

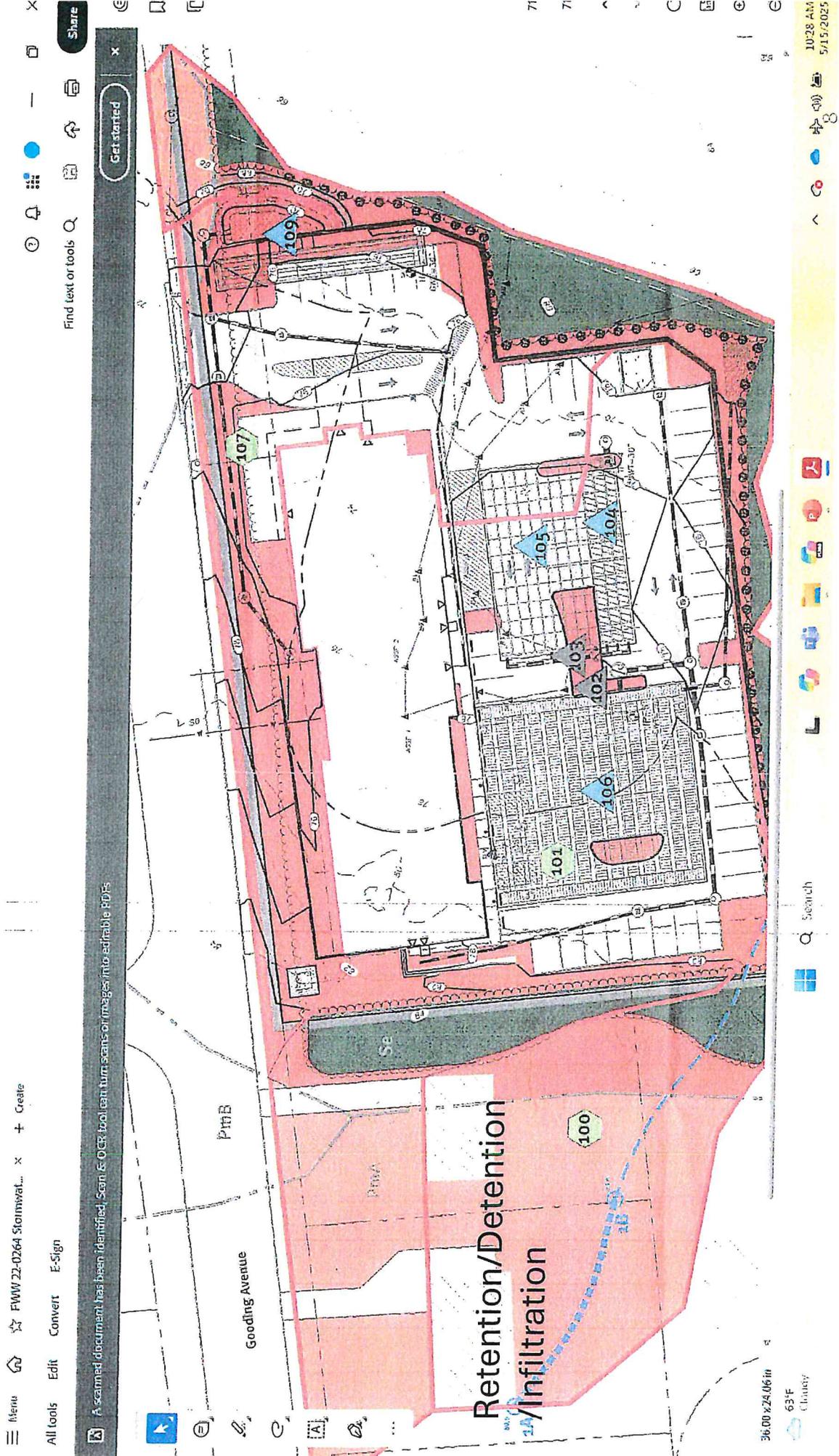
## **Errors within HydroCAD stormwater system model**

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- **Slide explanation of Error Messages**
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- **Detailed printout recreated HydroCAD analysis 100-year storm event with revised infiltration rate (0.27 in/hr)**

**Stormwater Management System proposed by Applicant to improve water quality and reduce stormwater runoff rates into Silver Creek**

**RAISE THE RED FLAG**



# Proposed Gooding Avenue Hotel *Modeling Stormwater Management System*



HydroCAD is a hydrology and hydraulics modeling system used for watershed analysis and design.

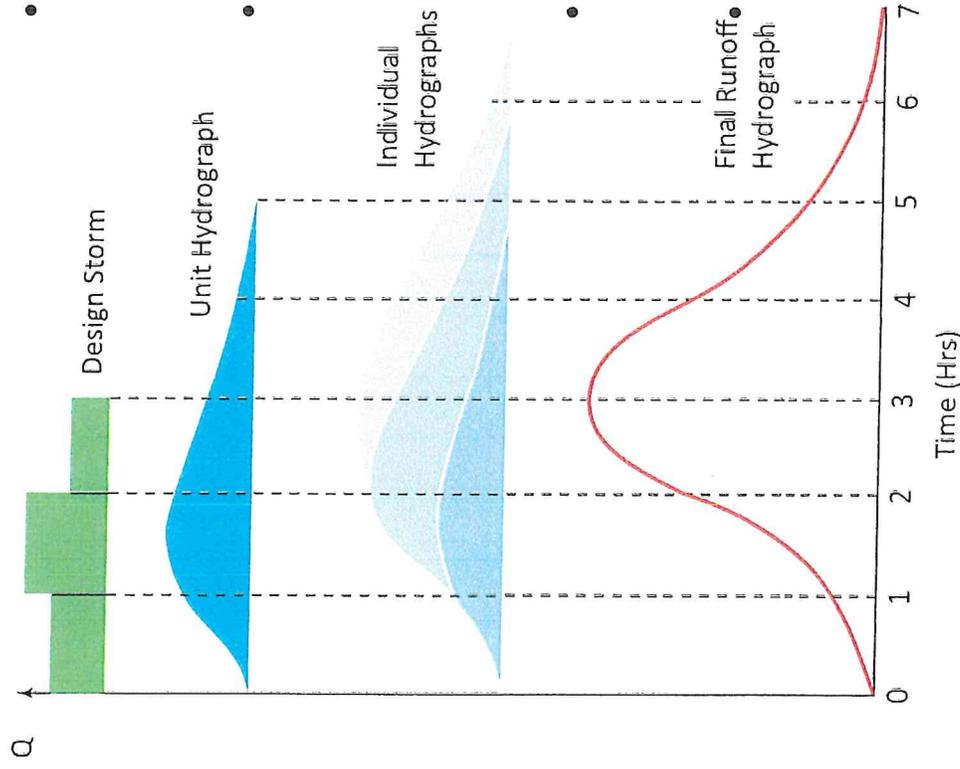
It provides runoff calculations, plus many techniques from TR-55, including CN lookup, CN weighting, and multiple procedures for calculating the time-of-concentration.

Runoff hydrographs can be routed through reaches and ponds, including a weir, culvert, orifice, or other device(s) that control the outflow.

Ponds can have compound outlets, such as a riser structure, as well as secondary outlets that are available for independent routing.

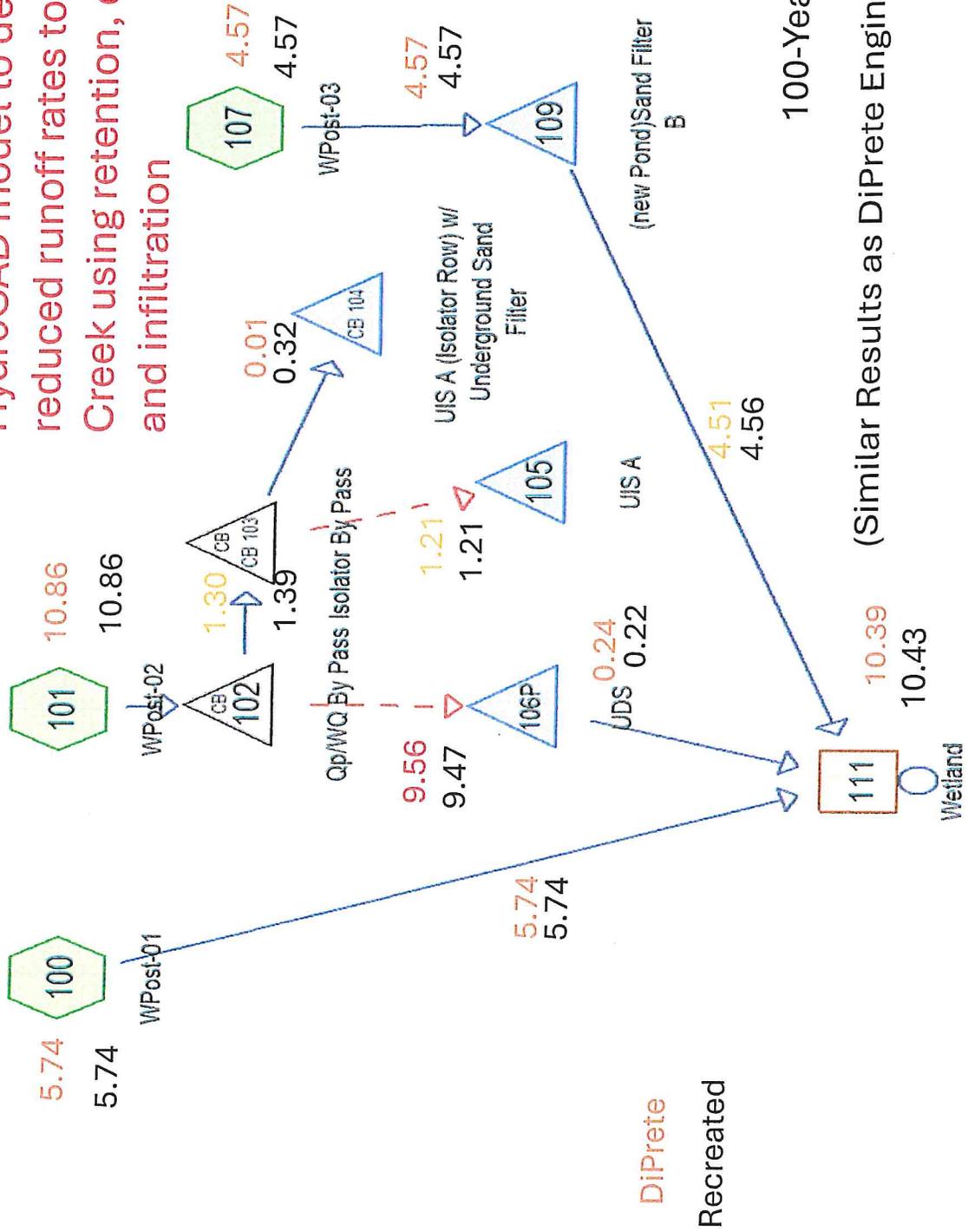
# Proposed Gooding Avenue Hotel

## Runoff Hydrographs



- A **design storm** refers to a specific rainfall event defined and described by the statistical likelihood of the event occurring in a given rainfall year.
- A **hydrograph** is a continuous plot of discharge (or flow rate versus time). Can be classified as rising limb, peak, and falling. A unit hydrograph, typically one inch, is developed to represent the watershed's response to runoff events
- **Individual Hydrographs** runoff from the areas closest to and furthest away from the discharge point within the watershed
- **Final Runoff Hydrograph** is the result of runoff from all areas contributing to the discharge location, creating the peak rate of runoff.

HydroCAD model to demonstrate reduced runoff rates to Silver Creek using retention, detention, and infiltration



100-Year Storm Event  
(Similar Results as DiPrete Engineering)

**2536-001-ALLS-PHCD-INHS**

Type III 24-hr 100-Year Rainfall=8.60"

Prepared by DiPrete Engineering

Printed 3/27/2025

HydroCAD® 10.20-6a s/n 01125 © 2024 HydroCAD Software Solutions LLC

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

<b>Subcatchment 10: WPre-01</b>	Runoff Area=2.765 ac 4.59% Impervious Runoff Depth=5.95" Flow Length=409' Tc=14.6 min CN=78 Runoff=14.58 cfs 1.371 af
<b>Subcatchment 100: WPost-01</b>	Runoff Area=0.858 ac 10.02% Impervious Runoff Depth=6.07" Flow Length=339' Tc=7.3 min CN=79 Runoff=5.74 cfs 0.434 af
<b>Subcatchment 101: WPost-02</b>	Runoff Area=1.334 ac 68.74% Impervious Runoff Depth=7.52" Tc=6.0 min CN=91 Runoff=10.86 cfs 0.836 af
<b>Subcatchment 107: WPost-03</b>	Runoff Area=0.572 ac 48.25% Impervious Runoff Depth=7.28" Tc=6.0 min CN=89 Runoff=4.57 cfs 0.347 af
<b>Reach 11: Wetland</b>	Inflow=14.58 cfs 1.371 af Outflow=14.58 cfs 1.371 af
<b>Reach 111: Wetland</b>	Inflow=10.39 cfs 1.182 af Outflow=10.39 cfs 1.182 af
<b>Pond 102: Qp/WQ ByPass</b>	Peak Elev=76.38' Inflow=10.86 cfs 0.836 af Primary=1.30 cfs 0.382 af Secondary=9.56 cfs 0.454 af Outflow=10.86 cfs 0.836 af
<b>Pond 103: Isolator ByPass</b>	Peak Elev=76.23' Inflow=1.30 cfs 0.382 af Primary=0.44 cfs 0.103 af Secondary=1.21 cfs 0.279 af Outflow=1.30 cfs 0.382 af
<b>Pond 104: UIS A (Isolator Row) with</b>	Peak Elev=75.90' Storage=3,412 cf Inflow=0.44 cfs 0.103 af Outflow=0.01 cfs 0.083 af
<b>Pond 105: UIS A with Underground Sand Filter</b>	Peak Elev=75.88' Storage=9,947 cf Inflow=1.21 cfs 0.279 af Outflow=0.04 cfs 0.222 af
<b>Pond 106: UDS A</b>	Peak Elev=72.84' Storage=13,272 cf Inflow=9.56 cfs 0.454 af Outflow=0.24 cfs 0.450 af
<b>Pond 109: Sand Filter B</b>	Peak Elev=70.82' Storage=2,185 cf Inflow=4.57 cfs 0.347 af Discarded=0.00 cfs 0.022 af Primary=4.50 cfs 0.298 af Outflow=4.51 cfs 0.321 af

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 2  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment 10: WPre01** Runoff Area=2.765 ac 4.59% Impervious Runoff Depth=5.95"  
Flow Length=409' Tc=14.6 min CN=78 Runoff=14.58 cfs 1.371 af

**Subcatchment 100: WPost-01** Runoff Area=0.858 ac 10.02% Impervious Runoff Depth=6.07"  
Flow Length=339' Tc=7.3 min CN=79 Runoff=5.74 cfs 0.434 af

**Subcatchment 101: WPost-02** Runoff Area=1.334 ac 68.74% Impervious Runoff Depth=7.52"  
Tc=6.0 min CN=91 Runoff=10.86 cfs 0.836 af

**Subcatchment 107: WPost-03** Runoff Area=0.572 ac 48.25% Impervious Runoff Depth=7.28"  
Tc=6.0 min CN=89 Runoff=4.57 cfs 0.347 af

