SURFACE WATER AND FOUL WATER

DRAINAGE STRATEGY

for

BARTON CIVIL ENGINEERS LIMITED

RESIDENTIAL DEVELOPMENT

at

WHALLEY'S FARM

PRESTON ROAD, CHORLEY, CHARNOCK RICHARD, PR7 5HR

OCTOBER 2023

REFORD

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1. INTRODUCTION

1.1 This surface water and foul water drainage strategy has been produced on behalf of Barton Civil Engineers Limited in support of a planning application for the redevelopment of the site for the erection of four detached bungalows on land at Whalley's Farm, Preston Road, Charnock Richard, Chorley, PR7 5HR. A location plan is included within Appendix A.

1.2 This 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 proposed development.

2. BASE INFORMATION

Existing site

2.1 The proposal relates to a trapezoidal piece of land (approx. 0.48ha) that lies to the west of the centre of Coppull and to the south of Preston Road, Chorley.

2.2 The site is currently a small haulage yard comprising an open surfaced yard and a modern workshop building with a few perimeter trees.

2.3 Heatons Farm lies on the northern side of Preston Road at this location and to the north lie a number of residential properties fronting Preston Road, Town Lane and The Foxwood.

2.4 A topographical survey has been carried out and the site has a fall to the east and Preston Road.

Site geology

2.5 The online Soilscapes viewer has identified the geology of this parcel of land as slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.

Understanding of existing drainage local to the site

2.6 Whittle Brook passes under Preston Road approx. 90m to the east of the development site entrance.

2.7 United Utilities sewer records have identified a public foul sewer within Preston Road that lies approx. 100m to the west of the site entrance. The public foul sewer flows to the north along Preston Road. The sewer records are included within Appendix B.

2.8 It has been reported that a surface water drain lies within Preston Road outside of the development site that flows to the east along Preston Road to discharge into Whittle Brook approx. 90m from the development site entrance.

2.9 Foul water from the existing site is treated by a sewage treatment plant and the effluent is discharged to ground.

2.10 Surface water runoff from the existing site discharges into the surface water drain that lies within Preston Road, which subsequently discharges into Whittle Brook.

Proposed development

2.11 The proposed development is to comprise four detached bungalows.

3. PROPOSED DRAINAGE STRATEGY

3.1 The proposed drainage layout is included within Appendix C.

Surface water drainage

3.2 In accordance with the National Standards for Sustainable Drainage, the drainage strategy should incorporate the use of Sustainable Drainage (SUDS) where possible. The approach promotes the use infiltration features in the first instance. If drainage cannot be achieved solely through infiltration due to site conditions or contamination risks, the preferred options are (in order of preference):

(i) a controlled discharge to a local waterbody or watercourse, or

(ii) a controlled discharge into the public sewer network (depending on availability and capacity).

3.3 The rate and volume of discharge should strive to provide betterment and be restricted to the pre-development values as far as practicable.

3.4 The online Soilscapes viewer has identified the geology of this parcel of land as slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.

3.5 Whittle Brook passes under Preston Road approx. 90m to the east of the development site entrance.

3.6 It has been reported that a surface water drain lies within Preston Road outside of the development site that flows to the east along Preston Road to discharge into Whittle Brook.

3.7 Surface water runoff from the existing site discharges into the surface water drain that lies within Preston Road, which subsequently discharges into Whittle Brook.

3.8 It is therefore intended that the surface water runoff from the developed site will be controlled to the pre-development runoff rate, Qbar, allowing surface water runoff generated by all rainfall events up to the 100 year critical rain storm plus 45% on

stored volumes to discharge into the surface water drain that lies within Preston Road, which subsequently discharges into Whittle Brook.

3.9 To determine the restricted surface water discharge rate from the developed site, the pre-development runoff rates have been calculated using the 'Causeway Flow' programme. The calculations are based upon the development site area of 0.48ha. The existing pre-development Greenfield runoff rates have been calculated as below:

Pre-development discharge

Site Makeup	Brownfield
Brownfield Method	Greenfield
Greenfield Method	IH124
Positively Drained Area (ha)	0.480
SAAR (mm)	1019
Soil Index	5
SPR	0.53
Region	10
Betterment (%)	0
	Calc
QBar (l/s)	4.7

Return Period (years)	Growth Factor	Q (l/s)
1	0.85	4.0
30	1.95	9.1
100	2.48	11.6

3.10 A 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 45% for climate change on stored volumes. Surface water runoff from the developed site will be restricted to 4.7 l/s and attenuation is provided within the proposed drainage network using oversized pipes and manholes. The surface water drainage design is included within Appendix D.

