



Proposed Development
Land North of Grange Road
Netley Abbey
Southampton

Water Quality Management Manual

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CONTENTS

1.0	WATER QUALITY	4
Table 1:	Analysis of required pollution hazard indices to indices achieved	6
Appendix A	CIRIA C753 Tables & Downstream Defender Mitigation Indices	
Appendix B	Downstream Defender manufacturer’s information	

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O	Initial issue	August 2023	KHN

1.0 WATER QUALITY

- 1.1 The water quality management for the surface run off from the proposed development has been designed in accordance with the requirements set out in CIRIA C753 the SuDS Manual.
- 1.2 Table 4.3 of CIRIA C753 (**Appendix A**) defines the minimum water quality management for discharges to receiving waters.
- 1.3 Referring to Table 4.3 the proposed development has the following land uses;
- Residential roofs;
 - Individual property driveways;
 - Residential car parks;
 - Low traffic roads (e.g. cul de sacs, general access roads)
- 1.4 Based on these land uses, Table 4.3 indicates that the simple index approach can be adopted for discharge to surface waters for water quality management.
- 1.5 Box 26.2 from CIRIA C753 (**Appendix A**) outlines the steps of the simple index approach.
- 1.6 Based on this approach for the individual steps the information is obtained as follows;

Step 1

Table 26.2 of CIRIA C753 (**Appendix A**) defines the pollution hazard indices for the proposed land use for total suspended solids (TSS), metals and hydrocarbons.

Step 2

Table 26.3 of CIRIA C753 & 'Downstream Defender' (**Appendix A**) defines the total mitigation index for the pollution hazard index.

1.7 The surface water run off for the development has been designed utilising SuDS components as follows;

- Residential Roofs discharges to attenuation pond and wetland through silt trap manholes, 'Downstream Defender' vortex separator an advanced hydrodynamic vortex separator (see manufacturer details in **Appendix B**). and swales.
- Residential car parks & drives run off discharges to trapped gullies then to attenuation pond and wetland through silt trap manholes, 'Downstream Defender' vortex separator and swales
- Low traffic roads run off discharges to trapped gullies then to attenuation pond and wetland through silt trap manholes, 'Downstream Defender' vortex separator and swales;
- Attenuation pond and wetland discharges to open water body after passing through swale.

It should be noted that;

- No surface water run off discharges directly to surface waters.
- The surface water discharge from the site is restricted to the greenfield run off rate.

1.8 The Downstream Defender removes pollutants including;

- Greater than 80% of fine sand particles;
- 100% of floatable debris;

- Greater than 50% of various forms of hydrocarbons, including free floating oils and polycyclic aromatic hydrocarbons (PAHs);
- Sediment bound pollutants.

1.9 The following Table 1 indicates the analysis of land use and its pollution hazard indices to the SuDS components utilised;

	Total suspended solids (TSS) Table 26.2	Total suspended solids (TSS) Table 26.3	Metals Table 26.2	Metals Table 26.3	Hydrocarbons Table 26.2	Hydrocarbons Table 26.3
Land use	Required	Achieved	Required	Achieved	Required	Achieved
Residential roofs	0.2	0.5, 0.5 & 0.8	0.2	0.6, 0.4 & 0.8	0.05	0.6, 0.4 & 0.8
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, home zones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie <300 traffic movements/day	0.5	0.5, 0.5 & 0.8	0.4	0.6, 0.4 & 0.8	0.4	0.6, 0.4 & 0.8

