FLOOD RISK ASSESSMENT

AND

DRAINAGE STRATEGY

for

PRINGLE HOMES

PROPOSED RESIDENTIAL DEVELOPMENT

on

LAND EAST OF CLITHEROE ROAD, WHALLEY

JULY 2026

REFORD

Consulting Engineers Limited

Hindley Fallows, Midgery Lane, Fulwood, Preston, PR2 9SX

Mobile: 07970 265334 Email: refordcel@hotmail.com

Company number: 09620365 VAT Reg. 215 5638 12

CONTENTS

1. INTRODUCTION

1.1 This flood risk assessment and drainage strategy has been produced on behalf of Pringle Homes in support of a planning application for a proposed residential development on Land East of Clitheroe Road, Whalley. A location plan is included within Appendix A.

1.2 The Flood Risk Assessment (FRA) is compliant with the requirements set out in the National Planning Policy Framework (NPPF) and the Planning Practice Guidance (NPPG) in relation to Flood Risk and Coastal Change, and describes the existing site conditions and proposed development. It assesses the potential sources of flooding to the site from tidal, fluvial, groundwater, surface water and other sources, taking a risk based approach in accordance with National Policy.

1.3 The drainage strategy describes the existing site conditions and proposed development. It assesses the potential impact of proposals on existing drainage and includes a proposed strategy for the provision of new drainage to serve the development.

Site summary

Site Name	Land East of Clitheroe Road
Location	Whalley
NGR (approx.)	SD736371
Application site area	3.42 ha approx.
Development type	Residential
Vulnerability	More Vulnerable
Indicative Flood Zone	Flood Zone 1
Local Planning Authority	Ribble Valley Borough Council

2. DESCRIPTION OF THE SITE

Existing site

2.1 The proposal relates to land (3.42 hectares approx.) at Clitheroe Road, Whalley.

2.2 The site lies to the north of the centre of Whalley. Clitheroe Road lies along the site's western boundary. The A59 lies along the site's northern boundary on embankment. Residential development lies to the south of the development site.

2.3 A watercourse lies within the northeastern part of the site. The watercourse flows to the west, under the A59 and Clitheroe Road, and reappears in open ditch on the western side of Clitheroe Road approx. 110m from the northwestern corner of the site. The watercourse ultimately discharges into the River Ribble.

2.4 An ordinary watercourse lies along the southern side of Wiswell Lane, approx. 170m to the south of the site, and flows to the south.

2.5 The site comprises grassland.

2.6 Access to the site is from Clitheroe Road.

2.7 The site has a fall from the eastern and southern boundaries to the northwestern part of the site.

Proposed development site

2.8 It is proposed that the development is for a residential development to comprise a market scheme of 39 dwellings.

3. SCOPE OF THE ASSESSMENT

Flood risk planning policy

3.1 The National Planning Policy Framework (NPPF) sets out the Government's national policies on different aspects of land use planning in England in relation to flood risk. Supporting Planning Practice Guidance is also available.

3.2 The NPPF sets out the vulnerability to flooding of different land uses. It encourages development to be located away from areas at highest risk (whether existing or future), and states that where development is necessary in such areas, the development should be made safe for its lifetime. It also stresses the importance of preventing increases in flood risk offsite to the wider catchment area.

3.3 The NPPF also states that alternative sources of flooding, other than fluvial (river flooding), should also be considered when preparing a Flood Risk Assessment.

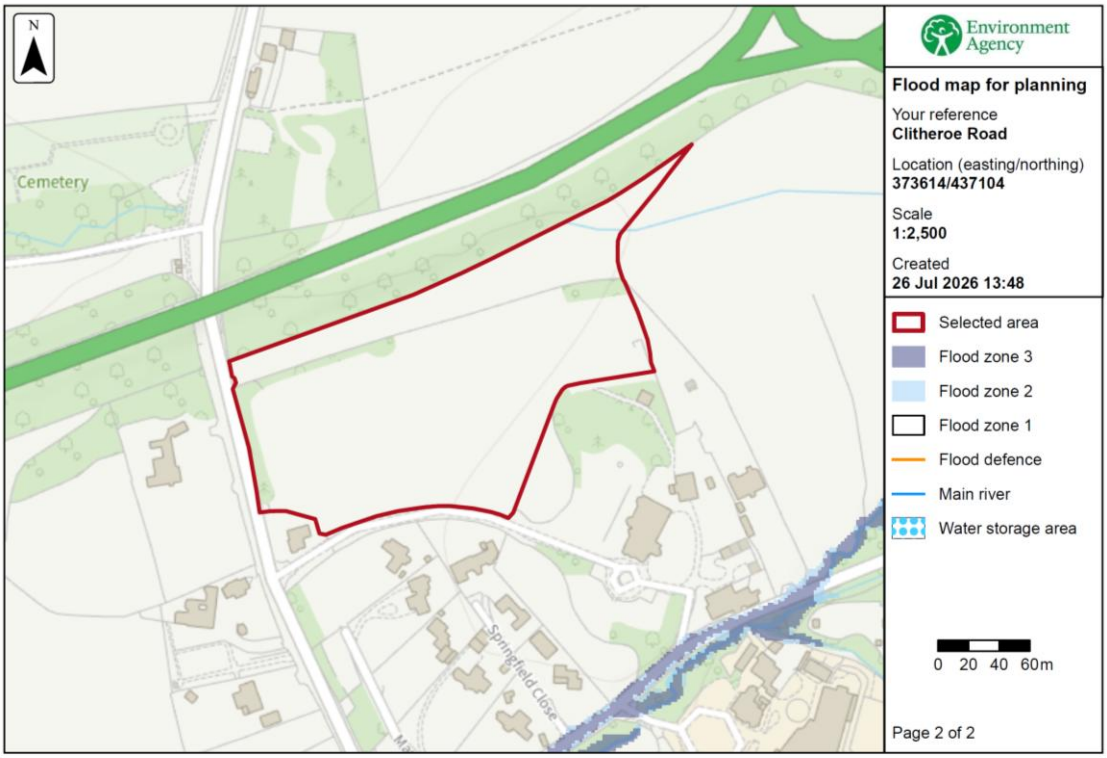
3.4 As set out in NPPF, local planning authorities should only consider development in flood risk areas appropriate where informed by a site specific Flood Risk Assessment. This document will identify and assess the risk associated with all forms of flooding to and from the development. Where necessary it will demonstrate how these flood risks will be managed so that the development remains safe throughout its lifetime, taking climate change into account.

3.5 This Flood Risk Assessment is written in accordance with the NPPF and the Planning Practice Guidance in relation to Flood Risk and Coastal Change.

Flood zones

3.6 In investigating the flood risk relating to the site, the Environment Agency's Flood Map for Planning identifies the proposed development site lies within Flood Zone 1. Flood Zone 1 is the lowest risk and is identified as land assessed as having a less than 0.1% annual probability of river or sea flooding.

