

Our Ref: J6776110521B

11th May 2021 (Rev B: 13/05/'21)

United Utilities & Manchester City Council LLFA Dept.
By Email Only

F. A. O. Mr R. Brenton & Mr O. Timmins,

Dear Robert & Oliver

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Re: Manchester College, Openshaw Campus, Drainage Scheme

Further to our previous submissions, further investigations on the existing drainage have been undertaken to prove that the site drains into the combined drain running East to West along the Southern section of the site. Drawing J6776 D01 (Appendix A) outlines the full College site area including existing soft and hard landscaped areas. Drawing J6776 D02 Rev A (Appendix B) outlines the proposed development areas including existing hard and soft landscaped areas. Drawing J6776 D03 (Appendix C) outlines the extent of further survey works undertaken and should be read alongside the survey information from Lanes for Drains previously issued.

Further to the above, it is confirmed that in all areas surveyed, all wastewater (both foul and surface) do indeed drain into the UU combined sewer as previously advised.

Based on this evidence, it is proposed to connect the new Phase 1 works (construction of 2 new teaching units and associated external works) to the combined UU sewer at a rate of brownfield run off calculated for the 1 in 2 year 15 minute storm event for the 1 in 2 year, 1 in 30 year and 1 in 100 year + 40% for climate change storms. Phase 2 and 3 works (the new sports pitch and car park to the North) will be put into the same phase (named phase 2 in this report) for this analysis, and it is proposed to connect into the partially blocked watercourse within Clayton Lane South. Obviously, we will request the Local Authority to clear the blockages at the appropriate time.

For phase 1 works, the total works area is 6,485.7m² (0.649 hectares), of which 602.2m² (0.060 hectares) is soft landscaping and the remaining 5,883.5m² (0.588 hectares) is hardstanding and building areas (see J6776 D03). This area of the site has been proven to connect to the existing combined sewer. The existing offsite flows conservatively account for the positively drained hardstanding areas only and do not account for any run-off from soft landscaping that may be picked up within the existing drainage system. This approach will lead to a very slight reduction in the allowable offsite flow and is therefore considered conservative.

For phase 2 works, the combined total works area is 10,332.13m² (1.033 hectares), of which 1,656.99m² (0.166 hectares) is soft landscaping and the rest is hardstanding and building areas (see J6776 D03). Again, this site area has been proven to connect to the existing combined sewer. The existing offsite flows will again conservatively account for the positively drained hardstanding areas only and do not account for any run-off from soft landscaping that may be picked up within the existing drainage system.

Table 1 shows the existing site area breakdown;

	Hard Landscaping Area (m ²)	Soft Landscaping Area (m ²)	Total Area (m ²)
Phase 1	5,884	602	6,486
Phase 2	8,675	1,657	10,332

Table 1: Existing Site Area

The existing flows based on the areas shown in table 1 have been calculated by using MicroDrainage software, (calculations available in Appendix D) and are shown in Table 2 below;

	Existing Flows For Each Storm Event (L/s) [Storm duration of 15 mins]		
	1 in 2 Year	1 in 30 Year	1 in 100 Year + 40 %
Phase 1	90.8	170.8	309.2
Phase 2	134.2	251.9	455.7
Total	225.0	422.7	1571.5

Table 2: Existing Offsite Flow in Each Storm Event

Based on the allowable offsite flows being 50% of the 1 in 2 year 15 minute storm values given in Table 2 for Phase 1 works, and limited to greenfield run off for the phase 2 works (see Appendix E for calcs), the proposed offsite flows are shown in Table 3 below;

	Proposed Flows For Each Storm Event (L/s) [Storm duration of 15 mins]		
	1 in 1 Year	1 in 30 Year	1 in 100 Year + 40 %
Phase 1	45.4	45.4	45.4
Phase 2	5.1	9.8	12.1 (excl. 40%)
Total	50.5	55.2	57.5

Table 3: Proposed Flows for Each Storm Event

Note the 1 in 1 year storm event has been chosen for the design aspect of the system instead of the 1 in 2 year event for conservatism. If the 1 in 2 year storm event was used instead, the system could surcharge in the 1 in 1 year event. By allowing for the 1 in 1 year storm, the design will ensure they system does not surcharge in the 1 in 1 year event before the Hydrobrake elements.

Following the development, the hard and soft landscaping areas are shown in Table 3 below;

	Hard Landscaping Area (m ²)	Soft Landscaping Area (m ²)	Total Area (m ²)
Phase 1	6,237	249	6,486
Phase 2	1,883	8,449	10,332

Table 4: Proposed Site Areas

Calculations for the phase 1 works design elements are shown in Appendix F and an updated drawing can be found in Appendix G to reflect these changes. The actual offsite flows from the Microdrainage calculations are shown in Table 5;

	Actual Flows For Each Storm Event (L/s) [Storm duration of 15 mins]		
	1 in 1 Year	1 in 30 Year	1 in 100 Year + 40 %
Phase 1	25.4	44.1	45.4

Table 5: Actual Offsite Surface Water Flows for Phase 1

Based on the surface water offsite flows, a significant reduction in discharge to the public sewer is achieved. Direct comparisons between the 1 in 30 year and 1 in 100 year + 40% allowance for climate change storm show reductions in offsite flows of 75% and 85% respectively.

The drainage has been designed for no surcharging in the 1 in 1 year storm event, no flooding in the 1 in 30 year storm event, and flooding contained on site during the 1 in 100 year + 40% storm event. It should be noted that approximately 8m³ flooding occurs in the 1 in 100 year + climate change event. This volume can safely be stored on site without affecting any buildings. It equates to less than 1mm of site coverage once the football pitch is constructed, and around 8mm if the event occurs prior to construction of the pitch.

Note, as the phase 2 works is limited to that of Greenfield Run-off, the allowable offsite flow for the pitch area and car park is a direct proportion to the total allowable off site discharge rate for them both together i.e. total phase 2 works allowable offsite flow in the 1 in 1 year storm event = 5.1 L/s, therefore the flow allocated to the football pitch = 4.0 L/s, and the flow allocated to the new car park is = 1.1 L/s. The actual design for the next phase drainage works will be undertaken once Consultant appointments are in place. Note, the College have not yet appointed Consultants to undertake any further phase works and so detailed designs for the next elements of works are not available. There will be a note to the effect of the total allowed offsite flow for both phases which should be designed to for the next phase. It should be noted that as part of the phase 2 works, Land Drainage Consent applications to Manchester City Council will be required.

Drainage details can be found in Appendix H. A flood routing plan can be found in Appendix I and a maintenance and management plan for the new drainage can be found in Appendix J.

If you have any queries on the above at this stage, please do not hesitate to contact.

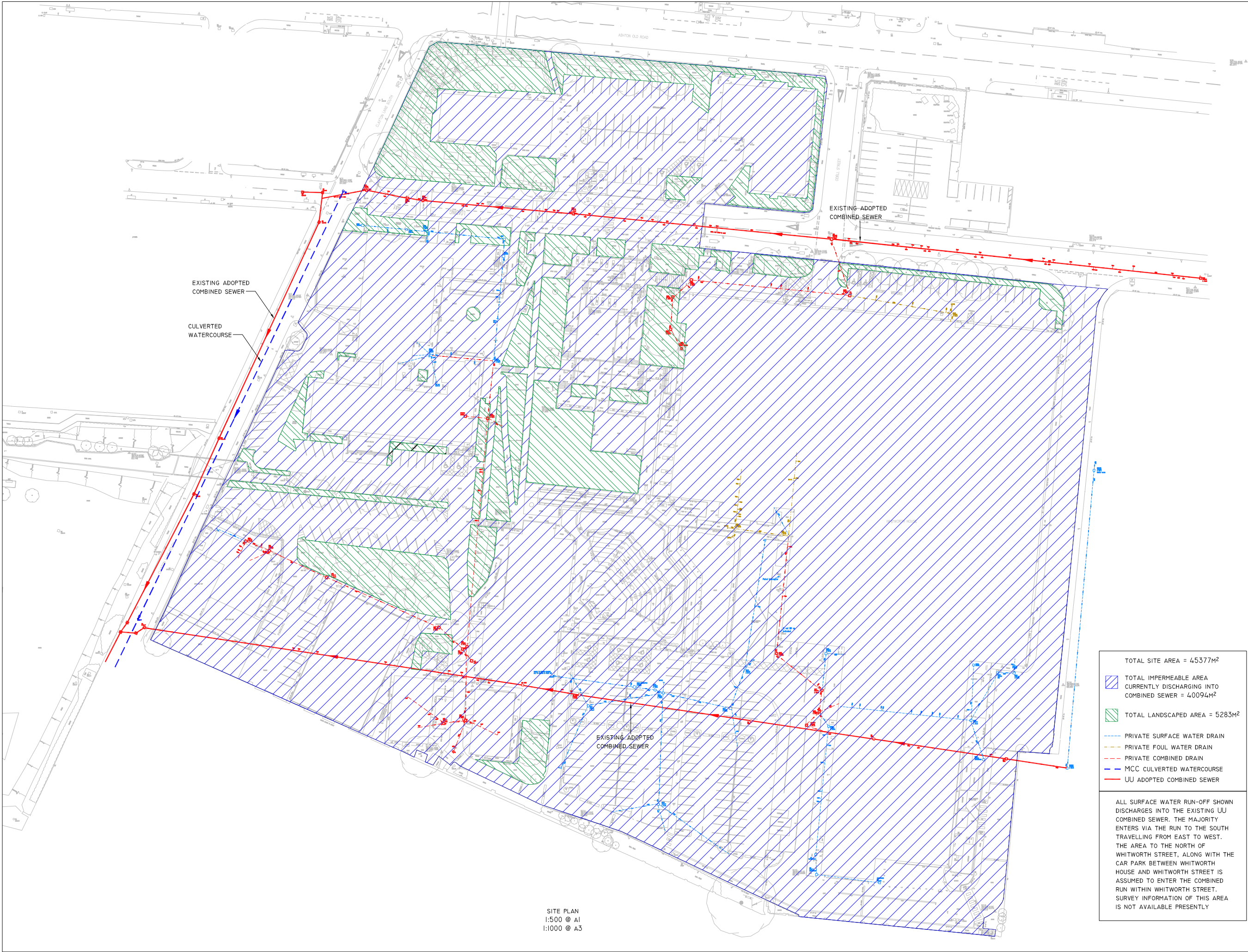
Kind Regards

Yours Sincerely



Alan Morris
For and on behalf of Bell Munro Consulting Limited

APPENDIX A



- NOTES:
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TOTAL SITE AREA = 45377M²

