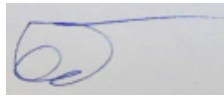




Land at Hornby St, Heywood, OL10 1BH
Stage 4 Drainage pack
23-510

Revision	Description	Issued by	Checked	Date
P01	First issue	BB	MN	09/02/2024

Prepared by:	Signed:	Date
BB		09/02/2024

Approved by:	Signed:	Date
MN		09/02/2024

Table of Contents

1	Introduction.....	4
2	Policy Compliance.....	4
3	Site Location and Proposed Development	5
4	Existing Drainage.....	6
5	Surface Water Drainage	7
6	Foul Water Drainage.....	7
7	Water Quality	7
8	Schedule of Maintenance	8
9	CONCLUSION	9

Appendices

Appendix A – Architect Plans

Appendix B - Drainage Design

Appendix C - Calculations

Appendix D - Sewer Records

1 Introduction

QED Structures has prepared this Stage 4 design pack for the development being carried out to Land at Hornby Street, Heywood, Greater Manchester, OL10 1BH.

It is understood that the proposed development is for the construction of a two-storey building comprised of 13 1-bedroom-1bath residential flats with cycle storage and bin storage. It can be seen that the site is currently an area of open green space in an urban setting.

United Utilities have provided local sewer records and these show a 150mm combined drain running northwards in the alleyway to the west of the site and a 225mm diameter combined drain running northwards in Hornby Street to the east.

It is recommended any new sewer connection at the site should be agreed with the local sewer provider to ensure there is capacity in the network (to ensure no increased risk). It is recommended non return valves are installed on the drainage connections from the property to reduce the risk of backflow into the property.

In accordance with the NPPF, developments are required to use SuDS to reduce both the volume and runoff rates to the drainage system. Current local Sustainable drainage guidance is to achieve as close as feasible to greenfield runoff rates for storm runoff from new developments. Greenfield rates for the site are fairly low, so a minimum orifice diameter hydrobrake is proposed to control runoff. This will have an orifice diameter of 50mm, the smallest as recommended in the CIRIA SuDS manual. This will reduce runoff rates to a maximum of 1.1l/s for all events up to and including the 1 in 100 year + 45%CC event.

To allow for attenuation an oversized piped system is proposed to provide the required storage needed for rainfall events up to and including the 1 in 100yr+45%CC rainfall event. The overall required storage on site is calculated to be 30cubic metres.

At this stage it is assumed all external areas are proposed to be impermeable. If some external areas are landscaped or permeable this may reduce potential storage volumes.

This report has been produced broadly in accordance with the National Planning Policy Framework (NPPF) as well as the EA Guidance on Flood Risk, Rochdale Borough Council Preliminary Flood Risk Assessment, The Greater Manchester SFRA and the Ciria SuDS Manual.

2 Policy Compliance

The purpose of this assessment is to demonstrate that the proposals outlined above can be satisfactorily accommodated without increasing the risk of flooding for the area or without placing the development itself at risk of flooding, as per the:

- National Planning Policy Framework
- EA Guidance on Flood Risk
- Rochdale Borough Council Preliminary Flood Risk Assessment (PRFA) 2014-2024
- The Greater Manchester SFRA 2019
- Ciria SuDS Manual

3 Site Location and Proposed Development

The proposed development is being carried out to Land at Hornby Street, Heywood, Greater Manchester, OL10 1BH.

It is understood that the proposed development is for the construction of a two-storey building comprised of 13 1-bedroom-1bath residential flats with cycle storage and bin storage. It can be seen that the site is currently an area of open green space in an urban setting.

It can be seen that the site is currently an area of open green space in an urban setting.

Proposed and existing Architects plans and topographical survey are included in Appendix A.

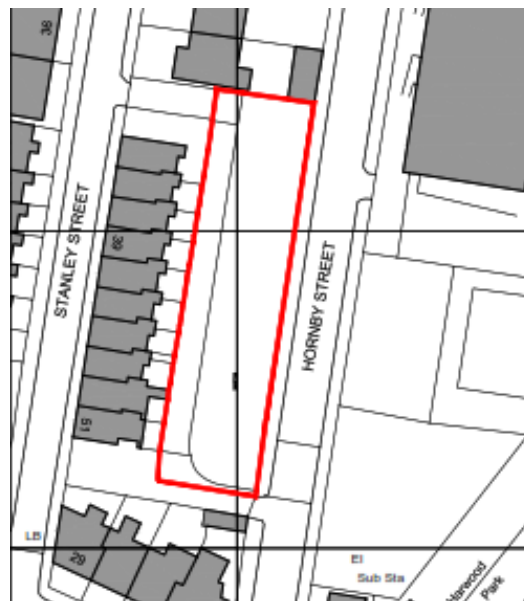


Figure 1: Site Location - redline shows the site

4 Existing Drainage

Given the site is currently open green space it is considered unlikely there are existing drainage connections from the site.

United Utilities have provided local sewer records and these show a 150mm combined drain running northwards in the alleyway to the west of the site and a 225mm diameter combined drain running northwards in Hornby Street to the east. Sewer record plans are included in Appendix D.



Figure 3: UU Sewer record extract

5 Surface Water Drainage

In accordance with the NPPF, developments are required to use SuDS to reduce both the volume and runoff rates to the drainage system. Current local Sustainable drainage guidance is to achieve as close as feasible to greenfield runoff rates for storm runoff from new developments.

Greenfield rates for the site are fairly low, so a minimum orifice diameter hydrobrake is proposed to control runoff. This will have an orifice diameter of 50mm, the smallest as recommended in the CIRIA SuDS manual. This will reduce runoff rates to a maximum of 1.1l/s for all events up to and including the 1 in 100 year + 45%CC event.

To allow for attenuation an oversized piped system is proposed to provide the required storage needed for rainfall events up to and including the 1 in 100yr+45%CC rainfall event. The overall required storage on site is calculated to be 30cubic metres.

At this stage it is assumed all external areas are proposed to be impermeable. If some external areas are landscaped or permeable this may reduce potential storage volumes.

Runoff will be discharged to the nearby United Utilities combined sewer system that runs along the western edge of the site. A proposed storm drainage strategy plan layout is included in Appendix B.

Runoff rates have been calculated and are displayed in the table below.

SURFACE WATER DISCHARGE RATES SUMMARY					
	Area (ha)	Discharge Rates (l/s)			
		2 year/ Q_{BAR}	30 year	100 year	100 year +45%CC
Pre Development Greenfield Rates	0.112	0.9	1.52	1.86	-
Proposed Runoff Rates	0.112	1.1	1.1	1.1	1.1

6 Foul Water Drainage

United Utilities have provided local sewer records and these show a 150mm combined drain running northwards in the alleyway to the west of the site and a 225mm diameter combined drain running northwards in Hornby Street to the east. Sewer record plans are included in Appendix D.

The foul water soil vent pipes will drain externally connecting into the combined 150mm pipe located in the alley to the west of the site. The proposed Foul Water Drainage layout plan is included in Appendix B.

Any new connections offsite would need to be approved by United Utilities prior to construction.

7 Water Quality

The primary risk to water quality is from the trafficked areas. As the development shows no proposed trafficked areas the risk is very low.

Residential roof runoff is considered to be largely uncontaminated and as such pollution mitigation is not deemed necessary in line with the pollution prevention guidance set out in the Ciria SuDS Manual C753.

8 Schedule of Maintenance

All onsite SuDS and drainage systems will be privately maintained. A long-term maintenance regime should be agreed with the site owners before adoption.

In addition to a long-term maintenance regime, it is recommended that all drainage elements implemented on site should be inspected following the first rainfall event post-construction and monthly for the first quarter following construction.

The property owner will be responsible for the management and maintenance of SuDS devices. Therefore, the proposed SuDS features will not be adoptable.

Typical key suds components operation and maintenance activities are provided below.

Item	Visual Inspection	Cleanse / De-sludge	CCTV Survey	Comments
Surface Water Drainage System (pipework, chambers etc.)	5 years	10 years	10 years	Cleansing to be carried as necessary
Gullies/Channels	1 year	1 year	N/A	Cleansing to be carried as necessary
Hydrobrake	6 monthly	As required	N/A	Cleansing to be carried as necessary. Inspect after heavy rainfall event
Catchpits	1 year	1 year	N/A	Cleansing to be carried as necessary
Permeable Block Paving	1 year	'Swept' clean of debris every 2 years.	N/A	Lift blocks and remove sand bedding and replace and re-bed paving – refer to individual manufacturers recommendations.
Bioretention areas	6 monthly	Annually		Bioretention facilities shall be inspected and cleaned up annually, preferably during the Spring

9 CONCLUSION

QED Structures has prepared this Stage 4 design pack for the development being carried out to Land at Hornby Street, Heywood, Greater Manchester, OL10 1BH.

It is understood that the proposed development is for the construction of a two-storey building comprised of 13 1-bedroom-1bath residential flats with cycle storage and bin storage. It can be seen that the site is currently an area of open green space in an urban setting.

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It is recommended any new sewer connection at the site should be agreed with the local sewer provider to ensure there is capacity in the network (to ensure no increased risk). It is recommended non return valves are installed on the drainage connections from the property to reduce the risk of backflow into the property.

