

## APPENDIX X.

### OPERATION AND MAINTENANCE PLAN

Municipal Stormwater Infrastructure

Operation and Maintenance Plan

Marblehead, MA



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## 1. Introduction

This Municipal Stormwater Infrastructure Operation and Maintenance (O&M) Plan has been prepared by Bobrek Engineering and Construction for the town of Marblehead, MA to fulfill the stormwater infrastructure O&M requirements within the USEPA's 2016 NPDES General Permit <sup>1</sup>for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4).

The following plan satisfies the Minimal Control Measure 6: "Good Housekeeping and Pollution Prevention for Permittee Owned Operations." The O&M Plan outlines inspection and maintenance procedures for catch basins, municipally owned streets and parking lots, and structural stormwater Best Management Practices (BMPs). An inventory of municipally owned facilities can be found in **Appendix A**.

The Department of Public Works is responsible for inspection and maintenance of the stormwater infrastructure. A map of the existing stormwater infrastructure in the town is provided is provided on the Town's website and is updated annually.

## 2. Catch Basin Cleaning and Inspections

The Department of Public Works hires a third-party to inspect and clean all the town-owned catch basins. The Town will implement the following catch basin inspection and cleaning procedures to reduce the discharge of pollutants from the MS4.

- 2.1 Routine inspection and cleaning of catch basins. Catch basins should be cleaned such that they are no more than 50 percent full<sup>2</sup> at any time. The Town currently hires a third party to inspect/clean all catch basins twice each permit year to evaluate sediment or debris accumulation. The standard operating procedure (SOP) can be found in **Appendix B**.

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<sup>1</sup> United States Environmental Protection Agency's 2016 National pollutant Discharge Elimination System General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) for the state of Massachusetts

<sup>2</sup> A catch basin sump is more than 50 percent full if the contents within the sump exceed one half the distance between the bottom interior of the catch basin to the invert of the deepest outlet of the catch basin

2.2 If a catch basin sump is more than 50 percent full during two consecutive routine inspections or cleaning events, the finding will be documented, the contributing drainage area will be investigated for sources of excessive sediment loading, and to the extent practicable, contributing sources will be addressed. If no contributing sources are found, the inspection and cleaning frequency will be increased.

2.3 Catch basins located near construction activities (roadway construction, residential, commercial, or industrial development or redevelopment) shall be inspected and cleaned on a regular basis to prevent catch basins becoming more than 50 percent full. Priority will also be given to catch basins that discharge to impaired waters.

2.4 All the information gathered from the activities above as well as the following list will be recorded in the annual report.

- Any action taken in response to excessive sediment or debris loadings.
- Total number of catch basins.
- Number of catch basins inspected.
- Number of catch basins cleaned.
- Total volume or mass of material removed from catch basins.

### 3. Streets and Parking Lots Sweeping

Streets and town-owned parking lots are swept often to reduce the discharge of pollutants from the MS4. Arterial roadways which includes those near beaches and within the downtown, are swept throughout the summer season (May 1 -Sept 1). Rural uncurbed roads with no catch basins will be swept and/or cleaned a minimum of once per year in the spring (following winter activities such as sanding). More frequent sweeping will be considered for targeted areas based on pollutant load reduction potential, inspections, pollutant loads, catch basin cleaning or inspection results, land use, impaired waters, or other factors. More frequent sweeping is required for Town-owned streets and parking lots in areas that discharge to certain nutrient-impaired waters. Sweeping must be performed in these areas a minimum of two times per year, once in the spring (following winter activities such as sanding) and at least once in the fall (Sept 1 – Dec 1; following leaf fall). Prior to disposal or reuse, catch basin cleanings

and street sweepings will be stored indoors or outside using proper controls to ensure that they do not discharge to receiving waters<sup>3</sup>.

- The number of miles cleaned, or the volume or mass of material removed will be recorded in the annual report.

#### 4. Winter Road Maintenance

The Town performs a variety of maintenance activities to ensure safe winter driving conditions on its roads and parking lots. The Town stores a 50/50 salt and sand mixture, and the mixture is stored in a covered barn.

