Post-Construction Stormwater Management Inspection & Maintenance Manual

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For reporting pollution into stormwater runoff contact the Director of Facilities and Safety at (804) 840-8354.

John Tyler Community College

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TABLE OF CONTENTS

APPENDICES

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 areas, which in turn increases the stormwater runoff from the land surface. Development also increases pollutant concentrations in stormwater runoff, as pollution associated with development is deposited onto hardened surfaces and carried by runoff into nearby water bodies. Such pollutants include sediment, suspended solids, nutrients, pesticides, herbicides, heavy metals, chlorides, hydrocarbons, other organics, and bacteria. To remove pollutants from stormwater runoff, structures are installed to reduce the pollutant loads using various processes. These stormwater structures are called Best Management Practices, commonly referred to as BMPs. They are designed to reduce flooding, remove pollutants and decrease the amount of stormwater runoff that ultimately flows into our creeks, streams, and rivers. Ensuring these BMP facilities function correctly requires long-term inspections and maintenance.

This manual presents the standard protocol for Post-Construction Stormwater Management Inspection and Maintenance procedures and satisfies the written procedures for long-term operation & maintenance (O&M) requirements of the small municipal separate storm sewer system (MS4) General Permit. As a regulated MS4, John Tyler Community College (JTCC) is obligated to meet the requirements of the MS4 General Permit (General Permit). The General Permit is issued through the Virginia Pollutant Discharge Elimination System (VPDES), which is administered at the state level by the Virginia Department of Environmental Quality (DEQ). The MS4 program is part of the Federal National Pollutant Discharge Elimination System (NPDES), which is authorized through the Clean Water Act and regulated through the US Environmental Protection Agency (EPA).

JTCC's Post-Construction Stormwater Management Program, which is a series of written procedures in this manual, ensures adequate long-term operation and maintenance of BMPs for JTCC.

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

- **Documentation** – Procedures to document efforts related to the Post-Construction Stormwater Management inspection and maintenance procedures are outlined in Section 2.0 of this manual.
- **Inspections –** Discussion of Post-Construction Stormwater Management facility types and components that require inspections are outlined in Section 4.0 of this manual. Instruction for the Post-Construction Stormwater Management Facility inspections are outlined in Section 5.0 of this manual. Stormwater facility inspection forms are provided in the Appendices.
- **Maintenance** – Discussion of typical maintenance requirements are provided in Section 6.0 of this manual.

2.0 DOCUMENTATION REQUIREMENTS

Documentation of Post-Construction Stormwater Management efforts is critical for demonstrating compliance with the General Permit. All documentation related to Post-Construction Stormwater Management is required to be maintained on file and available upon request and include:

- Project Records, including stormwater plans (retain for 3 years);
- Construction Record Drawings (as-builts retain in perpetuity or until the BMP is removed);
- Completed BMP Inspection Forms (retain for 5 years); and
- Completed BMP Maintenance Follow-up Forms, when applicable (retain for 5 years).

Documentation listed above is incorporated into annual reporting as required by the General Permit.

2.1 Construction Record Drawings

Upon completion of the construction of a stormwater BMP, a record drawing should be obtained. The record drawing, or as-built, serves the purpose of:

- Ensuring the BMP was built per the design plans and
- As a reference over time to assist with long-term inspection and maintenance.

Ideally, the record drawing would also prescribe inspection frequency and discuss critical maintenance needs. Information such as the design of the outfall structure, elevations, and vegetation plans will allow JTCC to restore the BMP to its original design, when necessary. Sometimes an issue with a BMP may not be evident during an inspection, such as if the facility should be holding water or be dry. A record drawing can be referenced to make that determination. Examples include, discovering the surface of an infiltration basin or a low-flow orifice being clogged, resulting in ponding. The intended function, such as time for water to drawdown out of the basin, may not be known until the record drawing is reviewed.

