STORMWATER MAINTENANCE PLAN AND FIELD MANUAL

FOR

420 Bloomfield Avenue
Lot 3, Block 701
Township of Verona
Essex County, New Jersey

Applicant
GOMES CONSULTING LLC
91 KOSSUTH STREET
NEWARK, NJ 07105
pedro@bygomes.com

Prepared by
Jarmel Kizel Architects & Engineers, Inc.

Jarmel Kizel Project No. GOMESGR24-223
Dated: October 23, 2026

Anthony Facchino, PE, PLS
Professional Engineer and Land Surveyor
N.J. License No. GE042585

Signature

This plan is recorded in

Deed Book # _____ Page # ____

with _____ County Clerk on Date _____

Jarmel Kizel
ARCHITECTS AND ENGINEERS INC.

ARCHITECTURE
ENGINEERING
SPACE PLANNING
INTERIOR DESIGN
IMPLEMENTATION SERVICES

PRINCIPALS
MARVIN JARMEL, IIDA
MATTHEW B. JARMEL, AIA, MBA
IRWIN H. KIZEL, AIA, PP
RICHARD A. JARMEL, PE

NJ STATE BOARD OF ARCHITECTS

CERTIFICATE OF AUTHORIZATION NUMBER 161

NJ STATE BOARD OF PROFESSIONAL ENGINEERS AND LAND SURVEYORS CERTIFICATE OF AUTHORIZATION NUMBER GA278177

42 Okner Parkway
Livingston, NJ 07039

TEL: (973) 994-9669
FAX: (973) 994-4069

www.jarmelkizel.com

Stormwater Maintenance Plan for
420Bloomfield Ave
Township of Verona, Essex County, New Jersey
Jarmel Kizel Project No. Gomesr24-190
October 26, 2026

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Stormwater Maintenance Plan for
420Bloomfield Ave
Township of Verona, Essex County, New Jersey
Jarmel Kizel Project No. Gomesr24-190
October 26, 2026

Note:

This manual is based on the documents and guidance provided by the New Jersey Department of Environmental Protection (NJDEP) and Verona ordinance 150-25.12.

Jarmel Kizel has only assembled these maintenance documents as per the guidance of the NJDEP and Verona ordinance 150-25.12. All responsibility and costs associated with the operation and maintenance of the stormwater management system including but not limited to the stormwater facilities is solely with the owner and/or his other designated managers, operators, contractors and maintenance personnel. The owner/maintainer is solely responsible for adhering to any supplier or manufacturer requirements and directions whether or not included in these documents. The owner/maintainer is also solely responsible for following all safety protocols including but not limited to the occupational safety and hazard act whether or not included in this document.

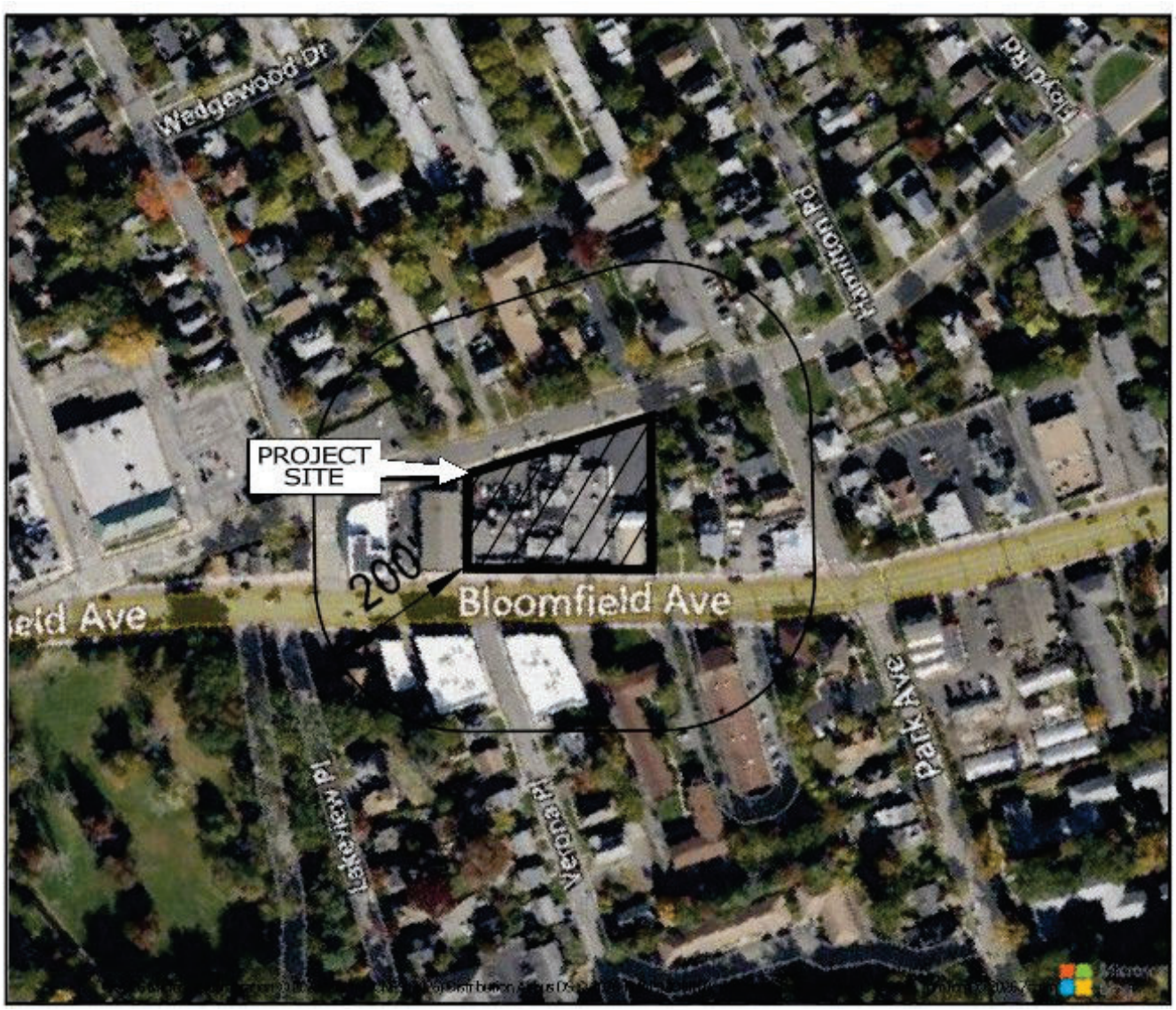
Part I- Maintenance Plan

A. 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	BMP No.	Location Description	State Plane Coordinates / Lat., Long.
Inlets and Manholes Storm sewer collection system and Detention Facilities	1	Multiple locations On-site	40º49’47”N 74º14’30”W

