

Shaun Tonge Engineering		Page 1
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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)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.355	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 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	16.000	0.200	80.0	0.014	4.00	0.0	0.600	o	100	Pipe/Conduit	
1.001	7.300	0.200	36.5	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.002	1.000	0.050	20.0	0.014	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.003	1.000	0.020	50.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.004	1.850	0.030	61.7	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.005	5.000	0.050	100.0	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)
1.000	50.00	4.31	136.450	0.014	0.0	0.0	0.0	0.86	6.8	1.9
1.001	50.00	4.40	136.250	0.014	0.0	0.0	0.0	1.28	10.1	1.9
1.002	50.00	4.41	136.050	0.028	0.0	0.0	0.0	1.73	13.6	3.8
1.003	50.00	4.43	136.000	0.028	0.0	0.0	0.0	1.09	8.6	3.8
1.004	50.00	4.46	135.980	0.028	0.0	0.0	0.0	0.98	7.7	3.8
1.005	50.00	4.54	135.900	0.028	0.0	0.0	0.0	1.00	17.8	3.8

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Online Controls for Storm

Depth/Flow Relationship Manhole: 3, DS/PN: 1.004, Volume (m³): 1.5

Invert Level (m) 135.980

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.5000	0.900	3.9700	1.700	5.4500	2.500	0.0000
0.200	3.4800	1.000	4.1800	1.800	5.6100	2.600	0.0000
0.300	3.1300	1.100	4.3900	1.900	5.7700	2.700	0.0000
0.400	2.7500	1.200	4.5800	2.000	5.9200	2.800	0.0000
0.500	2.8800	1.300	4.7700	2.100	0.0000	2.900	0.0000
0.600	3.2400	1.400	4.9500	2.200	0.0000	3.000	0.0000
0.700	3.5000	1.500	5.1200	2.300	0.0000		
0.800	3.7400	1.600	5.2900	2.400	0.0000		

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Storage Structures for Storm Cellular Storage Manhole: 3, DS/PN: 1.004 Invert Level (m) 135.980 Safety Factor 1.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>4.0</td><td>4.0</td><td>0.500</td><td>0.0</td><td>7.2</td></tr><tr><td>0.400</td><td>4.0</td><td>7.2</td><td></td><td></td><td></td></tr></tbody></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	4.0	4.0	0.500	0.0	7.2	0.400	4.0	7.2			
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)															
0.000	4.0	4.0	0.500	0.0	7.2															
0.400	4.0	7.2																		
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Micro Drainage

1 year Return Period 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 0.354

Region England and Wales Cv (Summer) 0.750

M5-60 (mm) 19.000

Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 10.0

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status ON

DVD Status ON

Inertia Status ON

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480

Return Period(s) (years) 1, 30, 100

Climate Change (%) 0, 0, 30

US/MH

PN

Name

Storm

Return Period

Climate Change

First (X) Surge

First (Y) Flood

First (Z) Overflow

Overflow Act.

1.000

1

15 Winter

1

+0%

100/15 Summer

100/15 Summer

1.001

2

15 Winter

1

+0%

30/15 Winter

1.002

3

15 Winter

1

+0%

30/15 Summer

1.003

4

15 Winter

1

+0%

30/15 Summer

1.004

3

15 Winter

1

+0%

30/15 Summer

1.005

4

15 Winter

1

+0%

Water

US/MH

PN

Name

Level (m)

Depth (m)

Volume (m³)

Flow / Cap.

Overflow (l/s)

Pipe Flow (l/s)

Status

Level Exceeded

1.000

1

136.487

-0.063

0.000

0.29

1.9

OK

4

1.001

2

136.281

-0.069

0.000

0.21

1.9

OK

1.002

3

136.103

-0.047

0.000

0.54

3.4

OK

1.003

4

136.082

-0.018

0.000

0.85

3.4

OK

1.004

3

136.079

-0.001

0.000

0.51

2.5

OK

1.005

4

135.942

-0.108

0.000

0.18

2.5

OK

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Micro Drainage

30 year Return Period 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 Coeffiecient 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

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Ratio R 0.354

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M5-60 (mm) 19.000

Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 10.0

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status ON

DVD Status ON

Inertia Status ON

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480

Return Period(s) (years) 1, 30, 100

Climate Change (%) 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Winter	30	+0%	100/15 Summer	100/15 Summer		
1.001	2	15 Winter	30	+0%	30/15 Winter			
1.002	3	15 Winter	30	+0%	30/15 Summer			
1.003	4	15 Winter	30	+0%	30/15 Summer			
1.004	3	15 Winter	30	+0%	30/15 Summer			
1.005	4	60 Winter	30	+0%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	136.513	-0.037	0.000	0.72		4.6	OK	4
1.001	2	136.362	0.012	0.000	0.47		4.3	SURCHARGED	
1.002	3	136.331	0.181	0.000	1.21		7.5	SURCHARGED	
1.003	4	136.294	0.194	0.000	1.74		6.8	SURCHARGED	
1.004	3	136.285	0.205	0.000	0.70		3.4	SURCHARGED	
1.005	4	135.950	-0.100	0.000	0.24		3.4	OK	

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100 year Return Period 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 0.354
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 10.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	30 Winter	100	+30%	100/15 Summer	100/15 Summer		
1.001	2	30 Winter	100	+30%	30/15 Winter			
1.002	3	30 Winter	100	+30%	30/15 Summer			
1.003	4	30 Winter	100	+30%	30/15 Summer			
1.004	3	30 Winter	100	+30%	30/15 Summer			
1.005	4	30 Winter	100	+30%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	136.700	0.150	0.426	0.78		5.0	FLOOD	4
1.001	2	136.693	0.343	0.000	0.47		4.3	FLOOD RISK	
1.002	3	136.688	0.538	0.000	1.42		8.8	SURCHARGED	
1.003	4	136.679	0.579	0.000	1.97		7.8	SURCHARGED	
1.004	3	136.670	0.590	0.000	0.72		3.5	SURCHARGED	
1.005	4	135.950	-0.100	0.000	0.25		3.5	OK	

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