CITY OF CHARLOTTE/MECKLENBURG COUNTY

POST CONSTRUCTION CONTROLS BEST MANAGEMENT PRACTICES MAINTENANCE HANDBOOK

Charlotte-Mecklenburg STORM WATER Services

2014

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1.0 OVERVIEW

The Post Construction Controls Regulations for the City of Charlotte, Mecklenburg County, Cornelius, Davidson, Huntersville, Matthews, Mint Hill and Pineville require that Best Management Practices (BMPs) be installed as part of meeting each jurisdiction's NPDES Stormwater Permit. Providing adequate maintenance is a key component for maximizing the performance and treatment of stormwater runoff and extending the service life of BMPS and the facilities where they are located.

2.0 PURPOSE AND INTENT

The purpose of this manual is to provide general guidelines for maintenance procedures and practices for BMP facilities in the City of Charlotte, Mecklenburg County, and the surrounding towns. These guidelines are intended to be used in conjunction with good maintenance and construction practices; it is not to provide a step-by-step performance method.

Some of the general maintenance practices found in this manual can be performed by individuals who have general housekeeping skills in landscaping and yard maintenance which only requires basic hand tools and little experience. Other tasks discussed in this manual require experienced professionals that can operate heavy equipment, are knowledgeable of vegetation and landscape plants, and are highly trained in construction safety practices.

Never perform activities above your ability or experience. Always use appropriate safety devices when working around ponds and water.

3.0 BIORETENTION

Bioretention facilities have many components that need to be maintained and monitored to ensure that the overall performance is extended appropriately. It is important to remember that the structure has an amended soil foundation which performs as a filter media. At the bottom of the amended soil layer is a sub-drain to carry filtered runoff to a storm system. The upper layer of the amended soil is a 3 inch layer of hammered mulch with various plants or trees as specified in the original approved design plan.

General maintenance practices need to be performed on a regular basis to ensure that the facility is well manicured and to eliminate an accumulation of debris from clogging the mulch and soil layers. The following routine maintenance tasks are provided and should be carried out after every significant rainfall event or periodically as needed during dryer seasonal periods. Again, the main goal is to provide good housekeeping activities so the exposed part of the facility is clean and performing adequately (Figure 3.1).

Figure 3.1
Well-maintained Bioretention Facility

3.1 Routine Maintenance Activities

The following activities are to be performed on a routine basis (see Section 10 for recommended maintenance schedule) and after any significant rainfall event. Most of the activities listed below can be performed by non-professionals or landscape maintenance staff. Not performing the activities listed below may result in major problems identified on the annual report or failures which can become very costly for the owner to correct.

Always use good safety techniques when performing maintenance activities and never do any task above your level of competence.

- *Watering:* Plants and shrubs may require watering after initial planting periods (first 2 to 3 years) or during drought.
- *Erosion*: Inspect inlet and outlet areas of bioretention facility for erosion. Re-seed any bare spots or areas where natural soils are exposed around the bioretention perimeter immediately. Inspect the drainage area for erosion. Repair erosion and stabilize as needed to prevent sediment build up in the bioretention areas.
- *Nutrients and Pesticides:* Nutrients and pesticides should not be required. Consult with a professional if questionable conditions occur. The addition of these types of chemicals or products may have an adverse effect on the performance of the water treatment.
- *Trash and Debris:* Remove all trash and debris from forebay or main facility area. All debris should be removed immediately to avoid blockage of the soil media, allow infiltration and to keep the outlet devices clear. All debris should be disposed of appropriately and recycled when possible. Periodic weeding may be needed to eliminate any grass or weeds in the bioretention area. Weeds should be removed by hand or hand tools, use of herbicides in bioretention areas are discouraged.
- *Leaves:* Remove any leaves that have accumulated in the cell area or near the facility. Leaves can block the soil media from infiltration and may be washed into the outlet structure which can cause flooding. Leaves can also cause an excess of nutrients which will affect the longevity of the bioretention.

- *Outlet Structure:* Clear any debris or trash that is blocking the overflow weir (Figure 3.2) and storm system. Clean off any protection device, such as wire fabric, used to keep trash and debris from entering the outlet structure.

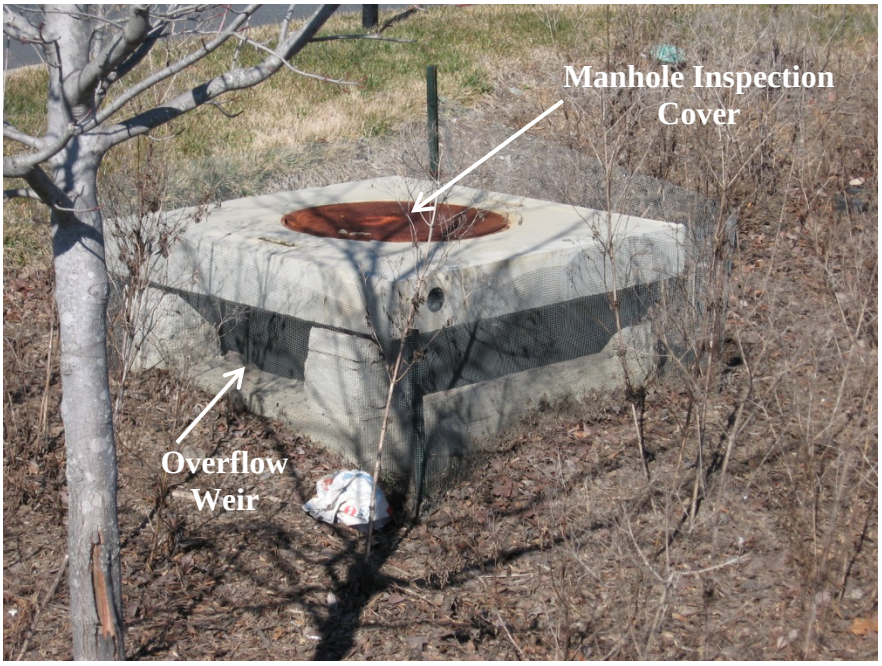

Figure 3.2
Overflow Weir

- *Plants:* Inspect plants that have been damaged or need irrigation. Dead or diseased plants are to be removed and replanted as soon as possible. If the entire facility shows signs of disease or widespread problems, contact a professional to minimize damage and plant replacements. Properly prune large plants that may be chocking out some of the understory plants.
- *Mowing:* Mow grass areas surrounding the facility 3 to 6 inches in height. Replace any sod areas as needed to prevent any erosion.
- *Grass Clippings:* Remove any grass clippings around the perimeter of the facility after grass cutting practices. Do not blow grass clippings into the bioretention because it can cause clogging and contain too many nutrients. These clippings can clog the soil media, outlet structure devices or be washed into the storm system and into creeks.
- *Riprap:* Replace any riprap that has been moved from the energy apron area. Should riprap be displaced on a regular basis, contact a professional for additional correction remedies. Sediment and asphalt sediment may accumulate in the riprap and should be removed on a regular basis to prevent sediment build up that can cause clogging.
- *Mulch:* The mulch layer should be refreshed periodically to maintain a 3 inch depth and completely replaced every 3 years. Replace the mulch layer immediately should the bioretention area be contaminated with heavy metals or any other pollutant that can significantly impact the operation of the bioretention facility. . Removing the mulch should be done carefully because the roots of the plants could be impacted and the topsoil from decomposition of mulch should not be mixed with the soil media

- *Infiltration:* Following a rainfall event observe the bioretention cell for standing water that remains longer than 2 days. If standing water is observed for more than 2 days, contact a professional or perform the following tasks if practical. 1) Rake the mulch layer away from the amended soil layer to inspect the condition of the underlying soil surface. Over time the soil surface may become compacted or accumulate sediments which will hinder water from infiltrating past the soil surface. 2) If the amended soil structure is compacted or has a thin cover of hardened sediments, remove the first inch or two of the soil and dispose of appropriately. This will generally correct the problem. 3) An additional measure that will improve infiltration of the soil is to cultivate or till the top layer of the soil. Care should be taken to avoid damaging trees or shrubs in the bioretention area. The mulch layer can then be spread over the soil structure to a 3 inch layer. It is good practice to replace the mulch layer during this type of maintenance.
- *Forebay:* The forebay area as shown in the photograph below (Figure 3.3) has appropriate storage available to pre-treat runoff during a storm event. Should the forebay storage be filled in with sedimentation, contact a professional to have the forebay area cleaned, or remove by hand and dispose of waste appropriately.

Figure 3.3
BMP Forebay

- *Maintenance Access:* Mow and maintain access areas regularly to provide unimpeded entry to the bioretention facility for inspection and maintenance activities. Any structural materials used for the

construction of an access road are to be maintained in a good condition to allow for construction equipment during maintenance activities.

3.2 Major Maintenance Activities

The following maintenance activities are to be performed by professionals that require specific training or specialized equipment.

- *Forebay:* Perform excavation or vacuuming of the forebay (Figure 3.4) every 7 years or when the storage volume has been depleted by 50%. Dispose of all debris appropriately and do not allow it to re-enter the storm system or be carried to a creek or stream. Identify a bench mark in the maintenance plan so the elevation of the original forebay bottom is known for future cleaning.

Figure 3.4
Forebay Vacuuming

- *Rip Rap:* Replace any rip rap that has been removed or in areas where the native soil is exposed.
- *Infiltration:* Bioretention facilities that do not drain within 2 days of a rainfall event (Figure 3.5) and which do not respond to the routine maintenance described above will require replacement of the amended soil layer. . Over time, compaction can occur on large bioretention cells and ones that are designed to take all storm events; therefore compaction tests may be needed for the entire depth of media To replace the amended soil, remove all plants (store in an appropriate area) remove the mulch layer and excavate all the amended soil taking care not to damage the under-drain system at the bottom of the facility. In some cases, cultivation of the bioretention facility's bottom may be necessary to encourage infiltration into the natural soils beneath. The amended soil that is used must meet all the original structural specifications as noted on the approved plans. A professional must certify that the soil

content has satisfied these structural specifications and provide a report to the City prior to completing the activity. If the mulch and the soil is not the cause of the infiltration problem, the filter fabric and under drain system should be checked for clogging.

Figure 3.5
Infiltration

- *Plants and Shrubs:* Treat or replace any diseased or dead vegetation (Figure 3.6) immediately. Re-establish all vegetation to the specifications described on the approved plan. If an on-going problem continues with a specific species of plant, consult with a professional to determine the cause. All plants used in the bioretention area should be well adapted for this local area.

