Memorandum

To: Ms. Christine Long, Chair
Framingham Planning Board

Date: June 8, 2016

Project #: 12642.00

From: Jocelyn Mayer, PE
Conor Nagle, PE

Re: 19 Flutie Pass Redevelopment
Stormwater Management Design

In January 2016 the Framingham Planning Board approved the 'AMC South Lot Development', a redevelopment of the existing parking lot south of Flutie Pass into an iFly, Kings Bowling and restaurant complex. At this time the Applicant, BRE DDR Shoppers World LLC, has revised the Project to include approximately 136 residential units and 3,750 square feet of retail in addition to the original development. The following memorandum demonstrates that there are no significant changes as a result of the increase in impervious area as it pertains to the Site's stormwater management design and that the design complies with the requirements of the Massachusetts Stormwater Management Regulations.

The stormwater report submitted to the Planning Board as part of the January 2016 Site Plan Approval detailed the stormwater design for the proposed conditions and mitigated the proposed change in stormwater runoff such that there would be no increase in peak flow from the Project Site.

The Project results in an additional 5,200± square feet in impervious area, associated with the building rooftops. The HydroCAD model has been revised to include the additional rooftop area. The results of the analysis, provided below, indicate that there is no increase in peak flows and as such, the stormwater system, previously approved by both the Planning Board and Conservation Commission, will still comply with each of the ten performance standards of the Massachusetts Stormwater Regulations. Supporting calculations are enclosed.

Peak Discharge Rates (cfs*)

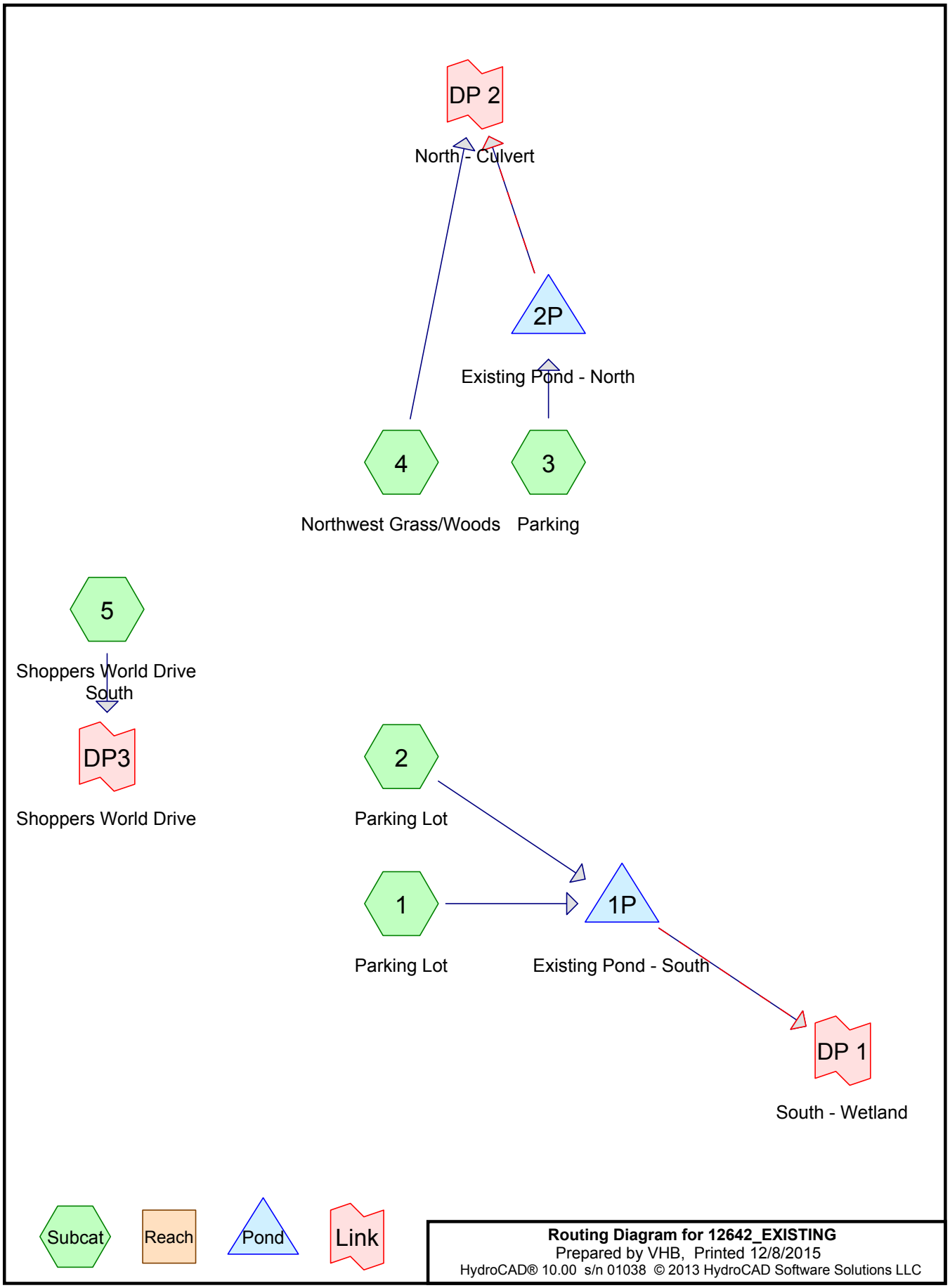
Design Point	2-year	10-year	25-year	100-year
Design Point: DP-1 (South Wetland)				
Existing	7.9	14.0	19.2	30.1
Proposed	7.4*	13.4*	18.4*	29.4*
Design Point: DP-2 (North Culvert)				
Existing	0.2	1.3	2.2	4.8
Proposed	0.0	0.7	1.3	4.6
Design Point: DP-3 (Shoppers World Drive)				
Existing	2.1	3.3	4.3	6.2
Proposed	2.5*	3.7*	4.7*	6.7*

*Increase in flow to DP-3 is offset by reduction in flow to DP-1.

101 Walnut Street
PO Box 9151
Watertown, MA 02472-4026
P 617.924.1770

Attachments:

- Existing HydroCAD Report – dated December 8, 2015
- Proposed HydroCAD Report - dated June 7, 2016
- Recharge Calculations – dated June 8, 2016
- Total Suspended Solids (TSS) Calculations – dated August 5, 2015



Routing Diagram for 12642_EXISTING
Prepared by VHB, Printed 12/8/2015
HydroCAD® 10.00 s/n 01038 © 2013 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
75,350	39	>75% Grass cover, Good, HSG A (1, 2, 3, 4, 5)
3,850	80	>75% Grass cover, Good, HSG D (1)
160,250	98	Paved parking (1, 2)
53,900	98	Paved parking, HSG A (3, 5)
6,900	98	Water Surface, HSG A (1)
150	98	Water Surface, HSG D (1)
18,350	30	Woods, Good, HSG A (4)
318,750	**80**	**TOTAL AREA**

Summary for Subcatchment 1: Parking Lot

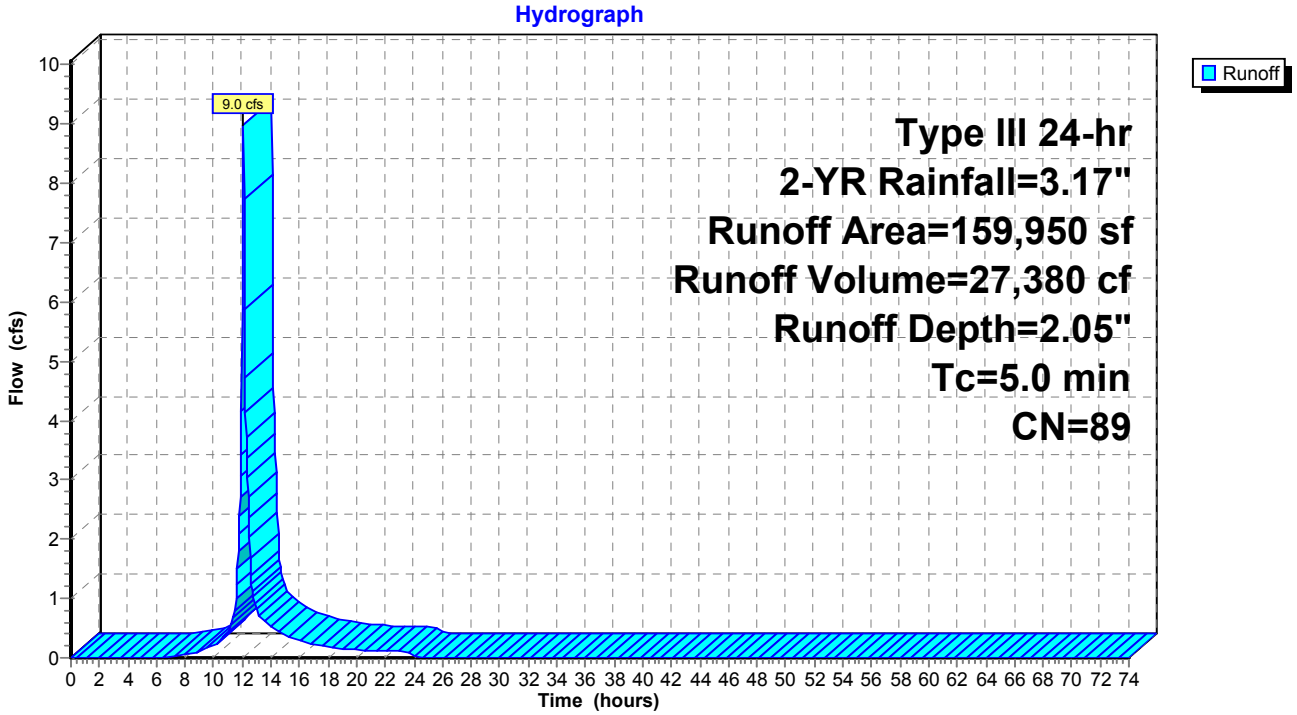
Runoff = 9.0 cfs @ 12.08 hrs, Volume= 27,380 cf, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-YR Rainfall=3.17"

	Area (sf)	CN	Description
*	126,350	98	Paved parking
	22,700	39	>75% Grass cover, Good, HSG A
	3,850	80	>75% Grass cover, Good, HSG D
	6,900	98	Water Surface, HSG A
*	150	98	Water Surface, HSG D
	159,950	89	Weighted Average
	26,550		16.60% Pervious Area
	133,400		83.40% Impervious Area

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

Subcatchment 1: Parking Lot



Summary for Subcatchment 2: Parking Lot

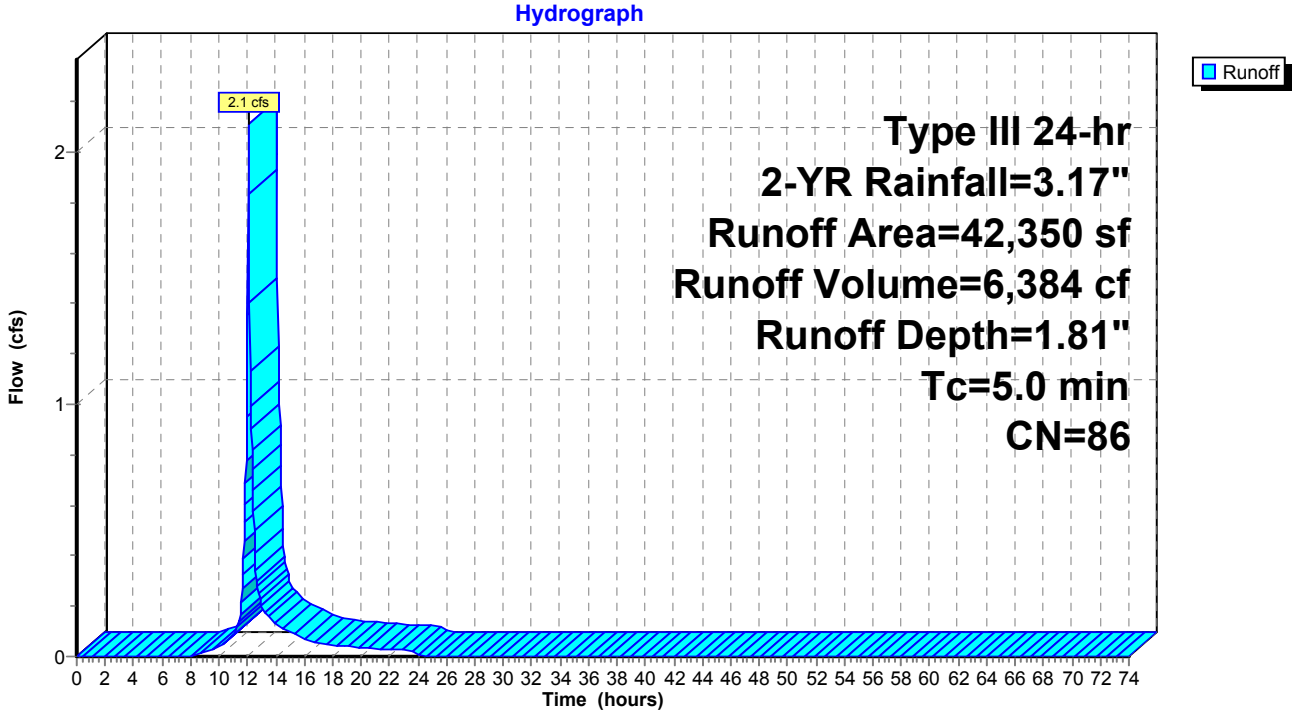
Runoff = 2.1 cfs @ 12.08 hrs, Volume= 6,384 cf, Depth= 1.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-YR Rainfall=3.17"

	Area (sf)	CN	Description
*	33,900	98	Paved parking
	8,450	39	>75% Grass cover, Good, HSG A
	42,350	86	Weighted Average
	8,450		19.95% Pervious Area
	33,900		80.05% Impervious Area

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

Subcatchment 2: Parking Lot



Summary for Subcatchment 3: Parking

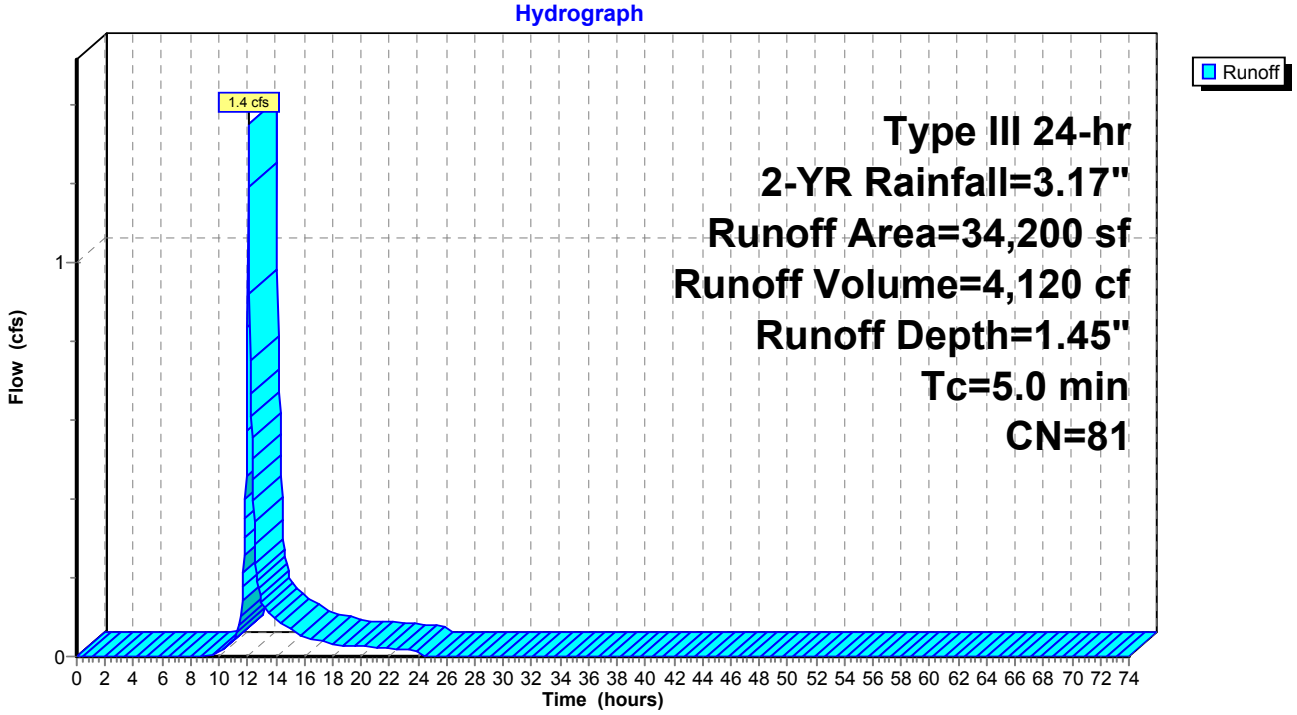
Runoff = 1.4 cfs @ 12.08 hrs, Volume= 4,120 cf, Depth= 1.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-YR Rainfall=3.17"

Area (sf)	CN	Description
24,350	98	Paved parking, HSG A
9,850	39	>75% Grass cover, Good, HSG A
34,200	81	Weighted Average
9,850		28.80% Pervious Area
24,350		71.20% Impervious Area

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

Subcatchment 3: Parking



Summary for Subcatchment 4: Northwest Grass/Woods

[45] Hint: Runoff=Zero

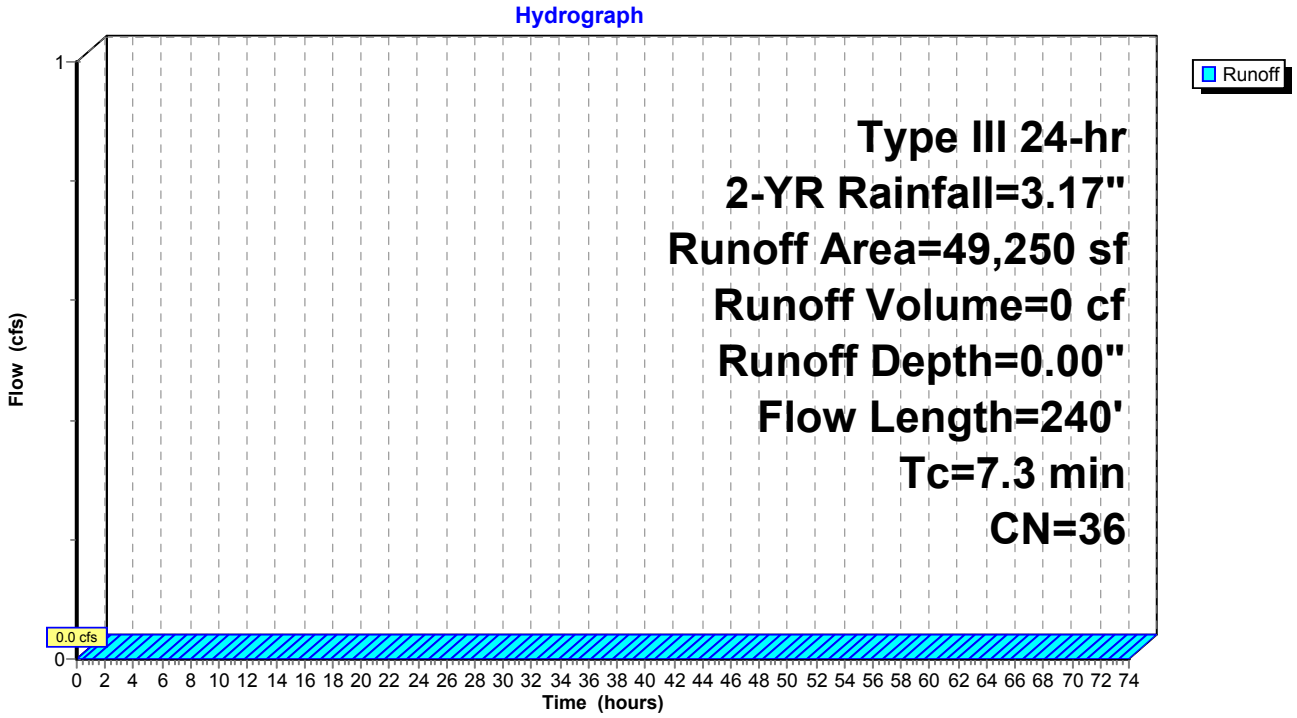
Runoff = 0.0 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-YR Rainfall=3.17"

Area (sf)	CN	Description
30,900	39	>75% Grass cover, Good, HSG A
18,350	30	Woods, Good, HSG A
49,250	36	Weighted Average
49,250		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	20	0.3000	0.35		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
3.3	30	0.0300	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
2.4	114	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	76	0.0130	1.71		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
7.3	240	Total			

Subcatchment 4: Northwest Grass/Woods



Summary for Subcatchment 5: Shoppers World Drive South

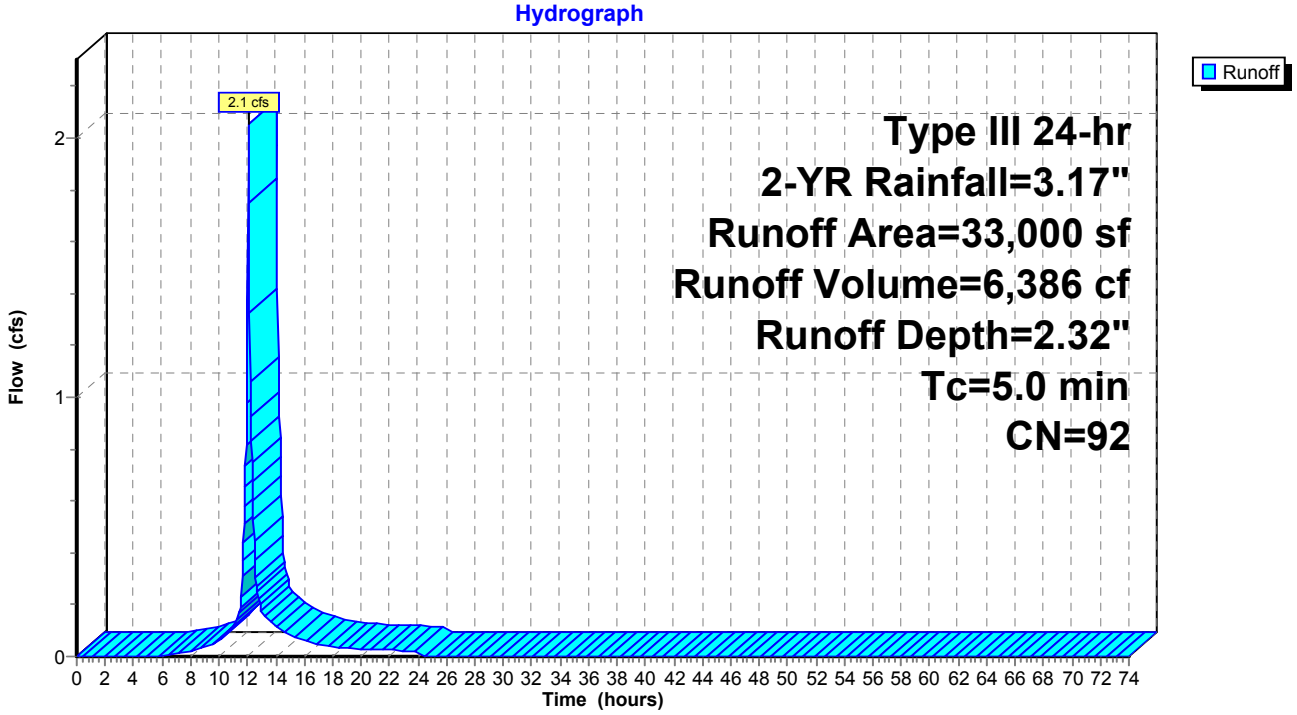
Runoff = 2.1 cfs @ 12.07 hrs, Volume= 6,386 cf, Depth= 2.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-YR Rainfall=3.17"

Area (sf)	CN	Description
29,550	98	Paved parking, HSG A
3,450	39	>75% Grass cover, Good, HSG A
33,000	92	Weighted Average
3,450		10.45% Pervious Area
29,550		89.55% Impervious Area

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

Subcatchment 5: Shoppers World Drive South



Summary for Pond 1P: Existing Pond - South

Inflow Area =	202,300 sf,	82.70% Impervious,	Inflow Depth =	2.00"	for 2-YR event
Inflow =	11.1 cfs @	12.08 hrs,	Volume=	33,765 cf	
Outflow =	7.9 cfs @	12.15 hrs,	Volume=	33,765 cf,	Atten= 29%, Lag= 4.6 min
Primary =	0.0 cfs @	0.00 hrs,	Volume=	0 cf	
Secondary =	7.9 cfs @	12.15 hrs,	Volume=	33,765 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Starting Elev= 155.00' Surf.Area= 7,687 sf Storage= 16,436 cf
Peak Elev= 155.59' @ 12.15 hrs Surf.Area= 8,254 sf Storage= 21,128 cf (4,692 cf above start)

Plug-Flow detention time= 247.6 min calculated for 17,329 cf (51% of inflow)
Center-of-Mass det. time= 19.9 min (832.6 - 812.7)

Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	49,544 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

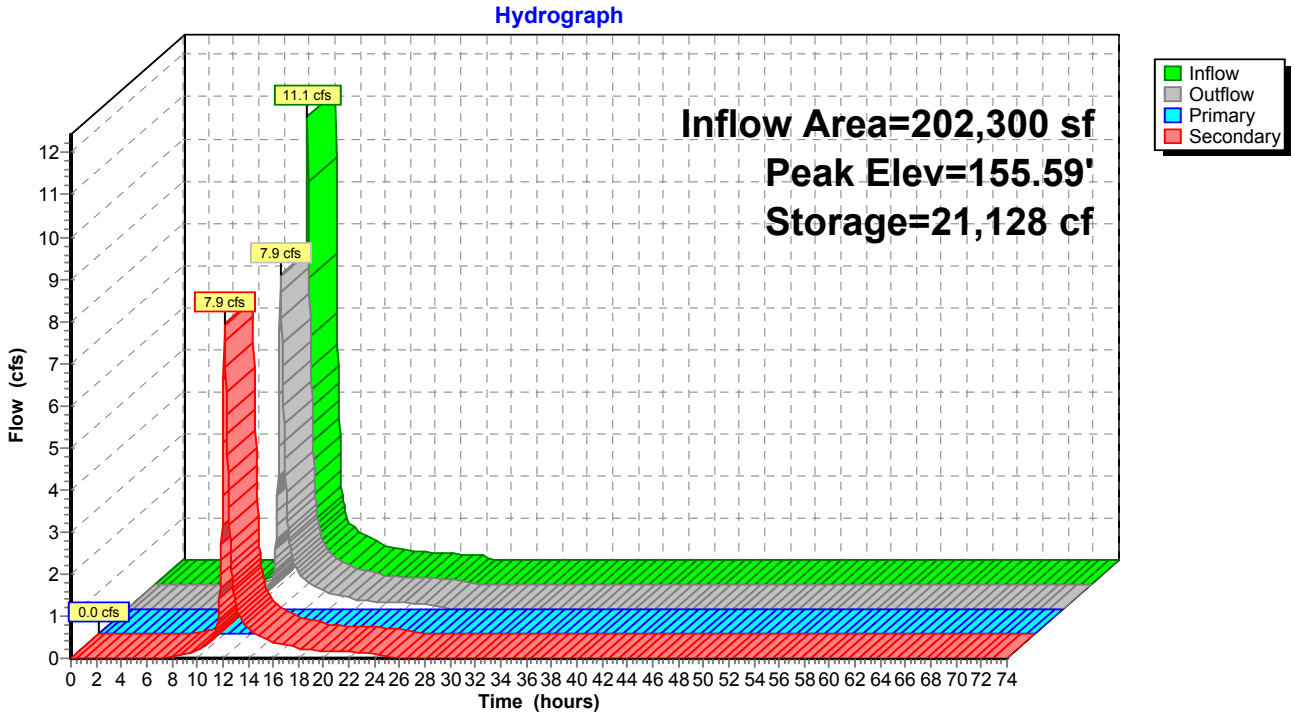
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
152.00	3,444	0	0
153.00	4,709	4,077	4,077
154.00	6,161	5,435	9,512
155.00	7,687	6,924	16,436
156.00	8,650	8,169	24,604
157.00	9,657	9,154	33,758
158.00	10,747	10,202	43,960
158.50	11,591	5,585	49,544

