4.4-b BIOSWALE

Alternative Names: Bio-Infiltration Swale, Grass Percolation Area, Infiltration Channel

BMP DESIGN APPROACH
☐ Pollutant Source Control
■ **Hydrologic Source Control**
■ **Stormwater Treatment**
SCALE OF APPLICATION
■ **All SFR and MFR < 1 acre**
■ **MFR 1-5 Acre and CICU < 5 acres**
■ **MFR and CICU > 5 acres and all WQIPs**
TYPE OF APPLICATION
☐ Temporary
■ **Permanent**

DESCRIPTION

A bioswale is a shallow swale with an amended soil matrix supported by densely planted or seeded vegetation. The engineered soil matrix promotes filtration of stormwater through the soil to encourage pollutant removal. Mechanisms of stormwater treatment employed include stormwater filtering by the soil matrix and vegetation, adsorption of soluble pollutants in the soil and by the vegetation, and typically some amount of stormwater infiltration. The primary difference between a bioswale and a vegetated swale is that the soil underlying a bioswale has been amended to readily accept stormwater and promote filtration through the soil matrix.

APPLICABILITY

- Should be sited on relatively flat terrain (typically less than a 5 percent slope).
- Appropriate wherever site conditions allow for vegetation establishment and design flow velocities will not cause scour.

Advantages

- Promotes removal of stormwater pollutants, including pollutants of concern for lake clarity.

- Can be incorporated into a number of different landscape settings, such as front and back yards of residential areas, road shoulder rights-of-way, and in connection with roof downspouts.
- Slows the rate of runoff compared to other types of impervious drainage systems such as curb and gutter and storm drain pipes.

Disadvantages

- May require irrigation to maintain vegetation.
- Unless pretreatment is provided, applicability is limited to sites with low sediment loads.
- Once clogged, restoration typically requires rebuilding the system.

DESIGN CONSIDERATIONS

- Swale bottoms should be relatively flat with a longitudinal slope around 1-3 percent. Where existing topography dictates slopes greater than 3 percent, check dams or a series of terraced bioswales shall be used to reduce the slope of the swale.
- The maximum ponding in the swale should be 6 inches.
- Amended soil should typically be 12 to 18 inches thick within the bioswale. The top 6 inches of amended soil should contain sufficient organics and nutrients to promote and sustain vegetation establishment.
- Consider designing an accessible sediment trap or an equivalent pretreatment device at the inlet of a bioswale for removal of coarse sediment and debris. Accessible maintenance facilities can markedly improve the ease of maintenance and contribute to extended effectiveness.
- An underdrain may be used to improve filtration rates.
- Design freeboard (distance between top of water at peak flow to top of channel) to be at least 6 inches, but preferably 12 inches.
- In swales wider than 4 feet, consider using level spreaders at the head of the swale and every 50 feet in the channel.
- Direct runoff into bioswales either as concentrated flow or as lateral sheet flow. Provide sufficient energy dissipation for concentrated flow prior to discharge to the swale. If flow is directed into a swale from curb cuts, make curb cuts at least 12-inches wide to prevent clogging.
- Select native vegetation and provide a dense and diverse selection of low-growing plants. For bioswales that will not be irrigated or sited within naturally wet areas, selected drought tolerant vegetation. If permanent irrigation will be used, a wider selection of plants will be available.
- Consider incorporating trees or shrubs along bioswales to aesthetically integrate the design with the landscape.

INSTALLATION CONSIDERATIONS

- Prior to swale construction, stabilize the drainage area to the facility with temporary BMPs to keep runoff and sediment from entering the swale.
- Scrape away and stockpile any organic topsoil for later use prior to excavating.

- Where site conditions allow, excavate the swale bottom to be relatively flat with a longitudinal slope of 1 percent or less.
- Side slopes should be 3:1 (run to rise) or flatter to encourage growth of vegetation and slope stability.
- Where topsoil is lacking or has been depleted, amend the soil with at least 4 to 6 inches of organic compost incorporated into the soil prior to planting.
- Ensure proper energy dissipation is provided at inlets and outlets of the swale.
- Establish vegetation as soon as possible to prevent erosion and scour. Consider a construction schedule that allows for planting early in the growing season or in late fall when successful vegetation establishment is most likely.
- Temporary or permanent irrigation may be necessary to assure vegetation establishment.

