

**Summary for Subcatchment 5S: Lower Paved Area**

Runoff = 0.27 cfs @ 12.08 hrs, Volume= 933 cf, Depth> 2.83"

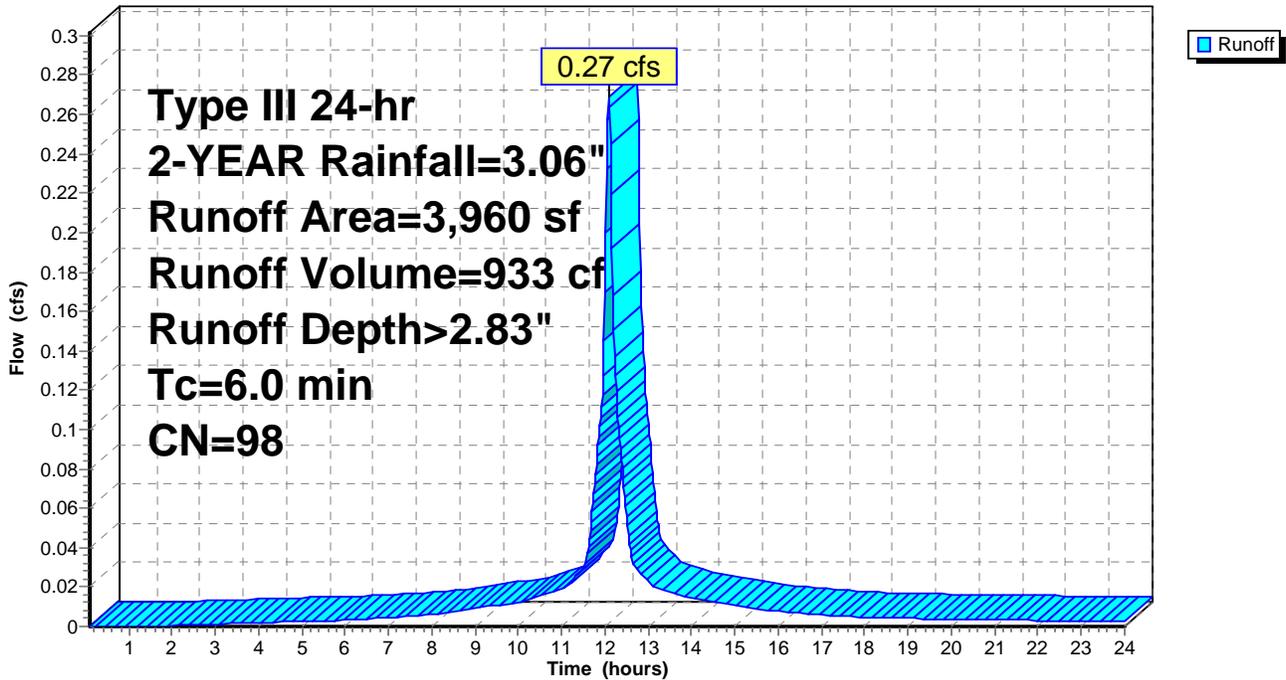
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs  
 Type III 24-hr 2-YEAR Rainfall=3.06"

Area (sf)	CN	Description
3,960	98	Paved parking, HSG A
3,960		100.00% Impervious Area

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

**Subcatchment 5S: Lower Paved Area**

Hydrograph



**Summary for Subcatchment 6S: Remaining Project Area**

Runoff = 0.06 cfs @ 14.72 hrs, Volume= 1,506 cf, Depth> 0.08"

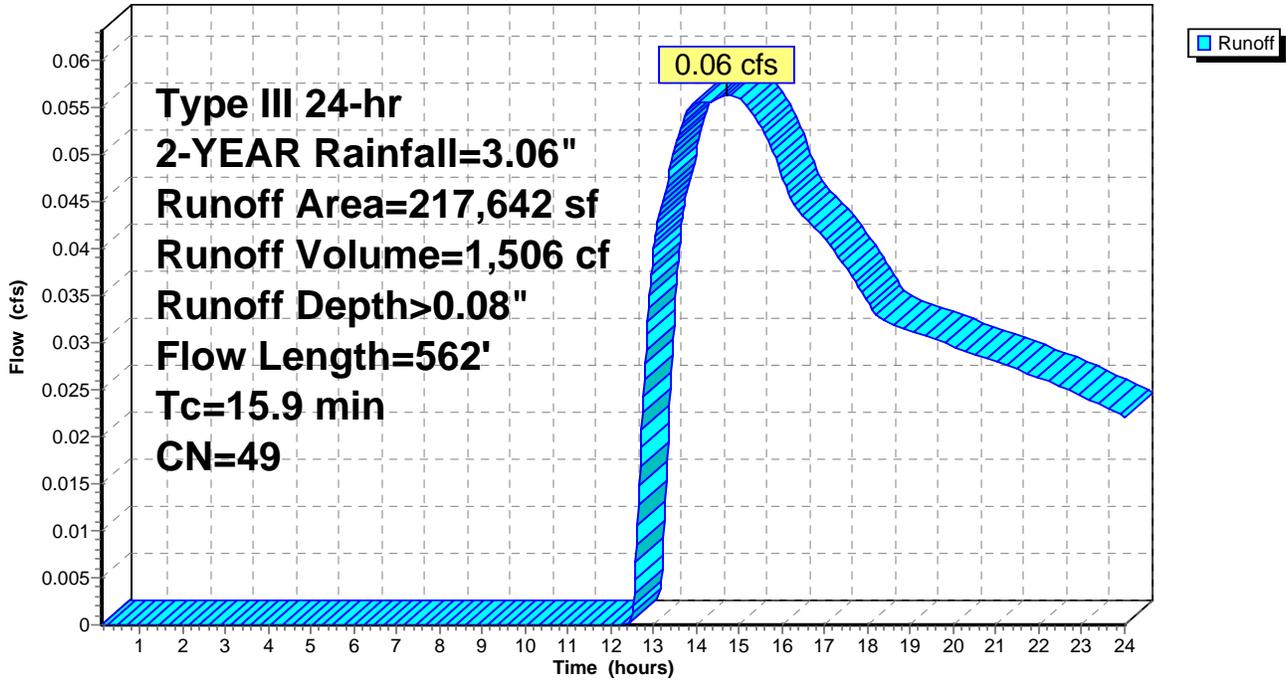
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs  
Type III 24-hr 2-YEAR Rainfall=3.06"

Area (sf)	CN	Description
2,763	49	50-75% Grass cover, Fair, HSG A
9,597	76	Gravel roads, HSG A
8,274	98	Paved parking, HSG A
7,927	49	50-75% Grass cover, Fair, HSG A
27,757	78	Meadow, non-grazed, HSG D
28,946	77	Woods, Good, HSG D
78,485	30	Woods, Good, HSG A
39,143	30	Meadow, non-grazed, HSG A
11,968	30	Woods, Good, HSG A
* 2,782	76	Gravel roads, HSG A (RIP RAP)
217,642	49	Weighted Average
209,368		96.20% Pervious Area
8,274		3.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.0500	0.10		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.06"
0.3	36	0.1676	2.05		<b>Shallow Concentrated Flow, woods pre grass strip</b> Woodland Kv= 5.0 fps
0.1	10	0.1000	2.21		<b>Shallow Concentrated Flow, grass strips (both)</b> Short Grass Pasture Kv= 7.0 fps
0.0	12	0.0833	5.86		<b>Shallow Concentrated Flow, pavement</b> Paved Kv= 20.3 fps
6.7	440	0.0480	1.10		<b>Shallow Concentrated Flow, rip rap</b> Woodland Kv= 5.0 fps
0.1	14	0.1667	2.86		<b>Shallow Concentrated Flow, grass strip</b> Short Grass Pasture Kv= 7.0 fps
15.9	562	Total			

### Subcatchment 6S: Remaining Project Area

Hydrograph



**Summary for Subcatchment EX: Existing Site**

Runoff = 0.08 cfs @ 13.84 hrs, Volume= 2,027 cf, Depth> 0.10"

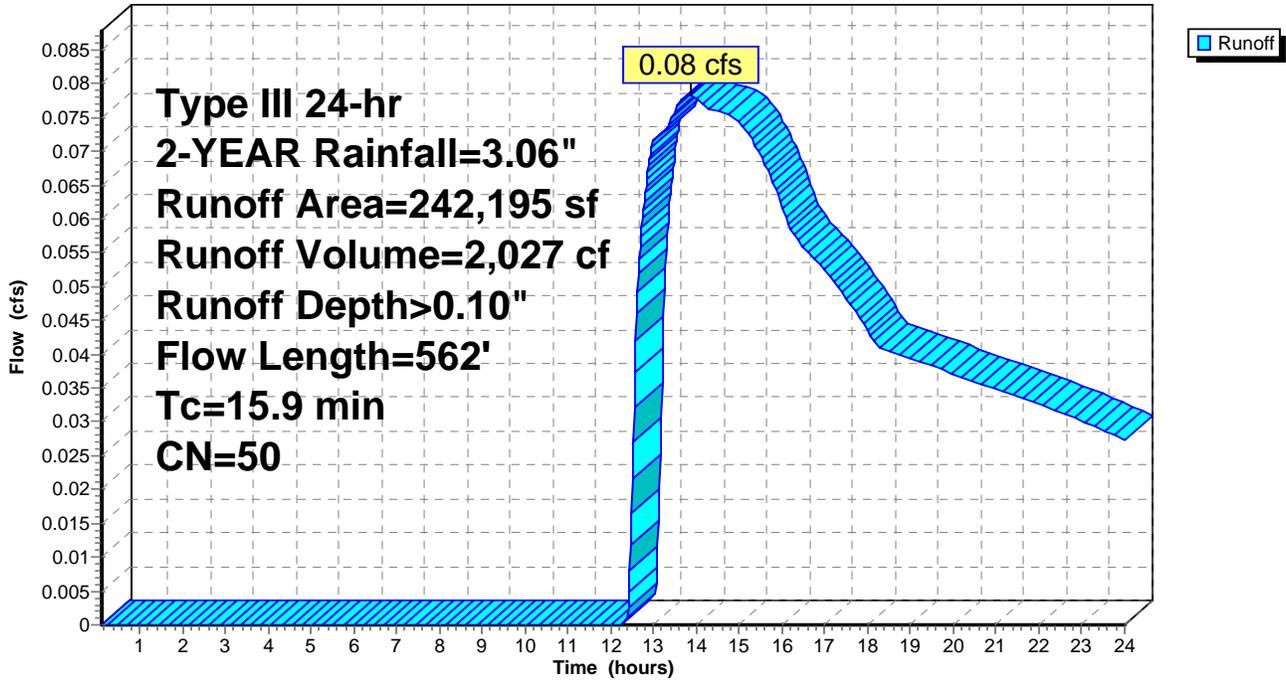
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs  
Type III 24-hr 2-YEAR Rainfall=3.06"

Area (sf)	CN	Description
11,475	49	50-75% Grass cover, Fair, HSG A
3,181	76	Gravel roads, HSG A
17,374	98	Paved parking, HSG A
4,242	49	50-75% Grass cover, Fair, HSG A
8,728	49	50-75% Grass cover, Fair, HSG A
* 3,480	76	Gravel roads, HSG A (RIP RAP)
59,405	77	Woods, Good, HSG D
82,915	30	Woods, Good, HSG A
9,737	30	Woods, Good, HSG A
41,658	30	Woods, Good, HSG A
242,195	50	Weighted Average
224,821		92.83% Pervious Area
17,374		7.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.0500	0.10		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.06"
0.3	36	0.1676	2.05		<b>Shallow Concentrated Flow, woods</b> Woodland Kv= 5.0 fps
0.0	12	0.1000	6.42		<b>Shallow Concentrated Flow, pavement</b> Paved Kv= 20.3 fps
0.1	10	0.1000	2.21		<b>Shallow Concentrated Flow, grass strip (both)</b> Short Grass Pasture Kv= 7.0 fps
6.7	440	0.0480	1.10		<b>Shallow Concentrated Flow, rip rap</b> Woodland Kv= 5.0 fps
0.1	14	0.1667	2.86		<b>Shallow Concentrated Flow, final grass strip</b> Short Grass Pasture Kv= 7.0 fps
15.9	562	Total			

### Subcatchment EX: Existing Site

Hydrograph



### Summary for Reach END: Proposed Site Runoff

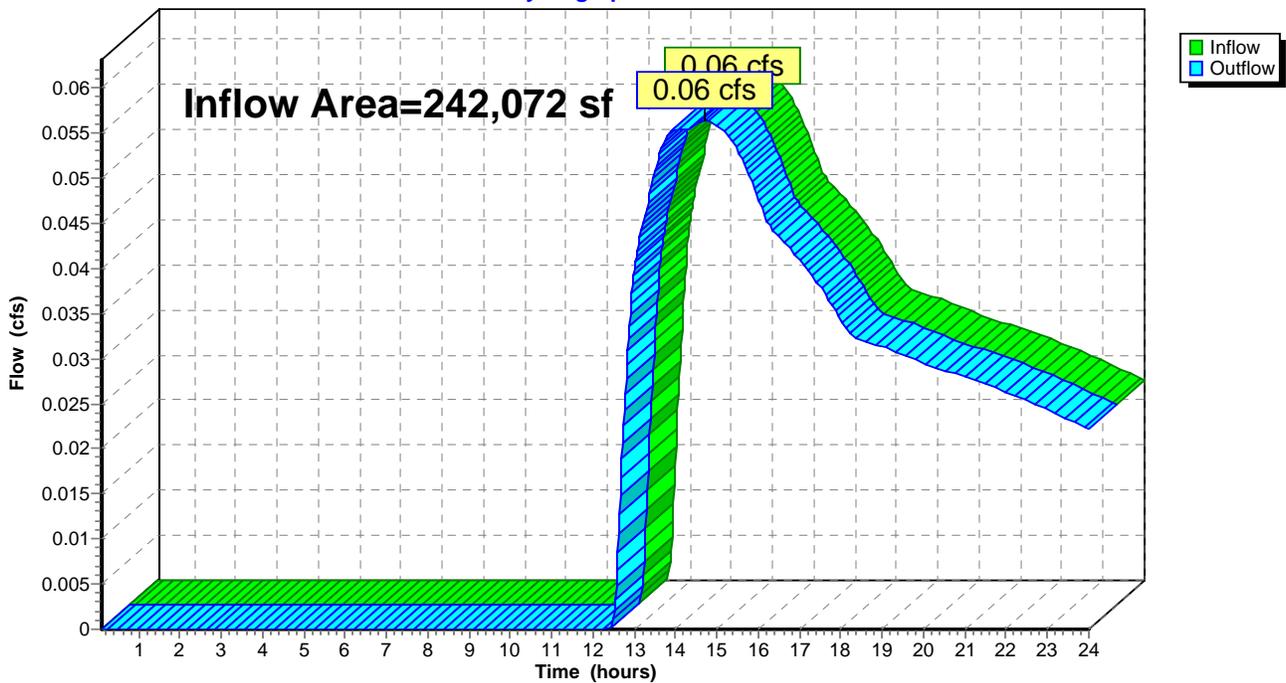
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 242,072 sf, 12.23% Impervious, Inflow Depth > 0.07" for 2-YEAR event  
Inflow = 0.06 cfs @ 14.72 hrs, Volume= 1,506 cf  
Outflow = 0.06 cfs @ 14.72 hrs, Volume= 1,506 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3

### Reach END: Proposed Site Runoff

Hydrograph



**Summary for Pond C1: Northeast Cultecs**

Inflow Area = 14,491 sf, 78.64% Impervious, Inflow Depth > 1.95" for 2-YEAR event  
 Inflow = 0.74 cfs @ 12.09 hrs, Volume= 2,357 cf  
 Outflow = 0.16 cfs @ 13.05 hrs, Volume= 1,884 cf, Atten= 79%, Lag= 57.5 min  
 Discarded = 0.00 cfs @ 0.10 hrs, Volume= 0 cf  
 Primary = 0.16 cfs @ 13.05 hrs, Volume= 1,884 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 232.17' @ 12.53 hrs Surf.Area= 0.046 ac Storage= 0.025 af

Plug-Flow detention time= 171.0 min calculated for 1,884 cf (80% of inflow)  
 Center-of-Mass det. time= 94.0 min ( 899.0 - 805.0 )

Volume	Invert	Avail.Storage	Storage Description
#1A	231.17'	0.018 af	<b>14.50'W x 84.75'L x 2.54'H Field A</b> 0.072 af Overall - 0.020 af Embedded = 0.052 af x 35.0% Voids
#2A	231.67'	0.020 af	<b>Cultec R-150XLHD x 32 Inside #1</b> Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap Row Length Adjustment= +0.75' x 2.65 sf x 4 rows
#3B	231.17'	0.012 af	<b>14.50'W x 54.00'L x 2.54'H Field B</b> 0.046 af Overall - 0.013 af Embedded = 0.033 af x 35.0% Voids
#4B	231.67'	0.013 af	<b>Cultec R-150XLHD x 20 Inside #3</b> Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap Row Length Adjustment= +0.75' x 2.65 sf x 4 rows
		0.062 af	Total Available Storage

Storage Group A created with Chamber Wizard  
 Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	231.17'	<b>0.090 in/hr Exfiltration X 0.00 over Surface area</b> Phase-In= 0.01'
#2	Primary	231.67'	<b>4.0" Round Culvert</b> L= 145.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 231.67' / 230.95' S= 0.0050 '/ Cc= 0.900 n= 0.012, Flow Area= 0.09 sf
#3	Primary	232.33'	<b>8.0" Round Culvert</b> L= 145.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.33' / 231.44' S= 0.0061 '/ Cc= 0.900 n= 0.012, Flow Area= 0.35 sf

**Discarded OutFlow** Max=0.00 cfs @ 0.10 hrs HW=231.17' (Free Discharge)  
 ↳1=Exfiltration ( Controls 0.00 cfs)

**Primary OutFlow** Max=0.16 cfs @ 13.05 hrs HW=232.09' TW=230.33' (Dynamic Tailwater)  
 ↳2=Culvert (Barrel Controls 0.16 cfs @ 1.83 fps)  
 ↳3=Culvert ( Controls 0.00 cfs)

**Pond C1: Northeast Cultecs - Chamber Wizard Field A**

**Chamber Model = Cultec R-150XLHD (Cultec Recharger® 150XLHD)**

Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf

Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap

Row Length Adjustment= +0.75' x 2.65 sf x 4 rows

33.0" Wide + 6.0" Spacing = 39.0" C-C Row Spacing

8 Chambers/Row x 10.25' Long +0.75' Row Adjustment = 82.75' Row Length +12.0" End Stone x 2 = 84.75' Base Length

4 Rows x 33.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 14.50' Base Width

6.0" Base + 18.5" Chamber Height + 6.0" Cover = 2.54' Field Height

32 Chambers x 27.2 cf +0.75' Row Adjustment x 2.65 sf x 4 Rows = 876.8 cf Chamber Storage

3,123.4 cf Field - 876.8 cf Chambers = 2,246.6 cf Stone x 35.0% Voids = 786.3 cf Stone Storage

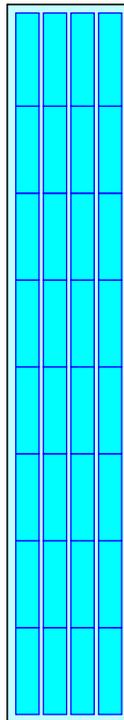
Chamber Storage + Stone Storage = 1,663.1 cf = 0.038 af

Overall Storage Efficiency = 53.2%

32 Chambers

115.7 cy Field

83.2 cy Stone



**Pond C1: Northeast Cultecs - Chamber Wizard Field B**

**Chamber Model = Cultec R-150XLHD (Cultec Recharger® 150XLHD)**

Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf

Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap

Row Length Adjustment= +0.75' x 2.65 sf x 4 rows

33.0" Wide + 6.0" Spacing = 39.0" C-C Row Spacing

5 Chambers/Row x 10.25' Long +0.75' Row Adjustment = 52.00' Row Length +12.0" End Stone x 2 = 54.00' Base Length

4 Rows x 33.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 14.50' Base Width

6.0" Base + 18.5" Chamber Height + 6.0" Cover = 2.54' Field Height

20 Chambers x 27.2 cf +0.75' Row Adjustment x 2.65 sf x 4 Rows = 551.0 cf Chamber Storage

1,990.1 cf Field - 551.0 cf Chambers = 1,439.1 cf Stone x 35.0% Voids = 503.7 cf Stone Storage

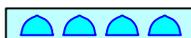
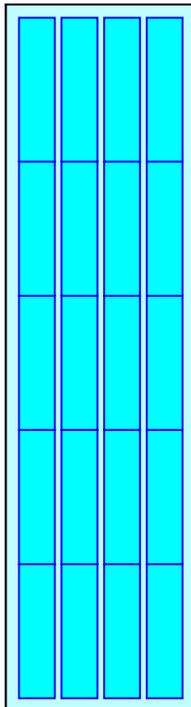
Chamber Storage + Stone Storage = 1,054.7 cf = 0.024 af

Overall Storage Efficiency = 53.0%

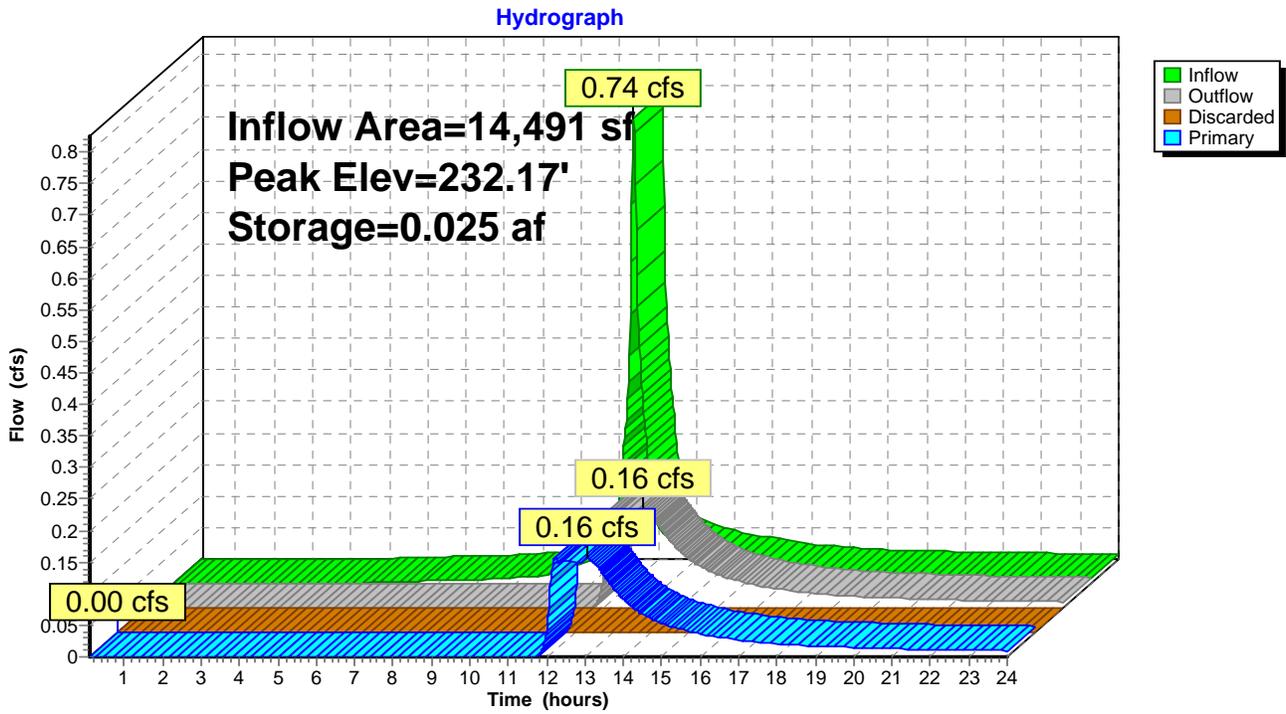
20 Chambers

73.7 cy Field

53.3 cy Stone



### Pond C1: Northeast Cultecs



**Summary for Pond C2: Intermediate Cultecs**

Inflow Area = 17,721 sf, 82.53% Impervious, Inflow Depth > 1.79" for 2-YEAR event  
 Inflow = 0.33 cfs @ 12.11 hrs, Volume= 2,645 cf  
 Outflow = 0.20 cfs @ 12.48 hrs, Volume= 2,644 cf, Atten= 38%, Lag= 22.4 min  
 Discarded = 0.06 cfs @ 13.35 hrs, Volume= 1,899 cf  
 Primary = 0.14 cfs @ 12.48 hrs, Volume= 746 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 230.35' @ 13.35 hrs Surf.Area= 392 sf Storage= 313 cf  
 Flood Elev= 233.94' Surf.Area= 392 sf Storage= 950 cf

Plug-Flow detention time= 29.6 min calculated for 2,644 cf (100% of inflow)  
 Center-of-Mass det. time= 29.6 min ( 887.6 - 858.1 )

Volume	Invert	Avail.Storage	Storage Description
#1A	228.78'	447 cf	<b>16.00'W x 24.50'L x 4.54'H Field A</b> 1,780 cf Overall - 503 cf Embedded = 1,277 cf x 35.0% Voids
#2A	229.78'	503 cf	<b>Cultec R-330XLHD x 9 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		950 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	228.78'	<b>5.100 in/hr Exfiltration over Wetted area</b> Phase-In= 0.01'
#2	Primary	230.00'	<b>8.0" Round Culvert</b> L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 230.00' / 230.00' S= 0.0000 1/ S= 0.0000 1/ Cc= 0.900 n= 0.012, Flow Area= 0.35 sf

**Discarded OutFlow** Max=0.06 cfs @ 13.35 hrs HW=230.35' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

**Primary OutFlow** Max=0.14 cfs @ 12.48 hrs HW=230.30' TW=230.15' (Dynamic Tailwater)

↑**2=Culvert** (Barrel Controls 0.14 cfs @ 1.37 fps)

**Pond C2: Intermediate Cultecs - Chamber Wizard Field A**

**Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)**

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 3 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

3 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 22.50' Row Length +12.0" End Stone x 2 = 24.50' Base Length

3 Rows x 52.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 16.00' Base Width

12.0" Base + 30.5" Chamber Height + 12.0" Cover = 4.54' Field Height

9 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 3 Rows = 502.9 cf Chamber Storage

1,780.3 cf Field - 502.9 cf Chambers = 1,277.4 cf Stone x 35.0% Voids = 447.1 cf Stone Storage

