

Downstream Defender®

Performance Testing Results

Test data demonstrates 80% removal of very fine sediment for all flows up to 1.2 cfs (Fig.4). As the Downstream Defender® does not incorporate an internal bypass, it will continue to capture sediment as flows increase. Whereas internally bypassing units will begin to discharge higher flows without any treatment, the test results project that the Downstream Defender® will continue to provide positive removal efficiencies up to its Peak Treatment Flow Rate of 3 cfs (Fig.4).

These results confirm the efficiency of the Downstream Defender® over the wide range of tested flow rates and highlight the benefit of internal components that stabilize the flow regime and prevent bypassing of untreated flow.

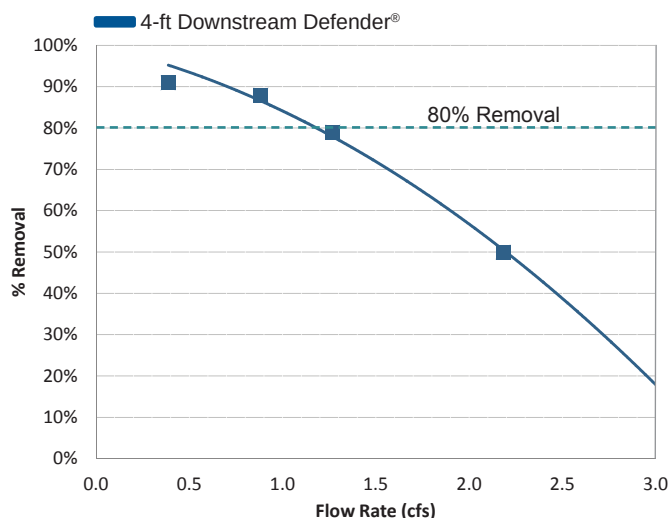


Fig.4 Results of the testing show 80% removal of the very fine test sediment up to 1.2 cfs.

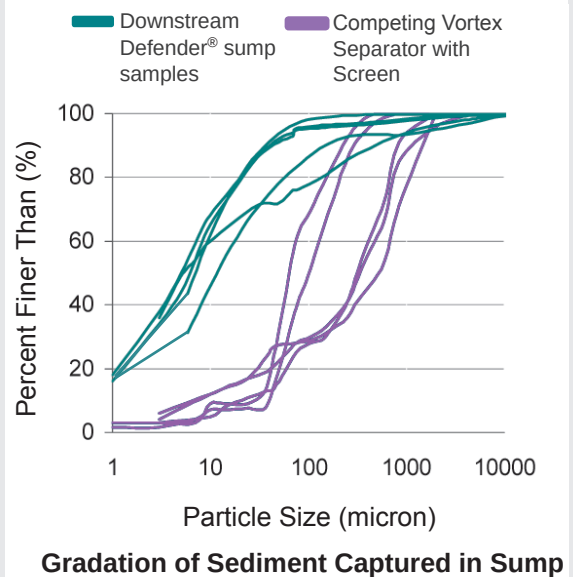
Downstream Defender® Sizing

Flow rates for the 6, 8, 10 and 12-ft diameter Downstream Defender® models for 80% removal of 50-micron sediment are shown in the table below.

Model Unit Diameter	Treatment Flow Rates (80% Removal)	Peak Treatment Flow Rates
(ft)	(cfs)	(cfs)
4	1.2	3.0
6	3.4	8.0
8	6.9	15.0
10	12.1	25.0
12	19.0	38.0

Field Samples Confirm Fine Sediment Removal Performance

The results from the 50-micron sediment removal laboratory testing are consistent with observations from field sampling of Downstream Defender® sump material at many different sites. Sediment captured and retained in the sumps of various Downstream Defender® installations has been shown to be significantly finer than the sediment captured and retained in other stormwater treatment chambers (Faram et al., 2007)¹. This observation has been corroborated from comparing particle size distributions of sediments captured in a competing vortex separator installed at sites with equivalent land use. In most cases, at least 80% of the material in the Downstream Defender® sump samples was 20-micron or finer. Sump samples from the competing vortex separator showed much less capture and retention of fine material, with only 10 - 18% of sump material in the range of 20-micron or finer.



References

1. Faram, M. G., Iwugo, K.O. and Andoh, R.Y.G., 2007, "A Field Study of Sediments Captured by Flow-Through Stormwater Interceptors", Novatech: 6th International Conference on Sustainable Techniques and Strategies in Urban Water Management, Lyon, France, 25-28 June, pp 641-648.