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Figure 3.6
Bioretention Plantings

- *Maintenance Access:* Maintenance access roads may need to be scraped or the gravel replaced due to settlement, erosion, or use. All maintenance roads are to remain in good condition throughout the life of the facility to allow for construction equipment during maintenance activities.

4.0 WETPOND

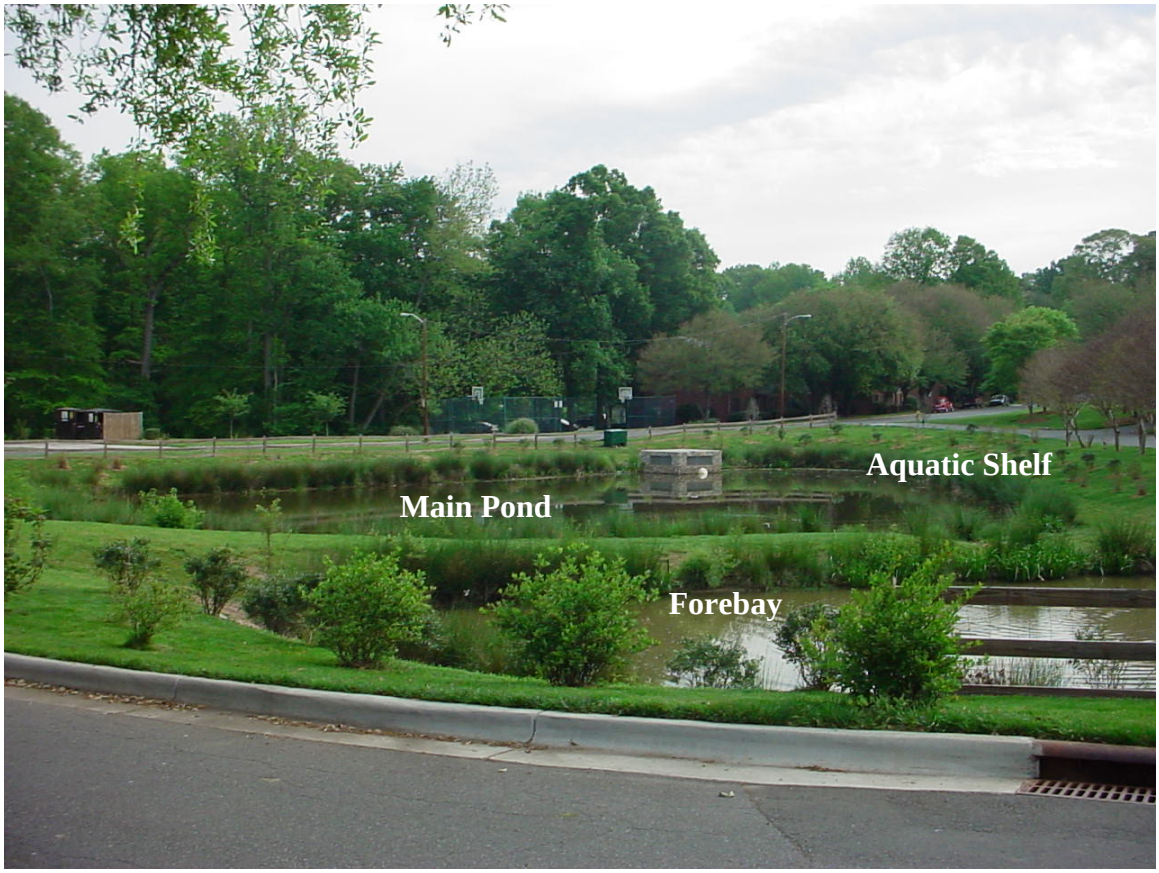

Figure 4.1
Wetpond

There are several major components of a wetpond (Figure 4.1) and each contributes to the overall performance of the facility to treat stormwater runoff. Runoff is discharged into a forebay (similar to a sediment basin) which provides for settlement and pre-treatment of particulates prior to flowing into the main pond area for additional treatment. After stormwater leaves the forebay area, it travels through the berm, or over a weir in the berm, separating the forebay from the pond storage area. The main body of the pond consists of an area of permanent deep water surrounded by an aquatic shelf. The aquatic shelf is an earth bench with shallow slopes where aquatic plants are planted for nutrient uptake. Most ponds are designed to temporarily store stormwater runoff for various storm events on top of the permanent pool elevation and are released over a specified period of time. The outlet structure, usually located at the downstream end of the pond, controls the discharge flow from the pond. The outlet has an energy dissipater downstream to protect the channel from erosive forces from the pond's discharge. Some ponds may also have an overflow weir designed in the embankment to release erosive flows safely downstream and protect the berm from failure.

Maintenance activities for a wetpond facility are necessary to ensure longevity of the water quality treatment expected from this type of BMP. Inlets shall be inspected and cleared of debris to ensure bypass is not a concern. Erosion within the drainage area of the BMP should be addressed to eliminate premature loss of storage within the forebay or main pond area. All outlet structures are to be kept clear of debris so the design discharge rates are not exceeded and water quality treatment is provided.

4.1 Routine Maintenance Activities

The following activities are to be performed on a routine basis (see Section 10 for recommended maintenance schedule) and after any significant rainfall event. Most of the activities listed below can be performed by non-

professionals or landscape maintenance staff. Not performing these activities may result in major problems identified in the annual report or failure of the BMPs which can become very costly for the owner to correct.

Always use good safety techniques when performing maintenance activities and never perform any task above your level of competence. Care should always be taken when performing tasks around the BMP pond areas. Never wade or work near the water edge without someone else being around and always use appropriate safety equipment, such as personal safety devices (PSD).

- *Watering:* Plants and shrubs may require watering after initial planting periods (first 2 to 3 years) or during drought.
- *Erosion*: Inspect inlet and outlet areas of the wetpond facility for erosion. Re-seed any bare spots or where natural soils are exposed around the facility's perimeter or embankments immediately. Inspect the drainage area for erosion. Repair erosion and stabilize as needed to prevent sediment build up in the wetpond.
- *Nutrients, Herbicides, and Pesticides:* Nutrients and pesticides should not be required. Consult with a professional if questionable conditions occur. The addition of these types of chemicals or products may have an adverse effect on the performance of the water treatment and can be harmful to the plants. Herbicides may be needed to control nuisance vegetation and must be applied by a licensed aquatic professional.
- *Algae Control:* Excessive algae is an indicator of too many nutrients in the pond that can have adverse effects on the environment, such as dissolved oxygen depletion that can lead to fish kill. You should always consult with a qualified professional when treating algae. Some suggestions would be to reduce nutrients in the drainage area (reduce fertilizing, remove pet waste and leaves/organics, use phosphorus free cleaners and detergents, and maintain septic and sewer systems). Another suggestion would be to aerate the pond with a fountain or other aeration device. It is discouraged to use chemicals to treat algae because it will cause adverse effects on the environment, aquatic life and plant life.
- *Wildlife control:* Monitor and implement measures to control destructive wildlife. Geese can destroy the vegetation, especially young plants, and goose protection fencing may be needed. Beavers can clog outlet structures, which can causing flooding and prevent the BMP from functioning as designed. Muskrats can damage plants and dams. Always consult a wildlife professional on how to properly control and/or remove.
- *Trash and Debris:* Immediately remove all trash and debris from the forebay or main facility area to avoid obstructions within the flow area of the facility and keep outlet devices clear. All debris should be disposed or recycled as appropriate. Periodic weeding may be needed to eliminate any grass or weeds from the facility area. Some trash and debris can be removed using a net and long handle. In some cases, a small water craft may be necessary to retrieve trash within the pond area. However, never use a water craft alone and always use appropriate safety equipment such as personal safety devices.
- *Leaves:* Remove any leaves that have accumulated in or near the facility area. Leaves can accumulate on or around vegetation and impact plant life. They also need to be removed after rainfall runoff to avoid being washed into the outlet structure which can cause flooding.
- *Outlet Structure:* Clear any debris or trash that is blocking the overflow weir and storm system. Clean off any protection device, such as wire fabric used to keep trash and debris from entering the outlet structure. Make sure that all outlet openings, such as an orifice or weir are kept clear of debris. Drain valves should be exercised several times a year for a short time to ensure that they are not blocked. and functioning properly.
- *Plants:* Inspect plants that have been damaged or need irrigation. Dead or diseased plants are to be removed and replanted as soon as possible. If the entire facility shows signs of disease or widespread problems, contact a professional to minimize damage and replace plants.
- *Mowing:* Mow grass areas surrounding the facility annually to prevent trees and unwanted undergrowth from becoming established. BMPs located near residential structures may require higher aesthetic standards. Only mow these areas to a minimum of 3 inches in height. Shorter vegetation may contribute to increased erosion and weeds.

- *Grass Clippings:* Remove any grass clippings around the perimeter of the facility after grass cutting practices. These clippings can contaminate the pond, clog outlet devices, or wash into the storm system and creeks.
- *Riprap:* Replace any riprap that has been moved from the energy apron area. Should riprap be displaced on a regular basis, contact a professional for additional correction remedies.
- *Forebay:* The forebay area, shown in the photograph below (Figure 4.2) has appropriate storage available to pre-treat runoff during a storm event. Should the forebay storage be filled in with sediment, contact a professional to have the forebay area cleaned or removed by hand and disposed of appropriately.

Figure 4.2
BMP Forebay

- *Maintenance Access: Mow* maintenance access areas are and maintain regularly to provide unimpeded entry to the BMP facility for inspection and maintenance activities. Maintain any structural materials used for the construction of an access road (figure 4.3) in a good condition to allow for construction equipment during maintenance activities.

Figure 4.3
Maintenance Access Road

4.2 Major Maintenance Activities

The following maintenance activities are to be performed by professionals that have specific training or specialized equipment.

- *Forebay:* Perform excavation or vacuuming of the forebay (Figure 4.4, 4.5) every 7 years or when the storage volume has been depleted by 50%. Dispose of all debris appropriately and do not allow it to re-enter the storm system or be carried to a creek or stream. The maintenance plan should contain a bench mark to identify the elevation of the original forebay bottom. The forebay area (Figure 4.4) is most likely the primary feature in a wetpond that will require periodic maintenance so that adequate storage is available for pre-treating runoff (deposit sediments) prior to flowing into the main pond area. To excavate or vacuum the forebay, it will first need to be drained or pumped dry (see Charlotte Land Development Standards Manual for the Dewatering Standard) in such a manner as to not allow untreated water to be discharged downstream of the facility. The forebay will need to be excavated (figure 4.4) to the original size based on the approved engineering plans of record and stabilized after the area has been restored. All outfall energy dissipaters will need to be reconstructed to the original size if disturbed during the maintenance of the forebay. Any plantings that are disturbed will need to be replaced as per the original approved planting plan.

