Maintaining Stormwater Systems

A Guidebook for Private Owners and Operators in Horry County

Revised May 2020

THIS GUIDEBOOK IS *a resource on maintaining stormwater management facilities. However, it is not a set of rules and regulations or a manual that provides guidance on how to design or build a stormwater management facility.*

For specific information regarding regulations, contact your local government agency.

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The Stormwater Story

Rainfall and snow melt keep gardens green, streams and rivers full, and wells from running dry. However, stormwater problems can occur when there is too much of a good thing, or when excessive pollution and changes in land use prevent natural infiltration and filtering processes from taking place.

Stormwater Challenges Once rain reaches the ground, what happens next depends largely on land cover type. Rain falling in a forest is slowed, filtered, and absorbed as it makes its way into the ground or to the nearest stream, river, or reservoir. In contrast, hard, impervious surfaces such as roof tops and roads send stormwater rushing to the nearest ditch, culvert, storm drain, and stream.

This stormwater picks up pollutants, such as heavy metals, gas, oil, nutrients, and sediment, along the way. Uncontrolled stormwater erodes stream banks, causes flooding, and carries nutrients and sediment downstream. An excess of nutrients contributes to the expansion of oxygen-depleted "dead zones" in local waterways, the Waccamaw and the PeeDee Rivers.

Stormwater Solutions To improve the quality and reduce the quantity of stormwater runoff, before it enters natural waterways, stormwater **Best Management Practices**, or **BMPs**, are prevalent throughout Horry County's residential and commercial areas.

BMPs range from structural facilities, such as ponds, bio-retention areas, and underground vaults to non-structural practices, such as street-sweeping and educational efforts.

Simple Things Residents Can Do

There are several simple things that residents can do to ensure that stormwater facilities function properly and the downstream aquatic environment is protected.

- Pick up after pets, always. Place their waste in the trash or flush it down the toilet.
- Place motor oil, paint and antifreeze in separate sturdy containers and recycle them at a local disposal facility.
- Compost yard waste or bag it for municipal collection.
- Recycle or put litter in the trash.
- Don't over-fertilize! It wastes time and money and may damage your lawn or neighboring waterways. Warm season grasses (e.g. centipede, bermuda) differ from cool season grasses (e.g. fescue) and usually need fertilizer in . Check with Clemson Extension Service's Home and Garden Information Center to avoid overfertilization.
- Call the Horry County Stormwater Hotline (843-381-8000) to report illegal discharges or DHEC Emergency Response (1-888-481-0125) for toxic spills.

The Stormwater Story

Over time, the approaches to managing stormwater have adapted to a variety of different challenges. The techniques used to control stormwater evolved from ditches and pipes that remove water quickly and reduce flooding to an intricate system of practices that retain water and improve its quality.

Pre-1900s -*Run It All in Ditches*

Everything (stormwater, kitchen waste, wastewater) drained to the nearest stream.

Early-1900s -*Run It All in Pipes*

All waste efficiently got to the stream through the same pipe. But, downstream neighbors became ill due to upstream-generated waste. It was then recognized that sewage and stormwater require different levels of water quality treatment.

From 1940s -*Run It in Separate Stormwater Pipes*

A system of catch basins and pipes was developed to get stormwater to the nearest stream.

Early-1970s -*Keep It From Stormwater Pipes*

Stormwater was detained in ponds. This approach worked in theory but not in practice, as too many detention ponds releasing water at a controlled rate at the same time caused downstream flooding and an increase in the frequency and duration of runoff events.

1970-80s -*Well, Just Don't Cause Flooding*

Stormwater Master Plans were developed. However, very few plans were actually completed as designed, and stormwater runoff was identified as a major pollution source.

Late-1980s -*Oh, and Don't Pollute Either*

Best Management Practices or ways to improve the quality of stormwater runoff were implemented. However, the lack of good data on **BMP** efficiency or comprehensive monitoring programs was problematic.

Early-1990s -*It's the Ecology*

Use of biological criteria and bioassessment protocols became a common parameter for determining the type of stormwater management practice. But there were still questions about which parameters actually contribute to solutions to runoff problems.

Late-1990s -*Water is Water is Watershed*

Planning was conducted according to where the water flows, a watershed approach. However, people didn't relate to watersheds, and the watershed approach may be too large in scale to have an impact at the site level or to be meaningful to residents, which is where political change begins.

Present -*Green and Bear It*

A range of approaches is considered to address basic issues and institutional practices associated with the way in which land is used or developed: green infrastructure, conservation development, low impact development (LID), better site design, etc. This paradigm returns to small-scale distributed approaches that will succeed if supported and enforced by local governments.

Adapted from Land and Water, May-June 2004, Andy Reese of Amec Earth and Environmental

Future - *A Vision of Comprehensive Stormwater Management*

Mimicking pre-development runoff characteristics will become increasingly important as regulations continue to encourage using watershed planning for expanded nutrient control and streambank preservation. Monitoring the effectiveness of green technologies at improving the quality and decreasing the quantity of stormwater runoff leads to improved designs and performance criteria. Stormwater is viewed as a resource as opposed to a waste product.

Key Points to Remember When Reading this Guidebook

A thorough inspection and maintenance program for any stormwater management facility will save time and money in the long term.

Identify Facility Characteristics and Maintenance Needs	Understand how the facility works and its specific maintenance needs. While this Guidebook includes general information on the maintenance needs of common stormwater management facilities, valuable information may also be gained by consulting with the local government.
Check the Maintenance Agreement	If there is a stormwater management facility maintenance agreement with the local government, consult it often to ensure that specific obligations are met.
Perform Routine Inspections	The frequency of required inspections may be found in the maintenance agreement, the technical guide provided by the manufacturer, or on the facility's design specifications. In some local jurisdictions, all inspections are conducted by staff, while maintenance is typically the responsibility of the owner.
Define Maintenance Tasks, Personnel, and Equipment	Defining maintenance tasks and who will undertake these tasks - along with establishing a regular inspection program - is the core of a successful stormwater management facility maintenance program.
Identify Costs and Allocate Resources	While routine maintenance costs can typically be predicted for an annual budget, some maintenance tasks will require infrequent but considerable expense. Non-routine expenses need to be identified, and a long-term fund allocation plan needs to be developed.
Involve the Community, if possible	Pollution treated by the stormwater management facility may be generated from surrounding yards, streets, and businesses. Implementing a pollution prevention program and educating neighbors on the purpose of the stormwater management facility is a cost-effective way to prolong its life and to protect water quality.
Establish a Record Keeping Procedure	Establishing a record keeping procedure will help to define chronic maintenance problems and aid in future budget preparation. A periodic examination of maintenance practices will assist in identifying persistent problems early.