WMS

Polystorm Lite and Polystorm

Installation Guide

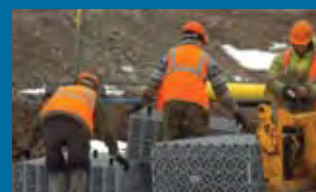
Water Management Solutions

Installation Guidelines

Installation

A full-page photograph showing two construction workers in white hard hats and high-visibility vests installing a geogrid system on a hillside. The workers are positioned on a grid of black plastic geogrid with circular openings. Several black plastic pipes are visible, some standing upright and others lying flat, used to secure the geogrid. The background shows a steep, eroded hillside under a cloudy sky.

The following section outlines site best practise for the installation of Polystorm Lite and Polystorm.



Installation for Attenuation Systems

5. Installation

5.1 Installation details

5.1.1 Health and Safety

Under the Construction (Design and Management) Regulations 2007, unless they are a domestic client, all parties involved in construction or building work have legal duties. These include:

Clients

- Check competence and resources of all appointees
- Ensure there are suitable management arrangements for the project welfare facilities
- Allow sufficient time and resources for all stages
- Provide pre-construction information to designers and contractors

Designers

- Eliminate hazards and reduce risks during design
- Provide information about remaining risks

Contractors

- Plan, manage and monitor own work and that of workers
- Check competence of all their appointees and workers
- Train own employees
- Provide information to their workers
- Comply with the specific requirements in Part 4 of the Regulations
- Ensure there are adequate welfare facilities for workers

It should be noted that additional legal duties are imposed where construction work is notifiable.

All installation activities should be carried out observing the requirements of The Health and Safety at Work Etc. Act 1974; and The Management of Health and Safety at Work Regulations 1999.

Polystorm Benefits for CDM Compliance

Storage applications using Polystorm Water Management Systems are actually beneficial to CDM compliance. This is because the system

avoids or reduces several risks associated with the construction of traditional storage tanks which can involve deep excavations and construction of large engineered structures. Specific advantages of Polystorm in this respect are:

- Individual Polystorm components are lightweight – making it easier for individual lifting of Polystorm cells.
- Installation of Polystorm is quick – so open excavation time is minimised and high numbers of manpower and machinery is reduced.

5.1.2 Risk Assessment

Contractors are required to submit a method statement which includes a methodology for installation and risk assessment for the work to be carried out.

5.1.3 Site Guidance

Good Practice Guide

The following are good practice principles for the handling and storage of all Polystorm cells on site:

- Store units away from direct sources of heat including sunlight for excessive periods
- Place packs of cells on level ground:
DO NOT stack filled pallets on site
- Store loose individual cells
NO MORE THAN 5 cells high
- Ensure a well positioned and secure stand for platform issued to remove the top layer of Polystorm cells from the pallet
- Although Polystorm cells contain an inhibitor giving ultra violet resistance for up to 6 months, avoid prolonged storage in direct sunlight
- DO NOT store cells near fuel bowsers, fuel tanks or any other solvents
- Although Polystorm cells are very robust and resistant to damage when handled normally, store in locations where impacts from vehicles and site plant will be avoided
- Ensure Polystorm cells are kept clean at all times

- Broken/cracked cells should not be installed. Broken/cracked cells should be recycled wherever possible
- Individual Polystorm Lite cells weigh 7kg and Polystorm 9kg so they can normally be safely lifted on site in accordance with current manual handling regulations.
- Avoid walking on the geosynthetic membrane to reduce risk of puncturing or tearing the textile
- Care must be taken when placing the cells into the excavation
- Install 1st layer of cells to minimise walking on the geomembrane textile

5.1.4 Floatation

When placed below the ground water table as an attenuation system (i.e. wrapped in a geomembrane) there is a risk that the buoyancy of a tank may cause it to float. This can be prevented by placing a sufficient weight of soil on top of the tank to counteract the upward forces. Our Technical Team can assist with groundwater calculations. Please contact Polypipe WMS technical support team. Also see section 4.

5.1.5 Excavation and Preparation

Excavate to the required plan dimensions and level, ensuring that the excavation orientation will allow easy installation of connecting pipework. Consideration should be given to maintaining construction plant access for reinstating around the installed Polystorm cells.

