

USDA
NATURAL RESOURCES
CONSERVATION SERVICE

MARYLAND CONSERVATION
PRACTICE STANDARD

GRASSED WATERWAY

CODE 412
(Reported by Ac.)

DEFINITION

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

PURPOSES

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

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

**CONDITIONS WHERE PRACTICE
APPLIES**

This practice applies to all sites where added capacity, vegetative protection, or both are required 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. This practice is not applicable where its construction would destroy important wetland or woody wildlife cover and the present watercourse are not seriously eroding.

Grassed Waterways with stone centers should be designed in accordance with Maryland conserva-

tion practice standard, Lined Waterways or Outlets, (Code 468).

CONSIDERATIONS

Consider the impacts of construction on water quality and quantity such as:

Water Quantity

1. Effects on the components of the water budget, especially on volumes and rates of runoff.

Water Quality

1. Effects on erosion and the movement of sediment, pathogens, and soluble and sediment attached substances carried by runoff;
2. Short-term and construction-related effects on downstream water resources.

Construction should be scheduled so that completion occurs during periods suitable for the establishment of vegetation. Attempt to locate waterways along natural watercourses. If watercourses are not available, locate waterway at edge of field rather than in the center. Avoid sharp turns. In crop fields, waterways that are perpendicular to crop rows are easier to maintain. Avoid locating waterways in wooded or other areas where establishment and maintenance of adequate vegetative cover will be difficult.

For additional protection of high value property such as buildings, consider higher frequency design storms.

Consider using energy dissipaters in waterways lined with erosion resistant materials when velocities exceed critical velocity.

Consider establishing filter strips on each side of the waterway to improve water quality and adding a vegetative buffer to the sides of the waterway for wildlife habitat.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

CRITERIA

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 slope is less than 1 percent, out-of-bank flow may be permitted if the out-of-bank velocity is less than two feet per second on bare soil. The minimum capacity in such cases shall be that required to convey the peak runoff from a 2-year frequency, 24-hour duration storm.

Where the waterway is an outlet for another conservation practice, the design capacity of the waterway shall be equal to or greater than that of the other practice.

Livestock and vehicular crossings shall be provided as necessary to prevent damage to the waterway and its vegetation.

Grade areas adjacent to the waterways to provide drainage toward the waterway.

Velocity

Design velocities shall be determined by using the procedures, "n" values, and recommendations in Chapter 7 of the Engineering Field Handbook, Part 650.

Retardance D shall be used to determine the stability of the waterway. Retardance B (for waterways which are not mowed) or C (for waterways which are regularly mowed) shall be used to determine that the design capacity is adequate.

The maximum velocity of the waterway shall be limited to the velocities as shown in Engineering Field Handbook, Part 650 Exhibit 7-3 (page 7-19), except that the velocity shall not exceed 6 feet per second. Velocities may be increased but may not exceed 8 feet per second with use of a permanent geotextile lining. Design and installation of geotextile shall follow manufacturer's recommendations. This maximum velocity is for the flow condition based on the 10-year, 24-hour storm and D retardance.

The minimum velocity of the waterway shall be 2 feet per second (fps) for a 10-year, 24-hour

peak runoff and using a retardance of either B or C, as appropriate.

Width

The bottom width of trapezoidal waterways shall not exceed 50 feet unless multiple or divided waterways or other means are provided to control meandering of low flows.

Side Slopes

Side slopes shall not be steeper than a ratio of two horizontal to one vertical. Design side slopes to accommodate the land user's maintenance equipment. The cross section shall be designed to permit easy crossing by equipment where necessary.

Depth

The minimum depth of a waterway shall be that required to keep the design runoff in the waterway.

Freeboard of 0.3 feet above the designed depth shall be provided when flow must be contained to prevent damage.

Drainage

Designs for sites having prolonged flows, a high water table, or seepage problems shall comply with Maryland conservation practice standards for Subsurface Drains (Code 606), Underground Outlets (Code 620), Lined Waterway or Outlet (Code 468) or other suitable measures to avoid saturated conditions. Avoid placing subsurface drainage in the center of the waterway. Water-tolerant vegetation may be an alternative on some wet sites.

Structural Measures

In cases where grade or erosion problems exist, special control measures may be needed such as stone centers, drop structures, or grade stabilization structures. Design in accordance with the appropriate guidelines and standards.

Stone centered waterways may be used where there is prolonged flow and wetness. For stone center waterways, refer to exhibit 7-6, (page 7-48) Engineering Field Handbook, Part 650 to

determine the stone size. The allowable velocity for stone centered waterways may be increased by 2.0 feet per second above that for a grassed lined waterway. The width of the stone lining shall be from 1/3 to 2/3 the width of the waterway with a thickness equal to 1.5 times the maximum stone size.

Linings of erosion resistant materials must be porous enough to permit water to freely pass. Use geotextile fabrics or granular filters to prevent movement of subgrade soils through the lining on all non-cohesive soils. Cohesive soils are defined as soils meeting the unified criteria of CL, CH, SC, or CG. Filters to prevent piping shall meet the gradation criteria given in Chapter 26, Gradation Design of Sand and Gravel Filters, Part 633 National Engineering Handbook.

Due to high velocities, waterways lined with erosion resistant materials shall have a freeboard of 0.25 feet above the design water depth.

Vegetation

The Maryland conservation practice standard for Critical Area Planting (Code 342) shall be used to determine the appropriate grass species to be established based on site conditions and use. Plants listed on the Maryland noxious weed list shall not be planted. Construction should be scheduled so that completion occurs during periods suitable for the establishment of vegetation.

