Stormwater Management
Operations and Maintenance Manual

for

Kings Gate East

at

Block 1103, Lots 2 &3
Block 1107, Lots 14,15,16 & 17
Rattling Run Road and Tomlin Station Road
Township of East Greenwich
Gloucester County, NJ
#31550 00

May 18, 2016

Prepared For:
Homeowner's Association of
King's Gate East

Prepared By:
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Project Information

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Project Owner: Kings Gate East Homeowner's Association

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List of Stormwater Management Measures

The stormwater management measures incorporated into this development are listed below. The corresponding Field Manuals for the stormwater management measures are located in Part II of the Maintenance Plan.

Infiltration/Detention Basin
Retention Basin/Wet Pond

Basin Locations:

Basin #1 (Detention/Infiltration) 805 Castleton Drive
Basin #2 (Retention/Wet Pond) 840 Derius Drive

Basin Latitude & Longitude:

Basin #1 (Detention) 39°46'10"N, 75°15'54.58"W
Basin #2 (Retention) 39°45'57"N, 75°16'7"W

Introduction

The on-site stormwater management facilities were designed to operate under conditions that require regular active maintenance to ensure their integrity and proper operation. The stormwater management features located on site consist of an approximately 36,750 square foot detention/infiltration basin off of Castleton Drive and an approximately 44,200 square foot retention basin/wet pond off of Derius Drive. As a minimum, the following maintenance plan must be implemented and adhered to by the Kings Gate East Homeowner's Association, herein after referred to as the Owner. Should specific conditions warrant additional maintenance measures, then same shall also be implemented as required.

Overview of Stormwater Management Practices & Maintenance

Overview of Detention/Infiltration Basin & General Maintenance

In accordance with the New Jersey Department of Environmental Protection (NJDEP) New Jersey Stormwater Best Management Practices Manual (BMP), Chapter 9.5, "all infiltration basin components expected to receive and/or trap debris and sediment must be inspected for clogging and excessive debris and sediment accumulation at least four times annually as well as after every storm exceeding 1-inch of rainfall." Such components may include bottoms, riprap or gabion, aprons and inflow points. The infiltration basin drain-down times should be used to evaluate the basin's actual performance. An increase or decreases in the normal drain-down time, the basin's bottom surface, subsoil surface and both groundwater and tailwater levels should be evaluated and appropriate measures taken to comply

with the maximum drain time requirement. The bottom of the sand layer in a surface infiltration basin should be inspected at least monthly as well as after every 1 inch of rainfall. The permeability rate of the soil below the basin may also be retested periodically. If the water fails to infiltrate 72 hours after the end of the storm, corrective measures must be taken. Annual tilling by light equipment can assist in maintaining infiltration capacity and break up clogged surfaces.

Sediment removal should take place when the basin is thoroughly dry. Disposal of debris, trash, sediment, and other waste material should be done at suitable disposal/recycling sites and in compliance with all applicable local, state, and federal waste regulations.

In addition to the quarterly inspections, it is recommended that the basin be inspected annually by a Licensed Professional Engineer to assure proper operation and to provide recommended changes to the maintenance thereof. Among the specific items that should be observed and reported on are erosion of the side slopes, breaching of embankments, damage to vegetation, excessive sediment/debris and deterioration of the headwalls, and outlet works. Any erosion on the basin's side slopes must be repaired and then re-seeded in accordance with the state soil erosion standards. Breaching of embankments may be caused by animals, settlement, or other factors. Deterioration of outlet structures may cause a basin failure to occur and result in property damage downstream. Due to all of the above concerns, any observed deficiencies must be reported and corrected immediately upon discovery. Other minor items such as displacement of riprap, deterioration of low-flow channels, etc., should also be noted and repaired in a timely fashion.

Overview of Retention Basins/Wet Ponds & Maintenance

Wet ponds, also known as retention basins, are used to address the stormwater quantity and quality impacts of land development. This type of stormwater facility has an elevated outlet structure that creates a permanent pool where stormwater runoff is detained and attenuated. Wet ponds can be designed as multi-stage, multi-function systems; extended detention in the permanent pool provides pollutant treatment for runoff from the Water Quality Design Storm through sedimentation and biological processing; detention and attenuation is also provided for larger storm event through the higher elevation outlets. The total suspended solids (TSS) removal rate is 50 – 90%, depending upon the storage volume in the permanent pool and the duration of detention time, if extended detention is provided. Proper care and attention in the long-term maintenance of the stormwater management measure is critically important to the safety and health of the public.

Wet ponds shall have a water surface elevation approximately at the design water surface elevation year round. If a wet pond has an exposed bottom or a shallow water level, there may be an issue caused by changes to the contributing drainage area, damage to the outlet structure(s), or damage to the bottom liner. An investigation is then required to determine the issue and restore proper function.

Regular and effective maintenance is crucial to ensure effective wet pond performance; in addition, maintenance plans are required for all stormwater management facilities associated with a major development, pursuant to N.J.A.C. 7:8-5.8. There are a number of required elements in all maintenance plans; these are discussed in more detail in Chapter 8: Maintenance of Stormwater Management Measures. Furthermore, maintenance activities are required through various regulations, including the New Jersey Pollutant Discharge Elimination System (NJPDES) Rules, N.J.A.C. 7:14A. Specific maintenance requirements for wet ponds are presented below; these requirements must be included in the wet pond's maintenance plan. In addition, the frequency of a clean out cycle for a wet pond should be considered in the maintenance plan since wet ponds are intended to accumulate sediment. The cleanout cycle for a wet pond in a stabilized watershed can vary, with an average cycle of approximately 10 years.

All wet pond components expected to receive and/or trap debris and sediment must be inspected for clogging and excessive accumulation at least twice annually, or as needed; these components may include bottoms, trash racks, outlet structures, and riprap or gabion aprons. Disposal of debris, trash,

sediment and other waste material must be done at suitable disposal/recycling sites and in compliance with all applicable local, state and federal waste regulations. All structural components must be inspected, at least once annually, for cracking, subsidence, spalling, erosion and deterioration.

