

CONSERVATION PRACTICE STANDARD

GRASSED WATERWAY

(Ac.)

CODE 412

DEFINITION

A natural or constructed channel that is shaped or graded and established with suitable vegetation to carry surface water at a non-erosive velocity to a stable outlet.

PURPOSE

- To convey runoff from terraces, diversions, or other water concentrations without causing erosion or flooding.
- To reduce gully erosion.
- To protect/improve water quality.

CONDITIONS WHERE PRACTICE APPLIES

In areas where added water conveyance capacity and vegetative protection are needed to control erosion resulting from concentrated runoff.

CRITERIA

General Criteria Applicable to All Purposes

Plan, design, and construct grassed waterways to comply with all Federal, State, and local laws and regulations.

Capacity. The minimum capacity shall convey the peak runoff expected from a storm of 10-year frequency, 24-hour duration. Capacity shall be increased as needed to account for potential volume of sediment expected to accumulate in the waterway between planned maintenance activities. If the waterway will receive flow from terraces, diversions, or other structures with a larger design storm, the waterway shall be designed for the same storm frequency and duration. When the waterway

slope is less than 1 percent, out-of-bank flow may be permitted if such flow will not cause excessive erosion. At a minimum, the design capacity required to remove the water before crops are damaged.

Stability. Determine the minimum depth and width requirements for stability of the grassed waterway using the procedures in the NRCS National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 7, Grassed Waterways; Agricultural Research Service (ARS) Agriculture Handbook 667, Stability Design of Grass-Lined Open Channels; or other equivalent method.

Width. The bottom width of trapezoidal waterways shall not exceed 100 feet unless multiple or divided waterways or other means are provided to control meandering of low flows.

Side slopes. Keep the side slopes flatter than a ratio of two horizontal to one vertical. Accommodate the equipment anticipated to be used for maintenance and tillage/harvesting equipment that will cross the waterway in the designed width.

Depth. The capacity of the waterway must be large enough so that the water surface of the waterway is below the water surface of the tributary channel, terrace, or diversion that flows into the waterway at design flow.

Provide freeboard above the designed depth when flow must be contained to prevent damage. Provide freeboard above the designed depth when the vegetation has the maximum expected retardance.

If the waterway has an embankment confining the section the depth shall include a settlement factor of

at least 10 percent and a minimum freeboard of 0.3 feet.

Drainage. When needed to help or keep vegetation established on sites having prolonged flows, high water tables, or seepage problems, include Subsurface Drains (606), Underground Outlets (620), stone center waterways or other suitable measures in waterway designs.

Outlets. Provide for stable outlet with adequate capacity. The outlet can be another vegetated channel, an earthen ditch, a grade-stabilization structure, filter strip or other suitable outlet.

Stone Center Waterways. In areas where field stone or other rock sources are available, a stone center may assist in establishment of the waterway and solve prolonged flows and wetness problems. A gravel bedding or geotextile fabric should be used under the rock to prevent erosion of the soil. The stone center portion should carry the one-year, 24-hour duration peak discharge or the maximum permissible velocity may be increased by one (1) foot-per-second. Installation shall follow Figure 7-11 and stone size determined from in EFH 650.16 or Hydraulic Engineering Circular 11 (FHWA 1989).

Natural Waterway. Natural grassed waterways (plow skips and swales) meet this standard when the following conditions are met:

1. Permanent vegetation has been established and there is no rilling in the waterway.
2. Runoff is able to enter the waterway along the entire length (no plowing parallel to the centerline of the waterway).
3. A minimum width of 20 feet and a maximum width of 50 feet is maintained with a maximum depth of 1.0 foot and a minimum depth of 0.4 foot.
4. The waterway is not used for an outlet for a diversion or terrace unless capacity and stability are checked and adequate.

Vegetative Establishment. Grassed waterways shall be vegetated according to NRCS Conservation Practice Standard Critical Area Planting (342) or the current Penn State publication "Erosion Control and Conservation Planting on Noncropland." Species selected shall be suited to the current site conditions and intended uses. Selected species will have the capacity to achieve adequate density, height, and vigor within an appropriate time frame to stabilize the waterway.

Establish vegetation as soon as conditions permit. Use erosion control blanket, anchored mulch, or rock(stone mulch), to protect flow thru channel or temporarily divert runoff to stabilized location to protect the vegetation until it is established. On low grade, low risk, small waterways, measures such as mulch, strawbale dikes, or check dams may be used if not regulated. Planting of a close growing crop, e.g. small grains or millet, on the contributing watershed prior to construction of the grassed waterway can also significantly reduce the flow through the waterway during establishment.

