FLOOD RISK ASSESSMENT

AND

DRAINAGE STRATEGY

for

PRINGLE HOMES

PROPOSED RESIDENTIAL DEVELOPMENT

on

LAND EAST OF CLITHEROE ROAD, WHALLEY

JULY 2025

REFORD

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APPENDICES

A Location plan

B United Utilities sewer records

C Topographical survey

D Preliminary surface water drainage design

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, Whalley
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 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 77 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.

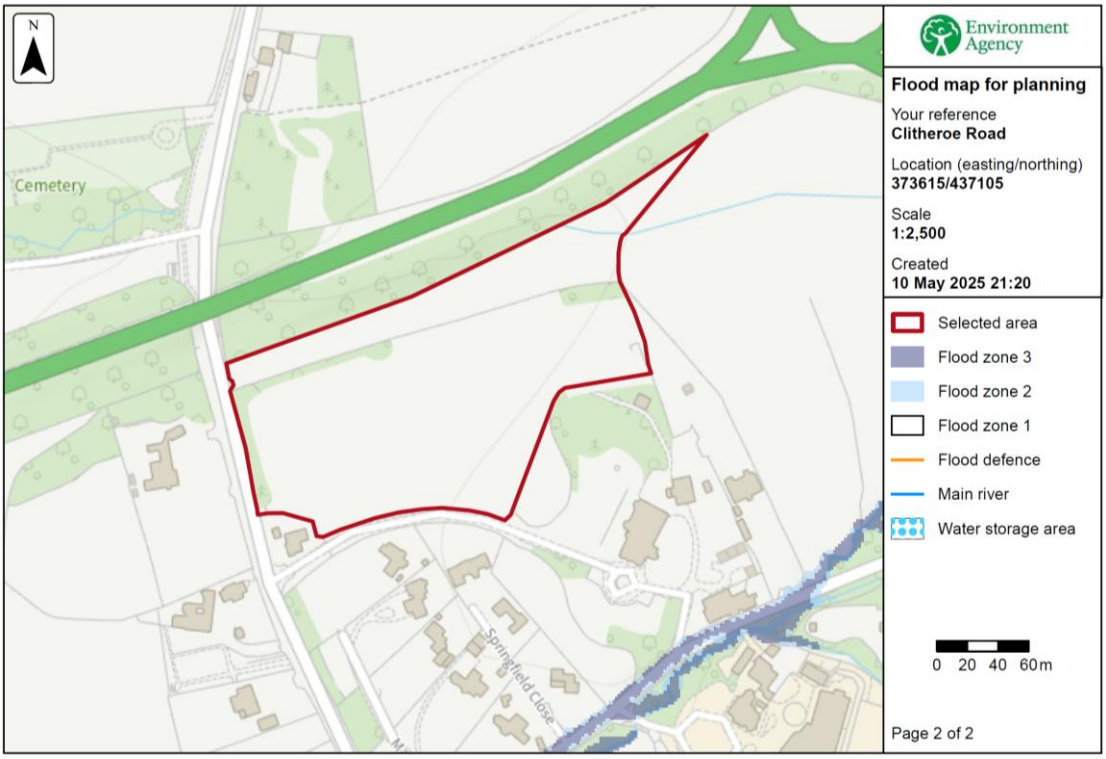
3.4 As set out in NPPF, local planning authorities should only consider development in flood risk areas appropriate where informed by a site specific Flood Risk Assessment. This document will identify and assess the risk associated with all forms of flooding to and from the development. Where necessary 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 risk to the site from surface water flooding except along the site's northern boundary where there is a high risk.

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 risk 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 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 risk to the site from surface water flooding except along the site's northern boundary where there is a high risk. A very low risk means that each year this area has a chance of flooding of less than 0.1%. A high risk 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 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 risk to the site from surface water flooding except along the site's northern boundary where there is a high risk.

6.12 The area of the site along the site's northern boundary where there is a high risk 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 the watercourse where it reappears in open ditch on the western side of Clitheroe Road approx. 110m from the northwestern corner of the site having passed under the A59 from the northeastern part of 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 the watercourse where it reappears in open ditch on the western side of Clitheroe Road approx. 110m from the northwestern corner of the site having passed under the A59 from the northeastern part of the site.

7.5 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 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 the watercourse where it reappears in open ditch on the western side of Clitheroe Road approx. 110m from the northwestern corner of the site having passed under the A59 from the northeastern part 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 the watercourse where it reappears in open ditch on the western side of Clitheroe Road approx. 110m from the northwestern corner of the site having passed under the A59 from the northeastern part 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, to the watercourse where it reappears in open ditch on 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.

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 risk to the site from surface water flooding except along the site's northern boundary where there is a high risk. The area of the site along the site's northern boundary where there is a high risk 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.