TOTAL IMPERMEABLE AREA CURRENTLY DISCHARGING INTO COMBINED SEWER = 40094M²

TOTAL LANDSCAPED AREA = 5283M²

PRIVATE SURFACE WATER DRAIN

PRIVATE FOUL WATER DRAIN

PRIVATE COMBINED DRAIN

MCC CULVERTED WATERCOURSE

UU ADOPTED COMBINED SEWER

ALL SURFACE WATER RUN-OFF SHOWN DISCHARGES INTO THE EXISTING UU COMBINED SEWER. THE MAJORITY ENTERS VIA THE RUN TO THE SOUTH TRAVELLING FROM EAST TO WEST. THE AREA TO THE NORTH OF WHITWORTH STREET, ALONG WITH THE CAR PARK BETWEEN WHITWORTH HOUSE AND WHITWORTH STREET IS ASSUMED TO ENTER THE COMBINED RUN WITHIN WHITWORTH STREET. SURVEY INFORMATION OF THIS AREA IS NOT AVAILABLE PRESENTLY

SITE PLAN
1:500 @ A1
1:1000 @ A3

INITIAL ISSUE		03.03.21		BMC	
CORRECTIONS		03.12		BT	
BMC					
BELL MUNRO CONSULTING LTD					
CONSULTING CIVIL & STRUCTURAL ENGINEERS TURING HOUSE 3 ARCHWAY MANCHESTER M15 5RL TEL: 0161 2096032 FAX: 0161 2096033 EMAIL: CONSULTING@BELLMUNRO.CO.UK WWW.BELLMUNRO.CO.UK					
CLIENT: CADDICK CONSTRUCTION					
PROJECT: OPENSHAW CAMPUS					
TITLE: EXISTING IMPERMEABLE AREA PLAN					
DRAWN BY: SMB	CHECKED BY: AM	SCALE: 1:500	DATE: 03/21	REVISION:	
DRAWING NUMBER: J6776/D01				REVISION: -	

APPENDIX B

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SITE PLAN
1:500 @ A1
1:1000 @ A3

NO.	REVISION TO EXISTING SOFT LANDSCAPING		17/01/21	AM
	INITIALS	DATE	18/03/21	PM
01	CONTRACTOR	17/01/21	17/01/21	PM

BMC

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CADDICK CONSTRUCTION

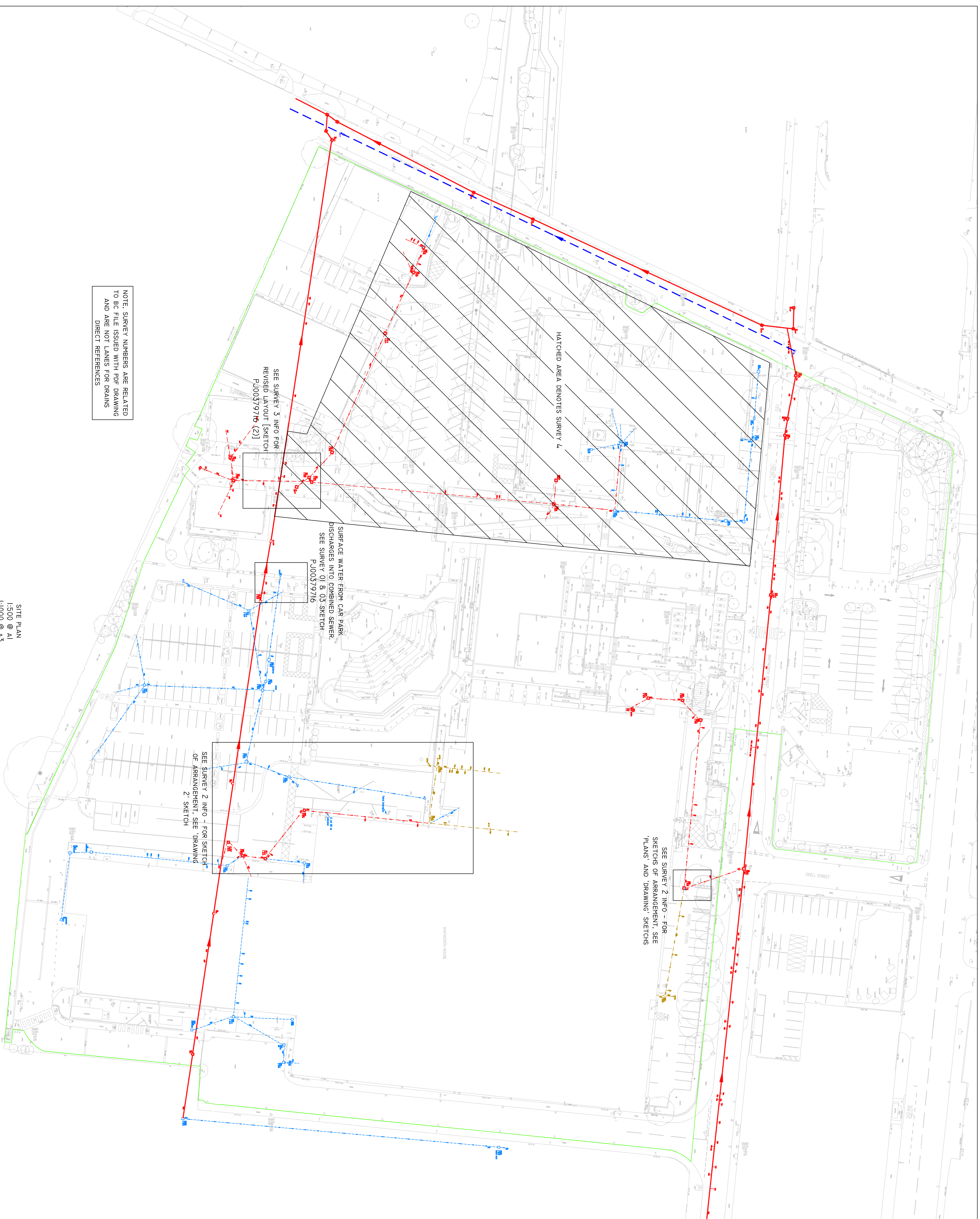
OPENSHAW CAMPUS

PROPOSED IMPERMEABLE AREA PLAN

DATE: 03/21

REVISION: A

APPENDIX C



SITE PLAN
1:500 @ A1
1:1000 @ A3

SEE SURVEY 2 INFO - FOR
SKETCHS OF ARRANGEMENT, SEE
'PLANS' AND 'DRAWING' SKETCHES

✓ SURFACE WATER FROM CAR PARK
DISCHARGES INTO COMBINED SEWER
SEE SURVEY 01 & 03 SKETCH
PJ003579716

SEE SURVEY 3 INFO FOR
REVISED LAYOUT [SKETCH
PJ00379716- (2)]

SEE SURVEY 2 INFO - FOR SKETCH
OF ARRANGEMENT, SEE 'DRAWING
2' SKETCH

HATCHED AREA DENOTES SURVEY 4

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--	INITIAL ISSUE	06.05.21	-
RMV	COMMENTS	DATE	

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CLIENT:
CADDICK CONSTRUCTION

PROJECT: OPENSHAW CAMPUS

mmL DRAINAGE SURVEY PLAN
--

TRAINING SITE	CHECKED BY	SCALE	DATE
AM	CM	1:500	05/2
TRAINING NUMBER			REVISION

DRAWING NUMBER: J6776/D03

FIGURE 1

APPENDIX D

Bell Munro Consulting Ltd		Page 1
Turing House 5 Archway Manchester M15 5RL	Phase 1 Brownfield Run Off M'Cr College Openshaw Campus	
Date 07/05/2021 File	Designed by A Morris Checked by C Munro	
XP Solutions	Network 2018.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.359	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.467	4-8	0.121

Total Area Contributing (ha) = 0.588

Total Pipe Volume (m³) = 5.089

Network Design Table 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	Auto Design
1.000	4.000	0.100	40.0	0.588	5.00	0.0	0.600	o	900	Pipe/Conduit	
1.001	4.000	0.100	40.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	46.69	5.01	0.500	0.588	0.0	0.0	0.0	4.96	3156.8	74.3
1.001	46.63	5.03	0.400	0.588	0.0	0.0	0.0	4.96	3156.8	74.3

Bell Munro Consulting Ltd			Page 2
Turing House 5 Archway Manchester M15 5RL		Phase 1 Brownfield Run Off M'Cr College Openshaw Campus	
Date 07/05/2021 File		Designed by A Morris Checked by C Munro	
XP Solutions		Network 2018.1	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
1	3.000	2.500	Open Manhole	1800	1.000	0.500	900				
2	3.000	2.600	Open Manhole	1800	1.001	0.400	900	1.000	0.400	900	
	3.000	2.700	Open Manhole	900		OUTFALL		1.001	0.300	900	

Bell Munro Consulting Ltd		Page 3
Turing House 5 Archway Manchester M15 5RL	Phase 1 Brownfield Run Off M'Cr College Openshaw Campus	
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XP Solutions	Network 2018.1	

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	900	1	3.000	0.500	1.600	Open Manhole	1800
1.001	o	900	2	3.000	0.400	1.700	Open Manhole	1800

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	4.000	40.0	2	3.000	0.400	1.700	Open Manhole	1800
1.001	4.000	40.0		3.000	0.300	1.800	Open Manhole	900

Bell Munro Consulting Ltd		Page 4
Turing House 5 Archway Manchester M15 5RL	Phase 1 Brownfield Run Off M'Cr College Openshaw Campus	
Date 07/05/2021 File	Designed by A Morris Checked by C Munro	
XP Solutions	Network 2018.1	

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.588	0.588	0.588
1.001	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.588	0.588	0.588

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)
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1.001		3.000	0.300	0.300	900	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.359		

Bell Munro Consulting Ltd		Page 7
Turing House 5 Archway Manchester M15 5RL	Phase 1 Brownfield Run Off M'Cr College Openshaw Campus	
Date 07/05/2021 File	Designed by A Morris Checked by C Munro	
XP Solutions	Network 2018.1	

100 year Return Period Summary of Critical Results by Maximum Outflow (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 0
 Number of Online Controls 0 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 0.359
 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
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status OFF
 Inertia Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 15
 Return Period(s) (years) 2, 30, 100
 Climate Change (%) 0, 0, 40

	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Water
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	Level
1.000	1	15 Winter	100	+40%					0.856
1.001	2	15 Winter	100	+40%					0.756

	US/MH	Depth	Volume	Flow /	Overflow	Pipe	Level
PN	Name	(m)	(m ³)	Cap.	(l/s)	Flow (l/s)	Status Exceeded
1.000	1	-0.544	0.000	0.33		312.6	OK
1.001	2	-0.544	0.000	0.32		309.2	OK

Bell Munro Consulting Ltd		Page 1
Turing House 5 Archway Manchester M15 5RL	Phase 2 Brownfield Run Off M'Cr College Openshaw Campus	
Date 07/05/2021 File	Designed by A Morris Checked by C Munro	
XP Solutions	Network 2018.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.359	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.689	4-8	0.178

Total Area Contributing (ha) = 0.867

Total Pipe Volume (m³) = 5.089

Network Design Table 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	Auto Design
1.000	4.000	0.100	40.0	0.867	5.00	0.0	0.600	o	900	Pipe/Conduit	
1.001	4.000	0.100	40.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	46.69	5.01	0.500	0.867	0.0	0.0	0.0	4.96	3156.8	109.6
1.001	46.63	5.03	0.400	0.867	0.0	0.0	0.0	4.96	3156.8	109.6