In some cases, especially with older facilities, a record drawing may not be available. In these cases, the Virginia BMP Clearinghouse can be referenced for additional information regarding inspections and maintenance of each type of stormwater BMP. The Clearinghouse can be found at:
https://www.swbmp.vwrrc.vt.edu/

2.2 BMP Inspection Forms

The General Permit requires BMPs be inspected at a minimum once per year by JTCC. Completion of comprehensive inspection forms assists the inspector to:

- Inspect each critical component of the facility;
- Identify maintenance needs; and
- Properly document inspections to demonstrate compliance with the General Permit.

BMP inspection forms in Appendix A have been developed to assist the inspector, and unique forms are provided dependent on the type of BMP being inspected. In addition to the completion of the inspection forms, where applicable, a BMP Maintenance Follow-up Form should be completed as described in the next Section. Inspection forms are discussed in additional detail in Section 5.0 of this Manual.

2.3 BMP Maintenance Follow-up Forms

In the case that issues are identified on BMP Inspection Forms, it is important to ensure the necessary maintenance is performed in a timely manner. It is critical that documentation demonstrating the completion of the maintenance is maintained on file to demonstrate compliance. This documentation

should be provided on the BMP Maintenance Follow-up Form in Appendix B. This Manual establishes time frames for completing maintenance needs identified during inspections. Time frames shall be designated by the Environmental Compliance Officer, or designee, and be prioritized based on the nature of the maintenance need. High prioritization should be given to situations that include issues with:

- BMP functionality regarding the potential to cause flooding (e.g., structural integrity of the embankment or clogged outflow structures);
- BMP functionality regarding the inability to remove pollutants as designed (e.g., clogged infiltration surface, dead vegetation); or
- BMP acting as a source of sediment (exposed soils requiring stabilization).

In the case of Corrective Maintenance, as identified in Section 6.2, a timeframe designation should be carefully considered by the Environmental Compliance Officer. In some cases, repairs may be necessary as soon as possible.

The Maintenance Follow-up Form is separated into two sections. The first section should be completed by the individual performing the BMP inspection. This section identifies the BMP, the inspection form on which an issue is identified, a description of the necessary maintenance, and an indicator of the severity of the issue(s) identified. The second section of the form is completed by the JTCC Environmental Compliance Officer and identifies who will perform the maintenance, sets a timeframe for performing the maintenance, and includes a description of the completed maintenance.

2.4 Annual Reporting to DEQ

JTCC must annually report to the DEQ information pertaining to its Post-Construction Stormwater Management efforts. Reporting requirements include the submittal of JTCC's Post-Construction Stormwater Management BMP electronic database that includes the following information:

- The stormwater management facility or BMP type;
- The stormwater management facility or BMPs location as latitude and longitude;
- The acres treated by the stormwater management facility or BMP, including total acres, pervious acres, and impervious acres;
- The date the facility was brought online (MM/YYYY). If the date brought online is not known, the permittee shall use June 30, 2005;
- The 6th Order Hydrologic Unit Code in which the stormwater management facility is located;
- Whether the stormwater management facility or BMP is owned or operated by the permittee or privately owned;
- Whether or not the stormwater management facility or BMP is part of the permittee's Chesapeake Bay TMDL action plan required in Part II A or local TMDL action plan required in Part II B, or both;
- If the stormwater management facility or BMP is privately owned, whether a maintenance agreement exists; and
- The date of the most recent inspection of the stormwater management facility or BMP.

The electronic database shall be updated no later than 30 days after a new BMP is brought online.

3.0 INSPECTION FREQUENCY

The General Permit requires inspection of all stormwater management facilities at a minimum once per year. In addition to the annual inspections, the Virginia Stormwater Management Program and regulations require a stormwater facility inspection after any storm event that exceeds the principal spillway, or more specifically, whenever the emergency spillway is engaged.

Further, the inspection frequency may vary for a specific BMP if additional inspections are prescribed on the construction record drawings. This is oftentimes the case for the first year of a newly constructed BMP to ensure stabilization takes hold and any necessary plants survive.

