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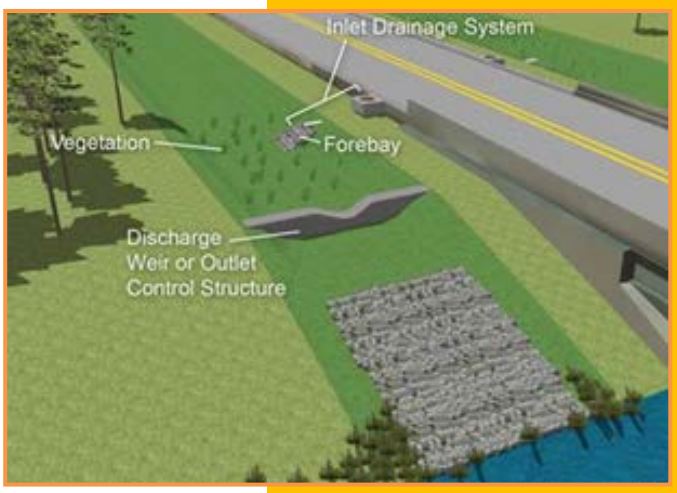

STORMWATER SYSTEM INSPECTION AND MAINTENANCE MANUAL

April 2015

ARCADIS
Infrastructure · Water · Environment · Buildings

In association with
AECOM

Georgia Department of Transportation

Stormwater System Inspection and Maintenance Manual

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Introduction

SECTION

1

1 Introduction

1.1 Purpose

This Stormwater System Inspection and Maintenance Manual (I&M Manual) provides a basis for the inspection and maintenance of the Georgia Department of Transportation (GDOT) stormwater system, particularly those structures and conveyances associated with the Municipal Separate Storm Sewer System (MS4). This I&M Manual complies with the requirements of the General National Pollutant Discharge Elimination System (NPDES) Stormwater MS4 Permit No. GAR041000 (MS4 Permit), namely Post-Construction Stormwater Minimum Control Measure (MCM) 4.2.5, Best Management Practice (BMP) #3 and Pollution Prevention/Good Housekeeping for Municipal-type Operations MCM 4.2.6, BMP #5. These MCMs require GDOT to develop and implement programs to prevent or reduce stormwater pollution from its facilities and to perform routine maintenance activities within the permit area.

This I&M Manual presents a program for the long-term operation and routine maintenance of post-construction structures designed for filtering and/or detention (e.g., detention ponds, wetlands, infiltration trenches, filter strips) and includes recommended inspection frequencies, checklists, and procedures for maintaining the various types of MS4 and post-construction structures that are subject to the MS4 Permit. This I&M Manual defines a level and extent of service for the inspection and maintenance of MS4 structures along GDOT highways within MS4 designated areas. The program, where possible and with enhancements focused on water quality aspects, will incorporate and tailor established GDOT inspection and maintenance policies and practices as mechanisms to achieve the ultimate goals of properly maintaining stormwater BMPs to meet permit requirements.

1.2 Use of this I&M Manual

The guidelines included in this I&M Manual define a standard of practice that is complementary to other standards of practice adopted and implemented by GDOT including the Manual for Erosion and Sediment Control in Georgia, which supports construction activity, and the GDOT Manual on Drainage Design for Highways (currently under revision, with anticipated issuance in 2014). The scope of this I&M Manual, while complementary to other practices, is limited specifically to the operations and maintenance of the GDOT Stormwater Management Plan (SWMP) for MS4 and post-construction structures. The objectives of the standards of practice defined in this I&M Manual are to:

- Define inspection and maintenance practices that meet the requirements of the MS4 Permit.

- Define the practices needed to keep stormwater management facilities and their components functioning in accordance with design objectives.

The need to update this I&M Manual will be evaluated annually and subsequent updates will be undertaken, as needed. Any revisions will be submitted to the Georgia Environmental Protection Division (EPD) with each annual report. The MS4 Permit requires GDOT to verify that procedures documented in this I&M Manual are properly implemented. GDOT will review implementation of the I&M Manual by evaluating numbers of corrective actions identified and completed.

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GDOT Maintenance Policy

SECTION

2

2 GDOT Maintenance Policy

The Stormwater I&M Manual is part of GDOT's program to perform routine inspections and maintenance of MS4 and post-construction structures in accordance with GDOT's MS4 permit requirements. The plan of operation, inspection, and maintenance presented in this manual is based on balancing MS4 Permit compliance, safety of the traveling public, legal obligations, and use of established GDOT maintenance policies and procedures. The plan of operation may change as warranted by modifications to one or more of these factors.

2.1 Extent of Service

For the purposes of GDOT's MS4 program, GDOT's extent of service for its stormwater system falls into two broad categories:

1. Category 1. Within GDOT properties and rights-of-way that are owned and operated by GDOT.

2. Category 2. Outside GDOT owned properties and rights-of-way but within GDOT permanent easements legally accepted by GDOT.

2.2 Level of Service

The level of service for GDOT's MS4 and post-construction structures is defined by the design standards for these structures and any design modifications made subsequently. For the purpose of its maintenance program GDOT determines the condition of these structures through a system of visual observations and field tests described in this manual to evaluate the degree to which the structure is functioning relative to its intended design.

A three-tier condition assessment method is used to rate the condition observed and maintenance priority for MS4 and post-construction structures in GDOT's inventory.

- *Level 1, Green*. Good condition. No corrective action required.

- *Level 2, Yellow*. Fair condition, but still functional. Follow-up inspection in 6 months (or as corrective action dictates) is recommended.

- *Level 3, Red*. Poor condition. Needing maintenance, repair, and/or replacement.

The levels will be assigned for each structure attribute based on inspection.

Inspection procedures and checklists for MS4 and post-construction structures are developed around the three-tier rating criteria. These and other related information are provided in the following sections and appendices to this I&M Manual:

- Section 4 – MS4 Structures and Controls
- Section 5 – Post-Construction Structures and Controls
- Appendix A – MS4 Structure Inspection Checklists
- Appendix B – Post-Construction Stormwater Structure Inspection Checklists

Georgia Department of Transportation

GDOT Maintenance Practices

SECTION

3

3 GDOT Maintenance Practices

GDOT has a multi-tiered approach to perform both routine and as-needed inspection, maintenance, and corrective actions of MS4 and post-construction stormwater structures. The combination of internal GDOT policies and procedures, implementation of comprehensive maintenance contracts (CMCs), other specialty services contracts with external contractors, and agreements with local municipalities, allow GDOT to provide necessary coverage to achieve permit compliance. Historically, inspections have been centered on stormwater conveyance and condition assessment; however, this I&M Manual focuses on water quality issues, with parallel implementation of the GDOT Facilities Stormwater Pollution Prevention Plan (SWPPP) and Illicit Discharge Detection and Elimination Plan (IDDE Plan).

3.1 Existing Maintenance Practices

GDOT maintains a system of practices that address the inspection and maintenance of drainage structures within various operations. The procedures described in this I&M Manual will be an integral part of this system, which includes guidelines from the following documents:

- *Manual on Drainage Design for Highways (2014)*. This manual provides an overview of drainage guidelines and references to appropriate design procedures to address environmental issues and other site-specific concerns. GDOT recently expanded this manual to include design guidance for post-construction stormwater structures.

- *Drainage Inspection Manual for Minor Drainage Structures (2008)*. Apart from general guidelines for the drainage inspection of minor drainage structures, this manual summarizes the material handling and storage procedures for use during storm sewer system repair. The manual presents a program to be used for inspection of drainage structures, including MS4 classified structures. These inspections, scheduled from December 1 to March 31, are conducted by routine maintenance personnel, but the Assistant Area Engineer of Maintenance is responsible for confirming that these inspections and maintenance are performed correctly. Other non-routine inspections will similarly be documented along with instances of repair, modification by construction, or abandonment. In all cases, the inspection procedures will, as a minimum, follow the GDOT Drainage Inspection Manual for Minor Drainage Structures.

Inspection criteria of the Drainage Inspection Manual for Minor Drainage Structures are as follows:

- Purpose of the inspection
- Inlet/outlet conditions
- Inlet/outlet ditch conditions
- Siltation, debris, pollutants.

The Biennial Drainage Structure Inspection Form includes:

- Structure location
- Stream type
- Pipe information
- Inlet and outlet headwall, apron, and end section details
- Structural conditions
- Corrective actions required for cleaning, repair, or replacement.

Acquired data from these inspections will be entered into the Biennial Drainage Inspection Module of the Highway Maintenance Management System (HMMS) or a similarly capable database that tracks the overall operational and structural conditions for drainage structures and prioritizes corrective actions.

- *Highway Maintenance Management System Foreman's Manual (2011).* The HMMS Foreman's Manual describes the procedures for material handling and storage for various activities conducted by GDOT and provides guidance on spill prevention in public use facilities and litter removal.

In addition, the HMMS Foreman's Manual describes certain maintenance activity types, each activity, special notes, and recommended procedures, along with average production, labor, material, and equipment for budgeting considerations. Certain existing drainage-related activity types will be enhanced with additional water quality inspection criteria. The HMMS Foreman's Manual will be a procedural guide to maintenance personnel in planning work tasks, including inspection needs, erosion control requirements during the activity, follow-up, and other activities. The HMMS Foreman's Manual will also be used to amend and expand the maintenance activity types to include MS4 and post-construction structures.

The HMMS Foreman's Manual presents procedures for the following maintenance activities:

- Activity 400: Manual Clean Drain Structure. This activity involves cleaning pipes, culverts, catch basins, drop inlets, and paved flumes by manually removing accumulated dirt and debris. A Special Performance Condition requires that structures be inspected routinely for cleaning based on the condition of the structure.

- Activity 405: Mechanical Clean Drain Structure. This activity involves mechanical cleaning of pipes, structures, and retention/detention facilities, including follow-up reporting if a structure requires additional corrective actions.

- Activity 410: Clean/Restore Ditches. This activity includes cleaning, reshaping, and reestablishment of vegetation of roadside and outfall ditches, and restoring the grade line if necessary to maintain adequate drainage. Special Performance Conditions

require work as soon as practical in ditches where silt has accumulated or where obstructed or blocked drainage is evident.

- Activity 415: Pipe Install/Repair. This activity includes repairs or new installations of items such as pipe, headwalls, wing-walls, and aprons to maintain adequate drainage. Repairs may also be performed by internal lining or grouting.

- Activity 420: Build/Repair Concrete Structure. This activity involves repairs or construction of catch basins, drop inlets, ditch paving, curb and gutter, and septic tanks, among other items.

- Activity 540: Litter Patrol. This activity includes removal of unwanted and/or unauthorized objects from roadways and right-of-ways such as tire fragments, dead animals, and collected litter.

- Activity 545: Litter Pick-up/Full. This activity includes full-width cleaning of continuous sections of the right-of-way to remove unsightly objects and obstructions to drainage. Special Performance Conditions require scheduling throughout the year as required, especially prior to mowing.

- Activity 900: Schedule Inspections. Description includes performing annual Pavement Conditions Evaluation System (PACES) inspections, Portland Cement Concrete (PCC) Pavement Evaluations, Day and Night Roadway Inspections, Drainage Inspections, and other assigned roadway inspections. Work categories reiterate the above inspection types as well as inspection of CMCs. Recommended procedures specify that inspections should be performed based on the most current GDOT policies, within the specified time frames.

GDOT will continue to perform (and will increase frequency when necessary) preventive maintenance measures to reduce sources of sediment and debris from entering stormwater systems. These preventive maintenance measures may include highway sweeping efforts (both by GDOT forces and contracted [referenced below]) to remove dirt, grit, and sediment from the roadways and drainage system. GDOT will also continue trash and litter pick-up, with internal schedules for maintenance crews and as-needed situations, and as part of right-of-way mowing contracts, CMCs, and highway beautification programs.

GDOT's HMMS tracking process will include the Maintenance Activity Evaluation (MM908) from State Summary, which accounts for actual work quantities for a given time period. This program (or a similarly capable database) will offer concerted efforts for tracking the magnitude of actual GDOT internal maintenance efforts relative to attention given to stormwater structures within MS4 designated areas.

- *General Facility Environmental Guidelines (2007)*. These guidelines present procedures for material handling and storage for various activities conducted by GDOT. The guidelines are focused on GDOT operations, maintenance, storage,

administrative, and public use facilities, each of which has some type of stormwater system. At least twice annually, each of these facilities will be inspected for safety, general housekeeping, and facility handling of potential pollutants (e.g., fuels, oils, coolants, herbicides/pesticides, chemicals, used batteries, scrap tires, wash water, waste disposal). A Maintenance Facility Checklist, which is included in this document, identifies conditions found and provides guidance for any needed corrective actions. With the parallel development and implementation of the GDOT Facilities SWPPP, each of these facilities within designated MS4 areas will undergo scheduled, site-specific MS4 inspections.

- *Integrated Roadside Vegetation Management Herbicides Standards Manual (2012).* This manual summarizes the procedures for herbicide handling and storage.

- *Environmental Compliance, Requirements for GDOT Maintenance Activities and Operations (2000).* This document presents requirements for GDOT maintenance activities and operations and outlines permit notifications that may be required by EPD and/or U.S. Army Corps of Engineers (USACE) for potential maintenance work. The tasks identified in the document include mechanical cleaning of drainage structures, ditch cleaning and restoration, storm drain pipe installation and repair, and culvert repair. According to this document, none of these tasks require a Notice of Intent with EPD or a Preconstruction Notification with USACE (unless work will be performed in live streams).

- *Drainage Maintenance Manual (2006).* GDOT's maintenance personnel use this manual to identify drainage deficiencies and determine the best procedures for correcting them. Drainage facilities included in the manual are pipe and box culverts, storm sewers, drop inlets and catch basins, high shoulders, low shoulders/edge ruts, ditches, slope drains, flumes, and curbs and gutters.

3.2 External Contracted Inspection and Maintenance Practices

GDOT external specialty maintenance contracts will provide several services, including annual cleaning of identified storm drain structures. Whether included as an aspect of a district or statewide sweeping and (identified in Section 3.1 as a preventive measure) storm drain cleaning services contract or an interstate corridor-specific CMC, storm drainage structures will receive GDOT's attention via these contracts.

Contracts to provide highway sweeping services will include provisions for cleaning storm drainage structures and pipes. The scope of storm drainage structure cleaning will involve removal and replacement of covering grates for items such as median barrier wall box inlets, drop inlets, catch basins, gutter drains, ramp drains, and bridge end drainage inlets, and vacuum removal of debris from the throat and chamber areas of the structures and from 15 feet in each direction of the

connecting piping. Inventory data for each structure will be collected and will include global positioning system (GPS) coordinates, GDOT district, route designation, nearest milepost, and structure identification number, as well as any notation of corrective action recommended. In addition, through highway sweeping, right-of-way mowing, or other contracts, litter encountered during these activities will be removed as a pollution prevention measure.

Other similar external contracts will encompass a broader array of highway and right-of-way maintenance activities (e.g., inspecting drainage structures [biennially] and addressing inlet/outlet overgrowth of vegetation or erosion, damages due to siltation, cracking, joint failures, blockages).

3.3 External Municipal Inspection and Maintenance Practices

GDOT will continue to enter into various contracts for maintenance of highways and memorandums of agreement with authorized cities, counties, and other stakeholders in MS4 designated areas to perform new construction as well as maintenance of existing facilities under the terms of the agreements. These agreements will allow GDOT the necessary oversight to manage potential problems, conduct timely inspections, and perform corrective actions promptly and effectively. Details of these efforts as they relate to MS4 structures will be tracked through a maintenance management system.

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MS4 Structures and Controls

SECTION

4

4 MS4 Structures and Controls

GDOT has for years installed, operated, and maintained stormwater collection and conveyance systems to provide safe and effective drainage along its highways. Unfortunately, these same systems may also transport roadway pollutants as runoff flows from impervious areas and erodes less stable surfaces. These pollutants may discharge to streams, rivers, lakes, marshes, and other water bodies.

MS4 structures are defined as collection and conveyance system components comprising pipes, ditches, channels, swales, manholes, junction boxes, catch basins, drop inlets, and appurtenant structures designed to manage and safely direct storm runoff from roadways and GDOT facilities. The inspection and maintenance of MS4 structures, as presented in this I&M Manual, extends the purpose of GDOT's current inspection and maintenance policy and procedures to reduce the potential for MS4 structures to adversely affect water quality. MS4 structures do not include bridge structures or roadway culverts[1] as defined by federal code and GDOT or culverts under roadways. The inspection and maintenance of these structures is not discussed in this I&M Manual.

Routine inspection and maintenance of MS4 structures must be conducted so that the structures continually function as designed structurally and hydraulically, and to prevent the potential discharge of pollutants to receiving waters. GDOT has measures in place to lessen pollutant loads. These measures include increasing efforts to reduce and pick up roadside litter, performing highway sweeping operations, cleaning catch basins and inlets and enhancing stormwater system inspection programs.

Primary indicators of MS4 structure impairments include structural deformation, erosion, corrosion, and blockages from animals, debris, siltation, and undesirable vegetation. It is important to note that the structural and hydraulic integrity of MS4 structures relates directly to water quality. Failure or impairment of these structures could lead to the release of sediment, debris, and potential pollutants to receiving waters. Inspection may also include observation and corrective action of potential illicit discharges, as defined in the IDDE Plan.

The remainder of this section presents general inspection and maintenance procedures and protocols for MS4 structures, incorporating relevant general inspection protocols from the Drainage Inspection Manual for Minor Drainage Structures. GDOT's practice of biennial inspection is applicable to MS4 structures. Detailed inspection checklists are provided in Appendix A.

Although the MS4 Stormwater Structure Inspection Checklists included in Appendix A provide the basics of the inspection criteria and may be manually used, an electronic process will be the primary method for recording inspection data. Table 4-1, located at the end of this section, offers an abbreviated exhibit of the types of detailed attributes collected and their correlation to the three-

[1] If the clear span is more than 20 feet (Drainage Inspection Manual for Minor Drainage Structures).

tiered condition assessment (discussed in section 2.2). The overall condition rating is assigned at the completion of the inspection based upon the most severe rating recorded from any of the individual attributes. The process for completing field inspection of an MS4 structure using the three-tiered condition assessment is:

Step 1. Select the relevant description of the structure's attributes (Table 4-1).

Step 2. Correlate the description with the condition assessment tier. For example, a blockage of 0 to 25% is assigned a green condition, 26-50% is assigned a yellow condition, and 51 – 100% is assigned a red condition.

Step 3. Assign the overall structure condition rating at the completion of the inspection based upon the most severe rating recorded from any of the individual attributes. For example, a structure with blockage condition of green (0%), erosion level condition of yellow (moderate erosion), surface condition of red (severe settling), structure defect condition of not applicable (green) receives an overall structure condition rating of red.

The recommended actions identified by the inspector will be addressed by following the maintenance approach and guidelines established in the *Drainage Maintenance Manual* and other existing maintenance practices.

4.1 Pipe Systems

4.1.1 Description and Function of Structure

Pipe systems are linear systems designed to collect, convey, and direct roadway runoff safely and effectively away from the roadway surface. These component structures are typically part of an interdependent conveyance system. The impairment of one pipe segment can compromise the functionality of the larger system.

Pipe structures are constructed from a variety of materials in accordance with GDOT specifications. The most common pipe structures include concrete and corrugated metal conduits that are designed or constructed primarily for subsurface stormwater runoff conveyance.

4.1.2 Inspection and Maintenance

Pipe systems are subject to functional impairment by a variety of conditions, including:

- Subsurface settlement
- Cracks and/or joint separation
- Corrosion
- Scour, undermining, or erosion at the inlet or outlet
- Obstruction due to vegetation, debris, or other objects
- Capacity reduction due to excessive sediment accumulation.

Figures 4.1-1, 4.1-2, 4.1-3, and 4.1-4 depict some of these conditions.

Figure 4.1-1
Sediment Accumulation

Figure 4.1-2
Inlet Obstructed

Figure 4.1-3
Trash/Debris Accumulation

Figure 4.1-4
Erosion/Collapse

The inspector will observe and note any of the following conditions on the checklist provided in Appendix A to determine appropriate actions to remedy functional impairments:

- Surface over the pipe system for settlement or lost cover.
- Structural condition of the outlet and inlet ends of the pipe system, including headwalls and aprons for cracks, separation, or collapsed end conditions.
- Scouring or undermining, including evidence of animal burrows.
- Obstructions due to excessive vegetation, particularly trees or other woody vegetation.
- Woody vegetation that may damage the pipe and/or inlet and outlet structure.

- Pipe structures for collapse or deformation. Pipes that have taken on a non-circular shape indicate a structural deficiency that could cause the structures to collapse and/or reduce the flow capacity of the system.

- Corrosion of metal pipes, particularly at the invert. Corrosion of the pipe reduces structural integrity and may create conditions for undermining and erosion. If the invert is rusted out and deformation is present, the pipe is in danger of collapse.

- Deposition of sediment and other debris. The inspector should estimate the severity of the sediment or siltation by estimating the depth of the deposits relative to the diameter of the pipe and recording the information on the inspection form. Water, sediment, and other debris in the structure often prevent a proper inspection of the structure. In these cases, every effort should be made to clear the structure so that an inspection can be performed.

- Scour at inlets. Scour at inlet ends of pipes is caused by turbulence that results when more water is collected at the inlet than can rapidly be discharged by the pipe. When water collects at the inlet end of pipe culverts, the cause should be determined as soon as possible and the necessary correction should be made promptly to preclude pipe failure.

- Scour at outlets. Scour at outlet ends of pipes is caused by fast, uncontrolled discharge of a volume of water into an outlet channel that is easily eroded or from a pipe with inadequately controlled discharge. Undermining and failure of the outlet headwall can result from such scouring.

In some cases, due to the size, length, and/or condition of the structure, the inspector may not be able to perform the inspection. These cases should be noted and submitted for alternate inspection methods (e.g., closed-circuit television inspection).

The inspector will record the inspection, performance condition assessment, and recommend action on Form A-1 (Appendix A).

4.2 Ditches, Channels, and Swales

4.2.1 Description and Function of Structure

Ditches, channels, and swales are open, linear systems designed to safely and effectively collect, convey, and direct roadway runoff away from the roadway surface. These component structures are typically part of a conveyance system that is interdependent for proper and effective function. The impairment of one segment can compromise the functionality of the larger system.

These MS4 structures may be concrete lined but also include natural or grass channels. Enhanced vegetated swales and channels designed for filtering and/or detention to provide water quality treatment are designated as post-construction structures.

4.2.2 Inspection and Maintenance

Ditch, channel, and swale systems are subject to functional impairment by a variety of conditions, including:

- Surface settlement or sinks
- Erosion
- Concrete liner cracks, separation, or blowout
- Obstruction due to debris, beaver dams, or other objects
- Capacity reduction due to excessive sediment accumulation
- Loss of grass or vegetative liner
- Animal burrows
- Obstruction due to excessive vegetation
- Damage from equipment or motor vehicles.

Figure 4.2-1 shows cracks and joint separation in the concrete channel. Note: removal of the vegetation may prevent further joint separation.

Figure 4.2-1
Cracks and Joint Separation in Concrete Channel

The inspector will observe and note any of the following conditions using checklists and forms provided in Appendix A-2 to determine appropriate actions to remedy functional impairments:

- Settlement or sinks along the surface.
- Erosion.
- Cracks, separation, or blowout of concrete liner.
- Accumulation of sediment or debris. The inspector will assess the severity of sediment accumulation or siltation by estimating the depth of the deposits and recording the information on the inspection form.
- Evidence of animal burrows.
- Obstructions due to excessive vegetation, particularly trees or other woody vegetation.
- Obstructions due to beaver dams or other objects.
- Damage due to equipment or motor vehicles.

Ditches, swales, and drainage channels should be maintained to the line, grade, depth, and cross section to which they were constructed or subsequently improved. Settlement should be corrected and repairs of broken or eroded surfaces should be made with appropriate materials.

Ditches, swales, and drainage channels should be kept reasonably clear of obstructing materials and kept clean of debris and trash that may impede the normal flow of water. These include gutters or curbs used along the side of a roadway surface to collect and control the flow of water and direct it to an inlet or outlet ditch, catch basin, or shoulder drain leading the water into a nearby stream or other natural watercourse.

The inspector will record the ditch, swale, and drainage channel inspection, performance condition assessment, and recommended action on Form A-2 (Appendix A).

4.3 Manholes, Junction Boxes, Catch Basins, and Inlets

4.3.1 Description and Function of Structure

Manholes, junction chambers, catch basins, and inlets are junction and connection points for the linear system described in Section 4.2 and are designed to safely and effectively collect, convey,

and direct roadway runoff away from the roadway surface. These MS4 component structures are part of a conveyance system that is interdependent for proper and effective function. The impairment of one structure can compromise the functionality of the larger system.

These MS4 structures are constructed conveyances made from a variety of materials in accordance with GDOT specifications.

4.3.2 Inspection and Maintenance

These MS4 structures are subject to functional impairment by a variety of conditions, including:

- Settlement
- Structural cracks
- Joint separation at inlet and outlet connections
- Infiltration or exfiltration due to cracks and joint separation
- Obstruction due to debris or other objects
- Capacity reduction due to excessive sediment accumulation
- Obstruction due to excessive vegetation
- Damage from equipment or motor vehicles.

Some of these conditions are shown on Figures 4.3-1 through 4.3-4.

Figure 4.3-1
Missing Proper Cover

Figure 4.3-2
Debris Accumulation

Figure 4.3-3
Grate Obstruction

Figure 4.3-4
Sediment/Debris Buildup

The inspector will observe and note any of the following conditions using checklists and forms provided in Appendix A to determine appropriate actions to remedy functional impairments:

- Settlement.
- Cracks or separation at inlets or outlets joints.
- Accumulation of sediment or debris. The inspector will assess the severity of the sediment or siltation by estimating the depth of the deposits and recording the information on the inspection form.
- Lost, misaligned, or damaged covers.
- Obstructions or blockages.
- Damage from equipment or motor vehicles.

Like other MS4 structures, manholes, junction boxes, catch basins, and inlets are subject to structural degradation, blockage, and sediment and debris accumulation. They must be routinely inspected and maintained to continually function as designed structurally and hydraulically and to prevent the potential discharge of pollutants to receiving waters.

These structures are typically found at GDOT facilities and along the highway right-of-way, and therefore have the potential to collect and accumulate sediment, debris, and trash.

Catch basins are typically designed to provide protection against sediment transport through the use of a sump at the base of the catch basin. It is important to remove and properly dispose of sediment and debris accumulated in the sump so that it can continue to function as designed and to reduce the amount of sediment, trash, and other debris that enters the storm drain and is transported to surface waters.

The removal of trash and other debris will improve the conveyance capacity of the structure, improve water quality, reduce the potential for outlet clogging during storm events, and reduce the amount of sediment and debris released to receiving waters. Trash should be removed on a routine basis as part of maintenance activities.

The inspector will record the inspection, performance condition assessment, and recommended action on Form A-3 (Appendix A).

Table 4-1 MS4 Structure Inventory and Inspection Database

All Structure Types (catch basin, inlet, manhole, headwall, etc.)

Blockage

Approximate percentage of blockage within the feature (ex. Sediment, debris, trash, etc).

Description	Correlates to Performance Condition Level
0%	**green**
1 - 25%	**green**
26 - 50%	**yellow**
51 - 75%	**red**
76 - 100%	**red**

Erosion Level

Approximate level of erosion around the structure.

Description	Correlates to Performance Condition Level
Sod / Grass - No erosion	**green**
RipRap - No erosion	**green**
Paved	**green**
Active waterway	**N/A**
Moderate erosion	**yellow**
Severe erosion	**red**
Other	**N/A**

Surface Condition

Condition of the surface surrounding the structure.

Description	Correlates to Performance Condition Level		
	No Action Required	Moderate	Severe
Syphon holes	**green**	**yellow**	**red**
Settling	**green**	**yellow**	**red**
Erosion	**green**	**yellow**	**red**
Exposed pipe	**green**	**yellow**	**red**
Other	**green**	**yellow**	**red**

Structure Defect

Structural defects related to MS4 structures.

Description	Correlates to Performance Condition Level		
	No Action Required	Moderate	Severe
Not Applicable	**N/A**	**N/A**	**N/A**
Scouring/Undermining	**green**	**yellow**	**red**
Structural Damage	**green**	**yellow**	**red**
Surface Settlement	**green**	**yellow**	**red**
Cracks/Joint Separation	**green**	**yellow**	**red**
Top/Cover Broken or Missing	**green**	**red**	**red**
Leaking	**green**	**red**	**red**
Root Intrusion	**green**	**yellow**	**red**

All Conveyance Types (pipes, swales, ditches, etc.)

Blockage

Approximate percentage of blockage within the feature (ex. Sediment, debris, trash, etc).

Description	Correlates to Performance Condition Level
0%	**green**
1 - 25%	**green**
26 - 50%	**yellow**
51 - 75%	**red**
76 - 100%	**red**

Water Level

Approximate level of erosion around the structure.

Description	Correlates to Performance Condition Level
0%	**green**
1 - 25%	**green**
26 - 50%	**yellow**
51 - 75%	**red**
76 - 100%	**red**

Surface Condition

Condition of the surface surrounding the conveyance.

Description	Correlates to Performance Condition Level		
	No Action Required	Moderate	Severe
Syphon holes	**green**	**yellow**	**red**
Settling	**green**	**yellow**	**red**
Erosion	**green**	**yellow**	**red**
Exposed pipe	**green**	**yellow**	**red**
Other	**green**	**yellow**	**red**

Conveyance Defect

Structural defects related to MS4 conveyances.

Description	Correlates to Performance Condition Level		
	No Action Required	Moderate	Severe
Not Applicable	**N/A**	**N/A**	**N/A**
Joint Separation	**green**	**yellow**	**red**
Pipe Collapsed	**green**	**yellow**	**red**
Surface Settlement	**green**	**yellow**	**red**
Pipe Corrosion	**green**	**yellow**	**red**
Root Intrusion	**green**	**yellow**	**red**
Lack of Stabilization	**green**	**yellow**	**red**
Erosion	**green**	**yellow**	**red**
Liner Damage	**green**	**yellow**	**red**
Scouring/Undermining	**green**	**yellow**	**red**
Surcharged Flow	**green**	**yellow**	**red**

Georgia Department of Transportation

Post-Construction Structures and Controls

SECTION

5

5 Post-Construction Structures and Controls

GDOT's Permit GAR041000, Table 4.2.5, defines post-construction structures as those "designed for filtering and/or detention." These structures/controls are engineered to filter, detain, and/or retain stormwater flows to allow the removal of pollutants prior to discharge into waterways. Post-construction structures are designed to stay in place and treat runoff after an impervious surface is built, as opposed to temporary erosion control practices used during a construction project (e.g., silt fences, sediment basins). Post-construction structures will be identified, inventoried, and maintained.

Post-construction structures are identified and described in the GDOT Manual on Drainage Design for Highways (Drainage Design Manual). Inspectors will refer to the Drainage Design Manual for design and performance specifications. Post-construction structures generally require annual inspections while more frequent routine inspections, such as after major storm events, may be required based on the location, past maintenance issues, or risk associated with safety or compliance with the MS4 Permit due to non-performance of a structure. This section discusses the inspection and maintenance procedures necessary for long-term operation of post-construction structures. The results of the compliance inspections will be documented on inspection checklists provided in Appendix B.

5.1 Filter Strips

5.1.1 Description and Function of Structure

Filter strips are uniformly graded and permanent areas of dense vegetation located between runoff pollutant sources (e.g., road and highway shoulders, medians, other paved areas) and post-construction structures or receiving water bodies. Vegetated filter strips may be constructed of turf, meadow grasses, or other dense vegetation. Filter strips may also surround an MS4 structure (e.g., drop inlet), as shown on Figure 5.1-1.

Figure 5.1-1 Channel between Filter Strip (top left), Filter Strip around Drop Outlet (top right), Concrete Level Spreader and Filter Strip (bottom left), and Concrete Level Spreader under Construction (bottom right)

Filter strips remove pollutants from stormwater runoff through increased sedimentation. Filter strips typically have a level or flow spreader to create and maintain sheet flow across the filter strip and may incorporate an infiltration berm at the lower end of the strip. Filter strips reduce the

impacts of temperature and encourage filtration and infiltration, which are facilitated by vegetation. Figure 5.1-2 shows a typical filter strip configuration and components.

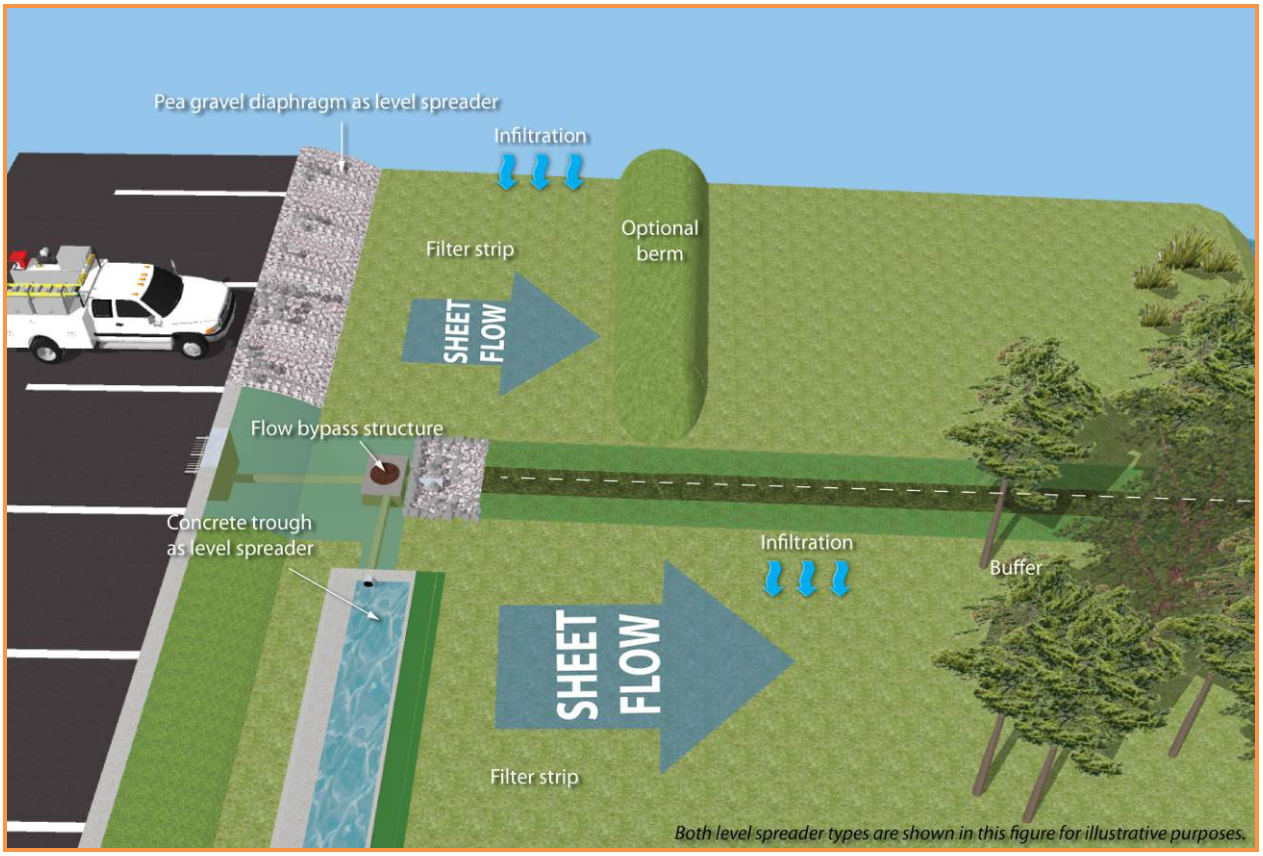


Figure 5.1-2 Typical Filter Strip Configuration and Components

The following key functional features of filter strips must be maintained:

- Runoff sheet flows across the entire filter strip.
- Uniform sheet flow conditions at the interface of the filter strip and the adjacent land cover, such as the buffer shown on Figure 5.1-2.
- Energy dissipation structures, such as flow spreaders or pea gravel diaphragms to control inflow velocity and erosive energy.
- Dense and uninterrupted vegetation.

Section 5.1.2 recommends inspection and maintenance practices for maximizing filter strip performance.