The Town will implement the following winter maintenance procedures to reduce the discharge of pollutants from the MS4:

- Minimize the use and optimize the application of sodium chloride and other salt<sup>4</sup> (while maintaining public safety) and consider opportunities for use of alternative materials.
- Optimize sand and/or chemical application rates through the use, where practicable, of automated application equipment (e.g., zero velocity spreaders), anti-icing and pre-wetting techniques, implementation of pavement management systems, and alternate chemicals. Maintain records of the application of sand, anti-icing and/or de-icing chemicals to document the reduction of chemicals to meet established goals.
- Prevent exposure of deicing product (salt, sand, or alternative products) storage piles to precipitation by enclosing or covering the storage piles. Implement good housekeeping, diversions, containment or other measures to minimize exposure resulting from adding to or removing materials from the pile. Store piles in such a manner as not to impact surface water resources, groundwater resources, recharge areas, and wells.
- The MS4 Permit prohibits snow disposal into waters of the United States. Snow disposal activities, including selection of appropriate snow disposal sites, will adhere to the Massachusetts Department of Environmental Protection Snow Disposal Guidance, Guideline

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<sup>3</sup> Proper controls include barriers such as mulch socks around the area or enclosed and covered storage facilities

<sup>4</sup> For purposes of the MS4 Permit, salt means any chloride-containing material used to treat paved surfaces for deicing, including sodium chloride, calcium chloride, magnesium chloride, and brine solutions.

No. BWR G2015-01 (Effective Date: December 21, 2015), located at:  
<http://www.mass.gov/eea/agencies/massdep/water/regulations/snow-disposal-guidance.html>

- Provide training for municipal employees on winter roadway maintenance procedures.

## 5. Structural Stormwater BMPs

An inventory of structural stormwater Best Management Practices (BMPs) owned and/or maintained by Marblehead is being developed and will be available in **Appendix C**. Structural stormwater BMPs will be inspected annually at a minimum. Recommended inspection procedures and checklists are provided in **Appendix D**.

## APPENDIX A

### MUNICIPAL FACILITY INVENTORY



## Town of Marblehead Municipal Facilities with Potential Stormwater Polluting Activities (created in 2020)

[illegible]

## APPENDIX B

### SOP 3 CATCH BASIN INSPECTIONS AND CLEANING

## SOP 3: CATCH BASIN INSPECTION AND CLEANING

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## 1. Introduction

Catch basins help minimize flooding and protect water quality by removing trash, sediment, decaying debris, and other solids from stormwater runoff. These materials are retained in a sump below the invert of the outlet pipe. Catch basin cleaning reduces foul odors, prevents clogs in the storm drain system, and reduces the loading of suspended solids, nutrients, and bacteria to receiving waters.

During regular cleaning and inspection procedures, data can be gathered related to the condition of the physical basin structure and its frame and grate and the quality of stormwater conveyed by the structure. Observations such as the following can indicate sources of pollution within the storm drain system:

- Oil sheen
- Discoloration
- Trash and debris

Both bacteria and petroleum can create a sheen on the water surface. The source of the sheen can be differentiated by disturbing it, such as with a pole. A sheen caused by an oil will remain intact and move in a swirl pattern; a sheen caused by bacteria will separate and appear “blocky”. Bacterial sheen is not a pollutant but should be noted.

Observations such as the following can indicate a potential connection of a sanitary sewer to the storm drain system, which is an illicit discharge.

- Indications of sanitary sewage, including fecal matter or sewage odors
- Foaming, such as from detergent
- Optical enhancers, fluorescent dye added to laundry detergent

Each catch basin should be cleaned and inspected at least annually. Catch basins in high-use areas may require more frequent cleaning. Performing street sweeping on an appropriate schedule will reduce the amount of sediment, debris, and organic matter entering the catch basins, which will in turn reduce the frequency with which structures need to be cleaned.

## 2. Cleaning Procedure

Catch basin inspection cleaning procedures should address both the grate opening and the basin’s sump. Document any and all observations about the condition of the catch basin structure and water quality on the Catch Basin Inspection Form below:

<b>Catch Basin I.D.</b>			<b>Final Discharge from Structure?</b> Yes <input type="checkbox"/> No <input type="checkbox"/> <b>If Yes, Discharge to Outfall No:</b> _____	
<b>Catch Basin Label:</b>	Stencil <input type="checkbox"/>	Ground Inset <input type="checkbox"/>	Sign <input type="checkbox"/>	None <input type="checkbox"/> Other _____
<b>Basin Material:</b>	Concrete <input type="checkbox"/> Corrugated metal <input type="checkbox"/> Stone <input type="checkbox"/> Brick <input type="checkbox"/> Other: _____ <input type="checkbox"/>	<b>Catch Basin Condition:</b>		Good <input type="checkbox"/> Poor <input type="checkbox"/> Fair <input type="checkbox"/> Crumbling <input type="checkbox"/>
<b>Pipe Material:</b>	Concrete <input type="checkbox"/> HDPE <input type="checkbox"/> PVC <input type="checkbox"/> Clay Tile <input type="checkbox"/> Other: _____ <input type="checkbox"/>	<b>Pipe Measurements:</b>		Inlet Dia. (in): d= _____ Outlet Dia. (in): D= _____
<b>Required Maintenance/ Problems (check all that apply):</b> <div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <input type="checkbox"/> Tree Work Required  <input type="checkbox"/> New Grate is Required  <input type="checkbox"/> Pipe is Blocked  <input type="checkbox"/> Frame Maintenance is Required  <input type="checkbox"/> Remove Accumulated Sediment  <input type="checkbox"/> Pipe Maintenance is Required  <input type="checkbox"/> Basin Undermined or Bypassed </div> <div style="width: 48%;"> <input type="checkbox"/> Cannot Remove Cover  <input type="checkbox"/> Ditch Work  <input type="checkbox"/> Corrosion at Structure  <input type="checkbox"/> Erosion Around Structure  <input type="checkbox"/> Remove Trash &amp; Debris  <input type="checkbox"/> Need Cement Around Grate  <b>Other:</b> _____ </div> </div>				
<b>Catch Basin Grate Type :</b>	<b>Sediment Buildup Depth :</b>	<b>Description of Flow:</b>	<b>Street Name/ Structure Location:</b>	
Bar: <input type="checkbox"/> Cascade: <input type="checkbox"/> Other: _____  Properly Aligned: Yes <input type="checkbox"/> No <input type="checkbox"/>	0-6 (in): _____ 6-12(in): _____ 12-18 (in): _____ 18-24 (in): _____ 24 + (in): _____	Heavy <input type="checkbox"/> Moderate <input type="checkbox"/> Slight <input type="checkbox"/> Trickling <input type="checkbox"/>		
<b>*If the outlet is submerged check yes and indicate approximate height of water above the outlet invert. h above invert (in):</b> _____			Yes <input type="checkbox"/>	No <input type="checkbox"/>
<input type="checkbox"/> <b>Flow</b> <input type="checkbox"/> <b>Standing Water</b> <b>(check one or both)</b>	<b>Observations:</b>		<b>Circle those present:</b>	
	Color: _____		Foam	Oil Sheen
	Odor: _____		Sanitary Waste	Bacterial Sheen
<b>Weather Conditions :</b>	Dry > 24 hours <input type="checkbox"/>	Wet <input type="checkbox"/>	Orange Staining	Floatables
<b>Sample of Screenings Collected for Analysis?</b> Yes <input type="checkbox"/> No <input type="checkbox"/>			Excessive sediment	Pet Waste
<b>Comments:</b>			Other: _____	Optical Enhancers

Catch basin inspection and cleaning procedures include the following:

1. Work upstream to downstream.
2. Clean sediment and trash off grate.
3. Visually inspect the outside of the grate.
4. Visually inspect the inside of the catch basin to determine cleaning needs.
5. Inspect catch basin for structural integrity.
6. Determine the most appropriate equipment and method for cleaning each catch basin.
  - a. Manually use a shovel to remove accumulated sediments, or
  - b. Use a bucket loader to remove accumulated sediments, or

- c. Use a high pressure washer to clean any remaining material out of catch basin while capturing the slurry with a vacuum.
  - d. If necessary, after the catch basin is clean, use the rodder of the vacuum truck to clean downstream pipe and pull back sediment that might have entered downstream pipe.
7. If contamination is suspected, chemical analysis will be required to determine if the materials comply with the Massachusetts DEP Hazardous Waste Regulations, 310 CMR 30.000 (<http://www.mass.gov/dep/service/regulations/310cmr30.pdf>). Chemical analysis required will depend on suspected contaminants. Note the identification number of the catch basin on the sample label, and note sample collection on the Catch Basin Inspection Form.
8. Properly dispose of collected sediments. See following section for guidance.
9. If fluids collected during catch basin cleaning are not being handled and disposed of by a third party, dispose of these fluids to a sanitary sewer system, with permission of the system operator.
10. If illicit discharges are observed or suspected, notify the appropriate Department (see "SOP 10: Addressing Illicit Discharges").
11. At the end of each day, document location and number of catch basins cleaned, amount of waste collected, and disposal method for all screenings.
12. Report additional maintenance or repair needs to the appropriate Department.