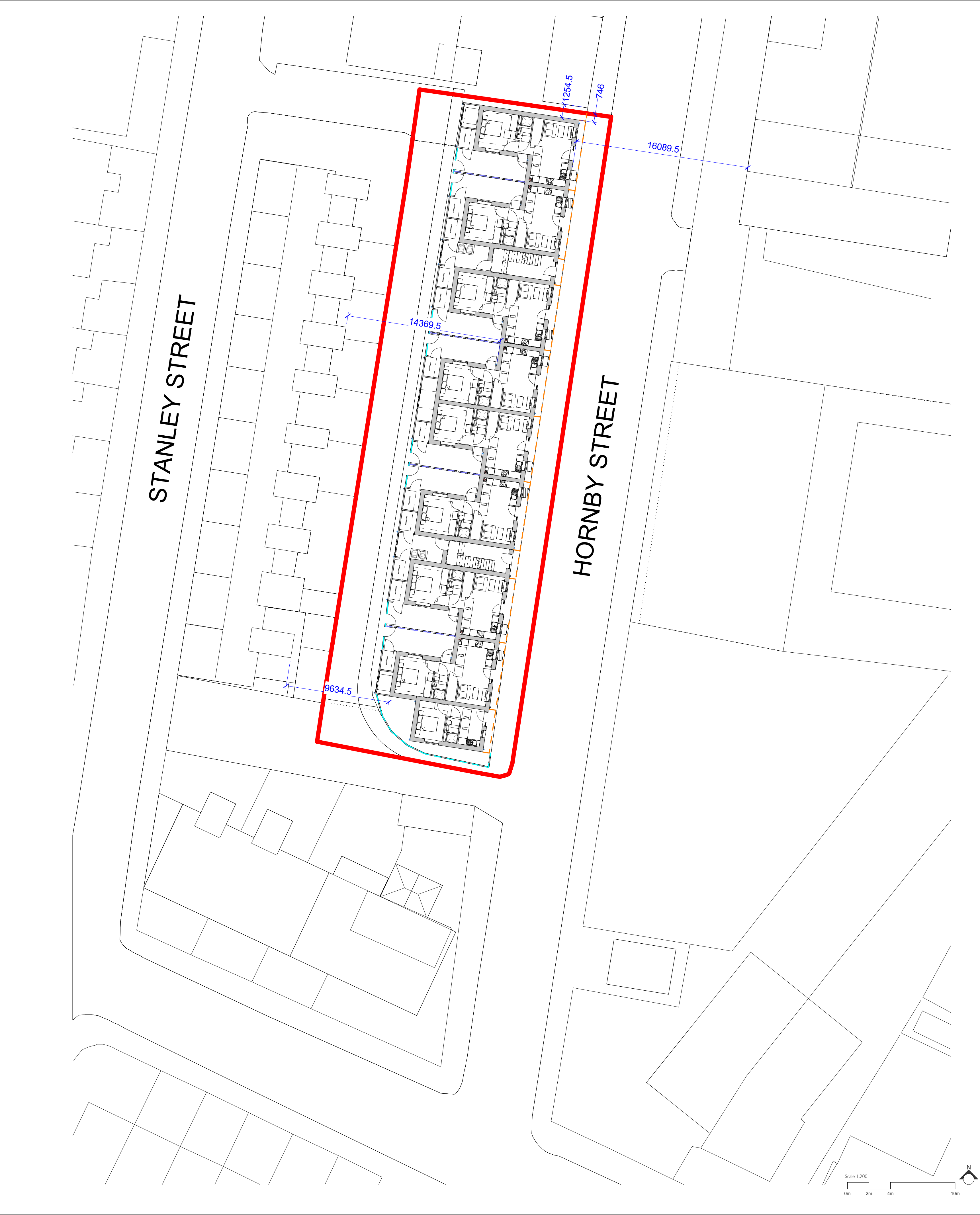
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At this stage it is assumed all external areas are proposed to be impermeable. If some external areas are landscaped or permeable this may reduce potential storage volumes.

This report has been produced broadly in accordance with the National Planning Policy Framework (NPPF) as well as the EA Guidance on Flood Risk, Rochdale Borough Council Preliminary Flood Risk Assessment, The Greater Manchester SFRA and the Ciria SuDS Manual.

APPENDIX A – ARCHITECT PLANS



Existing metal railings with gate securing access to alley.



Existing boundary treatment around the site and brick wall with gate access securing the terraces to the rear.



Red brick wall with rear gate access securing neighbouring properties.



Existing railings with gate access securing the alley. Timber panel fencing with concrete posts along boundary line.



Existing brick wall with railings securing the primary school opposite the site.

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Boundary Treatments Key

Proposed Boundary Treatments (TBC)

Red brick wall with timber gate (2100mm)

Timber panel fencing with contract post fencing (1500mm - 1800mm)

Low level metal railings (400mm)

Site Boundary



DRAFT

P02 Date 4 Revised in line with clients comments for DTM.
P01 24.11.23 Draft issue for comment.

Rev Date By Remarks

Client:	Cornerstone Place						
Project Name:	Hornby Street, Heyood						
Drawing Name:	Proposed Boundary Treatments						
Drawing Purpose:	Preliminary						
Dwg no.	Project	Origin	Vol/Sys	Level	Type	Role	Number
Project Number:	23-031		TRI dwg no:		02		Revision
Status	Scale @ A1	Drawn	Checked	Date	P02		
As indicated	JH	AJD	Nov 2023				

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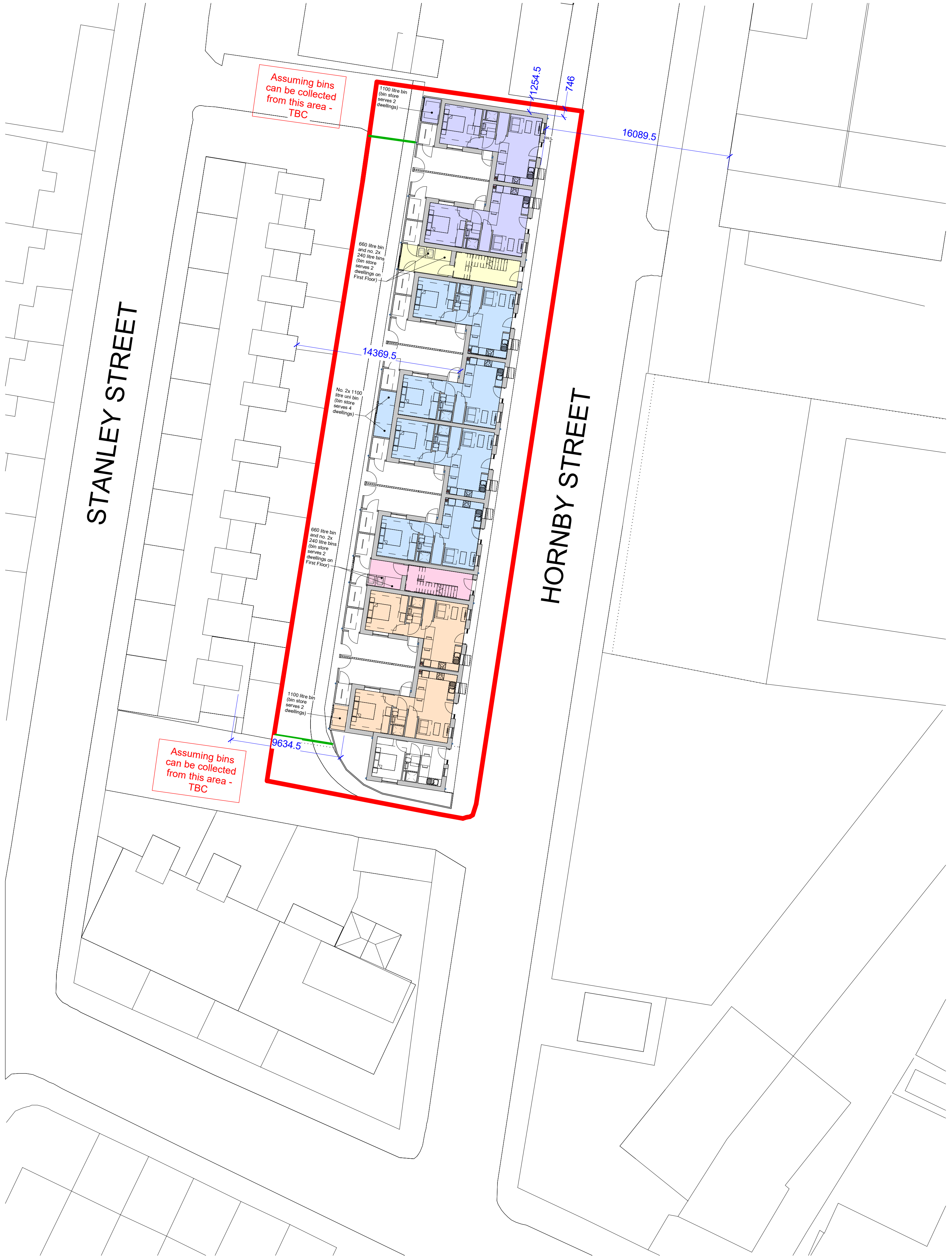
■ WHERE AN ITEM IS COVERED BY DRAWINGS OF DIFFERENT SCALE, THE LARGER SCALE DRAWING TO BE WORKED TO. DO NOT SCALE FROM THE DRAWING. FIGURED DIMENSIONS TO BE WORKED TO IN ALL CASES.

CHECK ALL DIMENSIONS ON SITE.

DRAWING TO BE READ IN CONJUNCTION WITH THE HEALTH & SAFETY PLAN, AND ALL RELEVANT RISK ASSESSMENTS AND THE FOLLOWING DRAWINGS:



Rev.	Date	By	Remarks	Date		Scale @A3	CDE no:	Project	Origin	Vol/Sys	Level	Type	Role	Number	TRIANGLE ARCHITECTS Tel: 0161 272 3500 E-mail: studio@trianglearchitects.co.uk Web: www.trianglearchitects.co.uk Twitter: @TriangleArch © TRIANGLE ARCHITECTS LIMITED Lower Ground Floor, 4 Jordan Street, Manchester, M15 4PY	Client:
				Nov 2023		1 : 100										Project:
				Drawn	Checked	Status	Project No.		TRI DWG no:		Revision		Drawing Purpose:			Drawing Name:
P02	28.11.23		Revised in line with client comments from DTM.	JH	AJD		23-031		20		P02		Preliminary			
P01	24.11.23		Draft Issue for Comment.					TRI no:								



Assuming bins
can be collected
from this area -
TBC

Assuming bins
can be collected
from this area -
TBC

STANLEY STREET

HORNBY STREET

1100 litre bin
(bin store
serves 2
dwellings)

660 litre bin
and no. 2x
240 litre bins
(bin store
serves 2
dwellings on
First Floor)

No. 2x 1100
litre uni bin
(bin store
serves 4
dwellings)

660 litre bin
and no. 2x
240 litre bins
(bin store
serves 2
dwellings on
First Floor)

