

STORMWATER MANAGEMENT FACILITIES OPERATIONS & MAINTENANCE MANUAL

for

Proposed Warehouse

Prepared for

1980 US HWY 1, LLC

Block 148, Lot(s) 34, 35.01 & 36

1980 Route 1

Township of North Brunswick

Middlesex County, New Jersey

Prepared by

BOHLER //

N.J. Certificate of Authorization 24GA28161700

30 Independence Blvd, Suite 200

Warren, NJ 07059

908-668-8300

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

August 2021

BENJ File No. J200616

TABLE OF CONTENTS

1.0	PROJECT DETAILS.....	3
1.1	Introduction and Description of Facilities:	3
1.2	Project Contacts:	3
2.0	INSPECTION AND MAINTENANCE:.....	4
2.1	Routine Inspection and Maintenance of the Stormwater Management Facilities:	4
2.1.1	Preventative Maintenance Procedures:	4
2.1.2	Corrective Maintenance Procedures:	6
2.1.3	Aesthetic Maintenance Procedures:	9
2.1.4	Summary of Maintenance Procedures:	11
2.1.5	Maintenance Equipment and Materials	11
2.1.6	Disposal Plan	13
2.1.7	Cost Estimate	13
2.1.8	Safety Measures & Procedures	14
2.1.9	Training Plan & Records	14
2.1.10	Annual Evaluation of Effectiveness of the Plan	15
2.1.11	Checklists, Logs and Field Manuals	15

Appendix

1. Bioretention Basin Field Manual
2. Pervious Pavement Field Manual
3. Filterra Owner's Manual Maintenance Guide
4. "Maintenance Work Order and Checklist" – a comprehensive form outlining both required and completed maintenance work.
5. "Maintenance Log" – a summary table for recording of all maintenance work at the site.
6. "Inspection Log" – a summary table for recording the results of all inspections of the basins.

1.0 PROJECT DETAILS

1.1 Introduction and Description of Facilities:

The subject property is located at 1980 US Highway 1 in the Township of North Brunswick, Middlesex County, New Jersey. The property is identified as Block 148, Lots 34, 35.01 and 36 on the Township of North Brunswick tax maps and is a total of 17.11 acres in size and will hereafter be referred to as "the site". The site is bordered to the north by Route 1 with commercial uses beyond; to the east by Adams Lane with commercial uses beyond; to the west wooded land and Excelsior Avenue with residential uses beyond; and to the south by wooded land and the Amtrak right-of-way beyond.

The various design parameters established by the NJDEP, Township of North Brunswick and Middlesex County will require the construction of a bioretention system and four pervious pavement areas to collect runoff from the proposed site development. The detention system is proposed to control the peak rate of runoff and to enhance discharge water quality for the site. Note that the subject site is within Metropolitan Planning Area PA-1 and previously developed therefore, the site is exempt from the NJDEP recharge requirements.

Under post-development conditions, the stormwater management facilities will include an above ground bioretention basin, pervious pavement areas and associated inlets, outlets, catch basins and piping.

This manual consists of three parts. The first part includes the introduction, project description and a list of project contacts. The second part provides the operation and maintenance instructions for the facilities and equipment. The third part (Appendix) provides information regarding the inspection and maintenance activities.

1.2 Project Contacts:

MUNICIPAL Engineer:

Address: 710 Hermann Road, North Brunswick, NJ 08902
Tel. (732) 247-0922 ext. 440
Attn: Michael Hritz

North Brunswick Dept. of Public Works:

Address: 710 Hermann Road, North Brunswick, NJ 08902
Tel. (732) 297-1134
Attn: Eric Chaszar

North Brunswick Stormwater Management Division

Address: 710 Hermann Road, North Brunswick, NJ 08902
Tel. (732) 297-1134
Attn: Eric Chaszar

Site Design Engineer:

Bohler Engineering
Address: 30 Independence Blvd, Suite 200, Warren, NJ 07059
Tel. (908) 668-8300
Attn: Brad Bohler, PE

Party Responsible for Maintaining Stormwater Management Facility:

1980 US HWY 1, LLC
C/O: Kevin Stubbs, AIA
801 Grand Avenue, Des Moines, IA 50392

2.0 INSPECTION AND MAINTENANCE:

2.1 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:

2.1.1 Preventative Maintenance Procedures:

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 or eroded areas; snow and ice removal; fence repair or replacement; restoration of vegetation; and repair or replacement of non-vegetated linings. 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, in the case of the small wet pond, and by mowing for dry detention basins.

b) *Maintenance of Adjacent Areas:*

Grass areas, trees, and shrubs adjacent to the basins require periodic routine maintenance to include fertilizing, de-thatching and soil conditioning in order to maintain healthy growth and to provide bank 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 basin, trash racks and inflow (headwall) points.

Removal of trash and debris will prevent possible damage to vegetated areas 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 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 should be located in strategic areas where the majority of the pedestrian traffic occurs. These receptacles should be emptied weekly. The disposal of the solid waste must be properly hauled off the site and transferred to an approved disposal site.

2.1.2 Corrective Maintenance Procedures:

a) *Removal of Debris and Sediment:*

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

b) *Structural Repairs:*

Structural damage to outlet and inlet structures, trash racks, access hatches, roadways and headwalls 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.

Preventative Maintenance Actions

Frequency	Preventative Maintenance Actions	Stormwater Measures/ No.
Monthly	Vegetation mowing and removal in growing season	e.g., Bioretention Basin
Quarterly	Quarterly inspection (Sediment removal, depending on the type of measure)	e.g., Bioretention Basin, Porous Pavement Areas, onsite inlets
Semiannual	Clean, sediment removal, depending on the type of measure Inspection of water quality units	e.g., Filterra Filters
Annual	Basin Structural Inspection	e.g., Bioretention Basin, Porous Pavement Areas, Filterra Filters, onsite inlets
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
Repair/ Replacement of Missing or Damaged Trash Racks	e.g., Bioretention Basin & Porous Pavement Areas
Repair/Replacement of Outlet Pipes or Orifices	e.g., Bioretention Basin, Porous Pavement Areas, Filterra Filters
Repair/Replace Stormwater Manufactured Treatment Devices	e.g., Filterra Filters
Re-Vegetation of Eroded Side Slope and Basin Bottoms	e.g., Bioretention Basins

2.1.3 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 basins 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.

2.1.4 Summary of Maintenance Procedures:

Preventative Maintenance

- a) Weed Growth
- b) Maintenance of Adjacent Areas
- c) Removal and Disposal of Trash/Debris and Sediment
- d) Elimination of Potential Mosquito Breeding Habitats
- e) Parking Lot Maintenance

Corrective Maintenance

- a) Removal of Debris and Sediment
- b) Structural Repairs
- c) Embankment and Slope Repairs
- d) Weed Harvesting
- e) Extermination of Mosquitoes
- f) Erosion Repair
- g) Elimination of Trees, Brush, Roots and Animal Burrows
- h) Snow and Ice Removal

Aesthetic Maintenance

- a) Graffiti Removal
- b) Grass Trimming/Landscape Maintenance
- c) Control of Weeds

2.1.5 Maintenance Equipment and Materials

Note: Only light equipment is allowed to be used within open basins to prevent compaction.