### 3. Disposal of Screenings

Catch basin cleanings from storm water-only drainage systems may be disposed at any landfill that is permitted by MassDEP to accept solid waste. MassDEP does not routinely require stormwater-only catch basin cleanings to be tested before disposal, unless there is evidence that they have been contaminated by a spill or some other means.

Screenings may need to be placed in a drying bed to allow water to evaporate before proper disposal. In this case, ensure that the screenings are managed to prevent pollution.

### 4. Related Standard Operating Procedures

1. SOP 10, Addressing Illicit Discharges
2. SOP 13, Water Quality Screening in the Field

## APPENDIX C

# INVENTORY OF STRUCTURAL STORMWATER BEST MANAGEMENT PRACTICES

[illegible]



## APPENDIX D

### STRUCTURAL STORMWATER BMP

### INSPECTION PROCEDURES AND CHECKLISTS

# SOP 9: INSPECTION AND MAINTENANCE OF STRUCTURAL STORMWATER BEST MANAGEMENT PRACTICES (BMPS)

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## 1. Introduction

Best Management Practices (BMPs) are policies, procedures and structures designed to reduce stormwater pollution, prevent contaminant discharges to natural water bodies, and reduce stormwater facility maintenance costs. Structural BMPs are permanent site features designed to treat stormwater before infiltrating it to the subsurface or discharging it to a surface water body. Regular inspection and maintenance of structural stormwater BMPs is critical for these engineered systems to function as designed (e.g., provide benefits to water quality, groundwater recharge, and peak flow attenuation).

This Standard Operating Procedure (SOP) provides general inspection and maintenance frequencies and procedures for eight common structural stormwater BMPs, including:

1. Bioretention Areas and Rain Gardens
2. Constructed Stormwater Wetlands
3. Extended Dry Detention Basins
4. Proprietary Media Filters
5. Sand and Organic Filters
6. Wet Basins
7. Dry Wells
8. Infiltration Basins

This SOP is based on the Massachusetts Stormwater Handbook and is not intended to replace the stormwater BMP Operation and Maintenance guidance contained in the Handbook. This SOP is also not intended to replace the Stormwater BMP Operation and Maintenance (O&M) Plan required by the Massachusetts Wetlands Protection Act, Order of Conditions.

The Department of Public Works is responsible for inspection and maintenance of structural stormwater BMPs and other stormwater infrastructure in Marblehead. A list of existing structural stormwater BMPs is included in the attachments, along with inspection and maintenance checklists for each type of BMP.

Structural stormwater BMPs will be inspected annually at a minimum. Inspection checklists for each type of structural BMP are provided in the attachments.

## 2. Procedures

### 2.1. Bioretention Areas and Rain Gardens

Bioretention areas and rain gardens are shallow depressions filled with sandy soil, topped with a thick layer of mulch, and planted with dense native vegetation. There are two types of bioretention cells:

- Filtering bioretention area: Areas that are designed solely as an organic filter.

- Exfiltration bioretention area: Areas that are configured to recharge groundwater in addition to acting as a filter.

### 3. Inspection and Maintenance

Regular inspection and maintenance are important to prevent against premature failure of bioretention areas or rain gardens. Regular inspection and maintenance of pretreatment devices and bioretention cells for sediment buildup, structural damage and standing water can extend the life of the soil media.

Maintenance Schedule: Bioretention Areas and Rain Gardens

Activity	Time of Year	Frequency
Inspect for soil erosion and repair	Year round	Monthly
Inspect for invasive species and remove if present	Year round	Monthly
Remove trash	Year round	Monthly
Mulch Void Areas	Spring	Annually
Remove dead vegetation	Fall and spring	Bi-annually
Replace dead vegetation	Spring	Annually
Prune	Spring or fall	Annually
Replace all media and vegetation	Late spring/early summer	As needed

When failure is discovered, excavate the bioretention area, scarify the bottom and sides, replace the filter fabric and soil, replant vegetation, and mulch the surface.

Never store snow within a bioretention area or rain garden. This would prevent the recharge and water quality treatment of ground water.

