STORMWATER MANAGEMENT FACILITY OPERATIONS & MAINTENANCE MANUAL

Prepared for:

Lawrence Logistics Center

Proposed Warehouse Development / Distribution Center

40 Enterprise Avenue
Block 601, Lot 1-8
Township of Lawrence
&
Block 23201, Lot 1
City of Trenton
Mercer County, New Jersey

Prepared by

BOHLER

N.J. Certificate of Authorization 24GA28161700

30 Independence Boulevard, Suite 200
Warren, NJ 07059
908-668-8300

_____

B.A. Bohler, P.E.
New Jersey Professional Engineer License No. 47421

February 2022

Stormwater Management Measures
Maintenance Plan & Field Manuals

Development Name: Lawrence Logistics Center

Address: 40 Enterprise Avenue

Block(s) / Lot(s): Block 601, Lot 1-8 / Block 23201, Lot 1

Township, County: Township of Lawrence/City of Trenton, Mercer County

Party Responsible for Maintenance:

40 Enterprise, LLC

Address: 51 Deforest Avenue, Summit, New Jersey 07901

Contact Person(s): Jonathan Fox Phone: (908) 219-9868

Prepared by: Bohler Engineering NJ, LLC Date: February 2022

This plan is recorded in

Deed Book # _____ Page # ____ with _____ County Clerk on Date _____

Last Revised on _____/_____/_____

Table of Contents

Part I- Maintenance

Part II- Field Manuals and Maintenance Records

Part I- Maintenance Plan

List of Stormwater Management Measures

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

Type of Stormwater Management Measure	Location Description	State Plane Coordinates
Bioretention Basin	Between the car parking area at the western face of the building and U.S. Route 1	513,650 Northing 426,580 Easting
Manufactured Treatment Device #1A, #1B, #1C	Located within the asphalt pavement area at the opening of the eastern driveway into the truck court area	513,530 Northing 427,300 Easting
Manufactured Treatment Device #2	Located in the landscape area to the East of the proposed inlets located in the western driveway adjacent Enterprise Avenue	513,250 Northing 426,940 Easting

Location Map

Refer to Proposed Drainage Area Map provided in the Appendix of this Report

Description of Stormwater Management Measures

Bioretention Basin
Design storm:
- Design Purposes:
  - NJDEP Water Quality storm
  - 2-year storm (3.31 inches);
  - 10-year storm (5.01 inches);
  - 25-year storm (6.19 inches);
  - 100-year storm (8.33 inches)
- Dimensions:
  - 88.0’ (W) X 236.6’ (L) X 1.0’ (H)

Manufactured Treatment Device
Design storm:
- Design Purposes:
  - NJDEP Water Quality storm
  - 2-year storm (3.31 inches);
  - 10-year storm (5.01 inches);
  - 25-year storm (6.19 inches);
  - 100-year storm (8.33 inches)
- Dimensions:
  - MTD #1 (StormFilter by Contech): 3 - 8’ x 20’ units
  - MTD #2 (Up-Flo Filter by Hydro International)) : 1 - 6’ x 12’ unit

Preventative and Corrective Maintenance Action Plan

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

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

As per NJDEP BMP Manual Ch. 8 (Feb. 2004), maintenance plans should include recommended corrective responses to various emergency conditions that may be encountered at the stormwater management measure. It should be noted that if the stormwater management measure includes a Class I or II dam as defined in the NJDEP Dam Safety Standards at N.J.A.C. 7:20, an emergency action plan for the dam is also required. See N.J.A.C. 7:20-1.7(f) for more information.

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

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

Routine Inspection and Maintenance of the Stormwater Management Facilities:

All stormwater management basins have been designed to control degradation of water quality. Without proper routine inspection and maintenance, the basins may lose some or all of their capability to function to their full capacity. Lack of adequate maintenance at these facilities could lead to system failures.

Regularly scheduled maintenance inspections of the stormwater facilities should be performed at least four (4) times each year. The primary purpose of these inspections is to ascertain the operational condition and safety of the facilities, particularly the condition of embankments, outlet structures, sedimentation 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 in the extent and scheduling of the procedures are warranted. Finally, the facility inspections should also be used to determine the need for and timing of Corrective Maintenance procedures.

Routine maintenance of these facilities should be separated into two (2) basic types: Functional Maintenance and Aesthetic Maintenance. Functional Maintenance is further broken down into two (2) categories: Preventative and Corrective. Aesthetic Maintenance, which is necessary to maintain the visual appeal and aesthetic quality of these facilities, should be incorporated on the same schedule as the preventative maintenance efforts. Listed below are the Preventative, Corrective and Aesthetic Maintenance Procedures to be performed on a routine basis:

Preventative Maintenance Procedures:

The purpose of Preventative Maintenance is to maximize the effectiveness of the stormwater management aspects of the basins so that they remain operational and safe and to minimize the need for potential emergency or extensive corrective maintenance. These procedures are as follows:

a) **Weed Growth** – Weeds associated with detention basins typically fall into three (3) categories: submergent, floating and emergent. All three (3) are typically found, to some extent, in a stormwater management system. However, excessive growth of any of these weeds can lead to problems.

The basins should be evaluated regularly to determine whether excessive invasive plant growth is evident. If it occurs, this situation can be corrected by appropriate application of fertilizers and weed killers. Weeds which have become a problem can be cleared through manual removal by professional pond maintenance technicians.

b) **Maintenance of Adjacent Areas** – Grass areas, trees, and shrubs throughout the site require periodic routine maintenance to include fertilizing, de-thatching and soil conditioning in order to maintain healthy growth and to provide soil stabilization. The application of fertilizers should follow manufacturer's instructions to reduce run-off of these compounds into the basins. Additionally, provisions should be made to re-seed and re-establish grass cover in areas damaged by sediment accumulation, stormwater flow, or other causes. These tasks should be performed, or at least evaluated, on a quarterly basis. Lawn areas should be mowed at least once a month during the growing season. Vegetated areas must be inspected at least annually for erosion and scour as well as unwanted growth, which should be removed with minimum disruption to the remaining vegetation.

   Note: All use of fertilizers, mechanical treatments, pesticides and other means to ensure optimum vegetation health must not compromise the intended purpose of the stormwater management facility. All vegetation deficiencies should be addressed without the use of fertilizers and pesticides whenever possible and if necessary, the minimum amount practical.

c) **Removal and Disposal of Trash/Debris and Sediment** – All stormwater management components expected to receive and/or trap debris and sediment must be inspected for clogging and excessive debris and sediment accumulation at least four times annually as well as after every storm exceeding one inch of rainfall in 24 hours. Such components should include the catch basins, outlet structures, and trash racks.

   Removal of trash and debris will prevent possible damage and minimize potential mosquito breeding habitats. Debris and trash must be properly hauled off the site and transferred to an approved disposal site.

The bioretention basin and underdrain for the porous pavement section should also be evaluated for excessive deposition of sediment. Accumulated sediment should be removed before it threatens the storage volume of the basin. Before de-sedimentation activities are performed, consideration should be given to evacuating all standing water from the basins. Disposal of discharged water and sediment must comply with all local, county, state and federal regulations. Only suitable disposal sites should be utilized. If stable soil conditions exist around the basin, sediment deposition should not be an excessive maintenance issue. Should a recurrent stabilization situation develop, the inspector should identify the upstream sources of sediment and recommend required stabilization measures.

d) **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 may become the source of a large mosquito population. A maintenance program dedicated to eliminating potential breeding areas is preferable to chemical means of controlling mosquitoes. The most important maintenance functions, is removal of all obstructions to natural flow patterns before stagnant water conditions can develop.

e) **Parking Lot Maintenance –** This management measure involves employing pavement cleaning practices, such as parking lot sweeping on a regular basis, to minimize pollutant export to the stormwater conveyance system/ detention basins and eventually the receiving waters. These cleaning practices are designed to remove sediment, debris, and other pollutants from access drive and parking lot surfaces that are a potential source of pollution impacting urban waterways. Mechanical machines that use vacuum assisted dry sweeping to remove particulate matter shall be utilized as these have the ability to remove finer sediment particles. Parking lots and access drives shall be swept/ vacuumed at least semi-annually or more often as conditions warrant. The disposal of the swept material must be properly hauled off the site and transferred to an approved disposal site. Other parking lot maintenance features include the use of on-site trash receptacle. These receptacles are located at each residential unit where the majority of the

pedestrian traffic occurs. The disposal of the solid waste must be properly hauled off the site and transferred to an approved disposal site.

