GENERAL DESCRIPTION

Enhanced grass swales are vegetated open channels designed to convey, treat and attenuate stormwater runoff (also referred to as enhanced vegetated swales). Check dams and vegetation in the swale slow the water to allow sedimentation, filtration through the root zone and soil matrix, evapotranspiration, and infiltration into the underlying native soil. Simple grass channels or ditches have long been used for stormwater conveyance, particularly for roadway drainage. Enhanced grass swales incorporate design features such as modified geometry and check dams that improve the contaminant removal and runoff reduction functions of simple grass channel and roadside ditch designs.

Where development density, topography and depth to water table permit, enhanced grass swales are a preferred alternative to both curbs and gutter and storm drains as a stormwater conveyance system. When incorporated into site design, they can reduce impervious cover, accent the natural landscape, and provide aesthetic benefits.

DESIGN GUIDANCE

GEOMETRY AND SITE LAYOUT

- Shape: Should be designed with a trapezoidal or parabolic cross section. Trapezoidal swales will generally evolve into parabolic swales over time. While the ideal trapezoidal cross-section design should be checked for capacity and conveyance assuming it is a parabolic cross-section, Swale width between curbs should not be 5 metres or greater.
- Bottom Width: Should be designed with a bottom width between 0.75 and 3.0 metres. Should allow for shallow flows and adequate water quality treatment, while preventing flows from concentrating and creating gullies.
- Longitudinal Slope: Slopes should be between 0.5% and 4%. Check dams should be incorporated on slopes greater than 3%.
- Length: When used to convey and treat road runoff, the length simply provided shall be sufficient to equal, or greater than the contributing roadway length.
- Flow Depth: A maximum flow depth of 100 mm is recommended during a 4-hour, 25 mm Chicago storm event.
- Side Slopes: Should be as flat as possible to aid in providing pre-treatment for surface incurring flows and to minimize the swale filtering surface. Steeper side slopes are likely to have erosion gullies from incoming lateral flows. A maximum slope of 2.5:1 (H:V) is recommended and a 4:1 slope is preferred unless where permits.

PRE-TREATMENT

A pea gravel diaphragm located along the top of each bank can be used to provide pre-treatment of any runoff entering the swale laterally along its length. Vegetated filter strips or mild side slopes (3:1) also provide pre-treatment for any lateral sheet flow entering the swale. Sedimentation basins in lieu to the swale are also pre-treatment option.

CONVEYANCE AND OVERFLOW

Grass swales must be designed for a minimum velocity of 0.5 m/s or less for the 4-hour 25 mm Chicago storm event. The swale should also convey the locally required design storm (usually the 10-year storm) at non-erosive velocities.

SOIL AMENDMENTS

If soils along the location of the swale are highly compacted, or of such low fertility that vegetative growth becomes compromised, they should be filled to a depth of 300 mm and amended with compost to achieve an organic content of 8 to 15% by weight or 20 to 40% by volume.

OPERATION AND MAINTENANCE

Generally, routine maintenance will be the same as for any other landscaped area; weeding, pruning, and litter removal. Grassed swales should be mown at least twice and aerating as needed. Remove accumulated sediment on the swale surface when dry and exceeding 25 mm depth.

For the first two years following construction the swale should be inspected at least quarterly and after every major storm event (> 25 mm). Subsequently, inspections should be conducted in the spring and fall of each year and after major storm events. Inspect for vegetation density (at least 80% coverage), damage by foot or vehicular traffic, accumulation of debris, trash and sediment, and structural damage (revegetation failures).

Trash and debris should be removed from pretreatment devices and the surface of the swale at least twice annually. Other maintenance activities include weeding, replacing dead vegetation, repairing eroded areas, dethatching and aerating as needed. Remove accumulated sediment on the swale surfaces when dry and exceeding 25 mm depth.

SITE CONSIDERATIONS

Available Space

Site topography and constraints the application of grass swales. Local site slopes between 5% and 6% are allowable. This presents problems for areas where providing resistance time and preventing erosion. On slopes steeper than 2%, check dams should be used.

Drainage Area & Runoff

The conveyance capacity should match the drainage area. Sheet flow to the grass swale is preferable. Sheet flow velocities are generally less than 2.0 metres. High discharge through the swale may only be allowable for filtering and infiltration, and therefore should be checked for capacity and conveyance assuming it is a parabolic cross-section.

Soil Type

Grass swales can be planted on sites with any type of soils.

Pollution Hot Spot

No pollution hot spots should be contained by the grass swale. Sites with any type of soils should be treated by grass swales.

Proximity to Underground Utilities

Utilities running parallel to the sides of the swale should be separated from the centerline of the swales. Where utilities are present, a minimum 800 mm setback is required. The swales may also be treated to grass swales.

Water Table

Infiltration sites with water table should be separated from the water table by at least 0.3 metres. Setback from Buildings

Grass swales should be treated a minimum of 4.0 metres from building foundations to prevent water drainage.