Report No:	Date:
DW2325-DS-2	**28th April 2023**
Project:	
Greenheys Redevelopment **Manchester Science Park** **Drainage Strategy**	
Client:	
Bruntwood SciTech Limited	

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Signature:

Report status: **Planning**

Approved for issue: Alan Wells BSc(Hons) CEng MICE MIStructE

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Date: 28th April 2023

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3.0 Proposals, New Drainage and Ground Conditions

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5.0 New Drainage Proposals

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Appendix A - Topographical Survey & Sewer Records

Appendix B - Current Site Proposal – BDP Site Redline drawing (Phase 1 & 2)
– Schematic Below Ground Drainage Layout
– Preliminary Stormwater Calculations

1.0 Introduction

1.1 It is proposed to provide a new office building on the site of the existing Greenheys Building at Manchester Science Park.

1.2 This assessment considers the previous drainage from the site, the proposed site requirements and the application of sustainable methods of drainage.

1.3 This Drainage Strategy covers the Phase 2 site area only and does not include the Phase 1 site areas. The additional Phase 1 areas indicate enabling works only and any drainage aspects for these will be considered by future developments.

1.4 This assessment has been prepared following an instruction by Mr Josh Woolgar on behalf of Bruntwood SciTech.

2.0 Existing Site and Watercourses / River System

2.1 The site is approx. 6,100m^2 in size and is bounded by Greenheys Lane to the West, Pencroft Way to the East and the BASE Building to the South. The site generally appears relatively flat but has a fall of approx. 600mm from East to West (towards Greenheys Lane) over a distance of around 140m.

2.2 The site currently contains the existing Greenheys Buildings and terraced properties (No 7 & 9 Greenheys lane), together with a large areas of car parking off Pencroft Way to the East and service yards off Greenheys Lane and Burlington Street. There are currently only very small areas of 'soft' landscaping on the proposed site, totalling less than 50m^2. Refer to the Topographical Survey in Appendix A.

2.3 The Public Sewer records from United Utilities indicate that there are no Adopted sewers on the site.

2.4 All foul and surface water from the existing car park, service yards, Greenheys Building and the terraced properties discharge into the Combined sewer in Greenheys Lane.

2.5 An Adopted 225mm diameter Combined sewer is present within the adjacent BASE building site, near Greenheys Lane, which discharges to the main Adopted Combined Sewer in Greenheys Lane. Refer to the Sewer Records in Appendix A.

2.6 The existing site 'hard' areas that are drained to the existing combined sewers in Greenheys Lane comprises 4,020m^2 of buildings plus 2,030m^2 of roadways and service yards; total existing surface area drained to the combined sewers = 6,050m^2.

2.7 The site is shown to be in Flood Zone 1, above any localised 1 in 1000-year river or stream flood events, as shown on the Environment Agency Flood Map for Planning and as such a site specific Flood Risk Assessment is not needed as the site is also well below 1 Ha in size. However, a site wide FRA has been produced and this accompanies this drainage strategy.

3.0 Proposals, New Drainage and Ground Conditions

3.1 The proposed site will have a new building and access road together with new areas of hard and soft landscaping. The current site proposal is contained in Appendix B.

The proposed hard surface area will be approximately:-

New Building	- 3,745 m^2
Road & Car Parking	- 530 m^2
Other Hardstanding Areas	- 335 m^2
Total Drained Area	- 4,610 m^2

3.2 The Phase 2 site investigations undertaken to date indicate a variable depth of made ground underlain by 'heavy' clays.

3.3 Ground percolation tests have not been carried out yet due to the nature of the 'heavy' clay and reference to previous soakaway testing which indicated that the ground is not suitable for any infiltration drainage methods

4.0 Strategic Flood Risk Assessments

4.1 We have considered the full range of sustainable drainage options for the site, which are listed as follows:-

a) Watercourses – Corn Brook is culverted and is on the far side of Greenheys Lane to the East, also see surface water sewers below.
b) Surface Water Sewers – The surface water sewer indicated on the UU sewer records to the far side of Greenheys Lane is the culverted Corn Brook; we understand that Corn Brook is under the ownership of Manchester City Council. Permission to connect into the culvert is to be sought from MCC.
c) Soakaways – The underlying strata is not suitable for any type of soakaway drainage due to the heavy clay soils.
d) Rainwater Harvesting – We examined the overall benefit of rainwater harvesting on the scheme but the very limited potential use for harvested rainwater, together with there being zero effect upon the amount of water entering the underground system during wet conditions has led us to discount this as an option.
e) Blue / Green Roof – This has been carefully considered and the current proposals incorporate a blue roof on the majority of the main building, to store water and to restrict flow into the surface water system during storm events.
f) Permeable Surfacing – We have used this on several schemes previously and looked closely at the merits of using the system on this scheme. However, the quantity of paved area is very small and we would anticipate that approval to discharge land drains into Corn Brook would not be given.
g) Swales – We have examined the potential for the incorporation of a Swale into the scheme, but this was discounted as there are no areas where swales could be located and, more importantly, the ground conditions and site topography.