Corrective Maintenance Procedures:

a) **Removal of Debris and Sediment –** Sediment, debris and trash which threaten the discharge capacity of the basins should be removed immediately and properly disposed of. As noted previously, it is recommended that all water be evacuated from the basins before any significant amount of sediment, settled debris or trash is removed from the basins.

b) **Structural Repairs** – Structural damage to outlet and inlet structures, trash racks, access hatches, and roadways as a result of vandalism, flood events, settlement or other causes must be repaired promptly. The urgency 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 structural damage if it occurs and the design and performance of structural repairs should only be undertaken by a Professional Engineer.

c) **Embankment and Slope Repairs** – Damage to embankments, and side slopes must be repaired promptly. This damage can be the result of unusual rain or flood events, vandalism, animals, vehicles or neglect. Typical problems can include settlement, scouring, cracking, sloughing, seepage and rutting. The urgency of the repairs will depend upon the nature of the damage and its effect on safety and operational efficiency of the facility. The analysis of the damage and the design and performance of geotechnical repairs should only be undertaken by qualified personnel and under the direction of a consulting Professional Engineer. All basin embankments should be inspected quarterly and after each significant storm greater than one (1) inch of rainfall in 24 hours. Any damage or indication of erosion shall be immediately inspected by a Professional Engineer.

d) **Weed Harvesting** – It may be necessary to remove congested weeds from the basin. Companies specializing in manual removal of weeds should be contacted to perform these operations. Note that such work does not usually, but may in some cases require the approval of various regulatory agencies.

e) **Extermination of Mosquitoes** – If neglected, basins can become a potential mosquito breeding area. The extermination of mosquitoes will usually require the services of the County Mosquito Commission. If mosquito control in the facility becomes necessary, the preventative maintenance program should be re-evaluated, and more emphasis should be placed on control of mosquito breeding habitats.

f) **Erosion Repair** – Vegetative cover or other protective measures are necessary to prevent the loss of soil due to the 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 that may result in danger to the stability of the facility. Soil loss can be controlled by a variety of materials and methods, including rip-rap, gabion lining, geotextile fabrics, sod, seeding, concrete lining and re-grading.

g) **Elimination of Trees, Brush, Roots and Animal Burrows** – The stability of embankments can be impaired by large roots and animal burrows. Additionally, burrows can present a safety hazard for maintenance personnel. Trees and brush with extensive, woody root systems should be completely removed to prevent destabilization and the creation of seepage routes. Regular mowing will prevent vegetation that can cause root problems. Roots should also be completely removed to prevent decomposition within the embankment. Root voids and burrows should be filled with material similar to the existing material, and capped just below grade with stone, concrete or other material. If the filling of the burrows does not discourage the animals from returning, further measures should be taken to either move the animal population or to make critical areas of the facility unattractive to them.

h) **Snow and Ice Removal** – Accumulations of snow and ice can threaten the functioning of the inlets, outlets and emergency spillways. Provision of the equipment, material and personnel to monitor and remove snow and ice from critical areas will assure the function of the facility during the winter months.

Aesthetic Maintenance Procedures:

a) **Graffiti Removal** - The timely removal of graffiti will restore the aesthetic quality of the basins. Removal can be accomplished by paint or other cover, or removal with scrapers, solvents or cleansers. Timely removal is important to discourage further graffiti and other acts of vandalism.

b) **Grass Trimming/Landscape Maintenance** – The lawn areas around the site shall be mowed on a regular basis as necessary to maintain the lawn at a height of 2 to 3-inches. These areas shall also be fertilized twice a year, once in the spring and once in the fall. Fertilizer for lawn areas shall be 10-20-10 applied at a rate of 11 lbs. per 1,000 sf. or as determined by a soil test. Any bare, dead or damaged lawn areas shall be re-seeded in accordance with the original procedures as outlined in the Soil Erosion and Sediment Control Plans using the same mix and seeding rates. Stabilization of bare or damaged areas shall be done in a timely fashion so as to avoid exposing the soil to erosion.

   If season prevents the re-establishment of turf cover, exposed areas should be stabilized with straw or salt hay mulch as described in the Soil Erosion and Sediment Control Plans until permanent seeding can be done. Seeding can be done between March 15th and June 15th and between September 15th and December 1st, only if adequate water is provided.

   The shrubs around the basins should also be maintained in order to promote a neat appearance and healthy, vigorous growth. All shrubs should be allowed to grow together in masses as shown on the plans and not pruned into individual plants. The planting beds should be mulched with hardwood mulch every two (2) years in order to provide a suitable growing medium for the shrubbery and to retain moisture around the root zones.

   Pruning of shrubs should also be done on a regular basis to maintain the shape and appearance of the shrub masses. The height of the shrubs may vary according to the plants natural growth habits, but should not exceed 6-feet. Pruning should be done as necessary throughout the year to remove dead branches and to control new growth. Any pruning, other than the removal of dead branches, should be done

in either late winter/early spring or after the shrub has flowered in the spring.

In the event that a shrub should experience more than 2/3 die back, it should be replaced in kind as soon as possible in either the spring or fall planting season. The replacement shrub should be the same species as the original and installed at the size and condition as specified on the original landscape plans. If, for any reason, a substitution of species or size must be made, it shall be subject to the approval of the project Landscape Architect.

The trees surrounding the basin areas shall be maintained regularly to ensure good health and exhibit an attractive appearance. Their maintenance should include fertilization twice annually, with one application in the spring and another in early fall. The trees shall be pruned in the late winter or early spring. However, dead branches should be removed as soon as they are noticed. Care should be taken to avoid cutting off the central leader of a tree if one is present.

If a tree is severely damaged or experiences more than 2/3 die back, it should be replaced in either the spring or fall planting season, whichever comes first. The only exception to this is if the replacement tree has a fall transplanting hazard. Replacement trees should be planted at the same size and condition as specified on the landscape plans. Any tree or shrub maintenance, tree pruning or plant material substitution of species or size shall be subject to the approval of the project Landscape Architect.

c) **Control of Weeds** – Although a regular grass maintenance program will minimize weed intrusion, some weeds will appear. Periodic weeding, either chemically or mechanically, will help to maintain a healthy turf, and keep grassed areas looking attractive. Application of chemicals should be minimized and monitored closely so as not to affect the ecosystems within the detention basin. Excessive growth of weeds within the basin can be controlled mechanically as discussed in the previous section.

The recording of all maintenance work and inspections provide valuable data on the facility's condition. Review of this information will also help

to establish more efficient and beneficial maintenance procedures and practices. As the owner is ultimately responsible for site maintenance, all recorded information should be directed to the owners of the basins for review and subsequent follow-up on recommendations. Data obtained from informal inspections should be retained; however, under current regulations, this data does not have to be submitted to NJDEP.

