FOUL & SURFACE WATER HYDRAULIC CALCULATIONS v02

Project	Welland Hospital Redevelopment Holbeach Road Site Spalding
Client	Lindum
Our ref.	P19062
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Prepared by	Andy Bowler BEng (Hons) Senior Engineer andy.bowler@hwaconsulting.co.uk

HOWARD WARD ASSOCIATES LTD

BREWERY HOUSE WALKERS YARD NOTTNGHAM NG12 2FF

T 0115 9332838

www.hwaconsulting.co.uk

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v01	First issue	03/05/2019
v02	Calcs amended to reflect new drainage strategy	22/05/2020

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1. DESIGN PRINCIPLES

1.1. The proposed works entail the re-development of the former Welland Hospital site off Holbeach Road in Spalding. The development comprises 19no. new dwellings comprising a mixture of 2 and 3-storey properties under approved planning condition reference H16-0853-17.

1.2. As part of the development the main spine runs of the foul and surface water drainage systems beneath the proposed adoptable highway are offered for adoption under Section 104 of the Water Industry Act 1991. The specific runs within the following calculations are as follows:

FOUL WATER		SURFACE WATER	
PIPE RUN	PIPE NO.	PIPE RUN	PIPE NO.
F1 – F2	1.000	S1-S2	1.007
F2 – F3	1.001	S2-S3	1.008
F3 – F5	1.002		
F4 – F5	2.000		
F5 – F6	1.003		

1.3. Foul water calculations are provided to demonstrate velocity greater than 0.75m/s.

1.4. All other private foul water drainage will be designed and installed compliant to Building Regulations Approved Document Part H.

1.5. The general strategy for the surface water is to have the drainage from the dwellings and external surfacing served by a private gravity system compliant to Building Regulations Approved Document Part H. Two separate networks are proposed:

- One to serve plots 6-17 and associated private external hard standing areas which will be attenuation to a maximum outflow of 2.5l/s and designed to accommodate the critical 1 in 100-year +30% Climate Change. The restriction from this system will be located within manhole reference S1.26 FC and will feed into the first adoptable manhole S1.

- The second will serve plots 1-5 and associated private external hard standing areas which will be attenuation to a maximum outflow of 2.5l/s and designed to accommodate the critical 1 in 100-year +30% Climate Change. The restriction from this system will be located within manhole reference S1.26 FC and will feed into the last adoptable manhole S3.

1.6. The combined flows from each network running through the adoptable system (S1-S3) will therefore be a maximum of the approved 5l/s and no surcharging of the S104 system will occur.

1.7. Climate Change of 30% allowance has been implemented as outlined within the Approved FRA document prepared by S M Hemmings dated 12th July 2018.

APPENDIX A – Foul Water Hydraulic Calculations

FOUL SEWERAGE DESIGN

Design Criteria for Foul Network 1

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Flow Per Person (l/per/day)	222.00	Maximum Backdrop Height (m)	1.500
Persons per House	3.00	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul Network 1

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	38.228	0.500	76.5	0.000	9	0.0	1.500	o	100	Pipe/Conduit	
1.001	13.113	0.140	93.7	0.000	1	0.0	1.500	o	150	Pipe/Conduit	
1.002	24.567	0.250	98.3	0.000	4	0.0	1.500	o	150	Pipe/Conduit	
2.000	33.304	0.420	79.3	0.000	5	0.0	1.500	o	100	Pipe/Conduit	
1.003	7.619	0.080	95.2	0.000	0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	3.900	0.000	0.0	9	0.0	18	0.43	0.76	6.0	0.4
1.001	3.350	0.000	0.0	10	0.0	18	0.39	0.91	16.0	0.5
1.002	3.210	0.000	0.0	14	0.0	21	0.43	0.88	15.6	0.6
2.000	3.430	0.000	0.0	5	0.0	14	0.35	0.75	5.9	0.2
1.003	2.960	0.000	0.0	19	0.0	24	0.48	0.90	15.9	0.9

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Manhole Schedules for Foul Network 1

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
F1	4.565	0.665	Open Manhole	900 x 675	1.000	3.900	100				
F2	4.427	1.077	Open Manhole	900 x 675	1.001	3.350	150	1.000	3.400	100	
F3	4.276	1.066	Open Manhole	900 x 675	1.002	3.210	150	1.001	3.210	150	
F6	4.235	0.805	Open Manhole	900 x 675	2.000	3.430	100				
F4	4.003	1.043	Open Manhole	900 x 675	1.003	2.960	150	1.002	2.960	150	
								2.000	3.010	100	
F5	4.113	1.233	Open Manhole	1200		OUTFALL		1.003	2.880	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F1	525939.021	323799.670	525939.021	323799.670	Required	
F2	525977.126	323802.732	525977.126	323802.732	Required	
F3	525979.782	323789.890	525979.782	323789.890	Required	
F6	526016.408	323771.197	526016.408	323771.197	Required	
F4	525983.575	323765.618	525983.575	323765.618	Required	
F5	525984.747	323758.089			No Entry	



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PIPELINE SCHEDULES for Foul Network 1

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	100	F1	4.565	3.900	0.565	Open Manhole	900 x 675
1.001	o	150	F2	4.427	3.350	0.927	Open Manhole	900 x 675
1.002	o	150	F3	4.276	3.210	0.916	Open Manhole	900 x 675
2.000	o	100	F6	4.235	3.430	0.705	Open Manhole	900 x 675
1.003	o	150	F4	4.003	2.960	0.893	Open Manhole	900 x 675

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	38.228	76.5	F2	4.427	3.400	0.927	Open Manhole	900 x 675
1.001	13.113	93.7	F3	4.276	3.210	0.916	Open Manhole	900 x 675
1.002	24.567	98.3	F4	4.003	2.960	0.893	Open Manhole	900 x 675
2.000	33.304	79.3	F4	4.003	3.010	0.893	Open Manhole	900 x 675
1.003	7.619	95.2	F5	4.113	2.880	1.083	Open Manhole	1200

Free Flowing Outfall Details for Foul Network 1

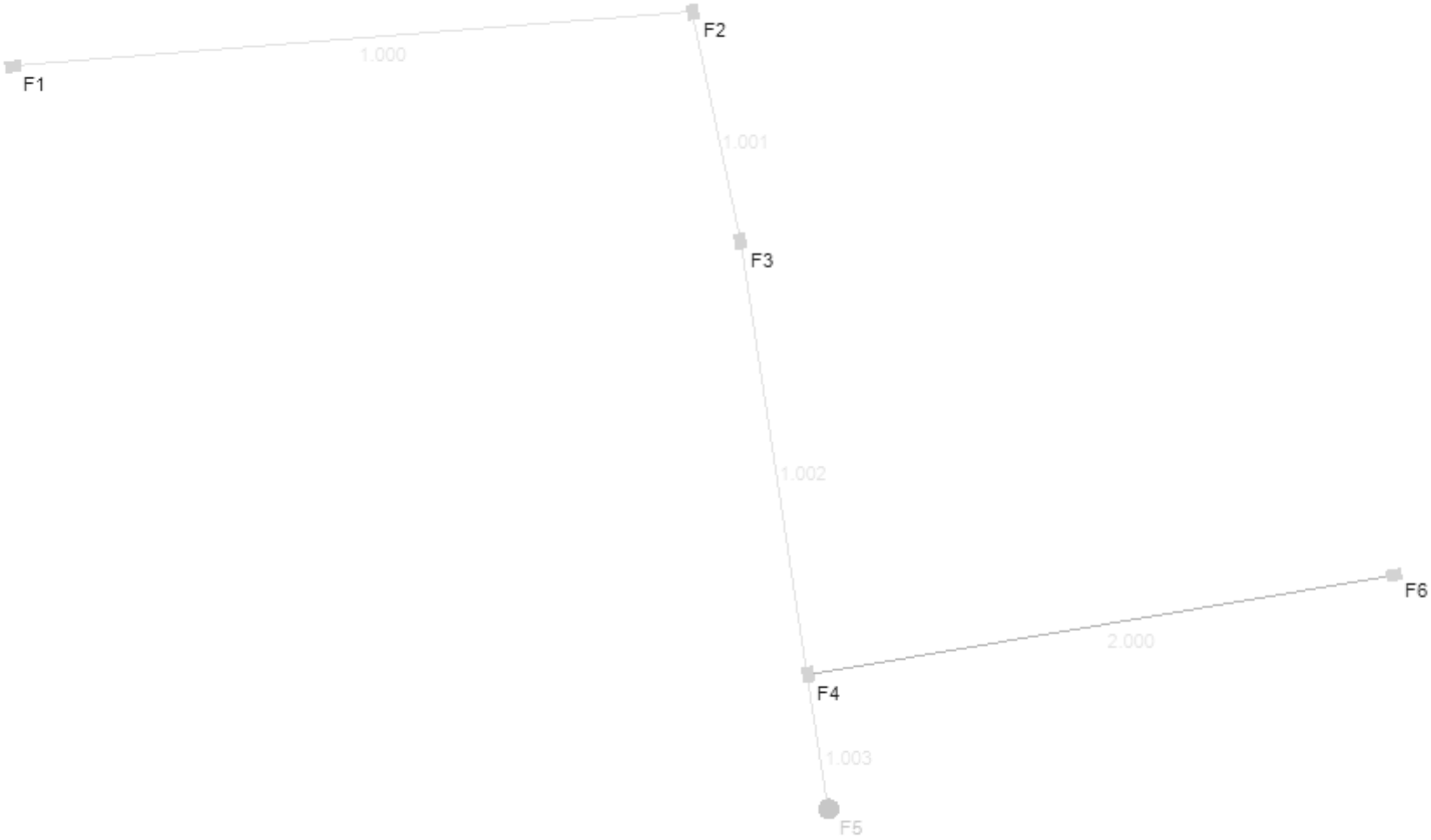
Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.003	F5	4.113	2.880	0.000	1200	0

