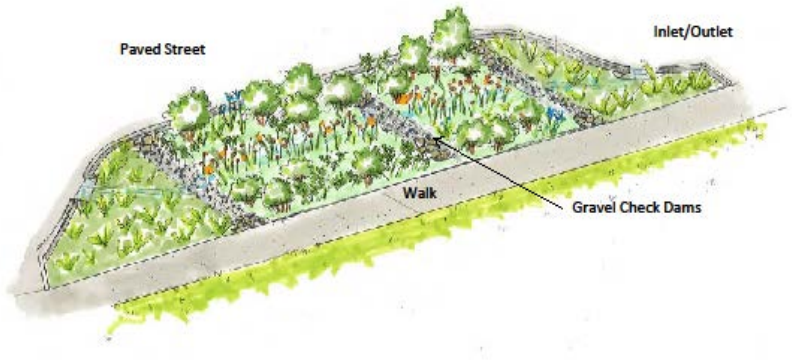
Stormwater Management Manual 2.3.12: Swale

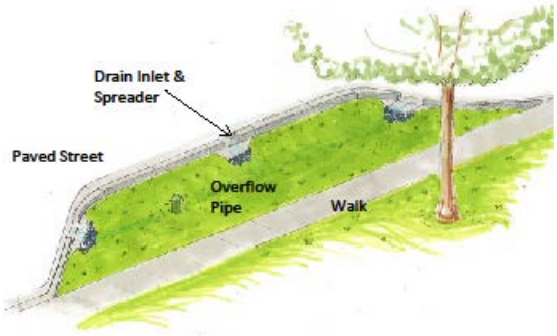
Facility Description

Swales are long and narrow vegetated and grassed depressions used to collect, detain and convey stormwater runoff which allows pollutants to settle and filter out as the water flows through the facility. Swales can also be designed to manage flow rates and volumes when designed under the Presumptive Approach. Swales come in two general types, vegetated and grassy.

Vegetated Swale



Grassy Swale



Swales can be used to help fulfill a site's required landscaping area requirement and should be integrated into the overall site design. Numerous design variations of shape and planting scheme can be used to fit the character of a site.

Swales qualify as filtration facilities. Swales meet the stormwater management standards for water quality when designed under the Simplified Approach. Swales meet the stormwater management standards for water quality, flow control and food control when designed under the Presumptive Approach.

Design Requirements

All facilities shall require an overflow to an approved discharge point unless sized to fully infiltrate the flood control storm.

Swales shall be deigned as filtration facilities using volume rate based analysis. Swales can be used in conjunction with other facilities to meet multiple stormwater management standards.

Sizing: The Simplified Approach shall be designed to receive less than 15,000 square-feet of impervious area runoff. Swales shall use a sizing factor of 0.06 for water quality with the Simplified Approach.

The Presumptive Approach shall be used for all other stormwater quality, flow control and flood control facilities. Vegetative swales may account for infiltration rates when using the presumptive method.

The Swale width and profile shall be designed to convey runoff from the Water Quality Design Storm (intensity is 0.22 inches/hour for on-line facilities and 0.13 inches/hour for off-line facilities) and shall meet the following criteria:

- Maximum flow depth during the Water Quality Design Storm is 4 inches.
- Maximum water velocity during the Water Quality Design Storm is 0.9 feet per second.
- Minimum hydraulic residence time (time for Qdesign to pass through the Swale) of 9 minutes.
- Minimum longitudinal slope of 0.5 percent, maximum slope of 6 percent. For slopes greater than 2 percent, check dams shall be used (one dam every 12 feet).
- Designed using a Manning "n" value of 0.25 for grassed Swales and 0.35 for vegetated Swales.

Flood Control Criteria: On-line stormwater quality swale facilities shall be designed to convey runoff from the Flood Control Design Storm and shall meet the following criteria:

- Maximum flow depth is 12 inches.
- Maximum water velocity through the facility shall not exceed 3 feet per second (fps) during the Flood Control Design Storm.

Soil Suitability: Swales are suitable for any soil types. Unless existing vegetated areas are approved as a swale, stormwater facility growing medium shall be used for the top 12 inches of the facility or the soil shall be amended to support plant growth.

Dimensions and Slopes: When designing swales, slopes and depth should be kept as mild as possible to avoid safety risks, improve aesthetics, and prevent erosion within the facility. Minimum Swale width shall be 5 feet and a maximum width of 12 feet. Maximum side slopes are 3 horizontal to 1 vertical for vegetated Swales, and 4 horizontal to 1 vertical for grassed Swales (to accommodate for mowing). Minimum flat bottom width is 2 feet. The

maximum bottom width is 8 feet. Maximum longitudinal slope is 6% and minimum slope is 0.5%. To minimize flow channelization, the Swale bottom shall be level, with a uniform longitudinal slope. Facility storage depth varies with layout and site constraints.

Swales within Public Streets: For Swales in the public right-of-way, all applicable City requirements for other street elements (curbs, sidewalks, trees, etc.) must be met. Swales located next to public sidewalks or curbs shall have a minimum 12 inch-wide flat area between the top of Swale slope and the sidewalk or curb.

Setbacks: The required setback from building foundations is 10 feet unless lined with a waterproof liner.

Flow Inputs: When the Simplified Method of sizing is used, the input or inputs into the Swale shall be at the upstream end and no other inputs (such as curb cuts or downspout connections) shall enter the Swale downstream.

