

# Stormwater Management Facility Maintenance Manual Inspection and Maintenance Plan



for

of Cherry Hill

Lot 1 in Block 133.01  
Lots 9 & 10 in Block 135.01  
Lot 12 in Block 148.01  
Cherry Hill Township, Camden County, New Jersey

September 26, 2019  
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Prepared for:

MBJ Associates, LLC  
2151 Route 70 West  
Cherry Hill, New Jersey 08002

Prepared by:



9615 Ventnor Avenue, Suite 3  
Margate, New Jersey 08402  
609-300-5171  
[www.sciulloengineering.com](http://www.sciulloengineering.com)

A handwritten signature in black ink, appearing to read "J. Sciullo".

Jason T. Sciullo, PE, PP, CFM  
NJ PE License No. 24GE04586000  
NJ Certificate of Authorization No. 24GE28290700

MBJ 001.03

## **INSPECTION AND MAINTENANCE CONTROL PLAN FOR Land Rover Cherry Hill**

### **PROJECT INFORMATION**

**a) DRAWINGS OF STORMWATER MANAGEMENT MEASURE**

The proposed Facility's Stormwater Management Facility is shown on the Preliminary and Final Site Plans which are included herein by reference.

**b) LOCATION OF STORMWATER MANAGEMENT MEASURE BY MEANS OF LATITUDE AND LONGITUDE AND BLOCK AND LOT:**

The proposed Facility's Best Management Practices Stormwater Management Facility is located on Block 135.01, Lots 9 and 10. The center of the proposed facility is approximately:

LAT: 39° 55' 13" LONG: -75° 01' 40"

**c) PREVENTATIVE CORRECTIVE MAINTENANCE TASKS AND SCHEDULES:**

Refer to SECTION III for Summary of Maintenance Procedures.

**e) NAME OF ENTITY RESPONSIBLE FOR INSPECTIONS AND MAINTENANCE:**

Company: M.B.J. Associates  
2151 Route 70 West  
Cherry Hill, New Jersey 08002  
Phone: 856-663-3200

### **PREVENTATIVE MAINTENANCE PROCEDURES**

#### **I. OBJECTIVES**

The purpose of this preventative maintenance schedule is to assure that the Stormwater Management Facility (SWMF) remains operational and safe at all times, while minimizing the need for emergency or corrective procedures.

#### **II. OVERVIEW**

This comprehensive Stormwater Management Maintenance Program is comprised of several related requirements including:

1. Providing adequate staffing, equipment, and materials.
2. Performing routine maintenance procedures on a regular basis.
3. Performing emergency maintenance procedures and repairs in a timely manner.
4. Conducting SWMF inspections to determine the need for and effectiveness of the maintenance work.
5. Providing training and instruction to maintenance personnel and inspectors.
6. Conducting periodic program reviews and evaluations to determine the overall effectiveness of the maintenance programs and the need for revised or additional maintenance procedures, personnel, and equipment.
7. Instilling pride of workmanship and a commitment to excellence in program personnel.

Preventative and corrective maintenance shall be performed to maintain the function of the stormwater management facilities, including, but not limited to: repairs or replacement to any associated appurtenance of the measure; removal of sediment, debris, or trash; restoration of eroded areas; snow and ice removal; restoration of vegetation.

In the event that the stormwater management measure becomes a public health nuisance or danger to public safety or public health, or if it is in need of maintenance or repair, the Township shall so notify the responsible person in writing. Upon receipt of that notice, the responsible person shall have 14 days to effect maintenance and repair of the facility in a manner that is approved by the Municipal Engineer or the Municipal Engineer's designee. The Township, at its discretion, may extend the time allowed for effecting maintenance and repair for good cause. If the responsible entity fails or refuses to perform such maintenance and repair within the allowable time, the Township may immediately proceed to do so with its own forces and equipment and/or through contractors and shall bill the cost thereof to the responsible person.

### **III. MAINTENANCE AND INSPECTION PROCEDURES**

Preventative and corrective maintenance shall be performed to maintain the function of the stormwater management facilities, including repairs or replacement to the structure; removal of sediment, debris, or trash; restoration of eroded areas; restoration of vegetation; and snow and ice removal. Regular and effective maintenance is crucial to ensure effective performance. In addition to the manufacturer's maintenance requirements, there are a number of required elements in all maintenance plans, pursuant to N.J.A.C. 7:8-5.8; these are discussed in more detail in BMP Manual *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 are presented below. Failure to correctly maintain the system will shorten its lifespan or result in system failure; therefore, the maintenance plan must ensure proper training of personnel and include the special equipment necessary in accordance with the industry's or manufacturer's requirements.

The maintenance plan and any future revisions based on evaluation of effectiveness shall be recorded upon the deed. The entity responsible for maintenance identified above shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and the deed as needed. The entity responsible for inspection, maintenance and repair identified above shall submit the updated inspection, maintenance and repair plan to the Township when the inspection, maintenance and repair plan is updated.

#### **A. General Maintenance of Contech® Engineered Solutions StormFilter**

The primary purpose of the Stormwater Management StormFilter® is to filter and prevent pollutants from entering waterways. Like any effective filtration system, periodically these pollutants must be removed to restore the StormFilter to its full efficiency and effectiveness. Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site. Maintenance activities

may be required in the event of a chemical spill or due to excessive sediment loading from site erosion or extreme storms. It is a good practice to inspect the system after major storm events.

### **Maintenance Procedures**

Although there are many effective maintenance options, the following procedure is believed to be efficient, using common equipment and existing maintenance protocols. The following two-step procedure is recommended:

#### 1. Inspection

- Inspection of the interiors of all stormwater structures within the system at least once a year and after major storms and determine the need for maintenance.
- Inspection of the interior of all stormwater piping and manifolds at least once a year.

#### 2. Maintenance

- StormFilter Cartridge replacement as needed.
- Sediment and debris removal.

### **Inspection and Maintenance Timing**

At least one scheduled inspection should take place per year as well as inspection after each major storms with maintenance following as warranted. First, an inspection should be done before the winter season. During the inspection the need for maintenance should be determined and, if disposal during maintenance will be required, samples of the accumulated sediments and media should be obtained. Second, if warranted, maintenance (replacement of the filter cartridges and removal of accumulated sediments and debris) should be performed during periods of dry weather.

In addition to these two activities, it is important to check the condition of all structures after major storms for potential damage caused by high flows and for high sediment accumulation that may be caused by localized erosion in the drainage area. It may be necessary to adjust the inspection/maintenance schedule depending on the actual operating conditions encountered by the system. In general, inspection activities can be conducted at any time, and maintenance should occur, if warranted, during dryer months in late summer to early fall.

### **Maintenance Frequency for Contech® Engineered Solutions StormFilter**

The primary factor for determining frequency of maintenance for the StormFilter is sediment loading. A properly functioning system will remove solids from water by trapping particulates in the porous structure of the filter media inside the cartridges. The flow through the system will naturally decrease as more and more particulates are trapped. Eventually the flow through the cartridges will be low enough to require replacement. It may be possible to extend the usable span of the cartridges by removing sediment from upstream trapping devices on a routine as-needed basis, in order to prevent material from being re-suspended and discharged to the StormFilter treatment system.