Grass Maintenance Equipment

- a) Riding Mowers
- b) Hand Mowers
- c) Gas Powered Trimmers
- d) Gas Powered Edgers
- e) Seed Spreaders
- f) Fertilizer Spreaders
- g) De-Thatching Equipment
- h) Pesticide and Herbicide Application Equipment
- i) Grass Clipping and Leaf Collection Equipment

Vegetative Maintenance Equipment

- a) Saws
- b) Pruning Shears
- c) Hedge Trimmers
- d) Aquatic Weed Harvester (owned/operated by subcontractor)

Transportation Equipment

Debris, Trash and Sediment Removal Equipment

- a) Loader (not to be used in the bottom of basins)
- b) Backhoe (not to be used in the bottom of the basins)
- c) Grader (not to be used in the bottom of the basins)
- d) Dredging Equipment (not to be used in the bottom of the basins)
- e) Portable Pump for Dewatering
- f) Jet Vac Equipment for removal of sediment in underground pipes

Miscellaneous Equipment

- a) Shovels
- b) Wheel Barrows
- c) Gloves
- d) Hand Pushed Tilling Machine
- e) Brooms

Standard Mechanics Tools

Tools for Maintenance of Equipment

Materials

- a) Topsoil
- b) Fill
- c) Seed
- d) Soil Amenities (Fertilizer, Lime, etc.)
- e) Chemicals (Pesticides, Herbicides, etc.)
- f) Mulch
- g) Paint Removers
- h) Spare Parts for Equipment

Parking Maintenance Equipment

- a) Sweeping/Vacuuming Equipment
- b) Trash Receptacles
- c) Snow Plowing Equipment
- d) Snow Shovels

2.1.6 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

2.1.7 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	1.5	35	\$5,250.00
2	Landscape Maintenance	\$400.00	Acre	1.5	2	\$1,200.00
3	Landscape Maintenance Materials	\$1,200.00	Acre	1.5	2	\$3,600.00
4	General Maintenance	\$500.00	L/S	1	2	\$1,000.00
5	Preventative Maintenance	\$2,000.00	L/S	1	1	\$2,000.00
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	6	\$3,000.00
8	Parking Lot Sweeping	\$50.00	Acre	6	12	\$3,600.00
9	Trash Collection	\$50.00	Day	1	52	\$2,600.00
10	StormFilter Unit Maintenance	\$5,000.00	L/S	2	1	\$10,000.00
Estimated Annual SWM Maintenance Cost						\$34,250.00
Estimated Annual Insurance Cost						\$ 500.00
Total Estimated Annual SWM Maintenance Costs						\$34,750.00

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.

2.1.8 Safety Measures & 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.

2.1.9 Training Plan & 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.

2.1.10 Annual Evaluation of 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
		<input type="checkbox"/> Maintain current version OR <input type="checkbox"/> Revise current version Revision date _____ (also update the last revision date on the cover page) <input type="checkbox"/> Requires a new deed recording (also update the last recording information on the cover page)
		<input type="checkbox"/> Maintain current version OR <input type="checkbox"/> Revise current version Revision date _____ (also update the last revision date on the cover page) <input type="checkbox"/> Requires a new deed recording (also update the last recording information on the cover page)
		<input type="checkbox"/> Maintain current version OR <input type="checkbox"/> Revise current version Revision date _____ (also update the last revision date on the cover page) <input type="checkbox"/> Requires a new deed recording (also update the last recording information on the cover page)

2.1.11 Checklists, Logs and Field Manuals

Appendix of this report contains sample checklists and logs regarding various aspects of the basin maintenance and inspection. A brief description of the use of each form is listed below:

1. Bioretention System Field Manual
2. Porous Paving System Field Manual
3. Filterra HC Owner's Manual & Maintenance Steps
4. "Maintenance Work Order and Checklist" – a comprehensive form outlining both required and completed maintenance work.
5. "Maintenance Log" – a summary table for recording of all maintenance work at the site.
6. "Inspection Log" – a summary table for recording the results of all inspections of the basins.

Bioretention System

Development Name: Proposed Warehouse Facility

Township, County: Township of North Brunswick, Middlesex County

Location of Basin: N: 587,650; E: 493,876

Location Description: Southwest corner of the site near Thalia Street

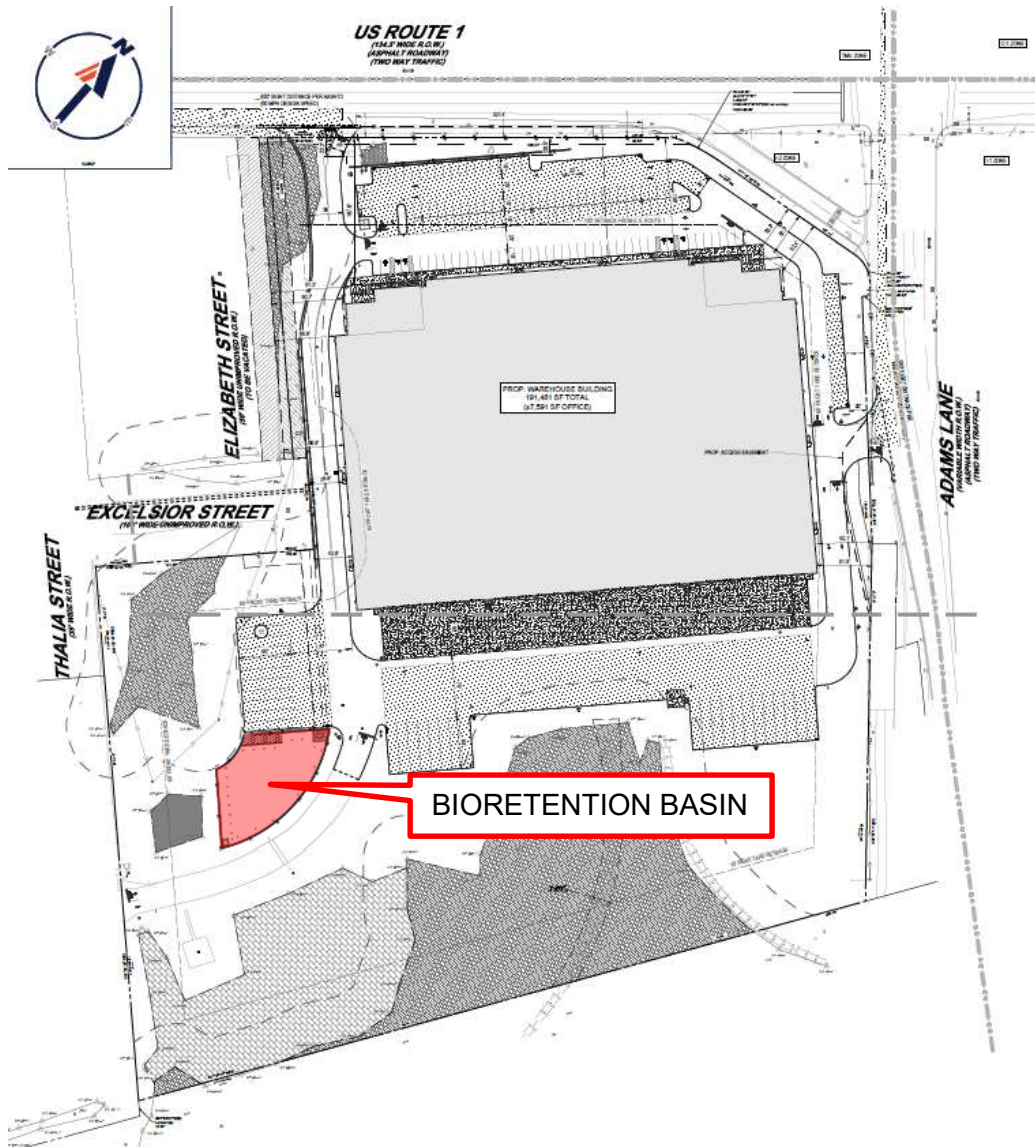


Table of Contents

Bioretention System Overview	3
Basic Design Information	4
Reference Documents.....	6
Inspection Checklist / Maintenance Actions	7
Preventative Maintenance Record	14
Corrective Maintenance Record	15

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 system is designed as an online system.
2. The design drain time is 19 hours.
3. The elevation of the seasonal high water table of this basin was observed on 05 / 21 / 2021 and it was 2.25 feet below the basin bottom surface, at EL. 110.5 feet.