When establishing or restoring vegetation, inspections should be performed biweekly. Once established, inspections of health, density and diversity should be performed at least twice annually during both the growing and non-growing seasons. The vegetative cover must be maintained at 85%; if vegetation has greater than 50% damage, the area must be reestablished in accordance with the original specifications and the inspection requirement above. Mowing/trimming of vegetation must be performed on a regular schedule based on specific site conditions; perimeter grass should be mowed at least once a month during growing season. Vegetated areas must be inspected at least once annually for erosion, scour and unwanted growth; any unwanted growth should be removed with minimum disruption to the remaining vegetation. All use of fertilizers, pesticides, mechanical treatments and other means to ensure optimum vegetation health must not compromise the intended purpose of the sand filter.

The approximate time it would normally take to completely drain the Water Quality Design Storm volume above the permanent pool must be indicated in the maintenance manual. If the actual drain time is significantly different from the design drain time, the components that could provide hydraulic control must be evaluated and appropriate measures taken to return the wet pond to minimum and maximum drain time requirements. If the actual drain time is significantly different than the design drain time, the outlet structure and both groundwater and tailwater levels must be evaluated and appropriate measures taken to comply with the maximum drain time requirements.

General Maintenance

This Maintenance and Repair (M&R) manual will provide a mechanism by which additional remedial repairs and routine maintenance items can be performed to avert long-term degradation of the concrete box riser, emergency overflow spillway, and earth embankments. "Informal inspections," also identified herein as "maintenance inspections," must be performed by the designated Inspector appointed by the Owner.

The person with maintenance responsibility must evaluate this maintenance plan for effectiveness at least annually and revise as necessary. A detailed written log of all preventative and corrective maintenance performed at the stormwater management facility must be kept, including a record of all inspections and copies of maintenance related work orders. The person with maintenance responsibility must retain and, upon request, make available the maintenance plan associated logs and other records for review by a public entity with administrative, health, environmental, or safety authority over the site.

Preventative and Corrective Maintenance Action Plan

As per N.J.A.C. 7:8-5.8(b) & (e), preventative and corrective maintenance shall be performed to maintain the function of the stormwater management measure, including, but not limited to, repairs or replacement to the structure; removal of sediment, debris, or trash; restoration of eroded areas; snow and ice removal; fence repair or replacement; restoration of vegetation; and repair or replacement of non-vegetated linings.

As per NJDEP BMP Manual Ch. 8Feb. 2004), maintenance plans should include specific preventative and corrective maintenance tasks such as removal of sediment, trash, anddebris; mowing, pruning, and restoration of vegetation; restoration of eroded areas; elimination of mosquito breeding habitats; control of aquatic vegetation; and repair or replacement of damaged or deteriorated components.

As per NJDEP BMP Manual Ch. 8 (Feb. 2004), maintenance plans should include recommended corrective responses to various emergency conditions that may be encountered at the stormwater management measure.

As per NJDEP BMP Manual Ch. 8 (Feb. 2004), the maintenance plan should address the maintenance of access points to the stormwater management measures in accordance with the following:

- all components of the stormwater management measures must be readily accessible for inspection and maintenance;
- trees, shrubs, and underbrush must be pruned or trimmed as necessary to maintain access to the stormwater management measure via roadways, paths, and ramps, including paths through perimeter vegetation to permanent pools, aquatic benches, and safety ledges to allow for the inspection and control of mosquito breeding; and
- the exact limits of inspection and maintenance easements and rights-of-way should be specified on stormwater management measure plans and included in the maintenance plan.

Preventative Maintenance Actions

The frequency of the preventative maintenance actions listed here is adopted from Chapter 9, BMP Manual of Structural Stormwater Management Measures. Design engineer and responsible party should adjust the frequency of preventative maintenance actions according to the situations of the stormwater management measures in the development.

Safety of inspection and maintenance personnel is essential. Non-technical staff can carry out some tasks quite effectively; however, all programs should carefully ensure the safety of everyone involved in maintenance tasks. Often, a professional may need to be hired to conduct the required work. Confined spaces should never be entered without proper training and permits from occupational and safety regulatory agencies. Additionally, professional judgment should be solicited regularly to ensure that all needs of the facility are met. Even though non-professionals can routinely perform some maintenance tasks, there are many problems that are not obvious to the untrained eye.

Frequency	Preventative Maintenance Actions	Stormwater Measures/No.
Bi-weekly	Turf Management- Bi-weekly inspections of vegetative health should be performed throughout the first growing season. Mowing and/or trimming of vegetation must be performed on a regular schedule based on specific site conditions. Grassed areas are typically to be mowed once per month during the growing season. All grass clippings shall be removed from the basin areas and disposed of properly. All use of fertilizer,	Detention/Infiltration Basin (Basin #1), Embankment and Grassed Areas along Retention Basin/Wet Pond (Basin #2)and in any basin access areas

