

Drainage Planning Conditions

Subject: Arundel Street, Manchester

Ref: 071713/DPC Rev V01

Date: 23.05.2022

The Planning Permission Ref: 123261/FO/2019
Condition 5a relates to drainage proposals for the development.

Condition 5a

Notwithstanding the details submitted on the 27 September 2018, (a) the development shall not commence until a scheme for the drainage of surface water shall be submitted for approval in writing by the City Council as the Local Planning Authority. This shall include: • Maximise use of green SuDS in design, e.g., green roof • Details of surface water attenuation that offers a reduction in surface water runoff rate in line with the Manchester Trafford and Salford Strategic Flood Risk Assessment, i.e., at least a 50% reduction in runoff rate compared to the existing rates, as the site is located within Conurbation Core Critical Drainage Area. • Runoff volume in the 1 in 100-year, 6 hours rainfall shall be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but never to exceed the runoff volume from the development site prior to redevelopment. • Evidence that the drainage system has been designed (unless an area is designated to hold and/or convey water as part of the design) so that flooding does not occur during a 1 in 100-year rainfall event with allowance for climate change in any part of a building. • Assessment of overland flow routes for extreme events that is diverted away from buildings (including basements). Overland flow routes need to be designed to convey the flood water in a safe manner in the event of a blockage or exceedance of the proposed drainage system capacity including inlet structures. A layout with overland flow routes needs to be presented with appreciation of these overland flow routes with regards to the properties on site and adjacent properties off site. • Hydraulic calculation of the proposed drainage system. • Construction details of flow control and SuDS elements.	Pre-Commencement
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Proposed Drainage:

The proposed drainage system consists of a separate foul and surface water network. Reference should be made to the following drainage design documents:

- Arundel Street – Detailed Drainage Strategy Report referenced 071713-CUR-00-XX-RE-C-92001 V01. This includes the following information:
 - 071713- CUR-XX-00-DR-C-92500_ P01 PROPOSED DRAINAGE LAYOUT
 - Micro-Drainage Calculations: Assumed existing 1, 30 and 100 Year +40%cc events
 - Micro-Drainage Calculations: Assumed Proposed 1, 30 and 100 Year +40%cc events
 - Micro-Drainage Calculations: Assumed Existing SW 100 Yr 6Hr Volumes
 - Micro-Drainage Calculations: Assumed Proposed SW 100 Yr 6Hr Volumes
- 071713-CUR-XX-00-DR-C-92501_ P01 PROPOSED OVERLAND FLOW ROUTES

With specific reference to the conditioned points:

Maximise use of green SuDS solution in design, e.g., green roof

As noted within the submitted Drainage Strategy, in following the standard hierarchy of drainage solutions, consideration should firstly be given to the discharge of surface water runoff by sustainable methods such as infiltration. An assessment was completed to establish the most sustainable method of discharge and is summarised below:

Surface Water Disposal	Potential	Description
Infiltration	X	Made Ground is likely to be present across the site. The British Geological Survey (BGS) infiltration report confirms that Groundwater may be vulnerable to contamination. Groundwater is likely to be less than 3m below the ground surface for at least part of the year, which may inundate the infiltration system. Therefore, infiltration is not considered to be a suitable option.
Watercourse	X	The nearest watercourse is the Bridgewater Canal which is approximately 65m north-west of the site. Therefore, discharge to watercourse is not considered to be a feasible option.
Surface Water Sewer	X	There are no surface water public sewers in the vicinity of the site. There is a highway drain (MCC) located adjacent to the site at the junction of Ellesmere Street/Egerton Street however to connect into this would require adoption of the drain by United Utilities under Section 102 agreement. MCC have advised that as there are alternative options for drainage, the solution should utilise connections into the public sewers. Therefore, discharge to a surface water sewer/highway drain is not considered viable.
Combined Water Sewer	✓	The nearest public sewers are located north and west of the development site. It is assumed that there are existing connections into the public sewer network which could be reused where suitable. United Utilities have confirmed that connection can be made into the public sewer network at an unrestricted rate.

Based on the above, the proposals are to discharge surface water to the combined public sewers at a restricted rate. The proposed flow rates will be restricted to a maximum of 50% of the pre-development flow rates with an allowance of 40% climate change for the proposed 100-year event. The restriction of 50% pre-development flow rates is based on Manchester City Council SuDS requirements. The 40% climate change allowance is based on Environment Agency guidance for developments.

Therefore, the proposed flow rates should not exceed:

- 1 year = 15.25 l/s
- 30 year = 36.7 l/s
- 100 year + 40%cc = 45.2 l/s

The flow rates currently modelled achieve the 1-year flow restriction of 15.25 l/s.

Use of SuDS has therefore been assessed and the current strategy proposes the use of permeable paving externally, which is currently assumed to consist of a 300mm stone layer providing 30% void for attenuation. The permeable paving is currently included in the drainage strategy model. The proposals also indicate that a roof garden is to be incorporated on building 1, and this would provide additional sustainable benefit. However, this element has not been included in the drainage calculations at this stage until final construction details are available.

Refer to drawing 071713-CUR-XX-00-DR-C-92500_P01 PROPOSED DRAINAGE LAYOUT enclosed in Appendix A and proposed Landscape details enclosed in Appendix E.

Details of surface water attenuation that offers a reduction in surface water runoff rate in line with the Manchester Trafford and Salford Strategic Flood Risk Assessment, i.e., at least a 50% reduction in runoff rate compared to the existing rates, as the site is located within Conurbation Core Critical Drainage Area.

The existing site has previous industrial use and would be considered Brownfield. The existing drainage network on site is unknown, however the run-off rate from the existing site has been estimated by creation of an existing assumed model discharging 0.3ha of run-off. The 1 in 1-, 30- and 100-year return periods have been simulated and the flow rates are as follows:

- 1 year = 30.5 l/s
- 30 year = 73.4 l/s
- 100 year = 90.4 l/s

The proposed flow rates will be restricted to a maximum of 50% of the pre-development flow rates with an allowance of 40% climate change for the proposed 100-year event. The restriction of 50% pre-development flow rates is based on Manchester City Council SuDS requirements. The 40% climate change allowance is based on Environment Agency guidance for developments.

Therefore, the proposed flow rates should not exceed:

- 1 year = 15.25 l/s
- 30 year = 36.7 l/s
- 100 year +40%cc = 45.2 l/s

The flow rates currently modelled achieve the 1-year flow restriction of 15.25 l/s up to the 100-year design event.

Refer to Micro-Drainage Calculations: Assumed existing 1, 30 and 100 Year +40%cc events and Assumed Proposed 1, 30 and 100 Year +40%cc events enclosed in Appendix B.

Runoff volume in the 1 in 100-year, 6 hours rainfall shall be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but never to exceed the runoff volume from the development site prior to redevelopment.

The volumes generated from the existing site in the 100 year 6-hour event is approximately 150.926m³. The volumes generated from the proposed site in the 100 year 6-hour event is approximately 173.979m³. The proposed volumes from site in the 100-year 6-hour event is 173.979m³, which exceeds the existing 100-year event volumes, however proposed flows are restricted to 1-year flows and therefore far exceeds the minimum 50% flow reduction and would be difficult to further reduce the flows to reduce volumes discharge during the 360-minute event.

