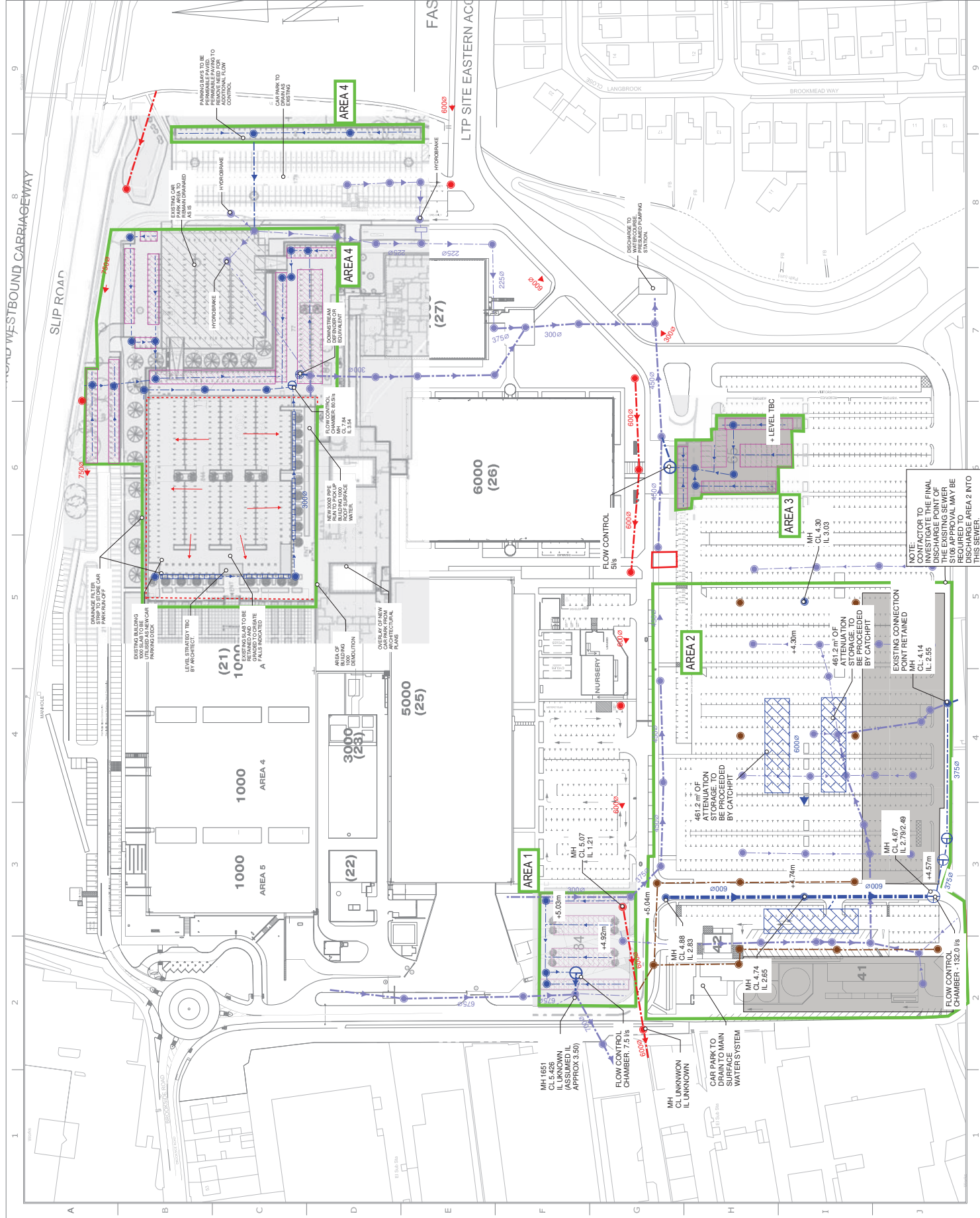
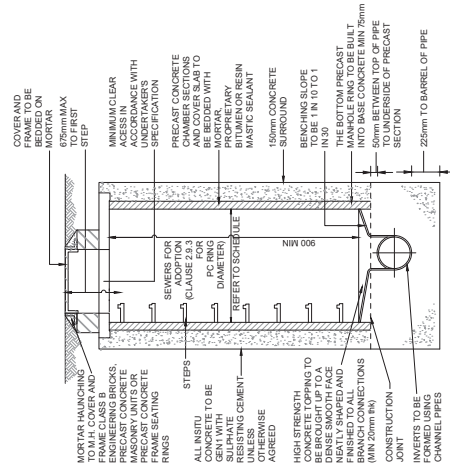
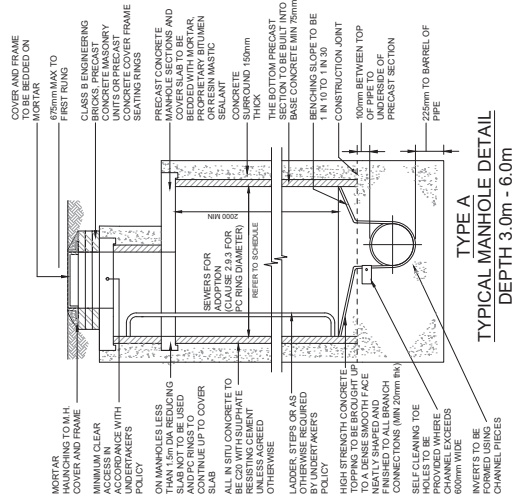


