



**Haverhill Existing Model 160511**

Prepared by Weston & Sampson

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**Area Listing (all nodes)**

Area (sq-ft)	CN	Description (subcatchment-numbers)
92,888	61	>75% Grass cover, Good, HSG B (1S, 2S)
216,469	48	Brush, Good, HSG B (1S, 2S, 3S, 4S, 5S)
12,770	98	Paved driveways & Roofs (1S)
28,704	98	Paved driveways and Roofs (2S)
47,907	98	Wetland (1S, 2S, 3S, 4S)
202,880	55	Woods, Good, HSG B (1S, 2S, 3S, 4S, 5S)
<b>601,618</b>	<b>60</b>	<b>TOTAL AREA</b>

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**Soil Listing (all nodes)**

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
512,237	HSG B	1S, 2S, 3S, 4S, 5S
0	HSG C	
0	HSG D	
89,381	Other	1S, 2S, 3S, 4S
<b>601,618</b>		<b>TOTAL AREA</b>

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**Ground Covers (all nodes)**

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
0	92,888	0	0	0	92,888	>75% Grass cover, Good
0	216,469	0	0	0	216,469	Brush, Good
0	0	0	0	12,770	12,770	Paved driveways & Roofs
0	0	0	0	28,704	28,704	Paved driveways and Roofs
0	0	0	0	47,907	47,907	Wetland
0	202,880	0	0	0	202,880	Woods, Good
<b>0</b>	<b>512,237</b>	<b>0</b>	<b>0</b>	<b>89,381</b>	<b>601,618</b>	<b>TOTAL AREA</b>

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Type III 24-hr 2-Year Rainfall=3.21"

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Time span=0.00-24.00 hrs, dt=0.04 hrs, 601 points x 3

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 1S: In/Into IW C**

Runoff Area=148,495 sf 25.06% Impervious Runoff Depth>0.64"  
Flow Length=809' Tc=18.6 min CN=66 Runoff=1.45 cfs 7,973 cf

**Subcatchment 2S: In/Into IW A**

Runoff Area=142,302 sf 26.58% Impervious Runoff Depth>0.74"  
Flow Length=935' Tc=13.9 min CN=68 Runoff=1.85 cfs 8,717 cf

**Subcatchment 3S: In/Into IW D**

Runoff Area=46,370 sf 6.69% Impervious Runoff Depth>0.31"  
Flow Length=443' Tc=20.1 min CN=57 Runoff=0.14 cfs 1,199 cf

**Subcatchment 4S: In/Into BVW B**

Runoff Area=155,514 sf 7.22% Impervious Runoff Depth>0.20"  
Flow Length=924' Tc=25.7 min CN=53 Runoff=0.18 cfs 2,559 cf

**Subcatchment 5S: Outside Resources**

Runoff Area=108,937 sf 0.00% Impervious Runoff Depth>0.15"  
Flow Length=668' Tc=22.7 min CN=51 Runoff=0.07 cfs 1,364 cf

**Pond 1P: Isolated Wetland C**

Peak Elev=120.14' Inflow=1.45 cfs 7,973 cf  
Outflow=1.45 cfs 7,973 cf

**Pond 2P: Isolated Wetland A**

Peak Elev=129.17' Inflow=1.85 cfs 8,717 cf  
Outflow=1.85 cfs 8,717 cf

**Pond 3P: Isolated Wetland D**

Peak Elev=112.03' Inflow=0.14 cfs 1,199 cf  
Outflow=0.14 cfs 1,199 cf

**Pond 4P: BVW B**

Inflow=3.28 cfs 20,449 cf  
Primary=3.28 cfs 20,449 cf

**Pond POI 1: Northern Site**

Inflow=3.29 cfs 21,813 cf  
Primary=3.29 cfs 21,813 cf

**Total Runoff Area = 601,618 sf Runoff Volume = 21,813 cf Average Runoff Depth = 0.44"**  
**85.14% Pervious = 512,237 sf 14.86% Impervious = 89,381 sf**

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Type III 24-hr 2-Year Rainfall=3.21"

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**Summary for Subcatchment 1S: In/Into IW C**

Runoff = 1.45 cfs @ 12.31 hrs, Volume= 7,973 cf, Depth> 0.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
Type III 24-hr 2-Year Rainfall=3.21"

	Area (sf)	CN	Description
*	12,770	98	Paved driveways & Roofs
	28,649	55	Woods, Good, HSG B
	48,595	61	>75% Grass cover, Good, HSG B
	34,034	48	Brush, Good, HSG B
*	24,447	98	Wetland
	148,495	66	Weighted Average
	111,278		74.94% Pervious Area
	37,217		25.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	90	0.0528	0.25		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.21"
2.4	10	0.0500	0.07		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.21"
1.0	63	0.0476	1.09		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
1.9	174	0.0488	1.55		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
0.9	55	0.0273	0.99		<b>Shallow Concentrated Flow, Heavy Brush</b> Kv= 6.0 fps
6.3	417	0.0336	1.10		<b>Shallow Concentrated Flow, Heavy Brush</b> Kv= 6.0 fps
18.6	809	Total			

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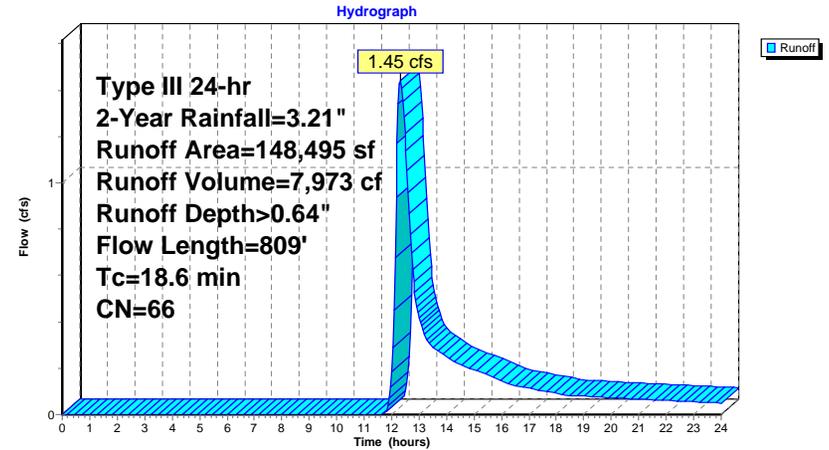
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Type III 24-hr 2-Year Rainfall=3.21"

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**Subcatchment 1S: In/Into IW C**



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**Summary for Subcatchment 2S: In/Into IW A**

Runoff = 1.85 cfs @ 12.22 hrs, Volume= 8,717 cf, Depth> 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
Type III 24-hr 2-Year Rainfall=3.21"

Area (sf)	CN	Description
* 9,125	98	Wetland
768	48	Brush, Good, HSG B
59,412	55	Woods, Good, HSG B
* 28,704	98	Paved driveways and Roofs
44,293	61	>75% Grass cover, Good, HSG B
142,302	68	Weighted Average
104,473		73.42% Pervious Area
37,829		26.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0200	1.38		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.21"
0.8	164	0.0300	3.52		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.1	101	0.0500	1.57		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
3.3	239	0.0593	1.22		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
7.5	331	0.0219	0.74		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.9	935	Total			

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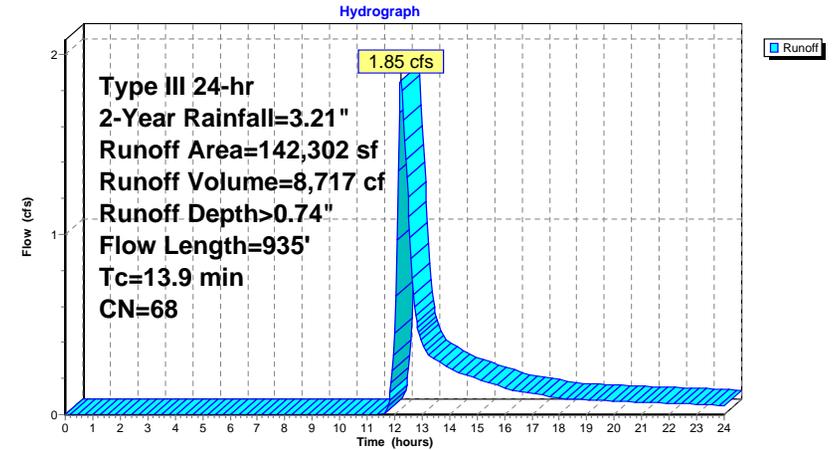
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Type III 24-hr 2-Year Rainfall=3.21"

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**Subcatchment 2S: In/Into IW A**



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**Summary for Subcatchment 3S: In/Into IW D**

Runoff = 0.14 cfs @ 12.50 hrs, Volume= 1,199 cf, Depth> 0.31"

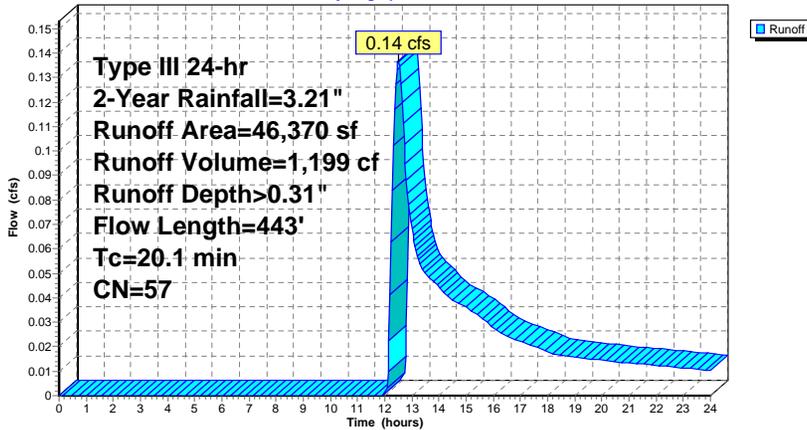
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
Type III 24-hr 2-Year Rainfall=3.21"

Area (sf)	CN	Description
3,100	98	Wetland
36,667	55	Woods, Good, HSG B
6,603	48	Brush, Good, HSG B
46,370	57	Weighted Average
43,270		93.31% Pervious Area
3,100		6.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.7	100	0.0511	0.11		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.21"
4.0	272	0.0511	1.13		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
1.4	71	0.0141	0.83		<b>Shallow Concentrated Flow, Heavy Brush</b> Kv= 7.0 fps
20.1	443	Total			

**Subcatchment 3S: In/Into IW D**

Hydrograph



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Type III 24-hr 2-Year Rainfall=3.21"

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**Summary for Subcatchment 4S: In/Into BVW B**

Runoff = 0.18 cfs @ 12.68 hrs, Volume= 2,559 cf, Depth> 0.20"

