

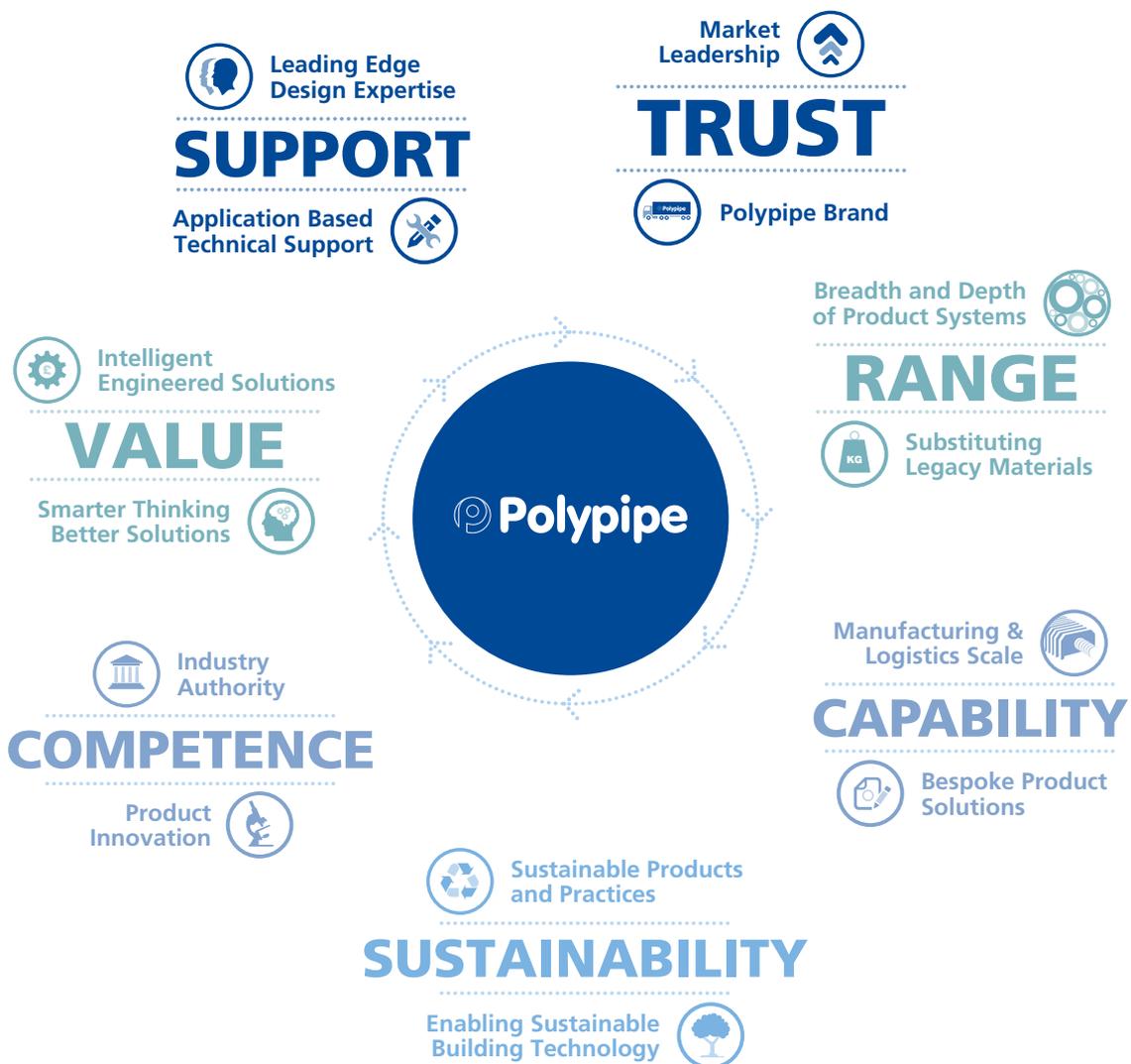
## Buildings & Infrastructure



Storm/Surface Water Management  
Middle East Edition

# Welcome to Polypipe

At Polypipe, conceiving, designing, manufacturing and delivering the most advanced products and systems is more than just an occupation. We see it as our passion. Everything we do has always been based around a few simple beliefs: Quality always beats quantity. Products are nothing without service and support. Sustainability isn't just a 'green' word and working with our customers is much better than simply supplying them.



Our products offer unrivalled choice and quality. With water management and drainage systems, we offer the industry's widest choice of plastic piping and geocellular solutions.

Polypipe understand the differences in culture and the challenges to landscape that come with designing, developing and manufacturing for projects internationally. With multi-site manufacturing bases in UK, Italy, France and the Middle East, we're the experts in providing a comprehensive range of solutions for a wide range of market sectors in any location.

## How to use this brochure

This product guide has been designed to provide you with quick, easy access to information on our range of Polypipe products and systems. A clear colour-coded navigation divides the guide into sections, each with its own introduction, followed by sub-contents segments that break down products by application and function.

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## Company overview

Polypipe designs, develops, manufactures and supplies the widest range of engineered plastic products and systems, enabling the movement of water in sustainable urban environments. With offices in the UK, Europe and Middle East alongside a local manufacturing facility and our extensive experience of working with major regional municipalities, clients, consultants and contractors, we can deliver our services quickly and efficiently to meet the challenging needs of today's construction industry.



### Water management solutions

The demand for comprehensive water management solutions has never been more pressing. Extreme stormwater events, driven by climate change are becoming more frequent. We have responded to this challenge by developing intelligently engineered, holistic water management solutions. The pioneering range of products that Polypipe offers, allows us to provide systems for a huge range of specialist water management solutions. These include geocellular and large diameter pipe systems for detention, attenuation and infiltration/soakaway applications, surface water treatment products and stormwater re-use solutions. From podium decks to stormwater tanks, the versatility of our product range means we can give designers and installers an unrivalled selection of solutions bespoke to the specific requirements of each project.

### Buildings and Infrastructure

At Polypipe we provide advanced solutions and unrivalled technical support to help our customers meet today's construction challenges by providing a versatile range of product systems suitable for a wide range of applications. With our civil, mechanical and public health engineering expertise, we lead the way in replacing traditional materials engineered for a variety of project types. Our range of solutions, include building drainage, stormwater systems, surface water drainage, sewerage systems, and water management solutions.



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# Technical services and support

Our industry expertise and knowledgeable technical team allow us to provide an unrivalled level of technical support for your project.



We work closely with our customers to help guide them through current regional legislation, assisting in selecting the right product ranges to meet with an individual project's requirements through to developing fully engineered systems for more challenging project needs.

## The calibre of our people

We place a huge emphasis on the knowledge and experience of the people we employ, offering unparalleled customer service to ensure your project receives the best possible solution. Our team includes fully qualified design engineers who offer detailed specification guidance and both fabrication and installation specialists. We are also members of influential bodies such as the British Plastics Federation and Construction Products Association and work closely with organisations such as DEFRA, CIRIA, CIBSE (Chartered Institution of Building Services Engineers), SoPHE (The Society of Public Health Engineers) and Construction Excellence, ensuring we are always closely involved with industry drivers.

## Design

From the outset, our Design Team bring their technical expertise and experience, providing assistance with hydraulic, structural and flotation calculations supported by system CAD Designs, specification and help reduce overburden in existing networks.

## Installation guidance

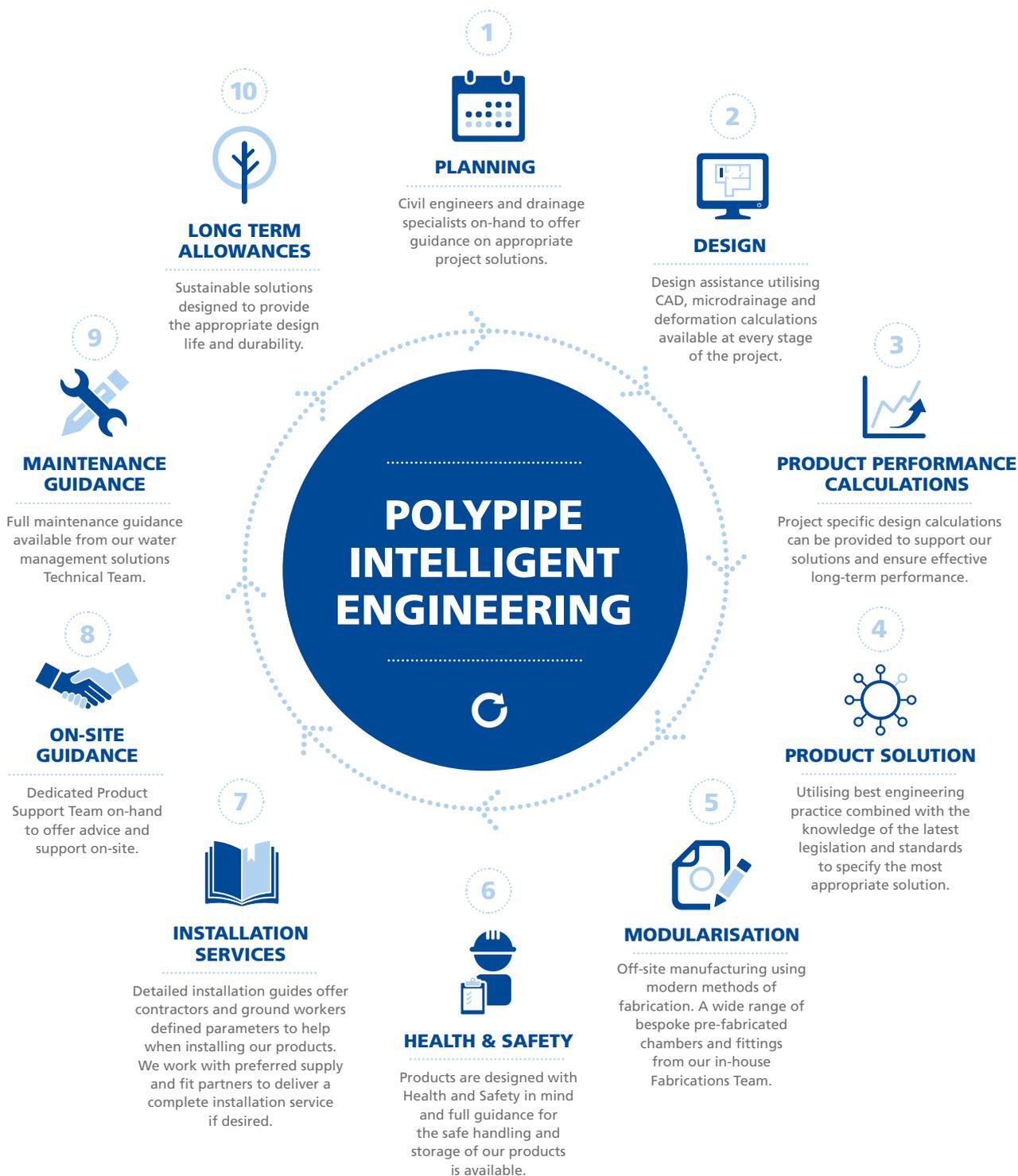
Providing guidance at the critical installation stage, co-ordinating deliveries and ensuring the most cost and time efficient pathways to completion.

## Bespoke fabrication

We are unique in having our own in-house fabrication unit. In the 2,600m<sup>2</sup> facility, our skilled and highly experienced technicians deliver modular engineered drainage and water management systems. These are provided ready-to-install, maximising the benefits of pre-fabrication, for ease of delivery and reduced installation time on-site.

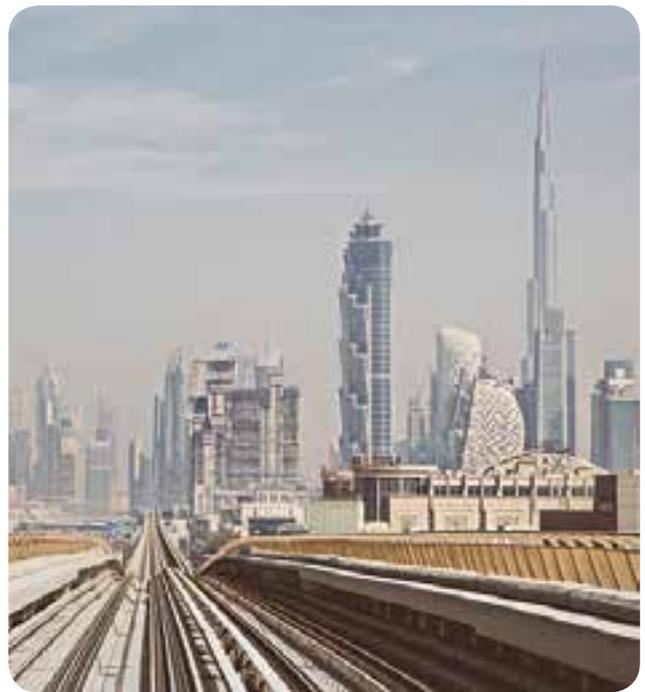
## Guidance and support

We are here to offer you support and guidance at every stage of your project. We have an extensive range of literature, including product datasheets and technical manuals available on our website [www.polypipe.com/middleeast](http://www.polypipe.com/middleeast) or you can contact our Middle East Technical Team for a rapid response to all enquiries on **+971 (0)4 807 3000**.



## Our markets

At Polypipe, we pride ourselves on the versatility of our product range, providing systems and solutions to the commercial, industrial, retail, infrastructure, residential and utilities market sectors.



### Rail

Our trackside Metro and station solutions for surface water drainage and water management have been installed in a number of important rail infrastructure projects internationally. Our products and systems are designed to ensure a quick installation to minimise construction progress and improve Health and Safety during handling and installation.

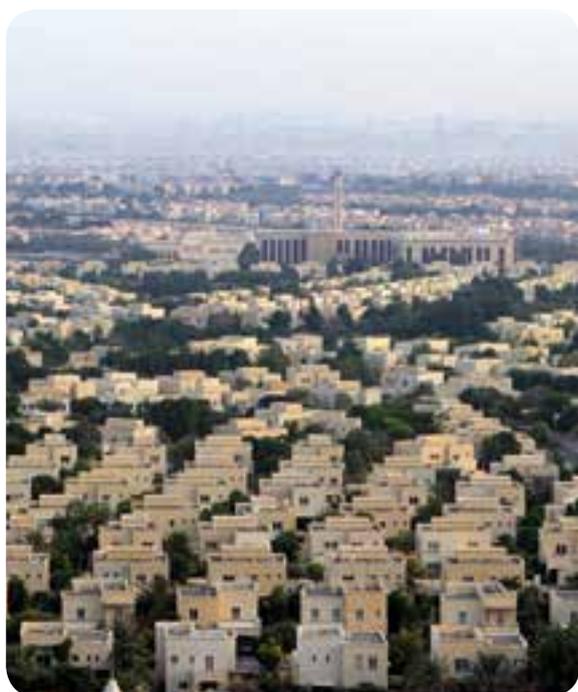
### Commercial and Public

We provide complete solutions for a range of commercial, public, industrial and retail projects with product solutions engineered for large commercial buildings, schools, hospitals, car parks, shopping centres and industrial developments. We have innovative products and systems for every project – from below ground ventilation, sewer and drainage systems to managing surface water, storing and reusing it as an alternative to mains supply.

### Roads and Highways

We offer a full range of surface water drainage systems, locally approved conforming to the latest standards and specifications to meet the needs of highway projects. Our Polystorm surface water management system is fast to install when compared to other traditional systems, speeding up installation to reduce construction progress.

[www.polypipe.com/middleeast](http://www.polypipe.com/middleeast)



## Residential

We have a range of water management solutions to suit any size of development. Permavoid and Polystorm geocellular systems extend the choice for water management further and can be used in conjunction with soft SuDS (Sustainable urban Drainage Systems) to enhance the biodiversity of a development and help reduce overburden on existing networks.



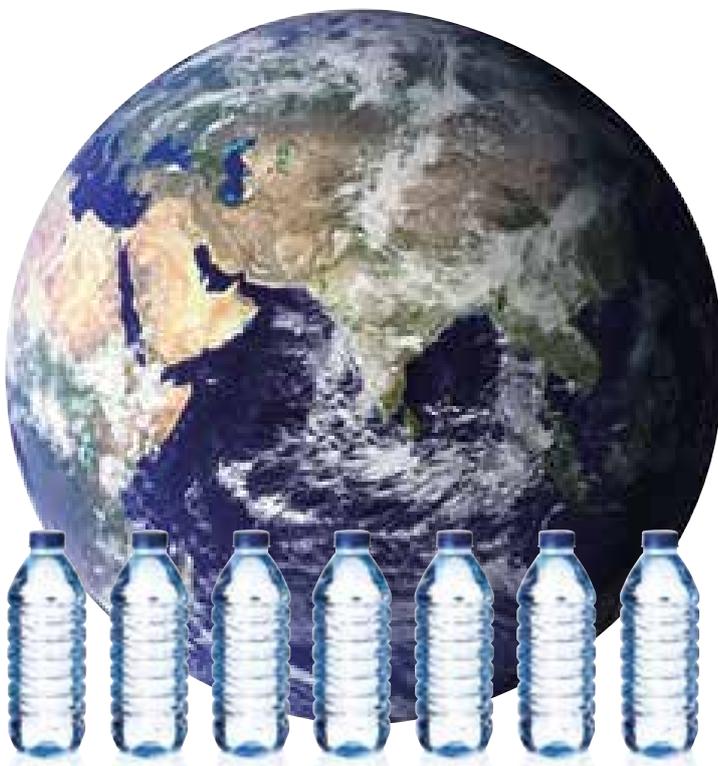
## Transport Hubs

We offer a range of drainage and water management systems, engineered for the requirements of airports, ports and harbours. Whether its capturing water, storing it, reusing it, or draining it away, all of our products have been manufactured with a high degree of durability, versatility and strength – for coping with increased traffic loading.

# Water conservation & management - why?

Water is needed in all aspects of life, the general objective is to make certain that adequate supplies of good quality water are maintained for the entire population of this planet, preserving the hydrological, biological and chemical functions of ecosystems, adapting human activities within the capacity limits of nature, and combating vectors of water related diseases.

UN Earth Summit, Rio De Janeiro, 1992



The seven litre-bottles of water equate to the amount of sea water covering our planet.



The actual percentage of freshwater can be represented by 1 x 300ml can of water.



The actual percentage of freshwater available for human consumption can be represented by 1 teaspoon.



Over 85% of available natural freshwater resources are being used in agriculture but with a shocking low efficiency rate of less than 50% on average.



35% of the world's population will be living in water scarce regions by 2025.

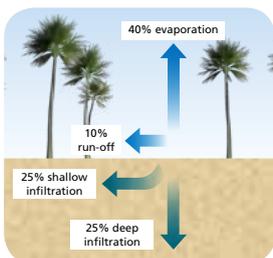
# Water challenges

As a result of rapid urbanization along with population growth across the Middle East, stress on the region's infrastructure has impacted significantly. The shift in climatic conditions and the frequency and intervals of rainfall has also increased, requiring a more engineered and considered approach to the management of water in the built environment. At Polypipe, we understand these challenges and have developed robust solutions, relative to the needs of today's construction industry.

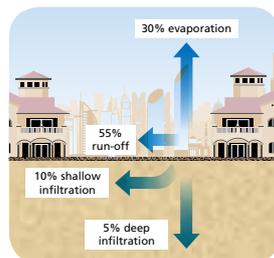


## Urbanisation

NATURAL GROUND COVER



IMPERVIOUS SURFACES



## Consequences



# Challenging tradition

## On-site benefits

As thermoplastic pipes are inherently lighter in weight than legacy materials, they are quicker and easier to install. In many circumstances, a lighter plant is required to install these products, providing cost savings on-site. Further cost savings are achieved as a lighter plant removes the need for temporary access works and prevents damage to road surfaces. Thermoplastic pipes can be **70% cheaper to transport** than equivalent concrete pipes due to their longer lengths and lighter weight providing excellent health and safety benefits when considering the storage and handling of pipes.

## Performance benefits

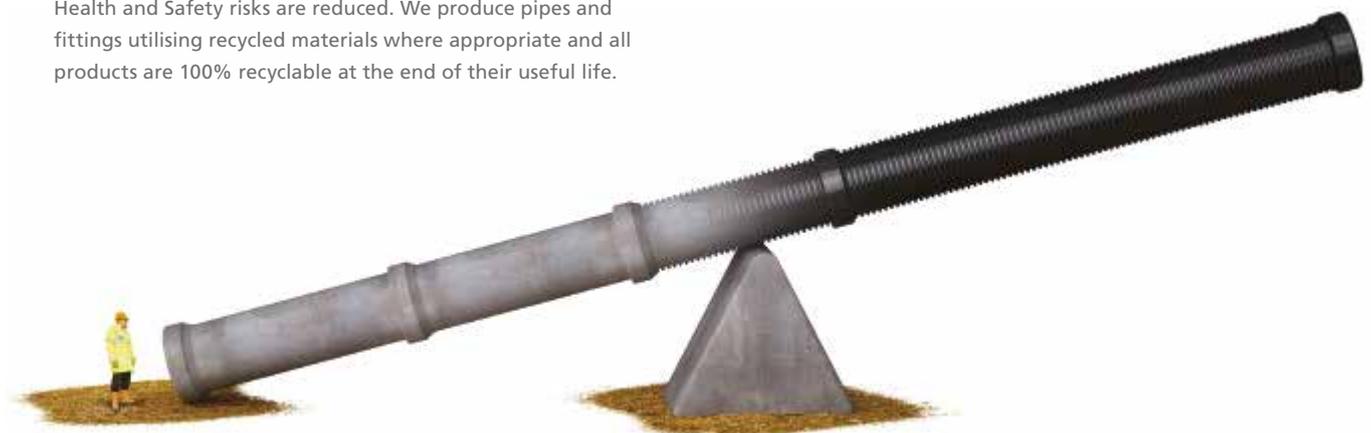
Typically, concrete pipes are usually supplied in maximum 2.5m lengths. Using these longer pipes ensures fewer joints are required along the pipeline, minimising potential leakage points. What's more, the thermoplastic pipes have integral sockets, excellent jointing systems and are flexible, meaning they are more tolerant to movement of the surrounding soil than legacy pipes.

## Environmental benefits

Thermoplastics are an integral part of sustainable developments. Lighter and more robust than most legacy materials, they typically **weigh up to 94% less** than their concrete equivalents. Due to this lighter weight, thermoplastic pipes and fittings help to reduce energy use and therefore greenhouse gas emissions. Thermoplastic pipes can also be transported in greater volumes than their concrete equivalents. Not only will a reduced number of deliveries provide environmental benefits, but the reduction in vehicle movements on-site also ensures that the associated Health and Safety risks are reduced. We produce pipes and fittings utilising recycled materials where appropriate and all products are 100% recyclable at the end of their useful life.

## Plastic benefits

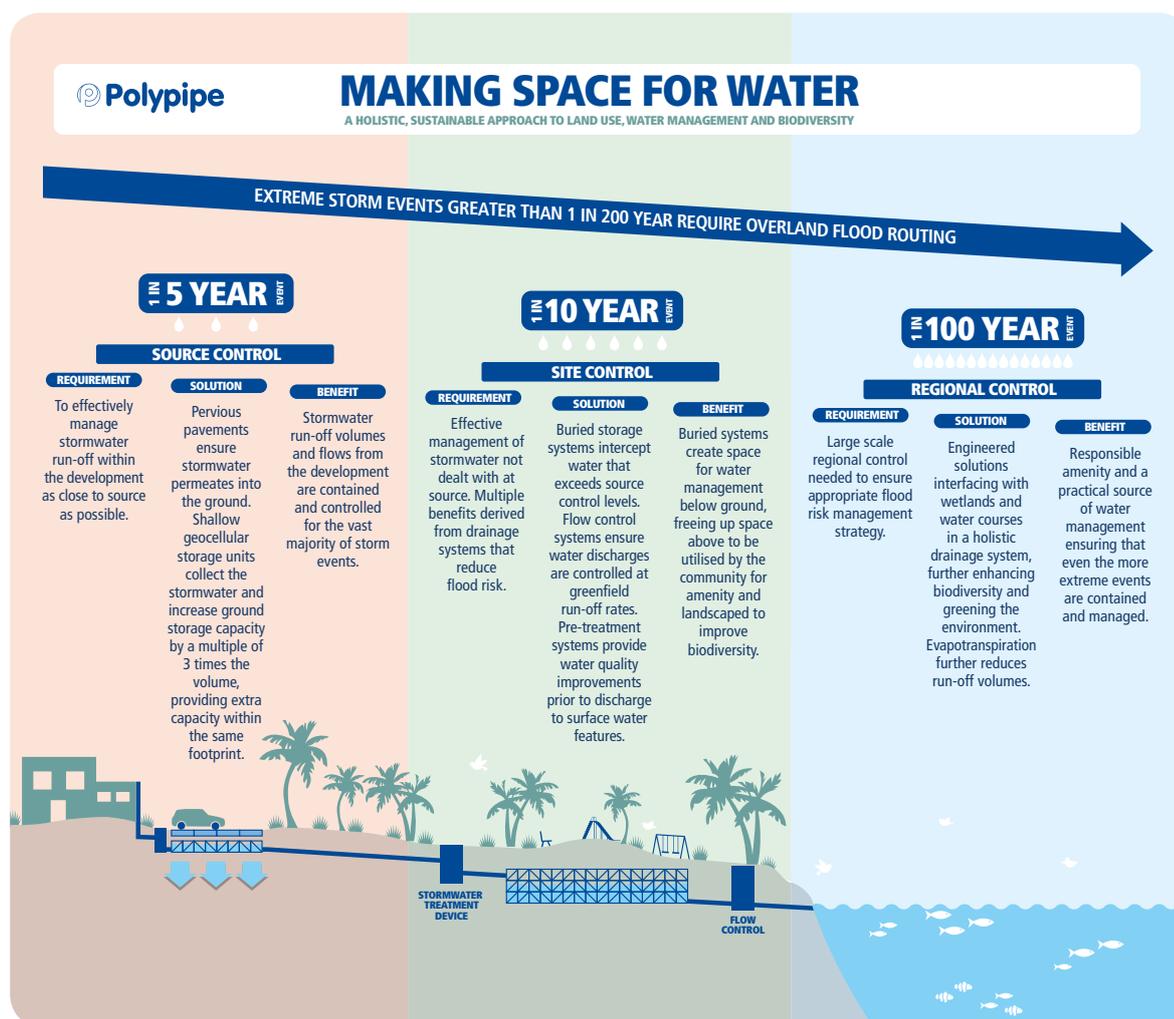
- Lower density weight than typical legacy materials, lowering transport and installation costs
- Lower modules means flexibility and reduced risk of breakage
- Strong and lighter in weight providing excellent Health and Safety benefits
- Reduced construction issues due to high-integrity systems
- Proven second life - 100% recyclable
- Non-corrosive
- Chemical resistant



# The growing importance of SuDS

'Making Space for Water' is an integrated, forward-thinking strategy for managing future flood risk in the urban environment.