Figure 4.4
Sedimentation in Forebay

Figure 4.5
Excavating Forebay

- *Earthen Berm (rip rap lined):* The berm between the forebay and the main body of the pond may need to be repaired to make sure that any eroded areas are backfilled, compacted and stabilized. This type of berm is generally constructed of good structural material and lined on the surface with rip rap to guard against erosion and breach failure. Any areas of the berm that are showing signs of settlement, undermining, or are eroding shall be backfilled, compacted, lined and stabilized immediately.
- *Dewatering:* Should the main pond need to be accessed for maintenance, the permanent pool of water will need to be lowered or completely drained (figure 4.6) as necessary to complete the required maintenance activity.

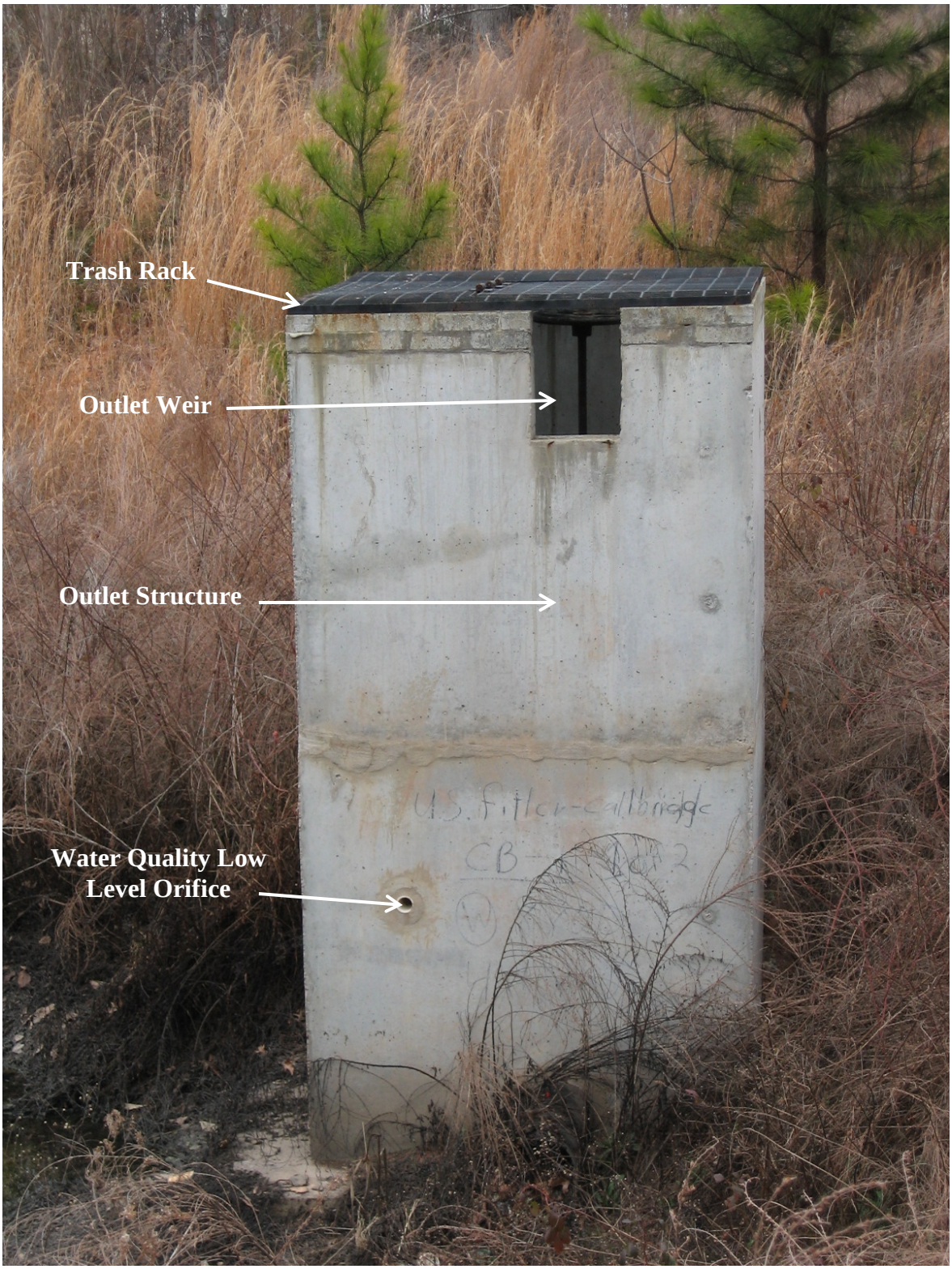

Figure 4.6

Outlet Structure

The permanent pool of water stored in the main pond area can be drained by opening the maintenance valve (see Figure 4.7) on the outlet structure until an adequate amount of water is released and the pond drains over a minimum of 2 days. This practice is necessary so disturbance to the downstream channels

is minimized. Should the discharge flow appear to be unclean after the initial flow has been released, then filtering of the discharge must be implemented so the downstream channel is not polluted. A suitable practice to perform this task can be found and followed as referenced in the Charlotte Land Development Standards Manual - Dewatering Standard.

Clean the outlet structure and maintenance valve after the pond has been drained successfully and before the pond reestablishes its permanent water levels.

- *Main Pond Maintenance:* Once the main pond's permanent pool of water and aquatic shelves, are drained, the permanent pool storage area can be accessed to perform maintenance activities. To address sedimentation and filling in of the original storage volume, well stabilized drainage areas may need excavation every 10 and 15 years. The main pond must be excavated (Figure 4.8) until the original design storage volume per the approved plans has been achieved. Dry all waste material appropriately and in a suitable area. Haul any contaminated soil to an appropriate landfill for disposal. Care shall be exercised to ensure that this maintenance operation prevents any waste from being discharged downstream of the site. Use all adequate erosion control materials and devices to prevent sedimentation from leaving the site during maintenance activities.

Figure 4.7
Outlet Structure

After sediment has been removed, perform all grading so pond characteristics are reconstructed per the original design, including slopes, aquatic shelf, energy dissipaters, berms, etc. Replant all aquatic plants (per the original plan) and close the drain valve to begin filling pond to permanent pool elevation.

Figure 4.8
Wetpond Excavation

- *Rip Rap:* Replace any rip rap that has been removed or is located in areas where the native soil is exposed.
- *Plants and Shrubs:* Treat any diseased or dead vegetation or replace immediately. Re-establish all vegetation to the specifications described on the approved plan. If an on-going problem continues with a specific species of plant, consult with a professional to determine the cause. All plants used in the BMP area are to be well adapted for the local area.
- *Invasive Plants: Remove* all invasive plants (Figure 4.9) from the main pond when 30 percent of the surface area of the pond is covered. The procedure for removing the invasive plants is similar to the main pond maintenance procedure. Care should be taken not to disturb wetland plants on the main pond's aquatic shelf which have not been impacted by the invasive species.

Figure 4.9
Invasive Plants

Replant all vegetation in the BMP per the original planting plan. Revisit the site periodically to ensure that the plants have been successfully established.

- *Maintenance Access:* Maintenance access roads may need to be scraped or have gravel replaced due to settlement, erosion, or use. All maintenance roads shall remain in good condition throughout the life of the facility to allow for construction equipment during maintenance activities.
- *Embankment:* The embankment of the pond shall be free of any settlement, eroded areas shall be backfilled and compacted appropriately, and all exposed native soil areas shall be stabilized immediately (Figure 4.10).

Figure 4.10
Embankment Erosion

- *Aquatic Shelf:* Maintenance of the aquatic shelf (figures 4.11, 4.12) should be performed when sediment has accumulated or inundated the plants to an extent that the life of the plants are impacted. When this occurs, remove and dispose of all plants in an appropriate landfill unless a qualified professional has determined that the plants can be removed and replanted successfully (Figure 4.9). Regrade the aquatic shelf to the design depth and dimensions as noted on the original approved plans or as specified in the BMP Design Manual. It is very important to make sure that all of the sloped areas leading to the aquatic shelf are stabilized prior to planting any vegetation. Protect new aquatic plants from animals and water fowl to ensure their successful reestablishment after re-construction of the aquatic shelf.

Figure 4.11
Well Established Aquatic Shelf

Figure 4.12
Dead Plants on Aquatic Shelf

- *Main Pond Slopes:* Ensure that all slope areas leading to the main pond are no greater than a 3:1 slope (horizontal to vertical). Repair and stabilize all slopes where native soils are exposed. Erosion from unstable slopes (figure 4.13) will prematurely fill in the forebay or pond with sediment, require maintenance to be performed earlier than expected, and can be very costly for the owner.
- *Pond Dam and Spillway:* Both the dam and spillway shall be kept free of woody vegetation by regular mowing during the growing season. Woody vegetation must not be planted on a dam embankment or allowed to grow within 15 feet of the toe of the dam and 25 feet from the principal spillway structure. If the dam or spillway has large woody vegetation (> 2") then a soil report for the structural integrity of the dam will be required by a soil engineer. The dam should also be inspected for any leaks or sink holes and repaired immediately if needed.

Figure 4.13
Slope Erosion

- *Outlet Structure:* The outlet structure (Figure 4.14) may need routine cleaning of debris. Any debris that covers the discharge openings can interrupt the performance of the pond and can impact downstream channel stability.

  Draining the pond should not be necessary to perform routine maintenance of the outlet structure. However, if it is needed, see dewatering procedure previously discussed. . Repair any visible leaks or cracks in the outlet structure immediately. Inspect the outlet pipe for leaks and make any necessary repairs immediately. A cleaning rod may be needed to pass through any low level orifice to ensure that debris has been cleared form the opening. Rake all strainers that are part of the original design so they are clean and open.

Figure 4.14
Outlet Structure

- *Maintenance Valve:* Check the maintenance drain valve during each maintenance operation of the pond to ensure that it opens and closes properly. Repair any malfunction of the valve immediately. This procedure should be performed at least twice a year during routine maintenance inspections.

