# Filter Strip (Acre) 393

**DEFINITION**

A strip or area of herbaceous vegetation situated between cropland, grazing land, or disturbed land (including forestland) and environmentally sensitive areas.

**PURPOSES**

- To reduce sediment, particulate organics, and sediment adsorbed contaminant loadings in runoff.
- To reduce dissolved contaminant loadings in runoff.
- To serve as Zone 3 of a Riparian Forest Buffer, Practice Standard 391.
- To restore, create, or enhance herbaceous habitat for wildlife and beneficial insects.
- To maintain or enhance watershed functions and values.

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies:

(1) In areas situated below cropland, grazing land, or disturbed land (including forestland).

(2) Where sediment, particulate matter, and/or dissolved contaminants may leave these areas and are entering environmentally-sensitive areas.

(3) In areas where permanent vegetative establishment is needed to enhance wildlife and beneficial insects, or maintain or enhance watershed function.

This practice applies when planned as part of a conservation management system.

**CRITERIA**

**General Criteria Applicable To All Purposes**

Filter strips shall be designated as vegetated areas to treat runoff and are not part of the adjacent cropland rotation.

Overland flow entering the filter strip shall be primarily sheet flow. Concentrated flow shall be dispersed.

State listed noxious weeds will not be established in the filter strip and will be controlled if present.

Filter strip establishment shall comply with local, state and federal regulations. *Sections 401 and 404 of the Clean Water Act may apply to filter strips adjacent to water bodies. Local permits and regulations may supersede criteria in this standard.*

**Additional Criteria To Reduce Sediment, Particulate Organics, And Sediment-Adsorbed Contaminant Loadings In Runoff**

Filter strip flow length shall be determined based on field slope percent and length, and filter strip slope percent, erosion rate, amount and particle size distribution of sediment delivered to the filter strip, density and height of the filter strip vegetation, and runoff volume associated with erosion-producing events. The minimum flow length for this purpose shall be 20 feet.

Filter strip location requirements:

- The filter strip shall be located along the down slope edge of a field or disturbed area. To the extent practical, it shall be placed on the approximate contour. Variation in placement on the contour should not exceed a 0.5 percent longitudinal (perpendicular to the flow length) gradient.
- The drainage area above the filter strip shall have greater than 1 percent but less than 10 percent slopes.

- The ratio of the drainage area to the filter strip area shall be less than 60:1 with RUSLE-R factor values 35-175.

- The average annual sheet and rill erosion rate above the filter strip shall be less than 10 tons per acre per year.

The filter strip shall be established to permanent herbaceous vegetation consisting of a single species or a mixture of grasses, legumes, and/or other forbs adapted to the soil, climate, nutrients, chemicals, and practices used in the current management system. Species selected shall have stiff stems and a high stem density near the ground surface. Stem density shall be such that the stem spacing does not exceed 1 inch.

*Pesticide applications on or near filter strips must comply with label restrictions concerning buffer areas and setbacks.*

*Contaminant source control shall be considered for all purposes of a filter strip. Reducing the total volume and the concentrations of contaminants in the run-on will increase effectiveness of the filter strip.*

Filter strips are part of a resource management system or an alternative conservation system for the land being managed. Other conservation practices and management techniques to treat the resources of concern that must be in place before the filter strip can effectively reduce the pollutants in the runoff include: erosion control, nutrient and pest management, residue management, and crop rotations.

