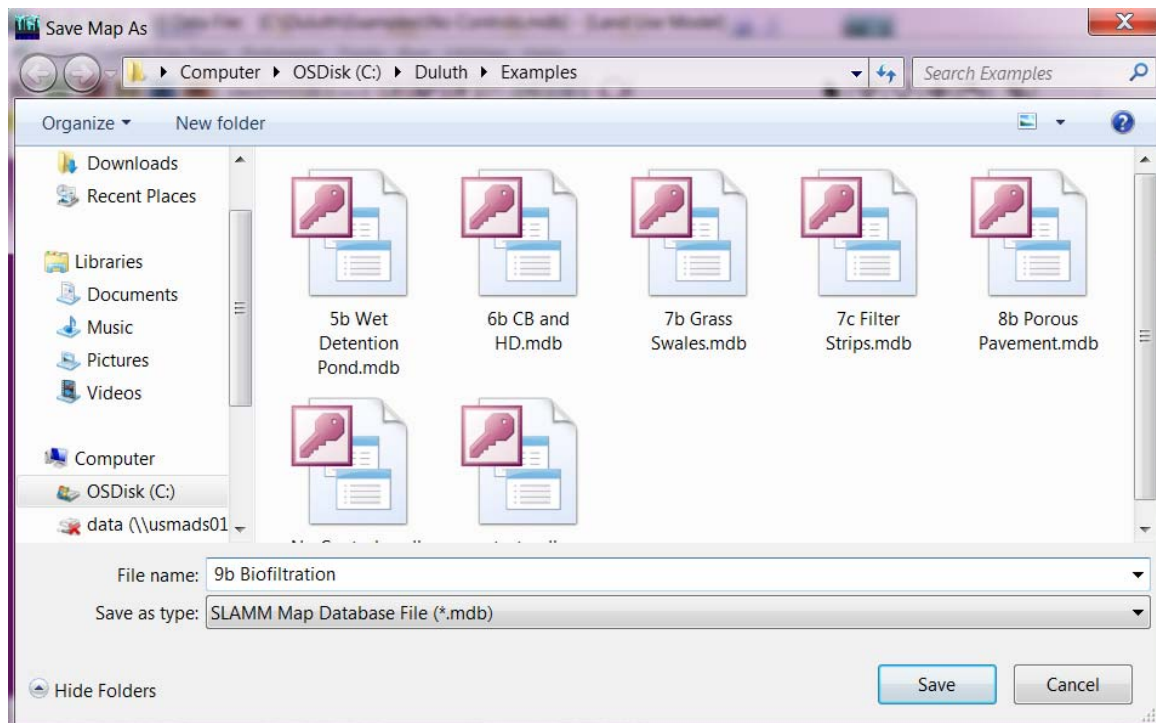


Biofilter Example

Biofilter Example

For this example, we will start with the model file we created for No Controls and add Biofilters. We will assume all of the source areas in the Commercial 1 land use will be routed to the Biofilters. A schematic showing the locations of the Biofilters can be found at the end of this document.

Open the **No Controls** model file and Save the File with a new name.



Change the Site Description in the Current File Data to reflect the Biofilters.

Current File Data

SLAMM Data File Name:

C:\WinSLAMM\Training Courses\Duluth 2012\Model Files\9b Biofiltration.mdb

Site Descript.: Biofilters, Commercial Development

Edit Seed: -42

Edit Rain File: C:\Program Files\WinSLAMM v10\Rain Files\WisReg - Madison\WI 1981.RAN

Edit Start Date: 01/01/81 ☒ Winter Season Range

Edit End Date: 12/31/81 Start of Winter (mm/dd) 12/02 End of Winter (mm/dd) 03/12

Edit Pollutant Probability Distribution File: C:\Program Files\WinSLAMM v10\WI_GF001.pndx

Biofilter Example

Disconnect the map and add the Biofilter control measure. Reconnect the map to make a contiguous network to the Outfall.

The screenshot displays the WinSLAMM v 10 software interface. The left pane shows the 'Land Use' table, and the right pane shows a network diagram.