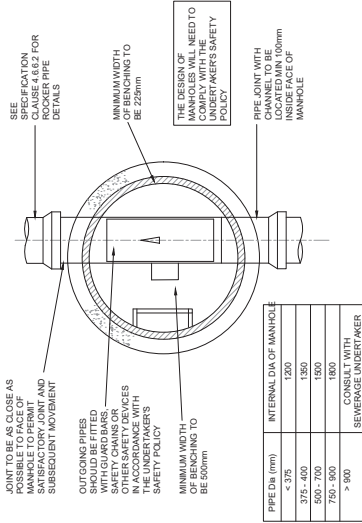


- |                                                                                     |                              |
|-------------------------------------------------------------------------------------|------------------------------|
|  | SITE BOUNDARY                |
|  | EXISTING SURFACE SEWER       |
|  | EXISTING FOUL SEWER          |
|  | PROPOSED SURFACE SEWER       |
|  | PROPOSED FOUL SEWER          |
|  | SURFACE WATER STORAGE        |
|  | UNIQUE DRAINAGE ITEM         |
|  | APPROXIMATE DEVELOPMENT AREA |
|  | PROPOSED PERMEABLE PAVING    |





**NOTE: MANHOLE CHAMBER ACCESS TO BE IN ACCORDANCE WITH FIGURE B.7 FROM SEWERS FOR ADOPTION 7 TO ALLOW ADEQUATE ACCESS FOR MAINTENANCE**



|     |          |             |    |            |
|-----|----------|-------------|----|------------|
| P-1 | 19.06.19 | PRELIMINARY | CN |            |
|     | Rev Date | Description | By | Check App. |

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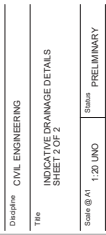
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Office

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LANGSTONE TECHNOLOGY PARK  
LANGSTONE ROAD  
HAVANT, PO9 1SA



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DESIGN DEVELOPMENT

# Downstream Defender®

## High-Level Treatment in a Small Footprint

### Product Profile

The Downstream Defender® is an advanced vortex separator used to treat stormwater runoff in pretreatment or stand-alone applications. Its unique flow-modifying internal components distinguish the Downstream Defender® from conventional and simple swirl separators that typically bypass untreated peak flows to prevent washout of captured pollutants. Its wide treatment flow range, low headloss, small footprint and low-profile make it a compact and economical solution for capturing nonpoint source pollution.