Check Dams: Swales longer than 24 feet require that check dams be installed at 12-foot intervals along the length of the Swale. Check dams shall be constructed of durable, non-toxic materials such as rock, concrete, or soil may be used by integrating the design of the dams into the grading of the Swale. Check dams shall be 12 inches in length (as measured along the path of flow) by 4 to 10 inches in height. Check dams shall extend the complete width of the Swale; materials other than soil shall extend into the side slopes of the Swale for a minimum of 6 inches, so as to reduce the potential for erosion.

Materials

Mulch: Washed pea gravel, river run rock or non-floating much is recommended for Swales. It should be applied 2 – 3 inches thick to cover all exposed soil between plants. It should not be over applied.

Waterproof Liners: The use of waterproof liners is discouraged as infiltration is encouraged on all facility types. Waterproofing liners may be required in areas where hydraulic isolation is necessary due to existing structural, hydrologic or geotechnical limitations exist. Swales located within 10 feet of building foundations must be lined with an impermeable membrane of 30 mil (minimum) plastic film or equivalent.

Vegetation

The entire swale must maintain 90 percent coverage by vegetation or 100 percent coverage by grass at establishment. Vegetation shall conform to the facility planting list located in **Appendix D**.

Vegetated swales shall be planted with minimum plant quantities from Schemes I, II or III. Minimum plant quantities for vegetated swales are as follows:

Vegetated Swale Planting Scheme	I	II	III
Ground Cover, 4-inch pots spaced 1' on center (per 100 square feet of the facility)	100	80	80
Large Shrubs, 3 gal. pots spaced 4' on center (per 100 square feet of the facility)		2	2
Small Shrubs, 1 gal. pots spaced 2' on center (per 100 square feet of the facility)		4	4
Evergreen tree, min. 6' height (per 200 square feet of the facility)		1	
Deciduous tree, 1-½ inch caliper(per 200 square feet of the facility)			1

Grassy swales must have 100 percent coverage by native grasses, turf grasses, native wildflower blends, native ground covers, or any combination thereof. Seed shall be applied at the rates specified by the supplier.

Native grasses, and ground covers used for publicly maintained facilities shall be designed not to require mowing. Where mowing cannot be avoided, facilities shall be designed to require mowing no more than once annually. Turf and lawn areas are not allowed for publicly maintained facilities; any exceptions will require City approval.

Vegetation or grass cover shall be established as soon as possible after the swale is completed, and before water is allowed to enter the facility. Unless vegetation or grass cover is established, biodegradable erosion control matting shall be installed in the flow area of the Swale before allowing water to flow through the Swale.

Trees:

Private Swales shall be planted with evergreen or deciduous trees and shall be planted within or adjacent to the Swale as follows:

Swale Tree Planting Scheme	
Evergreen tree, min. 6' height (planted 30' on center)	1
Deciduous tree, 1-½ inch caliper (planted 30' on center)	1

Trees within public rights of way are subject to the street tree ordinance.

Growing Medium: The growing medium shall be a minimum 12 inches of topsoil or the soil shall be amended to support plant growth. Imported topsoil shall be a sandy loam mixed with compost or a sand/soil/compost blend. It shall be roughly one-third compost by volume, free-draining, and support plant growth. The compost shall be derived from plant material; animal waste is not allowed. In all cases, the growing medium shall be 12 inches deep.

4.5.10 Swale Operation and Maintenance Plan

Swales are filtration stormwater conveyance facilities that provide flow control and stormwater quality benefits. Swales are long, narrow vegetated and grassed depressions used to collect and convey stormwater runoff which allows pollutants to settle and filter out as the water flows through the facility.

All facility components, vegetation, and source controls shall be inspected for proper operations and structural stability, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event.

Training and/or Written Guidance information for operating and maintaining Swales shall be provided to all property owners and tenants. A copy of the O & M Plan shall be provided to all property owners and tenants.

Inspection Logs shall be kept by the facility owner demonstrating the following items have been inspected and are being maintained properly:

- **Access** to Swales shall be safe and efficient. Obstacles preventing maintenance personnel and/or equipment access to the components of the facility shall be removed.
- **Channelization** and causes for altered water flow shall be identified and corrected upon discovery. Stormwater should exit the vegetative filter as sheet flow, unless a collection drainpipe is used.
- **Debris and Litter** shall be removed to prevent channelization, clogging, and interference with plant growth. Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- **Erosion Damage** shall be identified and controlled when native soil is exposed or erosion channels are forming.
- **Grassed Swales** shall be mowed to 4”-9” high and grass clippings shall be removed no less than 2 times per year.
- **Infiltrating Swales** shall be excavated and cleaned, and gravel or soil shall be replaced to correct low infiltration rates. The Swale should drain within 48 hours of a storm event.
- **Inlets** shall maintain a calm flow of water entering the Swale and shall be cleared when conveyance capacity is plugged to ensure unrestricted stormwater flow to the rain garden.
- **Mulch** shall be replenished as needed to ensure healthy plant growth.
- **Nuisance and Prohibited Vegetation** from the Eugene Plant List (such as blackberries and English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- **Outlet**s shall be cleared when 50% of the conveyance capacity is plugged.

- **Sedimentation** build-up near or exceeding 2" in depth shall be hand-removed with minimum damage to vegetation using proper erosion control measures. Sediment shall be removed if it is more than 4 inches thick or so thick as to damage or kill vegetation.
- **Slopes** shall be stabilized to prevent erosion and failure using appropriate measures when native soil is exposed.
- **Vegetation** shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion. Dead vegetation shall be removed to maintain less than 10% of area coverage or when vegetative filter function is impaired. Vegetation shall be replaced immediately to control erosion where soils are exposed and within 3 months to maintain cover density.

Spill Prevention Measures shall be exercised on site when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

Non-Chemical Pest Control measures shall be taken to prevent development of insects, mosquitoes, and rodents.