Vegetative Barrier (Feet) 601

DEFINITION

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

PURPOSES

- 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 eroding areas, including but not limited to: cropland, pastureland, rangeland, forestland, mine land, construction land, and the farm headquarters.

This practice applies only when used in conjunction with other conservation practices as part of a conservation management system.

CRITERIA

General Criteria Applicable to All Purposes

Physical Characteristics of Plants

Stiffness Index. Vegetative barriers will have the minimum Vegetation Stiffness Index (VSI) designated in Table 1 measured at a point 6 inches above the ground. VSI values reflect the importance of large stems in keeping barriers upright during runoff events.

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

Stem Diameter (Inch)	Concentrated Flow Areas Stem Density Per Square Foot @VSI=0.10	Other Purposes Stem Density Per Square Foot @VSI=0.05
0.10	1,000	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. Use species adapted to local soil and climate conditions, easily established, long-lived, and manageable. Select species that exhibit characteristics required for adequate function such as: emergence though 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. Take care when selecting plants to avoid invasive species. *Current approved species are Miscanthus or Switchgrass.*

Establishment of Vegetative Barriers

Establish Vegetative Barriers from roots, stems, transplants, or seed.

Use the seeding date, depth, and rate appropriate for the species selected and the site conditions. Firm the seedbed with a rolling cultipacker or similar tool if needed to ensure good seed soil contact.

Plant vegetative plugs or transplants in a single row at a dense enough spacing to ensure a functional barrier in one growing season. Spacing requirements are as follows:

1. For most herbaceous species, no more than 6 inches for bare-root seedlings, cuttings, sod chunks, plugs, rhizomes, or divisions consisting of no less than 5 viable stems.

2. For suckering shrubs or herbaceous species from 6-inch (gallon) potted material, no more than 12 inches.

Prepare the site to ensure seed germination or vegetated material establishment.

Use the optimum planting dates for the species selected and pack the soil after planting to ensure good root-to-soil contact.

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

Barrier Alignment. Remove obstructions, such as trees and debris that interfere with vegetative growth and maintenance, to improve vegetation establishment and alignment.

Barrier Width. Barrier widths will be the largest of 3 feet wide or 0.75 times the design vertical interval. Broadcast or drill seed in a strip at least 3 feet wide. If a row planter is used, sow a minimum of 2 rows per vegetative barrier.

Use multiples of planting and spraying equipment to plan crop strip width. Adjust width upward to 10% of planned width between the barriers.

Additional Criteria for Reducing Sheet and Rill Erosion

Erosion reduction by barriers is achieved by diverting flow, which reduces slope length (RUSLE 2 "L"), and/or through supporting practices such as permanent contour buffer strips.

Gradient. Gradients along the barrier will be no less than 0.2% and no greater than 1.0% except where the vegetative barrier crosses concentrated flow areas. Gradients entering a concentrated flow area may be up to 1.5% for 100 feet in order to get better row alignment.

In the interval between barriers, farm parallel with all tillage and equipment operations.

In order to redirect flow, and reduce slope length, a berm must exist at the upslope edge of the barrier and/or a channel must exist immediately upslope of the barrier. A berm or channel may develop at the upslope edge of the barrier or construct a berm to redirect flow. The minimum berm height/channel depth will be 3 inches or as high as required by local conditions. Normal tillage operations may form these berm/channels along the edge of the grass, but these berms will not form in no-till residue management systems. Where berm/channels are used, a stable conveyance system for control of concentrated runoff must exist in flow areas that receive diverted runoff.

Spacing. Determine the horizontal spacing between the vegetative barriers using RUSLE 2 calculations. Select the lesser of:

1. A vertical interval of no more than 6 feet,

2. An allowable "L" that achieves soil loss tolerance (T) for the planned conservation management system.

Vegetation. Select vegetation that will provide the designated minimum stem density and stem diameter with a vegetation stiffness index (VSI) of 0.05.

Additional Criteria for Reducing Gully Erosion

Alignment. Many fields have too much undulation to allow alignment on the contour across a concentrated flow area at angles convenient for the operation of farm equipment. In such terrain, install vegetative barriers across concentrated flow areas perpendicular to the direction of water flow. Vegetative barriers, when used to control ephemeral erosion, do not need to extend across the ridge top where water does not flow into the vegetative barrier.

Width and Length. Vegetative barriers will consist of a minimum of 2 rows. Vegetative barrier length will vary depending on the topography. As a minimum, each strip will extend far enough to provide 1.5 feet of elevation from the center of the flow area to the end of the vegetative barrier (Figure 1). To adequately treat pre-existing headcuts along the ephemeral, place one row of a barrier at the bottom of the headcut and the other row at the top.

