



POST-CONSTRUCTION STORMWATER MANAGEMENT

**A Programmatic Overview of Hopewell's Post-
Construction Stormwater Management
Program and Process**



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ACRONYMS

BMP	Best Management Practice
CH	Virginia BMP Clearinghouse
CPESC	Certified Professional in Erosion and Sediment Control
CWA	Clean Water Act
DEQ	Virginia Department of Environmental Quality
EPA	Environmental Protection Agency
IDDE	Illicit Discharge Detection and Elimination
MEP	Maximum Extent Practicable
MS4	Municipal Separate Storm Sewer System
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
VPDES	Virginia Pollutant Discharge Elimination System
VSMP	Virginia Stormwater Management Program

1.0 INTRODUCTION AND PURPOSE

Land development disturbs stable vegetated landscapes and increases impervious area, which in turn increases the amount of stormwater runoff to downstream properties and streams. The new impervious surfaces also allow for different types of pollutants to be easily washed away by rainfall. These pollutants can include:

- Excess nutrients nitrogen and phosphorus;
- Incorrectly applied fertilizers (includes), pesticides, and herbicides;
- Metals, oil (polycyclic aromatic hydrocarbons or PAHs), grease, and other materials related to automobiles and trucks;
- Chlorides (salt), and other organic materials that are applied to land surfaces;
- Sediment from construction activities and eroding streams; and
- Bacteria.

Stormwater Best Management Practices (BMPs) are designed and installed to manage the volume of runoff and reduce the pollutant load that flows to our rivers and streams. Ensuring that these facilities function correctly requires long-term inspections and procedures for maintenance when needed. This manual presents the City's standard procedures for performing inspections and maintenance of City and privately owned BMPs.

Regulatory Basis: This Post-Construction Stormwater Management Manual includes a series of written procedures that ensure adequate long-term inspection and maintenance of BMPs and has been developed as part of Minimum Control Measure 6 as described in the City's municipal separate storm sewer system (MS4), Permit. In accordance with the Permit, the City's program is designed to reduce the discharge of pollutants from the MS4 to the maximum extent practicable." (In addition to being the name of a permit, MS4 also refers to the storm sewer system itself: the inlets, pipes, and drainage channels on City owned property or public right of way.)

Hopewell's Post-Construction Stormwater Management Program includes three distinct components:

- **Program Documentation** requirements are outlined in Section 2.
- **Inspections** – Section 3 provides a description of the different BMPs and their components involved in the inspection process. Additional information about other types of stormwater BMPs can be found at the Virginia BMP Clearinghouse website: www.swbmp.vwrrc.vt.edu . Section 4 outlines the process of conducting an inspection and a description of the City's inspection form. The City's stormwater facility mapping, BMP inventory, a typical inspections form can be found in Appendix A.
- **Maintenance**– Section 5 provides description of routine and corrective maintenance that is performed on stormwater facilities.

2.0 PROGRAM DOCUMENTATION REQUIREMENTS

Documentation of Post-Construction Stormwater Management is important for tracking stormwater BMPs and ensuring that they are regularly inspected and maintained. Documentation is also important for demonstrating compliance with the MS4 permit. All documentation related to post-construction stormwater management is required to be kept for a minimum of 3 years for annual reporting and potential audits.

2.1 Inspection Requirements

For new construction projects with stormwater BMP(s), the owner or developer must record a maintenance agreement outlining the responsibilities for long-term inspections and maintenance of the

BMPs. The maintenance agreement must be stated to run with the land and provide for all necessary access to the property for purposes of maintenance and regulatory inspections.

Prior to final approval by the City, the new BMP(s) must be inspected by a professional registered in the Commonwealth of Virginia, certifying that the BMP(s) have been constructed in accordance with the approved plan.

As required by City ordinance, owners of stormwater BMPs are required to perform and document inspections in accordance with the recorded maintenance agreement. The inspections are intended to ensure that stormwater BMPs are being adequately maintained as designed. The City will conduct a regulatory inspection of private BMPs every 5 years to ensure the BMPs are being properly maintained

2.2 Inspection Forms

Inspection forms provide the necessary documentation to demonstrate when and what is being inspected. This Manual includes an inspection form for the predominant type of stormwater facilities that currently exist within the City: detention, retention and extended detention.

Inspection forms for other types of facilities such as permeable pavement, rain gardens, etc., when needed, can be found within the Virginia Stormwater Management Handbook, latest edition, or contact the City Department of Public Works. For proprietary stormwater practices such as underground vaults and chambers, tree boxes, or other devices, owners should contact the manufacturer for inspection and maintenance guidance.