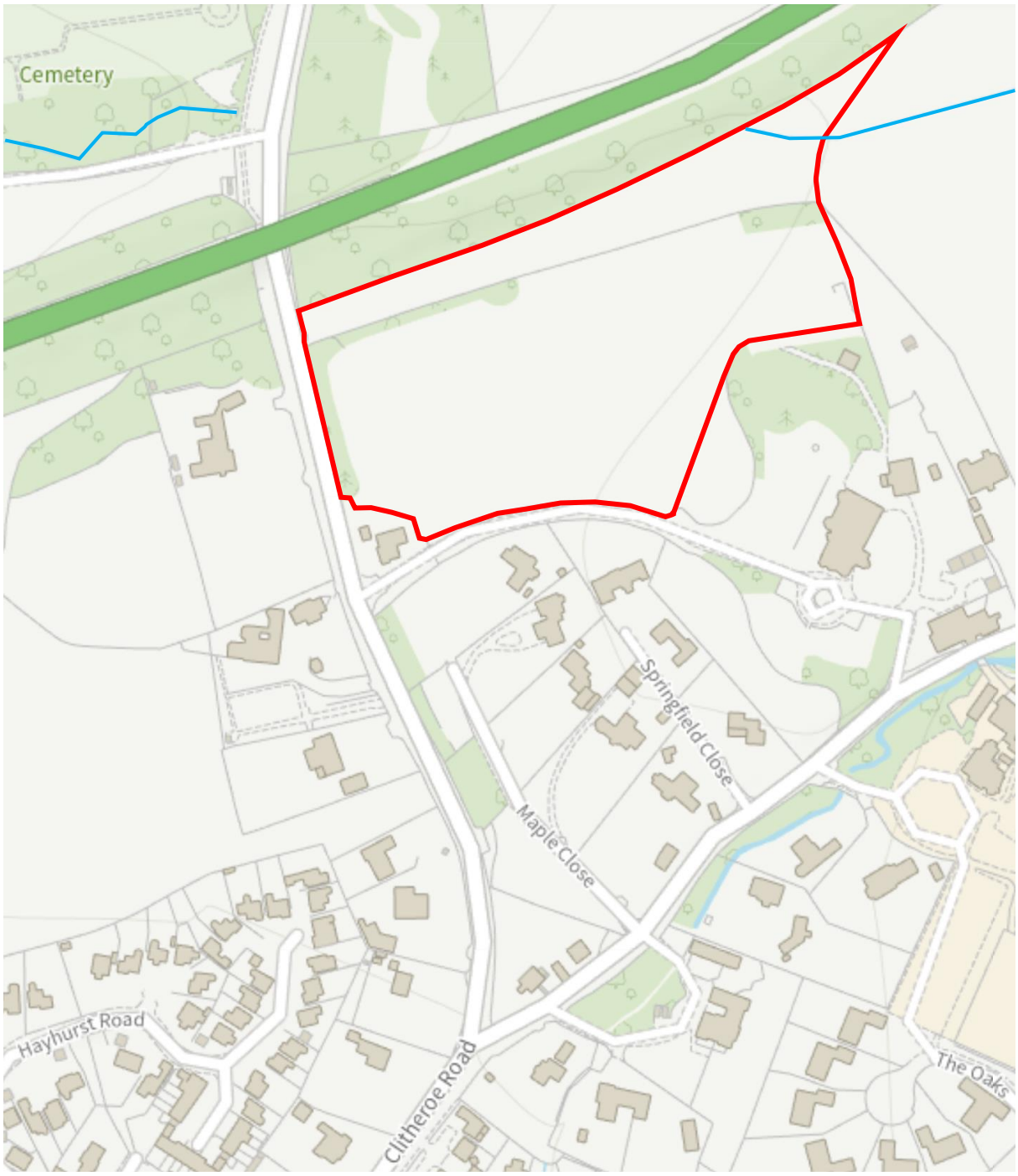
Drainage strategy

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 the watercourse where it reappears in open ditch on the western side of Clitheroe Road approx. 110m from the northwestern corner of the site having passed under the A59 from the northeastern part 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 watercourse where it reappears in open ditch on 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

