

EVERETT M
BROOKS
COMPANY

PROJECT ADDRESS: 956 Walnut Street
Newton, MA

PROJECT NO.: 25694

SHEET:

OF:

CALCULATIONS BY: ES

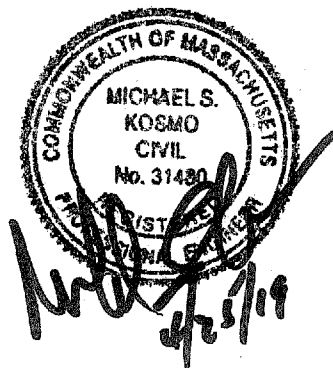
DATE: 4/25/19

CHECKED BY: *MSK*

DATE: *4/26/19*

Drainage Summary – Peak Storm Flow

	Existing Conditions	Proposed Conditions
100- Year Storm Event	1.66 cfs	1.48 cfs



SURVEYORS & ENGINEERS

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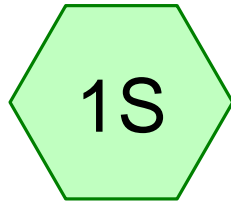
SHEET: OF:

CALCULATIONS BY: ES DATE: 5/25/19

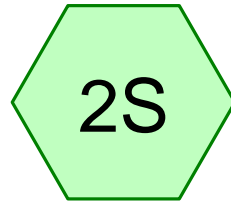
CHECKED BY: DATE:

Drainage Summary – Peak Storm Flow

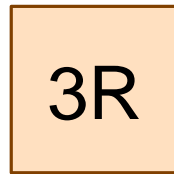
	Existing Conditions	Proposed Conditions
100- Year Storm Event	1.66 cfs	1.48 cfs



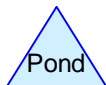
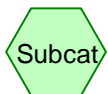
Existing House, Drive,
Walks



Remainder of Lot



Existing Watershed



Project Notes

The default Palette is empty, causing HydroCAD to build a palette on-the-fly which contains each of the basic node types. If you customize the palette by adding ANY nodes, this will override the automatic palette creation.

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

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

Subcatchment 1S: Existing House, Drive, Walks

Runoff Area=0.172 ac Runoff Depth>7.85"

Flow Length=290' Tc=3.1 min CN=98 Runoff=1.60 cfs 0.113 af

Subcatchment 2S: Remainder of Lot

Runoff Area=0.569 ac Runoff Depth>1.32"

Flow Length=290' Tc=19.7 min CN=39 Runoff=0.50 cfs 0.062 af

Reach 3R: Existing Watershed

Inflow=1.66 cfs 0.175 af

Outflow=1.66 cfs 0.175 af

Total Runoff Area = 0.741 ac Runoff Volume = 0.175 af Average Runoff Depth = 2.83"

Subcatchment 1S: Existing House, Drive, Walks

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 1.60 cfs @ 12.05 hrs, Volume= 0.113 af, Depth> 7.85"

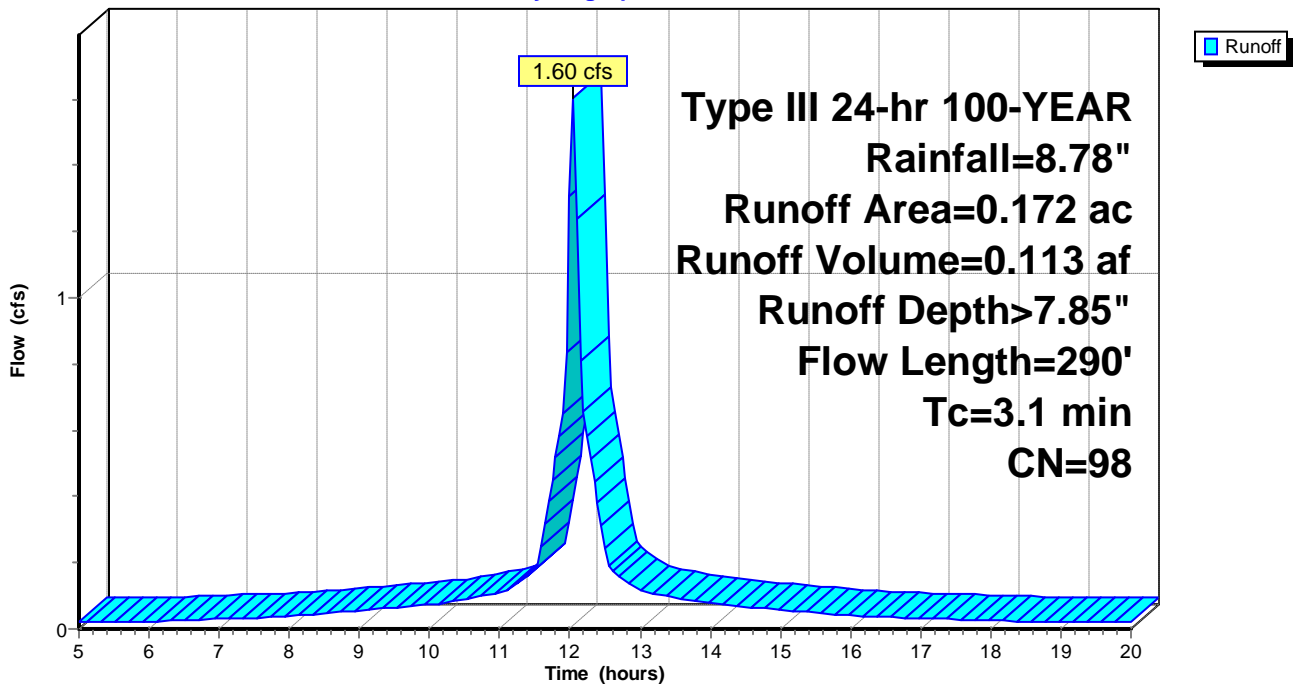
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-YEAR Rainfall=8.78"

Area (ac)	CN	Description
0.172	98	Paved parking & roofs

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	290	0.0320	1.5		Lag/CN Method,

Subcatchment 1S: Existing House, Drive, Walks

Hydrograph



Subcatchment 2S: Remainder of Lot

Runoff = 0.50 cfs @ 12.36 hrs, Volume= 0.062 af, Depth> 1.32"

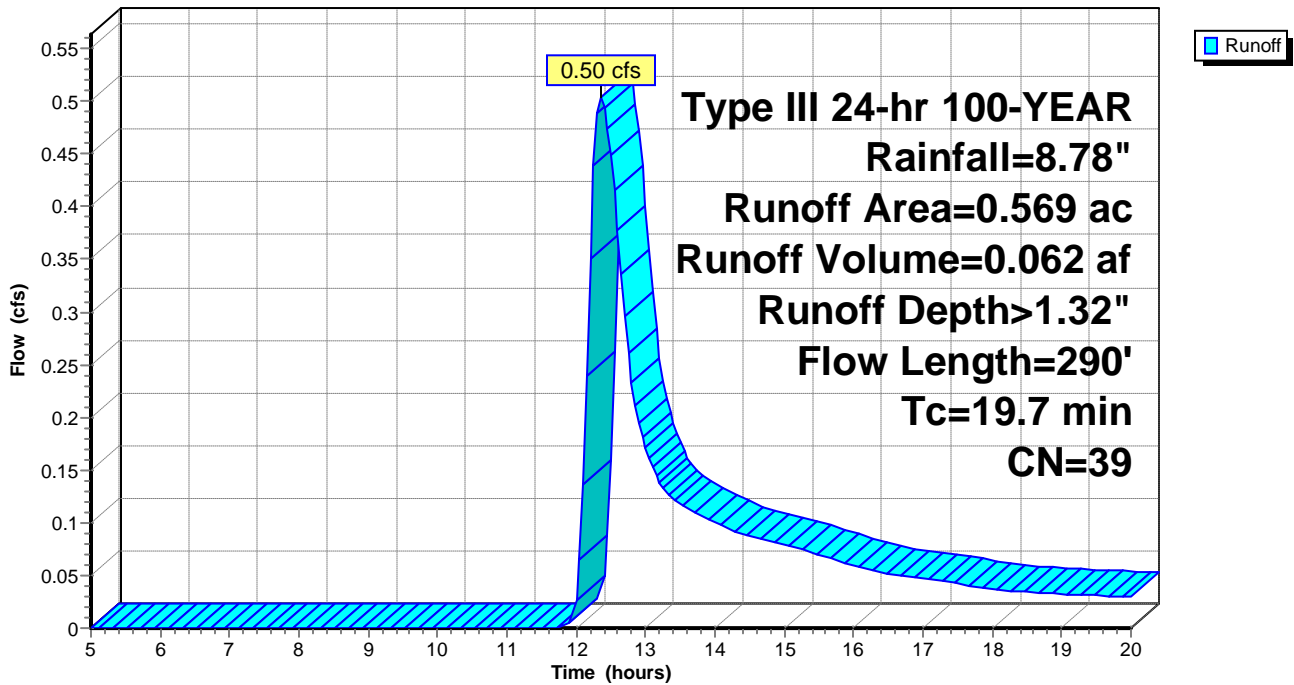
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-YEAR Rainfall=8.78"

