



**SURFACE WATER SUSTAINABLE DRAINAGE
AS-BUILT, CONSTRUCTION VERIFICATION REPORT
& DRAINAGE MANAGEMENT PLAN
DEVELOPMENT OF 71 NEW AFFORDABLE HOMES AT
LAND OFF LOUISA STREET, OPENSHAW
(PLANNING APPLICATION REF: 134775/FO/2022)**

1. Background

This document has been produced pursuant to condition 15 of planning reference 134775/FO/2022, the re-development of the brownfield, former Iron Foundry (and other industrial uses) in the Manchester City Council local authority catchment. The condition reads;

“No development hereby permitted shall be occupied until details of the implementation, maintenance and management of the sustainable drainage scheme and the culverted ordinary watercourses have been submitted to and approved by the local planning authority. The scheme shall be implemented and thereafter managed and maintained in accordance with the approved details. Those details shall include:

- *Verification report providing photographic evidence of construction as per design drawings.*
- *As built construction drawings if different from design construction drawings;*
- *Management and maintenance plan for the lifetime of the development which shall include the arrangements for adoption by any public body or statutory undertaker, or any other arrangements to secure the operation of the sustainable drainage scheme throughout its lifetime.*

Reason- To manage flooding and pollution and to ensure that a managing body is in place for the sustainable drainage system and a maintenance mechanism for the lifetime of the development, pursuant to policies EN8, EN14, EN17 and DM1 of the Manchester Core Strategy (2012).

This document and associated appendices seeks to provide a verification of the installed drainage network, provide the as-built drawings and associated information and detail the management and maintenance arrangements for the lifetime of the development to allow the discharge of planning condition 15.

2. Competence

This report has been written by Paul Sinclair BEng (Hons), Technical director of Westchurch Homes. The author has been in the housebuilding industry since 1998 in various technical roles at Redrow Homes until May 2021, the final 10 of those years as Technical Director. In 2012, the author acted as expert witness for drainage on behalf of Redrow at successful appeal hearing for the refusal of 45 No. dwellings at Overlea Drive, Hawarden in Flintshire Council area. For the past 4 years, fulfilling the role of Technical Director at Westchurch Homes Ltd developing predominantly brownfield, affordable housing sites across Northwest England.

3. Design

Banners Gate Ltd were responsible for the detailed road and sewer design for the scheme and secured Section 104 approval from United Utilities in October 2023 for the main sewer infrastructure. The technical approval as well as the approved Section 104 drawing is included within appendix 1 (See extract in fig 1 below) and indicates the extent of those pipes and manholes that will be adopted and maintained by UU in the future in accordance with their own maintenance schedules.



Fig 1 – Extent of S104 adoption (coloured pipes and manholes)

The proposed SUDS features are as follows;

- Cellular Storage located beneath areas of shared parking & POS areas of the site and associated chambers
- Hydrobrake Manhole as approved by United Utilities and to be adopted by UU restricting surface water outflow from the development to 6.3 l/s
- Associated oversize tanks/pipes to store restricted flows to be adopted by UU.

The proposed cellular storage scheme is a Polystorm system and associated geotextile membrane. The product details for the system are included within Appendix 5 including the membrane specification, installation guide and BBA Agreement certification.

3.1 Culverted Ordinary Watercourse

Through the preparation of & during the planning application process, feedback from LLFA raised the concern about an ordinary watercourse that was deemed to be directly beneath the site. A review of the LLFA map showed that the indicative position of the culverted watercourse is noted to the south of the development site, assumed to be located within the public park.

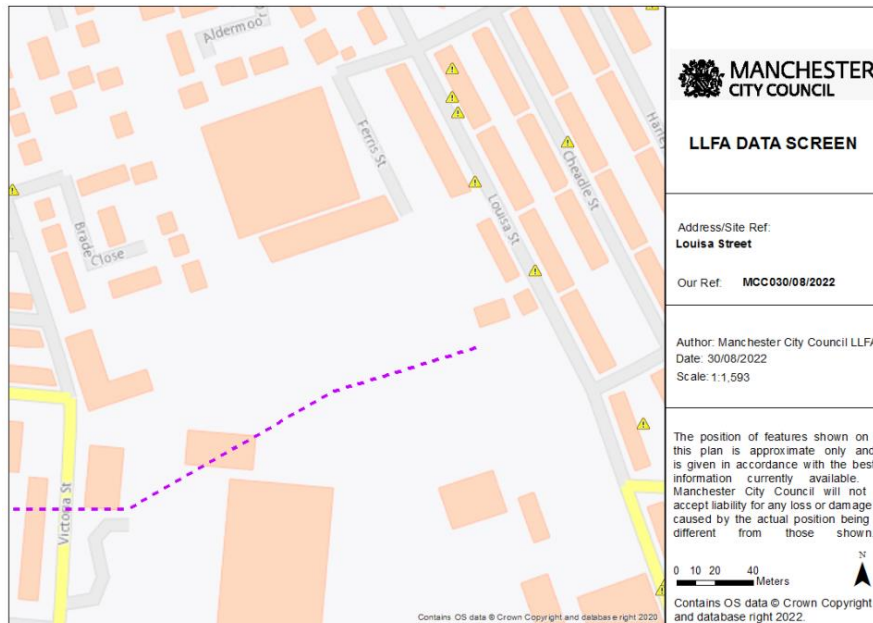


Fig 2 – Indicative location of culverted watercourse

A full and detailed drainage investigation was undertaken by Invek Surveys which concluded that the culverted watercourse could not be found and was likely to have been abandoned. The document, which was provided as part of the planning documentation is included in Appendix 2.

As a consequence of this work, it is clear that there is no management or maintenance liability towards the feature associated with the development of the site, and therefore this element of the condition should be satisfied by the results of appendix 2.

4. Construction, Installation & As-Built Info.

RJP Surveys have completed a full as-built of the site showing new manhole locations, new properties, fencelines etc. This drawing is included within Appendix 4.

The installation of the hydrobrake manhole will be inspected and signed off by United Utilities to facilitate adoption in the future.



Fig 3 Design and construction underway of Manhole CC01, hydrobrake control chamber.

The cellular storage was designed in principal by Banners Gate. Hydro Water Management Solutions Ltd are specialists in the design & installation of cellular storage units and systems. They produced a “unit diagram” drawing to deliver the necessary storage volumes.

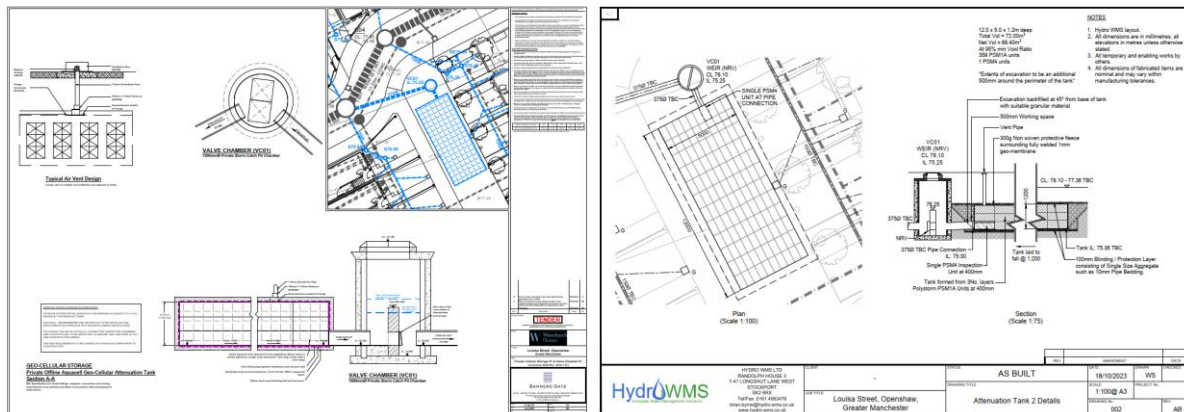


Fig 4 Banners Gate and Hydro WMS design for cellular storage tank 2 (To the rear of plots 1-8)

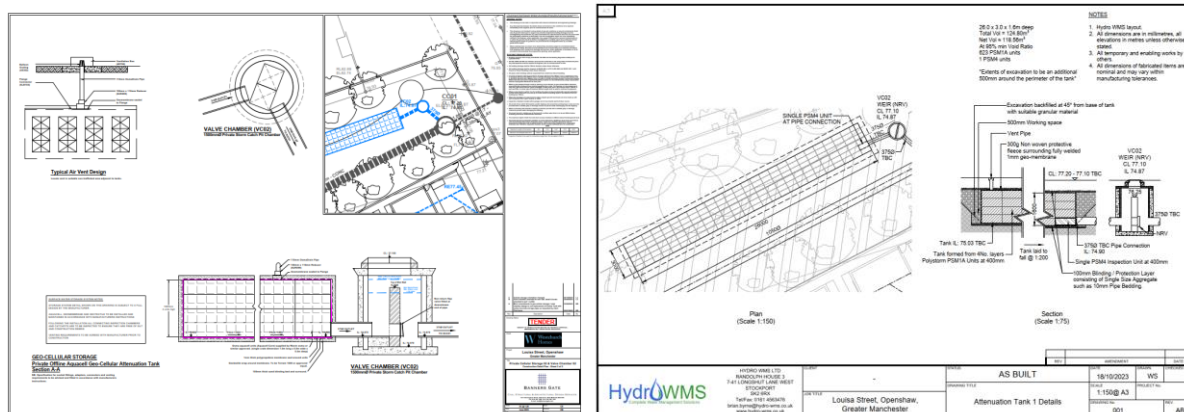


Fig 4 Banners Gate and Hydro WMS design for cellular storage tank 1 (within POS)

Hydro WMS were subsequently awarded the contract to undertake a full installation of the units including the waterproof membranes, jointing, vents etc. The product information, component parts, certification and insurance certification can be seen in Appendix 5.

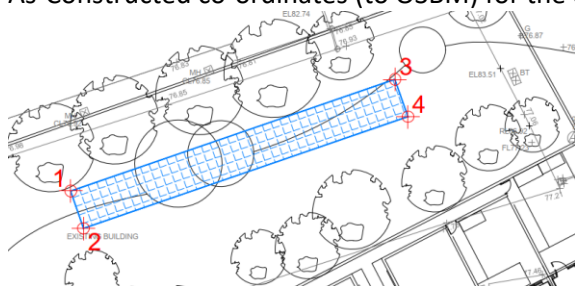
Hydro WMS have installed the units and have provided O&M manuals as well as CQA as-built information on the installation. These documents can be viewed in Appendix 6 and demonstrate that the surface water drainage SUDS system has been constructed as per the agreed scheme.



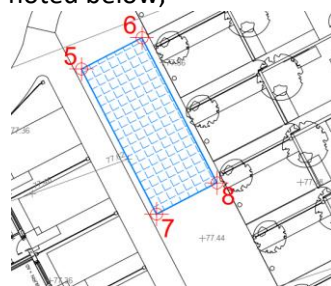


Fig 5 - Cell construction underway – Tanks 1&2

As-Constructed co-ordinates (to OSBM) for the cells are noted below;



1	E 388557.283	N 397649.170
2	E 388558.260	N 397646.333
3	E 388581.868	N 397657.632
4	E 388582.844	N 397654.795



5	E 388621.197	N 397628.182
6	E 388625.638	N 397630.479
7	E 388626.710	N 397617.523
8	E 388631.151	N 397619.820

5. Future Maintenance Responsibilities

The site has been transferred to a registered social provider, Jigsaw Homes Group who are the landowner of the site. All drainage on the site that is not to be adopted by United Utilities will be the responsibility of Jigsaw Homes Group. Jigsaw Homes are an enduring body who also own all of the newly constructed properties on the development.

The O+M manuals for the surface water system provides the information necessary for the RP to adequately manage all of the surface water features. Appendix 5 provides a summary of the maintenance requirements for the cellular storage SuDs elements.

6. Summary

This document provides all necessary verification, as-built information and management & maintenance requirements of the SuDs elements on the Louisa Street development and provides the background on the offsite culvert investigation. The report and associated information should allow the discharge of planning condition 15 in full.

APPENDIX 1

SECTION 104 APPROVAL & APPROVED S104 PLAN



© This drawing and the building works depicted are the copyright of Banners Gate Ltd and may not be reproduced or amended except by written permission. No liability will be accepted for amendments made by other persons.

GENERAL NOTES

- This drawing is to be read in conjunction with relevant architectural and engineering drawings.
- Any discrepancies between the details shown and actual on site conditions to be reported immediately to the engineer prior to commencement of works.
- This drawing is not intended to show details of ground conditions or ground contaminants. Each area of ground relied upon to support any structure depicted (including drainage) must be investigated by the Contractor for any areas of formation for said structures which do not accord with the anticipated conditions as described in the site investigation report are to be immediately notified to the Engineer, where applicable. Any suspect fluid ground or ground contaminants on or within the ground should be further investigated by a suitable expert. Any earthworks shown indicate typical slopes for guidance only and should be investigated further by a suitable geotechnical expert.
- Where existing trees are shown to be retained they should be subject to a full Arboricultural inspection for safety. All trees are to be planted so as to ensure they are a minimum of 5 metres from buildings and 3 metres from drainage and services, where applicable. A foundation is to be provided to accommodate the proposed tree planting, where applicable.

ADOPTABLE ROADS AND SEWERS

- Roads, footways and parking bays which form part of the highway to be adopted under Section 38 of the Highways Act 1980 shall comply with the requirements of the Adopting Authority.
- Sewers to be adopted under Section 104 of the Water Industries Act 1991 shall comply with the Sewerage Sector Guidance (SSG) 'Design & Construction Guidance' with any amendments specified by the Adopting Water Authority.
- All pipes to be used in adoptable sewerage shall be either clayware to BS EN 285 or concrete to BS EN 1916 and BS 5911: Part 1 with Class B bedding unless otherwise stated. With approval of the Adopting Authority solid wall concentric external 10 reinforced sPVC pipes complying with the relevant provisions of BS EN 13476 may be used.
- Where cover to a pipe is more than 1200mm under adoptable carriageway the trench shall be filled to formation of the carriageway with well compacted DTP Type 1 material.
- Where cover to a pipe is less than 1200mm under adoptable carriageway it shall be provided with concrete protection in accordance with the specification of the adopting authority and back filled to formation of the carriageway with well compacted DTP Type 1 material. Where concrete bed and surround is specified flexibility of joints is to be maintained by using compressible bitumen impregnated fibreboard at each pipe joint.
- All existing drainage invert levels, diameters and locations are to be checked by the Contractor prior to the commencement of any proposed drainage work. Any difference between actual and drawn details is to be reported to the Engineer immediately.
- Positions of existing services/statutory undertakers apparatus adjacent to or crossing proposed sewers is to be checked by the Contractor prior to starting work.

