



Stormwater Measures Maintenance Plan

***Prepared for
Princeton Audi Service Center
Lot 64 in Block 34001
Montgomery Township
Somerset County, New Jersey***

***November 10, 2015
Revised January 18, 2016***

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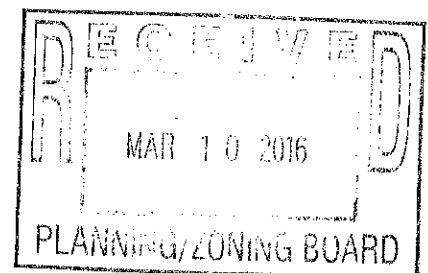


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Development Name: Princeton Audi Service Center

Address: Cherry Valley Road

Block(s) / Lot(s): 34001 / 64

Township, County: Montgomery Twp.

Party Responsible for Maintenance:

Princeton Audi

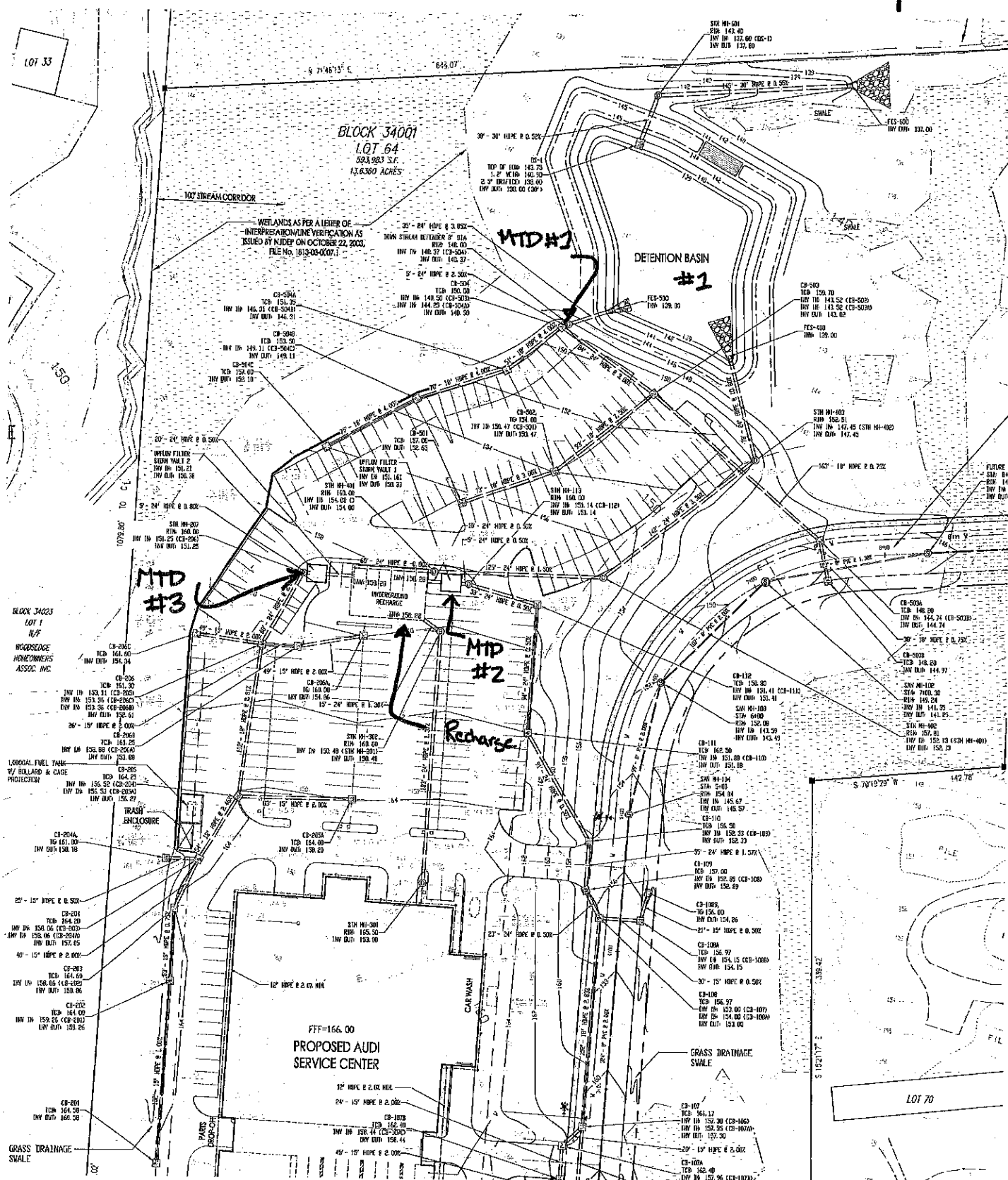
Address: 959 Route 206 Princeton, New Jersey 08540

Phone: 609-921-6401

This plan is recorded in

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

Last Revised on 01 / 18 / 2016



Location Plan

List of Stormwater Management Measures

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

Type of Stormwater Management Measure	BMP No.	Location Description	State Plane Coordinates / Lat., Long.
Extended Detention Basin	Basin #1	Northern side of site	N: 568004.17 E: 448249.49
Downstream Defender	MTD#1	Southwest corner of the detention basin	N: 567900.06 E: 448205.12
Upflow Filter Vault #1	MTD #2	Central Parking Lot	N: 567694.58 E:448172.01
Upflow Filter Vault #2	MTD #3	Central Parking Lot	N: 567675.41 E:448075.14
Underground Recharge Facility	Basin #2	Central Parking Lot	N: 567659.67 E: 448112.18

Description of Stormwater Management Measures

Extended Detention Basin

Design storm:

- Design Purposes:
 - o Water quality, water quantity
 - o 1.25 inches in 2 hours
 - o 2-year storm (3.3 inches);
 - o 10-year storm (5.0 inches);
 - o 100-year storm (8.2 inches)
- Dimensions: 163 ft. (Length) x 154 ft. (Width) x 6.1 ft.(Depth)

Downstream Defender

Design storm:

- Design Purposes:
 - o Water quality
 - o 1.25 inches in 2 hours

Upflow Filter Storm Vault

Design storm:

- Design Purposes:
 - o Water quality
 - o 1.25 inches in 2 hours

Underground Recharge Facility

Design storm:

- Design Purposes:
 - o Groundwater recharge
 - o 1.25 inches in 2 hours
- Dimensions: 52 ft. Length x 36.25 ft. Width x 4.2 ft. Depth

Overview of Stormwater Management Measures

In order to comply with the NJAC 7:8-2004 NJDEP Stormwater Regulations, an extended detention facility along with a manufactured treatment device is proposed to handle the increased runoff from the improved areas.

In order to comply with the water quality requirements set in the N.J.A.C. 7:8 -5.5, post construction load of total suspended solids (TSS) in stormwater runoff generated from the water quality design storm must be reduced by 80 percent.

This will be accomplished by the use of multiple manufactured treatment devices and an extended detention basin.

Soil percolation testing within the basin was not acceptable. The use of an underground Groundwater Recharge Facility, in the only location on site with passing percolation rates, is proposed. Two manufactured treatment devices are utilized to provided 80% TSS removal prior to stormwater entering the Groundwater Recharge Facility. The parking lot located at the northern end of the site will utilize a manufactured treatment device and an extended detention basin to achieve 80%TSS removal. Please see the appendix for design calculations.

Inspection Checklist / Maintenance Actions

Extended Detention Basin

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
A1 Pretreatment (Forebay)	1	Scouring or erosion is present at inlet structure and/or riprap apron	Y___ N___	Check the flow diversion device before the inlet pipe and whether the bypass flow channel is clogged Work Order # _____
	2	Clogged pipes or excessive sediment in the forebay	Y___ N___	Remove sediment or debris
	3	Damaged outlet structure (e.g., cracking, subsidence, spalling, erosion, or deterioration)	Y___ N___	Repair or replace the outlet structure Work Order # _____
A2 Pretreatment (MTD, if installed)	1	MTD inspection	Y___ N___	(If a MTD is used for pretreatment, see manufacturer's maintenance manual)
A3 Pretreatment (Structural BMP)	1	BMP inspection	Y___ N___	(See BMP No. _____ Field Manual)

Component No. Component Name	For Inspector		For Maintenance Crew
	Inspection Item and Inspection Item No.	Result	Preventative / Corrective Maintenance Actions
Note:			
B Basin Bed	1	Observed detention time is longer than the design detention time. Observed detention time is approximately _____ hours.	Y__ N__ Check if outlets are clogged, see section E-Outlet of this checklist
	2	Standing water is present after the design drain time The observed drain time is approximately _____ hours.	Y__ N__ Recheck to determine if there is standing water after 72 hours If standing water is present longer than 5 days, report to mosquito commission Check if the low flow outlet is clogged
	3	Excessive sediment, silt, or trash accumulation on low flow channel (if applicable)	Y__ N__ Clean pretreatment system Remove silt, sediment, and trash
	4	Excessive sediment, silt, or trash accumulation on basin bed	Y__ N__ Clean pretreatment system Remove silt, sediment, and trash

Component No. Component Name	For Inspector		Result	For Maintenance Crew
	Inspection Item and Inspection Item No.			Preventative / Corrective Maintenance Actions
	5	Erosion or channelization is present	Y__ N__	Check whether the flow bypass or diversion device is clogged Re-grade the basin bed Work Order # _____
	6	Damaged low flow channel or scouring under the channel	Y__ N__	Check for new runoff source to the drainage area Repair or replace low flow channel Work Order # _____
Note:				
B Basin Bed	7	Animal burrows/rodents are present	Y__ N__	Pest control Work Order # _____
	8	Liner of the basin is visible and/or is damaged (if applicable)	Y__ N__	Repair or replace liner Work Order # _____
C Vegetation	1	Large spot(s) showing bare soil	Y__ N__	Vegetative cover must be maintained at 85%. Revegetate the entire basin if 50% or more vegetation has been lost Check Landscaping plan for guidance (if available) Work Order # _____
	2	Overgrown vegetation	Y__ N__	Mow/trim the vegetation Work Order # _____