The inspections forms are intended to provide documentation that the facilities were inspected on an annual basis and that any maintenance items were noted. A follow-up inspection should be completed after every noted deficiency with the following information:

- ✓ Facility Number
- ✓ Date of initial inspection
- ✓ Date corrective maintenance performed
- ✓ Description of corrective maintenance performed

2.3 Annual Reporting to DEQ

Hopewell must annually report to the DEQ information pertaining to its Post-Construction Stormwater management efforts. The information is included in the overall MS4 annual report due October 1st of each year. Hopewell must maintain an electronic database or spreadsheet to be submitted annually that includes the following information:

1. The stormwater management facility type;
2. A general description of the facility's location, including the address or latitude and longitude;
3. The acres treated by the facility, including total acres, as well as the breakdown of pervious and impervious acres;
4. The date the facility was brought online (MM/YYYY). If the date is not known, the operator shall use June 30, 2005, as the date brought online for all previously existing stormwater management facilities;
5. The sixth order hydrologic unit code (HUC) in which the stormwater management facility is located;
6. The name of any impaired water segments within each HUC listed in the 2010 §305(b)/303(d) Water Quality Assessment Integrated Report to which the stormwater management facility discharges;
7. Whether the stormwater management facility is publically-owned or privately-owned;

8. Whether a maintenance agreement exists if the stormwater management facility is privately owned;
9. The date of the operator's most recent inspection of the stormwater management facility; and
10. Annually track and report the total number of inspections completed and, when applicable, the number of enforcement actions taken to ensure long-term maintenance.

2.4 Program Updates and Modifications

Modifications to the post-construction stormwater management program may occur as part of an iterative process to protect water quality. Updates and modifications to the Program may be made in accordance with the following procedures:

- Adding (but not eliminating or replacing) practices to the post-construction stormwater management Program outlined in this manual may be made by the City at any time. Additions shall be reported as part of the annual report.
- Updates and modifications to the post-construction stormwater management Program described in this manual are permitted provided that the updates and modifications are done in a manner that:
 - Is consistent with the conditions of the MS4 General Permit;
 - Follow any public notice and participation requirements established in the MS4 General Permit; and
 - Are documented in the annual report.
- Replacing, or eliminating without replacement, any ineffective or infeasible strategies, policies, and practices described in this manual with alternate strategies, policies, and BMPs may be requested at any time. Such requests must include the following:
 - An analysis of how or why the practices, strategies, or policies are ineffective or infeasible, including cost prohibitive;
 - Expectations on the effectiveness of the replacement practices, strategies, or policies;
 - An analysis of how the replacement BMPs are expected to achieve the goals of the practices to be replaced;
 - A schedule for implementing the replacement practices, strategies, and policies;
 - An analysis of how the replacement strategies and policies are expected to improve Hopewell's ability to meet the goals of the strategies and policies being replaced;
 - Requests or notifications must be made in writing to DEQ and signed by a principle executive officer or a duly authorized representative. The duly authorized representative must have overall responsibility of the City operations and written authorization must be provided to the Department.
 - Hopewell follows the public involvement requirements identified in the MS4 General Permit.

3.0 STORMWATER MANAGEMENT FACILITY TYPES

This section provides a brief overview of the types of BMPs that are currently approved through the VDEQ BMP Clearinghouse. At present, the list of City-owned stormwater BMPs include Wet Ponds, Dry (Extended Detention) Ponds, infiltration basins, Bioretention Basins, Permeable Pavement, Regenerative Stormwater Conveyance, and Constructed Wetlands. An explanation of some of these BMP types and their key components are included in the sections below.

An inventory of private and City owned BMPs is maintained by the Stormwater Program Manager and should be utilized and updated for tracking inspection and maintenance of stormwater facilities.

DEQ Design Specification No. 2
Vegetated Filter Strips



Vegetated Filter Strips are areas that manage runoff from adjacent developed areas by slowing the runoff and allowing sediment and attached pollutants to settle out, filtering runoff through the vegetation, and infiltrating into the existing or amended soils.

- Applies to small commercial and residential impervious areas.
- Critical design elements include maximum allowable contributing impervious area, slope, and minimum dimensions.

DEQ Design Specification No. 3
Grass Channels



Grass Swales are designed as conveyance systems with enhanced design features to also provide a level of stormwater treatment and retention.

- Designs can be cost effective when used in place of curb & gutter, pipes, and other conveyance systems.
- Key design elements include maximum allowable longitudinal slope (or the use of check dams), maximum velocity and depth of flow, large storm conveyance, and trapezoidal cross-section geometry.

DEQ Design Specification No. 5
Vegetated Roof



Vegetated Roofs are an alternative roof surface that typically consists of waterproofing and drainage materials and an engineered growing media that is designed to support plant growth.

- Captures and temporarily stores stormwater within the growing media.
- Provides significant life-cycle cost benefits to the building and the environment beyond the stormwater reduction.