Section 104 Agreement Plan Legend

- S104 Surface Water Sewer & Manhole
- S104 Surface Water Manhole Reference
- S104 Surface Water Storage Tank
- S104 Foul Water Sewer & Manhole
- S104 Foul Water Manhole Reference
- S104 Combined Water Sewer & Manhole
- S104 Combined Manhole Reference
- S38 Highway Gully & Connection
- Private Surface Water Cellular Storage
- Private Surface Water Plot Drainage
- Private Foul Water Plot Drainage
- Existing Combined Sewer & Manhole
- Proposed Finished Floor Level
- S104 Sewer Easement
- Development Boundary

G	Site boundary added.	23/10/2023	LJ
F	MH S2, S8 & S10 amended to UU S104 comments.	18/10/2023	LJ
D	Minor amendments to suit UU S104 comments.	02/10/2023	LJ
C	Drawing updated to suit IL given for C11 & to suit amendments to 1:20's	28/09/2023	LJ
B	Drawing updated to suit re-design of drainage to one outfall point & to lift outfall into combined sewer on Louisa Street following confirmation of IL	22/09/2023	LJ
A	Drawing updated to suit replacement of Carlow Tank with online concrete storage pipes as requested by client.	18/08/2023	LB
-	First issue	03/07/2023	OB

Rev.	Description	Date	By
Drawing Status			
TENDER			
SUBJECT TO UNITED UTILITIES SECTION 104 TECHNICAL APPROVAL. AMENDMENTS MAY THEREFORE BE REQUESTED.			
Client			
Project			
Louisa Street, Openshaw Greater Manchester			
Title			
Section 104 Agreement Plan			

BANNERS GATE

CIVIL, STRUCTURAL & ARCHITECTURAL DESIGN SERVICES

10-11 Birmingham Street, Halewood, West Midlands B63 3HN
Tel: 0121 687 1500 Fax: 0121 687 1501
E-mail: mail@bannersgate.com

Scale	A1 @ 1:250	Drawn	CS
Date	June 2023	Checked	OB
File	23102 / dwgs / civils / current	Drawing	23102-BGC-D / 100S104 G

From: seweradoptions@uuplc.co.uk
Sent: Friday, October 20, 2023 12:22
To: liamjones@bannersgate.com
Cc: davidallbright@bannersgate.com; Paul Sinclair; anthony.laithwaite@uuplc.co.uk; seweradoptions@uuplc.co.uk
Subject: RE: UU REF 04354124 - Section 104 - Louisa Street, Manchester

Good afternoon,

HOUSING DEVELOPMENT, Louisa Street, Openshaw, Manchester – UU Ref 04354124

I refer to your correspondence dated **17/10/2023** and to the plans enclosed therewith, and would inform you that your submission is now satisfactory for incorporating into a Water Industry Act 1991, Section 104 Agreement, providing that the works can be constructed in full accordance with the acceptable drawings numbered as follows;

S104 Agreement Plan – 23102-BGC-D-100S104 F - Section 104 Agreement Plan
A3 Land Registry Compliant Plan – Land Registry Plan- UU Rev A
Long Sections – 23102-BGC-D-201 F - Adoptable Highways & Drainage Longitudinal Sec & MH Schedule Plan
Manhole Schedules and/or 1:20 Manholes Details – 23102-BGC-D-371 B - Foul 1-20 Manholes - General Arrangement Plan / 23102-BGC-D-372 C - Storm 1-20 Manholes - General Arrangement Plan

Please be advised we require amendments to the Land Registry Plan as outlined by Anthony Laithwaite with assets & grid references to be added.

United Utilities Standard Construction Details are available for download via the following [link](#). **Please note: This will only be applicable to submissions working to Sewers for Adoption 6th Edition or for components included within the submission that are not covered by the Design & Construction guidance (i.e. flow control manholes or similar).**

To enable the Section 104 Agreement to be completed and inspections to start on site, I would be grateful if you could now provide me with the following:

- **Cheque/payment** for the remainder of the S104 fees **£4,384.55**
- Sign and return the enclosed “Request for approval to commence construction of sewers before signing of agreement form”.

The Developer or his contractor is responsible for verifying all existing service positions and levels on site, including those of the existing public sewerage system, before work commences.

Any costs associated with service diversions required to enable the scheme to be carried in accordance with the acceptable drawings must be borne by the developer.

Where connections are to be made to existing public sewer manholes, the costs for rebuilding the manhole to United Utilities requirements, if deemed necessary by United Utilities, must be borne by the developer. If the works cannot be constructed in accordance with the acceptable plans, the developer must submit revised proposals for appraisal before continuing with the works.

The developer must also obtain specific permission to construct any new manhole or make any connections to the public sewerage system. Please visit our website by clicking [here](#) where you will find the S106 Sewer Connection Application form. The form is in two parts but only the second part is required for this scheme which is called '**Request for permission to work on a public sewer**' application form, which the appointed contractor must complete and return to the address on the form.

I look forward to receiving the drawings and information requested above at your earliest convenience, but should you require any further information in the meantime, please do not hesitate to contact me.



Lewis Barr

Assistant Developer Engineer
Developer Services & Metering
Customer Services
07827286541
unitedutilities.com

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APPENDIX 2

CULVERT INVESTIGATION REPORT

		Doc Reference: LSR_01
Subject	Louisa Street Openshaw	Date: 13.04.2023
Client	Westchurch Homes	Page 1 of 2

Title:

Search for “unnamed” Culverted Watercourse off Louisa Street, Openshaw, Manchester

Background:

Invek Surveys Ltd were asked by our client, Westchurch Homes, to investigate the existence of an “unnamed” Culverted Watercourse (and survey if found) located off Louisa Street, Openshaw.

Experience:

Invek Surveys were established in May 1993 and have been involved in the field of drainage investigations and surveys for the past 30 years.

Methodology:

We attended site on Wednesday 8th February 2023 and initially undertook a site walkover where we utilised various plans issued by our client.

1. Manchester City Council LLFA screen capture showing a purple dotted line crossing the park off Louisa Street but only showing the start of the culvert within the park itself. This line showed NO access chambers, inlets or outlets from which access may have been sought.
2. United Utilities sewer plan that showed NO indication of this culverted watercourse.

Our team of four operatives split up, and with the aid of metal detectors, thoroughly searched the open grassed areas of the park – no covers were found. Please note that there were covers on the public combined sewer system there but none on any culverted watercourse etc.

There were areas of overgrown bushes and trees to the Northern boundary of the site that we were not able to access – photos of these areas were in the final report to our client.

With absolutely NO covers or other indicators that a culverted watercourse existed, there was no more that could be done in that park area.

As a side note, it was proved that the highway gullies in Louisa Street discharged direct to the main combined sewer; this was perhaps not unusual in an area of this age, but it may be concluded that if a culverted watercourse was located here, then it may have expected to receive the rainwater runoff from the highway etc...

Once we felt the park area had been exhausted in terms of searching for any clues to the existence of the watercourse, we then relocated to the area West of the park (the suspected downstream) and started to look in the area of Victoria Street.

		Doc Reference: LSR_01
Subject	Louisa Street Openshaw	Date: 13.04.2023
Client	Westchurch Homes	Page 2 of 2

Here we lifted many of the covers in an attempt to find evidence of this culverted watercourse but found only Combined Water sewers.

To help show the total search area covered, we showed it as a hatched Cyan layer to the final CAD and PDF report.

With the total lack of any covers on this watercourse it proved impossible to confirm if it even existed!

Back at the office we looked at historic plans of the area hoping that there may be clues give before a lot of the newer development here but again nothing was found!

Conclusion:

In conclusion it is our opinion that without extensive trial holes and invasive excavations, it would not be possible to locate this culverted watercourse, if indeed it still even exists today.

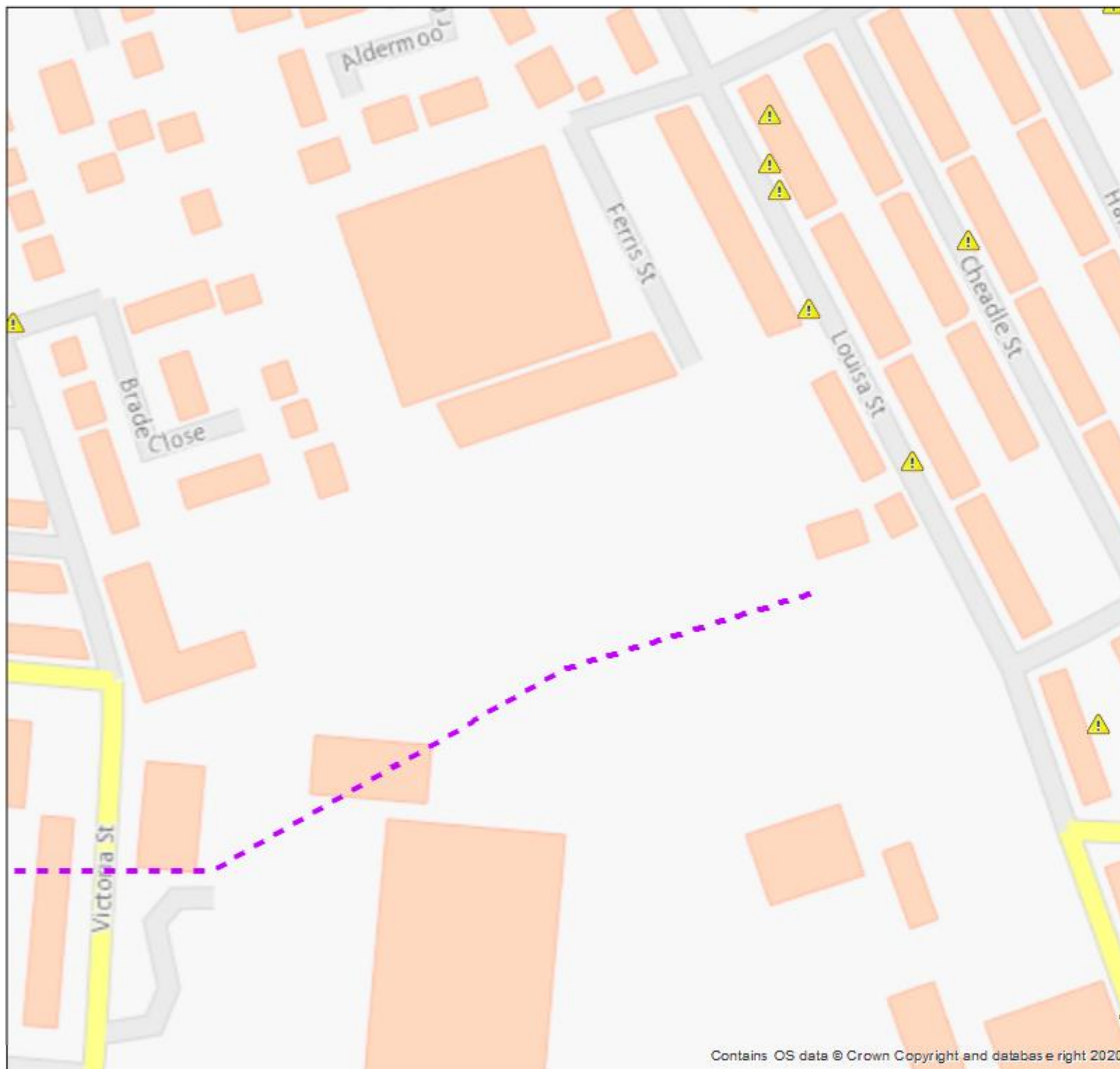
Attachments:

- Existing LLFA Off-Site Culvert
- Existing UU Records markup
- Louisa Street Openshaw Drainage Layout









**MANCHESTER
CITY COUNCIL**

LLFA DATA SCREEN

Address/Site Ref:

Louisa Street

Our Ref: **MCC030/08/2022**

Author: Manchester City Council LLFA

Date: 30/08/2022

Scale: 1:1,593

The position of features shown on this plan is approximate only and is given in accordance with the best information currently available. Manchester City Council will not accept liability for any loss or damage caused by the actual position being different from those shown.

0 10 20 40
Meters



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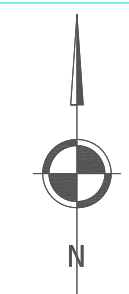
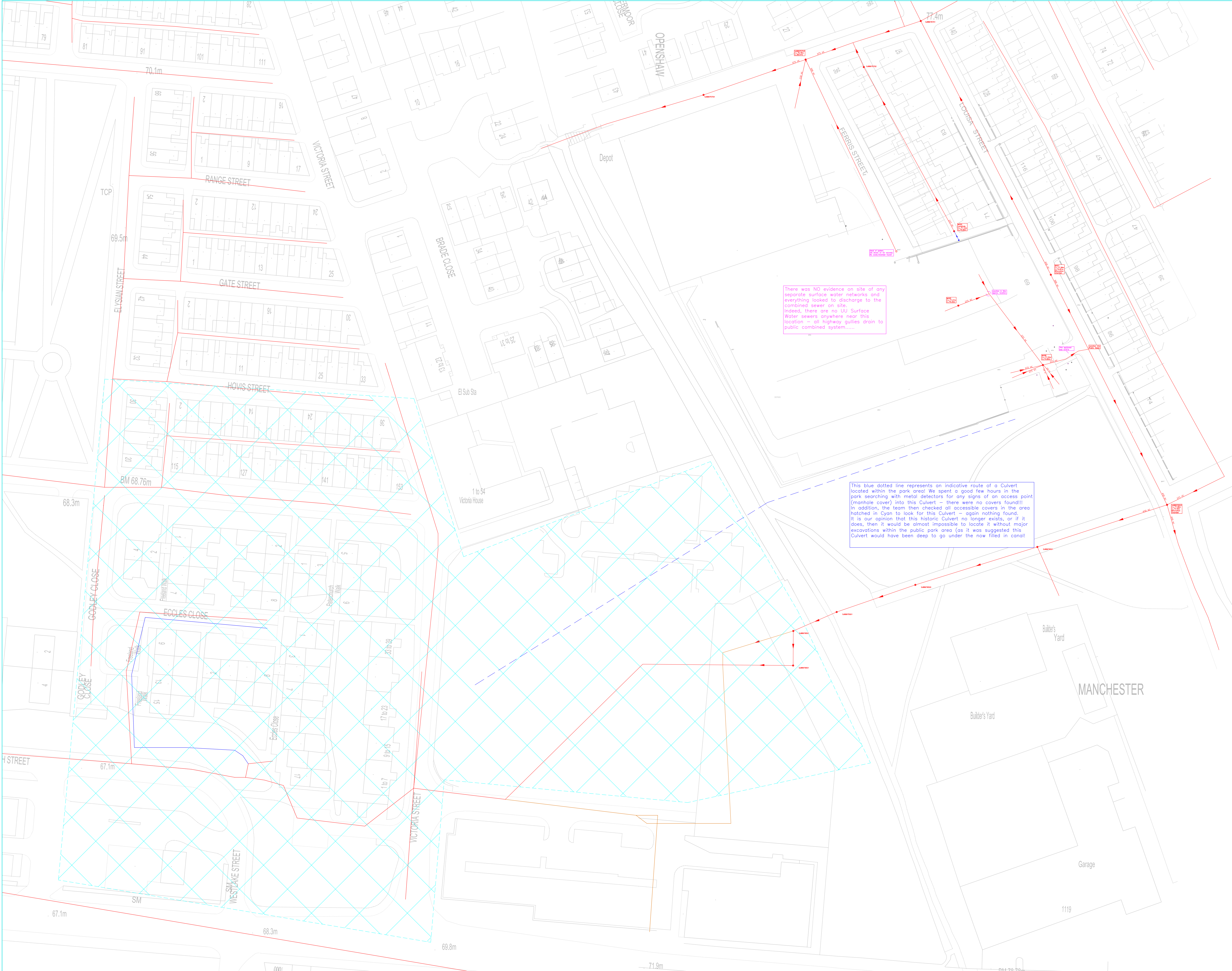
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The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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6702	77.16	FO	70																																																																																																																																																																																				



Legend/Notes:

- Combined Sewer
- Foul Sewer
- SW Sewer
- Assumed Sewer (Not Proven)
- Rising Main
- Highway Drainage
- Culvert Sewer
- Open Water Course
- Overflow Line
- Treated Line
- Rain Water Down Pipe
- Foul Down Pipe
- Combined Down Pipe
- Grey Water Down Pipe
- Highway Gully
- Septic Tanks
- Direction of overland flows
- Spot levels

There was NO evidence on site of any separate surface water networks and everything looked to discharge to the combined sewer on site. Indeed, there are no UU Surface Water sewers anywhere near this location – all highway gullies drain to public combined system.....

This blue dotted line represents an indicative route of a Culvert located within the park area! We spent a good few hours in the park searching with metal detectors for any signs of an access point (manhole cover) into this Culvert – there were no covers found!!! In addition, the team then checked all accessible covers in the area hatched in Cyan to look for this Culvert – again nothing found. It is our opinion that this historic Culvert no longer exists, or if it does, then it would be almost impossible to locate it without major excavations within the public park area (as it was suggested this Culvert would have been deep to go under the now filled in canal)

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SURVEYS LTD.