Simulation Criteria for Foul Network 1

Volumetric Runoff Coeff	0.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	0.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	0.000
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.000	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

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APPENDIX B – Surface Water Hydraulic Calculations

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Surface Network 1

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	10.291	0.100	102.9	0.005	5.00	0.0	0.600	o	100	Pipe/Conduit	
1.001	12.585	0.625	20.1	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
2.000	10.295	0.725	14.2	0.005	5.00	0.0	0.600	o	100	Pipe/Conduit	
1.002	13.040	0.150	86.9	0.030	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.000	10.113	0.100	101.1	0.005	5.00	0.0	0.600	o	100	Pipe/Conduit	
3.001	13.578	0.200	67.9	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
4.000	8.555	0.200	42.8	0.005	5.00	0.0	0.600	o	100	Pipe/Conduit	
4.001	1.971	0.100	19.7	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
5.000	10.256	0.300	34.2	0.007	5.00	0.0	0.600	o	100	Pipe/Conduit	
3.002	2.965	0.525	5.6	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.003	21.442	0.150	142.9	0.010	0.00	0.0	0.600	o	225	Pipe/Conduit	
6.000	10.607	0.150	70.7	0.007	5.00	0.0	0.600	o	100	Pipe/Conduit	
6.001	4.713	0.825	5.7	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
7.000	10.330	0.975	10.6	0.011	5.00	0.0	0.600	o	100	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.23	4.350	0.005	0.0	0.0	0.0	0.76	6.0	0.7
1.001	50.00	5.35	4.250	0.005	0.0	0.0	0.0	1.73	13.6	0.7
2.000	50.00	5.08	4.350	0.005	0.0	0.0	0.0	2.06	16.2	0.7
1.002	50.00	5.55	3.575	0.040	0.0	0.0	0.0	1.08	19.1	5.4
3.000	50.00	5.22	4.300	0.005	0.0	0.0	0.0	0.76	6.0	0.7
3.001	50.00	5.46	4.200	0.005	0.0	0.0	0.0	0.94	7.3	0.7
4.000	50.00	5.12	4.300	0.005	0.0	0.0	0.0	1.18	9.3	0.7
4.001	50.00	5.14	4.100	0.005	0.0	0.0	0.0	1.75	13.7	0.7
5.000	50.00	5.13	4.300	0.007	0.0	0.0	0.0	1.32	10.4	0.9
3.002	50.00	5.48	4.000	0.017	0.0	0.0	0.0	3.28	25.7	2.3
1.003	50.00	5.88	3.350	0.067	0.0	0.0	0.0	1.09	43.4	9.1
6.000	50.00	5.19	4.300	0.007	0.0	0.0	0.0	0.92	7.2	0.9
6.001	50.00	5.22	4.150	0.007	0.0	0.0	0.0	3.26	25.6	0.9
7.000	50.00	5.07	4.300	0.011	0.0	0.0	0.0	2.39	18.8	1.5

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STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Surface Network 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.004	18.549	0.150	123.7	0.020	0.00	0.0	0.600	o	225	Pipe/Conduit	
8.000	10.411	1.125	9.3	0.007	5.00	0.0	0.600	o	100	Pipe/Conduit	
1.005	10.861	0.100	108.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
9.000	9.930	0.150	66.2	0.009	5.00	0.0	0.600	o	100	Pipe/Conduit	
9.001	13.354	0.150	89.0	0.016	0.00	0.0	0.600	o	150	Pipe/Conduit	
10.000	10.133	0.300	33.8	0.005	5.00	0.0	0.600	o	100	Pipe/Conduit	
9.002	6.068	0.100	60.7	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit	
11.000	10.247	0.150	68.3	0.005	5.00	0.0	0.600	o	100	Pipe/Conduit	
11.001	12.514	0.250	50.1	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit	
12.000	10.209	0.400	25.5	0.005	5.00	0.0	0.600	o	100	Pipe/Conduit	
9.003	8.148	0.900	9.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.006	6.834	0.115	59.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.007	39.703	0.400	99.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.008	33.184	0.385	86.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
13.000	8.059	0.600	13.4	0.006	5.00	0.0	0.600	o	100	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.004	50.00	6.14	3.200	0.105	0.0	0.0	0.0	1.17	46.7	14.2
8.000	50.00	5.07	4.300	0.007	0.0	0.0	0.0	2.56	20.1	0.9
1.005	50.00	6.28	3.050	0.112	0.0	0.0	0.0	1.25	49.9	15.2
9.000	50.00	5.17	4.300	0.009	0.0	0.0	0.0	0.95	7.4	1.2
9.001	50.00	5.38	4.100	0.025	0.0	0.0	0.0	1.07	18.8	3.4
10.000	50.00	5.13	4.300	0.005	0.0	0.0	0.0	1.33	10.5	0.7
9.002	50.00	5.46	3.950	0.038	0.0	0.0	0.0	1.29	22.9	5.1
11.000	50.00	5.18	4.300	0.005	0.0	0.0	0.0	0.93	7.3	0.7
11.001	50.00	5.33	4.100	0.010	0.0	0.0	0.0	1.43	25.2	1.4
12.000	50.00	5.11	4.300	0.005	0.0	0.0	0.0	1.53	12.0	0.7
9.003	50.00	5.50	3.850	0.053	0.0	0.0	0.0	3.37	59.5	7.2
1.006	50.00	6.37	2.950	0.165	0.0	0.0	0.0	1.31	23.1	22.3
1.007	50.00	7.03	2.835	0.165	0.0	0.0	0.0	1.01	17.8«	22.3
1.008	50.00	7.54	2.435	0.165	0.0	0.0	0.0	1.08	19.1«	22.3
13.000	50.00	5.06	3.750	0.006	0.0	0.0	0.0	2.12	16.6	0.8

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STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Surface Network 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
13.001	18.349	0.200	91.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
14.000	8.238	0.800	10.3	0.010	5.00	0.0	0.600	o	100	Pipe/Conduit	
13.002	10.479	0.150	69.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
15.000	6.946	0.150	46.3	0.005	5.00	0.0	0.600	o	100	Pipe/Conduit	
15.001	2.558	0.800	3.2	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
13.003	4.919	0.250	19.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
13.004	3.770	0.450	8.4	0.085	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.009	14.247	0.170	83.8	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
13.001	50.00	5.35	3.100	0.006	0.0	0.0	0.0	1.05	18.5	0.8
14.000	50.00	5.06	3.750	0.010	0.0	0.0	0.0	2.42	19.0	1.4
13.002	50.00	5.50	2.900	0.016	0.0	0.0	0.0	1.20	21.3	2.2
15.000	50.00	5.10	3.750	0.005	0.0	0.0	0.0	1.14	8.9	0.7
15.001	50.00	5.11	3.600	0.005	0.0	0.0	0.0	4.36	34.2	0.7
13.003	50.00	5.54	2.750	0.021	0.0	0.0	0.0	2.28	40.3	2.8
13.004	50.00	5.55	2.500	0.106	0.0	0.0	0.0	3.50	61.9	14.4
1.009	50.00	7.64	1.750	0.271	0.0	0.0	0.0	2.22	353.4	36.7

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Manhole Schedules for Surface Network 1