There are many types of stormwater management facilities, which are introduced over pages 5 through 16. Taking a moment to understand what kind of stormwater management facility you have and how it works, will help you to better plan for its maintenance needs.

Dry Pond

Wet Pond

Infiltration Trench

Underground Detention

Bioretention Facility

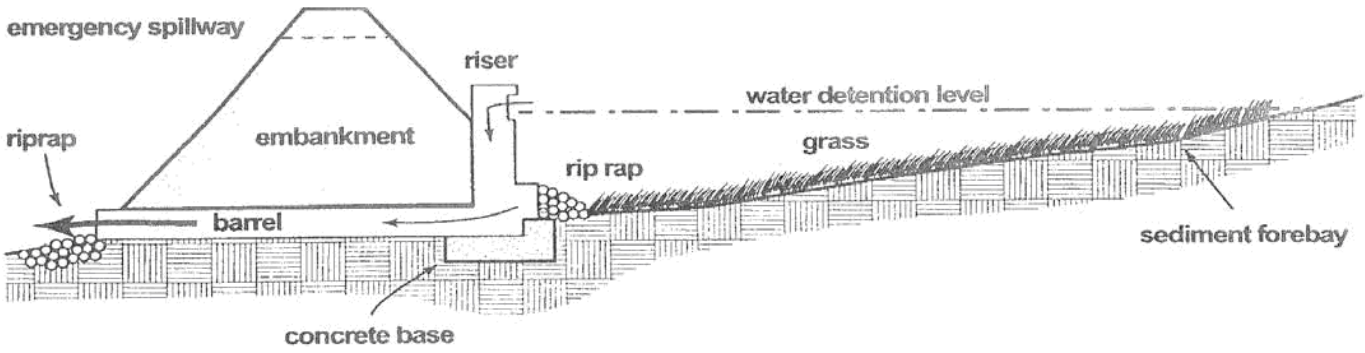
Vegetated Swale

Vegetated Roof Top

Permeable Paving

Extended Detention Basin – "Dry Ponds"

Dry ponds retain water for a specified period of time (usually 48 hours) after a storm. Water is impounded temporarily to allow many of the pollutants time to settle to the bottom. The impounded water is discharges through an outlet that provides for prolonged release.



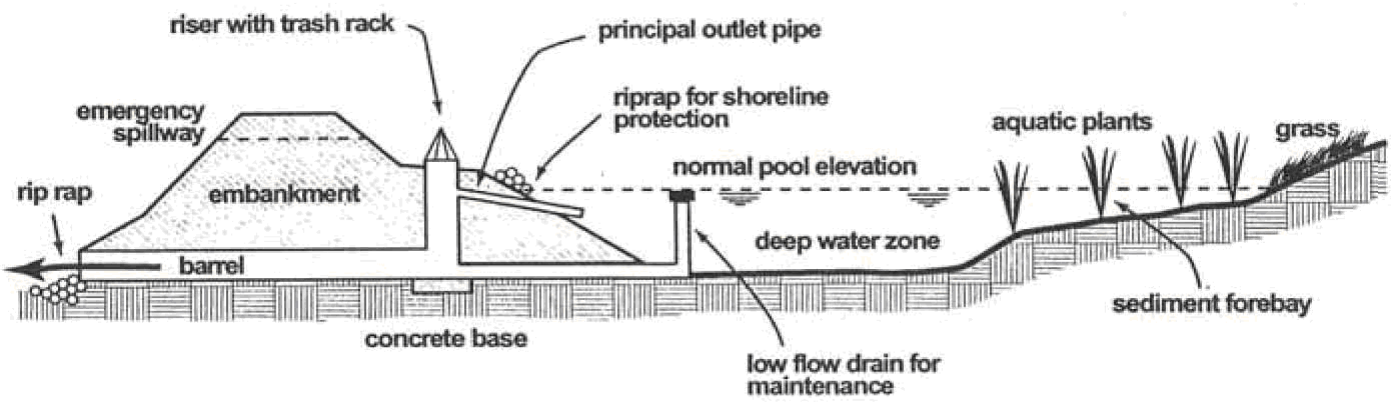
Dry ponds are very common in Horry County; however the most common problem with them is that they retain water over a long period of time. Consult with the Stormwater department to determine whether standing water is by design or that maintenance is required.

MAINTENANCE IS REQUIRED WHEN:

- Standing water is visible in inappropriate areas 72 hours after a rain event.
- Insects and/or odor become problems.
- Wetland vegetation emerges (unless the facility is specifically designed with a marsh or wetland area).
- There is visible damage to the embankment (such as sinkholes) or to the mechanical components.
- Animal burrows or trees present on embankment or near riser.
- Low flow orifice, forebay, or concrete trickle ditches blocked by trash, debris, or sediment.

Retention Basins – "Wet Pond"

Wet ponds are designed to contain a permanent pool of water much like a lake. Stormwater runoff is temporarily stored above the permanent pool and released at a controlled rate. The release is regulated by an outlet similar to that employed in a dry pond.



Wet Ponds are the most common stormwater facility found in Horry County. The advantages of a wet pond over a dry pond are higher pollutant removal and less chance that pollutants will be re-suspended during a storm. However, wet ponds also pose a higher safety liability than other Best Management Practices.