B. LOCATION MAP



C. LOCAL AGENCIES

The following agencies are listed for the owner/operator's reference:

Hudson, Essex & Passaic Soil Conservation District
15 Bloomfield Ave.
North Caldwell, New Jersey 07006
Tel.—(973) 364-0786
Fax.—(973) 364-0784

Essex County Engineering Department
900 Bloomfield Ave.
Verona, New Jersey 07044
Tel.—(973) 226-8506
Fax.—(973) 226-7469

Township of Verona
600 Bloomfield Ave.
Verona, NJ 07044
Phone 973-239-3220

D. Description of Stormwater Management Measures

Storm Sewer Collection System
Design storm:

- Design Purposes:
    - 100-year storm

- Dimensions: 12” & 15” HDPP

E. Preventative and Corrective Maintenance Action Plan

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.

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.

The maintenance plan should address the maintenance of access points to the stormwater management measures in accordance with the following:

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

Preventative Maintenance Actions

Frequency	Preventative Maintenance Actions	Stormwater Measures/ No.
Monthly	Vegetation removal in growing season	Inlets and Manholes
Quarterly	Sediment removal and examine system for debris, ensure inlets are clean and other semiannual preventative maintenance actions. Structural Inspection Other annual preventative maintenance actions- examine inlets, access points and other system components	Inlets and manholes
Every 2 Years	Replace Media Filter	BioPod
Unscheduled	Quick inspection after every rain of one (1) inch or more	Inlets and Manholes

Corrective Maintenance Actions

Potential Corrective Maintenance Actions	Stormwater Management Measures/No.
- Repair/Replacement of inlet castings	Inlets and Manholes
- Replacement of media	BioPod
- Remove sediment buildup	Retain it Underground Detention System

Inspection and Logs of All Preventative and Corrective Maintenance

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 in accordance with Verona ordinance 150-

25.12. **The inspection report shall include copies of photographs depicting the conditions of the BMPs.**

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.

F. Maintenance Personnel, Equipment, Tools, and Supplies

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 will 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 will also be listed.

Maintenance Personnel/Equipment/Tools/Supplies

Personnel/Equipment/Tools Name	Quantity
general maintenance crew	1
debris removal tools, shovels, buckets, wheel barrels, flashlight	1 set
leaf blower	1

G. Disposal Plan

The maintenance plan includes approved disposal and recycling sites and procedures for sediment, trash, debris and other material removed from stormwater management measures during maintenance operations.

Disposal/Recycling Procedures

- There is the potential for debris to build up on the surface of the system. Send debris to the appropriate disposal facility

Disposal Field – Offsite
Class B

FACILITY NAME/COUNTY	NJEMS PI	WASTE TYPE	PHONE	LOCATION	MUNICIPALITY
ESSEX					
Caputo Brothers	168325	BR, L, TP, TRS, TS	(973) 857-5410	Village Park Rd.	Cedar Grove
Evergreen Recycling Solutions, LLC	499991	T, TP, TS, W	(973) 242-3030	110 Evergreen Avenue	Newark
Silva Construction & Demolition	502757	A, BB, BR, C, T, TP, TRS, TS, W	(973) 483-3792	100 Riverside Avenue	Newark
T. Fiore Recycling Corp.	132148	A, AS, BB, BR, C, T, TP, TRS, TS, W	(973) 465-1818	411 Wilson Avenue	Newark

Class C

FACILITY NAME	NJEMS PI Number	WASTE TYPE	TELEPHONE	LOCATION	MUNICIPALITY
ESSEX					
Millburn Township Compost	132121	BR, L	(973) 564-7060	Kennedy Parkway	Millburn

Description of the Offsite Disposal:

Disposal may be by the township, by a private operator and conveyance entity, etc.

Class B

A = Asphalt	AM = Asphalt Millings
AS = Asphalt Shingles	BB = Brick & Block
BR = Brush	C = Concrete
CW = Creosote Wood	FW = Food Waste
G = Grass	GY = Gypsum
L = Leaves	LW = Lake Weed
PCS = Petroleum Contaminated Soil	PWR = Potable Water Residue
SS = Street Sweepings	T = Tires
TL = Tree Limbs/Tree Branches	TP = Tree Parts
TRS = Trees	TS = Tree Stumps
TT = Tree Trunks	W = Wood
WC = Wood Chips	WP = Wood Pallets

Class C

A = Asphalt	AM = Asphalt Millings
AS = Asphalt Shingles	BB = Brick & Block
BR = Brush	C = Concrete
CW = Creosote Wood	FW = Food Waste
G = Grass	GY = Gypsum
L = Leaves	LW = Lake Weed
PCS = Petroleum Contaminated Soil	PWR = Potable Water Residue
SS = Street Sweepings	T = Tires
TL = Tree Limbs/Tree Branches	TP = Tree Parts
TRS = Trees	TS = Tree Stumps
TT = Tree Trunks	W = Wood
WC = Wood Chips	WP = Wood Pallets

H. Cost Estimate

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 actual costs may vary widely from what is shown here with factors such as local requirements, equipment, personnel, weather, and maintenance methods and other factors.