Component No. Component Name	For Inspector		Result	For Maintenance Crew
	Inspection Item and Inspection Item No.			Preventative / Corrective Maintenance Actions
	3	Tree growth in the basin	Y___ N___	Clear, trim, or prune the trees according to the original Landscaping Plan Inspect to determine if the tree roots caused any structural damage Work Order # _____
Note:				
D Basin Embankment and Side Slopes	1	Signs of erosion, soil slide or bulges, seeps and wet spots, loss of vegetation, or erosion on the basin slope	Y___ N___	Check for excessive overland runoff flow through the embankment. Check for any sink hole development Direct the overland runoff to the forebay or pretreatment area Restabilize the bank Work Order # _____
E Outlet	1	Trash or debris accumulation more than 20%	Y___ N___	Clean and remove Determine source of trash and address to reduce future maintenance costs or basin failure

Component No. Component Name	For Inspector		For Maintenance Crew	
	Inspection Item and Inspection Item No.	Result	Preventative / Corrective Maintenance Actions	
	2	Trash rack is damaged or rusted greater than 50% Trash rack is bent, loose, or missing parts	Y__ N__	Repair or replace trash rack Work Order # _____
	3	Outlet components (e.g., orifice plates or weir plate) skewed, misaligned, or missing	Y__ N__	Repair or replace component Work Order # _____
	4	Discharge pipe apron is eroded or scoured	Y__ N__	Restabilize the discharge riprap apron Work Order # _____
	5	Standing water is present in the outlet structure longer than 72 hours	Y__ N__	Pump out the standing water Work Order # _____
Note:				
F Emergency Spillway	1	Trees or excessive vegetation present	Y__ N__	Remove trees and roots, and restore berms if necessary Work Order # _____
	2	Damaged structure	Y__ N__	Repair Work Order # _____
	1	Fence: broken or eroded parts	Y__ N__	Repair or replace Work Order # _____

	For Inspector		For Maintenance Crew
Component No. Component Name	Inspection Item and Inspection Item No.	Result	Preventative / Corrective Maintenance Actions
G Miscellaneous	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

Preventative Maintenance Record

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

Work Logs

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

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

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

Debris, sediment, and trash are handled (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.** ----- **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.

Inspection Checklist / Maintenance Actions

MTD

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 following 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	1	Y__ N__	
	2	Y__ N__	
	3	Y__ N__	
	4	Y__ N__	
	5	Y__ N__	
B	1	Y__ N__	
	2	Y__ N__	
	3	Y__ N__	
	4	Y__ N__	
	5	Y__ N__	
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
Required activities depend on the MTD		

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 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): _____

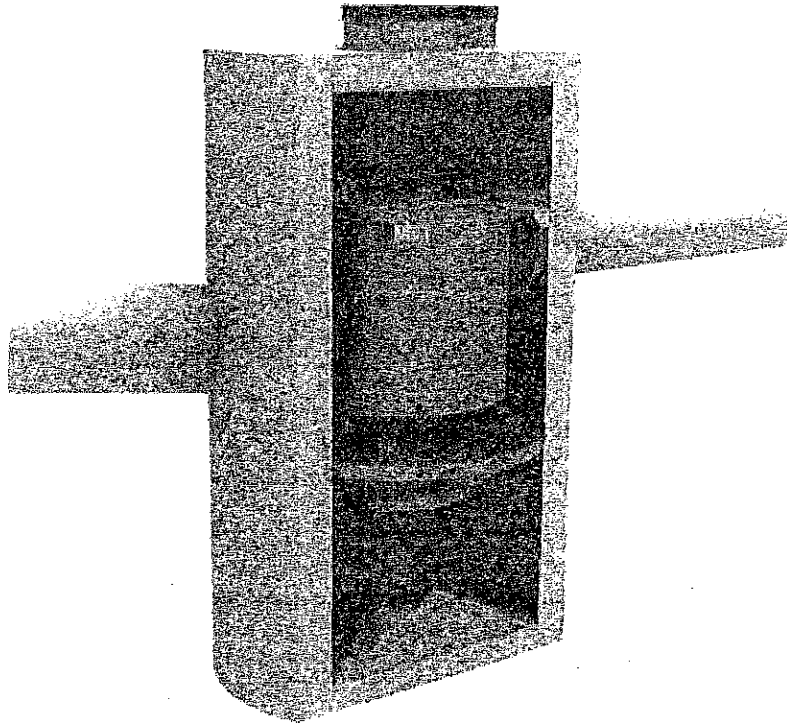
Approved by _____ / _____ **Date** _____
(name/signature)

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

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



Hydro 
International



Operation and Maintenance Manual

Downstream Defender®

Vortex Separator for Stormwater Treatment

Stormwater Solutions
Turning Water Around ...®

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4	Maintenance <ul style="list-style-type: none">- Overview- Determining Your Maintenance Schedule
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8	Downstream Defender® Installation Log
9	Downstream Defender® Inspection Log
10	Downstream Defender® Maintenance Log

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DISCLAIMER: Information and data contained in this manual is exclusively for the purpose of assisting in the operation and maintenance of Hydro International plc's Downstream Defender®. No warranty is given nor can liability be accepted for use of this information for any other purpose. Hydro International plc have a policy of continuous product development and reserve the right to amend specifications without notice.

Downstream Defender® by Hydro International

The Downstream Defender® is an advanced Hydrodynamic Vortex Separator designed to provide high removal efficiencies of settleable solids and their associated pollutants, oil, and floatables over a wide range of flow rates.

The Downstream Defender® has unique, flow-modifying internal components developed from extensive full-scale testing, CFD modeling and over thirty years of hydrodynamic separation experience in wastewater, combined sewer and stormwater applications. These internal components distinguish the Downstream Defender® from simple swirl-type devices and conventional oil/grit separators by minimizing turbulence and headlosses, enhancing separation, and preventing washout of previously stored pollutants.

The high removal efficiencies and inherent low headlosses of the Downstream Defender® allow for a small footprint making it a compact and economical solution for the treatment of non-point source pollution.

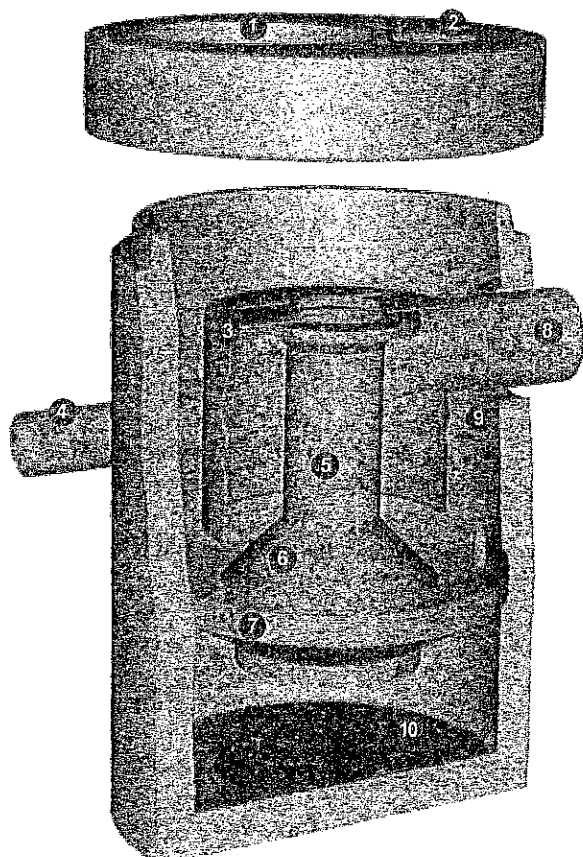
See page 12 for more about Hydro International's Stormwater BMP Maintenance Contractor Certification Program.

Benefits of the Downstream Defender®

- Removes sediment, floatables, oil and grease
- No pollutant washouts
- Small footprint
- No loss of treatment capacity between clean-outs
- Low headloss
- Efficient over a wide range of flows
- Easy to install
- Low maintenance

Applications

- New developments and retrofits
- Utility yards
- Streets and roadways
- Parking lots
- Pre-treatment for filters, infiltration and storage
- Industrial and commercial facilities
- Wetlands protection
- Pretreatment to Low Impact Development practices



Downstream Defender® Components

1. Central Access Port (all models)
2. Floatables Access Port (6-ft/1.8m, 8-ft/2.4m, 10-ft/3.0m and 12-ft/3.7m models only)
3. Dip Plate with Integral Floatables Lid
4. Tangential Inlet
5. Center Shaft
6. Center Cone
7. Benching Skirt
8. Outlet Pipe
9. Floatables Storage Zone
10. Isolated Sediment Storage Zone

Fig.1 Components of the Downstream Defender®.



Operation

Introduction

The Downstream Defender® operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirement and is manufactured from durable non-corrosive components. No manual procedures are required to operate the unit and maintenance is limited to monitoring accumulations of stored pollutants and periodic clean-outs. The Downstream Defender® has been designed to allow for easy and safe access for inspection/monitoring and clean-out procedures. Entry into the unit or removal of the internal components is not necessary for maintenance, thus safety concerns related to confined-space-entry are avoided.

Pollutant Capture and Retention

The internal components of the Downstream Defender® have been designed to protect the oil/floatingables and sediment storage volumes so that separator performance is not reduced as pollutants accumulate between clean-outs (Fig.2). The Downstream Defender® vessel remains wet between storm events. Oil and floatingables are stored on the water surface in the outer annulus separate from the sediment storage volume in the sump of the unit providing the option for separate oil disposal, and accessories such as adsorbent pads. Since the oil/floatingables and sediment storage volumes are isolated from the active separation region, the potential for re-suspension and washout of stored pollutants between clean-outs is minimized.