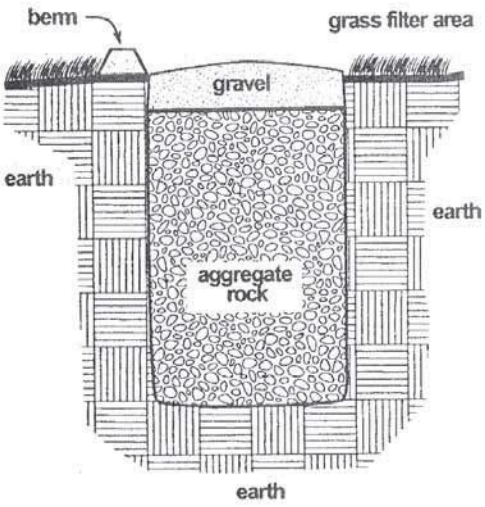
MAINTENANCE IS REQUIRED WHEN:

- There are visible signs of sediment accumulation.
- Insects and/or odor become problems.
- Algae blooms occur in the summer months or the ponded areas become dominated by a single aquatic plant.
- There is visible damage to the embankment or to the mechanical components.
- There are visible seeps on the downstream dam face.
- Woody vegetation is growing on the dam.
- Beavers are present in the plunge pool.

NOTE: If your wet pond is protected by perimeter fencing, periodic inspections of its integrity should be conducted.

Infiltration Trench

Infiltration trenches are gravel-filled excavations that temporarily store stormwater and allow it to percolate into the underlying soil.



Infiltration Trenches are classified in two ways:

In dispersed input facilities, runoff from impervious surfaces is directed over a gently sloping grass area before it reaches the facility, to remove large particles that otherwise might cause clogging.

In concentrated input facilities, runoff is transferred to the trench directly from the curb inlets, gutters, and pipes.

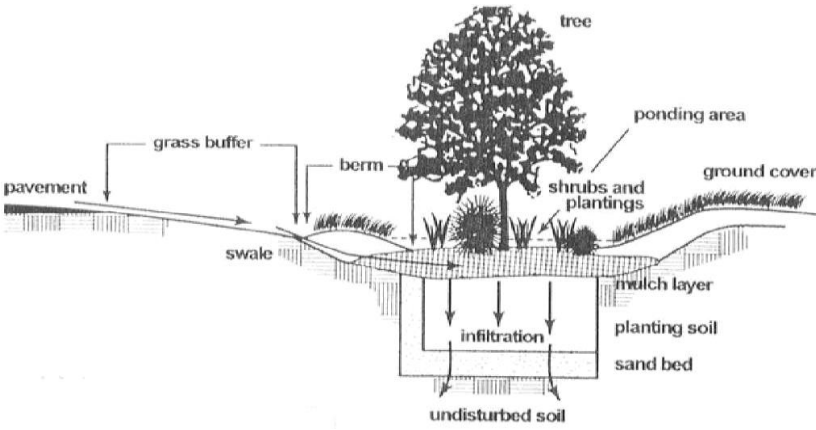
MAINTENANCE IS REQUIRED WHEN:

- Standing water is visible in the observation well 48 hours after a rain event.
- Insects and/or odor become problems.
- Wetland vegetation emerges.
- There is visible damage to the embankment (such as sinkholes) or to the mechanical components.
- Trash, leaves, and other debris are visible on the gravel surface.
- Runoff flows across, rather than into, the facility.

Bioretention Facility – Rain Gardens”

Bioretention facilities or “rain gardens” are vegetated basins designed to mimic the conditions found in a mature forest floor. Configured to act as a sink and underlain with specific layers of soil, sand, and organic mulch, runoff is trapped and treated by vegetation and microbes. The facility is planted with specific types of vegetation that can withstand both wet and dry weather extremes.

In areas where the local soils do not support infiltration, a bioretention facility may be underlain with layers of sand or gravel and an underdrain that carries treated water to the storm drain network.

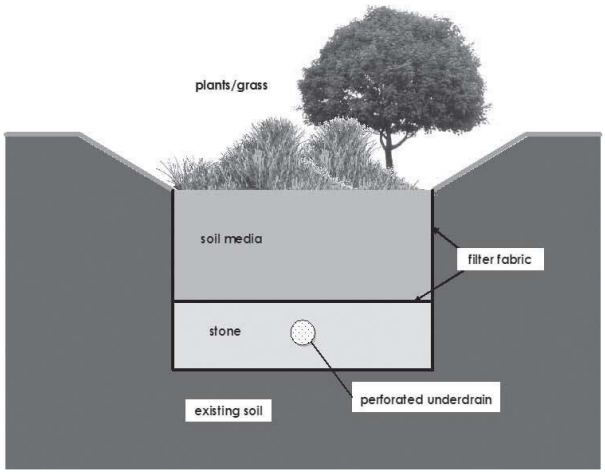


MAINTENANCE IS REQUIRED WHEN:

- Standing water is visible in the basin 72 hours after a rain event.
- Insects and/or odor become problems.
- Vegetation is wilting, discolored, or dying.
- Erosion is visible within the basin, on the **berms**, or on the slopes.
- Settling has occurred along the **berm**, if present.
- The overflow riser or grate is covered by debris.

Vegetated Swale

Vegetated swales may be seen along many of Horry County's roadways, although they are not designed to treat stormwater. Typically vegetated swales are concave conveyance systems designed to simply transfer runoff. Today they are constructed to serve a water quality purpose, trapping particulate matter in the vegetative groundcover and allowing stormwater to soak into the soil.