Ensure that the ground bearing capacity at the formation level is sufficient for the proposed operational loads. The base of the excavation should be smooth and level, free of large or sharp stones and soft spots to avoid punctures or tears of the geomembrane. Any soft spots should be excavated and replaced with suitable compacted granular material.

Place and compact a minimum 100mm thick layer of bedding material (typically coarse sand). If required, line the base and sides of the excavation with a protective geotextile before placement of the impermeable geomembrane. Excavation should be carried out in accordance with BS6031, paying particular attention to safety procedures.

5.1.6 Handling and Installation

All materials used should be checked before and after installation for any damage such as punctures or tears to the membrane.

The type of geosynthetic material used to encapsulate the Polystorm cells will determine the installation requirements. Please note the following information is generic and advice from the geosynthetic manufacturer should be sought to ensure that the appropriate protective measures are taken to comply with any proprietary requirements.

Physical Properties		
Thickness	Min 0.75 to 1.0mm	ASTM D5199
Density	900 kg/m ³	ASTM D1505
Mechanical Properties		
Tensile strength, at yield	Min 1600kN/m ²	ASTM D4885
Elongation at break	>500%	ASTM D4885
Puncture resistance	Min 170N	ASTM D4833
Tear resistance	Min 67N	ASTM D1004 Die C
Impact resistance	Min 15 Joules	ASTM 3998 mod
Stress crack resistance	Min 200 hrs	ASTM D5391 (SP-NCTL)
Permeability coefficient	Max 2.0 x 10 ⁻¹²	ASTM D
pH	Resistant to all naturally occurring soil acids and alkalis	
Chemical/biological resistance	Resistance to all substances found to naturally occur in soils and rainwater. Detailed information would need to be provided to geomembrane manufacturer in instances of contaminated land.	

Table 5-1 Impermeable Geomembrane

Before cells are installed a geomembrane should be laid over the subgrade level. Positioning of sheeting is undertaken by machinery or hand. After unrolling the sheeting, its position is adjusted so that a suitable overlap is achieved for the welding process. Before welding, the sheet must be checked for any damage including punctures or tears. If damage has occurred re-patch the damaged area with additional geomembrane material and weld over damaged area. Ensure the damaged area is overlapped by a minimum of 400mm.

Joint each sheet of geomembrane together according to the suppliers' recommendations.

Installation for Attenuation Systems

Polystorm Cell Installation

Before proceeding with the installation please ensure you carefully read and understand the Good Practise Guidelines stated earlier in the document.

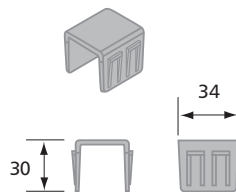
Ensure cells are arranged so that they are in the correct alignment with the adjoining pipework. Wherever possible, minimise the amount of walking on the geomembrane to reduce the chances of punctures or tears to the material by laying the first layer of cells.

5.1.7 Connecting Polystorm Cells

Place the Polystorm cells on the geomembrane in accordance with the construction drawings. Ensure the Polystorm cells are abut and the corners align with each other. During installation, Polystorm cells should be securely connected using clips and shear connectors. Clips and shear connectors are supplied in sealed polythene bags of 60 and 30.

Clip Connectors

Polypipe clips connect horizontally adjacent units.



Shear Connector

Vertical connections are formed with the Polypipe shear connector.