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Turing House 5 Archway Manchester M15 5RL		Phase 2 Brownfield Run Off M'Cr College Openshaw Campus	
Date 07/05/2021 File		Designed by A Morris Checked by C Munro	
XP Solutions		Network 2018.1	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
1	3.000	2.500	Open Manhole	1800	1.000	0.500	900				
2	3.000	2.600	Open Manhole	1800	1.001	0.400	900	1.000	0.400	900	
	3.000	2.700	Open Manhole	900		OUTFALL		1.001	0.300	900	

Bell Munro Consulting Ltd		Page 3
Turing House 5 Archway Manchester M15 5RL	Phase 2 Brownfield Run Off M'Cr College Openshaw Campus	
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XP Solutions	Network 2018.1	

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	900	1	3.000	0.500	1.600	Open Manhole	1800
1.001	o	900	2	3.000	0.400	1.700	Open Manhole	1800

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	4.000	40.0	2	3.000	0.400	1.700	Open Manhole	1800
1.001	4.000	40.0		3.000	0.300	1.800	Open Manhole	900

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Turing House 5 Archway Manchester M15 5RL	Phase 2 Brownfield Run Off M'Cr College Openshaw Campus	
Date 07/05/2021 File	Designed by A Morris Checked by C Munro	
XP Solutions	Network 2018.1	

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.867	0.867	0.867
1.001	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.867	0.867	0.867

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)
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1.001		3.000	0.300	0.300	900	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.359		

Bell Munro Consulting Ltd		Page 7
Turing House 5 Archway Manchester M15 5RL	Phase 2 Brownfield Run Off M'Cr College Openshaw Campus	
Date 07/05/2021 File	Designed by A Morris Checked by C Munro	
XP Solutions	Network 2018.1	

100 year Return Period Summary of Critical Results by Maximum Outflow (Rank
1) for Storm

Simulation Criteria

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

Synthetic Rainfall Details

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water
	Name								Level (m)
1.000	1 15	Winter	100	+40%					0.944
1.001	2 15	Winter	100	+40%					0.844

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Level Exceeded
		Depth (m)	Volume (m³)			Flow (l/s)	
1.000	1	-0.456	0.000	0.48		460.5	OK
1.001	2	-0.456	0.000	0.48		455.7	OK

APPENDIX E

Bell Munro Consulting Ltd		Page 1
Turing House 5 Archway Manchester M15 5RL	Phase 2 Proposed Flows Manchester College Openshaw Campus	
Date 07/05/2021 File	Designed by A Morris Checked by C Munro	
XP Solutions	Source Control 2018.1	
ICP SUDS Mean Annual Flood Input Return Period (years) 1 Soil 0.450 Area (ha) 1.033 Urban 0.000 SAAR (mm) 864 Region Number Region 10 Results l/s QBAR Rural 5.8 QBAR Urban 5.8 Q1 year 5.1 Q1 year 5.1 Q30 years 9.8 Q100 years 12.1		
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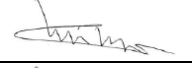
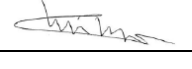
APPENDIX F



BELL MUNRO CONSULTING LTD.

**Manchester College
Openshaw Campus
Phase 1 Hydraulic Calcs
Rev B**

**Structural Calculations
May 2021**

	Initials	Signature	Date
Prepared by:	A.M		May 2021
Checked by:	CM		May 2021
Approved by:	CM		May 2021

Bell Munro Consulting Ltd.
Consulting Civil and Structural Engineers
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Ref: J6776

Bell Munro Consulting Ltd		Page 1
Turing House 5 Archway Manchester M15 5RL	Whole Site Model M'Cr Academy Openshaw College	
Date 11/05/2021 File Trial Model.MDX	Designed by A Morris Checked by C Munro	
XP Solutions	Network 2018.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	30	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.360	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.406	4-8	0.217

Total Area Contributing (ha) = 0.623

Total Pipe Volume (m³) = 24.318

Network Design Table for Storm

« - Indicates pipe capacity < flow

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	Auto Design
1.000	28.785	0.288	99.9	0.080	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	10.670	0.107	99.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	20.282	0.203	99.9	0.022	5.00	0.0	0.600	o	100	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	I.Area (ha)	Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.31	58.083	0.080	0.0	0.0	0.0	1.57	111.2	10.8
1.001	50.00	5.42	57.795	0.080	0.0	0.0	0.0	1.57	111.3	10.8
2.000	50.00	5.44	57.890	0.022	0.0	0.0	0.0	0.77	6.0	3.0

Bell Munro Consulting Ltd		Page 3
Turing House 5 Archway Manchester M15 5RL	Whole Site Model M'Cr Academy Openshaw College	
Date 11/05/2021 File Trial Model.MDX	Designed by A Morris Checked by C Munro	
XP Solutions	Network 2018.1	

Network Design Table 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	Auto Design
7.000	28.174	0.188	149.9	0.024	5.00	0.0	0.600	o	150	Pipe/Conduit	
6.002	16.343	0.073	223.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
8.000	27.221	0.181	150.0	0.090	5.00	0.0	0.600	o	225	Pipe/Conduit	
8.001	10.535	0.133	79.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.009	14.517	0.060	242.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.010	4.297	0.017	252.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
7.000	50.00	5.57	53.278	0.024	0.0	0.0	0.0	0.82	14.5	3.2
6.002	50.00	6.44	53.090	0.112	0.0	0.0	0.0	1.05	74.0	15.2
8.000	50.00	5.43	53.331	0.090	0.0	0.0	0.0	1.07	42.4	12.2
8.001	50.00	5.55	53.150	0.090	0.0	0.0	0.0	1.47	58.5	12.2
1.009	50.00	6.68	53.017	0.623	0.0	0.0	0.0	1.01	71.1«	84.4
1.010	50.00	6.75	52.960	0.623	0.0	0.0	0.0	0.98	69.6«	84.4

Bell Munro Consulting Ltd								Page 4		
Turing House 5 Archway Manchester M15 5RL				Whole Site Model M'Cr Academy Openshaw College						
Date 11/05/2021 File Trial Model.MDX				Designed by A Morris Checked by C Munro						
XP Solutions				Network 2018.1						
<u>Manhole Schedules for Storm</u>										
MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)
RE01	58.795	0.712	Open Manhole	300	1.000	58.083	300			
SW01	58.795	1.000	Open Manhole	600	1.001	57.795	300	1.000	57.795	300
RE02	58.807	0.917	Open Manhole	100	2.000	57.890	100			
SW02	58.828	1.141	Open Manhole	600	1.002	57.688	300	1.001	57.688	300
								2.000	57.687	100
HEAD OF RUN SVP	58.835	1.098	Open Manhole	150	3.000	57.737	150			
SW03	58.746	1.225	Open Manhole	600	3.001	57.521	225	3.000	57.521	150
SW04	58.771	1.454	Open Manhole	900	1.003	57.317	300	1.002	57.318	300
								3.001	57.318	225
SW05	58.711	1.471	Open Manhole	900	1.004	57.240	300	1.003	57.240	300
SW06	58.667	1.481	Open Manhole	900	1.005	57.186	300	1.004	57.186	300
SW07	58.843	4.843	Open Manhole	1200	1.006	54.000	300	1.005	55.862	300
RE03	58.817	0.450	Open Manhole	225	4.000	58.367	225			
DUMMY01	58.210	0.362	Sealed Manhole	225	4.001	57.848	150	4.000	57.849	225
SW08	57.924	3.821	Open Manhole	900	4.002	54.103	150	4.001	57.628	150
DUMMY02	58.800	5.193	Sealed Manhole	300	1.007	53.607	300	1.006	53.609	300
								4.002	53.654	150
RE04	54.900	1.439	Sealed Manhole	300	5.000	53.461	300			
SW09	54.909	1.694	Open Manhole	1200	1.008	53.215	300	1.007	53.216	300
								5.000	53.215	300
SW10	55.033	1.635	Open Manhole	900	6.000	53.398	300			
SW11	55.033	1.790	Open Manhole	1050	6.001	53.262	300	6.000	53.243	300
SW16	54.950	1.672	Open Manhole	900	7.000	53.278	150			
SW12	54.930	1.840	Open Manhole	1050	6.002	53.090	300	6.001	53.090	300
								7.000	53.090	150
SW14	55.860	2.529	Open Manhole	900	8.000	53.331	225			
SW15	55.000	1.850	Open Manhole	900	8.001	53.150	225	8.000	53.150	225
DUMMY03	54.950	1.933	Sealed Manhole	300	1.009	53.017	300	1.008	53.017	300
								6.002	53.017	300
								8.001	53.017	225
SW13	54.900	1.943	Open Manhole	1500	1.010	52.960	300	1.009	52.957	300
COMB01	54.900	1.957	Open Manhole	300		OUTFALL		1.010	52.943	300
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Turing House 5 Archway Manchester M15 5RL	Whole Site Model M'Cr Academy Openshaw College	
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XP Solutions	Network 2018.1	

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	300	RE01	58.795	58.083	0.412	Open Manhole	300
1.001	o	300	SW01	58.795	57.795	0.700	Open Manhole	600
2.000	o	100	RE02	58.807	57.890	0.817	Open Manhole	100
1.002	o	300	SW02	58.828	57.688	0.840	Open Manhole	600
3.000	o	150	HEAD OF RUN SVP	58.835	57.737	0.948	Open Manhole	150
3.001	o	225	SW03	58.746	57.521	1.000	Open Manhole	600
1.003	o	300	SW04	58.771	57.317	1.154	Open Manhole	900
1.004	o	300	SW05	58.711	57.240	1.171	Open Manhole	900
1.005	o	300	SW06	58.667	57.186	1.181	Open Manhole	900
1.006	o	300	SW07	58.843	54.000	4.543	Open Manhole	1200
4.000	o	225	RE03	58.817	58.367	0.225	Open Manhole	225
4.001	o	150	DUMMY01	58.210	57.848	0.212	Sealed Manhole	225
4.002	o	150	SW08	57.924	54.103	3.671	Open Manhole	900
1.007	o	300	DUMMY02	58.800	53.607	4.893	Sealed Manhole	300

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	28.785	99.9	SW01	58.795	57.795	0.700	Open Manhole	600
1.001	10.670	99.7	SW02	58.828	57.688	0.840	Open Manhole	600
2.000	20.282	99.9	SW02	58.828	57.687	1.041	Open Manhole	600
1.002	37.023	100.1	SW04	58.771	57.318	1.153	Open Manhole	900
3.000	21.647	100.2	SW03	58.746	57.521	1.075	Open Manhole	600
3.001	20.341	100.2	SW04	58.771	57.318	1.228	Open Manhole	900
1.003	7.724	100.3	SW05	58.711	57.240	1.171	Open Manhole	900
1.004	5.373	99.5	SW06	58.667	57.186	1.181	Open Manhole	900
1.005	26.472	20.0	SW07	58.843	55.862	2.681	Open Manhole	1200
1.006	8.332	21.3	DUMMY02	58.800	53.609	4.891	Sealed Manhole	300
4.000	26.657	51.5	DUMMY01	58.210	57.849	0.136	Sealed Manhole	225
4.001	23.998	109.1	SW08	57.924	57.628	0.146	Open Manhole	900
4.002	4.493	10.0	DUMMY02	58.800	53.654	4.996	Sealed Manhole	300
1.007	8.332	21.3	SW09	54.909	53.216	1.393	Open Manhole	1200