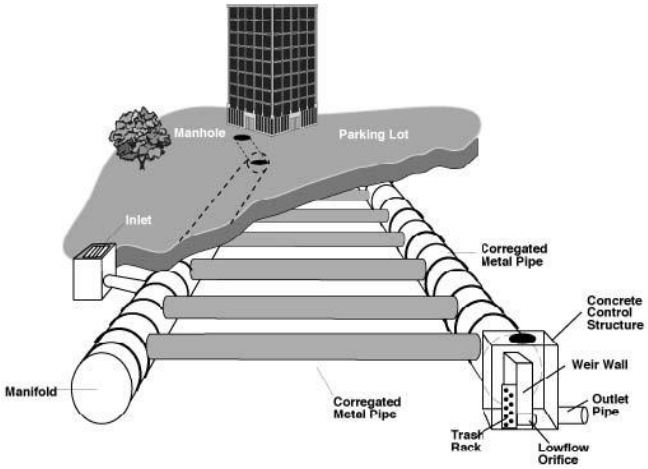
MAINTENANCE IS REQUIRED WHEN:

- Vegetation is bare in spots or appears unstable.
- Significant sediment has accumulated behind check dams*, if present.
- Erosion is visible in the bottom of the swale.
- Trash, grass clippings, leafy, and/or woody debris have accumulated.
- Standing water is visible after 48 hours.

check dams are small* **berms *built across a facility to slow water and create small areas of ponding.*

Underground Detention

Underground detention consists of large underground pipes or cells that provide storage and water quantity control through detention and /or extended detention of stormwater runoff.

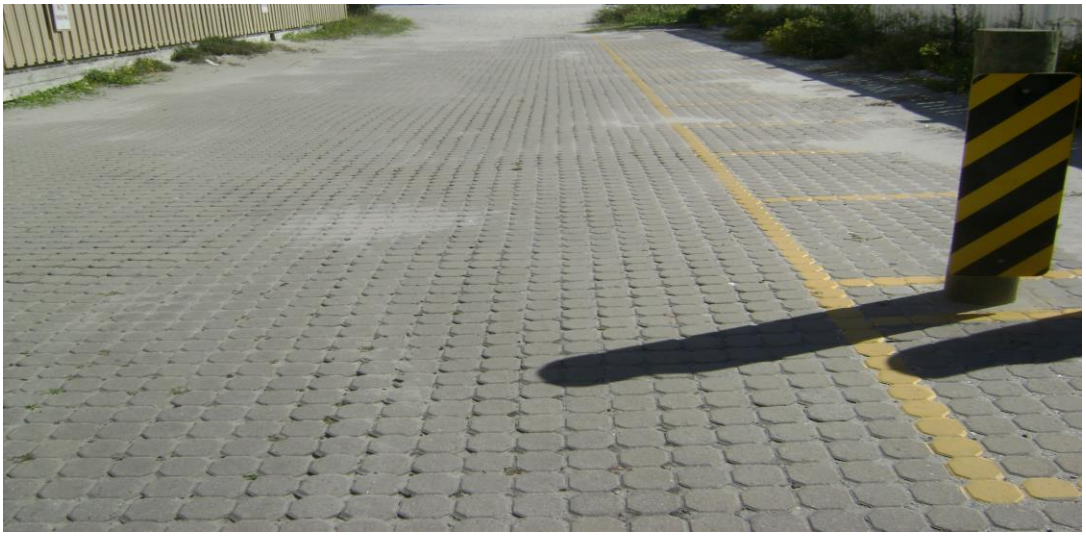


Underground detention is often used in limited space areas, such as parking lots and paved areas in commercial, industrial and residential developments, where adequate land for a surface **BMP** facility is not available.

Subsurface detention facilities are commonly associated with other manufactured pretreatment facilities to improve water quality before the stormwater is released into natural waters. For more information about manufactured BMPs, see page 17.

MAINTENANCE IS REQUIRED WHEN:

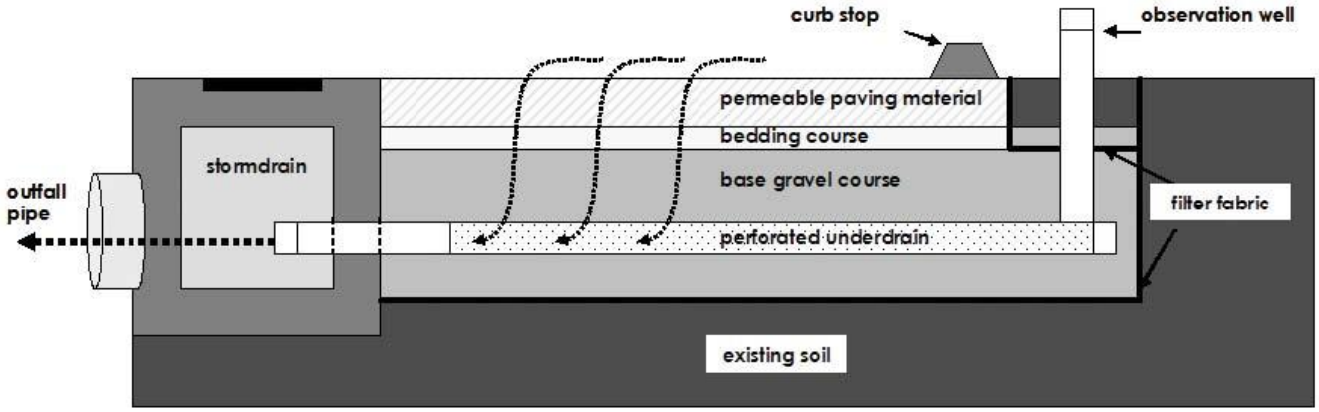
- Significant amounts of trash and/or sediment has accumulated in the vaults or tanks.
- There is visible damage to the inlets or outlets.



Permeable Paving Material

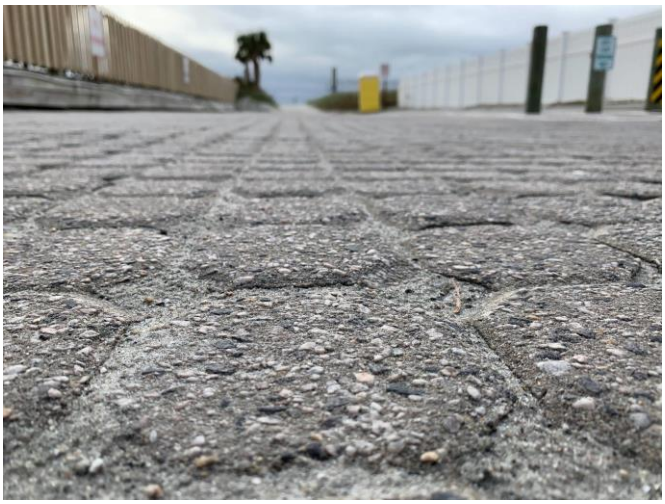
Permeable paving materials consist of bricks, gravel, or other permeable materials that provide structure and stability yet allow water to infiltrate through the ground's surface. They can be used in place of traditional asphalt in parking areas, sidewalks, and low traffic areas.