Cost Overview

Cost Type	Cost	Details
The annual fee for the stormwater maintenance permit per Verona 150-15-12 Fee	**Per Township fee schedule**	**To be paid on a yearly basis**
General cost for routine maintenance (quarterly maintenance)	$3,000.00 / year	Table A
Unscheduled maintenance inspection after 1 inch of rain	$300.00 / year	Table B
Cost associated with special tasks for specific stormwater measures (biennial)	$1,185.00 / year	Table C
Total cost	$4,485.00 / year	

Table A: General cost for routine maintenance (quarterly maintenance)

Cost Type	Required Quantity	Unit Price	Cost
Inspector	1 persons/day-2 hours each	$ 225.00/hr	$ 450.00
Personnel			
Crew	1 persons/day-2 hours each	$ 75.00/hr	$ 150.00
Equipment			
Blower			
Services			
Subcontractor for disposal	1	$ 150.00	$ 150.00
Subtotal	x4		$3,000.00
Total Cost			$ 3,000.00 / yr

Table B: General cost – unscheduled maintenance inspection after 1 inch of rain

Cost Type	Required Quantity	Unit Price	Cost
Personnel			
Crew	1 workers- 2 hours each	$ 75.00	$ 150.00
Subtotal	x2		$ 300.00
Total Cost			$ 300.000 / yr

Table C: Cost associated with special tasks for specific stormwater measures sand replacement

Cost Type	Required Quantity	Unit Price	Cost
Personnel			
Crew	2 people / 8 hours	$ 75.00	$ 1200.00
Equipment			
Truck	1	$ 50.00	$ 50.00
Lightweight backhoe rental	8 hours	$ 40.00 /hr	$ 320.00
Supplies			
Mulch	4 cubic yard	$ 75.00/CY	$ 140.00
Working garments/gloves/ protective measures			$ 0.00
Services			
Subcontractor for disposal	1	$ 500.00	$ 500.00
Subtotal			$ 2,370.00 / 2 years
Total Cost			$ 1,185.00 / yr

I. Safety Measures and Procedures

Maintenance plans should include procedures and equipment required to protect the safety of inspection and maintenance personnel. 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 a 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.

Safety Regulations and Requirements

The maintenance personnel/contractor to follow the safety protocols as is already regulated and standardized in the industry, including but not limited to the requirements of the following:

- Occupational Safety & Health Act of 1970
- Administrative Procedures Act (APA)
- National Environmental Policy Act (NEPA)
- Regulatory Planning and Review (Executive Order 12866)

Safety Tools, Equipment and Garments

Safety Tools and Equipment	Location	Responsible Person/Contact #
Subcontractor certified by OSHA to do work necessary for clean up.		Owner: **GOMES CONSULTING LLC** **91 KOSSUTH STREET** **NEWARK, NJ 07105** **pedro@bygomes.com**
All tools and equipment necessary to be accessible by subcontractor to do the work.		OSHA Certified Subcontractor
All tools and equipment to be OSHA certified.		OSHA Certified Subcontractor
Design Engineer		Jarmel Kizel 42 Okner Parkway Livingston, NJ 973-994-9669

Qualification for Performing the Task in Special Circumstances

Stormwater Measures	Location	(OSHA) Confined-Space Entry Permit
1926.1207 Training (a) The employer must provide training to each employee whose work is regulated by this standard, at no cost to the employee, and ensure that the employee possesses the understanding, knowledge, and skills necessary for the safe performance of the duties assigned under this standard. This training must result in an understanding of the hazards in the permit space and the methods used to isolate, control or in other ways protect employees from these hazards, and for those employees not authorized to perform entry rescues, in the dangers of attempting such rescues		Obtained by Subcontractor if needed.

Personnel entering inlet and manholes to use safe confined space entry procedures		OSHA Certified Subcontractor

Safety Training

OSHA Training Requirements, 1926.1207 Training (d) The employer must maintain training records to show that the training required by paragraphs 1926.1207(a) through (c) of this standard has been accomplished. The training records must contain each employee's name, the name of the trainers, and the dates of training. The documentation must be available for inspection by employees and their authorized representatives, for the period of time the employee is employed by that employer.

Safety Procedures

To effectively control and prevent hazards, employers should:

- Involve workers, who often have the best understanding of the conditions that create hazards and insights into how they can be controlled.
- Identify and evaluate options for controlling hazards, using a "hierarchy of controls."
- Use a hazard control plan to guide the selection and implementation of controls, and implement controls according to the plan.
- Develop plans with measures to protect workers during emergencies and nonroutine activities.
- Evaluate the effectiveness of existing controls to determine whether they continue to provide protection, or whether different controls may be more effective. Review new tech
- neologies for their potential to be more protective, more reliable, or less costly.

Emergency Procedures

OSHA Training Requirements, 1910.146 Permit required confined spaces
(k) Rescue and emergency services (1) An employer who designates rescue and emergency services, pursuant to paragraph (d)(9) of this section, shall: (i) Evaluate a prospective rescuer's ability to respond to a rescue summons in a timely manner, considering the hazard(s) identified; Note to paragraph (k)(1)(i): What will be considered timely will vary according to the specific hazards involved in each entry. For example, §1910.134, Respiratory Protection, requires that employers provide a standby person or persons capable of immediate action to rescue employee(s) wearing respiratory protection while in work areas defined as IDLH atmospheres. (g) and (k)(1)(i) through (iv) 52 Training Requirements in OSHA Standards (ii) Evaluate a prospective rescue service's ability, in terms of proficiency with rescue-related tasks and equipment, to function appropriately while rescuing entrants from the particular permit space or types

of permit spaces identified; (iii) Select a rescue team or service from those evaluated that: (A) Has the capability to reach the victim(s) within a time frame that is appropriate for the permit space hazard(s) identified; (B) Is equipped for and proficient in performing the needed rescue services; (iv) Inform each rescue team or service of the hazards they may confront when called on to perform rescue at the site.

Saint Barnabas Medical Center
94 Old Short Hills Road
Livingston, NJ 07039
(973) 322-5000
Fax: (973) 322-5007

Overlook Medical Center
99 Beauvoir Avenue
Summit, NJ 07901
(908) 522-2000
Fax: (908) 273-5134

J. Training Plan and Records

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.