Wet Sump

The sump of the Downstream Defender® retains a standing water

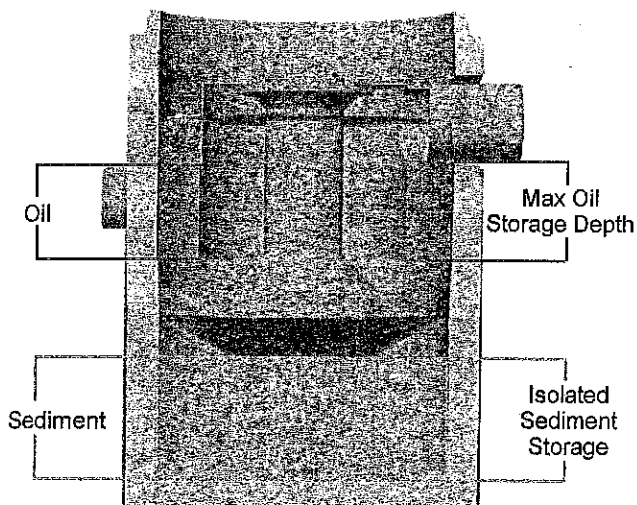


Fig.2 Pollutant storage volumes of the Downstream Defender®.

level between storm events. The water in the sump prevents stored sediment from solidifying in the base of the unit. (The clean-out procedure becomes more difficult and labor intensive if the system allows fine sediment to dry-out and consolidate. Dried sediment must be manually removed by maintenance crews. This is a labor intensive operation in a hazardous environment.)

Blockage Protection

The Downstream Defender® has large clear openings and no internal restrictions or weirs, minimizing the risk of blockage and hydraulic losses. In addition to increasing the system headloss, orifices and internal weirs can increase the risk of blockage within the unit.

Maintenance

Overview

The Downstream Defender® protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term functioning of the Downstream Defender®. The Downstream Defender® will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the Downstream Defender® will no longer be able to store removed sediment and oil. Maximum pollutant storage capacities are provided in Table 1.

Hydro International recommends that maintenance crews watch the Downstream Defender® maintenance training video at www.hydro-int.com/us/products/downstream-defender. Maintenance providers are also encouraged to participate in Hydro International's Maintenance Contractor Certification Program (see page 12).



Fig.3 Watch the Downstream Defender® instructional maintenance video at www.hydro-int.com/us/products/downstream-defender.

The Downstream Defender® allows for easy and safe inspection, monitoring and clean-out procedures. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables. Access ports are located in the top of the manhole. On the 6-ft (1.8m), 8-ft (2.4m), 10-ft (3.0m) and 12-ft (3.7m) units, the floatables access port is above the outlet pipe between the concrete manhole wall and the dip plate. The sediment removal access ports for all Downstream Defender® models are located directly over the hollow center shaft.

Maintenance events may include Inspection, Oil & Floatables Removal, and Sediment Removal. Maintenance events do not require entry into the Downstream Defender®, nor do they require the internal components of the Downstream Defender® to be removed. In the case of inspection and floatables removal, a vactor truck is not required. However, a vactor truck is required if the maintenance event is to include oil removal and/or sediment removal.

Determining Your Maintenance Schedule

The frequency of cleanout is determined in the field after installation. During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge Judge® can be used to determine the level of accumulated solids stored in the sump. This information can be recorded in the maintenance log (see page 9) to establish a routine maintenance schedule.

The vactor procedure, including both sediment and oil/floatables removal, for a 6-ft (1.8m) Downstream Defender® typically takes less than 30 minutes and removes a combined water/oil volume of about 500 gallons (1900 liters).

Inspection Procedures

Inspection is a simple process that does not involve entry into the Downstream Defender®. Maintenance crews should be familiar with the Downstream Defender® and its components prior to inspection.

Scheduling

- It is important to inspect your Downstream Defender® every six months during the first year of operation to determine your site-specific rate of pollutant accumulation
- Typically, inspection may be conducted during any season of the year
- Sediment removal is not required unless sediment depths exceed 75% of maximum clean-out depths stated in Table 1

Recommended Equipment

- Safety Equipment and Personal Protective Equipment (traffic cones, work gloves, etc.)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net
- Sediment probe (such as a Sludge Judge®)
- Trash bag for removed floatables
- Downstream Defender® Maintenance Log

Table 1. Downstream Defender® Pollutant Storage Capacities and Max. Cleanout Depths.

Unit Diameter		Total Oil Storage		Oil Clean-out Depth		Total Sediment Storage		Sediment Clean-out Depth		Max. Liquid Volume Removed	
(ft)	(m)	(gal)	(L)	(in)	(cm)	(yd³)	(m³)	(in)	(cm)	(gal)	(L)
4	1.2	70	265	<16	<41	0.70	0.53	<18	<45	384	1,454
6	1.8	216	818	<23	<58	2.10	1.61	<24	<61	1,239	4,690
8	2.4	540	2,044	<33	<84	4.65	3.56	<30	<76	2,884	10,917
10	3.0	1,050	3,975	<42	<107	8.70	6.65	<36	<91	5,546	20,994
12	3.7	1,770	6,700	<49	<125	14.70	11.24	<42	<107	9,460	35,810

NOTES

1. Refer to Downstream Defender® Clean-out Detail (Fig.2) for measurement of depths.
2. Oil accumulation is typically less than sediment, however, removal of oil and sediment during the same service is recommended.
3. Remove floatables first, then remove sediment storage volume.
4. Sediment removal is not required unless sediment depths exceed 75% of maximum clean-out depths stated in Table 1.



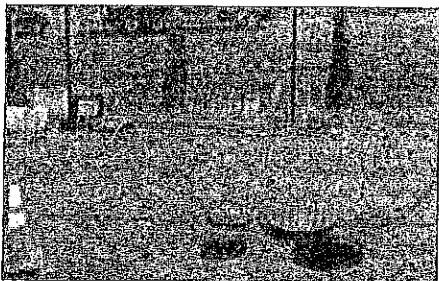


Fig.4



Fig.5

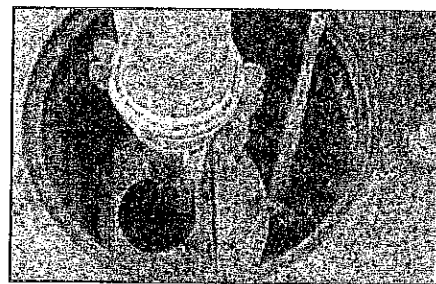


Fig.6

Inspection Procedures

1. Set up any necessary safety equipment around the access port or grate of the Downstream Defender® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the lids to the manhole (Fig. 4). NOTE: The 4-ft (1.2m) Downstream Defender® will only have one lid.
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. See Fig.7 and 8 for typical inspection views.
4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the outer annulus of the chamber.
5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel (Fig.5).
6. On the Maintenance Log (see page 9), record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.

7. Securely replace the grate or lid.
8. Take down safety equipment.
9. Notify Hydro International of any irregularities noted during inspection.

Floatables and Sediment Cleanout

Floatables cleanout is typically done in conjunction with sediment removal. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig.6).

Floatables and loose debris can also be netted with a skimmer and pole. The access port located at the top of the manhole provides unobstructed access for a vacuor hose and skimmer pole to be lowered to the base of the sump.

Scheduling

- Floatables and sump cleanout are typically conducted once a year during any season.
- If sediment depths are greater than 75% of maximum cleanout depths stated in Table 1, sediment removal is required.
- Floatables and sump cleanout should occur as soon as possible following a spill in the contributing drainage area.

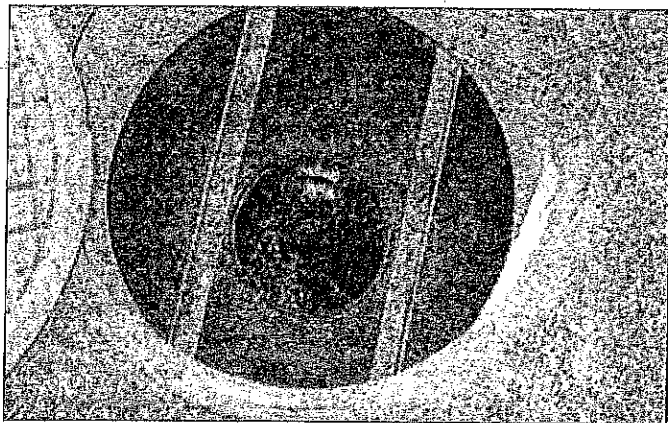


Fig.7 View over center shaft into sediment storage zone.



Fig.8 View of outer annulus of floatables and oil collection zone.

Recommended Equipment

- Safety Equipment (traffic cones, etc)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net (if only floatables are being removed)
- Sediment probe (such as a Sludge Judge®)
- Vactor truck (6-inch/150mm diameter flexible hose recommended)
- Downstream Defender® Maintenance Log

Floatables and Sediment Clean Out Procedures

1. Set up any necessary safety equipment around the access port or grate of the Downstream Defender® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the lids to the manhole NOTE: The 4-ft (1.2m) Downstream Defender® will only have one lid.
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.
4. Using the Floatables Port for access, remove oil and floatables stored on the surface of the water with the vactor hose or the skimmer net (Fig.9, top).
5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel and record it in the Maintenance Log (Pg.9).
6. Once all floatables have been removed, drop the vactor hose to the base of the sump via the Central Access Port. Vactor out the sediment and gross debris off the sump floor (Fig.6 and 9).

7. Retract the vactor hose from the vessel.

8. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.

