

WQ-11: VEGETATED FILTER STRIP

1.0 Vegetated Filter Strip

1.1 Description

Vegetated Filter Strips are gently sloping, densely vegetated areas that filter, slow, and infiltrate sheet flowing stormwater. Filter strips are best utilized to treat runoff from roads, highways, roof drainage, and pervious surfaces. In highly impervious areas, filter strips should be used for pretreatment for other BMPs such as a Bioretention Area. Vegetated Filter Strips can consist of turf grasses, or natural vegetation.

The use of indigenous vegetated areas that have surface features that disperse runoff is encouraged, as the use of these areas will also reduce overall site disturbance and soil compaction. Indigenous areas that have surface features that concentrate flow are not acceptable. Runoff must be distributed as sheet flow so that erosive conditions cannot develop. The vegetation in Vegetated Filter Strips must be dense and healthy.

1.2 Design

1.2.1 General Design Requirements

The slope of the Vegetated Filter Strip should not exceed 8%. The minimum width (flow length) of the Vegetated Filter Strip is **35 feet**. Ensure the water quality runoff discharges to a 35-foot minimum vegetated filter area width (or a width that achieves 80% TSS removal through the use of a pollutant loading model acceptable to County).

For an effective Vegetated Filter Strip, it is essential to prepare the soils properly and plant and maintain a dense, vigorous stand of turfgrass sod. Use Tall Fescue or Common Bermuda grass as the main permanent turf-type vegetation for engineered Vegetated Filter Strips.

Natural vegetation can be used as cover for Vegetated Filter Strips when:

- The natural vegetation consists of an existing dense herbaceous buffer,
- The herbaceous buffer has an existing minimum ground cover of 90%,
- The area is validated by Anderson County during a field site visit, and

Vegetated Filter Strips will not contain any natural draws or channels. If the buffer is herbaceous in nature but does not contain a thick stand of vegetation, then add additional turf-type vegetation species to stabilize the ground surface.

A shallow or seasonally high groundwater table will inhibit the opportunity for infiltration. Therefore, the lowest elevation in the Vegetated Filter Strip should be at least 2 feet above the water table

Do not remove trees to create the necessary Vegetated Filter Strip area.

Vegetated Filter Strips may be designed to discharge to a variety of features, including natural buffer areas, vegetated swales, infiltration basins, or other structural BMPs.

Vegetation must be established prior to receiving flow. A temporary stormwater diversion is necessary until the vegetation in the Vegetated Filter Strip is stabilized. The Vegetated Filter Strip must retain the capacity to pass flow without erosion. Since stable vegetation must be established in the Vegetated Filter Strip before it can be put on-line, consider the time of year as construction may be limited to the growing season in order to ensure that a vegetated cover is established.

It is crucial that the slope and vegetation of the proposed natural herbaceous Vegetated Filter Area be surveyed in the field to ensure that the vegetation and slopes comply with requirements of this Specification.

1.2.2 Sheet Flow Requirements

Level spreading devices or other measures are required to provide uniform sheet flow conditions at the interface of the Vegetated Filter Strip and the adjacent land cover. Ensure concentrated flows do not discharge to the Vegetated Filter Strip, as they lead to erosion and failure of the system. Completely impervious drainage areas with flow lengths greater than 25-ft discharging directly to Vegetated Filter Strips require a level spreader meeting the requirements of the *Level Spreader Specification*. Other level spreading applications can be used for flow lengths less than 25-ft when contributing drainage areas are graded to provide sheet flow runoff into the Vegetated Filter Strip. Examples of level spreader applications with flow lengths less than 25-ft include:

- A gravel-filled trench, installed along the entire up gradient edge of the Vegetated Filter Strip. Use gravel having a size range of ASTM D 448 size No. 6 (1/8-in – 3/8-in). Trenches are typically 12-inches wide and 24-inches to 36-inches deep, and are lined with a nonwoven geotextile. When placed directly adjacent to an impervious surface, provide a drop (between the pavement edge and the trench) of 1 to 2-inches in order to inhibit the formation of the initial deposition barrier.
- Curb stops with cut outs. The cut out height is no greater than 1-in with a maximum length of 6-in. Space cutouts no less than 6-ft apart on center.