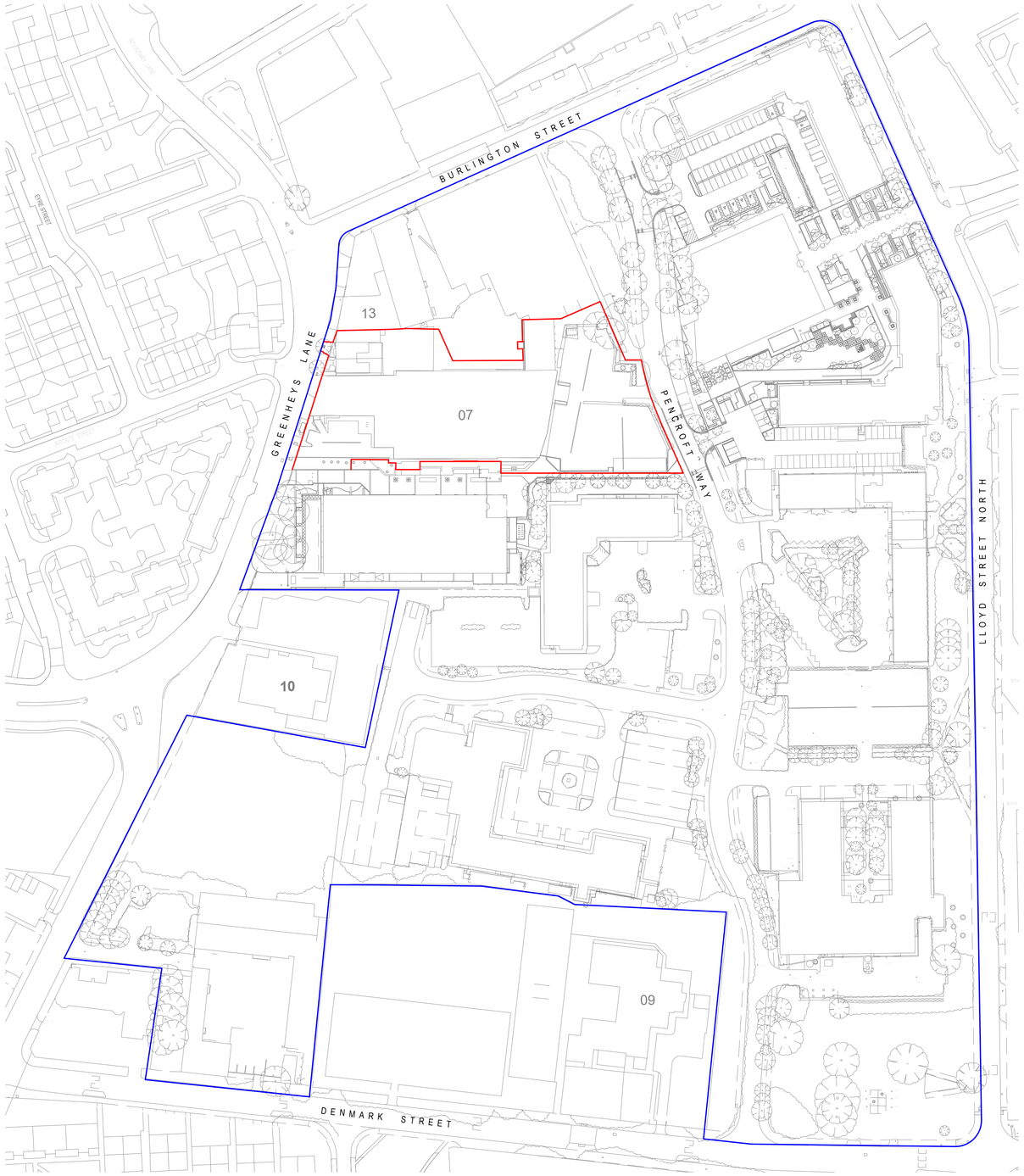
Appendix A

BDP Project Red & Blue line - Phase 1 & 2 – Drawing GRE-BDP-ZZ-XX-DR-A-00-020

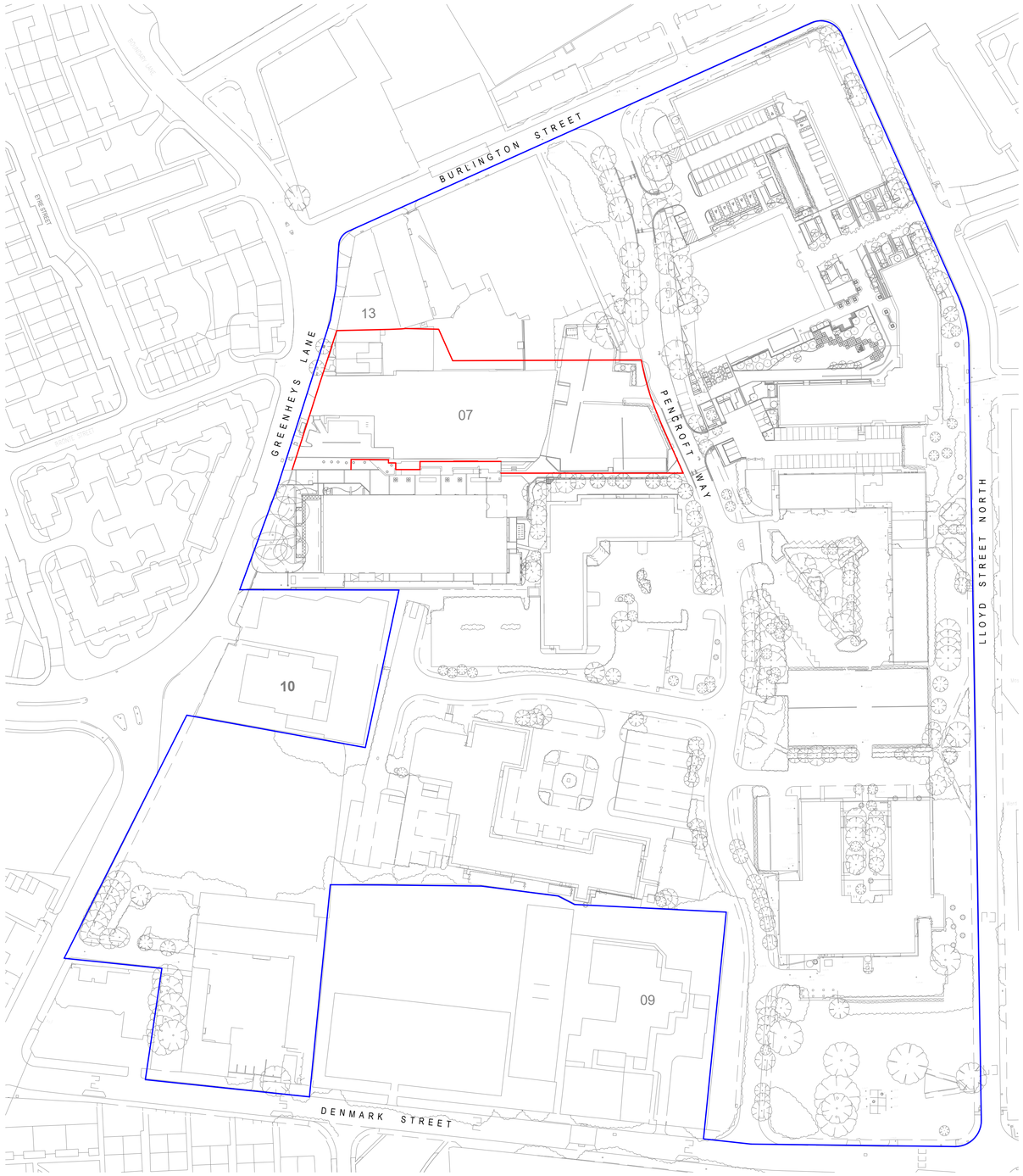
Topographical Survey – Drawing GRE-DWC-XX-DR-S-TS-01-P01

United Utilities Sewer Records

Mark Up of UU Sewer Records Indicating Manholes & Combined Sewer that were Unadopted during BASE Building development.



MSP SRF overlay of Greenheys Redevelopment Project Redline - Phase 1



MSP SRF overlay of Greenheys Redevelopment Project Redline - Phase 2

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NOTES

Subject to design development, survey, consultant input & statutory approval.

Red line

Blue line

REVISION	DESCRIPTION	DRAWN	CHECKED	DATE
P01	First Issue	PE	PE	16.04.23

KEYPLAN

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PROJECT TITLE: MSP Greenheys (Private & Confidential)