Warrington Business Park, Long Lane, Warrington, Cheshire, WA2 8TX
Tel: 01925 244376 Fax: 01925 241517
Email: kevin@invek.com – www.invek.com

Client
Westchurch Homes

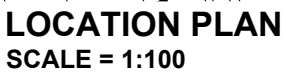
Drawing Title
**Louisa Street
Drainage Layout**

Scale(s)	N.T.S	Drawn	PW
Date	09.02.23	Checked	RD
Job Number	2061	Approved	KN

Sheet Size, Drawing Number & Revision
A1_2061/01_Rev_00

APPENDIX 3

SUDS ELEMENTS DESIGN DRAWINGS



HYDROBRAKE SPECIFIC NOTES

- Alternative types of hydrobrakes have different pump configuration & size, always consult the manufacturer.
- Warning signs are to be 40mm high red lettering on a white plastic base. The plastic base dimensions are to be approx 300mm x 6mm.
- The warning sign is to be mounted on a removable safety grid available from cover manufacturer.
- The sign in these manholes are to read "Caution - Hydrobrake located here".
- A sign must be fitted in the upstream MH to read "Caution - Hydrobrake downstream".
- A sign must be fitted in the downstream MH which reads "Caution - Hydrobrake upstream".
- Any difference between actual and drawn details is to be reported immediately.
- The base is to be resistant to attack by sewage.



Drawing Status

TENDER

SUBJECT TO UNITED UTILITIES SECTION 104 TECHNICAL APPROVAL,
AMENDMENTS MAY THEREFORE BE REQUESTED.

Project

Louisa Street, Openshaw
Greater Manchester



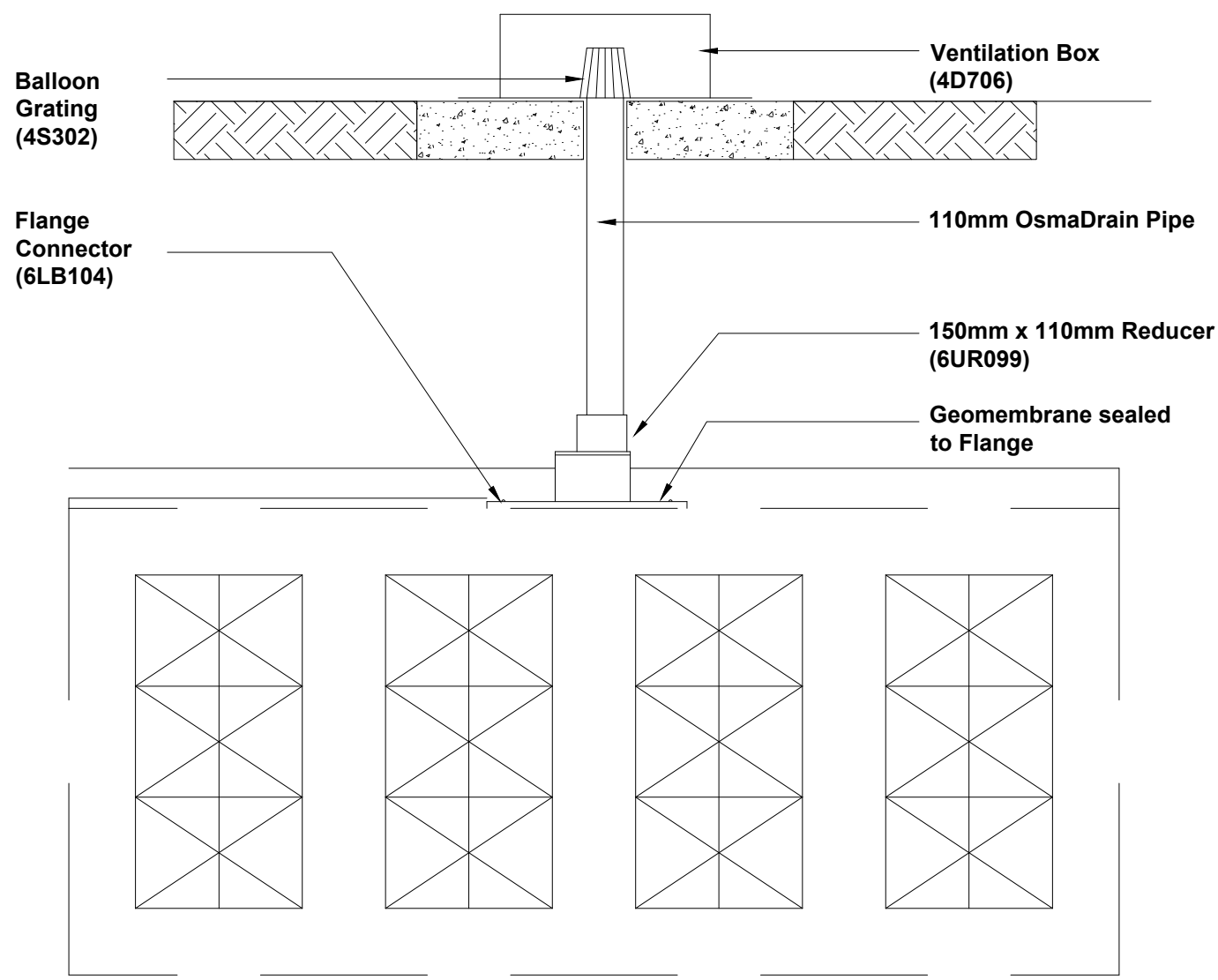
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CIVIL, STRUCTURAL & ARCHITECTURAL DESIGN SERVICES

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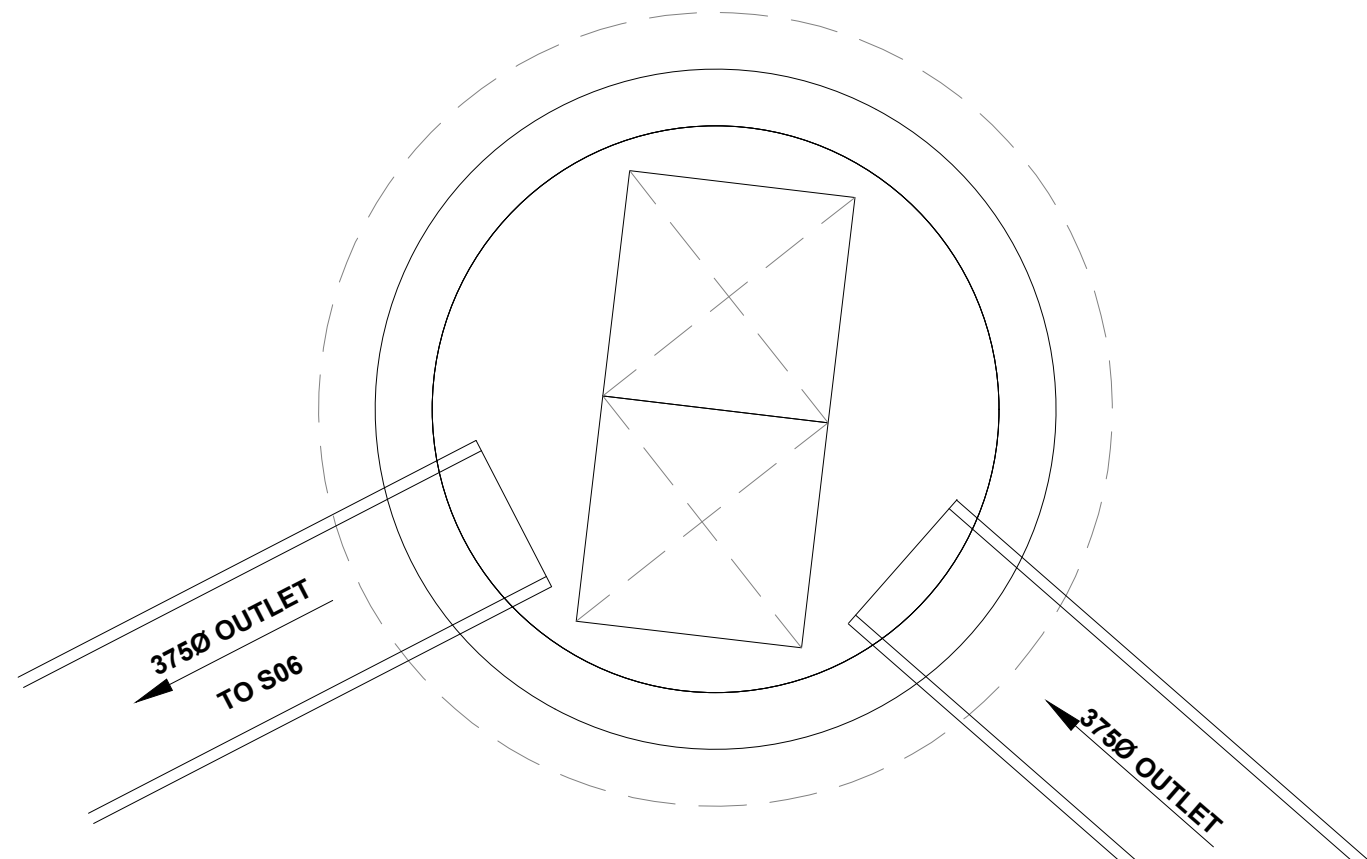
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Date	June 2023	Checked	DA
File	23102 / dwgs / civils / current	Drawing	23102-BGC-D / 321 C

Flow Control Chamber CC01

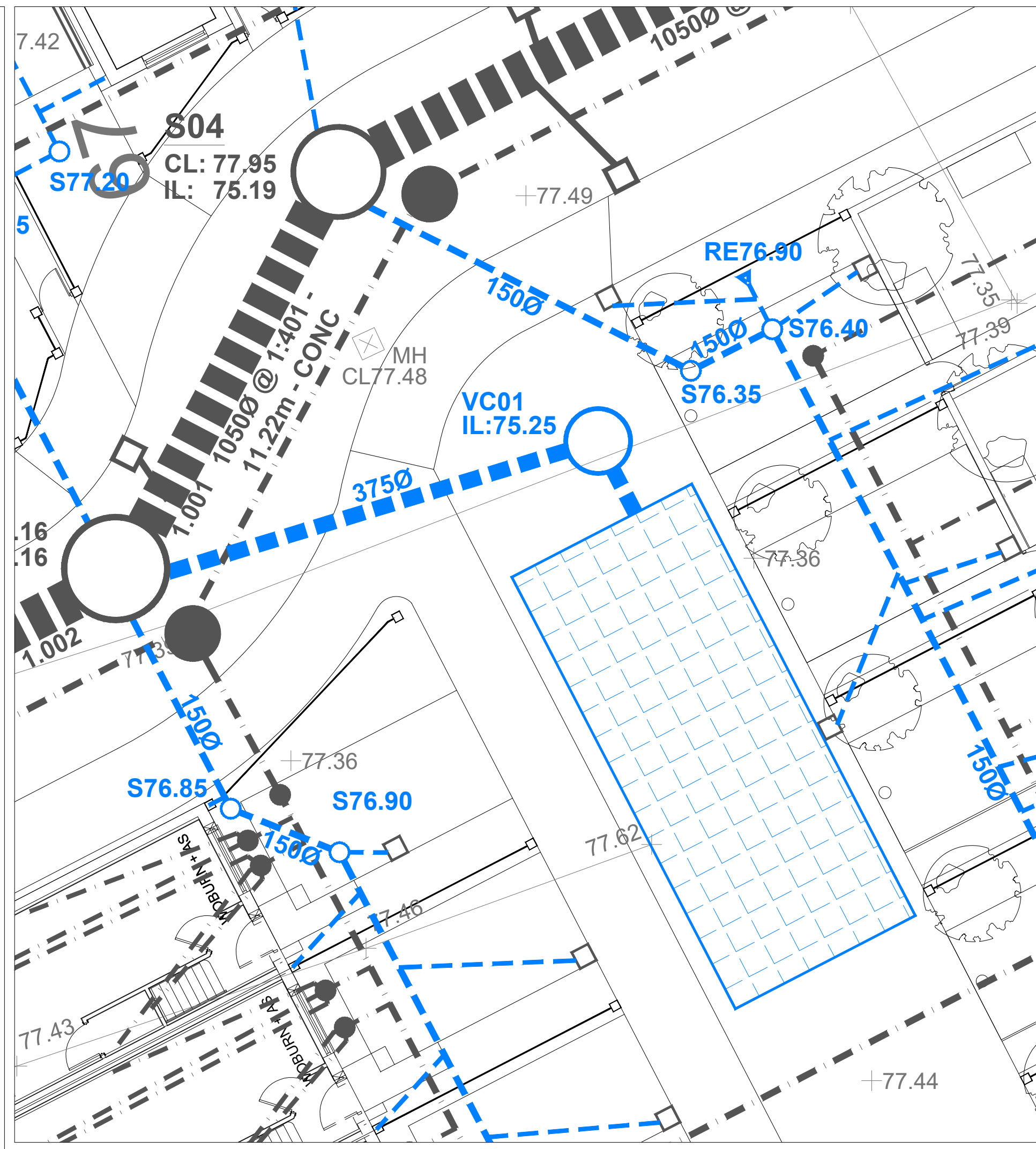


Typical Air Vent Design

Locate vent in suitable non-trafficked area adjacent to tanks.



VALVE CHAMBER (VC01) 1500mmØ Private Storm Catch Pit Chamber



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GENERAL NOTES

- This drawing is to be read in conjunction with relevant architectural and engineering drawings.
- Any discrepancies between the details shown and actual on site conditions to be reported immediately to the engineer prior to commencement of works.
- This drawing is not intended to show details of ground conditions or ground contaminants. Each area of ground relied upon to support any structure depicted (including drainage) must be investigated by the Contractor any areas of formation for said structures which do not accord with the anticipated conditions as described in the site investigation report are to be immediately notified to the Engineer, where applicable. Any suspect fluid ground or ground contaminants on or within the ground should be further investigated by a suitable expert. Any earthworks shown indicate typical slopes for guidance only and should be investigated further by a suitable geotechnical expert.
- Where existing trees are shown to be retained they should be subject to a full Arboricultural inspection for safety. All trees are to be planted so as to ensure they are a minimum of 5 metres from buildings and 3 metres from drainage and services, where applicable. A foundation is to be provided to accommodate the proposed tree planting, where applicable.

BUILDING DRAINAGE NOTES

- Building drainage shall comply with BS EN 752 2008 and the Building Regulations 2002 Part H (updated 2015).
- All SVP, RWP and BIG are indicative and must be confirmed on site using latest architectural plans. Any discrepancies must be reported to Engineer prior to commencement on site.
- All building drainage shall be 100mm diameter unless shown otherwise.
- All building drainage shall be clayware to BS EN 286 or uPVC to BS 4660 and BS EN 1401-1 with Class B or Class 5 bedding unless shown otherwise.
- All pipes under buildings without suspended floors shall have Class 5 bedding.
- Concrete protection shall be provided to all pipes with less than 300mm cover in pedestrian areas, to all pipes with less than 600mm cover in private driveways not used by commercial vehicles, and to all pipes with less than 1200mm cover to roads or private driveways used by commercial vehicles. Where concrete surround is specified flexibility of joints is to be maintained by using compressible bitumen impregnated fibreboard at each joint.
- Where a pipe passes through a wall an opening is to be formed to give at least 50mm clearance around the pipe. Driveway cover shall be supported by a inset. The opening is to be masked each side with rigid sheet material. Pipes embedded in walls shall have a joint formed within 150mm of each wall face. A rocker pipe of maximum 500mm length shall be used to continue the pipework.
- Where a pipe trench is within 1m of a building, the pipe is to be provided with concrete protection and the trench filled with concrete up to a level below the building equal to the distance from the building less 100mm.
- Where the formation of a pipe trench is above original ground level levels are to be made up with well compacted DTP Type 2 material or better.
- Inspection chambers located within garages are to have double seal bolt down covers.
- All private drives which fall towards a public highway and exceed two parking bays in area are to be provided with a suitable gully or drainage channel to prevent water discharging onto the highway.
- Where a driveway falls towards a dwelling it shall be provided with a suitable gully or drainage channel to prevent water damaging the building.
- The invert level of a rodding eye at the head of a surface water drain is to be set 450mm below finished ground level unless shown otherwise.
- The maximum depth of both foul and storm access chambers is 600mm below finished ground level.
- The invert level of an inspection chamber on a foul drain from a building is to be set in accordance with the following table unless otherwise shown. Inspection chambers should be used for connections longer than 12m as stated in Part H. This is assuming a 450mm floor construction thickness and 140 fall to inspection chamber which must be confirmed prior to construction.

