STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 2

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2	Maximum Time of Concentration (mins)	30	Maximum Backdrop Height (m)	1.500
		Foul Sewage (l/s/ha)	0.000	Min Design Depth for Optimisation (m)	1.200
FEH Rainfall Version	2013	Volumetric Runoff Coeff.	0.750	Min Vel for Auto Design only (m/s)	1.00
Site Location	GB 490175 99535 SZ 90175 99535	PIMP (%)	100	Min Slope for Optimisation (1:X)	500
Data Type	Point	Add Flow / Climate Change (%)	0		
Maximum Rainfall (mm/hr)	50	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Time Area Diagram for Surface Network 2 at outfall SWMH17.10 (pipe 1.010)

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.262	4-8	0.345	8-12	0.012

Total Area Contributing (ha) = 0.620

Total Pipe Volume (m³) = 64.439

Time Area Diagram at outfall SWMH17.10 (pipe 6.008)

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.246	4-8	0.141

Total Area Contributing (ha) = 0.388

Total Pipe Volume (m³) = 18.009

Network Design Table for Surface Network 2

« - 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

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)

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Network Design Table for Surface Network 2

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	56.721	0.110	515.6	0.216	5.00	0.0	0.600	o	600	Pipe/Conduit	
1.001	17.615	0.040	440.4	0.016	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.002	22.812	0.050	456.2	0.032	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.003	30.540	0.060	509.0	0.024	0.00	0.0	0.600	o	600	Pipe/Conduit	
2.000	6.105	0.020	305.3	0.236	5.00	0.0	0.600	o	600	Pipe/Conduit	
1.004	18.275	0.035	522.1	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
3.000	16.402	0.045	364.5	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	13.824	0.025	553.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
4.000	18.025	0.045	400.6	0.028	5.00	0.0	0.600	o	600	Pipe/Conduit	
1.005	12.836	0.025	513.4	0.000	0.00	0.0	0.600	ooo	225	Triple Pipe	
1.006	16.750	0.030	558.3	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.000	12.197	0.080	152.5	0.010	5.00	0.0	0.600	o	225	Pipe/Conduit	
5.001	8.820	0.055	160.4	0.033	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.007	4.996	0.010	499.6	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.008	6.850	0.005	1370.0	0.000	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)
1.000	50.00	5.89	4.550	0.216	0.0	0.0	0.0	1.07	301.3	29.3
1.001	50.00	6.14	4.440	0.233	0.0	0.0	0.0	1.15	326.3	31.5
1.002	50.00	6.48	4.400	0.265	0.0	0.0	0.0	1.13	320.5	35.8
1.003	50.00	6.95	4.350	0.289	0.0	0.0	0.0	1.07	303.2	39.1
2.000	50.00	5.07	4.310	0.236	0.0	0.0	0.0	1.39	392.6	31.9
1.004	50.00	7.24	4.290	0.525	0.0	0.0	0.0	1.06	299.4	71.0
3.000	50.00	5.40	4.325	0.000	0.0	0.0	0.0	0.68	27.0	0.0
3.001	50.00	5.63	4.280	0.000	0.0	0.0	0.0	1.03	290.8	0.0
4.000	50.00	5.25	4.300	0.028	0.0	0.0	0.0	1.21	342.3	3.8
1.005	50.00	7.61	4.255	0.553	0.0	0.0	0.0	0.57	68.0«	74.8
1.006	50.00	7.89	4.230	0.553	0.0	0.0	0.0	1.02	289.4	74.8
5.000	50.00	5.19	4.710	0.010	0.0	0.0	0.0	1.06	42.0	1.4
5.001	50.00	5.34	4.630	0.043	0.0	0.0	0.0	1.03	40.9	5.8
1.007	50.00	7.96	4.200	0.596	0.0	0.0	0.0	1.08	306.1	80.7
1.008	50.00	8.14	4.190	0.596	0.0	0.0	0.0	0.65	183.5	80.7

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Network Design Table for Surface Network 2