Among its many recommendations is the adoption of a 'joined-up' approach to drainage management in high-risk urban areas and the widespread use of Sustainable urban Drainage Systems (SuDS) to control the rate at which rainwater runs off paved areas and into sewer networks and rivers.



Each project has its challenges from turning a new desert development into a green urban environment, to building a more effective infrastructure that can cope with the excess run-off generated by heavy storm events. Assessing and managing flood risks in development, has become an important aspect of any new development, essential to analyse the flood risk and guide the selection of appropriate flood risk management solutions.

Whether your development suffers from too much, or too little water, a SuDS (Sustainable urban Drainage Systems) planning and engineering design approach can be integrated, to carefully address these challenges and provide an effective controlled detention, attenuation or infiltration/soakaway system as a part of a resilient city strategy.

# The growing importance of SuDS



Government planning policy has defined the need for Sustainable urban Drainage Systems (SuDS) to ensure that flood risk is taken into account during all stages of the planning process.

## CIRIA (SuDS Manual)

The SuDS Manual provides guidance on all aspects of the design, construction, operation and maintenance of SuDS. In particular, it places a real emphasis on the use of source control techniques and requires designers to consider pollution removal.

The SuDS Manual defines that a sustainable urban drainage system should consider certain basic requirements, including:

- Run-off from a developed area should be no greater than the run-off prior to development
- Run-off from a developed area should not result in any down-grading of downstream watercourses or habitat
- Consideration should be given at the development feasibility stage to water resource management and control in the developed area
- Run-off should replicate as far as possible the natural response of the site to rainfall

Urbanisation has led to increasing negative impacts on the environment, in particular pollution.

Depending on the land use, the following typical surface pollutants can be found in surface water run-off:

- Hydrocarbons and oils
- Sediments
- Heavy metals
- Fertilisers and pesticides
- Salts
- Animal waste
- Pathogens

Traditionally, pollutants are collected from impermeable surfaces into the drainage systems and treated downstream via large, deep, in-line separators that are typically designed to treat the first 'flush' only. Emulsified oils and hydrocarbons can still be discharged downstream, the discharged oil and hydrocarbons constitutes a major pollution source and is a serious threat to groundwater sources.

## SuDS Principles

1

PROTECT NATURAL SYSTEMS



2

INTEGRATE STORMWATER TREATMENT WITH URBAN AND LANDSCAPE DESIGN



3

IMPROVE STORMWATER RUN OFF QUALITY



4

REDUCE RUN OFF AND PEAK FLOWS



# Local authority legislation & regulations

Rapid urbanisation, climate change, limited network capacity, or no accessible network, has led to new government/ municipality regulations and legislation across the Middle East to find an alternative approach to stormwater management and flood mitigation. This requirement is underpinned further by sustainable codes. Local Authority dictates, whereby a more considered approach to managing water in the built environment and embraces International design principles. Polypipe offer a wide range of systems as part of the water management solutions, providing both deep and shallow geocellular installations to mitigate issues associated with excess storm/surface water run-off. One of the key options for managing storm/surface water run-off is known as "Source Control" which minimises run-off rates and volumes transferred from properties to local infrastructure networks.

**The following examples demonstrate a move towards a more sustainable future.**



## Qatar Green Building Council, Qatar

The mission of the Qatar Green Building Council is in complete alignment with the State of Qatar 2030 Vision. Driven by this vision and the global appreciation of the importance of founding viable futures through sustainable development, the Qatar Green Building Council is combining technical expertise with stakeholder engagement, education, community relations and strategy development to make a unique contribution to the local front of sustainable development. QGBC aims to increase awareness and knowledge of green building practices and build capacity of industry professionals through ongoing professional development and research. QGBC's efforts to build and engage an active membership body and network of stakeholders to champion the Green Building movement also extends to support the adoption, legislation and implementation of green building practice and standards.



## Dubai Emirates Green Building Council, Dubai, UAE

The EGBC vision is to be the prime driver in facilitating the nation's rapid evolution as a global leader in reducing the ecological footprint of the built environment. To achieve this, their focus is to strengthen collaborative efforts with industry leaders, academia, governmental entities and other like-minded organisations.



## Qatar Sustainability Assessment System, Qatar

Qatar Sustainability Assessment System (QSAS) is a green building certification system developed for the State of Qatar. The primary objective of Qatar Sustainability Assessment System (QSAS) is to create a sustainable built environment that minimizes ecological impact while addressing the specific regional needs and environment of Qatar.



## Abu Dhabi Estidama, Abu Dhabi, UAE

The Abu Dhabi Urban Planning Council (UPC) is recognized internationally for large-scale sustainable urban planning and for rapid growth. Plan Abu Dhabi 2030 urban master plan addresses sustainability as a core principle. Estidama, which is the Arabic word for sustainability, is an initiative developed and promoted by the UPC. Estidama is the intellectual legacy of the late Sheikh Zayed bin Sultan Al Nahyan and a manifestation of visionary governance promoting thoughtful and responsible development. The leadership of Abu Dhabi are progressing the principles and imperatives for sustainable development, through Estidama, while recognizing that the unique cultural, climatic and economic development needs of the region require a more localized definition of sustainability.

## Kuwait Green Building Council, Kuwait

The Kuwait Green Building Council is a non-profit organization, the initiative started in 2009 with organizations and businesses from different industries in Kuwait. These include Universities, Local Authorities, Contractors, Architects, Engineers, Energy companies, and other leading private companies. All are united in one common goal to provide leadership and advice to accelerate the rate of change in Kuwait to a sustainable environment.

# The complete picture for storm/surface water management for building and infrastructure projects



1

### Permavoid

A sub-base replacement geocellular water management system for use at shallower depths.



2

### Polystorm

A geocellular system used for detention, attenuation and infiltration/soakaway at deeper depths.



3

### Polystorm Extra

A geocellular system used to provide detention, attenuation, infiltration/soakaway at a variety of depths and can accommodate a wide range of traffic loadings, from pedestrianised to large HGV parks.



4

### Ridgistorm-XL

An engineered, large diameter pipe solution for surface water, foul water and combined sewer applications.



8

### RIDGISTORM Check Chambers

Flow control chambers available with pre-fabricated Vortex Flow Controllers and Orifice Plates.



9

### RIDGISTORM Separate

A range of upstream catchpits and silt traps to separate silt and other particles before entering a drainage system or the environment.



10

### RIDGISTORM Control Chambers

A range of pre-fabricated chambers with flow control components such as Gate Valves, Flap Valves and Penstocks.



11

### RIDGISTORM Access Manholes

Pre-fabricated manholes to provide easy access into a pipeline.

[www.polypipe.com/middleeast](http://www.polypipe.com/middleeast)

Our complete and comprehensive systems enable a one-stop approach to surface water management, treatment, attenuation and infiltration/soakaway to sewerage systems, our range takes into account the complete picture.



#### Ridgidrain

A high strength HDPE surface water drainage piping system, used for surface and sub-surface drainage applications.



#### Polysewer

A PVCu sewer pipe system available in sizes 150-300mm.



#### Ridgisewer

A highly durable and versatile polypropylene sewer pipe system, available in sizes 400-600mm.



#### Downstream Defender®

Advanced vortex separator used to treat stormwater run-off.



#### Landcoil

A land drainage system for the management of excess land water.

Refer to:  
[www.polypipe.com/middleeast](http://www.polypipe.com/middleeast)  
for further information on our wider  
product range.

# Geocellular solutions overview

We have the largest range of geocellular products and systems in the market, allowing you to select the optimum solution for surface water management and pollution control. With a choice of systems for shallow or deep excavations, Permavoid and Polystorm can match your exact site specifications and requirements.



Polystorm installation

## Permavoid for shallow applications

Permavoid is a geocellular replacement system, which has been specifically designed and tested to provide stormwater treatment, detention, attenuation or infiltration at shallower depths.

For more information, [see page 48](#).

## Polystorm for deep applications

The tried and tested Polystorm range is designed to provide detention, attenuation or infiltration/soakaway at a variety of depths. It is ideally suited for deeper applications and can accommodate a wide range of traffic loadings, from pedestrianised to heavy traffic areas.

For more information, [see page 20](#).



Permavoid installation

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## Polystorm geocellular system for deep applications

The tried and tested Polystorm geocellular range is designed to provide surface water retention, surface water attenuation or surface water infiltration as a soakway solution at a variety of depths. It is ideally suited to deeper applications and can accommodate a wide range of traffic loadings, from pedestrianised areas to large HGV parks.

Manufactured from virgin polymer, to guarantee known structural performance in hotter climates, Polystorm modular cells combine in an interlocking raft to provide water storage structures to help with localised flood alleviation and surface water management. Each cell has a 95% void ratio and provides a highly efficient, SuDS compliant water detention, attenuation or infiltration/soakaway solution.

See page 23 for Polystorm system key benefits.



95% void ratio



Manufactured from virgin polypropylene



Approved by regional municipalities



3rd party accredited 40°C long-term creep testing



Complies with latest Middle East specifications



## Making space for water

At Polypipe, we believe in less to do more. Our Polystorm systems have 95% void ratio, allowing more water storage requiring less space.



# Challenging tradition

Plastics are among the most researched materials in the world and rapid technological and manufacturing developments made in recent years have allowed for continuous innovation.

Plastics are lighter and more robust than traditional materials - less to do more. They help reduce energy usage and therefore greenhouse gas emissions because they are light in weight in production, transport and use.

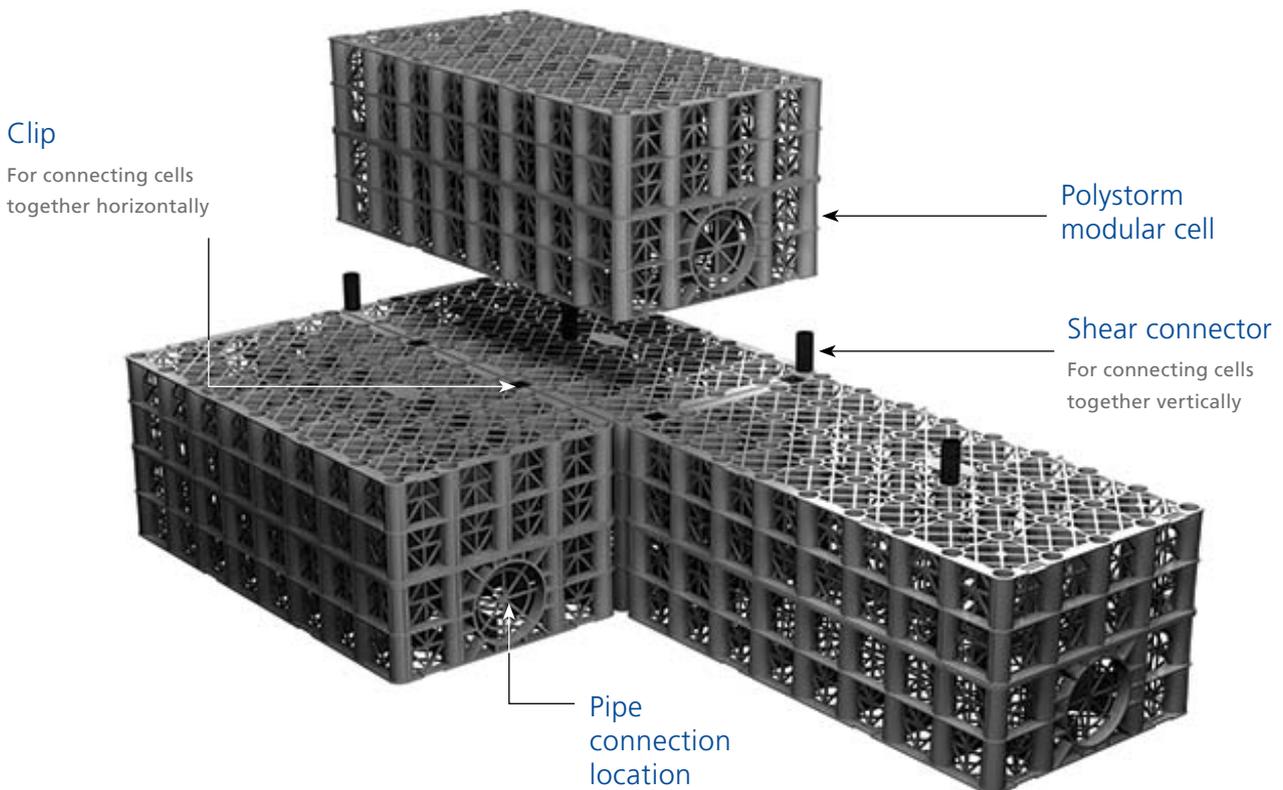
In comparison to traditional materials, such as concrete, plastics can be recycled, require no quarrying activities and reduce carbon footprint from transportation. Polypipe's Polystorm system offers numerous benefits in comparison to legacy materials.

TECHNICAL COMPARISON								
	Polystorm geocellular	Open swail	Pond	Gravel	Concrete	Pipe storage	Arched chamber	
DESIGN	Versatility	Highly versatile - by depth or shape	Versatile	Versatile	Versatile, but limited by footprint	Versatile	Limited by product design	Limited by product design and footprint requirement
	Design Life	50 year design life (refer CIRIA)	Unknown (but potentially limited by liners)	Unknown (but potentially limited by liners)	Typically 100 year design life	Versatile	Subject to material used	Subject to material used
	Maintenance	Minimal	Medium	Medium	System replacement. Storage volume likely to deteriorate over time	Maintainable via access	Maintainable via access	Maintainable via access
	Accessibility	Yes (with PSM4 access)	Yes	Yes	No	Yes	Yes	Partial (stone inaccessible)
PERFORMANCE	Structural performance	Yes	No	No	Partially	Yes	Yes	Yes (depth limitations)
	Void ratio	95%	100%	100%	40%	100% (less columns)	100% (but larger footprint)	Limited by gravel surround (at 40% void)
	3rd party accreditation	Yes	No	No	No	Subject to material Used	Subject to material Used	Subject to material Used
	Chemical resistance	Highly resistant	Subject to design	Subject to design	Subject to aggregate used	Prone to sulphur attack	Material dependent	Subject to material used
	Manufacturer support	Yes	No	No	No	No	Assumed	Assumed
INSTALLATION	Installed footprint	Optimal (small)	Large restricted amenity (unusable ground)	Large restricted amenity (unusable ground)	Large	Optimal	Restricted	Large (due to excavation)
	Assembly/constructability	Easy	Medium	Medium	Easy	Difficult	Medium	Medium
	Speed of Installation	Fast	Medium	Medium	Fast	Slow	Medium	Slow due to supportive site works (excavations)
	Weight	Light in weight	N/A	N/A	Heavy	Heavy	Material dependent	Material dependent
COMMERCIAL	Total Installed Cost (m³)	Medium	Low	Low	Medium (due to excavation)	High	High	High (due to large footprint - excavation/ product/ aggregate)
	Transportation	Truck/ container	N/A	N/A	Subject to quarry location	Wet or pre-cast	Truck/ container	Truck/ container
	Useable amenity	Yes	No	No	Yes	Yes	Yes	Yes

Slight variances to the above may be relevant dependent upon application. This is for guidance only.

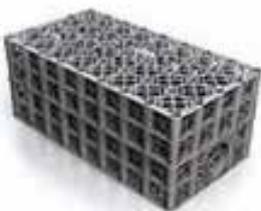
# Polystorm range components

The Polystorm geocellular range is manufactured from **virgin polymer** and is designed to provide detention, attenuation or infiltration/soakaway at a variety of depths. It is the system of choice for high frequency urban areas accommodating a wide range of traffic and non-trafficked loadings.



Polystorm modular cells are joined together with clips and shear connectors to provide water storage structures. Each cell has a 95% void ratio to provide a highly efficient, SuDS compliant water detention, attenuation or infiltration/soakaway solutions for projects that have high-sustainability targets.

## Polystorm systems



**Polystorm**  
Trafficked areas



**Polystorm Xtra**  
Heavy trafficked, deep or reduced cover areas



**Polystorm Access**  
Vertical maintenance and inspection

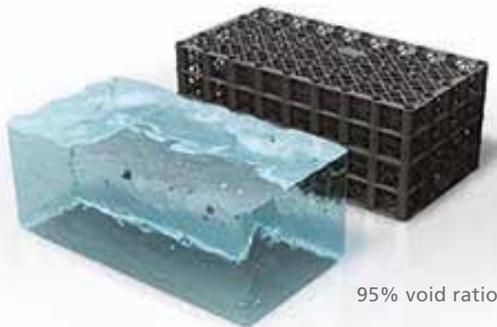


**Polystorm Inspect**  
Lateral maintenance and inspection



## Polystorm system key benefits

- Manufactured from virgin polymer
- 95% void ratio providing greater water storage capacity and reduced excavation costs
- BBA approved for the Middle East
- Modular units allow flexibility of shape, making it ideal for shallow excavation systems, narrow strips or for use in restricted areas
- Light in weight yet robust, affording excellent Health and Safety and installation benefits
- Unique rounded corners make it easy to handle and reduce likelihood of punctures to membranes
- The range can be designed for non-trafficked, trafficked or heavily trafficked applications
- Suitable for detention, attenuation and infiltration/soakaway systems
- In excess of 50 year design life
- Polystorm modular cells are manufactured from polypropylene
- Polystorm Access is manufactured from MDPE



## Polystorm range components continued



Clip Connectors



Shear Connectors



### Permafilter Geotextile for infiltration/ soakaway

Product code: PV23002

This geotextile has been specifically designed to remove hydrocarbon pollution, treating the captured water before infiltrating it into the ground for treatment and infiltration/soakaway.



### Geomembrane for detention and attenuation

An impermeable membrane for wrapping around geocellular structures to form watertight tanks. This is then wrapped in a geotextile which protects the geomembrane during installation.



Polystorm Shear Connectors



Polystorm Xtra Brick Bond Connectors

[www.polypipe.com/middleeast](http://www.polypipe.com/middleeast)



Polystorm cell with Drainage Flange Connection



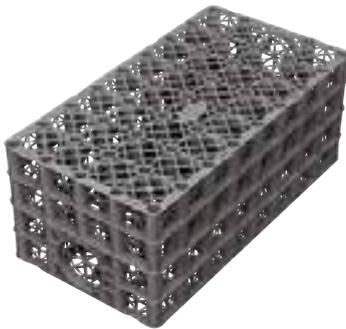
Clips



# Polystorm

Product code: PSM1

Polystorm is a modular geocellular structural cell, manufactured from virgin polymer, built to form a load bearing tank for use in a stormwater drainage system. Polystorm has a 40 tonnes/m<sup>2</sup> compressive strength and is ideally suited for detention, attenuation or infiltration/soakaway under trafficked or loaded areas such as car parks and housing & commercial developments. To ensure Polystorm can withstand the extreme elevated temperatures within the Middle East as well as, new GCC municipality requirements, the cells are rigorously tested at 40°C.



Element	Value
<b>TECHNICAL SPECIFICATION OVERVIEW</b>	
Product code	PSM1*
Length	1m
Width	0.5m
Depth	0.4m
Total volume	0.2m <sup>3</sup>
Unit weight	9kg
Unit storage volume	0.19m <sup>3</sup> (190 litres)
Void ratio	95%
Vertical compressive strength	Maximum 440kN/m <sup>2</sup> **
Lateral compressive strength	Maximum 63kN/m <sup>2</sup> **
Short-term vertical deflection	83kN/m <sup>2</sup> per mm
Short-term lateral deflection	4.2kN/m <sup>2</sup> per mm
Maximum burial depths:	
Light trafficked	3.7m***
Non-trafficked	3.8m***

\*Each unit includes 4 Clips and 2 Shear Connectors.

\*\*Compressive strength at yield, maximum recommended value for design purposes.

\*\*\*Based on ground conditions being dense sand and grave with no groundwater present, using the calculation methodology detailed within CIRIA C680 (2008). Where ground conditions differ, please consult our water management solutions Technical Department on +971 (0) 4 807 3000.

## Polystorm PSM1 key benefits

- Compressive strength of 40 tonnes
- Ideal for detention, attenuation or infiltration/soakaway applications with a suitable geomembrane or geotextile
- Designed for trafficked and loaded conditions
- BBA approved
- Visual and maintenance access can be achieved when used in conjunction with Polystorm Access and Polystorm Inspect
- Can be used as part of a value engineered hybrid system with Polystorm Xtra
- Integrated inlet and outlet
- 3D flow throughout the structure
- 95% void ratio
- 50 years creep limited life expectancy



# Polystorm Xtra Product code: PSM3

Designed for use in deeper excavation depths, heavily trafficked applications and where areas of reduced cover are required, Polystorm Xtra has a compressive strength of 83 tonnes/m<sup>2</sup>, making it suitable for use in very heavily trafficked areas including lorry parks and industrial access roads.



Element	Value
<b>TECHNICAL SPECIFICATION OVERVIEW</b>	
Product code	PSM3*
Length	1m
Width	0.5m
Depth	0.21m
Total volume	0.105m <sup>3</sup>
Unit weight	6kg
Unit storage volume	0.0986m <sup>3</sup> (98 litres)
Void ratio	94%
Vertical compressive strength	Maximum 834kN/m <sup>2</sup> **
Lateral compressive strength	Maximum 93kN/m <sup>2</sup> **
Short-term vertical deflection	97.8kN/m <sup>2</sup> per mm
Short-term lateral deflection	7.1kN/m <sup>2</sup> per mm
Maximum burial depths:	
Heavy trafficked	4.8m***
Light trafficked	5.3m***
Non-trafficked	5.45m***

\*Each unit includes 4 Clips and 2 Shear Connectors.  
 \*\*Compressive strength at yield, maximum recommended value for design purposes.  
 \*\*\*Based on ground conditions being dense sand and gravel with no groundwater present, using the calculation methodology detailed within CIRIA C680 (2008). Where ground conditions differ, please consult our water management solutions Technical Department on +971 (0) 4 807 3000.

For a full list of all datasheets, please visit our website at [www.middleeast.polypipe.com/downloads/installation-guides](http://www.middleeast.polypipe.com/downloads/installation-guides)

### Polystorm Xtra PSM3 Key Benefits

- Compressive strength of 80 tonnes
- Ideal for detention, attenuation or infiltration/soakaway applications/schemes with a suitable geomembrane or geotextile
- Designed for heavy trafficked conditions which require shallow excavations or deep burial depths
- Can be used as part of a value engineered hybrid system in non-loaded and light traffic applications with Polystorm
- Installed with blue lid facing down for increased strength
- Undergone testing in accordance to BBA certification
- Integrated inlet and outlet
- 3D flow throughout the structure
- 94% void ratio



# Polystorm Access

Product codes: see Polystorm Access System chart below

Polystorm Access provides a 1m x 0.5m shaft within a Polystorm geocellular structure to enable surface access for remote camera inspection and maintenance activities, such as flushing and rodding.

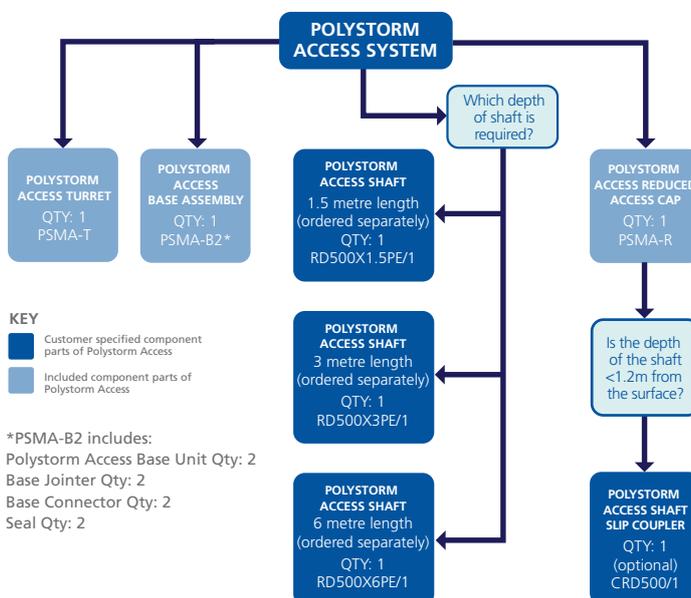
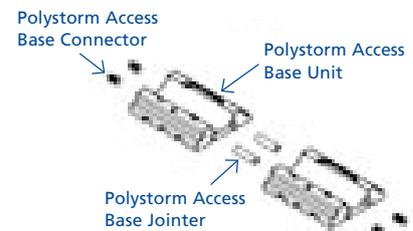
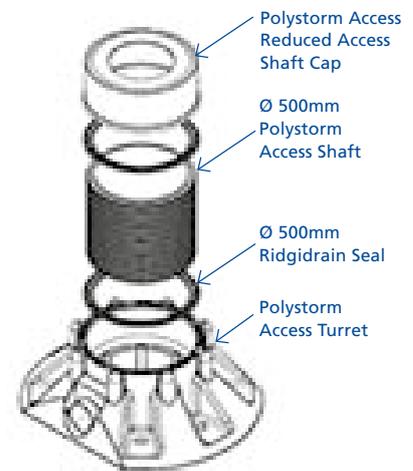
The system consists of a 500mm diameter shaft which extends from surface level to the top of a Polystorm structure, at which point a turret provides an interface between the shaft and the inspection chamber within the Polystorm structure. At the bottom of the chamber, a base unit interlocks with the surrounding layer of Polystorm cells whilst supporting the geomembrane. A 350mm reduced access shaft cap is provided to comply with inspection chamber regulations. Polystorm Access is suitable for use with Polystorm and Polystorm Xtra and may be combined with Polystorm Inspect for full length remote inspection and maintenance.



Please note: The Polystorm Access turret and base assembly are black. They are shown blue for illustration purposes.

## Polystorm Access key benefits

- Meets minimum 450mm width requirement for inspection chamber access, with 350mm reduced access where regulations dictate
- Integrated solution; can be used with Polystorm Inspect to monitor internal volume of geocellular structure
- Base unit provides smooth transition between Polystorm Inspect units
- Multiple inspection configurations can be achieved when used in conjunction with Polystorm Inspect
- Manufactured from polyethylene for light weight, ease of handling and high strength
- Sustainability: All components 100% recyclable after use



For our full Polystorm Access datasheet and installation guide, please visit our website [www.middleeast.polypipe.com/downloads/installation-guides](http://www.middleeast.polypipe.com/downloads/installation-guides)

# Polystorm Inspect

 Product code: PSM4

The Polystorm Inspect cell is complementary to the Polystorm range of modular cell solutions. Its primary purpose is to provide a tunnel along the length of a fully installed Polystorm structure to enable access for inspection and maintenance.

