Grass-Lined Channels

A grass-lined channel can be used to filter and convey runoff

Description

A grass-lined channel conveys stormwater runoff through a stable conduit. Vegetation lining the channel slows down concentrated runoff. Because grassed channels are not usually designed to control peak runoff loads by themselves, they are often used with other BMPs, such as subsurface drains and riprap stabilization.

Where moderately steep slopes require drainage, grassed channels can include excavated depressions or check dams to enhance runoff storage, decrease flow rates, and improve pollutant removal. Peak discharges can be reduced by temporarily holding them in the channel. Pollutants can be removed from stormwater by filtration through vegetation, by deposition, or in some cases by infiltration of soluble nutrients into the soil. The degree of pollutant removal in a channel depends on how long the water stays in the channel and the amount of contact with vegetation and the soil surface. Local conditions affect the removal efficiency.

Applicability

The first choice of lining should be grass or sod because this reduces runoff velocity and provides water quality benefits through filtration and infiltration. If the velocity in the channel would erode the grass or sod, riprap, concrete, or gabions can be used (USEPA, 2004). Geotextile materials can be used in conjunction with either grass or riprap linings to provide additional protection at the soil-lining interface. Use grassed channels in areas where erosion-resistant conveyances are needed, including areas with highly erodible soils and moderately steep slopes (though less than 5 percent). Install them only where space is available for a relatively large cross section. Grassed channels have a limited ability to control runoff from large storms, so do not use them in areas where flow rates exceed 5 feet per second.

Siting and Design Considerations

Site grass-lined channels in accordance with the natural drainage system. They should not cross ridges. The channel design should not have sharp curves or significant changes in slope. The channel should not receive direct sedimentation from disturbed areas and should be sited only on the perimeter of a construction site to convey relatively clean stormwater runoff. To reduce sediment loads, separate channels from disturbed areas by using a vegetated buffer or another BMP.

Basic design recommendations for grassed channels include the following:

- Construct and vegetate the channel before grading and paving activities begin.
- Make sure design velocities are less than 5 feet per second.

- Consider using geotextiles to stabilize vegetation until it is fully established.
- Consider covering the bare soil with sod, mulches with netting, or geotextiles to provide reinforced stormwater conveyance immediately.
- Use triangular channels with low velocities and small quantities of runoff; use parabolic grass channels for larger flows and where space is available; use trapezoidal channels with large, low-velocity flows (low slope).
- Install outlet stabilization structures if the runoff volume or velocity might exceed the capacity of the receiving area.
- Slope the sides of the channel less than 2:1; slope triangular channels along roads 2:1 or less for safety.
- Remove all trees, brushes, stumps, and other debris during construction.

Effectiveness

Grass-lined channels can effectively transport stormwater from construction areas if they are designed for expected flow rates and velocities and if they do not receive sediment directly from disturbed areas.

Limitations

If grassed channels are not properly installed, they can change the natural flow of surface water and adversely affect downstream waters. And if the design capacity is exceeded by a large storm event, the vegetation might not be adequate to prevent erosion and the channel might be destroyed. Clogging with sediment and debris reduces the effectiveness of grass-lined channels for stormwater conveyance.

Maintenance Considerations

The maintenance requirements for grass channels are relatively minimal. While vegetation is being established, inspect the channels after every rainfall. After vegetation is established, mow it, remove litter, and perform spot vegetation repair. The most important objective in grassed channel maintenance is to maintain a dense and vigorous growth of turf. Periodically clean the vegetation and soil buildup in curb cuts so that water flow into the channel is unobstructed. During the growing season, cut the channel grass no shorter than the level of the design flow.

Cost Considerations

Costs of grassed channels range according to depth. The cost of a 1.5-foot-deep grassed channel with 3:1 side slopes and a 2-foot-wide channel bottom is estimated to cost between $202 and $625 per 100 feet of channel length. The cost of a 3-foot-deep grassed channel with 3:1 side slope adn a 2-foot-wide bottom is expected to cost between $397 and $1,198 for 100 feet of channel (SEWRPC, 1991). Grassed channels can be left in place permanently after the construction site is stabilized to contribute to long-term stormwater management. The channels, in combination with other practices that detain, filter, and infiltrate runoff, can substantially reduce the size of permanent detention facilities like stormwater ponds and wetlands, thereby reducing the overall cost of stormwater management.

References

FHWA (Federal Highway Administration). 1995. *Best Management Practices for Erosion and Sediment Control*. FHWA-SLP-94-005. Federal Highway Administration, Sterling, VA.

MPCA (Minnesota Pollution Control Agency). 1998. *Protecting Water Quality in Urban Areas*. Minnesota Pollution Control Agency, Division of Water Quality, St. Paul, MN.

Smolen, M.D., D.W. Miller, L.C. Wyatt, J. Lichthardt, and A.L. Lanier. 1988. *Erosion and Sediment Control Planning and Design Manual*. North Carolina Sedimentation Control Commission; North Carolina Department of Environment, Health, and Natural Resources; and Division of Land Resources, Land Quality Section, Raleigh, NC.

SEWRPC (Southeast Wisconsin Regional Planning Commission). 1991. *Costs of Urban Nonpoint Source Water Pollution Control Measures*. Technical Report No. 31. Southeast Wisconsin Regional Planning Commission, Waukesha, WI.

USEPA (U.S. Environmental Protection Agency). 2004. Development Document for Final Action for Effluent Guidelines and Standards for the Construction and Development Category. EPA-821-B-04-001. Washington, DC.