighted Average
	4,559		14.13% Pervious Area
	27,711		85.87% Impervious Area

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

Subcatchment 2S: Proposed - To Detention

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 25yr-12hr Rainfall=3.88"

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Summary for Subcatchment 3S: Proposed - Detention Bypass

Runoff = 0.02 cfs @ 4.89 hrs, Volume= 0.010 af, Depth= 3.65"

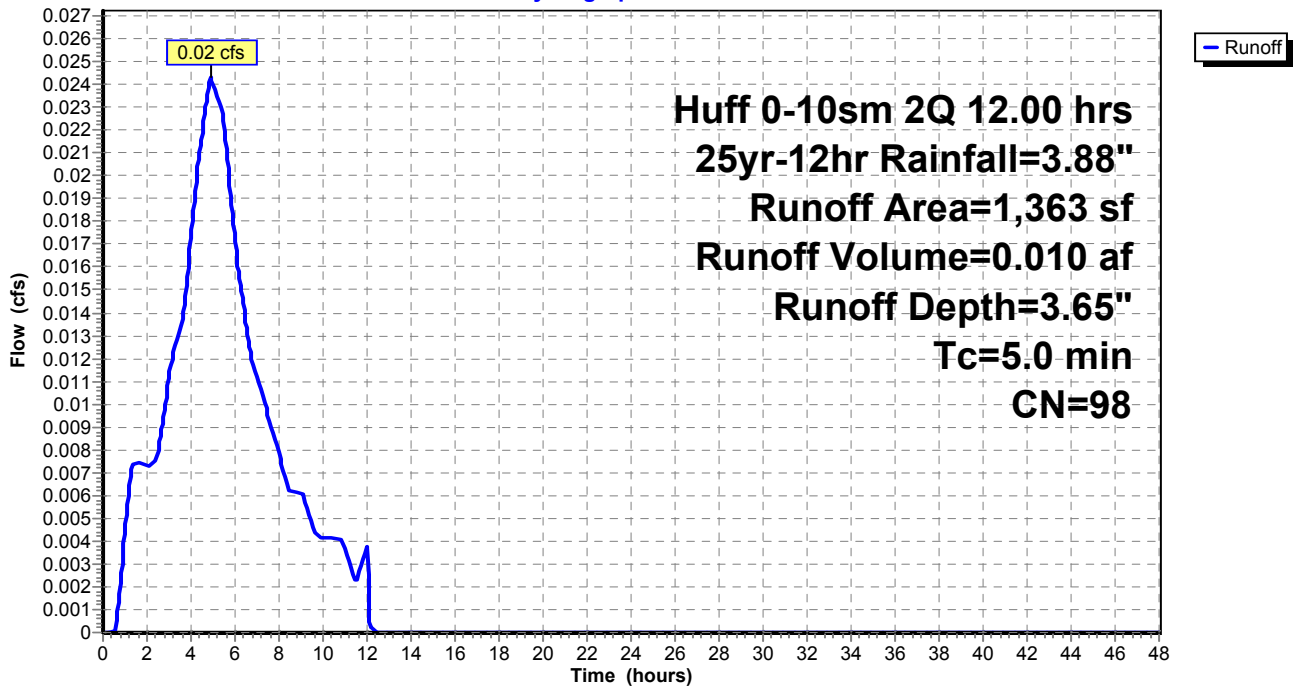
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
 Huff 0-10sm 2Q 12.00 hrs 25yr-12hr Rainfall=3.88"

Area (sf)	CN	Description
* 1,363	98	Dumpster and Adjacent Paved Areas
1,363		100.00% Impervious Area

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

Subcatchment 3S: Proposed - Detention Bypass

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 25yr-12hr Rainfall=3.88"

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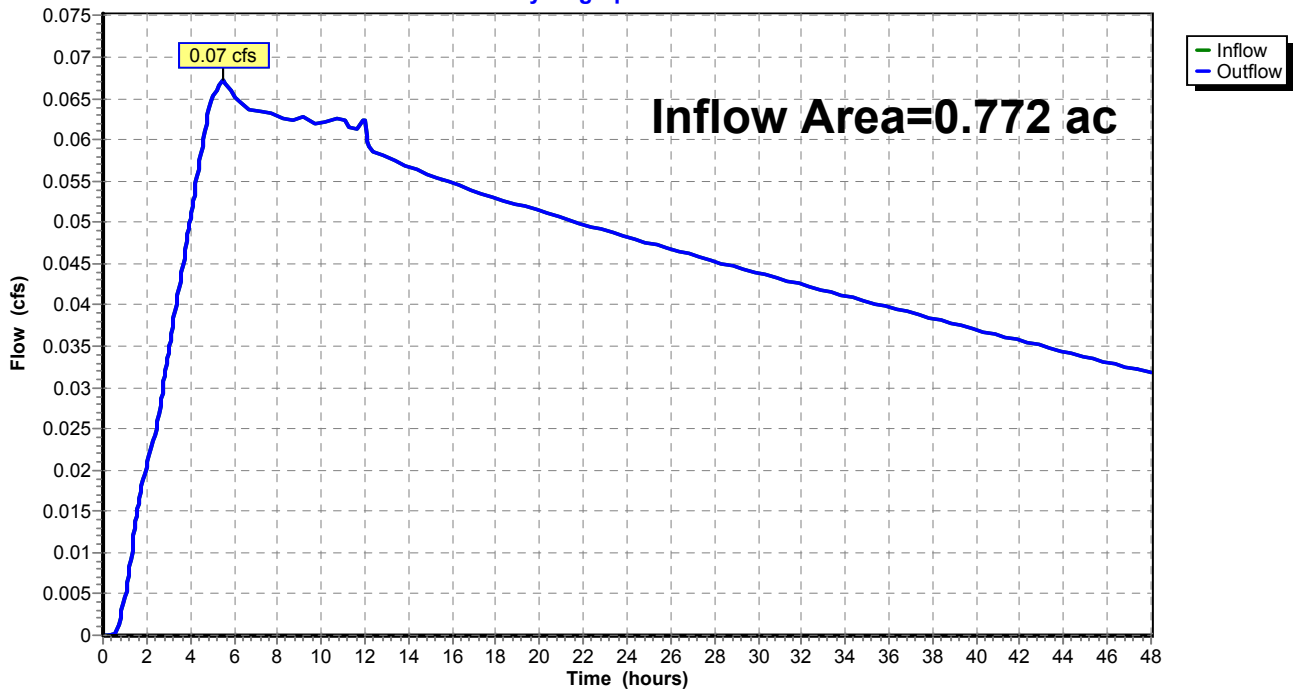
Summary for Reach 4R: Proposed Flow From Site

Inflow Area = 0.772 ac, 86.44% Impervious, Inflow Depth > 2.80" for 25yr-12hr event
Inflow = 0.07 cfs @ 5.48 hrs, Volume= 0.180 af
Outflow = 0.07 cfs @ 5.48 hrs, Volume= 0.180 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 4R: Proposed Flow From Site

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 25yr-12hr Rainfall=3.88"

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Summary for Pond 2P: Stormtech

Inflow Area = 0.741 ac, 85.87% Impervious, Inflow Depth = 3.31" for 25yr-12hr event
 Inflow = 0.55 cfs @ 4.90 hrs, Volume= 0.205 af
 Outflow = 0.06 cfs @ 12.06 hrs, Volume= 0.171 af, Atten= 89%, Lag= 429.6 min
 Primary = 0.06 cfs @ 12.06 hrs, Volume= 0.171 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs / 9
 Peak Elev= 815.99' @ 12.06 hrs Surf.Area= 3,409 sf Storage= 7,197 cf

Plug-Flow detention time= 1,112.3 min calculated for 0.170 af (83% of inflow)
 Center-of-Mass det. time= 1,064.9 min (1,412.8 - 347.9)

