SURFACE WATER AND FOUL WATER

DRAINAGE STRATEGY

for

G MIDDLEBROOK

and

LEA HOUGH CHARTERED SURVEYORS

LAND OFF SHEEPFOLD CRESCENT

BARROW BROOK, CLITHEROE, BB7 9XR

AUGUST 2018

REFORD

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CONTENTS

1. INTRODUCTION

1.1 This surface water and foul water drainage strategy has been produced on behalf of G Middlebrook and Lea Hough Chartered Surveyors in support of an outline planning application for a proposed residential development on land off Sheepfold Crescent, Barrow Brook, Clitheroe, BB7 9XR. 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 sewers 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 roughly rectangular piece of land (approx. 1.088 hectares) to the east Sheepfold Crescent.

2.2 The site lies to the east of the settlement of Barrow and adjacent to the A59, which runs along the site's eastern boundary in a north south direction. In the surroundings of the site, there is new residential development to the immediate west. To the west and south of this there are established residential areas.

2.3 To the further west, on what are currently open fields, there is a large allocated residential site with planning permission for about 500 houses, on which development is yet to start. To the north there is more mixed commercial uses centred on the A59 roundabout junction where there are employment and service uses, planning permission having been granted for various development types, some of which are yet to commence.

2.4 Access to the site is from Sheepfold Crescent.

2.5 The existing site comprises grassland.

2.6 The site has a general fall towards the northern boundary of the site.

Site geology

2.7 The online Soilscapes viewer has identified the geology of this parcel of land as slowly permeable seasonally wet acid loamy and clayey soils with impeded drainage. The soils are not conducive to infiltration.

2.8 Infiltration tests have not been carried out as the ground would not be conducive to infiltration.

Understanding of existing drainage local to the site

2.9 The Barrow Brook lies to the north of the site and flows to the west to ultimately discharge into the River Ribble approx. 2.2km to the west of the site.

2.10 The brook takes surface water runoff from the local area.

2.11 United Utilities sewer records show public foul and surface water sewers within Sheepfold Crescent and Waterside Reach that serve the existing residential properties.

2.12 The sewer records are included within Appendix B.

Proposed development

2.13 It is proposed that the development will comprise 20 residential dwellings and 9 apartments. The illustrative site layout plan is shown on drawing MIDD/01.Dwg.02 accompanying the planning application.

3. PROPOSED DRAINAGE STRATEGY

Surface water drainage

3.1 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).

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

3.3 The nature of the geology of the site means that infiltration back into the ground is not feasible.

3.4 The Barrow Brook lies to the north of the site and flows to the west to ultimately discharge into the River Ribble approx. 2.2km to the west of the site. The site falls to the north towards the Barrow Brook and surface water runoff from the site discharges into the brook.

3.5 It is intended that surface water runoff from the developed site will be attenuated and discharge into the Barrow Brook mimicking the existing situation.

3.6 The flow from the development will be controlled to pre-development runoff rates allowing surface water runoff generated by all rainfall events up to the 100 year critical rain storm plus 30% on stored volumes to discharge into the brook. The additional 30% is to allow for climate change and has been included in the surface water volume.

3.7 To determine the restricted surface water discharge rate from the developed site, Greenfield runoff has been calculated using the 'Causeway Flow' programme. The pre-development discharge rates have been calculated as follows:

- Qbar 9.7 l/s
- Q1 8.4 l/s
- Q30 16.4 l/s
- Q100 20.1 l/s

The calculation is below.

Pre-development discharge

Site Makeup	Greenfield
Greenfield Method	IH124
Positively Drained Area (ha)	1.088
SAAR (mm)	1178
Soil Index	4
SPR	0.47
Region	10
Growth Factor 1 year	0.87
Growth Factor 30 years	1.70
Growth Factor 100 years	2.08
Betterment (%)	0
	Calc
QBar (l/s)	9.7
Q 1 year (l/s)	8.4
Q 30 year (l/s)	16.4
Q 100 year (l/s)	20.1

3.8 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 30% for climate change on stored volumes. Attenuation is provided using underground

storage within the proposed landscaped areas and under car parking areas. The preliminary surface water drainage design is included within Appendix C.