Permeable paving materials appear in a variety of different forms. Brick pavers are commonly used in parking lots and other areas that may receive frequent use. Whereas paving systems that are cellular in nature and allow for vegetation to grow through them are commonly used in place of traditional concrete or asphalt, in low traffic areas.



MAINTENANCE IS REQUIRED WHEN:

- Puddling or ponding water is visible on the surface 48 hours after a rain event.
- Significant amounts of sediment have accumulated between the pavers.



Manufactured BMP System

From the ground's surface, most manufactured BMP's look like inconspicuous manholes. However underneath is a single or series of vaults and chambers designed to remove common stormwater pollutants, such as sediment, oil, trash, and grit.

Manufactured BMP facilities use gravitational, hydrodynamic, absorption, biochemical, and/or filter techniques to remove pollutants. They are regularly used in urban areas for water quality enhancement, where space for large facilities, such as wet ponds, is not available. Since they are often the same size as a typical stormwater inlet, manufactured BMP's are a common retrofit option.

Manufactured BMPs are used solely for water quality enhancement in areas where space for surface BMP's is not available.

Left: Snout ™
Right: Filterra ™

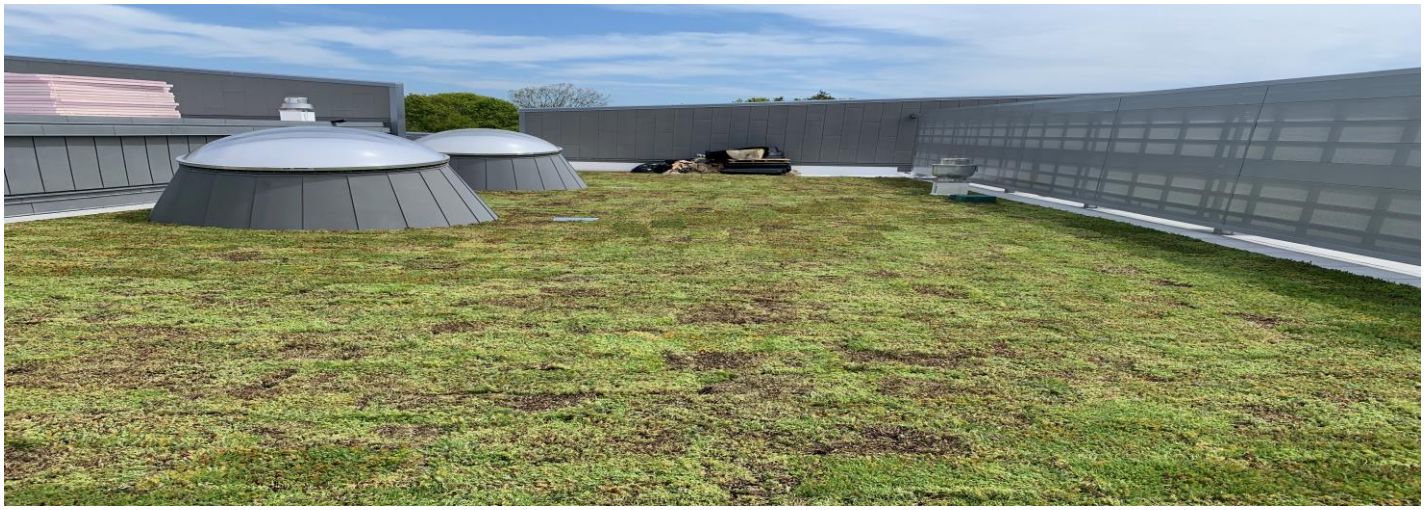
MAINTENANCE IS REQUIRED WHEN:

- Sediment accumulation in the sediment chamber is over the manufacturer's recommended depth.
- Floating oil layer has reached an appreciable volume.
- Obstructions from trash or debris are visible in the inlet or outlet (vent).

NOTE: Consult the BMP's manufacturer or the operations manual.

Examples of Manufactured BMP Systems:

Aqua-Swirl ™
Bay Saver ™
Downstream Defender ™
Filtrexx SiltSoxx ™
StormFilter ™
Vortechs ™



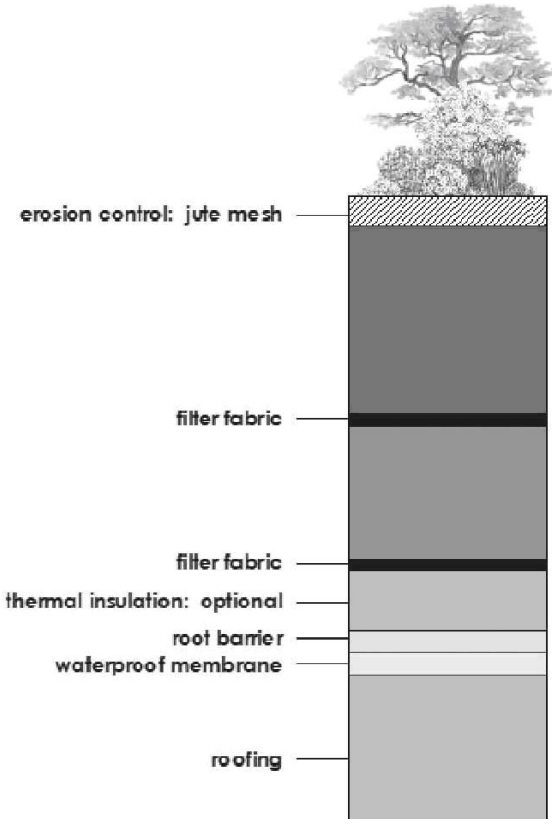
Vegetated Rooftop – “Green Roof”