3.7 An extract from the Environment Agency's Flood Map for Planning showing the approx. development site boundary is shown below.



Strategic Flood Risk Assessment

3.8 The site is within the area covered by the Ribble Valley Borough Council Strategic Flood Risk Assessment, Revised Level One Assessment, April 2017.

3.9 No reference is made to the application site within the SFRA.

Sequential Test

3.10 A requirement of NPPF is that all plans should apply a sequential, risk-based approach to the location of development, taking into account the current and future impacts of climate change so as to avoid, where possible, flood risk to people and property. The aim of the Sequential Test is to steer new development to areas with the lowest risk of flooding.

3.11 The purpose of the Sequential Test is to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed. A sequential approach should be

used in areas known to be at risk from other forms of flooding. In areas at risk of river or sea flooding, preference should be given to locating new development in Flood Zone 1. If there is no reasonably available site in Flood Zone 1, the flood vulnerability of the proposed development can be taken into account in locating development in Flood Zone 2 and then Flood Zone 3. Within each Flood Zone new development should be directed to sites at the lowest probability of flooding from all sources as indicated by the SFRA.

3.12 Strategic Flood Risk Assessments refine information on the probability of flooding, taking other sources of flooding and the impacts of climate change into account. They provide the basis for applying the Sequential Test, on the basis of the flood zones in NPPG Table 1.

3.13 The flood zones are the starting point for this sequential approach. As already stated, the Environment Agency's Flood Map for Planning identifies the site as lying within Flood Zone 1, the lowest risk.

3.14 With reference to NPPF, Environment Agency Flood Maps and the SFRA, the site lies within an area identified as being potentially developable and following the sequential approach, all of the development is located within Flood Zone 1.

3.15 The current development proposals are classified as "More Vulnerable" for residential use. Table 3 within the PPG indicates Flood Risk Vulnerability and Flood Zone 'compatibility'. Using Zone 1 and the "More Vulnerable" classification, the PPG considers that a development of this type would be deemed appropriate for development within Flood Zone 1.

3.16 Subject to the suitable assessment of flood risk, the development would be considered sequentially preferable in this location.

3.17 The Environment Agency Risk of Flooding from Surface Water map indicates a very low chance to the site from surface water flooding except along the site's northern boundary where there is a high chance.

3.18 Section 175 of the NPPF states that *"The sequential test should be used in areas known to be at risk now or in the future from any form of flooding, except in situations where a site-specific flood risk assessment demonstrates that no built development within the site boundary, including access or escape routes, land raising or other potentially vulnerable elements, would be located on an area that would be at risk of flooding from any source, now and in the future (having regard to potential changes in flood risk)."*

3.19 As there is no planned built development within the area of the site that is affected by the high chance of surface water flooding, a Sequential Test is not required.

4. CONSULTATIONS AND DATA ACQUISITIONS

Environment Agency

4.1 The Environment Agency's Flood Map for Planning confirms that the site lies within an area of Flood Zone 1, the lowest risk. There is no record of any historic flooding occurring at the site.

United Utilities

4.2 Sewer records have been obtained from United Utilities and are included within Appendix B.

4.3 There are no public sewers local to the site. The nearest public sewer is a combined sewer that lies on Clitheroe Road approx. 100m to the north of the northwestern corner of the site.

Site Investigation

4.4 The online Soilscapes Viewer has identified the site lying in a region characterised by slowly permeable seasonally wet acid loamy and clayey soils with impeded drainage.

4.5 Based upon the ground conditions identified, infiltration is unlikely to provide a viable drainage solution for surface water runoff generated by the site. Infiltration tests have therefore not been carried out.

Topographical Survey

4.6 A topographical survey of the development site has been carried out and is included within Appendix C.

4.7 The site has a fall from the eastern and southern boundaries to the northwestern part of the site.

5. SOURCES OF FLOOD RISK

5.1 Potential sources of flood risk to the site are identified below. The significance of these sources is investigated further into Section 6.

Fluvial flooding

5.2 The site to be developed is identified as lying within Flood Zone 1 on the Environment Agency's Flood Map for Planning, land assessed as having an annual probability of flooding of less than 0.1%.

5.3 A watercourse lies within the northeastern part of the site. The watercourse flows to the west, under the A59 and Clitheroe Road, and reappears in open ditch on the western side of Clitheroe Road approx. 110m from the northwestern corner of the site. The watercourse ultimately discharges into the River Ribble.

5.4 An ordinary watercourse lies along the southern side of Wiswell Lane, approx. 170m to the south of the site, and flows to the south.

Tidal flooding

5.5 The site is a significant distance from the nearest tidal estuary and is, therefore, not at risk of flooding from the sea. The site is not identified as being at risk of flooding from the sea by any Environment Agency Flood Zone maps or within the SFRA for the area. As such, coastal and tidal flooding is not considered further within this assessment.

Canals, reservoirs and other artificial sources

5.6 There are no canals or other artificial sources local to the site.

5.7 The Environment Agency risk of flooding from reservoirs map doesn't identify the site being at risk of flooding from any reservoir.

Groundwater

5.8 Groundwater flooding tends to occur after much longer periods of sustained high rainfall. The areas that are at risk tend to be those low-lying areas where the water table is shallow. Flooding tends to occur in areas that are underlain by major aquifers, although groundwater flooding is also noted in localised floodplain sands and gravels. The main causes of groundwater flooding are:

- Natural groundwater rising due to tidal influence, or exceptionally wet periods leading to rapid recharge;
- Groundwater rebound due to cessation of abstraction and mine dewatering;
- Existence of confined aquifers and springs.

Sewers

5.9 Flooding from a drainage system is often experienced during times of heavy rainfall when large amounts of surface water entering a system exceeds its discharge capacity and overwhelms the sewer network causing backing up of flood waters and flooding, which may occur within properties or discharging through manholes. Temporary problems such as blockages, siltation, collapses and equipment or operational failures and, in the case of surface water sewers, not being able to discharge due to high water level in the receiving watercourse can also result in sewer flooding.

5.10 There are no public sewers local to the site. The nearest public sewer is a combined sewer that lies on Clitheroe Road approx. 100m to the north of the northwestern corner of the site.

Pluvial runoff

5.11 The Environment Agency Risk of Flooding from Surface Water map indicates a very low chance to the site from surface water flooding except along the site's northern boundary where there is a high chance. A very low chance means that each year this area has a chance of flooding of less than 0.1%. A high chance means that this area has more than a 3.3% chance of flooding each year.

5.12 It should be noted that surface water flooding can be difficult to predict, much more so than river or sea flooding as it is hard to forecast exactly where or how much rain will fall in any storm. In addition, local features can greatly affect the chance and severity of flooding.

Development drainage

5.13 Surface water (including the risk of sewers and culverted watercourses surcharging) poses the highest risk of more frequent flooding. Surface water drainage from new developments is critical in reducing the risk of localised flooding.

