



Using the Western Washington Hydrology Model to Size StormTank URS for Runoff Treatment and Flow Control

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TABLE OF CONTENTS

- 1.0 GENERAL INFORMATION
 - 1.1 Scope
 - 1.2 Background
- 2.0 Modeling Procedures
 - 2.1 Define Precipitation Data
 - 2.2 Input Pre-Development Land Use / Ground Cover
 - 2.3 Input Post-Development Land Use / Ground Cover
 - 2.4 StormTank URS Bioretention Input
 - 2.5 Run Scenario
 - 2.6 Determine if Flow Control has Passed
 - 2.7 Determine if Water Treatment has been Achieved
 - 2.8 Save the Project and Print Results

1.0 GENERAL INFORMATION

1.1 Scope

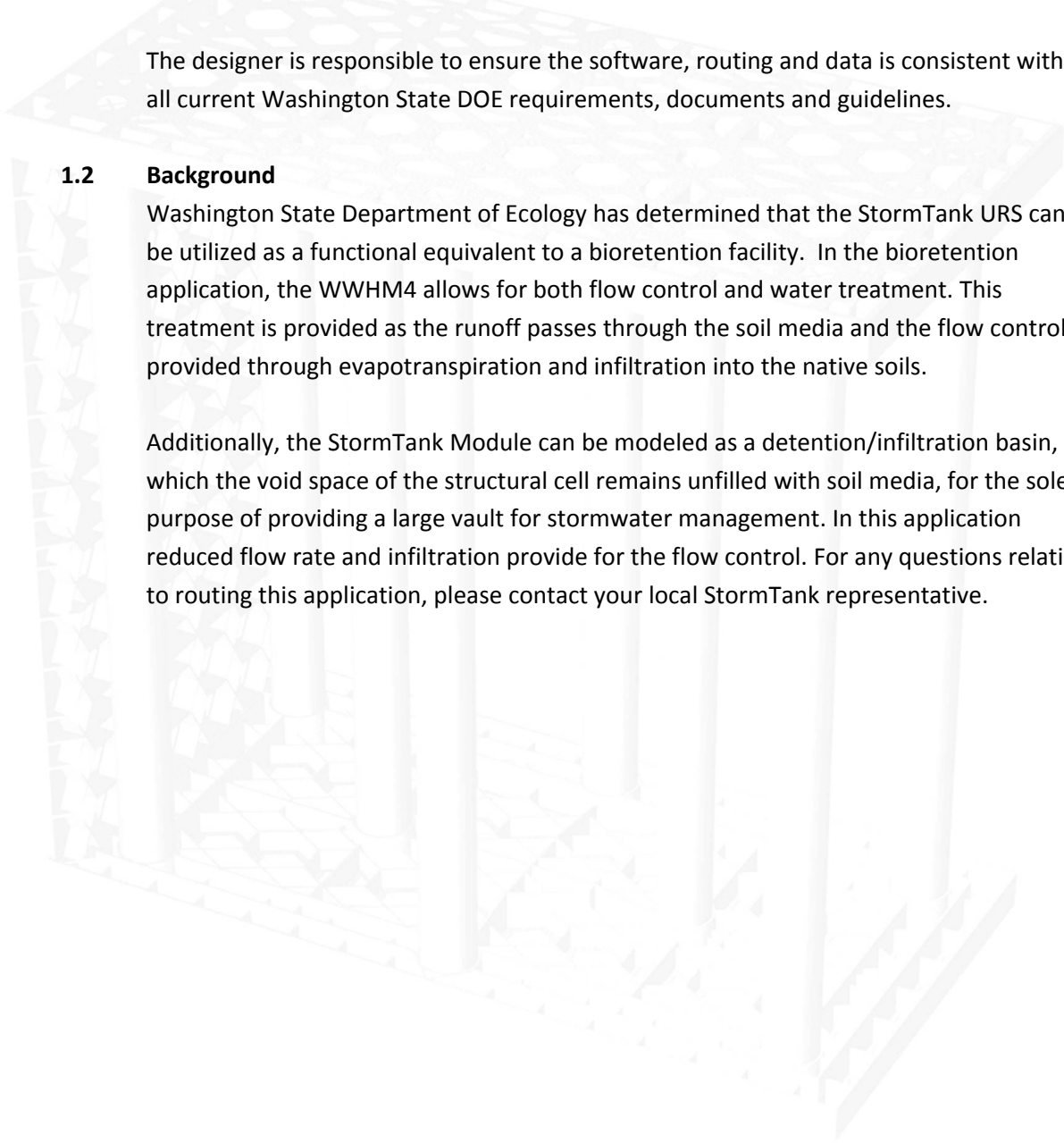
This document to provide guidance on how to complete hydrologic modeling of the StormTank URS configuration as a bioswale/rain garden/bioretenion facility, utilizing the Western Washington Hydrology Model (WWHM4).