5.1.2 Inspection and Maintenance

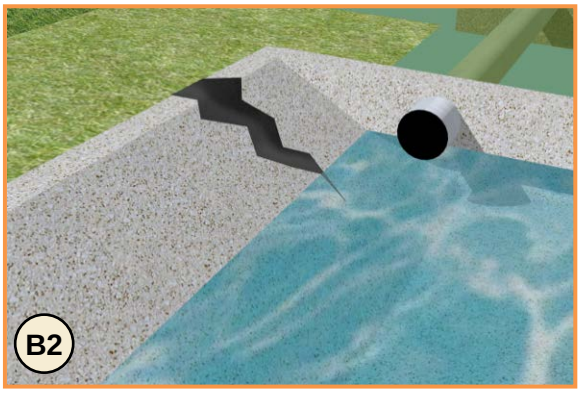
Filter strips are considered a preferential BMP because they are adaptable in a linear setting and are highly cost-effective. Inspections of filter strips should be conducted at least annually. The inspector will document observed conditions using Form B-1 (Appendix B), determine appropriate actions to remedy functional impairments per this I&M Manual, and document routine or as-needed maintenance performed.

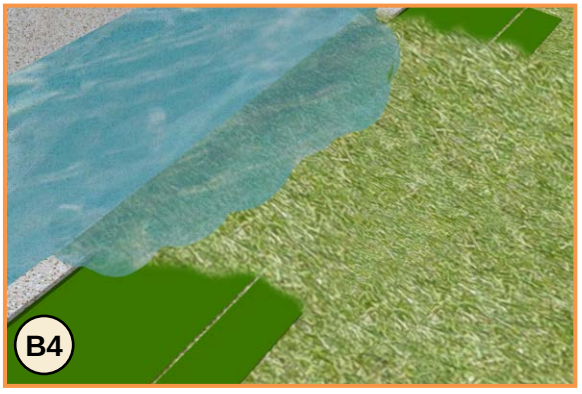
Inlet, Outlet, and Flow Bypass Structure to Filter Strip

- **A1: Inspect for trash, debris, and sediment:**
  - Remove trash and vegetative debris or sediment that has the potential to inhibit flow into the filter strip.
- **A2: Inspect for signs of erosion:**
  - Repair eroded areas by resodding or reseeding. Restore compacted fill, filter fabric, and rock riprap (if present). If erosion is a recurring problem, consult a design professional.
  - Identify and control the source of erosion damage if soil is exposed or erosion channels are forming.
  - Check the upstream areas for bank stability and evidence of piping or scour holes.
- **A3: Inspect inlet, flow bypass, and outlet pipes for damage or plugging:**
  - Repair or replace damaged piping if needed.
  - If plugged, remove material and identify and mitigate the source of sediment or debris.

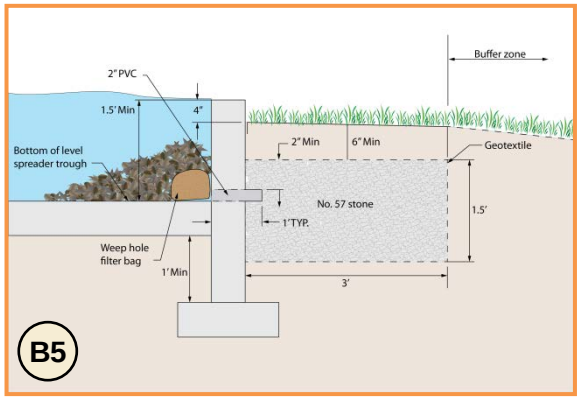
Level or Flow Spreader

- **B1: Inspect for trash, debris, or sediment in or around level spreader:**
  - Remove trash and debris, especially if it has the potential to inhibit proper flow.
  - Remove major sediment accumulations in concrete trough and any sediment buildup around the level spreader lip that could cause flow to concentrate.
  - Confirm that the drainage area is properly stabilized if sediment removal becomes a common occurrence.
- **B2: Inspect for cracks in concrete troughs:**
  - Patch cracks with non-shrink grout for simple repairs.
  - Inject chemical grout into cracks for more difficult repairs.
- **B3: Inspect for erosion or washout immediately downslope of the level spreader lip:**
  - Repair by resodding damaged areas. Regrade if necessary.
  - Repair, replenish, or furnish additional erosion protection materials as needed.
  - Determine cause of erosion and correct.
  - Repair any damage that could cause flow to channelize.
- **B4: Inspect concrete troughs for damage to the level spreader lip:**
  - Repair damage that could cause a reconcentration in flow.



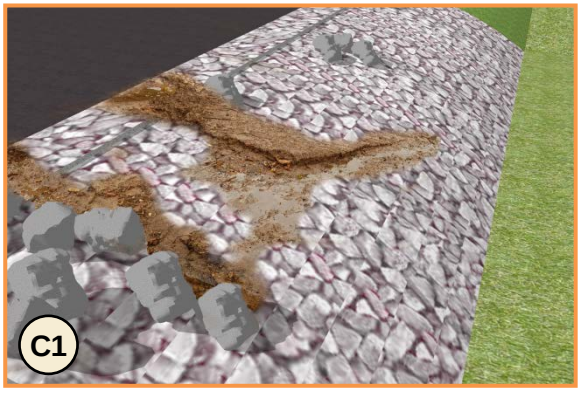


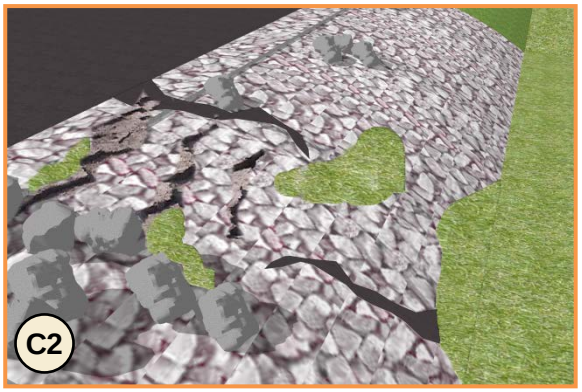
- **B5: Inspect drawdown system, if present, for clogging:**
    - If standing water indicates clogging, clear the concrete trough and flush drawdown system if possible.



Pea Gravel Diaphragm

- **C1: Inspect for sediment accumulation on pea gravel diaphragm:**
    - Remove sediment and replace any lost gravel with new, clean gravel.
- **C2: Inspect pea gravel diaphragm for damage:**
    - Repair damaged gravel diaphragm to original design specifications.
    - Supplement gravel if needed.





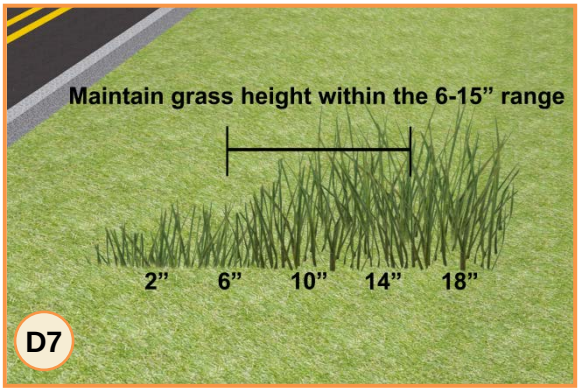
Filter Strip

- **D1: Inspect filter strip for trash or debris:**
    - Remove and properly dispose of trash and debris.

- **D2: Inspect for areas of unhealthy grass cover, bare areas, or dying grass:**
    - Inspect overall vegetative cover, which should be maintained at a coverage of 70 percent. Reseed and add topsoil to bare areas.
    - Provide lime and one-time fertilizer application if soil testing indicates that fertilization is needed.
    - Use rolled erosion control product on eroded areas and steeper slopes as needed.
    - If due to unusually dry conditions, water where practical.
    - If compaction is a concern, aerate the soil using a core aerator that collects cores, or collect cores by hand and dispose of the cores in an area that will not impact stormwater or receiving waters. Aerate only during times of the year when grass is actively growing.
    - If the problem persists, determine the source of the problem (e.g., soil, drainage). If needed, perform additional soil testing and carefully apply soil amendments (e.g., supplemental nutrients, compost).

- **D3: Inspect for the presence of areas of erosion or gullies forming in the filter strip:**
    - Ensure that runoff is entering the strip as sheet flow. Consider installing a level spreader or similar device if none is in place.
    - Regrade the soil if necessary to remove the gully. Plant ground cover and water until it is established.
    - Repair eroding areas by filling/regrading and reestablishing ground cover.
    - Use sod where possible and provide adequate erosion protection until repaired areas are well stabilized.
    - Irrigate and provide lime and one-time fertilizer application if needed.

- **D4: Inspect filter strip area for undesirable vegetation.**
  - Remove woody vegetation that can cause flow to channelize.
  - Remove vegetation that threatens the function or integrity of the filter strip.
- **D5: Inspect for areas of standing water:**
  - Dewater and discharge to an approved location. Regrading may be required.
  - If a filter strip exhibits signs of poor drainage, determine cause of standing water (e.g., compacted soil, significant erosion) and regrade if necessary. Standing water can result in a mosquito breeding ground.
- **D6: Inspect filter strip for sediment accumulation:**
  - Remove sediment from within the filter strip area when it reaches a depth of 1 to 3 inches. Reestablish vegetation and regrade if necessary.
- **D7: Ensure that minimum mowing height is maintained:**
  - Mow grass within the filter strip at a height that will maintain a dense vegetative cover. For highway right-of-way areas, a grass height of 6 to 15 inches may be practical.



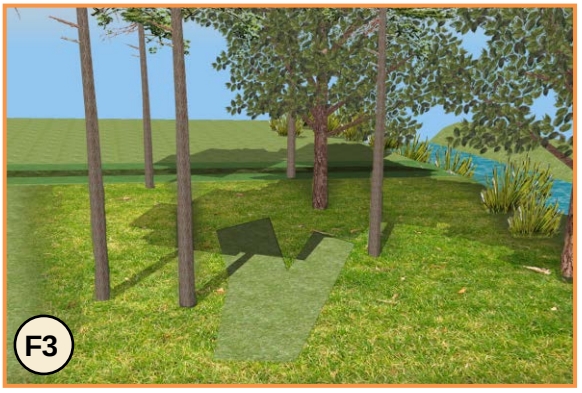
Berm

- **E1: Inspect for areas of erosion on or around berm:**
  - Repair eroding areas by filling/regrading and reestablishing ground cover.
  - Use sod where possible and provide adequate erosion protection until repaired areas are well stabilized.
  - Irrigate and provide lime and one-time fertilizer application if needed.
  - If necessary, restore the berm to the dimensions and elevations shown on the construction plans; use suitable backfill and compact as indicated on the construction plans/specifications.

- **E2: Inspect the base of the berm for sediment accumulation:**
  - Gather and remove sediment with hand tools when possible. Pay attention to the top and toe of the slope where sediment is likely to gather. Remove sediment from the filter strip area when it begins to cover and kill grass.
  - Re-establish vegetation and provide soil amendments if needed.
  - Ensure that the drainage area is properly stabilized if sediment accumulation becomes a common issue.

Buffer/Adjacent Ground Cover

- **F1: Inspect for areas of erosion or formation of gullies in buffer/adjacent area:**
  - Ensure runoff is entering the buffer/adjacent area as sheet flow. Consider installing a level spreader or similar device if none is in place.
  - Fill gullies and mulch and replant where needed.
  - Reoccurring erosion issues may indicate that runoff exceeds the amount that the buffer/adjacent area can accept. Consider installing a flow bypass system to route excess runoff through the buffer/adjacent area in a channel or pipe.
- **F2: Inspect for accumulated sediment:**
  - Remove sediment if accumulations are excessive. Typically, 6 inches is considered excessive.
- **F3: Inspect for disturbances within the buffer:**
  - Identify evidence of activities that have negatively impacted buffer areas (e.g., mowing) and remedy by communicating with responsible parties and identifying buffer boundaries.
  - Environmental regulations impose specific rules or restrictions for activities within buffers. Typically, regulated buffers should not be developed or disturbed.



5.2 Grass Channel

5.2.1 Description and Function of Structure

A grass channel is typically a broad and shallow vegetated channel with trapezoidal or parabolic geometry and a slight longitudinal slope, and is used to convey and treat stormwater runoff. Figure 5.2-1 shows two examples of a roadside grass channel. A grass channel functions as a "biofilter" and is planted with grassy vegetation to filter and capture sediment to improve water quality. A grass channel is commonly used as part of a “treatment train” approach to improve water quality. Depending on the design, a grass channel can also reduce stormwater runoff volume. A grass channel differs from the enhanced dry swale design because it does not have engineered filter media to promote additional pollutant removal and therefore has a lower pollutant removal rate than a dry or wet (enhanced) swale. A grass channel can partially infiltrate runoff from small storm events in areas with pervious soil. Figure 5.2-2 shows a typical grass channel configuration and components.

Figure 5.2-1 Two Examples of a Roadside Grass Channel

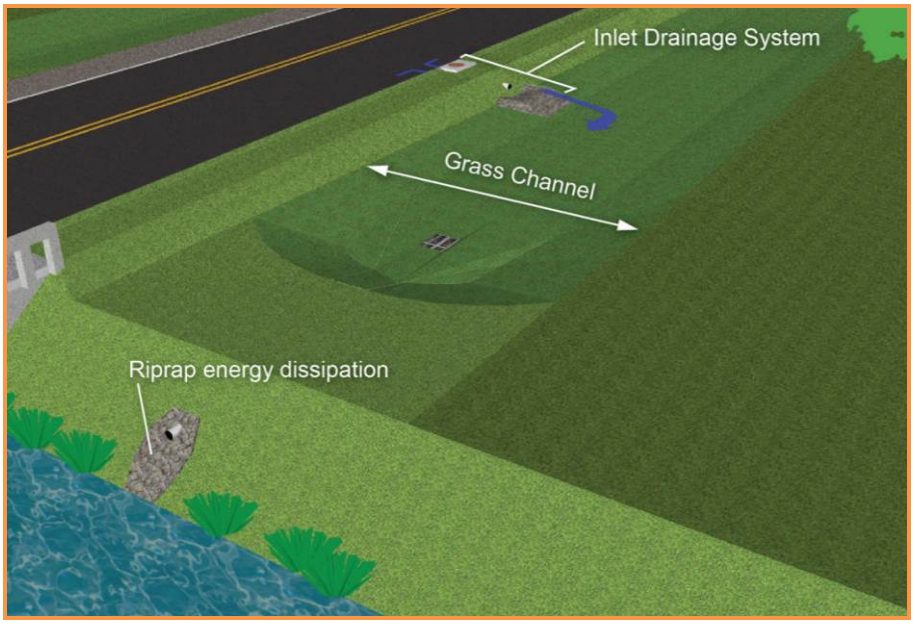


Figure 5.2-2 Typical Grass Channel Configuration and Components

Key functional features of grass channels include:

- Serve as pretreatment for other post-construction structures in a “treatment train” system.
- Maintain dense and uninterrupted vegetation for optimal filtration.

Section 5.2.2 recommends inspection and maintenance practices for maximizing grass channel performance.

5.2.2 Inspection and Maintenance

Inspections of grass channels should be conducted at least annually. The inspector will document observed conditions using Form B-2 (Appendix B), determine appropriate actions to remedy functional impairments per this I&M Manual, and document routine or as-needed maintenance performed.

Inlet and Outlet Drainage Systems

A grass channel may not have a structural inlet and flow may enter directly from the roadway via a filter strip. Section 5.1 discusses filter strip maintenance.

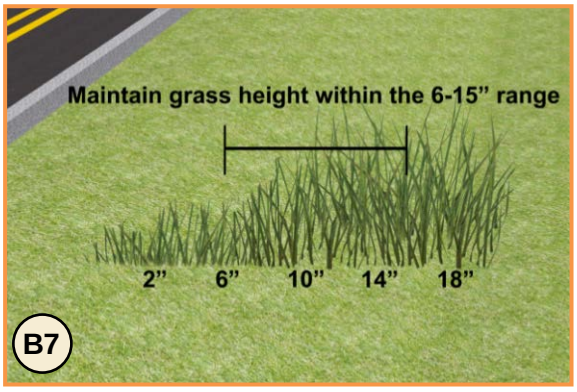
- **A1: Inspect for trash, debris, and sediment:**
  - Remove trash and vegetative debris or sediment that has the potential to inhibit flow into the grass channel.
- **A2: Inspect for signs of erosion:**
  - Repair eroded areas by resodding or reseeding. Restore compacted fill, filter fabric, and rock riprap (if present). If erosion is a recurring problem, consult a design professional.
  - Identify and control the source of erosion damage if soil is exposed or erosion is evident in the channel bottom or side slopes.
  - Check upstream areas for bank stability and evidence of piping or scour holes.
- **A3: Inspect inlet and outlet pipes for damage or plugging:**
  - Repair or replace damaged piping if needed.
  - If plugged, remove material and identify and mitigate the source of sediment or debris.

Grass Channel

- **B1: Inspect for trash or debris within the grass channel:**
  - Remove and properly dispose of trash and debris.
- **B2: Inspect for areas of unhealthy grass cover, bare areas, or dying grass:**
  - Inspect vegetative cover, which should be maintained at a coverage of 70 percent. Reseed and add topsoil to bare areas.
  - If needed, perform soil testing and carefully apply soil amendments. Also provide lime and one-time fertilizer application if soil testing indicates that pH adjustment and fertilization are needed.
  - Use a rolled erosion control product on eroded areas and steeper slopes as needed.
  - If due to unusually dry conditions, water where practical.
  - If compaction is a concern, aerate the soil using a core aerator that collects cores, or collect cores and dispose of the cores in an area that will not impact stormwater or receiving waters. Aerate only during times of the year when grass is actively growing.
  - If the problem persists, determine the source (e.g., soil, drainage) and perform appropriate corrective actions.
  - Provide lime and one-time fertilizer application if needed.

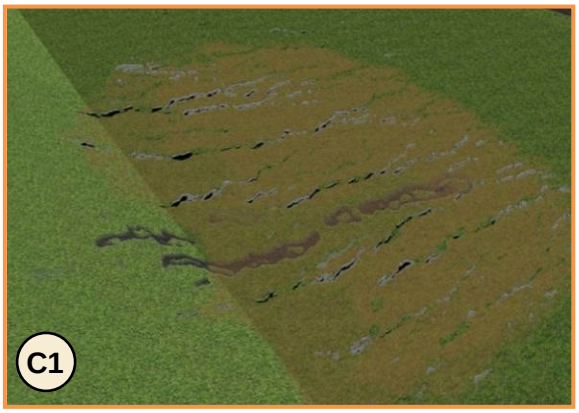
- **B3: Inspect for areas of erosion or formation of gullies in the channel:**
  - Runoff must enter the channel as sheet flow. Consider installing a level spreader or similar device if none is in place and there are signs of erosion from concentrated flow.
  - Regrade the soil if necessary to fill in eroded areas. Plant ground cover and water, if practicable, until it is established.
  - Repair eroding areas by filling/regrading and reestablishing ground cover.
  - Use sod where possible and provide adequate erosion protection until repaired areas have stabilized.
  - Provide lime and one-time fertilizer application if needed.
- **B4: Inspect channel area for undesirable vegetation:**
  - Remove woody vegetation that can cause flow to channelize.
  - Remove vegetation that threatens the function or integrity of the structure.
- **B5: Inspect for areas of standing water:**
  - Dewater and discharge to an approved location. Regrading may be required.
  - If a channel exhibits signs of poor drainage, determine cause of standing water (e.g., compacted soil, significant erosion) and regrade if necessary. Standing water can result in mosquito and pest problems.
- **B6: Inspect for sediment accumulating within grass channel:**
  - Remove sediment from within the channel area when it accumulates to a depth of 1 to 3 inches. Reestablish vegetation and regrade if necessary.

- **B7: Inspect and check that proper mowing height is maintained:**
    - Mow grass within the grass channel to maintain the grass height between 6 and 15 inches.



Side Slopes

- **C1: Inspect for evidence of erosion, rills or gullies forming on side slopes:**
    - Repair erosion after heavy storms.
    - Replace eroded soil to conform to the original geometry.
    - Rake, seed, and provide soil amendments (mulch or compost) to re-establish vegetation.
    - Provide lime and a one-time fertilizer application if needed.
    - Install matting in steep areas and overseed.



Pea Gravel Diaphragm (optional) and Stone Check Dam (optional)

See Section 5.12 for guidance on inspection and maintenance of optional components.

5.3 Enhanced Swales

5.3.1 Description and Function of Structure

Enhanced swales are vegetated open channels designed and constructed to capture and treat stormwater runoff within dry or wet cells formed by check dams or other means. Figure 5.3-1 shows examples of two types of enhanced swales. Enhanced swales are a structural BMP considered low impact development (LID) and green infrastructure (GI) practices. Specific features are incorporated in the design of the swales to enhance stormwater pollutant removal effectiveness and to distinguish the enhanced swale from a normal drainage or grass channel.

There are two types of enhanced swales: dry swale and wet swale. Figures 5.3-2 and 5.3-3 show a typical configuration and components of an enhanced dry swale and enhanced wet swale, respectively.

Key functional features of enhanced dry swales include:

- Filter bed of engineered soil media that filters pollutants from stormwater.
- Underdrain system that collects the filtered stormwater and discharges the filtered water downstream.
- Surface vegetation that provides pollutant removal and aesthetic benefits.

Key functional features of enhanced wet swales include:

- Vegetated channel designed to retain water or marshy conditions that support wetland vegetation.
- Wetland vegetation that provides pollutant removal and aesthetic benefits.

Figure 5.3-1 Examples of a Dry (left) and a Wet Swale (right) (source: Georgia Stormwater Management Manual [GSMM], Volume 2)

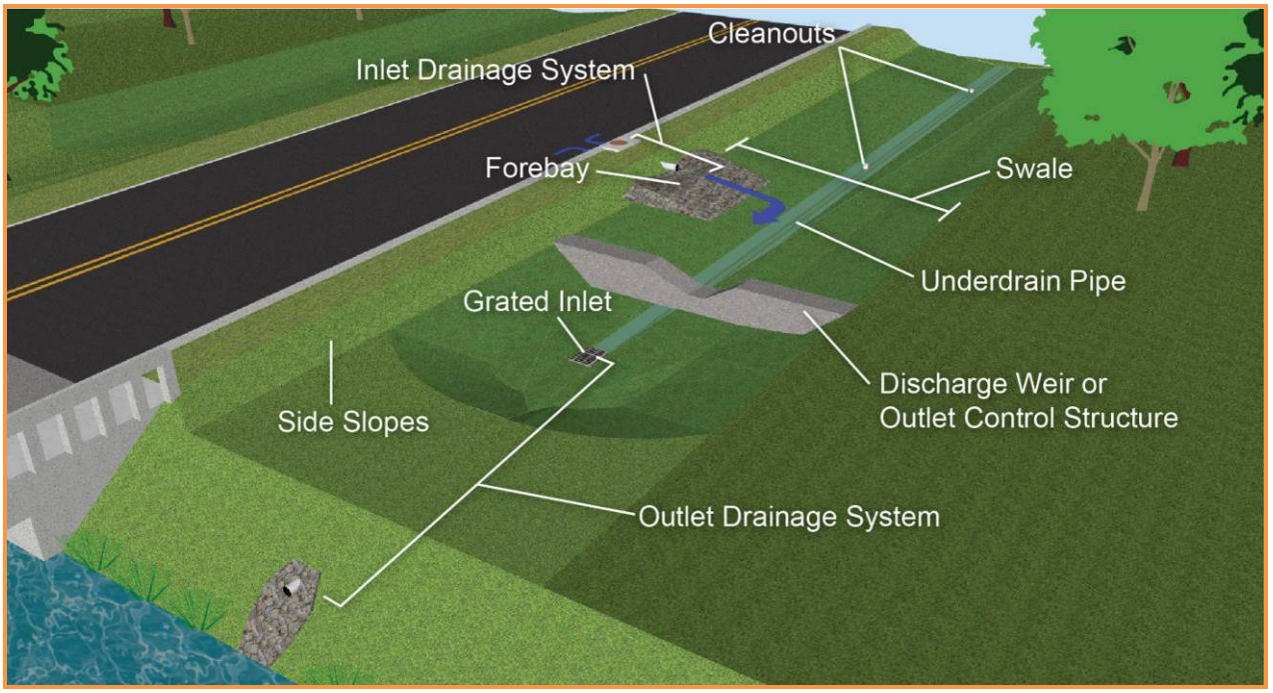


Figure 5.3-2 Typical Enhanced Dry Swale Configuration and Components

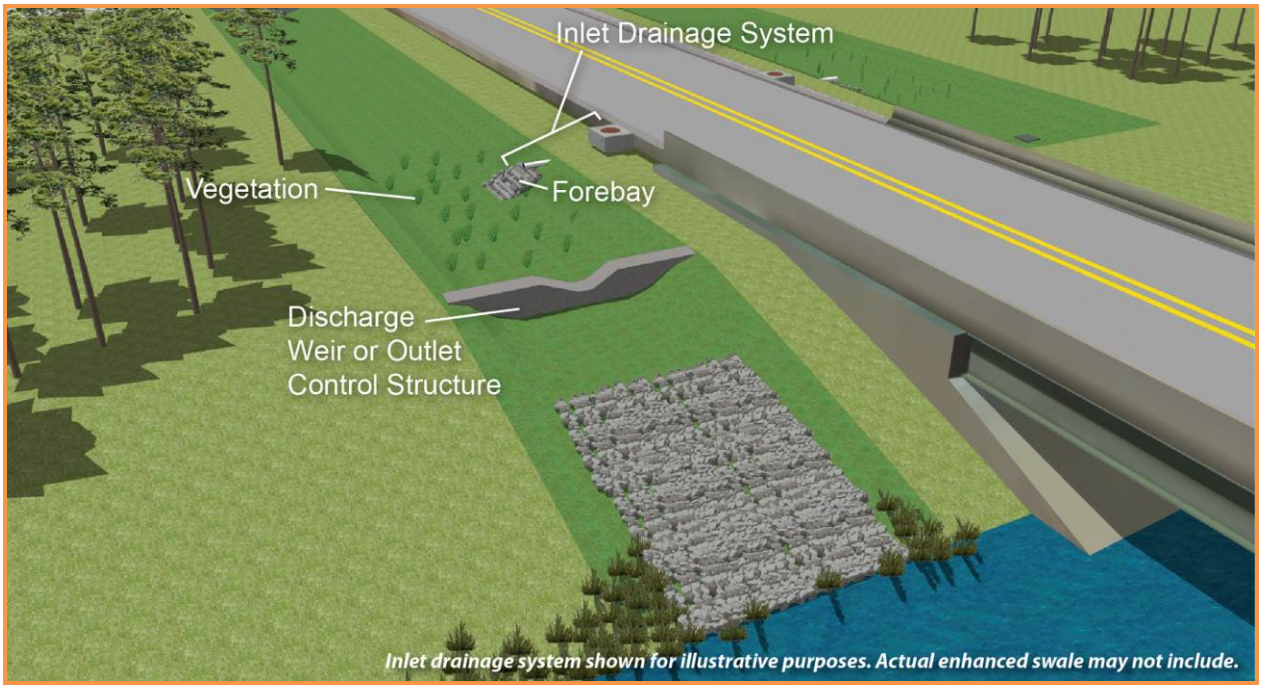


Figure 5.3-3 Typical Enhanced Wet Swale Configuration and Components

Section 5.3.2 recommends inspection and maintenance practices for maximizing enhanced swale performance.

5.3.2 Inspection and Maintenance

Enhanced swales are adaptable in a linear setting and are moderately cost-effective. They achieve the 80 percent total suspended solids (TSS) removal credit and are considered LID and GI practices.

Comprehensive inspections of enhanced swales should be conducted at least annually. The inspector will document observed conditions using Form B-3 (Appendix B), determine appropriate actions to remedy functional impairments per this I&M Manual, and document routine or as-needed maintenance performed.

Inlet and Outlet Drainage Systems

Enhanced swales may not have a structural inlet and flow may enter directly from the roadway via a filter strip. Section 5.1 discusses filter strip maintenance.

- **A1: Inspect for trash, debris, and sediment:**
  - Remove trash and vegetative debris or sediment that has the potential to inhibit flow into the grass swale.
- **A2: Inspect these areas for signs of erosion:**
  - Repair eroded areas by resodding or reseeding. Restore compacted fill, filter fabric, and rock riprap (if present). If erosion is a recurring problem, consult a design professional.
  - Identify and control the source of erosion damage if soil is exposed or erosion is evident in the channel bottom or side slopes.
  - Check the upstream areas for bank stability and evidence of piping or scour holes.

- **A3: Inspect inlet and outlet pipes for damage or plugging:**
    - Repair or replace damaged piping if needed.
    - If plugged, remove material and identify and mitigate the source of sediment or debris.

Forebay

- **B1: Inspect for sediment accumulation in forebay:**
    - Remove and dispose of sediment off site if it appears to occupy more than 50 percent of the forebay's storage capacity.
    - If surrounding soil is disturbed during cleanout of the forebay, reseed any areas of bare soil.
- **B2: Inspect forebay for presence of undesirable vegetation:**
    - Remove vegetation that threatens the function or integrity of the forebay such as woody vegetation that may cause structural deterioration or make removal of sediment from the forebay difficult.

- **B3: Inspect for erosion protection materials that are no longer intact:**
  - Replace materials as needed.
  - Repair or reshape the overflow spillway (where flow exits the forebay), taking care to maintain the design elevation of the spillway. Repair, supplement, or replace erosion protection materials as needed.

Swale

- **C1: Inspect swale for trash or debris:**
  - Remove and properly dispose of trash and debris.

- **C2: Inspect for areas of unhealthy vegetative cover, bare areas, or dying vegetation:**
  - Inspect vegetative cover, which should be maintained at a coverage of 70 percent. Reseed and add topsoil to bare areas.
  - If needed, perform soil testing and carefully apply soil amendments. Also, provide lime and one-time fertilizer application if soil testing indicates that fertilization is needed.
  - Use a rolled erosion control product on eroded areas and steeper slopes as needed.
  - If due to unusually dry conditions, water where practical.
  - If compaction is a concern, aerate the soil using a core aerator that collects cores, or collect cores by hand and dispose of the cores in an area that will not impact stormwater or receiving waters. Aerate only during times of the year when grass is actively growing.
  - If the problem persists, determine the source of the problem (e.g., soil, drainage) and perform corrective actions.

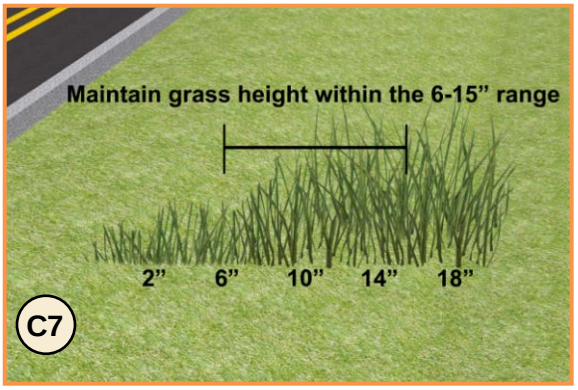
- **C3: Inspect swale for areas of erosion or gullies forming:**
  - Runoff must enter the swale as sheet flow. Consider installing a flow dissipater (forebay or riprap pad) if none is in place and there are signs of erosion from concentrated flow.
  - Repair eroding areas by filling/regrading and re-establishing ground cover.
  - Use sod where possible and provide adequate erosion protection until repaired areas have stabilized.
  - Provide lime and one-time fertilizer application if needed.

- **C4: Inspect swale area for undesirable vegetation:**
  - Remove woody vegetation that can cause flow to channelize.
  - Remove vegetation that threatens the function or integrity of the swale.

- **C5: Inspect dry swale for ponded water that is present 24 to 48 hours after a storm event:**
  - If a dry swale exhibits signs of poor drainage, determine cause of standing water (e.g., clogged filter media or underdrain, high groundwater table, localized low areas from heavy equipment or compacted soil, significant erosion) and roto-till or cultivate and regrade if necessary. Check cleanouts and flush if needed.

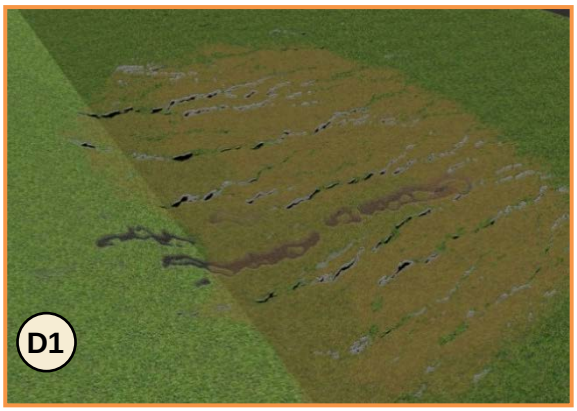
- **C6: Inspect grass swale for accumulated sediment:**
  - Remove sediment from within the swale area when reaches a depth of 1 to 3 inches. Re-establish vegetation and regrade if necessary.

- **C7: Inspect and check that proper mowing height is maintained for dry swales:**
    - Mow grass within dry swales at a height of 6 to 15 inches.



Side Slopes

- **D1: Inspect side slopes for evidence of erosion, rills, or gullies forming:**
    - Repair erosion after heavy storms.
    - Replace eroded soil to conform to the original geometry.
    - Rake, seed, and provide soil amendments (mulch or compost) to re-establish vegetation.
    - Provide lime and a one-time fertilizer application if needed.
    - Install matting in steep areas.



Check Dam

- **E1: Inspect for trash, debris, vegetation, or excessive sediment present:**
    - Remove and properly dispose of trash, debris, vegetation that threatens the function or integrity of the check dam, and sediment.
    - Use a string trimmer when mowing around check dams to avoid damaging the check dam's structure.

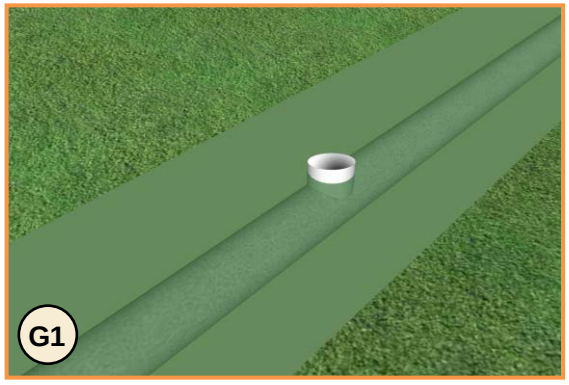
- **E2: Inspect for evidence of erosion around the sides of the check dam:**
    - Replace riprap and stone as needed and repair erosion; rebuild or reshape check dams according to design dimensions and elevations as necessary.

Wetland Vegetation (for Wet Swales)

- **F1: Inspect to determine if vegetation is impacting the function or integrity of the swale:**
  - Remove vegetation by physical removal or by hand-wiping with aquatic glyphosate (wear gloves). Do not spray because the herbicide will kill all vegetation it contacts. Herbicide(s) will be applied by qualified GDOT personnel.
  - Multiple wetland cells may exist between check dams; inspect the wet swale thoroughly.
- **F2: Inspect for unhealthy or dead plants:**
  - Replace dead or unhealthy plants using the original design drawings or landscaping plan if necessary.
  - Determine the source of the problem (e.g., soil, hydrology, disease). Remedy the problem before replacing plants.

Underdrain (for Dry Swales)

- **G1: Inspect for missing or damaged cleanout caps:**
  - Replace cleanout caps that are missing, cracked, or otherwise damaged. Damaged or missing caps will allow stormwater to exit the basin untreated.



- **G2: Periodically perform flow testing of cleanouts to determine if the underdrain system is clogged:**
    - If water does not exit freely, the underdrain is likely clogged. Use a high-pressure hose to flush out the underdrain system by spraying directly into the cleanouts.
    - Repair or replace the underdrain system if flushing does not allow water to drain freely. Repairs and replacement will be conducted in accordance with the original design specifications.
    - Consider flushing the underdrain system annually if it has a tendency to plug. Use a bucket or hose to pour water into cleanout and observe outlet control structure for flow.

Discharge Weir or Berm

- **H1: Trash, debris, vegetation, or excessive sediment is obstructing flow through the weir:**
    - Remove and properly dispose of trash, debris, vegetation that threatens the function or integrity of the weir or berm, and sediment.

- **H2: Evidence of damage to weir or berm:**
    - Configuration may include a weir or a berm.
    - If damage to a weir exists, report to maintenance personnel for assessment and replacement if necessary.
    - Repair eroding areas on the berm by filling and/or regrading and re-establishing ground cover. Use sod where possible and provide adequate erosion protection until repaired areas have stabilized.
    - Provide lime and one-time fertilizer application if needed.
    - If necessary, restore the berm to the dimensions and elevations shown on the construction plans; use suitable backfill and compact as indicated on the

construction plans/specifications.