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Turing House 5 Archway Manchester M15 5RL	Whole Site Model M'Cr Academy Openshaw College	
Date 11/05/2021 File Trial Model.MDX	Designed by A Morris Checked by C Munro	
XP Solutions	Network 2018.1	

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)
5.000	o	300	RE04	54.900	53.461	1.139	Sealed Manhole	300
1.008	o	300	SW09	54.909	53.215	1.394	Open Manhole	1200
6.000	o	300	SW10	55.033	53.398	1.335	Open Manhole	900
6.001	o	300	SW11	55.033	53.262	1.471	Open Manhole	1050
7.000	o	150	SW16	54.950	53.278	1.522	Open Manhole	900
6.002	o	300	SW12	54.930	53.090	1.540	Open Manhole	1050
8.000	o	225	SW14	55.860	53.331	2.304	Open Manhole	900
8.001	o	225	SW15	55.000	53.150	1.625	Open Manhole	900
1.009	o	300	DUMMY03	54.950	53.017	1.633	Sealed Manhole	300
1.010	o	300	SW13	54.900	52.960	1.640	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)
5.000	24.575	99.9	SW09	54.909	53.215	1.394	Open Manhole	1200
1.008	8.445	42.7	DUMMY03	54.950	53.017	1.633	Sealed Manhole	300
6.000	34.875	225.0	SW11	55.033	53.243	1.490	Open Manhole	1050
6.001	38.766	225.4	SW12	54.930	53.090	1.540	Open Manhole	1050
7.000	28.174	149.9	SW12	54.930	53.090	1.690	Open Manhole	1050
6.002	16.343	223.9	DUMMY03	54.950	53.017	1.633	Sealed Manhole	300
8.000	27.221	150.0	SW15	55.000	53.150	1.625	Open Manhole	900
8.001	10.535	79.0	DUMMY03	54.950	53.017	1.708	Sealed Manhole	300
1.009	14.517	242.0	SW13	54.900	52.957	1.643	Open Manhole	1500
1.010	4.297	252.8	COMB01	54.900	52.943	1.657	Open Manhole	300

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Turing House	Whole Site Model	
5 Archway	M'Cr Academy	
Manchester M15 5RL	Openshaw College	
Date 11/05/2021	Designed by A Morris	
File Trial Model.MDX	Checked by C Munro	
XP Solutions	Network 2018.1	

Area Summary for Storm

Free Flowing Outfall Details for Storm

Bell Munro Consulting Ltd		Page 8																				
Turing House 5 Archway Manchester M15 5RL	Whole Site Model M'Cr Academy Openshaw College																					
Date 11/05/2021 File Trial Model.MDX	Designed by A Morris Checked by C Munro																					
XP Solutions	Network 2018.1																					
Simulation Criteria for Storm <table><tr><td>Rainfall Model</td><td>FSR</td><td>Profile Type</td><td>Summer</td></tr><tr><td>Return Period (years)</td><td>30</td><td>Cv (Summer)</td><td>0.750</td></tr><tr><td>Region</td><td>England and Wales</td><td>Cv (Winter)</td><td>0.840</td></tr><tr><td>M5-60 (mm)</td><td>18.000</td><td>Storm Duration (mins)</td><td>30</td></tr><tr><td>Ratio R</td><td>0.360</td><td></td><td></td></tr></table>			Rainfall Model	FSR	Profile Type	Summer	Return Period (years)	30	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	18.000	Storm Duration (mins)	30	Ratio R	0.360		
Rainfall Model	FSR	Profile Type	Summer																			
Return Period (years)	30	Cv (Summer)	0.750																			
Region	England and Wales	Cv (Winter)	0.840																			
M5-60 (mm)	18.000	Storm Duration (mins)	30																			
Ratio R	0.360																					
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Turing House 5 Archway Manchester M15 5RL	Whole Site Model M'Cr Academy Openshaw College	
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XP Solutions	Network 2018.1	

Online Controls for Storm

Hydro-Brake® Optimum Manhole: SW13, DS/PN: 1.010, Volume (m³): 4.4

Unit Reference	MD-SHE-0269-4540-2000-4540
Design Head (m)	2.000
Design Flow (l/s)	45.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	269
Invert Level (m)	52.960
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	2100

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	45.4
Flush-Flo™	0.603	45.4
Kick-Flo®	1.319	37.1
Mean Flow over Head Range	-	39.1

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	8.5	1.200	40.6	3.000	55.2	7.000	83.2
0.200	27.7	1.400	38.2	3.500	59.4	7.500	86.0
0.300	41.9	1.600	40.7	4.000	63.4	8.000	88.8
0.400	44.1	1.800	43.1	4.500	67.1	8.500	91.5
0.500	45.1	2.000	45.4	5.000	70.7	9.000	94.0
0.600	45.4	2.200	47.5	5.500	74.0	9.500	96.6
0.800	44.8	2.400	49.5	6.000	77.2		
1.000	43.5	2.600	51.5	6.500	80.3		

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Turing House 5 Archway Manchester M15 5RL	Whole Site Model M'Cr Academy Openshaw College	
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XP Solutions	Network 2018.1	

Storage Structures for Storm

Cellular Storage Manhole: DUMMY03, DS/PN: 1.009

Invert Level (m) 53.017 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	160.0	160.0	0.801	0.0	201.6
0.800	160.0	201.6			

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Turing House 5 Archway Manchester M15 5RL	Whole Site Model M'Cr Academy Openshaw College	
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XP Solutions	Network 2018.1	

1 year Return Period Summary of Critical Results by Maximum Outflow (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 1
 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 0.359
 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
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status OFF
 Inertia Status OFF

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, 30, 100
 Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow
1.000	RE01	15 Winter	1	+0%	100/15 Winter		
1.001	SW01	15 Winter	1	+0%	100/15 Summer		
2.000	RE02	15 Winter	1	+0%	30/15 Summer		
1.002	SW02	15 Winter	1	+0%	100/15 Summer		
3.000	HEAD OF RUN SVP	15 Winter	1	+0%	100/15 Summer		
3.001	SW03	15 Winter	1	+0%	100/15 Summer		
1.003	SW04	15 Winter	1	+0%	30/15 Summer		
1.004	SW05	15 Winter	1	+0%	30/15 Summer		
1.005	SW06	15 Winter	1	+0%			
1.006	SW07	15 Winter	1	+0%	100/15 Summer		
4.000	RE03	15 Winter	1	+0%			
4.001	DUMMY01	15 Winter	1	+0%			
4.002	SW08	15 Winter	1	+0%	100/15 Summer		
1.007	DUMMY02	15 Winter	1	+0%	100/15 Summer		
5.000	RE04	15 Winter	1	+0%	100/15 Summer		
1.008	SW09	15 Winter	1	+0%	100/15 Summer	100/60 Winter	
6.000	SW10	15 Winter	1	+0%	100/15 Winter		

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Turing House 5 Archway Manchester M15 5RL	Whole Site Model M'Cr Academy Openshaw College	
Date 11/05/2021 File Trial Model.MDX	Designed by A Morris Checked by C Munro	
XP Solutions		Network 2018.1

1 year Return Period Summary of Critical Results by Maximum Outflow (Rank
1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Pipe Flow / Overflow Cap.	Pipe Flow (l/s)	Status
1.000	RE01		58.145	-0.238	0.000	0.09	9.5	OK
1.001	SW01		57.863	-0.232	0.000	0.12	9.5	OK
2.000	RE02		57.938	-0.052	0.000	0.45	2.6	OK
1.002	SW02		57.784	-0.204	0.000	0.22	22.8	OK
3.000	HEAD OF RUN SVP		57.799	-0.088	0.000	0.35	5.8	OK
3.001	SW03		57.590	-0.156	0.000	0.20	9.5	OK
1.003	SW04		57.460	-0.157	0.000	0.46	32.0	OK
1.004	SW05		57.395	-0.145	0.000	0.52	32.0	OK
1.005	SW06		57.267	-0.219	0.000	0.16	36.2	OK
1.006	SW07		54.102	-0.198	0.000	0.25	39.0	OK
4.000	RE03		58.390	-0.202	0.000	0.02	1.6	OK
4.001	DUMMY01		57.891	-0.107	0.000	0.18	2.9	OK
4.002	SW08		54.129	-0.124	0.000	0.07	2.9	OK
1.007	DUMMY02		53.713	-0.194	0.000	0.27	41.9	OK
5.000	RE04		53.498	-0.263	0.000	0.04	3.6	OK
1.008	SW09		53.348	-0.167	0.000	0.40	45.1	OK
6.000	SW10		53.439	-0.259	0.000	0.05	3.1	OK

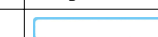
PN	US/MH Name	Level Exceeded
1.000	RE01	
1.001	SW01	
2.000	RE02	
1.002	SW02	
3.000	HEAD OF RUN SVP	
3.001	SW03	
1.003	SW04	
1.004	SW05	
1.005	SW06	
1.006	SW07	
4.000	RE03	
4.001	DUMMY01	
4.002	SW08	
1.007	DUMMY02	
5.000	RE04	1
1.008	SW09	1
6.000	SW10	

Bell Munro Consulting Ltd		Page 13
Turing House 5 Archway Manchester M15 5RL	Whole Site Model M'Cr Academy Openshaw College	
Date 11/05/2021 File Trial Model.MDX	Designed by A Morris Checked by C Munro	
XP Solutions		Network 2018.1

1 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) SurchARGE	First (Y) Flood	First (Z) Overflow	Overflow Act.
6.001	SW11	15 Winter	1	+0%	100/15 Summer			
7.000	SW16	15 Winter	1	+0%	30/30 Winter			
6.002	SW12	15 Winter	1	+0%	30/30 Summer	100/60 Winter		
8.000	SW14	15 Winter	1	+0%	100/15 Summer			
8.001	SW15	15 Winter	1	+0%	30/15 Winter			
1.009	DUMMY03	30 Winter	1	+0%	30/15 Summer			
1.010	SW13	30 Winter	1	+0%	30/15 Summer	100/60 Winter		

PN	US/MH Name	Water			Flooded		Pipe		Level Exceeded
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	
6.001	SW11	53.336	-0.226	0.000	0.13		9.2	OK	
7.000	SW16	53.325	-0.103	0.000	0.20		2.8	OK	
6.002	SW12	53.180	-0.210	0.000	0.19		11.9	OK	1
8.000	SW14	53.412	-0.144	0.000	0.27		10.6	OK	
8.001	SW15	53.221	-0.154	0.000	0.22		10.7	OK	
1.009	DUMMY03	53.186	-0.131	0.000	0.43		25.4	OK	
1.010	SW13	53.162	-0.098	0.000	0.53		25.4	OK	1