3.1 DEQ Stormwater Inspector Certification

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

4.0 STORMWATER MANAGEMENT FACILITIES

This section describes the types of BMPs found on the JTCC campuses and their general layout and function. If additional BMPs are added to the campuses that differ in type, the manual will require updates to assist with compliance in accordance with Section 2.4 of this manual. Updates should be incorporated into the Manual within 1-year of the installation of the new BMP type.

There are several types of BMPs on the JTCC campuses. A discussion of the facility types is included in the following sections.

4.1 Bioretention

Bioretention facilities are shallow landscaped depressions that incorporate many of the pollutant removal mechanisms that operate in our natural environment. The primary component of a bioretention practice is the filter bed, which has a mixture of sand, soil, and organic material as the filtering media in the ground with a surface mulch layer. During storms, runoff temporarily ponds 6 to 12 inches above the mulch layer and then rapidly filters through the bed. Normally, the filtered runoff is collected in an underdrain and returned to the storm drain system or receiving channel. The underdrain consists of a perforated pipe in a gravel layer installed along the bottom of the filter bed. Bioretention facilities also can be designed to infiltrate runoff into native soils without an underdrain. This can be done at sites with permeable soils, a low groundwater table, and a low risk of groundwater contamination. The second most critical component of bioretention facilities is the landscaping plan and plantings. The plantings are designed specific to the site and facility and they remove and store pollution. Small residential applications of bioretention are termed rain gardens.

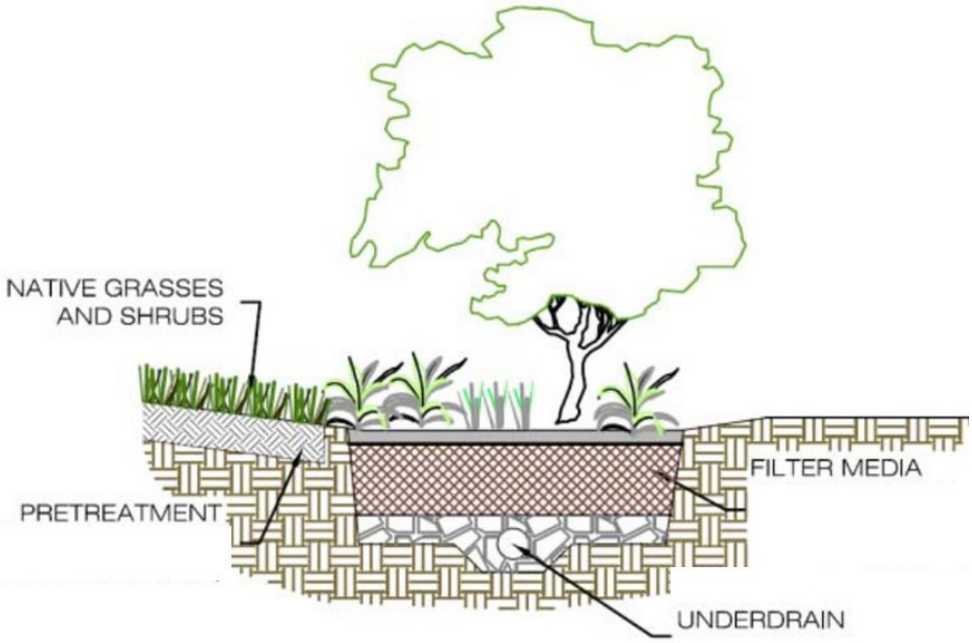

Figure 1: Typical Bioretention Facility Section

4.2 Detention

These basins have at least one inflow channel, an embankment/dam, a bottom level orifice, sometimes a riser in the basin, a principal spillway structure to route drainage through the dam, and an outlet structure. These basins do not have a normal 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. On rare occasions the extended detention basin may be designed to have a wet normal pool. If a plan does not indicate a wet marsh or normal pool elevation, investigate to ensure a constant pool of water is not due to blockage.