3.11 The proposed surface water drainage for the development will only take runoff from the roofs of the properties and the access drive. Surface water runoff from the areas

of parking, paths and patios within the developed site will runoff to channel drains or to adjacent areas of gravel filter strips or planted beds where it will be allowed to infiltrate into the upper strata and will be either taken up by plants or evaporated.

Foul Water Drainage

3.12 Foul water from the existing site is treated by a sewage treatment plant and the effluent is discharged to ground.

3.13 It is therefore intended that foul water from the developed site will be collected by a piped system and be treated by a sewage treatment plant, to be located within the developed site a minimum 7m away from habitable areas, and the effluent discharged into the surface water drain that lies within Preston Road, which subsequently discharges into Whittle Brook.

4. SUMMARY AND CONCLUSIONS

4.1 This surface water and foul water drainage strategy has been produced on behalf of Barton Civil Engineers Limited in support of a planning application for the redevelopment of the site for the erection of four detached bungalows on land at Whalley's Farm, Preston Road, Charnock Richard, Chorley, PR7 5HR.

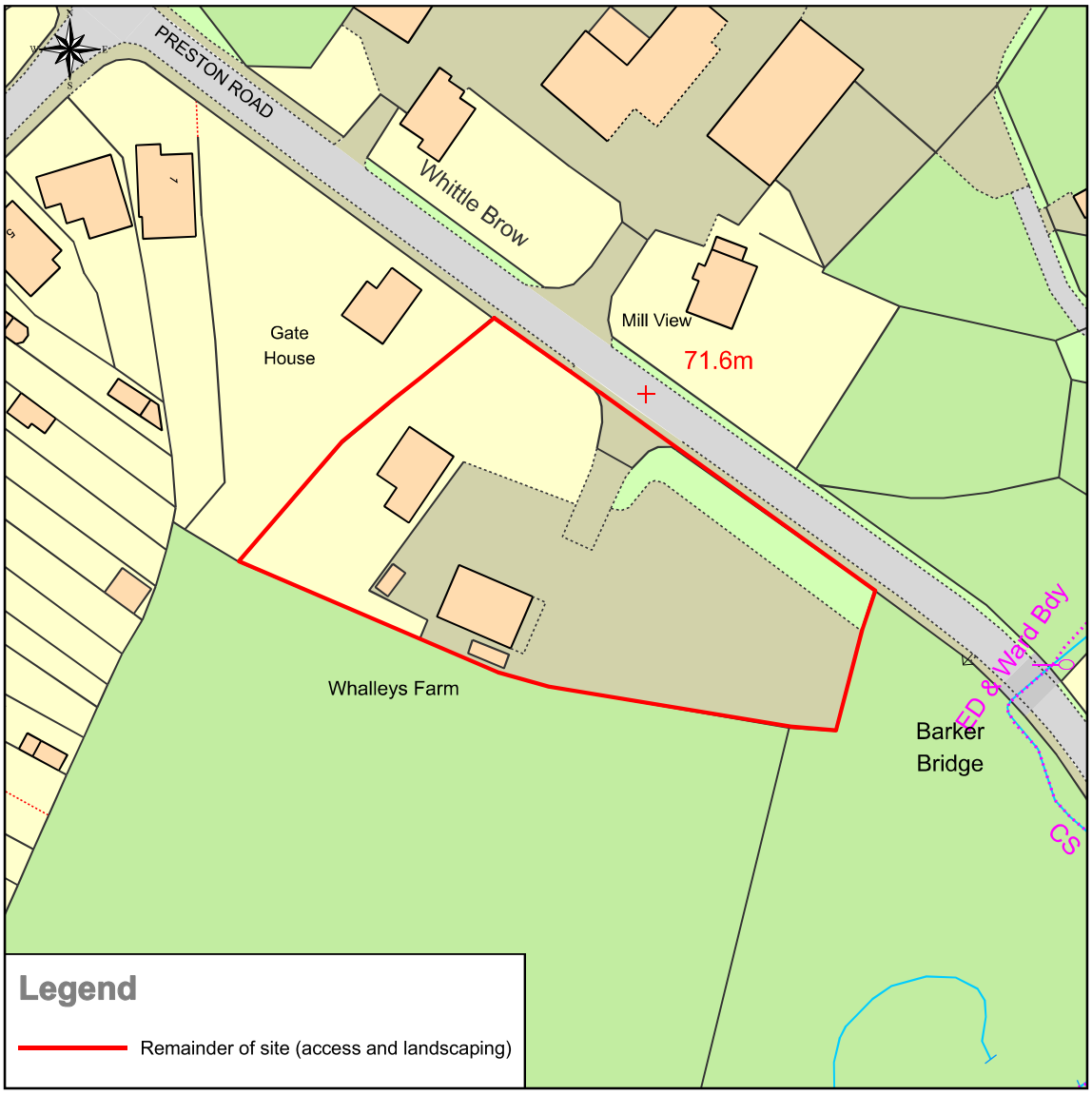
4.2 The online Soilscapes viewer has identified the geology of this parcel of land as slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.

