2.2 Sheet Flow to Filter Strip or Conservation Area

Photo credit: David Reutter, Franklin SWCD

Description

Both sheet flow to filter strip and sheet flow to conservation area are the practice of directing diffuse, uncollected runoff from an area of impervious cover (typically pavement) through an adjacent broad, pervious area of healthy vegetation and high soil quality on a mild slope.

Filter strips are uniformly sloped areas of maintained turf-forming grasses applied between the impervious surface and storm drainage conveyance infrastructure such as a storm sewer inlet or drainage ditch.

Conservation areas are undisturbed areas of forest, prairie, or mixed vegetation in a natural growth condition, typically contiguous with the receiving waters. Lawn, landscaping, and other routinely managed or high-use areas are not conservation areas.

A filter strip or conservation area alone does not achieve water quality goals and cannot serve as a development's exclusive or primary practice to manage the water quality volume (WQv) except to treat small pockets within a development (excluding pollutant hot spots) that cannot otherwise be directed to a standard practice.

These practices differ from the stream and wetland buffers (setbacks) discussed in Chapter 1 as having diverse vegetation and offering habitat, shade, flood attenuation, and channel stability in addition to pollutant treatment.

Planning and Feasibility

A jurisdictional wetland may not serve as a conservation area. Wetlands are sensitive to the increased inputs of stormwater runoff. Both practices may be used to diffuse stormwater discharge to a stream, wetland, or buffer.

Dense, healthy vegetation is central to the effectiveness of a filter strip or conservation area. Only apply these practices where it is reasonable to expect long-term survival of healthy vegetation and uncompacted soil.

Aerial imagery, LiDAR data, and county soil surveys will help to assess the potential for existing land to serve as a grass filter strip or conservation area, but the suitability of existing land cover, soil, and detailed topography requires a field level determination. Specify any necessary supplemental planting, gully repair, debris removal, etc. discovered by a field evaluation.

A filter strip can serve as a multi-use area with limited, passive recreational use as well as a convenient area for plowed snow storage and treatment. To protect the grass cover and minimize soil compaction, do not plan a filter strip in an

area expected to receive heavy pedestrian or vehicular traffic after the site is developed. Incorporating filter strips throughout a development site has many stormwater benefits including:

- pretreatment that reduces maintenance of the primary stormwater management practice,
- lower peak flow rates by extending the site's time of concentration, and
- a lower WQv for the drainage area through runoff reduction credits.

Placing a filter strip or conservation area on small residential lots is not recommended unless it can be ensured that eventual homeowners will protect both the water quality and drainage functions of the practice. Each practice may be particularly useful where construction of an individual residence on a large (2 or more acres) lot requires post-construction stormwater management.

Neither practice is suitable for treating hot spots where a high load or accumulation of a specific pollutant may stress the vegetation and/or result in groundwater contamination.

Credits

Table 2.2.1 Credits for Sheet Flow to a Filter Strip or a Conservation Area Meeting the Criteria in this Chapter

Objective	Credit	
Runoff Reduction Volume (RRv)	Filter Strip	0.06 ft^3 per square foot of filter strip constructed on Hydrologic Soil Group A or B soil 0.03 ft^3 per square foot of filter strip constructed on Hydrologic Soil Group C or D soil 0.06 ft^3 per square foot of filter strip restored by topsoil replacement with decompaction (see Chapter 1.4)
	Conservation Area	0.15 ft^3 per square foot of conservation area on Hydrologic Soil Group A or B soil 0.08 ft^3 per square foot of conservation area on Hydrologic Soil Group C or D soil
	RRv credits must be calculated using the Runoff Reduction Spreadsheet and may not exceed the WQv calculated for the practice.	

Design Criteria

Stormwater runoff must enter and continue through the vegetated practice as sheet flow. Sheet flow is unconfined runoff flowing in a thin, even layer or sheet over a broad surface area. Maintaining sheet flow over the contributing impervious area helps moderate the discharge rate and distribute flow over the entire practice area. As runoff progresses through the practice, vegetative surface roughness reduces the velocity. This increases the hydraulic residence time which both promotes infiltration to reduce runoff volume and maximizes the filtration and sedimentation of suspended pollutants. Runoff must not concentrate in rills or gullies within the practice that not only bypass treatment mechanisms but export the eroded sediment. Keep in mind that re-establishing broad sheet flow can be difficult once stormwater is collected and concentrated in a pipe or channel. The following criteria promote sheet flow over healthy soil and vegetation to establish limited runoff volume reduction and pollutant removal capacity.