3.9 It should be noted that the preliminary surface water drainage design identifies the volume of attenuation required for the 100 year event plus climate change and demonstrates, at this stage, that it can be accommodated within the indicative masterplan.

Foul Water Drainage

3.10 It is intended that foul water from the developed site will be collected by a piped system and discharged into the public foul sewer system to the immediate west of the site.

4. SUMMARY AND CONCLUSIONS

4.1 This surface water and foul water drainage strategy has been produced on behalf of G Middlebrook and Lea Hough Chartered Surveyors in support of an outline planning application for a proposed residential development on land off Sheepfold Crescent, Barrow Brook, Clitheroe, BB7 9XR.

4.2 The nature of the local geology means that infiltration of surface water runoff back into the ground is not feasible.

4.3 Surface water runoff from the developed site will be attenuated and discharge into the Barrow Brook to the north of the site. A restricted discharge will be made equivalent to the pre-development runoff rate.

4.4 The preliminary surface water drainage design has catered for surface water runoff generated by all rainfall events up to the 100 year critical rain storm plus 30% on stored volumes and demonstrates, at this stage, that it can be accommodated within the indicative masterplan. The additional 30% is to allow for climate change and has been included in the surface water volume.

4.5 Foul water from the developed site will be collected by a piped system and discharged into the public foul sewer system to the immediate west of the site.

APPENDIX A

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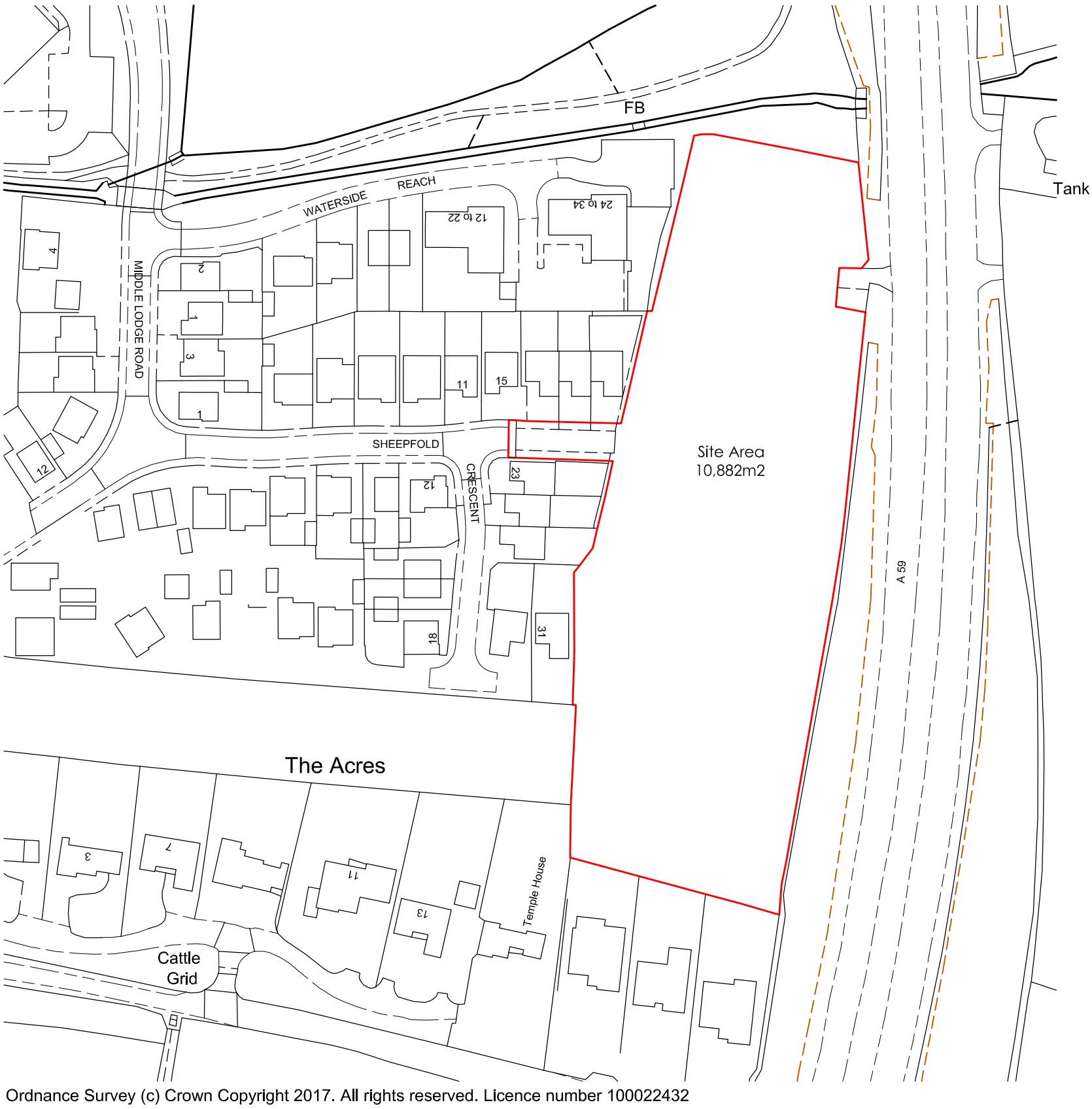