Volume	Invert	Avail.Storage	Storage Description
#1	812.50'	3,831 cf	25.25'W x 135.00'L x 4.00'H Stone Volume 13,635 cf Overall - 4,057 cf Embedded = 9,578 cf x 40.0% Voids
#2	813.50'	4,057 cf	StormTech SC-740 x 88 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 5 rows
		7,888 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	812.50'	1.1" Vert. Orifice/Grate C= 0.600
#2	Primary	816.00'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=0.06 cfs @ 12.06 hrs HW=815.99' (Free Discharge)

- 1=Orifice/Grate (Orifice Controls 0.06 cfs @ 8.94 fps)
- 2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

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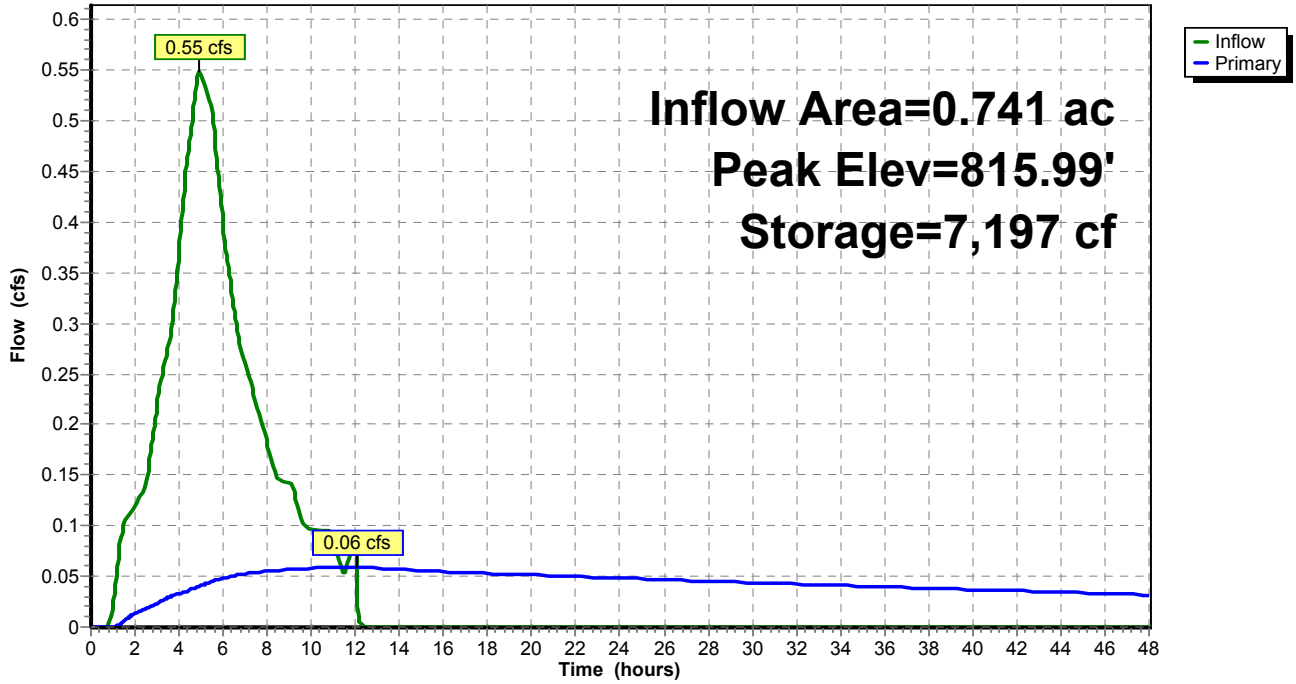
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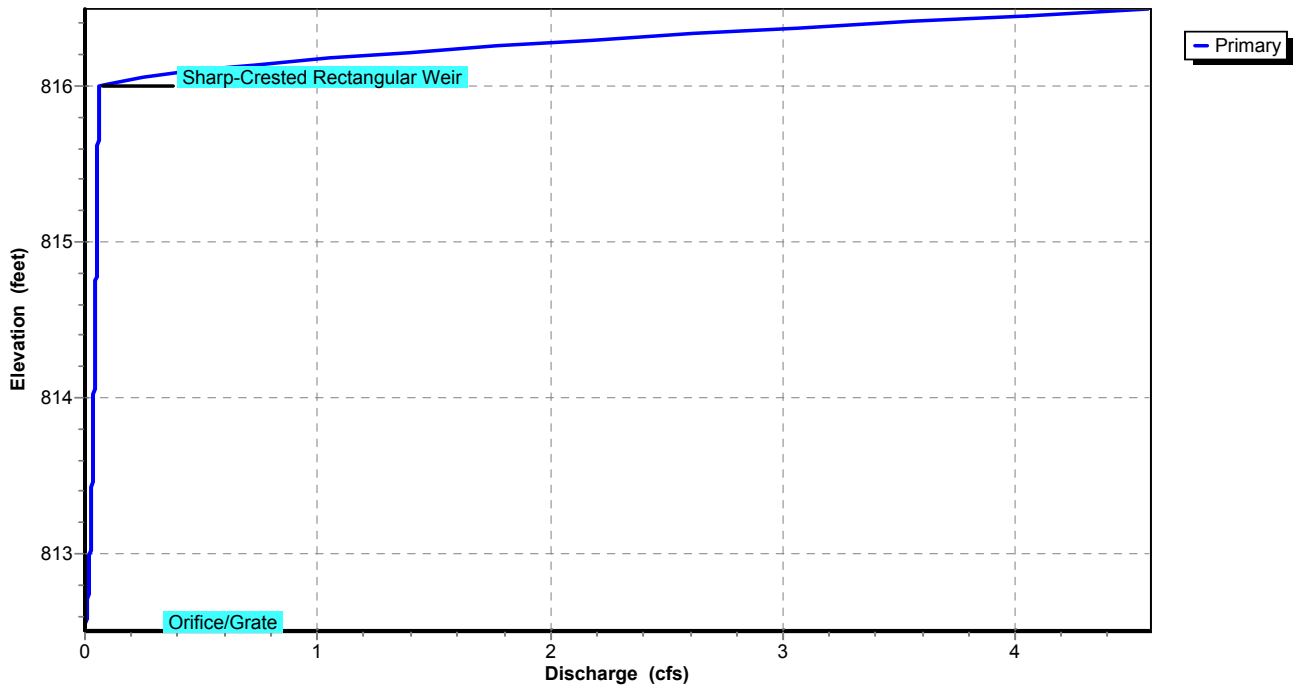
Pond 2P: Stormtech