Land Use Table:

Source Area #	Source Area	Area (acres)	Source Area Parameters	First Control Practice	Second Control Practice
6	Roofs 6				
7	Roofs 7				
8	Roofs 8				
9	Roofs 9				
10	Roofs 10				
11	Roofs 11				
12	Roofs 12				
	Parking	2.050			
13	Paved Parking 1	2.850	Entered		
14	Paved Parking 2				
15	Paved Parking 3				
16	Paved Parking 4				
17	Paved Parking 5				
18	Paved Parking 6				
19	Unpaved Parking 1				
20	Unpaved Parking 2				
21	Unpaved Parking 3				
22	Unpaved Parking 4				
23	Unpaved Parking 5				
24	Unpaved Parking 6				
	Driveways/Sidewalks	0.430			

Land Use #	Land Use Type	Land Use Label	Land Use Area (acres)
1	Commercial	Commercial 1	7.290

CP #	Control Practice Type	Control Practice Name or Location
1	Biofilter	DS Biofilters # 1

Network Diagram: The diagram shows a flow from 'Commercial 1' (red square) through 'Junction 2' (blue circle) to 'DS Biofilters # 1' (blue square labeled 'BF'). From there, it goes through 'Junction 1' (blue circle) to the 'Outfall' (green square labeled 'OUT').

Status Bar: Current File Data Entered | Total Area = 7.290 acres | No Upstream Source Areas | LU# = 1 | Index Number = 1 | Remaining Icons = 253 | Start Date: 01/01/01 | End Date: 12/31/01 | X = 2312

Biofilter Example

Double click on the Biofilter label to access the Biofilter form. All the “Small Landscaped 2” Source Areas will be Biofilters. We will enter the data for a “typical” Biofilter and then enter the number of Biofilters.

Note: when moving through the Biofilter form, press the “Enter” key to move to the next cell, not the “Tab” key.

Biofiltration Control Device

Drainage System Control Practice

Device Properties

Biofilter Number 1

Top Area (sf)	1363
Bottom Area (sf)	1363
Total Depth (ft)	3.50
Typical Width (ft) (Cost est. only)	10.00
Native Soil Infiltration Rate (in/hr)	0.02
Native Soil Infiltration Rate COV	N/A
Infil. Rate Fraction-Bottom (0-1)	1.00
Infil. Rate Fraction-Sides (0-1)	1.00
Rock Filled Depth (ft)	1.00
Rock Fill Porosity (0-1)	0.33
Engineered Media Type	Media Data
Engineered Media Infiltration Rate	13.00
Engineered Media Infiltration Rate COV	N/A
Engineered Media Depth (ft)	2
Engineered Media Porosity (0-1)	0.43
Percent solids reduction due to Engineered Media (0-100)	N/A
Inflow Hydrograph Peak to Average Flow Ratio	3.80
Number of Devices in Source Area or Upstream Drainage System	31

☐ Activate Pipe or Box Storage ☐ Pipe ☐ Box

Diameter (ft)	
Length (ft)	
Within Biofilter (check if Yes)	<input type="checkbox"/>
Perforated (check if Yes)	<input type="checkbox"/>
Bottom Elevation (ft above datum)	
Discharge Orifice Diameter (ft)	

Select Native Soil Infiltration Rate

<input type="radio"/> Sand - 8 in/hr	<input type="radio"/> Clay loam - 0.1 in/hr
<input type="radio"/> Loamy sand - 2.5 in/hr	<input type="radio"/> Silty clay loam - 0.05 in/hr
<input type="radio"/> Sandy loam - 1.0 in/hr	<input type="radio"/> Sandy clay - 0.05 in/hr
<input type="radio"/> Loam - 0.5 in/hr	<input type="radio"/> Silty clay - 0.04 in/hr
<input type="radio"/> Silt loam - 0.3 in/hr	<input type="radio"/> Clay - 0.02 in/hr
<input type="radio"/> Sandy silt loam - 0.2 in/hr	<input type="radio"/> Rain Barrel/Cistern - 0.00 in/hr

Change Geometry

Select Particle Size File: C:\WinSLAMM Files\NURP.CPZ

Control Practice #: 1 CP Index #: 1

Add Sharp Crested Weir

Weir Length (ft)	
Height from datum to bottom of weir opening (ft)	

Remove Broad Crested Weir

Weir crest length (ft)	10.00
Weir crest width (ft)	2.00
Height from datum to bottom of weir opening (ft)	3.40

Add Vertical Stand Pipe

Pipe diameter (ft)	
Height above datum (ft)	

Add Surface Discharge Pipe

Pipe Diameter (ft)	
Invert elevation above datum (ft)	
Number of pipes at invert elev.	