5.14 If surface water runoff is not managed appropriately, there may be an increased risk presented elsewhere from development drainage, and the aim should be to implement appropriate sustainable drainage systems (SuDS) to treat and contain flows and mimic the existing conditions.

5.15 Where possible the preference for dealing with surface water runoff from the developed site is for it to infiltrate back into the ground or alternatively to a waterbody or watercourse. Only if it is not possible for either of these options is surface water from the development to be allowed into public sewers.

5.16 The introduction of the development will increase the area of impermeable hardstanding on site and therefore has the potential to alter the surface water runoff regime of the site and to have an adverse effect on flood risk elsewhere in the wider catchment.

6. FLOOD RISK ASSESSMENT

6.1 This section of the Flood Risk Assessment looks at the flood risk to the site before any mitigation measures are put into place and hence identifies where mitigation will be required. Section 7 continues to explain the mitigation measures proposed and the residual risk following implementation of any proposed mitigation.

Risk of Flooding to Proposed Development

Fluvial Flood Risk

6.2 The site is identified as lying within Flood Zone 1 on the Environment Agency's Flood Map for Planning, the lowest risk.

6.3 A watercourse lies within the northeastern part of the site. The watercourse flows to the west, under the A59 and Clitheroe Road, and reappears in open ditch on the western side of Clitheroe Road approx. 110m from the northwestern corner of the site. The watercourse ultimately discharges into the River Ribble.

6.4 An ordinary watercourse lies along the southern side of Wiswell Lane, approx. 170m to the south of the site, and flows to the south.

6.5 The Environment Agency's Flood Map for Planning shows a fluvial flood risk from the ordinary watercourse that lies along the southern side of Wiswell Lane approx. 170m to the south of the site and flows to the south, mainly along the line of the watercourse. The flood risk will not affect the proposed development site and the risk of fluvial flooding to the proposed development is therefore very low.

Canals, reservoirs and other artificial sources

6.6 There are no canals or other artificial sources local to the site.

6.7 The Environment Agency risk of flooding from reservoirs map doesn't identify the site being at risk of flooding from any reservoir.

6.8 As such the risk of flooding from canals, reservoirs and other sources is very low.

Groundwater

6.9 There has been no historic flooding due to groundwater on the site and the flood risk from groundwater is therefore low.

Sewer Flooding and Pluvial Runoff

6.10 There are no public sewers local to the site. The nearest public sewer is a combined sewer that lies on Clitheroe Road approx. 100m to the north of the northwestern corner of the site. As such the risk is low from sewer flooding.

6.11 The Environment Agency Risk of Flooding from Surface Water map indicates a very low chance to the site from surface water flooding except along the site's northern boundary where there is a high chance.

6.12 The area of the site along the site's northern boundary where there is a high chance of surface water flooding is the lowest part of the site allowing surface water to accumulate. In addition it is not planned for any built development within this area. As such the risk to the development from pluvial runoff is very low.

Effect of the Development on the Wider Catchment

Development Drainage

6.13 The proposed development will introduce an area of impermeable hardstanding on site, and has the potential to significantly alter the surface water run-off regime of the site and have an adverse effect on flood risk elsewhere in the wider catchment.

6.14 It is intended that surface water runoff from the developed site will be controlled to the existing pre-development Greenfield runoff rate, allowing surface water runoff generated by all rainfall events up to the 100 year critical rain storm plus 50% on stored volumes to discharge into an existing manhole on the watercourse where it lies within culvert under the western side of Clitheroe Road approx. 110m from the northwestern corner of the site. The discharge point is within the same watercourse catchment as the site.

6.15 Attenuation will be provided for rainfall events up to the 100 year critical rain storm plus 50% on stored volumes to restrict surface water runoff from the developed site to pre-development runoff rates prior to discharge. As such there will be no change to the flood risk upstream or downstream of this location and the risk of flooding from the development drainage is low.

7. PREDICTED IMPACTS AND MITIGATION

7.1 This section of the FRA sets out the mitigation measures recommended to reduce the risk of flooding to the proposed development and outlines any residual impacts.

Site arrangements

Access / Egress

7.2 If an extreme event was to occur, the access to the site would be from Clitheroe Road, which lies within Flood Zone 1.

Upstream and downstream effects

7.3 There is no material effect on the floodplain due to the proposed development.

7.4 It is intended that surface water runoff from the developed site will be controlled to the existing pre-development Greenfield runoff rate, allowing surface water runoff generated by all rainfall events up to the 100 year critical rain storm plus 50% on stored volumes to discharge into an existing manhole on the watercourse where it lies within culvert under the western side of Clitheroe Road approx. 110m from the northwestern corner of the site.

7.5 The discharge point is within the same watercourse catchment as the site and as such there will be no change to the flood risk upstream or downstream of this location.

8. DRAINAGE STRATEGY

Surface water drainage

8.1 Guidance for the disposal of surface water from a development site is for soakaways to be considered as the primary solution. If this is not practical, discharge to a waterbody or watercourse is to be considered as the next available alternative. Only if neither of these options is available, and other sustainable drainage methods not possible, should the use of the public sewerage system be considered.

8.2 The online Soilscapes Viewer has identified the site lying in a region characterised by slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils with impeded drainage that is not conducive to infiltration. Based upon the ground conditions identified, infiltration is unlikely to provide a viable drainage solution for surface water runoff generated by the site. Infiltration tests have therefore not been carried out.

8.3 A watercourse lies within the northeastern part of the site. The watercourse flows to the west, under the A59 and Clitheroe Road, and reappears in open ditch on the western side of Clitheroe Road approx. 110m from the northwestern corner of the site. The watercourse ultimately discharges into the River Ribble.

8.4 It is therefore intended that surface water runoff from the developed site will be controlled to the existing pre-development Greenfield runoff rate, allowing surface water runoff generated by all rainfall events up to the 100 year critical rain storm plus 50% on stored volumes to discharge into an existing manhole on the watercourse where it lies within culvert under the western side of Clitheroe Road approx. 110m from the northwestern corner of the site. The additional 50% is to allow for climate change and has been included in the surface water volume.

8.5 To determine the restricted surface water discharge rates from the developed site, the pre-development Greenfield runoff rates have been calculated using the 'Causeway Flow' programme. The calculations are based upon the area of the site to be developed measured as 2.2ha, having removed the areas of landscaping that lie

around the peripherals of the site. The existing pre-development Greenfield runoff rates have been calculated as below.

Pre-development discharge

Site Makeup	Greenfield
Greenfield Method	IH124
Positively Drained Area (ha)	2.200
SAAR (mm)	1143
Soil Index	4
SPR	0.47
Region	10
Betterment (%)	0
	Calc
QBar (l/s)	18.9

Return Period (years)	Growth Factor	Q (l/s)
1	0.85	
30	1.95	
100	2.48	

8.6 New surface water drainage will therefore be constructed, appropriately sized to take surface water runoff from the proposed development and be attenuated to 18.9 l/s prior to a controlled discharge into an existing manhole on the watercourse where it lies within culvert under the western side of Clitheroe Road approx. 110m from the northwestern corner of the site.