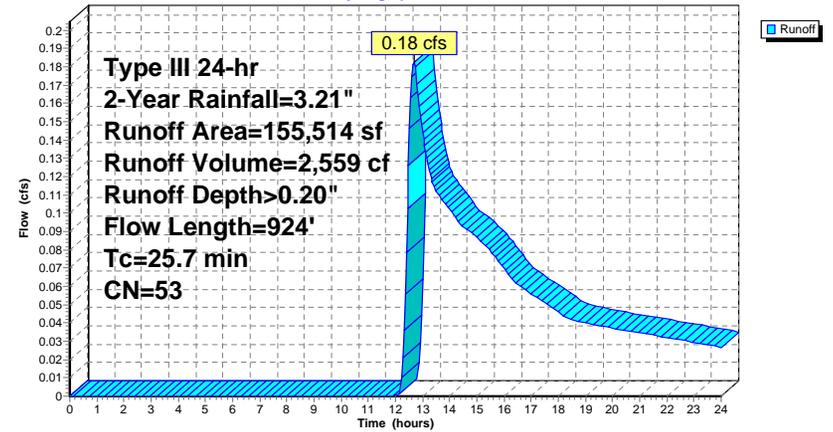
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
Type III 24-hr 2-Year Rainfall=3.21"

Area (sf)	CN	Description
11,235	98	Wetland
31,424	55	Woods, Good, HSG B
112,855	48	Brush, Good, HSG B
155,514	53	Weighted Average
144,279		92.78% Pervious Area
11,235		7.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.5	100	0.0450	0.11		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.21"
0.7	35	0.0286	0.85		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
6.6	526	0.0485	1.32		<b>Shallow Concentrated Flow, Heavy Brush</b> Kv= 6.0 fps
2.9	263	0.0456	1.49		<b>Shallow Concentrated Flow, Heavy Brush</b> Kv= 7.0 fps
25.7	924	Total			

**Subcatchment 4S: In/Into BVW B**

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**Summary for Subcatchment 5S: Outside Resources Areas**

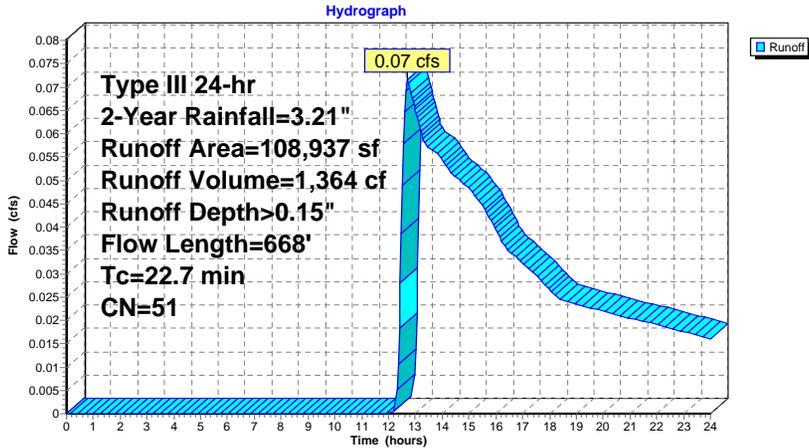
Runoff = 0.07 cfs @ 12.71 hrs, Volume= 1,364 cf, Depth> 0.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
Type III 24-hr 2-Year Rainfall=3.21"

Area (sf)	CN	Description
46,728	55	Woods, Good, HSG B
62,209	48	Brush, Good, HSG B
108,937	51	Weighted Average
108,937		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.2	100	0.0475	0.11		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.21"
1.0	82	0.0823	1.43		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
6.2	466	0.0440	1.26		Shallow Concentrated Flow, Heavy Brush Kv= 6.0 fps
0.3	20	0.0500	1.12		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
22.7	668	Total			

**Subcatchment 5S: Outside Resources Areas**



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**Summary for Pond 1P: Isolated Wetland C**

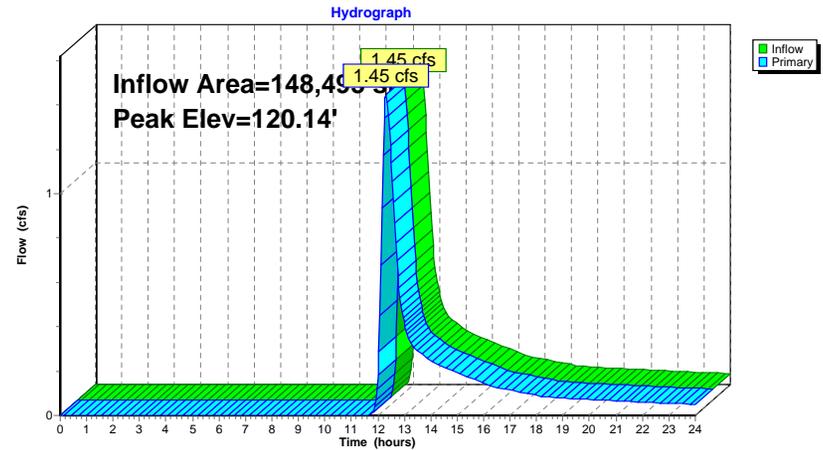
Inflow Area = 148,495 sf, 25.06% Impervious, Inflow Depth > 0.64" for 2-Year event  
Inflow = 1.45 cfs @ 12.31 hrs, Volume= 7,973 cf  
Outflow = 1.45 cfs @ 12.31 hrs, Volume= 7,973 cf, Atten= 0%, Lag= 0.0 min  
Primary = 1.45 cfs @ 12.31 hrs, Volume= 7,973 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 3  
Peak Elev= 120.14' @ 12.31 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	120.00'	10.0' long x 316.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.44 cfs @ 12.31 hrs HW=120.14' TW=0.00' (Dynamic Tailwater)  
1=Broad-Crested Rectangular Weir (Weir Controls 1.44 cfs @ 1.01 fps)

**Pond 1P: Isolated Wetland C**



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**Summary for Pond 2P: Isolated Wetland A**

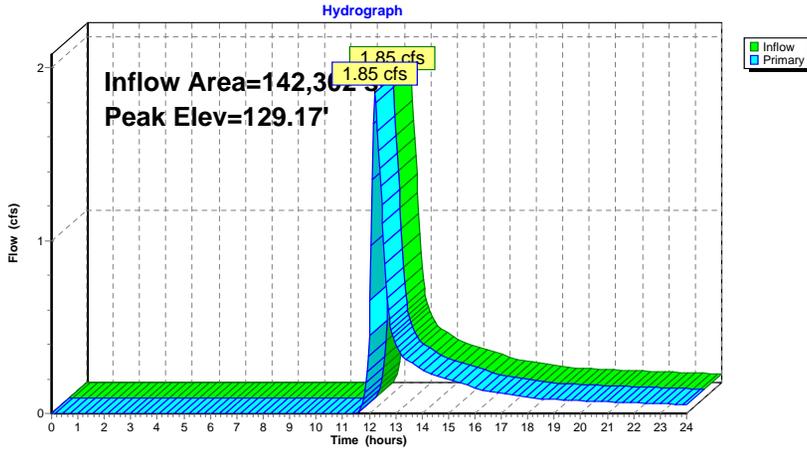
Inflow Area = 142,302 sf, 26.58% Impervious, Inflow Depth > 0.74" for 2-Year event  
 Inflow = 1.85 cfs @ 12.22 hrs, Volume= 8,717 cf  
 Outflow = 1.85 cfs @ 12.22 hrs, Volume= 8,717 cf, Atten= 0%, Lag= 0.0 min  
 Primary = 1.85 cfs @ 12.22 hrs, Volume= 8,717 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 3  
 Peak Elev= 129.17' @ 12.22 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	129.00'	<b>10.0' long x 472.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.84 cfs @ 12.22 hrs HW=129.17' TW=0.00' (Dynamic Tailwater)  
 1=Broad-Crested Rectangular Weir (Weir Controls 1.84 cfs @ 1.10 fps)

**Pond 2P: Isolated Wetland A**



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**Summary for Pond 3P: Isolated Wetland D**

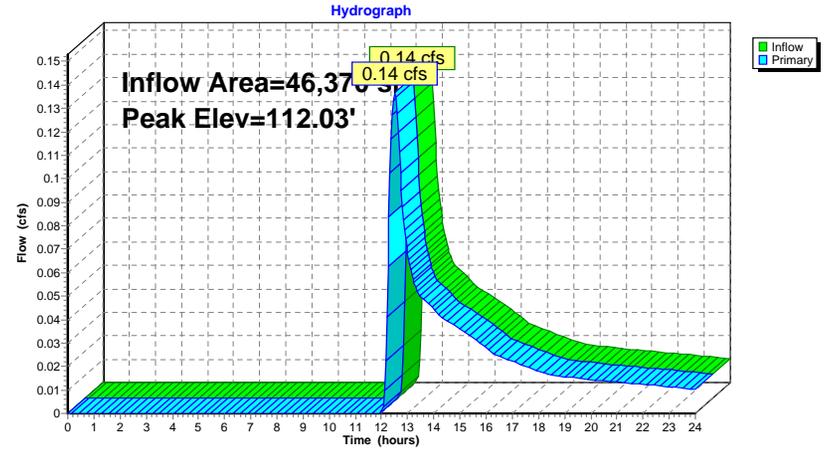
Inflow Area = 46,370 sf, 6.69% Impervious, Inflow Depth > 0.31" for 2-Year event  
 Inflow = 0.14 cfs @ 12.50 hrs, Volume= 1,199 cf  
 Outflow = 0.14 cfs @ 12.50 hrs, Volume= 1,199 cf, Atten= 0%, Lag= 0.0 min  
 Primary = 0.14 cfs @ 12.50 hrs, Volume= 1,199 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 3  
 Peak Elev= 112.03' @ 12.50 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	112.00'	<b>10.0' long x 129.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.14 cfs @ 12.50 hrs HW=112.03' TW=0.00' (Dynamic Tailwater)  
 1=Broad-Crested Rectangular Weir (Weir Controls 0.14 cfs @ 0.46 fps)

**Pond 3P: Isolated Wetland D**



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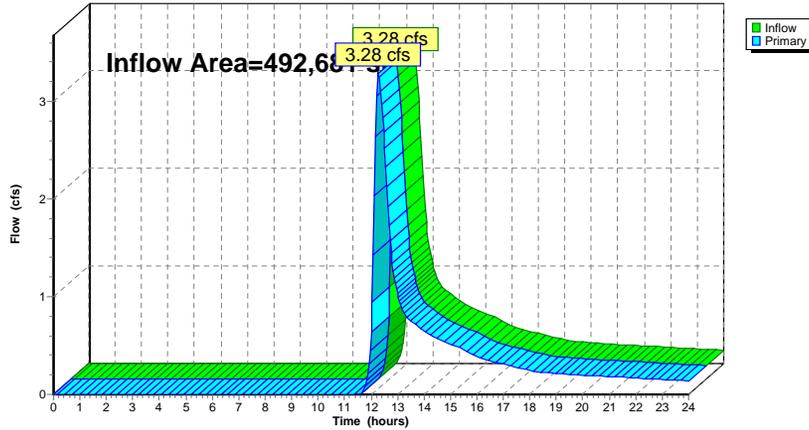
**Summary for Pond 4P: BVW B**

Inflow Area = 492,681 sf, 18.14% Impervious, Inflow Depth > 0.50" for 2-Year event  
Inflow = 3.28 cfs @ 12.27 hrs, Volume= 20,449 cf  
Primary = 3.28 cfs @ 12.27 hrs, Volume= 20,449 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 3

