LANDFORM
From Site to Finish

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MEMORANDUM

DATE	June 8, 2017
TO	Bruce Westby, City Engineer
CC	Tim Gladhill, Community Development Director, Bryon Cole,
FROM	Reid Schulz
RE	Cole Addition

Mr. Westby,

As part of the "Cole Addition" subdivision, we are requesting to vacate the drainage and utility easement on our subject property. It is our understanding that this easement is for the sole purpose to convey drainage to the neighboring property where a wetland/storage basin exists. As part of our proposed stormwater management plan, we are proposing to direct more water to the west through the public right of way, where City storm sewer infrastructure exists and reduce the rate and volume of water directed to the east on the adjacent property.

To ensure the high-water elevations of the wetland are not increased with our development, we modelled the existing conditions and the proposed conditions for the subwatershed area to this wetland. Enclosed please find the drainage maps and report. In summary, the HWL of the wetland in the proposed condition are less than the existing condition for the 2-yr, 10-yr and 100-yr events as modelled in hydrocad.

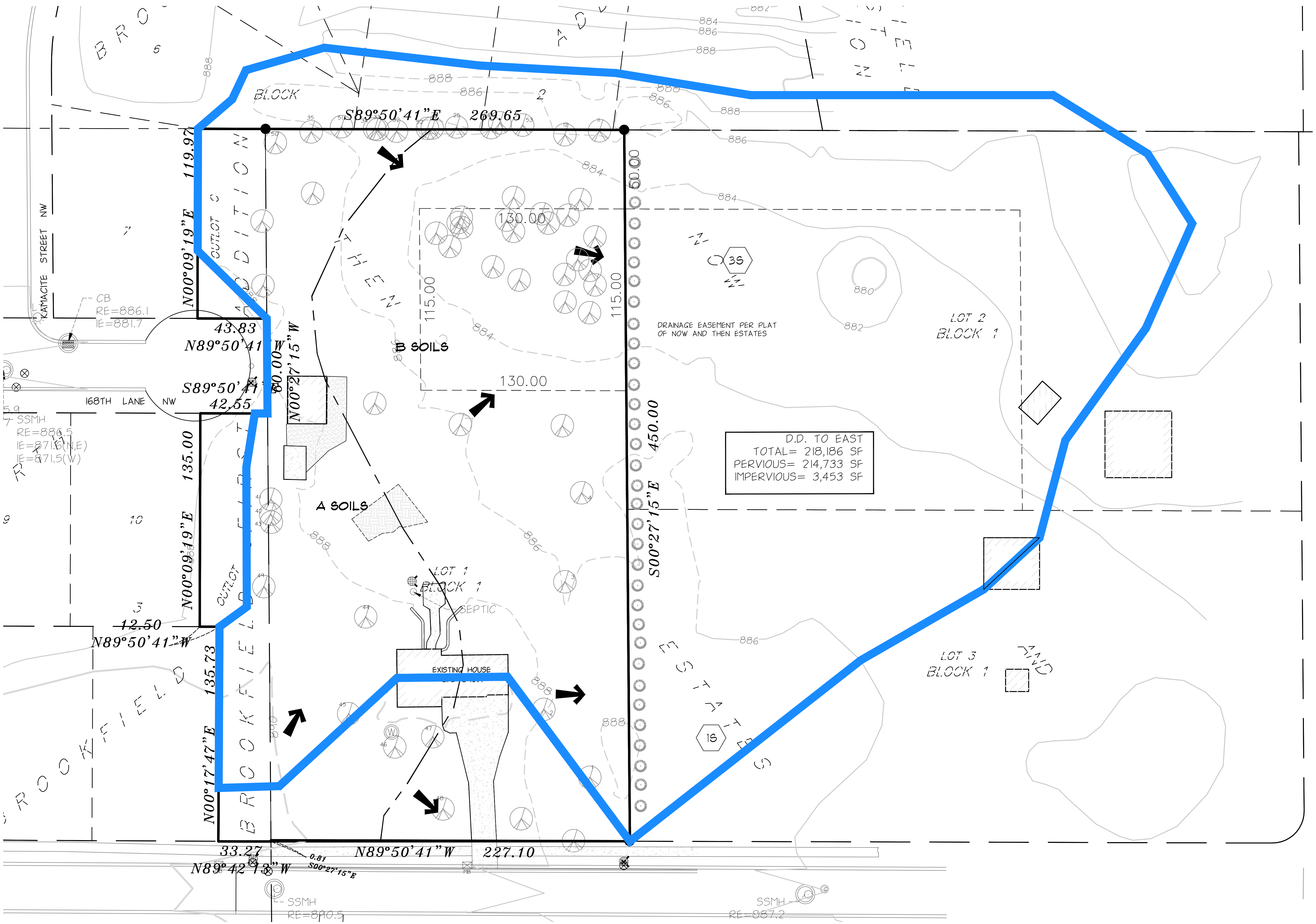
We appreciate the City reviewing this information and supporting the vacation of the existing easement. Please feel free to contact me with any questions or concerns.

Sincerely,

Reid Schulz
Project Lead

COLE ADDITION

RAMSEY, MN



S89°50'41"E 269.65
N00°09'19"E 119.97
43.83
N89°50'41"W
S89°50'41"E
42.55
N00°27'15"W
60.00
135.00
N00°09'19"E
12.50
N89°50'41"W
135.73
N00°17'47"E
33.27
N89°42'13"W
0.81
S00°27'15"E
N89°50'41"W 227.10
S00°27'15"E
450.00
60.00
130.00
115.00
B SOILS
A SOILS
LOT 1
BLOCK 1
SEPTIC
EXISTING HOUSE
DRAINAGE EASEMENT PER PLAT
OF NOW AND THEN ESTATES
D.D. TO EAST
TOTAL= 218,186 SF
PERVIOUS= 214,733 SF
IMPERVIOUS= 3,453 SF
LOT 2
BLOCK 1
LOT 3
BLOCK 1
KAMACITE STREET NW
168TH LANE NW
CB
RE=886.1
IE=881.7
SSMH
RE=886.5
IE=871.6(N,E)
IE=871.5(W)
SSMH
RE=890.5
SSMH
RE=887.2
OUTLOT
NORTH
0
60

L A N D F O R M

From Site to Finish

EXISTING DRAINAGE MAP - WETLAND

06-08-2017

PAGE No.

COLE ADDITION
RAMSEY, MN

3S: TO INFILTRATION A
TOTAL= 16,415 SF
PERVIOUS= 12,665 SF
IMPERVIOUS= 3,750 SF

2S: TO WETLAND
TOTAL= 124,016 SF
PERVIOUS= 123,046 SF
IMPERVIOUS=970 SF

4S: TO INFILTRATION B
TOTAL= 32,101 SF
PERVIOUS= 25,986 SF
IMPERVIOUS= 6,115 SF

INFILTRATION BASIN A
BTM=883.0
HWL=884.36
OUTLET=884.2

INFILTRATION BASIN B
BTM=884.3
HWL=885.67
OUTLET=885.5
INFIL.VOL.=2,591 CF

DRAINAGE EASEMENT PER PLAT OF NOW AND THEN ESTATES

KAMACITE STREET NW

168TH LANE NW

168TH AVENUE NW

BROOKFIELD

B SOILS

A SOILS

LOT 2 BLOCK 1

LOT 1 BLOCK 1

LOT 3 BLOCK 1

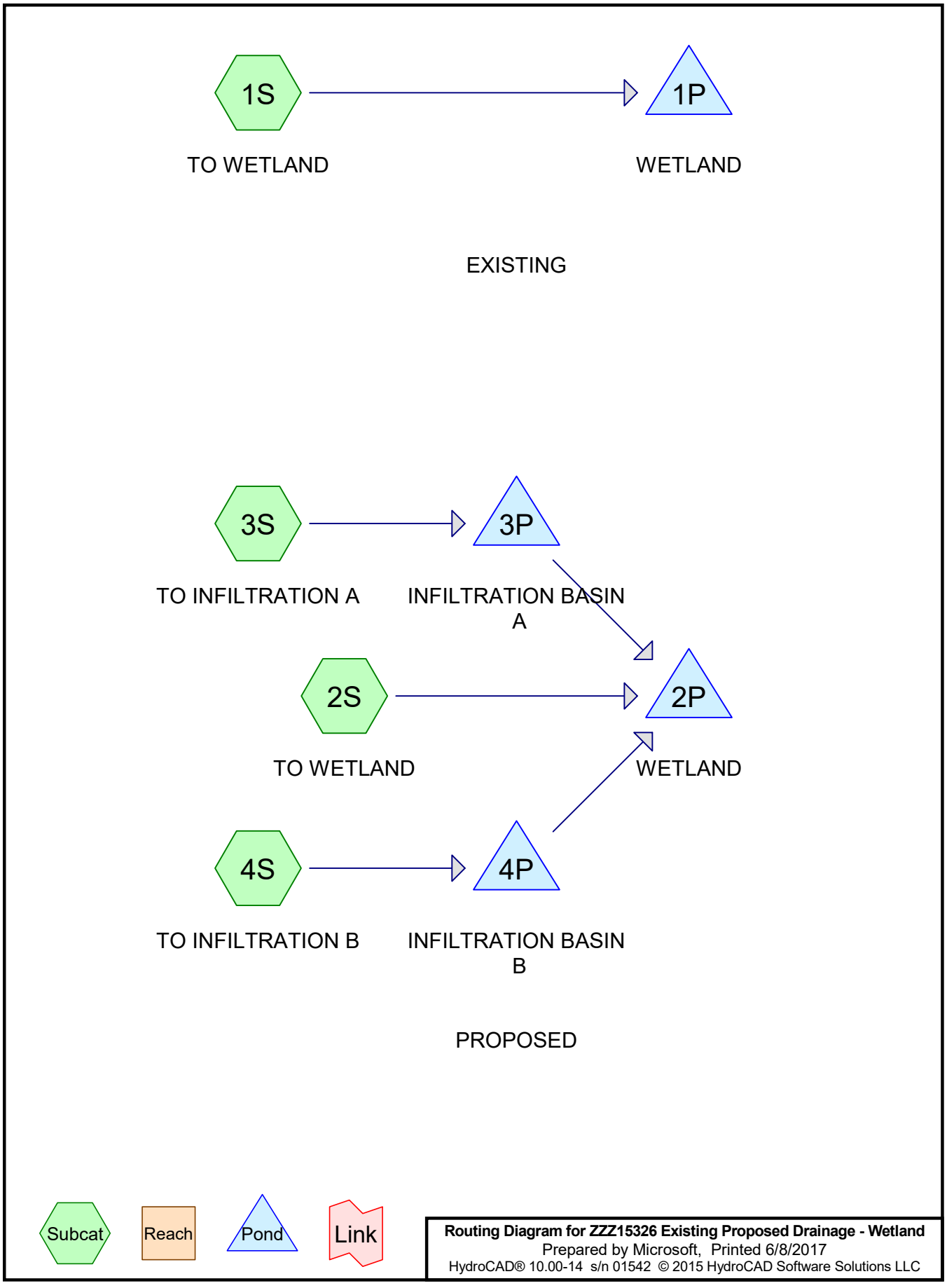
NORTH

0 60

LANDFORM
From Site to Finish

PROPOSED DRAINAGE MAP - WETLAND

06-08-2017



Routing Diagram for ZZZ15326 Existing Proposed Drainage - Wetland
Prepared by Microsoft, Printed 6/8/2017

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.995	49	50-75% Grass cover, Fair, HSG A (1S)
6.759	69	50-75% Grass cover, Fair, HSG B (1S, 2S)
0.390	39	>75% Grass cover, Good, HSG A (3S, 4S)
0.497	61	>75% Grass cover, Good, HSG B (3S, 4S)
0.328	98	Paved parking, HSG B (1S, 2S, 3S, 4S)
8.970	**66**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.385	HSG A	1S, 3S, 4S
7.584	HSG B	1S, 2S, 3S, 4S
0.000	HSG C	
0.000	HSG D	
0.000	Other	
8.970		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.995	6.759	0.000	0.000	0.000	7.754	50-75% Grass cover, Fair	1S, 2S
0.390	0.497	0.000	0.000	0.000	0.887	>75% Grass cover, Good	3S, 4S
0.000	0.328	0.000	0.000	0.000	0.328	Paved parking	1S, 2S, 3S, 4S
1.385	**7.584**	**0.000**	**0.000**	**0.000**	**8.970**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: TO WETLAND Runoff Area=218,186 sf 1.58% Impervious Runoff Depth=0.48"
Tc=10.0 min CN=65/98 Runoff=2.92 cfs 0.200 af

Subcatchment 2S: TO WETLAND Runoff Area=124,016 sf 0.78% Impervious Runoff Depth=0.61"
Tc=10.0 min CN=69/98 Runoff=2.39 cfs 0.145 af

Subcatchment 3S: TO INFILTRATION A Runoff Area=16,415 sf 22.84% Impervious Runoff Depth=0.68"
Flow Length=120' Slope=0.0230 '/' Tc=11.4 min CN=52/98 Runoff=0.29 cfs 0.021 af

Subcatchment 4S: TO INFILTRATION B Runoff Area=32,101 sf 19.05% Impervious Runoff Depth=0.57"
Flow Length=100' Slope=0.0400 '/' Tc=7.9 min CN=51/98 Runoff=0.53 cfs 0.035 af

Pond 1P: WETLAND Peak Elev=882.36' Storage=4,412 cf Inflow=2.92 cfs 0.200 af
Discarded=0.13 cfs 0.200 af Primary=0.00 cfs 0.000 af Outflow=0.13 cfs 0.200 af

Pond 2P: WETLAND Peak Elev=882.22' Storage=3,557 cf Inflow=2.39 cfs 0.148 af
Discarded=0.09 cfs 0.148 af Primary=0.00 cfs 0.000 af Outflow=0.09 cfs 0.148 af

Pond 3P: INFILTRATION BASIN A Peak Elev=884.21' Storage=567 cf Inflow=0.29 cfs 0.021 af
Discarded=0.00 cfs 0.016 af Primary=0.02 cfs 0.003 af Outflow=0.02 cfs 0.019 af

