

A Citizen's Guide to Maintaining Storm Water Best Management Practices

For Homeowners Associations and Property Owners



**Greenville
County**

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What is a BMP?

The term “Best Management Practices,” or BMP, was introduced and defined by the U.S. Environmental Protection Agency as a practice, or prohibition of practices, maintenance procedures, treatment requirements, and other management practices to prevent or reduce the pollution of waters of the United States.

What is non-point source pollution? Sources of non-point pollution include sediment, nutrients, motor oil, and lawn care products that run off hard surfaces and yards into storm drains. Storm drains typically empty into nearby surface waters and streams. Fortunately for Greenville County, which has thousands of miles of streams, there are thousands of BMPs in place. A variety of local, state and federal laws, including the Greenville County Storm Water Management Ordinance (SWMO) and the federal Clean Water Act, require the control of pollutants in storm water runoff using BMPs.

Do you have a BMP on your property or in your neighborhood? Ponds, ditches and depressions that you see every day may actually be engineered storm water facilities designed to reduce flooding and improve water quality. As development occurs, land is covered by roads, driveways, rooftops and other hard surfaces that do not allow storm water to infiltrate (or soak) into the ground naturally. Without BMPs, the end result of development may be increased flooding and degradation of Greenville County's water quality.

The most common BMPs in Greenville County are dry detention ponds, wet retention ponds, vegetated swales, vegetated buffers, and storm water wetlands. The long-term benefits of BMPs are only fully achieved when they are maintained properly. Maintenance of BMPs is vitally important for the County's flood reduction and environmental protection efforts.



(Photo courtesy of USDA NRCS)

Meet on-site with members of your homeowner's association to find out where your BMPs are located.

Definitions

Best Management Practice (BMP) - A practice, or prohibition of practices, maintenance procedures, treatment requirements, and other management practices to prevent or reduce the pollution of waters of the United States. Examples of BMPs include detention ponds, buffers and vegetated swales.

Bio-Infiltration - Vegetated areas, such as engineered channels, vegetated swales or rain gardens that are used to collect and filter urban storm water runoff.

Buffer - An area of vegetated land, preferably non-mowed native vegetation, left open adjacent to drainage ways, streams, wetlands, lakes, ponds and other surface waters for the purpose of minimizing the impacts of point and non-point source pollution.

Deed or Plat Restricted Areas - Easements, covenants, deed restricted open spaces, reserved plant areas, conservation easements, or public road right-of-ways that contain any part of the storm water management system of a development.

Storm Water Pond - Temporarily stores water before discharging to surface waters; primarily used to reduce peak discharges, but does not reduce runoff volumes. Can be classified into two groups:

Dry Detention Pond - Stores storm water runoff but dries up following a rainstorm or snow melt.

Wet Retention Pond - Stores storm water runoff, but also contains a permanent pool of water that effectively remove sediment and nutrients, in addition to other pollutants.

Filter Strip - A vegetated area designed to slow runoff velocities and filter out sediment and other non-point source pollution.

Mitigated Wetland - Created or restored wetlands that are intended to replace the beneficial functions of wetlands lost due to development activities.

Native Vegetation - Native vegetation species that provide natural root systems that help stabilize stream banks and provide pollutant filtering capabilities.

Non-Native Vegetation - Plant species not native to an area that tend to crowd out native species and dominate the area; also called exotic and invasive species.

Non-Point Source Pollution - Also known as polluted runoff, comes from diffuse or scattered sources in the environment rather than from a defined outlet such as a pipe. As water moves across and through the land it picks up and carries away pollutants, depositing them into surface waters.

Vegetated Swale - An open channel used in lieu of conventional storm sewer pipes to convey storm water and filter pollutants.

Storm Water Wetland - Constructed systems that mimic the functions of natural wetlands and are designed to mitigate the impacts of urbanization on storm water quality and quantity.

Common Types of BMPs

RETENTION POND- “WET POND”

Wet ponds are man-made with permanent pools of water that function much like natural ponds. Excess runoff is stored above the permanent pool and is discharged at a controlled rate through an outlet structure. A wet pond can be more effective when native plants are added to the slopes as a buffer. Adding wetland plants around a wet pond can also help create a storm water wetland detention facility.



The advantages of a wet pond over a dry pond include better pollutant removal and less chance that pollutants will be re-suspended and released during a storm. Wet ponds can also serve as an aesthetic or recreational amenity as well as a habitat for wildlife and aquatic species. Un-mowed native vegetated buffers on the perimeters of wet ponds make them less attractive to geese, a major source of pollution.

DETENTION POND- “DRY POND”

Dry ponds hold storm water temporarily but are less effective at pollutant filtering because they are typically planted with turf grass. Traditionally, dry basins have been the most common type of storm water management facility. The SWMO includes language that encourages the retrofitting of dry ponds to improve water quality. For more on retrofitting, see p. 13.



VEGETATED SWALE

Swales are one of the most commonly used storm water management practices. They are often used along highways, parking lots, residential streets and in between homes to convey water. Swales are designed to infiltrate and treat storm water runoff naturally.



VEGETATED BUFFERS

Buffers are vegetated areas that often surround wet ponds and wetlands, and run parallel to streams and lakes. Buffers can be effective in filtering out non-point pollution before it reaches a water body.



Buffers are required by the County's Tree Ordinance and minimum buffer widths can range from 20 feet to 35 feet wide for high quality streams and wetland areas.