**Pond 4P: BVW B**

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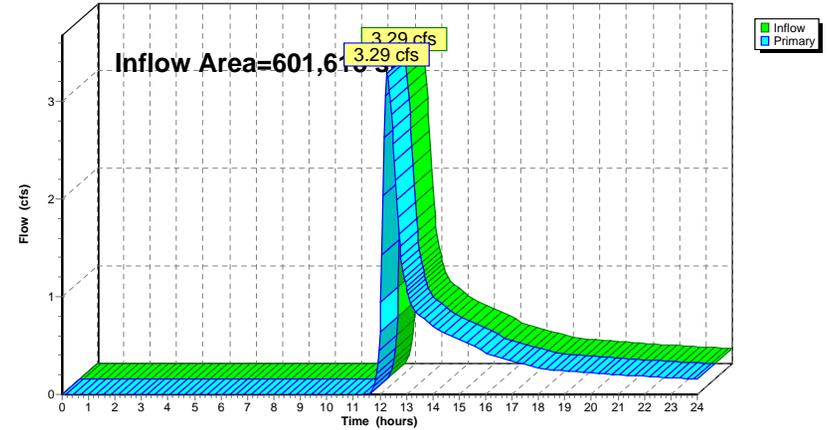
**Summary for Pond POI 1: Northern Site**

Inflow Area = 601,618 sf, 14.86% Impervious, Inflow Depth > 0.44" for 2-Year event  
Inflow = 3.29 cfs @ 12.27 hrs, Volume= 21,813 cf  
Primary = 3.29 cfs @ 12.27 hrs, Volume= 21,813 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 3

**Pond POI 1: Northern Site**

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Type III 24-hr 10-Year Rainfall=5.09"

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Time span=0.00-24.00 hrs, dt=0.04 hrs, 601 points x 3

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 1S: In/Into IW C**

Runoff Area=148,495 sf 25.06% Impervious Runoff Depth>1.78"  
Flow Length=809' Tc=18.6 min CN=66 Runoff=4.73 cfs 22,041 cf

**Subcatchment 2S: In/Into IW A**

Runoff Area=142,302 sf 26.58% Impervious Runoff Depth>1.94"  
Flow Length=935' Tc=13.9 min CN=68 Runoff=5.60 cfs 22,979 cf

**Subcatchment 3S: In/Into IW D**

Runoff Area=46,370 sf 6.69% Impervious Runoff Depth>1.15"  
Flow Length=443' Tc=20.1 min CN=57 Runoff=0.82 cfs 4,428 cf

**Subcatchment 4S: In/Into BVW B**

Runoff Area=155,514 sf 7.22% Impervious Runoff Depth>0.89"  
Flow Length=924' Tc=25.7 min CN=53 Runoff=1.76 cfs 11,596 cf

**Subcatchment 5S: Outside Resources**

Runoff Area=108,937 sf 0.00% Impervious Runoff Depth>0.78"  
Flow Length=668' Tc=22.7 min CN=51 Runoff=1.04 cfs 7,075 cf

**Pond 1P: Isolated Wetland C**

Peak Elev=120.31' Inflow=4.73 cfs 22,041 cf  
Outflow=4.73 cfs 22,041 cf

**Pond 2P: Isolated Wetland A**

Peak Elev=129.35' Inflow=5.60 cfs 22,979 cf  
Outflow=5.60 cfs 22,979 cf

**Pond 3P: Isolated Wetland D**

Peak Elev=112.10' Inflow=0.82 cfs 4,428 cf  
Outflow=0.82 cfs 4,428 cf

**Pond 4P: BVW B**

Inflow=11.91 cfs 61,043 cf  
Primary=11.91 cfs 61,043 cf

**Pond POI 1: Northern Site**

Inflow=12.66 cfs 68,119 cf  
Primary=12.66 cfs 68,119 cf

**Total Runoff Area = 601,618 sf Runoff Volume = 68,119 cf Average Runoff Depth = 1.36"**  
**85.14% Pervious = 512,237 sf 14.86% Impervious = 89,381 sf**

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Type III 24-hr 10-Year Rainfall=5.09"

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**Summary for Subcatchment 1S: In/Into IW C**

Runoff = 4.73 cfs @ 12.28 hrs, Volume= 22,041 cf, Depth> 1.78"

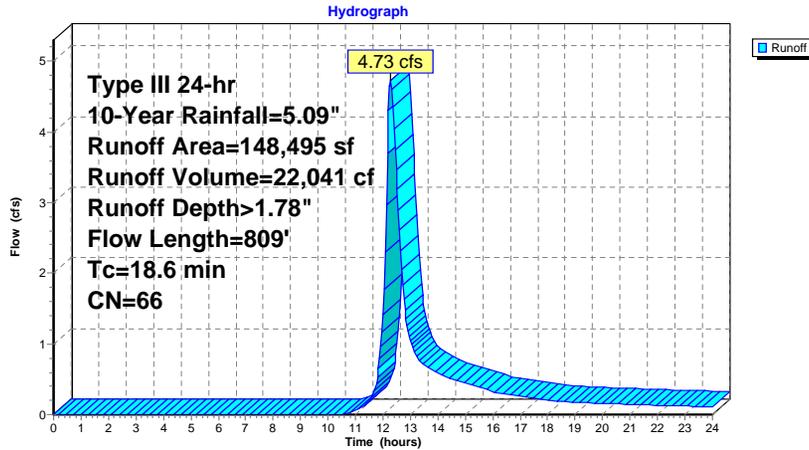
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
Type III 24-hr 10-Year Rainfall=5.09"

Area (sf)	CN	Description
12,770	98	Paved driveways & Roofs
28,649	55	Woods, Good, HSG B
48,595	61	>75% Grass cover, Good, HSG B
34,034	48	Brush, Good, HSG B
24,447	98	Wetland
148,495	66	Weighted Average
111,278		74.94% Pervious Area
37,217		25.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	90	0.0528	0.25		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.21"
2.4	10	0.0500	0.07		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.21"
1.0	63	0.0476	1.09		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
1.9	174	0.0488	1.55		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
0.9	55	0.0273	0.99		<b>Shallow Concentrated Flow, Heavy Brush</b> Kv= 6.0 fps
6.3	417	0.0336	1.10		<b>Shallow Concentrated Flow, Heavy Brush</b> Kv= 6.0 fps
18.6	809	Total			

**Subcatchment 1S: In/Into IW C**



**Summary for Subcatchment 2S: In/Into IW A**

Runoff = 5.60 cfs @ 12.20 hrs, Volume= 22,979 cf, Depth> 1.94"

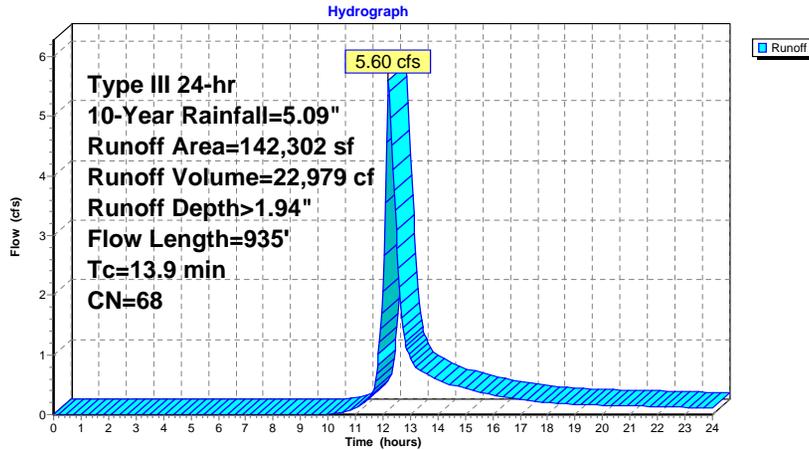
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
Type III 24-hr 10-Year Rainfall=5.09"

Area (sf)	CN	Description
9,125	98	Wetland
768	48	Brush, Good, HSG B
59,412	55	Woods, Good, HSG B
28,704	98	Paved driveways and Roofs
44,293	61	>75% Grass cover, Good, HSG B
142,302	68	Weighted Average
104,473		73.42% Pervious Area
37,829		26.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0200	1.38		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.21"
0.8	164	0.0300	3.52		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.1	101	0.0500	1.57		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
3.3	239	0.0593	1.22		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
7.5	331	0.0219	0.74		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.9	935	Total			

**Subcatchment 2S: In/Into IW A**



**Summary for Subcatchment 3S: In/Into IW D**

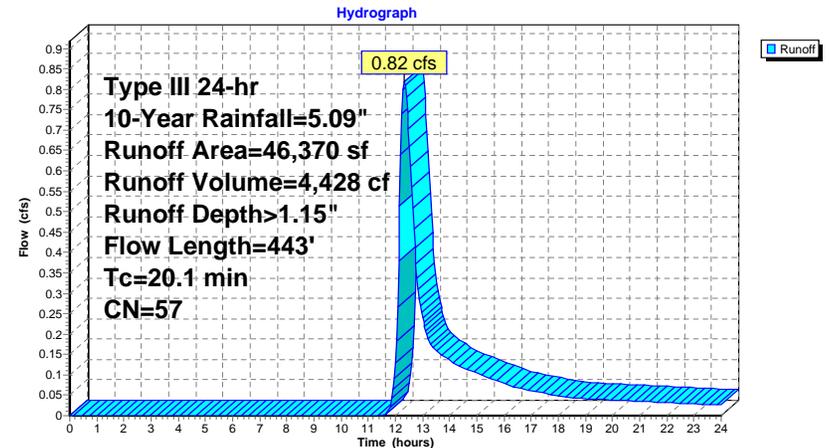
Runoff = 0.82 cfs @ 12.33 hrs, Volume= 4,428 cf, Depth> 1.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
Type III 24-hr 10-Year Rainfall=5.09"

Area (sf)	CN	Description
3,100	98	Wetland
36,667	55	Woods, Good, HSG B
6,603	48	Brush, Good, HSG B
46,370	57	Weighted Average
43,270		93.31% Pervious Area
3,100		6.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.7	100	0.0511	0.11		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.21"
4.0	272	0.0511	1.13		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.4	71	0.0141	0.83		Shallow Concentrated Flow, Heavy Brush Kv= 7.0 fps
20.1	443	Total			

**Subcatchment 3S: In/Into IW D**



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**Summary for Subcatchment 4S: In/Into BVW B**

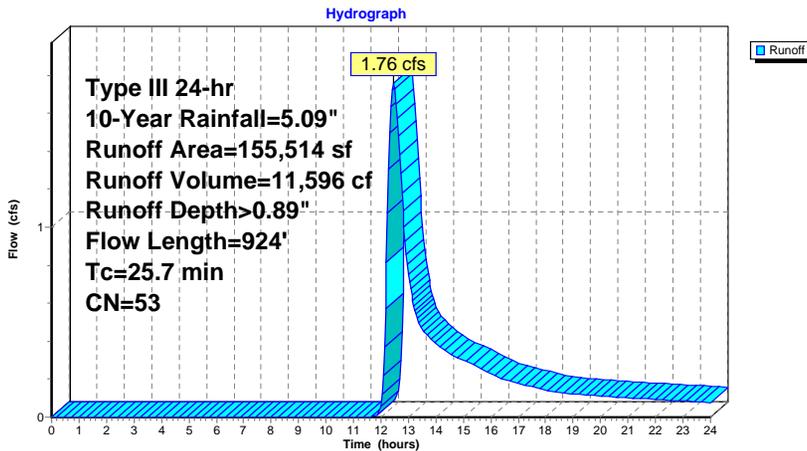
Runoff = 1.76 cfs @ 12.45 hrs, Volume= 11,596 cf, Depth> 0.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
Type III 24-hr 10-Year Rainfall=5.09"