1.3 Variations

Vegetated Filter Strip effectiveness may be enhanced through the addition of a pervious berm at the toe of the slope. A pervious berm allows for greater runoff velocity and volume reduction resulting in better pollutant removal ability, by providing a very shallow, temporarily ponded area.

The berm has a height of 6 to 12 inches and is constructed of sand, gravel, and sandy loam to encourage vegetative cover. Provide an outlet pipe(s) or overflow weir to ensure that the area drains within 24 hours, or to convey larger storm events. The berm is erosion resistant under the full range of storm events. The ponded area is planted with vegetation that is resistant to frequent inundation. Check dams may be implemented on Vegetated Filter Strip with slopes exceeding 5%.

Construct check dams of durable, nontoxic materials such as rock, brick, wood, not more than 6-inches in height, and placed at appropriate intervals to encourage ponding and prevent erosion. Care must be taken to prevent erosion around the ends of the check dams.

1.4 Installation

Begin Vegetated Filter Strip construction only when the upgradient site has been sufficiently stabilized and temporary erosion and sediment control measures are in place. The Vegetated Filter Strip will be installed at a time of the year when successful establishment without irrigation is most likely. However, temporary irrigation may be needed in periods of little rain or drought.

Grade the Vegetated Filter Strip (if required) to the design slope using a box blade or similar equipment. Avoid driving heavy equipment through the Vegetated Filter Strip to prevent compaction.

Vegetated Filter Strip soils must not be compacted. Loosen the soil by raking, tilling or using a field cultivator. After the Vegetated Filter Strip soils have been loosened, add topsoil or compost. Add lime and fertilizer based on the results of a soil test. Establish a permanent stand of vegetation by Sodding.

Construct level spreader device at the upgradient edge of the Vegetated Filter Strip. For gravel trenches, do not compact the subgrade.

The preferred installation of surface cover for Vegetated Filter Strip is Sodding with turf grass sod. The Vegetated Filter Strip may be seeded and protected with an Erosion Control Blanket, but Sodding is the preferred installation methods. Additional vegetation such as trees and shrubs may be planted, if proposed. Follow these steps to install sod for filter strips:

1. Make sure the soil is moist (but not overly wet) before laying Sod. Irrigating the soil several days before delivery is often adequate.
2. Install the Sod within 24 hours of delivery. Plan to un-stack and unroll the sod if it cannot be laid within 48 hours.
3. While installing, keep Sod in the shade to lessen the chance of heat buildup.
4. Start Sodding from a straight edge (driveway or sidewalk), and butt strips together, staggering them in a bricklike pattern
5. Avoid stretching Sod. Use a knife or sharp spade for trimming to fit irregularly shaped areas.
6. Lay Sod lengthwise across the face of slopes, and peg or stake the pieces to prevent slippage. After the sod has been placed, roll the lawn to ensure good sod-to-soil contact.
7. Begin watering.

Once the Vegetated Filter Strip is sufficiently stabilized, remove temporary erosion and sediment controls. It is very important that Vegetated Filter Strip vegetation be fully established before receiving upland stormwater flow. One full growing season is the recommended minimum time for sod establishment.

Frequent watering is essential for the first week after placing Sod. Ensure the short roots on the Sod does not dry out. After root establishment, watering becomes less frequent but longer, encouraging the roots to grow deeper without stressing the plant. Any drought at this point can severely diminish the health of the placed Sod. Gradually increasing the length of time between watering is important to develop a deep root system that can reach the moisture and nutrients needed to sustain long-term growth. Frequent light applications of watering results in a shallow-rooted plant, that is vulnerable to drought.