#### 3.1. Constructed Stormwater Wetlands

Constructed stormwater wetlands maximize pollutant removal from stormwater through the use of wetland vegetation uptake, retention, and settling. Constructed storm water wetlands must be used in conjunction with other BMPs, such as sediment forebays.

##### 3.1.1. Inspection and Maintenance

Regular inspection and maintenance are important for the health of constructed stormwater wetlands. They help identify the need for replacement of vegetation and media, detect potentially harmful invasive species, and ensure the overall health of the wetland.

#### Maintenance Schedule, Constructed Stormwater Wetlands: Years 0-3

Activity	Time of Year	Frequency
Inspect for invasive species and remove if present	Year round	Monthly
Record and Map:	Year round	Annually
Types and distribution of dominant wetland plants	Year round	Bi-annually
Presence and distribution of planted wetland species	Spring	Annually
Presence and distribution of invasive species	Fall and spring	Bi-annually
Indications other species are replacing planted wetland species	Spring	Annually
Percent of standing water that is not vegetated	Spring or fall	Annually
Replace all media and vegetation	Late spring/early summer	As needed
Stability of original depth zones and micro-topographic features		
Accumulation of sediment in the forebay and micropool and survival rate of plants		

#### Maintenance Schedule, Constructed Stormwater Wetlands: Years 4-Lifetime

Activity	Time of Year	Frequency
Inspect for invasive species and remove if present	Year round	Monthly
Clean forebays	Year round	Annually
Clean sediment in basin/wetland system	Year round	Once every 10 years
Mulch Void Areas	Spring	Annually
Remove dead vegetation	Fall and spring	Bi-annually
Replace dead vegetation	Spring	Annually
Prune	Spring or fall	Annually

Replace all media and vegetation	Late spring/early Summer	As needed
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Never store snow within a constructed stormwater wetland. This would prevent required water quality treatment and the recharge of groundwater.

### 3.2. Extended Dry Detention Basins

Extended dry detention basins are designed to control both stormwater quantity and quality. These BMPs are designed to hold stormwater for at least 24 hours, allowing solids to settle and reducing local and downstream flooding. Pretreatment is required to reduce the potential for overflow clogging. The outflow may be designed as either fixed or adjustable. Additional nutrient removal may be achieved by a micropool or shallow marsh.

#### 3.2.1. Inspection and Maintenance

Annual inspection of extended dry detention basins is required to ensure that the basins are operating properly. Potential problems include: erosion within the basin and banks, tree growth on the embankment, damage to the emergency spillway, and sediment accumulation around the outlet. Should any of these problems be encountered, necessary repairs should be made immediately.

Maintenance Schedule: Extended Dry Detention Basins

Activity	Time of Year	Frequency
Inspect basins	Spring and fall	Bi-annually and during and after major storms
Examine outlet structure for clogging or high outflow release velocities	Spring and fall	Bi-annually
Mow upper stage, side slopes, embankment and emergency spillway	Spring through fall	Bi-annually
Remove trash and debris	Spring	Bi-annually
Remove sediment from basin	Year round	At least once every 5 years

### 3.3. Proprietary Media Filters

Media Filters are designed to reduce total suspended solids and other target pollutants, such as organics, heavy metals, or nutrients – these materials are sorbed onto the filter media, which is contained in a concrete structure. The substrate used as filter media depends on the target pollutants, and may consist of leaf compost, pleated fabric, activated charcoal, perlite, amended sand in combination with perlite, and zeolite. Two types of Media Filters are manufactured: Dry media filters, which are designed to dewater within 72 hours, and wet media filters, which maintain a permanent pool of water as part of the treatment system.

### 3.4. Inspection and Maintenance

Maintenance in accordance with the manufacturer's requirements is necessary to ensure stormwater treatment. Inspection or maintenance of the concrete structure may require OSHA confined space training. Dry media filters are required to dewater in 72 hours, thus preventing mosquito and other insect breeding. Proper maintenance is essential to prevent clogging. Wet media filters require tight fitting seals to keep mosquitoes and other insects from entering and breeding in the permanent pools. Required maintenance includes routine inspection and treatment.