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

Content of Training

- **Stormwater Management Basic Training**
  - Purposes and Functions of BMPs
- Example Training Material
  - NJDEP Stormwater BMP Manual, Chapter Nine: Structural Stormwater Management Measures

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

- Vegetation Care
  Example Training Material
  - NJDEP Stormwater BMP Manual, Chapter Seven: Landscaping
  - Other
- Field Manual Usage Training
  Example Training Material
  - Field Manuals attached to this Maintenance Plan
  - “Pointy end of shovel goes into ground”.

- Equipment and Tools Operation Training
  Example Training Material
  - Equipment or tool manufacturer’s Operation & Maintenance Manual
  - Other

- Occupational Safety Training
  Example Training Material
  - OSHA Training
  - Equipment or tool manufacturer’s Operation & Maintenance Manual
  - Other

Training Records

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

K. Annual Evaluation of the Effectiveness of the Plan

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 party responsible 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)

L. Documents

Transfer Agreement

If the maintenance plan identifies a person other than the developer as having the responsibility for maintenance, the plan shall include documentation of such person's agreement to assume this responsibility, or the developer's obligation to dedicate a stormwater management facility to such person under an applicable ordinance or regulation.

OWNER OF RECORD:

GOMES CONSULTING LLC
91 KOSSUTH STREET
NEWARK, NJ 07105
pedro@bygomes.com

TRANSFER OF OWNERSHIP:
EFFECTIVE DATE OF OWNERSHIP: _____

OWNER: _____

ADDRESS: _____

PHONE: _____ FAX: _____

ALTERNATE PHONE: _____ EMAIL: _____

NOTES: _____

Deed
If the person responsible for maintenance is not a public agency, the maintenance plan and any future revisions shall be recorded upon the deed of record for each property on which the maintenance described in the maintenance plan must be undertaken.

As-Built Drawings with Drainage Plans
As-built construction plans of the stormwater management measure and copies of pertinent construction documents, such as laboratory test results, permits, and completion certificates can be requested with the Township in accordance with OPRA.

Soil Boring Logs
If any soil borings were taken prior to construction, a copy of the soil boring logs can be requested with the Township in accordance with OPRA.

Local, State, Federal Permits
Local, state, or federal permits related to the stormwater management measures for this development should be included in this Maintenance Plan. See Cost Estimate Section of This Maintenance Plan for more information.
The requirement to obtain State permits depends on specific circumstances, such as, but not limited to, the specific design of the stormwater management measures, the maintenance actions, the access and disturbance, the disposal methods, the location of disposal, the method to empty a basin, the method to dredge the basin, the pollutants in the basin, the damages to the basin, and the method to repair the basin.

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

Safety Regulations and Requirements
All local ordinances and state and federal regulations regarding occupational safety are be included in this Maintenance Plan.

Devices/Tools/Equipment Operation and Maintenance Manual and Warranties
Maintenance, repair, and replacement instructions for specialized, proprietary, and nonstandard equipment, tools, supplies, manufacturers' product instructions, and user manuals are included in this Maintenance Plan.

Part II- Field Manuals

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.

1. **INLETS**—In parking lots and driveways, rain (and melting snow) will travel across the ground as runoff to be collected into an underground piping system, by first dropping through metal grates into concrete boxes called inlets. The inlets have specially designed grates to prevent large pieces of debris and trash from getting into the inlet and pipes. All structures should be periodically inspected for debris and clean as needed.

2. **PIPES**—The runoff travels underground through the pipes to a point of discharge. These pipes are usually made of reinforced concrete (RCP), high density propylene (HDPP—usually black plastic), or polyvinyl chloride (PVC—usually white plastic). Most pipes are of solid wall construction to transport runoff water or to be used to temporarily detain water as part of the detention system. Other pipes may be perforated, which can be used to let water drain out through the holes into the

surrounding ground or water from the ground can flow into the pipes depending on soils, ground conditions, elevations, and so forth. Pipes should be periodically inspected for debris and clean as needed. Also the pipe system should be flush periodically in order to keep the sediment from accumulating inside the pipes.

3. **GUTTERS/DOWNSPOUTS/SPLASH PADS**—Under state and local stormwater regulations, runoff water flowing off of roofs is considered "clean" and does not necessarily have to be directed to the stormwater system which maybe basins, ponds, drywells, underground pipes and so forth. In general, allowing the water to flow through areas of dense vegetation (woodlands, meadows, and so forth, but not basic lawn areas) is sufficient to clean the water even further. In order for the water to flow clean, the system should be maintain clean.

4. **BioPod HF System (water Quality unit)-** BioPodTM HF is an advanced biofiltration system, designed for enhanced filtration, sorption and biological uptake to remove total suspended solids (TSS), dissolved metals, nutrients, gross solids, trash and debris as well as petroleum hydrocarbons from stormwater runoff. BioPodTM HF systems are a proven, Low-Impact Development (LID) solution for stormwater treatment that integrate seamlessly into standard site drainage and can accommodate a wide variety of vegetation to meet green infrastructure requirements.

5. **The RETAIN-IT™** Stormwater Management System (SMS)- is a versatile and efficient stormwater solution for managing urban runoff. The modular design features 8' x 8' precast concrete units with internal heights of 1.5–5'. Having one size module makes it incredibly simple to layout and design. RETAIN-IT™ modules can be stacked up to 10' to maximize storage and minimize footprint. Installation is faster and more efficient than other concrete options. The consistent module size simplifies the construction process and planning so that each module can be set within only a few minutes. With a small footprint and light pick weight, modules can typically be set directly from the truck without the need for a crane. RETAIN-IT™ modules can be customized to incorporate outlet control structures and water quality features such as sediment forebays and sand filters.

PART III—Gutters and Leaders

As part of good maintenance procedure, it is recommended that the gutters and leaders be periodically inspected and cleaned. The building drainage system should particularly be inspected during the autumn when falling and blowing leaves and miscellaneous materials can easily clog drain pipes, plug downspouts, and cover inlet grates. Gutters and leaders should also be inspected in the springtime for debris, correct pitch, loose connections, and other various problems that may have occurred over the winter. It is also suggested that the system be examined whenever large storms are predicted.