Remove Drain Tile/Underdrain

Pipe Diameter (ft)	0.50
Invert elevation above datum (ft)	0.50
Number of pipes at invert elev.	1

Use Random Number Generation to Account for Infiltration Rate Uncertainty

Initial Water Surface Elevation (ft)

Add Other Outlet

Stage Number	Stage (ft)	Other Outflow Rate (cfs)
1		
2		
3		
4		
5		

Remove Evapotranspiration

Soil porosity (saturation moisture content, 0-1)	0.427
Soil field moisture capacity (0-1)	0.154
Permanent wilting point (0-1)	0.029
Supplemental irrigation used?	<input type="checkbox"/>
Fraction of available capacity when irrigation starts (0-1)	
Fraction of available capacity when irrigation stops (0-1)	

Evaporation

Month	Evapotranspiration (in/day)	Evaporation (in/day)
Jan	0.00	
Feb	0.00	
Mar	0.00	
Apr	0.00	
May	0.16	
Jun	0.17	
Jul	0.18	
Aug	0.14	
Sep	0.10	
Oct	0.00	
Nov	0.00	
Dec	0.00	

Plant Types

1	2	3	4	
Fraction of biofilter that is vegetated	0.50	0.25	0.25	
Plant type	Prairie F	Shrubs	Other Gr	
Root depth (ft)	6.0	2.0	1.0	
ET Crop Adjustment Factor	0.50	0.50	0.55	

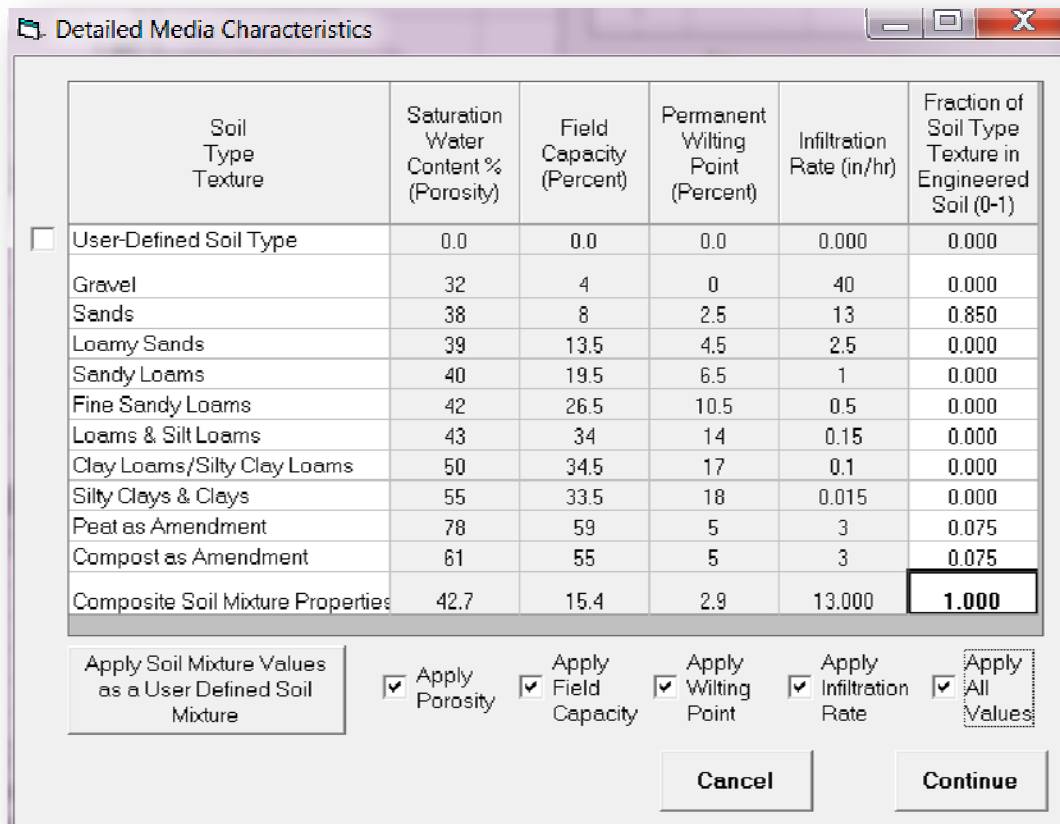
Biofilter Geometry Schematic

Refresh Schematic **Delete** **Cancel** **Continue**

Biofilter Example

The information the model needs to evaluate the Engineered Soil, or Media, in the Biofilter can be entered using default values or, as User Defined values.

Enter the fraction for each soil type. Then select "Apply All Values". Select "Continue".



