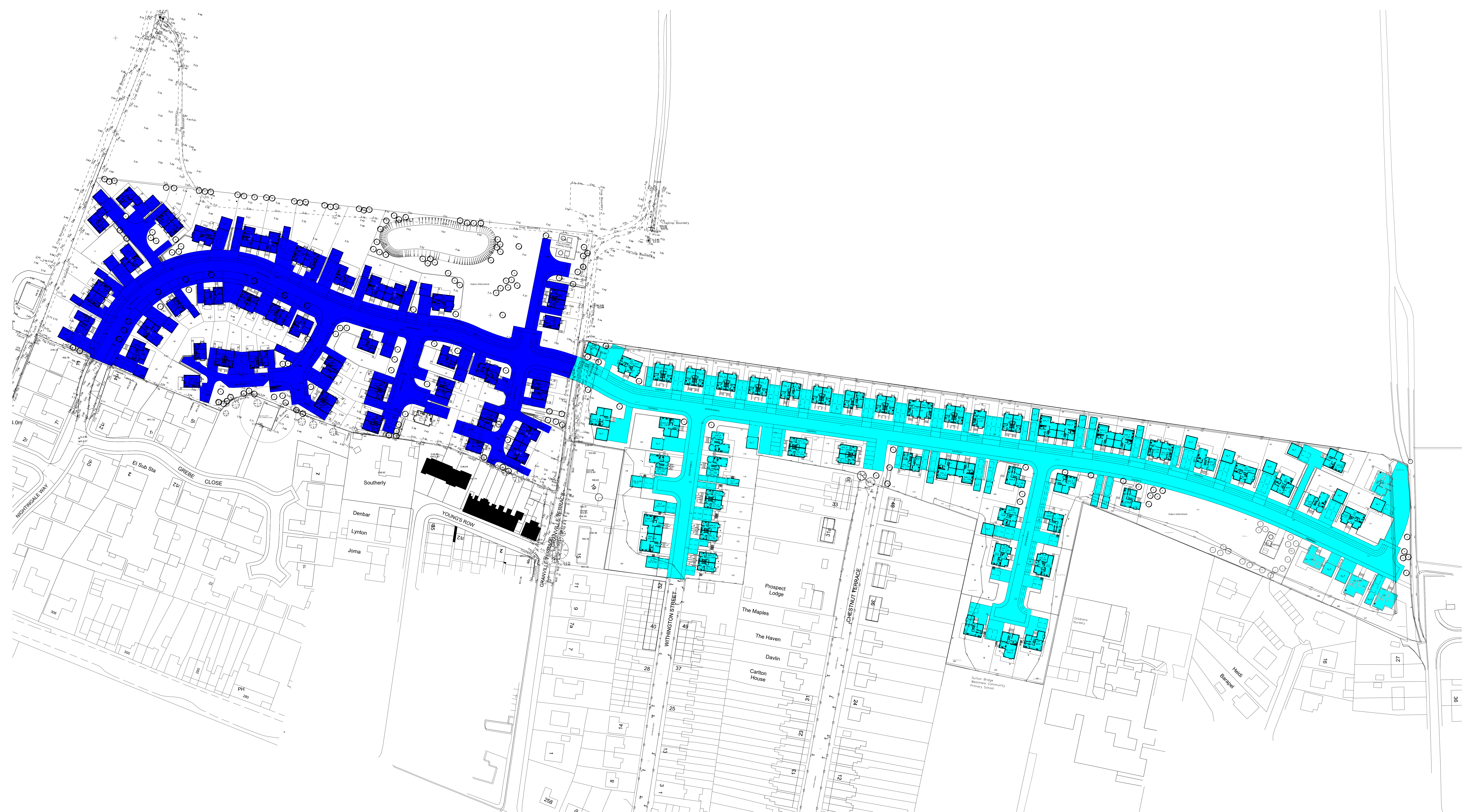


APPENDIX 6 – PROPOSED IMPERMEABLE AREA PLAN



GENERAL

Do not scale from this drawing.

All dimensions are in millimetres unless noted otherwise.

All setting out to architects drawings.

Drawing to be read in conjunction with all other SEA drawings and architects drawings.

This scheme has been designed using the survey information provided by others. It shall be the responsibility of the contractor to verify levels, boundaries etc prior to commencing any works on site. SEA Structural Engineers Ltd shall not accept any responsibility for errors resulting from the survey.

All setting out of houses and private drives/footpaths to be in accordance with the Architect's drawings; the Contractor is to check all dimensions and levels prior to commencement of work and report any discrepancies to the Engineer, including any encountered during construction works.

All dimensions should be checked on site prior to construction. Please notify the Engineer of any discrepancies before commencing or continuing any work.

HEALTH, SAFETY & THE ENVIRONMENT

In accordance with the Health and Safety at Work etc Act 1974 and the Construction (Design and Management) Regulations 2015, designs and details on this drawing have been the subject of a Designers Risk Assessment, to identify risks to construction, use, or demolition of the scheme.

It is not considered necessary for Designers to highlight obvious and/or common risks (such as deep excavations, manual handling and working around heavy plant) which Contractors should be familiar with.

So far as is reasonably practicable, risks inherent in the design have been eliminated. Where it has been considered that elimination of a risk (or part of a risk) is not reasonably practicable, it has been reduced.

Significant unusual residual risks are identified below, beside the measures which have been adopted to eliminate and/or reduce them:

None identified.

DRAWING KEY

	Proposed impermeable area draining to 108 drain Roof = 4380m ² Drives = 3886m ² Roads = 4245m ² 10% urban creep allowance calculated using roof and drive areas only = 825m ² Total impermeable area = 15,320m ²
	Proposed impermeable area draining to eastern Anglian Water storm sewer Roof = 5972m ² Drives = 4170m ² Roads = 7752m ² 10% urban creep allowance calculated using roof and drive areas only = 1015m ² Total impermeable area = 18,910m ²

Rev.	Date	By	Description
 SEA STRUCTURAL ENGINEERS [CONSULTING CIVIL & STRUCTURAL ENGINEERS] E: enquires@seaststructuralengineers.co.uk T: 01832 272352			
PROJECT RESIDENTIAL DEVELOPMENT LAND NORTH OF SUTTON BRIDGE			
DRAWING IMPERMEABLE AREA PLAN			
SCALE: NTS @A0		DATE: 06.08.2020	
DRAWN BY: SEA		REV: -	
STATUS: FOR PLANNING			
DWG No: 1886/S/E100			

APPENDIX 7 – GREENFIELD RUNOFF CALCULATIONS

Calculated by:	SEA
Site name:	Land North of Sutton Bridge
Site location:	Sutton Bridge

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	52.77483° N
Longitude:	0.17967° E
Reference:	3283632819
Date:	Aug 06 2020 21:15

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	3.2387
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Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	583	583
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	4.77	4.77
1 in 1 year (l/s):	4.15	4.15
1 in 30 years (l/s):	11.68	11.68
1 in 100 year (l/s):	16.96	16.96
1 in 200 years (l/s):	20.06	20.06

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

APPENDIX 8 – 1in1, 1in30 and 1in100+40% STORM WATER CALCULATIONS

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.000
Ratio-R	0.400	Preferred Cover Depth (m)	0.900
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
1	0.057	4.00	3.910	1500	1.500
2	0.057	4.00	3.868	1500	1.575
3	0.057	4.00	3.834	1500	1.575
4	0.057	4.00	3.802	1500	1.575
5	0.057	4.00	3.763	1500	1.575
6	0.057	4.00	3.726	1500	1.575
7	0.057	4.00	3.691	1500	1.575
8	0.057	4.00	3.669	1500	1.575
9	0.057	4.00	3.716	1500	1.500
10	0.057	4.00	3.713	1500	1.500
11	0.057	4.00	3.688	1500	1.500
12	0.057	4.00	3.648	1500	1.500
13	0.057	4.00	3.604	1500	1.575
14	0.057	4.00	3.554	1500	1.575
15	0.057	4.00	3.605	1500	1.500
16	0.057	4.00	3.581	1500	1.500
17	0.057	4.00	3.558	1500	1.500
18	0.057	4.00	3.513	1500	1.575
19	0.057	4.00	3.614	1500	1.500
20	0.057	4.00	3.578	1500	1.500
21	0.057	4.00	3.628	1500	1.500
22	0.057	4.00	3.588	1500	1.500
23	0.057	4.00	3.561	1500	1.500
23a	0.057	4.00	3.602	1500	1.500
24	0.057	4.00	3.544	1500	1.500
25	0.057	4.00	3.455	1500	1.575
26	0.050	4.00	3.481	1500	1.575
26a	0.000	4.00	3.426	1500	1.574
27	0.000	4.00	3.500	600	1.714
28	0.000	4.00	3.500	600	1.753
29	0.000	4.00	3.500	1500	1.834
30	0.000	4.00	3.500	1500	1.854

