SHEAR design
Consulting Civil and Structural Engineers

FUSION STUDENT ACCOMMODATION

ADDENDUM TO
FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

JUNCTION OF DEANSGATE, CHESTER ROAD
AND BRIDGEWATER VIADUCT, MANCHESTER M3 4LB

FOR FUSION MANCHESTER DEVCO LTD

NOVEMBER 2023
20047.02.03.D101

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Issue	Prepared by	Checked by	NOTES	Date
-	TU	DKK	First Issue	01.11.2023

1.0 INTRODUCTION

This Addendum is in response to the comments received from the Lead Local Flood Authority on 13/10/2023 in releation to Condtion 12, reference CDN/23/0448, of the planning permission reference 129406/FO/2021. This Addendum is to be read in conjunction with the Shear Design's Drainage Strategy report, dated June 2023 – document reference 20047.02.03.D100B.

Shear Design Ltd has prepared this report in accordance with the instructions of its Client – Fusion Manchester Devco Ltd for its Client's sole and specific use. This report is not assignable without the prior written permission of Shear Design Ltd. This report should not be relied upon exclusively for decision making purposes and should be read in conjunction with other Engineer's reports, specifications and drawings in addition to all other relevant reports, drawings and specifications.

2.0 LEAD LOCAL FLOOD AUTHORITY COMMENTS

The Lead Local Flood Authority has considered information uploaded to the Planning Portal on 4th July 2023, and an email sent to the authority on 13th September 2023. Consequently, the authority responded with the following observations and requirements;

To discharge condition 12, further information is needed to confirm that the proposed drainage has been installed as per the planning approval. The outstanding evidence required:

i. *Hydraulic calculation of the proposed drainage system; No hydraulic calculations have been submitted. When submitted, they must include all engineering parameters.*

Hydraulic calculations need to accurately reflect the site drainage arrangement. Manhole schedule for the modelled nodes need to be submitted and correlate with the proposed drainage layout. calculations should also accurately reflect two systems.

ii. *Construction details of flow control and SuDS elements - Developer needs to submit site specific construction details for flow controls and SuDS components (attenuation tank and blue roof specification).*

Ground floor drainage layout indicates the tank to potentially 'overflow into the basement tanks during an emergency'. The tank specification must include any overflow levels and detail the specific invert level of proposed overflow.

Engineering drawing indicating blue roof dimensions.

All attenuation specifications need to be submitted now (emergency overflow tank), to discharge our LLFA interest.

Surface water and foul drainage must be completely separate until the point of connection (FWH_29). This includes the basement tanks discharging via foul drainage.

iii. Manhole SMH_5 has a considerably low surface water discharge rate (0.2l/s) with a 10mm orifice plate, increasing the risk of blockage at this location. A blockage risk assessment will need to accompany the drainage submission. The management / maintenance plan must also stipulate regular chamber inspections to be completed following completion.

We would still have concerns of blockage with a 0.5l/s discharge via a 20mm orifice plate.

If this is the only viable option. The amendment in discharge rate / orifice plate needs to be reflected within the approved plan. The management / maintenance plan must also stipulate regular chamber inspections to be completed.

3.0 CONSULTANT ENGINEER'S RESPONSE

The respone has has been split in to the three LLFA requirements in *italics* with a description below in green pertaining to each one.

i. *Hydraulic calculation of the proposed drainage system; No hydraulic calculations have been submitted. When submitted, they must include all engineering parameters.*

Hydraulic calculations need to accurately reflect the site drainage arrangement. Manhole schedule for the modelled nodes need to be submitted and correlate with the proposed drainage layout. calculations should also accurately reflect two systems.

Hydraulic calculations are given in **Appendix A** of this document and these include the design settings, Link and Node information, Pipeline Schedule and Manhole Schedule. In addition to this the surface water calculations include Simulation Settings, Storm Durations, Flow Control, Permeable Paving (referred to as Carpark Storage Structure), Detention Tank (referred to as Depth Storage Structure) and results for 2 year, 30 year and 100 year + 40% simulations.

Therefore, all engineering parameters are included as requested. The hydraulic calculations accurately reflect the site drainage network. Most foul pipes are included with their associated discharge units provided by the MEP engineer but a few minor branches for floor gullies are not included. Most surface water pipes are included except for the furthest upstream end where it is not necessary to model the detail of pipework close to gullies, channels and permeable paving.

The proposed drainage layouts can be found in **Appendix B** and correlates with the manhole schedule in **Appendix C** and the aforementioned calculations. The drawing information correlates with the drainage model including the modelled nodes and accurately reflects the foul and surface water systems.

ii. *Construction details of flow control and SuDS elements - Developer needs to submit site specific construction details for flow controls and SuDS components (attenuation tank and blue roof specification).*

Ground floor drainage layout indicates the tank to potentially 'overflow into the basement tanks during an emergency'. The tank specification must include any overflow levels and detail the specific invert level of proposed overflow.

Engineering drawing indicating blue roof dimensions.

All attenuation specifications need to be submitted now (emergency overflow tank), to discharge our LLFA interest.

Surface water and foul drainage must be completely separate until the point of connection (FWH_29). This includes the basement tanks discharging via foul drainage.

The surface water detention tank and flow control chamber details are shown on drawing 20047-135D in **Appendix D**.

The blue/green roof dimensioned plan, architectural details and NBS specification are contained in **Appendix E**.

The detention tank has a revised overflow arrangement so that it now overflows via an external gully located on a small paved border adjacent to the footway on Deansgate. Drainage in this paved area, and at the main doorway, connects to the control chamber and flow can travel either way facilitating the overflow. The main doorway is higher than the small paved border and gully so is not at risk of flooding from a situation where the tank is overflowing. Exceedance flows of water from the tank will join other exceedance flow in the manner shown on the drawing within the drainage strategy. Drawing 20047-135D indicates the soffit of the attenation tank at 30.075 and the overflow gully cover level at 30.080. This ensures that the system will only ever overflow from the gully if the 1 in 100 year storm plus 40% climate change event is exceeded or if there is a blockage in the system downstream of the flow control device.

iii. *Manhole SMH_5 has a considerably low surface water discharge rate (0.2l/s) with a 10mm orifice plate, increasing the risk of blockage at this location. A blockage risk assessment will need to accompany the drainage submission. The management / maintenance plan must also stipulate regular chamber inspections to be completed following completion.*

We would still have concerns of blockage with a 0.5l/s discharge via a 20mm orifice plate.

If this is the only viable option. The amendment in discharge rate / orifice plate needs to be reflected within the approved plan. The management / maintenance plan must also stipulate regular chamber inspections to be completed.

To eliminate the risk of blockage the flow control orifice plate has been deleted allowing the discharge from the permeable paving and other small paved margins to freely drain into the drainage system. To compensate for the removal of the orifice plate the hydrobrake for the detention tank has been re-rated to 3.8 l/s, employing spare capacity previously provided within the detention tank. The tank itself has not changed in size but is now filled to capacity during the peak design event. These changes preserve the peak 5.0 l/s discharge rate from the development but omit the blockage risk arising from having a small diameter orifice. We have therefore not undertaken a blockage risk assessment.

When the management / maintenance plan is compiled prior to occupation a section will be included stipulating regular inspections all chambers.

APPENDIX A

FOUL WATER AND SURFACE WATER HYDRAULIC DRAINAGE CALCULATIONS (D102)

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20047.D102

Fusion Student Accommodation, Deansgate South, Manchester.

Foul Water and Surface Water Hydraulic Drainage Calculations

Contract No:	**20047.D102**
Date:	**27.10.2023**
By:	**TU**

DOCUMENT INDEX SHEET

Contract: Fusion Student Accommodation **Project No: 20047**

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Issue	Prepared by	Checked by	NOTES	Date
-	TU	TS/DK	First Issue	27/10/2023

1.0 DRAINAGE OVERVIEW

The proposed student accommodation development at Deansgate South is a tall building rising to 28 storeys and almost fully fills the site that it occupies. There is a front-of-house entrance into the ground floor at the west end of the building and there is a back of house entrance into the lower ground floor at the east end of the building.

Foul drainage is collected internally using sanitary pipework and drops to below ground at internal waste points on the lower ground floor. The foundation is formed from a single concrete pilecap over the full building footprint and within this pilecap there will be a network of foul drains connecting up the waste points into a system that emerges from the building to a boundary chamber and lateral drainage connection to the United Utilities combined sewer.

Rainwater is collected from roof level terraces including a top floor terrace with a green roof and drops within the building core to ground floor where it connects to the detention tank located beneath the ground floor. The ground floor has an external area of permeable paving adjacent to Bridgewater Viaduct draining into surface water drainage running below the ground floor slab and into the detention tank. Small external areas within the site boundary including the front of house entrance have individual gullies and channels connecting back into the detention tank. Part of the lower ground floor is set aside for the aforementioned rainwater detention tank and this sits on top of the floor slab immediately above the pilecap. Access to the tank is via manholes incorporated into the front of house area at ground floor. Similarly, a hydrobrake control chamber is located near the tank with an outlet set at 3.8 l/s. In an instance of a downstream blockage overflow will occur from the tank and control chamber once water exceeds the top of the tank. This overflow will emerge from a gully located in a small paved area adjacent to Deansgate upstream from the hydrobrake chamber with a cover level approximately the same as the top of the detention tank.

The lower ground floor entrance is accessed via an area of permeable paving, with water collected into surface water drainage arranged alongside the foul drainage within the pilecap. Channels provide backup drainage in the event of water running

off the permeable paving to prevent it from entering the building. Small external areas within the site boundary have individual gullies connecting back into the building. Water can discharge freely from this system bringing the overall surface water discharge to 5.0 l/s in accordance with the permitted discharge allowance, as agreed with United Utilities.

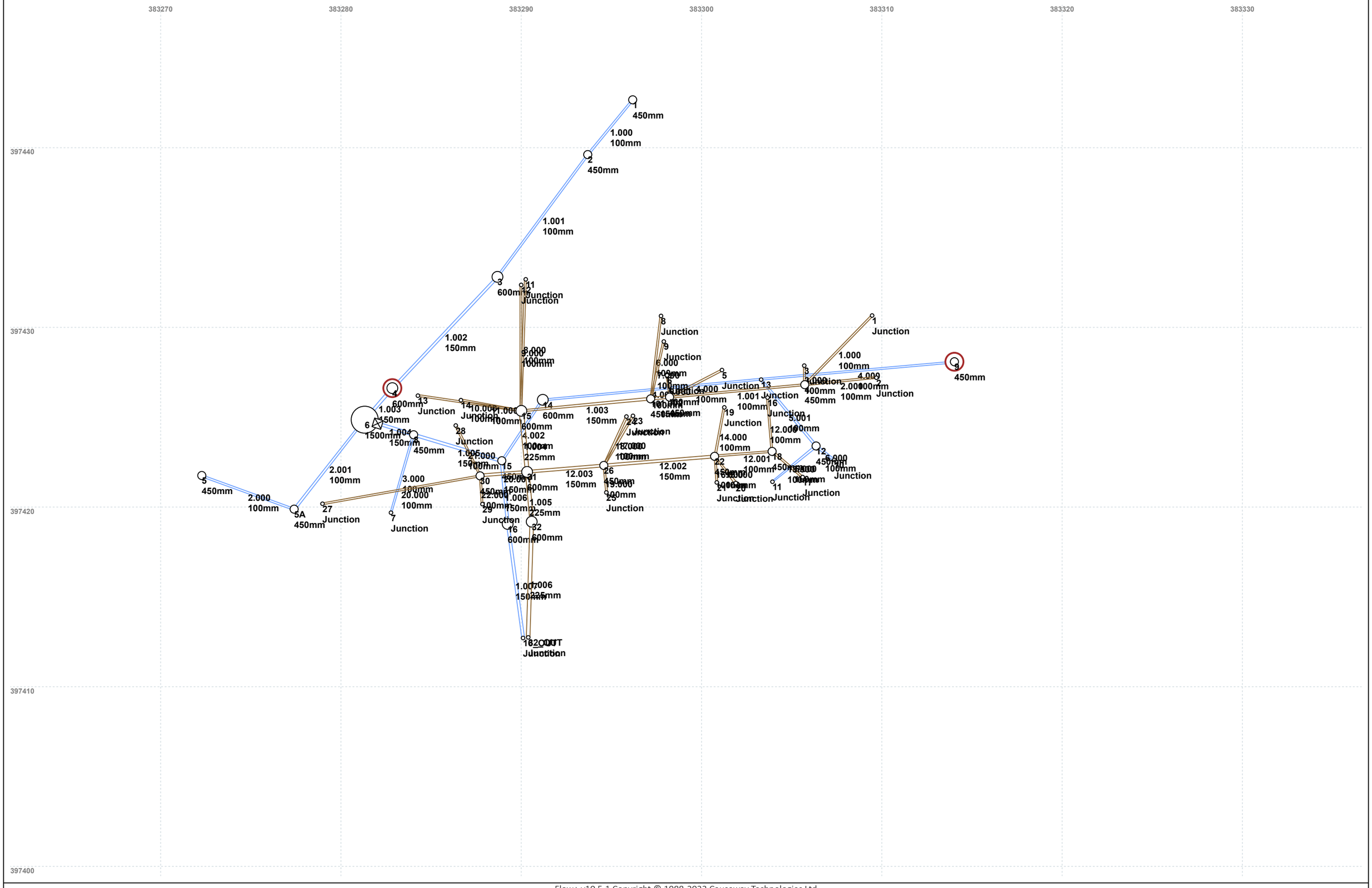
All underground drainage is conveyed by gravity and is part of a Causeway Flow hydraulic model with information provided in Appendices B and C. United Utilities has confirmed that they have measures in place to deal with sewer surcharging and that the development is not at risk. Therefore, there are no measures to prevent backflow from the main sewers. Vermin excluders may be fitted at inspection chambers should problems arise.