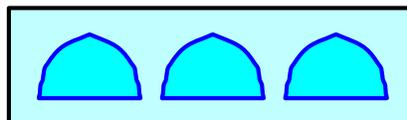
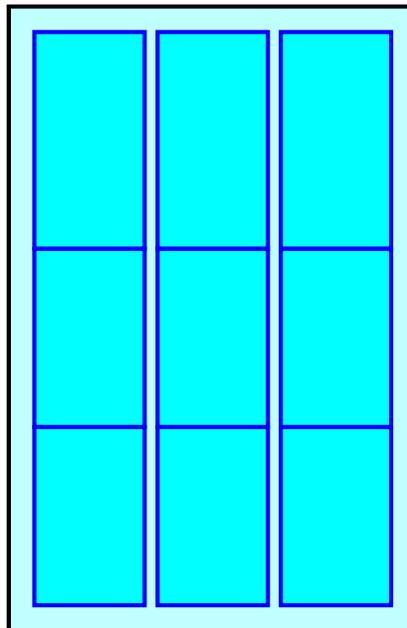
Chamber Storage + Stone Storage = 950.0 cf = 0.022 af

Overall Storage Efficiency = 53.4%

9 Chambers

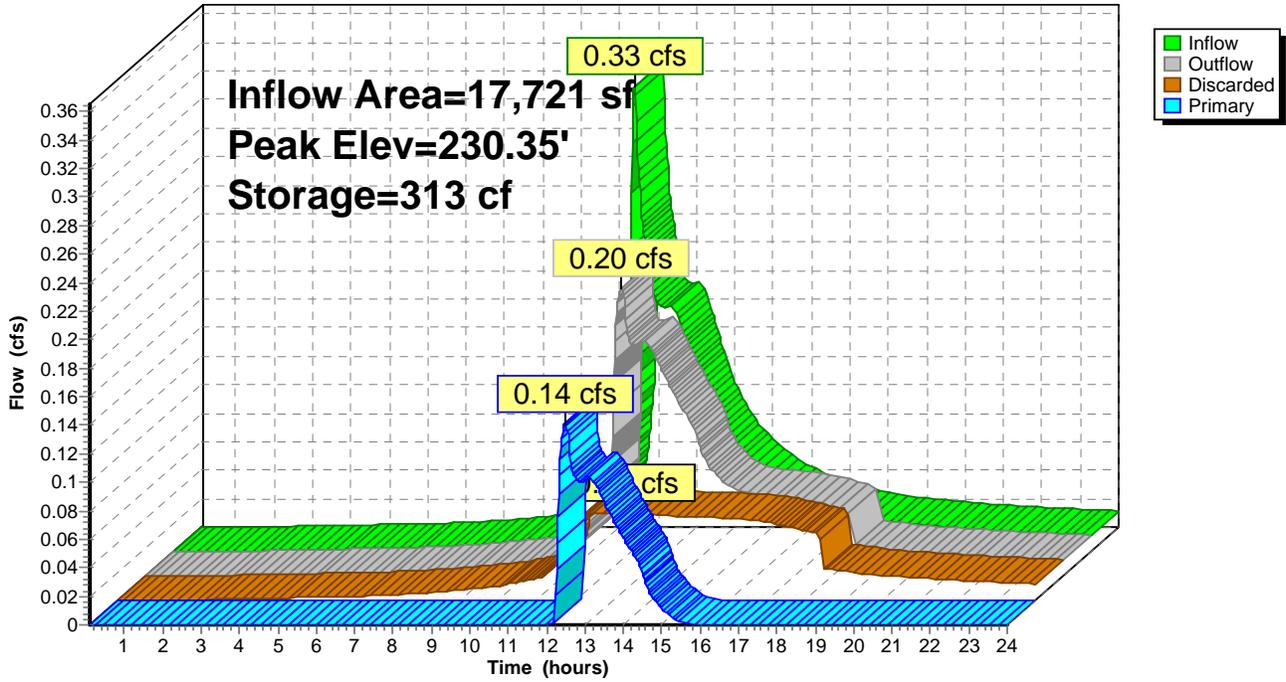
65.9 cy Field

47.3 cy Stone



### Pond C2: Intermediate Cultecs

Hydrograph



**Summary for Pond C3: Southwest Cultecs**

Inflow Area = 24,430 sf, 87.33% Impervious, Inflow Depth > 0.95" for 2-YEAR event  
 Inflow = 0.45 cfs @ 12.09 hrs, Volume= 1,934 cf  
 Outflow = 0.12 cfs @ 13.41 hrs, Volume= 1,934 cf, Atten= 74%, Lag= 79.1 min  
 Discarded = 0.12 cfs @ 13.41 hrs, Volume= 1,934 cf  
 Primary = 0.00 cfs @ 0.10 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 230.33' @ 13.41 hrs Surf.Area= 0.017 ac Storage= 0.012 af

Plug-Flow detention time= 42.3 min calculated for 1,932 cf (100% of inflow)  
 Center-of-Mass det. time= 42.3 min ( 808.7 - 766.4 )

Volume	Invert	Avail.Storage	Storage Description
#1A	229.07'	0.003 af	<b>6.33'W x 24.50'L x 3.71'H Field A</b> 0.013 af Overall - 0.004 af Embedded = 0.009 af x 35.0% Voids
#2A	229.74'	0.004 af	<b>Cultec R-330XLHD x 3 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 1 rows
#3B	229.07'	0.011 af	<b>11.17'W x 52.50'L x 3.71'H Field B</b> 0.050 af Overall - 0.017 af Embedded = 0.033 af x 35.0% Voids
#4B	229.74'	0.017 af	<b>Cultec R-330XLHD x 14 Inside #3</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 2 rows
		0.036 af	Total Available Storage

Storage Group A created with Chamber Wizard  
 Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	229.07'	<b>5.100 in/hr Exfiltration over Wetted area</b> Phase-In= 0.01'
#2	Primary	230.68'	<b>8.0" Round Culvert</b> L= 20.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 230.68' / 230.48' S= 0.0100 1/ S= 0.0100 1/ Cc= 0.900 n= 0.012, Flow Area= 0.35 sf

**Discarded OutFlow** Max=0.12 cfs @ 13.41 hrs HW=230.33' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.10 hrs HW=229.07' TW=0.00' (Dynamic Tailwater)

↑**2=Culvert** ( Controls 0.00 cfs)

**Pond C3: Southwest Cultecs - Chamber Wizard Field A**

**Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)**

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 1 rows

3 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 22.50' Row Length +12.0" End Stone x 2 = 24.50' Base Length

1 Rows x 52.0" Wide + 12.0" Side Stone x 2 = 6.33' Base Width

8.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.71' Field Height

3 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 1 Rows = 167.6 cf Chamber Storage

575.4 cf Field - 167.6 cf Chambers = 407.8 cf Stone x 35.0% Voids = 142.7 cf Stone Storage

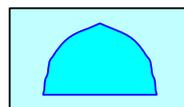
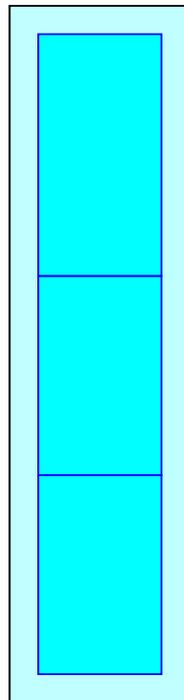
Chamber Storage + Stone Storage = 310.4 cf = 0.007 af

Overall Storage Efficiency = 53.9%

3 Chambers

21.3 cy Field

15.1 cy Stone



**Pond C3: Southwest Cultecs - Chamber Wizard Field B**

**Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)**

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 2 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

7 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 50.50' Row Length +12.0" End Stone x 2 = 52.50' Base Length

2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.17' Base Width

8.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.71' Field Height

14 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 2 Rows = 752.6 cf Chamber Storage

2,174.0 cf Field - 752.6 cf Chambers = 1,421.5 cf Stone x 35.0% Voids = 497.5 cf Stone Storage

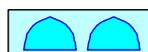
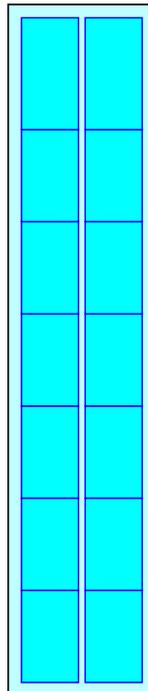
Chamber Storage + Stone Storage = 1,250.1 cf = 0.029 af

Overall Storage Efficiency = 57.5%

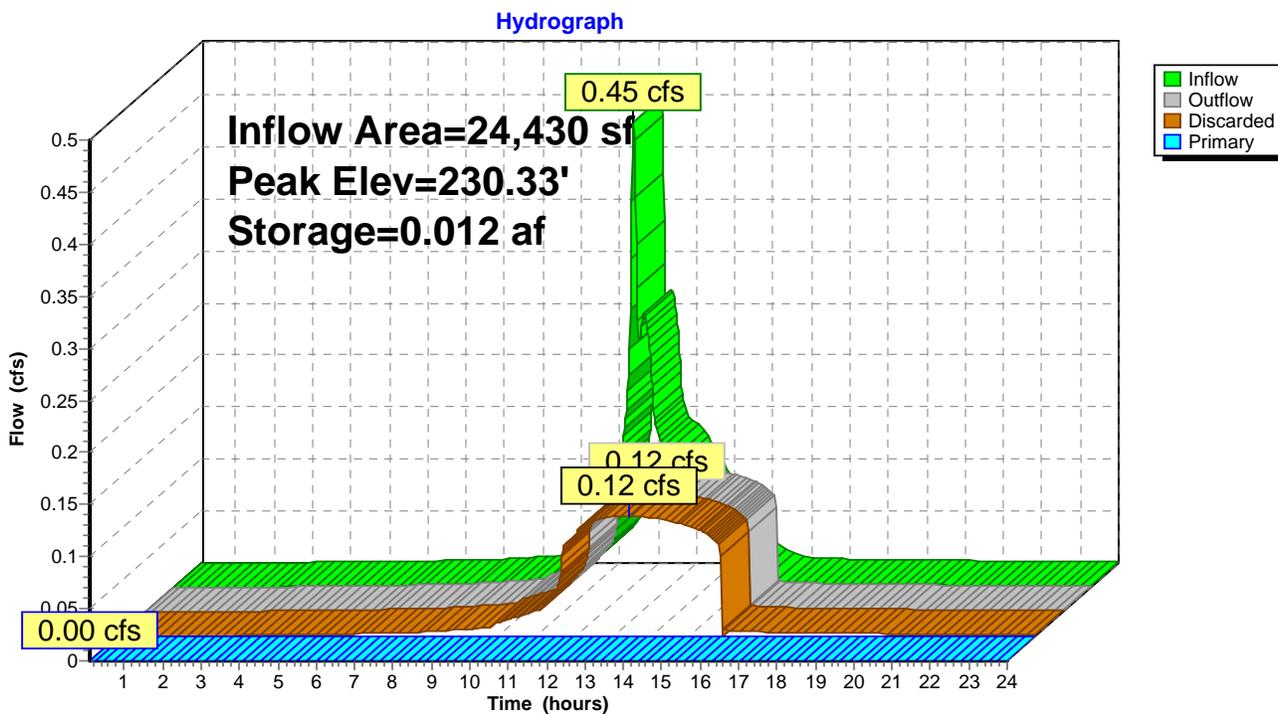
14 Chambers

80.5 cy Field

52.6 cy Stone



### Pond C3: Southwest Cultecs



**Summary for Pond CB1: Catch Basin #1**

Inflow Area = 10,259 sf, 69.83% Impervious, Inflow Depth > 1.64" for 2-YEAR event  
 Inflow = 0.45 cfs @ 12.09 hrs, Volume= 1,399 cf  
 Outflow = 0.45 cfs @ 12.10 hrs, Volume= 1,380 cf, Atten= 0%, Lag= 0.4 min  
 Primary = 0.45 cfs @ 12.10 hrs, Volume= 1,380 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 233.56' @ 12.10 hrs Surf.Area= 13 sf Storage= 27 cf

Plug-Flow detention time= 12.2 min calculated for 1,380 cf (99% of inflow)  
 Center-of-Mass det. time= 4.0 min ( 831.5 - 827.4 )

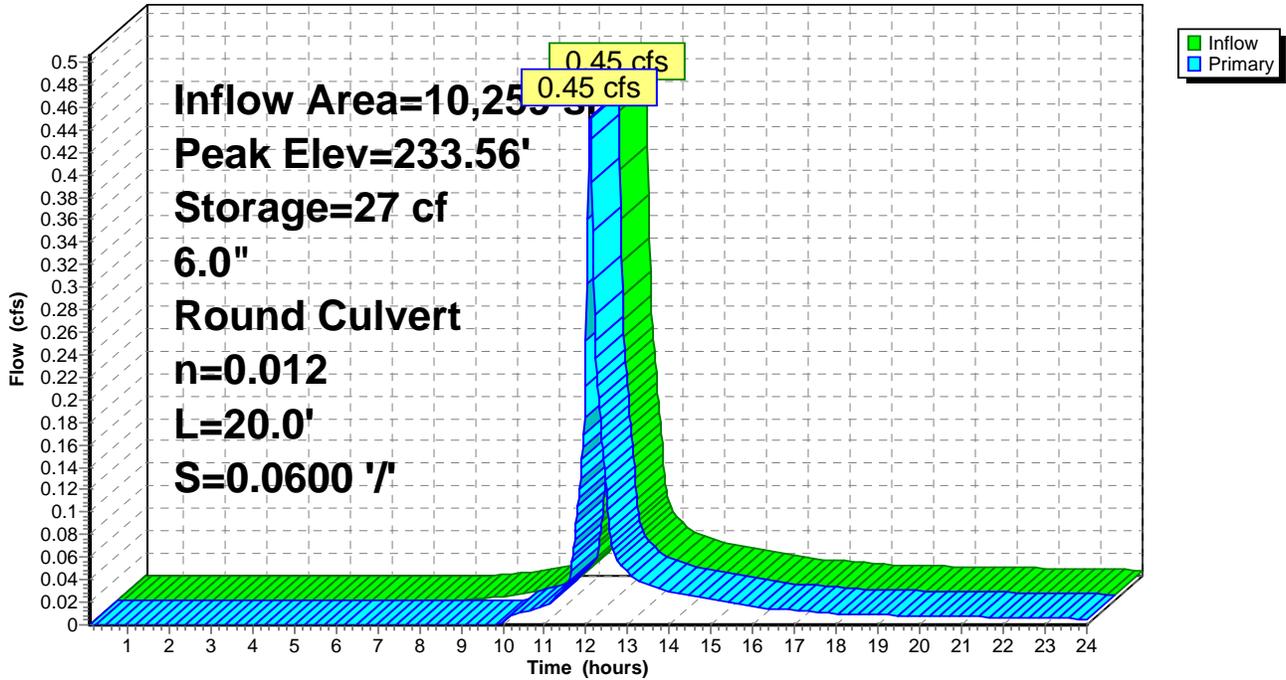
Volume	Invert	Avail.Storage	Storage Description
#1	231.50'	464 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
231.50	13	0	0
235.00	13	46	46
235.25	3,335	419	464

Device	Routing	Invert	Outlet Devices
#1	Primary	232.95'	<b>6.0" Round Culvert</b> L= 20.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.95' / 231.75' S= 0.0600 '/ Cc= 0.900 n= 0.012, Flow Area= 0.20 sf

**Primary OutFlow** Max=0.45 cfs @ 12.10 hrs HW=233.56' TW=231.96' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 0.45 cfs @ 2.28 fps)

### Pond CB1: Catch Basin #1

Hydrograph



**Summary for Pond CB2: Catch Basin #2**

Inflow Area = 4,232 sf, 100.00% Impervious, Inflow Depth > 2.83" for 2-YEAR event  
 Inflow = 0.29 cfs @ 12.08 hrs, Volume= 997 cf  
 Outflow = 0.29 cfs @ 12.09 hrs, Volume= 977 cf, Atten= 0%, Lag= 0.2 min  
 Primary = 0.29 cfs @ 12.09 hrs, Volume= 977 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 233.35' @ 12.09 hrs Surf.Area= 13 sf Storage= 24 cf

Plug-Flow detention time= 23.0 min calculated for 977 cf (98% of inflow)  
 Center-of-Mass det. time= 10.8 min ( 767.6 - 756.8 )

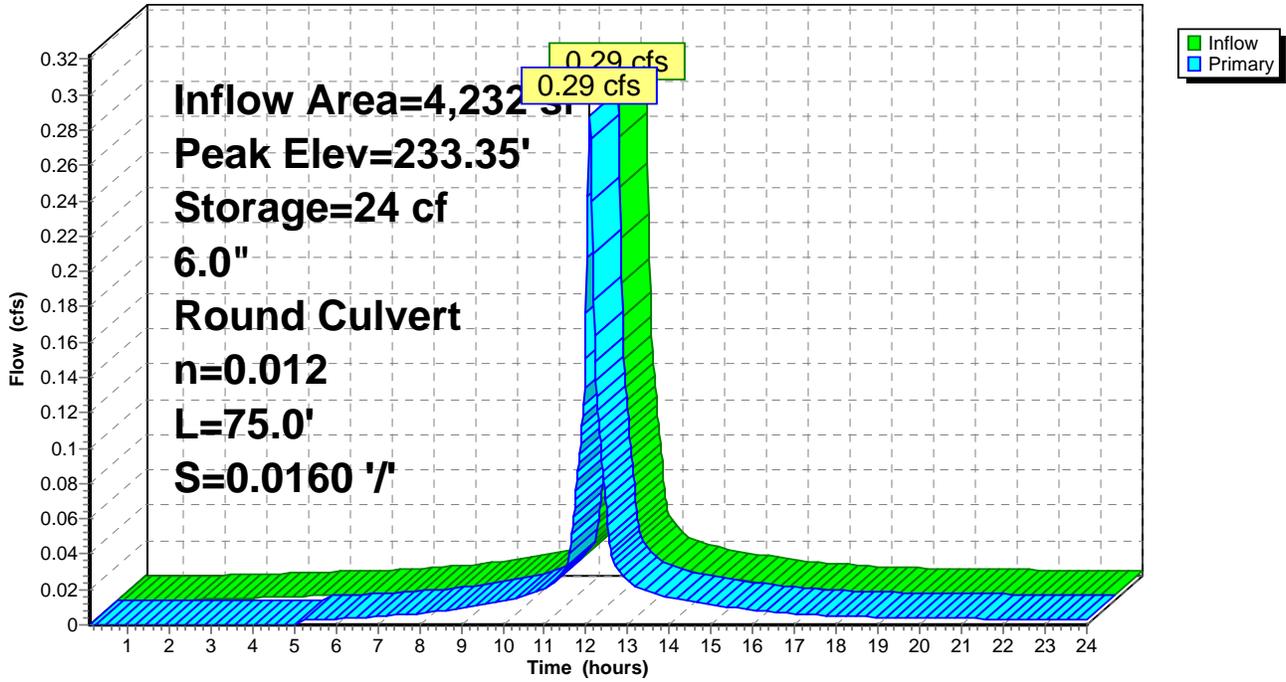
Volume	Invert	Avail.Storage	Storage Description
#1	231.50'	258 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
231.50	13	0	0
235.00	13	46	46
235.25	1,690	213	258

Device	Routing	Invert	Outlet Devices
#1	Primary	232.95'	<b>6.0" Round Culvert</b> L= 75.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.95' / 231.75' S= 0.0160 '/ Cc= 0.900 n= 0.012, Flow Area= 0.20 sf

**Primary OutFlow** Max=0.29 cfs @ 12.09 hrs HW=233.35' TW=231.94' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 0.29 cfs @ 1.70 fps)

### Pond CB2: Catch Basin #2

Hydrograph



**Summary for Pond CB3: Catch Basin #3**

Inflow Area = 3,960 sf, 100.00% Impervious, Inflow Depth > 2.83" for 2-YEAR event  
 Inflow = 0.27 cfs @ 12.08 hrs, Volume= 933 cf  
 Outflow = 0.27 cfs @ 12.09 hrs, Volume= 913 cf, Atten= 0%, Lag= 0.2 min  
 Primary = 0.27 cfs @ 12.09 hrs, Volume= 913 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 233.34' @ 12.09 hrs Surf.Area= 13 sf Storage= 24 cf

Plug-Flow detention time= 24.4 min calculated for 912 cf (98% of inflow)  
 Center-of-Mass det. time= 11.5 min ( 768.3 - 756.8 )

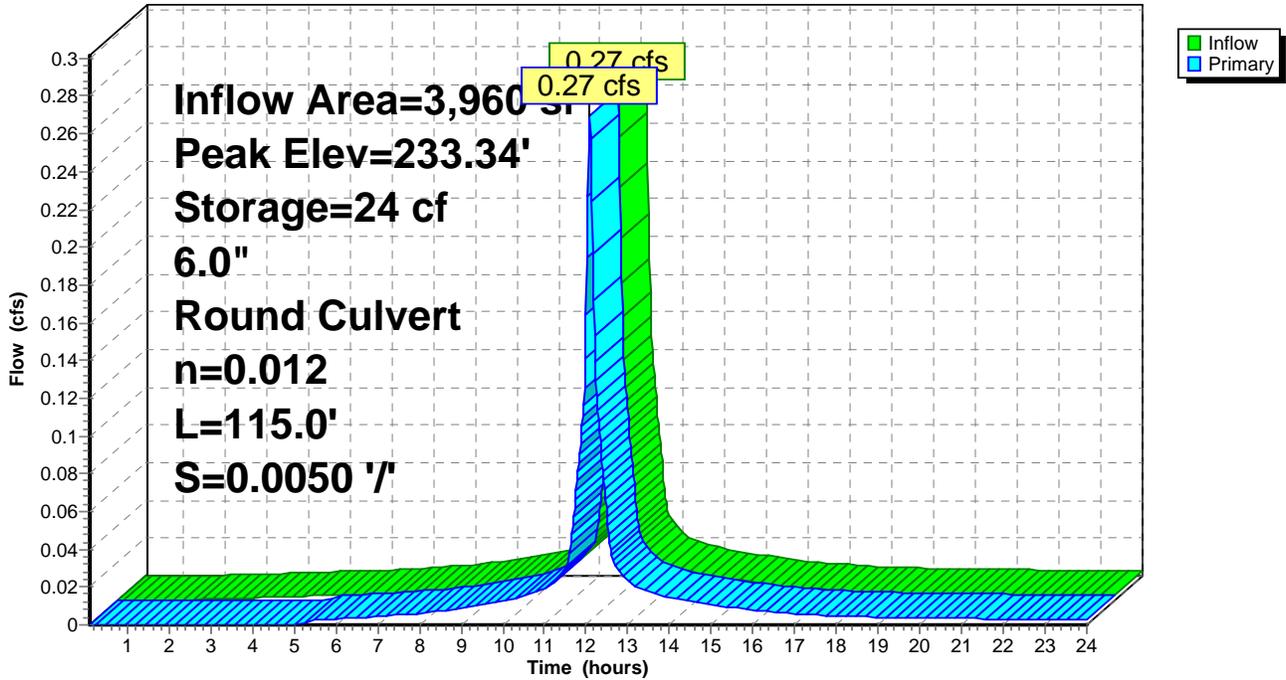
Volume	Invert	Avail.Storage	Storage Description
#1	231.50'	293 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
231.50	13	0	0
235.00	13	46	46
235.25	1,963	247	293

Device	Routing	Invert	Outlet Devices
#1	Primary	232.95'	<b>6.0" Round Culvert</b> L= 115.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.95' / 232.38' S= 0.0050 '/ Cc= 0.900 n= 0.012, Flow Area= 0.20 sf

**Primary OutFlow** Max=0.27 cfs @ 12.09 hrs HW=233.34' TW=231.62' (Dynamic Tailwater)  
 ↑1=Culvert (Barrel Controls 0.27 cfs @ 2.22 fps)

### Pond CB3: Catch Basin #3

Hydrograph



**Summary for Pond D1: Drywell**

Inflow Area = 3,960 sf, 100.00% Impervious, Inflow Depth > 2.77" for 2-YEAR event  
 Inflow = 0.27 cfs @ 12.09 hrs, Volume= 913 cf  
 Outflow = 0.27 cfs @ 12.09 hrs, Volume= 913 cf, Atten= 0%, Lag= 0.4 min  
 Discarded = 0.01 cfs @ 12.09 hrs, Volume= 372 cf  
 Primary = 0.26 cfs @ 12.09 hrs, Volume= 541 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 231.63' @ 12.09 hrs Surf.Area= 33 sf Storage= 35 cf

Plug-Flow detention time= 19.4 min calculated for 912 cf (100% of inflow)  
 Center-of-Mass det. time= 19.3 min ( 787.6 - 768.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	230.00'	98 cf	<b>5.00'D x 5.00'H Vertical Cone/Cylinder</b> Inside #2 141 cf Overall - 6.0" Wall Thickness = 98 cf
#2	230.00'	9 cf	<b>6.50'D x 5.00'H Vertical Cone/Cylinder</b> 166 cf Overall - 141 cf Embedded = 25 cf x 35.0% Voids
		107 cf	Total Available Storage