Preventative Maintenance Actions

Frequency	Preventative Maintenance Actions	Stormwater Measures/ No.
Monthly	Vegetation mowing and removal in growing season	-
Quarterly	Quarterly inspection (Sediment removal, depending on the type of measure)	e.g., Bioretention Basins, Manufactured Treatment Devices, onsite inlets
Semiannual	Clean, sediment removal, depending on the type of measure Inspection of water quality units	e.g., Manufactured Treatment Devices
Annual	Basin Structural Inspection	e.g., Bioretention Basins
Unscheduled	Quick inspection after every 1” rain	All Stormwater Management Measures

Corrective Maintenance Actions

Potential Corrective Maintenance Actions	Stormwater Management Measures/No.
Repair/Replacement of Eroded or Damaged Rip-Rap	e.g. Bioretention Basins & Scour Holes
Repair/ Replacement of Missing or Damaged Trash Racks	e.g., Bioretention Basins
Repair/Replacement of Outlet Pipes or Orifices	e.g., Bioretention Basins
Re-Vegetation of Eroded Side Slope and Basin Bottoms	e.g., Bioretention Basins, Landscape Areas

Inspection and Logs of All Preventative and Corrective Maintenance

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

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

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

- Bioretention Basins Field Manual
- StormFilter Inspection and Maintenance Procedures by Contech Engineered Solutions
- Operation and Maintenance Manual for Up-Flo Filter by Hydro International
- “Maintenance Work Order and Checklist” – a comprehensive form outlining both required and completed maintenance work.
- “Maintenance Log” – a summary table for recording of all maintenance work at the site.
- “Inspection Log” – a summary table for recording the results of all inspections of the basins.

The logs of all inspections, and both preventative and corrective maintenance performed should be attached in the “**Maintenance Logs and Inspection Records**” section. See Part II of the Maintenance Plan

Maintenance Personnel, Equipment, Tools, and Supplies

As per NJDEP BMP Manual Ch. 8 (Feb. 2004), maintenance plans should include equipment, tools, and supplies necessary to perform the various preventative and corrective maintenance tasks specified in the plan. Sources of specialized, proprietary, and nonstandard equipment, tools, and supplies should also be provided.

This section applies to both maintenance tasks that are performed by in-house personnel or are outsourced. The design engineer has to list the required amount of maintenance personnel, equipment, tools, and supplies necessary to perform the various preventative and corrective maintenance tasks specified in the plan. In addition, the sources of specialized, proprietary, and nonstandard equipment, tools and supplies for specific measures, such as manufactured treatment devices should also be listed.

Maintenance Personnel/Equipment/Tools/Supplies

Personnel/Equipment/Tools Name	Quantity
General Maintenance Crew	4
General Landscape Equipment	1
Vacuum Truck	1
Power Washer	1

Specialized, proprietary or nonstandard equipment, tools and supplies, if applicable

Name of the specialized, proprietary or nonstandard equipment, tools and supplies	Source
StormFilter	Contech Engineered Solution
Up-Flo Filtration System	Hydro International

Disposal Plan

As per NJDEP BMP Manual Ch. 8 (Feb. 2004), the maintenance plan should include approved disposal and recycling sites and procedures for sediment, trash, debris and other material removed from stormwater management measures during maintenance operations.

Disposal Field – Offsite

Description of the Offsite Disposal:

Private hauler handles disposal, unloading and covering offsite

Cost Estimate

As per N.J.A.C.7:8-5.8(b), cost estimates of maintenance tasks, including, but not limited to, sediment, trash and debris removal must be included in the maintenance plan. Below is an illustration of a cost breakdown and estimation for maintenance of stormwater management measures. The design engineer should estimate the cost based on the expected maintenance required for each stormwater management measure. The actual costs may vary with factors such as local requirements, equipment, personnel, weather, and maintenance methods.

COST ESTIMATES

Opinion of Probable Annual Stormwater Management Maintenance Costs

Item	Description	Rate	Unit	Total Units	Frequency Per Year	Item Total
1	Mowing	$100.00	Acre	4.0	35	$14,000.00
2	Landscape Maintenance	$400.00	Acre	4.0	2	$3,200.00
3	Landscape Maintenance Materials	$600.00	Acre	4.0	2	$4,800.00
4	General Maintenance	$500.00	L/S	1	2	$1,000.00
5	Preventative Maintenance	$1,000.00	L/S	1	1	$1,000.00
6	Corrective Maintenance (every 5 years)	$10,000.00	L/S	1	0.2	$2,000.00
7	Engineering Inspection	$500.00	L/S	1	2	$1,000.00
8	Parking Lot Sweeping	$50.00	Acre	4.7	5	$1,175.00
9	Trash Collection	$50.00	Day	1	52	$2,600.00
	Estimated Annual SWM Maintenance Cost					$30,775.00
	Estimated Annual Insurance Cost					$ 500.00
	Total Estimated Annual SWM Maintenance Costs					$31,27.00

The responsible party shall review and updated this “Opinion of Probable Annual Stormwater Management Maintenance Costs” table at least once annually. The update shall reflect the task items and quantity to be performed, the cost for each task item, and the frequency.

Safety Measures and Procedures

All maintenance activities must comply with all local, state and federal regulations regarding occupational safety. These include but are not limited to the following:

1. N.J.A.C. 7:26G-1 – Hazardous Waste Regulations
2. N.J.A.C. 7:8 – Stormwater Management
3. O.S.H.A. Permit-Required Confined Spaces and all other OSHA regulations applicable to any work that is conducted on site

The stormwater inspection/maintenance company is required to follow the above referenced requirements.

Training Plan and Records

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

I. Training Plan

Types of Training

- Mandatory Stormwater Management Basic Training and Field Manual Usage Training for new maintenance crews
- Occupational Safety Training
- Subcontractor training, if applicable
- OSHA Confined Space Entry Certification

Content of Training

- **Stormwater Management Basic Training**
    - Purposes and Functions of BMPs
        - Training Material
            - NJDEP Stormwater BMP Manual, Chapter Nine: Structural Stormwater Management Measures
            - Chapter 9.6 Manufactured Treatment Devices
    - Vegetation Care
        - Training Material
            - NJDEP Stormwater BMP Manual, Chapter Seven: Landscaping
              (provides information on vegetation and landscaping for stormwater management measures)
    - Field Manual Usage Training
        - Training Material
            - Field Manuals attached to this Maintenance Plan
    - Equipment and Tools Operation Training
        - Training Material
            - Equipment or tool manufacturer's Operation & Maintenance Manual
    - Occupational Safety Training
        - Training Material
            - OSHA Confined Space Entry Certification
            - Equipment or tool manufacturer's Operation & Maintenance Manual

- More training information is available at NJ Stormwater.org (http://www.nj.gov/dep/stormwater/training.htm)

II. Training Records

Training attendance sheets should be attached by the responsible party after each training.

Annual Evaluation of the Effectiveness of the Plan

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

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

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

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

Annual Evaluation Records

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

Documents

- Drainage Plans, prepared by Bohler Engineering, dated February 1, 2022.

Part II- Field Manuals

Attachment of Maintenance Manuals for Stormwater Management Measures on this Site

As per N.J.A.C. 7:8-5.8(b)&(e), preventative and corrective maintenance shall be performed to maintain the function of stormwater management measures, including repair or replacement of the structure; removal of sediment, debris or trash; restoration of eroded areas; snow and ice removal; fence repair or replacement; restoration of vegetation; repair or replacement of non-vegetated linings, and removal of rodent/wildlife and repair/restoration to damaged affected areas caused by them.

Each Maintenance Manual attached to this Maintenance Plan is a separate document pertaining to one specific stormwater management measure and should be used by inspections and maintenance crews in order to carry out the maintenance work required by N.J.A.C. 7:8-5.8(e). Design engineers should prepare the field manuals in accordance with the design of each measure and the specific requirements of the site. See the sample field manuals for further guidance.

- Bioretention Basins Field Manual
- StormFilter Inspection and Maintenance Procedures by Contech Engineered Solutions
- Operation and Maintenance Manual for Up-Flo Filter by Hydro International
- “Maintenance Work Order and Checklist” – a comprehensive form outlining both required and completed maintenance work.
- “Maintenance Log” – a summary table for recording of all maintenance work at the site.
- “Inspection Log” – a summary table for recording the results of all inspections of the basins.

Maintenance Logs and Inspection Records

As per N.J.A.C. 7:8-5.8(e), preventative and corrective maintenance shall be performed to maintain the function of the stormwater management measure(s), including repairs or replacement to the structure; removal of sediment, debris, or trash; restoration of eroded areas; snow and ice removal; fence repair or replacement; restoration of vegetation; and repair or replacement of non-vegetated linings.

