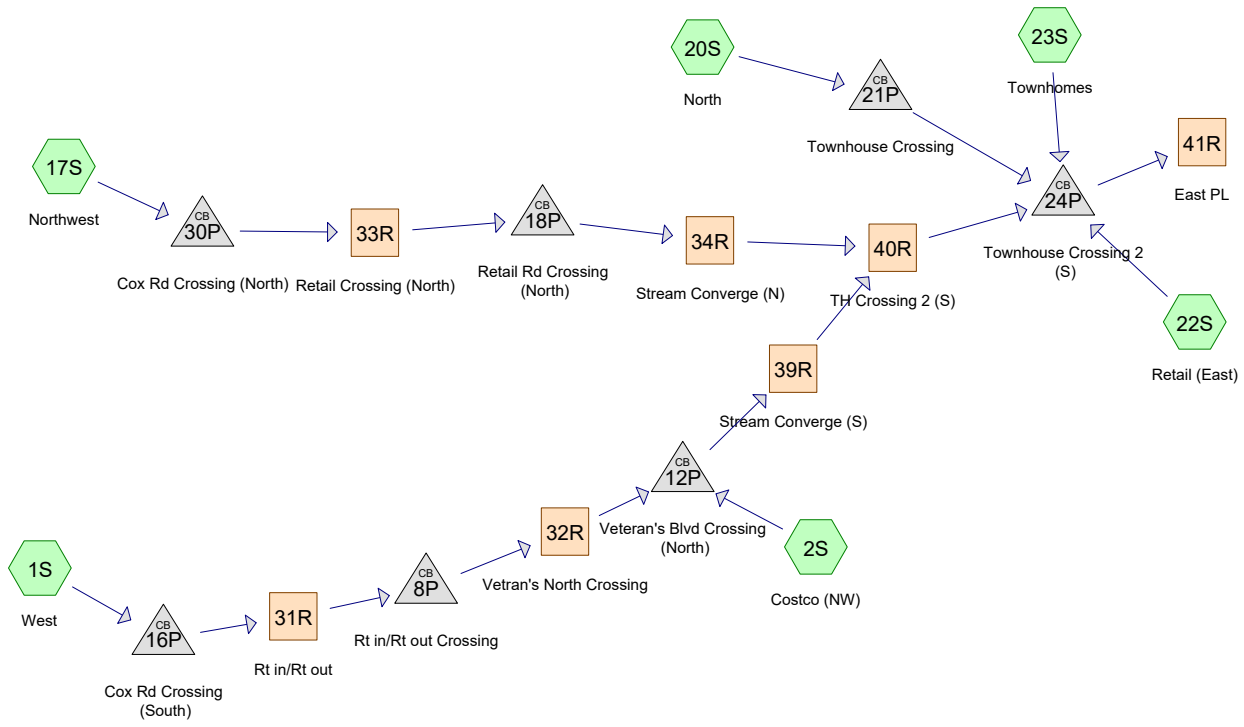


Subcat Reach Pond Link

Routing Diagram for Culvert
Prepared by HP Inc., Printed 8/18/2021
HydroCAD® 10.00-26 s/n 10100 © 2020 HydroCAD Software Solutions LLC

Summary for Subcatchment 1S: West

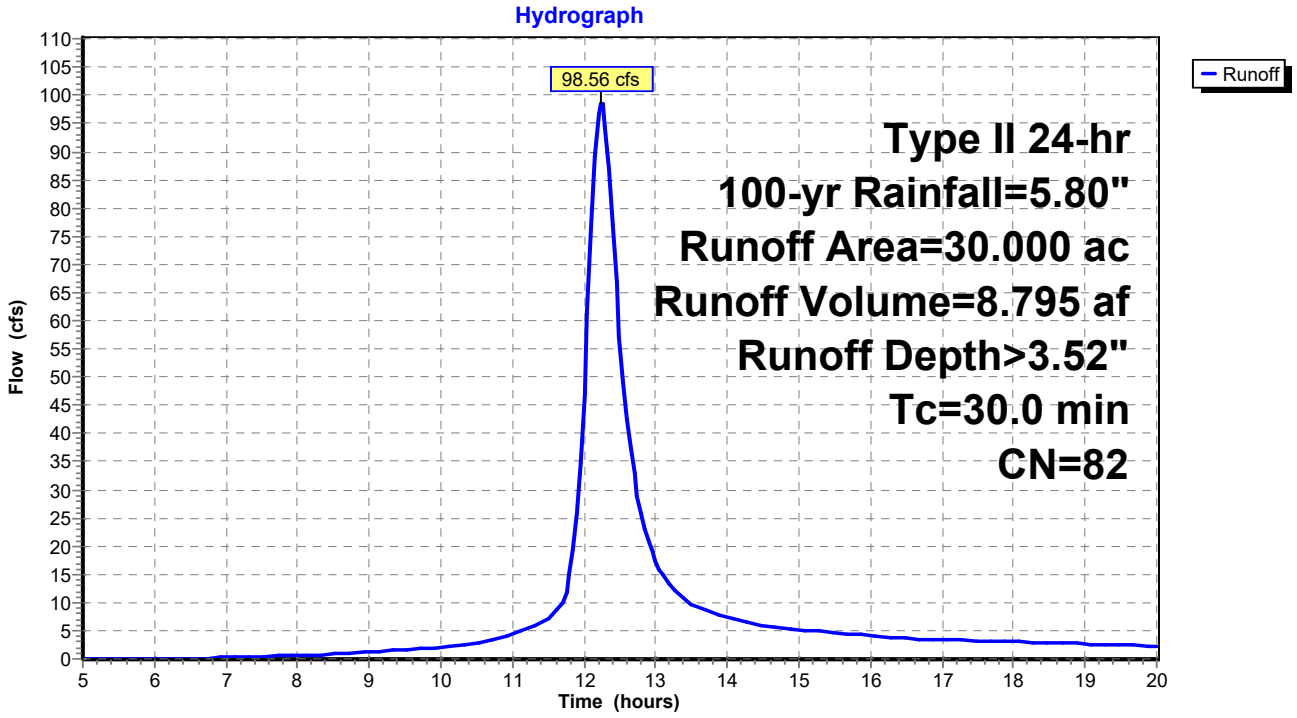
Runoff = 98.56 cfs @ 12.24 hrs, Volume= 8.795 af, Depth> 3.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.80"

	Area (ac)	CN	Description
*	30.000	82	
	30.000		100.00% Pervious Area

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

Subcatchment 1S: West



Summary for Subcatchment 2S: Costco (NW)

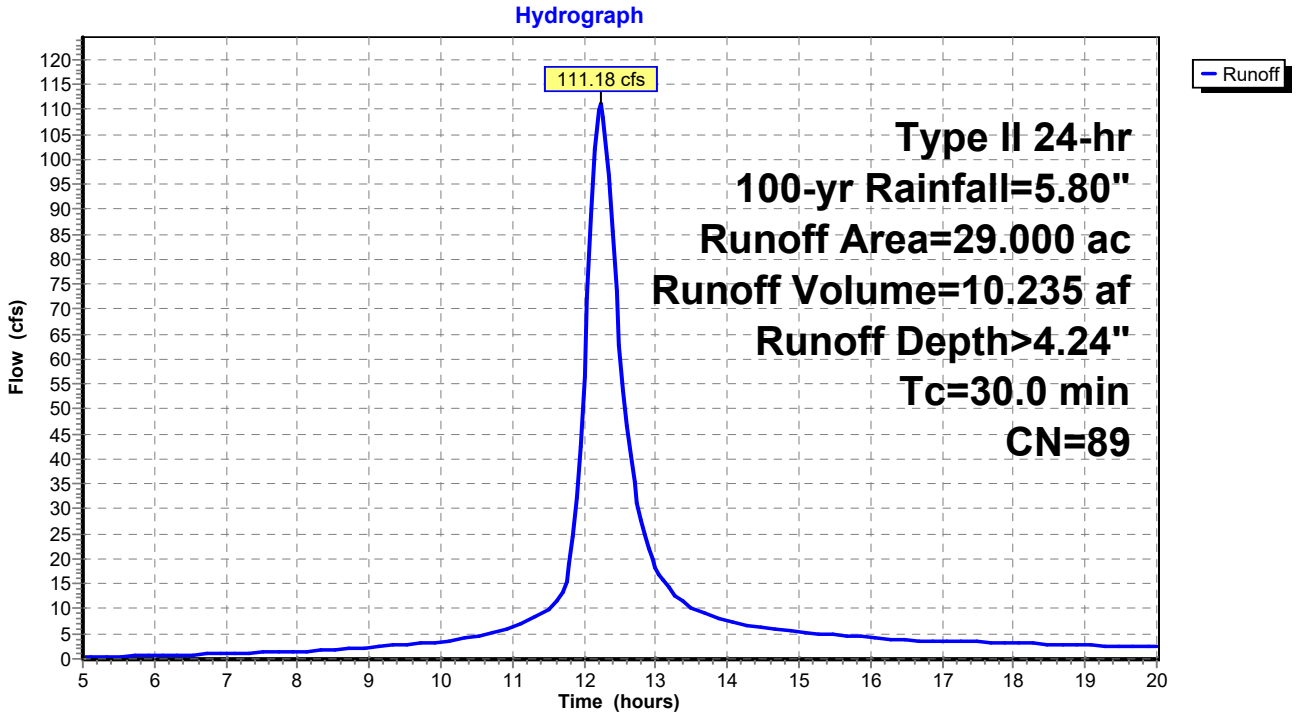
Runoff = 111.18 cfs @ 12.23 hrs, Volume= 10.235 af, Depth> 4.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.80"

	Area (ac)	CN	Description
*	29.000	89	
	29.000		100.00% Pervious Area

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

Subcatchment 2S: Costco (NW)