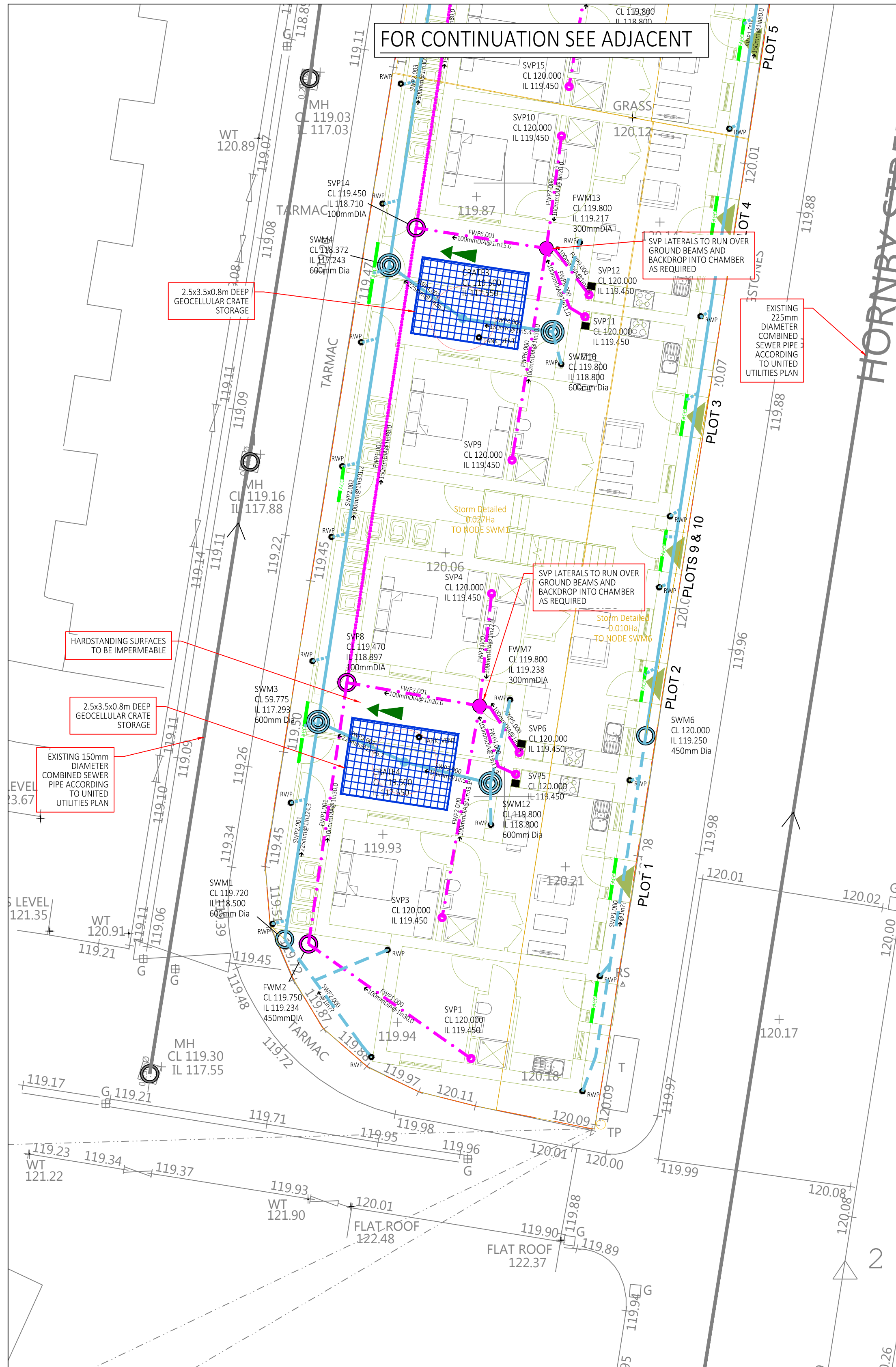
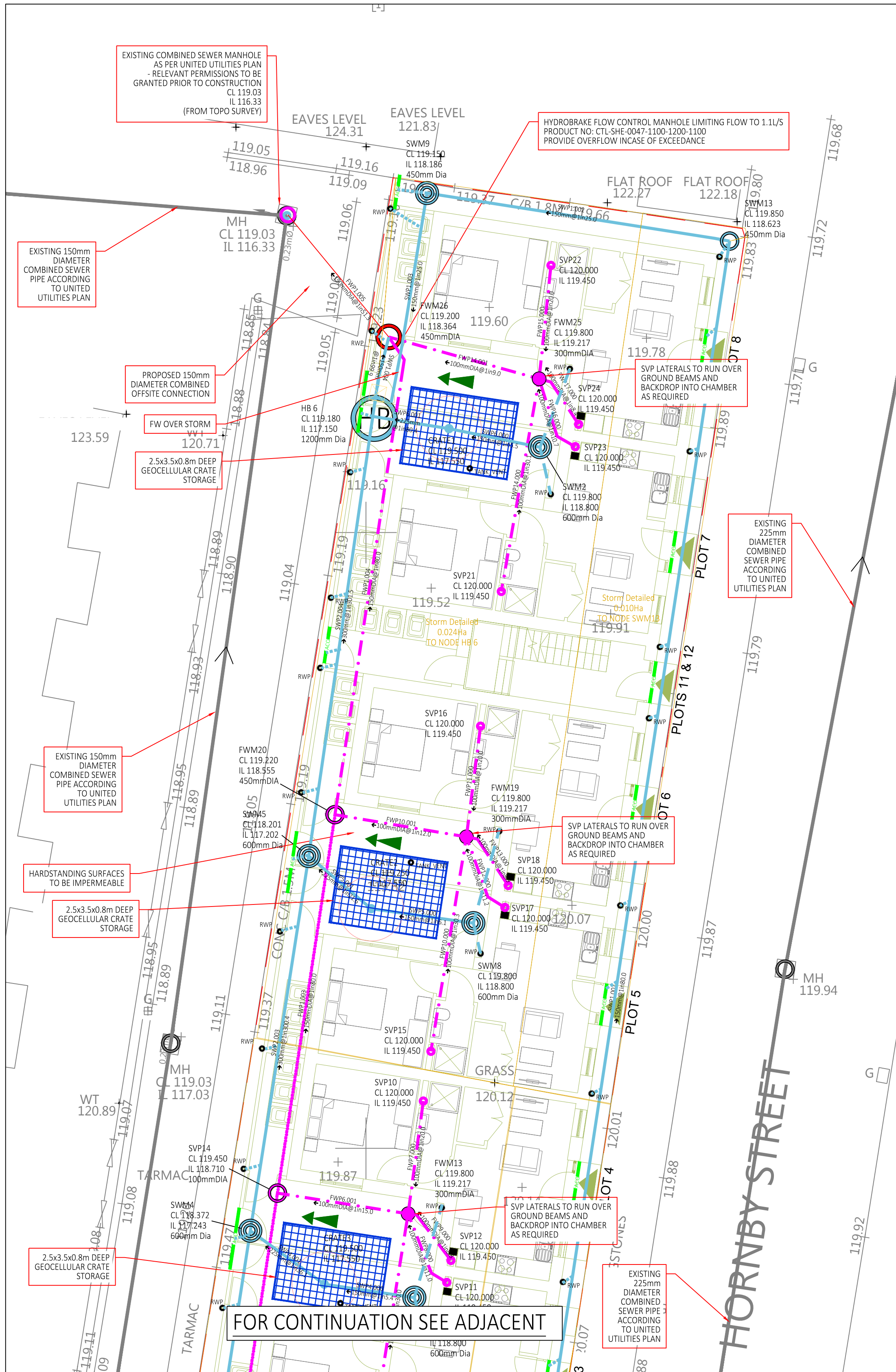
1100 litre bin
(bin store
serves 2
dwellings)



APPENDIX B – DRAINAGE STRATEGY

NOTES

- This drawing shall be read in conjunction with the civil engineering specification, and all relevant Architect's and Engineer's drawings.
- This document must not be altered, reproduced or distributed without prior written consent of the originator.
- Do not scale from this document – use figured dimensions only. All dimensions must be checked on site prior to commencement of any related works.
- Contractor to provide and have an approved method statement prior to works.
- All setting out to be in accordance with the Architects drawings. Any discrepancies between QED Structures and the Architects drawings to be referred to the Architect before proceeding. Dimensions must not be scaled.
- All levels are in metres above ordnance datum.
- The Contractor is to comply full with CDM regulations in the course of constructing the works.
- At the commencement of the works, the Contractor is to carry out trial pits and liaise with utility companies in order to establish the exact position of all existing utility plant in the vicinity of the works and take adequate precautions for their protection.
- The Contractor is to refer to Health and Safety Executive 'Note 47 – Avoiding Danger from Underground Services' and 'Document C56 – Avoiding Danger from Overhead Electric Lines.'
- Works on or adjacent to existing public highway will be executed in accordance with the Traffic Safety Code for Road Works and Traffic Signs Manual: Chapter 8.
- The Contractor will ascertain the CBR value of the subgrade in order to determine the required sub-base / capping thickness. Prior to laying any material, the subgrade must be inspected and any soft spots removed and filled with 6F2 capping material.
- Prior to the construction of any drainage works, the Contractor is to confirm the invert levels of existing manholes, drains and sewers. Any variations from the designed levels shown on the drawings must be reported to the Drainage Engineer in advance of construction works commencing. All new sewers and drains are to be laid in sequence starting from the outfall location.
- All drainage to be installed in accordance with relevant Building Regulation documents and current Sewers for Adoption. Connections to public sewers are to be agreed and inspection by the Water Authority.
- All drain and sewer pipes are Ø100mm and laid soffit to soffit, unless shown otherwise.
- Invert to base of soil stack bends to be 450mm below lowest branch connection for up to three storey buildings; for buildings up to five storeys, the invert to the base of soil stack bends should not be less than 750mm. All foul and surface water drainage stacks are to have above ground rodding access. Refer to above ground drainage layout(s) by others.
- All below ground connections are to match above ground outlet size, minimum Ø100mm. SVPs are to project 100mm above finished floor level.
- All internal manholes and inspection chambers to have double sealed recessed covers to suit floor finishes as defined by the Architect.
- All external covers in non-asphalt areas are to have recessed covers to suit the paving material.
- A CCTV survey and report in WINCAN format for all new drainage will be required prior to 'as built' drawing being issued.
- The Contractor is responsible for the traffic safety and management associated with the construction of the works. Works will not commence on the existing highway until their traffic management proposals have been agreed with Highway Authority.
- Where the works involve the obstruction of a footway, the Contractor will provide an alternative safe footway properly signed, guarded and lit.
- Where one-way traffic is unavoidable, traffic will be controlled by a proper system of vehicle-actuated traffic signals or manual stop / go signs and during the hours of darkness, by a proper system of vehicle-actuated traffic signals, all to the approval of Highway Authority.
- 65mm Minimum thickness tactile paving, coloured buff will be incorporated at all pedestrian crossings in accordance with the Department for Transport and Regions document "Guidance on the Use of Tactile Paving Surfaces." (DETR No. 1998)
- All signs and road markings will be in accordance with the "Traffic Signs Regulations and General Directions 2016". (TSRD 2016)
- All excavation and backfilling work in the existing highway to be in accordance with the provisions of the New Street Works Act 1991 or that specified on the working drawings.
- All highways works to be carried out in accordance with Highway Authority's highway standards, to the satisfaction of the Highway Authority Section 278 Inspector and in accordance with the Specification for Highway Works.
- Gullies, gully connections, drains, manholes, catch pit, soakaways, headwalls and other drainage structures intended to convey only highway water are to be constructed in accordance with the specification of Highway Authority and to the satisfaction of the Highway Inspector.
- Where existing junctions and accesses are to remain in operation within the works during the construction process, the Contractor will ensure that access to these units remains available at all times.
- Highways in the vicinity of the works must be kept free from mud, debris and dust falling from vehicles or wheels of vehicles connected with the works. Where the deposits of debris and mud are unavoidable, warning signs must be displayed whilst work is in progress and affected carriageways / footways must be regularly cleaned.