*Filter strips will be established to suitable grasses and forbs that are adapted to the soil and climate conditions.*

*Plant species must be selected according to the type and quantity of pollutant contained in the run-on and to the growth condition during the time of year that the pollutant can be expected to move as overland flow.*

*Plant species should be selected that have stiff, upright growth characteristics for flow retardance and pollutant filtering. Plants must remain upright during flow events and be able to withstand sediment accumulation.*

*Vegetation will be mowed in the filter strip area. Mowing height criteria are given in Table 1.*

*See the NRCS MI 645 Upland Wildlife Habitat Management Standard for Operation and Maintenance mowing specifications after the stand density is adequately established.*

*Vigorous vegetation growth must be achieved under normal management situations.*

*The selected plant species must be compatible with other objectives of the landowner.*

*Vegetation in the filter strip area will consist of a single species of grass or comprised of a mixture of grasses, legumes, or other forbs.*

*Established grass vegetation must attain a minimum stem density per square foot. Legumes and other forbs must also attain a minimum stem density per square foot. The stem density criteria for specific species are given in Table 1.*

*The recommended vegetation will be selected from Table 1, Planting Table for Grasses and Legumes.*

*Vegetation establishment procedures; seeding, liming, and fertilizing; will comply with the practice standard for Critical Area Planting (342).*

*Shape and prepare a firm seedbed in a manner consistent with environmental concerns and proper functioning of the filter strip. If necessary, shape the site so conventional equipment can be used for preparing the seedbed, seeding, fertilizing, maintenance, and harvesting.*

**Additional Criteria To Reduce Dissolved Contaminants In Runoff**

The criteria given in "Additional criteria to reduce sediment, particulate organics, and sediment-adsorbed contaminant loadings in runoff" also apply to this purpose.

Filter strip flow length required to reduce dissolved contaminants in runoff shall be based on management objectives, contaminants of concern, and the volume of runoff from the filter strip's drainage area compared with the filter strip's area and infiltration capacity.

The flow length determined for this purpose shall be in addition to the flow length determined for reducing sediment, particulate organics, and sediment-adsorbed contaminant loadings in runoff.

The minimum flow length for this purpose shall be 30 feet.

For filter strips with the purpose of removing nitrogen and pesticides contained in runoff water, the following criteria will apply:

1. *Filter strips, areas down-gradient from animal waste spreading, crop fields with pesticide or fertilizer runoff, or where phosphorus runoff is a concern, use Table 6 to determine filter strip width.*

2. *Filter strips, areas down-gradient from animal waste spreading, pasture, or other organic waste material treatment where pathogens are a concern will have minimum flow lengths as shown in Table 7.*

3. *Vegetation species will be selected that have high nutrient uptake and biomass production to remove the maximum amount of nitrogen in the harvested material. If legumes are selected as a part of the vegetation mixture, they will be restricted to only deep rooted (greater than 3 feet) species.*

*Vegetation selected for pesticide removal must have tolerance to the pesticide or be able to quickly recover from effects of the pesticide being entrapped in the filter strip.*

*For P removal, the filter strip is designed and constructed to promote infiltration of the run-on water into the soil profile. Infiltration basins, filled trenches, or vegetative barriers will be part of the design.*

1. *To remove P, vegetation species will be selected that have high maximum amount of phosphorus in the harvested material.*

2. *Vegetation will be mowed and harvested in the filter strip area. Mowing height criteria are given in Table 1.*

*Using filter strips and areas as sole treatment for pathogen removal may not reduce the pathogen counts to levels meeting water quality standards. Other management practices may need implementation.*

*For pathogen removal, design and construct the filter strip to promote infiltration of the run-on water into the soil profile. Infiltration basins, filled trenches, and vegetative barriers will be part of the filter strip design.*

*Vegetation will be mowed and harvested in the filter strip area. Mowing height criteria are given in Table 1. Keeping vegetation short is desirable for pathogen removal via sunlight and desiccation.*

*Where sediment and pathogens are identified as resource concerns, design filter strips so they filter sediments first with tall vegetation next to the field edge and mow vegetation short next to the water body to reduce pathogens.*

**Additional Criteria To Serve As Zone 3 Of A Riparian Forest Buffer, Practice Code 391**

Except for the location requirements, the criteria given in "Additional criteria to reduce sediment, particulate organics, and sediment-adsorbed contaminant loadings in runoff" also apply to this purpose.