Summary for Subcatchment 17S: Northwest

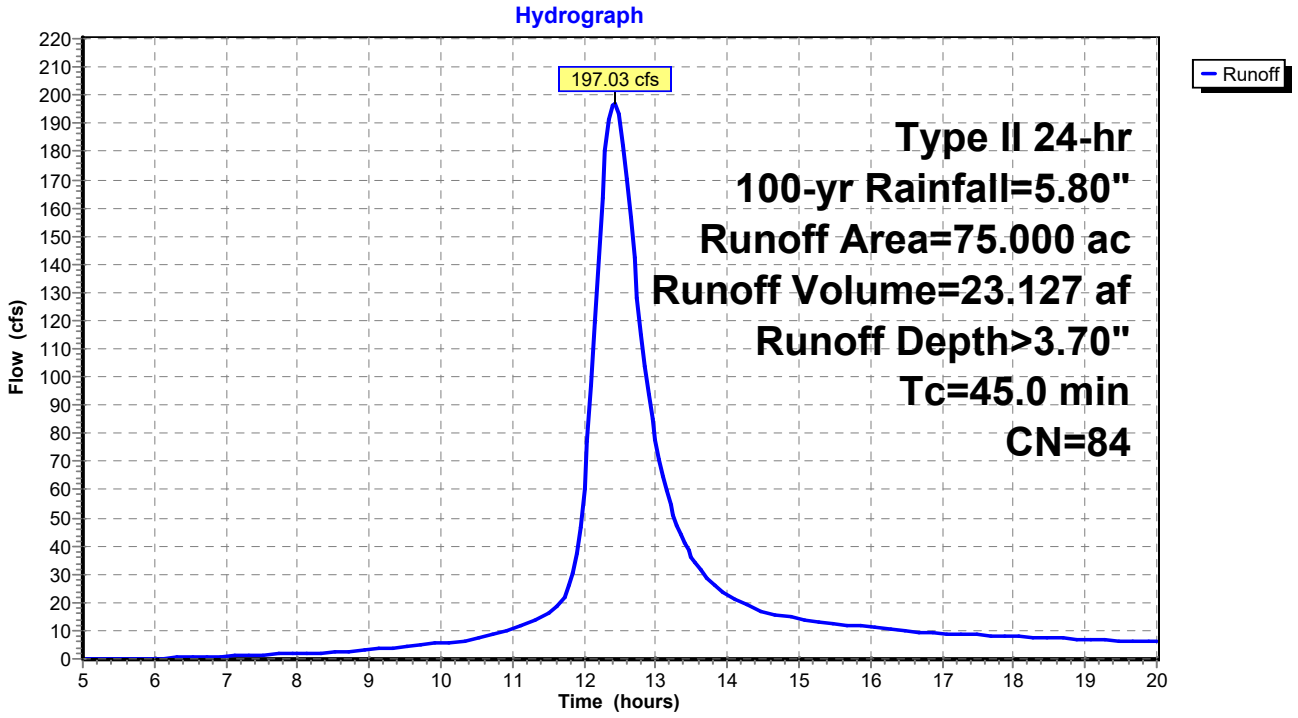
Runoff = 197.03 cfs @ 12.42 hrs, Volume= 23.127 af, Depth> 3.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.80"

	Area (ac)	CN	Description
*	75.000	84	
	75.000		100.00% Pervious Area

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

Subcatchment 17S: Northwest



Summary for Subcatchment 20S: North

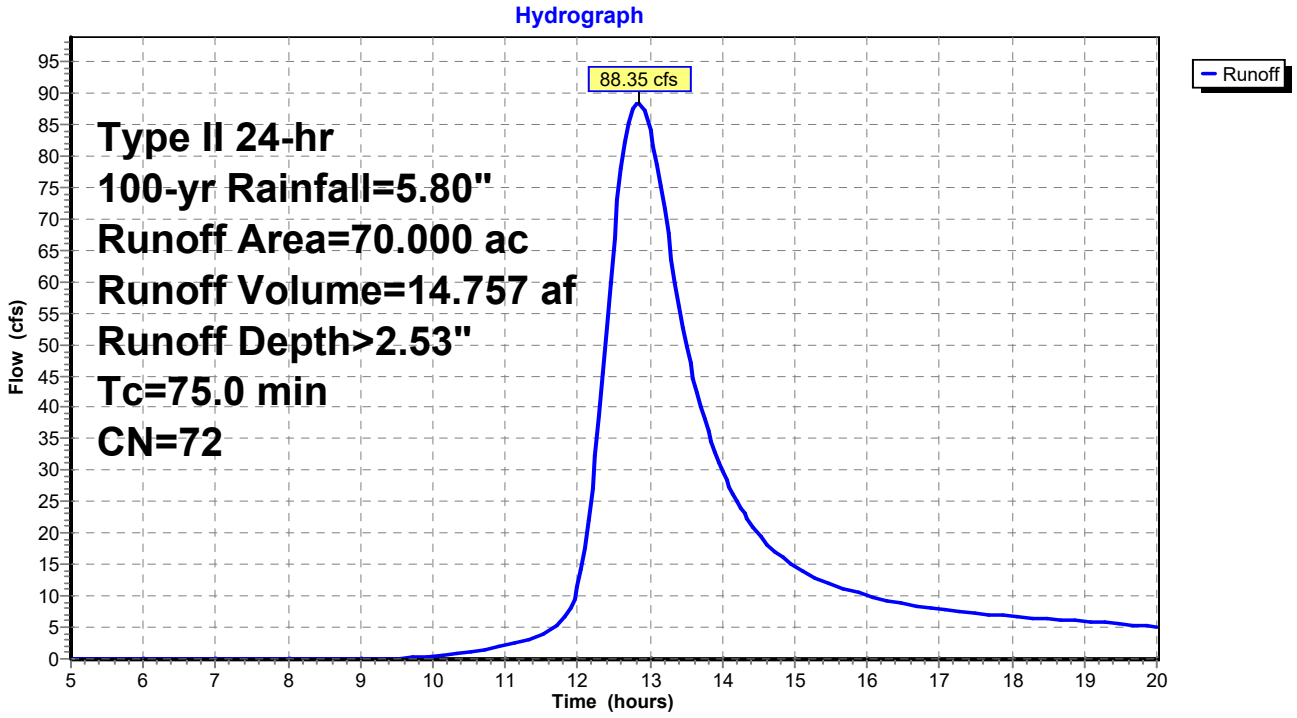
Runoff = 88.35 cfs @ 12.84 hrs, Volume= 14.757 af, Depth> 2.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.80"

	Area (ac)	CN	Description
*	70.000	72	
	70.000		100.00% Pervious Area

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

Subcatchment 20S: North



Summary for Subcatchment 22S: Retail (East)

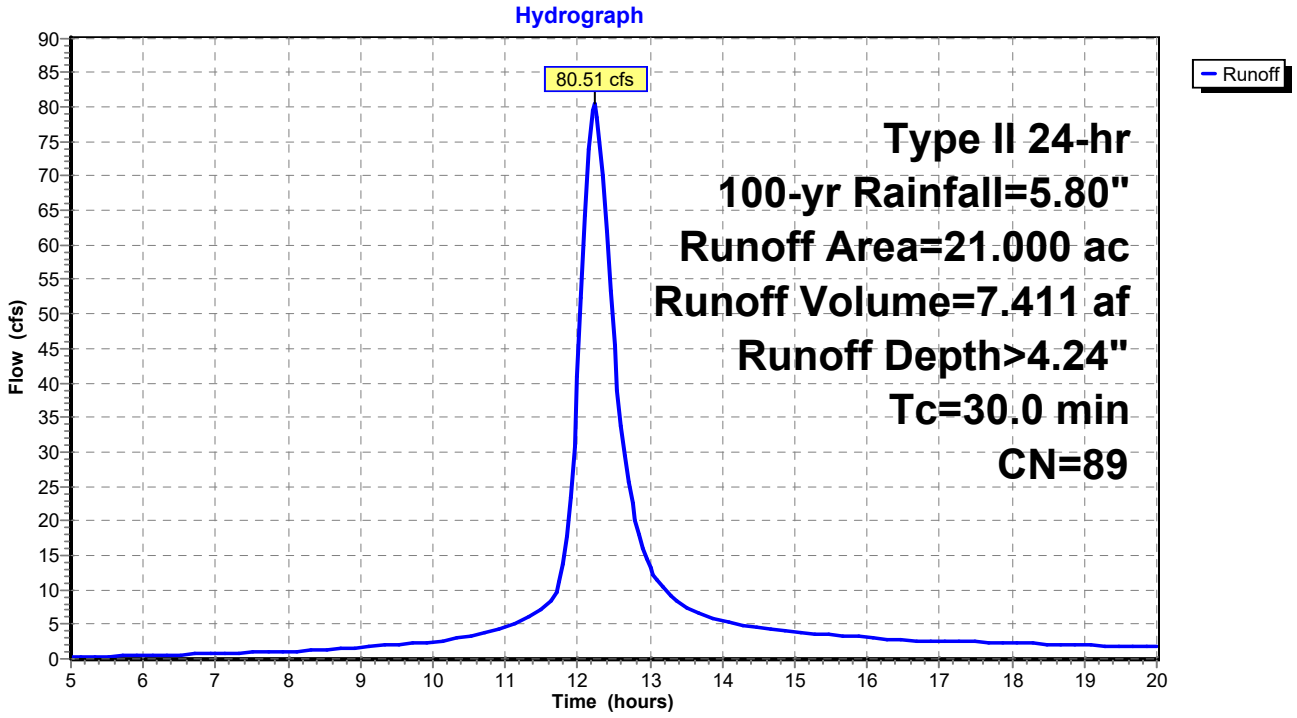
Runoff = 80.51 cfs @ 12.23 hrs, Volume= 7.411 af, Depth> 4.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.80"

	Area (ac)	CN	Description
*	21.000	89	
	21.000		100.00% Pervious Area

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

Subcatchment 22S: Retail (East)