4.3 Whittle Brook passes under Preston Road approx. 90m to the east of the development site entrance.

4.4 Surface water runoff from the developed site will be controlled to the pre-development runoff rate of 4.7 l/s allowing surface water runoff generated by all rainfall events up to the 100 year critical rain storm plus 45% on stored volumes to discharge into the surface water drain that lies within Preston Road, which subsequently discharges into Whittle Brook.

4.5 Foul water from the developed site will be collected by a piped system and be treated by a sewage treatment plant, to be located within the developed site a minimum 7m away from habitable areas, and the effluent discharged into the surface water drain that lies within Preston Road, which subsequently discharges into Whittle Brook.

APPENDIX A



Scale: 1:1250, paper size: A4

Plan Ref: BCE100/220202

Whalley Farm, Preston Road, Charnock Richard, Chorley

Ordnance Survey Licensed Mapping

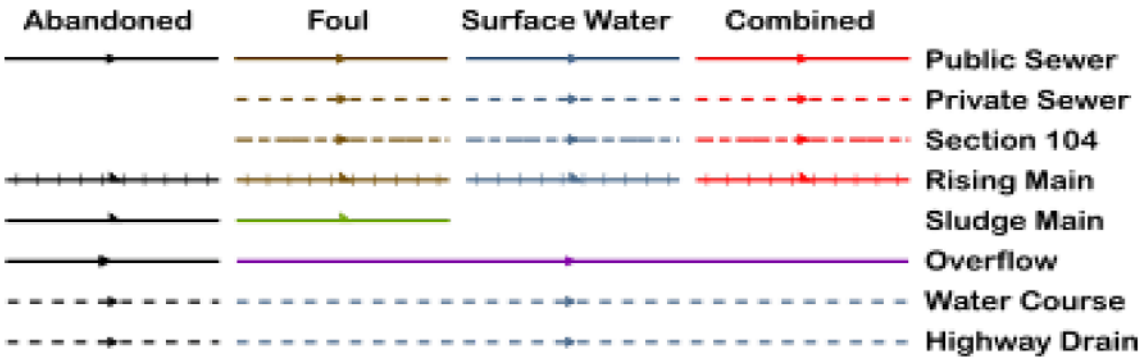
emapsite™ plans

Prepared by: Deborah Smith, 11-02-2022

APPENDIX B

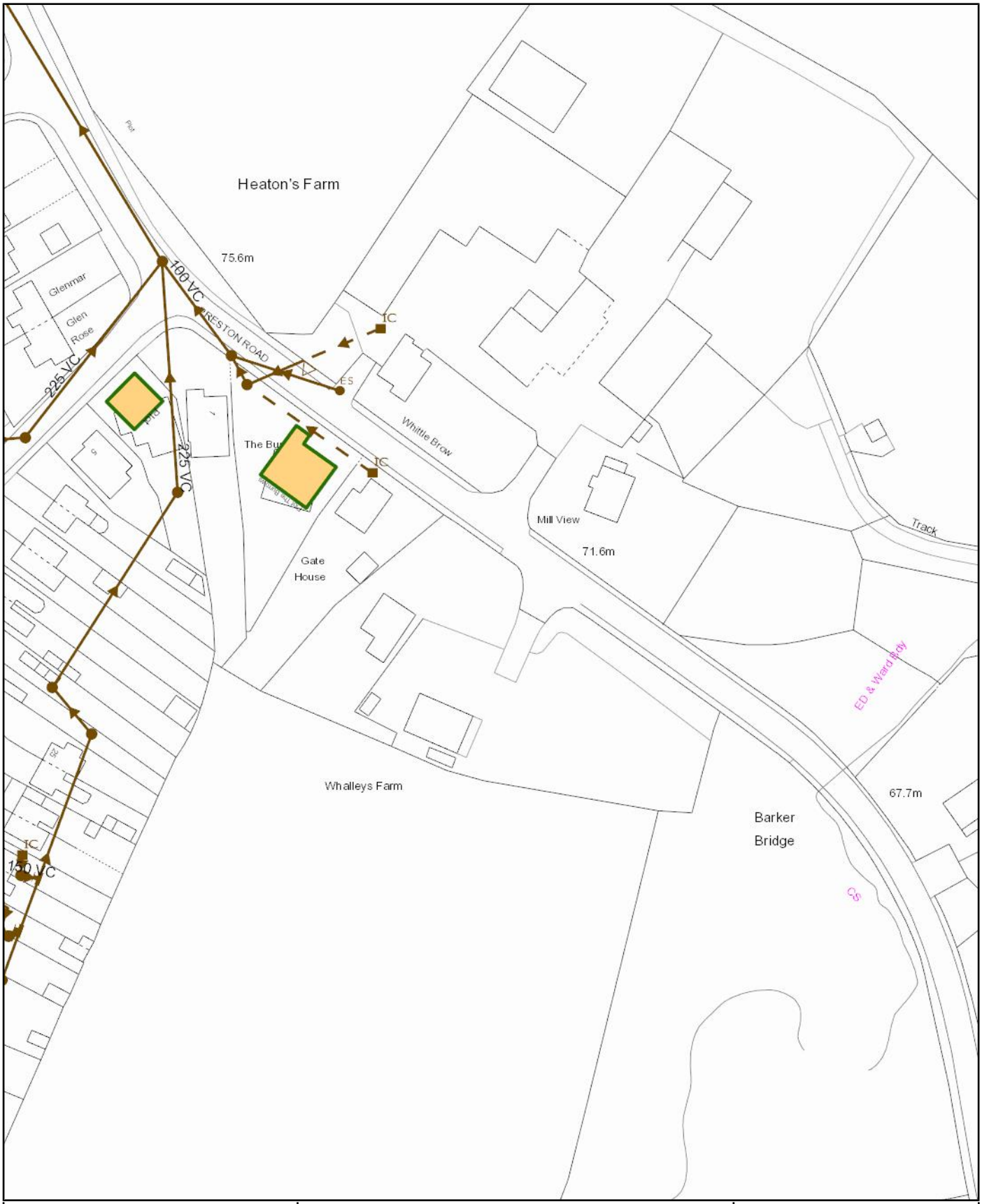
United Utilities
Water for the North West

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
- ST Septic Tank
- CK Control Kiosk
- Change of Characteristic



Scale:	1:1353	**SEWER RECORDS**	United Utilities Water for the North West
Date:	21/08/2023		
Address or Site Reference:	Whalley's Farm		
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

PROPOSED DRAINAGE LAYOUT

APPENDIX D

