

## Raingardens, Biofiltration and Vegetated Swales

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**Document Purpose** – This fact sheet is a companion to BWSR’s Native Vegetation Establishment and Enhancement Guidelines and provides detailed considerations for project planning and design with an emphasis on vegetation selection, installation and management.

**Introduction** – Urban rain gardens, biofiltration areas and vegetated swales play important roles in accomplishing the filtration and infiltration of stormwater in new developments, redevelopment, and linear projects in urban areas. They can also provide additional aesthetic and wildlife habitat benefits in urban and residential landscapes. The combination of vegetation, soils and microbial populations provide additional treatment of nutrients, and contaminants compared to stormwater practices that do not include vegetation. Stormwater management projects can also provide valuable habitat for bees, butterflies, birds and other species.



**Site Selection** – Subwatershed assessments using stormwater models and tools are useful to aid raingarden site selection. [WinSLAMM](#), [P8 Urban Catchment](#), and the [Recarga model](#) are examples of commonly used models. Local conservation staff play a key role in finding willing landowners and projects that will have significant water quality benefits. The location of building foundations, underground utility lines, and shallow bedrock and water tables can all influence the potential locations of stormwater practices. It is also beneficial to plan stormwater practices to be part of a treatment train to provide a system of water treatment through urban areas.

**General Planning Considerations** – These project types are typically small in size, but soil microbial activity along with native vegetation aids the removal and update of chemicals and nutrients. Engineered soils consisting of blended sand and compost are often used in raingardens and biofiltration areas to aid water quality treatment through infiltration or filtration. Basins are designed with a flat base to disperse water and increase infiltration. Mesic prairie, wet meadow or woodland species are most adapted to the growing conditions.



**Structural Design Considerations** – Pre-treatment of runoff draining to these practices is important to provide easier removal of sediment and trash, decrease maintenance needs, prolong the life of the primary filtration or infiltration area, and protect the health of vegetation. Pre-treatment is particularly important when water is being directed from roads or parking lots. Biofiltration systems may also need overflows or underdrains to ensure the practice drains within the appropriate timeframe (i.e., 48 hours) and aid the removal of water from larger storms that are beyond the design capacity of the project. Also consider infiltration restrictions in sensitive areas: near drinking water wells and wellhead protection areas, emergency response areas, and contaminated soils. Separation from bedrock and seasonal water table, and vegetation height in rights-of-way should also be considered.

**Plant and Seed Selection** – Deep rooted prairie grasses are beneficial in these project types as they have been shown to increase infiltration rates over time. It is often beneficial to create a matrix of prairie grasses and/or

sedges and then add desired forbs for large areas. This technique can decrease weed competition. Similar species can be grouped for aesthetic purposes; groups of species can also increase efficiency of bee pollination and make it easier to identify weeds that are establishing. Trees and shrubs with deep root systems should be avoided in practices with underdrains, as roots can enter and plug the flow of water. In practices without underdrains trees and shrubs can be beneficial by increasing evapotranspiration uptake of nutrients. Plantings consisting only of shrubs can be effective where little maintenance will occur as their shade and root systems can suppress weed growth.

Stormwater plantings can be great places to support pollinator populations by planting species that will provide nectar and pollen sources through the entire growing season. Trees, shrubs, grasses, forbs, sedges, rushes and ferns are all commonly used as part of biofiltration/bioinfiltration projects. Species should be selected that are native to the area and well adapted to site conditions.

### Commonly Used Native Species in Biofiltration Projects

<b>Shrubs:</b>	Dwarf-bush honeysuckle, Black chokeberry, Winterberry Holly, Red-osier dogwood
<b>Grasses;</b>	Switchgrass, Little bluestem, Indian grass
<b>Forbs:</b>	Butterfly milkweed, Marsh milkweed, Joe-pye weed, Cardinal flower, Blue lobelia, Culver’s root, Liatris species, Narrow-leaf coneflower, Smooth aster, Panicked aster, Golden alexanders, Wild iris
<b>Sedges</b>	Fox sedge, Bottlebrush sedge, Porcupine sedge, Tussock sedge
<b>Rushes:</b>	Soft rush, Path rush

Often low to medium diversity levels (10-30 species) are used if the project focuses on aesthetics and water treatment. As long as the intended functions are being accomplished, diversity levels can be adjusted as needed.

**Plant Source Considerations** – The source sequence outlined in Section 2 of the Native Vegetation Standards and Guidelines should be used for these systems, though additional native cultivars may be used in raingardens and biofiltration areas where aesthetics are a major consideration.



Raingarden with a diversity of grasses, forbs and sedges

**Vegetation Establishment** – Raingardens, biofiltration areas and swales are commonly planted with containerized plants (often plugs) spaced 12-24 inches apart. Most plantings are mulched with double shredded hardwood mulch to reduce floating and watering is important to ensure the success of plantings. It is becoming more common to install plants closer together (around 12 inches) to allow the vegetation to complete with weeds and decrease or eliminate the need for wood mulch. Seeding typically isn’t conducted for raingardens and biofiltration areas as it takes too long for vulnerable native species to establish and seeding limits opportunities for planting design. Seeding (or a combination of seed and plugs) can be conducted for larger vegetated swales, particularly when stormwater may be diverted until the planting is well established. It may also be necessary to divert water from raingardens and biofiltration areas until plants are at least four inches tall and can handle some inundation.

**Operations and Maintenance** – Maintenance typically involves hand weeding every few weeks the first year or two years followed by weeding about three times a year after plants are established. Removing sediment and trash, ensuring proper functioning of berms and pipes, and mulching are also periodic maintenance tasks. Watering may also be needed during the plants’ first year and in times of drought. The need for watering will be the greatest on side slopes and when engineered soils with a high percentage of sand are used.

**Information Sources**

Plants for Stormwater Design [Revised Plants for Stormwater Design now available | Erosion and Stormwater Management Certification Program](#)

Blue Thumb Plant Selector <http://bluethumb.org/plants/>

Minnesota Stormwater Manual <http://www.pca.state.mn.us/index.php/water/water-types-and-programs/stormwater/stormwater-management/minnesotas-stormwater-manual.html>