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
1.009	4.433	0.015	295.5	0.024	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.010	4.508	0.035	128.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
6.000	13.171	0.065	202.6	0.031	5.00	0.0	0.600	o	300	Pipe/Conduit	
6.001	23.685	0.100	236.8	0.041	0.00	0.0	0.600	o	300	Pipe/Conduit	
6.002	63.535	0.210	302.5	0.149	0.00	0.0	0.600	o	375	Pipe/Conduit	
6.003	14.949	0.055	271.8	0.051	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.004	9.363	0.025	374.5	0.071	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.005	7.401	0.020	370.1	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.006	13.950	0.035	398.6	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.007	6.567	0.020	328.4	0.045	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.008	4.521	0.035	129.2	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)
1.009	50.00	8.19	4.185	0.620	0.0	0.0	0.0	1.41	399.0	83.9
1.010	50.00	8.28	4.170	0.620	0.0	0.0	0.0	0.88	15.6«	83.9
6.000	50.00	5.20	4.850	0.031	0.0	0.0	0.0	1.10	77.8	4.2
6.001	50.00	5.59	4.785	0.072	0.0	0.0	0.0	1.02	71.9	9.7
6.002	50.00	6.61	4.610	0.221	0.0	0.0	0.0	1.04	114.5	29.9
6.003	50.00	6.81	4.325	0.272	0.0	0.0	0.0	1.23	195.4	36.8
6.004	50.00	6.96	4.270	0.343	0.0	0.0	0.0	1.04	166.1	46.4
6.005	50.00	7.08	4.245	0.343	0.0	0.0	0.0	1.05	167.1	46.4
6.006	50.00	7.31	4.225	0.343	0.0	0.0	0.0	1.01	161.0	46.4
6.007	50.00	7.41	4.190	0.388	0.0	0.0	0.0	1.12	177.6	52.5
6.008	50.00	7.49	4.170	0.388	0.0	0.0	0.0	0.88	15.6«	52.5

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Manhole Schedules for Surface Network 2

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)
SWMH17.1	6.852	2.302	Open Manhole	1500	1.000	4.550	600				
SWMH17.2	6.275	1.835	Open Manhole	1500	1.001	4.440	600	1.000	4.440	600	
SWMH17.3	6.098	1.698	Open Manhole	1500	1.002	4.400	600	1.001	4.400	600	
SWMH17.4	5.978	1.628	Open Manhole	1500	1.003	4.350	600	1.002	4.350	600	
SWMH18.1	6.206	1.896	Open Manhole	1500	2.000	4.310	600				
SWMH17.5	6.310	2.020	Open Manhole	1800	1.004	4.290	600	1.003	4.290	600	
								2.000	4.290	600	
SWCP19.1	5.539	1.214	Open Manhole	1800	3.000	4.325	225				
SWCP19.2	5.892	1.612	Open Manhole	1800	3.001	4.280	600	3.000	4.280	225	
Headwall 12	5.750	1.450	Junction		4.000	4.300	600				
SWCP17.6	6.534	2.279	Open Manhole	1800	1.005	4.255	225	1.004	4.255	600	
								3.001	4.255	600	
								4.000	4.255	600	
SWMH17.7	6.444	2.214	Open Manhole	1800	1.006	4.230	600	1.005	4.230	225	
HWMH20.1	6.428	1.718	Open Manhole	1350	5.000	4.710	225				
HWMH20.2	6.314	1.684	Open Manhole	1350	5.001	4.630	225	5.000	4.630	225	
SWCP17.8	5.428	1.228	Open Manhole	1800	1.007	4.200	600	1.006	4.200	600	
								5.001	4.575	225	
Headwall 13	5.350	1.160	Junction		1.008	4.190	600	1.007	4.190	600	
Headwall 14	5.350	1.165	Junction		1.009	4.185	600	1.008	4.185	600	
SWMH17.9	5.800	1.630	Open Manhole	2100	1.010	4.170	150	1.009	4.170	600	
SWMH17.10	5.750	1.615	Open Manhole	1500		OUTFALL		1.010	4.135	150	
SWMH21.1	6.546	1.696	Open Manhole	1350	6.000	4.850	300				
SWMH21.2	6.677	1.892	Open Manhole	1200	6.001	4.785	300	6.000	4.785	300	
SWMH21.3	6.386	1.776	Open Manhole	1350	6.002	4.610	375	6.001	4.685	300	
SWMH21.4	6.218	1.893	Open Manhole	1350	6.003	4.325	450	6.002	4.400	375	
SWMH21.5	6.391	2.121	Open Manhole	1350	6.004	4.270	450	6.003	4.270	450	
SWCP21.6	5.885	1.640	Open Manhole	1800	6.005	4.245	450	6.004	4.245	450	
Headwall 15	5.600	1.375	Junction		6.006	4.225	450	6.005	4.225	450	
Headwall 16	5.600	1.410	Junction		6.007	4.190	450	6.006	4.190	450	
SWMH21.7	5.690	1.520	Open Manhole	1500	6.008	4.170	150	6.007	4.170	450	
SWMH17.10	5.750	1.615	Open Manhole	1500		OUTFALL		6.008	4.135	150	