BDP JOB NUMBER: P3001624

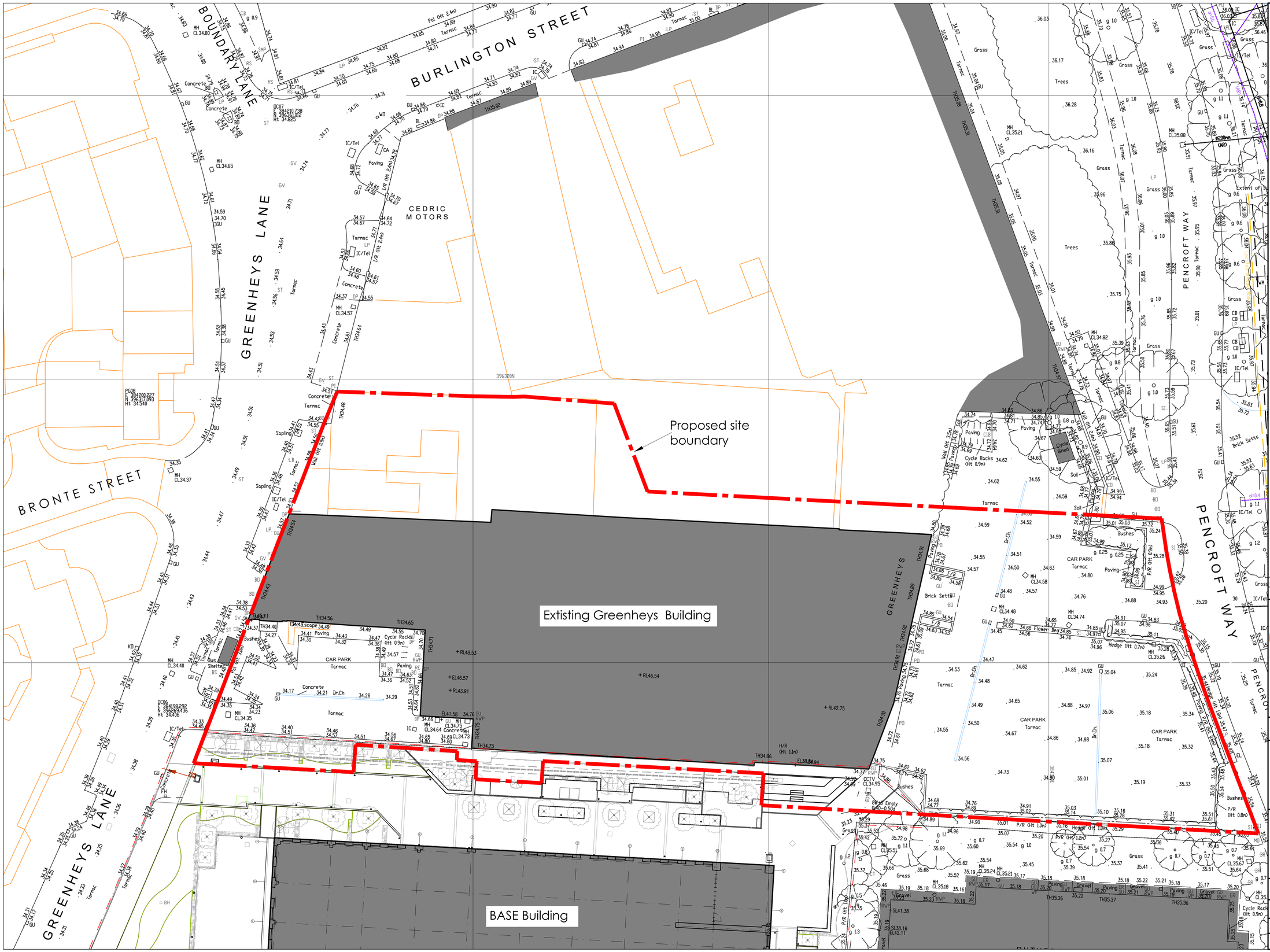
DRAWING TITLE: Project Red & Blue line - Phase 1 & 2

SCALE: @ A1 1 : 1000

DATE FIRST ISSUED: April 2023

DRAWING No: GRE-BDP-ZZ-XX-DR-A-00-020

REVISION: P01



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Project

Greenheys Redevelopment
Manchester Science Park

Drawing Title

Site Topo Survey

Drawing Status

info

Drawing No.

GRE-DWC-XX-DR-S-TS-01

Scale	Sheet Size	Revision
1:250	A1	P01

Date	Drawn	Checked	Auth
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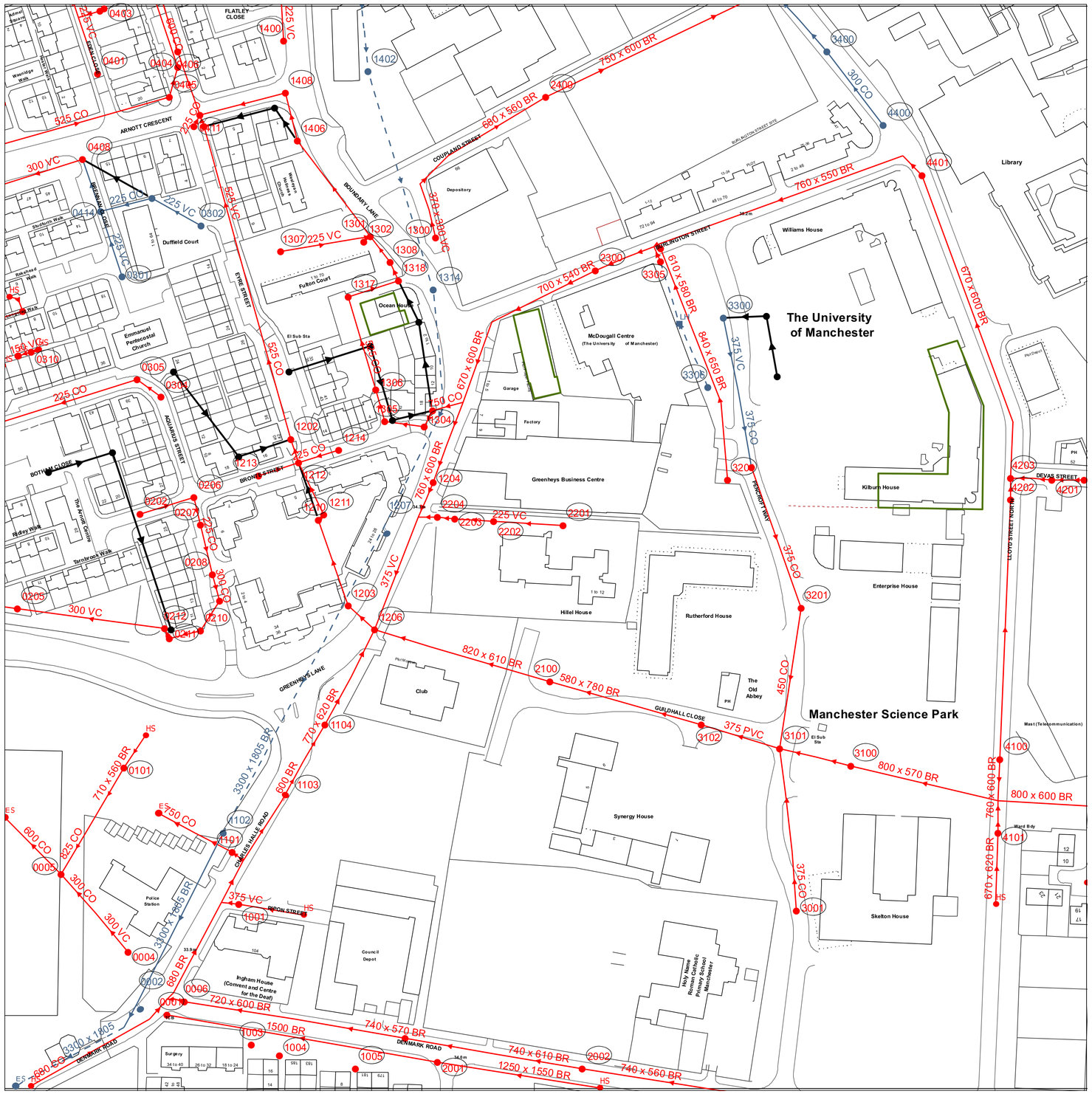

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WASTE WATER SYMBOLOGY

Foul Surface Combined Overflow

- Manhole
- Manhole, Side Entry
- MainSewer, Public
- MainSewer, Private
- MainSewer, S104
- Rising Main, Public
- Rising Main, Private
- Rising Main, S104
- Highway Drain, Private

Foul Surface Combined

- WW Site Termination
- Air Valve
- Cascade
- Non Return Valve
- Extent of Survey
- Flow Meter
- Gulley
- Hatch Box
- Head of System
- Hydrobrake / Vortex
- Inlet
- Inspection Chamber
- Bifurcation
- Catchpit
- Contaminated Surface Water
- WW Pumping Station
- Sludge Pumping Station
- Sewer Overflow
- T Junction/Saddle
- LampHole
- OilInterceptor
- PenStock
- Pump
- RoddingEye
- Soakaway
- Summit
- Valve
- Valve Chamber
- Washout Chamber
- DropShaft
- WW Treatment Works
- Septic Tank
- Vent Column
- Network Storage Tank
- Orifice Plate
- Vortex Chamber
- Penstock Chamber
- Blind Manhole

