STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	Add Flow / Climate Change (%)	0
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.000
Ratio R	0.400	Maximum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	550	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.496	4-8	0.277

Total Area Contributing (ha) = 0.773

Total Pipe Volume (m³) = 24.818

Network Design Table for Storm

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
S1.000	18.623	0.125	149.0	0.123	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	28.057	0.190	147.7	0.028	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	30.897	0.210	147.1	0.068	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	14.248	0.325	43.8	0.015	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.004	10.391	0.550	18.9	0.029	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.000	26.891	0.500	53.8	0.057	5.00	0.0	0.600	o	150	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)
S1.000	53.36	5.29	123.625	0.123	0.0	0.0	0.0	1.07	42.5	17.8
S1.001	51.48	5.73	123.500	0.151	0.0	0.0	0.0	1.07	42.7	21.1
S1.002	49.88	6.12	123.235	0.219	0.0	0.0	0.0	1.29	91.5	29.6
S1.003	49.50	6.22	123.025	0.234	0.0	0.0	0.0	2.38	168.3	31.4
S1.004	49.32	6.27	122.700	0.263	0.0	0.0	0.0	3.63	256.9	35.1
S2.000	53.20	5.33	122.900	0.057	0.0	0.0	0.0	1.37	24.3	8.2

Network Design Table for Storm

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
S2.001	10.339	0.100	103.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.005	7.676	0.200	38.4	0.031	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.006	15.076	0.150	100.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.007	12.585	0.500	25.2	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S3.000	10.463	0.500	20.9	0.058	5.00	0.0	0.600	o	150	Pipe/Conduit	
S3.001	8.186	0.750	10.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.008	15.833	0.050	316.7	0.037	0.00	0.0	0.600	o	600	Pipe/Conduit	
S4.000	28.222	0.190	148.5	0.156	5.00	0.0	0.600	o	225	Pipe/Conduit	
S4.001	2.557	0.020	127.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.002	18.011	0.120	150.1	0.033	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.003	2.231	0.015	148.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.004	23.692	0.160	148.1	0.032	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.005	12.273	0.085	144.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.006	12.228	0.310	39.4	0.063	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.007	13.825	1.085	12.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S5.000	10.802	0.185	58.4	0.043	5.00	0.0	0.600	o	150	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)
S2.001	52.43	5.50	122.400	0.057	0.0	0.0	0.0	0.99	17.5	8.2
S1.005	49.13	6.32	122.150	0.351	0.0	0.0	0.0	2.55	179.9	46.7
S1.006	48.54	6.48	121.950	0.351	0.0	0.0	0.0	1.57	110.9	46.7
S1.007	48.38	6.52	121.800	0.351	0.0	0.0	0.0	4.87	1376.2	46.7
S3.000	54.34	5.08	123.000	0.058	0.0	0.0	0.0	2.21	39.1	8.5
S3.001	54.13	5.12	122.500	0.058	0.0	0.0	0.0	3.07	54.2	8.5
S1.008	47.70	6.72	121.300	0.446	0.0	0.0	0.0	1.36	385.4	57.6
S4.000	52.70	5.44	123.625	0.156	0.0	0.0	0.0	1.07	42.6	22.3
S4.001	52.57	5.47	123.360	0.156	0.0	0.0	0.0	1.39	98.2	22.3
S4.002	51.57	5.70	123.340	0.189	0.0	0.0	0.0	1.28	90.6	26.4
S4.003	51.45	5.73	123.220	0.189	0.0	0.0	0.0	1.29	91.0	26.4
S4.004	50.21	6.04	123.205	0.221	0.0	0.0	0.0	1.29	91.2	30.1
S4.005	49.60	6.20	123.045	0.221	0.0	0.0	0.0	1.31	92.3	30.1
S4.006	49.30	6.28	122.960	0.284	0.0	0.0	0.0	2.51	177.5	37.9
S4.007	49.10	6.33	122.650	0.284	0.0	0.0	0.0	4.43	313.0	37.9
S5.000	54.07	5.14	121.900	0.043	0.0	0.0	0.0	1.32	23.3	6.3