STORM WATER WETLAND

A storm water wetland detention facility typically includes a small permanent pool of water. The bottom and the slopes are planted with native wetland plants that provide pollutant-filtering capabilities.



Maintenance Plans for BMPs

IF A PLAN ALREADY EXISTS

The Greenville County Storm Water Management Ordinance requires a storm water maintenance plan for BMPs. If your subdivision was permitted after 2008, a maintenance plan should have been included as a section of the original development approval. The maintenance plan typically includes:

- A description of inspection intervals and maintenance tasks required for each BMP.
- The party responsible for performing the maintenance tasks.

Before a Homeowner's Association takes ownership of storm water management facilities:

- If you don't already have one, get a copy of the site plan and as-built drawings that include all storm water management facility locations and types, easements, deed restrictions, and storm water facility maintenance agreements.
- Meet with the developer and the project engineer to discuss the storm water facilities, including the current conditions and near-term and long-term maintenance requirements of each facility.

IF A PLAN DOES NOT ALREADY EXIST

If a maintenance plan does not already exist, one will need to be created. There are many advantages to having a plan. It provides a historical record of each facility, it can be used in policy creation for the next HOA board, and can include a long-term maintenance budget, as well as help comply with County requirements. There are nine elements of a BMP maintenance plan that should be considered.

Elements of a Maintenance Plan



SAMPLE INSPECTION LOG

ROUTINE MAINTENANCE

Wet and Dry Ponds

TASK: Remove accumulated debris and litter, especially around the inlet and outlet areas.

INLET LOCATION: Inspect wet pond inlets and outlets at Main Street.

SCHEDULE: monthly

LAST INSPECTION: 11/03/15

CURRENT INSPECTION: 3/16/16

OBSERVATIONS: Removed litter from inlet/outlets. Some erosion will need to be stabilized.

COMMENTS: Outlets need to be checked after all major rain events. Vegetation around inlet area should be reviewed by landscaping company in the late summer to prevent erosion problems.

INSPECTOR: John Q. Public

It's not as important how you set up your inspection log, but that you faithfully follow a BMP Maintenance Plan.

Inventory of Facilities

The permitted site plan will show components of the storm water system including all BMPs such as ponds, wetlands and swales. Identify below-ground features like storm sewers and above ground features like permanent BMPs including buffers and undisturbed vegetated areas.

Identify Facility Characteristics and Maintenance Needs

Walk the site to get a complete understanding of BMP maintenance needs. Take note of the physical and design characteristics of each storm water facility and all drainage easements. Basic ongoing maintenance needs should be obvious. For example, vegetation will need to be cut in a dry pond 2-3 times per year.

Use Inspection Checklists

Checklists are essential to help ensure that all system components are functioning as originally designed. They are important not only during inspection, but will provide a historical record of facility functionality. The Greenville County LDD can provide templates that may be modified for your particular site and facility types.

Establish Record-Keeping Procedures

Tracking and record-keeping is best done using a computer database, i.e. Excel spreadsheets, etc. This allows HOAs, property managers, or volunteer inspectors to easily schedule inspections and record their observations. The database should include details for each BMP, including: BMP type and location, data from previous inspections, any previous maintenance performed, and digital photos of the facilities.

RECORD-KEEPING TOOLS

Database
Maintenance Records
Important phone numbers
Site map / plans
Photos

Budget and Allocate Resources

This task is typically the most difficult for the association or property manager. A good rule of thumb is to increase the routine maintenance budget by an average of 3-4 percent each year to account for inflation. For major long-term maintenance needs, consult and work with a civil engineer or landscape architect to estimate the cost of the ongoing work. Create a contingency fund for unexpected major expenses.

Create and Adopt a Written Policy Document

A written policy document should include the following:

- Name, location, and map of site.
- Name, address and phone number of current owner(s) and previous owner(s).
- History of the site including a copy of the permitted site plan, maintenance plan, as-built drawings, and other pertinent information and documentation including, evaluation and inspection records of the system by the County, etc.
- Regulatory and legal requirements (including legal implications of ownership, with regard to facility maintenance and the legal impacts of neglect).
- Record-keeping and reports for both on-going and long-term maintenance requirements and tasks performed.
- Yearly budget, including an adequate funding mechanism, budget approval process, collection and distribution of funds, and evaluation of services and policies.



Get your homeowner's association involved. Educate members on the maintenance plan, and train volunteers to be inspectors.

Conduct Periodic Program Reviews

On a yearly basis, review your inspection program, checklists, and contracts with landscaping companies and other contractors. Other items to check:

- Is your computerized record-keeping system efficient and up to date?
- Does your inspection checklist need to be evaluated for more detailed inspections or other information?
- Are you satisfied with the professional services currently under contract and are you getting what you paid for?
- Is the association fee adequately covering maintenance costs?
- Take time to update information such as phone numbers and addresses of inspectors and other support personnel. If applicable, update your maintenance equipment inventory,

Select Inspection Committee & Volunteers

Your landscaping company should alert you to additional maintenance needs in most instances. Inspections by committee members and volunteers can also help regularly monitor and identify maintenance needs. Inspections can be done by anyone interested in the task, but volunteer inspectors should be detail-oriented and willing to commit time and energy toward the effort.

Educate the Neighborhood and Community

It is important that everyone in the neighborhood with a storm water BMP understand the purpose of the facility and the maintenance required to keep the facility functioning properly. For example, a natural buffer area may be viewed as an unattractive nuisance by some residents, while others may see it as an important wildlife habitat and community amenity. You can use your neighborhood newsletter or HOA meetings to talk about storm water BMPs and the benefits of natural areas, etc.