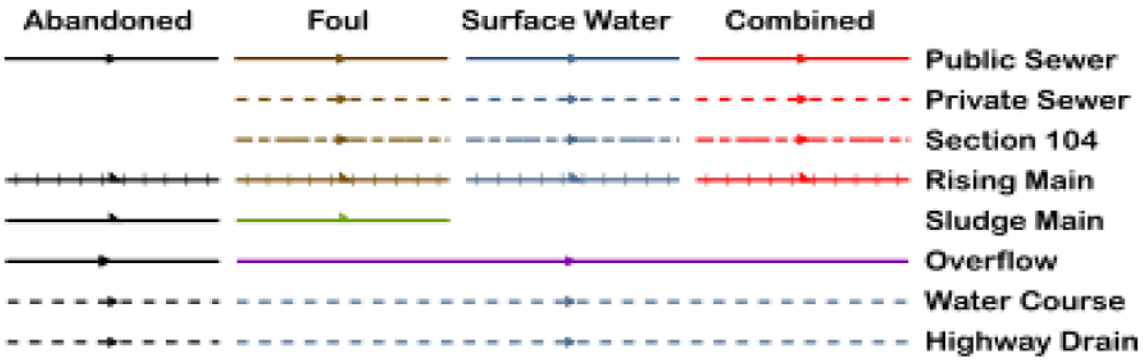


LOCATION PLAN

APPENDIX B

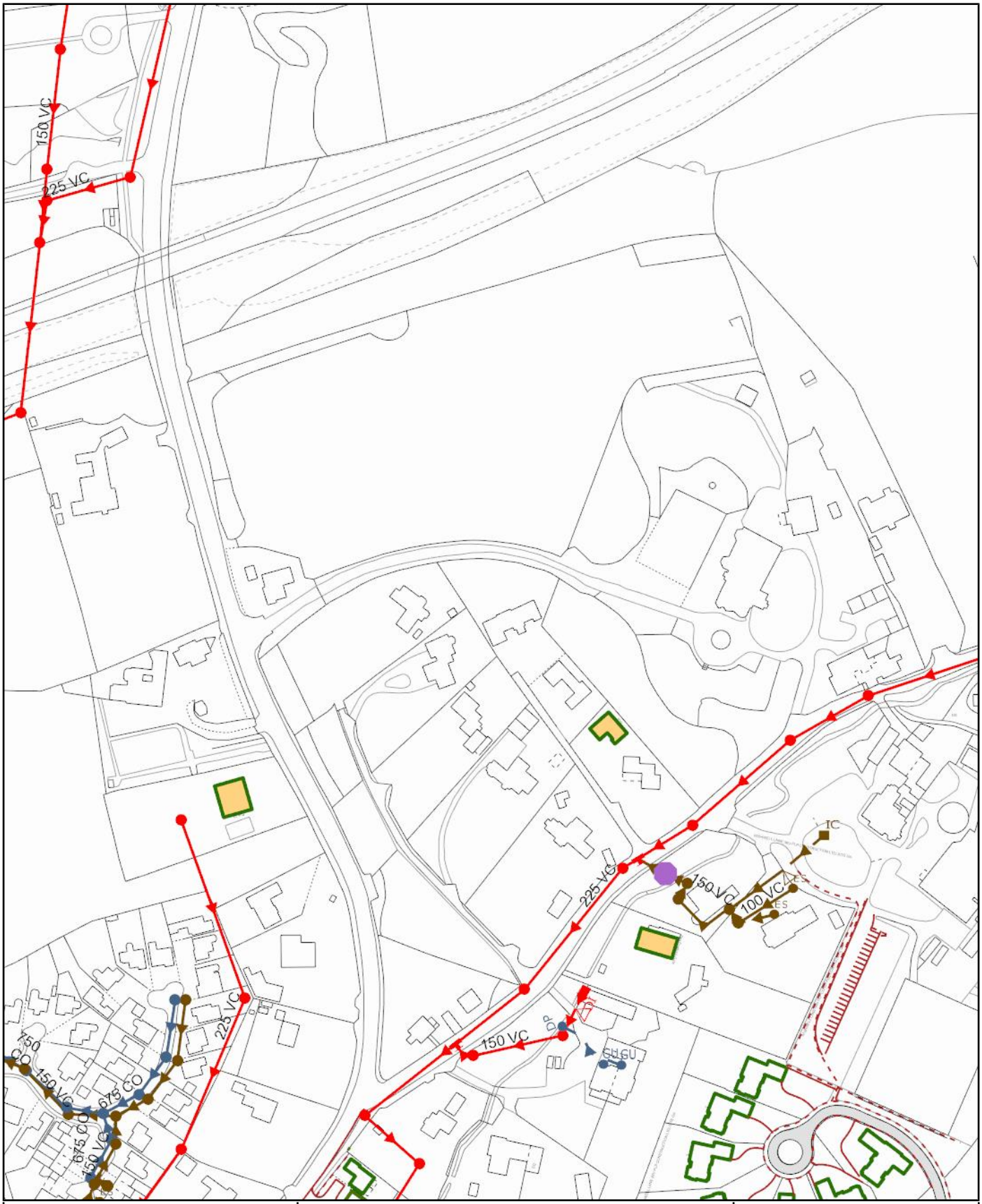
United Utilities
Water for the North West