Summary for Subcatchment 23S: Townhomes

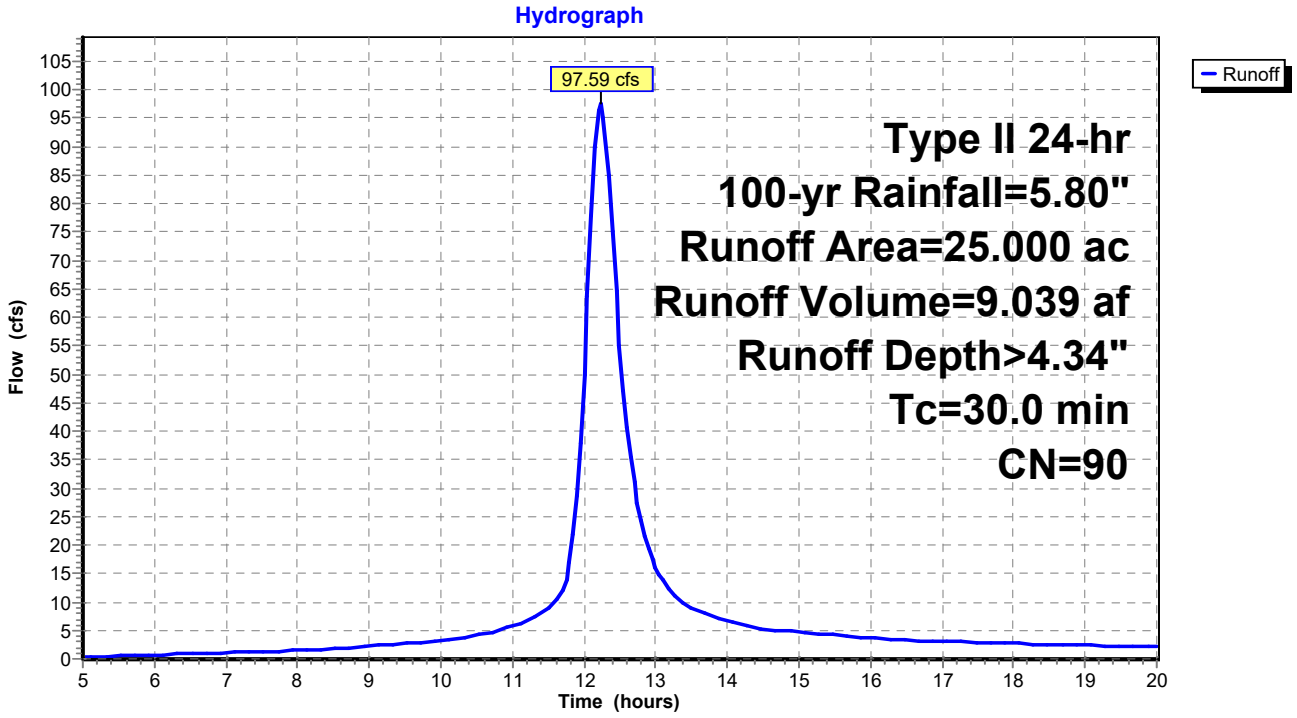
Runoff = 97.59 cfs @ 12.23 hrs, Volume= 9.039 af, Depth> 4.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=5.80"

	Area (ac)	CN	Description
*	25.000	90	
	25.000		100.00% Pervious Area

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

Subcatchment 23S: Townhomes



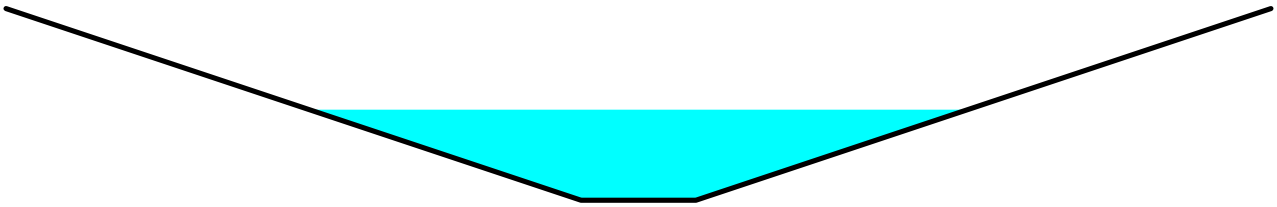
Summary for Reach 31R: Rt in/Rt out

Inflow Area = 30.000 ac, 0.00% Impervious, Inflow Depth > 3.52" for 100-yr event
Inflow = 98.56 cfs @ 12.24 hrs, Volume= 8.795 af
Outflow = 98.51 cfs @ 12.25 hrs, Volume= 8.789 af, Atten= 0%, Lag= 0.5 min

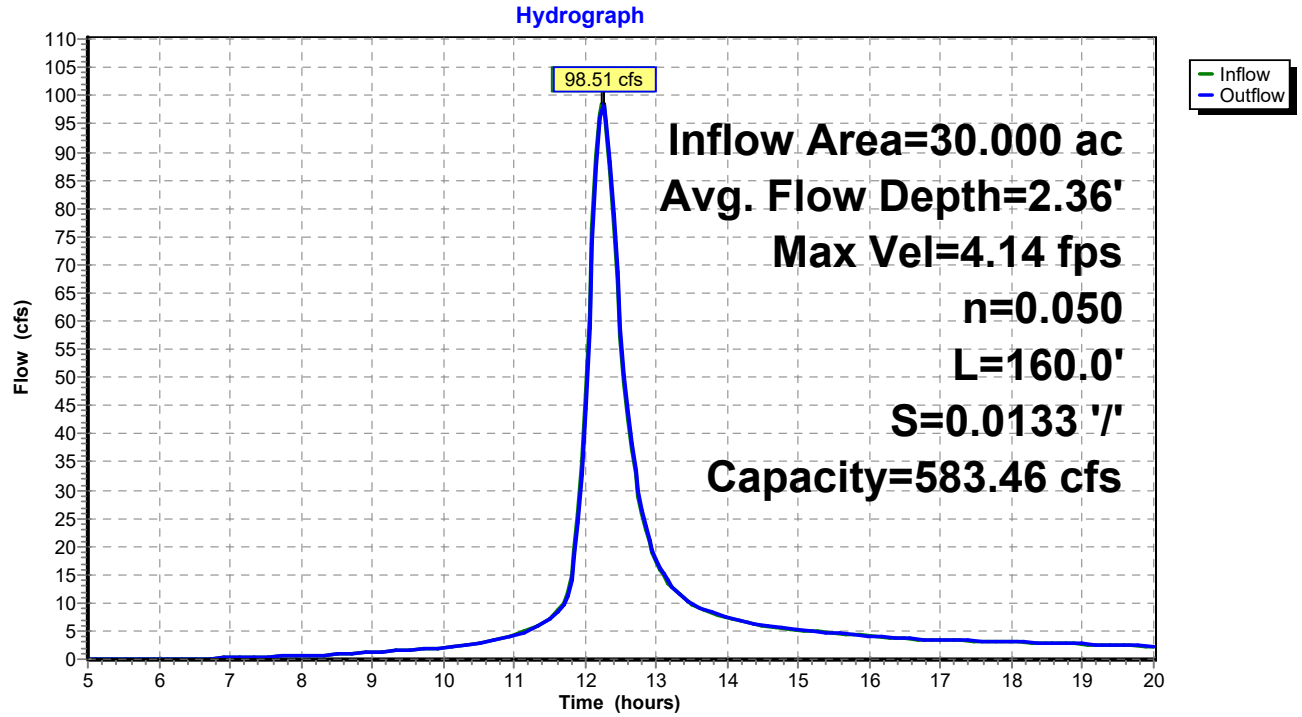
Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.14 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.68 fps, Avg. Travel Time= 1.6 min

Peak Storage= 3,806 cf @ 12.25 hrs
Average Depth at Peak Storage= 2.36'
Bank-Full Depth= 5.00' Flow Area= 90.0 sf, Capacity= 583.46 cfs

3.00' x 5.00' deep channel, n= 0.050
Side Slope Z-value= 3.0 '/' Top Width= 33.00'
Length= 160.0' Slope= 0.0133 '/'
Inlet Invert= 874.53', Outlet Invert= 872.40'



Reach 31R: Rt in/Rt out



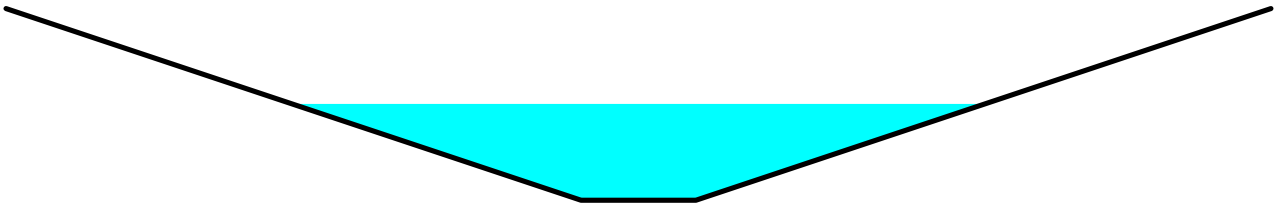
Summary for Reach 32R: Vetran's North Crossing

Inflow Area = 30.000 ac, 0.00% Impervious, Inflow Depth > 3.52" for 100-yr event
Inflow = 98.51 cfs @ 12.25 hrs, Volume= 8.789 af
Outflow = 96.63 cfs @ 12.29 hrs, Volume= 8.761 af, Atten= 2%, Lag= 2.6 min