If concentrated flows entering Zone 3 are greater than the filter strip's ability to disperse them, other means of dispersal, such as spreading devices, must be incorporated.

*Zone 3 will begin at the outer edge of Zone 2 and extend up-gradient a minimum of 20 feet. Additional length may be necessary to accommodate land shaping and harvesting equipment.*

*Zone 3 is composed of grasses, legumes, or forbs, or a combination of the three vegetation types.*

*Concentrated flow in Zone 3 will be transformed to sheet flow entering Zone 2 by use of mechanisms such as land shaping, vegetative barriers, or constructed water spreaders.*

*Zone 3 component of a riparian forest buffer will have the minimum length criteria given in Table 4.*

**Additional Criteria To Restore, Create, Or Enhance Herbaceous Habitat For Wildlife And Beneficial Insects**

If this purpose is intended in combination with one or more of the previous purposes, then the minimum criteria for the previous purpose(s) must be met.

Additional filter strip flow length devoted to this purpose must be added to the length required for the other purpose(s).

Any addition to the flow length for wildlife or beneficial insects shall be added to the downhill slope of the filter strip.

Vegetation to enhance wildlife may be added to that portion of the filter strip devoted to other purposes to the extent they do not detract from its primary functions.

Plant species selected for this purpose shall be for permanent vegetation adapted to the wildlife or beneficial insect population(s) targeted.

If this is the only purpose, filter strip width and length shall be based on requirements of the targeted wildlife or insects. Density of the vegetative stand established for this purpose shall consider targeted wildlife habitat requirements and encourage plant diversity. Dispersed woody vegetation may be used to the extent it does not interfere with herbaceous vegetative growth, or operation and maintenance of the filter strip.

Livestock and vehicular traffic in the filter strip shall be excluded during the nesting season of the target species.

*Select vegetation species that are compatible to desired wildlife species (see Wildlife Upland Habitat Management Standard 645).*

*If wildlife habitat is a secondary purpose, do not compromise the function or design of the primary purpose.*

*Multiple drill widths of various grass/forb species are desirable for habitat diversity and cover. For example: a strip planted to orchardgrass, switchgrass, and garrison creeping foxtail.*

**Additional Criteria To Maintain Or Enhance Watershed Functions And Values**

Filter strips shall be strategically located to enhance connectivity of corridors and non-cultivated patches of vegetation within the watershed.

Filter strips shall be strategically located to enhance aesthetics of the watershed.

Plant species selected for this purpose shall be for establishment of permanent vegetation.

**CONSIDERATIONS**

Filter strips should be strategically located to reduce runoff, and increase infiltration and ground water recharge throughout the watershed.

Filter strips for the single purposes of wildlife/beneficial insect habitat or to enhance watershed function should be strategically located to intercept contaminants, thereby enhancing air and water quality.

To avoid damage to the filter strip, consider using vegetation that is somewhat tolerant to herbicides used in the up-slope crop rotation.

Increasing the width of the filter strip will increase the potential for capturing particulates.

Consider using this practice to enhance the conservation of declining species of wildlife, including those that are threatened or endangered.

Consider using this practice to protect National Register listed or eligible (significant) archaeological and traditional cultural properties from potential damaging contaminants.

Filter strip size should be adjusted to a greater flow length to accommodate harvest and maintenance equipment.

Select grass species that sequester more carbon.

Increasing the width of filter strip will increase the potential for carbon sequestration.