Area (ac)	CN	Description
0.569	39	>75% Grass cover, Good, HSG A

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.7	290	0.0320	0.2		Lag/CN Method,

Subcatchment 2S: Remainder of Lot

Hydrograph



Reach 3R: Existing Watershed

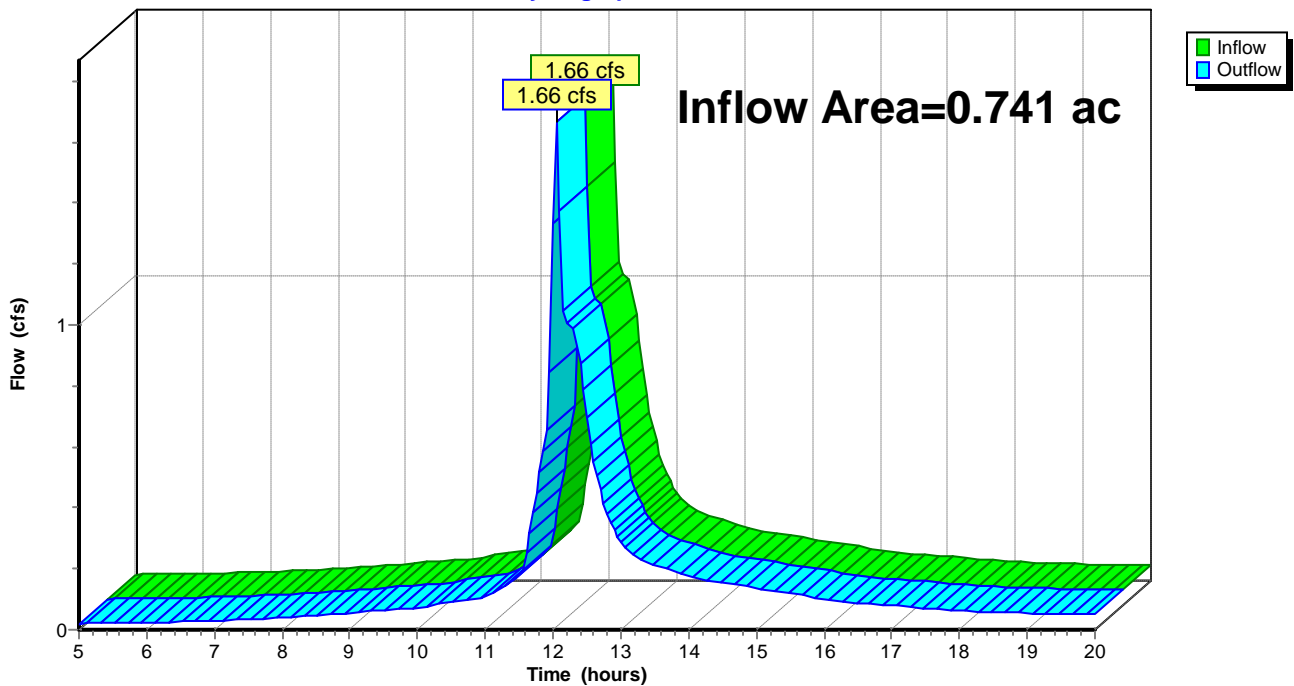
[40] Hint: Not Described (Outflow=Inflow)

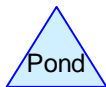
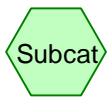
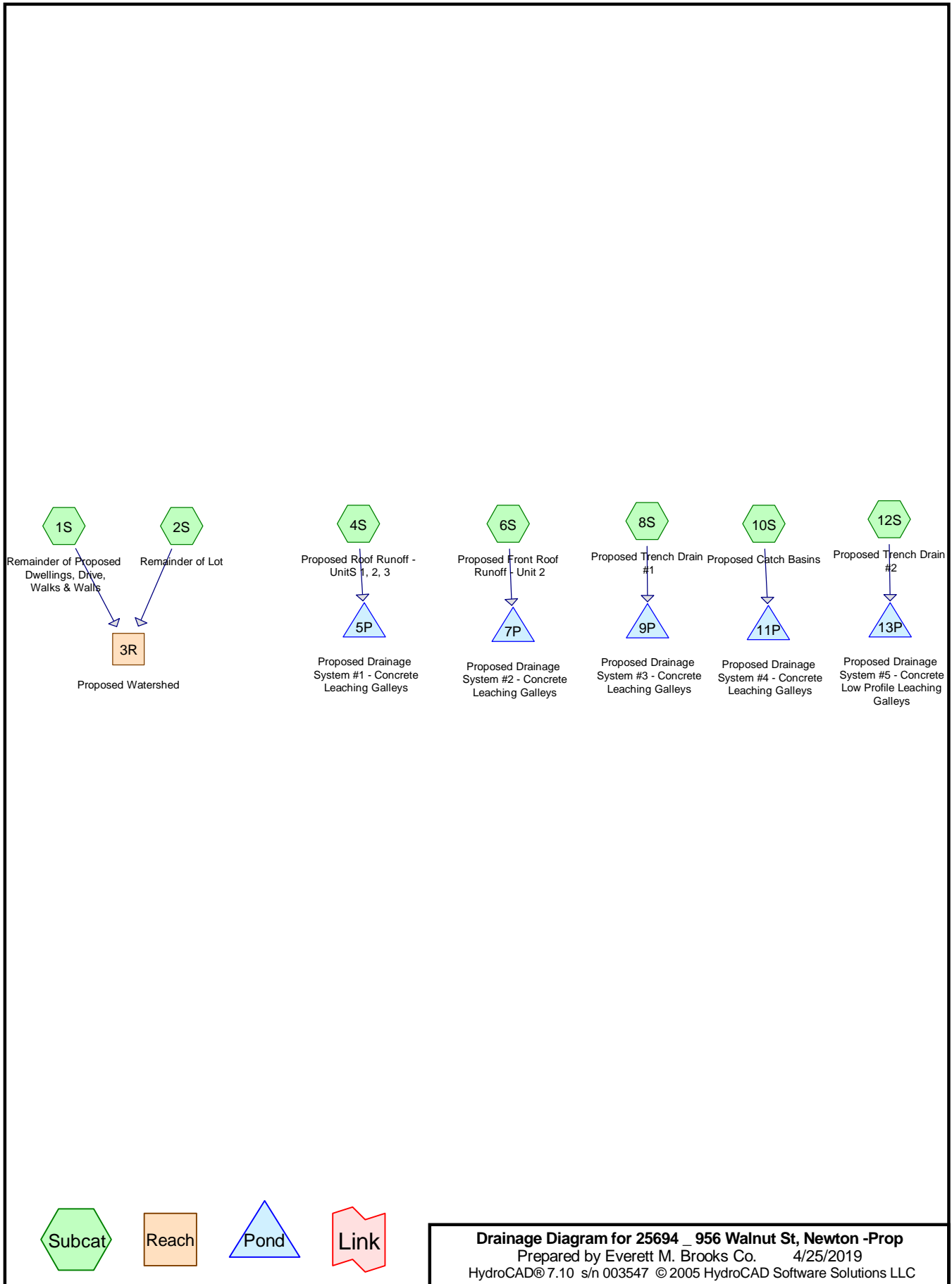
Inflow Area = 0.741 ac, Inflow Depth > 2.83" for 100-YEAR event
Inflow = 1.66 cfs @ 12.05 hrs, Volume= 0.175 af
Outflow = 1.66 cfs @ 12.05 hrs, Volume= 0.175 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 3R: Existing Watershed

Hydrograph





Drainage Diagram for 25694_ 956 Walnut St, Newton -Prop
 Prepared by Everett M. Brooks Co. 4/25/2019
 HydroCAD® 7.10 s/n 003547 © 2005 HydroCAD Software Solutions LLC

Project Notes

The default Palette is empty, causing HydroCAD to build a palette on-the-fly which contains each of the basic node types. If you customize the palette by adding ANY nodes, this will override the automatic palette creation.