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 - ALL DIMENSIONS ARE TO BE CHECKED ON SITE, ANY DISCREPANCIES RE TO BE REPORTED IMMEDIATELY TO QED STRUCTURES FOR CLARIFICATION BEFORE THE AFFECTED WORK COMMENCES.
 - THE CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY WORKS AND FOR THE STABILITY OF THE WORKS IN PROGRESS

LEGEND	
	PROPOSED CATCHPIT MANHOLE
	PROPOSED TYPE D SW INSPECTION CHAMBER
	PROPOSED TYPE E SW INSPECTION CHAMBER
	PROPOSED TYPE D FW INSPECTION CHAMBER
	PROPOSED TYPE E FW INSPECTION CHAMBER
	PROPOSED HYDROBRAKE MANHOLE
	HARD SURFACE CATCHMENT AREAS - 100% IMPERMEABLE
	CHANNEL DRAIN WITH TRAPPED OUTLET
	TANK VENT - EXACT LOCATION TBC
	PROPOSED SW PIPE RUN
	PROPOSED COMBINED DRAIN
	PROPOSED FW PIPE RUN
	EXISTING PRIVATE COMBINED RUN - RETAINED

PO1	Stage 4 issued for information	09/02/24		
REV	DESCRIPTION	DATE	BY	APP

CONSULTING CIVIL AND
STRUCTURAL ENGINEERS
TEL +44 (0) 1273 033680

QED PROJECT No.
23-510

CLIENT
Cornerstone Place

PROJECT
Hornby Street
Heywood
OL10 1BH

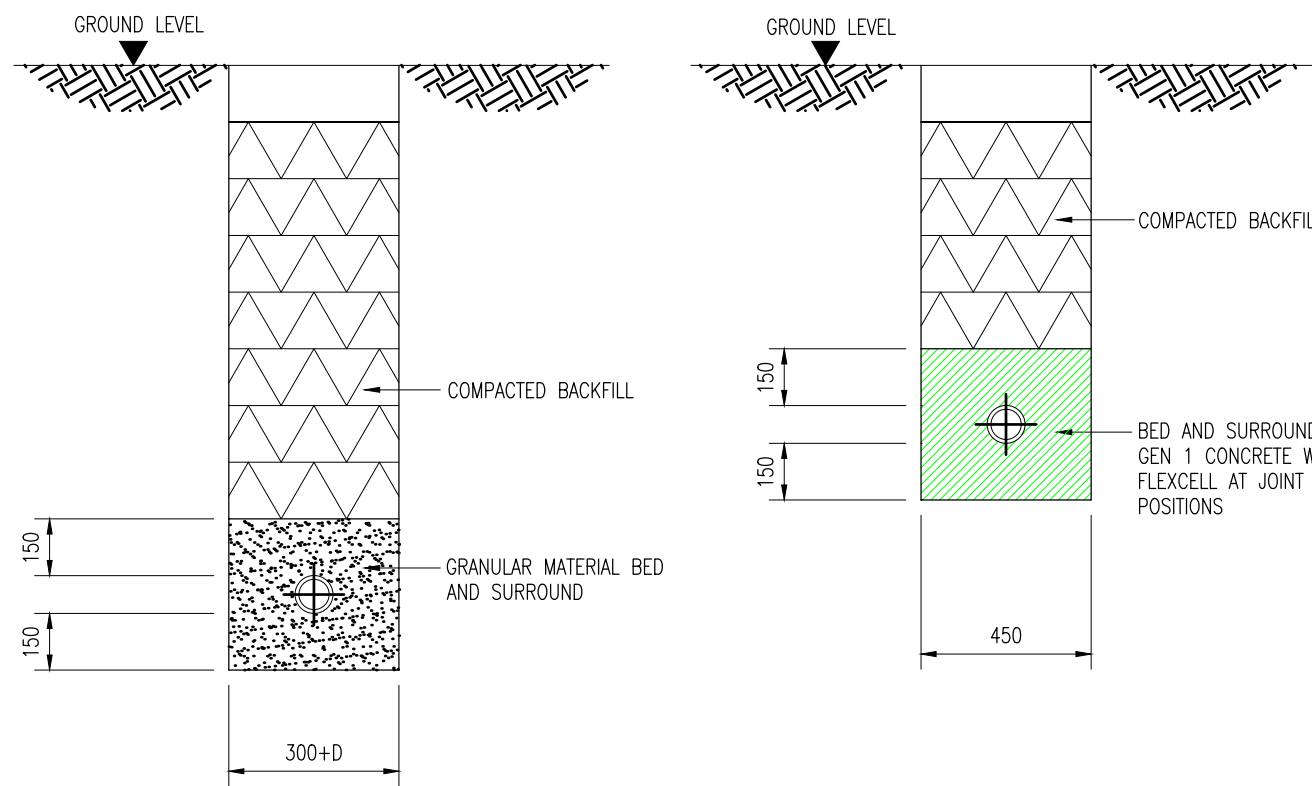
TITLE
SITE PLAN
DRAINAGE LAYOUT

DRAWN MN	ENGINEER MN	CHECKED BY MN	APPROVED BY MN
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DATE APPROVED 09/02/24 SCALE @ A1 1:100

STATUS
S3 - Suitable for Review and Comment

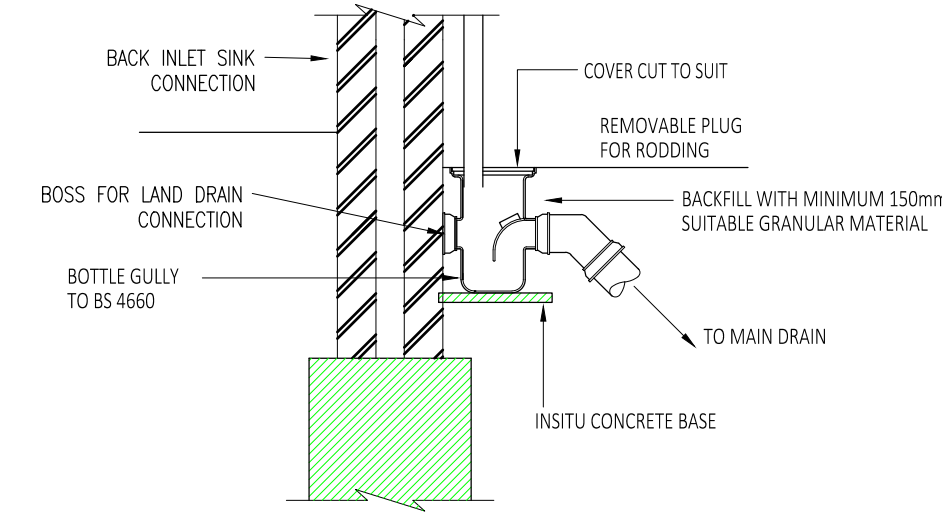
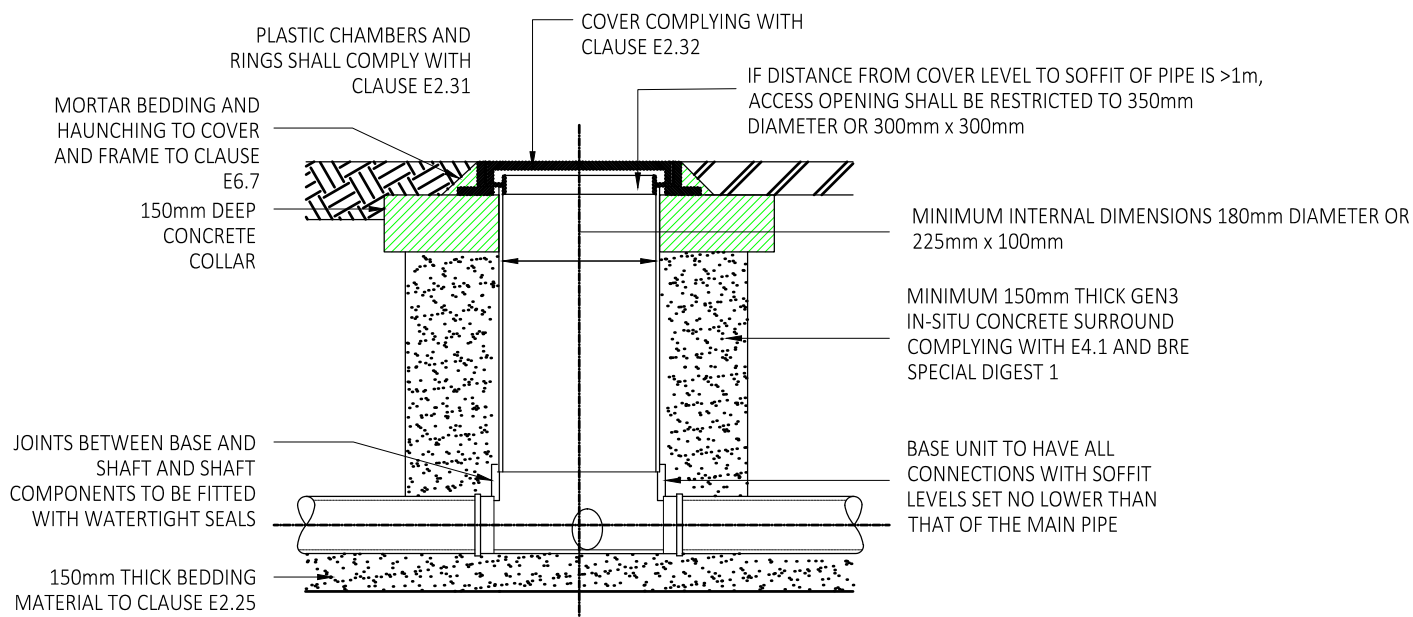
DRAWING No. 23-510-QED-XX-XX-DR-C-200	REVISION P01
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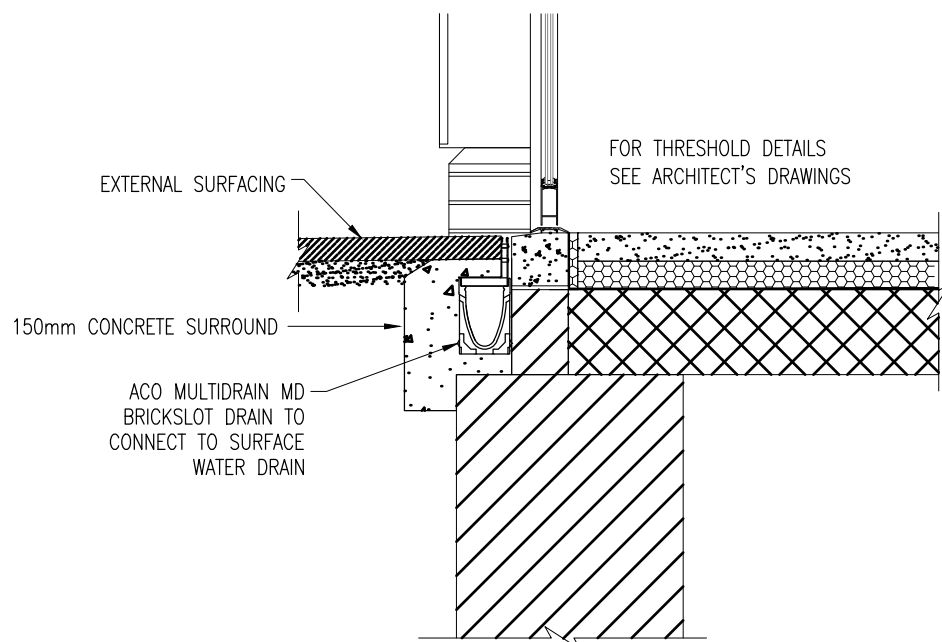
GRANULAR BEDDING
DETAIL.
(WHERE COVER >600mm)

