# WQ-05: GRASS CHANNELS

## 1.0 Grass Channels

### 1.1 Description

Grass channels can be designed and installed as an alternate to curb and gutter and hard piping stormwater conveyance systems. Grass channels improve water quality by providing partial pollutant removal as runoff is filtered by the vegetation and by the opportunity to infiltrate into the underlying soil layer. Grass channels also reduce flow velocities in comparison to hard piping systems.

Grass channels are similar to traditional drainage ditches, but are designed to generate a relatively slow flow velocity to facilitate water quality treatment of small but frequent storm events.

### 1.2 When and Where to Use

Grass channels are commonly installed along roadway and sidewalk corridors, and within residential developments. Grass channels require continual permanent vegetative cover in order to provide adequate treatment of runoff. It is important to maximize water contact with vegetation and the soil surface. For general purposes, select fine, close-growing, water-resistant turf grasses.

Grass channels are susceptible to erosion and channelization if a thick stand of permanent vegetation is not sustained. A thick permanent vegetative cover is essential for proper functioning and to prevent damage from erosion.

### 1.3 Application and Limitations

The suitability of grass channels at a site depends on land use, size of the drainage area, soil type, slope, imperviousness of the contributing watershed, and dimensions and slope of the channel system. Grass channels are not designed to treat drainage areas greater than 5 acres. Large drainage areas may be divided into sub-watersheds and treated using multiple grass channels.

### 1.4 Design Requirements

Perform the design of grass channels for the following two design conditions:

- Stability/Permissible Velocity: This design process involves evaluating how the channel will respond under low vegetation retardance conditions. This condition is defined when vegetation is cut low or lies down, producing a lower Manning's n value, lower flow depths, and higher flow velocities. The limiting factor for stability design is the permissible velocity of the flow in the vegetated channel.

- Capacity: This design process involves evaluating how the channel will respond under high vegetation retardance conditions. This condition is defined when vegetation is not maintained or is very long and rigid, producing a higher Manning's n value, higher flow depths, lower flow velocities, and higher shear stresses. The limiting factor for capacity design is the cross sectional area of the vegetated channel and the design shear stress.

**Table 1: Permissible Velocities**

| Permanent Cover | Permissible Velocity (ft./sec.) Without TRMS* | | | | | |
|---|---|---|---|---|---|---|
| | Erosion Resistant Soils % Slope | | | Easily Eroded Soils % Slope | | |
| | 0-5 | 5-10 | > 10 | 0-5 | 5-10 | > 10 |
| Bermuda Grass | 8 | 7 | 6 | 6 | 5 | 4 |
| Bahia<br>Centipede Grass<br>Tall Fescue<br>Kentucky Bluegrass | 7 | 6 | 5 | 5 | 4 | 3 |
| Grass-legume Mixture | 5 | 4 | NR | 4 | 3 | NR |

*Allow velocities over 5 ft/sec only where good cover and maintenance will be provided. If poor vegetation exists due to shade, climate, soils or other factors, reduce the permissible velocity.

NR = Not Recommended

For maximum water quality performance, grass channels are recommended to be off-line structures. If a grass channel is designed to be an online structure, it must be able to safely convey the runoff of the 10-year 24-hour storm event.

The following hydraulic design requirements will be met for all grass channel installations:

- Minimum channel slope of 0.5 percent.
- Maximum channel slope of 5%.
- Design a 2-foot minimum bottom width, with a level bottom.
- Design vegetated swales to have non-erosive peak runoff velocities and shear stresses for 10-year 24-hour storm event, and capable of conveying the 10-year 24-hour storm event without overtopping.
- Minimum length of 100 feet.
- The depth of flow for the water quality event should not exceed 4 inches.
- Provide a forebay at all inlets to grass channels.
- Side slopes no steeper than 3:1 (H:V).

## 1.5 Materials

### 1.5.1 Turf Reinforcement Matting (TRM)

Grass channels require non-erosive peak runoff velocities and shear stresses. Ensure the channel dimensions are capable of providing non-erosive flow rates and shear stresses. If non-erosive flow rates and shear stresses are not achieved, select an appropriate Permanent Turf Reinforcement Matting designed to provide non-erosive conditions. Do not use Temporary Erosion Control Blankets (ECBs) as they will degrade over time and lose their effectiveness.