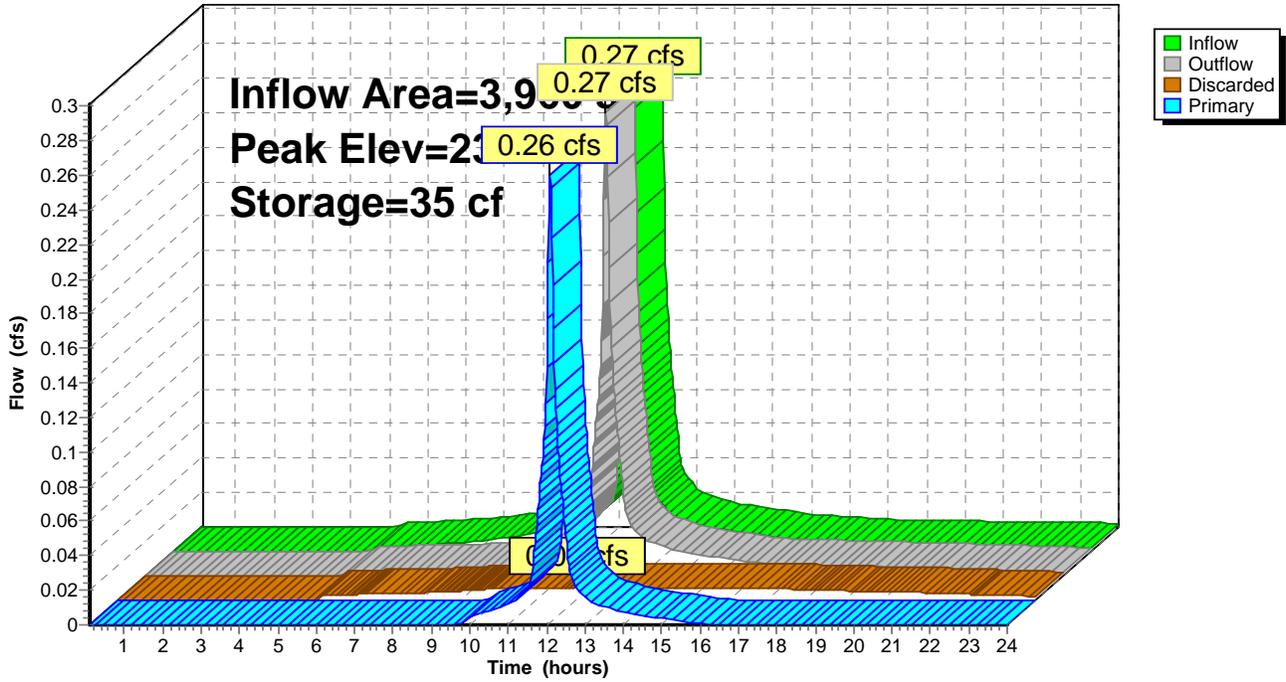
Device	Routing	Invert	Outlet Devices
#1	Primary	231.25'	<b>6.0" Round Culvert</b> L= 5.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 231.25' / 231.00' S= 0.0500 1/1 Cc= 0.900 n= 0.012, Flow Area= 0.20 sf
#2	Discarded	230.00'	<b>5.100 in/hr Exfiltration over Wetted area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.01 cfs @ 12.09 hrs HW=231.62' (Free Discharge)  
 ↳ **2=Exfiltration** (Exfiltration Controls 0.01 cfs)

**Primary OutFlow** Max=0.26 cfs @ 12.09 hrs HW=231.62' TW=229.71' (Dynamic Tailwater)  
 ↳ **1=Culvert** (Inlet Controls 0.26 cfs @ 1.64 fps)

### Pond D1: Drywell

Hydrograph



Time span=0.10-24.00 hrs, dt=0.02 hrs, 1196 points x 3  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment 1S: Roof Drain South West** Runoff Area=2,749 sf 100.00% Impervious Runoff Depth>4.33"  
 Flow Length=50' Slope=0.1300 '/' Tc=6.0 min CN=98 Runoff=0.28 cfs 992 cf

**Subcatchment 2S: Roof Drain North Side** Runoff Area=3,230 sf 100.00% Impervious Runoff Depth>4.33"  
 Flow Length=50' Slope=0.1300 '/' Tc=6.0 min CN=98 Runoff=0.33 cfs 1,166 cf

**Subcatchment 3S: Upper Paved Area** Runoff Area=10,259 sf 69.83% Impervious Runoff Depth>2.97"  
 Tc=6.0 min CN=85 Runoff=0.81 cfs 2,539 cf

**Subcatchment 4S: Middle Paved Area &** Runoff Area=4,232 sf 100.00% Impervious Runoff Depth>4.33"  
 Tc=6.0 min CN=98 Runoff=0.43 cfs 1,527 cf

**Subcatchment 5S: Lower Paved Area** Runoff Area=3,960 sf 100.00% Impervious Runoff Depth>4.33"  
 Tc=6.0 min CN=98 Runoff=0.41 cfs 1,429 cf

**Subcatchment 6S: Remaining Project Area** Runoff Area=217,642 sf 3.80% Impervious Runoff Depth>0.48"  
 Flow Length=562' Tc=15.9 min CN=49 Runoff=1.09 cfs 8,649 cf

**Subcatchment EX: Existing Site** Runoff Area=242,195 sf 7.17% Impervious Runoff Depth>0.52"  
 Flow Length=562' Tc=15.9 min CN=50 Runoff=1.41 cfs 10,536 cf

**Reach END: Proposed Site Runoff** Inflow=1.35 cfs 9,549 cf  
 Outflow=1.35 cfs 9,549 cf

**Pond C1: Northeast Cultecs** Peak Elev=232.61' Storage=0.040 af Inflow=1.24 cfs 4,027 cf  
 Discarded=0.00 cfs 0 cf Primary=0.39 cfs 3,526 cf Outflow=0.39 cfs 3,526 cf

**Pond C2: Intermediate Cultecs** Peak Elev=231.11' Storage=536 cf Inflow=0.49 cfs 4,692 cf  
 Discarded=0.07 cfs 2,506 cf Primary=0.34 cfs 2,185 cf Outflow=0.41 cfs 4,691 cf

**Pond C3: Southwest Cultecs** Peak Elev=231.04' Storage=0.021 af Inflow=0.94 cfs 4,127 cf  
 Discarded=0.13 cfs 3,228 cf Primary=0.31 cfs 900 cf Outflow=0.44 cfs 4,127 cf

**Pond CB1: Catch Basin #1** Peak Elev=234.37' Storage=37 cf Inflow=0.81 cfs 2,539 cf  
 6.0" Round Culvert n=0.012 L=20.0' S=0.0600 '/' Outflow=0.81 cfs 2,519 cf

**Pond CB2: Catch Basin #2** Peak Elev=233.54' Storage=26 cf Inflow=0.43 cfs 1,527 cf  
 6.0" Round Culvert n=0.012 L=75.0' S=0.0160 '/' Outflow=0.43 cfs 1,508 cf

**Pond CB3: Catch Basin #3** Peak Elev=233.49' Storage=26 cf Inflow=0.41 cfs 1,429 cf  
 6.0" Round Culvert n=0.012 L=115.0' S=0.0050 '/' Outflow=0.40 cfs 1,410 cf

**Pond D1: Drywell** Peak Elev=231.78' Storage=38 cf Inflow=0.40 cfs 1,410 cf  
 Discarded=0.01 cfs 453 cf Primary=0.39 cfs 949 cf Outflow=0.40 cfs 1,403 cf

**Total Runoff Area = 484,267 sf Runoff Volume = 26,838 cf Average Runoff Depth = 0.67"**  
**90.30% Pervious = 437,284 sf 9.70% Impervious = 46,983 sf**

**Summary for Subcatchment 1S: Roof Drain South West Side**

Runoff = 0.28 cfs @ 12.08 hrs, Volume= 992 cf, Depth> 4.33"

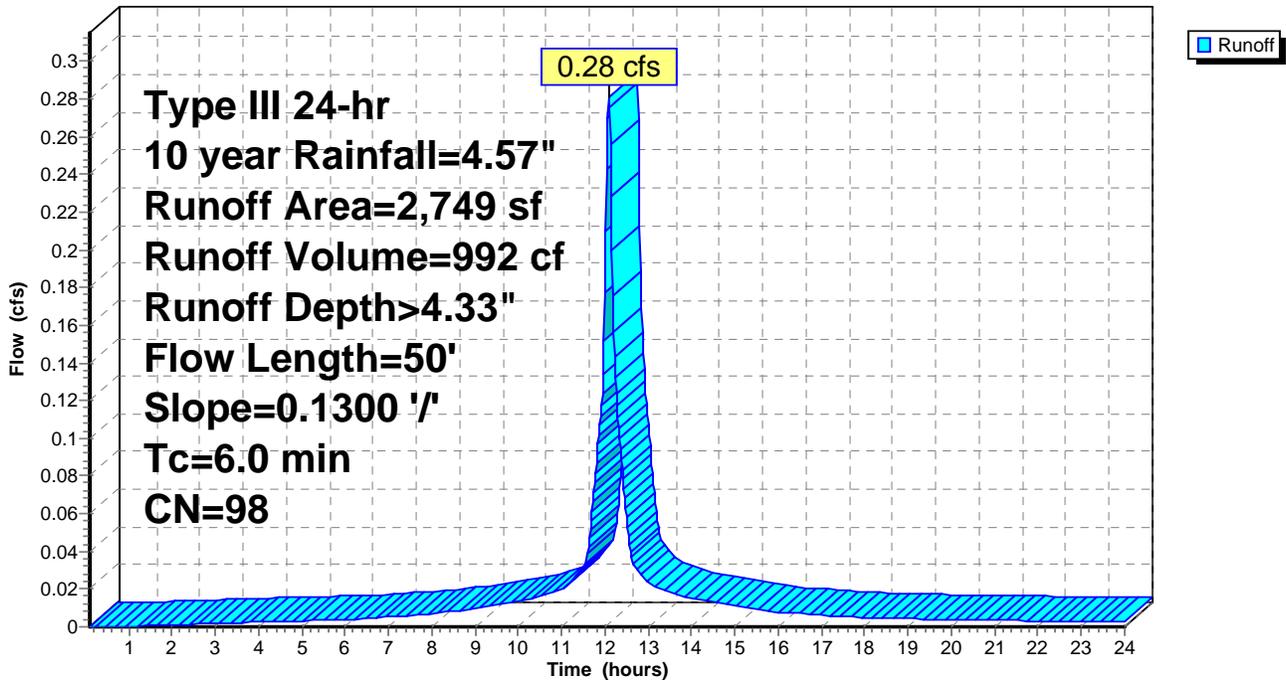
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10 year Rainfall=4.57"

Area (sf)	CN	Description
2,749	98	Roofs, HSG A
2,749		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.1300	0.14		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.06"

**Subcatchment 1S: Roof Drain South West Side**

Hydrograph



**Summary for Subcatchment 2S: Roof Drain North Side**

Runoff = 0.33 cfs @ 12.08 hrs, Volume= 1,166 cf, Depth> 4.33"

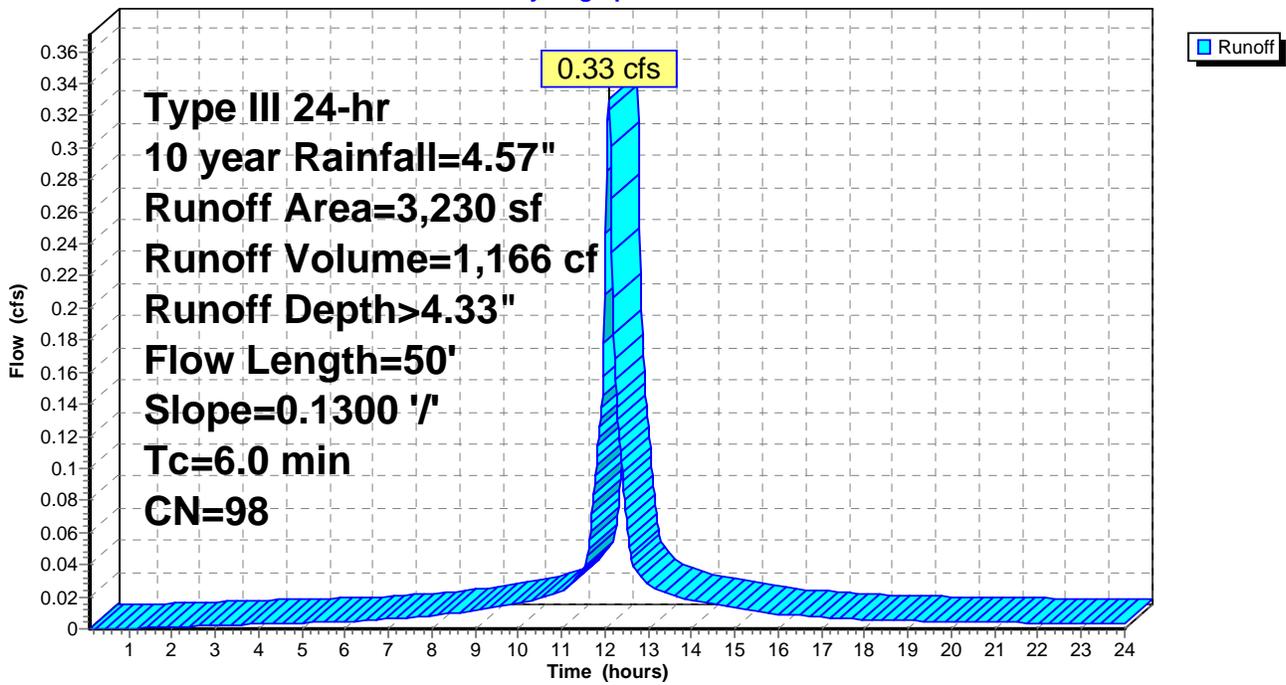
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10 year Rainfall=4.57"

Area (sf)	CN	Description
3,230	98	Roofs, HSG A
3,230		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.1300	0.14		Sheet Flow, sheet flow Woods: Light underbrush n= 0.400 P2= 3.06"

**Subcatchment 2S: Roof Drain North Side**

Hydrograph



**Summary for Subcatchment 3S: Upper Paved Area**

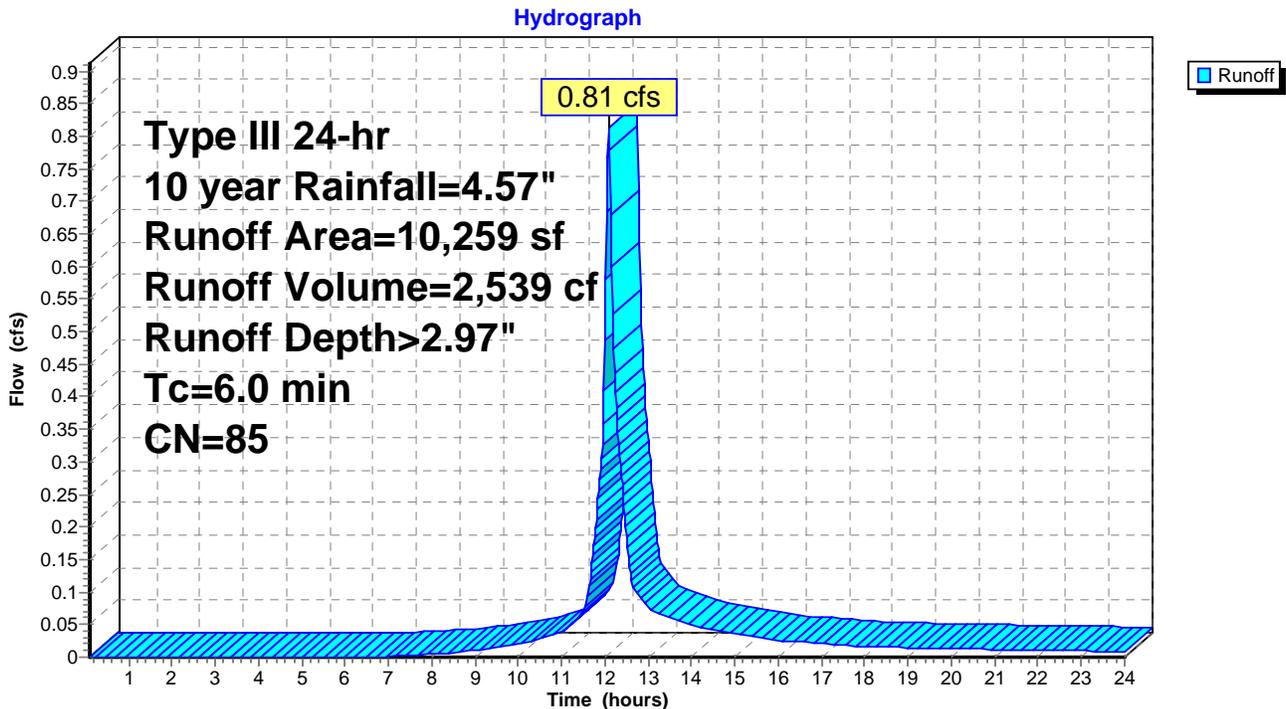
Runoff = 0.81 cfs @ 12.09 hrs, Volume= 2,539 cf, Depth> 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10 year Rainfall=4.57"

Area (sf)	CN	Description
7,164	98	Paved parking, HSG A
1,956	49	50-75% Grass cover, Fair, HSG A
441	49	50-75% Grass cover, Fair, HSG A
* 698	76	Gravel roads, HSG A (rip rap)
10,259	85	Weighted Average
3,095		30.17% Pervious Area
7,164		69.83% Impervious Area

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

**Subcatchment 3S: Upper Paved Area**



**Summary for Subcatchment 4S: Middle Paved Area & Eastern Roof**

Runoff = 0.43 cfs @ 12.08 hrs, Volume= 1,527 cf, Depth> 4.33"

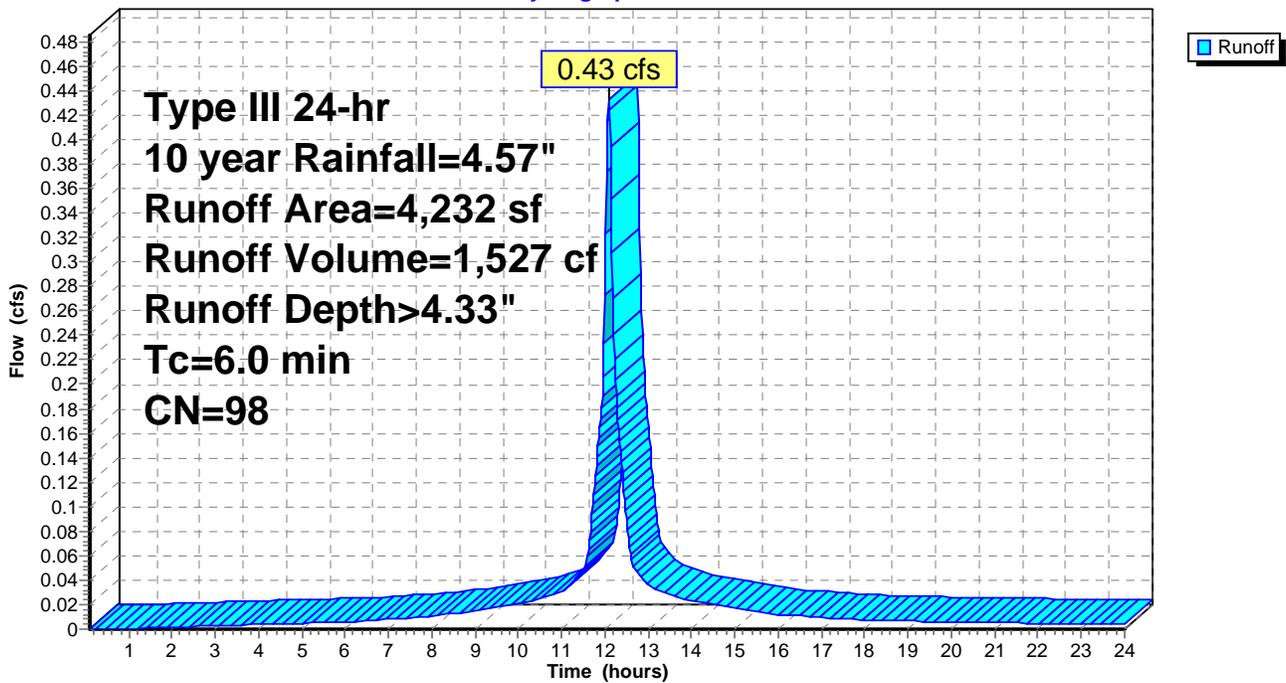
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10 year Rainfall=4.57"

Area (sf)	CN	Description
2,572	98	Paved parking, HSG A
1,660	98	Roofs, HSG A
4,232	98	Weighted Average
4,232		100.00% Impervious Area

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

**Subcatchment 4S: Middle Paved Area & Eastern Roof**

Hydrograph



**Summary for Subcatchment 5S: Lower Paved Area**

Runoff = 0.41 cfs @ 12.08 hrs, Volume= 1,429 cf, Depth> 4.33"

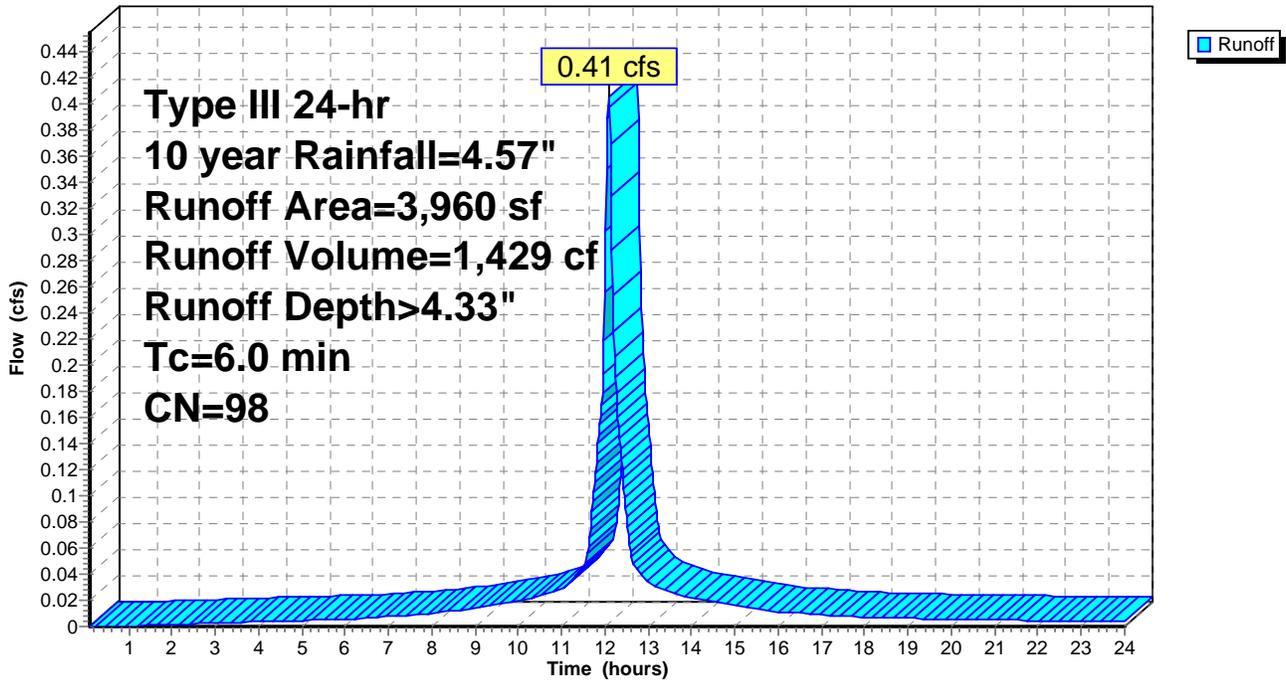
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs  
 Type III 24-hr 10 year Rainfall=4.57"

Area (sf)	CN	Description
3,960	98	Paved parking, HSG A
3,960		100.00% Impervious Area

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

**Subcatchment 5S: Lower Paved Area**

Hydrograph



**Summary for Subcatchment 6S: Remaining Project Area**

Runoff = 1.09 cfs @ 12.42 hrs, Volume= 8,649 cf, Depth> 0.48"

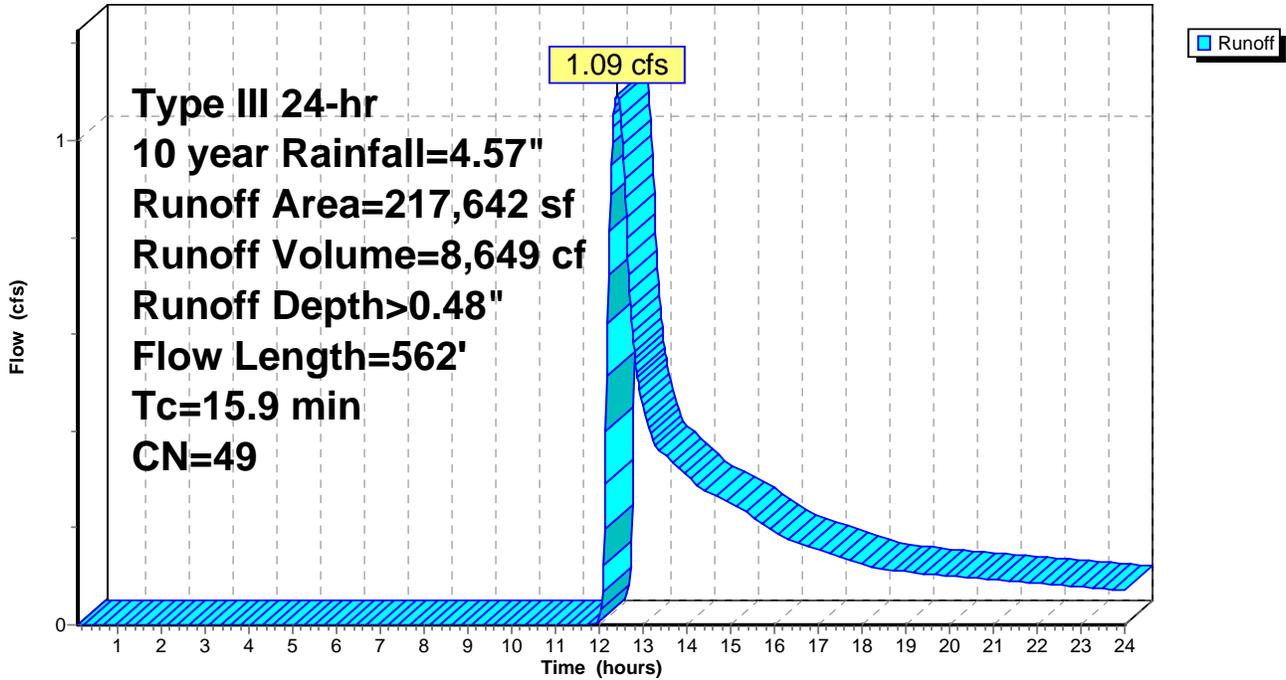
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10 year Rainfall=4.57"

Area (sf)	CN	Description
2,763	49	50-75% Grass cover, Fair, HSG A
9,597	76	Gravel roads, HSG A
8,274	98	Paved parking, HSG A
7,927	49	50-75% Grass cover, Fair, HSG A
27,757	78	Meadow, non-grazed, HSG D
28,946	77	Woods, Good, HSG D
78,485	30	Woods, Good, HSG A
39,143	30	Meadow, non-grazed, HSG A
11,968	30	Woods, Good, HSG A
* 2,782	76	Gravel roads, HSG A (RIP RAP)
217,642	49	Weighted Average
209,368		96.20% Pervious Area
8,274		3.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.0500	0.10		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.06"
0.3	36	0.1676	2.05		<b>Shallow Concentrated Flow, woods pre grass strip</b> Woodland Kv= 5.0 fps
0.1	10	0.1000	2.21		<b>Shallow Concentrated Flow, grass strips (both)</b> Short Grass Pasture Kv= 7.0 fps
0.0	12	0.0833	5.86		<b>Shallow Concentrated Flow, pavement</b> Paved Kv= 20.3 fps
6.7	440	0.0480	1.10		<b>Shallow Concentrated Flow, rip rap</b> Woodland Kv= 5.0 fps
0.1	14	0.1667	2.86		<b>Shallow Concentrated Flow, grass strip</b> Short Grass Pasture Kv= 7.0 fps
15.9	562	Total			