Area (sf)	CN	Description
11,235	98	Wetland
31,424	55	Woods, Good, HSG B
112,855	48	Brush, Good, HSG B
155,514	53	Weighted Average
144,279		92.78% Pervious Area
11,235		7.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.5	100	0.0450	0.11		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.21"
0.7	35	0.0286	0.85		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
6.6	526	0.0485	1.32		<b>Shallow Concentrated Flow, Heavy Brush</b> Kv= 6.0 fps
2.9	263	0.0456	1.49		<b>Shallow Concentrated Flow, Heavy Brush</b> Kv= 7.0 fps
25.7	924	Total			

**Subcatchment 4S: In/Into BVW B**



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Type III 24-hr 10-Year Rainfall=5.09"

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**Summary for Subcatchment 5S: Outside Resources Areas**

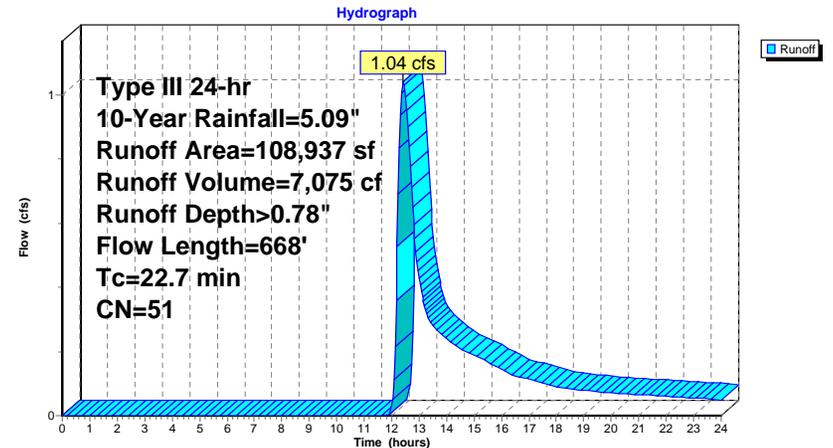
Runoff = 1.04 cfs @ 12.43 hrs, Volume= 7,075 cf, Depth> 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
Type III 24-hr 10-Year Rainfall=5.09"

Area (sf)	CN	Description
46,728	55	Woods, Good, HSG B
62,209	48	Brush, Good, HSG B
108,937	51	Weighted Average
108,937		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.2	100	0.0475	0.11		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.21"
1.0	82	0.0823	1.43		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
6.2	466	0.0440	1.26		<b>Shallow Concentrated Flow, Heavy Brush</b> Kv= 6.0 fps
0.3	20	0.0500	1.12		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
22.7	668	Total			

**Subcatchment 5S: Outside Resources Areas**



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Type III 24-hr 10-Year Rainfall=5.09"

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**Summary for Pond 1P: Isolated Wetland C**

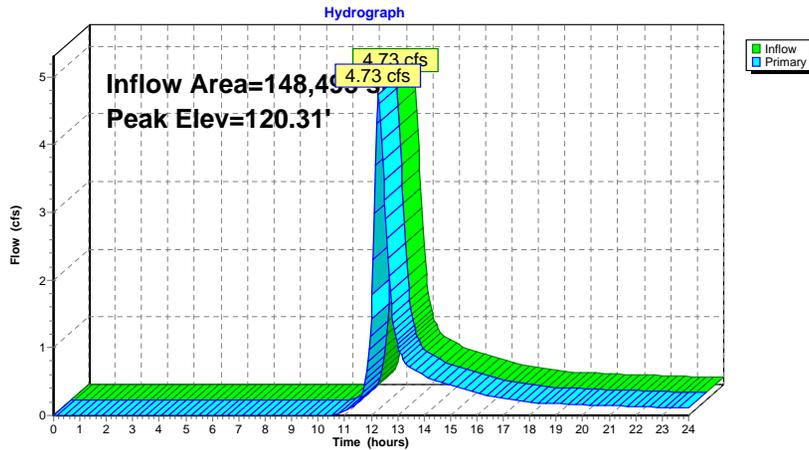
Inflow Area = 148,495 sf, 25.06% Impervious, Inflow Depth > 1.78" for 10-Year event  
 Inflow = 4.73 cfs @ 12.28 hrs, Volume= 22,041 cf  
 Outflow = 4.73 cfs @ 12.28 hrs, Volume= 22,041 cf, Atten= 0%, Lag= 0.0 min  
 Primary = 4.73 cfs @ 12.28 hrs, Volume= 22,041 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 3  
 Peak Elev= 120.31' @ 12.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	120.00'	<b>10.0' long x 316.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=4.72 cfs @ 12.28 hrs HW=120.31' TW=0.00' (Dynamic Tailwater)  
 1=Broad-Crested Rectangular Weir (Weir Controls 4.72 cfs @ 1.51 fps)

**Pond 1P: Isolated Wetland C**



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**Summary for Pond 2P: Isolated Wetland A**

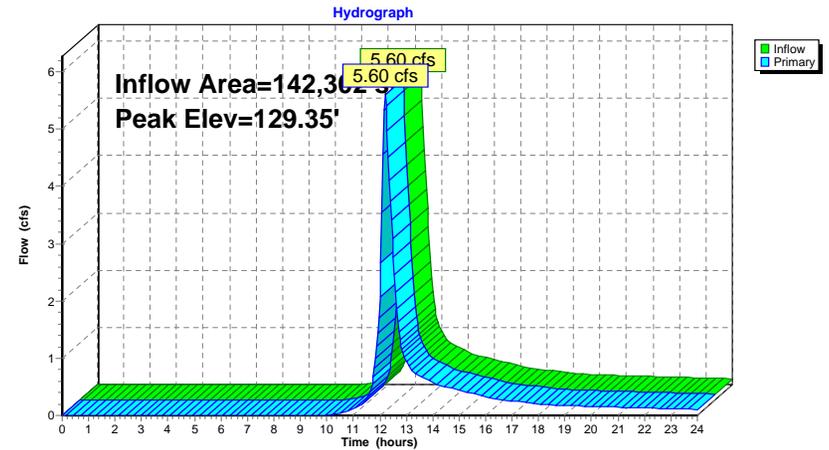
Inflow Area = 142,302 sf, 26.58% Impervious, Inflow Depth > 1.94" for 10-Year event  
 Inflow = 5.60 cfs @ 12.20 hrs, Volume= 22,979 cf  
 Outflow = 5.60 cfs @ 12.20 hrs, Volume= 22,979 cf, Atten= 0%, Lag= 0.0 min  
 Primary = 5.60 cfs @ 12.20 hrs, Volume= 22,979 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 3  
 Peak Elev= 129.35' @ 12.20 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	129.00'	<b>10.0' long x 472.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=5.58 cfs @ 12.20 hrs HW=129.35' TW=0.00' (Dynamic Tailwater)  
 1=Broad-Crested Rectangular Weir (Weir Controls 5.58 cfs @ 1.59 fps)

**Pond 2P: Isolated Wetland A**



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Type III 24-hr 10-Year Rainfall=5.09"

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**Summary for Pond 3P: Isolated Wetland D**

Inflow Area = 46,370 sf, 6.69% Impervious, Inflow Depth > 1.15" for 10-Year event  
 Inflow = 0.82 cfs @ 12.33 hrs, Volume= 4,428 cf  
 Outflow = 0.82 cfs @ 12.33 hrs, Volume= 4,428 cf, Atten= 0%, Lag= 0.0 min  
 Primary = 0.82 cfs @ 12.33 hrs, Volume= 4,428 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 3

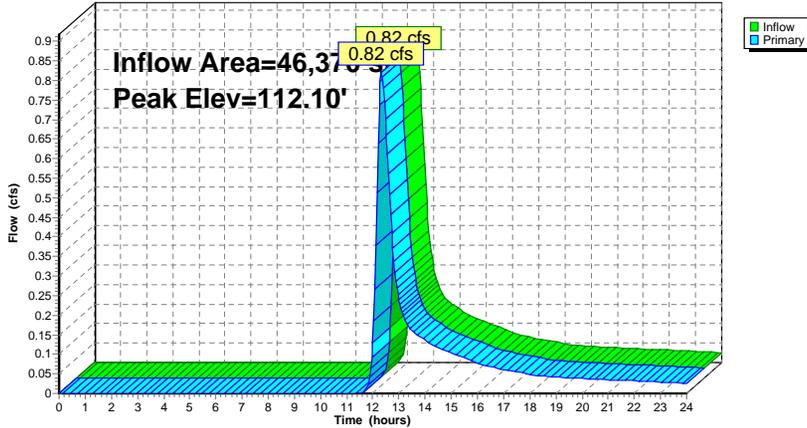
Peak Elev= 112.10' @ 12.33 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	112.00'	<b>10.0' long x 129.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.82 cfs @ 12.33 hrs HW=112.10' TW=0.00' (Dynamic Tailwater)  
 1=Broad-Crested Rectangular Weir (Weir Controls 0.82 cfs @ 0.84 fps)

**Pond 3P: Isolated Wetland D**

Hydrograph



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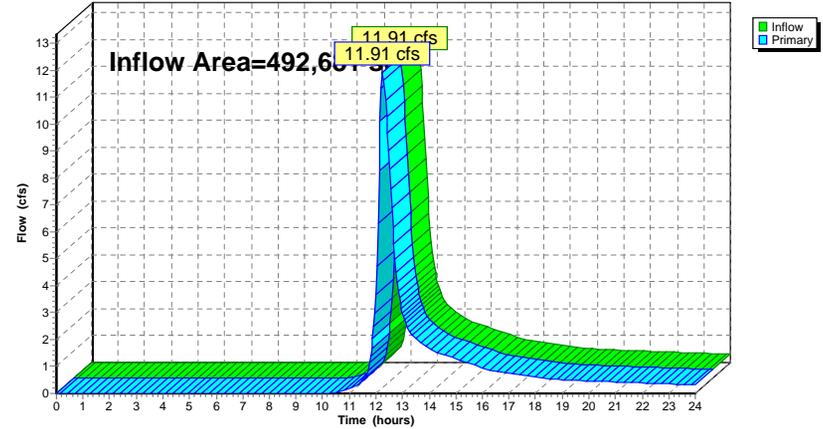
**Summary for Pond 4P: BVW B**

Inflow Area = 492,681 sf, 18.14% Impervious, Inflow Depth > 1.49" for 10-Year event  
 Inflow = 11.91 cfs @ 12.26 hrs, Volume= 61,043 cf  
 Primary = 11.91 cfs @ 12.26 hrs, Volume= 61,043 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 3

**Pond 4P: BVW B**

Hydrograph



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Type III 24-hr 10-Year Rainfall=5.09"