	mechanical treatments, pesticides, and other means to assure optimum vegetation health must not compromise the intended purpose of the basin. All vegetation should be returned to original specifications. Deficiencies should be addressed without the use of fertilizers, mechanical treatments, pesticides, and other means to assure optimum vegetation health whenever possible.	
Monthly	Weed Control – On a monthly basis, weeds and other undesirable growth shall be removed from the basin, particularly from around the outlet structures, headwalls, and riprapped areas.	Detention/Infiltration Basin (Basin #1), Embankment and Grassed Areas along Retention Basin/Wet Pond (Basin #2)and in any basin access areas
Quarterly	Debris Removal - On a quarterly basis and following rain events exceeding 1-inch of rainfall, the basin should be inspected for accumulated debris. Any accumulation of trash or debris is to be removed. Disposal of debris shall be in conformance with local, state, and federal regulations. This is necessary for safety, to prevent the blockage of outlet works, to limit the habitat for undesirable wildlife and pests, and to maintain the overall aesthetics of the basin.	Detention/Infiltration Basin (Basin #1), Components of Retention/Wet Pond (Basin #2) as needed.
Quarterly	Outlet Works- All outlet control structures shall be inspected quarterly and cleaned as necessary. In order to ensure that the basin will function properly, any silt and debris buildup must be removed from the bottom of the structures and the outfall pipes. Trash racks must be inspected and cleaned or painted as necessary. Trash rack pivots must be replaced in the event they become inoperable.	Detention/Infiltration Basin (Basin #1), Components of Retention/Wet Pond (Basin #2) as needed.
Semiannual	Sediment & Erosion Control- All accumulated sediment shall be removed from piping, structures, channels, riprap aprons, and the basin to provide unobstructed flow through the outlet structure. Sediment removal shall take place when the basin is thoroughly dry. Disposal of debris, trash, sediment, and other waste material should be discarded at suitable disposal/recycling sites and in compliance with all applicable local, state, and federal waste regulations. Any eroded areas and any areas of turf failure shall be filled and compacted. Ground cover shall be reestablished through seeding, fertilizing, lime application, and mulching. Problem areas shall be reworked until stability is provided by the establishment of a healthy turf.	Detention/Infiltration Basin (Basin #1) and Retention/Wet Pond (Basin #2)
Annual	Basin Structural Inspection - All structural components must be inspected for cracking, subsidence, spalling, erosion, and deterioration at least annually	Detention/Infiltration Basin (Basin #1) and Retention/Wet Pond (Basin #2)

Annual	Aeration- The basin bottom shall be aerated at least once per year. In addition, the basin bottom shall be scraped and replanted at least once each (5) five years to prevent sealing of the bottom by silt and sediment.	Retention/Wet Pond (Basin #2)
Biennial	Sand layer replacement for infiltration basin only	Detention/Infiltration Basin (Basin #1)
Unscheduled	Quick inspection after every 1" rain	Detention/Infiltration Basin (Basin #1) and Retention/Wet Pond (Basin #2)
Unscheduled	Rip-rap Aprons - Riprap aprons that become laden with silt or develop vegetative growth shall be removed and reinstalled after the apron area has been cleaned and regraded	Detention/Infiltration Basin (Basin #1) and Retention/Wet Pond (Basin #2)
Unscheduled	Basins not draining within 72 hours – If significant increases or decreases in the normal drain time are observed, the outlet structure, and groundwater and tailwater levels must be evaluated. A licensed Professional Engineer may need to be consulted and appropriate measures taken to comply with the maximum drain time requirements and maintain the proper functioning of the basins. In particular, if the basins do not drain noticeably within the specified drain time, Springfield Township should be notified. If the basin appears stagnant, then the Burlington County Mosquito Extermination Commission should be notified by calling (609) 265-5064. If mosquito control becomes necessary, this maintenance plan should be re-evaluated and emphasis must be placed on the control of mosquito breeding.	Detention/Infiltration Basin (Basin #1)

Recommendations:

It is recommended that the Owner contact a Professional Engineer and an environmental consultant prior to performing basin maintenance operations, other than vegetation overgrowth removal, to ensure that no state and/or local permits are required. Removal and disposal of accumulated sediment, trash, and debris shall be in compliance with all local, state, and federal regulations.

Corrective Maintenance Actions

A well-organized maintenance and repair program will protect the basins against deterioration and prolong their life. All components of the basin including the embankment, concrete overflow structure, emergency spillway and the reservoir are susceptible to damage and deterioration over time. This manual establishes a basic maintenance and repair program based primarily on systematic inspections by appointees of Owner. A checklist of items as defined in Inspections and Inspection Checklist must be used during each inspection. The completed checklist must be dated and signed by the Inspector and incorporated into this manual.

This manual is intended as a guide for the Owner and outlines the proper procedures for conducting routine maintenance and repair for the basins. The Owner shall appoint a key site person, from within their organization (Inspector), who will perform inspections for the year. This manual will then be transferred annually to the appointed Inspector. A continuous record of the maintenance and repair for

the basin must be maintained. The Designated Inspector's List lists the Officials and various Contractors. This section must be updated periodically, pending a change in the Officials, the Inspector, the Engineer, or the Contractor.

This section of the manual has been prepared to provide the Inspector with a simple and systematic method for inspecting, operating, and maintaining the basin. For the most part, the maintenance and repair involves observation rather than evaluation. The following sections provide a step-by-step procedure to assist the Inspector in performing all duties in a rational and orderly manner. The Inspector must become familiar with the background information in previous sections of this manual. The Inspector must also review the plans which are included with this manual.

Finally, prior to conducting an inspection or performing routing maintenance and repairs, the Inspector must review the Tools and Equipment List, the Inspections, and Inspection Checklist. Each time an inspection reveals the need for maintenance, the Inspector shall notify the Owner who may hire an agent to perform the work. Each time maintenance is performed on the basin, the Inspector must record the incident and place a copy of the maintenance checklist in this manual. Inspections must be performed quarterly and after each storm event exceeding 1-inch of rainfall. Routine maintenance, as defined in the previous section of this manual, shall be performed immediately after each inspection and after each major storm event.