Wastewater Symbology



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

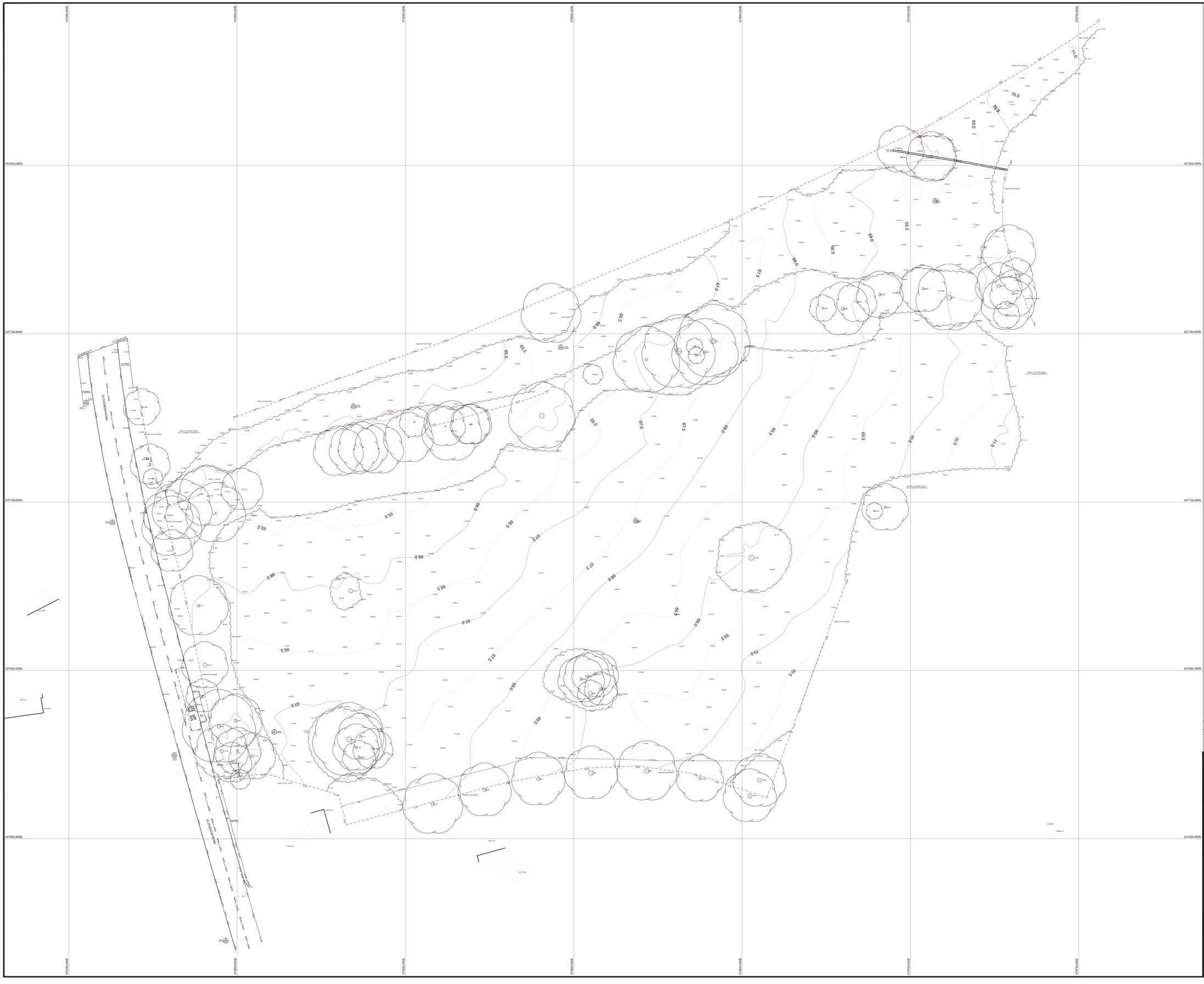
- Manhole
- HS Head of System
- ES Extent of Survey
- RE Rodding Eye
- IN Inlet
- DP Discharge Point
- HY Vortex
- PE Penstock
- WO Washout Chamber
- VA Valve
- AV Air Valve
- NRV Non Return Valve
- SO Soakaway
- GU Gully
- CA Cascade
- FM Flow Meter
- HA Hatch Box
- OI Oil Interceptor
- SM Summit
- 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

SURFACE WATER DRAINAGE LAYOUT

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	0.097	5.00	69.900	1200	2.616
2	0.042	5.00	69.500	1200	2.323
3	0.025	5.00	69.900	1200	2.615
4	0.099	5.00	69.300	1200	2.135
5	0.074	5.00	68.500	1200	1.500
6	0.015	5.00	67.000	1200	1.425
7	0.066	5.00	70.100	1200	1.350
8	0.121	5.00	69.000	1200	2.950
9	0.082	5.00	68.000	1200	2.325
10	0.051	5.00	67.300	1200	1.825
11	0.020	5.00	66.700	1500	1.500
12	0.064	5.00	66.300	1500	1.500
13	0.069	5.00	67.600	1200	2.200
14	0.059	5.00	67.100	1200	1.350
15	0.026	5.00	67.300	1200	2.040
16	0.066	5.00	66.500	1200	1.440
17	0.070	5.00	65.700	1500	1.575
18	0.049	5.00	66.500	1200	2.200
19	0.041	5.00	65.600	1500	1.855
20	0.050	5.00	65.400	1500	1.575
21			65.600	1200	1.955

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	18.000	0.600	67.284	67.177	0.107	168.2	225	5.30	55.0
1.001	2	5	30.000	0.600	67.177	67.000	0.177	169.5	225	5.80	53.1
2.000	3	4	20.000	0.600	67.285	67.165	0.120	166.7	225	5.33	54.9
2.001	4	5	28.000	0.600	67.165	67.000	0.165	169.7	225	5.80	53.1
1.002	5	6	50.000	0.600	67.000	65.575	1.425	35.1	225	6.17	51.8
1.003	6	11	15.000	0.600	65.575	65.275	0.300	50.0	225	6.31	51.3
3.000	7	8	30.000	0.600	68.750	67.150	1.600	18.8	150	5.21	55.4
3.001	8	9	30.000	0.600	66.050	65.675	0.375	80.0	225	5.56	54.0
3.002	9	10	16.000	0.600	65.675	65.475	0.200	80.0	225	5.74	53.3
3.003	10	11	16.000	0.600	65.475	65.275	0.200	80.0	225	5.92	52.7
1.004	11	12	20.000	0.600	65.200	64.800	0.400	50.0	300	6.46	50.8
1.005	12	17	38.000	0.600	64.800	64.200	0.600	63.3	300	6.78	49.8
4.000	13	15	14.000	0.600	65.400	65.260	0.140	100.0	225	5.18	55.5
5.000	14	15	8.000	0.600	65.750	65.670	0.080	100.0	150	5.13	55.7