CONCRETE BEDDING
DETAIL.
(WHERE COVER <600mm)

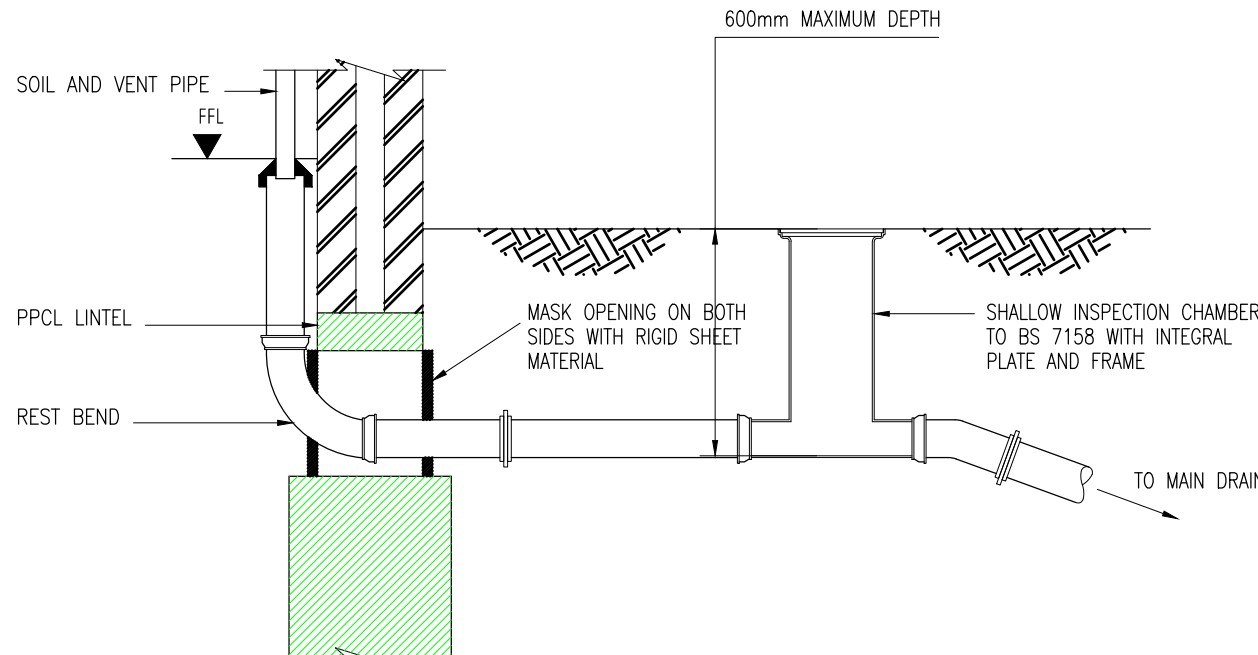
NOTE
ALL BACKFILLING AND REINSTATEMENT WITHIN ROADS AND STREETS TO BE
IN ACCORDANCE WITH THE HIGHWAY AUTHORITY AND HAUC SPECIFICATION.



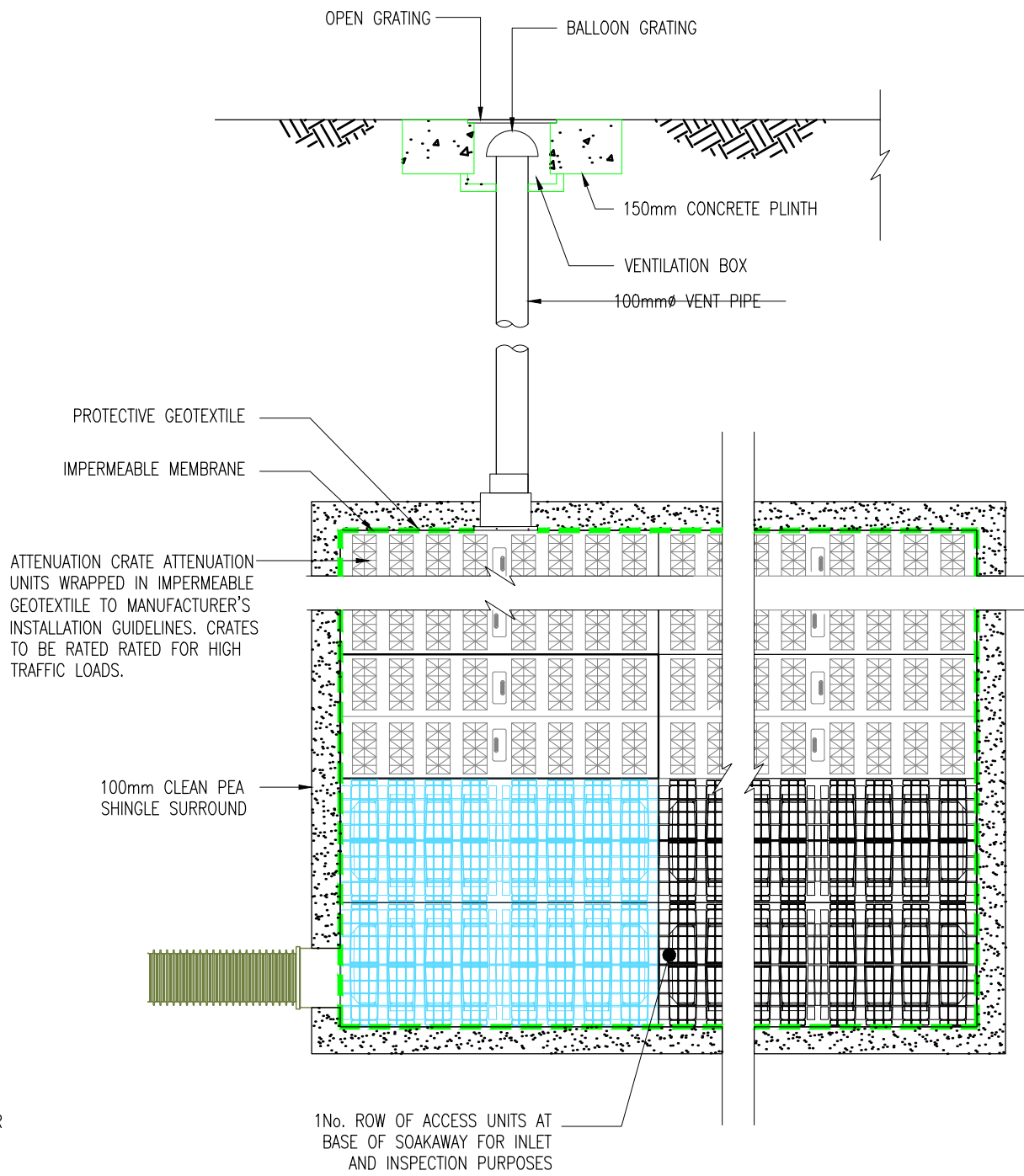
TRAPPED RWP CONNECTION.