1.5 Maintenance

1.5.1 Preventive Maintenance and Operation Activities

The following list included reoccurring maintenance and operation activities that are required to maintain a functional filter strip.

- Once a year, re-seed the Vegetated Filter Strip with primary turf- type vegetation to maintain a dense growth of vegetation
- Maintain a stable ground cover in the drainage area to reduce the sediment load to the vegetation.
- Mow Vegetated Filter Strip as needed during the growing season. Turf grass should not be cut shorter than 3 to 5 inches and may be allowed to grow as tall as 12 inches depending on aesthetic requirements
- Aerate the Vegetated Filter Strip once a year.
- Once a year perform a soil test and add lime and fertilizer as required.

1.5.2 Intermittent Maintenance and Repairs

Table 1 includes typical intermittent maintenance needs and repairs with remediation suggestions for each potential problem.

Table 1: Intermittent Maintenance and Repairs

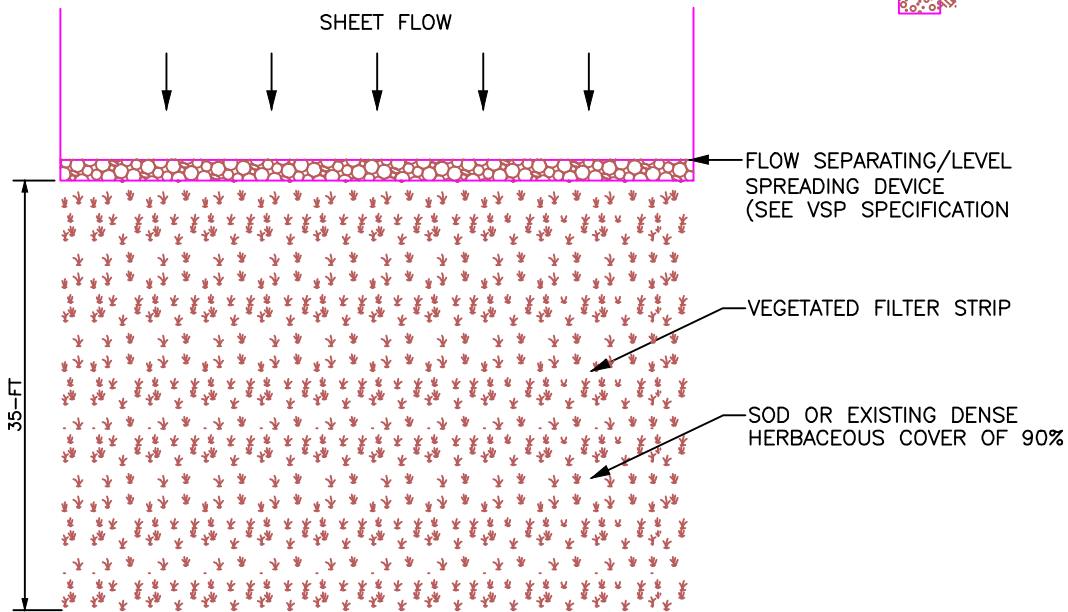
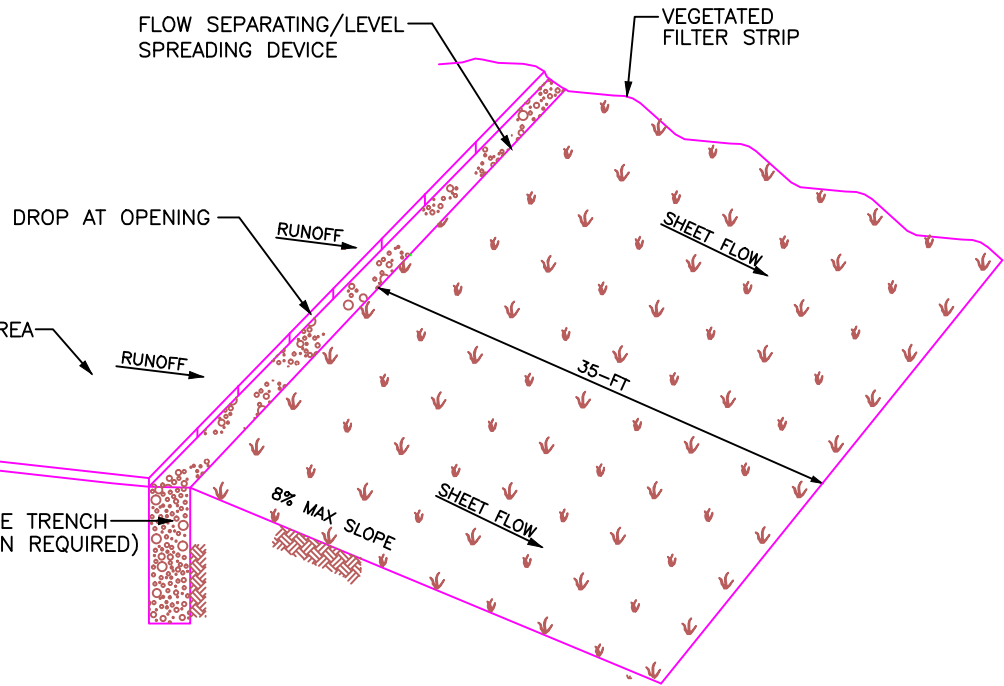
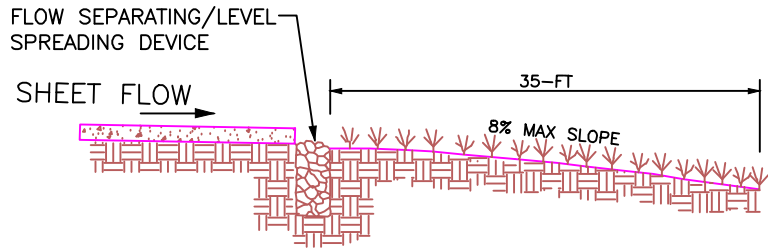
BMP Element:	Potential problem:	How to remediate the problem:
Level Spreader-VFS system	Trash/debris is present.	Remove the trash/debris.
Flow splitter device (if applicable)	The flow splitter device is clogged.	Unclog the conveyance and dispose of any sediment off-site.
	The flow splitter device is damaged.	Make any necessary repairs or replace if damage is too large for repair.
Level Spreader	The swale is overgrown with vegetation.	Mow vegetation. Re-grade and vegetate if the swale has become silted in.
	The level lip is cracked, settled, undercut, eroded or otherwise damaged.	Repair or replace lip.