Hydrograph



Pond 2P: Stormtech

Stage-Discharge



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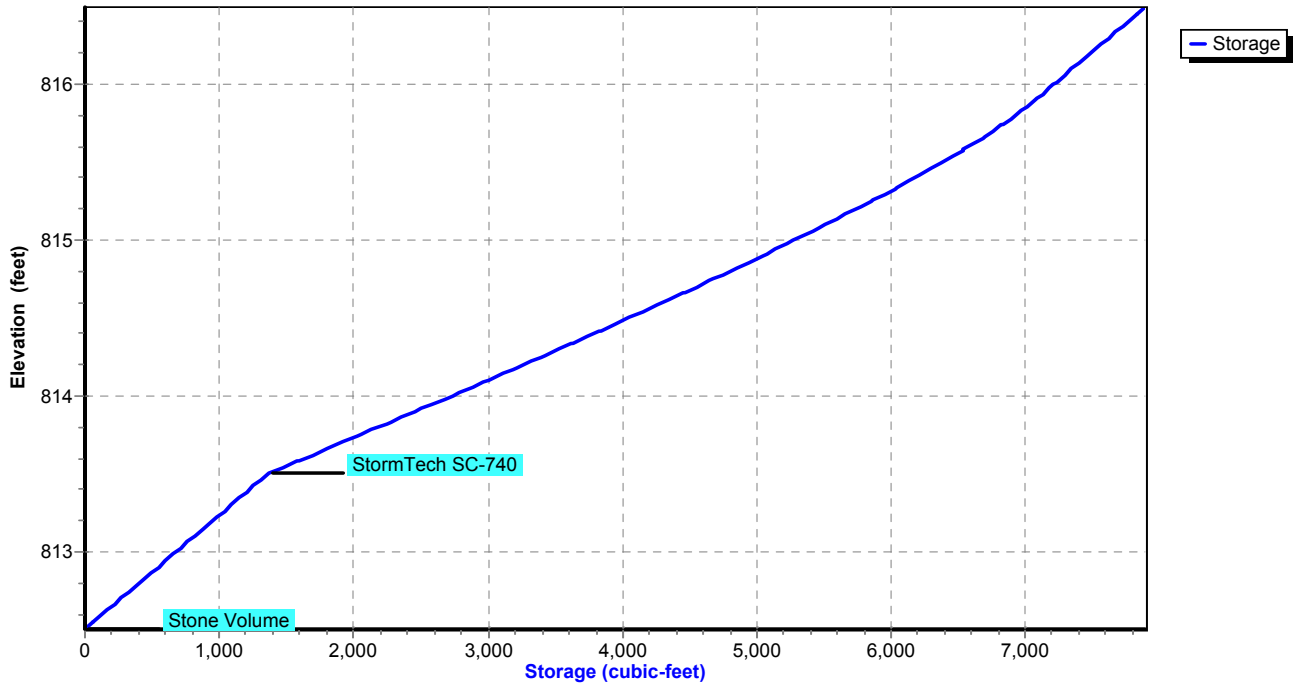
Huff 0-10sm 2Q 12.00 hrs 25yr-12hr Rainfall=3.88"

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Pond 2P: Stormtech

Stage-Area-Storage



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Huff 0-10sm 2Q 12.00 hrs 50yr-12hr Rainfall=4.42"

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Summary for Subcatchment 1S: Existing Conditions

Runoff = 0.40 cfs @ 5.44 hrs, Volume= 0.138 af, Depth= 2.15"

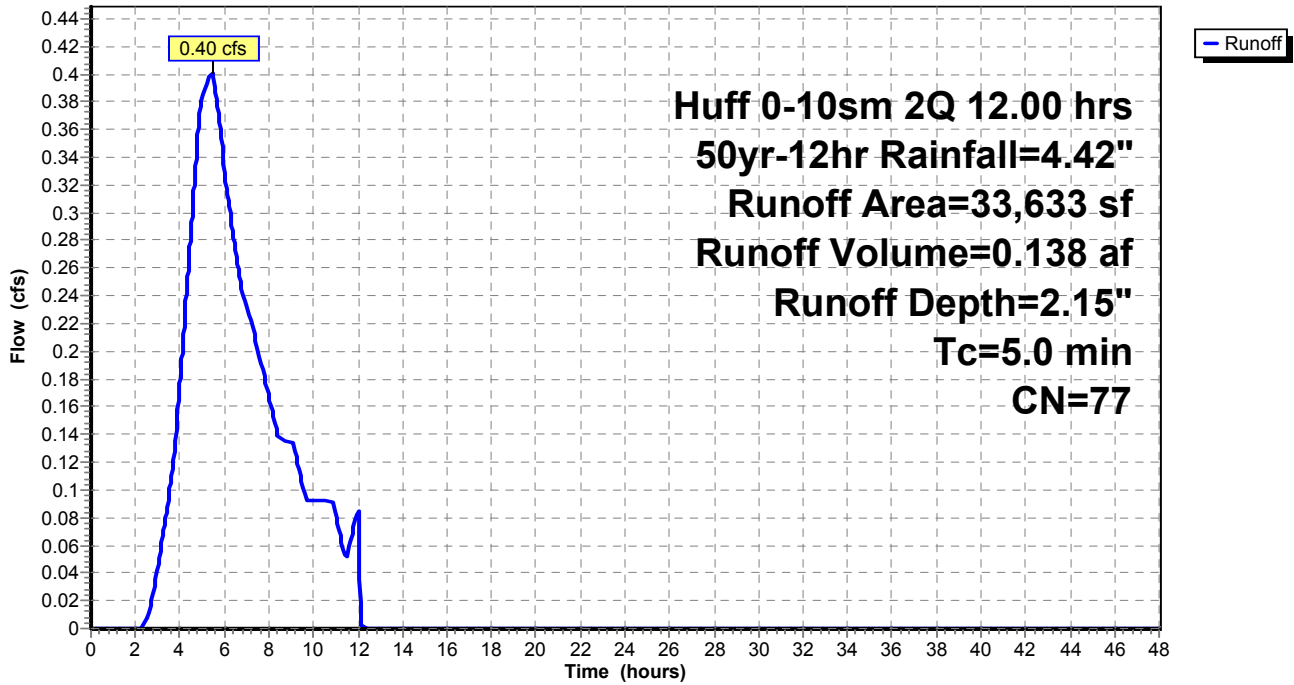
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
 Huff 0-10sm 2Q 12.00 hrs 50yr-12hr Rainfall=4.42"

Area (sf)	CN	Description
* 33,633	77	Previous Farm Land
33,633		100.00% Pervious Area

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

Subcatchment 1S: Existing Conditions

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 50yr-12hr Rainfall=4.42"

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Summary for Subcatchment 2S: Proposed - To Detention

Runoff = 0.63 cfs @ 4.90 hrs, Volume= 0.237 af, Depth= 3.85"

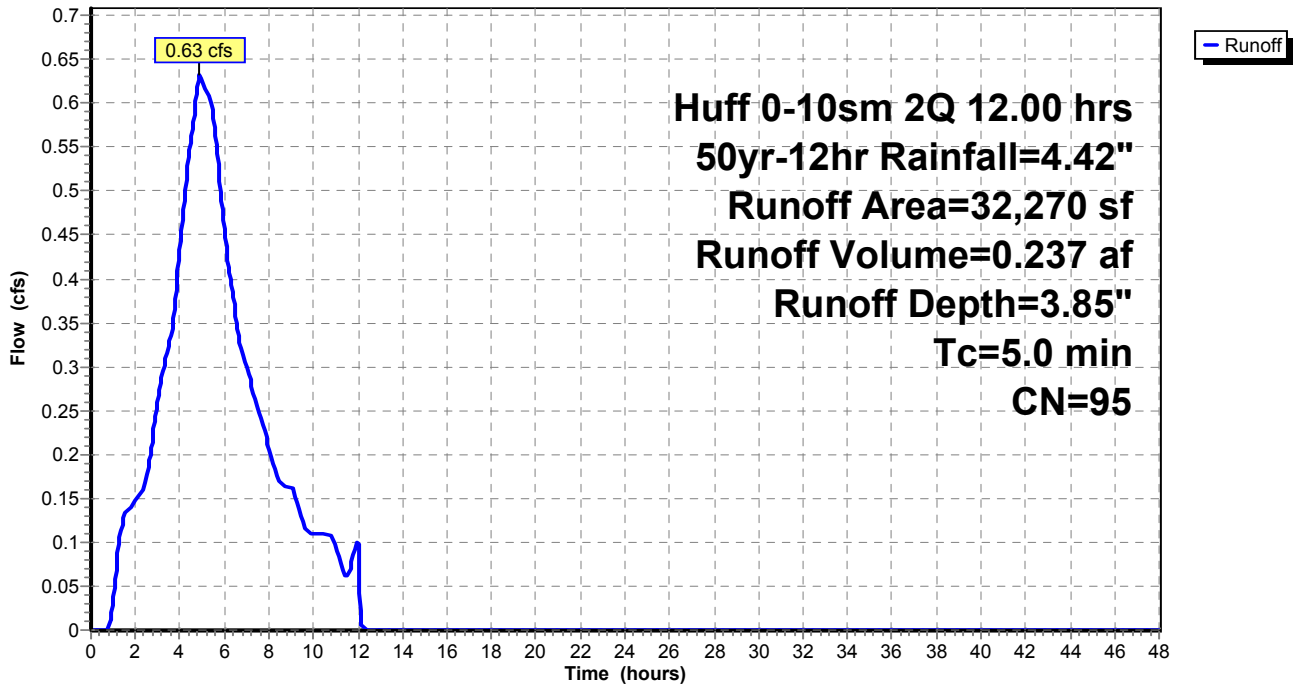
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
 Huff 0-10sm 2Q 12.00 hrs 50yr-12hr Rainfall=4.42"