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Manhole Schedules for Surface Network 2

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SWMH17.1	490019.677	99664.408	490019.677	99664.408	Required	
SWMH17.2	489975.968	99628.259	489975.968	99628.259	Required	
SWMH17.3	489962.258	99617.198	489962.258	99617.198	Required	
SWMH17.4	489941.722	99607.268	489941.722	99607.268	Required	
SWMH18.1	489915.433	99608.153	489915.433	99608.153	Required	
SWMH17.5	489911.408	99603.563	489911.408	99603.563	Required	
SWCP19.1	489922.165	99593.393	489922.165	99593.393	Required	
SWCP19.2	489905.892	99591.344	489905.892	99591.344	Required	
Headwall 12	489892.711	99616.242			No Entry	
SWCP17.6	489893.920	99598.257	489893.920	99598.257	Required	
SWMH17.7	489883.153	99591.268	489883.153	99591.268	Required	
HWMH20.1	489870.211	99563.764	489870.211	99563.764	Required	
HWMH20.2	489873.838	99575.409	489873.838	99575.409	Required	
SWCP17.8	489882.614	99574.526	489882.614	99574.526	Required	
Headwall 13	489883.514	99569.612			No Entry	
Headwall 14	489884.085	99562.785			No Entry	

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Manhole Schedules for Surface Network 2

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SWMH17.9	489884.141	99558.353	489884.141	99558.353	Required	
SWMH17.10	489883.663	99553.869			No Entry	
SWMH21.1	489826.700	99422.830	489826.700	99422.830	Required	
SWMH21.2	489833.509	99434.105	489833.509	99434.105	Required	
SWMH21.3	489840.064	99456.865	489840.064	99456.865	Required	
SWMH21.4	489851.097	99519.435	489851.097	99519.435	Required	
SWMH21.5	489855.481	99533.726	489855.481	99533.726	Required	
SWCP21.6	489864.327	99536.798	489864.327	99536.798	Required	
Headwall 15	489871.530	99538.499			No Entry	
Headwall 16	489884.787	99542.842			No Entry	
SWMH21.7	489884.252	99549.387	489884.252	99549.387	Required	
SWMH17.10	489883.663	99553.869			No Entry	

Surcharged Outfall Details for Surface Network 2

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.010	SWMH17.10	5.750	4.135	0.000	1500	0

Datum (m) 4.135 Offset (mins) 0

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Surcharged Outfall Details for Surface Network 2

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
60	0.150	420	0.150	780	0.150	1140	0.150	1500	0.150	1860	0.150	2220	0.150	2580	0.150	2940	0.150	3300	0.150	3660	0.150	4020	0.150	4380	0.150	4740	0.150
120	0.150	480	0.150	840	0.150	1200	0.150	1560	0.150	1920	0.150	2280	0.150	2640	0.150	3000	0.150	3360	0.150	3720	0.150	4080	0.150	4440	0.150	4800	0.150
180	0.150	540	0.150	900	0.150	1260	0.150	1620	0.150	1980	0.150	2340	0.150	2700	0.150	3060	0.150	3420	0.150	3780	0.150	4140	0.150	4500	0.150	4860	0.150
240	0.150	600	0.150	960	0.150	1320	0.150	1680	0.150	2040	0.150	2400	0.150	2760	0.150	3120	0.150	3480	0.150	3840	0.150	4200	0.150	4560	0.150	4920	0.150
300	0.150	660	0.150	1020	0.150	1380	0.150	1740	0.150	2100	0.150	2460	0.150	2820	0.150	3180	0.150	3540	0.150	3900	0.150	4260	0.150	4620	0.150	4980	0.150
360	0.150	720	0.150	1080	0.150	1440	0.150	1800	0.150	2160	0.150	2520	0.150	2880	0.150	3240	0.150	3600	0.150	3960	0.150	4320	0.150	4680	0.150	5040	0.150