Foul Surface Combined Overflow

- Screen Chamber
- Discharge Point
- Outfall

- Sludge Main, Public
- Sludge Main, Private
- Sludge Main, S104

ABANDONED PIPE

- MainSewer
- Rising Main
- Highway Drain
- Sludge Main

- Control Kiosk
- Unspecified

LEGEND

MANHOLE FUNCTION

- FO Foul
- SW Surface Water
- CO Combined
- OV Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	PVC	Polyvinyl Chloride
PE	Polyethylene	CI	Cast Iron
RP	Reinforced Plastic Matrix	SI	Spun Iron
CO	Concrete	ST	Steel
CSB	Concrete Segment Bolted	VC	Vitrified Clay
CSU	Concrete Segment Unbolted	PP	Polypropylene
CC	Concrete Box Culverted	PF	Pitch Fibre
PSC	Plastic/Steel Composite	MAC	Masonry, Coursed
GRC	Glass Reinforced Concrete	MAR	Masonry, Random
GRP	Glass Reinforced Plastic	U	Unspecified

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OS Sheet No: SJ8496SW

Scale: 1: 1250 Date: 17/02/2014

166 Nodes

Sheet 1 of 1

United Utilities

SEWER RECORDS

OS Sheet No: SJ8496SW

Scale: 1: 1250 Date: 17/02/2014

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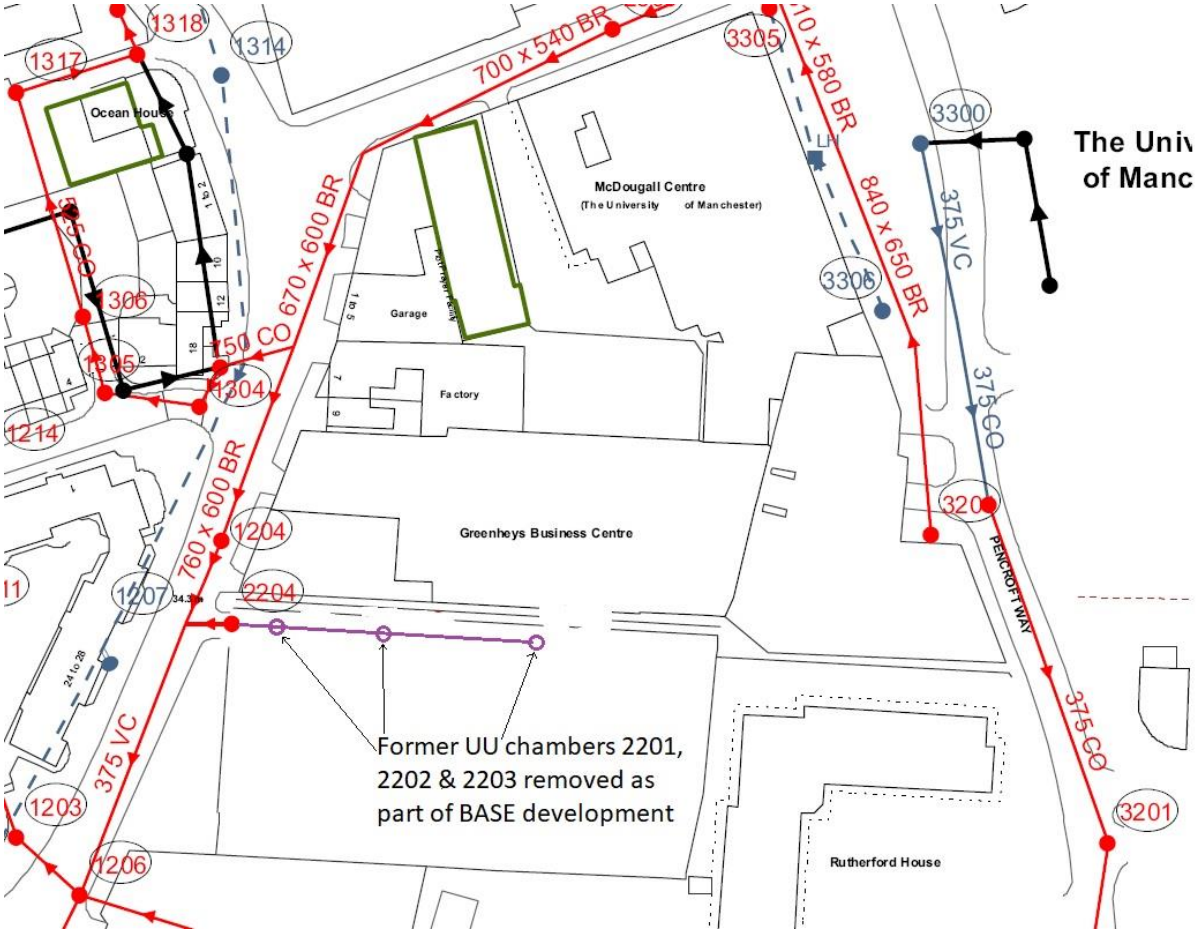
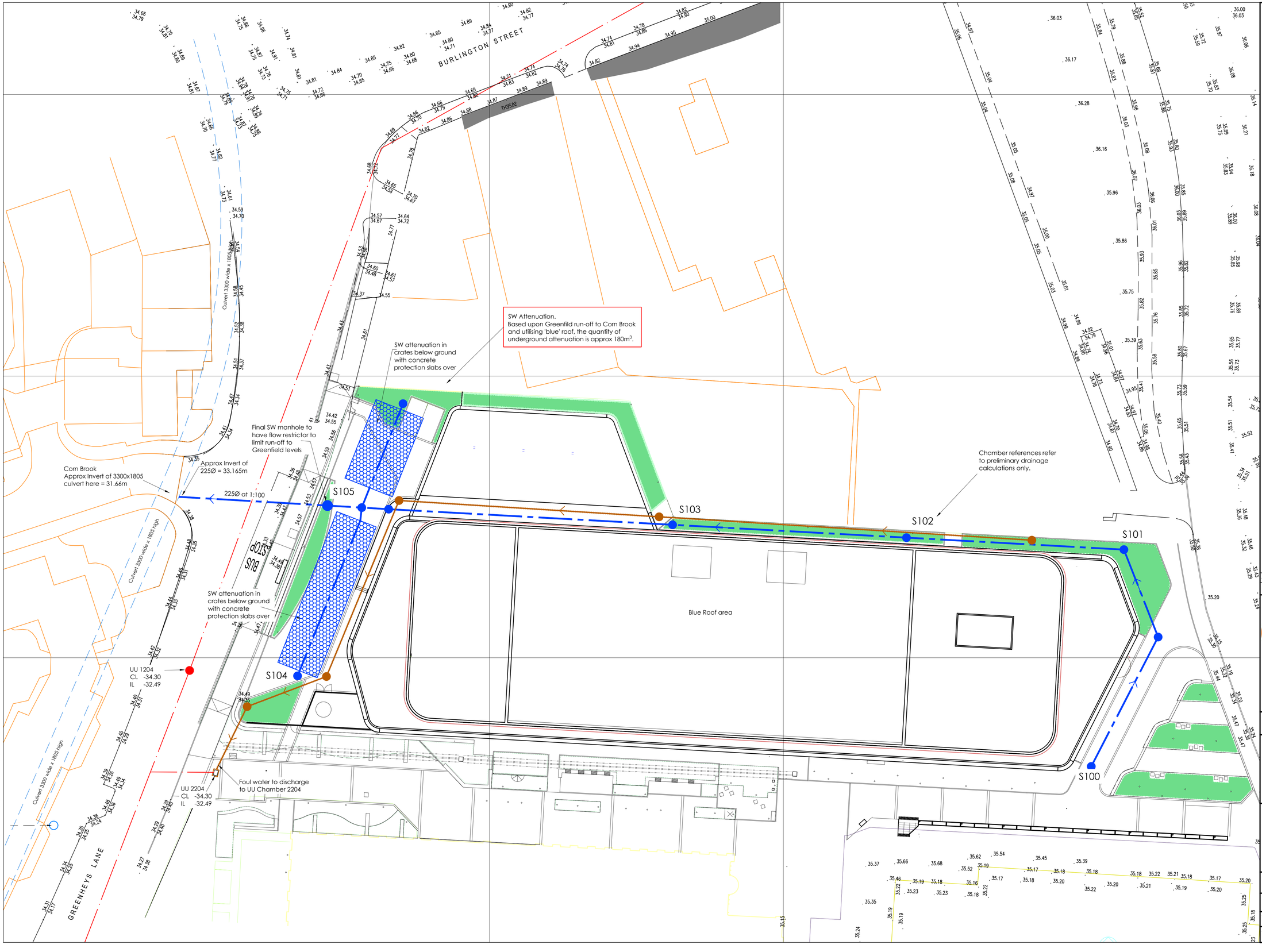