Pea Gravel Diaphragm (optional)

See Section 5.12 for guidance on the inspection and maintenance of optional components.

5.4 Infiltration Trench

5.4.1 Description and Function of Structure

Infiltration trenches are excavations typically filled with washed aggregate or media that create an underground reservoir to capture, hold, and infiltrate stormwater runoff. The captured runoff volume gradually exfiltrates into the underlying water table through the bottom and sides of the trench into the subsoil over a 2- to 3-day period. By diverting runoff into the soil, an infiltration trench treats the water quality volume and helps to preserve the natural water balance on a site and can recharge groundwater and preserve base flows in receiving streams.

Infiltration systems are limited to areas with porous soil where the water table and/or bedrock are located well below the bottom of the trench. These systems can be designed and constructed with underdrains and include overflow structures to safely handle larger storm events. The volume capacity of an infiltration trench may be increased using perforated pipe or other GDOT-approved structures that are designed and installed in conjunction with the aggregate.

Infiltration trenches require a filter strip or other pretreatment BMP to limit the amount of sediment that enters the infiltration trench. Sediment control is important to maintain the functional capacity of an infiltration trench. Infiltration trenches can have an exposed aggregate surface or may have a vegetated (grassed) surface. The grassed surface can function to limit sediment entry into the underlying media.

An infiltration trench with a filter strip acting as pretreatment is shown on Figure 5.4-1.

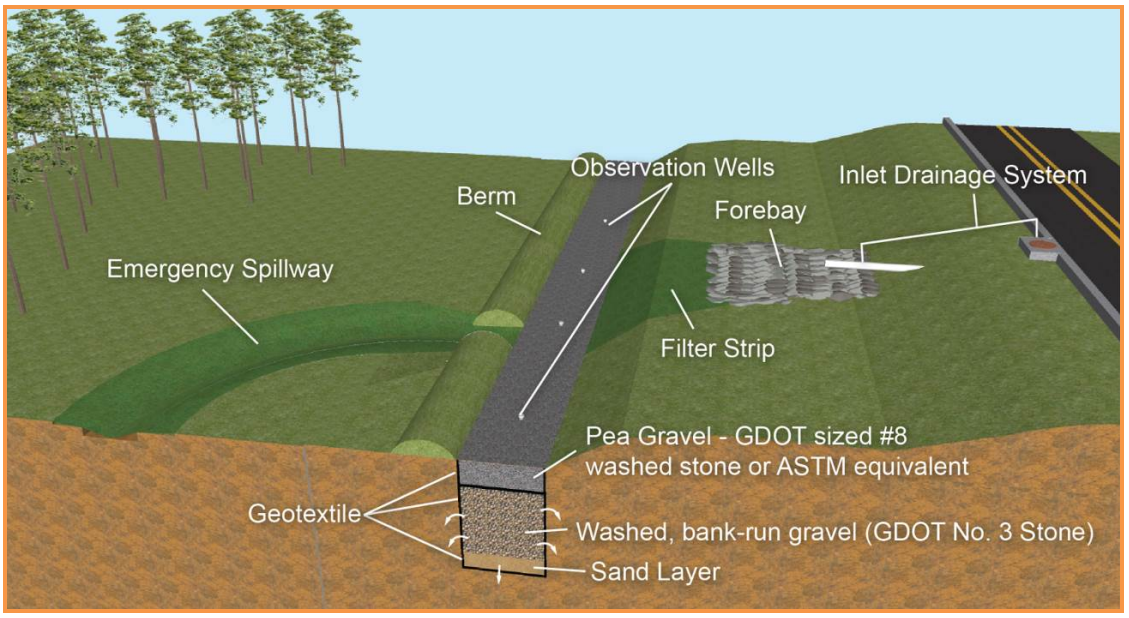


Figure 5.4-1 Typical Infiltration Trench Configuration and Components

Section 5.4.2 recommends inspection and maintenance practices for maximizing infiltration trench performance.

5.4.2 Inspection and Maintenance

Infiltration trenches receive pollutant removal credit and offer high pollutant removal capabilities when properly designed and maintained.

Infiltration trenches can either be used to capture sheet flow from a drainage area or function as an off-line device. Due to the relatively narrow shape, infiltration trenches can be adapted to many different types of sites and can be used as retrofits. Unlike other structural stormwater controls, they can easily fit into the perimeter or other unused areas of developed sites. Median strip infiltration trenches use a grass filter strip to direct sheet flow to the trench. Multiple trenches can be incorporated on larger sites or in the upland area of large sites to reduce the amount of runoff downstream that needs treatment. Infiltration devices are frequently used to infiltrate runoff from adjacent impervious surfaces, such as parking lots.

Upon installation, inspect infiltration trenches and continue inspections on a monthly basis. This frequency can be reduced if sediment removal is negligible. Periodically check observation wells/ cleanouts following a storm event and 72 subsequent hours of dry weather. Failure to percolate within this time period indicates clogging.

The inspector will document observed conditions using Form B-4 (Appendix B), determine appropriate actions to remedy functional impairments per this I&M Manual and document routine or as-needed maintenance performed.

Inlet Drainage System

- **A1: Inspect for trash, debris, and sediment:**
  - Remove trash and vegetative debris or sediment that has the potential to inhibit flow into the infiltration trench.
- **A2: Inspect these areas for signs of erosion:**
  - Repair eroded areas by resodding or reseeding. Restore compacted fill, geotextile, and rock riprap (if present). If erosion is a recurring problem, consult a design professional.
  - Identify and control the source of erosion damage if native soil is exposed or erosion channels are forming.
  - Check the upstream areas for bank stability and evidence of piping or scour holes.
- **A3: Inspect piping for damage or plugging:**
  - Repair or replace damaged piping if needed.
  - If plugged, remove material and identify and mitigate the source of sediment or debris.

Forebay

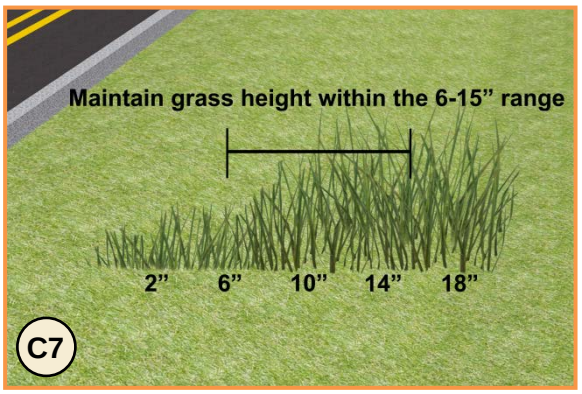
- **B1: Inspect sediment accumulation in forebay:**
  - Remove and dispose of sediment off site if it appears to occupy more than 50 percent of the forebay's storage capacity.
  - If surrounding soil is disturbed during cleanout of the forebay, reseed any areas of bare soil.
- **B2: Inspect forebay for presence of undesirable vegetation:**
  - Remove vegetation that threatens the function or integrity of the forebay such as woody vegetation that may cause structural deterioration or make removal of sediment from the forebay difficult.
- **B3: Inspect condition of erosion protection materials in forebay:**
  - Replace materials as needed.
  - Repair or reshape the forebay, taking care to maintain the design elevation and design dimensions. Repair, supplement, or replace erosion protection materials as needed.

Filter Strip

- **C1: Inspect filter strip for trash and/or debris:**
  - Remove and properly dispose of trash and debris.
- **C2: Inspect for areas of unhealthy grass cover, bare areas or dying grass:**
  - Inspect overall vegetative cover, which will be maintained at a coverage of 70 percent. Reseed and add topsoil to bare areas.
  - Provide lime and one-time fertilizer application if soil testing indicates that pH adjustment and fertilization are needed.
  - Use a rolled erosion control product on eroded areas and steeper slopes as needed.
  - If due to unusually dry conditions, water where practical.
  - If compaction is a concern, aerate the soil using a core aerator that collects cores and dispose of the cores in an area that will not impact stormwater or receiving waters. Aerate only during times of the year when grass is actively growing.
  - If the problem persists, determine the source of the problem (e.g., soil, drainage).
  - If needed, perform soil testing and carefully apply soil amendments.

- **C3: Inspect filter strip for areas of erosion or formation of gullies:**
  - Runoff must enter the strip as sheet flow.
  - Regrade the soil if necessary to remove the gully. Plant ground cover and water, if practical, until it is established.
  - Repair eroding areas by filling/regrading and reestablishing ground cover.
  - Use sod where possible and provide adequate erosion protection until repaired areas have stabilized.
  - Provide lime and one-time fertilizer application if needed.
- **C4: Inspect filter strip area for undesirable vegetation:**
  - Remove woody vegetation that can cause flow to channelize.
  - Remove vegetation that threatens the function or integrity of the filter strip.
- **C5: Inspect for areas of standing water:**
  - Dewater and discharge to an approved location. Regrading may be required.
  - If a filter strip exhibits signs of poor drainage, determine cause of standing water (e.g., compacted soil, significant erosion) and regrade if necessary.
- **C6: Sediment is accumulating within filter strip:**
  - Remove sediment from the filter strip area if it begins to cover and kill grass. Re-establish vegetation and regrade if necessary.

- **C7: Inspect and check that minimum mowing height is maintained:**
    - Mow grass within the filter strip at a height to maintain a dense vegetative cover. For highway right-of-way areas, a grass height of 6 to 15 inches may be practical.



Berm and Emergency Spillway

- **D1: Inspect areas around berm for erosion:**
    - Repair eroding areas by filling/regrading and reestablishing ground cover.
    - Use sod where possible and provide adequate erosion protection until repaired areas have stabilized.
    - Provide lime and one-time fertilizer application if soil testing indicates that pH adjustment and fertilization are needed.
    - If necessary, restore the berm to the dimensions and elevations shown on the construction plans; use suitable backfill and compact as indicated on the construction plans/specifications.

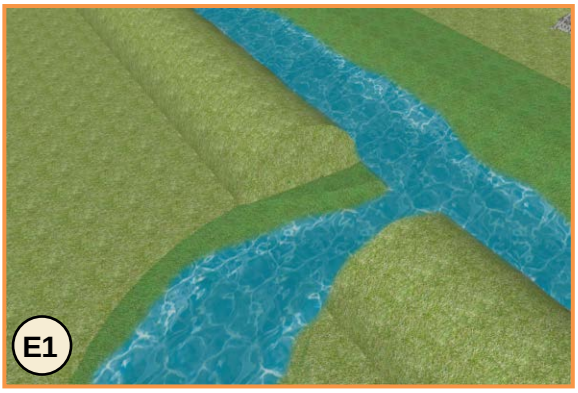
- **D2: Inspect base of berm for sediment accumulation:**
    - Gather and remove sediment with hand tools when possible. Pay attention to the top and toe of the slope where sediment is likely to gather.
    - Reestablish vegetation and provide soil amendments if needed.
    - If sediment accumulation is excessive, ensure that pretreatment measures are functioning properly and that the contributing drainage area is properly stabilized.

- **D3: Inspect emergency spillway for trash, debris, or undesirable vegetation:**
    - Remove trash, debris, and vegetation that threatens the function or integrity of the spillway.

- **D4: Inspect grass height and the condition of concrete or riprap in the emergency spillway:**
    - Mow grass to desired height of 6 to 15 inches if the height is more than 15 inches.
    - Repair or replace concrete or riprap if it is in poor condition.

Infiltration Trench

- **E1: Inspect for water ponding on surface of infiltration trench 72 hours or more after a storm event:**
    - Refer to Section 5.12 if the infiltration trench includes a perforated pipe, which provides additional storage.
    - Remove and replace the topsoil or first layer of stone and the top layer of geotextile if ponding occurs for longer than 72 hours.
    - If trench fails to infiltrate, the trench will likely need complete reconstruction to restore percolation.
    - Inspect observation wells to determine water level (if below the surface) and if appropriate infiltration is being achieved.
    - Replace observation well/cleanout caps that are missing, cracked, or otherwise damaged.



- **E2: Inspect vegetation growing on the surface of the trench:**
    - Remove undesirable vegetation that threatens the function or integrity of the infiltration trench.

Underdrain (optional), Pea Gravel Diaphram (optional), and Perforated Pipe for Additional Storage (optional)

See Section 5.12 for guidance on the inspection and maintenance of optional components.

5.5 Sand Filters

5.5.1 Description and Function of Structure

Sand filters (also referred to as filtration basins) are multi-chambered structures that treat stormwater by filtration through a sand media and include an underdrain collection system. Most sand filter systems consist of two-chamber structures. The first chamber is a sediment forebay or sedimentation chamber, which removes floatables and heavy sediment. The second chamber is a filtration chamber, which removes additional pollutants by filtering the runoff through a sand bed.

The filtered runoff is typically collected and returned to the conveyance system, although it can also be partially or fully exfiltrated into the surrounding soil in areas with porous soil. Sand filters are designed to completely drain the specified water quality volume within 40 hours and reaerate between rainfall events.

There are two primary sand filter system designs: surface sand filter and perimeter sand filter. These designs are shown on Figure 5.5-1 and summarized below:

- *Surface Sand Filter*. The surface sand filter is a ground-level open air structure that consists of a pretreatment sediment forebay and a filter bed chamber. This system is typically located offline and may be constructed as an excavation with earthen embankments or as a concrete or block structure.

- *Perimeter Sand Filter*. The perimeter sand filter is an enclosed filter system that is typically constructed just below grade in a vault along the edge of an impervious area, such as a parking lot. The system consists of a sedimentation chamber and a sand bed filter. Runoff flows into the structure through a series of inlet grates located along the top of the control.

Figure 5.5-1 Surface Sand Filter (left) and Perimeter Sand Filter (right)
Source: GSMM (2001)

Figures 5.5-2 and 5.5-3 show the typical configurations and components of a surface sand filter and perimeter sand filter, respectively.

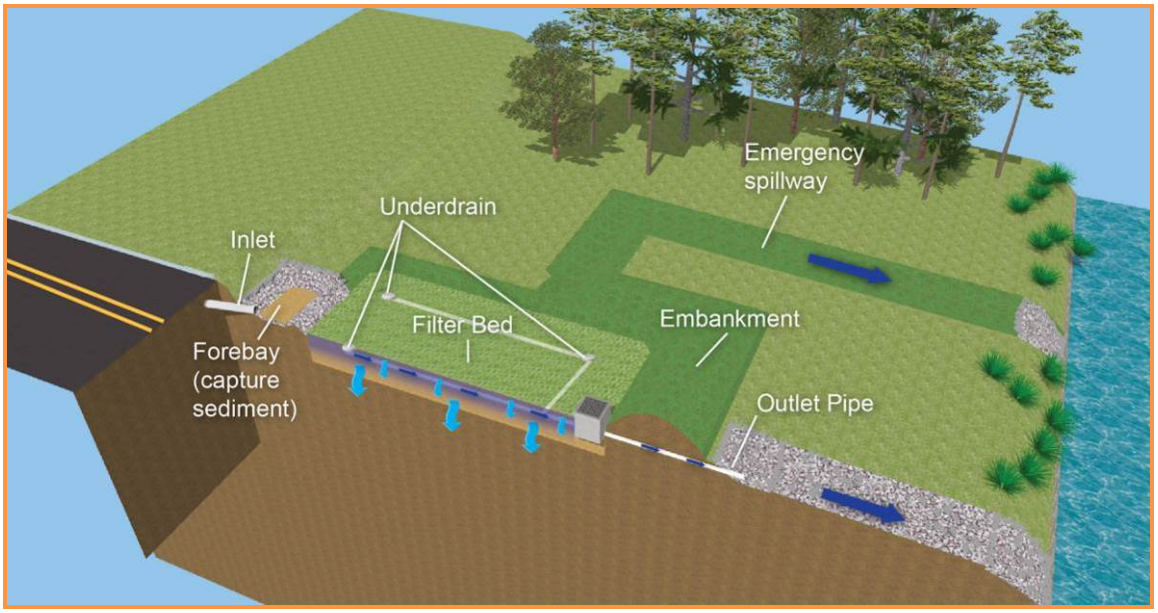


Figure 5.5-2 Typical Surface Sand Filter Configuration and Components

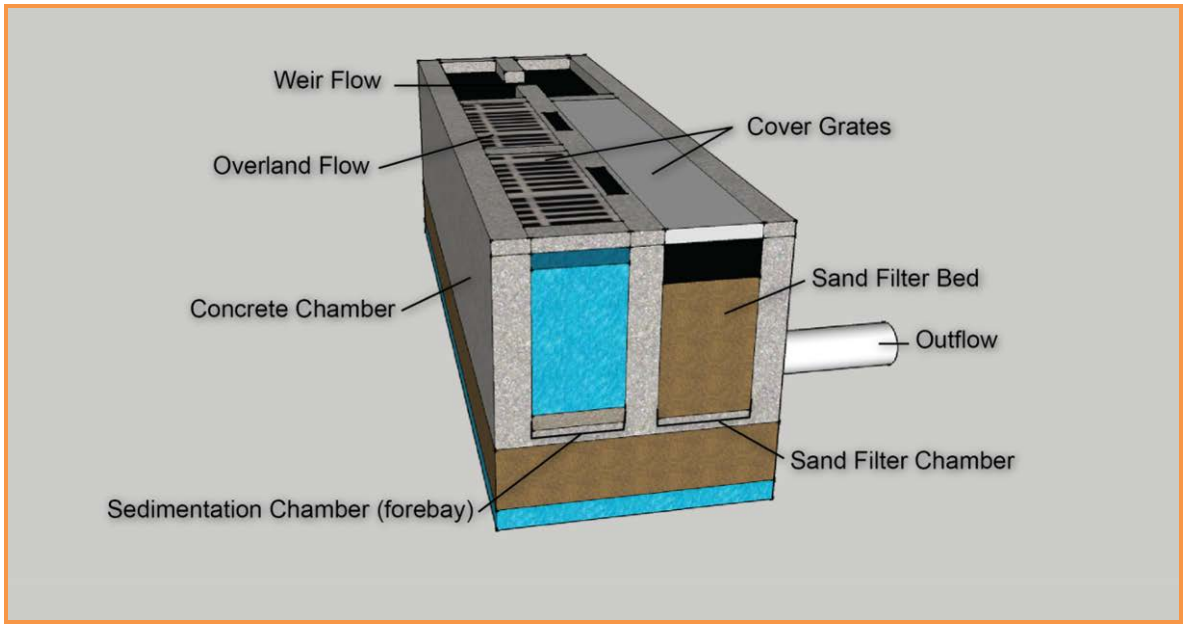


Figure 5.5-3 Typical Perimeter Sand Filter Configuration and Components

Key functional features of sand filters include:

- Forebay to capture sediment and debris prior to filtering runoff through the sand filter bed.
- Underdrain system to collect water after filtering through the filter bed
- Outlet/outflow structure and spillway sized to meet design objectives and safely convey stormwater downstream.

Section 5.5.2 recommends inspection and maintenance practices for maximizing sand filter performance.

5.5.2 Inspection and Maintenance

Comprehensive inspections of surface sand filters should be conducted at least quarterly. The inspector will document observed conditions using the Form B-5 (Appendix B), determine appropriate actions to remedy functional impairments per this I&M Manual, and document routine or as-needed maintenance performed.

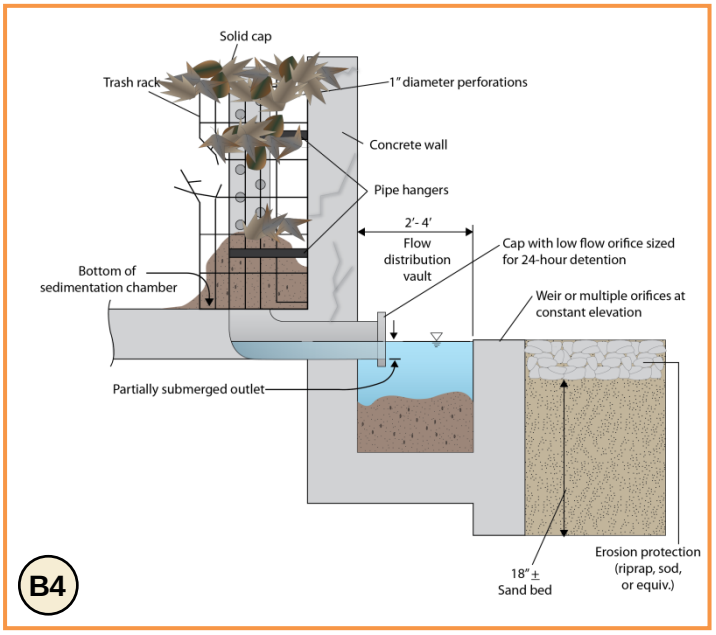
Inlet and Outlet Drainage Systems

- **A1: Inspect for trash, debris, and sediment:**
  - Remove trash and vegetative debris or sediment that has the potential to inhibit flow into the sand filter.
- **A2: Inspect these areas for signs of erosion:**
  - Repair eroded areas by resodding or reseeding. Restore compacted fill, geotextile, and rock riprap (if present). If erosion is a recurring problem, consult a design professional.
  - Identify and control the source of erosion damage if soil is exposed or erosion is evident in the channel bottom or side slopes.
  - Check the upstream areas for bank stability and evidence of piping or scour holes.
- **A3: Inspect inlet and outlet pipes and inlet grates for damage or plugging:**
  - Repair or replace damaged grates and/or piping if needed.
  - If plugged, remove material and identify and mitigate the source of sediment or debris.

Forebay/Sedimentation Chamber

- **B1: Inspect for sediment accumulation in forebay or sedimentation chamber:**
  - Remove sediment in forebay/ sedimentation chamber when sediment depth is greater than 6 inches.
  - Reseed any areas of bare soil if surrounding soil is disturbed during cleanout of the forebay.
- **B2: Inspect for undesirable vegetation in forebay:**
  - Remove vegetation that threatens the function or integrity of the forebay such as woody vegetation that may cause structural deterioration or make removal of sediment from the forebay difficult.
- **B3: Inspect status of erosion protection materials:**
  - Replace materials as needed.
  - Repair or reshape the forebay, taking care to maintain the original elevation and dimensions of the forebay. Repair, supplement, or replace erosion protection materials as needed.

- **B4: Inspect the perforated standpipe:**
    - Remove sediment or debris from trash rack, perforations, and partially submerged outlet device.
    - Remove overgrown vegetation if it has the potential to restrict flow through weirs or orifices.
    - Repair or replace damaged or corroded components.



Filter Bed

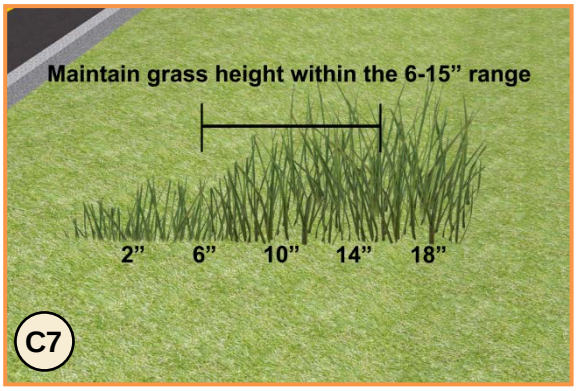
- **C1: Inspect area for trash or debris:**
  - Remove and properly dispose of trash and debris.
- **C2: Inspect areas for unhealthy grass cover, bare areas, or dying grass in surface sand filters:**
  - Monitor overall vegetative cover, which should be maintained at a coverage of 70 percent. Reseed and add topsoil to bare areas.
  - If needed, perform soil testing and carefully apply soil amendments. Provide lime and one-time fertilizer application if soil testing indicates that pH adjustment and fertilization are needed.
  - Use a rolled erosion control product on eroded areas and steeper slopes as needed.
  - If due to unusually dry conditions, water where practical.
  - Determine the source of the problem (e.g., soil, hydrology, disease). If sod was used, ensure that it was not grown in clay or impermeable soil. Replace sod if necessary.
- **C3: Inspect areas for presence of erosion or formation of gullies in the filter bed:**
  - If erosion has occurred, reestablish turf grass (seed or sod).
  - If channelization has occurred, reestablish the proper grade of the basin bottom by removing sediment and filling in, then re-establish vegetation.
  - Provide lime and one-time fertilizer application if needed.

- **C4: Inspect surface type filter bed area for undesirable vegetation:**
    - Remove woody vegetation that can cause flow to channelize.
    - Remove vegetation that threatens the function or integrity of the filter bed.

- **C5: Inspect surface filter beds for water ponding more than 72 hours after a storm event:**
    - Check outlet structure for clogging. If cattails or other wetland vegetation emerge, water is likely remaining in the basin too long. Possible causes include clogged filter media, high groundwater table, clogged outlet, or localized low areas from heavy equipment or soil compaction.

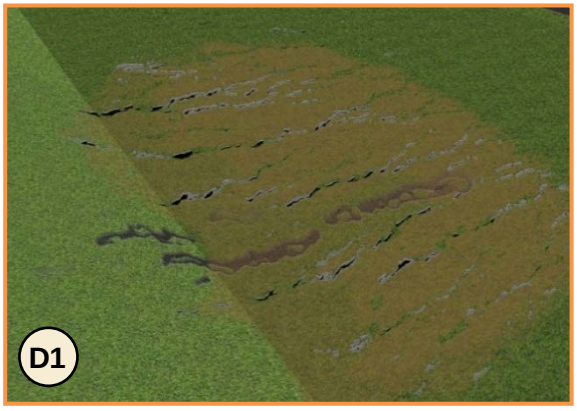
- **C6: Inspect filter bed for sediment accumulation.**
    - Remove the sediment if it is clogging the filter media or has reached a depth of 3 inches. Dispose of the sediment in a location where it will not cause impacts to streams or the BMP. Revegetate disturbed areas immediately with sod (preferred) or seed protected with securely staked erosion mat. Search for the source of the sediment and remedy the problem if possible.
    - Significant sediment accumulation impairs the pollutant removal capabilities of the filter bed by reducing the available storage for the water quality volume and can clog the filter media causing the basin to fail.
    - The top 2 to 5 inches of media are typically removed and replaced every 3 to 5 years for low sediment applications, more often for areas of high sediment yield or high oil and grease.

- **C7: Inspect and check that proper mowing height is maintained for surface sand filters:**
  - Mow grass within filter bed at a height of 6 to 15 inches.
  - Consider potential negative effect of compaction from mowing equipment. Consider using hand trimmers where practical.

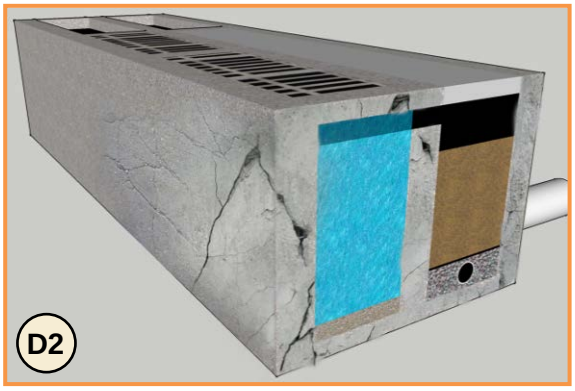


Side Slopes (Surface Sand Filter)/Vault (Perimeter Sand Filter)

- **D1: Inspect for evidence of erosion, rills or gullies forming on side slopes:**
  - Repair erosion after heavy storms.
  - Replace eroded soil to conform to the original geometry.
  - Rake, seed, and provide soil amendments (mulch or compost) to re-establish vegetation.
  - Provide lime and a one-time fertilizer application if needed.
  - Install erosion control matting in steep areas if needed.



- **D2: Inspect for evidence of degrading structural components on perimeter sand filter or leaks at the joints in the concrete structure or at other components, allowing groundwater to enter or runoff to escape untreated.**
  - Make necessary repairs or replace the structure if repairs cannot be made.



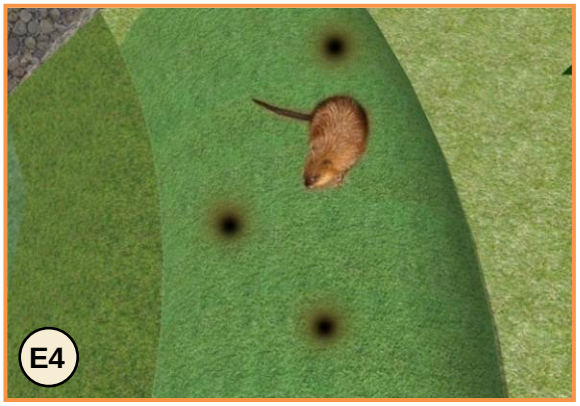
Embankment and Emergency Spillway

- **E1: Inspect for shrubs or trees growing on the embankment:**
  - Remove shrubs or trees immediately.
  - Fill/regrade and reestablish ground cover as necessary.

- **E2: Inspect grass cover for poor health and/or erosion:**
  - Repair eroding areas by filling/regrading and re-establishing ground cover.
  - Use sod where possible and provide adequate erosion protection until repaired areas have stabilized.
  - Water and provide lime and one-time fertilizer application if needed.
  - Consult a professional landscaper if needed.

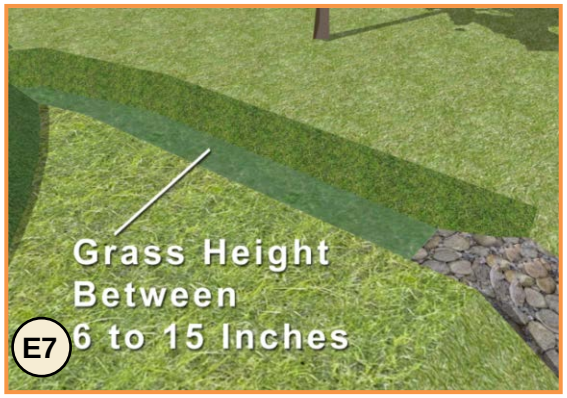
- **E3: Inspect for signs of seepage on the downstream face:**
  - Consult a design professional. This could indicate a serious issue and cause the embankment to fail.

- **E4: Inspect for evidence of animal activity:**
  - Repair animal burrows.



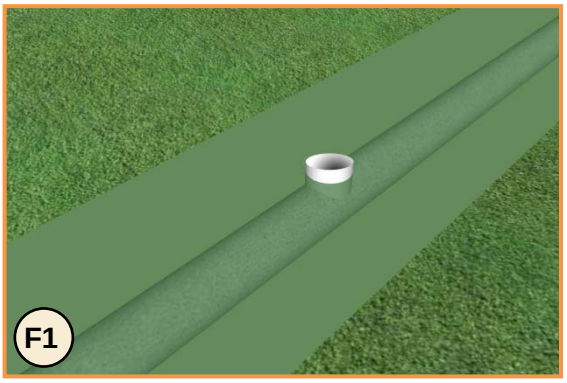
- **E5: Inspect for signs of settling, scouring, cracking, or sloughing:**
  - Repair by adding soil and/or regrade where needed. Compact as indicated in the original design documents and reestablish vegetation. Consult a design professional if needed and follow any applicable dam safety rules.

- **E6: Inspect for trash, debris, or undesirable vegetation in emergency spillway.**
    - Remove trash, debris, and vegetation that threatens the function or integrity of the spillway.
- **E7: Inspect grass height and condition of concrete or riprap:**
    - Maintain grass at a height of 6 to 15 inches.
    - If the emergency spillway is constructed of concrete or riprap, repair if in poor condition.



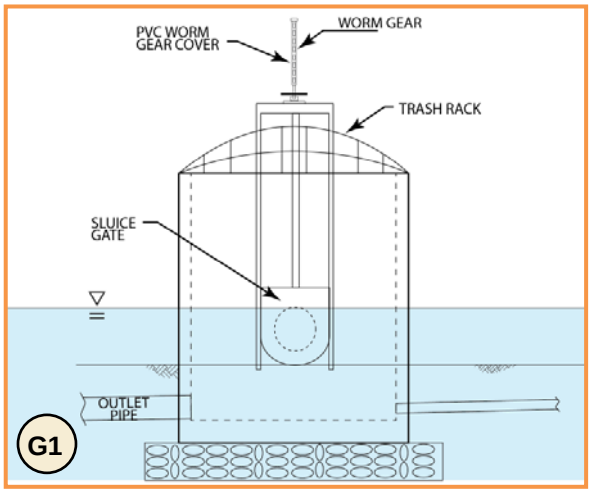
Underdrain

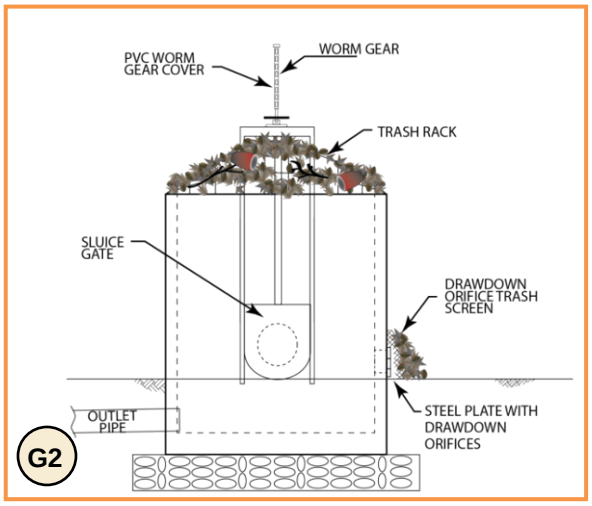
- **F1: Cleanout caps are missing or damaged:**
    - Replace cleanout caps that are missing, cracked, or otherwise damaged. Damaged or missing caps will allow stormwater to exit the basin untreated.
- **F2: Perform periodic flow testing of cleanouts to determine if underdrain system is clogged:**
    - Use a bucket or hose to pour water into cleanout and observe outlet control structure for flow. If water does not exit freely, the underdrain is likely clogged. Use a high-pressure hose to flush out the underdrain system by spraying directly into the cleanouts.
    - Repair or replace underdrain systems if flushing does not allow water to drain freely. Repair and replace in accordance with the original design specifications.
    - Consider flushing the underdrain system annually if it has a tendency to plug.

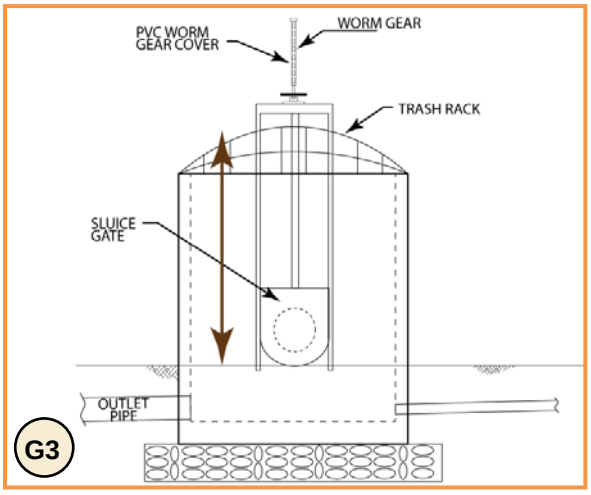


Outlet Control Structure

- **G1: Inspect water around outlet control structure:**
  - If the outlet appears to be clogged or blocked, remove material blocking the outlet opening. Replace the outlet if there are signs of excessive corrosion or damage.
  - Inspect for leaks that may allow untreated runoff to bypass the sand media.
- **G2: Inspect trash rack for trash, debris, damage, or corrosion:**
  - Remove trash and debris from trash rack.
  - Replace trash rack if it is corroded or damaged. Replace the trash rack according to design specifications.
- **G3: Ensure movable components (e.g., valves, sluice gates) are operable through their full range of motion:**
  - Remove sediment or debris within or near the moveable component.
  - If lubrication is necessary, lubricate with a marine-type grease.
  - If components are damaged beyond repair, consult a design professional for guidance on replacement.







5.6 Dry Detention Basins

5.6.1 Description and Function of Structure

Dry detention basins are earthen impoundments designed to temporarily store stormwater runoff and drain completely following storm events. The primary functions of dry detention basins are to attenuate and reduce peak flow rates from storm events and to remove solids.

Dry detention basins can be designed and constructed in several configurations and sized to fit the volume of runoff as well as site constraints. Dry detention basins can incorporate hardened low-flow channels or include landscaping features. The Manual on Drainage Design for Highways presents a detailed description of dry detention basins.

Figure 5.6-1 comprises photographs that depict two variations of dry detention basins.

