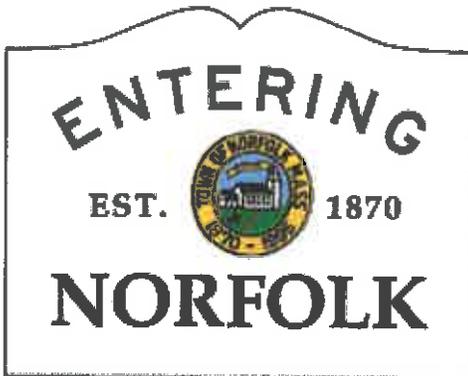




**Andrews Survey & Engineering, Inc.**  
Land Surveying - Civil Engineering - Site Planning



# Operation & Maintenance Plan

**April 19, 2016**



**Project:**

**Lakeland Farms  
A Townhouse Community  
84 Cleveland Street  
Norfolk, MA 02056**

**Assessors Map/Lot:**

**Map 15, Block 54, Lot 43**



**Owner / Applicant:**

**Lakeland Farms, LLC  
84 Cleveland Street  
Norfolk, MA 02056**



**Representative:**

**Andrews Survey & Engineering, Inc.  
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**ASE JN: 2014-111**

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# Long Term Pollution Prevention and Stormwater System Operation and Maintenance Plan

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## **Preface:**

The goal of this manual is to improve water quality by initiating performance standards for the operation and maintenance of stormwater management structures, facilities, and recognized practices. The stormwater performance standards are set up to meet the statutory and regulatory authorities of the Department of Environmental Protection, including the Wetland Protection Act, surface water discharge permits under the Clean Waters Act, the 401 certification program for fill in wetlands, and the 401 certification of federal permits based on the water quality standards.

The local Conservation Commission and the Department of Environmental Protection are responsible for ensuring the protection of wetlands through the issuance of permits for activities in flood plains and in or near wetlands, as per the Wetlands Protection Act, MGL c.131 s. 40. Proposed work within a resource area or a one hundred (100') foot buffer zone requires an order of conditions.

Resource areas include freshwater and coastal wetlands, banks, beaches, and dunes bordering on estuaries, streams, riverfront, ponds, lakes, or the ocean; lands under any of these bodies of water; land subject to tidal action, coastal storm flowage, or flooding.

The discharge of pollutants to water of the Commonwealth without a permit is prohibited under the state Clean Waters Act, MGL c. 21, ss 26-53. Stormwater discharges are subject to regulations when two criteria are met under 314 CMR 3.04(2). First, there must be "conveyance or system of conveyances (including pipes, ditches, and channels) primarily used for collecting and conveying stormwater runoff." 314 CMR 3.04(2)(a). Second, the stormwater runoff must be "contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, or oil and grease," or, be designated on a case-by-case basis. Such designations must be made when the "stormwater discharge" is subject to effluent or toxic pollutant limitations, is located in an industrial plant area, or may be a significant contributor of pollutants to waters of the Commonwealth. Any activity resulting in a discharge to waters of the United States must comply with Section 401 of the Federal Clean Water Act and comply with state water quality standards. All stormwater discharges must be set back from the receiving waters or wetlands and best management practices (BMP) must be implemented. A permit is required for any stormwater discharge to an Outstanding Resource Water (ORW) which meets the regulatory definition in 314 CMR 3.04(2). Outstanding Resource Waters are defined under Surface Water Quality Standards 314 CMR 4.06 and include public surface water supplies, coastal and some inland Areas of Critical Environmental Concern (ACECs), and certified vernal pools.

This manual is set up to explain how to operate and maintain Best Management Practices that control erosion and minimize delivery of sediment and other pollutants to surrounding water and air.

Chapter 1 is an introduction to the site and describes the Best Management Practices

used on this site.