Maximum Length of Connection	8m	11m	14m	17m	20m
Minimum Invert Depth below FFL	750mm	825mm	900mm	975mm	1050mm

*Inspection Chamber to be used for connections longer than 12m as stated in Part H.

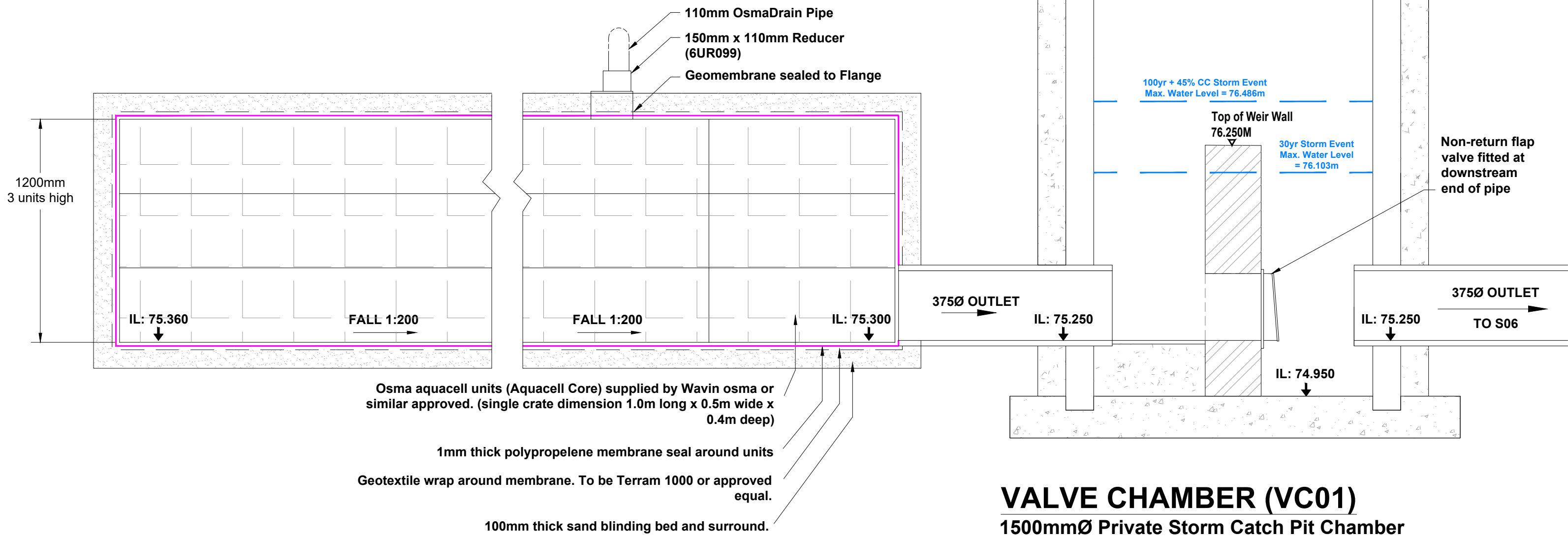
SURFACE WATER STORAGE SYSTEM NOTES

STORAGE SYSTEM DETAIL SHOWN ON THIS DRAWING IS SUBJECT TO A FULL DESIGN BY THE MANUFACTURER.

AQUACELL, GEOMEMBRANE AND GEOTEXTILE TO BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS

FOLLOWING THE INSTALLATION ALL CONNECTING INSPECTION CHAMBERS AND CATCHPITS ARE TO BE INSPECTED TO ENSURE THEY ARE FREE OF SILT AND CONSTRUCTION DEBRIS

VENTING REQUIREMENTS TO BE AGREED WITH MANUFACTURER PRIOR TO CONSTRUCTION



VALVE CHAMBER (VC01) 1500mmØ Private Storm Catch Pit Chamber

Rev.	Description	Date	By
B	Valve chamber amended to weir wall, detail & levels amended to suit 1 outfall.	22/09/2023	LJ
A	Minor amendments to geo-cellular storage / valve chamber design to suit replacement of Carlow Tank with online Concrete storage pipes as requested by client.	18/08/2023	OB
-	First Issue	03/07/2023	OB

Drawing Status

TENDER

SUBJECT TO UNITED UTILITIES SECTION 16A TECHNICAL APPROVAL, AMENDMENTS MAY THEREFORE BE REQUESTED.

Client

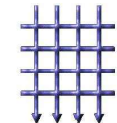


Project

**Louisa Street, Openshaw
Greater Manchester**

Title

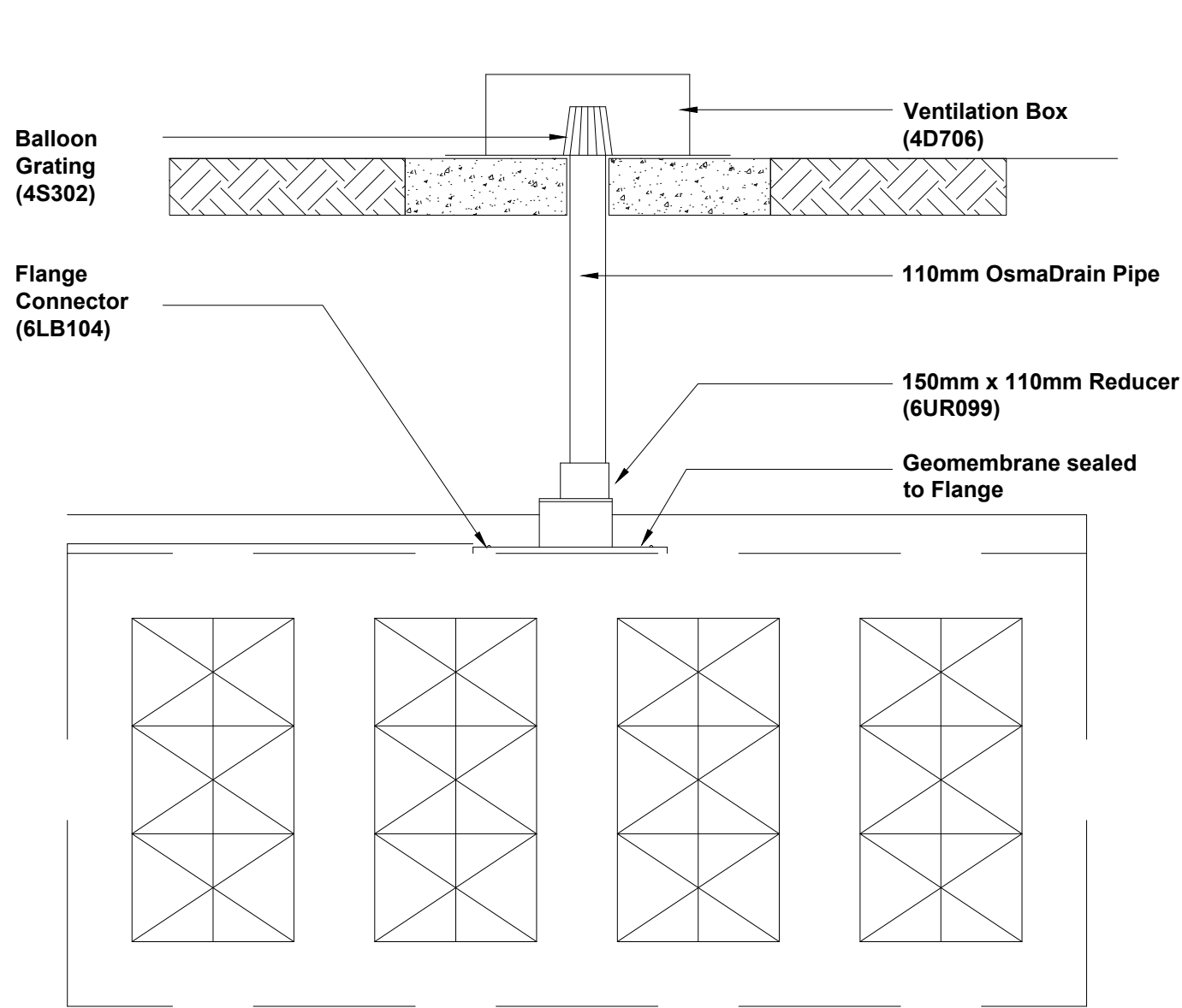
**Private Cellular Storage 01 & Valve Chamber 01
Construction Detail Plan - Sheet 1 of 2**



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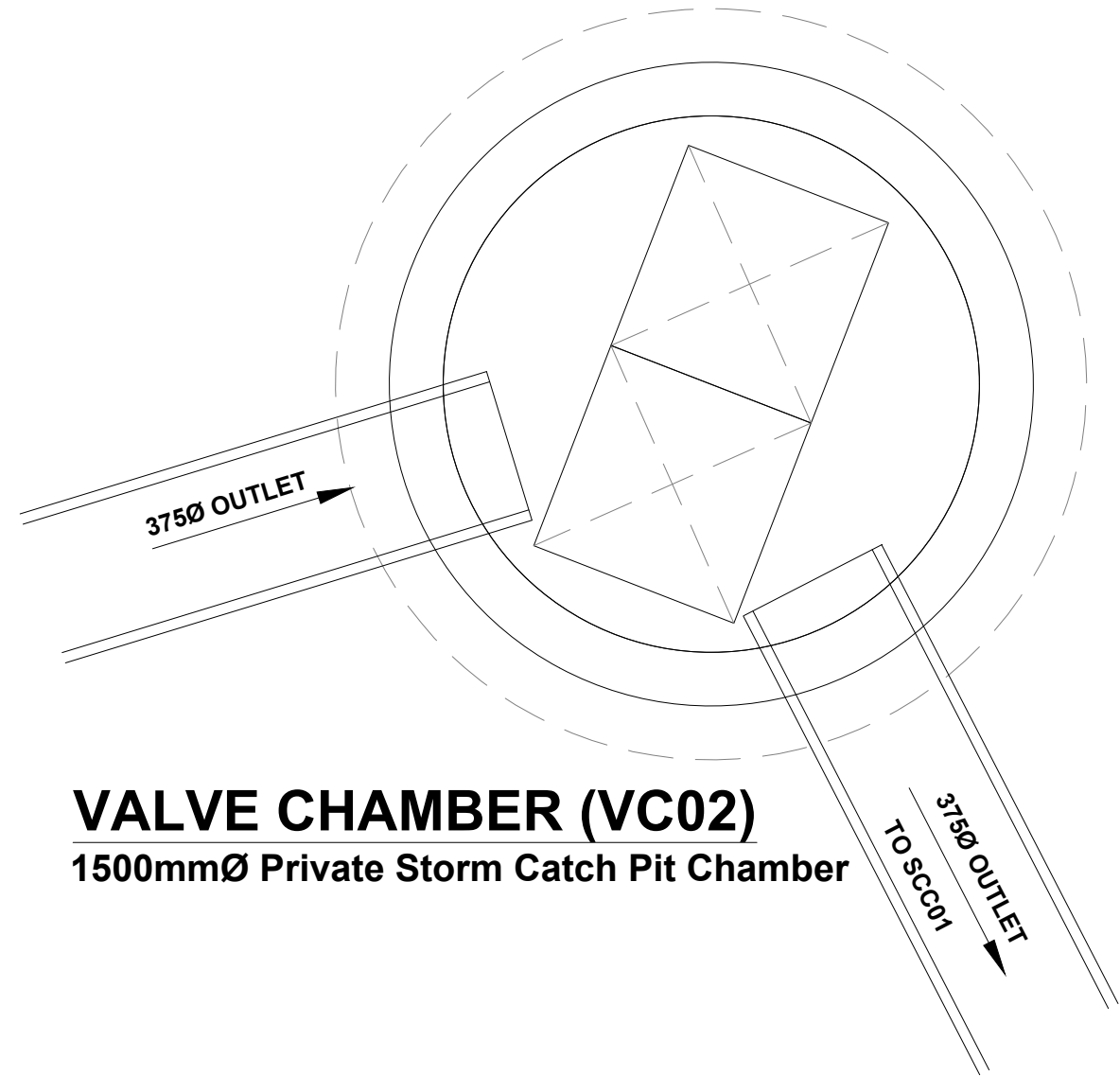
CIVIL, STRUCTURAL & ARCHITECTURAL DESIGN SERVICES
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E-mail: mail@bannersgate.com

Scale	A1 @ 1:20	Drawn	CS
Date	June 2023	Checked	OB
File	23102 / dwgs / civils / current	Drawing	23102-BGC-D / 361 B

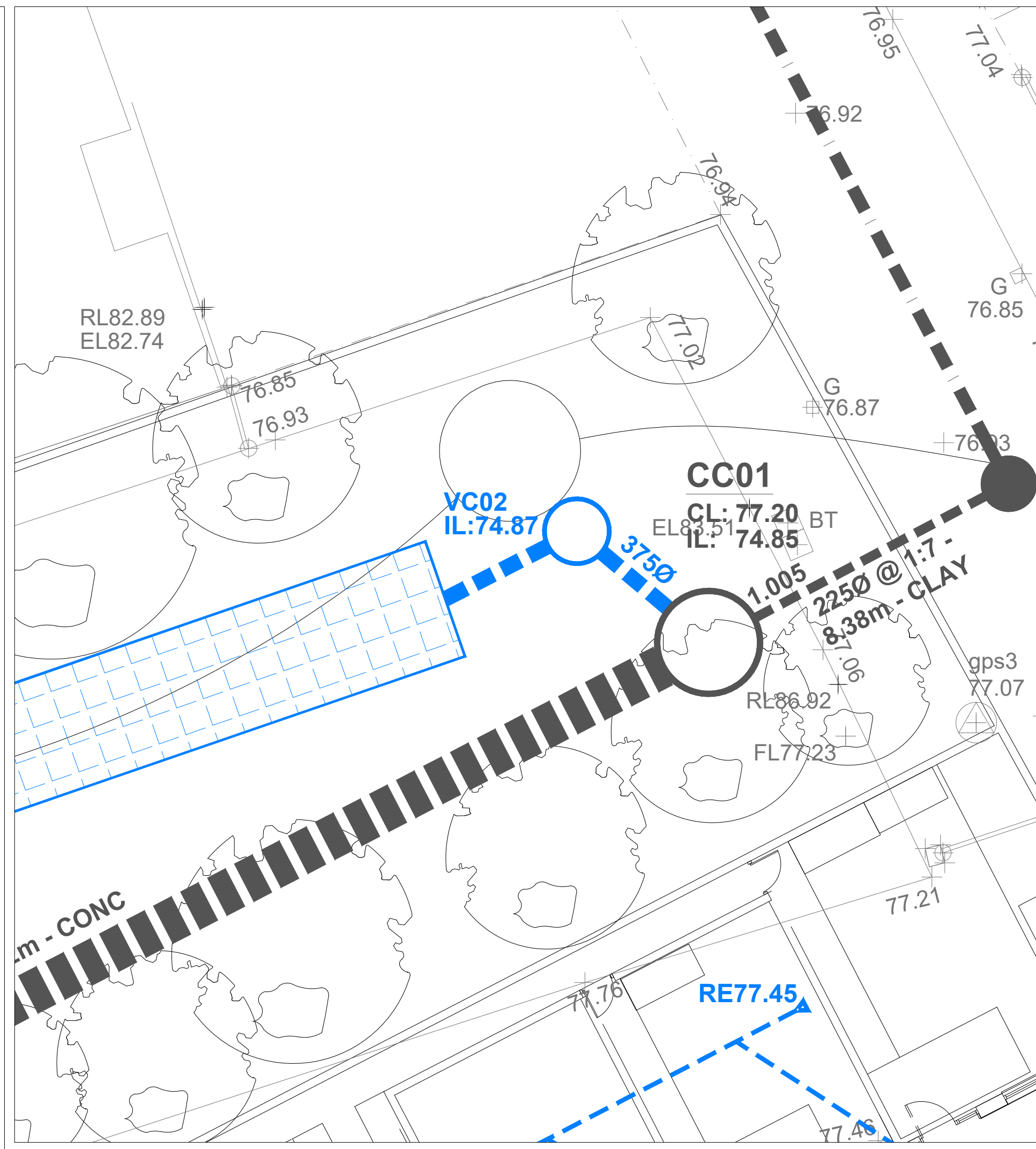


Typical Air Vent Design

Locate vent in suitable non-trafficked area adjacent to tanks.