### Components

- |                                    |                          |
|------------------------------------|--------------------------|
| 1. Inlet to Precast Vortex Chamber | 4. Outlet Pipe           |
| 2. Cylindrical Baffle              | 5. Sediment Storage Sump |
| 3. Center Shaft                    | 6. Access Lid            |

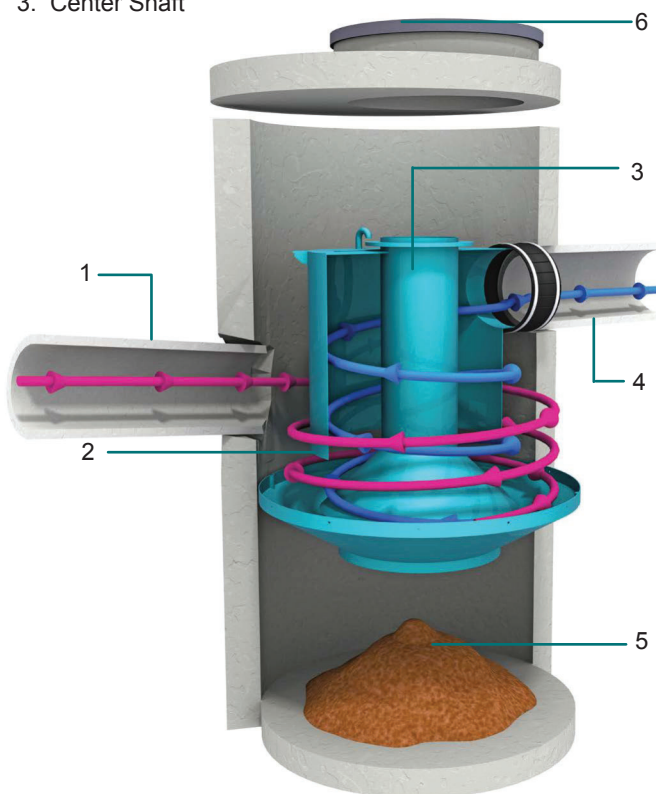


**Fig.1** The Downstream Defender® has internal components designed to maximize pollutant capture and minimize pollutant washout.

### Applications

- Removal of total suspended solids (TSS), floatable trash and petroleum products from stormwater runoff
- New construction or redevelopment of commercial and residential sites
- Pollutant hotspots such as maintenance yards, parking lots, gas stations, streets, highways, airports and transportation hubs
- Site constrained LID or green infrastructure based developments
- LEED® development projects

### Advantages

- Special internal components maximize pollutant capture and minimize footprint, headloss and washout
- Captures and retains a wide range of TSS particles
- High peak treatment flow rates
- Treats the entire storm with no washout or untreated bypass flows
- Low maintenance requirements - no dredging required, and no screens or media to block
- Variable inlet/outlet angles for ease of site layout

### How it Works

Advanced hydrodynamic vortex separation is a complex hydraulic process that augments gravity separation with low-energy rotary forces. The flow modifying internal components used in the Downstream Defender® harness the energy from vortex flow and maximize the time for separation to occur while deflecting high scour velocities (**Fig.1**).

Polluted stormwater is introduced tangentially into the side of the precast vortex chamber to establish rotational flow. A cylindrical baffle with an inner center shaft creates an outer (**magenta arrow**) and inner (**blue arrow**) spiraling column of flow and ensures maximum residence time for pollutant travel between the inlet and outlet.

Oil, trash and other floating pollutants are captured and stored on the surface of the outer spiraling column. Low energy vortex motion directs sediment into the protected sump region. Only after following a long three-dimensional flow path is the treated stormwater discharged from the outlet pipe. Maintenance ports at ground level provide access for easy inspection and clean-out.

# Downstream Defender®

## Drainage Profile

The Downstream Defender® is designed with a submerged tangential inlet to minimize turbulence within the device. Turbulence increases system headlosses and reduces performance by keeping pollutant particles in suspension.