Pond 4P: INFILTRATION BASIN B Peak Elev=884.99' Storage=1,255 cf Inflow=0.53 cfs 0.035 af
Discarded=0.01 cfs 0.023 af Primary=0.00 cfs 0.000 af Outflow=0.01 cfs 0.023 af

Total Runoff Area = 8.970 ac Runoff Volume = 0.401 af Average Runoff Depth = 0.54"
96.34% Pervious = 8.642 ac 3.66% Impervious = 0.328 ac

Summary for Subcatchment 1S: TO WETLAND

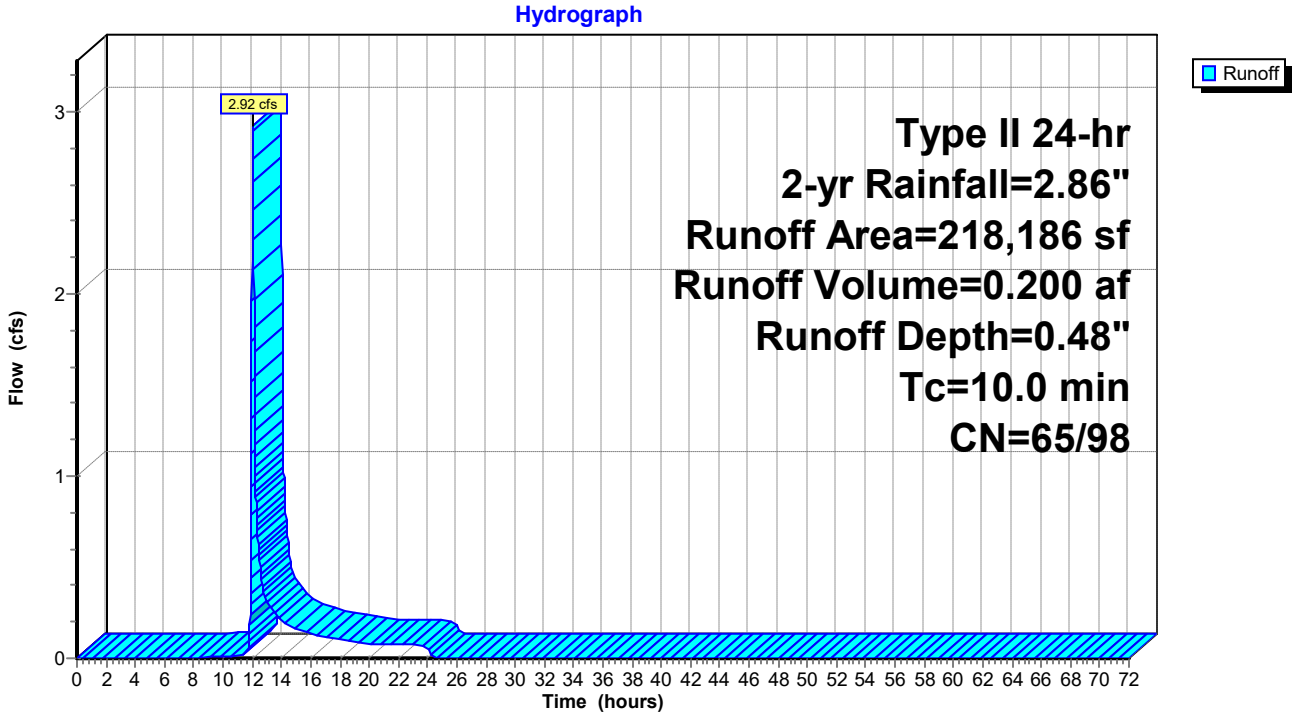
Runoff = 2.92 cfs @ 12.04 hrs, Volume= 0.200 af, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.86"

Area (sf)	CN	Description
3,453	98	Paved parking, HSG B
43,348	49	50-75% Grass cover, Fair, HSG A
171,385	69	50-75% Grass cover, Fair, HSG B
218,186	65	Weighted Average
214,733	65	98.42% Pervious Area
3,453	98	1.58% Impervious Area

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

Subcatchment 1S: TO WETLAND



Summary for Subcatchment 2S: TO WETLAND

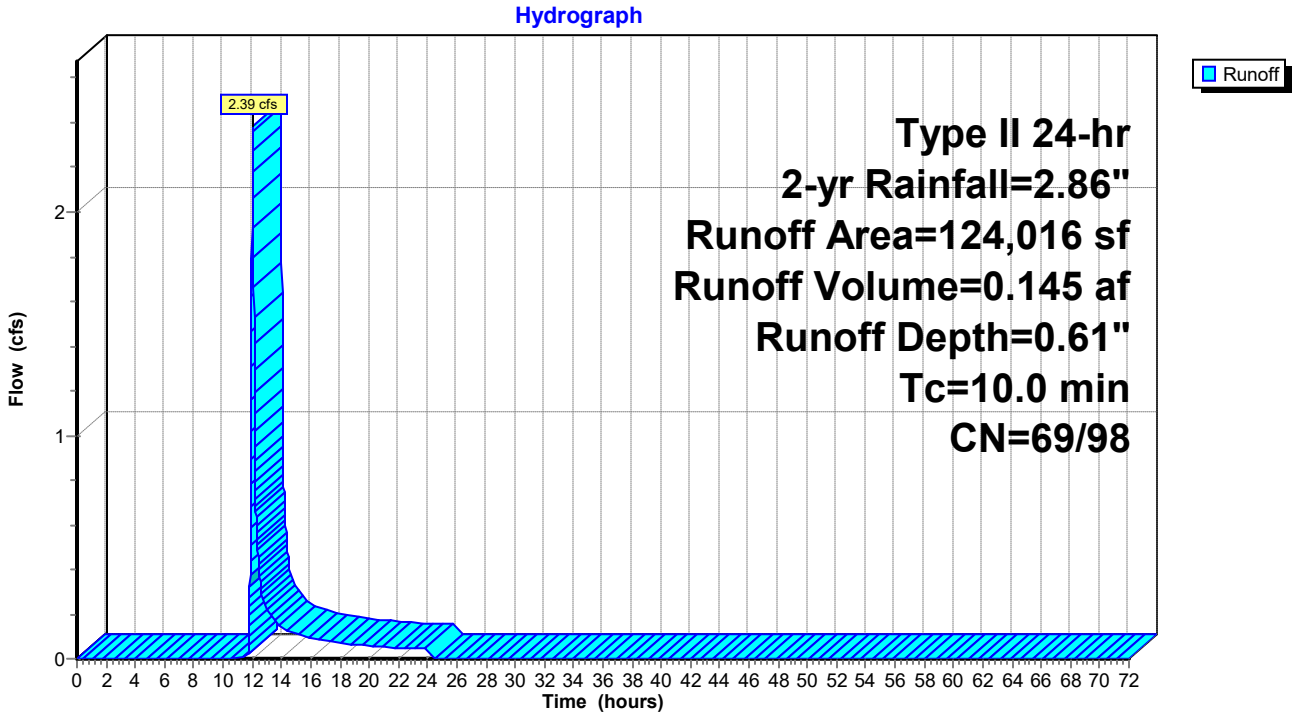
Runoff = 2.39 cfs @ 12.03 hrs, Volume= 0.145 af, Depth= 0.61"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.86"

Area (sf)	CN	Description
970	98	Paved parking, HSG B
123,046	69	50-75% Grass cover, Fair, HSG B
124,016	69	Weighted Average
123,046	69	99.22% Pervious Area
970	98	0.78% Impervious Area

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

Subcatchment 2S: TO WETLAND



Summary for Subcatchment 3S: TO INFILTRATION A

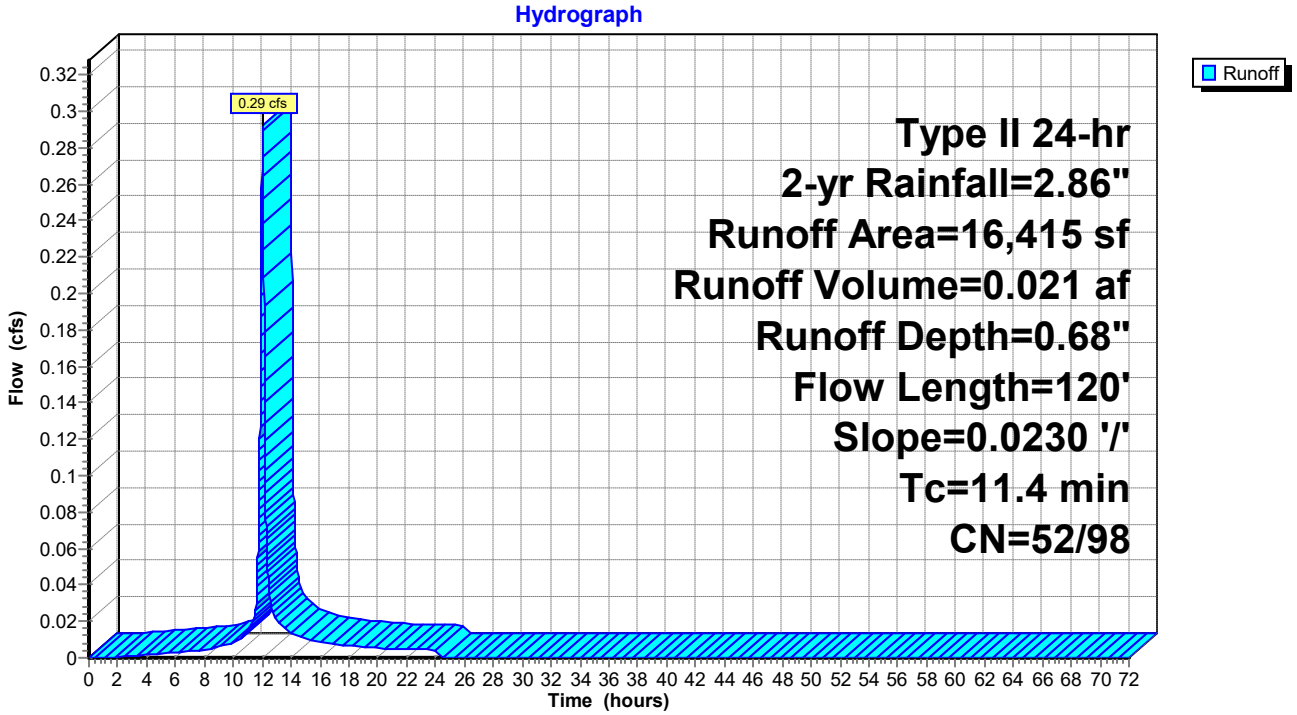
Runoff = 0.29 cfs @ 12.02 hrs, Volume= 0.021 af, Depth= 0.68"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.86"

Area (sf)	CN	Description
3,750	98	Paved parking, HSG B
7,665	61	>75% Grass cover, Good, HSG B
5,000	39	>75% Grass cover, Good, HSG A
16,415	63	Weighted Average
12,665	52	77.16% Pervious Area
3,750	98	22.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	120	0.0230	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.85"

Subcatchment 3S: TO INFILTRATION A



Summary for Subcatchment 4S: TO INFILTRATION B

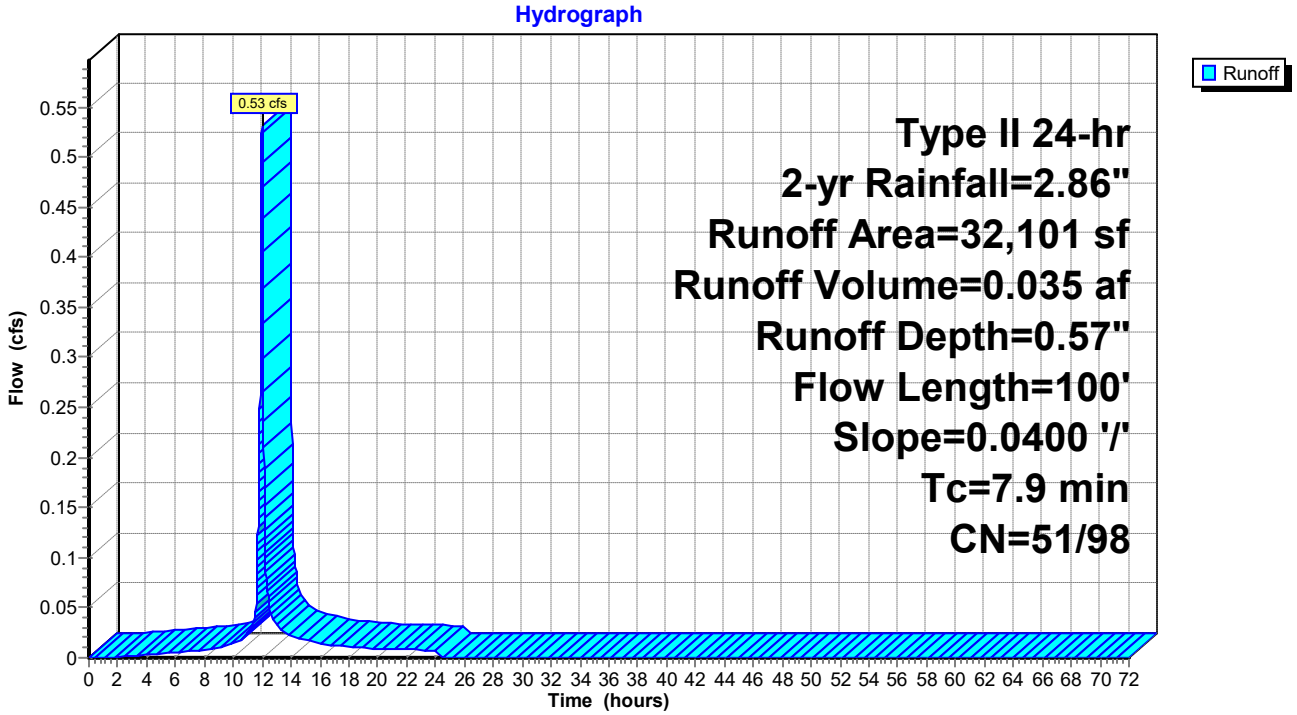
Runoff = 0.53 cfs @ 11.99 hrs, Volume= 0.035 af, Depth= 0.57"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.86"