Refer to the Micro-Drainage Calculations: Assumed Existing SW 100 Yr 6Hr Volumes and Assumed Proposed SW 100 Yr 6Hr Volumes enclosed in Appendix B.

Evidence that the drainage system has been designed (unless an area is designated to hold and/or convey water as part of the design) so that flooding does not occur during a 1 in 100-year rainfall event with allowance for climate change in any part of a building.

The system has been designed to accommodate the 100-year event with an allowance of 40% climate change.

Refer to drawing 071713- CUR-XX-00-DR-C-92500_ P01 PROPOSED DRAINAGE LAYOUT enclosed in Appendix A and Micro-Drainage Calculations: Proposed 1, 30 and 100 Year +40%cc events enclosed in Appendix B.

Assessment of overland flow routes for extreme events that is diverted away from buildings (including basements). Overland flow routes need to be designed to convey the flood water in a safe manner in the event of a blockage or exceedance of the proposed drainage system capacity including inlet structures. A layout with overland flow routes needs to be presented with appreciation of these overland flow routes with regards to the properties on site and adjacent properties off site.

Refer to the Overland Flow Routes drawing enclosed in Appendix C.

Hydraulic calculation of the proposed drainage system.

Refer to the Micro-Drainage Calculations enclosed in Appendix B.

Construction details of flow control and SuDS elements

The construction details are not currently available for the drainage proposals. At present the SuDS proposed on the scheme is permeable paving, the detail will be subject to the chosen permeable surface finish. The flow control is currently modelled as a hydro-brake flow control; however, the detailed design should confirm the specific product chosen.

Typical Hydro-brake details for the modelled product is enclosed in Appendix D and proposed Landscape details enclosed in Appendix E.

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Manchester
M1 5WG

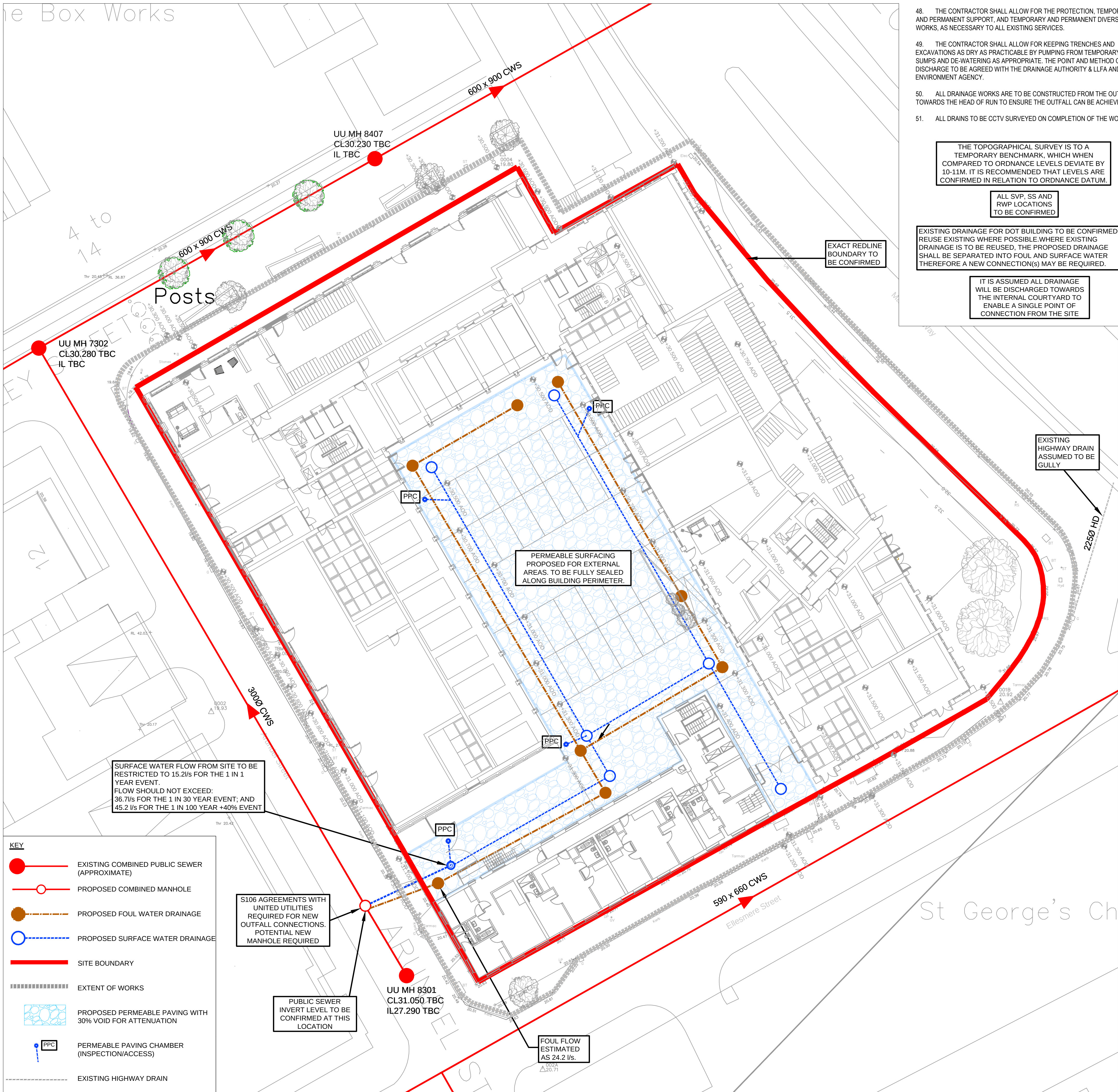
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Appendix A

Proposed Drawing:
071713- CUR-XX-00-DR-C-92500_ P01 PROPOSED DRAINAGE LAYOUT

ie Box Works



GENERAL NOTES:

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
- DO NOT SCALE THIS DRAWING. ANY AMBIGUITIES, OMISSIONS AND ERRORS ON DRAWINGS SHALL BE BROUGHT TO THE ENGINEERS ATTENTION IMMEDIATELY. ALL DIMENSIONS MUST BE CHECKED / VERIFIED ON SITE.
- ALL DRAINAGE WORKS TO BE IN ACCORDANCE WITH THE CIVIL ENGINEERING SPECIFICATION FOR THE WATER INDUSTRY (CESWI) AS INCLUDED IN SEWERS FOR ADOPTION 7th EDITION, THE REQUIREMENTS OF APPROVED DOCUMENT H (2002 EDITION) AND BUILDING REGULATIONS 2000.
- DO NOT SCALE THIS DRAWING. ALL DETAILS AND DIMENSIONS ARE TO BE CHECKED BY THE CONTRACTOR. ANY DISCREPANCIES TO BE REPORTED TO THE ENGINEER.
- ALL DIMENSIONS ARE IN METRES AND LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS OTHERWISE NOTED.
- THE CONTRACTOR MAY WISH TO SURVEY ALL EXISTING DRAINAGE PRIOR TO COMMENCEMENT TO CONFIRM LOCATION AND CONDITION OF EXISTING DRAINAGE. POTENTIAL PRE-CLEANING TO BE UNDERTAKEN IN ORDER TO FACILITATE SURVEY IF REQUIRED.
- EXISTING SEWER LOCATIONS WHERE THE PROPOSED DRAINAGE IS TO CONNECT, ARE TO BE SURVEYED AND EXACT LEVELS CONFIRMED AND PROVIDED TO ENGINEER PRIOR TO COMMENCEMENT OF WORKS.
- ALL EXISTING SERVICES TO BE LOCATED PRIOR TO COMMENCEMENT OF ANY DRAINAGE WORKS, AND WHERE NECESSARY PROTECTION OR DIVERSIONS TO BE UNDERTAKEN TO AVOID CONFLICT WITH THE PROPOSED WORK.
- ALL EXISTING DRAINS TO BE ABANDONED SHALL BE EITHER GRUBBED OR GROUTED UP. GROUTING TO BE PERFORMED BY CAPPING ALL ENDS / CONNECTIONS AND FILLING THE RETAINING VOID WITH GROUT, IN ACCORDANCE WITH CIVIL ENGINEERING SPECIFICATION FOR THE WATER INDUSTRY 7th EDITION (CESWI) 7TH EDITION.
- ALL SOFT SPOTS TO BE REMOVED FROM BOTTOM OF EXCAVATIONS AND TO BE REFILLED TO FORMATION LEVEL WITH THE SAME MATERIAL AS PERMANENT WORKS WHICH REST IN IT.
- FILLED GROUND MUST BE FILLED AND CONSOLIDATED BEFORE ANY SEWER WORKS ARE CARRIED OUT.
- ALL ADAPTABLE DRAINAGE WORKS INCLUDING WORKS TO EXISTING PUBLIC SEWERS TO BE UNDERTAKEN IN ACCORDANCE WITH 'SEWERS FOR ADOPTION 7th EDITION' AND 'CIVIL ENGINEERING SPECIFICATION FOR THE WATER INDUSTRY 7th EDITION' AND CONSTRUCTED TO THE RELEVANT STATUTORY UNDERTAKERS DETAILS.
- ALL PRIVATE DRAINAGE WORKS TO BE IN ACCORDANCE WITH 'CIVIL ENGINEERING SPECIFICATION FOR THE WATER INDUSTRY 7th EDITION', BS EN 752 2008 'DRAIN AND SEWER SYSTEMS OUTSIDE BUILDINGS' AND THE BUILDING REGULATIONS APPROVED 'DOCUMENT H'.
- ALL SEWERS, UNLESS AGREED OTHERWISE STATED, SHALL BE:
 - 150mm DIA TO BE VITRIFIED CLAY.
 - 225mm DIA TO BE VITRIFIED CLAY.
 - 300mm DIA TO BE VITRIFIED CLAY.
 - 375mm DIA AND GREATER TO BE CLASS 120 CONCRETE PIPES.
- ALL PIPE DIAMETERS GIVEN ARE NOMINAL INTERNAL PIPE DIAMETERS.
- PIPE MATERIALS IN ACCORDANCE WITH THE FOLLOWING:
 - ALL VITRIFIED CLAY PIPES TO BS EN 295-1.
 - ALL CONCRETE PIPES TO BE TO BS EN 1916.
 - ALL CONCRETE MANHOLES TO BE TO BS EN1917.
- AS AN ALTERNATIVE THE CONTRACTOR MAY USE AN APPROVED UNPLASTICISED POLYVINYL CHLORIDE (PVCU).
- ALL ADAPTABLE DRAINAGE PIPES WILL REQUIRE A MINIMUM OF 1200mm COVER, IN ACCORDANCE WITH SEWERAGE UNDERTAKERS REQUIREMENTS.
- ALL PRIVATE DRAINAGE PIPES WITH A COVER OF LESS THAN 600mm IN NON-TRAFFICKED AREAS AND LESS THAN 900mm IN TRAFFICKED AREAS TO BE BEDDED AND SURROUNDED IN CONCRETE (CLASS Z). COMPRESSIBLE MATERIAL SHALL BE PROVIDED AT EVERY PIPE JOINT. WHERE COVER EXCEEDS THIS DEPTH, PIPES ARE TYPICALLY BEDDED AND SURROUNDED IN CLASS S. REFER TO PIPE EMBEDMENT DETAILS DRAWING FOR SPECIFIC TYPES.

P01	UPDATED PROPOSALS FOR PLANNING	15.03.19	OJT	CG
Rev:	Description:	Date:	By:	Chkd:

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Status:

PRELIMINARY

Project:

ARUNDEL STREET

Orig Title:

PROPOSED DRAINAGE LAYOUT

Size:	Date:	Drawn By:	Designed By:	Checked By:
A1	07/03/17	OJT	CG	CG
Scale:	1:200			
Project No:	Originator:	Zone:	Level:	Type:
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Appendix B

Calculations:

Micro-Drainage Calculations: Assumed existing 1, 30 and 100 Year +40%cc events
Micro-Drainage Calculations: Assumed Proposed 1, 30 and 100 Year +40%cc events
Micro-Drainage Calculations: Assumed Existing SW 100 Yr 6Hr Volumes
Micro-Drainage Calculations: Assumed Proposed SW 100 Yr 6Hr Volumes

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Merchant Exchange 17-19 Whitworth Street West Manchester M1 5WG	Arundel Street Manchester Assumed Existing	
Date February 2017 File Assumed SW For flows on...	Designed by CG Checked by	
Micro Drainage	Network 2014.1.1	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	1	21.000	20.000	0.775	Open Manhole	1200
2.000	o	225	2	21.000	20.000	0.775	Open Manhole	1200
2.001	o	225	3	21.000	19.700	1.075	Open Manhole	1200
1.001	o	225	4	21.000	19.650	1.125	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	50.000	142.9	4	21.000	19.650	1.125	Open Manhole	1200
2.000	50.000	166.7	3	21.000	19.700	1.075	Open Manhole	1200
2.001	10.000	200.0	4	21.000	19.650	1.125	Open Manhole	1200
1.001	10.000	200.0		31.000	19.600	11.175	Open Manhole	0

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Date 02.03.17	Designed by CG									
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XP Solutions	Network 2016.1									
<u>Time Area Diagram for Storm</u> <table><tr><td>Time (mins)</td><td>Area (ha)</td><td>Time (mins)</td><td>Area (ha)</td></tr><tr><td>0-4</td><td>0.301</td><td>4-8</td><td>0.055</td></tr></table> Total Area Contributing (ha) = 0.356 Total Pipe Volume (m³) = 2.452			Time (mins)	Area (ha)	Time (mins)	Area (ha)	0-4	0.301	4-8	0.055
Time (mins)	Area (ha)	Time (mins)	Area (ha)							
0-4	0.301	4-8	0.055							
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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	PP	20.000	19.500	0.350	Open Manhole	150
1.001	o	225	1	20.000	19.450	0.325	Open Manhole	1500
2.000	o	150	PP	20.000	19.500	0.350	Open Manhole	150
2.001	o	225	3	20.000	19.450	0.325	Open Manhole	1500
1.002	o	225	2	20.000	19.150	0.625	Open Manhole	1500
3.000	o	150	PP	20.000	19.500	0.350	Open Manhole	150
1.003	o	225	3	20.000	19.025	0.750	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	5.000	100.0	1	20.000	19.450	0.400	Open Manhole	1500
1.001	30.000	100.0	2	20.000	19.150	0.625	Open Manhole	1500
2.000	5.000	100.0	3	20.000	19.450	0.400	Open Manhole	1500
2.001	10.000	33.3	2	20.000	19.150	0.625	Open Manhole	1500
1.002	5.000	100.0	3	20.000	19.100	0.675	Open Manhole	1500
3.000	5.000	12.5	3	20.000	19.100	0.750	Open Manhole	1500
1.003	10.000	153.8		20.000	18.960	0.815	Open Manhole	1500

