

M J M C		Page 0
Southgate House Southgate Wakefield WF1 1TL		
Date 24/11/2021 19:13 File TM_Surface Water Networ...	Designed by tomm Checked by	
Micro Drainage	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm Network

Pipe Sizes Circular Manhole Sizes Adoptable

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	40
Ratio R	0.300	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	0	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)	1000

Designed with Level Inverts

Network Design Table for Storm Network

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
1.000	45.130	1.612	28.0	0.157	4.00	0.0	0.600	o	300	Pipe/Conduit
1.001	48.541	0.121	401.2	0.185	0.00	0.0	0.600	o	900	Pipe/Conduit
2.000	12.773	0.391	32.7	0.055	4.00	0.0	0.600	o	300	Pipe/Conduit
3.000	9.920	0.066	150.3	0.055	4.00	0.0	0.600	o	300	Pipe/Conduit
2.001	27.502	0.771	35.7	0.115	0.00	0.0	0.600	o	300	Pipe/Conduit
4.000	19.024	0.696	27.3	0.050	4.00	0.0	0.600	o	300	Pipe/Conduit
2.002	23.931	1.065	22.5	0.050	0.00	0.0	0.600	o	300	Pipe/Conduit
2.003	7.212	0.018	400.7	0.000	0.00	0.0	0.600	o	900	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	0.00	4.25	72.531	0.157	0.0	0.0	0.0	2.98	210.8	0.0
1.001	0.00	4.77	70.319	0.342	0.0	0.0	0.0	1.56	991.2	0.0
2.000	0.00	4.08	73.669	0.055	0.0	0.0	0.0	2.76	195.1	0.0
3.000	0.00	4.13	73.344	0.055	0.0	0.0	0.0	1.28	90.5	0.0
2.001	0.00	4.30	73.278	0.225	0.0	0.0	0.0	2.64	186.7	0.0
4.000	0.00	4.11	73.203	0.050	0.0	0.0	0.0	3.02	213.4	0.0
2.002	0.00	4.42	72.507	0.325	0.0	0.0	0.0	3.33	235.5	0.0
2.003	0.00	4.50	70.216	0.325	0.0	0.0	0.0	1.56	991.9	0.0

M J M C		Page 1
Southgate House Southgate Wakefield WF1 1TL		
Date 24/11/2021 19:13 File TM_Surface Water Networ...	Designed by tomm Checked by	
Micro Drainage	Network 2020.1.3	

Network Design Table for Storm Network

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
1.002	10.694	0.027	396.1	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit
1.003	34.578	0.086	402.1	0.114	0.00	0.0	0.600	o	3000	Pipe/Conduit
1.004	28.079	0.248	113.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
1.005	25.086	0.222	113.0	0.000	0.00	0.0	0.600	o	225	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)
1.002	0.00	4.89	70.198	0.667	0.0	0.0	0.0	1.57	997.7	0.0
1.003	0.00	5.06	68.153	0.781	0.0	0.0	0.0	3.25	22988.2	0.0
1.004	0.00	5.44	68.067	0.781	0.0	0.0	0.0	1.23	48.8	0.0
1.005	0.00	5.78	67.819	0.781	0.0	0.0	0.0	1.23	48.9	0.0

M J M C		Page 2
Southgate House Southgate Wakefield WF1 1TL		
Date 24/11/2021 19:13	Designed by tomm	
File TM_Surface Water Networ...	Checked by	
Micro Drainage		Network 2020.1.3