Contributing Impervious Drainage Area

Sheet flow is considered to have a limited travel length before shallow concentrated flow develops and therefore the contributing drainage area to a filter strip or conservation area is limited by the flow path length rather than the total acreage. The contributing length of pavement (L_{imp}) in the direction of flow shall be a maximum of 100 feet (see Figure 2.2.1).

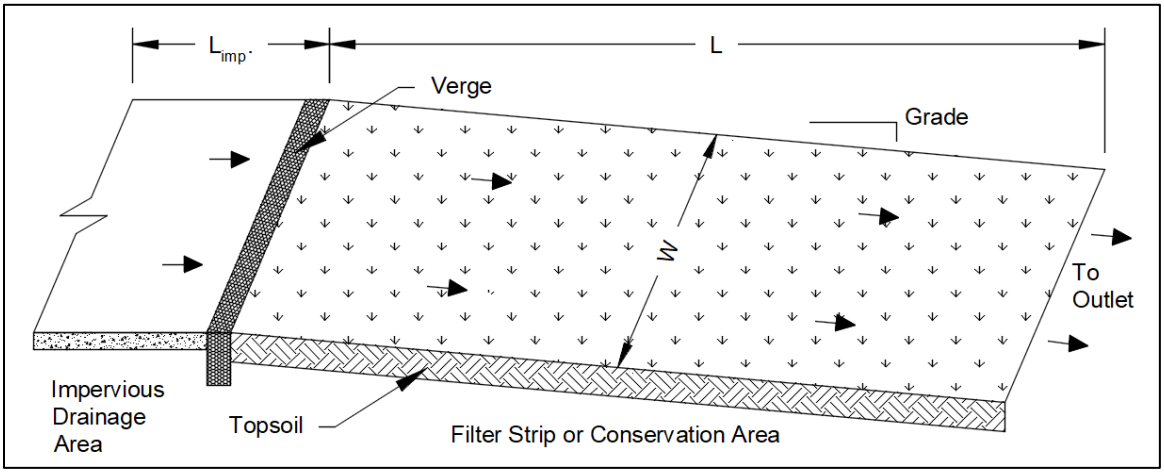

Figure 2.2.1 Basic Layout and Dimensions of a Filter Strip or Conservation Area (not to scale)

Grade and Dimensions

Figure 2.2.1 illustrates the general layout and dimensions of a filter strip or a conservation area. The width (W) of all practices shall be equal to the width of the drainage area contributing sheet flow. The minimum length (L) in the direction of flow of a filter strip or conservation area is listed in Table 2.2.2 according to the design grade up to the maximum allowable grade of 15 percent.

Design a filter strip to have a uniform slope with the contours perpendicular or convex to the flow. Do not use concave (funneling) topography for filter strips.

Table 2.2.2

Grade (%)	Filter Strip or Conservation Area Minimum Length (ft)
1.0 – 8.0	30
8.1 – 15.0	50

Conservation areas are ungraded, following the natural topography. The design grade may be an average for uneven areas. To the extent reasonable, only apply the RRv to area within the conservation area that receives runoff. Do not consider highly irregular topography that will concentrate flow or rock outcrops as a conservation area.

Soil

A filter strip or conservation area is more than simply a vegetated area. All practices must have healthy soil (i.e. uncompacted with sufficient tilth) to support a dense, healthy vegetative cover and the processes that treat and abstract runoff. Use the specifications for topsoil replacement given in Chapter 1.4 to establish a filter strip on compacted or graded soil. To receive the higher credit value for a filter strip on HSG C or D soil, use the specification for topsoil replacement with decompaction in Chapter 1.4.

Transition from Pavement to Practice

To ensure runoff is spread thin and even across the filter strip or conservation area, install a level gravel verge as the transition from pavement to the filter strip. The gravel verge dissipates energy due to minor variations in elevation and pretreats runoff by collecting course sediment. Figure 2.2.2 illustrates a typical gravel verge. A broad concrete verge may be substituted where the edge of pavement is relatively level and even with the leading edge of the filter strip.