Mark Up of UU Sewer Records Indicating Manholes & Combined Sewer that were Unadopted during BASE Building development

Appendix B – Current Scheme Site Proposals and Calculations

Schematic Drainage Layout & Details – Drawing GRE-DWC-XX-DR-S-DR100-P01

Preliminary Storm Water Drainage & Attenuation Calculations



GENERAL NOTES

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Contractor to check all dimensions and report all errors and omissions to the Engineer.

Details shown on this drawing are schematic only and are subject to detailed design and approval from Manchester City Council and United Utilities.

Rev	Detail	By	Auth	Date

Revisions

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Client
Bruntwood SciTech

Project
Greenheys Redevelopment
Manchester Science Park

Drawing Title
Schematic Below Ground Drainage Layout & Details

Drawing Status
scheme

Drawing No.
GRE-DWC-XX-DR-S-DR100

Scale	Sheet Size	Revision
1:250	A1	P01

Date	Drawn	Checked	Auth
Jan'23			

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Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	5.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	200.0
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	0.370	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
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Culvert 3			34.190	2705	384097.721	396117.622	3.227

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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)
S100-S101	S100	S101	28.960	0.600	34.003	33.810	0.193	150.1	225	5.00	60.7
S101-S102	S101	S102	26.392	0.600	33.810	33.634	0.176	150.0	225	5.00	60.7
Blue Roof 1-Blue Roof 1 Control	Blue Roof 1	Blue Roof 1 Control	4.355	0.600	35.000	34.989	0.011	395.9	100	5.00	60.7
Blue Roof 1 Control-S102	Blue Roof 1 Control	S102	2.711	0.600	34.989	34.921	0.068	39.9	100	5.00	60.7
S102-S103	S102	S103	35.782	0.600	33.634	33.395	0.239	149.7	225	5.00	60.7
Blue Roof 2-Blue Roof 2 Control	Blue Roof 2	Blue Roof 2 Control	4.380	0.600	35.000	34.989	0.011	398.2	100	5.00	60.7
Blue Roof 2 Control-S103	Blue Roof 2 Control	S103	2.744	0.600	34.989	34.920	0.069	39.8	100	5.00	60.7
S103-S105	S103	S105	43.203	0.600	33.395	33.107	0.288	150.0	225	5.00	60.7
S104-S105	S104	S105	27.445	0.600	33.382	33.107	0.275	99.8	225	5.00	60.7
S105-X Junction 2	S105	X Junction 2	21.357	0.600	33.107	32.894	0.213	100.3	225	5.00	60.7
Culvert 1-X Junction 2	Culvert 1	X Junction 2	18.977	0.600	31.345	31.314	0.031	612.2	1805	5.00	60.7
X Junction 2-X Junction	X Junction 2	X Junction	98.122	0.600	31.314	31.150	0.164	598.3	1805	5.00	60.7
S7-X Junction	S7	X Junction	28.810	0.600	33.011	32.730	0.281	102.5	225	5.00	60.7
X Junction-Culvert 2	X Junction	Culvert 2	14.374	0.600	31.150	31.126	0.024	598.9	1805	5.00	60.7

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)
S100-S101	1.065	42.3	9.5	0.922	1.115	0.058	0.0	73	0.864
S101-S102	1.065	42.4	9.5	1.115	1.291	0.058	0.0	73	0.864
Blue Roof 1-Blue Roof 1 Control	0.381	3.0	22.1	0.050	0.061	0.134	0.0	100	0.391
Blue Roof 1 Control-S102	1.225	9.6	22.1	0.061	0.129	0.134	0.0	100	1.258
S102-S103	1.066	42.4	31.6	1.291	1.530	0.192	0.0	145	1.166
Blue Roof 2-Blue Roof 2 Control	0.379	3.0	22.1	0.050	0.061	0.134	0.0	100	0.390
Blue Roof 2 Control-S103	1.226	9.6	22.1	0.061	0.130	0.134	0.0	100	1.259
S103-S105	1.065	42.3	61.6	1.530	1.268	0.374	0.0	225	1.085
S104-S105	1.308	52.0	9.9	0.993	1.268	0.060	0.0	66	1.013
S105-X Junction 2	1.305	51.9	75.1	1.268	1.231	0.456	0.0	225	1.330
Culvert 1-X Junction 2	1.933	4946.6	0.0	1.350	1.231	0.000	0.0	0	0.000
X Junction 2-X Junction	1.956	5004.0	75.1	1.231	1.345	0.456	0.0	149	0.743
S7-X Junction	1.291	51.3	3.3	1.476	1.345	0.020	0.0	38	0.727
X Junction-Culvert 2	1.955	5001.4	78.4	1.345	1.331	0.476	0.0	153	0.753

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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)
Culvert 2-Culvert 3	Culvert 2	Culvert 3	97.711	0.600	31.126	30.963	0.163	599.5	1805	5.00	60.7

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)
Culvert 2-Culvert 3	1.954	4999.1	78.4	1.331	1.422	0.476	0.0	153	0.753

Simulation Settings

Rainfall Methodology	FSR	Summer CV	0.750	Drain Down Time (mins)	240
FSR Region	England and Wales	Winter CV	0.840	Additional Storage (m³/ha)	0.0
M5-60 (mm)	18.000	Analysis Speed	Normal	Check Discharge Rate(s)	x
Ratio-R	0.370	Skip Steady State	x	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

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

Node S105 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	x
Invert Level (m)	33.107	Product Number	CTL-CHE-0076-3300-1400-3300
Design Depth (m)	1.400	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	3.3	Min Node Diameter (mm)	1200

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Node Blue Roof 1 Control Online Orifice Control

Flap Valve	x	Invert Level (m)	34.989	Design Flow (l/s)	0.8	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Depth (m)	0.100	Diameter (m)	0.036		

Node Blue Roof 2 Control Online Weir Control

Flap Valve	x	Invert Level (m)	35.089	Discharge Coefficient	0.590
Replaces Downstream Link	✓	Width (m)	1.000		

Node Blue Roof 1 Control Online Orifice Control

Flap Valve	x	Invert Level (m)	34.989	Design Flow (l/s)	0.8	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Depth (m)	0.100	Diameter (m)	0.036		

Node Blue Roof 2 Control Online Weir Control

Flap Valve	x	Invert Level (m)	35.089	Discharge Coefficient	0.590
Replaces Downstream Link	✓	Width (m)	1.000		

Node Blue Roof 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	35.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	675.0	0.0	0.100	675.0	0.0	0.101	0.0	0.0

Node Blue Roof 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	35.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

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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	675.0	0.0	0.100	675.0	0.0	0.101	0.0	0.0

Node S105 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	33.107
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	220.0	0.0	0.800	220.0	0.0	0.801	0.0	0.0

Other (defaults)

Entry Loss (manhole)	0.250	Entry Loss (junction)	0.000	Apply Recommended Losses	x
Exit Loss (manhole)	0.250	Exit Loss (junction)	0.000	Flood Risk (m)	0.300

