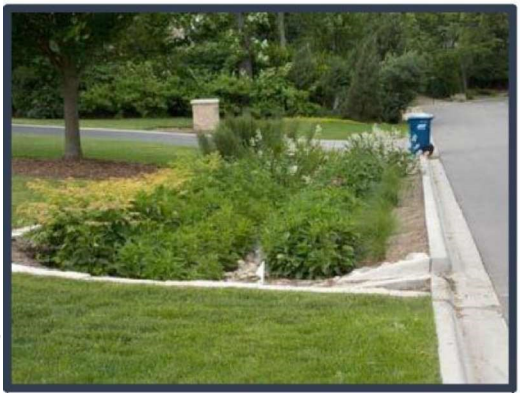
GREEN INFRASTRUCTURE: BIO-RETENTION / RAIN GARDENS

Bio-retention is a stormwater management practice that comprises shallow depressions that incorporates soil amendments and native vegetation to temporarily store and filter stormwater runoff, increase soil porosity, and facilitate drainage. Bio-retention areas are suitable for residential areas. Bio-retention is not suitable in locations with continuous flow or a high-water table, sites with slopes greater than 20 percent, locations less than 10 feet from a structure with a basement, locations less than 5 feet from a structure without a basement, areas with a tributary area that is too large and cannot be broken into smaller areas, and available space for which bio-retention is not adequate. The following table summarizes the minimum standards and criteria for the design of a bio-retention facility.



DESIGN PARAMETERS*

Design Storm	Varies, 6-month to 25-year
Drainage Area	5 acres (max.)
Site Slopes	6% (max.)
Sizing	5% of tributary impervious area
Dimensions	2:1 length to width ratio (min.)
Ponding Depth	6 inch (max.)
Drawdown Time	48 hour (max.)
Underlying Soils	0.27 inch/hour infiltration rate (min.) pH 5.5 to 6.5
Water Table Depth	2 feet below the bottom layer (min.)
Pretreatment	Level spreader or grass filter strip
Observation Wells	N/A
Additional Parameters	Must safely bypass higher flows, requires native vegetation

** Industry standards; permitting through the Village to ensure compliance with local and county requirements.*

CONSTRUCTION AND COSTS

The construction of bio-retention areas is critical to the success of the best management practice (BMP). Existing sub-grade should not be compacted and the site must be protected from the effects of erosion and sedimentation prior to and during construction of the bio-retention area. Bio-retention often replaces areas that would have been landscaped and require more maintenance, resulting in a lower net cost for bio-retention. In addition, the use of bio-retention can decrease the cost for stormwater conveyance systems at a site. The actual cost for bio-retention depends upon the drainage area controlled, storage area provided, or surface area consumed.

ADVANTAGES	DISADVANTAGES
• Applicable to small drainage areas, • Works well in highly impervious areas, • Works well in retrofit applications, • Relatively low maintenance, • Increases groundwater recharge, • Reduces runoff volume, • Ongoing improvement in soil porosity, • Improves water quality, • Recharges groundwater, • Reduces stormwater temperature impacts, • Enhances evapotranspiration, • Provides habitat, and • Enhances aesthetics.	• Requires extensive landscaping, • Should not be used in areas with steep slopes, • Construction must be carefully monitored to prevent compactions and clogging of the soils, • Additional sedimentation control practices are needed to block loose soil material from the area, • Soils upstream must be stabilized before draining into the bio-retention area to prevent clogging, • Inadequate pretreatment can cause a gradual reduction of infiltration rates, • Lack of proper maintenance can reduce the longevity of bio-retention area, • Knowledge of engineering and horticulture is required for successful implementation, and • Takes 2-3 years to establish functions.

MAINTENANCE

The following table provides guidance for maintaining a bio-retention BMP.

Maintenance Activity	Frequency
• Pruning and weeding, • Mulch replacement due to erosion, • Removal of trash and debris, • Removal of invasive plant species, • Supplemental watering during periods of extended drought, • Replacement of plantings.	As needed
• Inspect inflow points for clogging; remove any sediment and correct erosion, • Evaluate the health of trees, shrubs, and plants.	Semi-annually
• Cut down perennial plantings at the end of the growing season, • Test pH of planting soils. Apply limestone if pH is below 5.2 and apply iron sulfate plus sulfur if pH is above 7.0.	Annually
• Replace mulch over the entire area, and • Replace pea gravel if warranted	2- to 3-years

FLOOD REDUCTION

The design of a bioretention area can be revised to provide both infiltration and detention volume. Bio-retention areas can improve water quality, decrease peak discharge and decrease runoff volumes. The results depend upon the volume of storage, infiltration rate of the underlying soils, and the intensity and frequency of the rainfall. Studies have shown a reduction in peak discharge and runoff volume ranging from 10 to 50 percent, even for larger storms.

RESIDENTIAL RETROFIT

When constructing bio-retention areas as retrofits on a single residential lot, or across several lots as a shared BMP, the cost escalates significantly, due to the need to haul off a significant amount of earth. To reduce price in a residential retrofit scenario, it may be beneficial to provide a rain garden with less engineered soils. These modifications may require more maintenance by the homeowner to encourage and promote plant establishment. This retrofit option provides less infiltration potential, and a lesser degree of water quality improvements, but provides the same amount of surface storage and flood benefit.