### Subcatchment 6S: Remaining Project Area

Hydrograph



**Summary for Subcatchment EX: Existing Site**

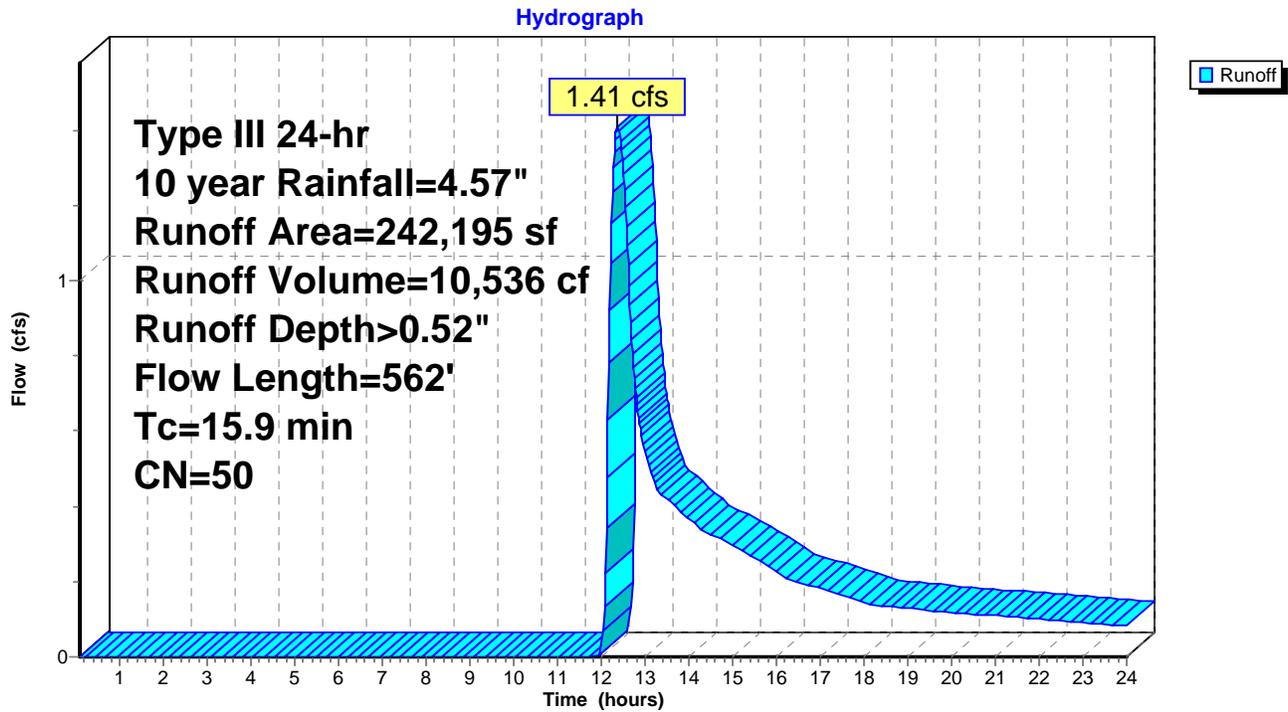
Runoff = 1.41 cfs @ 12.39 hrs, Volume= 10,536 cf, Depth> 0.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10 year Rainfall=4.57"

Area (sf)	CN	Description
11,475	49	50-75% Grass cover, Fair, HSG A
3,181	76	Gravel roads, HSG A
17,374	98	Paved parking, HSG A
4,242	49	50-75% Grass cover, Fair, HSG A
8,728	49	50-75% Grass cover, Fair, HSG A
* 3,480	76	Gravel roads, HSG A (RIP RAP)
59,405	77	Woods, Good, HSG D
82,915	30	Woods, Good, HSG A
9,737	30	Woods, Good, HSG A
41,658	30	Woods, Good, HSG A
242,195	50	Weighted Average
224,821		92.83% Pervious Area
17,374		7.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.0500	0.10		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.06"
0.3	36	0.1676	2.05		<b>Shallow Concentrated Flow, woods</b> Woodland Kv= 5.0 fps
0.0	12	0.1000	6.42		<b>Shallow Concentrated Flow, pavement</b> Paved Kv= 20.3 fps
0.1	10	0.1000	2.21		<b>Shallow Concentrated Flow, grass strip (both)</b> Short Grass Pasture Kv= 7.0 fps
6.7	440	0.0480	1.10		<b>Shallow Concentrated Flow, rip rap</b> Woodland Kv= 5.0 fps
0.1	14	0.1667	2.86		<b>Shallow Concentrated Flow, final grass strip</b> Short Grass Pasture Kv= 7.0 fps
15.9	562	Total			

### Subcatchment EX: Existing Site



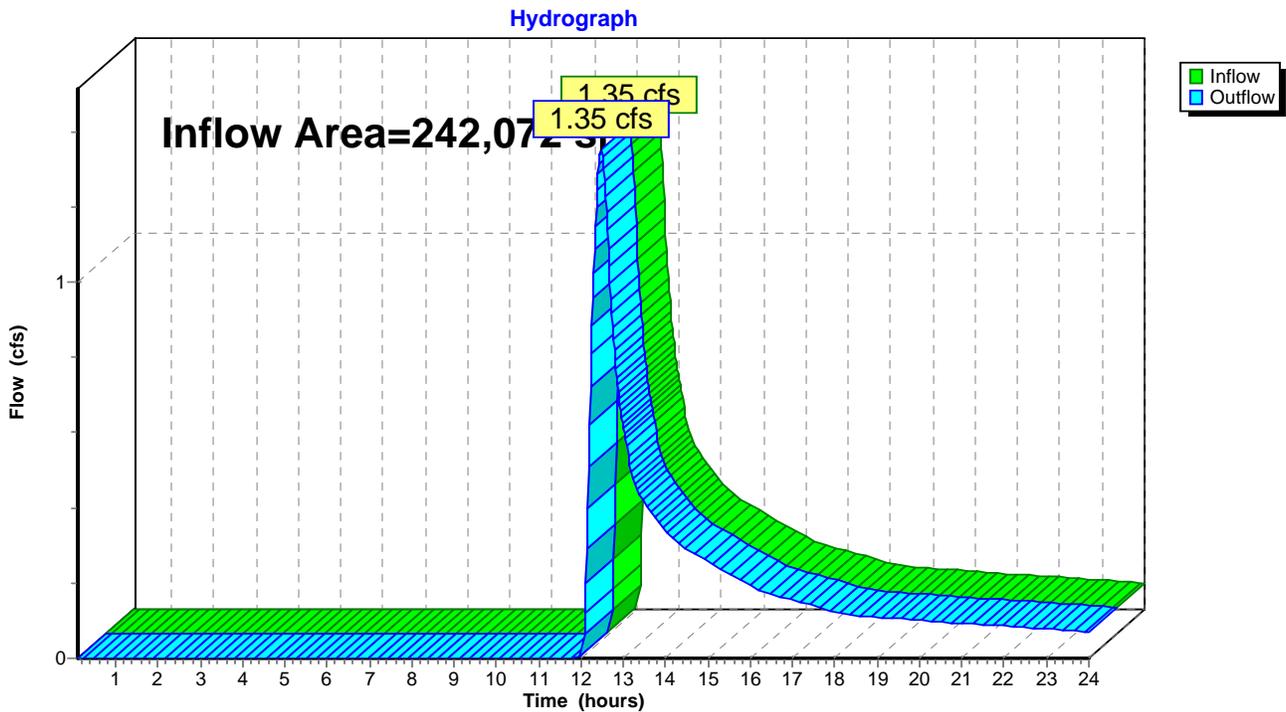
### Summary for Reach END: Proposed Site Runoff

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

Inflow Area = 242,072 sf, 12.23% Impervious, Inflow Depth > 0.47" for 10 year event  
Inflow = 1.35 cfs @ 12.47 hrs, Volume= 9,549 cf  
Outflow = 1.35 cfs @ 12.47 hrs, Volume= 9,549 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3

### Reach END: Proposed Site Runoff



**Summary for Pond C1: Northeast Cultecs**

Inflow Area = 14,491 sf, 78.64% Impervious, Inflow Depth > 3.34" for 10 year event  
 Inflow = 1.24 cfs @ 12.09 hrs, Volume= 4,027 cf  
 Outflow = 0.39 cfs @ 12.41 hrs, Volume= 3,526 cf, Atten= 69%, Lag= 18.8 min  
 Discarded = 0.00 cfs @ 0.10 hrs, Volume= 0 cf  
 Primary = 0.39 cfs @ 12.41 hrs, Volume= 3,526 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 232.61' @ 12.41 hrs Surf.Area= 0.046 ac Storage= 0.040 af

Plug-Flow detention time= 146.4 min calculated for 3,526 cf (88% of inflow)  
 Center-of-Mass det. time= 89.8 min ( 882.0 - 792.3 )

Volume	Invert	Avail.Storage	Storage Description
#1A	231.17'	0.018 af	<b>14.50'W x 84.75'L x 2.54'H Field A</b> 0.072 af Overall - 0.020 af Embedded = 0.052 af x 35.0% Voids
#2A	231.67'	0.020 af	<b>Cultec R-150XLHD x 32 Inside #1</b> Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap Row Length Adjustment= +0.75' x 2.65 sf x 4 rows
#3B	231.17'	0.012 af	<b>14.50'W x 54.00'L x 2.54'H Field B</b> 0.046 af Overall - 0.013 af Embedded = 0.033 af x 35.0% Voids
#4B	231.67'	0.013 af	<b>Cultec R-150XLHD x 20 Inside #3</b> Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap Row Length Adjustment= +0.75' x 2.65 sf x 4 rows
		0.062 af	Total Available Storage

Storage Group A created with Chamber Wizard  
 Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	231.17'	<b>0.090 in/hr Exfiltration X 0.00 over Surface area</b> Phase-In= 0.01'
#2	Primary	231.67'	<b>4.0" Round Culvert</b> L= 145.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 231.67' / 230.95' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 0.09 sf
#3	Primary	232.33'	<b>8.0" Round Culvert</b> L= 145.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.33' / 231.44' S= 0.0061 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf

**Discarded OutFlow** Max=0.00 cfs @ 0.10 hrs HW=231.17' (Free Discharge)  
 ↳1=Exfiltration ( Controls 0.00 cfs)

**Primary OutFlow** Max=0.39 cfs @ 12.41 hrs HW=232.61' TW=231.02' (Dynamic Tailwater)  
 ↳2=Culvert (Barrel Controls 0.19 cfs @ 2.14 fps)  
 ↳3=Culvert (Inlet Controls 0.20 cfs @ 1.43 fps)

**Pond C1: Northeast Cultecs - Chamber Wizard Field A**

**Chamber Model = Cultec R-150XLHD (Cultec Recharger® 150XLHD)**

Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf

Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap

Row Length Adjustment= +0.75' x 2.65 sf x 4 rows

33.0" Wide + 6.0" Spacing = 39.0" C-C Row Spacing

8 Chambers/Row x 10.25' Long +0.75' Row Adjustment = 82.75' Row Length +12.0" End Stone x 2 = 84.75' Base Length

4 Rows x 33.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 14.50' Base Width

6.0" Base + 18.5" Chamber Height + 6.0" Cover = 2.54' Field Height

32 Chambers x 27.2 cf +0.75' Row Adjustment x 2.65 sf x 4 Rows = 876.8 cf Chamber Storage

3,123.4 cf Field - 876.8 cf Chambers = 2,246.6 cf Stone x 35.0% Voids = 786.3 cf Stone Storage

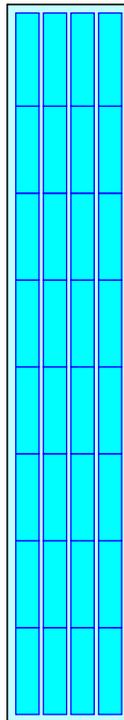
Chamber Storage + Stone Storage = 1,663.1 cf = 0.038 af

Overall Storage Efficiency = 53.2%

32 Chambers

115.7 cy Field

83.2 cy Stone



**Pond C1: Northeast Cultecs - Chamber Wizard Field B**

**Chamber Model = Cultec R-150XLHD (Cultec Recharger® 150XLHD)**

Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf

Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap

Row Length Adjustment= +0.75' x 2.65 sf x 4 rows

33.0" Wide + 6.0" Spacing = 39.0" C-C Row Spacing

5 Chambers/Row x 10.25' Long +0.75' Row Adjustment = 52.00' Row Length +12.0" End Stone x 2 = 54.00' Base Length

4 Rows x 33.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 14.50' Base Width

6.0" Base + 18.5" Chamber Height + 6.0" Cover = 2.54' Field Height

20 Chambers x 27.2 cf +0.75' Row Adjustment x 2.65 sf x 4 Rows = 551.0 cf Chamber Storage

1,990.1 cf Field - 551.0 cf Chambers = 1,439.1 cf Stone x 35.0% Voids = 503.7 cf Stone Storage

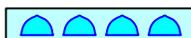
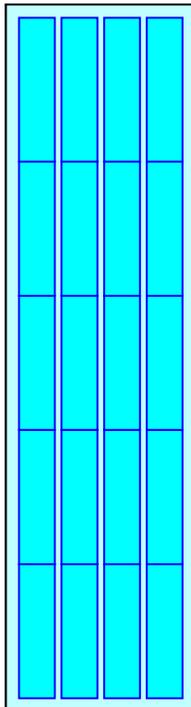
Chamber Storage + Stone Storage = 1,054.7 cf = 0.024 af

Overall Storage Efficiency = 53.0%

20 Chambers

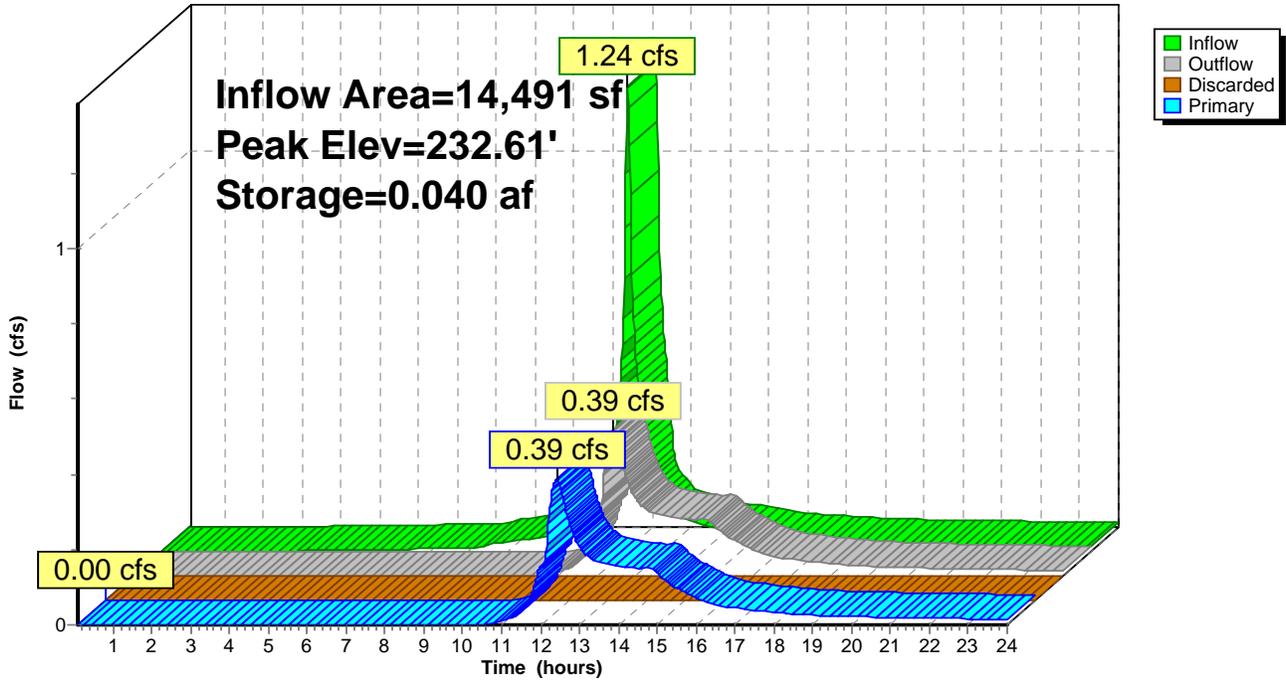
73.7 cy Field

53.3 cy Stone



### Pond C1: Northeast Cultecs

Hydrograph



**Summary for Pond C2: Intermediate Cultecs**

Inflow Area = 17,721 sf, 82.53% Impervious, Inflow Depth > 3.18" for 10 year event  
 Inflow = 0.49 cfs @ 12.34 hrs, Volume= 4,692 cf  
 Outflow = 0.41 cfs @ 12.52 hrs, Volume= 4,691 cf, Atten= 17%, Lag= 10.4 min  
 Discarded = 0.07 cfs @ 12.55 hrs, Volume= 2,506 cf  
 Primary = 0.34 cfs @ 12.52 hrs, Volume= 2,185 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 231.11' @ 12.55 hrs Surf.Area= 392 sf Storage= 536 cf  
 Flood Elev= 233.94' Surf.Area= 392 sf Storage= 950 cf

Plug-Flow detention time= 32.2 min calculated for 4,691 cf (100% of inflow)  
 Center-of-Mass det. time= 32.1 min ( 881.1 - 849.0 )

Volume	Invert	Avail.Storage	Storage Description
#1A	228.78'	447 cf	<b>16.00'W x 24.50'L x 4.54'H Field A</b> 1,780 cf Overall - 503 cf Embedded = 1,277 cf x 35.0% Voids
#2A	229.78'	503 cf	<b>Cultec R-330XLHD x 9 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		950 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	228.78'	<b>5.100 in/hr Exfiltration over Wetted area</b> Phase-In= 0.01'
#2	Primary	230.00'	<b>8.0" Round Culvert</b> L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 230.00' / 230.00' S= 0.0000 1/ S= 0.0000 1/ Cc= 0.900 n= 0.012, Flow Area= 0.35 sf

**Discarded OutFlow** Max=0.07 cfs @ 12.55 hrs HW=231.11' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

**Primary OutFlow** Max=0.34 cfs @ 12.52 hrs HW=231.10' TW=231.04' (Dynamic Tailwater)

↑**2=Culvert** (Inlet Controls 0.34 cfs @ 0.98 fps)

**Pond C2: Intermediate Cultecs - Chamber Wizard Field A**

**Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)**

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 3 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

3 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 22.50' Row Length +12.0" End Stone x 2 = 24.50' Base Length

3 Rows x 52.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 16.00' Base Width

12.0" Base + 30.5" Chamber Height + 12.0" Cover = 4.54' Field Height

9 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 3 Rows = 502.9 cf Chamber Storage

1,780.3 cf Field - 502.9 cf Chambers = 1,277.4 cf Stone x 35.0% Voids = 447.1 cf Stone Storage

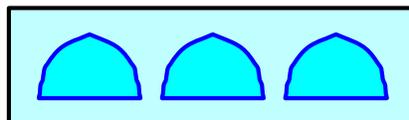
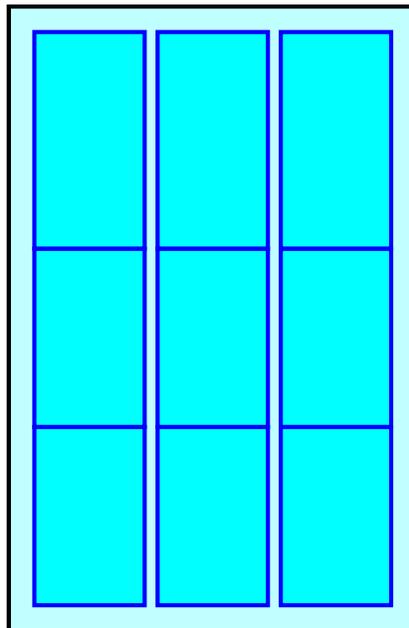
Chamber Storage + Stone Storage = 950.0 cf = 0.022 af

Overall Storage Efficiency = 53.4%

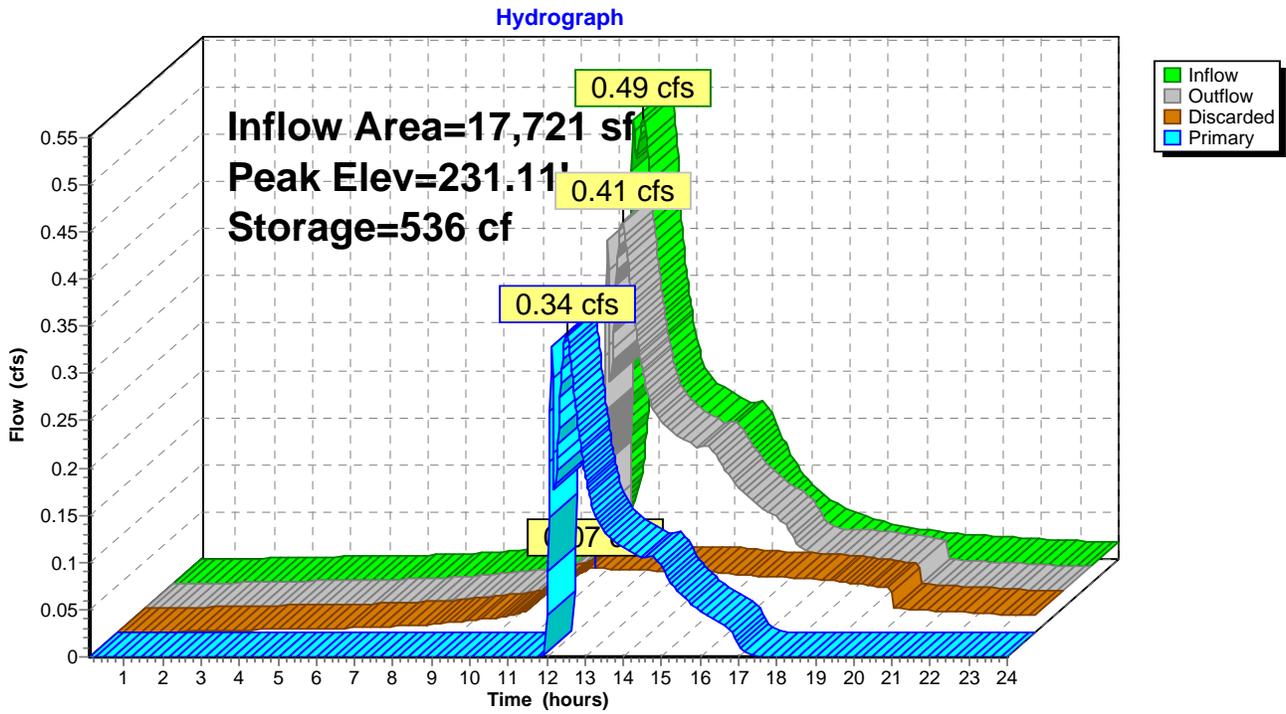
9 Chambers

65.9 cy Field

47.3 cy Stone



### Pond C2: Intermediate Cultecs



**Summary for Pond C3: Southwest Cultecs**

Inflow Area = 24,430 sf, 87.33% Impervious, Inflow Depth > 2.03" for 10 year event  
 Inflow = 0.94 cfs @ 12.11 hrs, Volume= 4,127 cf  
 Outflow = 0.44 cfs @ 12.56 hrs, Volume= 4,127 cf, Atten= 53%, Lag= 26.6 min  
 Discarded = 0.13 cfs @ 12.56 hrs, Volume= 3,228 cf  
 Primary = 0.31 cfs @ 12.56 hrs, Volume= 900 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 231.04' @ 12.56 hrs Surf.Area= 0.017 ac Storage= 0.021 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 53.1 min ( 835.8 - 782.7 )

Volume	Invert	Avail.Storage	Storage Description
#1A	229.07'	0.003 af	<b>6.33'W x 24.50'L x 3.71'H Field A</b> 0.013 af Overall - 0.004 af Embedded = 0.009 af x 35.0% Voids
#2A	229.74'	0.004 af	<b>Cultec R-330XLHD x 3 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 1 rows
#3B	229.07'	0.011 af	<b>11.17'W x 52.50'L x 3.71'H Field B</b> 0.050 af Overall - 0.017 af Embedded = 0.033 af x 35.0% Voids
#4B	229.74'	0.017 af	<b>Cultec R-330XLHD x 14 Inside #3</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 2 rows
		0.036 af	Total Available Storage

Storage Group A created with Chamber Wizard  
 Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	229.07'	<b>5.100 in/hr Exfiltration over Wetted area</b> Phase-In= 0.01'
#2	Primary	230.68'	<b>8.0" Round Culvert</b> L= 20.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 230.68' / 230.48' S= 0.0100 1/ Cc= 0.900 n= 0.012, Flow Area= 0.35 sf

**Discarded OutFlow** Max=0.13 cfs @ 12.56 hrs HW=231.04' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

**Primary OutFlow** Max=0.31 cfs @ 12.56 hrs HW=231.04' TW=0.00' (Dynamic Tailwater)

↑**2=Culvert** (Inlet Controls 0.31 cfs @ 1.62 fps)

**Pond C3: Southwest Cultecs - Chamber Wizard Field A**

**Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)**

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 1 rows

3 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 22.50' Row Length +12.0" End Stone x 2 = 24.50' Base Length

1 Rows x 52.0" Wide + 12.0" Side Stone x 2 = 6.33' Base Width

8.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.71' Field Height

3 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 1 Rows = 167.6 cf Chamber Storage

575.4 cf Field - 167.6 cf Chambers = 407.8 cf Stone x 35.0% Voids = 142.7 cf Stone Storage

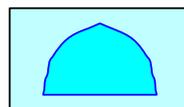
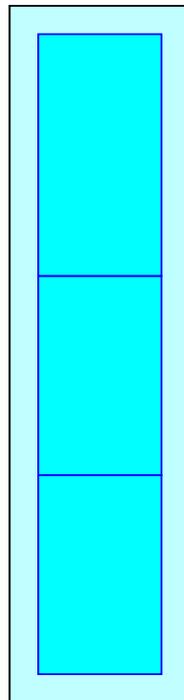
Chamber Storage + Stone Storage = 310.4 cf = 0.007 af