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	0.330	Preferred Cover Depth (m)	0.450
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	0.005	5.00	74.550	100	0.550
2	0.004	5.00	74.550	450	0.836
3	0.005	5.00	74.550	100	0.550
4			74.550	450	1.038
5	0.025	5.00	73.500	1500	1.860
6	0.004	5.00	74.150	100	0.550
7	0.002	5.00	74.150	450	0.853
8	0.004	5.00	74.150	100	0.550
9	0.002	5.00	74.150	450	0.988
10	0.005	5.00	73.450	1500	1.850
11	0.005	5.00	73.400	1500	1.825
12	0.004	5.00	73.750	100	0.550
13	0.002	5.00	73.750	450	0.853
14	0.004	5.00	73.750	100	0.550
15	0.002	5.00	73.750	450	0.988
16			73.350	1500	1.805
17	0.004	5.00	73.350	100	0.550
18	0.002	5.00	73.350	450	0.836
19	0.004	5.00	73.350	100	0.550
20	0.002	5.00	73.350	450	1.038
21			73.300	1800	1.800

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
22			69.500	1200	1.500

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	17.000	0.600	74.000	73.714	0.286	59.4	100	5.28	58.8
1.001	2	4	12.000	0.600	73.714	73.512	0.202	59.4	100	5.48	57.9
2.000	3	4	17.000	0.600	74.000	73.512	0.488	34.8	100	5.22	59.1
1.002	4	5	12.000	0.600	73.512	72.140	1.372	8.7	100	5.56	57.6
1.003	5	10	16.000	0.600	71.640	71.600	0.040	400.0	600	5.78	56.7
3.000	6	7	18.000	0.600	73.600	73.297	0.303	59.4	100	5.30	58.7
3.001	7	9	8.000	0.600	73.297	73.162	0.135	59.3	100	5.43	58.2
4.000	8	9	18.000	0.600	73.600	73.162	0.438	41.1	100	5.25	59.0
3.002	9	10	8.000	0.600	73.162	72.100	1.062	7.5	100	5.48	58.0
1.004	10	11	10.000	0.600	71.600	71.575	0.025	400.0	600	5.92	56.1
1.005	11	16	12.000	0.600	71.575	71.545	0.030	400.0	600	6.08	55.5