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	1.005	40.0	14.5	2.391	2.098	0.097	0.0
1.001	1.001	39.8	20.0	2.098	1.275	0.139	0.0
2.000	1.010	40.1	3.7	2.390	1.910	0.025	0.0
2.001	1.001	39.8	17.9	1.910	1.275	0.124	0.0
1.002	2.216	88.1	47.3	1.275	1.200	0.337	0.0
1.003	1.854	73.7	49.0	1.200	1.200	0.352	0.0
3.000	2.337	41.3	9.9	1.200	1.700	0.066	0.0
3.001	1.463	58.2	27.4	2.725	2.100	0.187	0.0
3.002	1.463	58.2	38.9	2.100	1.600	0.269	0.0
3.003	1.463	58.2	45.7	1.600	1.200	0.320	0.0
1.004	2.228	157.5	95.3	1.200	1.200	0.692	0.0
1.005	1.979	139.9	102.0	1.200	1.200	0.756	0.0
4.000	1.307	52.0	10.4	1.975	1.815	0.069	0.0
5.000	1.005	17.8	8.9	1.200	1.480	0.059	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)
4.001	15	16	20.000	0.600	65.260	65.060	0.200	100.0	225	5.43	54.5
4.002	16	17	30.000	0.600	65.060	64.275	0.785	38.2	225	5.67	53.6
1.006	17	20	38.000	0.600	64.125	63.825	0.300	126.7	375	7.17	48.6
6.000	18	19	28.000	0.600	64.300	63.820	0.480	58.3	300	5.23	55.3
1.007	20	19	24.000	0.600	63.825	63.745	0.080	300.0	375	7.56	47.5
1.008	19	21	10.000	0.600	63.745	63.645	0.100	100.0	225	7.68	47.2

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
4.001	1.307	52.0	22.7	1.815	1.215	0.154	0.0
4.002	2.122	84.4	32.0	1.215	1.200	0.220	0.0
1.006	1.608	177.6	137.8	1.200	1.200	1.046	0.0
6.000	2.062	145.8	7.3	1.900	1.480	0.049	0.0
1.007	1.041	114.9	141.1	1.200	1.480	1.096	0.0
1.008	1.307	52.0	151.6	1.630	1.730	1.186	0.0

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
1	69.900	2.616	1200					
				◯				
					0	1.000	67.284	225
2	69.500	2.323	1200		1	1.000	67.177	225
				◯				
					0	1.001	67.177	225
3	69.900	2.615	1200					
				◯				
					0	2.000	67.285	225

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
4	69.300	2.135	1200	1	2.000	67.165	225
				0	2.001	67.165	225
5	68.500	1.500	1200	1	2.001	67.000	225
				2	1.001	67.000	225
				0	1.002	67.000	225
6	67.000	1.425	1200	1	1.002	65.575	225
				0	1.003	65.575	225
7	70.100	1.350	1200	0	3.000	68.750	150
8	69.000	2.950	1200	1	3.000	67.150	150
				0	3.001	66.050	225
9	68.000	2.325	1200	1	3.001	65.675	225
				0	3.002	65.675	225
10	67.300	1.825	1200	1	3.002	65.475	225
				0	3.003	65.475	225
11	66.700	1.500	1500	1	3.003	65.275	225
				2	1.003	65.275	225
				0	1.004	65.200	300

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
12	66.300	1.500	1500	1	1.004	64.800	300
				0	1.005	64.800	300
13	67.600	2.200	1200	0	4.000	65.400	225
14	67.100	1.350	1200	0	5.000	65.750	150
15	67.300	2.040	1200	1	5.000	65.670	150
				2	4.000	65.260	225
				0	4.001	65.260	225
16	66.500	1.440	1200	1	4.001	65.060	225
				0	4.002	65.060	225
17	65.700	1.575	1500	1	4.002	64.275	225
				2	1.005	64.200	300
				0	1.006	64.125	375
18	66.500	2.200	1200	0	6.000	64.300	300
19	65.600	1.855	1500	1	6.000	63.820	300
				2	1.007	63.745	375
				0	1.008	63.745	225

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
20	65.400	1.575	1500	1	1.006	63.825	375
				0	1.007	63.825	375
21	65.600	1.955	1200	1	1.008	63.645	225

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 %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0	100	0	0	0
30	45	0	0	100	50	0	0

Node 5 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	67.000	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 10 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	65.475	Product Number	CTL-SHE-0094-5000-1800-5000
Design Depth (m)	1.800	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node 16 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	65.060	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 19 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	63.745	Product Number	CTL-SHE-0184-1890-1650-1890
Design Depth (m)	1.650	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	18.9	Min Node Diameter (mm)	1500

