

STORMWATER ANALYSIS AND CALCULATIONS

for

**108 Sohier Road
Beverly, Massachusetts**

Prepared for:

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SOURCE OF DATA

- Technical Report No. 20
- Technical Report No. 55
- Technical Paper No. 40
- Partial Field Survey by MAI
- Massachusetts Stormwater Management Handbook, February 2008

REPORT SUMMARY:

Calculation Objectives

The objective of these calculations is to document that the proposed project described in the Stormwater Management Report does not result in an increase of offsite rates of runoff or flooding down gradient of the site. The analysis is separated into existing and proposed conditions. Watershed plans have been incorporated into this report to depict existing and proposed watershed areas.

Selection of Storm Events

The storm events have been compiled from the Soil Conservation Service Technical Report No. 55 and Technical Paper No. 40. Rainfall frequency data has been provided as follows:

<u>Frequency (Years)</u>	<u>Rainfall [24-Hour Event (inches)]</u>
2	3.1
10	4.5
100	7.0

Classification of Soils

Drainage classes have been established based on soil maps provided by U.S. Department of Agriculture Natural Resources Conservation Service Web Soil Survey as well as onsite soil testing. Soil maps and descriptions are part of "Soil Survey of Essex County, Southern Part". According to NRCS, the following soil types and hydrologic groups are delineated within the limit of the hydrologic study:

306: Paxton - fine sandy loam - hydrologic soil group C

311: Woodbridge – fine sandy loam - hydrologic soil group C

651: Udorthents - area of soil material excavation and deposition*

*Udorthents are undesignated and contain variable soils. These areas are modeled in the hydrology calculations with a conservative hydrologic soil group rating of C

Hydrologic soil groups are assigned to each soil type by SCS based on their potential rate of water infiltration. Group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. At the other extreme, group D soils have very slow infiltration rates when thoroughly wet and thus a high runoff potential. These soils consist of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface and soils that are shallow over nearly impervious material.

Existing Conditions Overview

The locus property is comprised of approximately 5.1 acres located at 108 Sohier Road at the intersection of Sohier and Tozer Roads. The property is bound by Sohier Road on the east, Tozer

Road on the west and the Northshore Education Consortium to the north. There is a residential development directly across the street from the property along Sohier Road and Beverly High School is located approximately 0.2 miles to the south west on Sohier Road.

The property has been developed previously with a portion being part of the Old Salem Reservoir back in the 1940s. More recently, the locus was utilized as overflow parking with over 2 acres of pavement onsite. The site continues to be occupied by the bituminous concrete, broken bituminous and gravel. There are grassed areas along the roadways as well as wooded areas abutting the paved portions of the site. Topography of the site ranges from 5% within the paved areas to 20%-30% within the surrounding wooded areas. It is worth noting that the slope of Sohier Road increases exponentially from 3% upwards of 10% by the time it intersects with Tozer Road.

For the purpose of analyzing existing and proposed stormwater runoff, two design points have been designated for comparison.

Existing Design Points and Subcatchment Areas:

An existing drop inlet located at the west corner of the property was selected as design point #1. One subcatchment area directs stormwater from the property into this design point. Stormwater flows overland from paved surfaces through wooded areas and ultimately into an existing swale along Tozer Road which directly discharges to the drop inlet.

The second design point selected is existing drain manhole dmh#11 located at the intersection of Sohier and Tozer Roads. Four subcatchment areas contribute stormwater to this design point. Three of the subcatchment areas direct stormwater from paved surfaces and roadways into existing catchbasins which culminate at dmh#11. The remaining subcatchment area, SC #4 includes the majority of the locus property and directs stormwater from onsite paved surfaces, through wooded areas and into another existing swale on Tozer. This swale heads south directing stormwater into catchbasin cb#7 and culminating at dmh#11.

See the existing condition watershed plan and associated hydrologic model for detail of subcatchment areas and connections.

Proposed Conditions Overview

The applicant is proposing three new buildings onsite. Two of the buildings will house a total 75 units of affordable apartments for families. The third building will house multi-purpose community spaces and offices. Associated parking, utilities and landscaping is proposed throughout the site. Access to the site will be via two driveway openings off Sohier Road which interconnect within the property.

Stormwater Management:

This project utilizes conventional stormwater management techniques. Incorporated into the design are deep sump catchbasins and subsurface infiltration facilities for recharge, treatment and mitigation of stormwater. Design strategies for the stormwater systems follow methods from the Massachusetts Stormwater Handbook.

Subsurface Infiltration Facilities:

Subsurface infiltration facilities have been incorporated into this design to provide recharge of stormwater from impervious surfaces. Each facility consists of plastic chambers with open bottoms placed atop a stone bed. Chambers are constructed to store stormwater temporarily and let it infiltrate into the underlying soil. The facilities have been designed to recharge stormwater from the proposed roofs as well as a portion of the new driveways and hardscapes. A TSS removal rate of 80% is achieved by this BMP.

Deep Sump Catchbasin:

Similar to an ordinary catchbasin but fitted with an outlet hood to separate floatables such as oil, grease, trash and debris. They also have four foot deep sumps that promote settling of suspended solids. A TSS removal rate of 25% is achieved by this BMP.

Proposed Design Points and Subcatchment Areas:

The design points remain the same in the existing and proposed conditions as the existing drop inlet at the west of the property as well as existing dmh#11 located in the intersection of Sohier and Tozer Roads. There are ten (10) proposed subcatchment areas which contribute stormwater to the design points. One of the subcatchment areas outside the locus property will remain the same in existing and proposed conditions. This subcatchment, SC#3, is listed with the same numeric configuration within both hydrologic models. General descriptions of the remaining subcatchment areas are as follows:

Subcatchments SC#10 and SC#20 are located along the eastern property line and include portions of the two new driveways as well as portions of Sohier Road. These subcatchment areas direct stormwater from paved or grassed surfaces into existing catchbasin structures within Sohier Road that culminate at dmh#11.

Subcatchments SC#11, SC#13, SC#14 and SC#15 contribute stormwater runoff from proposed buildings, parking areas and lawn areas. Runoff is directed into a series of deep sump catchbasins and subsurface infiltration facilities for recharge and treatment. Excess stormwater will be directed from the facilities into the existing swale along Tozer and culminate at dmh#11.

There are only two (2) subcatchments which direct stormwater to design point #1 and those are SC#12 and SC#50. SC#12 includes the smaller community building and associated parking and recreation area which direct stormwater into a catchbasin and subsurface infiltration facility. Excess stormwater from the facility will be directed into the existing swale heading north on Tozer to the existing drop inlet. SC#50 is located along the north and northwest property lines and include parking from the abutting property, lawn and patio behind the community building and an existing wooded area along Tozer Road. Stormwater flows overland from the property into the wooded area and directly to the existing swale within Tozer Road.

See Included proposed watershed plan and associated proposed hydrologic model for connection details.

Summary of Flows at All Design Points (CFS)

A detailed analysis of existing and proposed subcatchment areas, ponds, and reaches is included in the HydroCAD analysis section of this report.

Design Point #1:

	<u>2-Year 24-Hour Storm Event</u>	<u>10-Year 24-Hour Storm Event</u>	<u>100-Year 24-Hour Storm Event</u>
Existing	2.4 CFS	4.5 CFS	8.3 CFS
Proposed	2.2 CFS	4.2 CFS	8.3 CFS

Design Point #2:

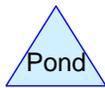
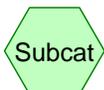
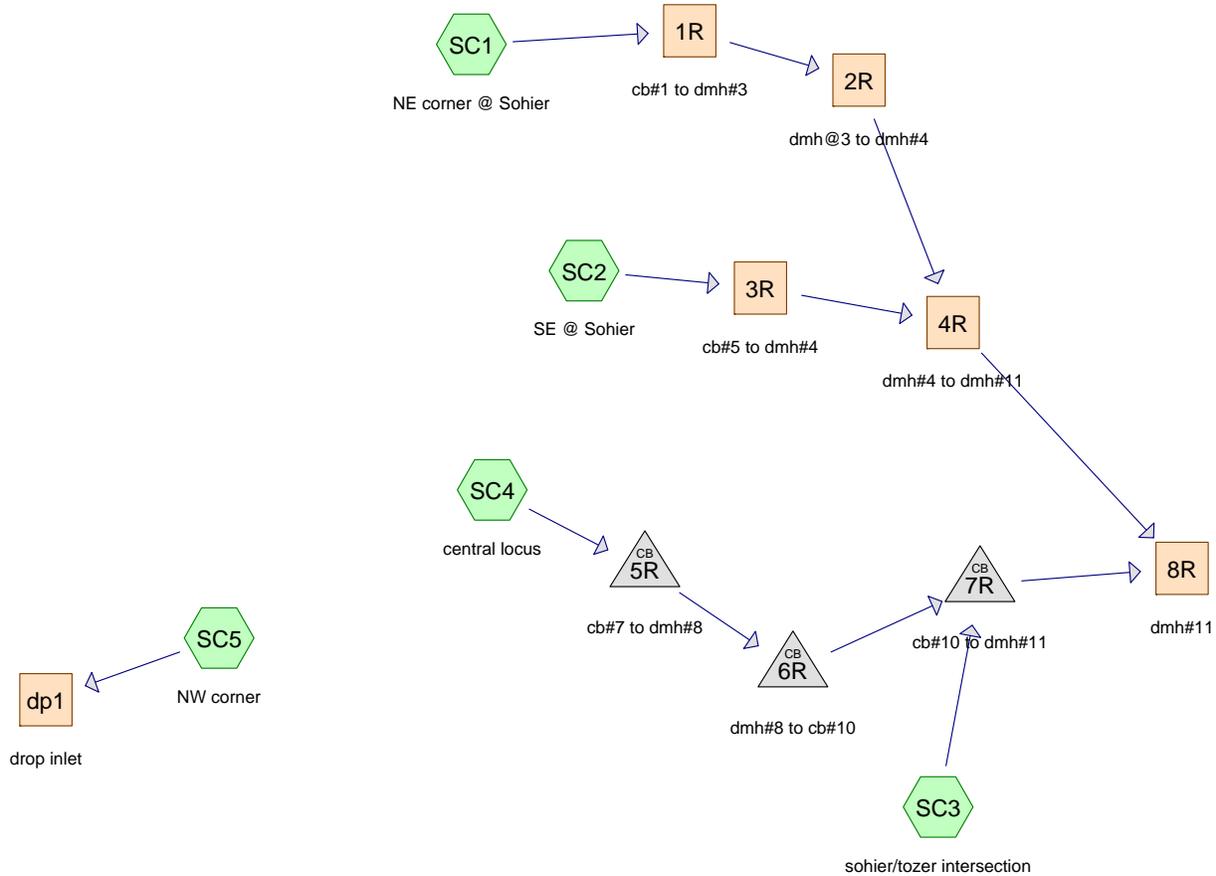
	<u>2-Year 24-Hour Storm Event</u>	<u>10-Year 24-Hour Storm Event</u>	<u>100-Year 24-Hour Storm Event</u>
Existing	8.6 CFS	14.2 CFS	24.3 CFS
Proposed	8.0 CFS	14.2 CFS	23.6 CFS

Conclusion

The calculations indicate peak flows have been met or reduced for the 2-year, 10-year, and 100-year storm events. We can therefore anticipate no adverse impacts with the completion of this project. In addition, the design provides for the required TSS removal and recharge volumes required by the MA DEP Stormwater Management Requirements.