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	20.974	0.600	2.410	2.368	0.042	500.0	600	4.32	50.0
1.001	2	3	16.813	0.600	2.293	2.259	0.034	500.0	675	4.56	50.0
1.002	3	4	15.813	0.600	2.259	2.227	0.032	500.0	675	4.79	50.0
1.003	4	5	19.282	0.600	2.227	2.188	0.039	500.0	675	5.07	50.0
1.004	5	6	18.431	0.600	2.188	2.151	0.037	500.0	675	5.33	50.0
1.005	6	7	17.664	0.600	2.151	2.116	0.035	500.0	675	5.58	50.0
1.006	7	8	11.233	0.600	2.116	2.094	0.022	500.0	675	5.74	50.0
1.007	8	13	32.105	0.600	2.094	2.030	0.064	500.0	675	6.20	50.0
2.000	9	11	13.685	0.600	2.216	2.189	0.027	500.0	600	4.21	50.0
3.000	10	11	12.406	0.600	2.213	2.188	0.025	500.0	600	4.19	50.0
2.001	11	12	19.561	0.600	2.188	2.148	0.040	489.0	600	4.51	50.0
2.002	12	13	21.620	0.600	2.148	2.104	0.044	491.4	600	4.84	50.0
1.008	13	14	24.923	0.600	2.029	1.979	0.050	498.5	675	6.56	50.0
1.009	14	18	20.152	0.600	1.979	1.939	0.040	500.0	675	6.85	50.0
4.000	15	16	11.615	0.600	2.105	2.081	0.024	484.0	600	4.18	50.0
4.001	16	17	11.089	0.600	2.081	2.058	0.023	482.1	600	4.34	50.0
4.002	17	18	22.302	0.600	2.058	2.013	0.045	500.0	600	4.69	50.0
1.010	18	26	15.982	0.600	1.938	1.906	0.032	500.0	675	7.08	50.0
5.000	19	20	17.659	0.600	2.114	2.078	0.036	490.5	600	4.27	50.0
5.001	20	23	8.303	0.600	2.078	2.061	0.017	500.0	600	4.40	50.0
6.000	21	22	19.979	0.600	2.128	2.088	0.040	500.0	600	4.31	50.0
6.001	22	23	13.571	0.600	2.088	2.061	0.027	500.0	600	4.52	50.0
7.000	23a	23	20.107	0.600	2.102	2.061	0.041	490.4	600	4.31	50.0
5.002	23	24	8.348	0.600	2.061	2.044	0.017	500.0	600	4.65	50.0
5.003	24	25	18.856	0.600	2.044	1.955	0.089	211.9	600	4.83	50.0
1.011	26	25	12.823	0.600	1.906	1.880	0.026	500.0	675	7.26	50.0
1.012	25	26a	14.243	0.600	1.880	1.852	0.028	500.0	675	7.46	50.0
1.013	26a	27	32.857	0.600	1.852	1.786	0.066	500.0	675	7.93	50.0
1.014	27	28	19.538	0.600	1.786	1.747	0.039	500.0	675	8.21	50.0
1.015	28	29	40.407	0.600	1.747	1.666	0.081	500.0	675	8.79	50.0
1.016	29	30	10.000	0.600	1.666	1.646	0.020	500.0	675	8.93	50.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	20.974	500.0	600	Circular	3.910	2.410	0.900	3.868	2.368	0.900
1.001	16.813	500.0	675	Circular	3.868	2.293	0.900	3.834	2.259	0.900
1.002	15.813	500.0	675	Circular	3.834	2.259	0.900	3.802	2.227	0.900
1.003	19.282	500.0	675	Circular	3.802	2.227	0.900	3.763	2.188	0.900
1.004	18.431	500.0	675	Circular	3.763	2.188	0.900	3.726	2.151	0.900
1.005	17.664	500.0	675	Circular	3.726	2.151	0.900	3.691	2.116	0.900
1.006	11.233	500.0	675	Circular	3.691	2.116	0.900	3.669	2.094	0.900

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1500	Manhole	Adoptable	2	1500	Manhole	Adoptable
1.001	2	1500	Manhole	Adoptable	3	1500	Manhole	Adoptable
1.002	3	1500	Manhole	Adoptable	4	1500	Manhole	Adoptable
1.003	4	1500	Manhole	Adoptable	5	1500	Manhole	Adoptable
1.004	5	1500	Manhole	Adoptable	6	1500	Manhole	Adoptable
1.005	6	1500	Manhole	Adoptable	7	1500	Manhole	Adoptable
1.006	7	1500	Manhole	Adoptable	8	1500	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.007	32.105	500.0	675	Circular	3.669	2.094	0.900	3.604	2.030	0.899
2.000	13.685	500.0	600	Circular	3.716	2.216	0.900	3.688	2.189	0.899
3.000	12.406	500.0	600	Circular	3.713	2.213	0.900	3.688	2.188	0.900
2.001	19.561	489.0	600	Circular	3.688	2.188	0.900	3.648	2.148	0.900
2.002	21.620	491.4	600	Circular	3.648	2.148	0.900	3.604	2.104	0.900
1.008	24.923	498.5	675	Circular	3.604	2.029	0.900	3.554	1.979	0.900
1.009	20.152	500.0	675	Circular	3.554	1.979	0.900	3.513	1.939	0.899
4.000	11.615	484.0	600	Circular	3.605	2.105	0.900	3.581	2.081	0.900
4.001	11.089	482.1	600	Circular	3.581	2.081	0.900	3.558	2.058	0.900
4.002	22.302	500.0	600	Circular	3.558	2.058	0.900	3.513	2.013	0.900
1.010	15.982	500.0	675	Circular	3.513	1.938	0.900	3.481	1.906	0.900
5.000	17.659	490.5	600	Circular	3.614	2.114	0.900	3.578	2.078	0.900
5.001	8.303	500.0	600	Circular	3.578	2.078	0.900	3.561	2.061	0.900
6.000	19.979	500.0	600	Circular	3.628	2.128	0.900	3.588	2.088	0.900
6.001	13.571	500.0	600	Circular	3.588	2.088	0.900	3.561	2.061	0.900
7.000	20.107	490.4	600	Circular	3.602	2.102	0.900	3.561	2.061	0.900
5.002	8.348	500.0	600	Circular	3.561	2.061	0.900	3.544	2.044	0.900
5.003	18.856	211.9	600	Circular	3.544	2.044	0.900	3.455	1.955	0.900
1.011	12.823	500.0	675	Circular	3.481	1.906	0.900	3.455	1.880	0.900
1.012	14.243	500.0	675	Circular	3.455	1.880	0.900	3.426	1.852	0.899
1.013	32.857	500.0	675	Circular	3.426	1.852	0.899	3.500	1.786	1.039
1.014	19.538	500.0	675	Circular	3.500	1.786	1.039	3.500	1.747	1.078
1.015	40.407	500.0	675	Circular	3.500	1.747	1.078	3.500	1.666	1.159
1.016	10.000	500.0	675	Circular	3.500	1.666	1.159	3.500	1.646	1.179

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.007	8	1500	Manhole	Adoptable	13	1500	Manhole	Adoptable
2.000	9	1500	Manhole	Adoptable	11	1500	Manhole	Adoptable
3.000	10	1500	Manhole	Adoptable	11	1500	Manhole	Adoptable
2.001	11	1500	Manhole	Adoptable	12	1500	Manhole	Adoptable
2.002	12	1500	Manhole	Adoptable	13	1500	Manhole	Adoptable
1.008	13	1500	Manhole	Adoptable	14	1500	Manhole	Adoptable
1.009	14	1500	Manhole	Adoptable	18	1500	Manhole	Adoptable
4.000	15	1500	Manhole	Adoptable	16	1500	Manhole	Adoptable
4.001	16	1500	Manhole	Adoptable	17	1500	Manhole	Adoptable
4.002	17	1500	Manhole	Adoptable	18	1500	Manhole	Adoptable
1.010	18	1500	Manhole	Adoptable	26	1500	Manhole	Adoptable
5.000	19	1500	Manhole	Adoptable	20	1500	Manhole	Adoptable
5.001	20	1500	Manhole	Adoptable	23	1500	Manhole	Adoptable
6.000	21	1500	Manhole	Adoptable	22	1500	Manhole	Adoptable
6.001	22	1500	Manhole	Adoptable	23	1500	Manhole	Adoptable
7.000	23a	1500	Manhole	Adoptable	23	1500	Manhole	Adoptable
5.002	23	1500	Manhole	Adoptable	24	1500	Manhole	Adoptable
5.003	24	1500	Manhole	Adoptable	25	1500	Manhole	Adoptable
1.011	26	1500	Manhole	Adoptable	25	1500	Manhole	Adoptable
1.012	25	1500	Manhole	Adoptable	26a	1500	Manhole	Adoptable
1.013	26a	1500	Manhole	Adoptable	27	600	Manhole	Adoptable
1.014	27	600	Manhole	Adoptable	28	600	Manhole	Adoptable
1.015	28	600	Manhole	Adoptable	29	1500	Manhole	Adoptable
1.016	29	1500	Manhole	Adoptable	30	1500	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	40	0	0