Design of above-ground drainage, including sanitary pipework and fittings, roof rainwater collection and detention tank venting is by others and not within the scope of information provided here.

A further point to mention is that the façade on all three elevations is specified as Corten Steel and is to have runoff collected into the proposed surface water drainage system with channels located beneath the lowest façade panels directing water to the proposed surface water drainage system. Façade runoff rates are not factored into the drainage calculations but on the other hand the tank has an element of spare capacity and the SUDS effect of the green roof will reduce flow into the tank.

APPENDIX A

Foul and surface water network diagram



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APPENDIX B

Foul water hydraulic drainage model information

Design Settings

Frequency of use (kDU)	0.50	Minimum Velocity (m/s)	1.00
Flow per dwelling per day (l/day)	0	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	1.000
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	0.850
Additional Flow (%)	0	Include Intermediate Ground	x

Nodes

Name	Units	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
1	1.3	28.100		383309.461	397430.659	0.950
2	1.0	28.100		383309.698	397427.198	0.950
3	1.3	28.100		383305.698	397427.871	0.950
4	1.0	28.100	Private	383305.727	397426.810	1.085
5	241.0	28.100		383301.134	397427.625	0.950
6	2.6	28.100		383298.088	397427.330	0.950
7	140.0	28.100	Private	383298.226	397426.118	1.230
8		28.100		383297.754	397430.636	0.950
9		28.100		383297.909	397429.213	0.950
10	1.0	28.100	Private	383297.180	397426.022	1.238
11	223.0	28.100		383290.250	397432.673	0.950
12	210.0	28.100		383289.997	397432.363	0.950
13	164.0	28.100		383284.269	397426.198	0.950
14	1.3	28.100		383286.656	397425.948	0.950
15	1.0	28.100	Private	383290.007	397425.355	1.362
16	1.3	28.100		383303.662	397426.092	0.950
17	1.3	28.100		383305.608	397421.668	0.950
18	1.0	28.100	Private	383303.915	397423.095	1.026
19	1.3	28.100		383301.264	397425.546	0.950
20	1.3	28.100		383301.902	397421.336	0.950
21	237.0	28.100		383300.846	397421.369	0.950
22	1.0	28.100	Private	383300.726	397422.822	1.117
23	1.3	28.100		383296.197	397425.075	0.950
24	1.3	28.100		383295.835	397425.037	0.950
25	114.0	28.100		383294.719	397420.810	0.950
26	1.0	28.100	Private	383294.580	397422.315	1.159
27	151.0	28.100		383278.977	397420.183	0.950
28	1.0	28.100		383286.369	397424.538	0.950
29	200.0	28.100		383287.849	397420.162	0.950
30	1.0	28.100	Private	383287.717	397421.737	1.328
31	1.0	28.100	Private	383290.325	397421.956	1.436
32	0.0	29.700	Private	383290.581	397419.184	3.084
32_OUT	0.0	29.680		383290.389	397412.746	3.175

Links (Results)

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.413	1.058	8.3	0.6	0.850	0.985	0.000	0	1.3	0.0	18	0.601
2.000	0.454	1.227	9.6	0.5	0.850	0.985	0.000	0	1.0	0.0	16	0.638
3.000	0.725	2.384	18.7	0.6	0.850	0.985	0.000	0	1.3	0.0	12	1.028
1.001	0.400	0.747	5.9	1.1	0.985	1.080	0.000	0	4.6	0.0	29	0.566
4.000	1.343	1.770	13.9	7.8	0.850	1.080	0.000	0	241.0	0.0	54	1.821
5.000	0.951	2.904	22.8	0.8	0.850	1.080	0.000	0	2.6	0.0	13	1.308
1.002	0.630	0.764	13.5	9.9	1.080	1.088	0.000	0	388.2	0.0	95	0.834
6.000	0.000	1.511	11.9	0.0	0.850	1.088	0.000	0	0.0	0.0	0	0.000
7.000	0.000	1.801	14.1	0.0	0.850	1.088	0.000	0	0.0	0.0	0	0.000
1.003	0.602	0.721	12.7	9.9	1.088	1.137	0.000	0	389.2	0.0	99	0.798
8.000	1.076	1.321	10.4	7.5	0.850	1.137	0.000	0	223.0	0.0	63	1.441
9.000	1.085	1.351	10.6	7.2	0.850	1.137	0.000	0	210.0	0.0	61	1.455
10.000	1.127	1.485	11.7	6.4	0.850	1.137	0.000	0	164.0	0.0	53	1.519
11.000	0.634	1.940	15.2	0.6	0.850	1.137	0.000	0	1.3	0.0	14	0.909
1.004	1.004	1.692	67.3	15.7	1.137	1.211	0.000	0	988.5	0.0	74	1.384
12.000	0.413	1.060	8.3	0.6	0.850	0.926	0.000	0	1.3	0.0	18	0.602
13.000	0.457	1.236	9.7	0.6	0.850	0.926	0.000	0	1.3	0.0	17	0.663
12.001	0.391	0.753	5.9	0.9	0.926	0.967	0.000	0	3.6	0.0	27	0.543
14.000	0.507	1.370	10.8	0.6	0.850	0.967	0.000	0	1.3	0.0	16	0.713
15.000	0.579	1.659	13.0	0.6	0.850	0.967	0.000	0	1.3	0.0	14	0.807
16.000	1.414	1.893	14.9	7.7	0.850	0.967	0.000	0	237.0	0.0	51	1.912
12.002	0.564	0.722	12.8	7.8	0.967	1.009	0.000	0	244.2	0.0	85	0.758
17.000	0.519	1.488	11.7	0.6	0.850	1.009	0.000	0	1.3	0.0	15	0.749
18.000	0.536	1.538	12.1	0.6	0.850	1.009	0.000	0	1.3	0.0	15	0.774

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Links (Results)

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
19.000	1.395	2.168	17.0	5.3	0.850	1.009	0.000	0	114.0	0.0	39	1.916
12.003	1.193	1.911	33.8	9.5	1.009	1.211	0.000	0	361.8	0.0	55	1.644
20.000	1.002	1.283	10.1	6.1	0.850	1.178	0.000	0	151.0	0.0	57	1.349
21.000	0.660	2.171	17.1	0.5	0.850	1.178	0.000	0	1.0	0.0	12	0.936
22.000	1.918	3.047	23.9	7.1	0.850	1.178	0.000	0	200.0	0.0	37	2.636
20.001	0.741	0.984	17.4	9.4	1.178	1.211	0.000	0	353.0	0.0	79	1.005
1.005	1.002	1.509	60.0	20.6	1.211	2.859	0.000	0	1704.3	0.0	91	1.369
1.006	1.002	1.508	60.0	20.6	2.859	2.950	0.000	0	1704.3	0.0	91	1.369

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	5.363	39.7	100	Circular_1	28.100	27.150	0.850	28.100	27.015	0.985
2.000	3.990	29.6	100	Circular_1	28.100	27.150	0.850	28.100	27.015	0.985
3.000	1.061	7.9	100	Circular_1	28.100	27.150	0.850	28.100	27.015	0.985
1.001	7.533	79.3	100	Circular_1	28.100	27.015	0.985	28.100	26.920	1.080
4.000	3.275	14.2	100	Circular_1	28.100	27.150	0.850	28.100	26.920	1.080
5.000	1.220	5.3	100	Circular_1	28.100	27.150	0.850	28.100	26.920	1.080
1.002	1.050	131.3	150	Circular_1	28.100	26.870	1.080	28.100	26.862	1.088
6.000	4.650	19.5	100	Circular_1	28.100	27.150	0.850	28.100	26.912	1.088
7.000	3.273	13.8	100	Circular_1	28.100	27.150	0.850	28.100	26.912	1.088
1.003	7.204	147.0	150	Circular_1	28.100	26.862	1.088	28.100	26.813	1.137
8.000	7.322	25.5	100	Circular_1	28.100	27.150	0.850	28.100	26.863	1.137
9.000	7.008	24.4	100	Circular_1	28.100	27.150	0.850	28.100	26.863	1.137
10.000	5.800	20.2	100	Circular_1	28.100	27.150	0.850	28.100	26.863	1.137
11.000	3.403	11.9	100	Circular_1	28.100	27.150	0.850	28.100	26.863	1.137
1.004	3.414	46.1	225	Circular_1	28.100	26.738	1.137	28.100	26.664	1.211
12.000	3.008	39.6	100	Circular_1	28.100	27.150	0.850	28.100	27.074	0.926
13.000	2.214	29.1	100	Circular_1	28.100	27.150	0.850	28.100	27.074	0.926
12.001	3.201	78.1	100	Circular_1	28.100	27.074	0.926	28.100	27.033	0.967
14.000	2.777	23.7	100	Circular_1	28.100	27.150	0.850	28.100	27.033	0.967
15.000	1.895	16.2	100	Circular_1	28.100	27.150	0.850	28.100	27.033	0.967
16.000	1.458	12.5	100	Circular_1	28.100	27.150	0.850	28.100	27.033	0.967
12.002	6.167	146.8	150	Circular_1	28.100	26.983	0.967	28.100	26.941	1.009
17.000	3.199	20.1	100	Circular_1	28.100	27.150	0.850	28.100	26.991	1.009
18.000	2.997	18.9	100	Circular_1	28.100	27.150	0.850	28.100	26.991	1.009
19.000	1.511	9.5	100	Circular_1	28.100	27.150	0.850	28.100	26.991	1.009
12.003	4.270	21.1	150	Circular_1	28.100	26.941	1.009	28.100	26.739	1.211
20.000	8.877	27.1	100	Circular_1	28.100	27.150	0.850	28.100	26.822	1.178

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1		Junction		4	450	Manhole	Private
2.000	2		Junction		4	450	Manhole	Private
3.000	3		Junction		4	450	Manhole	Private
1.001	4	450	Manhole	Private	7	450	Manhole	Private
4.000	5		Junction		7	450	Manhole	Private
5.000	6		Junction		7	450	Manhole	Private
1.002	7	450	Manhole	Private	10	450	Manhole	Private
6.000	8		Junction		10	450	Manhole	Private
7.000	9		Junction		10	450	Manhole	Private
1.003	10	450	Manhole	Private	15	600	Manhole	Private
8.000	11		Junction		15	600	Manhole	Private
9.000	12		Junction		15	600	Manhole	Private
10.000	13		Junction		15	600	Manhole	Private
11.000	14		Junction		15	600	Manhole	Private
1.004	15	600	Manhole	Private	31	600	Manhole	Private
12.000	16		Junction		18	450	Manhole	Private
13.000	17		Junction		18	450	Manhole	Private
12.001	18	450	Manhole	Private	22	450	Manhole	Private
14.000	19		Junction		22	450	Manhole	Private
15.000	20		Junction		22	450	Manhole	Private
16.000	21		Junction		22	450	Manhole	Private
12.002	22	450	Manhole	Private	26	450	Manhole	Private
17.000	23		Junction		26	450	Manhole	Private
18.000	24		Junction		26	450	Manhole	Private
19.000	25		Junction		26	450	Manhole	Private
12.003	26	450	Manhole	Private	31	600	Manhole	Private
20.000	27		Junction		30	450	Manhole	Private

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Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
21.000	3.108	9.5	100	Circular_1	28.100	27.150	0.850	28.100	26.822	1.178
22.000	1.581	4.8	100	Circular_1	28.100	27.150	0.850	28.100	26.822	1.178
20.001	2.617	79.3	150	Circular_1	28.100	26.772	1.178	28.100	26.739	1.211
1.005	2.784	58.0	225	Circular_1	28.100	26.664	1.211	29.700	26.616	2.859
1.006	6.441	58.0	225	Circular_1	29.700	26.616	2.859	29.680	26.505	2.950