DEQ Design Specification No. 6
Rainwater Harvesting



Rainwater Harvesting systems provide for the capture, storage, and release of rainwater for future beneficial use, either inside or outside the building. Systems usually capture rooftop runoff. Storage tanks can be a variety of materials and either above ground or underground.

- Ideal for sites with a beneficial use of the water, such as irrigation, toilet flushing, cooling towers, vehicle washing, etc.
- Benefits include reducing use of potable water for irrigation and other outdoor uses, flushing, etc.
- Key design elements include establishing a reliable water budget and pretreatment.

DEQ Design Specification No. 7
Permeable Pavement



Permeable Paving materials include concrete, asphalt, and interlocking pavers that allow runoff to filter through voids into a gravel storage reservoir.

- Can be designed as an infiltration practice, extended filtration practice (with an underdrain and stone sump), or a filtering practice (underdrain without sump).
- Key design elements include structural load capacity for traffic, surface slope, and limiting the size of the “external” drainage area (adjacent impervious that “runs onto” the permeable pavement).

DEQ Design Specification No. 8
Infiltration



Infiltration practices utilize temporary surface or underground storage to allow incoming stormwater runoff to infiltrate into underlying soils. Runoff first passes through multiple pretreatment mechanisms to trap sediment and organic matter before it reaches the practice.

- Can be designed as basin, trench, or small-scale practice
- Key design elements include runoff pre-treatment, soil permeability testing, and subsoil conditions – such as groundwater. Strict limitations on use at hotspots or Brownfields.

DEQ Design Specification No. 9
Bioretention



Bioretention is a landscaped practice that uses plants, mulch, and soil to treat runoff. Commonly used in parking lot islands and edges and as part of commercial site plans.

- Can be designed as an infiltration practice or an extended filtration practice (with an underdrain).
- Key design elements include surface ponding volume, soil media depth, and underdrain. Includes several design variations.

DEQ Design Specification No. 14
Wet Ponds



Wet ponds have a permanent pool of water and a landscaped fringe. Runoff from each storm enters the pond and raises the normal water level, and the outlet structure releases the runoff at a slower rate. This “draw down” or holding time allows pollutants to settle to the bottom while also reducing the discharge.

- Design requires a large contributing drainage area or a base flow to sustain the pool during dry periods.
- Key design elements include sediment forebays at the inflow, the embankment or dam, the riser/outlet structure, and the outlet channel.

DEQ Design Specification No. 15
Dry (Extended Detention) Ponds



Dry (Extended Detention) Ponds do not have a permanent pool, and remain dry except during and shortly after storm events. Some extended detention facilities may have a wet marsh with plantings in the bottom for additional pollutant removal.

- Can be designed to address channel protection and flooding requirements
- Key design elements include sediment forebays at the inflow, the embankment or dam, the riser/outlet structure, and the outlet channel.

Regenerative Stormwater Conveyance (RSC) System



The RSC System is an open-channel conveyance structure that encourages surface flow to transition to shallow groundwater flow through a series of step-pools and riffles and an underlying sand/mulch bed. Can be adapted for moderately steep slopes.

- Can be used to retrofit existing degraded outfalls or for new development in some cases.
- Critical design features include storage volume and peak flow design of riffles and pools, adequate energy dissipation and anchoring system, hydraulic design for large storms, and tying into existing stream channels.

4.0 INSPECTIONS

Completed inspection forms are required to document all inspections. If the inspection forms are not completed, or not available, then the inspections didn't occur. Inspection forms for various stormwater practices are provided in Appendix A. Inspection forms for other types of BMPs, as well as information on maintenance recommendations for all types of BMPs can be found at the Virginia BMP Clearinghouse at:

www.swbmp.vwrrc.vt.edu

4.1 DEQ Stormwater Inspector Certification

Individuals performing inspection of stormwater management facilities for the City of Hopewell are required to maintain a Stormwater Inspector Certification from DEQ. Information regarding the certification requirements is available at the DEQ Stormwater Certification webpage:

www.deq.virginia.gov/ConnectWithDEQ/TrainingCertification.aspx

Individuals performing inspections for privately owned BMPs must be licensed as a professional engineer, architect, landscape architect, or land surveyor pursuant to the Virginia Department of Professional and Occupational Regulation (Article 1 § 54.1-400 et seq. of Chapter 4 of Title 54.1); a person who works under the direction and oversight of the licensed professional engineer, architect, landscape architect, or land surveyor; or a person who holds an appropriate certificate of competence from the board.