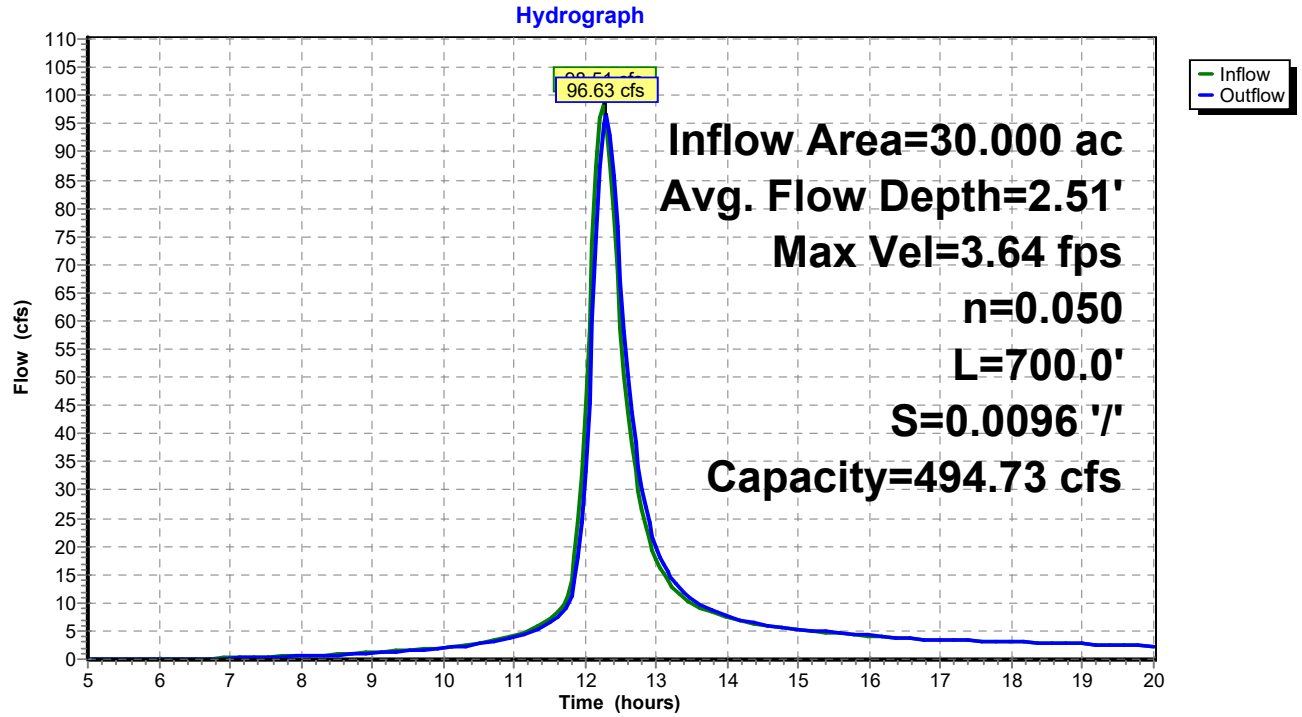
Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.64 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 1.49 fps, Avg. Travel Time= 7.8 min

Peak Storage= 18,563 cf @ 12.29 hrs
Average Depth at Peak Storage= 2.51'
Bank-Full Depth= 5.00' Flow Area= 90.0 sf, Capacity= 494.73 cfs

3.00' x 5.00' deep channel, n= 0.050
Side Slope Z-value= 3.0 '/' Top Width= 33.00'
Length= 700.0' Slope= 0.0096 '/'
Inlet Invert= 871.80', Outlet Invert= 865.10'



Reach 32R: Vetran's North Crossing



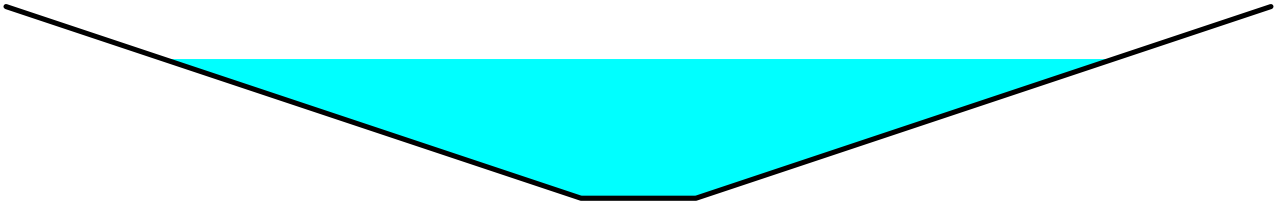
Summary for Reach 33R: Retail Crossing (North)

Inflow Area = 75.000 ac, 0.00% Impervious, Inflow Depth > 3.70" for 100-yr event
Inflow = 197.03 cfs @ 12.42 hrs, Volume= 23.127 af
Outflow = 196.97 cfs @ 12.43 hrs, Volume= 23.110 af, Atten= 0%, Lag= 0.5 min

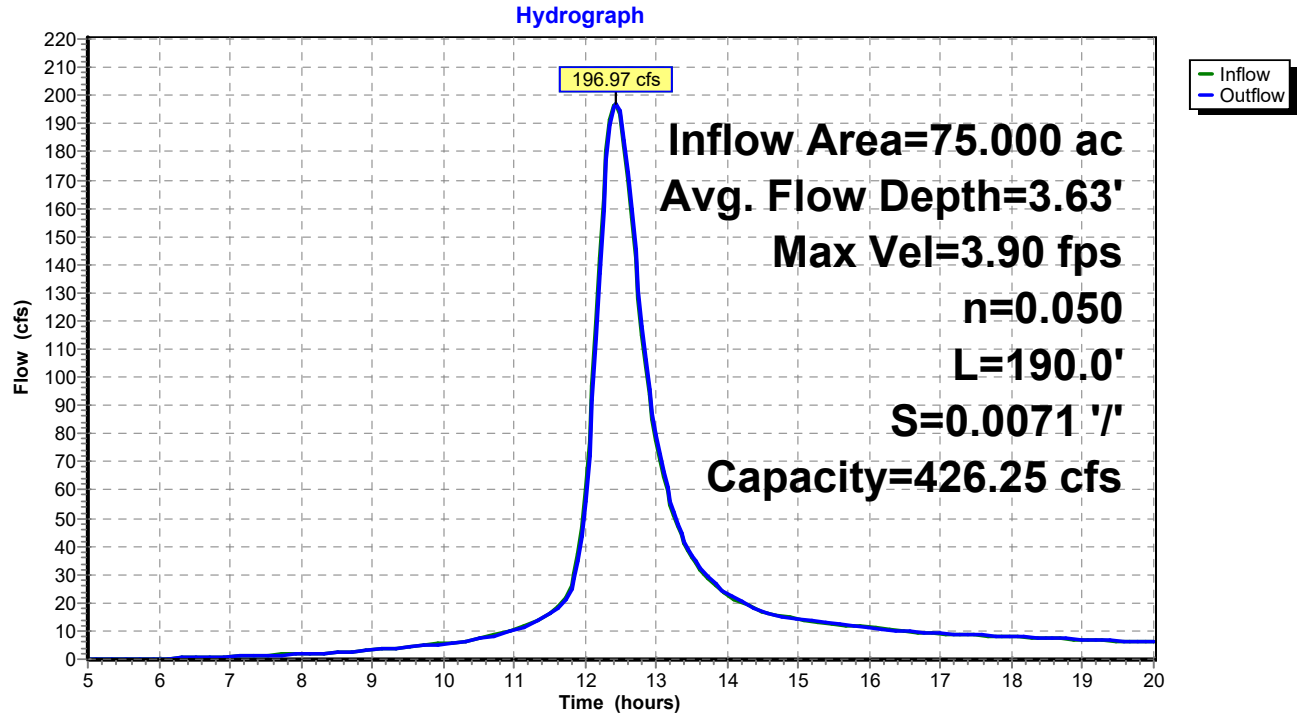
Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.90 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.73 fps, Avg. Travel Time= 1.8 min

Peak Storage= 9,592 cf @ 12.43 hrs
Average Depth at Peak Storage= 3.63'
Bank-Full Depth= 5.00' Flow Area= 90.0 sf, Capacity= 426.25 cfs

3.00' x 5.00' deep channel, n= 0.050
Side Slope Z-value= 3.0 '/' Top Width= 33.00'
Length= 190.0' Slope= 0.0071 '/'
Inlet Invert= 866.75', Outlet Invert= 865.40'



Reach 33R: Retail Crossing (North)



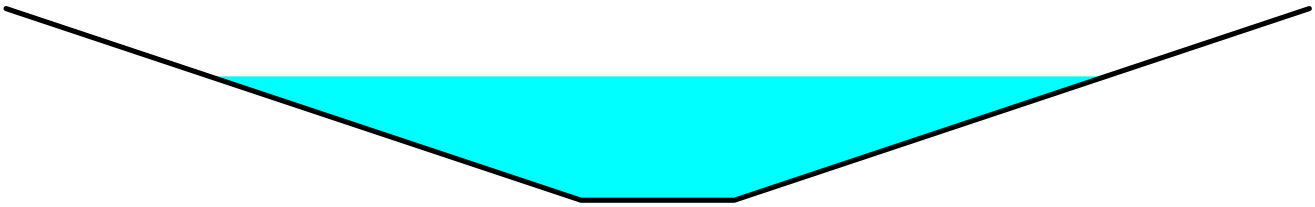
Summary for Reach 34R: Stream Converge (N)

Inflow Area = 75.000 ac, 0.00% Impervious, Inflow Depth > 3.70" for 100-yr event
Inflow = 196.97 cfs @ 12.43 hrs, Volume= 23.110 af
Outflow = 196.66 cfs @ 12.45 hrs, Volume= 23.080 af, Atten= 0%, Lag= 1.1 min

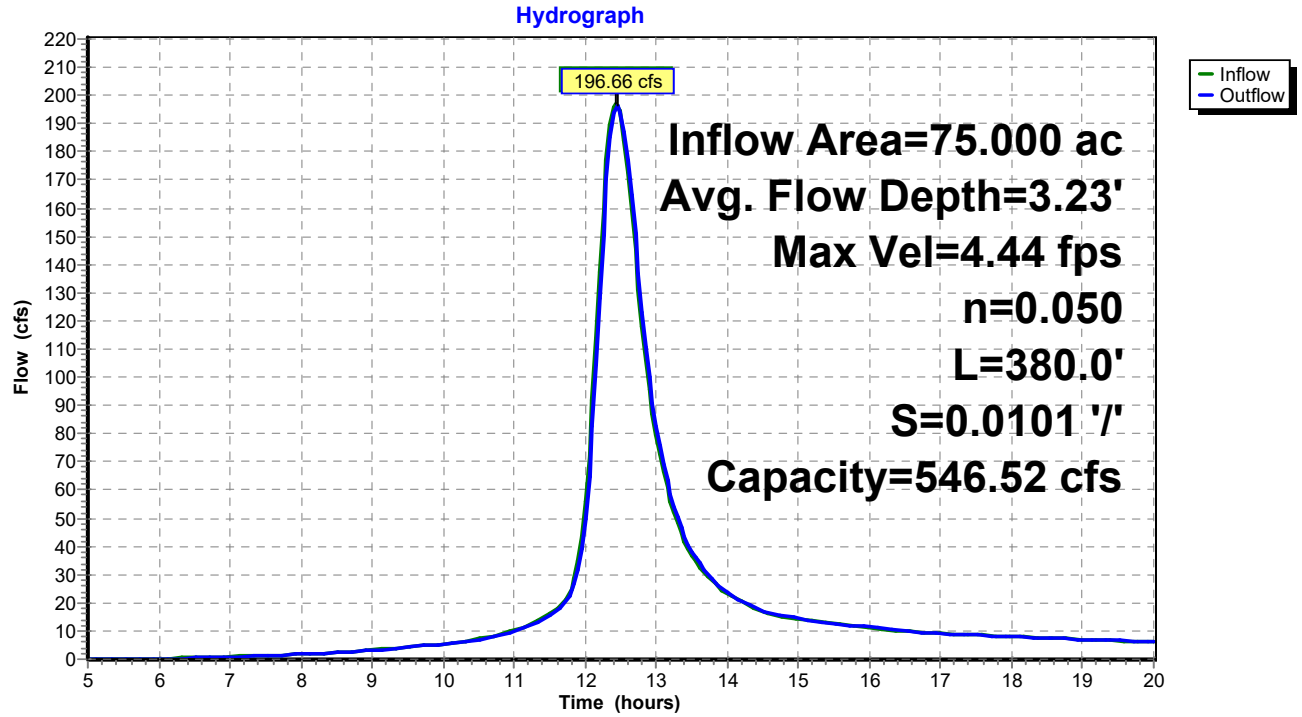
Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.44 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 1.92 fps, Avg. Travel Time= 3.3 min