LOCATION PLAN	
Site: Land off Barrow Brook Clitheroe BB7 9X	**Client:** G Middlesbrook **Drawn:** KH **Date:** 27.01.17 **Scale:** 1:1250 @ A3 **Project No:** MIDD01 / Dwg 00 **Amendments:**

Notes:
All work is to be carried out to the latest current British standards Codes of Practice and recognised working practices. All work and materials should comply with Health and Safety legislation and to be approved by the Local Authority Planning / Building Control Officer.
All dimensions are in millimetres unless where explicitly shown otherwise. The contractor should check and clarify all dimensions as work proceeds and notify the design team of any discrepancies. Do not scale off the drawings, if in doubt ask.
Avalon Chartered Town Planning are not liable for work undertaken prior to Full Planning Consent and/or Building Regulations Approval

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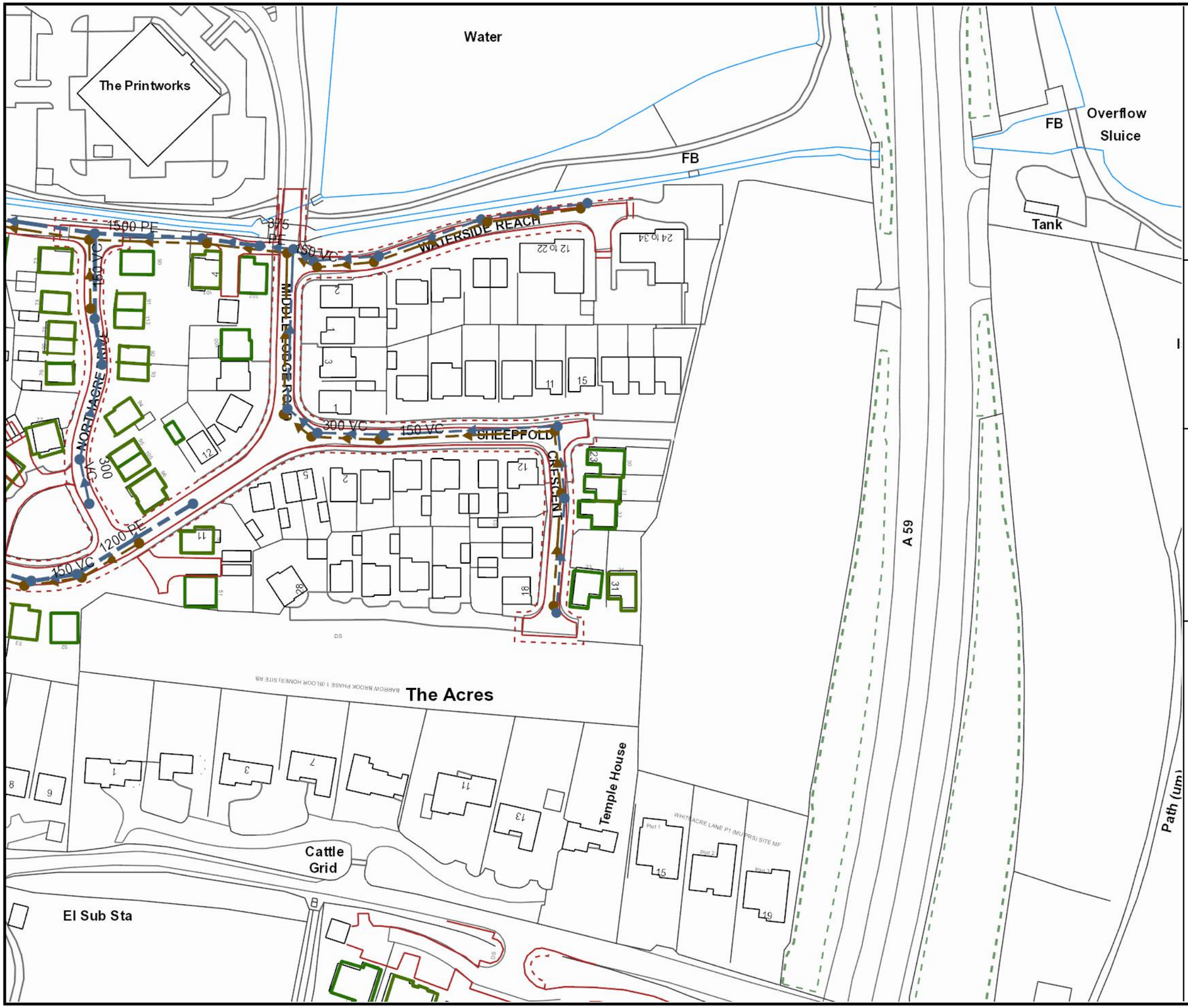
APPENDIX B



SEWER RECORDS

Address or Site Reference

sheepfold crescent,

Scale: 1:1250
Date: 12/08/2018

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

SURFACE WATER DRAINAGE LAYOUT

Drainage Design Report

Flow

v7.0

Network	Storm Network