4.2 Inspection Frequency

The Virginia Stormwater Management Program, the City's MS4 Permit, and City Ordinance require that the City perform annual inspections of all City owned stormwater management facilities. In addition, an inspection is required after any storm event that exceeds the facility principal spillway, or more specifically, whenever the emergency spillway is engaged. Detailed inspection requirements are provided in the BMP Clearinghouse.

The Virginia Stormwater Management regulations, the City's MS4 Permit, and City ordinance also require that the City perform inspections of all privately owned stormwater management facilities at least once every five years.

4.3 Stormwater Management Facility Information

This describes the general information that shall be documented for all stormwater management facility inspections:

- "Owner": The owner of the facility.
- "Facility Name": This is the name of the facility on the Inventory List and the site mapping
- "Property Address": Address where the facility is located.
- "Date BMP Placed in Service" The date the BMP became functional and was accepted as complete post construction. This is typically at bond release.
- "Latitude (N)" is the GPS latitude reading of the top of the dam at or above the principal spillway.
- "Longitude (W)" is the GPS longitude reading at the top of the dam or above the principal spillway.
- "As-Built Plans Available": Are the original As-Built plans available for reference? Indicate yes or no.
- "Inspection Date": The date the inspection took place.

- “Date of Last Inspection”: The date the last inspection took place.
- “Inspector(s)”: The name of the inspector performing the inspection.
- “Contact Information”: Contact information for the inspector. Phone numbers and/or email addresses are appropriate.

4.4 Inspection Criteria

The inspection form in Appendix A is designed so that individual components of the stormwater facility are inspected for specific issues. Each numbered heading is a different component of the facility. The lettered items list the issues to evaluate for that are specific to that component of the facility. Facilities may not have all components listed.

Each of the inspection component criteria are rated as either “Yes,” they need repairs, or “No,” they do not need repairs, with recommended maintenance actions based on design plans for the facility. Further information on maintenance recommendations for various stormwater BMPs can be found at the Virginia BMP Clearinghouse at:

www.swbmp.vwrrc.vt.edu.

Some stormwater facilities include an underground storage reservoir, trash screen, or other feature that should only be inspected by a qualified professional with Confined Space Entry credentials. Similarly, some proprietary stormwater facilities, i.e., filter cartridges, tree boxes, etc., should be inspected by a qualified/certified individual familiar with the specific stormwater practice.

5.0 FACILITY MAINTENANCE

The effectiveness of post-construction stormwater control BMPs depends upon regular inspections and maintenance of all aspects of the facility. There are typically two types of BMP maintenance, referred to as routine maintenance and corrective maintenance. Corrective maintenance consists of repairs performed to correct a deficient part of the BMP facility as identified in the inspection. Maintenance action returns the BMP component to the original design conditions for proper function. These activities are further described below.

5.1 Routine Maintenance

Routine maintenance consists of preventative measures that are essential to the ongoing care and upkeep of a BMP facility, and it should be performed regularly to ensure proper function. Additionally, it helps prevent potential nuisances (odors, mosquitoes, weeds, etc.), reduces the need for corrective maintenance, and reduces the chance of polluting stormwater runoff by identifying and repairing problems before they further deteriorate. The failure of structural stormwater BMPs can lead to downstream flooding, which can cause property damage, injury, and even death. This also leads to very costly repairs.

Examples of routine maintenance include:

- Remove any accumulated sediment from the forebays and micro-pools.
- Replace any plantings or vegetation called for in the approved plans that has died or is diseased.
- Repair the stormwater structures for erosion or undercutting as needed.
- Repair any erosion in the facility, including sloughing, animal burrows and slopes.
- Repair any deterioration at the outfall of the facility, including the riprap outlet protection.
- Remove blockages of all trash racks, inlets and outlets.

- Maintain adequate access to the facility and remove woody vegetation as needed.
- Exercise valves to prevent them from locking up where applicable.
- Remove all trash, debris and floatables periodically from the facility.

5.2 Corrective Maintenance

Corrective maintenance is any maintenance that should be addressed for the facility to properly function in accordance with the plans. These items require more intensive repair efforts and should be addressed as a higher priority than routine maintenance. If there are structural deficiencies, or issues that raise the water level in the facility beyond the design requirements, corrective action is required.

Examples of Corrective Maintenance include:

- Repair any deterioration or issues with the principal spillway and riser, such as evidence of spalling, joint failure, leakage, corrosion, etc.
- Extensive sediment removal is required when inspections indicate that 50% of the forebay sediment storage capacity has been filled.
- Control or remove invasive species when their coverage exceeds 15% of a wetland cell as soon as possible. Take care to preserve the designed plantings and vegetation.
- All woody vegetation should be removed from the embankment, if present, to prevent structural damage. Additionally, removal of growth should be considered more frequently if there are impacts to the storage volume (i.e. water levels rise because the vegetation is taking up the water storage space).