5.0 WETLAND

Figure 5.1
Wetland

There are several major components of a wetland (Figure 5.1) and each contributes to the overall performance of the facility to treat stormwater runoff. Runoff is discharged into a forebay (similar to a sediment basin) which provides for settlement and pre-treatment of particulates prior to flowing into the main pond area for additional treatment. After stormwater leaves the forebay area, it travels through the berm or over a weir in the berm which separates the forebay from the pond storage area. The main body of the pond consists of several different wetland plant zones (shallow and deep) with main channels running between them. These wetland plant zones are planted for nutrient uptake. Most ponds are designed to temporarily store stormwater runoff for various storm events on top of the permanent pool elevation and are released over a specified period of time. The outlet structure, usually located at the downstream end of the pond, controls the discharge flow from the pond. The outlet discharge has an energy dissipater downstream to protect the discharge channel from erosion. Some ponds may also have an overflow weir designed in the embankment to release erosive flows safely downstream and help protect the berm from failure.

Maintenance activities for a wetland facility are necessary to ensure longevity of the water quality treatment. This includes inspection of inlets to ensure they are clear of debris and bypass is not occurring. All erosion within the drainage area of the wetland should be stabilized to eliminate sedimentation and premature storage loss within the forebay or main pond area. Keep all outlet structures clear of debris so the design discharge rates are not exceeded and water quality treatment is provided.

5.1 Routine Maintenance Activities

Perform the following activities on a routine basis (see Section 10 for recommended maintenance schedule) and after any significant rainfall event. Most of the activities listed below can be performed by non-professionals or landscape maintenance staff. . Not performing the activities listed below may result in major failures and problems listed in the annual report which can become very costly correction expenses for the owner.

Always use good safety techniques when performing maintenance activities and never do any task above your level of competence. Care should always be taken when performing tasks around the BMP pond areas. Never wade or work near the water's edge without someone else being around and always use appropriate safety equipment, such as personal safety devices (PSD).

- *Watering:* Plants and shrubs may require watering after initial planting periods (first 2 to 3 years) or during drought.
- *Erosion*: Inspect inlet and outlet areas of the wetpond facility for erosion. Immediately re-seed any bare spots or areas where natural soils are exposed around the facility perimeter or embankments. Inspect the drainage area for erosion. Repair erosion and stabilize as needed to prevent sediment build up in the wetland.
- *Nutrients, Herbicides, and Pesticides:* Nutrients and pesticides should not be required. Consult with a professional if questionable conditions occur. The addition of these types of chemicals or products may have an adverse effect on the performance of the water treatment and can be harmful to the plants. Herbicides may be needed to control nuisance vegetation and must be applied by a licensed aquatic professional.
- *Algae Control:* Excessive algae is an indicator of too many nutrients in the pond that can have adverse effects on the environment, such as dissolved oxygen depletion that can lead to fish kill. You should always consult with a qualified professional when treating algae. Some suggestions would be to reduce nutrients in the drainage area (reduce fertilizing, remove pet waste and leaves/organics, use phosphorus free cleaners and detergents, and maintain septic and sewer systems). Another suggestion would be to aerate the pond with a fountain or other aeration device. It is discouraged to use chemicals to treat algae because it will cause adverse effects on the environment, aquatic life and plant life.
- *Wildlife control:* Monitor and implement measures to control destructive wildlife. Geese can destroy the vegetation, especially young plants, and protection fencing may be needed. Beavers can clog outlet structures, which can causing flooding and prevent the BMP from functioning as designed. Muskrats can damage plants and dams. Always consult a wildlife professional on how to properly control and/or remove unwanted wildlife.
- *Trash and Debris:* Remove all trash and debris from forebay or main facility area. All debris should be removed immediately to avoid obstructions within the flow area of the facility and to keep outlet devices clear. Dispose of all debris appropriately including recycling if possible. Periodic weeding may be needed to eliminate any grass or weeds from the facility area. Some trash and debris can be removed using a net on a long handle. In some cases, a small water craft may be necessary to retrieve trash within the pond area. However, never use a water craft alone and always use appropriate safety equipment such as personal safety devices.
- *Leaves:* Remove any leaves that have accumulated in or near the facility area. Leaves can accumulate on or around vegetation and impact plant life. They also need to be removed after a rainfall to avoid clogging of the outlet structure which can cause flooding.
- *Outlet Structure:* Clear any debris or trash that is blocking the overflow weir and storm system. Clean off any protection device, such as wire fabric, used to keep trash and debris from entering the outlet structure. Make sure that all outlet openings, such as an orifice or weir, are kept clear of debris. Drain valves should be exercised several times a year for a short time to ensure that they are not blocked and functioning properly.
- *Plants:* Inspect plants that have been damaged or need irrigation. Remove and replant dead or diseased plants as soon as possible. If the entire facility shows signs of disease or widespread problems, contact a professional to minimize damage and plant replacement. Wetland vegetation must be maintained to achieve at least 90% of surface area coverage.
- *Mowing:* Mow grass areas surrounding the facility annually to prevent trees and unwanted undergrowth from becoming established. BMPs located near residential structures may require higher aesthetic standards. Only mow these areas to a minimum of 3 inches in height. Shorter vegetation may contribute to increased erosion and weeds.

- *Grass Clippings:* Remove any grass clippings around the perimeter of the facility after grass cutting practices. These clippings can contaminate the pond, clog outlet devices, or be washed into the storm system and into creeks.
- *Rip Rap:* Replace any rip rap that has been moved from the energy apron area. Should rip rap be displace on a regular basis, contact a professional for additional correction remedies.
- *Forebay:* The forebay area has appropriate storage available to pre-treat runoff during a storm event. Should the forebay's storage area be filled in with sediment, contact a professional to have the forebay area cleaned or remove by hand and disposed of appropriately.

- *Maintenance Access:* Mow and maintain maintenance access areas regularly to provide unimpeded entry to the BMP facility for inspection and maintenance activities. Maintain any structural materials used for the construction of an access road (Figure 5.2) in a good condition to allow for construction equipment during maintenance activities.

Figure 5.2

Maintenance Access Road

5.2 Major Maintenance Activities

The following maintenance activities should be performed by professionals that have specific training or specialized equipment.

- *Forebay:* Perform excavation or vacuuming of the forebay every 7 years or when the storage volume is depleted by 50%. Dispose of all debris appropriately and do not allow it to re-enter the storm system or be carried to a creek or stream. A bench mark should be shown on the maintenance plan to identify the elevation of the original forebay bottom. The forebay area is most likely the primary feature in a wetland that will require periodic maintenance to ensure that adequate storage is available to pre-treat runoff (deposit sediments) before flowing into the main pond area. The forebay needs to be drained or pumped dry (see Charlotte Land Development Standards Manual for the Dewatering Standard) in such a manner that untreated water is not discharged downstream of the facility during maintenance practices. The forebay needs to be excavated to the original size based on the approved engineering plans record and stabilized after the area has been restored. All outfall energy dissipaters need to be reconstructed to the original size if disturbed during the maintenance of the forebay. Any plantings that are disturbed need to be replaced as per the original approved planting plan.
- *Sedimentation:* Monitor sediment accumulation and remove at 20 years or when surviving vegetation coverage is less than 90%. Depths in the wetland should be a minimum 30% shallow land (normal pool to 1 foot), 28% Shallow water (0-6 inches), and a minimum 15% deep pool (greater than 18 inches). After sediment has been removed and all grading is complete, make sure that all pond characteristics are reconstructed per the original design. This includes reconstruction of slopes, wetland plant zones (to the actual size and elevations), energy dissipaters, and berm stabilization of the pond area, replanting of aquatic plants (per the original plan) and closing the pond drain valve to allow the pond to refill to its permanent pool elevation.
- *Earthen Berm (Rip rap Lined):* The berm between the forebay and the main body of the pond may need to be repaired to make sure that any eroded areas are backfilled, compacted and stabilized. This berm is generally constructed of good structural material and lined on the surface with rip rap to guard against erosion and breach failure. Any areas of the berm that are showing signs of settlement, undermining, or erosion shall be backfilled, compacted, lined and stabilized immediately.
- *Dewatering:* Should the main pond need to be accessed for maintenance, the permanent pool of water needs to be lowered or completely drained (figure 5.3) as necessary.

Figure 5.3
Draining Pond with Maintenance Valve

The permanent pool of water stored in the main pond area can be drained by opening the maintenance valve on the outlet structure until an adequate amount of water is released. The pond should drain in a minimum of 2 days. Draining the water is necessary to minimize disturbance to the downstream channels. After the initial flow has been released, the discharge flow should appear clear. If it appears to be unclean, then an alternative operation (filtering) must be implemented to prevent pollution in the downstream channel. A suitable practice to perform this task can be found and followed as referenced in the Charlotte Land Development Standards Manual - Dewatering Standard.
Once the pond has been drained successfully, the outlet structure and maintenance valve can be cleaned, and then the pond can be allowed to refill to its permanent pond elevation. ..

- *Rip Rap:* Replace any rip rap that has been removed or in areas where the native soil is exposed.
- *Plants and Shrubs:* Treat or replace any diseased or dead vegetation immediately. Reestablish all vegetation to the specifications described on the approved plan. If an on-going problem continues with a specific species of plant, consult with a professional to determine the cause. All plants used in the BMP area are to be well adapted for this local area.
- *Invasive Plants: Remove* all invasive plants (figure 5.4) from all hydrological zones. The procedure for removing the invasive plants is similar to the main pond maintenance procedure. Care should be taken not to disturb required wetland plants. Use a licensed aquatic professional to control nuisance vegetation.

Figure 5.4
Invasive Plants

Replant all vegetation in the BMP per the original planting plan. Revisit the site periodically to ensure that the plants have been successfully established.

- *Maintenance Access:* Maintenance access roads may need to be scraped or gravel replaced due to settlement, erosion, or use. All maintenance roads are to remain in good condition throughout the life of the facility to allow for construction equipment during maintenance activities.
- *Embankment:* The embankment of the pond should be free of any settlement; eroded areas should be backfilled and compacted appropriately. Stabilize all exposed native soil areas immediately.
- *Main Pond Slopes:* All slope areas leading to the main pond should not be greater than a 3:1 slope (horizontal to vertical). Repair all slopes if any native soils are exposed. Erosion from unstable slopes will cause increased sedimentation in the forebay or pond, require premature maintenance to be performed, and will be very costly for the owner.
- *Pond Dam and Spillway:* Both the dam and spillway shall be kept free of woody vegetation by regular mowing during the growing season. Woody vegetation must not be planted on a dam embankment or allowed to grow within 15 feet of the toe of the dam and 25 feet from the principal spillway structure. If the dam or spillway has large woody vegetation (> 2") then a soil report for the structural integrity of the dam will be required by a soil engineer. The dam should also be inspected for any leaks or sink holes and repaired immediately if needed.
- *Outlet Structure:* The outlet structure may need routine cleaning of debris. Any debris that covers the discharge openings can interrupt the performance of the pond and impact downstream channel stability.