The inlet elevation of the Downstream Defender® is located one inlet pipe diameter lower than the elevation of the outlet invert (**Fig.2**). This arrangement ensures that influent flows are introduced to the treatment chamber quiescently below the water surface elevation, minimizing turbulence.

The unique flow-modifying internal components also minimize hydraulic losses. There are no internal weirs or orifices; large clear openings ensure low headloss at peak flow rates with little risk of blockages that cause upstream flooding.

## Sizing & Design

The Downstream Defender® can be used to meet a wide range of stormwater treatment objectives. It is available in 5 precast models that fit easily into the drainage network (**Table 1**). Selection and layout of the appropriate Downstream Defender® model depends on site hydraulics, site constraints and local regulations. Both online (**Fig.3a**) and offline (**Fig.3b**) configurations are common.

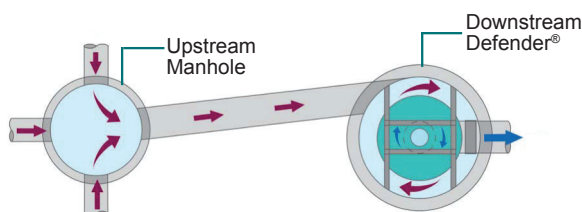


**Fig.3a** The Downstream Defender® in an online configuration.

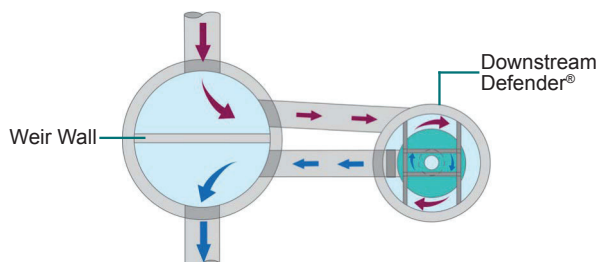


**Fig.3b** The Downstream Defender® in an offline configuration.

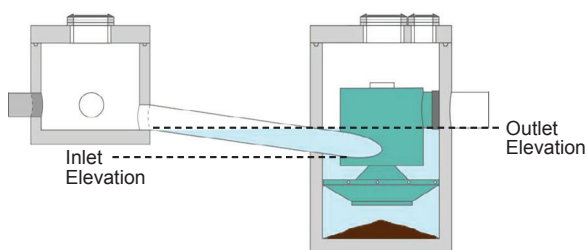


**Fig.2** The Downstream Defender® has a submerged inlet that reduces headloss and improves efficiency of pollutant capture.

**Table 1.** Downstream Defender® Design Chart.

| Model Number and Diameter |     | Peak Treatment Flow Rate |       | Maximum Pipe Diameter |      | Oil Storage Capacity |       | Sediment Storage Capacity |       | Minimum Distance from Outlet Invert to Top of Rim |      | Standard Height from Outlet Invert to Sump Floor |      |
|---------------------------|-----|--------------------------|-------|-----------------------|------|----------------------|-------|---------------------------|-------|---------------------------------------------------|------|--------------------------------------------------|------|
| (ft)                      | (m) | (cfs )                   | (L/s) | (in)                  | (mm) | (gal)                | (L)   | (yd³)                     | (m³)  | (ft)                                              | (m)  | (ft)                                             | (m)  |
| 4                         | 1.2 | 3.0                      | 85    | 12                    | 300  | 70                   | 265   | 0.70                      | 0.53  | 2.8                                               | 0.85 | 4.1                                              | 1.25 |
| 6                         | 1.8 | 8.0                      | 227   | 18                    | 450  | 216                  | 818   | 2.10                      | 1.61  | 3.2                                               | 0.98 | 5.9                                              | 1.80 |
| 8                         | 2.4 | 15.0                     | 425   | 24                    | 600  | 540                  | 2,044 | 4.65                      | 3.56  | 4.2                                               | 1.28 | 7.7                                              | 2.35 |
| 10                        | 3.0 | 25.0                     | 708   | 30                    | 750  | 1,050                | 3,975 | 8.70                      | 6.65  | 5.0                                               | 1.52 | 9.4                                              | 2.85 |
| 12*                       | 3.7 | 38.0                     | 1,076 | 36                    | 900  | 1,770                | 6,700 | 14.70                     | 11.24 | 5.6                                               | 1.71 | 11.2                                             | 3.41 |

\*Not available in all areas. Contact Hydro International for details.