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	7.9	0.8	0.450	0.736	0.005	0.0
1.001	1.001	7.9	1.4	0.736	0.938	0.009	0.0
2.000	1.311	10.3	0.8	0.450	0.938	0.005	0.0
1.002	2.629	20.6	2.2	0.938	1.260	0.014	0.0
1.003	1.211	342.4	6.0	1.260	1.250	0.039	0.0
3.000	1.001	7.9	0.6	0.450	0.753	0.004	0.0
3.001	1.002	7.9	0.9	0.753	0.888	0.006	0.0
4.000	1.206	9.5	0.6	0.450	0.888	0.004	0.0
3.002	2.834	22.3	1.9	0.888	1.250	0.012	0.0
1.004	1.211	342.4	8.5	1.250	1.225	0.056	0.0
1.005	1.211	342.4	9.2	1.225	1.205	0.061	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)
5.000	12	13	18.000	0.600	73.200	72.897	0.303	59.4	100	5.30	58.7
5.001	13	15	8.000	0.600	72.897	72.762	0.135	59.3	100	5.43	58.2
6.000	14	15	18.000	0.600	73.200	72.762	0.438	41.1	100	5.25	59.0
5.002	15	16	6.000	0.600	72.762	72.045	0.717	8.4	100	5.47	58.0
1.006	16	21	18.000	0.600	71.545	71.500	0.045	400.0	600	6.33	54.5
7.000	17	18	17.000	0.600	72.800	72.514	0.286	59.4	100	5.28	58.8
7.001	18	20	12.000	0.600	72.514	72.312	0.202	59.4	100	5.48	57.9
8.000	19	20	18.000	0.600	72.800	72.312	0.488	36.9	100	5.24	59.0
7.002	20	21	2.000	0.600	72.312	72.000	0.312	6.4	100	5.49	57.9
1.007	21	22	16.000	0.600	71.500	68.000	3.500	4.6	150	6.39	54.3

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
5.000	1.001	7.9	0.6	0.450	0.753	0.004	0.0
5.001	1.002	7.9	0.9	0.753	0.888	0.006	0.0
6.000	1.206	9.5	0.6	0.450	0.888	0.004	0.0
5.002	2.688	21.1	1.9	0.888	1.205	0.012	0.0
1.006	1.211	342.4	10.8	1.205	1.200	0.073	0.0
7.000	1.001	7.9	0.6	0.450	0.736	0.004	0.0
7.001	1.001	7.9	0.9	0.736	0.938	0.006	0.0
8.000	1.274	10.0	0.6	0.450	0.938	0.004	0.0
7.002	3.073	24.1	1.9	0.938	1.200	0.012	0.0
1.007	4.746	83.9	12.5	1.650	1.350	0.085	0.0

Simulation Settings

Rainfall Methodology	FSR	Summer CV	0.750	Drain Down Time (mins)	240
FSR Region	England and Wales	Winter CV	0.840	Additional Storage (m^3/ha)	20.0
M5-60 (mm)	18.900	Analysis Speed	Normal	Check Discharge Rate(s)	x
Ratio-R	0.330	Skip Steady State	x	Check Discharge Volume	x

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0	100	0	0	0
30	0	0	0	100	45	0	0

Node 21 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	71.500	Product Number	CTL-SHE-0091-4700-1800-4700
Design Depth (m)	1.800	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	4.7	Min Node Diameter (mm)	1200