Performing BMP Maintenance

Cost, safety, and effectiveness are key factors in determining who should carry out your BMP maintenance tasks. Some of the more routine maintenance tasks can be done by a BMP facility owner / HOA. Those tasks may include conducting periodic inspections, educating the neighborhood about storm water runoff, simple landscaping and vegetation removal, and picking up trash and debris.

It is recommended that a professional landscaping company be hired for the more difficult work. Mowing, working around sloping embankments, stabilizing eroded areas, and replanting vegetation are tasks a professional landscaping company might best manage. Trained professionals can also identify problems early in the process and help prevent expensive repairs later.

TIPS FOR WORKING WITH LAWN CARE COMPANIES

Your BMP is a storm water management system and requires special attention towards maintenance. Communicate with your landscaping company and discuss your specific BMP maintenance needs. Objectives might include:

- Communicating that the facility is a water quality device.
- Communicating preferred mowing practices; for instance,

mowing at a higher level and perhaps not at all in buffer areas. You can also request that the use of heavy equipment be avoided where possible, particularly in vegetated areas.

- Communicating the need to keep the BMP facility clear of grass clippings, debris, and leaf piles (convey this to the residents as well).
- Ask the company to minimize the application of pesticides, herbicides, and fertilizers.
 - Use pesticides only as needed and only in trouble areas
 - Use alternatives to pest control or none at all
 - Do not apply chemicals when there is rainfall in the forecast
 - Test the soil before applying fertilizer, and apply sparingly and only where needed.



Communication is the key. If the company cannot, or is not, willing to agree to your needs, find another company that will.

Involve the Whole Community in BMP Maintenance Responsibilities

Consider starting a volunteer maintenance program for your neighborhood. Even if heavy maintenance is left to the professionals, involving the community in on-going BMP maintenance activities is a cost-effective way to prolong the life of the BMP and to prevent water pollution.

Many times people are unaware that their activities contribute to pollution. Through communication people become aware of how their activities impact water quality and flooding and they become a stakeholder in protecting their environment. Consider the following for your community education program:

- What are the pollution and flooding problems that need to be addressed? Storm water runoff.
- What activity or activities are responsible for the pollution or flooding? When needed, encourage residents to change their habits to reduce pollution.



Join Your Neighbors for a BMP Clean Up Day!

What's a BMP?

A BMP, or Best Management Practice, is a facility designed to trap pollutants from our neighborhood before entering the Reedy River.

*Saturday, October 5, 2016
9 a.m. at the south pond*

Even if you can't make it, there are simple things you can do to protect our community's water quality. Following the suggestions on the attached brochure can help!

For more information call 555-2233



Storm drain stenciling is a good community project to encourage clean water.

- Who can help implement a community education program? Boy/Girl scouts, grass roots environmental groups, and Greenville County Soil and Water Conservation.
- How can the message be delivered? Options could include HOA meetings, email blasts, bulletin boards, and social media.
- How can alternatives to pollution be encouraged? Composting and hazardous waste days are a good start.

Inspecting Your BMPs

Primary Program Components

- Regular Inspections
- Vegetation Maintenance
- Embankment and Outlet Stabilization
- Debris and Litter Control
- Structural Components (Inlet/Outlet, etc.) Repair/Replacement
- Maintenance of Access Areas/Fences
- Sediment Removal

REGULAR INSPECTIONS

This section outlines the maintenance needs for the most common types of BMPs found in Greenville County. It is important to remember that while general maintenance tasks are outlined, actual maintenance needs vary according to specific site conditions. Many BMP inspections must be conducted on an annual or semi-annual inspection schedule.

VEGETATION MAINTENANCE

Most BMPs rely heavily on vegetation to filter out pollution and to prevent erosion on embankments and slopes. The following is a quick reference on how to keep your vegetation healthy.

- **Mowing.** Short turf grass looks nice but it doesn't have a deep root system and is less effective as a pollutant filter than tall native varieties. Cut grass to approximately 6-8 inches, particularly near basin embankments and slopes. Never mow down to the water's edge of a wet pond. Plant native vegetated buffers around wet ponds.
- **Weed and Pest Control.** More is not better when it comes to fertilizing and pesticide use, especially near basins, swales, lakes and streams. Excess fertilizer can runoff and flow into storm water management facilities that eventually drain into nearby water bodies.
- **Non-Native Vegetation.** Non-native species can impact the effectiveness of BMPs by blocking out the more effective native vegetation. Non-native species can actually destabilize embankments and slopes and reduce the pollutant filtering capabilities. Monitoring and mowing can help control unwanted non-native species.
- **No Mow Zones.** In accordance with the Greenville County Land Development Regulations and Tree Ordinance, undisturbed vegetative buffers are required along certain streams and should not be mowed.

Factors Affecting Type and Frequency of Maintenance

Function of the BMP Facility. Inspections will vary depending on the type of BMP.

Visibility of the BMP Facility. The needs and preferences of the surrounding community may determine to a large extent the amount of maintenance needed for aesthetic purposes.

Landscaping. Maintenance needs will vary depending on the types of vegetation used in landscaping. Native vegetation needs less care and less mowing than turf grass.

Upstream Conditions. The conditions of the watershed upstream from the BMP can significantly impact the amount of sediment and other pollutants entering your BMP facility. Upstream commercial areas or roads may result in an increased need for litter and sediment removal, and other similar maintenance tasks.

Safety. Since BMPs can often involve the impoundment of water, the safety of nearby residents must be considered. Fences and gates should be well-maintained.