Polystorm Inspect is a high strength, thermoplastic cell, which evenly distributes its load through the Polystorm structure. The tunnel end is left open by default but the unit can be closed off if required by clipping into place the moulded end plate. For purposes of identification, the cell features a yellow centre section and end plate.



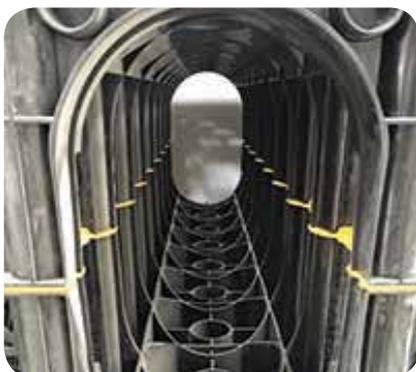
## Polystorm Inspect key benefits

- Creates a horizontal tunnel running through the middle of the tank to provide access for inspection and maintenance, i.e. jetting and rodding
- Can be used with Polystorm
- Tunnel can be used as a flow inlet track achieving greater stormwater flow distribution within the unit
- Large access tunnel (height 320mm and width 172mm nominal) – allows maximum field of vision while maintaining the system's structural performance
- High strength to weight ratio
- Light weight cell allows easier handling and reduced Health and Safety risk
- Utilises the same Shear Connectors and Clips as the Polystorm range
- The tunnel restricts the dissipation of silt in to the overall structure making inspection and maintenance easier
- Cells with 225mm or 300mm inlets are available (PSM4CRD225 or PSM4CRD300)

Unit type	Polystorm Inspect*
<b>TECHNICAL SPECIFICATION OVERVIEW</b>	
Product code	PSM4
Length	1m
Width	0.5m
Depth	0.4m
Total volume	0.2m <sup>3</sup>
Unit weight	11.6kg*
Cube storage volume	0.188m <sup>3</sup> (188 litres)
Volumetric void ratio	94%
Vertical compressive strength at yield	Minimum 440kN/m <sup>2</sup>
Lateral compressive strength at yield	Minimum 63kN/m <sup>2</sup>
Short-term vertical deflection	Minimum 70.1kN/m <sup>2</sup> per mm
Estimated long term vertical deflection (creep)	0.6113Ln (design life in hrs)

Note: The table above is applicable to PSM4 without the end plate.

\*Approximate weight.



For our full Polystorm Inspect datasheet, please visit our website [www.middleeast.polypipe.com/downloads/installation-guides](http://www.middleeast.polypipe.com/downloads/installation-guides)

# Design considerations

When designing our wide range of water management systems, we consider numerous factors including, performance, safety and load-bearing capabilities – allowing us to meet and surpass relevant local/international standards and regulations.

## Polystorm



**40 TONNES**  
Minimum Cover  
0.5m



**40 TONNES**  
Minimum Cover  
0.6m

## Polystorm Xtra



**80 TONNES**  
Minimum Cover  
1m

## Permavoid



**140 TONNES**  
Minimum Cover  
50mm

### Laboratory testing

- Ultimate compressive strength at yield
- Deflection parameters
- Creep
- Third party accreditations

### Analysis

- Failure
- Deflection (movement under load)
- Creep
- Flotation

### Partial factors of safety

- On material properties
- On loads
- Follow BPF and CIRIA guidance

### Applied loads

- Distributed
- Concentrated
- Traffic
- Backfill
- Stockpiles
- Earth pressure
- Construction traffic
- Cranes
- Uplift

# Structural performance checks

## Minimum cover depth required

- Dictated by the expected surcharge loading

## Maximum allowable burial depth

- Vertical pressure
- Dead loads e.g. backfill material
- Live loads e.g. vehicle loads
- Hydrostatic loads

## Lateral earth pressures

- Dictated by ground conditions

## Floatation – Special site considerations

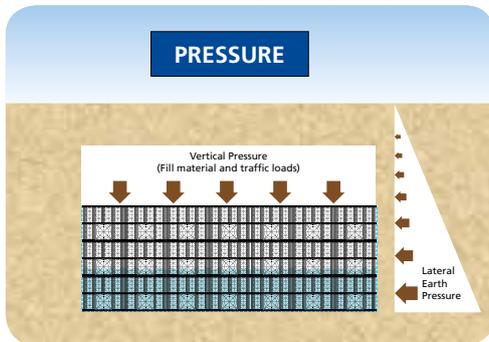
- Slopes/embankments adjacent to tank
- Accidental loadings

## Surface deflections

## Serviceability limit state

## Ultimate limit state

**ALL IN ACCORDANCE WITH CIRIA C680**



## System design

- 1 Structural analysis
- 2 Applied loads/live loads/dead loads
- 3 Burial depths
- 4 Geotechnical report
- 5 Compressive strength
- 6 Factors of safety
- 7 Floatation analysis
- 8 Tank sizing based on rainfall analysis
- 9 Zero discharge
- 10 Access & maintenance

**ALL IN ACCORDANCE WITH CIRIA C680**

## Access



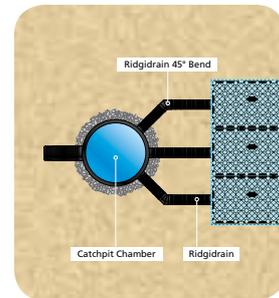
## Maintenance



## Pipe Connectivity



## Manifold arrangement

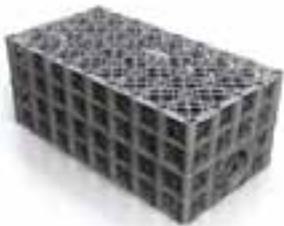


Refer to the Polystorm Technical Manual for future design guidance

# An 8 step guide to a total Polystorm system



## 1 Select modular cell



**Polystorm** Product code: PSM1

Trafficked

The Polystorm cell, made of virgin material, has a 44 tonnes per square metre compressive strength and is ideally suited for trafficked and loaded areas at greater depths.

[See page 26](#)



**Polystorm Xtra** Product code: PSM3

Heavy trafficked, deep or reduced cover

Designed for use in deeper burial depths for heavily trafficked applications, Polystorm Xtra has a compressive strength of 83 tonnes per square metre, making it suitable for use in very heavily trafficked areas, deep applications and where reduced cover is required.

[See page 27](#)



## Connection accessories



- Shear Connectors  
Product code: PSMSC



- Clips  
Product code: PSMCLIP



- Brick Bond Connectors  
Product code: PSMBSC



**2** Select access if maintenance and inspection is required



**2A** Polystorm Access (see page 28 for product codes)

Polystorm Access provides a 1m x 0.5m vertical shaft within a Polystorm geocellular structure to enable surface access for remote camera inspection and maintenance activities such as flushing and rodding. The system consists of a 500mm diameter shaft which extends from surface level to the top of a Polystorm structure, at which point a turret provides an interface between the shaft and the inspection chamber within the Polystorm structure.



**2B** Polystorm Inspect – Product code: PSM4

The Polystorm Inspect cell is complementary to the Polystorm range of modular cell solutions. Its primary purpose is to provide a tunnel along the length of a fully installed Polystorm structure to enable access for inspection and maintenance. Polystorm Inspect is a high strength thermoplastic cell which evenly distributes its load through the Polystorm structure. The tunnel end is left open by default but the unit can be closed off if required by clipping into place the moulded end plate. For purposes of identification the cell features a yellow centre section and end plate.

See page 29

**3** Select if treatment is required



Permavoid Medium Duty with Biomat – Product code: PSM1BM

Comprising of a high strength, low density, oil treating geosynthetic floating mat for use with the Polystorm range of modular geocellular units. For multi-stage oil interception the Permavoid Medium Duty with Biomat can be used in conjunction with Permachannel (linear treatment) or a pre-fabricated RIDGISTORM Separate Weir and Baffle Chamber (point treatment).

See page 68

## 8 step guide continued...

### 4 Select wrap



#### Geomembrane for detention & attenuation

An impermeable membrane for wrapping around geocellular structures to form watertight tanks. This is then wrapped in a geotextile which protects the geomembrane during installation.

See page 66



#### Permafilter Geotextile for infiltration/soakaway Product code: PV23002

This geotextile has been specifically designed to remove hydrocarbon pollution, treating the captured water before infiltrating it into the ground for treatment and infiltration/soakaway.

See page 65



#### Permatex 300 for infiltration or protection Product code: PV23006

A non-woven protective geotextile that can be used for infiltration/soakaway solutions or to wrap a geocellular tank before a geomembrane is installed for added protection.

See page 69

### 5 Flange Connections

A flange adaptor is attached at both the inlet and outlet points to allow water to enter and exit the tank.



Flange Adaptor to EN1401



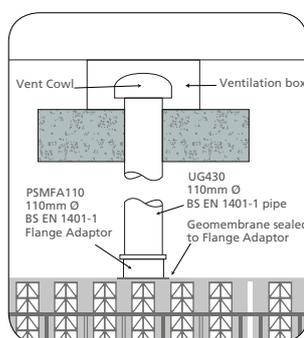
Polystyrene cell with Drainage Flange Connection

- 5a. Polystyrene cells with Flange Connections to Ridgidrain drainage pipes: PSMCRD225 (225mm), PSMCRD300 (300mm), PSMCRD375 (375mm)
- 5b. Polystyrene Inspect cells with Flange Connections to Ridgidrain drainage pipes: PSM4CRD225 (225mm), PSMCRD300 (300mm)
- 5c. Flange Adaptor to EN1401: PSMFA110 (110mm), PSMFA160 (160mm)
- 5d. Flange Adaptor to Ridgidrain: PSMFA150 (150mm), PSMFA225 (225mm), PSMFA300 (300mm), PSMFA375 (375mm), PSMFA450 (450mm), PSMFA600 (600mm)

### 6 Venting

Every attenuation tank requires at least one vent to maximise hydraulic performance, reduce stress on encapsulating geomembranes and avoid stagnant water. This can be done by installing either a Vent Cowl or a connection pipe to vent air directly into an upstream chamber.

- 6A** Vent Cowl  
To vent air above ground.



- 6B** BS EN1401-1 pipe    **6C** 150mm Ridgidrain pipe  
For ventilation into the upstream chamber.



## 7 Associated upstream products

### 7A Ridgidrain

Ridgidrain can be utilised within a Polystorm system by allowing captured surface water to enter the attenuation or infiltration/soakaway tank.



See page 74 & 75

### 7B RIDGISTORMSeparate Chambers

RIDGISTORMSeparate Chambers are self-cleaning and prevent the ingress of debris, silt, organic and even other particles into the Polystorm structure, extending its useful life.

#### Silt Traps

Small diameter (320-460mm)

Silt traps are available from the RIDGISTORMSeparate Silt Traps range.

See page 90



#### Catchpits

Larger diameter (450-3000mm)

Catchpits are available from the RIDGISTORMSeparate range.

See page 91



#### Weir and Baffle Chambers & Filter Chambers

In addition to silt traps and catchpits, we also offer RIDGISTORMSeparate Weir and Baffle Chambers and RIDGISTORMSeparate Filter Chambers with additional treatment features.

See page 92 & 93



## 8 Associated downstream products

### 8A RIDGISTORMCheck

A choice of Vortex or Orifice Plate Flow Control Chambers for precise control of site discharge rates.

See page 86 & 87



#### RIDGISTORMControl

Pre-fabricated structured wall chambers which feature 'in-line' system components such as penstocks, gate valves or flap valves to control system flows and facilitate maintenance.

See page 88



### 8B Ridgidrain

Ridgidrain can be utilised to drain away stored water from a Polystorm attenuation tank.

See page 74 & 75



# Applications

Rapid urbanisation has led to a huge increase in residential and commercial developments in the Middle East. This has created large, impervious surfaces which, in turn, contribute to a greater surface run-off during storm events. This puts the existing stormwater infrastructure under pressure.

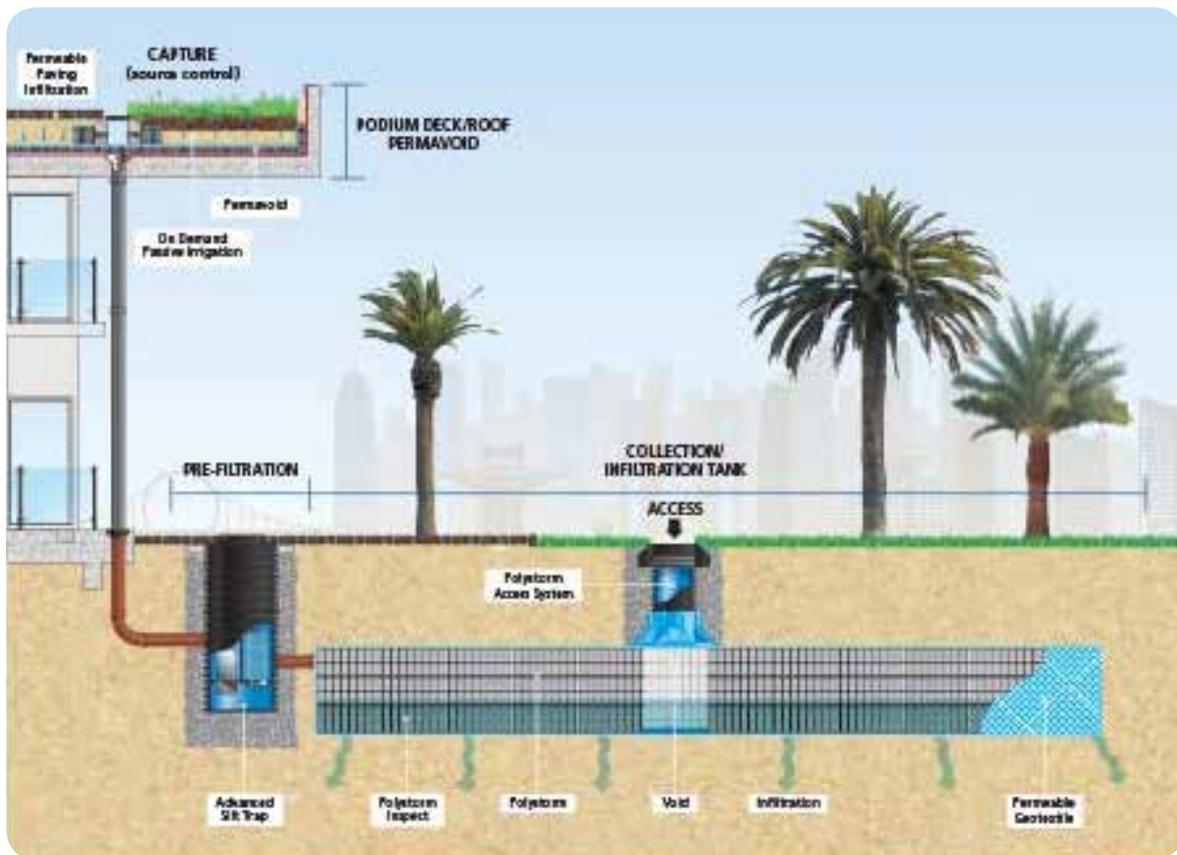


This is where Sustainable urban Drainage Systems (SuDS) solutions such as detention, soakaway and attenuation systems come in - and this is where Polypipe leads the way. Integrated water strategies help us address the many challenges facing projects throughout the region in order to minimise environmental impact.



# Infiltration/soakaways

The Middle East's ground conditions present a unique set of challenges for the efficient operation and maintenance of water management systems. Compared to traditional legacy materials, our soakaway solutions are economical, reliable and durable.



They offer controlled, sustainable ways of infiltrating stormwater run-off back into the ground, helping alleviate localised flooding whilst avoiding contamination of ground water.

## Infiltration/soakaway

Components that facilitate the infiltration/soakaway of water into the ground often include temporary storage zones to accommodate run-off volumes before it is slowly released to the soil. It uses the natural infiltration/soakaway properties of subsoil to reintroduce water into the environment at a rate and volume that will not saturate or flood the surrounding land.

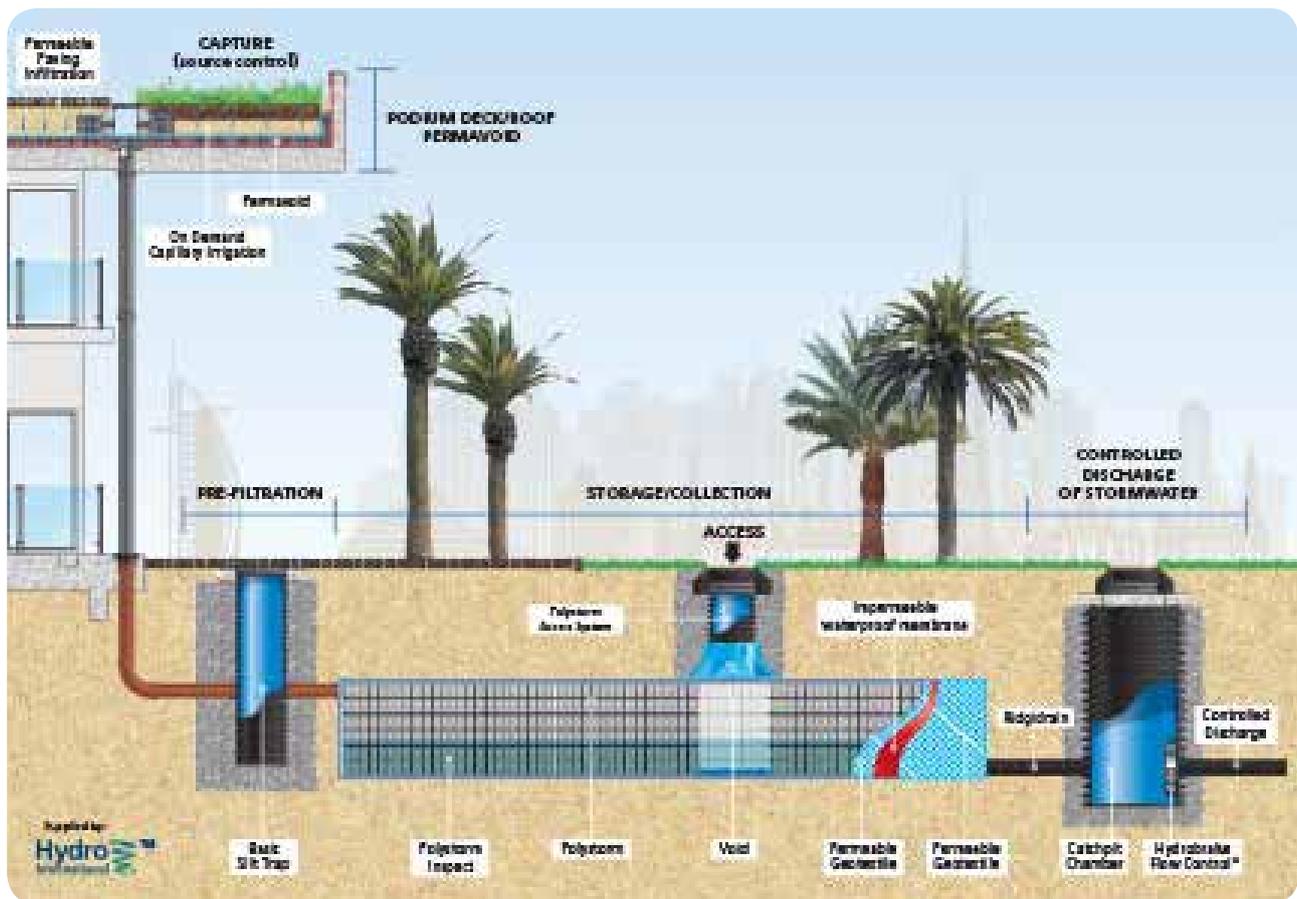
## Versatile solutions

Polypipe soakaway products and systems are versatile, adaptable and designed to cope with a variety of applications, from large commercial developments to schools, landscaped and residential areas. They're tried, tested, proven and intelligently engineered.



## Storage systems - detention

Polypipe's unrivalled expertise in detention solutions comes from years of experience, the development of Polystorm and its use for modular water management systems.



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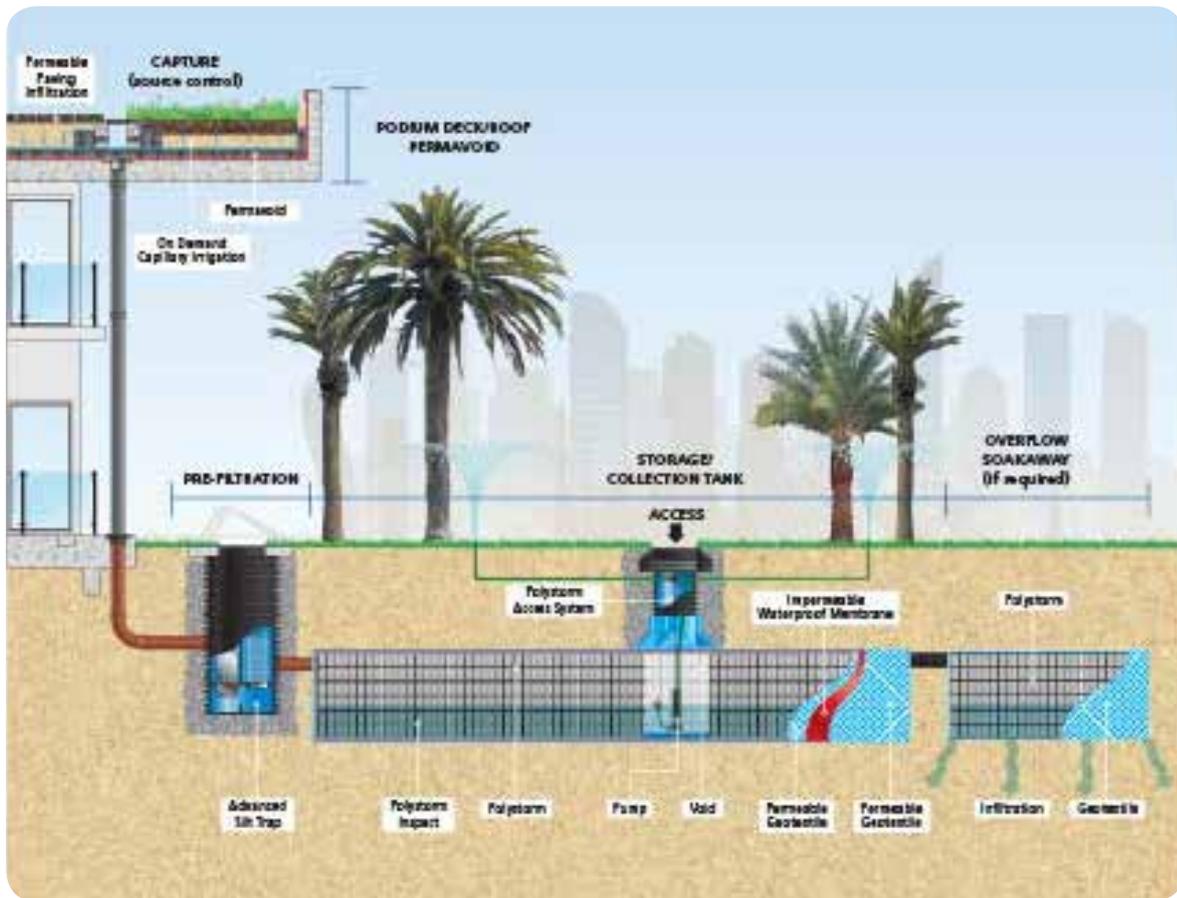
This is where Sustainable urban Drainage Systems (SuDS) such as detention systems come in. And this is where Polypipe leads the way. We are experts in integrated water strategies that address the many challenges facing projects throughout the region in order to minimise environmental degradation.

### Detention

Detention is the technique of holding stormwater on-site then discharging as required, in a controlled flowrate, into the existing stormwater infrastructure. Polystorm detention systems can be easily designed to accommodate the peak flows and incorporate a flow control device at the discharge point.

# Storage systems - attenuation

Polypipe's unrivalled expertise in attenuation solutions comes from years of experience, the development of Polystorm and its use for modular water management systems.



There is a growing and urgent need throughout the Middle East to address the problem of the regions huge water consumption enhanced by rapid urbanisation and population growth.



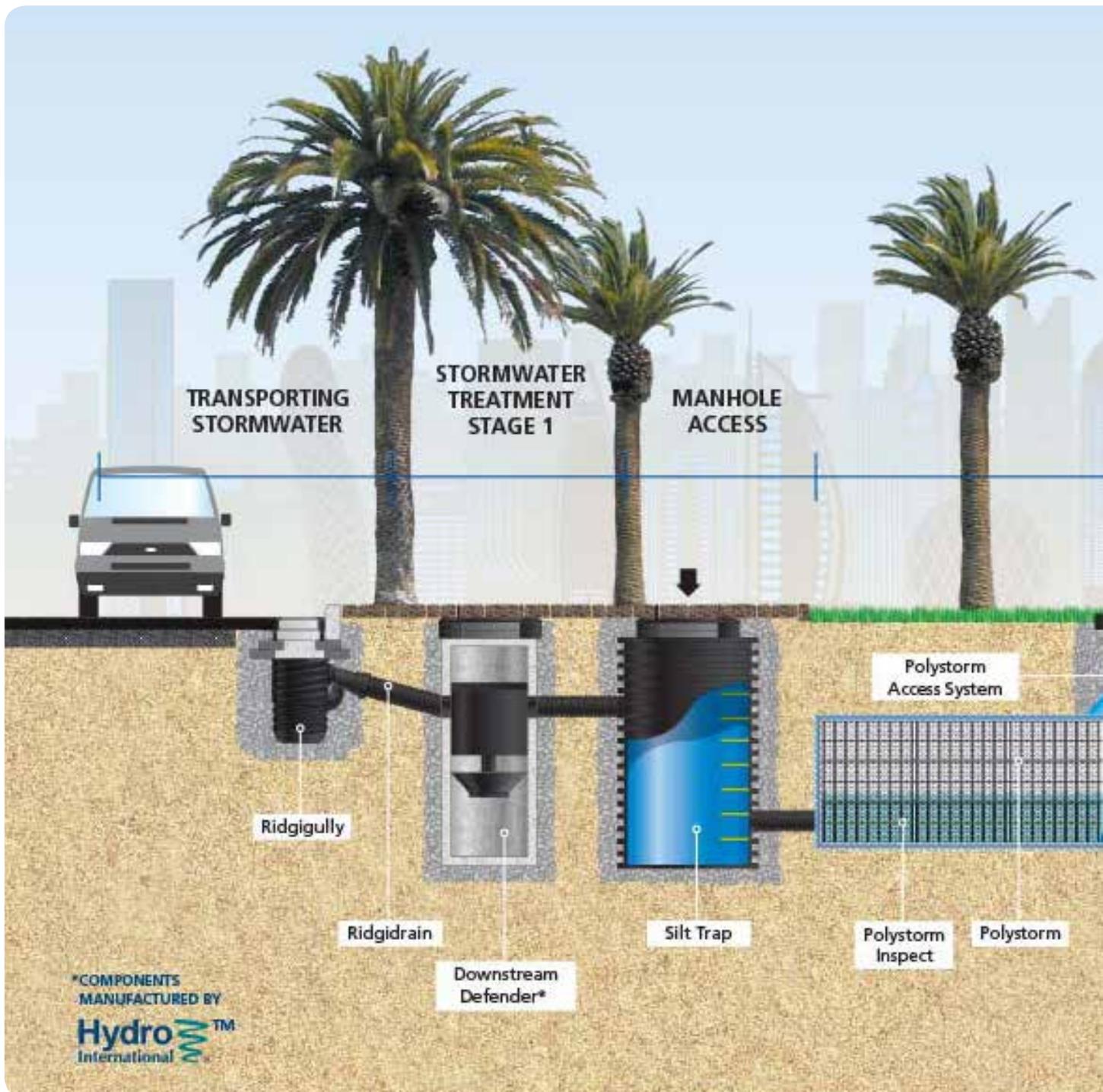
Given the lack of natural water reserves, governments are now taking action through legislation and regulation, to encourage more efficient use of this precious commodity by collecting surface water at source for irrigation systems. Estidama, GSAS/QSAS, Dubai Green Building Regulations all refer to this design approach.