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	74.019	0.019	0.6	0.0036	0.0000	OK
15 minute winter	2	11	73.741	0.027	1.1	0.0068	0.0000	OK
15 minute summer	3	11	74.016	0.016	0.6	0.0031	0.0000	OK
15 minute winter	4	11	73.532	0.020	1.7	0.0031	0.0000	OK
15 minute winter	5	11	71.688	0.048	4.7	0.0980	0.0000	OK
15 minute winter	6	11	73.617	0.017	0.5	0.0026	0.0000	OK
15 minute winter	7	11	73.318	0.021	0.7	0.0043	0.0000	OK
15 minute winter	8	11	73.616	0.016	0.5	0.0024	0.0000	OK
15 minute winter	9	11	73.179	0.017	1.4	0.0035	0.0000	OK
30 minute winter	10	24	71.678	0.078	5.6	0.1412	0.0000	OK
30 minute winter	11	24	71.678	0.103	6.0	0.1868	0.0000	OK
15 minute winter	12	11	73.217	0.017	0.5	0.0026	0.0000	OK
15 minute winter	13	11	72.918	0.021	0.7	0.0043	0.0000	OK
15 minute winter	14	11	73.216	0.016	0.5	0.0024	0.0000	OK
15 minute winter	15	11	72.780	0.018	1.4	0.0036	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	0.6	0.449	0.076	0.0229	
15 minute winter	2	1.001	4	1.1	0.795	0.140	0.0167	
15 minute summer	3	2.000	4	0.6	0.652	0.058	0.0164	
15 minute winter	4	1.002	5	1.7	1.569	0.082	0.0129	
15 minute winter	5	1.003	10	4.6	0.379	0.014	0.2072	
15 minute winter	6	3.000	7	0.5	0.484	0.064	0.0187	
15 minute winter	7	3.001	9	0.7	0.663	0.088	0.0084	
15 minute winter	8	4.000	9	0.5	0.597	0.053	0.0152	
15 minute winter	9	3.002	10	1.4	1.555	0.062	0.0072	
30 minute winter	10	1.004	11	5.5	0.424	0.016	0.2656	
30 minute winter	11	1.005	16	5.1	0.383	0.015	0.4671	
15 minute winter	12	5.000	13	0.5	0.485	0.064	0.0187	
15 minute winter	13	5.001	15	0.7	0.652	0.088	0.0085	
15 minute winter	14	6.000	15	0.5	0.583	0.053	0.0156	
15 minute winter	15	5.002	16	1.4	1.491	0.066	0.0056	

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	16	24	71.677	0.132	6.3	0.2337	0.0000	OK
15 minute winter	17	11	72.817	0.017	0.5	0.0026	0.0000	OK
15 minute winter	18	11	72.535	0.021	0.7	0.0043	0.0000	OK
15 minute winter	19	11	72.815	0.015	0.5	0.0023	0.0000	OK
15 minute winter	20	11	72.329	0.017	1.4	0.0035	0.0000	OK
30 minute winter	21	24	71.677	0.177	5.3	0.4507	0.0000	SURCHARGED
15 minute summer	22	1	68.000	0.000	3.6	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)
30 minute winter	16	1.006	21	4.1	0.302	0.012	1.0384	
15 minute winter	17	7.000	18	0.5	0.486	0.064	0.0176	
15 minute winter	18	7.001	20	0.7	0.662	0.088	0.0126	
15 minute winter	19	8.000	20	0.5	0.607	0.050	0.0150	
15 minute winter	20	7.002	21	1.4	1.591	0.058	0.0017	
30 minute winter	21	Hydro-Brake®	22	3.7				6.4

