Surface Water Drainage Verification Report

Simply UK

Coldharbour Road, Gravesend

CS&P REF: 9360

DATE: February 2026

INNOVATION IN THOUGHT AND STRUCTURE





INNOVATION IN THOUGHT AND STRUCTURE

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1.0 INTRODUCTION

Charles Scott & Partners were commissioned by Simply UK to complete a Verification Report for the surface water drainage installation which has been installed within the residential Care Home development at Coldharbour Road, Gravesend.

The development proposal is for an 75-bedroom Care Home, with associated parking and landscaped areas. The development received planning permission in March 2024 (Reference 20231182).

The production of a Verification Report for the surface water drainage installation is a pre-occupation requirement of Planning Condition 11:

"Notwithstanding the details shown on the approved plans, submitted documents and application form, before the development as hereby permitted is brought into use and occupied, a Verification Report, pertaining to the surface water drainage system and prepared by a suitably competent person, shall be submitted to, and approved in writing by the Local Planning Authority. The Report shall demonstrate that the drainage system constructed is consistent with that which was approved. The Report shall contain information and evidence (including photographs) of details and locations of inlets, outlets and control structures; landscape plans; full as built drawings; information pertinent to the installation of those items identified on the critical drainage assets drawing; and, the submission of an operation and maintenance manual for the sustainable drainage scheme as constructed. The development shall thereafter be carried out in full accordance with the approved details and thereafter maintained."

CS&P have not supervised the construction and installation of the surface water drainage and have been reliant on information supplied by the contractor and client to complete this report. Responsibility to ensure that the drainage features have been installed as per CS&P's design and details, and supplier's guidelines remains with the contractor.

Based on our limited inspections on-site, and the information provided to us by the contractor and client, we are of the opinion that the constructed surface water drainage is adequate and installed in accordance with CS&P's drainage design. No issues have been identified which could affect the operation, maintenance or performance of the drainage system.

2.0 SURFACE WATER DRAINAGE STRATEGY

Surface water runoff from the developments roof is collected via. rainwater pipes to the below ground drainage network. All other surface water runoff is collected by gullies, porous paving or drainage channels.

All surface water drainage from the site is discharged solely via. infiltration to the underlying Thanet sand deposits. This is achieved via. cellular storage crates which provide attenuation in addition to allowing infiltration. These attenuation crates have been sized to accommodate all storm events up to and including the 1 in 100-year storm event plus 45% allowance for climate change.

Where site levels permit, parking areas have been constructed using permeable paving to provide source treatment. The granular sub-base of these permeable paving areas is lined and positively drained via. perforated pipes to the below ground drainage network.

In summary, the main SuDS features of the site are listed below:

- Attenuation Storage
- Infiltration
- Permeable Paving

CS&P drainage plans and construction details drawings can be seen in **Appendix A**.

3.0 VERIFICATION OF DRAINAGE ELEMENTS

3.1 Drainage Pipes

All drainage pipes and fittings used for the developments underground surface water drainage network are Vision by Drainfast, except for perforated pipes. Perforated pipes are either Drainfast 150mm ID/ 172mm OD BBA Perforated Twinwall Plain Ended pipe, or Vision Drainage 160mm UPVC S/Socket half-perforated pipe.

Data sheets for the drainage pipes can be found in **Appendix B**.

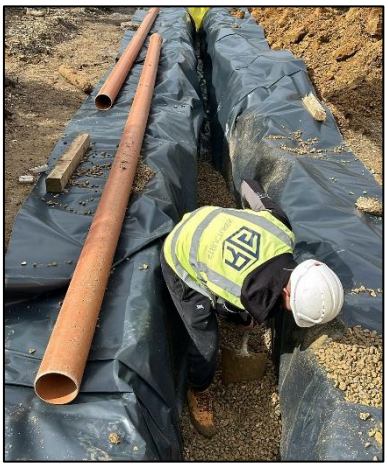


Figure 1 - Installation of perforated pipes

3.2 Precast Concrete Manholes

All manholes within the site are Marshalls precast concrete manholes. All manhole frames & covers within trafficked areas are class D400, with those installed within landscaped areas having a class B125 frame/cover.



Figure 2 – Precast Manhole Installation

3.3 Inspection Chambers

All inspection chambers within the development are supplied by Vision Drainage. Data sheet for inspection chambers can be found within **Appendix B.**

4.0 VERIFICATION OF SUDS FEATURES

4.1 Attenuation/Infiltration Tanks

ACO Stormbrixx HDGF attenuation crates have been adopted for this project.

There are two infiltration/attenuation tanks installed on site. One larger area which accommodates al roof drainage and parking areas, this is 25.2m x 10.2m x 1.22m in size and provides 295m^3 of net storage capacity. The other area drains the basement and access road, and is 10.8m x 4m x 0.61m in size, providing 25m^3 storage capacity.

The attenuation installation appears to be in accordance with CS&P design and construction drawings. ACO's data sheet and structural calculation for the attenuation tanks can be found in **Appendix C**.

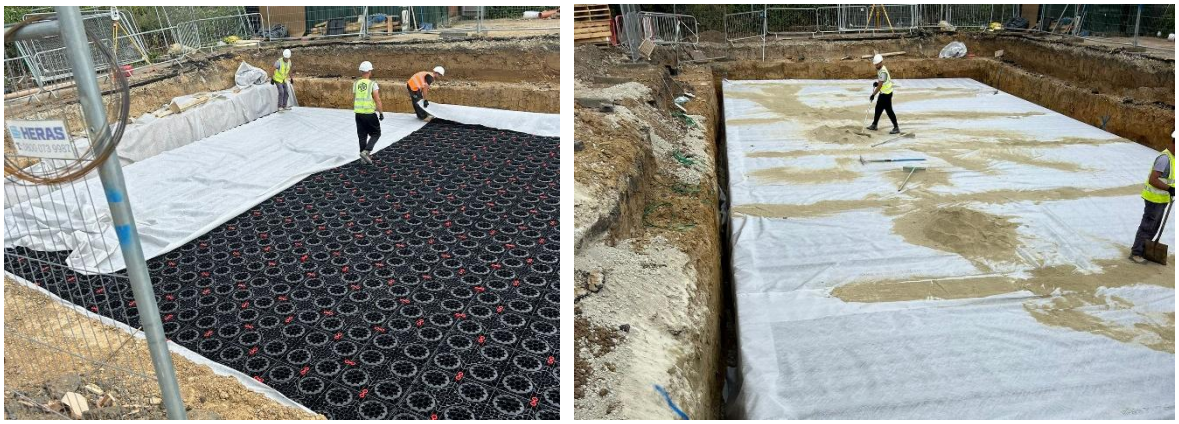


Figure 3 – Installation of Attenuation Tank

4.2 Permeable Paving

Permeable paving has been installed to collect surface water runoff from the car park area. The permeable paving is located in parking bays to the east of the site, as per CS&P's drainage drawing, to suit site finished levels.

The permeable paving appears to have been installed as per CS&P's detail shown in **Appendix A**.

The data sheet for the tanking membrane which has been installed around the permeable paving sub-base can be found in **Appendix D.**

4.3 Drainage Testing

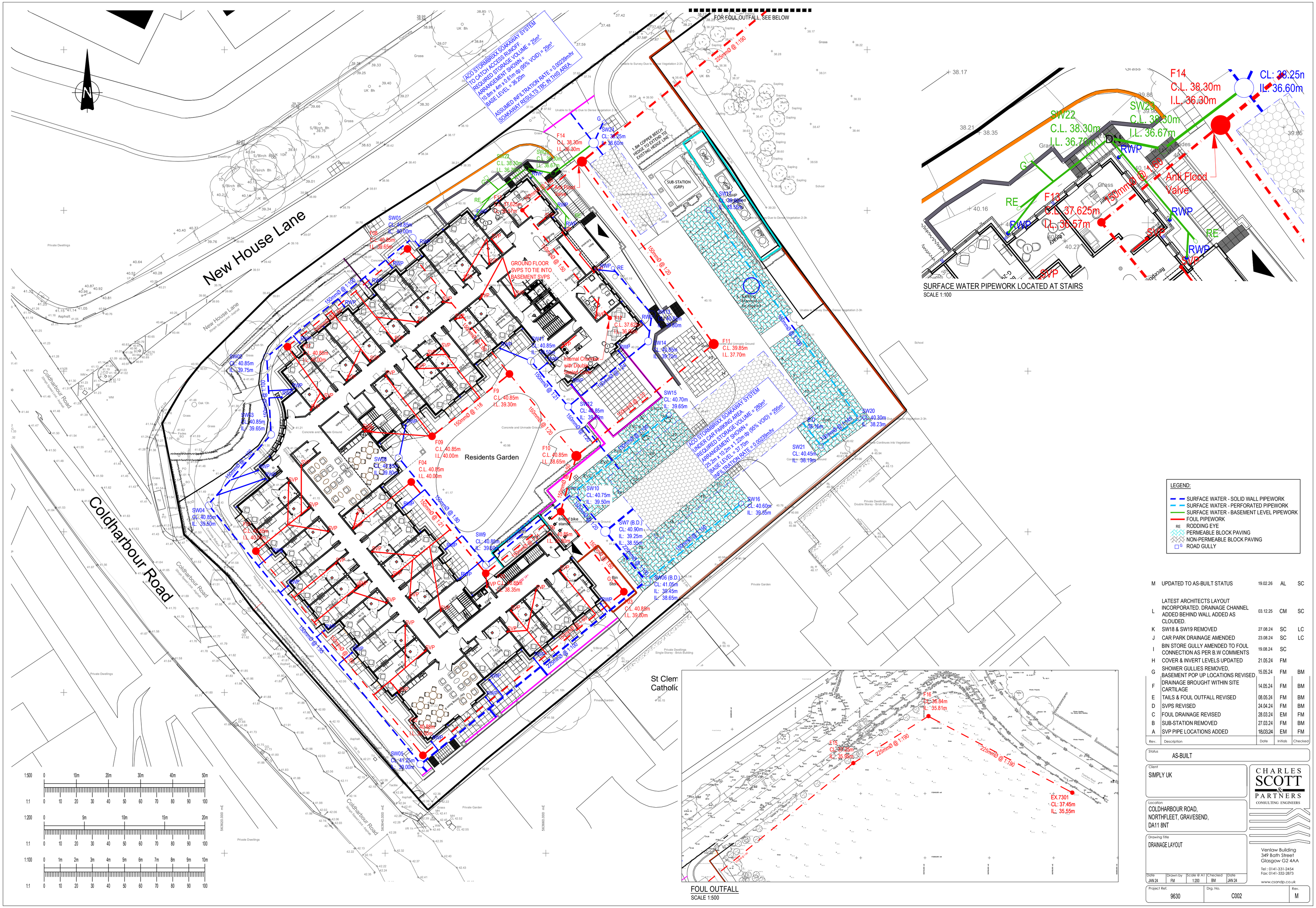
Reports from drainage testing conducted by RG Structures can be found in **Appendix E.**