Hydraulic Design Targets

1. Design parameters

	Water Quality Design Storm	2-year storm	10-year storm	100-year storm
Rainfall Depth (inches)	1.25 inch in 2 hours	3.35 inches in 24 hours	5.12 inches In 24 hours	8.63 inches In 24 hours
Runoff Volume (cubic feet)	8,407	25,352	39,683	68,171
Peak Flow Rate (cfs)	6.64	7.00	10.76	18.20
Water Surface Elevation (feet)	113.33	113.66	114.35	115.00

Note: The design engineer shall fill out the table in accordance with the design of the stormwater management measure. If the item is not applicable, enter **N/A** in the table.

2. The emergency spillway is at EL. 115.00 feet.

Basin Configuration Targets

1. Pretreatment is not provided. A perforated riser is not used.
2. Planting Soil Bed
 - The depth of the soil planting bed is 1.5 feet.
 - 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 2 inches/hour (pre-construction). Post-construction testing was completed on _____ and determined a planting soil permeability rate of _____ inches/hour.

3. Outlet Information:

Outlet Description	Outlet Type	Orifice Size / Weir Length	Invert Elevation
Water Quality Orifice	Underdrain	12"Ø PVC Pipe @ 0.10%	109.83
Outlet #1	Orifice	2.5"Ø	113.33
Outlet #2	Grate	5'x5'	114.80

4. Vegetation

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

For a bioretention system designed with an underdrain, the following also applies.

5. Underdrain

- The perforated laterals are 6 inches in diameter, at a slope of 0.10%.
- There are 11 lateral pipes in the basin. Each lateral is 42 to 135 feet long.
- The manifold pipe is 12 inches in diameter, perforated, at a slope of 0.10%, and 133 feet in length.

(Note: The cleanout pipe shall **not** be perforated.)

- The gravel layer surrounding the underdrain consists of 3 inches of gravel above the underdrain and 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.

Attach the following Disturbance Notices, if applicable to the site:

Wetland Disturbance Notice :

Maintenance of this BMP may disturb a wetland area. Contact NJDEP Division of Land Use Regulation for guidance and any required permit(s) before performing maintenance.

Reference Documents

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

- As-built Drawings with Drainage Plans
- Soil Boring Logs
- Permeability Test (Pre-construction)

**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.

A Basin Bed	1	<p>Standing water is present after the design drain time</p> <p>The observed drain time is approximately _____ hours.</p>	<p>Y__</p> <p>N__</p>	<p>Recheck to determine if there is standing water after 72 hours</p> <p>If standing water is present longer than 5 days, report to mosquito commission.</p> <p>Remove any sediment buildup</p> <p>Check the soil permeability</p> <p>Till the soil bed with rotary tiller or disc harrow</p> <p>Replace the planting soil, if necessary</p> <p>Work Order # _____</p>
	2	Excessive sediment, silt, or trash accumulation on basin bed	<p>Y__</p> <p>N__</p>	<p>Clean pretreatment system</p> <p>Remove silt, sediment, and trash</p>
	3	Erosion or channelization is present	<p>Y__</p> <p>N__</p>	<p>Check whether the flow bypass or diversion device is clogged</p> <p>Re-grade the infiltration bed</p> <p>Work Order # _____</p>
	4	Animal burrows/rodents are present	<p>Y__</p> <p>N__</p>	<p>Pest control</p> <p>Work Order # _____</p>
	5	Uneven bed	<p>Y__</p> <p>N__</p>	<p>Use light equipment to resurface the bed</p> <p>Work Order # _____</p>
	6	Evidence of sinkholes or subsidence	<p>Y__</p> <p>N__</p>	<p>Monitor for sinkhole development</p>

Notes:

B Vegetation	1	Large spot(s) showing bare soil	Y__ N__	<p>Vegetative cover must be maintained at 85%. Revegetate the entire basin if 50% or more vegetation has been lost.</p> <p>Check Landscaping plan for guidance (if available)</p> <p>Work Order # _____</p>
	2	Invasive plants are present	Y__ N__	<p>Remove the invasive plants and restore the vegetation in accordance with the landscaping plan</p> <p>Work Order # _____</p>
	3	The vegetation in the basin has been mowed or removed	Y__ N__	<p>Revegetate the system in accordance with the vegetation plan</p> <p>Work Order # _____</p> <p>Note: The vegetation in a bioretention system should not be mowed or removed</p>

Note:

C 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__	<p>Check for excessive overland runoff flow through the embankment.</p> <p>Check for any sink hole development</p> <p>Direct the overland runoff to the forebay or pretreatment area</p> <p>Restabilize the bank</p> <p>Work Order # _____</p>
---	---	--	------------	--

	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.
D 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%	Y__	Repair or replace trash rack
		Trash rack is bent, loose, or missing parts	N__	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:				
E 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 # _____
F 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.	A – Basin Bed	
	C – Bioretention System Embankment and Side Slopes	
	D – Outlet	
Vegetation removal	A – Basin Bed	
	C – Basin Embankment and Side Slopes	
	D – Outlet	
	E – Emergency Spillway	

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

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

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

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

Supervisor: _____ / _____ Date: _____
(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. (e.g., E-Outlet), Inspection Item No. ____ (e.g., 2, 3) _____.

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.

Pervious Paving System

Development Name: Proposed Warehouse Facility

Township, County: Township of North Brunswick, Middlesex County

BMP No.	Location Description	State Plane Coordinates
PP #1	Loading Area	587,998 Northing 494,069 Easting
PP #2	Trailer Storage Area West of Main Drive	587,747 Northing 493,799 Easting
PP #3	Row of Parking along Adam's Lane	588,466 Northing 493,953 Easting
PP #4	Front Parking Lot	588,321 Northing 493,586 Easting