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1.1	4.850	0.500	Open Manhole	100	1.000	4.350	100				
S1.2	4.830	0.580	Open Manhole	450	1.001	4.250	100	1.000	4.250	100	
S1.3	4.850	0.500	Open Manhole	100	2.000	4.350	100				
S1.4	4.850	1.275	Open Manhole	450	1.002	3.575	150	1.001	3.625	100	
								2.000	3.625	100	
S1.5	4.850	0.550	Open Manhole	100	3.000	4.300	100				
S1.6	4.930	0.730	Open Manhole	450	3.001	4.200	100	3.000	4.200	100	
S1.7	4.850	0.550	Open Manhole	100	4.000	4.300	100				
S1.8	4.850	0.750	Open Manhole	450	4.001	4.100	100	4.000	4.100	100	
S1.9	4.850	0.550	Open Manhole	100	5.000	4.300	100				
S1.10	4.890	0.890	Open Manhole	450	3.002	4.000	100	3.001	4.000	100	
								4.001	4.000	100	
								5.000	4.000	100	
S1.11	4.700	1.350	Open Manhole	450	1.003	3.350	225	1.002	3.425	150	
								3.002	3.475	100	
S1.12	4.850	0.550	Open Manhole	100	6.000	4.300	100				
S1.13	4.850	0.700	Open Manhole	450	6.001	4.150	100	6.000	4.150	100	
S1.14	4.850	0.550	Open Manhole	100	7.000	4.300	100				
S1.15	4.820	1.620	Open Manhole	600	1.004	3.200	225	1.003	3.200	225	
								6.001	3.325	100	
								7.000	3.325	100	
S1.16	4.850	0.550	Open Manhole	100	8.000	4.300	100				
S1.17	4.930	1.880	Open Manhole	600	1.005	3.050	225	1.004	3.050	225	
								8.000	3.175	100	
S1.18	4.850	0.550	Open Manhole	100	9.000	4.300	100				
S1.19	4.840	0.740	Open Manhole	450	9.001	4.100	150	9.000	4.150	100	
S1,20	4.850	0.550	Open Manhole	100	10.000	4.300	100				
S1.21	4.850	0.900	Open Manhole	450	9.002	3.950	150	9.001	3.950	150	
								10.000	4.000	100	
S1.22	4.850	0.550	Open Manhole	100	11.000	4.300	100				
S1.23	4.810	0.710	Open Manhole	450	11.001	4.100	150	11.000	4.150	100	
S1.24	4.850	0.550	Open Manhole	100	12.000	4.300	100				
S1.25	4.860	1.010	Open Manhole	450	9.003	3.850	150	9.002	3.850	150	
								11.001	3.850	150	
								12.000	3.900	100	
S1.26 FC	4.590	1.640	Open Manhole	1200	1.006	2.950	150	1.005	2.950	225	
								9.003	2.950	150	
S1	4.440	1.605	Open Manhole	1200	1.007	2.835	150	1.006	2.835	150	
S2	4.155	1.720	Open Manhole	1200	1.008	2.435	150	1.007	2.435	150	
S3.1	4.150	0.400	Open Manhole	100	13.000	3.750	100				
S3.2	4.150	1.050	Open Manhole	450	13.001	3.100	150	13.000	3.150	100	
S3.3	4.150	0.400	Open Manhole	100	14.000	3.750	100				
S3.4	4.150	1.250	Open Manhole	450	13.002	2.900	150	13.001	2.900	150	
								14.000	2.950	100	

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Manhole Schedules for Surface Network 1

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S3.5	4.150	0.400	Open Manhole	100	15.000	3.750	100				
S3.6	4.150	0.550	Open Manhole	450	15.001	3.600	100	15.000	3.600	100	
S3.7	4.150	1.400	Open Manhole	450	13.003	2.750	150	13.002	2.750	150	
								15.001	2.800	100	
S3.8 FC	4.135	1.635	Open Manhole	1200	13.004	2.500	150	13.003	2.500	150	
S3	4.230	2.480	Open Manhole	1500	1.009	1.750	450	1.008	2.050	150	
								13.004	2.050	150	
EXSTG.	4.230	2.650	Open Manhole	1200		OUTFALL		1.009	1.580	450	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1.1	525931.452	323780.253	525931.452	323780.253	Required	
S1.2	525929.735	323790.400	525929.735	323790.400	Required	
S1.3	525943.852	323782.360	525943.852	323782.360	Required	
S1.4	525942.141	323792.513	525942.141	323792.513	Required	
S1.5	525930.151	323815.797	525930.151	323815.797	Required	
S1.6	525931.839	323805.825	525931.839	323805.825	Required	
S1.7	525942.552	323817.904	525942.552	323817.904	Required	
S1.8	525943.983	323809.470	525943.983	323809.470	Required	
S1.9	525943.537	323818.071	525943.537	323818.071	Required	
S1.10	525945.249	323807.959	525945.249	323807.959	Required	
S1.11	525945.765	323805.039	525945.765	323805.039	Required	
S1.12	525961.483	323821.121	525961.483	323821.121	Required	
S1.13	525963.239	323810.661	525963.239	323810.661	Required	

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Manhole Schedules for Surface Network 1

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1.14	525965.308	323818.036	525965.308	323818.036	Required	
S1.15	525967.022	323807.849	525967.022	323807.849	Required	
S1.16	525983.254	323821.085	525983.254	323821.085	Required	
S1.17	525985.321	323810.881	525985.321	323810.881	Required	
S1.18	526001.938	323822.285	526001.938	323822.285	Required	
S1.19	525992.132	323820.719	525992.132	323820.719	Required	
S1,20	526004.212	323809.167	526004.212	323809.167	Required	
S1.21	525994.212	323807.528	525994.212	323807.528	Required	
S1.22	526007.323	323790.878	526007.323	323790.878	Required	
S1.23	525997.216	323789.191	525997.216	323789.191	Required	
S1.24	526005.216	323803.278	526005.216	323803.278	Required	
S1.25	525995.157	323801.535	525995.157	323801.535	Required	
S1.26 FC	525987.124	323800.171	525987.124	323800.171	Required	
S1	525980.381	323799.058	525980.381	323799.058	Required	
S2	525987.102	323759.928	525987.102	323759.928	Required	
S3.1	525987.480	323775.426	525987.480	323775.426	Required	
S3.2	525988.830	323767.481	525988.830	323767.481	Required	
S3.3	526005.558	323778.656	526005.558	323778.656	Required	

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Manhole Schedules for Surface Network 1

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S3.4	526006.924	323770.532	526006.924	323770.532	Required	
S3.5	526018.138	323780.635	526018.138	323780.635	Required	
S3.6	526019.317	323773.789	526019.317	323773.789	Required	
S3.7	526017.256	323772.274	526017.256	323772.274	Required	
S3.8 FC	526018.769	323767.593	526018.769	323767.593	Required	
S3	526020.030	323764.041	526020.030	323764.041	Required	
EXSTG.	526022.737	323750.053			No Entry	



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PIPELINE SCHEDULES for Surface Network 1

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	100	S1.1	4.850	4.350	0.400	Open Manhole	100
1.001	o	100	S1.2	4.830	4.250	0.480	Open Manhole	450
2.000	o	100	S1.3	4.850	4.350	0.400	Open Manhole	100
1.002	o	150	S1.4	4.850	3.575	1.125	Open Manhole	450
3.000	o	100	S1.5	4.850	4.300	0.450	Open Manhole	100
3.001	o	100	S1.6	4.930	4.200	0.630	Open Manhole	450
4.000	o	100	S1.7	4.850	4.300	0.450	Open Manhole	100
4.001	o	100	S1.8	4.850	4.100	0.650	Open Manhole	450
5.000	o	100	S1.9	4.850	4.300	0.450	Open Manhole	100
3.002	o	100	S1.10	4.890	4.000	0.790	Open Manhole	450
1.003	o	225	S1.11	4.700	3.350	1.125	Open Manhole	450
6.000	o	100	S1.12	4.850	4.300	0.450	Open Manhole	100
6.001	o	100	S1.13	4.850	4.150	0.600	Open Manhole	450
7.000	o	100	S1.14	4.850	4.300	0.450	Open Manhole	100
1.004	o	225	S1.15	4.820	3.200	1.395	Open Manhole	600

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	10.291	102.9	S1.2	4.830	4.250	0.480	Open Manhole	450
1.001	12.585	20.1	S1.4	4.850	3.625	1.125	Open Manhole	450
2.000	10.295	14.2	S1.4	4.850	3.625	1.125	Open Manhole	450
1.002	13.040	86.9	S1.11	4.700	3.425	1.125	Open Manhole	450
3.000	10.113	101.1	S1.6	4.930	4.200	0.630	Open Manhole	450
3.001	13.578	67.9	S1.10	4.890	4.000	0.790	Open Manhole	450
4.000	8.555	42.8	S1.8	4.850	4.100	0.650	Open Manhole	450
4.001	1.971	19.7	S1.10	4.890	4.000	0.790	Open Manhole	450
5.000	10.256	34.2	S1.10	4.890	4.000	0.790	Open Manhole	450
3.002	2.965	5.6	S1.11	4.700	3.475	1.125	Open Manhole	450
1.003	21.442	142.9	S1.15	4.820	3.200	1.395	Open Manhole	600
6.000	10.607	70.7	S1.13	4.850	4.150	0.600	Open Manhole	450
6.001	4.713	5.7	S1.15	4.820	3.325	1.395	Open Manhole	600
7.000	10.330	10.6	S1.15	4.820	3.325	1.395	Open Manhole	600
1.004	18.549	123.7	S1.17	4.930	3.050	1.655	Open Manhole	600