8.7 The proposed surface water drainage for the development will take runoff from the roofs of the properties, the access roads and car parking areas.

8.8 A preliminary surface water drainage design has been carried out for the proposed site development for all events up to the 100 year critical rain storm plus 50% on stored volumes. Attenuation is provided using underground storage under hardstanding areas. An additional 10% has been added to the residential properties areas to account for urban creep. The preliminary surface water drainage design is included within Appendix D.

8.9 In order for a discharge to be made into the watercourse, a new surface water sewer will need to be laid from the site, along Clitheroe Road into an existing manhole on the watercourse where it lies within culvert under the western side of Clitheroe Road.

Foul water drainage

8.10 The nearest public sewer is a combined sewer that lies on Clitheroe Road approx. 100m to the north of the northwestern corner of the site.

8.11 It is therefore intended that foul water from the proposed new dwellings will be collected by a piped system and discharged into the public sewer that lies on Clitheroe Road approx. 100m to the north of the northwestern corner of the site. This has been confirmed by United Utilities.

8.12 In order to make the connection, a new foul sewer will need to be laid from the site, along Clitheroe Road, to the public sewer within Clitheroe Road.

9. CONCLUSIONS

9.1 This flood risk assessment and drainage strategy has been produced on behalf of Pringle Homes in support of a planning application for a proposed residential development on Land East of Clitheroe Road, Whalley.

Flood risk assessment

9.2 The site lies within Flood Zone 1, the lowest risk which is identified as land assessed as having a less than 0.1% annual probability of river or sea flooding. The risk of fluvial flooding is very low.

9.3 The risk of flooding from canals, reservoirs and other artificial sources is very low.

9.4 The flood risk from groundwater is low.

9.5 The Environment Agency Risk of Flooding from Surface Water map indicates a very low chance to the site from surface water flooding except along the site's northern boundary where there is a high chance. The area of the site along the site's northern boundary where there is a high chance of surface water flooding is the lowest part of the site allowing surface water to accumulate. In addition it is not planned for any built development within this area. As such the risk to the development from pluvial runoff is very low.

9.6 The risk from sewer flooding is low.

9.7 The risk of flooding from the development drainage is low.

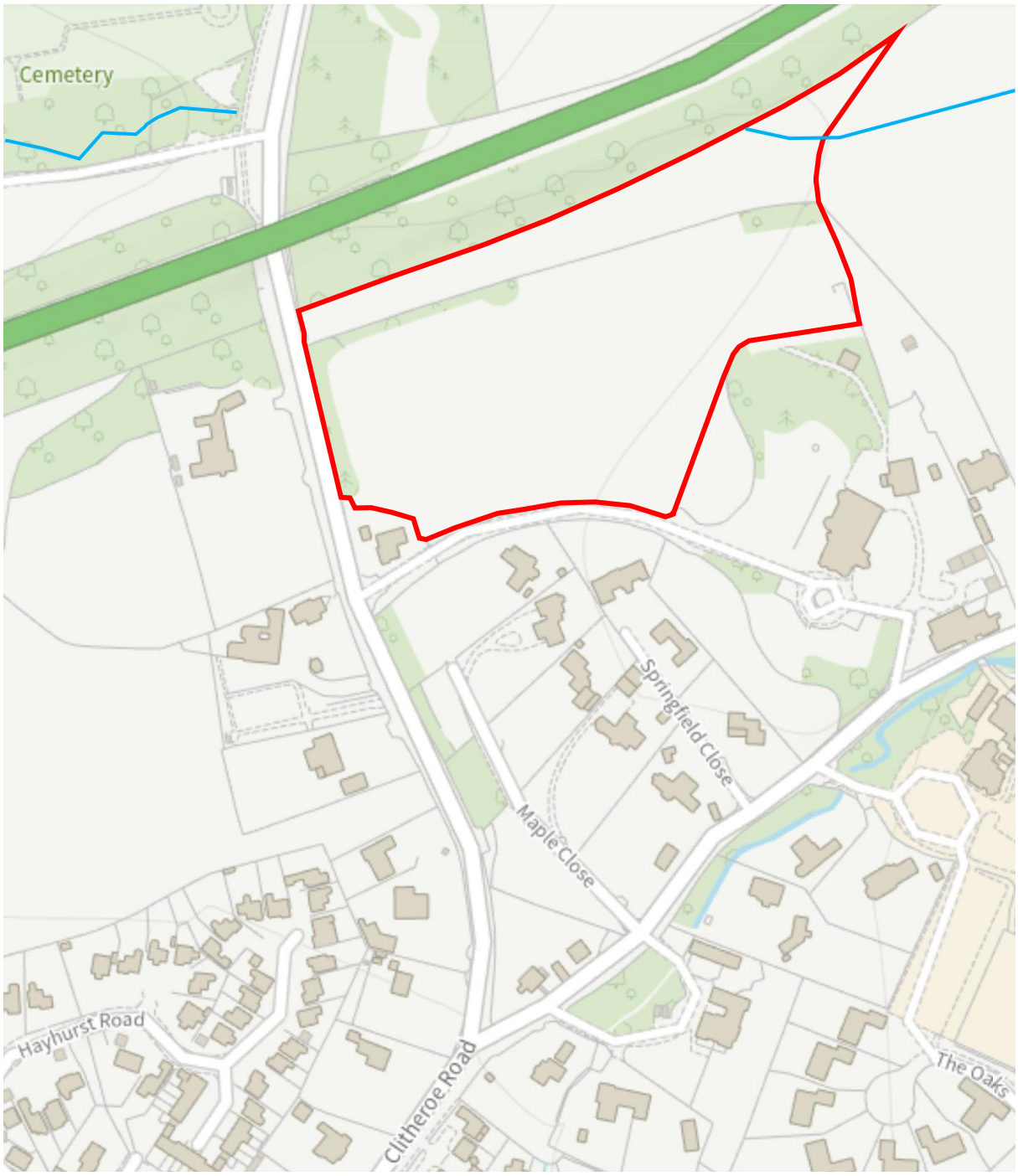
Drainage strategy

9.8 Surface water runoff from the developed site will be controlled to the existing pre-development Greenfield runoff rate, allowing surface water runoff generated by all rainfall events up to the 100 year critical rain storm plus 50% on stored volumes to discharge into an existing manhole on the watercourse where it lies within culvert under the western side of Clitheroe Road approx. 110m from the northwestern corner of the site. In order for a discharge to be made into the watercourse, a new surface

water sewer will need to be laid from the site, along Clitheroe Road, to the existing manhole on the watercourse where it lies within culvert under the western side of Clitheroe Road

9.9 Foul water from the proposed new dwellings will be collected by a piped system and discharged into the public sewer that lies on Clitheroe Road approx. 100m to the north of the northwestern corner of the site. In order to make the connection, a new foul sewer will need to be laid from the site, along Clitheroe Road, to the public sewer within Clitheroe Road.