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	74.029	0.029	1.5	0.0056	0.0000	OK
15 minute winter	2	10	73.756	0.042	2.7	0.0108	0.0000	OK
15 minute winter	3	10	74.026	0.026	1.5	0.0049	0.0000	OK
15 minute winter	4	11	73.543	0.031	4.1	0.0049	0.0000	OK
60 minute winter	5	48	71.866	0.226	6.5	0.4611	0.0000	OK
15 minute winter	6	10	73.626	0.026	1.2	0.0040	0.0000	OK
15 minute winter	7	11	73.331	0.034	1.8	0.0070	0.0000	OK
15 minute winter	8	10	73.624	0.024	1.2	0.0036	0.0000	OK
15 minute winter	9	11	73.190	0.028	3.5	0.0056	0.0000	OK
60 minute winter	10	48	71.866	0.266	7.9	0.4850	0.0000	OK
60 minute winter	11	47	71.866	0.291	6.6	0.5308	0.0000	OK
15 minute winter	12	10	73.226	0.026	1.2	0.0040	0.0000	OK
15 minute winter	13	11	72.931	0.034	1.8	0.0069	0.0000	OK
15 minute winter	14	10	73.224	0.024	1.2	0.0036	0.0000	OK
15 minute winter	15	11	72.791	0.029	3.5	0.0058	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	1.5	0.582	0.187	0.0431	
15 minute winter	2	1.001	4	2.6	1.000	0.329	0.0312	
15 minute winter	3	2.000	4	1.5	0.817	0.143	0.0307	
15 minute winter	4	1.002	5	4.1	2.007	0.196	0.0243	
60 minute winter	5	1.003	10	5.1	0.358	0.015	1.7448	
15 minute winter	6	3.000	7	1.2	0.595	0.148	0.0354	
15 minute winter	7	3.001	9	1.8	0.855	0.223	0.0164	
15 minute winter	8	4.000	9	1.2	0.736	0.123	0.0286	
15 minute winter	9	3.002	10	3.5	2.020	0.157	0.0139	
60 minute winter	10	1.004	11	5.8	0.384	0.017	1.2822	
60 minute winter	11	1.005	16	4.7	0.321	0.014	1.7357	
15 minute winter	12	5.000	13	1.2	0.597	0.148	0.0352	
15 minute winter	13	5.001	15	1.8	0.838	0.223	0.0168	
15 minute winter	14	6.000	15	1.2	0.716	0.123	0.0295	
15 minute winter	15	5.002	16	3.5	1.930	0.166	0.0109	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	16	47	71.866	0.321	6.6	0.5678	0.0000	OK
15 minute winter	17	10	72.826	0.026	1.2	0.0040	0.0000	OK
15 minute winter	18	11	72.547	0.033	1.8	0.0069	0.0000	OK
15 minute winter	19	10	72.823	0.023	1.2	0.0035	0.0000	OK
15 minute winter	20	11	72.341	0.029	3.5	0.0057	0.0000	OK
60 minute winter	21	47	71.866	0.366	6.0	0.9325	0.0000	SURCHARGED
15 minute summer	22	1	68.000	0.000	4.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	16	1.006	21	4.0	0.280	0.012	3.0049	
15 minute winter	17	7.000	18	1.2	0.601	0.148	0.0331	
15 minute winter	18	7.001	20	1.8	0.842	0.223	0.0250	
15 minute winter	19	8.000	20	1.2	0.729	0.117	0.0290	
15 minute winter	20	7.002	21	3.5	2.020	0.145	0.0035	
60 minute winter	21	Hydro-Brake®	22	4.1				20.8

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	74.034	0.034	2.0	0.0065	0.0000	OK
15 minute winter	2	10	73.764	0.050	3.6	0.0128	0.0000	OK
15 minute winter	3	10	74.030	0.030	2.0	0.0057	0.0000	OK
15 minute winter	4	11	73.548	0.036	5.5	0.0058	0.0000	OK
60 minute winter	5	50	71.995	0.355	8.6	0.7224	0.0000	OK
15 minute winter	6	10	73.630	0.030	1.6	0.0046	0.0000	OK
15 minute winter	7	10	73.336	0.039	2.4	0.0081	0.0000	OK
15 minute winter	8	10	73.628	0.028	1.6	0.0042	0.0000	OK
15 minute winter	9	10	73.194	0.032	4.7	0.0064	0.0000	OK
60 minute winter	10	50	71.995	0.395	10.1	0.7191	0.0000	OK
60 minute winter	11	50	71.995	0.420	8.1	0.7651	0.0000	OK
15 minute winter	12	10	73.230	0.030	1.6	0.0046	0.0000	OK
15 minute winter	13	10	72.936	0.039	2.4	0.0080	0.0000	OK
15 minute winter	14	10	73.228	0.028	1.6	0.0042	0.0000	OK
15 minute winter	15	10	72.795	0.033	4.7	0.0067	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	2.0	0.627	0.251	0.0536	
15 minute winter	2	1.001	4	3.5	1.077	0.443	0.0389	
15 minute winter	3	2.000	4	2.0	0.884	0.192	0.0381	
15 minute winter	4	1.002	5	5.5	2.173	0.264	0.0301	
60 minute winter	5	1.003	10	6.4	0.348	0.019	2.9612	
15 minute winter	6	3.000	7	1.6	0.648	0.199	0.0436	
15 minute winter	7	3.001	9	2.3	0.916	0.290	0.0201	
15 minute winter	8	4.000	9	1.6	0.803	0.166	0.0353	
15 minute winter	9	3.002	10	4.6	2.170	0.205	0.0168	
60 minute winter	10	1.004	11	7.0	0.350	0.021	2.0367	
60 minute winter	11	1.005	16	5.4	0.339	0.016	2.6246	
15 minute winter	12	5.000	13	1.6	0.650	0.199	0.0435	
15 minute winter	13	5.001	15	2.3	0.896	0.290	0.0205	
15 minute winter	14	6.000	15	1.6	0.778	0.166	0.0364	
15 minute winter	15	5.002	16	4.6	2.070	0.216	0.0132	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	16	50	71.995	0.450	8.0	0.7952	0.0000	OK
15 minute winter	17	10	72.830	0.030	1.6	0.0046	0.0000	OK
15 minute winter	18	10	72.553	0.039	2.4	0.0080	0.0000	OK
15 minute winter	19	10	72.827	0.027	1.6	0.0041	0.0000	OK
15 minute winter	20	10	72.346	0.034	4.7	0.0067	0.0000	OK
60 minute winter	21	50	71.995	0.495	6.8	1.2600	0.0000	SURCHARGED
15 minute summer	22	1	68.000	0.000	4.1	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)
60 minute winter	16	1.006	21	4.3	0.319	0.013	4.2792	
15 minute winter	17	7.000	18	1.6	0.656	0.199	0.0407	
15 minute winter	18	7.001	20	2.3	0.898	0.291	0.0306	
15 minute winter	19	8.000	20	1.6	0.786	0.157	0.0361	
15 minute winter	20	7.002	21	4.6	2.152	0.189	0.0042	
60 minute winter	21	Hydro-Brake®	22	4.1				27.5