The designer is responsible to ensure the software, routing and data is consistent with all current Washington State DOE requirements, documents and guidelines.

1.2 Background

Washington State Department of Ecology has determined that the StormTank URS can be utilized as a functional equivalent to a bioretention facility. In the bioretention application, the WWHM4 allows for both flow control and water treatment. This treatment is provided as the runoff passes through the soil media and the flow control is provided through evapotranspiration and infiltration into the native soils.

Additionally, the StormTank Module can be modeled as a detention/infiltration basin, in which the void space of the structural cell remains unfilled with soil media, for the sole purpose of providing a large vault for stormwater management. In this application reduced flow rate and infiltration provide for the flow control. For any questions relating to routing this application, please contact your local StormTank representative.

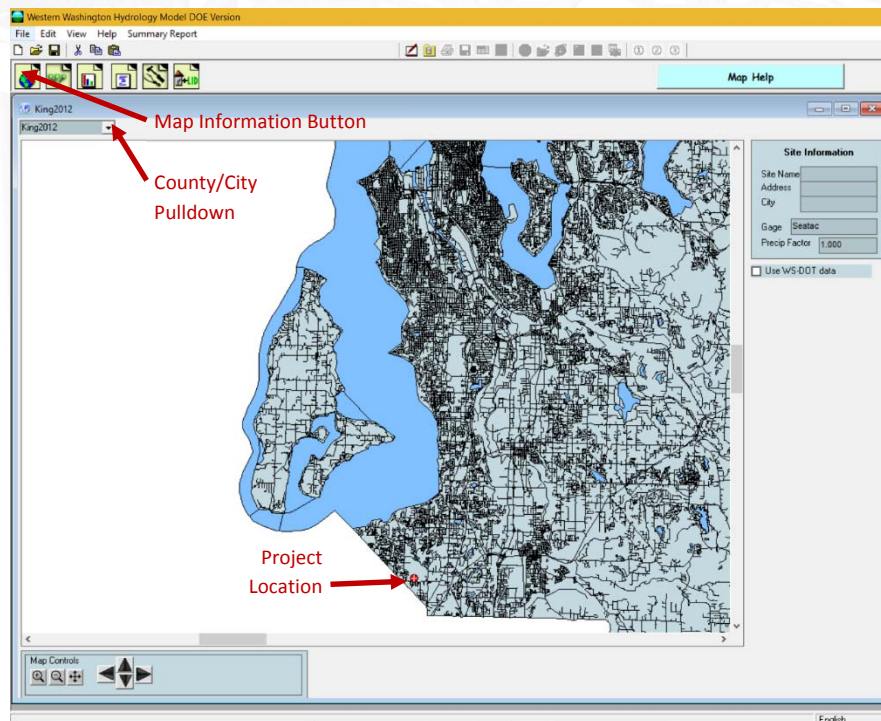


2.0 Modeling Procedures

For basic software information and instructions, please refer to the WWHM4 User Manual.

2.1 Define Precipitation Data

Begin by clicking on the Map Information button in the upper left corner, to open the County/City pulldown menu. Once the County/City has been selected, zoom in on the project location and click to select the location. The software will generate the precipitation data based on the selected location.