9. Securely replace the grate or lid.

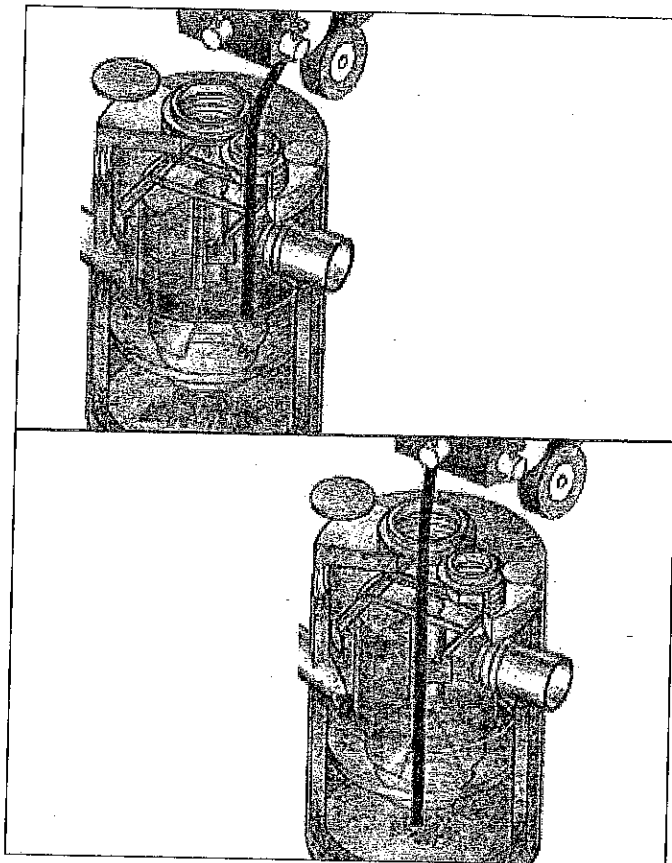


Fig.9 Floatables and sediment are removed with a vactor hose

Maintenance at a Glance

Activity	Frequency
Inspection	<ul style="list-style-type: none"> - Regularly during first year of installation - Every 6 months after the first year of installation
Oil and Floatables Removal	<ul style="list-style-type: none"> - Once per year, with sediment removal - Following a spill in the drainage area
Sediment Removal	<ul style="list-style-type: none"> - Once per year or as needed - Following a spill in the drainage area
NOTE: For most cleanouts it is not necessary to remove the entire volume of liquid in the vessel. Only removing the first few inches of oils/floatables and the sediment storage volume is required.	



Downstream Defender® Installation Log

HYDRO INTERNATIONAL REFERENCE NUMBER:	
SITE NAME:	
SITE LOCATION:	
OWNER:	CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY NAME:	COMPANY NAME:
ADDRESS:	ADDRESS:
TELEPHONE:	TELEPHONE:
FAX:	FAX:

INSTALLATION DATE: / /

MODEL (CIRCLE ONE): 4-FT 6-FT 8-FT 10-FT 12-FT
 (1.2m) (1.8m) (2.4m) (3m) (3.7m)



Downstream Defender® Maintenance Log

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

Location: _____

Owner Name: _____

Address: _____ Phone Number: _____

Site Status: _____

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

Date	Initials	Depth of Floatables and Oils Removed	Sediment Depth Measured Prior to Removal	Site Activity and Comments

*Note: Sediment removal is not required unless sediment depths exceed 75% of maximum clean-out depths stated in Table 1.

Notes



Downstream Defender® Inspection Log

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

Location: _____

Owner Name: _____

Address: _____ Phone Number: _____

Site Status: _____

Date: _____ Time: _____ Site conditions*: _____

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

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

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

Inspector Comments: _____

Overall Condition of Downstream Defender®: ☐ Acceptable ☐ Unacceptable
 ***"Acceptable" would mean properly functioning; "unacceptable" would mean damaged or required further maintenance.

If any of the above Inspection Items are checked "Yes" for "Maintenance Needed", list Maintenance actions and their completion dates below:

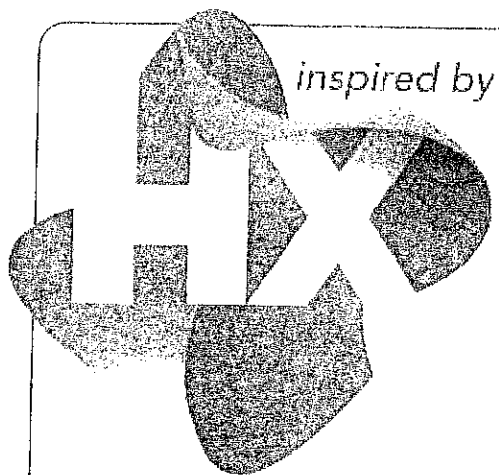
Maintenance Action Needed	Due Date

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

Inspected by: (signature) _____

Inspected by: (printed) _____





inspired by

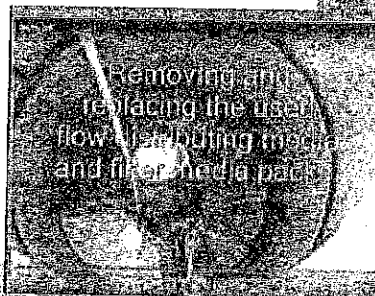
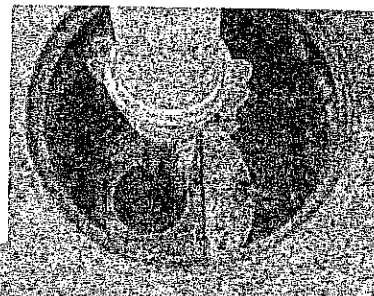
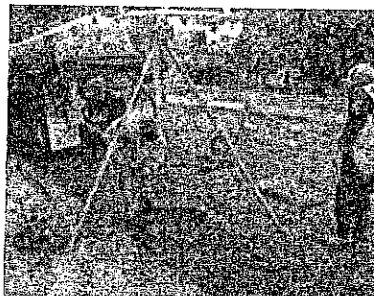
Hydro International Certification Program

for Stormwater BMP Maintenance Providers

The Hydro International Stormwater BMP Maintenance Certification verifies that a stormwater BMP maintenance provider has been trained on the proper inspection and maintenance procedures for Hydro International's manufactured stormwater treatment products.

Maintenance providers who complete this complimentary web-based program become a Hydro International Preferred Stormwater BMP Maintenance Partner. Become a Hydro International certified Stormwater BMP maintenance provider today.

Learn more at <http://www.hydro-int.com/us/products/service-parts>



Stormwater Solutions

94 Hutchins Drive
Portland, ME 04102

Tel: (207) 756-6200

Fax: (207) 756-6212

stormwaterinquiry@hydro-int.com

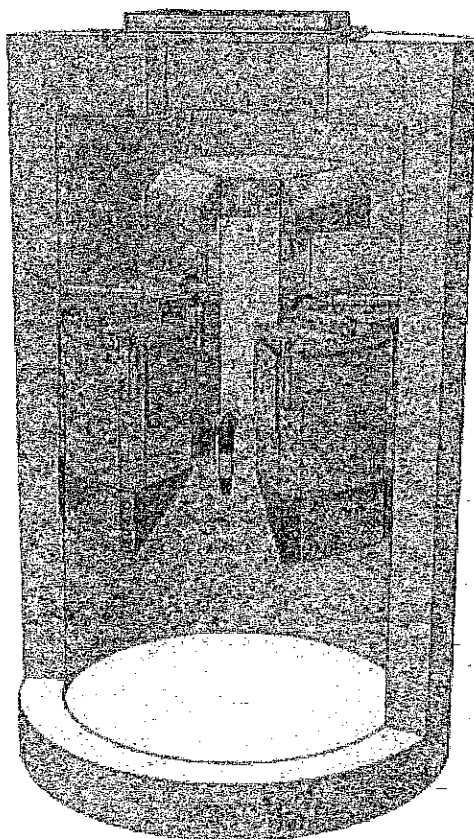
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Turning Water Around...®

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Hydro 
International



Operation and Maintenance Manual

Up-Flo® Filter

Filtration System for Stormwater Treatment

Stormwater Solutions
Turning Water Around ...®

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IMPORTANT - ORDER REPLACEMENT PARTS FOR MAINTENANCE - IMPORTANT

Annual maintenance requires replacement of the Media Packs and the Drain Down Filter. Contact Hydro International to order replacements. Allow 2-4 weeks for delivery.

Office hours Monday thru Friday 8:00 A.M. to 5:00 P.M. EST

Toll free: 1-800-848-2706

Phone: 207-756-6200

Fax: 207-756-6212

Email: stormwaterinquiry@hydro-int.com

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DISCLAIMER: Information and data contained in this manual is exclusively for the purpose of assisting in the operation and maintenance of Hydro International plc's Up-Flo® Filter. No warranty is given nor can liability be accepted for use of this information for any other purpose. Hydro International plc have a policy of continuous product development and reserve the right to amend specifications without notice.



Product Overview

The Up-Flo® Filter is a modular high-rate stormwater filtration device. As shown below, it is typically installed into a 4-ft diameter catch basin structure. Each Filter Module has a screen and support bracket that is attached to the concrete manhole and each contains a Media Pack that includes Flow Distribution Media and two Media Bags (Fig.1). Modules can attach to each other to form a "ring" of up to six modules. Up to two of the modules are attached to an Outlet Module that has a Bypass Hood and Drain Down Filter. The modular design can be supplied in different configurations depending on the application as shown in the following illustrations.

An upward flow path through the Filter Modules allows stormwater to be screened and filtered. In addition to the screening and filtering processes, gross pollutants will also settle into the sump or float to the surface of the water held within the manhole. The standard units are supplied with a 3-ft (0.9m) sump to allow for sediment and gross pollutant accumulations between maintenance intervals.

The following manual describes the operation of the Up-Flo® Filter and provides general maintenance requirements that will ensure the filter will continue to operate and perform as intended. In general, a minimum of two inspections are required per year to monitor sediment and gross pollutant accumulations. In order to achieve an annual TSS removal rate of 80% for the Up-Flo® Filter, the minimum maintenance frequency specified in the maintenance section for replacement of the Media Pack and removal of accumulated sediment from the sump is mandatory.