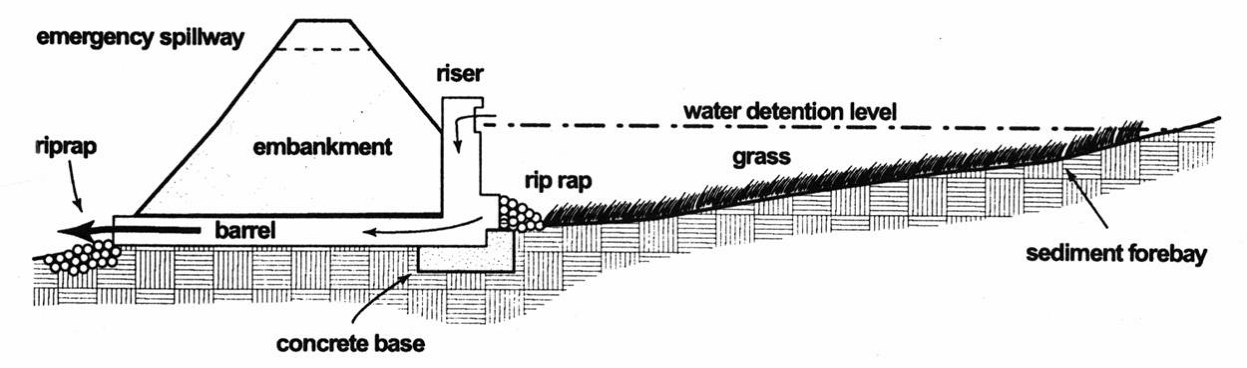

Figure 2: Typical Dry Detention Basin Section

4.3 Retention

These basins have at least one inflow channel, an embankment/dam, typically a riser in the basin although not always, a principal spillway structure to route the drainage through the embankment, and an outlet structure. Wet ponds consist of a permanent pool of standing water that promotes pollution removal and reduces flooding. Retention basins can also be dry facilities which would mimic the dry detention schematic. Runoff from each storm enters the pond and raises the normal water level, and the outlet structure releases the drainage at a slower rate over a longer period of time. This "draw down" or holding time allows pollutants to settle out of the stormwater and lessens the impact of the flow volume on the outlet channel.

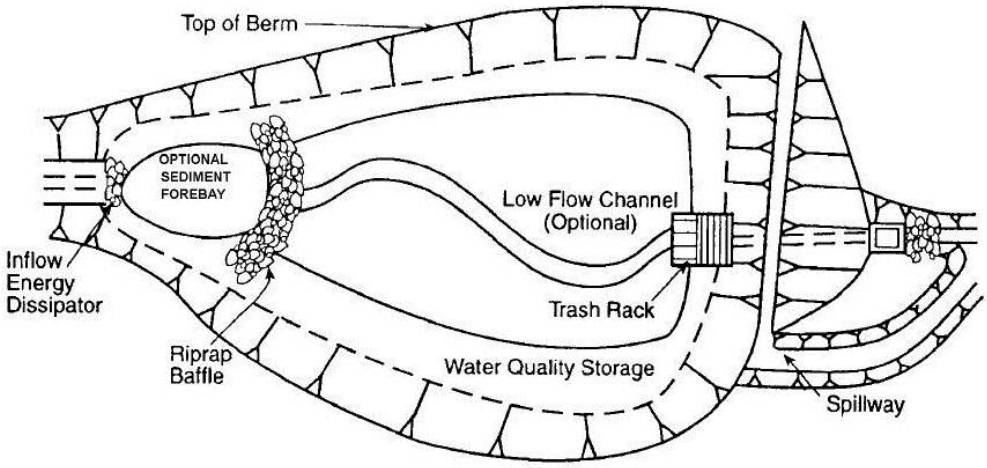

Figure 3: Typical Retention Facility Plan

4.4 Vegetated Roof

Vegetated roofs (or green roofs) are systems designed to capture and temporarily store stormwater runoff in the growing media before it is conveyed into the storm drain system. A portion of the stormwater either evaporates or is taken up by the plants, which helps reduce peak runoff volumes, peak runoff rates, and pollutant loads. The planting media is typically 2 to 6 inches thick, which is planted with drought tolerant species. Underneath is a root barrier, insulation layer, and a waterproof membrane above the roof deck material. Horizontal channels may also convey water to outlets that connect to pervious areas near the building or directly to the storm drain.