	Area (sf)	CN	Description
*	4,559	74	HSG C Grass
*	27,711	98	HSG C Impervious
	32,270	95	Weighted Average
	4,559		14.13% Pervious Area
	27,711		85.87% Impervious Area

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

Subcatchment 2S: Proposed - To Detention

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 50yr-12hr Rainfall=4.42"

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Summary for Subcatchment 3S: Proposed - Detention Bypass

Runoff = 0.03 cfs @ 4.89 hrs, Volume= 0.011 af, Depth= 4.18"

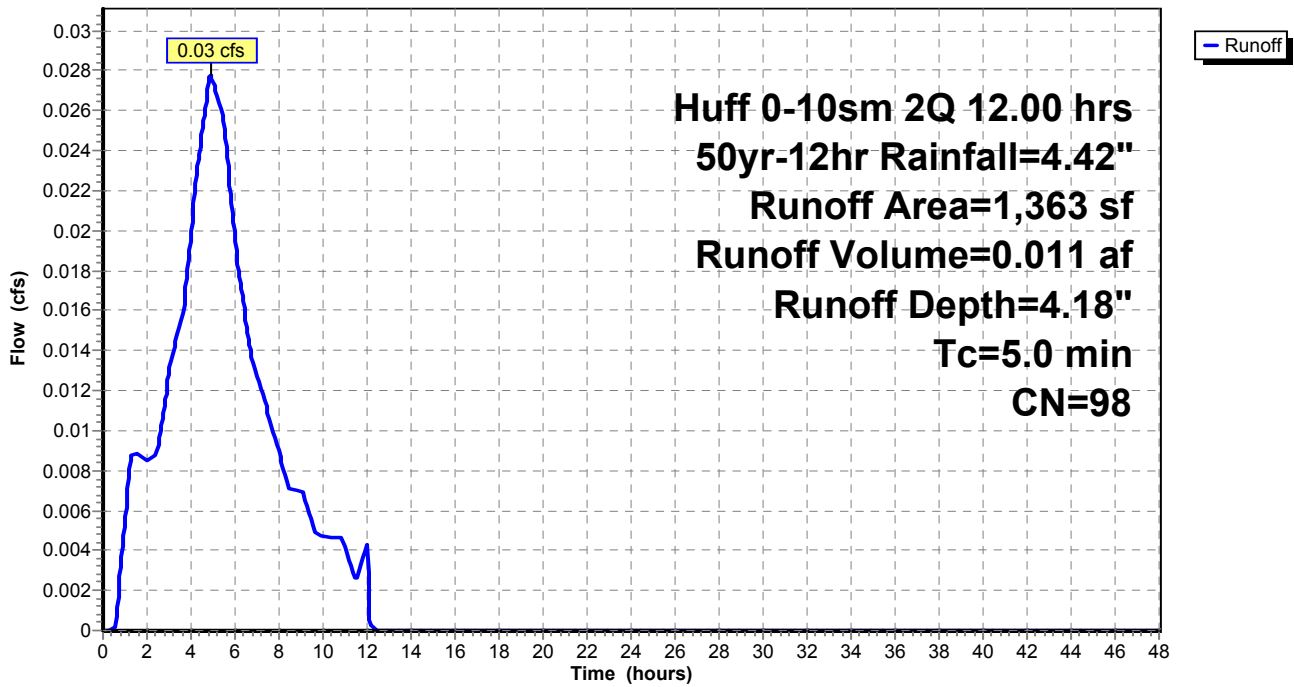
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
 Huff 0-10sm 2Q 12.00 hrs 50yr-12hr Rainfall=4.42"

Area (sf)	CN	Description
* 1,363	98	Dumpster and Adjacent Paved Areas
1,363		100.00% Impervious Area

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

Subcatchment 3S: Proposed - Detention Bypass

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 50yr-12hr Rainfall=4.42"

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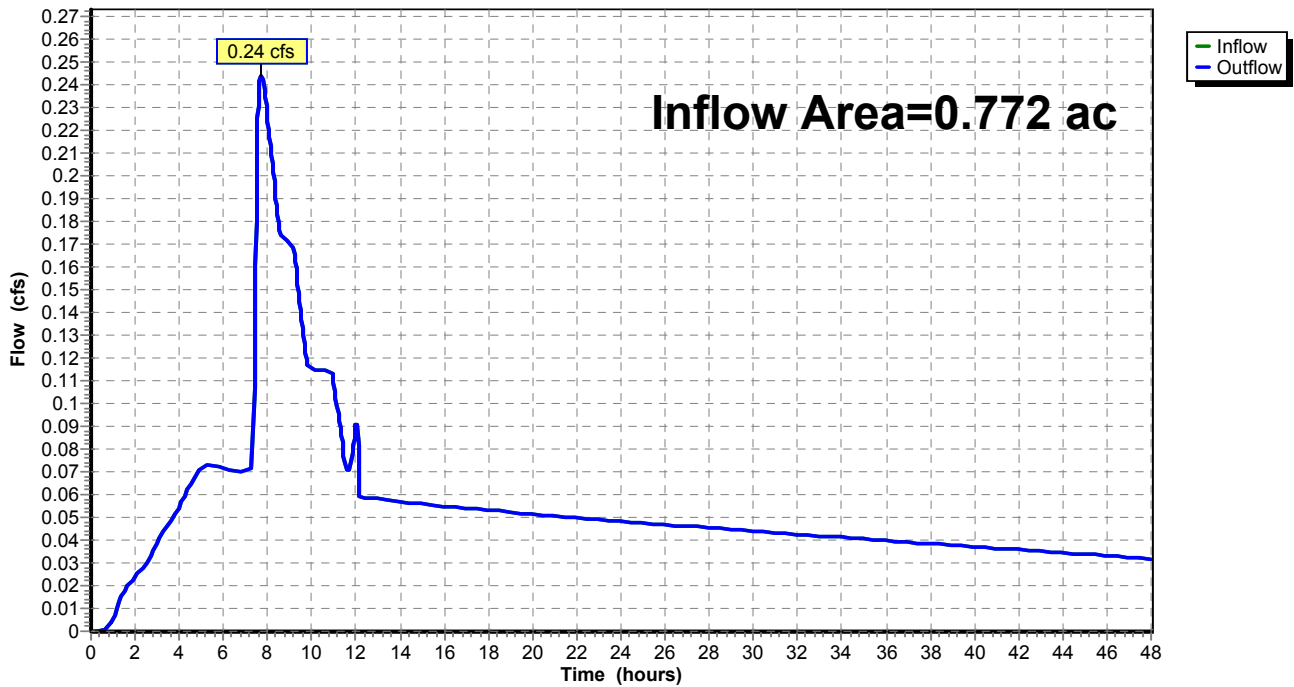
Summary for Reach 4R: Proposed Flow From Site

Inflow Area = 0.772 ac, 86.44% Impervious, Inflow Depth > 3.33" for 50yr-12hr event
Inflow = 0.24 cfs @ 7.71 hrs, Volume= 0.214 af
Outflow = 0.24 cfs @ 7.71 hrs, Volume= 0.214 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 4R: Proposed Flow From Site

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 50yr-12hr Rainfall=4.42"

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Summary for Pond 2P: Stormtech

Inflow Area = 0.741 ac, 85.87% Impervious, Inflow Depth = 3.85" for 50yr-12hr event
 Inflow = 0.63 cfs @ 4.90 hrs, Volume= 0.237 af
 Outflow = 0.23 cfs @ 7.71 hrs, Volume= 0.203 af, Atten= 63%, Lag= 168.9 min
 Primary = 0.23 cfs @ 7.71 hrs, Volume= 0.203 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs / 9
 Peak Elev= 816.06' @ 7.71 hrs Surf.Area= 3,409 sf Storage= 7,282 cf

