



# Bioretention Overview

*Bioretention is a terrestrial-based (up-land as opposed to wetland), water quality and water quantity control process. Bioretention employs a simplistic, site-integrated design that provides opportunity for runoff infiltration, filtration, storage and water uptake by vegetation.*

## Design Criteria

- Infiltration requires suitable soils.
- Minimum 10' setback and located down grade from home foundations.
- Best applied to drainage areas with relatively flat slopes (5%).

## Benefits

- Can be very effective for removing fine sediment, trace metals, nutrients, bacteria and organics (Davis et al. 1998).
- Provides many additional environmental (habitat, improves air quality, urban micro-climates), social (creates a unique sense of place) and economic benefits (reduces development and maintenance cost, greater lot yield, increases property values).
- Well suited for high impervious areas.
- Reduces runoff volume.
- Flexible design, affording many opportunities for creativity.

## Limitations

- Susceptible to clogging by sediment; therefore maintenance and pre-treatment is necessary to maintain effectiveness.
- Not effective for large drainage areas (use multiple structures, closer to source of runoff).
- Space consumption (5%-10% of drainage area).

## Description

In general, bioretention systems can be described as shallow, landscaped depressions commonly located in parking lot islands or within small pockets in residential areas that receive stormwater runoff (Metropolitan Council Small Sites BMP Manual, 2001).

Bioretention facilities capture rainwater runoff to be



Raingarden in a commercial development - Stillwater, MN

filtered through a prepared soil medium. Once the soil pore space capacity of the medium is exceeded, stormwater begins to pool at the surface of the planting soil. Pollutants are removed by a number of processes including adsorption, filtration, volatilization, ion exchange and decomposition (Prince George's County, MD, 1993). Filtered runoff can either be allowed to infiltrate into the surrounding soil (functioning as an infiltration basin or rainwater garden), or collected by an under-drain system and discharged to the storm sewer system or directly to receiving waters (functioning like a surface sand filter). Runoff from larger storms is generally diverted past the area to the storm drain system (Metropolitan Council Small Sites BMP Manual, 2001).

Bioretention is a stormwater treatment practice that utilizes the chemical, biological and physical properties of plants, microbes and soils for capturing/reducing stormwater runoff and removing pollutants from runoff. This process is often incorporated into many different types of filtration and infiltration stormwater treatment practices.

# Bioretention



## MANAGEMENT SUITABILITY

Med/High	Water Quality ( $V_{wq}$ )
Med	Channel Protection ( $V_{cp}$ )
Low/Med	Overbank Flood Protection ( $V_{p10}$ )
Low	Extreme Flood Protection ( $V_{p100}$ )
High	Recharge Volume ( $V_{re}$ )

## MECHANISMS

X*	Infiltration *with appropriate soils & site conditions
X	Filtration
X	Temperature Control
X	Settling
	Evaporation
X	Transpiration
X	Soil Adsorption
X	Biological/ Micro. Uptake

## POLLUTION REMOVAL

85%	Total Suspended Solids
50% / 45%	Nutrients - Total Phosphorus/ Total Nitrogen
95%	Metals - Cadmium, Copper, Lead, and Zinc
35%*	Pathogens - Coliform, Streptococci, E. Coli *less than 5 independent studies
80%*	Toxins - Hydrocarbon *less than 5 independent studies

## SITE FACTORS

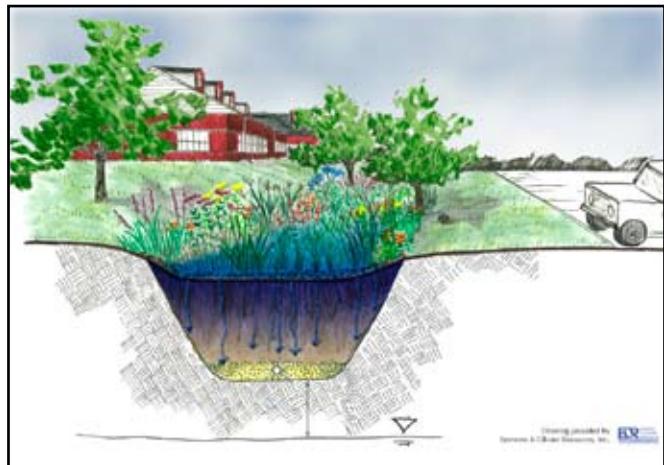
2 AC Max; 1 AC Max Impervious	Drainage Area For Filtration Design (Per Practice)
2 AC Max; 1/2 AC Max Impervious	Drainage Area For Infiltration Design (Per Practice)
20%	Max. Slope of Site
3'	Min. Depth to Bedrock & Seasonally High Water Table
A,B - Normal	NRCS Soil Type *can be used in C&D soil types with modifications (e.g. under-drains)
Good	Freeze/ Thaw Suitability
Suitable	Potential Hotspot Runoff *requires impermeable liner

Note: Average pollutant removal expected when sizing based on MPCA criteria. Values apply to treated runoff only.

## STORM SEQUENCE



Start of Storm Event - Initial runoff & storage



Duration of Storm Event - Storage & filtration/ infiltration



Following Storm Event - Remaining storage draw-down

Graphics Courtesy of Rice Creek Watershed District