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

The responsible party shall maintain a record of all maintenance actions performed, including:

- Inspection checklists from each performed inspection
- Preventative maintenance logs
- Corrective maintenance logs, including work orders
- Other maintenance record

Bioretention Basin Field Manual

Bioretention Basins

Development Name: Lawrence Logistics Center

Township, County: Township of Lawrence & City of Trenton, Mercer County

Type of Stormwater Management Measure	Location Description	State Plane Coordinates
Bioretention Basin	Between the car parking area at the western face of the building and U.S. Route 1	513,650 Northing 426,580 Easting

Location Map: Refer to Proposed Drainage Area Map for Bioretention Basin

Table of Contents

Bioretention System Overview

Functionality

Bioretention systems are used to remove a wide range of pollutants, such as suspended solids, nutrients, metals, hydrocarbons, and bacteria from stormwater runoff. They can also be used to reduce peak runoff rates and increase stormwater infiltration when designed as a multi-stage, multi-function facility.

A bioretention system can be configured as either a bioretention basin or a longer, narrower bioretention swale. In general, a bioretention basin has a flat bottom while a bioretention swale may have sloping bottom. Runoff storage depths above the soil bed surface are typically shallow. The TSS removal rate for bioretention systems is 80 or 90 percent, depending upon the thickness of the soil planting bed and the type of vegetation grown in the bed.

Proper care and attention in the long-term maintenance of the stormwater management measure is critically important to the safety and health of the public.

Type of BMP – Dry Basin / Infiltration

A bioretention system is a type of **dry** basin. Dry basins must fully drain within 72 hours of the most recent rainfall. Standing water in excess of 72 hours is a sign of basin failure. It may also contribute to mosquito breeding and other health and safety issues. The design drain time shall be closely monitored to ensure that potential failure is recognized early.

A bioretention system with infiltration can also be designed for extended detention, in which case it will attenuate peak flows from storms larger than the Water Quality Design Storm.

Basic Design Information

Hydrology Design Targets

1. The bioretention basins are designed as an online system.
2. The design drain time is 21.30 hrs (100-year storm) and 9.20 hours (WQ storm).
3. The elevation of the seasonal high water table of this basin was observed on 06/02/2021 and it was encounter to be at an elevation of approximately 41.30.
4. The system is designed to not infiltrate into the subsoil.

Hydraulic Design Targets

1. Design parameters

Bioretention Basin – Basin Bottom: 48.00

	Water Quality Design Storm	2-year storm	10-year storm	25- year storm	100-year storm
Rainfall Depth (inches)	1.25 inch in 2 hours	3.31 inches in 24 hours	5.01 inches In 24 hours	6.19 inches in 24 hours	8.33 inches In 24 hours
Runoff Volume (acre-feet)	0.154	0.554	0.917	1.177	1.655
Peak Flow Rate (Inflow) (cfs)	4.89	7.42	12.26	15.67	21.88
Peak Flow Rate (Outflow) (cfs)	0.20	3.30	8.70	11.84	12.78
Water Surface Elevation (feet)	48.33	48.48	48.61	48.67	48.84

Basin Configuration Targets

1. Planting Soil Bed
    - The depth of the soil planting bed is 18 inches.
    - Mixture of the planting soil consists of 85-95% of sand. (with no more than 25% of the sands as fine or very fine sands; no more than 15% silt and clay with 2% to 5% clay content). The organic matter shall be within 3% to 7%.
    - The pH of the planting soil should be in the range of 5.5 and 6.5.
    - Filter fabric is placed along the sides of the soil planting bed.
    - The system is designed with a planting soil permeability rate of 1.0 inches/hour (pre-construction). Post-construction testing was completed on _____ and determined a planting soil permeability rate of _____ inches/hour.

2. Outlet Information:

Bioretention Basin

Outlet Description	Outlet Type	Orifice Size / Weir Length	Invert Elevation
Culvert	Pipe	18" RCP @ 0.3%	43.94
Water Quality Outlet	Underdrain	12" Ø Perforated PVC @ 0.1%	44.44
Outlet #1	Horizontal Grate	5.0' x 5.0'	48.35

3. Vegetation
    - The vegetation type to be used in this bioretention system is terrestrial forested community. A Landscaping Plan is included in the Reference Documents section of this field manual.

4. Underdrain
    - The perforated underdrains is 12 inches in diameter, at a slope of 0.10%.
    - (Note: The cleanout pipes shall **not** be perforated.)
    - The gravel layer surrounding the underdrain consists of min. 3 inches of gravel above the underdrain and min. 3 inches of gravel below the underdrain.

Critical Maintenance Features

1. No heavy equipment on the basin surface.
2. Remove vegetation strictly in accordance with the landscaping plan.
3. Grass clippings shall be collected from the basin and properly disposed.
4. Keep the appearance of the basin aesthetic.

Reference Documents

Documents to be placed in this field manual should include the following:

- As-built Drawings with Drainage Plans

Inspection Checklist / Maintenance Actions
Bioretention System

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

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

Date of most recent rain event: _____

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

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

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

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Result**	**Preventative / Corrective Maintenance Actions**
A1 Pretreatment (Forebay)	1	Scouring or erosion is present at inlet structure and/or riprap apron	Y__ N__	Check the flow diversion device before the inlet pipe and whether the bypass flow channel is clogged Work Order # _____
	2	Clogged pipes or excessive sediment in the forebay	Y__ N__	Remove sediment or debris
	3	Damaged outlet structure (e.g., cracking, subsidence, spalling, erosion, or deterioration)	Y__ N__	Repair or replace the outlet structure Work Order # _____
A2 Pretreatment (MTD)	1	MTD inspection (if installed)	Y__ N__	(If a MTD is used for pretreatment, see Maintenance Manual Provided by the manufacturer)
A3 Pretreatment (Structural BMP)	1	BMP inspection	Y__ N__	(See BMP No. _____ Field Manual)
Note:				

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Result**	**Preventative / Corrective Maintenance Actions**
B Basin Bed	1	Standing water is present after the design drain time The observed drain time is approximately _____ hours.	Y__ N__	Recheck to determine if there is standing water after 72 hours If standing water is present longer than 5 days, report to mosquito commission. Remove any sediment buildup Check the soil permeability Till the soil bed with rotary tiller or disc harrow Replace the planting soil, if necessary Work Order # _____
	2	Excessive sediment, silt, or trash accumulation on basin bed	Y__ N__	Clean pretreatment system Remove silt, sediment, and trash
	3	Erosion or channelization is present	Y__ N__	Check whether the flow bypass or diversion device is clogged Re-grade the infiltration bed Work Order # _____
	4	Animal burrows/rodents are present	Y__ N__	Pest control Work Order # _____
Note:				

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Result**	**Preventative / Corrective Maintenance Actions**
B Basin Bed	5	Uneven bed	Y__ N__	Use light equipment to resurface the bed Work Order # _____
	6	Evidence of sinkholes or subsidence	Y__ N__	Monitor for sinkhole development
C Vegetation	1	Large spot(s) showing bare soil	Y__ N__	Vegetative cover must be maintained at 85%. Revegetate the entire basin if 50% or more vegetation has been lost. Check Landscaping plan for guidance (if available) Work Order # _____
	2	Invasive plants are present	Y__ N__	Remove the invasive plants and restore the vegetation in accordance with the landscaping plan Work Order # _____
	3	The vegetation in the basin has been mowed or removed	Y__ N__	Revegetate the system in accordance with the vegetation plan Work Order # _____ Note: The vegetation in a bioretention system should **not** be mowed or removed
Note:				