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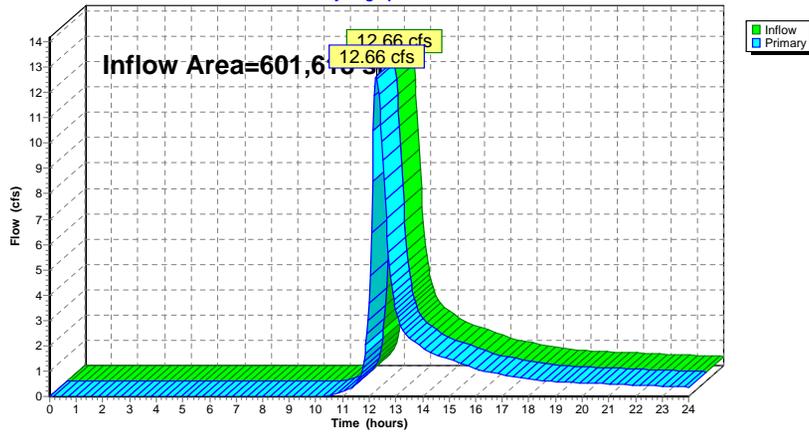
**Summary for Pond POI 1: Northern Site**

Inflow Area = 601,618 sf, 14.86% Impervious, Inflow Depth > 1.36" for 10-Year event  
 Inflow = 12.66 cfs @ 12.27 hrs, Volume= 68,119 cf  
 Primary = 12.66 cfs @ 12.27 hrs, Volume= 68,119 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 3

**Pond POI 1: Northern Site**

Hydrograph



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Type III 24-hr 25-Year Rainfall=6.27"

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Time span=0.00-24.00 hrs, dt=0.04 hrs, 601 points x 3

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 1S: In/Into IW C</b>	Runoff Area=148,495 sf 25.06% Impervious Runoff Depth>2.63" Flow Length=809' Tc=18.6 min CN=66 Runoff=7.18 cfs 32,559 cf
<b>Subcatchment 2S: In/Into IW A</b>	Runoff Area=142,302 sf 26.58% Impervious Runoff Depth>2.82" Flow Length=935' Tc=13.9 min CN=68 Runoff=8.32 cfs 33,460 cf
<b>Subcatchment 3S: In/Into IW D</b>	Runoff Area=46,370 sf 6.69% Impervious Runoff Depth>1.83" Flow Length=443' Tc=20.1 min CN=57 Runoff=1.42 cfs 7,081 cf
<b>Subcatchment 4S: In/Into BVW B</b>	Runoff Area=155,514 sf 7.22% Impervious Runoff Depth>1.50" Flow Length=924' Tc=25.7 min CN=53 Runoff=3.35 cfs 19,455 cf
<b>Subcatchment 5S: Outside Resources</b>	Runoff Area=108,937 sf 0.00% Impervious Runoff Depth>1.35" Flow Length=668' Tc=22.7 min CN=51 Runoff=2.12 cfs 12,213 cf
<b>Pond 1P: Isolated Wetland C</b>	Peak Elev=120.41' Inflow=7.18 cfs 32,559 cf Outflow=7.18 cfs 32,559 cf
<b>Pond 2P: Isolated Wetland A</b>	Peak Elev=129.46' Inflow=8.32 cfs 33,460 cf Outflow=8.32 cfs 33,460 cf
<b>Pond 3P: Isolated Wetland D</b>	Peak Elev=112.14' Inflow=1.42 cfs 7,081 cf Outflow=1.42 cfs 7,081 cf
<b>Pond 4P: BVW B</b>	Inflow=18.87 cfs 92,554 cf Primary=18.87 cfs 92,554 cf
<b>Pond POI 1: Northern Site</b>	Inflow=20.62 cfs 104,767 cf Primary=20.62 cfs 104,767 cf

**Total Runoff Area = 601,618 sf Runoff Volume = 104,767 cf Average Runoff Depth = 2.09"**  
 85.14% Pervious = 512,237 sf 14.86% Impervious = 89,381 sf

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Type III 24-hr 25-Year Rainfall=6.27"

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**Summary for Subcatchment 1S: In/Into IW C**

Runoff = 7.18 cfs @ 12.27 hrs, Volume= 32,559 cf, Depth> 2.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
Type III 24-hr 25-Year Rainfall=6.27"

	Area (sf)	CN	Description
*	12,770	98	Paved driveways & Roofs
	28,649	55	Woods, Good, HSG B
	48,595	61	>75% Grass cover, Good, HSG B
	34,034	48	Brush, Good, HSG B
*	24,447	98	Wetland
	148,495	66	Weighted Average
	111,278		74.94% Pervious Area
	37,217		25.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	90	0.0528	0.25		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.21"
2.4	10	0.0500	0.07		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.21"
1.0	63	0.0476	1.09		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
1.9	174	0.0488	1.55		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
0.9	55	0.0273	0.99		<b>Shallow Concentrated Flow, Heavy Brush</b> Kv= 6.0 fps
6.3	417	0.0336	1.10		<b>Shallow Concentrated Flow, Heavy Brush</b> Kv= 6.0 fps
18.6	809	Total			

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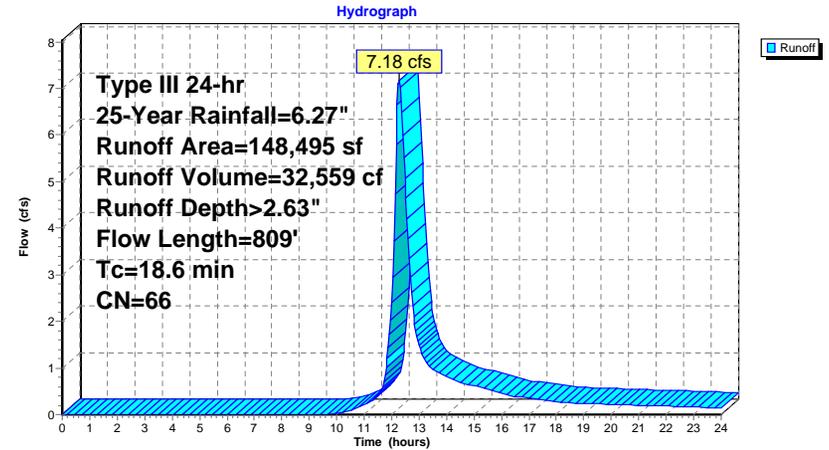
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Type III 24-hr 25-Year Rainfall=6.27"

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**Subcatchment 1S: In/Into IW C**



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**Summary for Subcatchment 2S: In/Into IW A**

Runoff = 8.32 cfs @ 12.20 hrs, Volume= 33,460 cf, Depth> 2.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
Type III 24-hr 25-Year Rainfall=6.27"

Area (sf)	CN	Description
* 9,125	98	Wetland
768	48	Brush, Good, HSG B
59,412	55	Woods, Good, HSG B
* 28,704	98	Paved driveways and Roofs
44,293	61	>75% Grass cover, Good, HSG B
142,302	68	Weighted Average
104,473		73.42% Pervious Area
37,829		26.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0200	1.38		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.21"
0.8	164	0.0300	3.52		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.1	101	0.0500	1.57		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
3.3	239	0.0593	1.22		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
7.5	331	0.0219	0.74		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.9	935	Total			

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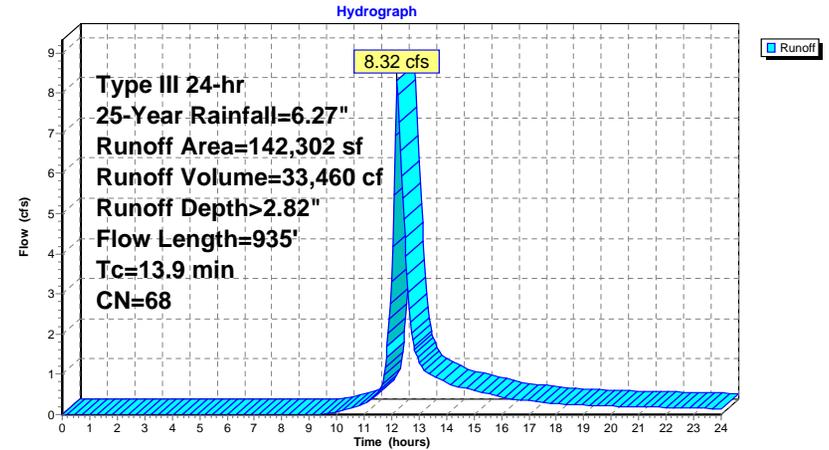
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**Subcatchment 2S: In/Into IW A**



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**Summary for Subcatchment 3S: In/Into IW D**

Runoff = 1.42 cfs @ 12.31 hrs, Volume= 7,081 cf, Depth> 1.83"

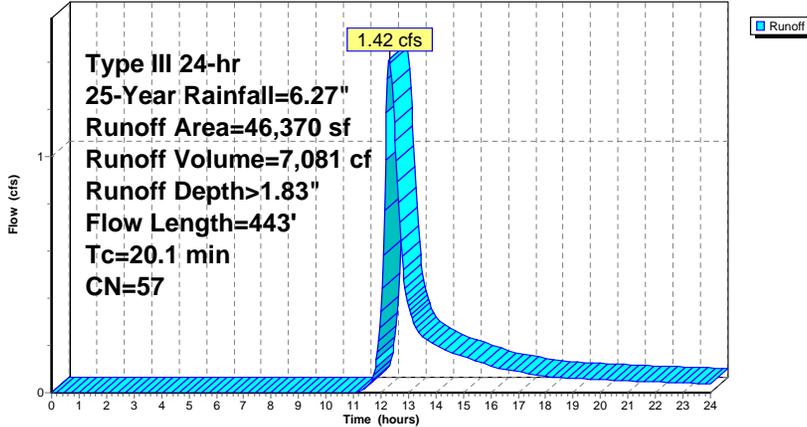
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
Type III 24-hr 25-Year Rainfall=6.27"

Area (sf)	CN	Description
3,100	98	Wetland
36,667	55	Woods, Good, HSG B
6,603	48	Brush, Good, HSG B
46,370	57	Weighted Average
43,270		93.31% Pervious Area
3,100		6.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.7	100	0.0511	0.11		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.21"
4.0	272	0.0511	1.13		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
1.4	71	0.0141	0.83		<b>Shallow Concentrated Flow, Heavy Brush</b> Kv= 7.0 fps
20.1	443	Total			

**Subcatchment 3S: In/Into IW D**

Hydrograph



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Type III 24-hr 25-Year Rainfall=6.27"

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**Summary for Subcatchment 4S: In/Into BVW B**

Runoff = 3.35 cfs @ 12.41 hrs, Volume= 19,455 cf, Depth> 1.50"

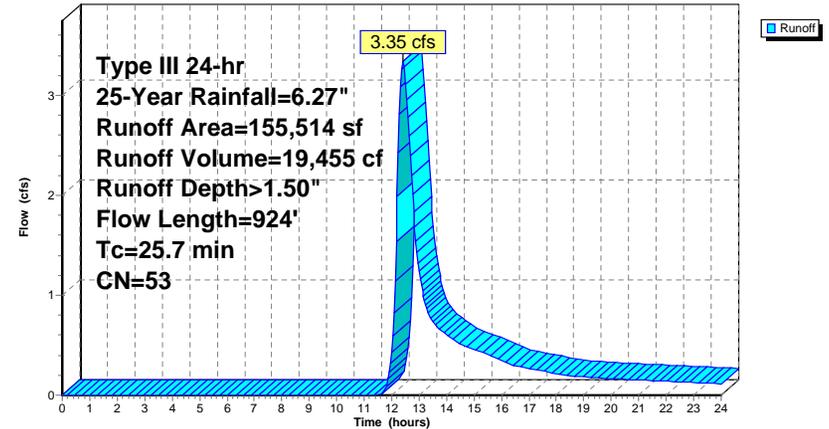
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
Type III 24-hr 25-Year Rainfall=6.27"