Figure 5.6-1 Dry Detention Basin with Low-Flow Channel (left) and Dry Detention Basin with Landscaping (right)

Figure 5.6-2 shows the typical configuration and components of a dry detention basin.

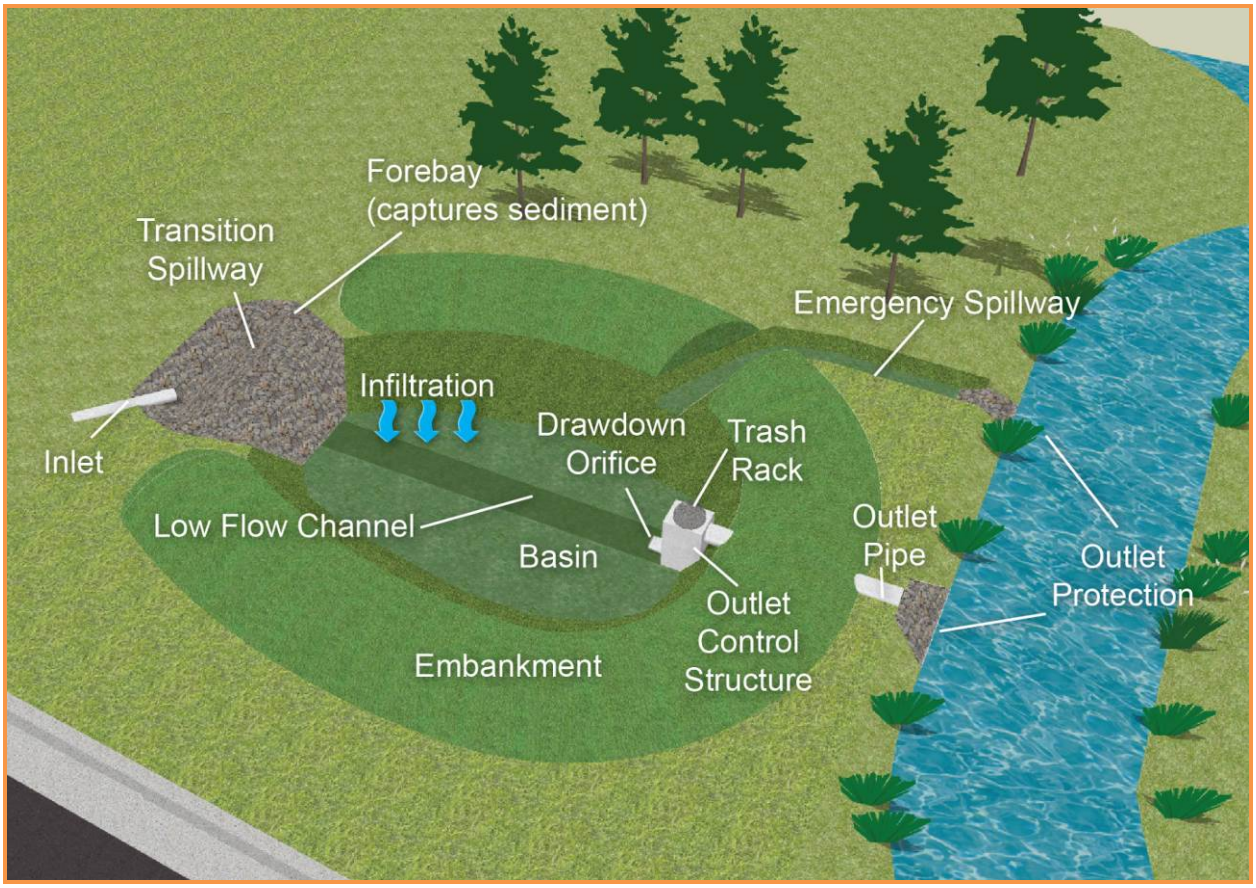


Figure 5.6-2 Typical Dry Detention Basin Configuration and Components

Key functional features of dry detention basins include:

- Forebay designed to provide pretreatment by capturing debris and sediment and to reduce the velocity of runoff entering the basin.
- Low-flow channel designed to promote infiltration and interception of suspended sediment and reduce the potential for nuisance conditions (e.g., odors, insects, weeds).
- Basin area storage volume to meet volume-based design objectives and hearty vegetation to enhance pollutant removal.
- Outlet structure and spillway sized to meet design objectives and safely convey stormwater downstream.

The Section 5.6.2 recommends inspection and maintenance practices for maximizing dry detention basin performance.

5.6.2 Inspection and Maintenance

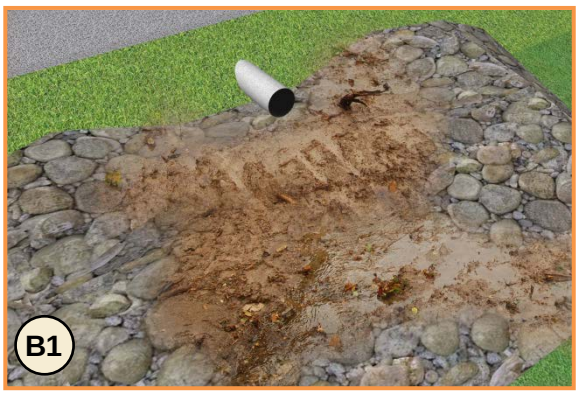
Comprehensive inspections of dry detention basins should be conducted at least annually. The inspector will document observed conditions using Form B-6 (Appendix B), determine appropriate actions to remedy functional impairments per this I&M Manual, and document routine or as-needed maintenance performed.

Inlet and Outlet Drainage Systems

- **A1: Inspect for trash, debris, and sediment:**
  - Remove trash and vegetative debris or sediment that has the potential to inhibit flow into the dry detention basin.
- **A2: Inspect these areas for signs of erosion:**
  - Repair eroded areas by resodding or reseeding. Restore compacted fill, geotextile, and rock riprap (if present). If erosion is a recurring problem, consult a design professional.
  - Identify and control the source of erosion damage if soil is exposed or erosion is evident in the channel bottom or side slopes.
  - Check the upstream areas for bank stability and evidence of piping or scour holes.
- **A3: Inspect inlet and outlet pipes for damage or plugging:**
  - Repair or replace damaged piping if needed.
  - If plugged, remove material and identify and mitigate the source of sediment or debris.

Forebay

- **B1: Inspect for sediment accumulation in forebay:**
  - Remove and dispose of sediment off site if it appears to occupy more than 50 percent of the forebay's storage capacity.
  - If surrounding soil is disturbed during cleanout of the forebay, reseed any areas of bare soil.



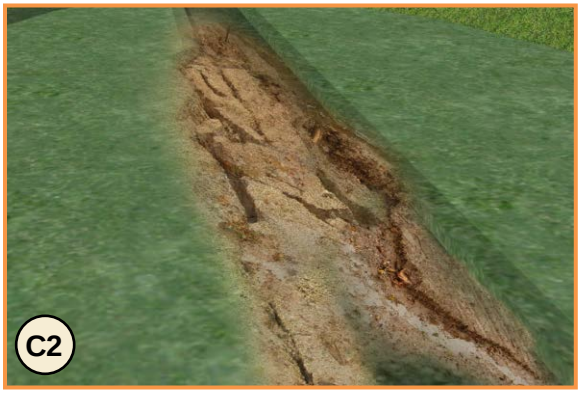
- **B2: Inspect for undesirable vegetation in forebay:**
  - Remove vegetation that threatens the function or integrity of the forebay such as woody vegetation that may cause structural deterioration or make removal of sediment from the forebay difficult.

- **B3: Inspect condition of erosion protection materials:**
  - Replace materials as needed.
  - Repair or reshape the forebay, taking care to maintain the original design elevation and dimensions. Repair, supplement, or replace erosion protection materials as needed.

Low-Flow Channel (if present)

- **C1: Inspect low-flow channel for accumulation of sediment:**
  - Search for the source of the sediment and remedy the problem if possible. Remove the sediment if it has reached a depth of 3 inches or is covering vegetation. Dispose of the sediment in a location where it will not cause impacts to streams or the BMP.
  - Replace riprap or turf reinforcement mat (TRM) if needed after sediment removal.

- **C2: Inspect low-flow channel for signs of erosion, formation of gullies, or problems with TRM:**
  - If erosion has occurred, reestablish turf grass (seed or sod).
  - Provide lime and one-time fertilizer application if needed.
  - Repair or replace TRM as necessary. TRM may not be visible; do not disturb TRM if vegetation is well-established and adequate to protect against erosion.
  - If TRM has been installed, inspect for damage and verify that it is properly toed in and anchored.



- **C3: Inspect low-flow channel for the emergence of undesirable vegetation:**
  - Remove vegetation the threatens the function or integrity of the low-flow channel.

Basin

- **D1: Inspect area for trash or debris:**
  - Remove and properly dispose of trash and debris.

- **D2: Inspect areas for unhealthy vegetative cover, bare areas, or dying vegetation:**
  - Monitor overall vegetative cover, which will be maintained at a coverage of 70 percent. Reseed and add topsoil to bare areas.
  - Dry detention basins may have soggy bottoms, making mowing costly and difficult. The use of water-tolerant, hardy, and slow-growing grass is recommended for the bottom of these basins. Consult the Manual on Drainage Design for Highways to determine ideal species for the site conditions and replant to maintain dense vegetation cover.
  - If needed, perform soil testing and carefully apply soil amendments. Provide lime and one-time fertilizer application if soil testing indicates that pH adjustment and fertilization are needed.
  - Use a rolled erosion control product on eroded areas and steeper slopes as needed.
  - If due to unusually dry conditions, water where practical.
  - Determine the source of the problem, (e.g., soil, hydrology, disease) and take corrective action. If sod was used, ensure that it was not grown in clay or impermeable soil. Replace sod if necessary.

- **D3: Inspect areas for presence of erosion or formation of gullies in the basin:**
  - If erosion has occurred, reestablish turf grass (seed or sod).
  - If channelization has occurred, re-establish the design grade of the basin bottom by removing sediment, and filling in, and re-establishing vegetation. Maintain the slope within the basin if a

low-flow channel is present. Ensure that the entire bottom of the basin slopes toward the channel.
    - Provide lime and one-time fertilizer application if needed.

- **D4: Inspect basin area for undesirable vegetation:**
    - Remove woody vegetation that inhibits inspection and maintenance.
    - Remove vegetation that threatens the function or integrity of the basin.

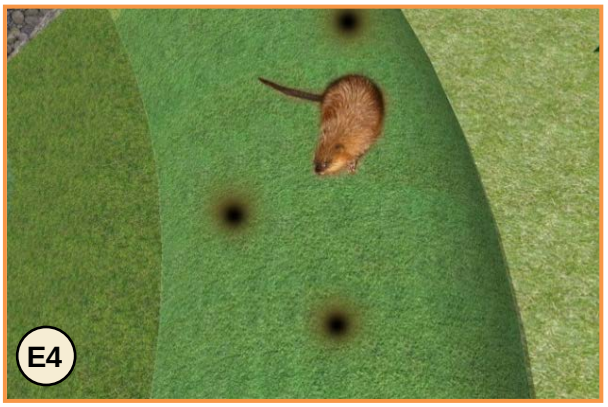
- **D5: Inspect basin for water that ponds for more than 5 days after a storm event:**
    - Check for cattails or other wetland vegetation as indicators that water has remained in the basin too long.
    - Check outlet structure for clogging and remove debris.
    - If ponding appears to be due to a design issue, consult a design professional.
    - Possible causes of ponding include a high groundwater table, clogged outlet, or localized low areas from compaction caused by heavy equipment. Regrade basin if necessary.

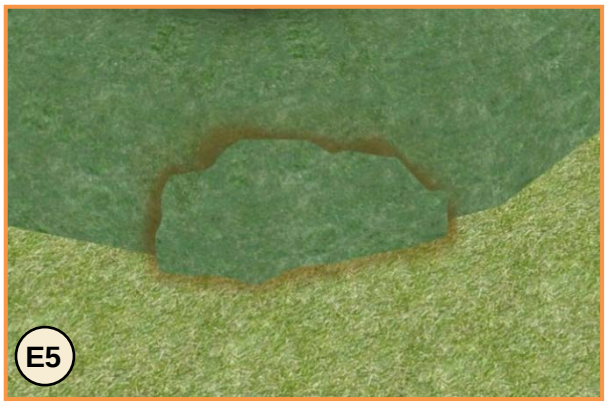
- **D6: Inspect basin for sediment accumulation:**
    - Search for the source of the sediment and remedy the problem if possible. Remove sediment if it has reached a depth of 3 inches. Dispose of the sediment in a location where it will not cause impacts to streams or the BMP. Revegetate disturbed areas immediately with sod (preferred) or seed protected with securely staked erosion mat.
    - Removal of accumulated sediment is extremely important. A significant accumulation of sediment impairs the pollutant-removal capabilities of the basin by reducing the available storage for the water quality volume.

Embankment and Emergency Spillway

- **E1: Inspect for shrubs or trees growing on the embankment:**
  - Remove shrubs or trees immediately.
  - Fill/regrade and reestablish ground cover as necessary.
- **E2: Inspect vegetation cover for poor health and/or erosion:**
  - Repair eroding areas by filling/ regrading and re-establishing ground cover.
  - Use sod where possible and provide adequate erosion protection until repaired areas are well-stabilized.
  - Provide lime and one-time fertilizer application if needed.
  - Consult a professional landscaper if needed.
- **E3: Inspect for signs of seepage on the downstream face.**
  - Consult a design professional. This could indicate a serious issue and cause the embankment to fail.

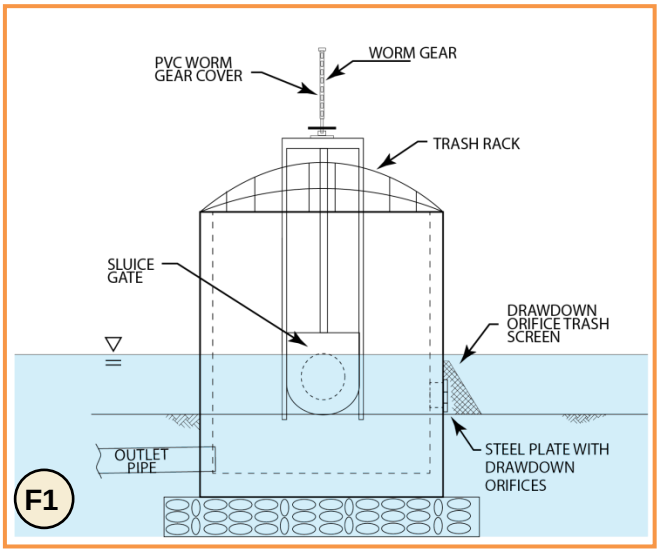
- **E4: Inspect for evidence of animal activity:**
  - Repair animal burrows.
- **E5: Inspect for signs of settling, scouring, cracking, or sloughing:**
  - Repair by adding soil and/or regrade where needed. Compact as indicated in the original design documents, and re-establish vegetation. Consult a design professional if needed and follow any applicable dam safety rules.
- **E6: Inspect for trash, debris, or undesirable vegetation in the emergency spillway:**
  - Remove trash, debris, and undesirable vegetation that threatens the function or integrity of the spillway.
- **E7: Inspect grass height and the condition of concrete or riprap in the emergency spillway:**
  - Mow grass to desired height of 6 to 15 inches.
  - Repair or replace concrete or riprap if it is in poor condition.

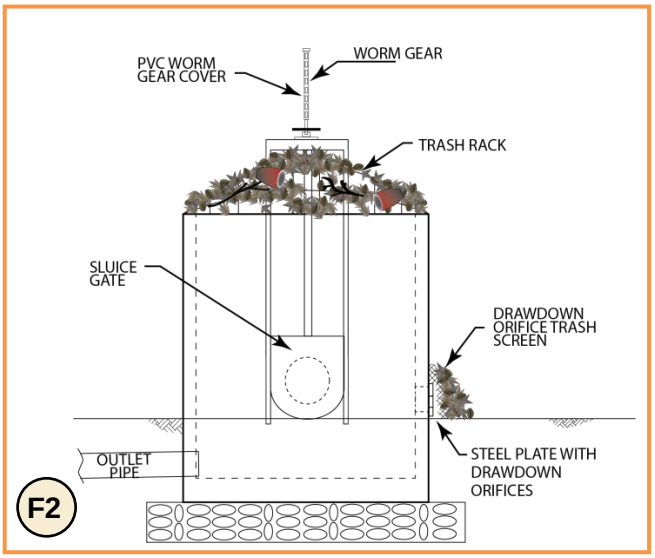




Outlet Control Structure

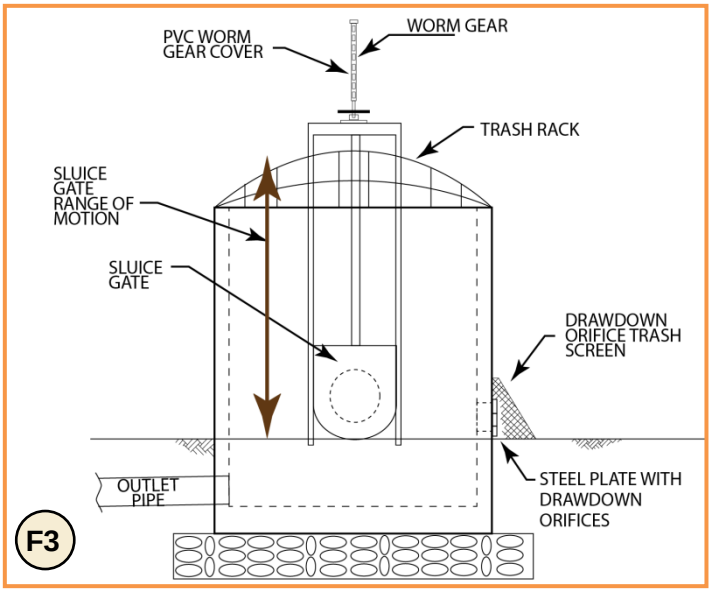
- **F1: Inspect for standing water around outlet control structure. If there is standing water above the outlet/orifice for more than 5 days after a storm event, this may indicate that the outlet/orifice is blocked:**
    - If the outlet appears to be clogged or blocked and standing water prevents access to the structure, hip waders or a small boat may be needed to make the necessary repairs. Do not enter the standing water unless you have been trained to do so. Trained contractors can be hired to make needed repairs.
    - If the water level in the basin is above the outlet/orifice opening, follow proper safety precautions before opening the sluice gate or valve (if present) or pumping out the basin.
    - Remove sediment or debris around trash screen. After the basin has been drained, remove the trash screen to access the outlet/orifice opening. Return the sluice gate to its original position.
    - Remove sediment and debris blocking the flow into the outlet/ orifice. Replace the outlet/orifice if there are signs of excessive corrosion.





- **F2: Inspect trash rack for trash, debris, damage, or corrosion.**
    - Remove trash and debris from trash rack.
    - Replace trash rack according to design specifications if it is corroded or damaged.

- **F3: Ensure that all moveable components (i.e., sluice gate or valves) are operable through their full range of motion:**
    - Remove sediment or debris within and near the moveable component.
    - If lubrication is necessary, lubricate with a marine-type grease. For screw-type sluice gates, a polyvinyl chloride cover is recommended to protect the worm gear from corrosion.
    - If components are damaged beyond repair, consult a design professional for guidance on replacement.



5.7 Wet Detention Ponds

5.7.1 Description and Function of Structure

A wet detention pond is an engineered earthen impoundment that maintains a permanent pool of water, with additional storage capacity for detaining and attenuating peak flows of stormwater runoff. Wet detention ponds consist of several appurtenant structures to control inflow and outflow and to maintain the permanent pool of water.

Wet detention ponds function to provide both water quality and flood control management. The attenuation of peak flows of stormwater runoff reduces flooding and erosion. The permanent pool, in combination with vegetation and bottom soil, provides for the capture and biological treatment of a variety of common pollutants carried in stormwater runoff.

Wet detention ponds can be designed and constructed in several configurations and sized to fit the volume of runoff as well as site constraints. The Manual on Drainage Design for Highways presents a detailed description of wet detention ponds. Figure 5.7-1 comprises photographs that depict a wet detention pond along a roadway that is part of a conveyance channel and a wet detention pond at a maintenance yard.

Figure 5.7-1
Wet Detention Pond as Part of a Conveyance Channel (left) and Wet Detention Pond at a DOT Maintenance Facility (right) (photos courtesy of GSMM and NCDOT)

Figure 5.7-2 shows the typical configuration and components of a wet detention pond.

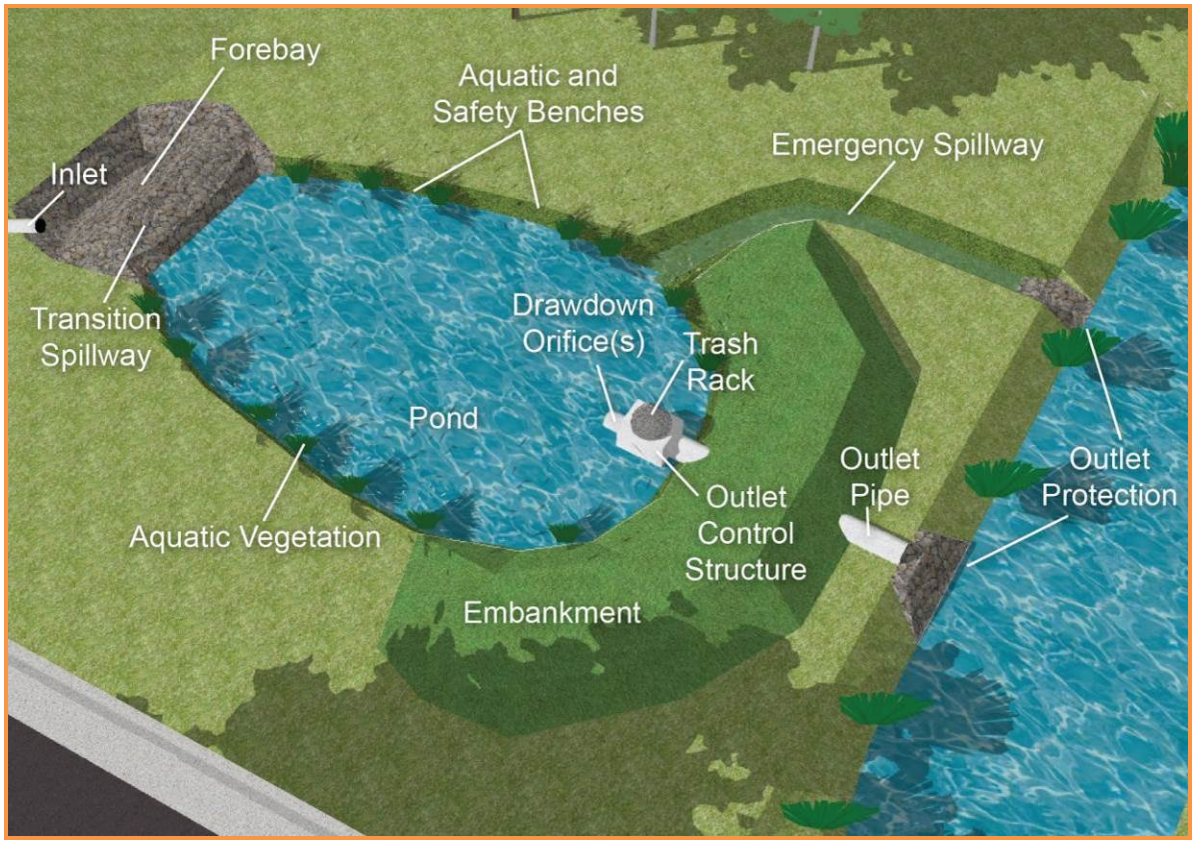


Figure 5.7-2
Typical Wet Detention Pond Configuration and Components

Key functional features of wet detention ponds that must be maintained include:

- Permanent pool of water that provides water quality benefits and should be maintained even during dry months.
- Drawdown orifice/device in order to detain stormwater runoff and release it over 24 hours.
- Aquatic and safety benches around the perimeter of the pond provide sure footing and an area to establish beneficial vegetation.
- Note safety features to avoid the hazards associated with the permanent pool.

The Section 5.7.2 recommends inspection and maintenance practices for maximizing wet detention pond performance.

5.7.2 Inspection and Maintenance

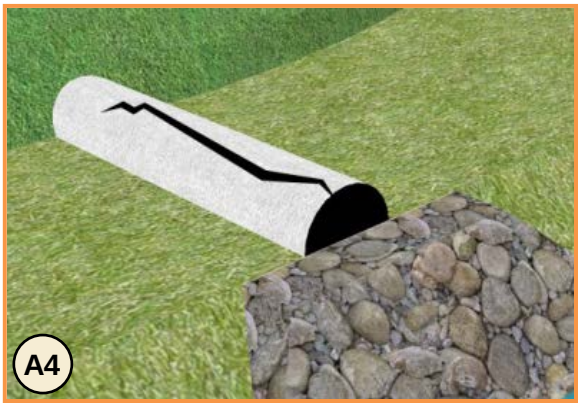
Comprehensive inspections of wet detention ponds should be conducted at least annually. The inspector will document observed conditions using Form B-7 (Appendix B), determine appropriate actions to remedy functional impairments per this I&M Manual, and document routine or as-needed maintenance performed.

Inlet and Outlet Drainage Systems

- **A1: Inspect for trash, debris, and sediment:**
  - Remove trash and vegetative debris or sediment that has the potential to inhibit flow into the wet detention pond.

- **A2: Inspect these areas for signs of erosion:**
  - Repair eroded areas by resodding or reseeding. Restore compacted fill, geotextile, and rock riprap (if present). If erosion is a recurring problem, consult a design professional.
  - Cause of erosion damage must be identified and controlled if soil is exposed or erosion is evident.
  - Check the upstream areas for bank stability and evidence of piping or scour holes.

- **A3: Inspect inlet channel, ditch, and outlet for undesirable vegetation:**
  - Remove undesirable vegetation (woody plants) that threatens the function or integrity of the inlet channel, ditch or outlet.



- **A4: Inspect inlet and outlet pipes for damage or plugging:**
  - Repair or replace damaged piping if needed.
  - If plugged, remove material and identify and mitigate the source of sediment or debris.

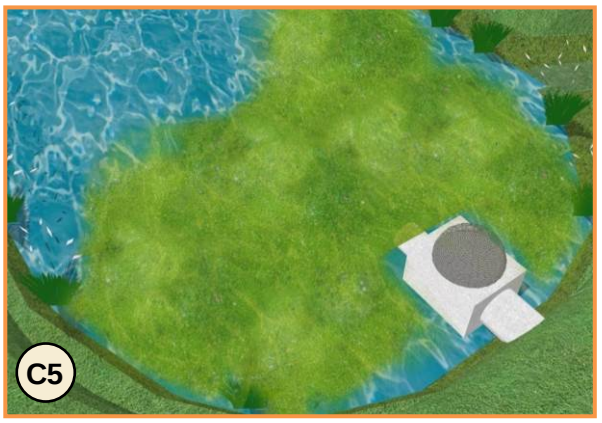
Forebay

- **B1: Inspect for sediment accumulation in forebay:**
  - Remove sediment in forebay when sediment depth is greater than 6 inches.
  - Reseed any areas of bare soil if surrounding soil is disturbed during cleanout of the forebay.
- **B2: Inspect for undesirable vegetation in the forebay:**
  - Remove vegetation that threatens the function or integrity of the forebay such as woody vegetation that may cause structural deterioration or make removal of sediment from the forebay difficult.
- **B3: Inspect condition of erosion protection materials:**
  - Replace materials as needed.
  - Repair or reshape the forebay, taking care to maintain the original design elevation and dimensions. Repair, supplement, or replace erosion protection materials as needed.

Pond

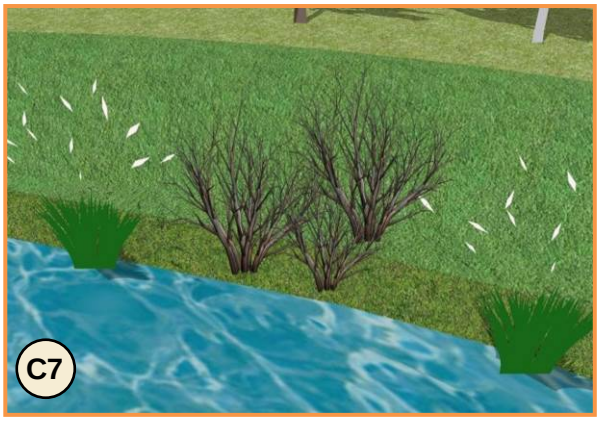
- **C1: Inspect the water level to verify it is at or near the design normal water level:**
  - The water level must be at or near the invert of the drawdown device except within 24 hours after storm events and during prolonged dry periods.
  - If the outlet appears to be clogged or blocked and standing water prevents access to the structure, trained contractors may be needed to make the necessary repairs. Never attempt to enter the wet pond unless you have been trained to do so.
- **C2: Inspect the pond for sediment accumulation:**
  - Remove sediment if it has accumulated to a depth of 12 inches or more. Use the basin bottom elevation from the design plans as a baseline. Remove and dispose of the sediment in a location where it will not cause impacts to streams or the pond.
- **C3: Inspect the pond for undesirable vegetation:**
  - Remove vegetation that threatens the function or integrity of the pond such as vegetation prone to clogging outlet structures.
- **C4: Inspect the pond for trash or debris:**
  - Remove trash and debris.

- **C5: Inspect the pond surface for algal growth:**
  - When algae covers 50 percent or more of the pond, consult a professional to develop a management plan to remove and prevent reoccurrence of algal growth.
  - Physical removal of the algae is an option, but reoccurrence is likely.
  - Chemical control options are available. Consult the Georgia Department of Agriculture to obtain the appropriate pesticide application license.



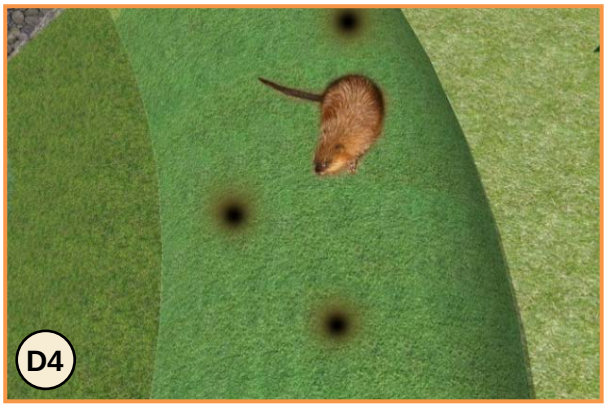
- **C6: Inspect the safety bench for erosion:**
  - Reestablish vegetation; fertilize upon re-establishment only if needed according to soil test recommendations. The use of fertilizer may be restricted in some areas.

- **C7: Inspect the aquatic and safety benches for dead, unhealthy, or undesirable plant material:**
  - Replace dead or unhealthy plant material, taking care to determine whether appropriate vegetation is present. Consult design drawings if necessary to confirm that intended plant species are present.
  - Remove undesirable vegetation by hand if possible or by wiping them with pesticide (do not spray pesticide).
  - Licenses with special endorsements may be required to apply pesticides in an aquatic environment.



Embankment and Emergency Spillway

- **D1: Inspect for shrubs or trees growing on the embankment and the emergency spillway:**
  - Remove shrubs or trees immediately.
  - Fill/regrade and re-establish ground cover as necessary.
- **D2: Inspect vegetation for poor health and/or erosion:**
  - Repair eroding areas by filling/ regrading and re-establishing ground cover.
  - Use sod where possible and provide adequate erosion protection until repaired areas are well-stabilized.
  - Provide lime and one-time fertilizer application if needed.
  - Consult a professional landscaper if needed.
- **D3: Inspect for signs of seepage on the downstream face:**
  - Consult a design professional. This could indicate a serious issue and cause the embankment to fail.
- **D4: Inspect for evidence of animal activity:**
  - Use traps to remove muskrats and consult a professional to remove beavers.
  - Repair animal burrows.

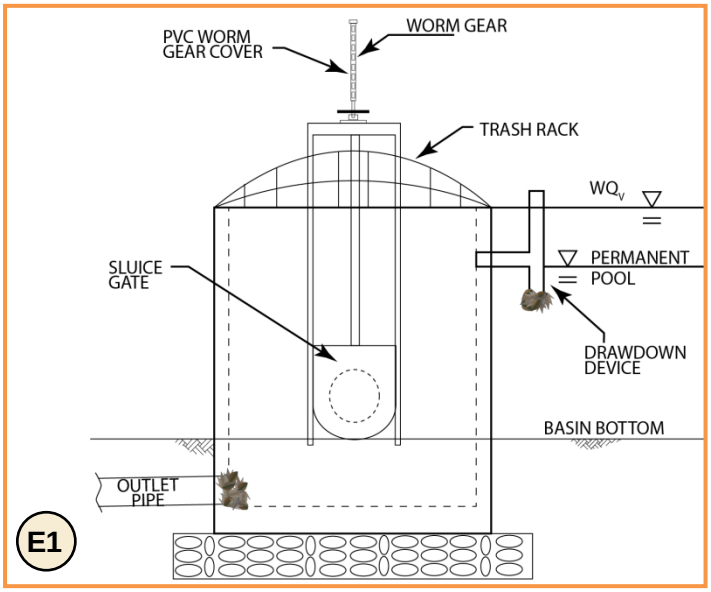


- **D5: Inspect for signs of settling, scouring, cracking, or sloughing:**
    - Repair by adding soil and/or regrade where needed. Compact as indicated in the original design documents and re-establish vegetation. Consult a design professional if needed and follow any applicable dam safety rules.

- **D6: Inspect for trash, debris, or undesirable vegetation in emergency spillway:**
    - Remove trash, debris, and undesirable vegetation that threatens the function or integrity of the spillway.

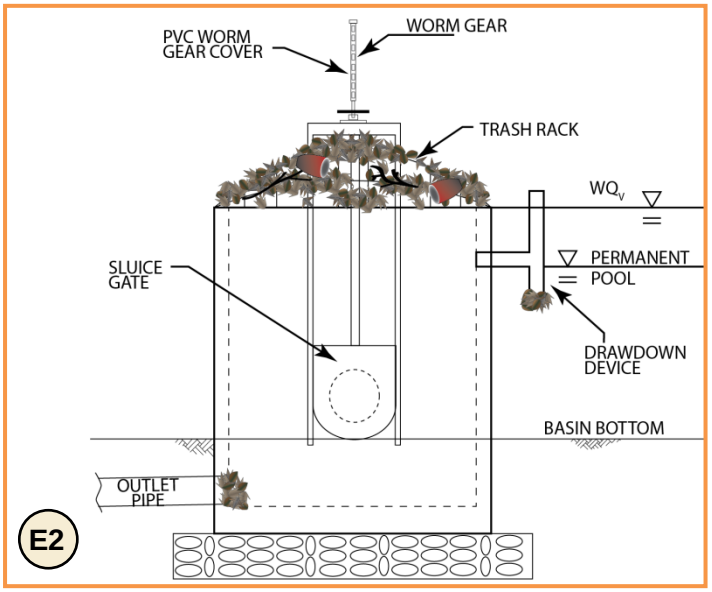
- **D7: Inspect grass height and the condition of concrete or riprap in the emergency spillway:**
    - Mow grass to a desired height of 6 to 15 inches.
    - Repair or replace concrete or riprap if it is in poor condition.

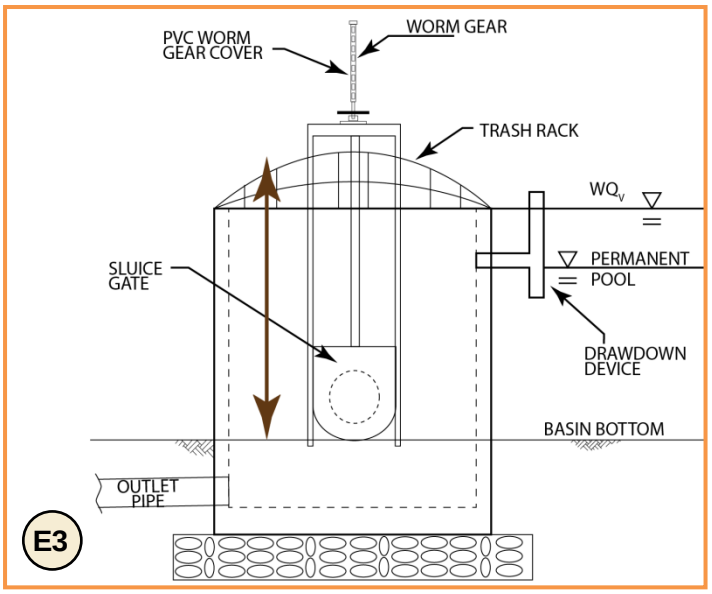
Outlet Control Structure



- **E1: Ensure that water is flowing freely through the outlet control structure; if the water level is above the outlet, this indicates that the drawdown device is blocked:**
  - If the outlet appears to be clogged or blocked and standing water prevents access to the structure, use hip waders or a small boat to make the necessary repairs. Do not enter the standing water unless you have been trained to do so. Trained contractors can be hired to make needed repairs.
  - If the water level in the pond is above the outlet, follow proper safety precautions before opening the sluice gate or valve or pumping out the pond.
  - After the pond has been drained, remove the trash screen to access the outlet. Return the sluice gate or valve to its original position.
  - Remove sediment and debris blocking the flow into the outlet. Replace any damaged or corroded components.

