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14 Beecham Court Pemberton Business Park Wigan WN3 6PR		
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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SN1.SWS

Pipe Sizes STANDARD Manhole Sizes UU MH

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	95
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.297	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	250	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	400

Designed with Level Soffits

Network Design Table for SN1.SWS

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	11.663	0.160	72.9	0.017	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	56.273	0.771	73.0	0.132	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	63.818	0.742	86.0	0.181	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	8.564	0.612	14.0	0.124	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.000	45.383	0.478	94.9	0.036	5.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	14.785	0.203	72.8	0.013	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.002	49.542	0.708	70.0	0.096	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.000	30.600	0.306	100.0	0.062	5.00	0.0	0.600	o	150	Pipe/Conduit	
3.001	30.147	0.293	102.9	0.078	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.003	48.250	1.270	38.0	0.092	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	56.71	5.13	61.450	0.017	0.0	0.0	0.0	1.53	61.0	2.6
1.001	54.25	5.74	61.290	0.149	0.0	0.0	0.0	1.53	60.9	21.9
1.002	51.99	6.37	60.446	0.331	0.0	0.0	0.0	1.70	119.9	46.6
1.003	51.89	6.40	57.818	0.454	0.0	0.0	0.0	4.87	537.4	63.8
2.000	54.93	5.56	60.431	0.036	0.0	0.0	0.0	1.34	53.4	5.4
2.001	54.31	5.72	59.952	0.049	0.0	0.0	0.0	1.53	61.0	7.3
2.002	52.70	6.16	59.576	0.145	0.0	0.0	0.0	1.88	133.0	20.7
3.000	55.15	5.51	59.629	0.062	0.0	0.0	0.0	1.00	17.8	9.2
3.001	53.90	5.83	59.166	0.140	0.0	0.0	0.0	1.55	109.6	20.4
2.003	51.85	6.41	58.722	0.377	0.0	0.0	0.0	3.31	525.9	53.0

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Network Design Table for SN1.SWS

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	38.002	0.190	200.0	0.097	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.005	15.944	0.074	215.5	0.071	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.006	23.768	1.033	23.0	0.089	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.000	55.441	0.560	99.0	0.103	5.00	0.0	0.600	o	375	Pipe/Conduit	
4.001	21.787	0.185	117.8	0.087	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.007	23.583	0.212	111.2	0.026	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.008	19.330	0.254	76.1	0.041	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.009	7.609	0.100	76.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.000	43.149	1.488	29.0	0.139	5.00	0.0	0.600	o	300	Pipe/Conduit	
5.001	27.581	1.379	20.0	0.110	0.00	0.0	0.600	o	375	Pipe/Conduit	
5.002	21.345	0.135	158.1	0.060	0.00	0.0	0.600	o	375	Pipe/Conduit	
5.003	10.949	0.083	132.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
5.004	25.509	0.166	154.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
5.005	17.116	0.098	174.7	0.034	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.010	20.331	0.143	142.2	0.192	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.011	27.395	0.783	35.0	0.087	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.012	6.489	0.016	405.6	0.051	0.00	0.0	0.600	o	600	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	50.40	6.85	57.131	0.928	0.0	0.0	0.0	1.43	228.1	126.7
1.005	49.80	7.04	56.941	0.999	0.0	0.0	0.0	1.38	219.7	134.8
1.006	49.52	7.13	56.867	1.089	0.0	0.0	0.0	4.25	676.3	146.0
4.000	55.15	5.51	56.645	0.103	0.0	0.0	0.0	1.82	201.1	15.3
4.001	54.31	5.73	56.085	0.190	0.0	0.0	0.0	1.67	184.3	27.9
1.007	48.91	7.34	55.825	1.304	0.0	0.0	0.0	1.93	306.5	172.8
1.008	48.51	7.48	55.610	1.345	0.0	0.0	0.0	2.33	371.0	176.7
1.009	48.35	7.53	55.356	1.345	0.0	0.0	0.0	2.33	371.2	176.7
5.000	56.21	5.25	57.950	0.139	0.0	0.0	0.0	2.93	207.2	21.1
5.001	55.75	5.36	56.395	0.249	0.0	0.0	0.0	4.07	449.2	37.6
5.002	54.77	5.61	55.016	0.309	0.0	0.0	0.0	1.44	158.9	45.8
5.003	54.32	5.72	54.881	0.309	0.0	0.0	0.0	1.58	174.0	45.8
5.004	53.23	6.01	54.798	0.309	0.0	0.0	0.0	1.46	161.0	45.8
5.005	52.49	6.22	54.632	0.343	0.0	0.0	0.0	1.37	151.1	48.8
1.010	47.88	7.70	54.335	1.880	0.0	0.0	0.0	2.04	576.9	243.8
1.011	47.57	7.81	54.192	1.967	0.0	0.0	0.0	4.13	1166.7	253.5
1.012	47.33	7.90	53.409	2.019	0.0	0.0	0.0	1.20	340.1	258.8