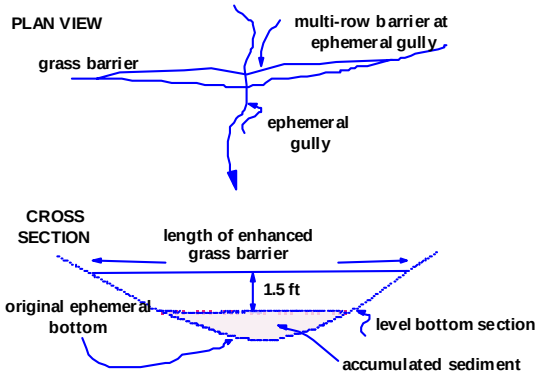

FIGURE 1 – Two row barriers in concentrated flow areas must extend long enough to avoid bypass around the ends at high flow.

Spacing. This practice functions by having backwaters from one barrier extend up to the base of the next barrier up slope. This backwater dissipates energy and causes sediment deposition in the gully channel.

Horizontal spacing between the vegetative barriers will be based on the vertical interval of 1.5 feet for conditions where no tillage is performed between the barriers and 3 feet for all other conditions where sediment deposition and bench development is anticipated.

Allow adjustments of 10% of the planned width of the crop strip between the barriers. Plan the crop strip width to fit multiple widths of planting, tillage, spraying, and harvesting equipment for wildlife habitat or maintenance concerns.

Minimum Level Bottom Section Length. The minimum level bottom section length (in feet) shall be numerically equal to the peak discharge (in 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 vegetative barrier. Level bottom section is defined as the bottom width of a trapezoidal waterway. Shape the outlet during construction or allow sediment to form the level bottom section by deposition (Figure 1). Use methods in the NRCS Engineering Field Handbook Chapter 2 to estimate peak discharge for local soil, climate, and management conditions.

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

Vegetation. Select vegetation that will provide the designated minimum stem density and stem diameter with a vegetation stiffness index (VSI) of 0.10 (Table 1).

Additional Criteria for Managing Water Flow

For this purpose, barriers are designed to slow runoff by increasing path length and by retarding and spreading run-on water for subsequent treatment within filter strips and flow channels to remove contaminants by ponding, filtration, infiltration, and exposure to sunlight.

Gradient. In order to divert flow, gradients along the barrier will be no less than 0.2% nor no greater than 1.0% except where the vegetative barrier crosses a draw (a concentrated flow area). Gradients entering a concentrated flow area may be up to 1.5% for 100 feet in order to get better row alignment.

In order to redirect flow, a berm must exist at the upslope edge of the barrier and/or a channel must exist immediately upslope of the barrier. Minimum berm height/channel depth will be 3 inches or as high as required by local conditions. These berm/channels may be created by normal tillage parallel to the vegetative barrier, but would need to be pre-formed in no-till situations.

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. At a minimum, each strip will extend far enough from concentrated flow areas to provide 1.5 feet of elevation from the center of the flow area to the end of the vegetative barrier (Figure 1).

Spacing. Determine the horizontal spacing between the vegetative barriers using RUSLE 2 calculations or actual measurements. Select the lesser of:

- A vertical interval of no more than 6 feet,
- An allowable "L" that achieves soil loss tolerance (T) for the planned conservation management system.

For barriers intended to retard and spread run-on, the maximum vertical interval is 1 foot.

Maximum Watershed. The total watershed in a vegetative barrier system will be 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 water velocities greater than allowed on bare soil for the soil texture in the concentrated flow area.*

* - See Engineering Field Handbook, Chapter 7.

Vegetation. Select vegetation that will provide the designated minimum stem density and stem diameter and have a vegetation stiffness index (VSI) of 0.05 for areas diverting runoff and VSI of 0.10 for areas retarding and ponding runoff (Table 1).

Additional Criteria for Stabilizing Steep Slopes

Use vegetative barriers to stabilize steep slopes if they are used in combination with other bioengineering principles. Concentrated flow channels are not acceptable on the slope face.

Alignment. Install the barrier on the contour. However, if overland water flow is expected down the slope face, the barrier alignment may deviate from the contour up to a grade of 2% to divert water.

Spacing. Determine the horizontal spacing between the vegetative barriers spacing that

1. Results in a vertical interval of no more than 6 feet.

2. If overland water flow is expected down the slope face, reduce the vertical interval of the barriers to no greater than 4 feet.

Vegetation. The vegetation will be a deeply rooted species that establishes easily and grows rapidly.

Select vegetation stiffness that will provide the designated minimum stem density and diameter with a vegetative stiffness index (VSI) of 0.05 (Table 1).

Maximum Watershed. No maximum watershed size is given as criteria for this purpose. If, however, concentrated flow occurs on the steep slope, install mitigation practices, such as a terrace or diversion, to eliminate the concentrated flow.

Additional Criteria for Trapping Sediment at the Bottom of Fields and/or the Ends of Furrows

Do not credit in field erosion reduction for barriers installed to trap sediment at the end of fields. Use barriers only for sediment trapping at the edge of the field or end of furrows where the area above is already within soil loss tolerance (T). They will effectively reduce sediment delivery to surface water down slope of the barrier and are desirable additions to conservation management systems.