**Reach 11: (new Reach)** Inflow=14.58 cfs 1.371 af  
Outflow=14.58 cfs 1.371 af

**Reach 111: Wetland** Inflow=10.41 cfs 1.010 af  
Outflow=10.41 cfs 1.010 af

**Pond 102: Qp/WQ By Pass** Peak Elev=76.37' Inflow=10.86 cfs 0.836 af  
Primary=1.39 cfs 0.567 af Secondary=9.47 cfs 0.269 af Outflow=10.86 cfs 0.836 af

**Pond 105: UIS A** Peak Elev=75.43' Storage=9,953 cf Inflow=1.31 cfs 0.418 af  
Outflow=0.25 cfs 0.418 af

**Pond 106P: UDS** Peak Elev=72.47' Storage=11,121 cf Inflow=9.47 cfs 0.269 af  
Outflow=0.22 cfs 0.269 af

**Pond 109: (new Pond)Sand Filter B** Peak Elev=70.82' Storage=0.031 af Inflow=4.57 cfs 0.347 af  
Discarded=0.01 cfs 0.039 af Primary=4.56 cfs 0.308 af Outflow=4.57 cfs 0.347 af

**Pond CB 103: Isolator By Pass** Peak Elev=75.44' Inflow=1.39 cfs 0.567 af  
Primary=0.32 cfs 0.150 af Secondary=1.31 cfs 0.418 af Outflow=1.39 cfs 0.567 af

**Pond Pond 103: UIS A (Isolator Row) w/** Peak Elev=75.44' Storage=3,202 cf Inflow=0.32 cfs 0.150 af  
Outflow=0.08 cfs 0.150 af

**Total Runoff Area = 5.529 ac Runoff Volume = 2.987 af Average Runoff Depth = 6.48"**  
**74.57% Pervious = 4.123 ac 25.43% Impervious = 1.406 ac**

**Bristol 2025test2**

Prepared by {enter your company name here}  
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Page 1

**Area Listing (all nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
0.292	74	> 75% grass HSG C (100)
0.192	74	> 75% grass cover HSG C (101)
0.286	80	> 75% grass cover HSG D (107)
0.146	80	> Grass cover HSG D (101)
0.488	74	>75% Grass cover, Good, HSG C (10, 107)
0.240	80	>75% Grass cover, Good, HSG D (10)
0.176	80	>75% grass HSG D (100)
1.152	98	Impervious (101, 107)
0.086	98	Off Site (100)
0.127	98	Off Site Impervious (10)
0.041	98	Offsite Impervious (101)
0.383	77	Woods HSG D (100, 101)
1.920	77	Woods/grass comb., Good, HSG D (10)
<b>5.529</b>	<b>82</b>	<b>TOTAL AREA</b>

**Summary for Subcatchment 10: WPre01**

Runoff = 14.58 cfs @ 12.20 hrs, Volume= 1.371 af, Depth= 5.95"

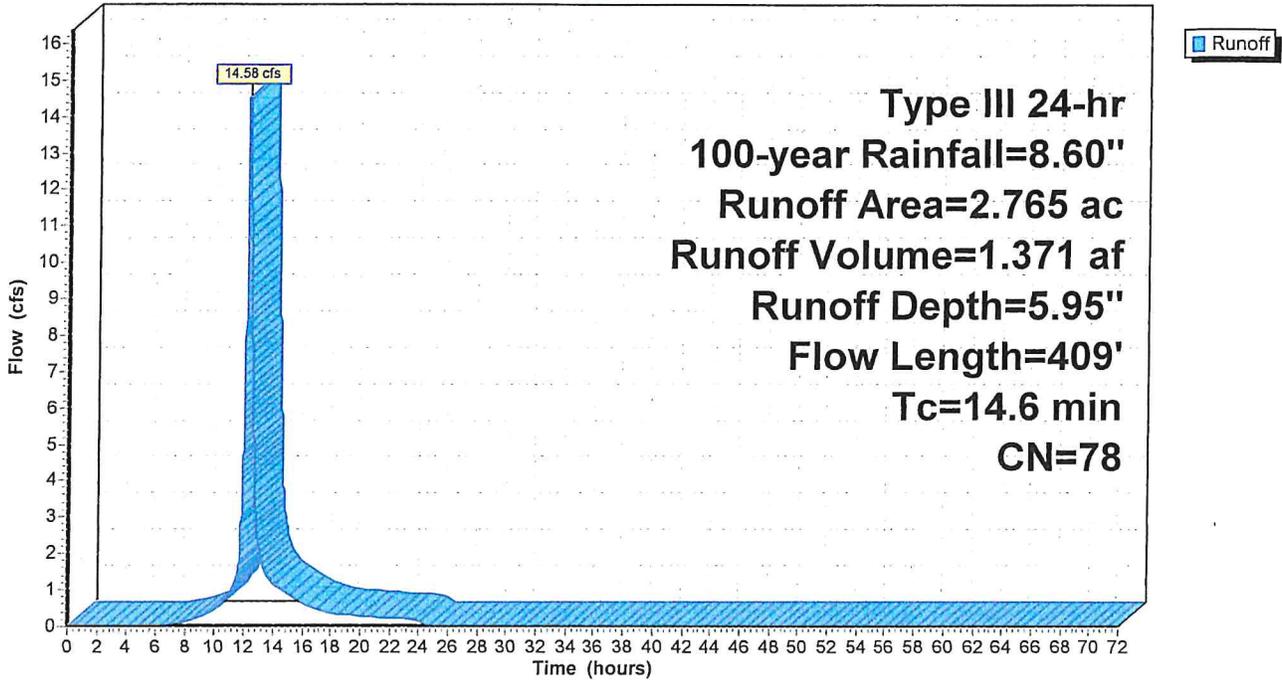
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-year Rainfall=8.60"

Area (ac)	CN	Description
* 0.127	98	Off Site Impervious
0.478	74	>75% Grass cover, Good, HSG C
0.240	80	>75% Grass cover, Good, HSG D
* 1.920	77	Woods/grass comb., Good, HSG D
2.765	78	Weighted Average
2.638		95.41% Pervious Area
0.127		4.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	37	0.0450	0.13		<b>Sheet Flow, Sheet Flow 1A-1B</b> Grass: Dense n= 0.240 P2= 3.30"
8.5	63	0.0778	0.12		<b>Sheet Flow, Sheet Flow 1B-1C</b> Woods: Light underbrush n= 0.400 P2= 3.30"
0.2	41	0.0341	2.97		<b>Shallow Concentrated Flow, Shallow Concentrated Flow 1C-1D</b> Unpaved Kv= 16.1 fps
1.3	268	0.0451	3.42		<b>Shallow Concentrated Flow, Shallow Concentrated Flow</b> Unpaved Kv= 16.1 fps
14.6	409	Total			

**Subcatchment 10: WPre01**

Hydrograph



**Summary for Subcatchment 100: WPost-01**

Runoff = 5.74 cfs @ 12.10 hrs, Volume= 0.434 af, Depth= 6.07"

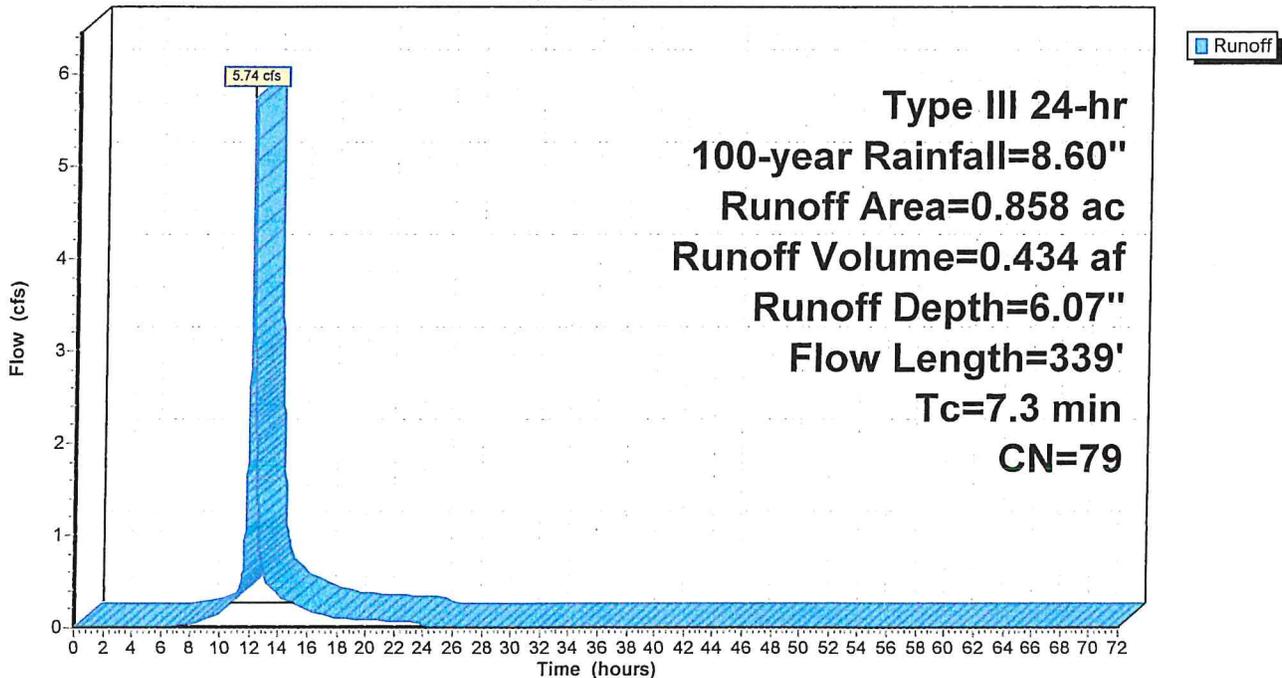
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-year Rainfall=8.60"

Area (ac)	CN	Description
* 0.086	98	Off Site
* 0.292	74	> 75% grass HSG C
* 0.176	80	>75% grass HSG D
* 0.304	77	Woods HSG D
0.858	79	Weighted Average
0.772		89.98% Pervious Area
0.086		10.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	100	0.0610	0.27		Sheet Flow, Sheet Flow 1A-1B Grass: Short n= 0.150 P2= 3.30"
1.1	239	0.0468	3.48		Shallow Concentrated Flow, Shalloe Concentrated Flow 1B-1C Unpaved Kv= 16.1 fps
7.3	339	Total			

**Subcatchment 100: WPost-01**

Hydrograph



Summary for Subcatchment 101: WPost-02

Runoff = 10.86 cfs @ 12.08 hrs, Volume= 0.836 af, Depth= 7.52"

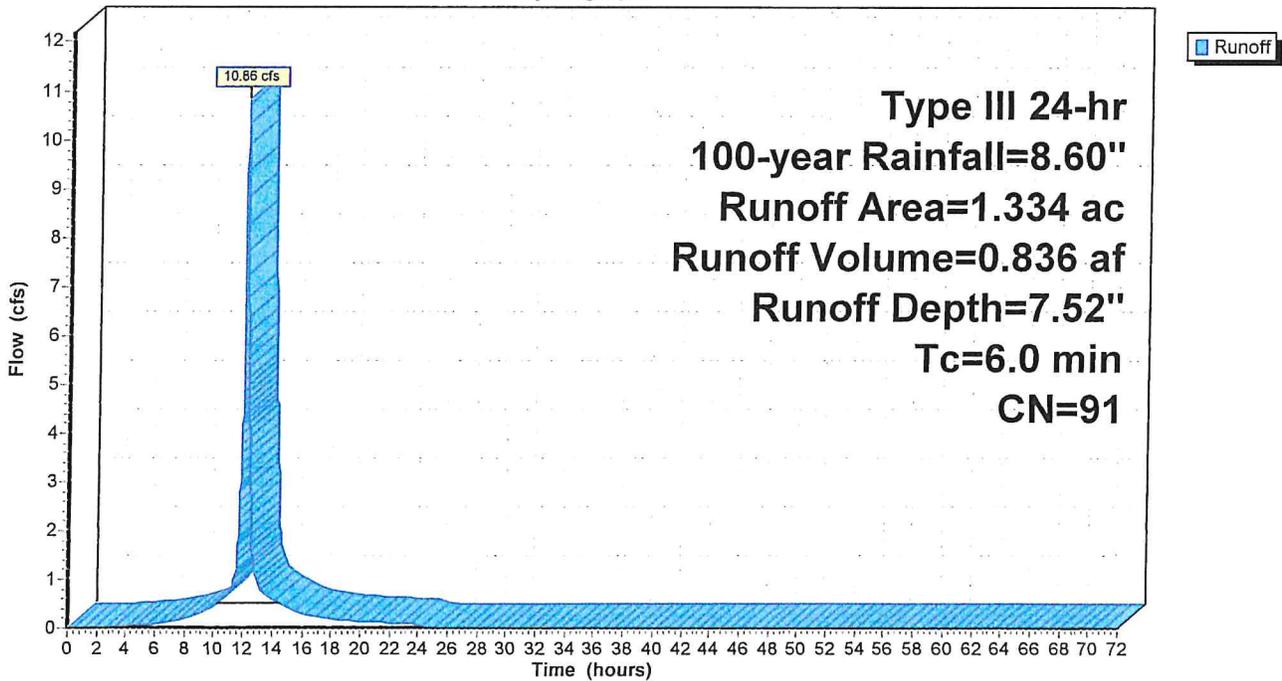
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-year Rainfall=8.60"

	Area (ac)	CN	Description
*	0.876	98	Impervious
*	0.041	98	Offsite Impervious
*	0.192	74	> 75% grass cover HSG C
*	0.146	80	> Grass cover HSG D
*	0.079	77	Woods HSG D
	1.334	91	Weighted Average
	0.417		31.26% Pervious Area
	0.917		68.74% Impervious Area

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

Subcatchment 101: WPost-02

Hydrograph



**Summary for Subcatchment 107: WPost-03**

Runoff = 4.57 cfs @ 12.08 hrs, Volume= 0.347 af, Depth= 7.28"

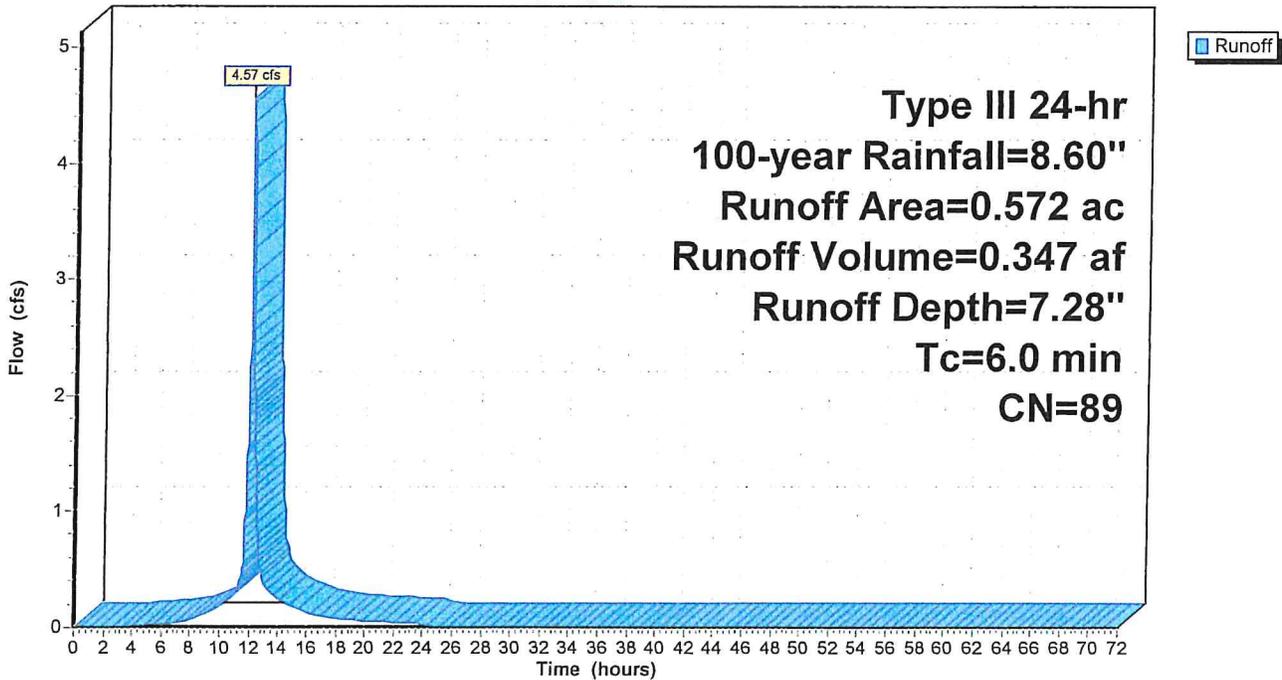
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-year Rainfall=8.60"