Network Design Table for Storm

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
S4.008	3.178	0.015	211.9	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.009	11.234	0.090	124.8	0.000	0.00	0.0	0.600	o	150	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)
S4.008	48.98	6.36	121.265	0.327	0.0	0.0	0.0	1.67	471.9	43.4
S1.009	53.73	5.21	121.250	0.000	3.6	0.0	0.0	0.90	15.9	3.6

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdr (mm)
S1	124.600	0.975	Open Manhole	450	S1.000	123.625	225				
S2	124.600	1.100	Open Manhole	450	S1.001	123.500	225	S1.000	123.500	225	
S3	124.600	1.365	Open Manhole	450	S1.002	123.235	300	S1.001	123.310	225	
S4	124.600	1.575	Open Manhole	900	S1.003	123.025	300	S1.002	123.025	300	
S5	124.000	1.300	Open Manhole	900	S1.004	122.700	300	S1.003	122.700	300	
S6	124.000	1.100	Open Manhole	450	S2.000	122.900	150				
S7	123.500	1.100	Open Manhole	450	S2.001	122.400	150	S2.000	122.400	150	
S8	123.450	1.300	Open Manhole	1200	S1.005	122.150	300	S1.004	122.150	300	
								S2.001	122.300	150	
SHW1	123.000	1.050	Open Manhole	1200	S1.006	121.950	300	S1.005	121.950	300	
SHW2	123.000	1.200	Open Manhole	1500	S1.007	121.800	600	S1.006	121.800	300	
S11	124.100	1.100	Open Manhole	1200	S3.000	123.000	150				
S12	123.600	1.100	Open Manhole	1200	S3.001	122.500	150	S3.000	122.500	150	
S13	123.500	2.200	Open Manhole	1500	S1.008	121.300	600	S1.007	121.300	600	
								S3.001	121.750	150	
S14	124.600	0.975	Open Manhole	450	S4.000	123.625	225				
S15	124.600	1.240	Open Manhole	450	S4.001	123.360	300	S4.000	123.435	225	
S16	124.600	1.260	Open Manhole	450	S4.002	123.340	300	S4.001	123.340	300	
S17	124.600	1.380	Open Manhole	450	S4.003	123.220	300	S4.002	123.220	300	
S18	124.600	1.395	Open Manhole	450	S4.004	123.205	300	S4.003	123.205	300	
S19	124.600	1.555	Open Manhole	450	S4.005	123.045	300	S4.004	123.045	300	
S20	124.300	1.340	Open Manhole	900	S4.006	122.960	300	S4.005	122.960	300	
S21	123.900	1.250	Open Manhole	900	S4.007	122.650	300	S4.006	122.650	300	
S22	123.000	1.100	Open Manhole	450	S5.000	121.900	150				
S23	123.200	1.935	Open Manhole	1500	S4.008	121.265	600	S4.007	121.565	300	
								S5.000	121.715	150	
SFCC1	123.200	1.950	Open Manhole	1800	S1.009	121.250	150	S1.008	121.250	600	
								S4.008	121.250	600	
SAW 3207	122.720	1.560	Open Manhole	300		OUTFALL		S1.009	121.160	150	