Bell Munro Consulting Ltd		Page 14
Turing House	Whole Site Model	
5 Archway	M'Cr Academy	
Manchester M15 5RL	Openshaw College	
Date 11/05/2021	Designed by A Morris	
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XP Solutions	Network 2018.1	

30 year Return Period Summary of Critical Results by Maximum Outflow (Rank
1) for Storm

Simulation Criteria

Number of Input Hydrographs	0	Number of Storage Structures	1
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

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

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, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH			Return Period	Climate Change	First (X)		First (Y)		First (Z)	
	Name	Storm				Surcharge		Flood		Overflow	
1.000	HEAD OF RUN	RE01	15	Winter	30	+0%	100/15	Winter			
1.001		SW01	15	Winter	30	+0%	100/15	Summer			
2.000		RE02	15	Winter	30	+0%	30/15	Summer			
1.002		SW02	15	Winter	30	+0%	100/15	Summer			
3.000		SVP	15	Winter	30	+0%	100/15	Summer			
3.001		SW03	15	Winter	30	+0%	100/15	Summer			
1.003		SW04	15	Winter	30	+0%	30/15	Summer			
1.004		SW05	15	Winter	30	+0%	30/15	Summer			
1.005		SW06	15	Winter	30	+0%					
1.006		SW07	15	Winter	30	+0%	100/15	Summer			
4.000		RE03	15	Winter	30	+0%					
4.001		DUMMY01	15	Winter	30	+0%					
4.002		SW08	15	Winter	30	+0%	100/15	Summer			
1.007		DUMMY02	15	Winter	30	+0%	100/15	Summer			
5.000		RE04	15	Winter	30	+0%	100/15	Summer			
1.008		SW09	15	Winter	30	+0%	100/15	Summer	100/60	Winter	
6.000		SW10	15	Winter	30	+0%	100/15	Winter			

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Turing House 5 Archway Manchester M15 5RL	Whole Site Model M'Cr Academy Openshaw College	
Date 11/05/2021 File Trial Model.MDX	Designed by A Morris Checked by C Munro	
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30 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
1.000	RE01		58.182	-0.201	0.000	0.23		23.2
1.001	SW01		57.905	-0.190	0.000	0.28		23.3
2.000	RE02		58.097	0.107	0.000	1.08		6.3
1.002	SW02		57.857	-0.131	0.000	0.59		60.1
3.000	HEAD OF RUN SVP		57.874	-0.013	0.000	0.84		14.1
3.001	SW03		57.732	-0.014	0.000	0.48		22.8
1.003	SW04		57.683	0.066	0.000	1.15		80.2
1.004	SW05		57.577	0.037	0.000	1.32		80.8
1.005	SW06		57.321	-0.165	0.000	0.40		90.3
1.006	SW07		54.175	-0.125	0.000	0.62		96.9
4.000	RE03		58.402	-0.190	0.000	0.06		3.8
4.001	DUMMY01		57.923	-0.075	0.000	0.48		7.8
4.002	SW08		54.147	-0.106	0.000	0.19		7.8
1.007	DUMMY02		53.790	-0.117	0.000	0.67		104.6
5.000	RE04		53.521	-0.240	0.000	0.09		8.8
1.008	SW09		53.472	-0.043	0.000	1.00		111.2
6.000	SW10		53.465	-0.233	0.000	0.11		7.5

PN	US/MH Name	Status	Level Exceeded
1.000	RE01	OK	
1.001	SW01	OK	
2.000	RE02	SURCHARGED	
1.002	SW02	OK	
3.000	HEAD OF RUN SVP	OK	
3.001	SW03	OK	
1.003	SW04	SURCHARGED	
1.004	SW05	SURCHARGED	
1.005	SW06	OK	
1.006	SW07	OK	
4.000	RE03	OK	
4.001	DUMMY01	FLOOD RISK*	
4.002	SW08	OK	
1.007	DUMMY02	OK	
5.000	RE04	OK	1
1.008	SW09	OK	1
6.000	SW10	OK	

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Turing House 5 Archway Manchester M15 5RL	Whole Site Model M'Cr Academy Openshaw College	
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XP Solutions		Network 2018.1

30 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) SurchARGE	First (Y) Flood	First (Z) Overflow	Overflow Act.
6.001	SW11	15 Winter	30	+0%	100/15 Summer			
7.000	SW16	15 Winter	30	+0%	30/30 Winter			
6.002	SW12	15 Summer	30	+0%	30/30 Summer	100/60 Winter		
8.000	SW14	15 Winter	30	+0%	100/15 Summer			
8.001	SW15	15 Winter	30	+0%	30/15 Winter			
1.009	DUMMY03	30 Winter	30	+0%	30/15 Summer			
1.010	SW13	30 Winter	30	+0%	30/15 Summer	100/60 Winter		

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
6.001	SW11	53.392	-0.170	0.000	0.38	25.8	OK	
7.000	SW16	53.391	-0.037	0.000	0.50	6.9	OK	
6.002	SW12	53.347	-0.043	0.000	0.46	29.1	OK	1
8.000	SW14	53.468	-0.088	0.000	0.66	26.0	OK	
8.001	SW15	53.386	0.011	0.000	0.53	25.9	SURCHARGED	
1.009	DUMMY03	53.425	0.108	0.000	0.75	44.3	SURCHARGED*	
1.010	SW13	53.385	0.125	0.000	0.92	44.1	SURCHARGED	1

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Turing House 5 Archway Manchester M15 5RL	Whole Site Model M'Cr Academy Openshaw College	
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100 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
1.000	RE01		58.331	-0.052	0.000	0.39		39.4
1.001	SW01		58.287	0.192	0.000	0.52		42.8
2.000	RE02		58.800	0.810	0.000	1.68		9.8
1.002	SW02		58.327	0.339	0.000	0.88		90.1
3.000	HEAD OF RUN SVP		58.606	0.719	0.000	1.39		23.4
3.001	SW03		58.169	0.423	0.000	0.85		40.1
1.003	SW04		58.021	0.404	0.000	1.87		129.7
1.004	SW05		57.743	0.203	0.000	2.12		130.2
1.005	SW06		57.367	-0.119	0.000	0.66		146.9
1.006	SW07		54.805	0.505	0.000	1.00		157.4
4.000	RE03		58.415	-0.177	0.000	0.10		6.9
4.001	DUMMY01		57.958	-0.040	0.000	0.87		14.1
4.002	SW08		54.301	0.048	0.000	0.33		13.7
1.007	DUMMY02		54.420	0.513	0.000	1.08		169.4
5.000	RE04		53.993	0.232	0.000	0.15		14.6
1.008	SW09		53.980	0.465	0.000	1.62		180.7
6.000	SW10		53.736	0.038	0.000	0.20		13.5

PN	US/MH Name	Status	Level Exceeded
1.000	RE01	OK	
1.001	SW01	SURCHARGED	
2.000	RE02	FLOOD RISK	
1.002	SW02	SURCHARGED	
3.000	HEAD OF RUN SVP	FLOOD RISK	
3.001	SW03	SURCHARGED	
1.003	SW04	SURCHARGED	
1.004	SW05	SURCHARGED	
1.005	SW06	OK	
1.006	SW07	SURCHARGED	
4.000	RE03	OK	
4.001	DUMMY01	FLOOD RISK*	
4.002	SW08	SURCHARGED	
1.007	DUMMY02	SURCHARGED*	
5.000	RE04	SURCHARGED*	1
1.008	SW09	SURCHARGED	1
6.000	SW10	SURCHARGED	

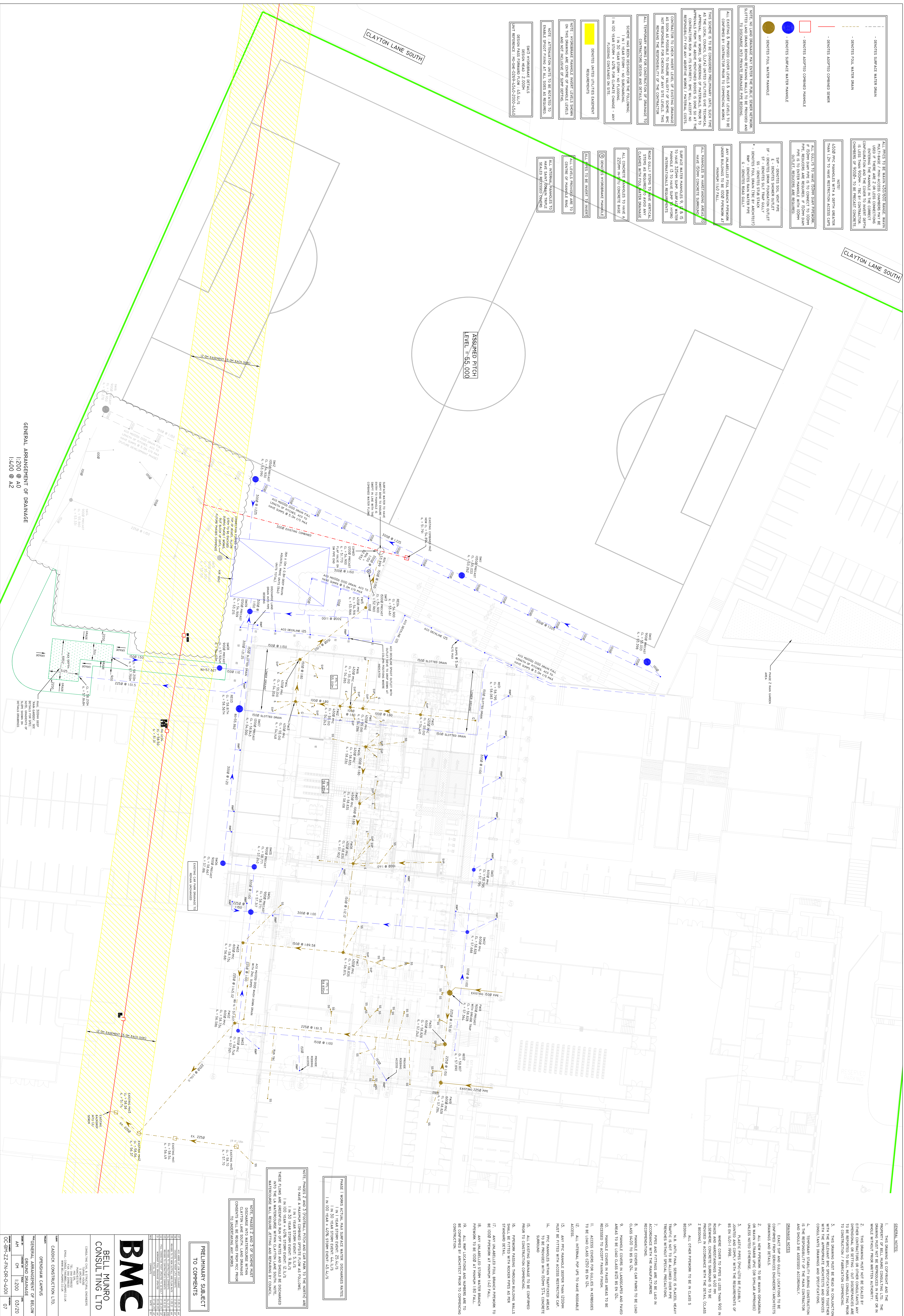
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Turing House 5 Archway Manchester M15 5RL	Whole Site Model M'Cr Academy Openshaw College	
Date 11/05/2021 File Trial Model.MDX	Designed by A Morris Checked by C Munro	
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100 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