ACO BRICKSLOT DRAIN.
(AT THRESHOLD)



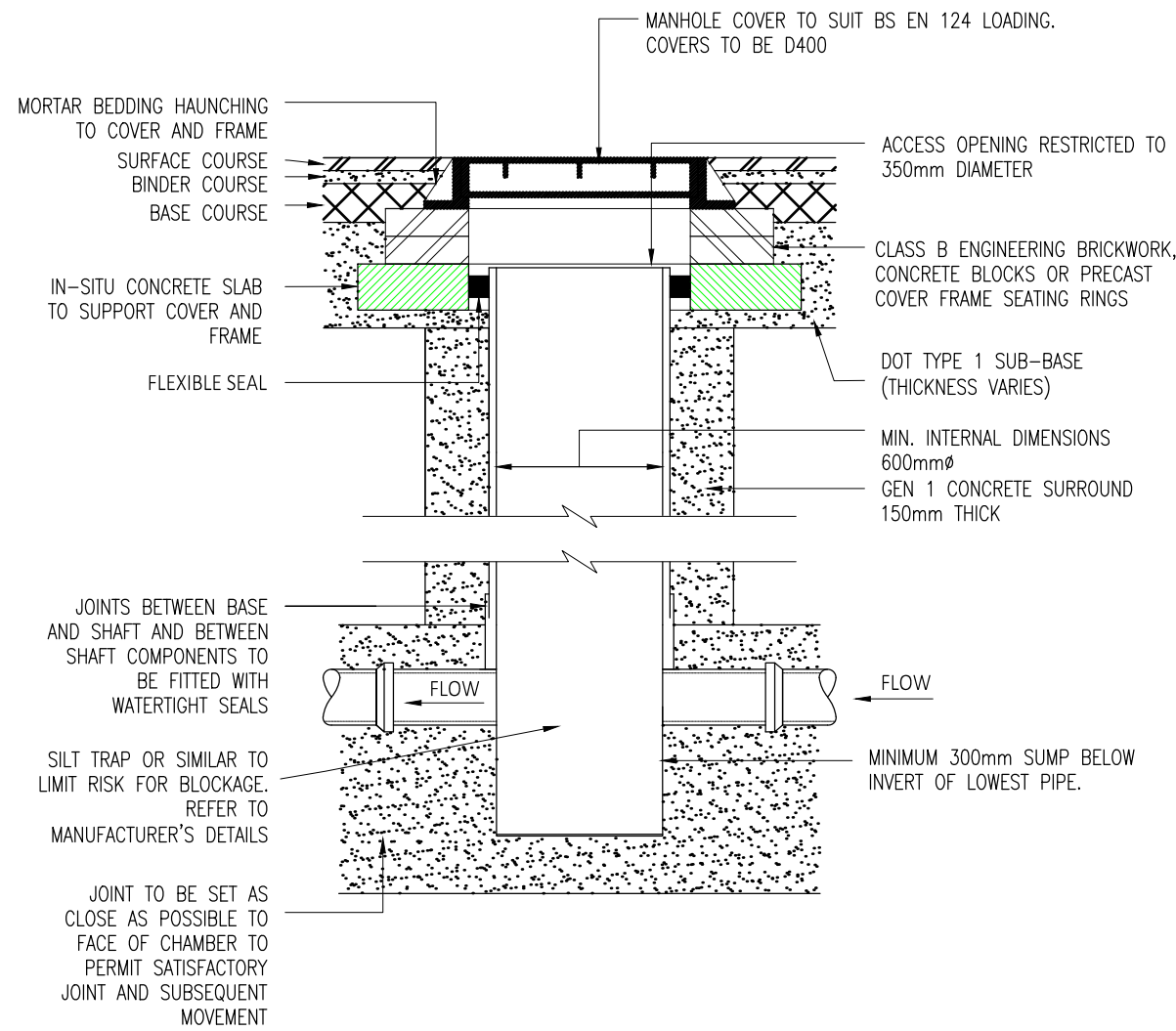
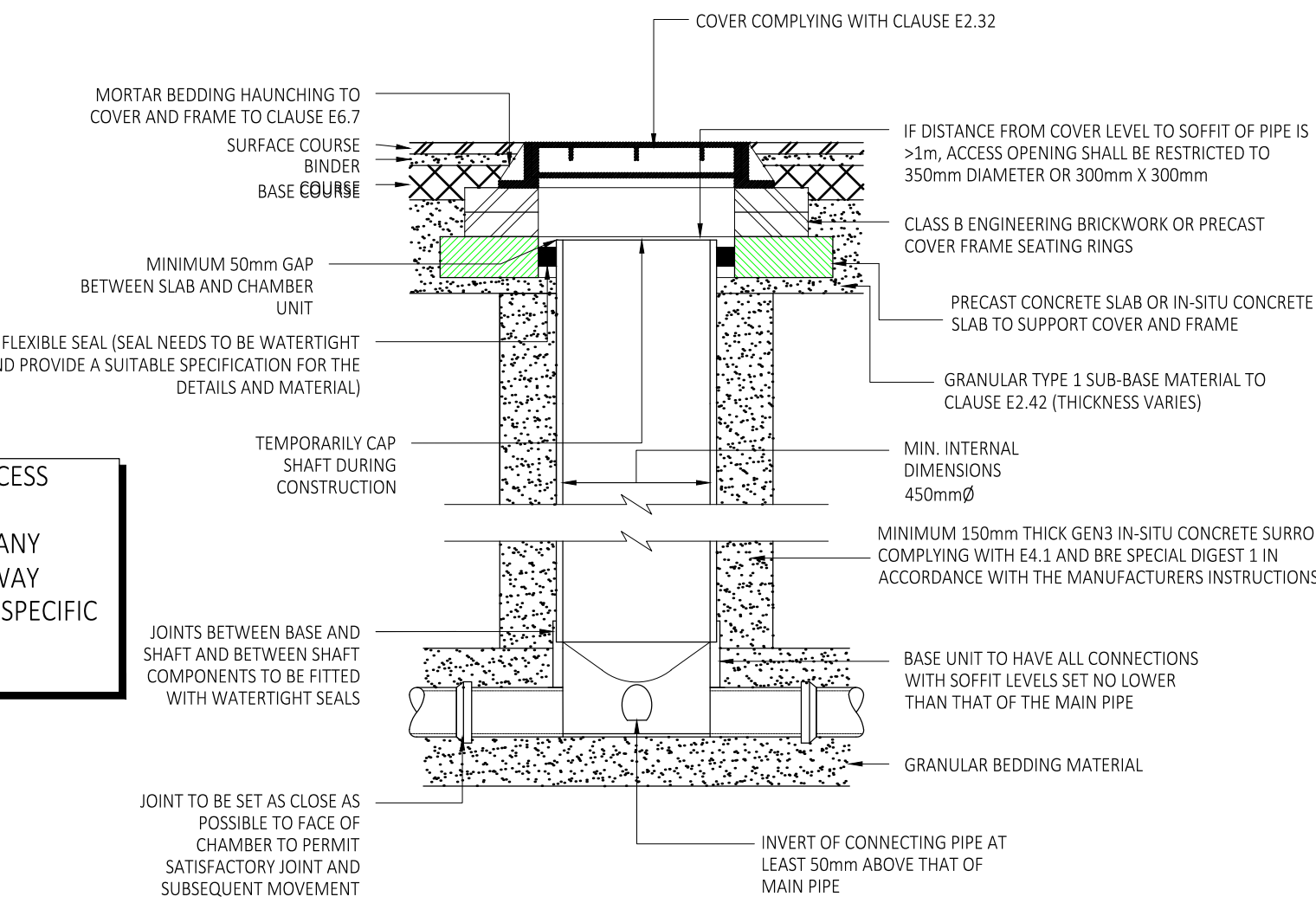
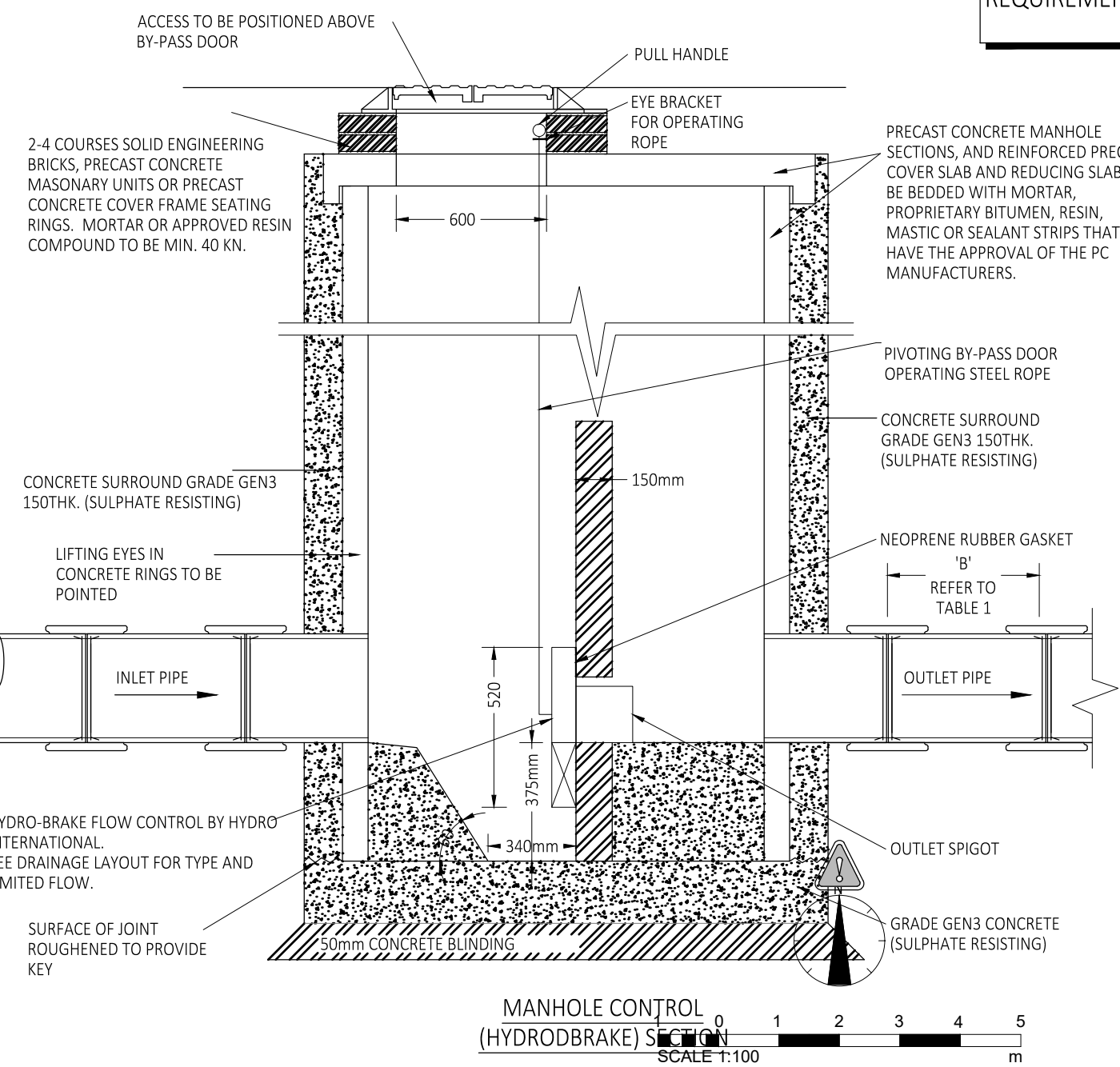
FOUL CONNECTION TO MAIN DRAINAGE.



