

## Summary Fact Sheet

**Category:** 2.0 Filtering Technologies  
**Practice:** 2.7 Water Quality Swale/Grassed Swale

**General Description:** Water quality swales are broad, shallow channels designed to convey, filter, and infiltrate stormwater runoff. This practice is designed to handle runoff from small drainage areas at low stormwater velocities. The swales are vegetated along the bottom and sides of the channel, with side vegetation at a height greater than the maximum design stormwater volume. The design of swales seeks to reduce stormwater volume through infiltration, improve water quality through infiltration and vegetative filtering, and reduce runoff velocity by increasing flow path lengths and channel roughness.

Check dams (stone, biologs, wood, concrete) may be used in swales to act as flow spreaders and encourage sheet flow along the swale. Check dams allow installation of swales in areas of slopes greater than 5% by creating individual drainage sections with low percentage slopes. Check dams may also be used as a stormwater detention mechanism, encouraging infiltration and retarding discharge.

### Water Quantity Controls

Any volume of stormwater in excess of the WQV can be detained by providing additional ponding and/or subsurface storage in the swale, thereby reducing the runoff volume and peak discharge rate. The voids in the soil and gravel layers provide stormwater storage capacity. The depth of the gravel layer may be increased to add additional storage. Exfiltration into the subsoil can potentially reduce the volume of stormwater that ultimately enters the conveyance system. The amount of volume reduction depends on the available detention storage in the gravel layer and ponding area, the maximum flow rate into the subsoil, and the flow rate into the swale, which is related to the storm intensity and drainage area size. Additional information is provided in PFM section 6-1300 and in Virginia Stormwater Management Handbook Standard and Specification 3.11.

The cross-section of a water quality swale can be sized to provide conveyance for any given design storm, as required.

### Water Quality Controls

As defined by Fairfax County, the phosphorus removal efficiency is 15% if existing subsoil underlies the swale, and is 35% if an engineered soil mixture is used instead.

Pollutant load reductions are achieved because of a decrease in stormwater runoff volume. Pollutant removal occurs in grassed swales through two main mechanisms. The vegetation in the channel removes large and coarse particulate matter and sediment from stormwater. Pollutant removal is also facilitated by aerobic decomposition and chemical precipitation that occurs within the soil matrix while the stormwater is infiltrating.

**Location:** Grassed swales should not be installed on soils with infiltration rates less than 0.3 inches per hour. The suitability of grassed swales depends on land use, soil type, slope, imperviousness of the contributing watershed, and dimensions and slope of the grassed swale system. In general, grassed swales can be used to manage runoff from drainage areas that are less than 10 acres in size (although much smaller areas are recommended), with slopes no

greater than 5 percent or velocities greater than 3 to 4 feet per second. Use of natural low-lying areas is encouraged and natural drainage courses should be preserved and utilized.

**Design Construction and Materials:** Swale capacity should be able to accommodate the peak flow from the design storm. SCS hydrologic group A and B soils are required for grassed swales unless a permeability rate of 0.27 inches per hour or greater can be demonstrated. Soil amendments can be used to increase permeability (see fact sheet 5.1). The side slopes of the swale shall be no steeper than 3H:1V and longitudinal slopes shall be 5% or less. Check dams may be used to increase the overall detention time provided by the system. Grass should be selected and installed in order to ensure swale stability and to provide sufficient surface roughness and filtering. Grassed swales typically consist of the following components.

| Item                     | Unit | Estimated unit cost (2005 Dollars) |
|--------------------------|------|------------------------------------|
| Grading                  | S.Y. | \$0.10 - \$0.15                    |
| Erosion control material | S.Y. | \$1 - \$2                          |
| Sod                      | S.F. | \$2 - \$4                          |
| Grass seed               | S.F. | \$1 - \$2                          |

**Cost:** The cost for a water quality swale to treat runoff from ½ impervious acre is comprised of both the installation cost and annualized costs. These cost calculations were based upon a water quality swale with a surface area of 900 ft<sup>2</sup>. A water quality swale is assumed to have a lifespan of 25 years, at which point it will be removed and replaced.

| Item                      | Required Cost per Year (2005 Dollars)          |            |            |            |            |            |            |            |            |            |            |     |    |              |
|---------------------------|--|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-----|----|--------------|
|                           | 0  | 1          | 2          | 3          | 4          | 5          | 6          | 7          | 8          | 9          | 10         | ... | 25 |              |
| Installation <sup>1</sup> | 6,000  |            |            |            |            |            |            |            |            |            |            |     |    |              |
| Mowing                    |  | 100        | 100        | 100        | 100        | 100        | 100        | 100        | 100        | 100        | 100        |     |    |              |
| Reseeding                 |  | 50         | 50         | 50         | 50         | 50         | 50         | 50         | 50         | 50         | 50         |     |    |              |
| Aeration                  |  | 50         | 50         | 50         | 50         | 50         | 50         | 50         | 50         | 50         | 50         |     |    |              |
| Remove & Replace          |  |            |            |            |            |            |            |            |            |            |            |     |    | 6,000        |
| <b>Total Cost</b>         | <b>6,000</b>                                   | <b>200</b> | <b>200</b> | <b>200</b> | <b>200</b> | <b>200</b> | <b>200</b> | <b>200</b> | <b>200</b> | <b>200</b> | <b>200</b> |     |    | <b>6,000</b> |
| Annualized Cost           | \$425 / year (includes replacement in year 25) |            |            |            |            |            |            |            |            |            |            |     |    |              |

<sup>1</sup>Developer Cost. Not included in annualized cost.

**Maintenance:** Maintenance activities include periodic mowing (with grass never cut shorter than the design flow depth), weed control, watering during drought conditions, reseeding of bare areas, and clearing of debris and blockages. Significant storm events can cause sediment to accumulate. Conduct regular inspections for evidence of erosion (especially at the edges of check dams) and sediment deposition.

Minimize or avoid the use of fertilizers and pesticides. Fertilizers should only be used to speed the recovery of areas where grass has been reseeded. The grass cover should be thick and reseeded as necessary. Periodic aeration should be performed and any debris should be removed when necessary. Parking should be restricted on and around swales to avoid soil compaction.

**Performance and Inspection:** To ensure proper performance, visually inspect that stormwater is being conveyed through the length of the water quality swale. Water ponding in a water quality swale for more than 24 hours may indicate operational problems. If excessive water ponding is observed corrective measures include inspection for accumulated sediments and removal, if necessary. Aerating the water quality swale should be conducted biannually to maintain the function of the soils and encourage infiltration. Reseeding or resodding may be required if the grassed cover becomes diseased or damaged. Annual inspections should be conducted to determine water infiltration and conveyance. Perform this inspection:

- annually in spring, and
- after extreme events (e.g., after hurricanes).



**Grassed Swale**  
*Source: LID Center*

**Potential LEED Credits:**

- Primary: Sustainable Sites – Credit 6 “Stormwater Management” (1-2 Points)  
Other: Sustainable Sites – Credit 7 “Landscape & Exterior Design to Reduce Heat Islands” (1-2 Points)  
Water Efficiency – Credit 1 “Water Efficient Landscaping” (1-2 Points)  
Innovation & Design Process (1-4 Points)

**Links to Additional Information:**

Fairfax County PFM:  
<http://www.co.fairfax.va.us/dpwes/publications/pfm/6.htm>

Virginia Stormwater Management Handbook:  
<http://www.dcr.virginia.gov/sw/stormwat.htm#pubs>

Northern Virginia BMP Handbook:  
<http://www.novaregion.org/pdf/NVBMP-Handbook.pdf>