Peak Storage= 16,815 cf @ 12.45 hrs
Average Depth at Peak Storage= 3.23'
Bank-Full Depth= 5.00' Flow Area= 95.0 sf, Capacity= 546.52 cfs

4.00' x 5.00' deep channel, n= 0.050
Side Slope Z-value= 3.0 '/' Top Width= 34.00'
Length= 380.0' Slope= 0.0101 '/'
Inlet Invert= 864.70', Outlet Invert= 860.85'



Reach 34R: Stream Converge (N)



Summary for Reach 39R: Stream Converge (S)

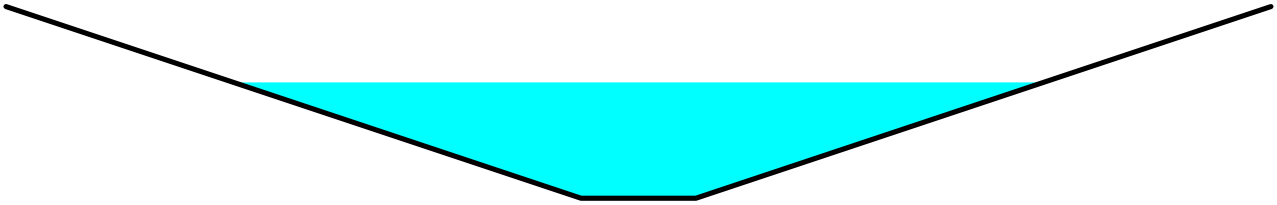
[82] Warning: Early inflow requires earlier time span

Inflow Area = 59.000 ac, 0.00% Impervious, Inflow Depth > 3.86" for 100-yr event
Inflow = 206.05 cfs @ 12.26 hrs, Volume= 18.996 af
Outflow = 205.99 cfs @ 12.27 hrs, Volume= 18.988 af, Atten= 0%, Lag= 0.4 min

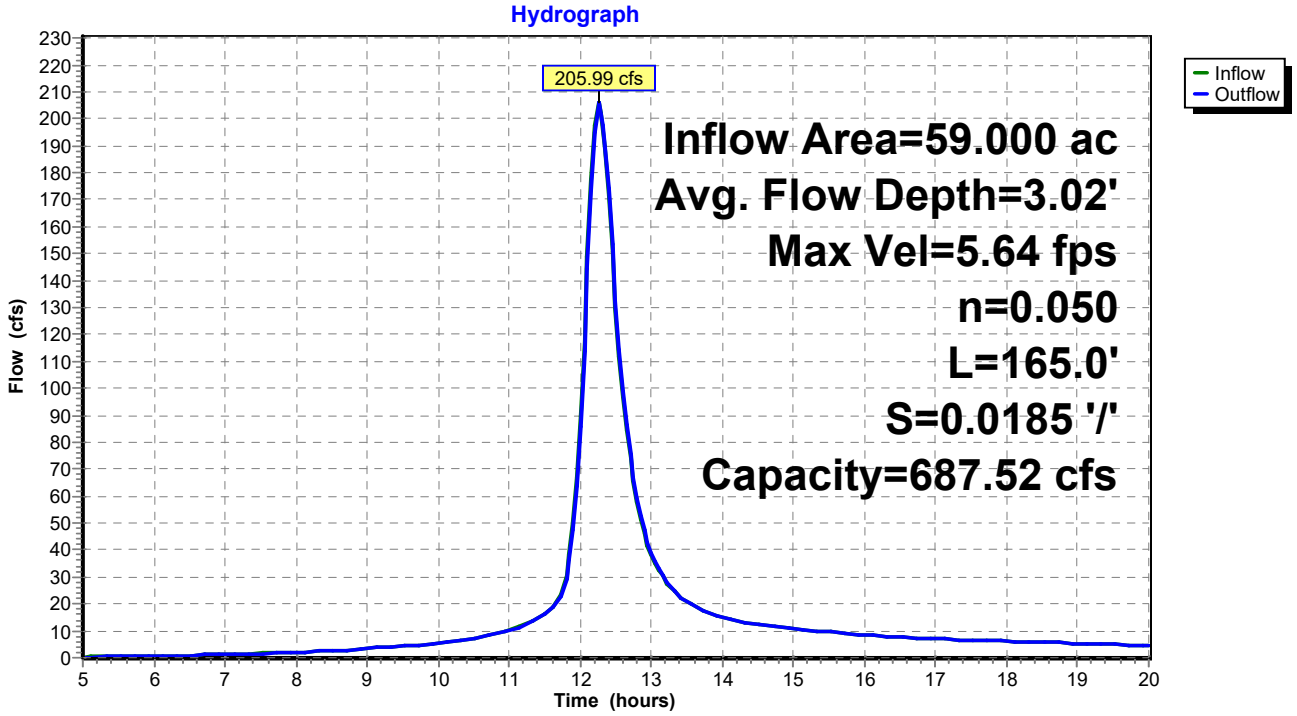
Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.64 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.34 fps, Avg. Travel Time= 1.2 min

Peak Storage= 6,024 cf @ 12.27 hrs
Average Depth at Peak Storage= 3.02'
Bank-Full Depth= 5.00' Flow Area= 90.0 sf, Capacity= 687.52 cfs

3.00' x 5.00' deep channel, n= 0.050
Side Slope Z-value= 3.0 '/' Top Width= 33.00'
Length= 165.0' Slope= 0.0185 '/'
Inlet Invert= 863.90', Outlet Invert= 860.85'



Reach 39R: Stream Converge (S)



Summary for Reach 40R: TH Crossing 2 (S)

[62] Hint: Exceeded Reach 34R OUTLET depth by 1.61' @ 12.30 hrs
[62] Hint: Exceeded Reach 39R OUTLET depth by 2.12' @ 12.55 hrs

Inflow Area = 134.000 ac, 0.00% Impervious, Inflow Depth > 3.77" for 100-yr event
Inflow = 377.51 cfs @ 12.34 hrs, Volume= 42.068 af
Outflow = 372.35 cfs @ 12.39 hrs, Volume= 41.929 af, Atten= 1%, Lag= 2.8 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.51 fps, Min. Travel Time= 3.5 min
Avg. Velocity = 1.45 fps, Avg. Travel Time= 8.4 min

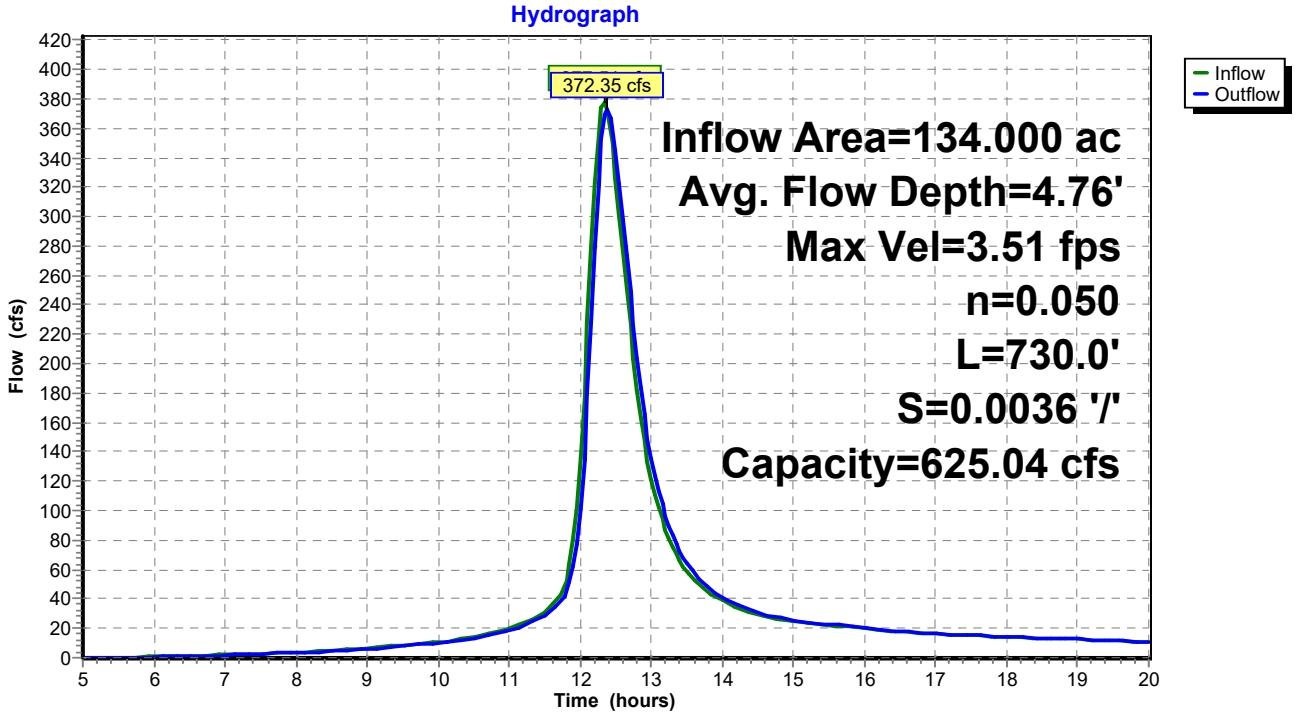
Peak Storage= 77,443 cf @ 12.38 hrs
Average Depth at Peak Storage= 4.76'
Bank-Full Depth= 6.00' Flow Area= 156.0 sf, Capacity= 625.04 cfs