Area (sf)	CN	Description
6,115	98	Paved parking, HSG B
12,000	39	>75% Grass cover, Good, HSG A
13,986	61	>75% Grass cover, Good, HSG B
32,101	60	Weighted Average
25,986	51	80.95% Pervious Area
6,115	98	19.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	100	0.0400	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.85"

Subcatchment 4S: TO INFILTRATION B



Summary for Pond 1P: WETLAND

Inflow Area = 5.009 ac, 1.58% Impervious, Inflow Depth = 0.48" for 2-yr event
Inflow = 2.92 cfs @ 12.04 hrs, Volume= 0.200 af
Outflow = 0.13 cfs @ 16.46 hrs, Volume= 0.200 af, Atten= 96%, Lag= 265.1 min
Discarded = 0.13 cfs @ 16.46 hrs, Volume= 0.200 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 882.36' @ 16.46 hrs Surf.Area= 6,779 sf Storage= 4,412 cf

Plug-Flow detention time= 633.8 min calculated for 0.200 af (100% of inflow)
Center-of-Mass det. time= 634.0 min (1,530.2 - 896.2)

Volume	Invert	Avail.Storage	Storage Description
#1	880.00'	40,401 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

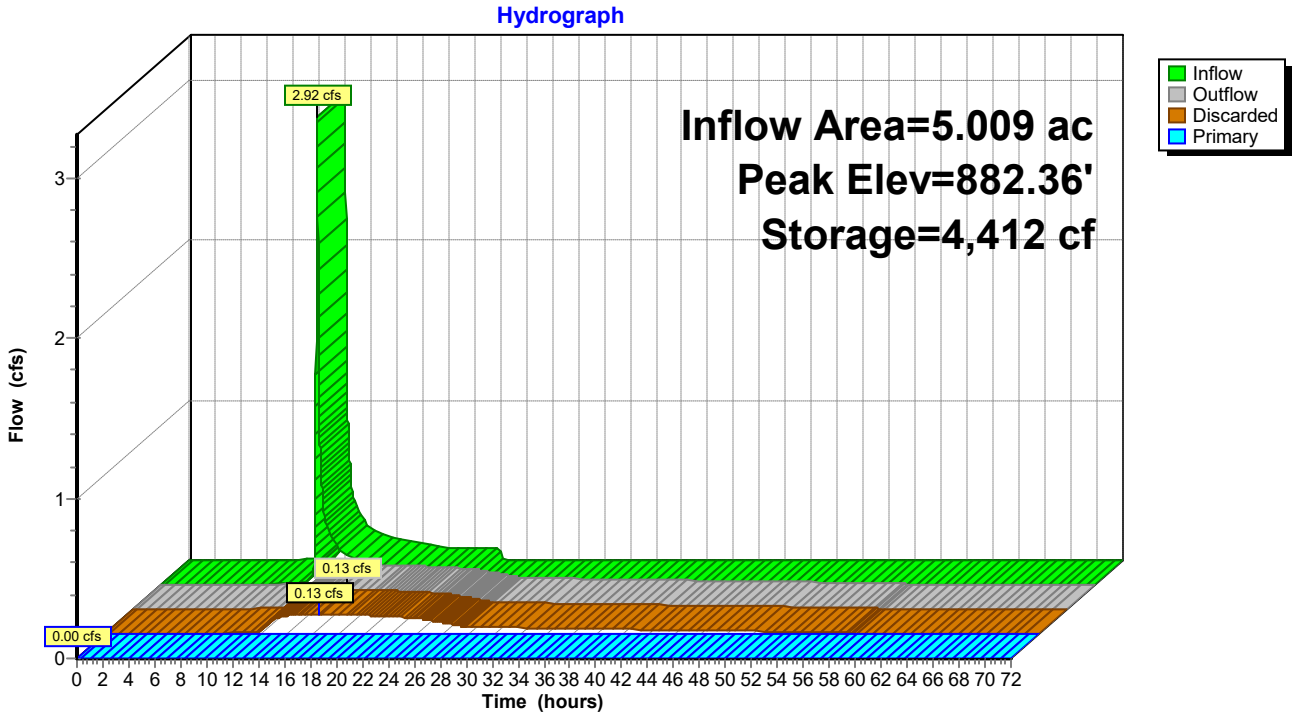
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
880.00	372	0	0
882.00	2,380	2,752	2,752
883.00	14,516	8,448	11,200
884.00	43,886	29,201	40,401

Device	Routing	Invert	Outlet Devices
#1	Discarded	880.00'	**0.800 in/hr Exfiltration over Surface area**
#2	Primary	883.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)**
			Head (feet) 0.00 0.50
			Width (feet) 0.00 20.00

Discarded OutFlow Max=0.13 cfs @ 16.46 hrs HW=882.36' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=880.00' (Free Discharge)
↑—**2=Custom Weir/Orifice** (Controls 0.00 cfs)

Pond 1P: WETLAND



Summary for Pond 2P: WETLAND

Inflow Area = 3.961 ac, 6.28% Impervious, Inflow Depth = 0.45" for 2-yr event
Inflow = 2.39 cfs @ 12.03 hrs, Volume= 0.148 af
Outflow = 0.09 cfs @ 16.26 hrs, Volume= 0.148 af, Atten= 96%, Lag= 253.5 min
Discarded = 0.09 cfs @ 16.26 hrs, Volume= 0.148 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 882.22' @ 16.26 hrs Surf.Area= 4,896 sf Storage= 3,557 cf

Plug-Flow detention time= 696.7 min calculated for 0.148 af (100% of inflow)
Center-of-Mass det. time= 696.9 min (1,582.8 - 885.9)

Volume	Invert	Avail.Storage	Storage Description
#1	880.00'	32,485 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

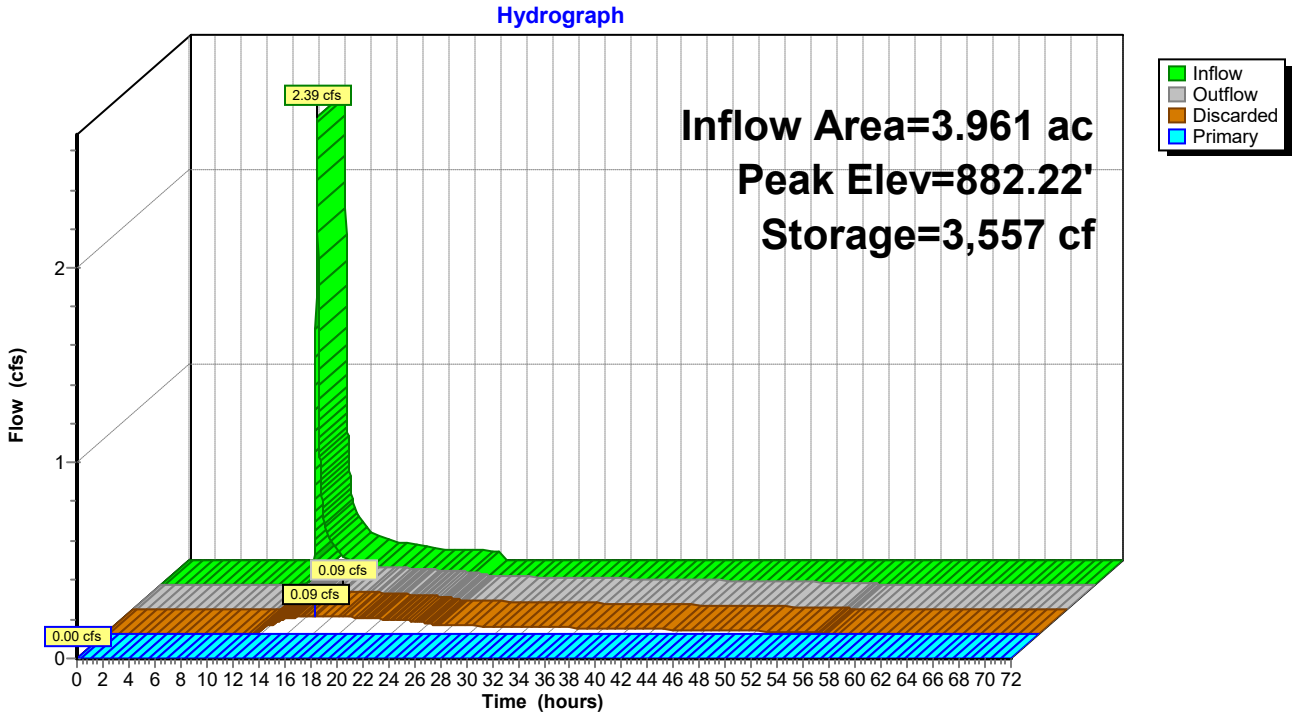
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
880.00	372	0	0
882.00	2,380	2,752	2,752
883.00	13,756	8,068	10,820
884.00	29,573	21,665	32,485

Device	Routing	Invert	Outlet Devices
#1	Discarded	880.00'	**0.800 in/hr Exfiltration over Surface area**
#2	Primary	883.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)**
			Head (feet) 0.00 0.50
			Width (feet) 0.00 20.00

Discarded OutFlow Max=0.09 cfs @ 16.26 hrs HW=882.22' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=880.00' (Free Discharge)
↑—**2=Custom Weir/Orifice** (Controls 0.00 cfs)

Pond 2P: WETLAND



Summary for Pond 3P: INFILTRATION BASIN A

Inflow Area = 0.377 ac, 22.84% Impervious, Inflow Depth = 0.68" for 2-yr event
Inflow = 0.29 cfs @ 12.02 hrs, Volume= 0.021 af
Outflow = 0.02 cfs @ 12.96 hrs, Volume= 0.019 af, Atten= 93%, Lag= 56.4 min
Discarded = 0.00 cfs @ 12.76 hrs, Volume= 0.016 af
Primary = 0.02 cfs @ 12.96 hrs, Volume= 0.003 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 884.21' @ 12.96 hrs Surf.Area= 803 sf Storage= 567 cf

Plug-Flow detention time= 1,162.8 min calculated for 0.019 af (90% of inflow)
Center-of-Mass det. time= 1,109.0 min (1,900.2 - 791.2)

Volume	Invert	Avail.Storage	Storage Description
#1	883.00'	3,253 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

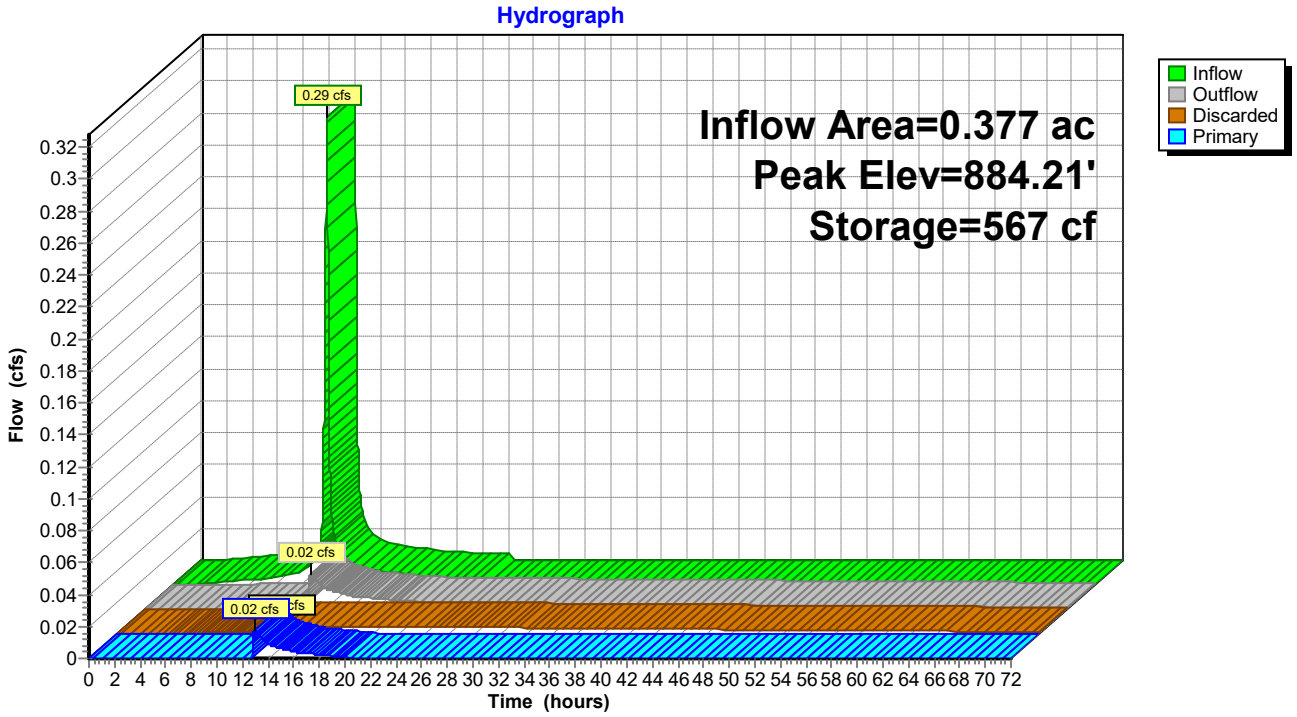
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
883.00	155	0	0
884.00	675	415	415
885.00	1,300	988	1,403
886.00	2,400	1,850	3,253

Device	Routing	Invert	Outlet Devices
#1	Primary	884.20'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.80 Width (feet) 6.00 10.00
#2	Discarded	883.00'	**0.300 in/hr Exfiltration over Surface area from 883.00' - 884.20'** Excluded Surface area = 155 sf

Discarded OutFlow Max=0.00 cfs @ 12.76 hrs HW=884.20' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.01 cfs @ 12.96 hrs HW=884.21' (Free Discharge)
↑—**1=Custom Weir/Orifice** (Weir Controls 0.01 cfs @ 0.23 fps)

