Project Title

Report to Discharge Drainage Related Planning Condition

At

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1.0 Introduction

1.1 In December 2024 a planning application was submitted to Manchester City Council for the erection of a single storey building comprising 2no. units (B8 storage or distribution) with associated alterations to car parking layout at Commerce House, 54 Derby Street, Manchester, M8 8HF.

1.2 Planning approval, Ref: 141689/FO/2024 was granted in February 2025.

1.3 This report has been prepared to remove this condition; Number 5.

2.0 Drainage Strategy

2.1 Existing Drainage

2.1.1 A review of the United Utilities adopted sewer records has identified no public sewers passing through the site.

2.1.2 Within Woolley Street to the east of the site is a 225mm / 300mm diameter combined water sewer flowing south.

2.1.3 No surface water sewers have been identified in close proximity.

2.1.3 Investigations would indicate that the current hard paved area outfalls to an existing private network that outfalls unrestricted to the combined sewer in Woolley Street.

2.2 Existing Runoff

2.2.1 The existing site is comprised of hard paved developed land and is thus considered to be Brownfield for drainage purposes. The existing brownfield flow rates from the area of the building only have been defined in Table 1 below based on the modified rational method for the various storm events and 100% of the existing site area currently draining to the combined water sewer via the existing connection.

Impermeable Area	Brownfield Runoff Rates (l/s)			
	1 yr	2 yr	30yr	100yr
0.042	3.5 l/s	4.7 l/s	7.6 l/s	11.1 l/s

Table 1: Brownfield Runoff Rates

2.2.1 To satisfy Manchester Council guidance & policy for brownfield sites, the post development peak rate will be 50% of the 1 in 1-year existing flow rate, thus 1.75l/s. This is increased to 2l/s.

2.3 Existing Geology

2.3.1 No formal Phase 1 or Phase 2 Geo-Environmental site assessment has been carried out at the site. A review of the BGS online mapping would indicate that there are superficial deposits encompassing Till, Devension – Silts and clays and that the bedrock strata comprise the Chester Formation – Sandstone.

2.3.2 On the 4th September 2023, a trial pit was excavated along the full width of the proposed building and 3m beyond the western boundary, to a depth of between 2.5m on the western side and 2.2m on the eastern side. This was considered the maximum depth to reduce the risk of collapse and negate any temporary supports.

2.3.3 The material excavated encompassed Made Ground comprising a sandy clay to the full depth.

Photograph 1 – Trial Pit Viewing East

Photograph 2 – Trial Pit Viewing West

2.3.4 Due to the clays and silts, infiltration has been discounted as a viable method for surface water management.

2.4 Hydrological Assessment

2.4.1 The River Irwell is located some 1000m to the south west of the site beyond 3rd party land, flowing south.

2.5 SuDS Hierarchal Approach

2.5.1 Based on the existing drainage configuration, plus an assessment of the local site conditions, the SuDS hierarchal approach for discharge of surface water at the development site is considered in detail below:

Method	Suitability	Suitability for Development
Infiltration to Ground	No	Investigation has identified that the clay sub ground would not be suitable for infiltration.
Connection to Watercourse	No	No watercourse in close proximity.
Connection to Surface Water Sewer	No	No surface water sewer in close proximity.
Connection to Combined Water Sewer	Yes	Reuse existing connection to the combined water sewer at restricted rates.

Table 2: SuDS Hierarchal Approach

2.6 Surface Water Drainage Strategy

2.6.1 The general principle of the surface water drainage strategy for the new building is to collect the runoff from the roof and direct it to a number of RWPs. These will then drop down to a new private surface water network that flows generally in a south easterly direction. This network passes through a flow control rated at 2l/s before connecting to the existing private drain that then outfalls to the combined water sewer. Due to the restricted rate, attenuation will take the form of an offline geocellular attenuation tank.

2.6.2 A hydraulic model has been built and simulated within the Causeway Flow design software. This confirms that no flooding will occur up to the extreme 100 year + 45% CC storm event. The drainage GA can be found in Appendix A with the calculations in Appendix B.