Draining the pond should not be necessary to perform routine maintenance of the outlet structure. However, if a situation warrants lower water levels, follow the procedure above for dewatering the pond. Immediately repair any leaks or cracks in the outlet structure that are visible. A cleaning rod may be needed to pass through any low level orifice to ensure that debris has been cleared form the opening. Clean and open all strainers that are part of the original design

- *Maintenance Valve:* Check the maintenance valve during each maintenance operation of the pond to ensure that it opens and closes properly. Immediately repair any malfunction of the drain valve. The maintenance valve should be checked at least twice a year during routine maintenance inspections.

6.0 ENHANCED GRASS SWALE / INFILTRATION TRENCH

Enhanced grass swales and infiltration trenches are reasonably flat channels with improved material constructed along the travel path of the storm runoff. This enhances and encourages infiltration characteristics. Maintenance for these BMPS consists of grooming vegetation and removing sediment. .

Figure 6.1
Grass Swale

6.1 Routine Maintenance Activities

Perform the following activities on a routine basis (see Section 10 for recommended maintenance schedule) and after any significant rainfall event. Most of the activities listed below can be performed by non-professionals or landscape maintenance staff. Not performing the activities listed below may result in major problems identified in annual reports or failures which can become very costly to correct.

- *Watering:* Watering may be required after initial planting periods or during drought to maintain a good vegetation cover.
- *Grass:* Mowing schedules and practices are dictated by the location of the BMP to a degree, but all grass will be mowed between 3- 6 inches. In areas that have high aesthetic requirements, grass should be mowed to a minimum of 3 inches. In more remote areas grass up to 6 inches may be more acceptable.
- *Grass Clippings:* Remove grass clippings if possible so infiltration into the subsoil material is not impeded.
- *Invasive Plants:* Invasive species must not be allowed to encroach within the swale. Care should be taken not to disturb required ground cover or plants. Use a licensed professional to control nuisance vegetation.
- *Trash:* Remove trash routinely during normal maintenance practices. Trash left uncollected can block check dams and cause water to over flow channel slopes during heavy rains.
- *Check Dams:* Clear all check dams of debris and restore any displaced rip rap during routine maintenance practices.

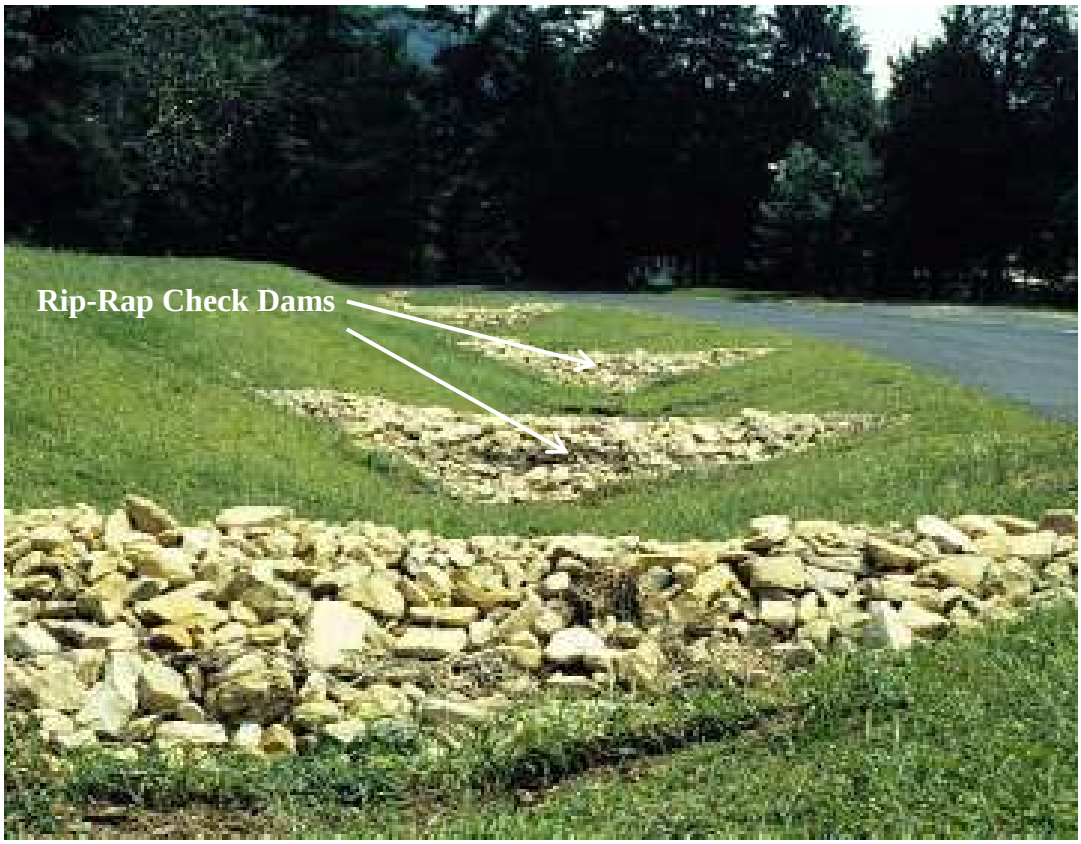

Figure 6.2
Grass Swale with Check Dams

- *Sedimentation:* Remove sediment when accumulation occurs. Removal of incidental accumulation will reduce major removal in the future. All sediment that is removed should be disposed of in an area so it does not re-enter the swale or is allowed to drain into creeks or streams.
- *Aeration:* Seasonal aeration improves infiltration characteristics of the channel bottom that mowing practices compact. Several passes with a common lawn aerator is sufficient to make this improvement. This operation can be performed in the fall and spring seasons and is highly encouraged.

6.2 Major Maintenance Activities

Perform the following maintenance activities by professionals that have specific training or specialized equipment.

- *Sedimentation:* Remove large amounts of sedimentation when infiltration has been reduced to the point that water stands in the channel for more than 2 days. Sediment can be removed by scraping the first inch or two of cover, including grass, until a clean portion of the subsoil layer is reached. If necessary, restore the subsoil removed with new amended soil as shown on the approved plan. Cultivation of the subsoil is recommended prior to re-establishing the vegetation to enhance infiltration characteristics and to address compaction created by construction equipment. Watering may be required after initial planting periods or during drought to maintain a good vegetation cover.
- *Removal of subsoil:* If the subsoil layer is contaminated or is filled with sediment, remove and replace the entire subsoil layer. Care is recommended when excavating near the bottom of the trench so the sub-drain pipe is not damaged. Replace the subsoil layer with the same material and consistency as shown on the approved plan.
- *Sub-drain maintenance:* Inspect and clean the sub-drain pipe located in the bottom of the trench annually and more often if signs of reduced infiltration are observed. Removal of the sub-drain cleanout cap provides access to the sub-drain pipe. Cleaning rods or devices are usually adequate to break up any clogged pipes due to the accumulation of debris and dirt. A high pressure nozzle can be pushed through the cleanout pipe to flush any loss trash and remaining dirt out of the system.
- *Check dams:* Check dams that are blocked should be removed and reconstructed to original elevation and size. Care should be taken to replace riprap stone with the same size stone as the original design.
- *Grass:* Immediately re-establish any exposed areas to reduce damage to the subsoil and/or erosion.
- *Nutrients, Herbicides, and Pesticides:* Nutrients and pesticides should not be required. Consult with a professional if questionable conditions occur. The addition of these types of chemicals or products may have an adverse effect on the performance of the water treatment and can be harmful to the plants. Herbicides may be needed to control nuisance vegetation and must be applied by a licensed aquatic professional.

7.0 FILTER STRIP

Filter strips are improved natural areas that encourage infiltration of rainfall runoff. They typically are constructed on fairly flat slopes and covered with loose soils and vegetation. Some localized ponding can be expected for short periods of time. Limiting equipment and activity from filter strips is important for limiting soil compaction and improving the functionality of this type of BMP.

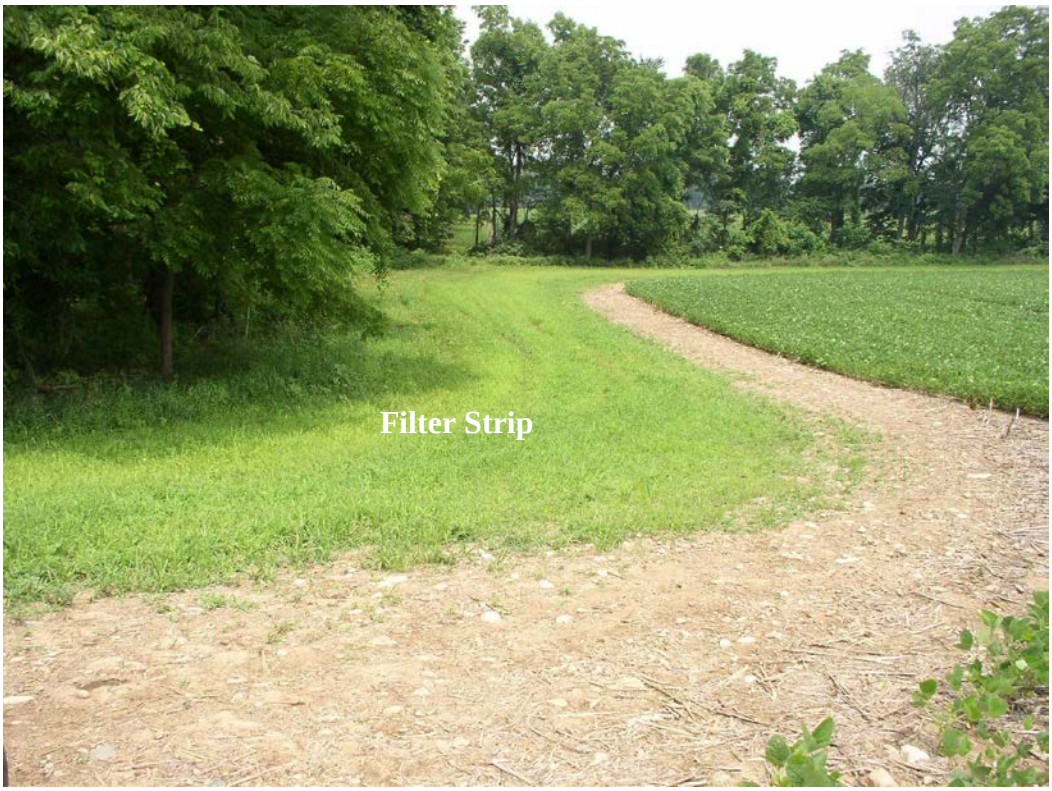

Figure 7.0
Filter Strip

7.1 Routine Maintenance Activities

The following activities shall be performed on a routine basis (see Section 10 for recommended maintenance schedule) and after any significant rainfall event. Most of the activities listed below can be performed by non-professionals or landscape maintenance staff. Not performing the activities listed below may result in major problems identified in the annual report or failures which can become very costly to the owner to correct.