Pond 3P: INFILTRATION BASIN A



Summary for Pond 4P: INFILTRATION BASIN B

Inflow Area = 0.737 ac, 19.05% Impervious, Inflow Depth = 0.57" for 2-yr event
Inflow = 0.53 cfs @ 11.99 hrs, Volume= 0.035 af
Outflow = 0.01 cfs @ 24.08 hrs, Volume= 0.023 af, Atten= 99%, Lag= 725.4 min
Discarded = 0.01 cfs @ 24.08 hrs, Volume= 0.023 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 884.99' @ 24.08 hrs Surf.Area= 2,242 sf Storage= 1,255 cf

Plug-Flow detention time= 1,604.4 min calculated for 0.023 af (66% of inflow)
Center-of-Mass det. time= 1,480.2 min (2,271.6 - 791.4)

Volume	Invert	Avail.Storage	Storage Description
#1	884.30'	8,301 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

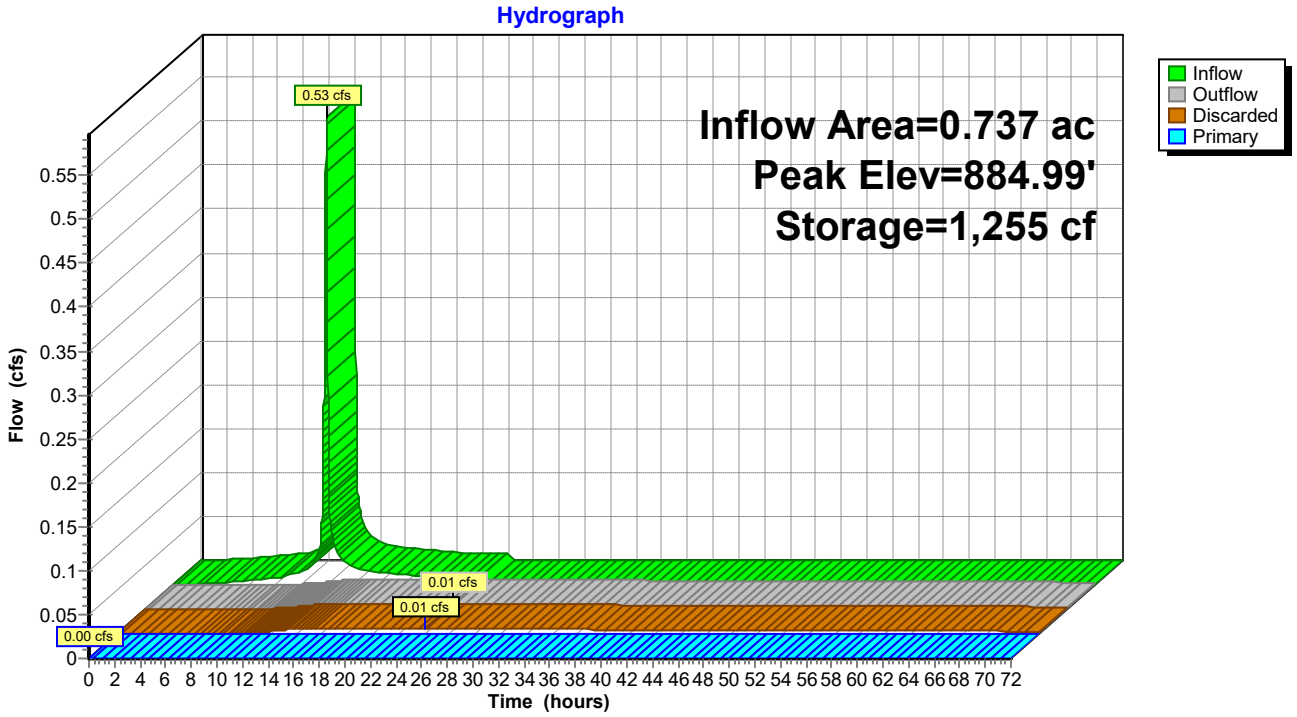
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
884.30	1,375	0	0
885.00	2,250	1,269	1,269
885.50	3,040	1,323	2,591
886.00	3,500	1,635	4,226
887.00	4,650	4,075	8,301

Device	Routing	Invert	Outlet Devices
#1	Primary	885.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.50 Width (feet) 3.00 6.00
#2	Discarded	884.30'	**0.300 in/hr Exfiltration over Surface area from 884.30' - 885.50'** Excluded Surface area = 1,375 sf

Discarded OutFlow Max=0.01 cfs @ 24.08 hrs HW=884.99' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=884.30' (Free Discharge)
↑**1=Custom Weir/Orifice** (Controls 0.00 cfs)

Pond 4P: INFILTRATION BASIN B



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: TO WETLAND Runoff Area=218,186 sf 1.58% Impervious Runoff Depth=1.23"
Tc=10.0 min CN=65/98 Runoff=9.01 cfs 0.512 af

Subcatchment 2S: TO WETLAND Runoff Area=124,016 sf 0.78% Impervious Runoff Depth=1.46"
Tc=10.0 min CN=69/98 Runoff=6.27 cfs 0.346 af

Subcatchment 3S: TO INFILTRATION A Runoff Area=16,415 sf 22.84% Impervious Runoff Depth=1.31"
Flow Length=120' Slope=0.0230 '/' Tc=11.4 min CN=52/98 Runoff=0.56 cfs 0.041 af

Subcatchment 4S: TO INFILTRATION B Runoff Area=32,101 sf 19.05% Impervious Runoff Depth=1.14"
Flow Length=100' Slope=0.0400 '/' Tc=7.9 min CN=51/98 Runoff=1.06 cfs 0.070 af

Pond 1P: WETLAND Peak Elev=883.08' Storage=12,429 cf Inflow=9.01 cfs 0.512 af
Discarded=0.31 cfs 0.512 af Primary=0.00 cfs 0.000 af Outflow=0.31 cfs 0.512 af

Pond 2P: WETLAND Peak Elev=882.87' Storage=9,124 cf Inflow=6.41 cfs 0.369 af
Discarded=0.23 cfs 0.369 af Primary=0.00 cfs 0.000 af Outflow=0.23 cfs 0.369 af

Pond 3P: INFILTRATION BASIN A Peak Elev=884.28' Storage=629 cf Inflow=0.56 cfs 0.041 af
Discarded=0.00 cfs 0.016 af Primary=0.47 cfs 0.023 af Outflow=0.48 cfs 0.039 af

Pond 4P: INFILTRATION BASIN B Peak Elev=885.49' Storage=2,554 cf Inflow=1.06 cfs 0.070 af
Discarded=0.01 cfs 0.044 af Primary=0.00 cfs 0.000 af Outflow=0.01 cfs 0.044 af

Total Runoff Area = 8.970 ac Runoff Volume = 0.969 af Average Runoff Depth = 1.30"
96.34% Pervious = 8.642 ac 3.66% Impervious = 0.328 ac

Summary for Subcatchment 1S: TO WETLAND

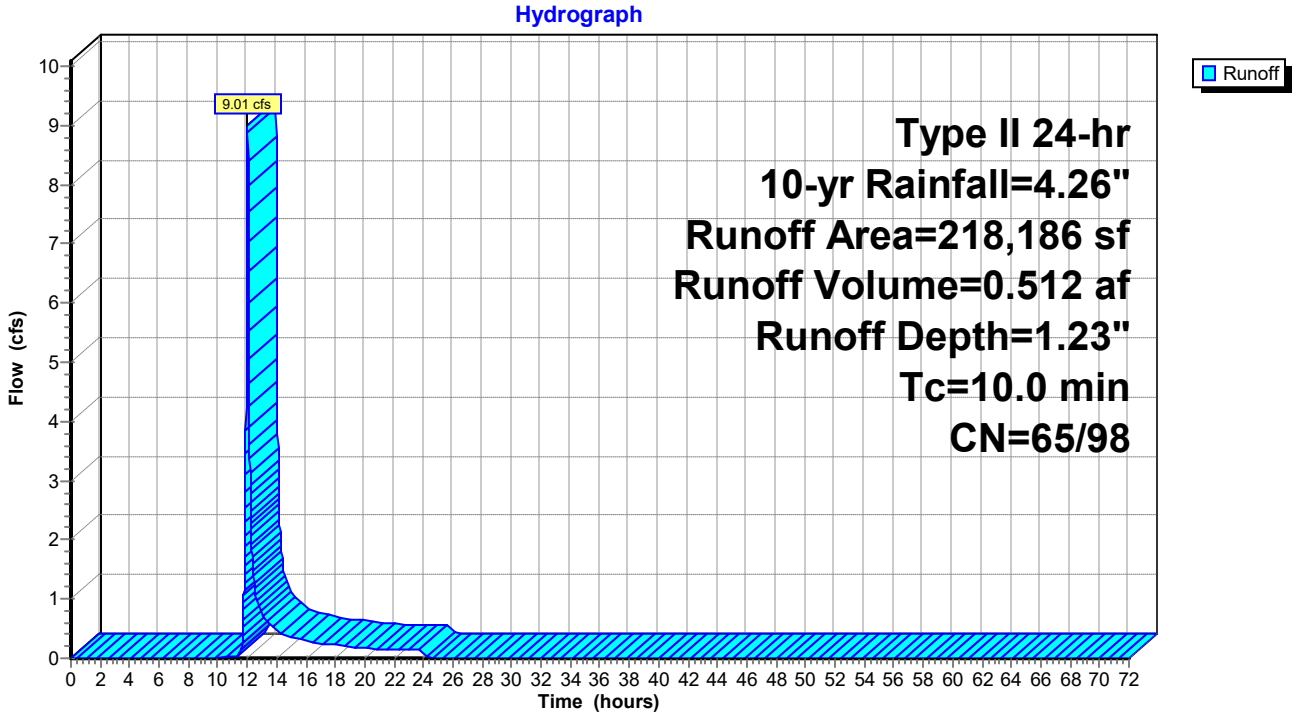
Runoff = 9.01 cfs @ 12.03 hrs, Volume= 0.512 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.26"

Area (sf)	CN	Description
3,453	98	Paved parking, HSG B
43,348	49	50-75% Grass cover, Fair, HSG A
171,385	69	50-75% Grass cover, Fair, HSG B
218,186	65	Weighted Average
214,733	65	98.42% Pervious Area
3,453	98	1.58% Impervious Area

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

Subcatchment 1S: TO WETLAND



Summary for Subcatchment 2S: TO WETLAND

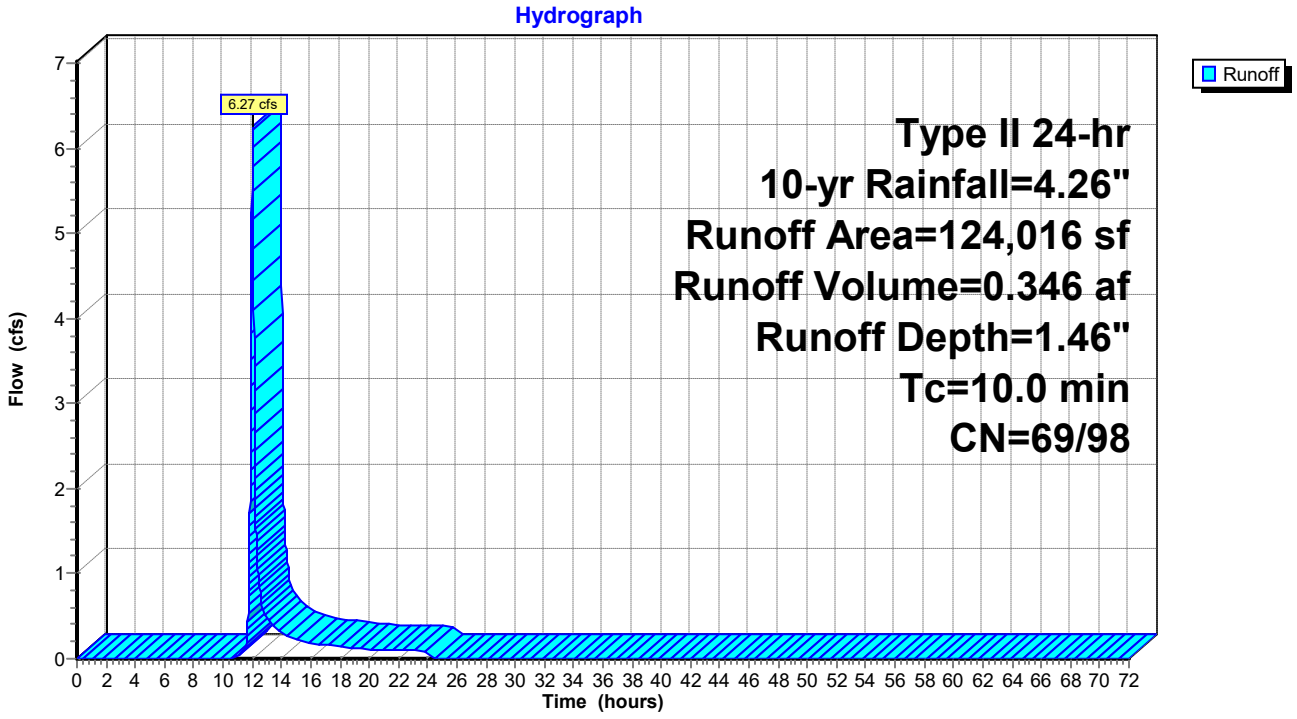
Runoff = 6.27 cfs @ 12.03 hrs, Volume= 0.346 af, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.26"

Area (sf)	CN	Description
970	98	Paved parking, HSG B
123,046	69	50-75% Grass cover, Fair, HSG B
124,016	69	Weighted Average
123,046	69	99.22% Pervious Area
970	98	0.78% Impervious Area