## Inspection and Maintenance

Nobody maintains our systems better than we do. To ensure optimal, ongoing device performance, be sure to recommend Hydro International as a preferred service and maintenance provider to your clients.



Call 1 (800) 848-2706 to schedule an inspection and cleanout or learn more at [hydro-int.com/service](http://hydro-int.com/service)

## Free Stormwater Sizing Tool

This simple online tool will recommend the best separator, model size and online/offline arrangement based on site-specific data entered by the user.

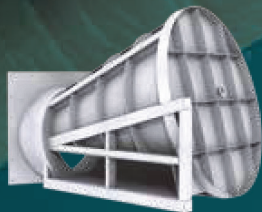
Go to [hydro-int.com/sizing](http://hydro-int.com/sizing) to access the tool.





## The Hydro-Brake® Flow Control Series

Hydro-Brake®  
Flood



Hydro-Brake®  
Optimum



Hydro-Brake®  
Agile

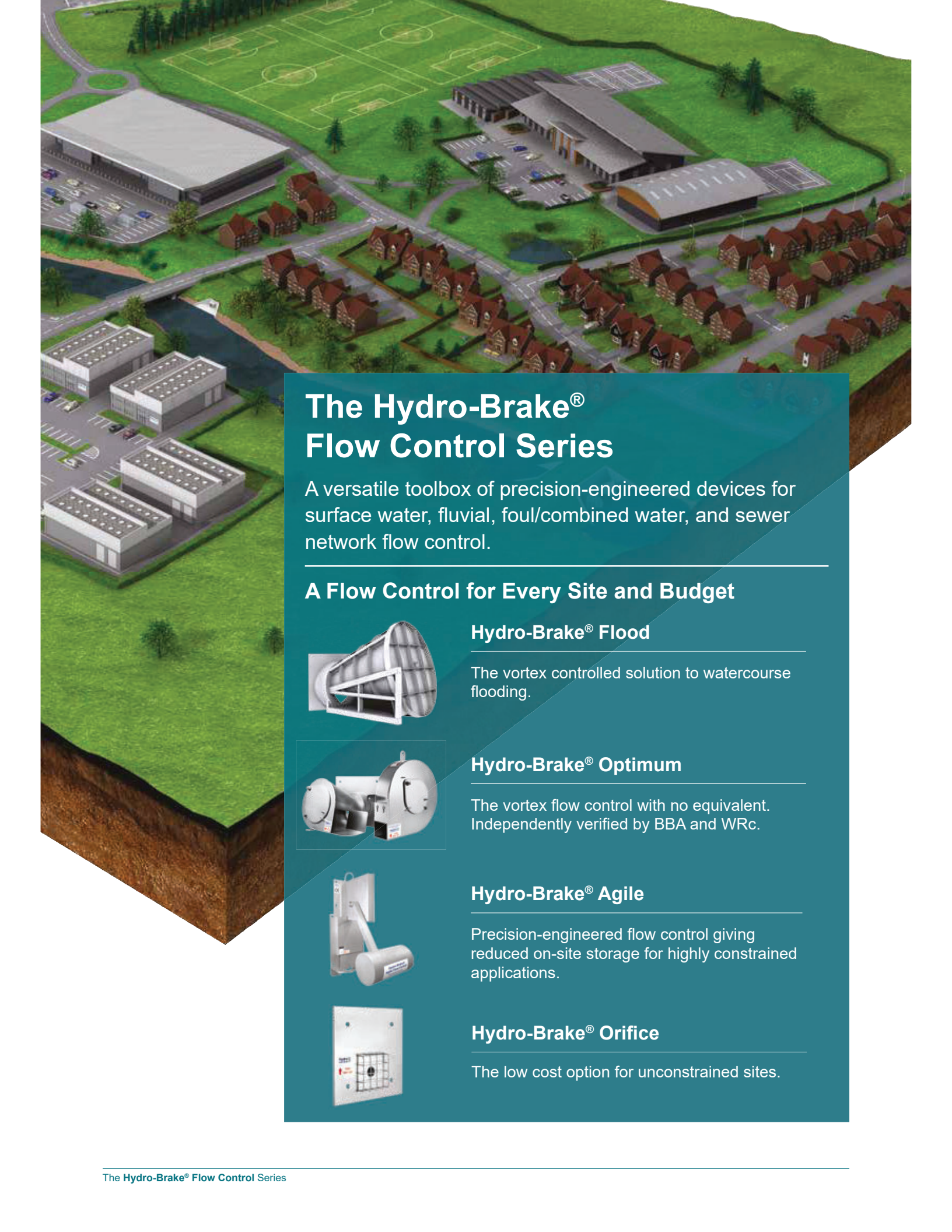


Hydro-Brake®  
Orifice



**The element of control**

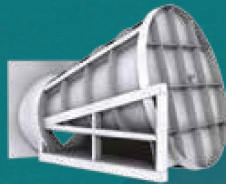
Stormwater Solutions  
Turning Water Around®



# The Hydro-Brake® Flow Control Series

A versatile toolbox of precision-engineered devices for surface water, fluvial, foul/combined water, and sewer network flow control.

## A Flow Control for Every Site and Budget



### Hydro-Brake® Flood

The vortex controlled solution to watercourse flooding.



### Hydro-Brake® Optimum

The vortex flow control with no equivalent. Independently verified by BBA and WRc.



### Hydro-Brake® Agile

Precision-engineered flow control giving reduced on-site storage for highly constrained applications.



### Hydro-Brake® Orifice

The low cost option for unconstrained sites.



## The Element of Control

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**Hydro International has set the highest standards in flow control technology during more than 35 years of specialist water engineering. When it comes to understanding, predicting and controlling the flow of water, Hydro works with scientific rigour.**