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.003		20.000	18.960	0.000	1500	0

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Online Controls for Storm

Hydro-Brake Optimum® Manhole: 3, DS/PN: 1.003, Volume (m³): 1.9

Unit Reference	MD-SHE-0182-1530-0520-1530
Design Head (m)	0.520
Design Flow (l/s)	15.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	182
Invert Level (m)	19.025
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.520	15.3
Flush-Flo™	0.263	15.3
Kick-Flo®	0.428	14.0
Mean Flow over Head Range	-	11.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.4	1.200	22.8	3.000	35.4	7.000	53.2
0.200	15.0	1.400	24.5	3.500	38.1	7.500	55.1
0.300	15.2	1.600	26.1	4.000	40.6	8.000	56.9
0.400	14.4	1.800	27.7	4.500	43.0	8.500	58.7
0.500	15.0	2.000	29.1	5.000	45.3	9.000	60.4
0.600	16.4	2.200	30.5	5.500	47.1	9.500	62.1
0.800	18.8	2.400	31.8	6.000	49.2		
1.000	20.9	2.600	33.0	6.500	51.3		

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Storage Structures for Storm

Porous Car Park Manhole: PP, DS/PN: 1.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	37.0
Max Percolation (l/s)	102.8	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	19.500	Cap Volume Depth (m)	0.300

Porous Car Park Manhole: PP, DS/PN: 2.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	37.0
Max Percolation (l/s)	102.8	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	19.500	Cap Volume Depth (m)	0.300

Porous Car Park Manhole: PP, DS/PN: 3.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	24.0
Max Percolation (l/s)	66.7	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	19.500	Cap Volume Depth (m)	0.300

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Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.355
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	PP 240	Winter	1	+0%					19.517
1.001	1	15 Winter	1	+0%					19.545
2.000	PP 240	Winter	1	+0%					19.517
2.001	3	15 Winter	1	+0%					19.538
1.002	2	15 Winter	1	+0%	1/15 Summer				19.529
3.000	PP 120	Winter	1	+0%					19.509
1.003	3	15 Winter	1	+0%	1/15 Summer				19.519

PN	US/MH Name	Depth (m)	Surcharged Volume (m³)	Flooded Flow / Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	PP	-0.133	0.000	0.03	0.4	OK	
1.001	1	-0.130	0.000	0.23	11.2	OK	
2.000	PP	-0.133	0.000	0.03	0.4	OK	
2.001	3	-0.137	0.000	0.15	11.2	OK	
1.002	2	0.154	0.000	0.50	15.9	SURCHARGED	
3.000	PP	-0.141	0.000	0.01	0.5	OK	
1.003	3	0.269	0.000	0.43	15.2	SURCHARGED	

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Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
1.000	5.000	0.050	100.0	0.037	5.00	0.0	0.600	o	150	Pipe/Conduit
1.001	30.000	0.300	100.0	0.111	0.00	0.0	0.600	o	225	Pipe/Conduit
2.000	5.000	0.050	100.0	0.037	5.00	0.0	0.600	o	150	Pipe/Conduit
2.001	10.000	0.300	33.3	0.111	0.00	0.0	0.600	o	225	Pipe/Conduit
1.002	5.000	0.050	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
3.000	5.000	0.400	12.5	0.024	5.00	0.0	0.600	o	150	Pipe/Conduit
1.003	10.000	0.065	153.8	0.036	0.00	0.0	0.600	o	225	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
1.000	19.500	0.037	0.0	1.00	17.8
1.001	19.450	0.148	0.0	1.31	52.0
2.000	19.500	0.037	0.0	1.00	17.8
2.001	19.450	0.148	0.0	2.27	90.4
1.002	19.150	0.296	0.0	1.31	52.0
3.000	19.500	0.024	0.0	2.87	50.6
1.003	19.025	0.356	0.0	1.05	41.8

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. . .	Arundel Street Manchester Gravity Outfall	
Date 02.03.17 File Assumed Proposed SW.MDX	Designed by CG Checked by	
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Online Controls for Storm

Hydro-Brake Optimum® Manhole: 3, DS/PN: 1.003, Volume (m³): 1.9

Unit Reference	MD-SHE-0182-1530-0520-1530
Design Head (m)	0.520
Design Flow (l/s)	15.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	182
Invert Level (m)	19.025
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.520	15.3
Flush-Flo™	0.263	15.3
Kick-Flo®	0.428	14.0
Mean Flow over Head Range	-	11.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.4	1.200	22.8	3.000	35.4	7.000	53.2
0.200	15.0	1.400	24.5	3.500	38.1	7.500	55.1
0.300	15.2	1.600	26.1	4.000	40.6	8.000	56.9
0.400	14.4	1.800	27.7	4.500	43.0	8.500	58.7
0.500	15.0	2.000	29.1	5.000	45.3	9.000	60.4
0.600	16.4	2.200	30.5	5.500	47.1	9.500	62.1
0.800	18.8	2.400	31.8	6.000	49.2		
1.000	20.9	2.600	33.0	6.500	51.3		

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Storage Structures for Storm

Porous Car Park Manhole: PP, DS/PN: 1.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	37.0
Max Percolation (l/s)	102.8	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	19.500	Cap Volume Depth (m)	0.300

Porous Car Park Manhole: PP, DS/PN: 2.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	37.0
Max Percolation (l/s)	102.8	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	19.500	Cap Volume Depth (m)	0.300

Porous Car Park Manhole: PP, DS/PN: 3.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	24.0
Max Percolation (l/s)	66.7	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	19.500	Cap Volume Depth (m)	0.300

Simulation Criteria

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Rainfall Model	FSR	Ratio R	0.355
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Profile(s)	Summer and Winter
n(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
(s) (years)	30
Change (%)	0

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Flow		
1.000	PP	-0.041	0.000	0.39		5.5	OK	
1.001	1	0.106	0.000	0.38		18.4	FLOOD	RISK
2.000	PP	-0.050	0.000	0.38		5.3	OK	
2.001	3	0.094	0.000	0.26		19.3	FLOOD	RISK
1.002	2	0.377	0.000	0.73		23.0	FLOOD	RISK
3.000	PP	-0.058	0.000	0.12		4.6	OK	
1.003	3	0.484	0.000	0.51		17.7	FLOOD	RISK

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Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
1.000	5.000	0.050	100.0	0.037	5.00	0.0	0.600	o	150	Pipe/Conduit
1.001	30.000	0.300	100.0	0.111	0.00	0.0	0.600	o	225	Pipe/Conduit
2.000	5.000	0.050	100.0	0.037	5.00	0.0	0.600	o	150	Pipe/Conduit
2.001	10.000	0.300	33.3	0.111	0.00	0.0	0.600	o	225	Pipe/Conduit
1.002	5.000	0.050	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
3.000	5.000	0.400	12.5	0.024	5.00	0.0	0.600	o	150	Pipe/Conduit
1.003	10.000	0.065	153.8	0.036	0.00	0.0	0.600	o	225	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
1.000	19.500	0.037	0.0	1.00	17.8
1.001	19.450	0.148	0.0	1.31	52.0
2.000	19.500	0.037	0.0	1.00	17.8
2.001	19.450	0.148	0.0	2.27	90.4
1.002	19.150	0.296	0.0	1.31	52.0
3.000	19.500	0.024	0.0	2.87	50.6
1.003	19.025	0.356	0.0	1.05	41.8