VALVE CHAMBER (VC02)
1500mmØ Private Storm Catch Pit Chamber



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- GENERAL NOTES**
- This drawing is to be read in conjunction with relevant architectural and engineering drawings.
 - Any discrepancies between the details shown and actual on site conditions to be reported immediately to the engineer prior to commencement of works.
 - This drawing is not intended to show details of ground conditions or ground contaminants. Each area of ground relied upon to support any structure depicted (including drainage) must be investigated by the Contractor any areas of formation for said structures which do not accord with the anticipated conditions as described in the site investigation report are to be immediately notified to the Engineer, where applicable. Any suspect fluid ground or ground contaminants on or within the ground should be further investigated by a suitable expert. Any earthworks shown indicate typical slopes for guidance only and should be investigated further by a suitable geotechnical expert.
 - Where existing trees are shown to be retained they should be subject to a full Arboricultural inspection for safety. All trees are to be planted so as to ensure they are a minimum of 5 metres from buildings and 3 metres from drainage and services, where applicable. A foundation is to be provided to accommodate the proposed tree planting, where applicable.
- BUILDING DRAINAGE NOTES**
- Building drainage shall comply with BS EN 752 2008 and the Building Regulations 2002 part H (updated 2015).
 - All SVP, RWP and BIG are indicative and must be confirmed on site using latest architectural plans. Any discrepancies must be reported to Engineer prior to commencement on site.
 - All building drainage shall be 100mm diameter unless shown otherwise.
 - All building drainage shall be clayware to BS EN 286 or uPVC to BS 4660 and BS EN 1401-1 with Class B or Class 5 bedding unless shown otherwise.
 - All pipes under buildings without suspended floors shall have Class 5 bedding.
 - Concrete protection shall be provided to all pipes with less than 600mm cover in pedestrian areas, to all pipes with less than 650mm cover in private driveways not used by commercial vehicles, and to all pipes with less than 1200mm cover to roads or private driveways used by commercial vehicles. Where concrete surround is specified flexibility of joints is to be maintained by using compressible bitumen impregnated fibreboard at each joint.
 - Where a pipe passes through a wall an opening is to be formed to give at least 50mm clearance around the pipe. Brickwork over shall be supported by a lintel. The opening is to be masked each side with rigid sheet material. Pipes embedded in walls shall have a joint formed within 150mm of each wall face. A rocker pipe of maximum 500mm length shall be used to continue the pipework.
 - Where a pipe trench is within 1m of a building, the pipe is to be provided with concrete protection and the trench filled with concrete up to a level below the building equal to the distance from the building less 100mm.
 - Where the formation of a pipe trench is above original ground level levels are to be made up with well compacted DTP Type 2 material or better.
 - Inspection chambers located within garages are to have double seal bolt down covers.
 - All private drives which fall towards a public highway and exceed two parking bays in area are to be provided with a suitable gully or drainage channel to prevent water discharging onto the highway.
 - Where a driveway falls towards a dwelling it shall be provided with a suitable gully or drainage channel to prevent water damaging the building.
 - The invert level of a rodding eye at the head of a surface water drain is to be set 450mm below finished ground level unless shown otherwise.
 - The maximum depth of both foul and storm access chambers is 600mm below finished ground level.
 - The invert level of an inspection chamber on a foul drain from a building is to be set in accordance with the following table unless otherwise shown. Inspection chambers should be used for connections longer than 12m as stated in Part H. This is assuming a 450mm floor construction thickness and 140 fall to inspection chamber which must be confirmed prior to construction.

Maximum Length of Connection	8m	11m	14m	17m	20m
Minimum Invert Depth below FFL	750mm	825mm	900mm	975mm	1050mm

*Inspection Chamber to be used for connections longer than 12m as stated in Part H.

SURFACE WATER STORAGE SYSTEM NOTES

STORAGE SYSTEM DETAIL SHOWN ON THIS DRAWING IS SUBJECT TO A FULL DESIGN BY THE MANUFACTURER.

AQUACELL, GEOMEMBRANE AND GEOTEXTILE TO BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS

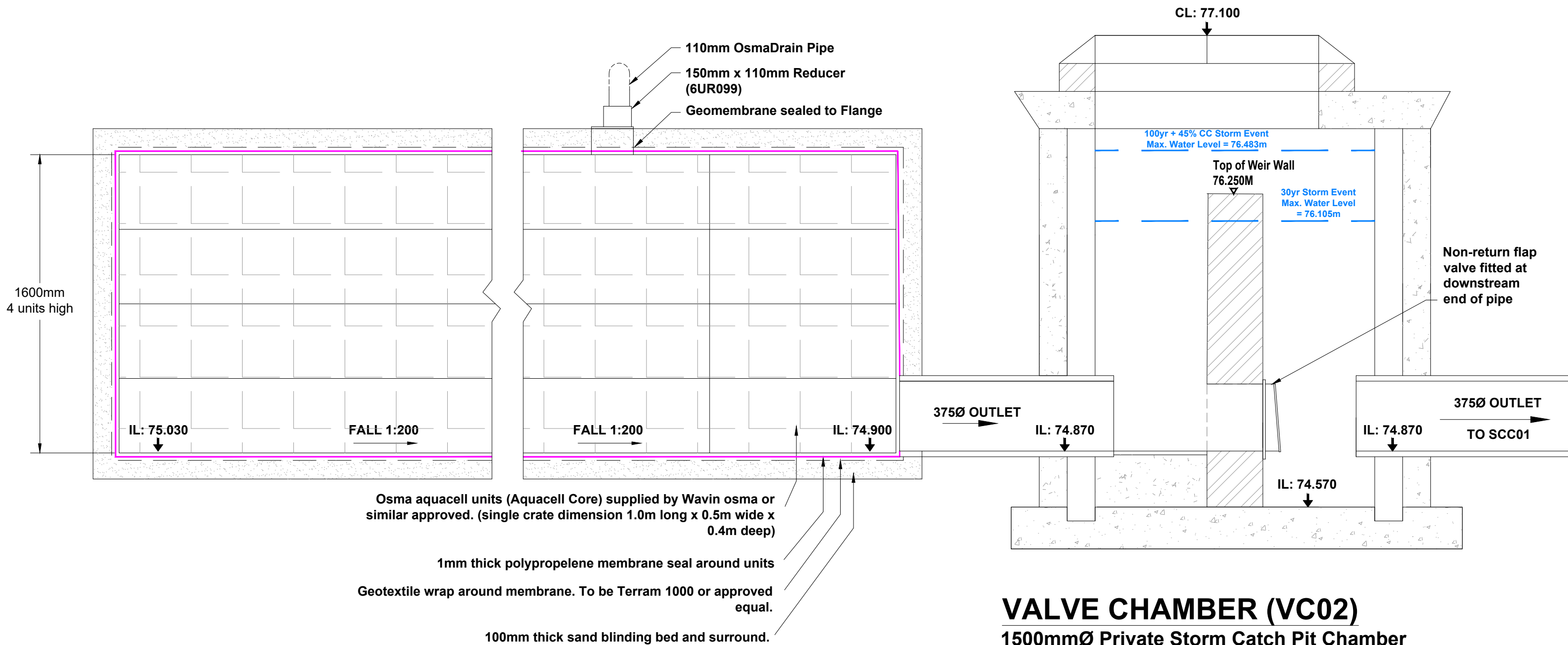
FOLLOWING THE INSTALLATION ALL CONNECTING INSPECTION CHAMBERS AND CATCHPITS ARE TO BE INSPECTED TO ENSURE THEY ARE FREE OF SILT AND CONSTRUCTION DEBRIS

VENTING REQUIREMENTS TO BE AGREED WITH MANUFACTURER PRIOR TO CONSTRUCTION

GEO-CELLULAR STORAGE

Private Offline Aquacell Geo-Cellular Attenuation Tank Section A-A

NB: Specification for socket fittings, adaptors, connectors and venting requirements to be advised and fitted in accordance with manufacturers instructions.



VALVE CHAMBER (VC02)
1500mmØ Private Storm Catch Pit Chamber

Rev.	Description	Date	By
C	Cellular storage orientation changed.	02/10/2023	LJ
B	Valve chamber amended to weir wall, detail & levels amended to suit 1 outfall.	22/09/2023	LJ
A	Minor amendments to geo-cellular storage / valve chamber design to suit replacement of Carlow Tank with online Concrete storage pipes as requested by client.	18/08/2023	OB
-	First Issue	03/07/2023	OB

Drawing Status

TENDER

SUBJECT TO UNITED UTILITIES SECTION 16A TECHNICAL APPROVAL, AMENDMENTS MAY THEREFORE BE REQUESTED.

Client

Westchurch Homes

Project

**Louisa Street, Openshaw
Greater Manchester**

Title

**Private Cellular Storage 02 & Valve Chamber 02
Construction Detail Plan - Sheet 2 of 2**

BANNERS GATE

CIVIL, STRUCTURAL & ARCHITECTURAL DESIGN SERVICES

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E-mail: mail@bannersgate.com

Scale	A1 @ 1:20	Drawn	CS
Date	June 2023	Checked	OB
File	23102 / dwgs / civils / current	Drawing	23102-BGC-D / 362 C

APPENDIX 4

DEVELOPMENT AS BUILT DRAWING

APPENDIX 5

PRODUCT DATA, BBA CERTIFICATION & CQA INSTALLATION INFORMATION

Polypipe Civils

Charnwood Business Park
North Road
Loughborough
Leicestershire LE11 1LE

Tel: 01509 615100 Fax: 01509 610215
e-mail: civilsales@polypipe.com
website: www.polypipe.com



Agrément Certificate
06/4297
Product Sheet 3

POLYSTORM STORMWATER MANAGEMENT SYSTEMS

POLYSTORM-R STORMWATER MANAGEMENT SYSTEM

This Agrément Certificate Product Sheet⁽¹⁾ relates to the Polystorm-R Stormwater Management System, an attenuation and infiltration system comprising recycled polypropylene modular units for use in storm water management systems as below-ground water storage or as a soakaway to manage run-off from impermeable surfaces.

(1) Hereinafter referred to as 'Certificate'.

CERTIFICATION INCLUDES:

- factors relating to compliance with Building Regulations where applicable
- factors relating to additional non-regulatory information where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.



KEY FACTORS ASSESSED

Hydraulic design — data is provided in this Certificate to assist in the design of a below-ground stormwater management system (see section 6).

Structural performance — the system has adequate strength and stiffness to resist long- and short-term loading when used in accordance with this Certificate (see section 7).

Maintenance — data is provided to assist in planning the maintenance of a completed system installation (see section 11).

Durability — the system will have a service life in excess of 60 years when installed in accordance with this Certificate (see section 12).

The BBA has awarded this Certificate to the company named above for the system described herein. This system has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of First issue: 16 April 2014

Brian Chamberlain
Head of Approvals — Engineering

Claire Curtis-Thomas
Chief Executive

The BBA is a UKAS accredited certification body — Number 113. The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk

Readers are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.

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website: www.bbacerts.co.uk

Regulations

In the opinion of the BBA, the Polystorm-R Stormwater Management System, if installed, used and maintained in accordance with this Certificate, will meet or contribute to meeting the relevant requirements of the following Building Regulations (the presence of a UK map indicates that the subject is related to the Building Regulations in the region or regions of the UK depicted):



The Building Regulations 2010 (England and Wales) (as amended)

Requirement:	H3(3)	Rainwater drainage
Comment:		The system can be used in a construction to meet this Requirement. See sections 6.1 to 6.9 of this Certificate.
Regulation:	7	Materials and workmanship
Comment:		The units are acceptable. See section 12 and the <i>Installation</i> part of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)(2)	Fitness and durability of materials and workmanship
Comment:		The units can contribute to satisfying this Regulation. See sections 11.1 to 11.6, 12 and the <i>Installation</i> part of this Certificate.
Regulation:	9	Building standards applicable to construction
Standard:	3.6	Surface water drainage
Comment:		The system can contribute to a construction satisfying this Standard, with reference to clauses 3.6.1 ⁽¹⁾⁽²⁾ to 3.6.5 ⁽¹⁾⁽²⁾ . See sections 6.1 to 6.9 of this Certificate.
Standard:	7.1(a)(b)	Statement of sustainability
Comment:		The units can contribute to meeting the relevant requirements of Regulation 9, Standards 1 to 6 and therefore will contribute to a construction meeting a bronze level of sustainability as defined in this Standard. (1) Technical Handbook (Domestic). (2) Technical Handbook (Non-Domestic).



The Building Regulations (Northern Ireland) 2012

Regulation:	23(a)(i)(iii)(b)	Fitness of materials and workmanship
Comment:		The units are acceptable. See section 12 and the <i>Installation</i> part of this Certificate.
Regulation:	82	Rainwater drainage
Comment:		The system can be used in a construction to satisfy this Regulation. See sections 6.1 to 6.9 of this Certificate.

Construction (Design and Management) Regulations 2007

Construction (Design and Management) Regulations (Northern Ireland) 2007

Information in this Certificate may assist the client, CDM co-ordinator, designer and contractors to address their obligations under these Regulations.

See sections: 3 *Delivery and site handling* (3.3, 3.5 and 3.6) and 15 *Procedure* (15.1 and 15.10) of this Certificate.

Additional Information

NHBC Standards 2014

In the opinion of the BBA, the use of the Polystorm-R Stormwater Management System, in relation to this Certificate, is not subject to the requirements of these Standards.