Establishing vegetation is critical in successfully installing grassed waterways. Special protection measures such as mulch anchoring, erosion control matting, straw or hay bale dikes, or other diversion methods may be used as needed to protect newly seeded waterway. Supplemental irrigation may also be warranted. The vegetation should be well established (85% plant cover) before large flows are permitted in the channel.

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, a stream channel, an earthen ditch, a grade stabilization structure, or other suitable outlet.

Materials

Rock Riprap – Rock riprap shall meet the requirements of Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, Section 311.

Gravel - Crushed rock or gravel shall be compliant with gradations and quality found in the Maryland State Highway Administration, Standard Specifications for Construction and Materials, Section 901.

Erosion Control Matting - Erosion control matting shall meet requirements of 1994 Maryland Standards and Specifications for Soil Erosion and Sediment Control and be installed in accordance with manufacturer's recommendations.

Permanent geotextile will be installed in accordance with manufacturer's recommendations.

SPECIFICATIONS

Plans and specifications for grassed waterways shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

All trees, stumps, brush and similar material shall be removed from the site and disposed of in a manner consistent with proper functioning of the waterway and environmental concerns.

The waterway shall be shaped to the grade and dimensions shown on the plans. Avoid installation of the waterway in fill material. Topsoil shall be stockpiled and spread where necessary to provide a seedbed for the vegetation.

Excess earthen materials shall be spread where it will not interfere with flow into the waterway. If necessary, excess water shall be diverted away until vegetation is established. Any protective works shall be removed, and the disturbed areas that are not to be farmed shall be seeded to permanent grass.

OPERATION AND MAINTENANCE

A written operation and maintenance plan shall be provided to and reviewed with the landowner. The plan shall 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.

1. Inspect for damage at least once a year and after each major storm. Fill in and seed any bare or washed areas following original seeding specifications;
2. If waterways are not fertilized at the same time that the surrounding cropland is fertilized, a maintenance application should be made. Apply one-half the amount of fertilizer used during vegetation establishment as needed to maintain a vigorous sod;
3. Minimize damage to vegetation by excluding livestock or by only allowing controlled grazing;

4. Remove sediment deposits to maintain capacity of grassed waterway;
5. Mow or control graze vegetation periodically to encourage dense vigorous growth and to maintain capacity.
6. Control noxious weeds as required state law;
7. Do not use as a field road. Avoid crossing with heavy equipment when wet;
8. Avoid turnrows or plowing parallel to waterway to prevent flow from entering channel;
9. Avoid spraying waterway with herbicides during crop applications and herbicide runoff into the waterway.
10. To enhance wildlife values, avoid mowing the diversion during the peak nesting season (April 15 to August 15).

SUPPORTING DATA AND DOCUMENTATION

Field Data and Survey Notes

The following is a list of the minimum data needed:

1. Plan view sketch;
2. Slope of each design reach (hand level survey permitted when slope is steeper than 2 percent);
3. Cross-section (minimum of one per reach not to exceed 300 ft);
4. Lengths of each reach and total length;
5. Profile and cross section of outlet and special protection if needed.

Design Data

Record on appropriate engineering paper. For guidance on the preparation of engineering plans see chapter 5 of the EFH, Part 650. The following is a list of the minimum required design data:

1. Locate practice on farm plan map in the case file;
2. Plan view including, location map, all system components, material and construction specifications;
3. Determine soil type, and any special restrictions. Provide soil loss calculations;
4. Determine peak runoff from the contributing drainage area for the required design storm in accordance with Chapter 2, Engineering Field Handbook, Part 650 or by other approved method;
5. Design for each reach in accordance with Chapter 7, Engineering Field Handbook, Part 650, or other source;
6. Show job class on plan;
7. Profile of waterway when slopes are less than 2%.
8. Profile of waterway when elevations are critical on slopes 2% or greater.
9. Cross section of each design reach to be shown on plans.
10. Quantities estimate;

11. Details of outlet protection or other structural components needed;
12. Planting plan. This must meet the criteria, specifications, and documentation requirements of the Maryland conservation practice standard for Critical Area Planting (Code 342). Show on plan;
13. Written Operation and Maintenance plan.

Construction Check Data/As-Built

Record on survey notepaper, SCS-ENG-28, or other appropriate engineering paper. Survey data will be plotted on plans in red. The following is a list of minimum data needed for As-builts:

1. Documentation of site visits on CPA-6. The documentation shall include the date, who performed the inspection, specifics as to what was inspected, all alternatives discussed, and decisions made and by whom;
2. Check notes recorded during or after completion of construction showing grade and cross section of constructed reaches and outlets including length, width and depth;
3. Calculate acreage;
4. Statement on seeding and fencing;
5. Final quantities and documentation for quantity changes, and materials certification;
6. Sign and date checknotes and plans by someone with appropriate approval authority. Include statement that practice meets or exceeds plans and NRCS practice Standards.

REFERENCES

1. Gradation Design of Sand and Gravel Filters, *National Engineering Handbook*, Part 633, Chapter 26.
2. Maryland Department of Environment, 1994 *Maryland Standard and Specifications for Soil Erosion and Sediment Control*.
3. Maryland Department of Transportation, State Highway Administration, *Standard Specifications for Construction and Materials*, Baltimore, Maryland, October 1993.
4. USDA, Natural Resources Conservation Service, *Maryland Field Office Technical Guide, Section IV, Standards and Specifications*.
5. USDA Natural Resources Conservation Service, *National Engineering Handbook*, Part 650 Chapters 2 and 7.
6. USDA Natural Resources Conservation Service, *National Handbook of Conservation Practices*.