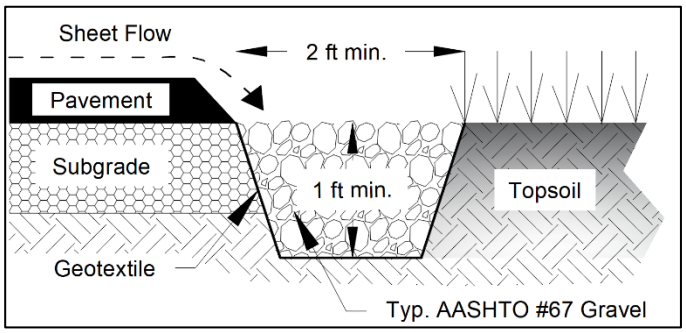

Figure 2.2.2 Typical Gravel Verge/Spreader (not to scale)

Flow from curb cuts must respread across the entire practice width by a gravel verge. Space curb cuts a maximum

of 10 feet apart. A grass receiving area as described in Chapter 2.1 spreads flow prior to a conservation area or where a more natural transition is desired (see Figure 2.2.4).

Conveyance and Overflow

Filter strips and conservation areas are in-line practices not designed for large storm conveyance with overflow provisions. Limiting L_{imp} to 100 feet should reduce the risk of damage during extreme rain events. Design soil reinforcement (geogrids or cells) where necessary to stabilize a filter strip.

These practices do not provide significant flow attenuation for large storm events and may not meet local regulations for peak-discharge (flood) control. Filter strips and conservation areas along a perimeter that treat the full WQv must not divert or convey runoff in a manner that will erode, flood, or otherwise degrade adjoining properties.

Disconnected Residential Roof Downspouts

Figure 2.2.3 depicts how a grass receiving area as discussed in Chapter 2.1 establishes sheet flow from disconnected downspouts prior to a filter strip or conservation area. Evenly space multiple grass receiving areas to distribute flow across the entire width of a filter strip or conservation area extending behind multiple lots.

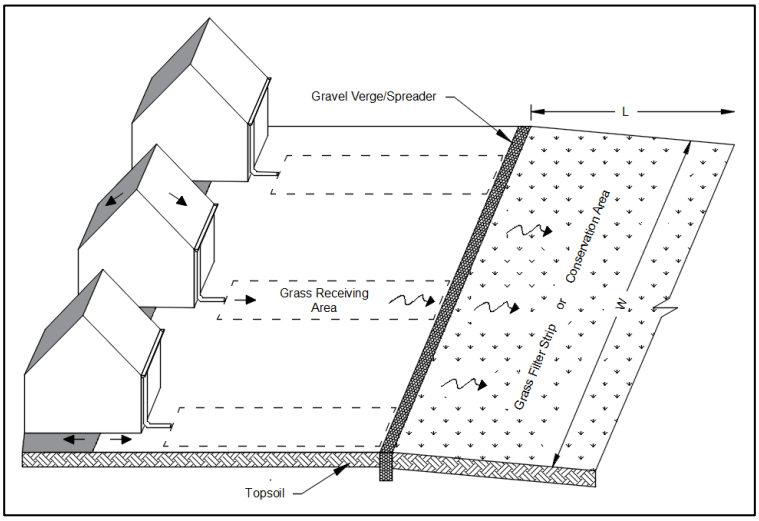

Figure 2.2.3 Illustration of Impervious Surface Disconnection of Multiple Residential Rear Roofs to Establish Sheet Flow Prior to a Grass Filter Strip or Conservation Area (not to scale)

Signage

Signs marking the practice boundary are recommended to ensure that current and future owners as well as landscaping contractors and other parties are aware the area serves as a stormwater management practice.

Establishing Filter Strip Vegetation

When soil restoration is complete, immediately seed a filter strip with a non-clumping, turf-forming perennial grass mix appropriate for the regional climate and local site conditions (for example, full sun, partial sun). Salt tolerant species may be necessary where snow storage is expected. Compatible legumes (for example, white clover) may be included in a seed mix to supply nitrogen. Do not sod a filter strip unless the clay content of the included soil is verified to be less than 20 percent. Seeding develops deeper roots with a better species mix. Refer to the permanent seeding specifications in Chapter 7 for further guidance.