The average maintenance lifecycle is approximately 1-5 years. Site conditions greatly influence maintenance requirements. StormFilter units located in areas with erosion or active construction may need to be inspected and maintained more often than those with fully stabilized surface conditions.

Regulatory requirements or a chemical spill can shift maintenance timing as well. The maintenance frequency may be adjusted as additional monitoring information becomes available during the inspection program. Areas that develop known problems should be inspected more frequently than areas that demonstrate no problems, particularly after major storms. Ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual StormFilter system or site. It is recommended that the site owner develop a database to properly manage StormFilter inspection and maintenance programs.

### **Inspection Procedures for Contech® Engineered Solutions StormFilter**

The primary goal of an inspection is to assess the condition of the cartridges relative to the level of visual sediment loading as it relates to decreased treatment capacity. It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, then typically large amounts of sediments will be present and very little flow will be discharged from the drainage pipes. If this is the case, then maintenance is warranted and the cartridges need to be replaced.

**Warning:** In the case of a spill, the worker should abort inspection activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct an inspection: Inspection should be performed by a person who is familiar with the operation and configuration of the StormFilter treatment unit.

1. If applicable, set up safety equipment to protect and notify surrounding vehicle and pedestrian traffic.
2. Visually inspect the external condition of the unit & take notes concerning defects/problems.
3. Open the access portals to the vault and allow the system vent.
4. Without entering the vault, visually inspect the inside of the unit, and note accumulations of liquids and solids.
5. Be sure to record the level of sediment build-up on the floor of the vault, in the forebay, and on top of the cartridges. If flow is occurring, note the flow of water per drainage pipe. Record all observations. Digital pictures are valuable for historical documentation.
6. Close and fasten the access portals.
7. Remove safety equipment.
8. If appropriate, make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.
9. Discuss conditions that suggest maintenance and make decision as to whether or not maintenance is needed.

### Maintenance Decision Tree for Contech® Engineered Solutions StormFilter

The need for maintenance is typically based on results of the inspection. The following Maintenance Decision Tree should be used as a general guide. (Other factors, such as Regulatory Requirements, may need to be considered)

1. Sediment loading on the vault floor.
  - a. If >4" of accumulated sediment, maintenance is required.
2. Sediment loading on top of the cartridge.
  - a. If >1/4" of accumulation, maintenance is required.
3. Submerged cartridges.
  - a. If >4" of static water above cartridge bottom for more than 24 hours after end of rain event, maintenance is required. (Catch basins have standing water in the cartridge bay.)
4. Plugged media.
  - a. If pore space between media granules is absent, maintenance is required.
5. Bypass condition.
  - a. If inspection is conducted during an average rain fall event and StormFilter remains in bypass condition (water over the internal outlet baffle wall or submerged cartridges), maintenance is required.
6. Hazardous material release.
  - a. If hazardous material release (automotive fluids or other) is reported, maintenance is required.
7. Pronounced scum line.
  - a. If pronounced scum line (say  $\geq 1/4$ " thick) is present above top cap, maintenance is required.

### Maintenance for Contech® Engineered Solutions StormFilter

Depending on the configuration of the particular system, maintenance personnel will be required to enter the vault to perform the maintenance.

**Important:** If vault entry is required, OSHA rules for confined space entry must be followed.

Filter cartridge replacement should occur during dry weather. It may be necessary to plug the filter inlet pipe if base flow is occurring. Replacement cartridges can be delivered to the site or customers facility. Information concerning how to obtain the replacement cartridges is available from Contech Engineered Solutions.

**Warning:** In the case of a spill, the maintenance personnel should abort maintenance activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct cartridge replacement and sediment removal maintenance:

1. If applicable, set up safety equipment to protect maintenance personnel and pedestrians from site hazards.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the doors (access portals) to the vault and allow the system to vent.

4. Without entering the vault, give the inside of the unit, including components, a general condition inspection.
5. Make notes about the external and internal condition of the vault. Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.
6. Using appropriate equipment offload the replacement cartridges (up to 150 lbs. each) and set aside.
7. Remove used cartridges from the vault using one of the following methods:

**Method 1:**

- A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access. Using appropriate hoisting equipment, attach a cable from the boom, crane, or tripod to the loose cartridge. Contact Contech Engineered Solutions for suggested attachment devices.
- B. Remove the used cartridges (up to 250 lbs. each) from the vault.
- C. Set the used cartridge aside or load onto the hauling truck.
- D. Continue steps a through c until all cartridges have been removed.

**Method 2:**

- A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.
  - B. Unscrew the cartridge cap.
  - C. Remove the cartridge hood and float.
  - D. At location under structure access, tip the cartridge on its side.
  - E. Empty the cartridge onto the vault floor. Reassemble the empty cartridge.
  - F. Set the empty, used cartridge aside or load onto the hauling truck.
  - G. Continue steps a through e until all cartridges have been removed.
8. Remove accumulated sediment from the floor of the vault and from the forebay. This can most effectively be accomplished by use of a vacuum truck.
  9. Once the sediments are removed, assess the condition of the vault and the condition of the connectors.
  10. Using the vacuum truck boom, crane, or tripod, lower and install the new cartridges. Once again, take care not to damage connections.
  11. Close and fasten the door.
  12. Remove safety equipment.
  13. Finally, dispose of the accumulated materials in accordance with applicable regulations. Make arrangements to return the used **empty** cartridges to Contech Engineered Solutions.

**Related Maintenance Activities - Performed on an as-needed basis**

StormFilter units are often just one of many structures in a more comprehensive stormwater drainage and treatment system. In order for maintenance of the StormFilter to be successful, it is imperative that all other components be properly maintained. The maintenance/repair of upstream facilities should be carried out

prior to StormFilter maintenance activities. In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil loading, and discharges of inappropriate materials.

### **Material Disposal**

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads. Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. This typically requires coordination with a local landfill for solid waste disposal. For liquid waste disposal a number of options are available including a municipal vacuum truck decant facility, local waste water treatment plant or on-site treatment and discharge.

### **Failure to Maintain and Repair**

In the event that the stormwater management measure becomes a public health nuisance or danger to public safety or public health, or if it is in need of maintenance or repair, The Township shall so notify the responsible entity in writing. Upon receipt of that notice, the responsible entity shall have 14 days to effect maintenance and repair of the facility in a manner that is approved by the Municipal Engineer or the Municipal Engineer's designee. The Township, at its discretion, may extend the time allowed for effecting maintenance and repair for good cause. If the responsible entity fails or refuses to perform such maintenance and repair within the allowable time, The Township may immediately proceed to do so with its own forces and equipment and/or through contractors and shall bill the cost thereof to the responsible entity. For this purpose, a stormwater management measure easement shall be provided by the property owner.

## **B. Maintenance Overview of a Subterranean Piped Retention/Detention System**

A retention/detention system is comprised of a series of pipes and fittings that form an underground storage area, which retains or detains storm water runoff from a given area. As sediment and debris settle out of the detained stormwater, build up occurs that requires the system to be regularly inspected and cleaned in order for the system to perform as originally designed. The following provides the available fittings and guidelines for inspection and maintenance of an HDPE underground storage system.

Maintaining a clean and obstruction-free retention/detention system helps to ensure the system performs the intended function of the primary design. Buildup of debris may obstruct flow through the laterals in a retention system or block the entranceway of the outlet pipe in a detention system. This may result in ineffective operation or complete failure of the system. Additionally, surrounding areas may potentially run the risk of damage due to flooding or other similar issues.

