



# First Defense®

Cost-effective stormwater treatment with adaptability to meet demanding site requirements

## Product Profile

The First Defense® is an enhanced vortex separator that combines an effective and economical stormwater treatment chamber with an integral peak flow bypass. It efficiently removes sediment total suspended solids (TSS), trash and hydrocarbons from stormwater runoff without washing out previously captured pollutants. The First Defense® is available in several model configurations to accommodate a wide range of pipe sizes, peak flows and depth constraints (Table 1, next page).

## Components

- |  |                               |
|--|-------------------------------|
| 1. Inlet Grate (optional)                  | 6. Internal Bypass            |
| 2. Inlet Chute                             | 7. Outlet Chute               |
| 3. Inlet Pipe (optional)                   | 8. Outlet Pipe                |
| 4. Floatables Draw Off Slot (not pictured) | 9. Oil and Floatables Storage |
| 5. Precast Vortex Chamber                  | 10. Sediment Storage Sump     |

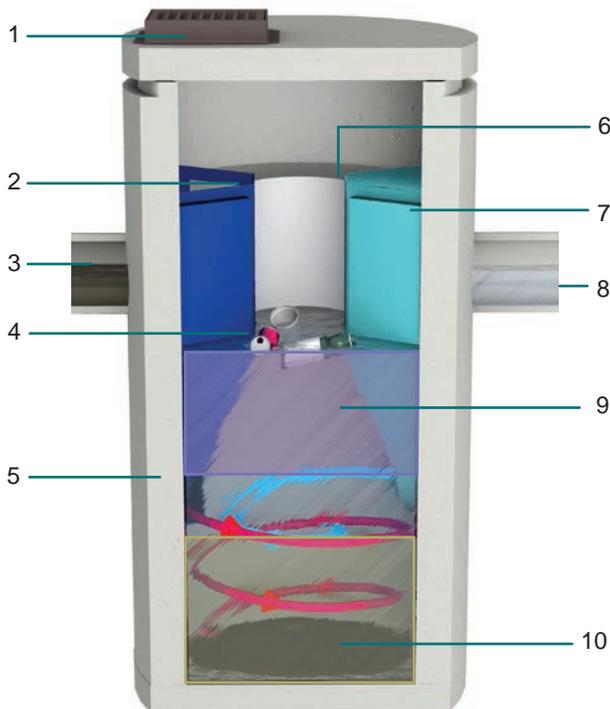


Fig.1 The First Defense® has internal components designed to efficiently capture pollutants and prevent washout at peak flows.

## Applications

- Stormwater treatment at the point of entry into the drainage line
- Sites constrained by space, topography or drainage profiles with limited slope and depth of cover
- Retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line
- Pretreatment for filters, infiltration and storage

## Advantages

- Inlet options include surface grate or multiple inlet pipes
- Integral high capacity bypass conveys large peak flows without the need for “offline” arrangements using separate junction manholes
- Proven to prevent pollutant washout at up to 500% of its treatment flow
- Long flow path through the device ensures a long residence time within the treatment chamber, enhancing pollutant settling
- Delivered to site pre-assembled and ready for installation

## How it Works

The First Defense® has internal components designed to remove and retain gross debris, total suspended solids (TSS) and hydrocarbons (Fig.1).

Contaminated stormwater runoff enters the inlet chute from a surface grate and/or inlet pipe. The inlet chute introduces flow into the chamber tangentially to create a low energy vortex flow regime (magenta arrow) that directs sediment into the sump while oils, floating trash and debris rise to the surface.

Treated stormwater exits through a submerged outlet chute located opposite to the direction of the rotating flow (blue arrow). Enhanced vortex separation is provided by forcing the rotating flow within the vessel to follow the longest path possible rather than directly from inlet to outlet.

Higher flows bypass the treatment chamber to prevent turbulence and washout of captured pollutants. An integral bypass conveys infrequent peak flows directly to the outlet chute, eliminating the need for, and expense of, external bypass control structures. Floatables are diverted away from the bypass into the treatment chamber through the floatables draw off slot.

# First Defense®

## Maintenance

The First Defense® needs minimal maintenance, but like all structural best management practices maintenance is necessary for the long-term protection of the environment.

Sediments captured by the First Defense® are stored in the sump; floatable trash and hydrocarbons are stored on the surface of the standing water. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig.2).

More detailed information can be found in the comprehensive First Defense® Operation and Maintenance Manual, available at <http://www.hydro-int.com/us/products/first-defense>.



Fig.2 Maintenance is performed with a standard sump vac.

## First Defense® Sizing & Design

### Design Options for Inlet and Internal Bypass Arrangements

For maximum flexibility the First Defense® inlet and internal bypass arrangements are available in several configurations (Fig.3a - 3c). Model parameters and design criteria are shown in Table 1.

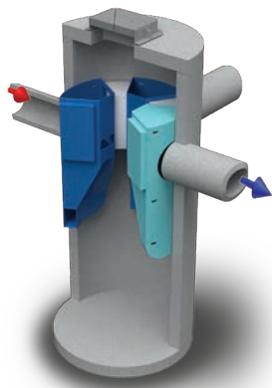


Fig.3a Inlet configurations for all models include options for inlet grates and multiple inlet pipes.

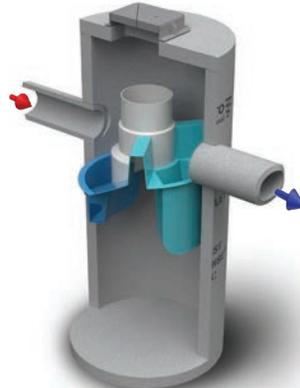


Fig.3b First Defense®-4HC with higher capacity internal bypass and larger maximum pipe diameter.

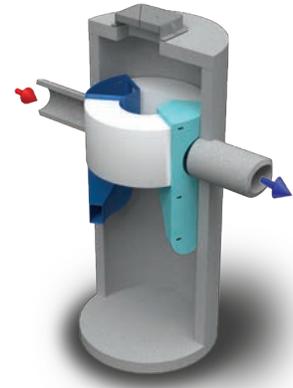


Fig.3c First Defense®-6DB, with higher capacity dual internal bypass and larger maximum pipe diameter.

Table 1. First Defense® Models and Design Criteria.

First Defense® Model Number	Diameter	Typical Flow Rates for TSS Treatment		Peak Online Flow Rate <sup>1</sup>	Maximum Pipe Diameter	Oil Storage Capacity	Minimum Sediment Storage Capacity <sup>2</sup>	Minimum Distance from Outlet Invert to Top of Rim <sup>1</sup>	Standard Distance from Outlet Invert to Sump Floor <sup>1</sup>
		106µm	230µm						
	(ft / m)	(cfs / L/s)	(cfs / L/s)	(cfs / L/s)	(in / mm)	(gal / L)	(yd <sup>3</sup> / m <sup>3</sup> )	(ft / m)	(ft / m)
FD-4	4 / 1.2	0.7 / 20	1.2 / 34	6.0 / 170	18 / 457	180 / 681	0.23 / 0.18	3.1 / 1.07	5.0 / 1.52
FD-4HC				15.0 / 425	24 / 610			2.3 - 4.0 / 0.7-1.2	
FD-6	6 / 1.8	2.2 / 63	3.8 / 108	18.0 / 510	24 / 610	420 / 1,590	0.52 / 0.40	4.0 / 1.22	6.0 / 1.83
FD-6DB				25.0 / 708	30 / 762				

<sup>1</sup>Varies. Refer to General Arrangement Drawing.

<sup>2</sup>Contact Hydro International when larger sediment storage capacity is required.