Hydro International offers recommendations for certified maintenance contractors. It is hoped that owners will take advantage of this service as these contractors have been trained and certified to ensure that maintenance will be performed properly. Should the owner choose to conduct maintenance procedures themselves, it is recommended that Hydro International be contacted to discuss the following procedures and consider contracting a representative from Hydro International for the first maintenance cycle.

See page 17 for more about Hydro International's Stormwater BMP Maintenance Contractor Certification Program.

Up-Flo® Filter Components

1. Inlet Grate
2. Siphonic Bypass Hood with Floatables Baffle
3. Filter Module
4. Outlet Module
5. Media Pack
6. Angled Screen
7. Drain Down Filter Assembly (refer to Fig.10 for closer view)
8. Sump

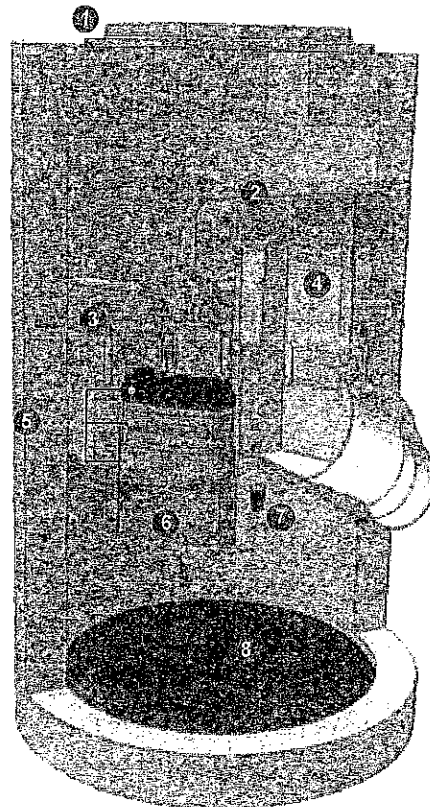


Fig.1 The components of the Up-Flo® Filter.



Operation

Introduction

The Up-Flo® Filter operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirements and is fabricated with durable non-corrosive components. Personnel are not required to operate the unit and maintenance is limited to periodic inspections, sediment and floatables removal, Media Pack replacement and Drain Down Filter replacement.

Pollutant Capture

The Up-Flo® Filter is designed to operate as a "treatment train" by incorporating multiple treatment technologies into a single device. Trash and gross debris are removed by sedimentation and screening before they are introduced to the filtration media, preventing surface blinding of the filter media. The Up-Flo® Filter is a wet-sump device. Between storm events, oil and floatables are stored on the water surface separate from the sediment storage volume in the sump (see Fig.2). The high-capacity bypass siphon acts as a floatables baffle to prevent washout of captured floatable pollutants during high intensity events.

Reduced Clogging

The Up-Flo® Filter has been designed to minimize the occurrence of clogging and blinding. The Up-Flo® Filter employs a unique Drain

Down Filter that allows the water level in the chamber to drop below the filter media between events. The Drain Down Filter mechanism creates a reverse flow that flushes captured pollutants off the surface of the Media Bag, helping to prevent blinding. By allowing the water to drain out, the Drain Down Filter also reduces the weight of the Media Bags. This makes the bags easier and safer to remove during maintenance operations.

Overflow Protection

The Angled Screens are designed to prevent ragging and blinding. The Angled Screens are situated below the Filter Modules, sheltering them from the direct path of the influent. Coarse debris settles in the sump before the runoff flows up through the screens, protecting them from blinding. In the unlikely event of a blockage, the high capacity siphonic Bypass Hood is designed to convey high enough flow to minimize the risk of large storm creating upstream flooding.

Good Housekeeping & Best Practices

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

Damage Due to Lack of Maintenance

Delayed maintenance would result in clogged Media Bags and/or blinded Angled Screens. In that situation, the Up-Flo® Filter would go into bypass and there would be no treatment of the incoming stormwater. Because the Bypass Weir can easily convey all of the flow to the Outlet Module, there would be no lasting damage to the system. Replacement of the Media Bags and removal of sediment from the sump would restore the Up-Flo® Filter to its original treatment efficiency. Establishing and adhering to a regular maintenance schedule ensures optimal performance of the system.

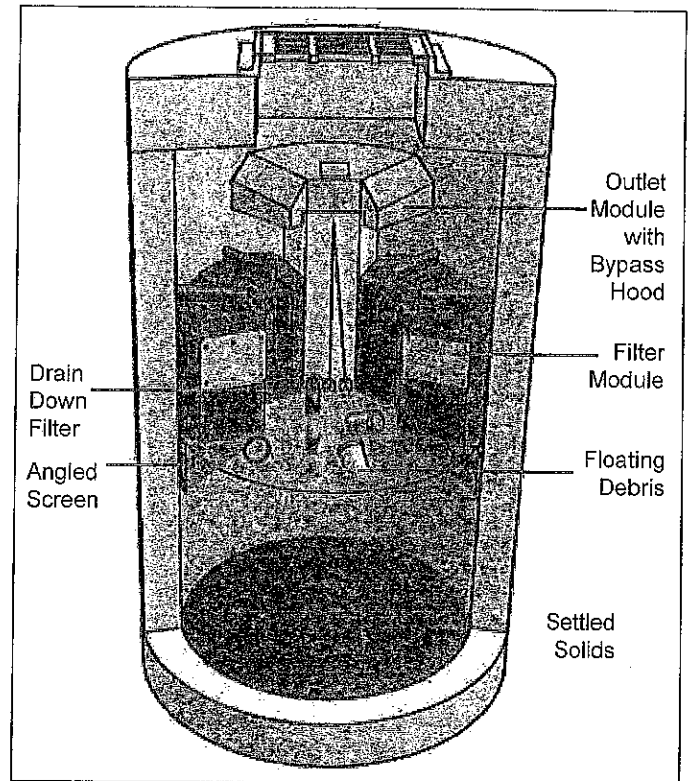


Fig.2 Pollutants captured in the Up-Flo® Filter.

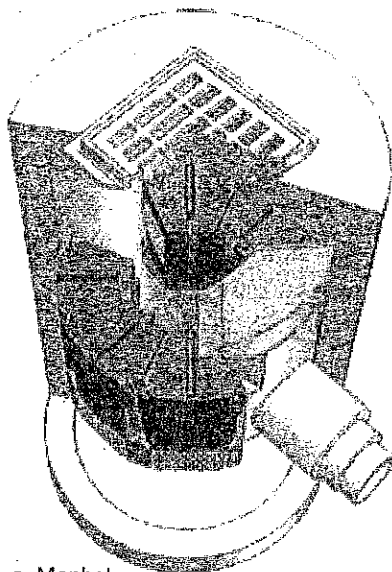
Inspection & Maintenance

Overview

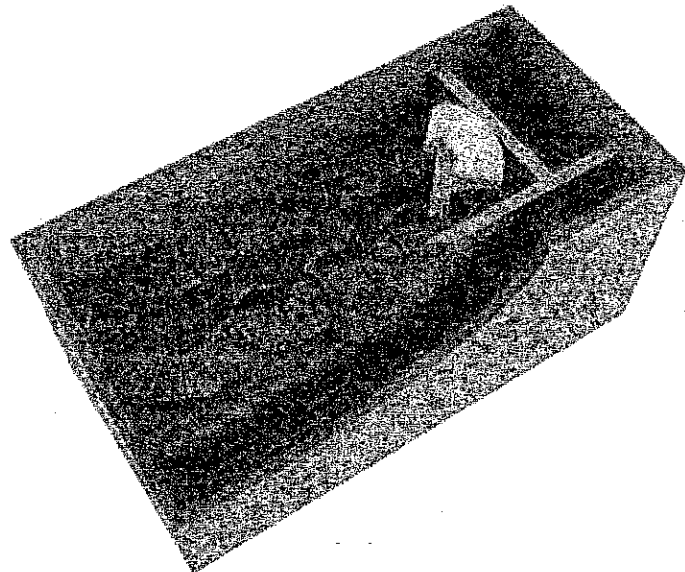
The Up-Flo® Filter protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the proper functioning of the Up-Flo® Filter.

Maintenance activities can be categorized as those that may be performed from outside the Up-Flo® vessel and those that are performed inside the vessel. Maintenance performed from outside the vessel includes removal of floatables and oils that have accumulated on the water surface and removal of sediment from the sump. Maintenance performed inside the vessel includes removal and replacement of Media Bags, Flow Distribution Media and the Drain Down Filter. A vactor truck is required for removal of oils, water, sediment, and to completely pump out the vessel to allow for maintenance inside. OSHA Confined Space Entry procedures must be followed when entering the Up-Flo® vessel.

The Up-Flo® Filter design allows for easy and safe inspection, monitoring and clean-out procedures. It has a wide central opening between the Filter Modules for easy and comfortable access to all of the components (see Fig.3). Completion of all the maintenance activities for a typical manhole Up-Flo® Filter takes less than one hour. In the case of inspection and floatables removal, a vactor truck is not required. Otherwise, a vactor truck is normally required for oil removal, removal of sediment from the sump, and replacement of the Media Packs and Drain Down Filter. In most cases, entry into the Up-Flo® Filter vessel is required for replacement of the Media Packs and Drain Down Filter, and OSHA Confined Space Entry procedures will have to be followed.



a. Manhole



b. Vault

Fig.3 The Up-Flo® Filter is installed in a) 4-ft (1.2m) round manholes or b) in rectangular precast vaults. Both configurations have a wide central opening in the Up-Flo® Filter.