INSPECTION AND MAINTENANCE

- Inspect after large runoff events and the spring melt period. Inspect for overall plant health; inflow and outflow function; and accumulation of sediment, trash, and debris.
- If a large quantity of sediment has discharged to the bioswale, examine the drainage area and identify potential sources of sediment that may be addressed through other pollutant source control BMPs identified in this Handbook. Alternatively, consider retrofitting the inlet to the bioswale to include a pretreatment device.
- Remove sediment when it creates an unfavorable condition for vegetation or hinders the function of the bioswale. Vegetation may need to be replaced or replanted after sediment removal. Salvage existing plants to the greatest extent possible.
- Reseed or replant bare areas. Consider planting alternative species in the event of unsuccessful vegetation establishment.
- If erosion occurs at the inlet or outlet, stabilize with rock riprap or other types of energy dissipation and stabilization BMPs identified in this Handbook.
- Irrigate vegetation as necessary to maintain soil moisture required for dense growth, but do not overwater. Irrigation will likely be needed during the first two years after planting for vegetation establishment. During periods of extended drought, native plants may also require irrigation.

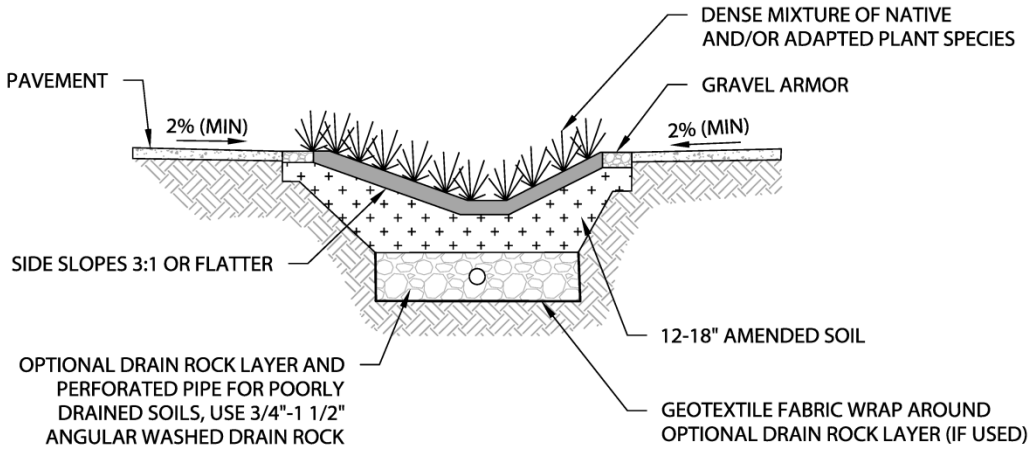
EFFECTIVENESS CONSIDERATIONS

The degree of pollutant removal within a bioswale depends on the composition of the engineered soil matrix, the degree of stormwater filtering through the soil matrix, and the maintenance of the system to ensure continued filtration capacity. Bioswales when properly maintained are considered an effective stormwater treatment BMP for removal of pollutants of concern for lake clarity (fine sediment particles and species of phosphorus). Bioswales may also be considered a hydrologic source control when the design storm runoff volume is designed to infiltrate.

Performance of bioswales can markedly decline if the voids in the amended soil matrix clog over time and stormwater runoff begins to flow on the surface of the bioswale similar to the function of a vegetated swale. Care should be taken when

designing a bioswale to ensure that stormwater will have relatively low sediment loads or adequate pretreatment to remove coarse sediment prior to entry into the bioswale. Because a bioswale relies upon filtration for pollutant removal, continued effectiveness may require relatively frequent maintenance to preserve the filtration capability of the bioswale.

Bioswale (Linear Basin) Figure



NOTES:

1. THIS DETAIL DISPLAYS KEY CONCEPTS FOR A BIOSWALE AND MAY NOT PROVIDE ALL NECESSARY DESIGN INFORMATION FOR INDIVIDUAL SITES.
2. SLOPE OF SWALE BOTTOM SHALL BE LESS THAN 3%.
3. BIOSWALES SHALL BE WELL VEGETATED USING NATIVE PLANT SPECIES IN AMENDED SOIL WITH APPROPRIATE KSAT.
4. FOR NON-PERMITTED PROJECTS, MULCH AND REVEGETATE BIOSWALE IN ACCORDANCE WITH THE TRPA BMP HANDBOOK. FOR PERMITTED PROJECTS, REVEGETATE BIOSWALE TO SPECIFICATIONS OF REVEGETATION PLAN.