- **E2: Inspect trash rack for trash, debris, damage, or corrosion:**
    - Remove trash and debris from trash rack.
    - Replace trash rack according to design specifications if it is corroded or damaged.
- **E3: Ensure movable components (e.g., sluice gates, valves) are operable through their full range of motion:**
    - Remove sediment or debris within and near the movable component.
    - If lubrication is necessary, lubricate with a marine-type grease.
    - If components are damaged beyond repair, consult a design professional for guidance on replacement.





5.8 Stormwater Wetlands

5.8.1 Description and Function of Structure

Stormwater wetlands function similar to wet detention ponds. Stormwater wetlands are earthen impoundments that maintain a permanent pool of water and may have additional storage for detaining runoff and attenuating peak flows. However, stormwater wetlands are shallower than wet detention ponds and have larger areas of wetland vegetation. Varying shallow water depths (wetland zones) increase aquatic plant diversity. Stormwater wetlands provide detention benefits (e.g., reduced peak flows and preventing stream channel erosion) and runoff water quality treatment. The permanent pool provides an area for sediment storage, which reduces TSS and the associated pollutants adhering to these particles. Contact with the permanent pool and wetland vegetation results in chemical and biological processes that reduce nutrients, metals, and pathogens.

Figure 5.8-1 depicts a shallow stormwater wetland adjacent to a parking area, similar to what may be found at a GDOT rest area, and a pocket wetland treating runoff from a roadway.

Figure 5.8-1
Shallow Stormwater Wetland (left) and Pocket Stormwater Wetland (right)
(photos courtesy of GSMM)

Typical components and configuration for a stormwater wetland are shown on Figure 5.8-2.

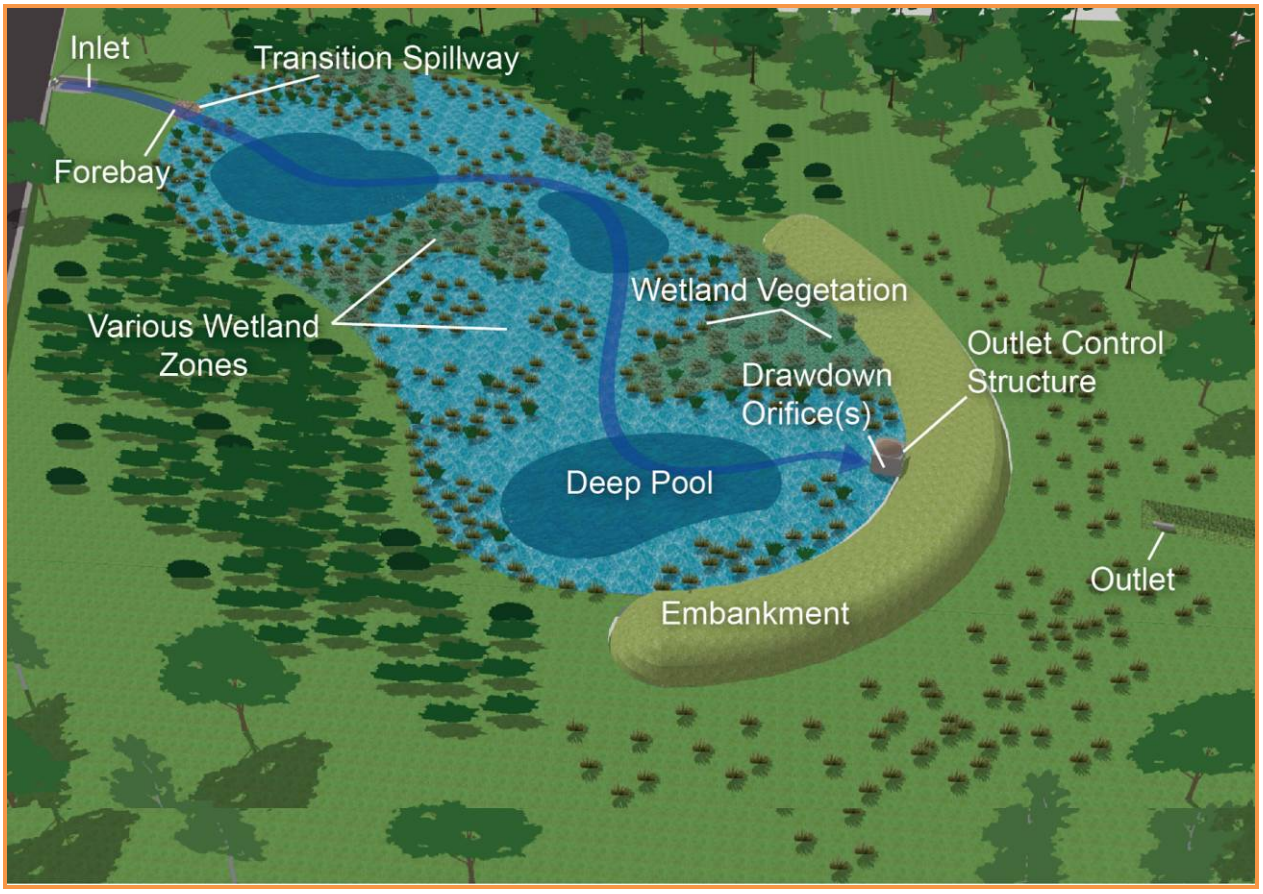


Figure 5.8-2
Typical Components and Configuration for a Stormwater Wetland

Key functional features of stormwater wetlands include:

- Forebay designed to provide pretreatment by capturing debris and sediment and to reduce the velocity of runoff entering the stormwater wetland.
- Permanent pool of water with varying depths that provides water quality benefits and sustains wetland vegetation.
- Drawdown orifice/device used to temporarily detain stormwater runoff after a storm event.

The Section 5.8.2 recommends inspection and maintenance practices for maximizing stormwater wetland performance.

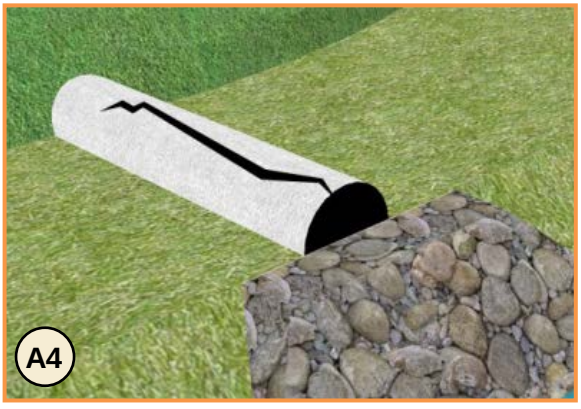
5.8.2 Inspection and Maintenance

Comprehensive inspections of stormwater wetlands should be conducted at least annually. The inspector will document observed conditions using Form B-8 (Appendix B), determine appropriate

actions to remedy functional impairments per this I&M Manual, and document routine or as-needed maintenance performed.

Inlet and Outlet Drainage Systems

- **A1: Inspect for trash, debris, and sediment:**
  - Remove trash and vegetative debris or sediment that has the potential to inhibit flow into the stormwater wetland.
- **A2: Inspect these areas for signs of erosion:**
  - Repair eroded areas by resodding or reseeding. Restore compacted fill, geotextile, and rock riprap (if present). If erosion is a recurring problem, consult a design professional.
  - Identify and control the source of erosion damage if soil is exposed or erosion is evident.
  - Check the upstream areas for bank stability and evidence of piping or scour holes.
- **A3: Inspect inlet channel, ditch, and outlet for undesirable vegetation:**
  - Remove undesirable vegetation that threatens the function or integrity of the inlet channel, ditch, or outlet such as woody vegetation or vegetation prone to clogging the outlet structure.
- **A4: Inspect inlet and outlet pipes for damage or plugging:**
  - Repair or replace damaged piping if needed.
  - If plugged, remove material and identify and mitigate the source of sediment or debris.



Forebay

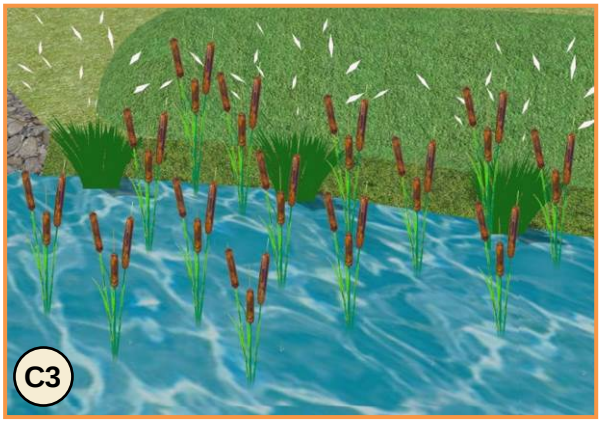
- **B1: Inspect for sediment accumulation in forebay.**
  - Remove sediment in forebay if sediment occupies more than 50 percent of the forebay's storage capacity. Use the sediment depth marker to determine depth. If no marker was installed, use best professional judgment.
  - Reseed any areas of bare soil if surrounding soil is disturbed during cleanout of the forebay.
- **B2: Inspect for undesirable vegetation in forebay:**
  - Remove vegetation that threatens the function or integrity of the forebay such as woody vegetation that may cause structural deterioration or make removal of sediment from the forebay difficult.
- **B3: Inspect condition of erosion protection materials:**
  - Replace materials as needed.
  - Repair or reshape the transition spillway, taking care to maintain the original elevation and design dimensions of the transition spillway. Repair, supplement, or replace erosion protection materials as needed.

Wetland Zones/Pools

- **C1: Inspect for inadequate aquatic plant density compared to design (see final approved planting plan):**
  - Consult a design professional for vegetation re-establishment and provide them with the final approved planting plan. Use of fertilizer is restricted in some locations and applicators must be licensed.

- **C2: Inspect the pools for sediment accumulation:**
  - Remove sediment if it accumulates to the point of reducing the original design depth by 75 percent or more. Unlike other stormwater controls, sediment will not be removed from a stormwater wetland by dredging. Dredging a wetland negatively impacts the vegetative cover. Remove solids from a wetland only if it is deemed critical to the functioning of the wetland. If dredging is unavoidable, spread the top layer of dredged material over the wetland to aid in re-establishing vegetation.

- **C3: Inspect wetland zones for undesirable vegetation:**
  - Remove vegetation that threatens the function or integrity of the wetland such as vegetation prone to clogging the outlet structure.
  - Remove undesirable vegetation by physical removal or by hand wiping with aquatic glyphosate (wear gloves). Do not spray because the herbicide will kill all vegetation it contacts.



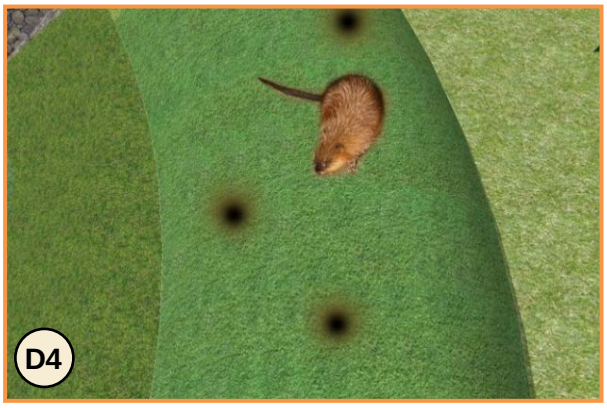
- **C4: Inspect wetland zones for trash or debris:**
  - Remove trash and debris.

- **C5: Inspect the wetland surface for algal growth:**
    - When algae covers 50 percent or more of the pool, consult a professional to develop a management plan to remove and prevent reoccurrence of algal growth.
    - Physical removal of the algae is an option, but reoccurrence is likely.
    - Chemical control options are available. Consult the Georgia Department of Agriculture to obtain the appropriate pesticide application license.

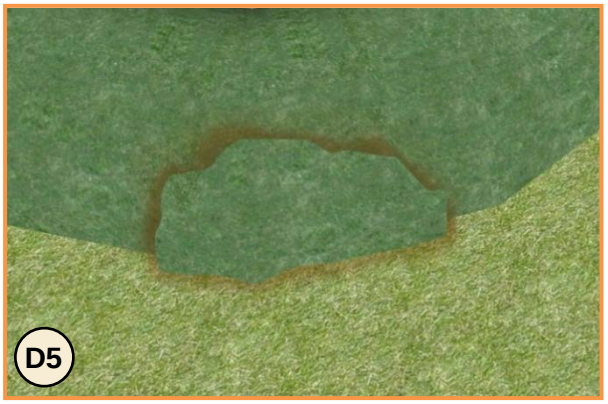
- **C6: Inspect wetland zones for dead or unhealthy plant material:**
    - Replace dead or unhealthy plant material, taking care to determine whether appropriate vegetation is present. Consult design drawings if necessary to confirm that intended plant species are present.
    - Remove undesirable vegetation by hand if possible or by wiping them with pesticide (do not spray pesticide).
    - Licenses with special endorsements may be required to apply pesticides in an aquatic environment.

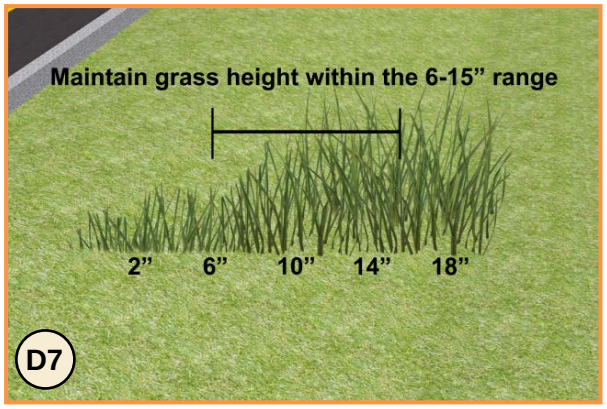
Embankment and Emergency Spillway

- **D1: Inspect for shrubs or trees growing on the embankment and emergency spillway:**
  - Remove shrubs or trees immediately.
  - Fill/regrade and re-establish ground cover as necessary.
- **D2: Inspect vegetation for poor health and/or erosion:**
  - Repair eroding areas by filling/ regrading and re-establishing ground cover.
  - Use sod where possible and provide adequate erosion protection until repaired areas are well-stabilized.
  - Provide lime and one-time fertilizer application if needed.
  - Consult a professional landscaper if needed.
- **D3: Inspect for signs of seepage on the downstream face:**
  - Consult a design professional. This could indicate a serious issue and cause the embankment to fail.
- **D4: Inspect for evidence of animal activity:**
  - Use traps to remove muskrats and consult a professional to remove beavers.
  - Repair animal burrows.



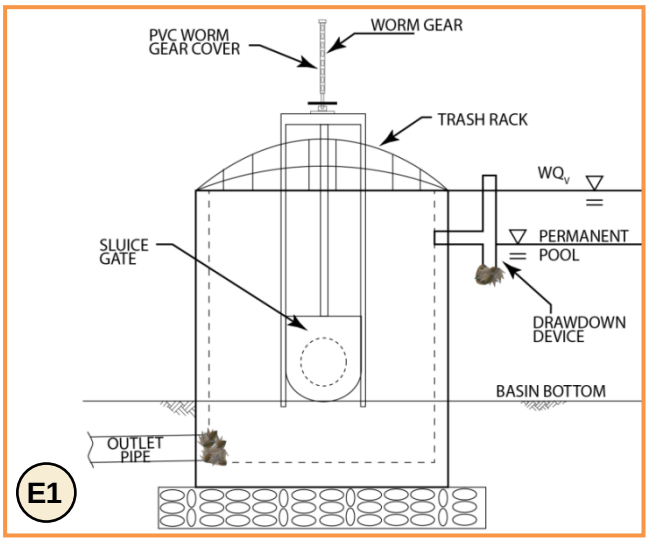
- **D5: Inspect for signs of settling, scouring, cracking, or sloughing:**
    - Repair by adding soil and/or regrade where needed. Compact as indicated in the original design documents and re-establish vegetation. Consult a design professional if needed and follow any applicable dam safety rules.
- **D6: Inspect for trash, debris, or undesirable vegetation in the emergency spillway:**
    - Remove trash, debris, and undesirable vegetation that threatens the function or integrity of the spillway.
- **D7: Inspect grass height and the condition of concrete or riprap in the emergency spillway:**
    - Mow grass to desired height of 6 to 15 inches.
    - Repair or replace concrete or riprap if it is in poor condition.

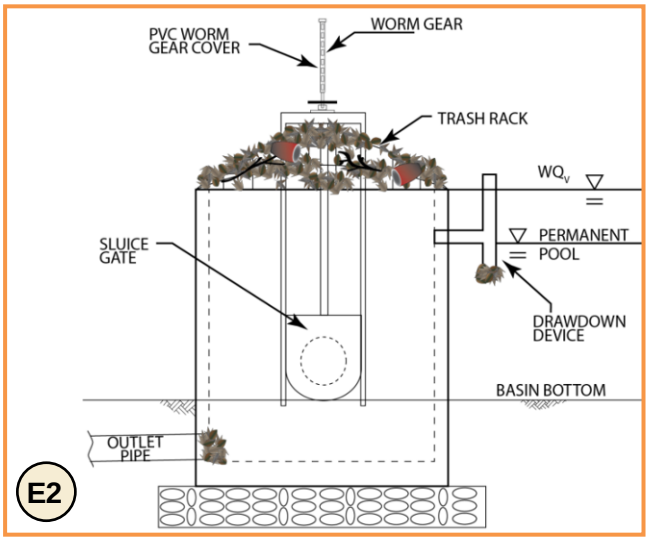




Outlet Control Structure

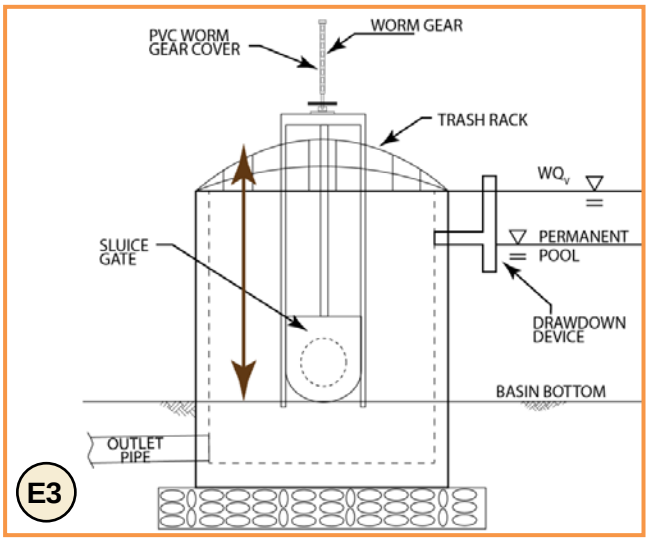
- **E1: Ensure that water is flowing freely through the outlet control structure; if standing water is present above the outlet/orifice opening, this indicates that the drawdown device is blocked:**
    - If the outlet appears to be clogged or blocked and standing water prevents access to the structure, use hip waders or a small boat to make the necessary repairs. Do not enter the standing water unless you have been trained to do so. Trained contractors can be hired to make needed repairs.
    - If the water level in the pool is above the outlet/orifice, follow proper safety precautions before opening the sluice gate or valve or pumping out the pool.
    - Remove sediment or debris around the drawdown device. After the deep pool has been drained, check the outlet pipe for plugging and remove debris as needed. Return the sluice gate to its original position.
- **E2: Inspect trash rack for trash, debris, damage, or corrosion:**
    - Remove trash and debris from trash rack.
    - Replace trash rack according to design specifications if it is corroded or damaged.

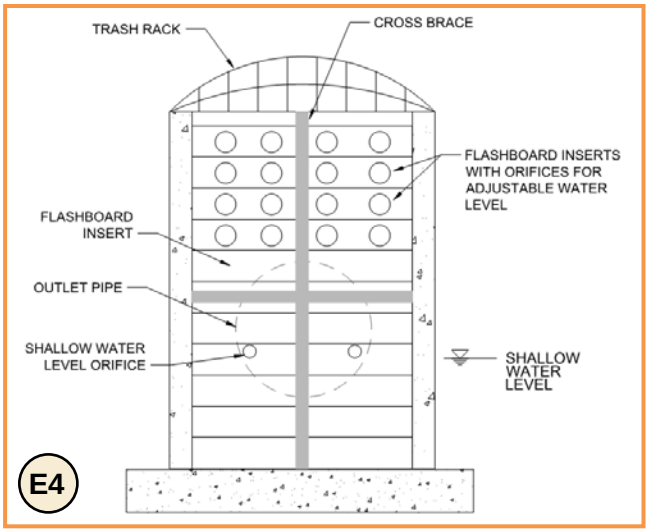




- **E3: Ensure movable components (i.e., sluice gates or valves) are operable through their full range of motion:**
    - Remove sediment or debris within and near the movable component.
    - If lubrication is necessary, lubricate with a marine-type grease.
    - If the components are damaged beyond repair, consult a design professional for guidance on replacement.

- **E4: Inspect flashboard riser (if present) for damage or plugging:**
    - Remove debris around the structure and orifices.
    - Inspect for missing or damaged flashboards. Replace or repair as appropriate, providing the same orifice sizes and configuration.
    - Check for leaks within the structure.
    - Remove or reconfigure flashboards if the wetland must be drained for maintenance or the water level requires adjustment.





5.9 Bioslopes

5.9.1 Description and Function of Structure

Bioslopes are filtration BMPs that are typically installed in roadway embankments. A special media allows sheet flow from the roadway to rapidly infiltrate and filter through the bioslope, where it is then collected and conveyed by an underdrain parallel to the roadway. Runoff in excess of the design flow rate bypasses the bioslope in the form of sheet flow that does not infiltrate. A filter strip is recommended, if space allows, and is typically placed directly upstream of the bioslope for pretreatment where it captures sediment and debris and prevents premature clogging of the bioslope. If a filter strip BMP cannot be implemented upstream of the bioslope, an ordinary grassed shoulder or pea gravel diaphragm may be used for pretreatment. Bioslopes combine the benefits of filter strips and dry enhanced swales, providing cost-effective treatment in areas where it is challenging to implement other BMPs. Figure 5.9-1 is a photograph of a roadside bioslope.

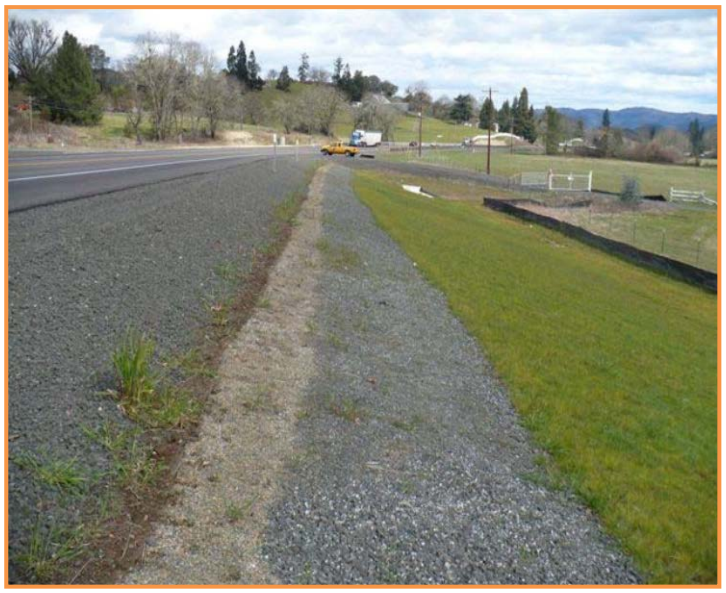


Figure 5.9-1
Bioslope with Pea Gravel Diaphragm
(photo courtesy of Oregon DOT)

Figure 5.9-2 shows the typical configurations and components of a bioslope.

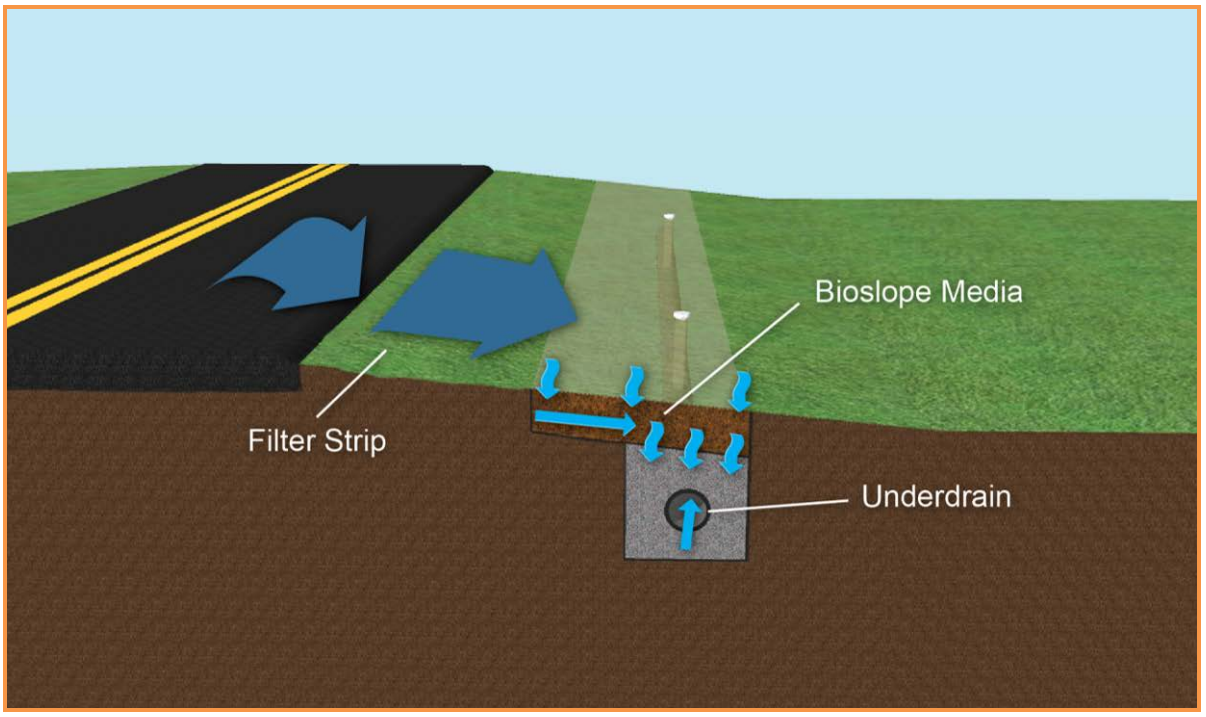


Figure 5.9-2
Typical Bioslope Configuration and Components

Key functional features of bioslopes include:

- Use filter strips or pea gravel diaphragms for pretreatment of stormwater runoff.
- Provide effective treatment along roadway embankments where runoff exits the pavement as sheet flow.
- Infiltrates and filters runoff through the bioslope media, where it is collected and conveyed by an underdrain.

The Section 5.9.2 recommends inspection and maintenance practices for maximizing bioslope performance.

5.9.2 Inspection and Maintenance

Bioslopes will typically be indistinguishable from the rest of the surrounding embankment unless staked out with markers or located using GPS. If the inspector cannot locate the bioslope, coordinates will be obtained and markers should be added to the site.

Inspections should be performed annually. The inspector will document observed conditions using Form B-9 (Appendix B), determine appropriate actions to remedy functional impairments per this I&M Manual, and document routine or as-needed maintenance performed.

Filter Strip

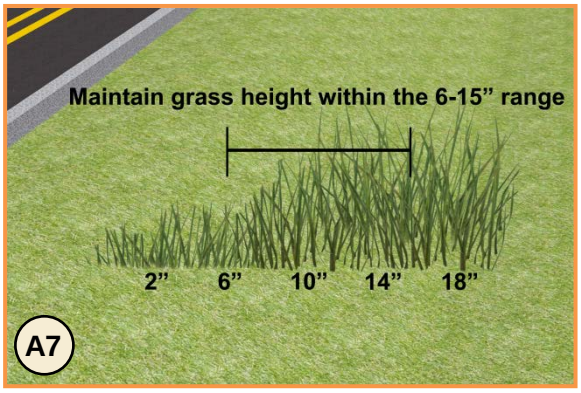
- **A1: Inspect filter strip for trash and/or debris:**
    - Remove and properly dispose of trash and debris.
- **A2: Inspect for areas of unhealthy grass cover, bare areas, or dying grass:**
    - Inspect overall vegetative cover, which will be maintained at a coverage of 70 percent. Reseed and add topsoil to bare areas.
    - Provide lime and one-time fertilizer application if soil testing indicates that pH adjustment and fertilization are needed.
    - Use a rolled erosion control product on eroded areas and steeper slopes as needed.
    - If due to unusually dry conditions, water where practical.
    - If compaction is a concern, aerate the soil using a core aerator that collects cores and dispose of the cores in an area that will not impact stormwater or receiving waters. Aerate only during times of the year when grass is actively growing.
    - If the problem persists, determine the source of the problem (e.g., soil, drainage). If needed, perform additional soil testing and carefully apply soil amendments, such as supplemental nutrients or compost.

- **A3: Inspect filter strip for areas of erosion or formation of gullies:**
    - Runoff must enter the strip as sheet flow.
    - Regrade the soil if necessary to remove the gully. Plant ground cover and water, if practical, until it is established.
    - Repair eroding areas by filling/regrading and reestablishing ground cover.
    - Use sod where possible and provide adequate erosion protection until repaired areas are well stabilized.
    - Provide lime and one-time fertilizer application if needed.

- **A4: Inspect filter strip area for undesirable vegetation:**
    - Remove woody vegetation that can cause flow to channelize.
    - Remove vegetation that threatens the function or integrity of the filter strip.

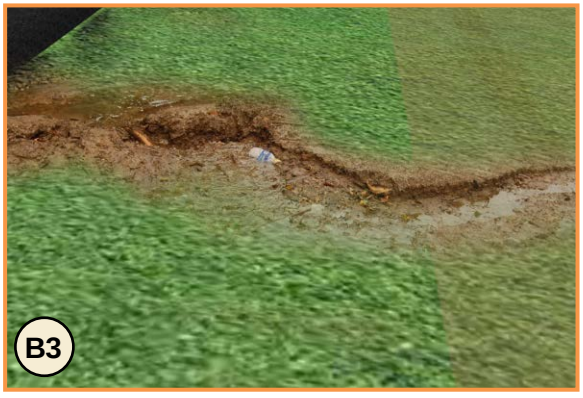
- **A5: Inspect for areas of standing water:**
    - Dewater and discharge to an approved location. Regrading may be required.
    - If a filter strip exhibits signs of poor drainage, determine cause of standing water (e.g., compacted soil, significant erosion) and regrade if necessary.

- **A6: Sediment is accumulating within filter strip:**
    - Remove sediment from the filter strip area when it reaches a depth of 1 to 3 inches. Reestablish vegetation and regrade if necessary.
- **A7: Inspect and check that minimum mowing height is maintained:**
    - Mow grass within the filter strip at a height to maintain a dense vegetative cover. For highway right-of-way areas, a grass height of 6 to 15 inches is practical.



Bioslope

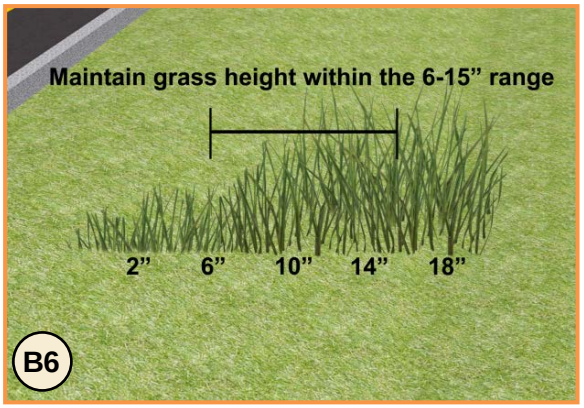
- **B1: Inspect area for trash or debris:**
  - Remove and properly dispose of trash and debris.
- **B2: Inspect areas for unhealthy vegetative cover, bare areas, or dying vegetation:**
  - Monitor overall vegetative cover, which will be maintained at a coverage of 70 percent. Reseed and add topsoil to bare areas.
  - If needed, perform soil testing and carefully apply soil amendments. Also, provide lime and one-time fertilizer application if soil testing indicates that pH adjustment and fertilization are needed.
  - If unusually dry conditions are the cause for unhealthy vegetation, water where practical.
  - If sod was used, check to see that it was not grown in clay or impermeable soil. Replace sod if necessary.
- **B3: Inspect areas for presence of erosion or formation of gullies in the bioslope:**
  - If erosion has occurred, reestablish turf grass (seed or sod). Use a rolled erosion control product on eroded areas and steeper slopes as needed.
  - If channelization has occurred, re-establish the design grade of the bioslope by removing sediment, filling in, and re-establishing vegetation. Provide lime and one-time fertilizer application if needed.



- **B4: Inspect bioslope area for undesirable vegetation:**
  - Remove woody vegetation that can cause flow to channelize.
  - Remove vegetation that threatens the function or integrity of the bioslope.

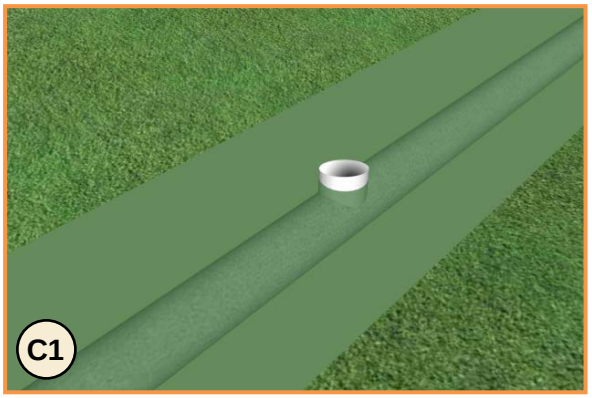
- **B5: Inspect bioslope for accumulation of sediment:**
  - Search for the source of the sediment and remedy the problem if possible.
  - Remove sediment if it is clogging the bioslope media or if it has reached a depth of 3 inches. Dispose of sediment in a location where it will not cause impacts to streams or the BMP. Revegetate disturbed areas immediately with sod (preferred) or seed, protected with a securely staked erosion mat.
  - Due to the sloped nature of this stormwater BMP, sediment may accumulate downslope. Inspect these areas as well.
  - Removal and replacement of the top 2 to 5 inches of media every 3 to 5 years for low sediment applications may be necessary. Media replacement may be needed more often for areas of high sediment yield or high oil and grease.

- **B6: Inspect and check that proper mowing height is maintained:**
  - Mow grass within bioslope at a height of 6 to 15 inches.



Underdrain

- **C1: Inspect for missing or damaged cleanout caps:**
  - Replace cleanout caps that are missing, cracked, or otherwise damaged. Damaged or missing caps will allow stormwater to bypass the bioslope untreated.
- **C2: Perform periodic flow testing of cleanouts to determine if underdrain system is clogged:**
  - Use a bucket or hose to pour water into cleanout and observe outlet control structure for flow.
  - If water does not exit freely, the underdrain is likely clogged. Use a high-pressure hose to flush out the underdrain system by spraying directly into the cleanouts.
  - Repair or replace underdrain system if flushing does not allow water to drain freely. Repair and replace in accordance with the original design specifications. Flush the underdrain system annually if it has a tendency to plug.
  - Rills or gullies downgradient may indicate that the underdrain is clogged.



