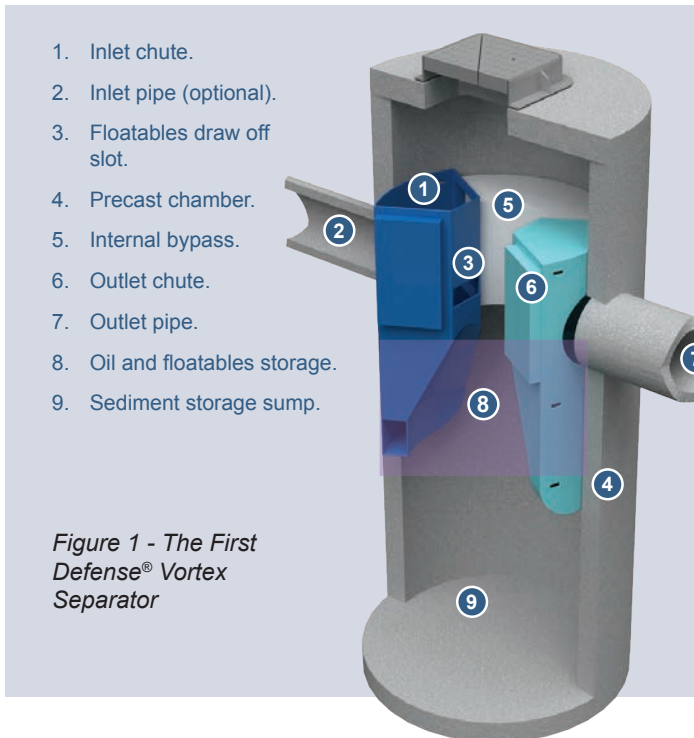


## First Defense® Vortex Separator

The First Defense® is an economical hydrodynamic vortex separator for effective removal of sediment, litter and oil from surface water runoff. Captured pollutants are kept safely within the device keeping public areas free from harmful pollutants.

Suitable for at-source pollution control in small to medium size catchments, the First Defense® provides space-saving, easy-to-install surface water treatment in a standard size manhole.



### Components

The First Defense® has been designed with flexibility and ease of installation in mind. It consists of a standard, structural concrete chamber with integral sealing system and factory fitted internal components.

It uses the principals of rotational flow to provide improved pollutant capture compared to linear or simple gravity sedimentation chambers.

An integral bypass chute, adaptable to meet site requirements, directs exceedance flows through the chamber without disturbing previously captured pollutants.

Watch a short video showing the First Defense® components and operation at:

<http://www.hydro-int.com/uk/products/first-defense-vortex-separator>



### Repeatable, Reliable Performance

The First Defense® internal components have been carefully designed to create a low energy rotational flow within the chamber to encourage removal of a number of common pollutants, including:

#### Coarse particles



Greater than 80% removal of medium-fine sand particles.

See Technical Abstract: Performance Verification of Sediment Removal with F-60 Silica Sand.

#### Gross Pollutants



Observational data from testing shows good retention of gross pollutants, including litter and leaf debris.

#### Liquid and Sediment Bound Hydrocarbons



Greater than 40% removal of various forms of hydrocarbons, including polycyclic aromatic hydrocarbons (PAHs). Other pollutants such as nutrients and metals attached to sediment particles will also be removed.

See Technical Abstract: Pollutant Removal Through Association with Sediments.

### Avoids Pollutant Wash Out

The First Defense® contains an integral bypass that conveys large, infrequent rainfall event flows directly to the outlet chute. This prevents turbulence in the chamber and hinders wash out of the captured pollutants.

See Technical Abstract: The Importance of Wash Out Protection.

## Sizing

For design purposes, the selected model's Treatment Flow Rate should be greater or equal to the site's Water Quality Flow Rate.

The hydraulic capacity of the chamber should be considered with respect to the peak discharge flow rate from the site or the pipe full flow rate.

Model Diameter (m)	Treatment Flow Rate (l/s) <sup>a)</sup>	Hydraulic Capacity (l/s) <sup>b)</sup>	Oil Storage Capacity (l)	Sediment Storage Capacity (m³)
1.2	29	120	681	0.76
1.8	90	510	1,590	2.7

**Notes:**

- a) Treatment flow rates based on 80% removal of F-60, medium-fine sand. Sizing based on removal of finer or coarser sediment ranges or for free oil removal can be provided if required.
- b) Maximum flow rate that can pass through the chamber without surcharge to the upstream network. Based on a single bypass chute. A secondary bypass chute can be added to increase the hydraulic capacity.