APPENDIX A

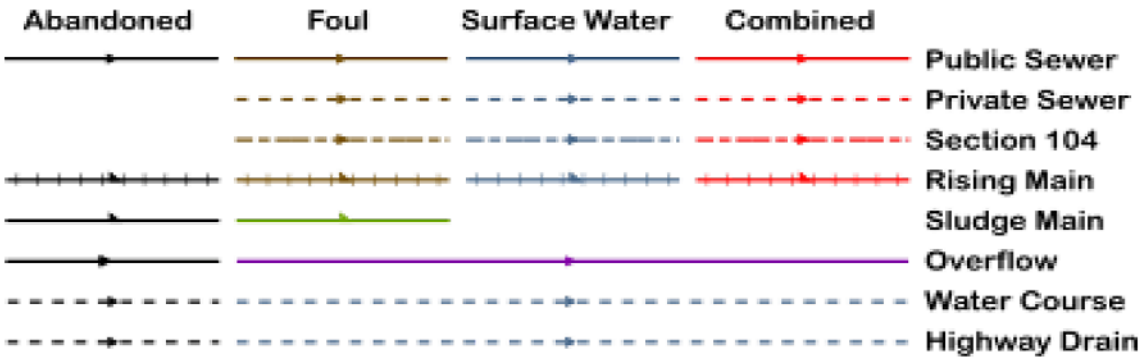


LOCATION PLAN

APPENDIX B

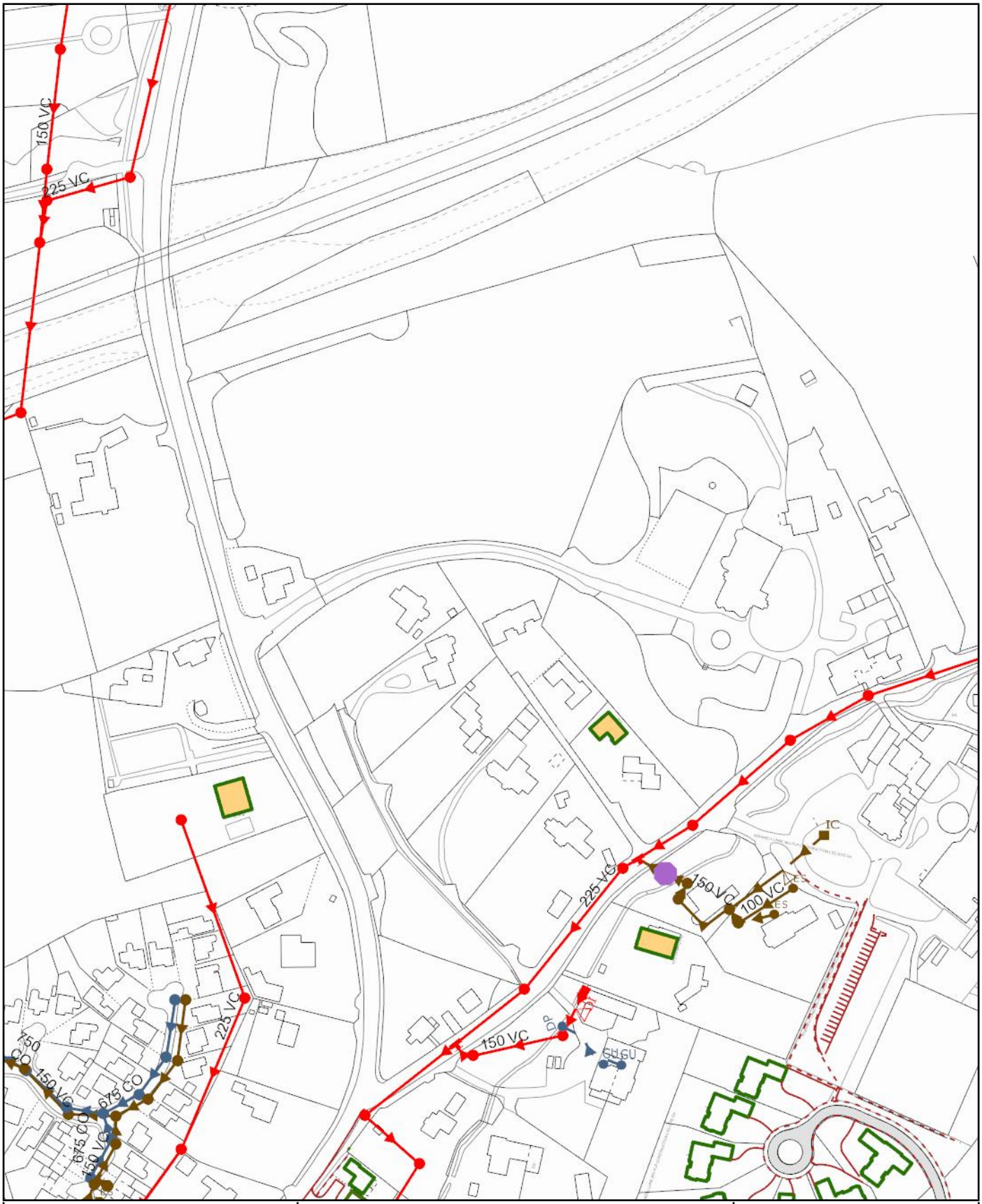
United Utilities
Water for the North West

Wastewater Symbology



All point assets follow the standard colour convention: red – combined, brown - foul, blue – surface water, purple - overflow