Node 29 Online Pump Control

Flap Valve	x	Design Depth (m)	1.259	Switch off depth (m)	0.000
Replaces Downstream Link	✓	Design Flow (l/s)	5.0		
Invert Level (m)	1.666	Switch on depth (m)	1.259		

Depth (m)	Flow (l/s)
1.259	5.000

Node 28 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	1.747
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	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	534.0	0.0	1.453	1086.0	0.0	1.753	1217.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	2.480	0.070	8.5	0.1761	0.0000	OK
15 minute winter	2	10	2.393	0.100	16.9	0.2502	0.0000	OK
10080 minute winter	3	8940	2.391	0.132	0.3	0.3288	0.0000	OK
10080 minute winter	4	6900	2.391	0.164	0.4	0.4084	0.0000	OK
10080 minute winter	5	6900	2.391	0.203	0.5	0.5056	0.0000	OK
10080 minute winter	6	6900	2.391	0.240	0.6	0.5976	0.0000	OK
10080 minute winter	7	10320	2.391	0.275	0.7	0.6847	0.0000	OK
10080 minute winter	8	10320	2.391	0.297	0.8	0.7396	0.0000	OK
10080 minute winter	9	9660	2.391	0.175	0.1	0.4422	0.0000	OK
10080 minute winter	10	9660	2.391	0.178	0.1	0.4498	0.0000	OK
10080 minute winter	11	9660	2.391	0.203	0.3	0.5129	0.0000	OK
10080 minute winter	12	9660	2.391	0.243	0.5	0.6138	0.0000	OK
10080 minute winter	13	7560	2.391	0.362	1.3	0.9013	0.0000	OK
10080 minute winter	14	7380	2.391	0.412	1.4	1.0259	0.0000	OK
10080 minute winter	15	7380	2.391	0.286	0.1	0.7225	0.0000	OK
10080 minute winter	16	7380	2.391	0.310	0.2	0.7831	0.0000	OK
10080 minute winter	17	7380	2.391	0.333	0.4	0.8412	0.0000	OK
10080 minute winter	18	7380	2.391	0.453	1.8	1.1280	0.0000	OK
10080 minute winter	19	10020	2.391	0.277	0.1	0.6996	0.0000	OK
10080 minute winter	20	10020	2.391	0.313	0.2	0.7905	0.0000	OK
10080 minute winter	21	9840	2.391	0.263	0.1	0.6642	0.0000	OK
10080 minute winter	22	9840	2.391	0.303	0.2	0.7653	0.0000	OK
10080 minute winter	23	10020	2.391	0.330	0.6	0.8334	0.0000	OK
10080 minute winter	23a	10020	2.391	0.289	0.1	0.7299	0.0000	OK
10080 minute winter	24	10020	2.391	0.347	0.7	0.8764	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	8.4	0.533	0.027	0.3308	
15 minute winter	2	1.001	3	16.4	0.434	0.039	0.6430	
10080 minute winter	3	1.002	4	0.3	0.165	0.001	0.9158	
10080 minute winter	4	1.003	5	0.4	0.181	0.001	1.5134	
10080 minute winter	5	1.004	6	0.5	0.194	0.001	1.8774	
10080 minute winter	6	1.005	7	0.6	0.205	0.001	2.2078	
10080 minute winter	7	1.006	8	0.7	0.217	0.002	1.6148	
10080 minute winter	8	1.007	13	0.8	0.205	0.002	5.5404	
10080 minute winter	9	2.000	11	0.1	0.089	0.000	1.0367	
10080 minute winter	10	3.000	11	0.1	0.084	0.000	0.9536	
10080 minute winter	11	2.001	12	0.4	0.162	0.001	1.8654	
10080 minute winter	12	2.002	13	0.5	0.319	0.001	2.5930	
10080 minute winter	13	1.008	14	1.3	0.267	0.003	5.2684	
10080 minute winter	14	1.009	18	1.4	0.263	0.003	4.8559	
10080 minute winter	15	4.000	16	0.1	0.099	0.000	1.6214	
10080 minute winter	16	4.001	17	0.3	0.138	0.001	1.7036	
10080 minute winter	17	4.002	18	0.5	0.299	0.002	3.8736	
10080 minute winter	18	1.010	26	1.8	0.296	0.004	4.2264	
10080 minute winter	19	5.000	20	0.1	0.099	0.000	2.4330	
10080 minute winter	20	5.001	23	0.2	0.103	0.001	1.2754	
10080 minute winter	21	6.000	22	0.1	0.098	0.000	2.6098	
10080 minute winter	22	6.001	23	0.3	0.103	0.001	2.0439	
10080 minute winter	23	5.002	24	0.6	0.232	0.002	1.3666	
10080 minute winter	23a	7.000	23	0.1	0.062	0.000	2.9440	
10080 minute winter	24	5.003	25	0.7	0.409	0.001	3.6581	

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
10080 minute winter	25	8280	2.391	0.511	2.7	1.2724	0.0000	OK
10080 minute winter	26	7560	2.391	0.485	1.9	1.1645	0.0000	OK
10080 minute winter	26a	7380	2.391	0.539	2.7	0.9520	0.0000	OK
10080 minute winter	27	8820	2.391	0.605	2.7	0.1711	0.0000	OK
10080 minute winter	28	7260	2.391	0.644	3.0	422.6625	0.0000	OK
10080 minute winter	29	8520	2.391	0.725	0.2	1.2809	0.0000	SURCHARGED
15 minute summer	30	1	1.646	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
10080 minute winter	25	1.012	26a	2.7	0.331	0.006	4.2388	
10080 minute winter	26	1.011	25	1.9	0.267	0.005	3.6170	
10080 minute winter	26a	1.013	27	2.7	0.336	0.006	10.5585	
10080 minute winter	27	1.014	28	2.7	0.630	0.006	6.7237	
10080 minute winter	28	1.015	29	-0.3	-0.022	-0.001	14.3038	
10080 minute winter	29	Pump	30	0.0				0.0