Headloss is dependent on the number and size of pipe connections, but is typically below 250 mm at the treatment flow rate.

Table 1 - First Defense® design information.

The First Defense® can be sized for different treatment goals and objectives.

## Expert Design Service

Hydro's professional engineers are on hand to provide free support with the correct sizing and application of the First Defense® within in each drainage design.

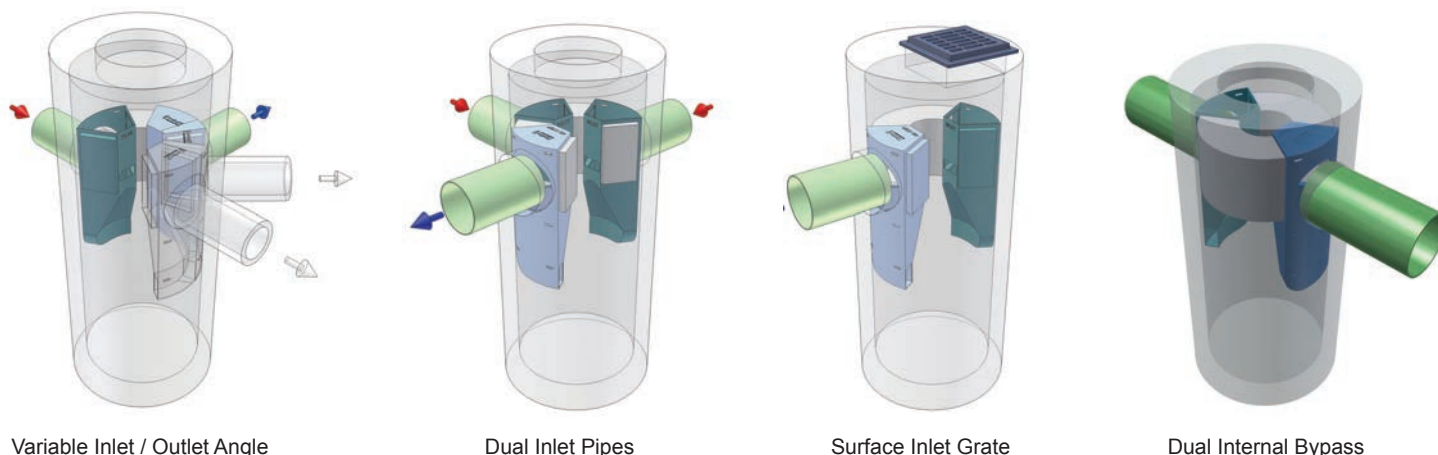
We can also provide estimated maintenance intervals, whole life cost estimates and predicted pollutant removal performance.

**Call the StormTrain® Hotline on: 01275 337955 or email [stormtrain@hydro-int.com](mailto:stormtrain@hydro-int.com)**

## Adaptable

The First Defense® has been specifically designed to be adaptable to site conditions, whilst also delivering effective treatment of surface water runoff.

For maximum flexibility, First Defense® inlet, outlet and internal bypass arrangements are available in several configurations:



# Design Data

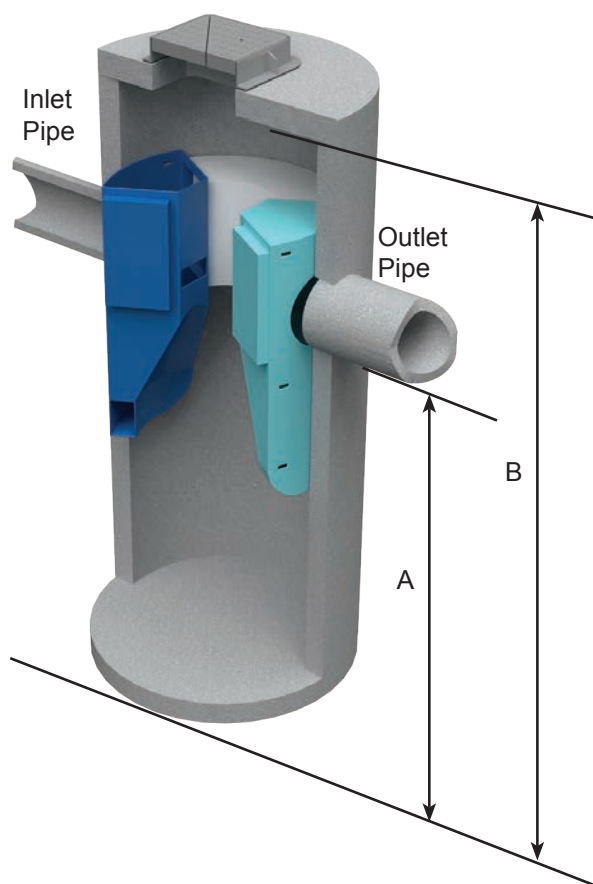
## First Defense®

### Vortex Separator

### Saves on Construction Costs

The First Defense® is typically delivered to site as a pre-cast concrete manhole, complete with an innovative manhole sealing system and internal components already installed. Installation is therefore similar to any other manhole installation on site. Full installation guidelines are available.

Lightweight High Density Polyethylene (HDPE) chambers can be provided where installation of a concrete manhole is not practical.



### Dimensions and Weights

The dimensions in Table 2 are given as a guide.

Unit	External Diameter of Unit (mm)	Inlet & Outlet Pipe Diameter (mm)	Depth (m)			Lift Weight (t)
			A	B	Component Depth <sup>a)</sup>	
<b>1.2 m Sealed Manhole System with HD Cover Slab</b>	1460	300	2.135	2.827	3.150	
HD Cover Slab <sup>b)</sup>					0.230	0.6
Base Section					0.900	1.5
Top Section					2.075	2.5
<b>1.8 m Sealed Manhole System with HD Cover Slab</b>	2160	600	2.841	3.740	4.050	
HD Cover Slab <sup>b)</sup>					0.290	1.4
Base Section					1.370	5.0
Top Section					2.600	8.0

**Notes:**

- a) Base and Top Section component depths are shown as the total height during transportation / before assembly on site. The total depth is the depth of the assembled unit.
- b) Cover slabs are heavy duty, suited for highways loading and are supplied with one or two access openings for maintenance.

Table 2 - First Defense® dimensions and weights.

# Design Data

## First Defense®

### Vortex Separator

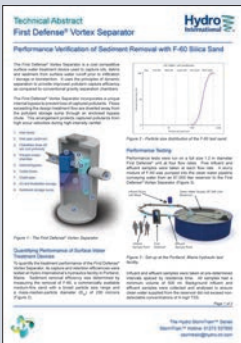
## Easy to Maintain

Maintenance of the First Defense® is simple, safe and cost-effective. Maintenance is carried out from the surface using a standard vacuum tanker and personnel are not required to enter the device.

With a large capacity to store sediments and oils (see Table 1) and with a proven ability to prevent wash out, maintenance intervals can be years rather than months - depending on site conditions.

Additional pollutant storage capacity can be build into the chamber to extend maintenance intervals if required.

## First Defense® Technical Guidance



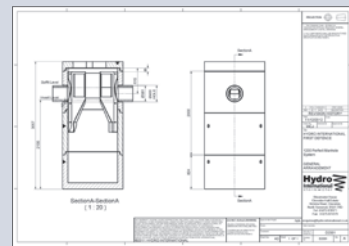
Technical Abstracts



Case Studies



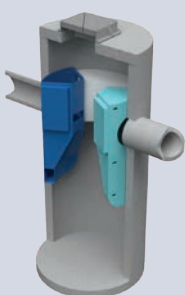
Installation and Maintenance Guidelines



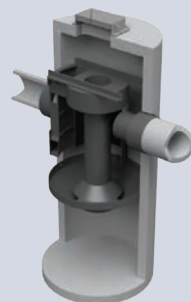
General Arrangement Drawings

## The Hydro StormTrain® Series of Surface Water Treatment Devices

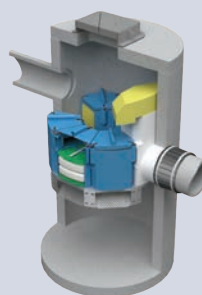
The First Defense® is one of the Hydro StormTrain® Series of surface water treatment devices. Each device delivers proven, measureable and repeatable surface water treatment performance. Each can be used independently to meet the specific needs of a site or combined to form a management train. They can be used alongside natural SuDS features to protect, enable or enhance them.



First Defense®  
Vortex Separator



Downstream Defender®  
Advanced Hydrodynamic  
Vortex Separator



Up-Flo™ Filter  
Fluidised Bed Up Flow  
Filtration System



Hydro BioCell™  
Bioretention System