Table 1: Analysis of required pollution hazard indices to indices achieved

1.10 Following the criteria laid down in CIRIA C753 the surface water runoff from the proposed site is in compliance

Appendix A

TABLE 4.3	Minimum water quality management requirements for discharges to receiving surface waters and groundwater			
	Land use	Pollution hazard level	Requirements for discharge to surface waters, including coasts and estuaries ²	Requirements for discharge to groundwater
	Residential roofs	Very low	Removal of gross solids and sediments only	
	Individual property driveways, roofs (excluding residential) residential car parks, low traffic roads (eg cul de sacs, homezones, general access roads), non-residential car parking with infrequent change (eg schools, offices)	Low	Simple index approach ³ <i>Note: extra measures may be required for discharges to protected resources¹</i>	
	Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	Simple index approach ³ <i>Note: extra measures may be required for discharges to protected resources¹</i>	Simple index approach ³ <i>Note: extra measures may be required for discharges to protected resources¹</i> In England and Wales, Risk Screening ⁴ must be undertaken first to determine whether consultation with the environmental regulator is required. In Northern Ireland, the need for risk screening should be agreed with the environmental regulator.
	Trunk Roads and motorways	High	Follow guidance and risk assessment process set out in HA (2009)	
	Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured, industrial sites	High	Discharges may require an environmental licence permit ³ . Obtain pre-permitting advice from the environmental regulator. Risk assessment is likely to be required ⁵ .	

Notes

The minimum water quality management requirements for discharges to receiving surface waters and groundwater are presented here. (For Northern Ireland, this guidance should be considered as interim until such time as Northern Ireland publishes its own legislation/policy/guidance)

- These are not required in Scotland and Northern Ireland. For England and Wales see step 3 of the simple index approach (Section 26.7.1).
- In Scotland, the Water Environment (Controlled Activities) (Scotland) Regulations (CAR) 2011 General Binding Rules, Rule 10 (d) (iv) effectively provides an exemption from requiring SuDS for coastal discharge. However, control of any contaminants likely to be present in surface water runoff is still required, but can be delivered using alternative methods such as proprietary treatment products. As the term 'SuDS' in this manual includes proprietary treatments products, this exemption is not valid in this context.
- The application of the simple index approach should follow the approach outlined in Section 26.7.1 (or equivalent approved).
- Risk screening is an assessment to identify high risk scenarios where the Environment Agency or Natural Resources Wales (NRW) would wish to be consulted regarding infiltration of water from surface runoff in order to agree the proposed design approach. The risk screening method is provided in Section 26.7.2.

5. The risk assessment should determine the appropriate design approach to mitigate risk to acceptable levels following the guidance outlined in Section 26.7.3. This assessment should be approved by the environmental regulator.

BOX **Steps of the simple Index approach**

26.2

Step 1 – Allocate suitable pollution hazard indices for the proposed land use

Step 2 – Select Suds with a total mitigation index that equals or exceeds the pollution hazard index

Step 3 – Where the discharge is to protected¹ surface waters or groundwater, consider the need for a more precautionary approach

Note:

1. Designated as those protected for the supply of drinking water (Table 4.3)

TABLE 26.2 Pollution hazard Indices for different land use classification

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured: industrial sites: trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

Notes

1. Motorways and trunk roads should follow the guidance and risk assessment process set out in Highways Agency (2009).
2. These should only be used if considered appropriate as part of a detailed risk assessment – required for all these land use types (Table 4.3). When dealing with high hazard sites, the environmental regulator should first be consulted for pre-permitting advice. This will help determine the most appropriate approach to the development of a design solution.

Where a site land use falls outside the defined categories, the indices should be adapted (and agreed with the drainage approving body) or else the more detailed risk assessment method should be adopted.

Where nutrient or bacteria and pathogen removal is important for a particular receiving water, equivalent indices should be developed for these pollutants (if acceptable to the drainage approving body) or the risk assessment method adopted.

TABLE 26.3	Indicative SuDS mitigation Indices for discharges of surface waters			
		Mitigation Indices ¹		
	Type of SuDS component	TSS	Metals	Hydrocarbons
	Filter strip	0.4	0.4	0.5
	Filter drain	0.4 ²	0.4	0.4
	Swale	0.5	0.6	0.6
	Bioretention system	0.8	0.8	0.8
	Permeable pavement	0.7	0.6	0.7
	Detention basin	0.5	0.5	0.6
	Pond ⁴	0.7 ⁵	0.7	0.5
	Wetland	0.8 ³	0.8	0.8
	Proprietary treatment systems ^{5,6}	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing area.		

