

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

VEGETATIVE BARRIER

(Ft.)

CODE 601

DEFINITION

Permanent strips of stiff, dense vegetation established along the general contour of slopes or across concentrated flow areas.

PURPOSE

- Reduce sheet and rill erosion.
- Reduce ephemeral gully erosion.
- Manage water flow.
- Stabilize steep slopes.
- Trap sediment.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where sheet and rill and/or concentrated flow erosion are resource concerns.

This practice is not well suited to soils that are shallow to rock or other restrictive layers, and to tilled crop strips. The "benching" process that occurs on slopes where barriers are installed (tillage erosion moves soil from the upper part of the cropped strip, which then accumulates in the lower part of the cropped strip) can expose soil material unfavorable for crop growth.

CRITERIA

General Criteria Applicable to All Purposes

Physical Characteristics of Plants

Stiffness Index

Establish vegetative barriers to vegetation having the minimum Vegetation Stiffness Index (VSI) designated in Table 1 measured at a point 6 inches above the ground.

Table 1. Stem Diameter and Minimum Stem Density Values for Vegetation Stiffness Index (VSI) Values of 0.05 and 0.10

Stem Diameter (Inches)	Concentrated Flow Areas Stem Density Per Square Foot @VSI=0.1	Other Purposes Stem Density Per Square Foot @VSI=0.05
0.10	1000	500
0.15	200	100
0.20	60	30
0.25	30	15
0.50	20	10
=/>1.00	1.0	1.0

Density

Gaps between plants will be no greater than 3 inches at the end of the first growing season.

Species Selection

Species must be adapted to local soil and climate conditions, be easily established, long-lived, and manageable.

Select species which exhibit characteristics that are required for adequate function such as: emergence through several inches of sediment or resuming growth from buried stem nodes; rhizomatous or stoloniferous growth habit; and stems that remain intact and erect year round.

Refer to Colorado Plant Materials Technical Note 59, Table 5, for information regarding plant suitability by Major Land Resource Area.

Vegetation in the barrier will be tolerant to herbicides used in the cropped field.

Do not establish any plant that is on the Federal or State noxious weed list.

Establishment

Establish barriers vegetatively or from seed.

Seeding dates, depths and rates will be appropriate for the species selected and the conditions of the site. Insure good seed-to-soil contact when planting seeds.

Plant vegetatively established barriers at a density to insure a functional barrier as quickly as possible (usually two growing season). For most herbaceous species, this will require a spacing in the row of no more than 6 inches for bare-root seedlings, cuttings, sod chunks, plugs, rhizomes, or divisions consisting of no less than 5 viable stems. Establish suckering shrubs or herbaceous species established from 6-inch (gallon) potted material at a spacing of no more than 12 inches.

Site preparation must be sufficient to ensure seed germination or proper rooting conditions for vegetated material establishment. Place plants to insure good root-to-soil contact, and pack after planting.

Use appropriate site stabilization measures such as erosion control blankets, silt barriers or mulches, during the barrier establishment period.

Barrier Width

Barrier widths will be 3 feet or 0.75 times the design vertical interval, whichever is larger. Plant broadcast or drilled seed in a strip at least 3 feet wide. Seed sown with a row planter will be seeded in a minimum of 2 rows.

Additional Criteria to Reduce Sheet and Rill Erosion**Gradient**

Gradients along the barrier will be no less than 0.2 percent and no greater than 1.0 percent, except where the vegetative barrier crosses concentrated flow areas. Gradients entering a concentrated flow area may be up to 1.5 percent for 100 feet in order to better align the rows.

All tillage and equipment operations in the interval between barriers will be parallel to the vegetative barrier.

A berm must exist at the upslope edge of the barrier and/or a channel must exist immediately upslope of the barrier to divert water along the vegetative barrier. The minimum berm height/channel depth is 3 inches. Deliver water flowing along a vegetative barrier berm/channel to a stable outlet.

Spacing

Horizontal spacing between the vegetative barriers will be determined using the lesser of the horizontal distance between barriers when the vertical interval is 6 feet, or the RUSLE2 "L" that achieves the allowable soil loss for the field considering the planned practices in the conservation management system.

Plan crop strip widths in multiples of widths of planting, tillage, spraying and harvest equipment. A 10 percent adjustment to the spacing between the barriers is allowable.

Vegetation

Select vegetation species to provide the designated minimum stem density with the designated stem diameter, and have a minimum VSI of 0.05. See Table 1 for guidance.

Additional Criteria to Reduce Ephemeral Gully Erosion**Alignment**

Vegetative barriers may be installed across concentrated flow areas perpendicular to the direction of water flow.

Width and Length

Vegetative barriers for this purpose will consist of a minimum of 2 rows. Vegetative barrier length will vary depending on the topography. Each strip will be long enough to ensure that the ends of the strip are at least 1.5 feet higher than the center of the concentrated flow area (see Figure 1). If a concentrated flow area has a pre-existing headcut, place one row of a barrier at the bottom of the headcut and the other row at the top.