Maintenance activities include inspection, floatables removal, oil removal, sediment removal, Media Pack replacement, and Drain Down Filter replacement. The minimum required frequency for replacement of the Media Pack is annually, whereas the minimum required frequency for removal of accumulated sediment from the sump is dependent on the Up-Flo® Filter configuration. Configurations with a larger sediment storage volume per module will require less frequent removal of accumulated sediment. Regardless, whenever sediment depth in the sump is found to be greater than 16 inches, sediment removal is required.



First Year Inspection and Maintenance

The frequency of inspection and maintenance can be determined in the field after installation. The frequency of ongoing maintenance needs is based on site characteristics such as contributing area, types of surfaces (e.g., paved and/or landscaped), site activities (e.g., short-term or long-term parking), and other site maintenance (e.g., sanding and sweeping). At a minimum, inspection and maintenance should be conducted at intervals of no more than six months during the first year of operation. Maintenance personnel should observe and record pollutant accumulations during the first year of service in order to benchmark the maintenance intervals that will later be established for the site. Pollutant accumulations should be measured or monitored using the following procedures:

- **Measurement of sediment depth in the sump:** A minimum of 8 inches (20 cm) should separate the Drain Down Filter inlet from stored sediment in the sump in order to minimize sediment migration into the Drain Down Filter. A simple probe, such as the Sludge-Judge®, can be used to determine the depth of the solids in the sump. In a typical 4-ft (1.2m) diameter manhole installation, the sediment depth should be no more than 16 inches (41 cm).
- **Maintenance personnel should then enter the structure, remove the Media Pack from one of the Filter Modules, and weigh the Media Bags.** Media Bags with a wet weight of approximately 40 lbs (18 kg) or more are an indication that the filter media has become full and that the Media Packs in all of the Filter Modules will require replacement (Fig.4). Minimum filtration rate is generally reached when the Media Bags have accumulated approximately 20 lbs (9 kg) of sediment. Determining the amount of accumulated sediment will be accomplished by removing both of the Media Bags from one of the Media Packs and weighing the bags separately. Since a new Media Bag weighs approximately 30 lbs (14 kg) wet, the difference in weight will approximately equal the weight of solids that have accumulated in the bag. A spent Media Bag weighs approximately 50 lbs (23 kg) wet.
- **Measurement of oil layer on water surface:** Since water in the Up-Flo® vessel drains down to an elevation below the bottom of the Filter Modules when the system is idle, the amount of accumulated oil must be minimized so that oil is not entrained in the Media Pack when stormwater begins to fill the vessel at the start of a storm event. Oil accumulation should be limited to 1.5 inches (4 cm) or less. Probes can be used to measure oil thickness.
- **Monitoring for Drain Down Filter clogging:** The water level in the Up-Flo® Filter should be monitored to ensure that the Drain Down Filter is operating properly. The Drain Down Filter is designed to lower the water level in the Up-Flo® vessel to an elevation below the bottom of the Filter Modules between storm events. Periodically conduct an inspection one to two days after a storm event during the first year of operation. Approximately 36 hours after a 1-in (2.5-cm) rainfall, the water level inside the vessel should have dropped to a point where it is equal with the base of the Filter Modules. If the water level has not reached that point, then the Drain Down Filter has either become clogged or blinded by trash or debris (Fig.5 a and b). If there is no evidence of trash or debris around the Drain Down Filter inlet, then it has likely become clogged with particles.
- **Monitoring for slime and debris covering the Flow Distribution Media or Angled Screens:** After removal of the Media Bags, the bottom Flow Distribution Media should be removed and inspected to determine if it is coated with slime or debris. Similarly, the Angled Screen should be inspected for blockages and ragging.



Fig.4 a) A new Media Bag of Hydro Filter Sand. b) A spent media bag of Hydro Filter Sand.

- Monitoring for floatables on the water surface: Similar to oil, the amount of accumulated floatables must be minimized to prevent trash and loose debris from becoming trapped on the Angled Screens when stormwater begins to fill the Up-Flo® vessel at the start of a storm event. Visual inspection is adequate to determine the amount of floatables. Floatables should be removed before they form a mat on the surface of the water.

The solids loading rate in the sump will be calculated by measuring the sediment depth in the sump and dividing the depth by the correlating interval of time since the sump was last cleaned. Similarly, starting with fresh Media Bags, the solids loading rate in the Media Packs will be calculated by weighing the Media Bags and dividing the weights by the correlating interval of time since they were installed. The wet weight of the heaviest bag will be used to determine the loading rate. As previously mentioned, a spent Media Bag weighs approximately 50 lbs (23 kg) wet. The spent Media Bag weight estimate was based on calculations of sediment loading in an Up-Flo® Filter that was run to exhaustion during laboratory testing.

The rate of oil accumulation will be calculated by measuring the thickness of the oil layer and dividing the thickness by the correlating interval of time since the sump was last cleaned. Ordinarily, oil thickness will not be measurable unless a spill has occurred. Consequently, any oil will typically be removed along with water when cleaning the sump.

Monitoring the Drain Down Filter for clogging, monitoring the Flow Distribution Media and Angled Screens for slime and debris, and monitoring the accumulation of floatables will provide an estimate of how long the Up-Flo® Filter can operate before its performance can become impaired by one of these factors.

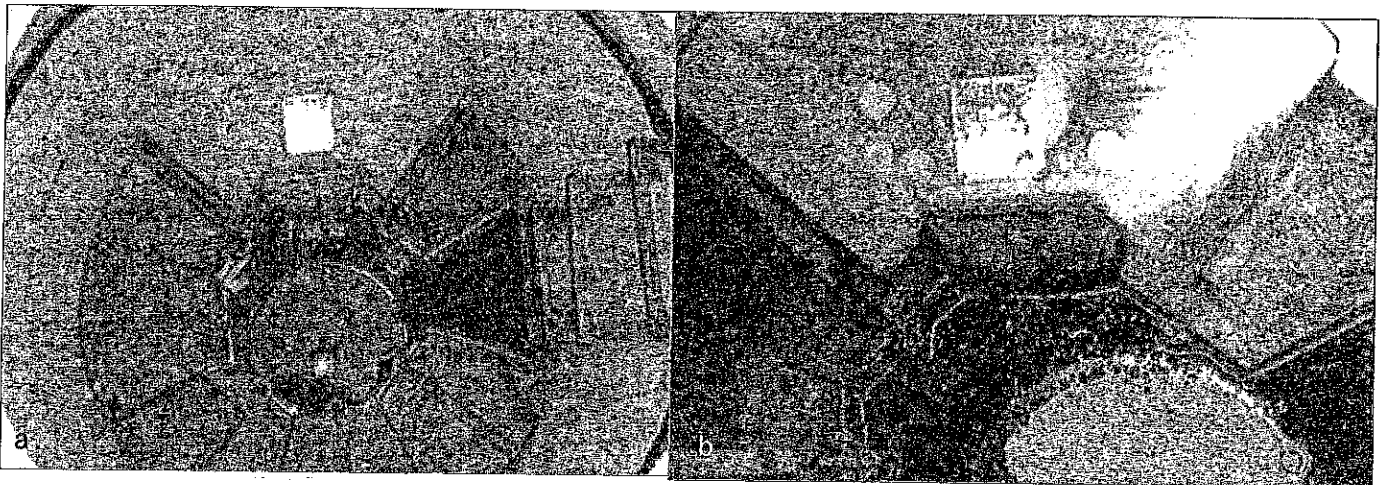


Fig. 5 a) The water level in a properly functioning Up-Flo® Filter will drain down to the base of the Filter Modules. b) When the Drain Down Filter becomes clogged, the base of the Filter Modules will be submerged in standing water. Note, above right, that the Drain Down Filter is submerged in standing water.

Routine Inspection and Maintenance

After completion of the first year of operation, determining and then following the established inspection and maintenance intervals will keep pollutant loadings within their respective limits. Removal of oils and floatables, replacement of the Drain Down Filter, replacement of Flow Distribution Media (see Fig.9, pg 11), and cleaning of Angled Screens will occur at the same frequency as cleaning of the sump and replacement of Media Bags unless the first year of operation indicates otherwise. Keeping to the established maintenance intervals will keep treatment flow rates at, or above, the design flow rate. Typically, annual maintenance is adequate.

In addition to scheduled maintenance, occasional checks for Up-Flo® Filter clogging can be performed by removing the manhole cover during a storm, monitoring the water level in the manhole or vault, and determining whether the filter is in bypass. A properly-sized filter (on-line or off-line) that is in bypass during a storm that is producing runoff at, or below, the filter's design filtration rate needs maintenance.



Routine Inspection

Inspection is a simple process that requires monitoring pollutant accumulations. Maintenance crews should be familiar with the Up-Flo® Filter and its components prior to inspection.

Scheduling

- Inspection may be conducted during any season of the year but should occur shortly after a predicted rainfall to ensure components are operating properly.

Recommended Equipment

- Safety Equipment and Personal Protective Equipment (traffic cones, work gloves, etc.)
- Scale to measure the weight of the Media Bags
- Crow bar to remove grate or lid
- Pole with skimmer or net
- Sediment probe (such as a Sludge-Judge®)
- Hydro International Up-Flo® Filter Maintenance Log
- Trash bags for removed floatables

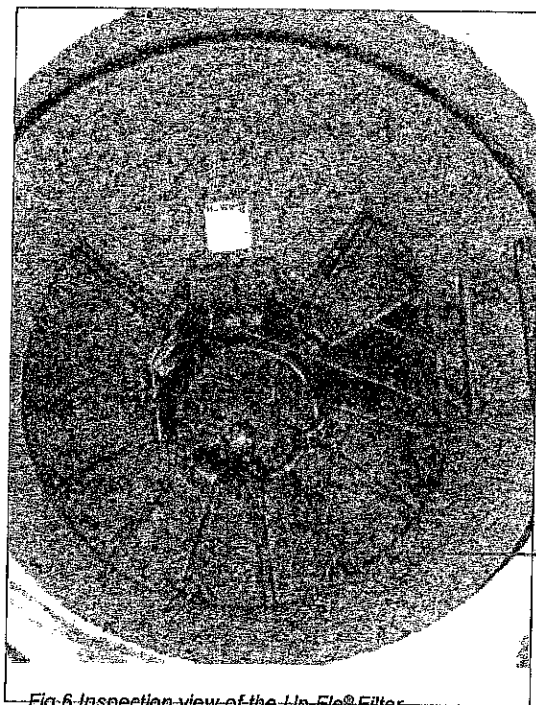


Fig.6 Inspection view of the Up-Flo® Filter.

