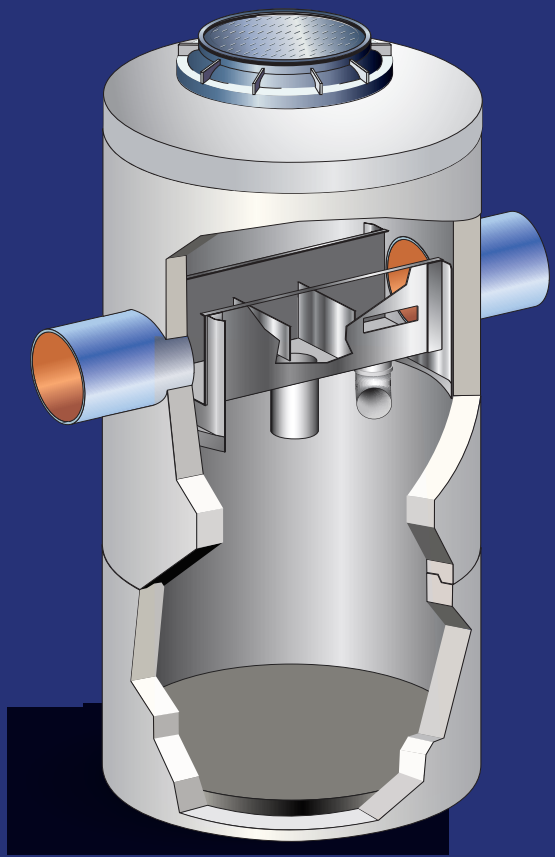
OCEAN PROTECT

VortSentry® HS

Technical Design Guide



Stopping Pollution Entering Waterways

09/22

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Introduction

The VortSentry® HS is a compact, below grade stormwater treatment system that employs helical flow technology to enhance gravitational separation of floating and settling pollutants from stormwater flows. With the ability to accept a wide range of pipe sizes, the VortSentry® HS can treat and convey flows from small to large sites. A unique internal bypass design means higher flows can be diverted without the use of external bypass structures.

Operational Overview

The internal flow controls of the VortSentry® HS are illustrated in *Figure 1.* Low, frequently occurring storm flows are directed into the treatment chamber through the primary inlet. The tangentially oriented downward pipe induces a swirling motion in the treatment chamber that increases capture and containment abilities. Moderate storm flows are directed into the treatment chamber through the secondary inlet, which allows for capture of floating trash and debris. The secondary inlet also provides for treatment of higher flows without significantly increasing the velocity or turbulence in the treatment chamber. This allows for a more quiescent separation environment. Settable solids and floating pollutants are captured and contained in the treatment chamber.

Flow exits the treatment chamber through the outlet flow control, which manages the amount of flow that is treated and helps maintain the helical flow patterns developed within the treatment chamber.

Flows exceeding the system's rated treatment flow are diverted away from the treatment chamber by the flow partition.

During bypass, the head equalising baffle applies head on the outlet flow control to limit the flow through the treatment chamber. This helps prevent re-suspension of previously captured pollutants.

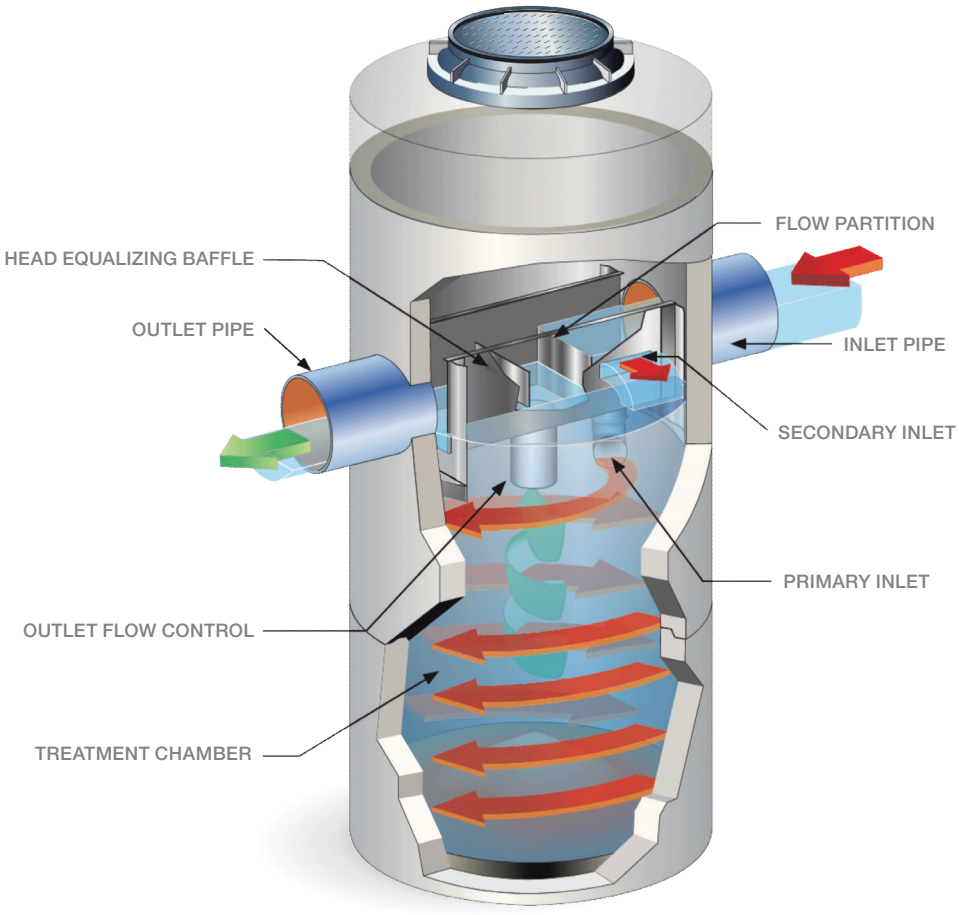

Figure 1: VortSentry® HS components

Selection Process

For online installation the first step in the selection process is to determine the proposed pipe size at the gross pollutant trap (GPT) location and then to select a model from *Table 1.*

