BIORETENTION CALCULATOR

These calculators size the area of rain garden or flow-through planter to treat the Water Quality Volume (WQv), or calculate the volume of water treated given user entered available dimensions. For sloped systems, use the volume-based Swale calculator.

Input cell =		User enters value
Default value =		User should only change value if able to provide explanation for adjustment
Calculation cell =		User should not change cell

CALCULATOR

Bioretention Calculator - by Water Quality Volume

1	Water Quality Volume - WQv	1200	cubic feet
2	Site Meets Infiltration Constraints?	Yes	
3	Underlying Infiltration Rate - f	0.5	inches/hour (generally require f ≥ 0.5"/hr)
4	**Underdrains Required?**	**No**	
5	Depth of Bioretention Soil Mix - d	1.5	feet (recommend >1.5 ft)
6	Porosity of Bioretention Soil Mix - n	0.35	recommend 0.35
	Hydraulic Conductivity of Bioretention Soil Mix - k	4	in/hr (recommend 4)
7	Max Ponding Depth above Filter - Pd	0.75	feet (recommend 0.5 to 1 ft)
8	Fill Time - T	1	hours (0-2 hours, recommend 1)
9	**Area Calculator**	**1,029**	square feet
10	Area Draining to Bioretention	21,650	square feet
11	Sizing Ratio (Bioretention Area/Drainage Area)	4.8%	typically between 4 to 7% of the impervious drainage area
12	Time Needed to Infiltrate WQv (no underdrain)	56	hours (if greater than 48 hours, install underdrains)

Bioretention Calculator - by Available Area

13	Available Area	1030	square feet
14	Site Meets Infiltration Constraints?	Yes	
15	Underlying Infiltration rate - f	0.5	inches/hour (generally require f ≥0.5"/hr)
16	**Underdrains Required?**	**No**	
17	Depth of Bioretention Soil Mix - d	1.5	feet (generally 0.5 to 1)
18	Porosity of Bioretention Soil Mix - n	0.35	recommend 0.35
	Hydraulic Conductivity of Bioretention Soil Mix - k	4	in/hr (recommend 5)
	Factor of Safety	2	recommend 2
19	Max Ponding Depth above Filter - Pd	0.75	feet (recommend 0.5 to 1 ft)
20	Fill Time - T	1	hours (0-2 hours, recommend 1)
21	**Treated Volume**	**1202**	cubic feet
22	Area Draining to Bioretention	21,650	square feet
23	Sizing Ratio (Bioretention Area/Drainage Area)	4.8%	typically between 4 to 7% of the impervious drainage area
24	Time Needed to Drain WQv	56	hours (if greater than 48 hours, install underdrains)

INSTRUCTIONS

Use either steps 1 through 12 to determine the required area of bioretention. Or use steps 13 through 24 to check what volume of water is treated given the available area for bioretention.

Step	
To Determine The Required Area for Bioretention Facility	
1	Enter the Water Quality Volume (WQv) for the drainage management area (DMA). The WQv is calculated in Step 14 of the Water Quality Volume and Water Quality Flow Rate Calculator.
2	Select Yes or No for whether the site meets all the infiltration constraints listed in the SDG. These include setbacks from buildings, depth to groundwater, site slope, etc.
3	Enter the infiltration rate of the underlying soils. This should be determined by geotechnical testing or, for conceptual studies, soil infiltration maps.
4	The need for underdrains is determined based on entries in Steps 2 and 3.
5	Enter the depth of the bioretention soil mix. This should be greater than 1.5 ft and is generally between 1.5 and 2.5 ft.
6	The default porosity and hydraulic conductivity of the bioretention soil mix are entered here. The conductivity is based on the media recommendations provided in the Bioretention Fact Sheet. Changing these default values is not recommended.
7	Enter the max ponding depth above the filter. This is typically 6 to 12 inches. It is recommended that the ponding depth be at least 2" below the bioretention overflow elevation.
8	The default value for fill time is 1 hour. Changing this value is not recommended.
9	The required area to treat the WQv is determined here.
10	Enter the square footage of the area draining to the bioretention system (see Water Quality Volume and Water Quality Flow Rate Calculator for area).
11	The ratio of the bioretention area to the DMA is calculated here as a check of the sizing. The percentage is typically between 4% to 7%.
12	For non-underdrained systems, the time needed to infiltrate the WQv is calculated here. If the drain time is greater than 48 hrs, underdrains should be installed.
To Determine the Volume of Water Treated by Available Area	
13	Enter the available area for the bioretention system here.
14	Select Yes or No for whether the site meets all the infiltration constraints listed in the SDG. These include setbacks from buildings, depth to groundwater, site slope, etc.
15	Enter the infiltration rate of the underlying soils. This should be determined by geotechnical testing or, for conceptual studies, soil infiltration maps.
16	The need for underdrains is determined here based on entries in Steps 2 and 3.
17	Enter the depth of the bioretention soil mix. This should be greater than 1.5 ft and is generally between 1.5 and 2.5 ft.
18	The default porosity and hydraulic conductivity of the bioretention soil mix are entered here. Changing these values is not recommended.
19	Enter the max ponding depth above the filter. This is typically 6 to 12 inches. It is recommended that the max ponding depth be at least 2" below the bioretention overflow elevation.
20	The default value for fill time is 1 hour. Changing this value is not recommended.
21	The volume of water treated by the bioretention system is shown here. If this volume is less than the required WQv then additional treatments will likely be required.
22	Enter the square footage of the area draining to the bioretention system (see Water Quality Volume and Water Quality Flow Rate Calculator for area).
23	The ratio of the bioretention area to the DMA is calculated here as a check of the sizing. The bioretention area is typically between 4 to 7% of the impervious drainage area.
24	For non-underdrained systems, the time needed to infiltrate the WQv is calculated here. If the drain time is greater than 48 hrs, underdrains should be installed.

DEFINITIONS

Water Quality Volume (WQv)	The runoff volume to be managed by the stormwater BMP such that treatment requirements are met. The WQv is calculated by the Water Quality Volume and Water Quality Flow Rate Calculator.
Infiltration Rate (f)	The rate of water entry into the soil, generally expressed as inches/hour, and determined by geotechnical tests or estimated from soil maps. It equals the hydraulic conductivity of the soil times the hydraulic gradient.
Porosity (n)	Volume of void space to total volume. This is expressed as a ratio, e.g. 0.35 means that one cubic foot of gravel contains 0.35 cubic feet of empty space.
Fill Time (T)	The time taken for water quality storm to fill the bioretention system.
Ponding Depth (Pd)	The depth above the bioretention surface where runoff is ponded temporarily before filtering through the media.
Depth of Engineered Soil (d)	The depth of the engineered bioretention soil.
Hydraulic Conductivity (k)	Measure of the ease in which water moves through a porous media, generally expressed as inches/hour.
Drain Time (t)	The time for the storage area to drain the water quality volume.