Outlet

- **D1: Inspect outlet for signs of erosion:**
  - Repair eroded areas by resodding or reseeding. Restore compacted fill, geotextile, and rock riprap (if present). If erosion is a recurring problem, consult a design professional.
  - Identify and control the source of erosion damage if soil is exposed or erosion is evident in the channel bottom or side slopes.
  - Check the upstream areas for bank stability and evidence of piping or scour holes.
- **D2: Inspect outlet pipes for damage or plugging:**
  - Repair or replace damaged piping if needed.
  - If plugged, remove material and identify and mitigate the source of sediment or debris.

Pea Gravel Diaphragm (optional)

See Section 5.12 for guidance on inspection and maintenance of optional components.

5.10 Bioretention Basins

5.10.1 Description and Function of Structure

Bioretention basins are structural BMPs that serve to reduce stormwater pollution through filtration, biological uptake, and microbial activity using landscape vegetation, engineered soil media, and an underdrain. Bioretention basins are effective in reducing TSS, nutrients, heavy metals, pathogens, and temperature. After pretreatment, runoff is temporarily impounded in the bioretention basin to allow it to percolate through an engineered soil media. Vegetation is purposefully selected and planted to enhance pollutant removal and aesthetics. Stormwater that is not absorbed by vegetation or exfiltrated to surrounding soil is collected in an underdrain at the bottom of the media. The underdrain is typically routed to an outlet structure and discharged through the outlet pipe.

Figure 5.10-1 depicts two variations of bioretention basins.

Figure 5.10-1
Landscaped Bioretention Basin (left) and Newly Planted Bioretention Basin after Storm Event (right) (photos courtesy of NCDOT and GSMM)

Figure 5.10-2 shows the typical configuration and components of a bioretention basin.

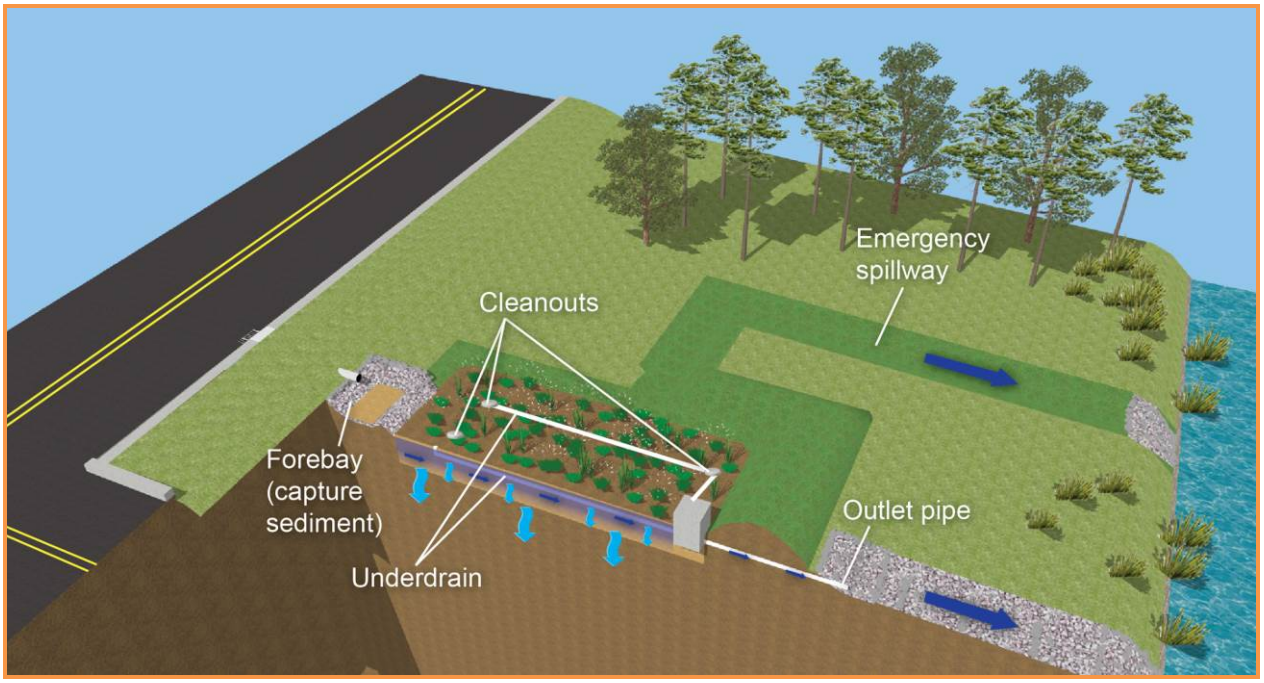


Figure 5.10-2
Typical Bioretention Basin Configuration and Components

Key functional features of bioretention basins include:

- Forebay designed to provide pretreatment by capturing debris and sediment and to reduce the velocity of runoff entering the bioretention basin.
- Healthy vegetation and a sufficient mulch layer essential to pollutant removal.
- Underdrain system to collect water after filtering through the bioretention basin.

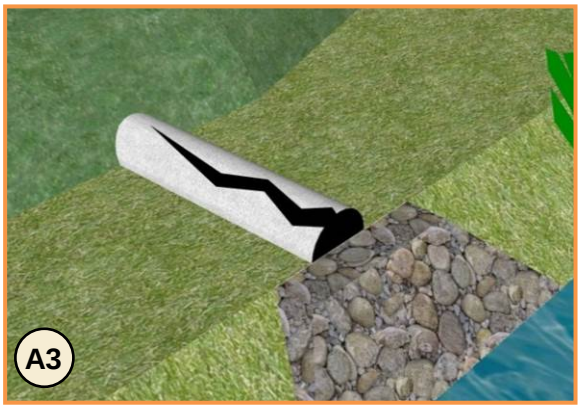
Section 5.10.2 recommends inspection and maintenance practices for maximizing bioretention basin performance.

5.10.2 Inspection and Maintenance

Comprehensive inspections of bioretention basins should be conducted at least annually. The inspector will document observed conditions using Form B-10 (Appendix B), determine appropriate actions to remedy functional impairments per this I&M Manual, and document routine or as-needed maintenance performed.

Inlet and Outlet Drainage Systems

- **A1: Inspect for trash, debris, and sediment:**
  - Remove trash and vegetative debris or sediment that has the potential to inhibit flow into the bioretention basin.
- **A2: Inspect these areas for signs of erosion:**
  - Repair eroded areas by resodding or reseeding. Restore compacted fill, geotextile, and rock riprap (if present). If erosion is a recurring problem, consult a design professional.
  - Identify and control the cause of erosion damage if soil is exposed or erosion is evident.
  - Check upstream areas for bank stability and evidence of piping or scour holes.
- **A3: Inspect inlet and outlet pipes for damage or plugging:**
  - Repair or replace damaged piping if needed.
  - If plugged, remove material and identify and mitigate the source of sediment or debris.



Forebay

- **B1: Inspect for sediment accumulation in forebay:**
  - Remove sediment in forebay if sediment depth is greater than 6 inches.
  - Reseed any areas of bare soil if surrounding soil is disturbed during cleanout of the forebay.

- **B2: Inspect for undesirable vegetation in forebay:**
  - Remove vegetation that threatens the function or integrity of the forebay such as woody vegetation that may cause structural deterioration or make removal of sediment from the forebay difficult.

- **B3: Inspect condition of erosion protection materials:**
  - Replace materials as needed.
  - Repair or reshape the forebay, taking care to maintain the original design elevation and dimensions. Repair, supplement, or replace erosion protection materials as needed.

Basin

- **C1: Inspect area for trash or debris:**
  - Remove and properly dispose of trash and debris.
- **C2: Inspect for unhealthy or dying plants:**
  - Replace dead or unhealthy plants using the original design drawings or landscaping plan if necessary.
  - Determine the source of the problem (e.g., soil, hydrology, disease). Remedy the problem before replacing plants.
- **C3: Inspect areas for presence of erosion or formation of gullies in the basin:**
  - If erosion has occurred, re-establish mulch cover.
  - If channelization has occurred, re-establish the basin bottom by removing sediment, filling in, and remulching.

- **C4: Inspect mulch cover for uniformity and whether it is breaking down or has floated away:**
  - Replenish mulch in void areas.
  - Replace entire mulch layer if necessary according to design plan specifications.
  - Remove the remaining mulch and replace with triple-shredded hardwood mulch at a maximum depth of 3 inches.
  - Do not replace with pine bark mulch.

- **C5: Inspect basin for standing water; the basin must drain within 12 hours after a storm event:**
  - Check outlet structure for clogging. If clogging appears to be a design issue, consult a design professional. If cattails or other wetland vegetation emerge, water is likely remaining in the basin too long. Possible causes include a high groundwater table, clogged media or underdrain, clogged outlet, or localized low areas from heavy equipment or soil compaction.
  - If the outlet and underdrain are functioning properly and there is limited or no flow through them, the media is likely clogged and must be replaced.
  - Remove and replace the top 2 to 5 inches of media every 3 to 5 years for normal applications, more often for areas of high sediment yield or high oil and grease loading.

- **C6: Inspect basin for accumulation of sediment:**
  - Identify and control the source of the sediment if possible. Remove the sediment if it has reached a depth of 3 inches. Dispose of the sediment in a location where it will not cause impacts to streams or the BMP. Remulch disturbed areas immediately according to planting plan.

- Removal of accumulated sediment is extremely important. A significant accumulation of sediment will impair the pollutant removal capabilities of the basin by reducing the available storage for the water quality volume.

- **C7: Inspect vegetation for pruning or removal needs:**
  - Prune according to best professional practices.
  - Pruning is not needed often for native plantings.
  - Remove trees because their roots can damage the underdrain and inhibit inspection and maintenance.

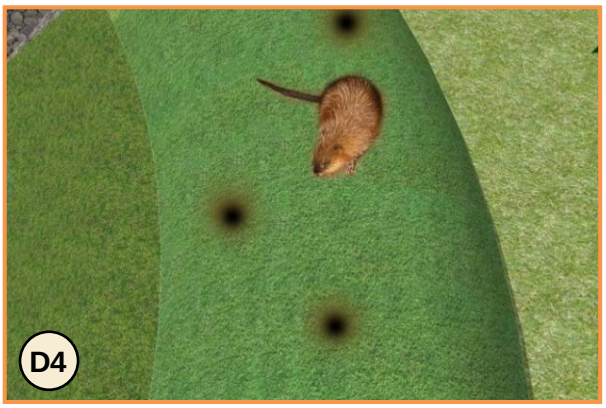
Embankment and Emergency Spillway

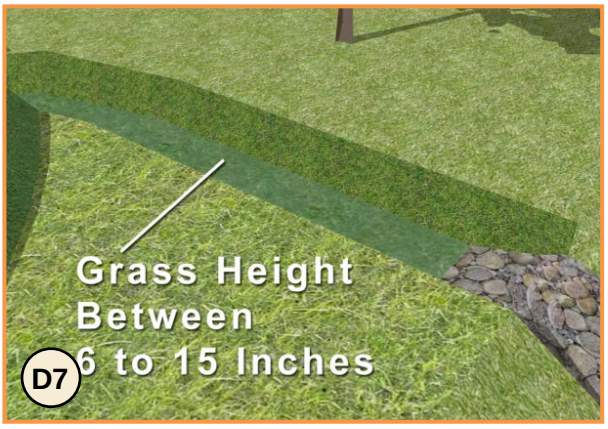
- **D1: Inspect for shrubs or trees growing on the embankment:**
  - Remove shrubs or trees immediately.
  - Fill/regrade and reestablish ground cover as necessary.

- **D2: Inspect grass cover for poor health and/or erosion:**
  - Repair eroding areas by filling/ regrading and re-establishing ground cover.
  - Use sod where possible and provide adequate erosion protection until repaired areas are well stabilized.
  - Provide lime and one-time fertilizer application if needed.
  - Consult a professional landscaper if needed.

- **D3: Inspect for signs of seepage on the downstream face:**
  - Consult a design professional. This could indicate a serious issue and cause the embankment to fail.

- **D4: Inspect for evidence of animal activity:**
  - Repair animal burrows.
- **D5: Inspect for signs of settling, scouring, cracking, or sloughing:**
  - Repair by adding soil and/or regrade where needed. Compact as indicated in the original design documents and re-establish vegetation. Consult a design professional if needed.
- **D6: Inspect for trash, debris, or undesirable vegetation in emergency spillway:**
  - Remove trash, debris, and undesirable vegetation that threatens the function or integrity of the spillway.
- **D7: Inspect grass height and condition of concrete or riprap:**
  - Grass height will be carefully maintained at a height of 6 to 15 inches.
  - If emergency spillway is constructed of concrete or riprap, repair if in poor condition.



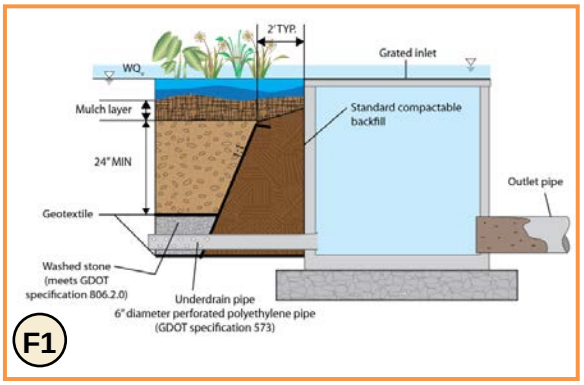


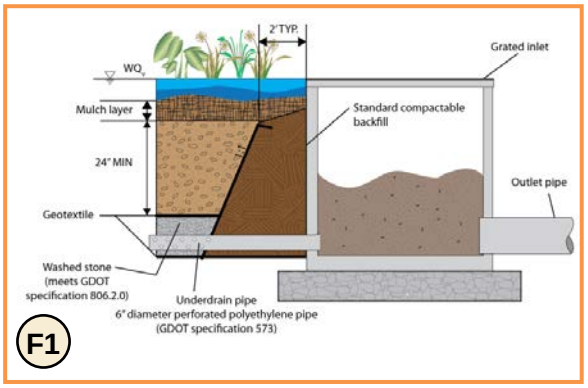
Underdrain

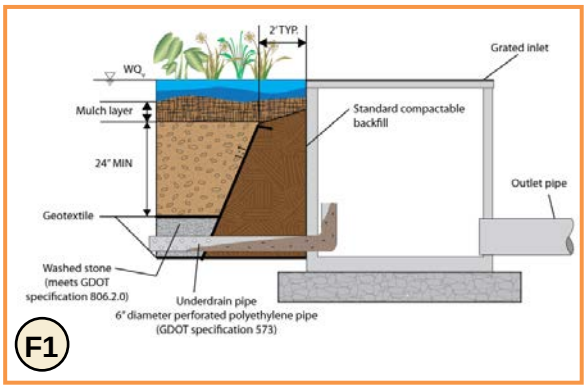
- **E1: Cleanout caps are missing or damaged:**
  - Replace cleanout caps that are missing, cracked, or otherwise damaged.
  - Damaged or missing caps may allow stormwater to exit the basin untreated.
- **E2: Perform periodic flow testing of cleanouts to determine if underdrain system is clogged:**
  - Use a bucket or hose to pour water into the cleanout and observe outlet control structure for flow. If water does not exit freely, the underdrain is likely clogged. Use a high-pressure hose to flush out the underdrain system by spraying directly into the cleanouts.
  - Repair or replace underdrain systems if flushing does not allow water to drain freely. Repair and replace in accordance with the original design specifications.
  - Flush the underdrain system annually if it has a tendency to plug.

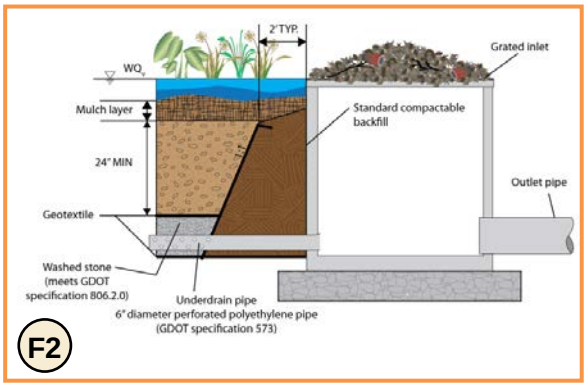
Outlet Control Structure

- **F1: Inspect for standing water around outlet control structure:**
  - If the outlet appears to be clogged or blocked, remove material blocking the outlet opening. Replace the outlet if there are signs of excessive corrosion or damage.
  - Inspect for leaks that may allow runoff to bypass the sand media untreated.
  - Check upturned elbow (if present) for plugging.
- **F2: Inspect trash rack/grate inlet for trash, debris, damage, or corrosion:**
  - Remove trash and debris from trash rack.
  - Replace trash rack according to design specifications if it is corroded or damaged.









5.11 Open-Graded Friction Course

5.11.1 Description and Function of Structure

Open-graded friction course (OGFC) is a thin, permeable layer of asphalt that encompasses a support structure consisting of a uniform coarse aggregate size with minimal fines, and serves as a final surface course or an overlay to conventional asphalt pavements. OGFC absorbs noise from vehicle traffic and has an increased resistance to surface friction. The permeability of OGFC allows for water to enter and flow through the aggregate matrix, and not directly off the pavement surface. As a result, OGFC increases the safety of motorists by decreasing splash and spray, reduces the potential for hydroplaning, improves the visibility of pavement markings, and benefits the environment. The large number of void spaces within the structure of OGFC provides a stormwater detaining effect, reduces TSS in stormwater runoff, and minimizes sediment impacts. This applies to all GDOT types of OGFC including conventional, modified, and porous European mix. Figure 5.11-1 illustrates a typical cross section of OGFC.

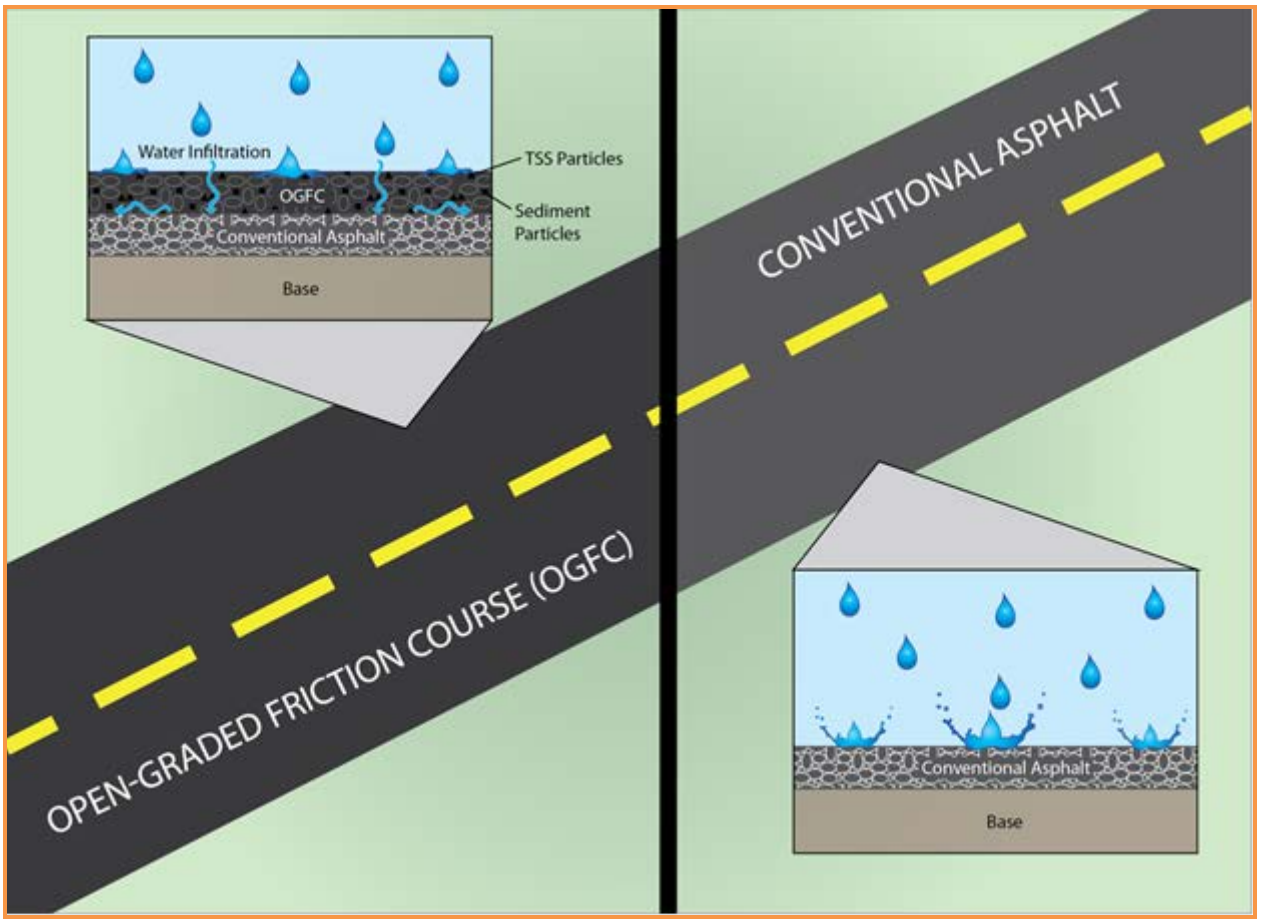


Figure 5.11-1
OGFC (left) and Conventional Asphalt (right) Cross Sections

Key functional features of OGFC that must be maintained include:

- Highways with rural shoulder sections (no curb and gutter) overlaid with OGFC and combined with filter strips provide low-cost treatment.

- Promote sheet flow along the pavement and shoulder. Some striping materials and sealing of longitudinal cracks can block lateral flow-through, decreasing OGFC effectiveness.

Figure 5.11-2 shows a typical configuration of an OGFC paired with a filter strip.

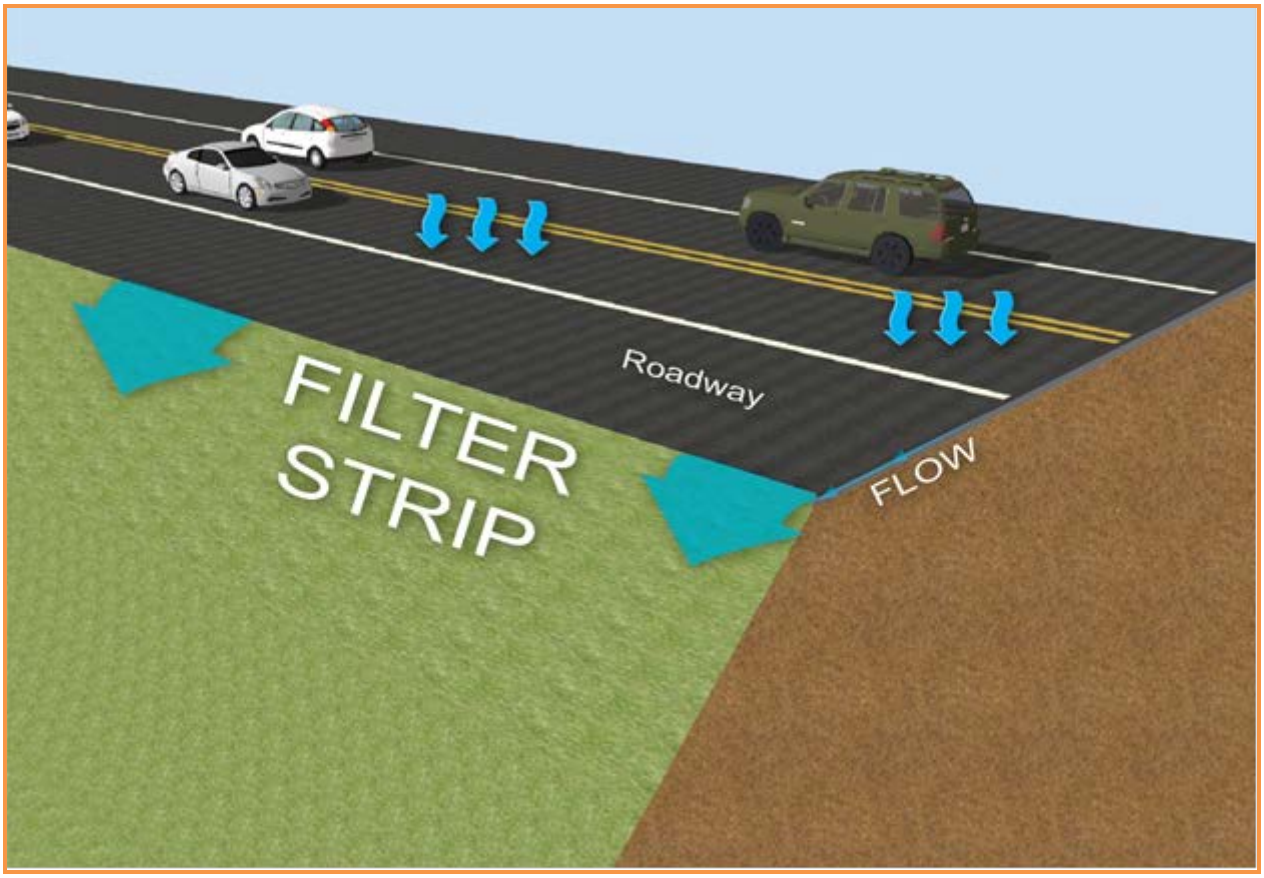


Figure 5.11-2
OGFC with a Filter Strip for Added Stormwater Treatment

Section 5.11.2 recommends inspection and maintenance practices for maximizing OGFC performance.

5.11.2 Inspection and Maintenance

Perform OGFC inspections annually. The inspector will document observed conditions using Form B-11 (Appendix B), determine appropriate actions to remedy functional impairments per this I&M Manual, and document routine or as-needed maintenance performed.

OGFC Surface

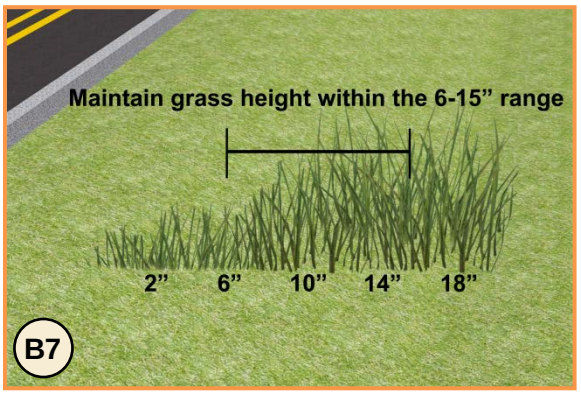
- **A1: Inspect the surface of the OGFC for cracks:**
  - For safety reasons, use conventional asphalt mix for minor repairs. Use OGFC for major repairs or replacement of surface.
- **A2: Inspect the surface of the OGFC for raveling (disintegration of material from the surface down):**
  - Use conventional asphalt mix for minor repairs.
  - For severe raveling, mill the surface and replaced with OGFC. The milled portion can be recycled into the new layer.
- **A3: Inspect the surface and shoulder for accumulation of sediment and/or debris:**
  - Remove debris and built up solids from the shoulder and dispose of properly. Due to the natural suction created by tires on the OGFC, clogging is not typical.
  - Re-establishment of grassed areas is discussed below.

Filter Strip (if present)

- **B1: Inspect filter strip for trash or debris:**
  - Remove and properly dispose of trash and debris.
- **B2: Inspect for areas of unhealthy grass cover, bare areas, or dying grass:**
  - Inspect overall vegetative cover, which will be maintained at a coverage of 70 percent. Reseed and add topsoil to bare areas.
  - Provide lime and one-time fertilizer application if soil testing indicates that pH adjustment and fertilization are needed.
  - Use a rolled erosion control product on eroded areas and steeper slopes as needed.
  - If due to unusually dry conditions, water where practical.
  - If compaction is a concern, aerate the soil using a core aerator that collects cores and dispose of the cores in an area that will not impact stormwater or receiving waters. Aerate only during times of the year when grass is actively growing.
  - If the problem persists, determine the source of the problem (e.g., soil, drainage). If needed, perform additional soil testing and carefully apply soil amendments, such as supplemental nutrients or compost.

- **B3: Inspect filter strip for areas of erosion or formation of gullies:**
    - Ensure runoff is entering the strip as sheet flow.
    - Regrade the soil if necessary to remove the gully. Plant a ground cover and water, if practical, until it is established.
    - Repair eroding areas by filling/regrading and re-establishing ground cover.
    - Use sod where possible and provide adequate erosion protection until repaired areas are well stabilized.
    - Provide lime and one-time fertilizer application if needed.
- **B4: Inspect filter strip area for undesirable vegetation:**
    - Remove woody vegetation that can cause flow to channelize.
    - Remove vegetation that threatens the function or integrity of the filter strip.
- **B5: Inspect for areas of standing water:**
    - Dewater and discharge to an approved location. Regrading may be required.
    - If a filter strip exhibits signs of poor drainage, determine cause of standing water (e.g., compacted soil, significant erosion) and regrade if necessary.

- **B6: Inspect filter strip for sediment accumulation:**
    - Remove sediment from the filter strip area when it reaches a depth of 1 to 3 inches. Re-establish vegetation and regrade if necessary.
- **B7: Inspect and check that minimum mowing height is maintained:**
    - Mow grass in the filter strip at a height to maintain a dense vegetative cover. For highway right-of-way areas, a grass height of 6 to 15 inches is practical.



5.12 Optional Components

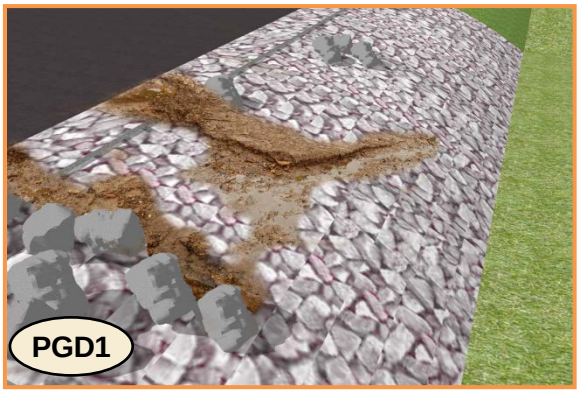
This section includes inspection and maintenance guidance for the less prevalent components of post-construction structures including pea gravel diaphragms, underdrain systems (typical for specific stormwater types but not for others), underground perforated pipes used for additional stormwater storage, and stone check dams to trap sediment and slow velocity of stormwater (i.e., in ditch lines or channels).

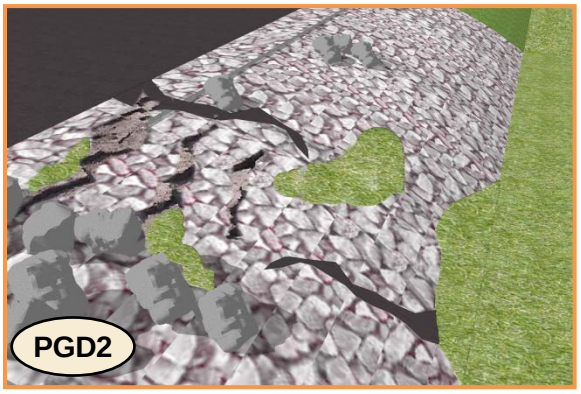
5.12.1 Inspection and Maintenance

Inspect optional components at the same time and with the same frequency as the post-construction structure. The inspector will document observed conditions of optional components using the forms provide in Appendix B for the post-construction structure, determine appropriate actions to remedy functional impairments per this I&M Manual, and document routine or as-needed maintenance performed.

Pea Gravel Diaphragm

Pea gravel diaphragms may be used on the roadway shoulder as a level spreader to distribute stormwater flow. They are sometimes used in combination with filter strips, enhanced swales, bioslopes, grass channels, and other stormwater control structures.

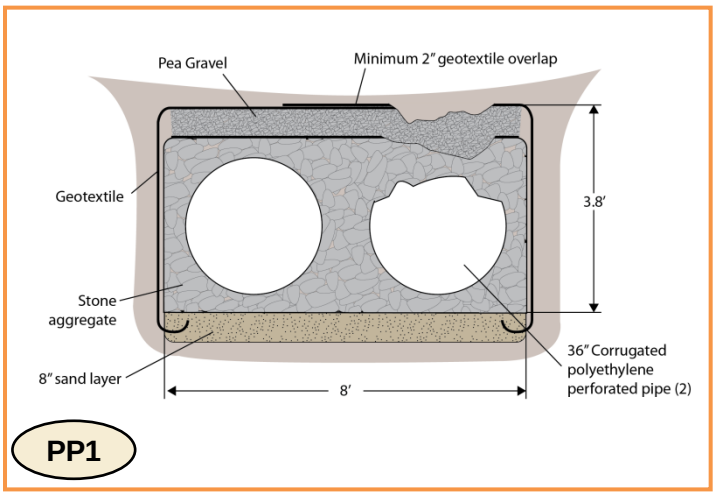


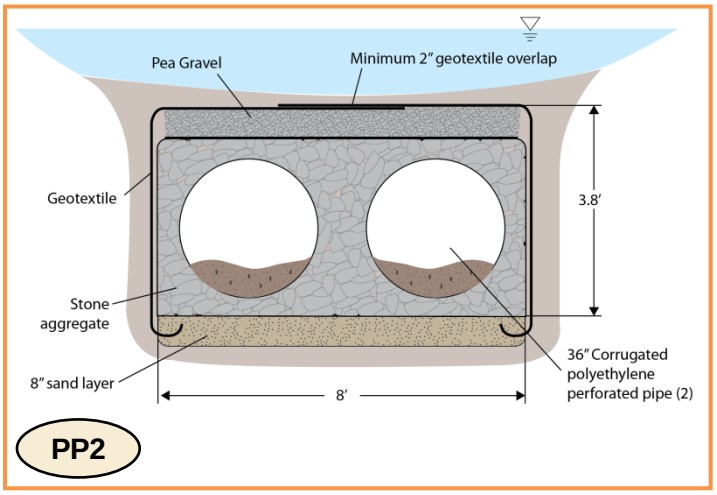


- **PGD1: Inspect for sediment accumulation on pea gravel diaphragm:**
  - Remove sediment and replace lost gravel with new, clean gravel.
- **PGD2: Inspect pea gravel diaphragm for damage:**
  - Repair damaged pea gravel diaphragm to original design specifications.
  - Supplement gravel if needed.

Perforated Pipe for Additional Storage

Perforated piping may be used for additional stormwater storage for infiltration trenches. Provide access for maintenance.





- **PP1: Inspect the ground surface above the perforated pipe for depressions that may indicate pipe breakage or damage:**
  - Check condition of pipes if access is provided for maintenance.
  - Remove and replace damaged pipes.
- **PP2: Inspect for water ponding that remains on surface of infiltration trench for 72 hours or more:**
  - Standing water could indicate that the infiltration trench aggregate or the perforated pipe is plugged.
  - Use closed-circuit television or lamps to check pipes for plugging. Clean out accumulated sediment and dispose of the sediment properly in an area that will not impact the infiltration trench.
  - Refer to Section 5.4 for guidance on handling plugged trenches.

Underdrain

Underdrains are perforated piping used to drain and discharge the treated stormwater from filtration BMPs. Underdrains are typically used in enhanced dry swales and sand filters but may be used with other BMPs as needed.

- **U1: Inspect for missing or damaged cleanout caps:**
  - Replace cleanout caps that are missing, cracked, or otherwise damaged. Damaged or missing caps may allow untreated stormwater to exit the stormwater control.
- **U2: Flushing of cleanouts indicates underdrain system is clogged:**
  - Use a bucket or hose to pour water into cleanout and observe outlet control structure for flow.
  - If water does not exit freely, the underdrain is likely clogged. Use a high-pressure hose to flush out the underdrain system by spraying directly into the cleanouts.
  - Repair or replace underdrain system if flushing does not allow water to drain freely. Repair and replace in accordance with the original design specifications.
  - Flush the underdrain system annually if it has a tendency to plug.

Stone Check Dam

Stone check dams are constructed of rock and washed aggregate and are placed across a natural or man-made ditch or channel. They reduce scour and channel erosion by reducing flow velocity and trapping sediment.

- **SCD1: Inspect for trash, debris, vegetation or excessive sediment:**
  - Remove and properly dispose of trash, debris, undesirable vegetation that threatens the function or integrity of the check dam, and sediment.
  - String trim or carefully mow around check dams to avoid damaging the check dam's structure.
- **SCD2: Inspect for evidence of erosion around the sides of the stone check dam:**
  - Replace or install riprap and stone as needed and repair erosion; rebuild or reshape check dams according to original design dimensions if necessary.