	There is erosion around the end of the level spreader that shows stormwater has bypassed it.	Re-grade the soil to create a berm that is higher than the level lip, and then plant a ground cover and water until it is established. Provide lime and a one-time fertilizer application.
	Trees or shrubs have begun to grow on the swale or just downslope of the level lip.	Remove them.
Bypass channel	Areas of bare soil and/or erosive gullies have formed.	Re-grade the soil if necessary to remove the gully, and then reestablish proper erosion control.
	Turf reinforcement is damaged or riprap is rolling downhill.	Study the site to see if a larger bypass channel is needed (enlarge if necessary). After this, reestablish the erosion control material.
Vegetated Filter Strip	Grass is too short or too long (if applicable).	Maintain grass at a height of approximately three to six inches.
	Areas of bare soil and/or erosive gullies have formed.	Re-grade the soil if necessary to remove the gully, and then plant a ground cover and water until it is established. Provide lime and a one-time fertilizer application.
	Sediment is building up on the filter strip.	Remove the sediment and re-stabilize the soil with vegetation if necessary. Provide lime and a one-time fertilizer application.
	Grass is dead, diseased, or dying.	Determine the source of the problem: soils, hydrology, disease, etc. Remedy the problem and replace plants. Provide a one-time fertilizer application.
	Nuisance vegetation is choking out grass.	Remove vegetation by hand if possible. If pesticide is used, do not allow it to get into the receiving water.