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
21.000	28		Junction		30	450	Manhole	Private
22.000	29		Junction		30	450	Manhole	Private
20.001	30	450	Manhole	Private	31	600	Manhole	Private
1.005	31	600	Manhole	Private	32	600	Manhole	Private
1.006	32	600	Manhole	Private	32_OUT		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	383309.461	397430.659	28.100	0.950		0	1.000	27.150	100
2	383309.698	397427.198	28.100	0.950		0	2.000	27.150	100
3	383305.698	397427.871	28.100	0.950		0	3.000	27.150	100
4	383305.727	397426.810	28.100	1.085	450	1 2 3 0	3.000 2.000 1.000 1.001	27.015 27.015 27.015 27.015	100 100 100 100
5	383301.134	397427.625	28.100	0.950		0	4.000	27.150	100
6	383298.088	397427.330	28.100	0.950		0	5.000	27.150	100
7	383298.226	397426.118	28.100	1.230	450	1 2 3 0	5.000 4.000 1.001 1.002	26.920 26.920 26.920 26.870	100 100 100 150
8	383297.754	397430.636	28.100	0.950		0	6.000	27.150	100
9	383297.909	397429.213	28.100	0.950		0	7.000	27.150	100
10	383297.180	397426.022	28.100	1.238	450	1 2 3 0	7.000 6.000 1.002 1.003	26.912 26.912 26.862 26.862	100 100 150 150
11	383290.250	397432.673	28.100	0.950		0	8.000	27.150	100
12	383289.997	397432.363	28.100	0.950		0	9.000	27.150	100
13	383284.269	397426.198	28.100	0.950		0	10.000	27.150	100

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
14	383286.656	397425.948	28.100	0.950			0	11.000	27.150	100
15	383290.007	397425.355	28.100	1.362	600		1	11.000	26.863	100
							2	10.000	26.863	100
							3	9.000	26.863	100
							4	8.000	26.863	100
							5	1.003	26.813	150
							0	1.004	26.738	225
16	383303.662	397426.092	28.100	0.950			0	12.000	27.150	100
17	383305.608	397421.668	28.100	0.950			0	13.000	27.150	100
18	383303.915	397423.095	28.100	1.026	450		1	13.000	27.074	100
							2	12.000	27.074	100
							0	12.001	27.074	100
19	383301.264	397425.546	28.100	0.950			0	14.000	27.150	100
20	383301.902	397421.336	28.100	0.950			0	15.000	27.150	100
21	383300.846	397421.369	28.100	0.950			0	16.000	27.150	100
22	383300.726	397422.822	28.100	1.117	450		1	16.000	27.033	100
							2	15.000	27.033	100
							3	14.000	27.033	100
							4	12.001	27.033	100
							0	12.002	26.983	150
23	383296.197	397425.075	28.100	0.950			0	17.000	27.150	100
24	383295.835	397425.037	28.100	0.950			0	18.000	27.150	100
25	383294.719	397420.810	28.100	0.950			0	19.000	27.150	100
26	383294.580	397422.315	28.100	1.159	450		1	19.000	26.991	100
							2	18.000	26.991	100
							3	17.000	26.991	100
							4	12.002	26.941	150
							0	12.003	26.941	150
27	383278.977	397420.183	28.100	0.950			0	20.000	27.150	100
28	383286.369	397424.538	28.100	0.950			0	21.000	27.150	100
29	383287.849	397420.162	28.100	0.950			0	22.000	27.150	100
30	383287.717	397421.737	28.100	1.328	450		1	22.000	26.822	100
							2	21.000	26.822	100
							3	20.000	26.822	100
							0	20.001	26.772	150

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Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
31	383290.325	397421.956	28.100	1.436	600		1 2 3 0	20.001 12.003 1.004 1.005	26.739 26.739 26.664 26.664	150 150 225 225
32	383290.581	397419.184	29.700	3.084	600		1 0	1.005 1.006	26.616 26.616	225 225
32_OUT	383290.389	397412.746	29.680	3.175			1	1.006	26.505	225

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APPENDIX C

Surface water hydraulic drainage model information

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	250.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	18.000	Minimum Backdrop Height (m)	1.000
Ratio-R	0.366	Preferred Cover Depth (m)	0.450
CV	1.000	Include Intermediate Ground	x
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.002	5.00	30.700	450	383296.182	397442.665	0.550
2			30.850	450	383293.688	397439.616	0.769
3	0.062	5.00	30.850	600	383288.681	397432.812	2.147
4			30.850	600	383282.851	397426.619	2.225
5		5.00	30.830	450	383272.282	397421.755	0.550
5A	0.001	5.00	30.080	450	383277.404	397419.882	0.550
6			30.850	1500	383281.320	397424.862	2.380
7		5.00	28.100		383282.775	397419.686	0.550
8			28.100	450	383284.032	397424.023	0.676
9	0.003	5.00	28.050	450	383314.026	397428.087	0.550
11		5.00	28.100		383303.935	397421.409	0.550
10		5.00	28.100		383307.358	397422.619	0.550
12			28.100	450	383306.353	397423.400	0.603
13			28.100		383303.307	397427.092	0.781
14			28.100	600	383291.196	397425.968	0.986
15			28.100	450	383288.921	397422.577	1.105
16			29.750	600	383289.248	397419.060	2.791
16_OUT			29.680		383290.101	397412.712	2.785

Links (Results)

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.021	8.0	0.4	0.450	0.669	0.002	0.0	16	0.543
1.001	1.042	8.2	0.4	0.669	0.823	0.002	0.0	16	0.554
1.002	1.003	17.7	13.7	1.997	2.075	0.064	0.0	99	1.104
1.003	1.041	18.4	13.6	2.075	2.100	0.064	0.0	96	1.136
2.000	2.885	22.7	0.0	0.450	0.450	0.000	0.0	0	0.000
2.001	2.940	23.1	0.2	0.450	2.125	0.001	0.0	7	0.875
1.004	6.163	108.9	13.8	2.230	0.526	0.065	0.0	36	4.250
3.000	1.001	7.9	0.0	0.450	0.526	0.000	0.0	0	0.000
1.005	2.938	51.9	13.7	0.526	0.955	0.065	0.0	52	2.485
4.000	1.000	7.9	0.6	0.450	0.681	0.003	0.0	19	0.595
5.000	1.004	7.9	0.0	0.450	0.503	0.000	0.0	0	0.000
6.000	1.582	12.4	0.0	0.450	0.503	0.000	0.0	0	0.000
5.001	1.494	11.7	0.0	0.503	0.681	0.000	0.0	0	0.000
4.001	1.002	7.9	0.6	0.681	0.886	0.003	0.0	19	0.596
4.002	1.003	7.9	0.6	0.886	0.955	0.003	0.0	19	0.596
1.006	1.014	17.9	14.3	0.955	2.641	0.068	0.0	101	1.123
1.007	1.004	17.7	14.1	2.641	2.635	0.068	0.0	101	1.112

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	3.939	57.1	100	Circular_1	30.700	30.150	0.450	30.850	30.081	0.669
1.001	8.448	54.9	100	Circular_1	30.850	30.081	0.669	30.850	29.927	0.823
1.002	7.825	100.3	150	Circular_1	30.850	28.703	1.997	30.850	28.625	2.075
1.003	2.330	93.2	150	Circular_1	30.850	28.625	2.075	30.850	28.600	2.100
2.000	5.454	7.3	100	Circular_1	30.830	30.280	0.450	30.080	29.530	0.450

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	450	Manhole	Private	2	450	Manhole	Private
1.001	2	450	Manhole	Private	3	600	Manhole	Private
1.002	3	600	Manhole	Private	4	600	Manhole	Private
1.003	4	600	Manhole	Private	6	1500	Manhole	Private
2.000	5	450	Manhole	Private	5A	450	Manhole	Private

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Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
2.001	6.335	7.0	100	Circular_1	30.080	29.530	0.450	30.850	28.625	2.125
1.004	2.839	2.7	150	Circular_1	30.850	28.470	2.230	28.100	27.424	0.526
3.000	4.515	59.4	100	Circular_1	28.100	27.550	0.450	28.100	27.474	0.526
1.005	5.098	11.9	150	Circular_1	28.100	27.424	0.526	28.100	26.995	0.955
4.000	10.765	59.5	100	Circular_1	28.050	27.500	0.450	28.100	27.319	0.681
5.000	3.132	59.1	100	Circular_1	28.100	27.550	0.450	28.100	27.497	0.503
6.000	1.273	24.0	100	Circular_1	28.100	27.550	0.450	28.100	27.497	0.503
5.001	4.786	26.9	100	Circular_1	28.100	27.497	0.503	28.100	27.319	0.681
4.001	12.163	59.3	100	Circular_1	28.100	27.319	0.681	28.100	27.114	0.886
4.002	4.083	59.2	100	Circular_1	28.100	27.114	0.886	28.100	27.045	0.955
1.006	3.532	98.1	150	Circular_1	28.100	26.995	0.955	29.750	26.959	2.641
1.007	6.405	100.1	150	Circular_1	29.750	26.959	2.641	29.680	26.895	2.635

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.001	5A	450	Manhole	Private	6	1500	Manhole	Private
1.004	6	1500	Manhole	Private	8	450	Manhole	Private
3.000	7		Junction		8	450	Manhole	Private
1.005	8	450	Manhole	Private	15	450	Manhole	Private
4.000	9	450	Manhole	Private	13		Junction	
5.000	11		Junction		12	450	Manhole	Private
6.000	10		Junction		12	450	Manhole	Private
5.001	12	450	Manhole	Private	13		Junction	
4.001	13		Junction		14	600	Manhole	Private
4.002	14	600	Manhole	Private	15	450	Manhole	Private
1.006	15	450	Manhole	Private	16	600	Manhole	Private
1.007	16	600	Manhole	Private	16_OUT		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	383296.182	397442.665	30.700	0.550	450	0	1.000	30.150	100
2	383293.688	397439.616	30.850	0.769	450	1 0	1.000 1.001	30.081 30.081	100 100
3	383288.681	397432.812	30.850	2.147	600	1 0	1.001 1.002	29.927 28.703	100 150
4	383282.851	397426.619	30.850	2.225	600	1 0	1.002 1.003	28.625 28.625	150 150
5	383272.282	397421.755	30.830	0.550	450	0	2.000	30.280	100
5A	383277.404	397419.882	30.080	0.550	450	1 0	2.000 2.001	29.530 29.530	100 100
6	383281.320	397424.862	30.850	2.380	1500	1 2 0	2.001 1.003 1.004	28.625 28.600 28.470	100 150 150
7	383282.775	397419.686	28.100	0.550		0	3.000	27.550	100
8	383284.032	397424.023	28.100	0.676	450	1 2 0	3.000 1.004 1.005	27.474 27.424 27.424	100 150 150
9	383314.026	397428.087	28.050	0.550	450	0	4.000	27.500	100

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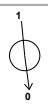
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
11	383303.935	397421.409	28.100	0.550			0	5.000	27.550	100
10	383307.358	397422.619	28.100	0.550			0	6.000	27.550	100
12	383306.353	397423.400	28.100	0.603	450		1	6.000	27.497	100
							2	5.000	27.497	100
							0	5.001	27.497	100
13	383303.307	397427.092	28.100	0.781			1	5.001	27.319	100
							2	4.000	27.319	100
							0	4.001	27.319	100
14	383291.196	397425.968	28.100	0.986	600		1	4.001	27.114	100
							0	4.002	27.114	100
15	383288.921	397422.577	28.100	1.105	450		1	4.002	27.045	100
							2	1.005	26.995	150
							0	1.006	26.995	150
16	383289.248	397419.060	29.750	2.791	600		1	1.006	26.959	150
							0	1.007	26.959	150
16_OUT	383290.101	397412.712	29.680	2.785			1	1.007	26.895	150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	18.000	Drain Down Time (mins)	1000
Ratio-R	0.366	Additional Storage (m³/ha)	20.0
Summer CV	1.000	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	40	0	0

Node 6 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	28.470	Product Number	CTL-SHE-0085-3800-1550-3800
Design Depth (m)	1.550	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	3.8	Min Node Diameter (mm)	1200

Node 9 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	27.500	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.350
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.30	Length (m)	5.000		

Node 4 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	28.625
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	55

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Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	12.0	0.0	1.500	12.0	0.0	1.501	0.0	0.0