## **Inspection/Maintenance Frequency**

All retention/detention systems must be cleaned and maintained. Underground systems may be maintained more cost effectively if these simple guidelines are followed. Inspection should be performed at a minimum of once per year. Cleaning should be done at the discretion of individuals responsible to maintain proper storage and flow. While maintenance can generally be performed year round, it should be scheduled during a relatively dry season.

## **Pre-Inspection**

A post-installation inspection should be performed to allow the owner to measure the invert prior to accumulation of sediment. This survey will allow the monitoring of sediment build-up without requiring access to the retention/detention system.

The following is the recommended procedure for pre-inspections:

1. Locate the riser section or cleanouts of the retention/detention system. The riser will typically be 24" in diameter or larger and the cleanouts are usually 4", 6" or 8" in diameter.
2. Remove the lid of the riser or clean outs.
3. Insert a measuring device into the opening and make note to a point of reference on the stick or string. (This is done so that sediment build up can be determined in the future without having to enter the system.)

## **Inspection/Maintenance**

A retention/detention system should be inspected at a minimum of one time a year or after major rain events if necessary.

The following is the recommended procedure to inspect system in service:

1. Locate the riser section of the retention/detention system. The riser will typically be 24" in diameter or larger.
2. Remove the lid from the riser.
3. Measure the sediment buildup at each riser and cleanout location. Only certified confined space entry personnel having appropriate equipment should be permitted to enter the retention/detention System.
4. Inspect each manifold, all laterals, and outlet pipes for sediment build up, obstructions, or other problems. Obstructions should be removed at this time.
5. If measured sediment build up is between 5% - 20% of the pipe diameter, cleaning should be considered; if sediment build up exceeds 20%, cleaning should be performed at the earliest opportunity. A thorough cleaning of the system (manifolds and laterals) shall be performed by either manual methods or by a vacuum truck.

The sections on Material Disposal and Failure to Maintain and Repair discussed above shall apply this retention/detention system as well.

## **C. PREVENTATIVE MAINTENANCE PROCEDURES**

### **1. Grass Cutting**

A regularly scheduled program of mowing and trimming of grass at SWMF's during the growing season will help to maintain a tightly knit turf and will also help to prevent diseases, pests, and the intrusion of weeds. The actual mowing requirements of an area should be tailored to the specific site conditions, grass type, and seasonal variations in the climate. In general, grass should not be allowed to grow more than 1 to 2 inches between cuttings. Allowing the grass to grow more than this amount prior to cutting it may result in damage to the blades growing points and limit its continued healthy growth. Agencies such as the local Soil Conservation District can provide valuable assistance in determining optimum mowing requirements.

### **2. Grass Maintenance**

Grassed areas require periodic fertilizing, de-thatching, and soil conditioning in order to maintain healthy growth. Additionally, provisions should be made to re-seed and re-establish grass cover in areas damaged by sediment accumulation, storm water flow, or other causes. Agencies such as the local Soil Conservation District can provide valuable assistance in establishing a suitable grass maintenance program.

### **3. Vegetative Cover**

Trees, shrubs, and ground cover require periodic maintenance, including fertilizing, pruning, and pest control in order to maintain healthy growth. Agencies such as the local Soil Conservation District can be of assistance in establishing a preventative maintenance program.

### **4. Removal and Disposal of Trash and Debris**

A regularly scheduled program of debris and trash removal from SWMF's will reduce the chance of outlet structures, trash racks, and other components becoming clogged and inoperable during storm events. Specific attention to the weirs within manholes as well as the oil and grease separators shall be included at each inspection. Additionally, removal of trash and debris will prevent possible damage to vegetated areas and eliminate potential mosquito breeding habitats. Disposal of debris and trash must comply with all local, county, state, and federal waste flow control regulations. Only suitable disposal and recycling sites should be utilized. Agencies such as the Division of Solid Waste Management of the New Jersey Department of Environmental Protection should be contacted for information on disposal regulations.

### **5. Sediment Removal and Disposal**

The roof drainage collection and subterranean storage system are designed as a closed system through the use of gutter guards at the source of the runoff. No other surface runoff is expected to enter this system. Accumulated sediment should be removed before it threatens the operation or storage volume of a SWMF. This includes the sections of the roof drainage collection system, the eccentric manifold at each end of the subterranean basin. Removal of accumulated sediment in these pipes shall be accomplished with the use of Vactor equipment. Disposal of sediment must comply with all local, county, state, and federal regulations. Only suitable disposal sites should be utilized. The sediment removal program in infiltration facilities must also include provisions for monitoring the porosity of the sub-base, and replacement or cleansing of the pervious materials as necessary. Agencies such as the Division of Soil Waste Management of the New Jersey Department of Environmental Protection should be contacted for information on disposal regulations.

## **6. Mechanical Components**

SWMF components, such as valves, sluice gates, pumps, fence gates, locks, and access hatches should remain functional at all times. Regularly scheduled maintenance should be performed in accordance with the manufacturers' recommendations. Additionally, all mechanical components should be operated at least once every three months to assure their continued performance.

## **7. Elimination of Potential Mosquito Breeding Habitats**

The most effective mosquito control program is one that eliminates potential breeding habitats. Almost any stagnant pool of water can be attractive to mosquitoes, and the source of a large mosquito population. Ponded water in areas such as open cans and bottles, debris and sediment accumulations and areas of ground settlement provide ideal locations for mosquito breeding. A maintenance program dedicated to eliminating potential breeding areas is certainly preferable to controlling the health and nuisance effects of flying mosquitoes. The local Mosquito Control Commission can provide valuable information on establishing this maintenance program.

## **8. Inspection**

Regularly scheduled inspections of the facility should be performed by qualified inspectors. The primary purpose of the inspections is to ascertain the operational condition of embankments, outlet structures, and other safety-related aspects. Inspections will also provide information on the effectiveness of regularly scheduled preventative and aesthetic maintenance procedures and will help to identify where changes are warranted. Finally, the facility inspections should be used to determine the need for and timing of corrective maintenance procedures. In addition to regularly scheduled inspections, an informal inspection should be performed during every visit to a SWMF by maintenance or supervisory personnel. An inspection checklist and is included as part of this maintenance plan.

## **9. Reporting**

The recording of all maintenance work and inspections provide valuable data on the facility condition. Along with the written reports, a chain of command for reporting and solving maintenance problems and addressing maintenance needs should be established.

# **D. CORRECTIVE MAINTENANCE PROCEDURES**

## **1. Removal of Debris and Sediment**

Sediment, debris, and trash should be removed immediately and properly disposed of in a timely manner. Equipment and personnel must be available to perform the removal work on short notice. The lack of an available disposal site should not delay the removal of trash, debris, and sediment. Temporary disposal sites may be utilized if necessary.

## **2. Structural Repairs**

Structural damage to gutter guards, outlet and inlet structures, trash racks, and headwalls from vandalism, flood events, or other causes must be repaired promptly. Equipment, material, and personnel must be available to perform these repairs on short notice. The analysis of structural damage and the design and performance of structural repairs shall only be undertaken by qualified personnel.