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
5760 minute winter	1	4860	2.924	0.514	0.3	1.2979	0.0000	OK
5760 minute winter	2	4860	2.924	0.631	0.6	1.5707	0.0000	OK
5760 minute winter	3	4860	2.924	0.665	0.9	1.6555	0.0000	OK
5760 minute winter	4	4860	2.924	0.697	1.2	1.7353	0.0000	SURCHARGED
5760 minute winter	5	4860	2.924	0.736	1.4	1.8325	0.0000	SURCHARGED
5760 minute winter	6	4860	2.924	0.773	1.6	1.9246	0.0000	SURCHARGED
5760 minute winter	7	4860	2.924	0.808	1.8	2.0116	0.0000	SURCHARGED
5760 minute winter	8	4860	2.924	0.830	2.1	2.0664	0.0000	SURCHARGED
5760 minute winter	9	4860	2.924	0.708	0.3	1.7880	0.0000	SURCHARGED
5760 minute winter	10	4860	2.924	0.711	0.3	1.7956	0.0000	SURCHARGED
5760 minute winter	11	4860	2.924	0.736	0.8	1.8588	0.0000	SURCHARGED
5760 minute winter	12	4860	2.924	0.776	1.0	1.9597	0.0000	SURCHARGED
5760 minute winter	13	4860	2.923	0.894	3.2	2.2282	0.0000	SURCHARGED
5760 minute winter	14	4860	2.923	0.944	3.3	2.3527	0.0000	SURCHARGED
5760 minute winter	15	4860	2.924	0.819	0.3	2.0684	0.0000	SURCHARGED
5760 minute winter	16	4860	2.924	0.843	0.6	2.1290	0.0000	SURCHARGED
5760 minute winter	17	4860	2.924	0.866	0.8	2.1871	0.0000	SURCHARGED
5760 minute winter	18	4860	2.924	0.986	4.2	2.4549	0.0000	SURCHARGED
5760 minute winter	19	4860	2.924	0.810	0.3	2.0457	0.0000	SURCHARGED
5760 minute winter	20	4860	2.923	0.845	0.6	2.1365	0.0000	SURCHARGED
5760 minute winter	21	4860	2.923	0.795	0.3	2.0102	0.0000	SURCHARGED
5760 minute winter	22	4860	2.923	0.835	0.5	2.1113	0.0000	SURCHARGED
5760 minute winter	23	4860	2.923	0.862	1.5	2.1795	0.0000	SURCHARGED
5760 minute winter	23a	4860	2.923	0.821	0.3	2.0756	0.0000	SURCHARGED
5760 minute winter	24	4860	2.923	0.879	1.8	2.2224	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)
5760 minute winter	1	1.000	2	0.3	0.299	0.001	5.5502	
5760 minute winter	2	1.001	3	0.6	0.184	0.001	5.9068	
5760 minute winter	3	1.002	4	0.9	0.196	0.002	5.6350	
5760 minute winter	4	1.003	5	1.1	0.219	0.003	6.8833	
5760 minute winter	5	1.004	6	1.3	0.237	0.003	6.5795	
5760 minute winter	6	1.005	7	1.5	0.247	0.004	6.3057	
5760 minute winter	7	1.006	8	1.8	0.261	0.004	4.0099	
5760 minute winter	8	1.007	13	1.9	0.205	0.005	11.4608	
5760 minute winter	9	2.000	11	0.3	0.108	0.001	3.8548	
5760 minute winter	10	3.000	11	0.3	0.103	0.001	3.4945	
5760 minute winter	11	2.001	12	0.7	0.200	0.002	5.5099	
5760 minute winter	12	2.002	13	0.9	0.319	0.003	6.0899	
5760 minute winter	13	1.008	14	3.0	0.267	0.007	8.8970	
5760 minute winter	14	1.009	18	3.2	0.263	0.008	7.1938	
5760 minute winter	15	4.000	16	0.3	0.099	0.001	3.2717	
5760 minute winter	16	4.001	17	0.5	0.138	0.002	3.1235	
5760 minute winter	17	4.002	18	0.8	0.299	0.002	6.2820	
5760 minute winter	18	1.010	26	4.0	0.297	0.010	5.7052	
5760 minute winter	19	5.000	20	0.3	0.099	0.001	4.9741	
5760 minute winter	20	5.001	23	0.5	0.103	0.002	2.3388	
5760 minute winter	21	6.000	22	0.2	0.098	0.001	5.6276	
5760 minute winter	22	6.001	23	0.5	0.103	0.002	3.8226	
5760 minute winter	23	5.002	24	1.5	0.232	0.005	2.3514	
5760 minute winter	23a	7.000	23	0.3	0.062	0.001	5.6637	
5760 minute winter	24	5.003	25	1.7	0.409	0.004	5.3113	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
5760 minute winter	25	4860	2.924	1.044	6.2	2.5994	0.0000	SURCHARGED
5760 minute winter	26	4860	2.924	1.018	4.2	2.4441	0.0000	SURCHARGED
5760 minute winter	26a	4860	2.923	1.071	6.2	1.8933	0.0000	SURCHARGED
5760 minute winter	27	4860	2.923	1.137	6.1	0.3219	0.0000	SURCHARGED
5760 minute winter	28	4860	2.923	1.176	6.1	891.3319	0.0000	SURCHARGED
4320 minute winter	29	4080	2.921	1.255	4.9	2.2180	0.0000	SURCHARGED
15 minute summer	30	1	1.646	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
5760 minute winter	25	1.012	26a	6.2	0.327	0.015	5.0844	
5760 minute winter	26	1.011	25	4.2	0.261	0.010	4.5775	
5760 minute winter	26a	1.013	27	6.1	0.332	0.015	11.7292	
5760 minute winter	27	1.014	28	6.1	0.630	0.015	6.9746	
5760 minute winter	28	1.015	29	6.2	-0.022	0.015	14.4244	
4320 minute winter	29	Pump	30	5.0				129.1

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	3.462	1.052	37.9	2.6587	0.0000	SURCHARGED
15 minute winter	2	11	3.436	1.143	81.5	2.8466	0.0000	SURCHARGED
15 minute winter	3	11	3.438	1.179	135.3	2.9366	0.0000	SURCHARGED
15 minute winter	4	11	3.418	1.191	226.5	2.9676	0.0000	SURCHARGED
15 minute winter	5	11	3.423	1.235	184.3	3.0774	0.0000	SURCHARGED
15 minute winter	6	11	3.393	1.242	200.3	3.0946	0.0000	SURCHARGED
15 minute winter	7	11	3.438	1.322	254.2	3.2939	0.0000	FLOOD RISK
15 minute winter	8	11	3.426	1.332	319.9	3.3170	0.0000	FLOOD RISK
15 minute winter	9	12	3.249	1.033	37.9	2.6109	0.0000	SURCHARGED
15 minute winter	10	12	3.249	1.036	37.9	2.6173	0.0000	SURCHARGED
15 minute winter	11	12	3.252	1.064	98.4	2.6892	0.0000	SURCHARGED
15 minute winter	12	12	3.248	1.100	151.8	2.7789	0.0000	SURCHARGED
15 minute winter	13	12	3.252	1.223	382.7	3.0470	0.0000	SURCHARGED
15 minute winter	14	12	3.187	1.208	418.1	3.0091	0.0000	SURCHARGED
15 minute winter	15	12	3.164	1.059	37.9	2.6750	0.0000	SURCHARGED
15 minute winter	16	12	3.156	1.075	61.0	2.7158	0.0000	SURCHARGED
8640 minute winter	17	5940	3.150	1.092	1.2	2.7603	0.0000	SURCHARGED
8640 minute winter	18	5940	3.150	1.212	7.0	3.0199	0.0000	SURCHARGED
8640 minute winter	19	5940	3.150	1.036	0.4	2.6187	0.0000	SURCHARGED
8640 minute winter	20	5940	3.150	1.072	0.8	2.7097	0.0000	SURCHARGED
8640 minute winter	21	5940	3.150	1.022	0.4	2.5834	0.0000	SURCHARGED
8640 minute winter	22	5940	3.150	1.062	0.8	2.6844	0.0000	SURCHARGED
8640 minute winter	23	5940	3.150	1.089	2.3	2.7527	0.0000	SURCHARGED
8640 minute winter	23a	5940	3.150	1.048	0.4	2.6491	0.0000	SURCHARGED
8640 minute winter	24	5940	3.150	1.106	2.7	2.7956	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)
15 minute winter	1	1.000	2	49.1	0.645	0.161	5.9079	
15 minute winter	2	1.001	3	73.7	0.471	0.177	6.0019	
15 minute winter	3	1.002	4	115.5	0.562	0.277	5.6449	
15 minute winter	4	1.003	5	-188.6	0.617	-0.452	6.8833	
15 minute winter	5	1.004	6	167.9	0.632	0.403	6.5795	
15 minute winter	6	1.005	7	221.8	0.635	0.532	6.3057	
15 minute winter	7	1.006	8	287.5	0.805	0.690	4.0099	
15 minute winter	8	1.007	13	318.8	0.893	0.765	11.4608	
15 minute winter	9	2.000	11	36.0	0.299	0.118	3.8548	
15 minute winter	10	3.000	11	34.9	0.290	0.114	3.4945	
15 minute winter	11	2.001	12	113.9	0.608	0.368	5.5099	
15 minute winter	12	2.002	13	160.4	0.710	0.520	6.0899	
15 minute winter	13	1.008	14	394.5	1.105	0.945	8.8970	
15 minute winter	14	1.009	18	429.4	1.203	1.030	7.1938	
15 minute winter	15	4.000	16	35.1	0.306	0.113	3.2717	
15 minute winter	16	4.001	17	63.4	0.476	0.204	3.1235	
8640 minute winter	17	4.002	18	1.2	0.299	0.004	6.2820	
8640 minute winter	18	1.010	26	7.0	0.296	0.017	5.7052	
8640 minute winter	19	5.000	20	0.4	0.099	0.001	4.9741	
8640 minute winter	20	5.001	23	0.8	0.103	0.003	2.3388	
8640 minute winter	21	6.000	22	0.4	0.098	0.001	5.6276	
8640 minute winter	22	6.001	23	0.8	0.103	0.003	3.8226	
8640 minute winter	23	5.002	24	2.3	0.232	0.008	2.3514	
8640 minute winter	23a	7.000	23	0.4	0.062	0.001	5.6637	
8640 minute winter	24	5.003	25	2.7	0.409	0.006	5.3113	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
8640 minute winter	25	5940	3.150	1.270	10.4	3.1643	0.0000	SURCHARGED
8640 minute winter	26	5940	3.150	1.244	7.3	2.9888	0.0000	SURCHARGED
8640 minute winter	26a	5940	3.150	1.298	10.3	2.2941	0.0000	FLOOD RISK
8640 minute winter	27	5940	3.150	1.364	10.3	0.3861	0.0000	SURCHARGED
8640 minute winter	28	5940	3.150	1.403	10.3	1123.7800	0.0000	SURCHARGED
8640 minute winter	29	5940	3.150	1.484	5.0	2.6227	0.0000	SURCHARGED
15 minute summer	30	1	1.646	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
8640 minute winter	25	1.012	26a	10.3	0.331	0.025	5.0844	
8640 minute winter	26	1.011	25	7.3	0.267	0.017	4.5775	
8640 minute winter	26a	1.013	27	10.3	0.336	0.025	11.7292	
8640 minute winter	27	1.014	28	10.3	0.630	0.025	6.9746	
8640 minute winter	28	1.015	29	5.0	-0.022	0.012	14.4244	
8640 minute winter	29	Pump	30	5.0				1334.3