4.4 Conclusions

Based on as-built information including photos and drainage testing reports, we would confirm all drainage has been installed in line with design intent and consequently will function as per design intent.

Appendix A

CS&P As-Built Drawings



Rev.	Description	Date	Initials	Checked
M	UPDATED TO AS-BUILT STATUS	19.02.26	AL	SC
L	LATEST ARCHITECTS LAYOUT INCORPORATED. DRAINAGE CHANNEL ADDED BEHIND WALL ADDED AS CLOUDED.	03.12.25	CM	SC
K	SW18 & SW19 REMOVED	27.08.24	SC	LC
J	CAR PARK DRAINAGE AMENDED	23.08.24	SC	LC
I	BIN STORE GULLY AMENDED TO FOUL CONNECTION AS PER B.W COMMENTS	19.08.24	SC	
H	COVER & INVERT LEVELS UPDATED	21.05.24	FM	
G	SHOWER GULLIES REMOVED, BASEMENT POP UP LOCATIONS REVISED	15.05.24	FM	BM
F	DRAINAGE BROUGHT WITHIN SITE CARTILAGE	14.05.24	FM	BM
E	TAILS & FOUL OUTFALL REVISED	08.05.24	FM	BM
D	SVPS REVISED	24.04.24	FM	BM
C	FOUL DRAINAGE REVISED	28.03.24	EM	FM
B	SUB-STATION REMOVED	27.03.24	FM	BM
A	SVP PIPE LOCATIONS ADDED	18.03.24	EM	FM

Status: AS-BUILT

Client: SIMPLY UK

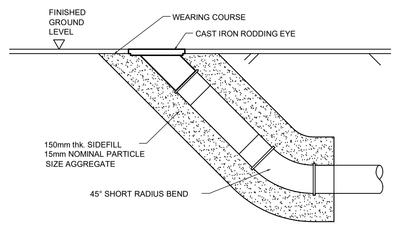
Location: COLDHARBOUR ROAD, NORTHFLEET, GRAVESEND, DA11 8NT

Drawing Title: DRAINAGE LAYOUT

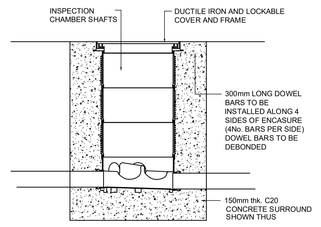
Date	Drawn by	Scale @ A1	Checked	Date
JAN 24	FM	1:200	BM	JAN 24

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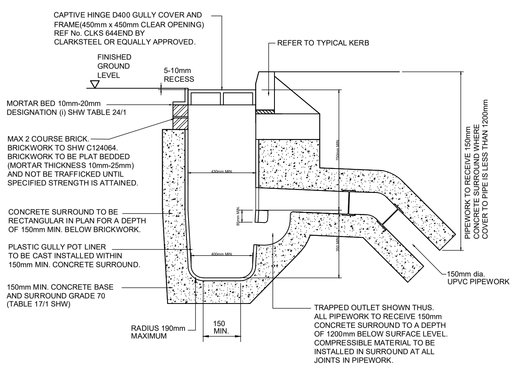
Project Ref.	Drg. No.	Rev.
9630	C002	M