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Result**	**Preventative / Corrective Maintenance Actions**
D Bioretention System Embankment and Side Slopes	1	Signs of erosion, soil slide or bulges, seeps and wet spots, loss of vegetation, or erosion on the basin slope	Y__ N__	Check for excessive overland runoff flow through the embankment. Check for any sink hole development Direct the overland runoff to the forebay or pretreatment area Restabilize the bank Work Order # _____
	2	Overgrown perimeter vegetation	Y__ N__	Mow the vegetation on the perimeter of the embankment Work Order # _____ Note: Mowing of vegetation should only take place in the area **outside** the basin. Dense vegetation must be maintained in the basin.
E Outlet	1	Trash or debris accumulation more than 20%	Y__ N__	Clean and remove Determine source of trash and address to reduce future maintenance costs or basin failure
	2	Trash rack is damaged or rusted greater than 50% Trash rack is bent, loose, or missing parts	Y__ N__	Repair or replace trash rack Work Order #_____
	3	Outlet components (e.g., orifice plates or weir plate) skewed, misaligned, or missing	Y__ N__	Repair or replace component Work Order #_____
	4	Discharge pipe apron is eroded or scoured	Y__ N__	Restabilize the discharge riprap apron Work Order #_____
Note:				

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Result**	**Preventative / Corrective Maintenance Actions**
F Emergency Spillway	1	Trees or excessive vegetation present	Y__ N__	Remove trees and roots, and restore berms if necessary Work Order #_____
	2	Damaged structure	Y__ N__	Repair Work Order #_____
G Miscellaneous	1	Fence: broken or eroded parts	Y__ N__	Repair or replace Work Order #_____
	2	Gate: missing gate or lock	Y__ N__	Repair or replace Work Order #_____
	3	Sign/plate: tiled, missing, or faded	Y__ N__	Repair or replace Work Order #_____
	4	Excessive or overgrown vegetation blocking access to the basin	Y__ N__	Clear, trim, or prune the vegetation to allow access for inspection and maintenance Work Order #_____
Note:				

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

_____

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

_____	_____	_____
Inspector Name	Signature	Date

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

File this checklist in the Maintenance Log after performing maintenance.

Preventative Maintenance Record

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

Work Logs

Activities	Components	Date Completed
Sediment/debris removal **Sediment removal should be taken place when the basin is thoroughly dry.**	A1/A2/A3 – Pretreatment	
	B – Basin Bed	
	D – Bioretention System Embankment and Side Slopes	
	E – Outlet	
Vegetation removal	A1/A2/A3 – Pretreatment	
	B – Basin Bed	
	D – Basin Embankment and Side Slopes	
	E – Outlet	
	F – Emergency Spillway	

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

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

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

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

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

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

Corrective Maintenance Record

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

2. **Issue to be resolved**:

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

4. **Required Actions**

Actions	Planned Date	Date Completed

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

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

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

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

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

StormFilter Inspection and Maintenance Procedures by Contech Engineered Solutions

CONTECH®
ENGINEERED SOLUTIONS

StormFilter Inspection and Maintenance Procedures

The Stormwater Management StormFilter®

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:

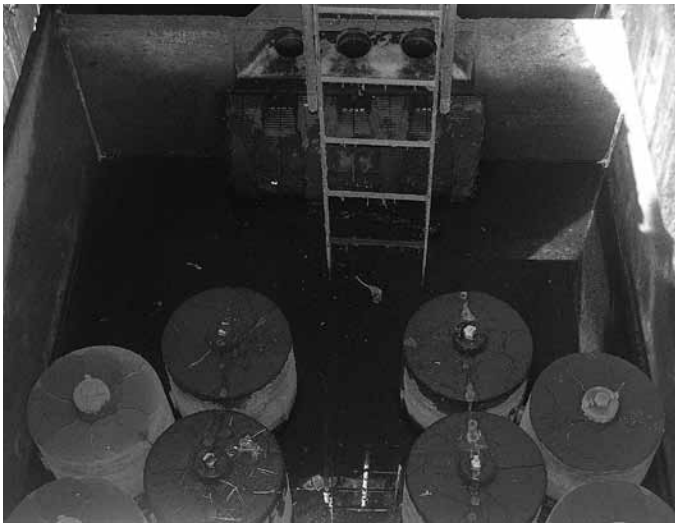
Important: Inspection should be performed by a person who is familiar with the operation and configuration of the StormFilter treatment unit.

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 weather 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 ≥ 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.

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.

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.

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:

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:

_____

_____

_____

_____

_____

_____

_____

RECYCLED PAPER

CONTECH®
ENGINEERED SOLUTIONS

800-338-1122

www.ContechES.com

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater and earth stabilization products. For information on other Contech division offerings, visit contech-cpi.com or call 800.338.1122.

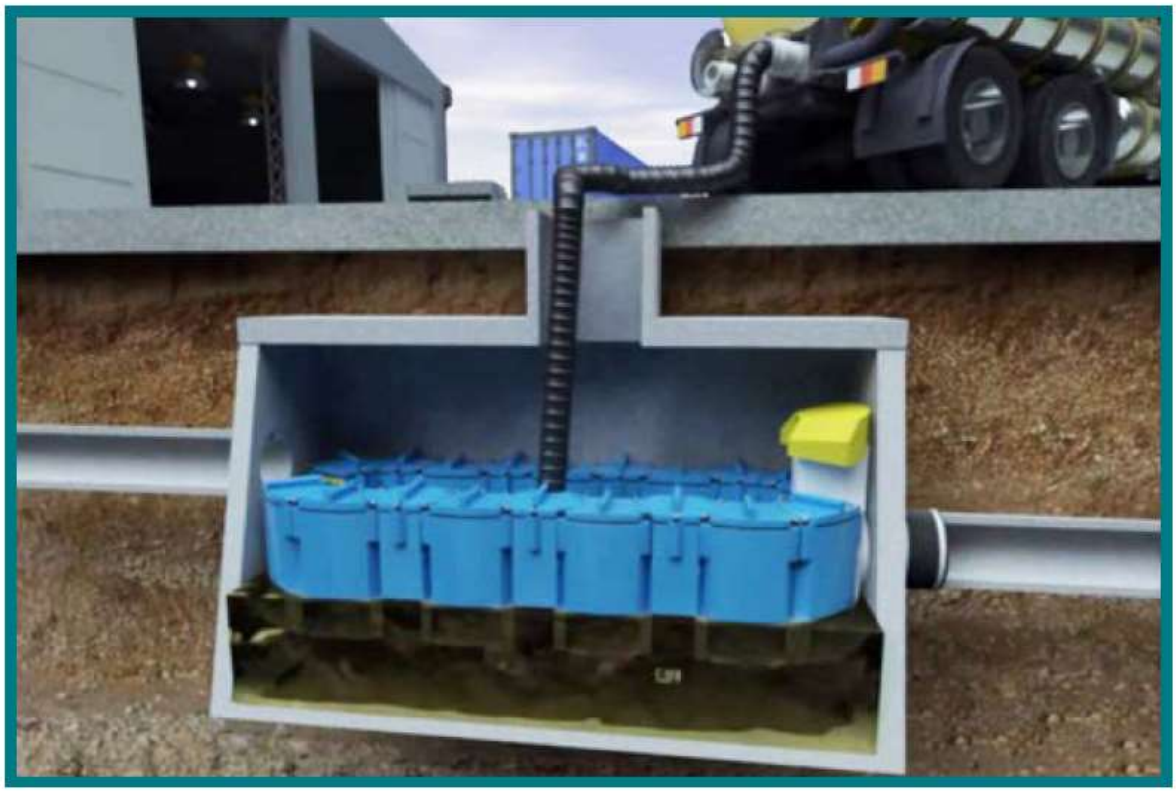
Support

- Drawings and specifications are available at www.conteches.com.
- Site-specific design support is available from our engineers.