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.000
Ratio-R	0.400	Preferred Cover Depth (m)	0.900
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)
31	0.080	5.00	3.700	1500	1.553
32	0.080	5.00	3.700	1500	1.589
33	0.080	5.00	3.700	1500	1.495
34	0.080	5.00	3.700	1500	1.546
35	0.080	5.00	3.700	1500	1.577
36	0.142	5.00	3.700	1500	1.664
37	0.142	5.00	3.700	1500	1.751
38	0.142	5.00	3.700	1500	1.864
39	0.132	5.00	3.700	1500	1.862
40	0.132	5.00	3.700	1500	1.957
41	0.132	5.00	3.700	1500	2.040
42	0.132	5.00	3.700	1500	2.110
43	0.132	5.00	3.700	1500	2.182
44	0.132	5.00	3.700	1500	2.231
45	0.132	5.00	3.700	1500	2.277
46	0.141	5.00	3.700	1500	2.341
47			3.700	2400	2.430
48			3.700	1500	2.448

Links (Input)

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)
8.000	31	32	17.838	0.600	2.147	2.111	0.036	500.0	600	5.27	50.0
8.001	32	36	37.206	0.600	2.111	2.036	0.075	496.1	600	5.85	50.0
9.000	33	35	41.048	0.600	2.205	2.123	0.082	500.0	600	5.63	50.0
10.000	34	35	15.499	0.600	2.154	2.123	0.031	500.0	600	5.24	50.0
9.001	35	36	43.300	0.600	2.123	2.036	0.087	500.0	600	6.30	50.0
8.002	36	37	43.344	0.600	2.036	1.949	0.087	500.0	600	6.97	50.0
8.003	37	38	56.298	0.600	1.949	1.836	0.113	500.0	600	7.83	50.0
8.004	38	41	87.767	0.600	1.836	1.660	0.176	500.0	600	9.19	50.0
11.000	39	40	47.405	0.600	1.838	1.743	0.095	500.0	600	5.73	50.0
11.001	40	41	40.660	0.600	1.743	1.660	0.083	489.9	600	6.35	50.0
8.005	41	42	35.100	0.600	1.660	1.590	0.070	500.0	600	9.73	50.0
8.006	42	43	35.779	0.600	1.590	1.518	0.072	500.0	600	10.28	49.5
8.007	43	44	24.666	0.600	1.518	1.469	0.049	500.0	600	10.66	48.6
8.008	44	45	23.199	0.600	1.469	1.423	0.046	500.0	600	11.02	47.7
8.009	45	46	32.108	0.600	1.423	1.359	0.064	500.0	600	11.51	46.6
8.010	46	47	44.719	0.600	1.359	1.270	0.089	500.0	600	12.20	45.1
8.011	47	48	8.511	0.600	1.270	1.252	0.018	472.8	600	12.33	44.8

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
8.000	17.838	500.0	600	Circular	3.700	2.147	0.953	3.700	2.111	0.989
8.001	37.206	496.1	600	Circular	3.700	2.111	0.989	3.700	2.036	1.064
9.000	41.048	500.0	600	Circular	3.700	2.205	0.895	3.700	2.123	0.977
10.000	15.499	500.0	600	Circular	3.700	2.154	0.946	3.700	2.123	0.977
9.001	43.300	500.0	600	Circular	3.700	2.123	0.977	3.700	2.036	1.064
8.002	43.344	500.0	600	Circular	3.700	2.036	1.064	3.700	1.949	1.151
8.003	56.298	500.0	600	Circular	3.700	1.949	1.151	3.700	1.836	1.264
8.004	87.767	500.0	600	Circular	3.700	1.836	1.264	3.700	1.660	1.440
11.000	47.405	500.0	600	Circular	3.700	1.838	1.262	3.700	1.743	1.357
11.001	40.660	489.9	600	Circular	3.700	1.743	1.357	3.700	1.660	1.440
8.005	35.100	500.0	600	Circular	3.700	1.660	1.440	3.700	1.590	1.510
8.006	35.779	500.0	600	Circular	3.700	1.590	1.510	3.700	1.518	1.582
8.007	24.666	500.0	600	Circular	3.700	1.518	1.582	3.700	1.469	1.631
8.008	23.199	500.0	600	Circular	3.700	1.469	1.631	3.700	1.423	1.677
8.009	32.108	500.0	600	Circular	3.700	1.423	1.677	3.700	1.359	1.741
8.010	44.719	500.0	600	Circular	3.700	1.359	1.741	3.700	1.270	1.830
8.011	8.511	472.8	600	Circular	3.700	1.270	1.830	3.700	1.252	1.848

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
8.000	31	1500	Manhole	Adoptable	32	1500	Manhole	Adoptable
8.001	32	1500	Manhole	Adoptable	36	1500	Manhole	Adoptable
9.000	33	1500	Manhole	Adoptable	35	1500	Manhole	Adoptable
10.000	34	1500	Manhole	Adoptable	35	1500	Manhole	Adoptable
9.001	35	1500	Manhole	Adoptable	36	1500	Manhole	Adoptable
8.002	36	1500	Manhole	Adoptable	37	1500	Manhole	Adoptable
8.003	37	1500	Manhole	Adoptable	38	1500	Manhole	Adoptable
8.004	38	1500	Manhole	Adoptable	41	1500	Manhole	Adoptable
11.000	39	1500	Manhole	Adoptable	40	1500	Manhole	Adoptable
11.001	40	1500	Manhole	Adoptable	41	1500	Manhole	Adoptable
8.005	41	1500	Manhole	Adoptable	42	1500	Manhole	Adoptable
8.006	42	1500	Manhole	Adoptable	43	1500	Manhole	Adoptable
8.007	43	1500	Manhole	Adoptable	44	1500	Manhole	Adoptable
8.008	44	1500	Manhole	Adoptable	45	1500	Manhole	Adoptable
8.009	45	1500	Manhole	Adoptable	46	1500	Manhole	Adoptable
8.010	46	1500	Manhole	Adoptable	47	2400	Manhole	Adoptable
8.011	47	2400	Manhole	Adoptable	48	1500	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	40	0	0

Node 47 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	1.270	Product Number	CTL-SHE-0094-5000-1830-5000
Design Depth (m)	1.830	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node 45 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.0	Invert Level (m)	1.445
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	875.0	0.0	1.500	875.0	0.0	1.501	0.0	0.0

Node 31 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	3.280	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	1	Depth (m)	0.300
Safety Factor	1.0	Width (m)	8.800	Inf Depth (m)	
Porosity	0.30	Length (m)	14.000		