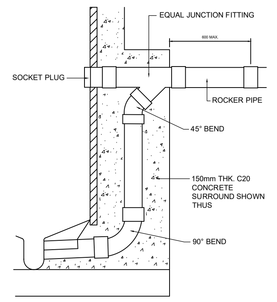
TYPICAL RODDING EYE DETAIL



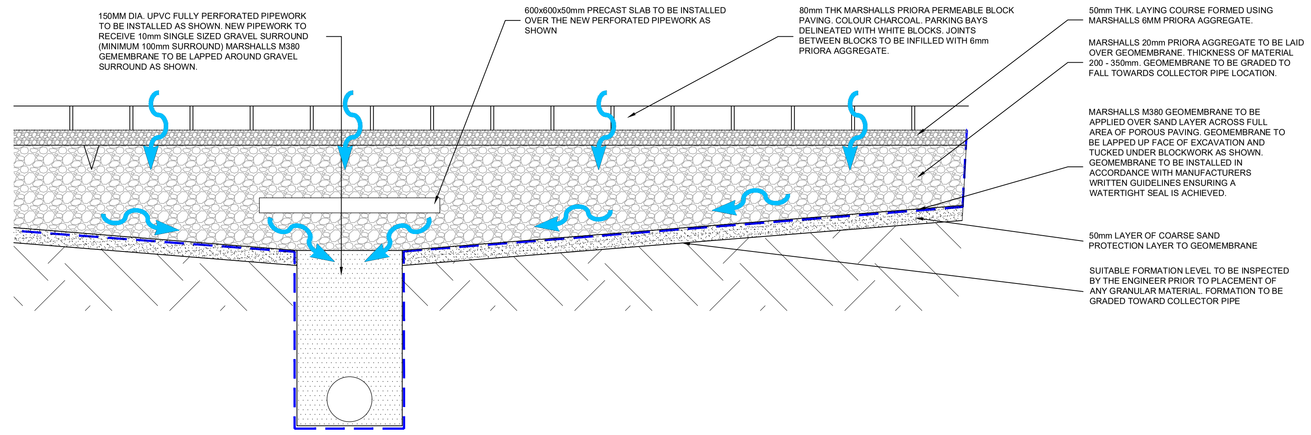
TYPICAL INSPECTION CHAMBER DETAIL



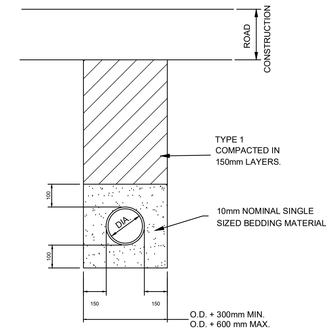
TYPICAL GULLY DETAIL



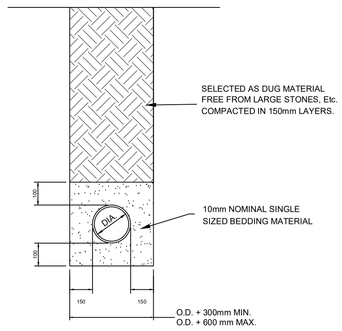
TYPICAL BACKDROP DETAIL



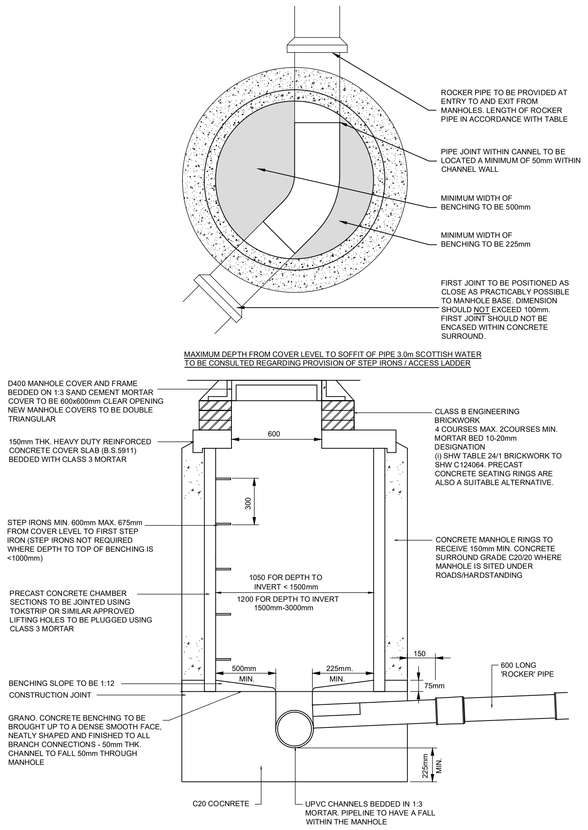
TYPICAL PERMEABLE PAVING DETAIL



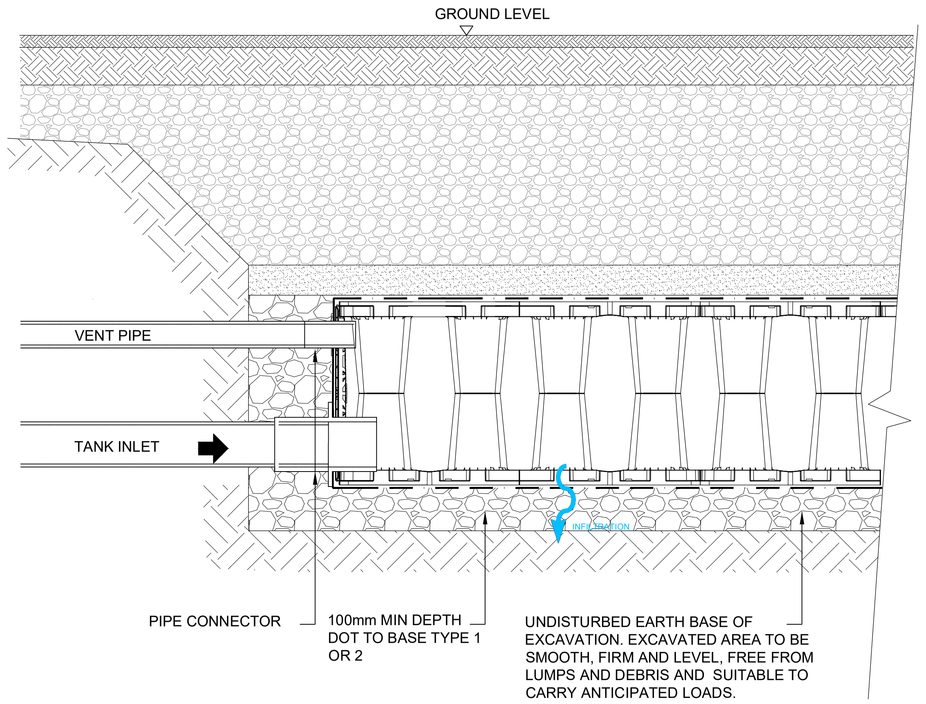
TYPICAL PIPE BEDDING DETAIL - VEHICULAR AREAS

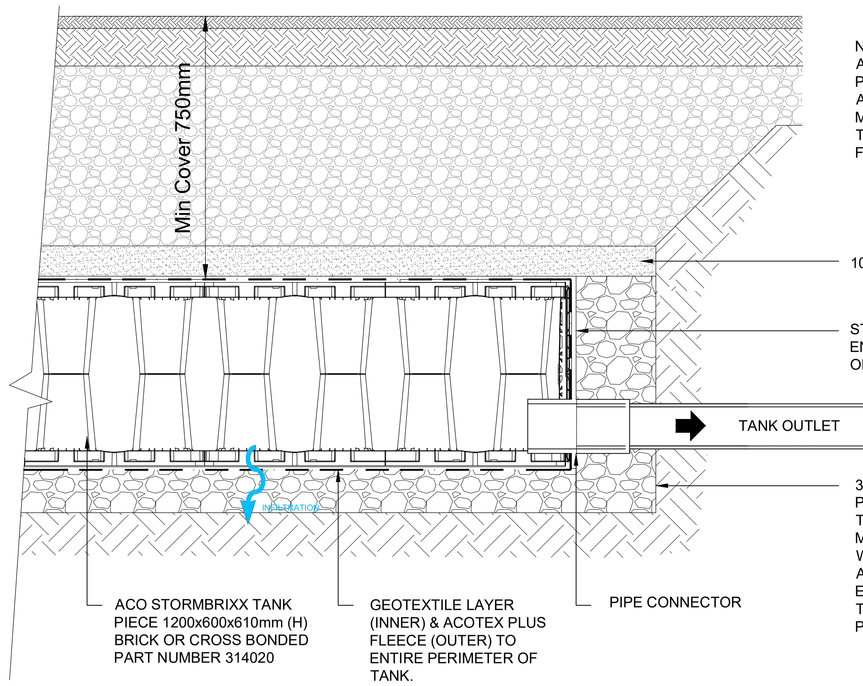


TYPICAL PIPE BEDDING DETAIL - LANDSCAPED AREAS



TYPICAL MANHOLE DETAIL <3m DEPTH





NOTE:-
ATTENUATION INSPECTION SHAFTS TO BE PROVIDED AT EITHER END OF NEW ATTENUATION SYSTEM TO ALLOW FUTURE MAINTAINANCE OF UNITS. MANUFACTURER TO PROVIDE GUIDANCE ON BEST LOCATION FOR CHAMBERS.

INFILTRATION RATES DESIGNED IN ACCORDANCE WITH THE TRIAL PITS AND INFILTRATION TESTS/REPORT CARRIED OUT BY APPLIED GEOLOGY LTD. - WE HAVE ADOPTED AN INFILTRATION RATE OF 6.64E-07m/s (OR 0.00239m/hr) FOR DEEP SOAKAWAY DESIGN. FOR SHALLOW SOAKAWAY DESIGN (0.65m BELOW GROUND LEVEL) WE RECOMMEND AN INFILTRATION RATE OF 6.64E-07m/s IS ADOPTED AS SHOWN ON RIDGE CONSULTANT'S DRAWING NO. 5022828/0500.
THIS CONVERTS TO A RATE OF0.00239m/hr. WE HAVE BASED OUR DESIGN ON TP3 FOR WORST CASE DESIGN.

TYPICAL SOAKAWAY DETAIL

Rev.	Description	Date	Initials	Checked
B	UPDATED TO AS-BUILT STATUS	FEB 26	AL	SC
A	SOAKAWAY DETAIL REVISED	31.01.24	FM	BM

Status: AS-BUILT

Client: SIMPLY UK

Location: COLDHARBOUR ROAD, NORTHFLEET, GRAVESEND, DA11 8NT

Drawing Title: DRAINAGE DETAILS

Drawn by	Scale @ A2	Checked	Date
FM	AS SHOWN	BM	JAN 24

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Project Ref.	Org. no.	Rev.
9630	C004	B

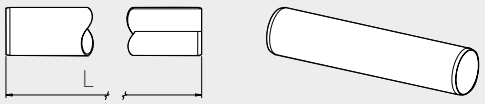
Appendix B
Pipework, Fittings & Inspection Chambers Data Sheet

Underground Drainage

PIPES

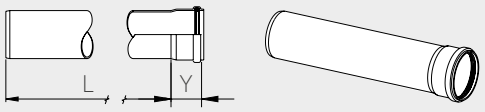
PIPE – PLAIN ENDED

CODE	SIZE	LENGTH	WALL THICKNESS
4VP3	110mm	3m	3.2mm
4VP6	110mm	6m	3.2mm
6VP3	160mm	3m	4.7mm
6VP6	160mm	6m	4.7mm



PIPE – SINGLE SOCKET

CODE	SIZE	LENGTH	Y (SOCKET LENGTH)
4VP3S	110mm	3m	70mm
4VP6S	110mm	6m	70mm
6VP3S	160mm	3m	95mm
6VP6S	160mm	6m	95mm

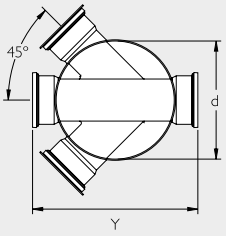


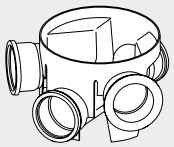
SHALLOW ACCESS CHAMBERS

280mm INSPECTION CHAMBER BASE 110mm INLET

205mm invert (inc. 2 socket plugs)

CODE	SIZE	DIAMETER (d)	Y
4VC280	110mm	280mm	392mm

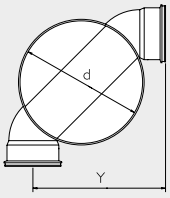


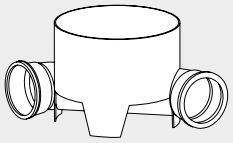


280mm INSPECTION CHAMBER BASE 110mm INLET 90° CHANNEL

205mm invert

CODE	SIZE	DIAMETER (d)	Y
4VC28090	110mm	280mm	305mm

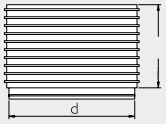


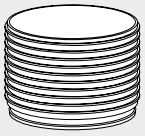


280mm CHAMBER SHAFT 185mm HEIGHT

Incl seal

CODE	SIZE	DIAMETER (d)	INVERT (i)
4VC280S	110mm	266mm	185mm

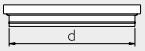




280mm SQUARE DOUBLE SEAL COVER & FRAME

For pedestrian areas only

CODE	SIZE	DIAMETER (d)
4VCF280S	110mm	266mm





Material: PVCu

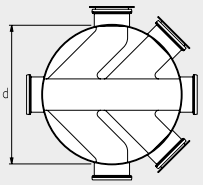
At installation, we recommend that a copper impregnated grease should be applied to the threads of the lid retaining screws for ease of removal.