Plug-Flow detention time= 970.0 min calculated for 0.203 af (86% of inflow)
 Center-of-Mass det. time= 926.9 min (1,272.2 - 345.3)

Volume	Invert	Avail.Storage	Storage Description
#1	812.50'	3,831 cf	25.25'W x 135.00'L x 4.00'H Stone Volume 13,635 cf Overall - 4,057 cf Embedded = 9,578 cf x 40.0% Voids
#2	813.50'	4,057 cf	StormTech SC-740 x 88 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 5 rows
		7,888 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	812.50'	1.1" Vert. Orifice/Grate C= 0.600
#2	Primary	816.00'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=0.23 cfs @ 7.71 hrs HW=816.06' (Free Discharge)

1=Orifice/Grate (Orifice Controls 0.06 cfs @ 9.02 fps)

2=Sharp-Crested Rectangular Weir (Weir Controls 0.17 cfs @ 0.77 fps)

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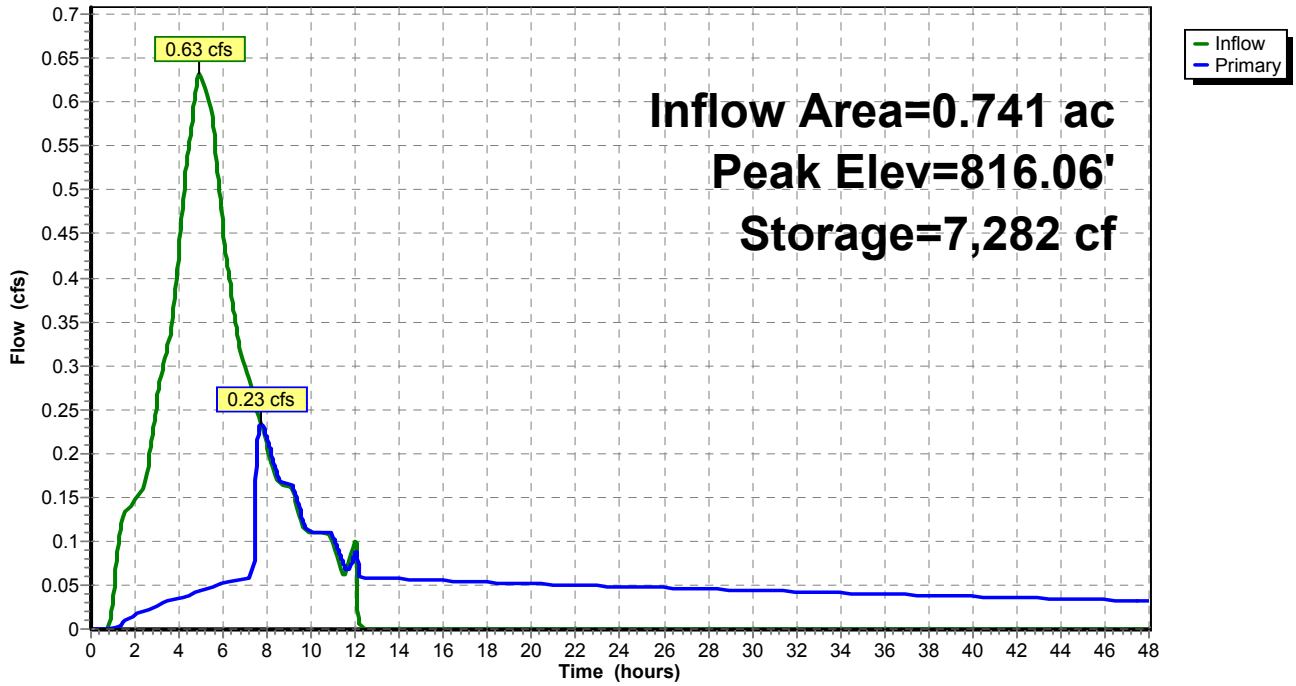
Huff 0-10sm 2Q 12.00 hrs 50yr-12hr Rainfall=4.42"

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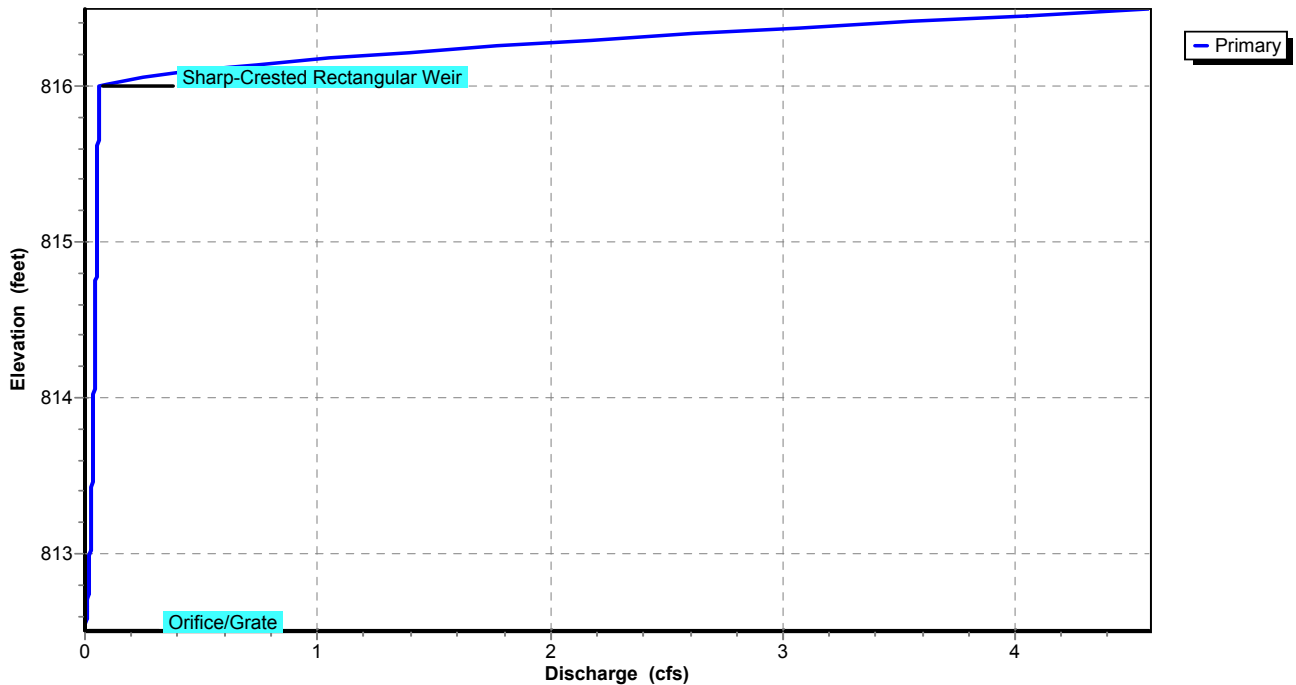
Pond 2P: Stormtech