800.338.1122
www.conteches.com

Operation and Maintenance Manual for Up-Flo Filter by Hydro International

Hydro International



Operation and Maintenance Manual

Up-Flo® Filter

Filtration System for Stormwater Treatment

Stormwater Solutions

94 Hutchins Drive
Portland, ME 04102

Tel: (207) 756-6200
Fax: (207) 756-6212
stormwaterinquiry@hydro-int.com

www.hydro-int.com

Overview & Product Description

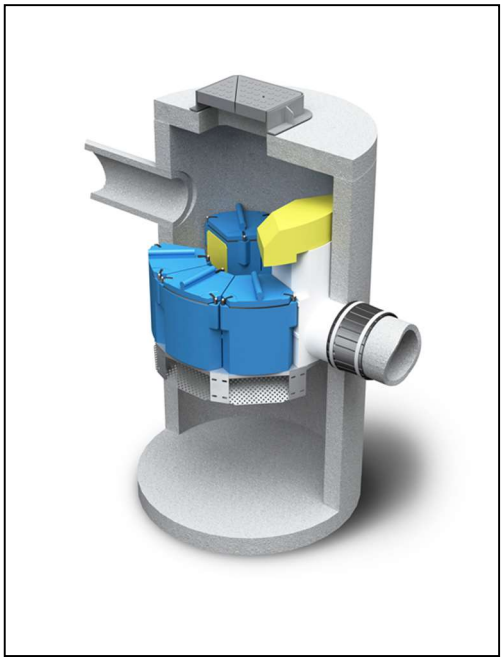
DON'T WANT TO GO IT ALONE? CALL HYDRO AND WE'LL TAKE CARE OF INSPECTION, REPLACEMENT MEDIA AND CLEANOUT.

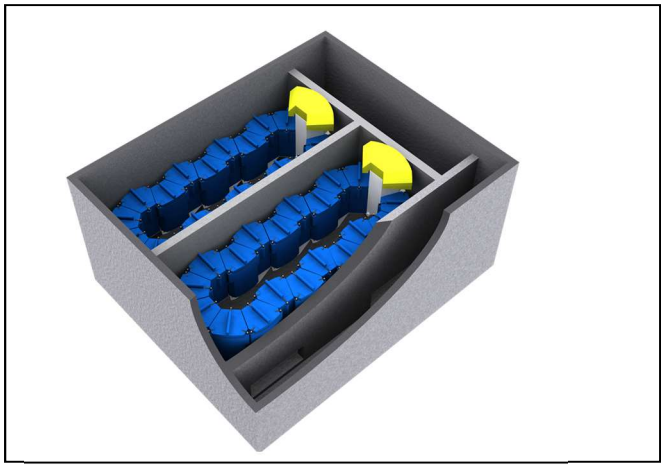
CALL 1 (888) 382-7808 FOR A QUOTE

The Up-Flo® Filter is a modular high-rate stormwater filtration device designed to capture trash, oil, sediment and remove fine pollutants such as dissolved and particulate metals and nutrients from stormwater runoff. In general, a minimum of two inspections are required per year to monitor sediment and gross pollutant accumulations.

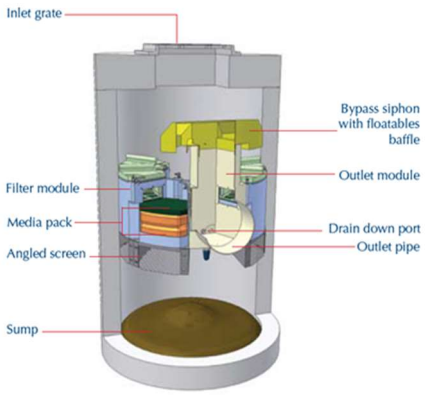
In order to sustain expected flow and removal rates for the Up-Flo® Filter, annual replacement of the Media Pack and removal of accumulated sediment from the sump is required. Depending on site use and pollutant characteristics, annual rainfall, design and functionality of the stormdrain conveyance system, annual replacement and clean out may be more or less often.

The Up-Flo Filter has modular components that connect together to form a ring of 1-6 Filter Modules or linearly to fit into rectangular precast structures with filter bays. Each filter bay can house 1-19 Filter Modules and precast structures can be constructed with multiple filter bays. Each Filter Module will have either a filtration Media Pack or filtration Ribbons.

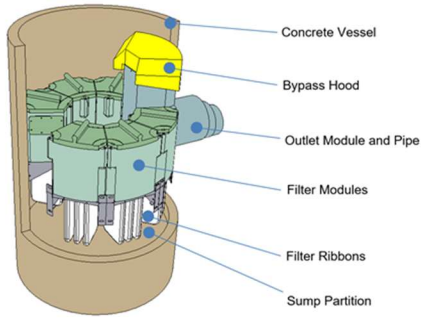




It does not matter what type of media is used, the Filter Modules house the filtration medium and the precast structure is used to suspend the Filter Modules to provide a sedimentation sump. Stainless steel support frames are used to support the Filter Modules and attach them to the precast structure. An Outlet Module (with hood) is used to connect the Filter Modules to a discharge pipe and convey filtered water away from the treatment area. A Draindown Filter and screen are provided when filtration media is used but not with filtration Ribbons.



Up-Flo with Filtration Media



Up-Flo with Filtration Ribbons

Maintenance activities can be categorized by those that can be performed from outside the Up-Flo® vessel and those that are performed inside the vessel. Maintenance performed from outside the vessel includes removal of floatables and oils that have accumulated on the water surface and removal of sediment from the sump. Maintenance performed inside the vessel includes removal and replacement of Media Packs (Filter Bags, flow Distribution Media and Draindown) or filtration Ribbons. A vactor truck is required for removal of oils, water, sediment, and to enter the vessel for performing inside maintenance. OSHA Confined Space Entry procedures need to be followed when entering the Up-Flo® vessel.

Inspection

The frequency of inspection and maintenance can be determined in the field after installation. Based on site characteristics such as contributing area, types of surfaces (e.g., paved and/or landscaped), site activities (e.g., short-term or long-term parking), and site maintenance (e.g., sanding and sweeping), inspection and maintenance should be conducted at intervals of no more than six months during the first year of operation. Typically, maintenance is recommended once per year thereafter.

By removing the manhole cover during a storm and monitoring the water level in the manhole or vault, site personnel can determine whether the filter is in bypass. A properly-sized filter that is in bypass during a storm that is producing runoff at, or below, the filter's design filtration rate needs maintenance. Otherwise, scheduled inspections will determine when one or more of the following maintenance thresholds have been reached:

- Sediment depth at sump storage capacity. Minimum 8" should separate the Draindown filter inlet from stored sediment in the sump or 6" should separate the bottom of the filtration Ribbons and sump floor. A simple probe, such as the Sludge-Judge®, can be used to determine the depth of the solids in the sump.
- Clogging of the Media Bags. Minimum filtration rate is generally reached when the Media Bags have accumulated approximately 20 lbs of sediment or when filtration Ribbons from one module have accumulated approximately 8 lbs. Determining the amount of accumulated sediment will be accomplished by removing both of the Media Bags from one of the Media Packs and weighing the bags separately or removing the filter Ribbon assembly as weighing. A spent Media Bag weighs approximately 50 lbs wet and a filter Ribbon assembly from one module weighs approximately 15 lbs spent .
- Draindown filter clogged. With modules supplied with filtration media, the Drain Down Filter is designed to lower the water level in the Up-Flo® vessel to an elevation below the bottom of the Filter Modules between storm events. If inspection one to two days after a storm event indicates otherwise, the Drain Down Filter has likely become clogged with sediment.
- Slime and debris covering the flow distribution media, angled screens or filtration Ribbons. After removal of the Media Bags or filtration Ribbons, the bottom flow distribution media should be removed and inspected to determine if it is coated with slime or debris. Similarly, the angled screen should be inspected for blockages and ragging.
- Oil forming a measureable thickness on the surface of the water. Since water in the Up-Flo® vessel drains down to an elevation below the bottom of the Filter Modules when the system is idle, the amount of accumulated oils must be minimized so that oils are not entrained into the Media Pack when stormwater begins to fill the vessel at the start of a storm event.
- Floatables completely covering the surface of the water. Similar to oils, the amount of accumulated floatables must be minimized to prevent trash and loose debris from becoming trapped on the angled screens when stormwater begins to fill the Up-Flo® vessel at the start of a storm event.