Area (ac)	CN	Description
* 0.276	98	Impervious
* 0.286	80	> 75% grass cover HSG D
0.010	74	>75% Grass cover, Good, HSG C
0.572	89	Weighted Average
0.296		51.75% Pervious Area
0.276		48.25% Impervious Area

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

**Subcatchment 107: WPost-03**

Hydrograph



### Summary for Reach 11: (new Reach)

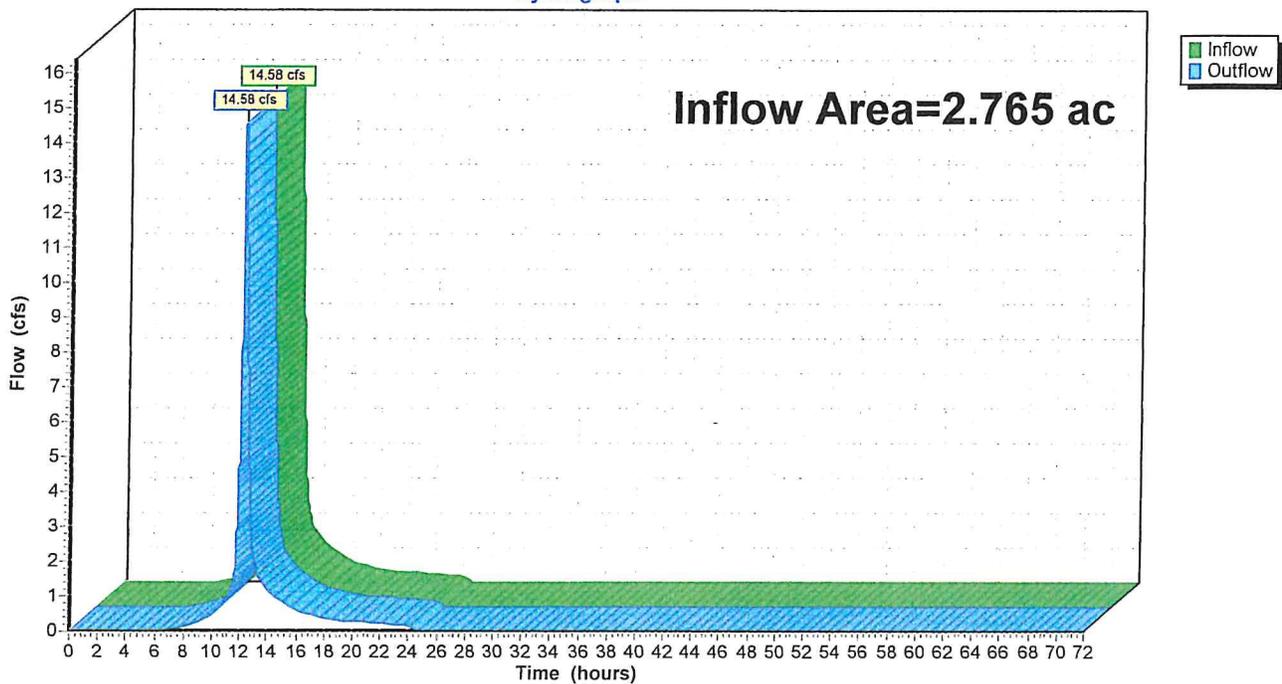
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.765 ac, 4.59% Impervious, Inflow Depth = 5.95" for 100-year event  
Inflow = 14.58 cfs @ 12.20 hrs, Volume= 1.371 af  
Outflow = 14.58 cfs @ 12.20 hrs, Volume= 1.371 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2

### Reach 11: (new Reach)

Hydrograph



### Summary for Reach 111: Wetland

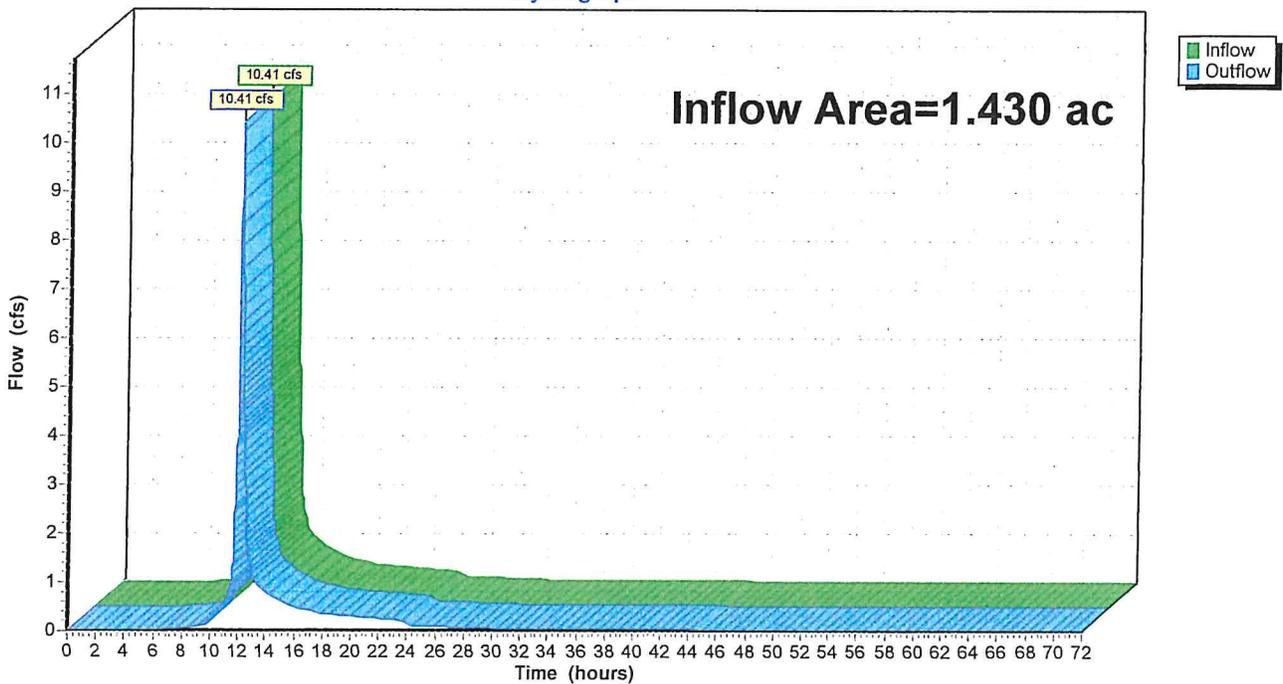
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.430 ac, 25.31% Impervious, Inflow Depth = 8.48" for 100-year event  
Inflow = 10.41 cfs @ 12.10 hrs, Volume= 1.010 af  
Outflow = 10.41 cfs @ 12.10 hrs, Volume= 1.010 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2

### Reach 111: Wetland

Hydrograph



**Summary for Pond 102: Qp/WQ By Pass**

Inflow Area = 1.334 ac, 68.74% Impervious, Inflow Depth = 7.52" for 100-year event  
 Inflow = 10.86 cfs @ 12.08 hrs, Volume= 0.836 af  
 Outflow = 10.86 cfs @ 12.08 hrs, Volume= 0.836 af, Atten= 0%, Lag= 0.0 min  
 Primary = 1.39 cfs @ 12.08 hrs, Volume= 0.567 af  
 Secondary = 9.47 cfs @ 12.08 hrs, Volume= 0.269 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 76.37' @ 12.08 hrs  
 Flood Elev= 78.61'

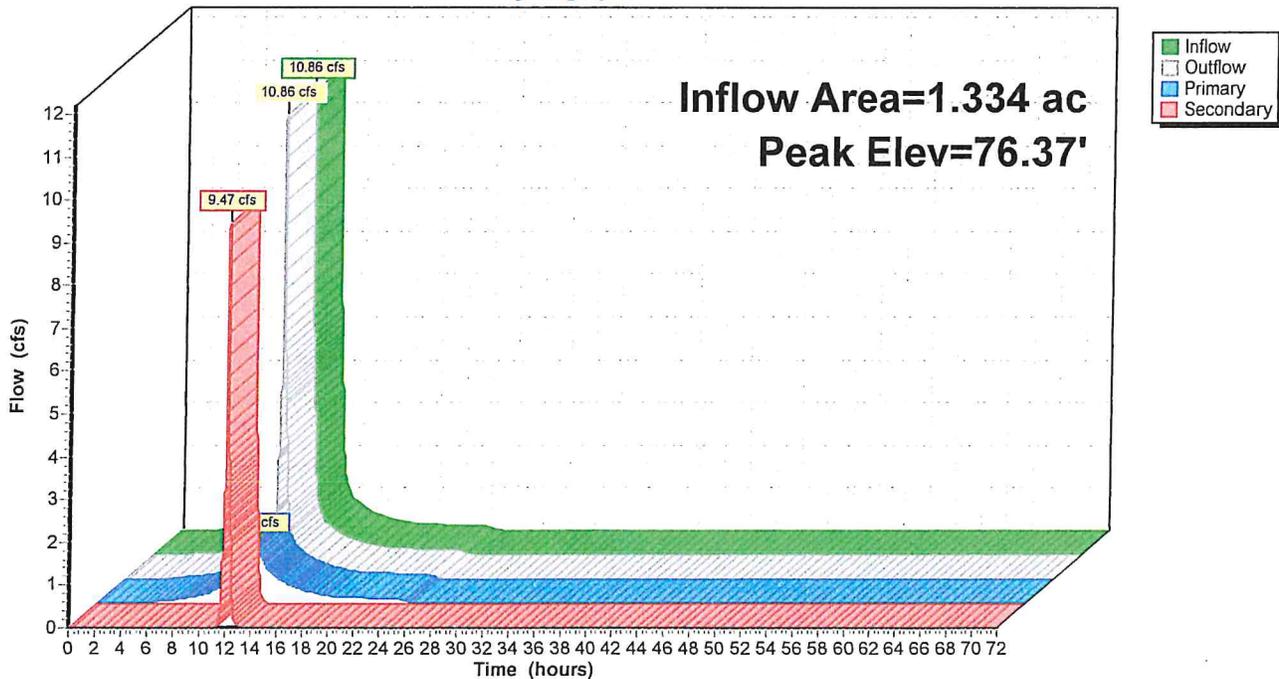
Device	Routing	Invert	Outlet Devices
#1	Primary	73.50'	6.0" Vert. 6.00" Vert WQ UIS C= 0.600
#2	Device 3	75.75'	6.0' long weir plate 2 End Contraction(s)
#3	Secondary	72.50'	18.0" Vert. 18" Vert. QP Pond C= 0.600

Primary OutFlow Max=1.39 cfs @ 12.08 hrs HW=76.37' TW=74.22' (Dynamic Tailwater)  
 ↳1=6.00" Vert WQ UIS (Orifice Controls 1.39 cfs @ 7.07 fps)

Secondary OutFlow Max=9.45 cfs @ 12.08 hrs HW=76.37' TW=71.43' (Dynamic Tailwater)  
 ↳3=18" Vert. QP Pond (Passes 9.45 cfs of 15.04 cfs potential flow)  
 ↳2=weir plate (Weir Controls 9.45 cfs @ 2.58 fps)

**Pond 102: Qp/WQ By Pass**

Hydrograph



**Summary for Pond 105: UIS A**

[80] Warning: Exceeded Pond CB 103 by 1.17' @ 24.26 hrs (0.88 cfs 0.020 af)

Inflow = 1.31 cfs @ 12.11 hrs, Volume= 0.418 af  
 Outflow = 0.25 cfs @ 15.82 hrs, Volume= 0.418 af, Atten= 81%, Lag= 222.7 min  
 Discarded = 0.25 cfs @ 15.82 hrs, Volume= 0.418 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 75.43' @ 15.82 hrs Surf.Area= 7,849 sf Storage= 9,953 cf  
 Flood Elev= 76.00' Surf.Area= 7,849 sf Storage= 10,874 cf

Plug-Flow detention time= 519.4 min calculated for 0.418 af (100% of inflow)  
 Center-of-Mass det. time= 519.4 min ( 1,347.7 - 828.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	4,278 cf	<b>Sand Filter (Prismatic)</b> Listed below (Recalc) 12,846 cf Overall x 33.3% Voids
#2A	73.00'	2,642 cf	<b>44.25'W x 80.60'L x 3.50'H Field A</b> 12,483 cf Overall - 4,548 cf Embedded = 7,935 cf x 33.3% Voids
#3A	73.50'	4,548 cf	<b>ADS_StormTech SC-740 +Cap</b> x 99 Inside #2 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 9 Rows of 11 Chambers
		11,468 cf	Total Available Storage

Storage Group A created with Chamber Wizard

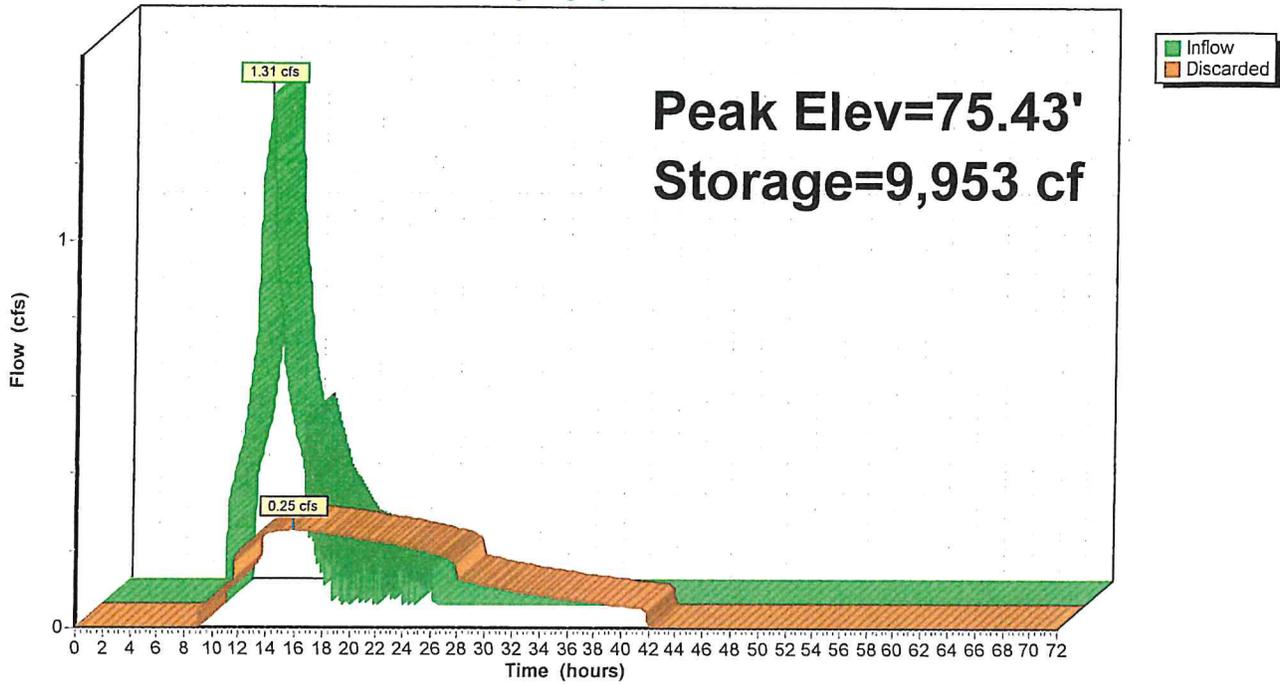
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
70.00	4,282	0	0
73.00	4,282	12,846	12,846