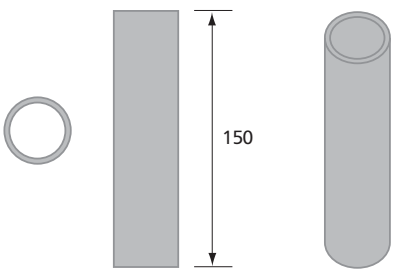


Figure 5-2 Clips and shear details

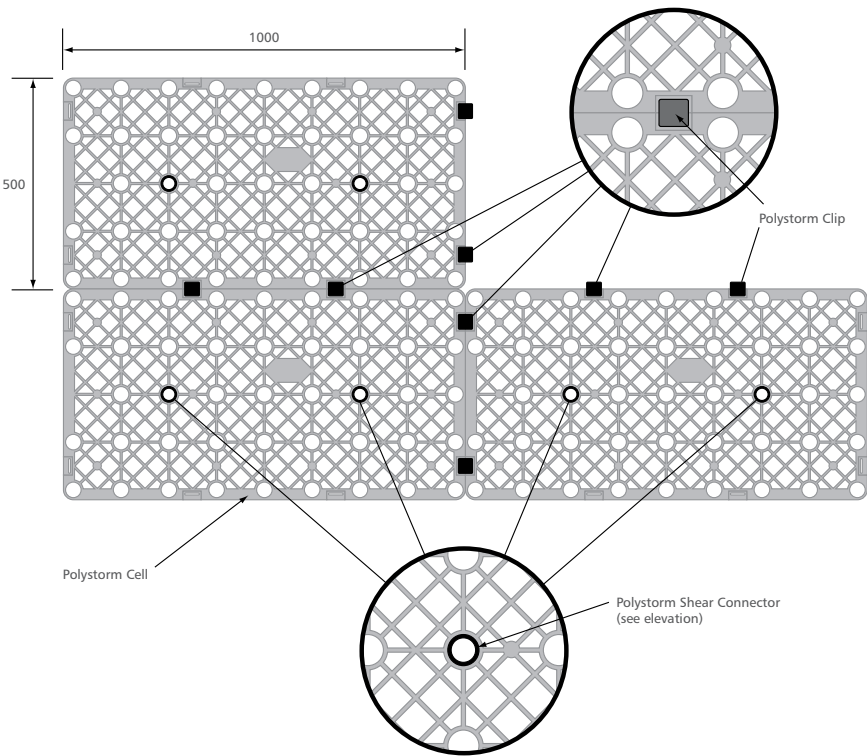


Figure 5-3 Location points for clips and shears

Shear Connector Installation

Insert shear connectors into Polystorm cell as shown. Ensure the shear connector is fully inserted before mounting the Polystorm cell.

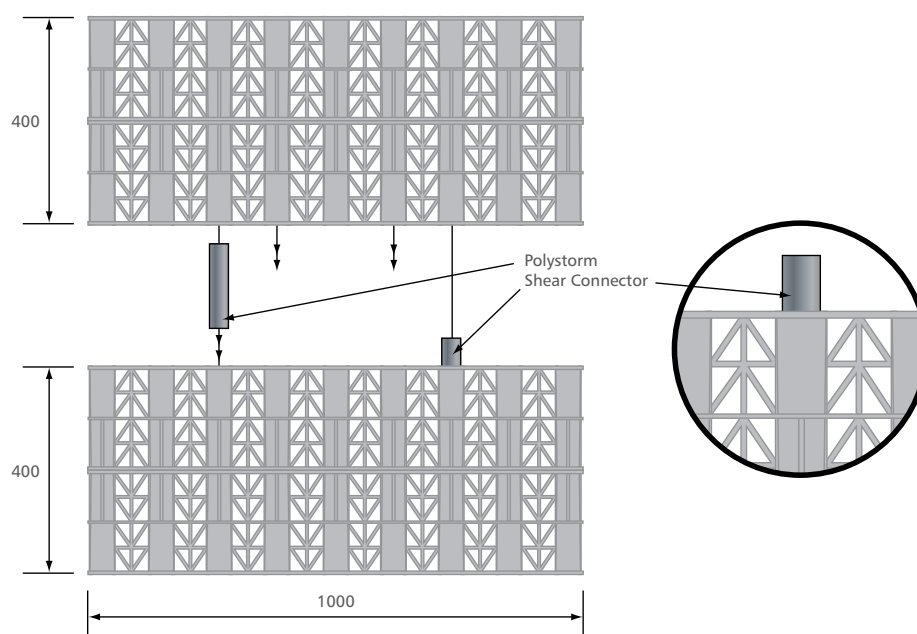


Figure 5-4 Shear connector installation

Clip connector installation

Polystorm cells are adjacently connected by clipping the two units together.