Appendix A: Stormwater Facility Inspection Forms

Bioretention
Constructed Wetlands
Dry Ponds
Infiltration
Permeable Pavement
Wet Ponds

Additional Inspection forms are available at the Virginia BMP Clearinghouse website:

www.swbmp.vwrrc.vt.edu

Inspections of underground and proprietary BMPs should be performed by a qualified professional familiar with the particular type or brand of BMP.

Annual BMP Maintenance Inspection Checklist for Bioretention Basin

Name of Facility this BMP Serves: _____

Inspection Date: _____ Weather: _____ Days Since last rain event: _____

Inspector Name: _____ Phone # _____

The maintenance inspection guidelines presented below are NOT all-inclusive. Specific facilities may require other measures not discussed here. It is the design engineer's responsibility to decide if additional measures are needed.

Inspection Date: _____ Person Conducting the Inspection: _____ Phone # _____

Item inspected	Repairs Needed/Notes	Date Repairs Completed
Facility Access: Access to the Bioretention Basin inlet channels, forebay, ponding area, and overflow structure is required in order to adequately inspect and maintain the basin.		
1. Condition of maintenance access (clear of blockages or encroachments by vegetation, stored materials, vehicle parking areas, etc.		
General Site & Contributing DA		
2. Evidence of trash, debris (leaves, branches and grass clippings), oil/grease, or sediment?		
3. Condition of turf areas: presence of exposed soil?		
4. Condition of landscaped areas: mulch washing into basin?		
Pre-treatment Forebay		
5. Buildup of sediment, debris, trash, etc?		
6. Standing water, odors, algae, or oil/grease		
7. Condition of vegetation?		
Inlets		
8. Condition of inflow curb cuts or pipe inflow points: presence of scour or debris build up?		
9. Sediment build-up at pavement edges preventing flow from entering the Basin?		
10. Evidence of erosion at or around inflow to basin?		
11. Excessive vegetation blocking flow at inflow points?		

Annual BMP Maintenance Inspection Checklist for Bioretention Basin

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Mulch Cover		
12. Mulch evenly spread/even coverage approx. 2' to 4" in depth?		
13. Sediment deposition?		
14. Areas of exposed soil		
Vegetation		
15. Unnecessary stakes or wires on plants?		
16. Check for 75 - 90% cover (plants plus mulch)		
17. Invasive species present?		
18. Excessive weeds (>10% coverage)?		
19. Grass cover, if present, at least 6" to 10" high?		
20. Dead vegetation (indicate % coverage)?		
Soil Media & Stone Reservoir		
21. Observation well is present, functioning, and removable cap is serviceable?		
22. Observation well: soil media & stone reservoir drains within 48 hours after rain event?		
23. Perforated pipe underdrain flows?		
24. Underdrain outlet is clear of blockages?		
Outfall Structure		
25. Outlet structure is stable and functions as intended (weir overflow, riser pipe, or inlet diversion when basin is full)?		
26. Overflow grate or trash rack is clear of debris, vegetation, mulch, etc.		
27. Outfall/outlet channel is stable?		

Note: Additional, but brief, inspections of this BMP should be performed after significant storm events to check for damage, debris accumulation, and standing water.

Annual BMP Maintenance Inspection and Report for Constructed Stormwater Wetlands

Name of Facility this BMP Serves: _____

The maintenance and inspection guidelines presented below are NOT all-inclusive. Some stormwater wetlands are very complex and therefore may require inspection by a qualified professional.

Inspection Date: _____ Person Conducting the Inspection: _____ Phone # _____

Item Inspected	Repairs Needed/Notes	Date Repairs Completed
Facility Access		
Access to all parts of the constructed wetland is needed so crews can safely maneuver when inspecting or performing maintenance tasks. 1. Check for blockages or encroachments by vehicles, stored materials, or woody vegetation.		
General Site		
1. Remove trash, debris (leaves, branches, and grass clippings) or sediment immediately.		
2. Check for adequate vegetation, bare soil, or erosion. Repair and stabilize immediately.		
3. If water levels in one or more cells are abnormally high or low, check for a blockage in the riser.		
4. If mosquitos are a serious problem, eliminate stagnant pools.		
Pre-treatment		
1. Remove trash, debris (leaves, branches, and grass clippings) immediately.		
2. If forebay capacity is reduced by 50% then dredge to remove sediment.		
3. Inspect for standing water, odors, algae, or oil/grease		
4. Examine for erosion, bare soil, or dead vegetation and repair and revegetate as needed		
Inlets		
1. Inspect for erosion at or around inlets. Repair and stabilize immediately		
2. Remove woody growth that blocks flow		
3. Remove trash, debris, or sediment immediately		
Vegetation (trees, shrubs, aquatic plants)		
1. Remove any stakes or wires on plants		
2. If invasive species (cattails) or weeds make up more than 15% of the vegetation in an individual cell, then initiate controls to remove and replace them		
3. Remove dead vegetation and replace		
4. Remove woody species on or near embankment every 2 years		
5. Thin or harvest woody growth every 5 years if the wetland appears to be overgrown		
Wetland Cells and Pools		
1. Where sediment has filled to 50% capacity, then dredge to restore design capacity		