Device	Routing	Invert	Outlet Devices
#1	Discarded	70.00'	<b>0.520 in/hr Exfiltration over Surface area</b> Conductivity to Groundwater Elevation = 68.00' Phase-In= 0.01'

**Discarded OutFlow** Max=0.25 cfs @ 15.82 hrs HW=75.43' (Free Discharge)  
 ↑1=Exfiltration ( Controls 0.25 cfs)

Pond 105: UIS A

Hydrograph



**Summary for Pond 106P: UDS**

Inflow = 9.47 cfs @ 12.08 hrs, Volume= 0.269 af  
 Outflow = 0.22 cfs @ 12.66 hrs, Volume= 0.269 af, Atten= 98%, Lag= 34.6 min  
 Primary = 0.22 cfs @ 12.66 hrs, Volume= 0.269 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 72.47' @ 12.66 hrs Surf.Area= 5,764 sf Storage= 11,121 cf  
 Flood Elev= 75.00' Surf.Area= 0 sf Storage= 22,639 cf

Plug-Flow detention time= 731.3 min calculated for 0.269 af (100% of inflow)  
 Center-of-Mass det. time= 731.3 min ( 1,457.7 - 726.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	3,495 cf	<b>60.0" Round CMP_Round 60" x 2</b> L= 89.0'
#2	70.00'	19,144 cf	<b>60.0" Round CMP_Round 60" x 13</b> L= 75.0'
		22,639 cf	Total Available Storage

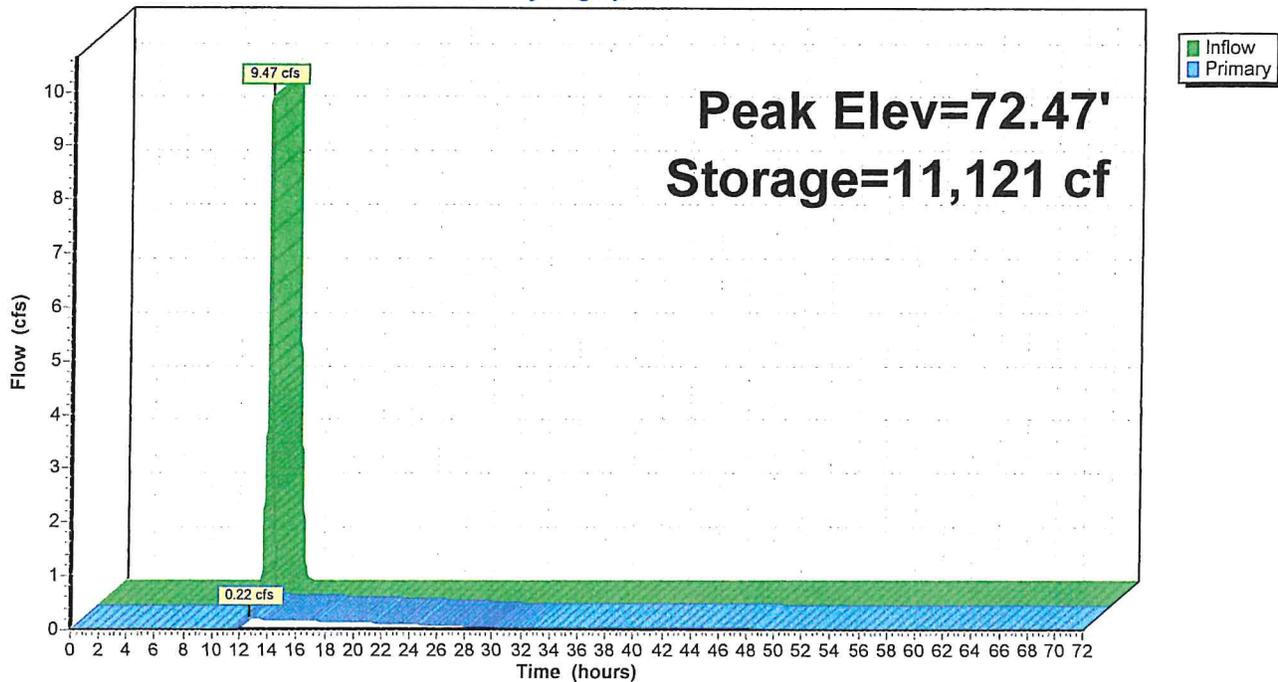
Device	Routing	Invert	Outlet Devices
#1	Device 4	70.00'	<b>1.0" Horiz. Low Flow CPv</b> C= 0.600 Limited to weir flow at low heads
#2	Device 4	70.65'	<b>2.0" W x 2.0" H Vert. Vert Orifice</b> C= 0.600
#3	Device 4	74.50'	<b>4.0' long x 0.5' breadth Broad-Crested Rectangular Outlet Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Primary	69.00'	<b>12.0" Round Culvert</b> L= 120.0' Ke= 0.500 Inlet / Outlet Invert= 69.00' / 68.00' S= 0.0083 '/ Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.22 cfs @ 12.66 hrs HW=72.47' TW=0.00' (Dynamic Tailwater)

- ↑ 4=Culvert (Passes 0.22 cfs of 5.73 cfs potential flow)
  - ↑ 1=Low Flow CPv (Orifice Controls 0.04 cfs @ 7.56 fps)
  - ↑ 2=Vert Orifice (Orifice Controls 0.18 cfs @ 6.34 fps)
  - ↑ 3=Broad-Crested Rectangular Outlet Weir ( Controls 0.00 cfs)

### Pond 106P: UDS

#### Hydrograph



**Summary for Pond 109: (new Pond)Sand Filter B**

Inflow Area = 0.572 ac, 48.25% Impervious, Inflow Depth = 7.28" for 100-year event  
 Inflow = 4.57 cfs @ 12.08 hrs, Volume= 0.347 af  
 Outflow = 4.57 cfs @ 12.09 hrs, Volume= 0.347 af, Atten= 0%, Lag= 0.3 min  
 Discarded = 0.01 cfs @ 39.11 hrs, Volume= 0.039 af  
 Primary = 4.56 cfs @ 12.09 hrs, Volume= 0.308 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 70.82' @ 12.09 hrs Surf.Area= 0.011 ac Storage= 0.031 af

Plug-Flow detention time= 157.7 min calculated for 0.347 af (100% of inflow)  
 Center-of-Mass det. time= 158.1 min ( 935.0 - 776.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	69.00'	0.019 af	<b>32.60'W x 10.00'L x 2.50'H Prismatoid</b>
#2	67.00'	0.002 af	<b>10.00'W x 10.75'L x 2.00'H Prismatoid</b> 0.005 af Overall x 33.0% Voids
#3	69.00'	0.014 af	<b>18.0" Round Pipe Storage x 4</b> L= 85.0'
#4	69.00'	0.002 af	<b>24.0" Round Pipe Storage x 2</b> L= 12.0'
		0.036 af	Total Available Storage

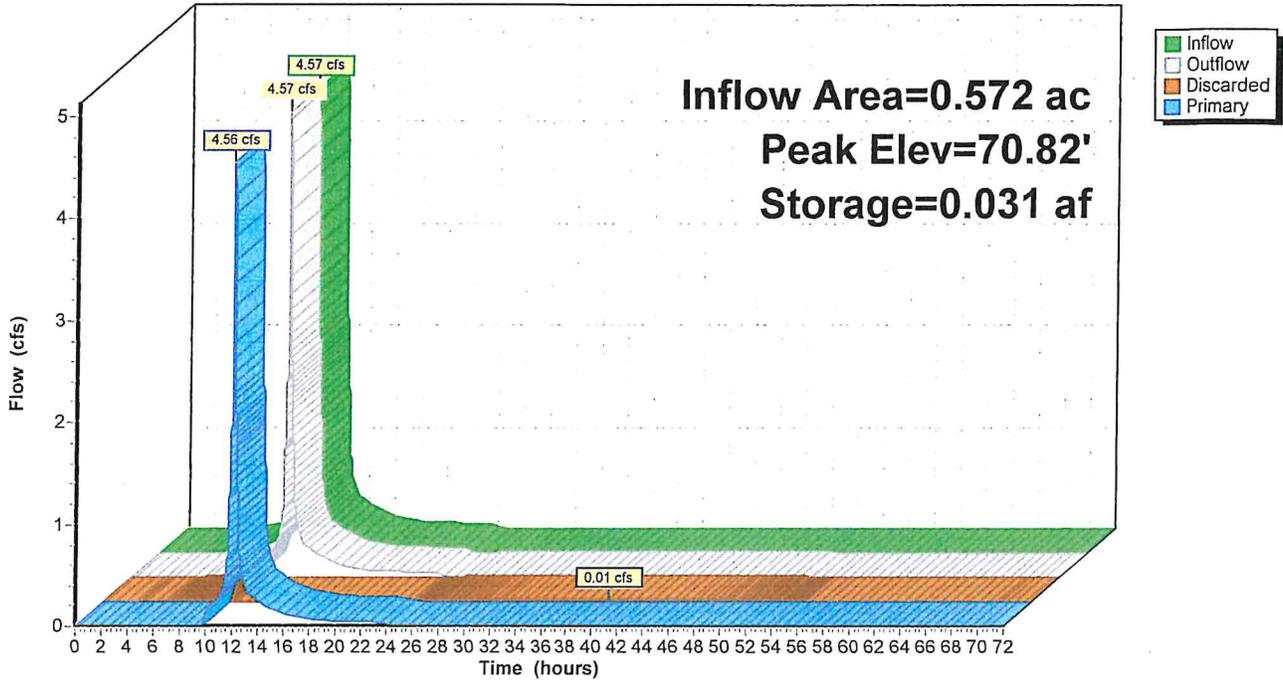
Device	Routing	Invert	Outlet Devices
#1	Discarded	67.00'	<b>0.520 in/hr Exfiltration over Surface area</b>
#2	Primary	70.50'	<b>10.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Discarded OutFlow** Max=0.01 cfs @ 39.11 hrs HW=69.76' (Free Discharge)  
 ↳1=Exfiltration (Exfiltration Controls 0.01 cfs)

**Primary OutFlow** Max=4.56 cfs @ 12.09 hrs HW=70.82' TW=0.00' (Dynamic Tailwater)  
 ↳2=Broad-Crested Rectangular Weir (Weir Controls 4.56 cfs @ 1.43 fps)

### Pond 109: (new Pond)Sand Filter B

Hydrograph



**Summary for Pond CB 103: Isolator By Pass**

[80] Warning: Exceeded Pond 102 by 1.63' @ 24.31 hrs (0.58 cfs 0.030 af)

Inflow Area = 1.334 ac, 68.74% Impervious, Inflow Depth = 5.10" for 100-year event  
 Inflow = 1.39 cfs @ 12.08 hrs, Volume= 0.567 af  
 Outflow = 1.39 cfs @ 12.08 hrs, Volume= 0.567 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.32 cfs @ 8.99 hrs, Volume= 0.150 af  
 Secondary = 1.31 cfs @ 12.11 hrs, Volume= 0.418 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 75.44' @ 15.82 hrs  
 Flood Elev= 78.96'

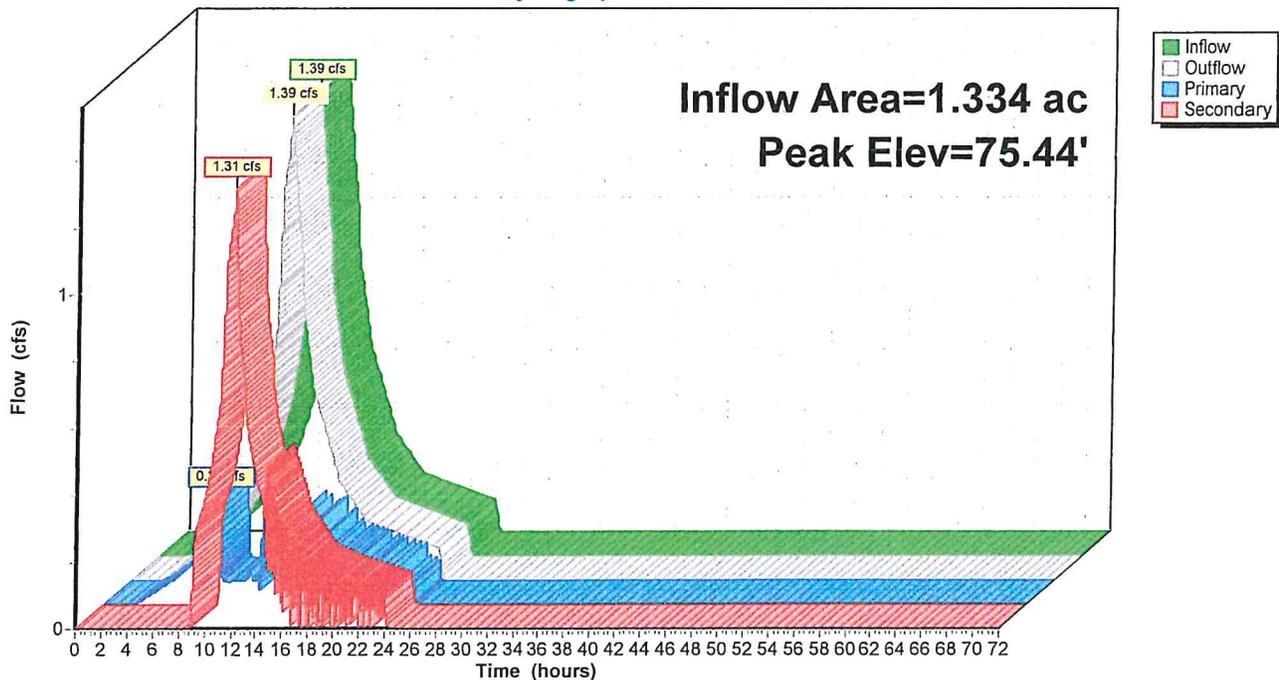
Device	Routing	Invert	Outlet Devices
#1	Primary	73.00'	15.0" Vert. Isolator Row C= 0.600
#2	Device 3	74.00'	4.0' long Weir PLate 2 End Contraction(s)
#3	Secondary	73.55'	15.0" Vert. CB 103 Isolator Bypass C= 0.600