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PIPELINE SCHEDULES for Surface Network 1

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
8.000	o	100	S1.16	4.850	4.300	0.450	Open Manhole	100
1.005	o	225	S1.17	4.930	3.050	1.655	Open Manhole	600
9.000	o	100	S1.18	4.850	4.300	0.450	Open Manhole	100
9.001	o	150	S1.19	4.840	4.100	0.590	Open Manhole	450
10.000	o	100	S1,20	4.850	4.300	0.450	Open Manhole	100
9.002	o	150	S1.21	4.850	3.950	0.750	Open Manhole	450
11.000	o	100	S1.22	4.850	4.300	0.450	Open Manhole	100
11.001	o	150	S1.23	4.810	4.100	0.560	Open Manhole	450
12.000	o	100	S1.24	4.850	4.300	0.450	Open Manhole	100
9.003	o	150	S1.25	4.860	3.850	0.860	Open Manhole	450
1.006	o	150	S1.26 FC	4.590	2.950	1.490	Open Manhole	1200
1.007	o	150	S1	4.440	2.835	1.455	Open Manhole	1200
1.008	o	150	S2	4.155	2.435	1.570	Open Manhole	1200
13.000	o	100	S3.1	4.150	3.750	0.300	Open Manhole	100
13.001	o	150	S3.2	4.150	3.100	0.900	Open Manhole	450

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
8.000	10.411	9.3	S1.17	4.930	3.175	1.655	Open Manhole	600
1.005	10.861	108.6	S1.26 FC	4.590	2.950	1.415	Open Manhole	1200
9.000	9.930	66.2	S1.19	4.840	4.150	0.590	Open Manhole	450
9.001	13.354	89.0	S1.21	4.850	3.950	0.750	Open Manhole	450
10.000	10.133	33.8	S1.21	4.850	4.000	0.750	Open Manhole	450
9.002	6.068	60.7	S1.25	4.860	3.850	0.860	Open Manhole	450
11.000	10.247	68.3	S1.23	4.810	4.150	0.560	Open Manhole	450
11.001	12.514	50.1	S1.25	4.860	3.850	0.860	Open Manhole	450
12.000	10.209	25.5	S1.25	4.860	3.900	0.860	Open Manhole	450
9.003	8.148	9.1	S1.26 FC	4.590	2.950	1.490	Open Manhole	1200
1.006	6.834	59.4	S1	4.440	2.835	1.455	Open Manhole	1200
1.007	39.703	99.3	S2	4.155	2.435	1.570	Open Manhole	1200
1.008	33.184	86.2	S3	4.230	2.050	2.030	Open Manhole	1500
13.000	8.059	13.4	S3.2	4.150	3.150	0.900	Open Manhole	450
13.001	18.349	91.7	S3.4	4.150	2.900	1.100	Open Manhole	450

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PIPELINE SCHEDULES for Surface Network 1

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
14.000	o	100	S3.3	4.150	3.750	0.300	Open Manhole	100
13.002	o	150	S3.4	4.150	2.900	1.100	Open Manhole	450
15.000	o	100	S3.5	4.150	3.750	0.300	Open Manhole	100
15.001	o	100	S3.6	4.150	3.600	0.450	Open Manhole	450
13.003	o	150	S3.7	4.150	2.750	1.250	Open Manhole	450
13.004	o	150	S3.8 FC	4.135	2.500	1.485	Open Manhole	1200
1.009	o	450	S3	4.230	1.750	2.030	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
14.000	8.238	10.3	S3.4	4.150	2.950	1.100	Open Manhole	450
13.002	10.479	69.9	S3.7	4.150	2.750	1.250	Open Manhole	450
15.000	6.946	46.3	S3.6	4.150	3.600	0.450	Open Manhole	450
15.001	2.558	3.2	S3.7	4.150	2.800	1.250	Open Manhole	450
13.003	4.919	19.7	S3.8 FC	4.135	2.500	1.485	Open Manhole	1200
13.004	3.770	8.4	S3	4.230	2.050	2.030	Open Manhole	1500
1.009	14.247	83.8	EXSTG.	4.230	1.580	2.200	Open Manhole	1200

Free Flowing Outfall Details for Surface Network 1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.009	EXSTG.	4.230	1.580	0.000	1200	0

Simulation Criteria for Surface Network 1

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Return Period (years) 2

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Synthetic Rainfall Details

Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840
Ratio R	0.400	Storm Duration (mins)	30
Profile Type	Summer		

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Online Controls for Surface Network 1

Hydro-Brake® Optimum Manhole: S1.26 FC, DS/PN: 1.006, Volume (m³): 2.4

Unit Reference	MD-SHE-0071-2500-1250-2500
Design Head (m)	1.250
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	71
Invert Level (m)	2.950
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	2.5	Kick-Flo®	0.639	1.8
Flush-Flo™	0.316	2.3	Mean Flow over Head Range	-	2.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.9	0.800	2.0	2.000	3.1	4.000	4.3	7.000	5.6
0.200	2.2	1.000	2.3	2.200	3.2	4.500	4.5	7.500	5.7
0.300	2.3	1.200	2.4	2.400	3.4	5.000	4.7	8.000	5.9
0.400	2.3	1.400	2.6	2.600	3.5	5.500	5.0	8.500	6.1
0.500	2.2	1.600	2.8	3.000	3.7	6.000	5.2	9.000	6.3
0.600	2.0	1.800	2.9	3.500	4.0	6.500	5.4	9.500	6.4

Hydro-Brake® Optimum Manhole: S3.8 FC, DS/PN: 13.004, Volume (m³): 1.9

Unit Reference	MD-SHE-0077-2500-0900-2500
Design Head (m)	0.900
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	77
Invert Level (m)	2.500
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	2.5	Kick-Flo®	0.568	2.0
Flush-Flo™	0.271	2.5	Mean Flow over Head Range	-	2.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.1	0.400	2.4	0.800	2.4	1.400	3.1	2.000	3.6
0.200	2.5	0.500	2.3	1.000	2.6	1.600	3.3	2.200	3.8
0.300	2.5	0.600	2.1	1.200	2.9	1.800	3.4	2.400	3.9

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Hydro-Brake® Optimum Manhole: S3.8 FC, DS/PN: 13.004, Volume (m³): 1.9

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
2.600	4.1	4.000	5.0	5.500	5.8	7.000	6.5	8.500	7.1
3.000	4.4	4.500	5.3	6.000	6.0	7.500	6.7	9.000	7.3
3.500	4.7	5.000	5.5	6.500	6.3	8.000	6.9	9.500	7.5

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Storage Structures for Surface Network 1

Cellular Storage Manhole: S1.11, DS/PN: 1.003

Invert Level (m) 3.725 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.94
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	15.0	0.0	0.210	15.0	0.0	0.211	0.0	0.0