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Remainder of Proposed Dwellings, Drive, Walk Runoff Area=0.155 ac Runoff Depth=8.54"
Flow Length=290' Tc=3.1 min CN=98 Runoff=1.44 cfs 0.110 af

Subcatchment 2S: Remainder of Lot Runoff Area=0.306 ac Runoff Depth=1.50"
Flow Length=290' Tc=19.7 min CN=39 Runoff=0.27 cfs 0.038 af

Subcatchment 4S: Proposed Roof Runoff - UnitS 1, 2, 3 Runoff Area=0.079 ac Runoff Depth=8.54"
Flow Length=150' Tc=0.7 min CN=98 Runoff=0.77 cfs 0.056 af

Subcatchment 6S: Proposed Front Roof Runoff - Unit 2 Runoff Area=0.103 ac Runoff Depth=8.54"
Flow Length=150' Tc=0.7 min CN=98 Runoff=1.00 cfs 0.073 af

Subcatchment 8S: Proposed Trench Drain #1 Runoff Area=0.131 ac Runoff Depth=4.41"
Flow Length=100' Tc=5.6 min CN=64 Runoff=0.67 cfs 0.048 af

Subcatchment 10S: Proposed Catch Basins Runoff Area=0.071 ac Runoff Depth=8.54"
Flow Length=45' Tc=0.9 min CN=98 Runoff=0.69 cfs 0.051 af

Subcatchment 12S: Proposed Trench Drain #2 Runoff Area=0.027 ac Runoff Depth=8.54"
Flow Length=54' Tc=0.4 min CN=98 Runoff=0.27 cfs 0.019 af

Reach 3R: Proposed Watershed Inflow=1.48 cfs 0.149 af
Outflow=1.48 cfs 0.149 af

Pond 5P: Proposed Drainage System #1 - Concr Peak Elev=138.07' Storage=0.014 af Inflow=0.77 cfs 0.056 af
Outflow=0.11 cfs 0.056 af

Pond 7P: Proposed Drainage System #2 - Concr Peak Elev=144.84' Storage=0.019 af Inflow=1.00 cfs 0.073 af
Outflow=0.14 cfs 0.073 af

Pond 9P: Proposed Drainage System #3 - Concr Peak Elev=149.63' Storage=0.006 af Inflow=0.67 cfs 0.048 af
Primary=0.06 cfs 0.036 af Secondary=0.65 cfs 0.012 af Outflow=0.71 cfs 0.048 af

Pond 11P: Proposed Drainage System #4 - Conc Peak Elev=145.24' Storage=0.013 af Inflow=0.69 cfs 0.051 af
Outflow=0.10 cfs 0.051 af

Pond 13P: Proposed Drainage System #5 - Conc Peak Elev=139.13' Storage=0.004 af Inflow=0.27 cfs 0.019 af
Outflow=0.05 cfs 0.019 af

Total Runoff Area = 0.872 ac Runoff Volume = 0.396 af Average Runoff Depth = 5.45"

Subcatchment 1S: Remainder of Proposed Dwellings, Drive, Walks & Walls

[49] Hint: $T_c < 2dt$ may require smaller dt

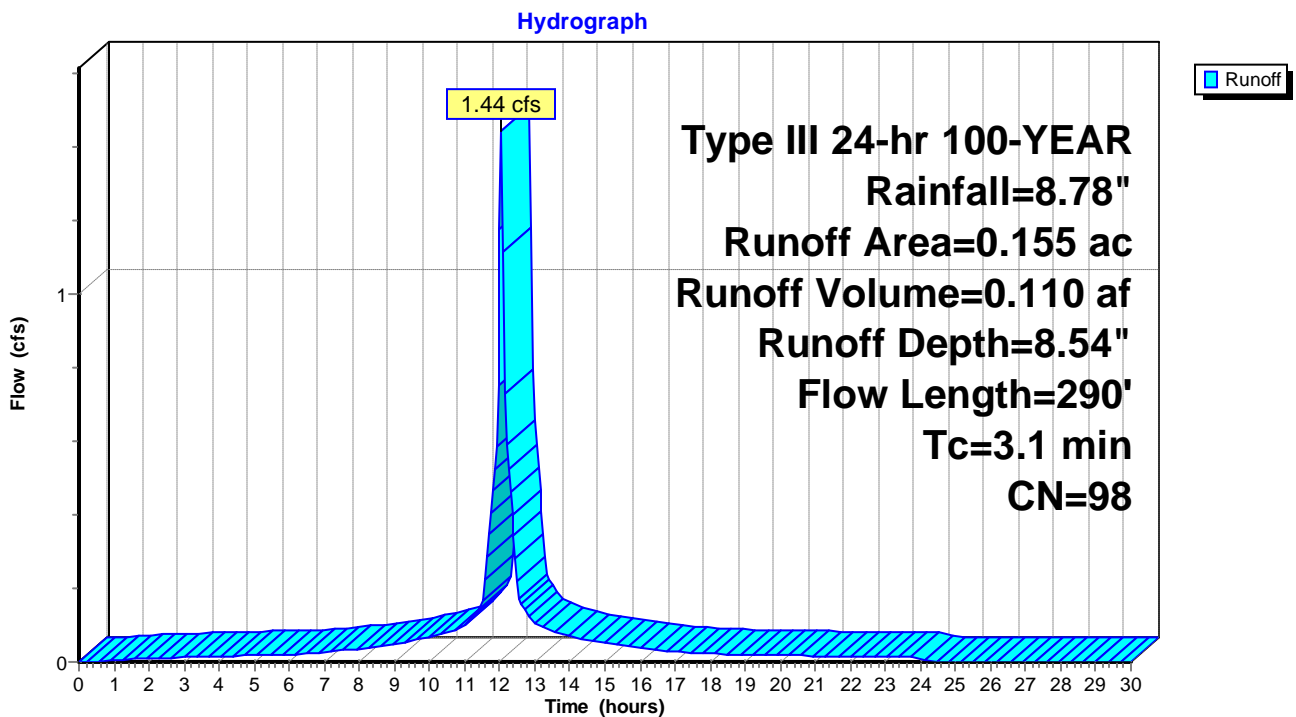
Runoff = 1.44 cfs @ 12.05 hrs, Volume= 0.110 af, Depth= 8.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, $dt= 0.05$ hrs
 Type III 24-hr 100-YEAR Rainfall=8.78"

Area (ac)	CN	Description
0.155	98	Paved parking & roofs

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	290	0.0320	1.5		Lag/CN Method,

Subcatchment 1S: Remainder of Proposed Dwellings, Drive, Walks & Walls



Subcatchment 2S: Remainder of Lot

Runoff = 0.27 cfs @ 12.36 hrs, Volume= 0.038 af, Depth= 1.50"