### **3. Dam, Embankment, and Slope Repairs**

Damage to dams, embankments, and side slopes must be repaired promptly. Typical problems include settlement, scouring, cracking, sloughing, seepage, and rutting. Equipment, materials, and personnel must be available to perform these repairs on short notice. The immediacy of the repairs will depend upon the nature of the damage and its effects on the safety and operation of the facility. The analysis of damage and the design and performance of geotechnical repairs should only be undertaken by qualified personnel.

### **4. Dewatering**

It may be necessary to remove ponded water from within a malfunctioning SWMF. This ponding may be the result of a blocked principal outlet (detention facility), inoperable low level outlet (retention facility), loss of infiltration capacity (infiltration facility), or poor bottom drainage. Portable pumps may be necessary to remove the ponded water temporarily until a permanent solution can be implemented.

### **5. Extermination of Mosquitoes**

If neglected, a SWMF can readily become an ideal mosquito breeding area. Extermination of mosquitoes will usually require the services of an expert, such as the local Mosquito Commission. Proper procedures carried out by trained personnel can control the mosquitoes with a minimum of damage or disturbance to the environment. If mosquito control in a facility becomes necessary, the preventative maintenance program should be re-evaluated, and more emphasis placed on control of mosquito breeding habitats.

### **6. Erosion Repair**

Vegetative cover or other protective measures are necessary to prevent the loss of soil from the erosive forces of wind and water. Where a re-seeding program has not been effective in maintaining a non-erosive vegetative cover, or other factors have exposed soils, to erosion, corrective steps should be initiated to prevent further loss of soil and any subsequent danger to the stability of the facility. Soil loss can be controlled by a variety of materials and methods, including riprap, gabion lining, sod, seeding, concrete lining, and re-grading. The local Conservation District can provide assistance in recommending materials and methodologies to control erosion.

### **7. Fence Repair**

Fences are damaged by many factors, including vandalism and storm events. Timely repair will maintain the security of the site.

### **8. Elimination of Trees, Brush, Roots, and Animal Burrows**

Large roots can impair the stability of dams, embankments, and side slopes and animal burrows. Burrows can present a safety hazard for maintenance personnel. Trees and brush with extensive, woody root systems should be completely removed from dams and embankments to prevent their destabilization and the creation of seepage routes. Roots should also be completely removed to prevent their decomposition within the dam or embankment. Root voids and burrows should be plugged by filling with material similar to the existing material, and capped just below grade with stone, concrete, or other material. If plugging of the burrows does not discourage the animals from returning, further measures should be taken to either remove the animal population or to make critical areas of the facility unattractive to them.

## **9. Snow and Ice Removal**

Accumulations of snow and ice can threaten the functioning of a SWMF, particularly at inlets, outlets, and emergency spillways. Providing the equipment, materials, and personnel to monitor and remove snow and ice from these critical areas is necessary to assure the continued functioning of the facility during the winter months.

## **E. AESTHETIC MAINTENANCE PROCEDURES**

### **1. Graffiti Removal**

The timely removal of this eyesore will restore the aesthetic quality of a SWMF. Removal can be accomplished by painting or otherwise covering it, or removing it with scrapers, solvents, or cleansers. Timely removal is important to discourage further graffiti and other acts of vandalism.

### **2. Grass Trimming**

Trimming of grass edges around structures and fences will provide for a neat and attractive appearance of the facility.

### **3. Control of Weeds**

Although a regular grass maintenance program will keep weed intrusion to a minimum, some weeds will appear. Periodic weeding, either chemically or mechanically, will not only help to maintain a healthy turf, but will also keep grassed areas attractive.

### **4. Details**

Careful, meticulous, and frequent attention to the performance of maintenance items such as painting, tree pruning, leaf collection, debris removal, and grass cutting will result in a SWMF that remains both functional and attractive.

## **F. CHECKLISTS AND LOGS**

Included in this report are Tables and Sample Checklists and Logs regarding various aspects of SWMF maintenance and inspection.

## **IV. MAINTENANCE EQUIPMENT AND MATERIALS**

### **A. GRASS MAINTENANCE EQUIPMENT**

1. Tractor-Mounted Mowers
2. Riding Mowers
3. Hand Mowers
4. Gas Powered Trimmers
5. Gas Powered Edgers
6. Seed Spreaders
7. Fertilizer Spreaders
8. De-Thatching Equipment
9. Pesticide and Herbicide Application Equipment
10. Grass Clipping and Leaf Collection Equipment

### **B. VEGETATIVE COVER MAINTENANCE EQUIPMENT**

1. Saws
2. Pruning Shears

- 3. Hedge Trimmers
- 4. Wood Chippers

**C. TRANSPORTATION EQUIPMENT**

- 1. Trucks for Transportation of Materials
- 2. Trucks for Transportation of Equipment
- 3. Vehicles for Transportation of Personnel

**D. DEBRIS, TRASH, AND SEDIMENT REMOVAL EQUIPMENT**

- 1. Loader
- 2. Backhoe
- 3. Grader
- 4. Vactor Equipment

**E. MISCELLANEOUS EQUIPMENT**

- 1. Shovels
- 2. Rakes
- 3. Picks
- 4. Wheelbarrows
- 5. Fence Repair Tools
- 6. Painting Equipment
- 7. Gloves
- 8. Standard Mechanics Tools
- 9. Tools for Maintenance of Equipment
- 10. Office Space
- 11. Office Equipment
- 12. Telephones
- 13. Safety Equipment
- 14. Tools for Concrete Work (Mixers, Form Materials, etc.)
- 15. Welding Equipment (for Repair of Trash Racks, etc.)

**F. MATERIALS**

- 1. Topsoil
- 2. Fill
- 3. Seed
- 4. Soil Amenities (Fertilizer, Lime, etc.)
- 5. Chemicals (Pesticides, Herbicides, etc.)
- 6. Mulch
- 7. Paint
- 8. Paint Removers (for Graffiti)
- 9. Spare Parts for Equipment
- 10. Oil and Grease for Equipment and SWMF Components
- 11. Concrete

**V. SWMF MAINTENANCE EQUIPMENT AND MATERIAL COSTS**

This estimate is taken from NJDEP Stormwater Management Facilities Manual Table 6-1 and adjusted for 2020 costs

**GRASS MAINTENANCE EQUIPMENT**

	<b>Purchase (dollars)</b>	<b>Rent (per day) (dollars)</b>
Hand Mower	300 - 500	25 - 40

Riding Mower	3,000 - 5,000	75 - 100
Tractor Mower	15,000 - 20,000	100 - 300
Trimmer / Edger	200 - 500	25 - 35
Spreader	100 - 200	20 - 30
Chemical Sprayer	200 - 500	25 - 40

**VEGETATIVE COVER MAINTENANCE EQUIPMENT**

	<b>Purchase (dollars)</b>	<b>Rent (per day) (dollars)</b>
Hand Saw	15	5
Chain Saw	300 - 500	15 - 35
Pruning Shears	25	5
Shrub Trimmer	200	25 - 35
Brush Chipper	1,000 - 5,000	50 - 150