Need for Professionals. Many BMPs are water treatment as well as storage facilities. While some routine maintenance can be undertaken by a non-professional, professionals should be consulted on a regular basis for their expertise and judgment.

Financing. The costs associated with non-routine BMP maintenance tasks can be considerable. A fund should be established to provide for the costs of long-term needs such as sediment removal and repair of structural components.

Source: Northern Virginia Planning District, Division of Environmental Services.

BMP MAINTENANCE QUICK GUIDE

Wet and Dry

ROUTINE MAINTENANCE

- Remove accumulated debris and litter, especially around the inlet and outlet areas. Mow routinely, unless there is native vegetation.
- Remove woody vegetation from all embankment areas.
- Stabilize / re-vegetate side and bottom areas.
- Stabilize / re-vegetate contributing areas to reduce incoming sediments.
- Implement a pollution prevention community education program.

INSPECTION SCHEDULE

Monthly
Bi-Annually
As Needed
As Needed
As Needed
As Needed

NON-ROUTINE MAINTENANCE

- De-thatch grass to remove accumulated sediment and debris
- Aerate compacted areas to promote infiltration
- Monitor sediment accumulations, and remove sediment when the pool volume has become reduced significantly (roughly 50% of the basin), or when the basin becomes stagnant
- Replace structural components, reconstruct embankments and spillways

< Every 2 Yrs.
Every 2-3 Yrs.
Semi-Annual Inspection
2-10 Yrs. for Dry Ponds
5-15 Yrs. for Wet Ponds
> 20 Yrs. if Maintained

Tips for When Non-Routine Maintenance is Required for Wet Ponds

- 💧 Major sediment accumulation.
- 💧 Insects and/or odor become problems.
- 💧 Algae blooms occur or ponding areas become dominated by a single aquatic plant species.
- 💧 Visible damage to the embankment or structural components.

Tips for When Non-Routine Maintenance is Required for Dry Ponds

- 💧 Standing water is visible in inappropriate areas after 72 hours.
- 💧 Insects and/or odor become problems.
- 💧 Emergence of non-native wetland vegetation.
- 💧 Visible damage to the embankments (such as sinkholes) or to structural components.

& Buffers

ROUTINE MAINTENANCE OF VEGETATED SWALES, BUFFERS

- Remove accumulated debris, litter and sediment.
- Mow routinely unless there is native vegetation.
- Replace non-native and invasive vegetation with native vegetation.
- Remove woody vegetation and stabilize side and bottom areas with native vegetation.

INSPECTION SCHEDULE

As Needed
Bi-Annually
As Needed
As Needed

Vegetated Swales

NON-ROUTINE MAINTENANCE

- Remove accumulated sediment

Semi-Annual Inspection

Tips for When Non-Routine Maintenance is Required

- Insects and/or odor become problems.
- Wetland vegetation emerges where not intended.
- Visible erosion or undercutting of banks is apparent.

Storm Water Wetland

ROUTINE MAINTENANCE

- Remove accumulated debris and litter.
- Supplement wetland plants if not well established.
- Inspect for invasive species and remove where possible.

INSPECTION SCHEDULE

Monthly
Annually
Monthly

NON-ROUTINE MAINTENANCE

- Remove accumulated sediment/pollutants.
- Stabilize/replace inlet/outlet structures.

Semi-Annual Inspection
Annual Inspection
20 Yrs. if Maintained

SPRING

- Non-native vegetation removal/control
- Vegetation planting
- Rain garden installation
- Debris removal
- Post-winter inspection of structures, embankments and outlets
- Embankment stabilization
- Structural component replacement
- Clear storm grates of leaves, debris

SUMMER

- Non-native vegetation removal/control
- Vegetation planting
- Rain garden installation
- Debris removal
- Non-native vegetation removal/control
- Embankment stabilization
- Monitor/remove sediment
- Check for odors, standing water
- Structural component replacement
- Clear storm grates of leaves, debris

FALL

- Non-native vegetation removal/control
- Debris removal
- Non-native vegetation removal/control
- Check for odors, standing water
- Structural component replacement
- Clear storm grates of leaves

WINTER

- Debris removal
- Clear storm grates of leaves and debris
- Monitor structures and outlets

Inspecting Your BMPs (continued)

EMBANKMENT AND OUTLET STABILIZATION

Finding the source of erosion and stabilizing it can improve the effectiveness of a BMP. Left unchecked, an erosion problem can necessitate dredging, replacement of an entire embankment or slope, and other structural components.

A prime cause of erosion is a lack of deep-rooted vegetation that holds soil in place. There are several techniques to stabilize banks including the use of environmentally-favorable products such as erosion control blankets (ECBs) combined with deep-rooted plants. The combination of structural and natural materials is known as bio-engineering. In addition to erosion, problems like sink holes, a rusty, broken or crushed pipe, odor, or algae blooms are all clear indications to call a professional civil engineer.

Animal burrows also jeopardize the integrity of embankments. Take steps to control animal burrowing by quickly filling existing holes and when necessary, eradicating the cause of the burrow.



Native vegetation was used on this bank stabilization project in Greenville County.

DEBRIS AND LITTER CONTROL

Regularly check for litter, debris and floating debris. Floating debris can clog basin inlets and outlets. When litter is a problem, outreach to the neighborhood can often help.