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

Subcatchment 2S: TO WETLAND



Summary for Subcatchment 3S: TO INFILTRATION A

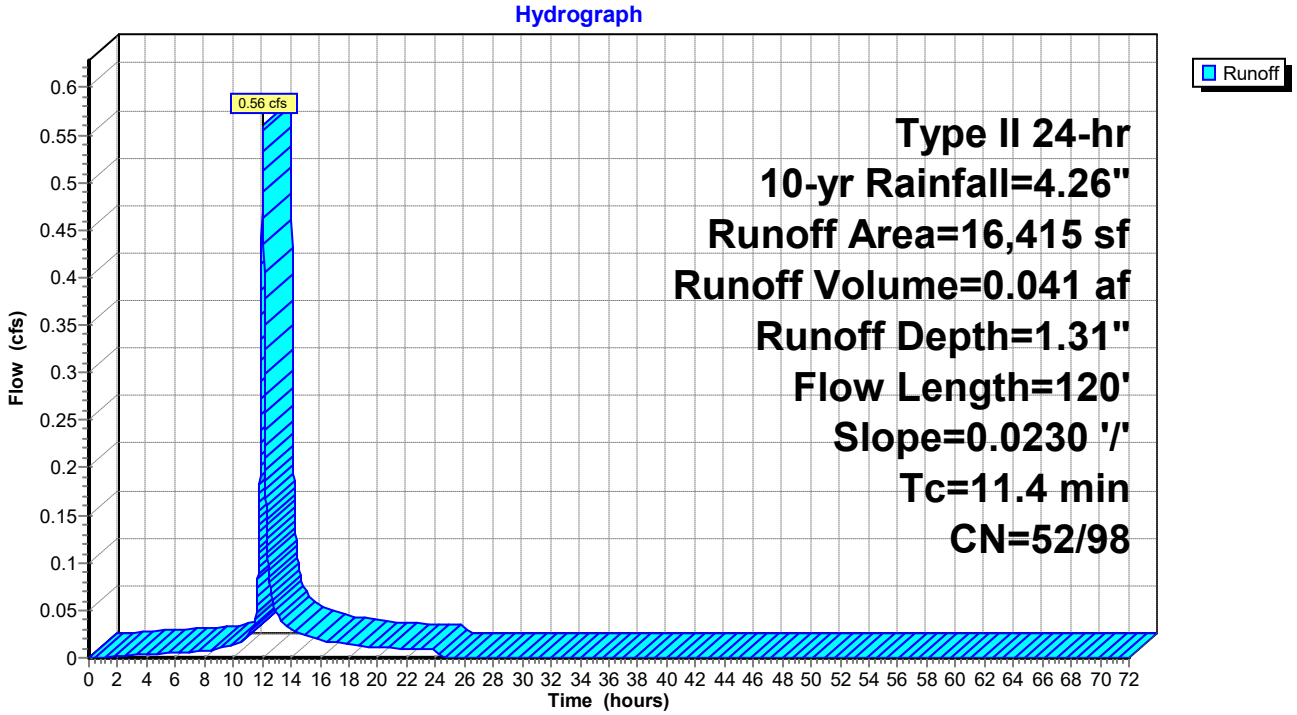
Runoff = 0.56 cfs @ 12.04 hrs, Volume= 0.041 af, Depth= 1.31"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.26"

Area (sf)	CN	Description
3,750	98	Paved parking, HSG B
7,665	61	>75% Grass cover, Good, HSG B
5,000	39	>75% Grass cover, Good, HSG A
16,415	63	Weighted Average
12,665	52	77.16% Pervious Area
3,750	98	22.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	120	0.0230	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.85"

Subcatchment 3S: TO INFILTRATION A



Summary for Subcatchment 4S: TO INFILTRATION B

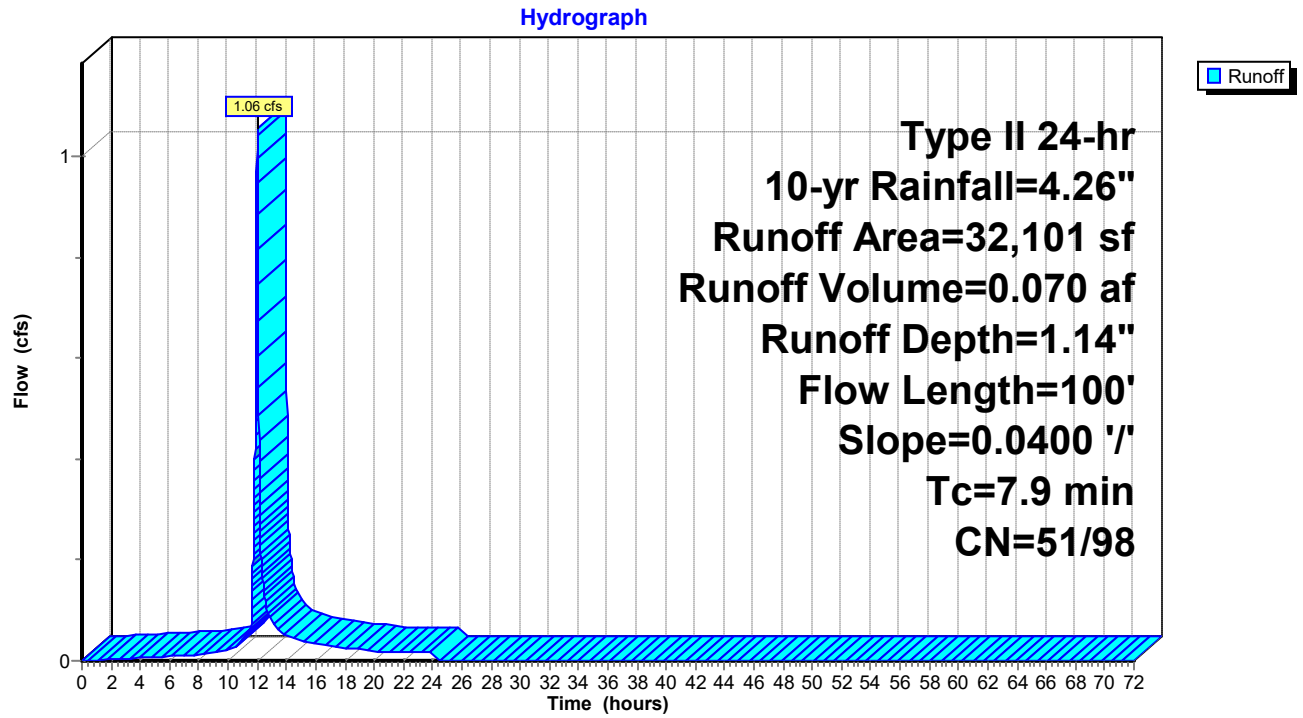
Runoff = 1.06 cfs @ 12.00 hrs, Volume= 0.070 af, Depth= 1.14"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.26"

Area (sf)	CN	Description
6,115	98	Paved parking, HSG B
12,000	39	>75% Grass cover, Good, HSG A
13,986	61	>75% Grass cover, Good, HSG B
32,101	60	Weighted Average
25,986	51	80.95% Pervious Area
6,115	98	19.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	100	0.0400	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.85"

Subcatchment 4S: TO INFILTRATION B



Summary for Pond 1P: WETLAND

Inflow Area = 5.009 ac, 1.58% Impervious, Inflow Depth = 1.23" for 10-yr event
Inflow = 9.01 cfs @ 12.03 hrs, Volume= 0.512 af
Outflow = 0.31 cfs @ 15.72 hrs, Volume= 0.512 af, Atten= 97%, Lag= 221.3 min
Discarded = 0.31 cfs @ 15.72 hrs, Volume= 0.512 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 883.08' @ 15.72 hrs Surf.Area= 16,820 sf Storage= 12,429 cf

Plug-Flow detention time= 654.8 min calculated for 0.512 af (100% of inflow)
Center-of-Mass det. time= 655.1 min (1,520.8 - 865.7)

Volume	Invert	Avail.Storage	Storage Description
#1	880.00'	40,401 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

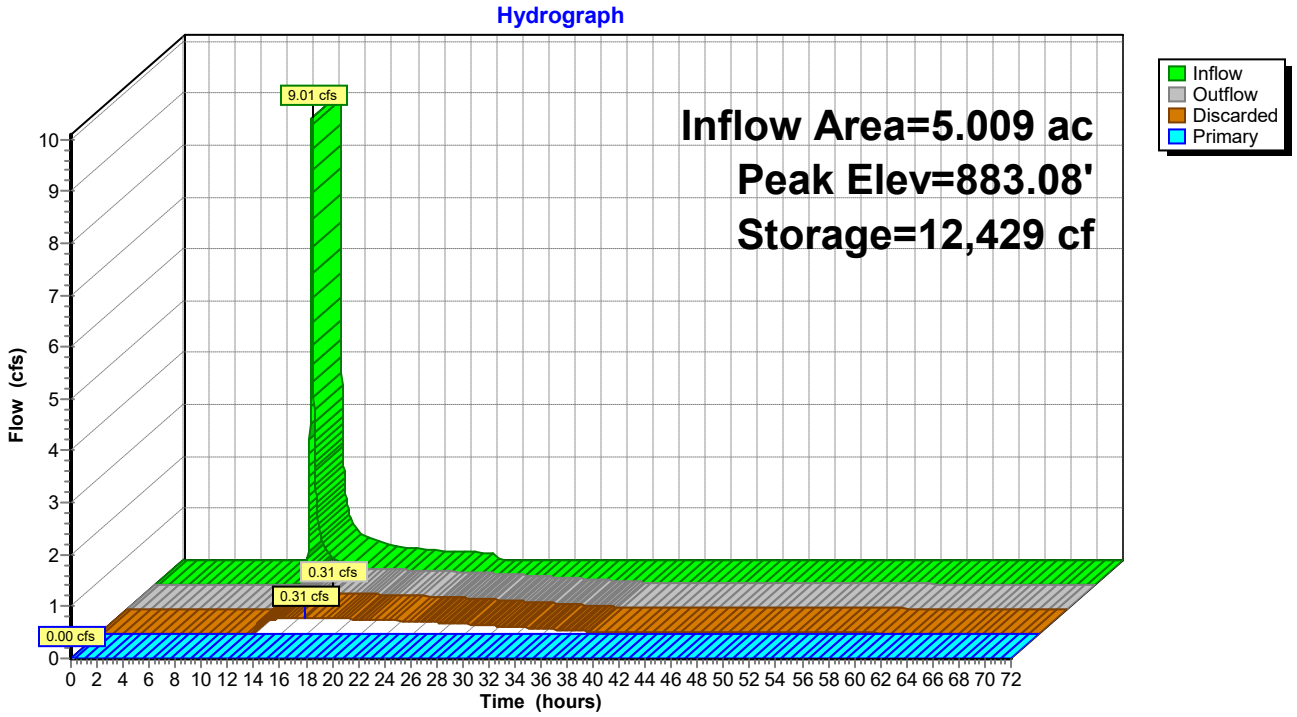
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
880.00	372	0	0
882.00	2,380	2,752	2,752
883.00	14,516	8,448	11,200
884.00	43,886	29,201	40,401

Device	Routing	Invert	Outlet Devices
#1	Discarded	880.00'	**0.800 in/hr Exfiltration over Surface area**
#2	Primary	883.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)**
			Head (feet) 0.00 0.50
			Width (feet) 0.00 20.00

Discarded OutFlow Max=0.31 cfs @ 15.72 hrs HW=883.08' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.31 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=880.00' (Free Discharge)
↑—**2=Custom Weir/Orifice** (Controls 0.00 cfs)

Pond 1P: WETLAND



Summary for Pond 2P: WETLAND

Inflow Area = 3.961 ac, 6.28% Impervious, Inflow Depth = 1.12" for 10-yr event
Inflow = 6.41 cfs @ 12.04 hrs, Volume= 0.369 af
Outflow = 0.23 cfs @ 15.48 hrs, Volume= 0.369 af, Atten= 96%, Lag= 206.5 min
Discarded = 0.23 cfs @ 15.48 hrs, Volume= 0.369 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 882.87' @ 15.48 hrs Surf.Area= 12,273 sf Storage= 9,124 cf

Plug-Flow detention time= 650.2 min calculated for 0.369 af (100% of inflow)
Center-of-Mass det. time= 650.5 min (1,508.5 - 858.0)

Volume	Invert	Avail.Storage	Storage Description
#1	880.00'	32,485 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

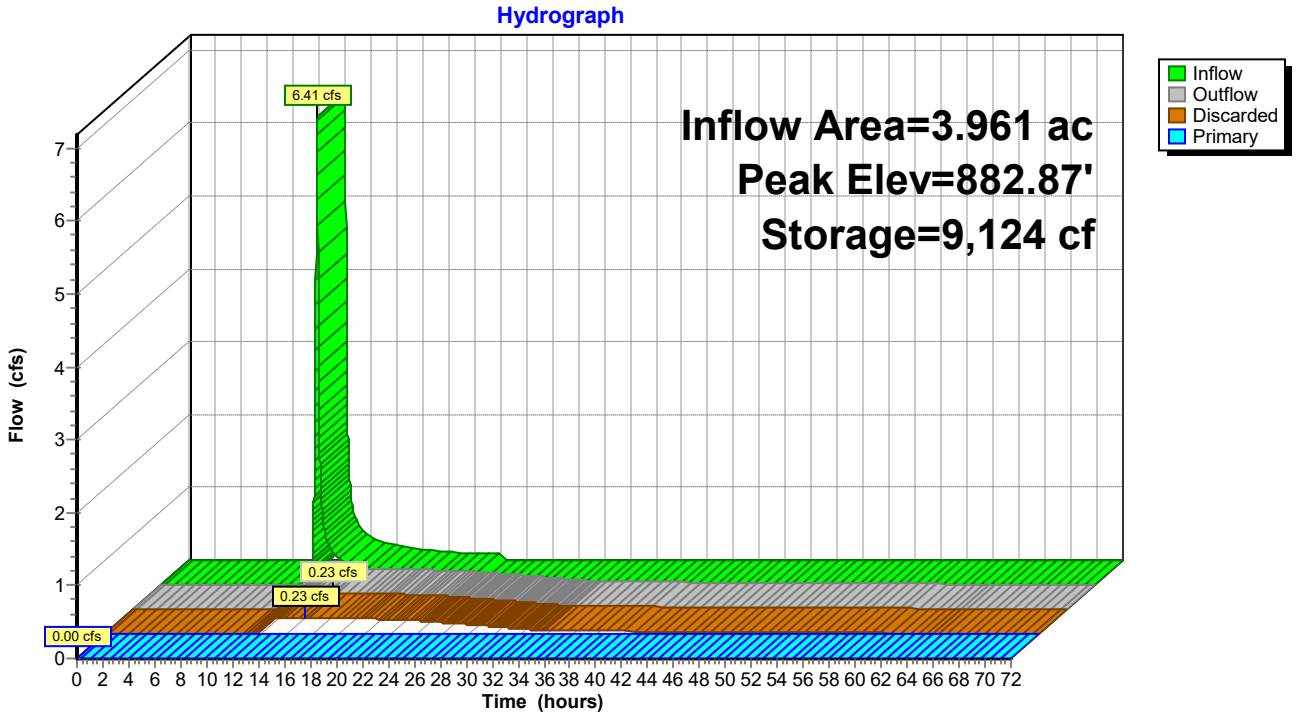
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
880.00	372	0	0
882.00	2,380	2,752	2,752
883.00	13,756	8,068	10,820
884.00	29,573	21,665	32,485