**TRANSPORTATION EQUIPMENT**

	<b>Purchase (dollars)</b>	<b>Lease (per month) (dollars)</b>	<b>Rent (per day) (dollars)</b>
Van	10,000 - 15,000	400	50 - 70
Pickup Truck	10,000 - 15,000	400	50 - 70
Dump Truck	30,000 - 50,000	1,200	75 - 150
Light Duty Trailer	3,000 - 5,000	150	30 - 50
Heavy Duty Trailer	10,000 - 20,000	500	100 - 200

**DEBRIS, TRASH, AND SEDIMENT REMOVAL EQUIPMENT**

	<b>Purchase (dollars)</b>	<b>Lease (per month) (dollars)</b>	<b>Rent (per day) (dollars)</b>
Front End Loader	50,000 - 100,000	1,500 - 2,000	200 - 400
Backhoe	30,000 - 50,000	1,200	150 - 300
Excavator	100,000+	2,000	400 - 1,000
Grader	100,000+	2,000	400 - 1,000
Vactor Equipment	100,000+	2,000	400 - 1,000

**MISCELLANEOUS EQUIPMENT**

	<b>Purchase (dollars)</b>	<b>Rent (per day) (dollars)</b>
Shovel	15	5
Leaf Rake	15	5
Soil Rake	15	5
Pick	15	5
Wheelbarrow	100 - 200	10
Gloves	5	N / A
Portable Compressor	500 - 1,000	50 - 100
Portable Generator	500 - 1,000	50 - 100
Concrete Mixer	500 - 1,000	25 - 50
Welding Equipment	500 - 1,500	35 - 70

**MATERIALS**

	<b>Purchase (dollars)</b>
Topsoil	35 / cubic yard
Fill Soil	15 / cubic yard

Grass Seed	5 / pound
Soil Amenities (Fertilizer, Lime, etc)	0.05 / sq ft
Chemicals (Pesticides, Herbicides, etc)	10 / gallon
Mulch	25 / cubic yard
Paint	20 / gallon
Paint Remover	10 / gallon
Machine / Motor Lubricants	5 / gallon
Dry Mortar Mix	4 / 50 pound bag
Concrete Delivered to Site	60 – 100 / cubic yard

Notes:

1. These estimates are approximation of the probable construction costs in 2015 dollars and are based upon previous construction experience and should be used as an approximate budget figure only.
2. Estimated equipment costs are based upon Industrial / Commercial grade equipment.

**VI. COST OF SWMF MAINTENANCE TASKS**

Taken from NJDEP Stormwater Management Facilities Manual Table 6-2

**PREVENTATIVE MAINTENANCE TASKS**

	<b>Small Facility (Man-Hours)</b>	<b>Large Facility (Man-Hours)</b>
Grass Cutting	1	1 - 2
Grass Maintenance	0.5	1
Trash & Debris Removal	0.5	1
Sediment Removal	4	8
Mobilization	1	1
Inspection & Reporting	1	2

**CORRECTIVE MAINTENANCE TASKS**

	<b>Small Facility (Man-Hours)</b>	<b>Large Facility (Man-Hours)</b>
Trash & Debris Removal	4	8
Structural Repairs	2-4	40
Dewatering	4	8
Mosquito Extermination	1	2-4
Erosion Repair	4	8
Fence Repair	2-4	4-8
Snow & Ice Removal	1	2
Mobilization	2	2

**AESTHETIC MAINTENANCE TASKS**

	<b>Small Facility (Man-Hours)</b>	<b>Large Facility (Man-Hours)</b>
Grass Trimming	0.5	2
Weed Control	0.5	2
Landscape Maintenance	1 - 2	2 - 4
Graffiti Removal	2 - 4	4 - 8

Notes:

1. This estimate is an approximation of the man-hours as provided in the NJDEP Stormwater Facility Maintenance Manual. It is based upon

- previous construction experience and should be used as an approximate budget figure only.
2. Cost estimates are presented in terms of man-hours. These values should be used in conjunction with applicable personnel rates to determine labor costs for a specific program or facility.
  3. Facility size definitions:
    - Small Facility: Total SWMF Site Area ¼ Acre
    - Large Facility: Total SWMF Site Area 1 Acre

Appropriate adjustments to the estimates presented should be made as necessary to account for actual SWMF size.

Table 6-3 Taken from NJDEP Stormwater Management Facilities Manual

**WORKSHEET FOR DETERMINING DEVELOPER'S 10-YEAR MAINTENANCE BOND FOR PRIVATELY HELD SWMF'S OR DEVELOPER'S CONTRIBUTION FOR MUNICIPAL MANAGEMENT OF SWMF'S**

**UNDERGROUND STORMWATER BASIN**

**1. General Maintenance**

A.	Rate per Hour for Labor & Equipment	40	\$	500 in cartridges annually
B.	Number of Required Hours of General Maintenance per Occurrence	4		
C.	Cost per Occurrence = A x B		\$	160
D.	Number of Occurrences per Year	1		
E.	Total Cost = C + D		\$	<b>660</b>

**2. Insurance**

A.	Annual Insurance Cost	To be determined	\$	To be determined
----	-----------------------	------------------	----	------------------

**3. Inspection - Annual**

A.	Rate per Hour for Labor	100		
B.	Number of Required Hours per Inspection	2		
C.	Total Cost = A x B		\$	<b>200</b>

**4. Total First Year Cost**

A.	General Maintenance (1.E)		\$	<b>660</b>
B.	Insurance (2.A)		\$	To be determined
C.	Inspection (3.C)		\$	<b>200</b>
D.	Total Cost for Year = SUM (A :C)		\$	<b>860 + insurance</b>

**Total For 10 yr Maintenance Bond**

A.	Total Cost = (4.G) x 10 years		\$	<b>8,600+insurance</b>
----	-------------------------------	--	----	------------------------

OR

**Calculation of Developer Contribution**

A.	Total Cost = (4.G) x 10 years		\$	8,600+insurance
B.	Developer Contribution Percentage	X 0.75		

C.	Total Developer Contribution = A x B		\$	6,450+insurance
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NOTE: This estimate is an approximation of the probable cost in 2020 dollars. It is based upon previous construction experience and should be used as an approximate budget figure only.

**VII. MAINTENANCE REQUIREMENTS FOR DRAINAGE SYSTEMS**

**SCHEDULE A**

**MAINTENANCE REQUIREMENTS FOR DRAINAGE SYSTEMS**

The following are those minimum activities that shall be the responsibility of the designated entity for maintenance to ensure that the drainage system will operate as designed. The designated party is only responsible for those activities discussed below that apply to the type of drainage structures existing on the project.

**Retention and Detention Basins**

The following are minimum requirements for maintenance of these systems. Other items recommended by the design engineer are encouraged to ensure the system will function as designed.

In the event of standing water in the drainage system longer than 3 days (72 hours) after all maintenance activities have been conducted, the Municipal or County Engineer’s Office shall be notified immediately.

(1) Inspection Schedule

Drainage systems must be inspected on a routine basis to ensure that they are functioning properly. Inspection shall be conducted a minimum of semi-annually and always after major storms.

(2) Inlet and Outlet Structure

All inlet and outlet structures shall be examined at the time of inspection for debris and accumulation of sediment which shall be removed from these structures.