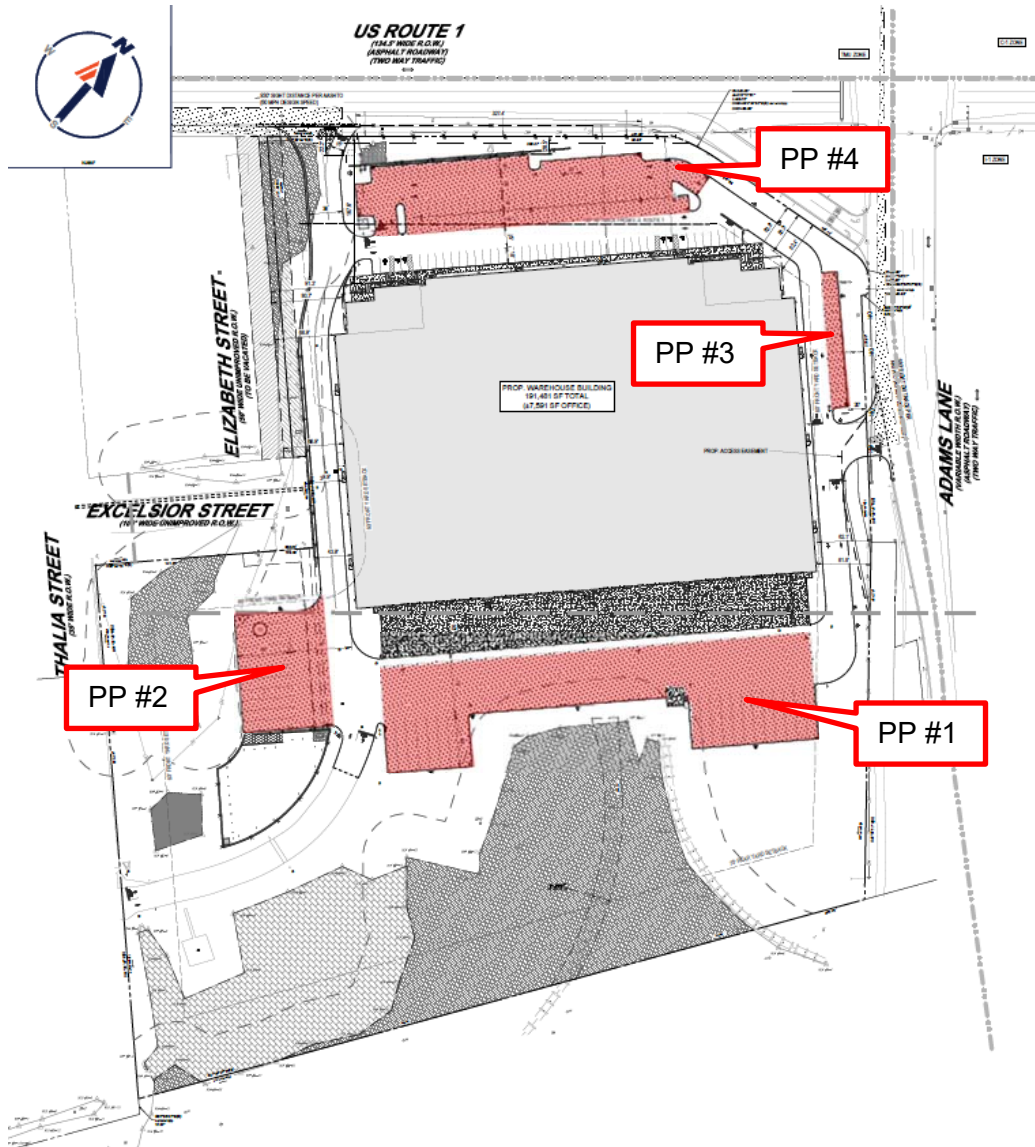


Table of Contents

Pervious Pavement System Overview	3
Basic Design Information	4
Reference Documents.....	5
Inspection Checklist / Maintenance Actions	6
Preventative Maintenance Record	9
Corrective Maintenance Record	10

Pervious Pavement System Overview

Functionality

Pervious paving systems are paved areas that produce less stormwater runoff than areas paved with conventional paving. This reduction is achieved primarily through the infiltration of a greater portion of the rain falling on the area than would occur with conventional paving. This increased infiltration occurs either through the paving material itself or through void spaces between individual paving blocks known as pavers.

Pervious paving systems are divided into two general types. Each type depends primarily upon the nature of the pervious paving surface course and the presence or absence of a runoff storage bed beneath the surface course. Porous paving and permeable paver with storage bed systems treat the stormwater quality design storm runoff through storage and infiltration. Therefore, these systems have adopted TSS removal rates similar to infiltration structures. The adopted TSS removal rate for each type of pervious paving system is from 80%.

Pervious paving systems are used to reduce runoff rates and volumes from paved, on-grade surfaces such as patios, walkways, driveways, fire lanes, and parking spaces. Pervious paving systems with runoff storage beds achieve these reductions through storage of runoff and eventual infiltration into the subgrade soils. Through this infiltration process, these types of pervious paving systems also achieve stormwater quality requirements.

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 Stormwater Management Measure

The pervious pavement system shall fully drain within 72 hours of the most recent rainfall. Standing water in excess of 72 hours is a sign of the porous pavement failure. It may also contribute to mosquito breeding and other health and safety issues. At no time shall there be ponding on the surface of the pavement.

Basic Design Information

Hydrology Design Targets

1. The system is porous pavement with storage bed.
2. This system is designed to not infiltrate into the subsoil.
3. The design drain time is:

BMP No.	100-Year Storm
PP #1	66.20 hrs
PP #2	30.55 hrs
PP #3	48.05 hrs
PP #4	25.85 hrs

4. The TSS removal rate is 80%.

Hydraulic Design Targets

1. This system is designed to detain the runoff from the 100-year storm through the asphalt porous pavement section, which generates the following volume of runoff and peak flow:

BMP No.	Volume (af)	Peak Flow (cfs)
PP #1	1.247	7.39
PP #2	0.151	0.17
PP #3	0.138	0.09
PP #4	0.363	1.74

2. The invert elevation of the overflow outlet is at grade of the asphalt porous pavement section.

System Configuration Targets

1. The system has no pretreatment.
2. The depth of uniformly graded coarse aggregate in the storage bed is:

BMP No.	Storage Bed Depth
PP #1	3.03 ft
PP #2	1.85 ft
PP #3	2.88 ft
PP #4	1.94 ft

Critical Maintenance Features

1. Avoid sand or silt onto the porous pavement area.
2. Sweep and vacuum the porous pavement area often to prevent clog.
3. Do not apply sealant to cracks or entire surface.

Reference Documents

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

- As-built Drawings with Drainage Plans
- Preliminary Stormwater Management Area Evaluation, including:
 - o Soil Boring Logs
 - o Permeability Test (Pre-construction)

Inspection Checklist / Maintenance Actions Pervious Pavement 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.

Component No. Component Name	For Inspector		For Maintenance Crew
	Inspection Item and Inspection Item No.	Result	Preventative / Corrective Maintenance Actions
A Pavement Surface (Porous Pavement)	1	<p>Standing water is present after the design drain time</p> <p>The observed drain time is approximately _____ hours.</p> <p>Excessive sediment or mud accumulation on top of the pavement</p>	<p>Y__</p> <p>N__</p> <p>Recheck to determine if there is standing water after 72 hours If standing water is present longer than 5 days, report to mosquito commission.</p> <p>If excessive sediment is present, the system may be clogged</p> <ul style="list-style-type: none"> - Sweep the surface - Power wash (at 45 degree angle to the top) - Vacuum the surface - Excavate to inspect the storage bed for clogging, replace the storage bed material if it is severely clogged - Check the permeability rate of the subsoil <p>Work Order # _____</p>
	2	Cracking, subsidence, spalling, or other damage to the pavement	<p>Y__</p> <p>N__</p> <p>Repair according to the manufacturer's procedures and material. See Reference Documents section.</p> <p>Work Order # _____</p>
	3	Weeds or other vegetation on the porous pavement	<p>Y__</p> <p>N__</p> <p>Remove the vegetation</p>
Note:			
B Outlet	1	Clogged overflow outlet	<p>Y__</p> <p>N__</p> <p>Clear and remove sediment</p>
	2	Discharge pipe apron is eroded or scoured	<p>Y__</p> <p>N__</p> <p>Restabilize the discharge riprap apron</p> <p>Work Order # _____</p>
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	A – Pavement Surface (Porous Pavement)	
	B – Outlet	

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 No. _____, Component No. _____, Inspection Item No. _____.

