

NATURAL RESOURCES CONSERVATION SERVICE
VIRGINIA CONSERVATION PRACTICE STANDARD

GRASSED WATERWAY

(Acre)

Code 412

DEFINITION

A natural or constructed channel that is shaped or graded to required dimensions and established with suitable vegetation.

and constructed to comply with all Federal, State, and local laws and regulations. All trees, stumps, brush, and similar material that will interfere with the functioning of the waterway shall be removed from the site and disposed of in a manner consistent with environmental concerns.

PURPOSES

This practice may be applied as part of a conservation management system to support one or more of the following purposes:

- to convey runoff from terraces, diversions, contoured crop rows, or other water concentrations without causing erosion or flooding
- to reduce gully erosion
- to protect and/or improve water quality

Each site must be evaluated to determine if the proposed waterway needs to be designed by multiple reaches (segments). This may be necessary due to significant changes within the associated drainage area, in channel grade, or in construction site conditions along the waterway profile that may affect peak rates of runoff.

Additional conservation practices installed adjacent to waterways such as terraces, diversions, etc. will be designed according to their respective standard to ensure stable transfer of runoff volume and minimize erosion impacts. It may be necessary to install and stabilize the grassed waterway prior (1 to 2 years) to construction of other practices to ensure the waterway can handle the anticipated flows.

CONDITIONS WHERE PRACTICE APPLIES

In areas where water conveyance capacity and vegetative protection are needed to control erosion resulting from concentrated runoff and where such control can be achieved by using this practice alone or in combination with other conservation practices.

Topsoiling procedures will be followed where necessary, due to one or more adverse site conditions. Topsoiling specifications shall be included in the vegetative requirements provided to the landuser along with the waterway design. Refer to the Virginia Conservation Practice Standard *Critical Area Planting (Code 342)* for requirements on topsoiling procedures. The Standard and Specification 3.30 (Topsoiling) in Chapter III of the Virginia Erosion and Sediment Control Handbook may also be used as a guide.

CRITERIA

GENERAL CRITERIA APPLICABLE TO ALL PURPOSES

Grassed waterways shall be planned, designed,

The waterway will be constructed to grade and dimensions as planned. Account for over-excavation if required for topsoiling or establishment of vegetation. Reflect this

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allowance in the design dimensions shown on the waterway plans.

All soil removed and not used in the construction and/or shaping of the waterway shall be disposed of, or spread on adjacent land far enough away that it will not interfere with the functioning of the waterway. Positive drainage into the waterway will be maintained. Grading will be such that no high or low areas exist along or near the edges of the waterway that will restrict or impede drainage into it.

Capacity

The minimum capacity shall be that required to convey the peak runoff expected from a storm of 10-year frequency, 24-hour 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. The minimum capacity, in such cases, shall be the capacity required to remove the water before crops are damaged.

Velocity

Design velocities shall not exceed those obtained by using procedures, "n" values, and recommendations in the NRCS Engineering Field Handbook (EFH) Part 650, Chapter 7 or the Agricultural Research Service (ARS) Agricultural Handbook 667, *Stability Design of Grassed-lined Open Channels*.

Waterway Shape

Waterway cross sections may be parabolic or trapezoidal; however, parabolic channels are the most common and generally the most satisfactory. Consider shape as it relates to the ease of crossing with farm equipment. Mounted or trailing implements can cause considerable damage to the waterway if side slopes are constructed too steep and/or channels are graded deeper than necessary.

Side slopes shall be designed to be no steeper than a ratio of two horizontal to one vertical. They shall be designed to accommodate the equipment anticipated to be used for maintenance and tillage/harvesting equipment that will cross the waterway. Side slopes 8:1 or

flatter should be used in trapezoidal channels that will be crossed with equipment.

A parabolic waterway shall be constructed so that the width of the waterway when measured at one-half (1/2) of the design depth is at least three-fourths (3/4) of the design top width.

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

Depth

The minimum depth of a waterway that receives water from terraces, diversions, or other tributary channels shall be that required to keep the design water surface elevation at or below the design water surface elevation in the tributary channel at their junction when both are flowing at design depth.

If topsoiling is planned, over-excavate the waterway during construction to allow for topsoil thickness. Required depths shall be shown on the design.

Freeboard above the designed depth shall be provided when flow must be contained to prevent damage. Freeboard shall be provided above the designed depth when the vegetation has the maximum expected retardance.