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	31	12	2.241	0.094	11.3	0.2618	0.0000	OK
15 minute winter	32	12	2.237	0.126	21.8	0.3494	0.0000	OK
15 minute winter	33	11	2.281	0.076	11.3	0.2146	0.0000	OK
15 minute winter	34	11	2.254	0.100	11.3	0.2794	0.0000	OK
15 minute winter	35	12	2.250	0.127	32.3	0.3543	0.0000	OK
15 minute winter	36	12	2.230	0.194	66.4	0.6729	0.0000	OK
15 minute winter	37	12	2.163	0.214	80.9	0.7262	0.0000	OK
15 minute winter	38	13	2.057	0.221	95.6	0.7266	0.0000	OK
15 minute winter	39	14	1.945	0.107	18.6	0.3407	0.0000	OK
15 minute winter	40	14	1.943	0.200	36.2	0.6233	0.0000	OK
15 minute winter	41	13	1.945	0.285	124.5	0.8736	0.0000	OK
15 minute winter	42	13	1.884	0.294	128.7	0.8879	0.0000	OK
15 minute winter	43	13	1.816	0.298	136.2	0.8877	0.0000	OK
15 minute winter	44	12	1.740	0.271	145.6	0.7987	0.0000	OK
480 minute winter	45	464	1.732	0.309	30.1	239.5413	0.0000	OK
480 minute winter	46	464	1.732	0.373	5.9	1.1072	0.0000	OK
480 minute winter	47	464	1.732	0.462	4.9	2.0880	0.0000	OK
15 minute summer	48	1	1.252	0.000	4.3	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	31	8.000	32	10.5	0.394	0.034	0.6316	
15 minute winter	32	8.001	36	18.4	0.398	0.060	2.2601	
15 minute winter	33	9.000	35	10.8	0.359	0.035	1.3126	
15 minute winter	34	10.000	35	10.3	0.333	0.034	0.5743	
15 minute winter	35	9.001	36	29.8	0.509	0.097	2.6453	
15 minute winter	36	8.002	37	64.1	0.759	0.210	3.6601	
15 minute winter	37	8.003	38	80.0	0.874	0.262	5.1780	
15 minute winter	38	8.004	41	93.1	0.829	0.304	9.9234	
15 minute winter	39	11.000	40	17.9	0.478	0.058	2.7510	
15 minute winter	40	11.001	41	27.8	0.528	0.090	4.3361	
15 minute winter	41	8.005	42	118.0	0.876	0.386	4.7297	
15 minute winter	42	8.006	43	127.7	0.927	0.417	4.9581	
15 minute winter	43	8.007	44	138.2	1.074	0.452	3.2454	
15 minute winter	44	8.008	45	148.2	2.241	0.484	1.6522	
480 minute winter	45	8.009	46	4.9	0.350	0.016	5.2951	
480 minute winter	46	8.010	47	4.9	0.248	0.016	9.3123	
480 minute winter	47	Hydro-Brake®	48	4.4				165.3

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	31	12	2.371	0.224	27.7	0.6278	0.0000	OK
15 minute winter	32	12	2.370	0.259	51.3	0.7194	0.0000	OK
15 minute winter	33	12	2.384	0.179	27.7	0.5074	0.0000	OK
15 minute winter	34	12	2.383	0.229	27.7	0.6414	0.0000	OK
15 minute winter	35	12	2.381	0.258	72.0	0.7190	0.0000	OK
15 minute winter	36	12	2.368	0.332	152.9	1.1527	0.0000	OK
15 minute winter	37	12	2.315	0.366	187.6	1.2417	0.0000	OK
15 minute winter	38	13	2.266	0.430	222.6	1.4156	0.0000	OK
15 minute winter	39	13	2.201	0.363	45.7	1.1558	0.0000	OK
15 minute winter	40	13	2.200	0.457	79.4	1.4246	0.0000	OK
15 minute winter	41	13	2.199	0.539	285.4	1.6487	0.0000	OK
960 minute winter	42	945	2.185	0.595	27.5	1.7958	0.0000	OK
960 minute winter	43	945	2.185	0.667	29.6	1.9858	0.0000	SURCHARGED
960 minute winter	44	945	2.185	0.716	31.7	2.1123	0.0000	SURCHARGED
960 minute winter	45	945	2.185	0.762	34.0	617.7990	0.0000	SURCHARGED
960 minute winter	46	945	2.185	0.826	5.8	2.4549	0.0000	SURCHARGED
960 minute winter	47	945	2.185	0.915	4.9	4.1395	0.0000	SURCHARGED
15 minute summer	48	1	1.252	0.000	4.4	0.0000	0.0000	OK

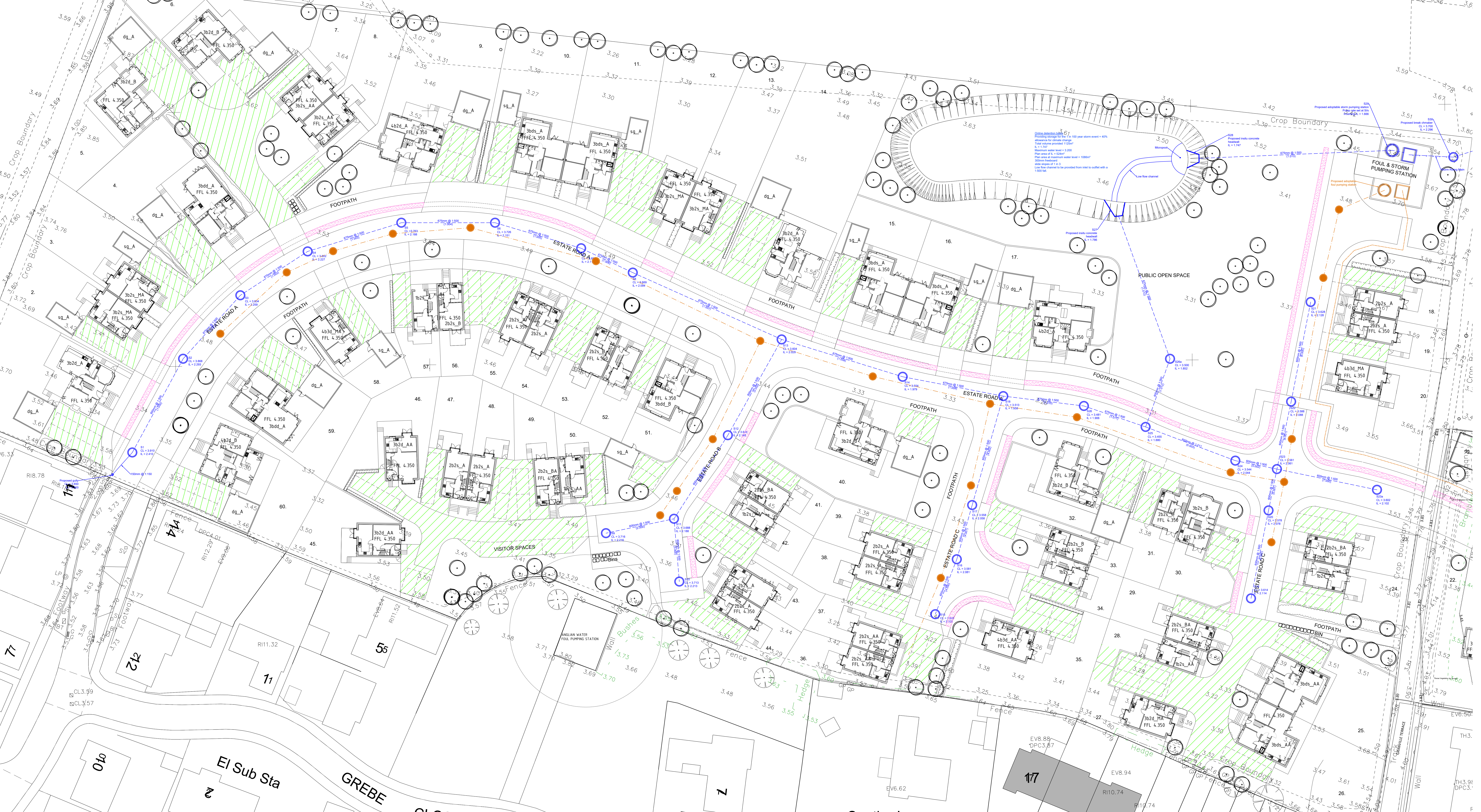
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	31	8.000	32	24.1	0.429	0.079	1.8974	
15 minute winter	32	8.001	36	45.8	0.431	0.149	5.1430	
15 minute winter	33	9.000	35	21.8	0.423	0.071	3.8266	
15 minute winter	34	10.000	35	24.2	0.364	0.079	1.6646	
15 minute winter	35	9.001	36	64.5	0.527	0.211	5.9738	
15 minute winter	36	8.002	37	146.0	0.864	0.477	7.3706	
15 minute winter	37	8.003	38	181.0	0.986	0.592	11.1494	
15 minute winter	38	8.004	41	199.7	0.911	0.653	21.1898	
15 minute winter	39	11.000	40	36.4	0.556	0.119	9.6856	
15 minute winter	40	11.001	41	54.2	0.578	0.175	10.1055	
15 minute winter	41	8.005	42	275.4	1.056	0.900	9.3187	
960 minute winter	42	8.006	43	26.7	0.559	0.087	10.0718	
960 minute winter	43	8.007	44	28.8	0.519	0.094	6.9479	
960 minute winter	44	8.008	45	31.1	0.634	0.102	6.5346	
960 minute winter	45	8.009	46	4.8	0.354	0.016	9.0441	
960 minute winter	46	8.010	47	4.9	0.230	0.016	12.5963	
960 minute winter	47	Hydro-Brake®	48	4.4				258.3

