Water Resources Division

Grassed Waterway

Description

Grassed Waterways are shaped or graded channels with suitable vegetation, designed to intermittently carry surface water runoff at non-erosive velocities to stable outlets. Grassed Waterways are preferred over bare channels or other conveyances, because the vegetation in them protects the soil, and retards the channel flow velocity. Grassed Waterways are also referred to as grassed swales.

Companion & Alternate Practices

Establish the vegetation in Grassed Waterways in accordance with specifications in the Seeding, Mulching, and Sodding best management practices (BMPs). Design Grassed Waterways so they are consistent with the retardance value that will control runoff and prevent erosion. In wet soil, Subsurface Drains with appropriate inlet and outlet control structures can be used to promote thick Sod growth and soil stability, by draining excess water.

Establishing Filter Strips on each side of the Grassed Waterway can provide wildlife habitat and improve water quality by reducing sediment, fertilizer, and pesticides entering the Grassed Waterway.

Pollutant Removal

Grassed Waterways reduce runoff velocity, filter sediment and absorbed chemicals from sheet erosion, and deliver intermittent flows to streams. Grassed Waterways can also provide wildlife grazing and habitat.

Grassed Swales are promoted by the MDEQ's Municipal Separate Storm Sewer System (MS4) Program as a recommended 'green infrastructure' practice, especially where they're used instead of traditional storm sewer drainage infrastructure.

Location

Grassed Waterways can be used in rural areas, and in urban and urbanizing areas, as long as velocity and flow design criteria are met.

Grassed Waterways are typically used in natural depressions where intermittent water flows concentrate to cause gullies. The depth to the groundwater table, climatic factors, and vegetative retardance are used to determine the species of vegetation needed. Grassed waterways are sometimes used to serve linear projects.

Consider the construction timetable and seeding windows to perform the work in a manner that optimizes conditions for the establishment of vegetative cover. (See the Seeding and Sodding BMPs). Avoid using dormant Seeding because of their high risk of failure. Note that the effectiveness of the waterway is reduced on snow-covered ground.

In cold or snowy climates, swales may serve a dual purpose by acting as both a snow storage/treatment and a storm water management practice. This dual purpose can particularly relevant when swales are used to treat road runoff. If used for this purpose, swales should incorporate salt-tolerant vegetation. (USEPA, 2002)

It is important to stabilize grassed Waterways before periods of potentially high runoff, especially in the spring and fall, to prevent gullies from displacing soils and transporting them to the water system.

Grassed Waterways can be applied to all sites where additional vegetative protection or capacity, or both, is needed to control erosion resulting from concentrated runoff. Grassed Waterways are used to prevent erosion and transport runoff to stable outlets from golf courses, parks, subdivision lawns, farm fields, and parking lots.

Grassed Waterways are not recommended on sites where their construction would destroy important woody wildlife cover. Waterways which do not usually require additional vegetation are often recognized by a meandering condition, with side slopes which are stabilized by woody plants or herbaceous vegetation.

Planning

Consider locations for Grassed Waterways that conform to the natural runoff system. Avoid placing channels with significant changes in direction or grade. To the extent possible, use the existing topography, rather than reshaping the land.

Until vegetation is fully established in a Grassed Waterway, divert water from the channel using temporary Check Dams, Diversions, or any other appropriate controls.

Grassed Waterways are generally unsuitable for sites subjected to prolonged wet conditions, whether from a high water table, springs, or seeps, because it may be impossible for grass to grow. In such cases, consider lining channels with Turf Reinforcement Matting or other scour prevention matting, which can withstand design flows or perennially wet conditions as well as Riprap, while allowing appropriately-selected vegetation to grow. If Subsurface Drains are used to remove excess water from a site to make it suitable for a Grassed Waterway, surface inlets may be necessary; appropriate outlet control structures should also be used.

Ensure that any necessary livestock or vehicular Crossings do not damage the grading or vegetation of Grassed Waterways.

Design

Grassed Waterways should be designed by professional engineers to ensure that they achieve the goal of erosion minimization through proper sizing and vegetation selection for the velocities expected.