2.7 Foul Flows

2.7.1 New foul drainage will connect to the same combined water network.

2.8 Maintenance

2.8.1 This section is intended to give an overview of the operation and maintenance for the drainage features included with the drainage strategy and in relation to typical details. Where proprietary products are specified, the manufacturer's instructions and recommendations should be followed in priority to this document unless specifically noted otherwise due to project constraints. The recommended operations and frequencies are typical only and should be more frequent initially to ensure that there are no unforeseen issues with the operation and then adjusted to suit the site requirements.

2.8.2 There are three types of maintenance activities associated with surface water drainage systems. The SuDS Manual, CIRIA C753, defines these as:

- Regular Maintenance – '*basic tasks undertaken on a frequent and predictable schedule' including vegetation management, litter and debris removal, and inspections*.'
- Occasional Maintenance – *'tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (sediment removal is an example.'*
- Remedial Maintenance – *'intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised by good design. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and as such timings are difficult to predict.*'

2.8.3 Specific maintenance needs should be monitored, and maintenance schedules adjusted to suit the location and condition of the drainage feature in question.

2.8.4 <u>Piped Networks, Inspection, Manhole and Catchpit Chambers</u>

The appropriate health and safety equipment must be used when accessing manholes. Confined space certificates must be held by any personnel entering a manhole and the appropriate permits should be obtained where required.

Pipes are proprietary products, and the materials can vary across the site and as such where used the manufacture's recommendations should be followed.

Pipes are intended to be the main conveyance across the development and where oversized they form the attenuation volume required by the limitation of the discharge rate. They are intended to be dry except for during rainfall events. These have been designed to be self-cleaning where possible for smaller diameter pipes, and for larger diameters the risk is reduced due to the overall pipe size.

Access for maintenance is provided through access chambers and manholes.

Regular inspection and maintenance are important to identify areas which may have been obstructed / clogged and may not be drainage correctly thus exposing the development to a greater level of flood risk.

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify any features that are not operating correctly. If required, take remedial action	Monthly for three months, then six monthly
	Debris removal from catchment surface / gratings (where may cause risks to performance)	Monthly (and after large storms)
	Remove sediment from trapped sumps, manholes and catchpits.	Annually or as required
Remedial Maintenance	Repair / rehabilitation of gratings, inlets and outlets	As required
Monitoring	Inspect / check all gratings, trapped sumps, manholes and catchpits to ensure that they are in good condition and operating as designed	Annually and after large storm events
Structure Rehabilitation / Repair	Regular Maintenance and Monitoring to identify if repair and / or replacement of features or pipework is required.	As required

Table 3: Operation and Maintenance Requirements of Piped Networks and Inspection Chambers

2.8.5 Flow Control Units

The flow control units are intended for flood control and flow restriction.

The flow control is specified as an orifice plate and is a proprietary product; therefore, manufacturer's recommendations should also be taken into consideration.

Access for maintenance has been provided by locating within manhole chambers.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required).	Inspect inlets for blockages, and clear if required. If faults persist jetting and CCTV survey may be required.	Monthly and after large storms.
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly.
	Debris removal from catchment surface (where may cause risks to performance).	Monthly
	Remove sediment from pre- treatment structures and flow control chambers.	Annually (or as required after heavy rainfall events)
Remedial Actions	Repair/rehabilitation of inlets.	As required.

Table 4: Operation and Maintenance Requirements for Flow Controls

2.8.6 Attenuation Storage

Geocellular tanks are modular storage systems made with plastic units. These units can be assembled to achieved re required volume and usually on multiple layers. Generally, the units have 95% of voids content and are used to create an efficient below ground structure to store surface water.

The geocellular units and geotextile are proprietary products and therefore manufacturer's recommendations should also be taken into consideration.

Access for maintenance should be provided by an access shaft located on the tank and from the manhole chambers downstream of the tank.

Regular inspection and maintenance are important for the effective operation of attenuation tanks as designed. As the feature is buried, a regular inspection regime is very important to ensure the correction functionality of the surface water drainage network.

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually.
	Remove debris form the catchment surface (where it may cause risks to performance).	Monthly.
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockages by sediment, algae or other matter; remove and replace surface infiltration medium as required.	Annually.
	Remove sediments from pre-treatment structures and/or internal forebays.	Annually, or as required.
Occasional Maintenance	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually
Remedial Actions	Survey inside of tank for sediment build-up and remove if necessary.	Every 5 years or as required.

