
Greenville County Technical Specification for:
WQ-08 ENHANCED DRY SWALES

1.0 Enhanced Dry Swales

1.1 Description

An Enhanced Dry Swale is a shallow open-channel drainage way stabilized with turf grass or other vegetation used to convey runoff and filter pollutants. Use Enhanced Dry Swales in medians and drainage conveyance swales or ditches as an enhancement to vegetated swales. Enhanced Dry Swales are useful along roads that have driveway entrances crossing the swale. The maximum contributing drainage area for Enhanced Dry Swales is five (5) acres.

Enhanced Dry Swales capture, treat, and release the stormwater quality runoff volume. Enhanced Dry Swales are different from normal drainage swales in that they have structures implemented to enhance detention and stormwater pollutant removal. Enhanced Dry Swales are used primarily for stormwater quality and have a limited ability to provide stormwater runoff volume control. Enhanced Dry Swales are vegetated channels that include a filter media that overlays an underdrain system. Enhanced Dry Swales are sized to allow the entire water quality storage volume to filter or infiltrate through the swale bottom. Because Enhanced Dry Swales are sensitive to fine sediments, do not install them on sites where the contributing area is not completely stabilized or is periodically being disturbed.

1.2 Design

Design Enhanced Dry Swales to treat the water quality volume of runoff from the entire drainage basin. Calculate the surface area of the Enhanced Dry Swale by dividing the water quality volume by the ponding depth (18 inches). Typical Enhanced Dry Swales have a minimum bottom width between 2- and 8-feet and minimum filter media depth of 2 feet. In order to allow for proper pollutant removal, design for the ponded runoff above the Enhanced Dry Swale surface to drain in a maximum of 12 hours. Design for runoff within the filter media to drain to a depth of 2-feet below the swale surface within 48 hours. Design the underdrain system to safely pass the peak draw down flow rate of the filter media.

1.3 Materials

Enhanced Dry Swales consist of an underdrain system, filter media, plantings/vegetation and a pre-treatment forebay.

Place berms, check dams, weirs, and other structures perpendicular to the Enhanced Dry Swale flow path to promote settling and infiltration.

1.3.1 Underdrain System

Use a minimum 4-inch diameter perforated PVC pipe in a 6-inch layer of No. 57 Aggregate gravel or equivalent filter material as the underdrain system. Place a permeable nonwoven geotextile filter fabric between the gravel and the overlying permeable filter media.

Table 1: Material Specifications

Material	Specification
No. 57 Aggregate	Use course aggregate No. 57 consisting of crushed slag or gravel.
Pipe Underdrains	Use perforated pipe underdrains with a minimum diameter of 4-inches.
Non-Woven Geotextile Fabric	Use Type C non-woven geotextile fabric.
Turf Reinforcement Matting (TRM)	Use a TRM that conforms with the current <i>Greenville County Rolled Erosion Control Products (RECP) Specification</i> for Turf Reinforcement Matting (TRM) description, materials, and construction requirements.

1.3.2 Filter Media

The filter media for Enhanced Dry Swales consists of a permeable layer that is a minimum of 2.0-feet deep. Provide a filter media with a minimum infiltration rate of 1.0 in/hour and a maximum rate of 6 in/hr. The filter media provides a medium for physical filtration for the stormwater runoff with enough organic matter content to support provide water and nutrients for plant life.

The USDA textural classification of the filter media is Loamy Sand or Sandy Loam. The filter media is furnished, and on-site soils are not acceptable.

Test the filter media to meet the following criteria:

Table 2: Filter Media Material Specifications

Item	Percent of Total Planting Mix by Weight	ASTM Sieve Size	Percent Passing by Weight
Sand* Clean, Washed, Well Graded, No Organic Material <i>Aggregate No. FA-10</i> <i>ASTM C-33 Concrete Sand</i> <i>AASHTO M-6</i> <i>AASHTO M-43, No. 9 or No. 10</i>	80% Max	3/8 in.	100
		No. 4	95-100
		No. 8	80-100
		No. 16	50-85
		No. 30	25-60
		No. 50	10-30
		No. 100	2-10
Screened Topsoil <i>Loamy Sand or Sandy Loam</i> <i>ASTM D5268</i> <i>(imported or manufactured topsoil)</i> <i>Max 5% clay content</i>	15% Max.	2 in.	100
		1 in.	95- 100
		No. 4	75-100
		No. 10	60-100
		No. 200	10-50
Organic Matter in the form of Compost, Leaf Compost, Peat Moss or Pinebark Nursery Mix**	5% Min	3/8 in.	85-100
		No. 8	50-80
		No. 30	0-40

**Do not use lime stone screenings.*

*** Potting grade pine bark with no particles larger than 1/2 inches.*

Submit the source of the filter media and test results to the ENGINEER prior to the start of construction of Enhanced Dry Swales. Do not add material to a stockpile of filter media once a stockpile has been sampled. Allow sufficient time for testing. Utilize a filter media from a certified source or laboratory to reduce mobilization time and construction delays.

Use a filter media that is uniform, free of stones, stumps, roots or other similar objects larger than two inches excluding mulch. Do not mix or dump materials or substances within Enhanced Dry Swales that may be harmful to plant growth, or prove a hindrance to the planting or maintenance operations.

1.3.3 Forebay

Provide pretreatment of runoff to Enhanced Dry Swales with a forebay. Forebays are typically provided by constructing a check dam at the inlet to the Enhanced Dry Swale. Protect forebay inlets to reduce erosive forces of the runoff. The preferable protective material is a Turf Reinforcement Mat (TRM).