- Chapter 2 outlines the inspection and maintenance schedules for the site.
- Chapter 3 outlines the operation and function of the Best Management Practices.
- Chapter 4 describes how and when the Best Management Practices should be inspected and how frequently they must be maintained and cleaned.

## **1. Project Description**

Lakeland Farms is a 40-unit townhouse community located on the south side of Cleveland Street approximately 1 mile north/northeast of Route 115 in Norfolk, MA. The project address is 84 Cleveland Street and has a total area of 8.81 acres. It is the primary residence of the applicant and consists of an existing single-family dwelling, detached garage, and numerous farm structures that were used while the applicant operated Brambly Farms. The property is bounded on the north by Cleveland Street, on the east by undeveloped residential property, on the south by a large electric transmission & gas easement, and on the west by undeveloped residential property comprised mostly of a small pond. The property is further identified on the Norfolk Assessor Tax Map 15, Block 54, Lot 43.

Wetland resources on the property have been delineated by B&C Associates, Inc. and are illustrated on the enclosed Site Plans. A Bordering Vegetated Wetland (BVW) is located on the south and west sides of the site and consumes approximately 2 acres of the property. The remainder of the property consists of a mix of gravel access drives, maintained lawn, wild grasses, and mature evergreen & deciduous trees.

Stormwater runoff from the development will be collected in a number of Best Management Practices (BMP's), including the following;

To control erosion and minimize delivery of sediment and other pollutants into the atmosphere and adjacent wetlands, Best Management Practices (BMP's) have been provided within the site's stormwater management system. These practices include but are not limited to:

- Deep Sump Catch Basin
- Downstream Defender
- Sediment Forebay
- Detention Basin
- Infiltration Basin;

This manual is designed to help responsible parties become aware of urban non-point pollution problems and to provide detailed information about operating and maintaining stormwater management practices. The success of the Best Management Practices is dependent on their continued operations and maintenance.

## 2. Maintenance Requirements

- Owner

The owner(s) of the BMP's shall be the person, persons, trust, corporation, etc., or their successors who have title to the land on which the BMP is located. It is anticipated that all BMP's will be owned and maintained by Lakeland Farms, LLC.

- Operation and Maintenance Responsibilities

- The party or parties responsible for the funding, operation and maintenance of the BMP's shall be the OWNER or their designees.
- BMP's each have specific maintenance requirements to ensure long-term effectiveness. These stormwater management systems will be operated, inspected and maintained on a regular basis by a qualified professional with expertise in inspecting drainage system components. All of the stormwater BMP's shall be kept in good working order at all times.
- A maintenance agreement providing for the funding, operation and maintenance of all the stormwater management BMP's shall be provided.

- Source of Funding for Operation and Maintenance

- The party or parties responsible for the funding, operation and maintenance of the BMP's shall be the OWNER or their designees.
- A maintenance agreement providing for the funding, operation and maintenance of all the stormwater management BMP's shall be provided.
- Approximate estimated annual maintenance costs for the site are:
  - Deep sump hooded catch basins - \$300 / structure
  - Manhole and connecting pipes - \$100 / structure
  - Proprietary Treatment Unit - \$800
  - Sediment Forebay & Detention/Inf. Basin - \$750

- Schedule for Inspection and Maintenance:

- BMP's each have specific maintenance requirements to ensure long-term effectiveness. These stormwater management systems will be operated, inspected and maintained on a regular basis in accordance with this manual. All of the stormwater BMP's shall be kept in good working order at all times.
- As a minimum, the owner shall follow the general guidelines outlined herein for the BMP's provided on this site.
- An Operation and Maintenance log must be maintained for the last three years, outlining inspections, repairs, replacement and disposal for each Best Management Practice (BMP). In the case of disposal, the log shall indicate the type and material and the disposal location. This rolling log shall be made available to the Mass DEP and/or the Norfolk Conservation Commission upon request.