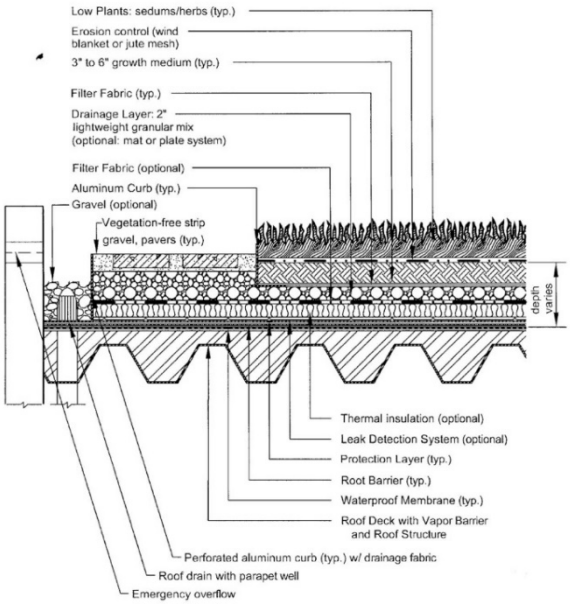

Figure 4: Typical Vegetated Roof Section

4.5 Manufactured Filter Device "Filterra"

A Filterra is a proprietary system similar to a bioretention in its function and application but has been optimized for high volume/flow treatment and high pollutant removal. Filterras are comprised of engineered biofiltration media and a plant that work together to remove pollutants typically found in urban stormwater runoff. The system is a fully equipped, pre-constructed, drop in place unit designed for applications in the urban landscape to treat contaminated runoff from impervious surfaces.

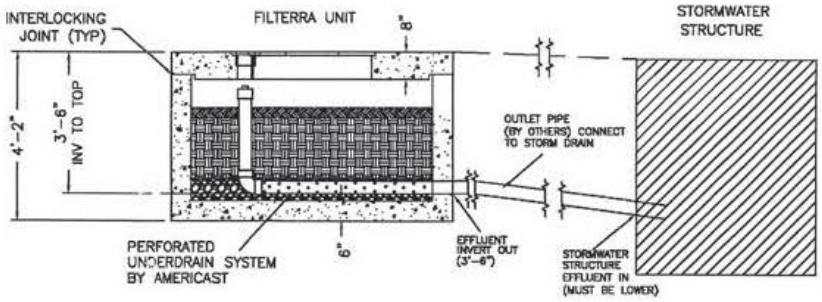

Figure 9: Typical Filterra Section

5.0 BMP INSPECTION FORMS

BMP inspection forms are an integral part of the Post-Construction Stormwater Management Program and provide documentation to demonstrate compliance to the General Permit requirements. The following sections are intended to provide guidance when completing the BMP inspection forms located in Appendix A.

5.1 Stormwater Management Facility Information

The following describes the general information required on the BMP inspection form:

- "Owner": JTCC;
- "Facility ID #": This is the facility identification # as identified on the IDDE & Post-Construction Stormwater Facility Map (incorporated by reference);
- **"**Inspection Date": The date the inspection is taking place;
- "As-Built Plans Available": Are the original As-Built plans available for reference? Indicate yes or no;
- "Date of Last Inspection": The date of the last inspection of the facility. This information should be maintained on file and in the BMP inventory database;
- **"**Inspector(s)": The name of the inspector performing the inspection;
- Determination if maintenance was required and performed that stemmed from a previous inspection. The inspector should be able to obtain and review the previous inspection form. During the current inspection, the inspector should be able to determine if previous maintenance items have been addressed; and
- Determination if maintenance is needed based on the current inspection. Maintenance would typically be required if "Yes" is selected for any of the issues on the form. In this case, a BMP Maintenance Follow-up Form should be submitted to the Environmental Compliance Officer.