- Capacity: The minimum capacity shall be the conveyance of peak runoff expected from the 10-year, 24-hour rainfall event. Grassed Waterways that are designed to carry clean water as part of a waste management system shall convey the peak runoff from the 25-year, 24-hour rainfall event. Capacity shall be increased as needed to account for the potential loss of channel volume due to expected sediment accumulation between maintenance activities. When the waterway slope is less than one (1) percent, up to 50 percent of the design flow may be allowed temporarily out of bank, if such flow will not cause erosion, affect crop production, or cause any other damage;

- Velocity: Design velocity shall be the lesser of (a) from 1.5 to 4.5 feet per second, or (b) those obtained by an approved alternate method, such as those defined in the NRCS Engineering Field Handbook, Part 650, Chapter 7, or the Agricultural Research Service Handbook 667. Maximum velocities shall be determined using a retardance of 'D' or less. Consider the use of products such as Turf Reinforcement Mats, which can greatly improve the sheer stress tolerance once a channel is fully vegetated. Turf Reinforcement Matting performs similarly to Riprap;

- Depth: Minimum channel depth shall be 0.8 feet. In locations where out-of-bank flow has the potential to cause erosion or other damage, channels shall include an additional minimum of 0.2 feet of freeboard above the design depth;

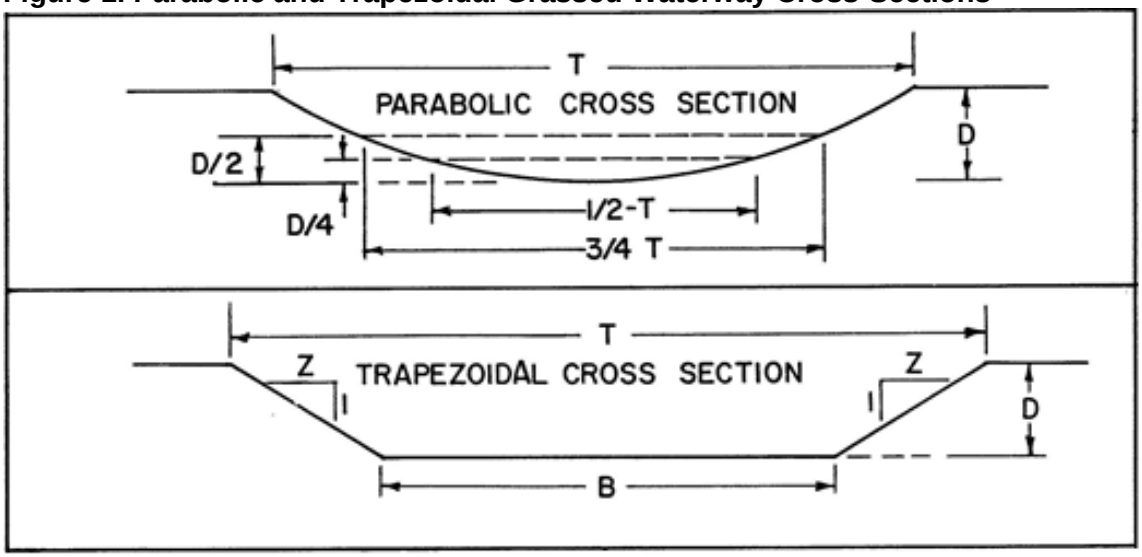
- Shape: Use either a parabolic or trapezoidal cross section, which are depicted in Figure 1. 'V'-shaped channels are not recommended because they tend to be more erosive, and thus prone to gully formation. Make the cross-sectional area large enough, relative to the design flow, soil type, and vegetation, to maintain runoff velocities below erosive levels. The bottom width of trapezoidal waterways shall not exceed 50 feet;

- Outlets: All Grassed Waterways shall have Stabilized Outlets with adequate capacity to prevent ponding, flooding damage, or scour.

Construction

Prior to constructing Grassed Waterways, protect upland areas from eroding by applying appropriate perimeter erosion and sedimentation control practices. Sedimentation can quickly render Grassed Waterways ineffective. Divert runoff away from Grassed Waterways until the vegetation in them is established.

Figure 1. Parabolic and Trapezoidal Grassed Waterway Cross-Sections



Source: NRCS, 1982.

All steep gully banks shall be graded to not steeper than 1H:1V. Earth fill shall be compacted.

Install any needed Subsurface Drains (with appropriate outlet control structures) before shaping the Grassed Waterway.

Use proper Land Clearing practices and grade according to the grading plan.

Excavate the channel according to the design.

Adequately compact the fill in the Grassed Waterway to prevent uneven settling along its length.

Plant Seed or Sod according to the design. Protect the channel with Mulch or a temporary liner sufficient to withstand anticipated velocities during the establishment period. Follow specifications in the Mulching BMP.

Maintenance

During the establishment period, check the channel after every rainfall. Assess the condition and operation of any temporary check dams, diversions, or other practices installed while vegetation is established. Repair eroded areas immediately. Also check channel outlets, and any BMPs implemented up-slope of the channel. Remove any accumulated sediment which ends up in the channel, and reevaluate upland BMPs accordingly.

Once established, ensure that Grassed Waterways have dense, mature vegetation at all times, to prevent erosion, and serve as an effective filter. Schedule regular mowing to keep the vegetation within the range specified for the desired design retardance, and to maintain dense vegetative vigor.

Literature Cited

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