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Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	30.166	0.016	0.4	0.0037	0.0000	OK
15 minute winter	2	11	30.096	0.015	0.4	0.0024	0.0000	OK
30 minute summer	3	23	28.857	0.154	11.6	0.1328	0.0000	SURCHARGED
30 minute summer	4	23	28.854	0.229	11.4	2.8138	0.0000	SURCHARGED
15 minute summer	5	1	30.280	0.000	0.0	0.0000	0.0000	OK
15 minute summer	5A	11	29.537	0.007	0.2	0.0013	0.0000	OK
30 minute summer	6	23	28.852	0.382	5.4	0.6756	0.0000	SURCHARGED
15 minute summer	7	1	27.550	0.000	0.0	0.0000	0.0000	OK
30 minute winter	8	24	27.450	0.026	3.4	0.0042	0.0000	OK
15 minute summer	9	12	27.517	0.017	0.6	0.1117	0.0000	OK
15 minute summer	11	1	27.550	0.000	0.0	0.0000	0.0000	OK
15 minute summer	10	1	27.550	0.000	0.0	0.0000	0.0000	OK
15 minute summer	12	1	27.497	0.000	0.0	0.0000	0.0000	OK
15 minute summer	13	13	27.336	0.017	0.5	0.0000	0.0000	OK
15 minute summer	14	13	27.131	0.017	0.5	0.0048	0.0000	OK
15 minute summer	15	14	27.047	0.052	3.9	0.0083	0.0000	OK
15 minute summer	16	14	27.008	0.049	3.9	0.0139	0.0000	OK
15 minute summer	16_OUT	14	26.942	0.047	3.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	0.4	0.537	0.050	0.0030	
15 minute winter	2	1.001	3	0.4	0.535	0.049	0.0063	
30 minute summer	3	1.002	4	11.4	0.994	0.645	0.1378	
30 minute summer	4	1.003	6	5.3	0.823	0.289	0.0410	
15 minute summer	5	2.000	5A	0.0	0.000	0.000	0.0006	
15 minute summer	5A	2.001	6	0.2	0.828	0.009	0.0255	
30 minute summer	6	Hydro-Brake®	8	3.4				
15 minute summer	7	3.000	8	0.0	0.000	0.000	0.0000	
30 minute winter	8	1.005	15	3.4	0.982	0.066	0.0188	
15 minute summer	9	4.000	13	0.5	0.552	0.060	0.0091	
15 minute summer	11	5.000	12	0.0	0.000	0.000	0.0000	
15 minute summer	10	6.000	12	0.0	0.000	0.000	0.0000	
15 minute summer	12	5.001	13	0.0	0.000	0.000	0.0020	
15 minute summer	13	4.001	14	0.5	0.551	0.059	0.0104	
15 minute summer	14	4.002	15	0.5	0.534	0.057	0.0035	
15 minute summer	15	1.006	16	3.9	0.741	0.215	0.0184	
15 minute summer	16	1.007	16_OUT	3.9	0.791	0.218	0.0313	5.9

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Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	30.172	0.022	0.8	0.0051	0.0000	OK
15 minute summer	2	11	30.102	0.021	0.8	0.0033	0.0000	OK
60 minute summer	3	46	29.238	0.535	16.7	0.4601	0.0000	SURCHARGED
60 minute summer	4	47	29.236	0.611	15.8	7.4990	0.0000	SURCHARGED
15 minute summer	5	1	30.280	0.000	0.0	0.0000	0.0000	OK
15 minute summer	5A	11	29.539	0.009	0.4	0.0018	0.0000	OK
60 minute summer	6	47	29.234	0.764	5.1	1.3505	0.0000	SURCHARGED
15 minute summer	7	1	27.550	0.000	0.0	0.0000	0.0000	OK
240 minute summer	8	172	27.450	0.026	3.4	0.0042	0.0000	OK
15 minute summer	9	12	27.524	0.024	1.1	0.1668	0.0000	OK
15 minute summer	11	1	27.550	0.000	0.0	0.0000	0.0000	OK
15 minute summer	10	1	27.550	0.000	0.0	0.0000	0.0000	OK
15 minute summer	12	1	27.497	0.000	0.0	0.0000	0.0000	OK
15 minute summer	13	12	27.343	0.024	1.0	0.0000	0.0000	OK
15 minute summer	14	13	27.138	0.024	1.0	0.0069	0.0000	OK
15 minute summer	15	12	27.050	0.055	4.2	0.0087	0.0000	OK
15 minute summer	16	12	27.010	0.051	4.2	0.0145	0.0000	OK
15 minute summer	16_OUT	12	26.945	0.050	4.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	0.8	0.634	0.096	0.0048	
15 minute summer	2	1.001	3	0.8	0.644	0.092	0.0099	
60 minute summer	3	1.002	4	15.8	0.907	0.892	0.1378	
60 minute summer	4	1.003	6	4.8	0.775	0.262	0.0410	
15 minute summer	5	2.000	5A	0.0	0.000	0.000	0.0010	
15 minute summer	5A	2.001	6	0.4	0.720	0.017	0.0259	
60 minute summer	6	Hydro-Brake®	8	3.4				
15 minute summer	7	3.000	8	0.0	0.000	0.000	0.0000	
240 minute summer	8	1.005	15	3.4	0.984	0.066	0.0186	
15 minute summer	9	4.000	13	1.0	0.676	0.122	0.0153	
15 minute summer	11	5.000	12	0.0	0.000	0.000	0.0000	
15 minute summer	10	6.000	12	0.0	0.000	0.000	0.0000	
15 minute summer	12	5.001	13	0.0	0.000	0.000	0.0034	
15 minute summer	13	4.001	14	1.0	0.665	0.121	0.0175	
15 minute summer	14	4.002	15	0.9	0.656	0.119	0.0058	
15 minute summer	15	1.006	16	4.2	0.757	0.235	0.0196	
15 minute summer	16	1.007	16_OUT	4.2	0.809	0.237	0.0333	11.2

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Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	30.180	0.030	1.4	0.0069	0.0000	OK
15 minute summer	2	11	30.109	0.028	1.4	0.0045	0.0000	OK
60 minute winter	3	57	30.019	1.316	22.2	1.1320	0.0000	SURCHARGED
60 minute winter	4	57	30.014	1.389	20.9	17.0654	0.0000	SURCHARGED
15 minute summer	5	1	30.280	0.000	0.0	0.0000	0.0000	OK
60 minute winter	5A	57	30.012	0.482	2.1	0.0940	0.0000	FLOOD RISK
60 minute winter	6	57	30.012	1.542	7.0	2.7249	0.0000	SURCHARGED
15 minute summer	7	1	27.550	0.000	0.0	0.0000	0.0000	OK
60 minute winter	8	58	27.452	0.028	3.8	0.0044	0.0000	OK
15 minute summer	9	11	27.534	0.034	2.1	0.2441	0.0000	OK
15 minute summer	11	1	27.550	0.000	0.0	0.0000	0.0000	OK
15 minute summer	10	1	27.550	0.000	0.0	0.0000	0.0000	OK
15 minute summer	12	1	27.497	0.000	0.0	0.0000	0.0000	OK
15 minute summer	13	12	27.352	0.033	1.9	0.0000	0.0000	OK
15 minute summer	14	12	27.149	0.035	1.9	0.0100	0.0000	OK
30 minute summer	15	21	27.055	0.060	5.0	0.0096	0.0000	OK
30 minute summer	16	21	27.015	0.056	5.0	0.0159	0.0000	OK
30 minute summer	16_OUT	21	26.949	0.054	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	1.4	0.732	0.172	0.0074	
15 minute summer	2	1.001	3	1.4	0.758	0.165	0.0151	
60 minute winter	3	1.002	4	20.9	1.188	1.180	0.1378	
60 minute winter	4	1.003	6	7.0	0.760	0.380	0.0410	
15 minute summer	5	2.000	5A	0.0	0.000	0.000	0.0213	
60 minute winter	5A	2.001	6	-1.8	0.725	-0.078	0.0496	
60 minute winter	6	Hydro-Brake®	8	3.8				
15 minute summer	7	3.000	8	0.0	0.000	0.000	0.0000	
60 minute winter	8	1.005	15	3.8	1.007	0.073	0.0207	
15 minute summer	9	4.000	13	1.9	0.817	0.238	0.0246	
15 minute summer	11	5.000	12	0.0	0.000	0.000	0.0000	
15 minute summer	10	6.000	12	0.0	0.000	0.000	0.0000	
15 minute summer	12	5.001	13	0.0	0.000	0.000	0.0054	
15 minute summer	13	4.001	14	1.9	0.790	0.238	0.0289	
15 minute summer	14	4.002	15	1.9	0.787	0.237	0.0097	
30 minute summer	15	1.006	16	5.0	0.789	0.279	0.0224	
30 minute summer	16	1.007	16_OUT	5.0	0.848	0.282	0.0377	27.0

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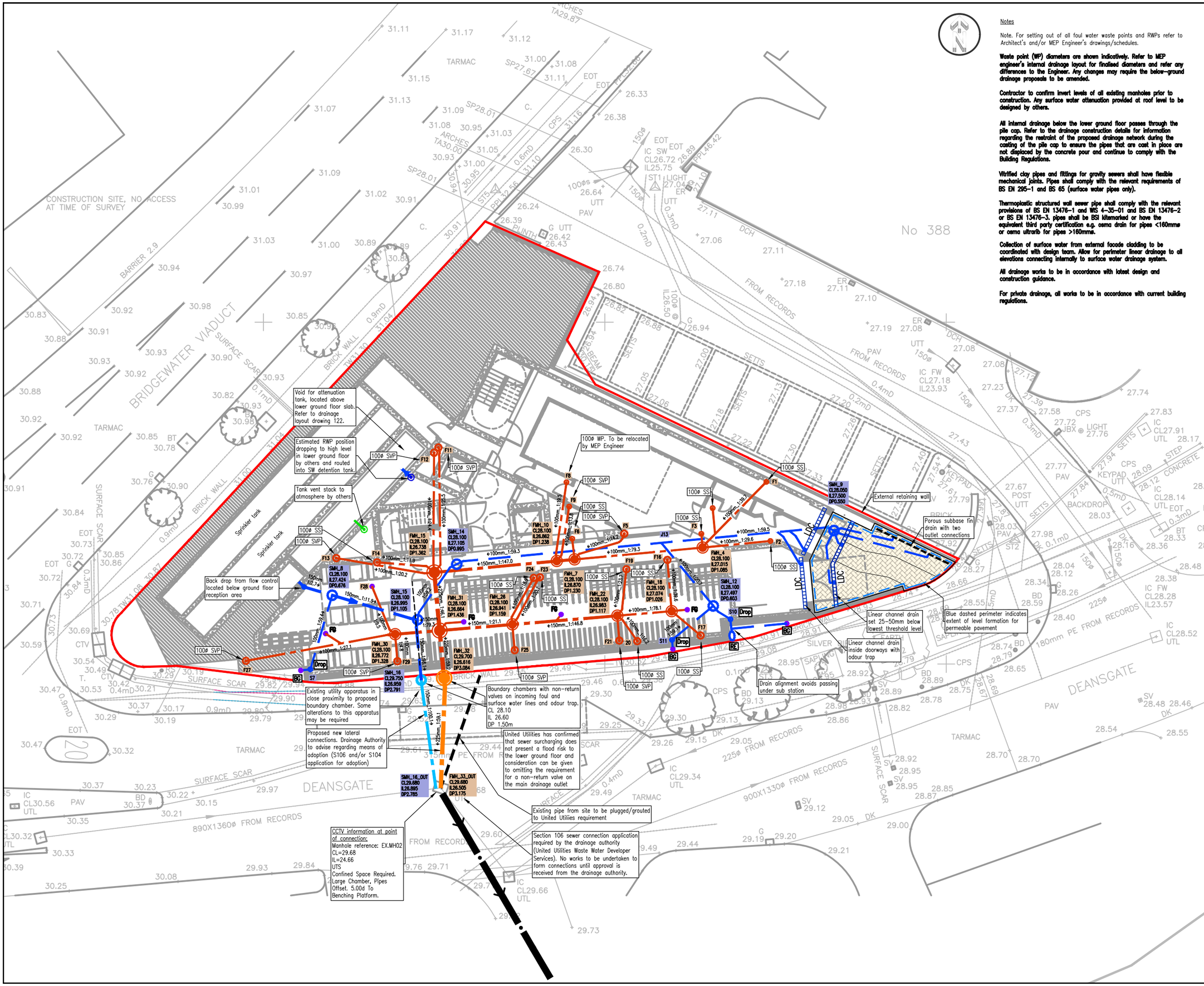
APPENDIX B

DRAINAGE LAYOUT DRAWINGS



Notes

Note. For setting out of all foul water waste points and RWPs refer to Architect's and/or MEP Engineer's drawings/schedules.

Waste point (WP) diameters are shown indicatively. Refer to MEP engineer's internal drainage layout for finalised diameters and refer any differences to the Engineer. Any changes may require the below-ground drainage proposals to be amended.

Contractor to confirm invert levels of all existing manholes prior to construction. Any surface water attenuation provided at roof level to be designed by others.