Technical Specification

1 Description

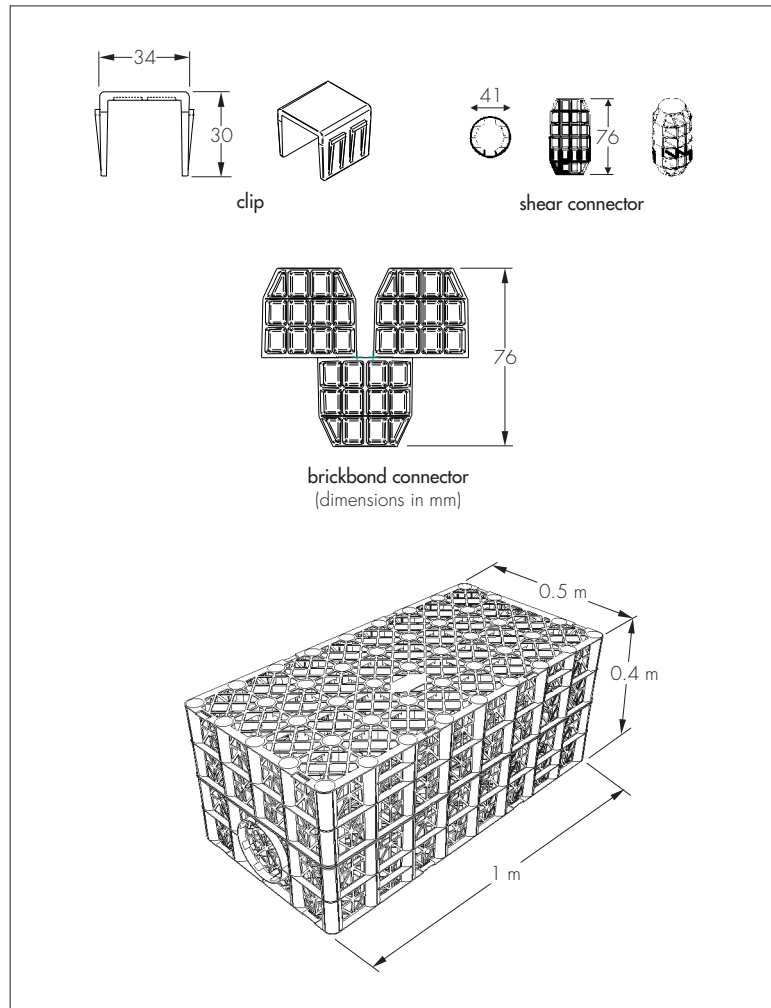
1.1 The Polystorm-R Stormwater Management System comprises modular units manufactured from recycled polypropylene (see Table 1 and Figure 1). The units have pre-formed sockets to enable connection with 160 mm diameter pipework (to BS EN 1401-1 : 1998). Alternatively, connection to 150 mm Ridgidrain, 110 mm or 100 mm pipework is possible using suitable adaptors.

Table 1 Characteristics of modular unit

Characteristic (unit)	Value
Dimensions (nominal) (l x w x h) (mm)	1000 x 500 x 400
Volume (nominal) (m ³)	0.20
Storage volume (nominal) (m ³)	0.19
Porosity (void ratio) (%)	95

1.2 Clips, shear and brick bond connectors are manufactured from black polypropylene and used to secure the units together.

Figure 1 Modular unit and components



1.3 Items used with the units to form a stormwater management system but outside the scope of this Certificate include:

- Adaptors and connecting pipework
- permeable geotextile — wrapped around each assembly when used for infiltration.
- geomembrane — wrapped around each assembly when used for storage (attenuation).
- air vents/connections/pipework
- silt traps
- flow control/chamber devices
- granular material/coarse sand.

2 Manufacture

2.1 The units are manufactured by injection moulding the recycled polypropylene material to one specification.

2.2 As part of the assessment and ongoing surveillance of product quality, the BBA has:

- agreed with the manufacturer the quality control procedures and product testing to be undertaken
- assessed and agreed the quality control operated over batches of incoming materials
- monitored the production process and verified that it is in accordance with the documented process
- evaluated the process for management of nonconformities
- checked that equipment has been properly tested, calibrated and operated by trained personnel
- undertaken to carry out the above measures on a regular basis through a surveillance process, to verify that the specifications and quality control operated by the manufacturer are being maintained.

2.3 The management system of Polypipe Civils has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2000 by BSI (Certificate Q06225).

3 Delivery and site handling

3.1 The units are supplied to site in packs of 12 or 15 units secured to a wooden pallet. Each pack carries a label bearing the product name, quantity, operator initials and pallet number.

3.2 Clips, shear connectors and brick bond connectors are packed in sealed polythene bags of 60, 30 and 30 respectively.

3.3 The unit packs should be carefully placed on level ground and should not be stacked on site. Loose individual units should not be stored more than two units high.

3.4 The units contain an inhibitor to resist the effects of ultraviolet light for up to six months. However, prolonged storage in direct sunlight and high temperatures should be avoided.

3.5 The units should not be stored near fuel bowzers, fuel tanks or other solvents to avoid potential chemical spillages.

3.6 The units are resistant to damage likely to be caused during normal handling. However, they should be stored in locations where impacts from vehicles and other construction plant will be avoided.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on the Polystorm-R Stormwater Management System.

Design Considerations

4 General

4.1 The design of the Polystorm-R Stormwater Management System must be in accordance with the Certificate holder's design guidelines. Guidance on the application of sustainable drainage systems (SUDS) for new developments can also be found in the Communities and Local Government Planning Policy Statement PPS25 and the Construction Industry Research and Information Association (CIRIA) Report C697.

4.2 The system is suitable for the surface water management system of stormwater run-off from impermeable surfaces and can be utilised in two main ways (see Figure 2):

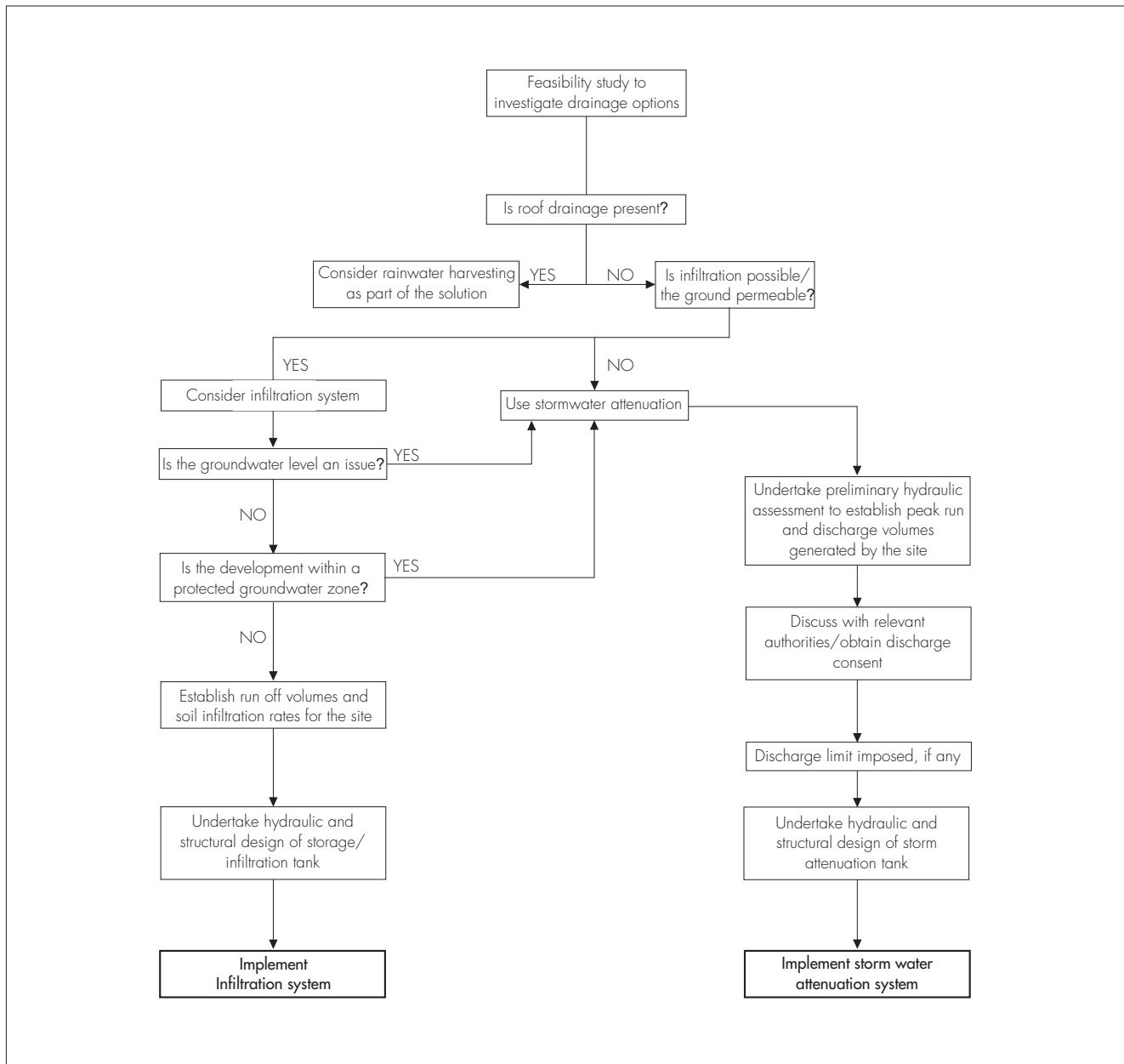
- infiltration — stormwater is collected in the units during rainfall and allowed to drain away by soaking into the surrounding ground over a substantial period of time after rainfall
- attenuation — stormwater is collected in the units during rainfall and released at a reduced flow rate through a flow control device into an appropriate outfall. This reduces peak flows in the watercourse and thereby, minimising the risk of flooding
- a combination of infiltration and attenuation.

4.3 Design of the appropriate system for a specific project must always be preceded by a detailed audit of the proposed site to establish:

- existing factors and considerations applicable to the site
- predicted factors relating to the site's use following the planned development, and the parameters within which the installation is required to function
- the type of function of application suggested by this audit.

4.4 Once the project criteria have been established from the site audit, there are two main parts to the design procedure of individual installations; hydraulic design and structural design.

Figure 2 Sustainable drainage system selection and design



5 Practicability of installation

The system is designed to be installed by a competent general builder, or a contractor, experienced with this type of system.

6 Hydraulic design

Infiltration

Calculation principles



6.1 There are two approaches, either of which may be adopted: the Construction Industry Research and Information Association (CIRIA) Report 156 or BRE Digest 365. Further information on the design of SUDS may be obtained from CIRIA Report C697.

6.2 A simplified approximate approach can be used on a small site (ie a single-house development), where detailed site infiltration rate information may not be required nor available (see Table 2). From Approved Document H of the England and Wales Building Regulations, a storage volume equal to the area to be drained multiplied by 10 mm, for areas up to 25 m² is allowed. Beyond this size, design should be carried out in accordance with BS EN 752 : 2008 or BRE Digest 365. It is suggested in BS EN 752 : 2008 that a storage volume equal to 20 mm multiplied by the area to be drained may be used. In Scotland, guidance for the design of single-house soakaways is given in Mandatory Standard 3.6, clause 3.6.5⁽¹⁾

(1) Technical Handbook (Domestic).

Table 2 Simplified soakaway design for single-house development⁽¹⁾

Number of units	Storage volume (m ³)	Maximum area to be drained (m ²)
1	0.19	19.0 ⁽²⁾
2	0.38	25.0 ⁽²⁾
3	0.57	28.5 ⁽³⁾
4	0.76	38.0 ⁽³⁾
5	0.95	47.5 ⁽³⁾
6	1.14	57.0 ⁽³⁾

(1) When doubt exists over suitability of ground for infiltration permeability, figures should be derived by test (see BRE Digest 365).

(2) In accordance with Approved Document H.

(3) In accordance with BS EN 752 : 2008, clause NA 4.4.8.

6.3 When the BRE or CIRIA approach is used, the design volumes and areas for trench or cuboid type installations can be found from Tables 3 and 4.

Table 3 Data for use in hydraulic design — one unit wide trench configurations

Number of units high	System volume (m ³)	Vertical surface area around sides and ends of tank (m ²)	Surface area beneath base of tank (m ²)
1	0.19	1.2	0.5
2	0.38	2.4	0.5

Table 4 Data for use in hydraulic design — three-dimensional system, two units high

System length (units long) (1 m side)	2 wide (0.5 m side)			4 wide (0.5 m side)			8 wide (0.5 m side)		
	volume (m ³)	side (m ²)	base (m ²)	volume (m ³)	side (m ²)	base (m ²)	volume (m ³)	side (m ²)	base (m ²)
1	0.76	3.2	1.0	1.52	4.8	2.0	3.04	8.0	4.0
2	1.52	4.8	2.0	3.04	6.4	4.0	6.08	9.6	8.0
4	3.04	8.0	4.0	6.08	9.6	8.0	12.16	12.8	16.0
8	6.08	14.4	8.0	12.16	16.0	16.0	24.32	19.2	32.0
10	7.60	17.6	10.0	15.20	19.2	20.0	30.40	22.4	40.0
100	76.00	161.6	100.0	152.00	163.2	200.0	304.00	166.4	400.0

6.4 For calculations, the size and volume of the units are given in Table 1. The total areas of the base and sides are required as water is absorbed through the geotextile soil interface. Storage volume is 95% of the total volume. As an example, using Table 4, for a typical system 1 metre wide (two units) linear trench 40 m long and two units high, the volume is 0.76 x 40 = 30.4 m³ and the side area 3.2 x 40 = 128 m².

Attenuation

Calculation principles

6.5 The anticipated total run-off volume from the site is estimated. The most commonly-used method for evaluating storm rainfall events in the UK is the Wallingford Procedure by which the total rainfall level of storms over defined time periods ranging from five minutes up to 48 hours is assessed. The allowable discharge rate from the site to an appropriate outfall is established, which will normally be set by the Environment Agency, Scottish Environmental Protection Agency or Planning Authorities. The volume to be stored underground in the system is then determined and the number of units needed to contain this volume is calculated on the basis that the storage volume is equal to 95% of the total volume of the system.

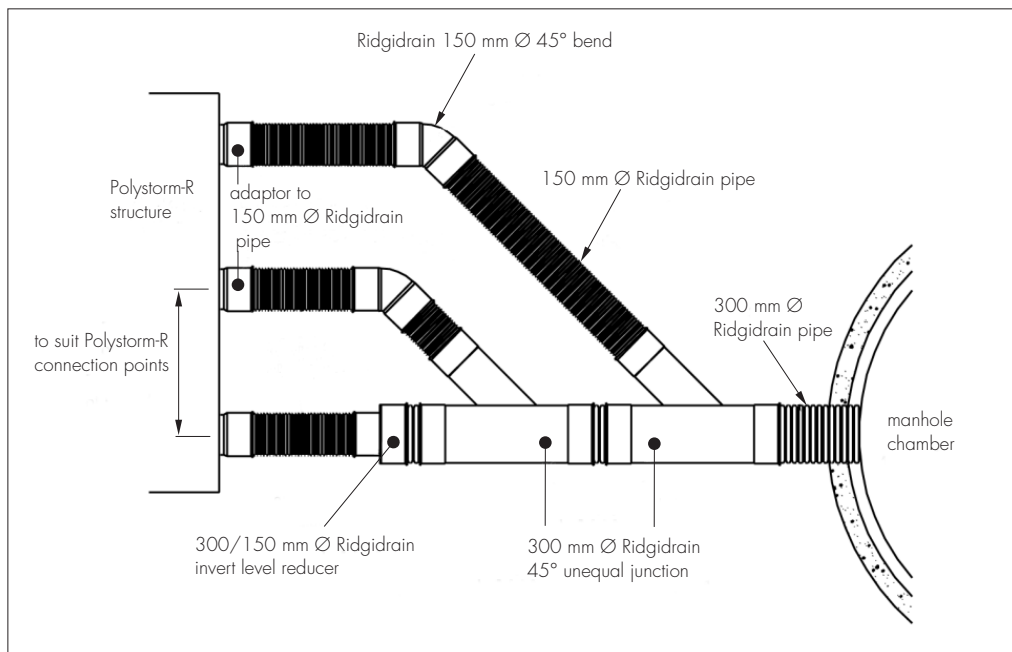
Connections

6.6 Connection is made to the system using a preformed socket and adaptor.

Manifold design

6.7 The units are manufactured to allow a connection to be formed by insertion of 160 mm diameter BS EN 1401-1 : 2009 pipes into the convenient knock-out incorporated in each cell. The capacity of a 160 mm pipe is limited and may be insufficient for the anticipated design flow. The flow may be split amongst a number of 160 mm pipes connected to a manifold to provide increased hydraulic capacity (see Figure 3). The system designer should ensure the pipework connecting the Polystorm-R units to the drainage system has sufficient capacity to cope with the design flow.