CONSIDERATIONS

Establish an appropriate width of vegetation on one or both sides of the waterway or add other sediment control measures above the waterway such as residue management to improve water quality and reduce sediment deposition in the waterway. These measures should be implemented if the row grade exceeds the criteria found in the Contour Farming Standard (330). Consider increasing the channel depth and/or designing areas of increased width or decreased slope to trap and store sediment to reduce the amount of sediment that leaves a field. Be sure to provide for regular cleaning out the waterway when trapping sediment in this manner.

Avoid areas where unsuitable subsurface, subsoil, substratum material that limits plant growth such as salts, acidity, root restrictions, etc., may be exposed during implementation of the practice. Where areas can not be avoided, seek recommendations from a soil scientist for ameliorating the condition or, if not feasible consider over-cutting the waterway and add topsoil over the cut area to facilitate vegetative establishment.

Design the width of a waterway to allow for equipment and cattle crossings. Additional width may be appropriate in transitioning outlets of diversions and terraces.

If the waterway increases the drainage area to the discharge point consider any possible negative effects to downstream property and /or resources.

Avoid discharging into sinkholes.

Avoid or protect if possible important wildlife habitat, such as woody cover or wetlands when determining the location of the grassed waterway. If trees and shrubs are incorporated, they should be retained or planted in the periphery of grassed waterways so they do not interfere with hydraulic functions. Medium or tall bunch grasses and

perennial forbs may also be planted along waterway margins to improve wildlife habitat. Waterways with these wildlife features are more beneficial when connecting other habitat types; e.g., riparian areas, wooded tracts and wetlands. When possible, select species of vegetation that can serve multiple purposes, such as benefiting wildlife, while still meeting the basic criteria needed for providing a stable conveyance for runoff.

Water-tolerant vegetation, such as reed canarygrass, may be an alternative to subsurface drains or stone centered waterways on some wet sites.

Use irrigation on dry sites or during dry weather as necessary to promote germination and vegetation establishment.

Provide livestock and vehicular crossings as necessary to prevent damage to the waterway and its vegetation.

Add width of appropriate vegetation to the sides of the waterway for wildlife habitat.

Consider including diverse legumes or other forbs that provide pollen and nectar for native bees.

The construction of a grassed waterway can disturb large areas and potentially affect cultural resources. Be sure to follow state cultural resource protection policies before construction begins.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for grassed waterways that describe the requirements for applying the practice according to this standard. As a minimum the plans and specifications shall include:

- A plan view of the layout of the grassed waterway.
- Typical cross sections of the grassed waterway(s).
- Profile(s) of the grassed waterway(s).
- Disposal requirements for excess soil material.
- Site specific construction specifications that describe in writing the installation of the grassed waterway. Include specification for control of concentrated flow during construction and vegetative establishment.
- Vegetative establishment requirements.

OPERATION AND MAINTENANCE

Provide an operation and maintenance plan to review with the landowner. Include the following items and others as appropriate in the plan.

- Establish a maintenance program to maintain waterway capacity, vegetative cover, and outlet stability. Vegetation damaged by machinery, herbicides, or erosion must be repaired promptly.
- Protect waterway from concentrated flow by using diversion of runoff or mechanical means of stabilization such as silt fences, mulching, hay bale barriers and etc. to stabilize grade during vegetation establishment.
- Minimize damage to vegetation by excluding livestock whenever possible, especially during wet periods. Permit grazing in the waterway only when a controlled grazing system is being implemented.
- Inspect grassed waterways regularly, especially following heavy rains. Fill, compacted, and re-seed damaged area immediately. Remove sediment deposits to maintain capacity of grassed waterway.
- Avoid use of herbicides that would be harmful to the vegetation in and adjacent to the waterway area
- Avoid using waterways as turn-rows during tillage and cultivation operations.
- Mow or periodically graze vegetation to maintain capacity and reduce sediment deposition. Mowing may be appropriate to enhance wildlife values, but must be conducted to avoid peak nesting seasons and reduced winter cover.
- Apply supplemental nutrients as needed to maintain the desired species composition and stand density of the waterway.
- Control noxious weeds.
- Do not use as field road. Avoid crossing with heavy equipment when wet.

REFERENCES

USDA, ARS. 1987. Stability design of grass-lined open channels. Agriculture Handbook 667.

USDA, NRCS. 2007. National Engineering Handbook, Part 650, Engineering Field Handbook, Chap. 7, Grassed waterways

Penn State “Erosion Control and Conservation
Planting on Non-cropland.”

USDA, NRCS. 1996. National Engineering
Handbook, Part 650, Engineering Field Handbook,
Chap. 16, Streambank and Shoreline Protection