Filename	C:\Users\Bob\Documents\reford\18.478 sheepfold crescent, barrow brook\drainage design\sheepfold crescent.pfd
Username	Bob Ford (r.e.ford@virginmedia.com)
Last analysed	15/08/2018 12:41:39
Report produced on	15/08/2018 12:44:43

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Rainfall Methodology	FSR
Return Period (years)	2
Additional Flow (%)	0
FSR Region	England and Wales
M5-60 (mm)	18.900
Ratio-R	0.280
CV	0.750
Time of Entry (mins)	5.00
Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	75.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Soffits
Minimum Backdrop Height (m)	2.000
Preferred Cover Depth (m)	1.200
Enforce best practice design rules	

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Node Type	Diameter (mm)	Depth (m)
1	0.037	5.00		93.000	Manhole	1200	1.425
2	0.090	5.00		91.000	Manhole	1200	1.625
3	0.032	5.00		91.750	Manhole	1200	2.493
4	0.026	5.00		92.500	Manhole	1200	3.344
5	0.020	5.00		92.100	Manhole	1200	3.086
6	0.047	5.00		91.600	Manhole	1200	2.978
7	0.104	5.00		90.000	Manhole	1200	1.425
8	0.015	5.00		91.100	Manhole	1200	2.795
9	0.023	5.00		90.600	Manhole	1200	2.377
10	0.033	5.00		90.000	Manhole	1200	1.855
11	0.028	5.00		89.500	Manhole	1200	1.500
12				89.500	Manhole	1200	1.541
13	0.025	5.00		89.000	Manhole	1200	1.500
14				88.000	Manhole	1200	1.425