Potential Corrective Maintenance Actions	Stormwater Management Measures/No.
• Repair/replacement of eroded or damaged riprap apron • Repair/replacement of missing or damaged trash racks • Repair/replacement of outlet pipes or orifices • Repair/replacement of any other stormwater management components which may be applicable. • Revegetation of eroded side slope, aquatic bench, marsh, basin bottom, grass swales, etc.	Detention/Infiltration Basin (Basin #1) and Retention/Wet Pond (Basin #2)

Maintenance Personnel, Equipment, Tools, and Supplies

Designated Inspectors List

This Section must be updated periodically to reflect the name(s) and telephone number(s) of the Inspectors and Contractors who are appointed by the Owner.
Year_____

Title	Name	Contact Information
Owner	*Kings Gate East Homeowner's Association*	
Inspector(s)		
Designated Contractor(s)		
Professional Engineer		

Year: _____

Title	Name	Contact Information
Owner		
Inspector(s)		
Designated Contractor(s)		
Professional Engineer		

Year: _____

Title	Name	Contact Information
Owner		
Inspector(s)		
Designated Contractor(s)		
Professional Engineer		

Plan Review & Previous Inspection Reports:

The Inspector shall review available plans and previous inspection reports prior to conducting an inspection. There is a minimum amount of plan work currently available. Previous inspection reports are available through the Owner. This section shall be periodically updated to incorporate additional plans and sketches for the operations, maintenance, inspection, or rehabilitation of the basin and its ancillary features.

Tools and Equipment

The following is a list of required inspection equipment for performing M&R procedures and inspections:

- A clip board, a pencil, and inspection checklist (the inspection checklist is included in the following section).
- A standard 6-foot collapsible ruler.
- A camera – photographs of observed portion of the basin will provide a measure of performance when comparing past and present maintenance practice.
- A probe – any stiff light stick or rod with a blunt tip of sufficient strength to penetrate soil. The probe can provide information on conditions below the surface of the basin such as the depth and softness of a saturated area.
- A weed whacker – can be used to clear non-visible areas and to perform routine maintenance on the embankments.
- A flashlight – a flashlight can be used to observe areas where there is a low level of light.
- A hammer – for sounding concrete to detect deteriorated areas.
- A pipe wrench – for opening dry well inspection ports.

Maintenance at the basin may require heavy equipment including the following:

- Chain saw
- Stump grinder
- Wheelbarrow
- Backhoe
- Dump Truck
- Pump – for dewatering purposes

Sources of the following materials should be identified for immediate use if warranted by the inspection:

- Native, silty sand for filling erosion rills and gullies.
- Topsoil mixture, fertilizer, and seed
- Large stone riprap for emergency repairs caused by erosion

Synthetic geo-fabric netting and stakes to prevent seed and topsoil from blowing away.

Safety Regulations and Requirements

All local ordinances and state and federal regulations for occupational safety should be followed as part of the maintenance of this stormwater management system. The Homeowner's Association maintain proper emergency procedures and provide emergency contact numbers to those who are performing the maintenance work on the on-site stormwater management system.

Training

As per NJDEP BMP Manual Ch. 8 (February 2004), maintenance training begins with a basic description of the purpose and function of the overall stormwater management measure and its major components. Such understanding will enable maintenance personnel to provide more effective component maintenance and more readily detect maintenance-related problems. Basic training can be obtained by reading the previous sections detailing the stormwater management measures in place on site. Depending on the size, character, location, and components of each stormwater management measure, maintenance personnel may also require training in specialized inspection and maintenance tasks and/or the operation and care of specialized maintenance equipment. Training should also be provided in the need for and use of all required safety equipment and procedures.

Disposal

Approved disposal and recycling sites and procedures shall be used for sediment, trash, debris, and other material removed from stormwater management measures during maintenance operations.

Inspection and Logs of All Preventative and Corrective Maintenance

As per N.J.A.C. 7:8-5.8(f), the person responsible for maintenance shall maintain a detailed log of all preventative and corrective maintenance for the structural stormwater management measures incorporated into the design of the development, including a record of all inspections and copies of all maintenance-related work orders.

As per NJDEP BMP Manual Ch. 8 (Feb, 2004), a maintenance plan shall include a schedule of regular inspections and tasks, and detailed logs of all preventative and corrective maintenance performed on the stormwater management measure, including all maintenance-related work orders. The person with maintenance responsibility must retain and, upon request, make available the maintenance plan and associated logs and other records for review by a public entity with administrative, health, environmental, or safety authority over the site.

Inspection Checklists for the stormwater management measures on this site include:

- Detention/Surface Infiltration Basin
- Retention Basin/Wet Pond

Inspection Checklist/Maintenance Actions

Surface Infiltration Basin

Checklist (circle one): Quarterly/Annual/Monthly/Special Event Inspection

Checklist No._____ **Inspection Date:**_____

Date of most recent rain event: _____

Rain Condition(circle one):
Drizzle/Shower/Downpour/Other_____

Ground Condition(circle one):
Dry/Moist / Ponding/Submerged/Snow accumulation

The inspection items and preventative/corrective maintenance actions listed belowrepresent general requirements.The design engineer and/or responsible party shall adjust the items and actions to better meet the conditions of the site, the specific design targets, and the requirements of regulatory authorities.

	For Inspector			For Maintenance Crew
Component No. Component Name	Inspection Item and Inspection Item No.		Result	Preventative/Corrective Maintenance Actions
B Infiltration Bed	1	Standing water is present after the design drain time The observed drain time is approximately _____ hours.	Y__ N__	Recheck to determine if there is standing water after 72 hours If standing water is present longer than 5 days, report to mosquito commission. Remove any sediment buildup Replace the sand Work Order # _____
	2	Excessive sediment, silt, or trash accumulation on basin bed	Y__ N__	Clean pretreatment system Remove silt, sediment, and trash Work Order # _____
Note:				

	For Inspector			For Maintenance Crew
Component No. Component Name	Inspection Item and Inspection Item No.		Result	Preventative/Corrective Maintenance Actions
Infiltration Bed	3	Erosion or channelization is present	Y__ N__	Check whether the flow bypass or diversion device is clogged Re-grade the infiltration bed Work Order # _____
	4	Animal burrows/rodents are present	Y__ N__	Pest control Work Order # _____
	5	Uneven bed	Y__ N__	Use light equipment to resurface the bed Work Order # _____
	6	Evidence of sinkholes or subsidence	Y__ N__	Monitor for sinkhole development
Note:				