Surcharged Outfall Details for Surface Network 2

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
6.008	SWMH17.10	5.750	4.135	0.000	1500	0

Datum (m) 4.135 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
60	0.150	420	0.150	780	0.150	1140	0.150	1500	0.150	1860	0.150	2220	0.150	2580	0.150	2940	0.150	3300	0.150	3660	0.150	4020	0.150	4380	0.150	4740	0.150
120	0.150	480	0.150	840	0.150	1200	0.150	1560	0.150	1920	0.150	2280	0.150	2640	0.150	3000	0.150	3360	0.150	3720	0.150	4080	0.150	4440	0.150	4800	0.150
180	0.150	540	0.150	900	0.150	1260	0.150	1620	0.150	1980	0.150	2340	0.150	2700	0.150	3060	0.150	3420	0.150	3780	0.150	4140	0.150	4500	0.150	4860	0.150
240	0.150	600	0.150	960	0.150	1320	0.150	1680	0.150	2040	0.150	2400	0.150	2760	0.150	3120	0.150	3480	0.150	3840	0.150	4200	0.150	4560	0.150	4920	0.150
300	0.150	660	0.150	1020	0.150	1380	0.150	1740	0.150	2100	0.150	2460	0.150	2820	0.150	3180	0.150	3540	0.150	3900	0.150	4260	0.150	4620	0.150	4980	0.150
360	0.150	720	0.150	1080	0.150	1440	0.150	1800	0.150	2160	0.150	2520	0.150	2880	0.150	3240	0.150	3600	0.150	3960	0.150	4320	0.150	4680	0.150	5040	0.150

Simulation Criteria for Surface Network 2

Volumetric Runoff Coeff 0.750 Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000
Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000 Run Time (mins) 60
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800 Output Interval (mins) 1

Number of Input Hydrographs 0 Number of Online Controls 2 Number of Offline Controls 0 Number of Storage Structures 4 Number of Time/Area Diagrams 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Site Location GB 490175 99535 SZ 90175 99535 Winter Storms Yes Storm Duration (mins) 30
Return Period (years) 2 Data Type Point Cv (Summer) 0.750
FEH Rainfall Version 2013 Summer Storms Yes Cv (Winter) 0.840

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Online Controls for Surface Network 2

Hydro-Brake® Optimum Manhole: SWMH17.9, DS/PN: 1.010, Volume (m³): 6.6

Unit Reference	MD-SHE-0087-4100-1580-4100	Objective	Minimise upstream storage	Invert Level (m)	4.170
Design Head (m)	1.580	Application	Surface	Minimum Outlet Pipe Diameter (mm)	100
Design Flow (l/s)	4.1	Sump Available	Yes	Suggested Manhole Diameter (mm)	1200
Flush-Flo™	Calculated	Diameter (mm)	87		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.580	4.1	Flush-Flo™	0.383	3.7	Kick-Flo®	0.780	3.0	Mean Flow over Head Range	-	3.4

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)	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	2.7	0.400	3.7	0.800	3.0	1.400	3.9	2.000	4.6	2.600	5.2	4.000	6.3	5.500	7.3	7.000	8.2	8.500	9.0
0.200	3.4	0.500	3.6	1.000	3.3	1.600	4.1	2.200	4.8	3.000	5.5	4.500	6.7	6.000	7.7	7.500	8.5	9.000	9.3
0.300	3.6	0.600	3.5	1.200	3.6	1.800	4.4	2.400	5.0	3.500	5.9	5.000	7.0	6.500	8.0	8.000	8.8	9.500	9.5