Device	Routing	Invert	Outlet Devices
#1	Discarded	880.00'	**0.800 in/hr Exfiltration over Surface area**
#2	Primary	883.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)**
			Head (feet) 0.00 0.50
			Width (feet) 0.00 20.00

Discarded OutFlow Max=0.23 cfs @ 15.48 hrs HW=882.87' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.23 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=880.00' (Free Discharge)
↑—**2=Custom Weir/Orifice** (Controls 0.00 cfs)

Pond 2P: WETLAND



Summary for Pond 3P: INFILTRATION BASIN A

Inflow Area = 0.377 ac, 22.84% Impervious, Inflow Depth = 1.31" for 10-yr event
Inflow = 0.56 cfs @ 12.04 hrs, Volume= 0.041 af
Outflow = 0.48 cfs @ 12.10 hrs, Volume= 0.039 af, Atten= 15%, Lag= 3.4 min
Discarded = 0.00 cfs @ 12.02 hrs, Volume= 0.016 af
Primary = 0.47 cfs @ 12.10 hrs, Volume= 0.023 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 884.28' @ 12.10 hrs Surf.Area= 851 sf Storage= 629 cf

Plug-Flow detention time= 596.1 min calculated for 0.039 af (95% of inflow)
Center-of-Mass det. time= 565.9 min (1,370.5 - 804.6)

Volume	Invert	Avail.Storage	Storage Description
#1	883.00'	3,253 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

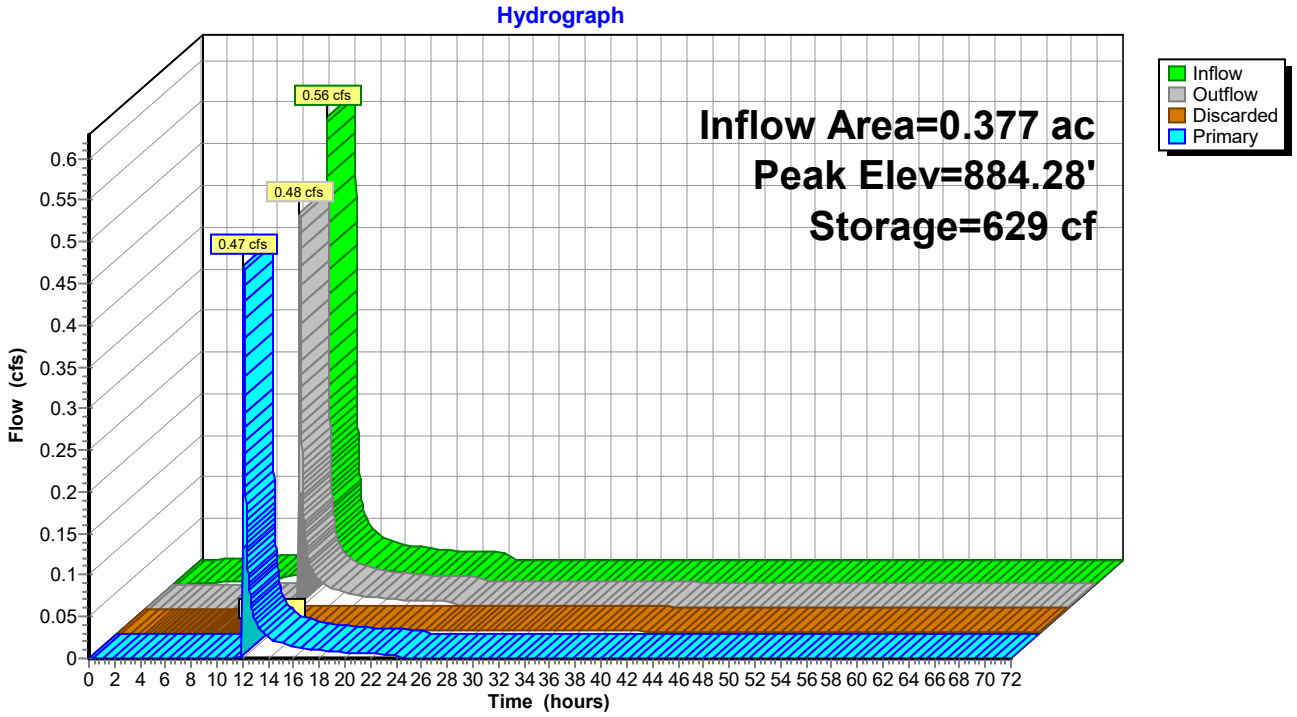
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
883.00	155	0	0
884.00	675	415	415
885.00	1,300	988	1,403
886.00	2,400	1,850	3,253

Device	Routing	Invert	Outlet Devices
#1	Primary	884.20'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.80 Width (feet) 6.00 10.00
#2	Discarded	883.00'	**0.300 in/hr Exfiltration over Surface area from 883.00' - 884.20'** Excluded Surface area = 155 sf

Discarded OutFlow Max=0.00 cfs @ 12.02 hrs HW=884.21' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.46 cfs @ 12.10 hrs HW=884.28' (Free Discharge)
↑—**1=Custom Weir/Orifice** (Weir Controls 0.46 cfs @ 0.93 fps)

Pond 3P: INFILTRATION BASIN A



Summary for Pond 4P: INFILTRATION BASIN B

Inflow Area = 0.737 ac, 19.05% Impervious, Inflow Depth = 1.14" for 10-yr event
Inflow = 1.06 cfs @ 12.00 hrs, Volume= 0.070 af
Outflow = 0.01 cfs @ 24.09 hrs, Volume= 0.044 af, Atten= 99%, Lag= 725.2 min
Discarded = 0.01 cfs @ 24.09 hrs, Volume= 0.044 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 885.49' @ 24.09 hrs Surf.Area= 3,021 sf Storage= 2,554 cf

Plug-Flow detention time= 1,616.0 min calculated for 0.044 af (63% of inflow)
Center-of-Mass det. time= 1,481.4 min (2,290.2 - 808.8)

Volume	Invert	Avail.Storage	Storage Description
#1	884.30'	8,301 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

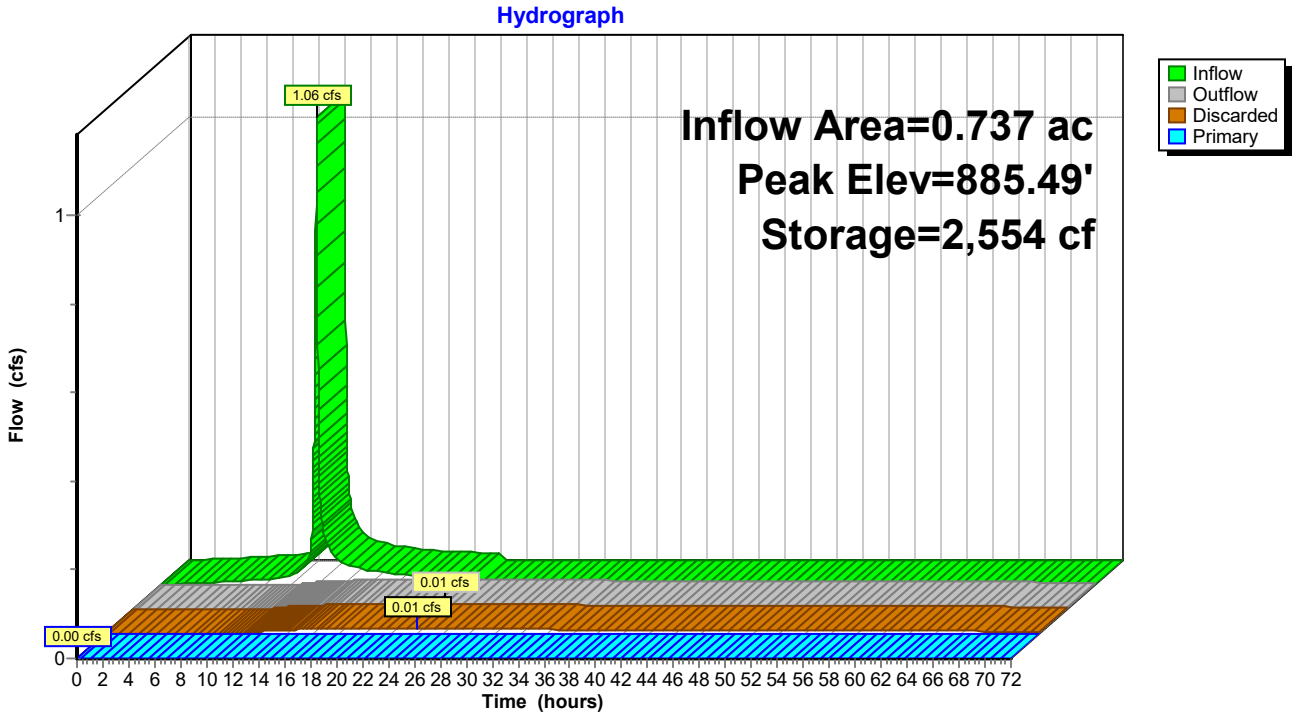
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
884.30	1,375	0	0
885.00	2,250	1,269	1,269
885.50	3,040	1,323	2,591
886.00	3,500	1,635	4,226
887.00	4,650	4,075	8,301

Device	Routing	Invert	Outlet Devices
#1	Primary	885.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.50 Width (feet) 3.00 6.00
#2	Discarded	884.30'	**0.300 in/hr Exfiltration over Surface area from 884.30' - 885.50'** Excluded Surface area = 1,375 sf

Discarded OutFlow Max=0.01 cfs @ 24.09 hrs HW=885.49' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=884.30' (Free Discharge)
↑**1=Custom Weir/Orifice** (Controls 0.00 cfs)

Pond 4P: INFILTRATION BASIN B



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: TO WETLAND Runoff Area=218,186 sf 1.58% Impervious Runoff Depth=3.21"
Tc=10.0 min CN=65/98 Runoff=24.63 cfs 1.339 af

Subcatchment 2S: TO WETLAND Runoff Area=124,016 sf 0.78% Impervious Runoff Depth=3.59"
Tc=10.0 min CN=69/98 Runoff=15.71 cfs 0.851 af

Subcatchment 3S: TO INFILTRATION A Runoff Area=16,415 sf 22.84% Impervious Runoff Depth=3.01"
Flow Length=120' Slope=0.0230 '/' Tc=11.4 min CN=52/98 Runoff=1.48 cfs 0.095 af

Subcatchment 4S: TO INFILTRATION B Runoff Area=32,101 sf 19.05% Impervious Runoff Depth=2.75"
Flow Length=100' Slope=0.0400 '/' Tc=7.9 min CN=51/98 Runoff=3.01 cfs 0.169 af

Pond 1P: WETLAND Peak Elev=883.73' Storage=29,634 cf Inflow=24.63 cfs 1.339 af
Discarded=0.67 cfs 1.055 af Primary=1.35 cfs 0.281 af Outflow=2.01 cfs 1.336 af

Pond 2P: WETLAND Peak Elev=883.68' Storage=23,947 cf Inflow=17.16 cfs 1.023 af
Discarded=0.46 cfs 0.842 af Primary=0.78 cfs 0.178 af Outflow=1.23 cfs 1.020 af

Pond 3P: INFILTRATION BASIN A Peak Elev=884.37' Storage=707 cf Inflow=1.48 cfs 0.095 af
Discarded=0.00 cfs 0.017 af Primary=1.45 cfs 0.076 af Outflow=1.45 cfs 0.092 af

Pond 4P: INFILTRATION BASIN B Peak Elev=885.69' Storage=3,197 cf Inflow=3.01 cfs 0.169 af
Discarded=0.01 cfs 0.046 af Primary=0.97 cfs 0.096 af Outflow=0.98 cfs 0.142 af

Total Runoff Area = 8.970 ac Runoff Volume = 2.453 af Average Runoff Depth = 3.28"
96.34% Pervious = 8.642 ac 3.66% Impervious = 0.328 ac