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	123.800	35.031	2 year 480 minute summer	12.679	3.351
2 year 15 minute winter	86.877	35.031	2 year 480 minute winter	8.423	3.351
2 year 30 minute summer	81.148	22.962	2 year 600 minute summer	10.422	2.851
2 year 30 minute winter	56.946	22.962	2 year 600 minute winter	7.121	2.851
2 year 60 minute summer	54.898	14.508	2 year 720 minute summer	9.320	2.498
2 year 60 minute winter	36.473	14.508	2 year 720 minute winter	6.264	2.498
2 year 120 minute summer	33.986	8.982	2 year 960 minute summer	7.700	2.028
2 year 120 minute winter	22.580	8.982	2 year 960 minute winter	5.101	2.028
2 year 180 minute summer	26.230	6.750	2 year 1440 minute summer	5.639	1.511
2 year 180 minute winter	17.050	6.750	2 year 1440 minute winter	3.790	1.511
2 year 240 minute summer	20.829	5.504	2 year 2160 minute summer	4.077	1.127
2 year 240 minute winter	13.838	5.504	2 year 2160 minute winter	2.809	1.127
2 year 360 minute summer	16.028	4.125	2 year 2880 minute summer	3.412	0.915
2 year 360 minute winter	10.419	4.125	2 year 2880 minute winter	2.293	0.915

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Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 4320 minute summer	2.606	0.681	30 year 1440 minute summer	9.793	2.625
2 year 4320 minute winter	1.716	0.681	30 year 1440 minute winter	6.581	2.625
2 year 5760 minute summer	2.160	0.553	30 year 2160 minute summer	6.954	1.922
2 year 5760 minute winter	1.398	0.553	30 year 2160 minute winter	4.791	1.922
2 year 7200 minute summer	1.844	0.470	30 year 2880 minute summer	5.744	1.539
2 year 7200 minute winter	1.190	0.470	30 year 2880 minute winter	3.860	1.539
2 year 8640 minute summer	1.616	0.412	30 year 4320 minute summer	4.302	1.125
2 year 8640 minute winter	1.043	0.412	30 year 4320 minute winter	2.833	1.125
2 year 10080 minute summer	1.446	0.369	30 year 5760 minute summer	3.515	0.900
2 year 10080 minute winter	0.933	0.369	30 year 5760 minute winter	2.275	0.900
30 year 15 minute summer	234.073	66.235	30 year 7200 minute summer	2.965	0.756
30 year 15 minute winter	164.262	66.235	30 year 7200 minute winter	1.913	0.756
30 year 30 minute summer	154.492	43.716	30 year 8640 minute summer	2.572	0.656
30 year 30 minute winter	108.415	43.716	30 year 8640 minute winter	1.660	0.656
30 year 60 minute summer	104.640	27.653	30 year 10080 minute summer	2.280	0.582
30 year 60 minute winter	69.521	27.653	30 year 10080 minute winter	1.472	0.582
30 year 120 minute summer	64.357	17.008	100 year 15 minute summer	302.300	85.541
30 year 120 minute winter	42.757	17.008	100 year 15 minute winter	212.141	85.541
30 year 180 minute summer	49.238	12.671	100 year 30 minute summer	201.457	57.005
30 year 180 minute winter	32.006	12.671	100 year 30 minute winter	141.373	57.005
30 year 240 minute summer	38.745	10.239	100 year 60 minute summer	137.337	36.294
30 year 240 minute winter	25.741	10.239	100 year 60 minute winter	91.244	36.294
30 year 360 minute summer	29.287	7.537	100 year 120 minute summer	84.653	22.371
30 year 360 minute winter	19.037	7.537	100 year 120 minute winter	56.242	22.371
30 year 480 minute summer	22.948	6.064	100 year 180 minute summer	64.672	16.642
30 year 480 minute winter	15.246	6.064	100 year 180 minute winter	42.039	16.642
30 year 600 minute summer	18.720	5.120	100 year 240 minute summer	50.757	13.414
30 year 600 minute winter	12.791	5.120	100 year 240 minute winter	33.722	13.414
30 year 720 minute summer	16.632	4.458	100 year 360 minute summer	38.116	9.808
30 year 720 minute winter	11.178	4.458	100 year 360 minute winter	24.776	9.808
30 year 960 minute summer	13.594	3.580	100 year 480 minute summer	29.744	7.860
30 year 960 minute winter	9.005	3.580	100 year 480 minute winter	19.761	7.860

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Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year 600 minute summer	24.183	6.615	100 year +40% CC 180 minute summer	90.541	23.299
100 year 600 minute winter	16.523	6.615	100 year +40% CC 180 minute winter	58.854	23.299
100 year 720 minute summer	21.425	5.742	100 year +40% CC 240 minute summer	71.059	18.779
100 year 720 minute winter	14.399	5.742	100 year +40% CC 240 minute winter	47.210	18.779
100 year 960 minute summer	17.429	4.589	100 year +40% CC 360 minute summer	53.362	13.732
100 year 960 minute winter	11.545	4.589	100 year +40% CC 360 minute winter	34.687	13.732
100 year 1440 minute summer	12.466	3.341	100 year +40% CC 480 minute summer	41.642	11.005
100 year 1440 minute winter	8.378	3.341	100 year +40% CC 480 minute winter	27.666	11.005
100 year 2160 minute summer	8.784	2.428	100 year +40% CC 600 minute summer	33.857	9.261
100 year 2160 minute winter	6.052	2.428	100 year +40% CC 600 minute winter	23.133	9.261
100 year 2880 minute summer	7.213	1.933	100 year +40% CC 720 minute summer	29.995	8.039
100 year 2880 minute winter	4.848	1.933	100 year +40% CC 720 minute winter	20.158	8.039
100 year 4320 minute summer	5.355	1.400	100 year +40% CC 960 minute summer	24.400	6.425
100 year 4320 minute winter	3.527	1.400	100 year +40% CC 960 minute winter	16.163	6.425
100 year 5760 minute summer	4.346	1.112	100 year +40% CC 1440 minute summer	17.452	4.677
100 year 5760 minute winter	2.813	1.112	100 year +40% CC 1440 minute winter	11.729	4.677
100 year 7200 minute summer	3.646	0.930	100 year +40% CC 2160 minute summer	12.297	3.399
100 year 7200 minute winter	2.353	0.930	100 year +40% CC 2160 minute winter	8.473	3.399
100 year 8640 minute summer	3.148	0.803	100 year +40% CC 2880 minute summer	10.098	2.706
100 year 8640 minute winter	2.032	0.803	100 year +40% CC 2880 minute winter	6.787	2.706
100 year 10080 minute summer	2.780	0.709	100 year +40% CC 4320 minute summer	7.497	1.960
100 year 10080 minute winter	1.794	0.709	100 year +40% CC 4320 minute winter	4.937	1.960
100 year +40% CC 15 minute summer	423.221	119.757	100 year +40% CC 5760 minute summer	6.084	1.557
100 year +40% CC 15 minute winter	296.997	119.757	100 year +40% CC 5760 minute winter	3.938	1.557
100 year +40% CC 30 minute summer	282.040	79.807	100 year +40% CC 7200 minute summer	5.104	1.302
100 year +40% CC 30 minute winter	197.922	79.807	100 year +40% CC 7200 minute winter	3.294	1.302
100 year +40% CC 60 minute summer	192.272	50.812	100 year +40% CC 8640 minute summer	4.408	1.124
100 year +40% CC 60 minute winter	127.741	50.812	100 year +40% CC 8640 minute winter	2.845	1.124
100 year +40% CC 120 minute summer	118.515	31.320	100 year +40% CC 10080 minute summer	3.892	0.993
100 year +40% CC 120 minute winter	78.738	31.320	100 year +40% CC 10080 minute winter	2.512	0.993