Table 5: Operation and Maintenance Requirements for Attenuation Crates

3.0 Drainage Related Planning Condition and Responses

3.1 Planning Conditions

3.1.1 The detailed planning condition is listed below in *italics* with the PG Consulting response in Blue beneath.

Condition 5

Notwithstanding details submitted, no development shall begin until a surface water drainage scheme for the site, based on sustainable drainage principles has been submitted to and approved in writing by the City Council as Local Planning Authority. The development shall be constructed and completed in accordance with the approved details.

The scheme shall include:

-Surface water drainage layout including all components, levels, connectivity and proposed overland flow routes for extreme events;

Refer to the Drainage Ga in Appendix A

-Progression through the drainage hierarchy shall be evidence based and supported by site investigation. Results of ground investigation carried out under Building Research Establishment Digest 365. Site investigations should be undertaken in locations and at proposed depths of the proposed infiltration devices. Proposal of the attenuation that is achieving half emptying time within 24 hours. If no ground investigations are possible or infiltration is not feasible on site, evidence of alternative surface water disposal routes (as follows) is required;

As described in the report, the SuDS hierarchal approach has been incorporated. Due to the cohesive ground, infiltration is discounted

-Where surface water is connected to the public sewer, agreement in principle from United Utilities is required that there is adequate spare capacity in the existing system taking future development requirements into account. An email of acceptance of proposed flows and/or new connection will suffice;

UU were consulted at planning stage and provided to adverse comment. The proposals provide a reduction in the surface water runoff connecting to the combined sewer.

-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 45% climate change in any part of a building;

Refer to the calculations in Appendix B that include a 45% increase in rainfall.

-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. Provide 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 proposals provide a significant reduction in the peak water runoff to the adjacent sewers.

-An existing and proposed impermeable areas drawing to accompany all discharge rate calculations;

The new building is located on the location of an existing hard paved area, thus no change in the impermeable areas.

-Hydraulic calculations to support the drainage proposal, including all engineering parameters;

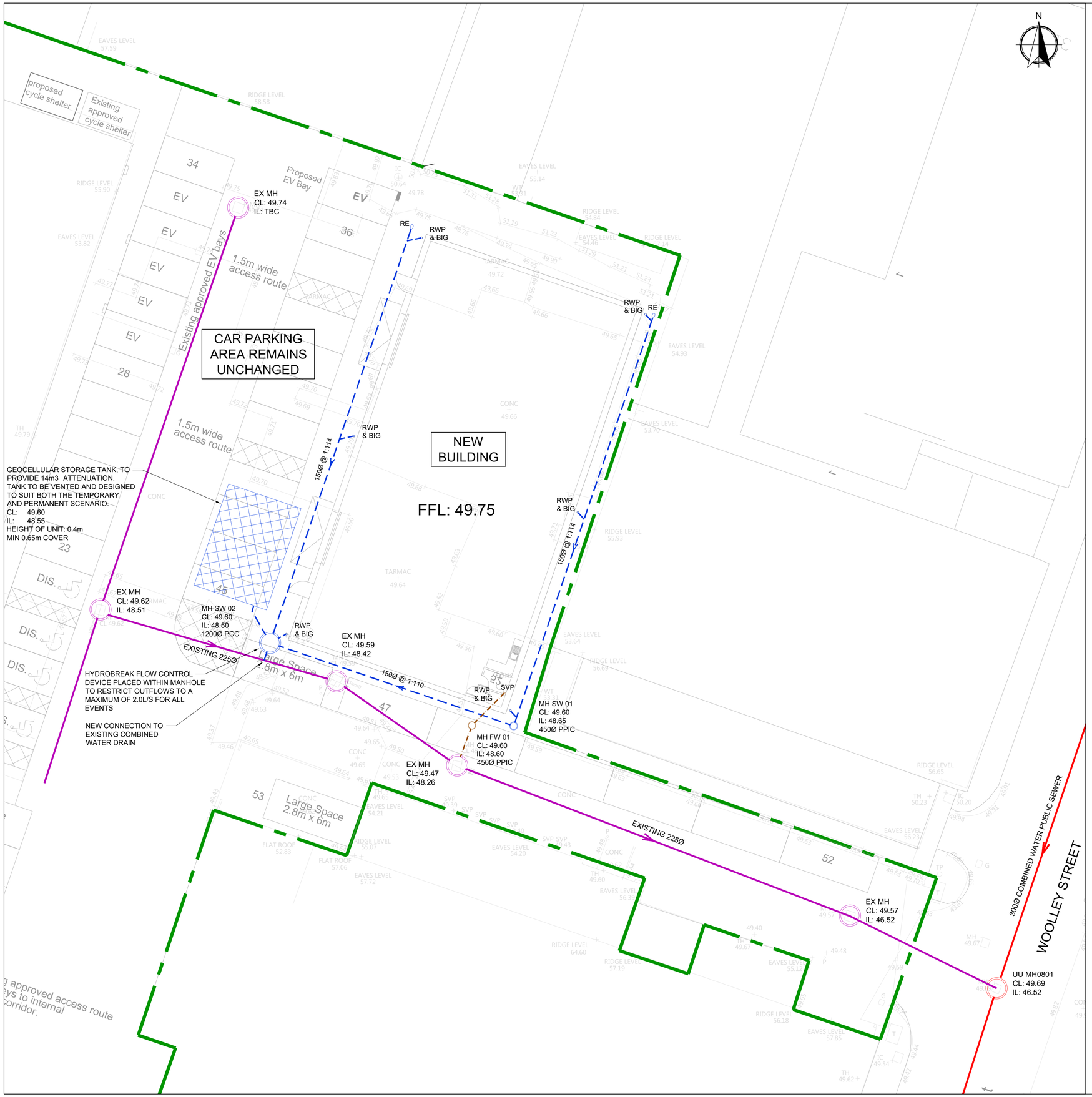
Refer to Appendix B.