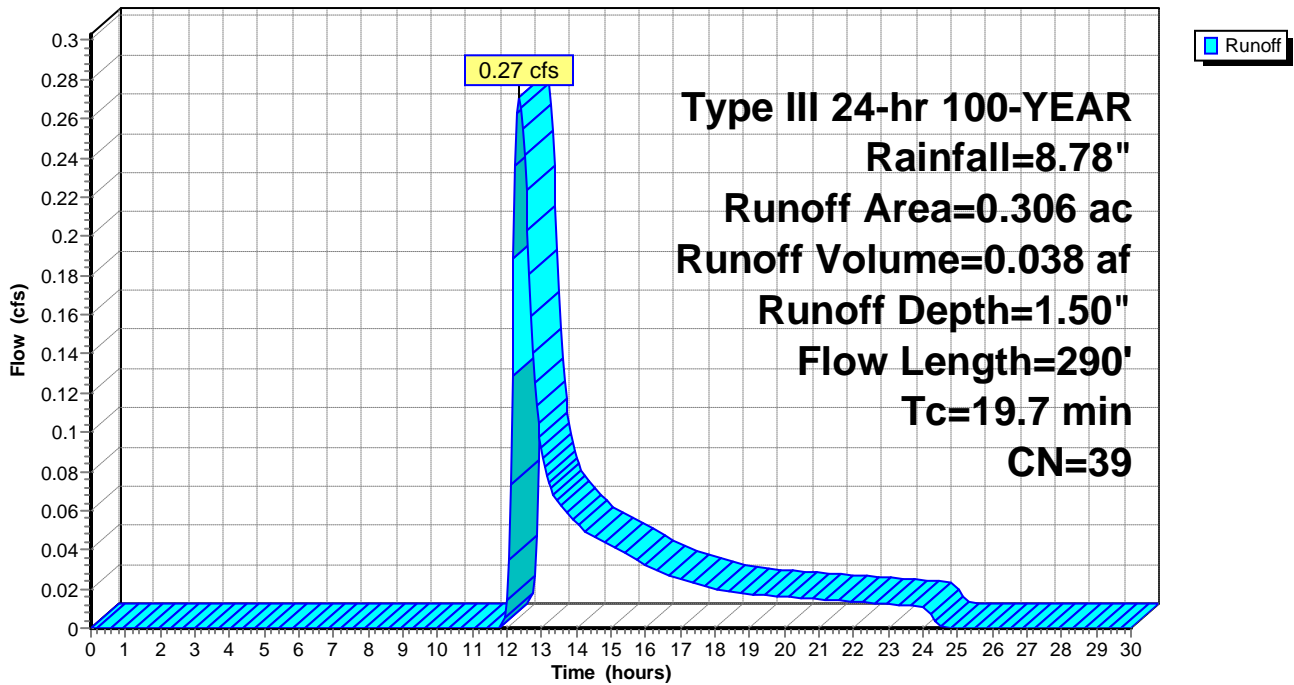
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-YEAR Rainfall=8.78"

Area (ac)	CN	Description
0.306	39	>75% Grass cover, Good, HSG A

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.7	290	0.0320	0.2		Lag/CN Method,

Subcatchment 2S: Remainder of Lot

Hydrograph



Subcatchment 4S: Proposed Roof Runoff - UnitS 1, 2, 3

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 0.77 cfs @ 12.01 hrs, Volume= 0.056 af, Depth= 8.54"

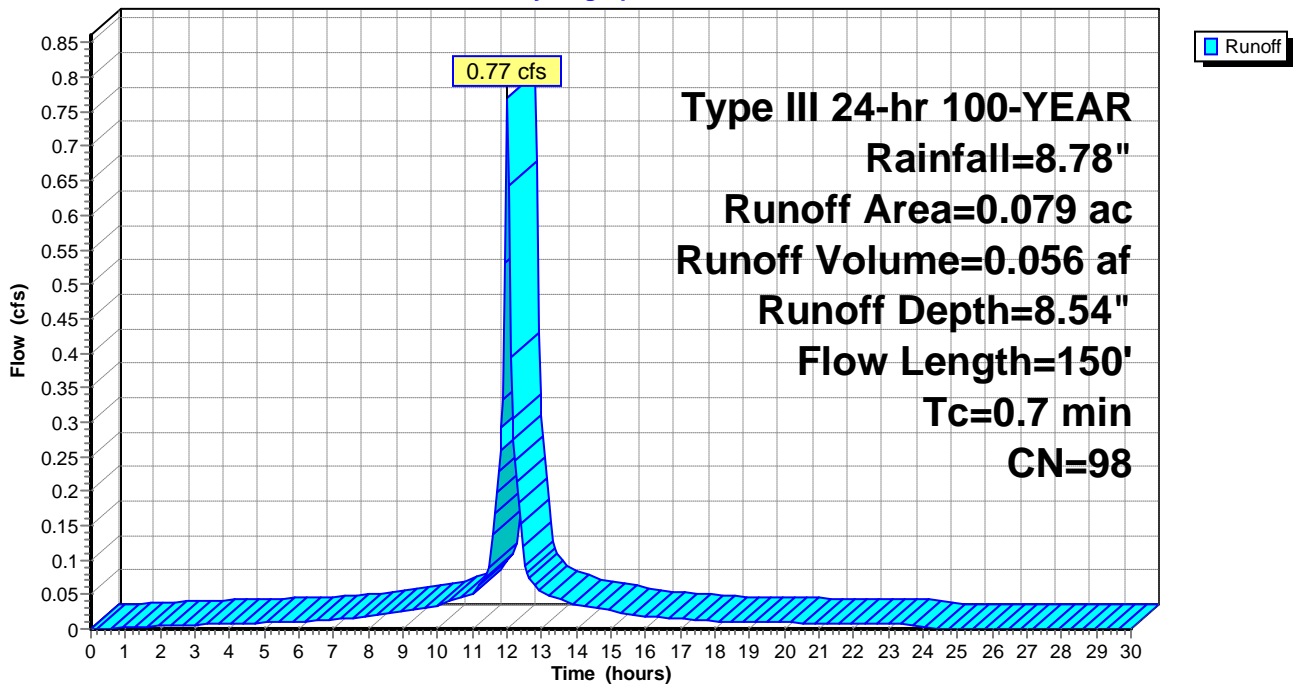
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-YEAR Rainfall=8.78"

Area (ac)	CN	Description
0.079	98	Paved parking & roofs

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	150	0.2500	3.8		Lag/CN Method,

Subcatchment 4S: Proposed Roof Runoff - UnitS 1, 2, 3

Hydrograph



Subcatchment 6S: Proposed Front Roof Runoff - Unit 2

[49] Hint: $T_c < 2dt$ may require smaller dt

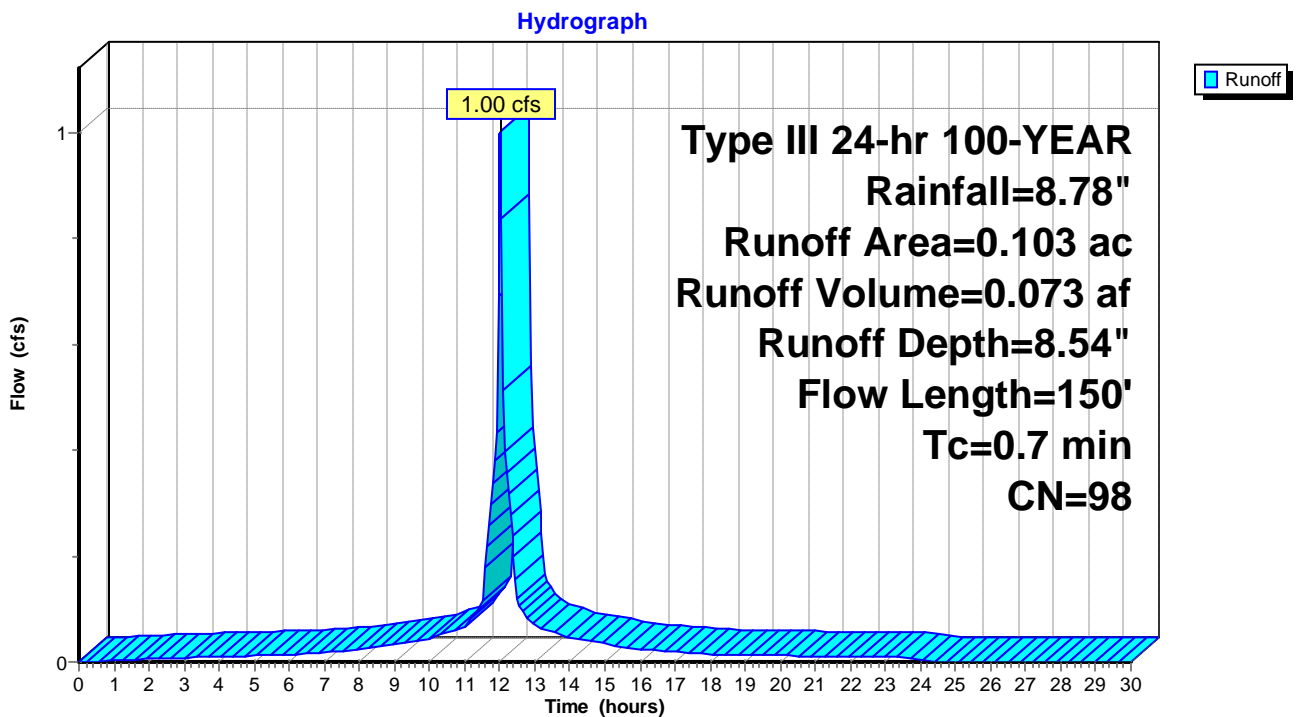
Runoff = 1.00 cfs @ 12.01 hrs, Volume= 0.073 af, Depth= 8.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, $dt= 0.05$ hrs
 Type III 24-hr 100-YEAR Rainfall=8.78"