Hydro-Brake® Optimum Manhole: SWMH21.7, DS/PN: 6.008, Volume (m³): 3.6

Unit Reference	MD-SHE-0053-1500-1450-1500	Objective	Minimise upstream storage	Invert Level (m)	4.170
Design Head (m)	1.450	Application	Surface	Minimum Outlet Pipe Diameter (mm)	75
Design Flow (l/s)	1.5	Sump Available	Yes	Suggested Manhole Diameter (mm)	1200
Flush-Flo™	Calculated	Diameter (mm)	53		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.450	1.5	Flush-Flo™	0.233	1.1	Kick-Flo®	0.472	0.9	Mean Flow over Head Range	-	1.1

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)	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	1.0	0.400	1.0	0.800	1.1	1.400	1.5	2.000	1.7	2.600	2.0	4.000	2.4	5.500	2.8	7.000	3.1	8.500	3.4
0.200	1.1	0.500	0.9	1.000	1.3	1.600	1.6	2.200	1.8	3.000	2.1	4.500	2.5	6.000	2.9	7.500	3.2	9.000	3.5
0.300	1.1	0.600	1.0	1.200	1.4	1.800	1.7	2.400	1.9	3.500	2.2	5.000	2.6	6.500	3.0	8.000	3.3	9.500	3.6

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Storage Structures for Surface Network 2

Cellular Storage Manhole: SWCP19.2, DS/PN: 3.001

Invert Level (m) 4.300 Infiltration Coefficient Side (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	144.0	144.0	0.800	144.0	183.0	0.801	0.0	183.0

Tank or Pond Manhole: Headwall 12, DS/PN: 4.000

Invert Level (m) 4.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	59.6	0.201	82.8	0.401	108.3	0.601	136.0	0.801	166.0	1.001	198.3	1.201	232.8	1.401	269.6
0.101	70.9	0.301	95.2	0.501	121.9	0.701	150.7	0.901	181.9	1.101	215.3	1.301	250.9	1.450	279.0

Tank or Pond Manhole: Headwall 14, DS/PN: 1.009

Invert Level (m) 4.185

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	69.0	0.201	92.2	0.401	117.8	0.601	145.5	0.801	175.6	1.001	207.9	1.165	236.0
0.101	80.3	0.301	104.7	0.501	131.4	0.701	160.3	0.901	191.4	1.101	224.8		

Tank or Pond Manhole: Headwall 16, DS/PN: 6.007

Invert Level (m) 4.190

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	166.2	0.201	199.1	0.401	234.3	0.601	271.8	0.801	311.5	1.001	353.5	1.201	397.7	1.401	444.2
0.101	182.4	0.301	216.4	0.501	252.8	0.701	291.3	0.901	332.2	1.101	375.3	1.301	420.7	1.410	446.4

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10 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

Simulation Criteria

Areal Reduction Factor 1.000 Hot Start Level (mm) 0 Foul Sewage per hectare (l/s) 0.000 MADD Factor * 10m³/ha Storage 2.000 Flow per Person per Day (l/per/day) 0.000
Hot Start (mins) 0 Manhole Headloss Coeff (Global) 0.500 Additional Flow - % of Total Flow 0.000 Inlet Coeffiecient 0.800

Number of Input Hydrographs 0 Number of Online Controls 2 Number of Offline Controls 0 Number of Storage Structures 4 Number of Time/Area Diagrams 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Site Location GB 490175 99535 SZ 90175 99535 Cv (Summer) 1.000
FEH Rainfall Version 2013 Data Type Point Cv (Winter) 1.000

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 10, 30, 100
Climate Change (%) 0, 0, 40

WARNING: Half Drain Time has not been calculated as the structure is too full.