(3) Maintenance of Vegetated Basins

- a. A dense turf with extensive root growth is encouraged to reduce erosion of the sides of the basin. Basin bottom shall be constructed of clean sand to enhance infiltration. Well establish turf forming a porous turf will prevent the formation of an impermeable layer.
- b. Grasses of the fescue family are recommended for seeding primarily due to their adaptability to dry sandy soils, drought resistance, hardiness, and ability to withstand brief inundations. Fescues will also permit longer intervals between mowings.
- c. Mowing of the grass is required twice a year, once around June and again in September. Additional mowing is recommended to ensure the aesthetic quality of the site.
- d. Fertilization and liming is left to the discretion of the maintenance entity. A 10-6-4 ratio fertilizer at a rate of 500 lb. per acre (11 lb. per 1,000 sf) is provided for guidance.

(4) Maintenance of Gravel Bottom Retention Basins

- a. Sediment shall not be allowed to build up to the point where it reduces the rate of infiltration that the system was designed to accommodate. In the event of standing water greater than 3 days (72) hours because of siltation, the system must be thoroughly cleaned.
- b. If the system still remains inoperable after a thorough cleaning; the system must be removed and replaced so that the system will function as designed.

(5) Maintenance of Non-Vegetated Basins (Soil Floors)

- a) All sediment accumulated in the basin bottom must be removed. Sediment removal is only to be conducted when the basin is completely dry, after the silt layer has mud cracks and has separated from the basin floor.
- b) Tilling is required periodically and at least once annually, from June through September, to restore the natural infiltration capacity the system was designed for by overcoming the effects of surface compaction. All sediment must be removed prior to tilling the basin bottom.
- c) Rotary tillers or disc harrows should be used since precise blade control and equipment maneuverability are essential in small areas.
- d) After tilling the basin floor should be smooth and free of ridges and furrows to enable easy removal of sediment during future cleaning operations. The basin floor should slope toward a low-flow channel wherever applicable.

## VIII. MAINTENANCE AND INSPECTION LOGS AND CHECKLISTS

SWM Maintenance List

Page 1 of 4

### Maintenance Work Order and Checklist for Stormwater Management Facilities

Name of Facility: \_\_\_\_\_

Location: \_\_\_\_\_ Date: \_\_\_\_\_

<b>Crew:</b>		<b>Work Started:</b>		<b>Time:</b>	
<b>Equipment:</b>		<b>Work Completed:</b>		<b>Time:</b>	
<b>Weather:</b>		<b>Total Man-hours for Work::</b>			

#### A. Preventative Maintenance

	Items Required	Items Done	Comments and Special Instructions
<b>1. Grass Cutting</b>	√	√	
A. Bottoms			
B. Embankments and Side Slopes			
C. Perimeter Areas			
D. Access Areas and Roads			
E. Other:			

	Items Required	Items Done	Comments and Special Instructions
<b>2. Grass Maintenance</b>	√	√	
A. Fertilizing			
B. Re-Seeding			
C. De-Thatching			
D. Pest Control			
E. Other:			

	Items Required	Items Done	Comments and Special Instructions
<b>3. Vegetative Cover</b>	√	√	
A. Fertilizing			
B. Pruning			
C. Pest Control			
D. Other:			

	Items Required	Items Done	Comments and Special Instructions
<b>4. Trash and Debris Removal</b>	√	√	
A. Bottoms			
B. Embankments and Side Slopes			
C. Perimeter Areas			
D. Access Areas and Roads			
E. Inlets			
F. Outlets and Trash Racks			
G. Other:			

**SWM Maintenance List**

		Items Required	Items Done	
<b>5. Sediment Removal</b>		√	√	Comments and Special Instructions
A.	Inlets			
B.	Outlets and Trash Racks			
C.	Bottoms			
E.	Other			

		Items Required	Items Done	
<b>6. Mechanical Components</b>		√	√	Comments and Special Instructions
A.	Valves			
B.	Sluice Gates			
C.	Pumps			
D.	Fence Gates			
E.	Locks			
F.	Access Hatches			
G.	Other:			

		Items Required	Items Done	
<b>7. Elimination of Potential Mosquito Breeding Habitats</b>		√	√	Comments and Special Instructions
A.				
B.				
C.				
D.				

		Items Required	Items Done	
<b>8. Pond Maintenance</b>			√	Comments and Special Instructions
A.	Aeration Equipment			
B.	Debris & Trash Removal			
C.	Weed Removal			
D.	Other:			

		Items Required	Items Done	
<b>9. Other Preventative Maintenance</b>		√	√	Comments and Special Instructions
A.				
B.				
C.				
D.				

**SWM Maintenance List**

**B. Corrective Maintenance**

Work Item	Items Required √	Items Done √	Location, Comments, and Special Instructions
<b>1. Removal of Debris &amp; Sediment</b>			
<b>2. Structural Repairs</b>			
<b>3. Dam, Embankment &amp; Slope Repairs</b>			
<b>4. Dewatering</b>			
<b>5. Control of Mosquitoes</b>			
<b>6. Pond Maintenance</b>			
<b>7. Erosion Repair , Roots &amp;</b>			
<b>8. Fence Repair</b>			
<b>9. Elimination of Trees, Brush and Animal Burrows</b>			
<b>10. Snow &amp; Ice Removal</b>			
<b>11. Other</b>			

**C. Aesthetic Maintenance**

Work Item	Items Required √	Items Done √	Location, Comments, and Special Instructions
<b>1. Graffiti Removal</b>			
<b>2. Grass Trimming</b>			
<b>3. Weeding</b>			
<b>4. Other</b>			

**SWM Maintenance List**

**Page 4 of 4**

**Remarks:** (Refer to Item No. If Applicable)

Work Order Prepared By: \_\_\_\_\_

Work Completed By: \_\_\_\_\_





**C. Aesthetic Maintenance**

**Date:**

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Work Item                      (√) Completed

**1. Graffiti Removal**

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**2. Grass Trimming**

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**3. Weeding**

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**4. Other:**

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**Remarks:**    (Refer to Item No, If Applicable)

Work Order Prepared By: \_\_\_\_\_

Work Completed By: \_\_\_\_\_



SWM Inspection List

Facility Item	OK <sup>1</sup>	Routine <sup>2</sup>	Urgent <sup>3</sup>	Comments <sup>4</sup>
<b>4. Ponds (Retention)</b>				
A. Vegetation				
B. Shoreline Erosion				
C. Aeration Equipment				
D. Trash and Debris				
E. Sediment				
F. Water Quality				
G. Other:				
<b>5. Inlet Structure</b>				
A. Condition of Structure				
B. Erosion				
C. Trash & Debris				
D. Sediment				
E. Aesthetics				
F. Other:				
<b>6. Outlet Structure (Detention &amp; Retention)</b>				
A. Condition of Structure				
B. Erosion				
C. Trash & Debris				
D. Sediment				
E. Mechanical Components				
F. Aesthetics				
G. Other:				
<b>7. Emergency Spillway</b>				
A. Vegetation				
B. Lining				
C. Erosion				
D. Trash & Debris				
E. Other:				
<b>8. Perimeter</b>				
A. Vegetation				
B. Erosion				
C. Trash & Debris				
D. Fences & Gates				
E. Aesthetics				
F. Other:				
<b>9. Access Roads</b>				
A. Vegetation				
B. Road Surface				
C. Fences & Gates				
D. Erosion				
E. Aesthetics				
F. Other:				

1. The item checked is in good condition and the maintenance program is adequate.
2. The item checked requires attention but does not present an immediate threat to the facility function or other facility components.
3. The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components.
4. Provide explanation and details if columns 2 or 3 are checked.