4. Required Actions

Actions	Planned Date	Date Completed

5. Responsible person(s):

6. Special requirements

- Time of the season or weather condition: _____
- Tools/equipment: _____
- Subcontractor (name or specific type): _____

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

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

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

Filterra HC Owner's Manual



filterra[®]
Bioretention Systems

C NTECH[®]
ENGINEERED SOLUTIONS

This Owner's Manual applies to all precast Filterra Configurations, including Filterra Bioscape Vault.

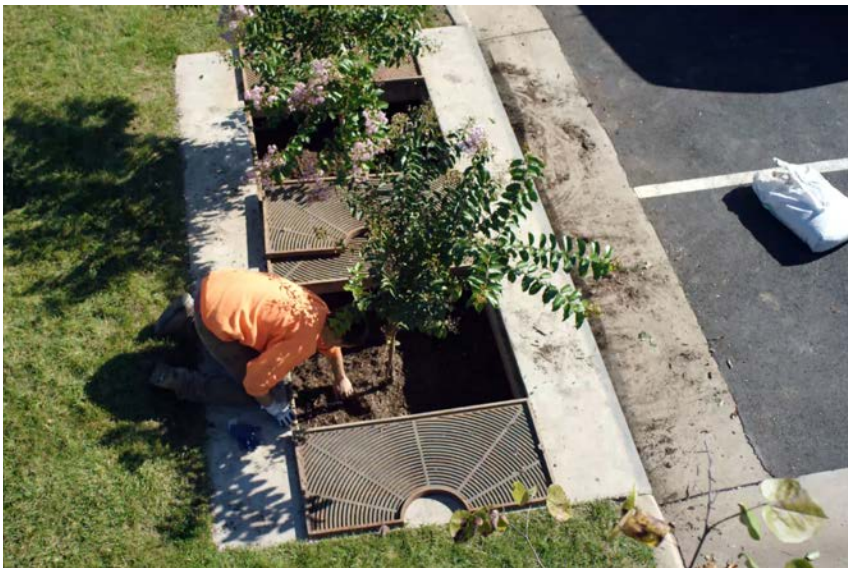




Table of Contents

Introduction	4
Activation Overview	4
Filterra HC Plant Selection Overview	6
Warranty Overview	6
Routine Maintenance Guidelines.....	6
Maintenance Visit Procedure.....	9
Appendix 1 – Activation Checklist	12
Appendix 2 – Planting Requirements for Filterra HC Systems.....	13
Appendix 3 – Filterra Tree Grate Opening Expansion Procedure	15



Introduction

Thank you for your purchase of the Filterra® HC Bioretention System. Filterra HC is a specially engineered stormwater treatment system incorporating high performance biofiltration media to remove pollutants from stormwater runoff. All components of the system work together to provide a sustainable long-term solution for treating stormwater runoff.

The Filterra HC system has been delivered to you with protection in place to resist intrusion of construction related sediment which can contaminate the biofiltration media and result in inadequate system performance. These protection devices are intended as a best practice and cannot fully prevent contamination. It is the purchaser's responsibility to provide adequate measures to prevent construction related runoff from entering the Filterra HC system.

Included with your purchase is Activation of the Filterra HC system by the manufacturer as well as a 1-year warranty from delivery of the system and 1-year of routine maintenance (mulch replacement, debris removal, and pruning of vegetation) up to twice during the first year after activation.

Design and Installation

Each project presents different scopes for the use of Filterra HC systems. Information and help may be provided to the design engineer during the planning process. Correct Filterra HC box sizing (per local regulations) is essential to predict pollutant removal rates for a given area. The engineer shall submit calculations for approval by the local jurisdiction. The contractor is responsible for the correct installation of Filterra HC units as shown in approved plans. A comprehensive installation manual covering all Filterra configurations is available at www.ContechES.com.

Activation Overview

Activation of the Filterra HC system is a procedure completed by the manufacturer to place the system into working condition. This involves the following items:

- Removal of construction runoff protection devices
- Planting of the system's vegetation
- Placement of pretreatment mulch layer using mulch certified for use in Filterra HC systems.

Activation **MUST** be provided by the manufacturer to ensure proper site conditions are met for Activation, proper installation of the vegetation, and use of pretreatment mulch certified for use in Filterra HC systems.



Minimum Requirements

The minimum requirements for Filterra HC Activation are as follows:

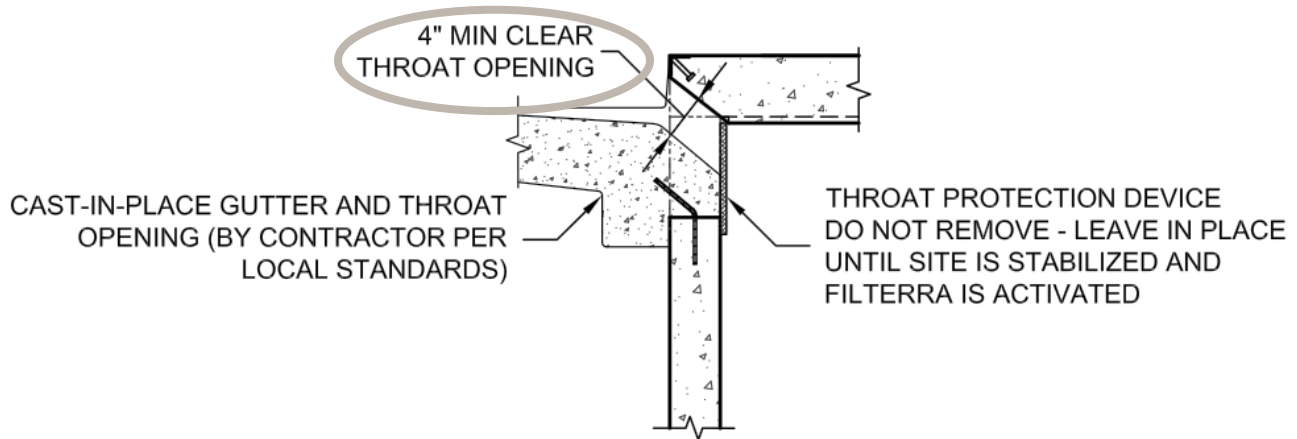
1. The site landscaping must be fully stabilized, i.e. full landscaping installed and some grass cover (not just straw and seed) is required to reduce sediment transport. Construction debris and materials should be removed from surrounding area.



2. Final paving must be completed. Final paving ensures that paving materials will not enter and contaminate the Filterra HC system during the paving process, and that the plant will receive runoff from the drainage area, assisting with plant survival for the Filterra HC system.



3. Filterra HC throat opening (if applicable) should be at least 4" in order to ensure adequate capacity for inflow and debris.



An Activation Checklist is included on page 12 to ensure proper conditions are met for Contech to perform the Activation services. A charge of \$500.00 will be invoiced for each Activation visit requested by Customer where Contech determines that the site does not meet the conditions required for Activation.

