BIORETENTION FACILITY

(feet)
CODE 800

Source: Jessica Cocroft, Winnebago Soil and Water Conservation District

DEFINITION

Facility that utilizes a soil media, mulch, and vegetation to treat stormwater runoff through filtration in clay soils areas and through infiltration in areas with porous soils.

A bioretention facility is also sometimes referred to as a rain garden. However, the term rain garden is typically used to describe a small, planted depression on an individual homeowner's property. A bioretention facility serves the same purpose but typically describes larger projects in community common areas as well as non-residential applications. Bioretention facilities may take on greater impervious areas due to their applications in commercial developments.

PURPOSE

The purposes of a properly designed bioretention facility include the decrease of peak flow rates and volume for smaller storms in the receiving stream and the removal of pollutants from stormwater runoff utilizing the chemical, biological, and physical properties of plants, microbes, and soils. A bioretention basin may be applied individually or as part of a system of stormwater management practices.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where the following or similar conditions exist:

- Drainage area is small, less than four acres (preferably less than one acre) with an impervious area of less than one acre;
- Impervious areas with shallow grade allow for sheet flow over level entrance areas;
- Stormwater runoff from impervious surfaces is diverted or conveyed by a curb or gutter to specific location(s) with inflow protection;
- The hydraulic conductivity, or permeability, of soil is sufficient for drainage within a 48 hour period;
- If soil permeability is not sufficient, replacement of clay soils with a sand mixture and/or an under drain system allows for adequate drainage; and,

- Sufficient fall can be achieved between inlet and outlet for under drain if required.

CRITERIA

Construction projects may be subject to local, county, state and federal rules and regulations. Bioretention facilities shall be designed by a registered professional engineer as part of the overall site design for long-term water quality and quantity. A landscape architect should be used to determine types of plants needed and locations in the facility. A landscape architect may also provide valuable insight during the design, construction and maintenance phases. Plans and specifications shall be referred to by the site superintendent and field personnel during the construction process.

The facility shall not be constructed within a stream buffer or in areas adjacent to streams where sediment may be deposited during flood events.

Bioretention is not a suitable BMP at locations where the wet season water table is within four feet of the proposed ground surface and where soil is unstable. A water table that is too shallow can prevent stormwater runoff from draining completely through the facility.

The size and the design shall be based on the contributing drainage area, underlying soils, utilities, and existing vegetation. It is recommended to size a bioretention facility for a 1 year, 24 hour storm. A bypass is recommended for use in larger storms.

Locate facilities at least 100 feet from any wells or source water locations; at least 25 feet from any septic fields and upgradient if possible; at least 25 feet and downgradient from basements; five feet or greater from a slab or foundation; and, shall not cross property lines.

The recommended minimum area shall be 200 square feet with the length at a 2:1 ratio of the width. This is to allow enough space for a dense, randomly distributed planting area while decreasing the chances of concentrated flow. The facility must have soil with sufficient hydraulic conductivity (or replaced with a sand mixture of over 50%). A planting soil bed, with either a mulch layer or a grass mixture as a cover crop is highly recommended.

Vegetation must be able to withstand periods of inundation and drought such as some native plants.

The facility shall be designed to capture stormwater runoff and filter the water through the soil bed over a period of 24 to 48 hours.

Inflow velocities shall be reduced to less than three feet per second upstream of the facility to prevent erosion and facilitate uniform distribution across the BMP. This may require the installation of practices such as **FILTER STRIP 835** or **ROCK OUTLET PROTECTION 910**.

The bioretention facility can be excavated before final stabilization of the surrounding watershed; however, the soil mixture and/or underdrain system shall not be placed until the entire contributing drainage area has been stabilized and any restrictive layer remediated. Bioretention facilities should not be used for control of sediment and erosion on construction sites. Stabilization may require the installation of practices such as **EROSION CONTROL BLANKET 830**, **EROSION CONTROL BLANKET – TURF REINFORCEMENT MAT (TRM) 831** and **MULCHING FOR SEEDING AND SOIL STABILIZATION 875**.

Final graded dimensions, side slopes, and final elevations shall be constructed according to design drawings and specifications.

Underdrains are recommended for all facilities that do not have sufficient hydraulic conductivity (cannot drain within 48 hours). An underdrain increases the ability of the soil to drain and therefore ensures an adequate aerobic state that allows plants to grow. A minimum 4-inch perforated pipe (**INFILTRATION TRENCH 547**) with an 8- to 12-inch gravel bed shall be installed as an underdrain system. Space the pipe at a maximum of ten foot on-center and maintain a minimum grade of 0.5 percent. At least one cleanout shall be installed every 50 feet on each underdrain. The cleanout can also be used as an overflow relief system if situated one foot above the bioretention facility. It is recommended to cover the overflow with a grate or screen to keep large debris from clogging the pipe. The under drain shall connect to a stormwater system with adequate capacity or daylight to a suitable outfall with erosion protection such as **ROCK OUTLET PROTECTION 910**. Before placement of the aggregate, underdrain, and bioretention soil mixture, the bottom of the excavated area shall be roto-tilled to a minimum depth of six inches to alleviate any compaction that might impede infiltration. The underdrain may include an adjustable flow regulator to provide the right amount of infiltration.