Routine Inspection Procedures

1. Set up any necessary safety equipment (such as traffic cones) to provide access to the Up-Flo® Filter. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the grate or lid to the manhole or vault.
3. Without entering the vessel, look down into the chamber to inspect the inside and to determine whether the high-water level indicator has been activated. Make note of any irregularities. See Fig.6 for a typical Inspection View.
4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the chamber.
5. Using a sediment probe such as a Sludge-Judge®, measure the depth of sediment that has collected in the sump of the vessel.
Maximum sediment depth is 16 inches (41 cm).
6. If the high-water level indicator has been activated after two consecutive storms, remove the Filter Module lid by turning the cam latch and remove the Filter Media Pack (refer to page 11 Replacement Procedures). Weigh the Media Bags from one or two modules. Media Bags should be replaced if the wet weight exceeds 40 lbs (18 kg).
7. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or a high standing water level (see Fig.6 for the standard standing water level).
8. Securely replace the grate or lid.
9. Remove safety equipment.
10. Contact Hydro International at (800) 848-2706 to discuss any irregularities noted during inspection.

— Bypass siphon sits evenly on Outlet Module.

— Standing water level is no higher than the base of the Filter Module. The Drain Down Filter will be visible if the water level is correct.

— Filter Module Lids are closed.

Routine Maintenance

Maintenance activities are grouped into two categories:

- **Activities *Not* Requiring Man Entry Into the Up-Flo® Filter**
These activities include floatables removal, oil removal and removal of sediment from the sump.
- **Activities *Requiring* Man Entry Into the Up-Flo® Filter**
Media Pack replacement and Drain Down Filter replacement.

Maintenance intervals are determined from monitoring the Up-Flo® Filter during its first year of operation. Depending on the site, some maintenance activities may have to be performed on a more frequent basis than others. In the case of floatables removal, a vactor truck is not required. Floatables and loose debris can be netted with a skimmer and pole.

A vactor truck is normally required for oil removal, removal of sediment from the sump, and to dewater the vessel for replacement of the Media Packs and Drain Down Filter (Fig.7). All inspection and maintenance activities would be recorded in an Inspection and Maintenance Log.

Completion of all the maintenance activities for a typical 4-ft (1.2m) diameter manhole installation takes less than one hour. Approximately 360 gallons of water and up to 0.6 yd³ (0.5 m³) of sediment may be removed in the process. In an installation equipped with six Filter Modules, 12 Media Bags (2 bags per module) would be removed and replaced. Assuming a spent Media Bag weight of 50 lbs (23 kg), up to 600 lbs (272 kg) of spent Media Bags would be removed. All consumables, including Media Bags, Flow Distribution Media, and replacement Drain Down Filters are supplied by Hydro International.

The access port located at the top of the manhole provides unobstructed access for a vactor hose and/or skimmer pole to be lowered to the base of the sump.

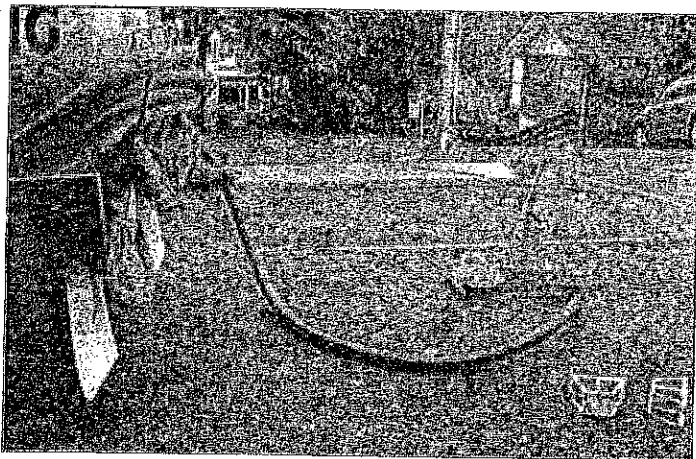


Fig.7 Sediment is removed from the sump with a vactor hose. Man entry is not required for this step.

Maintenance Activities Not Requiring Man Entry

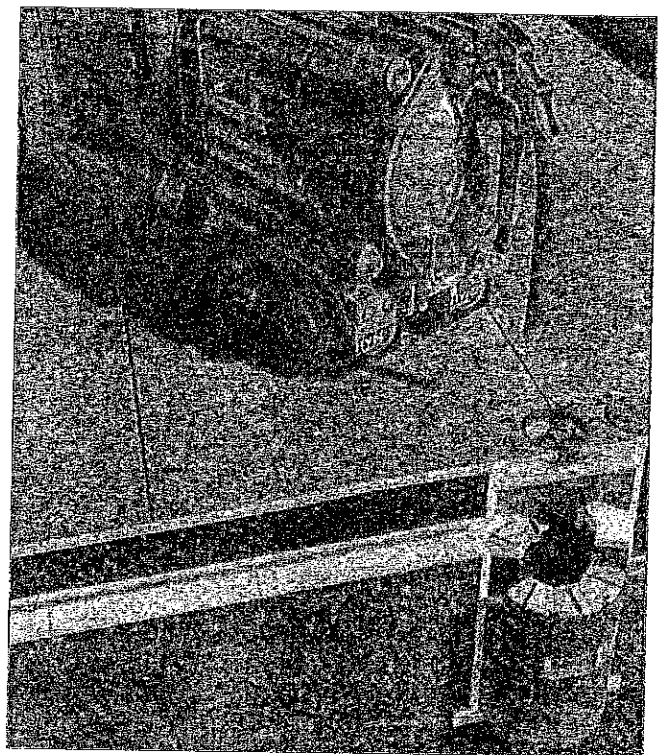
These activities include floatables removal, oil removal and removal of sediment from the sump.

Scheduling

- Floatables and sump cleanout may typically be done during any season of the year - before and after rainy season
- Floatables and sump cleanout should occur as soon as possible following a contaminated spill in the contributing drainage area

Recommended Equipment

- Safety Equipment (traffic cones, etc)
- Crow bar to remove grate or lid
- Pole with skimmer or net (if only floatables are being removed)
- Sediment probe (such as a Sludge-Judge®)
- Vactor truck (flexible hose preferred)
- Pressure nozzle attachment or other screen-cleaning device
- Hydro International Up-Flo® Filter Maintenance Log



*Maintenance Procedures Not Requiring Man Entry:
Floatables, Oil and Sediment Clean Out*

1. Set up any necessary safety equipment (such as traffic cones) around the access of the Up-Flo® Filter. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the grate or lid to the manhole or vault.
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.
4. If the standing water level in the sump is above the base of the Filter Modules (see Fig.8), tug the Pull Chain(s) to release the Drain Down Filter plug(s). Allow the excess water to drain out of the chamber.
5. Use the skimmer pole to fit the Drain Down Filter plug back into the open port.
6. Once all floatables and oil have been removed, drop the vactor hose to the base of the sump. Vactor out the sediment and gross debris from the sump floor. Up to 0.3 yd³ (0.2 m³) of sediment and 360 gallons (1,363 L) of water will be removed from a typical manhole Up-Flo® Filter during this process.
7. Retract the vactor hose from the vessel.
8. Inspect the Angled Screens for blockages and ragging. If present, remove the obstruction or ragging materials from the surface using a hose or other screen-cleaning device.
9. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables, oils, and gross debris removed, and the depth of sediment measured. Note any apparent irregularities such as damaged components or blockages.
10. Securely replace the grate or lid. Remove safety equipment.
11. Dispose of sediment and gross debris following local regulations.
12. Dispose of oil and sump water at a licensed water treatment facility or following local regulations.
13. Contact Hydro International at (800) 848-2706 to discuss any irregularities noted during cleanout.

Up-Flo® Filter Operation and Maintenance Manual

Maintenance Activities Requiring Man Entry

These activities include replacement of the Media Packs and Drain Down Filter.

Unless the Up-Flo® Filter has been installed as a very shallow unit, it is necessary to have an OSHA-confined space entry trained person enter the vessel to replace Media Packs.

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

Scheduling

- Call Hydro International to order replacement Media Packs and Drain Down Filter prior to scheduling maintenance.
- Because Media Pack replacement requires entry into the Up-Flo® chamber, maintenance events should be scheduled during dry weather.
- Media Pack replacement should occur immediately after a contaminated spill in the contributing drainage area.