Name	US Node	DS Node	Length (m)	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)	Min DS IL (m)	Lateral Area (ha)	Lateral Ins Point (%)	Lateral T of E (mins)
2.000	1	4	27.000	91.575	89.156	2.419	11.2	225	Circular	5.11	54.8				
1.000	2	3	20.000	89.375	89.257	0.118	169.5	225	Circular	5.33	53.9				
1.001	3	4	17.000	89.257	89.156	0.101	168.3	225	Circular	5.61	52.9				
1.002	4	5	24.000	89.156	89.014	0.142	169.0	225	Circular	6.01	51.5				
1.003	5	6	20.000	89.014	88.697	0.317	63.1	225	Circular	6.22	50.8				
1.004	6	8	20.000	88.622	88.305	0.317	63.1	300	Circular	6.38	50.2				
3.000	7	8	33.000	88.575	88.380	0.195	169.2	225	Circular	5.55	53.1				
1.005	8	9	20.000	88.305	88.223	0.082	243.9	300	Circular	6.72	49.2				
1.006	9	10	19.000	88.223	88.145	0.078	243.6	300	Circular	7.03	48.2				
1.007	10	11	17.000	88.145	88.000	0.145	117.2	300	Circular	7.23	47.7				
1.008	11	12	10.000	88.000	87.959	0.041	243.9	300	Circular	7.39	47.2				
1.009	12	13	25.000	87.959	87.500	0.459	54.5	300	Circular	7.59	46.7				
1.010	13	14	25.000	87.500	86.575	0.925	27.0	225	Circular	7.75	46.2				

Rainfall Methodology	FSR		Return Period (years)	Climate Change (%)
FSR Region	England and Wales		1	0
M5-60 (mm)	18.900		30	0
Ratio-R	0.280		100	0
Summer CV	0.750		100	30
Winter CV	0.840			
Analysis Speed	Normal			
Drain Down Time (mins)	240			
Additional Storage (m³/ha)	20.0			
Storm Durations (mins)	15			
	30			
	60			
	120			
	180			
	240			
	360			
	480			
	600			
	720			
	960			
	1440			
Check Discharge Rate(s)	x			
1 year (l/s)	8.4			
30 year (l/s)	16.4			
100 year (l/s)	20.1			
Check Discharge Volume	x			
100 year 360 minute (m³)				

Hydro-Brake®												
Node	Flap Valve	Online / Offline	Replaces Downstream Link	Loop to Node	Invert Level (m)	Design Depth (m)	Design Flow (l/s)	Objective	Sump Available	Product Number	Min Outlet Diameter (m)	Min Node Diameter (mm)
13	x	Online	x		87.500	1.500	9.7	(HE) Minimise upstream storage		CTL-SHE-0136-9700-1500-9700	0.150	1200

