

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

GRASSED WATERWAY

(Acre)

CODE 412

DEFINITION

A shaped or graded channel that is established with suitable vegetation to convey surface water at a non-erosive velocity using a broad and shallow cross section to a stable outlet.

PURPOSE

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

CONDITIONS WHERE PRACTICE APPLIES

This practice is applied in areas where added water conveyance capacity and vegetative protection are needed to prevent erosion and improve runoff water quality resulting from concentrated surface flow.

CRITERIA

General Criteria Applicable to All Purposes

Use of this standard requires compliance with all applicable federal, state, and local laws and regulations.

Capacity. Design the waterway to convey the peak runoff expected from the 10-year frequency, 24-hour duration storm. Increase capacity 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. Ensure that the design capacity, at a minimum, will remove excess water before

crops are damaged. The minimum capacity in such cases will be that required to carry within the channel the discharge as determined by using the "B" drainage curve in the Indiana Engineering Field Handbook (EFH) supplement, Chapter 14, page 14-16a.

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, EFH, Chapter 7, Grassed Waterways or Agricultural Research Service (ARS) Agriculture Handbook 667, Stability Design of Grass-Lined Open Channels. Designs based on the velocity method are acceptable.

When the velocity method is used, the design velocities will not exceed those obtained by using the procedures, "n" values, and recommendations in the NRCS EFH Part 650, Chapter 7, Indiana Supplement 7-1, Velocity Method Guidance. Velocities that are less than 1.5 feet per second will require special considerations in the Operations and Maintenance (O & M) section.

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. Reduce the side slopes as needed to accommodate the equipment anticipated to be used for maintenance and crop management equipment so that damage to the waterway is minimized.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service State Office, or download it from the Field Office Technical Guide for your State.

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

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 0.5 foot freeboard above the designed depth when flow must be contained to prevent damage.

Drainage. When needed to establish or maintain vegetation on sites having prolonged flows, high water tables, or seepage problems, use Indiana (IN) Field Office Technical Guide (FOTG) Standard (606) Subsurface Drain, (620) Underground Outlet, or other suitable measures in waterway designs.

Where used, subsurface drains will be located near the outer edge of the top width and at least 1-foot below the centerline grade.

Surface inlets (risers, blind inlets) will only be installed and designed up to the level needed to convey trickle flow or upstream tile outlet flow to subsurface drains, and inlets will have designed restricted flow (as with an orifice plate). Ensure that existing tile will handle additional capacity.

Where drainage practices are not practicable or sufficient to solve these seepage problems, use conservation practice Lined Waterway or Outlet (468) in place of Grassed Waterway (412).

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.

Newly constructed outlets must meet an appropriate NRCS standard. Existing outlets and surrounding areas (such as emergency flow areas) must be in good condition and meet one of the following criteria to be considered "stable and adequate":

1. Has required capacity of the Grade Stabilization Structure or other applicable standard.
2. The water flow pattern and amount flowing through the existing outlet and surrounding

areas will not be significantly altered by the new grassed waterway.

Designated Work Area. A fallow or mowed area is required on both sides of the grassed waterway extending beyond the design top width of the waterway during layout and construction.

Spoil. Any spoil placed adjacent to the grassed waterway will have a positive grade toward the waterway. Spoil not planted to crops will be temporarily seeded or planted to a crop.

Vegetative Establishment. Seedbed preparation, species selection, seeding mixes, seeding rates, dates, depths, fertility requirements, site adaptation and planting methods will be consistent with the requirements in the IN NRCS Seeding Tool and/or IN FOTG Standard (342) Critical Area Planting.

Dormant Seeding is not an acceptable method.

Companion/Nurse Crops. A companion or nurse crop will be used when rapid vegetative establishment for erosion control, slower germinating permanent vegetation is planned, and/or weed suppression are needed. Refer to IN FOTG Standard (340) Cover Crop for guidelines.

Temporary Seeding. Waterways constructed between May 15th and August 1st will be seeded with one of the following species:

Oats @ 2 bushel (64lb.) per acre Pure Live Seed Pure Live Seed (PLS);
Japanese or Pearl Millet @ 30 lb. per acre PLS;
Sorghum – Sudan Grass @ 20 lb. per acre PLS.