STRUCTURAL COMPONENT, INLET/OUTLET REPLACEMENT

Erosion, corrosion, and lack of maintenance can all contribute to loss of functionality of structural components. Valves, gates, pumps, and access hatches are some of the mechanical components of wet and dry ponds that may need maintenance and eventual replacement. When necessary, contact a professional civil engineer for an inspection and replacement cost estimates for these components.

INSECT CONTROL

Mosquitoes and other insect breeding areas can be created in shallow ponds of standing water. The development of a mosquito problem, particularly in dry ponds, is usually an early indication of a maintenance problem. It is likely the infiltration capacity of the BMP needs to be increased or sediment needs to be removed.

SEDIMENT REMOVAL FREQUENCY

BMP	Sediment Removal Frequency
Wet Basin	5-15 years
Dry Basin	2-10 years
Vegetated Swale	2 years

MAINTENANCE OF ACCESS AREAS

Access to BMPs for routine and non-routine maintenance is mandatory. For more on easements, see p. 15.

OVERALL WET POND MAINTENANCE

A healthy aquatic ecosystem has many benefits that are often overlooked. A healthy wet pond should require little maintenance. However, a good indicator of an unhealthy ecosystem is excessive algae growth. This could be caused by nutrients from over-fertilization practices by a landscape company or surrounding neighbors, upstream activities or by excess sediment accumulation.

Steps should be taken to reduce nutrients at their source and to encourage the growth of more desirable aquatic vegetation in a wet pond.

SEDIMENT/POLLUTION REMOVAL

Since the primary purpose of a BMP is to remove sediment and other pollutants from storm water runoff, sediment will eventually accumulate in a BMP and must be removed on occasion. There are no specific rules governing the timing of sediment removal because facility maintenance and loading varies. However some general guidelines on sediment removal frequency are listed above.

Note that your wet pond may have been designed with forebays to collect settled sediment. Forebays are designed for sediment removal access, and sediment may need to be removed more frequently from a forebay.

BMP COMPONENT REPLACEMENT

Like most all infrastructure, over the normal "lifespan" of a storm water management facility, eventually some BMP components will need to be replaced. Replacement costs should be part of a BMP maintenance and contingency fund. Components to replace may include both structural and non-structural elements:

- inflow, outflow devices
- trash racks
- valves, orifices
- earthwork such as embankments and side slope stabilization
- mulch and vegetation.

Maintenance Costs

ROUTINE MAINTENANCE COST CONSIDERATIONS

Routine maintenance costs can vary greatly depending on the type of BMPs you have. Costs for mowing, weed control, fertilization and debris removal are typically calculated per acre, per year. Cost estimates can be obtained from lawn care companies. A general rule of thumb is to increase your yearly maintenance budget by 3-4 percent for these activities.



The non-routine maintenance needs of a BMP, while infrequent, can be a major undertaking in terms of funding and logistics, and should always be overseen by a professional.

NON-ROUTINE MAINTENANCE COST CONSIDERATIONS

Non-routine costs are usually the most expensive. It is advised that a BMP maintenance and replacement contingency fund be established with annual HOA contributions. You may want to consider hiring a professional engineer to estimate replacement costs. When a fund is started, the primary non-routine maintenance cost is typically related to wet pond pollutant and sediment removal, or dredging.

Wet Pond Dredging

A major cause of depth reduction in wet ponds includes high sediments loads from upstream construction sites, shoreline erosion, agricultural runoff and decaying aquatic plants. Ideally, these types of problems should be corrected prior to dredging. Seek a professional engineer to determine if the depth of the pond has changed to the point that it no longer has at least fifty percent capacity of what was originally designed and built.

When dredging is required, a dredging feasibility study should be performed to determine areas to be dredged and to estimate costs. The cost depends on the volume of sediment removed and disposal. If on-site disposal is not an option, landfill and transportation costs can be high. Permits may be needed from local, state and federal agencies prior to beginning work. Dredging is an eventual cost, so plan ahead and set funds aside early.

Benefits of Dredging. Dredging restores the BMP to its original design and will improve it by:

- Removing excessive sediments
- Removing nutrient rich or toxic sediments
- Removing unwanted rooted aquatic plants
- Creating better fish habitat and preventing kills

Need a Retrofit?

Retrofits are storm water treatment practices put into place after development has occurred to improve water quality, protect downstream BMPs and water resources, reduce flooding, and meet other watershed restoration goals. Several types of retrofit opportunities exist including:

Create a wet or storm water wetland basin: Dry basins can be converted to wetland basins by excavating portions of the basin bottom to create wetland pockets and/or redesigning the outlet to allow for some water retention. Wetland and native vegetation is then planted on the bottom and on banks.

Stabilize shorelines and improve buffers: Shorelines of wet basins and streams with erosion problems could be stabilized using native vegetation. Native vegetation buffers should be established around the perimeter of all basins where possible to stabilize shorelines, filter pollutants and to discourage nuisance geese.

Replace turf grass with native vegetation: Turf grass is relatively intolerant of water level fluctuations and is high maintenance. It also is not as effective for pollutant removal as native vegetation. Turf grass should be replaced with native vegetation where feasible.