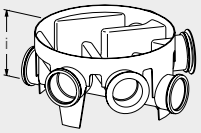
INSPECTION CHAMBERS

450mm INSPECTION CHAMBER BASE 110mm INLET

Includes 3 socket plugs

CODE	SIZE	INVERT (i)	DIAMETER (d)
450VC4	110mm	225mm	450mm

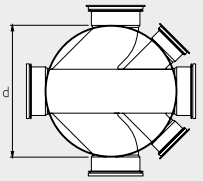


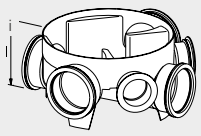


450mm INSPECTION CHAMBER BASE 160mm CHANNEL

2 x 160mm inlets & 2 x 110mm inlets. Includes 2 x 160mm and 1 x 110mm socket plugs

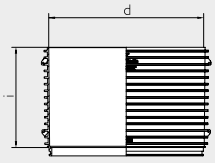
CODE	SIZE	INVERT (i)	DIAMETER (d)
450VC6	160mm	255mm	450mm

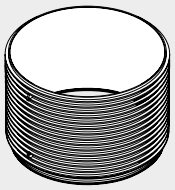




450mm INSPECTION CHAMBER SHAFT 300mm HEIGHT

CODE	INVERT (i)	DIAMETER (d)
450VCR	315mm	450mm





450mm CHAMBER SHAFT SEALING RING

For use with 450VCR

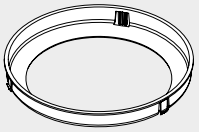
CODE	DIAMETER
450VCS	450mm



RESTRICTOR RING

For use when chamber base invert is between 1.2 and 3 meters

CODE	OUTSIDE DIAMETER	CLEAR OPENING
450VCR350	450mm	350mm

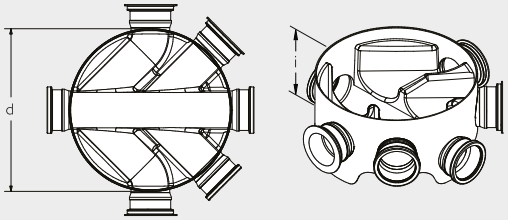


ADOPTABLE INSPECTION CHAMBERS

450mm INSPECTION CHAMBER BASE 110mm INLET

Includes 3 socket plugs

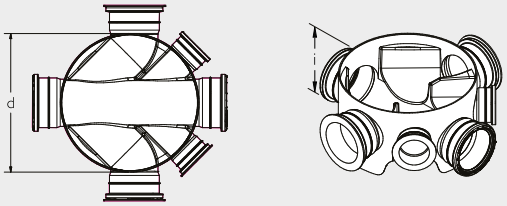
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450mm INSPECTION CHAMBER BASE 160mm CHANNEL

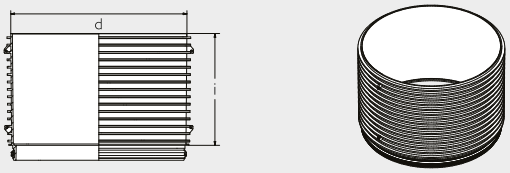
2 x 160mm inlets & 2 x 110mm inlets. Includes 2 x 160mm and 1 x 110mm socket plugs

CODE	SIZE	INVERT (i)	DIAMETER (d)
450VC6A	160mm	255mm	450mm



450mm INSPECTION CHAMBER SHAFT 300mm HEIGHT

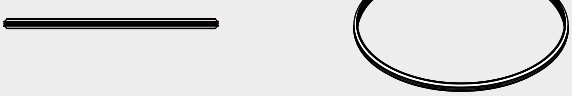
CODE	INVERT (i)	DIAMETER (d)
450VCRA	315mm	450mm



450mm CHAMBER SHAFT SEALING RING (replacement seal)

For use with 450VCRA

CODE	DIAMETER
450VCSA	450mm

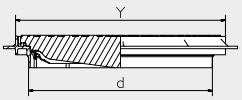


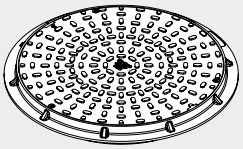
INSPECTION CHAMBER COVERS

SECURED PLASTIC COVER AND FRAME TO EN124 A15 50KN

Suitable for domestic driveways

CODE	Y	DIAMETER (d)
450VCFC	518mm	450mm

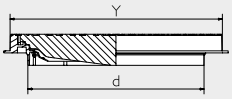


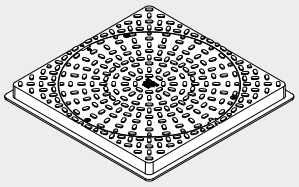


SECURED SQUARE PLASTIC COVER AND FRAME TO EN124 A15 50KN

Suitable for domestic driveways

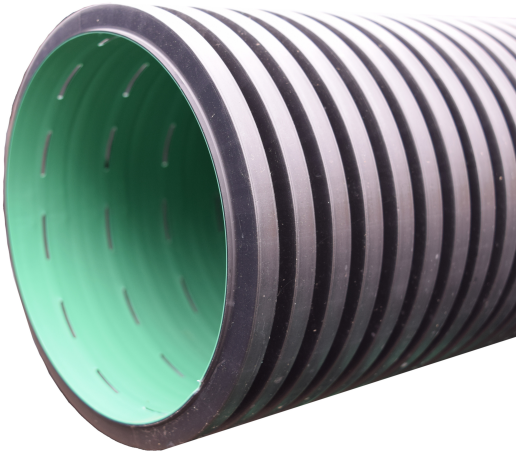
CODE	Y	DIAMETER (d)
450VCFS	545mm	450mm

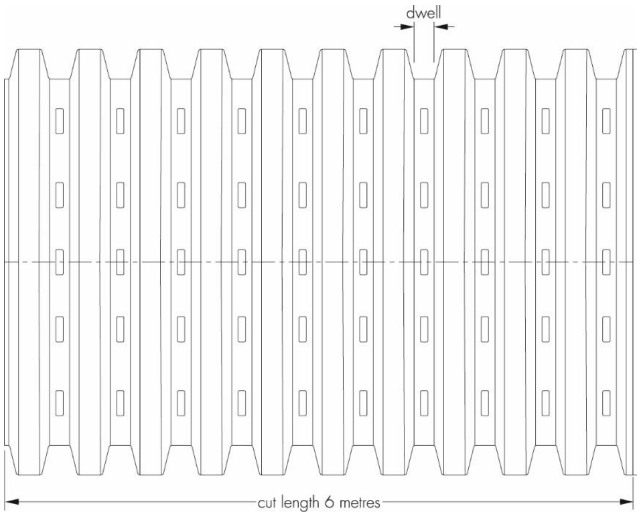




drainfast®

PRODUCT SPECIFICATION SHEET





Name

150mm ID/ 172mm OD BBA PERFORATED Twinwall Plain Ended Pipe x6m

Code

150TDPBLN

Description

6m length, 150mm B.B.A approved HDPE Perforated Twinwall Drain Plain Ended Pipes
Smooth bore for superior hydraulic flow; corrugated outer wall for additional strength.
Lightweight product - easier transport, handling and installation.
Recognised alternative to concrete and clayware pipes.
High strength and durability. Minimal jointing compared with traditional materials.
Excellent resistance to differential settlement.
BBA Certificate No: 09/H145

Size

150mm(ID) / 173mm(OD)

vision

PRODUCT SPECIFICATION SHEET

01 UNDERGROUND DRAINAGE



Name
160mm UPVC S/Socket Half Perforated Pipe x6m

Code
6VP6SP

Description
Vision Drainage 160mm Half Perforated Single Socket Pipe for surface water and sewage drainage systems. 6m length.

Manufactured under BS EN ISO 9001:2008 & 2015 certification and tested to the requirements of BS EN 13598-1:2010, BS EN 1401-1:2009 and BS EN 13476 -2:2018.

Size
160mm

Appendix C

Soakaway Tanks Data Sheet & Calculations



ACO StormBrixx SD, HD900 and HD

DATA SHEET

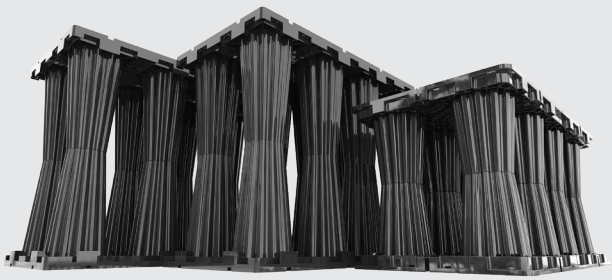
The ACO StormBrixx is a unique and patented plastic geocellular stormwater management system.

Its versatile design allows the system to be used in applications across all construction environments as a standalone solution or as part of an integrated Sustainable Drainage System (SuDS).

The range consists of StormBrixx SD (standard duty) and StormBrixx HD (heavy duty) stormwater management systems. StormBrixx SD is manufactured from recyclable polypropylene and has a design life of 50 years, whilst StormBrixx HD is manufactured from recycled polypropylene and has a design life of 60 years.