Cellular Storage Manhole: S1.26 FC, DS/PN: 1.006

Invert Level (m) 3.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

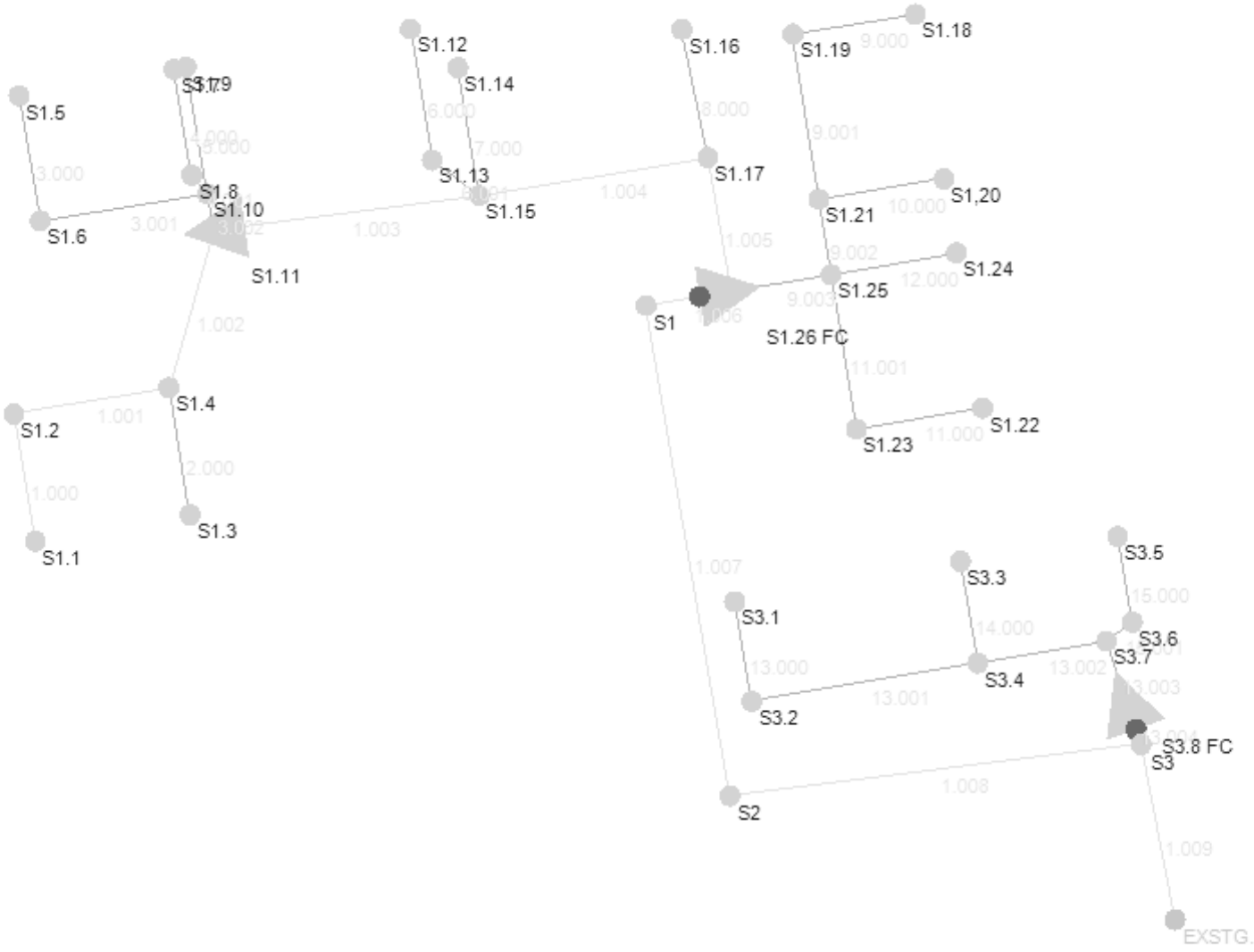
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	82.0	0.0	0.800	82.0	0.0	0.801	0.0	0.0

Cellular Storage Manhole: S3.8 FC, DS/PN: 13.004

Invert Level (m) 2.650 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	48.0	0.0	0.800	48.0	0.0	0.801	0.0	0.0

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Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 19.000	Cv (Summer) 0.750
Region	England and Wales	Ratio R 0.400	Cv (Winter) 0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	OFF

Profile(s)	Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	2
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	S1.1	15 Winter	2	+0%					4.376	-0.074
1.001	S1.2	15 Winter	2	+0%					4.267	-0.083
2.000	S1.3	15 Winter	2	+0%					4.365	-0.085
1.002	S1.4	15 Winter	2	+0%					3.636	-0.089
3.000	S1.5	15 Winter	2	+0%					4.326	-0.074
3.001	S1.6	15 Winter	2	+0%					4.223	-0.077
4.000	S1.7	15 Winter	2	+0%					4.321	-0.079
4.001	S1.8	15 Winter	2	+0%					4.121	-0.079
5.000	S1.9	15 Winter	2	+0%					4.323	-0.077
3.002	S1.10	15 Winter	2	+0%					4.025	-0.075
1.003	S1.11	15 Winter	2	+0%					3.429	-0.146
6.000	S1.12	15 Winter	2	+0%					4.328	-0.072
6.001	S1.13	15 Winter	2	+0%					4.165	-0.085
7.000	S1.14	15 Winter	2	+0%					4.322	-0.078
1.004	S1.15	15 Winter	2	+0%					3.297	-0.128
8.000	S1.16	15 Winter	2	+0%					4.316	-0.084
1.005	S1.17	60 Winter	2	+0%					3.185	-0.090
9.000	S1.18	15 Winter	2	+0%					4.332	-0.068
9.001	S1.19	15 Winter	2	+0%					4.148	-0.102
10.000	S1,20	15 Winter	2	+0%					4.320	-0.080
9.002	S1.21	15 Winter	2	+0%					4.007	-0.093
11.000	S1.22	15 Winter	2	+0%					4.324	-0.076
11.001	S1.23	15 Winter	2	+0%					4.126	-0.124
12.000	S1.24	15 Winter	2	+0%					4.318	-0.082
9.003	S1.25	15 Winter	2	+0%					3.890	-0.110
1.006	S1.26 FC	60 Winter	2	+0%	2/15 Winter				3.182	0.082
1.007	S1	60 Winter	2	+0%					2.871	-0.114
1.008	S2	60 Winter	2	+0%					2.470	-0.115
13.000	S3.1	15 Winter	2	+0%					3.767	-0.083
13.001	S3.2	15 Winter	2	+0%					3.124	-0.126

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Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1.1	0.000	0.15			0.9	OK	
1.001	S1.2	0.000	0.07			0.8	OK	
2.000	S1.3	0.000	0.06			0.9	OK	
1.002	S1.4	0.000	0.35			6.0	OK	
3.000	S1.5	0.000	0.15			0.9	OK	
3.001	S1.6	0.000	0.12			0.8	OK	
4.000	S1.7	0.000	0.10			0.9	OK	
4.001	S1.8	0.000	0.10			0.8	OK	
5.000	S1.9	0.000	0.12			1.2	OK	
3.002	S1.10	0.000	0.14			2.9	OK	
1.003	S1.11	0.000	0.26		7	10.4	OK	
6.000	S1.12	0.000	0.18			1.2	OK	
6.001	S1.13	0.000	0.05			1.2	OK	
7.000	S1.14	0.000	0.11			1.9	OK	
1.004	S1.15	0.000	0.39			16.3	OK	
8.000	S1.16	0.000	0.06			1.2	OK	
1.005	S1.17	0.000	0.23			9.6	OK	
9.000	S1.18	0.000	0.22			1.5	OK	
9.001	S1.19	0.000	0.22			3.8	OK	
10.000	S1,20	0.000	0.09			0.9	OK	
9.002	S1.21	0.000	0.30			5.8	OK	
11.000	S1.22	0.000	0.13			0.9	OK	
11.001	S1.23	0.000	0.07			1.6	OK	
12.000	S1.24	0.000	0.08			0.9	OK	
9.003	S1.25	0.000	0.16			8.3	OK	
1.006	S1.26 FC	0.000	0.11		63	2.2	SURCHARGED	
1.007	S1	0.000	0.13			2.2	OK	
1.008	S2	0.000	0.12			2.2	OK	
13.000	S3.1	0.000	0.07			1.0	OK	
13.001	S3.2	0.000	0.06			1.0	OK	

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Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
14.000	S3.3	15 Winter	2	+0%					3.771	-0.079	0.000
13.002	S3.4	15 Winter	2	+0%					2.938	-0.112	0.000
15.000	S3.5	15 Winter	2	+0%					3.772	-0.078	0.000
15.001	S3.6	15 Winter	2	+0%					3.612	-0.088	0.000
13.003	S3.7	30 Winter	2	+0%					2.796	-0.104	0.000
13.004	S3.8 FC	30 Winter	2	+0%	2/15 Winter				2.795	0.145	0.000
1.009	S3	60 Winter	2	+0%					1.792	-0.408	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
14.000	S3.3	0.10			1.7	OK	
13.002	S3.4	0.14			2.7	OK	
15.000	S3.5	0.11			0.9	OK	
15.001	S3.6	0.03			0.8	OK	
13.003	S3.7	0.09			2.8	OK	
13.004	S3.8 FC	0.06		29	2.4	SURCHARGED	
1.009	S3	0.02			4.6	OK	

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Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 19.000	Cv (Summer) 0.750
Region England and Wales		Ratio R 0.400	Cv (Winter) 0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	OFF