-Details of how the scheme shall be maintained and managed after completion.

Management and maintenance details have been provided in Section 2.8.

Appendix A – PG Consulting Drawing

PGC 795-DR-C-001: Drainage GA



DRAINAGE NOTES

1. THE CONTRACTOR IS RESPONSIBLE FOR THE CONFIRMATION OF ALL POSITIONS AND LEVELS OF EXISTING DRAINS, SEWERS AND MANHOLES PRIOR TO THE COMMENCEMENT OF THE PROPOSED WORKS AND ANY DISCREPANCIES REPORTED IMMEDIATELY TO PGC.
2. ALL PRIVATE DRAINAGE WITHIN THE SITE IS TO COMPLY WITH THE REQUIREMENTS OF BS EN 752 AND BUILDING REGULATIONS PART H.
3. NO DEVIATION FROM THE CONTENT OF THIS DRAWING IS ALLOWED WITHOUT PERMISSION OF PGC.
4. FOR DETAILS OF WORKMANSHIP AND MATERIALS REFER TO THE SPECIFICATION, BUILDING REGULATIONS AND BRITISH STANDARDS CURRENT AT THE TIME OF THE WORK.
5. ADEQUATE PROTECTION IS TO BE PROVIDED TO MAINTAIN INTEGRITY OF THE EXISTING SERVICES AND PROPOSED WORKS DURING CONSTRUCTION.
6. COVER LEVELS ARE PROVISIONAL AND THE FINAL LEVEL SHOULD BE ADJUSTED AND SET TO SUIT THE PROPOSED FINISHED LEVELS AS CONFIRMED BY THE ARCHITECT.
7. CONCRETE SURROUND IS TO BE PROVIDED TO ALL DRAINS WITH A COVER OF LESS THAN 1.2m OF THE FINISHED GROUND LEVEL IN HIGHWAY AREAS OR WITHIN 0.6m IF WITHIN LANDSCAPED AREAS. AN EXPANSION JOINT IS TO BE PROVIDED AT EACH AND EVERY PIPE JOINT.
8. ANY GRADIENTS OF DRAINS INDICATED ARE INDICATIVE ONLY AND THE CONTRACTOR SHALL INSTALL THE DRAINS TO THE SPECIFIED LEVELS SHOWN FOR EACH MANHOLE (U.O.N). CATCHPIT INVERT LEVELS ARE FOR THE OUTGOING PIPE WITH THE SUMP LEVEL SPECIFIED SEPARATELY.
9. ALL PIPEWORK WITHIN MANHOLES ARE TO BE LAID SOFFIT TO SOFFIT (U.O.N). ALL CHAMBER INVERT LEVELS ARE FOR THE OUTGOING PIPE LEVELS. BACKDROP PIPEWORK SHALL BE CONNECTED AT SOFFIT TO SOFFIT WITH THE RODDING ACCESS LEVEL SPECIFIED.
10. ALL INVERT LEVELS PROVIDED FOR 475mm PPIC CHAMBER ARE TO THE LOWEST PIPE WITHIN THE BENCHING ARRANGEMENT.
11. MANHOLE COVERS AND FRAMES ARE TO BE IN ACCORDANCE WITH BS EN 124 AND THE FOLLOWING:
    - VEHICULAR AREAS: CLASS D400 (E600 IN SERVICE YARD LOCATIONS), DOUBLE TRIANGULAR, 150mm DEEP DUCTILE IRON COVER AND FRAME WITH THREE POINT COVER SEATING, (NON-ROCK DESIGN) BADGED FW OR SW FOR FOUL OR SURFACE WATER DRAINAGE.
    - PEDESTRIAN AREAS: CLASS B125, 100mm DEEP., BADGED FW OR SW FOR FOUL OR SURFACE WATER DRAINAGE.