ATTENUATION TANK
DETAIL.

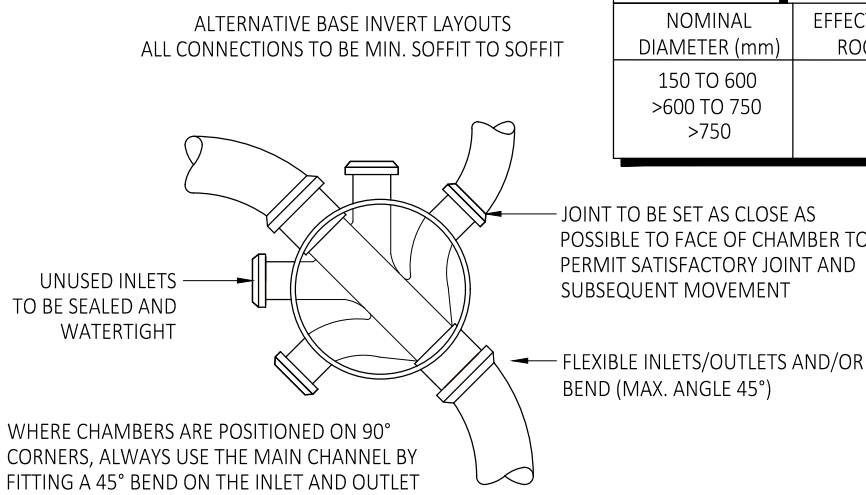
TYPE E TYPICAL INSPECTION CHAMBER DETAIL -
FLEXIBLE MATERIAL
(DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE UP TO 2m)

NOTE - WHERE THE ACCESS
CHAMBER IS IN THE
HIGHWAY(INCLUDING ANY
FOOTWAY), THE HIGHWAY
AUTHORITY CAN HAVE SPECIFIC
REQUIREMENTS



CATCHPIT INSPECTION CHAMBER.
(ACCESSO AICCP600B FOR 225/300 PIPES
600Ø CATCHPIT MANHOLE OR SIMILAR),
MAX. DEPTH 3m, NON-ENTRY)

TABLE 1	
NOMINAL DIAMETER (mm)	EFFECTIVE LENGTH OF ROCKER PIPE (m)
150 TO 600	0.6
>600 TO 750	1.0
>750	1.2



TYPE D INSPECTION CHAMBER DETAIL - FLEXIBLE
MATERIAL.

(FOR USE IN AREAS SUBJECT TO VEHICLE LOADING,
DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE UP TO 3M)

TYPE 3&4 CHAMBER TYPES, SIZES AND DEPTH				
MAX INVERT DEPTH (m)	0.6 - 2.01	0.6 - 2.01	1.2 - 3.02	1.2 - 3.02
BASE/SHAFT DIA (mm)	200	315	450	600
SFA7 TYPE	4	4	3-4	3-4
NO OF INLETS 1	Y	Y	Y	Y
1 TO 3	-	Y	Y	Y
4 TO 6	-	-	Y	-
INLET SIZES (mm)	110/160	110/160	110/160	150/225/300
MAX DEPTH (mm)	600	600	1200	3000
FOR DEPTH GREATER THAN 1200mm RESTRICT ACCESS TO 450mm DIAMETER				

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PO1	Stage 4 issued for information	09/02/24		
REV	DESCRIPTION	DATE	BY	APP

QED structures CONSULTING CIVIL AND STRUCTURAL ENGINEERS
TEL +44 (0) 1273 033680

QED PROJECT No.
23-510

CLIENT
Cornerstone Place

PROJECT
Hornby Street
Heywood
OL10 1BH

TITLE
DRAINAGE DETAILS

DRAWN MN	ENGINEER MN	CHECKED BY MN	APPROVED BY MN
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DATE APPROVED 09/02/24 SCALE @ A1 1:100

STATUS
S3 - Suitable for Review and Comment

DRAWING No. 23-510-QED-XX-XX-DR-C-210	REVISION P01
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APPENDIX C – CALCULATIONS



Design Settings

Rainfall Methodology	FEH-22	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	0.600
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	✓
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	x
CV	0.750	Connection Type	Level Soffits		
Time of Entry (mins)	4.00	Minimum Backdrop Height (m)	0.200		

SW Standard Link Type

Shape Circular | Barrels 1 | Auto Increment (mm) 75 | Follow Ground x

Available Diameters (mm)

100 | 150

Nodes

	Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
✓	1	0.027	4.00	119.720	600	1.220
✓	5			119.200	600	1.998
✓	HB 6	0.024	4.00	119.180	1200	2.030
✓	6_OUT			119.030		1.932
✓	3			119.550	600	2.257
✓	4			119.500	600	2.257
✓	2		4.00	119.800	600	1.000
✓	CRATE1			119.500		1.950
✓	8		4.00	119.800	600	1.000
✓	CRATE2			119.250		1.700
✓	10		4.00	119.800	600	1.000
✓	CRATE3			119.500		1.950
✓	12		4.00	119.800	600	1.000

Nodes

	Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
✓	CRATE4			119.500		1.950
✓	6	0.010	4.00	120.000	450	0.750
✓	9			119.150	450	0.964
✓	13	0.010	4.00	119.850	450	1.227

Links

	Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
?	1.000	6	13	50.170	0.600	119.250	118.623	0.627	80.0	150	4.74	50.0
?	1.001	13	9	10.931	0.600	118.623	118.186	0.437	25.0	150	4.83	50.0
?	1.002	9	HB 6	6.193	0.600	118.186	117.938	0.248	25.0	150	4.88	50.0
?	2.000	1	3	7.177	0.600	118.500	118.468	0.032	224.3	225	4.14	50.0
?	3.000	12	CRATE4	2.896	0.600	118.800	118.250	0.550	5.3	150	4.01	50.0
?	3.001	CRATE4	3	3.096	0.600	117.550	117.518	0.032	96.7	225	4.05	50.0
?	2.001	3	4	15.061	0.600	117.293	117.243	0.050	301.2	300	4.42	50.0
?	4.000	10	CRATE3	2.959	0.600	118.800	118.250	0.550	5.4	150	4.01	50.0
?	4.001	CRATE3	4	2.964	0.600	117.550	117.468	0.082	36.1	225	4.03	50.0

	Name	US Node	DS Node	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
	1.000	6	13	1.125	19.9	1.4	0.600	1.077	0.010	0.0	27	0.654
	1.001	13	9	2.021	35.7	2.7	1.077	0.814	0.020	0.0	28	1.194
	1.002	9	HB 6	2.023	35.7	2.7	0.814	1.092	0.020	0.0	28	1.195
	2.000	1	3	0.869	34.5	3.7	0.995	0.857	0.027	0.0	50	0.570
	3.000	12	CRATE4	4.421	78.1	0.0	0.850	1.100	0.000	0.0	0	0.000
	3.001	CRATE4	3	1.329	52.8	0.0	1.725	1.807	0.000	0.0	0	0.000
	2.001	3	4	0.900	63.7	3.7	1.957	1.957	0.027	0.0	48	0.492
	4.000	10	CRATE3	4.373	77.3	0.0	0.850	1.100	0.000	0.0	0	0.000
	4.001	CRATE3	4	2.183	86.8	0.0	1.725	1.807	0.000	0.0	0	0.000

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)
?	2.002	4	5	12.318	0.600	117.243	117.202	0.041	300.4	300	4.64	50.0
?	5.000	8	CRATE2	3.354	0.600	118.800	118.250	0.550	6.1	150	4.01	50.0
?	5.001	CRATE2	5	2.652	0.600	117.550	117.427	0.123	21.6	225	4.03	50.0
?	2.003	5	HB 6	15.677	0.600	117.202	117.150	0.052	301.5	300	4.93	50.0
?	6.000	2	CRATE1	3.019	0.600	118.800	118.250	0.550	5.5	150	4.01	50.0
?	6.001	CRATE1	HB 6	2.814	0.600	117.550	117.515	0.035	80.4	225	4.04	50.0
?	1.003	HB 6	6_OUT	5.193	0.600	117.150	117.098	0.052	99.9	150	5.02	50.0

	Name	US Node	DS Node	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)
	2.002	4	5	0.902	63.7	3.7	1.957	1.698	0.027	0.0	48	0.493
	5.000	8	CRATE2	4.107	72.6	0.0	0.850	0.850	0.000	0.0	0	0.000
	5.001	CRATE2	5	2.830	112.5	0.0	1.475	1.548	0.000	0.0	0	0.000
	2.003	5	HB 6	0.900	63.6	3.7	1.698	1.730	0.027	0.0	48	0.492
	6.000	2	CRATE1	4.329	76.5	0.0	0.850	1.100	0.000	0.0	0	0.000
	6.001	CRATE1	HB 6	1.459	58.0	0.0	1.725	1.440	0.000	0.0	0	0.000
	1.003	HB 6	6_OUT	1.005	17.8	9.6	1.880	1.782	0.071	0.0	79	1.026