Area (ac)	CN	Description
0.103	98	Paved parking & roofs

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	150	0.2500	3.8		Lag/CN Method,

Subcatchment 6S: Proposed Front Roof Runoff - Unit 2



Subcatchment 8S: Proposed Trench Drain #1

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 0.67 cfs @ 12.09 hrs, Volume= 0.048 af, Depth= 4.41"

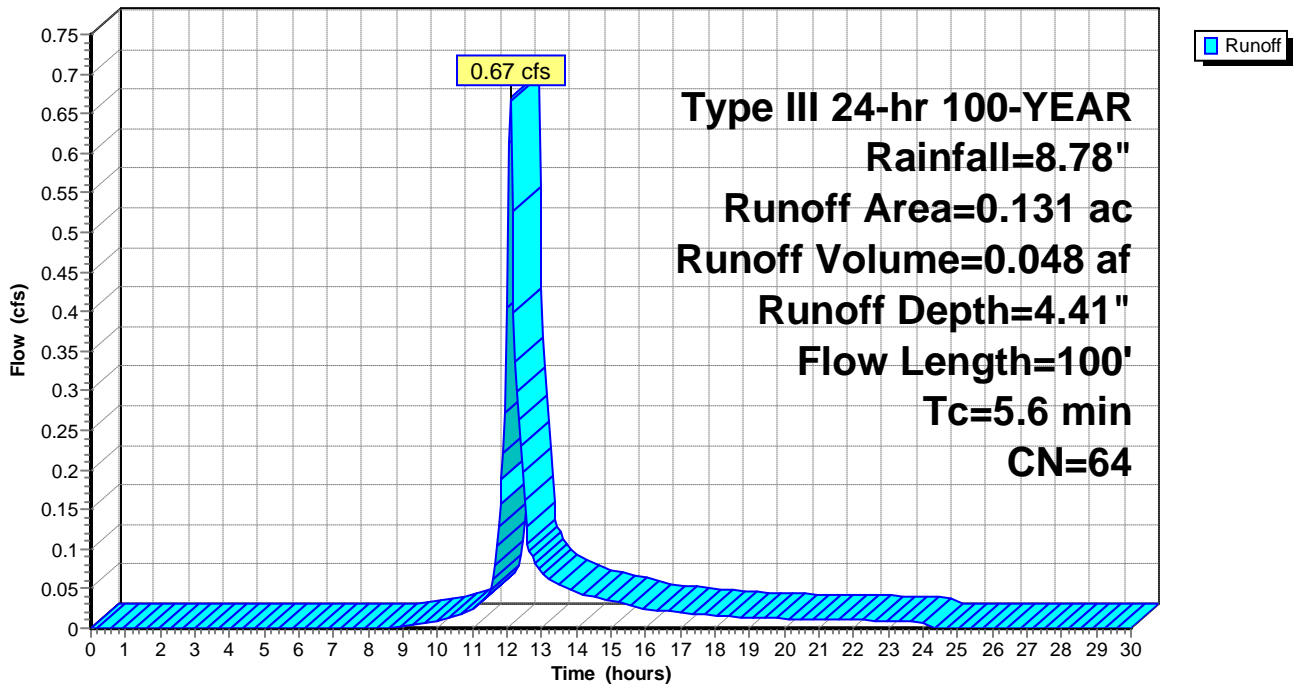
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, $dt= 0.05$ hrs
 Type III 24-hr 100-YEAR Rainfall=8.78"

Area (ac)	CN	Description
0.055	98	Paved parking & roofs
0.076	39	>75% Grass cover, Good, HSG A
0.131	64	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	100	0.0200	0.3		Lag/CN Method,

Subcatchment 8S: Proposed Trench Drain #1

Hydrograph



Subcatchment 10S: Proposed Catch Basins

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 0.69 cfs @ 12.01 hrs, Volume= 0.051 af, Depth= 8.54"

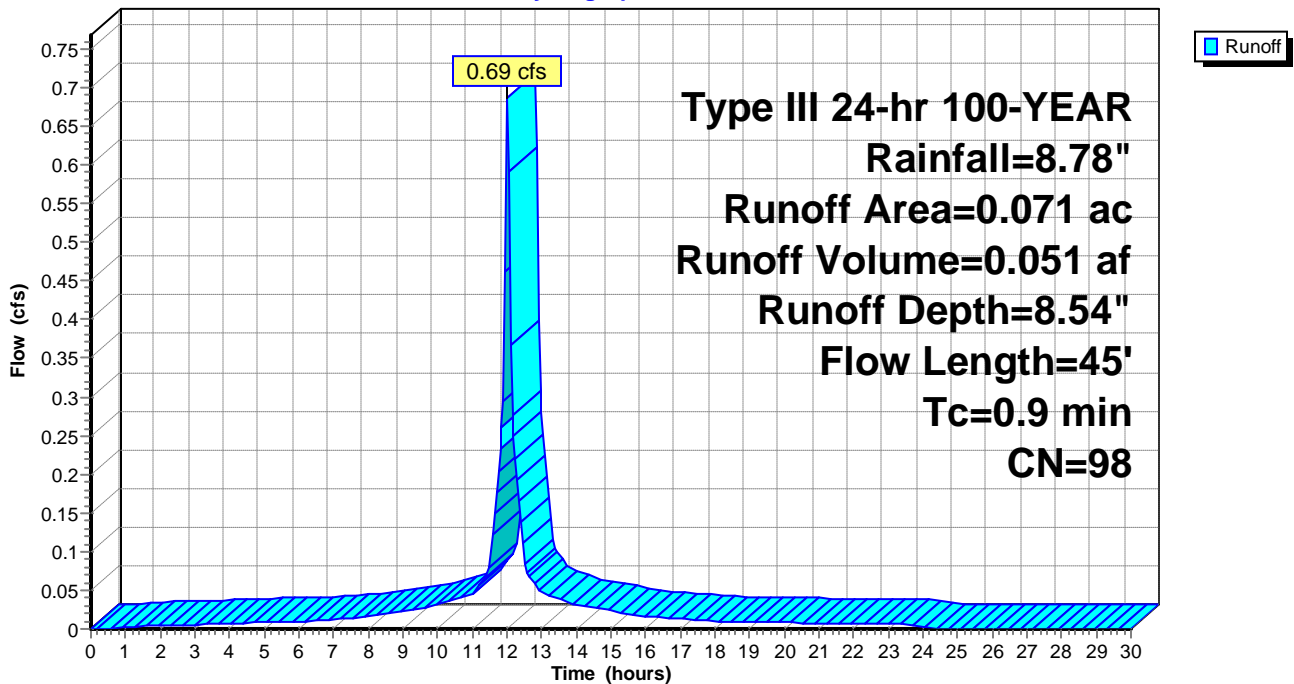
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-YEAR Rainfall=8.78"

Area (ac)	CN	Description
0.071	98	Paved parking & roofs

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	45	0.0200	0.8		Lag/CN Method,

Subcatchment 10S: Proposed Catch Basins

Hydrograph



Subcatchment 12S: Proposed Trench Drain #2

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 0.27 cfs @ 12.00 hrs, Volume= 0.019 af, Depth= 8.54"