All internal drainage below the lower ground floor passes through the pile cap. Refer to the drainage construction details for information regarding the restraint of the proposed drainage network during the casting of the pile cap to ensure the pipes that are cast in place are not displaced by the concrete pour and continue to comply with the Building Regulations.

Vitrified clay pipes and fittings for gravity sewers shall have flexible mechanical joints. Pipes shall comply with the relevant requirements of BS EN 295-1 and BS 65 (surface water pipes only).

Thermoplastic structured wall sewer pipe shall comply with the relevant provisions of BS EN 13476-1 and WIS 4-35-01 and BS EN 13476-2 or BS EN 13476-3. pipes shall be BSI kitemarked or have the equivalent third party certification e.g. osma drain for pipes <160mmø or osma ultrarib for pipes >160mmø.

Collection of surface water from external facade cladding to be coordinated with design team. Allow for perimeter linear drainage to all elevations connecting internally to surface water drainage system.

All drainage works to be in accordance with latest design and construction guidance.

For private drainage, all works to be in accordance with current building regulations.

NOTES

GENERAL

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS RELATE TO ORDNANCE DATUM UNLESS NOTED OTHERWISE.
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KEY

Existing foul sewer. For further information refer to the drainage strategy document 20047-D100 appendix C and to drawing 20047-105 Existing Drainage Layout.

LDC — Threshold channel with minimum B125 cover loading. For style refer to Architect.

Internal surface water drains. Refer to plan for pipe sizes and gradients.

Adoptable SW lateral drain. Refer to plan for pipe size and gradient

Proposed surface water inspection chamber.

Permeable paving fin drain outlet feature incorporating connectors and top hat seal through membrane

Permeable block paving. Minimum 480mm thick with 80mm block pavers or similar approved

Internal foul drains. Refer to plan for pipe size and gradients.

Proposed 450ø FW inspection chamber.

Adoptable foul lateral drain. Refer to plan for pipe size and gradient

Proposed demarcation chamber

100mm drop
150mm drop

All with roddable access above ground. Refer to Architect and MEP Engineer for confirmation of above ground pipe diameters.

Rain Water Pipe preliminary position.

FG — Trapped internal foul floor gully (roddable) with non-return valve

BG — Trapped external SW bottle gully (roddable)

FMH_... CL... IL... DP... — Chamber reference (foul water) Cover Level Invert Level Depth

SMH_... CL... IL... DP... — Chamber reference (surface water) Cover Level Invert Level Depth

RIBA STAGE 4

REV	DATE	DESCRIPTION	BY	CHK
G	26.10.23	Drainage reflects architect's omission of the basement area and the introduction of sprinkler tanks adjacent to the SW detention tank. Other changes; Internal lower ground floor inspection covers all set at 28.100. Foul and surface water drainage discharges separately from the building. Pipe inverts, lengths, gradients and chamber positions. Backdrop position from control chamber. Rear entrance linear channels and perm paving connections. Perimeter gully connections refined. Tank overflow via road gully adjacent to Deansgate. High level overflow omitted. RWP and tank vent positions.	TU	BH
F	22.06.23	Note and rev cloud amended at rear access doors relating to sub-stn level and internal channel drain.	TU	BH
E	13.06.23	Updated to suit revised architectural layouts and MEP Engineering plans.	TU	BH
D	04.11.22	Updated to suit MEP Engineer's current LCF drainage plan. Plant room pumping chamber added.	TU	BH
C	31.08.22	Notes added in relation to non-return valves protecting lower parts of building and drainage from sewer surcharging and flooding.	TU	TU
B	03.08.22	**Stage 3 Tender**	TU/EB	TS
A	18.07.22	**Drawing rescaled to 1:100 at A1 at tender status**	TU	TU/TS

AMENDMENTS

CLIENT: FUSION MANCHESTER DEVCO LTD

PROJECT: STUDENT ACCOMMODATION
DEANSGATE SOUTH, MANCHESTER

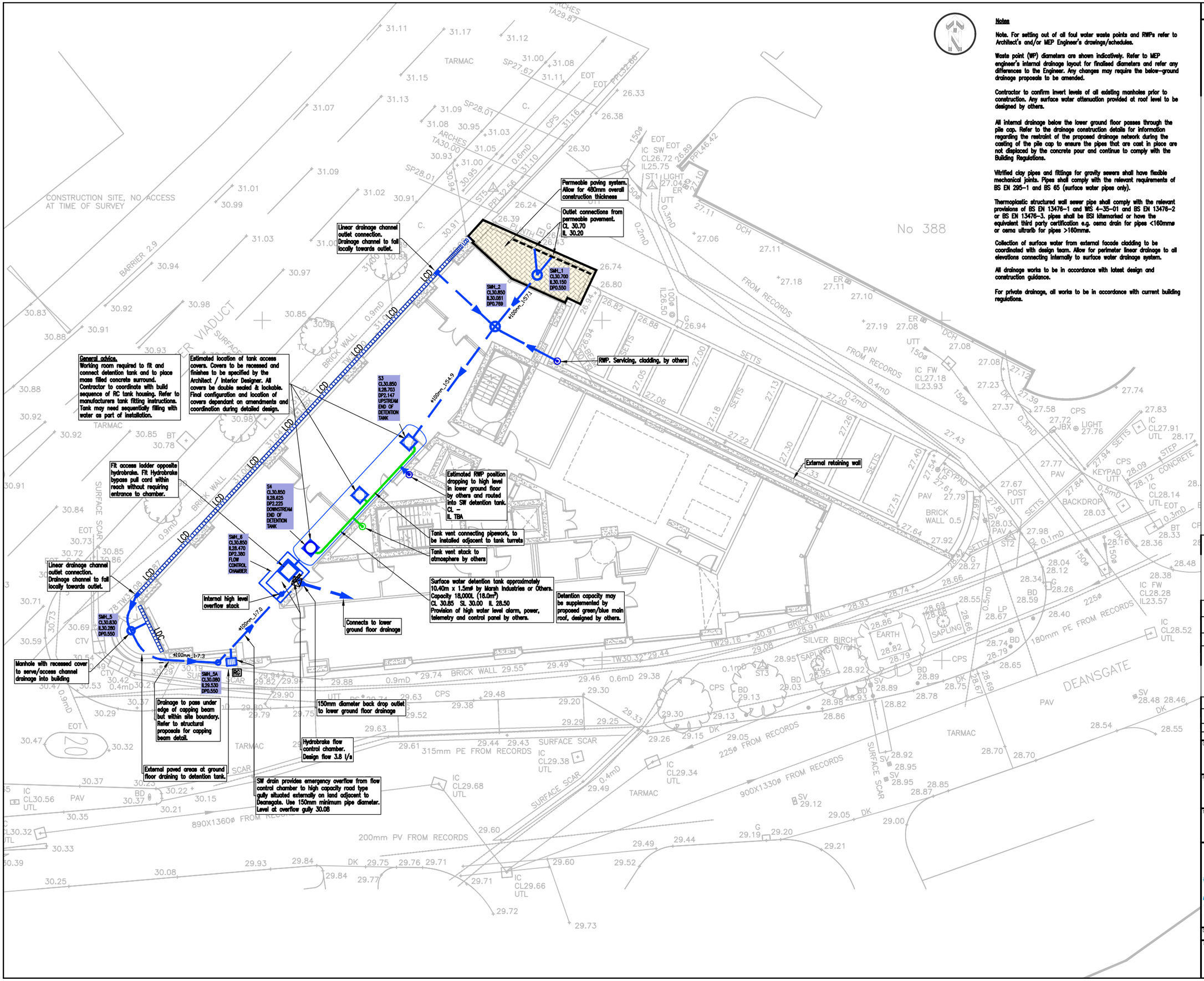
TITLE: DRAINAGE LAYOUT
LOWER GROUND FLOOR

SHEAR design
Consulting Civil and Structural Engineers
7 Ashtree Court - Woodsy Close - Cardiff Gate Business Park - Cardiff - CF23 8RW
Tel: 029 2054 7000 - Fax: 029 2054 7001 - www.shear-design.com - enquiries@shear-design.com

DRAWN:	CHECKED:	DATE:	SCALE:
TU	SJM	DECEMBER 2020	1:100 @ A1

SHEAR DESIGN REF:	DRAWING NUMBER:	REVISION:
20047	20047-121	G

STATUS: T



NOTES

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KEY

- LCD — Threshold channel with minimum B125 cover loading. For style refer to Architect.
- Internal surface water drains. Refer to plan for pipe sizes and gradients.
- Proposed 450ø SW inspection chamber.
- Proposed 250ø SW inspection chamber.
- Permeable paving fin drain outlet feature incorporating connectors and top hat seal through membrane
- Permeable block paving. Minimum 480mm thick with 80mm block pavers
- Rain Water Pipe preliminary position.
- Tank vent stack to atmosphere by others
- Trapped external SW bottle gully (roddable)
- RG — Road gully providing overflow point from SW control chamber and detention tank
- SMH.... CL... IL... DP... — Chamber reference (surface water) Cover Level Invert Level Depth

Note
Locations of all manhole covers in ground floor to be coordinated with interior designer.

RIBA STAGE 4

REV	DATE	DESCRIPTION	BY	CHK
G	26.10.23	Surface water detention tank and flow control chamber position adjusted. Flow control chamber changed from circular to rectangular insitu concrete with overflow. SW drainage at main entrance takes a perimeter route towards control chamber and incorporates a road gully to provide control chamber overflow and a second connection from the Viaduct elevation drip channel. Pipe inverts, lengths, gradients and chamber positions. Backdrop position from control chamber. Tank overflow via road gully adjacent to Deansgate. High level overflow omitted. RWP and tank vent positions.	TU	TU
F	08.06.23	Updated ground floor layout shown. Minor drainage amendments to suit.	TU	TU
E	01.03.23	Additional manhole added to the main entrance to assist operational maintenance of drainage	BGH	TU
D	04.11.22	Minor updates including amended chamber references	TU	TU
C	31.08.22	Hydrobrake reduced to 4.5 l/s to allow permeable paving to discharge at 0.2 l/s and bottles gullies ondeansgate elevation to free discharge at 0.3 l/s. The tank size remains the same due to some spare capacity. Detention capacity may be supplemented by proposed green/blue main roof, designed by others. Further annotation added at control chamber regarding location.	TU	TU
B	28.07.22	Stage 3 Tender	TU/EB	TS
A	27.07.22	Drawing rescaled to 1:100 at A1 at tender status Now shows ground floor level rather than roof level.	TU	TS

AMENDMENTS

CLIENT: FUSION MANCHESTER DEVCO LTD

PROJECT: STUDENT ACCOMMODATION
DEANSGATE SOUTH, MANCHESTER

TITLE: DRAINAGE LAYOUT
GROUND FLOOR

SHEAR design
Consulting Civil and Structural Engineers
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DRAWN:	CHECKED:	DATE:	SCALE:
TU	SJM	DECEMBER 2020	1:100 @ A1

SHEAR DESIGN REF:	DRAWING NUMBER:	REVISION:
20047	20047-122	G

STATUS: T

APPENDIX C

MANHOLE SCHEDULE

Foul drainage in lower ground floor

Node ID	IC Dia (mm)	Easting (m)	Northing (m)	CL (m)	IL (m)	Depth (m)	Pipe Dia (mm)
F1	Stub stack connection			28.100	27.150	0.950	100
F2	Stub stack connection			28.100	27.150	0.950	100
F3	Stub stack connection			28.100	27.150	0.950	100
FMH4	450	383305.727	397426.810	28.100	27.015 27.015 27.015 27.015	1.085	100 100 100 100
F5	Soil vent pipe connection			28.100	27.150	0.950	100
F6	Stub stack connection			28.100	27.150	0.950	100
FMH7	450	383298.226	397426.118	28.100	26.920 26.920 26.920 26.870	1.230	100 100 100 150
F8	Waste point (to be relocated by MEP engineer)			28.100	27.150	0.950	100
F9	Soil vent pipe connection			28.100	27.150	0.950	100
FMH10	450	383297.180	397426.022	28.100	26.862 26.912 26.912 26.862	1.238	150 100 100 150
F11	Soil vent pipe connection			28.100	27.150	0.950	100
F12	Soil vent pipe connection			28.100	27.150	0.950	100
F13	Soil vent pipe connection			28.100	27.150	0.950	100
F14	Stub stack connection			28.100	27.150	0.950	100
FMH15	600	383290.007	397425.355	28.100	26.813 26.863 26.863 26.863 26.863 26.738	1.362	150 100 100 100 100 225
F16	Stub stack connection			28.100	27.150	0.950	100
F17	Stub stack connection			28.100	27.150	0.950	100
FMH18	450	383303.915	397423.095	28.100	27.074 27.074 27.074	1.026	100 100 100
F19	Stub stack connection			28.100	27.150	0.950	100
F20	Stub stack connection			28.100	27.150	0.950	100
F21	Soil vent pipe connection			28.100	27.150	0.950	100
FMH22	450	383300.726	397422.822	28.100	27.033 27.033 27.033 27.033 26.983	1.117	100 100 100 100 150
F23	Stub stack connection			28.100	27.150	0.950	100
F24	Stub stack connection			28.100	27.150	0.950	100
F25	Soil vent pipe connection			28.100	27.150	0.950	100
FMH26	450	383294.580	397422.315	28.100	26.941 26.991 26.991 26.991 26.941	1.159	150 100 100 100 150
F27	Soil vent pipe connection			28.100	27.150	0.950	100
F28	Floor gully			28.100	27.150	0.950	100
F29	Soil vent pipe connection			28.100	27.150	0.950	100