    - IF COVERS ARE REQUIRED TO BE RECESSED A HOWE GREEN 1050 HEAVY DUTY, STAINLESS STEEL EDGE, EXTERNAL USE, 100mm RECESS OR SIMILAR APPROVED SHALL BE USED.
12. REFER TO ARCHITECT'S DRAWING FOR RWP'S/WPC'S POP UP SIZES. ALL REST BENDS ARE ASSUMED TO BE 100Ø,SET 600mm BELOW SSL, UNLESS OTHER SPECIFIED. THE CONTRACTOR SHALL ALLOW FOR SUITABLE VIKING JOHNSON ADAPTORS/COUPLINGS FOR JOINTING THE DIFFERENT PIPE MATERIALS/PIPE SIZES.
13. ALL BRICKWORK IN CONNECTION WITH DRAINAGE IS BE SOLID ENGINEERING BRICK CLASS B TO BS 3921.
14. ALL INSITU CONCRETE TO BE GEN3 UNLESS SPECIFIED OTHERWISE.
15. DRAINAGE CHANNELS ARE TO BE ACO MD SYSTEM C/W 'HEELGUARD' GRATES OR 'BRICKSLOT' TO LANDSCAPE ARCHITECT APPROVAL.
16. ALL PRECAST CONCRETE PIPES, CHAMBER PRODUCTS AND ROAD GULLIES SHALL BE TO BS 5911 AND BE KITEMARKED.
17. VITRIFIED CLAY PIPES TO CONFORM TO BS EN 295 MANUFACTURER: HEPWORTH SUPERSLEEVE;
    - 100/150mmØ -40 kN/m
    - 225mmØ -45 kN/m
    - 300mmØ -72 kN/m

    AND BE SUPPLIED WITH EPDM SEALING RINGS AS STANDARD.
18. PLASTIC PIPEWORK IS ACCEPTABLE AND SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS
19. UPON COMPLETION OF THE WORKS, ALL THE DRAINS SHALL BE CLEANED BY JETTING, REMOVING ALL DEBRIS FROM SITE. NO DEBRIS SHALL BE PERMITTED TO ENTER THE EXISTING DRAINAGE SYSTEM.
20. UPON COMPLETION OF THE WORKS THE CONTRACTOR SHALL SURVEY THE WORKS AND PROVIDE A SUITABLY 'MARKED-UP' DRAWINGS FOR ' RECORD' PURPOSES'.

GENERAL NOTES

1. DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL RELEVANT SPECIFICATIONS, ENGINEERS, ARCHITECTS & SERVICES DRAWINGS, INCLUDING APPROVED BUILDERS WORK DRAWINGS. CONTRACTOR TO NOTIFY ENGINEER OF DISCREPANCIES BETWEEN STRUCTURAL DRAWINGS AND SPECIFICATIONS OR OTHER DRAWINGS.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
3. DETAILS OF EXISTING SEWERS SHALL BE CONFIRMED BY THE CONTRACTOR ON SITE PRIOR TO THE COMMENCEMENT OF WORKS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY. THE CONTRACTOR SHOULD CHECK THE LEVELS OF ALL NEW OUT FALLS IN RELATION TO EXISTING SEWERS PRIOR TO ANY CONSTRUCTION TO ENSURE THE PROPOSED DESIGN CAN BE ACHIEVED.
4. DO NOT SCALE FROM THIS DRAWN, WORK TO DIMENSIONS OR COORDINATES PROVIDED. ALL LEVELS ARE IN MILLIMETRES, UNLESS OTHERWISE NOTED. ANY AMBIGUITIES, OMISSIONS AND ERRORS ON DRAWINGS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER IMMEDIATELY.