Overall Storage Efficiency = 53.9%

3 Chambers

21.3 cy Field

15.1 cy Stone



**Pond C3: Southwest Cultecs - Chamber Wizard Field B**

**Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)**

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 2 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

7 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 50.50' Row Length +12.0" End Stone x 2 = 52.50' Base Length

2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.17' Base Width

8.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.71' Field Height

14 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 2 Rows = 752.6 cf Chamber Storage

2,174.0 cf Field - 752.6 cf Chambers = 1,421.5 cf Stone x 35.0% Voids = 497.5 cf Stone Storage

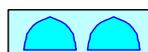
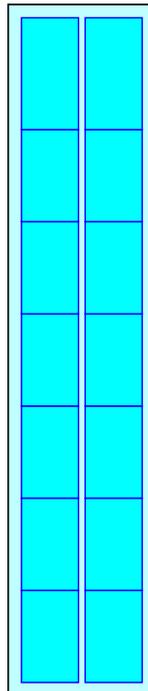
Chamber Storage + Stone Storage = 1,250.1 cf = 0.029 af

Overall Storage Efficiency = 57.5%

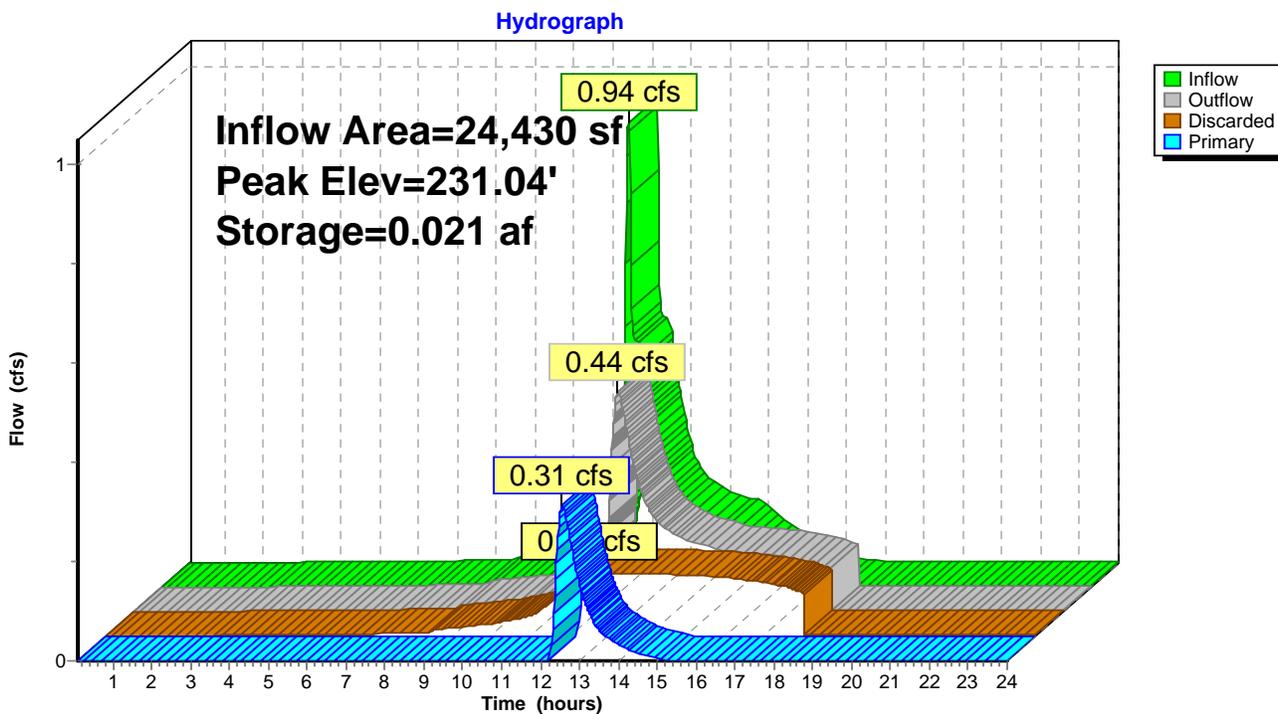
14 Chambers

80.5 cy Field

52.6 cy Stone



### Pond C3: Southwest Cultecs



**Summary for Pond CB1: Catch Basin #1**

Inflow Area = 10,259 sf, 69.83% Impervious, Inflow Depth > 2.97" for 10 year event  
 Inflow = 0.81 cfs @ 12.09 hrs, Volume= 2,539 cf  
 Outflow = 0.81 cfs @ 12.10 hrs, Volume= 2,519 cf, Atten= 1%, Lag= 0.6 min  
 Primary = 0.81 cfs @ 12.10 hrs, Volume= 2,519 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 234.37' @ 12.10 hrs Surf.Area= 13 sf Storage= 37 cf

Plug-Flow detention time= 7.7 min calculated for 2,517 cf (99% of inflow)  
 Center-of-Mass det. time= 3.0 min ( 813.4 - 810.4 )

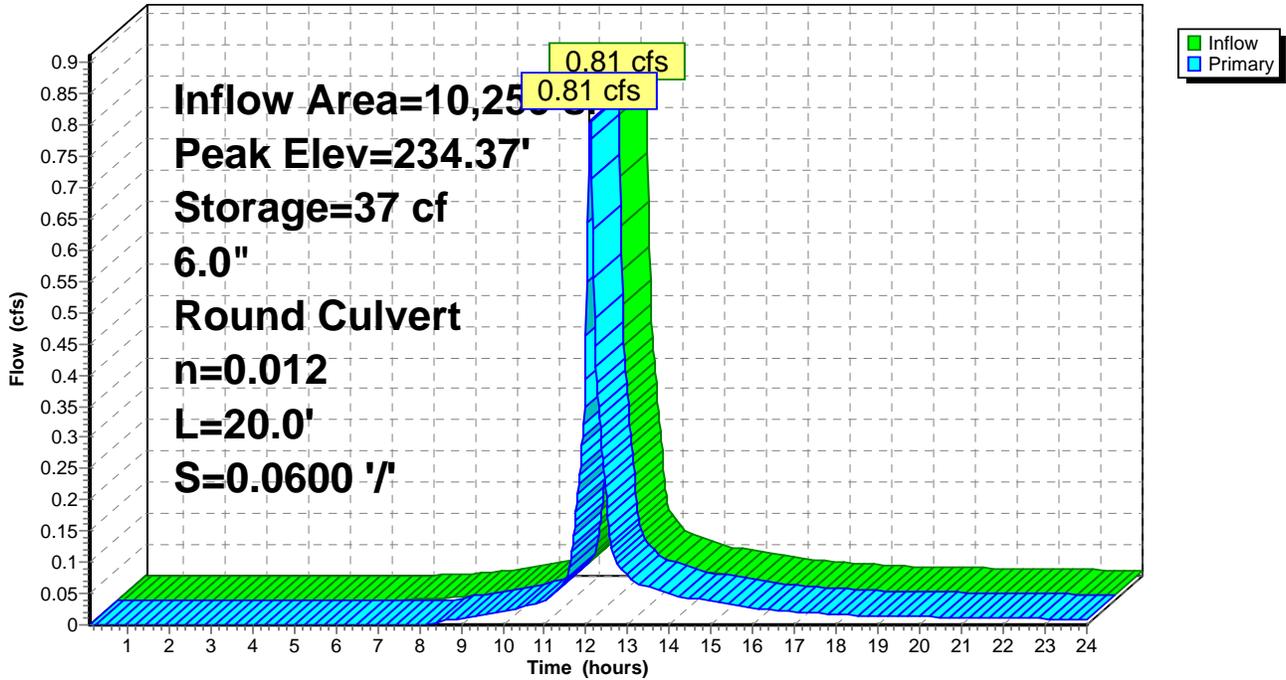
Volume	Invert	Avail.Storage	Storage Description
#1	231.50'	464 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
231.50	13	0	0
235.00	13	46	46
235.25	3,335	419	464

Device	Routing	Invert	Outlet Devices
#1	Primary	232.95'	<b>6.0" Round Culvert</b> L= 20.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.95' / 231.75' S= 0.0600 '/ Cc= 0.900 n= 0.012, Flow Area= 0.20 sf

**Primary OutFlow** Max=0.81 cfs @ 12.10 hrs HW=234.36' TW=232.30' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 0.81 cfs @ 4.10 fps)

### Pond CB1: Catch Basin #1

Hydrograph



**Summary for Pond CB2: Catch Basin #2**

Inflow Area = 4,232 sf, 100.00% Impervious, Inflow Depth > 4.33" for 10 year event  
 Inflow = 0.43 cfs @ 12.08 hrs, Volume= 1,527 cf  
 Outflow = 0.43 cfs @ 12.09 hrs, Volume= 1,508 cf, Atten= 0%, Lag= 0.3 min  
 Primary = 0.43 cfs @ 12.09 hrs, Volume= 1,508 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 233.54' @ 12.09 hrs Surf.Area= 13 sf Storage= 26 cf

Plug-Flow detention time= 16.2 min calculated for 1,508 cf (99% of inflow)  
 Center-of-Mass det. time= 7.9 min ( 756.9 - 749.0 )

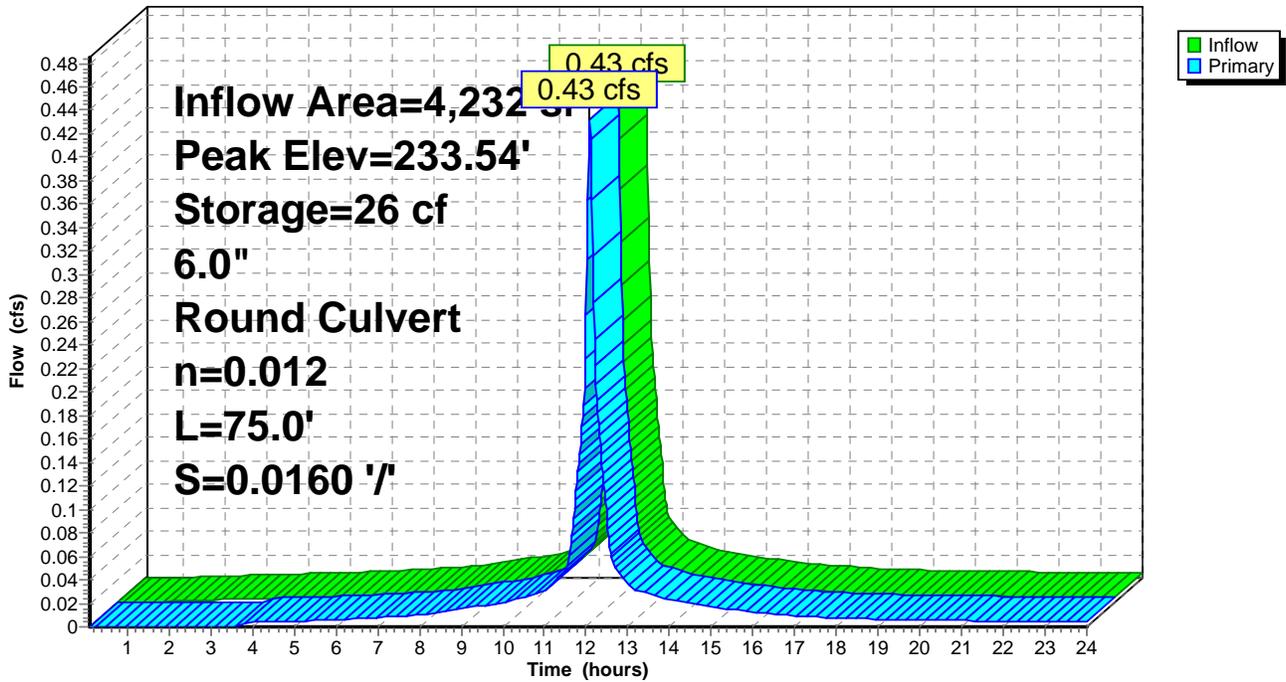
Volume	Invert	Avail.Storage	Storage Description
#1	231.50'	258 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
231.50	13	0	0
235.00	13	46	46
235.25	1,690	213	258

Device	Routing	Invert	Outlet Devices
#1	Primary	232.95'	<b>6.0" Round Culvert</b> L= 75.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.95' / 231.75' S= 0.0160 ' S= 0.0160 ' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf

**Primary OutFlow** Max=0.43 cfs @ 12.09 hrs HW=233.53' TW=232.28' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 0.43 cfs @ 2.19 fps)

### Pond CB2: Catch Basin #2

Hydrograph



**Summary for Pond CB3: Catch Basin #3**

Inflow Area = 3,960 sf, 100.00% Impervious, Inflow Depth > 4.33" for 10 year event  
 Inflow = 0.41 cfs @ 12.08 hrs, Volume= 1,429 cf  
 Outflow = 0.40 cfs @ 12.09 hrs, Volume= 1,410 cf, Atten= 0%, Lag= 0.3 min  
 Primary = 0.40 cfs @ 12.09 hrs, Volume= 1,410 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 233.49' @ 12.09 hrs Surf.Area= 13 sf Storage= 26 cf

Plug-Flow detention time= 17.3 min calculated for 1,410 cf (99% of inflow)  
 Center-of-Mass det. time= 8.4 min ( 757.4 - 749.0 )

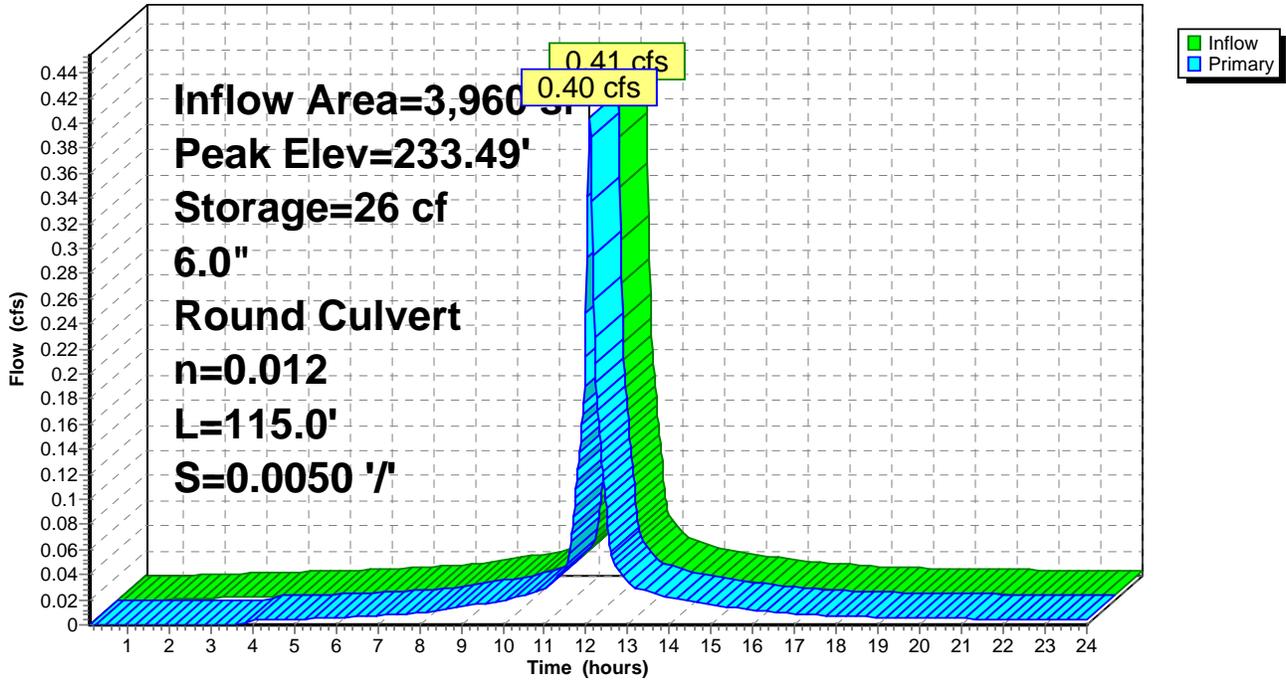
Volume	Invert	Avail.Storage	Storage Description
#1	231.50'	293 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
231.50	13	0	0
235.00	13	46	46
235.25	1,963	247	293

Device	Routing	Invert	Outlet Devices
#1	Primary	232.95'	<b>6.0" Round Culvert</b> L= 115.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.95' / 232.38' S= 0.0050 ' / ' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf

**Primary OutFlow** Max=0.40 cfs @ 12.09 hrs HW=233.49' TW=231.77' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 0.40 cfs @ 2.04 fps)

### Pond CB3: Catch Basin #3

Hydrograph



**Summary for Pond D1: Drywell**

Inflow Area = 3,960 sf, 100.00% Impervious, Inflow Depth > 4.27" for 10 year event  
 Inflow = 0.40 cfs @ 12.09 hrs, Volume= 1,410 cf  
 Outflow = 0.40 cfs @ 12.10 hrs, Volume= 1,403 cf, Atten= 0%, Lag= 0.5 min  
 Discarded = 0.01 cfs @ 12.10 hrs, Volume= 453 cf  
 Primary = 0.39 cfs @ 12.10 hrs, Volume= 949 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 231.78' @ 12.10 hrs Surf.Area= 33 sf Storage= 38 cf

Plug-Flow detention time= 17.8 min calculated for 1,401 cf (99% of inflow)  
 Center-of-Mass det. time= 14.4 min ( 771.8 - 757.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	230.00'	98 cf	<b>5.00'D x 5.00'H Vertical Cone/Cylinder</b> Inside #2 141 cf Overall - 6.0" Wall Thickness = 98 cf
#2	230.00'	9 cf	<b>6.50'D x 5.00'H Vertical Cone/Cylinder</b> 166 cf Overall - 141 cf Embedded = 25 cf x 35.0% Voids
		107 cf	Total Available Storage

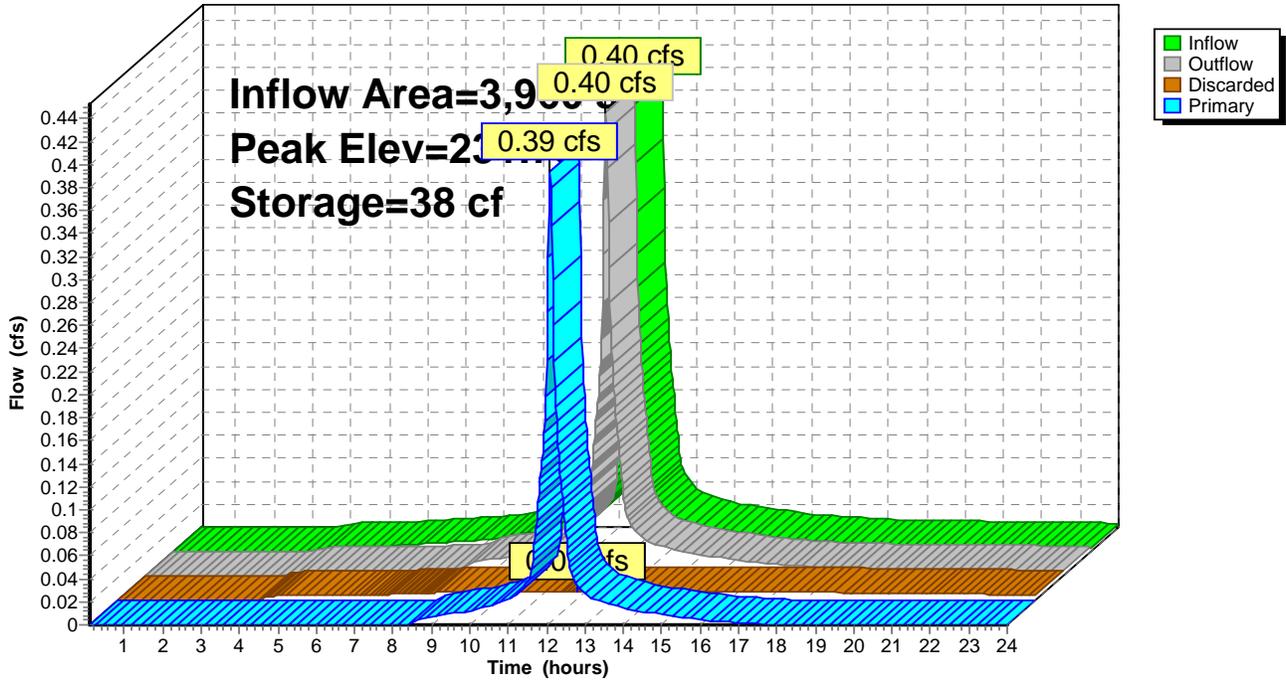
Device	Routing	Invert	Outlet Devices
#1	Primary	231.25'	<b>6.0" Round Culvert</b> L= 5.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 231.25' / 231.00' S= 0.0500 '/ Cc= 0.900 n= 0.012, Flow Area= 0.20 sf
#2	Discarded	230.00'	<b>5.100 in/hr Exfiltration over Wetted area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.01 cfs @ 12.10 hrs HW=231.78' (Free Discharge)  
 ↳ **2=Exfiltration** (Exfiltration Controls 0.01 cfs)

**Primary OutFlow** Max=0.39 cfs @ 12.10 hrs HW=231.78' TW=230.09' (Dynamic Tailwater)  
 ↳ **1=Culvert** (Inlet Controls 0.39 cfs @ 2.00 fps)

### Pond D1: Drywell

Hydrograph



Time span=0.10-24.00 hrs, dt=0.02 hrs, 1196 points x 3  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment 1S: Roof Drain South West** Runoff Area=2,749 sf 100.00% Impervious Runoff Depth>7.88"  
 Flow Length=50' Slope=0.1300 '/ Tc=6.0 min CN=98 Runoff=0.50 cfs 1,806 cf

**Subcatchment 2S: Roof Drain North Side** Runoff Area=3,230 sf 100.00% Impervious Runoff Depth>7.88"  
 Flow Length=50' Slope=0.1300 '/ Tc=6.0 min CN=98 Runoff=0.59 cfs 2,122 cf

**Subcatchment 3S: Upper Paved Area** Runoff Area=10,259 sf 69.83% Impervious Runoff Depth>6.33"  
 Tc=6.0 min CN=85 Runoff=1.68 cfs 5,414 cf

**Subcatchment 4S: Middle Paved Area &** Runoff Area=4,232 sf 100.00% Impervious Runoff Depth>7.88"  
 Tc=6.0 min CN=98 Runoff=0.77 cfs 2,781 cf

**Subcatchment 5S: Lower Paved Area** Runoff Area=3,960 sf 100.00% Impervious Runoff Depth>7.88"  
 Tc=6.0 min CN=98 Runoff=0.72 cfs 2,602 cf

**Subcatchment 6S: Remaining Project Area** Runoff Area=217,642 sf 3.80% Impervious Runoff Depth>2.21"  
 Flow Length=562' Tc=15.9 min CN=49 Runoff=8.66 cfs 40,137 cf

**Subcatchment EX: Existing Site** Runoff Area=242,195 sf 7.17% Impervious Runoff Depth>2.32"  
 Flow Length=562' Tc=15.9 min CN=50 Runoff=10.24 cfs 46,812 cf

**Reach END: Proposed Site Runoff** Inflow=10.04 cfs 45,495 cf  
 Outflow=10.04 cfs 45,495 cf

**Pond C1: Northeast Cultecs** Peak Elev=233.61' Storage=0.061 af Inflow=1.79 cfs 8,155 cf  
 Discarded=0.00 cfs 0 cf Primary=1.03 cfs 7,604 cf Outflow=1.03 cfs 7,604 cf

**Pond C2: Intermediate Cultecs** Peak Elev=232.78' Storage=876 cf Inflow=1.46 cfs 9,726 cf  
 Discarded=0.08 cfs 3,498 cf Primary=1.12 cfs 6,227 cf Outflow=1.20 cfs 9,725 cf

**Pond C3: Southwest Cultecs** Peak Elev=232.11' Storage=0.032 af Inflow=1.96 cfs 10,050 cf  
 Discarded=0.16 cfs 4,692 cf Primary=1.39 cfs 5,358 cf Outflow=1.55 cfs 10,050 cf

**Pond CB1: Catch Basin #1** Peak Elev=235.19' Storage=296 cf Inflow=1.68 cfs 5,414 cf  
 6.0" Round Culvert n=0.012 L=20.0' S=0.0600 '/ Outflow=1.06 cfs 5,394 cf

**Pond CB2: Catch Basin #2** Peak Elev=234.51' Storage=39 cf Inflow=0.77 cfs 2,781 cf  
 6.0" Round Culvert n=0.012 L=75.0' S=0.0160 '/ Outflow=0.75 cfs 2,761 cf

**Pond CB3: Catch Basin #3** Peak Elev=234.82' Storage=43 cf Inflow=0.72 cfs 2,602 cf  
 6.0" Round Culvert n=0.012 L=115.0' S=0.0050 '/ Outflow=0.71 cfs 2,582 cf

**Pond D1: Drywell** Peak Elev=232.46' Storage=53 cf Inflow=0.71 cfs 2,582 cf  
 Discarded=0.01 cfs 539 cf Primary=0.68 cfs 2,017 cf Outflow=0.69 cfs 2,556 cf

**Total Runoff Area = 484,267 sf Runoff Volume = 101,675 cf Average Runoff Depth = 2.52"**  
**90.30% Pervious = 437,284 sf 9.70% Impervious = 46,983 sf**

**Summary for Subcatchment 1S: Roof Drain South West Side**

Runoff = 0.50 cfs @ 12.08 hrs, Volume= 1,806 cf, Depth> 7.88"