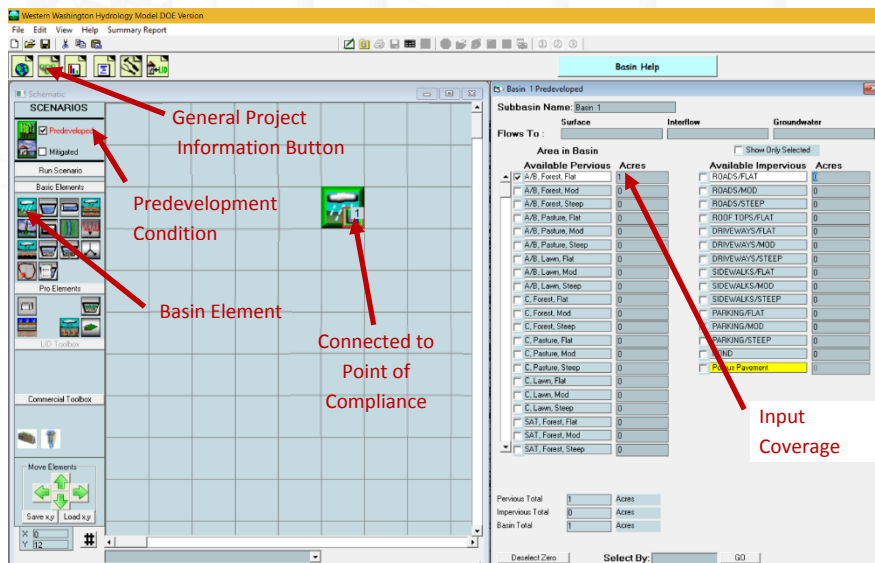
2.2 Input Pre-Development Land Use / Ground Cover

Begin by clicking on the General Project Information Button. Then select the Predevelopment Condition. Drag and drop the Basin Element onto the grid and input the coverage areas. Right click on the Basin Element, located on the grid, and select Connect to Point of Compliance.

Land uses are categorized by soil, vegetation, and slope, as follows:

- Soil type categories:
 - A/B (outwash soils)
 - C (till)
 - SAT (saturated/wetland/hydric soils)
- Vegetation categories:
 - Forest (second growth Douglas Fir)
 - Pasture (non-forested natural areas/scrub/shrub rural vegetation)
 - Lawn (sod lawn/grass/landscaped urban vegetation)
 - Impervious (roads, roof, driveways, sidewalks, parking, ponds and porous pavements)
- Land slope categories:
 - Flat (0-5%)
 - Moderate (5-15%)
 - Steep (>15%).

For most projects, the pre-development land condition shall be based on forested vegetated category and the applicable slope and soil categories.



2.3 Input Post-Development Land Use / Ground Cover

From the General Project Information section, now select the Mitigated Condition. Drag and drop the Basin Element onto the grid and input the coverage areas. Land uses are broken into the same categories as pre-development.

The screenshot displays the Western Washington Hydrology Model (DCE Version) interface. The main window is titled "Basin 1 Mitigated". The interface is divided into several sections:

- SCENARIOS:** A list of scenarios including "Predeveloped" and "Mitigated". A red arrow points to the "Mitigated" scenario.
- Basin Element:** A grid area where land use elements are placed. A red arrow points to a "Basin Element" icon.
- Input Coverage Areas:** A table with two columns: "Available Pervious Acres" and "Available Impervious Acres". A red arrow points to the "Input Coverage Areas" label.

Area in Basin	Available Pervious Acres	Available Impervious Acres
A/B: Forest, Flat	0	0
A/B: Forest, Mod	0	0
A/B: Forest, Steep	0	0
A/B: Pasture, Flat	0	0
A/B: Pasture, Mod	0	0
A/B: Pasture, Steep	0	0
A/B: Lawn, Flat	75	0
A/B: Lawn, Mod	0	0
A/B: Lawn, Steep	0	0
C: Forest, Flat	0	0
C: Forest, Mod	0	0
C: Forest, Steep	0	0
C: Pasture, Flat	0	0
C: Pasture, Mod	0	0
C: Pasture, Steep	0	0
C: Lawn, Flat	0	0
C: Lawn, Mod	0	0
C: Lawn, Steep	0	0
SAT: Forest, Flat	0	0
SAT: Forest, Mod	0	0
SAT: Forest, Steep	0	0