PIPELINE SCHEDULES for Storm

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)
S1.000	o	225	S1	124.600	123.625	0.750	Open Manhole	450
S1.001	o	225	S2	124.600	123.500	0.875	Open Manhole	450
S1.002	o	300	S3	124.600	123.235	1.065	Open Manhole	450
S1.003	o	300	S4	124.600	123.025	1.275	Open Manhole	900
S1.004	o	300	S5	124.000	122.700	1.000	Open Manhole	900
S2.000	o	150	S6	124.000	122.900	0.950	Open Manhole	450
S2.001	o	150	S7	123.500	122.400	0.950	Open Manhole	450
S1.005	o	300	S8	123.450	122.150	1.000	Open Manhole	1200
S1.006	o	300	SHW1	123.000	121.950	0.750	Open Manhole	1200
S1.007	o	600	SHW2	123.000	121.800	0.600	Open Manhole	1500
S3.000	o	150	S11	124.100	123.000	0.950	Open Manhole	1200
S3.001	o	150	S12	123.600	122.500	0.950	Open Manhole	1200
S1.008	o	600	S13	123.500	121.300	1.600	Open Manhole	1500
S4.000	o	225	S14	124.600	123.625	0.750	Open Manhole	450
S4.001	o	300	S15	124.600	123.360	0.940	Open Manhole	450
S4.002	o	300	S16	124.600	123.340	0.960	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)
S1.000	18.623	149.0	S2	124.600	123.500	0.875	Open Manhole	450
S1.001	28.057	147.7	S3	124.600	123.310	1.065	Open Manhole	450
S1.002	30.897	147.1	S4	124.600	123.025	1.275	Open Manhole	900
S1.003	14.248	43.8	S5	124.000	122.700	1.000	Open Manhole	900
S1.004	10.391	18.9	S8	123.450	122.150	1.000	Open Manhole	1200
S2.000	26.891	53.8	S7	123.500	122.400	0.950	Open Manhole	450
S2.001	10.339	103.4	S8	123.450	122.300	1.000	Open Manhole	1200
S1.005	7.676	38.4	SHW1	123.000	121.950	0.750	Open Manhole	1200
S1.006	15.076	100.5	SHW2	123.000	121.800	0.900	Open Manhole	1500
S1.007	12.585	25.2	S13	123.500	121.300	1.600	Open Manhole	1500
S3.000	10.463	20.9	S12	123.600	122.500	0.950	Open Manhole	1200
S3.001	8.186	10.9	S13	123.500	121.750	1.600	Open Manhole	1500
S1.008	15.833	316.7	SFCC1	123.200	121.250	1.350	Open Manhole	1800
S4.000	28.222	148.5	S15	124.600	123.435	0.940	Open Manhole	450
S4.001	2.557	127.9	S16	124.600	123.340	0.960	Open Manhole	450
S4.002	18.011	150.1	S17	124.600	123.220	1.080	Open Manhole	450

PIPELINE SCHEDULES for Storm

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)
S4.003	o	300	S17	124.600	123.220	1.080	Open Manhole	450
S4.004	o	300	S18	124.600	123.205	1.095	Open Manhole	450
S4.005	o	300	S19	124.600	123.045	1.255	Open Manhole	450
S4.006	o	300	S20	124.300	122.960	1.040	Open Manhole	900
S4.007	o	300	S21	123.900	122.650	0.950	Open Manhole	900
S5.000	o	150	S22	123.000	121.900	0.950	Open Manhole	450
S4.008	o	600	S23	123.200	121.265	1.335	Open Manhole	1500
S1.009	o	150	SFCC1	123.200	121.250	1.800	Open Manhole	1800

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)
S4.003	2.231	148.7	S18	124.600	123.205	1.095	Open Manhole	450
S4.004	23.692	148.1	S19	124.600	123.045	1.255	Open Manhole	450
S4.005	12.273	144.4	S20	124.300	122.960	1.040	Open Manhole	900
S4.006	12.228	39.4	S21	123.900	122.650	0.950	Open Manhole	900
S4.007	13.825	12.7	S23	123.200	121.565	1.335	Open Manhole	1500
S5.000	10.802	58.4	S23	123.200	121.715	1.335	Open Manhole	1500
S4.008	3.178	211.9	SFCC1	123.200	121.250	1.350	Open Manhole	1800
S1.009	11.234	124.8	SAW 3207	122.720	121.160	1.410	Open Manhole	300

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.009	SAW 3207	122.720	121.160	121.010	300	0