Depth/Area/Inf Area									
Node	Base Inf Coefficient (m/hr)	Side Inf Coefficient (m/hr)	Safety Factor	Porosity	Invert Level (m)	Time to half empty (mins)	Depth (m)	Area (m²)	Inf. Area (m²)
13	0.00000	0.00000	2.0	0.95	87.500		0.000	100.0	0.0
							1.000	100.0	0.0
							1.001	0.0	0.0
12	0.00000	0.00000	2.0	0.95	87.959	176	0.000	220.0	0.0
							0.600	220.0	0.0
							0.601	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.74%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	10	91.601	0.026	4.4	0.0426	0.0000	OK	2.000	4	4.3	0.547	0.028	0.3286	
15 minute winter	2	10	89.455	0.080	10.6	0.1801	0.0000	OK	1.000	3	10.4	0.727	0.262	0.2871	
15 minute winter	3	10	89.352	0.095	14.2	0.1323	0.0000	OK	1.001	4	14.1	0.747	0.353	0.3217	
15 minute winter	4	11	89.278	0.122	21.4	0.1566	0.0000	OK	1.002	5	21.4	1.112	0.536	0.4617	
15 minute winter	5	11	89.112	0.098	23.6	0.1234	0.0000	OK	1.003	6	23.5	1.473	0.358	0.3193	
15 minute winter	6	11	88.713	0.091	28.7	0.1321	0.0000	OK	1.004	8	28.7	0.900	0.205	0.6617	
15 minute winter	7	10	88.661	0.086	12.3	0.2239	0.0000	OK	3.000	8	12.2	0.825	0.306	0.5708	
15 minute winter	8	11	88.499	0.194	42.3	0.2397	0.0000	OK	1.005	9	43.3	0.932	0.612	1.0143	
15 minute winter	9	10	88.456	0.233	45.9	0.3089	0.0000	OK	1.006	10	48.2	1.076	0.680	1.2070	
15 minute winter	10	10	88.424	0.279	51.9	0.4146	0.0000	OK	1.007	11	60.7	1.136	0.592	1.1788	
15 minute summer	11	10	88.378	0.378	59.1	0.5691	0.0000	SURCHARGED	1.008	12	64.3	2.067	0.908	0.3661	
30 minute winter	12	24	88.045	0.086	42.7	18.1003	0.0000	OK	1.009	13	26.2	1.746	0.174	0.6960	
180 minute winter	13	132	87.790	0.290	16.4	27.9651	0.0000	SURCHARGED	1.010	14	9.1	1.563	0.091	0.1460	72.4
180 minute winter	14	132	86.621	0.046	9.1	0.0000	0.0000	OK							

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.74%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	10	91.615	0.040	10.7	0.0654	0.0000	OK	2.000	4	10.6	0.783	0.068	0.6002	
15 minute winter	2	12	89.587	0.212	26.0	0.4756	0.0000	OK	1.000	3	25.7	0.841	0.646	0.7864	
15 minute winter	3	12	89.548	0.291	34.9	0.4035	0.0000	SURCHARGED	1.001	4	30.0	0.854	0.752	0.6761	
15 minute winter	4	12	89.479	0.323	46.7	0.4160	0.0000	SURCHARGED	1.002	5	45.6	1.309	1.144	0.9545	
15 minute winter	5	11	89.269	0.255	51.4	0.3211	0.0000	SURCHARGED	1.003	6	54.2	1.679	0.826	0.7954	
15 minute winter	6	11	89.062	0.440	62.0	0.6372	0.0000	SURCHARGED	1.004	8	63.2	0.939	0.451	1.4084	
15 minute winter	7	11	89.096	0.521	30.0	1.3508	0.0000	SURCHARGED	3.000	8	28.0	0.849	0.702	1.3124	
15 minute winter	8	11	88.983	0.678	91.3	0.8399	0.0000	SURCHARGED	1.005	9	92.3	1.311	1.303	1.4084	
15 minute winter	9	11	88.798	0.575	97.5	0.7616	0.0000	SURCHARGED	1.006	10	98.6	1.401	1.391	1.3380	
15 minute winter	10	10	88.603	0.458	106.1	0.6813	0.0000	SURCHARGED	1.007	11	107.1	1.521	1.044	1.1971	
15 minute winter	11	8	88.473	0.473	114.2	0.7107	0.0000	SURCHARGED	1.008	12	115.4	2.219	1.629	0.5108	
180 minute winter	12	144	88.164	0.205	37.8	42.9782	0.0000	OK	1.009	13	36.7	1.069	0.243	1.5199	
180 minute winter	13	144	88.162	0.662	38.7	63.8786	0.0000	SURCHARGED	1.010	14	9.7	1.590	0.096	0.1524	166.2
600 minute summer	14	465	86.622	0.047	9.7	0.0000	0.0000	OK							