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Result**	**Preventative/Corrective Maintenance Actions**
Vegetation	1	Large spot(s) showing bare soil	Y__ N__	Vegetative cover must be maintained at 85%. Re-vegetate the entire basin if 50% or more vegetation has been lost. Check Landscaping plan for guidance (if available) Work Order # _____
	2	Overgrown vegetation	Y__ N__	Mow/trim the vegetation Work Order # _____
	3	Tree growth in the basin	Y__ N__	Clear, trim, or prune the trees according to the original Landscaping Plan Inspect to determine if the tree roots caused any structural damage Work Order # _____
Note:				

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Result**	**Preventative/Corrective Maintenance Actions**
Basin Embankment and Side Slopes	1	Signs of erosion, soil slide or bulges, seeps and wet spots, loss of vegetation, or erosion on the basin slope	Y__ N__	Check for excessive overland runoff flow through the embankment. Check for any sink hole development Restabilize the bank Work Order # _____
Note:				
Outlet	1	Trash or debris accumulation more than 20%	Y__ N__	Clean and remove Determine source of trash and address to reduce future maintenance costs or basin failure

	For Inspector			For Maintenance Crew
Component No. Component Name	Inspection Item and Inspection Item No.		Result	Preventative/Corrective Maintenance Actions
	2	Trash rack is damaged or rusted greater than 50% Trash rack is bent, loose, or missing parts	Y__ N__	Repair or replace trash rack Work Order #_____
	3	Outlet components (e.g., orifice plates or weir plate) skewed, misaligned, or missing	Y__ N__	Repair or replace component Work Order #_____
	4	Discharge pipe apron is eroded or scoured	Y__ N__	Restabilize the discharge riprap apron Work Order #_____
	5	Standing water is present in the outlet structure longer than 72 hours	Y__ N__	Pump out the standing water Work Order # _____
Note:				
F Emergency Spillway	1	Trees or excessive vegetation present	Y__ N__	Remove trees and roots, and restore berms if necessary Work Order #_____
	2	Damaged structure	Y__ N__	Repair Work Order #_____

	For Inspector			For Maintenance Crew
Component No. Component Name	Inspection Item and Inspection Item No.		Result	Preventative/Corrective Maintenance Actions
G Miscellaneous	1	Fence: broken or eroded parts	Y__ N__	Repair or replace Work Order #_____
	2	Gate: missing gate or lock	Y__ N__	Repair or replace Work Order #_____
	3	Sign/plate: tiled, missing, or faded	Y__ N__	Repair or replace Work Order #_____
	4	Excessive or overgrown vegetation blocking access to the basin	Y__ N__	Clear, trim, or prune the vegetation to allow access for inspection and maintenance Work Order #_____
Note:				

Follow Up Items (Component No. / Inspection Item No.):

Associated Work Orders: # _____, # _____, # _____, # _____, # _____

_____ _____ _____
Inspector Name Signature Date

Report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities, if standing water is present longer than 5 days.

File this checklist in the Maintenance Log after performing maintenance.

Preventative Maintenance Record

Corresponding Checklist No. _____
Component No._____, Inspection Item No._____

Work Logs

Activities	Components	Date Completed
Sediment/debris removal **Sediment removal should take place when the basin is thoroughly dry**		
	Infiltration Bed	
	Basin Embankment and Side Slopes	
	Outlet	
Vegetation removal		
	Infiltration Bed	
	Basin Embankment and Side Slopes	
	Outlet	
	Emergency Spillway	
(Other)		

Vegetation is removed by _____ (type of equipment) with minimum disruption to the remaining vegetation.

All use of fertilizers, pesticides, mechanical treatments, and other means to ensure optimum vegetation health must not compromise the intended purpose of the stormwater management measure. The fertilizer applied is _____ (type),and_____ (quantity per usage) is applied_____ (frequency of use).

Debris, sediment, and trash are handled(onsite / by _____ (contractor name) to disposal site _____). (See Disposal Plan Section)

If a sand layer is installed, replacement of the sand will occur according to the scheduled frequency (see Basin Configuration Targets above). The next scheduled replacement is _____ (date).

Crew member:_____/_____**Date:** _____
(name/ signature)

Supervisor:_____/_____ **Date:** _____
(name/ signature)

File this Preventative Maintenance Record in the Maintenance Log after performing maintenance.

Corrective Maintenance Record

1. **Work Order #** _____ **Date Issued** _____
2. **Issue to be resolved:**
3. The issue was from **Corresponding Checklist No. _____, Component No. _____,Inspection Item No. _____.**
4. **Required Actions**

Actions	Planned Date	Date Completed

5. **Responsible person(s):**

   _____

6. **Special requirements**
   - Time of the season or weather condition:_____
   - Tools/equipment:_____
   - Subcontractor (name or specific type):_____

Approved by _____/_____ **Date** _____
(name/signature)

Verification of completion by _____/_____ **Date** _____
(name/signature)

File this Corrective Maintenance Record in the Maintenance Log after performing maintenance.

The logs of all inspections, and both preventative and corrective maintenance performed should be attached in the **"Maintenance Logs and Inspection Records"** section.

Visual Aid for Dry Type Stormwater Basin Inspection

(Note: Basins shown here include various types of dry basins, not limited to the category of basin in this manual.)