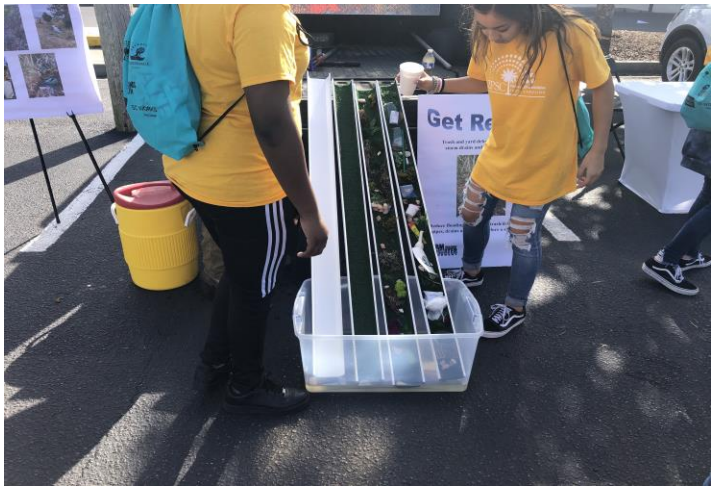
While vegetated rooftops, commonly known as “green roofs” have been used extensively in Europe for centuries, they are becoming popular stormwater management tools in urban areas through out the United States.

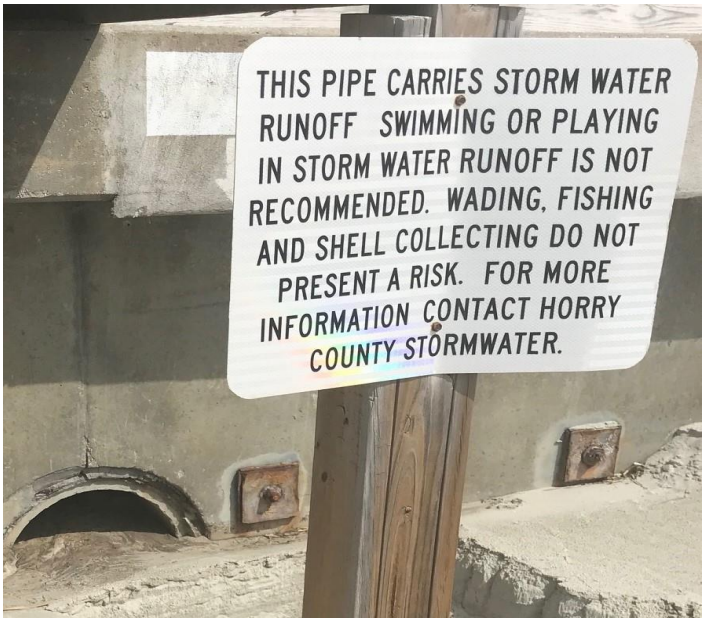
Green roofs intercept stormwater and slow its flow off of rooftops. In addition to reducing the amount of stormwater runoff and improving its quality, green roofs also reduce the effect of “heat islands” and provide micro-habitats for birds and insects.

MAINTENANCE IS REQUIRED WHEN:

- Leaks occur.
- Unwanted vegetation appears
- Vegetation shows signs of stress.







Non-Structural Best Management Practices

Non-Structural BMPs do not have a physical structure and are designed to eliminate or limit the amount of pollutants entering the stormwater system from the surrounding environment.

Non-Structural BMPs involve educational efforts, management strategies, and planning alternatives and are often associated with the way land is used and managed. Limiting the frequency of fertilizer applications and reaching out to the community about how to reduce their contributions to stormwater pollution are just two examples that may be considered as non-structural BMPs.

Implementing these practices can have a long-lasting effect on the health of the local environment and can significantly reduce maintenance costs for structural BMPs.

Examples of Non-Structural BMPs

- Trash Pick-Ups
- Storm Drain Marking
- Educational or Informative Articles
- Biological Stream Monitoring
- Tree Plantings
- Street Sweeping
- Lawn and Garden Management Workshops
- Invasive Plant Removals
- Carwashing Stations

Who is responsible for inspections and maintenance?

Horry County does not maintain nor is responsible for any stormwater facility not owned by the County. Unless the facility is on county property or with in a county easement, then maintenance is the responsibility of the homeowner, Home Owner Association or the commercial development.

It is important to check the maintenance agreement to identify specific legal obligations. In the event that the maintenance agreement is unable to be located, call the Horry County Stormwater Department to help determine the responsible parties. The agreement may have been kept on file with the County or with DHEC (South Carolina Department of Health and Environmental Control).

Developing an Inspection Strategy

Depending on the specific stormwater facility, inspection requirements will vary.

Some sand filtration systems require monthly or seasonal inspections while other BMP's can be inspected on an annual basis. Contact the Horry County Stormwater Department to help determine the frequency of your inspections; if you do not have a copy of your maintenance agreement.

It is unlikely that a lawn care or landscaping company has the knowledge or experience to perform a proper, comprehensive BMP inspection. A professional (engineer, landscape architect, surveyor, ect.) or someone who has had appropriate training should be hired to perform the inspections.

However, owners of stormwater facilities can conduct routine observations of their facilities to identify obvious problems, such as bank failures, broken pipes, or drainage blockages. See the next page for a self-inspection checklist.