Summary for Subcatchment 1S: TO WETLAND

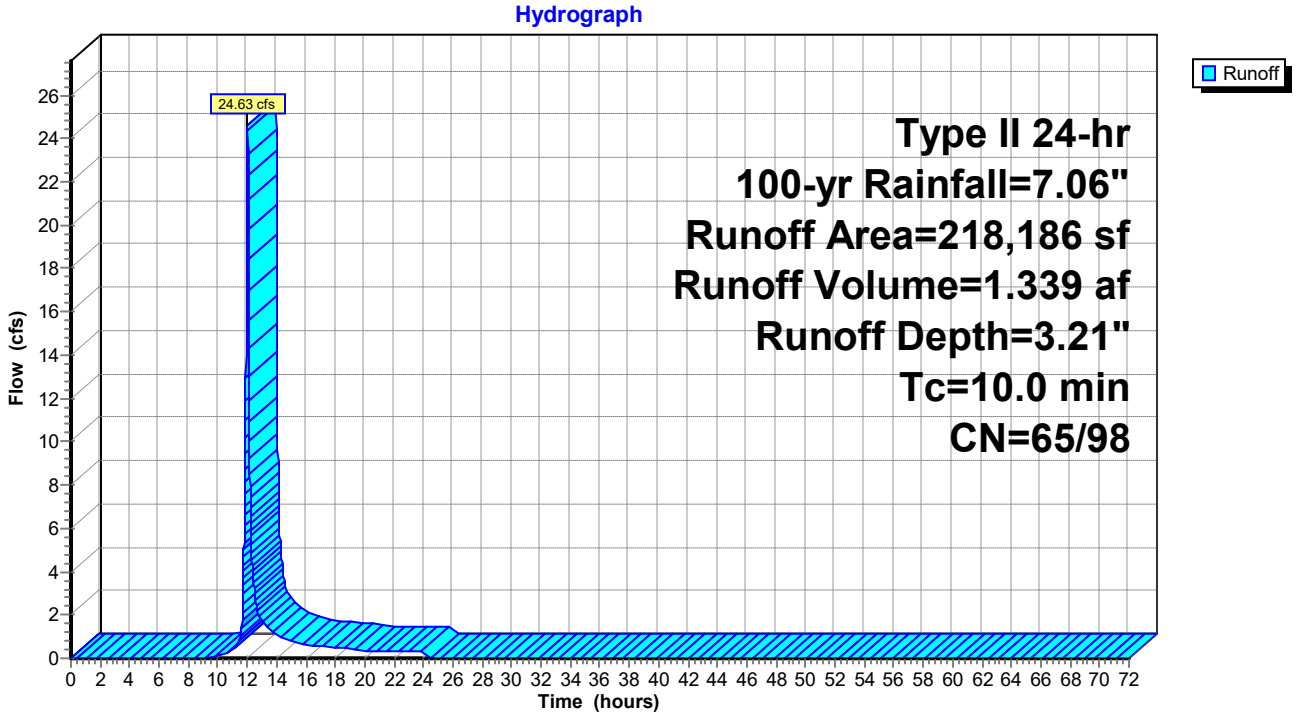
Runoff = 24.63 cfs @ 12.02 hrs, Volume= 1.339 af, Depth= 3.21"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.06"

Area (sf)	CN	Description
3,453	98	Paved parking, HSG B
43,348	49	50-75% Grass cover, Fair, HSG A
171,385	69	50-75% Grass cover, Fair, HSG B
218,186	65	Weighted Average
214,733	65	98.42% Pervious Area
3,453	98	1.58% Impervious Area

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

Subcatchment 1S: TO WETLAND



Summary for Subcatchment 2S: TO WETLAND

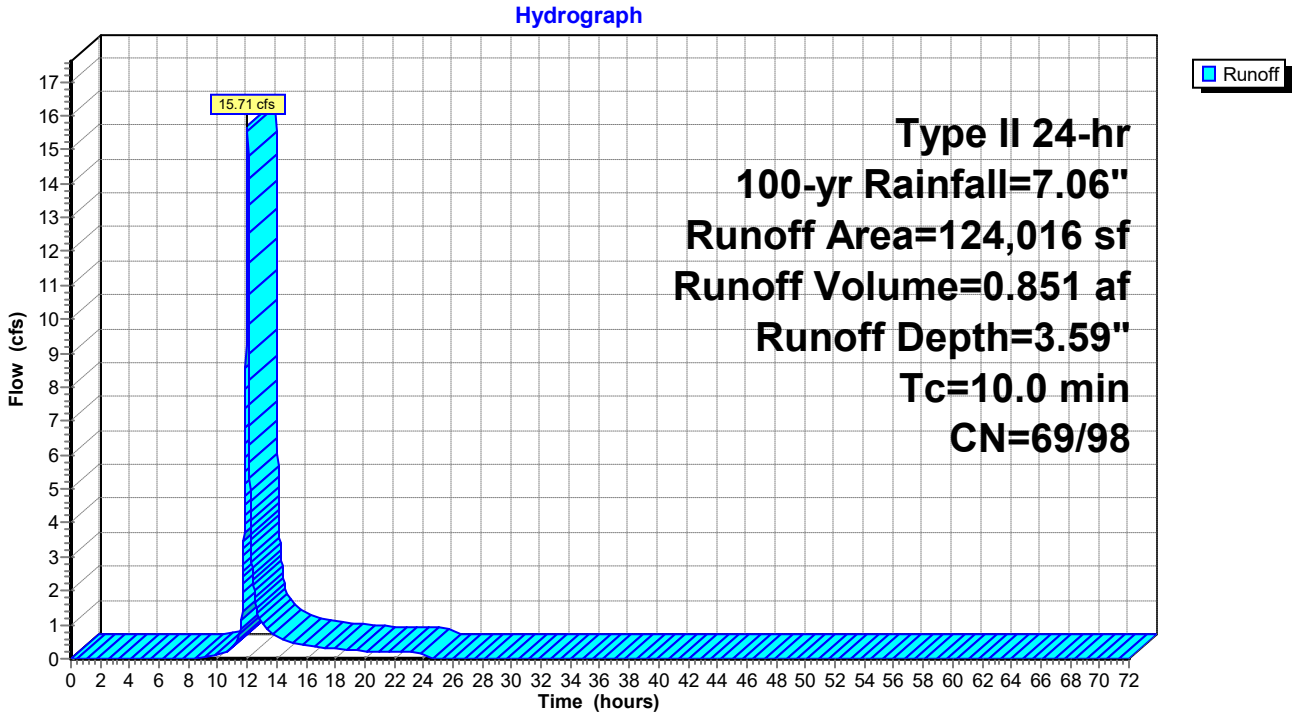
Runoff = 15.71 cfs @ 12.02 hrs, Volume= 0.851 af, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.06"

Area (sf)	CN	Description
970	98	Paved parking, HSG B
123,046	69	50-75% Grass cover, Fair, HSG B
124,016	69	Weighted Average
123,046	69	99.22% Pervious Area
970	98	0.78% Impervious Area

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

Subcatchment 2S: TO WETLAND



Summary for Subcatchment 3S: TO INFILTRATION A

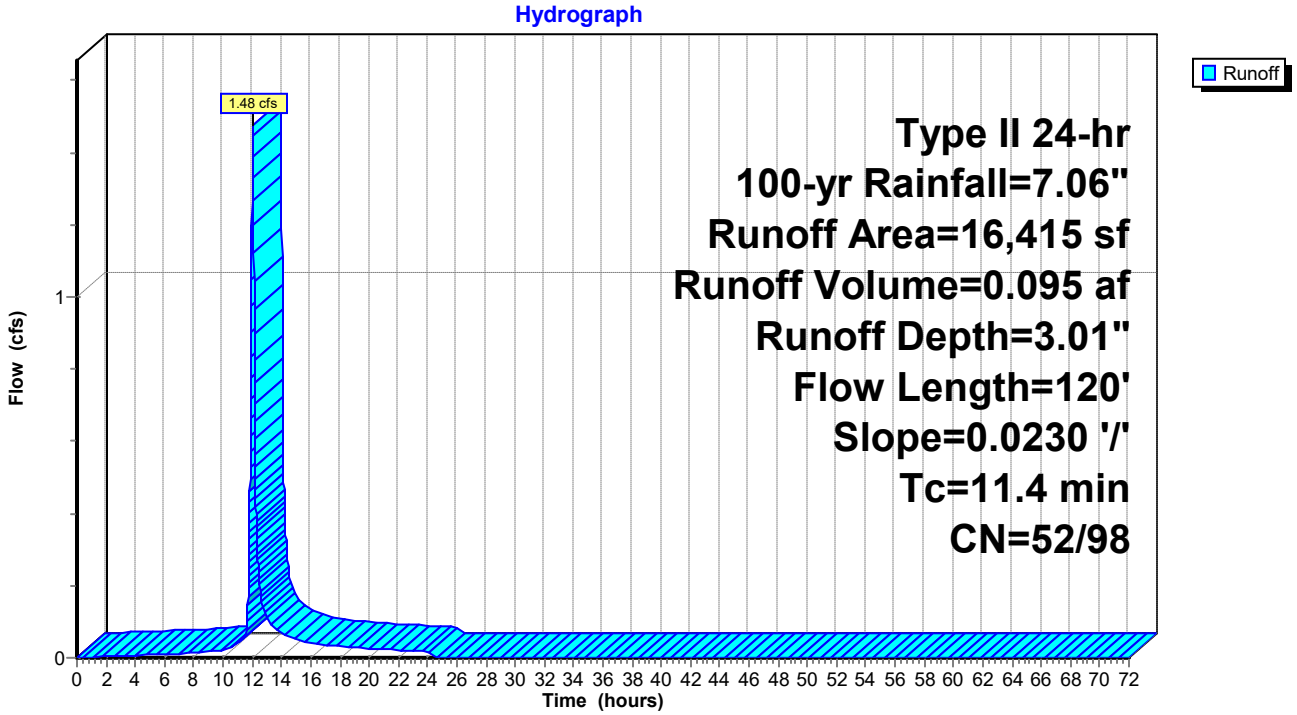
Runoff = 1.48 cfs @ 12.04 hrs, Volume= 0.095 af, Depth= 3.01"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.06"

Area (sf)	CN	Description
3,750	98	Paved parking, HSG B
7,665	61	>75% Grass cover, Good, HSG B
5,000	39	>75% Grass cover, Good, HSG A
16,415	63	Weighted Average
12,665	52	77.16% Pervious Area
3,750	98	22.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	120	0.0230	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.85"

Subcatchment 3S: TO INFILTRATION A



Summary for Subcatchment 4S: TO INFILTRATION B

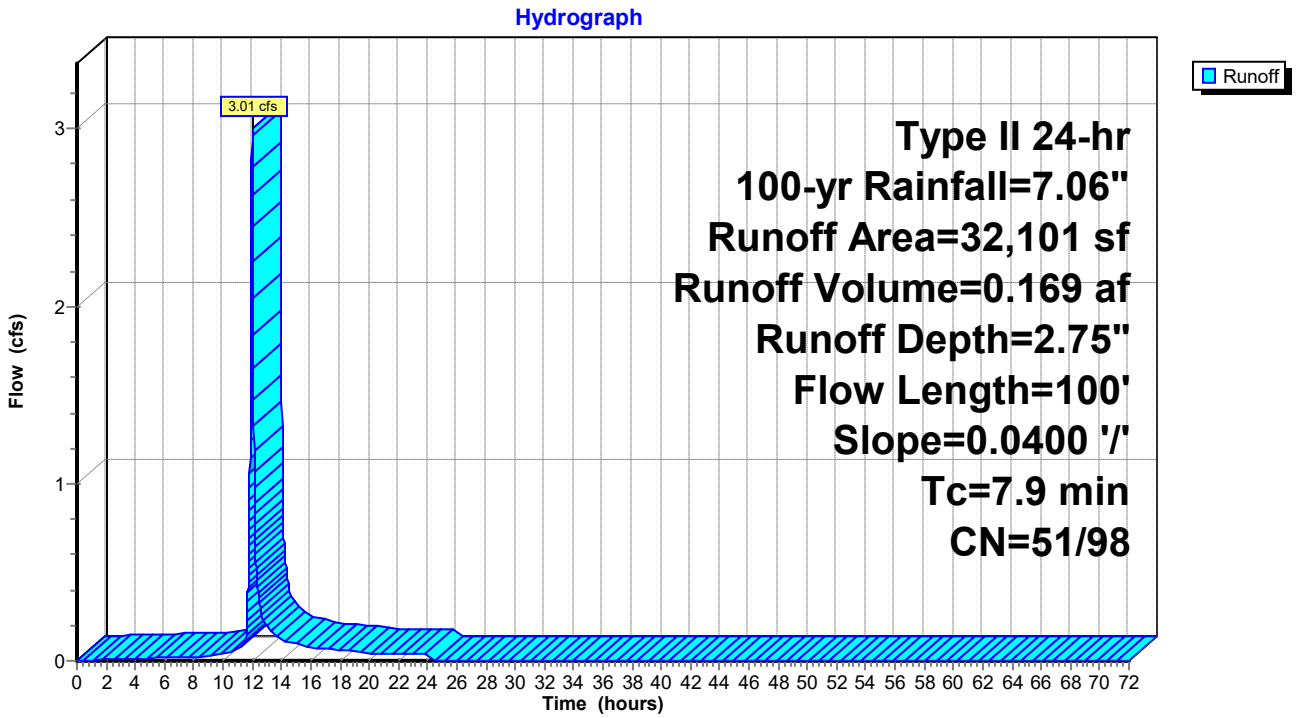
Runoff = 3.01 cfs @ 12.00 hrs, Volume= 0.169 af, Depth= 2.75"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.06"

Area (sf)	CN	Description
6,115	98	Paved parking, HSG B
12,000	39	>75% Grass cover, Good, HSG A
13,986	61	>75% Grass cover, Good, HSG B
32,101	60	Weighted Average
25,986	51	80.95% Pervious Area
6,115	98	19.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	100	0.0400	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.85"

Subcatchment 4S: TO INFILTRATION B



Summary for Pond 1P: WETLAND

Inflow Area = 5.009 ac, 1.58% Impervious, Inflow Depth = 3.21" for 100-yr event
Inflow = 24.63 cfs @ 12.02 hrs, Volume= 1.339 af
Outflow = 2.01 cfs @ 12.77 hrs, Volume= 1.336 af, Atten= 92%, Lag= 44.7 min
Discarded = 0.67 cfs @ 12.77 hrs, Volume= 1.055 af
Primary = 1.35 cfs @ 12.77 hrs, Volume= 0.281 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 883.73' @ 12.77 hrs Surf.Area= 35,965 sf Storage= 29,634 cf

Plug-Flow detention time= 529.7 min calculated for 1.336 af (100% of inflow)
Center-of-Mass det. time= 528.8 min (1,367.4 - 838.6)

Volume	Invert	Avail.Storage	Storage Description
#1	880.00'	40,401 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