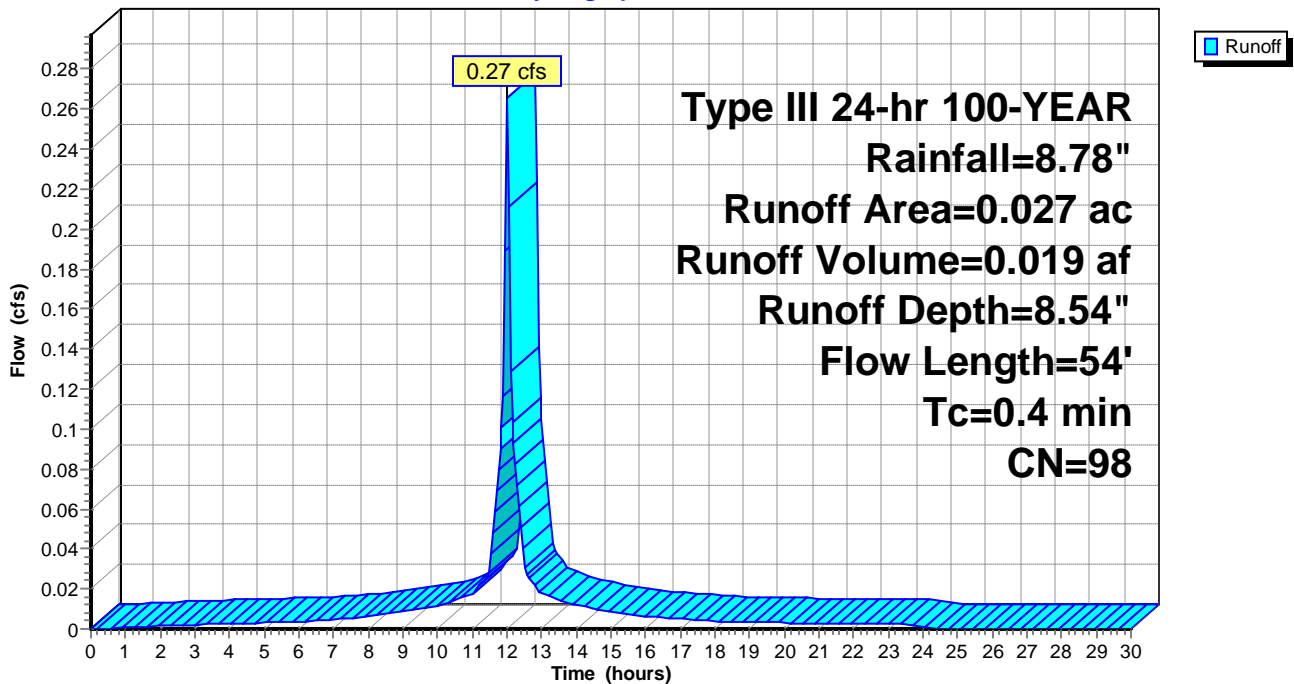
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, $dt= 0.05$ hrs
 Type III 24-hr 100-YEAR Rainfall=8.78"

Area (ac)	CN	Description
0.027	98	Paved parking & roofs

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	54	0.1250	2.2		Lag/CN Method,

Subcatchment 12S: Proposed Trench Drain #2

Hydrograph



Reach 3R: Proposed Watershed

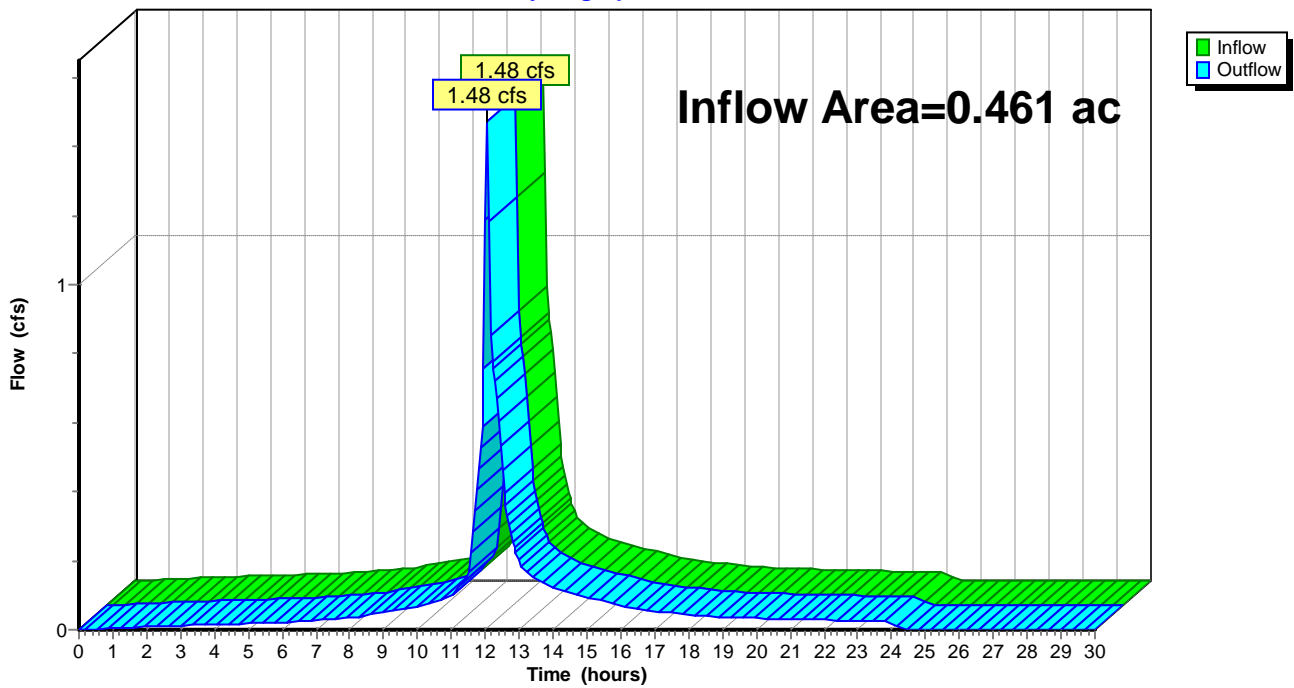
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.461 ac, Inflow Depth = 3.87" for 100-YEAR event
Inflow = 1.48 cfs @ 12.05 hrs, Volume= 0.149 af
Outflow = 1.48 cfs @ 12.05 hrs, Volume= 0.149 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Reach 3R: Proposed Watershed

Hydrograph



Pond 5P: Proposed Drainage System #1 - Concrete Leaching Galleys

(5) Concrete Leaching Galleys: 4' x 4' x 3.25' effective depth with 4' stone surround and 6" of stone beneath the entire system.

Inflow Area = 0.079 ac, Inflow Depth = 8.54" for 100-YEAR event
 Inflow = 0.77 cfs @ 12.01 hrs, Volume= 0.056 af
 Outflow = 0.11 cfs @ 11.60 hrs, Volume= 0.056 af, Atten= 86%, Lag= 0.0 min
 Discarded = 0.11 cfs @ 11.60 hrs, Volume= 0.056 af

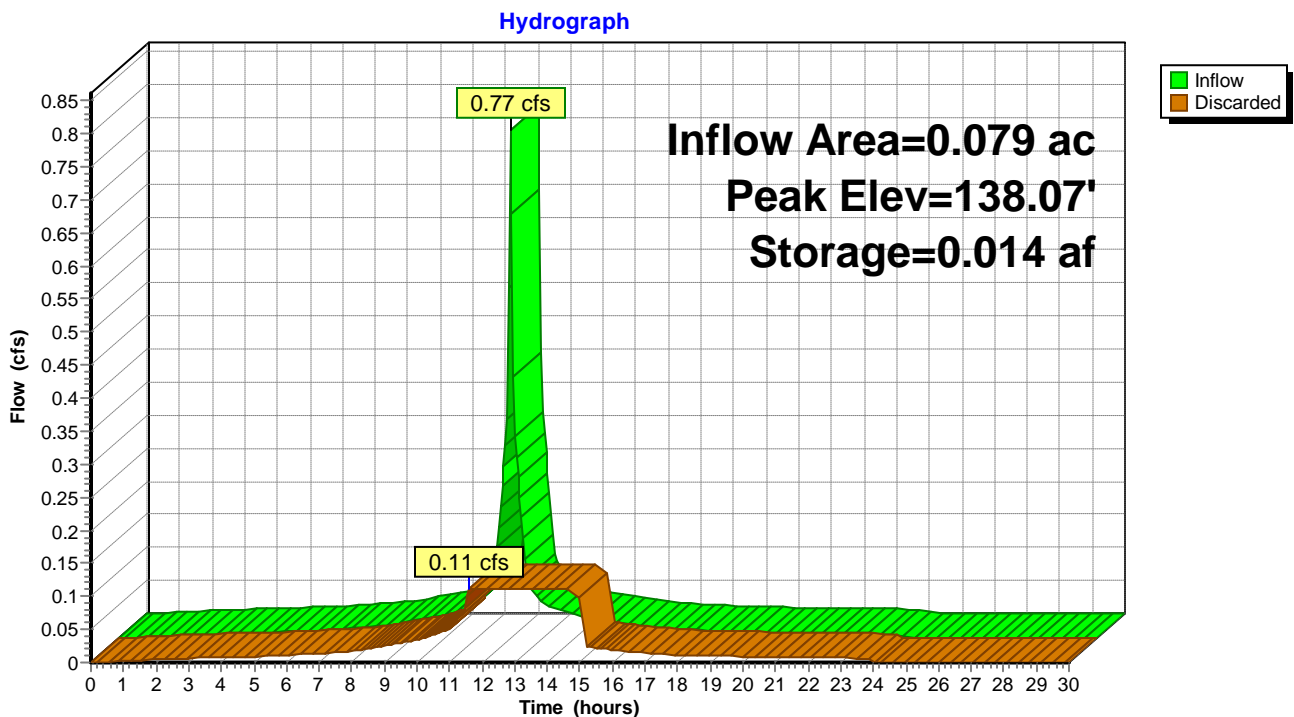
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 138.07' @ 12.47 hrs Surf.Area= 0.008 ac Storage= 0.014 af
 Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 30.1 min (765.2 - 735.2)