Sample Self Inspection Checklist

We encourage you to use this checklist and maintain a record of your inspections. Answering "YES" to any of these questions indicates that there may be a need for corrective action or consultation with a professional. We also recommend that you acquire the Record Drawings of your system (they can be obtained from your Developer or contact Horry County Stormwater Department)

Date: _____ Inspected by: _____

Location: _____

Items to Inspect:

Does the outfall structure show signs of settling, cracking, bulging, misalignment or other structural deterioration?	Yes	No
Do the embankments, emergency spillways, side slopes or inlet/outlet structures show signs of erosion?	Yes	No
Are the pipes going into and/or out of the pond clogged or obstructed?	Yes	No
Do the banks and the inlet areas show erosion, low spots, or lack of stabilization (grass)?	Yes	No
Are trees present on the banks or slopes of the ponds and/or ditches?	Yes	No
Are there areas on site (consider the entire site) un-stabilized and is there evidence of erosion?	Yes	No
Is there evidence of animal burrows?	Yes	No
Does the pond or any ditches need mowing, is there a build-up of clippings that could clog any of the storm drain grates?	Yes	No
Is there sediment in the pond and does it decrease the pond's ability to hold water?	Yes	No
Is there trash or debris in the pond/ditches?	Yes	No
Are there encroachments in any of the drainage easements or the Pond?	Yes	No
Do any safety devices such as fences, gates, covers or locks need repair?	Yes	No
Are there excessive algae or vegetation in the pond/ditch?	Yes	No
Is there any evidence of a fish kill?	Yes	No

Tips to Lessen Maintenance Costs

If properly cared for, a stormwater management facility can work effectively for years without major maintenance costs. Neglected, it can potentially be a continual financial drain.

Businesses and homeowner associations can minimize costs and the potential liability of those responsible for the facility's maintenance by promoting and following these simple rules:

DO!!

☑ DO keep properties, streets, and gutters free of trash, debris, and lawn clippings.

☑ DO provide information to those who maintain their own automobiles on where to recycle oil and antifreeze.

☑ DO encourage residents to take dirty vehicles to a commercial carwash or select a location where soapy water will infiltrate into the ground and not enter a storm drain.

☑ DO put a pan underneath your car if it is leaking to catch the fluids until it is repaired. Spread an absorbent material, such as kitty litter, to soak up drippings and dispose of it properly.

☑ DO educate residents on where to properly dispose of hazardous wastes, including oil and latex paint.

☑ DO plan lawn care to minimize the use of chemicals and pesticides. Sweep paved surfaces of fertilizers and put the clippings back on the lawn.

☑ DO limit the amount of impervious surfaces. For patios, walkways, and landscaping, consider porous pavements such as bricks, interlocking blocks, or gravel.

☑ DO plant native trees, shrubs, and groundcovers to help the water soak into the ground. Replace turf with native plants. Select species that need little or no fertilizer or pest control and are adapted to specific site conditions.

☑ DO sweep up and dispose of sand and ice melting chemical residues in the winter. This will protect grass and other plants, as well as reduce the amount entering the storm drain network.

DO NOT!!

☒ DO NOT dump used motor oil, antifreeze or other oil and grease into storm inlets. This is a criminal offense and will greatly increase BMP maintenance costs.

☒ DO NOT dump grass clippings, leaves, soil, or trash of any kind into the stormwater facility or a storm inlet. Leaves and grass clippings release bacteria, oxygen consuming materials and nutrients. They will also clog the facility's components.

☒ DO NOT dispose of pet wastes in the storm system, including grassy areas near a facility. Animal wastes contain disease-causing bacteria and release oxygen consuming materials.

☒ DO NOT wash dirty vehicles on streets or driveways. Whatever comes off the car ends up in the stormwater facility or directly in streams.

☒ DO NOT overfertilize the lawn. Whatever washes off the lawn or impervious areas (such as driveways or sidewalks) drains into the stormwater facility and shortens its life-span.

☒ DO NOT leave bare areas unstabilized. Erosion from bare soil results in sediments that can quickly clog a stormwater facility.

☒ DO NOT dispose of left over paint or hazardous materials into the storm drain. These materials can kill vegetation and aquatic life. Dumping into the storm drain system is also a criminal offense.

Troubleshooting Guide

SEDIMENT REMOVAL AND DISPOSAL

Impact on Facility Performance

The purpose of a stormwater treatment facility is to remove pollutants, including suspended solids, by capturing sediment. Sediment can include dirt, leaves, and litter. These materials can restrict or clog a facility. Timely removal of sediment will improve infiltration rates, water quality, and help prevent clogging and flooding.

Type of Facility This Applies To	Remove Sediment When
Vegetated Vegetated Rooftops, Bioretention Facilities, Ponds, Constructed Wetland Forebays, Swales, and Vegetated Filters	• Sediment depth is damaging or killing vegetation; or, • Sediment is preventing the facility from draining in the time designed (usually 48 - 72 hours).
Underground Manufactured Facilities, Sand Filters, Underground Detention	• At least once a year, or when • The basin is half-full of sediment, whichever comes first.
Infiltration Permeable Paving Materials (Grasscrete, permeable pavers, gravel), Infiltration Trenches	• Sediment is preventing the facility from draining in the time required (usually 48 hours).

What to Do

For small facilities, sediment can be removed by hand. Large facilities and underground facilities will need to be cleaned with heavy equipment by trained professionals. For example, a vacuum truck may need to be used for confined spaces.

- Remove sediment during dry months when it is easiest to remove because it weighs less and creates fewer secondary environmental impacts, such as wet sediment running off the site.

Vegetated Facilities:

- Use rakes and shovels to dig out accumulated sediment.
- Avoid damage to existing vegetation. If sediment is deep, some plants may need to be removed to excavate sediment.
- Reseed, replant, and mulch disturbed area to prevent erosion.
- Excavate sand and gravel and clean or replace.

Underground Facilities:

- Use a vacuum truck to remove sediment from the vaults or chambers.

Infiltration Facilities:

- Infiltration Trenches: Excavate sand or gravel and clean or replace.
- Permeable Paving Materials: Remove accumulated sediment from the surface with a dry broom, vacuum system, or other hand tools. A vacuum truck or street sweeping equipment may also be used, with professional assistance.

A vacuum truck may be required to remove sediment from stormwater facilities located underground.

How To Reduce Sediment Accumulation in the Facility

- Minimize external sources of sediment, such as eroding soil upstream of the facility.
- Sweep surrounding paved areas on the property regularly.

Troubleshooting Guide

VEGETATION MANAGEMENT

Importance to Facility Performance

Plants play an important role in stormwater facilities. They absorb water, improve infiltration rates of soil, prevent erosion by stabilizing soil, cool water, and capture pollutants. Plants create habitat for birds and other wildlife and provide aesthetic value to a property. Proper maintenance of vegetation improves the appearance and performance of the facility.