Device	Routing	Invert	Outlet Devices
#1	Primary	155.90'	**30.0" Round Culvert** L= 7.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 155.90' / 153.90' S= 0.2857 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf
#2	Device 1	154.10'	**4.0" Vert. Orifice** C= 0.600
#3	Device 1	155.30'	**45.0 deg Sharp-Crested Vee/Trap Weir** Cv= 2.56 (C= 3.20)
#4	Device 1	158.31'	**48.0" x 48.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	155.00'	**6.5' long x 20.0' 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=0.0 cfs @ 0.00 hrs HW=155.00' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Controls 0.0 cfs)
  ├─**2=Orifice** (Controls 0.0 cfs)
  ├─**3=Sharp-Crested Vee/Trap Weir** (Controls 0.0 cfs)
  └─**4=Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=7.9 cfs @ 12.15 hrs HW=155.59' TW=0.00' (Dynamic Tailwater)
└─**5=Broad-Crested Rectangular Weir** (Weir Controls 7.9 cfs @ 2.07 fps)

Pond 1P: Existing Pond - South



Summary for Pond 2P: Existing Pond - North

Inflow Area =	34,200 sf,	71.20% Impervious,	Inflow Depth =	1.45"	for 2-YR event
Inflow =	1.4 cfs @	12.08 hrs, Volume=	4,120 cf		
Outflow =	0.2 cfs @	12.71 hrs, Volume=	2,271 cf,	Atten= 86%,	Lag= 37.6 min
Primary =	0.2 cfs @	12.71 hrs, Volume=	2,271 cf		
Secondary =	0.0 cfs @	0.00 hrs, Volume=	0 cf		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Peak Elev= 161.71' @ 12.71 hrs Surf.Area= 1,890 sf Storage= 2,050 cf

Plug-Flow detention time= 234.8 min calculated for 2,269 cf (55% of inflow)
Center-of-Mass det. time= 118.1 min (957.2 - 839.1)

Volume	Invert	Avail.Storage	Storage Description
#1	160.00'	7,631 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

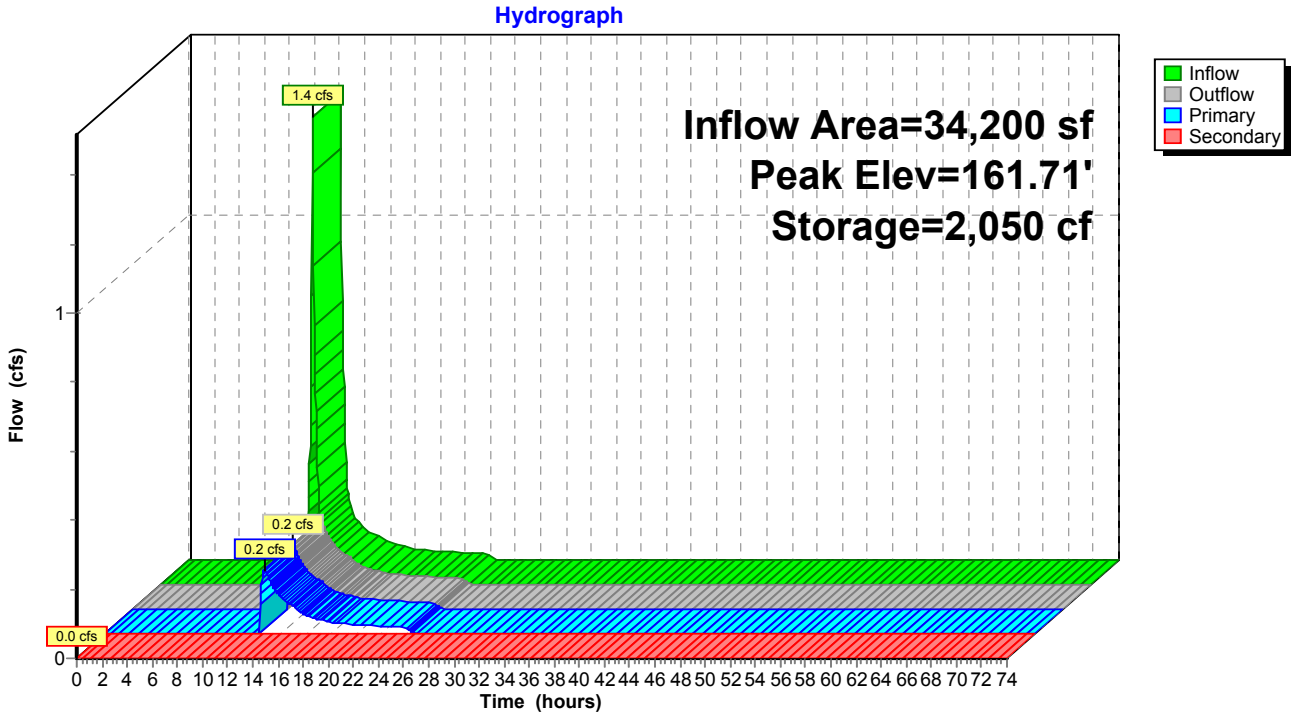
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
160.00	125	0	0
161.00	1,544	835	835
162.00	2,033	1,789	2,623
163.00	2,661	2,347	4,970
164.00	2,661	2,661	7,631

Device	Routing	Invert	Outlet Devices
#1	Primary	161.50'	**12.0" Round Culvert** L= 12.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 161.50' / 161.20' S= 0.0250 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Device 1	161.60'	**4.0' long x 2.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	163.60'	**48.0" W x 48.0" H Vert. Grate** C= 0.600
#4	Secondary	162.70'	**35.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=0.2 cfs @ 12.71 hrs HW=161.71' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 0.2 cfs @ 1.55 fps)
  ├─**2=Sharp-Crested Rectangular Weir** (Passes 0.2 cfs of 0.5 cfs potential flow)
  └─**3=Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=0.0 cfs @ 0.00 hrs HW=160.00' TW=0.00' (Dynamic Tailwater)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 2P: Existing Pond - North

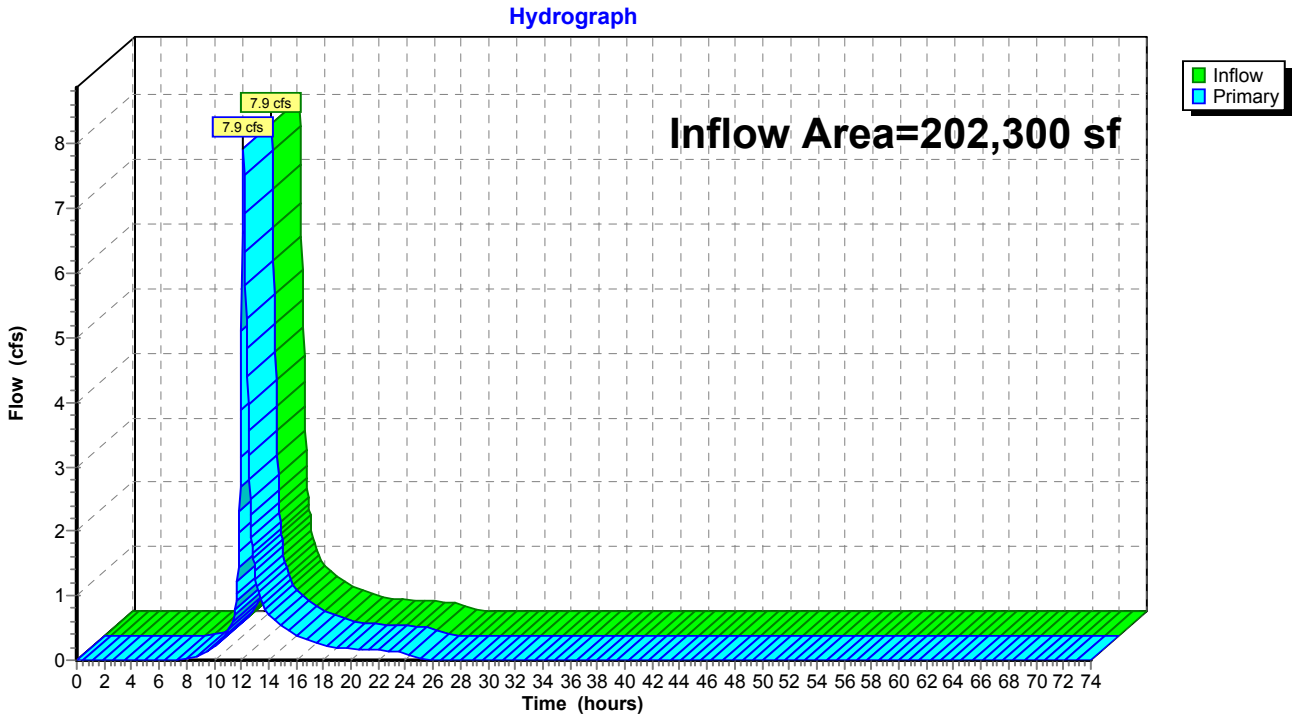


Summary for Link DP 1: South - Wetland

Inflow Area = 202,300 sf, 82.70% Impervious, Inflow Depth = 2.00" for 2-YR event
Inflow = 7.9 cfs @ 12.15 hrs, Volume= 33,765 cf
Primary = 7.9 cfs @ 12.15 hrs, Volume= 33,765 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs

Link DP 1: South - Wetland

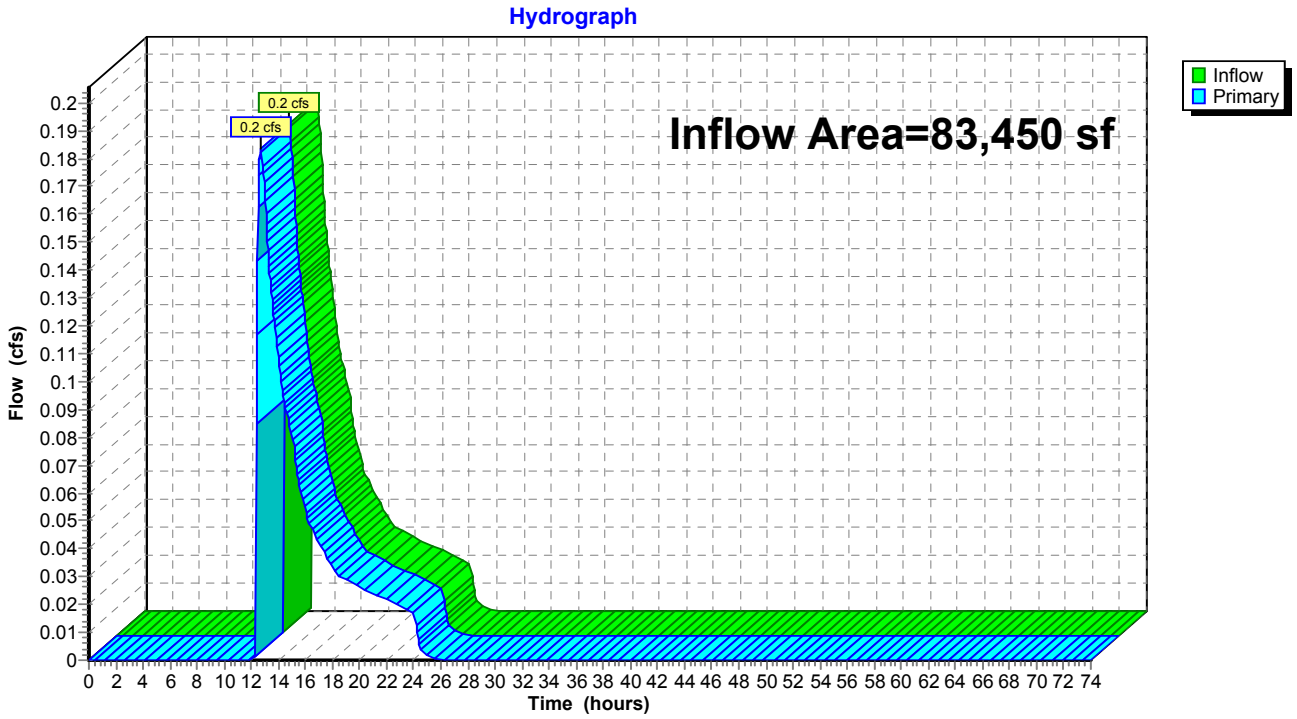


Summary for Link DP 2: North - Culvert

Inflow Area = 83,450 sf, 29.18% Impervious, Inflow Depth = 0.33" for 2-YR event
Inflow = 0.2 cfs @ 12.71 hrs, Volume= 2,271 cf
Primary = 0.2 cfs @ 12.71 hrs, Volume= 2,271 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs

Link DP 2: North - Culvert

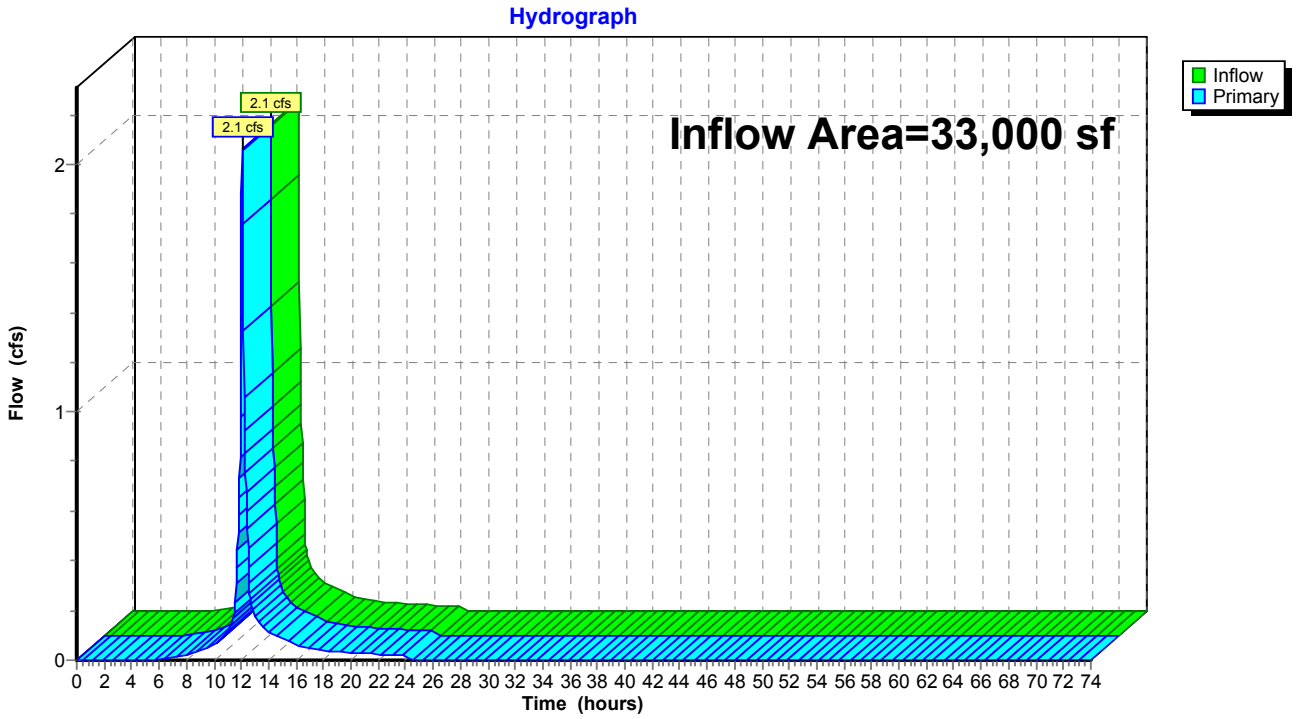


Summary for Link DP3: Shoppers World Drive

Inflow Area = 33,000 sf, 89.55% Impervious, Inflow Depth = 2.32" for 2-YR event
Inflow = 2.1 cfs @ 12.07 hrs, Volume= 6,386 cf
Primary = 2.1 cfs @ 12.07 hrs, Volume= 6,386 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs

Link DP3: Shoppers World Drive



Summary for Subcatchment 1: Parking Lot

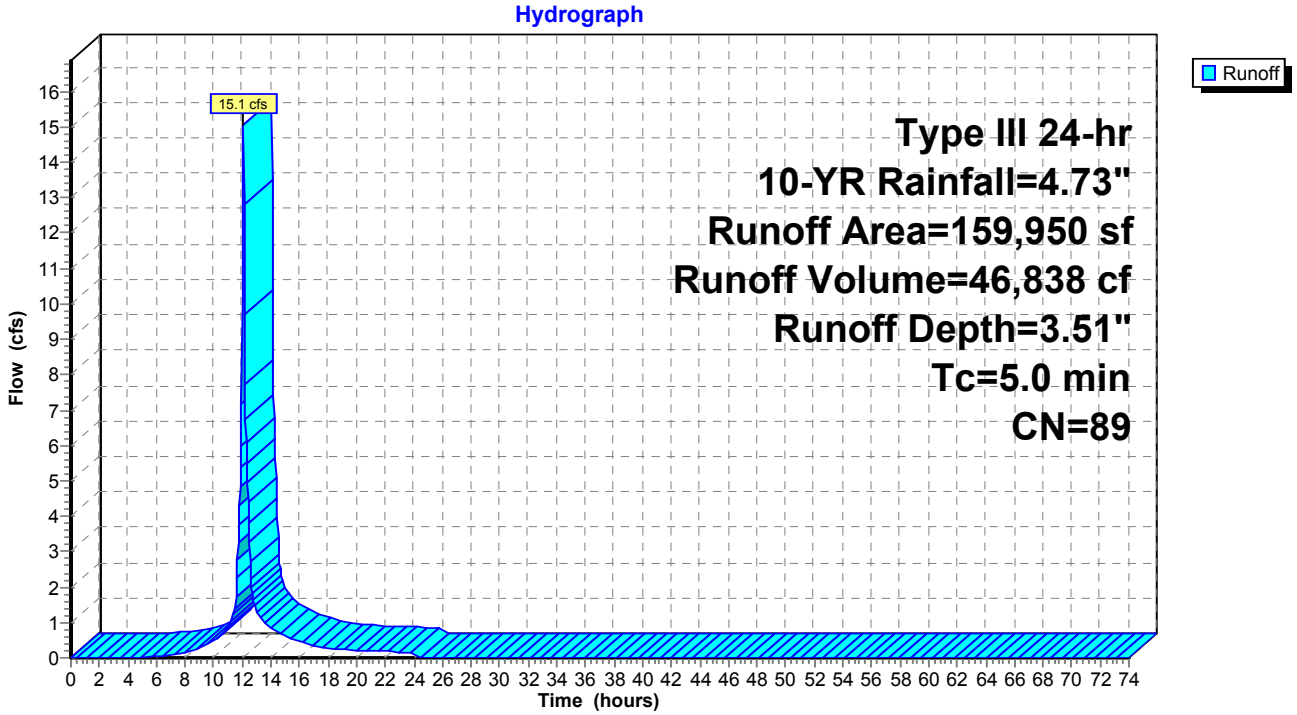
Runoff = 15.1 cfs @ 12.07 hrs, Volume= 46,838 cf, Depth= 3.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-YR Rainfall=4.73"

	Area (sf)	CN	Description
*	126,350	98	Paved parking
	22,700	39	>75% Grass cover, Good, HSG A
	3,850	80	>75% Grass cover, Good, HSG D
	6,900	98	Water Surface, HSG A
*	150	98	Water Surface, HSG D
	159,950	89	Weighted Average
	26,550		16.60% Pervious Area
	133,400		83.40% Impervious Area

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

Subcatchment 1: Parking Lot



Summary for Subcatchment 2: Parking Lot

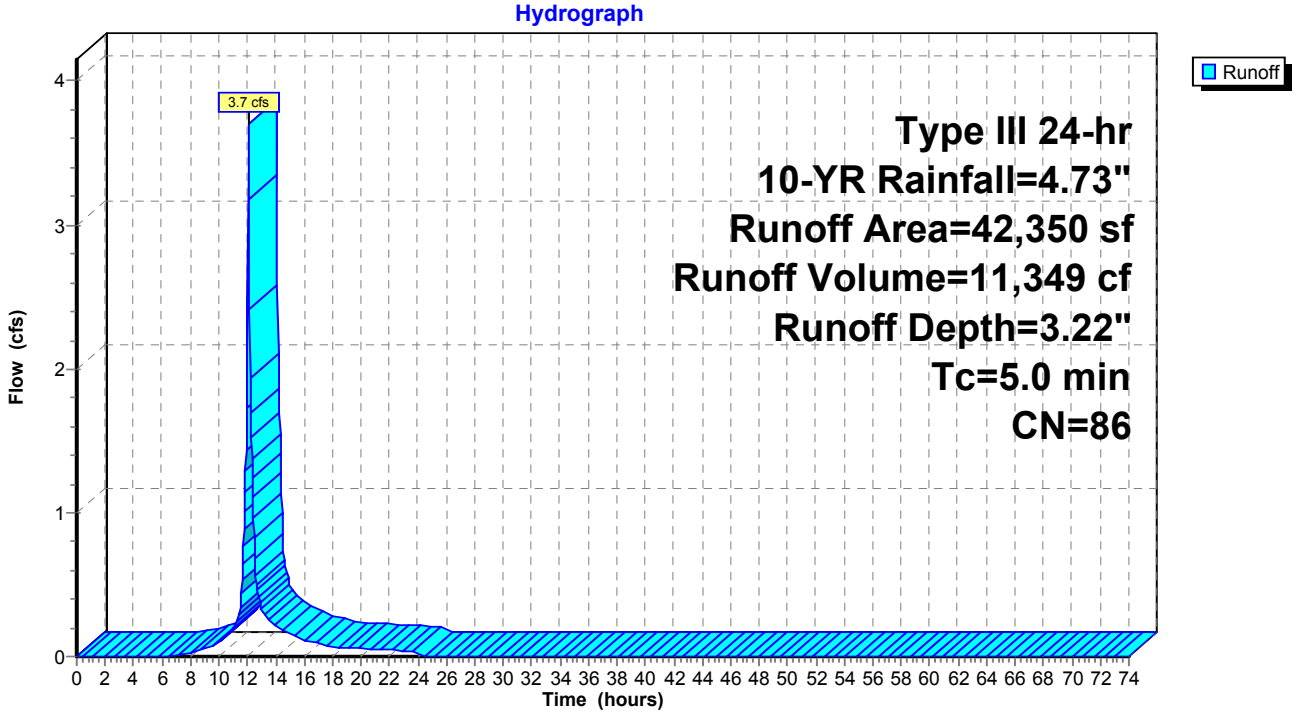
Runoff = 3.7 cfs @ 12.08 hrs, Volume= 11,349 cf, Depth= 3.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-YR Rainfall=4.73"

	Area (sf)	CN	Description
*	33,900	98	Paved parking
	8,450	39	>75% Grass cover, Good, HSG A
	42,350	86	Weighted Average
	8,450		19.95% Pervious Area
	33,900		80.05% Impervious Area

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

Subcatchment 2: Parking Lot



Summary for Subcatchment 3: Parking

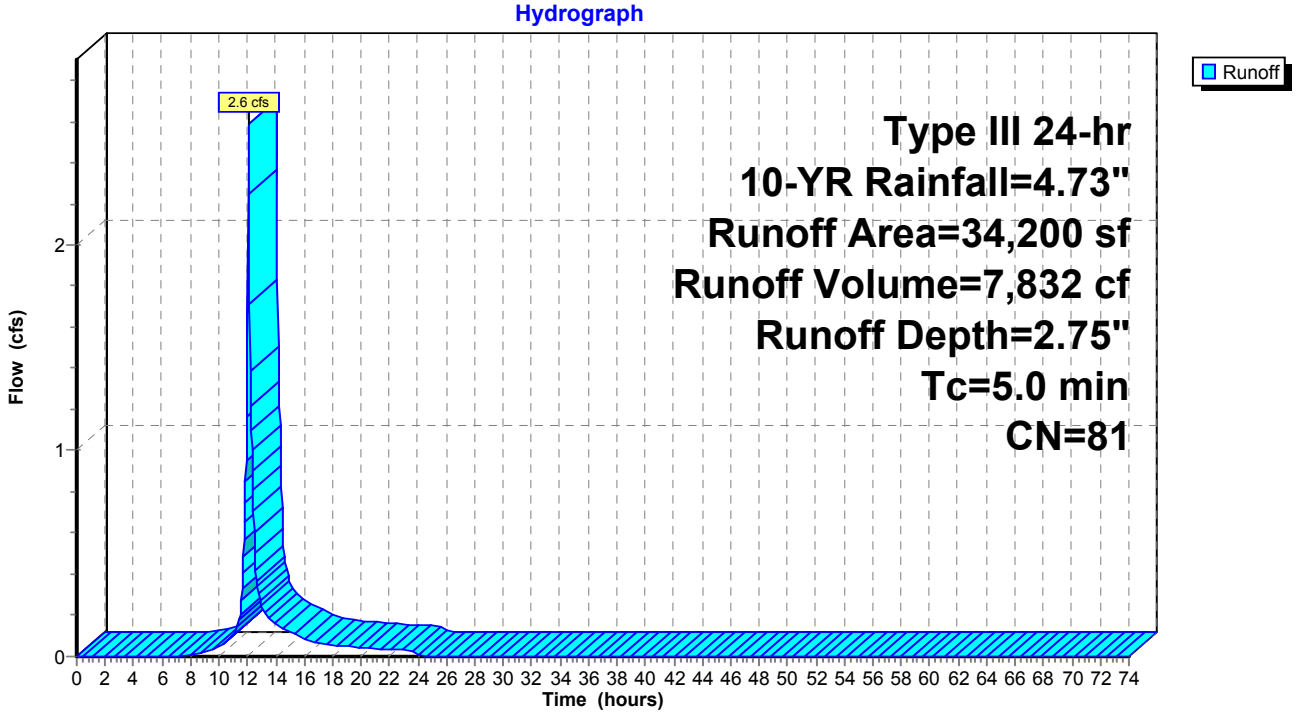
Runoff = 2.6 cfs @ 12.08 hrs, Volume= 7,832 cf, Depth= 2.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-YR Rainfall=4.73"

Area (sf)	CN	Description
24,350	98	Paved parking, HSG A
9,850	39	>75% Grass cover, Good, HSG A
34,200	81	Weighted Average
9,850		28.80% Pervious Area
24,350		71.20% Impervious Area

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

Subcatchment 3: Parking



Summary for Subcatchment 4: Northwest Grass/Woods

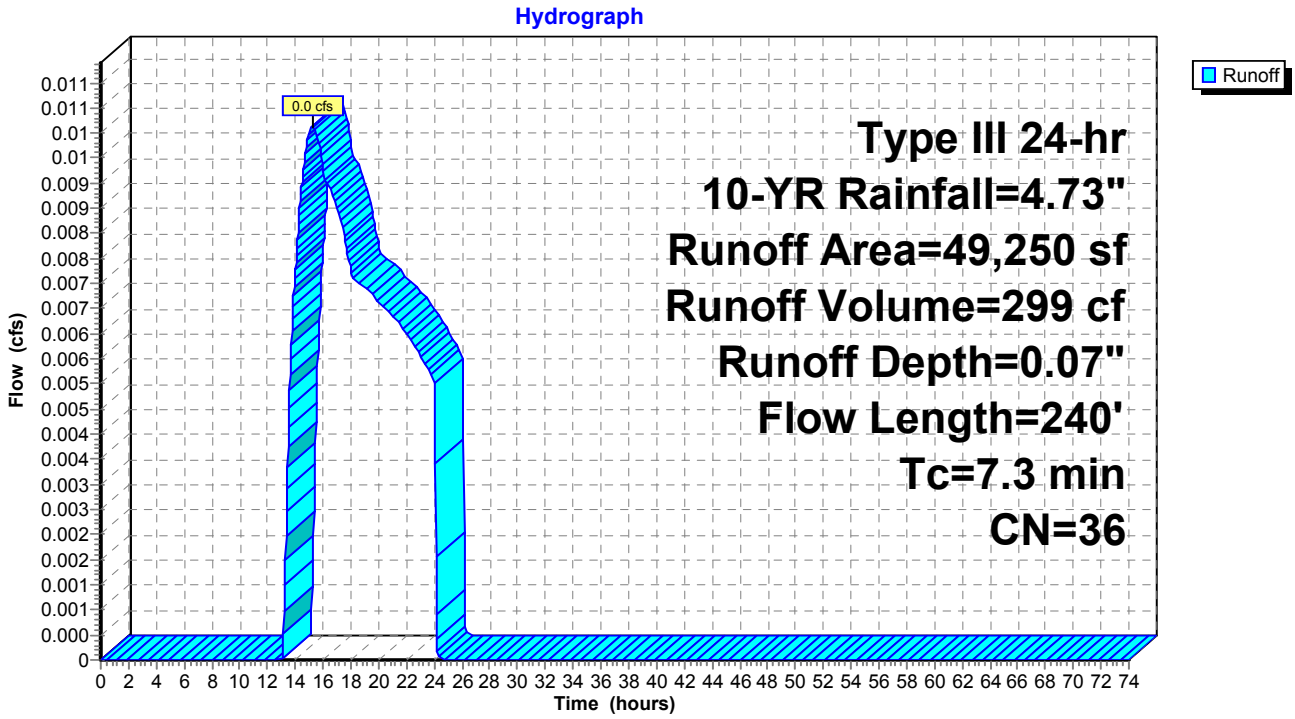
Runoff = 0.0 cfs @ 15.25 hrs, Volume= 299 cf, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-YR Rainfall=4.73"