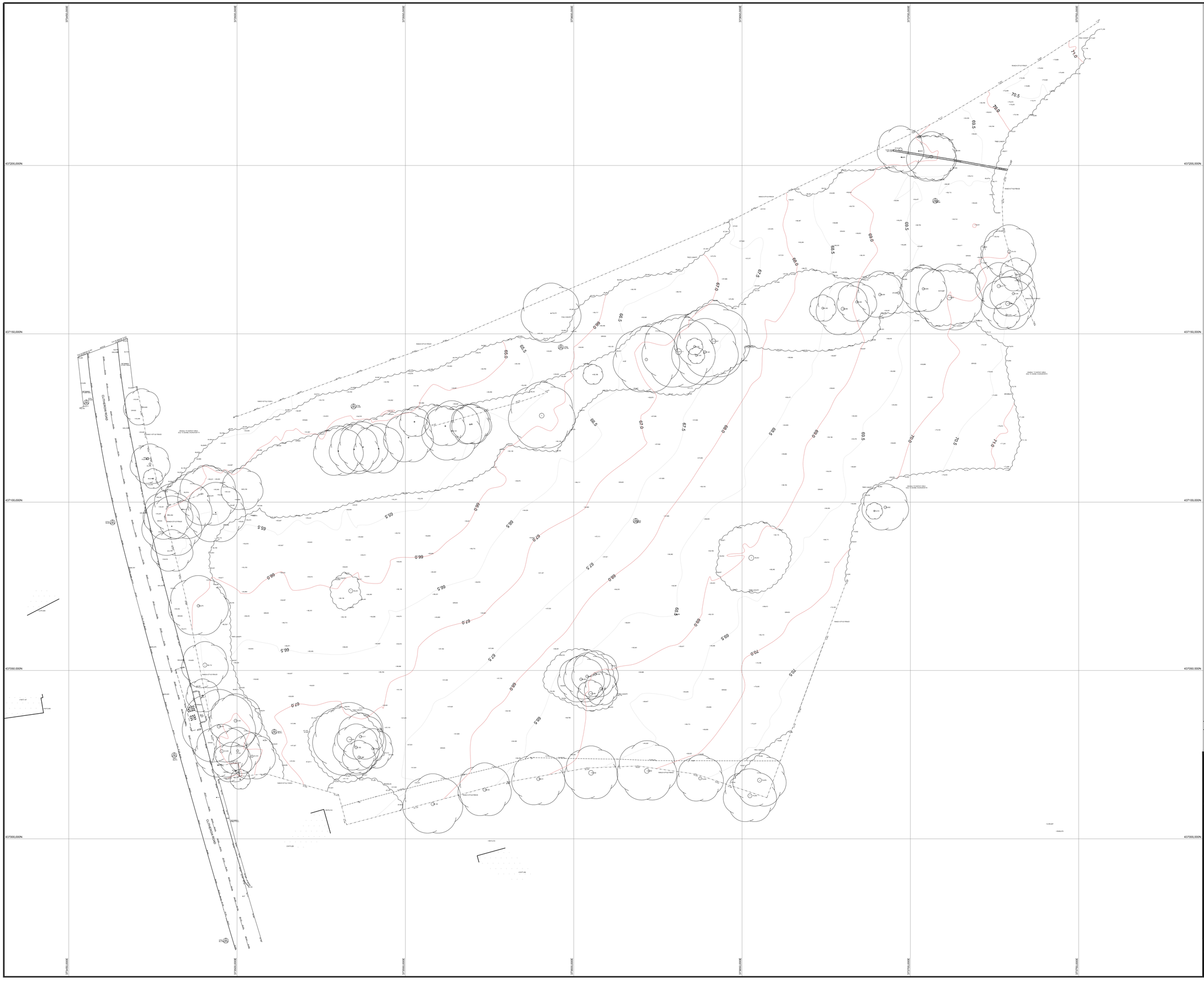
- Manhole
- HS Head of System
- ES Extent of Survey
- RE Rodding Eye
- IN Inlet
- DP Discharge Point
- HY Vortex
- PE Penstock
- WO Washout Chamber
- VA Valve
- AV Air Valve
- NRV Non Return Valve
- SO Soakaway
- GU Gully
- CA Cascade
- FM Flow Meter
- HA Hatch Box
- OI Oil Interceptor
- SM Summit
- DS Drop Shaft
- OP Orifice Plate
- Side Entry Manhole
- Outfall
- Screen Chamber
- IC Inspection Chamber
- Bifurcation Chamber
- LH Lamp Hole
- T Junction / Saddle
- CA Catchpit
- VC Valve Chamber
- Vent Column
- Vortex Chamber
- Penstock Chamber
- T Network Storage Tank
- V Sewer Overflow
- WwTW Ww Treatment Works
- Ww Pumping Station
- Septic Tank
- CK Control Kiosk
- DNM Network Monitoring Point
- Change of Characteristic



Scale:	1:2552	**SEWER RECORDS**	United Utilities Water for the North West
Date:	19/12/2024		
Address or Site Reference:	clitheroe road whalley		
Printed by:	Property Searches		

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

APPENDIX C



N

Topographical Survey Legend

Bin	Litter bin	TL	Tie line
BH	Bore Hole	TP	Telegraph pole
Bol	Bollard	TPS	Tactile paving slabs
BS	Bus stop	TS	Traffic signal light
BT	British telecom ic	TV	Television cover
CPS	Concrete paving slabs	VP	Vent pipe
DR	Drain	WM	Water meter
Elec	Electrical ic	WO	Wash Out
EP	Elec. pole	UTL	Unable to lift
ER	Earth rod	Fence annotation	
FH	Fire Hydrant	B/W	Barbed wire
FP	Flagpole	C/B	Closed boarded
FT	Floodlight	C/I	Corrugated iron
G	Gully	C/L	Chain link
GP	Gate post	C/P	Concrete panel
GV	Gas valve	H/R	Hand rail
IC	Inspection cover	I/R	Iron railings
JB	Junction box	O/B	Open boarded
KO	Kerb outlet	P/C	Post & chain
LB	Letter box	P/R	Post & rail
LP	Lamp post	P/W	Post & wire
Mkr	Utility marker	W/M	Wire mesh
MP	Mile post	Level prefix descriptions	
MW	Monitoring Well	**AL**	Arch level
NP	Name plate	**BL**	Bed level
P	Post	**CL**	Cover level
PM	Parking meter	**EH**	Eaves level
RE	Rodding eye	**FL**	Floor level
RS	Road sign	**IL**	Invert level
rwp	Rain water pipe	**PL**	Parapet level
SP	Sign post	**RH**	Roof/ridge level
ST	Stop tap	**SL**	Soffit level
SB	Service Box	**Spr**	Arch springing level
SV	Stop valve	**Top**	Top of pipe/culvert
TCB	Telephone call box	**WH**	Wall height
TH	Trial Hole	**WL**	Water level

BENCH MARK INFORMATION

All levels relate to O.S (Newlyn) Datum, Established using network RTK. Survey plotted on a plane local grid, orientated to National Grid.

NOTES

ONLY MANHOLES AND SERVICES VISIBLE AT TIME OF SURVEY SHOWN

DRAINAGE INFORMATION MUST BE CHECKED AND VERIFIED WITH LOCAL AUTHORITY RECORDS PRIOR TO WORK COMMENCING

Levels defining edge of carriageway are observed at channel (bottom of kerb). Unless otherwise stated.