Drainage

Designs for sites having prolonged flows, a high water table, or seepage problems shall include Virginia Conservation Practice Standards *Subsurface Drain (Code 606)* and *Underground Outlet (Code 620)*, stone center waterways or other suitable measures to avoid saturated conditions.

Outlets

All grassed waterways shall have a stable outlet with adequate capacity to prevent ponding or flooding damages. The outlet can be another vegetated channel, an earthen ditch, a grade-stabilization structure, a filter strip or other suitable outlet.

VEGETATIVE ESTABLISHMENT

Site Preparation

The waterway shall be shaped to grade and dimensions as shown on the plans. If topsoil is to be spread, scarify the soil subsurface to a minimum depth of 3 inches and spread topsoil. Additional excavation allowances for the spreading of topsoil shall be shown on the plans.

Smooth the area as needed to permit proper seedbed preparation and seeding.

Seedbed Preparation

A suitable seedbed will be prepared by disking, harrowing, or by using other appropriate tillage implements.

Incorporate lime and fertilizer into the top 3-6 inches of soil as a part of seedbed preparation. Lime and fertilizer application rates will be in accordance with a current soil test.

The final tillage operation for seedbed preparation shall be performed perpendicular to the waterway length. All required seedbed preparation shall be performed just prior to and in conjunction with the seeding/planting operation. Re-work the seedbed if significant rainfall occurs between the initial seedbed preparation and the seeding/planting operation.

Seeding

Grassed waterways shall be established to permanent grasses, legumes, or grass/legume mixtures. Species shall be adapted to the soil and site conditions, tolerant of the anticipated depth of sediment deposition, and tolerant of the anticipated amount of farm machinery traffic. Upon successful establishment they shall provide cover and be capable of withstanding the design velocity. Refer to the *NRCS Plant Establishment Guide for Virginia* for allowable species and/or seeding mixtures.

Depending upon the seeding/planting period, a nurse crop such as annual rye for the fall, or an annual such as foxtail millet for the spring should

be seeded with the permanent species to provide quick cover and erosion protection. Sow small grain or millet at a rate of twenty-five (25) pounds per acre along with the permanent species. Establishment shall be monitored and the nurse crop shall be mowed as needed to prevent any adverse effect its growth may have on the establishment of the permanent species.

Legume seeds shall be inoculated within one hour prior to planting time with the proper inoculant. If more than one legume is being seeded, the correct inoculant for each legume must be used. Two times the recommended rate of inoculant for each seed type shall be used. A medium recommended by the manufacturer to bond the inoculant to the seed shall also be used. The inoculant and/or the inoculated seed shall be protected from the sun and excessive heat at all times. Inoculants shall not be used beyond their expiration date.

Seed shall be uniformly applied with a cultipacker-seeder, cyclone seeder, no-till drill, conventional drill, or by hand, on a firm, freshly prepared seedbed. Seed applied by broadcasting shall be covered by light disking or by using a spike tooth harrow. If seed is applied by methods other than with a cultipacker-seeder or a no-till drill, a cultipacker should be used to firm the seedbed after seeding. Seeding depth for the permanent species should be 1/4 inch on clayey soils and 1/2 inch on sandy soils. Maximum seeding depth shall be 1 inch.

When construction is performed outside of the recommended seeding dates for the selected permanent species, the waterway shall be seeded to temporary ground cover. Planting depth for small grains, millet, or Sudan grass should be 1 to 2 inches. Follow up with permanent seeding at the first available recommended planting period. When temporary cover has been seeded, use a no-till drill to seed permanent species into the temporary cover. Perform additional seedbed preparation necessary to smooth out rills and/or gullies that may have formed since the initial seedbed preparation.

All soil contact implements used in the seeding operation should be operated perpendicular to the waterway length.

Mulching

Mulch shall be applied on all grassed waterways. Refer to the Virginia Conservation Practice Standard *Mulching (Code 484)* for requirements.

Generally, small grain straw is more readily available, and is the predominant choice as a mulching material. If straw is selected as the mulching material, it shall be applied at the rate of two (2) tons per acre immediately after seeding operations are completed.

When straw mulch is anchored with approved netting, it shall be installed in accordance with the manufacturer's specifications.

Depending on site conditions and design criteria, additional or substitute protective measures will be used if determined to be needed in vegetated waterway channels. Examples include jute mesh, silt fences, bale barriers, and soil stabilization blankets or mats. Straw bale barriers and other protective measures shall be properly installed. Follow manufacturer's specifications and recommendations in the installation of man-made measures. The Virginia Erosion and Sediment Control Handbook may also be used as a guide.