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**EXISTING CONDITIONS
WATERSHED ROUTING DIAGRAM**



Routing Diagram for 6063-PRE
 Prepared by Meridian Associates, Printed 9/14/2018
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**EXISTING CONDITIONS
2-YEAR 24 HOUR STORM EVENT ANALYSIS**

Summary for Subcatchment SC1: NE corner @ Sohier

Runoff = 1.0 cfs @ 12.09 hrs, Volume= 0.07 af, Depth> 2.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	11,625	98	impervious area
	5,200	74	>75% Grass cover, Good, HSG C
	16,825	91	Weighted Average
	5,200		30.91% Pervious Area
	11,625		69.09% Impervious Area

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

Summary for Subcatchment SC2: SE @ Sohier

Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.02 af, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	3,045	98	impervious area
	715	74	>75% Grass cover, Good, HSG C
	3,760	93	Weighted Average
	715		19.02% Pervious Area
	3,045		80.98% Impervious Area

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

Summary for Subcatchment SC3: sohier/tozer intersection

Runoff = 0.9 cfs @ 12.08 hrs, Volume= 0.07 af, Depth> 2.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	13,450	98	impervious area
	315	74	>75% Grass cover, Good, HSG C
	13,765	97	Weighted Average
	315		2.29% Pervious Area
	13,450		97.71% Impervious Area

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

Summary for Subcatchment SC4: central locus

Runoff = 7.0 cfs @ 12.17 hrs, Volume= 0.61 af, Depth> 1.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
* 103,540	98	impervious area
63,280	70	Woods, Good, HSG C
1,680	74	>75% Grass cover, Good, HSG C
7,030	79	50-75% Grass cover, Fair, HSG C
175,530	87	Weighted Average
71,990		41.01% Pervious Area
103,540		58.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0760	0.1		Sheet Flow, high point woods Woods: Light underbrush n= 0.400 P2= 3.10"
5.0	383	0.0660	1.3		Shallow Concentrated Flow, overland woods Woodland Kv= 5.0 fps
0.1	16	0.1400	2.6		Shallow Concentrated Flow, overland to cb7 Short Grass Pasture Kv= 7.0 fps
12.4	449	Total			

Summary for Subcatchment SC5: NW corner

Runoff = 2.4 cfs @ 12.14 hrs, Volume= 0.20 af, Depth> 1.39"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
* 24,435	98	impervious area
38,315	70	Woods, Good, HSG C
11,065	79	50-75% Grass cover, Fair, HSG C
73,815	81	Weighted Average
49,380		66.90% Pervious Area
24,435		33.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	50	0.0900	0.1		Sheet Flow, high point woods Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	72	0.2100	2.3		Shallow Concentrated Flow, overland woods Woodland Kv= 5.0 fps
2.3	460	0.0440	3.4		Shallow Concentrated Flow, within swale Unpaved Kv= 16.1 fps
9.7	582	Total			

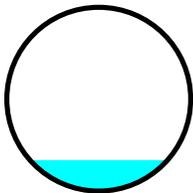
Summary for Reach 1R: cb#1 to dmh#3

Inflow Area = 0.386 ac, 69.09% Impervious, Inflow Depth > 2.16" for 2-yr event
 Inflow = 1.0 cfs @ 12.09 hrs, Volume= 0.07 af
 Outflow = 1.0 cfs @ 12.09 hrs, Volume= 0.07 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Max. Velocity= 11.2 fps, Min. Travel Time= 0.0 min
 Avg. Velocity = 3.8 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 12.09 hrs
 Average Depth at Peak Storage= 0.17'
 Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.9 cfs

12.0" Round Pipe
 n= 0.013 Concrete pipe, bends & connections
 Length= 17.0' Slope= 0.2000 '/'
 Inlet Invert= 111.60', Outlet Invert= 108.20'



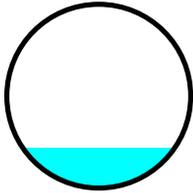
Summary for Reach 2R: dmh@3 to dmh#4

Inflow Area = 0.386 ac, 69.09% Impervious, Inflow Depth > 2.16" for 2-yr event
 Inflow = 1.0 cfs @ 12.09 hrs, Volume= 0.07 af
 Outflow = 1.0 cfs @ 12.09 hrs, Volume= 0.07 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Max. Velocity= 7.6 fps, Min. Travel Time= 0.4 min
 Avg. Velocity = 2.6 fps, Avg. Travel Time= 1.2 min

Peak Storage= 24 cf @ 12.09 hrs
 Average Depth at Peak Storage= 0.22'
 Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.2 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 188.0' Slope= 0.0670 '/'
Inlet Invert= 108.10', Outlet Invert= 95.50'



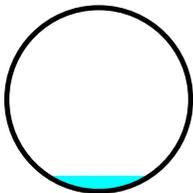
Summary for Reach 3R: cb#5 to dmh#4

Inflow Area = 0.086 ac, 80.98% Impervious, Inflow Depth > 2.35" for 2-yr event
Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.02 af
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 0.02 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.2 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.5 fps, Avg. Travel Time= 0.1 min

Peak Storage= 0 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.08'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.6 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 11.0' Slope= 0.1909 '/'
Inlet Invert= 97.60', Outlet Invert= 95.50'



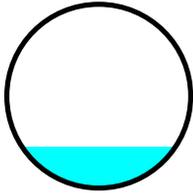
Summary for Reach 4R: dmh#4 to dmh#11

Inflow Area = 0.473 ac, 71.27% Impervious, Inflow Depth > 2.20" for 2-yr event
Inflow = 1.2 cfs @ 12.09 hrs, Volume= 0.09 af
Outflow = 1.2 cfs @ 12.09 hrs, Volume= 0.09 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 9.1 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.0 fps, Avg. Travel Time= 1.1 min

Peak Storage= 26 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 10.8 cfs

12.0" Round Pipe
 n= 0.013 Concrete pipe, bends & connections
 Length= 200.0' Slope= 0.0925 '/'
 Inlet Invert= 95.50', Outlet Invert= 77.00'



Summary for Reach 8R: dmh#11

Inflow Area = 4.818 ac, 62.73% Impervious, Inflow Depth > 1.92" for 2-yr event
 Inflow = 8.6 cfs @ 12.15 hrs, Volume= 0.77 af
 Outflow = 8.6 cfs @ 12.15 hrs, Volume= 0.77 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach dp1: drop inlet

Inflow Area = 1.695 ac, 33.10% Impervious, Inflow Depth > 1.39" for 2-yr event
 Inflow = 2.4 cfs @ 12.14 hrs, Volume= 0.20 af
 Outflow = 2.4 cfs @ 12.14 hrs, Volume= 0.20 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond 5R: cb#7 to dmh#8

Inflow Area = 4.030 ac, 58.99% Impervious, Inflow Depth > 1.82" for 2-yr event
 Inflow = 7.0 cfs @ 12.17 hrs, Volume= 0.61 af
 Outflow = 7.0 cfs @ 12.17 hrs, Volume= 0.61 af, Atten= 0%, Lag= 0.0 min
 Primary = 7.0 cfs @ 12.17 hrs, Volume= 0.61 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 93.06' @ 12.17 hrs

Flood Elev= 90.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	86.70'	12.0" Round Culvert L= 17.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 86.70' / 86.10' S= 0.0353 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=7.0 cfs @ 12.17 hrs HW=93.05' TW=89.64' (Dynamic Tailwater)

↑**1=Culvert** (Inlet Controls 7.0 cfs @ 8.9 fps)

Summary for Pond 6R: dmh#8 to cb#10

Inflow Area = 4.030 ac, 58.99% Impervious, Inflow Depth > 1.82" for 2-yr event
 Inflow = 7.0 cfs @ 12.17 hrs, Volume= 0.61 af
 Outflow = 7.0 cfs @ 12.17 hrs, Volume= 0.61 af, Atten= 0%, Lag= 0.0 min
 Primary = 7.0 cfs @ 12.17 hrs, Volume= 0.61 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 89.64' @ 12.17 hrs
 Flood Elev= 90.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	85.70'	12.0" Round Culvert L= 78.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 85.70' / 79.90' S= 0.0744 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=7.0 cfs @ 12.17 hrs HW=89.64' TW=83.98' (Dynamic Tailwater)
 ↑**1=Culvert** (Inlet Controls 7.0 cfs @ 8.9 fps)

Summary for Pond 7R: cb#10 to dmh#11

Inflow Area = 4.346 ac, 61.80% Impervious, Inflow Depth > 1.89" for 2-yr event
 Inflow = 7.6 cfs @ 12.16 hrs, Volume= 0.68 af
 Outflow = 7.6 cfs @ 12.16 hrs, Volume= 0.68 af, Atten= 0%, Lag= 0.0 min
 Primary = 7.6 cfs @ 12.16 hrs, Volume= 0.68 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 83.99' @ 12.16 hrs
 Flood Elev= 84.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	79.40'	12.0" Round Culvert L= 11.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 79.40' / 77.00' S= 0.2182 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=7.6 cfs @ 12.16 hrs HW=83.99' TW=0.00' (Dynamic Tailwater)
 ↑**1=Culvert** (Inlet Controls 7.6 cfs @ 9.7 fps)

EXISTING CONDITIONS
10-YEAR 24 HOUR STORM EVENT ANALYSIS

Summary for Subcatchment SC1: NE corner @ Sohier

Runoff = 1.5 cfs @ 12.09 hrs, Volume= 0.11 af, Depth> 3.49"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	11,625	98	impervious area
	5,200	74	>75% Grass cover, Good, HSG C
	16,825	91	Weighted Average
	5,200		30.91% Pervious Area
	11,625		69.09% Impervious Area

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

Summary for Subcatchment SC2: SE @ Sohier

Runoff = 0.4 cfs @ 12.08 hrs, Volume= 0.03 af, Depth> 3.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	3,045	98	impervious area
	715	74	>75% Grass cover, Good, HSG C
	3,760	93	Weighted Average
	715		19.02% Pervious Area
	3,045		80.98% Impervious Area

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

Summary for Subcatchment SC3: sohier/tozer intersection

Runoff = 1.4 cfs @ 12.08 hrs, Volume= 0.11 af, Depth> 4.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	13,450	98	impervious area
	315	74	>75% Grass cover, Good, HSG C
	13,765	97	Weighted Average
	315		2.29% Pervious Area
	13,450		97.71% Impervious Area

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

Summary for Subcatchment SC4: central locus

Runoff = 11.8 cfs @ 12.17 hrs, Volume= 1.04 af, Depth> 3.09"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
* 103,540	98	impervious area
63,280	70	Woods, Good, HSG C
1,680	74	>75% Grass cover, Good, HSG C
7,030	79	50-75% Grass cover, Fair, HSG C
175,530	87	Weighted Average
71,990		41.01% Pervious Area
103,540		58.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0760	0.1		Sheet Flow, high point woods Woods: Light underbrush n= 0.400 P2= 3.10"
5.0	383	0.0660	1.3		Shallow Concentrated Flow, overland woods Woodland Kv= 5.0 fps
0.1	16	0.1400	2.6		Shallow Concentrated Flow, overland to cb7 Short Grass Pasture Kv= 7.0 fps
12.4	449	Total			

Summary for Subcatchment SC5: NW corner

Runoff = 4.5 cfs @ 12.14 hrs, Volume= 0.36 af, Depth> 2.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
* 24,435	98	impervious area
38,315	70	Woods, Good, HSG C
11,065	79	50-75% Grass cover, Fair, HSG C
73,815	81	Weighted Average
49,380		66.90% Pervious Area
24,435		33.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	50	0.0900	0.1		Sheet Flow, high point woods Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	72	0.2100	2.3		Shallow Concentrated Flow, overland woods Woodland Kv= 5.0 fps
2.3	460	0.0440	3.4		Shallow Concentrated Flow, within swale Unpaved Kv= 16.1 fps
9.7	582	Total			

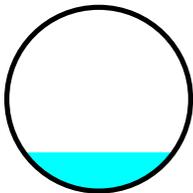
Summary for Reach 1R: cb#1 to dmh#3

Inflow Area = 0.386 ac, 69.09% Impervious, Inflow Depth > 3.49" for 10-yr event
 Inflow = 1.5 cfs @ 12.09 hrs, Volume= 0.11 af
 Outflow = 1.5 cfs @ 12.09 hrs, Volume= 0.11 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Max. Velocity= 12.8 fps, Min. Travel Time= 0.0 min
 Avg. Velocity = 4.2 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 12.09 hrs
 Average Depth at Peak Storage= 0.21'
 Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.9 cfs

12.0" Round Pipe
 n= 0.013 Concrete pipe, bends & connections
 Length= 17.0' Slope= 0.2000 '/'
 Inlet Invert= 111.60', Outlet Invert= 108.20'



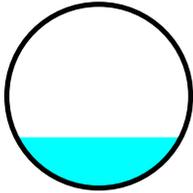
Summary for Reach 2R: dmh@3 to dmh#4

Inflow Area = 0.386 ac, 69.09% Impervious, Inflow Depth > 3.49" for 10-yr event
 Inflow = 1.5 cfs @ 12.09 hrs, Volume= 0.11 af
 Outflow = 1.5 cfs @ 12.09 hrs, Volume= 0.11 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Max. Velocity= 8.7 fps, Min. Travel Time= 0.4 min
 Avg. Velocity = 2.9 fps, Avg. Travel Time= 1.1 min

Peak Storage= 33 cf @ 12.09 hrs
 Average Depth at Peak Storage= 0.27'
 Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.2 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 188.0' Slope= 0.0670 '/'
Inlet Invert= 108.10', Outlet Invert= 95.50'