Filterra HC Plant Selection Overview

Plant Lists are available on the Contech website highlighting recommended plants for Filterra systems in your area. Keep in mind that plants are subject to availability due to seasonality and required minimum size for the Filterra HC system. Plants installed in the Filterra HC system are container plants (max 15 gallon) from nursery stock and will be immature in height and spread at Activation.

It is the responsibility of the owner to provide adequate irrigation when necessary to the plant of the Filterra HC system.

The “Planting Requirements for Filterra HC Systems” document is included as an appendix and discusses proper selection and care of the plants within Filterra HC systems.

Warranty Overview

Refer to the Contech Engineered Solutions LLC Stormwater Treatment System LIMITED WARRANTY for further information. The following conditions may void the Filterra HC system’s warranty and waive the manufacturer provided Activation and Maintenance services:

- Unauthorized activation or performance of any of the items listed in the activation overview
- Any tampering, modifications or damage to the Filterra HC system or runoff protection devices
- Removal of any Filterra HC system components
- Failure to prevent construction related runoff from entering the Filterra HC system
- Failure to properly store and protect any Filterra HC components (including media and underdrain stone) that may be shipped separately from the vault

Routine Maintenance Guidelines

Routine maintenance is included by the manufacturer on all Filterra HC systems for the first year after activation. This includes a maximum of 2 visits to remove debris, replace pretreatment mulch, and prune the vegetation. More information is provided in the Operations and Maintenance Guidelines. Some Filterra HC systems also contain diversion bypass or outlet bays. Depending on site pollutant loading, these bays may require periodic removal of debris, however this is not included in the first year of maintenance and would likely not be required within the first year of operation.

These services, as well as routine maintenance outside of the included first year, can be provided by certified maintenance providers listed on the Contech website. Training can also be provided to other stormwater maintenance or landscape providers.



Why Maintain?

All stormwater treatment systems require maintenance for effective operation. This necessity is often incorporated in your property's permitting process as a legally binding BMP maintenance agreement. Other reasons to maintain are:

- Avoiding legal challenges from your jurisdiction's maintenance enforcement program.
- Prolonging the expected lifespan the media in the Filterra HC system.
- Avoiding more costly media replacement.
- Helping reduce pollutant loads leaving your property.

Simple maintenance of the Filterra HC is required to continue effective pollutant removal from stormwater runoff before discharge into downstream waters. This procedure will also extend the longevity of the living biofilter system. The Filterra HC system is also subjected to various materials entering the inlet, including trash, silt, leaves, etc. which will be contained above the mulch layer. Too much silt may inhibit the Filterra HC system flow rate, which is the reason for site stabilization before activation. Regular replacement of the mulch stops accumulation of such sediment.

If the system is not maintained on regular intervals, is subject to a catastrophic spill or other event, or subject to unusual pollutant loading, full media bed replacement could be required. Please contact Contech for further evaluation if you feel this may be necessary.

When to Maintain?

Contech includes a 1-year maintenance plan with each system purchase. Annual included maintenance consists of a maximum of two (2) scheduled visits. Additional maintenance may be necessary depending on sediment and trash loading (by Owner or at additional cost). The start of the maintenance plan begins when the system is activated.

Maintenance visits are typically scheduled seasonally; the spring visit aims to clean up after winter loads including salts and sands while the fall visit helps the system by removing excessive leaf litter.

It has been found that in regions which receive between 30-50 inches of annual rainfall, (2) two visits are generally required; regions with less rainfall often only require (1) one visit per annum. Varying land uses can affect maintenance frequency; e.g. some fast food restaurants require more frequent trash removal. Contributing drainage areas which are subject to new development wherein the recommended erosion and sediment control measures have not been implemented may require additional maintenance visits.

Some sites may be subjected to extreme sediment or trash loads, requiring more frequent maintenance visits. This is the reason for detailed notes of maintenance actions per unit, helping the Supplier and Owner predict future maintenance frequencies, reflecting individual site conditions.

Owners must promptly notify the maintenance provider of any damage to the plant(s), which constitute(s) an integral part of the bioretention technology. Owners should also advise other landscape or maintenance contractors to leave all maintenance to the Supplier (i.e. no pruning or fertilizing) during the first year.



Exclusion of Services

Clean up due to major contamination such as oils, chemicals, toxic spills, etc. will result in additional costs and are not covered under the Supplier maintenance contract. Should a major contamination event occur the Owner must block off the outlet pipe of the Filterra HC (where the cleaned runoff drains to, such as drop inlet) and block off the inlet of the Filterra HC. The Supplier should be informed immediately.

Maintenance Visit Summary

Each maintenance visit consists of the following simple tasks (detailed instructions below).

1. Inspection of Filterra HC and surrounding area
2. Removal of tree grate (where applicable) and erosion control stones
3. Removal of debris, trash and mulch
4. Mulch replacement
5. Plant health evaluation & pruning or replacement as necessary
6. Clean area around Filterra HC
7. Complete paperwork

Maintenance Tools, Safety Equipment and Supplies

Ideal tools include camera, bucket, shovel, broom, pruners, hoe/rake, and tape measure. Appropriate Personal Protective Equipment (PPE) should be used in accordance with local or company procedures. This may include impervious gloves where the type of trash is unknown, high visibility clothing and barricades when working near traffic and also safety hats and shoes. A T-Bar or crowbar should be used for moving the tree grates (up to 170 lbs each) where applicable. Most visits require minor trash removal and a full replacement of mulch. If tree grate opening expansion is necessary, safety glasses/goggles and a 3lb or greater mini sledgehammer are required. See below for actual number of bagged mulch that is required in each media bay size. Mulch should be a double shredded, hardwood variety. Some visits may require additional Filterra engineered soil media for the Filterra HC system, available from the Supplier.

	Available Filterra® HC Media Bay Sizes (feet)	Filter Surface Area (ft²)	Mulch Volume at 3" Depth (ft³)	# of 2 ft² Mulch Bags
Standard Configuration Filterra and Filterra Bioscape Vaults	4x4	16	4	2
	4x6 or 6x4	24	6	3
	4.5x7.83 or 7.83x4.5 (Nominal 4x8/8x4)	35.24	9	5
	6x6	36	9	5
	6x8 or 8x6	48	12	6
	6x10 or 10x6	60	15	8
	6x12 or 12x6	72	18	9
	7x13 or 13x7	91	23	12
	14x8	112	28	14
	16x8	128	32	16
	18x8	144	36	18
	20x8	160	40	20
22x8	176	44	22	
Peak Diversion Filterra Vaults	4x4	16	4	2
	4.5x5.83 or 5.83x4.5 (Nominal 4x6/6x4)	26.24	7	4
	6x6	36	9	5
	6x8	48	12	6
	6x10 or 10x6	60	15	8
	7x10	70	18	9
	8x10.5	84	21	11
	8x12.5	100	25	13
	Custom and/or Filterra Bioscape	Media Area in ft²	0.25 x (Media Area in ft²)	0.125 x (Media Area in ft²)

Maintenance Visit Procedure

Keep sufficient documentation of maintenance actions to predict location specific maintenance frequencies and needs. An example Maintenance Report is included in this manual.



1. Inspection of Filterra HC and surrounding area

- Record individual unit before maintenance with photograph (numbered). Record on Maintenance Report (see example in this document) the following:

Record on Maintenance Report the following:

Standing Water	yes no
Damage to Box Structure	yes no
Damage to Grate (if applicable)	yes no
Is Bypass Clear	yes no

If yes answered to any of these observations, record with close-up photograph (numbered).