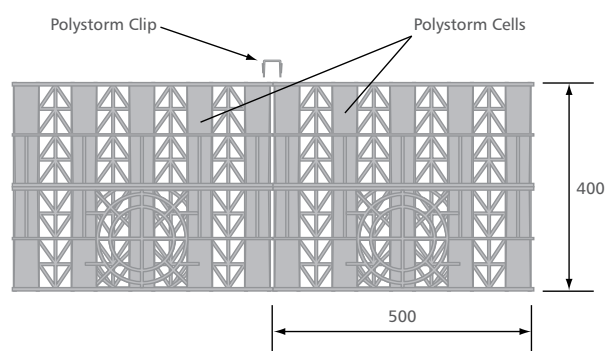


Figure 5-5 Clip connector installation

Installation for Attenuation Systems

5.2 Connections

Types of connections 160mm – 300mm (direct to cells)

160mm EN 1401-1 pipes connect directly into the convenient knock-out incorporated in the end of each cell. Connection to 110mm EN 1401-1 pipes or other products is accommodated through the use of standard Polypipe adapters. Polystorm cells are also available with either a 225mm or 300mm fabricated Ridgidrain pipe connection.

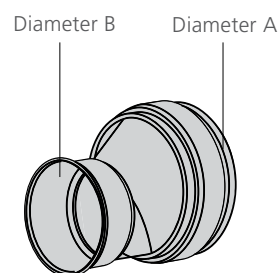


Figure 5-6 160/110mm invert level reducer

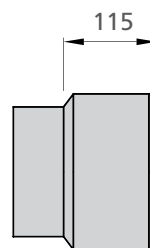


Figure 5-7 160mm diameter adaptor

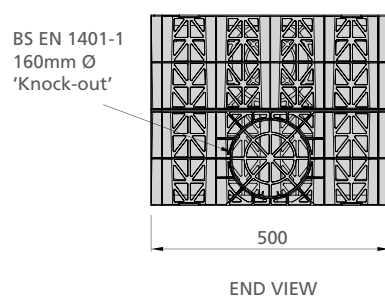


Figure 5-8 Polystorm cell 160mm diameter knockout

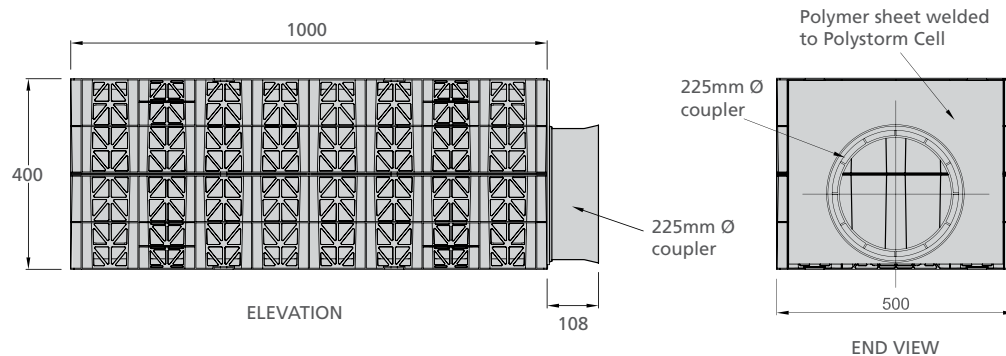


Figure 5-9 Fabricated Polystorm cell allowing 225mm diameter pipe connection

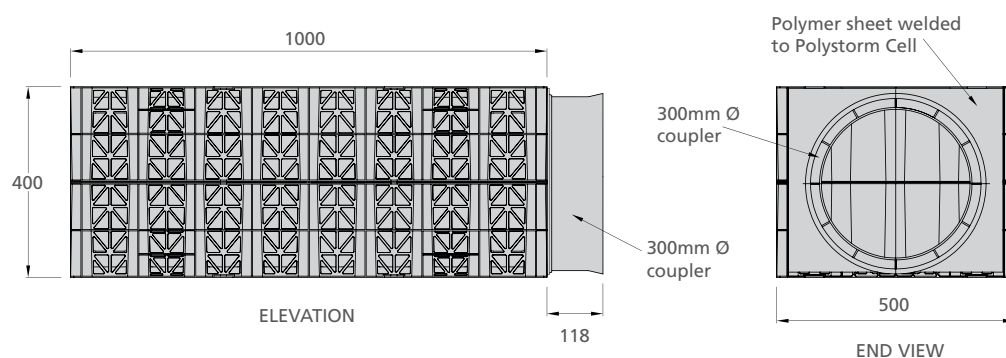


Figure 5-10 Fabricated Polystorm cell allowing 300mm diameter pipe connection

Types of connections 450mm – 600mm (direct to cells)