- *Watering:* Watering may be required after initial planting periods or during drought to maintain a good vegetation cover.
- Reseed filter strip to maintain a dense growth of vegetation.
- Repair erosion immediately to ensure that runoff disperses and flows are spread across the filter strip area to achieve maximum infiltration.
- Mow grass areas at least two to three times a year to a minimum height of 3inches.
- Clean debris and litter as needed.
  After a rainfall event, clear debris and trash from the openings of outlet structures.

Figure 7.1
Filter Strip Inlet

- Perform aeration of the filter strip in the fall and spring to encourage infiltration and address compaction from use or mowing practices.
- Remove grass clippings after any harvesting or mowing activities.

8.0 EXTENDED DRY DETENTION

Extended dry detention basins are impoundments constructed to create a storage area for stormwater runoff. These basins allow stormwater to be detained for a specified period of time during different size storm events. After the stormwater has been released from detention, the basin returns to a dry state. The storage level in this type of BMP is manually controlled or determined by an outlet structure. . Maintenance for this type of BMP usually consists of mowing the storage area periodically, cleaning the outlet device and making sure the embankment is safe and structurally sound. Some of these BMPs may have a forebay that pretreats the runoff prior to dispersing it into the main storage area. The forebay may need periodic excavation to remove sediment every 7 years or when sediment volume exceeds 50% of the storage volume. As seen in Figure 8.1 dry

detention ponds temporarily store water for several days to control discharge downstream. The Forebay in Figure 8.1 is clean and has ample storage to pre-treat runoff adequately.

Figure 8.1
Partially Full Dry Detention Basin

8.1 Routine Maintenance Activities

The following activities are performed on a routine basis (see Section 10 for recommended maintenance schedule) and after any significant rainfall event. Most of the activities listed below can be performed by non-professionals or landscape maintenance staff. Not performing these activities may result in major problems identified in the annual report or failures which can become very costly to the owner to correct.

Always use good safety techniques when performing maintenance activities and never perform any task above your level of competence. Care should always be taken when performing tasks around ponds or deep water areas. Never wade or work near the water edge without someone else being around and always use appropriate safety equipment, such as personal safety devices (PSD).

- *Forebay:* The forebay area as shown in the photograph above (Figure 8.1) has appropriate storage available to pre-treat runoff during a storm event. Should the forebay storage be filled in with sediment, contact a professional to have the forebay area cleaned, unless it can easily be removed by hand and disposed of appropriately.

- *Storage Area:* The storage area should be mowed periodically to prevent undergrowth and establishment of trees. It is suggested to keep the storage area maintained to a maximum of 6 inch grass height. This will minimize loss of storage area due to undergrowth and grass between

maintenance periods. Some dry detention ponds are used for recreation areas or other amenities and may need additional maintenance based on that land use.

- *Mowing:* Mow grass areas surrounding the facility annually to prevent trees and unwanted undergrowth from becoming established. BMPs that are located near residential areas and have high aesthetic requirements (Figure 8.2) may be mowed to a minimum of 3 inches in height.

Figure 8.2
Well Maintained Detention Basin

- *Grass Clippings:* Remove any grass clippings around the perimeter of the facility after grass cutting practices. These clippings can clog outlet devices or be washed into the storm system and into creeks.
- *Rip Rap:* Replace any rip rap that has been moved from the energy apron area. Should rip rap be displaced on a regular basis, contact a professional for additional correction remedies.
- *Outlet Structure:* Clear any debris or trash that is blocking the overflow weir and storm system. Clean off any protection device, such as wire fabric, that issued to keep trash and debris from entering the outlet structure. Clear all outlet openings, such as an orifice or weir, of debris. Drain valves should be opened several times a year for a short time to ensure that they are not blocked. Repair cracks or failures in the outlet structure immediately.
- *Maintenance Access:* Maintenance access roads may need to be scraped or gravel replaced due to settlement, erosion, or use. All maintenance roads should remain in good condition throughout the life of the facility to allow for construction equipment during maintenance activities.
- *Embankment:* The embankment of the storage area should be free of any settlement. Backfill any eroded areas compact it appropriately, and stabilize all exposed and eroding native soil areas immediately.

- *Emergency Weir:* The emergency weir for dry detention is usually a separate device constructed of concrete. Clear all debris from this structure after a significant rainfall event to reduce the risk of flooding. Repair any undermining of the weir or erosion around the perimeter area. All earthen areas of the weir should be stabilized with established grass. Repair any deficiencies of the weir such as cracks or depressions.
- *Pond Dam and Spillway:* Both the dam and spillway shall be kept free of woody vegetation by regular mowing during the growing season. Woody vegetation must not be planted on a dam embankment or allowed to grow within 15 feet of the toe of the dam and 25 feet from the principal spillway structure. If the dam or spillway has large woody vegetation (> 2") then a soil report for the structural integrity of the dam will be required by a soil engineer. The dam should also be inspected for any leaks or sink holes and repaired immediately if needed

8.2 Major Maintenance Activities

Professionals with specific training or specialized equipment shall perform the following maintenance activities:

- *Sedimentation:* Clean dry detention storage areas that have an accumulation of sediment or have over growth as shown in Figure 8.3. Sediment may need to be excavated and removed by a backhoe or loader depending on the amount that has accumulated. Detention basins that have reduced storage from lack of this type of maintenance may cause flooding downstream of the facility.

Figure 8.3
Over Grown Dry Detention

- *Emergency Weir:* Emergency weirs constructed of concrete shall remain in good condition throughout the life of the structure. Repair any broken or cracked sections of the weir immediately. Repair and stabilize any undercut or areas of erosion around the weir structure immediately.
- *Outlet Structure:* Repair outlet structures, such as cracks or settlement around the base immediately. This reduces catastrophic failures of the structure during heavy rain storms and potential flooding downstream.
- *Embankment: Repair* embankment failure immediately by backfilling and compacting the eroded area, and stabilizing with grass to prevent reoccurrence of erosion. Ensure that embankment construction and fill material complies with the Charlotte Mecklenburg BMP Design Manual.

9.0 SAND FILTER

Sand filters are BMPs that are usually constructed of concrete or pipe and incorporate a sand media layer which acts as a filter. Sand filters require routine cleaning which is usually done by specialized equipment.

Figure 9.0
Sand Filter

9.1 Routine Maintenance Activities

Perform the following activities on a routine basis (see Section 10 for recommended maintenance schedule) and after any significant rainfall event. Most of the activities listed below can be performed by non-professionals or landscape maintenance staff. Not performing the activities listed below may result in major problems identified in the annual report or failures which can become very costly to the owner to correct. Routine maintenance activities associated with a sand filter consist of removing debris and silt from discharge openings and grates. Do not enter any closed sand filter device. Only trained staff with specific training and specialized equipment shall perform this maintenance procedure. .

9.2 Major Maintenance Activities

Only professionals with specific training and specialized equipment should perform the following maintenance activities. .

- *Forebay:* A sand filter forebay is a chamber that collects floatables, trash, sediment and other debris. Cleaning the forebay may be accomplished by hand work, but will most likely be done by a vacuum truck. The structure may need to be dewatered prior to any cleaning operation. This can be done by opening the drain valve or vacuuming the water with a vacuum truck.
- *Sedimentation Chamber:* The sedimentation chamber is located downstream of the forebay and can be cleaned periodically by removing the first layer of sediment and restoring the sand filter media. Should the sand media become contaminated; the entire sand media will need to be replaced. This task can be done by vacuuming the sand media out of the structure.

10.0 Routine Maintenance Tasks and Schedule

Wet Pond Maintenance Tasks and Schedule	
TASK	**SCHEDULE**

Inspect and cleanout forebay	Monthly inspection. Remove sediment every 7 years or whenever the sediment volume exceeds 50% of storage volume
Measure sediment volume	Yearly – Dredging every 20 years or when 25% of permanent pool volume has been lost
Mow and inspect banks. Stabilize eroded areas	Monthly
Inspect and Clean Outlet / inlet	Monthly
Remove unwanted vegetation and trash	Monthly
Visually inspect water quality	Monthly
Inspect / exercise all mechanical devices, valves, etc.	Yearly
Inspect for structural damage, leaks, etc.	Yearly
Manage rodents	As needed
Check security	As needed

Dry Pond Maintenance Tasks and Schedule	
TASK	**SCHEDULE**
Inspect and cleanout forebay	Monthly inspection. Remove sediment every 7 years or when sediment volume exceeds 50% of storage volume
Mow and inspect bank. Stabilize eroded areas	Monthly
Inspect and clean outlet / inlet	Monthly
Remove unwanted vegetation and trash	Monthly
Inspect for structural damage, leaks, etc.	Yearly
Inspect / exercise all mechanical devices, valves, etc.	Yearly
Evaluate sediment level (remove as needed)	Yearly
Check security	As needed

Wetland Maintenance Tasks and Schedule	
TASK	**SCHEDULE**
Cleanout forebay	Monthly inspection. Remove sediment every 7 years or when sediment volume exceeds 50% of storage volume
Control invasive species; / Manage vegetation and replant to maintain design densities	Semi-Annual
Mow banks mowing and stabilize eroded areas	Monthly
Inspect and clean outlet / inlet	Monthly
Remove trash	Monthly
Inspect for structural damage, leaks, etc.	Yearly
Visually inspect water quality	Monthly
Manage rodents and mosquitos	As needed
Evaluate sediment level (remove at 20 yrs. or when plants are being impacted)	Yearly
Check security	As needed