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)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH17.1	15 Summer	10	+0%	100/15 Winter				4.804	-0.346	0.000	0.27			72.4	OK	
1.001	SWMH17.2	360 Winter	10	+0%	100/15 Summer				4.742	-0.298	0.000	0.05			10.5	OK	
1.002	SWMH17.3	360 Winter	10	+0%	100/15 Summer				4.742	-0.258	0.000	0.05			11.7	OK	
1.003	SWMH17.4	360 Winter	10	+0%	100/15 Summer				4.741	-0.209	0.000	0.05			12.2	OK	
2.000	SWMH18.1	360 Winter	10	+0%	100/15 Summer				4.741	-0.169	0.000	0.06			11.5	OK	
1.004	SWMH17.5	360 Winter	10	+0%	100/15 Summer				4.741	-0.149	0.000	0.12			22.4	OK	
3.000	SWCP19.1	360 Winter	10	+0%	10/30 Summer				4.740	0.190	0.000	0.00			0.0	SURCHARGED	
3.001	SWCP19.2	360 Winter	10	+0%	100/60 Summer				4.740	-0.140	0.000	0.01			1.1	OK	
4.000	Headwall 12	360 Winter	10	+0%	100/60 Summer				4.740	-0.160	0.000	0.00			0.8	OK*	
1.005	SWCP17.6	360 Winter	10	+0%	10/15 Summer				4.741	0.261	0.000	0.19			8.8	SURCHARGED	
1.006	SWMH17.7	360 Winter	10	+0%	30/240 Summer				4.739	-0.091	0.000	0.05			8.4	OK	
5.000	HWMH20.1	15 Summer	10	+0%	100/60 Summer				4.765	-0.170	0.000	0.10			3.6	OK	
5.001	HWMH20.2	15 Summer	10	+0%	100/15 Summer				4.743	-0.112	0.000	0.50			16.6	OK	
1.007	SWCP17.8	360 Winter	10	+0%	30/240 Summer				4.738	-0.062	0.000	0.04			9.4	OK	
1.008	Headwall 13	360 Winter	10	+0%					4.737	-0.053	0.000	0.03			9.2	OK*	
1.009	Headwall 14	360 Winter	10	+0%	30/240 Summer				4.737	-0.048	0.000	0.01			4.7	OK*	
1.010	SWMH17.9	360 Winter	10	+0%	10/15 Summer				4.737	0.417	0.000	0.31			3.7	SURCHARGED	
6.000	SWMH21.1	15 Summer	10	+0%	100/15 Summer				4.947	-0.203	0.000	0.17			10.8	OK	
6.001	SWMH21.2	15 Summer	10	+0%	100/15 Summer				4.923	-0.162	0.000	0.41			26.3	OK	
6.002	SWMH21.3	15 Summer	10	+0%	100/15 Summer				4.863	-0.122	0.000	0.73			78.6	OK	
6.003	SWMH21.4	960 Summer	10	+0%	10/360 Summer				4.814	0.039	0.000	0.06			8.5	SURCHARGED	
6.004	SWMH21.5	960 Summer	10	+0%	10/240 Summer				4.814	0.094	0.000	0.10			10.6	SURCHARGED	
6.005	SWCP21.6	960 Summer	10	+0%	10/240 Summer				4.814	0.119	0.000	0.11			10.3	SURCHARGED	
6.006	Headwall 15	1440 Summer	10	+0%					4.675	0.000	0.000	0.05			7.4	SURCHARGED*	
6.007	Headwall 16	960 Summer	10	+0%	10/120 Summer				4.814	0.174	0.000	0.01			2.2	SURCHARGED*	

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10 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

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)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
6.008	SWMH21.7	960 Summer	10	+0%	10/15 Summer				4.842	0.522	0.000	0.09			1.1	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

Simulation Criteria

Areal Reduction Factor 1.000 Hot Start Level (mm) 0 Foul Sewage per hectare (l/s) 0.000 MADD Factor * 10m³/ha Storage 2.000 Flow per Person per Day (l/per/day) 0.000
Hot Start (mins) 0 Manhole Headloss Coeff (Global) 0.500 Additional Flow - % of Total Flow 0.000 Inlet Coeffiecient 0.800

Number of Input Hydrographs 0 Number of Online Controls 2 Number of Offline Controls 0 Number of Storage Structures 4 Number of Time/Area Diagrams 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Site Location GB 490175 99535 SZ 90175 99535 Cv (Summer) 1.000
FEH Rainfall Version 2013 Data Type Point Cv (Winter) 1.000

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 10, 30, 100
Climate Change (%) 0, 0, 40

WARNING: Half Drain Time has not been calculated as the structure is too full.