Manhole Schedules for Storm Network

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)	Backdrop (mm)
SWMH1	74.393	1.862	Open Manhole	2400	1.000	72.531	300				
SWMH2	72.319	2.000	Open Manhole	2400	1.001	70.319	900	1.000	70.919	300	600
SWMH8	75.169	1.500	Open Manhole	2400	2.000	73.669	300				
SWMH12	74.844	1.500	Open Manhole	2400	3.000	73.344	300				
SWMH9	74.894	1.616	Open Manhole	2400	2.001	73.278	300	2.000	73.278	300	
								3.000	73.278	300	
SWMH11	74.703	1.500	Open Manhole	2400	4.000	73.203	300				
SWMH10	74.123	1.616	Open Manhole	2400	2.002	72.507	300	2.001	72.507	300	
								4.000	72.507	300	
SWMH4	73.058	2.842	Open Manhole	2400	2.003	70.216	900	2.002	71.442	300	1226
SWMH13	72.871	2.673	Open Manhole	2400	1.002	70.198	900	1.001	70.198	900	
								2.003	70.198	900	
SWMH5	72.353	4.200	Open Manhole	3900	1.003	68.153	3000	1.002	70.171	900	2018
SWMH6	71.722	3.655	Open Manhole	3900	1.004	68.067	225	1.003	68.067	3000	
SWMH7	69.683	1.864	Open Manhole	2400	1.005	67.819	225	1.004	67.819	225	
OUTFALL	68.970	1.373	Open Manhole	1350		OUTFALL		1.005	67.597	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SWMH1	436735.324	408659.259	436735.324	408659.259	Required	
SWMH2	436706.959	408694.361	436706.959	408694.361	Required	
SWMH8	436791.033	408682.843	436791.033	408682.843	Required	
SWMH12	436790.161	408699.077	436790.161	408699.077	Required	
SWMH9	436782.708	408692.530	436782.708	408692.530	Required	
SWMH11	436778.773	408725.506	436778.773	408725.506	Required	
SWMH10	436764.395	408713.048	436764.395	408713.048	Required	

M J M C		Page 4
Southgate House Southgate Wakefield WF1 1TL		
Date 24/11/2021 19:13	Designed by tomm	
File TM_Surface Water Networ...	Checked by	
Micro Drainage		Network 2020.1.3

PIPELINE SCHEDULES for Storm Network

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	300	SWMH1	74.393	72.531	0.362	Open Manhole	2400
1.001	o	900	SWMH2	72.319	70.319	0.500	Open Manhole	2400
2.000	o	300	SWMH8	75.169	73.669	0.450	Open Manhole	2400
3.000	o	300	SWMH12	74.844	73.344	0.450	Open Manhole	2400
2.001	o	300	SWMH9	74.894	73.278	0.566	Open Manhole	2400
4.000	o	300	SWMH11	74.703	73.203	0.450	Open Manhole	2400
2.002	o	300	SWMH10	74.123	72.507	0.566	Open Manhole	2400
2.003	o	900	SWMH4	73.058	70.216	1.792	Open Manhole	2400
1.002	o	900	SWMH13	72.871	70.198	1.173	Open Manhole	2400
1.003	o	3000	SWMH5	72.353	68.153	2.700	Open Manhole	3900
1.004	o	225	SWMH6	71.722	68.067	2.155	Open Manhole	3900
1.005	o	225	SWMH7	69.683	67.819	1.489	Open Manhole	2400

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	45.130	28.0	SWMH2	72.319	70.919	-0.100	Open Manhole	2400
1.001	48.541	401.2	SWMH13	72.871	70.198	1.173	Open Manhole	2400
2.000	12.773	32.7	SWMH9	74.894	73.278	0.566	Open Manhole	2400
3.000	9.920	150.3	SWMH9	74.894	73.278	0.566	Open Manhole	2400
2.001	27.502	35.7	SWMH10	74.123	72.507	0.566	Open Manhole	2400
4.000	19.024	27.3	SWMH10	74.123	72.507	0.566	Open Manhole	2400
2.002	23.931	22.5	SWMH4	73.058	71.442	0.566	Open Manhole	2400
2.003	7.212	400.7	SWMH13	72.871	70.198	1.623	Open Manhole	2400
1.002	10.694	396.1	SWMH5	72.353	70.171	0.682	Open Manhole	3900
1.003	34.578	402.1	SWMH6	71.722	68.067	2.155	Open Manhole	3900
1.004	28.079	113.2	SWMH7	69.683	67.819	0.364	Open Manhole	2400
1.005	25.086	113.0	OUTFALL	68.970	67.597	0.998	Open Manhole	1350