Area (sf)	CN	Description
30,900	39	>75% Grass cover, Good, HSG A
18,350	30	Woods, Good, HSG A
49,250	36	Weighted Average
49,250		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	20	0.3000	0.35		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
3.3	30	0.0300	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
2.4	114	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	76	0.0130	1.71		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
7.3	240	Total			

Subcatchment 4: Northwest Grass/Woods



Summary for Subcatchment 5: Shoppers World Drive South

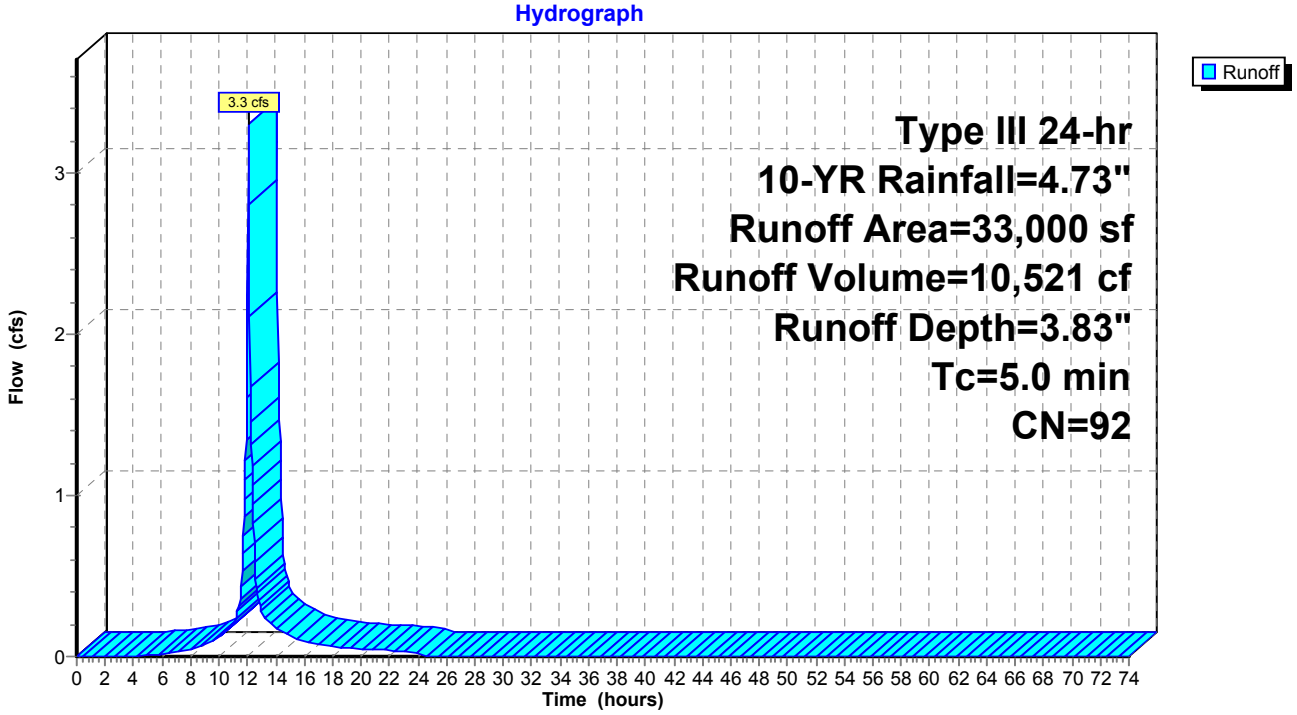
Runoff = 3.3 cfs @ 12.07 hrs, Volume= 10,521 cf, Depth= 3.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-YR Rainfall=4.73"

Area (sf)	CN	Description
29,550	98	Paved parking, HSG A
3,450	39	>75% Grass cover, Good, HSG A
33,000	92	Weighted Average
3,450		10.45% Pervious Area
29,550		89.55% Impervious Area

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

Subcatchment 5: Shoppers World Drive South



Summary for Pond 1P: Existing Pond - South

Inflow Area =	202,300 sf,	82.70% Impervious,	Inflow Depth =	3.45"	for 10-YR event
Inflow =	18.8 cfs @	12.07 hrs,	Volume=	58,188 cf	
Outflow =	14.0 cfs @	12.14 hrs,	Volume=	58,188 cf,	Atten= 25%, Lag= 4.1 min
Primary =	0.0 cfs @	0.00 hrs,	Volume=	0 cf	
Secondary =	14.0 cfs @	12.14 hrs,	Volume=	58,188 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Starting Elev= 155.00' Surf.Area= 7,687 sf Storage= 16,436 cf
Peak Elev= 155.87' @ 12.14 hrs Surf.Area= 8,529 sf Storage= 23,527 cf (7,091 cf above start)

Plug-Flow detention time= 164.1 min calculated for 41,729 cf (72% of inflow)
Center-of-Mass det. time= 16.9 min (814.3 - 797.4)

Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	49,544 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

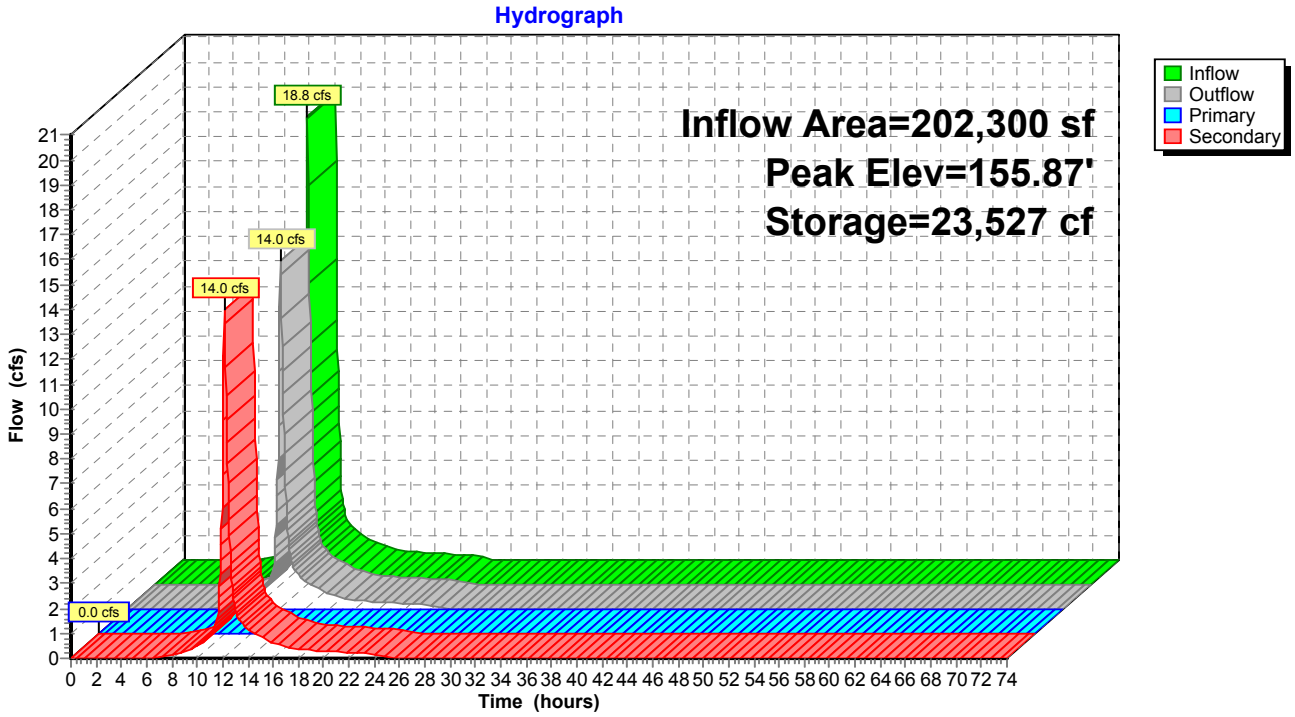
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
152.00	3,444	0	0
153.00	4,709	4,077	4,077
154.00	6,161	5,435	9,512
155.00	7,687	6,924	16,436
156.00	8,650	8,169	24,604
157.00	9,657	9,154	33,758
158.00	10,747	10,202	43,960
158.50	11,591	5,585	49,544

Device	Routing	Invert	Outlet Devices
#1	Primary	155.90'	**30.0" Round Culvert** L= 7.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 155.90' / 153.90' S= 0.2857 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf
#2	Device 1	154.10'	**4.0" Vert. Orifice** C= 0.600
#3	Device 1	155.30'	**45.0 deg Sharp-Crested Vee/Trap Weir** Cv= 2.56 (C= 3.20)
#4	Device 1	158.31'	**48.0" x 48.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	155.00'	**6.5' long x 20.0' 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=0.0 cfs @ 0.00 hrs HW=155.00' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Controls 0.0 cfs)
  ├─**2=Orifice** (Controls 0.0 cfs)
  ├─**3=Sharp-Crested Vee/Trap Weir** (Controls 0.0 cfs)
  └─**4=Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=13.9 cfs @ 12.14 hrs HW=155.87' TW=0.00' (Dynamic Tailwater)
└─**5=Broad-Crested Rectangular Weir** (Weir Controls 13.9 cfs @ 2.46 fps)

Pond 1P: Existing Pond - South



Summary for Pond 2P: Existing Pond - North

Inflow Area =	34,200 sf,	71.20% Impervious,	Inflow Depth =	2.75"	for 10-YR event
Inflow =	2.6 cfs @	12.08 hrs, Volume=	7,832 cf		
Outflow =	1.3 cfs @	12.23 hrs, Volume=	5,983 cf,	Atten= 51%,	Lag= 9.3 min
Primary =	1.3 cfs @	12.23 hrs, Volume=	5,983 cf		
Secondary =	0.0 cfs @	0.00 hrs, Volume=	0 cf		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Peak Elev= 162.09' @ 12.23 hrs Surf.Area= 2,090 sf Storage= 2,810 cf

Plug-Flow detention time= 143.6 min calculated for 5,980 cf (76% of inflow)
Center-of-Mass det. time= 59.1 min (879.6 - 820.5)

Volume	Invert	Avail.Storage	Storage Description
#1	160.00'	7,631 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

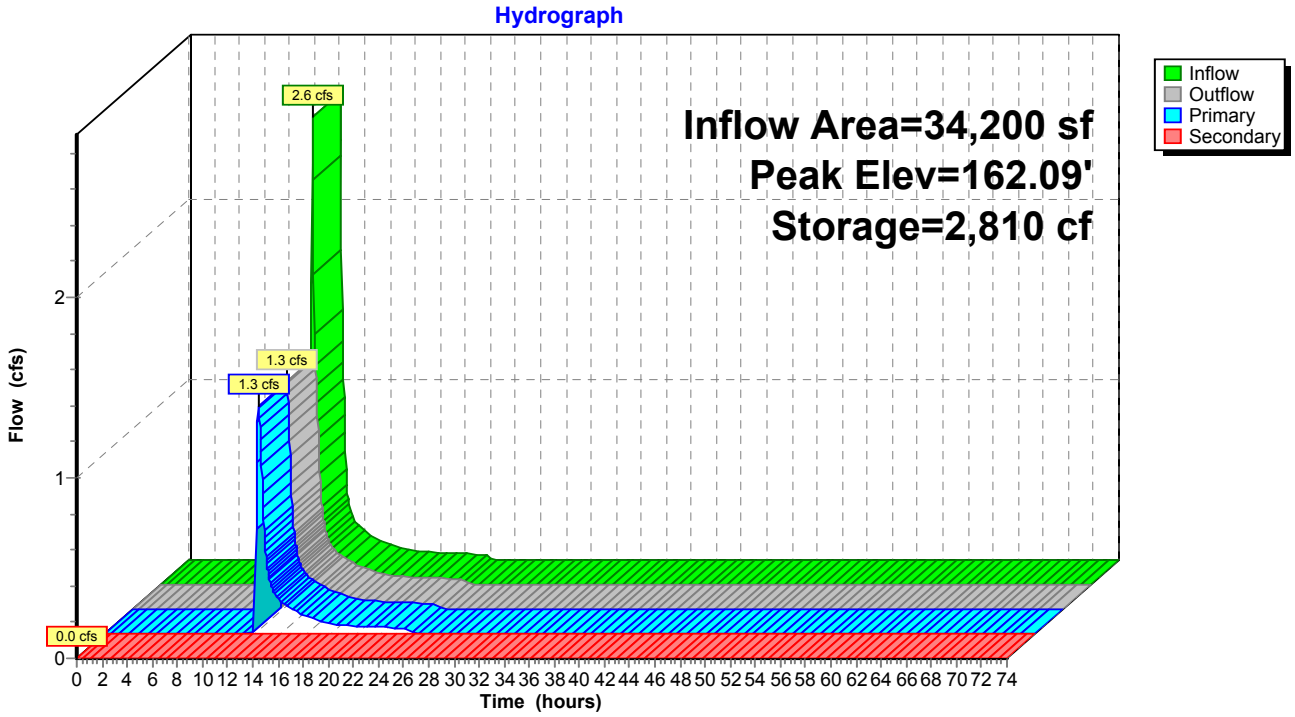
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
160.00	125	0	0
161.00	1,544	835	835
162.00	2,033	1,789	2,623
163.00	2,661	2,347	4,970
164.00	2,661	2,661	7,631

Device	Routing	Invert	Outlet Devices
#1	Primary	161.50'	**12.0" Round Culvert** L= 12.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 161.50' / 161.20' S= 0.0250 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Device 1	161.60'	**4.0' long x 2.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	163.60'	**48.0" W x 48.0" H Vert. Grate** C= 0.600
#4	Secondary	162.70'	**35.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=1.3 cfs @ 12.23 hrs HW=162.09' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 1.3 cfs @ 2.62 fps)
  ├─**2=Sharp-Crested Rectangular Weir** (Passes 1.3 cfs of 4.4 cfs potential flow)
  └─**3=Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=0.0 cfs @ 0.00 hrs HW=160.00' TW=0.00' (Dynamic Tailwater)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 2P: Existing Pond - North

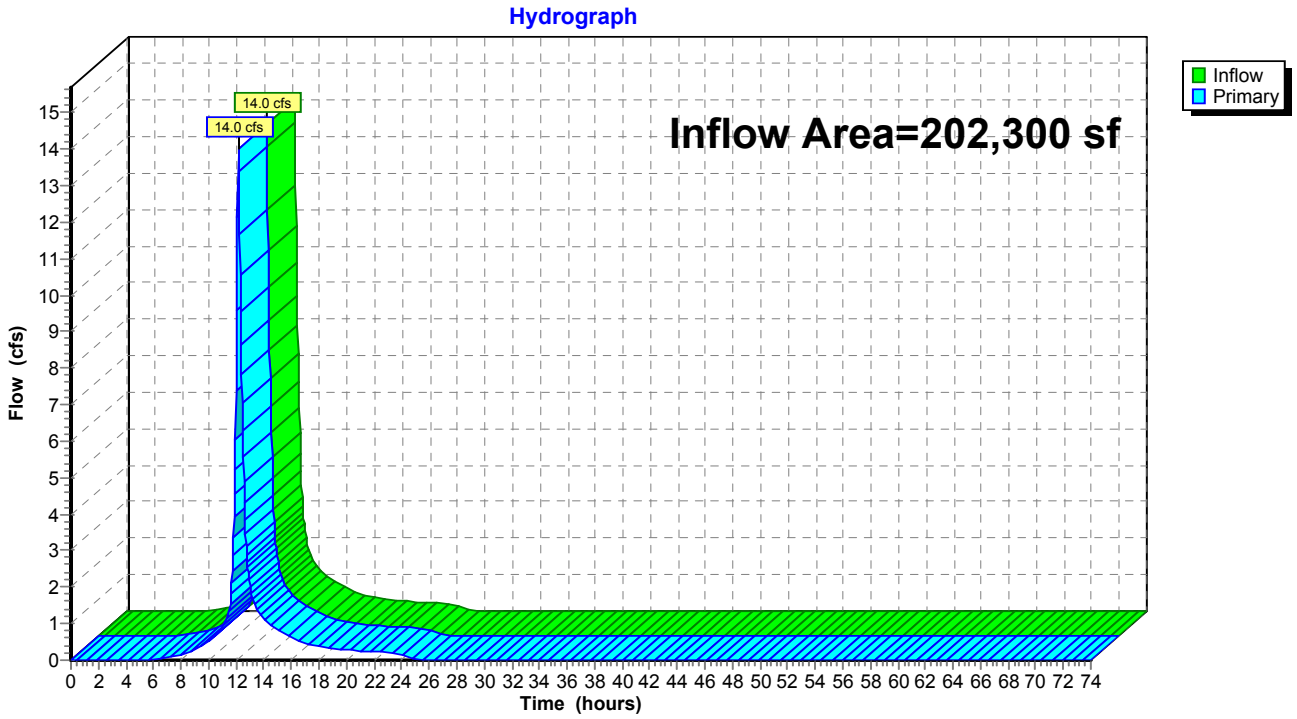


Summary for Link DP 1: South - Wetland

Inflow Area = 202,300 sf, 82.70% Impervious, Inflow Depth = 3.45" for 10-YR event
Inflow = 14.0 cfs @ 12.14 hrs, Volume= 58,188 cf
Primary = 14.0 cfs @ 12.14 hrs, Volume= 58,188 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs

Link DP 1: South - Wetland

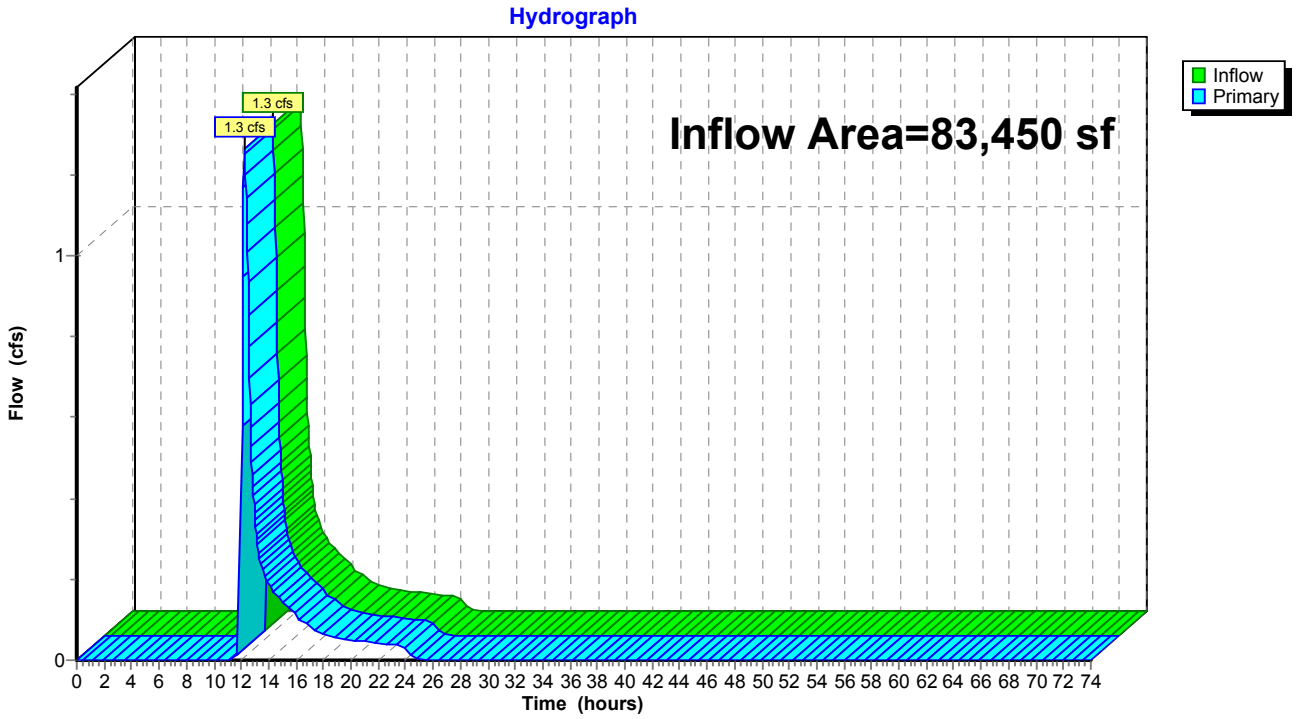


Summary for Link DP 2: North - Culvert

Inflow Area = 83,450 sf, 29.18% Impervious, Inflow Depth = 0.90" for 10-YR event
Inflow = 1.3 cfs @ 12.23 hrs, Volume= 6,282 cf
Primary = 1.3 cfs @ 12.23 hrs, Volume= 6,282 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs

Link DP 2: North - Culvert

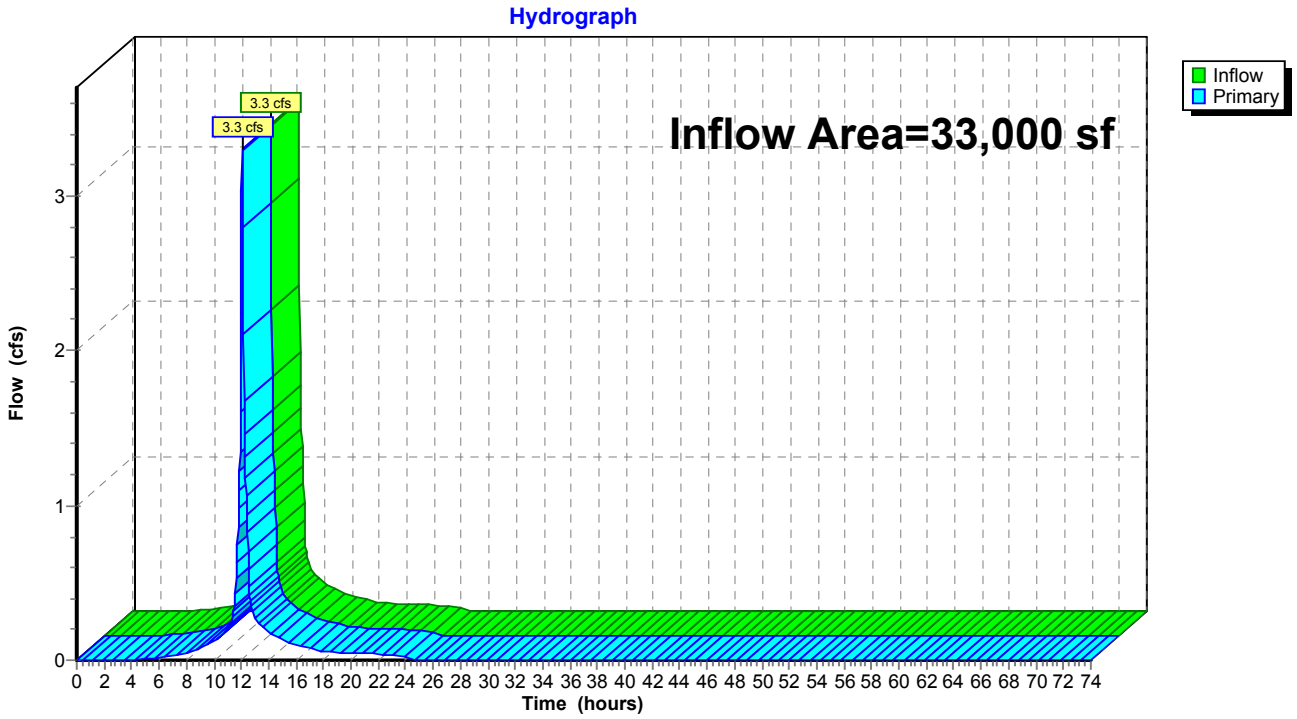


Summary for Link DP3: Shoppers World Drive

Inflow Area = 33,000 sf, 89.55% Impervious, Inflow Depth = 3.83" for 10-YR event
Inflow = 3.3 cfs @ 12.07 hrs, Volume= 10,521 cf
Primary = 3.3 cfs @ 12.07 hrs, Volume= 10,521 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs

Link DP3: Shoppers World Drive



Summary for Subcatchment 1: Parking Lot

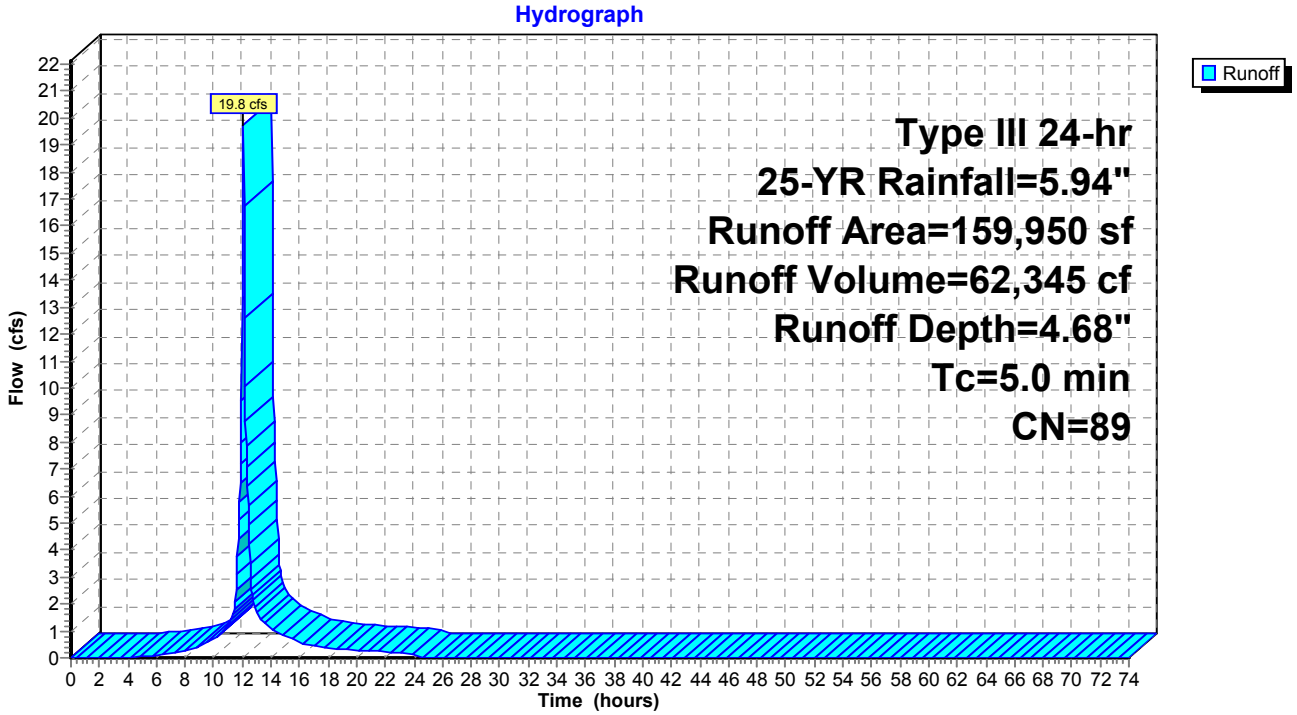
Runoff = 19.8 cfs @ 12.07 hrs, Volume= 62,345 cf, Depth= 4.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-YR Rainfall=5.94"

	Area (sf)	CN	Description
*	126,350	98	Paved parking
	22,700	39	>75% Grass cover, Good, HSG A
	3,850	80	>75% Grass cover, Good, HSG D
	6,900	98	Water Surface, HSG A
*	150	98	Water Surface, HSG D
	159,950	89	Weighted Average
	26,550		16.60% Pervious Area
	133,400		83.40% Impervious Area

