Operation and Maintenance Manual

Downstream Defender®
Vortex Separator for Stormwater Treatment
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.

**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 ranges 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

**Downstream Defender® Components**
1. Central Access Port  
2. Floatables Access Port (6-ft., 8-ft. and 10-ft. models only)  
3. Dip Plate  
4. Tangential Inlet  
5. Center Shaft  
6. Center Cone  
7. Benching Skirt  
8. Floatables Lid  
9. Outlet Pipe  
10. Floatables Storage  
11. Isolated Sediment Storage Zone
Hydro Maintenance Services

Hydro International has been engineering stormwater treatment systems for over 30 years. We understand the mechanics of removing pollutants from stormwater and how to keep systems running at an optimal level.

Nobody Knows Our Systems Better Than We Do

Avoid Service Negligence

Sanitation services providers not intimately familiar with stormwater treatment systems are at risk of the following:

- Inadvertently breaking parts or failing to clean/replace system components appropriately.
- Charging you for more frequent maintenance because they lacked the tools to service your system properly in the first place.
- Billing you for replacement parts that might have been covered under your Hydro warranty plan.
- Charging for maintenance that may not yet have been required.

Leave the Dirty Work to Us

Trash, sediment and polluted water is stored inside treatment systems until they are removed by our team with a vactor truck. Sometimes teams must physically enter the system chambers in order to prepare the system for maintenance and install any replacement parts. Services include but are not limited to:

- Solids removal
- Removal of liquid pollutants
- Replacement media installation (when applicable)

Better Tools, Better Results

Not all vactor trucks are created equal. Appropriate tools and suction power are needed to service stormwater systems appropriately. Companies who don’t specialize in stormwater treatment won’t have the tools to properly clean systems or install new parts.

Service Warranty

Make sure you’re not paying for service that is covered under your warranty plan. Only Hydro International’s service teams can identify tune-ups that should be on us, not you.

Treatment Systems Serviced by Hydro:

- Stormwater filters
- Stormwater separators
- Baffle boxes
- Biofilters/bioretention systems
- Storage structures
- Catch basins
- Stormwater ponds
- Permeable pavement

Save Time & Money: Call Hydro for a Quote

1 (888) 382-7808

Learn More at Hydro-Int.com/Service
Operation

Introduction
The Downstream Defender® operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirement and is fabricated with 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. Additionally, the Downstream Defender® is designed and installed into the storm drain system so that the 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 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 will no longer be able to store removed oil and sediment. Maximum pollutant storage capacities are provided in Table 1.

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.

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.

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 6) to establish a routine maintenance schedule.

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

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

<table>
<thead>
<tr>
<th>Unit Diameter (feet)</th>
<th>Total Oil Storage (gallons)</th>
<th>Oil Clean-out Depth (inches)</th>
<th>Total Sediment Storage (gallons)</th>
<th>Sediment Clean-out Depth (inches)</th>
<th>Max. Liquid Volume Removed (gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>70</td>
<td>&lt;16</td>
<td>141</td>
<td>&lt;18</td>
<td>384</td>
</tr>
<tr>
<td>6</td>
<td>216</td>
<td>&lt;23</td>
<td>424</td>
<td>&lt;24</td>
<td>1,239</td>
</tr>
<tr>
<td>8</td>
<td>540</td>
<td>&lt;33</td>
<td>939</td>
<td>&lt;30</td>
<td>2,884</td>
</tr>
<tr>
<td>10</td>
<td>1,050</td>
<td>&lt;42</td>
<td>1,757</td>
<td>&lt;36</td>
<td>5,546</td>
</tr>
<tr>
<td>12</td>
<td>1,776</td>
<td>&lt;49</td>
<td>2,970</td>
<td>&lt;42</td>
<td>9,460</td>
</tr>
</tbody>
</table>

NOTES
1. Refer to Downstream Defender® Clean-out Detail (Fig. 1) 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.
**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 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.

**Floatables and Sediment Cleanout**

Floatables cleanup 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 vactor hose and skimmer pole to be lowered to the base of the sump.

**Scheduling**

- Floatables and sump cleanup 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 cleanup 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 net (if only floatables are being removed)
- Sediment probe (such as a Sludge Judge®)
- Vactor truck (6-inch flexible hose recommended)
- Downstream Defender® Maintenance Log

**Maintenance at a Glance**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Frequency</th>
</tr>
</thead>
</table>
| 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.

**Fig.6 View of outer annulus of floatables and oil collection zone.**

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

**Fig.9 Floatables and sediment are removed with a vactor hose.**
### Downstream Defender® Installation Log

<table>
<thead>
<tr>
<th>HYDRO INTERNATIONAL REFERENCE NUMBER:</th>
</tr>
</thead>
<tbody>
<tr>
<td>SITE NAME:</td>
</tr>
<tr>
<td>SITE LOCATION:</td>
</tr>
<tr>
<td>OWNER:</td>
</tr>
<tr>
<td>CONTRACTOR:</td>
</tr>
<tr>
<td>CONTACT NAME:</td>
</tr>
<tr>
<td>CONTACT NAME:</td>
</tr>
<tr>
<td>COMPANY NAME:</td>
</tr>
<tr>
<td>COMPANY NAME:</td>
</tr>
<tr>
<td>ADDRESS:</td>
</tr>
<tr>
<td>ADDRESS:</td>
</tr>
<tr>
<td>TELEPHONE:</td>
</tr>
<tr>
<td>TELEPHONE:</td>
</tr>
<tr>
<td>FAX:</td>
</tr>
<tr>
<td>FAX:</td>
</tr>
<tr>
<td>INSTALLATION DATE:</td>
</tr>
<tr>
<td>/ /</td>
</tr>
<tr>
<td>MODEL (CIRCLE ONE):</td>
</tr>
<tr>
<td>4-FT 6-FT 8-FT 10-FT CUSTOM</td>
</tr>
</tbody>
</table>

### Downstream Defender® Inspection and Maintenance Log

<table>
<thead>
<tr>
<th>Date</th>
<th>Initials</th>
<th>Depth of Floatables and Oils</th>
<th>Sediment * Depth Measured</th>
<th>Volume of Sediment Removed</th>
<th>Site Activity and Comments</th>
</tr>
</thead>
</table>

*Note: Sediment removal is not required unless sediment depths exceed 75% of maximum clean-out depths stated in Table 1.*
DO IT RIGHT THE FIRST TIME
LEARN MORE AT HYDRO-INT.COM/SERVICE

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

Stormwater Solutions
94 Hutchins Drive
Portland, ME 04102

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

www.hydro-int.com