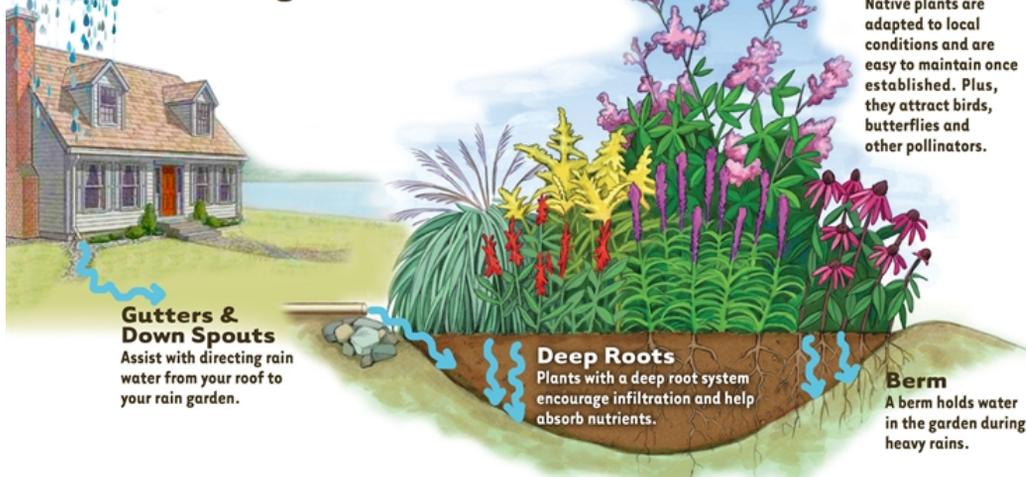
Seek a civil engineer to design your BMP retrofit.

What You Can Do to Prevent Pollution

Everyone can do something to help improve water quality.

- Wash cars on the lawn where soapy water can't quickly run toward the nearest storm sewer, picking up other pollutants as it goes. Wash your car with non-toxic, low phosphate soap and use water sparingly. Ideally, take your car to a car wash where water goes to a wastewater treatment plant.
- Keep cars tuned up and in good operating condition. Check for drips and repair leaks immediately to keep oil off pavement and out of storm sewers.
- Collect oil and other automotive products and recycle, or tightly seal and wrap them for proper disposal.
- Monitor fuel use from any underground gas and oil tanks to make sure they are not leaking.
- Clean up pet wastes from which nutrients and bacteria are washed into BMPS, lakes and streams.
- Use a rain barrel and direct downspouts away from foundations to planting beds and lawns where water can safely soak into the ground.
- Sweep your walks and driveways instead of hosing them down.
- Buy no-phosphate cleaners and detergents. Phosphates act as a fertilizer and increases algae and aquatic weeds in surface waters.
- Install a rain garden

How does a rain garden work?



MOSQUITOES AND WATER

Prevent Mosquito Breeding

Wet and dry ponds are not traditionally mosquito breeding grounds. In fact, mosquito larvae must live in still water for five or more days to complete their growth cycle before becoming adult mosquitoes capable of transmitting disease. Often the number of mosquitoes in an area can be reduced by removing sources of standing water.

- Discard old tires, buckets, drums and any water holding containers.
- Keep roof gutters and downspouts clear of debris.
- Keep trash containers covered.
- Empty plastic wading pools at least once a week and store indoors when not in use.
- Drain unused swimming pools.
- Fill in tree knot holes and hollow stumps that hold water
- Change the water in bird baths twice a week.
- Use bat houses, or "mosquito magnets" that run on propane to help rid your backyard and open areas of pests.

CONSIDER A RAIN GARDEN

Rain gardens are just what they sound like... gardens that soak up rain water, mainly from your roof, but also from your driveway and lawn. They are landscaped areas planted with wildflowers and other native vegetation to replace areas of lawn. The gardens fill with a few inches of water and allow the water to slowly filter into the ground rather than running off to storm sewers. Compared to a patch of conventional lawn, a rain garden allows about 30 percent more water to soak into the ground. Holding back the runoff helps prevent pollutants such as fertilizers from washing off your yard, into storm

sewers and eventually into nearby surface waters. By reducing the amount of water that enters the local storm drain systems, rain gardens also reduce the chances for local flooding, as well as bank and shoreline damage where storm drains empty into streams. Rain gardens are considered Low Impact Development (LID) stormwater management features (see p. 16).

Benefits of Native Vegetation

In the guide, "Planting with Native Plants," the US Environmental Protection Agency (USEPA) outlines the many benefits of native plants. Site designers, developers and individual homeowners may continue to realize the benefits of native vegetation when used in and around storm water ponds, vegetated buffers, and rain gardens.

So, what is a native plant?

Native plants are plants that have evolved over thousands of years in a particular region. They have adapted to the geography, hydrology, and climate of that region. Native plants occur in communities, that is, they have evolved together with other plants. As a result, a community of native plants provides habitat for a variety of native wildlife species such as songbirds and butterflies. Native plants save time and money by eliminating or significantly reducing the need for fertilizers, pesticides, water and lawn equipment. Native plants, through their deep root systems, help better absorb storm water pollutants and assist in embankment and slope stabilization.

Native plants do not require fertilizers. Vast amounts of fertilizers are applied to lawns. Excess phosphorous and nitrogen (the main component of fertilizers) run off into wet basins, swales, and ultimately nearby surface waters as runoff pollution. This threatens aquatic life and interferes with recreational and other uses.

Native plants require less water than lawns. The modern suburban lawn requires significant amounts of water to thrive. The deep root systems of many native plants increase the soil's capacity to store water. Native plants can significantly reduce water runoff and, consequently, pollution and flooding.

Native plants offer ancillary benefits. Native plants offer other benefits like providing shelter for wildlife, promoting biodiversity, reducing air pollution, and saving on typical lawn care expenses. Natural landscapes do not require mowing. Lawns, however, must be mowed regularly.

