# Grass Swale

A grass swale, also known as a grassed channel, is a linear vegetated ditch used to treat and reduce flow velocities of storm water runoff. Grass swales are applicable nearly everywhere and they are especially effective at receiving runoff from highways and residential areas, due to their linear nature.

## Advantages

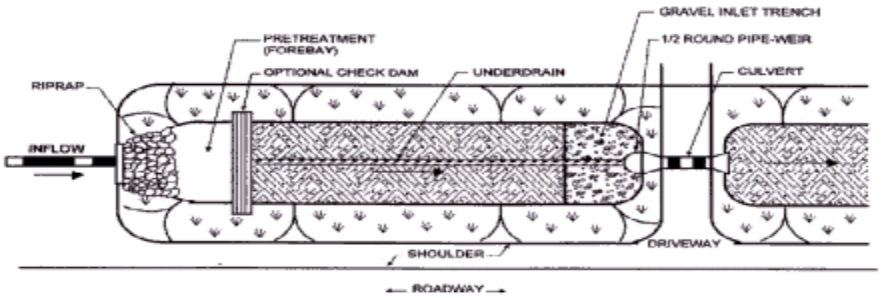
- Traps sediment and other pollutants
- Reduces runoff and promotes infiltration, which in turn, controls peak discharges
- Good option for retrofitting small areas, especially in terms of replacing drainage ditches
- Linear nature makes them effective at treating runoff from highways and residential areas
- May provide groundwater recharge, if design and soils allow for increased infiltration

## Limitations

- Individual dry swales can only treat a small area
- Limited data exists to gauge their effectiveness. They appear to be ineffective in reducing bacteria levels in storm water runoff, and their ability to remove phosphorous is questionable.
- May not be applicable to sites with many driveway culverts or extensive sidewalk systems.
- Require more maintenance than curb and gutter systems.

**AT-A-GLANCE SUMMARY**

| Benefit | |
|---|---|
| Major | ● |
| Moderate | ▨ |
| Minor/None | ○ |
| Reduction in Peak Flow | ▨ |
| Runoff volume reduction | ○ |
| Pollutant Removals | |
| Sediment | ● |
| Floatables | ● |
| Heavy metals | ○ |
| Oil and grease | ● |
| Fecal coliform | ▨ |
| BOD | ○ |
| Total Phosphorous | ▨ |
| Nitrogen | ▨ |
| Costs | ● |
| Maintenance | ▨ |




## Costs

Grass swales typically cost 50 cents per square foot, which is comparable to other storm water treatment BMPs (www.stormwatercenter.net, "Fact Sheet: Grassed Channel").

## Maintenance

Maintenance requirements for a grass swale are listed below.

| Activity | Schedule |
|---|---|
| Inspect pea gravel diaphragm for clogging and correct the problem.<br>Inspect grass along side slopes for erosion and formation of rills or gullies and correct.<br>Remove trash and debris accumulated in the inflow forebay.<br>Inspect and correct erosion problems in the sand/soil bed of dry swales.<br>Based on inspection, plant an alternative grass species if the original grass cover has not been successfully established.<br>Replant wetland species (for wet swale) if not sufficiently established | Annual<br><br>(Semi-annual the first year) |
| Rototill or cultivate the surface of the sand/soil bed of dry swales if the swale does not draw down within 48 hours.<br>Remove sediment build-up within the bottom of the swale once it has accumulated to 25% of the original design volume. | As needed (infrequent) |
| Mow grass to maintain a height of three to four inches | As needed (frequent seasonally) |

**Source:** *www.stormwatercenter.net, "Fact Sheet: Grassed Channel"*

## Retrofit Potential

Grass swales can serve as a replacement for drainage ditches in a retrofit scenario. While drainage ditches are designed to carry water away from roadways, they do not provide the treatment parameter that grass swales do. Grass swales thus become a viable storm water treatment option for retrofitting a small site.

## Design Requirements

- Swales should be designed to treat drainage areas less than 5 acres.
- Swales can be used on most soils, although highly impermeable soils will likely require replacement to enhance infiltration.
- Swales should be used on sites with relatively flat slopes (less than 4%).
- The bottom of the swale should be at least 2 feet from the water table, so as to prevent groundwater contamination and water in the swale bottom.
- The flat channel bottom should have a width of 2 - 8 feet.
- The shape of the swale should be trapezoidal or parabolic in cross section with side slopes not to exceed 2:1 (horizontal:vertical) in order to maximize the wetted perimeter and enhance treatment.
- A vegetated filter or buffer should be placed on either side of the swale, especially if it will receive runoff from nearby impervious area.
- The swale should be designed to handle flow from a minimum of a 2-year storm without causing erosion, but should have capactity to handle a 10-year storm.
- The swale should be designed to pond less than 18 inches of water for a maximum of 48 hours, although a 24-hour ponding time is more desirable.
- Longitudinal slope should be between 1% and 2% to minimize flow velocities. Slopes exceeding 4% may require the installation of check dams to reduce the effective slope less than 4%.
- The grade of the swale should be continuous and uniform.
- Unless existing soils are highly permeable, they should be replaced with a 50/50 mix of sand/soil to improve infiltration.

