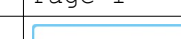


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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.360	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

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.215	4-8	0.065

Total Area Contributing (ha) = 0.280

Total Pipe Volume (m³) = 12.210

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	17.106	0.200	85.5	0.015	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	16.405	0.100	164.1	0.015	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	38.865	0.225	172.7	0.030	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	22.139	0.200	110.7	0.015	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	16.208	1.250	13.0	0.015	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	I.Area (ha)	Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	45.80	5.26	52.200	0.015	0.0	0.0	0.0	1.09	19.2	1.9
1.001	44.54	5.61	52.000	0.030	0.0	0.0	0.0	0.78	13.8	3.6
1.002	42.38	6.26	51.875	0.060	0.0	0.0	0.0	0.99	39.4	6.9
2.000	45.34	5.39	53.200	0.015	0.0	0.0	0.0	0.95	16.9	1.8
2.001	44.99	5.48	53.000	0.030	0.0	0.0	0.0	2.81	49.7	3.7

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Synthetic Rainfall Details <table><tr><td>Rainfall Model</td><td>FSR</td><td>Profile Type</td><td>Summer</td></tr><tr><td>Return Period (years)</td><td>1</td><td>Cv (Summer)</td><td>0.750</td></tr><tr><td>Region</td><td>England and Wales</td><td>Cv (Winter)</td><td>0.840</td></tr><tr><td>M5-60 (mm)</td><td>18.000</td><td>Storm Duration (mins)</td><td>30</td></tr><tr><td>Ratio R</td><td>0.360</td><td></td><td></td></tr></table>			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	0.360		
Rainfall Model	FSR	Profile Type	Summer																			
Return Period (years)	1	Cv (Summer)	0.750																			
Region	England and Wales	Cv (Winter)	0.840																			
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Ratio R	0.360																					
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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 6, DS/PN: 1.005, Volume (m³): 6.5

Unit Reference	MD-SHE-0103-5000-1200-5000
Design Head (m)	1.200
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	103
Invert Level (m)	51.200
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	5.0
Flush-Flo™	0.354	5.0
Kick-Flo®	0.745	4.0
Mean Flow over Head Range	-	4.4

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)
0.100	3.4	1.200	5.0	3.000	7.7	7.000	11.5
0.200	4.7	1.400	5.4	3.500	8.3	7.500	11.8
0.300	5.0	1.600	5.7	4.000	8.8	8.000	12.2
0.400	5.0	1.800	6.0	4.500	9.3	8.500	12.6
0.500	4.9	2.000	6.3	5.000	9.8	9.000	12.9
0.600	4.7	2.200	6.6	5.500	10.2	9.500	13.3
0.800	4.1	2.400	6.9	6.000	10.7		
1.000	4.6	2.600	7.2	6.500	11.1		

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Storage Structures for Storm

Tank or Pond Manhole: 6, DS/PN: 1.005

Invert Level (m) 51.200

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	120.0	1.000	120.0	1.001	0.0

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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 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 0.360

Region England and Wales Cv (Summer) 0.750

M5-60 (mm)

18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0

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, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	100	+40%					52.271
1.001	2	15 Winter	100	+40%	100/15 Summer				52.222
1.002	3	180 Winter	100	+40%	100/15 Winter				52.154
2.000	7	15 Winter	100	+40%					53.276
2.001	8	15 Winter	100	+40%					53.062
1.003	4	180 Winter	100	+40%	100/15 Summer				52.150
1.004	5	180 Winter	100	+40%	30/60 Winter				52.145
3.000	11	180 Winter	100	+40%					52.146
3.001	12	180 Winter	100	+40%	100/120 Winter				52.146
1.005	6	180 Winter	100	+40%	30/30 Summer				52.144
1.006	7	60 Winter	30	+0%					51.139
1.007	8	60 Winter	30	+0%					50.855

PN	US/MH Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.079	0.000	0.44			7.9	OK	
1.001	2	0.072	0.000	1.15			14.7	SURCHARGED	

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

PN	US/MH Name	Surcharged		Flooded		Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)				
1.002	3	0.054	0.000	0.22			8.2	SURCHARGED	
2.000	7	-0.074	0.000	0.49			7.8	OK	
2.001	8	-0.088	0.000	0.35			16.2	OK	
1.003	4	0.275	0.000	0.30			14.0	SURCHARGED	
1.004	5	0.570	0.000	0.39			14.9	SURCHARGED	
3.000	11	-0.254	0.000	0.01			1.4	OK	
3.001	12	0.046	0.000	0.16			12.4	SURCHARGED	
1.005	6	0.644	0.000	0.06			5.0	SURCHARGED	
1.006	7	-0.261	0.000	0.04			5.0	OK	
1.007	8	-0.245	0.000	0.08			5.0	OK	