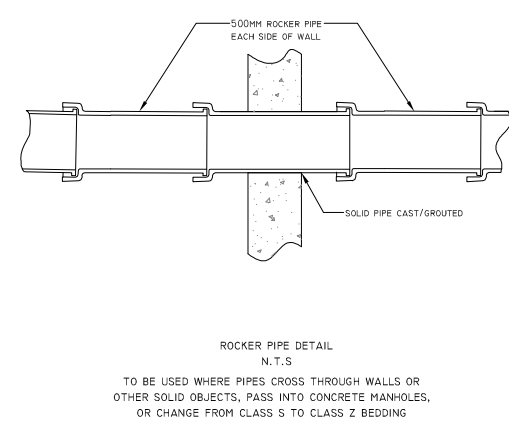
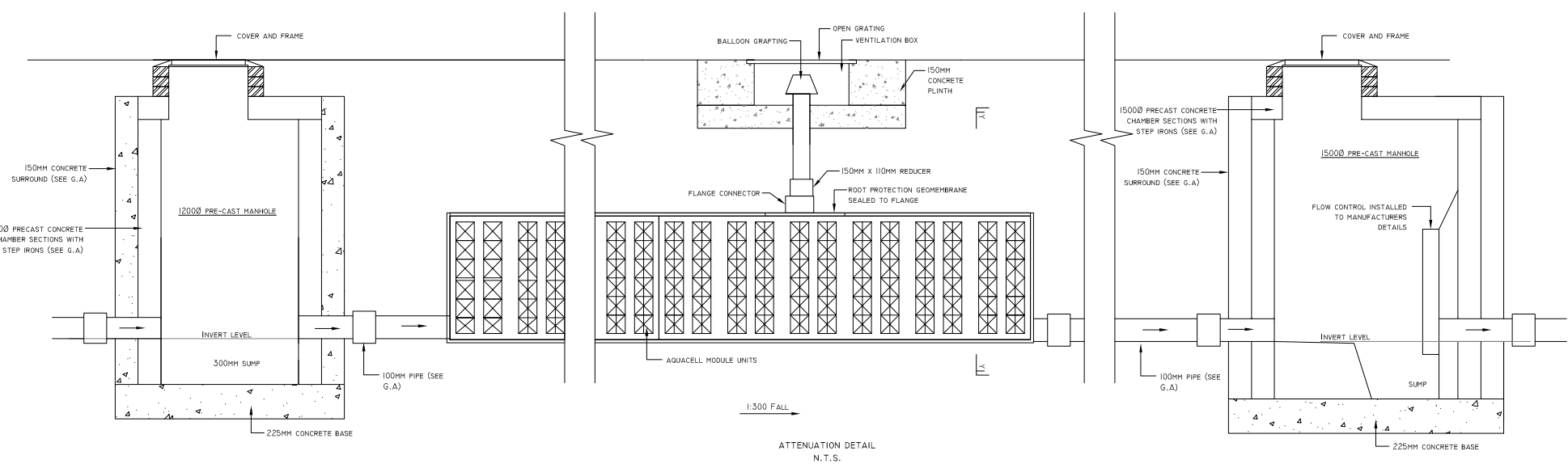
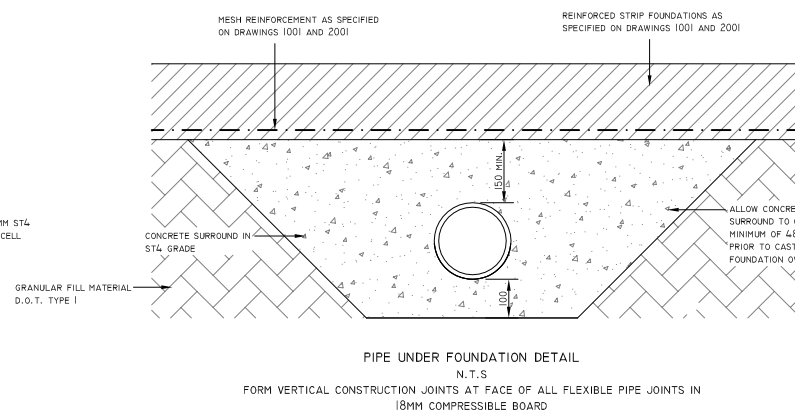
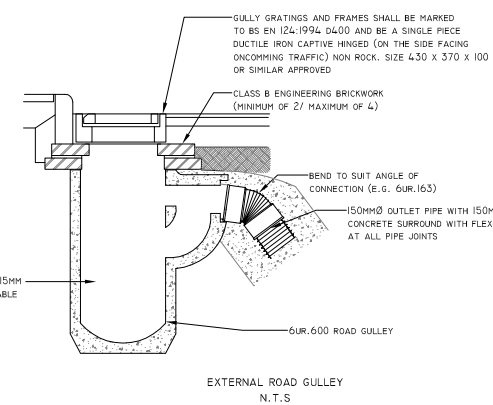
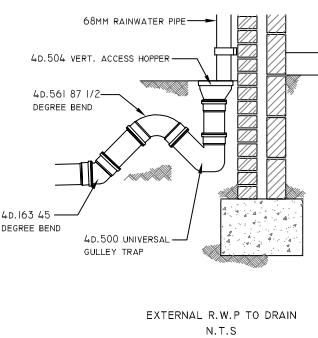
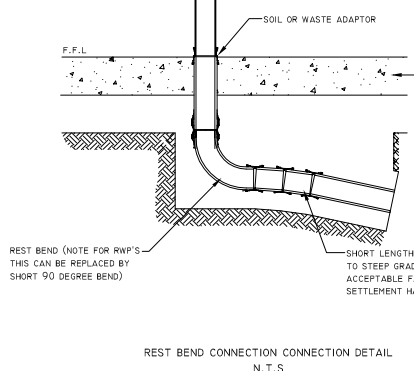
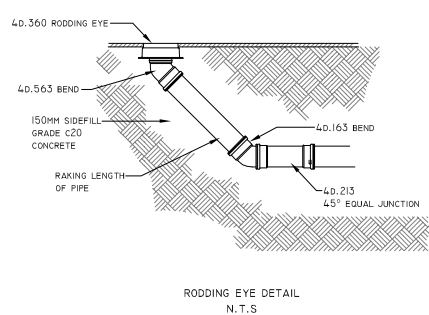
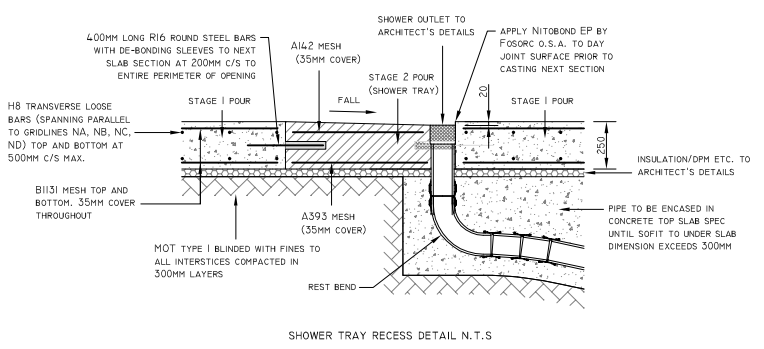
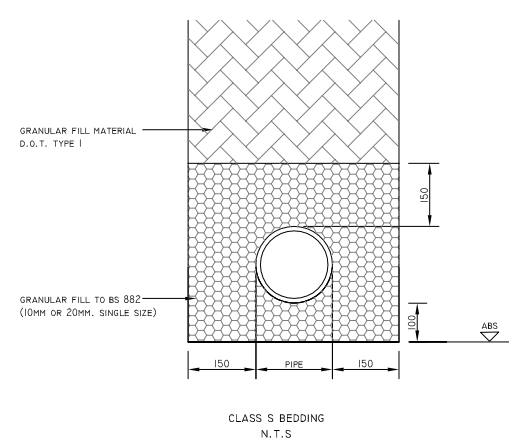
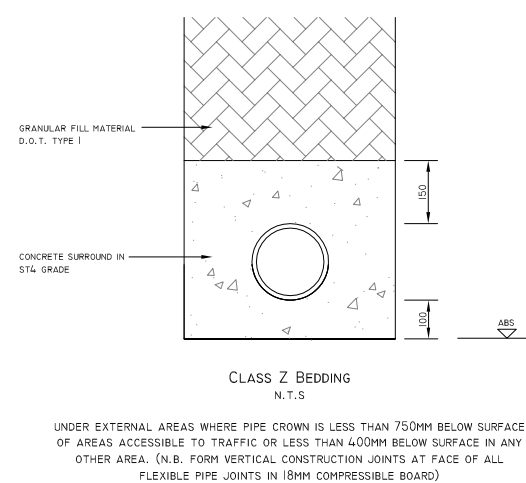
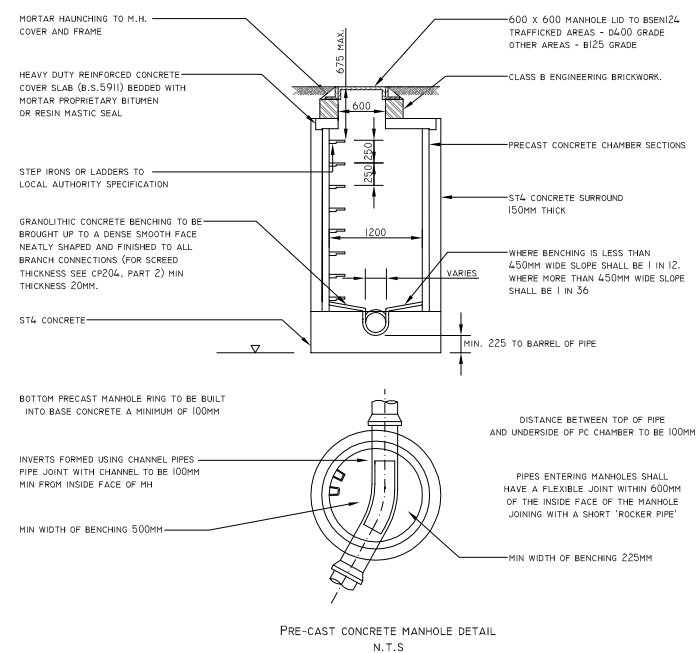
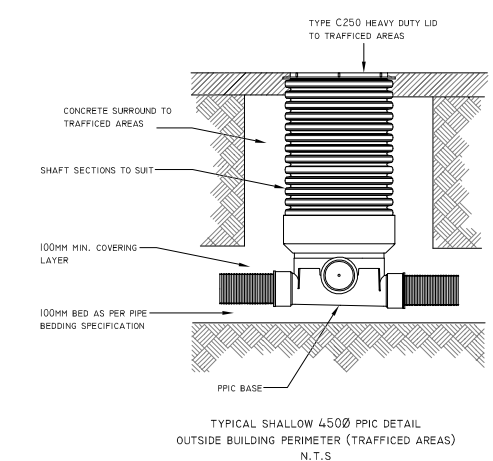
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) SurchARGE	First (Y) Flood	First (Z) Overflow	Overflow Act.
6.001	SW11	15 Summer	100	+40%	100/15 Summer			
7.000	SW16	15 Winter	100	+40%	30/30 Winter			
6.002	SW12	15 Summer	100	+40%	30/30 Summer	100/60 Winter		
8.000	SW14	15 Winter	100	+40%	100/15 Summer			
8.001	SW15	15 Winter	100	+40%	30/15 Winter			
1.009	DUMMY03	30 Winter	100	+40%	30/15 Summer			
1.010	SW13	60 Summer	100	+40%	30/15 Summer	100/60 Winter		