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

Subcatchment 1: Parking Lot



Summary for Subcatchment 2: Parking Lot

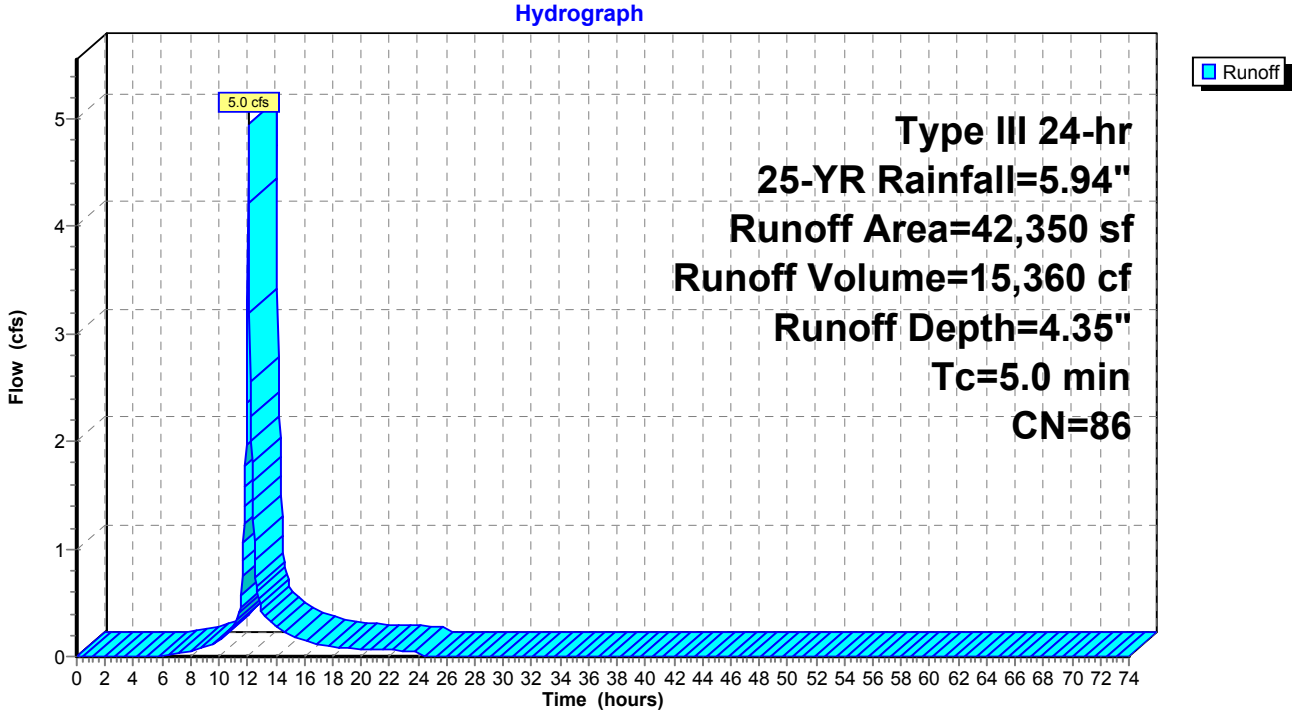
Runoff = 5.0 cfs @ 12.07 hrs, Volume= 15,360 cf, Depth= 4.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-YR Rainfall=5.94"

	Area (sf)	CN	Description
*	33,900	98	Paved parking
	8,450	39	>75% Grass cover, Good, HSG A
	42,350	86	Weighted Average
	8,450		19.95% Pervious Area
	33,900		80.05% Impervious Area

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

Subcatchment 2: Parking Lot



Summary for Subcatchment 3: Parking

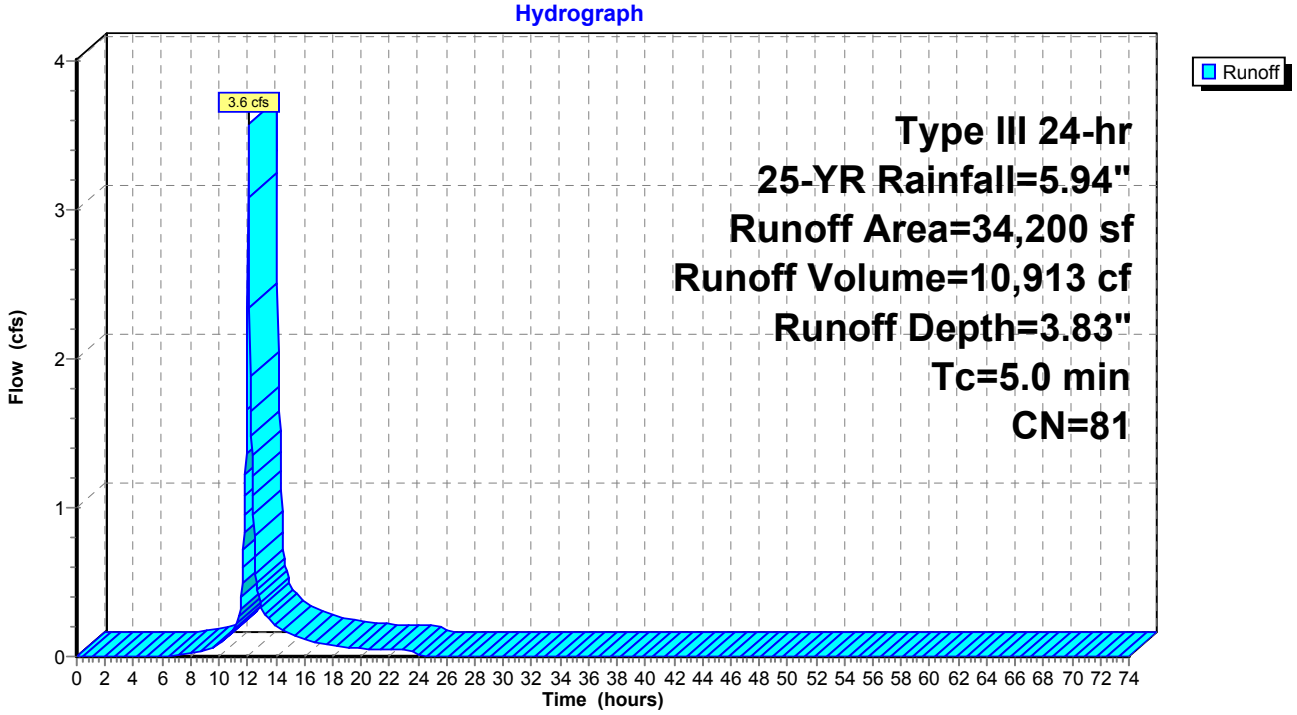
Runoff = 3.6 cfs @ 12.08 hrs, Volume= 10,913 cf, Depth= 3.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-YR Rainfall=5.94"

Area (sf)	CN	Description
24,350	98	Paved parking, HSG A
9,850	39	>75% Grass cover, Good, HSG A
34,200	81	Weighted Average
9,850		28.80% Pervious Area
24,350		71.20% Impervious Area

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

Subcatchment 3: Parking



Summary for Subcatchment 4: Northwest Grass/Woods

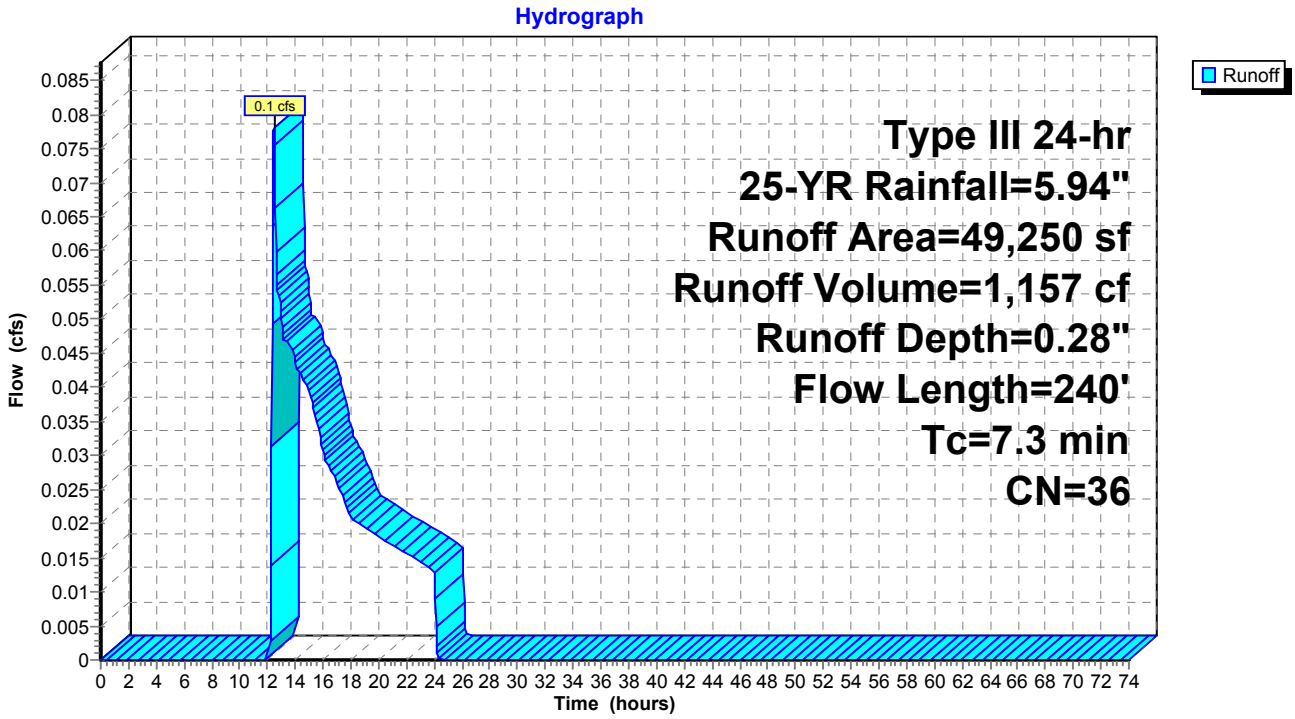
Runoff = 0.1 cfs @ 12.46 hrs, Volume= 1,157 cf, Depth= 0.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-YR Rainfall=5.94"

Area (sf)	CN	Description
30,900	39	>75% Grass cover, Good, HSG A
18,350	30	Woods, Good, HSG A
49,250	36	Weighted Average
49,250		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	20	0.3000	0.35		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
3.3	30	0.0300	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
2.4	114	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	76	0.0130	1.71		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
7.3	240	Total			

Subcatchment 4: Northwest Grass/Woods



Summary for Subcatchment 5: Shoppers World Drive South

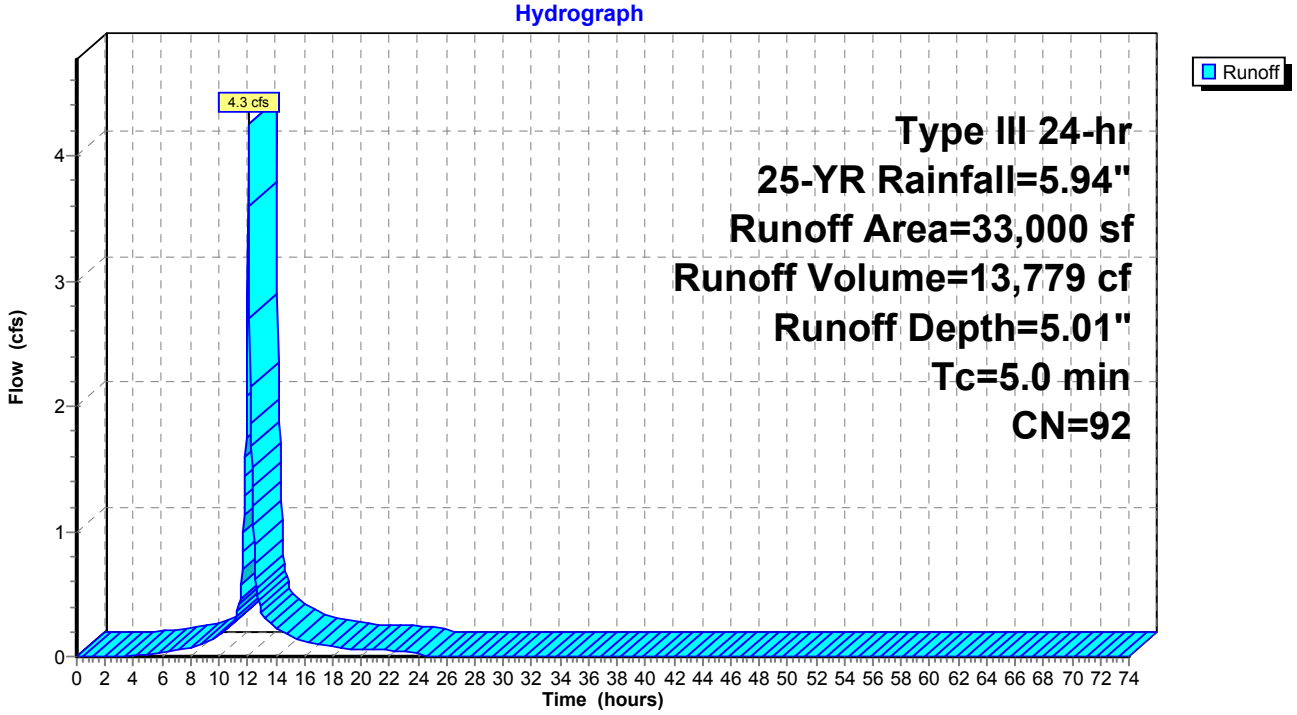
Runoff = 4.3 cfs @ 12.07 hrs, Volume= 13,779 cf, Depth= 5.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-YR Rainfall=5.94"

Area (sf)	CN	Description
29,550	98	Paved parking, HSG A
3,450	39	>75% Grass cover, Good, HSG A
33,000	92	Weighted Average
3,450		10.45% Pervious Area
29,550		89.55% Impervious Area

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

Subcatchment 5: Shoppers World Drive South



Summary for Pond 1P: Existing Pond - South

Inflow Area =	202,300 sf,	82.70% Impervious,	Inflow Depth =	4.61"	for 25-YR event
Inflow =	24.7 cfs @	12.07 hrs,	Volume=	77,705 cf	
Outflow =	19.2 cfs @	12.14 hrs,	Volume=	77,705 cf,	Atten= 22%, Lag= 3.7 min
Primary =	0.2 cfs @	12.14 hrs,	Volume=	69 cf	
Secondary =	19.0 cfs @	12.14 hrs,	Volume=	77,636 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Starting Elev= 155.00' Surf.Area= 7,687 sf Storage= 16,436 cf
Peak Elev= 156.07' @ 12.14 hrs Surf.Area= 8,723 sf Storage= 25,233 cf (8,798 cf above start)

Plug-Flow detention time= 139.4 min calculated for 61,237 cf (79% of inflow)
Center-of-Mass det. time= 15.6 min (805.0 - 789.5)

Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	49,544 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

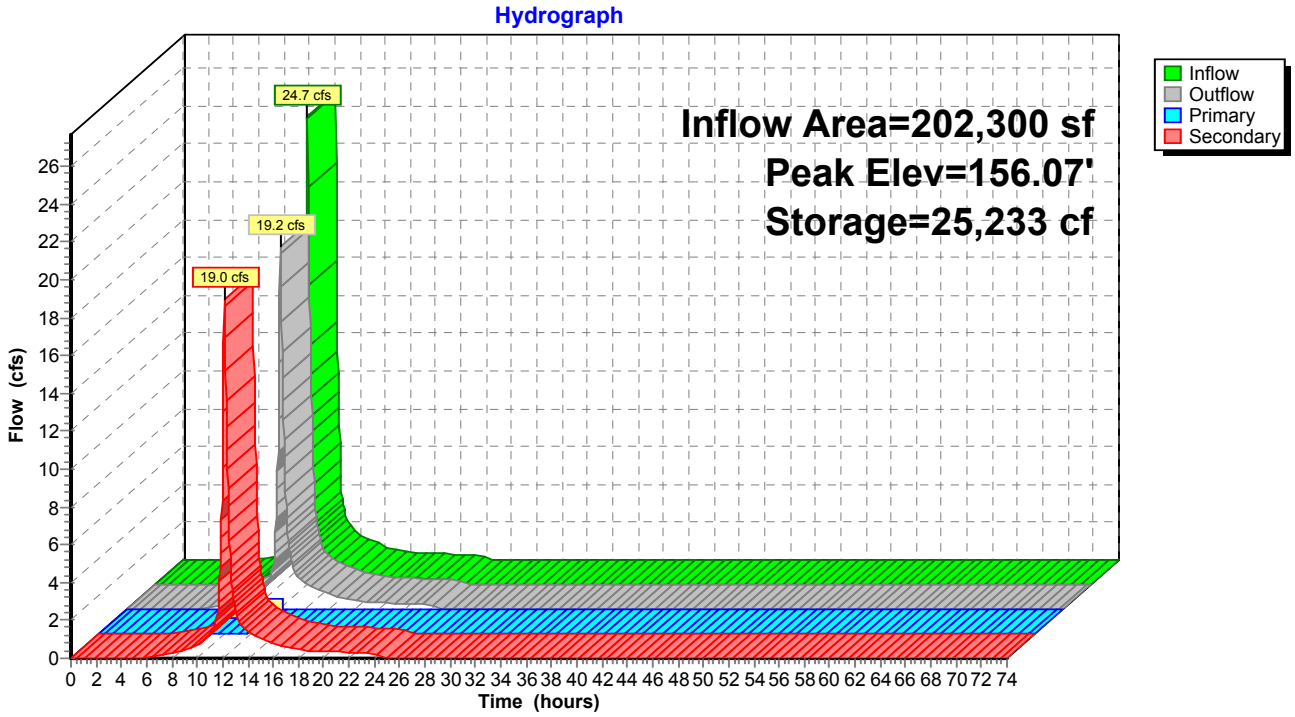
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
152.00	3,444	0	0
153.00	4,709	4,077	4,077
154.00	6,161	5,435	9,512
155.00	7,687	6,924	16,436
156.00	8,650	8,169	24,604
157.00	9,657	9,154	33,758
158.00	10,747	10,202	43,960
158.50	11,591	5,585	49,544

Device	Routing	Invert	Outlet Devices
#1	Primary	155.90'	**30.0" Round Culvert** L= 7.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 155.90' / 153.90' S= 0.2857 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf
#2	Device 1	154.10'	**4.0" Vert. Orifice** C= 0.600
#3	Device 1	155.30'	**45.0 deg Sharp-Crested Vee/Trap Weir** Cv= 2.56 (C= 3.20)
#4	Device 1	158.31'	**48.0" x 48.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	155.00'	**6.5' long x 20.0' 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=0.2 cfs @ 12.14 hrs HW=156.06' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 0.2 cfs @ 1.37 fps)
  ├─**2=Orifice** (Passes < 0.2 cfs potential flow)
  ├─**3=Sharp-Crested Vee/Trap Weir** (Passes < 0.4 cfs potential flow)
  └─**4=Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=18.7 cfs @ 12.14 hrs HW=156.06' TW=0.00' (Dynamic Tailwater)
└─**5=Broad-Crested Rectangular Weir** (Weir Controls 18.7 cfs @ 2.71 fps)

Pond 1P: Existing Pond - South



Summary for Pond 2P: Existing Pond - North

Inflow Area =	34,200 sf,	71.20% Impervious,	Inflow Depth =	3.83"	for 25-YR event
Inflow =	3.6 cfs @	12.08 hrs, Volume=	10,913 cf		
Outflow =	2.2 cfs @	12.17 hrs, Volume=	9,064 cf,	Atten= 37%,	Lag= 5.8 min
Primary =	2.2 cfs @	12.17 hrs, Volume=	9,064 cf		
Secondary =	0.0 cfs @	0.00 hrs, Volume=	0 cf		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Peak Elev= 162.35' @ 12.17 hrs Surf.Area= 2,255 sf Storage= 3,381 cf

Plug-Flow detention time= 118.0 min calculated for 9,064 cf (83% of inflow)
Center-of-Mass det. time= 48.2 min (859.2 - 811.0)

Volume	Invert	Avail.Storage	Storage Description
#1	160.00'	7,631 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

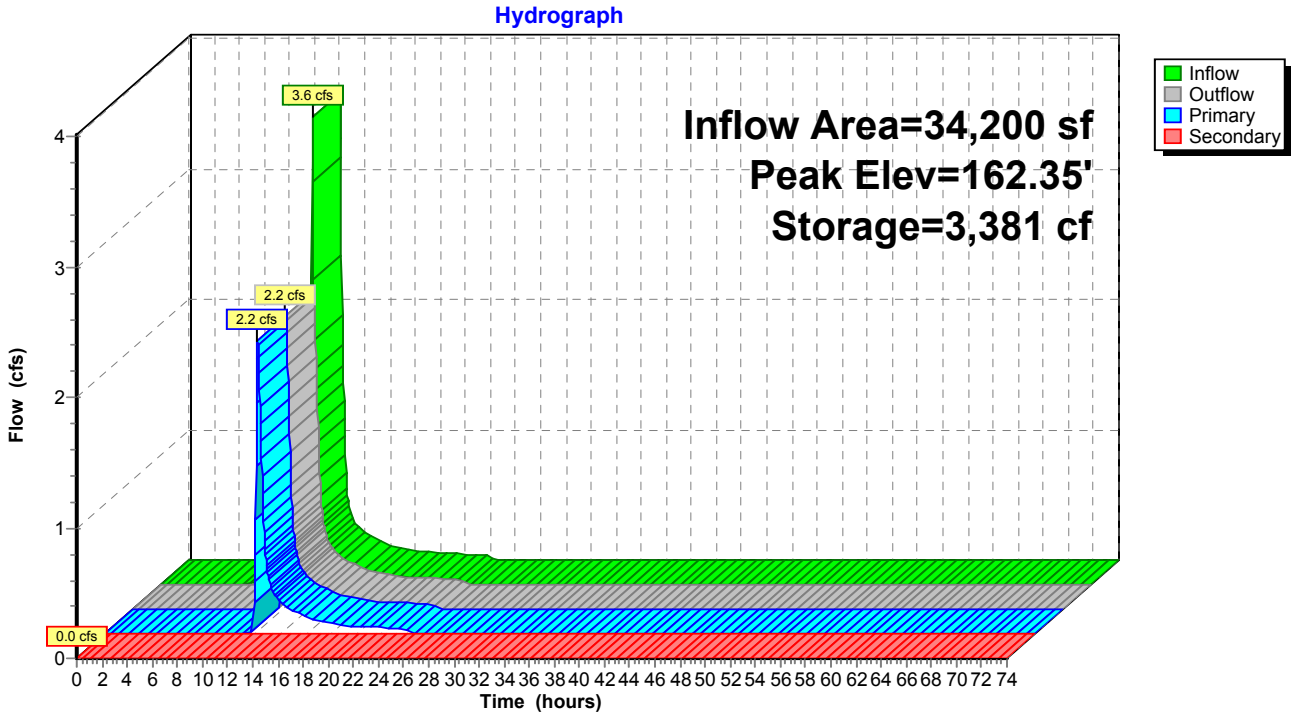
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
160.00	125	0	0
161.00	1,544	835	835
162.00	2,033	1,789	2,623
163.00	2,661	2,347	4,970
164.00	2,661	2,661	7,631

Device	Routing	Invert	Outlet Devices
#1	Primary	161.50'	**12.0" Round Culvert** L= 12.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 161.50' / 161.20' S= 0.0250 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Device 1	161.60'	**4.0' long x 2.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	163.60'	**48.0" W x 48.0" H Vert. Grate** C= 0.600
#4	Secondary	162.70'	**35.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=2.2 cfs @ 12.17 hrs HW=162.35' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 2.2 cfs @ 3.14 fps)
  ├─**2=Sharp-Crested Rectangular Weir** (Passes 2.2 cfs of 8.2 cfs potential flow)
  └─**3=Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=0.0 cfs @ 0.00 hrs HW=160.00' TW=0.00' (Dynamic Tailwater)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 2P: Existing Pond - North

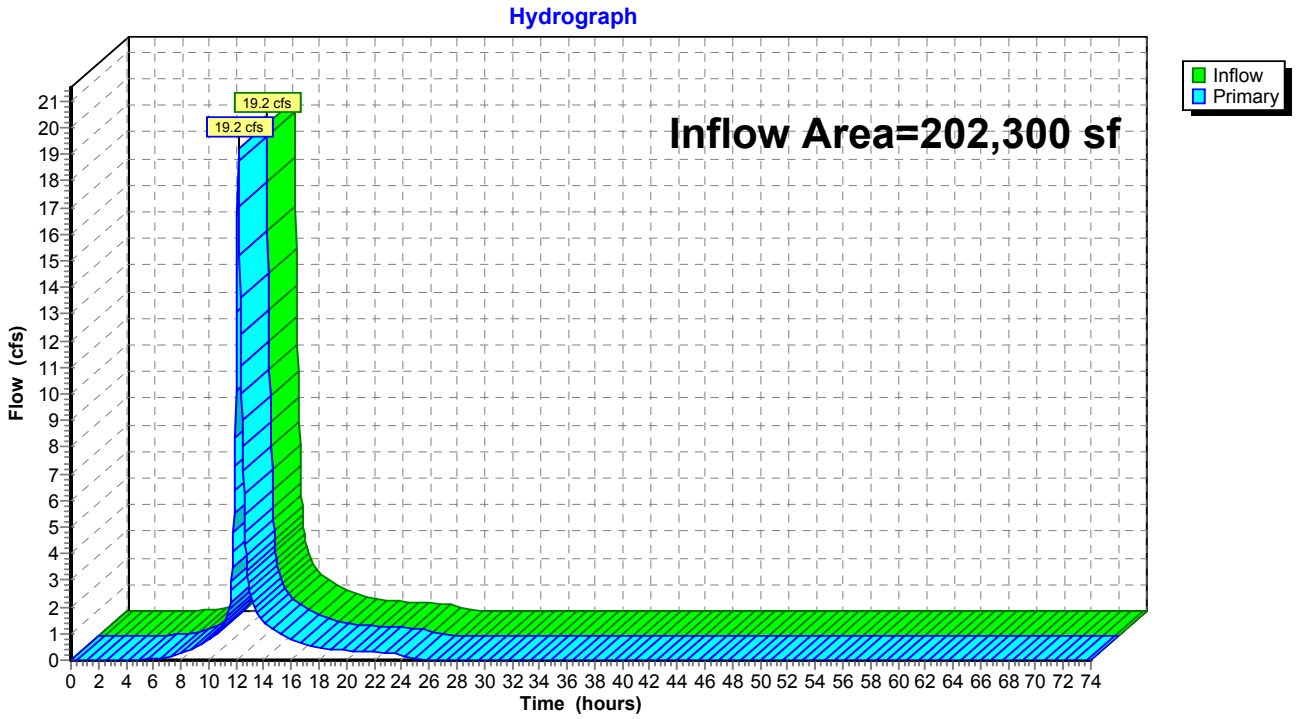


Summary for Link DP 1: South - Wetland

Inflow Area = 202,300 sf, 82.70% Impervious, Inflow Depth = 4.61" for 25-YR event
Inflow = 19.2 cfs @ 12.14 hrs, Volume= 77,705 cf
Primary = 19.2 cfs @ 12.14 hrs, Volume= 77,705 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs

Link DP 1: South - Wetland

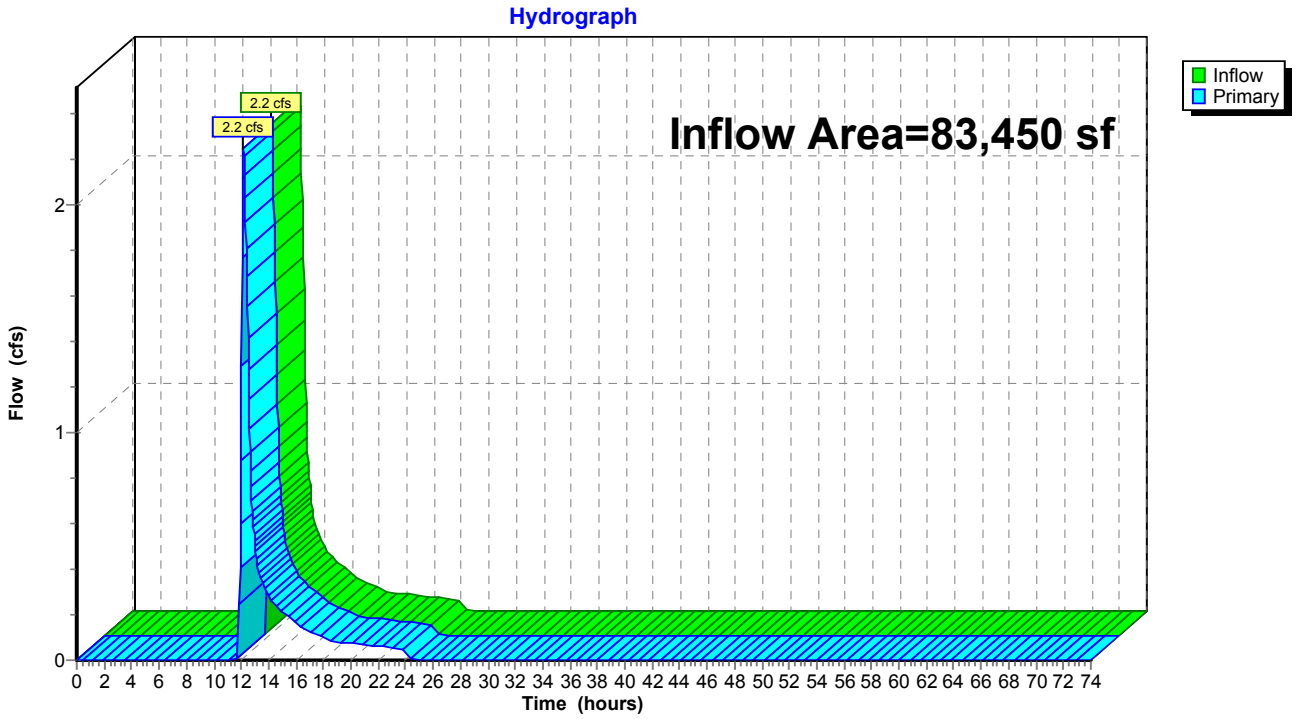


Summary for Link DP 2: North - Culvert

Inflow Area = 83,450 sf, 29.18% Impervious, Inflow Depth = 1.47" for 25-YR event
Inflow = 2.2 cfs @ 12.17 hrs, Volume= 10,221 cf
Primary = 2.2 cfs @ 12.17 hrs, Volume= 10,221 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs

Link DP 2: North - Culvert

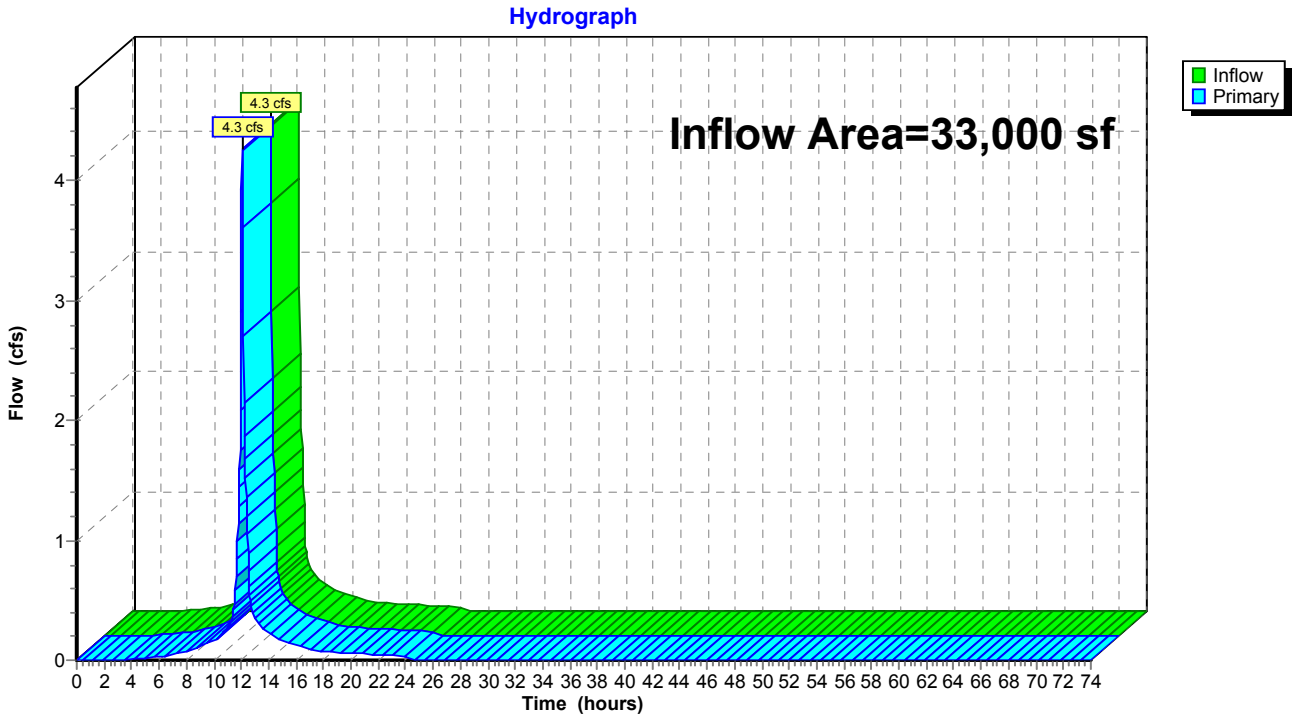


Summary for Link DP3: Shoppers World Drive

Inflow Area = 33,000 sf, 89.55% Impervious, Inflow Depth = 5.01" for 25-YR event
Inflow = 4.3 cfs @ 12.07 hrs, Volume= 13,779 cf
Primary = 4.3 cfs @ 12.07 hrs, Volume= 13,779 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs

Link DP3: Shoppers World Drive



Summary for Subcatchment 1: Parking Lot

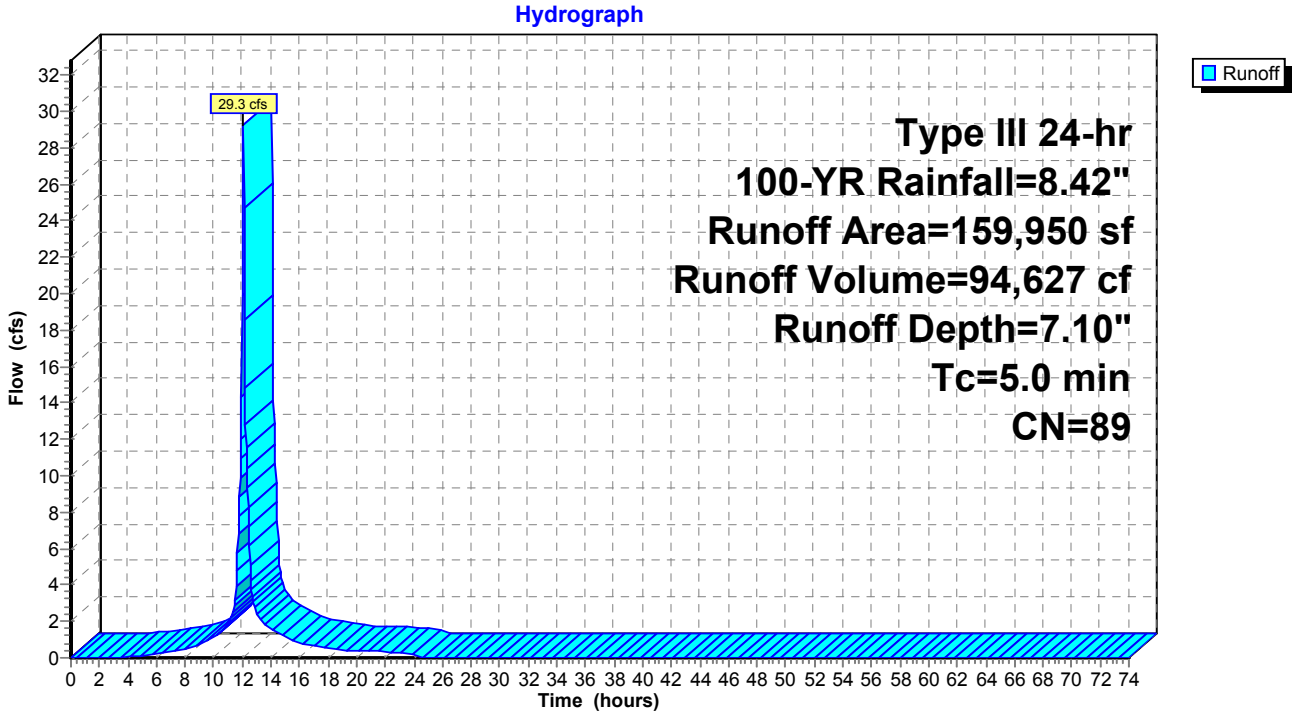
Runoff = 29.3 cfs @ 12.07 hrs, Volume= 94,627 cf, Depth= 7.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-YR Rainfall=8.42"

	Area (sf)	CN	Description
*	126,350	98	Paved parking
	22,700	39	>75% Grass cover, Good, HSG A
	3,850	80	>75% Grass cover, Good, HSG D
	6,900	98	Water Surface, HSG A
*	150	98	Water Surface, HSG D
	159,950	89	Weighted Average
	26,550		16.60% Pervious Area
	133,400		83.40% Impervious Area

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

Subcatchment 1: Parking Lot



Summary for Subcatchment 2: Parking Lot

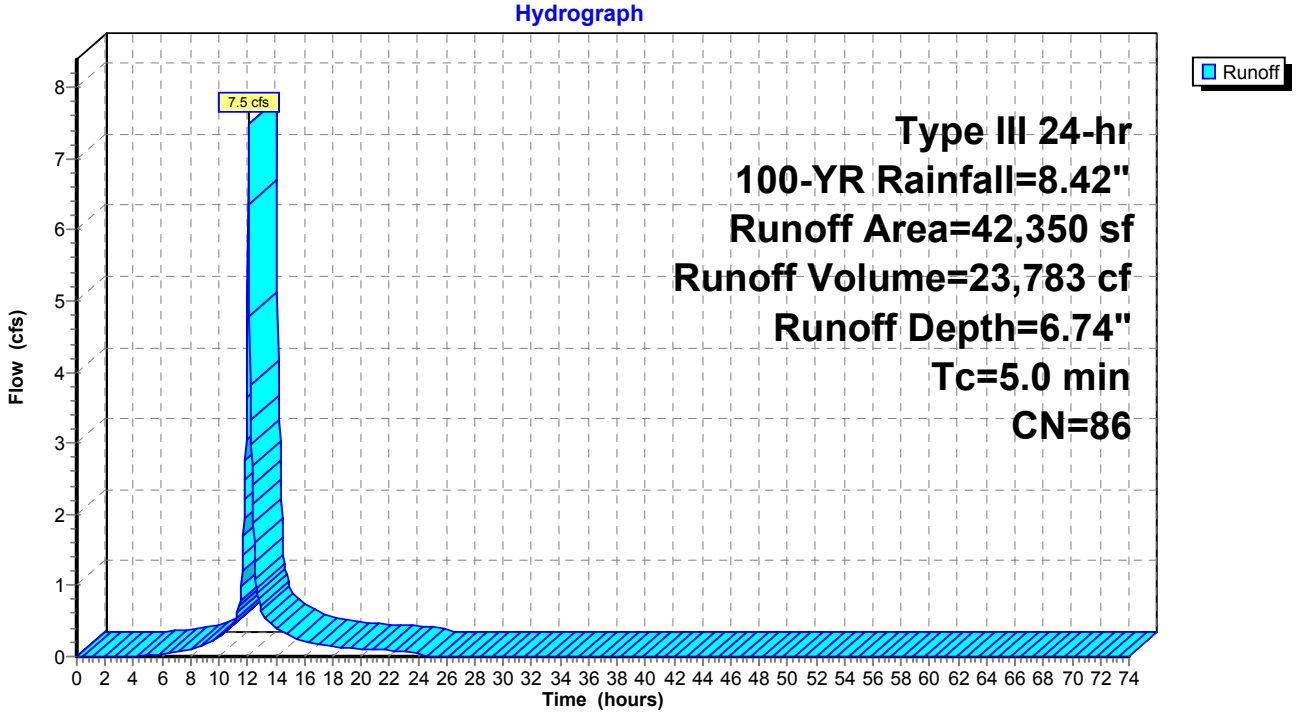
Runoff = 7.5 cfs @ 12.07 hrs, Volume= 23,783 cf, Depth= 6.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-YR Rainfall=8.42"

	Area (sf)	CN	Description
*	33,900	98	Paved parking
	8,450	39	>75% Grass cover, Good, HSG A
	42,350	86	Weighted Average
	8,450		19.95% Pervious Area
	33,900		80.05% Impervious Area

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

Subcatchment 2: Parking Lot



Summary for Subcatchment 3: Parking

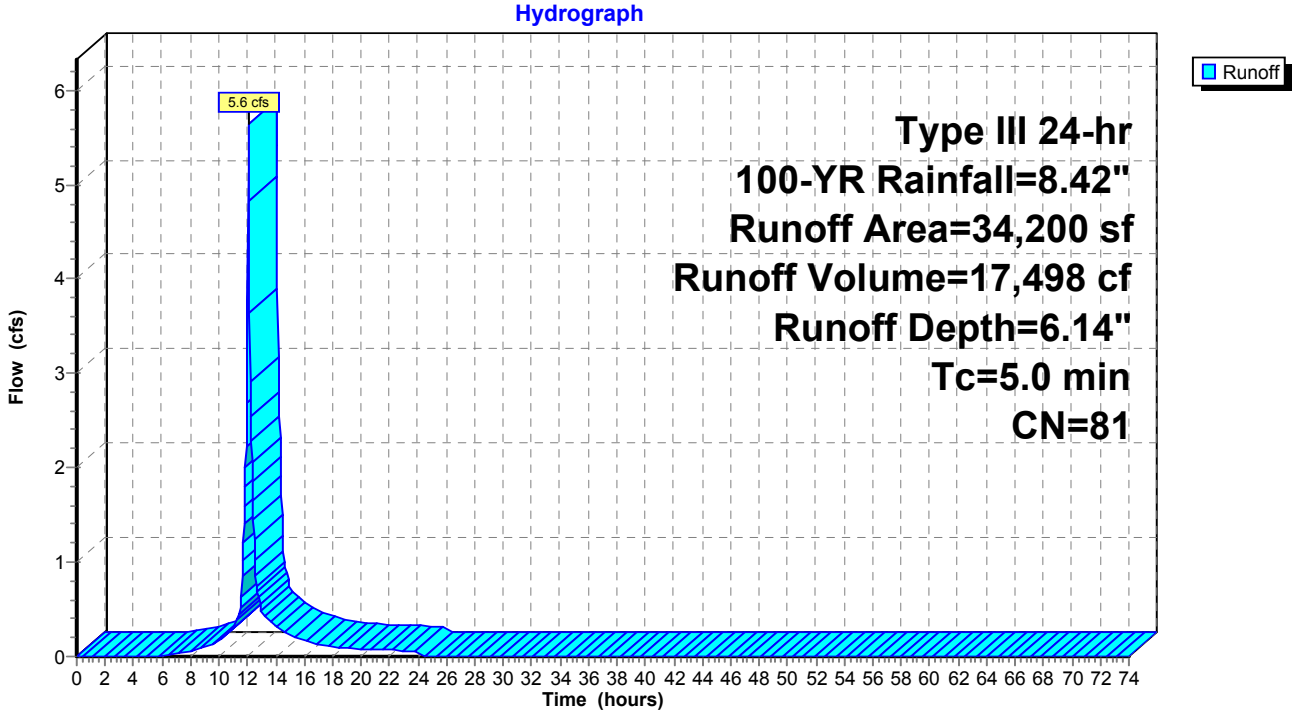
Runoff = 5.6 cfs @ 12.07 hrs, Volume= 17,498 cf, Depth= 6.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-YR Rainfall=8.42"

Area (sf)	CN	Description
24,350	98	Paved parking, HSG A
9,850	39	>75% Grass cover, Good, HSG A
34,200	81	Weighted Average
9,850		28.80% Pervious Area
24,350		71.20% Impervious Area

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

Subcatchment 3: Parking



Summary for Subcatchment 4: Northwest Grass/Woods

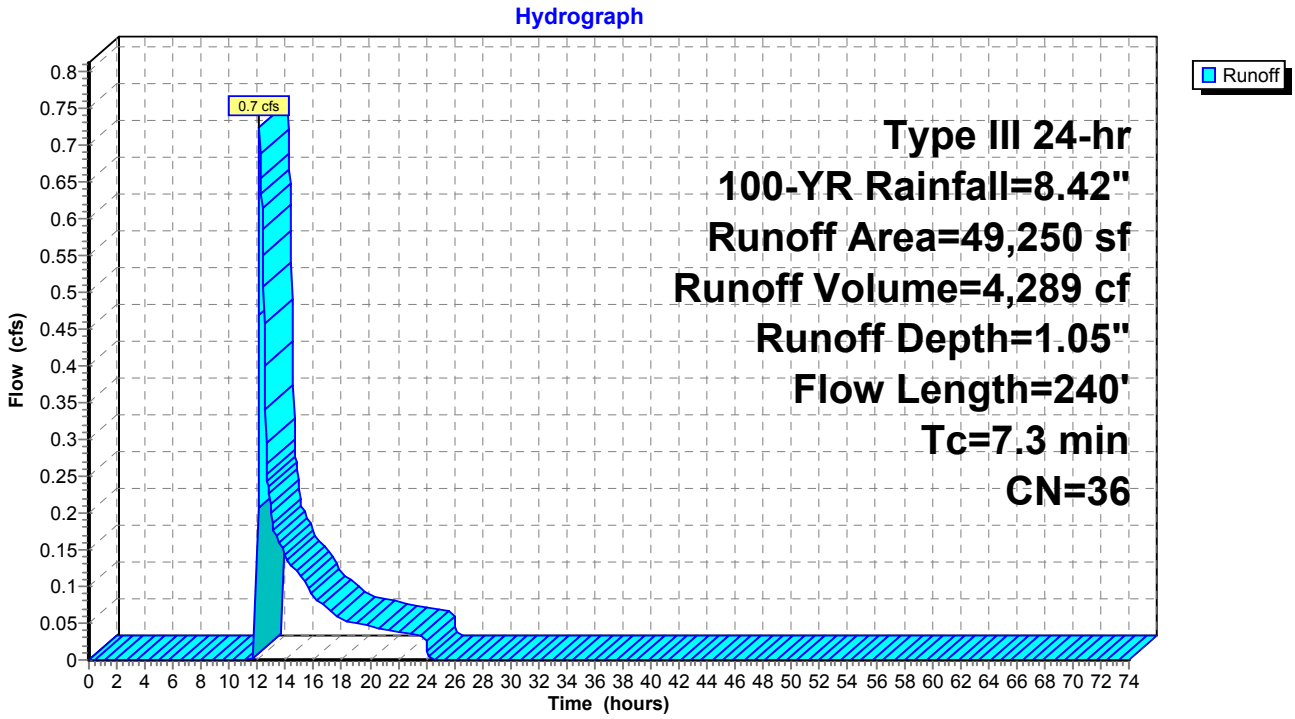
Runoff = 0.7 cfs @ 12.16 hrs, Volume= 4,289 cf, Depth= 1.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-YR Rainfall=8.42"

Area (sf)	CN	Description
30,900	39	>75% Grass cover, Good, HSG A
18,350	30	Woods, Good, HSG A
49,250	36	Weighted Average
49,250		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	20	0.3000	0.35		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
3.3	30	0.0300	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
2.4	114	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	76	0.0130	1.71		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
7.3	240	Total			

Subcatchment 4: Northwest Grass/Woods



Summary for Subcatchment 5: Shoppers World Drive South

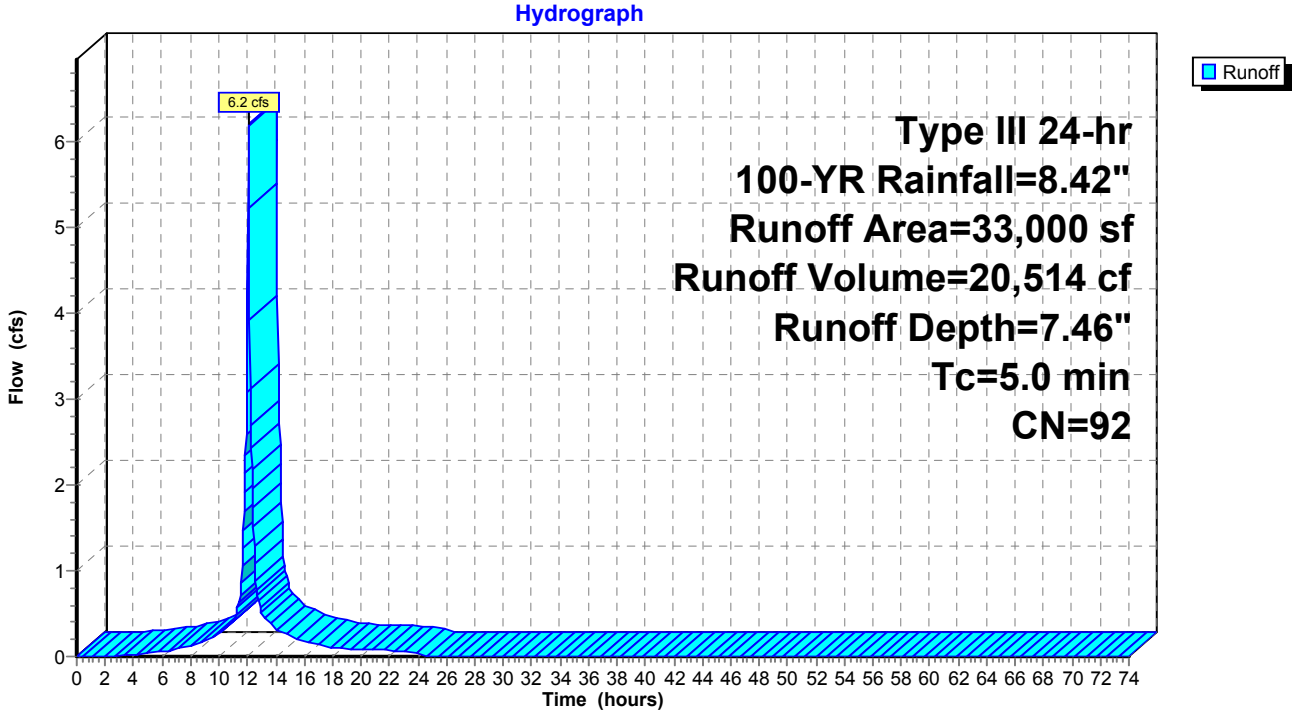
Runoff = 6.2 cfs @ 12.07 hrs, Volume= 20,514 cf, Depth= 7.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-YR Rainfall=8.42"

Area (sf)	CN	Description
29,550	98	Paved parking, HSG A
3,450	39	>75% Grass cover, Good, HSG A
33,000	92	Weighted Average
3,450		10.45% Pervious Area
29,550		89.55% Impervious Area

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

Subcatchment 5: Shoppers World Drive South



Summary for Pond 1P: Existing Pond - South

Inflow Area =	202,300 sf,	82.70% Impervious,	Inflow Depth =	7.02"	for 100-YR event
Inflow =	36.8 cfs @	12.07 hrs, Volume=	118,410 cf		
Outflow =	30.1 cfs @	12.13 hrs, Volume=	118,410 cf,	Atten= 18%,	Lag= 3.3 min
Primary =	1.5 cfs @	12.13 hrs, Volume=	895 cf		
Secondary =	28.5 cfs @	12.13 hrs, Volume=	117,515 cf		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Starting Elev= 155.00' Surf.Area= 7,687 sf Storage= 16,436 cf
Peak Elev= 156.40' @ 12.13 hrs Surf.Area= 9,056 sf Storage= 28,177 cf (11,741 cf above start)

Plug-Flow detention time= 112.1 min calculated for 101,919 cf (86% of inflow)
Center-of-Mass det. time= 13.8 min (792.1 - 778.3)

Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	49,544 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

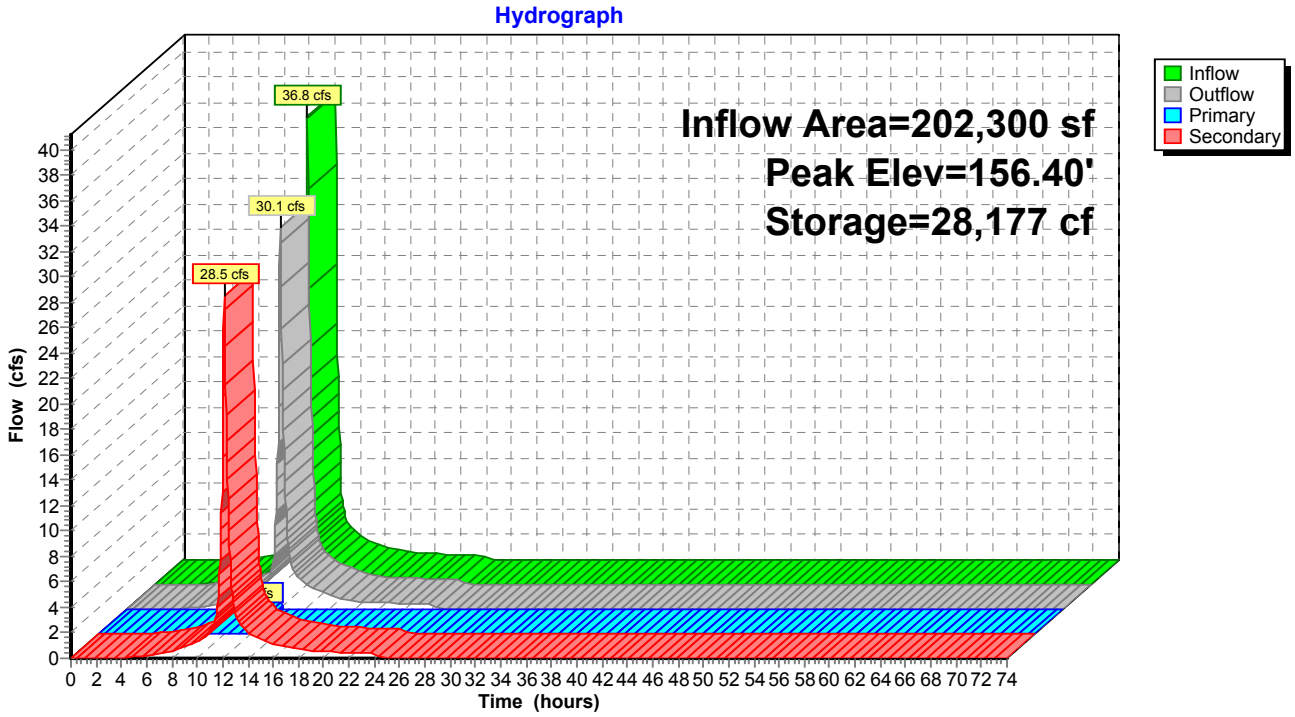
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
152.00	3,444	0	0
153.00	4,709	4,077	4,077
154.00	6,161	5,435	9,512
155.00	7,687	6,924	16,436
156.00	8,650	8,169	24,604
157.00	9,657	9,154	33,758
158.00	10,747	10,202	43,960
158.50	11,591	5,585	49,544

Device	Routing	Invert	Outlet Devices
#1	Primary	155.90'	**30.0" Round Culvert** L= 7.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 155.90' / 153.90' S= 0.2857 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf
#2	Device 1	154.10'	**4.0" Vert. Orifice** C= 0.600
#3	Device 1	155.30'	**45.0 deg Sharp-Crested Vee/Trap Weir** Cv= 2.56 (C= 3.20)
#4	Device 1	158.31'	**48.0" x 48.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	155.00'	**6.5' long x 20.0' 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=1.5 cfs @ 12.13 hrs HW=156.39' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 1.5 cfs of 1.6 cfs potential flow)
  ├─**2=Orifice** (Orifice Controls 0.3 cfs @ 3.38 fps)
  ├─**3=Sharp-Crested Vee/Trap Weir** (Weir Controls 1.2 cfs @ 2.43 fps)
  └─**4=Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=28.2 cfs @ 12.13 hrs HW=156.39' TW=0.00' (Dynamic Tailwater)
└─**5=Broad-Crested Rectangular Weir** (Weir Controls 28.2 cfs @ 3.12 fps)

Pond 1P: Existing Pond - South



Summary for Pond 2P: Existing Pond - North

Inflow Area =	34,200 sf,	71.20% Impervious,	Inflow Depth =	6.14"	for 100-YR event
Inflow =	5.6 cfs @	12.07 hrs, Volume=	17,498 cf		
Outflow =	4.1 cfs @	12.16 hrs, Volume=	15,649 cf,	Atten= 28%,	Lag= 5.1 min
Primary =	3.3 cfs @	12.16 hrs, Volume=	15,468 cf		
Secondary =	0.8 cfs @	12.16 hrs, Volume=	181 cf		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs
Peak Elev= 162.75' @ 12.16 hrs Surf.Area= 2,502 sf Storage= 4,315 cf

Plug-Flow detention time= 90.8 min calculated for 15,640 cf (89% of inflow)
Center-of-Mass det. time= 40.5 min (838.2 - 797.7)

Volume	Invert	Avail.Storage	Storage Description
#1	160.00'	7,631 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