KEY

- EXISTING COMBINED WATER SEWER
- EXISTING COMBINED WATER DRAINAGE
- PROPOSED FOUL WATER DRAINAGE
- PROPOSED SURFACE WATER DRAINAGE
- SITE BOUNDARY

RWP	RAINWATER PIPE
SVP	SOIL VENT PIPE
RE	RODDING EYE
BIG	BACK INLET GULLY

NOTE ALL RWP AND WPC LOCATIONS TO BE CONFIRMED BY OTHERS

ALL COVER AND FRAMES IN FEATURE PAVING TO BE RECESSED

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Appendix B – Hydraulic Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	10	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	749	1500
499	1350	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Circular Link Type

Template	Freeform Carrier	Auto Increment (mm)	75
Shape	Circular	Follow Ground	x
Barrels	1		

Available Diameters (mm)

100	150

twin Link Type Group

Link Type	Minimum size (mm)	Maximum size (mm)	Link Type	Minimum size (mm)	Maximum size (mm)
Circular			culvert 600	600	1200

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
RE01	0.021	4.00	49.700	100	0.800
SW01			49.600	450	0.950
RE02	0.021	4.00	49.700	100	0.950
TANK		4.00	49.600	100	1.050
SW02			49.600	1200	1.100
EX DRAIN			49.500	225	1.030

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Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	RE01	SW01	28.500	0.600	48.900	48.650	0.250	114.0	150	4.51	50.0
1.001	SW01	SW02	16.500	0.600	48.650	48.500	0.150	110.0	150	4.79	50.0
2.000	RE02	SW02	28.500	0.600	48.750	48.500	0.250	114.0	150	4.51	50.0
3.000	TANK	SW02	3.000	0.600	48.550	48.500	0.050	60.0	150	4.04	50.0
1.002	SW02	EX DRAIN	2.000	0.600	48.500	48.470	0.030	66.7	150	4.82	50.0

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	0.940	16.6	2.8	0.650	0.800	0.021	0.0	42	0.703
1.001	0.957	16.9	2.8	0.800	0.950	0.021	0.0	41	0.710
2.000	0.940	16.6	2.8	0.800	0.950	0.021	0.0	42	0.703
3.000	1.301	23.0	0.0	0.900	0.950	0.000	0.0	0	0.000
1.002	1.233	21.8	5.7	0.950	0.880	0.042	0.0	52	1.042

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	28.500	114.0	150	Circular	49.700	48.900	0.650	49.600	48.650	0.800
1.001	16.500	110.0	150	Circular	49.600	48.650	0.800	49.600	48.500	0.950
2.000	28.500	114.0	150	Circular	49.700	48.750	0.800	49.600	48.500	0.950
3.000	3.000	60.0	150	Circular	49.600	48.550	0.900	49.600	48.500	0.950
1.002	2.000	66.7	150	Circular	49.600	48.500	0.950	49.500	48.470	0.880

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	RE01	100	Manhole	Adoptable	SW01	450	Manhole	Adoptable
1.001	SW01	450	Manhole	Adoptable	SW02	1200	Manhole	Adoptable
2.000	RE02	100	Manhole	Adoptable	SW02	1200	Manhole	Adoptable
3.000	TANK	100	Manhole	Adoptable	SW02	1200	Manhole	Adoptable
1.002	SW02	1200	Manhole	Adoptable	EX DRAIN	225	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
RE01	82.045	81.525	49.700	0.800	100		0	1.000	48.900	150
SW01	71.537	45.085	49.600	0.950	450		1	1.000	48.650	150
							0	1.001	48.650	150
RE02	53.910	85.424	49.700	0.950	100		0	2.000	48.750	150
TANK	40.611	61.396	49.600	1.050	100		0	3.000	48.550	150