*Consider the effects of seasonal weather variations such as frozen soils, snow cover, and varying ranges of soil moisture on the efficiency of the filter strip.*

*Consider the effects of vegetation on water use and retention with the soil profile*

*Maintain a balance for the removal or accumulation of nutrients within the soil-plant system of the filter area.*

*Observe the effect on the visual quality on-site and down-gradient from the vegetated filter strip.*

*Be sure the selection and management of the vegetation is consistent with the essential purpose of the vegetated filter strip.*

*Filter strip slopes between 2 and 6 percent are most effective. Steeper slopes require a greater area and length of flow. Shallower slopes cause ponding.*

*The filter should be maintained at the minimum flow length stated in the criteria. The length may be extended if changes occur in the contributing area of the watershed that would increase the amount of runoff or pollutants toward the filter strip.*

*Filter lengths (and widths) should be adjusted to accommodate harvest and maintenance equipment.*

*Provisions for preventing continuous or daily discharge to the vegetated filter strip should be made unless an adequate area for infiltration and soil storage of all applied effluent is provided. Temporary storage or alternate areas for application of the effluent should be considered.*

*For filter areas maintained in trees and shrubs, refer to the practice standard for Riparian Forest Buffer (391).*

**PLANS AND SPECIFICATIONS**

Based on this standard, plans and specifications shall be prepared for each specific field site where a filter strip will be installed. A plan includes information about the location, construction sequence, vegetation establishment, and management and maintenance requirements.

Specifications shall include:

1) Length, width, and slope of the filter strip to accomplish the planned purpose (length refers to flow length across the filter strip).

2) Species selection and seeding or sprigging rates to accomplish the planned purpose.

3) Planting dates, care, and handling of the seed to ensure that planted materials have an acceptable rate of survival.

4) A statement that only viable, high quality, and regionally adapted seed will be used.

5) Site preparation sufficient to establish and grow selected species.

**OPERATION AND MAINTENANCE**

For the purposes of filtering contaminants, permanent filter strip vegetative plantings should be harvested as appropriate to encourage dense growth, maintain an upright growth habit, and remove nutrients and other contaminants that are contained in the plant tissue.

Control undesired weed species, especially state-listed noxious weeds.

Prescribed burning may be used to manage and maintain the filter strip when an approved burn plan has been developed.

Inspect the filter strip after storm events and repair any gullies that have formed, remove unevenly deposited sediment accumulation that will disrupt sheet flow, reseed disturbed areas, and take other measures to prevent concentrated flow through the filter strip.

Apply supplemental nutrients as needed to maintain the desired species composition and stand density of the filter strip.

To maintain or restore the filter strip's function, periodically grade the filter strip area when sediment deposition at the filter strip-field interface jeopardizes its function, and then reestablish the filter strip vegetation, if needed. If wildlife habitat is a purpose, destruction of vegetation within the portion

of the strip devoted to that purpose should be minimized by grading only to the extent needed to remove sediment and fill concentrated flow areas.

*A narrative will be prepared in the plan that will state the required operation and maintenance of the filter strip.*

1. *Concentrated flow within the filter strip area will be minimized. If concentrated flow occurs, repair and reconstruction will be made immediately to reestablish laminar (sheet) flow. Remove settled solids as much as practicable prior to directing flow to the filter strip.*
2. *Vegetation in the filter strip will be maintained in a vigorous growing condition.*
3. *The filter strip area will be maintained in the vegetative species that supports the design criteria.*
4. *The filter strip area shall be inspected on a seasonal basis and following major storm and runoff events. Any damages or sediment accumulation that would adversely impair the function of the filter must be corrected immediately.*
5. *Periodic tillage and reestablishment of some or all of the filter strip vegetation will be required as needed to remove accumulated sediment. An accumulation of sediment greater than 6 inches or any sediment accumulation that prevents the filter strip from performing as intended - this would be a criterion for removal and/or reestablishment of the affected filter strip area.*
6. *Vegetative plant density as required by the design criteria shall be maintained. It may require overseeding or other management methods such as clipping and harvesting to promote an adequate density of plant stems.*
7. *Nutrients that accumulate in the stems and leaves of the plant will be harvested and removed from the site. Periodic foliage harvest or intensive grazing as part of a planned prescribed haying and grazing system may accomplish this.*
8. *Grazing of the filter strip as part of a planned grazing system must limit access and control grazing to maintain the critical plant height listed in Minimum Mowing Height column of Table 1. Grazing the filter strip will be permitted only when the soil moisture conditions will support animal traffic without excessive soil compaction. Grazing shall be Flash Grazing in accordance with the Additional Criteria To Improve Or Maintain The Health And Vigor Of Plant Communities section of the Prescribed Grazing (528) practice standard.*
9. *Vegetation harvest must be performed on a regular basis to stimulate growth, maintain an upright growth habit, plus provide for removal of nutrients that are contained in the plant tissue.*
10. *The filter strip area and management will need to be adjusted if management changes occur in the contributing area.*
11. *Do not use filter strips as a travel way, cropland head land, or lane for livestock or farm equipment.*