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	50.170	80.0	150	SW_Standard	120.000	119.250	0.600	119.850	118.623	1.077
1.001	10.931	25.0	150	SW_Standard	119.850	118.623	1.077	119.150	118.186	0.814
1.002	6.193	25.0	150	SW_Standard	119.150	118.186	0.814	119.180	117.938	1.092
2.000	7.177	224.3	225	SW_Standard	119.720	118.500	0.995	119.550	118.468	0.857
3.000	2.896	5.3	150	SW_Standard	119.800	118.800	0.850	119.500	118.250	1.100
3.001	3.096	96.7	225	SW_Standard	119.500	117.550	1.725	119.550	117.518	1.807
2.001	15.061	301.2	300	SW_Standard	119.550	117.293	1.957	119.500	117.243	1.957
4.000	2.959	5.4	150	SW_Standard	119.800	118.800	0.850	119.500	118.250	1.100
4.001	2.964	36.1	225	SW_Standard	119.500	117.550	1.725	119.500	117.468	1.807
2.002	12.318	300.4	300	SW_Standard	119.500	117.243	1.957	119.200	117.202	1.698
5.000	3.354	6.1	150	SW_Standard	119.800	118.800	0.850	119.250	118.250	0.850
5.001	2.652	21.6	225	SW_Standard	119.250	117.550	1.475	119.200	117.427	1.548
2.003	15.677	301.5	300	SW_Standard	119.200	117.202	1.698	119.180	117.150	1.730
6.000	3.019	5.5	150	SW_Standard	119.800	118.800	0.850	119.500	118.250	1.100
6.001	2.814	80.4	225	SW_Standard	119.500	117.550	1.725	119.180	117.515	1.440

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	6	450	Manhole	SW_Standard	13	450	Manhole	SW_Standard
1.001	13	450	Manhole	SW_Standard	9	450	Manhole	SW_Standard
1.002	9	450	Manhole	SW_Standard	HB 6	1200	Manhole	SW_HB
2.000	1	600	Manhole	SW_Standard	3	600	Manhole	SW_Standard
3.000	12	600	Manhole	SW_Standard	CRATE4		Junction	
3.001	CRATE4		Junction		3	600	Manhole	SW_Standard
2.001	3	600	Manhole	SW_Standard	4	600	Manhole	SW_Standard
4.000	10	600	Manhole	SW_Standard	CRATE3		Junction	
4.001	CRATE3		Junction		4	600	Manhole	SW_Standard
2.002	4	600	Manhole	SW_Standard	5	600	Manhole	SW_Standard
5.000	8	600	Manhole	SW_Standard	CRATE2		Junction	
5.001	CRATE2		Junction		5	600	Manhole	SW_Standard
2.003	5	600	Manhole	SW_Standard	HB 6	1200	Manhole	SW_HB
6.000	2	600	Manhole	SW_Standard	CRATE1		Junction	
6.001	CRATE1		Junction		HB 6	1200	Manhole	SW_HB



Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.003	5.193	99.9	150	SW_Standard	119.180	117.150	1.880	119.030	117.098	1.782

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.003	HB 6	1200	Manhole	SW_HB	6_OUT		Junction	

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	1440	Check Discharge Volume	x

Storm Durations

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

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

Node HB 6 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	1.003	Sump Available	✓
Replaces Downstream Link	✓	Product Number	CTL-SHE-0047-1100-1200-1100
Invert Level (m)	117.150	Min Outlet Diameter (m)	0.075
Design Depth (m)	1.200	Min Node Diameter (mm)	1200
Design Flow (l/s)	1.1		

Node CRATE1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	117.550
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	316

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	8.7	0.0	0.800	8.7	0.0	0.801	0.0	0.0

Node CRATE4 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	117.550
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	320

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	8.7	0.0	0.800	8.7	0.0	0.801	0.0	0.0

Node CRATE3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	117.550
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	320

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	8.7	0.0	0.800	8.7	0.0	0.801	0.0	0.0

Node CRATE2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	117.550
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	316

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	8.7	0.0	0.800	8.7	0.0	0.801	0.0	0.0

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.83%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	118.620	0.120	16.8	0.0339	0.0000	OK
240 minute winter	5	228	118.444	1.242	2.4	0.3514	0.0000	SURCHARGED
240 minute winter	HB 6	228	118.445	1.295	5.3	1.4647	0.0000	SURCHARGED
15 minute summer	6_OUT	1	117.098	0.000	0.9	0.0000	0.0000	OK
240 minute winter	3	232	118.451	1.158	3.3	0.3276	0.0000	SURCHARGED
240 minute winter	4	232	118.454	1.211	2.9	0.3428	0.0000	SURCHARGED
15 minute summer	2	1	118.800	0.000	0.0	0.0000	0.0000	OK
240 minute winter	CRATE1	228	118.444	0.894	1.9	6.6161	0.0000	SURCHARGED
15 minute summer	8	1	118.800	0.000	0.0	0.0000	0.0000	OK
240 minute winter	CRATE2	232	118.449	0.899	1.7	6.6161	0.0000	SURCHARGED
15 minute summer	10	1	118.800	0.000	0.0	0.0000	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	2.000	3	16.8	0.838	0.486	0.1439	
240 minute winter	5	2.003	HB 6	-2.4	0.073	-0.038	1.1040	
240 minute winter	HB 6	Hydro-Brake®	6_OUT	1.1				48.9
240 minute winter	3	2.001	4	2.1	0.290	0.033	1.0606	
240 minute winter	4	2.002	5	-2.7	0.266	-0.042	0.8674	
15 minute summer	2	6.000	CRATE1	0.0	0.000	0.000	0.0000	
240 minute winter	CRATE1	6.001	HB 6	2.1	-0.201	0.037	0.1119	
15 minute summer	8	5.000	CRATE2	0.0	0.000	0.000	0.0000	
240 minute winter	CRATE2	5.001	5	2.0	0.150	0.018	0.1055	
15 minute summer	10	4.000	CRATE3	0.0	0.000	0.000	0.0000	

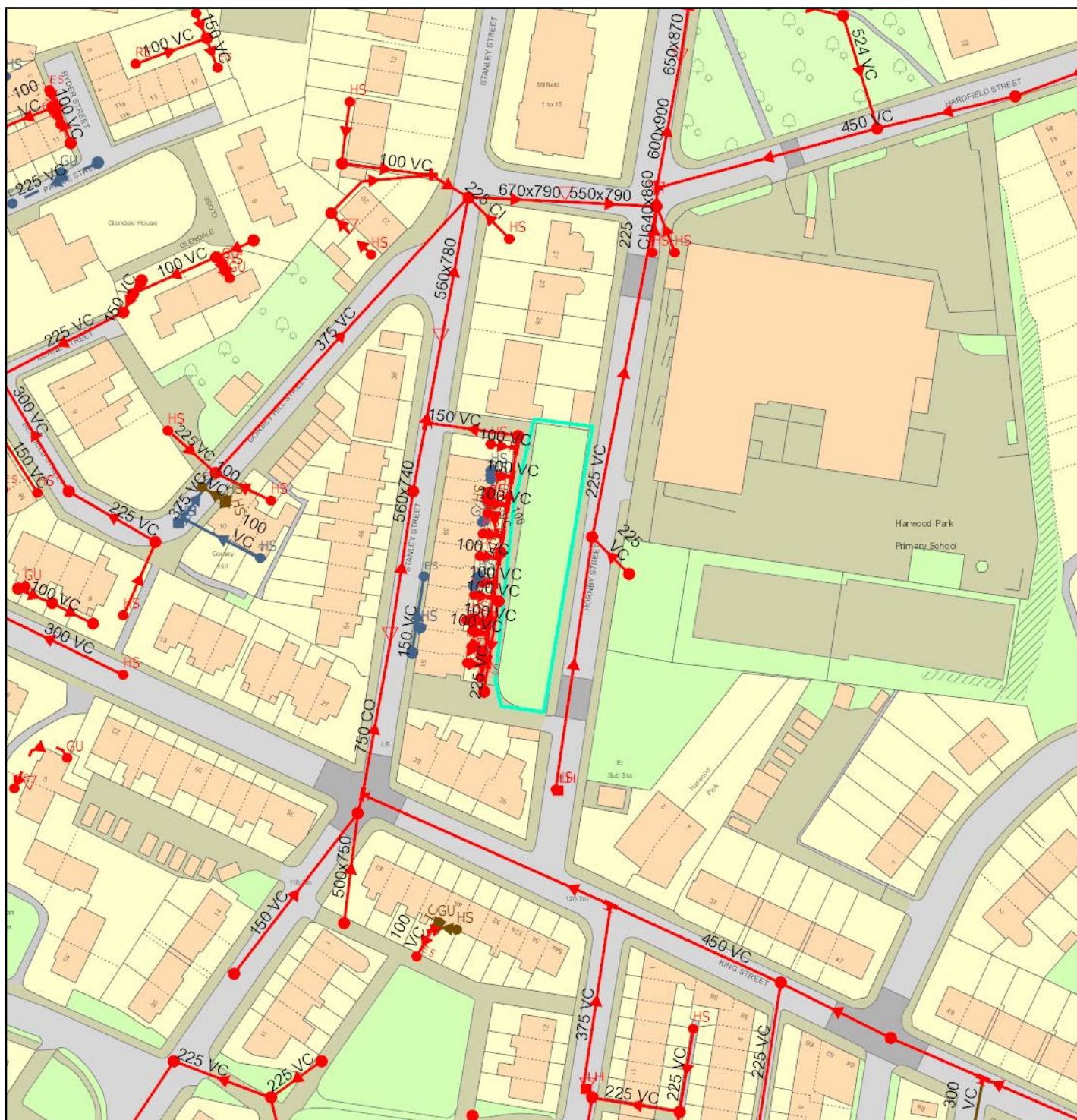
Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.83%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	CRATE3	232	118.445	0.895	1.8	6.6161	0.0000	SURCHARGED
15 minute summer	12	1	118.800	0.000	0.0	0.0000	0.0000	OK
240 minute winter	CRATE4	232	118.451	0.901	1.8	6.6161	0.0000	SURCHARGED
15 minute winter	6	10	119.309	0.059	6.5	0.0094	0.0000	OK
240 minute winter	9	228	118.446	0.259	2.5	0.0413	0.0000	SURCHARGED
15 minute winter	13	10	118.687	0.064	12.5	0.0102	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)
240 minute winter	CRATE3	4.001	4	-1.8	-0.133	-0.021	0.1179	
15 minute summer	12	3.000	CRATE4	0.0	0.000	0.000	0.0000	
240 minute winter	CRATE4	3.001	3	-1.8	-0.212	-0.034	0.1231	
15 minute winter	6	1.000	13	6.5	0.957	0.326	0.3401	
240 minute winter	9	1.002	HB 6	2.5	1.135	0.070	0.1090	
15 minute winter	13	1.001	9	12.5	1.676	0.349	0.0812	



APPENDIX D – SEWER RECORDS

Land at Hornby Street



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