SWM Inspection List

Facility Item	OK <sup>1</sup>	Routine <sup>2</sup>	Urgent <sup>3</sup>	Comments <sup>4</sup>
<b>10. Miscellaneous</b>				
A. Effectiveness of Exist. Maint. Program				
B. Dam Inspections				
C. Potential Mosquito Habitats				
D. Mosquitoes				
E.				
F.				
G. :				

1. The item checked is in good condition and the maintenance program is adequate.
2. The item checked requires attention but does not present an immediate threat to the facility function or other facility components.
3. The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components.
4. Provide explanation and details if columns 2 or 3 are checked.

---

**Remarks:** (Refer to Item No, If Applicable)

Inspector: \_\_\_\_\_

### Maintenance Log Stormwater Management Facilities

Name of Facility: \_\_\_\_\_

Location: \_\_\_\_\_ Date: \_\_\_\_\_

Date: 

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Facility Item

Indicate Condition (i.e. 1, 2, or 3)

**1. Embankments and Side Slopes**

A. Vegetation														
B. Linings														
C. Erosion														
D. Settlement														
E. Sloughing:														
F. Trash and Debris														
G. Seepage														
H. Aesthetics														
I. Other														

**2. Bottoms (Detention and Infiltration)**

A. Vegetation														
B. Erosion														
C. Standing Water														
D. Settlement														
E. Trash and Debris														
F. Sediment														
G. Aesthetics														
H. Other														

**3. Low Flow Channels (Detention)**

A. Vegetation														
B. Linings														
C. Erosion														
D. Settlement:														
E. Standing Water														
F. Trash and Debris														
G. Sediment														
H. Other														

**4. Ponds**

A. Vegetation														
B. Shoreline Erosion														
C. Aeration Equipment														
D. Trash & Debris														
E. Sediment														
F. Water Quality														
G. Other:														

- 1 The item checked is in good condition and the maintenance program is adequate.
- 2 The item checked requires attention, but does not present an immediate threat to the facility function or other facility components.
- 3 The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components.

SWM Maintenance Log

Date: 

--	--	--	--	--	--	--	--	--	--

Facility Item                      Indicate Condition (i.e. 1, 2, or 3)

**5. Inlet Structure**

A. Condition of Structure											
B. Erosion											
C. Trash & Debris											
D. Sediment:											
E. Aesthetics											
F. Other:											

**6. Outlet Structure (Detention & Retention)**

A. Condition of Structure											
B. Erosion											
C. Trash & Debris											
D. Sediment											
E. Mechanical Components											
F. Aesthetics											
G. Other											

**7. Emergency Spillway**

A. Vegetation											
B. Lining											
C. Trash & Debris											
D. Other:											

**8. Perimeter**

A. Vegetation											
B. Erosion											
C. Trash & Debris											
D. Fences & Gates:											
E. Aesthetics											
F. Other:											

**9. Access Roads**

A. Vegetation											
B. Road Surface											
C. Trash & Debris											
D. Fences & Gates											
E. Aesthetics											
F. Other:											

- 1 The item checked is in good condition and the maintenance program is adequate.
- 2 The item checked requires attention, but does not present an immediate threat to the facility function or other facility components.
- 3 The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components.

SWM Maintenance Log

**10. Miscellaneous**

A. Effectiveness of Exist. Maintenance Program												
B. Dam Inspections												
C. Potential Mosquito Habitats												
D. Mosquitoes												
E.												
F.												
G.												

- 1 The item checked is in good condition and the maintenance program is adequate.
- 2 The item checked requires attention, but does not present an immediate threat to the facility function or other facility components.
- 3 The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components.

**Remarks:** (Refer to Item No, If Applicable)

Prepared By: \_\_\_\_\_

## StormFilter Inspection and Maintenance Procedures



## Maintenance Guidelines

The primary purpose of the Stormwater Management StormFilter® is to filter and prevent pollutants from entering our waterways. Like any effective filtration system, periodically these pollutants must be removed to restore the StormFilter to its full efficiency and effectiveness.

Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site. Maintenance activities may be required in the event of a chemical spill or due to excessive sediment loading from site erosion or extreme storms. It is a good practice to inspect the system after major storm events.

## Maintenance Procedures

Although there are many effective maintenance options, we believe the following procedure to be efficient, using common equipment and existing maintenance protocols. The following two-step procedure is recommended::

### 1. Inspection

- Inspection of the vault interior to determine the need for maintenance.

### 2. Maintenance

- Cartridge replacement
- Sediment removal

## Inspection and Maintenance Timing

At least one scheduled inspection should take place per year with maintenance following as warranted.

First, an inspection should be done before the winter season. During the inspection the need for maintenance should be determined and, if disposal during maintenance will be required, samples of the accumulated sediments and media should be obtained.

Second, if warranted, a maintenance (replacement of the filter cartridges and removal of accumulated sediments) should be performed during periods of dry weather.



In addition to these two activities, it is important to check the condition of the StormFilter unit after major storms for potential damage caused by high flows and for high sediment accumulation that may be caused by localized erosion in the drainage area. It may be necessary to adjust the inspection/maintenance schedule depending on the actual operating conditions encountered by the system. In general, inspection activities can be conducted at any time, and maintenance should occur, if warranted, during dryer months in late summer to early fall.

## Maintenance Frequency

The primary factor for determining frequency of maintenance for the StormFilter is sediment loading.

A properly functioning system will remove solids from water by trapping particulates in the porous structure of the filter media inside the cartridges. The flow through the system will naturally decrease as more and more particulates are trapped. Eventually the flow through the cartridges will be low enough to require replacement. It may be possible to extend the usable span of the cartridges by removing sediment from upstream trapping devices on a routine as-needed basis, in order to prevent material from being re-suspended and discharged to the StormFilter treatment system.

The average maintenance lifecycle is approximately 1-5 years. Site conditions greatly influence maintenance requirements. StormFilter units located in areas with erosion or active construction may need to be inspected and maintained more often than those with fully stabilized surface conditions.

Regulatory requirements or a chemical spill can shift maintenance timing as well. The maintenance frequency may be adjusted as additional monitoring information becomes available during the inspection program. Areas that develop known problems should be inspected more frequently than areas that demonstrate no problems, particularly after major storms. Ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual StormFilter system or site. It is recommended that the site owner develop a database to properly manage StormFilter inspection and maintenance programs..



## Inspection Procedures

The primary goal of an inspection is to assess the condition of the cartridges relative to the level of visual sediment loading as it relates to decreased treatment capacity. It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, then typically large amounts of sediments will be present and very little flow will be discharged from the drainage pipes. If this is the case, then maintenance is warranted and the cartridges need to be replaced.

**Warning:** In the case of a spill, the worker should abort inspection activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct an inspection:

**Important:** Inspection should be performed by a person who is familiar with the operation and configuration of the StormFilter treatment unit.

1. If applicable, set up safety equipment to protect and notify surrounding vehicle and pedestrian traffic.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the access portals to the vault and allow the system vent.
4. Without entering the vault, visually inspect the inside of the unit, and note accumulations of liquids and solids.
5. Be sure to record the level of sediment build-up on the floor of the vault, in the forebay, and on top of the cartridges. If flow is occurring, note the flow of water per drainage pipe. Record all observations. Digital pictures are valuable for historical documentation.
6. Close and fasten the access portals.
7. Remove safety equipment.
8. If appropriate, make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.
9. Discuss conditions that suggest maintenance and make decision as to whether or not maintenance is needed.