Georgia Department of Transportation

Implementation

SECTION

6

6 Implementation

GDOT will implement this I&M Manual by performing routine and as-needed inspection and maintenance to achieve the following goals within designated MS4 areas:

- *MS4 structures*. Begin the inspection of accessible structures within 10 percent of roadway miles annually by Permit Year 2 (2013).
- *Post-construction stormwater structures*. Begin the inspection of 20 percent of the identified structures annually by Permit Year 4 (2015).

To achieve these goals, GDOT will use available and beneficial aspects of established procedures for inspection and maintenance, as referenced in Section 3, with enhancements to focus on the water quality attributes of those systems and structures along with improved tracking to prioritize corrective actions.

6.1 Key Staff, Roles, and Responsibilities

GDOT staff involved with implementation of this I&M Manual includes the MS4 Program Manager at the state level, District Environmental Compliance Engineer at the GDOT District level, and Area Engineer for areas within the Districts as shown on Figure 6.1-1.

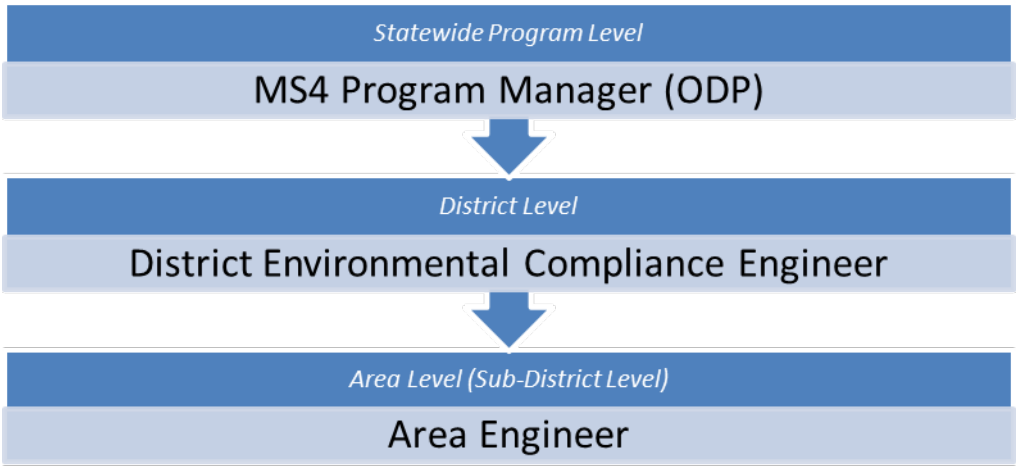


Figure 6.1-1
Key GDOT Staff for I&M Manual Implementation

The MS4 Program Manager resides in the GDOT Office of Design Policy (ODP) at the Central Office and is charged with overall implementation of the SWMP and its various components, including this I&M Manual. The District Environmental Compliance Engineers, working with the Area Engineer, are responsible for permit compliance for GDOT facilities and operations within their respective districts. The Office of Maintenance will be involved in implementation of required corrective measures.

The MS4 and post-construction structure inspections will be performed by Area Maintenance Engineers delegated personnel or contractors under their supervision. The inspector will complete the respective inspection checklist and submit the form along with any recommended corrective actions to the District Environmental Compliance Engineers, with a copy to the District Engineer or District Maintenance Engineer. Corrective actions required as a result of the inspections will be coordinated through the Area Maintenance Engineers and their assigned subordinates. The District Environmental Compliance Engineers are responsible for ensuring that the necessary corrective actions are completed within their districts and for submitting the compiled Annual Area-wide MS4 Structure Checklist (Appendix C) and all associated inspection checklists to the Central Office by February 28 of each year.

6.2 Program Development

The current maintenance management system will be the central reporting, tracking, and archiving tool for MS4 operation, inspection, and maintenance information. Inspection reports, recommended follow-up actions, and resulting corrective actions for MS4-related systems and structures, will be maintained in the maintenance management system. I&M will be conducted for GDOT structures on a regular basis according to guidelines presented in this I&M Manual including:

- Appendix A – MS4 Structure Inspection Checklists
- Appendix B – Post-Construction Stormwater Structure Inspection Checklists
- Appendix C – MS4 Structure Inventory, Inspection, and Maintenance Summary

Inspections completed as part of implementation of this I&M Manual will be performed in addition to those already being performed. Inspection results will be recorded on the appropriate inspection forms and entered into the maintenance management system, such that follow-up maintenance work and its progress can be easily tracked and reported to the District Maintenance Engineer, MS4 Program Manager, and Georgia EPD, as appropriate.

Recommended follow-up or corrective actions determined necessary as a result of a comprehensive inspection will be recorded on the inspection forms and will be entered into the maintenance management system, along with the other data collected during the inspection, for resolution tracking and reporting. Completed inspection forms will be stored at the respective District Office or Area Office as appropriate.

Corrective actions will be prioritized based on human health and safety, impairment to receiving waters of the state, cost, benefit, and feasibility.

6.3 Training

Training is a critical component of the GDOT MS4 Permit and implementation of this I&M Manual. Key GDOT staff members will be trained after adoption of the I&M Manual by Permit Year 3. Details of the training program related to the MS4 Permit can be obtained from the GDOT MS4 Program Manager.

6.4 Schedule

This I&M Manual was developed during the first 2 years of the permit cycle (2012 and 2013), as current GDOT policies, procedures, and programs were evaluated to determine their possible role in the MS4 Permit compliance approach. The proposed schedule for the MS4 structure inventory process will commence in 2014 followed by (or concurrently with) inspections to achieve the goal of inspecting accessible MS4 structures along 10 percent of the roadway miles annually and 20 percent of the total identified post-construction structures annually. Appendix D provides a table of proposed MS4 structure quantities and schedule for inventory. Appendix E offers a similar table of proposed post-construction structure quantities and inventory schedule. Table 6-1 present the I&M Manual Program Implementation Schedule.

Table 6-1 I&M Manual Program Implementation Schedule

Program Element	2012	2013	2014	2015	2016
Evaluate current GDOT procedures and programs for adaptation to MS4 Permit	X				
Develop I&M Manual Program for MS4 structures	X	X			
Inventory MS4 structures		X	X	X	X
Inventory post-construction structures		X	X	X	X
Inspection of MS4 structures along 10% of roadway miles annually		X	X	X	X
Complete development of I&M Manual Program for post-construction structures			X		
Inspect 20% of post-construction structures annually				X	X
Inspection and maintenance training program			X	X	X

Recommended follow-up or corrective actions required as a result of the inspections will be scheduled with other maintenance activities and prioritized by each district. The MS4 Structure

Inventory, Inspection, and Maintenance Summary provided in Appendix C and all associated Inspection Checklists will be compiled by the Central Office by February 28 of each year.

It is anticipated that Georgia EPD will either renew or reissue GDOT's MS4 Permit prior to its expiration in January 2017. Implementation of the I&M Manual will continue into the next permit cycle.

Georgia Department of Transportation

Recordkeeping and Reporting

SECTION

7

7 Recordkeeping and Reporting

The I&M Manual will be provided to each GDOT facility and District Office. The ODP will be responsible for updating the manual as needed and distributing updates to the District Offices. For the District Office, the District Environmental Compliance Engineer will oversee implementation of the I&M Manual at each facility.

7.1 Recordkeeping

The MS4 Permit requires GDOT to maintain records of activities related to pollution prevention and good housekeeping for municipal-type operations. These records will be compiled during annual reporting. The records maintained at local facilities will mainly include inspection forms and MS4 Permit required metrics for MS4 structures and post-construction structures within that Area and/or District. Completed structure inspection forms and records of follow-up corrective actions will be maintained at the respective Area Office or District Office, as dictated by the District Environmental Compliance Engineer, and titled MS4 Structure Inspections with subtitles of the state route designation or GDOT facility name. Copies of the inspection forms and follow-up actions will be submitted electronically to the Central Office through the District Environmental Compliance Engineer. As required by the permit, GDOT will maintain at least 3 years of records at each facility.

The MS4 Permit requires GDOT to develop procedures for receiving and investigating complaints related to MS4 structures. These complaints and follow-up actions will be compiled and maintained in a database in the Central Office. The information recorded will include (at a minimum), a summary of the notifications, initial report date, record of resolution, and date resolved.

7.2 Reporting

Records will be reported to Georgia EPD in each MS4 Annual Report in accordance with permit requirements. The Annual Report will summarize pollution prevention and good housekeeping activities conducted and maintenance actions completed by GDOT. Records will be gathered by the District Offices under the supervision of the District Environmental Compliance Engineers and forwarded to the Central Office on a quarterly basis, unless otherwise specified in this I&M Manual. The ODP will review and compile the reports and submit copies of the appropriate documents to Georgia EPD with the MS4 Annual Report, unless more immediate notification is required.

Appendix A

MS4 Stormwater Structure
Inspection Checklists

Pipe Systems including Pipe Inlets / Outlets
Inspection Checklist Form A-1

Structure ID #:	**Inspection Date:**
Inspector:	**Installation Date:**

Inspection Type: ☐ Initial ☐ Routine/Scheduled ☐ Follow-up ☐ Complaint ☐ Other:

Inspection Notes:

Pipe Type:	**Pipe Material:**	**Liner Present?:**	**Rise:**
☐ Box Culvert ☐ Circular Pipe ☐ Elliptical Pipe ☐ Pipe Culvert ☐ Trench Drain ☐ Sanitary Storm Combo	☐ Aluminized steel ☐ Concrete ☐ Corrugated Metal Pipe - Coated ☐ Corrugated Metal Pipe - Plain ☐ Corrugated Plastic Pipe ☐ Iron ☐ PVC ☐ Vitrified clay ☐ High-density polyethylene ☐ Unknown ☐ Other:	☐ Yes ☐ No	_____ **Span:** _____ **Number of Barrels:** _____

Inlet/Outlet Type and Description:

☐ Inlet
- ☐ Standard Drop
- ☐ Standard Precast Drop
- ☐ Standard Drop Types V-1 and V-2
- ☐ Drain Inlet
- ☐ Standard Drop Types M-1 and M-2
- ☐ Standard Median Drop
- ☐ Special Design Median Drop
- ☐ Type "V"
- ☐ Modified Standard 5001-M Drop
- ☐ Ditch Drop
- ☐ Safety Inlet with Grate

☐ Pipe Outlet
- ☐ Weir
- ☐ Orifice

Structure ID #:	Date:

- ☐ Box Culvert End
- ☐ Headwall
  - ☐ Standard Pipe Culvert Concrete
  - ☐ Standard Tapered Inlet or Outlet
  - ☐ Standard Rubble Masonry for Pipe Culvert
- ☐ End wall
  - ☐ Standard Pipe Arch Culverts
  - ☐ Standard Sand Cement Bag Rip Rap
  - ☐ Standard Precast Reinforced Concrete
- ☐ End Section
  - ☐ Standard for End Wall and Apron
  - ☐ Standard Safety (Metal)

Structure ID #:	Date:

Pipe Systems including Pipe Inlets / Outlets Inspection Checklist Form A-1

Complete the form below by indicating the performance condition for each inspection item.

Performance Condition Key:

☐ N/A: Not applicable, the condition of the inspection item could not be determined or the component is not present.

🟩 Level 1: Good condition, no corrective action required.

🟨 Level 2: Fair condition, but still functional. Follow-up inspection in 6 months (or as corrective action dictates) is recommended.

🟥 Level 3: Poor condition, needing maintenance, repair and/or replacement.

Refer to Section 4 in the GDOT Stormwater System Inspection and Maintenance Manual for additional information on pipe systems inspection items and maintenance activities.

	N/A	0 - 25%	26 - 50%	51 - 100%
Blockage:	☐	🟩	🟨	🟥
Water Level:	☐	🟩	🟨	🟥

Erosion around the pipe system:

	N/A	No Erosion	Moderate	Severe
Sod / Grass		🟩	🟨	🟥
Rip Rap		🟩	🟨	🟥
Paved		🟩	🟨	🟥
Active Waterway	☐			
Other:	☐			

Condition of the surface surrounding the pipe system:

	N/A	No Action Required	Moderate	Severe
Scouring/Undermining	☐	🟩	🟨	🟥
Syphon holes	☐	🟩	🟨	🟥
Settling	☐	🟩	🟨	🟥
Erosion	☐	🟩	🟨	🟥
Exposed pipe	☐	🟩	🟨	🟥
Other:	☐	🟩	🟨	🟥

Structure ID #:	Date:

Structural defects related to pipe system:

	N/A	No Action Required	Moderate	Severe
Cracks/Joint Separation	☐	☐	☐	☐
Pipe Collapsed	☐	☐	☐	☐
Surface Settlement	☐	☐	☐	☐
Pipe corrosion	☐	☐	☐	☐
Root Intrusion	☐	☐	☐	☐
Surcharged Flow	☐	☐	☐	☐
Leaking	☐	☐	☐	☐

Engineering judgment on the priority of repairs needed:

- ☐ Immediate
- ☐ Within 2 years
- ☐ Beyond 2 years

Recommended actions for the inlet/outlet issues:

- ☐ Install
- ☐ Place riprap
- ☐ Remove debris
- ☐ Repair structural damage
- ☐ Replace
- ☐ No action

Recommended actions for the pipe issues:

- ☐ Clean pipe of debris/sediment
- ☐ Repair structural defects
- ☐ Remove or replace pipe
- ☐ No action

Item Number	Recommended Actions/Comments:	Entered into MMS?

Structure ID #:	Date:

Media		
Name of media documents or files:	Type: ☐ Photo ☐ Video ☐ Document ☐ As Built ☐ Other:	Aspect Description: ☐ Overview ☐ Side ☐ Inside ☐ Behind ☐ Other:
Name of media documents or files:	Type: ☐ Photo ☐ Video ☐ Document ☐ As Built ☐ Other:	Aspect Description: ☐ Overview ☐ Side ☐ Inside ☐ Behind ☐ Other:
Name of media documents or files:	Type: ☐ Photo ☐ Video ☐ Document ☐ As Built ☐ Other:	Aspect Description: ☐ Overview ☐ Side ☐ Inside ☐ Behind ☐ Other:
Name of media documents or files:	Type: ☐ Photo ☐ Video ☐ Document ☐ As Built ☐ Other:	Aspect Description: ☐ Overview ☐ Side ☐ Inside ☐ Behind ☐ Other:

Ditches and Swales
Inspection Checklist Form A-2

Structure ID #:	**Inspection Date:**
Inspector:	**Installation Date:**

Inspection Type: ☐ Initial ☐ Routine/Scheduled ☐ Follow-up ☐ Complaint ☐ Other:

Inspection Notes:

Conveyance Type:	**Liner Present?:**	**Material:**
☐ Ditch ☐ Swale ☐ Stream	☐ Yes ☐ No	☐ Concrete ☐ Paved ☐ Earthen ☐ Armored ☐ Unknown ☐ Other:

Structure ID #:	Date:

Ditches and Swales
Inspection Checklist Form A-2

Complete the form below by indicating the performance condition for each inspection item.

Performance Condition Key:

☐ N/A: Not applicable, the condition of the inspection item could not be determined or the component is not present.

🟩 Level 1: Good condition, no corrective action required.

🟨 Level 2: Fair condition, but still functional. Follow-up inspection in 6 months (or as corrective action dictates) is recommended.

🟥 Level 3: Poor condition, needing maintenance, repair and/or replacement.

Refer to Section 4 in the GDOT Stormwater System Inspection and Maintenance Manual for additional information on ditches and swales inspection items and maintenance activities.

	N/A	0 - 25%	26 - 50%	51 - 100%
Blockage:	☐	🟩	🟨	🟥
Water Level:	☐	🟩	🟨	🟥

Structural defects related to ditch, swales or stream:

	N/A	No Action Required	Moderate	Severe
Surface Settlement	☐	🟩	🟨	🟥
Lack of Stabilization	☐	🟩	🟨	🟥
Erosion	☐	🟩	🟨	🟥
Liner Damage	☐	🟩	🟨	🟥
Scouring/Undermining	☐	🟩	🟨	🟥
Surcharged Flow	☐	🟩	🟨	🟥
Root Intrusion	☐	🟩	🟨	🟥
Syphon holes	☐	🟩	🟨	🟥

Structure ID #:	Date:

Engineering judgment on the priority of repairs needed:

- ☐ Immediate
- ☐ Within 2 years
- ☐ Beyond 2 years

Recommended actions for the conveyance issue:

- ☐ Clean pipe of debris/sediment
- ☐ Repair structural defects
- ☐ Remove and replace pipe
- ☐ No action

Item Number	Recommended Actions/Comments:	Entered into MMS?

Structure ID #:	Date:

Media		
Name of media documents or files:	Type: ☐ Photo ☐ Video ☐ Document ☐ As Built ☐ Other:	Aspect Description: ☐ Overview ☐ Side ☐ Inside ☐ Behind ☐ Other:
Name of media documents or files:	Type: ☐ Photo ☐ Video ☐ Document ☐ As Built ☐ Other:	Aspect Description: ☐ Overview ☐ Side ☐ Inside ☐ Behind ☐ Other:
Name of media documents or files:	Type: ☐ Photo ☐ Video ☐ Document ☐ As Built ☐ Other:	Aspect Description: ☐ Overview ☐ Side ☐ Inside ☐ Behind ☐ Other:
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Name of media documents or files:	Type: ☐ Photo ☐ Video ☐ Document ☐ As Built ☐ Other:	Aspect Description: ☐ Overview ☐ Side ☐ Inside ☐ Behind ☐ Other:

Manholes, Junction Boxes, Catch Basins, and Inlets
Inspection Checklist Form A-3

Structure ID #:	**Inspection Date:**
Inspector:	**Installation Date:**

Inspection Type: ☐ Initial ☐ Routine/Scheduled ☐ Follow-up ☐ Complaint ☐ Other:

Inspection Notes:

Structure Type and Description:

☐ Inlet
- ☐ Standard Drop
- ☐ Standard Precast Drop
- ☐ Standard Drop Types V-1 and V-2
- ☐ Drain Inlet
- ☐ Standard Drop Types M-1 and M-2
- ☐ Standard Median Drop
- ☐ Special Design Median Drop
- ☐ Type "V"
- ☐ Modified Standard 5001-M Drop
- ☐ Ditch Drop
- ☐ Safety Inlet with Grate

☐ Headwall
- ☐ Standard Pipe Culvert Concrete
- ☐ Standard Tapered Inlet or Outlet
- ☐ Standard Rubble Masonry for Pipe Culvert

☐ End wall
- ☐ Standard Pipe Arch Culverts
- ☐ Standard Sand Cement Bag Rip Rap

☐ Junction Box; Pipe Collars, Pipe Elbow and Pipe Curve Alignment

☐ Intersection

☐ Stand Pipe

☐ Manhole
- ☐ Standard Brick
- ☐ Standard Precast Reinforced Concrete

Structure ID #:	Date:

- ☐ Catch Basin
  - ☐ Cast Iron Grate Inlets
  - ☐ Type A with C.I. Inlet
  - ☐ Type 1 and Type 2
  - ☐ For 6" or 8" Curb and Gutter
  - ☐ Precast for 6" or 8" Curb and Gutter
  - ☐ For 4" Curb and Guttter
  - ☐ Precast for 4" Curb and Gutter
  - ☐ For Header or 4", 6", 8", and 10" Integral Curbs
  - ☐ Precast for Header or 4", 6", 8", and 10" Integral Curbs
  - ☐ For 6" Mountable Curb and Gutter
  - ☐ Precast for 6" Mountable Curb and Gutter
  - ☐ For 6" or 8" Curb and Gutter in Sags or Low Points
  - ☐ Precast for 6" or 8" Curb and Gutter in Sags or Low Points
  - ☐ For 4" Curb and Gutter in Sags or Low Points
  - ☐ Precast for 4" Curb and Gutter in Sags or Low Points
  - ☐ For Header or 4", 6", 8", and 10" Integral Curbs in Sags or Low Points
  - ☐ Precast for Header or 4", 6", 8", and 10" Integral Curbs in Sags or Low Points
  - ☐ For 6" Mountable Curb and Gutter in Sags or Low Points
  - ☐ Precast for 6" Mountable Curb and Gutter in Sags or Low Points
  - ☐ Adjacent to Approach Slab

- ☐ End Section
  - ☐ Standard for End Wall and Apron
  - ☐ Standard Safety (Metal)

- ☐ Spillway
  - ☐ Standard Concrete
  - ☐ Standard Concrete Adjacent to Approach Slabs
  - ☐ Grouted Rubble Spillways or Aprons
  - ☐ Asphaltic Concrete

- ☐ Flume; Concrete

- ☐ Control Structure
  - ☐ Weir
  - ☐ Orifice

- ☐ Misc Or Combo
  - ☐ Standard Sand Cement Bag Ditch Check
  - ☐ Standard Circular Base Units and Riser
  - ☐ Berm, Side or Surface Ditch
  - ☐ Drop Tapered Inlet Section
  - ☐ Temp Pipe Slope Drain with Drain Inlet
  - ☐ Special Grate Inlet
  - ☐ Circular Corrugated Metal Base
  - ☐ Longitudinal Edge Drains with Lateral
  - ☐ Inlet Drainage Structure at Surface Ditch
  - ☐ Standard Perforated Underdrain

Structure ID #:	Date:

Structure Shape:

- ☐ Buried
- ☐ Combination
- ☐ Breached
- ☐ Trapezoid
- ☐ Broadcrested
- ☐ V-Notched
- ☐ Double wing
- ☐ Left wing
- ☐ Right wing
- ☐ Flared end
- ☐ Plain end
- ☐ Grated
- ☐ Grated inlet
- ☐ Hooded grate
- ☐ Raised
- ☐ L-Shaped
- ☐ U-Shaped
- ☐ Round
- ☐ Rectangular
- ☐ Straight
- ☐ Winged
- ☐ Orifice
- ☐ Other:

Structure Material:

- ☐ Block
- ☐ Brick
- ☐ Concrete
- ☐ Corrugated Metal Pipe - Coated
- ☐ Corrugated Metal Pipe - Plain
- ☐ Iron
- ☐ Plastic
- ☐ Vitrified clay
- ☐ Wood
- ☐ Paved
- ☐ Earthen
- ☐ Unknown
- ☐ Other:

Illicit Discharge Present?:

- ☐ Yes
- ☐ No

Anti-Theft Device:

- ☐ Yes
- ☐ No

Invert Depth: _____

Throat Depth: _____

Outside Connection: _____

Data Collection Method:

- ☐ Aerial photograph
- ☐ As-built
- ☐ Sub-meter GPS
- ☐ Survey-grade GPS

Structure ID #:	Date:

Manholes, Junction Boxes, Catch Basins, and Inlets Inspection Checklist Form A-3

Complete the form below by indicating the performance condition for each inspection item.

Performance Condition Key:

☐ N/A: Not applicable, the condition of the inspection item could not be determined or the component is not present.

🟩 Level 1: Good condition, no corrective action required.

🟨 Level 2: Fair condition, but still functional. Follow-up inspection in 6 months (or as corrective action dictates) is recommended.

🟥 Level 3: Poor condition, needing maintenance, repair and/or replacement.

Refer to Section 4 in the GDOT Stormwater System Inspection and Maintenance Manual for additional information on manholes, junction boxes, catch basins and inlet items and maintenance activities.

Blockage:	N/A ☐	0 - 25% 🟩	26 - 50% 🟨	51 - 100% 🟥

Erosion Level:

	N/A	No Erosion	Moderate	Severe
Sod / Grass		🟩	🟨	🟥
Rip Rap		🟩	🟨	🟥
Paved		🟩	🟨	🟥
Active Waterway	☐			
Other	☐			

Structure ID #:	Date:

Structural defects related to MS4 structures:

	N/A	No Action Required	Moderate	Severe
Scouring/Undermining	☐	☐	☐	☐
Structural Damage	☐	☐	☐	☐
Surface Settlement	☐	☐	☐	☐
Cracks/Joint Separation	☐	☐	☐	☐
Top/Cover Broken or Missing	☐	☐	☐	☐
Leaking	☐	☐	☐	☐
Root Intrusion	☐	☐	☐	☐

Condition of the surface surrounding the structure:

	N/A	No Action Required	Moderate	Severe
Syphon holes	☐	☐	☐	☐
Settling	☐	☐	☐	☐
Erosion	☐	☐	☐	☐
Exposed pipe	☐	☐	☐	☐
Other:	☐	☐	☐	☐

Engineering judgment on the priority of repairs needed:

☐ Immediate
☐ Within 2 years
☐ Beyond 2 years

Recommended actions for the structure issue:

☐ Install
☐ Place riprap
☐ Remove debris
☐ Repair structural damage
☐ Replace
☐ No action

Structure ID #:	Date:

Item Number	Recommended Actions/Comments:	Entered into MMS?

Media

Name of media documents or files:	Type: ☐ Photo ☐ Video ☐ Document ☐ As Built ☐ Other:	Aspect Description: ☐ Overview ☐ Side ☐ Inside ☐ Behind ☐ Other:
Name of media documents or files:	Type: ☐ Photo ☐ Video ☐ Document ☐ As Built ☐ Other:	Aspect Description: ☐ Overview ☐ Side ☐ Inside ☐ Behind ☐ Other:
Name of media documents or files:	Type: ☐ Photo ☐ Video ☐ Document ☐ As Built ☐ Other:	Aspect Description: ☐ Overview ☐ Side ☐ Inside ☐ Behind ☐ Other:
Name of media documents or files:	Type: ☐ Photo ☐ Video ☐ Document ☐ As Built ☐ Other:	Aspect Description: ☐ Overview ☐ Side ☐ Inside ☐ Behind ☐ Other:

Appendix B

Post-Construction Stormwater
Structure Inspection Checklists

GDOT Filter Strip
Inspection Checklist Form B-1

Structure ID #:	Date:
Inspector:	Precipitation within last 72 hours: Yes No

Stormwater system within:

- ☐ Right-of-Way (Highway, Adjacent Park and Ride Lot)
- ☐ Easement
- ☐ GDOT Facility Property

Further location description:

Filter Strip shape:

- ☐ Linear
- ☐ Other: _____

Vegetation:

- ☐ Grass turf
- ☐ Meadow Grass
- ☐ Landscaped
- ☐ Other: _____

General dimensions:

_____' width _____' length

Structure protection:

- ☐ Fence
- ☐ Guard rail
- ☐ Bollards
- ☐ Signage
- ☐ Other: _____

Discharges to:

- ☐ GDOT MS4 conveyance system
- ☐ GDOT post-construction structure

Structure Type_____

- ☐ Off R/W
- ☐ Adjacent MS4 jurisdiction structure
- ☐ Live stream/lake/pond
- ☐ Wetlands
- ☐ Other: _____

Additional components:

- ☐ Concrete level spreader
- ☐ Pea gravel diaphragm
- ☐ Flow bypass structure
- ☐ Energy dissipation structures
- ☐ Riprap
- ☐ Infiltration berm
- ☐ None
- ☐ Other: _____

Structure ID #:	Date:

GDOT Filter Strip Inspection Checklist Form B-1

Complete the form below by indicating the performance condition for each inspection item.
Performance Condition Key:

- Level 1: Good condition, no corrective action required.
- Level 2: Fair condition, but still functional. Follow-up inspection in 6 months (or as corrective action dictates) is recommended.
- Level 3: Poor condition, needing maintenance, repair and/or replacement.

Refer to Section 5.1 in the GDOT Stormwater System Inspection and Maintenance Manual for additional information on filter strip inspection items and maintenance activities.

Filter Strip Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
Inlet Drainage System	A1.		☐	Trash, debris, and sediment present?
	A2.		☐	Are there signs of erosion?
	A3.		☐	Damaged or plugged inlet pipes?
Outlet Drainage System	A1.		☐	Trash, debris, and sediment present?
	A2.		☐	Are there signs of erosion?
	A3.		☐	Damaged or plugged outlet pipes?
Flow Bypass Structure	A1.		☐	Trash, debris, and sediment present?
	A2.		☐	Are there signs of erosion?
	A3.		☐	Damaged or plugged flow bypass pipes?
Level or Flow Spreader	B1.		☐	Trash, debris, or sediment present in or around level spreader?
	B2.		☐	Cracks in concrete trough?
	B3.		☐	Evidence of erosion or washout immediately downslope of level spreader lip?
	B4.		☐	Evidence of damage to lip of concrete troughs?
	B5.		☐	If present, is drawdown system clogged?

Structure ID #:	Date:

Filter Strip Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
Pea Gravel Diaphragm	C1.		☐	Sediment accumulation present on pea gravel diaphragm?
	C2.		☐	Is pea gravel diaphragm damaged?
Filter Strip	D1.		☐	Trash or debris present?
	D2.		☐	Unhealthy grass cover, bare areas, or dying grass present or 30% or more of surface area?
	D3.		☐	Evidence of erosion or gullies?
	D4.		☐	Is there vegetation that threatens the function or integrity of the filter strip?
	D5.		☐	Standing water present?
	D6.		☐	Sediment accumulation depth greater than 3 inches present in filter strip?
	D7.		☐	Is vegetation height less than 6 inches or greater than 15 inches?
Berm	E1.		☐	Evidence of erosion on or around berm?
	E2.		☐	Sediment accumulation at base of berm?
Buffer/Adjacent Ground Cover	F1.		☐	Evidence of erosion or gullies in buffer/adjacent area?
	F2.		☐	Sediment accumulation greater than 6 inches present?
	F3.		☐	Disturbances within buffer?

Corrective Actions Required:	Entered into MMS?

GDOT Grass Channel
Inspection Checklist Form B-2

Structure ID #:	Date:
Inspector:	Precipitation within last 72 hours: Yes No

Stormwater system within:

- ☐ Right-of-Way (Highway, Adjacent Park and Ride Lot)
- ☐ Easement
- ☐ GDOT Facility Property

Further location description:

Channel shape/features:

- ☐ Trapezoidal
- ☐ Parabolic
- ☐ Other: _____

Vegetation:

- ☐ Grass turf
- ☐ Meadow Grass
- ☐ Other: _____

General dimensions:

bottom width _____'
top width _____'
length _____'
depth _____'

Structure protection:

- ☐ Fence
- ☐ Guard rail
- ☐ Bollards
- ☐ Signage
- ☐ Other: _____

Discharges to:

- ☐ GDOT MS4 conveyance system
- ☐ GDOT post-construction structure

Structure Type_____

- ☐ Off R/W
- ☐ Adjacent MS4 jurisdiction structure
- ☐ Live stream/lake/pond
- ☐ Wetlands
- ☐ Other: _____

Additional components:

- ☐ Check dams
- ☐ Energy dissipation structures
- ☐ Riprap
- ☐ Splash blocks
- ☐ Infiltration berm
- ☐ None
- ☐ Other: _____

Structure ID #:	Date:

GDOT Grass Channel Inspection Checklist Form B-2

Complete the form below by indicating the performance condition for each inspection item.
Performance Condition Key:

- Level 1: Good condition, no corrective action required.
- Level 2: Fair condition, but still functional. Follow-up inspection in 6 months (or as corrective action dictates) is recommended.
- Level 3: Poor condition, needing maintenance, repair and/or replacement.

Refer to Section 5.2 in the GDOT Stormwater System Inspection and Maintenance Manual for additional information on grass channel inspection items and maintenance activities. Refer to Section 5.12 for additional information on optional components.

Grass Channel Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
Inlet Drainage System	A1.		☐	Trash, debris, and sediment present?
	A2.		☐	Are there signs of erosion?
	A3.		☐	Damaged or plugged inlet pipe?
Outlet Drainage System	A1.		☐	Trash, debris, and sediment present?
	A2.		☐	Are there signs of erosion?
	A3.		☐	Damaged or plugged outlet pipe?
Grass Channel	B1.		☐	Trash or debris present?
	B2.		☐	Unhealthy grass cover, bare areas, or dying grass present over 30% or more of the surface area?
	B3.		☐	Evidence of erosion or gullies?
	B4.		☐	Is there vegetation that threatens the function or integrity of the structure?
	B5.		☐	Standing water present?
	B6.		☐	Sediment accumulation depth greater than 3 inches present?
	B7.		☐	Is vegetation height less than 6 inches or greater than 15 inches?

Structure ID #:	Date:

Grass Channel Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
Side Slopes	C1.		☐	Evidence of erosion, rills, or gullies forming?
Pea Gravel Diaphragm (optional)	PGD1.		☐	Sediment accumulation present on pea gravel diaphragm?
	PGD2.		☐	Is pea gravel diaphragm damaged?
Stone Check Dam (optional)	SCD1.		☐	Trash, debris, undesirable vegetation or excessive sediment present?
	SCD2.		☐	Evidence of erosion around the sides of the stone check dam?

Corrective Actions Required:	Entered into MMS?

GDOT Enhanced Swale Inspection Checklist Form B-3

Structure ID #:	Date:
Inspector:	Precipitation within last 72 hours: Yes No

Stormwater system within:

- ☐ Right-of-Way (Highway, Adjacent Park and Ride Lot)
- ☐ Easement
- ☐ GDOT Facility Property

Further location description:

Swale Type:

- ☐ Dry swale
- ☐ Wet swale
- ☐ Other: _____

Vegetation:

- ☐ Grass turf
- ☐ Meadow Grass
- ☐ Wetland Vegetation
- ☐ Landscaped
- ☐ Other: _____

General dimensions:

width (top) _____'

length _____'

depth _____'

Structure protection:

- ☐ Fence
- ☐ Guard rail
- ☐ Bollards
- ☐ Signage
- ☐ Other: _____

Discharges to:

- ☐ GDOT MS4 conveyance system
- ☐ GDOT post-construction structure

Structure Type_____

- ☐ Off R/W
- ☐ Adjacent MS4 jurisdiction structure
- ☐ Live stream/lake/pond
- ☐ Wetlands
- ☐ Other: _____

Additional components:

- ☐ Check dams
- ☐ Forebay
- ☐ Pea gravel diaphragm
- ☐ Flow spreaders
- ☐ Weir
- ☐ Splash blocks
- ☐ Infiltration berms
- ☐ None
- ☐ Other: _____

Structure ID #:	Date:

GDOT Enhanced Swale Inspection Checklist Form B-3

Complete the form below by indicating the performance condition for each inspection item.
Performance Condition Key:

- Level 1: Good condition, no corrective action required.
- Level 2: Fair condition, but still functional. Follow-up inspection in 6 months (or as corrective action dictates) is recommended.
- Level 3: Poor condition, needing maintenance, repair and/or replacement.

Refer to Section 5.3 in the GDOT Stormwater System Inspection and Maintenance Manual for additional information on enhanced swale inspection items and maintenance activities. Refer to Section 5.12 for additional information on optional components.

Enhanced Swale Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
Inlet Drainage System	A1.		☐	Trash, debris, and sediment present?
	A2.		☐	Are there signs of erosion?
	A3.		☐	Damaged or plugged inlet pipe?
Outlet Drainage System	A1.		☐	Trash, debris, and sediment present?
	A2.		☐	Are there signs of erosion?
	A3.		☐	Damaged or plugged outlet pipe?
Forebay	B1.		☐	Sediment accumulation greater than 50% of storage capacity present?
	B2.		☐	Is there vegetation that threatens the function or integrity of the forebay?
	B3.		☐	Do erosion protection materials need replacement or repair?
Swale	C1.		☐	Trash or debris present?
	C2.		☐	Unhealthy vegetative cover, bare areas, or dying vegetation present over 30% or more of the surface area?
	C3.		☐	Evidence of erosion or gullies?
	C4.		☐	Is there vegetation that threatens the function or integrity of the swale?
	C5.		☐	For dry swales, is ponded water present 24 – 48 hours after storm event?

Structure ID #:	Date:

Enhanced Swale Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
Swale, cont'd.	C6.		☐	Sediment accumulation depth greater than 3 inches present in grass swale?
	C7.		☐	Is vegetation height less than 6 inches or greater than 15 inches?
Side Slopes	D1.		☐	Evidence of erosion, rills, or gullies forming on side slopes?
Check Dam	E1.		☐	Trash, debris, undesirable vegetation or excessive sediment present?
	E2.		☐	Evidence of erosion around the sides of the check dam?
Wetland Vegetation (for Wet Swales)	F1.		☐	Is there vegetation that threatens the function or integrity of the swale?
	F2.		☐	Unhealthy or dead plants present?
Underdrain (for Dry Swales)	G1.		☐	Are cleanout caps missing or damaged?
	G2.		☐	Does flow testing of cleanouts indicate underdrain system is clogged?
Discharge Weir or Berm	H1.		☐	Is trash, debris, undesirable vegetation or sediment obstructing flow through weir?
	H2.		☐	Is weir or berm damaged?
Pea Gravel Diaphragm (optional)	PGD1.		☐	Sediment accumulation present on pea gravel diaphragm?
	PGD2.		☐	Is pea gravel diaphragm damaged?