Issue:	**The inflow pipe is clogged by sediment and vegetation.**
Corrective Action:	**Clear and remove sediment and unwanted vegetation.**
Preventative Action:	**Routine inspection and removal of sediment and unwanted vegetation.**

Issue:	**The Inflow pipe is entirely clogged by sediment and trees.**
Corrective Action:	**Clear and remove sediment and trees.**
Preventative Action:	**Routine inspection & removal of sediment and unwanted vegetation.**

Issue:	**The excessive sediment in inflow pipe (shown above) might be caused by a blockage of flow to the basin due to excessive vegetation and overgrown trees.**
Corrective Action:	**Clear and remove trees and vegetation. If necessary, re-grade the bottom slope to ensure the flow properly spreads over the basin bottom.**
Preventative Action:	**Routine inspection and removal of sediment and unwanted vegetation.**

Issue:	**Eroded inflow apron**
Corrective Action:	**Repair apron.**

Preventative Action: **Routine inspection and rehabilitation, if necessary.**

Issue: **The vegetation loss and the blackish soil may indicate frequent inundation.**

Corrective Action: **Check the permeability rate of the soil and the water table elevation. Replace the soil if necessary.**

Preventative Action: **Routine inspection and tilling/aeration, if necessary.**

Issue: **The low flow channel has excessive accumulation of sediment and debris. The outflow orifice is clogged by a trash bag and debris. Note that there is no trash rack installed.**

Corrective Action:	**Check the permeability rate of the soil and the water table elevation.Replace the soil if necessary.**
Preventative Action:	**Routine inspection and cleaning.**

Issue:	**Trash rack is damaged.**
Corrective Action:	**Repair the trash rack.**
Preventative Action:	**Routine inspection, especially after large storm events. Tighten any loose bolts and repair structural flaws.**

A well maintained detention basin

Inspection Checklist / Maintenance Actions

Retention Basin/Wet Pond

Checklist (circle one): Quarterly / Annual / Monthly / Special Event Inspection

Checklist No._____ **Inspection Date:** _____

Date of most recent rain event: _____

Rain Condition (circle one):
Drizzle / Shower / Downpour / Other _____

Ground Condition (circle one):
Dry / Moist / Ponding / Submerged / Snow accumulation

The inspection items and preventative/corrective maintenance actions listed below represent general requirements. The design engineer and/or responsible party shall adjust the items and actions to better meet the conditions of the site, the specific design targets, and the requirements of regulatory authorities.

Component No. Component Name	For Inspector			For Maintenance Crew
	Inspection Item and Inspection Item No.		Result	Preventative / Corrective Maintenance Actions
Pond Area	1	The water level in the pond is below the design water surface elevation	Y__ N__	Check for: *Changes in inflow *patterns (less runoff, *lower groundwater table) *Damages to the outlet structure *Damages to the liner (if applicable) Repair any structural damages Work Order # _____
	2	Islands or shallow marsh emerging out of the pond	Y__ N__	Check whether there is excessive sediment in the pond Check whether the incoming flow has excessive sediment Find the source of excessive sediment and method to reduce the source Remove excessive sediment Work Order # _____
	3	The observed detention time is longer than the design detention time. The observed detention time is approximately _____ hours.	Y__ N__	Check whether the outlets are clogged, see section E-Outlet of this checklist
Note:				
Pond Area	4	Debris or trash floating on the water	Y__ N__	Remove debris and trash If trash and debris are excessive, find the source and the method to reduce the source.

Component No. Component Name	For Inspector			For Maintenance Crew
	Inspection Item and Inspection Item No.		Result	Preventative / Corrective Maintenance Actions
	5	Excessive dead vegetation in the pond	Y__ N__	Clear and remove vegetation
	6	Mosquito breeding	Y__ N__	Aerate or circulate the pond Remove dead vegetation Consult local mosquitocommissionfor guidance Work Order # _____
	7	Presence of domestic waterfowl and wildlife	Y__ N__	Minimize mowing at the perimeter of the pong with a no-mow fringe to keep waterfowl from accessing the pond Contact NJDEP - Division of Fish and Wildlife for guidance and permits to capture and release
Note:				

Component No. Component Name	For Inspector			For Maintenance Crew
	Inspection Item and Inspection Item No.		Result	Preventative / Corrective Maintenance Actions
Pond Area	8	Erosion on pond side	Y__ N__	Check whether the surrounding area has uncontrolled drainage into the pond Install an energy dissipater to slow down the incoming flow (e.g. deep-rooted riparian vegetation or bioengineering method) Check if the liner is damaged (if a liner is installed) Work Order # _____
	9	Liner of the basin is visible and is damaged (if applicable)	Y__ N__	Repair the liner Work Order # _____
	10	The aerator/fountain is not working	Y__ N__	Refer to the manufacturer's Operation and Maintenance Manual. Work Order # _____

Note: If emptying the pond is required before sediment removal, it shall be noted that a permit may be required before discharging the pond water. Contact NJDEP Division of Land Use Regulation before discharge

Note:

	For Inspector			For Maintenance Crew
Component No. Component Name	Inspection Item and Inspection Item No.		Result	Preventative / Corrective Maintenance Actions
Vegetation	1	Invasive plants are present	Y__ N__	Remove the invasive plants and restore the vegetation in accordance with the landscaping plan Work Order # _____
	2	Algae blooming	Y__ N__	Remove algae Aerate the pond Find the nutrient source and the solution to reduce the nutrient loading Work Order # _____
Pond Embankment and Side Slopes	1	Signs of erosion, soil slide or bulges, seeps and wet spots, loss of vegetation, or erosion on the basin slope	Y__ N__	Check for excessive overland runoff flow through the embankment. Check for any sink hole development Restabilize the bank Work Order # _____
Note:				
Outlet	1	Trash or debris accumulation more than 20%	Y__ N__	Clean and remove Determine source of trash and address to reduce future maintenance costs or basin failure