2. Remove debris		
3. Repair sparse vegetative cover, erosion or slumping on inside and outside slopes		
Outlet		
1. Remove trash, debris or sediment deposits		
2. Remove woody growth within 5 feet of the outlet		
3. Repair erosion or displaced riprap		

Note: Additional, but brief, inspections of this BMP should be done after significant storm events to check for damage. Do this when the area receives ≥ 2 inches rainfall in a 24-hour period.

Annual BMP Maintenance Inspection and Report for Dry Pond

Name of Facility this BMP Serves: _____

The maintenance and inspection guidelines presented below are NOT all-inclusive. Specific facilities may require other measures not discussed here. It is the design engineer's responsibility to decide if additional measures are needed.

Inspection Date: _____ Person Conducting the Inspection: _____ Phone # _____

Item Inspected	Repairs Needed/Notes	Date Repairs Completed
Facility Access		
Clear access to all of the facility parts is needed so crews can safely maneuver when inspecting or performing maintenance tasks.		
1. Remove blockages or encroachments by vehicles, fences, vegetation or stored materials.		
2. A maintenance right-of-way or easement must extend to the BMP from a public or private road.		
General Site		
1. Remove trash, debris (leaves, branches, and grass clippings), oil/grease, or excess sediment.		
2. Inspect all curb drains for damage or blockage and repair as needed.		
3. Reseed areas of inadequate vegetation or bare soil and repair any erosion.		
Dam or Berm (if present)		
1. The dam should be covered with a thick, healthy grass cover, free of trees and brush. Mow it periodically during the growing season; grass should not be cut less than 6 inches in height.		
2. When needed, apply lime, fertilizer, and seed in the fall.		
3. Remove all trees, woody vegetation, and other deep-rooted growth from the dam and extending 25 feet beyond the toe of the dam. Seedlings and vine cover should also be removed.		
4. Fill all eroded areas with topsoil, then reseed and mulch. Repeat until vegetation is established.		
Side and Bottom Slopes, Inlet and Outlet Pipes		
1. Inspect inside and outside slopes for sparse vegetation, erosion, or slumping and make repairs immediately.		
2. Seed and mulch all bare areas and pathways		
3. Fill and compact all animal burrows and remove burrowing animals.		
4. Check that the pond empties properly (no pools of standing water) and there are no cave-ins		
5. Inspect the inlet pipe for damage, erosion, or undercutting		
6. Remove trash, litter, and yard waste.		
Outfall/Outlet Structure		

1. Examine outfall structure for erosion or stones that have been displaced and replace.		
2. Remove seedling trees and shrubs as needed to enable proper function.		

Note: Additional, but brief, inspections of this BMP should be done after significant storm events to check for damage. Do this when the area receives ≥ 2 inches rainfall in a 24-hour period.

Annual BMP Maintenance Inspection Checklist for Infiltration Practices

Name of Facility this BMP Serves: _____

The maintenance and inspection guidelines presented below are NOT all-inclusive. Specific facilities may require other measures not discussed here. It is the design engineer's responsibility to decide if additional measures are needed.

Inspection Date: _____ Person Conducting the Inspection: _____ Phone # _____

Item Inspected	Repairs Needed/Notes	Date Repairs Completed
Facility Access		
Access to all parts of the infiltration facility (BMP) is needed so crews can safely maneuver when inspecting or performing maintenance tasks.		
1. Remove blockages or encroachments by vehicles, stored materials, fences, or vegetation		
2. A maintenance right-of-way or easement must extend to the BMP from a public or private road		
General Site		
1. Remove trash/litter, debris (leaves, branches, and grass clippings) or sediment		
2. Reseed areas of inadequate vegetation. Repair and stabilize areas of bare soil or erosion immediately		
3. Repair deteriorating components of the BMP		
4. If mosquitos are a problem, eliminate standing water and establish vegetation		
Pre-treatment		
1. Remove trash/litter, debris (leaves, branches, and grass clippings) immediately		
2. Address standing water, odors, water stains, algae, or floating aquatic vegetation		
3. Reseed areas of inadequate vegetation in the grass filter. Repair and stabilize areas of bare soil or erosion immediately		
Inlet Pipe(s)		
1. Repair and stabilize cracking, bulging, or sloughing areas immediately		
2. Repair and stabilize erosion or undercutting around inlets immediately		
3. Remove trash/litter, debris (leaves, branches, and grass clippings) immediately		
Vegetation		
1. Mow grass to height of 4 to 9 inches and remove clippings.		
2. Remove volunteer seedlings from the bottom to keep roots from puncturing the filter fabric. Remove plants that drop fruit/leaves		
3. Remove dead vegetation and replace		

