

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 1









Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
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)	500

Designed with Level Soffits

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
1.000	22.404	0.134	167.2	0.079	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	17.662	0.106	166.6	0.007	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	48.135	0.288	167.1	0.046	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	86.515	0.818	105.8	0.072	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	67.382	0.135	499.1	0.076	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.005	41.259	0.082	503.2	0.024	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.006	34.186	0.068	502.7	0.051	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.007	15.102	1.522	9.9	0.000	0.00	0.0	0.600	o	750	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	50.00	5.37	71.500	0.079	0.0	0.0	0.0	1.01	40.1	10.7
1.001	50.00	5.66	71.366	0.086	0.0	0.0	0.0	1.01	40.2	11.6
1.002	48.63	6.46	71.260	0.132	0.0	0.0	0.0	1.01	40.1	17.4
1.003	45.44	7.40	70.897	0.204	0.0	0.0	0.0	1.53	108.0	25.1
1.004	42.81	8.30	69.629	0.280	0.0	0.0	0.0	1.25	550.4	32.5
1.005	41.36	8.86	69.494	0.304	0.0	0.0	0.0	1.24	548.1	34.1
1.006	40.30	9.32	69.412	0.355	0.0	0.0	0.0	1.24	548.4	38.8
1.007	40.24	9.34	69.344	0.355	0.0	0.0	0.0	8.91	3937.8	38.8

Unit 3 Sherwood Oaks Close
 Sherwood Oaks Business Park
 Mansfield Nottinghamshire ...



Date 09/01/2018 14:04
 File Storm Sep 17.mdx

Designed by Thomas.Nunn
 Checked by

XP Solutions Network 2017.1.2

Manhole Schedules for Surface Network 1

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)
S1	73.273	1.773	Open Manhole	1200	1.000	71.500	225				
S2	73.654	2.288	Open Manhole	1200	1.001	71.366	225	1.000	71.366	225	
S3	73.654	2.394	Open Manhole	1200	1.002	71.260	225	1.001	71.260	225	
S4	73.217	2.320	Open Manhole	1200	1.003	70.897	300	1.002	70.972	225	
S5	73.082	3.453	Open Manhole	1800	1.004	69.629	750	1.003	70.079	300	
S6	73.357	3.863	Open Manhole	1800	1.005	69.494	750	1.004	69.494	750	
S7	72.716	3.304	Open Manhole	2100	1.006	69.412	750	1.005	69.412	750	
S8	71.747	2.403	Open Manhole	1800	1.007	69.344	750	1.006	69.344	750	
S8	71.489	3.667	Open Manhole	1200		OUTFALL		1.007	67.822	750	

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	225	S1	73.273	71.500	1.548	Open Manhole	1200
1.001	o	225	S2	73.654	71.366	2.063	Open Manhole	1200
1.002	o	225	S3	73.654	71.260	2.169	Open Manhole	1200
1.003	o	300	S4	73.217	70.897	2.020	Open Manhole	1200
1.004	o	750	S5	73.082	69.629	2.703	Open Manhole	1800
1.005	o	750	S6	73.357	69.494	3.113	Open Manhole	1800
1.006	o	750	S7	72.716	69.412	2.554	Open Manhole	2100
1.007	o	750	S8	71.747	69.344	1.653	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)
1.000	22.404	167.2	S2	73.654	71.366	2.063	Open Manhole	1200
1.001	17.662	166.6	S3	73.654	71.260	2.169	Open Manhole	1200
1.002	48.135	167.1	S4	73.217	70.972	2.020	Open Manhole	1200
1.003	86.515	105.8	S5	73.082	70.079	2.703	Open Manhole	1800
1.004	67.382	499.1	S6	73.357	69.494	3.113	Open Manhole	1800
1.005	41.259	503.2	S7	72.716	69.412	2.554	Open Manhole	2100
1.006	34.186	502.7	S8	71.747	69.344	1.653	Open Manhole	1800
1.007	15.102	9.9	S8	71.489	67.822	2.917	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)
1.007	S8	71.489	67.822	0.000	1200	0

Simulation Criteria for Surface Network 1


Volumetric Runoff Coeff	0.840	Additional Flow - % of Total Flow	40.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coefficient	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 Storage Structures	0
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

PJS Consulting Egnineers Limited		Page 3
Unit 3 Sherwood Oaks Close Sherwood Oaks Business Park Mansfield Nottinghamshire ...		
Date 09/01/2018 14:04 File Storm Sep 17.mdx	Designed by Thomas.Nunn Checked by	
XP Solutions	Network 2017.1.2	

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)	20.000	Storm Duration (mins)	15
Ratio R	0.400		

PJS Consulting Egnineers Limited		Page 4
Unit 3 Sherwood Oaks Close Sherwood Oaks Business Park Mansfield Nottinghamshire ...		
Date 09/01/2018 14:04 File Storm Sep 17.mdx	Designed by Thomas.Nunn Checked by	
XP Solutions	Network 2017.1.2	

Online Controls for Surface Network 1

Hydro-Brake® Optimum Manhole: S8, DS/PN: 1.007, Volume (m³): 20.4

Unit Reference	MD-SHE-0267-4100-1300-4100
Design Head (m)	1.300
Design Flow (l/s)	41.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	267
Invert Level (m)	69.344
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.300	41.0
Flush-Flo™	0.452	40.8
Kick-Flo®	0.936	35.0
Mean Flow over Head Range	-	34.3

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	8.5	1.200	39.4	3.000	61.4	7.000	92.6
0.200	27.5	1.400	42.5	3.500	66.1	7.500	95.8
0.300	39.7	1.600	45.3	4.000	70.5	8.000	98.8
0.400	40.7	1.800	47.9	4.500	74.7	8.500	101.8
0.500	40.7	2.000	50.4	5.000	78.6	9.000	104.7
0.600	40.3	2.200	52.8	5.500	82.4	9.500	107.5
0.800	38.5	2.400	55.1	6.000	85.9		
1.000	36.1	2.600	57.2	6.500	89.3		

Summary of Results for 15 minute 100 year Winter (Surface Network 1)

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

PN	US/MH Name	Water Surcharged Flooded			Pipe		Status
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	
1.000	S1	72.576	0.851	0.000	1.21	44.4	SURCHARGED
1.001	S2	72.375	0.784	0.000	1.34	48.2	SURCHARGED
1.002	S3	72.191	0.706	0.000	1.80	69.2	SURCHARGED
1.003	S4	71.179	-0.018	0.000	1.00	104.3	OK
1.004	S5	70.262	-0.117	0.000	0.29	138.3	OK
1.005	S6	70.258	0.014	0.000	0.22	98.7	SURCHARGED
1.006	S7	70.253	0.091	0.000	0.19	83.3	SURCHARGED
1.007	S8	70.248	0.154	0.000	0.02	40.8	SURCHARGED

Unit 3 Sherwood Oaks Close
 Sherwood Oaks Business Park
 Mansfield Nottinghamshire ...



Date 09/01/2018 14:04
 File Storm Sep 17.mdx

Designed by Thomas.Nunn
 Checked by

XP Solutions

Network 2017.1.2

Rainfall Hyetograph for 15 minute 100 year Winter (Surface Network 1)

Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)	Time (mins)	Rain (mm/hr)
1	23.493	4	56.524	7	210.685	10	148.028	13	44.651
2	42.871	5	91.491	8	244.726	11	91.491	14	42.871
3	44.651	6	148.028	9	210.685	12	56.524	15	23.493