Benefits

- Fully certified performance - DiBt, MFPA, compliance with BS EN 17152-1
- Brick bonding and cross bonding for optimum stability
- Remote and man access for ease of maintenance
- High void ratio which minimises excavation volume (97% for SD and HD900, 95% for HD)
- Reduced CO_2 emissions



ACO StormBrixx SD, HD900 and HD

Simplified handling and logistics

- Compact delivery method with stackable nestled design allowing up to four times fewer deliveries
- Unique stackable design that simplifies on site storage and handling during installation
- Time savings: movement on site and installation

The ACO StormBrixx Range





Complies with BS EN 17152-1

NEW — ACO StormBrixx HD900

Void ratio:	97%
Short term vertical compressive strength:	605kN/m²
Short term lateral compressive strength:	120kN/m²
Accessibility:	Remote access
One layer height:	920mm

Components overview - dimensions and weights

Product Code	Description	Length [mm]	Width [mm]	Height [mm]	Weight [kg/m²]
314054	Half Body	1208	604	460/496	12.3
314091	Side Panel	907	592	104	3.13
314092	Top Cover	550	550	45	0.76
314094	Half Layer Cover Plate	1200	600	94	3.66
314098	Half Layer Side Panel	450	592	104	1.5

ACO StormBrixx SD

Void ratio:	97%
Short term vertical compressive strength:	350kN/m²
Short term lateral compressive strength:	70kN/m²
Accessibility:	Remote access
One layer height:	914mm

Components overview - dimensions and weights

Product Code	Description	Length [mm]	Width [mm]	Height [mm]	Weight [kg/m²]
314090	Half Body	1200	600	494	9.41
314091	Side Panel	907	592	104	3.13
314092	Top Cover	550	550	45	0.76
314094	Half Layer Cover Plate	1200	600	94	3.66
314098	Half Layer Side Panel	450	592	104	1.5



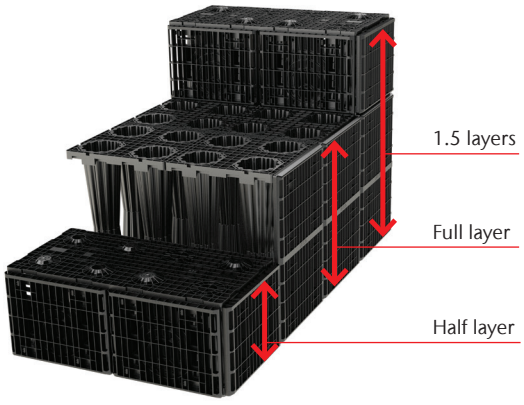
ACO StormBrixx HD

Void ratio:	95%
Short term vertical compressive strength:	455kN/m²
Short term lateral compressive strength:	95kN/m²
Accessibility:	Man access & remote access
One layer height:	612mm

Components overview - dimensions and weights

Product Code	Description	Length [mm]	Width [mm]	Height [mm]	Weight [kg/m²]
314061	Half Body GF	1205	602	306/343	10
314021	Side Panel	580	580	35	1.6
314022	Top Cover	550	550	43	0.8



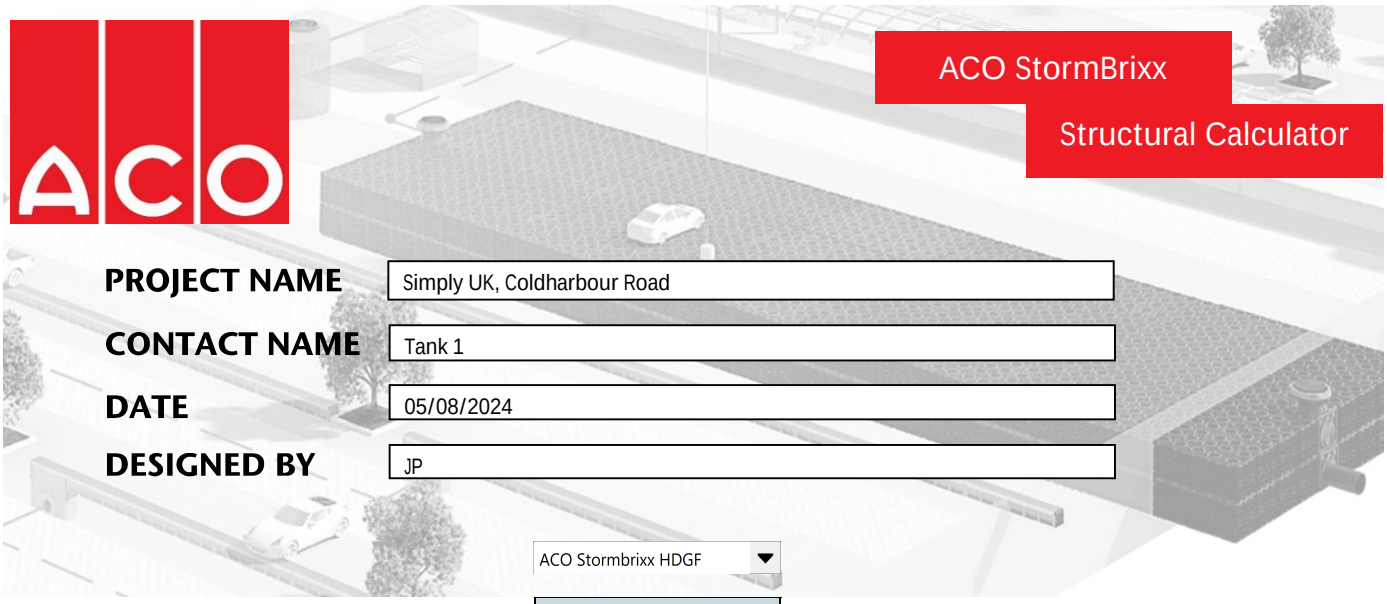


The ACO StormBrixx SD and HD900 half layer is suitable for where installation depth is restricted.

ACO Water Management Contacts:
Sales: uk-swc@aco.co.uk
Technical: technical@aco.co.uk
Tel: 01462 816666
www.aco.co.uk

ACO. we care for water

ACO-2051-0220

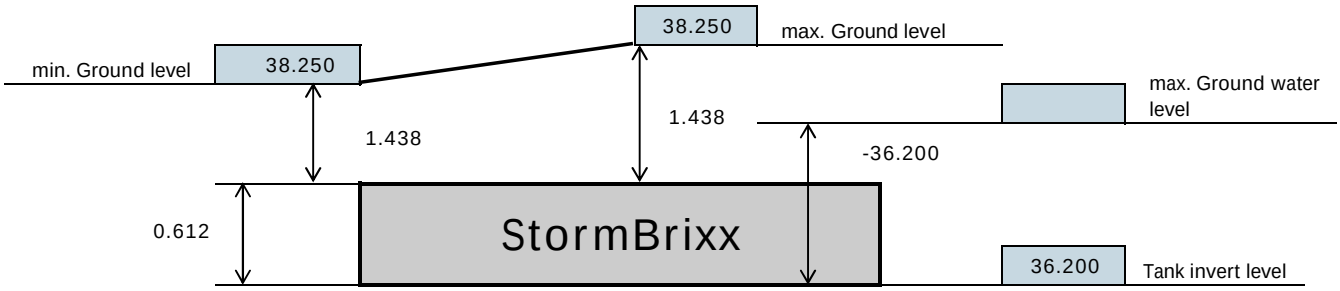


ACO StormBrixx Structural Calculator

PROJECT NAME	Simply UK, Coldharbour Road
CONTACT NAME	Tank 1
DATE	05/08/2024
DESIGNED BY	JP

ACO Stormbrixx HDGF

Number of installed layers: 1 Layer



Live loads:

Low speed roads (< 15 mph) (Articulated HGV GVW < 60T)

UDL [kN/m²]	10
Point [kN]	100
Tyre contact area [mm²] Width x Length:	200 x 600

Suface/Pavement type:

LSA Calculator

Load spread angle = 31.85 °

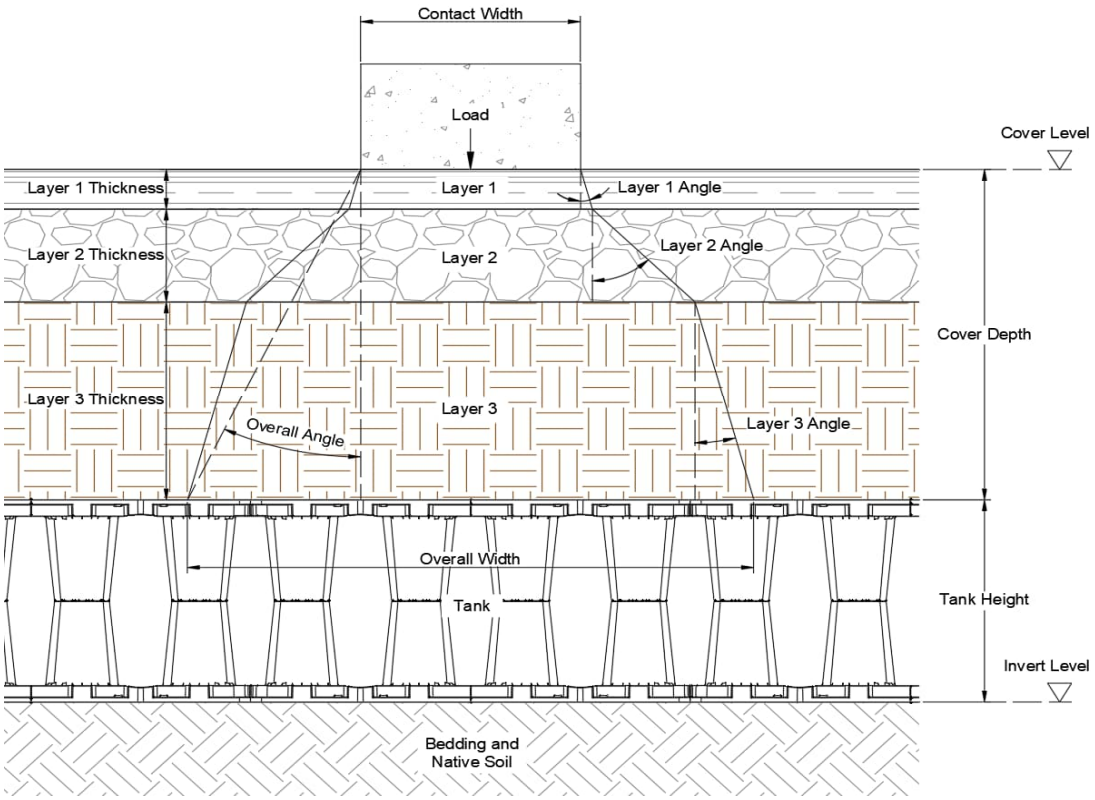
Soil:

Stiff clay (e.g. London clay)

Bulk weight	18 kN/m³
Internal Angle of Friction	24.00 °

Cover Level (Min Only)	38.25	m
Invert Level	36.2	m
Tank Type	HDGF	
Tank Height	0.612	m
Cover derivation	From levels	
Total depth of cover	1.438	m
Number of layers	3	

Layer	Surface Type	Thickness (m)	Bulk Weight (kN/m3)	Load Spread Angle (deg)
Layer 1	Competent Soil/Asphalt	0.2	18	26.6
Layer 2	MOT Type 1	1.088	21	33
Layer 3	Sharp Sand	0.15	18	30
Total		1.438	m	
Load Spread Angle		31.85	degrees	
Average Bulk Weight		20.27	kN/m^3	



Vertical Loads - Case 1 (shallowest cover)

Surcharge load

Depth of backfill =	1.438	m		
Bulk unit weight =	18	kN/m^3		
Partial load factor for surcharge soil =	1.4			
Soil load = depth x weight x factor = 1.438 x 18 x 1.4 =			36.2	kN/m^2
Distrib. Load from vehicles (from table 4.2) =	10	kN/m^2		
Partial load factor for loading =	1.6			
Traffic load = load x factor = 10 x 1.6 =			16	kN/m^2
Total load = 36.2 + 16 =			52.2	kN/m^2
Material factor of safety =	2.75			
So design load = total load x material factor = 52.2 x 2.75 =			143.7	kN/m^2
Compressive strength of ACO StormBrixx =			455	kN/m^2 ✔

Wheel load

Wheel load 100kN on a 200mm x 600mm area (from Table 4.2)				
Load spread angle (a) =	31.85	degrees		
Cover depth =	1.438	m		
Tan a = Tan (31.85) =			0.620	
Loaded area = [(2xdepthxTana)+ tyre area 1] x [(2xdepthxTana)+ tyre area 2]				
= [(2 x 1.44 x 0.62) + 0.2] x [(2 x 1.44 x 0.62) + 0.6] =			4.726	m²
Distributed wheel load on top of tank will be 100 ÷ 4.726 =			21.16	kN/m²
Partial factor for loading =	1.6			
Material factor of safety =	2.75			
Design load = 21.16 x 1.6 x 2.75 =			93.1	kN/m^2
Compressive strength of ACO StormBrixx =			455	kN/m^2 ✔

Surcharge load + Wheel Load

Total load could be surcharge soil load plus wheel point load				
From above, design soil load is 18 x 1.438 x 1.4 x 2.75 =			99.7	kN/m^2
From above, wheel point load is 21.16 x 1.6 x 2.75 =			93.1	kN/m^2
Total of surcharge load + point wheel load = 99.65 + 93.1 =			192.8	kN/m^2
Compressive strength of ACO StormBrixx =			455	kN/m^2 ✔

Vertical Loads - Case 2 (deepest cover)

Surcharge load

Depth of backfill =	1.438	m		
Bulk unit weight =	18	kN/m^3		
Partial load factor for surcharge soil =	1.4			
Soil load = depth x weight x factor = 1.438 x 18 x 1.4 =			36.2	kN/m^2
Distrib. Load from vehicles (from table 4.2)	10	kN/m^2		
Partial load factor for loading	1.6			
Traffic load = load x factor = 10 x 1.6 =			16	kN/m^2
Total load = 36.2 + 16 =			52.2	kN/m^2
Material factor of safety =	2.75			
So design load = total load x material factor = 52.2 x 2.75 =			143.7	kN/m^2
Compressive strength of ACO StormBrixx =			455	kN/m^2 ✔

Wheel load

Wheel load 100kN on a 200mm x 600mm area (from Table 4.2)				
Load spread angle (a) =	31.8493	degrees		
Cover depth =	1.438	m		
Tan a = Tan (31.84926725678) =			0.621	
Loaded area = [(2xdepthxTana)+ tyre area 1] x [(2xdepthxTana)+ tyre area 2]				
= [(2 x 1.438 x 0.621) + 0.2] x [(2 x 1.438 x 0.621) + 0.6] =			4.74	m^2

Distributed wheel load on top of tank will be 100 ÷ 4.741 =		21.09	kN/m^2
Partial factor for loading =	1.6		
Material factor of safety =	2.75		
Design load = 21.09 x 1.6 x 2.75 =		92.8	kN/m^2
Compressive strength of ACO StormBrixx =		455	kN/m^2 ✓

Surcharge load + Wheel Load

Total load could be surcharge soil load plus wheel point load			
From above, design soil load is 18 x 1.438 x 1.4 x 2.75 =		99.7	kN/m^2
From above, wheel point load is 21.09 x 1.6 x 2.75 =		92.8	kN/m^2
Total of surcharge load + point wheel load = 99.65 + 92.8 =		192.5	kN/m^2
Compressive strength of ACO StormBrixx =		455	kN/m^2 ✓

Lateral Loads

Worst case will be with maximum depth of cover + vehicle loading

Internal angle of friction **F**'$_{crit}$ =	24.00	degrees	
Active earth pressure coefficient Ka = (1-sin**F**'$_{crit}$)/(1+sin**F**'$_{crit}$)			
= (1-Sin 24)/(1 + Sin 24) =		0.422	
Density of soil = g_1 =	18	kN/m^3	
Calculation allows for the case where ground water level may be above the invert of the tank			
Then submerged density of soil g_2 = g_1 - 10 =		8	kN/m^3

Soil Load

Depth of soil for earth pressure calc = depth to invert - 200mm = 2.05 - 0.2 = Z =		1.850	m
Depth of soil for earth pressure calculation above ground water level = Z1 =		1.850	m
Depth of soil for earth pressure below ground water level = Z2 =		0.000	m
Partial load factor =	1.35		
Applied soil pressure = Ka x (g_1Z_1 + g_2Z_2) x factor			
= 0.422 x (18 x 1.85 + 8 x 0) x 1.35 =		18.96	kN/m^2
Vehicle surcharge load = q =	10	kN/m^2	
Partial load factor =	1.5		
Applied vehicle pressure = Ka x q x factor = 0.422 x 10 x 1.5 =		6.33	kN/m^2
Material factor of safety =	2.75		
Design load = (applied soil pressure + applied vehicle pressure) x Material factor			
= (18.96 + 6.33) x 2.75 =		69.5	kN/m^2 ✓

Hydrostatic load

Depth of water above base of tank - 0.2m		0	m
Water pressure = density (1.0) x depth of water x g =		0.0	kN/m^2
Design load = Applied pressure x Load factor x Material factor =		0.0	kN/m^2 ✓
Total lateral load = soil load + hydrostatic load =		69.5	kN/m^2
Laterial strength of ACO StormBrixx =		95	kN/m^2 ✓

Floatation

There are three possible scenarios: water level below, part way up or over the tank
From the data given at the head of this calculation, the case is water level below the tank

Depth of water displaced =		0	m
Uplift force = depth of water displaced x buoyancy = 0 x 10 =		0	kN/m^2
Partial factor of safety for uplift =	1.5		
Design uplift force = Uplift force x factor = (0 x 1.5) =		0.00	kN/m^2

Density of soil cover =	18	kN/m^3	
Minimum cover depth =	1.438	m	
Weight of soil (at minimum cover depth) = depth x density = 1.438 x 18 =		25.884	kN/m^2
Partial factor of safety for soil=	0.95		
Design pressure = weight of soil x factor = 25.88 x 0.95 =		24.5898	kN/m^2
Design Pressure must be greater than Design Uplift	✔		

Surface Deflections

Deflection of ACO StormBrixx is 1mm for every 50kN/m2 applied pressre
Serviceability limit state factor of safety = 1.5
So design deflection parameter is 1.5mm for every 50kN/m2 applied pressure

From above calcs for vertical loads (at shallowest cover)

Pressure from wheel loads on the top of the tank =	21.2	kN/m^2	
For serviceability analyses the factor of safety on live loads is 1.0			
This is a live load so the design load is 21.2 x 1.0 =	21.2	kN/m^2	
Deflection of the tank = 1.5 x (21.2 ÷ 50) =		0.63	mm ✔

Design Notes

1. The load category of "Low speed roads (< 15 mph) (Articulated HGV GVW < 60T)" has been used based on given information; if this is unsuitable please advise a more suitable load category.