**Primary OutFlow** Max=0.32 cfs @ 8.99 hrs HW=73.99' TW=73.99' (Dynamic Tailwater)  
 ↳1=Isolator Row (Orifice Controls 0.32 cfs @ 0.30 fps)

**Secondary OutFlow** Max=1.31 cfs @ 12.11 hrs HW=74.22' TW=73.87' (Dynamic Tailwater)  
 ↳3=CB 103 Isolator Bypass (Passes 1.31 cfs of 1.86 cfs potential flow)  
 ↳2=Weir PLate (Weir Controls 1.31 cfs @ 1.53 fps)

**Pond CB 103: Isolator By Pass**

Hydrograph



**Summary for Pond Pond 103: UIS A (Isolator Row) w/ Underground Sand Filter**

[80] Warning: Exceeded Pond CB 103 by 1.17' @ 24.26 hrs (4.40 cfs 0.439 af)

Inflow Area = 1.334 ac, 68.74% Impervious, Inflow Depth = 1.35" for 100-year event  
 Inflow = 0.32 cfs @ 8.99 hrs, Volume= 0.150 af  
 Outflow = 0.08 cfs @ 15.84 hrs, Volume= 0.150 af, Atten= 76%, Lag= 411.0 min  
 Discarded = 0.08 cfs @ 15.84 hrs, Volume= 0.150 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 75.44' @ 15.84 hrs Surf.Area= 2,502 sf Storage= 3,202 cf  
 Flood Elev= 76.00' Surf.Area= 2,502 sf Storage= 3,526 cf

Plug-Flow detention time= 527.6 min calculated for 0.150 af (100% of inflow)  
 Center-of-Mass det. time= 527.7 min ( 1,221.2 - 693.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	1,210 cf	<b>Sand Filter (Prismatic)</b> Listed below (Recalc) 3,633 cf Overall x 33.3% Voids
#2A	73.00'	999 cf	<b>15.75'W x 81.94'L x 3.50'H Field A</b> 4,517 cf Overall - 1,516 cf Embedded = 3,001 cf x 33.3% Voids
#3A	73.50'	1,516 cf	<b>ADS_StormTech SC-740 +Cap</b> x 33 Inside #2 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 3 Rows of 11 Chambers
#4	73.50'	34 cf	<b>4.00'D x 5.46'H Vertical Cone/Cylinder</b> x 0.5 -Impervious
		3,759 cf	Total Available Storage

Storage Group A created with Chamber Wizard

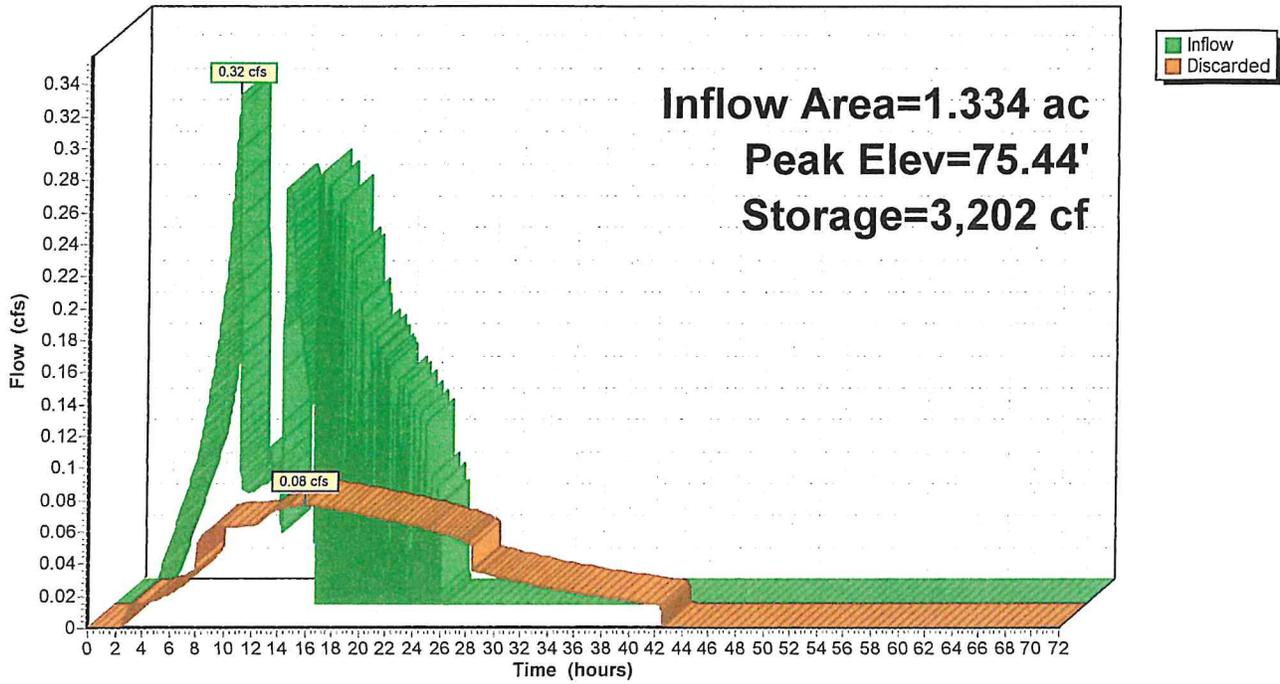
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
70.00	1,211	0	0
73.00	1,211	3,633	3,633

Device	Routing	Invert	Outlet Devices
#1	Discarded	70.00'	<b>0.520 in/hr Exfiltration over Surface area</b> Conductivity to Groundwater Elevation = 68.00' Phase-In= 0.01'

**Discarded OutFlow** Max=0.08 cfs @ 15.84 hrs HW=75.44' (Free Discharge)  
 ↑1=Exfiltration ( Controls 0.08 cfs)

### Pond Pond 103: UIS A (Isolator Row) w/ Underground Sand Filter

Hydrograph



**What happens** when one uses an infiltration rate of 0.27 for the proposed stormwater management system operations as modelled by HydroCAD



The model was slightly modified to allow the routing to continue, so that the specific problems can be identified. (See next slide)

### Error 700: Unable to extend routing tables above xx'

While performing a pond routing, the water surface elevation has exceeded the expected range. HydroCAD attempted to extend the routing tables above the initial range, but failed because the storage and/or discharge curves are no longer increasing past the specified elevation.

This typically occurs because there is no additional storage or discharge capacity available. This makes it impossible to complete the routing operation.

- To correct the problem, you must provide additional [storage](#) and/or [discharge](#) information for higher elevations.

**The system fails**

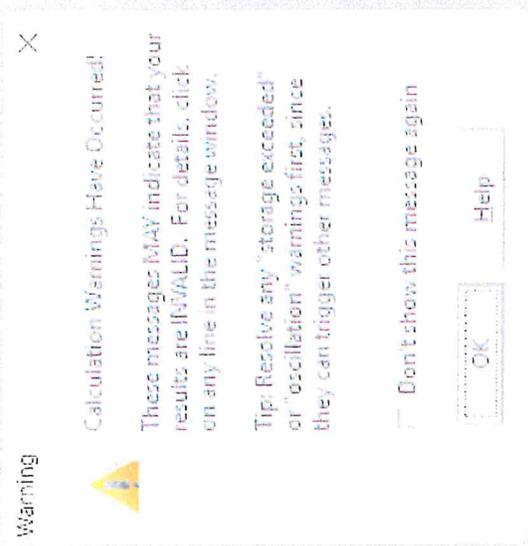
What happens when one uses an infiltration rate of 0.27 for the proposed stormwater management system operations as modelled by HydroCAD



Pass  
By Pass  
(Isolator Row) w/ Underground Sand Filter

Sand Filter B

w=Inflow  
y require smaller dt or Finer Routing (severity=3)



The system fails

# Proposed Gooding Avenue Hotel

## Model Shows Error Messages



HydroCAD Model shows Error Messages resulting from decreasing the infiltration rate. These messages MAY indicate that your results are INVALID

Warning

Calculation Warnings: Have Occurred!  
 These messages MAY indicate that your results are INVALID. For details, click on any line in the message window.

Tip: Resolve any "storage exceeded" or "oscillation" warnings first, since they can trigger other messages.

Don't show this message again

OK Help

101 WPPost-02  
 107 WPPost-03  
 109 (new Pond)Sand Filter B

10 WPpe01  
 11 (new) Reach

[28] Note: Updating Pond 106P: UDS  
 [28] Note: Updating Subcat 100: WPPost-01  
 [28] Note: Updating Subcat 107: WPPost-03  
 [28] Note: Updating Pond 109: (new Pond)Sand Fil  
 [28] Note: Updating Reach 111: Wetland  
 [40] Note: Update 111: 100% Infiltration  
 [28] Note: Updating Pond CB 103: Isolator By Pass  
 [28] Note: Updating Pond CB 104: UIS A (Isolator I  
 [28] Note: Updating Pond 105: UIS A  
 [11] Note: Warning: Pond 109 QoutQin may require amo

(80) Warning: Pond CB 103 Exceed Pond 102 by 2.88' at 24.34 hours (1.21 cfs)  
 (80) Warning: Pond CB 104 Exceed Pond 103 by 2.47' at 24.11 hours (8.03 cfs)  
 (80) Warning: Pond CB 105 Exceed Pond 103 by 2.47' at 24.11 hours (6.73 cfs)

Brass 2023 X=6.12 Y=4.45 12 Nodes 1 Selected 69°F

# Proposed Gooding Avenue Hotel

## Explanation of Error Messages



At some point during the routing, the node's water surface elevation has exceeded the water surface elevation of an inflowing pond, indicating a *possible reverse flow*. The message shows the maximum amount of reverse head, the time at which it occurred, and an estimate of the potential reverse flow.

**Important:** The pond routing is *not* altered by this situation, even though the higher tailwater may in reality cause a reverse flow. The routing continues to be performed as if a one-way valve were preventing the backflow. The user is responsible for adjusting the model in any way that is deemed necessary to accommodate this situation.

**Current Messages**

- [13] Note: Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 2
- [16] Note: Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
- [19] Note: Type III 24-hr 100-year Rainfall=8.60"
- [22] Note: Reach routing by Dyn-Stor-Ind method
- [25] Note: Pond routing by Dyn-Stor-Ind method
- [28] Note: Updating Subcat 100: WPost-01
- [28] Note: Updating Subcat 101: WPost-02
- [28] Note: Updating Pond 102: Qp/WQ By Pass
- [28] Note: Updating Pond CB 103: Isolator By Pass
- [28] Note: Updating Pond Pond 104: UIS A (Isolator Row) w/ Underground Sand Filter
- [28] Note: Updating Pond 105: UIS A
- [28] Note: Updating Pond 106P: UDS
- [28] Note: Updating Subcat 107: WPost-03
- [28] Note: Updating Pond 109: (new Pond)Sand Filter B
- [28] Note: Updating Reach 111: Wetland
- [40] Hint: Reach 111 Not Described (Outflow=Inflow)
- [87] Warning: Pond CB 103 Oscillations may require smaller dt or Finer Routing (severity=3)**
- [80] Warning: Pond CB 103 Exceeded Pond 102 by 2.88' @ 24.34 hrs (1.21 cfs 0.171 af)**
- [80] Warning: Pond Pond 104 Exceeded Pond CB 103 by 2.47' @ 24.11 hrs (8.03 cfs 2.305 af)**
- [80] Warning: Pond 105 Exceeded Pond CB 103 by 2.47' @ 24.11 hrs (6.72 cfs 0.690 af)**
- [37] Hint: Longer time span advised for full volumes

## [80] Warning: {node} Exceeded Pond x by x.x' @ x.x hrs (x.x cfs x.x af)

---

At some point during the routing, the node's water surface elevation has exceeded the water surface elevation of an inflowing pond, indicating a *possible reverse flow*. The message shows the maximum amount of reverse head, the time at which it occurred, and an estimate of the potential reverse flow.

In some situations, the reverse head may be caused by an excessively large time increment. Reduce the [dt](#) or increase the [finer routing increment](#) to see if this reduces or eliminates the problem. Certain routing methods may require a finer routing increment when two adjacent nodes have very similar water surface elevations.

**Important:** The [pond routing](#) is *not* altered by this situation, even though the higher tailwater may in reality cause a reverse flow. The routing continues to be performed as if a one-way valve were preventing the backflow. The user is responsible for adjusting the model in any way that is deemed necessary to accommodate this situation. If the potential reverse flow volume is significant in proportion to the total outflow volume, you can consider [modeling a reverse flow](#), which will also suppress this warning.

Note: This and other warning messages can be triggered by basic routing failures, such as oscillations. If any [oscillation warnings](#) are present, these must be resolved *first*.

**Bristol 2025test2**

Type III 24-hr 100-year Rainfall=8.60"

Prepared by {enter your company name here}

Printed 1/16/2026

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Page 1

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 2  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment 10: WPre01** Runoff Area=2.765 ac 4.59% Impervious Runoff Depth=5.95"  
Flow Length=409' Tc=14.6 min CN=78 Runoff=14.58 cfs 1.371 af

**Subcatchment 100: WPost-01** Runoff Area=0.858 ac 10.02% Impervious Runoff Depth=6.07"  
Flow Length=339' Tc=7.3 min CN=79 Runoff=5.74 cfs 0.434 af

**Subcatchment 101: WPost-02** Runoff Area=1.334 ac 68.74% Impervious Runoff Depth=7.52"  
Tc=6.0 min CN=91 Runoff=10.86 cfs 0.836 af

**Subcatchment 107: WPost-03** Runoff Area=0.572 ac 48.25% Impervious Runoff Depth=7.28"  
Tc=6.0 min CN=89 Runoff=4.57 cfs 0.347 af

**Reach 11: (new Reach)** Inflow=14.58 cfs 1.371 af  
Outflow=14.58 cfs 1.371 af

**Reach 111: Wetland** Inflow=10.42 cfs 1.083 af  
Outflow=10.42 cfs 1.083 af

**Pond 102: Qp/WQ By Pass** Peak Elev=76.37' Inflow=10.86 cfs 0.836 af  
Primary=1.38 cfs 0.500 af Secondary=9.48 cfs 0.336 af Outflow=10.86 cfs 0.836 af

**Pond 105: UIS A** Peak Elev=75.78' Storage=10,579 cf Inflow=1.25 cfs 0.379 af  
Outflow=0.14 cfs 0.379 af

**Pond 106P: UDS** Peak Elev=72.50' Storage=11,322 cf Inflow=9.48 cfs 0.336 af  
Outflow=0.22 cfs 0.336 af

**Pond 109: (new Pond)Sand Filter B** Peak Elev=70.82' Storage=0.031 af Inflow=4.57 cfs 0.347 af  
Discarded=0.01 cfs 0.028 af Primary=4.56 cfs 0.313 af Outflow=4.57 cfs 0.341 af

**Pond CB 103: Isolator By Pass** Peak Elev=75.78' Inflow=1.38 cfs 0.500 af  
Primary=0.30 cfs 0.131 af Secondary=1.25 cfs 0.379 af Outflow=1.38 cfs 0.500 af

**Pond Pond 104: UIS A (Isolator Row) w/** Peak Elev=75.78' Storage=3,422 cf Inflow=0.30 cfs 0.131 af  
Outflow=0.04 cfs 0.131 af

**Total Runoff Area = 5.529 ac Runoff Volume = 2.987 af Average Runoff Depth = 6.48"**  
**74.57% Pervious = 4.123 ac 25.43% Impervious = 1.406 ac**

**Summary for Subcatchment 10: WPre01**

Runoff = 14.58 cfs @ 12.20 hrs, Volume= 1.371 af, Depth= 5.95"