Figure 2.2.4 Depiction of Impervious Surface Disconnection to Establish Sheet Flow to a Conservation Area

Plan to seed a filter strip between March 15 through June 1 or August 1 through October 15 to assure proper germination and plant growth. Seeding between June 1 and August 1 is possible but will require frequent watering and erosion control blankets to retain moisture. Allow time for a dense grass cover to grow prior to discharging stormwater runoff onto the grass filter strip.

A filter strip is considered established when both (1) plants can no longer be pulled free from the soil by hand; and (2) 90 percent cover is achieved which may take multiple growing seasons.

Establishing a Conservation Area

A conservation area has an unmanaged cover of woods, brush, herbaceous vegetation, or a mixture of these cover types in good hydraulic condition which is defined as greater than 75 percent ground cover of vegetation and/or forest litter (USDA, 1986). Avoid area dominated by invasive species (for example, Bush honeysuckle, Autumn-olive, Multiflora rose, and Tree-of-Heaven) that may be subject to future clearing.

A conservation area should not need grading aside from isolated, minor erosion repairs or incidental utility installation and must remain outside the limit of disturbance. Any work including invasive species removal or supplemental plantings must be done by hand or with lightweight, tracked vehicles to prevent compaction and damage to vegetation.

Prior to construction, a conservation area must be fully protected with perimeter silt fence or temporary diversions to prevent construction sediment from fouling the area. Install temporary barricades (for example, chain link or snow fence) and limit of disturbance signage to prevent accidental disturbance or clearing.

Install the gravel verge and place the conservation area into service only after the contributing drainage area has been fully stabilized.

Establishing New Conservation Area

Establishing a new conservation area on graded or construction disturbed soil is a lengthy process and should only be applied where long-term work to establish vegetation can be performed by the owner. The conservation area must first be rapidly established with herbaceous vegetation to develop an unmaintained prairie or meadow. Tree whips or saplings may be intermixed to allow the area to forest over a considerable amount of time. Plans to re-establish a conservation area must include the following.

- A planting plan utilizing native trees, shrubs, herbaceous vegetation, and tall prairie grasses must be prepared in advance by a qualified ecological professional. The plan should specify the desired mix of native species and their quantity or density to achieve 100 percent cover.
- Prior to planting or seeding, restore soil using the specification for topsoil replacement with decompaction in Chapter 1.4.
- Planting and seeding should be performed by hand or with lightweight, tracked equipment to minimize subsequent soil compaction under the supervision of a qualified, professional landscaper. For maximum survivability, the planting should occur only from September through November and March through May of each year. Sow native grass and wildflower seeds at the proper time of year for each species.
- A two-year maintenance agreement and monitoring period is required to ensure plant survival after installation and re-populate as necessary.

Construction Considerations

Carefully plan the timing of filter strip construction. Establish a filter strip during optimal seeding time and allot time for vegetation to grow prior to placing in service.

Protect filter strips and conservation areas from sediment, erosion, and compaction throughout construction.

Do not use a filter strip or conservation area for construction staging or storing materials or equipment.

Maintenance Considerations

Both practices require a low level of maintenance. Basic lawn care activity such as mowing, weeding, and periodic re-seeding should sustain dense turf on a filter strip. A conservation area, by definition, requires minimal maintenance activity, usually limited to invasive species management and gully repair.

Filter strips and conservation areas are not as identifiable as traditional stormwater management infrastructure. The designer and developer must determine how to inform current and future owners of the practice's purpose and how to safeguard it. The following considerations assure long-term maintenance and operation of a filter strip or conservation area.

- Clearly identify the purpose and boundaries of the practice(s) on the construction plans, stormwater pollution prevention plan (SWP3), long-term operation and management plan, and where applicable, plat maps and real estate documents.
- Protect a conservation area through a legal instrument (drainage easement, deed restriction, environmental covenant, etc.) to ensure that no future clearing, landcover change, or development occurs within the area, except as stipulated in the maintenance plan.
- Where possible, place practices within a residential development under control of a homeowner's association.
- Local authorities may require easements to access practices isolated along the perimeter or rear of a development for inspection or maintenance purposes.

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