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.74%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	31	13	3.372	1.225	215.7	6.3285	0.0000	SURCHARGED
15 minute winter	32	13	3.372	1.261	125.1	3.4992	0.0000	SURCHARGED
15 minute winter	33	13	3.428	1.223	104.5	3.4702	0.0000	FLOOD RISK
15 minute winter	34	13	3.380	1.226	50.3	3.4352	0.0000	SURCHARGED
15 minute winter	35	13	3.408	1.285	182.0	3.5750	0.0000	FLOOD RISK
15 minute winter	36	13	3.353	1.317	247.9	4.5747	0.0000	SURCHARGED
15 minute winter	37	13	3.364	1.415	291.1	4.7947	0.0000	SURCHARGED
15 minute winter	38	12	3.191	1.355	347.4	4.4577	0.0000	SURCHARGED
1440 minute winter	39	1410	3.092	1.254	3.7	3.9935	0.0000	SURCHARGED
1440 minute winter	40	1410	3.092	1.349	6.7	4.2027	0.0000	SURCHARGED
1440 minute winter	41	1410	3.091	1.431	27.9	4.3805	0.0000	SURCHARGED
1440 minute winter	42	1410	3.091	1.501	29.2	4.5289	0.0000	SURCHARGED
1440 minute winter	43	1410	3.090	1.572	32.1	4.6807	0.0000	SURCHARGED
1440 minute winter	44	1410	3.090	1.621	35.6	4.7834	0.0000	SURCHARGED
1440 minute winter	45	1410	3.091	1.668	39.2	1252.5880	0.0000	SURCHARGED
1440 minute winter	46	1410	3.090	1.731	5.7	5.1459	0.0000	SURCHARGED
1440 minute winter	47	1410	3.090	1.820	6.0	8.2331	0.0000	SURCHARGED
15 minute summer	48	1	1.252	0.000	4.4	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	31	8.000	32	-176.4	-0.626	-0.577	5.0246	
15 minute winter	32	8.001	36	125.3	0.464	0.408	10.4801	
15 minute winter	33	9.000	35	81.2	0.427	0.265	11.5623	
15 minute winter	34	10.000	35	58.3	0.410	0.190	4.3657	
15 minute winter	35	9.001	36	143.8	0.538	0.470	12.1966	
15 minute winter	36	8.002	37	237.8	0.890	0.777	12.2090	
15 minute winter	37	8.003	38	291.2	1.034	0.952	15.8579	
15 minute winter	38	8.004	41	334.2	1.187	1.092	24.7220	
1440 minute winter	39	11.000	40	3.1	0.252	0.010	13.3529	
1440 minute winter	40	11.001	41	6.4	0.205	0.021	11.4530	
1440 minute winter	41	8.005	42	25.6	0.549	0.084	9.8869	
1440 minute winter	42	8.006	43	28.4	0.487	0.093	10.0781	
1440 minute winter	43	8.007	44	31.9	0.451	0.104	6.9479	
1440 minute winter	44	8.008	45	35.5	0.619	0.116	6.5346	
1440 minute winter	45	8.009	46	5.1	0.336	0.017	9.0441	
1440 minute winter	46	8.010	47	6.0	0.181	0.020	12.5963	
1440 minute winter	47	Hydro-Brake®	48	5.0				421.2

APPENDIX 9 – PROPOSED DRAINAGE LAYOUT



GENERAL

Do not scale from this drawing.

All dimensions are in millimetres unless noted otherwise.

All setting out to architects drawings.

Drawing to be read in conjunction with all other SEA drawings and architects drawings.

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All setting out of houses and private drives/footpaths to be in accordance with the Architect's drawings, the Contractor is to check all dimensions and levels prior to commencement of work and report any discrepancies to the Engineer, including any encountered during construction works.

All dimensions should be checked on site prior to construction. Please notify the Engineer of any discrepancies before commencing or continuing any work.

HEALTH, SAFETY & THE ENVIRONMENT

In accordance with the Health and Safety at Work etc. Act 1974 and the Construction (Design and Management) Regulations 2015, designs and details on this drawing have been the subject of a Designers Risk Assessment, to identify risks in construction, use, or demolition of the scheme.

It is not considered necessary for Designers to highlight obvious and/or common risks (such as deep excavations, manual handling and working around heavy plant) which Contractors should be familiar with.

So far as is reasonably practicable, risks inherent in the design have been eliminated. Where it has been considered that elimination of a risk (or part of a risk) is not reasonably practicable, it has been reduced.

Significant unusual residual risks are identified below, beside the measures which have been adopted to eliminate and/or reduce them:

None identified.

DRAWING KEY:

	Proposed adoptable storm water drainage
	Proposed adoptable storm water rising main
	Existing Anglian Water storm sewer with easement
	Proposed adoptable foul water drainage
	Proposed adoptable foul rising main
	Proposed permeable block paving drives
	All storm pipework within drive to be perforated
	Proposed highway filter drain in accordance with LCC details

MAINTENANCE SCHEDULES

Operation and maintenance requirements for filter drains		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove filter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, (inlet/outlet) pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treated systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
Occasional maintenance	Remove sediment from pre-treated devices	Six monthly, or as required
	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required

Operation and maintenance requirements for pervious pavements

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations - pay particular attention to areas where water runs along previous surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required - once per year on less frequently used pavements
	Remediate any landscaping which, through vegetation maintenance or soil silt, has been raised to within 50 mm of the level of the paving	As required
Remedial Actions	Remedial work to any depressions, rifting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost paving material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Request for evidence of poor operation and/or weed growth - if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Operation and maintenance requirements for detention basins

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass - for spillways and access routes	Monthly (during growing season, or as required)
	Cut grass - meadow grass in and around basin	Half yearly (spring - before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
Occasional maintenance	Inspect cascades, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies	Monthly (for first year), then annually (or as required)
	Check any prestroke and other mechanical devices	Annually
	Trim all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
Remedial actions	Manage wetland plants in outlet pool - where provided	Annually (as set out in Chapter 25)
	Revised areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 5 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	As required (likely to be minimal requirements where effective upstream source control is provided)
	Repair erosion or other damage by reseedling or re-turfing	As required
	Revegetation of top soil	As required
	Rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstatement design levels	As required

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PROJECT:
RESIDENTIAL DEVELOPMENT
LAND NORTH OF SUTTON
BRIDGE

DRAWING:
PROPOSED DRAINAGE LAYOUT
(1 OF 3)

SCALE: 1:250 @A0 DATE: 06.08.2020
DRAWN BY: SEA REV: 1
STATUS: FOR PLANNING

DWG No: 1886/S/E101



GENERAL

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All setting out to architects drawings.

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Significant unusual residual risks are identified below, beside the measures which have been adopted to eliminate and/or reduce them:

None identified.