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Results for 2 year Critical Storm Duration. Lowest mass balance: 99.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S100	10	34.075	0.072	9.2	0.0115	0.0000	OK
15 minute winter	S101	11	33.882	0.072	9.1	0.0115	0.0000	OK
720 minute winter	Blue Roof 1	510	35.035	0.035	2.0	22.2457	0.0000	OK
720 minute winter	Blue Roof 1 Control	510	35.027	0.038	0.8	0.0000	0.0000	OK
15 minute winter	S102	11	33.704	0.070	9.1	0.0111	0.0000	OK
10080 minute winter	Blue Roof 2	6600	35.090	0.090	0.3	57.9880	0.0000	OK
10080 minute winter	Blue Roof 2 Control	6600	35.090	0.101	0.2	0.0000	0.0000	FLOOD RISK
15 minute winter	S103	11	33.507	0.112	16.1	0.0179	0.0000	OK
15 minute summer	S104	9	33.459	0.077	9.1	0.0123	0.0000	OK
360 minute winter	S105	272	33.223	0.116	4.9	24.4339	0.0000	OK
15 minute summer	Culvert 1	1	31.345	0.000	0.0	0.0000	0.0000	OK
360 minute winter	X Junction 2	272	31.342	0.028	2.0	0.0000	0.0000	OK
15 minute winter	S7	11	33.048	0.037	3.2	0.0661	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	S100	S100-S101	S101	9.1	0.831	0.214	0.3165	
15 minute winter	S101	S101-S102	S102	9.1	0.851	0.214	0.2826	
720 minute winter	Blue Roof 1	Blue Roof 1-Blue Roof 1 Control	Blue Roof 1 Control	0.8	0.300	0.254	0.0111	
720 minute winter	Blue Roof 1 Control	Orifice	S102	0.4				
720 minute winter	Blue Roof 1 Control	Orifice	S102	0.4				
15 minute winter	S102	S102-S103	S103	9.0	0.608	0.211	0.5414	
10080 minute winter	Blue Roof 2	Blue Roof 2-Blue Roof 2 Control	Blue Roof 2 Control	0.2	0.025	0.065	0.0334	
10080 minute winter	Blue Roof 2 Control	Weir	S103	0.1				
10080 minute winter	Blue Roof 2 Control	Weir	S103	0.1				
15 minute winter	S103	S103-S105	S105	16.3	1.510	0.385	0.4997	
15 minute summer	S104	S104-S105	S105	9.2	1.510	0.177	0.1860	
360 minute winter	S105	Hydro-Brake®	X Junction 2	2.0				
15 minute summer	Culvert 1	Culvert 1-X Junction 2	X Junction 2	0.0	0.000	0.000	0.0438	
360 minute winter	X Junction 2	X Junction 2-X Junction	X Junction	2.0	0.246	0.000	0.7990	
15 minute winter	S7	S7-X Junction	X Junction	3.1	0.716	0.060	0.1240	

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Results for 2 year Critical Storm Duration. Lowest mass balance: 99.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	X Junction	12	31.185	0.035	3.1	0.0000	0.0000	OK
15 minute winter	Culvert 2	15	31.165	0.039	2.9	0.2225	0.0000	OK
15 minute winter	Culvert 3	15	30.971	0.008	2.9	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	X Junction	X Junction-Culvert 2	Culvert 2	2.9	0.326	0.001	0.1552	
15 minute winter	Culvert 2	Culvert 2-Culvert 3	Culvert 3	2.9	0.468	0.001	0.6851	10.2

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S100	10	34.106	0.103	17.5	0.0164	0.0000	OK
15 minute winter	S101	11	33.913	0.103	17.3	0.0163	0.0000	OK
480 minute winter	Blue Roof 1	360	35.060	0.060	4.8	38.4625	0.0000	OK
480 minute winter	Blue Roof 1 Control	360	35.058	0.069	1.2	0.0000	0.0000	OK
15 minute winter	S102	11	33.733	0.099	17.3	0.0158	0.0000	OK
2160 minute winter	Blue Roof 2	1440	35.093	0.093	1.5	59.5820	0.0000	OK
2160 minute winter	Blue Roof 2 Control	1440	35.092	0.103	0.7	0.0000	0.0000	FLOOD RISK
15 minute winter	S103	11	33.556	0.161	30.8	0.0255	0.0000	OK
15 minute summer	S104	9	33.485	0.103	17.2	0.0164	0.0000	OK
720 minute winter	S105	735	33.384	0.277	5.9	58.4414	0.0000	SURCHARGED
360 minute summer	Culvert 1	224	31.346	0.001	0.0	0.0086	0.0000	OK
240 minute summer	X Junction 2	288	31.346	0.032	2.6	0.0000	0.0000	OK
15 minute winter	S7	10	33.062	0.051	6.0	0.0909	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	S100	S100-S101	S101	17.3	0.975	0.408	0.5130	
15 minute winter	S101	S101-S102	S102	17.2	1.003	0.406	0.4548	
480 minute winter	Blue Roof 1	Blue Roof 1-Blue Roof 1 Control	Blue Roof 1 Control	1.2	0.302	0.407	0.0231	
480 minute winter	Blue Roof 1 Control	Orifice	S102	0.6				
480 minute winter	Blue Roof 1 Control	Orifice	S102	0.6				
15 minute winter	S102	S102-S103	S103	17.3	0.741	0.407	0.8432	
2160 minute winter	Blue Roof 2	Blue Roof 2-Blue Roof 2 Control	Blue Roof 2 Control	0.7	0.093	0.243	0.0337	
2160 minute winter	Blue Roof 2 Control	Weir	S103	0.4				
2160 minute winter	Blue Roof 2 Control	Weir	S103	0.4				
15 minute winter	S103	S103-S105	S105	31.4	1.660	0.741	0.8583	
15 minute summer	S104	S104-S105	S105	17.3	1.705	0.333	0.3208	
720 minute winter	S105	Hydro-Brake®	X Junction 2	2.6				
360 minute summer	Culvert 1	Culvert 1-X Junction 2	X Junction 2	0.0	-0.004	0.000	0.0924	
240 minute summer	X Junction 2	X Junction 2-X Junction	X Junction	2.6	0.274	0.001	1.0165	
15 minute winter	S7	S7-X Junction	X Junction	5.8	0.863	0.114	0.1947	

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	X Junction	12	31.196	0.046	6.0	0.0000	0.0000	OK
15 minute winter	Culvert 2	14	31.174	0.048	5.5	0.2748	0.0000	OK
15 minute winter	Culvert 3	14	30.977	0.014	4.8	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	X Junction	X Junction-Culvert 2	Culvert 2	5.5	0.391	0.001	0.2356	
15 minute winter	Culvert 2	Culvert 2-Culvert 3	Culvert 3	4.8	0.541	0.001	1.0019	22.6