Summary Totals:

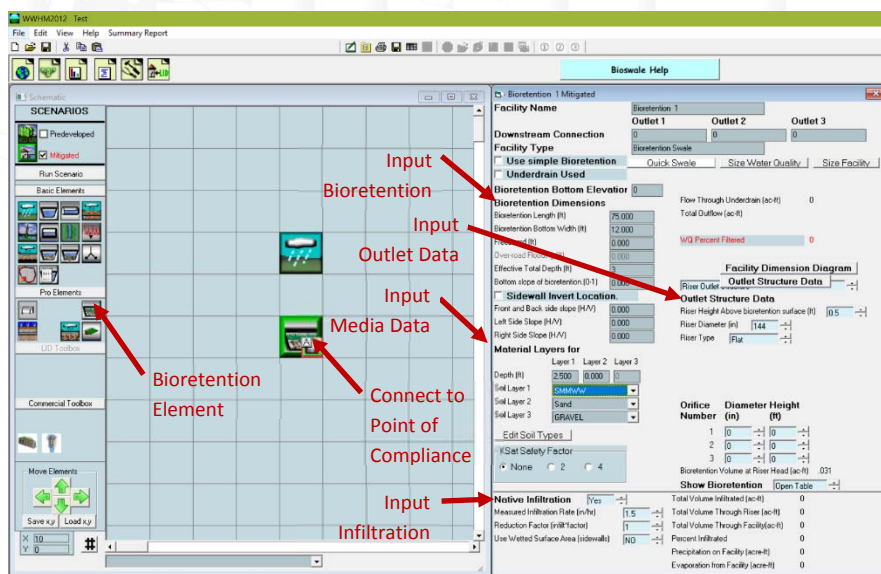
Pervious Total	0.75	Acres
Impervious Total	0.25	Acres
Basin Total	1	Acres

2.4 StormTank URS Bioretention Input

Input and configuration of the StormTank Bioretention Element is a multi-step process:

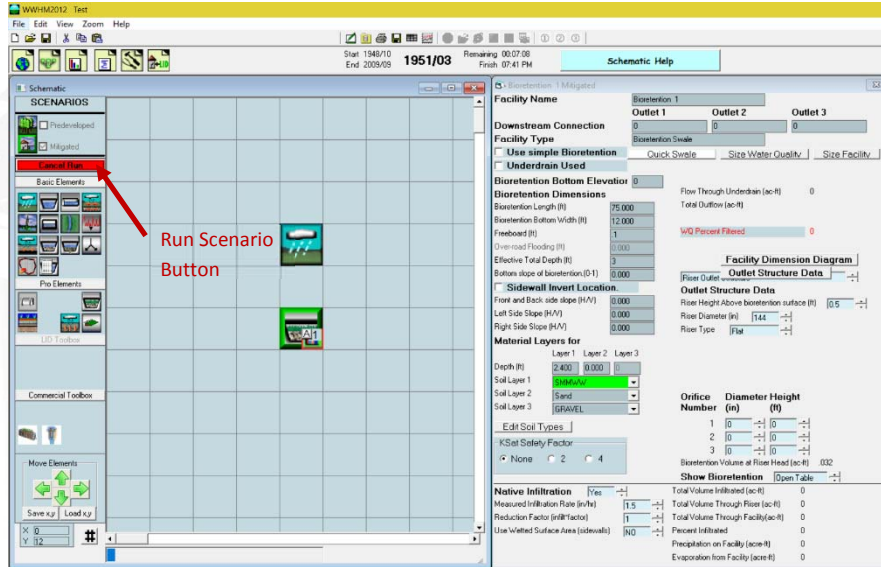
1. Begin by dragging and dropping a Bioretention Element onto the grid.
2. Input the Bioretention (StormTank URS) geometry into the and the soil media properties.
 - a. Input the dimensional characteristics of the system:
 - i. Swale Bottom Elevation (ft.): Enter the invert of the system
 - ii. Swale Length (ft.): Enter the total length of the units
 - iii. Swale Bottom Width (ft.): Enter the total width of the units
 - iv. Freeboard (ft.): Enter the proposed freeboard
 - v. Bottom Slope of Swale (ft./ft.): Set to minimum value of 0.001.
 - vi. Left Side Slope (H:V): Set to 0 to represent vertical side slopes.
 - vii. Right Side Slope (H:V): Set to 0 to represent vertical side slopes.
 3. Input the outlet structure dimensions, remember the height of the outlet weir, freeboard and media depth should equal the total height of the URS Module.
 - a. Complete the Outlet Structure Data section
 - i. The element must have an overflow for volume more than capacity.
 - ii. Select Riser Outlet Structure from the dropdown type menu.
 - iii. The typical height is based on the provided air gap depth, between the top of media and the top platen of the product.
 - iv. The riser diameter should be selected to ensure adequate capacity should overflow occur.
 1. Utilize a flat riser, without weir notch.
 2. Do not enter values for orifice diameter or height table.
 - b. If applicable, include an underdrain pipe.
 - i. Check the box next to "Underdrain Used"
 - ii. Input the underdrain diameter and the orifice equal to the pipe diameter.
4. Input the soil media:
 - a. Enter the soil depth for Layer 1, leaving Layers 2 and 3 at zero.
 - i. A minimum 12" soil depth is required for flow control.
 - ii. A minimum 18" soil depth is required for water treatment.
 - b. Enter the media data, in the Edit Soils Type area, in accordance with Volume V, Chapter 7 of the 2012 SMMWW.:
 - i. For non-underdrain designs, specify the filter media type as follows:
 1. An "Amended 3.0 in/hr." soil layer can be selected for projects with less than 5,000 sf of pollution generating impervious, less than 10,000 sf of total impervious and less than 0.75 acres of lawn/landscaping.