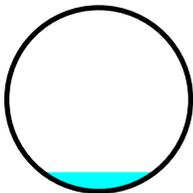
Summary for Reach 3R: cb#5 to dmh#4

Inflow Area = 0.086 ac, 80.98% Impervious, Inflow Depth > 3.70" for 10-yr event
Inflow = 0.4 cfs @ 12.08 hrs, Volume= 0.03 af
Outflow = 0.4 cfs @ 12.08 hrs, Volume= 0.03 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 8.2 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.8 fps, Avg. Travel Time= 0.1 min

Peak Storage= 0 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.10'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.6 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 11.0' Slope= 0.1909 '/'
Inlet Invert= 97.60', Outlet Invert= 95.50'



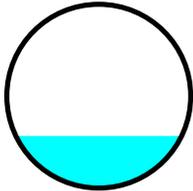
Summary for Reach 4R: dmh#4 to dmh#11

Inflow Area = 0.473 ac, 71.27% Impervious, Inflow Depth > 3.53" for 10-yr event
Inflow = 1.9 cfs @ 12.09 hrs, Volume= 0.14 af
Outflow = 1.9 cfs @ 12.09 hrs, Volume= 0.14 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 10.3 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.4 fps, Avg. Travel Time= 1.0 min

Peak Storage= 36 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 10.8 cfs

12.0" Round Pipe
 n= 0.013 Concrete pipe, bends & connections
 Length= 200.0' Slope= 0.0925 '/'
 Inlet Invert= 95.50', Outlet Invert= 77.00'



Summary for Reach 8R: dmh#11

Inflow Area = 4.818 ac, 62.73% Impervious, Inflow Depth > 3.20" for 10-yr event
 Inflow = 14.2 cfs @ 12.15 hrs, Volume= 1.29 af
 Outflow = 14.2 cfs @ 12.15 hrs, Volume= 1.29 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach dp1: drop inlet

Inflow Area = 1.695 ac, 33.10% Impervious, Inflow Depth > 2.54" for 10-yr event
 Inflow = 4.5 cfs @ 12.14 hrs, Volume= 0.36 af
 Outflow = 4.5 cfs @ 12.14 hrs, Volume= 0.36 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond 5R: cb#7 to dmh#8

Inflow Area = 4.030 ac, 58.99% Impervious, Inflow Depth > 3.09" for 10-yr event
 Inflow = 11.8 cfs @ 12.17 hrs, Volume= 1.04 af
 Outflow = 11.8 cfs @ 12.17 hrs, Volume= 1.04 af, Atten= 0%, Lag= 0.0 min
 Primary = 11.8 cfs @ 12.17 hrs, Volume= 1.04 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 114.63' @ 12.18 hrs

Flood Elev= 90.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	86.70'	12.0" Round Culvert L= 17.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 86.70' / 86.10' S= 0.0353 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=11.6 cfs @ 12.17 hrs HW=114.45' TW=104.98' (Dynamic Tailwater)

↳ **1=Culvert** (Inlet Controls 11.6 cfs @ 14.8 fps)

Summary for Pond 6R: dmh#8 to cb#10

Inflow Area = 4.030 ac, 58.99% Impervious, Inflow Depth > 3.09" for 10-yr event
 Inflow = 11.8 cfs @ 12.17 hrs, Volume= 1.04 af
 Outflow = 11.8 cfs @ 12.17 hrs, Volume= 1.04 af, Atten= 0%, Lag= 0.0 min
 Primary = 11.8 cfs @ 12.17 hrs, Volume= 1.04 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 105.01' @ 12.17 hrs
 Flood Elev= 90.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	85.70'	12.0" Round Culvert L= 78.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 85.70' / 79.90' S= 0.0744 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=11.8 cfs @ 12.17 hrs HW=104.98' TW=91.17' (Dynamic Tailwater)
 ↑**1=Culvert** (Outlet Controls 11.8 cfs @ 15.0 fps)

Summary for Pond 7R: cb#10 to dmh#11

Inflow Area = 4.346 ac, 61.80% Impervious, Inflow Depth > 3.17" for 10-yr event
 Inflow = 12.7 cfs @ 12.16 hrs, Volume= 1.15 af
 Outflow = 12.7 cfs @ 12.16 hrs, Volume= 1.15 af, Atten= 0%, Lag= 0.0 min
 Primary = 12.7 cfs @ 12.16 hrs, Volume= 1.15 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 91.23' @ 12.16 hrs
 Flood Elev= 84.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	79.40'	12.0" Round Culvert L= 11.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 79.40' / 77.00' S= 0.2182 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=12.7 cfs @ 12.16 hrs HW=91.22' TW=0.00' (Dynamic Tailwater)
 ↑**1=Culvert** (Inlet Controls 12.7 cfs @ 16.2 fps)

EXISTING CONDITIONS
100-YEAR 24 HOUR STORM EVENT ANALYSIS

Summary for Subcatchment SC1: NE corner @ Sohier

Runoff = 2.5 cfs @ 12.08 hrs, Volume= 0.19 af, Depth> 5.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	11,625	98	impervious area
	5,200	74	>75% Grass cover, Good, HSG C
	16,825	91	Weighted Average
	5,200		30.91% Pervious Area
	11,625		69.09% Impervious Area

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

Summary for Subcatchment SC2: SE @ Sohier

Runoff = 0.6 cfs @ 12.08 hrs, Volume= 0.04 af, Depth> 6.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	3,045	98	impervious area
	715	74	>75% Grass cover, Good, HSG C
	3,760	93	Weighted Average
	715		19.02% Pervious Area
	3,045		80.98% Impervious Area

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

Summary for Subcatchment SC3: sohier/tozer intersection

Runoff = 2.2 cfs @ 12.08 hrs, Volume= 0.17 af, Depth> 6.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	13,450	98	impervious area
	315	74	>75% Grass cover, Good, HSG C
	13,765	97	Weighted Average
	315		2.29% Pervious Area
	13,450		97.71% Impervious Area

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

Summary for Subcatchment SC4: central locus

Runoff = 20.3 cfs @ 12.17 hrs, Volume= 1.84 af, Depth> 5.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
* 103,540	98	impervious area
63,280	70	Woods, Good, HSG C
1,680	74	>75% Grass cover, Good, HSG C
7,030	79	50-75% Grass cover, Fair, HSG C
175,530	87	Weighted Average
71,990		41.01% Pervious Area
103,540		58.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	50	0.0760	0.1		Sheet Flow, high point woods Woods: Light underbrush n= 0.400 P2= 3.10"
5.0	383	0.0660	1.3		Shallow Concentrated Flow, overland woods Woodland Kv= 5.0 fps
0.1	16	0.1400	2.6		Shallow Concentrated Flow, overland to cb7 Short Grass Pasture Kv= 7.0 fps
12.4	449	Total			

Summary for Subcatchment SC5: NW corner

Runoff = 8.3 cfs @ 12.13 hrs, Volume= 0.68 af, Depth> 4.80"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
* 24,435	98	impervious area
38,315	70	Woods, Good, HSG C
11,065	79	50-75% Grass cover, Fair, HSG C
73,815	81	Weighted Average
49,380		66.90% Pervious Area
24,435		33.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	50	0.0900	0.1		Sheet Flow, high point woods Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	72	0.2100	2.3		Shallow Concentrated Flow, overland woods Woodland Kv= 5.0 fps
2.3	460	0.0440	3.4		Shallow Concentrated Flow, within swale Unpaved Kv= 16.1 fps
9.7	582	Total			

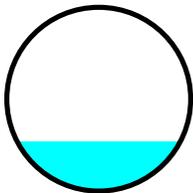
Summary for Reach 1R: cb#1 to dmh#3

Inflow Area = 0.386 ac, 69.09% Impervious, Inflow Depth > 5.93" for 100-yr event
 Inflow = 2.5 cfs @ 12.08 hrs, Volume= 0.19 af
 Outflow = 2.5 cfs @ 12.08 hrs, Volume= 0.19 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Max. Velocity= 14.8 fps, Min. Travel Time= 0.0 min
 Avg. Velocity = 4.8 fps, Avg. Travel Time= 0.1 min

Peak Storage= 3 cf @ 12.08 hrs
 Average Depth at Peak Storage= 0.27'
 Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.9 cfs

12.0" Round Pipe
 n= 0.013 Concrete pipe, bends & connections
 Length= 17.0' Slope= 0.2000 '/'
 Inlet Invert= 111.60', Outlet Invert= 108.20'



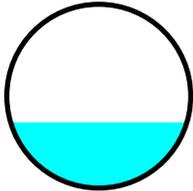
Summary for Reach 2R: dmh@3 to dmh#4

Inflow Area = 0.386 ac, 69.09% Impervious, Inflow Depth > 5.93" for 100-yr event
 Inflow = 2.5 cfs @ 12.08 hrs, Volume= 0.19 af
 Outflow = 2.5 cfs @ 12.09 hrs, Volume= 0.19 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Max. Velocity= 10.0 fps, Min. Travel Time= 0.3 min
 Avg. Velocity = 3.3 fps, Avg. Travel Time= 0.9 min

Peak Storage= 47 cf @ 12.09 hrs
 Average Depth at Peak Storage= 0.36'
 Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.2 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 188.0' Slope= 0.0670 '/'
Inlet Invert= 108.10', Outlet Invert= 95.50'



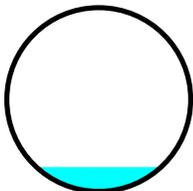
Summary for Reach 3R: cb#5 to dmh#4

Inflow Area = 0.086 ac, 80.98% Impervious, Inflow Depth > 6.17" for 100-yr event
Inflow = 0.6 cfs @ 12.08 hrs, Volume= 0.04 af
Outflow = 0.6 cfs @ 12.08 hrs, Volume= 0.04 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 9.4 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 3.1 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.13'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.6 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 11.0' Slope= 0.1909 '/'
Inlet Invert= 97.60', Outlet Invert= 95.50'



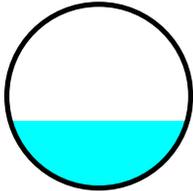
Summary for Reach 4R: dmh#4 to dmh#11

Inflow Area = 0.473 ac, 71.27% Impervious, Inflow Depth > 5.97" for 100-yr event
Inflow = 3.1 cfs @ 12.09 hrs, Volume= 0.24 af
Outflow = 3.1 cfs @ 12.09 hrs, Volume= 0.24 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 11.9 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.9 fps, Avg. Travel Time= 0.9 min

Peak Storage= 52 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.37'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 10.8 cfs

12.0" Round Pipe
 n= 0.013 Concrete pipe, bends & connections
 Length= 200.0' Slope= 0.0925 '/'
 Inlet Invert= 95.50', Outlet Invert= 77.00'



Summary for Reach 8R: dmh#11

Inflow Area = 4.818 ac, 62.73% Impervious, Inflow Depth > 5.59" for 100-yr event
 Inflow = 24.3 cfs @ 12.15 hrs, Volume= 2.25 af
 Outflow = 24.3 cfs @ 12.15 hrs, Volume= 2.25 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach dp1: drop inlet

Inflow Area = 1.695 ac, 33.10% Impervious, Inflow Depth > 4.80" for 100-yr event
 Inflow = 8.3 cfs @ 12.13 hrs, Volume= 0.68 af
 Outflow = 8.3 cfs @ 12.13 hrs, Volume= 0.68 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond 5R: cb#7 to dmh#8

Inflow Area = 4.030 ac, 58.99% Impervious, Inflow Depth > 5.47" for 100-yr event
 Inflow = 20.3 cfs @ 12.17 hrs, Volume= 1.84 af
 Outflow = 20.3 cfs @ 12.17 hrs, Volume= 1.84 af, Atten= 0%, Lag= 0.0 min
 Primary = 20.3 cfs @ 12.17 hrs, Volume= 1.84 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 183.07' @ 12.17 hrs

Flood Elev= 90.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	86.70'	12.0" Round Culvert L= 17.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 86.70' / 86.10' S= 0.0353 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=20.1 cfs @ 12.17 hrs HW=182.50' TW=154.23' (Dynamic Tailwater)

↑**1=Culvert** (Inlet Controls 20.1 cfs @ 25.6 fps)

Summary for Pond 6R: dmh#8 to cb#10

Inflow Area = 4.030 ac, 58.99% Impervious, Inflow Depth > 5.47" for 100-yr event
 Inflow = 20.3 cfs @ 12.17 hrs, Volume= 1.84 af
 Outflow = 20.3 cfs @ 12.17 hrs, Volume= 1.84 af, Atten= 0%, Lag= 0.0 min
 Primary = 20.3 cfs @ 12.17 hrs, Volume= 1.84 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 154.37' @ 12.17 hrs
 Flood Elev= 90.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	85.70'	12.0" Round Culvert L= 78.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 85.70' / 79.90' S= 0.0744 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=20.3 cfs @ 12.17 hrs HW=154.23' TW=113.11' (Dynamic Tailwater)
 ↑1=Culvert (Outlet Controls 20.3 cfs @ 25.9 fps)