Figure 3 Typical manifold design



Flow control

6.8 The outflow from the system must be controlled to comply with the discharge rate consent of the site. The main methods to achieve outflow control are: orifice plate, vortex control or small pipe. Comparative features and benefits of these various control flow devices should be considered prior to selection.

Outflow positioning and head calculations

6.9 The invert level of the outflow pipe should be flush with the bottom of the lowest unit to allow the system to drain. As the system fills, a depth of water develops on the upstream side of the outflow control. For a system with two layers of units, this depth is 0.8 m when the units are full, creating a driving head to push the flow through the control device. For design purposes, the head used in calculations is taken as that at the invert line of the outflow device.

7 Structural performance

General

7.1 The structural design of each installation incorporating the system should be verified by a suitably qualified and experienced engineer.

7.2 Guidance on the design and installation of systems incorporating the units can be found in CIRIA Report C680. Consideration should be given to the effects of cumulative deflection in systems comprising several layers of units.

7.3 The system can be placed under landscaped or car park areas. For areas where greater loads are anticipated, these applications are outside the scope of this Certificate. Advice should be sought from the Certificate holder.

7.4 Care should be taken when the system is used for infiltration below trafficked areas and close to structures. It is important to ensure that the infiltrating water will not soften the soils or cause loss of fines and settlement.

7.5 The engineer responsible for the design of the installation must confirm that the ground-bearing capacity at the formation level is sufficient for the proposed operational loads. In areas of weak or compressible soils, advice should be sought from a geotechnical engineer.

7.6 When the system is wrapped in an impermeable geomembrane and placed below the groundwater table, flotation may occur. To prevent this, the weight of the soil over the top of the system must be greater than the uplift force caused by the system's buoyancy in the water. This can be achieved with most types of fill if the depth of cover fill is equal to, or greater than, the depth of penetration of the system below groundwater level.

Unit performance characteristics

7.7 Characteristic compressive strength at the yield point and elastic deflection values for the system have been determined from independent, short-term tests (see Table 5).

Table 5 Short-term performance values

Element (unit)	Value
Characteristic compressive strength at yield ($\text{kN}\cdot\text{m}^{-2}$)	
vertical loading on top face	610
lateral loading on side face	63
Short-term deflection (mm per $\text{kN}\cdot\text{m}^{-2}$) (applied load)	
vertical loading on top side face	1 per 60
lateral loading on side face	1 per 4.4

7.8 The following equations have been established from creep tests, on a single unit, exceeding 9,000 hours and can be used to estimate the long-term vertical and lateral deflection for periods up to 60 years at 20°C (see Table 6).

Table 6 Equations for estimating long-term creep deflection

For loads up to ($\text{kN}\cdot\text{m}^{-2}$)	Equation for estimation of long-term deflection
162 (vertical)	Deflection = $0.2798 \ln [\text{time (hours)}] + 0.4855$
31 (lateral)	Deflection = $1.0192 \ln [\text{time (hours)}] - 3.8674$

7.9 The following partial load and material factors, as defined in CIRIA Report C680, should be used for design (Table 7).

Table 7 Partial factors for loads and materials

Description	Ultimate limit state	Serviceability limit state
Partial factors for loads		
Vertical dead-load (F_{dl})	1.40	1.00
Earth pressure (horizontal) + hydrostatic (horizontal) load (F_{ep})	1.35	1.00
Imposed live-load (F_{ll})	1.60	1.00
Partial safety factors for materials (F_m)	2.75	1.50

7.10 Example maximum installation depths and minimum depths of cover calculated as described in this section and in accordance with CIRIA Report C680 are shown in Tables 8, 9 and 10:

For small-scale applications such as soakaways for individual house roof drainage — the system is located below a garden a minimum of 5 m from the building, inaccessible to motor vehicles. Table 8 indicates the maximum depth and minimum cover.

Table 8 Design criteria for use of Polystorm-R as soakaway for an individual house⁽¹⁾

Criterion	Value
Maximum depth to base of system (m)	2.74
Minimum depth of cover required over system to prevent accidental damage (m)	0.50

(1) The following assumptions apply:

- soakaway constructed in sandy gravels with a soil weight not exceeding $20 \text{ kg}\cdot\text{m}^{-3}$ and angle of shearing resistance for surrounding soil not less than 30°
- groundwater at least one metre below the base of the units
- soakaway located beneath small gardens or landscaped areas, no vehicles in accordance with CIRIA C680, Table 4.2.

For installation below landscaped and lightly-trafficked areas — the information given in Tables 9 and 10 are only applicable in temperate climate conditions such as those in the UK. Site specific calculations should be carried out for configurations and prevailing ground conditions other than those shown.

Table 9 Maximum installation depths (to base of system)

Typical soil type	Soil weight (kN·m ⁻³)	Angle of friction (φ)	Maximum installation depth (from invert of structure) (m)			
			No groundwater present		Groundwater level 1.0 m below ground level (attenuation structure)	
			Trafficked (cars only) ⁽¹⁾	Non-trafficked ⁽²⁾	Trafficked (cars only) ⁽¹⁾	Non-trafficked ⁽²⁾
Over consolidated stiff clay	20	24°	1.96	2.21	1.65	1.79
Silty sandy clay	19	26°	2.22	2.48	1.76	1.90
Loose sand and gravel	18	30°	2.74	3.02	1.93	2.06
Medium-dense sand and gravel	19	34°	3.09	3.35	1.98	2.09
Dense sand and gravel	20	38°	3.51	3.76	2.08	2.18

(1) Trafficked areas taken as driveways to individual houses and car parks with height barrier to limit vehicle size with vehicles up to 3,000 kg gross vehicle weight (GVW), defined in CIRIA C680, Table 4.2.

(2) Non-trafficked areas taken as small gardens or landscaped areas where no vehicles are used, defined in CIRIA C680, Table 4.2.

Notes:

- Calculations are based on tanks comprising two layers of units.
- The load spread through asphaltic surfaces (for trafficked areas) is assumed to be 27°. The load spread through landscaped areas is taken as φ.
- Ground surface is horizontal.
- Shear planes or other weaknesses are not present within the structure of the soil.
- Weight of ground water taken as 10 kN·m⁻³.
- Accidental loading is not considered.
- Partial load and material factors shall be as defined in Table 7.

Table 10 Minimum cover depths over Polystorm-R

Live load conditions	Landscaped area ⁽¹⁾	Trafficked	
		Car park with vehicle mass <3000 kg ⁽²⁾	Car park with occasional vehicle mass <9000 kg ⁽³⁾
Minimum cover depth required (m)	0.50	0.50	0.85

(1) Landscaped areas taken as small gardens or landscaped areas where no vehicles are used, defined in CIRIA C680, Table 4.2.

(2) Trafficked areas taken as driveways to individual houses and car parks with height barrier to limit vehicle size with vehicles up to 3,000 kg gross vehicle weight (GVW), defined in CIRIA C680, Table 4.2.

(3) Trafficked areas taken as car parks with vehicles up to 9,000 kg gross vehicle weight (GVW), defined in CIRIA C680, Table 4.2.

Notes:

- Calculations are based on tanks comprising one layer of units.
- Assumes angle of friction of the surrounding soil of 38° and a soil weight of 20 kN·m⁻³. Groundwater must be at least one metre below base of units.
- The load spread through asphaltic surfaces (for trafficked areas) is assumed to be 27°. The load spread through landscaped areas is taken as φ.
- Ground surface is horizontal.
- Shear planes or other weaknesses are not present within the structure of the soil.
- Calculations based on there being no groundwater present.
- Accidental loading is not considered.
- Partial load and material factors shall be as defined in Table 7.

8 Geotextiles and geomembranes

Infiltration

8.1 The system requires a geotextile wrapping when used as an infiltration device to prevent:

- silt that may be contained in the surface water run-off from contaminating the surrounding soil, in addition to reducing its permeability
- surrounding soil from entering the units.

8.2 Selection of an appropriate geotextile requires careful consideration (see section 8.6).

Attenuation

8.3 The system requires a sealed geomembrane wrapping to create an attenuation storage tank and prevent:

- the release of surface water into the surrounding ground
- inflow of groundwater that may overload downstream systems and contain pollutants on contaminated sites.

8.4 Site conditions may require the use of a thick, protective geotextile to prevent puncture or excessive strain in the geomembrane, on which further advice should be sought from the geomembrane manufacturer.

8.5 Selection of an appropriate geomembrane requires careful consideration (see section 8.6).

8.6 A recognised design methodology is to follow these steps:

- define the application filter requirements — retention (attenuation storage) or permeability (soakaway)
- define boundary conditions — site investigation to establish in-situ soil parameters, enabling lateral earth pressures and water flow conditions to be calculated

- determine soil retention requirements — using the in-situ soil parameters, determine if additional bed and surround measures should be specified
- determine geosynthetic permeability requirements — the breakthrough head should be considered in addition to water flow rates
- determine anti-clogging requirements (infiltration only) — ensure that the porosity of the geotextile in conjunction with the specified bed and surround is sufficient to prevent the geotextile from prematurely clogging
- determine resistance to mechanical damage requirements — the geosynthetic should be sufficiently robust to survive installation activities
- determine durability requirements — consideration should be given as to whether the geosynthetic will be subjected to a significant chemical exposure, either present in the ground or rainwater run off
- miscellaneous design considerations:
 - intrusion of geosynthetic into drainage layer
 - biological and bio-chemical clogging factors
 - safety factors.

8.7 All joints should be sealed, using proprietary techniques recommended by the manufacturer. Advice on seam testing procedures is given in CIRIA Report SP124.

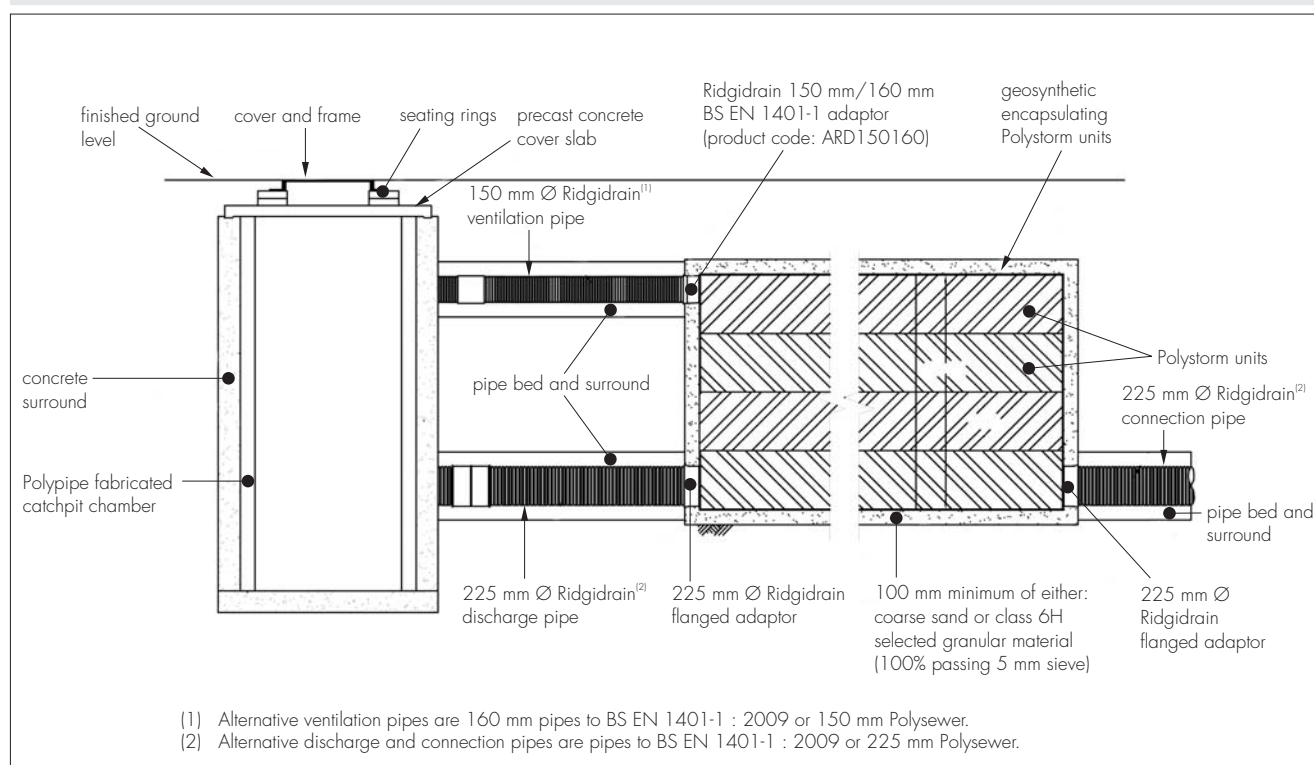
8.8 The designer/installer should confirm with the geosynthetic manufacturer that the specification of the proposed material is suitable for the application and site conditions by following the design methodology (see section 8.6).

9 Venting

9.1 Adequate venting must be provided to the system. As a minimum, one 110 mm diameter air vent is required per 7500 m² of impermeable catchment area to be drained (see Figure 4). Air vent connections and pipework for use with this system are outside the scope of this Certificate.

9.2 Typical air vent connectors and pipework can be seen in the Certificate holder's *Design Manual*. It is recommended that all air vent installations in storage applications (using a geomembrane) are made using a flange adaptor. Thermal welding, adhesive or double-sided tape should be used between the geomembrane and flange adaptor to ensure a watertight seal.

Figure 4 Typical Polystorm-R arrangement including ventilation pipe



10 Resistance to chemicals

10.1 An assessment by the BBA indicates that the components of the system are suitable for use in contact with the chemicals likely to be found in rainwater.

10.2 An assessment of the suitability for use of the system on brownfield sites should be made only after a suitable site (outside the scope of this Certificate) investigation to determine the possibility for chemical attack. Particular care must be taken where acids and organic solvents are present at high concentrations. Further information can be obtained from the Certificate holder.

11 Maintenance

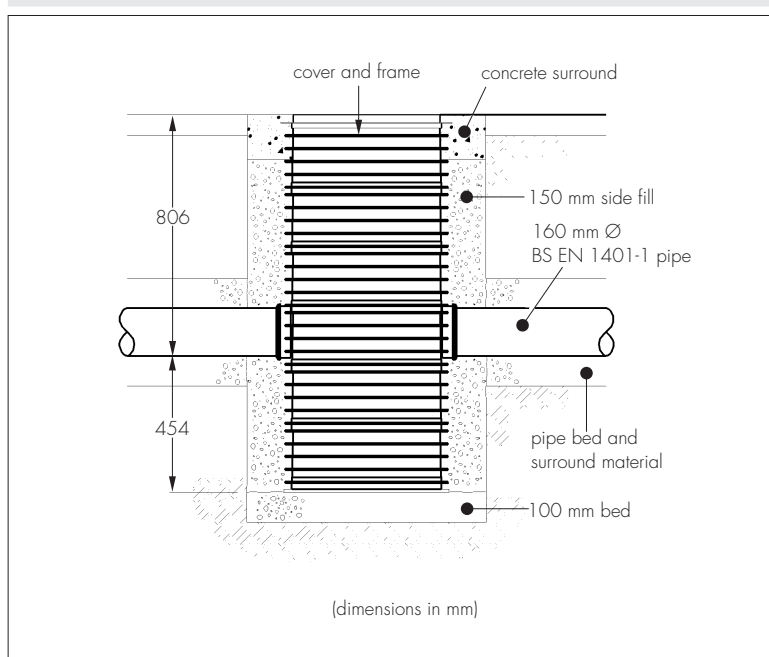
 11.1 The owner of the structure is responsible for maintenance.

11.2 For soakaways to individual houses, the only necessary maintenance of the system is to keep all gullies clear of debris such as leaves.

11.3 For large installations or where the receiving waters are environmentally sensitive, a system of regular inspections should be established to prevent siltation of the system which, if allowed to develop, would reduce effectiveness. They should also be inspected after every major storm event.