8.00' x 6.00' deep channel, n= 0.050
Side Slope Z-value= 3.0 '/' Top Width= 44.00'
Length= 730.0' Slope= 0.0036 '/'
Inlet Invert= 860.85', Outlet Invert= 858.25'



‡

Reach 40R: TH Crossing 2 (S)



Summary for Reach 41R: East PL

Inflow Area = 250.000 ac, 0.00% Impervious, Inflow Depth > 3.51" for 100-yr event
Inflow = 569.98 cfs @ 12.35 hrs, Volume= 73.136 af
Outflow = 569.23 cfs @ 12.37 hrs, Volume= 73.040 af, Atten= 0%, Lag= 1.1 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.14 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 1.82 fps, Avg. Travel Time= 3.2 min

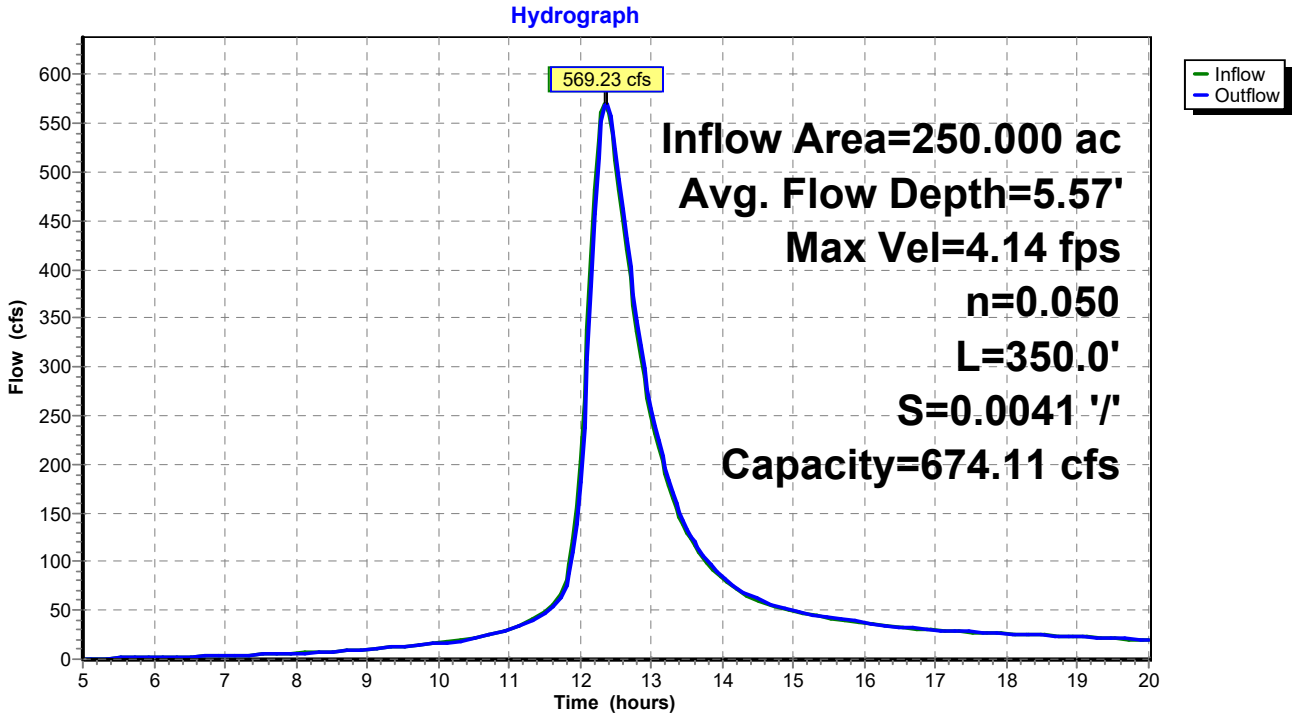
Peak Storage= 48,135 cf @ 12.37 hrs
Average Depth at Peak Storage= 5.57'
Bank-Full Depth= 6.00' Flow Area= 156.0 sf, Capacity= 674.11 cfs

8.00' x 6.00' deep channel, n= 0.050
Side Slope Z-value= 3.0 '/' Top Width= 44.00'
Length= 350.0' Slope= 0.0041 '/'
Inlet Invert= 858.05', Outlet Invert= 856.60'



‡

Reach 41R: East PL



Summary for Pond 8P: Rt in/Rt out Crossing

[57] Hint: Peaked at 876.25' (Flood elevation advised)
[62] Hint: Exceeded Reach 31R OUTLET depth by 1.48' @ 12.25 hrs

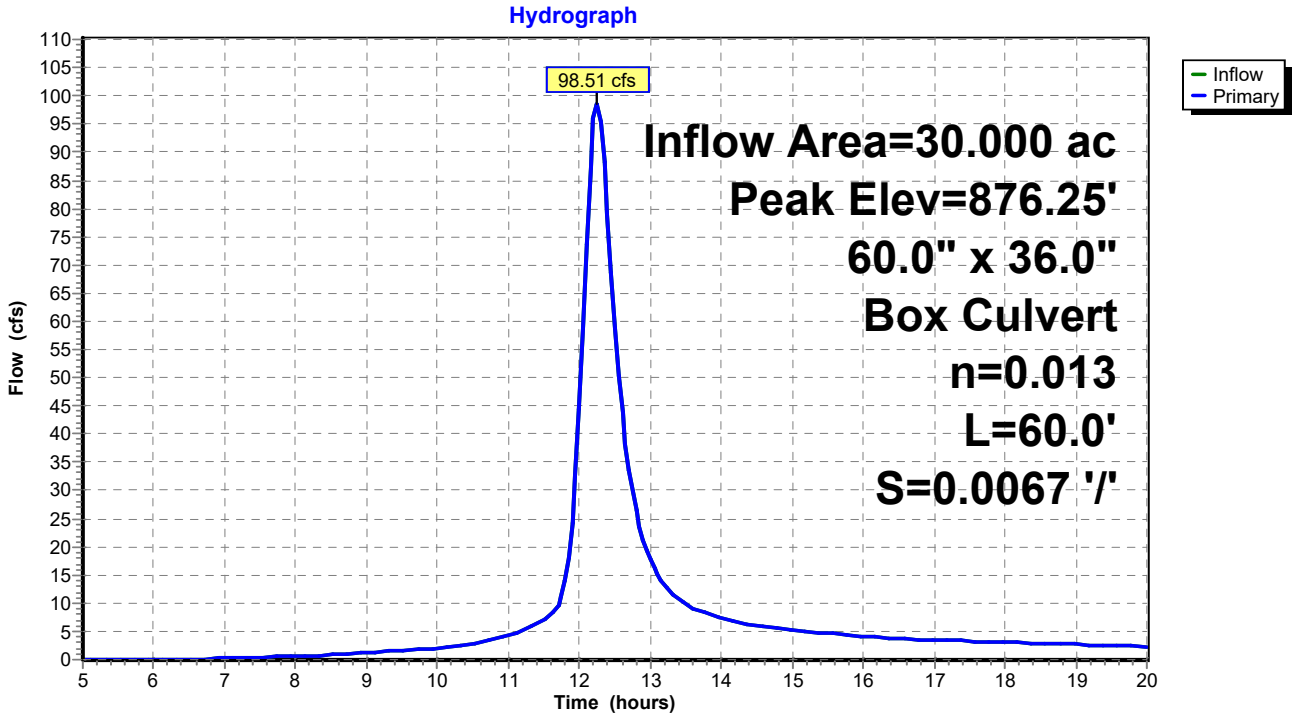
Inflow Area = 30.000 ac, 0.00% Impervious, Inflow Depth > 3.52" for 100-yr event
Inflow = 98.51 cfs @ 12.25 hrs, Volume= 8.789 af
Outflow = 98.51 cfs @ 12.25 hrs, Volume= 8.789 af, Atten= 0%, Lag= 0.0 min
Primary = 98.51 cfs @ 12.25 hrs, Volume= 8.789 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 876.25' @ 12.26 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	872.20'	**60.0" W x 36.0" H Box Box Culvert** L= 60.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 872.20' / 871.80' S= 0.0067 '/' Cc= 0.900 n= 0.013, Flow Area= 15.00 sf

Primary OutFlow Max=96.84 cfs @ 12.25 hrs HW=876.24' TW=874.29' (Dynamic Tailwater)
↳**1=Box Culvert** (Inlet Controls 96.84 cfs @ 6.46 fps)

Pond 8P: Rt in/Rt out Crossing



Summary for Pond 12P: Veteran's Blvd Crossing (North)

[82] Warning: Early inflow requires earlier time span
[57] Hint: Peaked at 868.57' (Flood elevation advised)
[62] Hint: Exceeded Reach 32R OUTLET depth by 0.96' @ 12.25 hrs