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
6.001	SW11	53.644	0.082	0.000	0.67		45.6	SURCHARGED	
7.000	SW16	53.737	0.309	0.000	0.83		11.5	SURCHARGED	
6.002	SW12	53.640	0.250	0.000	0.74		46.2	SURCHARGED	1
8.000	SW14	53.741	0.185	0.000	1.17		45.8	SURCHARGED	
8.001	SW15	53.733	0.358	0.000	0.82		40.3	SURCHARGED	
1.009	DUMMY03	54.810	1.493	0.000	1.05		62.4	FLOOD RISK*	
1.010	SW13	53.968	0.708	0.000	0.95		45.4	SURCHARGED	1

APPENDIX G



APPENDIX H



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CONSTRUCTION

02	SHOWER RECESS DETAIL ADDED	15.11.20	SH
01	PIPE UNDER FOUNDATION DETAIL ADDED	15.09.20	SH
00	INITIAL ISSUE	15.09.20	SH
REV	DATE	BY	IT

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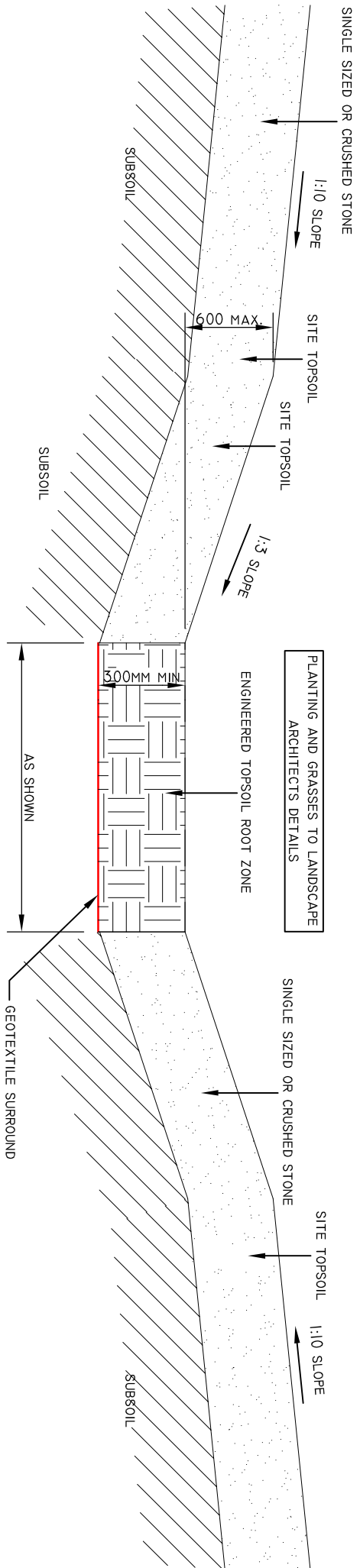
OPENSHAW CAMPUS

BELOW GROUND DRAINAGE DETAILS

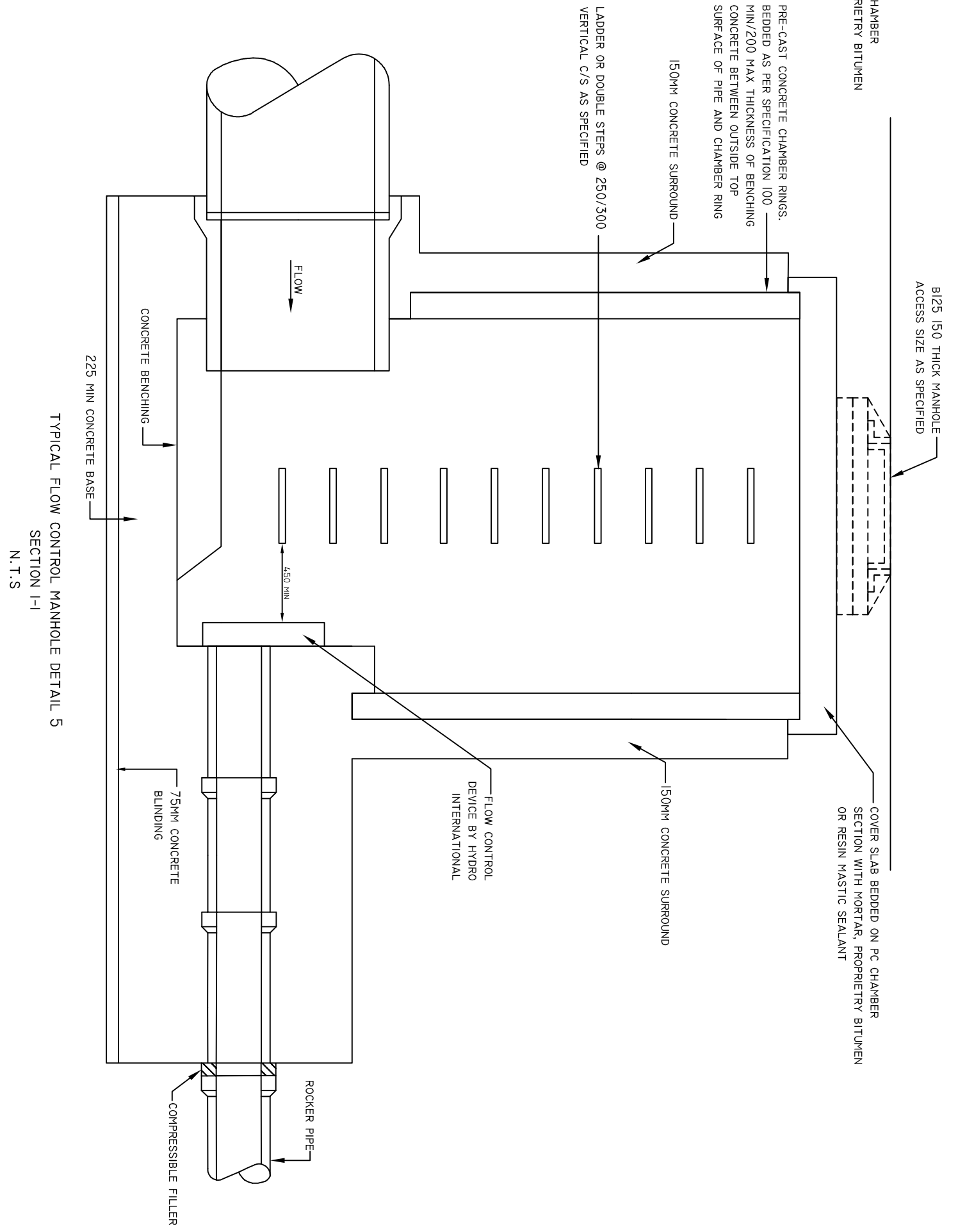
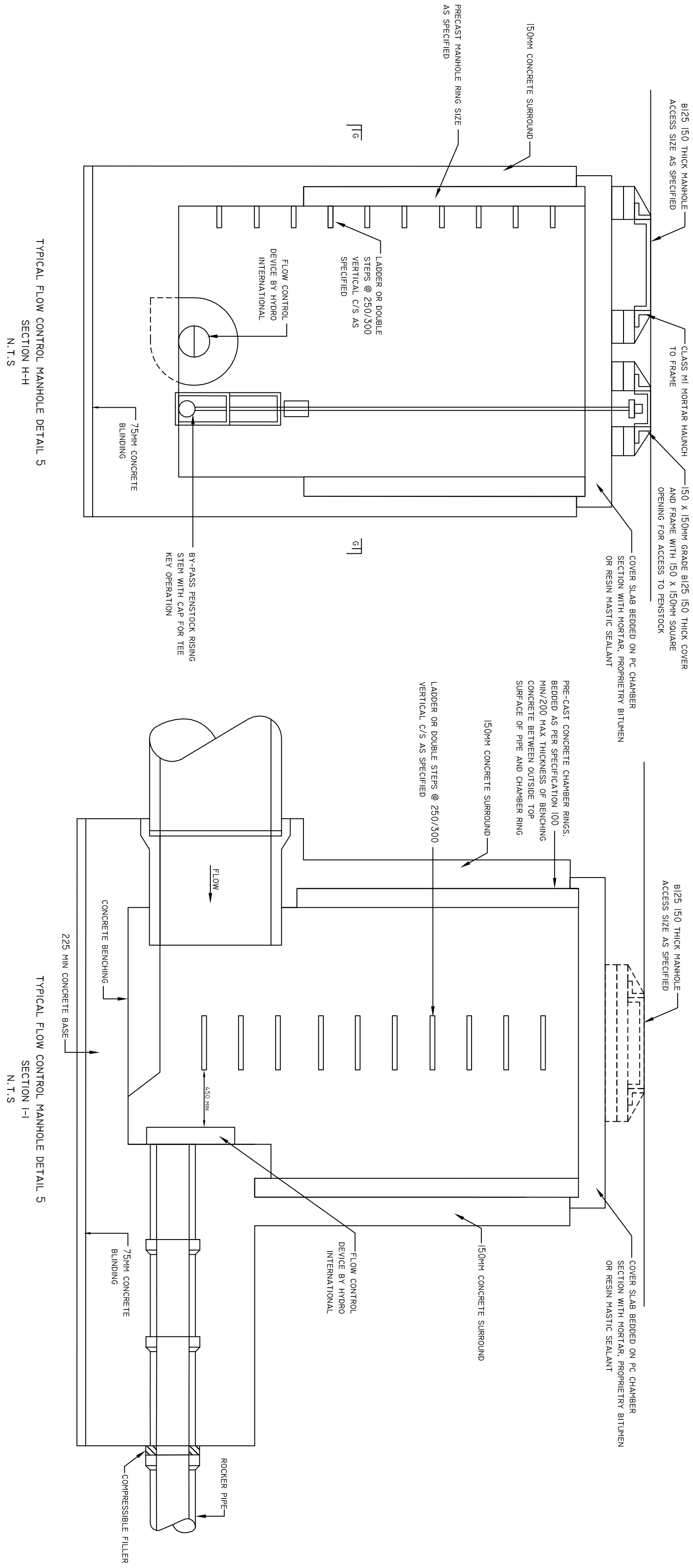
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PROJECT NO.	OC-BM-ZZ-FN-DR-D-4002	REVISION	02

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PROPOSED RAIN GARDEN DETAIL
N.T.S.