DRAWING KEY:

- Proposed adoptable storm water drainage
- Proposed adoptable storm water rising main
- Existing Anglian Water storm sewer with easement
- Proposed adoptable foul water drainage
- Proposed adoptable foul rising main
- Proposed permeable block paving drives
- All storm pipework within drive to be perforated
- Proposed highway filter drain in accordance with LCC details

Maintenance Schedules		
Operation and maintenance requirements for filter drains		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, siltoutlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
Occasional maintenance	Remove sediment from pre-treatment devices	Six monthly, or as required
	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NUIS, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required

Operation and maintenance requirements for pervious pavements		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations - pay particular attention to areas where water runs off previous surface from adjacent impermeable areas as this area is most likely to collect the most sediment
	Stabilise and mow contributing and adjacent areas	As required
Occasional maintenance	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required - once per year on less frequently used pavements
	Remediate any limeworking which, through vegetation maintenance or soil silt, has been raised to within 50 mm of the level of the paving	As required
Remedial Actions	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost paving material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth - if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Operation and maintenance requirements for detention basins		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass - for spillways and access routes	Monthly (during growing season, or as required)
	Cut grass - meadow grass in and around basin	Half yearly (spring - before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect canopies, siltoutlet pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies	Monthly (for first year), then annually or as required
Occasional maintenance	Check any prestroke and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool - where provided	Annually (as set out in Chapter 25)
	Revised areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 5 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseedling or re-turfing	As required
	Revegetation of top soil	As required
	Rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

Rev

Date

By

Description

CONSULTING CIVIL & STRUCTURAL ENGINEERS

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PROJECT

RESIDENTIAL DEVELOPMENT
LAND NORTH OF SUTTON
BRIDGE

DRAWING

PROPOSED DRAINAGE LAYOUT
(2 OF 3)

SCALE: 1:250 @A0

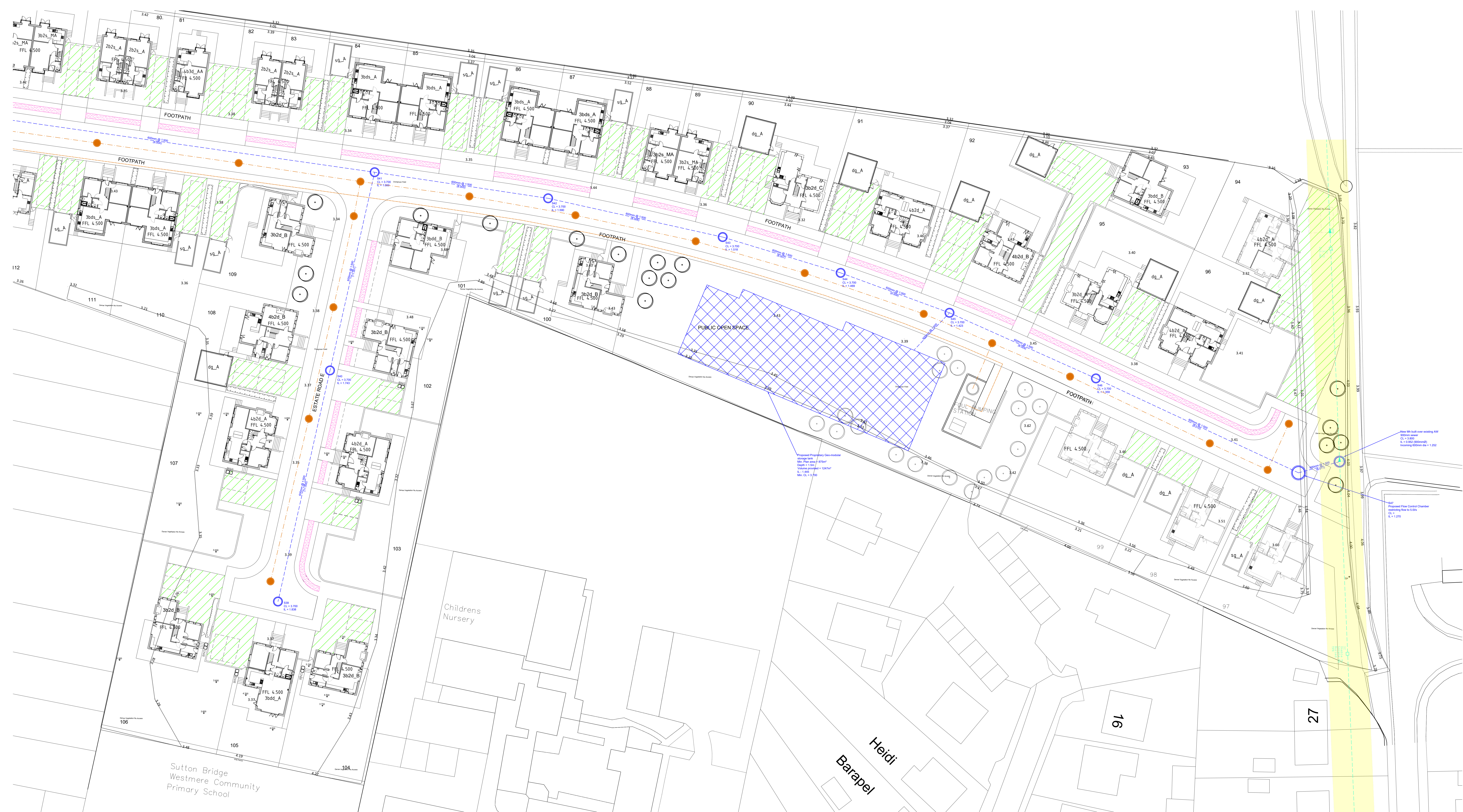
DATE: 06.08.2020

DRAWN BY: SEA

REV: -

STATUS: FOR PLANNING

DWG No: 1886/S/E102



GENERAL

Do not scale from this drawing.
All dimensions are in millimetres unless noted otherwise.
All setting out to architects drawings.
Drawing to be read in conjunction with all other SEA drawings and architects drawings.
This scheme has been designed using the survey information provided by others. It shall be the responsibility of the contractor to verify levels, boundaries etc prior to commencing any works on site. SEA Structural Engineers Ltd. shall not accept any responsibility for errors resulting from the survey.
All setting out of houses and private drives/footpaths to be in accordance with the Architect's drawings, the Contractor is to check all dimensions and levels prior to commencement of work and report any discrepancies to the Engineer, including any encountered during construction works.
All dimensions should be checked on site prior to construction. Please notify the Engineer of any discrepancies before commencing or continuing any work.
HEALTH, SAFETY & THE ENVIRONMENT
In accordance with the Health and Safety at Work etc Act 1974 and the Construction (Design and Management) Regulations 2015, designs and details on this drawing have been the subject of a Designers Risk Assessment, to identify risks in construction, use, or demolition of the scheme.
It is not considered necessary for Designers to highlight obvious and/or common risks (such as deep excavations, manual handling and working around heavy plant) which Contractors should be familiar with.
So far as is reasonably practicable, risks inherent in the design have been eliminated. Where it has been considered that elimination of a risk (or part of a risk) is not reasonably practicable, it has been reduced.
Significant unusual residual risks are identified below, beside the measures which have been adopted to eliminate and/or reduce them:
None identified.

DRAWING KEY:

- Proposed adoptable storm water drainage
- Proposed adoptable storm water rising main
- Existing Anglian Water storm sewer with easement
- Proposed adoptable foul water drainage
- Proposed adoptable foul rising main
- Proposed permeable block paving drives
- All storm pipework within drive to be perforated
- Proposed highway filter drain in accordance with LCC details

MAINTENANCE SCHEDULES

Operation and maintenance requirements for filter drains		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove filter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, silt/sediment pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treated systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
Occasional maintenance	Remove sediment from pre-treatment devices	Six monthly, or as required
	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NJUG, 2007 or BS 3398:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required

Operation and maintenance requirements for pervious pavements		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations - pay particular attention to areas where water runs off previous surface from adjacent impermeable areas as this area is most likely to collect the most sediment
	Stabilise and mow contributing and adjacent areas	As required
Occasional maintenance	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required - once per year on less frequently used pavements
	Remediate any lining which, through vegetation maintenance or soil silt, has been raised to within 50 mm of the level of the paving	As required
Remedial Actions	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost bedding material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth - if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Operation and maintenance requirements for detention basins		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass - for spillways and access routes	Monthly (during growing season, or as required)
	Cut grass - meadow grass in and around basin	Half yearly (spring - before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect canopies, structures pipework etc for evidence of physical damage	Monthly
Occasional maintenance	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Monthly (for first year), then annually or as required
	Check any prestroke and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool - where provided	Annually (as set out in Chapter 25)
	Reveal areas of poor vegetation growth	As required
Remedial actions	Prune and trim any trees and remove cuttings	Every 5 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by regrading or re-turfing	As required
	Regrading of top soil	As required
	Rehabilitation of inlets, outlets and overflows	As required
	Reveal unseen surfaces and reinstatement design levels	As required

Rev

Date

By

Description



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PROJECT
RESIDENTIAL DEVELOPMENT
LAND NORTH OF SUTTON
BRIDGE

DRAWING
PROPOSED DRAINAGE LAYOUT
(3 OF 3)

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