Maintenance Schedule: Proprietary Media Filters

Activity	Time of Year	Frequency
Inspect for standing water, trash, sediment and clogging	Per manufacturer's schedule	Bi-annually (minimum)
Remove trash and debris	N/A	Each inspection
Examine to determine if system drains in 72 hours	Spring, after large storm	Annually
Inspect filtering media for clogging	Per manufacturer's schedule	Per manufacturer's schedule

### 3.5. Sand and Organic Filters

Sand and organic filters, also known as filtration basins, are intended for stormwater quality control rather than quantity control. These filters improve water quality by removing pollutants through a filtering media and settling pollutants on top of the sand bed and/or in a pretreatment basin. Pretreatment is required to prevent filter media from clogging. Runoff from the filters is typically discharged to another BMP for additional treatment.

#### 3.5.1. Inspection and Maintenance

If properly maintained, sand and organic filters have a long life. Maintenance requirements of the filters include raking the sand and removing sediment, trash, and debris from the surface of the BMP. Over time, fine sediments will penetrate deep into the sand requiring replacement of several inches or the entire sand layer. Discolored sand is an indicator of the presence of fine sediments, suggesting that the sand should be replaced.

#### Maintenance Schedule: Sand and Organic Filters

Activity	Frequency
Inspect filters and remove debris	After every major storm for the first 3 months after construction completion. Every 6 months thereafter.

### 3.6. Wet Basins

Wet basins are intended to treat stormwater quality through the removal of sediments and soluble pollutants. A permanent pool of water allows sediments to settle and removes the soluble pollutants, including some metals and nutrients. Additional dry storage is required to control peak discharges during large storm events. If properly designed and maintained, wet basins can add fire protection, wildlife habitats, and aesthetic values to a property.

#### 3.6.1. Inspection and Maintenance

To ensure proper operation, wet basin outfalls should be inspected for evidence of clogging or excessive outfall releases. Potential problems to investigate include erosion within the basin and banks, damage to the emergency spillway, tree growth on the embankment, sediment accumulation around the outlet, and the emergence of invasive species. Should any of these problems be encountered, perform repairs immediately. An on-site sediment disposal area will reduce sediment removal costs.

#### Maintenance Schedule: Wet Basins

Activity	Time of Year	Frequency
Inspect wet basins	Spring and/or fall	Annually (Minimum)
Mow upper stage, side slopes, embankment and emergency spillway	Spring through fall	Bi-annually (Minimum)
Remove sediment, trash and debris	Spring through fall	Bi-annually (Minimum)
Remove sediment from basin	Year round	As required, but at least once every 10 years

### 3.7. Dry Wells

Dry wells are used to infiltrate uncontaminated runoff. These BMPs should never be used to infiltrate stormwater or runoff that has the potential to be contaminated with sediment and other pollutants. Dry wells provide groundwater recharge and can reduce the size and cost required of downstream BMPs or



storm drains. However, they are only applicable in drainage areas of less than one acre and may experience high failure rates due to clogging.

### 3.7.1. Inspection and Maintenance

Proper dry well function depends on regular inspection. Clogging has the potential to cause high failure rates. The water depth in the observation well should be measured at 24 and 48 hour intervals after a storm and the clearance rate calculated. The clearance rate is calculated by dividing the drop in water level (inches) by the time elapsed (hours).

#### Maintenance Schedule: Dry Wells

Activity	Frequency
Inspect dry wells	After every major storm for the first 3 months after construction completion. Annually thereafter.

### 3.8. Infiltration Basins

Infiltration basins are designed to contain stormwater and provide groundwater recharge. Pollution prevention and pretreatment are required to ensure that contaminated stormwater is not infiltrated. Infiltration basins reduce local flooding and preserve the natural water balance of the site. High failure rates, however, often occur due to improper siting, inadequate pretreatment, poor design, and lack of maintenance.

### 3.8.1. Inspection and Maintenance

Regular maintenance is required to prevent clogging, which results in infiltration basin failure. Clogging may be due to upland sediment erosion, excessive soil compaction, or low spots. Inspections should include signs of differential settlement, cracking, erosion, leakage in the embankments, tree growth on the embankments, riprap condition, sediment accumulation, and turf health.

#### Maintenance Schedule: Infiltration Basins

Activity	Time of Year	Frequency
Preventative maintenance	Spring and fall	Bi-annually
Inspection	Spring and fall	After every major storm for the first 3 months after construction completion. Bi-annually thereafter and discharges through the high outlet orifice.
Mow/rake buffer area, side slopes and basin bottom	Spring and fall	Bi-annually
Remove trash, debris and organic matter	Spring and fall	Bi-annually

#### 4. Employee Training

- Employees who perform inspection or maintenance on structural BMPs are trained ##NUMBER times per year on proper procedures.
- If services are contracted, the contractor should be given a copy of this and any applicable SOPs to ensure compliance with MS4 regulations.