**Table 2: Material Specifications**

| Material | Specification |
|---|---|
| Turf Reinforcement Matting (TRM) | Use a TRM meeting appropriate design velocities and shear stresses. |

### 1.5.2 Forebay

Provide pretreatment of runoff to grass channels with a Forebay. Forebays are typically provided by constructing a check dam at the inlet of the swale. Protect Forebay inlets to reduce erosive forces of the runoff. The preferable protective material is a Turf Reinforcement Mat (TRM).

### 1.5.3 Outlet Structures

Discharge stormwater runoff from grass channels to a storm drainage system on site, or discharge to a stable protected outlet point.

## 1.6 Construction Requirements

### 1.4.1 Site Preparation

Do not install grass channels when the contributing area is not completely stabilized or is periodically being disturbed.

### 1.4.2 Excavation

Ensure excavation minimizes the compaction of the bottom of grass channels. Operate excavators and backhoes on the ground adjacent to grass channels or use low ground-contact pressure equipment. Do not operate heavy equipment on the bottom of grass channels.

### 1.4.5 Surface

Install grass channels with a minimum bottom width of 2-feet where applicable to ensure an adequate filtration area. Install grass channel side slopes that are 3H:1V for ease of maintenance and for side inflow to remain as sheet flow. When site constraints are restrictive, the maximum side slopes are 2H:1V.

Install grass channels with an optimal surface channel slope ranging from 1% to 2%, forcing a slow and shallow flow. This aspect of grass channels allows particulates to settle out of the runoff and limits erosion.

Flow can enter a grass channel through a pretreatment Forebay or it may enter along the sides of the channel as sheet flow produced by a level spreader or other type of flow regulation trench along the top of the bank.

### 1.4.6 Grass

Plant all grass channels grasses to applicable standards and specifications.