5.2 Inspection Elements

The inspection form is designed so that individual elements of the stormwater facility are inspected for the occurrence of typical issues. For each element issue, the inspector indicates a "yes," "no," or "N/A." Where "yes" is indicated, the corresponding corrective action identified on the form needs to be scheduled. Proper evaluation of element issues is critical to identify maintenance needs; and therefore, preserve proper functionality of the BMP. The notes section of the form can be utilized to indicate the severity of maintenance needs. The following sections define and describe each component of the Inspection Form.

5.2.1 Contributing Drainage Area

The contributing drainage area includes any area that drains to the facility, both onsite and offsite. These areas should be examined as a potential source of trash, debris, or erosion if any of these are within the facility. Eliminating the source of the issue is essential and works as a preventative measure to ensure long term functionality of the BMP.

5.2.2 Pretreatment

Pretreatment is the initial structure or measure through which stormwater runoff is routed before it enters the BMP. It serves as a preliminary filter, or trap, to remove silt and sediment that could reduce the pollutant removal efficiency of the BMP. As a result, the pretreatment structures or measures require clean out more often than the facility itself. If there are significant amounts of sediment in the pretreatment structure, it should be removed to maintain its function and to prevent the sediment from being re-suspended in runoff and conveyed to the BMP and subsequently downstream to the receiving waters.

5.2.3 Inlets

Inlets, such as drop inlets and curb inlets, route runoff through the storm sewer and into BMPs for treatment from the contributing drainage area. The inspector should determine if sediment, trash, or other obstructions are preventing flow from being conveyed to the BMP.

5.2.4 Sediment Forebay

A sediment forebay is a pretreatment structure that traps debris, trash, sediment and other pollutants from entering the BMP. Sediment must be cleaned out once the level in the forebay reaches 50% of the capacity. This can be measured by placing a marked stake in the forebay with the marking indicating the 50% level. The marker is useful since the forebay may often maintain a wet pool. Excessive sediment accumulation may also indicate exposed soils within the drainage area to the BMP that require stabilization.

5.2.5 Vegetation

For certain BMPs, such as constructed wetlands, the planting plan serves as a component of the design. Vegetation assists with filtering and biological uptake of pollutants, and maintaining the plantings is critical to ensure functionality. The BMP vegetation should match the design plans for the number and species of plants present. Having more plants than what is shown on the plans is acceptable as long as it is not an invasive species and/or the overgrowth is not impacting the storage volume and the BMP's ability to drain. Mosquito breeding can also be a concern, especially once cattail matting has become established in the BMP. Therefore, cattails are not a desirable species within a BMP. Considering the general planting location in the facility is also helpful. For example, if there is a section of plants adjacent to a road shoulder that is dying, it may be indicative of contaminated runoff, such as from de-icing operations. Vegetation should be replaced in accordance with the approved plans, acceptable species and quantities from the Virginia BMP Clearinghouse for the BMP type, or as specified by a licensed Landscape Architect or Professional Engineer.

5.2.6 Emergency Spillway

The emergency spillway is a channel that conveys stormwater during large storm events from the BMP to an outfall, usually the same one as the principal spillway or main outlet. It prevents the facility from overtopping during the large storm events. Not all facilities have an emergency spillway. Spillways can be lined with various materials including grass with or without erosion control matting, riprap, or concrete, based on the velocity of flows predicted through the spillway. The spillway is usually visible as a low spot a minimum of 1' below the top of embankment off to one side. Consult the design plans for additional details.

5.2.7 BMP Outfall

The BMP outfall is the location where flows are discharged from the BMP. The BMP outfall should discharge into a stabilized receiving channel. At the location where the discharge from the BMP enters the receiving channel, there is typically a riprap stone lining to prevent erosion, otherwise known as outlet protection. The purpose of many stormwater facilities is to protect the downstream channels, and thus, an evaluation of the outfall and the channel immediately downstream should be conducted to determine if erosion is occurring.