### 3. Operation of Best Management Practices

#### Deep Sump Hooded Catch Basin

Is an underground concrete structure which is designed to retain removed trash, debris and coarse sediment from stormwater runoff and serve as temporary spill containment devices for floatables such as oil and greases prior to discharge into a storm sewer pipe. The functions of a deep sump hooded catch basin include:

- A grate and/or vertical notch found in the curbing, that allow stormwater to enter the structure while filtering out larger objects such as trash and leaves;
- A four foot (minimum) sump below the invert of the storm sewer pipe provides an area for detention time which allows sands and other sediments to settle out of the runoff prior to discharge.

#### Proprietary Separators (Downstream Defender)

All underground structures which are designed as flow through units containing a settling or separation unit designed to remove sediment and pollutants from stormwater runoff and serve as temporary spill containment devices for floatables such as trash, oil and greases prior to discharge into a storm sewer pipe by utilizing the power of swirling or flowing water to separate the floatables and coarser sediments. The functions of a proprietary separator include:

- Multiple chambers trap floatables and filter out coarser sediments within the stormwater runoff;
- Limit fine particulates from entering other downstream BMP's;

#### Sediment Forebay

Is a post-construction practice consisting of an excavated pit, bermed area or cast (in-place or pre-) structure combined with a weir, designed to slow incoming stormwater runoff and facilitate the gravity separation of suspended solids prior to flowing to a subsequent BMP or system discharge. The functions of the sediment forebay include:

- Filter out sediments within the stormwater runoff
- Reduce runoff velocities;
- Reduce peak discharge flows.

#### Infiltration Basin

Is a stormwater runoff impoundment that is constructed over permeable soils which allow for the recharge of treated runoff into the groundwater. The functions of an infiltration basin include:

- Provide groundwater recharge;
- Reduce local flooding;
- Preserve the natural water balance of the site.

#### **4. Inspection and Maintenance of Best Management Practices**

##### **Deep Sump Hooded Catch Basins and Manholes**

At a minimum, deep sump hooded catch basin and manhole inlets shall be inspected four times per year. Inlet inspection should be conducted at the end of the foliage and snow removal seasons. Each structure should be cleaned whenever the depth of sediment deposits is greater than or equal to one half the depth of the sump from the bottom of the structure to the bottom of the lowest pipe invert. Structures shall be inspected for a buildup of sediments, oils and debris, cracks, breaks, or deformations. Any function of the catch basin or manhole structure that is not in working order will be replaced with similar materials, as per the detail, to prevent the storm sewer system from failing.

The catch basins and manhole sumps will be cleaned by means of hand held shovels, scallop shovel and/or vactor trucks. The grate opening shall be clear of any foreign or lodged object. Sands and salts used in the winter will be removed from the catch basin sumps in the early spring. Leaves, pine needles, and branches brought down by autumn winds, rain, and cold weather will be removed from the catch basins sumps in the late fall.

Collected sediment and debris will be properly disposed of per local, state and federal requirements. Any sediment and debris removed from a catch basin deemed to be contaminated must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.000, and handled as hazardous waste.

##### **Proprietary Separators (Downstream Defender)**

At a minimum, the proprietary separator should be inspected once per year. If the unit is subject to oil spills or runoff from unstabilized areas the separator should be inspected more frequently (4 times per year). An initial annual inspection will indicate the required future frequency of maintenance if the unit was maintained after the construction period. Structures shall be inspected for a buildup of sediments, oils and debris, cracks, breaks, or deformations. Any function of the proprietary separator structure that is not in working order will be replaced with similar materials, as per the detail, to prevent the storm sewer system from failing. Although all parts of the separator should be inspected, inspection and maintenance should focus on the inner and middle chambers since this is where the pollutants (floatable and sinking) will accumulate. Inspection for TSS build-up can be conducted using a Sludge Judge, Core Pro, AccuSludge or equivalent sampling device that allows the measurement of the depth of TSS/sediment in the unit. The unit should be inspected for TSS through each of the access covers. Several readings (2 or 3) should be made at each access cover to ensure that an accurate TSS depth measurement is recorded.