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.74%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	10	91.620	0.045	13.8	0.0740	0.0000	OK	2.000	4	13.7	0.797	0.088	0.6126	
15 minute winter	2	12	90.112	0.737	33.5	1.6512	0.0000	SURCHARGED	1.000	3	25.2	0.854	0.632	0.7954	
15 minute winter	3	12	90.055	0.798	36.4	1.1070	0.0000	SURCHARGED	1.001	4	33.5	0.862	0.838	0.6761	
15 minute winter	4	12	89.962	0.806	54.7	1.0371	0.0000	SURCHARGED	1.002	5	51.8	1.319	1.301	0.9545	
15 minute winter	5	12	89.681	0.667	56.4	0.8409	0.0000	SURCHARGED	1.003	6	58.4	1.716	0.891	0.7954	
15 minute winter	6	12	89.383	0.761	69.8	1.1010	0.0000	SURCHARGED	1.004	8	71.3	1.013	0.509	1.4084	
15 minute winter	7	11	89.422	0.847	38.7	2.1949	0.0000	SURCHARGED	3.000	8	33.9	0.852	0.850	1.3124	
15 minute winter	8	12	89.273	0.968	107.2	1.1980	0.0000	SURCHARGED	1.005	9	107.8	1.531	1.522	1.4084	
15 minute winter	9	12	89.016	0.793	114.5	1.0503	0.0000	SURCHARGED	1.006	10	115.1	1.634	1.624	1.3380	
15 minute winter	10	11	88.745	0.600	124.7	0.8917	0.0000	SURCHARGED	1.007	11	125.4	1.780	1.222	1.1971	
15 minute winter	11	8	88.559	0.559	133.5	0.8409	0.0000	SURCHARGED	1.008	12	134.2	2.472	1.895	0.5679	
180 minute winter	12	164	88.305	0.346	49.1	72.7778	0.0000	SURCHARGED	1.009	13	40.9	1.156	0.271	1.7605	
180 minute winter	13	168	88.303	0.803	43.5	77.5009	0.0000	SURCHARGED	1.010	14	9.7	1.590	0.096	0.1524	204.0
30 minute summer	14	100	86.622	0.047	9.7	0.0000	0.0000	OK							

Results for 100 year +30% Critical Storm Duration. Lowest mass balance: 99.74%

Event	US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	10	91.626	0.051	17.9	0.0843	0.0000	OK	2.000	4	17.8	0.845	0.114	0.6280	
15 minute winter	2	13	90.869	1.494	43.6	3.3456	0.0000	FLOOD RISK	1.000	3	30.0	0.851	0.754	0.7954	
15 minute winter	3	13	90.795	1.538	44.6	2.1354	0.0000	SURCHARGED	1.001	4	39.3	0.988	0.983	0.6761	
15 minute winter	4	13	90.670	1.514	66.7	1.9474	0.0000	SURCHARGED	1.002	5	60.8	1.529	1.525	0.9545	
15 minute winter	5	12	90.277	1.263	66.0	1.5929	0.0000	SURCHARGED	1.003	6	69.1	1.738	1.054	0.7954	
15 minute winter	6	12	89.885	1.263	82.1	1.8283	0.0000	SURCHARGED	1.004	8	83.7	1.189	0.598	1.4084	
15 minute winter	7	12	89.967	1.392	50.4	3.6060	0.0000	FLOOD RISK	3.000	8	41.6	1.045	1.043	1.3124	
15 minute winter	8	12	89.737	1.432	127.5	1.7727	0.0000	SURCHARGED	1.005	9	127.3	1.808	1.798	1.4084	
15 minute winter	9	12	89.378	1.155	136.0	1.5297	0.0000	SURCHARGED	1.006	10	136.0	1.932	1.919	1.3380	
15 minute winter	10	12	88.985	0.840	148.5	1.2490	0.0000	SURCHARGED	1.007	11	148.8	2.113	1.451	1.1971	
15 minute winter	11	7	88.588	0.588	159.4	0.8843	0.0000	SURCHARGED	1.008	12	159.9	2.725	2.257	0.6162	
240 minute winter	12	232	88.526	0.567	52.0	119.0492	0.0000	SURCHARGED	1.009	13	39.1	1.170	0.259	1.7605	
240 minute winter	13	232	88.524	1.024	41.6	96.5467	0.0000	SURCHARGED	1.010	14	9.7	1.589	0.096	0.1524	219.4
30 minute summer	14	153	86.622	0.047	9.7	0.0000	0.0000	OK							