5.2.8 Principle Spillway

The principle spillway is the structure that controls how much flow exits the BMP during more frequent storm events. Flows typically pass through the control structure (e.g., orifice, riser) and subsequently through a culvert that passes through an embankment, if present. The principle spillway is used in most storm events, unlike the emergency spillway, which is only used during very large events. Because this is typically the only conveyance through the embankment, the functionality and structural integrity of the principle spillway is critical. Often, a riser may serve as the principal spillway and connect the discharge culvert to convey flows to the BMP outfall. The riser usually has a small opening, or orifice, that controls the amount of flow through the system. The functionality of the riser can have a large impact on the water level in the basin; and therefore, whether the designed pollutant removal is met. Larger storms may spill over the top of the riser through a grate. Inspections should ensure the top of the riser is free from obstruction as well as any orifices in the structure. Damage or deterioration can take the form of rust, cracking, exposed rebar, or additional holes in the structure.

5.2.9 Berm/Embankment

The embankment or berm is the fill section that detains runoff within the facility. The face of the dam is the front side that interacts with the water level and the top, or crown, is the highest flat surface. The downstream side is the back of the dam from the top down to where the fill section meets the natural grade (called the “toe” of the dam), typically just below the outfall. Basins outlet on the downstream side, which can be a more problematic area due to the effects of water pressure and saturation on the face and through the embankment. Trees should not be allowed to grow in the embankment since their root systems can affect the structural integrity. A dug basin, however, will not have all of these components since it is excavated into the existing earth and not created by fill placement. Additionally, roadways are not considered embankments because they typically have culvert pipes through them to convey stormwater effectively. Issues with the embankment can be critical to the function of the facility, downstream safety, as well as environmental concerns in the case of a failure.

5.2.10 Low Flow Orifice

The low flow orifice is the smaller outflow hole, usually in the riser, that slows the discharge from the pond, protecting against downstream erosion. It also provides settling time for the runoff within the facility. The low flow orifice tends to clog because of its small size and will typically have a trash rack or screen on the front of it.

5.2.11 Miscellaneous

This section captures any other pertinent features or issues of the facility not otherwise addressed in the checklist. Issues may be identified in the footprint area and with general issues such as difficulty in accessing the BMP. Note any of the criteria needing repair and include applicable location information for reporting.

6.0 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.

6.1 Routine Maintenance

Routine maintenance consists of preventative measures that are essential to the ongoing care and upkeep of a BMP. These measures are 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. Upon being identified during an inspection, routine maintenance should be conducted within six (6) months of the inspection.

Examples of routine maintenance include:

- Removal of any accumulated sediment from the forebays;
- Replacement of plants called for in the approved plans that have died or are diseased;
- Repair of the stormwater structures for erosion or undercutting;
- Repair of any erosion in the facility, including sloughing, animal burrows, and slopes;
- Repair of any deterioration at the outfall of the facility, including the riprap outlet protection;
- Removal of blockages from all trash racks, inlets, and outlets;
- Maintenance of adequate access to the facility and removal of woody vegetation as needed;
- Removal of trees from embankments;
- Exercise of valves to prevent them from locking up where applicable; or
- Removal all trash, debris, and floatables periodically from the facility.

6.2 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 intentions, corrective maintenance is required and should be conducted as soon as possible to prevent downstream damage to properties and/or the environment. Upon being identified during an inspection, corrective maintenance should be conducted within one (1) year of the inspection contingent on complexity. Reasonable progress steps should at least be taken.

Examples of Corrective Maintenance include:

- Repair of any deterioration or issues with the principal spillway and riser, such as evidence of spalling, joint failure, leakage, corrosion, etc.;
- Extensive sediment removal when inspections indicate that 50% of the forebay sediment storage capacity has been filled;
- Control or removal of invasive species and plant growth if there are impacts to the storage volume (i.e., water levels rise because the vegetation is taking up the water storage space); or
- Removal of woody vegetation from the embankment, if present, to prevent structural damage.

Further information on maintenance recommendations for various types of BMPs can be found at the Virginia BMP Clearinghouse at: http://www.vwrrc.vt.edu/swc/NonProprietaryBMPs.html.

Appendix A: Stormwater Facility Inspection Forms

Appendix B: BMP Maintenance Follow-up Form