TREE SPREADS ARE SYMBOLIC ONLY AND ARE REPRESENTATIVE OF THE THE AVERAGE SPREAD. THE DRIP LINE LAYER DENOTES THE TREES EXTREMITY

SURVEY STATIONS

STN1	373455.238	437129.602	63.585
STN2	373496.662	436969.723	66.160
STN3	373481.348	437024.816	66.518
STN4	373463.014	437093.983	64.561
STN5	373534.604	437128.425	64.838
STN6	373596.181	437146.013	65.756
STN6A	373618.436	437094.408	67.566
STN7	373707.392	437189.481	69.569

REVISIONS

REV	DESCRIPTION	SURVEYED	DRAWN	DATE

JLP Surveying

JLP Surveying Consultants Ltd,
Suite 45 Rodney House,
King Street,
Wigan
WN1 1BT
Tel - 01942 243313
Fax - 01942 492230
Mobile - 07710 428498
EMAIL:- peterhouston@jlpsurveys.com

PROJECT

Clitheroe Road
Whalley

DRAWING TITLE

Topographical Land Survey

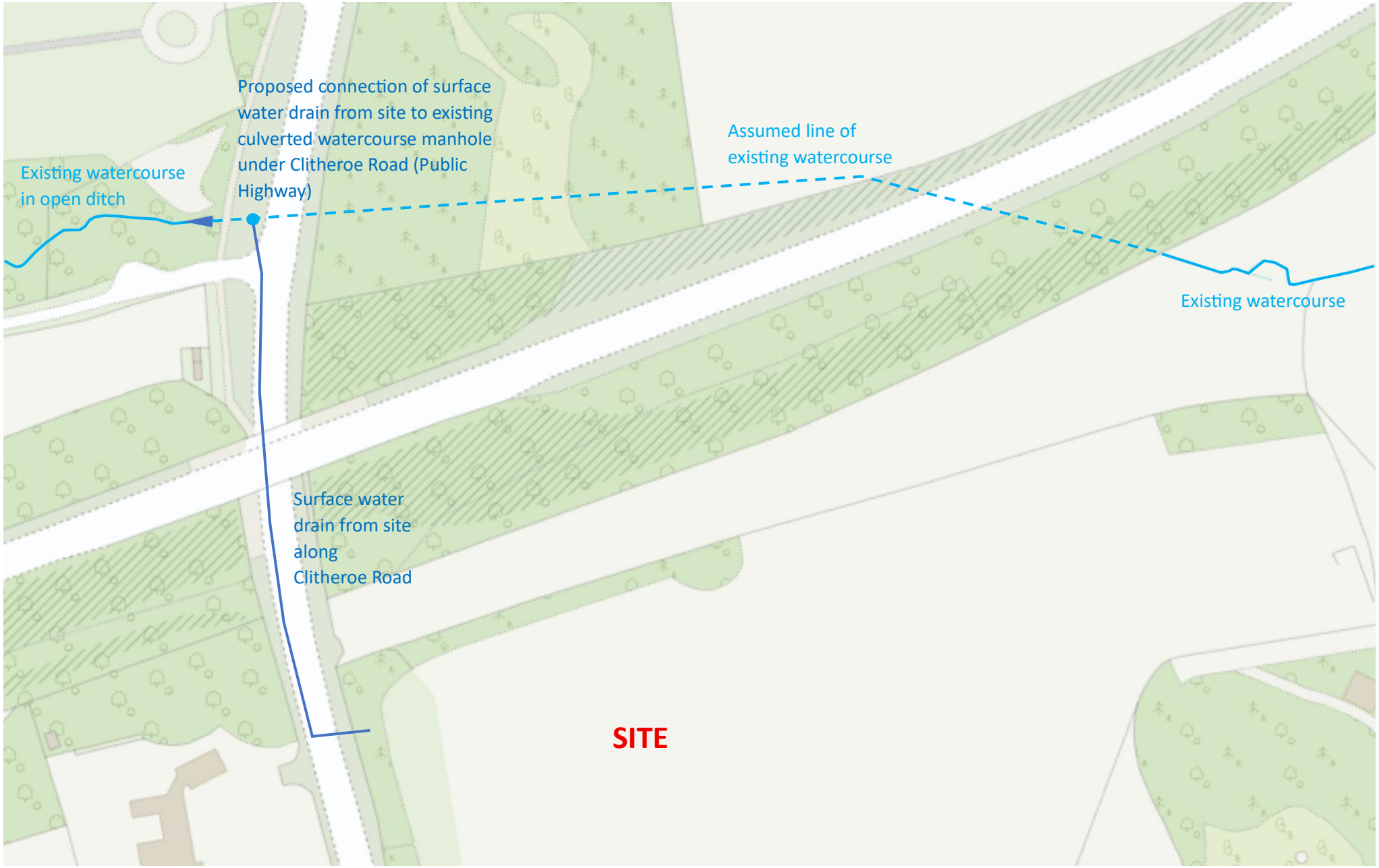
SCALE	SHEET SIZE	No. of SHEETS	DATE	REVISION
1 : 500	A1	1	14.11.2024	

DRAWING NUMBER

S24-0921

APPENDIX D

PROPOSED SURFACE WATER DRAINAGE LAYOUT



SURFACE WATER DRAINAGE FROM SITE TO WATERCOURSE

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	75.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	18.900	Minimum Backdrop Height (m)	2.000
Ratio-R	0.290	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
1	0.071	5.00	69.500	1200	3.045
2	0.083	5.00	69.000	1200	2.663
3	0.080	5.00	67.700	1200	1.575
4	0.055	5.00	67.000	1200	1.500
5	0.085	5.00	69.500	1200	2.210
6	0.135	5.00	69.500	1200	1.425
7	0.038	5.00	68.500	1200	1.425
8	0.046	5.00	67.000	1800	1.858
9	0.000		65.000	1800	1.650
10	0.000		65.000	1800	1.775
11	0.092	5.00	68.000	1200	1.425
12	0.115	5.00	67.300	1200	1.425
13	0.146	5.00	65.600	1200	1.500
14	0.017	5.00	65.500	1800	2.350
15	0.030	5.00	65.400	1800	2.290
16	0.040	5.00	66.500	1200	3.033
17	0.063	5.00	65.600	2100	2.570
18	0.000		65.600	1500	2.665
19	0.000		65.600	1500	2.736

