Module 5g: Biofiltration

Problem Description

This example will show you how to run the biofiltration option.

Steps involved:

1) Revise Example 1a
2) Calculate pre-conditions
3) Add a bioretention trench under biofiltration as a land use control practice
4) Calculate post-conditions
5) Add bioretention trench under biofiltration as a drainage control practice

The class will be filling out Table E in steps 2, 4 and 5

Table E. Bioretention results under biofiltration

	A	B	C	D
Constituent	Site Totals	Roof Area 1 Pre-condition	Roof Area 1 Post-condition	Outfall Post-Condition
Runoff (cu ft)				
TSS (mg/L)				
TSS (lbs)				
Total Copper (lbs)				
Particulate Lead (lbs)				

1) Revise Example 1a

Save "Example 1 a" as "Example 1e". Add "Biofiltration for Rooftop" to the Site Description.

2) Calculate pre-conditions

Run the model.
Enter the results for the entire site for Runoff (cu ft), TSS (mg/L), TSS (lbs), Total Copper (lbs), and Particulate Lead (lbs) in Column A, Table E on this page.

Question: The total load in TSS from the site is 4,390 lbs. The goal is a 40% reduction. What is the pollutant load, in terms of TSS (lbs), from the rooftop? What percentage of the site's loading is from rooftops?

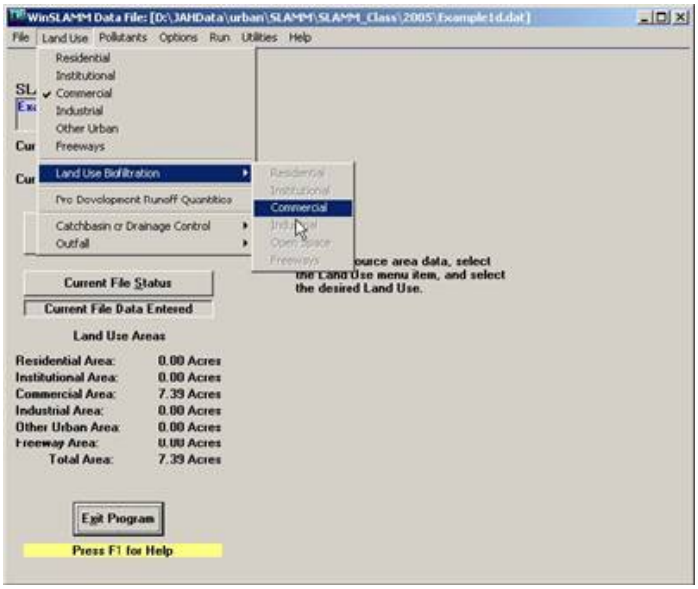
Answer: TSS Load = 269 / 4,390= 6%
By removing just the load from the rooftop, 6 percent of the load can be removed.
Enter the results for just the rooftop in Column B, Table E on this page.

Note: A Biofilter can also be used as a Source Area Control. The user would click on the cell below the "B" in the same row as the Source Area in the Land Use screen. After all the relevant data is entered, "B" would then appear just as a "S" does for Street Sweeping. See example1d for more explanation on Source Area Controls.

3) Add a bioretention trench under biofiltration as a land use control practice

To add bioretention trench on rooftops click on **Land Use** *tab then* **Land Use Biofiltration** *then* **Commercial**

Note: All other landuses should be grayed out



The following window pops up.

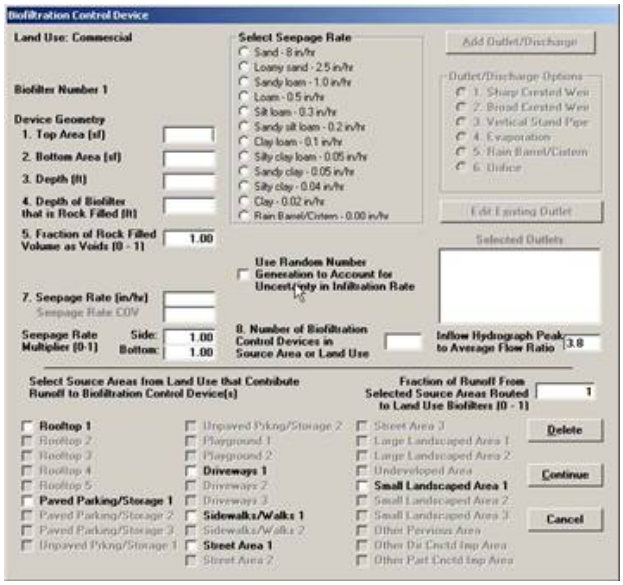
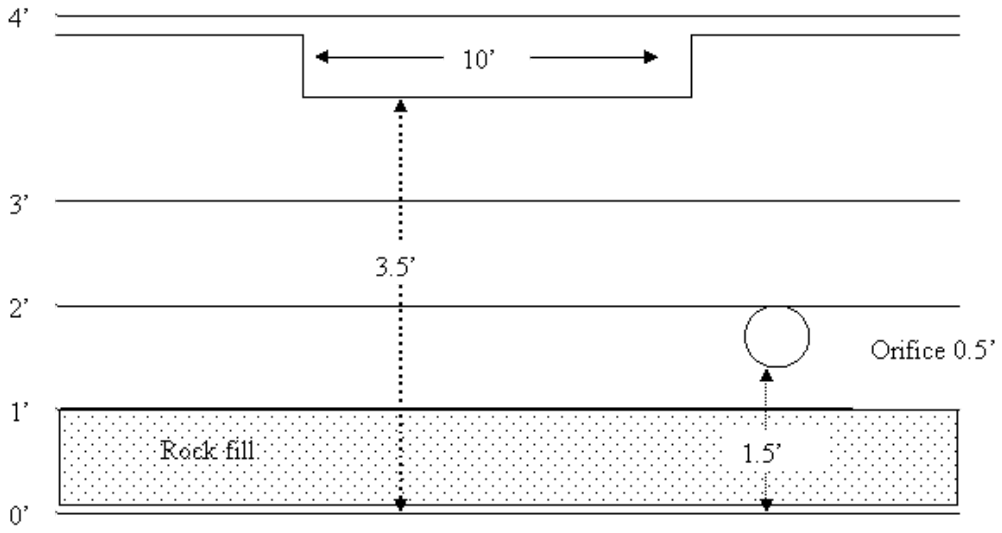