Node 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	67.284
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	100.0	0.0	1.200	100.0	0.0	1.201	0.0	0.0

Node 3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	67.285
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	54.0	0.0	1.200	54.0	0.0	1.201	0.0	0.0

Node 8 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	66.050
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	152.0	0.0	1.200	152.0	0.0	1.201	0.0	0.0

Node 13 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	65.400
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	208

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	94.0	0.0	1.200	94.0	0.0	1.201	0.0	0.0

Node 18 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	64.300
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	156.0	0.0	1.200	156.0	0.0	1.201	0.0	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.03%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	1	92	67.446	0.162	8.3	15.7116	0.0000	OK
120 minute winter	2	92	67.446	0.269	3.4	0.4015	0.0000	SURCHARGED
120 minute winter	3	92	67.446	0.161	5.2	8.4591	0.0000	OK
120 minute winter	4	92	67.446	0.281	5.7	0.5776	0.0000	SURCHARGED
120 minute winter	5	92	67.445	0.445	7.3	0.9431	0.0000	SURCHARGED
15 minute winter	6	10	65.624	0.049	7.3	0.0660	0.0000	OK
15 minute winter	7	10	68.801	0.051	10.2	0.1085	0.0000	OK
120 minute winter	8	96	66.231	0.181	13.7	26.5291	0.0000	OK
120 minute winter	9	96	66.231	0.556	8.9	1.0200	0.0000	SURCHARGED
120 minute winter	10	96	66.230	0.755	6.7	1.2753	0.0000	SURCHARGED
15 minute winter	11	10	65.261	0.061	14.6	0.1245	0.0000	OK
15 minute winter	12	10	64.886	0.086	24.5	0.2253	0.0000	OK
60 minute winter	13	48	65.536	0.136	13.9	12.3719	0.0000	OK
15 minute winter	14	10	65.832	0.082	9.1	0.1639	0.0000	OK
15 minute winter	15	10	65.546	0.286	18.2	0.3967	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)
120 minute winter	1	1.000	2	3.1	0.391	0.078	0.6337	
120 minute winter	2	1.001	5	3.2	0.159	0.080	1.1931	
120 minute winter	3	2.000	4	-3.8	0.295	-0.095	0.7012	
120 minute winter	4	2.001	5	3.0	0.240	0.076	1.1136	
120 minute winter	5	Hydro-Brake®	6	5.0				
15 minute winter	6	1.003	11	7.3	1.164	0.099	0.0937	
15 minute winter	7	3.000	8	10.0	1.905	0.243	0.1578	
120 minute winter	8	3.001	9	5.0	0.553	0.086	1.1109	
120 minute winter	9	3.002	10	4.4	0.276	0.076	0.6363	
120 minute winter	10	Hydro-Brake®	11	4.4				
15 minute winter	11	1.004	12	14.6	1.169	0.092	0.2695	
15 minute winter	12	1.005	17	24.0	1.475	0.172	1.2335	
60 minute winter	13	4.000	15	-8.0	0.566	-0.153	0.4538	
15 minute winter	14	5.000	15	8.9	0.960	0.504	0.0745	
15 minute winter	15	4.001	16	6.3	0.301	0.121	0.7954	

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.03%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	16	10	65.554	0.493	12.2	1.0107	0.0000	SURCHARGED
30 minute winter	17	21	64.429	0.304	35.3	0.8072	0.0000	OK
120 minute winter	18	92	64.400	0.100	12.3	14.9250	0.0000	OK
30 minute winter	19	21	64.409	0.664	38.9	1.4673	0.0000	SURCHARGED
30 minute winter	20	21	64.420	0.595	38.8	1.4286	0.0000	SURCHARGED
15 minute summer	21	1	63.645	0.000	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)
15 minute winter	16	Hydro-Brake®	17	5.0				
30 minute winter	17	1.006	20	32.9	0.858	0.185	3.9139	
120 minute winter	18	6.000	19	-9.5	0.372	-0.065	1.2720	
30 minute winter	19	Hydro-Brake®	21	18.9				112.5
30 minute winter	20	1.007	19	35.2	0.490	0.306	2.6471	