Notes

1. SuDS components only return these indices if they follow the design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters.
2. Filter drains can remove coarse sediments, but their use for this purpose will have significant implications with respect to maintenance requirements, and this should be taken into account in the design and Maintenance Plan.
3. Ponds and wetlands can remove coarse sediments, but their use for this purpose will have significant implications with respect to the maintenance requirements and amenity value of the system. Sediment should normally be removed upstream, unless they are specifically designed to retain the sediment in a separate part of the component, where it cannot easily migrate to the main body of water.
4. Where a wetland is not specifically designed to provide significantly enhanced treatment, it should be considered as having the same mitigation indices as the pond.
5. See Chapter 14 for approaches to demonstrate product performance. A British Water/Environment Agency assessment code of practice is currently under development that will allow manufacturers to complete an agreed test protocol for systems intended to treat contaminated surface water runoff. Full details can be found at <http://tinyurl.com/qf7vui7>
6. SEPA only considers proprietary treatment systems as appropriate in exceptional circumstances where other types of SuDS component are not practicable. Proprietary treatment systems may also be considered appropriate for existing sites that are causing pollution where there is a requirement to retrofit. SEPA (2014) also provides a flowchart with a summary of checks on suitability of a proprietary system.

Model	Downstream Defender® Select Mitigation Indices ^{(a)(b)}		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons (Oils)
Vortex	0.3	0.2	0.2
Vortex Plus	0.5	0.4	0.5
Advanced Vortex	0.5	0.4	0.5
Notes: (a) All mitigation indices supplied by Hydro International Ltd are independently verified and calculated using the methods laid out in the British Water How To Guide: Applying the CIRIA SuDS Manual Simple Index Approach to Proprietary / Manufactured Stormwater Treatment Devices. Performance declarations are available on request or on the British Water website. (b) Mitigation Indices quoted for the Downstream Defender® Select are valid when the unit is designed according to the Treatment Flow Rate (see Table 3).			

Appendix B

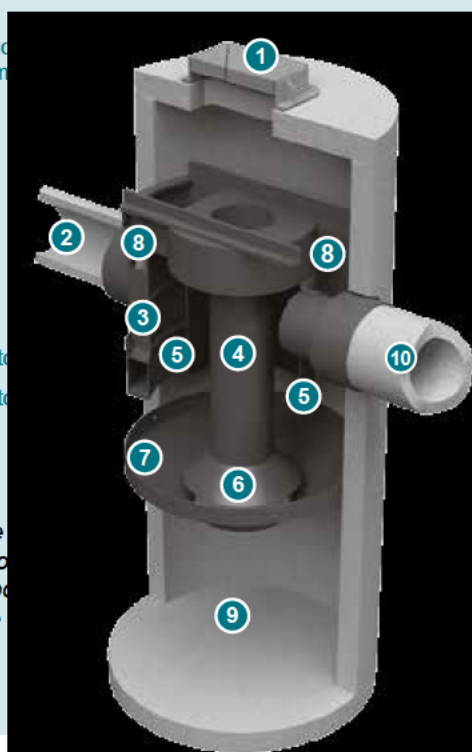
Downstream Defender® Advanced Hydrodynamic Vortex Separator

The Downstream Defender® is an advanced hydrodynamic vortex separator for the effective and reliable removal of fine particles, oils and other floatable debris from surface water runoff.

Its innovative design delivers high efficiency across a wide range of flows in a much smaller footprint than conventional or other swirl-type devices and it is the perfect choice for any catchment likely to convey high quantities of contamination.

1. Access for removal of floatables and sediment.
2. Inlet pipe.
3. Inlet chute.
4. Centre shaft.
5. Dip plate.
6. Centre cone.
7. Benching skirt.
8. Floatables and oil storage zone.
9. Isolated sediment storage zone.
10. Outlet pipe.

Figure 1 - The unique components of the Downstream Defender® enhance pollutant removal performance and prevent wash out.