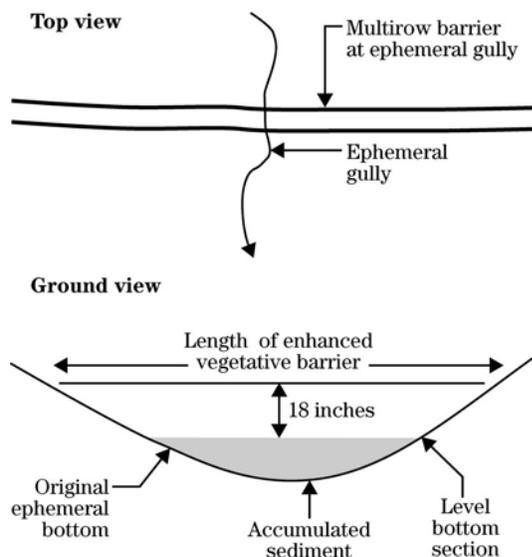


Figure 1. Barriers in concentrated flow areas must extend far enough up the hillslope to avoid bypass around the ends of the barrier during peak flows.

Spacing

Base the spacing between vegetative barriers on a vertical interval of 1.5 feet for conditions where there is no tillage between the barriers, and 3 feet for all other conditions where sediment deposition and bench development is anticipated.

Crop strip width will be in multiples of widths of planting, tillage, spraying, and harvesting equipment. A Adjustments of ± 10 percent in the width of the crop strip are allowed to accommodate equipment operations.

Minimum Level Bottom Section Length

The minimum level bottom section length (in feet) shall be numerically equal to the peak discharge [in cubic feet per second (cfs)] for a 2-year 24-hour design storm from the total watershed upslope of the lowest barrier. This equates to a specific discharge of 1 cfs/ft of vegetative barrier. The level bottom section is the bottom width of a trapezoidal waterway shaped during construction, or formed by sediment deposition (See Figure 1). Use methods in Chapter 2 of the Engineering Field Handbook to estimate peak discharge for local soil, climate and management conditions.

If the channel does not have a level bottom section, design the barriers so that the peak discharge through the barriers for a 2-year, 24-hour storm does not exceed allowable velocities for the soil, vegetation, and slope conditions as determined using Chapter 7 of the Engineering Field Handbook.

Vegetation

Establish species that will provide the designated minimum stem density with the designated stem diameter and have a VSI of 0.10. See Table 1 for guidance.

Additional Criteria to Manage Water Flow

Gradient

Barriers will have a minimum grade of 0.2 percent and a maximum grade of 1.0 percent, except where the vegetative barrier crosses a concentrated flow area. Gradients entering a concentrated flow area may be up to 1.5 percent for 100 feet in order to better align the rows.

The minimum berm height/channel depth along the upper edge of the barrier is 3 inches.

Deliver water flowing along the barrier to a stable outlet.

Width and Length

Vegetative barriers may consist of 1 or 2 rows. Vegetative barriers may be wider to adjust for planter and/or sprayer width, or for improved contour alignment. Vegetative barrier length will vary depending on the topography. Each strip will be long enough to ensure that the ends of the strip are at least 1.5 feet higher than the center of the concentrated flow area (see Figure 1).

Spacing

Horizontal spacing between barriers shall be the lesser of the horizontal distance between barriers with a vertical interval of four feet, or the RUSLE2 "L" that achieves the allowable soil loss for the field, considering the planned practices in the conservation management system.

To retard and spread run-off, the maximum vertical interval is 1 foot.

Plan crop strip widths in multiples of widths of planting, tillage, spraying and harvest equipment. A 10 percent adjustment to the spacing between the barriers is allowable.

Maximum Watershed

The maximum watershed for a vegetative barrier system is the smaller of the size that will provide runoff to impound 1 foot of water upslope of the lowest barrier in the system, or generate the maximum allowable velocity on bare soil for the soil texture in the concentrated flow area as determined in Chapter 7 in the Engineering Field Handbook.

Vegetation

Establish species that will provide the designated minimum stem density with the designated stem diameter, and have a VSI of 0.05 for areas diverting runoff, and a VSI of 0.1 for areas retarding and ponding runoff. See Table 1 for guidance.

Additional Criteria to Stabilize Steep Slopes

For this purpose, concentrated flow channels may not exist on slopes. Disperse concentrated flows before applying this practice to stabilize steep slopes.

Barrier Row Grade

The maximum grade of barrier rows shall not exceed 1/2 of the up-and-down hill slope percent used for conservation planning, or 2 percent, whichever is less.

