GENERAL DESCRIPTION

As a stormwater filter and infiltration practice, bioretention temporarily stores, treats and infiltrates runoff. Designing on rainfall and infiltration rate and physical conditions, the system may be designed without a underdrain for full infiltration, with an underdrain for partial infiltration, or with an impermeable liner and underdrain to hold retention only (a biobar). The primary component of the practice is the filter bed which is a mixture of sand, fines and organic materials. Other elements include a mulch ground cover and plants adapted to the conditions of a stormwater practice. Bioretention is designed to capture small storm events in the areas where storage requirements are too low to pass large storm event flows. Bioretention can be adapted to fit many different development contexts and provide a convenient area for storm storage and treatment.

DESIGN GUIDANCE

SOIL CHARACTERISTICS

Bioretention can be constructed on any soil type, but hydrologic soil group A and B soils are the most suitable. Bioretention should be sited in the areas of the development with the highest native soil infiltration rates. Bioretention in soils with infiltration rates less than 15 mm/hr will require an underdrain. Designers should verify the native soil infiltration rates before the establishment and depth through measurement of hydraulic conductivity under field saturated conditions.

GEOMETRY & SITE LOCATION

Key Design Elements:

- The minimum footprint of the filter bed area is based on the drainage area
- Typical drainage areas to bioretention are 100 m² to 0.5 hectares
- The maximum recommended drain area is 1.2 times the area of imperious drainage area to treatment facility area range from 5:1 to 15:1
- Bioretention can be constructed to fit multiple building footprint layouts. However, cells that are narrow may concentrate flow as it spreads through the cell and result in erosion.
- The filter bed surface should be level to encourage stormwater to spread out evenly over the surface.

PRE-TREATMENT

Pre-treatment prevents premature clogging by capturing coarse sediment particles before they reach the filter bed. Where the runoff source area produces little sediment, such as roofs, bioretention can function effectively without pre-treatment. To prevent pooling at the inlet and to act as a two-cell design that minimizes a filter bed's footprint is recommended. Pre-treatment practices that may be feasible, depending on the needs of the construction and conditions of the runoff source area include:

- Two-cell design (channel flow): Finely sized ponding volume should account for 25% of the water quality storage requirement and be designed with a depth to width ratio of 1:5
- Wave attenuation filter strip (channel depth): Should be a minimum of 30 mm in minimum. If wave strips are used, more frequent maintenance of the filter bed can be expected.
- Gravel diaphragm (channel flow): A small trench filled with pea gravel, which is placed horizontally in parallel to the edge of the filter bed. The pre-treatment practice will promote settling out of sediment and maintain sheet flow into the facility. A depth of 90-150 mm into the gravel bed can be used to drain excess water and promote sediment.
- Rip rap and/or debris retention (channel flow): Suitable for small bioretention cells with drainage area below 100 square metres.

GRAVEL STORAGE LAYER

- DEPTH: Should be a minimum of 300 mm deep and sized to provide the required storage volume. Granular material should be 50 mm diameter clear stone.
- PEA GRAVEL CHOKING LAYER: A 100 mm deep layer of pea gravel (3 to 10 mm diameter) should be placed beneath the filter media bed. Consists of gravel used as a choking layer separating it from the overlying filter media bed.
- COMPOSITION: To ensure a consistent and homogeneous bed, filter media should be free-mixed from an approved supplier.
- DEPTH: Recommended depth is between 1.0 and 1.25 m. However, in some circumstances, pot level removal benefits may be achieved in beds shallower than 1.0 m. Areas are to be included in the design, depth must be at least 1.0 m.
- MULCH: A 75 mm layer of mulch on the surface of the filter bed enhances plant survival, suppresses weed growth and prevents runoff before it reaches the filter bed.

CONVEYANCE AND OVERFLOW

Bioretention can be designed to be live or offline from the drainage system. In-line conveyance systems can be designed to convey water and sediment to the filter bed or a drywell. Overflow systems must be sized to safely convey larger storm events to an alternative treatment system. Overflow systems are designed to provide the maximum water surface elevation of the bioretention area, which is typically 150-250 mm above the bottom of the filter bed. Overflow bioretention practices use flow splitters or bypass channels that only allow the required water storage area to exit the facility. This may be accomplished with a splash, a grate, or a flow control valve. Overflow systems should be designed to allow the flow path channel to the filter bed to clear all the channels where flow does not pass over the surface of the filter bed. Using a well or curb opening minimumegrading and reducing maintenance frequency.

OPERATION AND MAINTENANCE

Bioretention requires routine inspection and maintenance of the landscaping as well as periodic inspection for less frequent maintenance or new installation. Generally, routine maintenance includes:

- Monitoring the water level, accumulation of debris, trash and sediment, and structural damage to pretreatment devices.
- Trash and debris should be removed from pretreatment devices, the bioretention area surface and inlet and outlet areas. Maintenance includes removing Inspection includes removing trash, pruning, weedimg, reducing dead vegetation and removing irrigated areas as needed. Remove accumulated sediment on the bioretention area surface when dry and exceeding 25 mm depth.

CONSTRUCTION CONSIDERATIONS

Ideally, bioretention sites should remain outside the limit of disturbance until construction of the bioretention facility. VEHICLES, equipment and seed should be avoided in the bioretention area. Locations should not be used as sediment basins during construction, as the concentration of fines will prevent complete infiltration and infiltration. To prevent soil compaction by heavy equipment. The bioretention area should not be disturbed before, during or after construction.

For further guidance regarding key steps during construction, see the CVC/TORA Low Impact Development Planning and Design Guide, Section 4.5.2 - Construction Considerations.