The proprietary separators will be cleaned by using a vactor truck or clam shell bucket. Each structure should be cleaned when there is an appreciable depth of oil in the unit (more than a sheen) or if floatables other than oil cover over 50% of the open water surface on the inlet side of the outlet baffle wall. It should also be maintained once the accumulated TSS/sediment depths are greater than 14" in the inner chamber. For typical stabilized post-construction sites it is anticipated that maintenance will be required annually or once every two years. More frequent or less frequent maintenance will be required depending on individual site conditions. The long

term maintenance frequency can be established based on the maintenance requirements during the first several years of operation if site conditions do not change.

Collected sediment and debris will be properly disposed of per local, state and federal requirements. Any sediment and debris removed from a catch basin deemed to be contaminated must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.000, and handled as hazardous waste.

All manufacturers' specifications and documents shall be reviewed and complied with as part of maintenance procedures.

#### Sediment Forebay

At a minimum, the forebay shall be inspected after every major storm event (1-inch of rain or greater) for the first six (6) months, then monthly thereafter. Sediment and debris should be removed a minimum of four (4) times per year, starting in the spring and spaced at even time increments until the late fall season, thereafter.

Grass vegetation within the sediment forebay will be mowed, at a minimum of twice a year, keeping the height of the grass between three (3) and six (6) inches. Inspections should identify areas of rilling and gulying or other areas which need to be reestablished. Replace any vegetation damaged during cleaning by reseeding or resodding. When reseeding, incorporate practices such as hydroseeding with a tackifier, blanket or similar practice to ensure that no scour occurs in the sediment forebay, while the seeds germinate and develop roots.

Collected sediment and debris will be properly disposed of per local, state and federal requirements. Any sediment and debris removed from the sediment forebay deemed to be contaminated must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.000, and handled as hazardous waste.

#### Infiltration Basins

At a minimum shall be inspected after every major storm event (1-inch of rain or greater) for the first six (6) months, then in the spring and fall of every year, thereafter. Note how long water remains standing in basin after a storm; standing water within the basin >72 hours after storm events suggests potential clogging and should be immediately addressed. Also, check for signs of differential settlement, cracking, erosion, leakage in embankments, tree growth in embankments, condition of riprap, sediment accumulation and the health of the turf.

Infiltration basins shall be mowed a minimum of twice per year. Grass clippings and accumulated organic matter should be removed to a non-sensitive area. Repairs and reseeding should be done as required. Sediment and debris should be removed manually when infiltration basin is thoroughly dry, a minimum of once per year or when the sediment level reaches a depth of 3".

At a minimum, inspect and clean pretreatment devices associated with the infiltration basins at least twice a year.

## Best Management Practices (BMP) Inspection Log

General Information			
Project Name	Lakeland Farms		
Location	84 Cleveland Street, Norfolk, MA		
Date of Inspection		Start/End Time	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Inspector's Qualifications			
<b>Type of Inspection:</b> <input type="checkbox"/> Regular <input type="checkbox"/> Emergency			
Weather Information			
<b>Weather at time of this inspection?</b> <input type="checkbox"/> Clear <input type="checkbox"/> Cloudy <input type="checkbox"/> Rain <input type="checkbox"/> Sleet <input type="checkbox"/> Fog <input type="checkbox"/> Snowing <input type="checkbox"/> High Winds <input type="checkbox"/> Other: _____      Temperature: _____			
<b>Are there any discharges at the time of inspection?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <b>If yes, describe:</b>  			

### Site-specific BMPs

- *The structural BMPs are identified on the BEST MANAGEMENT PRACTICES LOCUS included within the LONG TERM POLLUTION PREVENTION & STORMWATER SYSTEM OPERATION & MAINTENANCE PLAN. Carry a copy of the Locus map with you during your inspections. This list will ensure that you are inspecting all required BMPs at your site.*
- *Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.*