2. A load spread angle of 31.85 degrees has been assumed for vertical load distribution

3. The lateral load calculations have assumed a backfill with minimum internal angle of friction of 24 degrees and a maximum bulk weight of 18kN/m3.

Appendix D

Permeable Paving Tanking Membrane

Marshalls
Creating Better Spaces

Landscape House, Premier Way,
Lowfields Business Park,
Elland HX5 9HT
Tel: 0333 000 20 50
www.marshalls.co.uk/commercial

T: 01422 312000
F: 01422 312943
E: advisoryservices@marshalls.co.uk

MM380 Tanking Membrane

Date Created: 24/05/18





Mm380 Tanking Membrane

Demonstrating superior tear and puncture resistance as well as excellent chemical resistance, Marshalls MM380 Tanking Membrane has been designed specifically to tank "Type C" non-filtration permeable pavements.

The unique co-polymer blend provides confidence that attenuated water will be retained within the structure and not leak into the sub grade.

Despite its inherent strength, at 0.38 microns MM380 is thinner than alternative membranes, making it lighter to carry and easier to roll out. Manufactured in “Marshalls Red” for easy identification on site and double folded to minimise pack size, its 80m2 roll size minimises time spent rolling out and jointing the membrane.

All necessary ancillary products are available including Marshalls Tanking Tape – for the waterproof jointing of Marshalls M380 Membranes and 110mm and 160mm flexible top hat units – to create neat, secure pipe outfalls.

DESCRIPTION	
Base Raw Material	Polymer Blend
CE Marking/DOP	https://www.marshalls.co.uk/dop

Marshalls
Creating Better Spaces

Landscape House, Premier Way,
Lowfields Business Park,
Elland HX5 9HT
Tel: 0333 000 20 50
www.marshalls.co.uk/commercial

T: 01422 312000
F: 01422 312943
E: advisoryservices@marshalls.co.uk

MM380 Tanking Membrane

Date Created: 24/05/18

PHYSICAL PROPERTIES

Tolerances on Work Dimensions (mm)	Length 20m -0%/ +10% EN 1848-2 Width 4m +/- 2.5% EN 1848-2 Thickness 0.38 mm +/- 10% EN 1849-2
Length (mm)	20000
Width (mm)	4000
Thickness (mm)	380 Microns
Mass	395 g/m2 +/- 12% EN 1849-2
Material Safety Data Sheets	Material Safety Data Sheets (COSHH) are available on request
Tensile Strength	24.2 20.7 N/50mm MDV EN 12311-1
Resistance To Tearing	185 185 N MDV EN 12310-1
Resistance To Impact	30 mm/dia >MLV EN 12691

FURTHER INFORMATION

Product Evolution	The evolution of new product design is continuous and information is subject to change without notice. Customers should check with the supplier to ensure that they have the latest details
Contact Us	For technical information on the design, specification and construction when utilising the product, contact the Technical Advisory Services Department on 0370 411 2233

Appendix E

Drainage Testing Reports

Date Submitted: 12/09/2024 09:37 AM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing

Job Details

Site Name	C130 - Gravesend
Site Address	Coldharbour Road, Gravesend DA11 7RU
Location Area	Sw17 to sw21
Client Name	Simply Develop
Job No.	1

Inspection Details

Date of Permit Inspection	10/09/2024
Inspected By	Jason Sweeney

Preliminaries

Is method statement complete and available	Yes
Have current drawings been issued and worked to	Yes

Drainage Run Location

Drainage Run Location	Sw17 to sw21

Description of Pipework

Pipe Description	Storm
Type of Pipe	UPVC
Size of Pipe	150mm

Testing

Type of Test carried out	Water

Test Results

Result 1	N/A
Result 2	N/A
Result 3	N/A

RGL Sign Off

Signature	
Date	10/09/2024

Main Contractor Sign Off

Date Submitted: 12/09/2024 09:37 AM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing

Sign Off by Main Contractor

Preliminaries

Is method statement complete and available	Yes
Have current drawings been issued and worked to	Yes

Testing

Type of Test Carried Out by RGL	Water
Test witnessed on behalf on behalf of Main Contractor by	Eli

Declaration

Acknowledgment	I am satisfied that the drainage results shown above are satisfactory to enable RG Structures Ltd to backfill drainage in location shown on image in Drainage Run Location section above Thank[redacted]
Signature on behalf on Main Contractor	[redacted]
Enter Name	Eli
Date	12/09/2024

Date Submitted: 28/08/2024 09:08 AM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing

Job Details

Site Name	C130 - Gravesend
Site Address	Coldharbour Road, Gravesend DA11 7RU
Location Area	Big soak away tank
Client Name	Simply Develop
Job No.	1

Inspection Details

Date of Permit Inspection	27/08/2024

Preliminaries

Is method statement complete and available	Yes
Have current drawings been issued and worked to	Yes

Drainage Run Location

Drainage Run Location	Soak away tank
Upload Image (s)	 

Date Submitted: 28/08/2024 09:08 AM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing









Date Submitted: 28/08/2024 09:08 AM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing









Date Submitted: 28/08/2024 09:08 AM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing



Description of Pipework

Pipe Description	Storm
Type of Pipe	UPVC
Size of Pipe	150mm

RGL Sign Off

Signature	[redacted]
Date	27/08/2024

Main Contractor Sign Off

Sign Off by Main Contractor

Preliminaries

Is method statement complete and available	Yes
Have current drawings been issued and worked to	Yes

Date Submitted: 28/08/2024 09:08 AM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing

Testing

Type of Test Carried Out by RGL	Air

Declaration

Acknowledgment	I am satisfied that the drainage results shown above are satisfactory to enable RG Structures Ltd to backfill drainage in location shown on image in Drainage Run Location section above Thank You
Signature on behalf on Main Contractor	
Enter Name	Eli
Date	27/08/2024

Date Submitted: 05/06/2024 02:16 PM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing

Job Details

Site Name	C130 - Gravesend
Site Address	Coldharbour Road, Gravesend DA11 7RU
Location Area	Storm 06-07 & 07-10
Client Name	Simply Develop
Job No.	130

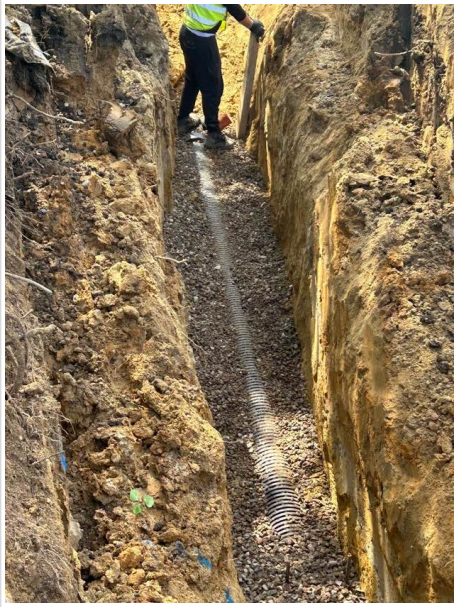
Inspection Details

Date of Permit Inspection	05/06/2024

Preliminaries

Is method statement complete and available	Yes
Have current drawings been issued and worked to	Yes

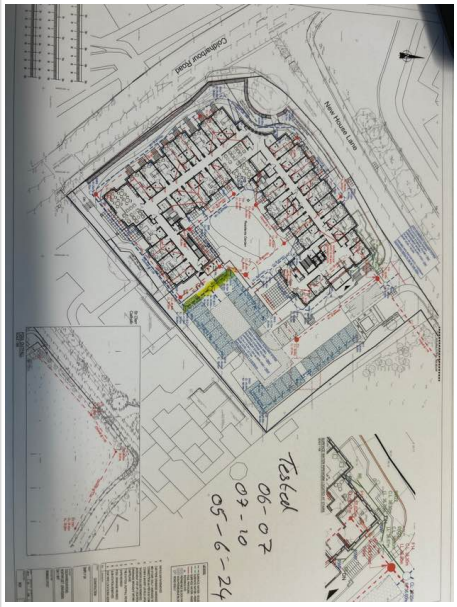
Drainage Run Location

Drainage Run Location	06-07&07-10
Upload Image (s)	 

Date Submitted: 05/06/2024 02:16 PM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing





Description of Pipework

Pipe Description	Storm
Type of Pipe	UPVC
Size of Pipe	225mm, 150mm

Testing

Type of Test carried out	Air
Test carried out by	Other
If Other, enter details	Toni

Test Results

Result 1	Pass
Result 2	Pass
Result 3	Pass

RGL Sign Off

Date Submitted: 05/06/2024 02:16 PM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing

Signature	
Date	05/06/2024

Main Contractor Sign Off

Sign Off by Main Contractor

Preliminaries

Is method statement complete and available	Yes
Have current drawings been issued and worked to	Yes

Testing

Type of Test Carried Out by RGL	Air
Test witnessed on behalf on behalf of Main Contractor by	Eli

Declaration

Acknowledgment	I am satisfied that the drainage results shown above are satisfactory to enable RG Structures Ltd to backfill drainage in location shown on image in Drainage Run Location section above Thank You
Signature on behalf on Main Contractor	
Enter Name	Eli
Date	05/06/2024