The dialog box titled "Detailed Media Characteristics" contains a table with 6 columns: Soil Type Texture, Saturation Water Content % (Porosity), Field Capacity (Percent), Permanent Wilting Point (Percent), Infiltration Rate (in/hr), and Fraction of Soil Type Texture in Engineered Soil (0-1). The table lists 12 soil types and a composite mixture. Below the table are checkboxes for "Apply Soil Mixture Values as a User Defined Soil Mixture" and "Apply" for each of the five properties. The "Apply All Values" checkbox is checked. "Cancel" and "Continue" buttons are at the bottom right.

Soil Type Texture	Saturation Water Content % (Porosity)	Field Capacity (Percent)	Permanent Wilting Point (Percent)	Infiltration Rate (in/hr)	Fraction of Soil Type Texture in Engineered Soil (0-1)
<input type="checkbox"/> User-Defined Soil Type	0.0	0.0	0.0	0.000	0.000
Gravel	32	4	0	40	0.000
Sands	38	8	2.5	13	0.850
Loamy Sands	39	13.5	4.5	2.5	0.000
Sandy Loams	40	19.5	6.5	1	0.000
Fine Sandy Loams	42	26.5	10.5	0.5	0.000
Loams & Silt Loams	43	34	14	0.15	0.000
Clay Loams/Silty Clay Loams	50	34.5	17	0.1	0.000
Silty Clays & Clays	55	33.5	18	0.015	0.000
Peat as Amendment	78	59	5	3	0.075
Compost as Amendment	61	55	5	3	0.075
Composite Soil Mixture Properties	42.7	15.4	2.9	13.000	1.000

☐ Apply Soil Mixture Values as a User Defined Soil Mixture

☒ Apply Porosity ☒ Apply Field Capacity ☒ Apply Wilting Point ☒ Apply Infiltration Rate ☒ Apply All Values

Cancel Continue

When the boxes next to "Apply" are checked, the program will use the calculated values in the Biofilter form. The values will not appear until an Engineered Soil Depth is entered.

Biofilter Example

Run the model.

Results

Runoff Volume: 162,761 cu ft
Runoff Volume Percent Reduction: 51.13 %
Particulate Solids Concentration: 93.15 mg/L
Particulate Solids Yield: 946.5 lbs
Particulate Solids Percent Reduction: 61.77 %
Rv (with controls): 0.19
Approx. Urban Stream Classification: Poor
Total Phosphorus: 3.18 lbs
Total Phosphorus Percent Reduction: 55.3 %

Land Uses	Junctions	Control Practices	Outfall	Output Summary			
File Name: C:\2012 November Madison\Examples\1d Biofilter.mdb							
Outfall Output Summary							
	Runoff Volume (cu. ft.)	Percent Runoff Reduction	Runoff Coefficient (Rv)	Particulate Solids Conc. (mg/L)	Particulate Solids Yield (lbs)	Percent Particulate Solids Reduction	
Total of All Land Uses without Controls	333043		0.39	119.1	2476		
Outfall Total with Controls	162761	51.13 %	0.19	93.15	946.5	61.77 %	
Current File Output: Annualized Total After Outfall Controls		163208	Years in Model Run:	1.00	949.1		
Pollutant	Concentration - No Controls	Concentration - With Controls	Concentration Units	Pollutant Yield - No Controls	Pollutant Yield - With Controls	Pollutant Yield Units	Percent Yield Reduction
Total Phosphorus	0.3423	0.3132	mg/L	7.117	3.182	lbs	55.29 %
<div>Print Output Summary to Text File Print Output Summary to .csv File Total Area Modeled: 7.290</div>							
Total Control Practice Costs				Receiving Water Impacts Due To Stormwater Runoff (CWP Impervious Cover Model)			
Capital Cost	N/A	Perform Outfall Flow Duration Curve Calculations		Calculated Rv		Approximate Urban Stream Classification	
Land Cost	N/A			Without Controls	0.39	Poor	
Annual Maintenance Cost	N/A			With Controls	0.19	Fair	
Present Value of All Costs	N/A						
Annualized Value of All	N/A						

The pollution reduction reported at the outfall is the overall pollution reduction for the entire site.

To see the pollution reduction from just the Biofilters, select the "Control Practices" tab.

Biofilter Example

Land Uses		Junctions		Control Practices		Outfall		Output Summary		
Runoff Volume		Part. Solids Yield (lbs)		Part. Solids Conc. (mg/L)		Summary Table				
Data File: C:\2012 November Ma										
Rain File: WisReg - Madison WI 1										
Date: 11-12-12 Time: 9:11:15 AM										
Site Description: Biofilters										
Control Practice No.	Control Practice Type	Total Inflow Volume (cf)	Total Outflow Volume (cf)	Percent Volume Reduction	Total Influent Load (lbs)	Total Effluent Load (lbs)	Percent Load Reduction	Flow Weighted Influent Conc (mg/L)	Flow Weighted Effluent Conc (mg/L)	Percent Conc. Reduction
1	Biofilter	333043	162763	51.13	2476	946.5	61.77	119.1	93.15	21.767

The Biofilters are reducing the runoff volume by 51.1% and the TSS load by 61.8% from the source areas in the Commercial 1 land use.