	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed and Notes
1	Deep sump catch basin	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
2	Downstream Defender	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
3	Detention Basin	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
4	Infiltration Basin	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
5		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
6		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
7		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
8		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
9		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
10		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

**Overall Site Issues**

*Below are some general site issues that should be assessed during inspections. Customize this list as needed for conditions at your site.*

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
1	Are discharge points and receiving waters free of any sediment deposits?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
2	Are storm drain inlets properly working?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
3	Is trash/litter from site areas collected and placed in covered dumpsters?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
4	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
5	Are materials that are potential stormwater contaminants stored inside or under cover?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
5	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
6	(Other)	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

**Non-Compliance**

Describe any incidents of non-compliance not described above:

**CERTIFICATION STATEMENT**

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

**Print name and title:** \_\_\_\_\_

**Signature:** \_\_\_\_\_ **Date:** \_\_\_\_\_



## Operation and Maintenance Manual

**Downstream Defender®**

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Vortex Separator for Stormwater Treatment

Stormwater Solutions  
Turning Water Around ...®

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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.

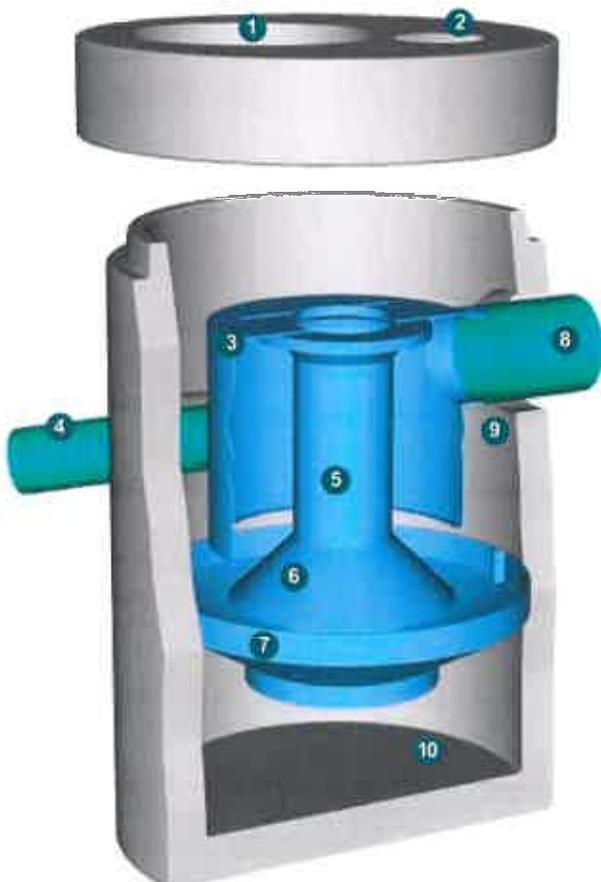
See page 12 for more about Hydro International's Stormwater BMP Maintenance Contractor Certification Program.

## 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/floatables 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 floatables 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 adsorbant pads. Since the oil/floatables 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

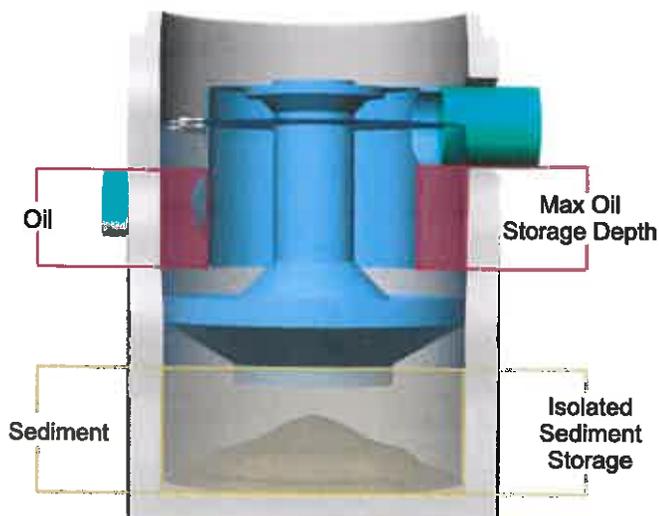


Fig.2 Pollutant storage volumes of the Downstream Defender®.