2. Removal of tree grate (if applicable) and erosion control stones

- Remove cast iron grates, if applicable, for access into Filterra HC box.
- Dig out silt (if any) and mulch and remove trash & foreign items.

3. Removal of debris, trash and mulch

Record on Maintenance Report the following:

Silt/Clay	yes no
Cups/ Bags	yes no
Leaves	yes no
Buckets Removed	_____



- After removal of mulch and debris, measure distance from the top of the Filterra engineered media soil to the top of the top slab. Compare the measured distance to the distance shown on the approved Contract Drawings for the system. Add Filterra media (not top soil or other) to bring media up as needed to distance indicated on drawings.

Record on Maintenance Report the following:

Distance to Top of Top Slab (inches)	_____
Inches of Media Added	_____



4. Mulch replacement

- Add double shredded mulch evenly across the entire unit to a depth of 3".
- Refer to Filterra Mulch Specifications for information on acceptable sources.
- Ensure correct repositioning of erosion control stones by the Filterra HC inlet to allow for entry of trash during a storm event.
- Replace Filterra HC grates (if applicable) correctly using appropriate lifting or moving tools, taking care not to damage the plant.
- Where applicable, if 6" tree grate opening is too close to plant trunk, the grate opening may be expanded to 12" using a mini sledgehammer. Refer to instructions in Appendix 3.



5. Plant health evaluation and pruning or replacement as necessary

- Examine the plant's health and replace if necessary.
- Prune as necessary to encourage growth in the correct directions

Record on Maintenance Report the following:

Height above top of Filterra Unit	_____ (ft)
Width at Widest Point	_____ (ft)
Health	healthy unhealthy
Damage to Plant	yes no
Plant Replaced	yes no



6. Clean area around Filterra HC

- Clean area around unit and remove all refuse to be disposed of appropriately.



7. Complete paperwork

- Deliver Maintenance Report and photographs to appropriate location (normally Contech during maintenance contract period).
- Some jurisdictions may require submission of maintenance reports in accordance with approvals. It is the responsibility of the Owner to comply with local regulations.

Maintenance Checklist

Drainage System Failure	Problem	Conditions to Check	Condition that Should Exist	Actions
Inlet	Excessive sediment or trash accumulation.	Accumulated sediments or trash impair free flow of water into Filterra HC.	Inlet should be free of obstructions allowing free distributed flow of water into Filterra HC HC.	Sediments and/or trash should be removed.
Mulch Cover	Trash and floatable debris accumulation.	Excessive trash and/or debris accumulation.	Minimal trash or other debris on mulch cover.	Trash and debris should be removed and mulch cover raked level. Ensure bark nugget mulch is not used.
Mulch Cover	"Ponding" of water on mulch cover.	"Ponding" in unit could be indicative of clogging due to excessive fine sediment accumulation or spill of petroleum oils.	Stormwater should drain freely and evenly through mulch cover.	Recommend contact manufacturer and replace mulch as a minimum.
Vegetation	Plants not growing or in poor condition.	Soil/mulch too wet, evidence of spill. Incorrect plant selection. Pest infestation. Vandalism to plants.	Plants should be healthy and pest free.	Contact manufacturer for advice.
Vegetation	Plant growth excessive.	Plants should be appropriate to the species and location of Filterra HC.		Trim/prune plants in accordance with typical landscaping and safety needs.
Structure	Structure has visible cracks.	Cracks wider than 1/2 inch or evidence of soil particles entering the structure through the cracks.		Vault should be repaired.

Maintenance is ideally to be performed twice annually.

Filterra HC Inspection & Maintenance Log

Filterra HC System Size/Model: _____ Location: _____

Date	Mulch & Debris Removed	Depth of Mulch Added	Mulch Brand	Height of Vegetation Above Top of Vault	Vegetation Species	Issues with System	Comments
1/1/17	5 – 5 gal Buckets	3"	Lowe's Premium Brown Mulch	4'	Galaxy Magnolia	- Standing water in downstream structure	- Removed blockage in downstream structure

Appendix 1 – Filterra® Activation Checklist



Project Name: _____ Company: _____

Site Contact Name: _____ Site Contact Phone/Email: _____

Site Owner/End User Name: _____ Site Owner/End User Phone/Email: _____

Preferred Activation Date: _____ (provide 2 weeks minimum from date this form is submitted)

Site Designation	System Size	Final Pavement / Top Coat Complete	Landscaping Complete / Grass Emerging	Construction materials / Piles / Debris Removed	Throat Opening Measures 4" Min. Height	Plant Species Requested
		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	

Attach additional sheets as necessary.

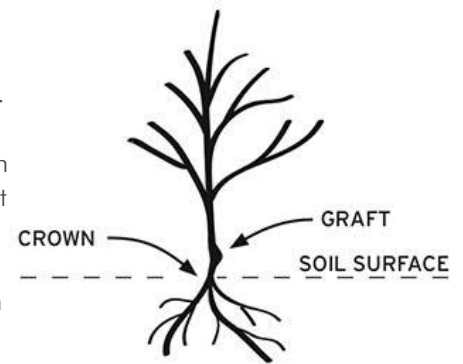
NOTE: A charge of \$500.00 will be invoiced for each Activation visit requested by Customer where Contech determines that the site does not meet the conditions required for Activation. ONLY Contech authorized representatives can perform Activation of Filterra HC systems; unauthorized Activations will void the system warranty and waive manufacturer supplied Activation and 1st Year Maintenance.

Signature _____ Date _____

Appendix 2 – Planting Requirements for Filterra® HC Systems

Plant Material Selection

- Select plant(s) as specified in the engineering plans and specifications.
- Select plant(s) with full root development but not to the point where root bound.
- Use local nursery container plants only. Ball and burlapped plants are not permitted.
- For precast Filterra HC systems with a tree grate, plant(s) must not have scaffold limbs at least 14 inches from the crown due to spacing between the top of the mulch and the tree grate. Lower branches can be pruned away provided there are sufficient scaffold branches for tree or shrub development.
- For precast Filterra HC systems with a tree grate, at the time of installation, it is required that plant(s) must be at least 6" above the tree grate opening at installation for all Filterra configurations. This DOES NOT apply to Full Grate Cover designs.
- Plant(s) shall not have a mature height greater than 25-30 feet.
- A 7-15 gallon container size shall be used.
- For precast Filterra HC systems, plant(s) should have a single trunk at installation, and pruning may be necessary at activation and maintenance for some with a tree grate of the faster growing species, or species known to produce basal sprouts



Plant Installation

- During transport protect the plant foliage from wind and excessive jostling.
- Prior to removing the plant(s) from the container, ensure the soil moisture is sufficient to maintain the integrity of the root ball. If needed, pre-wet the container plant.
- Cut away any roots which are growing out of the container drain holes. Plants with excessive root growth from the drain holes should be rejected.
- Plant(s) should be carefully removed from the pot by gently pounding on the sides of the container with the fist to loosen root ball. Then carefully slide out. Do not lift plant(s) by trunk as this can break roots and cause soil to fall off. Extract the root ball in a horizontal position and support it to prevent it from breaking apart. Alternatively, the pot can be cut away to minimize root ball disturbance.
- Remove any excess soil from above the root flare after removing plant(s) from container.
- Excavate a hole with a diameter 4" greater than the root ball, gently place the plant(s).
- If plant(s) have any circling roots from being pot bound, gently tease them loose without breaking them.
- If root ball has a root mat on the bottom, it should be shaved off with a knife just above the mat line.
- Plant the tree/shrub/grass with the top of the root ball 1" above surrounding media to allow for settling.
- All plants should have the main stem centered in the tree grate (where applicable) upon completion of installation.
- With all trees/shrubs, remove dead, diseased, crossed/rubbing, sharply crotched branches or branches growing excessively long or in wrong direction compared to majority of branches.
- To prevent transplant shock (especially if planting takes place in the hot season), it may be necessary to prune some of the foliage to compensate for reduced root uptake capacity. This is accomplished by pruning away some of the smaller secondary branches or a main scaffold branch if there are too many. Too much foliage relative to the root ball can dehydrate and damage the plant.
- Plant staking may be required.