Summary for Pond 7R: cb#10 to dmh#11

Inflow Area = 4.346 ac, 61.80% Impervious, Inflow Depth > 5.55" for 100-yr event
 Inflow = 21.8 cfs @ 12.16 hrs, Volume= 2.01 af
 Outflow = 21.8 cfs @ 12.16 hrs, Volume= 2.01 af, Atten= 0%, Lag= 0.0 min
 Primary = 21.8 cfs @ 12.16 hrs, Volume= 2.01 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 113.26' @ 12.16 hrs
 Flood Elev= 84.30'

Device	Routing	Invert	Outlet Devices
#1	Primary	79.40'	12.0" Round Culvert L= 11.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 79.40' / 77.00' S= 0.2182 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=21.8 cfs @ 12.16 hrs HW=113.24' TW=0.00' (Dynamic Tailwater)
 ↑1=Culvert (Inlet Controls 21.8 cfs @ 27.8 fps)

**PROPOSED CONDITIONS
WATERSHED ROUTING DIAGRAM**

PROPOSED CONDITIONS
2-YEAR 24 HOUR STORM EVENT ANALYSIS

Summary for Subcatchment sc10: NE corner @ Sohier

Runoff = 1.0 cfs @ 12.09 hrs, Volume= 0.07 af, Depth> 1.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	10,985	98	impervious area
	9,440	74	>75% Grass cover, Good, HSG C
	20,425	87	Weighted Average
	9,440		46.22% Pervious Area
	10,985		53.78% Impervious Area

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

Summary for Subcatchment sc11: west bldg A

Runoff = 2.6 cfs @ 12.09 hrs, Volume= 0.19 af, Depth> 2.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	33,095	98	impervious area
	10,575	74	>75% Grass cover, Good, HSG C
	43,670	92	Weighted Average
	10,575		24.22% Pervious Area
	33,095		75.78% Impervious Area

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

Summary for Subcatchment sc12: community bldg area

Runoff = 1.5 cfs @ 12.08 hrs, Volume= 0.12 af, Depth> 2.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	20,290	98	impervious area
	3,410	74	>75% Grass cover, Good, HSG C
	23,700	95	Weighted Average
	3,410		14.39% Pervious Area
	20,290		85.61% Impervious Area

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Type III 24-hr 2-yr Rainfall=3.10"

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

Summary for Subcatchment sc13: bldg A

Runoff = 1.3 cfs @ 12.08 hrs, Volume= 0.11 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
* 19,410	98	impervious area
19,410		100.00% Impervious Area

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

Summary for Subcatchment sc14: south bldg A

Runoff = 0.7 cfs @ 12.08 hrs, Volume= 0.05 af, Depth> 2.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
* 9,155	98	impervious area
955	74	>75% Grass cover, Good, HSG C
10,110	96	Weighted Average
955		9.45% Pervious Area
9,155		90.55% Impervious Area

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

Summary for Subcatchment sc15: bldg B

Runoff = 1.1 cfs @ 12.08 hrs, Volume= 0.09 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
* 16,055	98	impervious area
16,055		100.00% Impervious Area

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Type III 24-hr 2-yr Rainfall=3.10"

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

Summary for Subcatchment SC16: south locus

Runoff = 1.3 cfs @ 12.15 hrs, Volume= 0.11 af, Depth> 1.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
* 12,295	98	impervious area
12,665	70	Woods, Good, HSG C
17,910	74	>75% Grass cover, Good, HSG C
42,870	80	Weighted Average
30,575		71.32% Pervious Area
12,295		28.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	30	0.0200	0.1		Sheet Flow, yard Grass: Short n= 0.150 P2= 3.10"
1.9	20	0.3500	0.2		Sheet Flow, wooded slope Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	31	0.0960	1.5		Shallow Concentrated Flow, wooded to exist swale Woodland Kv= 5.0 fps
4.3	325	0.0330	1.3		Shallow Concentrated Flow, exist grass Short Grass Pasture Kv= 7.0 fps
10.3	406	Total			

Summary for Subcatchment sc20: SE @ Sohier

Runoff = 1.4 cfs @ 12.09 hrs, Volume= 0.10 af, Depth> 2.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
* 16,735	98	impervious area
8,360	74	>75% Grass cover, Good, HSG C
25,095	90	Weighted Average
8,360		33.31% Pervious Area
16,735		66.69% Impervious Area

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

Summary for Subcatchment SC3: sohier/tozer intersection

Runoff = 0.9 cfs @ 12.08 hrs, Volume= 0.07 af, Depth> 2.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	13,450	98	impervious area
	315	74	>75% Grass cover, Good, HSG C
	13,765	97	Weighted Average
	315		2.29% Pervious Area
	13,450		97.71% Impervious Area

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

Summary for Subcatchment sc50: NW corner

Runoff = 2.2 cfs @ 12.12 hrs, Volume= 0.17 af, Depth> 1.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
*	19,400	98	impervious area
	29,505	70	Woods, Good, HSG C
	12,845	74	>75% Grass cover, Good, HSG C
	6,845	79	50-75% Grass cover, Fair, HSG C
	68,595	80	Weighted Average
	49,195		71.72% Pervious Area
	19,400		28.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	50	0.1200	0.1		Sheet Flow, within woods Woods: Light underbrush n= 0.400 P2= 3.10"
0.4	57	0.2100	2.3		Shallow Concentrated Flow, overland thru woods Woodland Kv= 5.0 fps
2.0	407	0.0440	3.4		Shallow Concentrated Flow, thru swale Unpaved Kv= 16.1 fps
8.5	514	Total			

Summary for Reach 1R: cb#1 to dmh#3

Inflow Area = 0.469 ac, 53.78% Impervious, Inflow Depth > 1.82" for 2-yr event
Inflow = 1.0 cfs @ 12.09 hrs, Volume= 0.07 af
Outflow = 1.0 cfs @ 12.09 hrs, Volume= 0.07 af, Atten= 0%, Lag= 0.0 min

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Type III 24-hr 2-yr Rainfall=3.10"

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Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Max. Velocity= 11.3 fps, Min. Travel Time= 0.0 min

Avg. Velocity = 4.0 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 12.09 hrs

Average Depth at Peak Storage= 0.17'

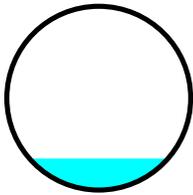
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.9 cfs

12.0" Round Pipe

n= 0.013 Concrete pipe, bends & connections

Length= 17.0' Slope= 0.2000 '/'

Inlet Invert= 111.60', Outlet Invert= 108.20'



Summary for Reach 2R: dmh@3 to dmh#4

Inflow Area = 0.914 ac, 76.30% Impervious, Inflow Depth > 1.38" for 2-yr event

Inflow = 1.1 cfs @ 12.19 hrs, Volume= 0.11 af

Outflow = 1.1 cfs @ 12.19 hrs, Volume= 0.11 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Max. Velocity= 7.9 fps, Min. Travel Time= 0.4 min

Avg. Velocity = 2.9 fps, Avg. Travel Time= 1.1 min

Peak Storage= 26 cf @ 12.19 hrs

Average Depth at Peak Storage= 0.23'

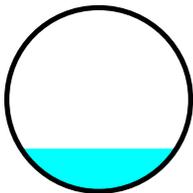
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.2 cfs

12.0" Round Pipe

n= 0.013 Concrete pipe, bends & connections

Length= 188.0' Slope= 0.0670 '/'

Inlet Invert= 108.10', Outlet Invert= 95.50'



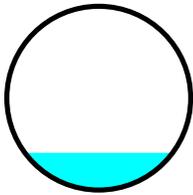
Summary for Reach 3R: cb#5 to dmh#4

Inflow Area = 0.576 ac, 66.69% Impervious, Inflow Depth > 2.07" for 2-yr event
Inflow = 1.4 cfs @ 12.09 hrs, Volume= 0.10 af
Outflow = 1.4 cfs @ 12.09 hrs, Volume= 0.10 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 12.3 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 4.2 fps, Avg. Travel Time= 0.0 min

Peak Storage= 1 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.20'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.6 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 11.0' Slope= 0.1909 '/'
Inlet Invert= 97.60', Outlet Invert= 95.50'



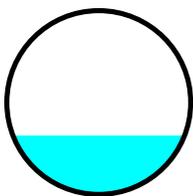
Summary for Reach 4R: dmh#4 to dmh#11

Inflow Area = 1.491 ac, 72.59% Impervious, Inflow Depth > 1.65" for 2-yr event
Inflow = 2.4 cfs @ 12.09 hrs, Volume= 0.21 af
Outflow = 2.4 cfs @ 12.09 hrs, Volume= 0.20 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 11.1 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.9 fps, Avg. Travel Time= 0.9 min

Peak Storage= 43 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.32'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 10.8 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 200.0' Slope= 0.0925 '/'
Inlet Invert= 95.50', Outlet Invert= 77.00'



Summary for Reach 8R: dmh#11

Inflow Area = 4.394 ac, 68.54% Impervious, Inflow Depth > 1.66" for 2-yr event
Inflow = 8.0 cfs @ 12.12 hrs, Volume= 0.61 af
Outflow = 8.0 cfs @ 12.12 hrs, Volume= 0.61 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach 9R: existing swale at Tozer

Inflow Area = 0.544 ac, 85.61% Impervious, Inflow Depth = 0.00" for 2-yr event
Inflow = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af
Outflow = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Max. Velocity= 0.0 fps, Min. Travel Time= 0.0 min

Avg. Velocity = 0.0 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs

Average Depth at Peak Storage= 0.00'

Bank-Full Depth= 1.00' Flow Area= 2.5 sf, Capacity= 32.4 cfs

1.00' x 1.00' deep channel, n= 0.016 Asphalt, rough

Side Slope Z-value= 1.5 '/' Top Width= 4.00'

Length= 490.0' Slope= 0.0440 '/'

Inlet Invert= 105.00', Outlet Invert= 83.44'



Summary for Reach 10R: exist swale along Tozer

Inflow Area = 1.603 ac, 83.49% Impervious, Inflow Depth > 1.66" for 2-yr event
Inflow = 3.7 cfs @ 12.13 hrs, Volume= 0.22 af
Outflow = 3.7 cfs @ 12.14 hrs, Volume= 0.22 af, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Max. Velocity= 3.3 fps, Min. Travel Time= 0.8 min

Avg. Velocity = 1.0 fps, Avg. Travel Time= 2.7 min

Peak Storage= 174 cf @ 12.14 hrs

Average Depth at Peak Storage= 0.33'

Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 37.0 cfs

2.00' x 1.00' deep channel, n= 0.030 Earth, grassed & winding

Side Slope Z-value= 4.0 '/' Top Width= 10.00'

Length= 158.0' Slope= 0.0316 '/'

Inlet Invert= 98.00', Outlet Invert= 93.00'



Summary for Reach dp1: drop inlet

Inflow Area = 2.119 ac, 43.00% Impervious, Inflow Depth > 0.98" for 2-yr event
 Inflow = 2.2 cfs @ 12.12 hrs, Volume= 0.17 af
 Outflow = 2.2 cfs @ 12.12 hrs, Volume= 0.17 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: cultec in parking

Inflow Area = 0.544 ac, 85.61% Impervious, Inflow Depth > 2.54" for 2-yr event
 Inflow = 1.5 cfs @ 12.08 hrs, Volume= 0.12 af
 Outflow = 0.1 cfs @ 11.43 hrs, Volume= 0.12 af, Atten= 93%, Lag= 0.0 min
 Discarded = 0.1 cfs @ 11.43 hrs, Volume= 0.12 af
 Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 113.79' @ 13.40 hrs Surf.Area= 1,936 sf Storage= 2,043 cf

Plug-Flow detention time= 153.5 min calculated for 0.12 af (100% of inflow)
 Center-of-Mass det. time= 153.3 min (934.7 - 781.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	112.25'	1,678 cf	26.17'W x 74.00'L x 3.54'H Field A 6,858 cf Overall - 2,664 cf Embedded = 4,194 cf x 40.0% Voids
#2A	112.75'	2,664 cf	Cultec R-330XL x 50 Inside #1 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 5 rows
		4,341 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	114.00'	12.0" Round Culvert - to exist swale L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 114.00' / 106.00' S= 0.2000 1' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	114.90'	4.0" Vert. Orifice/Grate X 2.00 C= 0.600
#3	Device 1	114.70'	6.0" Vert. Orifice/Grate C= 0.600
#4	Discarded	112.25'	2.400 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 11.43 hrs HW=112.29' (Free Discharge)