11.4 It is recommended that a silt trap is incorporated into the pipework at the inlet to the tank (see Figure 5). There must be a maintenance plan that ensures regular cleaning of the trap to ensure correct performance.

Figure 5 Typical silt trap



11.5 For all flow control devices it is sensible to incorporate access (via a manhole or similar) to the location of the pipe entry, orifice or vortex control. This will enable easy removal of any blockage. The orifice itself may be protected by a debris screen.

11.6 Paved surface areas above an installation should be inspected at the same time to ensure the system continues to provide the required structural support.

12 Durability

 The structural properties of the recycled polypropylene used in the components of the system will deteriorate with time and should be taken into account at the design stage by the application of suitable safety factors. In the opinion of the BBA, the system, when used in accordance with this Certificate, will have a life in excess of 60 years.

13 Reuse and recyclability

The units consist of polypropylene material which is readily recyclable.

14 General

The Polystorm-R Stormwater Management System should be installed in accordance with the Certificate holder's installation instructions and relevant legislation. Special attention should be paid to temporary work requirements in excavations.

15 Procedure

15.1 The hole or trench is excavated to the required plan, dimensions and level ensuring that the excavation will allow installation of connecting pipework. It must be ensured that sufficient construction plant access is maintained for reinstating around the installed system. The base must be smooth and level without sharp drops or humps. Slopes must be cut to a safe angle or adequately supported and safe access must be provided to allow personnel to enter the excavation. Excavation should be carried out in accordance with BS 6031 : 2009, with particular attention paid to safety procedures.

15.2 It must be ensured that the ground-bearing capacity at formation level is adequate for the design loads.

15.3 The base must be inspected for soft spots in the formation — any present must be excavated and replaced with compacted granular fill material.

15.4 For an attenuation application, a 100 mm thick bedding layer of coarse sand is laid on the base of the excavation. The geotextile protection fleece is laid on base and sides, if required. The geomembrane is laid over the sand bedding/fleece and up the sides of the excavation. Joints should be made in accordance with the manufacturer's recommendations with allowance made for connecting pipework or adaptors. The geomembrane and joints are inspected for damage.

15.5 For an infiltration application, a 100 mm thick bedding of either coarse sand or Class 6H selected granular material [with 100% passing the 5 mm sieve, in accordance with the Manual of Contract Documents for Highway Works (MCHW), Volumes 1 and 2] is laid on the base of the excavation. The geotextile is laid over the bedding and up the sides of the excavation and joints formed in accordance with the manufacturer's recommendations, and allowance made for connecting pipework or adaptors.

15.6 The system is installed in accordance with the installation schedule for correct orientation. Wherever possible, continuous vertical joints should be avoided. The units are arranged within the system so that preformed sockets are in the correct alignment for inlet and outlet pipes. For single-layer applications, Polystorm clips (four per unit) are used only and for multi-layers Polystorm clips, in conjunction with shear connectors and brick-bond connectors (when using brick-bond arrangement) are used.

15.7 The geotextile or geomembrane encapsulation to base, sides and top of installation, including protective geotextile (where required) is completed. Geomembranes must be welded in accordance with the manufacturer's recommendations. The geomembrane and/or geotextile are inspected for damage and all welds are tested as required.

15.8 Drainage connections are made to the installation using proprietary adaptors. Preformed socket positions for pipe connections must be located at the correct position for receiving pipework. In attenuation applications, all pipe connections penetrating the geomembrane must be adequately sealed.

15.9 The installation is backfilled around the side of the encapsulated system to form a 100 mm layer of coarse sand or Class 6H selected granular material immediately adjacent to the system. Any remaining excavated areas around the system are backfilled with Class 6N or 6P selected granular material in accordance with the MCHW, Volumes 1 and 2. The backfill is compacted in 150 mm layers.

15.10 A coarse sand protection layer 100 mm thick should be placed over the top of the system that are wrapped in either a geotextile (infiltration system) or a geomembrane with protective geotextile (attenuation system). Backfilling is continued with:

- trafficked areas (eg restricted access car parks) — Type 1 or 2 sub-base material compacted in 150 mm layers in accordance with the MCHW, Volumes 1 and 2. Compaction plant over the top of the system must not exceed 2300 kg per metre width. Where the system is to be installed beneath a paved area the pavement sub-base may form part of the backfill material provided minimum cover depths are maintained
- landscaped and non-trafficked areas — selected as-dug material with size of particles less than 40 mm within 300 mm of top of system. Above this level selected as-dug material may be used. Backfill is placed and compacted in layers no greater than 300 mm thick. Compaction plant over top of system must not exceed 2300 kg per metre width.

15.11 The pavement construction or landscaping is completed over the system.

16 Tests

Tests were carried out on the system to determine:

- short-term resistance to vertical and horizontal loading
- long-term resistance to vertical and horizontal loading
- volumetric capacity.

17 Investigations

17.1 The manufacturing process was examined including the method adopted for quality control, and details obtained on the quality and composition of the material used.

17.2 An assessment of the system was made in relation to:

- material properties
- design procedures.

17.3 A site visit was made to assess the practicability and ease of installation and connection.

Bibliography

BRE Digest 365 *Soakaway Design*.

BS 6031 : 2009 *Code of practice for earthworks*

BS EN 752 : 2008 *Drain and sewer systems outside buildings*

BS EN 1401-1 : 2009 *Plastics piping systems for non-pressure underground drainage and sewerage. Unplasticized poly(vinylchloride) (PVC-U) — Specifications for pipes, fittings and the system*

BS EN ISO 9001 : 2000 *Quality management systems — Requirements*

CIRIA Report 156 *Infiltration drainage — Manual of good practice*

CIRIA Report C680 *Structural design of modular geocellular drainage tanks*

CIRIA Report C697 *The SUDS manual*

CIRIA Report SP124 : 1996 *Barriers, liners and cover systems for containment and control of land contamination*

Manual of Contract Documents for Highway Works, Volume 1 *Specification for Highway Works*

Manual of Contract Documents for Highway Works, Volume 2 *Notes for Guidance on the Specification for Highway Works*

PPS25, *Development and Flood Risk*.

18 Conditions

18.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is issued only to the company, firm, organisation or person named on the front page — no other company, firm, organisation or person may hold or claim that this Certificate has been issued to them
- is valid only within the UK
- has to be read, considered and used as a whole document — it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

18.2 Publications, documents, specifications, legislation, regulations, standards and the like referenced in this Certificate are those that were current and/or deemed relevant by the BBA at the date of issue or reissue of this Certificate.

18.3 This Certificate will remain valid for an unlimited period provided that the product/system and its manufacture and/or fabrication, including all related and relevant parts and processes thereof:

- are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA
- continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine
- are reviewed by the BBA as and when it considers appropriate.

18.4 The BBA has used due skill, care and diligence in preparing this Certificate, but no warranty is provided.

18.5 In issuing this Certificate, the BBA is not responsible and is excluded from any liability to any company, firm, organisation or person, for any matters arising directly or indirectly from:

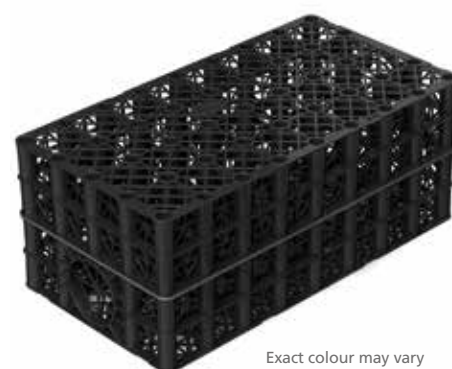
- the presence or absence of any patent, intellectual property or similar rights subsisting in the product/system or any other product/system
- the right of the Certificate holder to manufacture, supply, install, maintain or market the product/system
- actual installations of the product/system, including their nature, design, methods, performance, workmanship and maintenance
- any works and constructions in which the product/system is installed, including their nature, design, methods, performance, workmanship and maintenance
- any loss or damage, including personal injury, howsoever caused by the product/system, including its manufacture, supply, installation, use, maintenance and removal
- any claims by the manufacturer relating to CE marking.

18.6 Any information relating to the manufacture, supply, installation, use, maintenance and removal of this product/system which is contained or referred to in this Certificate is the minimum required to be met when the product/system is manufactured, supplied, installed, used, maintained and removed. It does not purport in any way to restate the requirements of the Health and Safety at Work etc. Act 1974, or of any other statutory, common law or other duty which may exist at the date of issue or reissue of this Certificate; nor is conformity with such information to be taken as satisfying the requirements of the 1974 Act or of any statutory, common law or other duty of care.

Product code: PSM1A

The Polystorm-R modular cell is ideally suited for loaded applications at greater depths, such as housing, commercial and infrastructure projects and has a compressive strength of up to 61 tonnes/m². It offers all the proven performance of the Polystorm cell, with the added benefits of being manufactured from over 90% recycled material content.

Wherever performance criteria and standards allow, we will always maximise the sustainability of our products by using post consumer plastics in their manufacture. By sourcing and carefully controlling the quality of the recycled material we use our precision injection moulding. Therefore we are able to guarantee consistent quality in our recycled plastic, giving you the confidence and the performance levels you expect from the market leader.



Exact colour may vary due to recycled materials.

Key Benefits

- Made from specially selected and controlled recycled materials
- Environmentally friendly, sustainable solution
- Has undergone stringent testing to ensure product performance
- Compressive strength of 61 tonnes/m²
- Ideal for retention, attenuation and infiltration applications with a suitable geomembrane or geotextile
- BBA approved
- Allow flexibility of shape - ideal for shallow excavation systems, narrow strips or use in restricted areas
- Can be used as part of a value engineered hybrid system with Polystorm, Polystorm Lite and Polystorm Xtra
- Integrated inlet and outlet
- 3D flow throughout the structure
- 95% void ratio
- Light weight yet robust - excellent Health and Safety and installation benefits
- 60 years creep limited life expectancy

Technical Support

Detailed guidance and assistance is available.

For further information, please contact our Technical Team on **+44 (0) 1509 615100** or email civils@polypipe.com



ELEMENT	VALUE
PHYSICAL PROPERTIES	
Length	1m
Width	0.5m
Depth	0.4m
Total volume	0.2m ³
Unit weight	9kg (approx)
Unit storage volume	0.19m ³ (190 litres)
Void ratio	95%
SHORT TERM COMPRESSIVE STRENGTH	
Vertical	610 kN/m ² **
Lateral	63 kN/m ² **
SHORT TERM DEFLECTION	
Short-term vertical deflection	60 kN/m ² per mm
LONG TERM DEFLECTION	
Estimated long term vertical deflection (creep)	0.2798 Ln (design life in hrs) +0.485 [Based on an applied test load = 162 kN/m ²] Creep data limit 60 years
Estimated long term lateral deflection (creep)	1.0192 Ln (design life in hrs) -3.864 [Based on an applied test load = 30.8 kN/m ²] Creep data limit 60 years

Note: Polystorm-R is ideal for use in trafficked and pedestrian applications subject to a structural design check and suitable installation conditions

* Each unit includes 4 Clips and 2 Shear Connectors.

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

RECOMMENDED MAXIMUM DEPTH OF INSTALLATION (to cell invert) [m]

TYPICAL SOIL TYPE	TYPICAL ANGLE OF SHEAR RESISTANCE	SOIL WEIGHT kN/m ³	WITHOUT GROUNDWATER (below base of cells) NORMAL CASE		WITH GROUNDWATER AT 1M BELOW GROUND LEVEL AND UNITS WRAPPED IN GEOMEMBRANE	
			Pedestrian	Trafficked (cars) <3000kg GVW	Pedestrian	Trafficked (cars) <3000kg GVW
Stiff over consolidated clay e.g. London clay	24	20.0	2.2	1.9	1.8	1.6
Normally consolidated silty sandy clay e.g. alluvium, made ground	26	19.0	2.4	2.2	1.9	1.7
Loose sand and gravel	30	18.0	3.0	2.7	2.0	1.9
Medium dense sand and gravel	33	19.0	3.2	2.9	2.0	1.9
Dense sand and gravel	38	20.0	3.7	3.5	2.1	2.0

Note:

1) Stated depths based on the calculation methodology detailed within CIRIA C680 (2008)

2) Assuming water density = 10.0kN/m³

3) Assumed ultimate limit state (ULS) partial factor of safety applied to: Material = 2.75 Lateral pressure = 1.35

Durability

The polymer material used in the manufacture of the Polystorm-R unit has an adequate resistance to attack from the type and quantities of chemicals that may be expected to naturally occur in uncontaminated soils and rainwater runoff. When installed in accordance with our recommendations, it is expected that the Polystorm-R unit will have a design life in excess of 60 years*. The installer of a proposed geocellular structure should ensure that an appropriate design check has been undertaken, in accordance with the recommended methodology and factors of safety given in CIRIA C680 (2008), Structural Design of Modular Geocellular Drainage Tanks, prior to the commencement of construction activities.

* Derived from long term extrapolated creep testing

Notes

1. Unless stated, all values are nominal and may vary within normal production tolerances.
2. The characteristic unit parameters stated have been based on Polypipe BBA certificate N° 06/4297, sheet 3.
3. Polypipe reserve the right to change product specifications without prior notice.
4. This document is uncontrolled and updates will not be issued automatically.

RECOMMENDED MINIMUM COVER LEVELS [m]

LIVE LOAD CONDITIONS	PEDESTRIAN	LIGHT TRAFFICKED	
		Car park with vehicle mass <GVW	
Minimum cover depth required (m)	0.50	<3000kg 0.50	<9000kg 0.65

Note

1) Stated depths based on the calculation methodology detailed within CIRIA C680 (2008)

2) Assumed serviceability limit state (SLS) partial factor of safety applied to: Material = 1.5 Live load = 1.0 Dead load = 1.0

3) Shallower minimum burial depths may be applicable subject to an assessment of the specific site conditions. For further details please consult our Technical Team on 01509 615100.

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P.O. 303128

HydroDMS

Site	Contractor	Date
Louisa Stephens	Westchurch Homes	21/6/23
Supervisor	George	Dean

[illegible]

Start Up Type	Operator	Time	Date	Machine	Temp	Speed
Webb	Operator	1220	11123	2212	400	750
Start Up Type	Operator	Time	Date	Machine	Temp	Speed
Start Up Type	Operator	Time	Date	Machine	Temp	Speed

203-2

1. soon

20

33.

16m

5054

5.

700

Measure Agreed	Signed		Print	On Behalf Of	On Behalf Of
	Signed	Signed			
20 x 3 x 10			George S. Smith	On Behalf Of	Hydro Wms West Hards Homes

P.O. 303178

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APPENDIX 6

SUDS MAINTENANCE REQUIREMENTS

Hydro Water Management Solutions Maintenance Requirements

Regular inspection and maintenance is required to ensure the effective long term operation of below ground modular storage systems. The following table details the recommended maintenance requirements for modular systems.

Maintenance schedule	Required action	Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required take remedial action.	Monthly for 3 months then annually
	Debris removal from catchment surface (where may cause risk to performance)	Monthly or as required
	Remove sediment from pre-treatment structures and/or manifold connections	Monthly or as required
Remedial actions	Repair/rehabilitation of inlets/outlets, overflows and vents	Annual inspection or as required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build up and remove if necessary	Annually and after large storms

The maintenance plan and schedule should be developed during the design phase. Specific maintenance requirements should be identified based on upstream drainage sedimentation controls and the schedule developed to suit these needs.

Maintenance details should be detailed in the project Health & safety file and a risk assessment should be undertaken and recorded.

Note,

It is generally recommended that the cells be flushed through with large volumes of water under low pressure.

Certain modular units will allow higher pressure jetting to remove larger objects or heavier deposits of sediment. These modules can be accessed via integral access chambers (where applicable) and surveyed/flushed in a linear fashion or alternately water can be flushed/jetted through via the inlet/outlet pipe connections.

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