Environmental Concerns

All required federal, state, and local permits must be obtained by the owner prior to NRCS construction assistance.

Potential impacts to adjacent wetland areas must be addressed. USDA wetland conservation provisions apply. The practice must comply with NRCS wetland technical assistance policy contained in GM 190, Part 410.26.

Planning and implementation of this practice will be preceded by an environmental evaluation using the "Environmental Evaluation Data Sheet", form VA-EE-1 and related guidelines found in GM-190, part 410 (Virginia Amendments).

Reporting and/or certification procedure

Reporting the grassed waterway as "applied" and/or certifying the completion of this practice

will only be done after the practice has been installed in accordance with this conservation practice standard and seeding/planting of the permanent species was performed within the recommended time period. If seeding/planting of the permanent species is performed outside of the recommended time period, reporting and/or certifying will not be done until the vegetative cover becomes sufficiently established to carry out its intended function.

CONSIDERATIONS

Important wildlife habitat, such as woody cover or wetlands, should be avoided or protected if possible when siting 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. Mid-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.

Consider the establishment of wildlife enhancing cover types and species on waterways, or consider adding width of appropriate vegetation to the sides of the waterway for wildlife habitat.

Establish filter strips on each side of the waterway to improve water quality.

Waterways planned for crop fields under intense cultivation should be established to grasses and/or legumes that are tolerant of moderately heavy use. Provide livestock and vehicular crossings as necessary to prevent damage to the waterway and its vegetation. The type and size of farm equipment presently used or proposed on fields associated with the waterway will affect the design and the species of vegetative cover selected. Generally, modern farm equipment is more easily accommodated on waterways that are shallower, broader, and have flatter side slopes. Consequently, waterways may need to be constructed wider than required by design specifications.

Consider the need for farm roads in the vicinity. Plan and establish roads concurrently with waterway construction. Waterways shall not be used as farm roads.

Consider the conservation system required for the associated field(s). The implementation and/or installation of needed practices on adjoining fields may lengthen the life of the waterway considerably. The system applied to the watershed will influence peak rate of runoff, the volume of water conveyed, and the degree of sedimentation. Grassed waterways should be constructed and adequately stabilized with permanent vegetative cover prior to the installation of practices such as diversions or terraces, or prior to receiving flow from crop rows.

Construction-related effects on downstream water resources must be considered. In addition to mulching, measures such as silt fences, straw bale barriers, temporary vegetation, jute mesh, and soil stabilization blankets or mats may be used to minimize adverse effects.

The need to line the center of the grassed waterway with stone must be considered when the waterway will be subjected to periods of prolonged flow or is expected to be wet for a long duration.

Waterways that must be stone lined to handle velocities that exceed those allowable for vegetated earthen waterways will be designed according to Virginia Conservation Practice Standard *Lined Waterway or Outlet (Code 468)*.

Use irrigation as necessary to promote germination and vegetation establishment.

PLANS AND SPECIFICATIONS

Specifications for installation and maintenance of practices installed under the Virginia Conservation Standard *Grassed Waterway (Code 412)* shall be prepared according to the Criteria, Considerations, and Operation and Maintenance described in this standard and shall be recorded on approved specification sheets, job sheets, and as narrative statements in conservation plans.

As a minimum, record and maintain the following planning and design data. Include information on either the drawings, approved forms, or in the engineering field book as appropriate:

1. Completed form VA-EE-1.

2. Location map. Including tract number, field number(s), and acreage in field(s). Include plan view of waterway in relation to an identifiable point.
3. Field survey notes.
4. All pertinent design information such as: drainage area, runoff curve number, vegetative retardance, V1 and V2 velocity, channel grade, and peak rate of runoff. Separate the data required for each segment (reach) of the main or lateral, if applicable.
5. Required design top width and depth for each segment (reach). Show bottom width and side slope ratio for trapezoidal cross sections.
6. Planned construction dimensions (including allowances for topsoiling procedure) and length of waterway.
7. Vegetative establishment requirements. (Shall include as a minimum: approximate acres to be seeded, topsoiling procedure if required, soil amendments to be applied, species and rates of vegetative cover proposed, mulching and/or other protective measures required, amount of netting needed, and recommended date of planting).
8. Document in the case file that copies of the construction plan and the vegetation establishment requirements have been provided to the landowner or the designated decisionmaker.