	For Inspector			For Maintenance Crew
Component No. Component Name	Inspection Item and Inspection Item No.		Result	Preventative / Corrective Maintenance Actions
	2	Trash rack is damaged or rusted greater than 50% Trash rack is bent, loose, or missing parts	Y__ N__	Repair or replace trash rack Work Order #_____
	3	Outlet components (e.g., orifice plates or weir plate) skewed, misaligned, or missing	Y__ N__	Repair or replace component Work Order #_____
	4	Discharge pipe apron is eroded or scoured	Y__ N__	Restabilize the discharge riprap apron Work Order #_____
	5	Standing water is present in the outlet structure longer than 72 hours	Y__ N__	Pump out the standing water Work Order # _____
Emergency Spillway	1	Trees or excessive vegetation present	Y__ N__	Remove trees and roots, and restore berms if necessary Work Order #_____
	2	Damaged structure	Y__ N__	Repair Work Order #_____
Note:				
Miscellaneous	1	Fence: broken or eroded parts	Y__ N__	Repair or replace Work Order #_____
	2	Gate: missing gate or lock	Y__ N__	Repair or replace Work Order #_____

	For Inspector			For Maintenance Crew
Component No. Component Name	Inspection Item and Inspection Item No.		Result	Preventative / Corrective Maintenance Actions
	3	Sign/plate: tiled, missing, or faded	Y__ N__	Repair or replace Work Order #_____
	4	Excessive or overgrown vegetation blocking access to the basin	Y__ N__	Clear, trim, or prune the vegetation to allow access for inspection and maintenance Work Order #_____
Note:				

Follow Up Items (Component No. / Inspection Item No.):
(_____

Associated Work Orders: #_____, #_____, #_____, #_____, #_____

_____ _____ _____
Inspector Name **Signature** **Date**

Report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.

File this checklist in the Maintenance Log after performing maintenance.

Preventative Maintenance Record

Corresponding Checklist No. _____
Component No._____, Inspection Item No._____

Work Logs

Activities	Components	Date Completed
Sediment/debris removal **Sediment removal should take place when the basin is thoroughly dry.**		
	Pond Area	
	Pond Embankment and Side Slopes	
	Outlet	
Vegetation removal		
	Pond Area	
	Pond Embankment and Side Slopes	
	Outlet	
	Emergency Spillway	

Vegetation is removed by _____ (type of equipment) with minimum disruption to the remaining vegetation.

All use of fertilizers, pesticides, mechanical treatments, and other means to ensure optimum vegetation health must not compromise the intended purpose of the stormwater management measure. The fertilizer applied is _____ (type), and_____ (quantity per usage) is applied _____ (frequency of use).

Debris, sediment, and trash are handled (onsite / by _____ (contractor name) to disposal site _____). (See Part I: Maintenance Plan – Disposal Plan Section)

Crew member:_____/_____ **Date:** _____
(name/ signature)

Supervisor:_____/_____ **Date:** _____

A permit may be required to discharge when emptying the pond. Contact NJDEP Division of Land Use Regulation before discharging.
File this Preventative Maintenance Record in the Maintenance Log after performing maintenance

Corrective Maintenance Record

7. **Work Order #** _____ **Date Issued** _____

8. **Issue to be resolved:**

9. The issue was from **Corresponding Checklist No.** _____, **Component No.** . _____, **Inspection Item No.** . _____.

10. **Required Actions**

Actions	Planned Date	Date Completed

11. **Responsible person(s):**

_____

12. **Special requirements**
    - Time of the season or weather condition:_____
    - Tools/equipment:_____
    - Subcontractor (name or specific type):_____

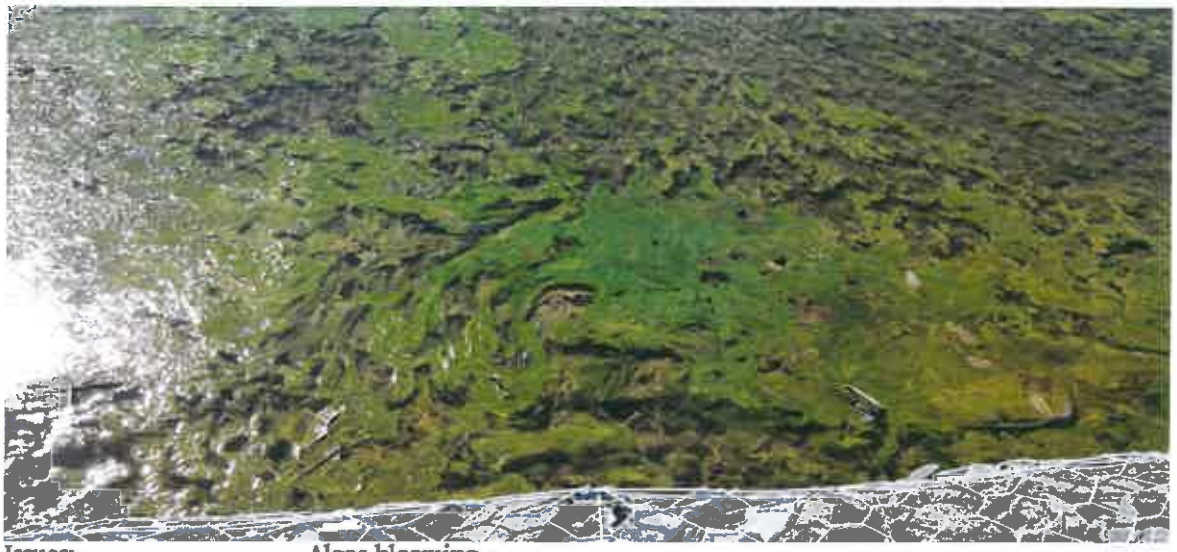
Approved by _____/_____ **Date** _____
(name/signature)

Verification of completion by _____/_____ **Date** _____
(name/signature)

File this Corrective Maintenance Record in the Maintenance Log after performing maintenance

Visual Aid for Wet Type Stormwater Basin Inspection

Note: Basins shown here include various types of wet basins, not limited to the category of basin in this manual.