#### 5. Attachments

1. Structural BMP Inventory Template
2. Structural BMP Inspection and Maintenance Checklists

## ATTACHMENT 1

### EXAMPLE STRUCTURAL BMP INVENTORY TEMPLATE

EXAMPLE Inventory of Structural Stormwater Best Management Practices (BMPs)

BMP ID or Description	Location	BMP Type	Inspection Frequency	Date of Last Inspection	Additional Notes

## ATTACHMENT 2

### Structural BMP Inspection and Maintenance Checklists

## INSPECTION OF BIORETENTION AREAS / RAIN GARDENS

### General Information

BMP Description	Bioretention Area / Rain Garden		
BMP Location			
Inspector's Name			
Date of Inspection		Date of Last Inspection	
Start Time		End Time	
Type of Inspection: Regular <input type="checkbox"/> Pre-Storm Event <input type="checkbox"/> During Storm Event <input type="checkbox"/> Post-Storm Event <input type="checkbox"/>			
Describe the weather conditions at time of inspection			

### Specific Information

Maintenance Activity	Maintenance Frequency	Is Status of BMP Satisfactory?		Corrective Action Needed
Inspect for soil erosion and repair	Monthly	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Inspect for invasive species and remove if present	Monthly	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Remove trash	Monthly	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Mulch void areas	Annually	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Remove dead vegetation	Bi-Annually	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Replace dead vegetation	Annually	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Prune	Annually	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Replace all media and vegetation	As Needed	Yes <input type="checkbox"/>	No <input type="checkbox"/>	

## INSPECTION OF CONSTRUCTED STORMWATER WETLANDS

### YEARS 0-3 OF OPERATION

#### General Information

BMP Description	Constructed Stormwater Wetland		
BMP Location			
Inspector's Name			
Date of Inspection		Date of Last Inspection	
Start Time		End Time	
Type of Inspection: Regular <input type="checkbox"/> Pre-Storm Event <input type="checkbox"/> During Storm Event <input type="checkbox"/> Post-Storm Event <input type="checkbox"/>			
Describe the weather conditions at time of inspection			

#### Specific Information

Maintenance Activity	Maintenance Frequency	Is Status of BMP Satisfactory?	Corrective Action Needed
Inspect for invasive species and remove if present	Monthly	Yes <input type="checkbox"/> No <input type="checkbox"/>	
Replace all media and vegetation	As Needed	Yes <input type="checkbox"/> No <input type="checkbox"/>	

In addition, the following information should be recorded and mapped at least once per year:

- Types and distribution of dominant wetland plants
- Presence and distribution of planted wetland species
- Presence and distribution of invasive species
- Indications other species are replacing planted wetland species
- Percent of standing water that is not vegetated
- Replace all media and vegetation
- Stability of original depth zones and micro-topographic features
- Accumulation of sediment in the forebay and micropool and survival rate of plants

## INSPECTION OF CONSTRUCTED STORMWATER WETLANDS

### Year 4 - Lifetime of Operation

#### General Information

BMP Description	Constructed Stormwater Wetland		
BMP Location			
Inspector's Name			
Date of Inspection		Date of Last Inspection	
Start Time		End Time	
Type of Inspection: Regular <input type="checkbox"/> Pre-Storm Event <input type="checkbox"/> During Storm Event <input type="checkbox"/> Post-Storm Event <input type="checkbox"/>			
Describe the weather conditions at time of inspection			

#### Specific Information

Maintenance Activity	Maintenance Frequency	Is Status of BMP Satisfactory?		Corrective Action Needed
Inspect for invasive species and remove if present	Monthly	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Clean forebays	Annually	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Clean sediment in basin/wetland system	Once every 10 years	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Mulch void areas	Annually	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Remove dead vegetation	Bi-Annually	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Replace dead vegetation	Annually	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Prune	Annually	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Replace all media and vegetation	As Needed	Yes <input type="checkbox"/>	No <input type="checkbox"/>	