Volume	Invert	Avail.Storage	Storage Description
#1	134.50'	0.009 af	12.00'W x 28.00'L x 3.75'H Gravel 0.029 af Overall - 0.006 af Embedded = 0.023 af x 40.0% Voids
#2	135.00'	0.006 af	4.00'W x 20.00'L x 3.25'H Galley Inside #1
		0.015 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	134.50'	0.11 cfs Exfiltration when above invert

Discarded OutFlow Max=0.11 cfs @ 11.60 hrs HW=134.55' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.11 cfs)

Pond 5P: Proposed Drainage System #1 - Concrete Leaching Galleys



Pond 7P: Proposed Drainage System #2 - Concrete Leaching Galleys

(7) Concrete Leaching Galleys: 4' x 4' x 3.25' effective depth with 4' stone surround and 6" of stone beneath the entire system.

Inflow Area = 0.103 ac, Inflow Depth = 8.54" for 100-YEAR event
 Inflow = 1.00 cfs @ 12.01 hrs, Volume= 0.073 af
 Outflow = 0.14 cfs @ 11.60 hrs, Volume= 0.073 af, Atten= 86%, Lag= 0.0 min
 Discarded = 0.14 cfs @ 11.60 hrs, Volume= 0.073 af

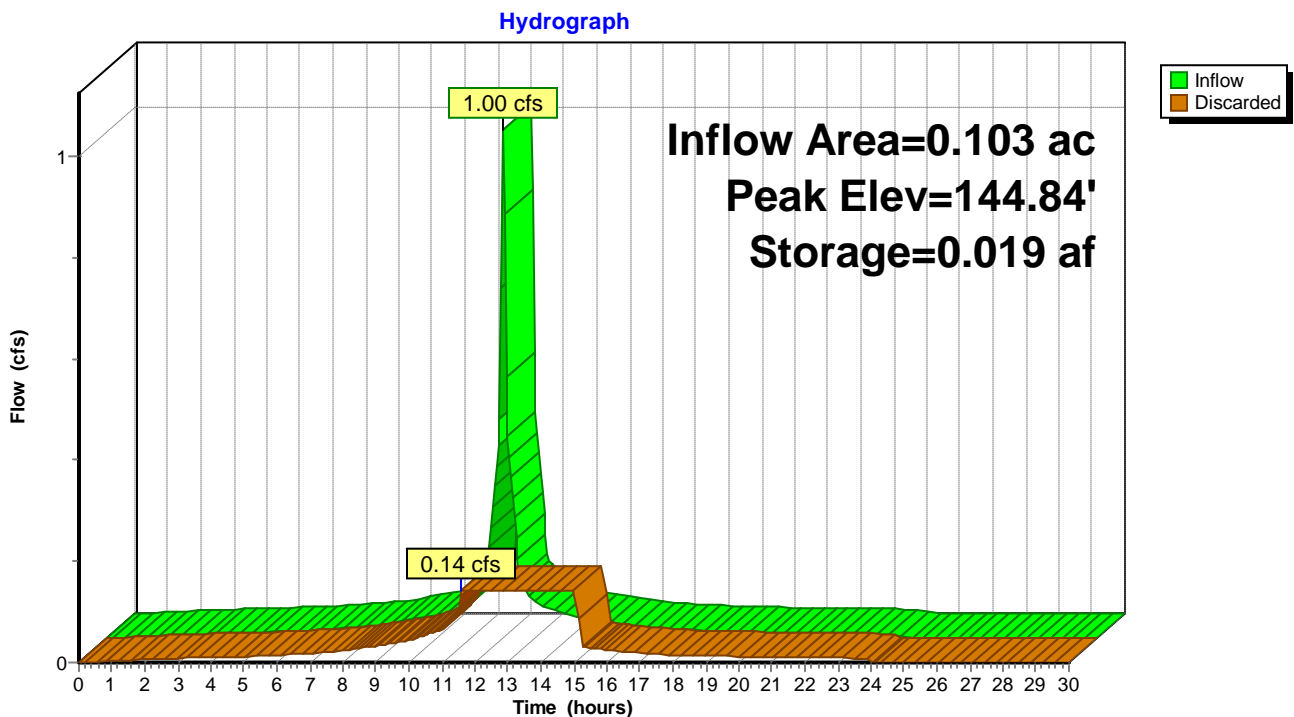
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 144.84' @ 12.47 hrs Surf.Area= 0.010 ac Storage= 0.019 af
 Plug-Flow detention time= 31.7 min calculated for 0.073 af (100% of inflow)
 Center-of-Mass det. time= 31.3 min (766.5 - 735.2)

Volume	Invert	Avail.Storage	Storage Description
#1	141.25'	0.012 af	12.00'W x 36.00'L x 3.75'H Gravel 0.037 af Overall - 0.008 af Embedded = 0.029 af x 40.0% Voids
#2	141.75'	0.008 af	4.00'W x 28.00'L x 3.25'H Galley Inside #1
		0.020 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	141.25'	0.14 cfs Exfiltration when above invert

Discarded OutFlow Max=0.14 cfs @ 11.60 hrs HW=141.31' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.14 cfs)

Pond 7P: Proposed Drainage System #2 - Concrete Leaching Galleys



Pond 9P: Proposed Drainage System #3 - Concrete Leaching Galleys

(3) Concrete Leaching Galleys: 4' x 4' x 3.25' effective depth with 3' stone surround and 6" of stone beneath the entire system.

[93] Warning: Storage range exceeded by 4.63'

[88] Warning: Qout>Qin may require Finer Routing>1

Inflow Area = 0.131 ac, Inflow Depth = 4.41" for 100-YEAR event
 Inflow = 0.67 cfs @ 12.09 hrs, Volume= 0.048 af
 Outflow = 0.71 cfs @ 12.12 hrs, Volume= 0.048 af, Atten= 0%, Lag= 1.6 min
 Primary = 0.06 cfs @ 11.65 hrs, Volume= 0.036 af
 Secondary = 0.65 cfs @ 12.12 hrs, Volume= 0.012 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 149.63' @ 12.12 hrs Surf.Area= 0.003 ac Storage= 0.006 af
 Plug-Flow detention time= 29.6 min calculated for 0.048 af (100% of inflow)
 Center-of-Mass det. time= 27.4 min (860.0 - 832.6)