Foul drainage in lower ground floor

Node ID	IC Dia (mm)	Easting (m)	Northing (m)	CL (m)	IL (m)	Depth (m)	Pipe Dia (mm)
FMH30	450	383287.717	397421.737	28.100	26.822 26.822 26.822 26.772	1.328	100 100 100 150
FMH31	600	383290.325	397421.956	28.100	26.664 26.739 26.739 26.664	1.436	225 150 150 225
FMH32 with B125 cover	600	383290.581	397419.184	29.700	26.616 26.616	3.084	225 225
FMH32_OUT Existing MH02					26.505 (Pipe)	3.175	225

Surface water drainage in lower ground floor and ground floor

Node ID	IC Dia (mm)	Easting (m)	Northing (m)	CL (m)	IL (m)	Depth (m)	Pipe Dia (mm)
SMH1	450	383296.182	397442.665	30.700	30.150	0.550	100
SMH2	450	383293.688	397439.616	30.850	30.081 30.081	0.769	100 100
S3	Access cover on upstream end of detention tank			30.850	29.927		100
S4	Access cover on downstream end of detention tank			30.850	28.625		150
SMH5	450	383272.282	397421.755	30.830	30.280	0.550	100
SMH5A	450	383277.404	397419.882	30.080	29.530 29.530	0.550	100 100
SMH6	1200 x 1800	383281.320	397424.862	30.850	28.600 28.625 28.470	2.380	150 100 150
S7	Internal drop from external bottle gully			28.100	27.550	0.550	100
SMH8	450	383284.032	397424.023	28.100	27.424 27.474 27.424	0.676	150 100 150
SMH9	450	383314.026	397428.087	28.050	27.500	0.550	100
S10	Internal drop from external bottle gully			28.100	28.550	0.550	100
S11	Internal drop from external bottle gully			28.100	28.550	0.550	100
SMH12	450	383306.353	397423.400	28.100	27.497 27.497 27.497	0.603	100 100 100
J13	Pipe junction			28.100	27.319 27.319 27.319	0.781	100 100 100
SMH14	450	383291.196	397425.968	28.100	27.114 27.114	0.986	100 100
SMH15	450	383288.921	397422.577	28.100	26.995 27.045 26.995	1.105	150 100 150
SMH16 with B125 cover	600	383289.248	397419.060	29.750	26.959 26.959	2.791	150 150
SMH16_OUT Existing MH02					26.895 (Pipe)		150

NOTES

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Note:

All internal manhole covers to be recessed, double sealed and lockable. Finishes including edge of cover and frame to Architect's specification.

All external manhole covers to be D400.

RIBA STAGE 4

REV	DATE	DESCRIPTION	BY	CHK
C	26.10.23	Updated to suit latest drainage layout design	TU	TU
B	12.06.23	Updated to suit latest drainage layout design	TU	TU
A	04.11.22	Updated to suit latest drainage layout design	TU	BH

AMENDMENTS

CLIENT: FUSION MANCHESTER DEVCO LTD

PROJECT: STUDENT ACCOMMODATION
DEANSGATE SOUTH, MANCHESTER

TITLE: MANHOLE SCHEDULE

SHEAR design
Consulting Civil and Structural Engineers
7 Ashtree Court - Woodsy Close - Cardiff Gate Business Park - Cardiff - CF23 8RW
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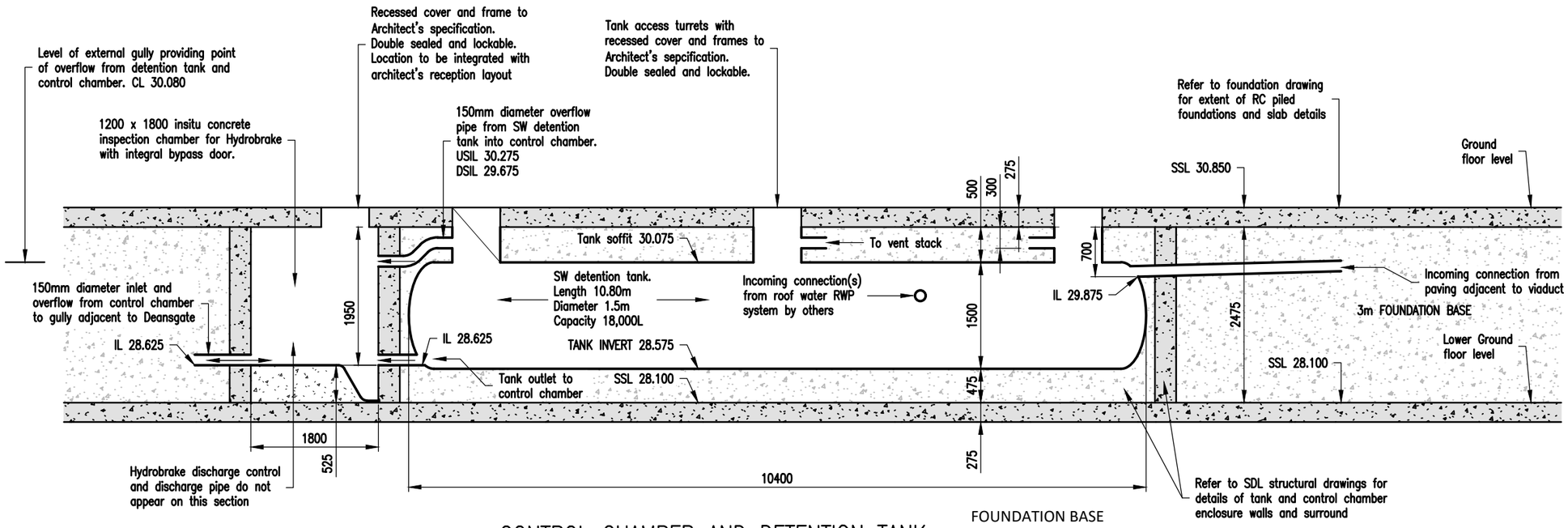
DRAWN:	CHECKED:	DATE:	SCALE:
TU	TS/BH	JULY 2022	NTS @ A1

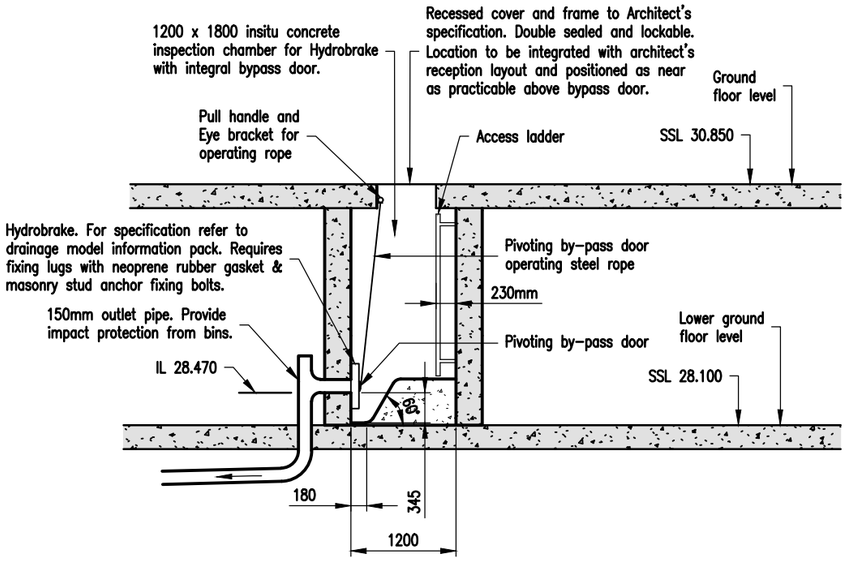
SHEAR DESIGN REF:	DRAWING NUMBER:	REVISION:	STATUS:
20047	20047-138	C	T

APPENDIX D

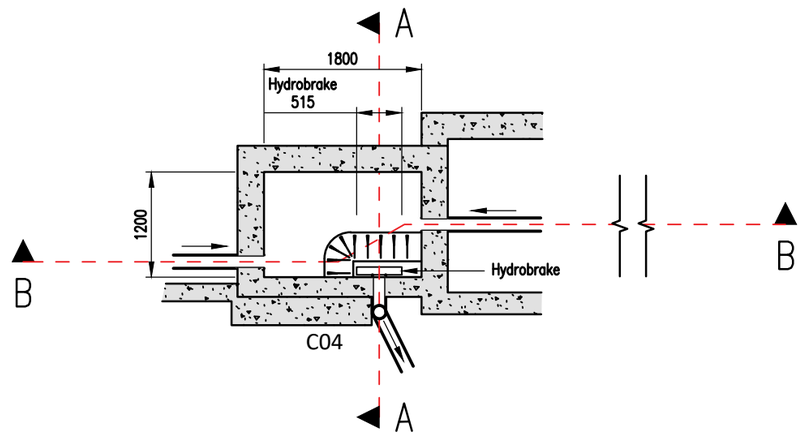
DETENTION TANK AND FLOW CONTROL CHAMBER DETAILS



CONTROL CHAMBER AND DETENTION TANK SECTION B–B



CONTROL CHAMBER SECTION A–A



CONTROL CHAMBER PLAN

NOTES:

1. PRIOR TO ORDERING THE CONTRACTOR MUST PROVIDE A COPY OF THE ORDER FORM AND REFERENCE NUMBER TO SHEAR DESIGN FOR APPROVAL.
2. A ROUTINE MAINTENANCE REGIME TO CLEAN ALL FLOW CONTROL DEVICES ON SITE IN ACCORDANCE WITH THE SUPPLIERS RECOMMENDATIONS MUST BE ADOPTED BY THE END USER TO MINIMISE THE RISK OF BLOCKAGE.

CONTROLLED DETENTION TANK	MANHOLE REF	HYDRO–BRAKE REF	HYDRAULIC CHARACTERISTICS	MIN OUTLET ID
BENEATH GF SLAB	SMH6	SHE–0084–3800–1550–3800	FLOW 3.8 L/S HEAD 1.550m	150mm

REFER TO MANHOLE SCHEDULE FOR COVER LEVEL AND INVERT LEVEL.
REFER TO TABLE ABOVE FOR SUMP LEVEL.