Diagram of the bioretention trench



Enter in the following Biofilter information:

Biofilter Geometry

Top Area (sf)		1500
Bottom Area (sf)		1500
Depth (ft)		4.0
Depth of Biofilter that is Rock filled (ft)		1.0
Fraction of Rock Filled Volume as Voids	0.33	

Infiltration information

Seepage Rate exiting biofilter (in/hr)	0.5
Seepage Rate Multipliers	
Sides	1
Bottom	1

Flow and structure number information

Number of Biofiltrarion Control Devices	1
The Inflow Hydrograph Peak to Average Ratio	3.8

Runoff Sources in Land Use Area

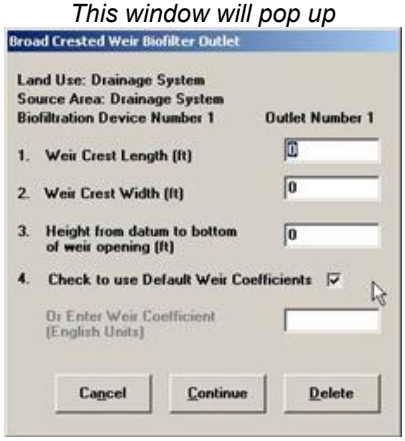
Select rooftops only þ Rooftop1

Fraction of Runoff from Selected Areas Routed to Biofilter 1

Random Number Generator to account for uncertainty in infiltration rates should not be checked

Enter the outlet structure data – First add a Broad Crested Weir – Click **Add Outlet/Discharge** *and select* **Broad Crested Weir**

This window will pop up



Enter in the following information.

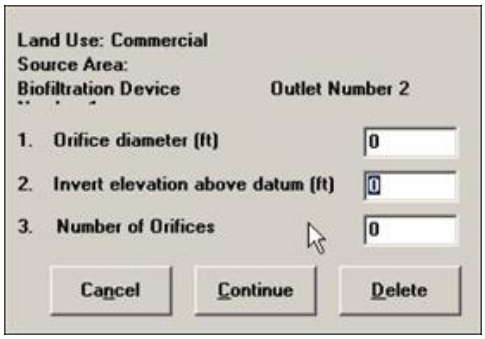
1. Weir Crest Length (ft)	10
2. Weir Crest Width (ft)	0.5
3. Height from Datum to Bottom of weir opening (ft)	3.8
4. Check to use Default Weir Coefficients	þ

Click **Continue**

Note: the Biofiltration routine will produce an error unless a Broad Crested Weir is added as an outlet structure.

Next add an Orifice - Click **Add Outlet/Discharge** *and select* **Orifice**

This window will pop up



Enter in the following information regarding the Orifice:
1. Orifice diameter (ft) 0.5
2. Invert elevation above datum (ft) 1.5
3. Number of Orifices 1.0

Click **Continue**

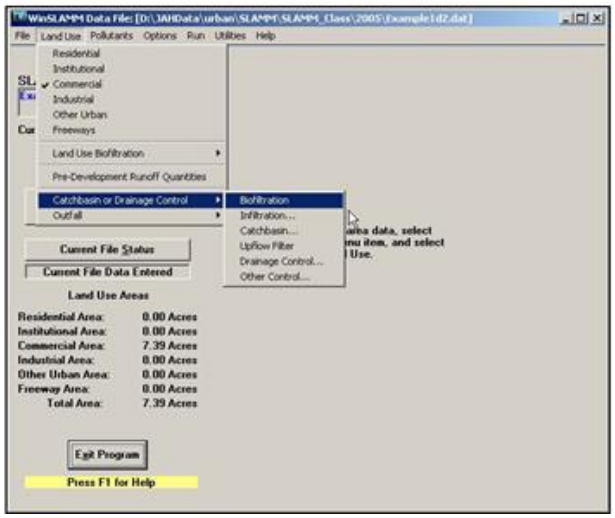
4) Calculate post-conditions

Run the model.
Enter results for the rooftops in Table E, Column C.