Debris removed from the drainage system should be examined for reuse. That is, it can be separated into trash, recyclables, and organic matter. Organic materials such as leaves and twigs could possibly be composted if there is sufficient room at the site for such activity.

Equipment for gutter and leader cleaning could include ladders, “grab” poles, rakes, plumber’s snakes, and garden hoses. Heavy duty rubber or leather work gloves, non-slip work shoes, and protective eyewear are also recommended.

PART IV—Inlets & Manholes

Inlets and Manholes and discharge control devices should be inspected after several storms to ensure that they are functioning properly and that there is no erosion or debris problems developing. Source of sediment contamination should be identified and controlled when native soil is exposed or erosion channels are present. Inspect for sediment and debris buildup. Sediment buildup exceeding 2 inches in depth or that begins to constrict the flow path should be removed. The Inlet control devices should particularly be inspected during the autumn when falling and blowing leaves and miscellaneous materials can easily clog drain pipes, plug downspouts, and cover inlet grates. Clean out leaves, trash, debris, etc.

Maintain records of all inspections and maintenance activity. Include estimate of sediment and/or debris removed. Indicate sediment and/or debris disposal methods.

BioPod units and Retain-it detention facility

Functionality

BioPod with infiltration are stormwater management systems designed to maximize the removal of pollutants from stormwater. They consist of a pre-treatment zone and a treatment zone. The treatment zone includes a mulch bed and underlying components. Pollutants are treated through settling, filtration, and adsorption by the mulch 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 / Filtration and Infiltration

A Retain-it infiltration 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.

PART V - Inspection Checklist / Maintenance Actions

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

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

Preventative Maintenance **Date of most recent rain event: _____**

Frequency Circle One Quarterly Annual Rain Event

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

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

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Inspected**	**Preventative / Corrective Maintenance Actions Comments**
	1	Structures broken or in disrepair, sediment, water present after 72 hours.	Y__ N__	
	2	Sediment and standing water observed after 72 hours.	Y__ N__	

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Inspected**	**Preventative / Corrective Maintenance Actions Comments**
Storm Sewer Collection system	3	Excessive sediment or debris present in the inspection port	Y__ N__	.
	4	Little or no flow into the system	Y__ N__	
	5	Downspout or Overflow pipe is clogged	Y__ N__	
	6	Odor present	Y__ N__	
Storm Sewer Collection system	7	Overflow from the top of the casting	Y__ N__	
	9	Vegetation	Y__ N__	
Site conditions	10	Embankment erosion control	Y__ N__	

	For Inspector			For Maintenance Crew
Component No. Component Name	**Inspection Item and Inspection Item No.**		**Inspected**	**Preventative / Corrective Maintenance Actions Comments**
Bio Pod (Water Quality units)	11	Inspected in accordance with Inspection and maintenance manual Attached in	Y__ N__	
Retain It (Stormwater Basin)	12	Inspected in accordance with Inspection and maintenance manual	Y__ N__	

The inspection report shall include copies of photographs depicting the conditions of the BMPs.

_____ _____ _____

Inspector Name Signature Date

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

PART VI—Maintenance Manuals (BioPod and Retain It)

BioPod™ HF

High Flow System with StormMix™ Media

Inspection and Maintenance Manual



Oldcastle Infrastructure™
A CRH COMPANY

BioPod™ High Flow (HF) Biofilter with StormMix™ Biofiltration Media

Desription

The BioPod™ HF Biofilter System (BioPod HF) is a storm water biofiltration treatment system used to remove pollutants from storm water runoff. Impervious surfaces and other urban and suburban landscapes generate a variety of pollutants that can enter storm water and contaminate downstream receiving waters unless treatment is provided. The BioPod HF system uses proprietary StormMix™ biofiltration media to capture and retain pollutants including total suspended solids (TSS), metals, nutrients, gross solids, trash and debris.

Function

The BioPod HF system uses engineered, high-flow rate filter media to remove storm water pollutants, allowing for a smaller footprint than conventional bioretention systems. Contained within a compact precast concrete vault, the BioPod HF system consists of a biofiltration chamber and an optional integrated high-flow bypass. The biofiltration chamber is filled with horizontal layers of aggregate, biofiltration media and mulch. Storm water passes vertically down through the mulch and biofiltration media for treatment. The mulch provides pretreatment by retaining most of the solids or sediment. The biofiltration media provides further treatment by retaining finer sediment and dissolved pollutants. The aggregate allows the media bed to drain evenly for discharge through an underdrain pipe or by infiltration.

Inspection & Maintenance Overview

State and local regulations require all storm water management systems to be inspected on a regular basis and maintained as necessary to ensure performance and protect downstream receiving waters. Without maintenance, excessive pollutant buildup can limit system performance by reducing the operating capacity of the system and increasing the potential for scouring of pollutants during periods of high flow.

The BioPod HF may require periodic irrigation to establish and maintain vegetation. Vegetation will typically become established about two years after planting. Irrigation requirements are ultimately dependent on climate, rainfall and the type of vegetation selected.

Inspection & Maintenance Frequency

Periodic inspection is essential for consistent system performance and is easily completed. Inspection is typically conducted a minimum of twice per year, but since pollutant transport and deposition varies from site to site, a site-specific maintenance frequency should be established during the first two or three years of operation.

Inspection Equipment

The following equipment is helpful when conducting BioPod HF inspections:

- Recording device (pen and paper form, voice recorder, iPad,etc.)
- Suitable clothing (appropriate footwear, gloves, hardhat, safety glasses, etc.)
- PPE as required for entry
- Traffic control equipment (cones, barricades, signage, flagging, etc.)
- Manhole hook or pry bar
- Flashlight
- Tape measure
- Socket