Corrective Actions Required:	Entered into MMS?

GDOT Infiltration Trench Inspection Checklist Form B-4

Structure ID #:	Date:
Inspector:	Precipitation within last 72 hours: Yes No

Stormwater system within:

- ☐ Right-of-Way (Highway, Adjacent Park and Ride Lot)
- ☐ Easement
- ☐ GDOT Facility Property

Further location description:

General dimensions:

_____' width _____' length

Design features:

- ☐ Observation well
- ☐ Aggregate surface
- ☐ Grass surface
- ☐ Underdrain
- ☐ Other: _____

Discharges to:

- ☐ GDOT MS4 conveyance system
- ☐ GDOT post-construction structure

Structure Type_____

- ☐ Off R/W
- ☐ Adjacent MS4 jurisdiction structure
- ☐ Live stream/lake/pond
- ☐ Wetlands
- ☐ Other: _____

Structure protection:

- ☐ Fence
- ☐ Guard rail
- ☐ Bollards
- ☐ Signage
- ☐ Other: _____

Additional components:

- ☐ Level spreader
- ☐ Filter strip
- ☐ Diversion structure
- ☐ Other pretreatment structure
- ☐ Overflow control structure
- ☐ Underdrain
- ☐ None
- ☐ Other: _____

Structure ID #:	Date:

GDOT Infiltration Trench Inspection Checklist Form B-4

Complete the form below by indicating the performance condition for each inspection item.
Performance Condition Key:

- Level 1: Good condition, no corrective action required.
- Level 2: Fair condition, but still functional. Follow-up inspection in 6 months (or as corrective action dictates) is recommended.
- Level 3: Poor condition, needing maintenance, repair and/or replacement.

Refer to Section 5.4 in the GDOT Stormwater System Inspection and Maintenance Manual for additional information on infiltration trench inspection items and maintenance activities. Refer to Section 5.12 for additional information on optional components.

Infiltration Trench Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
Inlet Drainage System	A1.		☐	Trash, debris, and sediment present?
	A2.		☐	Are there signs of erosion?
	A3.		☐	Damaged or plugged inlet pipe?
Forebay	B1.		☐	Sediment accumulation greater than 50% of storage capacity present?
	B2.		☐	Is there vegetation that threatens the function or integrity of the forebay?
	B3.		☐	Do erosion protection materials need replacement or repair?
Filter Strip	C1.		☐	Trash or debris present?
	C2.		☐	Unhealthy grass cover, bare areas, or dying grass cover over 30% or more of the surface area?
	C3.		☐	Evidence of erosion or gullies?
	C4.		☐	Is there vegetation that threatens the function or integrity of the filter strip?
	C5.		☐	Standing water present?
	C6.		☐	Sediment accumulation depth greater than 3 inches present?
	C7.		☐	Is vegetation height less than 6 inches or greater than 15 inches?

Structure ID #:	Date:

Infiltration Trench Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
Berm and Emergency Spillway	D1.		☐	Evidence of erosion?
	D2.		☐	Sediment accumulation present at base of berm?
	D3.		☐	Is there trash, debris, or vegetation that threatens the function or integrity of the spillway?
	D4.		☐	Is vegetation height less than 6 inches or greater than 15 inches? Is the concrete or riprap in poor condition?
Infiltration Trench	E1.		☐	Evidence of ponding water on infiltration trench surface 72 hours or more after a storm event?
	E2.		☐	Undesirable vegetation growing on trench surface?
Pea Gravel Diaphragm (optional)	PGD1.		☐	Sediment accumulation on pea gravel diaphragm?
	PGD2.		☐	Is pea gravel diaphragm damaged?
Perforated Pipe for Additional Storage (optional)	PP1.		☐	Evidence of depressions on ground surface above perforated pipes?
	PP2.		☐	Standing water on ground surface above perforated pipes for 72 hours or longer?
Underdrain (optional)	U1.		☐	Are cleanout caps missing or damaged?
	U2.		☐	Does flow testing of cleanouts indicate underdrain system is clogged?

Corrective Actions Required:	Entered into MMS?

GDOT Sand Filter
Inspection Checklist Form B-5

Structure ID #:	Date:
Inspector:	Precipitation within last 72 hours: Yes No

Stormwater system within:

- ☐ Right-of-Way (Highway, Adjacent Park and Ride Lot)
- ☐ Easement
- ☐ GDOT Facility Property

Further location description:

Sand Filter Type:

- ☐ Surface
- ☐ Perimeter
- ☐ Other: _____

Design Components:

- ☐ Trash/debris rack
- ☐ Forebay
- ☐ Sedimentation chamber
- ☐ Overflow structure
- ☐ Other: _____

Contributing runoff area:

- ☐ Grass/vegetated
- ☐ Paved

Approximate size: _____ac.

Structure/Access protection:

- ☐ Fence
- ☐ Guard rail
- ☐ Bollards
- ☐ Signage
- ☐ Access covers
- ☐ Other: _____

Discharges to:

- ☐ GDOT MS4 conveyance system
- ☐ GDOT post-construction structure

Structure Type_____

- ☐ Off R/W
- ☐ Adjacent MS4 jurisdiction structure
- ☐ Live stream/lake/pond
- ☐ Wetlands
- ☐ Other: _____

Additional components:

- ☐ Inlet/inflow control
- ☐ Outlet/discharge control
- ☐ Energy dissipation structures
- ☐ Underdrain
- ☐ Oil/grease traps
- ☐ None
- ☐ Other: _____

Structure ID #:	Date:

GDOT Sand Filter Inspection Checklist Form B-5

Complete the form below by indicating the performance condition for each inspection item.
Performance Condition Key:

Level 1: Good condition, no corrective action required.

Level 2: Fair condition, but still functional. Follow-up inspection in 6 months (or as corrective action dictates) is recommended.

Level 3: Poor condition, needing maintenance, repair and/or replacement.

Refer to Section 5.5 in the GDOT Stormwater System Inspection and Maintenance Manual for additional information on sand filter inspection items and maintenance activities.

Sand Filter Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
Inlet Drainage System	A1.		☐	Trash, debris, and sediment present?
	A2.		☐	Are there signs of erosion?
	A3.		☐	Damaged or plugged inlet pipes and grates?
Outlet Drainage System	A1.		☐	Trash, debris, and sediment present?
	A2.		☐	Are there signs of erosion?
	A3.		☐	Damaged or plugged outlet pipes?
Forebay/ Sedimentation Chamber	B1.		☐	Sediment accumulation greater than 6 inches present in forebay/ or sedimentation chamber?
	B2.		☐	Is there vegetation that threatens the function or integrity of the forebay?
	B3.		☐	Are erosion protection materials in poor condition?
	B4.		☐	Trash, debris, sediment, overgrown vegetation, damage, or corrosion on perforated stand-pipe?
Filter Bed	C1.		☐	Trash or debris present?
	C2.		☐	Unhealthy grass cover, bare areas, or dying grass present over 30% or more of the surface area in surface type filter bed?
	C3.		☐	Evidence of erosion or gullies?
	C4.		☐	Is there vegetation that threatens the function or integrity of the filter bed?
	C5.		☐	Water ponding more than 72 hours after storm event in surface filter bed?

Structure ID #:	Date:

Sand Filter Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
Filter Bed, cont'd.	C6.		☐	Sediment accumulation depth greater than 3 inches?
	C7.		☐	Is vegetation height less than 6 inches or greater than 15 inches?
Side Slopes (Surface Sand Filter)/Vault (Perimeter Sand Filter)	D1.		☐	Evidence of erosion, rills, or gullies forming on side slopes?
	D2.		☐	Evidence of degrading structural components on perimeter sand filter or leaks at the joints in the concrete structure or other components allowing groundwater to enter or discharge runoff untreated?
Embankment and Emergency Spillway	E1.		☐	Are shrubs or trees present on embankment?
	E2.		☐	Evidence of erosion and/or unhealthy grass cover?
	E3.		☐	Evidence of seepage on downstream face?
	E4.		☐	Evidence of animal activity?
	E5.		☐	Evidence of settling, scouring, cracking, or sloughing?
	E6.		☐	Is there trash, debris, or vegetation that threatens the function or integrity of the spillway?
	E7.		☐	Is vegetation height less than 6 inches or greater than 15 inches?
Underdrain	F1.		☐	Are cleanout caps missing or damaged?
	F2.		☐	Does flow testing of cleanouts indicate underdrain system is clogged?
Outlet Control Structure	G1.		☐	Standing water present around above the outlet control structure?
	G2.		☐	Trash, debris, damage, or corrosion on trash rack?
	G3.		☐	Are all movable components operational through their full range of motion?

Corrective Actions Required:	Entered into MMS?

GDOT Dry Detention Basin Inspection Checklist Form B-6

Structure ID #:	Date:
Inspector:	Precipitation within last 72 hours: Yes No

Stormwater system within:

- ☐ Right-of-Way (Highway, Adjacent Park and Ride Lot)
- ☐ Easement
- ☐ GDOT Facility Property

Further location description:

General dimensions:

_____' width _____' length _____' depth

Vegetation:

- ☐ Grass turf
- ☐ Meadow Grass
- ☐ Wetland Vegetation
- ☐ Landscaped
- ☐ Other: _____

Discharges to:

- ☐ GDOT MS4 conveyance system
- ☐ GDOT post-construction structure

Structure Type_____

- ☐ Off R/W
- ☐ Adjacent MS4 jurisdiction structure
- ☐ Live stream/lake/pond
- ☐ Wetlands
- ☐ Other: _____

Structure/Access protection:

- ☐ Fence
- ☐ Guard rail
- ☐ Bollards
- ☐ Signage
- ☐ Access covers
- ☐ Other: _____

Additional components:

- ☐ Forebay
- ☐ Energy dissipation structures
- ☐ Emergency spillway control structure
- ☐ Inlet trash/debris capture structure
- ☐ Outlet/drawdown control structure
- ☐ Trash rack
- ☐ None
- ☐ Other: _____

Structure ID #:	Date:

GDOT Dry Detention Basin Inspection Checklist Form B-6

Complete the form below by indicating the performance condition for each inspection item.
Performance Condition Key:

Level 1: Good condition, no corrective action required.

Level 2: Fair condition, but still functional. Follow-up inspection in 6 months (or as corrective action dictates) is recommended.

Level 3: Poor condition, needing maintenance, repair and/or replacement.

Refer to Section 5.6 in the GDOT Stormwater System Inspection and Maintenance Manual for additional information on dry detention basin inspection items and maintenance activities.

Dry Detention Basin Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
Inlet Drainage System	A1.		☐	Trash, debris, and sediment present?
	A2.		☐	Are there signs of erosion?
	A3.		☐	Damaged or plugged inlet pipes?
Outlet Drainage System	A1.		☐	Trash, debris, and sediment present?
	A2.		☐	Are there signs of erosion?
	A3.		☐	Damaged or plugged outlet pipes?
Forebay	B1.		☐	Sediment accumulation greater than 50% of storage capacity present?
	B2.		☐	Undesirable vegetation present?
	B3.		☐	Are erosion protection materials in good condition?
Low Flow Channel (if present)	C1.		☐	Sediment accumulation greater than 3 inches present?
	C2.		☐	Evidence of erosion, formation of gullies, or problems with turf reinforcement mat (TRM)?
	C3.		☐	Undesirable vegetation present?
Basin	D1.		☐	Trash or debris present?
	D2.		☐	Unhealthy grass cover, bare areas, or dead grass cover over 30% or more of the surface area?
	D3.		☐	Evidence of erosion or gullies?

Structure ID #:	Date:

Dry Detention Basin Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
Basin, cont'd.	D4.		☐	Undesirable vegetation threatening the function or integrity of the basin?
	D5.		☐	Evidence of water ponding more than 5 days after storm event?
	D6.		☐	Sediment accumulation greater than 3 inches present?
Embankment and Emergency Spillway	E1.		☐	Are shrubs or trees present on embankment?
	E2.		☐	Evidence of erosion and/or unhealthy vegetation cover?
	E3.		☐	Evidence of seepage on downstream face?
	E4.		☐	Evidence of animal activity?
	E5.		☐	Evidence of settling, scouring, cracking, or sloughing?
	E6.		☐	Trash, debris, or undesirable vegetation present in emergency spillway?
	E7.		☐	Is vegetation height less than 6 inches or greater than 15 inches? Is concrete, and/or riprap in the emergency spillway damaged?
Outlet Control Structure	F1.		☐	Is standing water above the outlet/orifice more than 5 days after storm event?
	F2.		☐	Trash, debris, damage, or corrosion on trash rack?
	F3.		☐	Are all moveable components operable through their full range of motion?

Corrective Actions Required:	Entered into MMS?

GDOT Wet Detention Pond Inspection Checklist Form B-7

Structure ID #:	Date:
Inspector:	Precipitation within last 72 hours: Yes No

Stormwater system within:

- ☐ Right-of-Way (Highway, Adjacent Park and Ride Lot)
- ☐ Easement
- ☐ GDOT Facility Property

Further location description:

Wet Detention Type:

- ☐ Off-line
- ☐ In-line
- ☐ In Channel

Vegetation:

- ☐ Grass turf
- ☐ Meadow Grass
- ☐ Wetland Vegetation
- ☐ Landscaped
- ☐ Other: _____

General dimensions:

_____' width _____' length _____' depth

Structure/Access protection:

- ☐ Fence
- ☐ Guard rail
- ☐ Bollards
- ☐ Signage
- ☐ Access covers
- ☐ Other: _____

Discharges to:

- ☐ GDOT MS4 conveyance system
- ☐ GDOT post-construction structure

Structure Type_____

- ☐ Off R/W
- ☐ Adjacent MS4 jurisdiction structure
- ☐ Live stream/lake/pond
- ☐ Wetlands
- ☐ Other: _____

Additional components:

- ☐ Forebay
- ☐ Energy dissipation structures
- ☐ Emergency spillway control structure
- ☐ Inlet trash/debris capture structure
- ☐ Outlet/drawdown control structure
- ☐ Trash rack
- ☐ None
- ☐ Other: _____

Structure ID #:	Date:

GDOT Wet Detention Pond Inspection Checklist Form B-7

Complete the form below by indicating the performance condition for each inspection item.
Performance Condition Key:

- Level 1: Good condition, no corrective action required.
- Level 2: Fair condition, but still functional. Follow-up inspection in 6 months (or as corrective action dictates) is recommended.
- Level 3: Poor condition, needing maintenance, repair and/or replacement.

Refer to Section 5.7 in the GDOT Stormwater System Inspection and Maintenance Manual for additional information on wet detention pond inspection items and maintenance activities.

Wet Detention Pond Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
Inlet Drainage System	A1.		☐	Trash, debris, and sediment present?
	A2.		☐	Are there signs of erosion?
	A3.		☐	Is there vegetation that threatens the function or integrity of the inlet channel or ditch?
	A4.		☐	Damaged or plugged inlet pipes?
Outlet Drainage System	A1.		☐	Trash, debris, and sediment present?
	A2.		☐	Are there signs of erosion?
	A3.		☐	Is there vegetation that threatens the function or integrity of the outlet?
	A4.		☐	Damaged or plugged outlet pipes?
Forebay	B1.		☐	Sediment accumulation greater than 6 inches present?
	B2.		☐	Is there vegetation that threatens the function or integrity of the forebay?
	B3.		☐	Are erosion protection materials in good condition?
Pond	C1.		☐	Is the water level at or near the design normal water level?
	C2.		☐	Sediment accumulation greater than 12 inches present?
	C3.		☐	Is there vegetation that threatens the function or integrity of the pond?
	C4.		☐	Trash or debris present?
	C5.		☐	Algal growth covering greater than 50% of pond?

Structure ID #:	Date:

Wet Detention Pond Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
Pond, cont'd.	C6.		☐	Evidence of erosion on safety bench?
	C7.		☐	Is there vegetation that threatens the function or integrity of the aquatic or safety bench?
Embankment and Emergency Spillway	D1.		☐	Are shrubs or trees present on embankment and emergency spillway?
	D2.		☐	Evidence of erosion and/or unhealthy vegetation cover?
	D3.		☐	Evidence of seepage on downstream face?
	D4.		☐	Evidence of animal activity?
	D5.		☐	Evidence of settling, scouring, cracking, or sloughing?
	D6.		☐	Is there trash, debris, or vegetation that threatens the function or integrity of the embankment or spillway?
	D7.		☐	Is vegetation height less than 6 inches or greater than 15 inches? Is concrete, and/or riprap in the emergency spillway in poor condition?
Outlet Control Structure	E1.		☐	Is the water level above the outlet/orifice opening?
	E2.		☐	Trash, debris, damage, or corrosion on trash rack?
	E3.		☐	Are all moveable components operable through their full range of motion?

Corrective Actions Required:	Entered into MMS?

GDOT Stormwater Wetland Inspection Checklist Form B-8

Structure ID #:	Date:
Inspector:	Precipitation within last 72 hours: Yes No

Stormwater system within:

- ☐ Right-of-Way (Highway, Adjacent Park and Ride Lot)
- ☐ Easement
- ☐ GDOT Facility Property

Further location description:

Wetland Type:

- ☐ Shallow
- ☐ Pocket
- ☐ Permanent Pool

Vegetation:

- ☐ Grassy
- ☐ Woody
- ☐ Wetland Vegetation
- ☐ Landscaped
- ☐ Other: _____

General dimensions:

_____' width _____' length _____' depth

Structure/Access protection:

- ☐ Fence
- ☐ Guard rail
- ☐ Bollards
- ☐ Signage
- ☐ Access covers
- ☐ Other: _____

Discharges to:

- ☐ GDOT MS4 conveyance system
- ☐ GDOT post-construction structure

Structure Type_____

- ☐ Off R/W
- ☐ Adjacent MS4 jurisdiction structure
- ☐ Live stream/lake/pond
- ☐ Wetlands
- ☐ Other: _____

Additional components:

- ☐ Forebay
- ☐ Energy dissipation structures
- ☐ Emergency spillway control structure
- ☐ Inlet trash/debris capture structure
- ☐ Outlet/drawdown control structure
- ☐ Trash rack
- ☐ None
- ☐ Other: _____

Structure ID #:	Date:

GDOT Stormwater Wetland Inspection Checklist Form B-8

Complete the form below by indicating the performance condition for each inspection item.
Performance Condition Key:

- Level 1: Good condition, no corrective action required.
- Level 2: Fair condition, but still functional. Follow-up inspection in 6 months (or as corrective action dictates) is recommended.
- Level 3: Poor condition, needing maintenance, repair and/or replacement.

Refer to Section 5.8 in the GDOT Stormwater System Inspection and Maintenance Manual for additional information on stormwater wetland inspection items and maintenance activities.

Stormwater Wetland Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
Inlet Drainage System	A1.		☐	Trash, debris, and sediment present?
	A2.		☐	Are there signs of erosion?
	A3.		☐	Is there vegetation that threatens the function or integrity of the inlet channel, or ditch?
	A4.		☐	Damaged or plugged inlet pipes?
Outlet Drainage System	A1.		☐	Trash, debris, and sediment present?
	A2.		☐	Are there signs of erosion?
	A3.		☐	Is there vegetation that threatens the function or integrity of the outlet?
	A4.		☐	Damaged or plugged outlet pipes?
Forebay	B1.		☐	Sediment accumulation greater than 50% of storage capacity?
	B2.		☐	Is there vegetation that threatens the function or integrity of the forebay?
	B3.		☐	Are erosion protection materials in good condition?
Wetland Zones/ Pools	C1.		☐	Is aquatic plant density less than design density (refer to final approved planting plan)?
	C2.		☐	Sediment accumulation such that original design depth is reduced by 75% or more?
	C3.		☐	Is there vegetation that threatens the function or integrity of the wetland?
	C4.		☐	Trash or debris present?

Structure ID #:	Date:

Stormwater Wetland Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
Wetland Zones/ Pools, cont'd.	C5.		☐	Algal growth present over greater than 50% of wetland pool?
	C6.		☐	Are unhealthy or dead plants present?
Embankment and Emergency Spillway	D1.		☐	Are shrubs or trees present on the embankment and emergency spillway?
	D2.		☐	Evidence of erosion and/or unhealthy vegetation cover?
	D3.		☐	Evidence of seepage on downstream face?
	D4.		☐	Evidence of animal activity?
	D5.		☐	Evidence of settling, scouring, cracking, or sloughing?
	D6.		☐	Is there trash, debris, and undesirable vegetation that threatens the function or integrity of the spillway?
	D7.		☐	Is vegetation height less than 6 inches or greater than 15 inches? Is concrete, and/or riprap in the emergency spillway maintained?
Outlet Control Structure	E1.		☐	Is the water level above the outlet/orifice opening?
	E2.		☐	Trash, debris, damage, or corrosion on trash rack?
	E3.		☐	Are all movable components operable through their full range of motion?
	E4.		☐	If present, is flashboard riser damaged or plugged?

Corrective Actions Required:	Entered into MMS?

GDOT Bioslope
Inspection Checklist Form B-9

Structure ID #:	Date:
Inspector:	Precipitation within last 72 hours: Yes No

Stormwater system within:

- ☐ Right-of-Way (Highway, Adjacent Park and Ride Lot)
- ☐ Easement
- ☐ GDOT Facility Property

Further location description:

Bioslope dimensions:

Filter Strip:

_____' width _____' length

Treatment Zone:

_____' width _____' length

Vegetation:

- ☐ Grass turf
- ☐ Meadow Grass
- ☐ Landscaped
- ☐ Other: _____

Discharges to:

- ☐ GDOT MS4 conveyance system
- ☐ GDOT post-construction structure

Structure Type_____

- ☐ Off R/W
- ☐ Adjacent MS4 jurisdiction structure
- ☐ Live stream/lake/pond
- ☐ Wetlands
- ☐ Other: _____

Structure protection:

- ☐ Fence
- ☐ Guard rail
- ☐ Bollards
- ☐ Signage
- ☐ Other: _____

Additional components:

- ☐ Level spreader
- ☐ Pea gravel diaphragm
- ☐ Vegetated filter strip
- ☐ Treatment zone
- ☐ Underdrain
- ☐ None
- ☐ Other: _____

Structure ID #:	Date:

GDOT Bioslope Inspection Checklist Form B-9

Complete the form below by indicating the performance condition for each inspection item.
Performance Condition Key:

- Level 1: Good condition, no corrective action required.
- Level 2: Fair condition, but still functional. Follow-up inspection in 6 months (or as corrective action dictates) is recommended.
- Level 3: Poor condition, needing maintenance, repair and/or replacement.

Refer to Section 5.9 in the GDOT Stormwater System Inspection and Maintenance Manual for additional information on bioslope inspection items and maintenance activities. Refer to Section 5.12 for additional information on optional components.

Bioslope Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
Filter Strip	A1.		☐	Trash and/or debris present?
	A2.		☐	Unhealthy grass cover, bare areas, or dying grass present or 30% or more of surface area?
	A3.		☐	Evidence of erosion or gullies?
	A4.		☐	Is there vegetation that threatens the function or integrity of the filter strip?
	A5.		☐	Standing water present?
	A6.		☐	Sediment accumulation depth greater than 3 inch present in filter strip?
	A7.		☐	Is vegetation height less than 6 inches or greater than 15 inches?
Bioslope	B1.		☐	Trash or debris present?
	B2.		☐	Unhealthy vegetative cover, bare areas, or dying vegetation present?
	B3.		☐	Evidence of erosion or gullies?
	B4.		☐	Is there vegetation that threatens the function or integrity of the bioslope?
	B5.		☐	Sediment accumulation greater than 3 inches present?
	B6.		☐	Is vegetation height less than 6 inches or greater than 15 inches?

Structure ID #:	Date:

Bioslope Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
Underdrain	C1.		☐	Are cleanout caps missing or damaged?
	C2.		☐	Does flow testing of cleanouts indicate underdrain system is clogged?
Outlet	D1.		☐	Evidence of erosion?
	D2.		☐	Damaged or plugged outlet pipes?
Pea Gravel Diaphragm (optional)	PGD1.		☐	Sediment accumulation present on pea gravel diaphragm?
	PGD2.		☐	Is pea gravel diaphragm damaged?

Corrective Actions Required:	Entered into MMS?

GDOT Bioretention Basin
Inspection Checklist Form B-10

Structure ID #:	Date:
Inspector:	Precipitation within last 72 hours: Yes No

Stormwater system within:

- ☐ Right-of-Way (Highway, Adjacent Park and Ride Lot)
- ☐ Easement
- ☐ GDOT Facility Property

Further location description:

General dimensions:

_____' width _____' length _____' depth

Vegetation:

- ☐ Grass turf
- ☐ Meadow Grass
- ☐ Wetland Vegetation
- ☐ Landscaped
- ☐ Other: _____

Discharges to:

- ☐ GDOT MS4 conveyance system
- ☐ GDOT post-construction structure

Structure Type_____

- ☐ Off R/W
- ☐ Adjacent MS4 jurisdiction structure
- ☐ Live stream/lake/pond
- ☐ Wetlands
- ☐ Other: _____

Structure/Access protection:

- ☐ Fence
- ☐ Guard rail
- ☐ Bollards
- ☐ Signage
- ☐ Access covers
- ☐ Other: _____

Additional components:

- ☐ Forebay
- ☐ Energy dissipation structures
- ☐ Emergency spillway control structure
- ☐ Inlet trash/debris capture structure
- ☐ Outlet/drawdown control structure
- ☐ Underdrain
- ☐ Trash rack/Grate Inlet
- ☐ None
- ☐ Other: _____

Structure ID #:	Date:

GDOT Bioretention Basin Inspection Checklist Form B-10

Complete the form below by indicating the performance condition for each inspection item.
Performance Condition Key:

- Level 1: Good condition, no corrective action required.
- Level 2: Fair condition, but still functional. Follow-up inspection in 6 months (or as corrective action dictates) is recommended.
- Level 3: Poor condition, needing maintenance, repair and/or replacement.

Refer to Section 5.10 in the GDOT Stormwater System Inspection and Maintenance Manual for additional information on bioretention basin inspection items and maintenance activities.

Bioretention Basin Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
Inlet Drainage System	A1.		☐	Trash, debris, and sediment present?
	A2.		☐	Are there signs of erosion?
	A3.		☐	Damaged or plugged inlet pipes?
Outlet Drainage System	A1.		☐	Trash, debris, and sediment present?
	A2.		☐	Are there signs of erosion?
	A3.		☐	Damaged or plugged outlet pipes?
Forebay	B1.		☐	Sediment accumulation greater than 6 inches?
	B2.		☐	Is there vegetation that threatens the function or integrity of the forebay?
	B3.		☐	Are erosion protection materials in good condition?
Basin	C1.		☐	Trash or debris present?
	C2.		☐	Are unhealthy or dying plants present?
	C3.		☐	Evidence of erosion or gullies?
	C4.		☐	Is mulch cover non-uniform, breaking down, or missing?
	C5.		☐	Evidence of standing water more than 12 hours after storm event?
	C6.		☐	Sediment accumulation of depth greater than 3 inches?

Structure ID #:	Date:

Bioretention Basin Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
Basin, con'td.	C7.		☐	Vegetation in need of pruning or removing?
Embankment and Emergency Spillway	D1.		☐	Are shrubs or trees present on embankment?
	D2.		☐	Evidence of erosion and/or unhealthy grass coverage?
	D3.		☐	Evidence of seepage on downstream face?
	D4.		☐	Evidence of animal activity?
	D5.		☐	Evidence of settling, scouring, cracking, or sloughing?
	D6.		☐	Is there trash, debris, and undesirable vegetation that threatens the function or integrity of the spillway?
	D7.		☐	Is vegetation height less than 6 inches or greater than 15 inches? Is concrete, and/or riprap in the emergency spillway maintained?
Underdrain	E1.		☐	Are cleanout caps missing or damaged?
	E2.		☐	Does flow testing of cleanouts indicate underdrain system is clogged?
Outlet Control Structure	F1.		☐	Standing water present around the outlet control structure?
	F2.		☐	Trash, debris, damage, or corrosion on trash rack/grate inlet?

Corrective Actions Required:	Entered into MMS?

GDOT Open-Graded Friction Course (OGFC) Inspection Checklist Form B-11

Structure ID #:	Date:
Inspector:	Precipitation within last 72 hours: Yes No

Stormwater system within:

- ☐ Right-of-Way (Highway, Adjacent Park and Ride Lot)
- ☐ Easement
- ☐ GDOT Facility Property

Further location description:

OGFC Type:

- ☐ Conventional
- ☐ Modified
- ☐ Porous European Mix (PEM)
- ☐ Other: _____

Discharges to:

- ☐ GDOT MS4 conveyance system
- ☐ GDOT post-construction structure

Structure Type_____

- ☐ Off R/W
- ☐ Adjacent MS4 jurisdiction structure
- ☐ Live stream/lake/pond
- ☐ Wetlands
- ☐ Other: _____

Additional components:

- ☐ Level spreader
- ☐ Pea gravel diaphragm
- ☐ Filter strip
- ☐ Swale
- ☐ Infiltration berm
- ☐ Flow bypass structure
- ☐ Energy dissipation structure
- ☐ None
- ☐ Other: _____

Structure ID #:	Date:

GDOT Open-Graded Friction Course (OGFC) Inspection Checklist Form B-11

Complete the form below by indicating the performance condition for each inspection item.
Performance Condition Key:

Level 1: Good condition, no corrective action required.

Level 2: Fair condition, but still functional. Follow-up inspection in 6 months (or as corrective action dictates) is recommended.

Level 3: Poor condition, needing maintenance, repair and/or replacement.

Refer to Section 5.11 in the GDOT Stormwater System Inspection and Maintenance Manual for additional information on OGFC inspection items and maintenance activities.

Open-Graded Friction Course Component		Performance Condition (Level 1, 2 or 3)	Photo	Inspection Item
OGFC Surface	A1.		☐	Are cracks present?
	A2.		☐	Are there signs of raveling (disintegration of the material from the surface down)?
	A3.		☐	Sediment and/or debris accumulation on the surface and shoulder?
Filter Strip (if present)	B1.		☐	Trash or debris present?
	B2.		☐	Unhealthy grass cover, bare areas, or dying grass present?
	B3.		☐	Evidence of erosion or gullies?
	B4.		☐	Is there vegetation that threatens the function or integrity of the filter strip?
	B5.		☐	Standing water present?
	B6.		☐	Sediment accumulation depth greater than 3 inch present?
	B7.		☐	Is vegetation height less than 6 inches or greater than 15 inches?

Structure ID #:	Date:

Corrective Actions Required:	**Entered into MMS?**

Appendix C

MS4 Structure Inventory, Inspection, and Maintenance Summary

MS4 Structure Inventory, Inspection, and Maintenance Summary

Reporting Period	Goal/Actual	% of Total Roadway Miles in MS4/miles[2]	Existing Structure Type				New Structure Type				Total MS4 Structures
			Catch Basins/ Inlets	Manholes / Junction Chambers	Conveyance Pipe Systems w/Inlets and Outlets	Other	Catch Basins/ Inlets	Manholes / Junction Chambers	Conveyance Pipe Systems w/Inlets and Outlets	Other	
	Inventory										
	Goal (Estimated)[1]	% miles									
	Actual[1]	% miles									
	Inspection										
	Goal (Estimated)[1]	% miles									
	Actual[1]	% miles									
	Maintenance										
	Goal (Estimated)[1]	% miles									
	Actual[1]	% miles									

Appendix D

Estimate of MS4 Structures along the Linear Facilities

Appendix D

Estimate of MS4 Structures
Along the Linear Facilities

Georgia Department of Transportation
Mileage by Route Type and Population for the Estimation of MS4 Structures

District	Route Type	Pop_Description	Population	Class	Mileage	Structures		
1	Interstate	Rural	1 - 5,000	Small	5.62	169		
1	Interstate	Small Urbanized Area	50,000 - 200,000	Medium	83.41	4,171		
1	Interstate	Large Urbanized Area	More than 200,000	Large	190.05	13,874		
1	State Route	Rural	1 - 5,000	Small	363.80	9,095		
1	State Route	Small Urbanized Area	50,000 - 200,000	Medium	299.68	8,990	**Structures**	***Outfalls*****
1	State Route	Large Urbanized Area	More than 200,000	Large	154.57	5,874	**42,172**	**1,709**
2	Interstate	Rural	1 - 5,000	Small	0.30	9		
2	Interstate	Large Urbanized Area	More than 200,000	Large	7.45	544		
2	State Route	Rural	1 - 5,000	Small	300.55	7,514	**Structures**	***Outfalls*****
2	State Route	Large Urbanized Area	More than 200,000	Large	236.34	8,981	**17,048**	**800**
3	Interstate	Rural	1 - 5,000	Small	163.11	4,893		
3	Interstate	Small Urbanized Area	50,000 - 200,000	Medium	3.06	153		
3	Interstate	Large Urbanized Area	More than 200,000	Large	0.04	3		
3	State Route	Rural	1 - 5,000	Small	273.95	6,849		
3	State Route	Small Urbanized Area	50,000 - 200,000	Medium	142.41	4,272	**Structures**	***Outfalls*****
3	State Route	Large Urbanized Area	More than 200,000	Large	322.11	12,240	**28,410**	**2,267**
4	Interstate	Rural	1 - 5,000	Small	112.73	3,382		
4	Interstate	Small Urbanized Area	50,000 - 200,000	Medium	38.93	1,947		
4	State Route	Rural	1 - 5,000	Small	501.11	12,528	**Structures**	***Outfalls*****
4	State Route	Small Urbanized Area	50,000 - 200,000	Medium	193.20	5,796	**23,652**	**553**
5	Interstate	Small Urbanized Area	50,000 - 200,000	Medium	17.25	863		
5	Interstate	Large Urbanized Area	More than 200,000	Large	16.62	1,213		
5	State Route	Rural	1 - 5,000	Small	157.73	3,943		
5	State Route	Small Urbanized Area	50,000 - 200,000	Medium	117.68	3,530	**Structures**	***Outfalls*****
5	State Route	Large Urbanized Area	More than 200,000	Large	179.42	6,818	**16,367**	**825**
6	Interstate	Rural	1 - 5,000	Small	37.92	1,138		
6	Interstate	Small Urbanized Area	50,000 - 200,000	Medium	190.74	9,537		
6	Interstate	Large Urbanized Area	More than 200,000	Large	8.33	608		
6	State Route	Rural	1 - 5,000	Small	375.33	9,383		
6	State Route	Small Urbanized Area	50,000 - 200,000	Medium	676.94	20,308	**Structures**	***Outfalls*****
6	State Route	Large Urbanized Area	More than 200,000	Large	54.52	2,072	**43,046**	**3,123**
7	Interstate	Rural	1 - 5,000	Small	6.71	201		
7	Interstate	Large Urbanized Area	More than 200,000	Large	211.16	15,415		
7	State Route	Rural	1 - 5,000	Small	42.89	1,072	**Structures**	***Outfalls*****
7	State Route	Large Urbanized Area	More than 200,000	Large	719.82	27,353	**44,041**	**1,761**

	Structures	***Outfalls*****
Total	***214,737***	***11,038***
Per Year	**21,474**	**2,760**

** Outfall estimations are based on the number of NHD Stream and GDOT Route intersections

Appendix D

Estimate of MS4 Structures
Along the Linear Facilities

Table 2: Proposed Schedule for MS4 Structures Inventory

Permit Year	Inventory Area (GDOT District)	Estimated MS4 Structures by GDOT District	No. of MS4 Structures to Inventory by Permit Year	Remaining No. Of MS4 Structures to Collect	Percentage of Total Estimated Structures by GDOT District	Percentage of MS4 Structures Statewide
2 (2013)	District 1	42,172	22,000	20,172	52.2%	
	Sub-Total		22,000			10.2%
3 (2014)	District 1	20,172	20,172	0	47.8%	
	District 7	44,041	2,000	42,041	4.5%	
	Sub-Total		22,172			10.3%
4 (2015)	District 7	42,041	22,000	20,041	50.0%	
	Sub-Total		22,000			10.2%
5 (2016)	District 7	20,041	20,041	0	45.5%	
	District 6	43,046	2,000	41,046	4.6%	
	Sub-Total		22,041			10.3%
Total			88,213			

Appendix E

Estimate of Post-Construction
Structures along Linear Facilities

Post-Construction Stormwater Management in New Development and Redevelopment
BMP #1

Proposed Schedule for Post-Construction Structure Mapping[1]

Permit Year	Percentage of Structures for Inventory Mapping
2 (2013)	25
3 (2014)	25
4 (2015)	25
5 (2016)	25

[1]Revised March 2014