Area (sf)	CN	Description
11,235	98	Wetland
31,424	55	Woods, Good, HSG B
112,855	48	Brush, Good, HSG B
155,514	53	Weighted Average
144,279		92.78% Pervious Area
11,235		7.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.5	100	0.0450	0.11		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.21"
0.7	35	0.0286	0.85		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
6.6	526	0.0485	1.32		<b>Shallow Concentrated Flow, Heavy Brush</b> Kv= 6.0 fps
2.9	263	0.0456	1.49		<b>Shallow Concentrated Flow, Heavy Brush</b> Kv= 7.0 fps
25.7	924	Total			

**Subcatchment 4S: In/Into BVW B**

Hydrograph



**Haverhill Existing Model 160511**

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Type III 24-hr 25-Year Rainfall=6.27"

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**Summary for Subcatchment 5S: Outside Resources Areas**

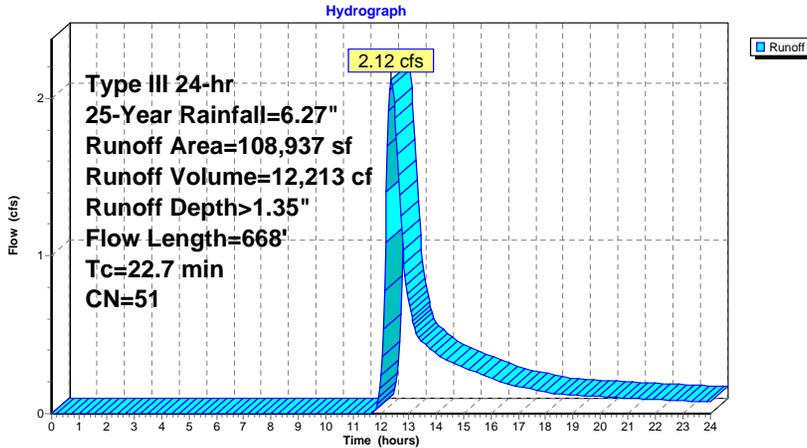
Runoff = 2.12 cfs @ 12.38 hrs, Volume= 12,213 cf, Depth> 1.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
Type III 24-hr 25-Year Rainfall=6.27"

Area (sf)	CN	Description
46,728	55	Woods, Good, HSG B
62,209	48	Brush, Good, HSG B
108,937	51	Weighted Average
108,937		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.2	100	0.0475	0.11		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.21"
1.0	82	0.0823	1.43		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
6.2	466	0.0440	1.26		Shallow Concentrated Flow, Heavy Brush Kv= 6.0 fps
0.3	20	0.0500	1.12		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
22.7	668	Total			

**Subcatchment 5S: Outside Resources Areas**



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Type III 24-hr 25-Year Rainfall=6.27"

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**Summary for Pond 1P: Isolated Wetland C**

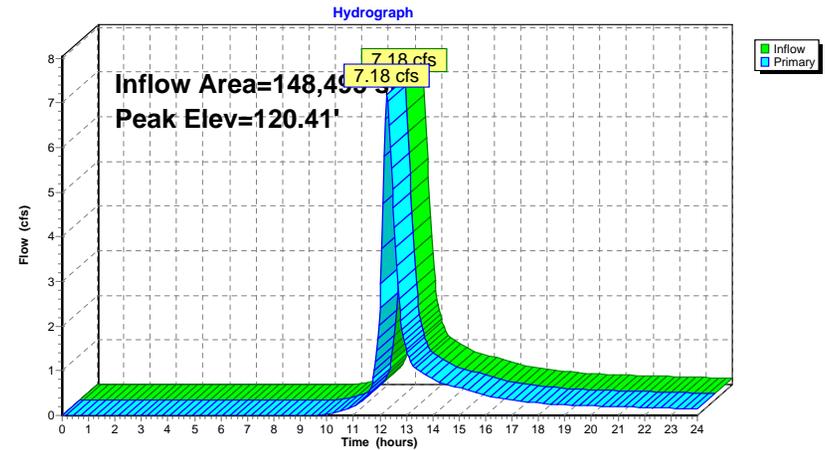
Inflow Area = 148,495 sf, 25.06% Impervious, Inflow Depth > 2.63" for 25-Year event  
Inflow = 7.18 cfs @ 12.27 hrs, Volume= 32,559 cf  
Outflow = 7.18 cfs @ 12.27 hrs, Volume= 32,559 cf, Atten= 0%, Lag= 0.0 min  
Primary = 7.18 cfs @ 12.27 hrs, Volume= 32,559 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 3  
Peak Elev= 120.41' @ 12.27 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	120.00'	10.0' long x 316.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=7.14 cfs @ 12.27 hrs HW=120.41' TW=0.00' (Dynamic Tailwater)  
1=Broad-Crested Rectangular Weir (Weir Controls 7.14 cfs @ 1.73 fps)

**Pond 1P: Isolated Wetland C**



**Haverhill Existing Model 160511**

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Type III 24-hr 25-Year Rainfall=6.27"

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**Summary for Pond 2P: Isolated Wetland A**

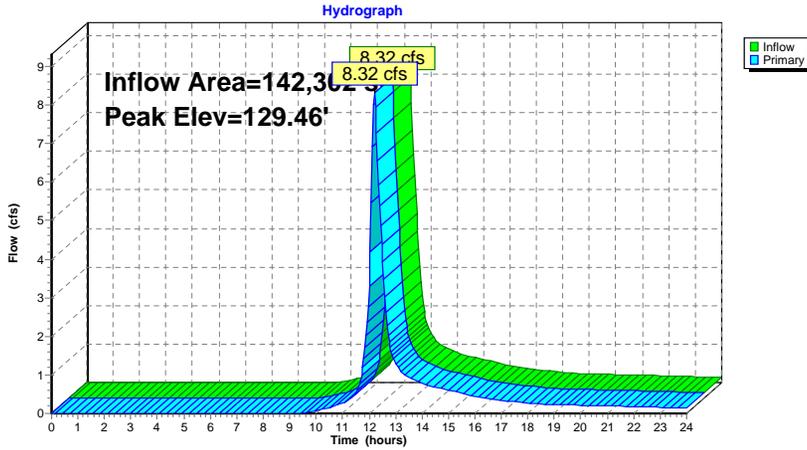
Inflow Area = 142,302 sf, 26.58% Impervious, Inflow Depth > 2.82" for 25-Year event  
 Inflow = 8.32 cfs @ 12.20 hrs, Volume= 33,460 cf  
 Outflow = 8.32 cfs @ 12.20 hrs, Volume= 33,460 cf, Atten= 0%, Lag= 0.0 min  
 Primary = 8.32 cfs @ 12.20 hrs, Volume= 33,460 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 3  
 Peak Elev= 129.46' @ 12.20 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	129.00'	<b>10.0' long x 472.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=8.31 cfs @ 12.20 hrs HW=129.46' TW=0.00' (Dynamic Tailwater)  
 1=Broad-Crested Rectangular Weir (Weir Controls 8.31 cfs @ 1.82 fps)

**Pond 2P: Isolated Wetland A**



**Haverhill Existing Model 160511**

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Type III 24-hr 25-Year Rainfall=6.27"

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**Summary for Pond 3P: Isolated Wetland D**

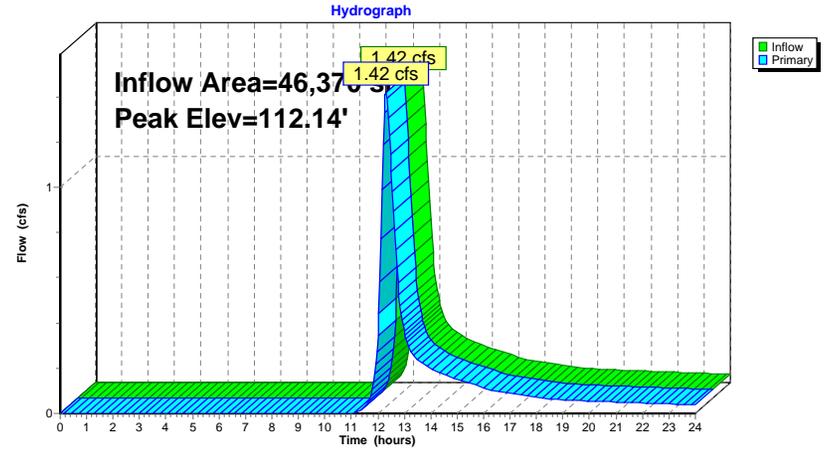
Inflow Area = 46,370 sf, 6.69% Impervious, Inflow Depth > 1.83" for 25-Year event  
 Inflow = 1.42 cfs @ 12.31 hrs, Volume= 7,081 cf  
 Outflow = 1.42 cfs @ 12.31 hrs, Volume= 7,081 cf, Atten= 0%, Lag= 0.0 min  
 Primary = 1.42 cfs @ 12.31 hrs, Volume= 7,081 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 3  
 Peak Elev= 112.14' @ 12.31 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	112.00'	<b>10.0' long x 129.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.41 cfs @ 12.31 hrs HW=112.14' TW=0.00' (Dynamic Tailwater)  
 1=Broad-Crested Rectangular Weir (Weir Controls 1.41 cfs @ 1.01 fps)

**Pond 3P: Isolated Wetland D**



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Type III 24-hr 25-Year Rainfall=6.27"

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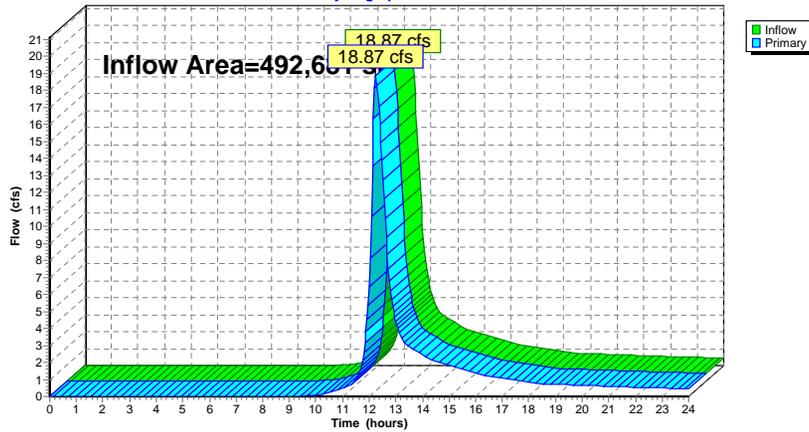
**Summary for Pond 4P: BVW B**

Inflow Area = 492,681 sf, 18.14% Impervious, Inflow Depth > 2.25" for 25-Year event  
Inflow = 18.87 cfs @ 12.25 hrs, Volume= 92,554 cf  
Primary = 18.87 cfs @ 12.25 hrs, Volume= 92,554 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 3

**Pond 4P: BVW B**

Hydrograph



**Haverhill Existing Model 160511**

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Type III 24-hr 25-Year Rainfall=6.27"