↳4=Exfiltration (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=112.25' TW=105.00' (Dynamic Tailwater)

↳1=Culvert - to exist swale (Controls 0.0 cfs)

↳2=Orifice/Grate (Controls 0.0 cfs)

↳3=Orifice/Grate (Controls 0.0 cfs)

Summary for Pond 2P: cultec grass - c100s

Inflow Area = 0.369 ac, 100.00% Impervious, Inflow Depth > 2.87" for 2-yr event
 Inflow = 1.1 cfs @ 12.08 hrs, Volume= 0.09 af
 Outflow = 1.1 cfs @ 12.10 hrs, Volume= 0.08 af, Atten= 3%, Lag= 1.2 min
 Primary = 1.1 cfs @ 12.10 hrs, Volume= 0.08 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 103.90' @ 12.10 hrs Surf.Area= 600 sf Storage= 502 cf

Plug-Flow detention time= 88.0 min calculated for 0.08 af (90% of inflow)
 Center-of-Mass det. time= 40.8 min (797.3 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	102.50'	377 cf	15.00'W x 40.00'L x 2.04'H Field A 1,225 cf Overall - 283 cf Embedded = 942 cf x 40.0% Voids
#2A	103.00'	283 cf	Cultec C-100 x 20 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 4 rows
		660 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	103.20'	12.0" Round Culvert L= 20.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 103.20' / 101.00' S= 0.1100 1/8" Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	103.50'	6.0" Vert. Orifice/Grate X 3.00 C= 0.600

Primary OutFlow Max=1.1 cfs @ 12.10 hrs HW=103.90' TW=98.32' (Dynamic Tailwater)

↳1=Culvert (Passes 1.1 cfs of 1.7 cfs potential flow)

↳2=Orifice/Grate (Orifice Controls 1.1 cfs @ 2.1 fps)

Summary for Pond 3P: cultec parking - 330

Inflow Area = 1.235 ac, 78.56% Impervious, Inflow Depth > 2.33" for 2-yr event
 Inflow = 3.3 cfs @ 12.09 hrs, Volume= 0.24 af
 Outflow = 2.7 cfs @ 12.14 hrs, Volume= 0.20 af, Atten= 17%, Lag= 3.2 min
 Discarded = 0.0 cfs @ 8.75 hrs, Volume= 0.06 af
 Primary = 2.7 cfs @ 12.14 hrs, Volume= 0.14 af

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Type III 24-hr 2-yr Rainfall=3.10"

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Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 115.08' @ 12.14 hrs Surf.Area= 1,666 sf Storage= 2,622 cf

Plug-Flow detention time= 104.0 min calculated for 0.20 af (83% of inflow)
 Center-of-Mass det. time= 35.3 min (828.5 - 793.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	112.80'	1,599 cf	65.33'W x 25.50'L x 3.71'H Field A 6,178 cf Overall - 2,179 cf Embedded = 3,999 cf x 40.0% Voids
#2A	113.30'	2,179 cf	Cultec R-330XL x 39 Inside #1 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 13 rows
		3,779 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	114.00'	18.0" Round Culvert L= 100.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 114.00' / 106.00' S= 0.0800 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	114.90'	4.0" Vert. Orifice/Grate X 3.00 C= 0.600
#3	Device 1	114.40'	6.0" Vert. Orifice/Grate X 4.00 C= 0.600
#4	Discarded	112.80'	1.020 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 8.75 hrs HW=112.84' (Free Discharge)
 ↳ **4=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=2.7 cfs @ 12.14 hrs HW=115.07' TW=98.33' (Dynamic Tailwater)
 ↳ **1=Culvert** (Passes 2.7 cfs of 4.8 cfs potential flow)
 ↳ ↳ **2=Orifice/Grate** (Orifice Controls 0.2 cfs @ 1.4 fps)
 ↳ ↳ **3=Orifice/Grate** (Orifice Controls 2.5 cfs @ 3.1 fps)

Summary for Pond 4P: cultec in parking

Inflow Area =	0.446 ac, 100.00% Impervious, Inflow Depth > 2.87" for 2-yr event
Inflow =	1.3 cfs @ 12.08 hrs, Volume= 0.11 af
Outflow =	0.6 cfs @ 12.26 hrs, Volume= 0.08 af, Atten= 56%, Lag= 10.8 min
Discarded =	0.0 cfs @ 8.54 hrs, Volume= 0.04 af
Primary =	0.6 cfs @ 12.26 hrs, Volume= 0.03 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 121.04' @ 12.26 hrs Surf.Area= 1,174 sf Storage= 1,782 cf

Plug-Flow detention time= 164.3 min calculated for 0.08 af (73% of inflow)
 Center-of-Mass det. time= 75.3 min (831.8 - 756.5)

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Type III 24-hr 2-yr Rainfall=3.10"

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Volume	Invert	Avail.Storage	Storage Description
#1A	118.90'	1,011 cf	30.50'W x 38.50'L x 3.54'H Field A 4,159 cf Overall - 1,632 cf Embedded = 2,527 cf x 40.0% Voids
#2A	119.40'	1,632 cf	Cultec R-330XL x 30 Inside #1 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 6 rows
		2,643 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	119.00'	12.0" Round Culvert - to exist swale L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 119.00' / 118.00' S= 0.0250 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	120.70'	6.0" Vert. Orifice/Grate X 2.00 C= 0.600
#3	Discarded	118.90'	1.020 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 8.54 hrs HW=118.94' (Free Discharge)↑**3=Exfiltration** (Exfiltration Controls 0.0 cfs)**Primary OutFlow** Max=0.6 cfs @ 12.26 hrs HW=121.04' TW=108.33' (Dynamic Tailwater)↑**1=Culvert - to exist swale** (Passes 0.6 cfs of 4.7 cfs potential flow)↑**2=Orifice/Grate** (Orifice Controls 0.6 cfs @ 2.0 fps)**Summary for Pond 5R: cb#7 to dmh#8**

Inflow Area = 2.587 ac, 62.64% Impervious, Inflow Depth > 1.53" for 2-yr event
 Inflow = 5.0 cfs @ 12.14 hrs, Volume= 0.33 af
 Outflow = 5.0 cfs @ 12.14 hrs, Volume= 0.33 af, Atten= 0%, Lag= 0.0 min
 Primary = 5.0 cfs @ 12.14 hrs, Volume= 0.33 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 89.63' @ 12.15 hrs

Flood Elev= 90.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	86.70'	12.0" Round Culvert L= 17.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 86.70' / 86.10' S= 0.0353 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=4.9 cfs @ 12.14 hrs HW=89.62' TW=87.92' (Dynamic Tailwater)↑**1=Culvert** (Inlet Controls 4.9 cfs @ 6.3 fps)**Summary for Pond 6R: dmh#8 to cb#10**

Inflow Area = 2.587 ac, 62.64% Impervious, Inflow Depth > 1.53" for 2-yr event
 Inflow = 5.0 cfs @ 12.14 hrs, Volume= 0.33 af
 Outflow = 5.0 cfs @ 12.14 hrs, Volume= 0.33 af, Atten= 0%, Lag= 0.0 min
 Primary = 5.0 cfs @ 12.14 hrs, Volume= 0.33 af

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Type III 24-hr 2-yr Rainfall=3.10"

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Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 87.92' @ 12.14 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	85.70'	12.0" Round Culvert L= 78.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 85.70' / 79.90' S= 0.0744 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=5.0 cfs @ 12.14 hrs HW=87.92' TW=82.19' (Dynamic Tailwater)

↑**1=Culvert** (Inlet Controls 5.0 cfs @ 6.3 fps)

Summary for Pond 7R: cb#10 to dmh#11

Inflow Area = 2.903 ac, 66.46% Impervious, Inflow Depth > 1.67" for 2-yr event
 Inflow = 5.7 cfs @ 12.13 hrs, Volume= 0.40 af
 Outflow = 5.7 cfs @ 12.13 hrs, Volume= 0.40 af, Atten= 0%, Lag= 0.0 min
 Primary = 5.7 cfs @ 12.13 hrs, Volume= 0.40 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 82.21' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	79.40'	12.0" Round Culvert L= 11.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 79.40' / 77.00' S= 0.2182 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=5.7 cfs @ 12.13 hrs HW=82.20' TW=0.00' (Dynamic Tailwater)

↑**1=Culvert** (Inlet Controls 5.7 cfs @ 7.3 fps)

PROPOSED CONDITIONS
10-YEAR 24 HOUR STORM EVENT ANALYSIS

Summary for Subcatchment sc10: NE corner @ Sohier

Runoff = 1.7 cfs @ 12.09 hrs, Volume= 0.12 af, Depth> 3.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	10,985	98	impervious area
	9,440	74	>75% Grass cover, Good, HSG C
	20,425	87	Weighted Average
	9,440		46.22% Pervious Area
	10,985		53.78% Impervious Area

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

Summary for Subcatchment sc11: west bldg A

Runoff = 4.0 cfs @ 12.08 hrs, Volume= 0.30 af, Depth> 3.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	33,095	98	impervious area
	10,575	74	>75% Grass cover, Good, HSG C
	43,670	92	Weighted Average
	10,575		24.22% Pervious Area
	33,095		75.78% Impervious Area

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

Summary for Subcatchment sc12: community bldg area

Runoff = 2.3 cfs @ 12.08 hrs, Volume= 0.18 af, Depth> 3.92"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	20,290	98	impervious area
	3,410	74	>75% Grass cover, Good, HSG C
	23,700	95	Weighted Average
	3,410		14.39% Pervious Area
	20,290		85.61% Impervious Area

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Type III 24-hr 10-yr Rainfall=4.50"

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

Summary for Subcatchment sc13: bldg A

Runoff = 2.0 cfs @ 12.08 hrs, Volume= 0.16 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
* 19,410	98	impervious area
19,410		100.00% Impervious Area

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

Summary for Subcatchment sc14: south bldg A

Runoff = 1.0 cfs @ 12.08 hrs, Volume= 0.08 af, Depth> 4.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
* 9,155	98	impervious area
955	74	>75% Grass cover, Good, HSG C
10,110	96	Weighted Average
955		9.45% Pervious Area
9,155		90.55% Impervious Area

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

Summary for Subcatchment sc15: bldg B

Runoff = 1.6 cfs @ 12.08 hrs, Volume= 0.13 af, Depth> 4.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
* 16,055	98	impervious area
16,055		100.00% Impervious Area

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Type III 24-hr 10-yr Rainfall=4.50"

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

Summary for Subcatchment SC16: south locus

Runoff = 2.5 cfs @ 12.14 hrs, Volume= 0.20 af, Depth> 2.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
* 12,295	98	impervious area
12,665	70	Woods, Good, HSG C
17,910	74	>75% Grass cover, Good, HSG C
42,870	80	Weighted Average
30,575		71.32% Pervious Area
12,295		28.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	30	0.0200	0.1		Sheet Flow, yard Grass: Short n= 0.150 P2= 3.10"
1.9	20	0.3500	0.2		Sheet Flow, wooded slope Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	31	0.0960	1.5		Shallow Concentrated Flow, wooded to exist swale Woodland Kv= 5.0 fps
4.3	325	0.0330	1.3		Shallow Concentrated Flow, exist grass Short Grass Pasture Kv= 7.0 fps
10.3	406	Total			

Summary for Subcatchment sc20: SE @ Sohier

Runoff = 2.2 cfs @ 12.09 hrs, Volume= 0.16 af, Depth> 3.39"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
* 16,735	98	impervious area
8,360	74	>75% Grass cover, Good, HSG C
25,095	90	Weighted Average
8,360		33.31% Pervious Area
16,735		66.69% Impervious Area

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

Summary for Subcatchment SC3: sohier/tozer intersection

Runoff = 1.4 cfs @ 12.08 hrs, Volume= 0.11 af, Depth> 4.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	13,450	98	impervious area
	315	74	>75% Grass cover, Good, HSG C
	13,765	97	Weighted Average
	315		2.29% Pervious Area
	13,450		97.71% Impervious Area

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

Summary for Subcatchment sc50: NW corner

Runoff = 4.2 cfs @ 12.12 hrs, Volume= 0.32 af, Depth> 2.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
*	19,400	98	impervious area
	29,505	70	Woods, Good, HSG C
	12,845	74	>75% Grass cover, Good, HSG C
	6,845	79	50-75% Grass cover, Fair, HSG C
	68,595	80	Weighted Average
	49,195		71.72% Pervious Area
	19,400		28.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	50	0.1200	0.1		Sheet Flow, within woods Woods: Light underbrush n= 0.400 P2= 3.10"
0.4	57	0.2100	2.3		Shallow Concentrated Flow, overland thru woods Woodland Kv= 5.0 fps
2.0	407	0.0440	3.4		Shallow Concentrated Flow, thru swale Unpaved Kv= 16.1 fps
8.5	514	Total			