In Greenville County, and the Southeast in general, some of the more common invasive species include kudzu and Japanese honeysuckle. The list to the right gives a few ideas for preferred native species but you can view the SC Native Plant Society's native plant guide online for a more comprehensive list.

Indian grass is the state native grass of South Carolina.



Watch for local native plant and tree sales. Soil and Water Conservation Districts and grass roots organizations often sponsor plant sales.

Desirable Plant Species*

Trees

<u>Common Name</u>	<u>Genus/species</u>
Red Maple	Acer rubrum
Swamp White Oak	Quercus bicolor
Southern Red Oak	Quercus falcata
Basswood	Tilia americana

Shrubs

<u>Common Name</u>	<u>Genus/species</u>
Buttonbush	Cephalanthus occidentalis
Red-Osier Dogwood	Cornus sericea
Elderberry	Sambucus nigra
Blackhaw	Viburnum prunifolium

Flowers

<u>Common Name</u>	<u>Genus/species</u>
Blue Flag Iris	Iris Virginica
Black-Eyed Susan	Rudbeckia hirta

Grasses

<u>Common Name</u>	<u>Genus/species</u>
Little Bluestem	Schizachyrium scoparium
Switch Grass	Panicum virgatum
Love Grass	Eragrostis spectabilis
Indian Grass	Sorghastrum nutans

*Refer to <http://scnps.org/education/homeowners/> for more native species.



Many trees in Greenville County are protected. If you are planning to remove a tree, first check the Tree Protection Ordinance to make sure this is allowed.

Storm Water Wetlands

In recent years there has been a national movement towards introducing wetlands where none currently exist, and replacing wetlands that have been impacted, to improve water quality, reduce flooding and to retain natural habitat.

STORM WATER WETLANDS

Storm water wetlands, or constructed wetlands, are incorporated into the shallow pools of wet basins. These "naturalized basins" are designed primarily to treat storm water runoff. They also provide a natural method of shoreline protection against wave action compared to the placement of rock riprap.

While storm water wetlands usually have less biodiversity than natural wetlands in terms of plant and animal life, they do offer water quality benefits and natural habitat, and can support macro- and micro- invertebrates.

Storm water wetlands are allowed under the Greenville County Design Manual and are highly recommended as a BMP to meet water quality standards. Storm water wetlands also offer aesthetic value and require less maintenance than many other BMPs.

Include any storm water wetlands in your routine maintenance schedule. Watch carefully for invasive plant species and sediment accumulation.



MITIGATED WETLANDS

Mitigated wetlands are created on a site to replace lost wetland functions due to fill or other negative impacts. Mitigated wetlands are usually placed on a site independent of a wet basin. The goal is ensure that more wetlands are replaced rather than destroyed.

Since mitigated wetlands are designed to replace the inherent features of a natural wetland, mitigated wetlands are required to meet strict performance standards established by the U.S. Army Corps of Engineers. Those standards require mitigated wetlands to be monitored for at least 5 years. The developer is responsible for developing and implementing the monitoring and management plan until the performance standards are met. The association should then monitor the wetlands for invasive species and other negative impacts, and implement an annual maintenance program to keep the wetland thriving.

Easements on Your Property

If you have a BMP in your subdivision or on your property, a deed restriction or easement is required. These legally binding agreements noted on the plat, and in the purchasing agreement for your home, allows access to storm water facilities and requires the property owner to maintain the access point. BMPs that typically need a dedicated easement include detention basins, overland flow paths, swales, wetlands and buffers.

Here are some common sense guidelines for easement maintenance.

Source: Charlotte-Mecklenburg County, NC Storm Water Services

EASEMENT DOs AND DON'Ts

Recommended

- Plant trees and shrubs at the top of the embankments or berms to avoid blocking the flow of water. Native, water tolerant grasses and wetlands plants however can be planted at the base of a basin or swale.
- Plant non-woody trees, shrubs and flowers away from outlets and inlets to avoid root blockages.

Not Recommended

- Do not erect any permanent structures like buildings, walls or fences made of blocks or bricks.
- Do not install tennis courts, swimming pools, dams or anything that might block the flow of water.

Low Impact Development (LID)

LID is an approach to land development and re-development that works with nature to manage storm water close to its source. It employs principles such as preserving and recreating natural landscape features and minimizing impervious areas to create drainage facilities that treat storm water as a resource rather than a waste product. Low Impact Development (LID) techniques for storm water management use holistic design methods to reduce the “footprint” of a site’s impervious areas (buildings, walkways parking areas, etc.).

A site incorporating LID design generally produces much less storm water runoff than those designed with traditional storm water management methods. In a traditional design, runoff is collected and concentrated into pipes, conveyed, and detained in large structures at the “end-of-pipes”. Using an LID approach, storm water runoff is managed near its source in a number of small landscape features. These features encourage infiltration and extend the time of concentration, diminish flow, and recreate a more natural hydrologic landscape, similar to the pre-development conditions.