Alignment. Use vegetative barriers as field buffers at the bottom of fields and/or the ends of furrows whether the furrows are aligned up and down the slope, across the slope, or on the contour.

Width. The minimum width is 3 feet for vegetative barriers used as field buffers. There is no maximum crop strip width or slope length.

CONSIDERATIONS

During the planning process, consider the following:

General Considerations

Consider management practices such as conservation cropping rotation and residue management in designing the cropland conservation system.

Add associated structural practices such as water and sediment control basins, subsurface drainage, and underground outlets to adequately handle surface and subsurface water.

This practice may improve the efficiency of other practices such as stripcropping, filter strips, riparian forest buffers, grassed waterways, diversions, and terraces.

On tilled fields: consider soil profiles that have sufficient depth to retain productivity where benches will develop as soil is moved down gradient by tillage. Soil upslope of barriers will gradually build up while soil will be removed down slope of the barrier. Consider the effect on soil depth, subsoil characteristics, and response to amendments.

Evaluate soils in the area of the fields where barriers are being established for their potential to create field access problems by ponding water behind the barriers. Subsurface drains perpendicular to or along the length of the barrier may improve drainage of the area upslope of the barrier.

Consider the effects on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water discharge.

Consider effects on erosion and the movement of sediment, pathogens, and soluble and sediment-attached substances that would be carried by the runoff.

Consider increasing the minimum width of the barrier to increase potential for carbon sequestration.

Wildlife Habitat

Consider the effects on wetlands and water related wildlife habitats.

Consider the effects on the availability of food and nesting and escape cover.

Economics

Consider the effects on the production of crops in adjacent fields from shading, and competition for water and nutrients.

Consider the impact of land taken out of production and occupied by the vegetative barriers.

Considerations to Enhance the Functioning of Other Practices

Field Stripcropping and Contour Buffer Strips. These strips are similar to vegetative barriers except they are wider, do not have as strict alignment criteria, and require sediment accumulations to be periodically removed and redistributed on the land. Vegetative barriers established with field strips where they cross concentrated flow areas could reduce the failure of field strips caused by concentrated flow. Barriers used in association with field strips and contour buffer strips will be located immediately upslope of these 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. Locate barriers used in association with filter strips immediately upslope of and/or periodically within 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. Vegetative barriers will also additional provide wildlife cover in borders of predominantly sod-forming grasses. Locate barriers used in association with filter strips immediately upslope of and/or periodically within the filter strip.

Riparian Forest Buffers. Vegetative barriers could be used on the upslope edge of the vegetation zones. Locate barriers used in association with riparian forest buffers immediately upslope of zone two or zone three of the buffer. Consider shading effects on vegetative barrier growth when selecting species.

PLANS AND SPECIFICATIONS

Plans and specifications will include:

1. Field map with location of vegetative barriers.
2. Width of crop strip.
3. Vegetative barrier and crop strip orientation.
4. Width of barrier.
5. Vegetative species and cultivar.
6. Vegetation establishment date, seeding rate, or vegetation spacing.
7. Guidance for operation and maintenance.

OPERATION AND MAINTENANCE

Carry out the following actions to ensure that this practice functions as intended. These actions include normal activities in the application and use of the practice and repair and maintenance of the practice.

1. Replant or seed establishment failures immediately or short gaps in seeded barriers with transplanted plant material.

2. During the establishment years, use mowing of herbaceous barriers as a management practice to encourage the development of a dense stand and prevent shading of crops in adjacent fields. Do not mow closer than 15 inches or the recommended height for the species, whichever is taller. Schedule mowing to coincide with access through crops in adjacent fields. Mowing in concentrated flow areas is discouraged because it will lower the vegetative stiffness index (VSI) by reducing average stem diameter.

3. Burn some herbaceous barriers, based on a case by case analysis, to encourage the development of a dense stand and prevent the accumulation of residue in the barrier. Perform burning when the vegetation is dormant and with adequate supervision to prevent the fire from damaging surrounding areas. A controlled burn plan is required.

4. Accomplish weed control by mowing, spraying, or wick application of labeled herbicides.

5. Vegetation in the barrier will be tolerant to or protected from herbicide used in the cropped field.

6. Crop tillage and planting operations will be parallel with the vegetative barrier.

7. Use of pest control in adjacent fields will not damage the vegetative barrier.

8. Fill and plant washouts or rills that develop immediately. Use transplanted materials to fill short gaps in established barriers.

9. Do not use vegetative barriers as a field road or turn row. Vegetative barriers in concentrated flow areas will not be crossed with machinery.

10. Do not cut vegetative barriers with water furrow plows or similar implements to install drainage ditches to allow the passage of surface and subsurface water. If necessary, drain water with underground outlets installed up gradient of the barrier.