NOTES

GENERAL

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS RELATE TO ORDNANCE DATUM UNLESS NOTED OTHERWISE.
3. DO NOT SCALE FROM THIS DRAWING. USE FIGURED DIMENSIONS ONLY.
4. ANY DISCREPANCIES TO BE REPORTED IMMEDIATELY TO THE ENGINEER.
5. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, SUBCONTRACTORS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
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RIBA STAGE 4

REV	DATE	DESCRIPTION	BY	CHK
C	24.10.23	Design developed to suit updates to substructure and drainage. Further detail and sections added to flow control chamber. Hydrobrake specification and associated dimensions shown.	TU	TU
B	13.06.23	Minor updates	TU	TU
A	04.11.22	RIBA Stage 4 issue	TU	TU

AMENDMENTS

CLIENT: FUSION MANCHESTER DEVCO LTD

PROJECT: STUDENT ACCOMMODATION DEANSGATE SOUTH, MANCHESTER

TITLE: SURFACE WATER DETENTION TANK AND FLOW CONTROL CHAMBER

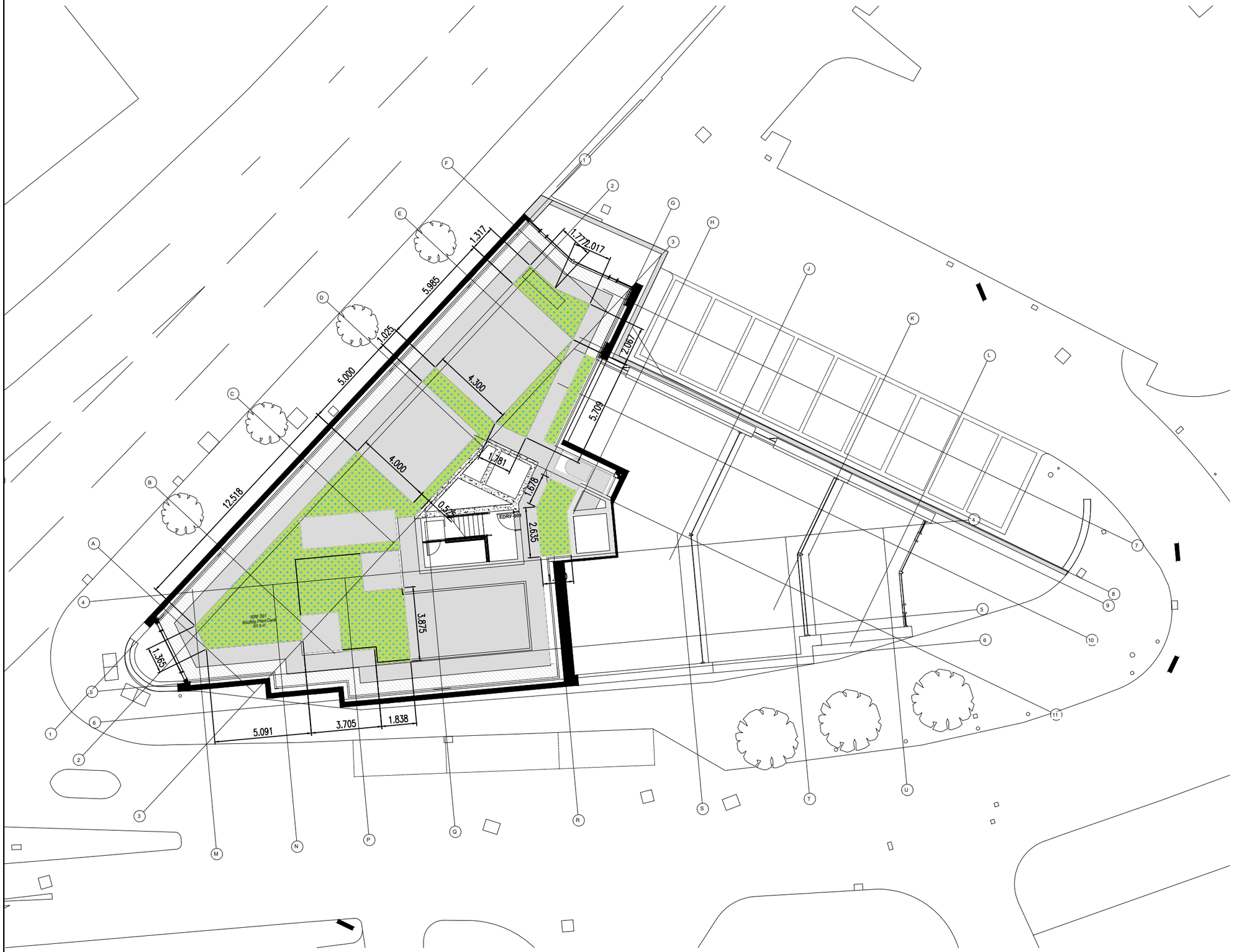
SHEAR design
Consulting Civil and Structural Engineers
7 Ashtree Court - Woodsy Close - Cardiff Gate Business Park - Cardiff - CF23 8RW
Tel: 029 2054 7000 - Fax: 029 2054 7001 - www.shear-design.com - enquiries@shear-design.com

DRAWN:	CHECKED:	DATE:	SCALE:
TU	TS/BH	JULY 2022	1:50 @ A2

SHEAR DESIGN REF:	DRAWING NUMBER:	REVISION:	STATUS:
20047	20047-135	C	T

APPENDIX E

BLUE/GREEN ROOF DETAILS AND SPECIFICATION



NOTES

GENERAL

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS RELATE TO ORDNANCE DATUM UNLESS NOTED OTHERWISE.
3. DO NOT SCALE FROM THIS DRAWING. USE FIGURED DIMENSIONS ONLY.
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5. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, SUBCONTRACTORS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
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Notes

Blue roof to be designed by specialist sub-contractor. Calculations to be provided to engineer for review and in accordance with the requirement of the FRA.

Maximum available area of blue roof attenuation as set out by design team.

KEY

EXTENT OF BLUE/GREEN ROOF ON UPPER LEVEL.
TOTAL PLAN AREA = 84m².

RIBA STAGE 4

REV	DATE	DESCRIPTION	BY	CHK
D	27.10.23	Blue/Green Roof Area and Dimensions added.	TU	TU
C	13.06.23	Updated to suit current Architect's roof layout	TU	TU
B	04.11.22	Updated to suit current Architect's roof layout	TU	TU
A	16.08.22	Updated to suit current Architect's roof layout	TU	DK

AMENDMENTS

CLIENT: FUSION MANCHESTER DEVCO LTD

PROJECT: STUDENT ACCOMMODATION
DEANSGATE SOUTH, MANCHESTER

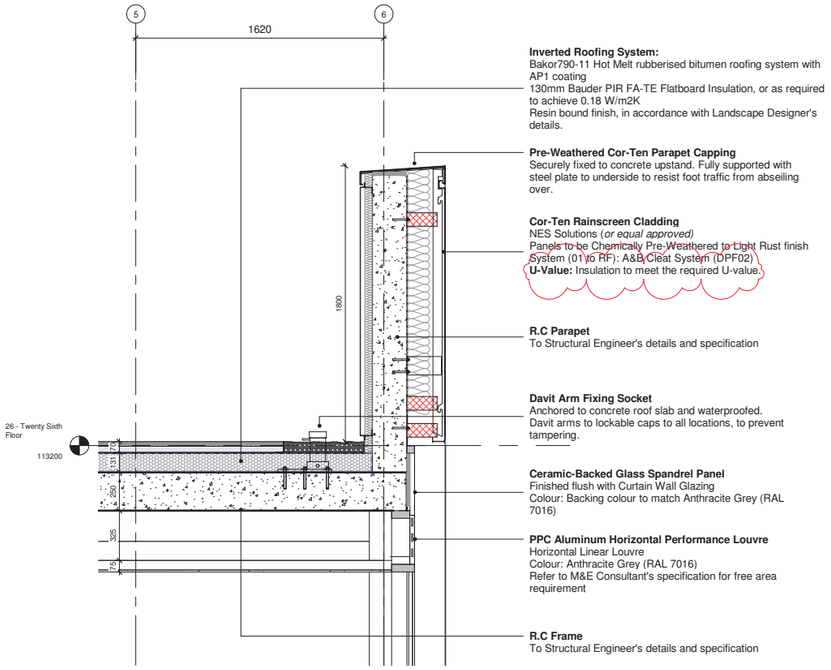
TITLE: DRAINAGE LAYOUT
TOP ROOF LEVEL

SHEAR design
Consulting Civil and Structural Engineers
7 Ashtree Court - Woodsy Close - Cardiff Gate Business Park - Cardiff - CF23 8RW
Tel: 029 2054 7000 - Fax: 029 2054 7001 - www.shear-design.com - enquiries@shear-design.com

DRAWN:	CHECKED:	DATE:	SCALE:
TU	SJM	DECEMBER 2020	1:100 @ A1

SHEAR DESIGN REF:	DRAWING NUMBER:	REVISION:
20047	20047-128	D

STATUS: T



Inverted Roofing System:
Bakor790-11 Hot Melt rubberised bitumen roofing system with AP1 coating
130mm Bauder PIR FA-TE Flatboard Insulation, or as required to achieve 0.18 W/m2K
Resin bound finish, in accordance with Landscape Designer's details.

Pre-Weathered Cor-Ten Parapet Capping
Securely fixed to concrete upstand. Fully supported with steel plate to underside to resist foot traffic from abseiling over.

Cor-Ten Rainscreen Cladding
NES Solutions *(or equal approved)*
Panels to be Chemically Pre-Weathered to Light Rust finish
System (01 to RF): A&B Cleat System (DPF02)
U-Value: Insulation to meet the required U-value.

R.C Parapet
To Structural Engineer's details and specification

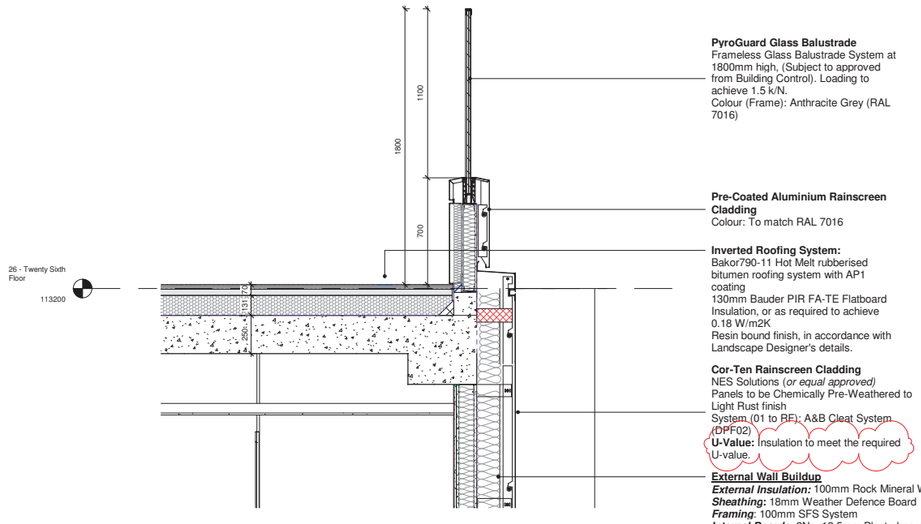
Davit Arm Fixing Socket
Anchored to concrete roof slab and waterproofed.
Davit arms to lockable caps to all locations, to prevent tampering.

Ceramic-Backed Glass Spandrel Panel
Finished flush with Curtain Wall Glazing
Colour: Backing colour to match Anthracite Grey (RAL 7016)

PPC Aluminum Horizontal Performance Louvre
Horizontal Linear Louvre
Colour: Anthracite Grey (RAL 7016)
Refer to M&E Consultant's specification for free area requirement

R.C Frame
To Structural Engineer's details and specification

1 Typical Terrace Roof Detail Through Parapet
1 : 20



PyroGuard Glass Balustrade
Frameless Glass Balustrade System at 1800mm high, (Subject to approved from Building Control). Loading to achieve 1.5 k/N.
Colour (Frame): Anthracite Grey (RAL 7016)

Pre-Coated Aluminium Rainscreen Cladding
Colour: To match RAL 7016

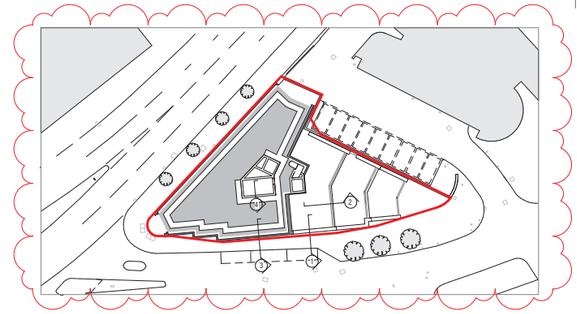
Inverted Roofing System:
Bakor790-11 Hot Melt rubberised bitumen roofing system with AP1 coating
130mm Bauder PIR FA-TE Flatboard Insulation, or as required to achieve 0.18 W/m2K
Resin bound finish, in accordance with Landscape Designer's details.

Cor-Ten Rainscreen Cladding
NES Solutions *(or equal approved)*
Panels to be Chemically Pre-Weathered to Light Rust finish
System (01 to RF): A&B Cleat System (DPF02)
U-Value: Insulation to meet the required U-value.

External Wall Buildup
External Insulation: 100mm Rock Mineral Wool
Sheathing: 18mm Weather Defence Board
Framing: 100mm SFS System
Internal Boards: 2No. 12.5mm Plasterboard.