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)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH17.1	15 Summer	30	+0%	100/15 Winter				4.861	-0.289	0.000	0.35			92.8	OK	
1.001	SWMH17.2	360 Winter	30	+0%	100/15 Summer				4.851	-0.189	0.000	0.06			12.4	OK	
1.002	SWMH17.3	360 Winter	30	+0%	100/15 Summer				4.851	-0.149	0.000	0.05			13.6	OK	
1.003	SWMH17.4	360 Winter	30	+0%	100/15 Summer				4.850	-0.100	0.000	0.06			14.0	OK	
2.000	SWMH18.1	360 Winter	30	+0%	100/15 Summer				4.849	-0.061	0.000	0.07			14.2	OK	
1.004	SWMH17.5	360 Winter	30	+0%	100/15 Summer				4.849	-0.041	0.000	0.14			26.6	OK	
3.000	SWCP19.1	360 Winter	30	+0%	10/30 Summer				4.847	0.297	0.000	0.00			0.0	SURCHARGED	
3.001	SWCP19.2	360 Winter	30	+0%	100/60 Summer				4.847	-0.033	0.000	0.01			1.1	OK	
4.000	Headwall 12	360 Winter	30	+0%	100/60 Summer				4.847	-0.053	0.000	0.00			1.0	OK*	
1.005	SWCP17.6	360 Winter	30	+0%	10/15 Summer				4.847	0.367	0.000	0.21			9.4	SURCHARGED	
1.006	SWMH17.7	360 Winter	30	+0%	30/240 Summer				4.845	0.015	0.000	0.06			9.2	SURCHARGED	
5.000	HWMH20.1	360 Winter	30	+0%	100/60 Summer				4.845	-0.090	0.000	0.02			0.6	OK	
5.001	HWMH20.2	360 Winter	30	+0%	100/15 Summer				4.845	-0.010	0.000	0.08			2.7	OK	
1.007	SWCP17.8	360 Winter	30	+0%	30/240 Summer				4.845	0.045	0.000	0.05			11.1	SURCHARGED	
1.008	Headwall 13	480 Winter	30	+0%					4.790	0.000	0.000	0.03			9.3	SURCHARGED*	
1.009	Headwall 14	360 Winter	30	+0%	30/240 Summer				4.844	0.059	0.000	0.01			4.8	SURCHARGED*	
1.010	SWMH17.9	480 Summer	30	+0%	10/15 Summer				4.846	0.526	0.000	0.31			3.7	SURCHARGED	
6.000	SWMH21.1	15 Summer	30	+0%	100/15 Summer				4.997	-0.153	0.000	0.21			13.6	OK	
6.001	SWMH21.2	15 Summer	30	+0%	100/15 Summer				4.987	-0.098	0.000	0.51			32.7	OK	
6.002	SWMH21.3	15 Summer	30	+0%	100/15 Summer				4.949	-0.036	0.000	0.88			94.3	OK	
6.003	SWMH21.4	960 Winter	30	+0%	10/360 Summer				4.935	0.160	0.000	0.05			7.1	SURCHARGED	
6.004	SWMH21.5	960 Winter	30	+0%	10/240 Summer				4.934	0.214	0.000	0.09			9.0	SURCHARGED	
6.005	SWCP21.6	960 Winter	30	+0%	10/240 Summer				4.934	0.239	0.000	0.09			9.0	SURCHARGED	
6.006	Headwall 15	1440 Summer	30	+0%					4.675	0.000	0.000	0.07			9.9	SURCHARGED*	
6.007	Headwall 16	960 Winter	30	+0%	10/120 Summer				4.934	0.294	0.000	0.01			2.2	SURCHARGED*	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

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)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
6.008	SWMH21.7	960 Winter	30	+0%	10/15 Summer				4.962	0.642	0.000	0.09			1.1	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

Simulation Criteria

Areal Reduction Factor 1.000 Hot Start Level (mm) 0 Foul Sewage per hectare (l/s) 0.000 MADD Factor * 10m³/ha Storage 2.000 Flow per Person per Day (l/per/day) 0.000
Hot Start (mins) 0 Manhole Headloss Coeff (Global) 0.500 Additional Flow - % of Total Flow 0.000 Inlet Coeffiecient 0.800

Number of Input Hydrographs 0 Number of Online Controls 2 Number of Offline Controls 0 Number of Storage Structures 4 Number of Time/Area Diagrams 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH Site Location GB 490175 99535 SZ 90175 99535 Cv (Summer) 1.000
FEH Rainfall Version 2013 Data Type Point Cv (Winter) 1.000

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 10, 30, 100
Climate Change (%) 0, 0, 40

WARNING: Half Drain Time has not been calculated as the structure is too full.