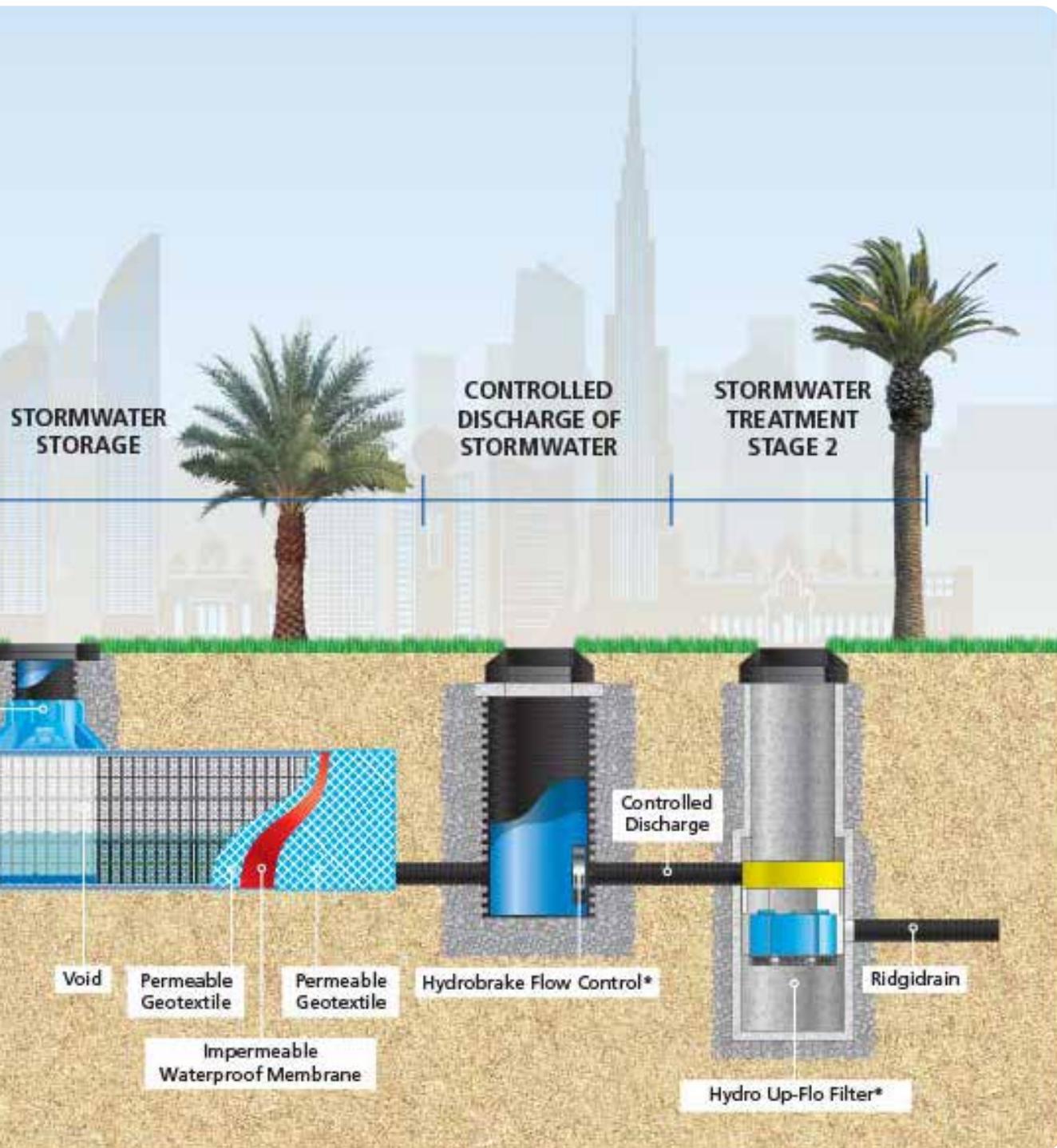
## Attenuation

Attenuation is the technique of storing surface water run-off on-site, in sustainable, robust geocellular cells, then re-using as required. Such systems can easily be tailored to fit a variety of applications. They're not just a sustainable on-site irrigation solution, they can also help minimise the water needed for soft landscaped areas.

# Treatment train

Ground conditions vary widely throughout the Middle East. Our modern products and systems are designed to handle extreme and challenging ground conditions – from very dry to high water tables – present in the region.





# Typical Polystorm Installation - soakaway/infiltration



**1** On-site storage (UV protection)



**2** Excavation, base preparation and geotextile fabric



**3** Install light in weight units one at a time



**4** Always begin installation from corner to ensure correct alignment



**5** Product can be identified by plate and packaging sticker



**6** Lock polystorm units together utilising supplied shear connectors and 'U' clips



**7** Construction sequence (continue until tank is complete)



**8** Typical speed of installation 400m<sup>3</sup>/day (team of 12)



**9** 300 GSM geotextile should encapsulate tank (minimum 300mm overlap)



**10** Geotextile 'star cut' should be made for pipe connections and vent pipes



**11** Care should be taken when backfilling with aggregates (type as per design)



**12** All types of backfill material should be evenly compacted around complete tank



**13** Continue backfilling on top of completed tank (refer to design for minimum depth)



**14** Continue backfill compaction with clean excavated material



**15** Softscape – completed tank installation



**16** Hardscape – completed tank installation

## Case study – Kent College, Dubai, UAE



Whilst initial site plans included the specification of a traditional concrete soakaway tank, the client opted for a Polystorm tank to provide necessary stormwater soakaway on-site.

Dubai residents have another first class education option for their children with the introduction of the brand-new Kent College. The ultra-modern campus, which also boasts a sister school in Canterbury (UK), will offer a British education to children aged 3-18, while being grounded with local values and customs.

As part of this ambitious project, the appointed MEP Contractor, Power Point Electrical and Mechanical Works called on Polypipe to assist with a suitable drainage solution, having successfully used the company's drainage solutions on previous projects.

Ted Jacobs Engineering, the chosen MEP Consultant, originally opted for a Push-Fit drainage system for the school. After visiting Polypipe's Technical Centre, the consultant recognised the benefits that the Terrain Solvent Weld system could offer.

Thanks to its unique joint integrity, Ted Jacobs opted for Terrain Solvent Weld to manage the school's soil and waste drainage.

Visiting Polypipe's state-of-the-art Technical Centre also presented the opportunity for Ted Jacobs' staff to appreciate the benefits of utilising Polystorm, Polypipe's internationally recognised engineered stormwater geocellular solution.

Choosing a Polystorm geocellular solution versus the traditional alternative meant that the College would benefit from a soakaway solution to sit beneath the grounds of the campus. The 95% void fill ratio of Polystorm means that any storm event can be adequately captured within the system, with stormwater discharged in a controlled manner into the surrounding area.

The significant time and cost savings offered using the Polystorm system, combined with a local manufacturing base in the UAE ensured that materials were readily available resulting in Polypipe supplying a 157m<sup>3</sup> tank to the Main Contractor Chicago Maintenance & Construction Co LLC for the project and provide technical support throughout the installation process.

## Case study – Jebel Ali Hills Development, Dubai, UAE



Polypipe worked closely with international infrastructure consultants, Parsons to design and determine a suitable stormwater management strategy, given the lack of local drainage networks and need to address rainfall events.

This substantial new development by Meraas is located close to the new Dubai Theme Parks, south of Jebel Ali. Polystorm geocellular solutions were specified due to their third-party accredited structural capability in a challenging environment, where long term performance and durability were critical for such a prestigious development.



## Case study – Northgate Mall, Doha, Qatar



The \$290m North Gate Shopping Mall project in Doha, on Al Shamal North Road, provides an exceptional, international standard mixed-use project offering a unique point of difference in Qatar.

Following detailed consideration, Polystorm Geocellular Stormwater Solutions were proposed by Habtoor Leighton Group as an alternative to traditional concrete tanks to form part of the developments' stormwater management strategy. Polystorm provided substantial cost savings, installation speed and durability relative to the local environment and ground conditions in Doha. This was successfully installed in a fraction of the time when compared to conventional methods.



## Case study – Etihad Museum, Dubai, UAE



Dubai is home to a new Etihad Museum, telling the story of the union between the seven Emirates after the treaty was signed in 1971.

Working with Al Shafar Group and MEP Consultants CH2M Hill, Polystorm Geocellular Systems was specified and installed on this futuristic new development.

Polystorm geocellular tanks were designed to manage large discharge requirements during storm events, utilised to detain and control the water during peak flows. Polystorm was specifically manufactured to meet the regions' extreme environment, whilst also achieving demanding structural requirements to ensure maximum design life.



## Permavoid overview

Permavoid is a shallow geocellular water conservation system aimed at managing surface water at source, as close to where it falls as possible. Its high strength and integrity allows it to be designed into pavement structures, and means it is ideal for use in projects requiring shallow soakaway, attenuation or detention such as in contaminated ground and in areas with high water tables. When combined with other parts of the Permavoid range, the complete system allows for superior management and improvement of water quality.



Shallower attenuation, detention or soakaway structures are often necessary in the Middle East because the ground at greater depths can present construction challenges. This could be the presence of chemicals or contamination left over from previous land use, underground watercourses or – more commonly in this region – an unusually high water table. A shallow approach is preferable because it does not rely on expensive pumping equipment and also has a reduced environmental impact due to the reduced excavation and work that needs to take place on-site.

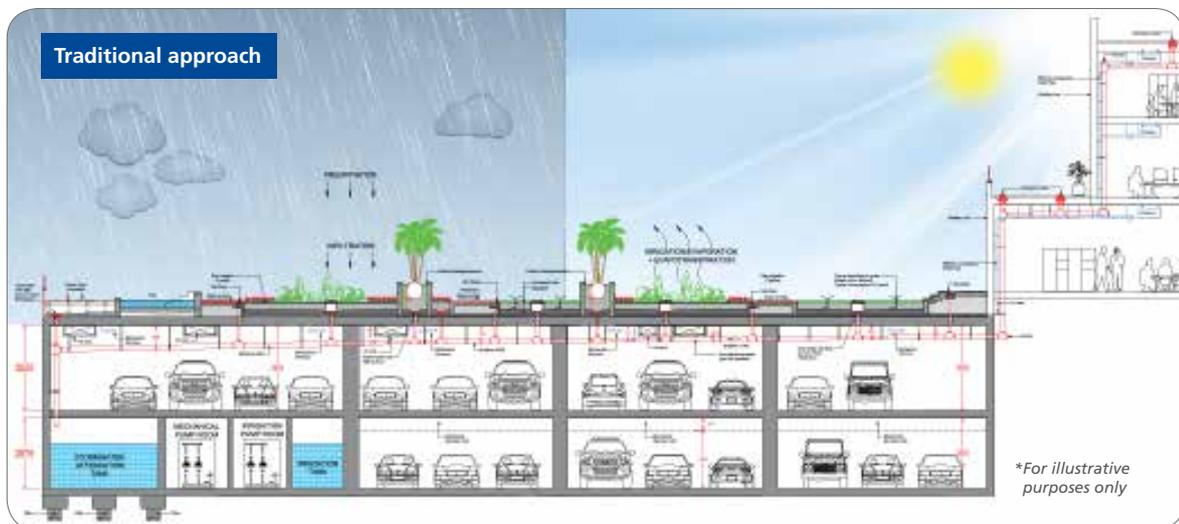
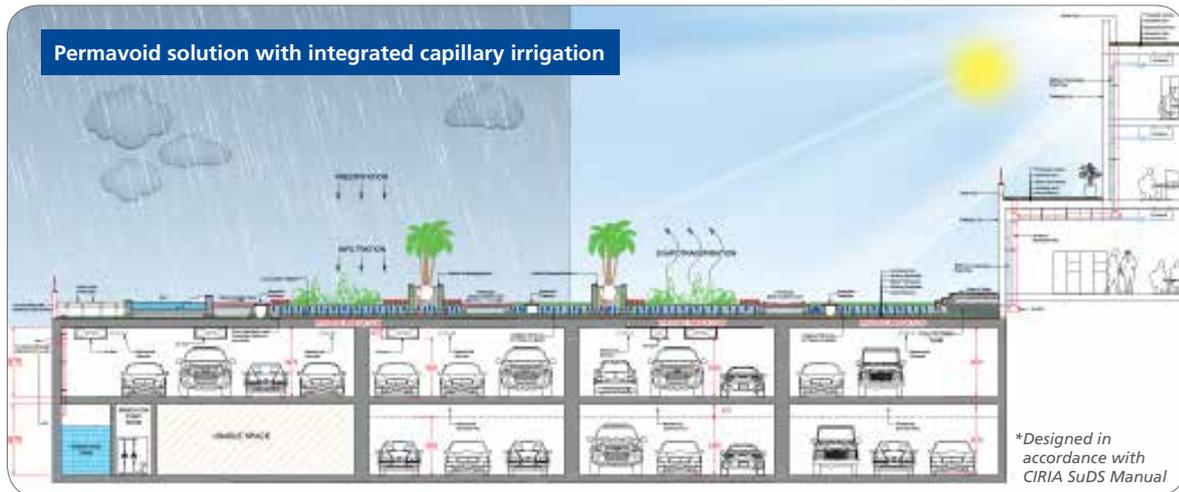
### Applications

The Permavoid system is designed to be used in place of traditional aggregate providing a unique, high strength, consistent structural raft with all the benefits of a high void ratio modular geocellular structure.

It can be incorporated into a wide variety of applications such as roof gardens, podium decks, urban landscaping and sports pitches.

# Challenging tradition

Permavoid saves on construction costs, maintenance, labour, water and energy consumption and replanting, compared to traditional installation methods.

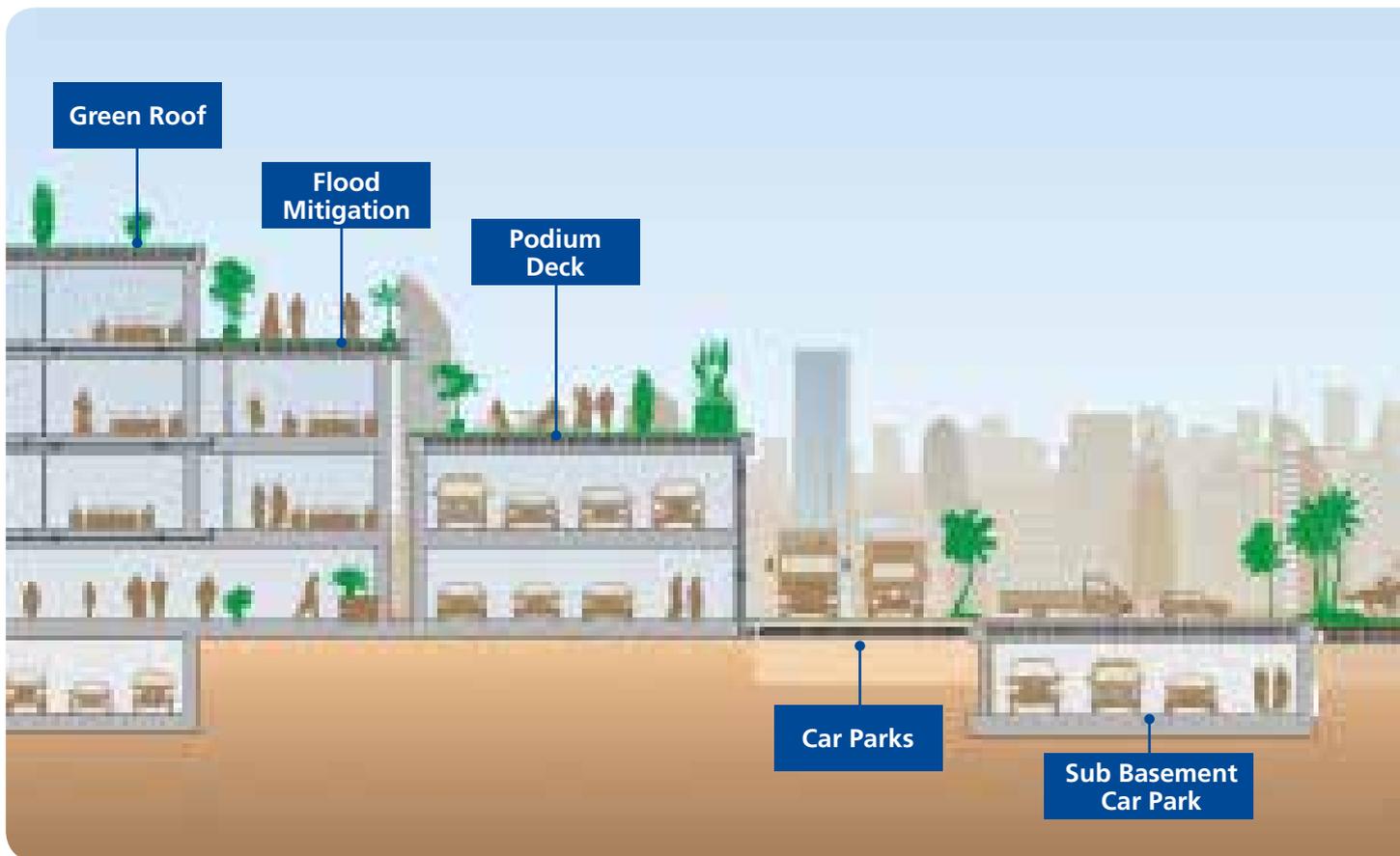


## Key Benefits - Permavoid Solution

- Landscape drainage mainly confined within the landscaped zone
- Basement high-level mechanical services zone with reduced SSL to soffit height
- Local Authority requirement for stormwater attenuation is used in the Permavoid installations. RCC tanks, pumps and mechanical plant/equipment are therefore not required reducing structural/sub-structure considerations
- Storm/surface water discharge to the external Authority drainage network is controlled/attenuated through the Permavoid installations and provides use for passive irrigation
- Storm/surface water protection devices (e.g. silt traps/ interceptors) can form part of the Permavoid installation
- Mechanical irrigation can be reduced by utilising the passive irrigation potential of the Permavoid solution reducing water consumption
- Significantly reduced access and maintenance from landscape drainage
- Overflow/discharge pipework from the Permavoid system are totally flexible as to their locations
- Additional usable / sellable space (parking etc.)
- Compliance with regional Authority sustainability initiatives

# Source Control, dealing with water where it falls

Permavoid applications



## SuDS Principles



**1** Protect natural systems



**2** Integrate stormwater treatment with urban and landscape design

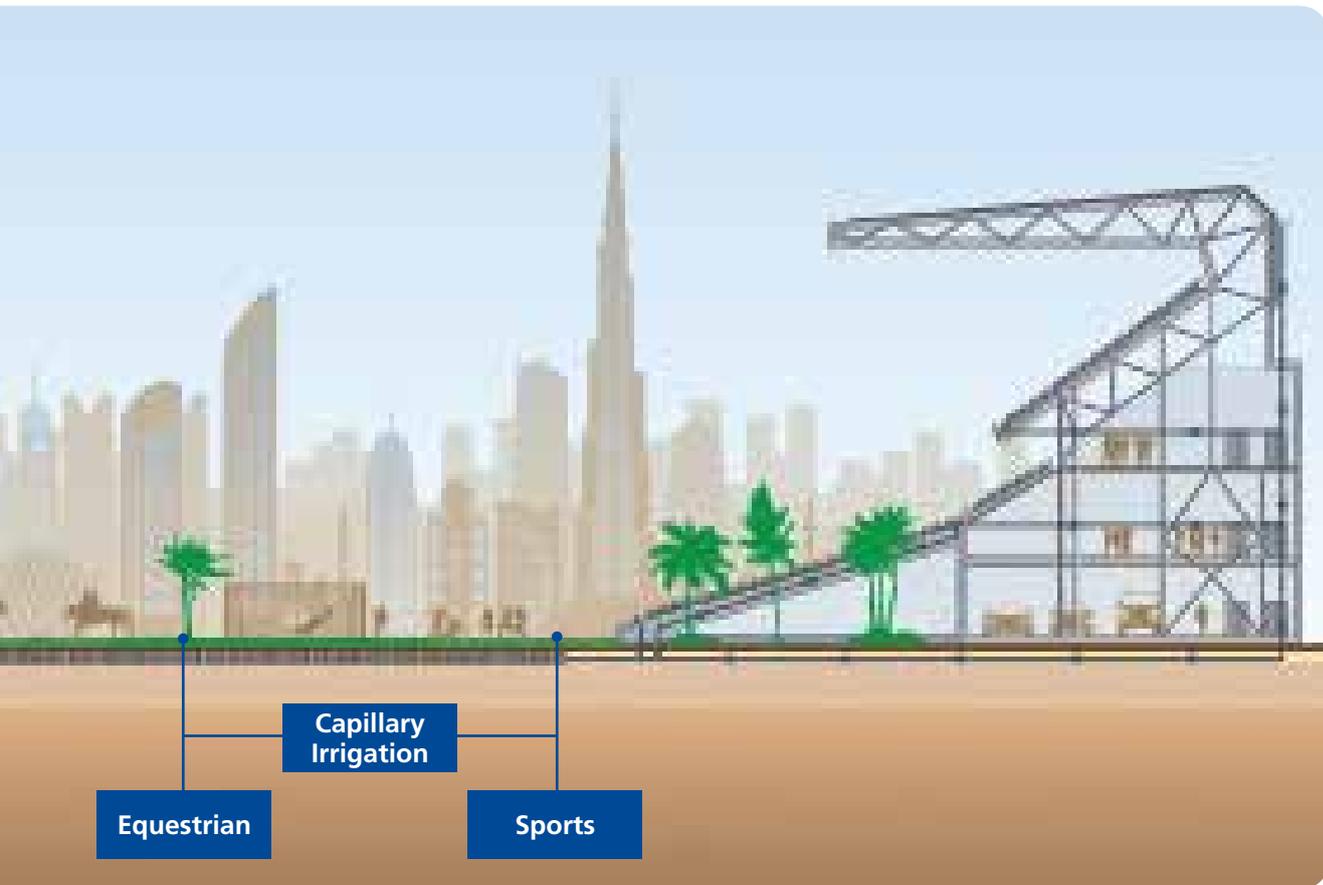


**3** Improve stormwater runoff quality



**4** Reduce run-off and peak flows

The capture of stormwater at source and subsequent control of surface water run-off is integral to the SuDS philosophy. This minimises changes in the volume and rate of surface water run-off from pre-development to post-development.



## Sustainable drainage

Sustainable stormwater design treats rainfall run-off as a valuable resource! Infiltration and flow-through planters are contained landscape areas designed to capture and retain stormwater run-off.



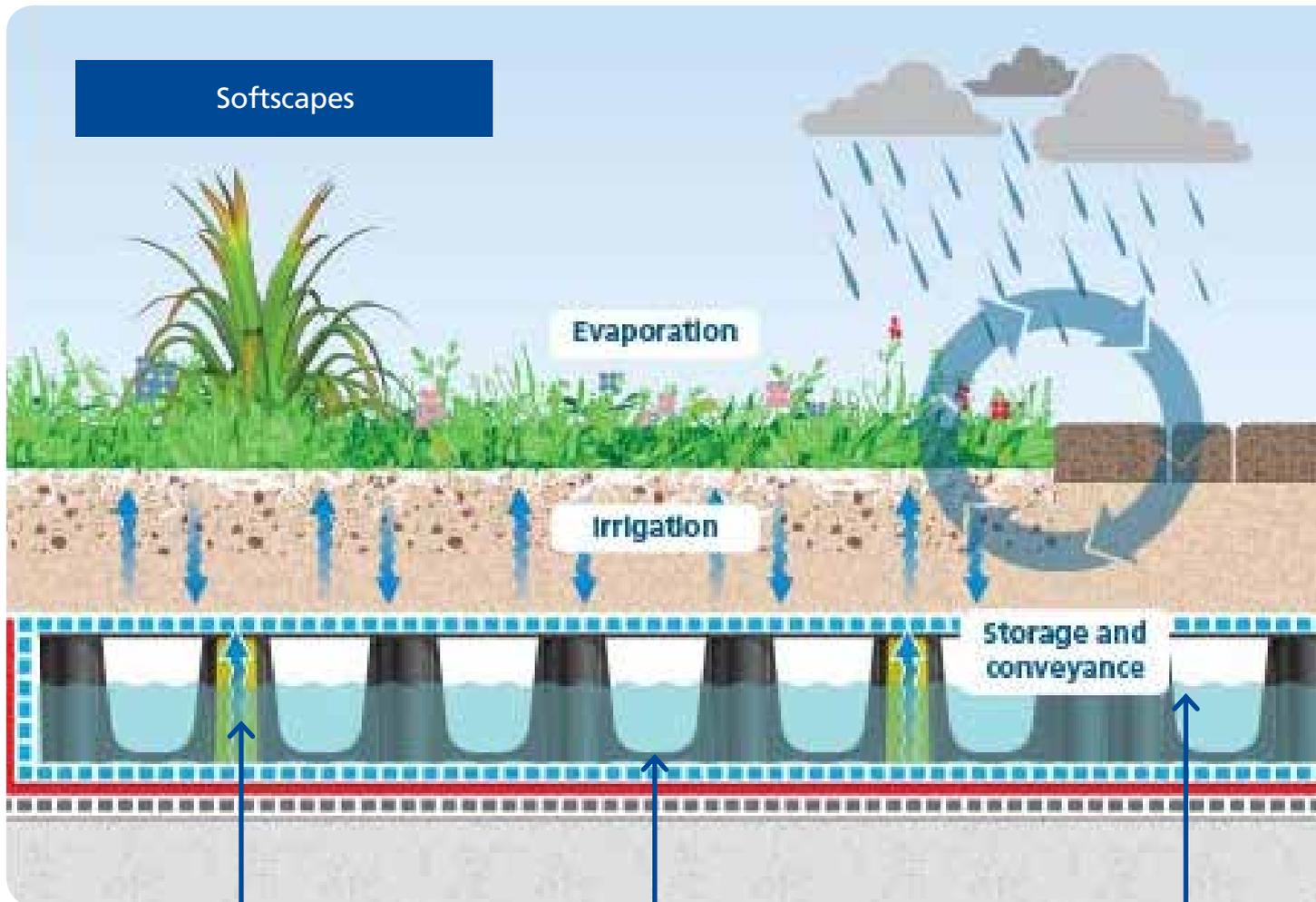
## Traditional drainage

The conventional approach to stormwater management is treating rainfall as a waste rather than a resource.