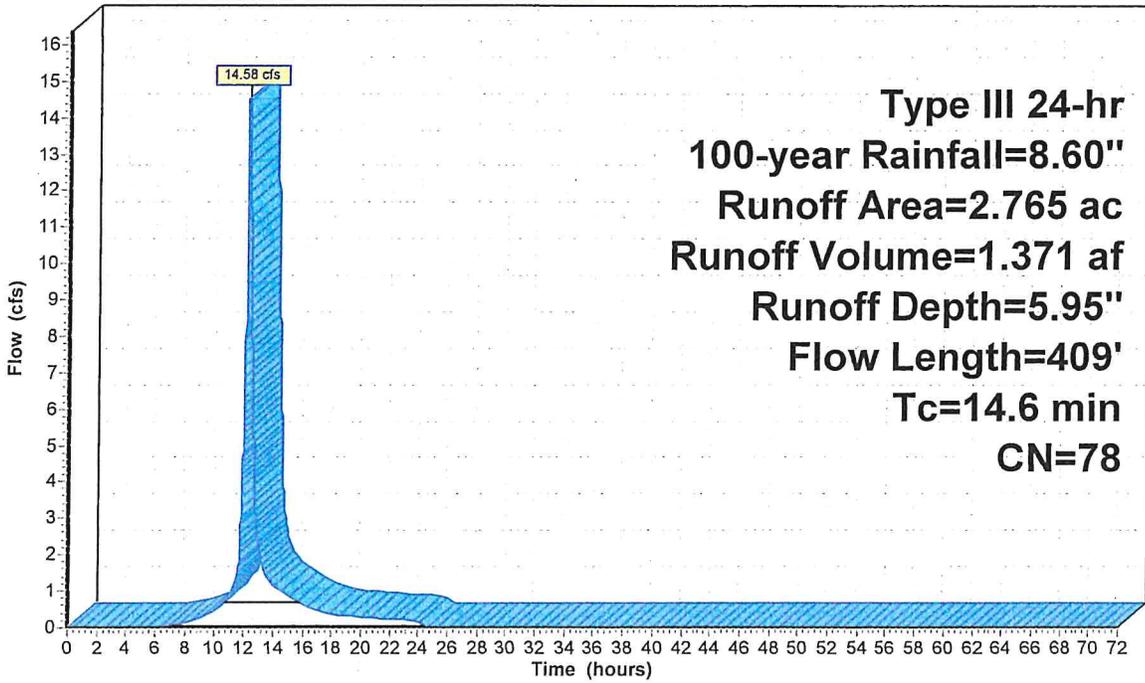
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-year Rainfall=8.60"

Area (ac)	CN	Description
* 0.127	98	Off Site Impervious
0.478	74	>75% Grass cover, Good, HSG C
0.240	80	>75% Grass cover, Good, HSG D
* 1.920	77	Woods/grass comb., Good, HSG D
2.765	78	Weighted Average
2.638		95.41% Pervious Area
0.127		4.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	37	0.0450	0.13		<b>Sheet Flow, Sheet Flow 1A-1B</b> Grass: Dense n= 0.240 P2= 3.30"
8.5	63	0.0778	0.12		<b>Sheet Flow, Sheet Flow 1B-1C</b> Woods: Light underbrush n= 0.400 P2= 3.30"
0.2	41	0.0341	2.97		<b>Shallow Concentrated Flow, Shallow Concentrated Flow 1C-1C</b> Unpaved Kv= 16.1 fps
1.3	268	0.0451	3.42		<b>Shallow Concentrated Flow, Shallow Concentrated Flow</b> Unpaved Kv= 16.1 fps
14.6	409	Total			

**Subcatchment 10: WPre01**

Hydrograph



**Summary for Subcatchment 100: WPost-01**

Runoff = 5.74 cfs @ 12.10 hrs, Volume= 0.434 af, Depth= 6.07"

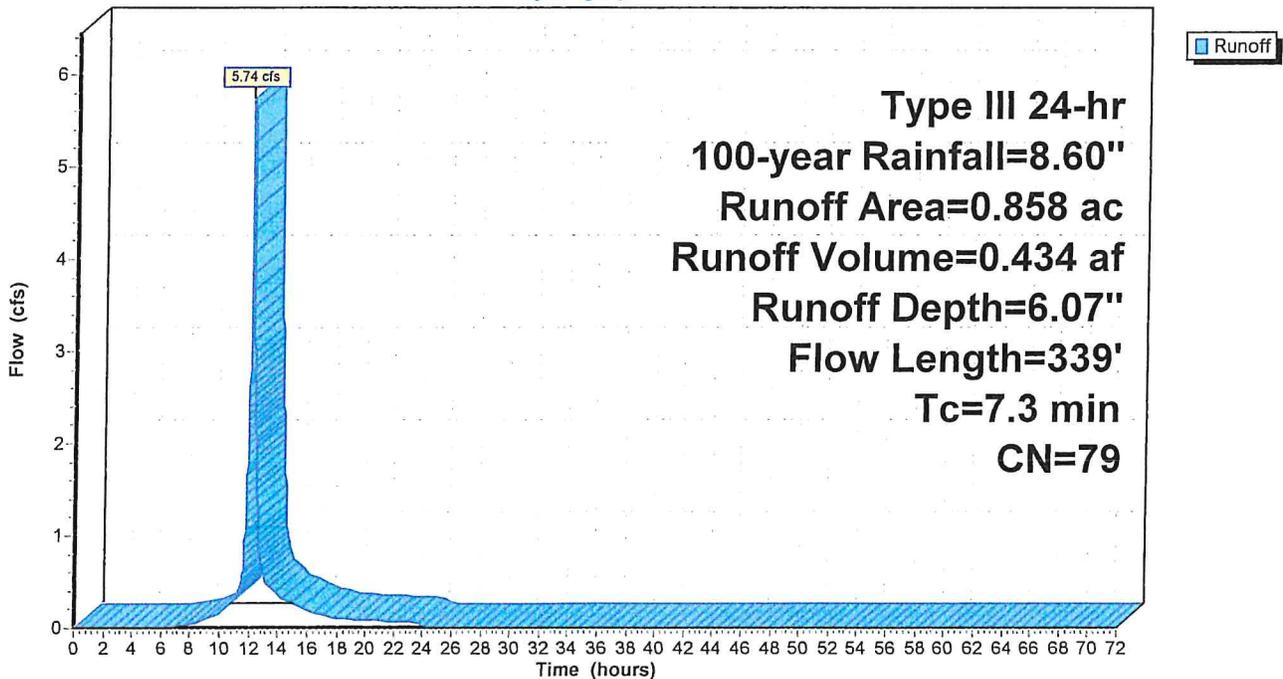
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-year Rainfall=8.60"

Area (ac)	CN	Description
* 0.086	98	Off Site
* 0.292	74	> 75% grass HSG C
* 0.176	80	>75% grass HSG D
* 0.304	77	Woods HSG D
0.858	79	Weighted Average
0.772		89.98% Pervious Area
0.086		10.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	100	0.0610	0.27		<b>Sheet Flow, Sheet Flow 1A-1B</b> Grass: Short n= 0.150 P2= 3.30"
1.1	239	0.0468	3.48		<b>Shallow Concentrated Flow, Shalloe Concentrated Flow 1B-1C</b> Unpaved Kv= 16.1 fps
7.3	339	Total			

**Subcatchment 100: WPost-01**

Hydrograph



**Summary for Subcatchment 101: WPost-02**

Runoff = 10.86 cfs @ 12.08 hrs, Volume= 0.836 af, Depth= 7.52"

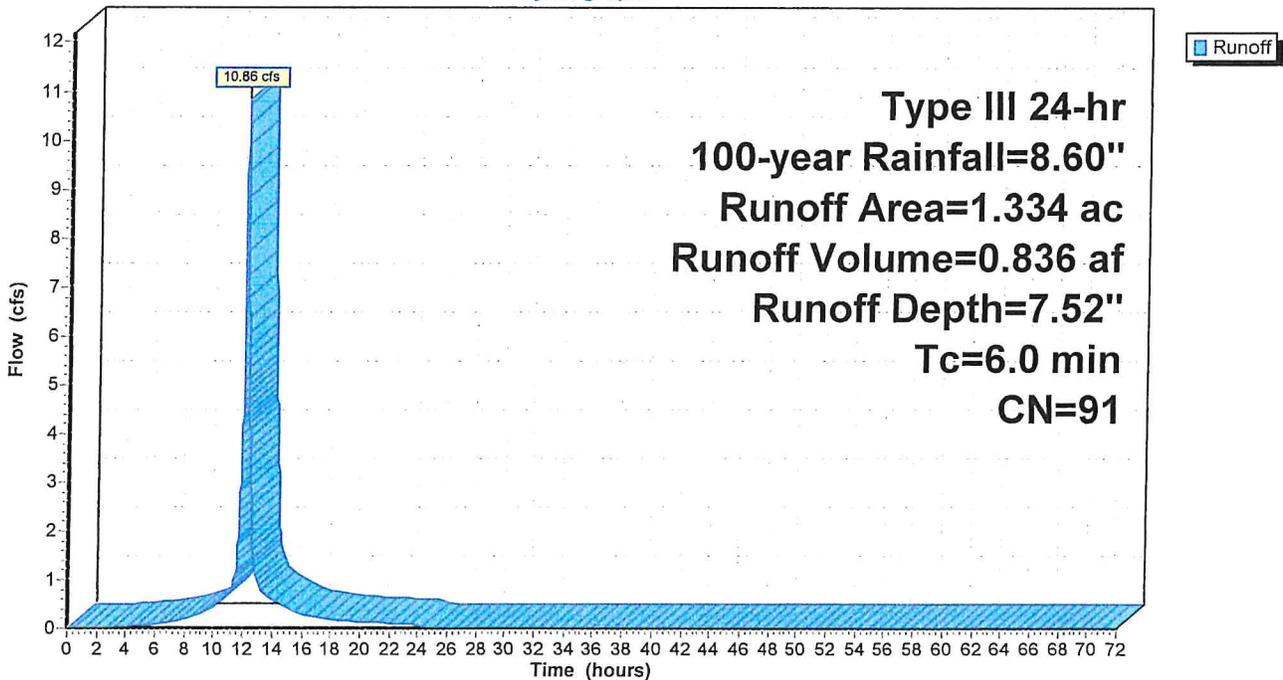
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-year Rainfall=8.60"

Area (ac)	CN	Description
* 0.876	98	Impervious
* 0.041	98	Offsite Impervious
* 0.192	74	> 75% grass cover HSG C
* 0.146	80	> Grass cover HSG D
* 0.079	77	Woods HSG D
1.334	91	Weighted Average
0.417		31.26% Pervious Area
0.917		68.74% Impervious Area

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

**Subcatchment 101: WPost-02**

Hydrograph



**Summary for Subcatchment 107: WPost-03**

Runoff = 4.57 cfs @ 12.08 hrs, Volume= 0.347 af, Depth= 7.28"

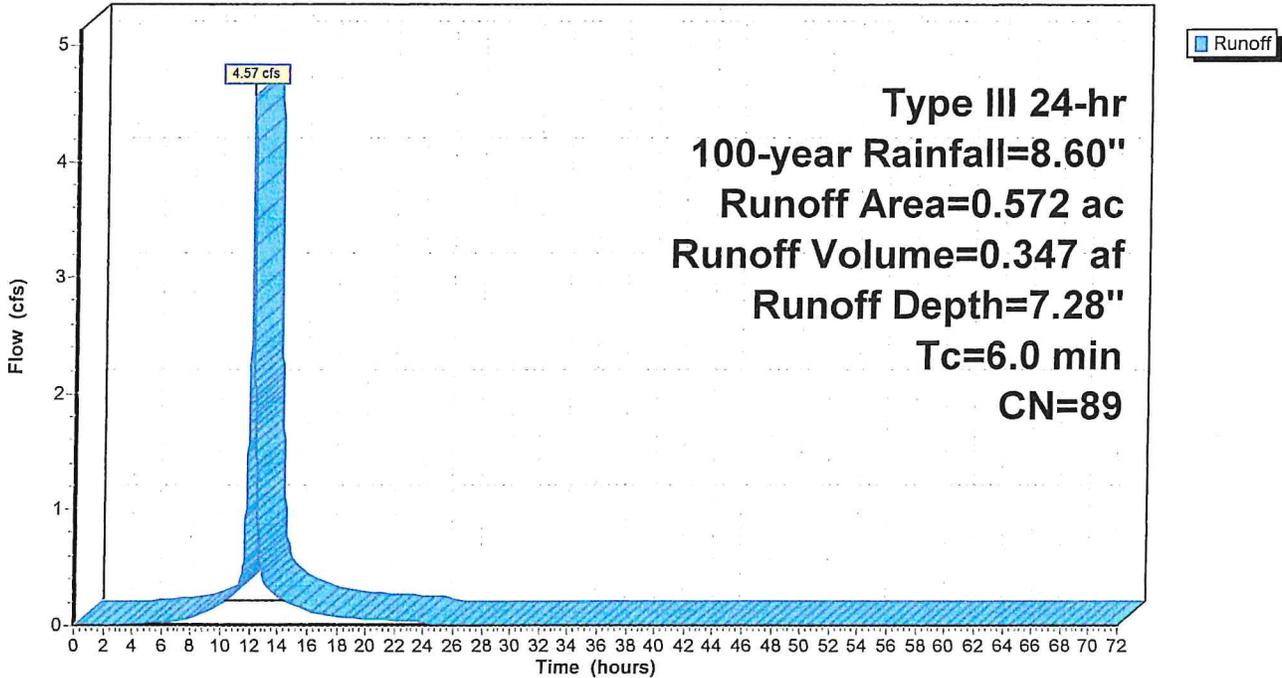
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-year Rainfall=8.60"

Area (ac)	CN	Description
* 0.276	98	Impervious
* 0.286	80	> 75% grass cover HSG D
0.010	74	>75% Grass cover, Good, HSG C
0.572	89	Weighted Average
0.296		51.75% Pervious Area
0.276		48.25% Impervious Area