As a minimum, record and maintain the following check out data:

1. Cross-section at the main outlet and at the confluence of any laterals. Also, cross-sections at other areas along the main or laterals if depth and/or width dimensions are less than those measured at their respective outlet.
2. Grade and length of waterway channel. Grades and lengths will be shown by segments where applicable.
3. Deviations from the planned design, if applicable. Deviations will meet the

requirements of this Standard. If unforeseen conditions prevent meeting this Standard, justification will be thoroughly documented, and the appropriate NRCS Engineer will be contacted for approval.

4. A statement indicating extent of compliance with this Standard will be included on the design documentation. Document the condition of vegetative cover at time of final check out.
5. Actual seeding date.
6. Total acreage of waterway.
7. Certifying signature along with date of practice acceptance.

All field survey notes and construction check data will be recorded in a standard engineering field book or other approved forms in accordance with Technical Release 62 and Chapter 1, Engineering Field Handbook.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be provided to and reviewed with the landowner. The plan should include the following items and others as appropriate:

A maintenance program shall be established to maintain waterway capacity, vegetative cover, and outlet stability. Vegetation damaged by machinery, herbicides, or erosion must be repaired promptly.

Seeding shall be protected from concentrated flow and grazing until vegetation is established.

Restrict heavy equipment access and exclude cattle when waterway is abnormally wet.

Inspect waterways regularly, especially after heavy rains. Damaged areas will be filled, compacted, and seeded immediately. Remove sediment deposits to maintain capacity of grassed waterway. Re-fertilize, re-seed, and re-mulch as needed until cover becomes well established.

Evaluate the site within three to four months of seeding. If the stand is uniform but too thin (50 to 80% ground cover), apply additional seed during the next optimum seeding period with a no-till drill or grain drill as site conditions dictate. Areas with an establishment rate of less than fifty percent (50%) will be re-seeded in accordance with the original vegetation establishment plan.

Once the grassed waterway is established, inspection shall become an on-going process. Any damage (structural and/or vegetative) caused by farm machinery, erosion, sedimentation, drought, cattle, herbicides, etc. will be repaired promptly. Noxious weeds shall be controlled. Caution will be used when spraying chemicals on adjacent lands and/or on grassed waterways to control weeds.

Mow or periodically graze the waterway to maintain capacity and reduce sediment deposition. If the waterway is grazed or cut for hay the remaining height of the vegetative cover should be no lower than what is required to meet the design retardance level for stability.

Grassed waterways or adjacent areas established to wildlife enhancing species should not be mowed or grazed during the nesting season (April 1 to August 15). Also, these waterways should be restricted to a limited amount of farm equipment and/or vehicle traffic. Do not use the waterway as a field road.

Plowing and other tillage operations performed on adjoining cropland should be conducted in a manner to avoid dead furrows and/or prevent soil buildup along the waterway edges. If these conditions occur, the land user will need to periodically grade these areas to re-establish positive drainage into the waterway. Any areas of the waterway damaged during this procedure will be repaired promptly and re-seeded in accordance with the original vegetation establishment plan.

Remove any sediment deposits as needed to maintain capacity of the grassed waterway.

Test the soil every 3 to 4 years and apply lime and fertilizer as needed.

REFERENCES

1. NRCS Engineering Field Handbook (EFH), NEH Part 650, Chapter 1, Engineering Surveys, Chapter 2, Estimating Runoff, and Chapter 7, Grassed Waterways and Outlets.
2. Agricultural Research Service (ARS) Agricultural Handbook 667, *Stability Design of Grass-lined Open Channels*.
3. Virginia Erosion and Sediment Control Handbook, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation.
4. National Handbook of Conservation Practices Job Sheet 412- Grassed Waterway/Vegetated Filter System.
5. GM-190, Part 410, "Compliance with NEPA", Virginia Amendment.
6. *Plant Establishment Guide for Virginia* (December 2000)
7. NRCS, Virginia Field Office Technical Guide (FOTG), Section IV.
8. Ohio Engineering Programs Version 5.2- Hydrology Tools and/or Waterway Design Options

**NATURAL RESOURCES CONSERVATION SERVICE
VIRGINIA CONSERVATION PRACTICE STANDARD**

**GRASSED WATERWAY
Approved Practice Narratives**

(Acre)

(CODE 412)

412 D1 Grassed Waterway: Establish and maintain a grassed waterway in accordance with this standard and any design(s) or specification(s) provided.

412 D2 Grassed Waterway: Maintain existing grassed waterway in accordance with this standard and any design(s) or specification(s) provided.

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