Summary for Reach 1R: cb#1 to dmh#3

Inflow Area = 0.469 ac, 53.78% Impervious, Inflow Depth > 3.10" for 10-yr event
Inflow = 1.7 cfs @ 12.09 hrs, Volume= 0.12 af
Outflow = 1.7 cfs @ 12.09 hrs, Volume= 0.12 af, Atten= 0%, Lag= 0.0 min

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Type III 24-hr 10-yr Rainfall=4.50"

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Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Max. Velocity= 13.2 fps, Min. Travel Time= 0.0 min

Avg. Velocity = 4.4 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 12.09 hrs

Average Depth at Peak Storage= 0.22'

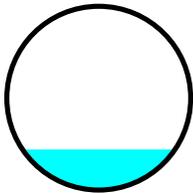
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.9 cfs

12.0" Round Pipe

n= 0.013 Concrete pipe, bends & connections

Length= 17.0' Slope= 0.2000 '/'

Inlet Invert= 111.60', Outlet Invert= 108.20'



Summary for Reach 2R: dmh@3 to dmh#4

Inflow Area = 0.914 ac, 76.30% Impervious, Inflow Depth > 2.62" for 10-yr event

Inflow = 2.9 cfs @ 12.10 hrs, Volume= 0.20 af

Outflow = 2.9 cfs @ 12.11 hrs, Volume= 0.20 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Max. Velocity= 10.4 fps, Min. Travel Time= 0.3 min

Avg. Velocity = 3.3 fps, Avg. Travel Time= 1.0 min

Peak Storage= 52 cf @ 12.11 hrs

Average Depth at Peak Storage= 0.38'

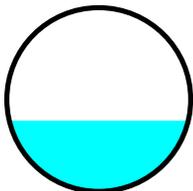
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.2 cfs

12.0" Round Pipe

n= 0.013 Concrete pipe, bends & connections

Length= 188.0' Slope= 0.0670 '/'

Inlet Invert= 108.10', Outlet Invert= 95.50'



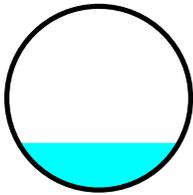
Summary for Reach 3R: cb#5 to dmh#4

Inflow Area = 0.576 ac, 66.69% Impervious, Inflow Depth > 3.39" for 10-yr event
Inflow = 2.2 cfs @ 12.09 hrs, Volume= 0.16 af
Outflow = 2.2 cfs @ 12.09 hrs, Volume= 0.16 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 14.1 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 4.7 fps, Avg. Travel Time= 0.0 min

Peak Storage= 2 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.26'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.6 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 11.0' Slope= 0.1909 '/'
Inlet Invert= 97.60', Outlet Invert= 95.50'



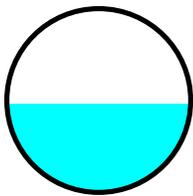
Summary for Reach 4R: dmh#4 to dmh#11

Inflow Area = 1.491 ac, 72.59% Impervious, Inflow Depth > 2.92" for 10-yr event
Inflow = 5.1 cfs @ 12.10 hrs, Volume= 0.36 af
Outflow = 5.1 cfs @ 12.10 hrs, Volume= 0.36 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 13.6 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 4.4 fps, Avg. Travel Time= 0.8 min

Peak Storage= 75 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.48'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 10.8 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 200.0' Slope= 0.0925 '/'
Inlet Invert= 95.50', Outlet Invert= 77.00'



Summary for Reach 8R: dmh#11

Inflow Area = 4.394 ac, 68.54% Impervious, Inflow Depth > 2.92" for 10-yr event
Inflow = 14.2 cfs @ 12.12 hrs, Volume= 1.07 af
Outflow = 14.2 cfs @ 12.12 hrs, Volume= 1.07 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach 9R: existing swale at Tozer

Inflow Area = 0.544 ac, 85.61% Impervious, Inflow Depth = 0.15" for 10-yr event
Inflow = 0.1 cfs @ 13.34 hrs, Volume= 0.01 af
Outflow = 0.1 cfs @ 13.39 hrs, Volume= 0.01 af, Atten= 0%, Lag= 3.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Max. Velocity= 1.8 fps, Min. Travel Time= 4.6 min

Avg. Velocity = 1.3 fps, Avg. Travel Time= 6.4 min

Peak Storage= 15 cf @ 13.39 hrs

Average Depth at Peak Storage= 0.03'

Bank-Full Depth= 1.00' Flow Area= 2.5 sf, Capacity= 32.4 cfs

1.00' x 1.00' deep channel, n= 0.016 Asphalt, rough

Side Slope Z-value= 1.5 '/' Top Width= 4.00'

Length= 490.0' Slope= 0.0440 '/'

Inlet Invert= 105.00', Outlet Invert= 83.44'



Summary for Reach 10R: exist swale along Tozer

Inflow Area = 1.603 ac, 83.49% Impervious, Inflow Depth > 2.98" for 10-yr event
Inflow = 5.7 cfs @ 12.13 hrs, Volume= 0.40 af
Outflow = 5.7 cfs @ 12.13 hrs, Volume= 0.40 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Max. Velocity= 3.8 fps, Min. Travel Time= 0.7 min

Avg. Velocity = 1.2 fps, Avg. Travel Time= 2.3 min

Peak Storage= 238 cf @ 12.13 hrs

Average Depth at Peak Storage= 0.41'

Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 37.0 cfs

2.00' x 1.00' deep channel, n= 0.030 Earth, grassed & winding

Side Slope Z-value= 4.0 '/' Top Width= 10.00'

Length= 158.0' Slope= 0.0316 '/'

Inlet Invert= 98.00', Outlet Invert= 93.00'



Summary for Reach dp1: drop inlet

Inflow Area = 2.119 ac, 43.00% Impervious, Inflow Depth > 1.86" for 10-yr event
 Inflow = 4.2 cfs @ 12.12 hrs, Volume= 0.33 af
 Outflow = 4.2 cfs @ 12.12 hrs, Volume= 0.33 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: cultec in parking

Inflow Area = 0.544 ac, 85.61% Impervious, Inflow Depth > 3.92" for 10-yr event
 Inflow = 2.3 cfs @ 12.08 hrs, Volume= 0.18 af
 Outflow = 0.2 cfs @ 13.34 hrs, Volume= 0.15 af, Atten= 93%, Lag= 75.1 min
 Discarded = 0.1 cfs @ 10.66 hrs, Volume= 0.14 af
 Primary = 0.1 cfs @ 13.34 hrs, Volume= 0.01 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 114.84' @ 13.34 hrs Surf.Area= 1,936 sf Storage= 3,512 cf

Plug-Flow detention time= 238.4 min calculated for 0.15 af (84% of inflow)
 Center-of-Mass det. time= 173.2 min (943.6 - 770.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	112.25'	1,678 cf	26.17'W x 74.00'L x 3.54'H Field A 6,858 cf Overall - 2,664 cf Embedded = 4,194 cf x 40.0% Voids
#2A	112.75'	2,664 cf	Cultec R-330XL x 50 Inside #1 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 5 rows
		4,341 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	114.00'	12.0" Round Culvert - to exist swale L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 114.00' / 106.00' S= 0.2000 1' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	114.90'	4.0" Vert. Orifice/Grate X 2.00 C= 0.600
#3	Device 1	114.70'	6.0" Vert. Orifice/Grate C= 0.600
#4	Discarded	112.25'	2.400 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 10.66 hrs HW=112.29' (Free Discharge)

↳4=Exfiltration (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.1 cfs @ 13.34 hrs HW=114.84' TW=105.03' (Dynamic Tailwater)

↳1=Culvert - to exist swale (Passes 0.1 cfs of 2.2 cfs potential flow)

↳2=Orifice/Grate (Controls 0.0 cfs)

↳3=Orifice/Grate (Orifice Controls 0.1 cfs @ 1.3 fps)

Summary for Pond 2P: cultec grass - c100s

Inflow Area = 0.369 ac, 100.00% Impervious, Inflow Depth > 4.26" for 10-yr event
 Inflow = 1.6 cfs @ 12.08 hrs, Volume= 0.13 af
 Outflow = 1.6 cfs @ 12.11 hrs, Volume= 0.12 af, Atten= 4%, Lag= 1.4 min
 Primary = 1.6 cfs @ 12.11 hrs, Volume= 0.12 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 104.05' @ 12.11 hrs Surf.Area= 600 sf Storage= 542 cf

Plug-Flow detention time= 68.6 min calculated for 0.12 af (94% of inflow)
 Center-of-Mass det. time= 33.0 min (782.3 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	102.50'	377 cf	15.00'W x 40.00'L x 2.04'H Field A 1,225 cf Overall - 283 cf Embedded = 942 cf x 40.0% Voids
#2A	103.00'	283 cf	Cultec C-100 x 20 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 4 rows
		660 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	103.20'	12.0" Round Culvert L= 20.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 103.20' / 101.00' S= 0.1100 1/8" Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	103.50'	6.0" Vert. Orifice/Grate X 3.00 C= 0.600

Primary OutFlow Max=1.6 cfs @ 12.11 hrs HW=104.05' TW=98.40' (Dynamic Tailwater)

↳1=Culvert (Passes 1.6 cfs of 2.2 cfs potential flow)

↳2=Orifice/Grate (Orifice Controls 1.6 cfs @ 2.6 fps)

Summary for Pond 3P: cultec parking - 330

Inflow Area = 1.235 ac, 78.56% Impervious, Inflow Depth > 3.68" for 10-yr event
 Inflow = 5.0 cfs @ 12.08 hrs, Volume= 0.38 af
 Outflow = 4.2 cfs @ 12.14 hrs, Volume= 0.34 af, Atten= 17%, Lag= 3.2 min
 Discarded = 0.0 cfs @ 7.24 hrs, Volume= 0.06 af
 Primary = 4.2 cfs @ 12.14 hrs, Volume= 0.28 af

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Type III 24-hr 10-yr Rainfall=4.50"

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Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 115.45' @ 12.14 hrs Surf.Area= 1,666 sf Storage= 3,023 cf

Plug-Flow detention time= 80.5 min calculated for 0.34 af (89% of inflow)
 Center-of-Mass det. time= 28.4 min (809.5 - 781.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	112.80'	1,599 cf	65.33'W x 25.50'L x 3.71'H Field A 6,178 cf Overall - 2,179 cf Embedded = 3,999 cf x 40.0% Voids
#2A	113.30'	2,179 cf	Cultec R-330XL x 39 Inside #1 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 13 rows
		3,779 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	114.00'	18.0" Round Culvert L= 100.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 114.00' / 106.00' S= 0.0800 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	114.90'	4.0" Vert. Orifice/Grate X 3.00 C= 0.600
#3	Device 1	114.40'	6.0" Vert. Orifice/Grate X 4.00 C= 0.600
#4	Discarded	112.80'	1.020 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 7.24 hrs HW=112.84' (Free Discharge)
 ↳ **4=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=4.2 cfs @ 12.14 hrs HW=115.45' TW=98.41' (Dynamic Tailwater)
 ↳ **1=Culvert** (Passes 4.2 cfs of 7.2 cfs potential flow)
 ↳ ↳ **2=Orifice/Grate** (Orifice Controls 0.8 cfs @ 3.0 fps)
 ↳ ↳ **3=Orifice/Grate** (Orifice Controls 3.4 cfs @ 4.3 fps)

Summary for Pond 4P: cultec in parking

Inflow Area =	0.446 ac, 100.00% Impervious, Inflow Depth > 4.26" for 10-yr event
Inflow =	2.0 cfs @ 12.08 hrs, Volume= 0.16 af
Outflow =	1.4 cfs @ 12.16 hrs, Volume= 0.13 af, Atten= 29%, Lag= 4.6 min
Discarded =	0.0 cfs @ 7.01 hrs, Volume= 0.05 af
Primary =	1.4 cfs @ 12.16 hrs, Volume= 0.08 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 121.47' @ 12.16 hrs Surf.Area= 1,174 sf Storage= 2,126 cf

Plug-Flow detention time= 123.8 min calculated for 0.13 af (79% of inflow)
 Center-of-Mass det. time= 46.4 min (795.7 - 749.3)

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Type III 24-hr 10-yr Rainfall=4.50"