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Network Design Table for SN1.SWS

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
1.013	20.312	0.043	472.4	0.133	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.014	52.340	0.131	399.5	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.015	6.415	0.050	128.3	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.016	5.520	0.094	58.7	0.000	0.00	0.0	0.600	o	300	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)
1.013	46.52	8.20	53.393	2.152	0.0	0.0	0.0	1.11	314.9	271.1
1.014	44.73	8.92	53.350	2.152	0.0	0.0	0.0	1.21	342.7	271.1
1.015	57.04	5.05	53.219	0.000	38.4	0.0	0.0	2.15	607.5	38.4
1.016	56.85	5.09	53.169	0.000	38.4	0.0	0.0	2.06	145.3	38.4

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100 year Return Period Summary of Critical Results by Maximum Level (Rank
1) for SN1.SWS

PN	US/MH Name	Surcharged Flooded		Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)				
1.000	1	0.324	0.000	0.27	14.0	SURCHARGED	
1.001	2	0.474	0.000	1.05	61.6	SURCHARGED	
1.002	3	0.381	0.000	1.23	140.9	SURCHARGED	
1.003	4	1.126	0.000	0.59	180.6	SURCHARGED	
2.000	5	-0.133	0.000	0.34	17.4	OK	
2.001	6	-0.118	0.000	0.45	23.8	OK	
2.002	7	-0.133	0.000	0.58	72.6	OK	
3.000	8	0.395	0.000	1.51	25.7	SURCHARGED	
3.001	9	-0.124	0.000	0.63	62.3	OK	
2.003	10	0.026	0.000	0.38	182.1	SURCHARGED	
1.004	11	1.534	0.000	1.73	348.4	SURCHARGED	
1.005	12	1.219	0.000	2.14	361.5	SURCHARGED	
1.006	13	0.906	0.000	0.68	381.4	SURCHARGED	
4.000	14	0.805	0.000	0.22	41.6	FLOOD RISK	
4.001	15	1.337	0.000	0.53	83.3	SURCHARGED	
1.007	16	1.489	0.000	1.70	433.8	SURCHARGED	
1.008	17	1.094	0.000	1.55	439.1	SURCHARGED	
1.009	18	0.744	0.000	2.47	440.8	SURCHARGED	
5.000	19	-0.176	0.000	0.35	68.3	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank
1) for SN1.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.001	20	15 Winter	100	+30%					56.541
5.002	21	15 Winter	100	+30%	100/15 Summer				56.255
5.003	22	15 Winter	100	+30%	100/15 Summer				56.176
5.004	23	15 Winter	100	+30%	100/15 Summer				56.125
5.005	24	15 Winter	100	+30%	100/15 Summer				56.036
1.010	25	15 Winter	100	+30%	100/15 Summer				55.955
1.011	26	15 Winter	100	+30%	100/15 Summer				55.598
1.012	27	480 Winter	100	+30%	100/15 Summer				55.534
1.013	28	480 Winter	100	+30%	100/15 Summer				55.532
1.014	29	480 Winter	100	+30%	100/15 Summer				55.528
1.015	30	480 Winter	100	+30%	100/15 Summer				55.522
1.016	31	480 Winter	100	+30%	100/15 Summer				55.574

		Surcharged		Flooded		Pipe			
PN	US/MH Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Level Exceeded	
5.001	20	-0.229	0.000	0.32		125.7	OK		
5.002	21	0.864	0.000	0.99		132.8	SURCHARGED		
5.003	22	0.920	0.000	1.08		121.9	SURCHARGED		
5.004	23	0.952	0.000	0.79		110.3	SURCHARGED		
5.005	24	1.029	0.000	0.92		112.2	SURCHARGED		
1.010	25	1.020	0.000	1.57		594.5	SURCHARGED		
1.011	26	0.806	0.000	0.69		614.4	SURCHARGED		
1.012	27	1.525	0.000	0.67		134.7	SURCHARGED		
1.013	28	1.539	0.000	0.64		142.5	SURCHARGED		
1.014	29	1.578	0.000	0.47		141.5	SURCHARGED		
1.015	30	1.703	0.000	0.18		60.9	SURCHARGED		
1.016	31	2.105	0.000	0.29		22.3	SURCHARGED		

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200 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SN1.SWS

Simulation Criteria

Areal Reduction Factor 1.000

Additional Flow - % of Total Flow 0.000

Hot Start (mins) 0

MADD Factor * 10m³/ha Storage 2.000

Hot Start Level (mm) 0

Inlet Coefficient 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 Storage Structures 1

Number of Online Controls 1

Number of Time/Area Diagrams 0

Number of Offline Controls 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model

FSR

Ratio R 0.300

Region England and Wales Cv (Summer) 0.750

M5-60 (mm)

19.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm)

300.0

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status

ON

DVD Status

OFF

Inertia Status

OFF

Profile(s)

Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440

Return Period(s) (years)

100, 200

Climate Change (%)

30, 0

									Water
PN	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level
	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	(m)
1.000	1 15	Winter	200	+0%	100/15	Summer			61.742
1.001	2 15	Winter	200	+0%	100/15	Summer			61.732
1.002	3 15	Winter	200	+0%	100/15	Summer			60.986
1.003	4 15	Winter	200	+0%	100/15	Summer			58.896
2.000	5 15	Winter	200	+0%					60.517
2.001	6 15	Winter	200	+0%					60.052
2.002	7 15	Winter	200	+0%					59.732
3.000	8 15	Winter	200	+0%	100/15	Summer			60.056
3.001	9 15	Winter	200	+0%					59.331
2.003	10 15	Winter	200	+0%	100/15	Winter			58.906
1.004	11 15	Winter	200	+0%	100/15	Summer			58.717
1.005	12 15	Winter	200	+0%	100/15	Summer			58.248
1.006	13 15	Winter	200	+0%	100/15	Summer			57.879
4.000	14 15	Winter	200	+0%	100/15	Summer			57.501
4.001	15 15	Winter	200	+0%	100/15	Summer			57.473
1.007	16 15	Winter	200	+0%	100/15	Summer			57.440
1.008	17 15	Winter	200	+0%	100/15	Summer			56.854
1.009	18 15	Winter	200	+0%	100/15	Summer			56.271
5.000	19 15	Winter	200	+0%					58.066

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200 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SN1.SWS

PN	US/MH Name	Surcharged Flooded		Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)				
1.000	1	0.067	0.000	0.19	10.1	SURCHARGED	
1.001	2	0.217	0.000	0.99	57.9	SURCHARGED	
1.002	3	0.240	0.000	1.15	131.3	SURCHARGED	
1.003	4	0.703	0.000	0.55	169.7	SURCHARGED	
2.000	5	-0.139	0.000	0.30	15.5	OK	
2.001	6	-0.125	0.000	0.40	21.2	OK	
2.002	7	-0.144	0.000	0.52	65.1	OK	
3.000	8	0.277	0.000	1.38	23.5	SURCHARGED	
3.001	9	-0.135	0.000	0.57	56.3	OK	
2.003	10	-0.266	0.000	0.34	163.9	OK	
1.004	11	1.136	0.000	1.66	334.2	SURCHARGED	
1.005	12	0.857	0.000	2.07	350.2	SURCHARGED	
1.006	13	0.562	0.000	0.65	366.5	SURCHARGED	
4.000	14	0.481	0.000	0.20	38.2	SURCHARGED	
4.001	15	1.013	0.000	0.52	81.8	SURCHARGED	
1.007	16	1.165	0.000	1.65	419.2	SURCHARGED	
1.008	17	0.794	0.000	1.51	428.8	SURCHARGED	
1.009	18	0.465	0.000	2.40	428.7	SURCHARGED	
5.000	19	-0.184	0.000	0.31	60.9	OK	

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200 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SN1.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.001	20	15 Winter	200	+0%					56.532
5.002	21	15 Winter	200	+0%	100/15 Summer				55.905
5.003	22	15 Winter	200	+0%	100/15 Summer				55.845
5.004	23	15 Winter	200	+0%	100/15 Summer				55.809
5.005	24	15 Winter	200	+0%	100/15 Summer				55.745
1.010	25	15 Winter	200	+0%	100/15 Summer				55.691
1.011	26	15 Winter	200	+0%	100/15 Summer				55.379
1.012	27	360 Winter	200	+0%	100/15 Summer				55.222
1.013	28	360 Winter	200	+0%	100/15 Summer				55.220
1.014	29	360 Winter	200	+0%	100/15 Summer				55.215
1.015	30	360 Winter	200	+0%	100/15 Summer				55.210
1.016	31	360 Winter	200	+0%	100/15 Summer				55.263

		Surcharged		Flooded		Pipe		Level	
PN	US/MH Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Exceeded	
5.001	20	-0.238	0.000	0.29		112.0	OK		
5.002	21	0.514	0.000	0.95		128.1	SURCHARGED		
5.003	22	0.589	0.000	1.03		115.6	SURCHARGED		
5.004	23	0.635	0.000	0.75		104.1	SURCHARGED		
5.005	24	0.737	0.000	0.87		106.2	SURCHARGED		
1.010	25	0.756	0.000	1.49		562.9	SURCHARGED		
1.011	26	0.587	0.000	0.65		579.1	SURCHARGED		
1.012	27	1.213	0.000	0.75		149.7	SURCHARGED		
1.013	28	1.227	0.000	0.72		158.1	SURCHARGED		
1.014	29	1.265	0.000	0.52		157.0	SURCHARGED		
1.015	30	1.391	0.000	0.19		61.3	SURCHARGED		
1.016	31	1.794	0.000	0.29		22.3	SURCHARGED		