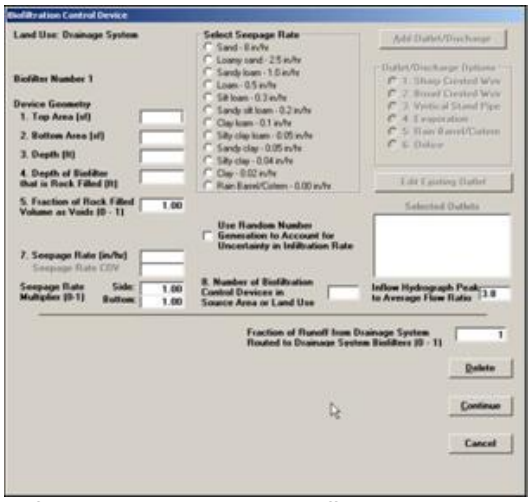
5) Add bioretention trench under biofiltration as a drainage control practice

Open Example 1a again and save "Example 1a" as "Example 1e2." Change the file description to reflect Biofiltration as a Drainage Control Practice.

To add Biofiltration as a Drainage Control – Click Landuse then **Catchbasin or Drainage Control** *- Select* **Biofiltration**



This screen will pop up



Notice that the Drainage Control Biofiltration window that opens is different than the one that opens for the Land Use Biofiltration. The individual source areas are no longer available. The Drainage Control Biofiltration window is the same as the Outfall Control Biofiltration window.

Enter the data from Pages 3 and 4 into the Biofiltration Screen.
Run the model.
Enter results in Table E, Column D.

Output Analysis

Note: Look at the Example1e.bfo and Example1d2.bfo files to help answer the following questions. These files can be viewed with Microsoft Excel. Open the files in Microsoft Excel using the space-delimited option. The entire file does not load.

Example1e.BFO

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	BFNm	Rain#	Date	Rain	Incre.	TimeStep	Stage	MaxStage	Volume	Area	HydQOut	NatSeepOut	EvapOut	OrificOut	TtlQOutAr	Qin
25243	1	11	10644.92	1.58	37	52.0669	1.660198	1.66	2490.298	1500	0.266	0.02	0	0	0.286	0.381
25244	1	11	10644.92	1.58	38	52.0773	1.714803	1.715	2572.205	1500	0.308	0.02	0	0	0.328	0.415
25245	1	11	10644.92	1.58	39	52.0878	1.749163	1.749	2623.744	1500	0.333	0.02	0	0	0.353	0.381
25246	1	11	10644.92	1.58	40	52.0982	1.754521	1.755	2631.782	1500	0.337	0.02	0	0	0.357	0.347
25247	1	11	10644.92	1.58	41	52.1086	1.741145	1.755	2611.717	1500	0.327	0.02	0	0	0.347	0.313
25248	1	11	10644.92	1.58	42	52.119	1.715666	1.755	2573.499	1500	0.309	0.02	0	0	0.329	0.279
25249	1	11	10644.92	1.58	43	52.1294	1.682369	1.755	2523.553	1500	0.285	0.02	0	0	0.305	0.245
25250	1	11	10644.92	1.58	44	52.1398	1.64561	1.755	2468.415	1500	0.252	0.02	0	0	0.272	0.211
25251	1	11	10644.92	1.58	45	52.1503	1.608336	1.755	2412.504	1500	0.219	0.02	0	0	0.239	0.176

Example1e

The "<filename>.bfo" files can also be viewed within WinSLAMM. To view the files in the model, Click **Utilities** then **View File**. Use **Notepad** and select all files under file type, and look for "<filename>.bfo".

Output Analysis

Question: What size would the Bioretenetion trench have to be to reach a goal of 40% reduction of TSS (lbs)?

Answer: If 2% of the site's area is used for a Biofilter, the 40% TSS (lbs) reduction goal is met.

Question: Would you change the depth of the filter to reach the goal?

Answer: No, it does not need to be changed.

Table E. Biofiltration results

	A	B	C	D
Constituent	Site Totals	Roof Area 1 Pre-condition	Roof Area 1 Post-condition	Outfall Post-Condition
Runoff (cu ft)	561,484	130,750	51,893	434,915

TSS (mg/L)	125	33	33	121
TSS (lbs)	4,390	269	107	3,275
Total Copper (lbs)	0.68	.087	0.03	0.58
Particulate Lead (lbs)	1.12	0.17	0.07	0.85