Hydrograph



Pond 2P: Stormtech

Stage-Discharge



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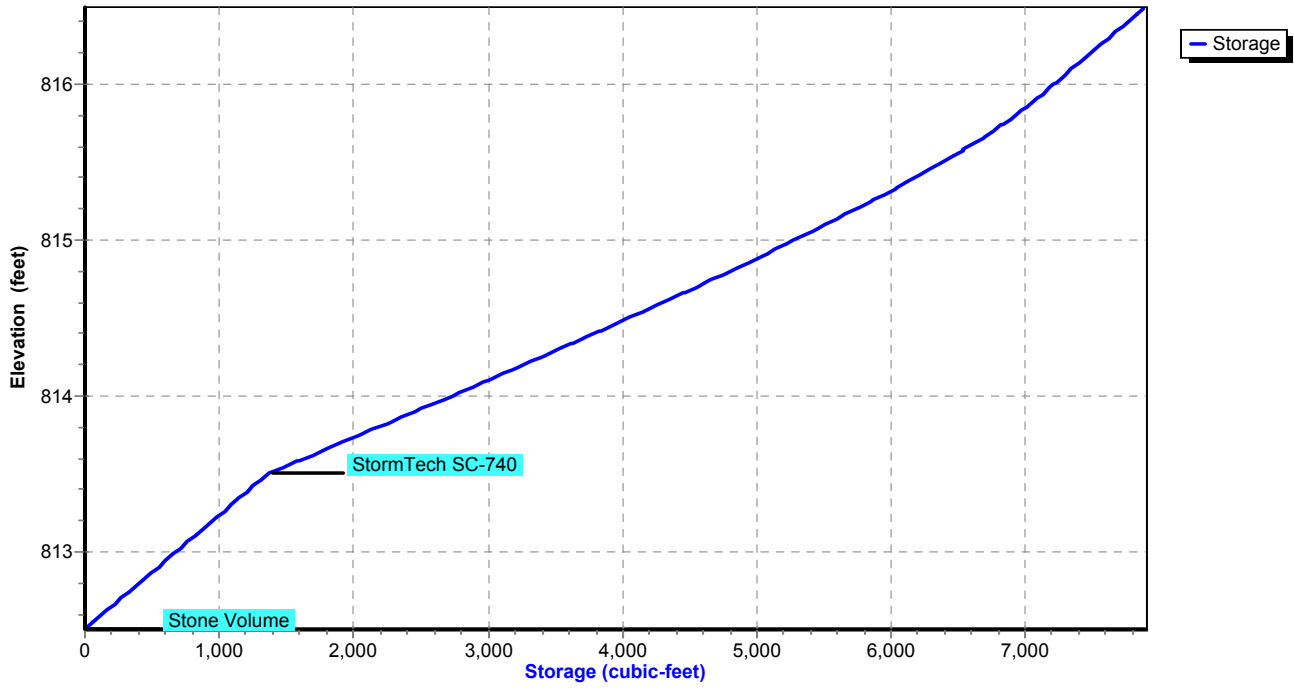
Huff 0-10sm 2Q 12.00 hrs 50yr-12hr Rainfall=4.42"

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Pond 2P: Stormtech

Stage-Area-Storage



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Huff 0-10sm 2Q 12.00 hrs 100yr-12hr Rainfall=5.00"

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Summary for Subcatchment 1S: Existing Conditions

Runoff = 0.49 cfs @ 5.43 hrs, Volume= 0.169 af, Depth= 2.62"

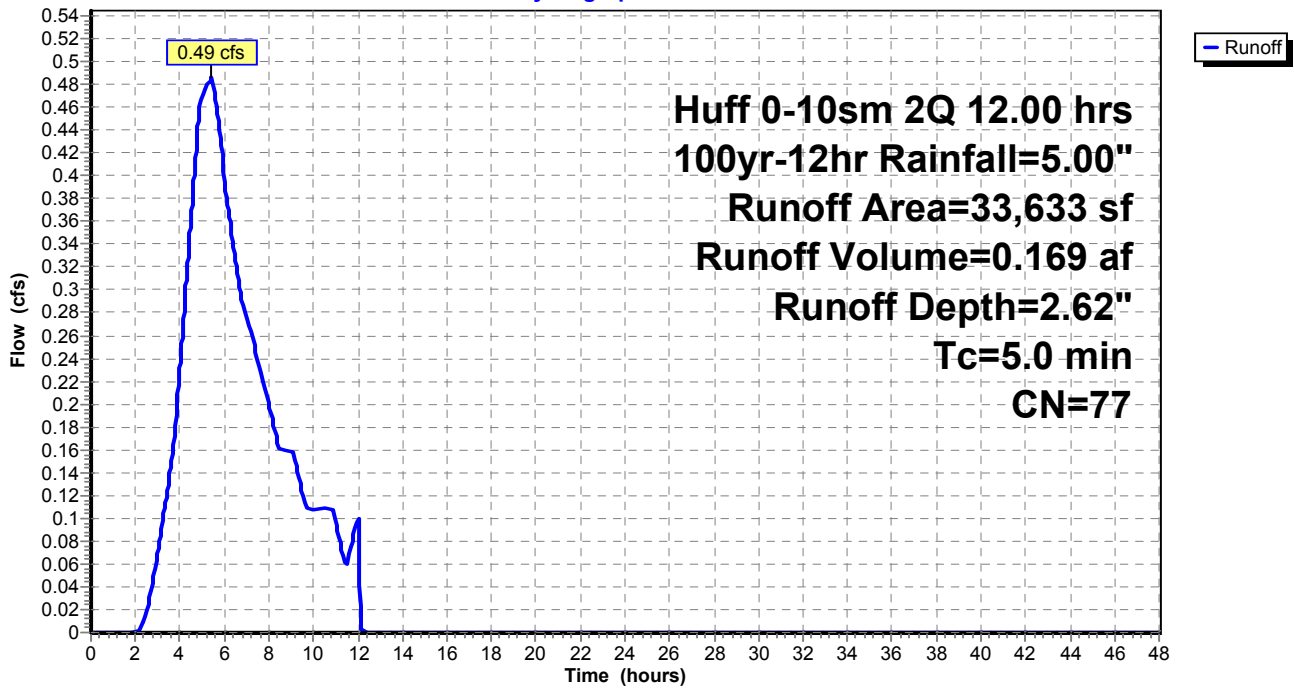
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
 Huff 0-10sm 2Q 12.00 hrs 100yr-12hr Rainfall=5.00"

Area (sf)	CN	Description
* 33,633	77	Previous Farm Land
33,633		100.00% Pervious Area

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

Subcatchment 1S: Existing Conditions

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 100yr-12hr Rainfall=5.00"

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Summary for Subcatchment 2S: Proposed - To Detention

Runoff = 0.72 cfs @ 4.90 hrs, Volume= 0.273 af, Depth= 4.42"

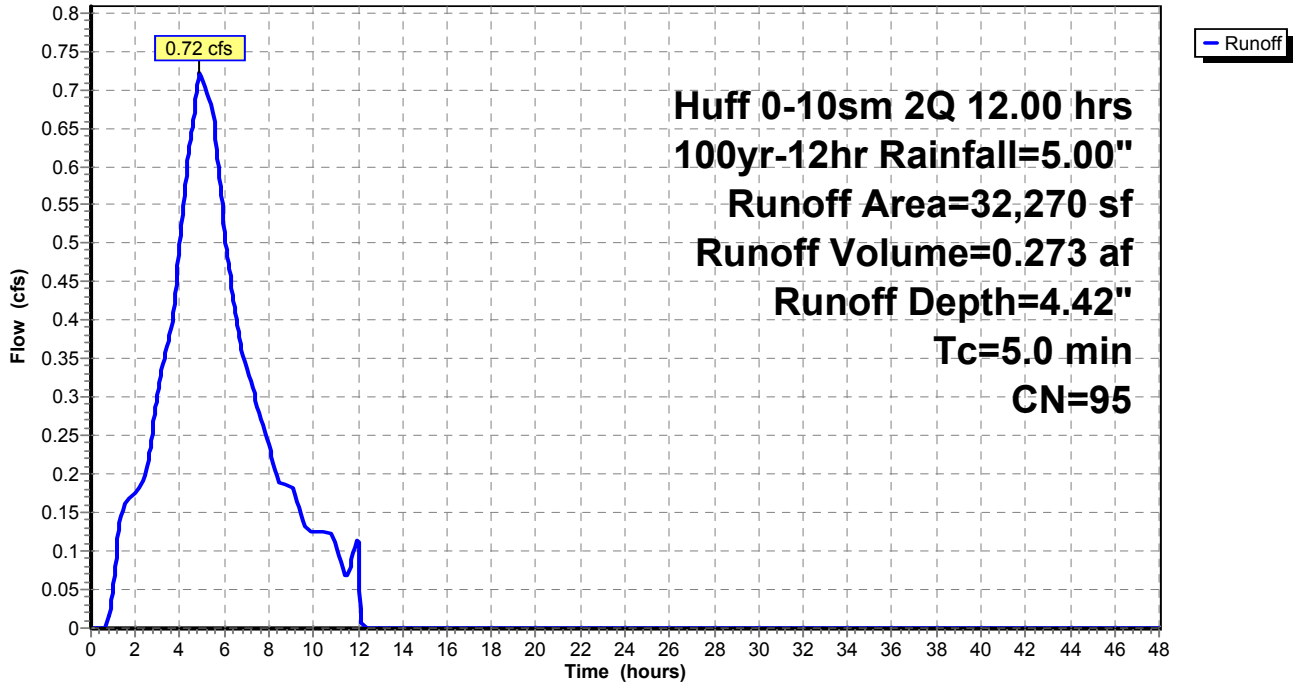
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
 Huff 0-10sm 2Q 12.00 hrs 100yr-12hr Rainfall=5.00"