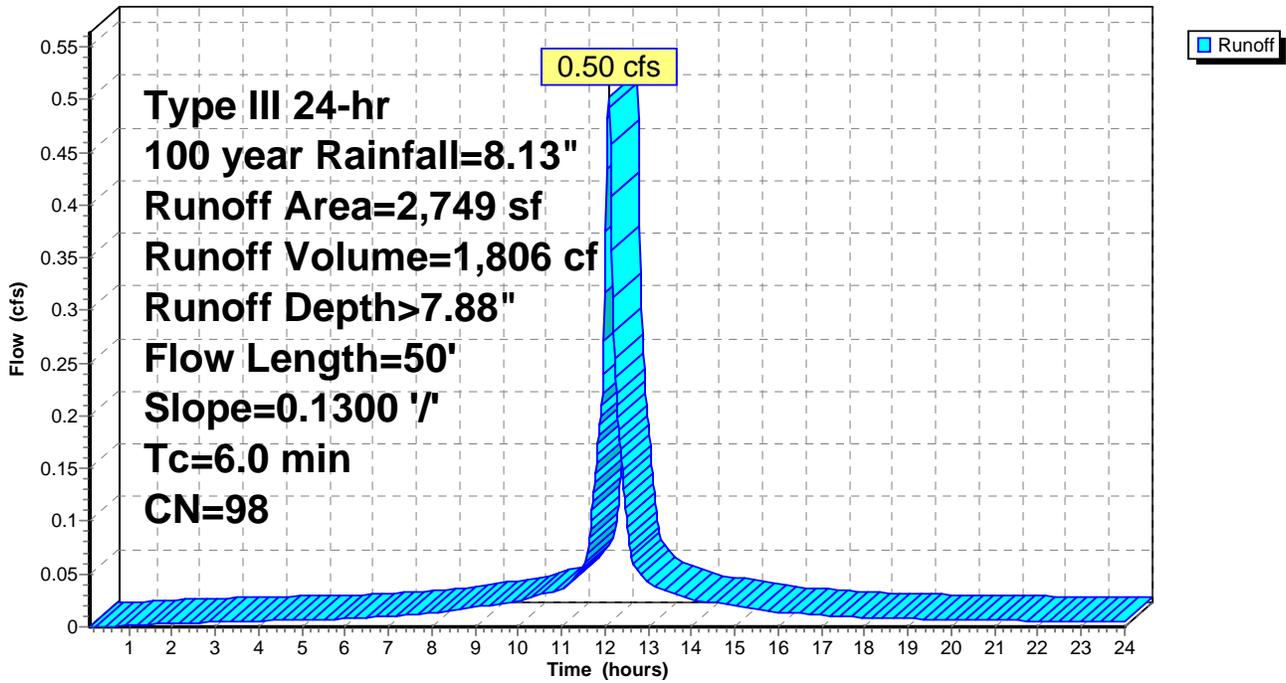
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs  
Type III 24-hr 100 year Rainfall=8.13"

Area (sf)	CN	Description
2,749	98	Roofs, HSG A
2,749		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.1300	0.14		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.06"

**Subcatchment 1S: Roof Drain South West Side**

Hydrograph



**Summary for Subcatchment 2S: Roof Drain North Side**

Runoff = 0.59 cfs @ 12.08 hrs, Volume= 2,122 cf, Depth> 7.88"

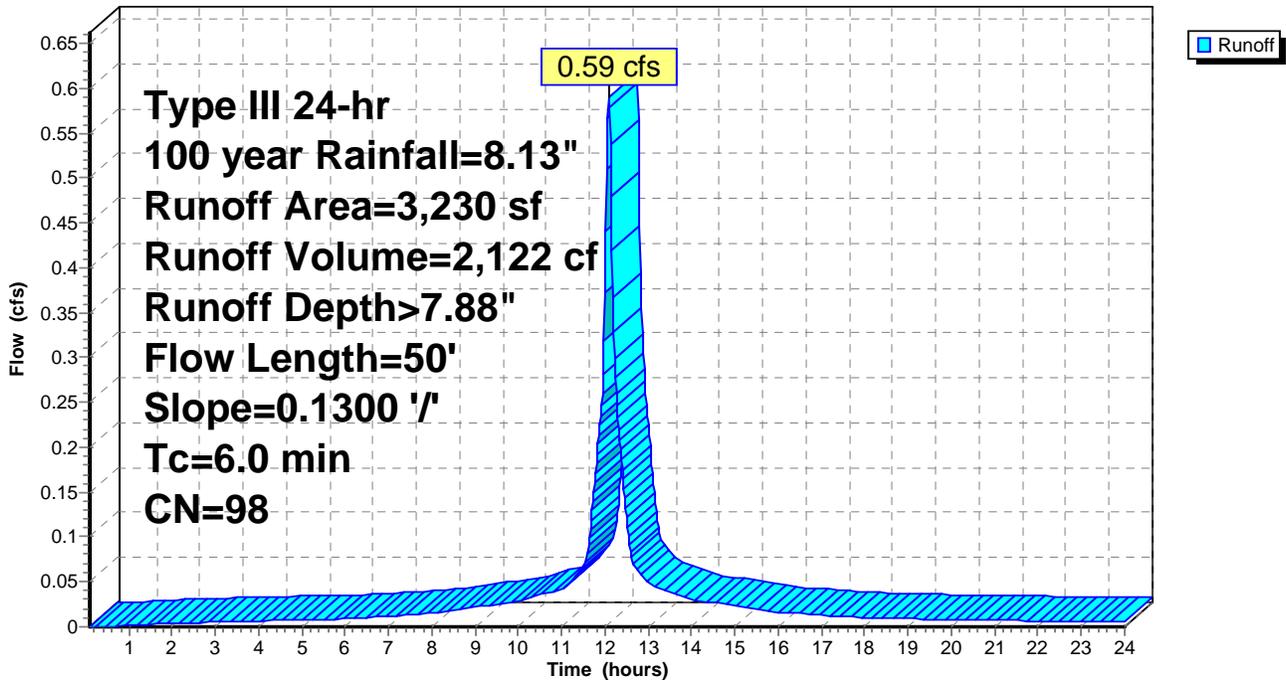
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs  
 Type III 24-hr 100 year Rainfall=8.13"

Area (sf)	CN	Description
3,230	98	Roofs, HSG A
3,230		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.1300	0.14		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.06"

**Subcatchment 2S: Roof Drain North Side**

Hydrograph



**Summary for Subcatchment 3S: Upper Paved Area**

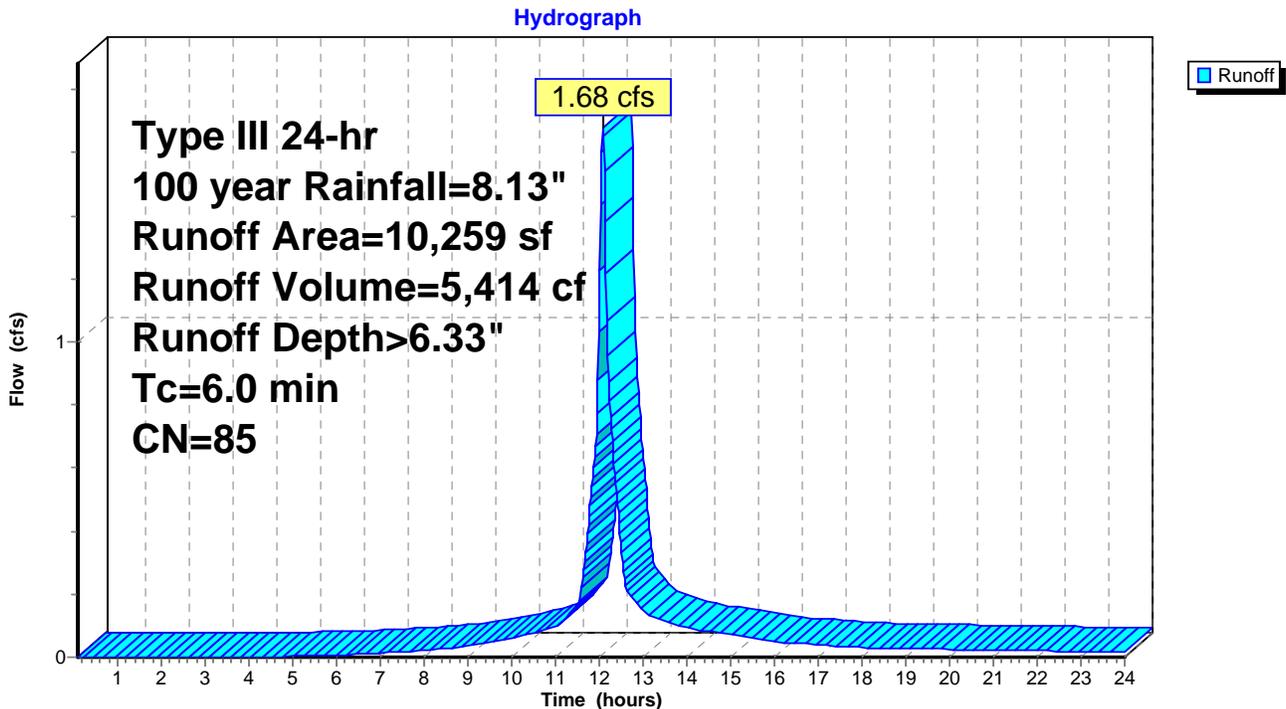
Runoff = 1.68 cfs @ 12.09 hrs, Volume= 5,414 cf, Depth> 6.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs  
Type III 24-hr 100 year Rainfall=8.13"

Area (sf)	CN	Description
7,164	98	Paved parking, HSG A
1,956	49	50-75% Grass cover, Fair, HSG A
441	49	50-75% Grass cover, Fair, HSG A
* 698	76	Gravel roads, HSG A (rip rap)
10,259	85	Weighted Average
3,095		30.17% Pervious Area
7,164		69.83% Impervious Area

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

**Subcatchment 3S: Upper Paved Area**



**Summary for Subcatchment 4S: Middle Paved Area & Eastern Roof**

Runoff = 0.77 cfs @ 12.08 hrs, Volume= 2,781 cf, Depth> 7.88"

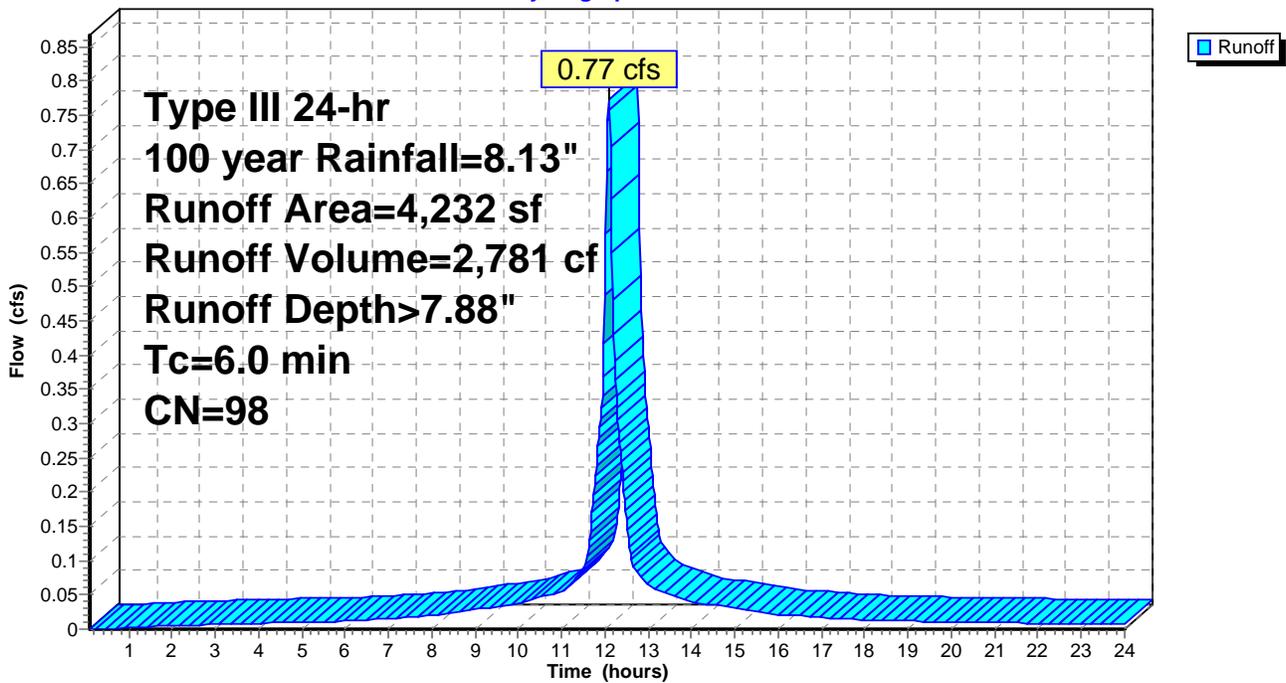
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs  
 Type III 24-hr 100 year Rainfall=8.13"

Area (sf)	CN	Description
2,572	98	Paved parking, HSG A
1,660	98	Roofs, HSG A
4,232	98	Weighted Average
4,232		100.00% Impervious Area

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

**Subcatchment 4S: Middle Paved Area & Eastern Roof**

Hydrograph



**Summary for Subcatchment 5S: Lower Paved Area**

Runoff = 0.72 cfs @ 12.08 hrs, Volume= 2,602 cf, Depth> 7.88"

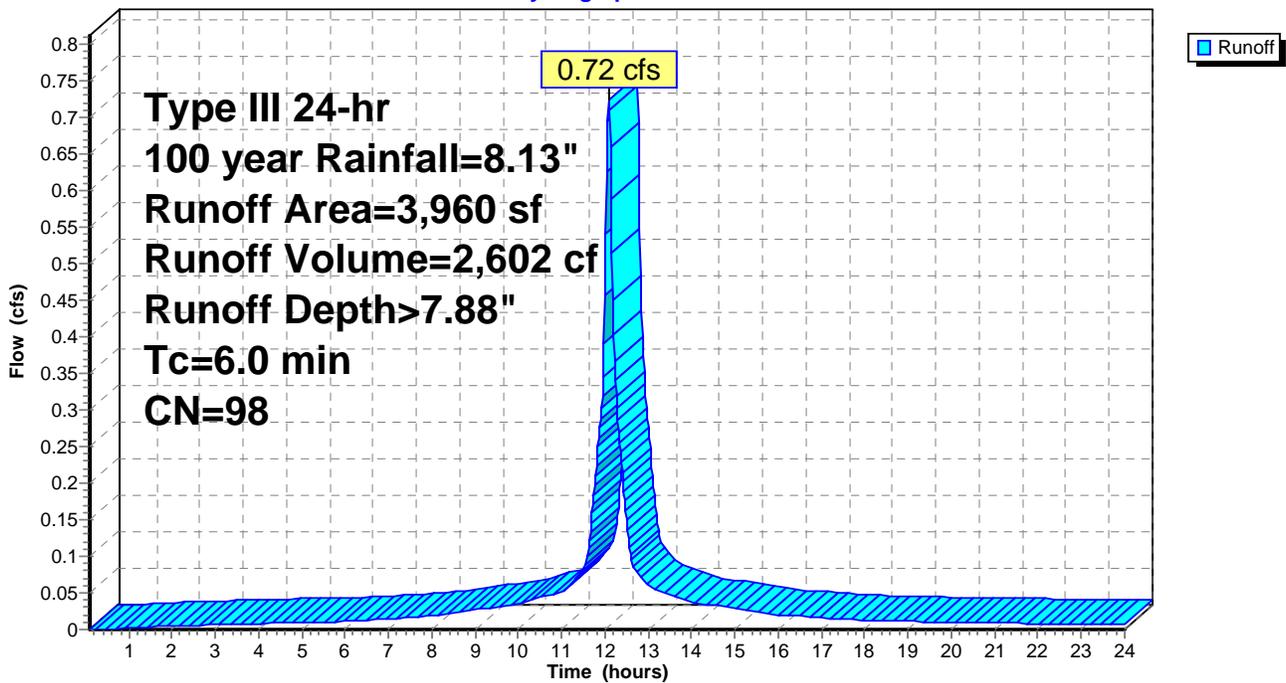
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs  
 Type III 24-hr 100 year Rainfall=8.13"

Area (sf)	CN	Description
3,960	98	Paved parking, HSG A
3,960		100.00% Impervious Area

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

**Subcatchment 5S: Lower Paved Area**

Hydrograph



**Summary for Subcatchment 6S: Remaining Project Area**

Runoff = 8.66 cfs @ 12.24 hrs, Volume= 40,137 cf, Depth> 2.21"

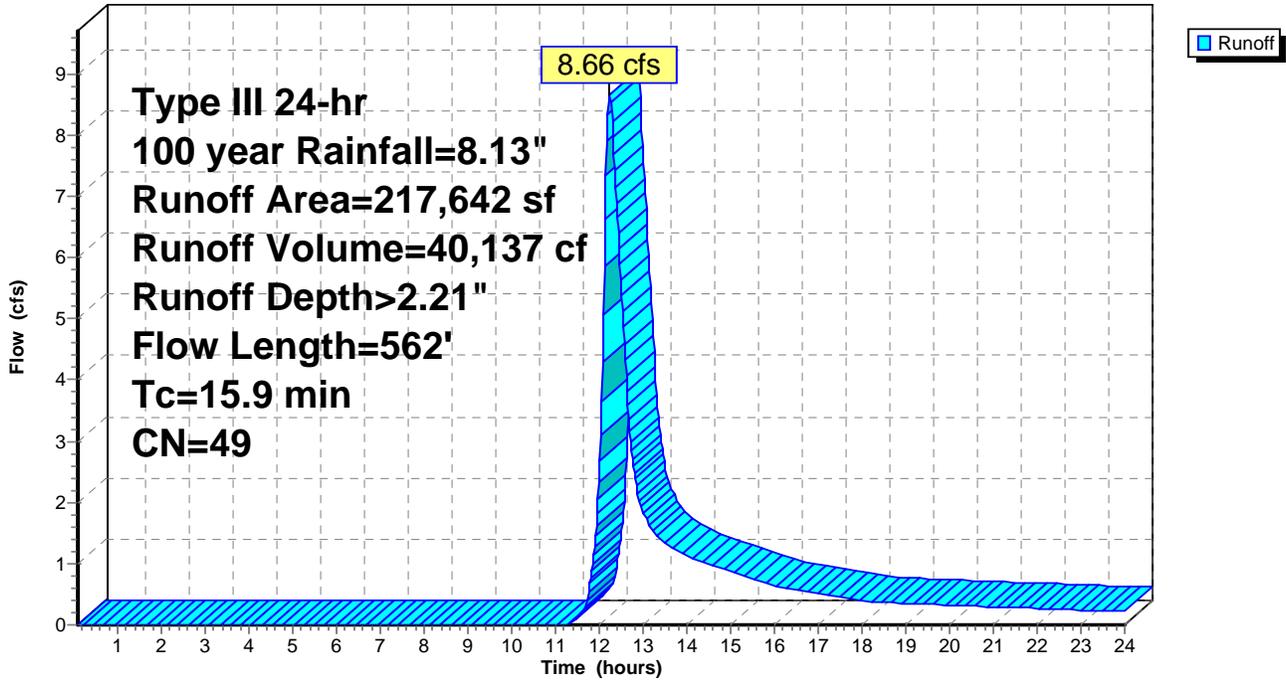
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs  
 Type III 24-hr 100 year Rainfall=8.13"

Area (sf)	CN	Description
2,763	49	50-75% Grass cover, Fair, HSG A
9,597	76	Gravel roads, HSG A
8,274	98	Paved parking, HSG A
7,927	49	50-75% Grass cover, Fair, HSG A
27,757	78	Meadow, non-grazed, HSG D
28,946	77	Woods, Good, HSG D
78,485	30	Woods, Good, HSG A
39,143	30	Meadow, non-grazed, HSG A
11,968	30	Woods, Good, HSG A
* 2,782	76	Gravel roads, HSG A (RIP RAP)
217,642	49	Weighted Average
209,368		96.20% Pervious Area
8,274		3.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.0500	0.10		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.06"
0.3	36	0.1676	2.05		<b>Shallow Concentrated Flow, woods pre grass strip</b> Woodland Kv= 5.0 fps
0.1	10	0.1000	2.21		<b>Shallow Concentrated Flow, grass strips (both)</b> Short Grass Pasture Kv= 7.0 fps
0.0	12	0.0833	5.86		<b>Shallow Concentrated Flow, pavement</b> Paved Kv= 20.3 fps
6.7	440	0.0480	1.10		<b>Shallow Concentrated Flow, rip rap</b> Woodland Kv= 5.0 fps
0.1	14	0.1667	2.86		<b>Shallow Concentrated Flow, grass strip</b> Short Grass Pasture Kv= 7.0 fps
15.9	562	Total			

### Subcatchment 6S: Remaining Project Area

Hydrograph



**Summary for Subcatchment EX: Existing Site**

Runoff = 10.24 cfs @ 12.24 hrs, Volume= 46,812 cf, Depth> 2.32"

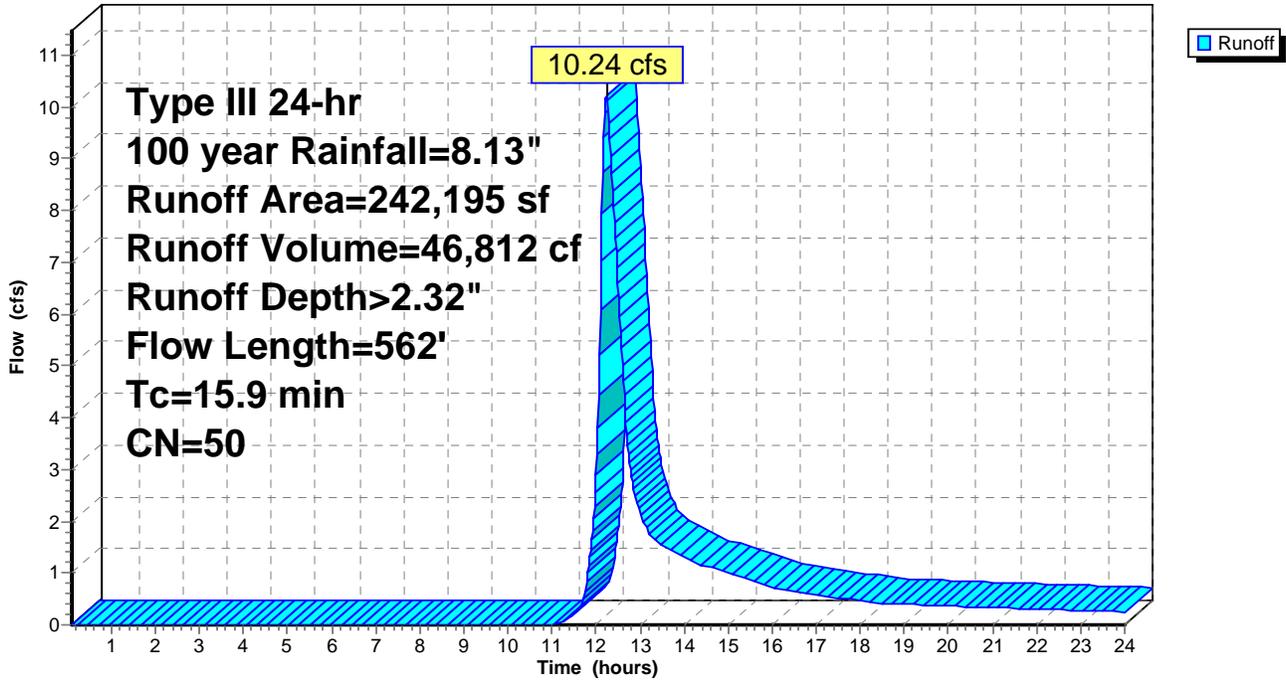
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs  
Type III 24-hr 100 year Rainfall=8.13"

Area (sf)	CN	Description
11,475	49	50-75% Grass cover, Fair, HSG A
3,181	76	Gravel roads, HSG A
17,374	98	Paved parking, HSG A
4,242	49	50-75% Grass cover, Fair, HSG A
8,728	49	50-75% Grass cover, Fair, HSG A
* 3,480	76	Gravel roads, HSG A (RIP RAP)
59,405	77	Woods, Good, HSG D
82,915	30	Woods, Good, HSG A
9,737	30	Woods, Good, HSG A
41,658	30	Woods, Good, HSG A
242,195	50	Weighted Average
224,821		92.83% Pervious Area
17,374		7.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.0500	0.10		<b>Sheet Flow, sheet flow</b> Woods: Light underbrush n= 0.400 P2= 3.06"
0.3	36	0.1676	2.05		<b>Shallow Concentrated Flow, woods</b> Woodland Kv= 5.0 fps
0.0	12	0.1000	6.42		<b>Shallow Concentrated Flow, pavement</b> Paved Kv= 20.3 fps
0.1	10	0.1000	2.21		<b>Shallow Concentrated Flow, grass strip (both)</b> Short Grass Pasture Kv= 7.0 fps
6.7	440	0.0480	1.10		<b>Shallow Concentrated Flow, rip rap</b> Woodland Kv= 5.0 fps
0.1	14	0.1667	2.86		<b>Shallow Concentrated Flow, final grass strip</b> Short Grass Pasture Kv= 7.0 fps
15.9	562	Total			

### Subcatchment EX: Existing Site

Hydrograph



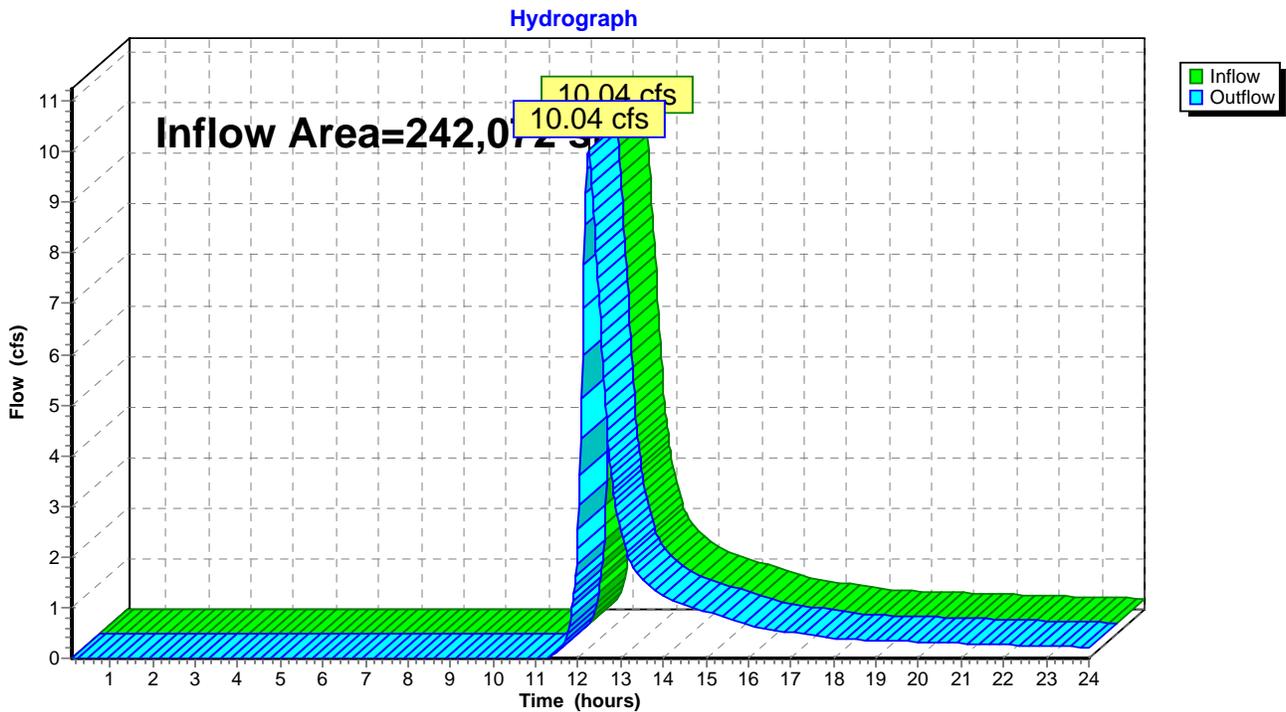
### Summary for Reach END: Proposed Site Runoff