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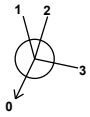
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW02	43.401	51.017	49.600	1.100	1200		1	3.000	48.500	150
							2	2.000	48.500	150
							3	1.001	48.500	150
							0	1.002	48.500	150
EX DRAIN	39.164	42.203	49.500	1.030	225		1	1.002	48.470	150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
Rainfall Events	Singular	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	20.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.400	Starting Level (m)	
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	45	0	0

Node SW02 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	48.500	Product Number	CTL-SHE-0067-2000-1000-2000
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node TANK Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	48.550
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	67

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	35.0	35.0	0.400	35.0	43.4	0.401	0.0	43.4

Approval Settings

Node Size	✓	Coordinates	✓
Node Losses	✓	Accuracy (m)	1.000
Link Size	✓	Crossings	✓
Minimum Diameter (mm)	150	Cover Depth	✓
Link Length	✓	Minimum Cover Depth (m)	
Maximum Length (m)	100.000	Maximum Cover Depth (m)	3.000

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Approval Settings

Backdrops	✓	Surcharged Depth	✓
Minimum Backdrop Height (m)		Return Period (years)	
Maximum Backdrop Height (m)	1.500	Maximum Surcharged Depth (m)	0.100
Full Bore Velocity	✓	Flooding	✓
Minimum Full Bore Velocity (m/s)		Return Period (years)	30
Maximum Full Bore Velocity (m/s)	3.000	Time to Half Empty	x
Proportional Velocity	✓	Discharge Rates	✓
Return Period (years)		Discharge Volume	✓
Minimum Proportional Velocity (m/s)	0.750	100 year 360 minute (m^3)	
Maximum Proportional Velocity (m/s)	3.000		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	109.521	30.991	30 year 360 minute summer	31.221	8.034
1 year 15 minute winter	76.857	30.991	30 year 360 minute winter	20.295	8.034
1 year 30 minute summer	71.439	20.215	30 year 480 minute summer	24.324	6.428
1 year 30 minute winter	50.133	20.215	30 year 480 minute winter	16.160	6.428
1 year 60 minute summer	48.435	12.800	30 year 600 minute summer	19.756	5.404
1 year 60 minute winter	32.179	12.800	30 year 600 minute winter	13.498	5.404
1 year 120 minute summer	30.053	7.942	30 year 720 minute summer	17.490	4.687
1 year 120 minute winter	19.966	7.942	30 year 720 minute winter	11.754	4.687
1 year 180 minute summer	23.233	5.979	30 year 960 minute summer	14.215	3.743
1 year 180 minute winter	15.102	5.979	30 year 960 minute winter	9.416	3.743
1 year 240 minute summer	18.475	4.882	30 year 1440 minute summer	10.161	2.723
1 year 240 minute winter	12.274	4.882	30 year 1440 minute winter	6.829	2.723
1 year 360 minute summer	14.169	3.646	100 year +45% CC 15 minute summer	505.670	143.087
1 year 360 minute winter	9.210	3.646	100 year +45% CC 15 minute winter	354.856	143.087
1 year 480 minute summer	11.185	2.956	100 year +45% CC 30 minute summer	332.000	93.944
1 year 480 minute winter	7.431	2.956	100 year +45% CC 30 minute winter	232.982	93.944
1 year 600 minute summer	9.182	2.511	100 year +45% CC 60 minute summer	222.268	58.739
1 year 600 minute winter	6.274	2.511	100 year +45% CC 60 minute winter	147.669	58.739
1 year 720 minute summer	8.203	2.199	100 year +45% CC 120 minute summer	134.215	35.469
1 year 720 minute winter	5.513	2.199	100 year +45% CC 120 minute winter	89.169	35.469
1 year 960 minute summer	6.768	1.782	100 year +45% CC 180 minute summer	101.219	26.047
1 year 960 minute winter	4.483	1.782	100 year +45% CC 180 minute winter	65.795	26.047
1 year 1440 minute summer	4.949	1.326	100 year +45% CC 240 minute summer	78.690	20.795
1 year 1440 minute winter	3.326	1.326	100 year +45% CC 240 minute winter	52.280	20.795
30 year 15 minute summer	268.706	76.035	100 year +45% CC 360 minute summer	58.701	15.106
30 year 15 minute winter	188.566	76.035	100 year +45% CC 360 minute winter	38.157	15.106
30 year 30 minute summer	174.929	49.499	100 year +45% CC 480 minute summer	45.550	12.038
30 year 30 minute winter	122.757	49.499	100 year +45% CC 480 minute winter	30.262	12.038
30 year 60 minute summer	116.589	30.811	100 year +45% CC 600 minute summer	36.875	10.086
30 year 60 minute winter	77.459	30.811	100 year +45% CC 600 minute winter	25.195	10.086
30 year 120 minute summer	70.438	18.615	100 year +45% CC 720 minute summer	32.556	8.725
30 year 120 minute winter	46.797	18.615	100 year +45% CC 720 minute winter	21.879	8.725
30 year 180 minute summer	53.298	13.715	100 year +45% CC 960 minute summer	26.340	6.936
30 year 180 minute winter	34.645	13.715	100 year +45% CC 960 minute winter	17.448	6.936
30 year 240 minute summer	41.604	10.995	100 year +45% CC 1440 minute summer	18.700	5.012
30 year 240 minute winter	27.641	10.995	100 year +45% CC 1440 minute winter	12.567	5.012