Mulch Installation

- Only mulch that meets Contech Engineered Solutions' mulch specifications can be used in the Filterra HC system.
- Mulch must be applied to a depth of 3" evenly over the surface of the media.

Irrigation Requirements

- Each Filterra HC system must receive adequate irrigation to ensure survival of the living system during periods of drier weather.
- Irrigation sources include rainfall runoff from downspouts and/or gutter flow, applied water through the top/grate or in some cases from an irrigation system with emitters installed during construction.
- At Activation: Apply about one (cool climates) to two (warm climates) gallons of water per inch of trunk diameter over the root ball.
- During Establishment: In common with all plants, each Filterra HC plant will require more frequent watering during the establishment period. One inch of applied water per week for the first three months is recommended for cooler climates (2 to 3 inches for warmer climates). If the system is receiving rainfall runoff from the drainage area, then irrigation may not be needed. Inspection of the soil moisture content can be evaluated by gently brushing aside the mulch layer and feeling the soil. Be sure to replace the mulch when the assessment is complete. Irrigate as needed**.
- Established Plants: Established plants have fully developed root systems and can access the entire water column in the media. Therefore, irrigation is less frequent but requires more applied water when performed. For a mature system assume 3.5 inches of available water within the media matrix. Irrigation demand can be estimated as 1" of irrigation demand per week. Therefore, if dry periods exceed 3 weeks, irrigation may be required. It is also important to recognize that plants which are exposed to windy areas and reflected heat from paved surfaces may need more frequent irrigation. Long term care should develop a history which is more site specific.

** Five gallons per square yard approximates 1 inch of water. Therefore, for a 6' by 6' Filterra HC approximately 20-60 gallons of water is needed. To ensure even distribution of water it needs to be evenly sprinkled over the entire surface of the filter bed, with special attention to make sure the root ball is completely wetted. NOTE: if needed, measure the time it takes to fill a five-gallon bucket to estimate the applied water flow rate then calculate the time needed to irrigate the Filterra HC system. For example, if the flow rate of the sprinkler is 5 gallons/minute then it would take 12 minutes to irrigate a 6' by 6' filter.



Appendix 3 – Filterra® Tree Grate Opening Expansion Procedure

The standard grates used on all Filterra configurations that employ Tree Grates are fabricated with a 6" opening that is designed with a breakaway section that can be removed, allowing the grate opening to be expanded to 12" as the tree matures and the trunk widens.

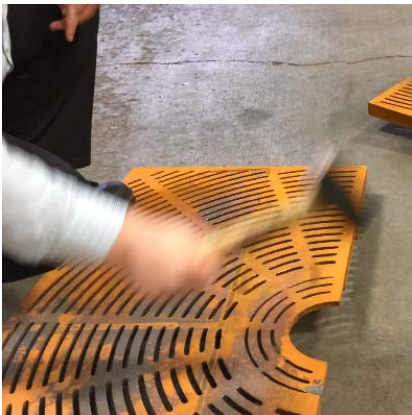
The following tools are required to expand the opening:

- Mini sledgehammer (3 lb. or greater)
- Safety Glasses / Goggles

The following guidelines should be followed to properly expand the tree opening from 6" to 12":



1. Remove the grate from the Filterra frame, place it flat on a hard surface, and support the grate by stepping on the edge or using other weighted items such as a few mulch bags if this is being done during a Filterra maintenance event. Put on safety glasses/goggles. Align the mini sledgehammer as shown in the figure to the left. The head of the sledgehammer should be aimed just inside the wide cast iron bar between the larger grate section and the breakaway section.



2. Repeatedly hit the grate at this spot with the mini sledgehammer.



3. After several hits, the breakaway section should snap cleanly off of the larger grate section. Reinstall the grate into the Filterra grate frame. Recycle or dispose of the breakaway section per local guidelines.



9025 Centre Pointe Drive, Suite 400
West Chester, OH 45069
info@conteches.com | 800-338-1122
www.ContechES.com

© 2021 Contech Engineered Solutions LLC, a QUIKRETE Company

ALL RIGHTS RESERVED. PRINTED IN THE USA.

NOTHING IN THIS CATALOG SHOULD BE CONSTRUED AS A WARRANTY. APPLICATIONS SUGGESTED HEREIN ARE DESCRIBED ONLY TO HELP READERS MAKE THEIR OWN EVALUATIONS AND DECISIONS, AND ARE NEITHER GUARANTEES NOR WARRANTIES OF SUITABILITY FOR ANY APPLICATION. CONTECH MAKES NO WARRANTY WHATSOEVER, EXPRESS OR IMPLIED, RELATED TO THE APPLICATIONS, MATERIALS, COATINGS, OR PRODUCTS DISCUSSED HEREIN. ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND ALL IMPLIED WARRANTIES OF FITNESS FOR ANY PARTICULAR PURPOSE ARE DISCLAIMED BY CONTECH. SEE CONTECH'S CONDITIONS OF SALE (AVAILABLE AT WWW.CONTECHES.COM/COS) FOR MORE INFORMATION.

Filterra® Maintenance Steps



1. Inspection of Filterra and surrounding area



2. Removal of tree grate and erosion control stones



3. Removal of debris, trash and mulch



4. Mulch replacement



5. Clean area around Filterra



6. Complete paperwork and record plant height and width

Contech has created a network of Certified Maintenance Providers (CCMP's) to provide maintenance on Filterra systems. To find a CCMP in your area please visit www.conteches.com/maintenance

**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. EMBANKMENTS AND SIDE SLOPES			
B. PERIMETER AREAS			
C. ACCESS AREAS AND ROADS			
D. 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. PERVIOUS PAVEMENT AREAS			
A. STONE BED			
B. OUTLETS AND TRASH RACKS			
C. ACCESS HATCHES			
D. OTHERS			
8. OTHER PREVENTIVE MAINTENANCE			
A. PARKING LOT SWEEPING			
B. EMPTYING TRASH RECEPTACLES			

**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. EMBANKMENTS AND SIDE SLOPES					
B. PERIMETER AREAS					
C. ACCESS AREAS AND ROADS					
D. 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. POROUS PAVEMENT AREA					
A. STONE BED					
B. OUTLETS AND TRASH RACKS					
C. ACCESS HATCHES					
D. OTHERS					
8. 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. SAND LAYER REPLACEMENT					
11. 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. EMBANKMENTS AND SIDE SLOPES			
B. PERIMETER AREAS			
C. ACCESS AREAS AND ROADS			
D. 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: _____