Unique Flow Modifying Components

The Downstream Defender® consists of a structural concrete chamber with unique flow modifying internal components. It is these internal components that differentiate the Downstream Defender® from catchpits, sedimentation basins or sedimentation sumps. They facilitate advanced hydrodynamic vortex separation by reducing turbulence, lengthening the flow path to increase chamber residence time and introducing shear planes.

The internal components also ensure that the pollutant storage zones are isolated and protected from high flows that could cause pollutant re-entrainment or wash out.

Compared to devices that have poorly designed internal components, the Downstream Defender® captures and retains more of the annual pollutant load.

Watch a short video showing the Downstream Defender® components and operation at:

<http://www.hydro-int.com/en-gb/products/downstream-defender-0>



Repeatable, Reliable Performance

The Downstream Defender® delivers high removal of pollutants through advanced, hydrodynamic separation across a wide range of flows. The device has a proven track record of tackling an assortment of pollutants including:

Fine particles



Greater than 80% removal of fine sand particles.

Gross Pollutants



100% of floatable debris, such as food wrappers, Styrofoam cups and drinks cartons removed in independent site trials.

Liquid and Sediment Bound Hydrocarbons



Greater than 50% removal of various forms of hydrocarbons, including free floating oils and polycyclic aromatic hydrocarbons (PAHs).

Sediment Bound Heavy Metals and Nutrients

Heavy Metals

As an efficient device for removal of fine sediment, the Downstream Defender® is also effective for removal of sediment bound pollutants.

Nutrients

Design Data

Downstream Defender®

Advanced Hydrodynamic Vortex Separator

No Risk of Pollutant Wash Out

The Downstream Defender® has been specially designed to isolate the pollutant storage zones and is proven to prevent pollutant wash out. See Technical Abstract: The Importance of Pollutant Wash Out Protection.

Sizing

The Downstream Defender® can be sized for different treatment goals and objectives.

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

The hydraulic capacity of the selected model should be considered with respect to the peak discharge flow rate from the site.

Model Diameter (m)	Treatment Flow Rate (l/s) ^{a)}	Hydraulic Capacity (l/s) ^{b)}	Oil Storage Capacity (l)	Sediment Storage Capacity (m³)
1.2	42	120	270	0.7
1.8	96	270	1350	1.7
2.55	192	542	2500	3.8
3.0	265	750	4650	4.4

Notes:

- a) Treatment flow rates based on >80% removal of US Silica Sand OK110 with no flow bypass. 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.

Head loss at the treatment flow rate is typically less than 500 mm.

Table 1 - Downstream Defender® design information.

Expert Design Service

Hydro's professional engineers are on hand to provide free support with the correct sizing and selection of the Downstream Defender® within 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

Setting Out

The Downstream Defender® can accommodate a change in pipe direction to suit site specific requirements. Combined with the high rate internal bypass, this helps to avoid the need for additional manholes on site. Head loss across the chamber is kept to a minimum (see Table 1).

The inlet and outlet pipes should be sized in accordance with Table 2 (opposite), and a minimum of 90 degrees between inlet and outlet is required.