Legend

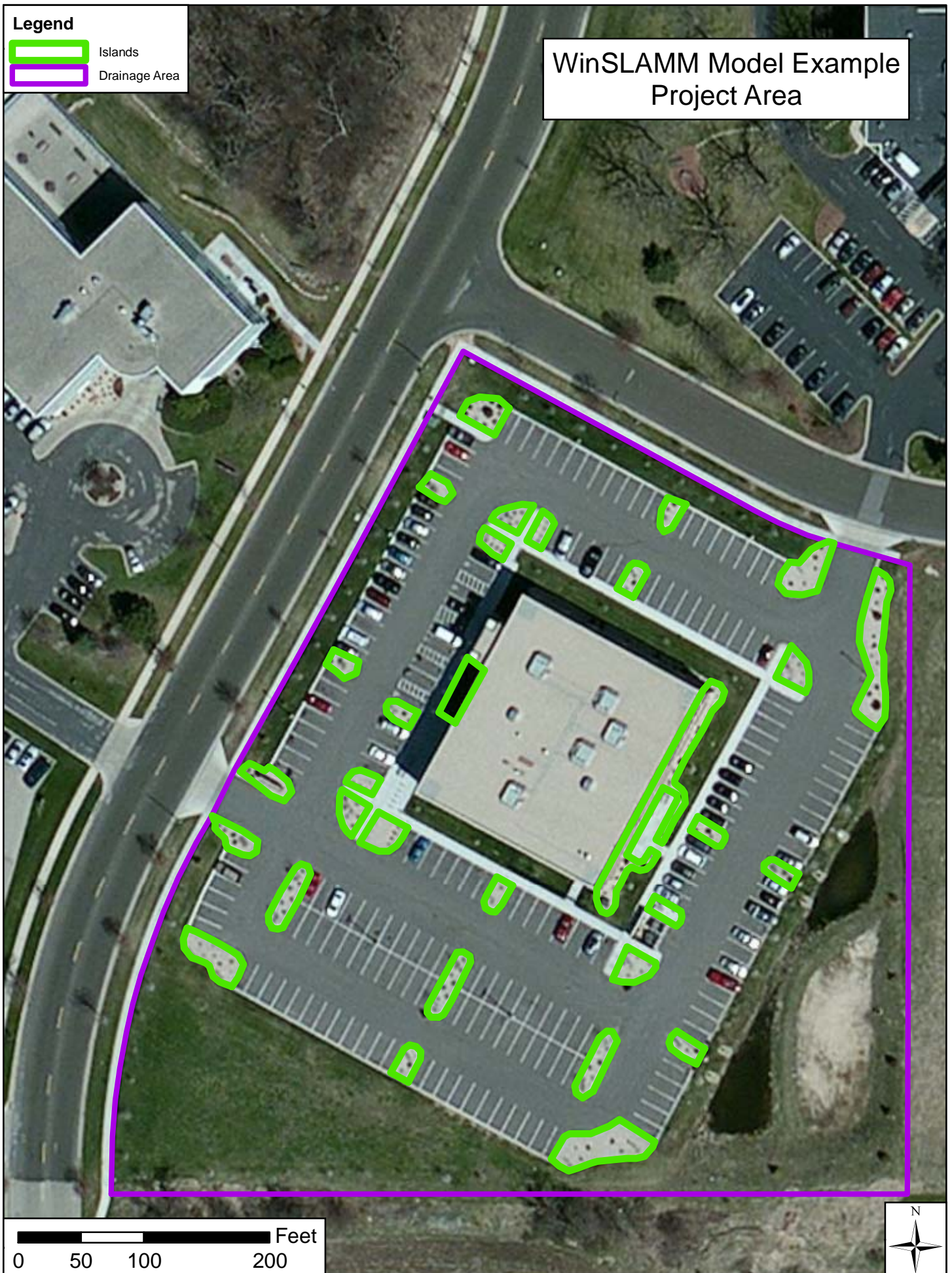


Islands



Drainage Area

**WinSLAMM Model Example
Project Area**



0 50 100 200 Feet