Spacing

The maximum vertical interval for this purpose is 6 feet when barriers are designed so that runoff water flows along the barrier and not through it (i.e. functions as a terrace); and 4 feet when overland flow occurs between the barriers.

Vegetation

The vegetation will be deep-rooted species that establish easily and grow rapidly.

The vegetation stiffness shall provide the designated minimum stem density with the designated stem diameter and have a VSI of 0.05 based on Table 1.

Additional Criteria to Trap Sediment**Alignment**

Barriers will be aligned as close to perpendicular as possible to flows from fields or out of the ends of furrows.

Width

Vegetative barriers for this purpose will be a minimum of 3 feet wide.

CONSIDERATIONS**General Considerations**

Conservation Crop Rotation 328, and Residue and Tillage Management 329, 345 and 346 can decrease sheet and rill erosion on cropland.

Water and Sediment Control Basin 638, Subsurface Drain 606, and Underground Outlet 620, are practices for management of surface and subsurface water.

This practice may improve the efficiency of other practices such as Stripcropping 585, Filter Strip 393, Riparian Forest Buffer 391, Grassed Waterway 412, Diversion 362 and Terrace 600.

On tilled fields, consider soil profiles that have sufficient depth to retain productivity where benches will develop as soil moves down gradient by tillage. Soil upslope of barriers will gradually build up while soil down slope of the barrier moves down the slope. Consider the effect of this movement with respect to soil depth, subsoil characteristics and response to soil amendments.

Established vegetative barriers systems can pond water above the barriers. For these situations, install subsurface drains across the slope parallel to the barrier or through the ponded areas above barriers installed across concentrated flow areas.

Increasing the minimum width of the barrier and choosing species with greater above- and below-ground biomass will increase the potential for carbon sequestration.

Considerations to Enhance the Functioning of Other Practices**Filter Strips**

Vegetative barriers incorporated into the upslope portion of filter strips will increase filter strip longevity by promoting sediment deposition above the filter strip.

Field Borders

Vegetative barriers incorporated into the upslope portion of field borders at the bottom of slopes will increase field border longevity by promoting sediment deposition above the field border.

Riparian Forest Buffers

Vegetative barriers can decrease sediment delivery to riparian buffers when located just upslope of the buffer. Consider the shading effects on vegetative barrier growth when selecting species for this purpose.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for each field or treatment unit according to the Criteria and Operation and Maintenance sections of this standard. Specifications shall describe the requirements for applying this practice to meet the intended purpose.

Record practice specifications on the Colorado Vegetative Barrier, 601 Conservation Practice Job Sheet.

Plans and specifications will include the following components, as a minimum.

1. Field map with location of vegetative barrier(s)
2. Length, width and number of rows for vegetative barrier(s)
3. Field slope, and horizontal and vertical intervals between barriers, for barrier systems
4. Vegetative stiffness index value, stem diameter and minimum stem density
5. Vegetative species, seeding rate and seeding date
6. Barrier establishment procedures, site preparation and fertilizer
7. Site stabilization or mulching if needed, to ensure barrier establishment

OPERATION AND MAINTENANCE

Carry out the following actions to insure that this practice functions as intended, including normal application and use of the practice and repair and maintenance of the practice.

1. Establishment failures will be replanted or reseeded immediately; short gaps in seeded barriers may be reestablished more effectively and immediately with transplanted plant material.
2. Mowing vegetative barriers to encourage the development of a dense stand and prevent shading of crops in adjacent fields is acceptable. Mow at a 15-inch stem height, or the recommended height for the species, whichever is taller.
3. Mow barriers in concentrated flow areas during their dormant period to avoid reducing the average stem diameter and thus lowering the VSI.

4. Burning barriers is acceptable if the species used will tolerate fire. Carry out burns just prior to the spring regrowth period while the vegetation is dormant. Conduct burns in accordance with State and local requirements.
5. Control any plant on the Federal or State noxious weed list. Control other weeds as necessary to ensure a dense stand within the barrier.
6. Crop tillage and planting operations will be parallel with the vegetative barrier.
7. Perform pest management in adjacent fields with techniques and pesticides that will not damage the vegetative barrier.
8. Fill washouts or rills that develop and replant immediately. Reestablish short gaps in established barriers with transplanted plant material.
9. Do not use Vegetative Barriers as a field road or turn row. Do not cross Vegetative Barriers in concentrated flow areas with machinery.
10. Do not cross Vegetative Barriers with water furrow plows or similar implements to cut drainage ditches to allow the passage of surface and subsurface water. If necessary, drain water with underground outlets installed up gradient of the barrier.

REFERENCES

Colorado Field Office Technical Guide, Section I. Plant Materials Technical Note No. 59. 2002. Plant Suitability and Seeding Rates for Conservation Plantings in Colorado. USDA, NRCS, Lakewood, CO.

http://efotg.nrcs.usda.gov/references/public/CO/COPMTN_59.pdf

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