The site-specific solids loading rate in the sump and in the Media Packs will be determined during the first year of Up-Flo® Filter operation. Starting with a clean sump, the solids loading rate in the sump will be calculated by measuring the sediment depth in the sump and dividing the depth by the correlating interval of time since it was cleaned. Similarly, starting with fresh Media Bags or Ribbons, the solids loading rate in the Media Packs and Ribbons will be calculated by weighing the Media Bags or Ribbons and dividing the weights by the respective time interval since they were installed. The wet weight of the heaviest bag or Ribbon assembly from a single module will be used to determine the loading rate.

After completion of the first year of operation, the inspection and maintenance intervals for cleaning the sump and replacing Media Bags or Ribbons will be established to keep the solids loading within the respective limits of the sump and filter medium. Replacement of the Draindown Filter, replacement of flow Distribution Media, and removal of oils and floatables will occur at the same frequency unless the first year of operation indicates otherwise. Keeping to the established maintenance intervals will keep treatment flow rates at, or above, the design flow rate.

Maintenance

The access port located at the top of the manhole or vault provides access to the Up-Flo® vessel for maintenance personnel to enter the vessel and comfortably remove and replace Media Packs or Ribbon assemblies. The same access would be used for maintenance personnel working from the surface to net or skim debris and floatables or to vactor out sediment, oil, and water. Unless the Up-Flo® Filter has been installed in a very shallow unit, it is necessary to have personnel with OSHA-confined space entry performing the maintenance that occurs inside the vessel.

Maintenance activities include inspection, floatables removal, oil removal, sediment removal, Media Pack and Ribbon assembly replacement, and Draindown Filter replacement. Filtration medium housed in the Filter Modules is easily accessed by loosening three latches used to secure the Filter Module Lid. Maintenance intervals are determined from monitoring the Up-Flo® Filter during its first year of operation. Depending on the site, some maintenance activities may have to be performed on a more frequent basis than others. In the case of floatables removal, a vactor truck is not required. Otherwise, a vactor truck is normally required for oil removal, removal of sediment from the sump, and to dewater the vessel for replacement of the Media Packs and Draindown Filter. All inspection and maintenance activities would be recorded in an Inspection and Maintenance Log.

Good housekeeping practices upstream of the Up-Flo® Filter can significantly extend Media Bag life. For example, sweeping paved surfaces, collecting leaves and grass trimmings, and protecting bare ground from the elements will reduce loading to the system. Media Packs should not be installed in the Filter Modules until construction activities are complete and site stabilization is effective.

Up-Flo Filter Inspection & Maintenance Logs

SITE REFERENCE NAME OR NUMBER FOR THIS UP-FLO® FILTER LOCATION:	
SITE NAME:	
SITE LOCATION:	
OWNER:	SITE CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY NAME:	COMPANY NAME:
ADDRESS:	ADDRESS:
TELEPHONE:	TELEPHONE:
FAX:	FAX:

INSTALLATION DATE: / /

CONFIGURATION (CIRCLE ONE): MANHOLE VAULT SYSTEM

TOTAL NUMBER OF UP-FLO® FILTER MODULES: _____

Hydro International

Up-Flo® Filter Inspection Log

Site Name: _____ Owner Change since last inspection? Y N

Location: _____

Owner Name: _____

Address: _____ Phone Number: _____

Site Status: _____

Date: _____ Time: _____ Site conditions*: _____

**(Stable, Under Construction, Needing Maintenance, etc.)*

Inspection Frequency Key: A=annual; M=monthly; S=after major storms

Inspection Items	Inspection Frequency	Inspected? (Yes/No)	Maintenance Needed? (Yes/No)	Comments/Description
Debris Removal				
Adjacent area free of debris?	M			
Inlets and Outlets free of debris?	M			
Facility (internally) free of debris?	M			
Vegetation				
Surrounding area fully stabilized? (no evidence of eroding material into Up-Flo® Filter)	A			
Grass mowed?	M			
Water retention where required				
Water holding chamber(s) at normal pool?	A			
Evidence of erosion?	A			
Sediment Deposition				
Filtration Chamber free of sediments?	A			
Sedimentation sump not more than 50% full?	A			
Structural Components				
Any evidence of structural deterioration?	A			
Grates in good condition?	A			
Spalling or cracking of structural parts?	A			
Outlet/Overflow Spillway	A			
Other				
Noticeable odors?	A			
Any evidence of filter(s) clogging?	M			
Evidence of flow bypassing facility?	A			

Inspector Comments: _____

_____

_____

_____

Overall Condition of Up-Flo® Filter**: ☐ Acceptable ☐ Unacceptable

***"Acceptable" would mean properly functioning; "unacceptable" would mean damaged or required further maintenance.*

If any of the above Inspection Items are checked "Yes" for "Maintenance Needed", list Maintenance actions and their completion dates below or on the Maintenance Log provided on page 15 of the Up-Flo® Filter Operation & Maintenance Manual:

Maintenance Action Needed	Due Date

The next routine inspection is schedule for approximately: (date) _____

Inspected by: (signature) _____

Inspected by: (printed) _____

Hydro International

Up-Flo® Filter Maintenance Log

Site Name: _____ Owner Change since last inspection? Y N

Location: _____

Owner Name: _____

Address: _____ Phone Number: _____

Site Status: _____

Date: _____ Time: _____ Site conditions: _____
**(Stable, Under Construction, Needing Maintenance, etc.)*

Estimated volume of oil/floatable trash removed: _____

Sediment depth measured in sump prior to removal: _____

Number of Filter Modules fitted with new media packs: _____

Inspector Comments: _____

_____

_____

_____

Overall Condition of Up-Flo® Filter: ☐ Acceptable ☐ Unacceptable
***"Acceptable" would mean properly functioning; "unacceptable" would mean damaged or required further maintenance.*

Maintained by: (signature) _____

Maintained by: (printed) _____

Do it Right the First Time

Learn more at hydro-int.com/service

CALL **1 (888) 382-7808** TO SCHEDULE AN INSPECTION

Stormwater Solutions

94 Hutchins Drive
Portland, ME 04102

Tel: (207) 756-6200
Fax: (207) 756-6212
stormwaterinquiry@hydro-int.com

www.hydro-int.com

Turning Water Around...®

MAINTENANCE LOGS AND INSPECTION RECORDS

MAINTENANCE WORK ORDER AND CHECKLIST
FOR STORMWATER MANAGEMENT FACILITIES

NAME OF FACILITY _____
LOCATION _____ DATE _____
CREW _____ WORK STARTED _____
EQUIPMENT _____ WORK COMPLETED _____
WEATHER _____ TOTAL MANPOWER OF WORK _____

A. PREVENTATIVE MAINTENANCE

WORK ITEMS	ITEMS REQUIRED	ITEMS DONE	COMMENTS AND SPECIAL INSTRUCTIONS
1. GRASS CUTTING			
A. BOTTOMS			
B. EMBANKMENTS AND SIDE SLOPES			
C. PERIMETER AREAS			
D. ACCESS AREAS AND ROADS			
E. OTHERS			
2. GRASS MAINTENANCE			
A. FERTILIZING			
B. RE-SEEDING			
C. DE-THATCHING			
D. PEST CONTROL			
E. OTHERS			
3. VEGETATIVE COVER			
A. FERTILIZING			
B. PRUNING			
C. PEST CONTROL			
D. OTHERS			
4. TRASH AND DEBRIS REMOVAL			
A. BOTTOMS			
B. EMBANKMENTS AND SIDE SLOPES			
C. PERIMETER AREAS			
D. ACCESS AREAS AND ROADS			
E. INLETS			
F. OUTLETS AND TRASH RACKS			
G. OTHERS			
5. SEDIMENT REMOVAL			
A. INLETS			
B. OUTLETS AND TRASH RACKS			
C. BOTTOM			
D. OTHERS			
6. ELIMINATION OF POTENTIAL MOSQUITO BREEDING HABITATS			