Type of Facility	Facility Needs Maintenance When
Vegetated Vegetated Rooftops, Bioretention Facilities, Ponds, Swales, and Vegetated Filters	• Areas of exposed, bare soil. • Vegetation is buried by sediment. • Vegetation appears unhealthy or has died. • Nuisance and invasive plants are present. • Vegetation is compromising the facility's structure by blocking inlets or outlets, or roots are intruding into the component of the facility. • Dropped leaves and other debris are contributing to sediment accumulation or are blocking inlets or outlets.

What to Do

Maintenance activities can easily be incorporated into existing site landscape maintenance contracts. Vegetation can be maintained with a formal or more natural appearance depending on your preference.

General maintenance:

- Remove dropped leaves, dead plants, grass and other plant clippings. Plant debris adds nutrient pollution as it breaks down and can clog facility piping and reduce infiltration.
- Avoid using fertilizers, herbicides, or pesticides in the facility. These products add to the pollution problems the facilities are designed to remedy.
- Use mulch to inhibit weed growth, retain moisture, and add nutrients. Replenish when needed. Ensure mulch does not inhibit water flow.
- Irrigate all new plantings as needed for the first two years.

Caring for desired vegetation:

- Plant in late-fall or early-spring so plant roots can establish during the cool, rainy seasons, before summer.
- Amend and aerate compacted soils before replanting by adding compost to increase nutrients and enhance soil texture.
- Protect young plantings from herbivory from deer and waterfowl.

Mowing:

- Grass facilities are designed for routine mowing. Mow at least twice a year.
- Grass should be mowed to keep it 4 - 9 inches tall. Grass that is at least 4 inches tall capture more pollutants and is hardier.

Nuisance and unwanted vegetation:

- Remove nuisance and invasive vegetation, such as English Ivy, before it goes to seed in the spring. Conduct additional weeding in the fall.
- Immediately remove vegetation that is clogging or impeding flow into the facility.
- Remove potentially large and deep-rooted trees or bushes when they might impede the flow path or compromise facility structures.
- Provide erosion control on any soil exposed by vegetation removal.

Troubleshooting Guide

EROSION, BANK FAILURE, AND CHANNEL FORMATION

Importance to Facility Performance

Stormwater flowing through a facility can cause erosion. Erosion can increase sediment build up, clog outlets, reduce water quality benefits, add to pollution, and cause facility components to fail. Eroded channels create an easy path for water to travel down reducing the ability of the facility to filter pollutants and infiltrate water.

Type of Facility	Facility Needs Maintenance When
Vegetated Vegetated Rooftops, Bioretention Facilities, Ponds, Swales, and Vegetated Filters	• The formation of flow restricting channels occurs in the bottom of the facility, around inlet pipes and curb cuts, or at overflows. • Undercutting, scouring, and slumping occur along banks and **berms**. • Channels and undercutting occur through check dams*. **check dams are small* **berms** *built across a swale or channel to slow water and create small areas of ponding.*

What to Do

Any area with erosion more than two inches deep needs maintenance.

- Fill the eroded area with soil, compact it lightly, and cover with mulch, compost, seed, sod, or other erosion prevention materials.
- Plant banks with deep or heavily rooted plants to permanently stabilize soil.
- Plant the bottom of the facility with grass or grass-like plants to slow water and stabilize soil.
- Install or repair structures designed to dissipate energy and spread flow, such as splash blocks on downspouts, or riprap around inlet pipes and curb cuts.
- If erosion continues to be a problem, consult a professional to determine the cause and the solution.

POLLUTION YOU CAN SEE OR SMELL

Importance to Facility Performance

Stormwater facilities often collect a variety of trash and debris. Trash and debris, especially floating debris, can clog pipes or treatment media. It can also cause odors through decay or by collecting spilled or dumped materials. Stormwater facilities are designed to help prevent pollutants from entering rivers and streams. Any visible water quality pollutants may wash out of the facility spreading the pollution problem.

Type of Facility	Facility Needs Maintenance When
All Types of Facilities	Any unusual or unpleasant smells from sources such as: • Natural plant decay • Dying plants trapped under sediment. • A spill or a leak (e.g., gasoline or sewage). Visible pollution such as: • Sheens and discoloration • Turbid (cloudy) water • Other pollution on the surface of the water.

What to Do

Check monthly for trash and debris and look for opportunities to minimize the pollutant source.

- Regularly remove trash and plant debris.
- Remove accumulated sediment (see "Sediment Removal" in this guidebook).
- Make sure inlets and outlets are not clogged.
- Identify the source of trash, debris, or pollutant, such as a spill, leak, or illicit discharge.
- If there is evidence of a spill or leak, call 9-1-1. Use trained professionals for any cleanup or remediation.

Troubleshooting Guide

PONDING WATER

Importance to Facility Performance

Most facilities are designed to drain in a certain amount of time. This varies from two to 48 hours depending on the type of facility. Ponding water is usually a sign that the facility's filter or outlet is clogged or it is not infiltrating properly.

Type of Facility	Facility Needs Maintenance When
Vegetated Vegetated Rooftops, Bioretention Facilities, Ponds, Swales, and Vegetated Filters **Underground** Manufactured Facilities and Sand Filters **Infiltration** Permeable Paving Materials	• Clogging of overflows or outlets with debris, trash, or other obstructions. • Fine sediments filtering into the soil or other filtration media (like sand or gravel) that can prevent proper infiltration. • Water that has remained ponded for more than 72 hours. • Evidence of seepage at toe of slope on embankment (wet and dry ponds).

What to Do

Any area with erosion more than two inches deep needs maintenance.

- For surface facilities, first try raking the top few inches of soil to break up clogged sections and restore water flow.
- Clean out overflows and outlets with hand tools, if possible. Difficult or hard to access blockages may require professional contractors.
- Identify sources of sediment and debris and prevent them from entering the facility.
- Make sure the facility has adequate vegetation. Vegetation absorbs water and roots help keep soil loose so it can infiltrate water.
- Make sure there is a sufficient amount of mulch in vegetated facilities. This will also help to absorb excess water.