2 Typical Terrace Roof Detail Through Glazed Balustrade
1 : 20

KEY PLAN



NOTES:
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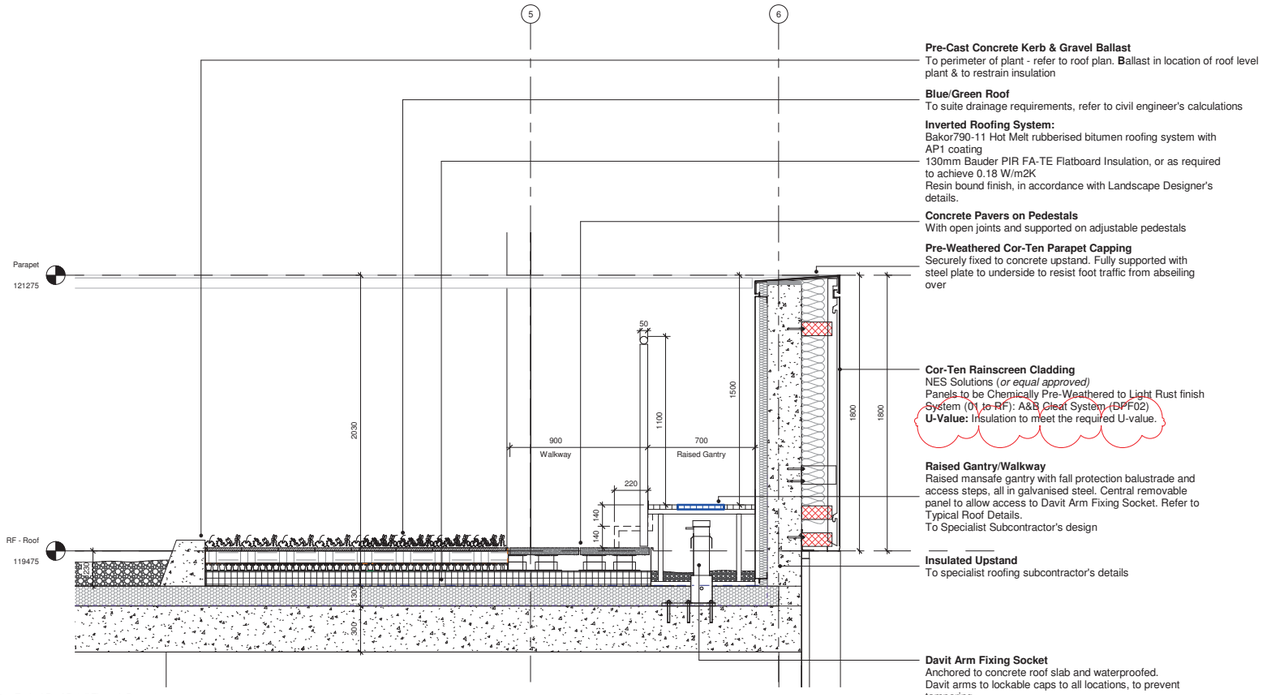
Figured dimensions only to be taken from this drawing. DO NOT SCALE.

All contractors must visit the site and be responsible for checking all setting out dimensions and notifying the Architect of any discrepancies prior to any manufacture or construction work.

To read in conjunction with:
- *Structural Engineer's Drawings and Specification.*
- *Facade Engineer's Drawings and Specification.*
- *M&E Consultant's Drawings and Specification.*
- *Acoustic Consultant's Report.*



Pre-Cast Concrete Kerb & Gravel Ballast
To perimeter of plant - refer to roof plan. **B**allast in location of roof level plant & to restrain insulation

Blue/Green Roof
To suite drainage requirements, refer to civil engineer's calculations

Inverted Roofing System:
Bakor790-11 Hot Melt rubberised bitumen roofing system with AP1 coating
130mm Bauder PIR FA-TE Flatboard Insulation, or as required to achieve 0.18 W/m2K
Resin bound finish, in accordance with Landscape Designer's details.

Concrete Pavers on Pedestals
With open joints and supported on adjustable pedestals

Pre-Weathered Cor-Ten Parapet Capping
Securely fixed to concrete upstand. Fully supported with steel plate to underside to resist foot traffic from abseiling over

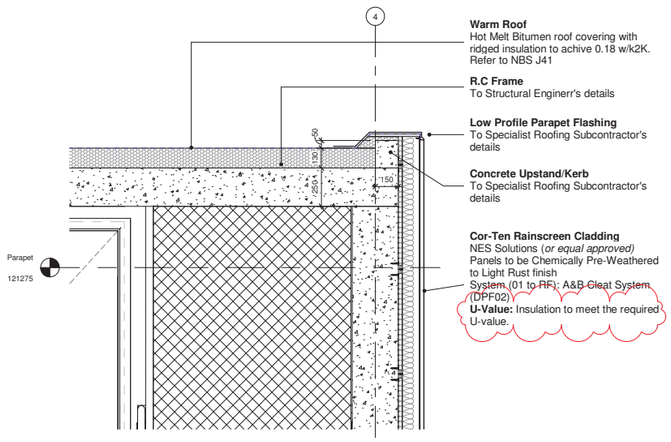
Cor-Ten Rainscreen Cladding
NES Solutions *(or equal approved)*
Panels to be Chemically Pre-Weathered to Light Rust finish
System (01 to RF): A&B Cleat System (DPF02)
U-Value: Insulation to meet the required U-value.

Raised Gantry/Walkway
Raised mansafe gantry with fall protection balustrade and access steps, all in galvanised steel. Central removable panel to allow access to Davit Arm Fixing Socket. Refer to Typical Roof Details.
To Specialist Subcontractor's design

Insulated Upstand
To specialist roofing subcontractor's details

Davit Arm Fixing Socket
Anchored to concrete roof slab and waterproofed.
Davit arms to lockable caps to all locations, to prevent tampering.

3 Typical Roof Detail Through Parapet
1 : 20



Warm Roof
Hot Melt Bitumen roof covering with ridged insulation to achive 0.18 w/k2K.
Refer to NBS J41

R.C Frame
To Structural Enginerr's details

Low Profile Parapet Flashing
To Specialist Roofing Subcontractor's details

Concrete Upstand/Kerb
To Specialist Roofing Subcontractor's details

Cor-Ten Rainscreen Cladding
NES Solutions *(or equal approved)*
Panels to be Chemically Pre-Weathered to Light Rust finish
System (01 to RF): A&B Cleat System (DPF02)
U-Value: Insulation to meet the required U-value.

4 Typical Roof Detail Through Stair/Lift Pop-Up
1 : 20

PROPOSALS TO BE FURTHER DEVELOPED WITH SPECIALIST FACADE CONSULTANT AT NEXT STAGE

Rev.	Description	Date	Drawn	Chk.
T-03	Drawings updated to suit comments from the Design and Client Team following introduction of the new stair	09/05/23	CJ	CMc
T-02	Drawings coordinated and updated in line with Design Team comments.	15/11/22	BH	CMc
T-01	Drawings coordinated and updated in line with Design Team comments.	11/11/22	BH	CMc
T-00	First Issue	26/08/22	SW	CMc

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Client: Fusion Students

Project: Deansgate South, Manchester

Drawing Title: External Details - Typical Roof & Balustrade

Drawing Status: TENDER

Corstorphine & Wright

Warwick Studio
Brook Hall, Brook Street, Warwick, CV34 4BL
01926 658 444
corstorphine-wright.com

Drawing No.	Revision
20269-3001	T-03

Drawn	Checked	Paper Size	Scale	Date
SW	CMc	A1	As indicated	08/09/22

Q37
Green roofs

General

130 Extensive green roof Type A

1. Manufacturer: Bauder Ltd
2. Contact details
   2.1. Address: 70 Landseer Road
   Ipswich
   Suffolk
   IP3 0DH
   2.2. Telephone: +44 (0)1473 257671
   2.3. Web: www.bauder.co.uk
   2.4. Email: info@bauder.co.uk
3. Product reference: Sedum on Extensive Substrate System
4. Waterproofing: Bauder Bakor790-11 Hot Melt Rubberized Bitumen Roof Coating System (specified in J31)
5. Protection layer: Bauder FSM 600 Protection Layer
6. Drainage/ water storage layer: Bauder DSE20 Drainage Layer
7. Filter layer: Bauder Filter Fleece
8. Substrate/ growing medium: Bauder Extensive Substrate
9. Vegetation: Bauder SB Sedum Blanket
10. Installation:: In accordance with 'Fire Performance of Green Roofs and Walls' approved document.
11. Additional Requirements:: Sub-Contractor Design to include coordination with drainage and blue roof allowances.

Performance

210 Contractor's design of green roofs

1. Design responsibility: Complete the detailed design of the green roof
2. Structural and fire requirements
   2.1. Generally: As section B50 and B05.
   2.2. Modifications: None
   2.3. Design: Complete the design in accordance with the designated code of practice to satisfy specified performance criteria.
   2.4. Submit:: Confirmation that design and installation will comply with 'Fire Performance of Green Roofs and Walls' approved document.
3. Additional requirements: Sub-Contractor Design to include coordination with drainage and blue roof allowances

255 Maximum permitted green roof loads

1. Permanent loads
   1.1. Green roof layers: As loading schedule by Structural engineer
2. Imposed loads
   2.1. Actions: As loading schedule
   2.2. Vegetation: As loading schedule
   2.3. Allowance for additional loads during construction: As loading schedule

3. Service loads: As loading schedule
4. Requirement: Restrict site activities to ensure that design loads are not exceeded, or submit proposals for temporary supports.

Products

310 Inverted roof insulation

1. Description: Refer to section J31

Execution

710 Installation generally

1. General:: To be designed and installed in accordance with 'Fire Performance of Green Roofs and Walls' approved document.
2. Preparation: Clear all surfaces of debris.
   2.1. Timing: After certification of waterproof membrane integrity.
   2.2. Surface condition: Visually inspect waterproof membrane, report any damage.
3. Faults in waterproof membrane: Report.
4. Contamination: Do not use materials detrimental to healthy plant growth.
5. Storage: Do not overload.
   5.1. Point loads: Avoid.
6. Outlets: Do not block.
   6.1. Outlet grilles: Installed.

720 Adverse weather

1. Unfinished work: Secure from damage and wind uplift.
2. Conditions: Do not install or work with frozen materials.

730 Installation of inverted roof insulation

1. Preparation: Clear roof of other trades.
2. Condition of substrate: Clean.
3. Fitting: Loose lay.
4. Joints: Butt together.
   4.1. End joints: Stagger.
5. Cutting: Minimize.
   5.1. Perimeters and upstands: Fit full sized pieces.
   5.2. Penetrations: Cut cleanly and fit closely.
6. Stability: Springing and rocking not permitted.
7. Protection: Cover to prevent wind uplift.

740 Root barrier installation

1. Joints: Minimize.
   1.1. Overlaps (minimum): Manufacturer's recommendation
2. Upstands: Extend to top of growing medium.

750 Protection layer installation

1. Joints: Minimize.
   1.1. Overlaps (minimum): Manufacturer's recommendation

2. Upstands: Extend to top of growing medium.

755 Separation layer installation

1. Joints: Minimize.
   1.1. Overlaps (minimum): Manufacturer's recommendation
2. Upstands: Extend to top of growing medium.

760 Moisture retention mat installation

1. Joints: Minimize.
   1.1. Overlaps (minimum): Manufacturer's recommendation
2. Upstands: Fit closely around penetrations and outlets.

770 Drainage layer installation

1. Extent: Continuous over entire roof area.
2. Fitting: Manufacturer's recommendation
3. Upstands: Fit closely around penetrations and outlets.

780 Filter membrane installation

1. Joints: Minimize.
   1.1. Overlaps (minimum): Manufacturer's recommendation
2. Fitting: Manufacturer's recommendation
3. Upstands: Extend to top of growing medium.

790 Growing medium installation

1. Handling: Minimize.
   1.1. Conditions: Handle in the driest condition possible. Do not handle or install when wet or frozen.
2. Layers
   2.1. Depth (maximum): 80 mm.
   2.2. Sequence: Gently firm each layer before spreading the next.

800 Vegetation blanket installation

1. Handling blankets
   1.1. Timing: Lay within 36 hours of lifting from growing position.
   1.2. Excessive stacking: Not permitted.
   1.3. Material loss (maximum): 3% of total surface area.
2. Growing medium condition: Thoroughly watered.
3. Laying blankets
   3.1. Dry, damaged, frosty or waterlogged blankets: Do not lay.
   3.2. Orientation: Diagonal or perpendicular to slope of roof.
   3.3. Joints: Stagger. Butt together or slightly overlap to prevent gaps. Do not stretch blankets. Secure with biodegradeable pegs.
   3.4. Edges: Finish with whole blankets.
   3.5. Consolidation: Firm as laying proceeds to ensure full contact with the growing medium. Do not use rollers.
4. Dressing: Growing medium
   4.1. Application: Brush in to fill joints.
5. Watering: Thorough, immediately after laying and dressing.

820 Edge-retaining profile installation

1. Cutting: Neat, accurate and without spalling.
   1.1. Junctions: vertical, secured using proprietary connectors.
2. Position: True to line and level. Smooth continuous lines.
3. Fixing: Manufacturer's standard

Completion

910 Inspection

1. Timing: Before handover.
   1.1. Give notice (minimum): Three days.

920 Completion

1. General: Leave the works in a clean, tidy condition.
2. Surfaces: Clean immediately before handover.
3. Outlets: Clean and clear of obstructions.
4. Completed green roof: Protect from adjacent or high level working.

930 Documentation

1. Timing: Submit at handover.
2. Contents
   2.1. Growing medium declaration of analysis.
   2.2. Manufacturers' guarantees and warranties.
   2.3. Procedures for maintenance of the green roof.
   2.4. Record drawings showing the location of planting and associated features.

Ω End of Section