MAINTENANCE WORK ORDER AND CHECKLIST
FOR STORMWATER MANAGEMENT FACILITIES

NAME OF FACILITY _____
LOCATION _____ DATE _____
CREW _____ WORK STARTED _____
EQUIPMENT _____ WORK COMPLETED _____
WEATHER _____ TOTAL MANPOWER OF WORK _____

B. CORRECTIVE MAINTENANCE

WORK ITEMS	ITEMS REQUIRED	ITEMS DONE	COMMENTS AND SPECIAL INSTRUCTIONS
1. REMOVAL OF DEBRIS AND SEDIMENT			
2. STRUCTURAL REPAIRS			
3. EMBANKMENTS AND SIDE SLOPES			
4. DEWATERING			
5. BASIN MAINTENANCE			
6. CONTROL OF MOSQUITOES			
7. EROSION REPAIR			
8. FENCE REPAIR			
9. SNOW AND ICE REMOVAL			
10. OTHER			

C. AESTHETIC MAINTENANCE

WORK ITEMS	ITEMS REQUIRED (X)	ITEMS DONE (X)	LOCATION AND COMMENTS
1. GRAFFITI REMOVAL			
2. GRASS TRIMMING			
3. WEEDING			
4. OTHERS			

REMARKS (REFER TO ITEM NO. IF APPLICABLE) _____

WORK ORDER PREPARED BY: _____

MAINTENANCE LOG
FOR STORMWATER MANAGEMENT FACILITIES

NAME OF FACILITY _____
LOCATION _____ DATE _____
CREW _____ WORK STARTED _____
EQUIPMENT _____ WORK COMPLETED _____
WEATHER _____ TOTAL MANPOWER OF WORK _____

A. PREVENTATIVE MAINTENANCE

WORK ITEMS	ITEMS REQUIRED	DATE REQUIRED	ITEMS DONE	DATE DONE	COMMENTS AND SPECIAL INSTRUCTIONS
1. GRASS CUTTING					
A. BOTTOMS					
B. EMBANKMENTS AND SIDE SLOPES					
C. PERIMETER AREAS					
D. ACCESS AREAS AND ROADS					
E. OTHERS					
2. GRASS MAINTENANCE					
A. FERTILIZING					
B. RE-SEEDING					
C. DE-THATCHING					
D. PEST CONTROL					
E. OTHERS					
3. VEGETATIVE COVER					
A. FERTILIZING					
B. PRUNING					
C. PEST CONTROL					
D. OTHERS					
4. TRASH AND DEBRIS REMOVAL					
A. BOTTOMS					
B. EMBANKMENTS AND SIDE SLOPES					
C. PERIMETER AREAS					
D. ACCESS AREAS AND ROADS					
E. INLETS					
F. OUTLETS AND TRASH RACKS					
G. OTHERS					
5. SEDIMENT REMOVAL					
A. INLETS					
B. OUTLETS AND TRASH RACKS					
C. BOTTOM					
D. OTHERS					
6. ELIMINATION OF POTENTIAL MOSQUITO BREEDING HABITATS					
7. OTHER PREVENTIVE MAINTENANCE					
A. PARKING LOT SWEEPING					
B. EMPTYING TRASH RECEPTACLES					

MAINTENANCE LOG
FOR STORMWATER MANAGEMENT FACILITIES

NAME OF FACILITY _____
LOCATION _____ DATE _____
CREW _____ WORK STARTED _____
EQUIPMENT _____ WORK COMPLETED _____
WEATHER _____ TOTAL MANPOWER OF WORK _____

B. CORRECTIVE MAINTENANCE

WORK ITEMS	ITEMS REQUIRED	DATE REQUIRED	ITEMS DONE	DATE DONE	COMMENTS AND SPECIAL INSTRUCTIONS
1. REMOVAL OF DEBRIS AND SEDIMENT					
2. STRUCTURAL REPAIRS					
3. EMBANKMENTS AND SIDE SLOPES					
4. DEWATERING					
5. BASIN MAINTENANCE					
6. CONTROL OF MOSQUITOES					
7. EROSION REPAIR					
8. FENCE REPAIR					
9. SNOW AND ICE REMOVAL					
10. OTHER					

C. AESTHETIC MAINTENANCE

WORK ITEMS	ITEMS REQUIRED	DATE REQUIRED	ITEMS DONE	DATE DONE	COMMENTS AND SPECIAL INSTRUCTIONS
1. GRAFFITI REMOVAL					
2. GRASS TRIMMING					
3. WEEDING					
4. OTHERS					

REMARKS (REFER TO ITEM NO. IF APPLICABLE) _____

WORK PERFORMED BY: _____

INSPECTION LOG
FOR STORMWATER MANAGEMENT FACILITIES

NAME OF FACILITY _____
LOCATION _____
DATE _____
WEATHER _____

A. PREVENTIVE MAINTENANCE

FACILITY ITEM	ITEMS REQUIRED	ITEMS DONE	COMMENTS AND SPECIAL INSTRUCTION
1. GRASS CUTTING			
A. BOTTOMS			
B. EMBANKMENTS AND SIDE SLOPES			
C. PERIMETER AREAS			
D. ACCESS AREAS AND ROADS			
E. OTHERS			
2. GRASS MAINTENANCE			
A. FERTILIZING			
B. RE-SEEDING			
C. DE-THATCHING			
D. PEST CONTROL			
E. OTHERS			
3. VEGETATIVE COVER			
A. FERTILIZING			
B. PRUNING			
C. PEST CONTROL			
D. OTHERS			
4. TRASH AND DEBRIS REMOVAL			
A. BOTTOMS			
B. EMBANKMENTS AND SIDE SLOPES			
C. PERIMETER AREAS			
D. ACCESS AREAS AND ROADS			
E. INLETS			
F. OUTLETS AND TRASH RACKS			
G. OTHERS			
5. SEDIMENT REMOVAL			
A. INLETS			
B. OUTLETS AND TRASH RACKS			
C. BOTTOM			
D. VORTECHNIC UNITS			
E. OTHERS			
6. ELIMINATION OF POTENTIAL MOSQUITO			
7. OTHER PREVENTIVE MAINTENANCE			
A. PARKING LOT SWEEPING			
B. EMPTYING TRASH RECEPTACLES			

INSPECTION LOG
FOR STORMWATER MANAGEMENT FACILITIES

NAME OF FACILITY _____
LOCATION _____
DATE _____
WEATHER _____

B. CORRECTIVE MAINTENANCE

FACILITY ITEM	ITEMS REQUIRED	ITEMS DONE	COMMENTS AND SPECIAL INSTRUCTION
1. REMOVAL OF DEBRIS AND SEDIMENT			
2. STRUCTURAL REPAIRS			
3. EMBANKMENTS AND SIDE SLOPES			
4. BASIN MAINTENANCE			
5. CONTROL OF MOSQUITOES			
6. EROSION REPAIR			
7. FENCE REPAIR			
8. SNOW AND ICE REMOVAL			
9. BASIN DRAIN TIME			
10. OTHER			

C. AESTHETIC MAINTENANCE

FACILITY ITEM	ITEMS REQUIRED	ITEMS DONE	COMMENTS AND SPECIAL INSTRUCTION
1. GRASS TRIMMING			
2. WEEDING			
3. OTHERS			

REMARKS (REFER TO ITEM NO. IF APPLICABLE)

(1) ITEMS CHECKED ARE IN GOOD CONDITION, AND THE MAINTENANCE PROGRAM IS ADEQUATE.
(2) ITEMS CHECKED REQUIRE ATTENTION, BUT DOES NOT PRESENT AN IMMEDIATE THREAT TO THE FACILITY FUNCTION OR OTHER FACILITY COMPONENTS.
(3) THE ITEMS 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: _____