Observation Well		
1. Verify that the observation well is capped		
2. Measure drawdown rate in the observation well for three days following a >½ inch storm event. If standing water is still observed after three days, this is a clear sign that the basin is clogged. Repair by a professional		
Surface, Dikes, Berms and Side Slopes		
1. Remove trash/litter, debris (leaves, branches, and grass clippings) and accumulated sediment immediately		
2. Repair erosion or slumping side slopes and inadequate vegetation. Remove burrowing animals and backfill and compact burrows		
3. If water is not detained in the basin, check for a breach and repair immediately		
4. Weedy growth on the stone surface indicates sediment accumulation and potential clogging. Evaluate by a professional		
Overflow or Emergency Spillway		
1. Remove sediment and debris whenever 25% or more of capacity is blocked. Replace or reinforce stone whenever only one layer remains		
Outlet		
1. Remove trash/litter, debris or sediment deposits		
2. Fill in low spots and stabilize. Correct ponding		
3. Repair erosion or displaced riprap and stabilize		

Note: Additional, but brief, inspections of this BMP should be done after significant storm events to check for damage. Do this when the area receives ≥ 2 inches rainfall in a 24-hour period.

Operation & Maintenance Checklist: Permeable Pavement

Name of Facility & Location: _____

Inspection Date: _____ Weather: _____ Days Since last rain event: _____

Inspector Name: _____ Phone # _____

Indicators of common maintenance issues:

1. Ponding or slow draining. Rule of thumb: if more than an inch deep one minute after a rainfall event, maintenance is necessary.
2. Surface Crusting in the gaps between pavers. This could be caused by run-on sediments or long term accumulation and decay of organic debris.
3. Weeds. Weeds will not germinate in the paver gaps unless there is a collection of soil or moisture. Remove weeds immediately. Chemical treatment may be required prior to maintenance.
4. Covered Joint Material. Similar to surface crusting, this can be caused by run-on sediment or long term accumulation and decay of organic debris. This usually indicates that more frequent maintenance is required.

Preventative Maintenance removes most miscellaneous debris before being trapped in the joint aggregate material causing clogging. This usually eliminates the need to remove and replace joint material to restore infiltration.

- **Do not apply salt or sand during snow removal activities.**
- **Do not stockpile snow on permeable pavers.**

Seasonal Preventive Maintenance			Date Repairs Completed
Time Period	Frequency		
March 1 through April 15	Once/ quarter	Broom or blow entire surface.	
		Clean debris from paver surface in location of any snow stockpile area.	
		Every fifth year, vacuum or power wash problem areas and refill joint material	
April 1 through May 15	Once/ quarter	Broom or blow flowers and pollen from trees and shrubs.	
		Collect any additional debris from areas mulched or planted.	
		Replenish joint aggregate material as necessary.	
July 15 through August 30	Once/ quarter	Broom or blow lawn and shrub clippings or tree fruits.	
		Collect any additional debris from high traffic summer activities	
		Replenish joint aggregate material as necessary.	
October 15 through November 30	May require more frequent application	Broom or blow leaves off pavement surface – especially in corners where wind traps debris.	
		Replenish joint aggregate material as necessary.	

Annual BMP Maintenance Inspection: Permeable Pavement

Name of Facility & Location: _____

Inspection Date: _____ Weather: _____ Days Since last rain event: _____

Inspector Name: _____ Phone # _____

The maintenance and inspection guidelines presented below are NOT all-inclusive.

Item Inspected	Repairs Needed/Notes	Date Repairs Completed
General Site – Contributing Drainage Area		
1. Drainage area contributing run-on: <ul style="list-style-type: none"> • Trash/litter • Organic debris (leaves, branches, grass clippings, mulch) • Exposed soil, erosion, sedimentation 		
2. Drainage system to facility (damage, blocked curbs or drains, etc.)		
3. Dead vegetation		
4. Trees and shrubs within 5 feet of pavers.		
Pre-treatment cell(s)		
5. Access		
6. Trash/litter		
7. Dead vegetation		
8. Standing water		
Pavement Surface		
9. Trash/litter accumulating on pavers		
10. Organic debris (leaves, branches, grass clippings, mulch) accumulating on pavers		
11. Stone material between pavers (evenly spread within ¼" of paver surface)		
12. Stone material between pavers Clear of sediment or other accumulation		
13. Paver surface is even and water spreads evenly		
Observation Well		
14. Observation wells are capped & operational		
15. Evidence of water in stone reservoir more than 48 hrs after rain event		
Outlet/Overflow		
16. Condition of outlet.		
17. Allows free flow of water from pavement surface (no debris/vegetation blockages)		

Note: Additional inspections of Permeable Pavements should be performed after significant storm events to check for damage, debris accumulation, and standing water.