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

Inflow Area = 242,072 sf, 12.23% Impervious, Inflow Depth > 2.26" for 100 year event  
Inflow = 10.04 cfs @ 12.24 hrs, Volume= 45,495 cf  
Outflow = 10.04 cfs @ 12.24 hrs, Volume= 45,495 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3

### Reach END: Proposed Site Runoff



**Summary for Pond C1: Northeast Cultecs**

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=1)

Inflow Area = 14,491 sf, 78.64% Impervious, Inflow Depth > 6.75" for 100 year event  
 Inflow = 1.79 cfs @ 12.10 hrs, Volume= 8,155 cf  
 Outflow = 1.03 cfs @ 12.44 hrs, Volume= 7,604 cf, Atten= 43%, Lag= 20.5 min  
 Discarded = 0.00 cfs @ 0.10 hrs, Volume= 0 cf  
 Primary = 1.03 cfs @ 12.44 hrs, Volume= 7,604 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 233.61' @ 12.43 hrs Surf.Area= 0.046 ac Storage= 0.061 af

Plug-Flow detention time= 105.2 min calculated for 7,604 cf (93% of inflow)  
 Center-of-Mass det. time= 69.0 min ( 845.3 - 776.3 )

Volume	Invert	Avail.Storage	Storage Description
#1A	231.17'	0.018 af	<b>14.50'W x 84.75'L x 2.54'H Field A</b> 0.072 af Overall - 0.020 af Embedded = 0.052 af x 35.0% Voids
#2A	231.67'	0.020 af	<b>Cultec R-150XLHD x 32 Inside #1</b> Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap Row Length Adjustment= +0.75' x 2.65 sf x 4 rows
#3B	231.17'	0.012 af	<b>14.50'W x 54.00'L x 2.54'H Field B</b> 0.046 af Overall - 0.013 af Embedded = 0.033 af x 35.0% Voids
#4B	231.67'	0.013 af	<b>Cultec R-150XLHD x 20 Inside #3</b> Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap Row Length Adjustment= +0.75' x 2.65 sf x 4 rows
		0.062 af	Total Available Storage

Storage Group A created with Chamber Wizard  
 Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	231.17'	<b>0.090 in/hr Exfiltration X 0.00 over Surface area</b> Phase-In= 0.01'
#2	Primary	231.67'	<b>4.0" Round Culvert</b> L= 145.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 231.67' / 230.95' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 0.09 sf
#3	Primary	232.33'	<b>8.0" Round Culvert</b> L= 145.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.33' / 231.44' S= 0.0061 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf

**Discarded OutFlow** Max=0.00 cfs @ 0.10 hrs HW=231.17' (Free Discharge)

↳ **1=Exfiltration** ( Controls 0.00 cfs)

**Primary OutFlow** Max=1.03 cfs @ 12.44 hrs HW=233.61' TW=232.76' (Dynamic Tailwater)

↳ **2=Culvert** (Outlet Controls 0.15 cfs @ 1.70 fps)

↳ **3=Culvert** (Outlet Controls 0.88 cfs @ 2.52 fps)

**Pond C1: Northeast Cultecs - Chamber Wizard Field A**

**Chamber Model = Cultec R-150XLHD (Cultec Recharger® 150XLHD)**

Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf

Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap

Row Length Adjustment= +0.75' x 2.65 sf x 4 rows

33.0" Wide + 6.0" Spacing = 39.0" C-C Row Spacing

8 Chambers/Row x 10.25' Long +0.75' Row Adjustment = 82.75' Row Length +12.0" End Stone x 2 = 84.75' Base Length

4 Rows x 33.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 14.50' Base Width

6.0" Base + 18.5" Chamber Height + 6.0" Cover = 2.54' Field Height

32 Chambers x 27.2 cf +0.75' Row Adjustment x 2.65 sf x 4 Rows = 876.8 cf Chamber Storage

3,123.4 cf Field - 876.8 cf Chambers = 2,246.6 cf Stone x 35.0% Voids = 786.3 cf Stone Storage

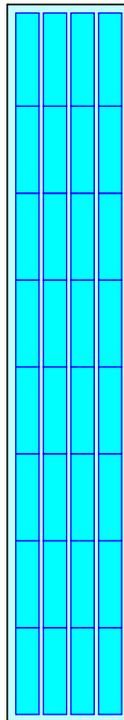
Chamber Storage + Stone Storage = 1,663.1 cf = 0.038 af

Overall Storage Efficiency = 53.2%

32 Chambers

115.7 cy Field

83.2 cy Stone



**Pond C1: Northeast Cultecs - Chamber Wizard Field B**

**Chamber Model = Cultec R-150XLHD (Cultec Recharger® 150XLHD)**

Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf

Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap

Row Length Adjustment= +0.75' x 2.65 sf x 4 rows

33.0" Wide + 6.0" Spacing = 39.0" C-C Row Spacing

5 Chambers/Row x 10.25' Long +0.75' Row Adjustment = 52.00' Row Length +12.0" End Stone x 2 = 54.00' Base Length

4 Rows x 33.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 14.50' Base Width

6.0" Base + 18.5" Chamber Height + 6.0" Cover = 2.54' Field Height

20 Chambers x 27.2 cf +0.75' Row Adjustment x 2.65 sf x 4 Rows = 551.0 cf Chamber Storage

1,990.1 cf Field - 551.0 cf Chambers = 1,439.1 cf Stone x 35.0% Voids = 503.7 cf Stone Storage

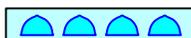
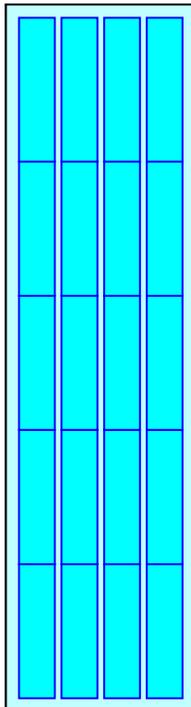
Chamber Storage + Stone Storage = 1,054.7 cf = 0.024 af

Overall Storage Efficiency = 53.0%

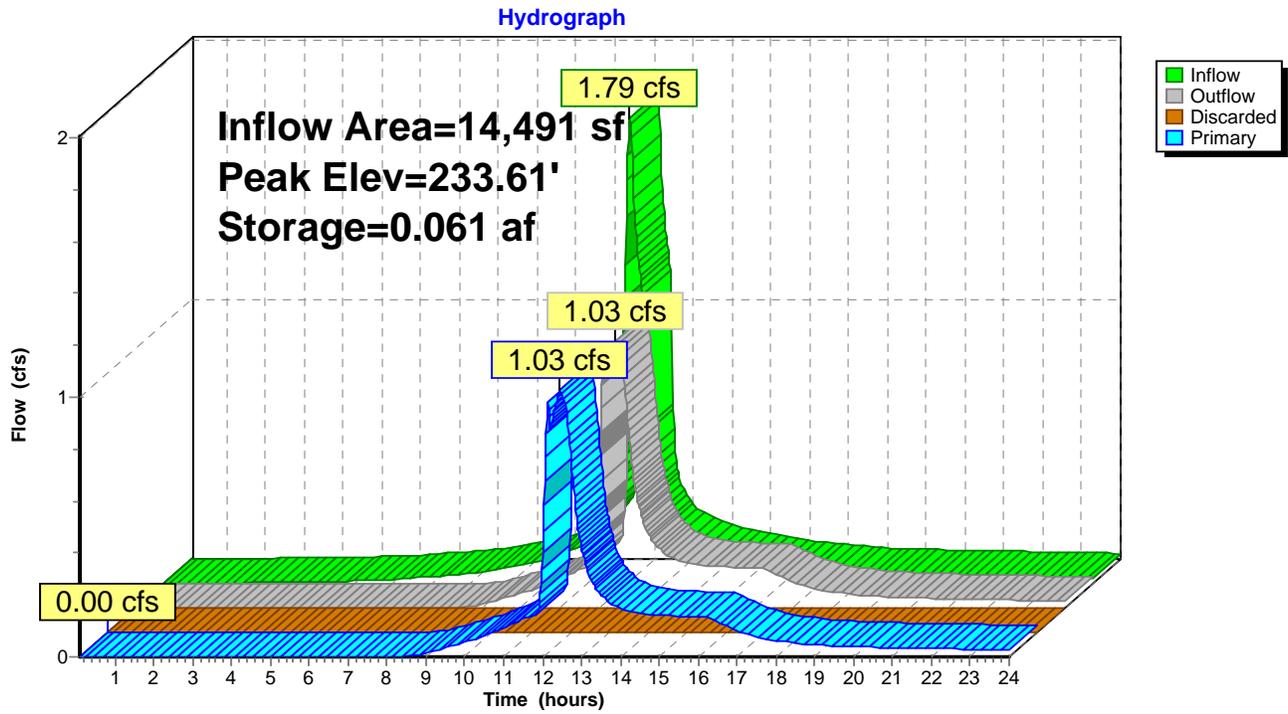
20 Chambers

73.7 cy Field

53.3 cy Stone



### Pond C1: Northeast Cultecs



**Summary for Pond C2: Intermediate Cultecs**

Inflow Area = 17,721 sf, 82.53% Impervious, Inflow Depth > 6.59" for 100 year event  
 Inflow = 1.46 cfs @ 12.13 hrs, Volume= 9,726 cf  
 Outflow = 1.20 cfs @ 12.45 hrs, Volume= 9,725 cf, Atten= 18%, Lag= 19.4 min  
 Discarded = 0.08 cfs @ 12.37 hrs, Volume= 3,498 cf  
 Primary = 1.12 cfs @ 12.45 hrs, Volume= 6,227 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 232.78' @ 12.37 hrs Surf.Area= 392 sf Storage= 876 cf  
 Flood Elev= 233.94' Surf.Area= 392 sf Storage= 950 cf

Plug-Flow detention time= 26.9 min calculated for 9,725 cf (100% of inflow)  
 Center-of-Mass det. time= 26.8 min ( 849.3 - 822.4 )

Volume	Invert	Avail.Storage	Storage Description
#1A	228.78'	447 cf	<b>16.00'W x 24.50'L x 4.54'H Field A</b> 1,780 cf Overall - 503 cf Embedded = 1,277 cf x 35.0% Voids
#2A	229.78'	503 cf	<b>Cultec R-330XLHD x 9 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		950 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	228.78'	<b>5.100 in/hr Exfiltration over Wetted area</b> Phase-In= 0.01'
#2	Primary	230.00'	<b>8.0" Round Culvert</b> L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 230.00' / 230.00' S= 0.0000 1/ S= 0.0000 1/ Cc= 0.900 n= 0.012, Flow Area= 0.35 sf

**Discarded OutFlow** Max=0.08 cfs @ 12.37 hrs HW=232.78' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

**Primary OutFlow** Max=1.12 cfs @ 12.45 hrs HW=232.76' TW=232.04' (Dynamic Tailwater)

↑**2=Culvert** (Inlet Controls 1.12 cfs @ 3.21 fps)

**Pond C2: Intermediate Cultecs - Chamber Wizard Field A**

**Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)**

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 3 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

3 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 22.50' Row Length +12.0" End Stone x 2 = 24.50' Base Length

3 Rows x 52.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 16.00' Base Width

12.0" Base + 30.5" Chamber Height + 12.0" Cover = 4.54' Field Height

9 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 3 Rows = 502.9 cf Chamber Storage

1,780.3 cf Field - 502.9 cf Chambers = 1,277.4 cf Stone x 35.0% Voids = 447.1 cf Stone Storage

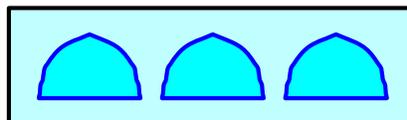
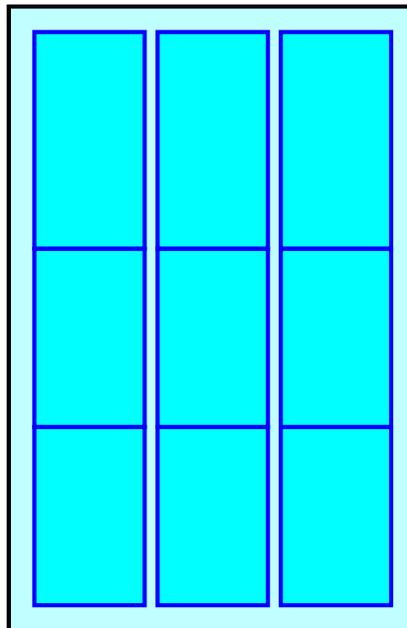
Chamber Storage + Stone Storage = 950.0 cf = 0.022 af

Overall Storage Efficiency = 53.4%

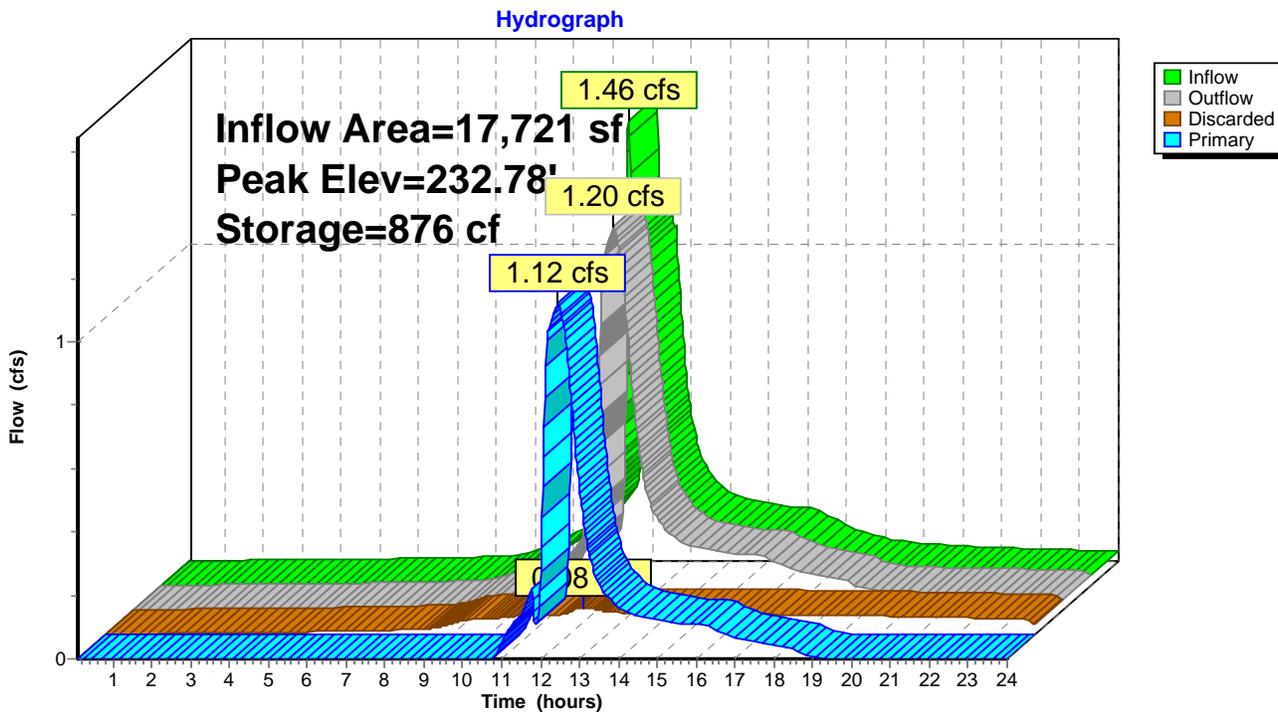
9 Chambers

65.9 cy Field

47.3 cy Stone



### Pond C2: Intermediate Cultecs



**Summary for Pond C3: Southwest Cultecs**

Inflow Area = 24,430 sf, 87.33% Impervious, Inflow Depth > 4.94" for 100 year event  
 Inflow = 1.96 cfs @ 12.14 hrs, Volume= 10,050 cf  
 Outflow = 1.55 cfs @ 12.30 hrs, Volume= 10,050 cf, Atten= 21%, Lag= 9.9 min  
 Discarded = 0.16 cfs @ 12.30 hrs, Volume= 4,692 cf  
 Primary = 1.39 cfs @ 12.30 hrs, Volume= 5,358 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 232.11' @ 12.30 hrs Surf.Area= 0.017 ac Storage= 0.032 af

Plug-Flow detention time= 34.7 min calculated for 10,042 cf (100% of inflow)  
 Center-of-Mass det. time= 34.6 min ( 812.7 - 778.1 )

Volume	Invert	Avail.Storage	Storage Description
#1A	229.07'	0.003 af	<b>6.33'W x 24.50'L x 3.71'H Field A</b> 0.013 af Overall - 0.004 af Embedded = 0.009 af x 35.0% Voids
#2A	229.74'	0.004 af	<b>Cultec R-330XLHD x 3 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 1 rows
#3B	229.07'	0.011 af	<b>11.17'W x 52.50'L x 3.71'H Field B</b> 0.050 af Overall - 0.017 af Embedded = 0.033 af x 35.0% Voids
#4B	229.74'	0.017 af	<b>Cultec R-330XLHD x 14 Inside #3</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 2 rows
		0.036 af	Total Available Storage

Storage Group A created with Chamber Wizard  
 Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	229.07'	<b>5.100 in/hr Exfiltration over Wetted area</b> Phase-In= 0.01'
#2	Primary	230.68'	<b>8.0" Round Culvert</b> L= 20.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 230.68' / 230.48' S= 0.0100 1/ S= 0.0100 1/ Cc= 0.900 n= 0.012, Flow Area= 0.35 sf

**Discarded OutFlow** Max=0.16 cfs @ 12.30 hrs HW=232.11' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.16 cfs)

**Primary OutFlow** Max=1.39 cfs @ 12.30 hrs HW=232.11' TW=0.00' (Dynamic Tailwater)

↑**2=Culvert** (Inlet Controls 1.39 cfs @ 3.99 fps)

**Pond C3: Southwest Cultecs - Chamber Wizard Field A**

**Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)**

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 1 rows

3 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 22.50' Row Length +12.0" End Stone x 2 = 24.50' Base Length

1 Rows x 52.0" Wide + 12.0" Side Stone x 2 = 6.33' Base Width

8.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.71' Field Height

3 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 1 Rows = 167.6 cf Chamber Storage

575.4 cf Field - 167.6 cf Chambers = 407.8 cf Stone x 35.0% Voids = 142.7 cf Stone Storage

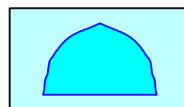
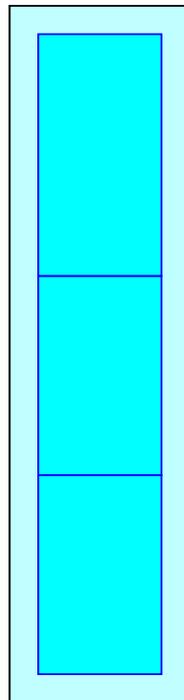
Chamber Storage + Stone Storage = 310.4 cf = 0.007 af

Overall Storage Efficiency = 53.9%

3 Chambers

21.3 cy Field

15.1 cy Stone



**Pond C3: Southwest Cultecs - Chamber Wizard Field B**

**Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)**

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 2 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

7 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 50.50' Row Length +12.0" End Stone x 2 = 52.50' Base Length

2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.17' Base Width

8.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.71' Field Height

14 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 2 Rows = 752.6 cf Chamber Storage

2,174.0 cf Field - 752.6 cf Chambers = 1,421.5 cf Stone x 35.0% Voids = 497.5 cf Stone Storage

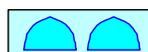
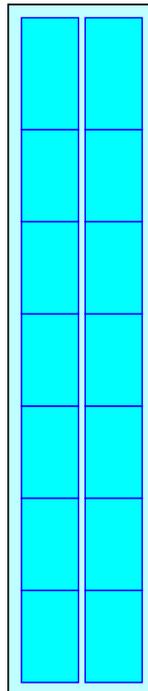
Chamber Storage + Stone Storage = 1,250.1 cf = 0.029 af

Overall Storage Efficiency = 57.5%

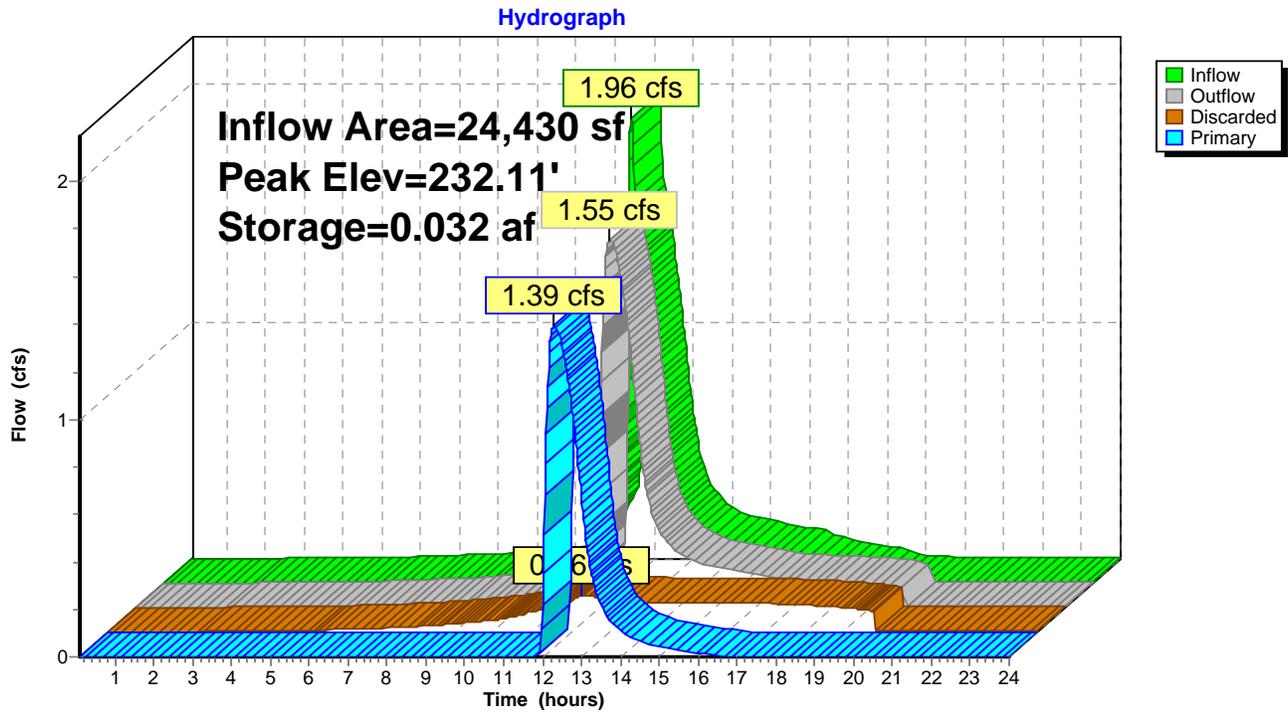
14 Chambers

80.5 cy Field

52.6 cy Stone



### Pond C3: Southwest Cultecs



**Summary for Pond CB1: Catch Basin #1**

Inflow Area = 10,259 sf, 69.83% Impervious, Inflow Depth > 6.33" for 100 year event  
 Inflow = 1.68 cfs @ 12.09 hrs, Volume= 5,414 cf  
 Outflow = 1.06 cfs @ 12.17 hrs, Volume= 5,394 cf, Atten= 37%, Lag= 5.2 min  
 Primary = 1.06 cfs @ 12.17 hrs, Volume= 5,394 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 235.19' @ 12.18 hrs Surf.Area= 2,578 sf Storage= 296 cf

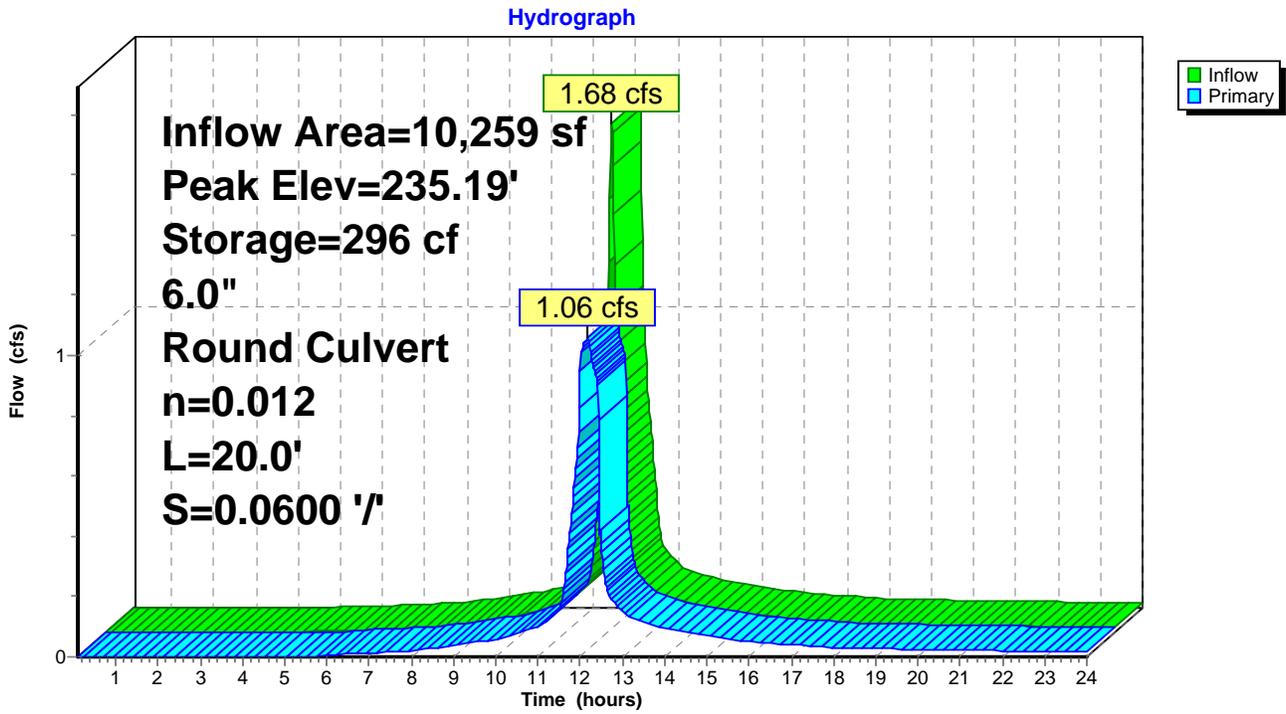
Plug-Flow detention time= 5.0 min calculated for 5,390 cf (100% of inflow)  
 Center-of-Mass det. time= 2.7 min ( 792.1 - 789.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	231.50'	464 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
231.50	13	0	0
235.00	13	46	46
235.25	3,335	419	464