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	PP	20.000	19.500	0.350	Open Manhole	150
1.001	o	225	1	20.000	19.450	0.325	Open Manhole	1500
2.000	o	150	PP	20.000	19.500	0.350	Open Manhole	150
2.001	o	225	3	20.000	19.450	0.325	Open Manhole	1500
1.002	o	225	2	20.000	19.150	0.625	Open Manhole	1500
3.000	o	150	PP	20.000	19.500	0.350	Open Manhole	150
1.003	o	225	3	20.000	19.025	0.750	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	5.000	100.0	1	20.000	19.450	0.400	Open Manhole	1500
1.001	30.000	100.0	2	20.000	19.150	0.625	Open Manhole	1500
2.000	5.000	100.0	3	20.000	19.450	0.400	Open Manhole	1500
2.001	10.000	33.3	2	20.000	19.150	0.625	Open Manhole	1500
1.002	5.000	100.0	3	20.000	19.100	0.675	Open Manhole	1500
3.000	5.000	12.5	3	20.000	19.100	0.750	Open Manhole	1500
1.003	10.000	153.8		20.000	18.960	0.815	Open Manhole	1500

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Online Controls for Storm

Hydro-Brake Optimum® Manhole: 3, DS/PN: 1.003, Volume (m³): 1.9

Unit Reference	MD-SHE-0182-1530-0520-1530
Design Head (m)	0.520
Design Flow (l/s)	15.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	182
Invert Level (m)	19.025
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.520	15.3
Flush-Flo™	0.263	15.3
Kick-Flo®	0.428	14.0
Mean Flow over Head Range	-	11.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.4	1.200	22.8	3.000	35.4	7.000	53.2
0.200	15.0	1.400	24.5	3.500	38.1	7.500	55.1
0.300	15.2	1.600	26.1	4.000	40.6	8.000	56.9
0.400	14.4	1.800	27.7	4.500	43.0	8.500	58.7
0.500	15.0	2.000	29.1	5.000	45.3	9.000	60.4
0.600	16.4	2.200	30.5	5.500	47.1	9.500	62.1
0.800	18.8	2.400	31.8	6.000	49.2		
1.000	20.9	2.600	33.0	6.500	51.3		

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Storage Structures for Storm

Porous Car Park Manhole: PP, DS/PN: 1.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	37.0
Max Percolation (l/s)	102.8	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	19.500	Cap Volume Depth (m)	0.300

Porous Car Park Manhole: PP, DS/PN: 2.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	37.0
Max Percolation (l/s)	102.8	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	19.500	Cap Volume Depth (m)	0.300

Porous Car Park Manhole: PP, DS/PN: 3.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	24.0
Max Percolation (l/s)	66.7	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	19.500	Cap Volume Depth (m)	0.300

**360 minute 100 year Winter I+0%
Average Rainfall Intensity 9.847 mm/hr**

Storm Selector

360 minute 100 year Winter I+0%

Time (mins)	US Level (m)	DS Level (m)	Surcharged Depth (m)	Pipe Velocity (m/s)	Pipe Flow (l/s)
6	19.665	19.623	-0.210	0.2	0.2
12	19.679	19.623	-0.196	0.4	0.8
18	19.688	19.623	-0.187	0.4	1.7
24	19.694	19.623	-0.181	0.5	2.4
30	19.696	19.623	-0.179	0.5	2.8
36	19.697	19.623	-0.178	0.5	2.9
42	19.698	19.623	-0.177	0.5	3.1
48	19.698	19.623	-0.177	0.5	3.1
54	19.698	19.623	-0.177	0.5	3.1
60	19.698	19.623	-0.177	0.5	3.1
66	19.698	19.623	-0.177	0.5	3.1
72	19.699	19.623	-0.176	0.5	3.2
78	19.700	19.623	-0.175	0.5	3.3
84	19.701	19.623	-0.174	0.5	3.6
90	19.705	19.623	-0.170	0.5	4.0
96	19.707	19.623	-0.168	0.6	4.3
102	19.712	19.623	-0.163	0.6	5.0
108	19.716	19.623	-0.159	0.6	5.5
114	19.722	19.623	-0.153	0.6	6.5
120	19.726	19.623	-0.149	0.6	7.2
126	19.732	19.623	-0.143	0.7	8.4
132	19.737	19.623	-0.138	0.7	9.2
138	19.743	19.623	-0.132	0.7	10.7
144	19.747	19.623	-0.128	0.7	11.4
150	19.754	19.623	-0.121	0.7	12.9
156	19.758	19.623	-0.117	0.7	13.8
162	19.763	19.623	-0.112	0.8	15.0
168	19.766	19.623	-0.109	0.8	15.7
174	19.770	19.623	-0.105	0.8	16.8
180	19.772	19.623	-0.103	0.8	17.2
186	19.773	19.623	-0.102	0.8	17.6
192	19.771	19.623	-0.104	0.8	17.4
198	19.767	19.623	-0.108	0.8	16.6
204	19.764	19.623	-0.111	0.8	16.1
210	19.759	19.623	-0.116	0.8	14.8
216	19.755	19.623	-0.120	0.8	14.1
222	19.748	19.623	-0.127	0.7	12.6

Total Volumes: Over Overflow (Spill Flow) 0.000m³ Pipe 150.926m³

**360 minute 100 year Winter I+0%
Average Rainfall Intensity 9.971 mm/hr**

Storm Selector

360 minute 100 year Winter I+0%

▼

Time (mins)	US Level (m)	DS Level (m)	Surcharged Depth (m)	Pipe Velocity (m/s)	Pipe Flow (l/s)
6	19.046	18.983	-0.204	0.1	0.1
12	19.064	18.983	-0.186	0.4	0.7
18	19.074	18.983	-0.176	0.5	1.5
24	19.079	18.983	-0.171	0.5	1.9
30	19.083	18.983	-0.167	0.6	2.3
36	19.085	18.983	-0.165	0.6	2.5
42	19.086	18.983	-0.164	0.6	2.6
48	19.086	18.983	-0.164	0.6	2.7
54	19.086	18.983	-0.164	0.6	2.7
60	19.086	18.983	-0.164	0.6	2.7
66	19.087	18.983	-0.163	0.6	2.7
72	19.087	18.983	-0.163	0.6	2.7
78	19.089	18.983	-0.161	0.6	2.8
84	19.091	18.983	-0.159	0.6	3.0
90	19.094	18.983	-0.156	0.6	3.3
96	19.099	18.983	-0.151	0.7	3.6
102	19.110	18.983	-0.140	0.7	4.5
108	19.117	18.983	-0.133	0.7	5.2
114	19.126	18.983	-0.124	0.8	6.0
120	19.134	18.983	-0.116	0.8	7.0
126	19.143	18.983	-0.107	0.8	8.0