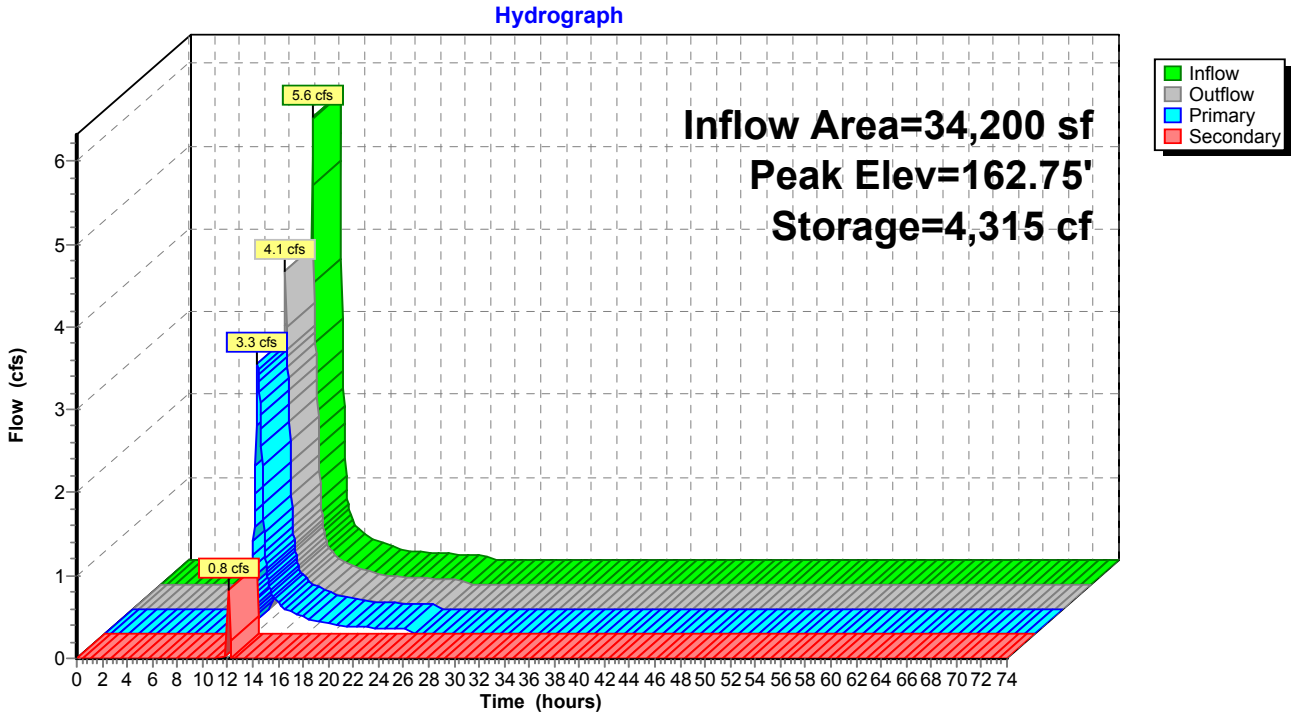
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
160.00	125	0	0
161.00	1,544	835	835
162.00	2,033	1,789	2,623
163.00	2,661	2,347	4,970
164.00	2,661	2,661	7,631

Device	Routing	Invert	Outlet Devices
#1	Primary	161.50'	**12.0" Round Culvert** L= 12.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 161.50' / 161.20' S= 0.0250 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Device 1	161.60'	**4.0' long x 2.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	163.60'	**48.0" W x 48.0" H Vert. Grate** C= 0.600
#4	Secondary	162.70'	**35.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=3.3 cfs @ 12.16 hrs HW=162.75' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 3.3 cfs @ 4.16 fps)
  ├─**2=Sharp-Crested Rectangular Weir** (Passes 3.3 cfs of 15.1 cfs potential flow)
  └─**3=Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=0.8 cfs @ 12.16 hrs HW=162.75' TW=0.00' (Dynamic Tailwater)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 0.8 cfs @ 0.51 fps)

Pond 2P: Existing Pond - North

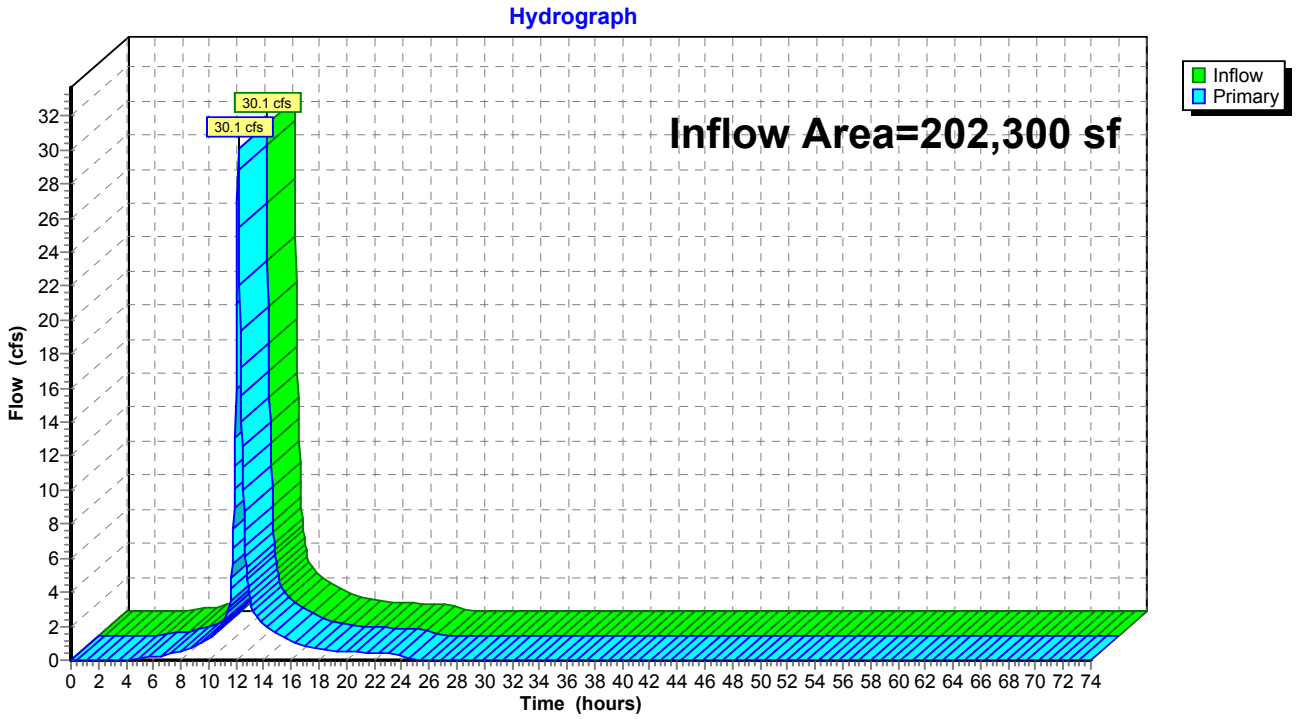


Summary for Link DP 1: South - Wetland

Inflow Area = 202,300 sf, 82.70% Impervious, Inflow Depth = 7.02" for 100-YR event
Inflow = 30.1 cfs @ 12.13 hrs, Volume= 118,410 cf
Primary = 30.1 cfs @ 12.13 hrs, Volume= 118,410 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs

Link DP 1: South - Wetland

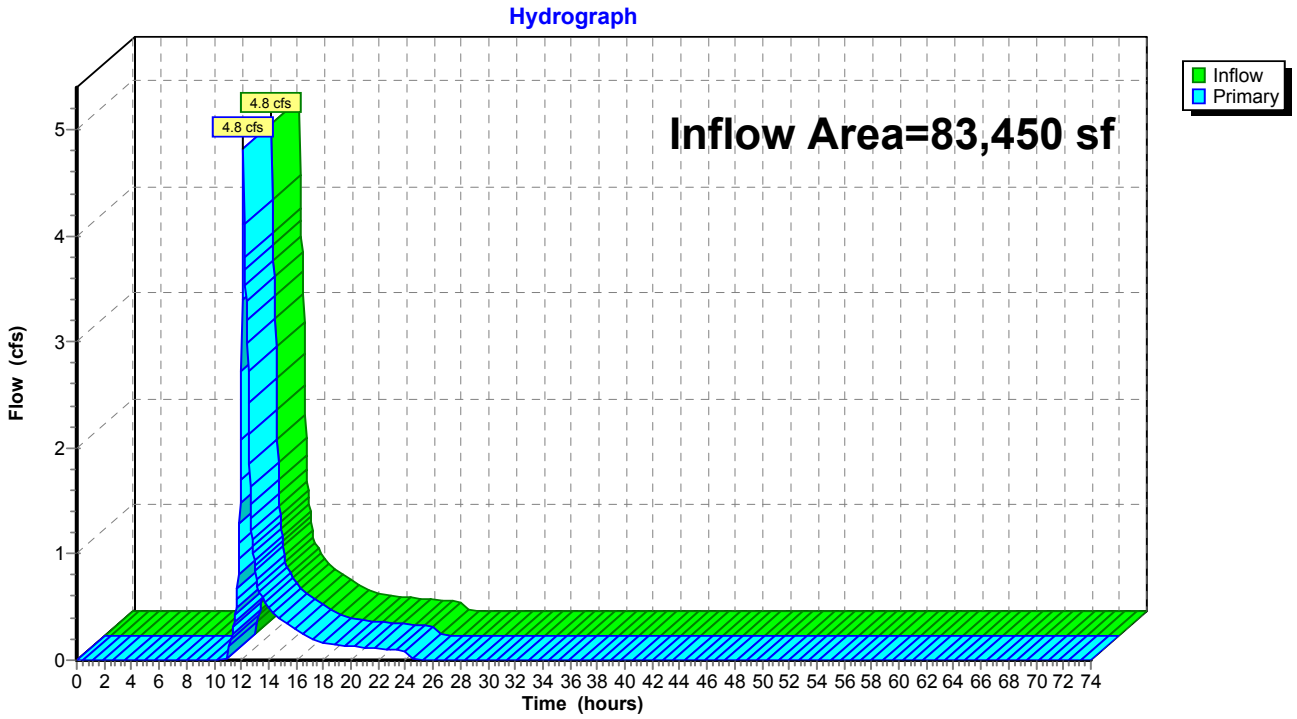


Summary for Link DP 2: North - Culvert

Inflow Area = 83,450 sf, 29.18% Impervious, Inflow Depth = 2.87" for 100-YR event
Inflow = 4.8 cfs @ 12.16 hrs, Volume= 19,938 cf
Primary = 4.8 cfs @ 12.16 hrs, Volume= 19,938 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs

Link DP 2: North - Culvert

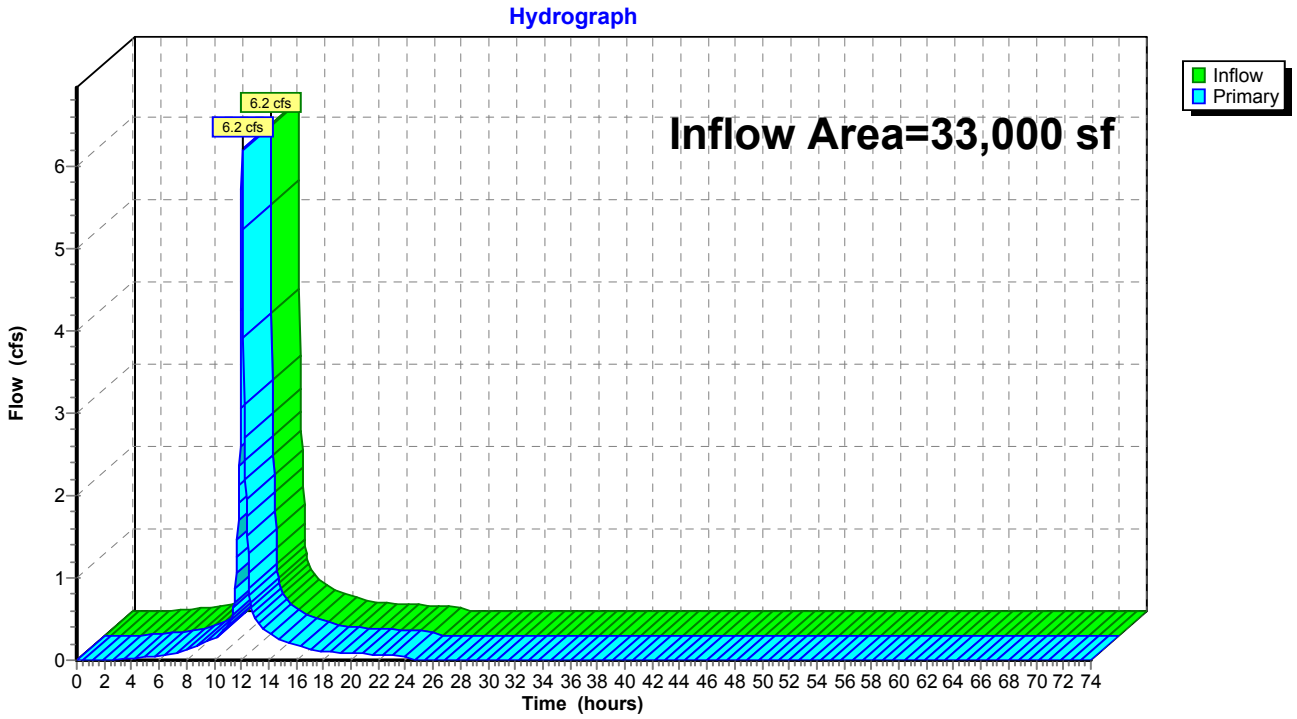


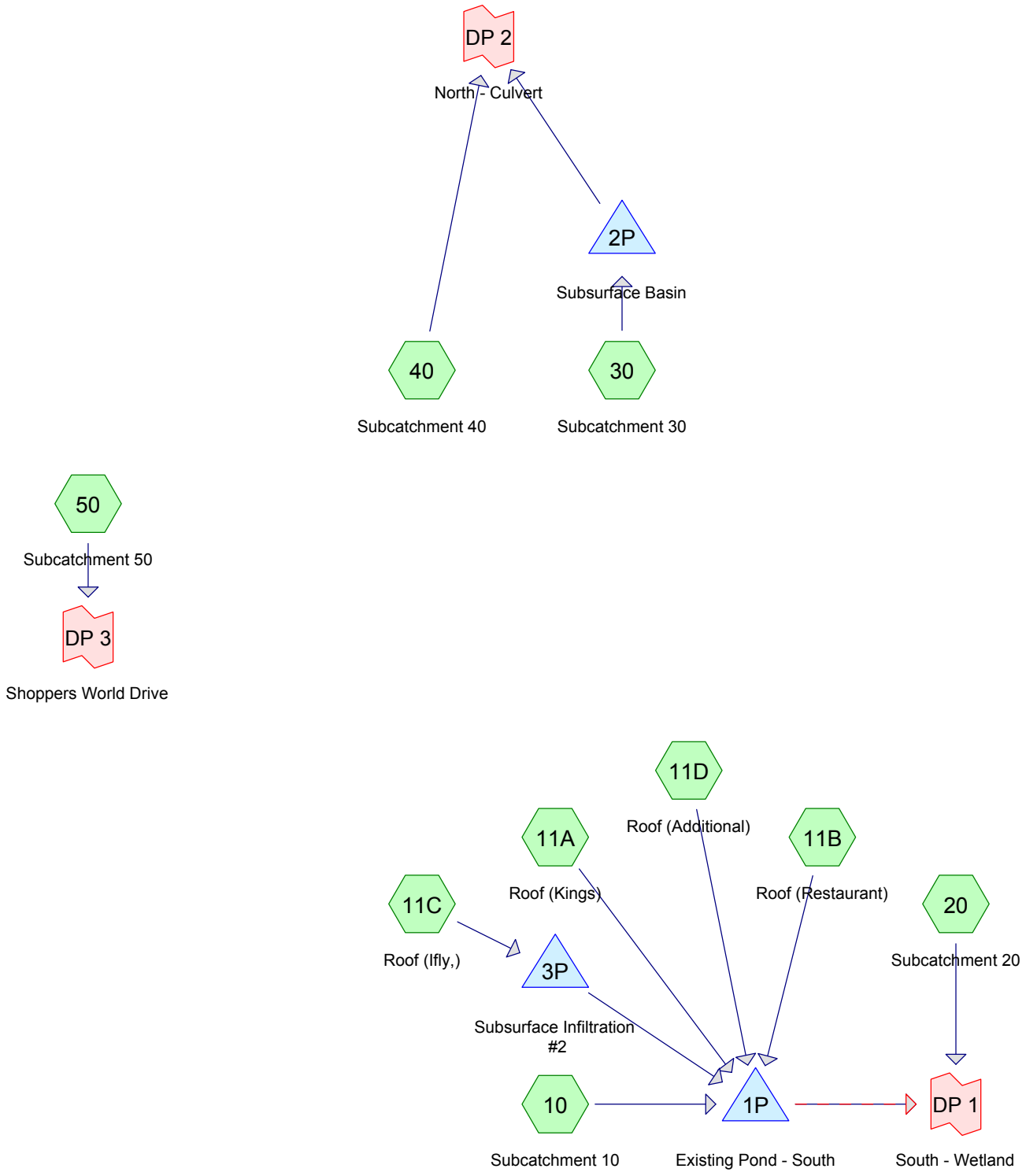
Summary for Link DP3: Shoppers World Drive

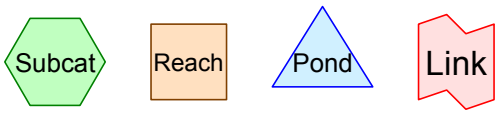
Inflow Area = 33,000 sf, 89.55% Impervious, Inflow Depth = 7.46" for 100-YR event
Inflow = 6.2 cfs @ 12.07 hrs, Volume= 20,514 cf
Primary = 6.2 cfs @ 12.07 hrs, Volume= 20,514 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.04 hrs

Link DP3: Shoppers World Drive







Routing Diagram for 12642_PROPOSED - REV
Prepared by {enter your company name here}, Printed 6/7/2016
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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
68,532	39	>75% Grass cover, Good, HSG A (10, 20, 30, 40, 50)
1,800	80	>75% Grass cover, Good, HSG D (10)
184,291	98	Paved parking, HSG A (10, 30, 50)
38,745	98	Roofs, HSG A (11A, 11B, 11C, 11D)
6,895	98	Water Surface, 0% imp, HSG A (10)
140	98	Water Surface, 0% imp, HSG D (10)
18,347	30	Woods, Good, HSG A (40)
318,750	**81**	**TOTAL AREA**

Time span=0.00-74.00 hrs, dt=0.01 hrs, 7401 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

Subcatchment10: Subcatchment10 Runoff Area=164,554 sf 73.74% Impervious Runoff Depth=1.73"
Tc=5.0 min CN=85 Runoff=8.0 cfs 23,751 cf

Subcatchment11A: Roof (Kings) Runoff Area=21,000 sf 100.00% Impervious Runoff Depth=2.94"
Tc=5.0 min CN=98 Runoff=1.5 cfs 5,141 cf

Subcatchment11B: Roof (Restaurant) Runoff Area=8,468 sf 100.00% Impervious Runoff Depth=2.94"
Tc=5.0 min CN=98 Runoff=0.6 cfs 2,073 cf

Subcatchment11C: Roof (Ifly,) Runoff Area=4,050 sf 100.00% Impervious Runoff Depth=2.94"
Tc=5.0 min CN=98 Runoff=0.3 cfs 991 cf

Subcatchment11D: Roof (Additional) Runoff Area=5,227 sf 100.00% Impervious Runoff Depth=2.94"
Tc=5.0 min CN=98 Runoff=0.4 cfs 1,280 cf

Subcatchment20: Subcatchment20 Runoff Area=7,365 sf 0.00% Impervious Runoff Depth=0.00"
Tc=5.0 min CN=39 Runoff=0.0 cfs 0 cf

Subcatchment30: Subcatchment30 Runoff Area=36,250 sf 79.86% Impervious Runoff Depth=1.81"
Tc=5.0 min CN=86 Runoff=1.8 cfs 5,465 cf

Subcatchment40: Subcatchment40 Runoff Area=37,223 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=240' Tc=7.3 min CN=35 Runoff=0.0 cfs 0 cf

Subcatchment50: Subcatchment50 Runoff Area=34,613 sf 98.21% Impervious Runoff Depth=2.83"
Tc=5.0 min CN=97 Runoff=2.5 cfs 8,154 cf

Pond 1P: Existing Pond - South Peak Elev=155.56' Storage=20,912 cf Inflow=10.5 cfs 32,245 cf
Primary=0.0 cfs 0 cf Secondary=7.4 cfs 32,245 cf Outflow=7.4 cfs 32,245 cf

Pond 2P: Subsurface Basin Peak Elev=160.82' Storage=1,761 cf Inflow=1.8 cfs 5,465 cf
Discarded=0.2 cfs 5,339 cf Primary=0.0 cfs 127 cf Outflow=0.3 cfs 5,467 cf

Pond 3P: Subsurface Infiltration #2 Peak Elev=157.28' Storage=286 cf Inflow=0.3 cfs 991 cf
Discarded=0.0 cfs 992 cf Primary=0.0 cfs 0 cf Outflow=0.0 cfs 992 cf

Link DP 1: South - Wetland Inflow=7.4 cfs 32,245 cf
Primary=7.4 cfs 32,245 cf

Link DP 2: North - Culvert Inflow=0.0 cfs 127 cf
Primary=0.0 cfs 127 cf

Link DP 3: Shoppers World Drive Inflow=2.5 cfs 8,154 cf
Primary=2.5 cfs 8,154 cf

Total Runoff Area = 318,750 sf Runoff Volume = 46,855 cf Average Runoff Depth = 1.76"
30.03% Pervious = 95,714 sf 69.97% Impervious = 223,036 sf

Summary for Subcatchment 10: Subcatchment 10

Runoff = 8.0 cfs @ 12.08 hrs, Volume= 23,751 cf, Depth= 1.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.17"

Area (sf)	CN	Description
121,346	98	Paved parking, HSG A
6,895	98	Water Surface, 0% imp, HSG A
140	98	Water Surface, 0% imp, HSG D
34,373	39	>75% Grass cover, Good, HSG A
1,800	80	>75% Grass cover, Good, HSG D
164,554	85	Weighted Average
43,208		26.26% Pervious Area
121,346		73.74% Impervious Area

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

Summary for Subcatchment 11A: Roof (Kings)

Runoff = 1.5 cfs @ 12.07 hrs, Volume= 5,141 cf, Depth= 2.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.17"

Area (sf)	CN	Description
21,000	98	Roofs, HSG A
21,000		100.00% Impervious Area

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

Summary for Subcatchment 11B: Roof (Restaurant)

Runoff = 0.6 cfs @ 12.07 hrs, Volume= 2,073 cf, Depth= 2.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.17"

Area (sf)	CN	Description
8,468	98	Roofs, HSG A
8,468		100.00% Impervious Area

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

Summary for Subcatchment 11C: Roof (Ifly,)

Runoff = 0.3 cfs @ 12.07 hrs, Volume= 991 cf, Depth= 2.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.17"

Area (sf)	CN	Description
4,050	98	Roofs, HSG A
4,050		100.00% Impervious Area

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

Summary for Subcatchment 11D: Roof (Additional)

Runoff = 0.4 cfs @ 12.07 hrs, Volume= 1,280 cf, Depth= 2.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.17"

Area (sf)	CN	Description
5,227	98	Roofs, HSG A
5,227		100.00% Impervious Area

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

Summary for Subcatchment 20: Subcatchment 20

Runoff = 0.0 cfs @ 24.01 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.17"

Area (sf)	CN	Description
7,365	39	>75% Grass cover, Good, HSG A
7,365		100.00% Pervious Area

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

Summary for Subcatchment 30: Subcatchment 30

Runoff = 1.8 cfs @ 12.07 hrs, Volume= 5,465 cf, Depth= 1.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.17"

Area (sf)	CN	Description
28,950	98	Paved parking, HSG A
7,300	39	>75% Grass cover, Good, HSG A
36,250	86	Weighted Average
7,300		20.14% Pervious Area
28,950		79.86% Impervious Area

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

Summary for Subcatchment 40: Subcatchment 40

Runoff = 0.0 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.17"

Area (sf)	CN	Description
18,876	39	>75% Grass cover, Good, HSG A
18,347	30	Woods, Good, HSG A
37,223	35	Weighted Average
37,223		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	20	0.3000	0.35		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
3.3	30	0.0300	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
2.4	114	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	76	0.0130	1.71		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
7.3	240	Total			

Summary for Subcatchment 50: Subcatchment 50

Runoff = 2.5 cfs @ 12.07 hrs, Volume= 8,154 cf, Depth= 2.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.17"

Area (sf)	CN	Description
33,995	98	Paved parking, HSG A
618	39	>75% Grass cover, Good, HSG A
34,613	97	Weighted Average
618		1.79% Pervious Area
33,995		98.21% Impervious Area

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

Summary for Pond 1P: Existing Pond - South

Inflow Area =	203,299 sf,	78.75% Impervious,	Inflow Depth =	1.90"	for 2-YR event
Inflow =	10.5 cfs @	12.07 hrs,	Volume=	32,245 cf	
Outflow =	7.4 cfs @	12.15 hrs,	Volume=	32,245 cf,	Atten= 29%, Lag= 4.4 min
Primary =	0.0 cfs @	0.00 hrs,	Volume=	0 cf	
Secondary =	7.4 cfs @	12.15 hrs,	Volume=	32,245 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Starting Elev= 155.00' Surf.Area= 7,687 sf Storage= 16,436 cf
Peak Elev= 155.56' @ 12.15 hrs Surf.Area= 8,229 sf Storage= 20,912 cf (4,477 cf above start)

Plug-Flow detention time= 269.3 min calculated for 15,809 cf (49% of inflow)
Center-of-Mass det. time= 20.9 min (828.1 - 807.2)

Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	49,544 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
152.00	3,444	0	0
153.00	4,709	4,077	4,077
154.00	6,161	5,435	9,512
155.00	7,687	6,924	16,436
156.00	8,650	8,169	24,604
157.00	9,657	9,154	33,758
158.00	10,747	10,202	43,960
158.50	11,591	5,585	49,544

Device	Routing	Invert	Outlet Devices
#1	Primary	155.90'	**30.0" Round Culvert** L= 7.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 155.90' / 153.90' S= 0.2857 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf
#2	Device 1	154.10'	**4.0" Vert. Orifice** C= 0.600
#3	Device 1	155.30'	**45.0 deg Sharp-Crested Vee/Trap Weir** Cv= 2.56 (C= 3.20)
#4	Device 1	158.31'	**48.0" x 48.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	155.00'	**6.5' long x 20.0' 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=0.0 cfs @ 0.00 hrs HW=155.00' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Controls 0.0 cfs)
  ├─**2=Orifice** (Controls 0.0 cfs)
  ├─**3=Sharp-Crested Vee/Trap Weir** (Controls 0.0 cfs)
  └─**4=Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=7.4 cfs @ 12.15 hrs HW=155.56' TW=0.00' (Dynamic Tailwater)
└─**5=Broad-Crested Rectangular Weir** (Weir Controls 7.4 cfs @ 2.02 fps)

Summary for Pond 2P: Subsurface Basin

Inflow Area =	36,250 sf,	79.86% Impervious,	Inflow Depth =	1.81"	for 2-YR event
Inflow =	1.8 cfs @	12.07 hrs, Volume=	5,465 cf		
Outflow =	0.3 cfs @	12.58 hrs, Volume=	5,467 cf,	Atten= 85%,	Lag= 30.6 min
Discarded =	0.2 cfs @	12.58 hrs, Volume=	5,339 cf		
Primary =	0.0 cfs @	12.58 hrs, Volume=	127 cf		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Peak Elev= 160.82' @ 12.58 hrs Surf.Area= 3,898 sf Storage= 1,761 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 55.5 min (877.5 - 822.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	160.00'	2,726 cf	**38.17'W x 102.12'L x 2.33'H Field A** 9,094 cf Overall - 2,280 cf Embedded = 6,814 cf x 40.0% Voids
#2A	160.50'	2,280 cf	**ADS_StormTech SC-310** x 154 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 11 rows
		5,006 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	160.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	162.30'	**3.7' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Primary	160.70'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	161.50'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.2 cfs @ 12.58 hrs HW=160.82' (Free Discharge)
└─**1=Exfiltration** (Controls 0.2 cfs)

Primary OutFlow Max=0.0 cfs @ 12.58 hrs HW=160.82' TW=0.00' (Dynamic Tailwater)
├─**2=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)
├─**3=Orifice/Grate** (Orifice Controls 0.0 cfs @ 1.16 fps)
└─**4=Orifice/Grate** (Controls 0.0 cfs)

Pond 2P: Subsurface Basin - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-310 (ADS StormTech®SC-310)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
Row Length Adjustment= +0.44' x 2.07 sf x 11 rows