M J M C		Page 5
Southgate House Southgate Wakefield WF1 1TL		
Date 24/11/2021 19:13 File TM_Surface Water Networ...		
Designed by tomm Checked by		
Micro Drainage		Network 2020.1.3

Surcharged Outfall Details for Storm Network

Outfall Pipe Number	Outfall C. Level Name (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.005	OUTFALL	68.970	67.597	0.000	1350

Datum (m) 67.599 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
1440	0.000	5760	0.000	10080	0.000	14400	0.000	18720	0.000
2880	0.000	7200	0.000	11520	0.000	15840	0.000	20160	0.000
4320	0.000	8640	0.000	12960	0.000	17280	0.000		

Simulation Criteria for Storm Network

Volumetric Runoff Coeff 0.840 Foul Sewage per hectare (l/s) 0.000
 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 Run Time (mins) 2160
 Manhole Headloss Coeff (Global) 0.500 Output Interval (mins) 1

Number of Input Hydrographs 0 Number of Storage Structures 0
 Number of Online Controls 1 Number of Time/Area Diagrams 0
 Number of Offline Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	480
Ratio R	0.360		

©1982-2020 Innovyze

M J M C		Page 6
Southgate House Southgate Wakefield WF1 1TL		
Date 24/11/2021 19:13 File TM_Surface Water Networ...	Designed by tomm Checked by	
Micro Drainage	Network 2020.1.3	

Online Controls for Storm Network

Hydro-Brake® Optimum Manhole: SWMH6, DS/PN: 1.004, Volume (m³): 260.5

Unit Reference	MD-SHE-0066-3500-3655-3500
Design Head (m)	3.655
Design Flow (l/s)	3.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	66
Invert Level (m)	68.067
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	3.655	3.5
Flush-Flo™	0.284	1.9
Kick-Flo®	0.589	1.5
Mean Flow over Head Range	-	2.5

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)
0.100	1.6	1.200	2.1	3.000	3.2	7.000	4.7
0.200	1.9	1.400	2.2	3.500	3.4	7.500	4.9
0.300	1.9	1.600	2.4	4.000	3.6	8.000	5.0
0.400	1.9	1.800	2.5	4.500	3.9	8.500	5.2
0.500	1.7	2.000	2.6	5.000	4.0	9.000	5.3
0.600	1.5	2.200	2.8	5.500	4.2	9.500	5.5
0.800	1.7	2.400	2.9	6.000	4.4		
1.000	1.9	2.600	3.0	6.500	4.6		

M J M C		Page 7
Southgate House Southgate Wakefield WF1 1TL		
Date 24/11/2021 19:13 File TM_Surface Water Networ...	Designed by tomm Checked by	
Micro Drainage	Network 2020.1.3	

Summary of Results for 480 minute 100 year Winter (Storm Network)

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

		Water	Surcharged	Flooded				Half Drain	Pipe	
	US/MH	Level	Depth	Volume	Flow /	Overflow	Time	Flow		
PN	Name	(m)	(m)	(m ³)	Cap.	(l/s)	(mins)	(l/s)	Status	
1.000	SWMH1	72.568	-0.263	0.000	0.04			7.7	OK	
1.001	SWMH2	71.689	0.470	0.000	0.02			16.8	SURCHARGED	
2.000	SWMH8	73.694	-0.275	0.000	0.02			2.7		
3.000	SWMH12	73.383	-0.261	0.000	0.04			2.7	OK	
2.001	SWMH9	73.328	-0.250	0.000	0.07			11.1	OK	
4.000	SWMH11	73.221	-0.282	0.000	0.01			2.5	OK	
2.002	SWMH10	72.562	-0.245	0.000	0.08			16.0	OK	
2.003	SWMH4	71.689	0.573	0.000	0.04			16.0	SURCHARGED	
1.002	SWMH13	71.689	0.591	0.000	0.07			32.8	SURCHARGED	
1.003	SWMH5	71.689	0.536	0.000	0.00			34.2	SURCHARGED	
1.004	SWMH6	71.689	3.397	0.000	0.08			3.5	FLOOD RISK	
1.005	SWMH7	67.860	-0.184	0.000	0.08			3.5	OK	