Total Volumes: Over Overflow (Spill Flow) 0.000m³ Pipe 173.979m³

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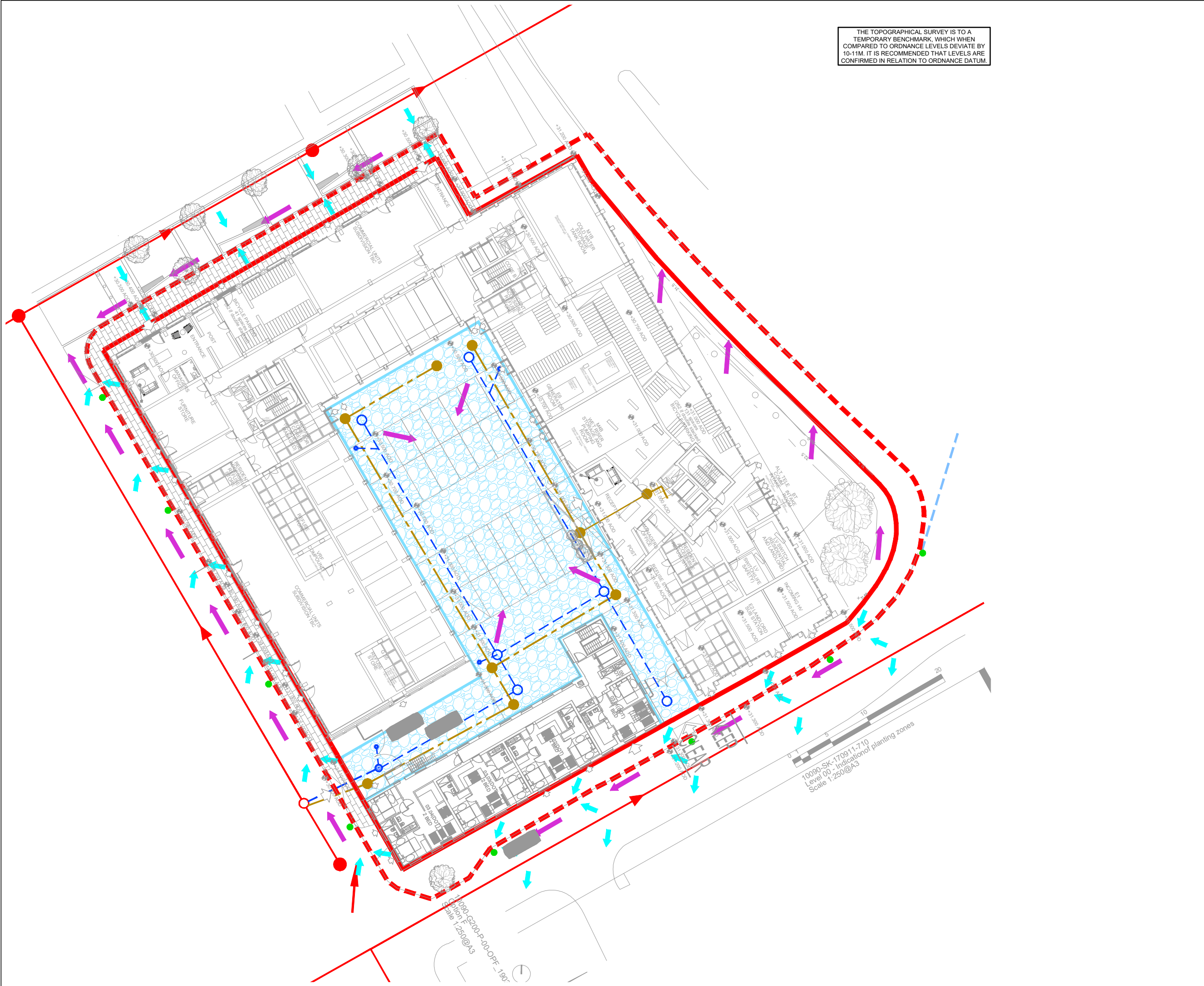
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Appendix C

Proposed Drawing:

071713-CUR-XX-00-DR-C-92501_ P01 PROPOSED OVERLAND FLOW ROUTES



THE TOPOGRAPHICAL SURVEY IS TO A TEMPORARY BENCHMARK, WHICH WHEN COMPARED TO ORDNANCE LEVELS DEVIATE BY 10-11M. IT IS RECOMMENDED THAT LEVELS ARE CONFIRMED IN RELATION TO ORDNANCE DATUM.

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
2. DO NOT SCALE THIS DRAWING. ANY AMBIGUITIES, OMISSIONS AND ERRORS ON DRAWINGS SHALL BE BROUGHT TO THE ENGINEERS ATTENTION IMMEDIATELY. ALL DIMENSIONS MUST BE CHECKED / VERIFIED ON SITE.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.

KEY

- INDICATES THE FLOW ROUTE BASED ON FULL INLET CAPACITY OF COMPONENTS .i.e FALLS AT SURFACE
- INDICATES THE GENERAL GROUND LEVEL FALLS TO THE DRAINAGE SYSTEM
- EXISTING GULLY LOCATIONS TAKEN FROM TOPOGRAPHICAL SURVEY

GROUND LEVELS TO FALL AWAY FROM THE PROPOSED BUILDING LOCATIONS.

A	UPDATED LAYOUT	22.05.19	OJT	CG
Rev:	Description:	Date:	By:	Chkd:



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Structures - Civils - Environmental - Infrastructure - Transport Planning - Sustainability - Expert Advisory Services
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Status: PRELIMINARY

Project: ARUNDEL STREET MANCHESTER

Dwg Title: OVERLAND FLOW ROUTING

Scale:	Size:	First Issue:	Drawn:	Checked:
1:200	A1	22.05.2019	OJT	CG

Dwg No:	Rev:
071713-CUR-XX-00-DR-C-92-501	P01

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Appendix D

Proposed Flow Control:
SHE-0182-1530-0520-1530_Design_Drawing
SHE-0182-1530-0520-1530_Hydraulic_Characteristics