Two layers of aggregate are recommended under the soil bed. A layer of ½ - and ¾-inch washed, crushed rock (CA-8: IDOT Course Aggregate gradation number 8) shall separate the soil bed from the larger 3 inch aggregate (CA-1). A geotextile fabric is optional over the tilled soil surface and under the large aggregate. The fabric should have a sufficient permeability to drain the bioretention facility in 48 hours. Geotextiles shall be selected according to material specification **GEOTEXTILE 592**.

The planting soil bed is a mixture of organic mulch, planting soil, and sand. Typically the mixture consists of 20-30 percent planting soil, 20-30 percent organic compost, and 50-60 percent sand. Clay shall be limited to less than 5 percent. A minimum depth of 18 inches is recommended to provide adequate moisture capacity and create space for the root systems of plants. If larger vegetation is used (i.e. trees or shrubs), the planting soil must be at least four inches deeper than the bottom of the largest root ball. This soil mix will not be as firm as natural soils, so larger trees or shrubs shall be supported with guy wires or similar support. The planting soil mixture shall be free of stones, stumps, roots, or weedy material over one inch in diameter. Brush or seeds from noxious weeds shall not be present in the material.

Set the bioretention facility ponding depth to 6-9 inches, not exceeding 1 foot. Ponding design depths shall be kept to a minimum to reduce hydraulic overload of the soil bed and to maximize the surface area to facility depth ratio. Design the overflow structure to maintain the integrity of the facility and ponding depth. The rate and volume of overflow from the bioretention facility must not cause downstream erosion.

Trees, shrubs, and other plant materials shall be installed as specified in the project plans and according to applicable landscape standards with the exception that pesticides, herbicides and fertilizer shall not be applied during planting under any circumstances. After establishment, pesticides, fertilizer and other soil amendments may be applied at a minimum. Plant selection shall include native species tolerant of both wet and dry cycles. Deep rooted perennials are encouraged to increase the rate of infiltration.

An optional layer of the bioretention cell is the mulch. The mulch layer plays an important role in the performance of the bioretention facility. It helps maintain soil moisture and helps prevent erosion. It serves as a pre-treatment layer by

trapping sediments. The mulch layer should be a standard landscape style, shredded hardwood mulch. The mulch shall be milled and screened to a maximum four inch particle size and shall be free from sawdust, clay, trash and any artificially introduced chemical compounds. Grass clippings shall not be used as mulch. The layer of mulch shall not exceed three inches in depth to ensure plant roots are rooted in the soil. Ensure clearance of mulch around new plantings to facilitate watering and air exchange. The mulch may float and move as water backs up so raking the mulch back into place or reapplication may be necessary. If not using mulch, grass used as a cover crop would be an acceptable alternative.

Native vegetation including native trees and shrubs shall be used whenever possible.

CONSIDERATIONS

Bioretention is not recommended for upland areas with slopes greater than 20 percent. Steeper slopes may contribute to clogging if the area receives runoff with high sediment loads. Removing clogged sediment from the bioretention facility can be difficult.

When properly designed and maintained, bioretention facilities provide aesthetic enhancement as well as habitat for wildlife.

Provisions for safety may be mandatory based on local ordinance and should be considered regardless of requirements. A perimeter fence may be required based on local ordinance or specific site conditions.

PLANS AND SPECIFICATIONS

Plans and specifications for installing and maintaining a bioretention facility shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. Standard construction documents, including a grading plan, planting plan, technical specifications, and a facility maintenance plan should include the following items:

1. Facility location and alignment
2. Grade, depth, width, and side slope grade
3. Facility cross section
4. Material specifications including planting prescriptions

All plans shall include the installation, inspection, and maintenance schedules with the responsible party identified.

Bioretention facilities control stormwater runoff close to the source. They are typically shallow depressions located in upland areas used to treat stormwater runoff from pervious and impervious surfaces at commercial, residential, industrial areas and other developments. They can be designed so the runoff is either diverted directly into the bioretention facility or conveyed via a curb, gutter and/or pipe collection system.

Bioretention facilities are adaptable to most sites and integrate well with buffers, landscape berms, and setback areas.

The bioretention facility may also include pretreatment, a storage layer, flow regulation and an observation well.

Be aware of salt use in the drainage area of the bioretention facility. Salt tolerant plants or diverting the runoff away from the facility may reduce the number of replantings.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be provided for the bioretention facility.

For the first one to three years, bioretention systems require significant

maintenance to ensure successful establishment. The primary maintenance requirements are inspection, and repair and replacement of damaged or failed components and vegetation. Conduct routine inspections. Inspections are particularly important during vegetative establishment and should be done immediately following significant rainfall events. Routine inspections for standing water and corrective measures to restore proper infiltration rates are necessary. Invasive and/or weedy vegetation shall be removed immediately upon discovery. During the first growing season, watering and weeding shall be completed on a weekly basis or as needed.

Over the lifetime of the facility, bioretention maintenance resembles that of any maintained landscape area and shall include:

1. Inspect biannually for erosion
2. Mulch as needed to cover bare soil
3. Annually inspect vegetation to evaluate health and replace dead or diseased vegetation
4. If stressed vegetation is present, investigate soil further. If soil is contaminated, full or partial soil replacement is required
5. Inspect overflow devices
6. Remove trash and sediment as necessary
7. Aerate periodically

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