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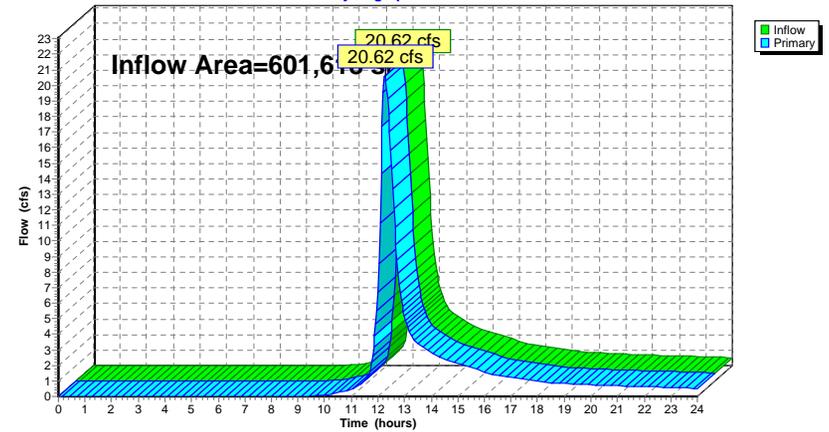
**Summary for Pond POI 1: Northern Site**

Inflow Area = 601,618 sf, 14.86% Impervious, Inflow Depth > 2.09" for 25-Year event  
Inflow = 20.62 cfs @ 12.26 hrs, Volume= 104,767 cf  
Primary = 20.62 cfs @ 12.26 hrs, Volume= 104,767 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 3

**Pond POI 1: Northern Site**

Hydrograph



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Time span=0.00-24.00 hrs, dt=0.04 hrs, 601 points x 3

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 1S: In/Into IW C**

Runoff Area=148,495 sf 25.06% Impervious Runoff Depth>4.06"  
Flow Length=809' Tc=18.6 min CN=66 Runoff=11.24 cfs 50,214 cf

**Subcatchment 2S: In/Into IW A**

Runoff Area=142,302 sf 26.58% Impervious Runoff Depth>4.29"  
Flow Length=935' Tc=13.9 min CN=68 Runoff=12.77 cfs 50,886 cf

**Subcatchment 3S: In/Into IW D**

Runoff Area=46,370 sf 6.69% Impervious Runoff Depth>3.04"  
Flow Length=443' Tc=20.1 min CN=57 Runoff=2.48 cfs 11,765 cf

**Subcatchment 4S: In/Into BVW B**

Runoff Area=155,514 sf 7.22% Impervious Runoff Depth>2.60"  
Flow Length=924' Tc=25.7 min CN=53 Runoff=6.26 cfs 33,738 cf

**Subcatchment 5S: Outside Resources**

Runoff Area=108,937 sf 0.00% Impervious Runoff Depth>2.39"  
Flow Length=668' Tc=22.7 min CN=51 Runoff=4.16 cfs 21,705 cf

**Pond 1P: Isolated Wetland C**

Peak Elev=120.56' Inflow=11.24 cfs 50,214 cf  
Outflow=11.24 cfs 50,214 cf

**Pond 2P: Isolated Wetland A**

Peak Elev=129.61' Inflow=12.77 cfs 50,886 cf  
Outflow=12.77 cfs 50,886 cf

**Pond 3P: Isolated Wetland D**

Peak Elev=112.20' Inflow=2.48 cfs 11,765 cf  
Outflow=2.48 cfs 11,765 cf

**Pond 4P: BVW B**

Inflow=30.68 cfs 146,603 cf  
Primary=30.68 cfs 146,603 cf

**Pond POI 1: Northern Site**

Inflow=34.42 cfs 168,307 cf  
Primary=34.42 cfs 168,307 cf

**Total Runoff Area = 601,618 sf Runoff Volume = 168,307 cf Average Runoff Depth = 3.36"**  
**85.14% Pervious = 512,237 sf 14.86% Impervious = 89,381 sf**

**Haverhill Existing Model 160511**

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Type III 24-hr 100-Year Rainfall=8.08"

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**Summary for Subcatchment 1S: In/Into IW C**

Runoff = 11.24 cfs @ 12.26 hrs, Volume= 50,214 cf, Depth> 4.06"

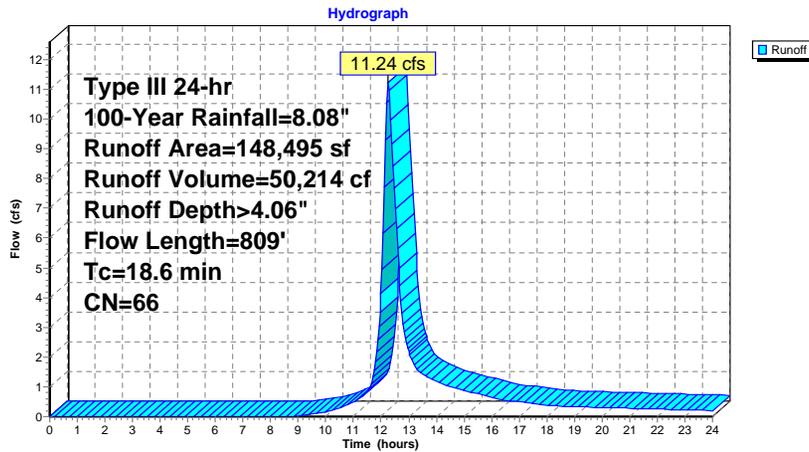
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
Type III 24-hr 100-Year Rainfall=8.08"

Area (sf)	CN	Description
12,770	98	Paved driveways & Roofs
28,649	55	Woods, Good, HSG B
48,595	61	>75% Grass cover, Good, HSG B
34,034	48	Brush, Good, HSG B
24,447	98	Wetland
148,495	66	Weighted Average
111,278		74.94% Pervious Area
37,217		25.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	90	0.0528	0.25		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.21"
2.4	10	0.0500	0.07		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.21"
1.0	63	0.0476	1.09		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
1.9	174	0.0488	1.55		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
0.9	55	0.0273	0.99		<b>Shallow Concentrated Flow, Heavy Brush</b> Kv= 6.0 fps
6.3	417	0.0336	1.10		<b>Shallow Concentrated Flow, Heavy Brush</b> Kv= 6.0 fps
18.6	809	Total			

**Subcatchment 1S: In/Into IW C**



**Summary for Subcatchment 2S: In/Into IW A**

Runoff = 12.77 cfs @ 12.20 hrs, Volume= 50,886 cf, Depth> 4.29"

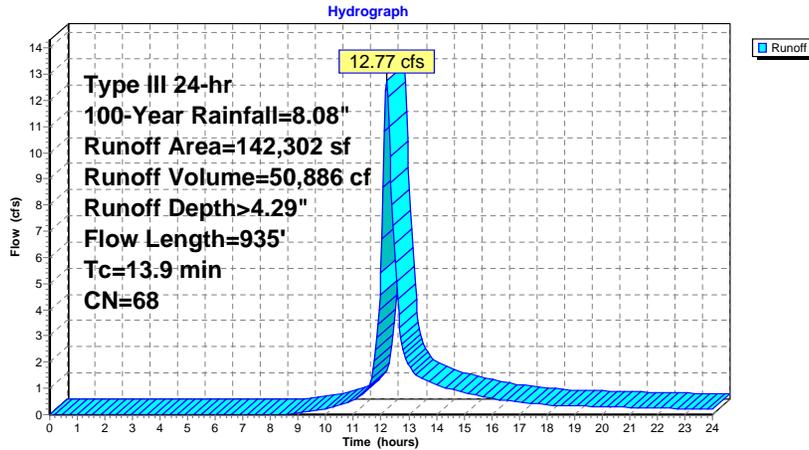
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
Type III 24-hr 100-Year Rainfall=8.08"

Area (sf)	CN	Description
9,125	98	Wetland
768	48	Brush, Good, HSG B
59,412	55	Woods, Good, HSG B
28,704	98	Paved driveways and Roofs
44,293	61	>75% Grass cover, Good, HSG B
142,302	68	Weighted Average
104,473		73.42% Pervious Area
37,829		26.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0200	1.38		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 3.21"
0.8	164	0.0300	3.52		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
1.1	101	0.0500	1.57		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
3.3	239	0.0593	1.22		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
7.5	331	0.0219	0.74		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
13.9	935	Total			

**Subcatchment 2S: In/Into IW A**



**Summary for Subcatchment 3S: In/Into IW D**

Runoff = 2.48 cfs @ 12.29 hrs, Volume= 11,765 cf, Depth> 3.04"

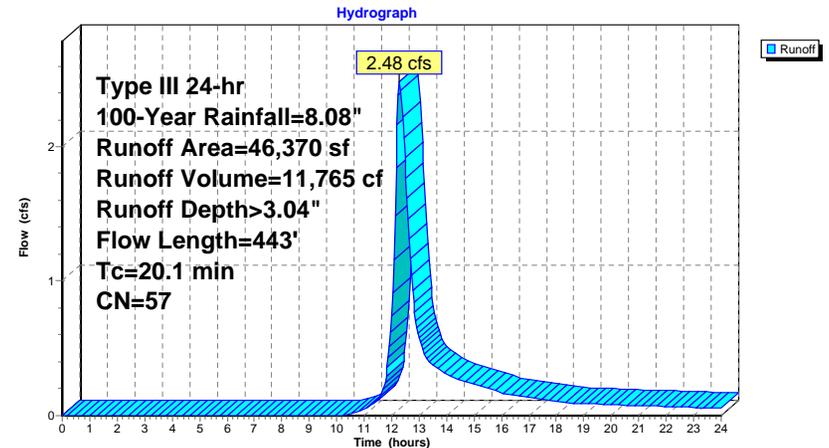
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Type III 24-hr 100-Year Rainfall=8.08"

Area (sf)	CN	Description
3,100	98	Wetland
36,667	55	Woods, Good, HSG B
6,603	48	Brush, Good, HSG B
46,370	57	Weighted Average
43,270		93.31% Pervious Area
3,100		6.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.7	100	0.0511	0.11		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.21"
4.0	272	0.0511	1.13		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
1.4	71	0.0141	0.83		Shallow Concentrated Flow, Heavy Brush Kv= 7.0 fps
20.1	443	Total			

**Subcatchment 3S: In/Into IW D**



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**Summary for Subcatchment 4S: In/Into BVW B**

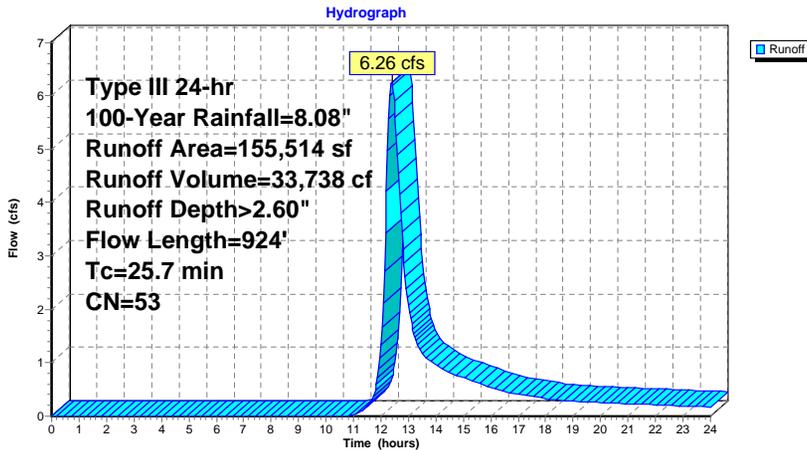
Runoff = 6.26 cfs @ 12.39 hrs, Volume= 33,738 cf, Depth> 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
Type III 24-hr 100-Year Rainfall=8.08"