Technical Specification

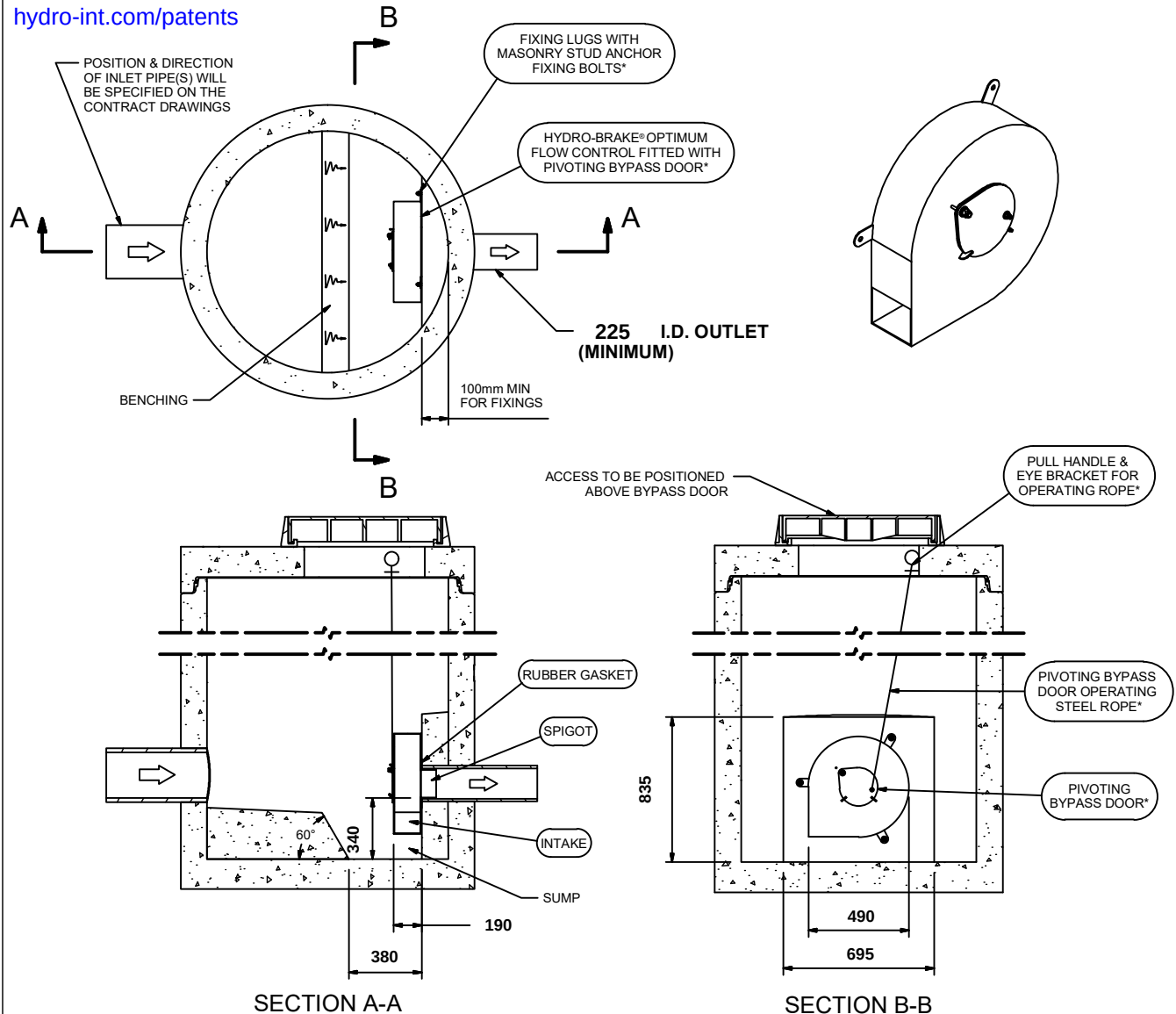
Control Point	Head (m)	Flow (l/s)
Primary Design	0.520	15.300
Flush-Flo™	0.263	15.300
Kick-Flo®	0.428	13.954
Mean Flow		11.839

Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Indicative Weight: 115 kg



hydro-int.com/patents



IMPORTANT:

○ LIMIT OF HYDRO INTERNATIONAL SUPPLY

THE DEVICE WILL BE HANDLED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS

* WHERE SUPPLIED

HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

**DESIGN
ADVICE**



The head/flow characteristics of this SHE-0182-1530-0520-1530 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
International®

DATE 5/23/2022 1:40 PM

SITE Arundel St

DESIGNER Chloe Grimsley

REF 071713

SHE-0182-1530-0520-1530

Hydro-Brake® Optimum

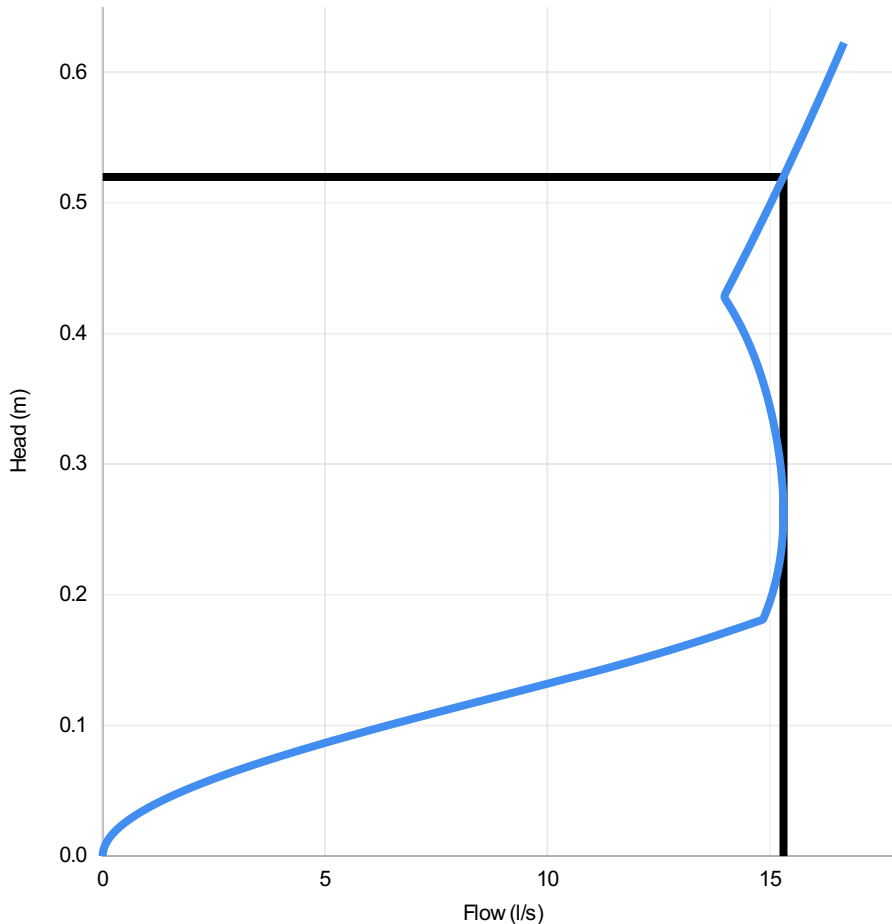
Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	0.520	15.300
Flush-Flo	0.263	15.300
Kick-Flo®	0.428	13.954
Mean Flow		11.839



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Head (m)	Flow (l/s)
0.000	0.000
0.018	0.249
0.036	0.963
0.054	2.087
0.072	3.556
0.090	5.301
0.108	7.236
0.126	9.264
0.143	11.286
0.161	13.094
0.179	14.685
0.197	15.016
0.215	15.157
0.233	15.247
0.251	15.292
0.269	15.298
0.287	15.270
0.305	15.212
0.323	15.128
0.341	15.017
0.359	14.879
0.377	14.708
0.394	14.498
0.412	14.238
0.430	13.988
0.448	14.260
0.466	14.527
0.484	14.788
0.502	15.044
0.520	15.296

DESIGN ADVICE



The head/flow characteristics of this SHE-0182-1530-0520-1530 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
International

DATE 23/05/2022 13:40

Site Arundel St

DESIGNER Chloe Grimsley

Ref 071713

SHE-0182-1530-0520-1530

Hydro-Brake Optimum®

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Appendix E

Proposed Landscape Drawings

4.0 HARD LANDSCAPE MATERIALS

DESIGN MATERIALS

Hard materials have been selected to respond to the specific requirements of the setting and also to the functional urban public realm requirements of quality and durability. The contrast between the more functional use of the ground floor and the intimate spaces of the roof garden are reflected in the material combinations.