# Permavoid drainage, conveyance and capillary irrigation system

Podium Deck/Green Roof/Blue Roof/Landscaping



## Capillary action

Also known as 'wicking', capillary action is the ability of water to naturally flow through narrow spaces without the assistance of external forces. Through combining the use of capillary fibre cylinders, Permatex capillary geotextile and a soil depth between 10 and 100cm, soil moisture levels are determined by the capillary rise relative to the particle size distribution and organic matter content of the soil (more organic content = higher capillary rise). Capillary irrigation activates only when the plants are evaporating water and is a 100% 'on-demand' natural irrigation system, requiring no energy for pumping or conveyance and eliminates water losses due to surface evaporation.

## Sources of water

- Stormwater from higher roof areas
- Treated Sewerage Effluent (TSE)
- Air conditioning condensate
- Treated grey water
- Surface water run-off
- Wash down
- Tap water (as a last resort), if required

## Water levels

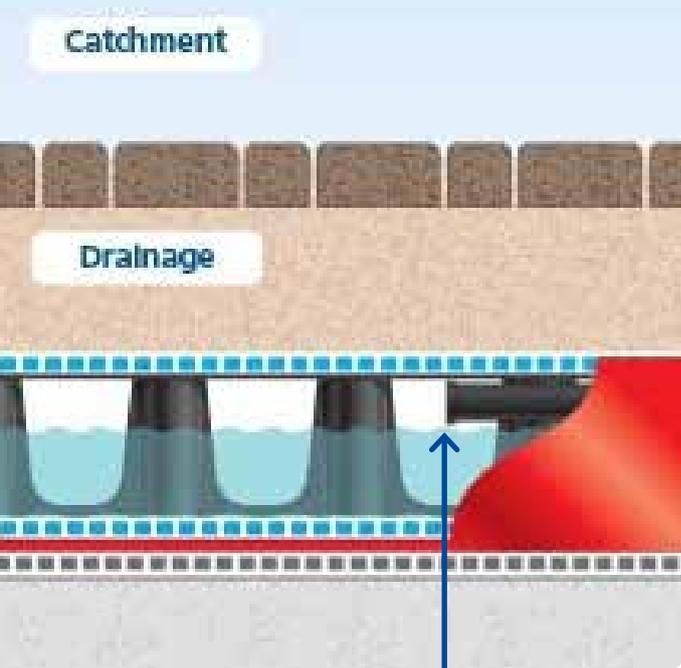
- Fully controlled through flexible positioning of outlet
- Minimum depth: 10mm
- Maximum depth: 75mm
- Air layer must be maintained to encourage aerobic conditions

Polypipe capillary irrigation technology can make a little water go a long way, using geocellular structures and patented geotextiles to release stored water by a process known as 'capillary action', or 'wicking'. This allows moisture controlled sub surface irrigation of soft landscapes and green areas, utilising multiple sources of water.



## Hardscapes

Permeable surfaces can be used if permitted



### Overflow

- To determine water storage level (preferably cascade to green area on lower levels)
- Flexible outlet positioning (side or under-side discharge)
- Careful planning can achieve zero discharge

### Key

- CAPILLARY GEOTEXTILE
- WATERPROOF MEMBRANE
- PROTECTIVE GEOTEXTILE

## Key benefits

### Sustainable city

- Better green space using less water
- Healthier, stronger plants & vegetation
- Reduced sewer/network loads (reduced water and energy consumption)
- Stormwater run-off management
- Water is seen as a gift instead of a nuisance
- Reduction of the urban heat island effect: plants reflect incoming sunlight back into the atmosphere and provide active evaporative cooling
- Change roofs into beautiful natural areas, increasing biodiversity and positively effecting people's health
- Region moves from a desert to a sustainable, liveable city through means of cyclic water management

### Construction

- Provides load bearing, shallow solution
- Reduced building heat influx
- No slab penetrations or underslung pipework
- No pipework falls required
- Flexible inlet/outlet positioning
- Can be used with permeable surfaces
- Fully controlled discharge
- Possibility to cascade water across varying roof levels to ground level
- Requires no space for in-building or in-ground water storage tanks or technical installations such as pumps
- Easy to construct without installation of conventional irrigation lines, drip lines, valves and bubblers or sprinklers

### Challenging tradition

- Permavoid saves on construction costs, maintenance, labour, water & energy consumption and replanting, compared to traditional installation methods

- GEOCELLULAR SOLUTIONS OVERVIEW
- POLYSTORM OVERVIEW
- CHALLENGING TRADITION
- POLYSTORM RANGE COMPONENTS
- POLYSTORM DATASHEETS
- DESIGN CONSIDERATIONS
- STRUCTURAL PERFORMANCE CHECKS
- AN 8 STEP GUIDE TO A TOTAL POLYSTORM SYSTEM
- APPLICATIONS
- INFILTRATION/ SOAKAWAYS
- STORAGE SYSTEMS
- ATTENUATION/ DETENTION
- TREATMENT TRAIN
- TYPICAL POLYSTORM INSTALLATION
- POLYSTORM CASE STUDIES
- PERMAVOID OVERVIEW
- CHALLENGING TRADITION
- SOURCE CONTROL - DEALING WITH WATER WHERE IT FALLS
- PERMAVOID DRAINAGE, CONVEYANCE & CAPILLARY IRRIGATION SYSTEM
- ROOFS
- PODIUM DECK
- URBAN LANDSCAPING
- SPORTS
- THE PERMAVOID SYSTEM - TREATMENT
- PERMAVOID SYSTEM COMPONENTS
- PERMAVOID DATASHEETS
- PERMAVOID CASE STUDIES

# Roofs

The Permavoid system provides an effective water storage and flow control solution for impermeable and permeable surfaces such as roofs.



The SuDS manual, CIRIA Report C697/C573, provides best practice guidance on all aspects of the design, construction, operation and maintenance of SuDS. In particular, it places emphasis on the use of source control techniques.

The capture of stormwater at source and subsequent control of surface water run-off is integral to the SuDS philosophy. This minimises changes in the volume and rate of surface water run-off from pre-development to post-development. Incorporating SuDS reduces flood risk and environmental damage. SuDS source control schemes can also be used to:

- Use stormwater as a resource
- Treat surface water run-off to reduce pollution
- Enhance amenity and bio-diversity

Our rainwater interception system can be used within the following roof applications:

## Green roofs

A green roof is one that is partially or completely covered with vegetation and a growing medium, planted over a waterproofing membrane and incorporating drainage and irrigation systems. Green roofs slow the rate of rainfall to the drainage system and can store and attenuate water. The benefits created by a green roof, apart from helping with a stormwater management system, include:

- Providing insulation
- Creating a habitat for wildlife

- A natural usable space providing amenity
- Reducing urban air temperatures and mitigating the heat island effect

## Brown roofs

Brown roofs, also known as biodiverse roofs, are similar to green roofs except they incorporate locally sourced materials to form the natural growing medium, usually locally sourced aggregate and soils. The roofs are allowed to self-colonise with plants or can be seeded with native species to increase their biodiversity potential.

## Blue roofs

A blue roof is specifically designed to store water, intercepting rainwater at source and reducing peak flows using flow control outlets. Blue roofs can be open water surfaces, storage within a porous media or beneath a surface within a proprietary modular geocellular system. Stored water is treated (where required) and re-used for the irrigation of green/brown roofs, amenity/recreation and biodiversity. It can also be re-used internally for laundry, car washing and toilet flushing. Blue roofs are an effective solution for making space for water in urban sustainable drainage schemes.

# Podium Deck

Our Permavoid Podium Deck attenuation water management system provides an ideal first stage source control (capturing water as close to where it falls) that can be easily integrated into an overall Sustainable urban Drainage System (SuDS) strategy.



## Podium Deck key benefits

- Multi functional - acts as a combined drainage and attenuation system
- Reducing run-off and flood risk
- Maximises space - increases deck area and eliminates the need for pipe work to the underside of the deck
- Load bearing system - strong enough to carry traffic loads
- 95% void ratio - collects and retains almost three times more water than aggregate sub-base
- Quick and easy to install - reduced time, labor and materials on-site
- 100% recyclable
- High water capacity, restricted drains needed
- Low flow rates due to special shape inside

This can significantly enhance the sustainability of a project by allowing stormwater or condensate waste to be harvested on the Podium Deck area to be used for the passive irrigation of green areas or toilet and urinal flushing without the need for pumping.

Used beneath permeable paving instead of an aggregate sub-base, it reduces the need for surface drains and channels and for falls in the deck surface, allowing developers to utilise more of the deck area for parking, green roofing or leisure facilities. It consists of light weight, modular cells that can be interlocked to create a load supporting structural raft across the entire podium deck area, while providing integral drainage and water harvesting. The system has high compressive strength and bending resistance with a proprietary jointing system. Podium Decks can include multi-purpose roofs (hard and soft scapes), green roofs and sub-basement car parks that have been landscaped. As these types of deck increase in size and use, the requirement to achieving efficient water management becomes more difficult.

The Permavoid Podium Deck system addresses a number of the technical challenges presented by the need for stormwater drainage on decks and roofs that are beyond the capabilities of traditional gravel and geocomposite layers. The water storage capacity afforded by the system means that there is no need for drainage outlets to be taken through the deck, water can be taken to the edge of the slab where rainwater down pipe connections are easy to make. In addition, the Permavoid layer is designed to have sufficient hydraulic capacity to facilitate lateral drainage over very large areas without the need for constructed falls within the deck. The units are strong enough to allow emergency vehicle access without the need for deep granular layers, thus reducing the weight of the deck construction.

# Urban landscaping

The introduction of SuDS in urban areas allows landscape architects and engineers to design multi-functional urban spaces.



As space becomes even more limited in the urban environment we need to look to more sustainable ways of managing the flow of stormwater.

The Permavoid system can help enhance natural features in built-up areas. As it provides excellent source control at shallow depths, the system can not only manage, but also treat water from high stormwater volumes. It also creates a structural platform on which green areas can be cultivated, irrigated and oxygenated. The management of surface water run-off from

roads and highways can provide substantial benefits to the built environment. Water management features can be prime design elements in road and highway drainage. Incorporated into a new development or retrofitted into an overall SuDS scheme, Permavoid can enhance the natural environment by providing improved attenuation and treatment at source.

# Sports

Permavoid Modular Cells are ideal for combined subsurface drainage and irrigation storage.



Due to the specialist nature of such systems, please contact Polypipe to discuss specific applications and requirements to assist in achieving a high-performance solution.

Working in conjunction with some of the worlds leading experts and designers in sports surfaces, Polypipe manufacture specialist sports drainage and irrigation systems to meet the needs of today's demanding sporting bodies and events.

Permavoid from Polypipe provides a unique approach to pitch design, recognising the challenges faced by architects, clubs and owners to ensure the playing surface stands up to the rigours of different uses.

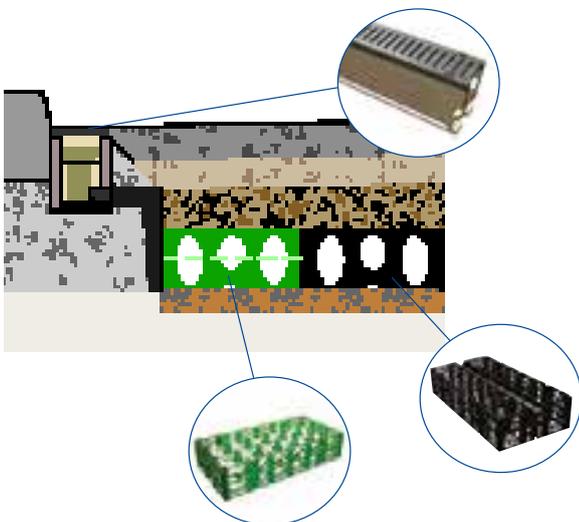
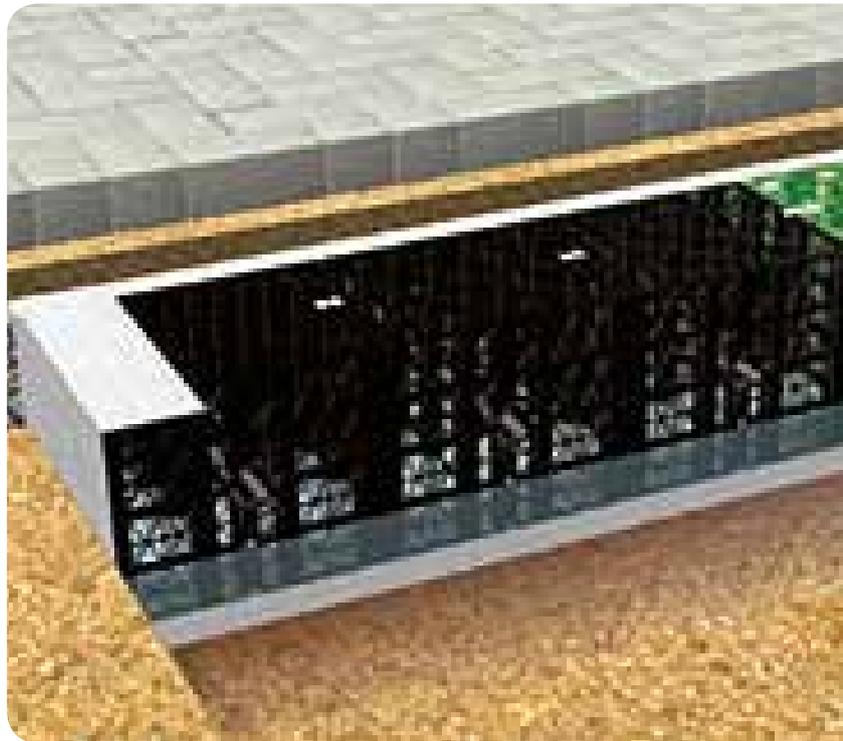
## The Permavoid system – treatment

Permavoid is an engineered, geocellular water management system that meets the demands of current legislation and guidance for source control and surface water treatment. The system comprises of high-strength recycled polypropylene modular cells, connected together using tapered ties to create a consistent structural raft of exceptional high compressive and tensile strength, ideal for sub-base replacement.

### Why a shallower application?

Shallower attenuation or infiltration structures are often necessary because the ground at greater depths presents a construction challenge, of one kind or another. This could be due to the presence of chemicals or contamination left over from previous land use, a high water table or hard rock areas.

Some drainage engineers prefer a shallower approach because it does not rely on expensive pumping equipment. Shallower methods also reduce environmental impact because they require less excavation and fewer trips to transport infill and rubble to and from the site. They are also much more versatile and cost-effective than deeper solutions, as no trench supports are required and the need for expensive, heavy plant, usually required during installation, is eliminated.



### Within impervious pavements

Within impervious pavements, Permavoid can be installed as a replacement for granular sub-base to enhance the attenuation capacity, due to the high void ratio of the Permavoid modular cell. Permachannel and Permaceptors are used to capture water from hardstanding areas. They treat surface water run-off and transfer the flow into the adjoining Permavoid layer.

The water treatment efficiency of the system is enhanced with the addition of Permavoid Biomats. These have a floating oil treatment geotextile which prevents any excess oils and hydrocarbons entering the storage system.



## The Permavoid system key benefits

- Designed and tested for detention, attenuation or infiltration at shallower depths
- Provides effective source control
- Can be installed above a high water table
- Allows water to be spread across a wide area
- Ideal for brownfield or contaminated sites
- Provides treatment to remove silt and hydrocarbon deposits
- Removes the requirement for pumping stations
- Oil interception at source – no need for petrol interceptors
- Can be used in combination with the full range of Polystorm geocellular solutions for deeper applications
- Interlocking raft for rigidity and a high compressive and tensile strength under load
- Suitable for use beneath porous and non-porous surfaces
- Reduction in excavation depth and cost
- No need for trench supports or plant to deliver and remove trench support panels
- Can be used in conjunction with soft SuDS to help 'make space for water'

## Within pervious pavements

As Permavoid can be installed as a replacement for granular sub-base; the attenuation capacity of pervious pavements can be significantly increased due to the high void ratio of the Permavoid modular cell and the thickness of traditional granular layers may be reduced in many instances. The water treatment efficiency of the pavement can also be significantly enhanced by the introduction of Permafilter oil treatment geotextile at formation level to prevent any excess oils and hydrocarbons from passing through the storage system. This is also relevant where pavements are designed as infiltration features.



# Permavoid system components

The Permavoid system comprises of:



## Permavoid (85 & 150)

Product codes: PVPP85 & PVPP150

Geocellular sub-base replacement system that locks together to form an interlocking raft of exceptional high compressive and tensile strength.

[See page 62](#)



## Permavoid 2 (85)

Product code: PVPP85V

Geocellular sub-base replacement system that locks together to form an interlocking raft of exceptional high compressive and tensile strength.

[See page 62](#)



## Permachannel

Product code: PV03001

A linear treatment system that combines run-off collection, silt & effluent interception and water treatment functions.

[See page 63](#)

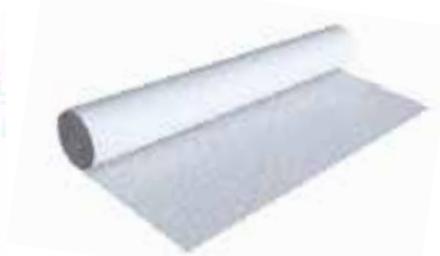


## Permavoid Biomat

Product code: PV150BM

High strength geocellular unit containing a low density, oil treating, geosynthetic floating mat.

[See page 64](#)



## Permafilter Geotextile

Product code: PV23002

A non-woven, dimpled, needle – punched geotextile designed for hydrocarbon pollution treatment.

[See page 65](#)



## Geomembrane

An impermeable membrane for wrapping around Permavoid structures to form watertight tanks.

[See page 66](#)



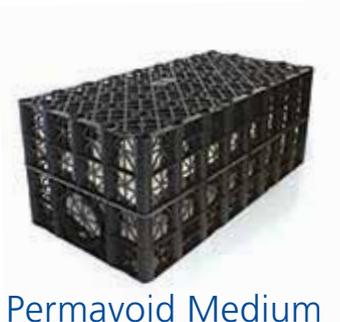
## Permaties

Product code: PVCLIP

Fully interlocking tapered tie connections to securely link Permavoid cells together horizontally in a single structure and to transfer tensile loads.

[See page 67](#)

Our Technical Manual and datasheets for the Permavoid system components can be found on our website [www.middleeast.polypipe.com/downloads/installation-guides](http://www.middleeast.polypipe.com/downloads/installation-guides)



## Permavoid Medium Duty with Biomat

Product code: PSM1BM

Comprising of a low density, oil treating geosynthetic floating mat for use with the Polystorm range of modular geocellular units.

[See page 68](#)



## Shear Connector

Product code: PVSC

Securely links multiple layers of Permavoid together in a single structure.

[See page 67](#)



## Permavoid Connectors

A range of Spigot and Saddle Connectors allowing piped connection to the Permavoid structure.

[See page 70](#)



## Permavoid Permatex Capillary Geotextile

Product code: PV23008

A heavy-duty, non-woven, needle punched geotextile made from UV stabilised polypropylene. It is specifically formulated to absorb water to irrigate mineral substrates when used in conjunction with Permavoid Capillary Cone units.

[See page 69](#)



## Permavoid Permatex 300

Product code: PV23006

A heavy duty, non-woven, polypropylene, geotextile designed to protect and separate Permavoid geocellular layers.

[See page 69](#)



## Orifice Plate Flow Control Chambers

A pre-fabricated orifice plate flow control unit, incorporating a removable filter to protect the orifice.

[See page 87](#)

For full range of Permavoid components, please contact our technical team of experts: +971 (0) 4 807 3000

# Permavoid 85 & 150

Product codes: PVPP85, PVPP150 & PVPP85V

Permavoid is a geocellular interlocking system designed for shallow groundwater storage or infiltration, to be used in place of traditional aggregate sub-base. The system has an exceptionally high compressive and tensile strength and bending resistance, with a proprietary jointing system to create a consistent structural raft within the pavement that is ideal for the shallow attenuation of surface water.



Permavoid 85

Permavoid 150

Permavoid 2 85

Element	85mm	150mm	85mm
<b>PHYSICAL PROPERTIES</b>			
Weight per unit	2.25kg	3kg	2.5kg
Weight per square metre	9kg	12kg	6kg
Length	708mm	708mm	708mm
Width	354mm	354mm	708mm
Depth	85mm	150mm	85mm
<b>SHORT TERM COMPRESSIVE STRENGTH</b>			
Vertical	715kN/m <sup>2</sup>		
Lateral	156kN/m <sup>2</sup>		
<b>SHORT TERM DEFLECTION</b>			
Vertical	1mm per 126kN/m <sup>2</sup>		
Lateral	1mm per 15kN/m <sup>2</sup>		
<b>TENSILE STRENGTH</b>			
Of a single joint	42.4kN/m <sup>2</sup>		
Of a single joint at (1% secant modulus)	18.8kN/m <sup>2</sup>		
Bending resistance of unit	0.71kN/m		
Bending resistance of single joint	0.16kN/m		
Volumetric void ratio	92%		
Average effective perforated surface area	52%		
<b>OTHER PROPERTIES</b>			
Intrinsic permeability (k)	1.0 x 10 <sup>-5</sup>		
Ancillary	Permavoid Permatie		
	Permavoid Shear Connector		
Material	Polypropylene (PP)		

## Hydraulic Performance

3 units wide, 1 unit deep (1.06m x 0.15m)

<b>FREE DISCHARGE</b>						
Gradient %	0	1	2	3	4	5
Flow Rate 85mm l/m/s	4	6	7	-	-	-
Flow Rate 150mm l/m/s	8	13	15	17	19	21

## Permavoid 85 & 150 key benefits

- High strength, high capacity and shallow sub-base replacement system
- Stormwater attenuation and/or infiltration system
- Used as part of a SuDS scheme to offer stormwater storage at shallow construction depths
- Units are manufactured from 90% recycled polypropylene (PP)
- 100% recyclable

## Applications

The Permavoid units are suitable for use as a stormwater attenuation and/or infiltration system. The system comprises of single, interconnected cells which can be installed in the ground as part of sub-base formation. Permavoid is suitable for use in a range of applications including residential, industrial estates, car parks, sports pitches, roofs, basements, pedestrian areas and rainwater harvesting.

## Performance

The structural load bearing capacity of the Permavoid units have been tested in accordance with the following European Standard: BS 7533-13:2009. The system's structural design life expectancy, based upon creep test data (tested in accordance with CIRIA guidelines) is as follows; for lightly loaded areas such as car parks, a design life of 50 years is achievable. For areas with prolonged HGV loading, a typical design life may only be 25 years, depending on the design of the pavement surfacing and structural layers over the tank.

## Installation standard

All calculations for Permavoid units are based upon site-specific load cases, pavement construction types and thicknesses, soil cover and ground conditions; the suitability must therefore be approved for each project.

# Permachannel Product code: PVO3001

The Permachannel functions as a combined run-off collection, silt/oil interceptor and treatment system. The system is designed to be ideally laid with zero gradient to prevent the development of lateral velocities, stilling sheet run-off from each sub-catchment and encouraging silt deposition within each channel. The outlets discharge from the side of the channel via a weir and baffle component, which separates oils and prevents the effluent and silt from progressing beyond the channel into the rest of the drainage system.



## Applications

Permachannel is used for stormwater collection, interception and the treatment of associated pollutants. The system comprises of single or multiple interconnected channels appropriately located to collect surface water run-off from sub-catchments of predominantly impervious or pervious pavements. Permachannel is suitable for use in a range of applications, including residential, industrial estates, car parks, sports pitches, roofs, basements, pedestrian areas and rainwater harvesting.

## Performance

Permachannel is rated to D400 loading in accordance with BS EN 124:1994 when installed with a concrete bed and haunch in accordance with site specific construction details.

## Installation standard

Permachannel must be installed on a load bearing concrete bed and haunch in accordance with site specific construction details.

For our full range of Permavoid datasheets and standard details, please visit our website [www.middleeast.polypipe.com/downloads/installation-guides](http://www.middleeast.polypipe.com/downloads/installation-guides)

## Permachannel key benefits

- Gravity separation of oils and silts at source
- Trapped effluent naturally treated by aerobic digestion
- Can enhance water quality and eliminate the need for end of line petrol/oil interceptors
- The system complies with the regulations of the treatment train criteria in a SuDS scheme as defined in PPG3
- 100% recyclable

Element	Value
<b>PHYSICAL PROPERTIES</b>	
Weight per unit	29kg
Length	1000mm
Width	150mm
Depth	210mm
Material	Polymer concrete
Grating	Ductile iron standard steel safe
Catchment area	30m <sup>2</sup>
Loading	Rated to D400
Average effective perforated surface area	Polymer concrete
Chemical resistance	The polymer concrete has a capillary-free, non-porous sealed structure, which makes it naturally resistant to most chemicals (i.e. petrol, oils and acids)

Effluent concentrations are below PPG3 Class I requirements.

Note: Ancillary universal channel connector 40mm diameter.

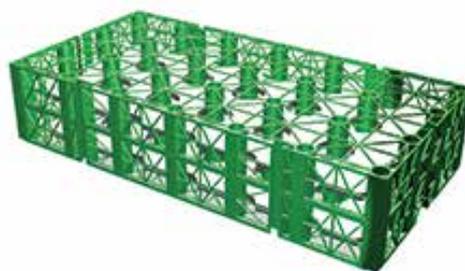
# Permavoid Biomat

Product code: PV150BM

Permavoid Biomat is a high strength geocellular unit, designed for use with the Permavoid system, containing a low density, oil treating, geosynthetic floating mat (biomat). The biomat floats on water and is designed to intercept and treat any potential residual emulsified oils that may be present within the surface water. The use of Permavoid Biomat provides additional oil detention and water treatment capability to an underground water storage system.