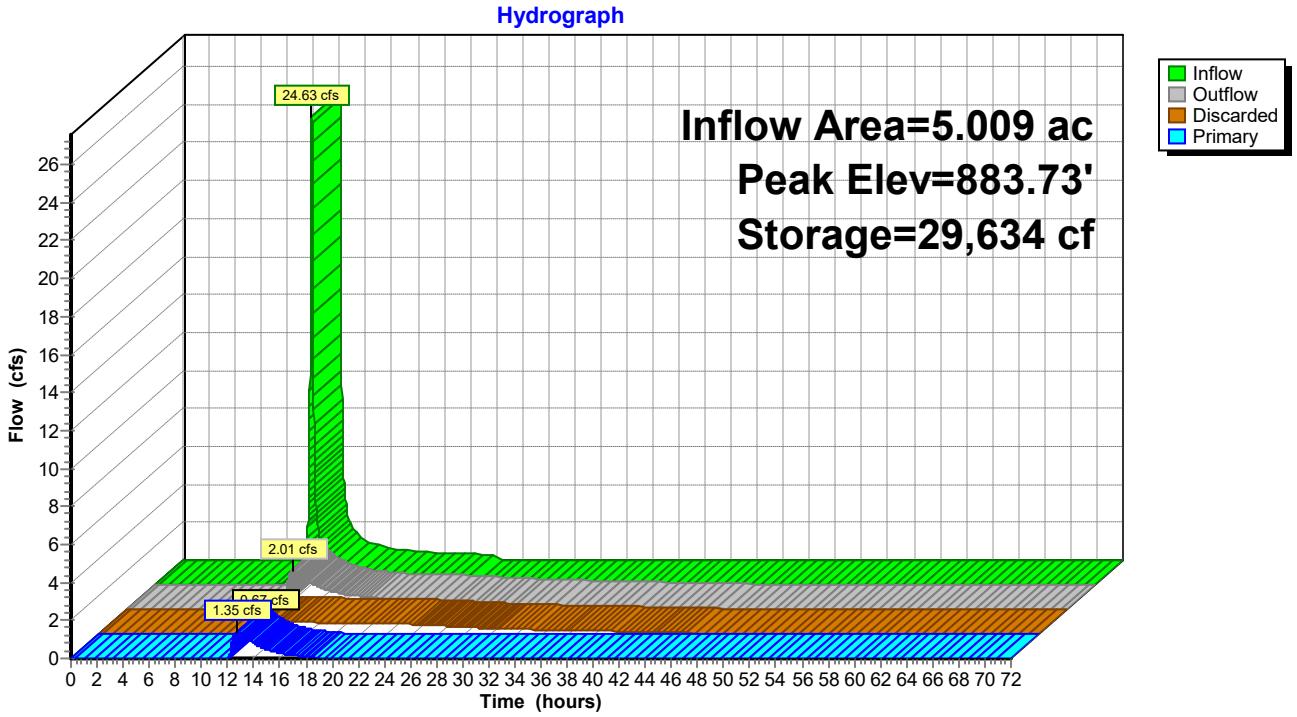
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
880.00	372	0	0
882.00	2,380	2,752	2,752
883.00	14,516	8,448	11,200
884.00	43,886	29,201	40,401

Device	Routing	Invert	Outlet Devices
#1	Discarded	880.00'	**0.800 in/hr Exfiltration over Surface area**
#2	Primary	883.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)**
			Head (feet) 0.00 0.50
			Width (feet) 0.00 20.00

Discarded OutFlow Max=0.67 cfs @ 12.77 hrs HW=883.73' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.67 cfs)

Primary OutFlow Max=1.33 cfs @ 12.77 hrs HW=883.73' (Free Discharge)
↑—**2=Custom Weir/Orifice** (Weir Controls 1.33 cfs @ 1.26 fps)

Pond 1P: WETLAND



Summary for Pond 2P: WETLAND

Inflow Area = 3.961 ac, 6.28% Impervious, Inflow Depth = 3.10" for 100-yr event
Inflow = 17.16 cfs @ 12.03 hrs, Volume= 1.023 af
Outflow = 1.23 cfs @ 13.17 hrs, Volume= 1.020 af, Atten= 93%, Lag= 68.4 min
Discarded = 0.46 cfs @ 13.17 hrs, Volume= 0.842 af
Primary = 0.78 cfs @ 13.17 hrs, Volume= 0.178 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 883.68' @ 13.17 hrs Surf.Area= 24,586 sf Storage= 23,947 cf

Plug-Flow detention time= 624.2 min calculated for 1.020 af (100% of inflow)
Center-of-Mass det. time= 622.9 min (1,462.1 - 839.2)

Volume	Invert	Avail.Storage	Storage Description
#1	880.00'	32,485 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

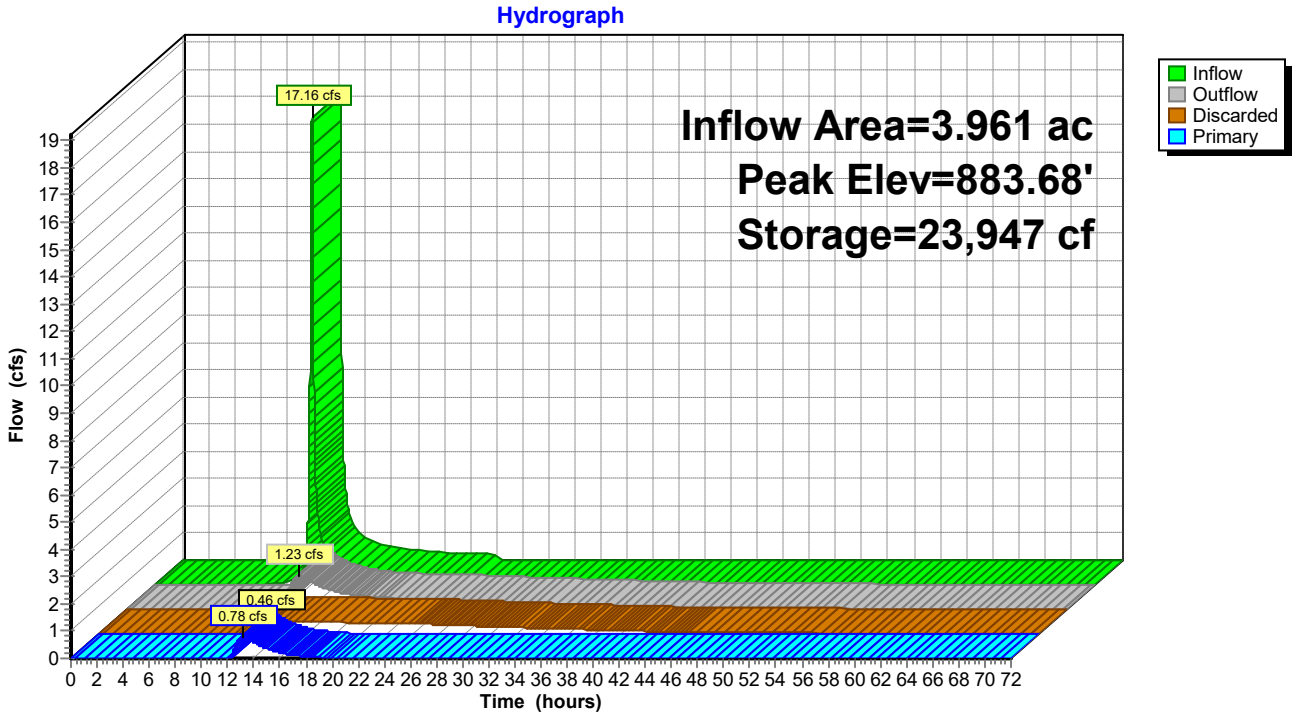
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
880.00	372	0	0
882.00	2,380	2,752	2,752
883.00	13,756	8,068	10,820
884.00	29,573	21,665	32,485

Device	Routing	Invert	Outlet Devices
#1	Discarded	880.00'	**0.800 in/hr Exfiltration over Surface area**
#2	Primary	883.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)**
			Head (feet) 0.00 0.50
			Width (feet) 0.00 20.00

Discarded OutFlow Max=0.46 cfs @ 13.17 hrs HW=883.68' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.46 cfs)

Primary OutFlow Max=0.77 cfs @ 13.17 hrs HW=883.68' (Free Discharge)
↑—**2=Custom Weir/Orifice** (Weir Controls 0.77 cfs @ 1.13 fps)

Pond 2P: WETLAND



Summary for Pond 3P: INFILTRATION BASIN A

Inflow Area = 0.377 ac, 22.84% Impervious, Inflow Depth = 3.01" for 100-yr event
Inflow = 1.48 cfs @ 12.04 hrs, Volume= 0.095 af
Outflow = 1.45 cfs @ 12.05 hrs, Volume= 0.092 af, Atten= 2%, Lag= 1.1 min
Discarded = 0.00 cfs @ 11.77 hrs, Volume= 0.017 af
Primary = 1.45 cfs @ 12.05 hrs, Volume= 0.076 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 884.37' @ 12.05 hrs Surf.Area= 906 sf Storage= 707 cf

Plug-Flow detention time= 265.4 min calculated for 0.092 af (98% of inflow)
Center-of-Mass det. time= 252.1 min (1,059.4 - 807.4)

Volume	Invert	Avail.Storage	Storage Description
#1	883.00'	3,253 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

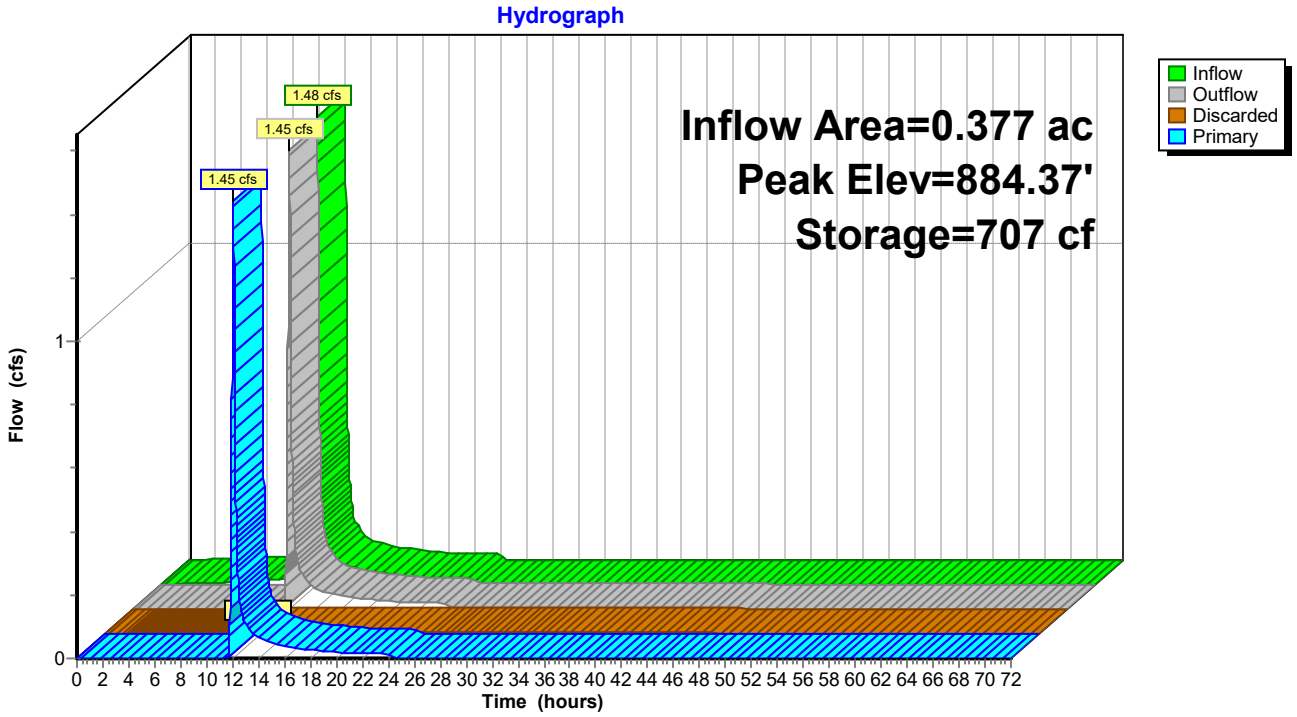
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
883.00	155	0	0
884.00	675	415	415
885.00	1,300	988	1,403
886.00	2,400	1,850	3,253

Device	Routing	Invert	Outlet Devices
#1	Primary	884.20'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.80 Width (feet) 6.00 10.00
#2	Discarded	883.00'	**0.300 in/hr Exfiltration over Surface area from 883.00' - 884.20'** Excluded Surface area = 155 sf

Discarded OutFlow Max=0.00 cfs @ 11.77 hrs HW=884.21' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=1.44 cfs @ 12.05 hrs HW=884.37' (Free Discharge)
↑—**1=Custom Weir/Orifice** (Weir Controls 1.44 cfs @ 1.33 fps)

Pond 3P: INFILTRATION BASIN A



Summary for Pond 4P: INFILTRATION BASIN B

Inflow Area = 0.737 ac, 19.05% Impervious, Inflow Depth = 2.75" for 100-yr event
Inflow = 3.01 cfs @ 12.00 hrs, Volume= 0.169 af
Outflow = 0.98 cfs @ 12.14 hrs, Volume= 0.142 af, Atten= 67%, Lag= 8.5 min
Discarded = 0.01 cfs @ 12.02 hrs, Volume= 0.046 af
Primary = 0.97 cfs @ 12.14 hrs, Volume= 0.096 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 885.69' @ 12.14 hrs Surf.Area= 3,218 sf Storage= 3,197 cf

Plug-Flow detention time= 603.1 min calculated for 0.142 af (84% of inflow)
Center-of-Mass det. time= 526.0 min (1,337.7 - 811.7)

Volume	Invert	Avail.Storage	Storage Description
#1	884.30'	8,301 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
884.30	1,375	0	0
885.00	2,250	1,269	1,269
885.50	3,040	1,323	2,591
886.00	3,500	1,635	4,226
887.00	4,650	4,075	8,301

Device	Routing	Invert	Outlet Devices
#1	Primary	885.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.50 Width (feet) 3.00 6.00
#2	Discarded	884.30'	**0.300 in/hr Exfiltration over Surface area from 884.30' - 885.50'** Excluded Surface area = 1,375 sf

Discarded OutFlow Max=0.01 cfs @ 12.02 hrs HW=885.52' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.97 cfs @ 12.14 hrs HW=885.69' (Free Discharge)
↑**1=Custom Weir/Orifice** (Weir Controls 0.97 cfs @ 1.39 fps)

Pond 4P: INFILTRATION BASIN B