STREETS: The footpaths to the immediate curtilage of the development will match the materiality on adjacent footways on the surrounding streets. The materiality will comprise of a combination of resin bound gravel and high quality clay pavers laid to the centre of the path. In addition, the pedestrian crossing points will respond to the paving layout established in the area including the installation of tactile paving and drop kerbs.

GROUND FLOOR COURTYARD: This will be paved in high quality vehicle loaded concrete plank and textured clay sett paving to bring a domestic scale to the courtyard and provide contrast and interest within the layout. Planting and trees will be protected by a raised textured kerb.

ROOF GARDENS: The various roof gardens will use clay pavers, composite decking and bound gravel to create distinct areas and to reflect the importance of this communal setting. Clay sett paving will be used in the seating areas and this will breakdown into loose plank footpaths interspersed with planting in the more informal areas of the roof garden. The growing zones, maintenance access paths and plant nursery areas will be paved in resin bound gravel. Within the highest roof garden 'The Residents Room', the routes and gathering spaces will use composite decking for a softer finish.

Planter edges will be in upstand steel to give a crisp contrast to the planting. Seat surfaces and the pergola will be in timber in keeping with creating personal and domestic scaled outdoor living spaces. Raised planters are provided for residents to grow their own produce and carry out home composting.



CLAY PAVERS



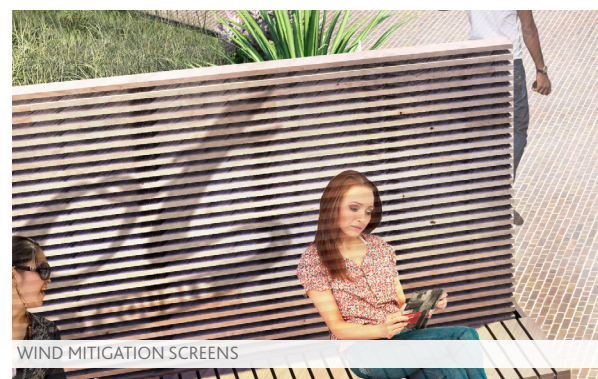
CLAY PAVERS - CONTRASTING COLOURS



STEEL EDGE UPSTAND



RAISED PLANTER



WIND MITIGATION SCREENS



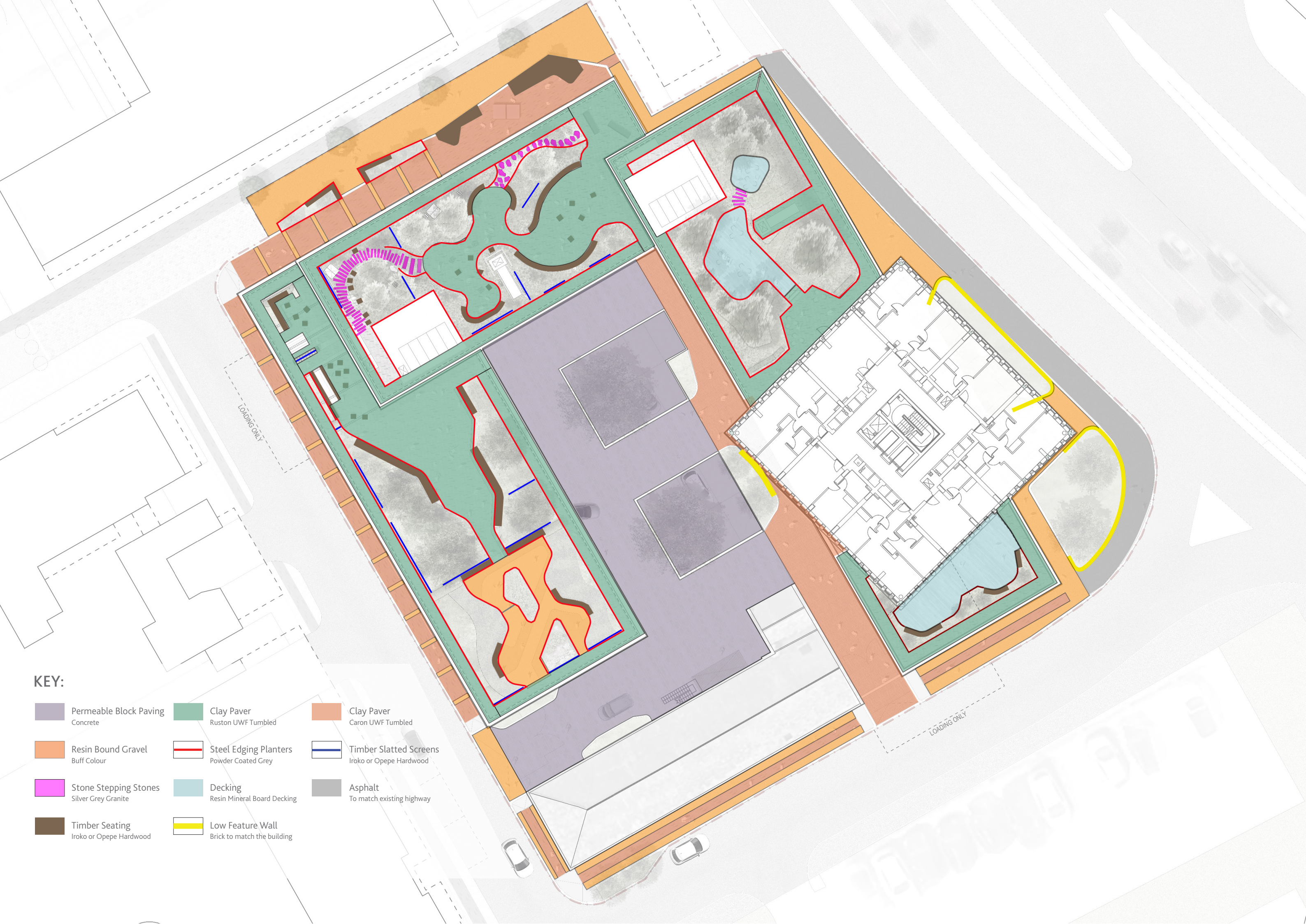
RESIN BOUND GRAVEL



COMPOSITE DECKING

KEY:

- | | | |
|---|---|---|
|  Permeable Block Paving
Concrete |  Clay Paver
Ruston UWF Tumbled |  Clay Paver
Caron UWF Tumbled |
|  Resin Bound Gravel
Buff Colour |  Steel Edging Planters
Powder Coated Grey |  Timber Slatted Screens
Iroko or Opepe Hardwood |
|  Stone Stepping Stones
Silver Grey Granite |  Decking
Resin Mineral Board Decking |  Asphalt
To match existing highway |
|  Timber Seating
Iroko or Opepe Hardwood |  Low Feature Wall
Brick to match the building | |



KEY:

-  Grass
Amenity Turf
-  Shrub Planting
Ornamental / Perennial Varieties
-  Shrub Planting
Shade Tolerant Species
-  Allotment Planting
Herbaceous Varieties
-  Hedges / Screens
Instant Hedges
-  SEDUM CYCLE STORE
Sedum roof covering to Cycles
-  LOW RAISED PLANTERS
Low raised planters integrated
into building facade
-  CLIMBING PLANTING
Climbing planting integrated
into building facade elements