**TABLE 1 - Planting Table for Grasses and Legumes**
**Recommended species of grasses, legumes, and other forbes. (Select one of the species or seeding mixes below.)**

| Species or Seeding Mixture | Cool/ Warm Season | Seeding Rate (Lb./Acre) | Established Density (Stems/$Ft^2$) | Minimum Mowing Height (In.) | Sediment Trapping | Nutrient Trapping | Wildlife Value |
|---|---|---|---|---|---|---|---|
| **Single Grass Species** | | | | | | | |
| Smooth Bromegrass | Cool | 15-30 | 50 | 4 | Y | | |
| Garrison Creeping Foxtail | Cool | 6-10 | 70 | 4 | | Y | |
| Orchardgrass | Cool | 10-15 | 70 | 4 | Y | Y | Y |
| Reed Canarygrass | Cool | 10 | 50 | 4 | Y | Y | |
| Tall Fescue ** | Cool | 15-25 | 60 | 4 | Y | | |
| Tall Wheatgrass *** | Cool | 8-12 | | 6 | Y | | Y |
| **Introduced Plant Mixtures** | | | | | | | |
| Timothy<br>Alfalfa | Cool | 5-10<br>6-10 | 60 | 4 | Y | Y | Y |
| Bromegrass<br>Alfalfa | Cool | 6-12<br>6-10 | 60 | 4 | Y | Y | Y |
| Orchardgrass<br>Alfalfa | Cool | 2-5<br>6-10 | 60 | 4 | Y | Y | Y |
| Orchardgrass<br>Timothy<br>Red Clover<br>Alfalfa | | 2.5<br>2.5<br>3<br>3 | 70 | 4 | | | |
| Orchardgrass<br>Redtop<br>Alsike Clover<br>White Dutch Clover | | 2.5<br>1<br>3<br>3 | 70 | 4 | | | |
| **Prairie Grasses** | | | | | | | |
| Intermediate Wheatgrass | Cool | 8-12 | 60 | 4 | Y | | Y |
| Big Bluestem | Warm | 10-20 | 40-50 | 10-12 | | Y | Y |
| Eastern Gamagrass | Warm | 8* | 40 | 10-12 | Y | Y | Y |
| Indiangrass | Warm | 10-15* | 40-50 | 12 | | Y | Y |
| **Native Plants** | | | | | | | |
| Switchgrass | Warm | 5-10* | 50 | 12 | Y | | Y |
| Big Blue Stem<br>Indiangrass<br>Little Blue Stem<br>Wildflower Mixture | | 2 *<br>2<br>2<br>0.5 | 50 | 12 | | | |

* Pounds of PLS - Pure Live Seed.
** Use Endophyte-free tall fescue if area is planned for grazing or forage.
*** Do not include tall wheatgrass with filter strips for forestland applications.