## INSPECTION OF PROPRIETARY MEDIA FILTERS

### General Information

BMP Description	Media Filter		
BMP Location			
Media Type			
Inspector's Name			
Date of Inspection		Date of Last Inspection	
Start Time		End Time	
Type of Inspection: Regular <input type="checkbox"/> Pre-Storm Event <input type="checkbox"/> During Storm Event <input type="checkbox"/> Post-Storm Event <input type="checkbox"/>			
Describe the weather conditions at time of inspection			

### Specific Information

Maintenance Activity	Maintenance Frequency	Is Status of BMP Satisfactory?		Corrective Action Needed
Inspect for standing water, trash, sediment and clogging	Bi-Annually (minimum)	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Remove trash and debris	Each Inspection	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Examine to determine if system drains in 72 hours	Annually	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Inspect filtering media for clogging	Per manufacturer's schedule	Yes <input type="checkbox"/>	No <input type="checkbox"/>	

## INSPECTION OF SAND AND ORGANIC FILTERS

**Inspections should be conducted after every major storm event for the first 3 months following completion, then every 6 months thereafter.**

### General Information

BMP Description	Sand/Organic Filter		
BMP Location			
Media Type			
Inspector's Name			
Date of Inspection		Date of Last Inspection	
Start Time		End Time	
Type of Inspection: Regular <input type="checkbox"/> Pre-Storm Event <input type="checkbox"/> During Storm Event <input type="checkbox"/> Post-Storm Event <input type="checkbox"/>			
Describe the weather conditions at time of inspection			

### Specific Information

Maintenance Activity	Maintenance Frequency	Is Status of BMP Satisfactory?	Corrective Action Needed
Remove sediment, trash, and debris	Every 6 months	Yes <input type="checkbox"/> No <input type="checkbox"/>	
Rake sand	Every 6 months	Yes <input type="checkbox"/> No <input type="checkbox"/>	

## INSPECTION OF DRY WELLS

**Regular inspections should be conducted after every major storm event for the first 3 months following completion, then annually thereafter.**

### General Information

BMP Description	Dry Well		
BMP Location			
Inspector's Name			
Date of Inspection		Date of Last Inspection	
Start Time		End Time	
Type of Inspection: Regular <input type="checkbox"/> Pre-Storm Event <input type="checkbox"/> During Storm Event <input type="checkbox"/> Post-Storm Event <input type="checkbox"/>			
Describe the weather conditions at time of inspection			
Describe condition of dry well at time of inspection			

After a major storm event, the water depth in the observation well should be measured at 24 and 48 hour intervals and the clearance rate calculated.

## INSPECTION OF WET BASINS

*Inspections should be conducted after every major storm event for the first 3 months following completion, then biannually thereafter.*

### General Information

BMP Description	Wet Basin		
BMP Location			
Inspector's Name			
Date of Inspection		Date of Last Inspection	
Start Time		End Time	
Type of Inspection: Regular <input type="checkbox"/> Pre-Storm Event <input type="checkbox"/> During Storm Event <input type="checkbox"/> Post-Storm Event <input type="checkbox"/>			
Describe the weather conditions at time of inspection			
Describe condition of wet basin at time of inspection			

### Specific Information

Maintenance Activity	Maintenance Frequency	Is Status of BMP Satisfactory?	Corrective Action Needed
Preventative maintenance	Bi-Annually	Yes      No	
Mow/rake buffer area, side slopes and basin bottom	Bi-Annually	Yes <input type="checkbox"/> No <input type="checkbox"/>	
Remove trash, debris and organic matter	Bi-Annually	Yes      No	
Inspect and clean pretreatment devices	Every other month and after every major storm event	Yes      No	

## INSPECTION OF OTHER BMP

### General Information

BMP Description			
BMP Location			
Inspector's Name			
Date of Inspection		Date of Last Inspection	
Start Time		End Time	
Type of Inspection: Regular <input type="checkbox"/> Pre-Storm Event <input type="checkbox"/> During Storm Event <input type="checkbox"/> Post-Storm Event <input type="checkbox"/>			
Describe the weather conditions at time of inspection			

### Specific Information

Maintenance Activity	Maintenance Frequency	Is Status of BMP Satisfactory?		Corrective Action Needed
		Yes <input type="checkbox"/>	No <input type="checkbox"/>	
		Yes	No	
		Yes	No	
		Yes	No	
		Yes	No	
		Yes	No	
		Yes	No	