Profile(s)	Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	30
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	S1.1	15 Winter	30	+0%					4.387	-0.063
1.001	S1.2	15 Winter	30	+0%					4.274	-0.076
2.000	S1.3	15 Winter	30	+0%					4.372	-0.078
1.002	S1.4	15 Winter	30	+0%					3.676	-0.049
3.000	S1.5	15 Winter	30	+0%					4.337	-0.063
3.001	S1.6	15 Winter	30	+0%					4.233	-0.067
4.000	S1.7	15 Winter	30	+0%					4.330	-0.070
4.001	S1.8	15 Winter	30	+0%					4.129	-0.071
5.000	S1.9	15 Winter	30	+0%					4.333	-0.067
3.002	S1.10	15 Winter	30	+0%					4.036	-0.064
1.003	S1.11	15 Winter	30	+0%					3.472	-0.103
6.000	S1.12	15 Winter	30	+0%					4.340	-0.060
6.001	S1.13	15 Winter	30	+0%					4.171	-0.079
7.000	S1.14	15 Winter	30	+0%					4.331	-0.069
1.004	S1.15	120 Winter	30	+0%	30/120 Winter				3.432	0.007
8.000	S1.16	15 Winter	30	+0%					4.323	-0.077
1.005	S1.17	120 Winter	30	+0%	30/15 Winter				3.429	0.154
9.000	S1.18	15 Winter	30	+0%					4.345	-0.055
9.001	S1.19	15 Winter	30	+0%					4.174	-0.076
10.000	S1,20	15 Winter	30	+0%					4.327	-0.073
9.002	S1.21	15 Winter	30	+0%					4.040	-0.060
11.000	S1.22	15 Winter	30	+0%					4.333	-0.067
11.001	S1.23	15 Winter	30	+0%					4.138	-0.112
12.000	S1.24	15 Winter	30	+0%					4.325	-0.075
9.003	S1.25	15 Winter	30	+0%					3.911	-0.089
1.006	S1.26 FC	120 Winter	30	+0%	30/15 Winter				3.426	0.326
1.007	S1	720 Winter	30	+0%					2.871	-0.114
1.008	S2	720 Winter	30	+0%					2.470	-0.115
13.000	S3.1	15 Winter	30	+0%					3.774	-0.076
13.001	S3.2	15 Winter	30	+0%					3.133	-0.117

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Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1.1	0.000	0.29			1.6	OK	
1.001	S1.2	0.000	0.13			1.6	OK	
2.000	S1.3	0.000	0.11			1.6	OK	
1.002	S1.4	0.000	0.78			13.6	OK	
3.000	S1.5	0.000	0.29			1.6	OK	
3.001	S1.6	0.000	0.23			1.6	OK	
4.000	S1.7	0.000	0.19			1.6	OK	
4.001	S1.8	0.000	0.18			1.6	OK	
5.000	S1.9	0.000	0.23			2.3	OK	
3.002	S1.10	0.000	0.27			5.4	OK	
1.003	S1.11	0.000	0.56		3	22.2	OK	
6.000	S1.12	0.000	0.34			2.3	OK	
6.001	S1.13	0.000	0.10			2.2	OK	
7.000	S1.14	0.000	0.20			3.6	OK	
1.004	S1.15	0.000	0.26			10.8	SURCHARGED	
8.000	S1.16	0.000	0.12			2.3	OK	
1.005	S1.17	0.000	0.26			10.9	SURCHARGED	
9.000	S1.18	0.000	0.42			2.9	OK	
9.001	S1.19	0.000	0.49			8.4	OK	
10.000	S1,20	0.000	0.17			1.6	OK	
9.002	S1.21	0.000	0.67			12.8	OK	
11.000	S1.22	0.000	0.24			1.6	OK	
11.001	S1.23	0.000	0.15			3.3	OK	
12.000	S1.24	0.000	0.14			1.6	OK	
9.003	S1.25	0.000	0.34			17.7	OK	
1.006	S1.26 FC	0.000	0.12		140	2.3	SURCHARGED	
1.007	S1	0.000	0.13			2.3	OK	
1.008	S2	0.000	0.12			2.3	OK	
13.000	S3.1	0.000	0.13			1.9	OK	
13.001	S3.2	0.000	0.11			1.9	OK	

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Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
14.000	S3.3	15 Winter	30	+0%					3.779	-0.071
13.002	S3.4	60 Winter	30	+0%					3.030	-0.020
15.000	S3.5	15 Winter	30	+0%					3.780	-0.070
15.001	S3.6	15 Winter	30	+0%					3.617	-0.083
13.003	S3.7	60 Winter	30	+0%	30/15 Winter				3.028	0.128
13.004	S3.8 FC	60 Winter	30	+0%	30/15 Winter				3.027	0.377
1.009	S3	15 Winter	30	+0%					1.793	-0.407

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
14.000	S3.3	0.000	0.19			3.2	OK	
13.002	S3.4	0.000	0.14			2.7	OK	
15.000	S3.5	0.000	0.20			1.6	OK	
15.001	S3.6	0.000	0.06			1.6	OK	
13.003	S3.7	0.000	0.11			3.3	SURCHARGED	
13.004	S3.8 FC	0.000	0.06		68	2.5	SURCHARGED	
1.009	S3	0.000	0.02			4.7	OK	

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Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 19.000	Cv (Summer) 0.750
Region	England and Wales	Ratio R 0.400	Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status OFF

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 100
Climate Change (%) 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	S1.1	15 Winter	100	+30%					4.400	-0.050
1.001	S1.2	15 Winter	100	+30%					4.281	-0.069
2.000	S1.3	15 Winter	100	+30%					4.379	-0.071
1.002	S1.4	180 Winter	100	+30%	100/15 Winter				4.252	0.527
3.000	S1.5	15 Winter	100	+30%					4.350	-0.050
3.001	S1.6	180 Winter	100	+30%					4.252	-0.048
4.000	S1.7	15 Winter	100	+30%					4.339	-0.061
4.001	S1.8	180 Winter	100	+30%	100/180 Winter				4.251	0.051
5.000	S1.9	15 Winter	100	+30%					4.344	-0.056
3.002	S1.10	180 Winter	100	+30%	100/180 Winter				4.251	0.151
1.003	S1.11	180 Winter	100	+30%	100/15 Winter				4.250	0.675
6.000	S1.12	15 Winter	100	+30%					4.354	-0.046
6.001	S1.13	180 Winter	100	+30%					4.248	-0.002
7.000	S1.14	15 Winter	100	+30%					4.341	-0.059
1.004	S1.15	180 Winter	100	+30%	100/15 Winter				4.248	0.823
8.000	S1.16	15 Winter	100	+30%					4.331	-0.069
1.005	S1.17	180 Winter	100	+30%	100/15 Winter				4.245	0.970
9.000	S1.18	15 Winter	100	+30%					4.363	-0.037
9.001	S1.19	180 Winter	100	+30%					4.248	-0.002
10.000	S1,20	15 Winter	100	+30%					4.336	-0.064
9.002	S1.21	180 Winter	100	+30%	100/15 Winter				4.246	0.146
11.000	S1.22	15 Winter	100	+30%					4.344	-0.056
11.001	S1.23	180 Winter	100	+30%					4.245	-0.005
12.000	S1.24	15 Winter	100	+30%					4.333	-0.067
9.003	S1.25	180 Winter	100	+30%	100/120 Winter				4.245	0.245
1.006	S1.26 FC	180 Winter	100	+30%	100/15 Winter				4.242	1.142
1.007	S1	180 Winter	100	+30%					2.873	-0.112
1.008	S2	180 Winter	100	+30%					2.472	-0.113
13.000	S3.1	15 Winter	100	+30%					3.781	-0.069
13.001	S3.2	120 Winter	100	+30%	100/30 Winter				3.436	0.186

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Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1.1	0.000	0.49			2.7	OK	
1.001	S1.2	0.000	0.21			2.7	OK	
2.000	S1.3	0.000	0.18			2.7	OK	
1.002	S1.4	0.000	0.30			5.2	SURCHARGED	
3.000	S1.5	0.000	0.49			2.7	OK	
3.001	S1.6	0.000	0.09			0.7	OK	
4.000	S1.7	0.000	0.32			2.7	OK	
4.001	S1.8	0.000	0.07			0.7	SURCHARGED	
5.000	S1.9	0.000	0.39			3.8	OK	
3.002	S1.10	0.000	0.11			2.2	SURCHARGED	
1.003	S1.11	0.000	0.22		34	8.6	SURCHARGED	
6.000	S1.12	0.000	0.57			3.8	OK	
6.001	S1.13	0.000	0.04			0.9	OK	
7.000	S1.14	0.000	0.34			6.0	OK	
1.004	S1.15	0.000	0.31			13.1	SURCHARGED	
8.000	S1.16	0.000	0.20			3.8	OK	
1.005	S1.17	0.000	0.33			13.9	SURCHARGED	
9.000	S1.18	0.000	0.71			4.9	OK	
9.001	S1.19	0.000	0.19			3.3	OK	
10.000	S1,20	0.000	0.28			2.7	OK	
9.002	S1.21	0.000	0.26			5.0	SURCHARGED	
11.000	S1.22	0.000	0.40			2.7	OK	
11.001	S1.23	0.000	0.06			1.3	OK	
12.000	S1.24	0.000	0.24			2.7	OK	
9.003	S1.25	0.000	0.13			7.0	SURCHARGED	
1.006	S1.26 FC	0.000	0.13		320	2.5	SURCHARGED	
1.007	S1	0.000	0.15			2.5	OK	
1.008	S2	0.000	0.14			2.5	OK	
13.000	S3.1	0.000	0.22			3.3	OK	
13.001	S3.2	0.000	0.06			1.1	SURCHARGED	