## Permavoid Biomat key benefits

- Secondary treatment phase for potential residual hydrocarbons
- Pollutant-intercepting floating mat
- Same size as Permavoid so can be incorporated into Permavoid attenuation designs
- Floating medium maintained at air-water interface allowing optimum conditions for aerobic degradation
- Self maintaining, degrades residual oils by absorption and aerobic digestion
- Units are manufactured from 90% recycled polypropylene (PP)
- 100% recyclable



## Installation standard

All calculations for Permavoid Biomat units are based upon site-specific load cases, pavement construction types and thickness, soil cover and ground conditions and the suitability must therefore be approved for each project.

## Applications

Permavoid Biomat units are an effective water treatment component suitable for use as a stormwater attenuation and/or infiltration system. The system comprises single, interconnected cells which can be installed in the ground as part of a sub-base formation. Permavoid Biomat is suitable for use in a range of applications, including residential, industrial estates, car parks, sports pitches, roofs, basements, pedestrian areas and stormwater collection.

## Performance

The structural load bearing capacity of the Permavoid Biomat units have been tested in accordance with the following European Standard: BS 7533-13:2009. The system's structural design life expectancy, based upon creep test data (tested in accordance with CIRIA guidelines) is as follows: For lightly loaded areas such as car parks, a design life of 50 years is achievable. For areas with prolonged HGV loading, a typical design life may only be 25 years, depending on the design of the pavement surfacing and structural layers over the tank.

Element	Value
<b>PHYSICAL PROPERTIES</b>	
Weight per unit	3kg
Length	708mm
Width	354mm
Depth	150mm
<b>SHORT TERM COMPRESSIVE STRENGTH</b>	
Vertical	715kN/m <sup>2</sup>
Lateral	156kN/m <sup>2</sup>
<b>SHORT TERM DEFLECTION</b>	
Vertical	1mm per 126kN/m <sup>2</sup>
Lateral	1mm per 15kN/m <sup>2</sup>
<b>TENSILE STRENGTH</b>	
Of a single joint	42.4kN/m <sup>2</sup>
Of a single joint at (1% secant modulus)	18.8kN/m <sup>2</sup>
Bending resistance of unit	0.71kN/m <sup>2</sup>
Bending resistance of single joint	0.16kN/m <sup>2</sup>
Volumetric void ratio	92%
Average effective perforated surface area	52%
<b>OTHER PROPERTIES</b>	
Intrinsic permeability (k)	Minimum 1.0 x 10 <sup>-5</sup>
Oil detention	56g/m <sup>2</sup>
Effluent discharge at max. oil loading	10ppm
Ancillary	Permavoid Permatie Permavoid Shear Connector

# Permafilter Geotextile Product code: PV23002

Permafilter Geotextile is a non-woven, dimpled, needle-punched geotextile that has been specifically designed for hydrocarbon pollution treatment in sustainable drainage systems (SuDS) and other civil engineering applications.

## Permafilter Geotextile key benefits

- Captures residual hydrocarbons
- Removes pollutants by biodegradation
- 100% recyclable
- Enhances water quality when used as part of a source control SuDS and eliminates the need for end of line petrol/oil interceptors
- Designed to be self-maintaining for the life of the installation



Element	Value
<b>PHYSICAL PROPERTIES</b>	
Weight per unit	300g/m <sup>2</sup>
Roll length	100m
Roll width	2.4m
Roll weight	72kg
<b>MECHANICAL PROPERTIES</b>	
Tensile strength EN10319 (md/cmd)	9/12kN/m
Static puncture (CBR test) EN12236	1575N
<b>HYDRAULIC PROPERTIES</b>	
Water permeability EN ISO 11058	57 l/m <sup>2</sup> /s
<b>OTHER PROPERTIES</b>	
Air permeability	1000 l/m <sup>2</sup> /s
Max. oil detention	6l/10m <sup>2</sup>
Effluent discharge at max. oil loading	10ppm
Material	Modified polyester

## Applications

Permafilter Geotextile is suitable for use in a range of applications, including residential, industrial estates, swales, sports pitches, car parks, roofs, basements, pedestrian areas and rainwater harvesting.

## Performance

The dimpled geotextile comprises of a proprietary blend of polyester fibres that incorporates hydrophilic (water attracting and oil repellent) and hydrophobic (oil attracting and water repellent) properties to achieve superior oil detention. Permafilter Geotextile is capable of retaining oil contamination ranging from daily car drip losses, up to catastrophic spillages i.e. originating from car oil-sump failures. The entrapped hydrocarbons are biodegraded by naturally occurring microorganisms, providing a self-cleansing mechanism.

## Laying generally

Permafilter will be laid to suit site specific requirements. Overlaps shall be a minimum of 300mm or heat sealed. Ensure geotextile is clean and debris free before installing Permafilter.

For our full range of Permafilter datasheets and standard details, please visit our website [www.middleeast.polypipe.com/downloads/installation-guides](http://www.middleeast.polypipe.com/downloads/installation-guides)

# Permavoid Geomembrane

Geomembranes are impermeable liners used in sustainable drainage systems (SuDS) to form water tight tanks. The membrane used depends on a risk assessment of the site and the ground and groundwater conditions.

Element	Value	Test Method
<b>PHYSICAL PROPERTIES</b>		
Thickness mm $\pm 10\%$	1.0	ASTN D-751
Density g/cm <sup>3</sup> minimum	0.9	ASTM D-792
Tensile stress at break minimum N/mm <sup>2</sup>	18	ASTM D-638
Elongation at break %	>700	ASTM D-638
Puncture resistance minimum N	150	FTMS 101C method 2065
Tear resistance minimum N	60	ASTM D-104
Dimensional stability % change max	$\pm 2.0$	ASTM D-1204 1hr at 100°C
Stress crack resistance	100%	ASTM 5397
Volatile loss 5% loss max	0.2	ASTM D-1203 method A
Ozone resistance	No cracks	ASTM D-1149
Carbon black content	2-3%	ASTM 1603
Moisture vapour g/m <sup>2</sup> /day	<0.1	ASTM E96
Friction angle (non-woven Geotextile)	21°	Shear box
Methane permeability	0.11 g/m <sup>2</sup> /day/atm	European standard
Methane transmission rate	$1.8 \times 10^{-9}$ m <sup>3</sup> /m <sup>2</sup> /s/atm	BRE
Permeability coefficient	$1.8 \times 10^{-12}$	
Core material	Polypropylene	

## Laying generally

For detention and attenuation applications the units need a sealed geomembrane to prevent the release of water and prevent the ingress of groundwater. All joints should be sealed using proprietary techniques recommended by the manufacturer. Advice on seam testing procedures as given in CIRIA SP 124:1996. Barriers, liners and cover systems for containment and control of land contamination.



## Applications

The Geomembrane is suitable for use in a range of applications, including residential, industrial estates, swales, sports pitches, car parks, roofs, basements, pedestrian areas and stormwater collection.

## Performance

A robust, heavy duty Geomembrane resistant to puncture. Geomembrane combines excellent chemical resistance with low flexural modulus to provide a malleable, flexible membrane suitable for non-smooth surfaces and factory pre-fabrication to optimise on-site installation. Jointing shall be formed using fusion or extrusion bead welding in accordance with manufacturing recommendations.

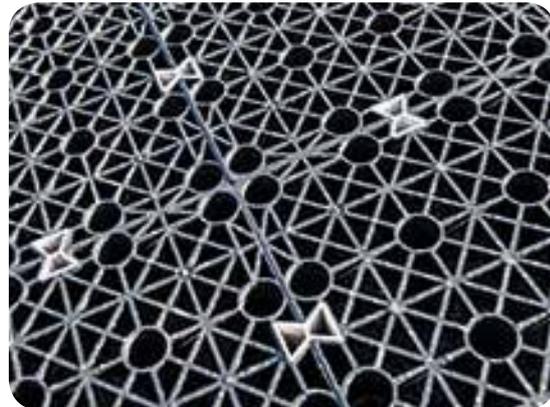
## Permavoid Geomembrane key benefits

- Heavy duty polypropylene membrane
- Used to create a water-tight construction and minimise risk of subgrade softening
- 100% recyclable

## Permaties Product code: PVCLIP

Permatie is a patented tapered tie that interlocks the Permavoid geocellular units into a secure and consistent raft. Once connected, the ties provide tensile resistance within the Permavoid structure.

Element	Value
<b>PHYSICAL PROPERTIES</b>	
Weight per unit	30g
Length	74mm
Width	45mm
Depth	34mm
<b>OTHER PROPERTIES</b>	
Material	Polypropylene



## Shear Connector Product code: PVSC

When two or more layers of Permavoid are used to form a structure, Shear Connectors are inserted between the layers to create stability and prevent lateral movement and shear resistance.

Element	Value
<b>PHYSICAL PROPERTIES</b>	
Weight per unit	10g
Length	40mm
Diameter	35mm
<b>OTHER PROPERTIES</b>	
Material	Polypropylene



# Permavoid Medium Duty with Biomat

Product code: PSM1BM

Permavoid Medium Duty with Biomat is designed for use with Polystorm attenuation and infiltration systems and comprises of a tri-laminate of low density plastic composite (biomat).

The biomat floats on water and is designed to intercept and treat any potential residual emulsified oils that may be present within the surface water. The use of Permavoid Medium Duty with Biomat provides additional oil detention and water treatment capability to an underground water storage system.

## TECHNICAL SPECIFICATION OVERVIEW

Length	1m
Width	0.5m
Depth	0.4m
Total volume	0.2m <sup>3</sup>
Unit weight	9kg (approx)
Unit storage volume	0.19m <sup>3</sup> (190 litres)
Void ratio	95%
Vertical compressive strength	Maximum 610 kN/m <sup>2</sup> **
Lateral compressive strength	Maximum 63 kN/m <sup>2</sup> **
Short-term vertical deflection	70.1 kN/m <sup>2</sup> per mm
Short-term lateral deflection	4.4 kN/m <sup>2</sup> per mm
Estimated long term vertical deflection (creep)	0.2798 Ln (design life in hrs) [Based on an applied test load = 162 kN/m <sup>2</sup> ] Creep data limit 60 years
Estimated long term lateral deflection (creep)	1.0192 Ln (design life in hrs) [Based on an applied test load = 30.8 kN/m <sup>2</sup> ] Creep data limit 60 years

## OTHER PROPERTIES

Intrinsic permeability (k)	Minimum 1.0 x 10 <sup>-5</sup>
Oil detention	56g/m <sup>2</sup>
Effluent discharge at max. oil loading	10ppm

Note: Permavoid Medium Duty With Biomat is ideal for use in trafficked and pedestrian applications subject to a structural design check and suitable installation conditions.

\*Each unit includes four clips and two shear connectors.

\*\*Compressive strength at yield, maximum recommended value for design purposes.



Exact colour may vary due to recycled materials.

## Applications

The Permavoid Medium Duty with Biomat units are suitable for use as a stormwater detention, attenuation or infiltration system. Used to provide hydrocarbon treatment, they are suitable for a range of applications including, retail, residential, commercial and off-road car parking.

## Performance

The structural load bearing capacity of the Permavoid units have been tested in accordance with CIRIA C680. The structural design life is a minimum 60 years.

The units provide 3D flow and have a void ratio of 95%.

## Permavoid Medium Duty with Biomat key benefits

- Pollutant-intercepting floating mat degrades residual oils by absorption and aerobic digestion
- Can be incorporated into Polystorm detention, attenuation and infiltration systems
- 95% void ratio
- Light weight yet robust – excellent Health and Safety and installation benefits
- 60 years creep limited life expectancy
- 100% recyclable
- Units are manufactured from recycled materials

# Permavoid Permatex 300

Product code: PV23006

A heavy duty, non-woven, needle punched, polypropylene geotextile designed to protect and separate Permavoid geocellular layers.

ELEMENT	VALUE	TEST METHOD
PHYSICAL PROPERTIES		
Roll length	65m	
Roll width	5.25m	
Mass per unit area	300g/sq.m	EN ISO 9864
Thickness under load 2kPa	2mm	EN ISO 9863-1
CBR puncture resistance	4000N	EN ISO 12236
Dynamic cone drop	11mm	EN ISO 13433
Tensile strength (min) at max. load	25kN/m	EN ISO 10319
Tensile extension (max) at max. load	50%	EN ISO 10319
Protection efficiency	300N	EN ISO 14575
Breakthrough head	nil	BS EN ISO 10319
Coefficient of permeability	55 x 10 <sup>-3</sup> m/s	EN ISO 11058
Characteristic opening size	70 microns	EN ISO 12956

It comprises of a three-layer composite scrim reinforced with low elongation. 300mm lap-jointing is required.

## Applications

- Separation
- Protection



## Laying generally

Permatex protection geotextile shall be laid continuously around the drainage to suit site specific requirements. Overlaps shall be a minimum of 300mm or heat sealed. Ensure geotextile is clean and debris free before installing Permavoid.

# Permavoid Permatex Capillary Geotextile

Product code: PV23008

A heavy-duty, non-woven, needle punched geotextile made from UV stabilised polypropylene.

Element	Value
PHYSICAL PROPERTIES	
Nominal thickness	2.5mm
Weight	285g/m <sup>2</sup>
Roll width	6m
Roll length	125m
Roll weight	210kg
Roll diameter	0.5m
MECHANICAL PROPERTIES	
Tensile strength	22kN/m
Puncture resistance	3350N
HYDRAULIC PROPERTIES	
Water detention capacity	1.14 l/m <sup>2</sup>
Design life	60 years
Dynamic cone drop	17mm
Opening size 0-90	95 microns
Horizontal capillary distance in conjunction with capillary cones*	Min. 750mm for sports mixes

It is specifically formulated to absorb water to irrigate mineral substrates when used in conjunction with Permavoid Capillary Cone units.



## Permavoid Permatex Capillary Geotextile key benefits

- Can be used as part of a passive irrigation system
- Can remove excess soil moisture
- Transports stormwater laterally across a wide surface area, thus irrigating surrounding soil/ growing media and maintaining the correct amount of soil moisture to promote growth

\*All values stated above are nominal and may vary within manufacturing tolerances.

## Preformed Spigot Connector with weldable membrane



ELEMENT	VALUE
<b>PHYSICAL PROPERTIES</b>	
Weight per unit	50g
<b>OTHER PROPERTIES</b>	
Material	Polypropylene

When forming a Permavoid attenuation or storage structure, it is necessary to use the Preformed Spigot Connector with weldable membrane in association with the Permavoid Geomembrane. A welded joint can be made to ensure the tank is leak free.

## Orifice Plate Flow Control Chamber



ELEMENT	VALUE
<b>PHYSICAL PROPERTIES</b>	
Weight per unit	Variable
Minimum diameter	500mm
Height	Variable
Sump depth	300mm as standard, others available on request
<b>OTHER PROPERTIES</b>	
Material	Polypropylene

Discharge limitations are normally achieved by the incorporation of pre-fabricated orifice plate flow control devices, fitted with removable filters to protect the orifices. These are sized to suit the permitted discharge rate and the size of the sub-catchment using standard hydraulic theory.

## Universal Permachannel Connector

Product code: PV06305



ELEMENT	VALUE
<b>PHYSICAL PROPERTIES</b>	
Weight per unit	210 g
Length	260mm
Width	180mm
Depth	39mm
Spigot diameter	40mm
Spigot Length	135mm
<b>OTHER PROPERTIES</b>	
Material	Polypropylene

The Permachannel Connector is installed where adjacent Permachannel units butt against each other to form a 40mm diameter outlet. The connector fits into the outlet from the Permachannel and allows water to be conveyed from the Permachannel into the Permavoid system. One connection unit is required per linear metre of Permachannel.

If required, outlet connections can be extended using 40mm HDPE pipework.

## Saddle Connector for infiltration applications



ELEMENT	VALUE
<b>PHYSICAL PROPERTIES</b>	
Weight per unit	80g
<b>OTHER PROPERTIES</b>	
Material	Polypropylene

Proprietary saddle connections for use within Permavoid storage structures installed to soakaway captured water.

# Permavoid Wicking Geotextile

Product code: PV23008

A heavy-duty, non-woven, needle-punched geotextile made from a blend of modified polyester fibres. It is specially formulated to absorb water to irrigate mineral substrates when used in conjunction with Permafoam units.

ELEMENT	VALUE
<b>PHYSICAL PROPERTIES</b>	
Nominal thickness	3.6mm
Surface weight	500gm <sup>2</sup>
Saturated weight	4.5K/gm <sup>2</sup>
Roll width	2m
Roll length	25m
Roll weight	26kg
<b>MECHANICAL PROPERTIES</b>	
Maximum tensile strength – Longitudinal	10kN/m
Maximum tensile strength – Lateral	28kN/m
Puncture resistance	2600N
<b>HYDRAULIC PROPERTIES</b>	
Water detention capacity	4 l/m <sup>2</sup>
Water permeability	37 l/m <sup>2</sup> /s

## Laying generally

Permavoid Wicking Geotextile shall be laid continuously to suit the site specific requirements. Overlaps shall be a minimum of 300mm or heat sealed.



## Applications

The Wicking Geotextile is suitable for use in most landscaped applications including roof gardens, soft SuDS applications and sports pitches.

## Performance

A robust heavy duty geotextile, when constantly charged with water, it allows moisture to be fed naturally by capillary action to landscaped areas for irrigation. 300mm lap jointing is required. Used in conjunction with Permafoam units. Water is drawn by capillary attraction to ensure the Wicking Geotextile is kept charged.

### Permavoid Wicking Geotextile key benefits

- Passive capillary irrigation
- Can remove excess soil moisture

## Case study – National Bank of Oman, Muscat, Oman



Polypipe Middle East provided significant cost and time savings at the Bank's new Muscat headquarters.

When the National Bank of Oman designed its impressive new headquarters with Ibrahim Jaidah Architects and Engineers, it wasn't just the creation of a new 10-storey building that needed to be considered. Whilst traditional concrete storage tanks may have been the usual design approach to manage stormwater, Buro Happold, the chosen Design Consultant, together with Contractor, Al Turki Enterprises, and Ibrahim Jaidah, recognised the benefits of utilising Polypipe's geocellular solutions. Polypipe's Polystorm and Permavoid geocellular solutions were not only seen as an alternative to concrete tanks, but through smart engineering offered up to 50% cost savings and significantly reduced installation time.

Polypipe provided a unique solution comprising of a 3,400m<sup>2</sup> Permavoid tank designed to sit below the podium deck and mitigate the impact of stormwater events, whilst also replacing much traditional underslung pipework and providing more usable space back to the client. The system was accompanied by an additional 50m<sup>3</sup> Polystorm tank to ensure the discharge wouldn't overwhelm the local drainage network.

While initial designs for the concrete tank advised that the installation phase may take several months to complete, Polypipe's engineered geocellular solution could be completed in just a few days.

Polypipe's technical experts undertook regular site visits during the installation phase to offer advice and ensure a right-first-time installation.



## Case study – Passivhaus, Doha, Qatar



Plastic pipework, water treatment and irrigation systems from British manufacturer Polypipe have been used throughout Qatar's groundbreaking Passivhaus-Baytna sustainable villa project to help meet the target of using 50% less energy and water than in a traditionally-built villa.

Polypipe worked as a supply partner on the project with Qatar Green Building Council (QGBC) and Barwa Real Estate. In terms of sustainable development, conserving water is a key issue in the Middle East. With extremely limited fresh water resources, growing populations and urbanisation are placing increasing demands on supply, with annual demand for water increasing significantly over the last decade and projected to continue to increase. The Passivhaus concept originated in Germany and focuses on energy efficiency, looking to reduce overall energy consumption in the construction and running of the building. In the Middle East, we also have to consider water preservation. Virtually all fresh water is obtained via the desalination process, which is not only expensive, but also uses large quantities of energy and has many adverse environmental impacts, so we need to think very carefully about how we use water in the home.

A range of Polypipe products were used in the project. These included Terrain PVC-u above and below ground drainage products, used with the Terrain Pleura ventilation system. For the hot and cold water distribution systems, Polyplumb pipework was chosen for its fast and reliable installation. A key feature is the use of a Permavoid water treatment unit for treating foul and greywater which is then used for sub-soil irrigation.

Polypipe has focused its development resources on providing piping solutions to enable the utilisation of building technologies aimed at the reduction of CO<sub>2</sub> emissions and redirection of energy usage.

In addition, the materials used, are, in themselves, environmentally friendly. Plastics are lighter and more robust than traditional materials so you need less to do more. They help reduce energy usage because they are lightweight in production, transport and use. In contrast to traditional materials like concrete or clay, plastics are recyclable, require no quarrying activities and reduce the carbon footprint from transport.

Polypipe's involvement in the Baytna project has provided a valuable opportunity to demonstrate the contribution and impact what Polypipe products can make to sustainable development in the Middle East.

# Ridgidrain

Offering increased sustainability without compromise in performance, Ridgidrain is suitable for use in Civils and Infrastructure non-pressurised surface and sub-surface drainage applications.



## High strength performance

The very first twinwall surface drainage system in the UK with Highways Authority Product Approval Scheme (HAPAS) status, Ridgidrain has a high strength to weight ratio and flexibility to resist high traffic loads. It has a low friction inner wall for improved hydraulics and comes in 6m lengths to significantly reduce the number of joints and risk of leakage. Made from high strength HDPE, using a structured wall design to produce a robust yet flexible pipe, Ridgidrain has a high resistance to the most common chemicals. It offers excellent performance, meaning you get all the benefits of sustainability, strength and lower weight without compromising on long term effectiveness.



(BBA and HAPAS Approved)



(Network Rail Parts and Drawing Systems (PADS) Approved)  
Certificate Number: PA05/05460



## Ridgidrain key benefits

- Full range of pipes and fittings from 100-600mm
- BBA and BBA HAPAS approved
- Network Rail Parts and Drawing Systems (PADS) approved
- Structured wall design for high ring stiffness and strength
- Manufactured to SN6 with a predicted design life in excess of 60 years
- Non-pressure and leak tested up to 100mm/wg (0.01 bar)
- Smooth bore giving excellent hydraulic properties
- Longer lengths so fewer joints for improved resilience to leakage
- Light weight for reduced transport, installation costs and improved Health and Safety benefits
- Up to 94% lighter than concrete means fewer deliveries to site
- Reduces CO<sub>2</sub> consumed in production, transportation and on-site handling
- Manufactured from 100% recycled material
- Resistant to ground movement and differential settlement
- Integrally socketed in diameters 400-600mm for ease of installation
- Unperforated, half perforated and full perforated options available
- Ridgitrack is available for higher loading applications

## Applications

- Highways
- Rail
- Airports
- Residential
- Commercial
- Industrial
- Agricultural
- Education

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For more technical information and dimensions on Ridgidrain please visit our website [www.polypipe.com/middleeast](http://www.polypipe.com/middleeast)



(Applies to Ridgigully only)

## Ridgigully

A high quality, light in weight, easy to handle and install alternative to heavy concrete gullies. Ridgigully is manufactured in durable HDPE in 3 sizes. Ridgigully is suitable for both trapped and untrapped systems with a 160mm spigot outlet as standard, which is easily adapted using the multi adaptor (ARG multi) to Ridgidrain, Polysewer and other pipe systems. A range of accessories are available, including gully risers that key into the gully and eliminate the need for brickwork to finish level.

### Ridgigully key benefits

- Unique, patented screw thread corrugations
- Light in weight with superior strength
- Effective keying into the concrete surround
- Nested gullies lock together for easy handling, transportation and safer storage on-site
- BBA approved

Ridgigully				
Description	Code	Diameter mm	Capacity litres	Pack qty
750mm Ridgigully	RG450750	450	80	16
900mm Ridgigully	RG450900	450	104	16
BS EN 1401 Coupling	UG602	160	-	-
Multi Adaptor	ARGMulti	-	-	20



## Ridgiflex

Ideal for flexible gully connections, 150mm single wall corrugated Ridgiflex has the same external profile as Ridgidrain. Available in 25m coils, it is compatible with standard Ridgidrain fittings.

Ridgiflex Gully Connection Pipe			
ID mm	OD mm	Code	Length m
150	178	RF150X25	25



## Midigully

Midigully is an ideally sized gully for domestic and smaller capacity industrial and commercial applications.

### Midigully key benefits

- Manufactured in durable HDPE
- Spigot outlet, suitable for connection to 110mm BS EN 1401 sockets that can also be adapted to 100mm Ridgidrain
- Nested gullies lock together for easy handling, transportation and safer storage on-site
- A range of adaptors available
- Optional aluminium silt buckets and cast iron gratings

Midigully				
Code	Diameter mm	Depth mm	Capacity litres	Pack qty
RG300600	300	600	24	36

Midigully Accessories	
Description	Code
110mm BS EN 1401 coupling	UG402 ▲
Silt Bucket	RGSB ▲
Grating	RGG ▲

▲ Made to order and subject to lead times.



Gully Chute

## Gully Chutes and large diameter gullies

Gully Chutes, larger diameter gullies and sumpless gullies are also available where larger flow rates are required, or an interface with slot drains or dished channels is required. For further information on our fabrication capabilities and benefits, please see Section 5, or contact our Technical Team on **+971 (0) 4 807 3000**.

## Ridgistorm-XL overview

Ridgistorm-XL is an innovative large diameter piping system, available in sizes 750-3000mm in diameter. It can be used for a wide range of applications including surface water drainage, foul and combined sewers, large scale flood alleviation schemes and even displacement ventilation and renewable energy.



### A versatile solution

Robust, reliable and long-lasting, Ridgistorm-XL is one of the most adaptable large diameter piping solutions in the UK. In fact, our designers can engineer exact stiffness classifications for the pipe system to meet variable loading specifications by analysing site conditions and installation parameters. This means we can deliver an effective solution that is fully adaptable.



### Standards, approvals and certifications

- Water Company Approved for Capital Works projects and installation under Section 104 and Section 106 agreements\*
- Compliant with MCHW, Volume 1, Series 500 (Specification for Highway Works)\*\*
- AIP acceptance to Specification for Highway Works, Series 2500 through BD2/05 Standard for highways schemes
- Structural calculations in accordance with BS EN 1295-1, the Structural Design Standard for Buried Pipelines
- WRC approved
- Manufactured to meet the material requirements of BS EN 13476:2007 (Part 1-3), Plastic Piping Systems for Non-Pressure Underground Drainage and Sewerage
- Compliant with the requirements of the Civil Engineering Specification for the Water Industry 7th Edition (CESWI)
- Compliant with the requirements of Sewers for Adoption 7th Edition (SfA)
- Compliant with the requirements of Sewers for Scotland 3rd Edition (SfS)
- Certified to BSI ISO9001 and BSI ISO14001

\*We would recommend that local water company approval is confirmed before a final design is complete. \*\*SHW Series 500 applies to 750 and 900mm only.