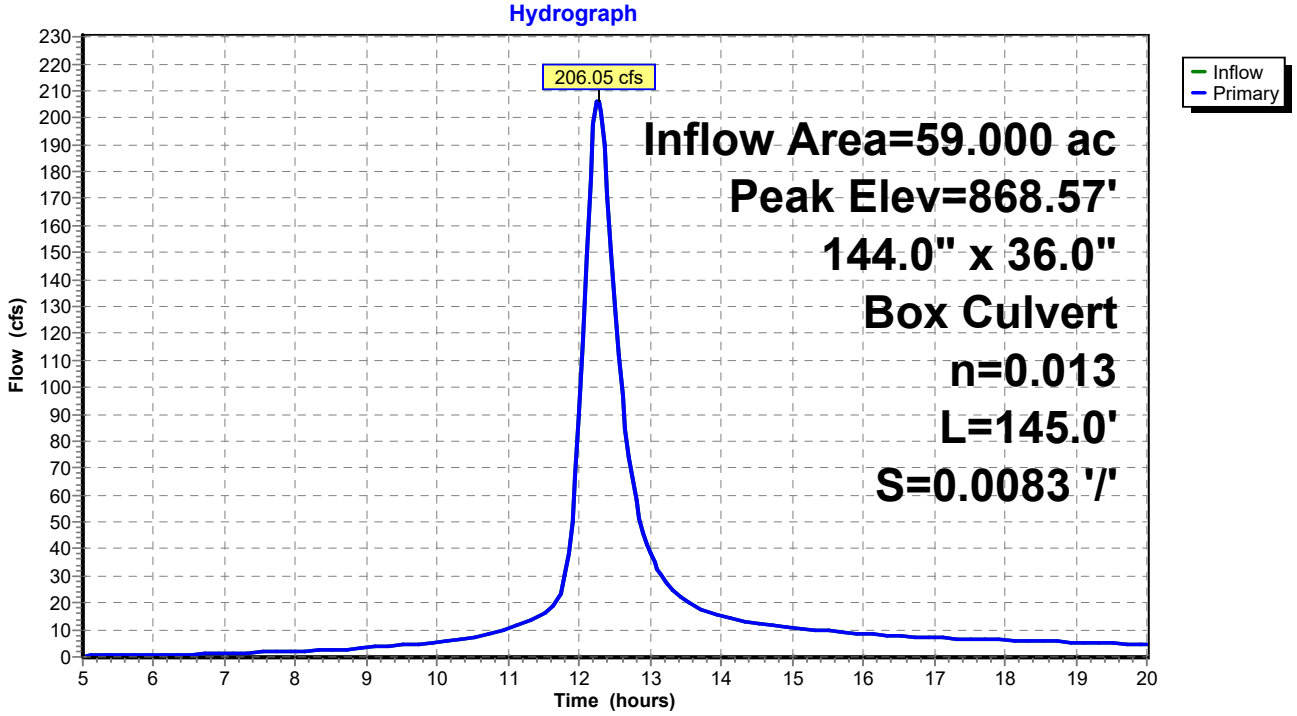
Inflow Area = 59.000 ac, 0.00% Impervious, Inflow Depth > 3.86" for 100-yr event
Inflow = 206.05 cfs @ 12.26 hrs, Volume= 18.996 af
Outflow = 206.05 cfs @ 12.26 hrs, Volume= 18.996 af, Atten= 0%, Lag= 0.0 min
Primary = 206.05 cfs @ 12.26 hrs, Volume= 18.996 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 868.57' @ 12.27 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	865.10'	**144.0" W x 36.0" H Box Box Culvert** L= 145.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 865.10' / 863.90' S= 0.0083 '/' Cc= 0.900 n= 0.013, Flow Area= 36.00 sf

Primary OutFlow Max=203.17 cfs @ 12.26 hrs HW=868.55' TW=866.92' (Dynamic Tailwater)
└**1=Box Culvert** (Inlet Controls 203.17 cfs @ 5.64 fps)

Pond 12P: Veteran's Blvd Crossing (North)



Summary for Pond 16P: Cox Rd Crossing (South)

[57] Hint: Peaked at 882.62' (Flood elevation advised)

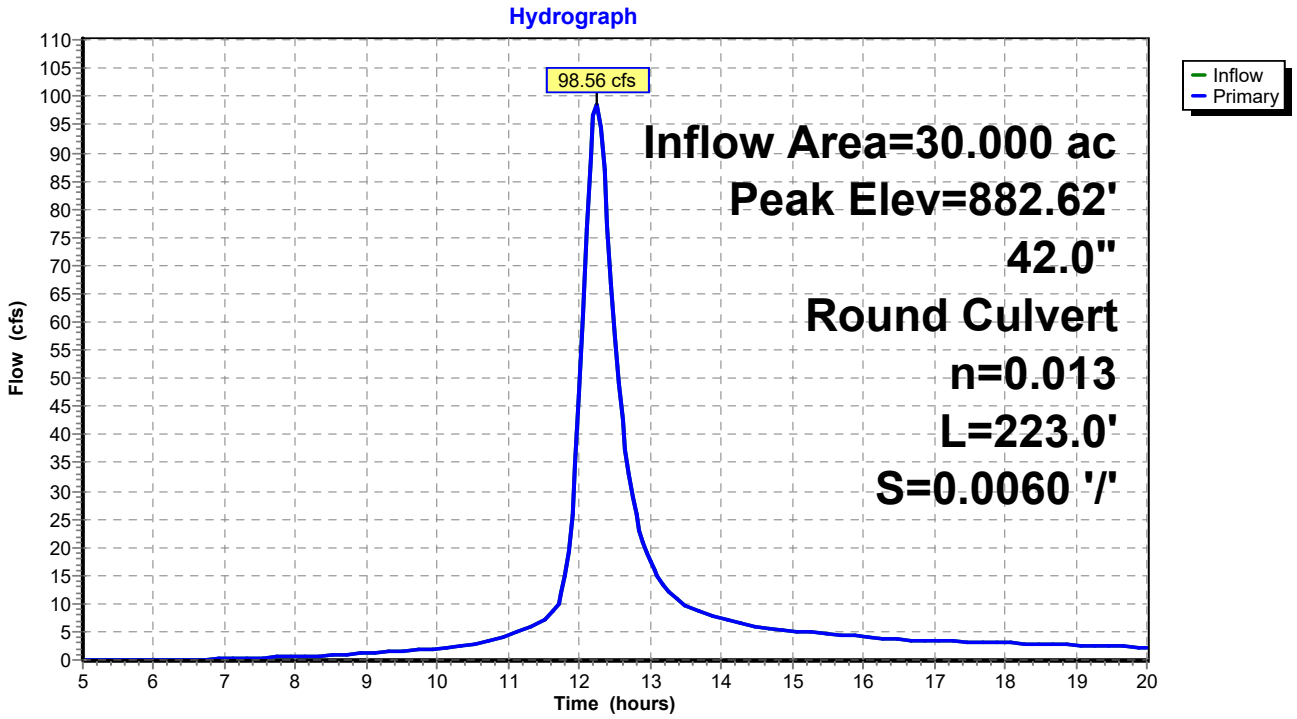
Inflow Area = 30.000 ac, 0.00% Impervious, Inflow Depth > 3.52" for 100-yr event
Inflow = 98.56 cfs @ 12.24 hrs, Volume= 8.795 af
Outflow = 98.56 cfs @ 12.24 hrs, Volume= 8.795 af, Atten= 0%, Lag= 0.0 min
Primary = 98.56 cfs @ 12.24 hrs, Volume= 8.795 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 882.62' @ 12.24 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	875.86'	**42.0" Round Ex. 42"** L= 223.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 875.86' / 874.53' S= 0.0060 '/' Cc= 0.900 n= 0.013, Flow Area= 9.62 sf

Primary OutFlow Max=98.12 cfs @ 12.24 hrs HW=882.58' TW=876.88' (Dynamic Tailwater)
↑—**1=Ex. 42"** (Barrel Controls 98.12 cfs @ 10.20 fps)

Pond 16P: Cox Rd Crossing (South)



Summary for Pond 18P: Retail Rd Crossing (North)

[57] Hint: Peaked at 870.85' (Flood elevation advised)
[63] Warning: Exceeded Reach 33R INLET depth by 0.47' @ 12.45 hrs

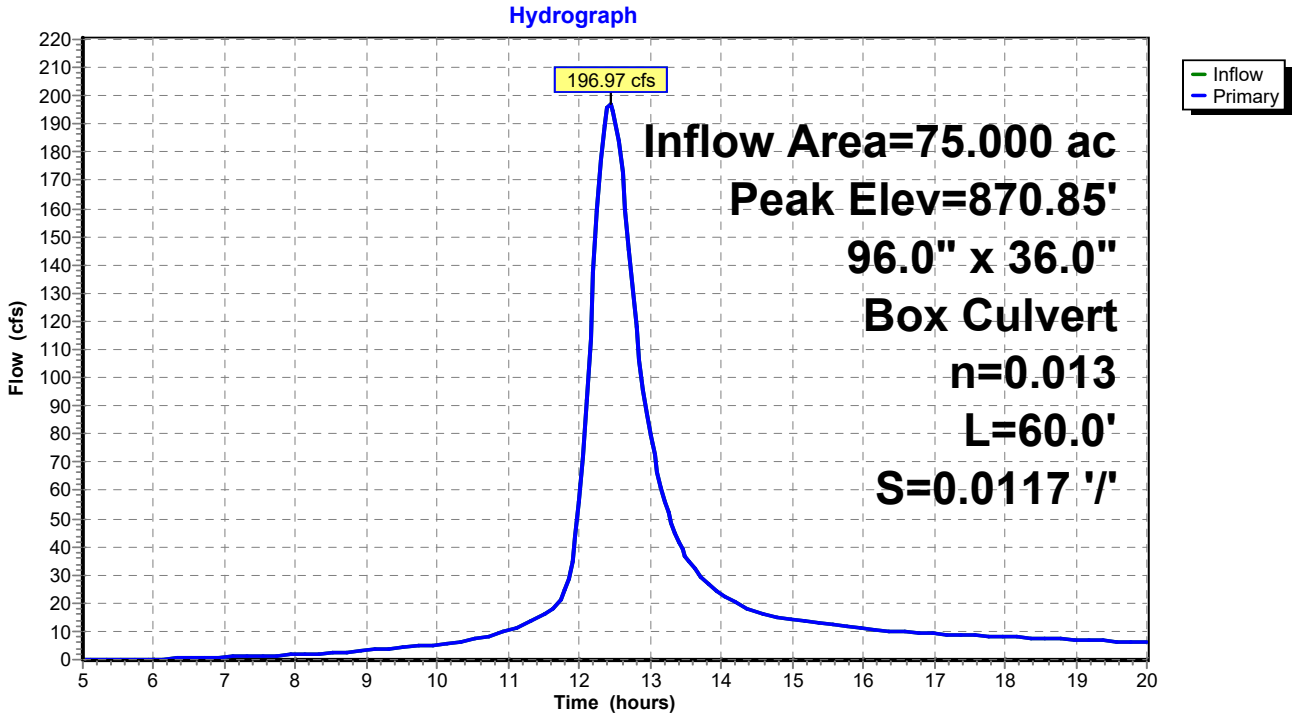
Inflow Area = 75.000 ac, 0.00% Impervious, Inflow Depth > 3.70" for 100-yr event
Inflow = 196.97 cfs @ 12.43 hrs, Volume= 23.110 af
Outflow = 196.97 cfs @ 12.43 hrs, Volume= 23.110 af, Atten= 0%, Lag= 0.0 min
Primary = 196.97 cfs @ 12.43 hrs, Volume= 23.110 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 870.85' @ 12.44 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	865.40'	**96.0" W x 36.0" H Box Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 865.40' / 864.70' S= 0.0117 '/' Cc= 0.900 n= 0.013, Flow Area= 24.00 sf