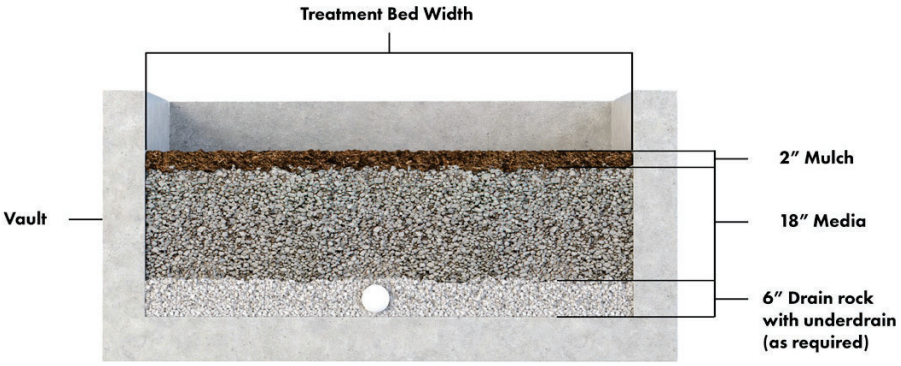
Inspection Procedures

BioPod HF inspections are visual and are conducted without entering the unit. To complete an inspection, safety measures including traffic control should be deployed before the access covers or tree grates are removed. Once the covers have been removed, the following items should be checked and recorded (see form provided on page 8) to determine whether maintenance is required:

- If the BioPod HF unit is equipped with an internal bypass, inspect the inlet chamber and outlet chamber and note whether there are any broken or missing parts. In the unlikely event that internal parts are broken or missing, contact Oldcastle Storm water at (800) 579-8819 to determine appropriate corrective action.
- Note whether the curb inlet or inlet pipe is blocked or obstructed.
- If the unit is equipped with an internal bypass, observe, quantify and record the accumulation of trash and debris in the inlet chamber. The significance of accumulated trash and debris is a matter of judgment. Often, much of the trash and debris may be removed manually at the time of inspection if a separate maintenance visit is not yet warranted.
- If it has not rained within the past 24 hours, note whether standing water is observed in the biofiltration chamber.
- Finally, observe, quantify and record presence of invasive vegetation and the amount of trash and debris and sediment load in the biofiltration chamber. Erosion of the mulch and biofiltration media bed should also be recorded. Often, much of the invasive vegetation and trash and debris may be removed manually at the time of inspection if a separate maintenance visit is not yet warranted. Sediment load may be rated light, medium or heavy depending on the conditions. Loading characteristics may be determined as follows:
  - **Light sediment load** – sediment is difficult to distinguish among the mulch fibers at the top of the mulch layer; the mulch appears almost new.
  - **Medium sediment load** – sediment accumulation is apparent and may be concentrated in some areas; probing the mulch layer reveals lighter sediment loads under the top 1” of mulch.
  - **Heavy sediment load** – sediment is readily apparent across the entire top of the mulch layer; individual mulch fibers are difficult to distinguish; probing the mulch layer reveals heavy sediment load under the top 1” of mulch.

Maintenance Indicators

Mulch acts as a prefilter to protect the StormMix™ media from sediment loading and subsequent loss of hydraulic capacity. As runoff carries sediment into the BioPod HF, the sediment will accumulate on top of the mulch layer and then, over time, begin to work its way down through the mulch and eventually into the media bed. Mulch replacement should be performed when the mulch layer is full of sediment but the StormMix media is still relatively clean. Maintenance personnel should observe sediment accumulation on the surface of the mulch layer and then dig down into the mulch and potentially into the media bed to the point where the mulch or media appears relatively clean. The sediment penetration depth can be used to rate the sediment load and determine maintenance requirements as follows:



BioPod™ HF

Sediment Conditions	Inspection Rating	Maintenance Requirements
Little visible sediment	Light sediment load	None
Sediment on mulch surface only	Light sediment load	None
Sediment throughout mulch layer	Medium sediment load	Minor maintenance
Sediment less than 3" into media layer	Medium sediment load	Minor maintenance
Sediment less more 3" into media layer	Heavy sediment load	Full maintenance
Standing water on top of media layer	Heavy sediment load	Full maintenance

The following photographs help illustrate these conditions.

Light Sediment Load

- Little visible sediment or light sediment on mulch surface only
- Mulch layer appears relatively fresh, open, and fibrous
- No maintenance required



Medium Sediment Load

- Thick sediment throughout mulch layer and up to 3” into top of media layer
- Digging down 3” to 6” below the top of the mulch reveals relatively clean media with little sediment accumulation
- Minor maintenance required



Heavy Sediment Load

- Thick sediment throughout mulch layer and more than 3” into top of the media bed
- Digging down more than 6” below the top of the mulch layer reveals heavy sediment accumulation
- Full maintenance required



Heavy Sediment Load

- Thick sediment and standing water on surface of mulch layer more than 24 hours after a storm event
- Full maintenance required



Maintenance should be scheduled if any of the following conditions are identified during inspection:

- The concrete structure is damaged or the tree grate or access cover is damaged or missing
- The inlet obstructed
- Standing water is observed in the biofiltration chamber more than 24 hours after a rainfall event (use discretion if the BioPod HF is located downstream of a storage system that attenuates flow)
- Trash and debris in the inlet chamber cannot be easily removed at the time of inspection
- Trash and debris, invasive vegetation or sediment load in the biofiltration chamber is heavy or excessive erosion has occurred

Maintenance Equipment

- Suitable clothing (appropriate footwear, gloves, hardhat, safety glasses, etc.)
- PPE as required for entry
- Traffic control equipment (cones, barricades, signage, flagging, etc.)
- Manhole hook or pry bar
- Flashlight
- Tape measure
- Rake, hoe, shovel and broom
- Bucket
- Pruners
- Vacuum truck (optional)
- Socket

Maintenance Procedures

Maintenance should be conducted during dry weather when no flows are entering the system. In most cases, maintenance may be conducted without entering. Entry may be required to maintain depending on system depth. Once safety measures such as traffic control are deployed, the access covers may be removed and the following activities may be conducted to complete maintenance:

- Remove all trash and debris from the inlet chamber manually or by using a vacuum truck as required.
- Remove all trash and debris and invasive vegetation from the biofiltration chamber manually or by using a vacuum truck as required.
- If the sediment load is medium or light but erosion of the biofiltration media bed is evident, redistribute the mulch with a rake or replace missing mulch as appropriate. If erosion persists, rocks may be placed in the eroded area to help dissipate energy and prevent recurring erosion.
- If the sediment load is heavy, remove the mulch layer using a hoe, rake, shovel and bucket, or by using a vacuum truck as required. If the sediment load is particularly heavy, inspect the surface of the biofiltration media once the mulch has been removed. If the media appears clogged with sediment, remove and replace one or two inches of biofiltration media prior to replacing the mulch* layer.
- Prune vegetation as appropriate and replace damaged or dead plants as required.
- Replace the tree grate and/or access covers and sweep the area around the BioPod HF to leave the site clean.
- All material removed from the BioPod HF during maintenance must be disposed of in accordance with local environmental regulations. In most cases, the material may be handled in the same manner as disposal of material removed from sumped catch basins or manholes.