### Ridgistorm-XL key benefits

- Pipe lengths available from 1.25-12m
- Integrally socketed system to aid pipe alignment
- Pre-fabricated modularised system incorporating flow controllers and treatment devices, manholes and fittings
- Lighter weight for reduced plant requirements
- Multiple jointing options include electro-fusion welding, seal jointing and extrusion welding
- Extremely durable – service lifetime expectancy of at least 100 years
- Designed to optimum stiffness classification
- Excellent load bearing capability
- Superior performance in areas of differential settlement
- Excellent resistance to sulphate and chemical attack
- Superior hydraulic performance achieved through smooth bore
- Saddles available for 150mm lateral pipe connections
- Pre-fabricated dry weather flow channels available

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For more technical information and dimensions on Ridgistorm-XL please visit our website [www.polypipe.com/middleeast](http://www.polypipe.com/middleeast)

# Applications

Ridgistorm-XL is a versatile solution, proven for applications ranging from pipelines for surface water drainage and foul sewer schemes, to attenuation structures and large diameter manholes and pre-fabricated component chambers.



## Waste water and sewer

Our Ridgistorm-XL pipe system offers the perfect solution for use in sewer and waste water systems. The pipes have excellent chemical resistance, are lighter in weight than concrete equivalents thereby reducing on-site Health and Safety risks, yet are strong and durable enough to withstand ground movement and differential settlement. All of our solutions are fully compliant with Sewers for Adoption, 7th Edition, CESWI and are accepted for use by all UK Water Companies for Capital Works, Section 104 and Section 106 agreements. Low Flow Channels can be incorporated within the Ridgistorm-XL pipes for improved performance. Lifting points, Safety Chain Assemblies, Guardrail Assemblies and specialist ironmongery have been developed in response to pipeline designers and contractors seeking innovation in safer, faster and more cost-effective installations.

### Applications

- Sewer pipework
- Low flow systems
- Pumping stations
- Valve chambers
- Flow meter chambers
- Inter process pipework
- CSO storage

## Flood alleviation

Developers are facing the challenges of having to store increasing volumes of flood water, as they look to satisfy the requirements of local authorities and Government agencies to obtain planning. Increasingly, engineered solutions are being required to satisfy these requirements. Ridgistorm-XL single pipe runs or multi-leg tanks offer flexibility in design and can form part of an engineered solution, being located under highways or POS (public open space) areas.

### Applications

- On-line attenuation
- Off-line attenuation
- Infiltration tanks
- Multi-leg storage
- Low flow systems
- Stormwater run-off
- Culverts



## Component chambers and manholes

Ridgistorm-XL is the ideal solution for pre-fabricated manholes or component chambers. They are modular, ready-to-install man-access solutions that integrate at any point in a drainage network system to control flow and to facilitate inspection and maintenance.

### Applications

- Inlet chambers
- Oversized manholes
- Offset manholes
- Pumping stations
- Overflow storage tanks
- Weir walls
- Catchpits
- Control chambers
  - Flow controllers
  - Non-return valves
  - Penstocks
  - Flap valves
  - Gate valves

For more information about our component chambers and manholes, please see Section 5.

## Ridgistorm-XL piping system



### Engineered pipe profile providing individual stiffness class

Ridgistorm-XL can be engineered to suit any application. By analysing the site conditions and installation parameters, our design engineers can create a solution with the appropriate profile strength and stiffness classifications. Our production flexibility allows pipe strength to be produced at varying stiffness classes between SN1-SN8, meaning it is never over nor under engineered, exactly meeting the design requirements of a particular project. Utilising the latest manufacturing technology and state-of-the-art software enables us to create unique profile designs to match your site requirements.

### Exceptional leak tightness

Ridgistorm-XL is designed as a flexible structure to minimise the effects of ground movement, differential settlement and deformation. Exceptional structural integrity is achieved with Ridgistorm-XL due to its engineered pipe profile. It is manufactured in lengths up to 12m to reduce the number of joints, therefore minimising the number of potential leakage points and removing the risk of groundwater pollution.



750mm | 900mm | 1050mm | 1200mm | 1500mm | 1800mm | 2100mm | 2400mm | 2700mm



## Life expectancy

Ridgistorm-XL is manufactured in accordance with BS EN 13476:2007 (Part 1-3) under ISO 9001 and ISO 14001 certified management systems. A lifetime expectancy of **100+ years** can be predicted for Ridgistorm-XL using guidelines set out in BS EN ISO 9080.



3000mm

## Pipe Profiles

Pipe profile designs can be adapted to maximise strength and minimise the use of material within the pipeline. This improves pipeline performance and provides a fully engineered solution. Our range of profiles are integral to the strength and performance of the pipeline.

### VW profile

Profile type VW enables the production of a solid pipe with a smooth inner and outer surface. These pipes can be produced with a wall thickness of 5-80mm. This profile is often used in pressure pipelines and certain chamber applications.



### PR profile

Pipes produced with a PR profile achieve high stiffness with relatively low weight. This is a common pipe profile for use in surface water, foul and combined sewer drainage.



### Olympia profile

In addition to the PR profile, the Olympia profile option can achieve greater pipeline stiffness with a comparatively low weight. This profile is often used in the larger diameters of Ridgistorm-XL.



### SQ profile

This profile option has a smooth inner and outer surface, including internal profile to one layer. High stiffness is achieved through the SQ profile, making it ideal for extremely high loads or larger diameters.



### SQ2 profile

SQ2 offers the same benefits as the single-layer SQ profile, yet it can be produced with additional profile layers for added ring stiffness.



### CPR profile

The majority of our pre-fabricated components have a CPR profile achieving high stiffness with relatively low weight.



## Fabrications overview

Our ability to provide pre-fabricated, engineered solutions offer a range of benefits that will not only ensure undertaking your project is more effective and efficient, it will also result in measurable cost savings. Our modern methods of manufacturing reduce installation time and costs on-site and also minimise Health and Safety risks during handling, storage and installation.



### In-house fabrications department

Providing a unique and comprehensive service through our in-house fabrication facility, we are able to create fully engineered solutions to precisely match specific project requirements. Whether you require a one piece manhole, catchpit, flow control device or treatment filter, a customised fitting or specialist bend, our team can engineer the right system accurately and to the highest quality.

### Seamless integration

Our pre-fabricated solutions are designed to integrate seamlessly within existing drainage or water management systems, including our Ridgidrain, Ridgisewer or Ridgistorm-XL systems, or can be engineered to connect to other materials.

Other fabrications are available for our drainage and sewer ranges.

### Off-site construction

We can help you to meet your project deadlines by delivering your ready-to-install, pre-fabricated system to site. Our solutions are manufactured in our factory-controlled environment, ensuring a superior finish in comparison to those constructed on-site. Additionally, the wastage usually associated with on-site construction is removed, so we are not only saving time and money, but we are also providing more environmentally friendly products and systems.

The products included over the following pages are only an example of what is possible.

For more technical and dimensions on fabrications please visit our website [www.polypipe.com/middleast](http://www.polypipe.com/middleast)



### Fabrications key benefits

- Tailor-made, fully-welded, watertight structured wall chambers to suit project-specific requirements
- One-piece installation, off-site construction - delivered ready-to-install reducing installation time and costs
- Strong but light in weight, minimising Health and Safety risks in handling and installation
- Manufactured in a factory controlled environment for improved quality of finish
- Eliminates wastage associated with in-situ construction
- WRc approved

Other Ridgistorm-XL fabricated solutions available include:

- Bends
- Junctions
- Reducers
- Dual run H chambers

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# RIDGISTORMCheck Vortex Flow Control Chamber

Where flows within a drainage system are required to be limited or checked (i.e. prior to discharge from site), with improved hydraulic performance and reduced maintenance, we are able to offer our RIDGISTORMCheck Vortex Flow Control Chamber.



Pre-fabricated under factory controlled conditions, our RIDGISTORMCheck Chamber is available in a range of diameters from 1050-3000mm and incorporates a vortex flow control unit, fitted onto a preformed headwall. Each vortex flow control unit is manufactured to suit the unique hydraulic characteristics of the site's drainage system design. RIDGISTORMCheck Vortex Flow Control Chambers are typically supplied as a single unit, allowing simple installation and eliminating a number of construction risks associated with in-situ construction. When installed in conjunction with our range of pipe systems, they offer a fully integrated drainage system.

## Applications

Site specific RIDGISTORMCheck Vortex Flow Control Chambers are engineered to suit a range of stormwater systems, providing a hydraulically efficient means of flow regulation that does not use moving parts or require power to operate.

## Performance

RIDGISTORMCheck Vortex Flow Control Chambers are fabricated from Ridgistorm-XL pipework, which is manufactured to meet the material requirements of BS EN 13476:2007 (Part 1-3).

### Manual Bypass Design

The manual bypass design offers a bypass to the flow control device to facilitate maintenance. Manually operated from the surface, the activation of the bypass system opens a door in the head-wall allowing water in the chamber to drain down via the bypass pipe.

### Non-Bypass Chamber

For sites where discharge rates must be guaranteed to not exceed a prescribed limit(s).

## RIDGISTORMCheck Vortex Flow Control Chamber key benefits

- Self-activating vortex flow controller which controls forward flow of water
- No moving parts - virtually maintenance free
- Manufactured with an integral sump for silt catchment/removal
- Available as non-bypass or manual bypass with built in overflow
- Manufactured to adoptable standards
- Multiple inlet and outlet options, allowing quick and seamless connection to pipelines
- Depths can be tailored to suit project requirements
- Step rungs to BS EN 13101 and ladders to BS EN 14396
- Integral lifting points available on request to improve Health and Safety during handling and installation

Element	Value
<b>PHYSICAL PROPERTIES</b>	
Diameter mm	1050-3000
Depth	To suit requirements
Material	HDPE
Colour	Black with blue interior
Flow control units	Grade 304 Stainless Steel
Chemical resistance	HDPE is naturally resistant to most chemicals associated with stormwater drainage systems
Inlets/outlets mm	100-3000
Hydraulic performance	Vortex flow control unit to suit site specific flow rates and head

# RIDGISTORMCheck Orifice Plate Flow Control Chamber

Where flows within a drainage system are required to be limited or checked (i.e. prior to discharge from site), in a simple and cost effective design, we are able to offer our RIDGISTORMCheck Orifice Plate Flow Control Chamber. Incorporating an integral orifice plate flow control with an optional removable Permavoid filter unit wrapped in a 2mm polyethylene mesh, to provide filtration and ease of maintenance.



RIDGISTORMCheck Orifice Plate Flow Control Chamber offers a cost-effective means of limiting flows, particularly when used in conjunction with our range of attenuation systems on smaller scale projects.

## Applications

Site specific RIDGISTORMCheck Orifice Plate Flow Control Chambers are engineered to suit a range of stormwater attenuation and infiltration systems, providing a means of flow regulation and are used regularly when designing to source control principles. The optional filter unit on the outlet provides a filtration system for reduced maintenance.

## Performance

RIDGISTORMCheck Orifice Plate Flow Control Chambers are fabricated from Ridgistorm-XL pipework, which is manufactured to meet the material requirements of BS EN 13476:2007 (Part 1-3).

### RIDGISTORMCheck Orifice Plate Flow Control Chamber key benefits

- Manufactured with an integral sump for silt detention
- One-piece installation, off-site construction, delivered ready-to-install reducing installation time and costs
- Multiple inlet and outlet options, supplied with integral sockets as standard allowing quick and seamless connection to pipeline
- Depths can be tailored to suit project requirements
- Step rungs to BS EN 13101 and ladders to BS EN 14396
- Integral lifting points available on request to improve Health and Safety of handling and installation

Element	Value
<b>PHYSICAL PROPERTIES</b>	
Diameter mm	500-3000
Depth	To suit requirements
Material	HDPE
Colour	Black with blue interior
Chemical resistance	HDPE is naturally resistant to most chemicals associated with stormwater drainage systems
Inlets/outlets mm	100-3000
Hydraulic performance	Orifice plate flow controls to suit site specific flow rates and head

For the full datasheets and standard details, for both of the RIDGISTORMCheck Chambers, please visit our website [www.polypipe.com/toolbox](http://www.polypipe.com/toolbox)

# RIDGISTORMControl Penstock and Valve Chambers

Where a drainage or sewer system design requires the inclusion of control devices to limit or isolate flows, our range of RIDGISTORMControl Chambers are available with pre-installed Penstocks, Flap Valves and Gate Valves.



Flap Valve



Penstock

RIDGISTORMControl Chambers are typically supplied as single units, manufactured in factory controlled conditions to improve the quality of finish and eliminate wastage associated with in-situ construction.

## Applications

Our pre-fabricated RIDGISTORMControl Chambers incorporate a range of flow control devices to limit or isolate flows within surface water, sewer and combined sewer systems.

### Typical valves include:

#### Gate Valves

Gate Valves are used to permit or prevent the flow of water and can isolate drainage sections. The valve opens by lifting a wedge out of the path of the flow of water.

#### Flap Valves

Flap Valves are non-return hinge valves to prevent backflow upstream. They can also be used for outflow applications such as ponds, ditches, swales and tidal.

#### Penstocks

Penstocks consist of a gate which can isolate or control water flow. The gate can also be used as a flow control device to limit the flow of water passing through the system.

## Performance

RIDGISTORMControl Penstock and Valve Chambers are fabricated from Ridgiform-XL pipework, which is manufactured to meet the material requirements of BS EN 13476:2007 (Part 1-3).

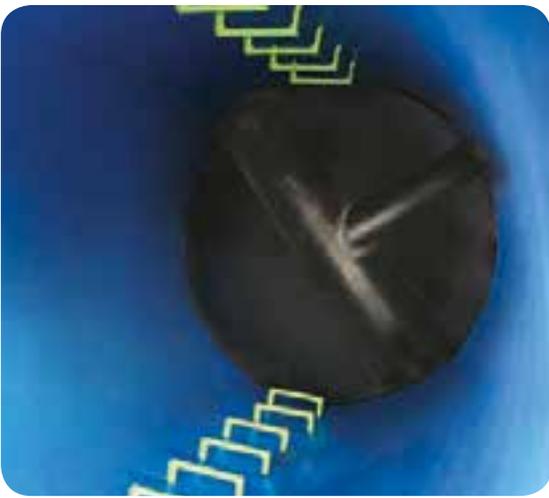
## RIDGISTORMControl Penstock and Valve Chamber key benefits

- Facilitates maintenance, controls system flows and protects the drainage system from surcharging
- System components available include: Penstocks, Gate Valves and Flap Valves
- Multiple inlet and outlet options, supplied with integral sockets as standard allowing quick and seamless connection to pipeline
- Chamber depths are tailored to suit project requirements
- Lockable steel covers available
- Integral benching
- Step rungs to BS EN 13101 and ladders to BS EN 14396
- Optional riser section
- Integral lifting points available on request to improve Health and Safety of handling and installation

Element	Value
<b>PHYSICAL PROPERTIES</b>	
Diameter mm	1200-3000
Depth	To suit requirements
Material	HDPE
Colour	Black with blue interior
Loading	Determined by structural design
Chemical resistance	HDPE is naturally resistant to most chemicals associated with stormwater drainage systems
Inlets/outlets mm	100-3000

# RIDGISTORMAccess Manholes

Whether your project calls for stormwater, foul water or combined sewer systems, we can manufacture high density polyethylene (HDPE) pre-fabricated manholes, to provide easy access into and maintenance of a pipeline. RIDGISTORMAccess Manholes are utilised where pipe runs change direction, combine, change invert level, diameter or pipe material.



## Applications

RIDGISTORMAccess Manholes are engineered for use in stormwater, foul and combined sewer applications to enable access to the pipework system for inspection and maintenance. Factory installed, preformed benching and channelling is available to spring line (SHW) or soffit (SFA) depending on the specification required. RIDGISTORMAccess Manholes can be pre-fabricated with a number of features to reduce the need for direct access into the pipe, such as an offset channel, or maximising step landing width, or to minimise operational Health and Safety risks with the pre-fabrication of Safety Chain Assembly and Guardrail Assembly.

## Compatibility

RIDGISTORMAccess Manholes can be integrated into our surface water (Ridgidrain and Ridgiform-XL) and sewer (Polysewer, Ridgisewer and Ridgiform-XL) pipework systems, or engineered to connect to other pipe materials.

## Performance

RIDGISTORMAccess Manholes are fabricated from Ridgiform-XL pipework, which is manufactured to meet the material requirements of BS EN 13476:2007 (Part 1-3).

## RIDGISTORMAccess Manholes key benefits

- Provides easy access for maintenance
- Manufactured to adoptable standards
- Full range of accessories available including Safety Chain Assembly and Guardrail Assembly
- Multiple inlet and outlet options, supplied with integral sockets as standard allowing quick and seamless connection to pipeline
- Depths can be tailored to suit project requirements
- Factory installed, high quality integral benching
- Step rungs to BS EN 13101 and ladders to BS EN 14396
- Optional riser section
- Riser location ring
- Integral lifting points available on request to improve Health and Safety of handling and installation

Element	Value
<b>PHYSICAL PROPERTIES</b>	
Diameter mm	900-3000
Depth	To suit requirements
Material	HDPE
Colour	Black with blue interior
Loading	Determined by structural design
Chemical resistance	HDPE is naturally resistant to most chemicals naturally found in stormwater run-off and uncontaminated ground
Inlets/outlets mm	100-3000

# RIDGISTORM Separate Silt Traps

Located upstream of detention, attenuation and infiltration drainage systems, RIDGISTORM Separate Silt Traps capture and retain silt and separate out other particles by encouraging settlement in the unit sump, preventing ingress into Sustainable urban Drainage Systems (SuDS). This range of small diameter silt traps are standard stock items and are readily available.



Mini silt trap  
Product code: PSMST110



Advanced silt trap  
Product code: PSMST160/15



Basic silt trap  
Product code: PSMST160

## RIDGISTORM Separate Silt Traps key benefits

- Improves water quality by removing silt, grit and litter, protecting downstream elements of the drainage systems
- Self cleansing
- Prevents the ingress of debris, silt and litter into the structure
- Multiple inlet and outlet options, supplied with integral sockets as standard allowing quick and seamless connection to pipeline
- Plastic or lockable steel covers available from Polypipe Building Products

## Applications

For use in stormwater drainage systems typically located upstream of detention, attenuation and infiltration drainage elements to protect the ingress of silt and other particles.

### SILT TRAP ASSOCIATED PRODUCTS

PRODUCT	DESCRIPTION	CODE
PVC 320mm cover & frame (round)	320mm sealed screw down cover & frame, includes seals and fixing screws	UG501
PVC 320mm cover & frame (square)	320mm square plastic cover with PP frame, includes seals and fixing screws	UG502
460mm silt trap cover & frame (round)	Round cover complete with seals and fixing screws (35kN test load)	UG511
450mm silt trap cover & frame (square)	Square PP cover complete with seals and fixing screws (35kN test load)	UG512
Polypropylene cover & frame	Reduced access square PP cover and frame with seals and fixing screws (35kN test load)	ICDC1
Chamber riser section	Silt trap side riser (215mm effective height)	ICDR1
Silt trap sealing ring	EPDM 110mm seal	UG488

Note: Polypropylene (PP)

PHYSICAL PROPERTIES	MINI	BASIC	ADVANCED
Nominal diameter mm	320	460	460
Depth mm	440	1220	830
Inlet and Outlet mm	110 (BS EN 1401-1)	160 (BS EN 1401-1)	160 (BS EN 1401-1)
Sump depth mm	250	420	280
Material	Polypropylene	Polypropylene	Polypropylene
Colour	Black chamber	Black chamber	Black chamber
Chemical resistance	Polypropylene is resistant to the most chemicals associated with stormwater drainage systems	Polypropylene is resistant to the most chemicals associated with stormwater drainage systems	Polypropylene is resistant to the most chemicals associated with stormwater drainage systems

Note: For a Basic Silt Trap risers and seals are required. The bucket and filter are easily removable from the Advanced Silt Trap to enable cleaning.

# RIDGISTORMSeparate Catchpits

Our purpose-built large diameter high density polyethylene (HDPE) pre-fabricated catchpits are ideal for stormwater and land drainage applications and are the simplest and most cost-effective way of separating out silt and debris, providing an easily maintainable drainage system.



RIDGISTORMSeparate Catchpits are designed to separate silt and other particles from stormwater, helping to protect the downstream drainage system and local environment. They can be integrated into our range of pipe systems, such as Ridgidrain and Ridgistorm-XL, to offer a fully integrated drainage system.

## Applications

RIDGISTORMSeparate Catchpits are pre-fabricated for use in a range of stormwater systems requiring silt and debris separation and detention.

## Performance

RIDGISTORMSeparate Catchpits are fabricated from Ridgistorm-XL pipework, which is manufactured to meet the material requirements of BS EN 13476:2007 (Part 1-3).



For the full RIDGISTORMSeparate datasheets and standard details, please visit our website [www.polypipe.com/toolbox](http://www.polypipe.com/toolbox)

### RIDGISTORMSeparate Catchpits key benefits

- Provides easy access for silt collection
- Network Rail Parts and Drawing System (PADS) approved for use in access areas
- Separates silt and debris from the downstream drainage system
- Fully-welded, watertight structured wall chambers to suit project-specific requirements
- One-piece installation, off-site construction, delivered ready-to-install reducing installation time and costs
- Multiple inlet and outlet options, supplied with integral sockets as standard allowing quick and seamless connection to pipeline
- Depths can be tailored to suit project requirements
- Step rungs to BS EN 13101 and ladders to BS EN 14396
- Integral lifting points available on request to improve Health and Safety of handling and installation

Element	Value
<b>PHYSICAL PROPERTIES</b>	
Diameter mm	450–3000
Depth	To suit requirements
Sump depth	To suit (min. 50mm)
Material	HDPE
Colour	Black with blue interior
Chemical resistance	HDPE is naturally resistant to most chemicals associated with stormwater drainage systems
Inlets/outlets mm	100-3000

# RIDGISTORM Separate Weir and Baffle Chamber

RIDGISTORM Separate Weir and Baffle Chambers can be installed within new installations or retrofit into existing drainage systems. They are designed to provide basic silt and oil separation, retaining these pollutants in the drainage system and protecting downstream systems.



RIDGISTORM Separate Weir and Baffle Chambers can be integrated into our range of pipe systems, such as Ridgidrain and Ridgistorm-XL, or even engineered to connect to other materials to offer a fully integrated drainage system.

## Applications

RIDGISTORM Separate Weir and Baffle Chambers are pre-fabricated for use in a range of stormwater attenuation and infiltration systems requiring 'in-line' silt and oil separation.

Element	Value
<b>PHYSICAL PROPERTIES</b>	
Diameter mm	900-3000
Depth	To suit requirements
Sump depth	To suit (min. 50mm)
Material	HDPE
Colour	Black with blue interior
Chemical resistance	HDPE is naturally resistant to most chemicals associated with stormwater drainage systems
Inlets/outlets mm	100-3000

## RIDGISTORM Separate Weir and Baffle Chamber key benefits

- Separates silt and oil to protect the downstream drainage network
- Tailor-made, fully-welded, watertight pre-fabricated chambers to suit project-specific requirements
- One-piece installation, off-site construction - delivered ready-to-install reducing installation time and costs
- Multiple inlet and outlet options allowing quick and seamless connection to pipelines
- Depths can be tailored to suit project requirements
- Step rungs to BS EN 13101 and ladders to BS EN 14396
- Integral lifting points



For the full RIDGISTORM Separate datasheets and standard details, please visit our website [www.polypipe.com/toolbox](http://www.polypipe.com/toolbox)

# RIDGISTORM Separate Filter Chamber

RIDGISTORM Separate Filter Chambers incorporate both a sump and removable filter unit on the chamber outlet to capture silt and debris. The filter unit is easily removed for maintenance purposes and can also be incorporated into Catchpits and Weir and Baffle Chambers.



RIDGISTORM Separate Filter Chambers can be integrated into our range of pipe systems, such as Ridgidrain and Ridgistor-XL, to offer a fully integrated drainage system.

## Applications

RIDGISTORM Separate Filter Chambers are pre-fabricated for use in a range of stormwater systems requiring silt and debris separation.

## Performance

RIDGISTORM Separate Filter Chambers are fabricated from Ridgistor-XL pipework, which is manufactured to meet the material requirements of BS EN 13476:2007 (Part 1-3).



### RIDGISTORM Separate Filter Chamber key benefits

- Easily accessible removable filter
- Washable filter unit
- Multiple inlet and outlet options, supplied with integral sockets as standard allowing quick and seamless connection to pipeline
- Depths can be tailored to suit project requirements
- Step rungs to BS EN 13101 and ladders to BS EN 14396
- Integral lifting points available on request to improve Health and Safety of handling and installation

Element	Value
<b>PHYSICAL PROPERTIES</b>	
Diameter mm	500-3000
Depth	To suit requirements
Sump depth	To suit (min. 50mm)
Material	HDPE
Colour	Black with blue interior
Chemical resistance	HDPE is naturally resistant to most chemicals associated with stormwater drainage systems
Inlets/outlets mm	100-3000

# Downstream Defender®

Manufactured by  
**Hydro**  
International 

## Advanced vortex separation maximizes sediment removal while controlling costs.

The Downstream Defender® is an advanced vortex separator used to treat stormwater run-off in pre-treatment 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 non-point source pollution.

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

## Applications

- Removal of total suspended solids (TSS), floatable trash and petroleum products from stormwater run-off
- 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

## Performance

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 pre-cast vortex chamber to establish rotational flow. A cylindrical baffle with an inner centre 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.



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

## Downstream Defender® key benefits

- 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

## Design

### 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 and design

The Downstream Defender® can be used to meet a wide range of stormwater treatment objectives. It is available in 5 pre-cast models that fit easily into the drainage network (see table below). 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.

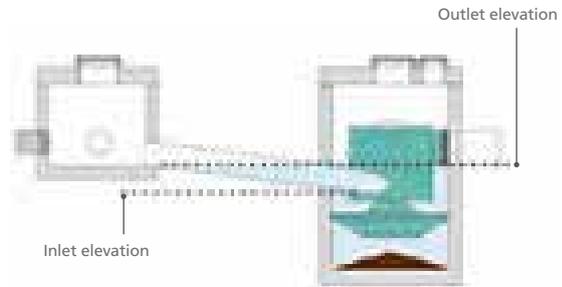


Fig.2 The Downstream Defender® has a submerged inlet that reduces headloss and improves efficiency of pollutant capture.