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Results for 1 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	RE01	10	48.945	0.045	3.1	0.0238	0.0000	OK
15 minute winter	SW01	10	48.693	0.043	3.1	0.0069	0.0000	OK
15 minute winter	RE02	10	48.794	0.044	3.1	0.0197	0.0000	OK
30 minute winter	TANK	26	48.593	0.043	3.4	1.5116	0.0000	OK
15 minute winter	SW02	10	48.656	0.156	6.2	0.1767	0.0000	SURCHARGED
15 minute winter	EX DRAIN	10	48.499	0.029	1.7	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	RE01	1.000	SW01	3.1	0.727	0.187	0.1222	
15 minute winter	SW01	1.001	SW02	3.1	0.327	0.182	0.1798	
15 minute winter	RE02	2.000	SW02	3.1	0.516	0.186	0.3117	
30 minute winter	TANK	3.000	SW02	-3.4	-0.435	-0.147	0.0243	
15 minute winter	SW02	1.002	EX DRAIN	1.7	0.690	0.079	0.0050	2.6

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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 winter	RE01	10	48.973	0.073	7.7	0.0389	0.0000	OK
15 minute summer	SW01	9	48.744	0.094	7.7	0.0150	0.0000	OK
15 minute winter	RE02	10	48.821	0.071	7.7	0.0322	0.0000	OK
60 minute winter	TANK	48	48.705	0.155	5.4	5.4245	0.0000	SURCHARGED
15 minute winter	SW02	8	48.715	0.215	15.8	0.2431	0.0000	SURCHARGED
15 minute summer	EX DRAIN	9	48.500	0.030	1.9	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 winter	RE01	1.000	SW01	7.6	0.898	0.459	0.2674	
15 minute summer	SW01	1.001	SW02	8.9	0.561	0.526	0.2416	
15 minute winter	RE02	2.000	SW02	7.7	0.601	0.463	0.3688	
60 minute winter	TANK	3.000	SW02	-5.4	0.419	-0.235	0.0528	
15 minute winter	SW02	1.002	EX DRAIN	1.9	0.704	0.086	0.0053	6.6

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Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	RE01	11	49.079	0.179	14.5	0.0956	0.0000	SURCHARGED
60 minute winter	SW01	58	48.921	0.271	7.1	0.0430	0.0000	SURCHARGED
15 minute winter	RE02	10	48.982	0.232	14.5	0.1044	0.0000	SURCHARGED
60 minute winter	TANK	59	48.920	0.370	10.8	12.9634	0.0000	SURCHARGED
60 minute winter	SW02	59	48.920	0.420	13.5	0.4752	0.0000	SURCHARGED
30 minute summer	EX DRAIN	26	48.500	0.030	2.0	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 winter	RE01	1.000	SW01	13.3	0.848	0.803	0.5017	
60 minute winter	SW01	1.001	SW02	6.7	0.412	0.394	0.2905	
15 minute winter	RE02	2.000	SW02	13.9	0.788	0.835	0.5017	
60 minute winter	TANK	3.000	SW02	-10.8	-0.614	-0.470	0.0528	
60 minute winter	SW02	1.002	EX DRAIN	2.0	0.712	0.090	0.0055	20.6

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