Results for 30 year +45% CC Critical Storm Duration. Lowest mass balance: 99.03%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	1	232	68.085	0.801	17.6	77.5786	0.0000	SURCHARGED
240 minute winter	2	232	68.085	0.908	8.4	1.3551	0.0000	SURCHARGED
240 minute winter	3	232	68.084	0.799	9.7	42.0697	0.0000	SURCHARGED
240 minute winter	4	232	68.084	0.919	9.7	1.8922	0.0000	SURCHARGED
240 minute winter	5	232	68.084	1.084	9.4	2.2962	0.0000	SURCHARGED
15 minute winter	6	10	65.637	0.062	11.2	0.0826	0.0000	OK
15 minute winter	7	10	68.844	0.094	28.0	0.1972	0.0000	OK
240 minute winter	8	232	66.862	0.812	27.0	118.8287	0.0000	SURCHARGED
240 minute winter	9	232	66.861	1.186	9.0	2.1774	0.0000	SURCHARGED
240 minute winter	10	232	66.860	1.385	5.4	2.3404	0.0000	SURCHARGED
15 minute winter	11	10	65.278	0.078	23.6	0.1578	0.0000	OK
15 minute winter	12	12	64.994	0.194	50.5	0.5082	0.0000	OK
180 minute winter	13	168	66.108	0.708	20.8	64.4521	0.0000	SURCHARGED
180 minute winter	14	168	66.108	0.358	7.0	0.7181	0.0000	SURCHARGED
180 minute winter	15	168	66.108	0.848	13.0	1.1748	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)
240 minute winter	1	1.000	2	-8.2	0.391	-0.204	0.7159	
240 minute winter	2	1.001	5	-4.3	0.120	-0.109	1.1931	
240 minute winter	3	2.000	4	-7.2	-0.180	-0.179	0.7954	
240 minute winter	4	2.001	5	2.2	0.232	0.054	1.1136	
240 minute winter	5	Hydro-Brake®	6	5.0				
15 minute winter	6	1.003	11	11.2	1.308	0.151	0.1279	
15 minute winter	7	3.000	8	27.6	2.447	0.668	0.3379	
240 minute winter	8	3.001	9	-8.6	0.618	-0.149	1.1931	
240 minute winter	9	3.002	10	4.4	0.241	0.075	0.6363	
240 minute winter	10	Hydro-Brake®	11	4.4				
15 minute winter	11	1.004	12	23.4	1.162	0.149	0.6194	
15 minute winter	12	1.005	17	49.4	1.541	0.353	2.2531	
180 minute winter	13	4.000	15	-12.6	0.373	-0.242	0.5568	
180 minute winter	14	5.000	15	7.1	0.906	0.401	0.1408	
180 minute winter	15	4.001	16	4.9	0.220	0.094	0.7954	

Results for 30 year +45% CC Critical Storm Duration. Lowest mass balance: 99.03%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	16	168	66.107	1.047	7.9	2.1437	0.0000	SURCHARGED
240 minute winter	17	236	64.986	0.861	29.9	2.2859	0.0000	SURCHARGED
240 minute winter	18	236	64.981	0.681	24.3	102.0594	0.0000	SURCHARGED
240 minute winter	19	236	64.981	1.236	37.6	2.7309	0.0000	SURCHARGED
240 minute winter	20	236	64.983	1.158	34.0	2.7819	0.0000	SURCHARGED
15 minute summer	21	1	63.645	0.000	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)
180 minute winter	16	Hydro-Brake®	17	5.0				
240 minute winter	17	1.006	20	29.1	0.764	0.164	4.1913	
240 minute winter	18	6.000	19	-19.5	-0.276	-0.134	1.9717	
240 minute winter	19	Hydro-Brake®	21	18.9				450.1
240 minute winter	20	1.007	19	33.6	0.414	0.292	2.6471	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.03%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	1	176	67.973	0.689	19.6	66.7375	0.0000	SURCHARGED
180 minute winter	2	176	67.973	0.796	9.5	1.1880	0.0000	SURCHARGED
180 minute winter	3	176	67.973	0.688	10.7	36.1811	0.0000	SURCHARGED
180 minute winter	4	176	67.973	0.808	10.6	1.6619	0.0000	SURCHARGED
180 minute winter	5	176	67.972	0.972	10.2	2.0593	0.0000	SURCHARGED
15 minute winter	6	10	65.635	0.060	10.6	0.0800	0.0000	OK
15 minute winter	7	10	68.836	0.086	24.9	0.1824	0.0000	OK
240 minute winter	8	228	66.749	0.699	23.9	102.3433	0.0000	SURCHARGED
240 minute winter	9	228	66.748	1.073	7.7	1.9708	0.0000	SURCHARGED
240 minute winter	10	228	66.747	1.272	5.7	2.1504	0.0000	SURCHARGED
15 minute winter	11	10	65.275	0.075	21.8	0.1519	0.0000	OK
15 minute winter	12	11	64.924	0.124	45.8	0.3253	0.0000	OK
120 minute winter	13	116	66.014	0.614	25.6	55.9513	0.0000	SURCHARGED
120 minute winter	14	116	66.015	0.265	8.4	0.5308	0.0000	SURCHARGED
120 minute winter	15	116	66.014	0.754	16.2	1.0454	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	-9.2	0.366	-0.230	0.7159	
180 minute winter	2	1.001	5	-5.0	-0.125	-0.125	1.1931	
180 minute winter	3	2.000	4	-8.0	-0.201	-0.200	0.7954	
180 minute winter	4	2.001	5	2.3	0.274	0.058	1.1136	
180 minute winter	5	Hydro-Brake®	6	5.0				
15 minute winter	6	1.003	11	10.5	1.287	0.143	0.1225	
15 minute winter	7	3.000	8	24.5	2.387	0.594	0.3082	
240 minute winter	8	3.001	9	-7.4	0.617	-0.128	1.1931	
240 minute winter	9	3.002	10	4.2	0.245	0.072	0.6363	
240 minute winter	10	Hydro-Brake®	11	4.4				
15 minute winter	11	1.004	12	21.7	1.164	0.138	0.4099	
15 minute winter	12	1.005	17	45.2	1.606	0.323	1.8609	
120 minute winter	13	4.000	15	-15.8	0.566	-0.304	0.5568	
120 minute winter	14	5.000	15	8.4	0.948	0.473	0.1408	
120 minute winter	15	4.001	16	4.9	0.250	0.094	0.7954	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.03%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	16	116	66.014	0.954	9.4	1.9528	0.0000	SURCHARGED
15 minute winter	17	11	64.894	0.769	76.3	2.0416	0.0000	SURCHARGED
240 minute winter	18	236	64.875	0.575	21.0	86.1523	0.0000	SURCHARGED
240 minute winter	19	236	64.875	1.130	35.2	2.4963	0.0000	SURCHARGED
240 minute winter	20	232	64.877	1.052	31.9	2.5267	0.0000	SURCHARGED
15 minute summer	21	1	63.645	0.000	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)
120 minute winter	16	Hydro-Brake®	17	5.0				
15 minute winter	17	1.006	20	74.1	0.968	0.417	4.1913	
240 minute winter	18	6.000	19	-16.7	-0.247	-0.115	1.9717	
240 minute winter	19	Hydro-Brake®	21	18.9				453.1
240 minute winter	20	1.007	19	31.6	0.413	0.275	2.6471	

Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 99.03%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	1	344	68.477	1.193	18.3	115.5462	0.0000	SURCHARGED
360 minute winter	2	344	68.477	1.300	9.0	1.9402	0.0000	SURCHARGED
360 minute winter	3	344	68.476	1.191	10.0	62.6942	0.0000	SURCHARGED
360 minute winter	4	344	68.476	1.311	9.8	2.6988	0.0000	SURCHARGED
360 minute winter	5	344	68.476	1.476	9.3	3.1260	0.0000	FLOOD RISK
15 minute winter	6	10	65.641	0.066	12.8	0.0887	0.0000	OK
15 minute winter	7	10	68.867	0.117	37.3	0.2468	0.0000	OK
360 minute winter	8	336	67.247	1.197	27.1	175.2260	0.0000	SURCHARGED
360 minute winter	9	336	67.246	1.571	8.8	2.8847	0.0000	SURCHARGED
360 minute winter	10	336	67.245	1.770	5.1	2.9910	0.0000	FLOOD RISK
360 minute winter	11	344	65.350	0.150	12.1	0.3060	0.0000	OK
360 minute winter	12	344	65.349	0.549	18.1	1.4395	0.0000	SURCHARGED
180 minute winter	13	176	66.485	1.085	29.5	98.7659	0.0000	SURCHARGED
180 minute winter	14	176	66.485	0.735	9.5	1.4733	0.0000	SURCHARGED
180 minute winter	15	176	66.484	1.224	18.9	1.6969	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)
360 minute winter	1	1.000	2	-8.7	0.396	-0.219	0.7159	
360 minute winter	2	1.001	5	-4.8	-0.121	-0.121	1.1931	
360 minute winter	3	2.000	4	-7.5	-0.189	-0.187	0.7954	
360 minute winter	4	2.001	5	2.2	0.194	0.054	1.1136	
360 minute winter	5	Hydro-Brake®	6	5.1				
15 minute winter	6	1.003	11	12.8	1.359	0.173	0.1412	
15 minute winter	7	3.000	8	36.6	2.564	0.887	0.4285	
360 minute winter	8	3.001	9	-8.5	0.584	-0.146	1.1931	
360 minute winter	9	3.002	10	4.9	0.246	0.084	0.6363	
360 minute winter	10	Hydro-Brake®	11	5.0				
360 minute winter	11	1.004	12	12.1	1.140	0.077	1.0576	
360 minute winter	12	1.005	17	18.1	1.218	0.129	2.6759	
180 minute winter	13	4.000	15	-18.4	-0.464	-0.355	0.5568	
180 minute winter	14	5.000	15	8.9	0.929	0.499	0.1408	
180 minute winter	15	4.001	16	-5.9	0.241	-0.114	0.7954	

Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 99.03%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	16	176	66.483	1.423	10.6	2.9148	0.0000	FLOOD RISK
360 minute winter	17	344	65.345	1.220	29.2	3.2390	0.0000	SURCHARGED
360 minute winter	18	344	65.339	1.039	25.6	155.5653	0.0000	SURCHARGED
360 minute winter	19	344	65.339	1.594	36.8	3.5203	0.0000	FLOOD RISK
360 minute winter	20	344	65.341	1.516	33.1	3.6418	0.0000	FLOOD RISK
15 minute summer	21	1	63.645	0.000	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)
180 minute winter	16	Hydro-Brake®	17	5.0				
360 minute winter	17	1.006	20	28.3	0.762	0.159	4.1913	
360 minute winter	18	6.000	19	-20.7	-0.294	-0.142	1.9717	
360 minute winter	19	Hydro-Brake®	21	18.8				608.6
360 minute winter	20	1.007	19	32.7	0.412	0.284	2.6471	