1.6 References.

NCDENR Stormwater BMP Manual, Chapter 8 Level Spreader Grass Filter, Chapter Revised 03-09-10

City of Pennsylvania, Stormwater Best Management Practices Manual, Chapter 6 – Vegetated Filter Strip

New Jersey Stormwater Best Management Practices Manual, Chapter 9.10 – Standards for Vegetative Filters



NTS

Anderson County, SC

VEGETATED FILTER STRIP

STANDARD DRAWING NO. WQ-11

APPROVED BY: _____ January, 2013
Anderson County, SC DATE

VEGETATED FILTER STRIP MAINTENANCE AND RESPONSIBILITY AGREEMENT

The Permanent *Stormwater System Maintenance and Responsibility Agreement* requires adequate maintenance for stormwater management/Best Management Practices (BMP) facilities including Vegetated Filter Strips. Document Vegetated Filter Strips deficiencies during **annual** inspections. Complete any necessary repairs and/or preventive maintenance procedures in a timely manner to ensure proper functioning as Vegetated Filter Strips.

Important maintenance procedures:

- Immediately after the installation, water newly planted vegetation twice weekly as needed until the vegetation becomes established (typically six weeks).
- Ensure the grass cover is dense and healthy. Re-sod or re-seed if necessary to ensure a dense stand of grass.
- Maintain stable groundcover in the drainage area to reduce the sediment load.
- Two to three times per year, grass filter strips will be mowed and the clippings harvested to promote the growth of thick vegetation with optimum pollutant removal efficiency. Turf grass should not be cut shorter than 3 to 5 inches and may be allowed to grow as tall as 12 inches depending on the aesthetic requirements. Forested filter strips do not require this type of maintenance.
- Once a year, the soil will be aerated if necessary.
- Once a year, soil pH will be tested and lime will be added if necessary.
- Annually inspect the BMP to ensure proper function and effectiveness as a stormwater best management practice.

After vegetation is established, perform inspections once a quarter and after every storm event greater than 1.0 inch, and annually thereafter. Keep operation and maintenance records in a known location and make them available upon request.

Perform recommended maintenance activities as follows:

Required Maintenance	Frequency
Periodic pruning and weeding.	As needed
Remove trash and debris.	As needed
Inspect inflow points for clogging. Remove any sediment.	Every 6-months
Repair eroded areas. Re-seed or sod as necessary.	Every 6-months
Inspect trees and shrubs to evaluate their health.	Every 6-months
Remove and replace dead or severely diseased vegetation.	Every 6-months
Removal of evasive vegetation.	Every 6-months
Nutrient and pesticide management.	Annual, or as needed
Water vegetation, shrubs, and trees.	Every 6-months

Perform trouble shooting activities as follows:

Field Condition	Common Solutions
Trash/ Debris is present	Remove trash/ debris
Water is channelizing and causing erosion.	Re-grade if necessary to smooth it over and Provide additional erosion protection as needed such as erosion control blankets and turf reinforcement matting to prevent future erosion problems.
Too much sediment has accumulated.	Remove accumulated sediment to recover capacity. A sediment forebay may be required. Remove sediment that exceeds 2 inches on more than 10% of the vegetated treatment area, or anywhere that it is interfering with performance.
The flow control device is clogged or damaged	Unclog and properly dispose of any sediment off site. Make any necessary repairs or replace device if necessary.
Grass is too long or too short.	Maintain grass at a height of approximately three to six inches.
Plants are desiccated, dead, diseased or dying	Determine the source of the problem (soils, hydrology, disease, etc.). Remedy the problem and replace plants. Provide a one-time fertilizer application. Provide additional irrigation and fertilizer as needed.
Nuisance vegetation is choking out desirable species	Remove vegetation by hand if possible. If pesticide is used, do not allow it to get into the receiving water (stream, pond, etc.).