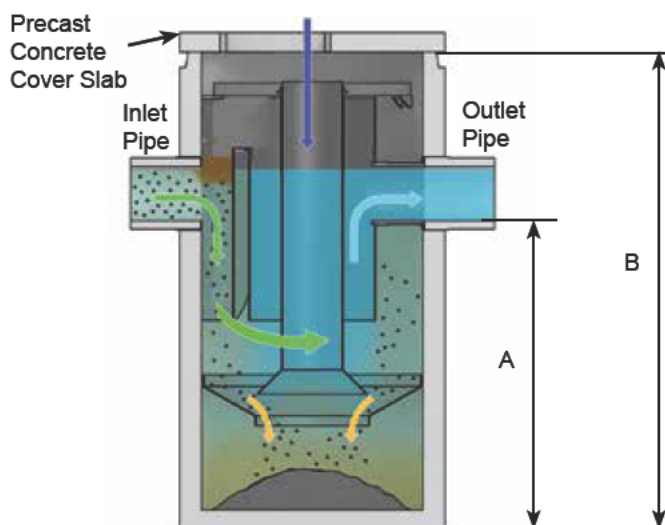
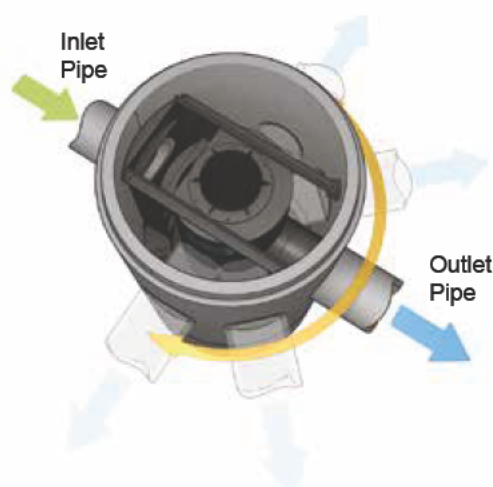
Inlet and outlet pipe connections are at the same invert level.

Additional manhole sections can be provided to extend the chamber to meet site cover and invert levels or provide additional pollutant storage where required.

Design Data

Downstream Defender®

Advanced Hydrodynamic Vortex Separator



Dimensions and Weights

General arrangement drawings of all units are available for download from:

<http://www.hydro-int.com/en-gb/products/downstream-defender-0>

Unit	External Diameter of Unit (mm)	Inlet & Outlet Pipe Diameter (mm)	Depth (m)			Lift Weight (t)
			A	B	Component Depth ^{a)}	
1.2 m Sealed Manhole System with HD Cover Slab	1460	300	1.910	2.600	2.830	
HD Cover Slab ^{b)}					0.230	0.6
Base Section					0.825	1.5
Top Section					1.765	2.5
1.8 m Sealed Manhole System with HD Cover Slab	2160	450	2.510	3.800	4.050	
HD Cover Slab ^{b)}					0.290	1.4
Base Section					1.235	5.0
Top Section					2.485	8.0
2.55 m System with HD Cover Slab	2850	600	2.950	4.750	4.950	
HD Cover Slab ^{b)}					0.200	2.8
Base Section					1.750	8.0
Top Section					3.000	10.0
3.0 m System with HD Cover Slab	3350	750	3.125	5.000	5.200	
HD Cover Slab ^{b)}					0.200	4.6
Base Section					2.000	12.5
Top Section					3.000	14.0

Notes:

- 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.
- Cover slabs are heavy duty, suited for highways loading and are supplied with one or two access openings for maintenance.
- Inlets and outlets are supplied with cast-in holes only. No stub pipes are provided.

Dimensional Tolerances: Height ± 25 mm; Diameter ± 12 mm; Wall Thickness ± 10 mm

Table 2 - Downstream Defender® dimensions and weights.

Design Data

Downstream Defender®

Advanced Hydrodynamic Vortex Separator

Easy to Install

The Downstream Defender® is typically delivered to site as a precast concrete manhole with 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.

Easy to Maintain

Maintenance of the Downstream Defender® 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 can be built into the chamber to extend maintenance intervals if required.

Watch a short video showing the Downstream Defender® maintenance at:

<http://www.hydro-int.com/en-gb/products/downstream-defender-0>



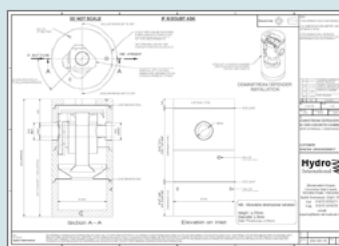
Downstream Defender® Technical Guidance



Case Studies



Installation and Maintenance Guidelines



General Arrangement Drawings

The Hydro StormTrain® Series of Surface Water Treatment Devices

The Downstream Defender® is one of the Hydro StormTrain® Series of surface water treatment devices. Each device delivers proven, measurable 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 Biofilter™
Biofiltration System