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Results for 100 year Critical Storm Duration. Lowest mass balance: 99.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S100	10	34.124	0.121	22.6	0.0192	0.0000	OK
15 minute winter	S101	11	33.930	0.120	22.3	0.0190	0.0000	OK
480 minute winter	Blue Roof 1	368	35.079	0.079	6.2	50.3392	0.0000	OK
480 minute winter	Blue Roof 1 Control	368	35.077	0.088	1.4	0.0000	0.0000	OK
15 minute winter	S102	11	33.749	0.115	22.4	0.0183	0.0000	OK
1440 minute winter	Blue Roof 2	930	35.098	0.098	2.6	62.6282	0.0000	OK
1440 minute winter	Blue Roof 2 Control	930	35.095	0.106	1.6	0.0000	0.0000	FLOOD RISK
960 minute winter	S103	945	33.591	0.196	4.4	0.0312	0.0000	OK
960 minute winter	S104	945	33.590	0.208	1.6	0.0331	0.0000	OK
960 minute winter	S105	945	33.590	0.483	6.2	101.8994	0.0000	SURCHARGED
60 minute summer	Culvert 1	150	31.346	0.001	0.0	0.0076	0.0000	OK
60 minute summer	X Junction 2	152	31.346	0.032	2.6	0.0000	0.0000	OK
15 minute winter	S7	10	33.070	0.059	7.8	0.1039	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	S100	S100-S101	S101	22.3	1.033	0.526	0.6243	
15 minute winter	S101	S101-S102	S102	22.1	1.065	0.522	0.5517	
480 minute winter	Blue Roof 1	Blue Roof 1-Blue Roof 1 Control	Blue Roof 1 Control	1.4	0.300	0.477	0.0302	
480 minute winter	Blue Roof 1 Control	Orifice	S102	0.7				
480 minute winter	Blue Roof 1 Control	Orifice	S102	0.7				
15 minute winter	S102	S102-S103	S103	22.4	0.784	0.527	1.0147	
1440 minute winter	Blue Roof 2	Blue Roof 2-Blue Roof 2 Control	Blue Roof 2 Control	1.6	0.202	0.530	0.0342	
1440 minute winter	Blue Roof 2 Control	Weir	S103	0.8				
1440 minute winter	Blue Roof 2 Control	Weir	S103	0.8				
960 minute winter	S103	S103-S105	S105	4.4	0.578	0.105	1.6525	
960 minute winter	S104	S104-S105	S105	1.6	0.543	0.031	1.0731	
960 minute winter	S105	Hydro-Brake®	X Junction 2	2.6				
60 minute summer	Culvert 1	Culvert 1-X Junction 2	X Junction 2	0.0	-0.011	0.000	0.0924	
60 minute summer	X Junction 2	X Junction 2-X Junction	X Junction	2.6	0.274	0.001	1.2254	
15 minute winter	S7	S7-X Junction	X Junction	7.5	0.928	0.147	0.2347	

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Results for 100 year Critical Storm Duration. Lowest mass balance: 99.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	X Junction	12	31.202	0.052	7.8	0.0000	0.0000	OK
15 minute winter	Culvert 2	14	31.179	0.053	7.2	0.3073	0.0000	OK
15 minute winter	Culvert 3	14	30.982	0.019	6.4	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	X Junction	X Junction-Culvert 2	Culvert 2	7.2	0.431	0.001	0.2830	
15 minute winter	Culvert 2	Culvert 2-Culvert 3	Culvert 3	6.4	0.574	0.001	1.2311	29.8

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Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	S100	1320	34.280	0.277	1.6	0.0440	0.0000	SURCHARGED
1440 minute winter	S101	1320	34.280	0.470	1.6	0.0747	0.0000	SURCHARGED
480 minute winter	Blue Roof 1	304	35.150	0.150	8.7	64.4456	6.4991	FLOOD
480 minute winter	Blue Roof 1 Control	304	35.145	0.156	2.0	0.0000	0.0000	FLOOD RISK
1440 minute winter	S102	1320	34.280	0.646	3.0	0.1026	0.0000	SURCHARGED
240 minute winter	Blue Roof 2	156	35.150	0.150	14.8	64.4456	1.3851	FLOOD
180 minute winter	Blue Roof 2 Control	128	35.103	0.114	6.0	0.0000	0.0000	FLOOD RISK
1440 minute winter	S103	1320	34.279	0.884	7.8	0.1406	0.0000	SURCHARGED
1440 minute winter	S104	1320	34.278	0.896	1.6	0.1424	0.0000	SURCHARGED
1440 minute winter	S105	1320	34.278	1.171	9.5	169.3734	0.0000	SURCHARGED
1440 minute winter	Culvert 1	1320	31.349	0.004	0.0	0.0215	0.0000	OK
1440 minute winter	X Junction 2	1320	31.349	0.035	3.0	0.0000	0.0000	OK
15 minute winter	S7	10	33.081	0.070	10.9	0.1241	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)
1440 minute winter	S100	S100-S101	S101	1.6	0.514	0.038	1.1518	
1440 minute winter	S101	S101-S102	S102	1.6	0.413	0.038	1.0496	
480 minute winter	Blue Roof 1	Blue Roof 1-Blue Roof 1 Control	Blue Roof 1 Control	2.0	0.301	0.672	0.0341	
480 minute winter	Blue Roof 1 Control	Orifice	S102	1.0				
480 minute winter	Blue Roof 1 Control	Orifice	S102	1.0				
1440 minute winter	S102	S102-S103	S103	3.0	0.525	0.070	1.4231	
240 minute winter	Blue Roof 2	Blue Roof 2-Blue Roof 2 Control	Blue Roof 2 Control	6.0	0.770	2.023	0.0343	
180 minute winter	Blue Roof 2 Control	Weir	S103	3.0				
180 minute winter	Blue Roof 2 Control	Weir	S103	3.0				
1440 minute winter	S103	S103-S105	S105	7.4	0.518	0.175	1.7182	
1440 minute winter	S104	S104-S105	S105	1.6	0.523	0.031	1.0915	
1440 minute winter	S105	Hydro-Brake®	X Junction 2	3.0				
1440 minute winter	Culvert 1	Culvert 1-X Junction 2	X Junction 2	0.0	0.001	0.000	0.1065	
1440 minute winter	X Junction 2	X Junction 2-X Junction	X Junction	3.0	0.284	0.001	1.0466	
15 minute winter	S7	S7-X Junction	X Junction	10.6	1.021	0.207	0.3004	

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Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.18%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	X Junction	12	31.211	0.061	11.1	0.0000	0.0000	OK
15 minute winter	Culvert 2	14	31.188	0.062	10.3	0.3545	0.0000	OK
15 minute winter	Culvert 3	14	30.990	0.027	9.2	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 winter	X Junction	X Junction-Culvert 2	Culvert 2	10.3	0.446	0.002	0.3597	
15 minute winter	Culvert 2	Culvert 2-Culvert 3	Culvert 3	9.2	0.602	0.002	1.6250	39.0

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5.0 New Drainage Proposals

5.1 Foul and surface water drainage within the site will be kept separate.

5.2 Foul water will discharge into the existing Adopted combined sewer manhole near Greenheys Lane, located within the adjacent BASE Building site to the South. Approval from UU is to be sought.

5.3 The discharge point for the surface water is to be to the culverted Corn Brook, in Greenheys Lane near its junction with Bronte Street. Approval from Manchester City Council is to be sought.

5.4 The surface water discharge from site must be limited to prevent overloading the existing culvert. Subject to agreement with MCC this would be restricted to 'Green field Runoff'.

5.5 The proposed 'hard' drained area is approx. 4,610m^2, reduced from the existing drained area of 6,050m^2.

5.6 A 'blue' roof is to be provided over most of the main building. This will store rainwater during storm events with restricted discharge to limit the flow into the underground surface water drainage system.

5.7 In addition to the blue roof, surface water will also be attenuated in underground tanks located in the service yard / access area.

5.8 Surface water discharge from site is to be agreed with MCC to a 'Green field' run-off, calculated at approximately 3.3 litres / second.

5.9 The attenuation will be calculated based upon a 1 in 100-year storm event plus 40% increase to allow for Climate Change. Preliminary drainage and storage calculations are contained in Appendix B.

5.10 Based upon the current site proposals incorporating the blue roof system, the below ground attenuation to be provided will be approximately 180m^3 for a discharge rate of 3.3 l/s to the culvert. The attenuation will comprise a 'crate' system under the access road area. The 'top water' level in the attenuation tanks will be kept below the lowest proposed level on site and on the adjacent Greenheys Lane.