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

**Subcatchment 107: WPost-03**

Hydrograph



### Summary for Reach 11: (new Reach)

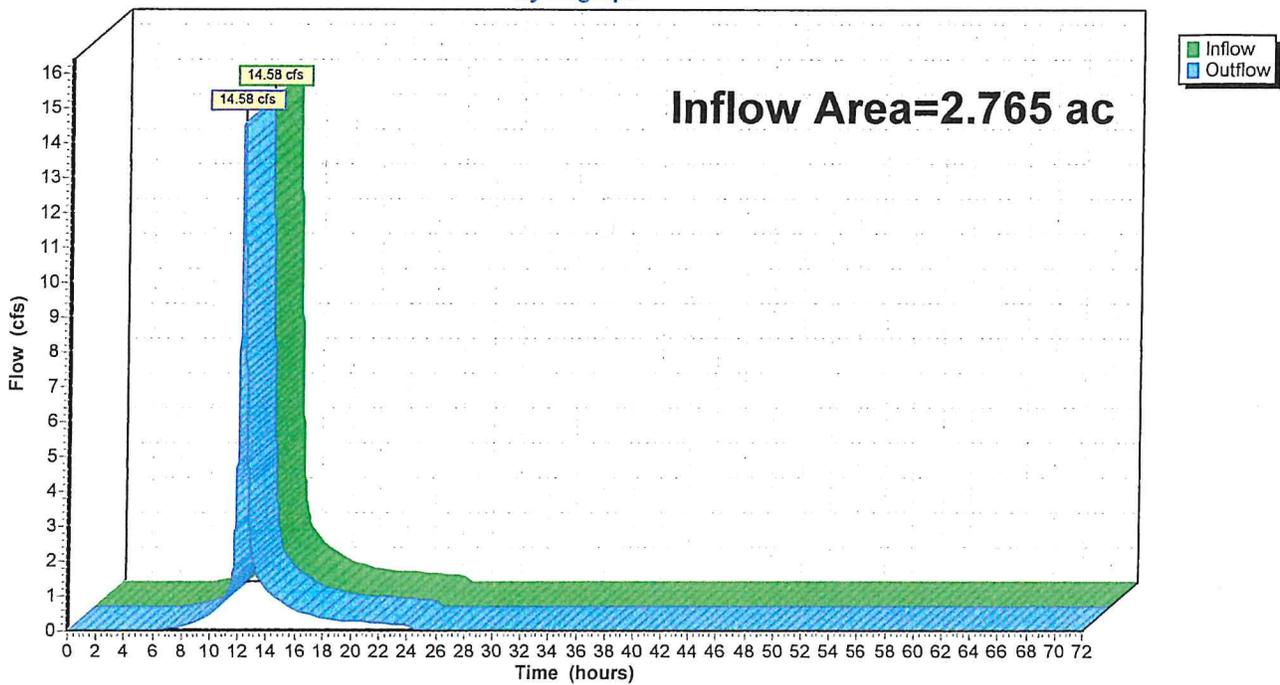
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.765 ac, 4.59% Impervious, Inflow Depth = 5.95" for 100-year event  
Inflow = 14.58 cfs @ 12.20 hrs, Volume= 1.371 af  
Outflow = 14.58 cfs @ 12.20 hrs, Volume= 1.371 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2

### Reach 11: (new Reach)

Hydrograph



### Summary for Reach 111: Wetland

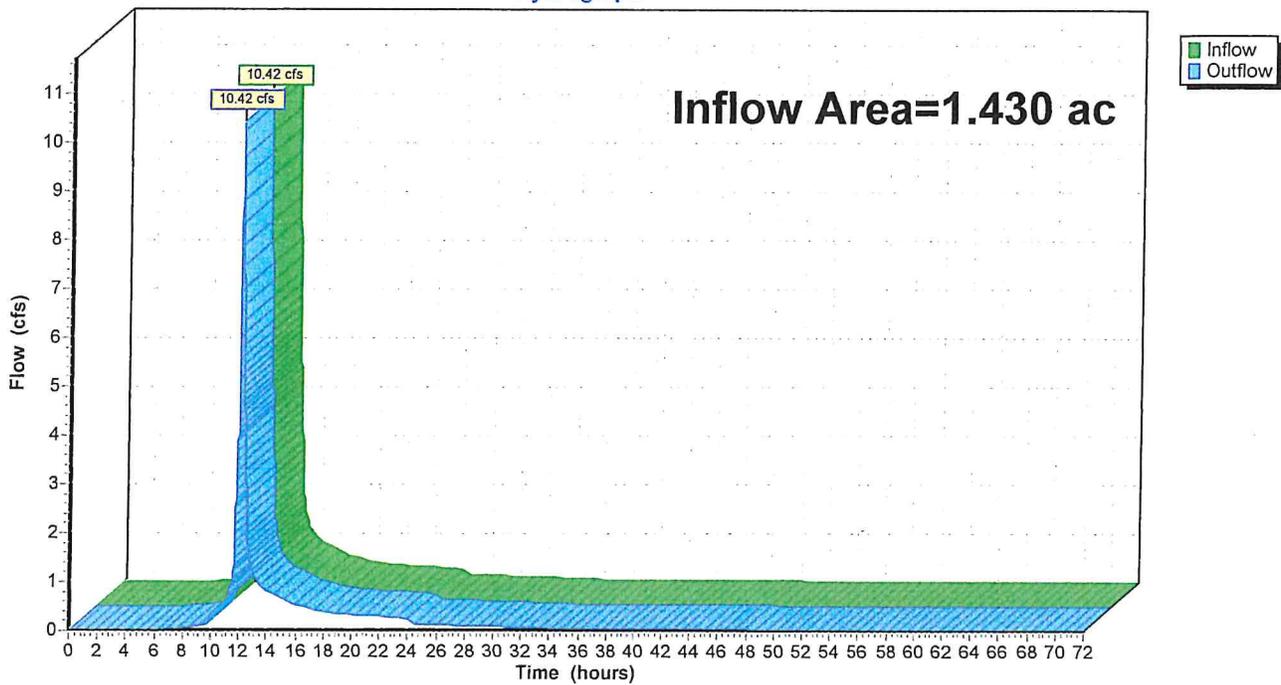
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.430 ac, 25.31% Impervious, Inflow Depth > 9.08" for 100-year event  
Inflow = 10.42 cfs @ 12.10 hrs, Volume= 1.083 af  
Outflow = 10.42 cfs @ 12.10 hrs, Volume= 1.083 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2

### Reach 111: Wetland

Hydrograph



### Summary for Pond 102: Qp/WQ By Pass

Inflow Area = 1.334 ac, 68.74% Impervious, Inflow Depth = 7.52" for 100-year event  
 Inflow = 10.86 cfs @ 12.08 hrs, Volume= 0.836 af  
 Outflow = 10.86 cfs @ 12.08 hrs, Volume= 0.836 af, Atten= 0%, Lag= 0.0 min  
 Primary = 1.38 cfs @ 12.07 hrs, Volume= 0.500 af  
 Secondary = 9.48 cfs @ 12.08 hrs, Volume= 0.336 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 76.37' @ 12.08 hrs  
 Flood Elev= 78.61'

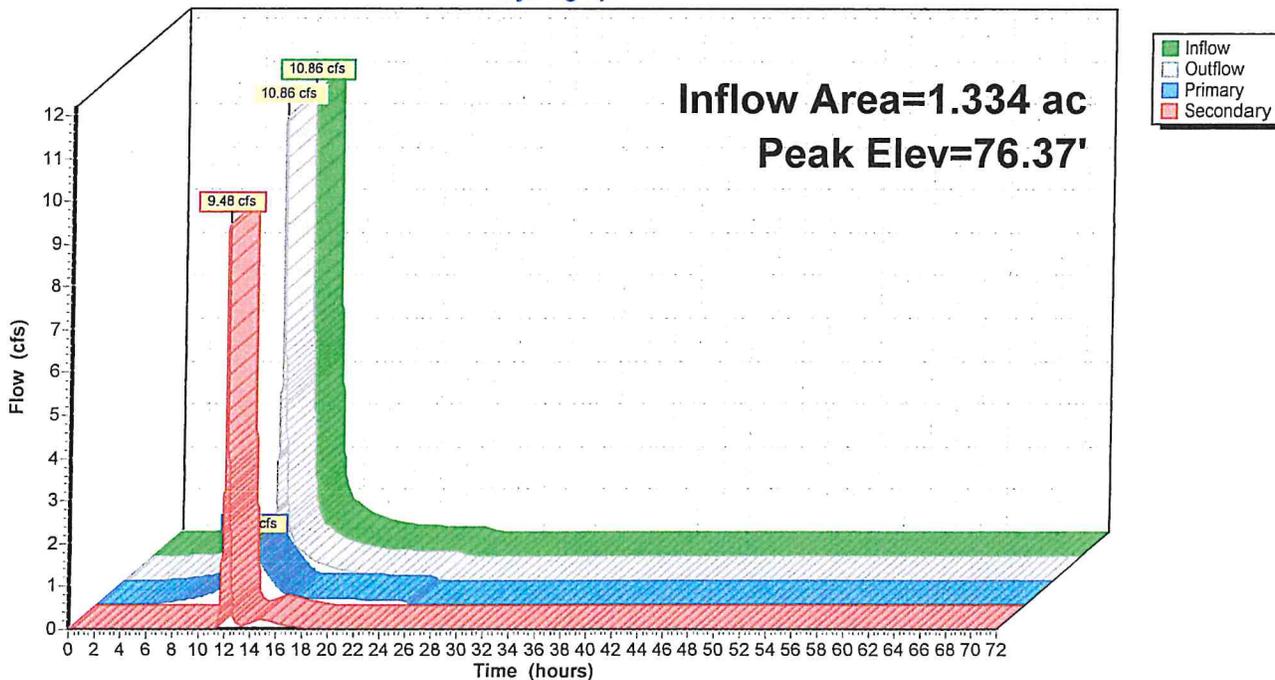
Device	Routing	Invert	Outlet Devices
#1	Primary	73.50'	6.0" Vert. 6.00" Vert WQ UIS C= 0.600
#2	Device 3	75.75'	6.0' long weir plate 2 End Contraction(s)
#3	Secondary	72.50'	18.0" Vert. 18" Vert. QP Pond C= 0.600

Primary OutFlow Max=1.37 cfs @ 12.07 hrs HW=76.37' TW=74.26' (Dynamic Tailwater)  
 ↑1=6.00" Vert WQ UIS (Orifice Controls 1.37 cfs @ 7.00 fps)

Secondary OutFlow Max=9.46 cfs @ 12.08 hrs HW=76.37' TW=71.43' (Dynamic Tailwater)  
 ↑3=18" Vert. QP Pond (Passes 9.46 cfs of 15.04 cfs potential flow)  
 ↑2=weir plate (Weir Controls 9.46 cfs @ 2.58 fps)

### Pond 102: Qp/WQ By Pass

Hydrograph



**Summary for Pond 105: UIS A**

[80] Warning: Exceeded Pond CB 103 by 2.47' @ 24.11 hrs (6.72 cfs 0.690 af)

Inflow = 1.25 cfs @ 11.97 hrs, Volume= 0.379 af  
 Outflow = 0.14 cfs @ 15.34 hrs, Volume= 0.379 af, Atten= 89%, Lag= 202.3 min  
 Discarded = 0.14 cfs @ 15.34 hrs, Volume= 0.379 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 75.78' @ 15.34 hrs Surf.Area= 7,849 sf Storage= 10,579 cf  
 Flood Elev= 76.00' Surf.Area= 7,849 sf Storage= 10,874 cf

Plug-Flow detention time= 1,018.9 min calculated for 0.379 af (100% of inflow)  
 Center-of-Mass det. time= 1,018.8 min ( 1,833.8 - 814.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	4,278 cf	<b>Sand Filter (Prismatic)</b> Listed below (Recalc) 12,846 cf Overall x 33.3% Voids
#2A	73.00'	2,642 cf	<b>44.25'W x 80.60'L x 3.50'H Field A</b> 12,483 cf Overall - 4,548 cf Embedded = 7,935 cf x 33.3% Voids
#3A	73.50'	4,548 cf	<b>ADS_StormTech SC-740 +Cap</b> x 99 Inside #2 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 9 Rows of 11 Chambers
		11,468 cf	Total Available Storage

Storage Group A created with Chamber Wizard

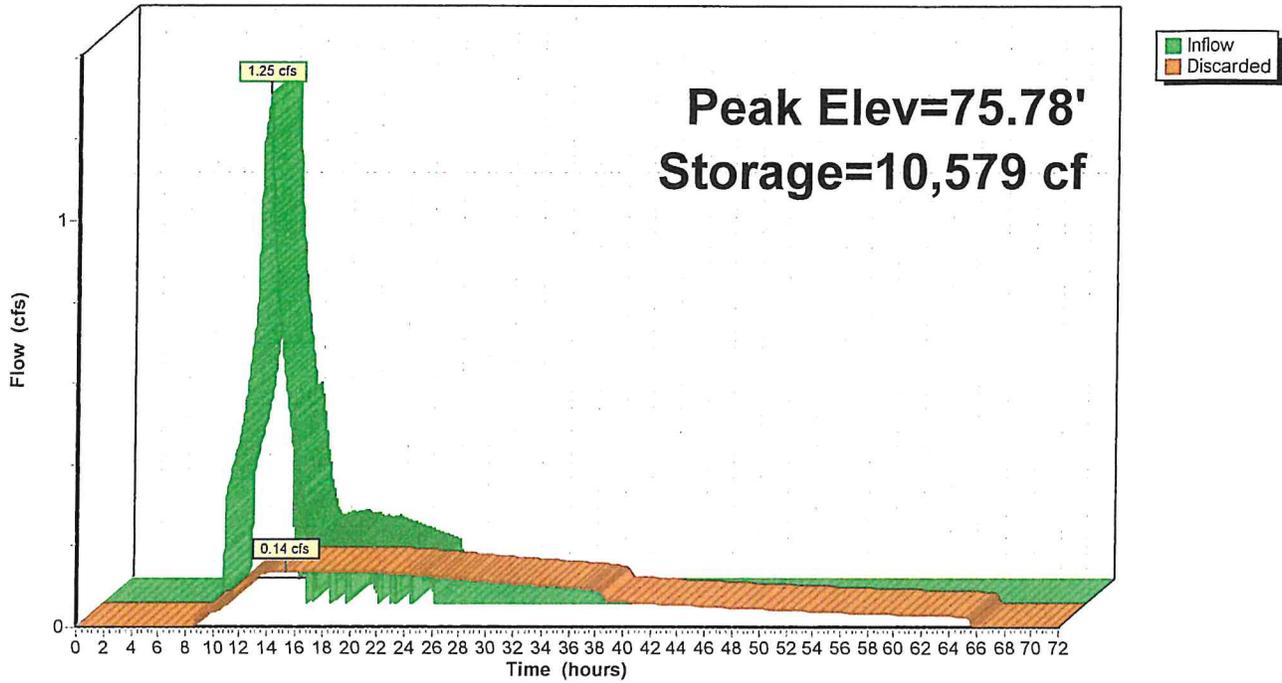
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
70.00	4,282	0	0
73.00	4,282	12,846	12,846

Device	Routing	Invert	Outlet Devices
#1	Discarded	70.00'	<b>0.270 in/hr Exfiltration over Surface area</b> Conductivity to Groundwater Elevation = 68.00' Phase-In= 0.01'

**Discarded OutFlow** Max=0.14 cfs @ 15.34 hrs HW=75.77' (Free Discharge)  
 ↑=Exfiltration ( Controls 0.14 cfs)

### Pond 105: UIS A

#### Hydrograph



**Summary for Pond 106P: UDS**

Inflow = 9.48 cfs @ 12.08 hrs, Volume= 0.336 af  
 Outflow = 0.22 cfs @ 12.81 hrs, Volume= 0.336 af, Atten= 98%, Lag= 43.8 min  
 Primary = 0.22 cfs @ 12.81 hrs, Volume= 0.336 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 72.50' @ 12.81 hrs Surf.Area= 5,765 sf Storage= 11,322 cf  
 Flood Elev= 75.00' Surf.Area= 0 sf Storage= 22,639 cf

Plug-Flow detention time= 751.9 min calculated for 0.336 af (100% of inflow)  
 Center-of-Mass det. time= 751.6 min ( 1,512.7 - 761.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	3,495 cf	<b>60.0" Round CMP_Round 60" x 2</b> L= 89.0'
#2	70.00'	19,144 cf	<b>60.0" Round CMP_Round 60" x 13</b> L= 75.0'
		22,639 cf	Total Available Storage