Bioretention Maintenance Tasks and Schedule	
TASK	**SCHEDULE**
Prevent sedimentation	Monthly inspection and watch on surrounding drainage areas such as out parcels and parking lots
Clean off the drop box	Monthly
Mow the perimeter	Monthly (maintain 2 – 6 inch height)
Inspect for proper drawdown / clogging	Monthly
Stabilize eroded areas	Monthly
Remove trash	Monthly
Pruning	Yearly
Renew mulch	Yearly
Replace mulch	Every 3 years
Inspect plants, replace as necessary	Monthly
Test P Index of soil media and replace if over 50 ppm (first this has been mentioned?)	Every 2 years
Replace pea gravel diaphragm	As needed
Remove sediment	As needed
Mow perimeter	Monthly

Sand Filter Maintenance Tasks and Schedule	
TASK	**SCHEDULE**
Street sweep parking lot	Quarterly
Remove trash	Monthly
Inspect outlet for obstructions	Monthly
Inspect for clogging	Monthly
Inspect inlet grates	Monthly
Skim sand media	Yearly
Pump oil and grit from sedimentation chamber	Yearly or at 50% full
Replace sand media	As needed (expect 3 years)

Infiltration Trench Maintenance Tasks and Schedule	
TASK	**SCHEDULE**
Maintain stone or mulch top surface	Yearly
Clean forebay if present	Yearly or at 50% full
Remove trash	Monthly
Remove unwanted vegetation	Monthly
Check observation wells following precipitation events to ensure proper infiltration	Monthly

Grassed Channels / Enhanced Swales Maintenance Tasks and Schedule	
TASK	**SCHEDULE**
Mowing	Weekly – Monthly (as needed to retain 2-6 inch height)
Inspect condition of dispersion devices and check dams	Yearly
Remove trash	Weekly – Monthly (prior to mowing)
Reseed	Yearly
Stabilize eroded areas	Monthly
Remove sediment	Yearly
Inspect for clogging (enhanced swale)	Monthly
Inspect pea gravel diaphragm and replace / repair as necessary	Monthly

Filter Strip with Flow Dispersion Maintenance and Schedule	
TASK	**SCHEDULE**
Mow grass	Weekly – Monthly (as needed to retain 2-6 inch height)
Stabilize eroded areas throughout the filter strip and below the flow dispersion device	Monthly
Inspect gravel diaphragm (if present) and remove sediment	Yearly
Check outlet pipes on berms (if present) for clogging	Monthly
Remove debris / unwanted vegetation from behind lip of level spreader (if present)	Monthly
Repair flow dispersion device to prevent formation of channels in filter strip	Monthly as needed
Reseed grass	Yearly

11.0 Charlotte-Mecklenburg BMP Maintenance and Inspection Check List

Mecklenburg County BMP Maintenance and Inspection Check List
Grassed Channels / Swales
[Note: a separate form must be used for each BMP]

Project Name: _____
Project Address: _____
Owner's Name: _____
Owner's Address: _____
Recorded Book and Page Number of the Lot: _____
BMP Name and Location: _____
Inspection Date: _____
Inspector: _____
Inspector Address/Phone Number: _____

Date Last Inspected: _____

Type of Inspection: Visual

Maintenance Item	Satisfactory	Unsatisfactory	Inspection Frequency	Comments/Actions Required
1. Debris Cleanout				
Clear of trash and debris			W-M	
2. Vegetation Management				
Grass height (maintain 3-6 inch height)			W-M	
Unwanted vegetation present			M	
Ground cover well established (annual reseeding needed)			Q	
3. Erosion				
Evidence of soil erosion in swale or contributing areas			M	
4. Dewatering				
Evidence of standing water			M	
5. Sedimentation				
Sediment accumulation			Y	
6. Energy dispersion / check dams				
Condition of dispersion devices			Y	
Condition of check dams			Y	
Inspect pea gravel diaphragm and replace / repair as necessary			M	
7. Miscellaneous				

W=Weekly, M=Monthly, Q=Quarterly, Y=Yearly (revision 0)

Escrow Account Documentation (if applicable**):** Attach documentation of BMP maintenance escrow account activity to this form. This may be provided in the form of a bank statement which includes the current balance and account activity for the previous 12 months.

Maintenance Actions Taken: If any of the above items were marked "U" for unsatisfactory, explain the actions taken and time table for correction. Attach additional pages as necessary.

_____
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_____

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_____

Additional Comments:

_____

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_____

I do hereby certify that I conducted an inspection of the BMP described herein. I further certify that at the time of my inspection said BMP was performing properly and was in compliance with the terms and conditions of the approved maintenance agreement required by the Post-Construction Storm Water Ordinance.

Certification:

_____ _____

Inspectors Signature **Date**

(Seal)

[Note: The Post-Construction Storm Water Ordinance requires that inspections of all BMPs begin within one (1) year from the date of as-built certification, continue each year thereafter, and that these inspections are completed by a North Carolina Professional Engineer or Landscape Architect. All inspections must be documented and submitted using this form.

Mecklenburg County BMP Maintenance and Inspection Check List
Wet Pond
[Note: a separate form must be used for each BMP]

Project Name: _____
Project Address: _____
Owner's Name: _____
Owner's Address: _____
Recorded Book and Page Number of the Lot: _____
BMP Name and Location: _____
Inspection Date: _____
Inspector: _____
Inspector Address/Phone Number: _____
Date Last Inspected: _____

Maintenance Item	Satisfactory	Unsatisfactory	Inspection Frequency	Comments/Actions Required
1. Debris Cleanout				
Clear of trash and debris			M	
2. Vegetation Management				
Banks / surrounding areas mowed			M	
Unwanted vegetation present			M	
Condition of wetland plants			M	
3. Erosion				
Evidence of soil erosion on banks or contributing drainage areas or outlet			M	
4. Sedimentation				
Forebay sediment inspection (cleanout every 7 years or when 50% full)			M	
Pond volume measurement (dredge every 20 years or when 25% of permanent pool volume lost)			Y	
5. Energy dissipators				
Condition of dissipator at inlets			Y	
Condition of dissipator at outfall			Y	
6. Inlet				
Condition of pipe and/ or swale (cracks, leaks, sedimentation, woody vegetation)			M	
7. Outlet				
Condition of orifice (drawdown device)			M	
Condition of riser outlet and trash rack			M	
8. Emergency spillway and dam				
Condition of spillway			Y	

Condition of dam (i.e. leaks, holes, woody vegetation)			Y	
9. Mechanical devices				
Inspection of all valves, etc. (should be exercised yearly)			Y	
10. Visual Inspection				
Appearance of water (ie. sheen, muddy, oily, clear, algae, etc.)			M	
Mosquito larvae			M	
11. Forebay embankment				
Condition of forebay embankment (breached?)			M	
12. Water elevation				
Is pond at normal pool elevation?			M	
13. Miscellaneous				

W=Weekly, M=Monthly, Q=Quarterly, Y=Yearly (revision 6/07)

If applicable: Attach documentation of BMP maintenance escrow account activity to this form. This may be provided in the form of a bank statement which includes the current balance and account activity for, the previous 12 months.

Maintenance Actions Taken: If any of the above items were marked "U" for unsatisfactory, explain the actions taken and time table for correction. Attach additional pages as necessary.

_____

_____

Additional Comments:

_____

_____

I do hereby certify that I conducted an inspection of the BMP described herein. I further certify that at the time of my inspection said BMP was performing properly and was in compliance with the terms and conditions of the approved maintenance agreement required by the Post-Construction Storm Water Ordinance.

Certification:

_____ _____

Inspectors Signature **Date**

(Seal)

[Note: The Post-Construction Storm Water Ordinance requires that inspections of all BMPs begin within one (1) year from the date of as-built certification, that they continue each year thereafter., and that these inspections are completed by a North Carolina Professional Engineer or Landscape Architect. All inspections must be documented and submitted using this form which must be signed and sealed by the inspector.

Mecklenburg County BMP Maintenance and Inspection Check List
Wetland

Note: A separate form must be used for each BMP

Project Name: _____
Project Address: _____
Owner's Name: _____
Owner's Address: _____
Recorded Book and Page Number of the Lot: _____
BMP Name and Location: _____
Inspection Date: _____
Inspector: _____
Inspector Address/Phone Number: _____
Date Last Inspected: _____

Maintenance Item	Satisfactory	Unsatisfactory	Inspection Frequency	Comments/Actions Required
1. Debris Cleanout				
Clear of trash and debris			M	
2. Vegetation Management				
Banks/ surrounding areas mowed			M	
Unwanted vegetation present (replant semi-annually to maintain design densities)			M	
Condition of wetland plants			M	
3. Erosion				
Evidence of soil erosion on banks, contributing drainage areas, or outlet			M	
4. Sedimentation				
Forebay sediment inspection (cleanout every 7 years or when 50% full)			M	
Sediment level in wetland (cleanout every 20 years or when plants are being impacted)			Y	
5. Energy dissipators				
Condition of dissipater at inlets			Y	
Condition of dissipater at outfall			Y	
6. Inlet				
Condition of pipe and/ or swale (cracks, leaks, sedimentation, woody vegetation)			M	
7. Outlet				
Condition of orifice (drawdown device)			M	
Condition of outlet			M	
8. Mechanical devices				

Inspection of all valves, etc. (yearly)			Y	
9. Visual water inspection				
Appearance of water (ie. sheen, muddy, oily, clear, algae, etc.)			M	
Water level maintained at permanent pool			Y	
Mosquito larvae			M	
10. Dam / Embankment				
Seepage through embankment			Y	
Woody vegetation on embankment			Y	
11. Miscellaneous				

W=Weekly, M=Monthly, Q=Quarterly, Y=Yearly

Escrow Account documentation (if applicable): Attach documentation of BMP maintenance escrow account activity to this form. This may be provided in the form of a bank statement which includes the current balance and account activity for the previous 12 months.

Maintenance Actions Taken: If any of the above items were marked "U" for unsatisfactory, explain the actions taken and time table for correction. Attach additional pages as necessary.

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Additional Comments:

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I do hereby certify that I conducted an inspection of the BMP described herein. I further certify that at the time of my inspection said BMP was performing properly and was in compliance with the terms and conditions of the approved maintenance agreement required by the Post-Construction Storm Water Ordinance.

Certification:

_____ _____

Inspectors Signature **Date**

(seal)

Note: The Post-Construction Storm Water Ordinance requires that inspections of all BMPs begin within one (1) year from the date of as-built certification, continue each year thereafter, and that these inspections are completed by a North Carolina Professional Engineer or Landscape Architect. All inspections must be documented and submitted using this form which must be signed and sealed by the inspector.