Date Submitted: 05/09/2024 02:48 PM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing

Job Details

Site Name	C130 - Gravesend
Site Address	Coldharbour Road, Gravesend DA11 7RU
Location Area	Storm 11-12 & 12-14
Client Name	Simply Develop
Job No.	130

Preliminaries

Is method statement complete and available	Yes
Have current drawings been issued and worked to	Yes

Drainage Run Location

Drainage Run Location	SW11-12 & 12-14
Upload Image (s)	 

Date Submitted: 05/09/2024 02:48 PM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing





Description of Pipework

Pipe Description	Storm
Type of Pipe	UPVC
Size of Pipe	150mm

Testing

Type of Test carried out	Air
Test carried out by	Other
If Other, enter details	Toni

Test Results

Result 1	Pass
Result 2	Pass
Result 3	Pass

RGL Sign Off

Date Submitted: 05/09/2024 02:48 PM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing

Signature	
Date	05/09/2024

Main Contractor Sign Off

Sign Off by Main Contractor

Preliminaries

Is method statement complete and available	Yes
Have current drawings been issued and worked to	Yes

Testing

Type of Test Carried Out by RGL	Air
Test witnessed on behalf on behalf of Main Contractor by	Eli

Declaration

Acknowledgment	I am satisfied that the drainage results shown above are satisfactory to enable RG Structures Ltd to backfill drainage in location shown on image in Drainage Run Location section above Thank You
Signature on behalf on Main Contractor	
Enter Name	Eli
Date	05/09/2024

Date Submitted: 13/06/2024 01:35 PM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing

Job Details

Site Name	C130 - Gravesend
Site Address	Coldharbour Road, Gravesend DA11 7RU
Location Area	Storm 08-09 & 09-10
Client Name	Simply Develop
Job No.	130

Inspection Details

Date of Permit Inspection	13/06/2024
Inspected By	Jason Sweeney

Preliminaries

Is method statement complete and available	Yes
Have current drawings been issued and worked to	Yes

Drainage Run Location

Drainage Run Location	08-09 09-10
Upload Image (s)	 

Date Submitted: 13/06/2024 01:35 PM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing



Description of Pipework

Pipe Description	Storm
Type of Pipe	UPVC
Size of Pipe	150mm

Testing

Type of Test carried out	Air
Test carried out by	Other
If Other, enter details	Toni

Test Results

Result 1	Pass
Result 2	Pass
Result 3	Pass

RGL Sign Off

Signature	[redacted]
Date	13/06/2024

Main Contractor Sign Off

Sign Off by Main Contractor

Date Submitted: 13/06/2024 01:35 PM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing

Preliminaries

Is method statement complete and available	Yes
Have current drawings been issued and worked to	Yes

Testing

Type of Test Carried Out by RGL	Air
Test witnessed on behalf on behalf of Main Contractor by	Eli

Declaration

Acknowledgment	I am satisfied that the drainage results shown above are satisfactory to enable RG Structures Ltd to backfill drainage in location shown on image in Drainage Run Location section above Thank You
Signature on behalf on Main Contractor	
Enter Name	Eli
Date	13/06/2024

Date Submitted: 21/05/2024 02:10 PM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing

Job Details

Site Name	C130 - Gravesend
Site Address	Coldharbour Road, Gravesend DA11 7RU
Location Area	Storm 02-03
Client Name	Simply Develop
Job No.	130

Inspection Details

Date of Permit Inspection	21/05/2024
Inspected By	Jason Sweeney

Preliminaries

Is method statement complete and available	Yes
Have current drawings been issued and worked to	Yes

Drainage Run Location

Drainage Run Location	Sw02-03
Upload Image (s)	 

Date Submitted: 21/05/2024 02:10 PM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing





Description of Pipework

Pipe Description	Storm
Type of Pipe	UPVC
Size of Pipe	150mm

Testing

Type of Test carried out	Air
Test carried out by	Other
If Other, enter details	Toni

Test Results

Result 1	Pass
Result 2	Pass
Result 3	Pass

RGL Sign Off

Signature	[redacted]
Date	21/05/2024

Main Contractor Sign Off

Sign Off by Main Contractor

Date Submitted: 21/05/2024 02:10 PM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing

Preliminaries

Is method statement complete and available	Yes
Have current drawings been issued and worked to	Yes

Testing

Type of Test Carried Out by RGL	Air
Test witnessed on behalf on behalf of Main Contractor by	Eli

Declaration

Acknowledgment	I am satisfied that the drainage results shown above are satisfactory to enable RG Structures Ltd to backfill drainage in location shown on image in Drainage Run Location section above Thank You
Signature on behalf on Main Contractor	
Enter Name	Eli
Date	21/05/2024

Date Submitted: 24/05/2024 02:00 PM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing

Job Details

Site Name	C130 - Gravesend
Site Address	Coldharbour Road, Gravesend DA11 7RU
Location Area	Storm 04-05 and 05-06
Client Name	Simply Develop
Job No.	130

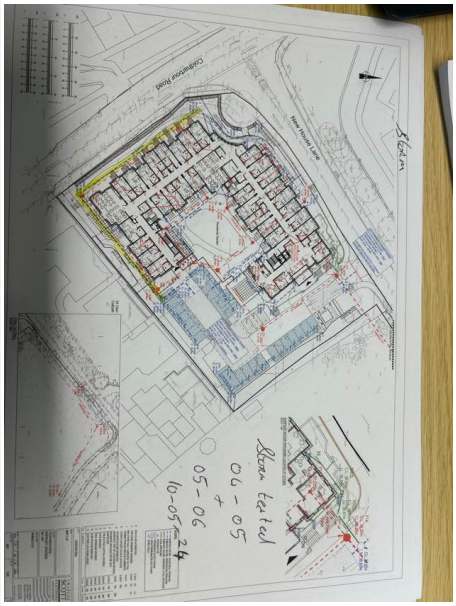
Inspection Details

Date of Permit Inspection	24/05/2024
Inspected By	Jason Sweeney

Preliminaries

Is method statement complete and available	Yes
Have current drawings been issued and worked to	Yes

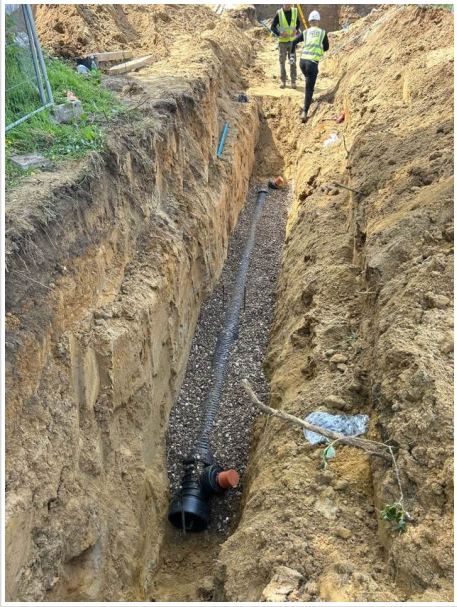
Drainage Run Location

Drainage Run Location	04-05 and 05-06
Upload Image (s)	 

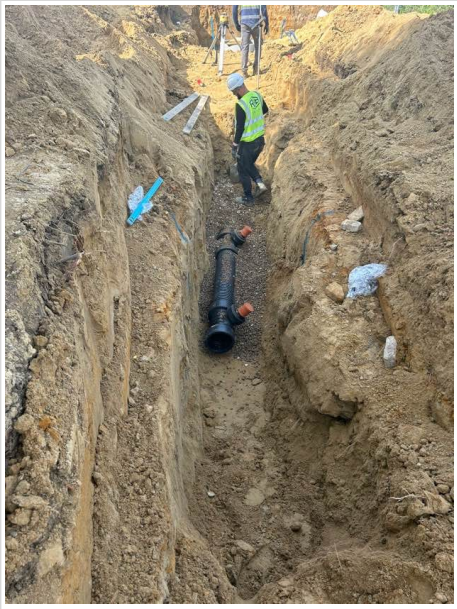
Date Submitted: 24/05/2024 02:00 PM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing









Description of Pipework

Pipe Description	Storm
Type of Pipe	UPVC
Size of Pipe	225mm, 150mm

Testing

Type of Test carried out	Air

Date Submitted: 24/05/2024 02:00 PM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing

Test carried out by	Other
If Other, enter details	Toni

Test Results

Result 1	Pass
Result 2	Pass
Result 3	Pass

RGL Sign Off

Signature	
Date	24/05/2024

Main Contractor Sign Off

Sign Off by Main Contractor

Preliminaries

Is method statement complete and available	Yes
Have current drawings been issued and worked to	Yes

Testing

Type of Test Carried Out by RGL	Air
Test witnessed on behalf on behalf of Main Contractor by	Eli

Declaration

Acknowledgment	I am satisfied that the drainage results shown above are satisfactory to enable RG Structures Ltd to backfill drainage in location shown on image in Drainage Run Location section above Thank You
Signature on behalf on Main Contractor	
Enter Name	Eli

Date Submitted: 24/05/2024 02:00 PM
Submitted By: jason@rgstructures.uk
RG Structures Ltd.
0208 9302430
www.rgstructures.uk

RGL-QM-06 Permit for Drainage Testing

Date	24/05/2024



CHARLES SCOTT & PARTNERS

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GLASGOW
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