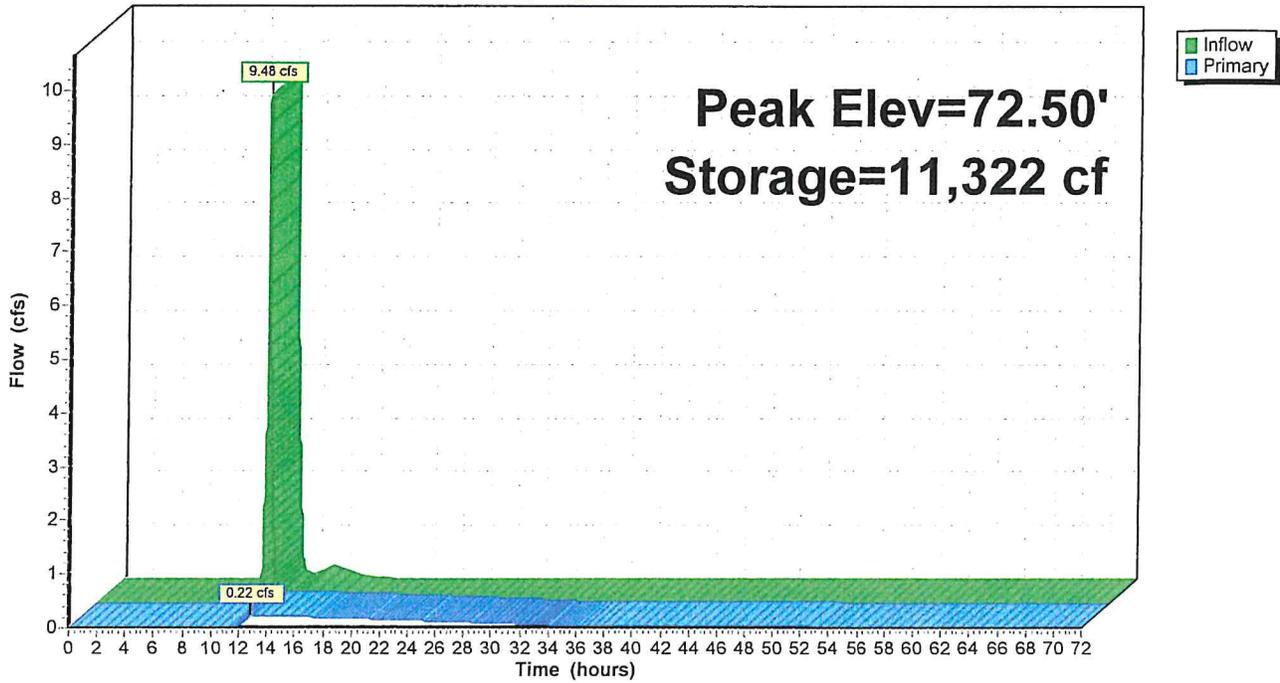
Device	Routing	Invert	Outlet Devices
#1	Device 4	70.00'	<b>1.0" Horiz. Low Flow CPv</b> C= 0.600 Limited to weir flow at low heads
#2	Device 4	70.65'	<b>2.0" W x 2.0" H Vert. Vert Orifice</b> C= 0.600
#3	Device 4	74.50'	<b>4.0' long x 0.5' breadth Broad-Crested Rectangular Outlet Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Primary	69.00'	<b>12.0" Round Culvert</b> L= 120.0' Ke= 0.500 Inlet / Outlet Invert= 69.00' / 68.00' S= 0.0083 ' / ' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.22 cfs @ 12.81 hrs HW=72.50' TW=0.00' (Dynamic Tailwater)

- ↑ 4=Culvert (Passes 0.22 cfs of 5.76 cfs potential flow)
  - ↑ 1=Low Flow CPv (Orifice Controls 0.04 cfs @ 7.61 fps)
  - ↑ 2=Vert Orifice (Orifice Controls 0.18 cfs @ 6.40 fps)
  - ↑ 3=Broad-Crested Rectangular Outlet Weir ( Controls 0.00 cfs)

Pond 106P: UDS

Hydrograph



**Summary for Pond 109: (new Pond)Sand Filter B**

Inflow Area = 0.572 ac, 48.25% Impervious, Inflow Depth = 7.28" for 100-year event  
 Inflow = 4.57 cfs @ 12.08 hrs, Volume= 0.347 af  
 Outflow = 4.57 cfs @ 12.09 hrs, Volume= 0.341 af, Atten= 0%, Lag= 0.3 min  
 Discarded = 0.01 cfs @ 52.93 hrs, Volume= 0.028 af  
 Primary = 4.56 cfs @ 12.09 hrs, Volume= 0.313 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 70.82' @ 12.09 hrs Surf.Area= 0.011 ac Storage= 0.031 af

Plug-Flow detention time= 177.3 min calculated for 0.341 af (98% of inflow)  
 Center-of-Mass det. time= 167.4 min ( 944.3 - 776.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	69.00'	0.019 af	<b>32.60'W x 10.00'L x 2.50'H Prismaticoid</b>
#2	67.00'	0.002 af	<b>10.00'W x 10.75'L x 2.00'H Prismaticoid</b>
			0.005 af Overall x 33.0% Voids
#3	69.00'	0.014 af	<b>18.0" Round Pipe Storage x 4</b>
			L= 85.0'
#4	69.00'	0.002 af	<b>24.0" Round Pipe Storage x 2</b>
			L= 12.0'
		0.036 af	Total Available Storage

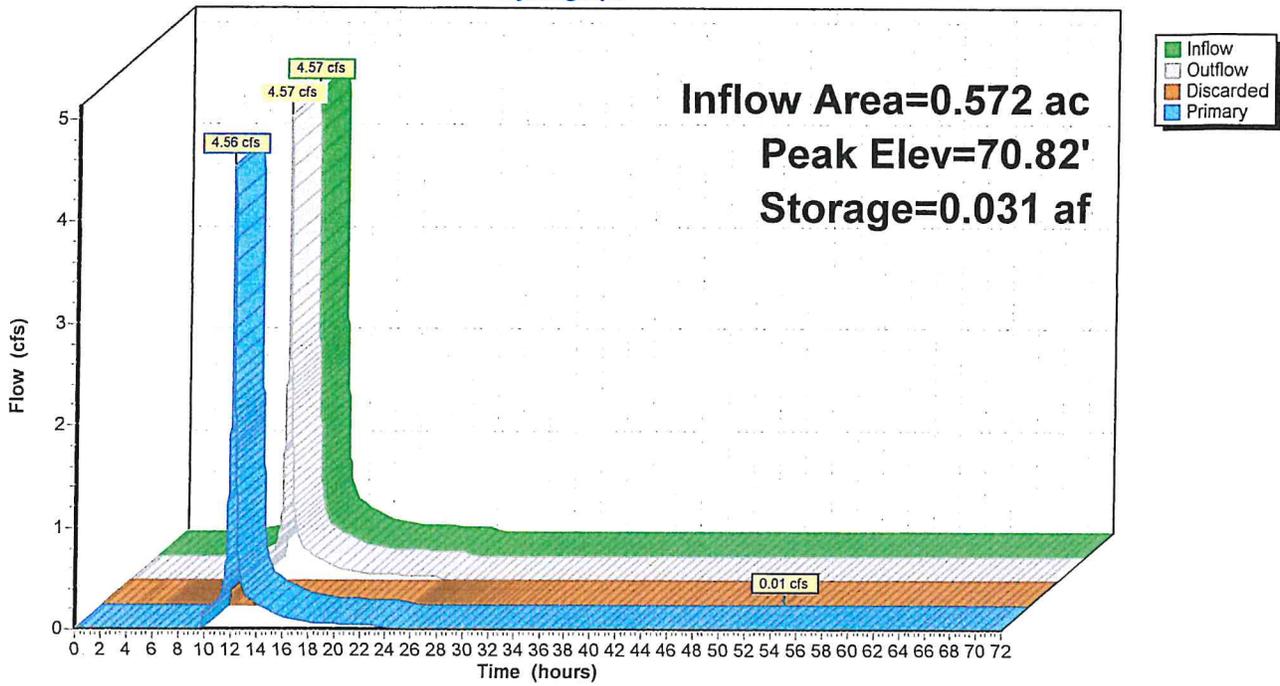
Device	Routing	Invert	Outlet Devices
#1	Discarded	67.00'	<b>0.270 in/hr Exfiltration over Surface area</b>
#2	Primary	70.50'	<b>10.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b>
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Discarded OutFlow** Max=0.01 cfs @ 52.93 hrs HW=69.76' (Free Discharge)  
 ↳ **1=Exfiltration** (Exfiltration Controls 0.01 cfs)

**Primary OutFlow** Max=4.56 cfs @ 12.09 hrs HW=70.82' TW=0.00' (Dynamic Tailwater)  
 ↳ **2=Broad-Crested Rectangular Weir** (Weir Controls 4.56 cfs @ 1.43 fps)

### Pond 109: (new Pond)Sand Filter B

Hydrograph



### Summary for Pond CB 103: Isolator By Pass

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=3)

[80] Warning: Exceeded Pond 102 by 2.88' @ 24.34 hrs (1.21 cfs 0.171 af)

Inflow Area = 1.334 ac, 68.74% Impervious, Inflow Depth = 4.50" for 100-year event  
 Inflow = 1.38 cfs @ 12.07 hrs, Volume= 0.500 af  
 Outflow = 1.38 cfs @ 12.07 hrs, Volume= 0.500 af, Atten= 0%, Lag= 0.0 min  
 Primary = 0.30 cfs @ 14.12 hrs, Volume= 0.131 af  
 Secondary = 1.25 cfs @ 11.97 hrs, Volume= 0.379 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 75.78' @ 15.34 hrs  
 Flood Elev= 78.96'

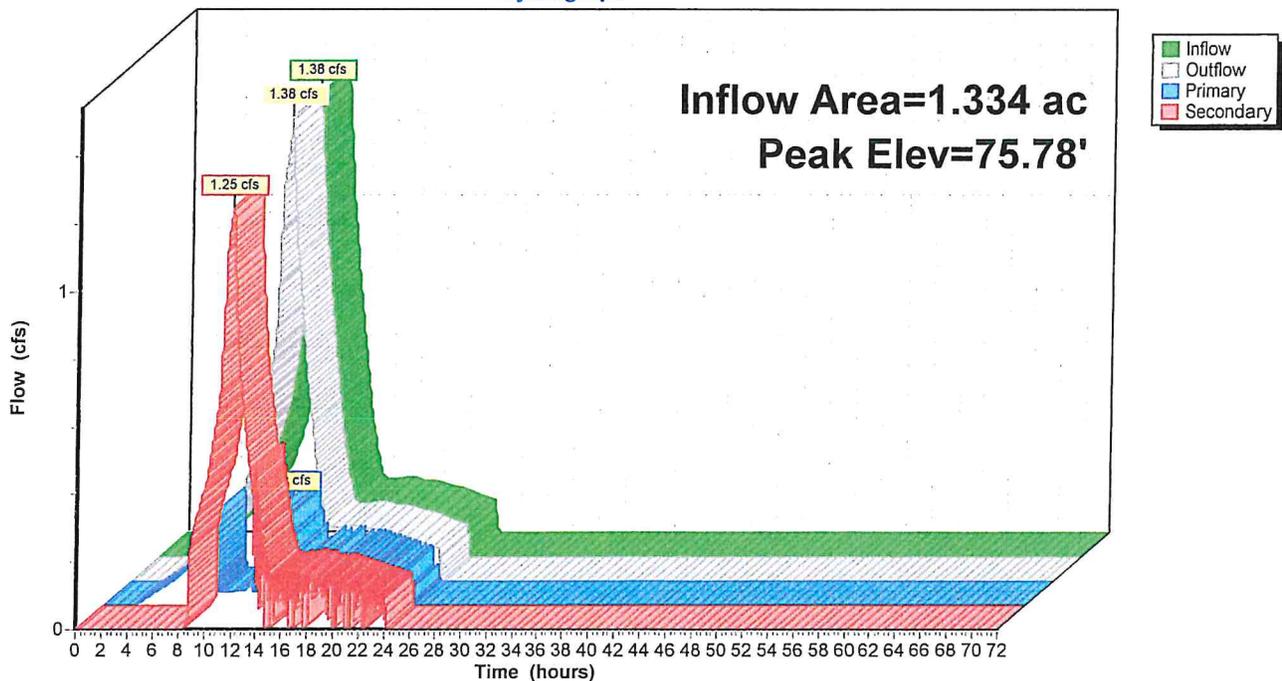
Device	Routing	Invert	Outlet Devices
#1	Primary	73.00'	15.0" Vert. Isolator Row C= 0.600
#2	Device 3	74.00'	4.0' long Weir PLate 2 End Contraction(s)
#3	Secondary	73.55'	15.0" Vert. CB 103 Isolator Bypass C= 0.600

Primary OutFlow Max=0.00 cfs @ 14.12 hrs HW=75.63' TW=75.63' (Dynamic Tailwater)  
 ↳1=Isolator Row ( Controls 0.00 cfs)

Secondary OutFlow Max=1.25 cfs @ 11.97 hrs HW=74.21' TW=74.00' (Dynamic Tailwater)  
 ↳3=CB 103 Isolator Bypass (Passes 1.25 cfs of 1.45 cfs potential flow)  
 ↳2=Weir PLate (Weir Controls 1.25 cfs @ 1.50 fps)

### Pond CB 103: Isolator By Pass

Hydrograph



**Summary for Pond Pond 104: UIS A (Isolator Row) w/ Underground Sand Filter**

[80] Warning: Exceeded Pond CB 103 by 2.47' @ 24.11 hrs (8.03 cfs 2.305 af)

Inflow Area = 1.334 ac, 68.74% Impervious, Inflow Depth = 1.18" for 100-year event  
 Inflow = 0.30 cfs @ 14.12 hrs, Volume= 0.131 af  
 Outflow = 0.04 cfs @ 15.17 hrs, Volume= 0.131 af, Atten= 86%, Lag= 63.0 min  
 Discarded = 0.04 cfs @ 15.17 hrs, Volume= 0.131 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 75.78' @ 15.17 hrs Surf.Area= 2,502 sf Storage= 3,422 cf  
 Flood Elev= 76.00' Surf.Area= 2,502 sf Storage= 3,526 cf

Plug-Flow detention time= 1,050.1 min calculated for 0.131 af (100% of inflow)  
 Center-of-Mass det. time= 1,050.1 min ( 1,746.4 - 696.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	70.00'	1,210 cf	<b>Sand Filter (Prismatic)</b> Listed below (Recalc) 3,633 cf Overall x 33.3% Voids
#2A	73.00'	999 cf	<b>15.75'W x 81.94'L x 3.50'H Field A</b> 4,517 cf Overall - 1,516 cf Embedded = 3,001 cf x 33.3% Voids
#3A	73.50'	1,516 cf	<b>ADS_StormTech SC-740 +Cap</b> x 33 Inside #2 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 3 Rows of 11 Chambers
#4	73.50'	34 cf	<b>4.00'D x 5.46'H Vertical Cone/Cylinder</b> x 0.5 -Impervious
		3,759 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
70.00	1,211	0	0
73.00	1,211	3,633	3,633

Device	Routing	Invert	Outlet Devices
#1	Discarded	70.00'	<b>0.270 in/hr Exfiltration over Surface area</b> Conductivity to Groundwater Elevation = 68.00' Phase-In= 0.01'

**Discarded OutFlow** Max=0.04 cfs @ 15.17 hrs HW=75.78' (Free Discharge)  
 ↳ **1=Exfiltration** ( Controls 0.04 cfs)

### Pond Pond 104: UIS A (Isolator Row) w/ Underground Sand Filter

Hydrograph