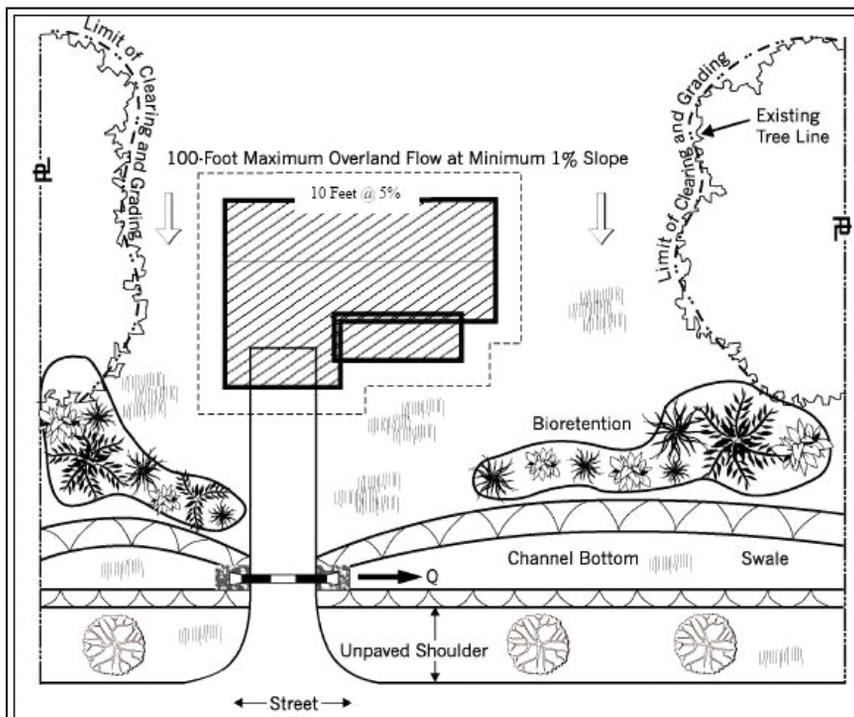
These methods can help create healthier work and living environments, increase the health of our rivers, lakes, and streams, conserve natural resources, and help contribute to a more sustainable community.

Property owners and Homeowner Associations should consult with qualified professionals regarding the installation and maintenance of LID features.



Storm Water Management practices that are suited to Low Impact Development include:

- ◆ Green Roofs
- ◆ Rain Barrels, Cisterns, & Dry Wells
- ◆ Pervious Pavement / Driveways
- ◆ Planter Boxes
- ◆ Vegetated Swales
- ◆ Full Dispersion Techniques
- ◆ Disconnected Impervious Areas
- ◆ Green Space Preservation
- ◆ Rain Gardens / Bio-retention Cells



The graphic to the left illustrates the typical layout of a single family residential lot using the following LID design methods:

- ◆ Maintains natural drainage patterns
- ◆ Directs runoff to depressed areas for better infiltration
- ◆ Preserves existing trees
- ◆ Reduces impervious areas
- ◆ Disconnects impervious areas from one another
- ◆ Limits clearing and grading as much as possible
- ◆ Locates impervious areas on less permeable soils
- ◆ Maintains the existing natural terrain and avoids construction in steep slope areas
- ◆ Preserves tree canopy and natural vegetative buffers
- ◆ Re-vegetates cleared and graded

Agency Resources

Greenville County Land Development Division (LDD)

Tel: (864) 467-4610

www.greenvillecounty.org/ldd

SC Department of Health and Environmental Control

Tel: (803) 898-DHEC (3432)

<http://www.scdhec.gov/HomeAndEnvironment/Water/Stormwater/>

Greenville County Soil and Water Conservation District (GCSWCD)

Tel: (864) 467-2756

https://www.greenvillecounty.org/soil_and_water/

Greenville County Planning and Codes Compliance

Tel: (864) 467-7090

https://www.greenvillecounty.org/Codes_Enforcement/

USDA - Natural Resource Conservation Service (NRCS) -

Tel: (864) 467-2755

www.sc.nrcs.usda.gov/

U.S. Environmental Protection Agency (USEPA)

Tel: (803) 898-3432

<https://www.epa.gov/soakuptherain>

Publications and Websites

- 1) [A Citizen's Guide to Storm Water Pond Maintenance in South Carolina](https://www.scdhec.gov/HomeAndEnvironment/Docs/ponds.pdf)
<https://www.scdhec.gov/HomeAndEnvironment/Docs/ponds.pdf>
- 2) [Neighborhood Guide to Stormwater Management Systems](http://www.ircstormwater.com/documents/Neighborhood_Guide.pdf)
http://www.ircstormwater.com/documents/Neighborhood_Guide.pdf
- 3) [Maintaining Your Neighborhood Stormwater Facilities](http://www.co.thurston.wa.us/stormwater/facilities/docs/Maintain2.pdf)
<http://www.co.thurston.wa.us/stormwater/facilities/docs/Maintain2.pdf>
- 4) [Stormwater Wet Pond and Wetland Management Guidebook](https://www3.epa.gov/npdes/pubs/pondmgmtguide.pdf)
<https://www3.epa.gov/npdes/pubs/pondmgmtguide.pdf>
- 5) [Neighborhood Stormwater Pond Maintenance Log and Resources](https://www.clemson.edu/extension/natural_resources/water/stormwater_ponds/resources/files/final_binder_pond_maintenance.pdf)
https://www.clemson.edu/extension/natural_resources/water/stormwater_ponds/resources/files/final_binder_pond_maintenance.pdf

Vendors

Please contact the Greenville County Land Development Division for a directory of businesses and contractors that provide installation, inspection, operation and maintenance services for storm water management facilities in the Greenville area.

CREDITS: Patty Werner and Susan Vancil, Lake County Storm Water Management Commission; USDA - Natural Resource Conservation Service

COPIES: Limited copies of this guide are available from the Greenville County Land Development Division. The Guide is also available for download from Greenville County's website at: http://www.greenvillecounty.org/land_development

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A Citizen's Guide to Maintaining Storm
Water Best Management Practices
For Homeowners Associations and Property Owners