* NoFloat cypress mulch should be used in the BioPod HF. Timely replacement of the mulch layer according to the maintenance indicators described above should protect the biofiltration media below the mulch layer from clogging due to sediment accumulation. However, whenever the mulch is replaced, the BioPod HF should be visited 24 hours after the next major storm event to ensure that there is no standing water in the biofiltration chamber. Standing water indicates that the biofiltration media below the mulch layer is clogged and must be replaced. Please contact Oldcastle Infrastructure at (800) 579-8819 to purchase the proprietary StormMix™ biofiltration media.



Biopod HF Planter



Biopod HF Tree

BioPod HF Inspection & Maintenance Log

BioPod HF Model _____ **Inspection Date** _____

Location _____

Condition of Internal Components — **NOTES:**

☐ Good ☐ Damaged ☐ Missing

Curb Inlet Blocked — **NOTES:**

☐ Yes ☐ No

Standing Water in Biofiltration Chamber — **NOTES:**

☐ Yes ☐ No

Trash and Debris in Inlet Chamber — **NOTES:**

☐ Yes ☐ No

Trash and Debris in Biofiltration Chamber — **NOTES:**

☐ Yes ☐ No

Invasive Vegetation in Biofiltration Chamber — **NOTES:**

☐ Yes ☐ No

Sediment in Biofiltration Chamber — **NOTES:**

☐ Light ☐ Medium ☐ Heavy

Erosion in Biofiltration Chamber — **NOTES:**

☐ Yes ☐ No

Maintenance Requirements

☐ YES - Schedule Maintenance ☐ NO - Schedule Re-Inspection

retain-it®
Stormwater Management Systems

OWNERS MAINTENANCE MANUAL

retain-it, LLC
560 Salmon Brook Street
Granby, CT 06035
(860) 413-3050

retain-it ®

Owners Maintenance Manual

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Sample Maintenance Log

Description

retain-it ® is a subsurface Storm Water Management system constructed of precast concrete structures. They are installed in a side by side configuration creating a continuous internal flow channel integrated throughout the system. Systems are constructed with designated inlet and outlet modules, some with multiple inlets and outlets depending on the site storm water system layout. Infiltration systems typically have an inlet and sidewalls/ base constructed on a stone infiltration blanket with geofabric installed at the native soil interface. Other systems incorporate outlet flow control devices. Detention systems are typically lined with a watertight membrane and have inlet and outlet control devices.

The retain-it ® system can consist of multiple varying layouts, with no two the same. Given this, it should be noted that the operation and maintenance requirements are very similar regardless of the intended layout. It is important that the end user know the specific elements of each system so as to understand how best to optimize it's operation.

Installation per Design: Operation is simple to follow where the installation was performed in accordance with the design specifications, drawings and calculations. Specifics shall be identified in the design drawings. As-built drawings will benefit the locating of specific design modules where the system has been buried below a parking lot area. Optional access manholes or removable grates may be installed above every inlet/outlet pipe and at critical design elements designated by the design.

Daily Operation and Long Term Maintenance: In general, daily usage of the system is self sufficient and will operate without requiring any outside assistance, except for periodic inspection to verify optimal performance and maintenance for removal of collected pollutants. A longer term maintenance program should incorporate a more thorough inspection of the all elements of the system to verify proper operating condition. This is more important with the infiltration type of systems where the soil infiltration surface may become restricted due to fine particle build up. Long term maintenance should include provisions for cleaning and removal of collected solids, oils and debris from the system.

System Operation: The system operational function is initiated according to rainfall runoff flows entering the structure. Internally, the runoff flows in a set pattern or sequence throughout the module layout in accordance with the hydraulic design conditions. The flows primarily operate on system head derived from the changes in

elevation from the internal water surface and the outlet invert elevation. Some designs incorporate internal flow controls to satisfy hydraulic conditions that enhance water quality treatment or other intended purposes. Modified systems may incorporate a pump, but in general there are no mechanical apparatus required.

End user operations primarily consist of inspection and maintenance of the system over time.

Periodic Inspection: Important note - All storm water management systems react differently depending on the conditions that are characteristic to the contributing water shed. Variables such as storm intensity, runoff flow rates, site geology, surface stabilization and pollution load will affect the system operation. As does the inspection and maintenance frequency to ensure optimum effectiveness.

Inspections should be done periodically, with a greater number scheduled during the system start up and less frequently as the operator becomes familiar with the system performance characteristics. It is recommended that the end user keep records of the performance using the inspection log record sheet found in the back of this manual. These records shall identify the cycle of maintenance “system calibration” required for the specific applications based on the contributing water shed variables operating under “normal” conditions.

Please note that immediate maintenance may be required during “non-normal” events such as during adverse weather conditions or emergency fuel spills. See information on emergency spills in this manual.

Visual inspection of all assessable components shall be performed throughout the lifetime of the system. Access has been supplied at critical points to monitor hydraulic performance and removed pollutants buildup.

Standard Maintenance:

After construction has been completed and all disturbed surfaces have been stabilized by means of vegetation, asphalt or concrete surfaces, and all drainage system components have been constructed and are free of construction debris and sediments; then the storm water management system can be considered in an operational status.

Periodic visual inspections will help to identify issues of concern.The usual indicators are signs of slow flows, backed up water, visible oil, trash and debris or an excessive amount of sediment in the storage area.