Add topsoil over cut areas to facilitate vegetative establishment where exposed subsoil is not conducive for growth. Erosion control blanket will be installed on areas where topsoil is placed (as fill in flow area).

Establish vegetation as soon as conditions permit. Use mulch anchoring, nurse crop, rock or straw or hay bale dikes, fabric or rock checks, filter fences, or runoff diversion to protect the vegetation until it is established.

Mulching Requirements. Follow requirements in the IN FOTG Standard (484)

Mulching. An erosion control blanket (ECB) will be installed on all grassed waterway sections where either of the following exist:

1. The design velocity during establishment is 3.0 feet per second (fps) or greater.
2. Earthfill is used to fill an eroded area.

The blanket will cover at least half of the design depth.

Where soil and/or site conditions will limit the establishment, growth or vigor of vegetation, apply straw mulch on full design widths of grassed waterways where ECB is not used and the outer edges of grassed waterways with ECB.

CONSIDERATIONS

The considerations section contains information that is optional to the planner.

Construct grassed waterways with a minimum of 1 foot of depth where sedimentation could be a concern.

Consider using erosion control blanket on all grassed waterways to protect the soil until vegetation is established.

Consider increasing seeding rates by at least 50% on sites considered to be high risk due to soil type, velocity or other conditions.

Consider adding a nurse crop to permanent seedings to stabilize soil during establishment.

Consider substituting ECB with quickly photo-degrading (90 days or less) netting for the commonly used 12-month type, to reduce wildlife entanglement and snagging of equipment.

Add width of appropriate vegetation to the sides of the waterway for wildlife habitat. Care should be taken to avoid creating small isolated planting zones that could become population sinks where wildlife attracted to an area experience reproductive loss due to predation.

Where wildlife is a concern, do not mow between April 1 and August 15.

Where environmentally-sensitive areas need to be protected from dissolved contaminants, pathogens, or sediment in runoff, consider

establishment of an increased width of vegetation on the waterway above the flow area. Increasing the width of the waterway above the flow area will increase filtering of sediment and pathogens as well as increase infiltration of runoff and increase nutrient removal. Where sediment control is the primary concern, consider using vegetation in the waterway which can withstand partial burial and adding sediment control measures above the waterway such as residue management. 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 of the waterway when trapping sediment in this manner.

Tillage and crop planting often takes place parallel to the waterway, resulting in preferential flow – and resulting erosion – along the edges of the waterway. Consider installation of measures that ensure that runoff from adjacent areas will enter the waterway. Measures such as directing spoil placement or small swales can direct this preferential flow into the grassed waterway.

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.

To minimize nutrient build-up and subsequent nutrient loss, harvest the vegetation during maximum nutrient uptake periods and properly dispose of it.

Avoid areas where unsuitable plant growth limiting subsoil and/or substratum material 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 improving 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 plant species 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 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.

Consider including diverse legumes, forbs, and flowering plants such as milkweeds that provide pollen and nectar for native bees and other pollinators. In dry regions, these sites may be able to support flowering forbs with higher water requirements and thus provide bloom later in the summer

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 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.

Any plant species, whose presence or overpopulation may jeopardize this practice or negatively impact off-site uses, will be controlled. Spraying or other control methods will be performed on a "spot" basis to protect forbs/legumes that benefit native pollinators and other wildlife.

- 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 the 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, compact, and reseed damaged areas immediately. Remove sediment deposits to maintain capacity of grassed waterway.
- Avoid use of herbicides and minimize drift that would be harmful to the desirable vegetation.
- Avoid use of insecticides and minimize drift that would be harmful to pollinators.
- Avoid using waterways as turn-rows during tillage and cultivation operations.
- Mow vegetation to maintain capacity and reduce sediment deposition.
- Apply supplemental nutrients as needed to maintain the desired species composition and stand density of the waterway.
- Control noxious and undesirable weeds.

- Do not use waterways as a field road. Avoid crossing with heavy equipment when wet.
- Lift tillage equipment off the waterway when crossing and turn off chemical application equipment.

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.