- Beneath the soil layer, an underdrain system should be installed--typically a gravel layer encasing a longitudinal perforated pipe.

- Preatreatment should be achieved by including a sediment forebay at the inlet. The pre-treatment volume should equate 0.1 inches per impervious acre.

- A pea gravel diaphragm and gentle side slopes should be included along the top of the channels to provide pretreatment for lateral sheet flow.

## Design Process (Schueler, 1996)

1. Compute the Water Quality Treatment Volume (WQTV) for the given land surfaces as required by the local permitting agency.

2. Identify the required swale bottom width, depth, length and slope necessary to store the WQTV within a shallow ponding depth (18 inches maximum).

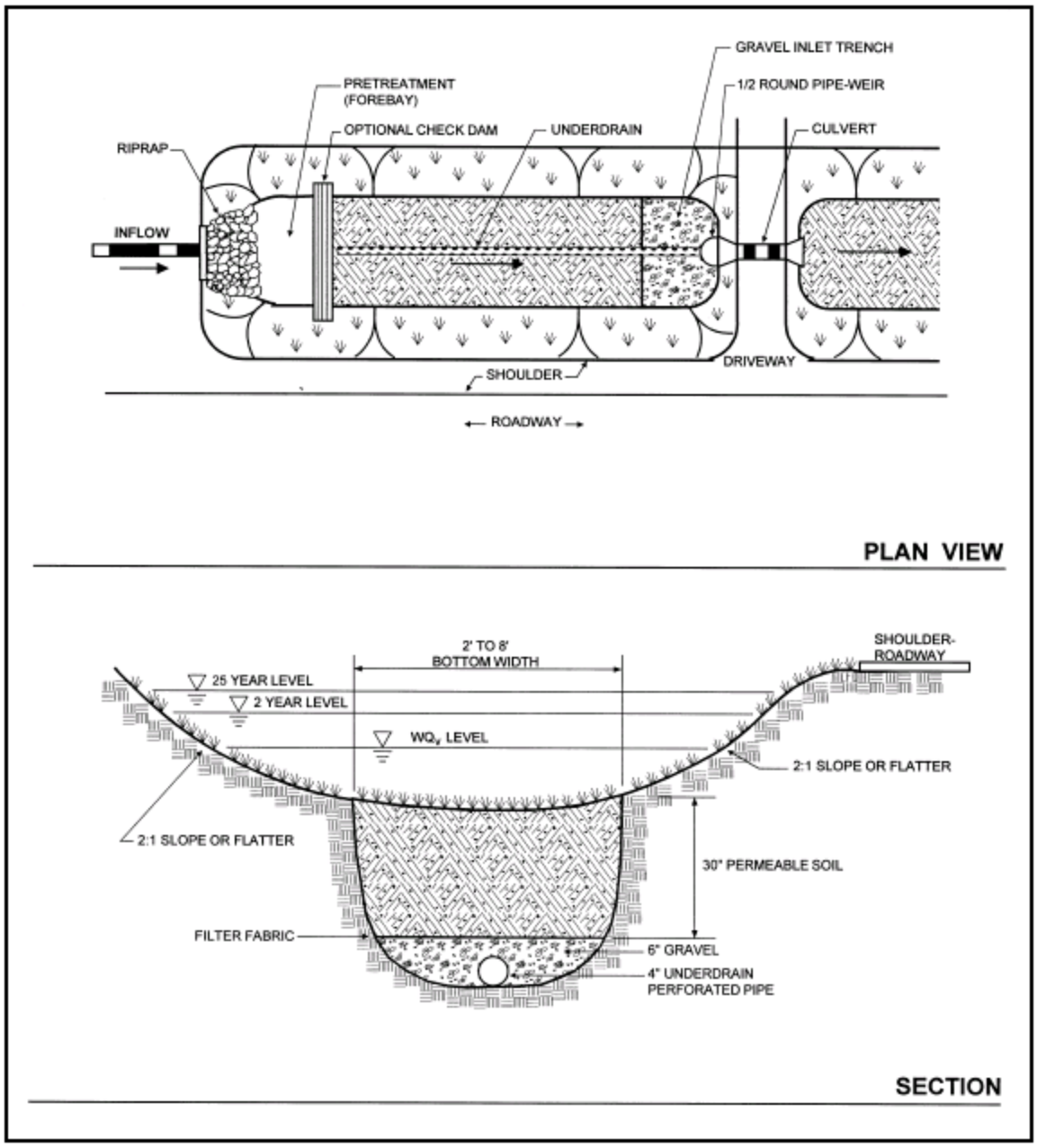
3. Compute the WQTV drawdown time to ensure that it is less than 24 hours.

4. Compute the 2-year and 10-year frequency storm event peak discharges.

5. Check the 2-year velocity for erosive potential (adjust swale geometry, if necessary, and reevaluate WQV design parameters).

6. Check the 10-year depth and velocity for capacity (adjust swale geometry, if necessary and re-evaluate WQV and 2-year design parameters).

7. Provide minimum freeboard above 10-year stormwater surface profile (6-inch minimum recommended).




**Schematic of Dry Swale**
*Source: Center for Watershed Protection*