CONSTRUCTION

NO.	REVISION	DATE	BY
01	INITIAL ISSUE	12/25/21	AM

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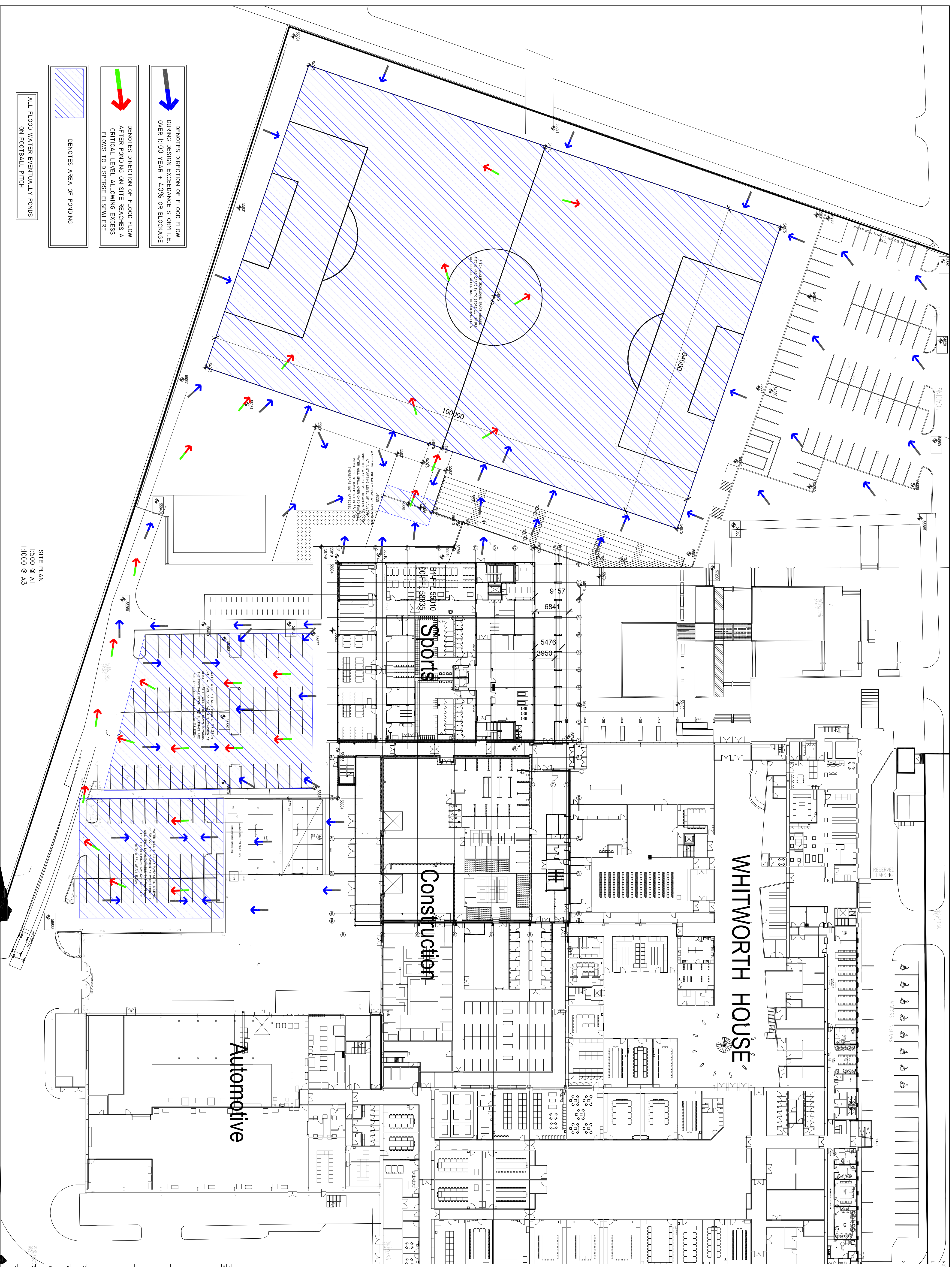
BELOW GROUND DRAINAGE DETAILS 02

AM	CM	N.T.S.	05/21
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APPENDIX I

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CADDICK CONSTRUCTION

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SCOTT
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OPENSHAW CAMPUS

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FLOOD ROUTING PLAN

FLOOD ROUTING PLAN

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APPENDIX J



Turing House,
5 Archway
Manchester
M15 5RL

SuDS MAINTANENCE PLAN

For

Proposed New Teaching Buildings

At

The Manchester College

Openshaw Campus

M11 2WH

Project: J6776

Date: 13/05/2021

Author: A Morris

Revision: -

The Owner's manual

This will include the following:

- This document.
- Location of all SuDS component on site (drainage and suds drawings).
- Operation and maintenance schedule (below) and a maintenance record.
- Emergency Plan (below)
- Explanation of the consequences of not carrying out the maintenance that is specified (below)

General Requirements

Collection of all litter and debris from communal areas is to be undertaken on a weekly basis by the College's maintenance team or appointed contractor.

Financial Management

It is proposed that all SuDS facilities will be managed and maintained in perpetuity by the College or Management Company acting on behalf of the College.

Modular Cellular Storage

These comprise of geo-cellular (hollow box) systems wrapped in an impermeable geo-textile. The units have a high void ratio (often 95%) to provide storm-water storage underground. Water from the building roof and associated hardstanding areas (including pavements, buildings and roads) is routed to a series of these cellular storage tanks. The storage tank location and arrangements can be found on Bell Munro Consulting Drawing number OC-BM-ZZ-FN-DR-D-4001. The maintenance of the modular cellular storage is to be undertaken by the College or their appointed management company. The operation and maintenance requirements are given in the table below;

Maintenance Schedule	Required Action	Recommended Frequency
Regular maintenance	Remove sediment and debris from catch pits and geo-cellular crates and air vents	Annually
Remedial Actions	Repair/rehabilitation of inlets, outlets and vents	As required
Monitoring	Inspect catch pits and note rate of sediment accumulation	Monthly in the first year, annually thereafter.

Vortex Flow Controls

These are proprietary systems which are custom made to control the discharge off site to greenfield or brownfield levels. Some of the proposed flow controls may be prone to blocking and should be monitored closely. The maintenance of the flow control is to be undertaken by the College or their appointed management company. The operation and maintenance requirements are given in the table below;

Maintenance Schedule	Required Action	Recommended Frequency
Regular maintenance	Remove litter and debris and grass cuttings (if applicable) from the upstream SUDs systems to prevent these being washed into the control. Inspection of control chamber and removal of any sediments, debris etc.	Quarterly or as required following monitoring
Remedial Actions	Check drain down doors are operational, check the vortex flow control fixing to manhole chamber and access into the control chamber is functional	Quarterly or as required following monitoring
Monitoring	Inspect flow controls and check flow is not impeded	Monthly or after periods of heavy rainfall

Rain Garden

There are shallow, broad and vegetated channels designed to store and/or convey runoff and remove pollutants. The maintenance of the rain gardens is to be by the College or their appointed management company.

Maintenance Schedule	Required Action	Recommended Frequency
Regular Maintenance	Remove litter and debris and grass cuttings (if applicable) from the rain gardens and banking to prevent blockage of the watercourse. Check banking for signs of erosion or scour.	Monthly
Remedial Actions	Remove litter and debris as required	Monthly
Monitoring	Inspect flow controls and check flow is not impeded	Monthly or after heavy rainfall

Inlet Structures and Inspection Chambers

Inlet structures such as rain water down pipes, road gullies and channel drawings. They should be free from obstruction at all times to allow free flow through SuDS. Inspection chambers and rodding eyes are used on bends or where pipes come together. They allow access and cleaning to the system if necessary.

Maintenance Schedule	Required Action	Recommended Frequency
Regular maintenance	Inspect rainwater down pipes and Aco drains, removing obstructions and silt as necessary. Check there is no physical damage.	Monthly
	Trim vegetation 1m min surround to structure and keep area free from silt and debris	Monthly
	Remove inspection chamber cover and inspect. Water should be free flowing and the exist route is unobstructed. Remove debris and silt. Undertake inspection after leaf fall in Autumn.	Annually
	Check topsoil levels are 20mm above edges of chambers to avoid mower damage.	As necessary
Remedial Actions	Repair physical damage if possible or replace if required.	As required / annual
Monitoring	Visual inspections to check for damage as required	As required

Below Ground Drainage Pipes

Below ground drainage pipes convey water to the SuDS system. They should be free from obstruction at all times to allow free flow.

Maintenance Schedule	Required Action	Recommended Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If require take remedial action.	Monthly for the first 3 months, then annually.
	Remove debris from the catchment surface (where it may cause risks to performance).	Monthly
	Remove sediment from pre-treatment inlet structure and inspection chambers.	Annually or as required
	Maintain vegetation to designed limited within eh vicinity of the below ground drainage pipe and tanks to avoid damage.	Monthly or as required
Remedial Actions	Repair physical damage if possible or replace if required.	As required / annual
Monitoring	Inspect all inlets, outlets and vents to ensure that they are in good condition and operating as designed.	Annually
	Survey inside of pipe runs for sediment build up and remove if necessary.	Every 5 years or as required.

Design Life

The design life of the development is likely to exceed the design life of each of the SUDs components listed above. During the routine inspections of any drainage components, it may become apparent that they have reached the end of their functional lifetime. In the interest of sustainability repairs should be the first-choice solution where possible. If this is not the case then it may be necessary for the College (if on their property) or the management company to undertake complete replacement of the component in question.

Emergency Plan

Key indicators to prevent flooding;

1. Manholes over flowing
2. Vent pipe overflowing
3. Gullies overflowing or water taking a long time to disperse
4. Aco channels overflowing or water taking a long time to disperse
5. Any other unusual visual items not normally seen such as waterlogged ground

In the event of the above occurring, action is required to be undertaken as outlined below;

1. Check for obvious blockages in area where flooding is occurring (blocked gully's / drains / flow control units etc).
2. If there is nothing obvious as to why there is a blockage, call the statutory wastewater provider – United Utilities to make them aware and report the problem on 0345 672 3723
3. Call a suitable drain inspection company such as 'Lanes for Drains' to survey and possibly jet any blockages. Local depot contact number – 0161 788 2222 and inform them of the problems.

Ensure that in the event of the above, the operation, maintenance and emergency plans as well as the drainage drawings for the development are available to the contractors.

Spillage – Emergency action

Most spillages on a development are of compounds that do not pose a serious risk to the environment if they enter the drainage system in a slow and controlled manner with available time for natural breakdown. Therefore, small spillages of oil, milk or other known organic substances should be remove where possible using soak mats as recommended by the Environment Agency, with residual spillage allowed to bioremediate in the drainage system.

In the event of a serious spillage, either by volume of unknow or toxic compounds, then isolate the spillage with soil, turf or fabric and block outlet pipes from chambers downstream of the spillage with a bung.

Contact the Environment Agency immediately. Tel: 03708 506 506