The pipe size for each model in *Table 1,* denotes the maximum hydraulic capacity that the VortSentry® can convey when in an online configuration.

When the VortSentry® is part of a treatment train the TFR can be selected to complement or match the flow of the other treatment systems. Modelling of the treatment system using MUSIC is often required to determine the overall performance of the treatment train.

If the listed pipe size for the selected HS model is not able to meet the sites hydraulic flow capacity then a larger model will need to be selected.

Model	Treatable Flow Rate Range (L/s)	Max. Pipe Diameter (mm)	Diameter (m)	Sediment Storage Capacity (m^3)	Oil Storage Capacity (litre)	Typical Depth Below invert (m)
HS09	5.3 - 15.6	450	0.9	0.4	314	1.7
HS12	11.8 - 34.0	600	1.2	0.7	598	2.1
HS15	21.8 - 62.3	750	1.5	1.1	798	2.4
HS18	36 - 104.8	900	1.8	1.6	1409	2.8
HS21	55 - 158.6	1050	2.1	2.1	2458	3.2
HS24	79.4 - 229.4	1200	2.4	2.8	3199	3.5

Table 1: VortSentry® HS available models

VortSentry® HS systems are designed to achieve an 80% Total Suspended Solids reduction at the Treatable Flow Rate (TFR) based on lab generated performance analysis for a particle gradation with an average particle size (d50) of 110-microns (µm).

The VortSentry® HS is designed to treat all flows up to the TFR. Due to its internal bypass weir configuration, flow rates in the treatment chamber only increase minimally once the TFR is surpassed. At influent rates higher than the TFR, the flow partition will allow most flow exceeding the treatment flow rate to bypass the treatment chamber. This allows removal efficiency to remain relatively constant in the treatment chamber and reduces the risk of washout during bypass flows regardless of influent flow rates.

Treatment flow rates are defined as - *The rate at which the VortSentry® HS will remove a specific gradation of sediment at a specific removal efficiency.*

The TFR can be varied depending on the gradation and removal efficiency specified by the design engineer and the unit size is scaled according to the project goal.

Hydraulic Capacity up to peak flow

The VortSentry® HS has an open accessible centre trough that is designed to the suit the hydraulic capacity of the incoming pipe. The trough walls are sized to ensure that its crest is above the maximum Top Water Level (TWL) at the weir and also within the treatment chamber. This ensures that no captured floating pollutants is inadvertently lost during a larger event.

The open trough arrangement helps with visual inspection for blockages and access to all areas for maintenance.

Configurations

The VortSentry® has the inlet and outlet pipes at 180° to each other as per *Figure 1.*

Multiple pipe inlets directly into the HS is not practical. For multiple inlets pipes, bring these together with a junction pit and then locate the HS after the pit.

Mass load consideration

The VortSentry® HS is designed to capture and retain sediments and oils. The oils and litter that float and the material that settles into the sump of the VortSentry® HS needs to be periodically removed as per any other GPT. The sump sediment storage capacity of each VortSentry® HS model is listed in *Table 1.* The frequency of maintenance depends on the amount of material generated within the contributing catchment and then mobilised in storm events.

The model selection process should consider the amount of anticipated pollution load and the subsequent frequency of maintenance. Annual sediment loads have been documented and can vary from 400 to 900 kg/ha/yr for Urban, Industrial and Commercial catchments. The density can also vary from 1.3 to 2.0 Tonne/m^3 depending on the mix of organic, litter and sediment.

For assistance with selecting an appropriate VortSentry® HS for your project or for additional dimensional or hydraulic information please contact the engineering department of Ocean Protect.

Performance

Full Scale Laboratory Test Results

The VortSentry® Hydrodynamic Separator system has undergone extensive testing in Scarborough, Maine, USA. Testing was conducted on the 1200-mm diameter VortSentry® HS12. Test flow rates ranged from 5-L/s to 40-L/s, and removal efficiencies were calculated for all flows.

All VortSentry® HS models have the same aspect ratio regardless of system diameter.

Please contact Ocean Protect to request any additional information on the testing undertaken to date for the VortSentry® HS.

Maintenance

The table below outlines the primary types of maintenance activities that typically take place as part of an ongoing maintenance schedule for the VortSentry® HS.

Service Type	Description of Typical Activities	Frequency
Minor Service	Visual inspection of flow control trough Removal of larger pollutants in trough Measuring of sediment depth	At 6 Months
Major Service	Removal of accumulated sediment and gross pollutants	At 12 Months

For further information please refer to the *VortSentry® HS Operations and Maintenance Manual.*

Ocean Protect supplies and maintains a complete range of filtration, hydrodynamic separation, screening and oil/water separation technologies.

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