Device	Routing	Invert	Outlet Devices
#1	Primary	232.95'	<b>6.0" Round Culvert</b> L= 20.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.95' / 231.75' S= 0.0600 '/ Cc= 0.900 n= 0.012, Flow Area= 0.20 sf

**Primary OutFlow** Max=1.05 cfs @ 12.17 hrs HW=235.19' TW=233.15' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 1.05 cfs @ 5.36 fps)

### Pond CB1: Catch Basin #1



**Summary for Pond CB2: Catch Basin #2**

Inflow Area = 4,232 sf, 100.00% Impervious, Inflow Depth > 7.88" for 100 year event  
 Inflow = 0.77 cfs @ 12.08 hrs, Volume= 2,781 cf  
 Outflow = 0.75 cfs @ 12.10 hrs, Volume= 2,761 cf, Atten= 3%, Lag= 0.8 min  
 Primary = 0.75 cfs @ 12.10 hrs, Volume= 2,761 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 234.51' @ 12.11 hrs Surf.Area= 13 sf Storage= 39 cf

Plug-Flow detention time= 9.7 min calculated for 2,761 cf (99% of inflow)  
 Center-of-Mass det. time= 4.9 min ( 745.4 - 740.5 )

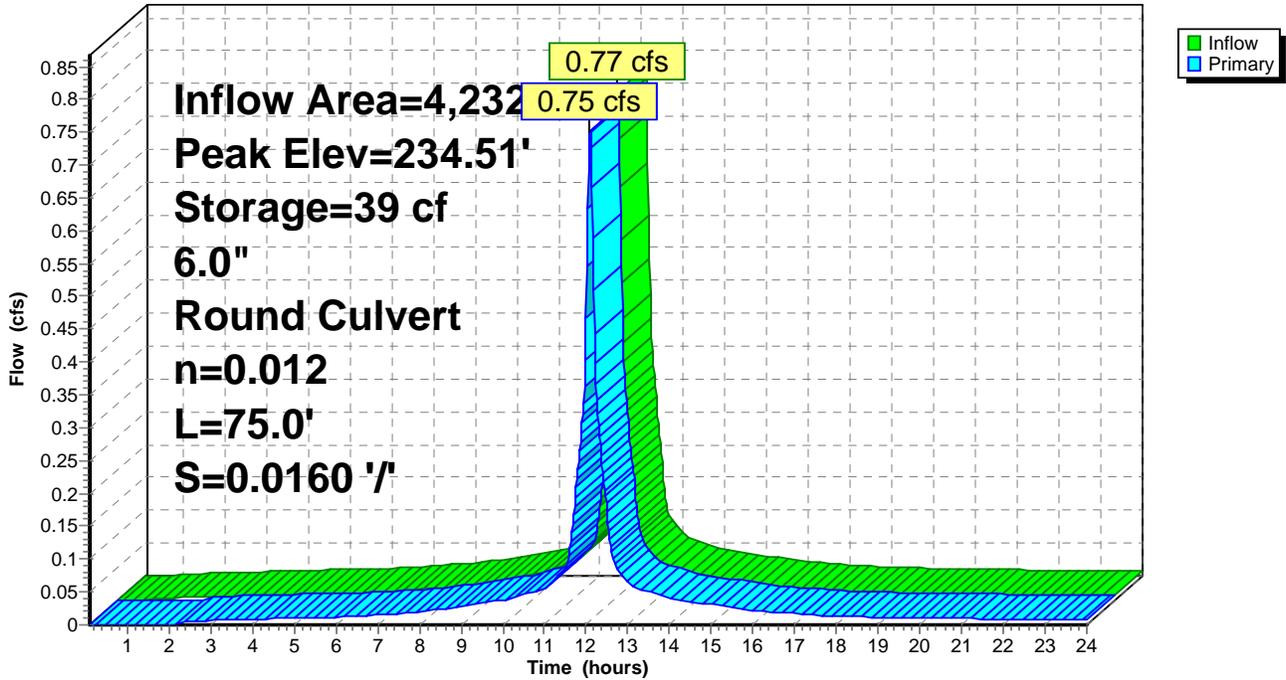
Volume	Invert	Avail.Storage	Storage Description
#1	231.50'	258 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
231.50	13	0	0
235.00	13	46	46
235.25	1,690	213	258

Device	Routing	Invert	Outlet Devices
#1	Primary	232.95'	<b>6.0" Round Culvert</b> L= 75.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.95' / 231.75' S= 0.0160 ' S= 0.0160 ' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf

**Primary OutFlow** Max=0.75 cfs @ 12.10 hrs HW=234.49' TW=232.92' (Dynamic Tailwater)  
 ↑1=Culvert (Outlet Controls 0.75 cfs @ 3.81 fps)

### Pond CB2: Catch Basin #2

Hydrograph



**Summary for Pond CB3: Catch Basin #3**

Inflow Area = 3,960 sf, 100.00% Impervious, Inflow Depth > 7.88" for 100 year event  
 Inflow = 0.72 cfs @ 12.08 hrs, Volume= 2,602 cf  
 Outflow = 0.71 cfs @ 12.10 hrs, Volume= 2,582 cf, Atten= 2%, Lag= 1.1 min  
 Primary = 0.71 cfs @ 12.10 hrs, Volume= 2,582 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 234.82' @ 12.10 hrs Surf.Area= 13 sf Storage= 43 cf

Plug-Flow detention time= 10.3 min calculated for 2,582 cf (99% of inflow)  
 Center-of-Mass det. time= 5.2 min ( 745.7 - 740.5 )

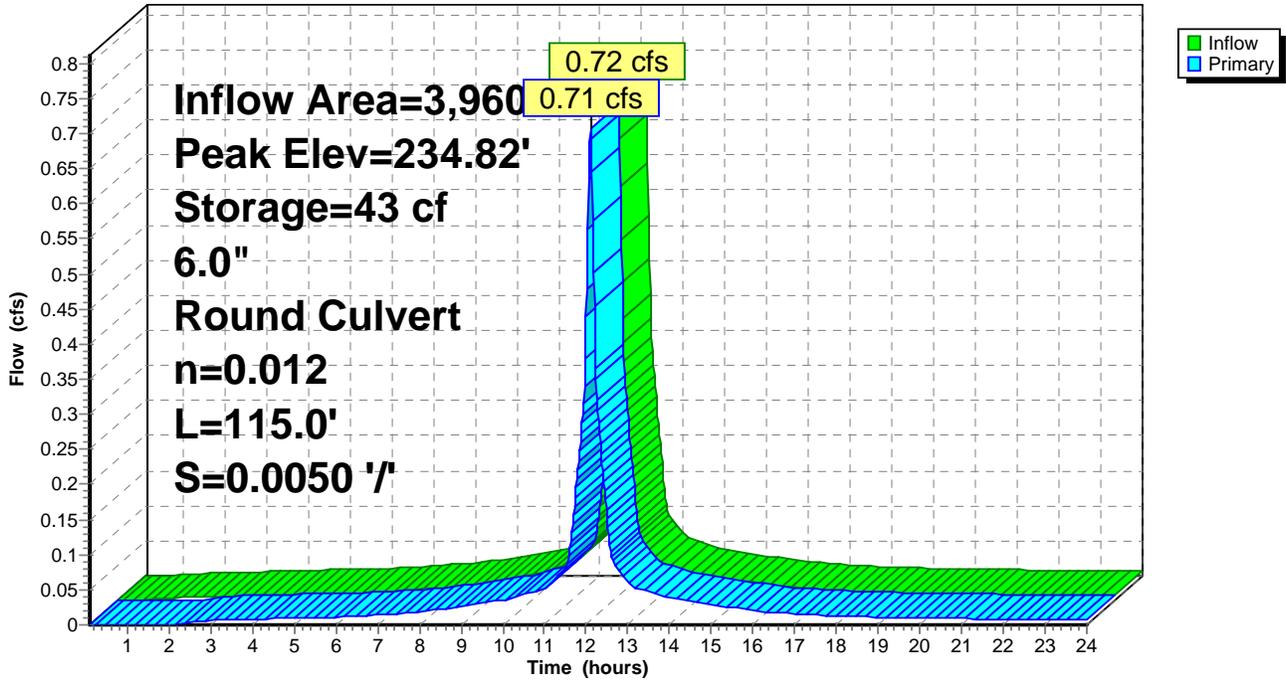
Volume	Invert	Avail.Storage	Storage Description
#1	231.50'	293 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
231.50	13	0	0
235.00	13	46	46
235.25	1,963	247	293

Device	Routing	Invert	Outlet Devices
#1	Primary	232.95'	<b>6.0" Round Culvert</b> L= 115.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.95' / 232.38' S= 0.0050 '/ Cc= 0.900 n= 0.012, Flow Area= 0.20 sf

**Primary OutFlow** Max=0.71 cfs @ 12.10 hrs HW=234.82' TW=232.34' (Dynamic Tailwater)  
 ↑1=Culvert (Barrel Controls 0.71 cfs @ 3.60 fps)

### Pond CB3: Catch Basin #3

Hydrograph



**Summary for Pond D1: Drywell**

Inflow Area = 3,960 sf, 100.00% Impervious, Inflow Depth > 7.82" for 100 year event  
 Inflow = 0.71 cfs @ 12.10 hrs, Volume= 2,582 cf  
 Outflow = 0.69 cfs @ 12.10 hrs, Volume= 2,556 cf, Atten= 3%, Lag= 0.1 min  
 Discarded = 0.01 cfs @ 12.15 hrs, Volume= 539 cf  
 Primary = 0.68 cfs @ 12.10 hrs, Volume= 2,017 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.10-24.00 hrs, dt= 0.02 hrs / 3  
 Peak Elev= 232.46' @ 12.15 hrs Surf.Area= 33 sf Storage= 53 cf

Plug-Flow detention time= 13.2 min calculated for 2,556 cf (99% of inflow)  
 Center-of-Mass det. time= 6.4 min ( 752.1 - 745.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	230.00'	98 cf	<b>5.00'D x 5.00'H Vertical Cone/Cylinder</b> Inside #2 141 cf Overall - 6.0" Wall Thickness = 98 cf
#2	230.00'	9 cf	<b>6.50'D x 5.00'H Vertical Cone/Cylinder</b> 166 cf Overall - 141 cf Embedded = 25 cf x 35.0% Voids
		107 cf	Total Available Storage

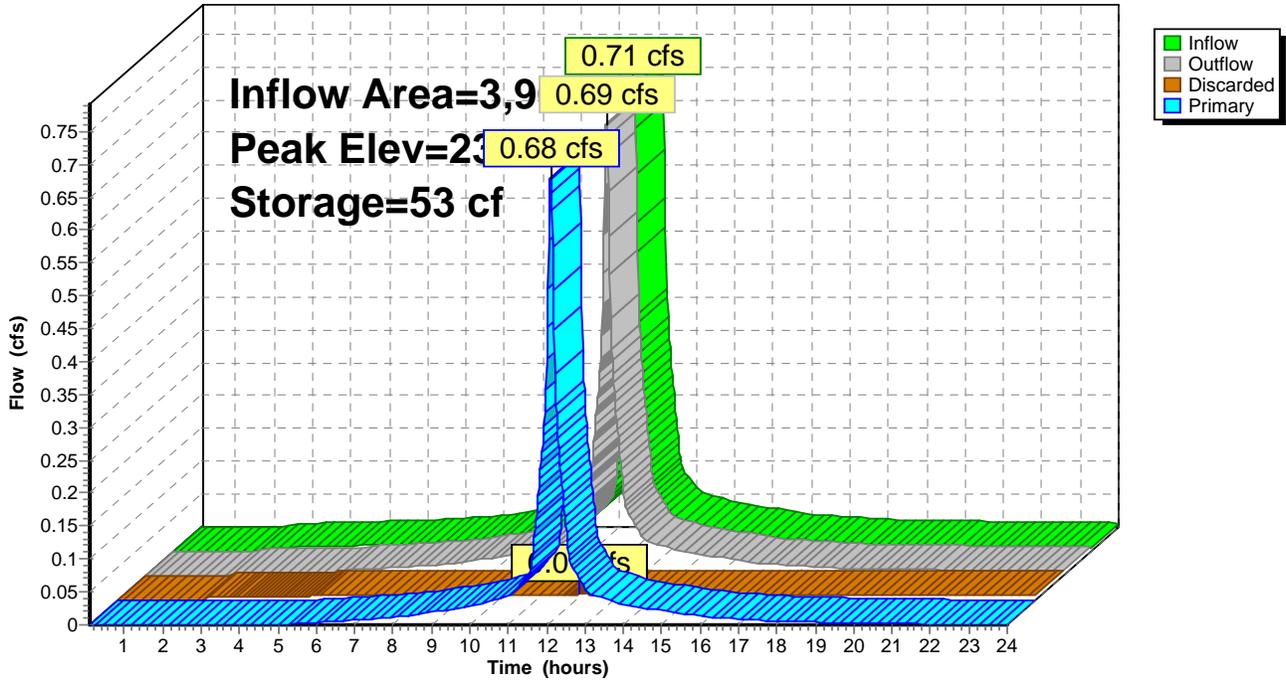
Device	Routing	Invert	Outlet Devices
#1	Primary	231.25'	<b>6.0" Round Culvert</b> L= 5.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 231.25' / 231.00' S= 0.0500 ' / ' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf
#2	Discarded	230.00'	<b>5.100 in/hr Exfiltration over Wetted area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.01 cfs @ 12.15 hrs HW=232.46' (Free Discharge)  
 ↳ **2=Exfiltration** (Exfiltration Controls 0.01 cfs)

**Primary OutFlow** Max=0.67 cfs @ 12.10 hrs HW=232.35' TW=231.53' (Dynamic Tailwater)  
 ↳ **1=Culvert** (Inlet Controls 0.67 cfs @ 3.43 fps)

### Pond D1: Drywell

Hydrograph





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***ATTACHMENT C  
SOIL INFORMATION***

***Boring Log B-1***

***Boring Log B-2***

***Boring Log B-1 Sieve Analysis***



## BORING LOG

Project: Nagog Water Treatment Plant Location: Concord, MA Client: Town of Concord Driller: Crawford Drilling Services, LLC Drilling Methods: Hollow Stem Auger, Drive and Wash Weather: 49 degrees, clear Performed By: LEU      Date: 9/24/2015 Checked By: ZFK      Time: 7:50 AM	Proposed Building       Boring Locus Map	Boring: <b>B-1</b> Location: See Plan Approx. Ground Elevation: Unknown Approx. Groundwater Elevation: Unknown Date/Time Datum: G.S. Project No. 200-1501
---	---	---

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description		Stratum Change Depth (feet)	Note No.
1	S1	4-62-25-28	24/14	Fine SAND, brown, fragments of rock			
2							
3	S2	12-20-15-15	24/8.5	Fine SAND, brown and dark grey, fragments of rock			
4							
5							
6	S3	20-9-7-10	24/10.5	Coarse SAND with some gravel, dark brown. Isolated rock fragments			
7							
8	S4	5-6-7-7	24/10.5	Coarse SAND with some gravel, medium brown to dark grey. Isolated rock fragments			1
9							
10							
11							
12	C1	N/A	60/29	RQD = 91.4%			2
13							
14							
15							
16							
17	C2	N/A	60/23	Predominately fractured ledge. RQD = 21.7%			3
18							
19							
20				Boring terminated at BGF 19'			
21							
22							
23							
24							
25							

**NOTES:**

- 1      2" split spoon refusal at 9' BGS
- 2      Drive and wash 9' to 19' BGS
- 3      Lost 600 gallons of water

**LEGEND**

S - Split Spoon Sample	O/A - Sample Collected Off the Augers
UT - Undisturbed Tube Sample	
Trace - Approximately 0 to 10%	Some - Approximately 20 to 35%
Little - Approximately 10 to 20%	And - Approximately 35 to 50%
0-4 Coarse Soil N Value - Very Loose	11-30 Coarse Soil N Value - Medium Dense
5-10 Coarse Soil N Value - Loose	31-50 Coarse Soil N Value - Dense
0-2 Fine Soil N Value - Very Soft	4-8 Fine Soil N Value - Medium Stiff
2-4 Fine Soil N Value - Soft	8-15 Fine Soil N Value - Stiff



## BORING LOG

Project: Nagog Water Treatment Plant Location: Concord, MA Client: Town of Concord Driller: Crawford Drilling Services, LLC Drilling Methods: Hollow Stem Auger Weather: 64 degrees, sunny and clear Performed By: LEU      Date: 9/24/2015 Checked By: ZFK      Time: 9:45 AM	Proposed Building       Boring Locus Map	Boring: <b>B-2</b> Location: See Plan Approx. Ground Elevation: Unknown Approx. Groundwater Elevation: Unknown Date/Time Datum: G.S. Project No. 200-1501
---	---	---

Depth (feet)	Sample No.	Blows per 6-inch	Pen./ Rec.	Soil Description		Stratum Change Depth (feet)	Note No.
1	S1	10-22-26-30	24/18	Fine SAND with some gravel, brown, medium brown to light grey, angular rock			
2							
3							
4							
5							
6							
7							
8	S2	40-80	12/10	Fine SAND, some gravel, some angular rock. Medium brown to light grey			
9							
10				Boring terminated at 9' due to split spoon refusal			Refusal
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							

**NOTES:**

1      2" split spoon

**LEGEND**

S - Split Spoon Sample	O/A - Sample Collected Off the Augers
UT - Undisturbed Tube Sample	
Trace - Approximately 0 to 10%	Some - Approximately 20 to 35%
Little - Approximately 10 to 20%	And - Approximately 35 to 50%
0-4 Coarse Soil N Value - Very Loose	11-30 Coarse Soil N Value - Medium Dense
5-10 Coarse Soil N Value - Loose	31-50 Coarse Soil N Value - Dense
0-2 Fine Soil N Value - Very Soft	4-8 Fine Soil N Value - Medium Stiff
2-4 Fine Soil N Value - Soft	8-15 Fine Soil N Value - Stiff





**Briggs Engineering & Testing**  
*A DIVISION OF PK ASSOCIATES, INC.*

Environmental Partners Group  
 1900 Crown Colony Drive  
 Suite 200  
 Quincy, MA 02169  
 Attn: Mr. Ziad Kary

Report Date: 11/2/15

Project: **E.P.G./Nagog Pond WWTP**  
 Briggs #: 24077

Tested: 10/30/15  
 Received: 10/22/15

1	<u>Sample No.</u> M-26570	<u>Description</u> Soil Boring	<u>Source of Material</u> B1, S3 5'-7'
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2. Sieve Analysis {ASTM C 136, and ASTM C 117}

<u>Sieve Size</u>		<u>Results</u>	<u>Specifications</u>
<u>Standard</u>	<u>Alternate</u>	<u>{% Passing by Wt.}</u>	
100 mm	4"	100	
75 mm	3"	100	
63 mm	2-1/2"	100	
50 mm	2"	100	
37.5 mm	1-1/2"	100	
25 mm	1"	100	
19 mm	3/4"	73	
12.5 mm	1/2"	63	
9.5 mm	3/8"	57	
4.75 mm	#4	51	
2.36 mm	#8	45	
1.18 mm	#16	39	
0.600 mm	#30	31	
0.300 mm	#50	21	
0.150 mm	#100	19	
0.075 mm	#200	12.4	

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*A Division of PK Associates, Inc.*

Sean Skorohod  
 Director of Testing Services  
 Construction Technology Division

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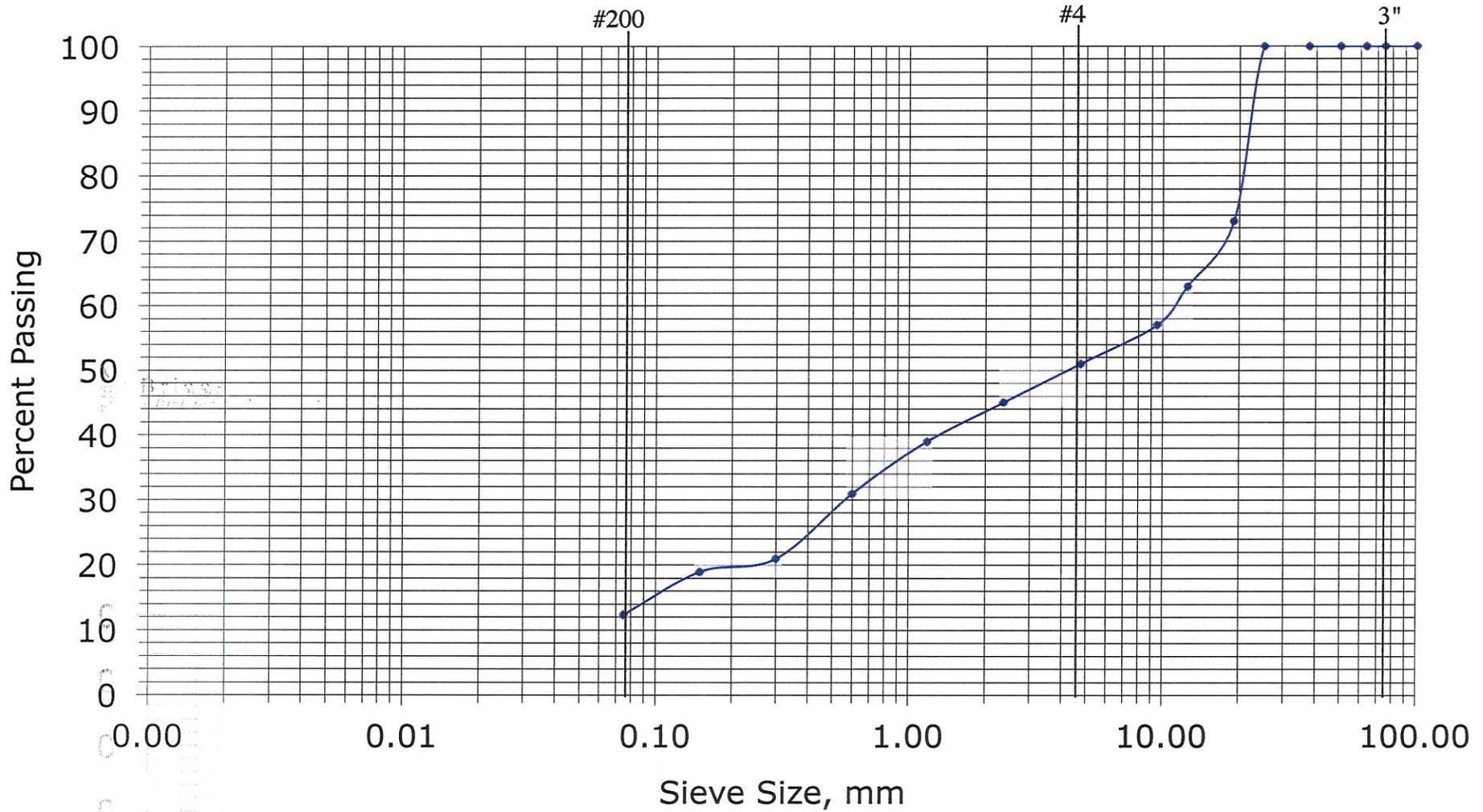




**Briggs Engineering & Testing**  
A Division of PK Associates, Inc.

Project:	E.P.G./Nagog Pond WWTP
Date Tested:	10/30/15
Lab Ref. No.:	M-26570

### Sieve Analysis





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***ATTACHMENT D***  
***STANDARD 3 RECHARGE CALCULATIONS***



**Standard 3 Stormwater Calculations:**

Required Recharge Volume:

Required Recharge Volume=Rv

Rv (cf) = F x Impervious Area (Post-Development)

NRCS HYDROLOGIC SOIL TYPE	APPROX SOIL TEXTURE	TARGET DEPTH FACTOR (F)
A	sand	<b>0.6-inch</b>
B	loam	<b>0.35-inch</b>
C	silty loam	<b>0.25-inch</b>
D	clay	<b>0.1-inch</b>

area (sf)	soil type	F (in)	F (ft)	Rv (cf)
19262.14	A	0.6	0.05	963.107
4343.524	A	0.6	0.05	217.1762
1437.48	D	0.1	0.008333	11.979
4613.726	D	0.1	0.008333	38.44772
29,656.87			<b>Total:</b>	<b>1,230.71</b>

Recharge Sizing Calcs

See HydroCAD Report of this attachment

Capture Area Adjustment:

(total site impervious area/site impervious area draining to recharge facilities)\*Rv

Total Site Impervious Area (sf)= 29,656.87  
 Impervious Area to Recharge (sf)= 20,730.90  
 Ratio= 0.70 72%>65%, requirement satisfied  
 1/Ratio= 1.43

<b>Capture Area Adjustment (sf)=</b>	<b>1,760.61</b>
--------------------------------------	-----------------

72 Hour Drawdown:

Tdrawdown=Rv/(K\*bottom area)

Rv(cf)= 1,760.61	(Capture Area adjustment used)	330 XLHD Total Area	
K(in/hr)= 5.1	(Determined from sieve analysis	Area/Chamber (sf)	27.88
K(ft/hr)= 0.425	correlation using attached sieve analysis)	# of Chambers	26
A(sf)= 724.88	Surface Area of Cultec Chambers in A type soil	Total Area (sf)	724.88

<b>Tdrawdown(hr)=</b>	<b>5.71</b>
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