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Volume	Invert	Avail.Storage	Storage Description
#1A	118.90'	1,011 cf	30.50'W x 38.50'L x 3.54'H Field A 4,159 cf Overall - 1,632 cf Embedded = 2,527 cf x 40.0% Voids
#2A	119.40'	1,632 cf	Cultec R-330XL x 30 Inside #1 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 6 rows
		2,643 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	119.00'	12.0" Round Culvert - to exist swale L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 119.00' / 118.00' S= 0.0250 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	120.70'	6.0" Vert. Orifice/Grate X 2.00 C= 0.600
#3	Discarded	118.90'	1.020 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 7.01 hrs HW=118.94' (Free Discharge)↑**3=Exfiltration** (Exfiltration Controls 0.0 cfs)**Primary OutFlow** Max=1.4 cfs @ 12.16 hrs HW=121.47' TW=108.46' (Dynamic Tailwater)↑**1=Culvert - to exist swale** (Passes 1.4 cfs of 5.3 cfs potential flow)↑**2=Orifice/Grate** (Orifice Controls 1.4 cfs @ 3.5 fps)**Summary for Pond 5R: cb#7 to dmh#8**

Inflow Area = 2.587 ac, 62.64% Impervious, Inflow Depth > 2.78" for 10-yr event
 Inflow = 8.1 cfs @ 12.14 hrs, Volume= 0.60 af
 Outflow = 8.1 cfs @ 12.14 hrs, Volume= 0.60 af, Atten= 0%, Lag= 0.0 min
 Primary = 8.1 cfs @ 12.14 hrs, Volume= 0.60 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 97.02' @ 12.14 hrs

Flood Elev= 90.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	86.70'	12.0" Round Culvert L= 17.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 86.70' / 86.10' S= 0.0353 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=8.0 cfs @ 12.14 hrs HW=96.92' TW=92.44' (Dynamic Tailwater)↑**1=Culvert** (Inlet Controls 8.0 cfs @ 10.2 fps)**Summary for Pond 6R: dmh#8 to cb#10**

Inflow Area = 2.587 ac, 62.64% Impervious, Inflow Depth > 2.78" for 10-yr event
 Inflow = 8.1 cfs @ 12.14 hrs, Volume= 0.60 af
 Outflow = 8.1 cfs @ 12.14 hrs, Volume= 0.60 af, Atten= 0%, Lag= 0.0 min
 Primary = 8.1 cfs @ 12.14 hrs, Volume= 0.60 af

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Type III 24-hr 10-yr Rainfall=4.50"

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Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 92.45' @ 12.14 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	85.70'	12.0" Round Culvert L= 78.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 85.70' / 79.90' S= 0.0744 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=8.1 cfs @ 12.14 hrs HW=92.44' TW=85.87' (Dynamic Tailwater)

↑**1=Culvert** (Outlet Controls 8.1 cfs @ 10.4 fps)

Summary for Pond 7R: cb#10 to dmh#11

Inflow Area = 2.903 ac, 66.46% Impervious, Inflow Depth > 2.93" for 10-yr event
 Inflow = 9.3 cfs @ 12.13 hrs, Volume= 0.71 af
 Outflow = 9.3 cfs @ 12.13 hrs, Volume= 0.71 af, Atten= 0%, Lag= 0.0 min
 Primary = 9.3 cfs @ 12.13 hrs, Volume= 0.71 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 85.92' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	79.40'	12.0" Round Culvert L= 11.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 79.40' / 77.00' S= 0.2182 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=9.3 cfs @ 12.13 hrs HW=85.91' TW=0.00' (Dynamic Tailwater)

↑**1=Culvert** (Inlet Controls 9.3 cfs @ 11.8 fps)

PROPOSED CONDITIONS
100-YEAR 24 HOUR STORM EVENT ANALYSIS

Summary for Subcatchment sc10: NE corner @ Sohier

Runoff = 2.9 cfs @ 12.08 hrs, Volume= 0.21 af, Depth> 5.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	10,985	98	impervious area
	9,440	74	>75% Grass cover, Good, HSG C
	20,425	87	Weighted Average
	9,440		46.22% Pervious Area
	10,985		53.78% Impervious Area

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

Summary for Subcatchment sc11: west bldg A

Runoff = 6.6 cfs @ 12.08 hrs, Volume= 0.51 af, Depth> 6.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	33,095	98	impervious area
	10,575	74	>75% Grass cover, Good, HSG C
	43,670	92	Weighted Average
	10,575		24.22% Pervious Area
	33,095		75.78% Impervious Area

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

Summary for Subcatchment sc12: community bldg area

Runoff = 3.7 cfs @ 12.08 hrs, Volume= 0.29 af, Depth> 6.40"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	20,290	98	impervious area
	3,410	74	>75% Grass cover, Good, HSG C
	23,700	95	Weighted Average
	3,410		14.39% Pervious Area
	20,290		85.61% Impervious Area

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Type III 24-hr 100-yr Rainfall=7.00"

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

Summary for Subcatchment sc13: bldg A

Runoff = 3.1 cfs @ 12.08 hrs, Volume= 0.25 af, Depth> 6.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
* 19,410	98	impervious area
19,410		100.00% Impervious Area

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

Summary for Subcatchment sc14: south bldg A

Runoff = 1.6 cfs @ 12.08 hrs, Volume= 0.13 af, Depth> 6.52"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
* 9,155	98	impervious area
955	74	>75% Grass cover, Good, HSG C
10,110	96	Weighted Average
955		9.45% Pervious Area
9,155		90.55% Impervious Area

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

Summary for Subcatchment sc15: bldg B

Runoff = 2.5 cfs @ 12.08 hrs, Volume= 0.21 af, Depth> 6.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
* 16,055	98	impervious area
16,055		100.00% Impervious Area

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Type III 24-hr 100-yr Rainfall=7.00"

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

Summary for Subcatchment SC16: south locus

Runoff = 4.7 cfs @ 12.14 hrs, Volume= 0.38 af, Depth> 4.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
* 12,295	98	impervious area
12,665	70	Woods, Good, HSG C
17,910	74	>75% Grass cover, Good, HSG C
42,870	80	Weighted Average
30,575		71.32% Pervious Area
12,295		28.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	30	0.0200	0.1		Sheet Flow, yard Grass: Short n= 0.150 P2= 3.10"
1.9	20	0.3500	0.2		Sheet Flow, wooded slope Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	31	0.0960	1.5		Shallow Concentrated Flow, wooded to exist swale Woodland Kv= 5.0 fps
4.3	325	0.0330	1.3		Shallow Concentrated Flow, exist grass Short Grass Pasture Kv= 7.0 fps
10.3	406	Total			

Summary for Subcatchment sc20: SE @ Sohier

Runoff = 3.7 cfs @ 12.08 hrs, Volume= 0.28 af, Depth> 5.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
* 16,735	98	impervious area
8,360	74	>75% Grass cover, Good, HSG C
25,095	90	Weighted Average
8,360		33.31% Pervious Area
16,735		66.69% Impervious Area

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

Summary for Subcatchment SC3: sohier/tozer intersection

Runoff = 2.2 cfs @ 12.08 hrs, Volume= 0.17 af, Depth> 6.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	13,450	98	impervious area
	315	74	>75% Grass cover, Good, HSG C
	13,765	97	Weighted Average
	315		2.29% Pervious Area
	13,450		97.71% Impervious Area

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

Summary for Subcatchment sc50: NW corner

Runoff = 7.9 cfs @ 12.12 hrs, Volume= 0.62 af, Depth> 4.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-yr Rainfall=7.00"

	Area (sf)	CN	Description
*	19,400	98	impervious area
	29,505	70	Woods, Good, HSG C
	12,845	74	>75% Grass cover, Good, HSG C
	6,845	79	50-75% Grass cover, Fair, HSG C
	68,595	80	Weighted Average
	49,195		71.72% Pervious Area
	19,400		28.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	50	0.1200	0.1		Sheet Flow, within woods Woods: Light underbrush n= 0.400 P2= 3.10"
0.4	57	0.2100	2.3		Shallow Concentrated Flow, overland thru woods Woodland Kv= 5.0 fps
2.0	407	0.0440	3.4		Shallow Concentrated Flow, thru swale Unpaved Kv= 16.1 fps
8.5	514	Total			

Summary for Reach 1R: cb#1 to dmh#3

Inflow Area = 0.469 ac, 53.78% Impervious, Inflow Depth > 5.47" for 100-yr event
Inflow = 2.9 cfs @ 12.08 hrs, Volume= 0.21 af
Outflow = 2.9 cfs @ 12.09 hrs, Volume= 0.21 af, Atten= 0%, Lag= 0.0 min

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Type III 24-hr 100-yr Rainfall=7.00"

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Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Max. Velocity= 15.4 fps, Min. Travel Time= 0.0 min

Avg. Velocity = 5.1 fps, Avg. Travel Time= 0.1 min

Peak Storage= 3 cf @ 12.09 hrs

Average Depth at Peak Storage= 0.29'

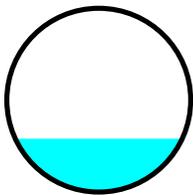
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.9 cfs

12.0" Round Pipe

n= 0.013 Concrete pipe, bends & connections

Length= 17.0' Slope= 0.2000 '/'

Inlet Invert= 111.60', Outlet Invert= 108.20'



Summary for Reach 2R: dmh@3 to dmh#4

Inflow Area = 0.914 ac, 76.30% Impervious, Inflow Depth > 4.98" for 100-yr event

Inflow = 4.8 cfs @ 12.10 hrs, Volume= 0.38 af

Outflow = 4.8 cfs @ 12.11 hrs, Volume= 0.38 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Max. Velocity= 11.9 fps, Min. Travel Time= 0.3 min

Avg. Velocity = 3.9 fps, Avg. Travel Time= 0.8 min

Peak Storage= 76 cf @ 12.11 hrs

Average Depth at Peak Storage= 0.51'

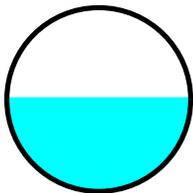
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.2 cfs

12.0" Round Pipe

n= 0.013 Concrete pipe, bends & connections

Length= 188.0' Slope= 0.0670 '/'

Inlet Invert= 108.10', Outlet Invert= 95.50'



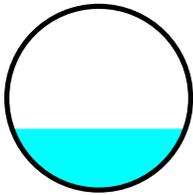
Summary for Reach 3R: cb#5 to dmh#4

Inflow Area = 0.576 ac, 66.69% Impervious, Inflow Depth > 5.82" for 100-yr event
Inflow = 3.7 cfs @ 12.08 hrs, Volume= 0.28 af
Outflow = 3.7 cfs @ 12.08 hrs, Volume= 0.28 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 16.3 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 5.4 fps, Avg. Travel Time= 0.0 min

Peak Storage= 3 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 15.6 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 11.0' Slope= 0.1909 '/'
Inlet Invert= 97.60', Outlet Invert= 95.50'



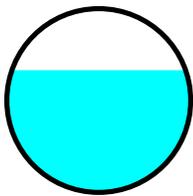
Summary for Reach 4R: dmh#4 to dmh#11

Inflow Area = 1.491 ac, 72.59% Impervious, Inflow Depth > 5.30" for 100-yr event
Inflow = 8.5 cfs @ 12.09 hrs, Volume= 0.66 af
Outflow = 8.4 cfs @ 12.10 hrs, Volume= 0.66 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Max. Velocity= 15.3 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 5.2 fps, Avg. Travel Time= 0.6 min

Peak Storage= 111 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.66'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 10.8 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 200.0' Slope= 0.0925 '/'
Inlet Invert= 95.50', Outlet Invert= 77.00'



Summary for Reach 8R: dmh#11

Inflow Area = 4.394 ac, 68.54% Impervious, Inflow Depth > 5.29" for 100-yr event
Inflow = 23.6 cfs @ 12.12 hrs, Volume= 1.94 af
Outflow = 23.6 cfs @ 12.12 hrs, Volume= 1.94 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Reach 9R: existing swale at Tozer

Inflow Area = 0.544 ac, 85.61% Impervious, Inflow Depth = 1.94" for 100-yr event
Inflow = 1.5 cfs @ 12.26 hrs, Volume= 0.09 af
Outflow = 1.5 cfs @ 12.28 hrs, Volume= 0.09 af, Atten= 0%, Lag= 1.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Max. Velocity= 5.6 fps, Min. Travel Time= 1.5 min

Avg. Velocity = 2.2 fps, Avg. Travel Time= 3.7 min

Peak Storage= 131 cf @ 12.28 hrs

Average Depth at Peak Storage= 0.20'

Bank-Full Depth= 1.00' Flow Area= 2.5 sf, Capacity= 32.4 cfs

1.00' x 1.00' deep channel, n= 0.016 Asphalt, rough

Side Slope Z-value= 1.5 '/' Top Width= 4.00'

Length= 490.0' Slope= 0.0440 '/'