## Maintenance Decision Tree

The need for maintenance is typically based on results of the inspection. The following Maintenance Decision Tree should be used as a general guide. (Other factors, such as Regulatory Requirements, may need to be considered)

1. Sediment loading on the vault floor.
  - a. If  $>4"$  of accumulated sediment, maintenance is required.
2. Sediment loading on top of the cartridge.
  - a. If  $>1/4"$  of accumulation, maintenance is required.
3. Submerged cartridges.
  - a. If  $>4"$  of static water above cartridge bottom for more than 24 hours after end of rain event, maintenance is required. (Catch basins have standing water in the cartridge bay.)
4. Plugged media.
  - a. If pore space between media granules is absent, maintenance is required.
5. Bypass condition.
  - a. If inspection is conducted during an average rain fall event and StormFilter remains in bypass condition (water over the internal outlet baffle wall or submerged cartridges), maintenance is required.
6. Hazardous material release.
  - a. If hazardous material release (automotive fluids or other) is reported, maintenance is required.
7. Pronounced scum line.
  - a. If pronounced scum line (say  $\geq 1/4"$  thick) is present above top cap, maintenance is required.



## Maintenance

Depending on the configuration of the particular system, maintenance personnel will be required to enter the vault to perform the maintenance.

**Important:** If vault entry is required, OSHA rules for confined space entry must be followed.

Filter cartridge replacement should occur during dry weather. It may be necessary to plug the filter inlet pipe if base flows is occurring.

Replacement cartridges can be delivered to the site or customers facility. Information concerning how to obtain the replacement cartridges is available from Contech Engineered Solutions.

**Warning:** In the case of a spill, the maintenance personnel should abort maintenance activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct cartridge replacement and sediment removal maintenance:

1. If applicable, set up safety equipment to protect maintenance personnel and pedestrians from site hazards.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the doors (access portals) to the vault and allow the system to vent.
4. Without entering the vault, give the inside of the unit, including components, a general condition inspection.
5. Make notes about the external and internal condition of the vault. Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.
6. Using appropriate equipment offload the replacement cartridges (up to 150 lbs. each) and set aside.
7. Remove used cartridges from the vault using one of the following methods:

### Method 1:

- A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

Using appropriate hoisting equipment, attach a cable from the boom, crane, or tripod to the loose cartridge. Contact Contech Engineered Solutions for suggested attachment devices.

- B. Remove the used cartridges (up to 250 lbs. each) from the vault.



**Important:** Care must be used to avoid damaging the cartridges during removal and installation. The cost of repairing components damaged during maintenance will be the responsibility of the owner.

- C. Set the used cartridge aside or load onto the hauling truck.
- D. Continue steps a through c until all cartridges have been removed.

### Method 2:

- A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.
- B. Unscrew the cartridge cap.
- C. Remove the cartridge hood and float.
- D. At location under structure access, tip the cartridge on its side.
- E. Empty the cartridge onto the vault floor. Reassemble the empty cartridge.
- F. Set the empty, used cartridge aside or load onto the hauling truck.
- G. Continue steps a through e until all cartridges have been removed.

8. Remove accumulated sediment from the floor of the vault and from the forebay. This can most effectively be accomplished by use of a vacuum truck.
9. Once the sediments are removed, assess the condition of the vault and the condition of the connectors.
10. Using the vacuum truck boom, crane, or tripod, lower and install the new cartridges. Once again, take care not to damage connections.
11. Close and fasten the door.
12. Remove safety equipment.
13. Finally, dispose of the accumulated materials in accordance with applicable regulations. Make arrangements to return the used **empty** cartridges to Contech Engineered Solutions.

## Related Maintenance Activities - Performed on an as-needed basis

StormFilter units are often just one of many structures in a more comprehensive stormwater drainage and treatment system.

In order for maintenance of the StormFilter to be successful, it is imperative that all other components be properly maintained. The maintenance/repair of upstream facilities should be carried out prior to StormFilter maintenance activities.

In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil loading, and discharges of inappropriate materials.

## Material Disposal

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads.

Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. This typically requires coordination with a local landfill for solid waste disposal. For liquid waste disposal a number of options are available including a municipal vacuum truck decant facility, local waste water treatment plant or on-site treatment and discharge.



# Inspection Report

Date: Personnel:

Location: \_\_\_\_\_ System Size: \_\_\_\_\_

System Type: Vault  Cast-In-Place  Linear Catch Basin  Manhole  Other

Sediment Thickness in Forebay: \_\_\_\_\_ Date: \_\_\_\_\_

Sediment Depth on Vault Floor: \_\_\_\_\_

Structural Damage: \_\_\_\_\_

Estimated Flow from Drainage Pipes (if available): \_\_\_\_\_

Cartridges Submerged: Yes  No  Depth of Standing Water: \_\_\_\_\_

StormFilter Maintenance Activities (check off if done and give description)

Trash and Debris Removal: \_\_\_\_\_

Minor Structural Repairs: \_\_\_\_\_

Drainage Area Report \_\_\_\_\_

Excessive Oil Loading: Yes  No  Source: \_\_\_\_\_

Sediment Accumulation on Pavement: Yes  No  Source: \_\_\_\_\_

Erosion of Landscaped Areas: Yes  No  Source: \_\_\_\_\_

Items Needing Further Work: \_\_\_\_\_

Owners should contact the local public works department and inquire about how the department disposes of their street waste residuals.

Other Comments:

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Review the condition reports from the previous inspection visits.

# StormFilter Maintenance Report

Date: \_\_\_\_\_ Personnel: \_\_\_\_\_

Location: \_\_\_\_\_ System Size: \_\_\_\_\_

System Type: Vault  Cast-In-Place  Linear Catch Basin  Manhole  Other

List Safety Procedures and Equipment Used: \_\_\_\_\_

## System Observations

Months in Service: \_\_\_\_\_

Oil in Forebay (if present): Yes  No

Sediment Depth in Forebay (if present): \_\_\_\_\_

Sediment Depth on Vault Floor: \_\_\_\_\_

Structural Damage: \_\_\_\_\_

## Drainage Area Report

Excessive Oil Loading: Yes  No  Source: \_\_\_\_\_

Sediment Accumulation on Pavement: Yes  No  Source: \_\_\_\_\_

Erosion of Landscaped Areas: Yes  No  Source: \_\_\_\_\_

## StormFilter Cartridge Replacement Maintenance Activities

Remove Trash and Debris: Yes  No  Details: \_\_\_\_\_

Replace Cartridges: Yes  No  Details: \_\_\_\_\_

Sediment Removed: Yes  No  Details: \_\_\_\_\_

Quantity of Sediment Removed (estimate?): \_\_\_\_\_

Minor Structural Repairs: Yes  No  Details: \_\_\_\_\_

Residuals (debris, sediment) Disposal Methods: \_\_\_\_\_

Notes:

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- Drawings and specifications are available at [www.conteches.com](http://www.conteches.com).
- Site-specific design support is available from our engineers.

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