Normal operational flows can be observed to flow freely at the predicted design elevations, from the inlet to the outlet module, following a serpintine path thru the storage and attenuation modules. Note that some modules are designed to permanently

retain water where others may hold water and slowly release it over a typical 24 hour period. During a storm water event, the flows and water surface elevations will fluctuate from a low flow to a high flow/ storage status. The storage modules should fill during the event and drain down within a 24 hour period after the event has stopped. All pipes, orifices, weirs and standpipes should pass flows freely and at optimum capacity.

Standard maintenance is performed using a vacuum truck to suction the accumulated sediments, oils and greases and trash and debris from the system. Whereas an on-site maintenance staff can remove these items by hand, it is preferred that the vacuum truck be used as dictated by specific system conditions. When a specialized module designed to have a permanent water level is used, the vacuum truck should pump the liquid level down to inspect the below water elevation structures and sump storage areas.

Oils and greases can be handled by on-site staff by utilizing absorbent products that soak up the oils (and not) converting the oils from a liquid into a manageable solid form. These oil soaked absorbent materials should be disposed of in an approved manner.

Sediments, trash and debris shall be removed and disposed of in an approved manner.

Any indications of hazardous material, determined by visual inspection, testing, smell or abnormality, should be reported and handled per appropriate regulations.

Flow Conditions

System operators should familiarize themselves with proper hydraulic flow condition indicators, acceptable depths of sedimentation, debris and trash build up, and concentrations of oils and greases.

Hydraulic flow conditions are those that are established by the design as either a flow/storage or as a water quality treatment function. Both have performance characteristics that can be visually identified so as to determine the effective and efficient operation of the system.

The engineering design drawings should note the various expected water surface level elevations that are achieved during different design storms within the various modules. Since it is difficult for a visual inspection to coincide with the exact time given water elevations are predicted, the following guidelines are given for evaluation.

Visual Inspection Guide:

<u>Internal Flow Evaluation</u>

Low flow: water should flow freely from the inlet to the outlet, travelling the intended attenuation path thru the system with the water surface elevation below the structure

beam height (12” deep), the system should drain completely 24 hours after a storm event,

Medium flow: the system should hold and maintain a water level during the 24 hour storm event and yet continually fill as the storm increases or drain downward as the event recedes. Flow within the system should occur freely from inlet to outlet only being restricted when a flow control structure has been integrally designed in place. Flow control devices may result in a water level backing up either temporarily or permanently; noting devices such as water quality modules may require a permanent water level to operate properly (see water quality treatment). Other system applications should drain completely 24 hours after a storm event.

High flow: the system should fill to the maximum design storm water level elevation (hydraulic grade line) per design. In most cases, that is the highest storage elevation available in the system, at the underside of the module top slab, or the invert of the overflow pipe. As the storm event recedes, the water level should begin to drain down via flow thru the system and discharge. The system should drain completely within 24 hours after a storm event.

Pollutant Storage Capacities

<u>Oil and Grease</u>

Oil and Grease Collection (with optional Oil water separator module specified) - Oil and grease accumulation is generally a function related to vehicle parking lot and drive areas, oil generating land uses or emergency spill conditions. It is important to maintain the system from accumulating excessive volumes of oils in that they may wash over into other sections of the system potentially clogging and reducing the infiltration capacity, blocking control devices and contaminating the overall system. The following standards apply.

Oil should not accumulate more than a visible sheen on the water surface in the oil water separation module only. A sheen is described as a fine, thin oil layer on the water surface identified by the glossy rainbow colors. A dipstick (dry wooden stick) can be used as a probe to determine the thickness of oil on the surface.

Accumulated oils could be associated with insufficient maintenance or a potential large volume oil resource. Any accumulation of oil should be promptly maintained by an experienced waste handler. Emergency spills such as those generated by an accidental spill shall be contained and removed immediately before the next storm event. Spills shall be handled in accordance with local environmental regulations. See spill and accumulated oil maintenance procedures.

Sediments

Sediments (with optional primary grit module or sedimentation modules specified) - Sediments shall be periodically removed from the system as they accumulate within the designated storage modules. The inlet modules are generally equipped with a sediment storage sump located in the base of the inlet structure. Inspection should be performed after major storm events or a minimum of annually, unless a different inspection cycle has been determined to be sufficient. Inspection shall consist of using a probe to determine the presence of and depth of the accumulated solids. Access is via the 24" manhole.

Note that excessive volumes of sediments will reduce the performance and efficiency of the system. Regional accumulations of solids such as those associated with ice and snow, may result in large springtime volumes of sand and gravels used for traction and ice control.

Trash and Debris

Trash and Debris (with optional trash and debris module specified) - Trash and debris accumulates in the inlet module in three forms; floating debris, neutrally buoyant, and heavy material. The floating debris is visible from the access manhole floating on the water surface in the form of but not limited to wood, paper, plastic, foam, bottles and cans. The neutrally buoyant material resides below the surface and combines with the natural flow regime of the system. It is hard to detect and can only be recognized when at a high concentration appears as a thickening of the water viscosity. Heavier material will simply settle to the sump base and combine with the sediments.

Note that trash and debris typically cause the most problems when they become lodged in a flow control device such as an outlet elbow, riser pipe, and orifice or weir structure. This can be detected visibly when the system is pumped down during maintenance. It can also be evaluated as a condition when flow is impeded and the water level backs up higher than the design elevations.

Emergency Spill Conditions (with optional emergency spill control module specified):

Emergency spill conditions are defined as an excessive accumulation of hydrocarbons such as oil, gasoline, diesel fuel, transmission oil or antifreeze usually resulting from an accidental discharge. Excessive accumulation is described as any amount larger than a thin "sheen" visible on the water surface.

Care should be given in handling these types of fluids. The incident should be reported to the appropriate authorities and should be mitigated by a hazardous waste consultant approved for such matters.

retain-it ®

Maintenance Log

Storm Water Management System

Location: ID #:

Date	Inspection Notes	Inspector

Note the following conditions:

Inlet Module

Outlet Module

Water Quality Module

Oil Elbow

Oil Accumulation

Sedimentation Accumulation

Trash and Debris Quantity

Flow Conditions

Flow Control Outlet Structure

Overflow Pipe