Annual BMP Maintenance Inspection Checklist for Wet Ponds

Name of Facility this BMP Serves: _____

The maintenance and inspection guidelines presented below are NOT all-inclusive. Specific facilities may require other measures not discussed here. It is the design engineer's responsibility to decide if additional measures are needed.

Inspection Date: _____ Person Conducting the Inspection: _____ Phone # _____

Item Inspected	Repairs Needed/Notes	Date Repairs Completed
Facility Access		
Access to all parts of the wet pond is needed so crews can safely maneuver when inspecting or performing maintenance tasks.		
1. Remove blockages or encroachments by vehicles, stored materials, fences, or woody vegetation		
2. A maintenance right-of-way or easement must extend to the BMP from a public or private road		
3. Inspect security fence; repair as needed		
4. Inspect safety signage; provide sufficient, legible lettering for emergency contact		
General Site		
1. Remove trash/litter, debris (leaves, branches, and grass clippings) or sediment		
2. Reseed areas of inadequate vegetation. Repair and stabilize areas of bare soil or erosion immediately		
3. If mosquitos are a serious problem, consider stocking the pond with mosquito fish		
Pre-treatment		
1. Remove trash/litter, debris (leaves, branches, and grass clippings) immediately		
2. If forebay capacity is reduced by 50% then dredge to remove sediment		
3. Address standing water, odors, algae, or oil/grease		
4. Reseed areas of inadequate vegetation. Repair and stabilize areas of bare soil or erosion immediately		
Inlet Pipe(s)		
1. Repair and stabilize cracking, bulging, or sloughing areas		
2. Repair and stabilize erosion or undercutting around inlets immediately.		
3. Remove any woody growth that blocks flow		
4. Remove trash/litter, debris (leaves, branches, and grass clippings) immediately		
Vegetation (trees, shrubs, aquatic plants)		
1. Remove any stakes or wires on plants.		
2. If invasive species or weeds make up more than 15% of the vegetation in an individual cell, then initiate controls to remove and replace them.		
3. Remove dead vegetation and replace		

Permanent Pool and Side Slopes		
1. Remove trash/litter, debris (leaves, branches, and grass clippings) immediately		
2. Repair erosion or slumping side slopes and inadequate vegetation. Remove burrowing animals and backfill and compact burrows		
Riser/Principle Spillway		
1. Remove excess trash/litter, debris, or other obstructions in the trash rack immediately.		
2. Repair riser if pieces are missing, broken, or misaligned		
3. Remove any blockages of the orifice		
Emergency Spillway		
1. Remove woody vegetation near or on the spillway		
2. Remove excess trash/litter, debris or other obstructions immediately.		
3. Repair any erosion, soft spots, seepage or sinkholes and stabilize.		
Berm/Dam/Embankment		
1. Repair and stabilize areas of sparse vegetation, settlement, cracking, bulging, misalignment, sloughing, or erosion of the dam immediately.		
2. Remove woody vegetation on the dam and extending at least 25 feet beyond the toe of the dam. Remove roots, fill the holes, and compact with suitable material. Remove all seedlings, vine cover, and brush to allow for inspection.		
3. Repair and stabilize soft spots, boggy areas, seepage or sinkholes immediately.		
Outlet		
1. Remove trash/litter, debris or sediment deposits		
2. Remove woody growth within 5 feet of the outlet pipe barrel		
3. Repair erosion or displaced riprap and stabilize		

Note: Additional, but brief, inspections of this BMP should be done after significant storm events to check for damage. Do this when the area receives ≥ 2 inches rainfall in a 24-hour period.

Appendix B: BMP Maintenance Follow-up Form

BMP Maintenance Follow-up FORM

To be completed by inspector

Location: _____ BMP ID # (see BMP Inventory map): _____

Was the maintenance need generated from an inspection? _____ If yes, date on inspection form: _____

Description of required maintenance: _____

Is maintenance critical to the function of the BMP? Yes No Not sure

To be completed by the Stormwater Program Manager

Individual performing or overseeing maintenance: _____

Requested date for maintenance to be completed by: _____

Date(s) maintenance completed: _____

Did maintenance solve the identified problem? Yes No Not sure

If no or not sure, describe further necessary maintenance and a date for the additional maintenance to be performed:

Description of maintenance performed: _____

Attach photographs to this form and retain for records.