1.3.4 Outlet Structures

Discharge water from the underdrain system of Enhanced Dry Swales to a storm drainage system on site, or discharge to a stable protected outlet point.

1.3.5 Overflows

For maximum performance, Enhanced Dry Swales are recommended to be off-line structures. If a Enhanced Dry Swale is designed to be an online structure, the overflow structure must be able to safely pass runoff for the 10-year 24-hour storm event.

1.3.6 Plantings

Use plantings that conform to the standards of the current edition of *American Standard for Nursery Stock* as approved by the American Standards Institute, Inc.

Use plant materials that have normal, well developed stems or branches and a vigorous root system. Only use plantings that are healthy, free from physical defects, plant diseases, and insect pests.

Use plant species that are tolerant to wide fluctuations in soil moisture content. Use plantings capable of tolerating saturated soil conditions for the length of time anticipated for the water quality volume, as well as anticipated runoff constituents.

Use turfgrass species with a thick dense cover, slow growing, applicable to the expected moisture conditions (dry or wet), do not require frequent mowing, and have low nutrient requirements. The preferred method of establishing turf grass is sodding. Use temporary erosion control blankets to provide temporary cover when establishing turf grass by seeding.

1.4 Construction Requirements

1.4.1 Site Preparation

Do not install Enhanced Dry Swales on sites where the contributing area is not completely stabilized or is periodically being disturbed.

Separate Enhanced Dry Swales from the water table to ensure groundwater does not enter the facility leading to groundwater contamination or Enhanced Dry Swale failure. Ensure a vertical distance of 2 feet between the bottom of Enhanced Dry Swales and the seasonally high ground water table.

1.4.2 Excavation

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

1.4.3 Underdrain System

Prior to placing the underdrain system, alleviate compaction on the bottom of the Enhanced Dry Swale by using a primary tilling operation such as a chisel plow, ripper, or subsoiler to a depth of 12 inches. Substitute methods must be approved by the ENGINEER. Rototillers typically do not till deep enough to reduce the effects of compaction from heavy equipment.

Remove any ponded water from the bottom of the excavated area. Line the excavated area with a Class 2, Type C nonwoven geotextile fabric.

Place a layer of No. 57 Aggregate a minimum of 2-inches deep on top of the nonwoven filter fabric. Place the pipe underdrains on top of the underlying aggregate layer. Lay the underdrain pipe at a minimum 0.5 percent longitudinal slope. The perforated underdrain drain pipe may be connected to a stormwater conveyance system or stabilized outlet.

Place No. 57 Aggregate around the pipe underdrain system to a minimum depth of 6-inches. Place a Class 2, Type C nonwoven geotextile fabric between the boundary of the gravel and the filter media to prohibit the filter media from filtering down to the perforated pipe underdrain.

1.4.4 Filter Media

Place and grade the filter media using low ground-contact pressure equipment or excavators and/or backhoes operating on the ground adjacent to the Enhanced Dry Swale. Do not use heavy equipment within the perimeter of the Enhanced Dry Swale before, during, or after the placement of the filter media. Place the filter media in vertical layers with a thickness of 12 inches. Compact the filter media by saturating the entire Enhanced Dry Swale after each lift of filter media is placed until water flows from the underdrain system. Apply water for saturation by spraying or sprinkling. Perform saturation of each lift in the presence of the ENGINEER. Do not use equipment to compact the filter media. Use an appropriate sediment control BMP to treat any sediment-laden water discharged from the underdrain during the settling process.

Test the installed filter media to determine the actual infiltration rate after placement. Ensure the infiltration rate is within the range of 1 to 6 inches per hour.

1.4.5 Enhanced Dry Swale Surface

Install Enhanced Dry Swales with a bottom width ranging between 2- and 8-feet where applicable to ensure an adequate filtration area. Where the site allows, increase the filtration area by using wider channels, giving consideration to prevent uncontrolled sub-channel formation. Install Enhanced Dry Swale surface side slopes that are 4H:1V for ease of maintenance and for side inflow to remain as sheet flow. The maximum Enhanced Dry Swale surface side slopes are 2H:1V.

Install Enhanced Dry Swales with a minimal surface channel slope ranging from 1% to 2%, forcing a slow and shallow flow. This aspect of the Enhanced Dry Swale allows particulates to settle out of the runoff and limits erosion. Place flow control structures (berms, check dams, weirs, and other structures) perpendicular to the Enhanced Dry Swale flow path to promote settling and infiltration. Space flow control structures a minimum of 50-feet and install energy dissipation techniques on the downstream side of these structures.

Flow can enter the Enhanced Dry Swale through a pretreatment forebay or it may enter along the sides of the swale as sheet flow produced by level spreader trenches along the top of the bank.

1.4.6 Plantings

Plant all Enhanced Dry Swale grasses, native grasses, perennials, shrubs, and other plant materials specified to applicable landscaping standards.

1.5 Inspection and Maintenance

Regular inspection and maintenance is critical to the effective operation of Enhanced Dry Swales. 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:

- Keep a record of the average de-watering time of the infiltration trench to determine if maintenance is required.
- Perform light core aeration as required to ensure adequate filtration when the surface of the filter bed becomes clogged with fine sediments over.
- Perform mowing to maintain storage volume and to maintain appearance periodically as needed.
- Remove trash and debris periodically as needed.

Table 4: 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 cover is not established.	Annual (semi-annually first year)
Inspect for clogging and correct the problem	Annual
Roto-till or cultivate the surface of the bed when the Enhanced Dry Swale does not draw down in 48 hours.	As needed
Remove sediment build-up within the bottom of the Enhanced Dry Swale.	As needed, after 25% of the original design volume has filled.