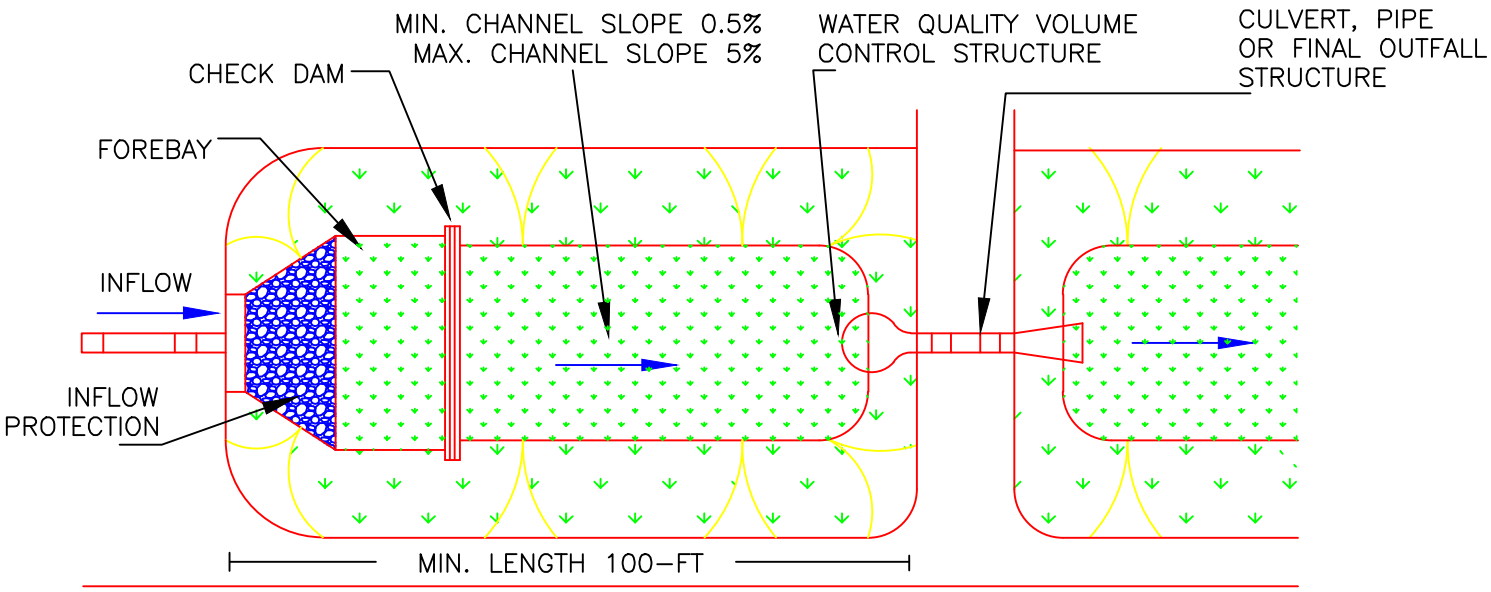
## 1.5 Inspection and Maintenance

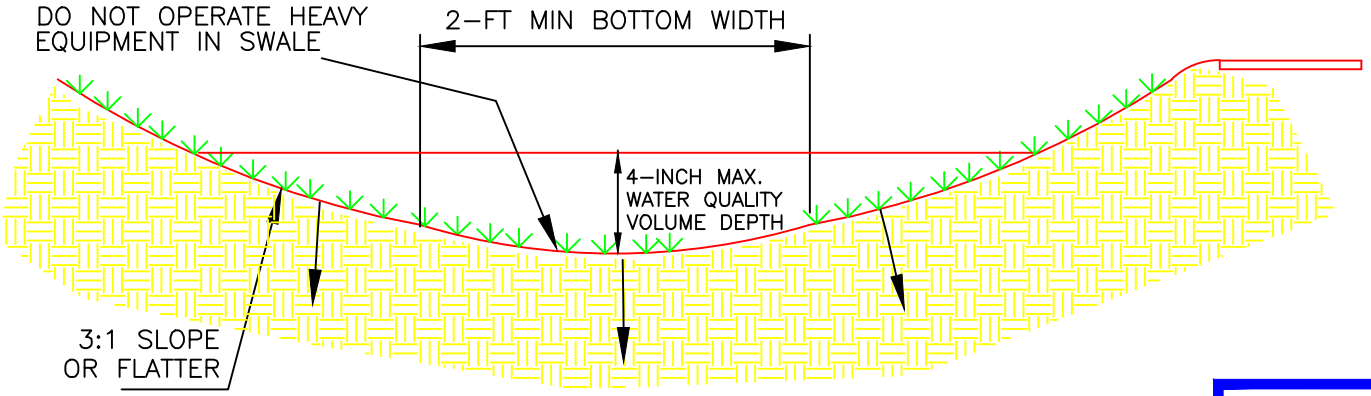
Regular inspection and maintenance is critical to the effective operation of grass channels. Maintenance responsibility is vested with a responsible authority by means of an enforceable maintenance agreement that is executed as a condition of plan approval. Typical maintenance responsibilities include:

- Mow grass within swales at least twice during the growing season to maintain a maximum height of approximately 6 inches.
- Repair erosion, rills, and gullies.
- Remove accumulated sediment as necessary.
- Grass channels may periodically require aeration of the channel bed in order to increase the permeability of the system.

**Table 3: Summary of Maintenance Requirements**

| Required Maintenance | Frequency |
|---|---|
| Mow grass to maintain design height and remove clippings. | As needed (frequent/seasonally) |
| Nutrient and pesticide management. | Annual, or as needed |
| Inspect side slopes for erosion and repair. | Annual, or as needed |
| Inspect channel bottom for erosion and repair. | Annual, or as needed |
| Remove trash and debris accumulated in Forebay. | Annual |
| Inspect vegetation. Plant an alternative grass species if original permanent cover is not established. | Annual (semi-annually first year) |
| Inspect for clogging and correct the problem. | Annual |
| Aeration of the surface of the bed when the grass channel does not draw down in 48 hours. | As needed |
| Remove sediment build-up within the bottom of the grass channel. | As needed, after 25% of the original design volume has filled. |




# Anderson County, SC

## GRASS CHANNEL

STANDARD DRAWING NO. WQ-05

APPROVED BY: _____ JANUARY 2013
DATE