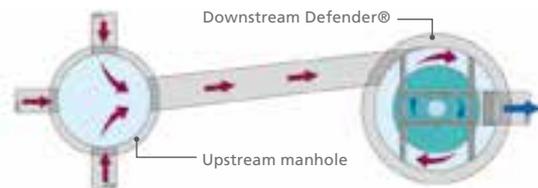


Fig.3a The Downstream Defender® in an online configuration.

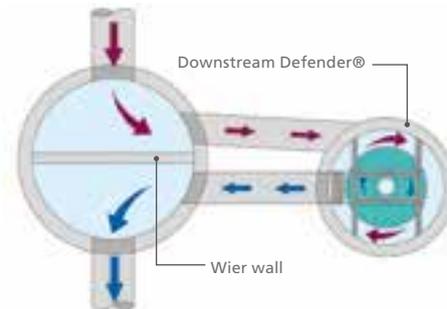


Fig.3b The Downstream Defender® in an offline configuration.

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.

# First Defense®

Manufactured by  
**Hydro**  
International

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

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 run-off 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.

- |  |                               |
|--|-------------------------------|
| 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. Pre-cast Vortex Chamber                 | 10. Sediment Storage Sump     |

## 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
- Pre-treatment for filters, infiltration and storage

## Performance

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

Contaminated stormwater run-off 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.

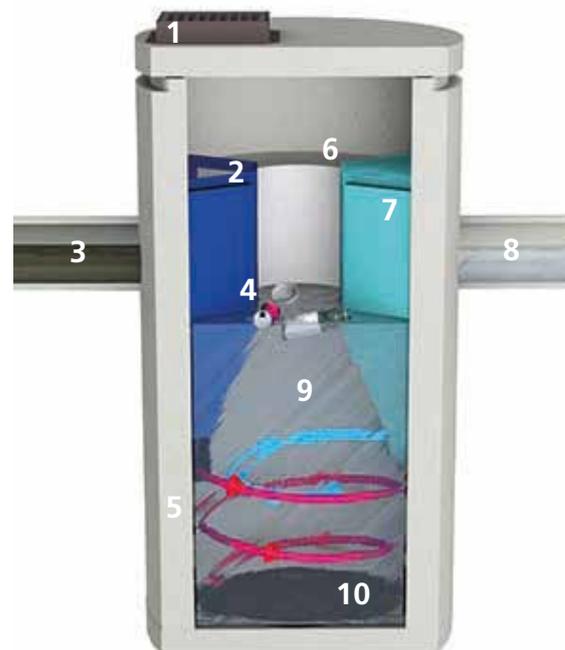


Fig.1 The First Defense® has internal components designed to efficiently capture pollutants and prevent washout at peak flows.

## First Defense® key benefits

- 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

## 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 information can be found in the First Defense® Operation and Maintenance Manual, available at [www.hydro-int.com/us/products/first-defense](http://www.hydro-int.com/us/products/first-defense).

## Sizing and 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 the table below.



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



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

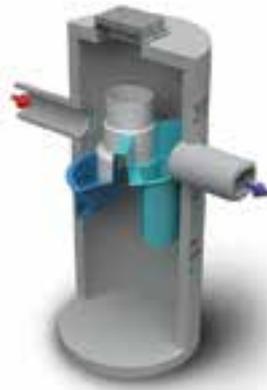


Fig.3b First Defense®-4HC with higher capacity internal bypass and larger maximum pipe diameter.



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

FIRST DEFENSE® MODELS AND DESIGN CRITERIA									
MODEL NUMBER	DIAMETER	TYPICAL FLOW RATES FOR TSS TREATMENT		PEAK ONLINE FLOW RATE	MAXIMUM PIPE DIAMETER	OIL STORAGE CAPACITY	MINIMUM SEDIMENT STORAGE CAPACITY <sup>2</sup>	MINIMUM DISTANCE FROM OUTLET TO TOP OF RIM <sup>3</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> Contact Hydro International when larger pipe sizes are required.  
<sup>2</sup> Contact Hydro International when custom sediment storage capacity is required.  
<sup>3</sup> The minimum distance for the 4HC and 6DB models depends on pipe diameter.

# Up-Flo® Filter

Manufactured by  
**Hydro**  
International 

## Highest stormwater quality. Lowest upkeep.

The Up-Flo® Filter is a multi-stage stormwater treatment system that combines pre-treatment with fluidized bed filtration technology for superior filtration rates and media longevity. The Up-Flo® Filter optimizes the balance between high treatment performance and total cost of ownership.

- |   |   |
|---|---|
| 1. Inlet grate (pictured) or Inlet Pipe (not shown) | 5. Bypass Hood/Siphon                   |
| 2. Pre-cast Filtration Chamber                      | 6. Outlet Module with Drain Down Filter |
| 3. Filter Module                                    | 7. Pollutant Storage Sump               |
| 4. 4mm Screening                                    | 8. Media bags                           |

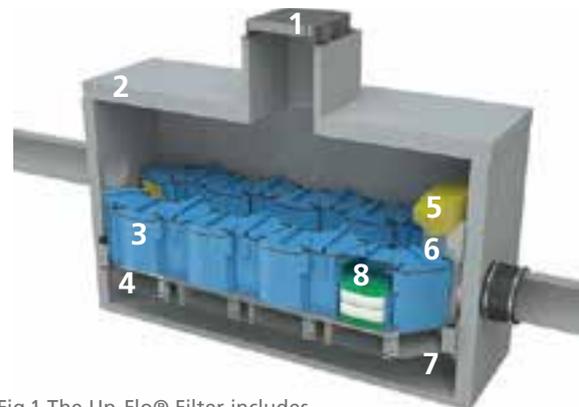


Fig.1 The Up-Flo® Filter includes sedimentation, screening and filtration in a single device.

## Applications

- Removal of sediment, nutrients and metals from run-off
- Source control for redevelopment or new construction
- Treatment downstream of Water Quality Volume detention systems
- Sites operating under an industrial or multi-sector general permits
- Protection for groundwater recharge systems
- LEED® construction projects

## How it works

- 1. Pre-treatment:** Oil and floatables rise to the surface while sediment settles in the sump.
- 2. Screening:** Flow is directed upward through an angled screen to remove debris before entering the filter module.
- 3. Filtration:** Water flows upwards through engineered media bags (see Fig.2) before leaving the outlet module to be discharged through the outlet pipe.

During peak flows, excess water is siphoned through the yellow bypass hood which also prevents the escape of oil and trash. As water levels return to normal, captured pollutants are washed off media bags, preventing blinding and prolonging media life.

## Filter Module components

Each Filter Module contains two filter bags containing an engineered media mix designed to optimize pollutant removal by evenly spreading the flow across the entire surface area.

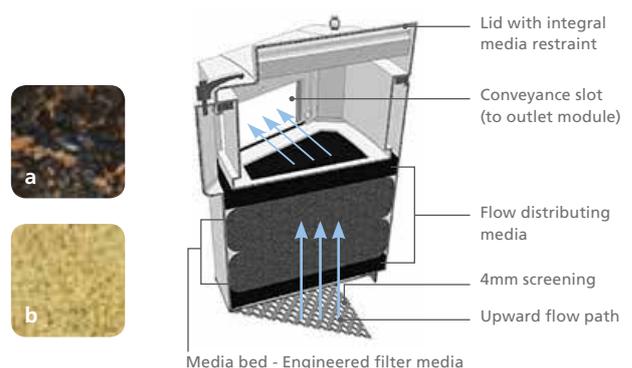


Fig.2 Engineered media mixes, include (a) CPZ™ Mix for TSS, Nutrients, Metals and Organics removal or (b) Hydro Filter Sand for TSS, Particle-bound Nutrients, and Metals removal.

## Up-Flo® key benefits

- Sedimentation, screening and filtration in one structure
- Upflow fluidised bed technology prevents clogging of filter media
- Includes an integral high flow bypass and trap for oils and trash
- Economical media bag replacement process requires neither heavy lifting equipment nor purchase of entirely new cartridge
- Independently verified through TARP field monitoring program

UP-FLO® FILTER DIMENSIONS								
CHAMBER	DIAMETER	MAXIMUM FILTER MODULES	HEIGHT	SUMP DEPTH	INLET/OUTLET DROP	MAXIMUM PIPE DIAMETER	OPERATING HEAD	MAXIMUM TREATMENT FLOW
	ft / m	No.	ft / m	ft / m	ft / m	in / mm	ft / m	cfs / L/s
Round Manhole	4 / 1.2	6	7.5 / 2.29	3.0 / 0.91		15 / 375		
Rectangular Vault	6 x 8 / 1.8 x 2.4	7	6.5 / 1.98	2.0 / 0.60	0.8 / 0.24	24 / 609	2.5 / 0.76	0.056 cfs per module
	6 x 13 / 1.8 x 3.9	18						
	8.5 x 13 / 2.5 x 3.9	36						
	15 x 13 / 4.5 x 3.9	54						

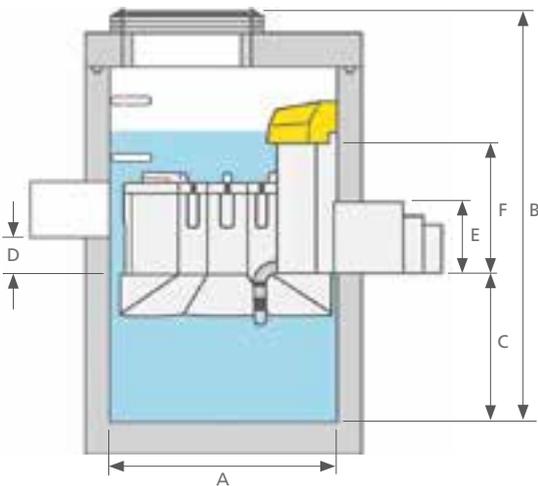


Fig.3 Key dimensions of the Up-Flo® Filter.

## Sizing and design

The modular design of the Up-Flo® Filter ensures that project specific treatment goals are easily met. Standard and typical dimensions listed above. Use our sizing calculator to determine appropriate site-specific sizing.

## Maintenance

**Easy:** Maintenance is simple with easy access to the sump and replaceable media packs. A vector truck is used to remove sediment and debris from the sump (Fig.4a).

**Light in weight:** Unlike other filter systems whose media cartridges weigh upwards of 250lbs, our light-weight media bags can be manually replaced without removing the entire module (Fig.4b).



Fig.4a Sediment is removed with a standard vector truck.



Fig.4b Media bags are replaced manually with no heavy lifting equipment required.

# Hydro-Brake® Optimum

Manufactured by  
**Hydro**  
International 

The Hydro-Brake® Optimum is Hydro International's flagship passive flow control device and the most advanced vortex flow control available. Hydro-Brake® Optimum is the only vortex flow control for which the head and discharge relationship can be fine-tuned to optimise your design. Designers can size a Hydro-Brake® Optimum to achieve the perfect hydraulic performance curve and engineer the best possible passive flow control performance.

## Applications

- Surface water management and SuDS
- Combined drainage systems and CSOs
- Watercourse flood prevention
- Sewer network optimisation
- Wastewater treatment plants

## Performance

**There is no equivalent:** Hydro-Brake® Optimum dispenses with the need to choose from a range of sizes and types and instead offers built-in flexibility to size each unit for absolute fit. Each Hydro-Brake Optimum® is individually-sized, so you achieve performance without compromise for every project.

**Maximise storage savings:** The increased hydraulic efficiency of the Hydro-Brake® Optimum means you can reduce on-site storage by up to 15% than if an alternative vortex control is used. With reduced storage, you can lower construction and excavation costs as well as saving project time and overall land-use.

**Best value for every project:** Selecting the superior performance of Hydro-Brake® Optimum does not mean a higher cost for your project. On the contrary, because your upstream storage can be fine-tuned to achieve the smallest volumes, construction, excavation and material costs are reduced.

**Easy to install:** Hydro-Brake® Optimum comes with a range of installation options and accessories to make construction and installation as simple as possible.

**Setting the standard:** The Hydro-Brake® Optimum is the culmination of more than 35 years of research and development by Hydro International, and the company continues to take an international lead in vortex technology and expertise. Hydro-Brake® Optimum is the only vortex flow control to be independently certified by BBA and WRc.

**Minimal maintenance:** With up to 20% larger outlet clearances compared to other vortex devices, there is significantly less risk of blockage with a Hydro-Brake® Optimum. With no power source or moving parts, it offers minimal, predictable maintenance.



**Future-proofed:** Hydro-Brake® Optimum can be supplied with an adjustable inlet so flows can be altered by up to 40% post-installation, to allow for future changes in operating conditions, for example as a result of site expansion or climate change.

**Flow control chamber:** A Hydro-Brake® Optimum flow control can be supplied pre-fitted in a pre-cast reinforced concrete chamber. Custom options including high level emergency bypass, rodding pipe and removable units are also available.

## Hydro-Brake® key benefits

- No external energy source
- No moving parts
- Future-proof
- Large outlet clearances prevent blockages
- Minimal Maintenance
- Easy to Install



## Hydro-Brake® Flow Control Series Selection Guide

The Hydro-Brake® Flow Control Series is a versatile toolbox for surface water, fluvial, foul water, and sewer network flow control. No matter what the site and budget, every flow control offers the same precision-engineered performance.

UP-FLO® FILTER DIMENSIONS				
FEATURES	HYDRO-BRAKE® FLOOD ALLEVIATION	HYDRO-BRAKE® OPTIMUM	HYDRO-BRAKE® AGILE	HYDRO-BRAKE® ORIFICE
	ft / m	No.	ft / m	ft / m
Suitability	For watercourses; Flood storage reservoirs	Most sites, from very low to very high flow rates	Constrained sites with stringent discharge consents	Unconstrained sites with generous discharge consents
Flow Range (l/s) *	550 - 12000	0.7 - 550	4.5 - 35	2.5 - 100
Head Range (m) *	1.5 - 10	0.4 - 4.0	0.5 - 1.4	0.25 - 2.0
Ability to Match Greenfield Discharge Rate	N/A	Very good	Good	Not suited to all sites
Moving Parts	No	No	Yes	No
External Power Requirement	No	No	No	No
Constant Discharge	No	No	Yes	No
On-site Storage	Low	Low	Very Low	Unconstrained
Risk of Blockage	Very Low	Very Low	Not suited to all sites	Not suited to all sites

\*Flows and heads outside of these ranges may be possible (contact Hydro International to discuss).

### Expert Design Support

No matter how big or small the project, Hydro International's professional engineers are on hand to provide free support to designers and specifiers to aid with the correct selection and configuration of Hydro flow controls for each project design.

Our dedicated design support team advises on best-practice sizing, flow and storage calculations for the Hydro-Brake® Flow Control Series within your surface water, fluvial, sewer or wastewater plant design.

### Consultancy

Hydro International's Consultancy team is available for civil engineering, flood risk management and hydraulic system modelling for new and retrofit development, fluvial or wastewater treatment plant projects.

### Documentation

Our dedicated design support team can assist with the output of hydraulic data to support your system design and dimensioned installation drawings, as well as advising on successful integration with other Hydro International water treatment and storage products.

# Land drainage

Excess water can lead to restricted land access, reduced crop yields, soil erosion and environmental damage, making effective drainage a critical component of any water management scheme.



## Landcoil drainage systems

Our Landcoil range is specifically designed to aid in the successful management of land water. It offers significant improvements in areas where poor drainage negatively affects ground quality, from agricultural applications requiring enhanced soil conservation or crop production capabilities; to sports and leisure projects struggling with waterlogged sections of pitch or turf. Manufactured in one of the UK's largest dedicated manufacturing facilities, our PVCu Landcoil range includes a choice of diameters, colours and coil lengths. It is also durable, easy to install, carries the BS 4962 quality Kitemark and is supported by an extensive range of fittings.



BS4962  
Certificate number  
KM06710



### Land drainage key benefits

- Full range of pipes and fittings in sizes from 60-200mm
- Kitemarked to BS 4962 (blue coil and couplers only)
- Blue as standard, also available in black
- Perforated and unperforated options available
- Flexible, durable and easy to install
- Extremely cost-effective
- Supported by a full range of fittings
- Manufactured from PVCu

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Land drainage

**102 - 103**

For more technical information and dimensions on Land drainage please visit our website [www.polypipe.com/middleeast](http://www.polypipe.com/middleeast)

## Company overview

Polypipe is the UK's largest plastic pipe systems manufacturer, employing over 2,000 people with an increasing international presence in the Middle East.



### Unrivalled service

At Polypipe, we design, manufacture and deliver some of the most advanced thermoplastic products and systems available. Through our commitment to industry expertise and our dedication to the highest standards of quality, we not only provide superior products, but superior standards of service. Our Support Teams are here to help you at every stage of your project, from planning through to maintenance. Through our sustainability drive you can rest assured that by using a Polypipe product, you are ensuring that your project takes the utmost environmental considerations into account.

### The broadest product range

Offering well over 20,000 product lines, Polypipe has an enviable reputation amongst installers, contractors, stockists and specifiers for being able to provide exactly the right solution for any project. With over 100 product systems, our unmatched portfolio offers dependable, innovative solutions for pressure and non-pressure applications, enabling the movement of water, air, power, chemicals and telecommunications throughout the built environment.

### Market leadership

As a respected industry leader, Polypipe continues to develop innovative products and solutions to meet changing market needs and growing demands. Customers trust us to provide fully engineered solutions for the growing diversity and complexity of the construction challenges they face. We have a significant UK manufacturing base that guarantees availability through a nationwide network of stockists and a dedicated, owned and managed logistics fleet.

### Brand values

At Polypipe, we seek to deliver constant improvements in construction industry best practice by leading the way in product research and innovation, employing and retaining some of the most respected experts in the field and delivering the highest standards of customer service, value and reliability. We also define and drive quality in pipe manufacture and performance and use leading-edge technology to deliver whole-life value and sustainability by providing systems engineered to perform.

[www.polypipe.com/middleeast](http://www.polypipe.com/middleeast)

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## Innovation and research

At Polypipe, we always aim to bring innovative new products to the market in direct response to our customers' needs, requirements and feedback.



### Challenging convention

We have always challenged convention by exploring new ways to meet the needs of the construction industry. Chief among them has been the development of thermoplastic piping systems to replace traditional concrete and clay materials. This results in solutions that are lighter in weight whilst also being tougher and more adaptable, ultimately making them more sustainable. Our priority is to always provide the industry with robust and innovative solutions that meet the demanding performance criteria of today's construction projects.

### Customer driven innovation

We look to do things efficiently and to the highest standards, not only acting on customer requirements but also being proactive with project demands and meeting all changes in legislation. We value process innovation, strong manufacturing investment and product development. However, our prime concern is always to deliver the very highest quality for our customers in manufacturing, materials, service and supply.

### Expert staff

Our materials and product development specialists represent some of the leading authorities in the industry. Many even have actively engaged trade bodies including the British Plastic Federation (BPF), ICE, SoPHE, CIRIA and CIBSE, as well as other local and regional building associations. It is their knowledge and experience that allows us to offer the very highest standards of product design and development.



[www.polypipe.com/middleeast](http://www.polypipe.com/middleeast)

## Quality control

We invest heavily in research and new production technology. This allows us to provide more precise performance specifications, greater reliability and high quality products that are BBA, BSI Kitemark and WRc approved. Supporting our product accreditations, our business systems are regularly assessed by BSI to ensure we maintain our BS EN ISO 9001:2008 and BS EN ISO 14001:2004 certifications. This ensures we conform to regulatory requirements and that we provide greener credentials for our products.

## Testing and certification

We work closely with regulatory bodies to ensure our products meet all UK and international regulations for performance and sustainability; a vital consideration in an industry where compliance and certification are absolute priorities. Wherever possible, our products are covered by third party accreditations, including BBA, BSI Kitemark etc.



# Polypipe project and technical support



## LONG TERM ALLOWANCES

Sustainable solutions designed to provide the appropriate design life and durability.



## MAINTENANCE GUIDANCE

Full maintenance guidance available from our Water Management Solutions Technical Team.



## ON-SITE GUIDANCE

Dedicated Product Support Team on-hand to offer advice and support on-site.



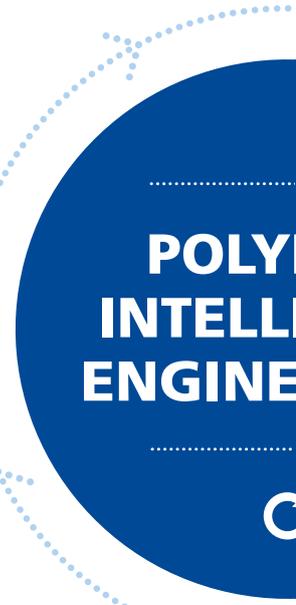
## INSTALLATION SERVICES

Detailed installation guides offer contractors and groundworkers defined parameters to help when installing our products. We work with preferred supply and fit partners to deliver a complete installation service if desired.



## HEALTH & SAFETY

Products are designed with Health and Safety in mind and full guidance for the safe handling and storage of our products is available.



# PIPE INTEGRATED ENGINEERING

1



## PLANNING

Civil Engineers and Drainage Specialists on-hand to offer guidance on appropriate project solutions.

2



## DESIGN

Design assistance utilising CAD, microdrainage and deformation calculations available at every stage of the project.

3



## PRODUCT PERFORMANCE CALCULATIONS

Project specific design calculations can be provided to support our solutions and ensure effective long-term performance.

4



## PRODUCT SOLUTION

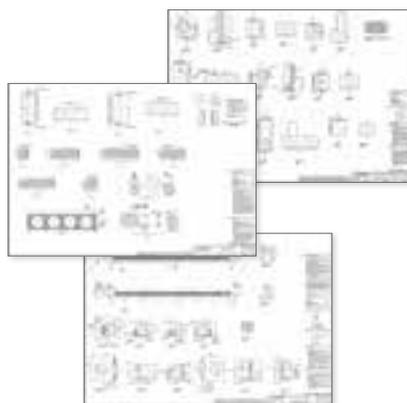
Utilising best engineering practice combined with the knowledge of the latest legislation and standards to specify the most appropriate solution.

5



## MODULARISATION

Off-site manufacture using modern methods of fabrication. A wide range of bespoke pre-fabricated chambers and fittings from our in-house Fabrications Team.



## Technical resources

At Polypipe, we offer a comprehensive selection of downloadable product and technical literature that is available on our website to provide you with detailed information about our systems and solutions.



[www.polypipe.com/toolbox](http://www.polypipe.com/toolbox)

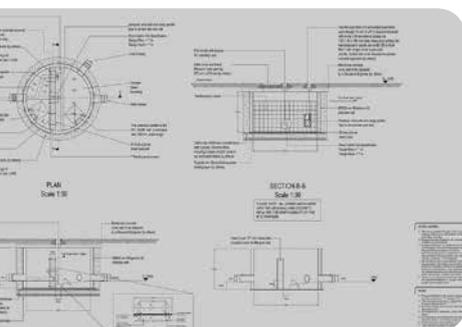
### Brochures and technical manuals

We provide an extensive range of brochures and technical manuals, which contain topics including:

- Structural design
- Hydraulic performance
- Chemical resistance
- Applications
- Installation guidance
- Maintenance
- Structural performance
- Pollution control
- Minimum cover depths

### Technical bulletins

These bulletins offer an overview of the benefits offered by our products and guidance on the typical applications they can be used for as well as explanations of compliance requirements.



## Technical Centre

The Polypipe Technical Centre in Dubai is designed to enhance knowledge and demonstrate the movement and management of water. Our state-of-the-art training facility will give you a unique insight into the future of how water can be managed more effectively in today's fast moving and developing construction industry.

## Standards, approvals and certifications

Available to download are all the BBA and WRc certificates needed to support your specification or contract.

## Specification clauses, CAD drawings and technical datasheets

Our toolbox contains downloadable CAD drawings and specification clauses to ensure full design, manufacture and installation compliance, plus a full range of technical datasheets covering every product.

## Installation guides, Health and Safety and COSHH datasheets

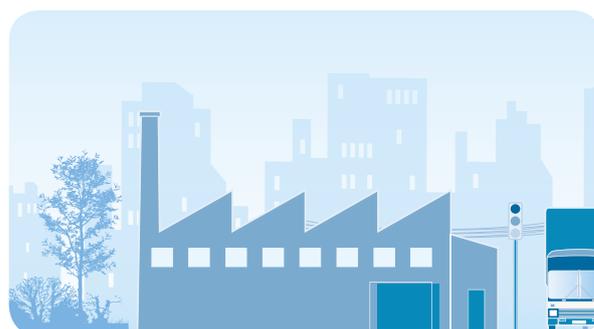
Guidance for easy, safe product handling, loading, off-loading and installation is available along with product safety information (COSHH) – supported by materials safety datasheets – which are also available to download from our website.

## Case studies

Our website provides a broad range of recent case studies, including everything from infrastructure projects for roads, motorways, airports and energy, residential developments, education and commercial buildings.

# Enabling sustainable building technology

At Polypipe, we provide plastic piping systems that enable the effective installation and performance of sustainable building technology, helping meet the twin global challenges of carbon reduction and water management.



## Water management solutions

### Roof to River

Offering a comprehensive range of standalone and modular SuDS products, rainwater harvesting and surface water treatment solutions, plus legislative and technical support services, our water management solutions team address the requirements of every construction and civil engineering project.

## Carbon efficient solutions

### Sustainable indoor environments

Ever stricter building regulations and an increasing number of environmentally conscious customers are driving the demand for greener building products and technologies. We fulfill this demand with a full range of systems that enable collection, transmission, emission and control in heating, ventilation and cooling systems.

## Sector focus

Our product systems respond directly to sector-specific requirements thanks to focused Technical and Development Teams with hands on expertise in the following areas:

### Civils and Infrastructure

Delivering performance and sustainability, our surface water drainage and cable management systems, supported by our in-house Fabrications Team, offer civils and infrastructure project planners a complete suite of solutions.

### Buildings

We offer the broadest range of residential product and service solutions, as well as innovative solutions in response to legislative and industry targets for more sustainable developments. This includes major commercial projects from car parks and high rise office and residential buildings to hospitals, educational premises and shopping centres which have all benefited from our range of value engineered products and comprehensive service support.

[www.polypipe.com/middleeast](http://www.polypipe.com/middleeast)

# Online technical resource

## Product literature



## Solutions literature



## Applications literature



## Data sheets



## Certificates



## Find us online

To stay in touch with the latest news, case studies and literature from Polypipe.



News



Case studies



Literature



[www.polypipe.com/middleeast](http://www.polypipe.com/middleeast)

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## Buildings & Infrastructure

Storm/Surface Water Management

Middle East Edition



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