

Jubb Consulting		Page 1
Alexander House Excelsior Road Cardiff CF14 3AT		
Date 18/09/2017 12:35 File C15112_SW Calcs 2017091...	Designed by rpowell Checked by	
Micro Drainage	Network 2016.1	

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)	18.000	Minimum Backdrop Height (m)	0.200
Ratio R	0.265	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	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	0.251	4-8	0.076

Total Area Contributing (ha) = 0.327

Total Pipe Volume (m³) = 4.419

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
1.000	52.937	0.720	73.5	0.090	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	15.936	0.320	49.8	0.092	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	35.478	0.861	41.2	0.052	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	22.534	0.160	140.8	0.093	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	1.967	0.074	26.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	2.000	0.050	40.0	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)
1.000	38.45	5.58	9.960	0.090	0.0	0.0	0.0	1.53	60.7	9.4
1.001	38.07	5.72	9.240	0.182	0.0	0.0	0.0	1.86	73.9	18.8
2.000	39.00	5.38	9.870	0.052	0.0	0.0	0.0	1.57	27.8	5.5
1.002	37.19	6.06	8.920	0.327	0.0	0.0	0.0	1.10	43.7	32.9
1.003	37.16	6.08	8.760	0.327	0.0	0.0	0.0	2.55	101.3	32.9
1.004	37.12	6.09	8.170	0.327	0.0	0.0	0.0	2.07	82.5	32.9

Jubb Consulting										Page 2	
Alexander House Excelsior Road Cardiff CF14 3AT											
Date 18/09/2017 12:35 File C15112_SW Calcs 2017091...					Designed by rpowell Checked by						
Micro Drainage					Network 2016.1						
<u>Manhole Schedules for Storm</u>											
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)
1	10.810	0.850	Open Manhole	1200	1.000	9.960	225				
2	11.000	1.760	Open Manhole	1200	1.001	9.240	225	1.000	9.240	225	
3	10.720	0.850	Open Manhole	1200	2.000	9.870	150				
3	10.975	2.055	Open Manhole	1200	1.002	8.920	225	1.001	8.920	225	
								2.000	9.009	150	14
4	11.110	2.350	Open Manhole	1200	1.003	8.760	225	1.002	8.760	225	
5	11.090	2.920	Open Manhole	1200	1.004	8.170	225	1.003	8.686	225	516
	11.090	2.970	Open Manhole	0		OUTFALL		1.004	8.120	225	
<u>Free Flowing Outfall Details for Storm</u>											
Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)					
1.004		11.090	8.120	4.660	0	0					
<u>Simulation Criteria for Storm</u>											
Volumetric Runoff Coeff		0.750	Additional Flow - % of Total Flow		0.000						
Areal Reduction Factor		1.000	MADD Factor * 10m³/ha Storage		2.000						
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 Offline Controls		0						
Number of Online Controls		0	Number of Storage Structures		0						
			Number of Time/Area Diagrams		0						
			Number of Real Time Controls		0						
<u>Synthetic Rainfall Details</u>											
Rainfall Model		FSR		Profile Type Summer							
Return Period (years)		1		Cv (Summer) 0.750							
Region		England and Wales		Cv (Winter) 0.840							
M5-60 (mm)		18.000		Storm Duration (mins) 30							
Ratio R		0.265									
©1982-2016 XP Solutions											

Jubb Consulting		Page 3
Alexander House Excelsior Road Cardiff CF14 3AT		
Date 18/09/2017 12:35 File C15112_SW Calcs 2017091...	Designed by rpowell Checked by	
Micro Drainage	Network 2016.1	

Summary of Critical Results by Maximum Level (Rank 1) for Storm

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 Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.256
 Region England and Wales Cv (Summer) 0.750
 M5-60 (mm) 18.700 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 0.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720,
 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640,
 10080
 Return Period(s) (years) 1, 30, 100
 Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	100	+0%	100/15 Summer				10.348
1.001	2	15 Winter	100	+0%	30/15 Summer				10.229
2.000	3	15 Winter	100	+0%	100/15 Summer				10.259
1.002	3	15 Winter	100	+0%	30/15 Summer				10.051
1.003	4	15 Winter	100	+0%	30/15 Summer				9.279
1.004	5	15 Winter	100	+0%	30/15 Summer				8.710

PN	US/MH Name	Surcharged		Flooded		Pipe		Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)			
1.000	1	0.163	0.000	0.46		26.7		SURCHARGED	
1.001	2	0.764	0.000	0.74		48.5		SURCHARGED	
2.000	3	0.239	0.000	0.57		15.3		SURCHARGED	
1.002	3	0.906	0.000	2.16		86.5		SURCHARGED	
1.003	4	0.294	0.000	2.26		86.7		SURCHARGED	
1.004	5	0.315	0.000	2.74		86.4		SURCHARGED	