2. For projects not meeting these criteria, a 1.5 in/hr. rate shall be manually inputted, using the “Edit Soil Types” button.
 - a. Edit the K Sat value to match the design infiltration rate.
 - b. K Sat is entered in units of centimeters per hour.
 - c. All other default value shall be maintained.
 - d. Follow the rate reduction criteria per the 2012 SMMWW.
3. Maintain the default values for the remaining parameters, as appropriate.
4. Enter a name for the new soil type and click Save.
 - ii. For underdrain designs, utilize the edit soil to input a manual soil (as stated above) with an infiltration rate of 6 inches/hr. (15.24 cm/hr.).
5. Enter native soil infiltration properties, if needed:
 - a. If soils do not infiltrate and an underdrain is utilized, leave the infiltration option a “No”.
 - b. If soils infiltrate and an underdrain is not utilized, select “Yes”
 - i. Input the design infiltration rate
 - ii. Input the reduction factor (which is a multiplier, i.e. 0.5 = 50% reduction)
 - iii. Ensure the use wetted surface area option is set to “No”
 - c. Once modeled, the underdrain should pass a minimum 91% of flows.
6. Right click the Bioretention Element and select the “Connect to Point of Compliance” option.
7. Right click the Basin Element and select “Connect to Element” and then click on the Bioretention Element on the grid.