Our customers are constantly challenged to deliver imaginative solutions, despite tough commercial and physical constraints. Committed to precision in product development and manufacture, we partner with you to engineer the best-possible water management solutions.

Hydro International's unrivalled knowledge and outstanding technical design support give our customers complete reassurance of system performance and value.

**We give you the element of control.**

## Precision-Engineered for Reliable, Repeatable Performance

---

The Hydro-Brake® Flow Control Series offers a comprehensive choice for sustainable, performance-optimised attenuation and control whatever the project. Fully scalable and adaptable to your site conditions, there is no need to compromise on your project requirements.

All Hydro International flow controls are manufactured to the same exacting standards of quality. Tested, proven and independently accredited by regulatory bodies across the world, they offer the reassurance of reliable, repeatable performance.

## Technical Design Support

---

Faced with increasingly varied environmental and planning stipulations, engineers need to adapt their solutions accordingly and balance flow rates with storage requirements and optimise the drainage system performance over the duration of a storm. In these circumstances, Hydro International's expert design support can advise on the correct flow control selection and design.

A full range of technical services, including detailed hydraulic modelling, easy-to-use design tools and integration into industry-standard software, all help engineers to achieve optimum hydraulic performance.

## Buildable, Maintainable, Adoptable

---

Hydro International flow controls are designed and manufactured for ease of installation and reliable through-life performance with minimum intervention. Simple, predictable, low-maintenance regimes make them straightforward for management organisations to take on, and remove any concerns for adopting authorities.