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	74.042	0.042	2.9	0.0079	0.0000	OK
15 minute winter	2	10	73.777	0.063	5.1	0.0162	0.0000	OK
15 minute winter	3	10	74.036	0.036	2.9	0.0069	0.0000	OK
15 minute winter	4	11	73.557	0.045	7.9	0.0071	0.0000	OK
120 minute winter	5	98	72.639	0.999	7.8	2.0346	0.0000	SURCHARGED
15 minute winter	6	10	73.637	0.037	2.3	0.0056	0.0000	OK
15 minute winter	7	11	73.346	0.049	3.4	0.0100	0.0000	OK
15 minute winter	8	10	73.633	0.033	2.3	0.0051	0.0000	OK
15 minute winter	9	11	73.202	0.040	6.7	0.0079	0.0000	OK
120 minute winter	10	100	72.636	1.036	9.2	1.8874	0.0000	SURCHARGED
120 minute winter	11	98	72.636	1.061	7.3	1.9335	0.0000	SURCHARGED
15 minute winter	12	10	73.237	0.037	2.3	0.0056	0.0000	OK
15 minute winter	13	11	72.946	0.049	3.4	0.0100	0.0000	OK
15 minute winter	14	10	73.233	0.033	2.3	0.0051	0.0000	OK
15 minute winter	15	11	72.803	0.041	6.7	0.0083	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	2.8	0.684	0.363	0.0707	
15 minute winter	2	1.001	4	5.0	1.172	0.640	0.0515	
15 minute winter	3	2.000	4	2.9	0.971	0.278	0.0501	
15 minute winter	4	1.002	5	7.8	2.387	0.380	0.0395	
120 minute winter	5	1.003	10	5.8	0.325	0.017	4.5068	
15 minute winter	6	3.000	7	2.3	0.712	0.289	0.0575	
15 minute winter	7	3.001	9	3.4	1.005	0.426	0.0267	
15 minute winter	8	4.000	9	2.3	0.882	0.240	0.0465	
15 minute winter	9	3.002	10	6.7	2.399	0.301	0.0223	
120 minute winter	10	1.004	11	6.3	0.341	0.018	2.8168	
120 minute winter	11	1.005	16	5.2	0.325	0.015	3.3801	
15 minute winter	12	5.000	13	2.3	0.715	0.289	0.0573	
15 minute winter	13	5.001	15	3.4	0.982	0.426	0.0273	
15 minute winter	14	6.000	15	2.3	0.853	0.240	0.0481	
15 minute winter	15	5.002	16	6.7	2.282	0.317	0.0176	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	16	96	72.634	1.089	7.2	1.9241	0.0000	SURCHARGED
15 minute winter	17	10	72.837	0.037	2.3	0.0056	0.0000	OK
120 minute winter	18	98	72.637	0.123	1.2	0.0254	0.0000	SURCHARGED
15 minute winter	19	10	72.833	0.033	2.3	0.0050	0.0000	OK
120 minute winter	20	100	72.635	0.323	2.4	0.0640	0.0000	SURCHARGED
120 minute winter	21	96	72.633	1.133	6.4	2.8842	0.0000	SURCHARGED
15 minute summer	22	1	68.000	0.000	4.1	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	1.006	21	5.1	0.262	0.015	5.0702	
15 minute winter	17	7.000	18	2.3	0.723	0.289	0.0535	
120 minute winter	18	7.001	20	1.2	0.798	0.153	0.0939	
15 minute winter	19	8.000	20	2.3	0.851	0.228	0.0482	
120 minute winter	20	7.002	21	2.4	1.839	0.099	0.0156	
120 minute winter	21	Hydro-Brake®	22	4.1				49.7