**TABLE 2**
**Filter Strip Length To Remove Sediment From Runoff**

| Land Slope Percent of Contribution Area (%) Above Filter Strip | Length of Flow (Feet) Hydrologic Soil Group of Filter Area | | | |
|---|---|---|---|---|
| | A | B | C | D |
| 0 - 1 | 20 | 20 | 22 | 24 |
| 1 - 3 | 20 | 25 | 28 | 30 |
| 3 - 5 | 24 | 30 | 33 | 36 |
| 5 - 8 | 28 | 35 | 40 | 42 |
| 8 - 12 | 32 | 40 | 44 | 48 |
| 12 - 15 | 40 | 50 | 55 | 60 |
| 15 - 20 | 48 | 60 | 66 | 72 |
| > 20 | * | * | * | * |

* For slopes that exceed 20%, consult NRCS technical specialist for design guidance.

**TABLE 3**
**Filter Strip Length Through Undisturbed Forest Floor Forestland**

| Land Slope Percent of Contributing Area (%) Above Filter Strip | Length of Flow (Feet) |
|---|---|
| 0 - 3 | 25 |
| 3 - 5 | 35 |
| 5 - 8 | 45 |
| 8 - 12 | 55 |
| 12 - 18 | 65 |
| 18 - 30 | 80 |
| 30 – 40 | 85 |
| 40 - 50 | 90 |
| 50 - 60 | 120 |
| 60 - 70 | 150 |
| > 70 | * |

* For slopes that exceed 70%, consult NRCS technical specialist for design guidance.

**TABLE 4**
**Filter Width For Zone 3 Vegetation In A Riparian Forest Buffer**

| Land Slope Percent of Contributing Area (%) Above Filter Strip | Length of Flow (Feet) |
|---|---|
| 0 - 8 | 20 |
| 9 - 15 | 30 |
| > 15 | 40 |

**TABLE 5**
**Filter Length For Areas Subject To Run-On Of Nitrogen And Pesticides**

| Land Slope Percent of Contribution Area (%) Above Filter Strip | Length of Flow (Feet) Hydrologic Soil Group of Filter Area | | | |
|---|---|---|---|---|
| | A | B | C | D |
| 0 - 1 | 24 | 30 | 33 | 36 |
| 1 - 3 | 32 | 40 | 44 | 48 |
| 3 - 5 | 40 | 50 | 55 | 60 |
| 5 - 8 | 48 | 60 | 66 | 72 |
| 8 - 12 | 56 | 70 | 77 | 84 |
| 12 - 15 | 72 | 90 | 100 | 108 |
| > 15 | * | * | * | * |

* For slopes that exceed 15%, consult NRCS technical specialist.

**TABLE 6**
**Filter Length For Areas Subject To Run-On Of Phosphorus**

| Land Slope Percent of Contribution Area (%) Above Filter Strip | Length of Flow (Feet) Hydrologic Soil Group of Filter Area | | | |
|---|---|---|---|---|
| | A | B | C | D |
| 0 - 1 | 24 | 30 | 33 | 36 |
| 1 - 3 | 40 | 50 | 55 | 60 |
| 3 - 5 | 56 | 70 | 77 | 84 |
| 5 - 8 | 72 | 90 | 100 | 108 |
| 8 - 12 | 96 | 120 | 132 | 144 |
| 12 - 15 | 120 | 150 | 165 | 180 |
| > 15 | * | * | * | * |

* For slopes that exceed 15%, consult NRCS technical specialist.

**TABLE 7**
**Filter Length For Areas Subject To Run-On Of Pathogens (Bacteria and Virus)**

| Land Slope Percent of Contribution Area (%) Above Filter Strip | Length of Flow (Feet) Hydrologic Soil Group of Filter Area | | | |
|---|---|---|---|---|
| | A | B | C | D |
| 0 - 1 | 20 | 25 | 28 | 30 |
| 1 - 3 | 24 | 30 | 33 | 36 |
| 3 - 5 | 32 | 40 | 44 | 48 |
| 5 - 8 | 48 | 60 | 66 | 72 |
| 8 - 12 | 100 | 125 | 137 | 150 |
| 12 - 15 | 144 | 180 | 198 | 216 |
| > 15 | * | * | * | * |

* For slopes that exceed 15%, consult NRCS technical specialist.