Area (sf)	CN	Description
11,235	98	Wetland
31,424	55	Woods, Good, HSG B
112,855	48	Brush, Good, HSG B
155,514	53	Weighted Average
144,279		92.78% Pervious Area
11,235		7.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.5	100	0.0450	0.11		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.21"
0.7	35	0.0286	0.85		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
6.6	526	0.0485	1.32		<b>Shallow Concentrated Flow, Heavy Brush</b> Kv= 6.0 fps
2.9	263	0.0456	1.49		<b>Shallow Concentrated Flow, Heavy Brush</b> Kv= 7.0 fps
25.7	924	Total			

**Subcatchment 4S: In/Into BVW B**



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**Summary for Subcatchment 5S: Outside Resources Areas**

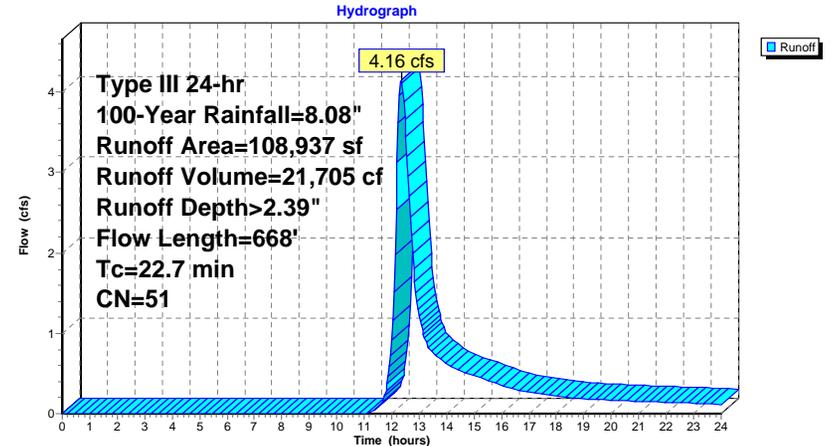
Runoff = 4.16 cfs @ 12.35 hrs, Volume= 21,705 cf, Depth> 2.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
Type III 24-hr 100-Year Rainfall=8.08"

Area (sf)	CN	Description
46,728	55	Woods, Good, HSG B
62,209	48	Brush, Good, HSG B
108,937	51	Weighted Average
108,937		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.2	100	0.0475	0.11		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.21"
1.0	82	0.0823	1.43		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
6.2	466	0.0440	1.26		<b>Shallow Concentrated Flow, Heavy Brush</b> Kv= 6.0 fps
0.3	20	0.0500	1.12		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
22.7	668	Total			

**Subcatchment 5S: Outside Resources Areas**



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**Summary for Pond 1P: Isolated Wetland C**

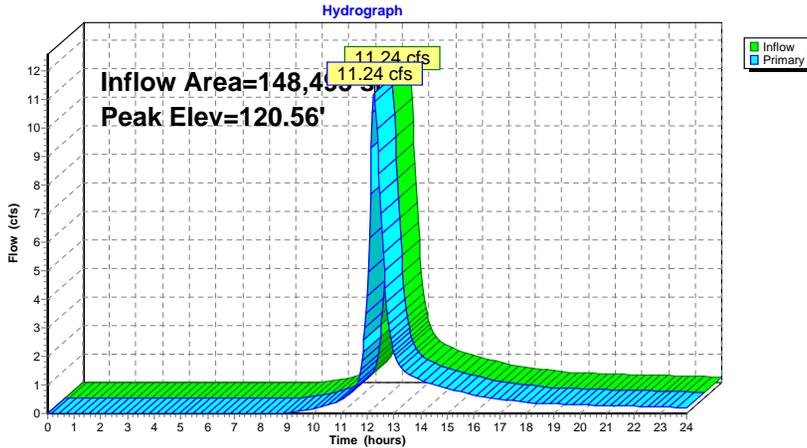
Inflow Area = 148,495 sf, 25.06% Impervious, Inflow Depth > 4.06" for 100-Year event  
 Inflow = 11.24 cfs @ 12.26 hrs, Volume= 50,214 cf  
 Outflow = 11.24 cfs @ 12.26 hrs, Volume= 50,214 cf, Atten= 0%, Lag= 0.0 min  
 Primary = 11.24 cfs @ 12.26 hrs, Volume= 50,214 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 3  
 Peak Elev= 120.56' @ 12.26 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	120.00'	<b>10.0' long x 316.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=11.18 cfs @ 12.26 hrs HW=120.56' TW=0.00' (Dynamic Tailwater)  
 ↳1=Broad-Crested Rectangular Weir (Weir Controls 11.18 cfs @ 2.01 fps)

**Pond 1P: Isolated Wetland C**



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Type III 24-hr 100-Year Rainfall=8.08"

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**Summary for Pond 2P: Isolated Wetland A**

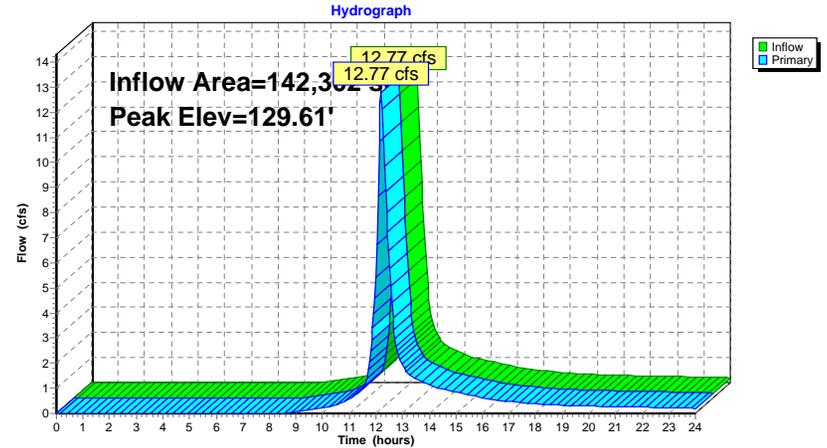
Inflow Area = 142,302 sf, 26.58% Impervious, Inflow Depth > 4.29" for 100-Year event  
 Inflow = 12.77 cfs @ 12.20 hrs, Volume= 50,886 cf  
 Outflow = 12.77 cfs @ 12.20 hrs, Volume= 50,886 cf, Atten= 0%, Lag= 0.0 min  
 Primary = 12.77 cfs @ 12.20 hrs, Volume= 50,886 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 3  
 Peak Elev= 129.61' @ 12.20 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	129.00'	<b>10.0' long x 472.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=12.72 cfs @ 12.20 hrs HW=129.61' TW=0.00' (Dynamic Tailwater)  
 ↳1=Broad-Crested Rectangular Weir (Weir Controls 12.72 cfs @ 2.10 fps)

**Pond 2P: Isolated Wetland A**



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**Summary for Pond 3P: Isolated Wetland D**

Inflow Area = 46,370 sf, 6.69% Impervious, Inflow Depth > 3.04" for 100-Year event  
 Inflow = 2.48 cfs @ 12.29 hrs, Volume= 11,765 cf  
 Outflow = 2.48 cfs @ 12.29 hrs, Volume= 11,765 cf, Atten= 0%, Lag= 0.0 min  
 Primary = 2.48 cfs @ 12.29 hrs, Volume= 11,765 cf

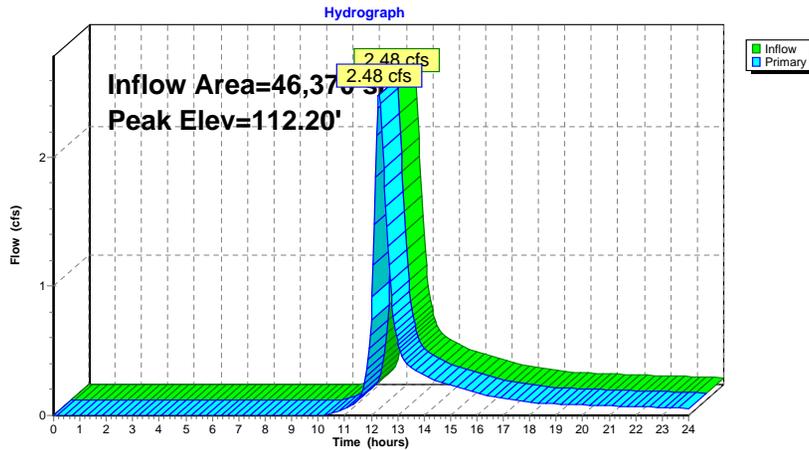
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 3

Peak Elev= 112.20' @ 12.29 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	112.00'	<b>10.0' long x 129.0' 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) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=2.47 cfs @ 12.29 hrs HW=112.20' TW=0.00' (Dynamic Tailwater)  
 ←1=Broad-Crested Rectangular Weir (Weir Controls 2.47 cfs @ 1.21 fps)

**Pond 3P: Isolated Wetland D**



**Haverhill Existing Model 160511**

Prepared by Weston & Sampson

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Type III 24-hr 100-Year Rainfall=8.08"

Printed 6/6/2016

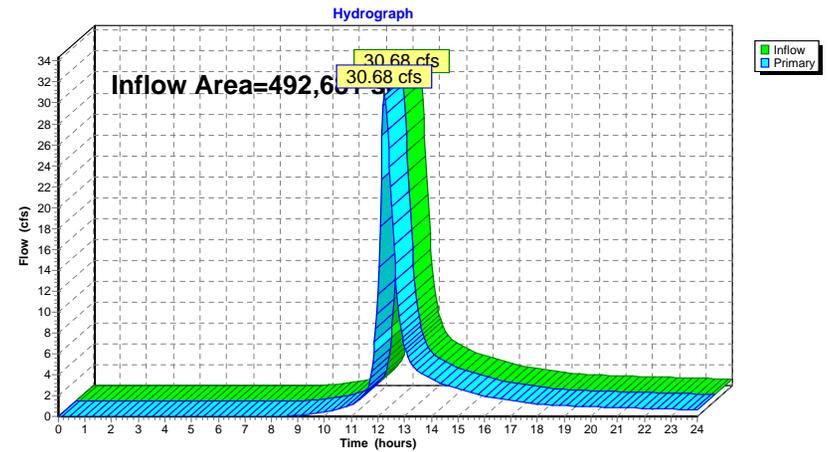
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**Summary for Pond 4P: BVW B**

Inflow Area = 492,681 sf, 18.14% Impervious, Inflow Depth > 3.57" for 100-Year event  
 Inflow = 30.68 cfs @ 12.25 hrs, Volume= 146,603 cf  
 Primary = 30.68 cfs @ 12.25 hrs, Volume= 146,603 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 3

**Pond 4P: BVW B**



**Summary for Pond POI 1: Northern Site**

Inflow Area = 601,618 sf, 14.86% Impervious, Inflow Depth > 3.36" for 100-Year event  
Inflow = 34.42 cfs @ 12.26 hrs, Volume= 168,307 cf  
Primary = 34.42 cfs @ 12.26 hrs, Volume= 168,307 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs / 3

**Pond POI 1: Northern Site**

Hydrograph