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](http://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](http://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)	(yd <sup>3</sup> )	(m <sup>3</sup> )	(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.



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



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

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 vacor 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 clean-out 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.

**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.

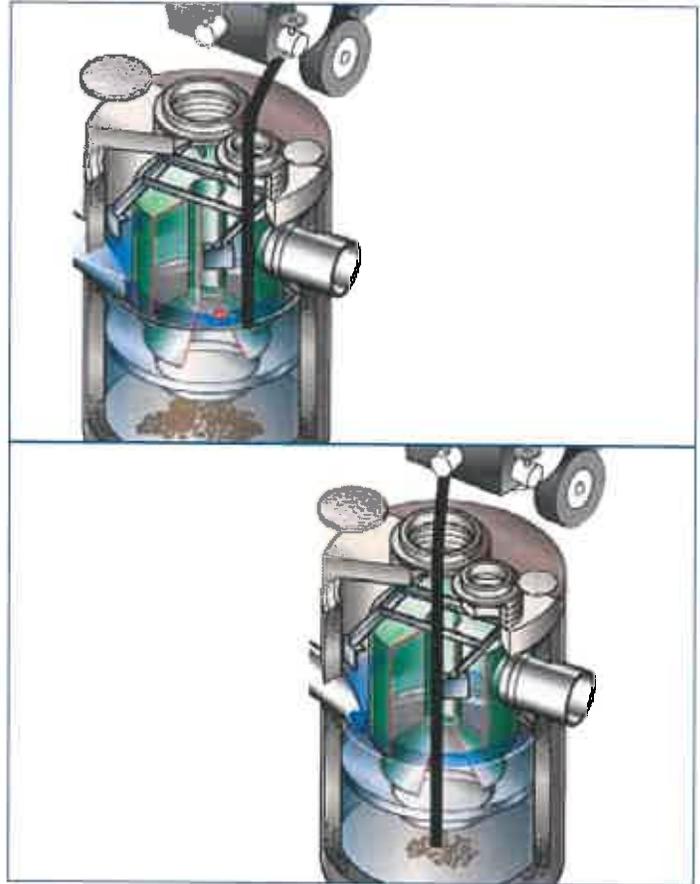


Fig.9 Floatables and sediment are removed with a vactor hose

**Maintenance at a Glance**

Activity	Frequency
Inspection	- Regularly during first year of installation - Every 6 months after the first year of installation
Oil and Floatables Removal	- Once per year, with sediment removal - Following a spill in the drainage area
Sediment Removal	- 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**

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## 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
<b>Debris Removal</b>				
Adjacent area free of debris?	M			
Inlets and Outlets free of debris?	M			
Chamber free of debris?	M			
<b>Vegetation</b>				
Surrounding area fully stabilized? (no evidence of eroding material in Downstream Defender®)	A			
Grass mowed?	M			
<b>Water retention where required</b>				
Water holding chamber(s) at normal pool?	M			
Evidence of erosion?	A			
<b>Sediment Deposition</b>				
Sedimentation sump not more than 50% full?	A			
<b>Structural Components</b>				
Any evidence of structural deterioration?	A			
Rim & cover in good condition?	A			
Spalling or cracking of structural parts?	A			
Outlet/Overflow Spillway	A			
<b>Other</b>				
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 schedule for approximately: (date) \_\_\_\_\_

Inspected by: (signature) \_\_\_\_\_

Inspected 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.

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>



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