	Area (sf)	CN	Description
*	4,559	74	HSG C Grass
*	27,711	98	HSG C Impervious
	32,270	95	Weighted Average
	4,559		14.13% Pervious Area
	27,711		85.87% Impervious Area

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

Subcatchment 2S: Proposed - To Detention

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 100yr-12hr Rainfall=5.00"

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Summary for Subcatchment 3S: Proposed - Detention Bypass

Runoff = 0.03 cfs @ 4.89 hrs, Volume= 0.012 af, Depth= 4.76"

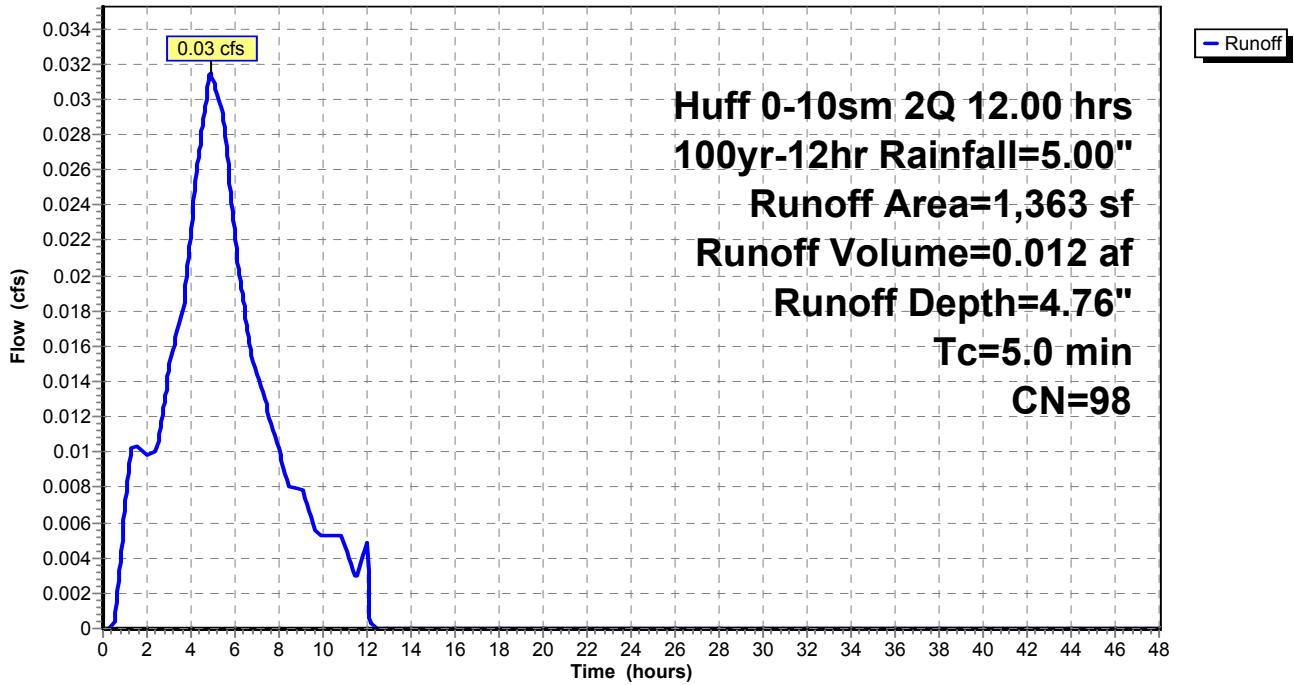
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
 Huff 0-10sm 2Q 12.00 hrs 100yr-12hr Rainfall=5.00"

Area (sf)	CN	Description
* 1,363	98	Dumpster and Adjacent Paved Areas
1,363		100.00% Impervious Area

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

Subcatchment 3S: Proposed - Detention Bypass

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 100yr-12hr Rainfall=5.00"

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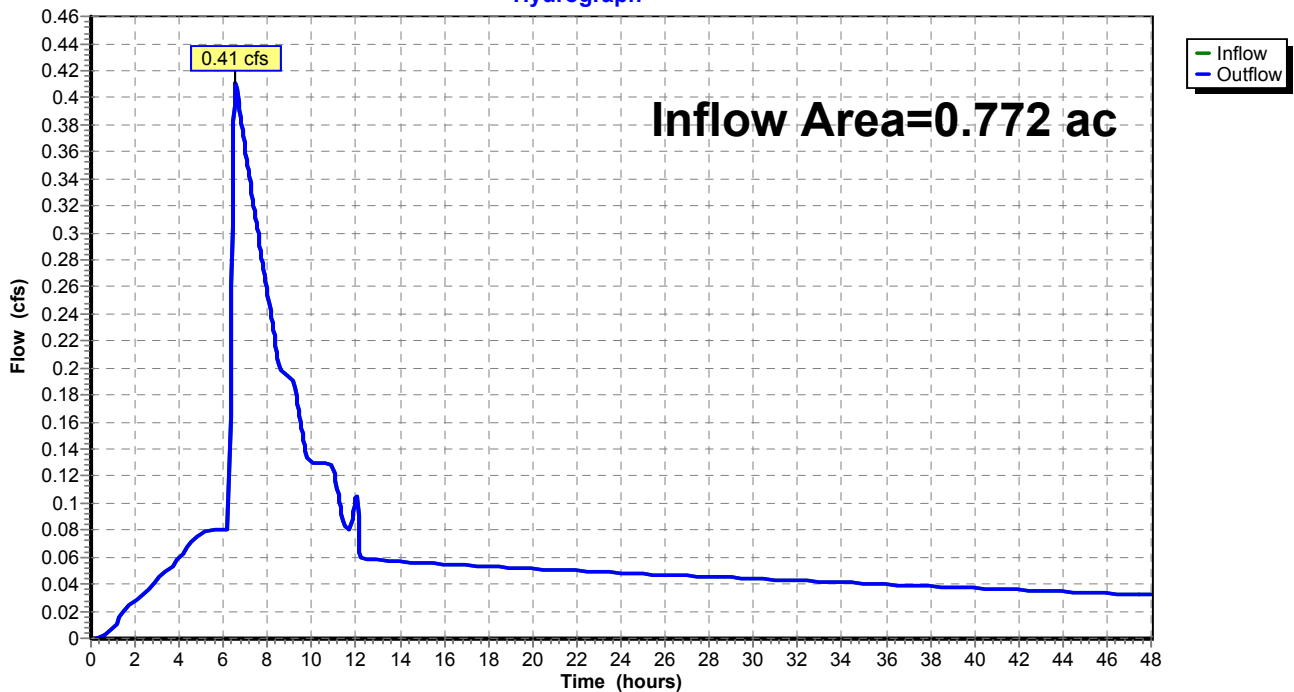
Summary for Reach 4R: Proposed Flow From Site