Primary OutFlow Max=195.38 cfs @ 12.43 hrs HW=870.82' TW=867.92' (Dynamic Tailwater)
↳**1=Culvert** (Inlet Controls 195.38 cfs @ 8.14 fps)

Pond 18P: Retail Rd Crossing (North)



Summary for Pond 21P: Townhouse Crossing

[57] Hint: Peaked at 866.67' (Flood elevation advised)

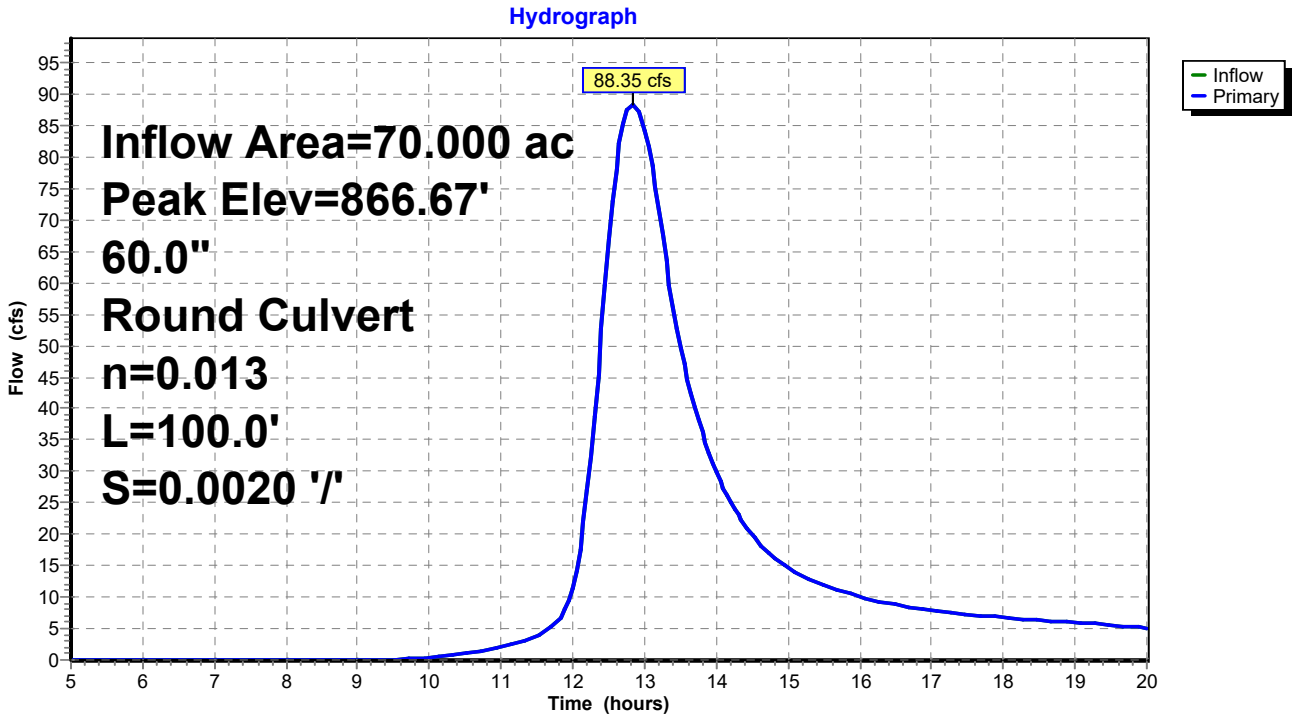
Inflow Area = 70.000 ac, 0.00% Impervious, Inflow Depth > 2.53" for 100-yr event
Inflow = 88.35 cfs @ 12.84 hrs, Volume= 14.757 af
Outflow = 88.35 cfs @ 12.84 hrs, Volume= 14.757 af, Atten= 0%, Lag= 0.0 min
Primary = 88.35 cfs @ 12.84 hrs, Volume= 14.757 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 866.67' @ 12.45 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	861.15'	**60.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 861.15' / 860.95' S= 0.0020 '/' Cc= 0.900 n= 0.013, Flow Area= 19.63 sf

Primary OutFlow Max=88.38 cfs @ 12.84 hrs HW=865.39' TW=863.70' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 88.38 cfs @ 6.70 fps)

Pond 21P: Townhouse Crossing



Summary for Pond 24P: Townhouse Crossing 2 (S)

[57] Hint: Peaked at 866.31' (Flood elevation advised)
[63] Warning: Exceeded Reach 40R INLET depth by 0.69' @ 12.35 hrs
[80] Warning: Exceeded Pond 21P by 0.50' @ 12.20 hrs (47.13 cfs 0.848 af)

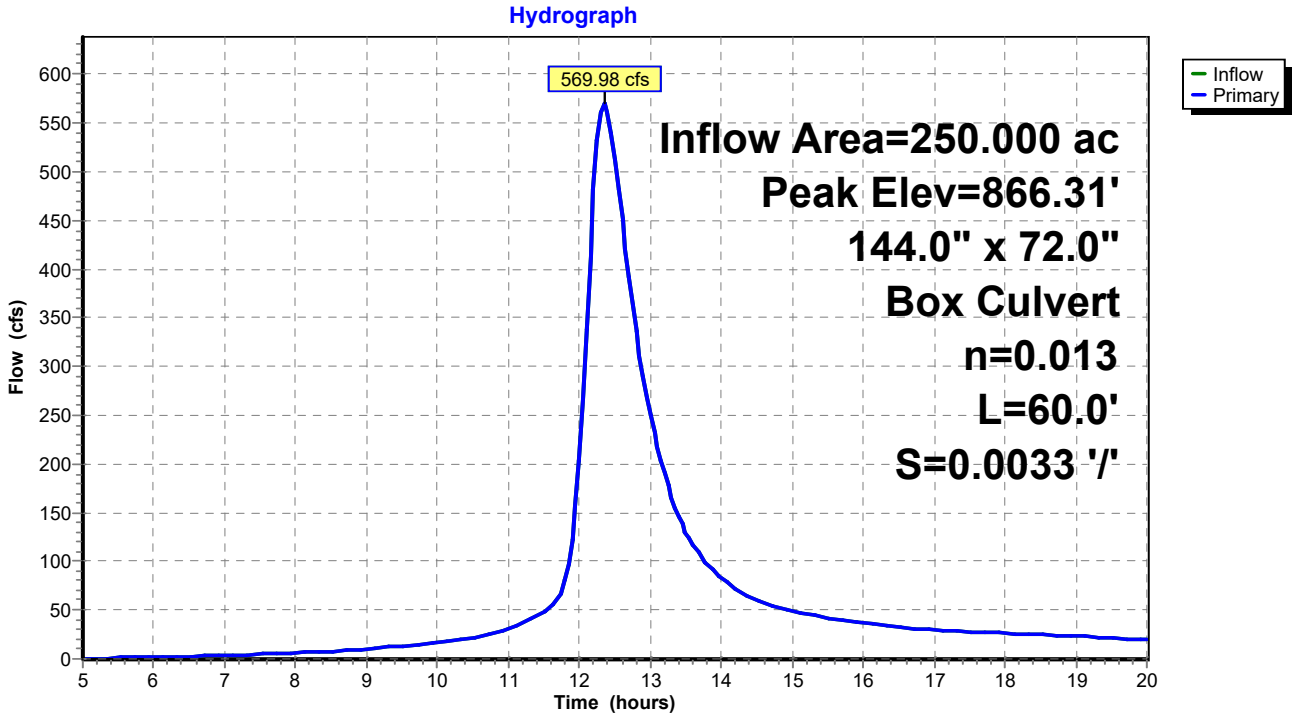
Inflow Area = 250.000 ac, 0.00% Impervious, Inflow Depth > 3.51" for 100-yr event
Inflow = 569.98 cfs @ 12.35 hrs, Volume= 73.136 af
Outflow = 569.98 cfs @ 12.35 hrs, Volume= 73.136 af, Atten= 0%, Lag= 0.0 min
Primary = 569.98 cfs @ 12.35 hrs, Volume= 73.136 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 866.31' @ 12.37 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	858.25'	**144.0" W x 72.0" H Box Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 858.25' / 858.05' S= 0.0033 '/' Cc= 0.900 n= 0.013, Flow Area= 72.00 sf

Primary OutFlow Max=563.39 cfs @ 12.35 hrs HW=866.29' TW=863.61' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 563.39 cfs @ 7.82 fps)

Pond 24P: Townhouse Crossing 2 (S)



Summary for Pond 30P: Cox Rd Crossing (North)

[57] Hint: Peaked at 880.97' (Flood elevation advised)

Inflow Area = 75.000 ac, 0.00% Impervious, Inflow Depth > 3.70" for 100-yr event
Inflow = 197.03 cfs @ 12.42 hrs, Volume= 23.127 af
Outflow = 197.03 cfs @ 12.42 hrs, Volume= 23.127 af, Atten= 0%, Lag= 0.0 min
Primary = 197.03 cfs @ 12.42 hrs, Volume= 23.127 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 880.97' @ 12.43 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	867.41'	**48.0" Round Ex. 48"** L= 148.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 867.41' / 866.75' S= 0.0045 '/' Cc= 0.900 n= 0.013, Flow Area= 12.57 sf

Primary OutFlow Max=196.16 cfs @ 12.42 hrs HW=880.89' TW=870.38' (Dynamic Tailwater)
↑—**1=Ex. 48"** (Inlet Controls 196.16 cfs @ 15.61 fps)

Pond 30P: Cox Rd Crossing (North)