Mecklenburg County BMP Maintenance and Inspection Check List
Bioretention
Note: A separate form must be used for each BMP

Project Name: _____
Project Address: _____
Owner's Name: _____
Owner's Address: _____
Recorded Book and Page Number of the Lot: _____
BMP Name and Location: _____
Inspection Date: _____
Inspector: _____
Inspector Address/Phone Number: _____
Date Last Inspected: _____

Maintenance Item	Satisfactory	Unsatisfactory	Inspection Frequency	Comments/Actions Required
1. Debris Cleanout				
Clear of trash and debris			M	
2. Vegetation Management				
Banks/ surrounding areas mowed			M	
Unwanted vegetation present			M	
Condition of plants			M	
Condition of mulch - Must be double hammered hardwood, 3 inches deep (replace every 3 years and renew yearly)			M	
3. Erosion				
Evidence of soil erosion on banks or contributing areas			M	
4. Sedimentation				
Forebay (if present) sediment inspection (cleanout when 50% full)			M	
Evidence of sediment in bioretention cell			M	
5. Energy dissipators				
Condition of dissipator at inlets			Y	
Condition of dissipator at outfall			Y	
Inspect pea gravel diaphragm (replace as needed)			M	
6. Inlet				
Condition of pipe of swale (cracks, leaks, sedimentation, woody vegetation)			M	
7. Outlet				
Condition of outlet / drop box			M	

8. Dewatering (drawdown must be between 48 hours and 120 hours)				
Evidence of standing water			M	
9. Overall functionality				
Evidence of bypass			M	
P Index test results for soil media (indicate test results and date last tested)			Y2	
10. Miscellaneous				

W=Weekly, M=Monthly, Q=Quarterly, Y=Yearly, Y2=every 2 yrs.

Escrow Account Documentation (if applicable): Attach documentation of BMP maintenance escrow account activity to this form. This may be provided in the form of a bank statement which includes the current balance and account activity for the previous 12 months.

Maintenance Actions Taken: If any of the above items were marked "U" for unsatisfactory, explain the actions taken and time table for correction. Attach additional pages as necessary.

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Additional Comments:

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Certification:

_____ _____

Inspectors Signature **Date**

(seal)

[Note: The Post-Construction Storm Water Ordinance requires that inspections of all BMPs begin within one (1) year from the date of as-built certification, continue each year thereafter, and that these inspections are completed by a North Carolina Professional Engineer or Landscape Architect. All inspections must be documented and submitted using this form which must be signed and sealed by the inspector.

Mecklenburg County BMP Maintenance and Inspection Check List
Dry Pond
Note: A separate form must be used for each BMP

Project Name: _____
Project Address: _____
Owner's Name: _____
Owner's Address: _____
Recorded Book and Page Number of the Lot: _____
BMP Name and Location: _____
Inspection Date: _____
Inspector: _____
Inspector Address/Phone Number: _____
Date Last Inspected: _____

Maintenance Item	Satisfactory	Unsatisfactory	Inspection Frequency	Comments/Actions Required
1. Debris Cleanout				
Clear of trash and debris			M	
2. Vegetation Management				
Banks/ surrounding areas mowed			M	
Unwanted vegetation present			M	
3. Erosion				
Evidence of soil erosion on banks, contributing drainage areas or bottom of pond			M	
4. Sedimentation				
Forebay (if present) sediment inspection (cleanout every 7 years or when 50% full)			M	
Sediment level in pond			Y	
5. Energy dissipators				
Condition of dissipator at inlets			Y	
Condition of dissipator at outfall			Y	
6. Outlet / Inlet				
Condition of orifice, drawdown device and/or trash rack			M	
Condition of outlet			M	
Condition of inlet			M	
7. Mechanical devices				
Inspection of all valves, etc. (yearly)			Y	
8. Dewatering				
Evidence of standing water			M	
9. Structural Integrity				
Evidence of structural damage (leaks, cracks)			Y	

10. Emergency Spillway & Dam				
Condition of spillway			Y	
Condition of dam			Y	
11. Miscellaneous				

W=Weekly, M=Monthly, Q=Quarterly, Y=Yearly

Escrow Account Documentation: (if applicable): Attach documentation of BMP maintenance escrow account activity to this form. This may be provided in the form of a bank statement which includes the current balance and account activity, as well as deposits and withdraws for the previous 12 months.

Maintenance Actions Taken: If any of the above items were marked "U" for unsatisfactory, explain the actions taken and time table for correction. Attach additional pages as necessary.

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Additional Comments:

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Certification:

_____ _____

Inspectors Signature **Date**

(seal)

[Note: The Post-Construction Storm Water Ordinance requires that inspections of all BMPs begin within one (1) year from the date of as-built certification, continue each year thereafter and that these inspections are completed by a North Carolina Professional Engineer or Landscape Architect. All inspections must be documented and submitted using this form which must be signed and sealed by the inspector.

Mecklenburg County BMP Maintenance and Inspection Check List
Sand Filter
Note: A separate form must be used for each BMP

Project Name: _____
Project Address: _____
Owner's Name: _____
Owner's Address: _____
Recorded Book and Page Number of the Lot: _____
BMP Name and Location: _____
Inspection Date: _____
Inspector: _____
Inspector Address/Phone Number: _____
Date Last Inspected: _____

Maintenance Item	Satisfactory	Unsatisfactory	Inspection Frequency	Comments/Actions Required
1. Debris Cleanout				
Clear of trash and debris			M	
2. Street Sweeping				
Parking lot street sweeping			Q	
3. Erosion				
Evidence of soil erosion around contributing areas			M	
4. Sedimentation chamber				
Sediment level in chamber (pump yearly or when 50% full)			M	
5. Sand media				
Condition of media (skim annually, replace as necessary)			M	
6. Outlet / Inlet				
Condition of outlet			M	
Condition of inlets and grates			M	
7. Mechanical devices				
Inspection of all valves, etc.			Y	
8. Dewatering				
Evidence of filter clogging			M	
9. Structural Integrity				
Evidence of structural damage (leaks, cracks, etc)			Y	
10. Overall functionality				
Evidence of odors			M	
Evidence of bypass			M	

11. Miscellaneous

W=Weekly, M=Monthly, Q=Quarterly, Y=Yearly

Escrow Account Documentation (if applicable): Attach documentation of BMP maintenance escrow account activity to this form. This may be provided in the form of a bank statement which includes the current balance and account activity for the previous 12 months.

Maintenance Actions Taken: If any of the above items were marked "U" for unsatisfactory, explain the actions taken and time table for correction. Attach additional pages as necessary.

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Additional Comments:

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Certification:

_____ _____

Inspectors Signature **Date**

(seal)

[Note: The Post-Construction Storm Water Ordinance requires that inspections of all BMPs begin within one (1) year from the date of as-built certification, continue each year thereafter, and that these inspections are completed by a North Carolina Professional Engineer or Landscape Architect. All inspections must be documented and submitted using this form which must be signed and sealed by the inspector.

Mecklenburg County BMP Maintenance and Inspection Check List
Infiltration Trench
Note: A separate form must be used for each BMP

Project Name: _____
Project Address: _____
Owner's Name: _____
Owner's Address: _____
Recorded Book and Page Number of the Lot: _____
BMP Name and Location: _____
Inspection Date: _____
Inspector: _____
Inspector Address/Phone Number: _____
Date Last Inspected: _____

Maintenance Item	Satisfactory	Unsatisfactory	Inspection Frequency	Comments/Actions Required
1. Debris Cleanout				
Clear of trash and debris			M	
2. Vegetation Management				
Banks/ surrounding areas mowed			M	
Unwanted vegetation present			M	
3. Erosion				
Evidence of soil erosion around contributing areas			M	
4. Sedimentation				
Forebay sediment inspection (cleanout yearly or when 50% full)			M	
Evidence of sediment in trench			M	
5. Energy dissipators				
Condition of dissipator at inlets			Y	
Condition of dissipator at outfall			Y	
6. Surface aggregate				
Condition of stone or mulch			Y	
7. Dewatering				
Evidence of standing water			M	
Check water level in observation well			M	
8. Overflow spillway				
Condition of spillway			Y	
9. Overall functionality				
Evidence of bypass			M	

10. Miscellaneous

W=Weekly, M=Monthly, Q=Quarterly, Y=Yearly

Escrow Account Documentation (if applicable)**:** Attach to this form documentation of BMP maintenance escrow account activity. This may be provided in the form of a bank statement which includes the current balance, as well as deposits and withdraws for the previous 12 months.

Maintenance Actions Taken: If any of the above items were marked "U" for unsatisfactory, explain the actions taken and time table for correction. Attach additional pages as necessary.

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Additional Comments:

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Certification:

_____ _____

Inspectors Signature **Date**

(seal)

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Mecklenburg County BMP Maintenance and Inspection Check List
Filter Strips with Flow Dispersion
[Note: a separate form must be used for each BMP]

Project Name: _____
Project Address: _____
Owner's Name: _____
Owner's Address: _____
Recorded Book and Page Number of the Lot: _____
BMP Name and Location: _____
Inspection Date: _____
Inspector: _____
Inspector Address/Phone Number: _____
Date Last Inspected: _____

Maintenance Item	Satisfactory	Unsatisfactory	Inspection Frequency	Comments/Actions Required
1. Debris Cleanout				
Clear of trash and debris			W-M	
2. Vegetation Management				
Grass height (maintain 2-6 inch height)			W-M	
Unwanted vegetation present			M	
Ground cover well established (yearly reseeding needed)			Y	
3. Erosion				
Evidence of soil erosion in filter strip and below dispersion device			M	
4. Drainage				
Evidence of standing water			M	
Evidence of bypass			M	
Check outlet pipes for clogging			M	
5. Sedimentation				
Sediment accumulation			Y	
Sediment in gravel diaphragm (if present)			Y	
6. Energy dispersion / check dams				
Condition / functionality of dispersion devices			M	
Debris on dispersion devices			M	
Condition of check dams			M	
Inspect pea gravel diaphragm (replace as needed)			M	

7. Miscellaneous

W=Weekly, M=Monthly, Q=Quarterly, Y=Yearly

Escrow Account Documentation (if applicable)**:** Attach to this form documentation of BMP maintenance escrow account activity. This may be provided in the form of a bank statement which includes the current balance and account activity for the previous 12 months.

Maintenance Actions Taken: If any of the above items were marked "U" for unsatisfactory, explain the actions taken and time table for correction. Attach additional pages as necessary.

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Additional Comments:

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Certification:

_____ _____

Inspectors Signature **Date**

(seal)

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