Inflow Area = 0.772 ac, 86.44% Impervious, Inflow Depth > 3.90" for 100yr-12hr event
Inflow = 0.41 cfs @ 6.56 hrs, Volume= 0.251 af
Outflow = 0.41 cfs @ 6.56 hrs, Volume= 0.251 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs

Reach 4R: Proposed Flow From Site

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 100yr-12hr Rainfall=5.00"

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Summary for Pond 2P: Stormtech

Inflow Area = 0.741 ac, 85.87% Impervious, Inflow Depth = 4.42" for 100yr-12hr event
 Inflow = 0.72 cfs @ 4.90 hrs, Volume= 0.273 af
 Outflow = 0.39 cfs @ 6.57 hrs, Volume= 0.238 af, Atten= 45%, Lag= 100.3 min
 Primary = 0.39 cfs @ 6.57 hrs, Volume= 0.238 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs / 9
 Peak Elev= 816.09' @ 6.57 hrs Surf.Area= 3,409 sf Storage= 7,324 cf

Plug-Flow detention time= 843.7 min calculated for 0.238 af (87% of inflow)
 Center-of-Mass det. time= 805.6 min (1,148.6 - 343.0)

Volume	Invert	Avail.Storage	Storage Description
#1	812.50'	3,831 cf	25.25'W x 135.00'L x 4.00'H Stone Volume 13,635 cf Overall - 4,057 cf Embedded = 9,578 cf x 40.0% Voids
#2	813.50'	4,057 cf	StormTech SC-740 x 88 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 5 rows
		7,888 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	812.50'	1.1" Vert. Orifice/Grate C= 0.600
#2	Primary	816.00'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=0.39 cfs @ 6.57 hrs HW=816.09' (Free Discharge)

1=Orifice/Grate (Orifice Controls 0.06 cfs @ 9.06 fps)

2=Sharp-Crested Rectangular Weir (Weir Controls 0.33 cfs @ 0.96 fps)

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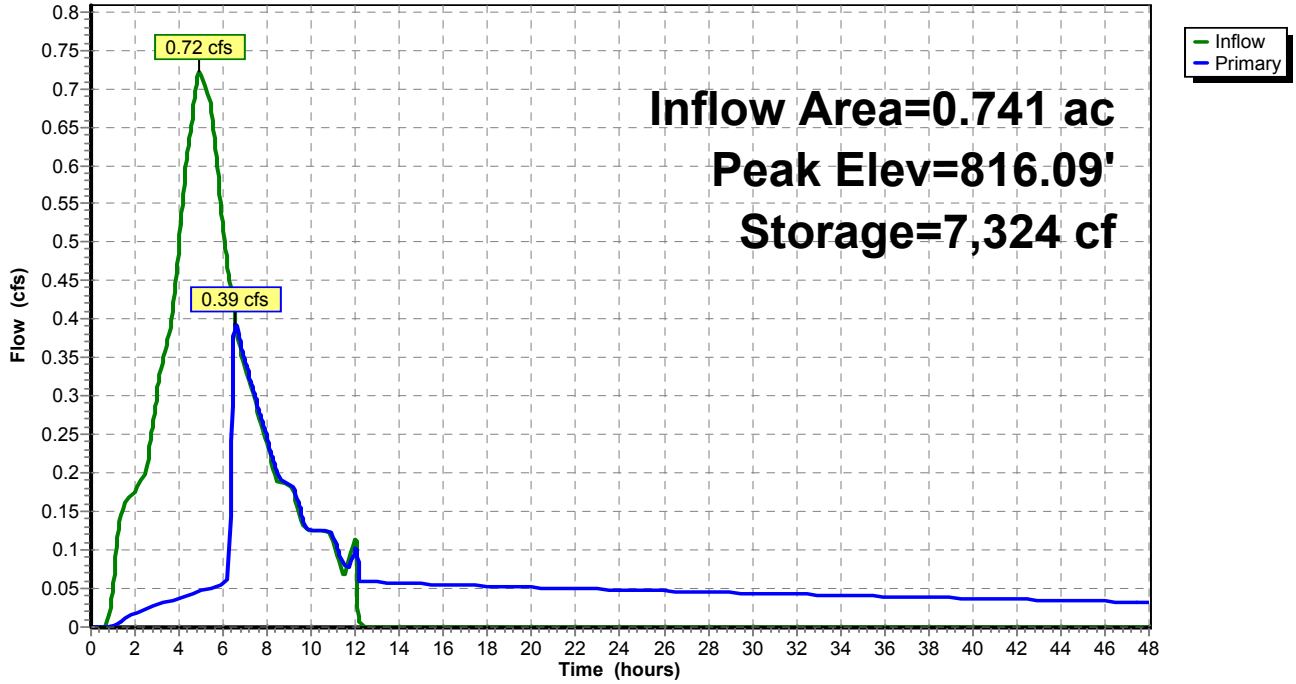
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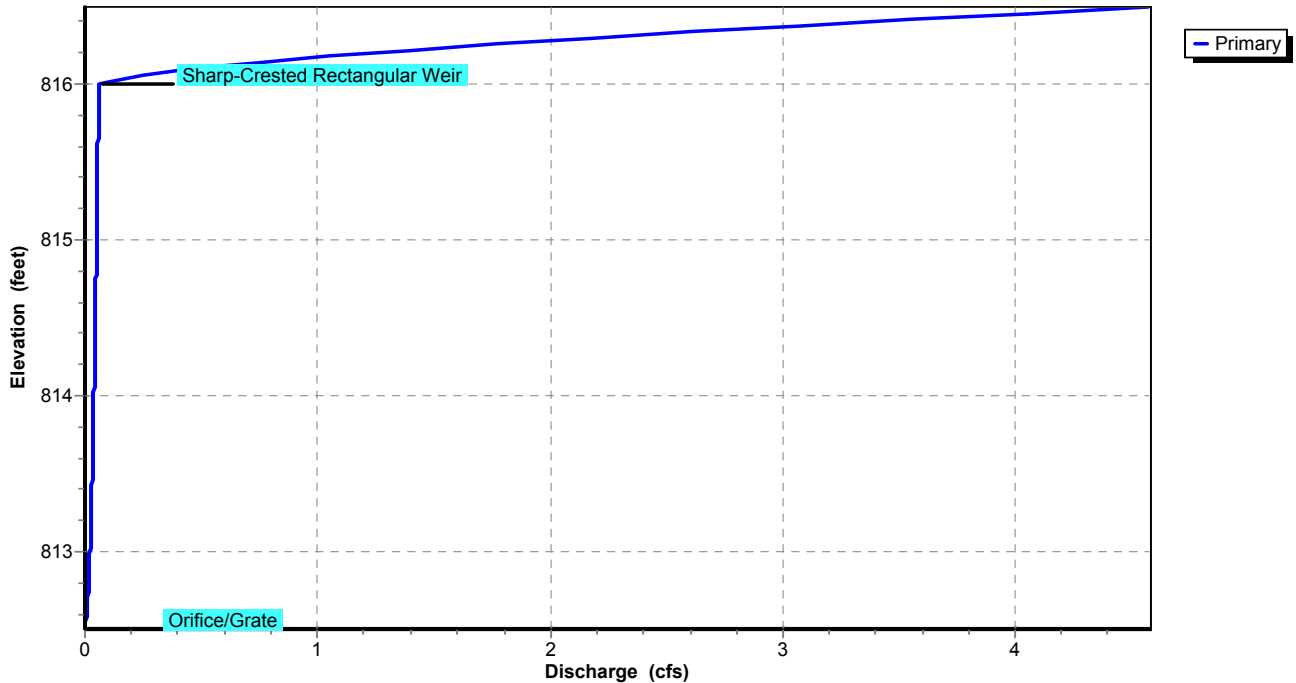
Pond 2P: Stormtech

Hydrograph



Pond 2P: Stormtech

Stage-Discharge



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Pond 2P: Stormtech

Stage-Area-Storage