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

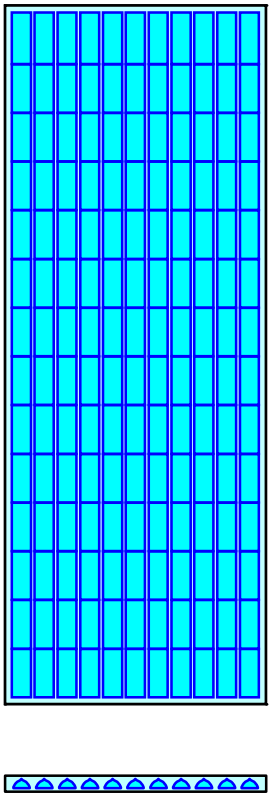
14 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 100.12' Row Length +12.0" End Stone x 2 = 102.12' Base Length
11 Rows x 34.0" Wide + 6.0" Spacing x 10 + 12.0" Side Stone x 2 = 38.17' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

154 Chambers x 14.7 cf +0.44' Row Adjustment x 2.07 sf x 11 Rows = 2,280.2 cf Chamber Storage

9,094.2 cf Field - 2,280.2 cf Chambers = 6,814.0 cf Stone x 40.0% Voids = 2,725.6 cf Stone Storage

Chamber Storage + Stone Storage = 5,005.8 cf = 0.1 af
Overall Storage Efficiency = 55.0%

154 Chambers
336.8 cy Field
252.4 cy Stone



Summary for Pond 3P: Subsurface Infiltration #2

Inflow Area =	4,050 sf,100.00% Impervious,	Inflow Depth =	2.94"	for 2-YR event	
Inflow =	0.3 cfs @	12.07 hrs,	Volume=	991 cf	
Outflow =	0.0 cfs @	12.57 hrs,	Volume=	992 cf,	Atten= 87%, Lag= 30.3 min
Discarded =	0.0 cfs @	12.57 hrs,	Volume=	992 cf	
Primary =	0.0 cfs @	0.00 hrs,	Volume=	0 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Peak Elev= 157.28' @ 12.57 hrs Surf.Area= 691 sf Storage= 286 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 43.0 min (798.7 - 755.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	156.50'	496 cf	**18.17'W x 38.04'L x 2.33'H Field A** 1,612 cf Overall - 373 cf Embedded = 1,239 cf x 40.0% Voids
#2A	157.00'	373 cf	**ADS_StormTech SC-310** x 25 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 5 rows
		869 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	156.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	158.80'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.0 cfs @ 12.57 hrs HW=157.28' (Free Discharge)
└─**1=Exfiltration** (Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=156.50' TW=155.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 3P: Subsurface Infiltration #2 - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-310 (ADS StormTech®SC-310)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
Row Length Adjustment= +0.44' x 2.07 sf x 5 rows

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

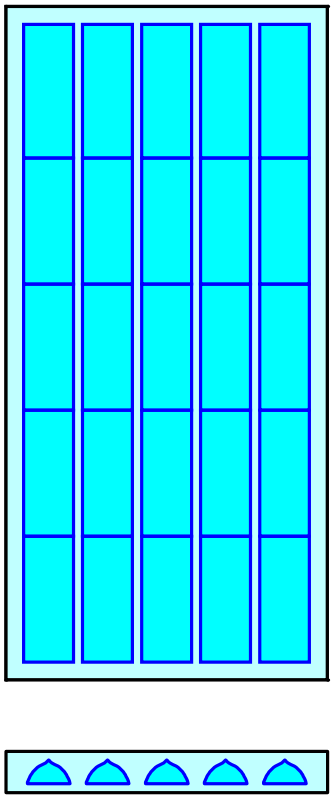
5 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 36.04' Row Length +12.0" End Stone x 2 = 38.04' Base Length
5 Rows x 34.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 18.17' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

25 Chambers x 14.7 cf +0.44' Row Adjustment x 2.07 sf x 5 Rows = 373.1 cf Chamber Storage

1,612.4 cf Field - 373.1 cf Chambers = 1,239.3 cf Stone x 40.0% Voids = 495.7 cf Stone Storage

Chamber Storage + Stone Storage = 868.8 cf = 0.0 af
Overall Storage Efficiency = 53.9%

25 Chambers
59.7 cy Field
45.9 cy Stone



Summary for Link DP 1: South - Wetland

Inflow Area =	210,664 sf,	75.99% Impervious,	Inflow Depth =	1.84"	for 2-YR event
Inflow =	7.4 cfs @	12.15 hrs, Volume=	32,245 cf		
Primary =	7.4 cfs @	12.15 hrs, Volume=	32,245 cf,	Atten= 0%,	Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs

Summary for Link DP 2: North - Culvert

Inflow Area = 73,473 sf, 39.40% Impervious, Inflow Depth = 0.02" for 2-YR event
Inflow = 0.0 cfs @ 12.58 hrs, Volume= 127 cf
Primary = 0.0 cfs @ 12.58 hrs, Volume= 127 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs

Summary for Link DP 3: Shoppers World Drive

Inflow Area =	34,613 sf,	98.21% Impervious,	Inflow Depth =	2.83"	for 2-YR event
Inflow =	2.5 cfs @	12.07 hrs, Volume=	8,154 cf		
Primary =	2.5 cfs @	12.07 hrs, Volume=	8,154 cf,	Atten= 0%,	Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs

Time span=0.00-74.00 hrs, dt=0.01 hrs, 7401 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

Subcatchment10: Subcatchment10 Runoff Area=164,554 sf 73.74% Impervious Runoff Depth=3.12"
Tc=5.0 min CN=85 Runoff=14.2 cfs 42,776 cf

Subcatchment11A: Roof (Kings) Runoff Area=21,000 sf 100.00% Impervious Runoff Depth=4.49"
Tc=5.0 min CN=98 Runoff=2.3 cfs 7,864 cf

Subcatchment11B: Roof (Restaurant) Runoff Area=8,468 sf 100.00% Impervious Runoff Depth=4.49"
Tc=5.0 min CN=98 Runoff=0.9 cfs 3,171 cf

Subcatchment11C: Roof (Ifly,) Runoff Area=4,050 sf 100.00% Impervious Runoff Depth=4.49"
Tc=5.0 min CN=98 Runoff=0.4 cfs 1,517 cf

Subcatchment11D: Roof (Additional) Runoff Area=5,227 sf 100.00% Impervious Runoff Depth=4.49"
Tc=5.0 min CN=98 Runoff=0.6 cfs 1,957 cf

Subcatchment20: Subcatchment20 Runoff Area=7,365 sf 0.00% Impervious Runoff Depth=0.15"
Tc=5.0 min CN=39 Runoff=0.0 cfs 91 cf

Subcatchment30: Subcatchment30 Runoff Area=36,250 sf 79.86% Impervious Runoff Depth=3.22"
Tc=5.0 min CN=86 Runoff=3.2 cfs 9,714 cf

Subcatchment40: Subcatchment40 Runoff Area=37,223 sf 0.00% Impervious Runoff Depth=0.05"
Flow Length=240' Tc=7.3 min CN=35 Runoff=0.0 cfs 163 cf

Subcatchment50: Subcatchment50 Runoff Area=34,613 sf 98.21% Impervious Runoff Depth=4.38"
Tc=5.0 min CN=97 Runoff=3.8 cfs 12,628 cf

Pond 1P: Existing Pond - South Peak Elev=155.85' Storage=23,291 cf Inflow=18.0 cfs 55,768 cf
Primary=0.0 cfs 0 cf Secondary=13.4 cfs 55,768 cf Outflow=13.4 cfs 55,768 cf

Pond 2P: Subsurface Basin Peak Elev=161.22' Storage=2,910 cf Inflow=3.2 cfs 9,714 cf
Discarded=0.2 cfs 7,408 cf Primary=0.7 cfs 2,308 cf Outflow=0.9 cfs 9,717 cf

Pond 3P: Subsurface Infiltration #2 Peak Elev=157.75' Storage=517 cf Inflow=0.4 cfs 1,517 cf
Discarded=0.0 cfs 1,517 cf Primary=0.0 cfs 0 cf Outflow=0.0 cfs 1,517 cf

Link DP 1: South - Wetland Inflow=13.4 cfs 55,859 cf
Primary=13.4 cfs 55,859 cf

Link DP 2: North - Culvert Inflow=0.7 cfs 2,472 cf
Primary=0.7 cfs 2,472 cf

Link DP 3: Shoppers World Drive Inflow=3.8 cfs 12,628 cf
Primary=3.8 cfs 12,628 cf

Total Runoff Area = 318,750 sf Runoff Volume = 79,882 cf Average Runoff Depth = 3.01"
30.03% Pervious = 95,714 sf 69.97% Impervious = 223,036 sf

Summary for Subcatchment 10: Subcatchment 10

Runoff = 14.2 cfs @ 12.07 hrs, Volume= 42,776 cf, Depth= 3.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.73"

Area (sf)	CN	Description
121,346	98	Paved parking, HSG A
6,895	98	Water Surface, 0% imp, HSG A
140	98	Water Surface, 0% imp, HSG D
34,373	39	>75% Grass cover, Good, HSG A
1,800	80	>75% Grass cover, Good, HSG D
164,554	85	Weighted Average
43,208		26.26% Pervious Area
121,346		73.74% Impervious Area

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

Summary for Subcatchment 11A: Roof (Kings)

Runoff = 2.3 cfs @ 12.07 hrs, Volume= 7,864 cf, Depth= 4.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.73"

Area (sf)	CN	Description
21,000	98	Roofs, HSG A
21,000		100.00% Impervious Area

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

Summary for Subcatchment 11B: Roof (Restaurant)

Runoff = 0.9 cfs @ 12.07 hrs, Volume= 3,171 cf, Depth= 4.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.73"

Area (sf)	CN	Description
8,468	98	Roofs, HSG A
8,468		100.00% Impervious Area

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

Summary for Subcatchment 11C: Roof (lfly,)

Runoff = 0.4 cfs @ 12.07 hrs, Volume= 1,517 cf, Depth= 4.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.73"

Area (sf)	CN	Description
4,050	98	Roofs, HSG A
4,050		100.00% Impervious Area

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

Summary for Subcatchment 11D: Roof (Additional)

Runoff = 0.6 cfs @ 12.07 hrs, Volume= 1,957 cf, Depth= 4.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.73"

Area (sf)	CN	Description
5,227	98	Roofs, HSG A
5,227		100.00% Impervious Area

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

Summary for Subcatchment 20: Subcatchment 20

Runoff = 0.0 cfs @ 13.73 hrs, Volume= 91 cf, Depth= 0.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.73"

Area (sf)	CN	Description
7,365	39	>75% Grass cover, Good, HSG A
7,365		100.00% Pervious Area

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

Summary for Subcatchment 30: Subcatchment 30

Runoff = 3.2 cfs @ 12.07 hrs, Volume= 9,714 cf, Depth= 3.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.73"

Area (sf)	CN	Description
28,950	98	Paved parking, HSG A
7,300	39	>75% Grass cover, Good, HSG A
36,250	86	Weighted Average
7,300		20.14% Pervious Area
28,950		79.86% Impervious Area

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

Summary for Subcatchment 40: Subcatchment 40

Runoff = 0.0 cfs @ 15.58 hrs, Volume= 163 cf, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.73"

Area (sf)	CN	Description
18,876	39	>75% Grass cover, Good, HSG A
18,347	30	Woods, Good, HSG A
37,223	35	Weighted Average
37,223		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	20	0.3000	0.35		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
3.3	30	0.0300	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
2.4	114	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	76	0.0130	1.71		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
7.3	240	Total			

Summary for Subcatchment 50: Subcatchment 50

Runoff = 3.8 cfs @ 12.07 hrs, Volume= 12,628 cf, Depth= 4.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.73"

Area (sf)	CN	Description
33,995	98	Paved parking, HSG A
618	39	>75% Grass cover, Good, HSG A
34,613	97	Weighted Average
618		1.79% Pervious Area
33,995		98.21% Impervious Area

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

Summary for Pond 1P: Existing Pond - South

Inflow Area =	203,299 sf,	78.75% Impervious,	Inflow Depth =	3.29"	for 10-YR event
Inflow =	18.0 cfs @	12.07 hrs,	Volume=	55,768 cf	
Outflow =	13.4 cfs @	12.14 hrs,	Volume=	55,768 cf,	Atten= 26%, Lag= 4.0 min
Primary =	0.0 cfs @	0.00 hrs,	Volume=	0 cf	
Secondary =	13.4 cfs @	12.14 hrs,	Volume=	55,768 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Starting Elev= 155.00' Surf.Area= 7,687 sf Storage= 16,436 cf
Peak Elev= 155.85' @ 12.14 hrs Surf.Area= 8,503 sf Storage= 23,291 cf (6,856 cf above start)

Plug-Flow detention time= 174.8 min calculated for 39,333 cf (71% of inflow)
Center-of-Mass det. time= 17.6 min (812.2 - 794.6)

Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	49,544 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
152.00	3,444	0	0
153.00	4,709	4,077	4,077
154.00	6,161	5,435	9,512
155.00	7,687	6,924	16,436
156.00	8,650	8,169	24,604
157.00	9,657	9,154	33,758
158.00	10,747	10,202	43,960
158.50	11,591	5,585	49,544

Device	Routing	Invert	Outlet Devices
#1	Primary	155.90'	**30.0" Round Culvert** L= 7.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 155.90' / 153.90' S= 0.2857 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf
#2	Device 1	154.10'	**4.0" Vert. Orifice** C= 0.600
#3	Device 1	155.30'	**45.0 deg Sharp-Crested Vee/Trap Weir** Cv= 2.56 (C= 3.20)
#4	Device 1	158.31'	**48.0" x 48.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	155.00'	**6.5' long x 20.0' 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=0.0 cfs @ 0.00 hrs HW=155.00' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Controls 0.0 cfs)
  ├─**2=Orifice** (Controls 0.0 cfs)
  ├─**3=Sharp-Crested Vee/Trap Weir** (Controls 0.0 cfs)
  └─**4=Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=13.4 cfs @ 12.14 hrs HW=155.85' TW=0.00' (Dynamic Tailwater)
└─**5=Broad-Crested Rectangular Weir** (Weir Controls 13.4 cfs @ 2.43 fps)

Summary for Pond 2P: Subsurface Basin

Inflow Area =	36,250 sf,	79.86% Impervious,	Inflow Depth =	3.22"	for 10-YR event
Inflow =	3.2 cfs @	12.07 hrs, Volume=	9,714 cf		
Outflow =	0.9 cfs @	12.40 hrs, Volume=	9,717 cf,	Atten= 71%,	Lag= 19.9 min
Discarded =	0.2 cfs @	12.40 hrs, Volume=	7,408 cf		
Primary =	0.7 cfs @	12.40 hrs, Volume=	2,308 cf		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Peak Elev= 161.22' @ 12.40 hrs Surf.Area= 3,898 sf Storage= 2,910 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 55.8 min (861.4 - 805.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	160.00'	2,726 cf	**38.17'W x 102.12'L x 2.33'H Field A** 9,094 cf Overall - 2,280 cf Embedded = 6,814 cf x 40.0% Voids
#2A	160.50'	2,280 cf	**ADS_StormTech SC-310** x 154 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 11 rows
		5,006 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	160.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	162.30'	**3.7' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Primary	160.70'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	161.50'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.2 cfs @ 12.40 hrs HW=161.22' (Free Discharge)
└─**1=Exfiltration** (Controls 0.2 cfs)

Primary OutFlow Max=0.7 cfs @ 12.40 hrs HW=161.22' TW=0.00' (Dynamic Tailwater)
├─**2=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)
├─**3=Orifice/Grate** (Orifice Controls 0.7 cfs @ 2.45 fps)
└─**4=Orifice/Grate** (Controls 0.0 cfs)

Pond 2P: Subsurface Basin - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-310 (ADS StormTech®SC-310)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
Row Length Adjustment= +0.44' x 2.07 sf x 11 rows

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

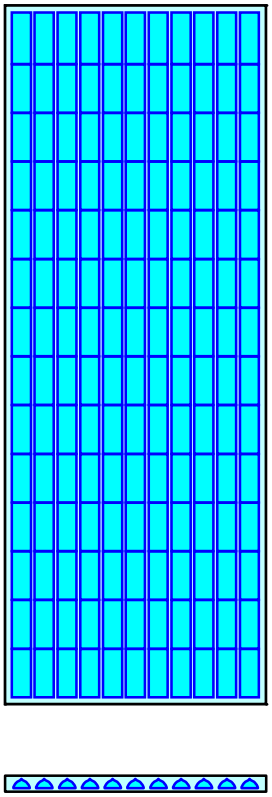
14 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 100.12' Row Length +12.0" End Stone x 2 = 102.12' Base Length
11 Rows x 34.0" Wide + 6.0" Spacing x 10 + 12.0" Side Stone x 2 = 38.17' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

154 Chambers x 14.7 cf +0.44' Row Adjustment x 2.07 sf x 11 Rows = 2,280.2 cf Chamber Storage

9,094.2 cf Field - 2,280.2 cf Chambers = 6,814.0 cf Stone x 40.0% Voids = 2,725.6 cf Stone Storage

Chamber Storage + Stone Storage = 5,005.8 cf = 0.1 af
Overall Storage Efficiency = 55.0%

154 Chambers
336.8 cy Field
252.4 cy Stone



Summary for Pond 3P: Subsurface Infiltration #2

Inflow Area =	4,050 sf,	100.00% Impervious,	Inflow Depth =	4.49"	for 10-YR event
Inflow =	0.4 cfs @	12.07 hrs,	Volume=	1,517 cf	
Outflow =	0.0 cfs @	12.92 hrs,	Volume=	1,517 cf,	Atten= 91%, Lag= 50.7 min
Discarded =	0.0 cfs @	12.92 hrs,	Volume=	1,517 cf	
Primary =	0.0 cfs @	0.00 hrs,	Volume=	0 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Peak Elev= 157.75' @ 12.92 hrs Surf.Area= 691 sf Storage= 517 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 89.9 min (837.9 - 748.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	156.50'	496 cf	**18.17'W x 38.04'L x 2.33'H Field A** 1,612 cf Overall - 373 cf Embedded = 1,239 cf x 40.0% Voids
#2A	157.00'	373 cf	**ADS_StormTech SC-310** x 25 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 5 rows
		869 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	156.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	158.80'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.0 cfs @ 12.92 hrs HW=157.75' (Free Discharge)
└**1=Exfiltration** (Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=156.50' TW=155.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 3P: Subsurface Infiltration #2 - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-310 (ADS StormTech®SC-310)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
Row Length Adjustment= +0.44' x 2.07 sf x 5 rows

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

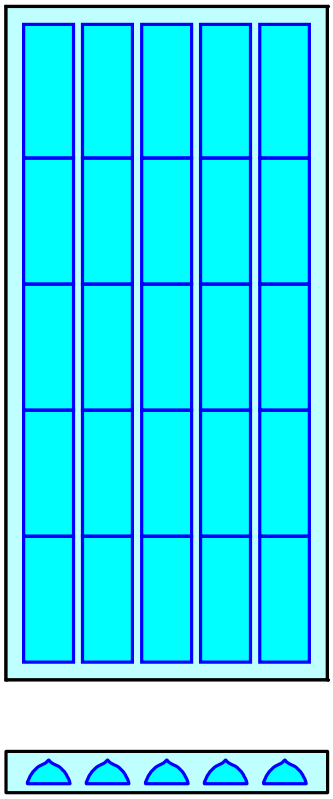
5 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 36.04' Row Length +12.0" End Stone x 2 = 38.04' Base Length
5 Rows x 34.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 18.17' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

25 Chambers x 14.7 cf +0.44' Row Adjustment x 2.07 sf x 5 Rows = 373.1 cf Chamber Storage

1,612.4 cf Field - 373.1 cf Chambers = 1,239.3 cf Stone x 40.0% Voids = 495.7 cf Stone Storage

Chamber Storage + Stone Storage = 868.8 cf = 0.0 af
Overall Storage Efficiency = 53.9%

25 Chambers
59.7 cy Field
45.9 cy Stone



Summary for Link DP 1: South - Wetland

Inflow Area = 210,664 sf, 75.99% Impervious, Inflow Depth = 3.18" for 10-YR event
Inflow = 13.4 cfs @ 12.14 hrs, Volume= 55,859 cf
Primary = 13.4 cfs @ 12.14 hrs, Volume= 55,859 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs

Summary for Link DP 2: North - Culvert

Inflow Area =	73,473 sf,	39.40% Impervious,	Inflow Depth =	0.40"	for 10-YR event
Inflow =	0.7 cfs @	12.40 hrs, Volume=	2,472 cf		
Primary =	0.7 cfs @	12.40 hrs, Volume=	2,472 cf,	Atten= 0%,	Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs

Summary for Link DP 3: Shoppers World Drive

Inflow Area =	34,613 sf,	98.21% Impervious,	Inflow Depth =	4.38"	for 10-YR event
Inflow =	3.8 cfs @	12.07 hrs, Volume=	12,628 cf		
Primary =	3.8 cfs @	12.07 hrs, Volume=	12,628 cf,	Atten= 0%,	Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs

Time span=0.00-74.00 hrs, dt=0.01 hrs, 7401 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

Subcatchment10: Subcatchment10 Runoff Area=164,554 sf 73.74% Impervious Runoff Depth=4.25"
Tc=5.0 min CN=85 Runoff=19.1 cfs 58,224 cf

Subcatchment11A: Roof (Kings) Runoff Area=21,000 sf 100.00% Impervious Runoff Depth=5.70"
Tc=5.0 min CN=98 Runoff=2.9 cfs 9,978 cf

Subcatchment11B: Roof (Restaurant) Runoff Area=8,468 sf 100.00% Impervious Runoff Depth=5.70"
Tc=5.0 min CN=98 Runoff=1.2 cfs 4,024 cf

Subcatchment11C: Roof (Ifly,) Runoff Area=4,050 sf 100.00% Impervious Runoff Depth=5.70"
Tc=5.0 min CN=98 Runoff=0.6 cfs 1,924 cf

Subcatchment11D: Roof (Additional) Runoff Area=5,227 sf 100.00% Impervious Runoff Depth=5.70"
Tc=5.0 min CN=98 Runoff=0.7 cfs 2,484 cf

Subcatchment20: Subcatchment20 Runoff Area=7,365 sf 0.00% Impervious Runoff Depth=0.43"
Tc=5.0 min CN=39 Runoff=0.0 cfs 263 cf

Subcatchment30: Subcatchment30 Runoff Area=36,250 sf 79.86% Impervious Runoff Depth=4.35"
Tc=5.0 min CN=86 Runoff=4.3 cfs 13,148 cf

Subcatchment40: Subcatchment40 Runoff Area=37,223 sf 0.00% Impervious Runoff Depth=0.24"
Flow Length=240' Tc=7.3 min CN=35 Runoff=0.0 cfs 739 cf

Subcatchment50: Subcatchment50 Runoff Area=34,613 sf 98.21% Impervious Runoff Depth=5.58"
Tc=5.0 min CN=97 Runoff=4.8 cfs 16,108 cf

Pond 1P: Existing Pond - South Peak Elev=156.04' Storage=24,977 cf Inflow=23.9 cfs 74,710 cf
Primary=0.1 cfs 43 cf Secondary=18.2 cfs 74,667 cf Outflow=18.4 cfs 74,710 cf

Pond 2P: Subsurface Basin Peak Elev=161.57' Storage=3,759 cf Inflow=4.3 cfs 13,148 cf
Discarded=0.2 cfs 8,700 cf Primary=1.2 cfs 4,450 cf Outflow=1.5 cfs 13,150 cf

Pond 3P: Subsurface Infiltration #2 Peak Elev=158.29' Storage=718 cf Inflow=0.6 cfs 1,924 cf
Discarded=0.0 cfs 1,924 cf Primary=0.0 cfs 0 cf Outflow=0.0 cfs 1,924 cf

Link DP 1: South - Wetland Inflow=18.4 cfs 74,973 cf
Primary=18.4 cfs 74,973 cf

Link DP 2: North - Culvert Inflow=1.3 cfs 5,189 cf
Primary=1.3 cfs 5,189 cf

Link DP 3: Shoppers World Drive Inflow=4.8 cfs 16,108 cf
Primary=4.8 cfs 16,108 cf

Total Runoff Area = 318,750 sf Runoff Volume = 106,891 cf Average Runoff Depth = 4.02"
30.03% Pervious = 95,714 sf 69.97% Impervious = 223,036 sf

Summary for Subcatchment 10: Subcatchment 10

Runoff = 19.1 cfs @ 12.07 hrs, Volume= 58,224 cf, Depth= 4.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.94"

Area (sf)	CN	Description
121,346	98	Paved parking, HSG A
6,895	98	Water Surface, 0% imp, HSG A
140	98	Water Surface, 0% imp, HSG D
34,373	39	>75% Grass cover, Good, HSG A
1,800	80	>75% Grass cover, Good, HSG D
164,554	85	Weighted Average
43,208		26.26% Pervious Area
121,346		73.74% Impervious Area

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

Summary for Subcatchment 11A: Roof (Kings)

Runoff = 2.9 cfs @ 12.07 hrs, Volume= 9,978 cf, Depth= 5.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.94"

Area (sf)	CN	Description
21,000	98	Roofs, HSG A
21,000		100.00% Impervious Area

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

Summary for Subcatchment 11B: Roof (Restaurant)

Runoff = 1.2 cfs @ 12.07 hrs, Volume= 4,024 cf, Depth= 5.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.94"

Area (sf)	CN	Description
8,468	98	Roofs, HSG A
8,468		100.00% Impervious Area

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

Summary for Subcatchment 11C: Roof (lfly,)

Runoff = 0.6 cfs @ 12.07 hrs, Volume= 1,924 cf, Depth= 5.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.94"

Area (sf)	CN	Description
4,050	98	Roofs, HSG A
4,050		100.00% Impervious Area

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

Summary for Subcatchment 11D: Roof (Additional)

Runoff = 0.7 cfs @ 12.07 hrs, Volume= 2,484 cf, Depth= 5.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.94"

Area (sf)	CN	Description
5,227	98	Roofs, HSG A
5,227		100.00% Impervious Area

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

Summary for Subcatchment 20: Subcatchment 20

Runoff = 0.0 cfs @ 12.33 hrs, Volume= 263 cf, Depth= 0.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.94"

Area (sf)	CN	Description
7,365	39	>75% Grass cover, Good, HSG A
7,365		100.00% Pervious Area

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

Summary for Subcatchment 30: Subcatchment 30

Runoff = 4.3 cfs @ 12.07 hrs, Volume= 13,148 cf, Depth= 4.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.94"

Area (sf)	CN	Description
28,950	98	Paved parking, HSG A
7,300	39	>75% Grass cover, Good, HSG A
36,250	86	Weighted Average
7,300		20.14% Pervious Area
28,950		79.86% Impervious Area

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

Summary for Subcatchment 40: Subcatchment 40

Runoff = 0.0 cfs @ 12.50 hrs, Volume= 739 cf, Depth= 0.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.94"

Area (sf)	CN	Description
18,876	39	>75% Grass cover, Good, HSG A
18,347	30	Woods, Good, HSG A
37,223	35	Weighted Average
37,223		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	20	0.3000	0.35		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
3.3	30	0.0300	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
2.4	114	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	76	0.0130	1.71		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
7.3	240	Total			

Summary for Subcatchment 50: Subcatchment 50

Runoff = 4.8 cfs @ 12.07 hrs, Volume= 16,108 cf, Depth= 5.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YR Rainfall=5.94"

Area (sf)	CN	Description
33,995	98	Paved parking, HSG A
618	39	>75% Grass cover, Good, HSG A
34,613	97	Weighted Average
618		1.79% Pervious Area
33,995		98.21% Impervious Area

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

Summary for Pond 1P: Existing Pond - South

Inflow Area =	203,299 sf,	78.75% Impervious,	Inflow Depth =	4.41"	for 25-YR event
Inflow =	23.9 cfs @	12.07 hrs,	Volume=	74,710 cf	
Outflow =	18.4 cfs @	12.13 hrs,	Volume=	74,710 cf,	Atten= 23%, Lag= 3.7 min
Primary =	0.1 cfs @	12.13 hrs,	Volume=	43 cf	
Secondary =	18.2 cfs @	12.13 hrs,	Volume=	74,667 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Starting Elev= 155.00' Surf.Area= 7,687 sf Storage= 16,436 cf
Peak Elev= 156.04' @ 12.13 hrs Surf.Area= 8,693 sf Storage= 24,977 cf (8,542 cf above start)

Plug-Flow detention time= 147.1 min calculated for 58,274 cf (78% of inflow)
Center-of-Mass det. time= 16.0 min (803.8 - 787.8)

Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	49,544 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
152.00	3,444	0	0
153.00	4,709	4,077	4,077
154.00	6,161	5,435	9,512
155.00	7,687	6,924	16,436
156.00	8,650	8,169	24,604
157.00	9,657	9,154	33,758
158.00	10,747	10,202	43,960
158.50	11,591	5,585	49,544

Device	Routing	Invert	Outlet Devices
#1	Primary	155.90'	**30.0" Round Culvert** L= 7.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 155.90' / 153.90' S= 0.2857 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf
#2	Device 1	154.10'	**4.0" Vert. Orifice** C= 0.600
#3	Device 1	155.30'	**45.0 deg Sharp-Crested Vee/Trap Weir** Cv= 2.56 (C= 3.20)
#4	Device 1	158.31'	**48.0" x 48.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	155.00'	**6.5' long x 20.0' 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=0.1 cfs @ 12.13 hrs HW=156.04' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 0.1 cfs @ 1.28 fps)
  ├─**2=Orifice** (Passes < 0.2 cfs potential flow)
  ├─**3=Sharp-Crested Vee/Trap Weir** (Passes < 0.4 cfs potential flow)
  └─**4=Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=18.2 cfs @ 12.13 hrs HW=156.04' TW=0.00' (Dynamic Tailwater)
└─**5=Broad-Crested Rectangular Weir** (Weir Controls 18.2 cfs @ 2.69 fps)

Summary for Pond 2P: Subsurface Basin

Inflow Area =	36,250 sf,	79.86% Impervious,	Inflow Depth =	4.35"	for 25-YR event
Inflow =	4.3 cfs @	12.07 hrs, Volume=	13,148 cf		
Outflow =	1.5 cfs @	12.34 hrs, Volume=	13,150 cf,	Atten= 66%,	Lag= 16.1 min
Discarded =	0.2 cfs @	12.34 hrs, Volume=	8,700 cf		
Primary =	1.2 cfs @	12.34 hrs, Volume=	4,450 cf		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Peak Elev= 161.57' @ 12.34 hrs Surf.Area= 3,898 sf Storage= 3,759 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 52.6 min (849.7 - 797.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	160.00'	2,726 cf	**38.17'W x 102.12'L x 2.33'H Field A** 9,094 cf Overall - 2,280 cf Embedded = 6,814 cf x 40.0% Voids
#2A	160.50'	2,280 cf	**ADS_StormTech SC-310** x 154 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 11 rows
		5,006 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	160.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	162.30'	**3.7' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Primary	160.70'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	161.50'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.2 cfs @ 12.34 hrs HW=161.57' (Free Discharge)
└─**1=Exfiltration** (Controls 0.2 cfs)

Primary OutFlow Max=1.2 cfs @ 12.34 hrs HW=161.57' TW=0.00' (Dynamic Tailwater)
├─**2=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)
├─**3=Orifice/Grate** (Orifice Controls 1.2 cfs @ 3.52 fps)
└─**4=Orifice/Grate** (Orifice Controls 0.0 cfs @ 0.90 fps)

Pond 2P: Subsurface Basin - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-310 (ADS StormTech®SC-310)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
Row Length Adjustment= +0.44' x 2.07 sf x 11 rows

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

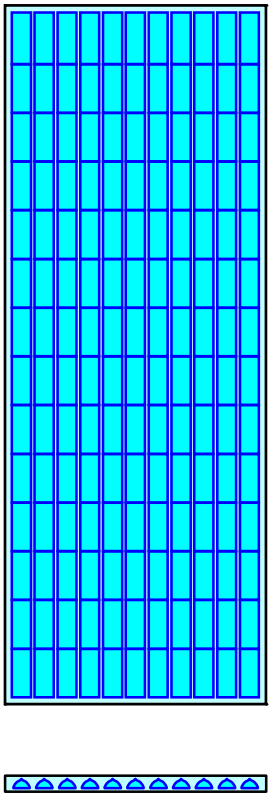
14 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 100.12' Row Length +12.0" End Stone x 2 = 102.12' Base Length
11 Rows x 34.0" Wide + 6.0" Spacing x 10 + 12.0" Side Stone x 2 = 38.17' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

154 Chambers x 14.7 cf +0.44' Row Adjustment x 2.07 sf x 11 Rows = 2,280.2 cf Chamber Storage

9,094.2 cf Field - 2,280.2 cf Chambers = 6,814.0 cf Stone x 40.0% Voids = 2,725.6 cf Stone Storage

Chamber Storage + Stone Storage = 5,005.8 cf = 0.1 af
Overall Storage Efficiency = 55.0%

154 Chambers
336.8 cy Field
252.4 cy Stone



Summary for Pond 3P: Subsurface Infiltration #2

Inflow Area =	4,050 sf,100.00% Impervious,	Inflow Depth =	5.70"	for 25-YR event	
Inflow =	0.6 cfs @	12.07 hrs,	Volume=	1,924 cf	
Outflow =	0.0 cfs @	13.20 hrs,	Volume=	1,924 cf,	Atten= 93%, Lag= 67.6 min
Discarded =	0.0 cfs @	13.20 hrs,	Volume=	1,924 cf	
Primary =	0.0 cfs @	0.00 hrs,	Volume=	0 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Peak Elev= 158.29' @ 13.20 hrs Surf.Area= 691 sf Storage= 718 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 134.0 min (878.4 - 744.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	156.50'	496 cf	**18.17'W x 38.04'L x 2.33'H Field A** 1,612 cf Overall - 373 cf Embedded = 1,239 cf x 40.0% Voids
#2A	157.00'	373 cf	**ADS_StormTech SC-310** x 25 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 5 rows
		869 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	156.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	158.80'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.0 cfs @ 13.20 hrs HW=158.29' (Free Discharge)
└─**1=Exfiltration** (Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=156.50' TW=155.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 3P: Subsurface Infiltration #2 - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-310 (ADS StormTech®SC-310)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
Row Length Adjustment= +0.44' x 2.07 sf x 5 rows

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

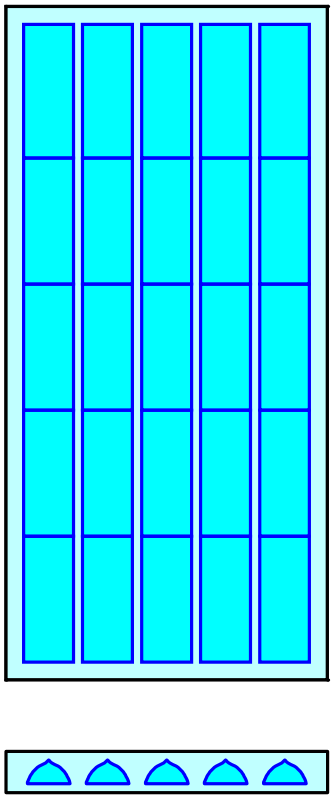
5 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 36.04' Row Length +12.0" End Stone x 2 = 38.04' Base Length
5 Rows x 34.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 18.17' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

25 Chambers x 14.7 cf +0.44' Row Adjustment x 2.07 sf x 5 Rows = 373.1 cf Chamber Storage

1,612.4 cf Field - 373.1 cf Chambers = 1,239.3 cf Stone x 40.0% Voids = 495.7 cf Stone Storage

Chamber Storage + Stone Storage = 868.8 cf = 0.0 af
Overall Storage Efficiency = 53.9%

25 Chambers
59.7 cy Field
45.9 cy Stone



Summary for Link DP 1: South - Wetland

Inflow Area = 210,664 sf, 75.99% Impervious, Inflow Depth = 4.27" for 25-YR event
Inflow = 18.4 cfs @ 12.13 hrs, Volume= 74,973 cf
Primary = 18.4 cfs @ 12.13 hrs, Volume= 74,973 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs

Summary for Link DP 2: North - Culvert

Inflow Area =	73,473 sf,	39.40% Impervious,	Inflow Depth =	0.85"	for 25-YR event
Inflow =	1.3 cfs @	12.36 hrs, Volume=	5,189 cf		
Primary =	1.3 cfs @	12.36 hrs, Volume=	5,189 cf,	Atten= 0%,	Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs

Summary for Link DP 3: Shoppers World Drive

Inflow Area =	34,613 sf,	98.21% Impervious,	Inflow Depth =	5.58"	for 25-YR event
Inflow =	4.8 cfs @	12.07 hrs, Volume=	16,108 cf		
Primary =	4.8 cfs @	12.07 hrs, Volume=	16,108 cf,	Atten= 0%,	Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs

Time span=0.00-74.00 hrs, dt=0.01 hrs, 7401 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

Subcatchment10: Subcatchment10 Runoff Area=164,554 sf 73.74% Impervious Runoff Depth=6.62"
Tc=5.0 min CN=85 Runoff=29.2 cfs 90,767 cf

Subcatchment11A: Roof (Kings) Runoff Area=21,000 sf 100.00% Impervious Runoff Depth=8.18"
Tc=5.0 min CN=98 Runoff=4.1 cfs 14,315 cf

Subcatchment11B: Roof (Restaurant) Runoff Area=8,468 sf 100.00% Impervious Runoff Depth=8.18"
Tc=5.0 min CN=98 Runoff=1.7 cfs 5,772 cf

Subcatchment11C: Roof (Ifly,) Runoff Area=4,050 sf 100.00% Impervious Runoff Depth=8.18"
Tc=5.0 min CN=98 Runoff=0.8 cfs 2,761 cf

Subcatchment11D: Roof (Additional) Runoff Area=5,227 sf 100.00% Impervious Runoff Depth=8.18"
Tc=5.0 min CN=98 Runoff=1.0 cfs 3,563 cf

Subcatchment20: Subcatchment20 Runoff Area=7,365 sf 0.00% Impervious Runoff Depth=1.34"
Tc=5.0 min CN=39 Runoff=0.2 cfs 821 cf

Subcatchment30: Subcatchment30 Runoff Area=36,250 sf 79.86% Impervious Runoff Depth=6.74"
Tc=5.0 min CN=86 Runoff=6.5 cfs 20,358 cf

Subcatchment40: Subcatchment40 Runoff Area=37,223 sf 0.00% Impervious Runoff Depth=0.95"
Flow Length=240' Tc=7.3 min CN=35 Runoff=0.4 cfs 2,951 cf

Subcatchment50: Subcatchment50 Runoff Area=34,613 sf 98.21% Impervious Runoff Depth=8.06"
Tc=5.0 min CN=97 Runoff=6.8 cfs 23,248 cf

Pond 1P: Existing Pond - South Peak Elev=156.38' Storage=27,951 cf Inflow=36.0 cfs 114,759 cf
Primary=1.4 cfs 792 cf Secondary=27.8 cfs 113,967 cf Outflow=29.2 cfs 114,759 cf

Pond 2P: Subsurface Basin Peak Elev=162.56' Storage=5,006 cf Inflow=6.5 cfs 20,358 cf
Discarded=0.2 cfs 10,844 cf Primary=4.8 cfs 9,515 cf Outflow=5.1 cfs 20,358 cf

Pond 3P: Subsurface Infiltration #2 Peak Elev=158.93' Storage=869 cf Inflow=0.8 cfs 2,761 cf
Discarded=0.0 cfs 2,419 cf Primary=0.6 cfs 342 cf Outflow=0.6 cfs 2,761 cf

Link DP 1: South - Wetland Inflow=29.4 cfs 115,580 cf
Primary=29.4 cfs 115,580 cf

Link DP 2: North - Culvert Inflow=5.3 cfs 12,466 cf
Primary=5.3 cfs 12,466 cf

Link DP 3: Shoppers World Drive Inflow=6.8 cfs 23,248 cf
Primary=6.8 cfs 23,248 cf

Total Runoff Area = 318,750 sf Runoff Volume = 164,555 cf Average Runoff Depth = 6.20"
30.03% Pervious = 95,714 sf 69.97% Impervious = 223,036 sf

Summary for Subcatchment 10: Subcatchment 10

Runoff = 29.2 cfs @ 12.07 hrs, Volume= 90,767 cf, Depth= 6.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=8.42"

Area (sf)	CN	Description
121,346	98	Paved parking, HSG A
6,895	98	Water Surface, 0% imp, HSG A
140	98	Water Surface, 0% imp, HSG D
34,373	39	>75% Grass cover, Good, HSG A
1,800	80	>75% Grass cover, Good, HSG D
164,554	85	Weighted Average
43,208		26.26% Pervious Area
121,346		73.74% Impervious Area

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

Summary for Subcatchment 11A: Roof (Kings)

Runoff = 4.1 cfs @ 12.07 hrs, Volume= 14,315 cf, Depth= 8.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=8.42"

Area (sf)	CN	Description
21,000	98	Roofs, HSG A
21,000		100.00% Impervious Area

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

Summary for Subcatchment 11B: Roof (Restaurant)

Runoff = 1.7 cfs @ 12.07 hrs, Volume= 5,772 cf, Depth= 8.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=8.42"

Area (sf)	CN	Description
8,468	98	Roofs, HSG A
8,468		100.00% Impervious Area

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

Summary for Subcatchment 11C: Roof (lfly,)

Runoff = 0.8 cfs @ 12.07 hrs, Volume= 2,761 cf, Depth= 8.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=8.42"

Area (sf)	CN	Description
4,050	98	Roofs, HSG A
4,050		100.00% Impervious Area

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

Summary for Subcatchment 11D: Roof (Additional)

Runoff = 1.0 cfs @ 12.07 hrs, Volume= 3,563 cf, Depth= 8.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=8.42"

Area (sf)	CN	Description
5,227	98	Roofs, HSG A
5,227		100.00% Impervious Area

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

Summary for Subcatchment 20: Subcatchment 20

Runoff = 0.2 cfs @ 12.10 hrs, Volume= 821 cf, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=8.42"

Area (sf)	CN	Description
7,365	39	>75% Grass cover, Good, HSG A
7,365		100.00% Pervious Area

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

Summary for Subcatchment 30: Subcatchment 30

Runoff = 6.5 cfs @ 12.07 hrs, Volume= 20,358 cf, Depth= 6.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=8.42"

Area (sf)	CN	Description
28,950	98	Paved parking, HSG A
7,300	39	>75% Grass cover, Good, HSG A
36,250	86	Weighted Average
7,300		20.14% Pervious Area
28,950		79.86% Impervious Area

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

Summary for Subcatchment 40: Subcatchment 40

Runoff = 0.4 cfs @ 12.16 hrs, Volume= 2,951 cf, Depth= 0.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=8.42"

Area (sf)	CN	Description
18,876	39	>75% Grass cover, Good, HSG A
18,347	30	Woods, Good, HSG A
37,223	35	Weighted Average
37,223		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	20	0.3000	0.35		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
3.3	30	0.0300	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.00"
2.4	114	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	76	0.0130	1.71		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
7.3	240	Total			

Summary for Subcatchment 50: Subcatchment 50

Runoff = 6.8 cfs @ 12.07 hrs, Volume= 23,248 cf, Depth= 8.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=8.42"

Area (sf)	CN	Description
33,995	98	Paved parking, HSG A
618	39	>75% Grass cover, Good, HSG A
34,613	97	Weighted Average
618		1.79% Pervious Area
33,995		98.21% Impervious Area

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

Summary for Pond 1P: Existing Pond - South

Inflow Area =	203,299 sf,	78.75% Impervious,	Inflow Depth =	6.77"	for 100-YR event
Inflow =	36.0 cfs @	12.07 hrs,	Volume=	114,759 cf	
Outflow =	29.2 cfs @	12.12 hrs,	Volume=	114,759 cf,	Atten= 19%, Lag= 3.2 min
Primary =	1.4 cfs @	12.12 hrs,	Volume=	792 cf	
Secondary =	27.8 cfs @	12.12 hrs,	Volume=	113,967 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Starting Elev= 155.00' Surf.Area= 7,687 sf Storage= 16,436 cf
Peak Elev= 156.38' @ 12.12 hrs Surf.Area= 9,031 sf Storage= 27,951 cf (11,515 cf above start)

Plug-Flow detention time= 116.4 min calculated for 98,310 cf (86% of inflow)
Center-of-Mass det. time= 14.1 min (791.9 - 777.8)

Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	49,544 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
152.00	3,444	0	0
153.00	4,709	4,077	4,077
154.00	6,161	5,435	9,512
155.00	7,687	6,924	16,436
156.00	8,650	8,169	24,604
157.00	9,657	9,154	33,758
158.00	10,747	10,202	43,960
158.50	11,591	5,585	49,544

Device	Routing	Invert	Outlet Devices
#1	Primary	155.90'	**30.0" Round Culvert** L= 7.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 155.90' / 153.90' S= 0.2857 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 4.91 sf
#2	Device 1	154.10'	**4.0" Vert. Orifice** C= 0.600
#3	Device 1	155.30'	**45.0 deg Sharp-Crested Vee/Trap Weir** Cv= 2.56 (C= 3.20)
#4	Device 1	158.31'	**48.0" x 48.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	155.00'	**6.5' long x 20.0' 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=1.4 cfs @ 12.12 hrs HW=156.38' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 1.4 cfs of 1.5 cfs potential flow)
  ├─**2=Orifice** (Orifice Controls 0.3 cfs @ 3.33 fps)
  ├─**3=Sharp-Crested Vee/Trap Weir** (Weir Controls 1.2 cfs @ 2.40 fps)
  └─**4=Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=27.7 cfs @ 12.12 hrs HW=156.38' TW=0.00' (Dynamic Tailwater)
└─**5=Broad-Crested Rectangular Weir** (Weir Controls 27.7 cfs @ 3.10 fps)

Summary for Pond 2P: Subsurface Basin

Inflow Area =	36,250 sf,	79.86% Impervious,	Inflow Depth =	6.74"	for 100-YR event
Inflow =	6.5 cfs @	12.07 hrs,	Volume=	20,358 cf	
Outflow =	5.1 cfs @	12.15 hrs,	Volume=	20,358 cf,	Atten= 22%, Lag= 4.6 min
Discarded =	0.2 cfs @	12.15 hrs,	Volume=	10,844 cf	
Primary =	4.8 cfs @	12.15 hrs,	Volume=	9,515 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Peak Elev= 162.56' @ 12.15 hrs Surf.Area= 3,898 sf Storage= 5,006 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 47.6 min (832.8 - 785.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	160.00'	2,726 cf	**38.17'W x 102.12'L x 2.33'H Field A** 9,094 cf Overall - 2,280 cf Embedded = 6,814 cf x 40.0% Voids
#2A	160.50'	2,280 cf	**ADS_StormTech SC-310** x 154 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 11 rows
		5,006 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	160.00'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	162.30'	**3.7' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Primary	160.70'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	161.50'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.2 cfs @ 12.15 hrs HW=162.53' (Free Discharge)
└─**1=Exfiltration** (Controls 0.2 cfs)

Primary OutFlow Max=4.7 cfs @ 12.15 hrs HW=162.54' TW=0.00' (Dynamic Tailwater)
├─**2=Broad-Crested Rectangular Weir** (Weir Controls 1.2 cfs @ 1.38 fps)
├─**3=Orifice/Grate** (Orifice Controls 2.1 cfs @ 5.91 fps)
└─**4=Orifice/Grate** (Orifice Controls 1.4 cfs @ 4.04 fps)

Pond 2P: Subsurface Basin - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-310 (ADS StormTech®SC-310)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
Row Length Adjustment= +0.44' x 2.07 sf x 11 rows

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

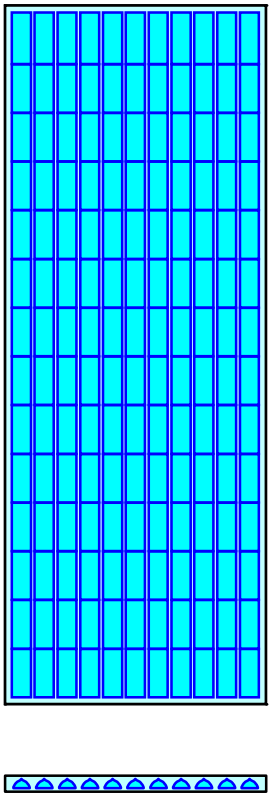
14 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 100.12' Row Length +12.0" End Stone x 2 = 102.12' Base Length
11 Rows x 34.0" Wide + 6.0" Spacing x 10 + 12.0" Side Stone x 2 = 38.17' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

154 Chambers x 14.7 cf +0.44' Row Adjustment x 2.07 sf x 11 Rows = 2,280.2 cf Chamber Storage

9,094.2 cf Field - 2,280.2 cf Chambers = 6,814.0 cf Stone x 40.0% Voids = 2,725.6 cf Stone Storage

Chamber Storage + Stone Storage = 5,005.8 cf = 0.1 af
Overall Storage Efficiency = 55.0%

154 Chambers
336.8 cy Field
252.4 cy Stone



Summary for Pond 3P: Subsurface Infiltration #2

Inflow Area =	4,050 sf,100.00% Impervious,	Inflow Depth =	8.18"	for	100-YR event
Inflow =	0.8 cfs @	12.07 hrs, Volume=	2,761 cf		
Outflow =	0.6 cfs @	12.23 hrs, Volume=	2,761 cf,	Atten= 26%,	Lag= 9.6 min
Discarded =	0.0 cfs @	12.23 hrs, Volume=	2,419 cf		
Primary =	0.6 cfs @	12.23 hrs, Volume=	342 cf		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs
Peak Elev= 158.93' @ 12.23 hrs Surf.Area= 691 sf Storage= 869 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 150.7 min (890.3 - 739.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	156.50'	496 cf	**18.17'W x 38.04'L x 2.33'H Field A** 1,612 cf Overall - 373 cf Embedded = 1,239 cf x 40.0% Voids
#2A	157.00'	373 cf	**ADS_StormTech SC-310** x 25 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 5 rows
		869 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	156.50'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 0.00'
#2	Primary	158.80'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.0 cfs @ 12.23 hrs HW=158.93' (Free Discharge)
└─**1=Exfiltration** (Controls 0.0 cfs)

Primary OutFlow Max=0.5 cfs @ 12.23 hrs HW=158.93' TW=156.16' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 0.5 cfs @ 1.02 fps)

Pond 3P: Subsurface Infiltration #2 - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-310 (ADS StormTech®SC-310)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
Row Length Adjustment= +0.44' x 2.07 sf x 5 rows

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

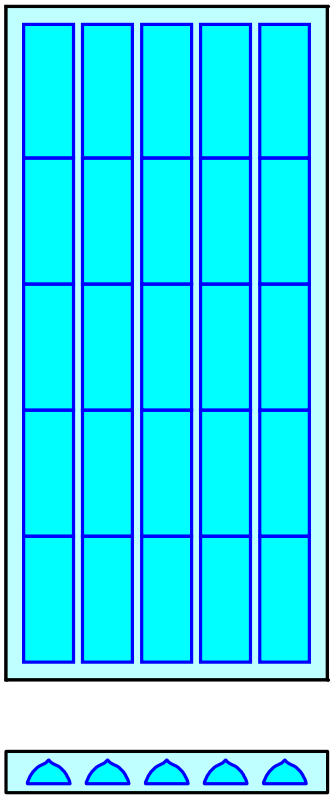
5 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 36.04' Row Length +12.0" End Stone x 2 = 38.04' Base Length
5 Rows x 34.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 18.17' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

25 Chambers x 14.7 cf +0.44' Row Adjustment x 2.07 sf x 5 Rows = 373.1 cf Chamber Storage

1,612.4 cf Field - 373.1 cf Chambers = 1,239.3 cf Stone x 40.0% Voids = 495.7 cf Stone Storage

Chamber Storage + Stone Storage = 868.8 cf = 0.0 af
Overall Storage Efficiency = 53.9%

25 Chambers
59.7 cy Field
45.9 cy Stone



Summary for Link DP 1: South - Wetland

Inflow Area = 210,664 sf, 75.99% Impervious, Inflow Depth = 6.58" for 100-YR event
Inflow = 29.4 cfs @ 12.12 hrs, Volume= 115,580 cf
Primary = 29.4 cfs @ 12.12 hrs, Volume= 115,580 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs

Summary for Link DP 2: North - Culvert

Inflow Area = 73,473 sf, 39.40% Impervious, Inflow Depth = 2.04" for 100-YR event
Inflow = 5.3 cfs @ 12.15 hrs, Volume= 12,466 cf
Primary = 5.3 cfs @ 12.15 hrs, Volume= 12,466 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs

Summary for Link DP 3: Shoppers World Drive

Inflow Area =	34,613 sf,	98.21% Impervious,	Inflow Depth =	8.06"	for 100-YR event
Inflow =	6.8 cfs @	12.07 hrs, Volume=	23,248 cf		
Primary =	6.8 cfs @	12.07 hrs, Volume=	23,248 cf,	Atten= 0%,	Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-74.00 hrs, dt= 0.01 hrs

Recharge Calculations

Project Name:	**Shoppers World**	**Proj. No.:**	12642.0
Project Location:	**Framingham/ Natick, MA**	**Date:**	7/15/2015
		REV. Date:	6/8/2016
		Calculated by:	PLH
		Checked by:	NSS

Proposed Impervious Surface Summary - Design Point 2

Net Proposed Impervious Areas by Hydrologic Soil Group (HSG) in acres

Subcatchment	HSG A	HSG B	HSG C	HSG D	Total Area
30	0.2				0.2
11D	0.1				0.1
TOTAL	**0.2**	**0.0**	**0.0**	**0.0**	**0.3**

Required Recharge Volume (Cubic Feet)

HSG	Area (acres)	Recharge Depth * (in.)	Volume (c.f.)
A	0.3	0.60	697
B	0.0	0.35	0
C	0.0	0.25	0
D	0.0	0.10	0
TOTAL			**697**

* Per 2008 Massachusetts DEP Recharge Requirement

Provided Recharge Volume (Cubic Feet)

Infiltration Volumes Provided in Infiltration Basins (below lowest overflow outlet)

Subsurface Infiltration #1 (2P)	2582.00	
Subsurface Infiltration #2 (3P)	860.00	
Total	**3,442.00**	c.f.

Basin Drawdown Time

Basin to drain within 72 hours

Subsurface Infiltration System #1

Storage Volume (cf)	2,582.00	
Hydraulic Conductivity (K) (in/hr)	2.41	Based on Rawls Rate for Sandy Loam
Bottom Area (sf)	3,897	

$$Time_{drawdown} = \frac{StorageVolume}{(K)(BottomArea)}$$

Drawdown Time (hours)	**3.30**

Subsurface Infiltration System #2

Storage Volume (cf)	860.00	
Hydraulic Conductivity (K) (in/hr)	2.41	Based on Rawls Rate for Sandy Loam
Bottom Area (sf)	691	

$$Time_{drawdown} = \frac{StorageVolume}{(K)(BottomArea)}$$

Drawdown Time (hours)	**6.20**

TSS Removal Calculation Worksheet

Vanasse Hangen Brustlin, Inc.
Consulting Engineers and Planners
101 Walnut Street
Watertown, MA 02471
(617) 924-1770

Project Name:	**Shoppers World**	Sheet:	**1 of 1**
Project Number:	**12642.00**	Date:	**5-Aug-2015**
Location:	**Framingham/Natick, MA**	Computed by:	**PLH**
Discharge Point:	**DP 1**	Checked by:	**NSS**
Drainage Area(s):	**Subcatchments 10, 11, 20**		

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (B*C)	Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**25%**	**1.00**	**0.25**	**0.75**
Stormceptor STC-900	**75%**	**0.75**	**0.56**	**0.19**
Wet Basin	**80%**	**0.19**	**0.15**	**0.04**
	0%	**0.04**	**0.00**	**0.04**
	0%	**0.04**	**0.00**	**0.04**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.
Removal rates for proprietary devices are from approved studies and/or manufacturer data
***To be conservative, 75% removal is used for this calculation based upon the NJCAT study provided on the MA STEP website.

Treatment Train TSS Removal = **96%**

TSS Removal Calculation Worksheet

Vanasse Hangen Brustlin, Inc.
Consulting Engineers and Planners
101 Walnut Street
Watertown, MA 02471
(617) 924-1770

Project Name:	**Shoppers World**	Sheet:	**1 of 1**
Project Number:	**12642.00**	Date:	**5-Aug-2015**
Location:	**Framingham/Natick, MA**	Computed by:	**PLH**
Discharge Point:	**DP 2**	Checked by:	**NSS**
Drainage Area(s):	**Subcatchments 30**		

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (B*C)	Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**25%**	**1.00**	**0.25**	**0.75**
Isolator Row	**25%**	**0.75**	**0.19**	**0.56**
Subsurface Infiltration Structure	**80%**	**0.56**	**0.45**	**0.11**
	0%	**0.11**	**0.00**	**0.11**
	0%	**0.11**	**0.00**	**0.11**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.
Removal rates for proprietary devices are from manufacturer data
** Equals remaining load from previous BMP (E)

Treatment Train TSS Removal = **89%**