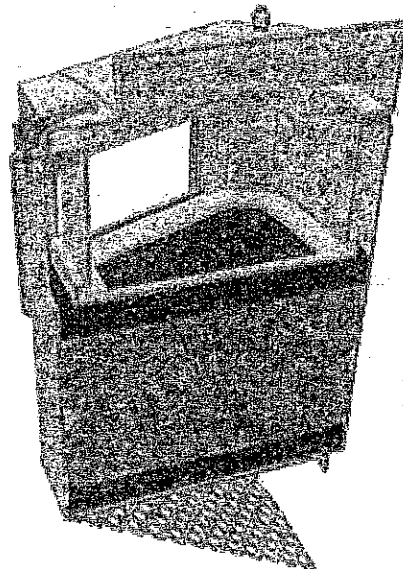


Fig.8 Cutaway view of the Filter Module

Recommended Equipment

- Safety Equipment (traffic cones, etc.)
- Crow bar to remove grate or lid
- Pole with skimmer or net (If floatables removal is not to be done with vactor hose)
- Sediment probe (such as a Sludge-Judge®)
- Vactor truck (flexible hose preferred)
- OSHA Confined Space Entry Equipment
- Up-Flo® Filter Replacement Media Packs (available from Hydro International)
- Hydro International Up-Flo® Filter Maintenance Log
- Screwdriver (flat head)
- Replacement Drain Down Filter components supplied by Hydro International

*Maintenance Procedures Requiring Man Entry:**Media Pack and Drain Down Filter Replacement Procedures*

1. Follow Floatables and Sump Cleanout Procedures, 1 – 13.

2. Following OSHA Confined Space Entry procedures, enter the Up-Flo® Filter Chamber.
3. Open the Filter Module by turning the three cam latches on the front and sides of the module. Remove the lid ❶ to gain access to the Media Pack (Fig.9).
4. Remove and discard the spent Media Pack. The Media Pack contents include:
 - A top layer of green ❷ Flow Distributing Media.
 - Two (2) Media Bags ❸ equipped with nylon handles.
 - A bottom layer of green ❷ Flow Distributing Media.
5. Insert a new Media Pack, supplied by Hydro International.
 - First, insert a bottom layer of green Flow Distributing Media. Be sure that the media sits snugly and level at the bottom of the Filter Module.
 - Next, insert the first of two (2) replacement Media Bags. Smooth the bag out with your hands to make sure that the bag extends snugly to the walls and corners of the Filter Module.
 - Insert the second Media Bag, following the same procedure.

1. Filter Module Cover and Media Restraint
2. Flow Distributing Media
3. Filter Media Bags
4. Replaceable Media Pack
5. Cam Latch
6. Conveyance Channel
7. Filter Module
8. Support Bracket / Angled Screen

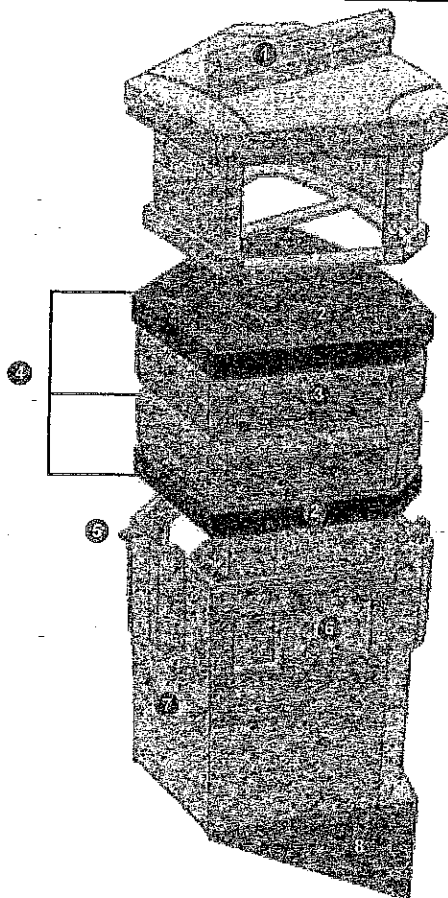


Fig.9 The Filter Module houses the Media Restraint and the Media Pack.



- Insert the top layer of green Flow Distributing Media. Be sure that the piece fits snugly against the walls and corners of the Filter Module.
- Put the lid on and secure the three latches. Check to make sure that the latches are closed properly.

6. Use a screwdriver to unscrew the Drain Down Filter from the face of the Outlet Module (see Fig.10). DO NOT DISCARD THIS PIECE.

7. Install new Drain Down Filter supplied by Hydro International.

8. Exit the Up-Flo® Filter chamber and securely replace the grate or lid.

9. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables, oil and gross debris removed, and the depth of sediment measured. Note the number of Media Packs replaced. Note any irregularities such as damaged components or blockages.

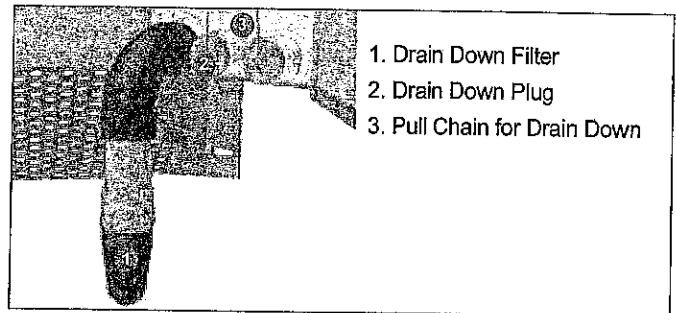


Fig.10 The Drain Down Filter.

10. Remove safety equipment.

11. Dispose of spent media packs at your local landfill, following local regulations.

12. Return the spent Drain Down Filter to Hydro International.

13. Contact Hydro International to discuss any irregularities noted during annual maintenance.

Solids Disposal

Sediment, floatables, gross debris, and spent Media Bags can generally be disposed of at the local landfill in accordance with local regulations. The toxicity of the residues captured will depend on the activities in the contributing drainage area, and testing of the residues may be required if they are considered potentially hazardous.

Sump water can generally be disposed of at a licensed water treatment facility but the local sewer authority should be contacted for permission prior to discharging the liquid. Significant accumulations of oil removed separately from sump water should be transported to a licensed hazardous waste treatment facility for treatment or disposal. **In all cases, local regulators should be contacted about disposal requirements.**

Maintenance at a Glance

Activity	Frequency
Inspection	<ul style="list-style-type: none"> - Regularly during first year of installation - Every 6 months after the first year of installation
Floatables/Oils Removal	<ul style="list-style-type: none"> - Twice per year or as needed - Following a contaminated spill in the drainage area
Sediment Removal	<ul style="list-style-type: none"> - Every six to 12 months, depending on the Up-Flo® Filter Configuration - The maximum allowable sediment depth in any Up-Flo Filter configuration is 16 inches (41 cm) - Following a contaminated spill in the drainage area
Media Pack Replacement	<ul style="list-style-type: none"> - Once per year - Replacement is required anytime inspection reveals that the high-water level indicator has been activated after two consecutive storms and the subsequent weighing of the Media Bags shows a wet weight greater than 40 lbs - Following a contaminated spill in the drainage area
Drain Down Filter Replacement	<ul style="list-style-type: none"> - Once per year with Media Pack replacement - Replacement is required anytime inspection reveals that the water level inside the vessel has not reached a level equal with the base of the Filter Modules approximately 36 hours after a 1-inch (2.5 cm) rainfall - As needed, in the event of continuous base flow conditions

Up-Flo® Filter Installation Log



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

INSTALLATION DATE: / /

CONFIGURATION (CIRCLE ONE): MANHOLE VAULT SYSTEM

TOTAL NUMBER OF UP-FLO® FILTER MODULES: _____





Up-Flo® Filter Inspection Log

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

Location: _____

Owner Name: _____

Address: _____ Phone Number: _____

Site Status: _____

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

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

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





Inspector Comments: _____

Overall Condition of Up-Flo® Filter**:

☐ Acceptable

☐ Unacceptable

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

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

Maintenance Action Needed	Due Date

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

Inspected by: (signature) _____

Inspected by: (printed) _____





Up-Flo® Filter Maintenance Log

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

Location: _____

Owner Name: _____

Address: _____ Phone Number: _____

Site Status: _____

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

Estimated volume of oil/floatable trash removed: _____

Sediment depth measured in sump prior to removal: _____

Number of Filter Modules fitted with new media packs: _____

Inspector Comments: _____

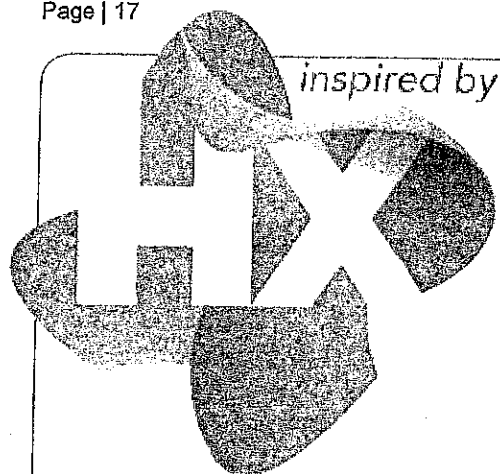
Overall Condition of Up-Flo® Filter: ☐ Acceptable ☐ Unacceptable

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

Maintained by: (signature) _____

Maintained by: (printed) _____





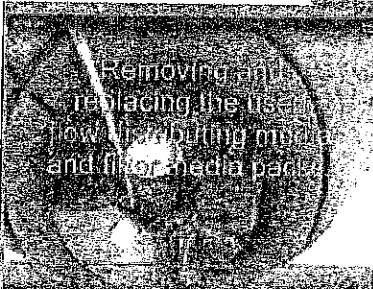
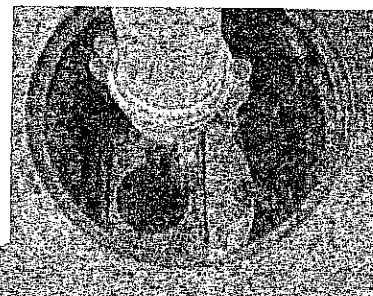
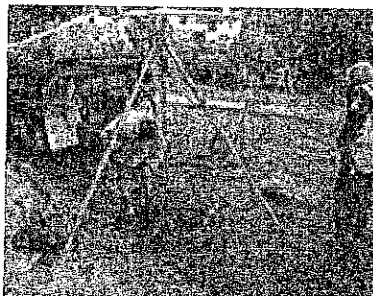
Hydro International Certification Program

for Stormwater BMP Maintenance Providers

The Hydro International Stormwater BMP Maintenance Certification verifies that a stormwater BMP maintenance provider has been trained on the proper inspection and maintenance procedures for Hydro International's manufactured stormwater treatment products.

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