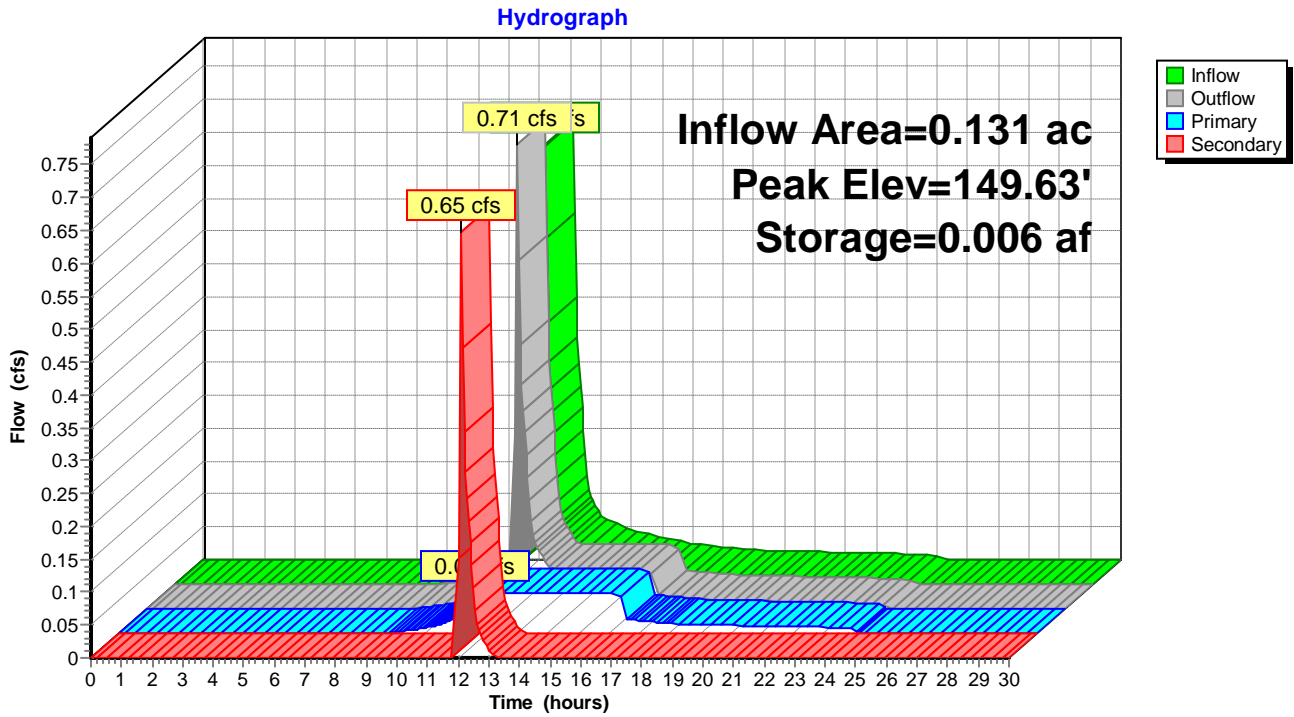
Volume	Invert	Avail.Storage	Storage Description
#1	141.25'	0.004 af	10.00'W x 14.00'L x 3.75'H Gravel 0.012 af Overall - 0.002 af Embedded = 0.010 af x 40.0% Voids
#2	141.75'	0.002 af	4.00'W x 8.00'L x 3.25'H Galley Inside #1
		0.006 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	141.25'	0.06 cfs Exfiltration when above invert
#2	Secondary	147.20'	4.0" Horiz. Orifice/Grate Limited to weir flow C= 0.600

Primary OutFlow Max=0.06 cfs @ 11.65 hrs HW=141.35' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.06 cfs)

Secondary OutFlow Max=0.57 cfs @ 12.12 hrs HW=149.04' (Free Discharge)
 ↑2=Orifice/Grate (Orifice Controls 0.57 cfs @ 6.5 fps)

Pond 9P: Proposed Drainage System #3 - Concrete Leaching Galleys



Pond 11P: Proposed Drainage System #4 - Concrete Leaching Galleys

(7) Concrete Leaching Galleys: 4' x 4' x 3.25' effective depth with 2' stone surround and 6" of stone beneath the entire system.

Inflow Area = 0.071 ac, Inflow Depth = 8.54" for 100-YEAR event
 Inflow = 0.69 cfs @ 12.01 hrs, Volume= 0.051 af
 Outflow = 0.10 cfs @ 11.60 hrs, Volume= 0.051 af, Atten= 85%, Lag= 0.0 min
 Discarded = 0.10 cfs @ 11.60 hrs, Volume= 0.051 af

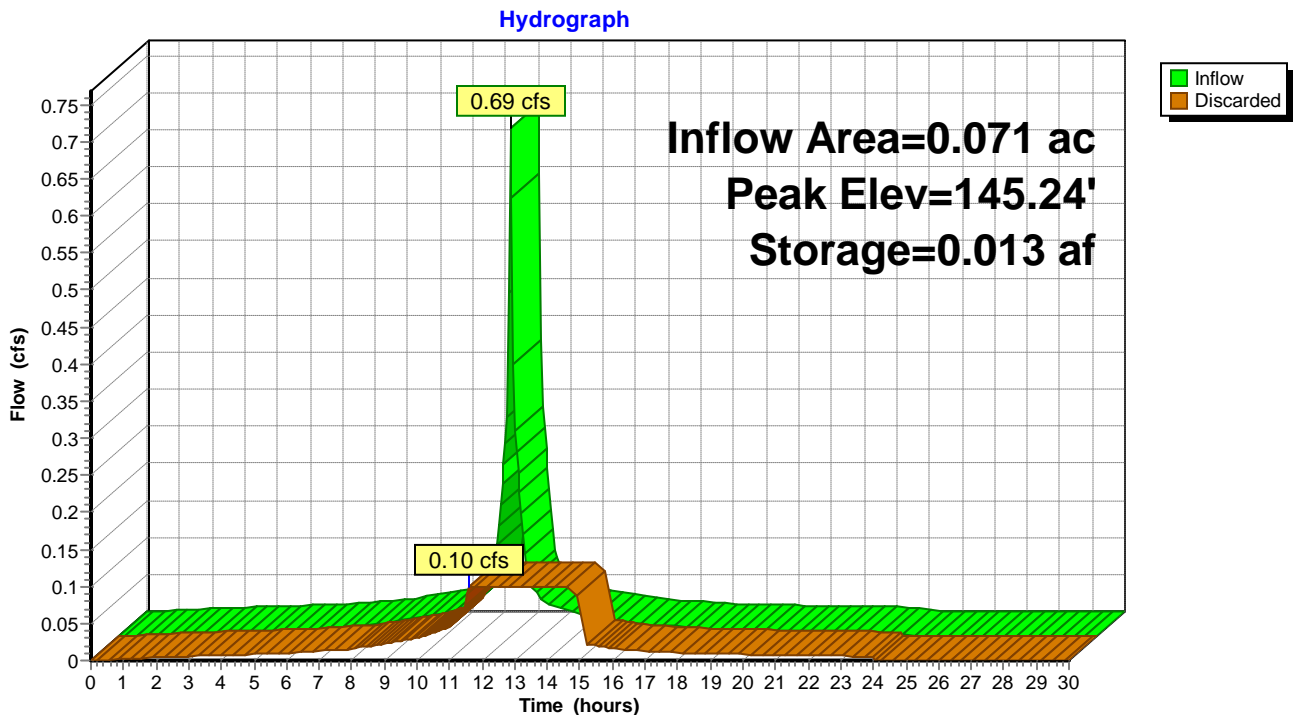
Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 145.24' @ 12.47 hrs Surf.Area= 0.006 ac Storage= 0.013 af
 Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 29.3 min (764.6 - 735.4)

Volume	Invert	Avail.Storage	Storage Description
#1	141.75'	0.005 af	8.00'W x 32.00'L x 3.75'H Gravel 0.022 af Overall - 0.008 af Embedded = 0.014 af x 40.0% Voids
#2	142.25'	0.008 af	4.00'W x 28.00'L x 3.25'H Galley Inside #1
		0.014 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	141.75'	0.10 cfs Exfiltration when above invert

Discarded OutFlow Max=0.10 cfs @ 11.60 hrs HW=141.80' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.10 cfs)

Pond 11P: Proposed Drainage System #4 - Concrete Leaching Galleys



Pond 13P: Proposed Drainage System #5 - Concrete Low Profile Leaching Galleys

(4) Concrete Low Profile Leaching Galleys: 4' x 4' x 2.0' effective depth with 1.5' stone surround and 6" of stone beneath the entire system.

Inflow Area = 0.027 ac, Inflow Depth = 8.54" for 100-YEAR event
 Inflow = 0.27 cfs @ 12.00 hrs, Volume= 0.019 af
 Outflow = 0.05 cfs @ 11.65 hrs, Volume= 0.019 af, Atten= 81%, Lag= 0.0 min
 Discarded = 0.05 cfs @ 11.65 hrs, Volume= 0.019 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs / 2
 Peak Elev= 139.13' @ 12.40 hrs Surf.Area= 0.003 ac Storage= 0.004 af
 Plug-Flow detention time= 16.8 min calculated for 0.019 af (100% of inflow)
 Center-of-Mass det. time= 16.2 min (751.1 - 734.9)

Volume	Invert	Avail.Storage	Storage Description
#1	137.00'	0.002 af	7.00'W x 19.00'L x 2.50'H Gravel 0.008 af Overall - 0.003 af Embedded = 0.005 af x 40.0% Voids
#2	137.50'	0.003 af	4.00'W x 16.00'L x 2.00'H Galley Inside #1
		0.005 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	137.00'	0.05 cfs Exfiltration when above invert

Discarded OutFlow Max=0.05 cfs @ 11.65 hrs HW=137.04' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.05 cfs)

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