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	1	2	20.000	0.600	66.455	66.337	0.118	169.5	225	5.33	54.9
1.001	2	3	36.000	0.600	66.337	66.125	0.212	169.8	225	5.93	52.6
1.002	3	4	18.000	0.600	66.125	65.575	0.550	32.7	225	6.06	52.2
1.003	4	8	14.000	0.600	65.500	65.442	0.058	241.4	300	6.30	51.4
2.000	5	7	36.000	0.600	67.290	67.075	0.215	167.4	225	5.60	53.9
3.000	6	7	20.000	0.600	68.075	67.075	1.000	20.0	225	5.11	55.8
2.001	7	8	46.000	0.600	67.075	65.517	1.558	29.5	225	5.91	52.7
1.004	8	9	36.000	0.600	65.142	63.350	1.792	20.1	600	6.41	51.0
1.005	9	10	50.000	0.600	63.350	63.225	0.125	400.0	600	7.09	48.8
1.006	10	14	30.000	0.600	63.225	63.150	0.075	400.0	600	7.51	47.6
4.000	11	12	24.000	0.600	66.575	65.875	0.700	34.3	225	5.18	55.5
4.001	12	13	44.000	0.600	65.875	64.175	1.700	25.9	225	5.46	54.4
4.002	13	14	16.000	0.600	64.100	63.450	0.650	24.6	300	5.55	54.1
1.007	14	15	16.000	0.600	63.150	63.110	0.040	400.0	600	7.73	47.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	1.001	39.8	10.6	2.820	2.438	0.071	0.0
1.001	1.000	39.8	22.0	2.438	1.350	0.154	0.0
1.002	2.294	91.2	33.1	1.350	1.200	0.234	0.0
1.003	1.007	71.2	40.2	1.200	1.258	0.289	0.0
2.000	1.007	40.1	12.4	1.985	1.200	0.085	0.0
3.000	2.939	116.8	20.4	1.200	1.200	0.135	0.0
2.001	2.416	96.1	36.9	1.200	1.258	0.258	0.0
1.004	5.449	1540.6	82.0	1.258	1.050	0.593	0.0
1.005	1.211	342.4	78.5	1.050	1.175	0.593	0.0
1.006	1.211	342.4	76.6	1.175	1.750	0.593	0.0
4.000	2.241	89.1	13.8	1.200	1.200	0.092	0.0
4.001	2.582	102.7	30.5	1.200	1.200	0.207	0.0
4.002	3.181	224.9	51.7	1.200	1.750	0.353	0.0
1.007	1.211	342.4	122.8	1.750	1.690	0.963	0.0

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)
1.008	15	17	32.000	0.600	63.110	63.030	0.080	400.0	600	8.17	45.9
5.000	16	17	32.000	0.600	63.467	63.330	0.137	233.6	300	5.52	54.2
1.009	17	18	16.000	0.600	63.030	62.935	0.095	168.4	225	8.43	45.2
1.010	18	19	12.000	0.600	62.935	62.864	0.071	169.0	225	8.63	44.7

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.008	1.211	342.4	123.5	1.690	1.970	0.993	0.0
5.000	1.024	72.4	5.9	2.733	1.970	0.040	0.0
1.009	1.004	39.9	134.3	2.345	2.440	1.096	0.0
1.010	1.003	39.9	132.9	2.440	2.511	1.096	0.0

Simulation Settings

Rainfall Methodology	FSR	Summer CV	0.750	Additional Storage (m³/ha)	20.0
Rainfall Events	Singular	Winter CV	0.840	Starting Level (m)	
FSR Region	England and Wales	Analysis Speed	Normal	Check Discharge Rate(s)	x
M5-60 (mm)	18.900	Skip Steady State	x	Check Discharge Volume	x
Ratio-R	0.290	Drain Down Time (mins)	240		

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	50	0	0

Node 3 Online Hydro-Brake® Control

Flap Valve	✓	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	66.125	Product Number	CTL-SHE-0100-5000-1400-5000
Design Depth (m)	1.400	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node 7 Online Hydro-Brake® Control

Flap Valve	✓	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	67.075	Product Number	CTL-SHE-0100-5000-1400-5000
Design Depth (m)	1.400	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node 17 Online Hydro-Brake® Control

Flap Valve	✓	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	63.030	Product Number	CTL-SHE-0172-1890-2500-1890
Design Depth (m)	2.500	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	18.9	Min Node Diameter (mm)	2100

Node 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	66.455
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	212

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	95.0	0.0	1.200	95.0	0.0	1.201	0.0	0.0

Node 5 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	67.290
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	120.0	0.0	1.200	120.0	0.0	1.201	0.0	0.0

Node 15 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	63.110
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	175.0	0.0	1.200	175.0	0.0	1.201	0.0	0.0

Node 16 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	63.467
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	224

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	100.0	0.0	1.200	100.0	0.0	1.201	0.0	0.0

Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 99.42%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	1	176	67.624	1.169	32.2	107.3300	0.0000	SURCHARGED
180 minute winter	2	176	67.623	1.286	21.5	2.2559	0.0000	SURCHARGED
180 minute winter	3	172	67.621	1.496	12.9	3.2126	0.0000	FLOOD RISK
15 minute winter	4	10	65.660	0.160	35.7	0.2977	0.0000	OK
240 minute winter	5	232	68.388	1.098	29.0	127.2935	0.0000	SURCHARGED
15 minute winter	6	12	68.873	0.798	76.3	2.4141	0.0000	SURCHARGED
15 minute winter	7	12	68.500	1.425	86.1	2.3710	0.0000	FLOOD RISK
15 minute winter	8	10	65.225	0.083	65.3	0.2511	0.0000	OK
360 minute winter	9	352	64.696	1.346	19.0	3.4244	0.0000	SURCHARGED
360 minute winter	10	352	64.695	1.470	16.4	3.7421	0.0000	SURCHARGED
15 minute winter	11	11	66.705	0.130	51.9	0.3143	0.0000	OK
15 minute winter	12	11	66.326	0.451	115.8	1.2387	0.0000	SURCHARGED
360 minute winter	13	352	64.696	0.596	35.1	1.8346	0.0000	SURCHARGED
360 minute winter	14	352	64.696	1.546	51.3	4.1575	0.0000	SURCHARGED
360 minute winter	15	352	64.695	1.585	53.6	204.0330	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	1	1.000	2	-20.8	-0.524	-0.523	0.7954	
180 minute winter	2	1.001	3	-8.1	0.209	-0.203	1.4318	
180 minute winter	3	1.002	4	5.1	1.229	0.056	0.0747	
15 minute winter	4	1.003	8	35.0	0.982	0.491	0.5005	
240 minute winter	5	2.000	7	-17.8	-0.448	-0.445	1.4318	
15 minute winter	6	3.000	7	64.7	1.626	0.553	0.7954	
15 minute winter	7	2.001	8	5.0	1.280	0.052	0.1798	
15 minute winter	8	1.004	9	64.9	1.521	0.042	2.8774	
360 minute winter	9	1.005	10	16.4	0.556	0.048	14.0839	
360 minute winter	10	1.006	14	16.0	0.409	0.047	8.4503	
15 minute winter	11	4.000	12	50.9	1.615	0.571	0.7617	
15 minute winter	12	4.001	13	103.0	2.777	1.003	1.7499	
360 minute winter	13	4.002	14	35.0	1.948	0.156	1.1267	
360 minute winter	14	1.007	15	50.7	0.966	0.148	4.5068	
360 minute winter	15	1.008	17	31.4	0.183	0.092	9.0137	

Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 99.42%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	16	352	64.696	1.229	16.2	115.7617	0.0000	SURCHARGED
360 minute winter	17	352	64.695	1.665	34.1	6.5844	0.0000	SURCHARGED
180 minute winter	18	100	63.051	0.116	18.9	0.2057	0.0000	OK
60 minute summer	19	91	62.972	0.108	18.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	16	5.000	17	-14.5	0.367	-0.201	2.2534	
360 minute winter	17	1.009	18	18.8	0.912	0.472	0.3307	
180 minute winter	18	1.010	19	18.9	0.955	0.473	0.2370	419.3