

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**GRASSED WATERWAY**

(Ac.)

CODE 412

**DEFINITION**

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

On watershed subareas of less than 15 acres and the 10 year-24-hour peak flow is less than 10 cfs, the following criteria may be used for shaping the waterway in lieu of a detailed design:

**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.

**Parabolic Channel**

WATERWAY SLOPE	FLOW	DESIGN DEPTH	DESIGN TOP WIDTH
%	(CFS)	(FEET)	(FEET)
3 TO 10	<5	0.75	15
7+ TO 10	5 TO 10	0.75	15
3+ TO 7	5 TO 10	1.0	15
2 TO 3	5 TO 10	1.25	15

**CONDITIONS WHERE PRACTICE APPLIES**

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

**Triangular Channel**

(with 6:1 or flatter side slopes)

WATERWAY SLOPE	FLOW	MINIMUM DESIGN DEPTH
%	(CFS)	(FEET)
6+ TO 10	<5	1.0
4+ TO 6	<5	1.1
2+ TO 4	<5	1.25
8+ TO 10	5 TO 10	1.0
4+ TO 8	5 TO 10	1.25
3+ TO 4	5 TO 10	1.35
2+ TO 3	5 TO 10	1.5

**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 the 10-year frequency, 24-hour duration storm. Capacity shall be increased as needed to account for potential volume of sediment expected to accumulate in the waterway between planned maintenance activities. 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 shall remove the water before crops are damaged.

On watershed areas of less than 5 acres and the 10 year-24 hour peak flow less than 5 cfs; refer to Practice Standard Critical Area Planting (342).

**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.** Keep the bottom width of trapezoidal waterways less than 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. . Where practicable, the side slopes for flat bottom waterways shall not be steeper than 4:1.

**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.

**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 a 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.

**Vegetative Establishment.** Grassed waterways shall be vegetated according to NRCS Conservation Practice Standard Critical Area Planting (342). 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 mulch anchoring, nurse crop, rock, straw or hay bale dikes, fabric checks, filter fences, or runoff diversion to protect the vegetation until it is established. 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. 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 cannot 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.

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.

On highly erosive soils and where vegetation is difficult to establish, sills may be installed to control minor head cutting within the waterway during grass establishment. Refer to Idaho

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Appendix to Engineering Field Handbook, Chapter 7 for spacing. Sills may be constructed of concrete, wood or other suitable materials. Sills shall extend across a minimum of two-thirds the waterway width for triangular and parabolic channels. In trapezoidal channels the minimum width shall be  $L = B + 1.33DZ$ : where L = Sill Length, B = Design water surface width in waterway, D = Design Water Depth, Z = Sideslope of channel. Concrete sills shall be a minimum of 4 inches thick and a minimum of 30 inches deep.

Water-tolerant vegetation may be an alternative to subsurface drains or stone center waterways on some wet sites.

Use irrigation in dry regions or supplemental irrigation 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 legumes or other forbs that provide pollen and nectar for native bees. Legumes and forbs should not exceed more than 15% of the seeding mixture. In dry regions, these sites may be able to support flowering forbs with higher water requirements and thus provide bloom later in the summer

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.
- Vegetative specifications should be documented on ID-CPA-025.

## 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, haybale 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, compact, and reseed damaged areas 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 waterways as a 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.