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)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SWMH17.1	480 Winter	100	+40%	100/15 Winter				5.338	0.188	0.000	0.07			17.8	SURCHARGED	
1.001	SWMH17.2	480 Winter	100	+40%	100/15 Summer				5.338	0.298	0.000	0.09			19.2	SURCHARGED	
1.002	SWMH17.3	480 Winter	100	+40%	100/15 Summer				5.338	0.338	0.000	0.09			21.8	SURCHARGED	
1.003	SWMH17.4	480 Winter	100	+40%	100/15 Summer				5.337	0.387	0.000	0.10			23.8	SURCHARGED	
2.000	SWMH18.1	480 Winter	100	+40%	100/15 Summer				5.337	0.427	0.000	0.10			19.8	SURCHARGED	
1.004	SWMH17.5	480 Winter	100	+40%	100/15 Summer				5.337	0.447	0.000	0.23			43.1	SURCHARGED	
3.000	SWCP19.1	480 Winter	100	+40%	10/30 Summer				5.337	0.787	0.000	0.00			0.0	FLOOD RISK	
3.001	SWCP19.2	480 Winter	100	+40%	100/60 Summer				5.337	0.457	0.000	0.00			0.1	SURCHARGED	
4.000	Headwall 12	480 Winter	100	+40%	100/60 Summer				5.337	0.437	0.000	0.00			1.6	SURCHARGED*	
1.005	SWCP17.6	480 Winter	100	+40%	10/15 Summer				5.337	0.857	0.000	0.59			26.3	SURCHARGED	
1.006	SWMH17.7	480 Winter	100	+40%	30/240 Summer				5.335	0.505	0.000	0.16			25.6	SURCHARGED	
5.000	HWMH20.1	480 Winter	100	+40%	100/60 Summer				5.335	0.400	0.000	0.02			0.8	SURCHARGED	
5.001	HWMH20.2	480 Winter	100	+40%	100/15 Summer				5.334	0.479	0.000	0.11			3.6	SURCHARGED	
1.007	SWCP17.8	480 Winter	100	+40%	30/240 Summer				5.334	0.534	0.000	0.13			27.1	FLOOD RISK	
1.008	Headwall 13	1440 Summer	100	+40%					4.790	0.000	0.000	0.05			17.4	SURCHARGED*	
1.009	Headwall 14	480 Winter	100	+40%	30/240 Summer				5.334	0.549	0.000	0.01			4.8	FLOOD RISK*	
1.010	SWMH17.9	480 Winter	100	+40%	10/15 Summer				5.343	1.023	0.000	0.31			3.7	SURCHARGED	
6.000	SWMH21.1	15 Summer	100	+40%	100/15 Summer				5.894	0.744	0.000	0.43			27.2	SURCHARGED	
6.001	SWMH21.2	15 Summer	100	+40%	100/15 Summer				5.825	0.740	0.000	0.84			53.7	SURCHARGED	
6.002	SWMH21.3	15 Summer	100	+40%	100/15 Summer				5.750	0.765	0.000	1.40			150.4	SURCHARGED	
6.003	SWMH21.4	960 Winter	100	+40%	10/360 Summer				5.373	0.598	0.000	0.08			12.3	SURCHARGED	
6.004	SWMH21.5	960 Winter	100	+40%	10/240 Summer				5.373	0.653	0.000	0.15			15.4	SURCHARGED	
6.005	SWCP21.6	960 Winter	100	+40%	10/240 Summer				5.373	0.678	0.000	0.16			15.3	SURCHARGED	
6.006	Headwall 15	15 Summer	100	+40%					4.675	0.000	0.000	1.68			234.4	SURCHARGED*	
6.007	Headwall 16	960 Winter	100	+40%	10/120 Summer				5.372	0.732	0.000	0.01			1.4	FLOOD RISK*	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

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)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
6.008	SWMH21.7	1440 Winter	100	+40%	10/15 Summer				5.395	1.075	0.000	0.11			1.3	FLOOD RISK	

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