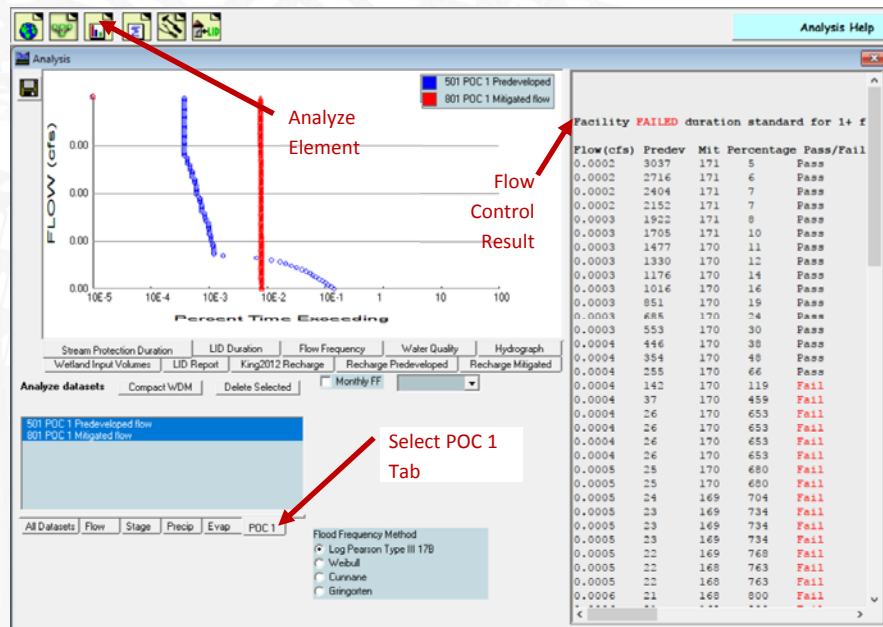
2.5 Run Scenario

Start by reselecting the Predevelopment scenario and click the Run Scenario button to begin the simulation. Once completed, return to the Mitigated Scenario and click Run Scenario again.



2.6 Determine if Flow Control has Passed

1. Select the Analysis Toolbar and select POC1.
 - a. A warning message may appear indicating “Can’t compute flow frequency analysis. There are too many zero flows”, click OK.
2. If the facility has met Flow Control, the display will indicate the facility passed. If it has failed, adjustments will need made to the facility dimensions and the scenario rerun.



2.7 Determine if Water Treatment has been Achieved

1. Return to the General Project Information Screen.
2. Check the results in the lower right-hand corner of the screen.
 - a. If exceeding 91%, the design has achieved water treatment.
 - b. Note, designs meeting flow control and infiltrating typically meet water treatment requirements.

The screenshot displays the SWMM2D software interface. The main workspace shows a schematic of a bioretention facility. The right-hand panel contains the following data:

Facility Name		Bioretention 1	Outlet 2	Outlet 3
Downstream Connection		0	0	0
Facility Type		Bioretention Swale		
Use simple Bioretention		<input type="checkbox"/>	Quick Swale	Size Water Quality
Underdrain Used		<input type="checkbox"/>	Size Facility	
Bioretention Bottom Elevation		0		
Bioretention Dimensions				
Bioretention Length (ft)	0.000	Flow Through Underdrain (ac-ft)	0	
Bioretention Bottom Width (ft)	6.000	Total Outflow (ac-ft)		
Freeboard (ft)	0.100	WQ Percent Filtered	99.61	
Overroad Flooding (ft)	0.000	Facility Dimension Diagram		
Efficient Infiltration (ft)	3			
Sidewall Invert Location				
Bottom slope of bioretention (ft-ft)	0.000	Rise Outlet Structure		
Front and Back side slope (H:V)	0.000	Outlet Structure Data		
Left Side Slope (H:V)	0.000	Rise Height Above bioretention surface (ft)	0.05	
Right Side Slope (H:V)	0.000	Rise Diameter (in)	144	
		Riser Type	Flux	
Material Layers for		Layer 1	Layer 2	Layer 3
Depth (ft)	0.000	0.000	0	
Soil Layer 1	Gravel			
Soil Layer 2	GRAVEL			
Soil Layer 3	GRAVEL			
Edit Soil Types				
KSsl Safety Factor				
None	2	4		
Orifice		Diameter	Height	
	Number	(in)	(ft)	
	1	0	0	
	2	0	0	
	3	0	0	
KSsl Safety Factor				
None	2	4		
Bioretention Volume at Rise Head (ac-ft)			0.13	
Show Bioretention			Open Table	
Native Infiltration		<input checked="" type="checkbox"/>		
Total Volume Infiltrated (ac-ft)			16.579	
Measured Infiltration Rate (in/hr)	1.5		0.005	
Reduction Factor (infiltrFactor)	1		16.644	
Use Wetted Surface Area (sdwella)	NO		99.61	
Precipitation on Facility (ac-in)			1.878	
Evaporation from Facility (ac-in)			0.504	

2.8 Save the Project and Print Results