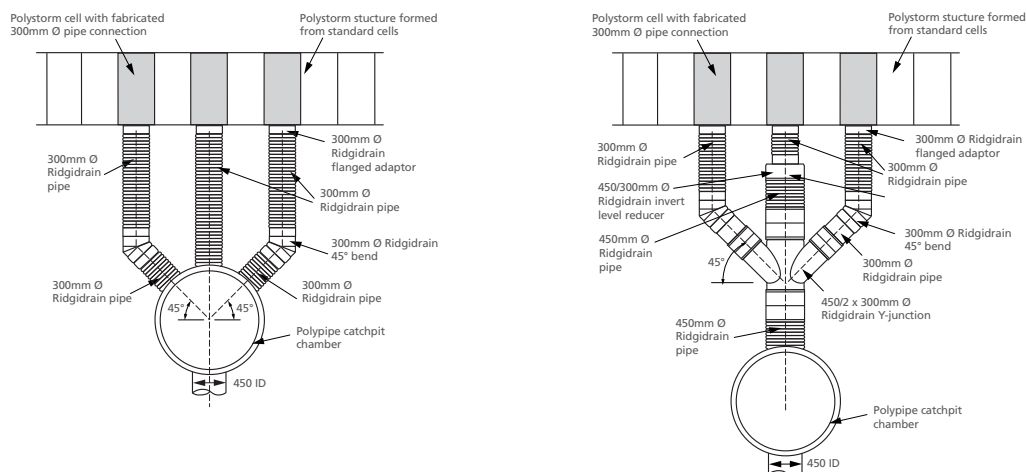


Figure 5-11 Typical Polystorm 450mm inlet manifold detail Figure 5-12 Typical Polystorm 450mm inlet manifold detail

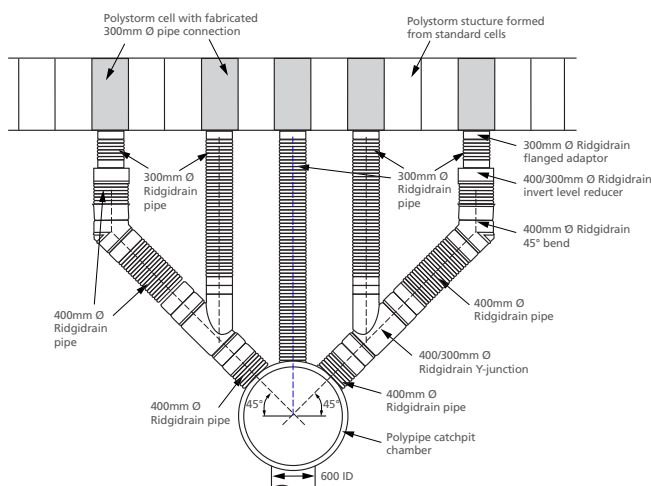


Figure 5-13 Typical Polystorm manifold detail

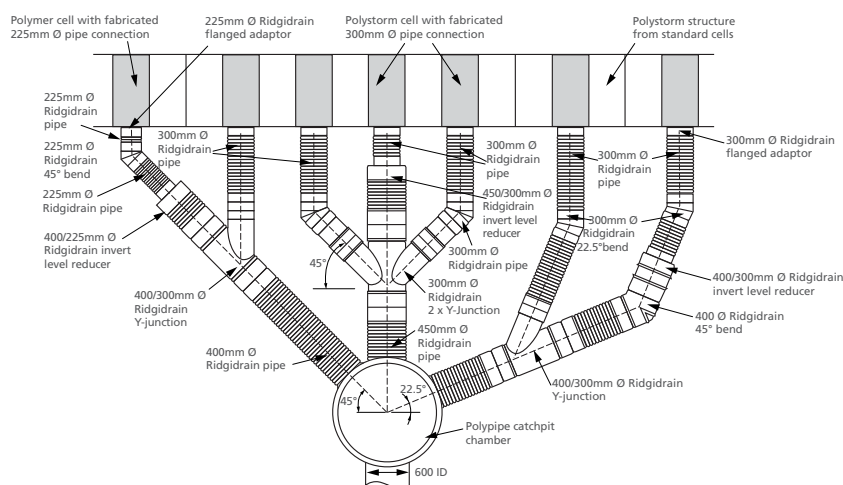


Figure 5-14 Typical Polystorm 600mm inlet manifold detail

Note: For inlets larger than 600mm please contact Polypipe WMS technical team.

Please also visit www.polypipewms.co.uk for downloadable Auto CAD files of the illustrations above.