Inlet Invert= 105.00', Outlet Invert= 83.44'



Summary for Reach 10R: exist swale along Tozer

Inflow Area = 1.603 ac, 83.49% Impervious, Inflow Depth > 5.39" for 100-yr event
Inflow = 9.0 cfs @ 12.13 hrs, Volume= 0.72 af
Outflow = 9.0 cfs @ 12.14 hrs, Volume= 0.72 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Max. Velocity= 4.3 fps, Min. Travel Time= 0.6 min

Avg. Velocity = 1.4 fps, Avg. Travel Time= 1.9 min

Peak Storage= 332 cf @ 12.14 hrs

Average Depth at Peak Storage= 0.52'

Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 37.0 cfs

2.00' x 1.00' deep channel, n= 0.030 Earth, grassed & winding

Side Slope Z-value= 4.0 '/' Top Width= 10.00'

Length= 158.0' Slope= 0.0316 '/'

Inlet Invert= 98.00', Outlet Invert= 93.00'



Summary for Reach dp1: drop inlet

Inflow Area = 2.119 ac, 43.00% Impervious, Inflow Depth > 3.98" for 100-yr event
 Inflow = 8.3 cfs @ 12.15 hrs, Volume= 0.70 af
 Outflow = 8.3 cfs @ 12.15 hrs, Volume= 0.70 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: cultec in parking

Inflow Area = 0.544 ac, 85.61% Impervious, Inflow Depth > 6.40" for 100-yr event
 Inflow = 3.7 cfs @ 12.08 hrs, Volume= 0.29 af
 Outflow = 1.6 cfs @ 12.26 hrs, Volume= 0.25 af, Atten= 56%, Lag= 10.8 min
 Discarded = 0.1 cfs @ 9.21 hrs, Volume= 0.16 af
 Primary = 1.5 cfs @ 12.26 hrs, Volume= 0.09 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 115.71' @ 12.26 hrs Surf.Area= 1,936 sf Storage= 4,282 cf

Plug-Flow detention time= 157.8 min calculated for 0.25 af (85% of inflow)
 Center-of-Mass det. time= 93.7 min (853.2 - 759.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	112.25'	1,678 cf	26.17'W x 74.00'L x 3.54'H Field A 6,858 cf Overall - 2,664 cf Embedded = 4,194 cf x 40.0% Voids
#2A	112.75'	2,664 cf	Cultec R-330XL x 50 Inside #1 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 5 rows
		4,341 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	114.00'	12.0" Round Culvert - to exist swale L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 114.00' / 106.00' S= 0.2000 1' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	114.90'	4.0" Vert. Orifice/Grate X 2.00 C= 0.600
#3	Device 1	114.70'	6.0" Vert. Orifice/Grate C= 0.600
#4	Discarded	112.25'	2.400 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.1 cfs @ 9.21 hrs HW=112.29' (Free Discharge)

↳4=Exfiltration (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=1.5 cfs @ 12.26 hrs HW=115.71' TW=105.20' (Dynamic Tailwater)

↳1=Culvert - to exist swale (Passes 1.5 cfs of 4.2 cfs potential flow)

↳2=Orifice/Grate (Orifice Controls 0.7 cfs @ 3.9 fps)

↳3=Orifice/Grate (Orifice Controls 0.8 cfs @ 4.2 fps)

Summary for Pond 2P: cultec grass - c100s

Inflow Area = 0.369 ac, 100.00% Impervious, Inflow Depth > 6.76" for 100-yr event
 Inflow = 2.5 cfs @ 12.08 hrs, Volume= 0.21 af
 Outflow = 2.4 cfs @ 12.11 hrs, Volume= 0.20 af, Atten= 6%, Lag= 1.8 min
 Primary = 2.4 cfs @ 12.11 hrs, Volume= 0.20 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 104.45' @ 12.11 hrs Surf.Area= 600 sf Storage= 638 cf

Plug-Flow detention time= 49.5 min calculated for 0.20 af (96% of inflow)
 Center-of-Mass det. time= 24.8 min (767.2 - 742.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	102.50'	377 cf	15.00'W x 40.00'L x 2.04'H Field A 1,225 cf Overall - 283 cf Embedded = 942 cf x 40.0% Voids
#2A	103.00'	283 cf	Cultec C-100 x 20 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 4 rows
		660 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	103.20'	12.0" Round Culvert L= 20.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 103.20' / 101.00' S= 0.1100 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	103.50'	6.0" Vert. Orifice/Grate X 3.00 C= 0.600

Primary OutFlow Max=2.4 cfs @ 12.11 hrs HW=104.45' TW=98.51' (Dynamic Tailwater)

↳1=Culvert (Passes 2.4 cfs of 3.3 cfs potential flow)

↳2=Orifice/Grate (Orifice Controls 2.4 cfs @ 4.0 fps)

Summary for Pond 3P: cultec parking - 330

Inflow Area = 1.235 ac, 78.56% Impervious, Inflow Depth > 6.14" for 100-yr event
 Inflow = 8.2 cfs @ 12.08 hrs, Volume= 0.63 af
 Outflow = 6.7 cfs @ 12.14 hrs, Volume= 0.59 af, Atten= 18%, Lag= 3.3 min
 Discarded = 0.0 cfs @ 5.08 hrs, Volume= 0.07 af
 Primary = 6.7 cfs @ 12.14 hrs, Volume= 0.52 af

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Type III 24-hr 100-yr Rainfall=7.00"

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Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 116.50' @ 12.14 hrs Surf.Area= 1,666 sf Storage= 3,774 cf

Plug-Flow detention time= 61.1 min calculated for 0.59 af (93% of inflow)
 Center-of-Mass det. time= 24.6 min (793.2 - 768.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	112.80'	1,599 cf	65.33'W x 25.50'L x 3.71'H Field A 6,178 cf Overall - 2,179 cf Embedded = 3,999 cf x 40.0% Voids
#2A	113.30'	2,179 cf	Cultec R-330XL x 39 Inside #1 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 13 rows
		3,779 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	114.00'	18.0" Round Culvert L= 100.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 114.00' / 106.00' S= 0.0800 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	114.90'	4.0" Vert. Orifice/Grate X 3.00 C= 0.600
#3	Device 1	114.40'	6.0" Vert. Orifice/Grate X 4.00 C= 0.600
#4	Discarded	112.80'	1.020 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 5.08 hrs HW=112.84' (Free Discharge)
 ↳ **4=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=6.7 cfs @ 12.14 hrs HW=116.50' TW=98.52' (Dynamic Tailwater)
 ↳ **1=Culvert** (Passes 6.7 cfs of 11.3 cfs potential flow)
 ↳ ↳ **2=Orifice/Grate** (Orifice Controls 1.5 cfs @ 5.8 fps)
 ↳ ↳ **3=Orifice/Grate** (Orifice Controls 5.1 cfs @ 6.5 fps)

Summary for Pond 4P: cultec in parking

Inflow Area = 0.446 ac, 100.00% Impervious, Inflow Depth > 6.76" for 100-yr event
 Inflow = 3.1 cfs @ 12.08 hrs, Volume= 0.25 af
 Outflow = 2.2 cfs @ 12.16 hrs, Volume= 0.22 af, Atten= 29%, Lag= 4.6 min
 Discarded = 0.0 cfs @ 4.33 hrs, Volume= 0.05 af
 Primary = 2.2 cfs @ 12.16 hrs, Volume= 0.17 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 122.25' @ 12.16 hrs Surf.Area= 1,174 sf Storage= 2,550 cf

Plug-Flow detention time= 101.1 min calculated for 0.22 af (86% of inflow)
 Center-of-Mass det. time= 39.5 min (781.9 - 742.4)

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Volume	Invert	Avail.Storage	Storage Description
#1A	118.90'	1,011 cf	30.50'W x 38.50'L x 3.54'H Field A 4,159 cf Overall - 1,632 cf Embedded = 2,527 cf x 40.0% Voids
#2A	119.40'	1,632 cf	Cultec R-330XL x 30 Inside #1 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 6 rows
		2,643 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	119.00'	12.0" Round Culvert - to exist swale L= 40.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 119.00' / 118.00' S= 0.0250 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	120.70'	6.0" Vert. Orifice/Grate X 2.00 C= 0.600
#3	Discarded	118.90'	1.020 in/hr Exfiltration over Surface area Phase-In= 0.01'

Discarded OutFlow Max=0.0 cfs @ 4.33 hrs HW=118.94' (Free Discharge)↑**3=Exfiltration** (Exfiltration Controls 0.0 cfs)**Primary OutFlow** Max=2.2 cfs @ 12.16 hrs HW=122.25' TW=108.58' (Dynamic Tailwater)↑**1=Culvert - to exist swale** (Passes 2.2 cfs of 6.3 cfs potential flow)↑**2=Orifice/Grate** (Orifice Controls 2.2 cfs @ 5.5 fps)**Summary for Pond 5R: cb#7 to dmh#8**

Inflow Area = 2.587 ac, 62.64% Impervious, Inflow Depth > 5.12" for 100-yr event
 Inflow = 13.6 cfs @ 12.14 hrs, Volume= 1.10 af
 Outflow = 13.6 cfs @ 12.14 hrs, Volume= 1.10 af, Atten= 0%, Lag= 0.0 min
 Primary = 13.6 cfs @ 12.14 hrs, Volume= 1.10 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 127.77' @ 12.15 hrs

Flood Elev= 90.70'

Device	Routing	Invert	Outlet Devices
#1	Primary	86.70'	12.0" Round Culvert L= 17.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 86.70' / 86.10' S= 0.0353 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=13.4 cfs @ 12.14 hrs HW=127.55' TW=114.90' (Dynamic Tailwater)↑**1=Culvert** (Inlet Controls 13.4 cfs @ 17.1 fps)**Summary for Pond 6R: dmh#8 to cb#10**

Inflow Area = 2.587 ac, 62.64% Impervious, Inflow Depth > 5.12" for 100-yr event
 Inflow = 13.6 cfs @ 12.14 hrs, Volume= 1.10 af
 Outflow = 13.6 cfs @ 12.14 hrs, Volume= 1.10 af, Atten= 0%, Lag= 0.0 min
 Primary = 13.6 cfs @ 12.14 hrs, Volume= 1.10 af

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Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 114.92' @ 12.14 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	85.70'	12.0" Round Culvert L= 78.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 85.70' / 79.90' S= 0.0744 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

Primary OutFlow Max=13.6 cfs @ 12.14 hrs HW=114.90' TW=96.40' (Dynamic Tailwater)↑**1=Culvert** (Outlet Controls 13.6 cfs @ 17.4 fps)**Summary for Pond 7R: cb#10 to dmh#11**

Inflow Area = 2.903 ac, 66.46% Impervious, Inflow Depth > 5.29" for 100-yr event
 Inflow = 15.4 cfs @ 12.13 hrs, Volume= 1.28 af
 Outflow = 15.4 cfs @ 12.13 hrs, Volume= 1.28 af, Atten= 0%, Lag= 0.0 min
 Primary = 15.4 cfs @ 12.13 hrs, Volume= 1.28 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 96.52' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	79.40'	12.0" Round Culvert L= 11.0' Square-edged headwall, Ke= 0.500 Inlet / Outlet Invert= 79.40' / 77.00' S= 0.2182 '/ Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf

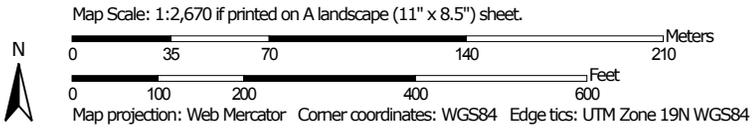
Primary OutFlow Max=15.4 cfs @ 12.13 hrs HW=96.52' TW=0.00' (Dynamic Tailwater)↑**1=Culvert** (Inlet Controls 15.4 cfs @ 19.6 fps)

APPENDIX

Soil Map—Essex County, Massachusetts, Southern Part
(108 Sohier Road, Beverly, MA)



Soil Map may not be valid at this scale.



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Essex County, Massachusetts, Southern Part
Survey Area Data: Version 14, Oct 6, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 29, 2014—Sep 19, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	1.0	3.8%
102E	Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes	2.5	10.0%
306C	Paxton fine sandy loam, 8 to 15 percent slopes, very stony	10.0	39.2%
306D	Paxton fine sandy loam, 15 to 25 percent slopes, very stony	1.6	6.4%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	0.0	0.0%
310C	Woodbridge fine sandy loam, 8 to 15 percent slopes	0.3	1.0%
311B	Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony	5.9	23.3%
602	Urban land	0.0	0.0%
651	Udorthents, smoothed	4.1	16.2%
Totals for Area of Interest		25.4	100.0%