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Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
14.000	S3.3	15 Winter	100	+30%					3.788	-0.062
13.002	S3.4	120 Winter	100	+30%	100/15 Winter				3.436	0.386
15.000	S3.5	15 Winter	100	+30%					3.790	-0.060
15.001	S3.6	15 Winter	100	+30%					3.622	-0.078
13.003	S3.7	120 Winter	100	+30%	100/15 Winter				3.434	0.534
13.004	S3.8 FC	120 Winter	100	+30%	100/15 Winter				3.433	0.783
1.009	S3	180 Winter	100	+30%					1.795	-0.405

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
14.000	S3.3	0.000	0.31			5.5	OK	
13.002	S3.4	0.000	0.13			2.5	SURCHARGED	
15.000	S3.5	0.000	0.34			2.7	OK	
15.001	S3.6	0.000	0.11			2.7	OK	
13.003	S3.7	0.000	0.10			3.1	SURCHARGED	
13.004	S3.8 FC	0.000	0.06		145	2.5	SURCHARGED	
1.009	S3	0.000	0.02			5.0	OK	

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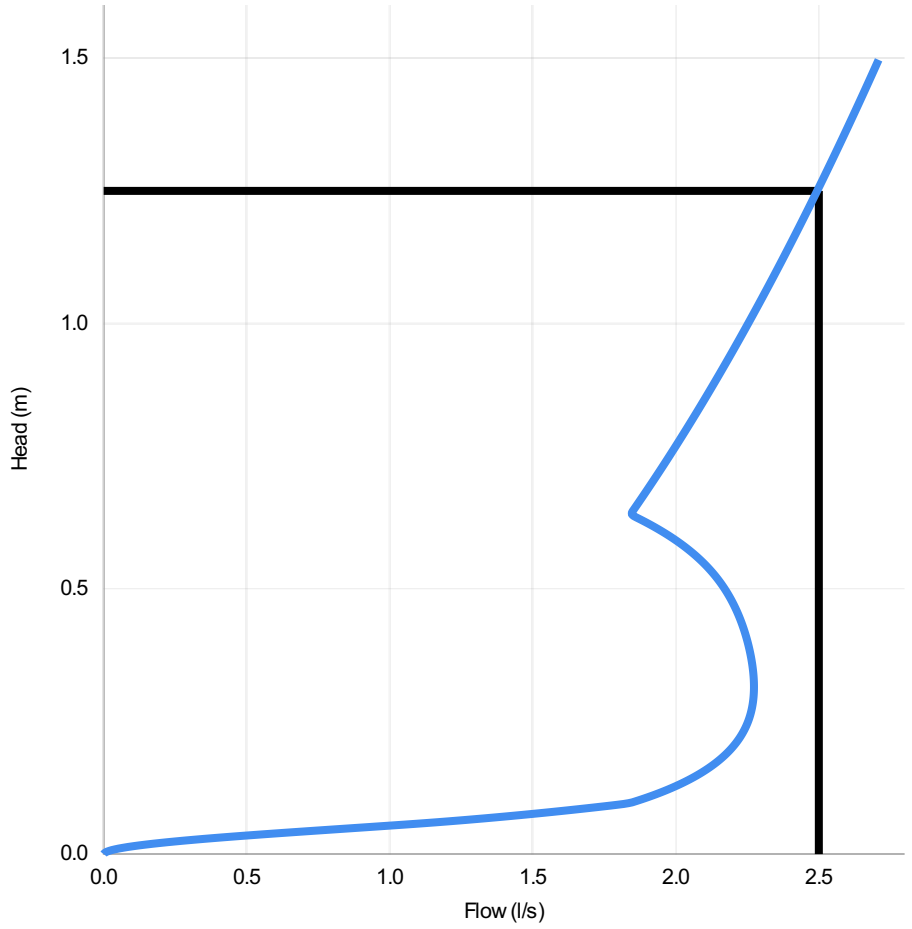
Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.250	2.500
Flush-Flo	0.316	2.273
Kick-Flo®	0.639	1.840
Mean Flow		2.073

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

WRc APPROVED
PT/329/0412

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Head (m)	Flow (l/s)
0.000	0.000
0.043	0.710
0.086	1.685
0.129	2.005
0.172	2.141
0.216	2.219
0.259	2.258
0.302	2.273
0.345	2.270
0.388	2.256
0.431	2.233
0.474	2.199
0.517	2.148
0.560	2.074
0.603	1.966
0.647	1.849
0.690	1.904
0.733	1.957
0.776	2.008
0.819	2.058
0.862	2.106
0.905	2.153
0.948	2.199
0.991	2.244
1.034	2.288
1.078	2.331
1.121	2.373
1.164	2.414
1.207	2.454
1.250	2.494

DESIGN ADVICE

The head/flow characteristics of this SHE-0071-2500-1250-2500 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

! **The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.**

Hydro International®

DATE	22/05/2020 18:41
Site	Welland Hospital, Holbeach Road, Spalding
DESIGNER	Andrew Bowler
Ref	P19-062 - S1.26 FC

SHE-0071-2500-1250-2500

Hydro-Brake Optimum®

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Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.250	2.500
Flush-Flo™	0.316	2.273
Kick-Flo®	0.639	1.840
Mean Flow		2.073

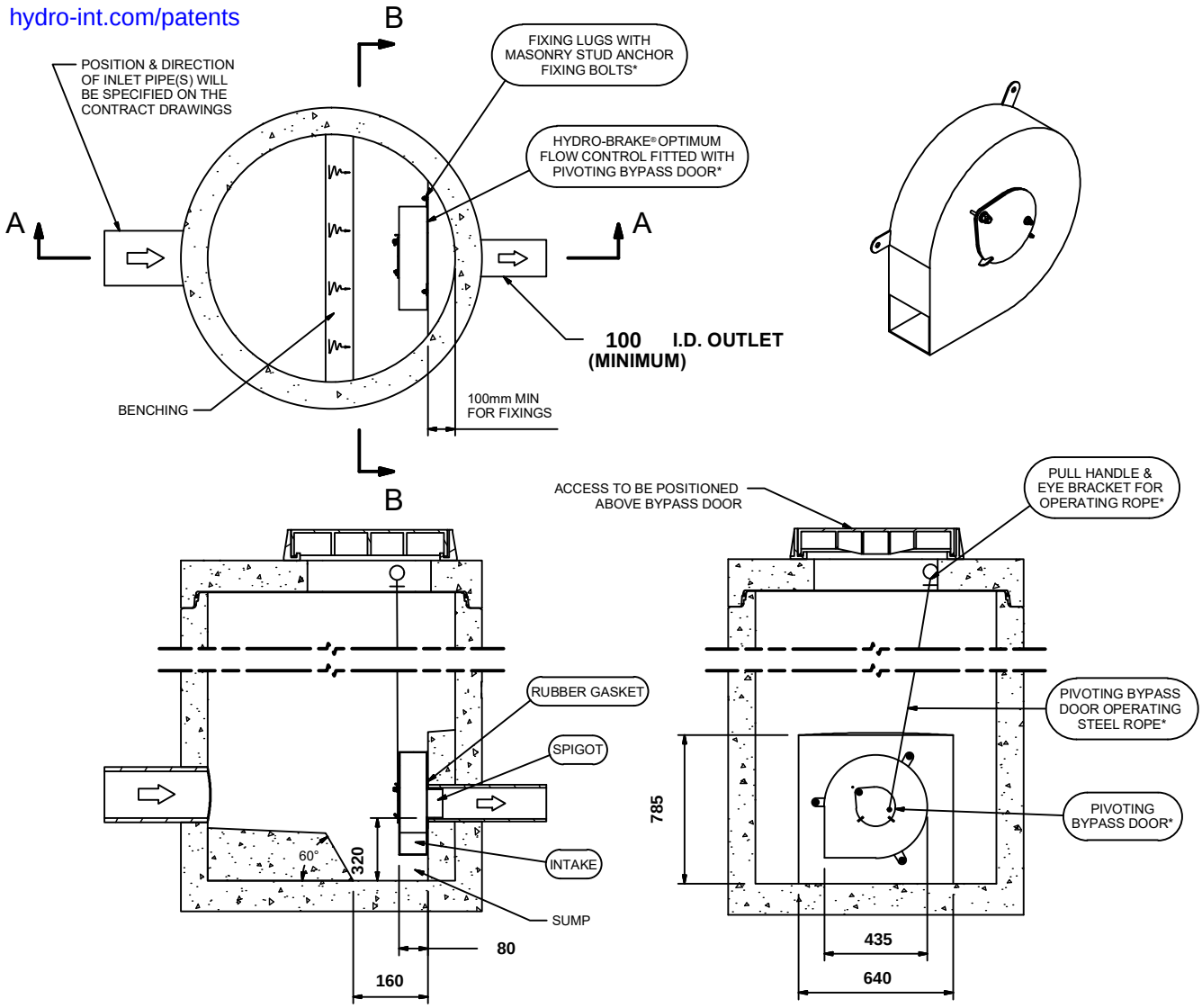
Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet

BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE 08/4596

WRc Approved PT/329/0412

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SECTION A-A

SECTION B-B

IMPORTANT: (oval) LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS
* WHERE SUPPLIED
HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE

The head/flow characteristics of this SHE-0071-2500-1250-2500 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International®

DATE	5/22/2020 6:41 PM
SITE	Welland Hospital, Holbeach Road, Spalding
DESIGNER	Andrew Bowler
REF	P19-062 - S1.26 FC

SHE-0071-2500-1250-2500
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andy.bowler@hwaconsulting.co.uk

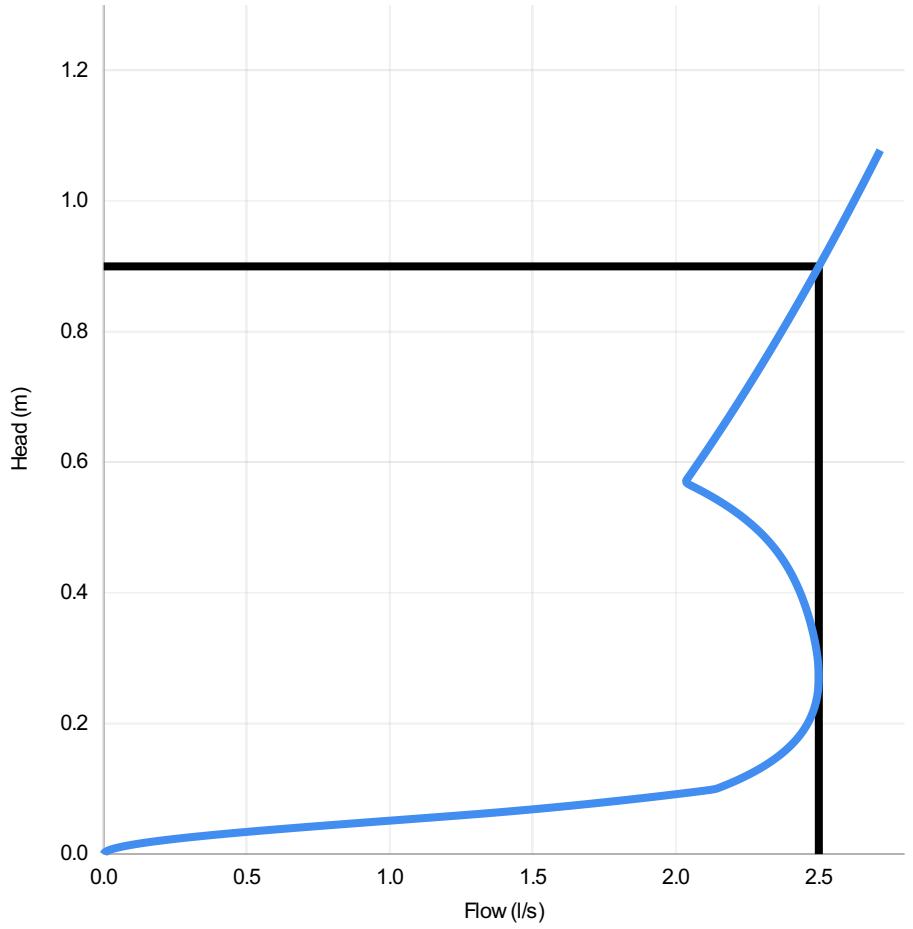
Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	0.900	2.500
Flush-Flo	0.271	2.500
Kick-Flo®	0.568	2.030
Mean Flow		2.189

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CERTIFICATE No 08/4596

WRc APPROVED
PT/329/0412

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Head (m)	Flow (l/s)
0.000	0.000
0.031	0.423
0.062	1.327
0.093	2.026
0.124	2.265
0.155	2.374
0.186	2.441
0.217	2.479
0.248	2.497
0.279	2.499
0.310	2.492
0.341	2.478
0.372	2.458
0.403	2.432
0.434	2.397
0.466	2.350
0.497	2.286
0.528	2.198
0.559	2.079
0.590	2.064
0.621	2.112
0.652	2.159
0.683	2.205
0.714	2.250
0.745	2.294
0.776	2.337
0.807	2.379
0.838	2.420
0.869	2.460
0.900	2.500

DESIGN ADVICE

The head/flow characteristics of this SHE-0077-2500-0900-2500 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

! **The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.**

Hydro International®

DATE	22/05/2020 18:42
Site	Welland Hospital, Holbeach Road, Spalding
DESIGNER	Andrew Bowler
Ref	P19-062 - S3.8 FC

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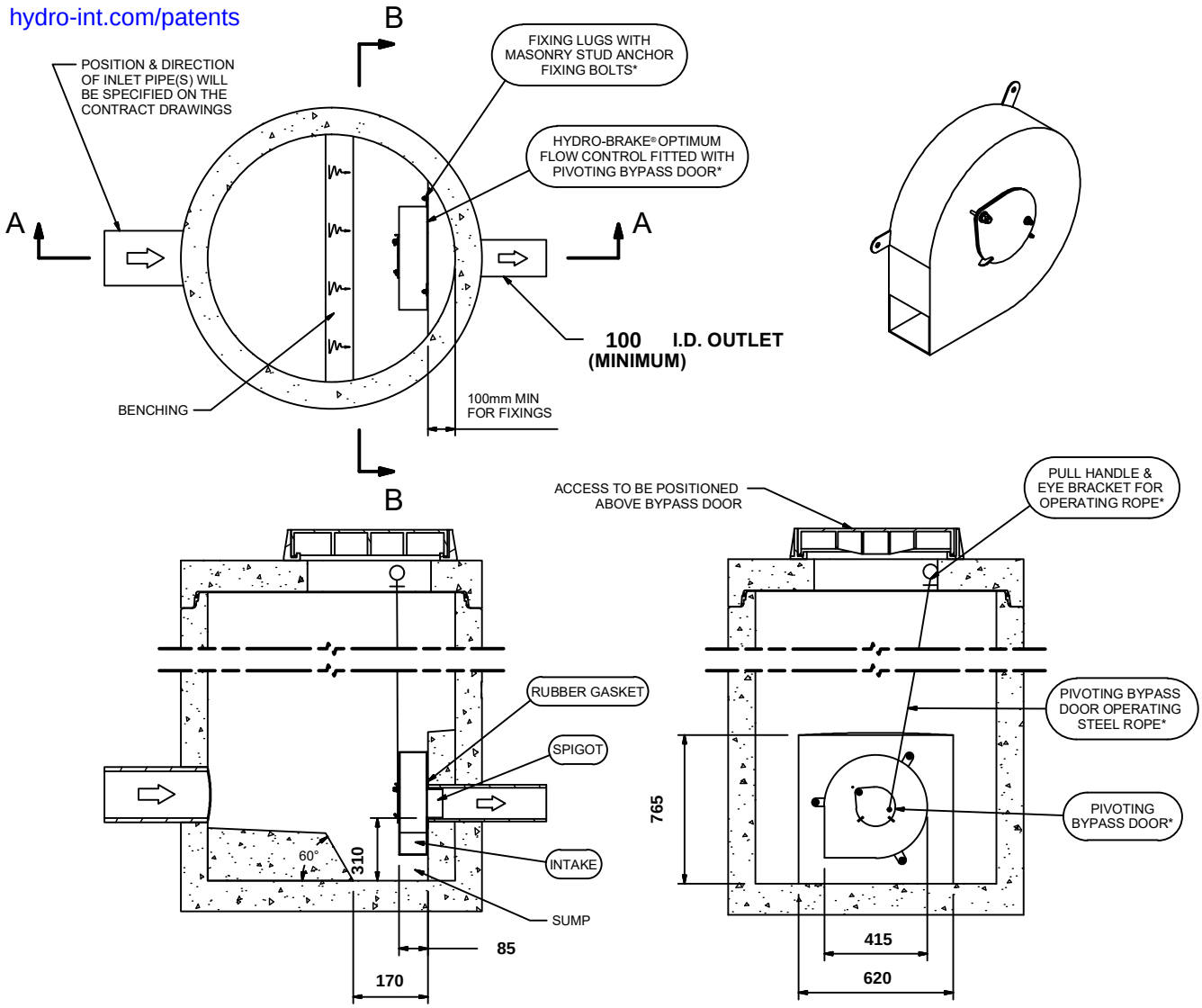
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Hydro International®

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SITE	Welland Hospital, Holbeach Road, Spalding
DESIGNER	Andrew Bowler
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