Issues:	Algae blooming.
Corrective Action:	**Remove algae.**
Preventative Action:	**Routine inspection and aeration of the pond. Remove algae before blooming. A finding of the nutrient source and method to reduce the nutrient loading may be needed.**

Issues:	**The outlet grating is covered by trash. Excessive trash in the pond.**
Corrective Action:	**Clear and remove trash.**
Preventative Action:	**Routine inspection and removal of trash. A finding of the trash source and method to reduce the trash may be needed.**

Issues:	**The water level in the wet pond is significantly below the design water surface elevation.**
Corrective Action:	**Check if the outlet structure or the liner is damaged. Repair any damage.**
Preventative Action:	**Routine inspection of the basin and the liner.**

Issues:	**Erosion on the embankment.**
Corrective Action:	**Repair the embankment.Report to local authority and DEP Dam Safety as required by the local and DEP rules.**
Preventative Action:	**Construct a riprap apron on the slope. Routine inspection before erosion becomes severe.**

Issues: This basin was designed as a detention basin (dry basin), but now looks like a constructed wetland (wet basin). If the maintenance crews do not refer back to the original design information, they may perform the wrong maintenance work.

Note: The maintenance crew must refer to the as-built drawings and design information to avoid confusion and inappropriate maintenance work.

If the original design information is not available, the pond configuration may signal whether it was designed as a wet basin or dry basin. As shown here, the water level is at the invert elevation of the outlet (orifice behind the trash rack). If the water level is at the first outlet from the basin bottom (this can be determined by checking the inside the outlet box), then it is a wet basin and is at correct water surface level. However, if there is another outlet below the water, then it may signal that it is a failed dry basin now filled with water.

Also the pond has a circle of riprap (also known as an energy dissipater) around the edge at the water level. A dry basin will generally not have this configuration; therefore, it suggests a wet pond.

Cost Estimate

Cost Overview

Cost Type	Cost	Details
Cost of sediment , trash, and debris removal	$3,200	Bi-weekly routine cleaning and maintenance over the course of one year
General cost for routine maintenance (e.g., quarterly maintenance)	$929.00	Table A
General cost – unscheduled maintenance	$120.00	Table B
Cost associated with special tasks for specific stormwater measures (e.g.,biennial sand replacement for sand filter)	$53,358.00	Table C
Total cost	$57,607.00	

Table A: General cost for routine maintenance (e.g., quarterly maintenance)

Cost Type	Required Quantity	Unit Price	Cost
Personnel			
Crew	2	$120/Day	$240
Supervisor	1	$160/Day	$160
Equipment			
Truck	1	$25/Day	$25
Mower	2	$50/Day	$100
Supplies			
Seed	20 SY	$2.50/SY	$50.00
Topsoil	20 SY	$2.70/SY	$54.00
Working garments/gloves/protective measures	(As Needed) Estimated	$100.00	$100.00
Services			
Subcontractor for disposal	(As Needed)	$200.00	$200.00
Subtotal			$929.00
Overhead			
Total Cost			**$929.00**

Table B: General cost – unscheduled maintenance in a year (e.g., inspection after 1 inch of rain)

Cost Type	Required Quantity	Unit Price	Cost
Personnel			
Crew	1	$15/hour	$120
Subtotal			$120
Overhead			
Total Cost			**$120.00**

CostEstimate of Unscheduled Inspections

TableC: Cost associated with special tasks for specific stormwater measures (e.g., biennial sand replacement)

Cost Type	Required Quantity	Unit Price	Cost
Personnel			
Crew	2 people for 3 days	$120/Day	$720
Supervisor	1 person for 3 days	$160/Day	$480
Equipment			
Truck	1 truck for 3 days	$25/Day	$75
Lightweight backhoe rental	1 backhoe for 3 days	$600/Day	$1,800
Supplies			
Sand	11,428 SY	$4.00/SY	$45,712
Working garments/gloves/ protectivemeasures			
Services			
Subcontractor for disposal	11,428 SY	$0.40/SY	$4,571
Subtotal			$53,358
Overhead			
Total Cost			**$53,358**

The Homeowner's Association may be required to obtain State permits depending on specific circumstances, such as, but not limited to, the specific design of the stormwater management measures, the maintenance actions, the access and disturbance, the disposal methods, the location of disposal, the method to empty a basin, the method to dredge the basin, the pollutants in the basin, the damages to the basin, and the method to repair the basin.

Check Maintenance Guidance in NJDEP Stormwater Management Website for details and links to the relevant permitsand program areas (http://www.njstormwater.org).

Annual Evaluation of the Effectiveness of the Plan

As per N.J.A.C. 7:8-5.8(g), the person responsible for maintenance shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and the deed as needed.

The responsible party should evaluate the effectiveness of the maintenance plan by comparing the maintenance plan with the actual performance of the maintenance. The items to evaluate may include, but not limited to,

- Whether the inspections have been performed as scheduled;
- Whether the preventive maintenance has been performed as scheduled;
- Whether the frequency of preventative maintenance needs to increase or decrease;
- Whether the planned resources were enough to perform the maintenance;
- Whether the repairs were completed on time;
- Whether the actual cost was consistent with the estimated cost;
- Whether the inspection, maintenance, and repair records have been kept.

If actual performance of those items has been deviated from the maintenance plan, the responsible party should find the causes and implement solutions in a revised maintenance plan.

Annual Evaluation Records

Evaluator(s)	Date of Evaluation	Decision
		__Maintain current version OR __Revise current version Revision date _____ (also update the last revision date on the cover page) __Requires a new deed recording (also update the last recording information on the cover page)
		__Maintain current version OR __Revise current version Revision date _____ (also update the last revision date on the cover page) __Requires a new deed recording (also update the last recording information on the cover page)
		__Maintain current version OR __Revise current version Revision date _____ (also update the last revision date on the cover page) __Requires a new deed recording (also update the last recording information on the cover page)

Maintenance Logs and Inspection Records

(Should be included after this sheet as they are completed)