


Shaun Tonge Engineering		Page 1
11 Broomhead Road Wombell Barnsley S73 0SA		
Date 25/09/2018 10:55 File Storm.mdx	Designed by Shaun Checked by	
CADS		Network 2018.1

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	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.353	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	11.900	0.150	79.3	0.015	5.00	0.0	0.600	o	100	Pipe/Conduit	
1.001	9.600	0.168	57.1	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
2.000	14.500	0.268	54.1	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit	
1.002	7.800	0.137	56.9	0.015	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.003	23.000	0.153	150.3	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	47.95	5.23	106.900	0.015	0.0	0.0	0.0	0.86	6.8	1.9
1.001	47.35	5.39	106.750	0.015	0.0	0.0	0.0	1.02	8.0	1.9
2.000	47.94	5.23	106.900	0.000	0.0	0.0	0.0	1.05	8.2	0.0
1.002	46.87	5.51	106.582	0.030	0.0	0.0	0.0	1.02	8.0	3.8
1.003	45.21	5.98	106.395	0.030	0.0	0.0	0.0	0.82	14.4	3.8

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 5, DS/PN: 1.003, Volume (m³): 1.4

Unit Reference	MD-SHE-0084-3000-0900-3000
Design Head (m)	0.900
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	84
Invert Level (m)	106.445
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	3.0
Flush-Flo™	0.267	3.0
Kick-Flo®	0.570	2.4
Mean Flow over Head Range	-	2.6

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	2.5	1.200	3.4	3.000	5.2	7.000	7.8
0.200	3.0	1.400	3.7	3.500	5.6	7.500	8.1
0.300	3.0	1.600	3.9	4.000	6.0	8.000	8.3
0.400	2.9	1.800	4.1	4.500	6.3	8.500	8.6
0.500	2.7	2.000	4.3	5.000	6.7	9.000	8.8
0.600	2.5	2.200	4.5	5.500	7.0	9.500	9.0
0.800	2.8	2.400	4.7	6.000	7.3		
1.000	3.1	2.600	4.9	6.500	7.5		

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 \* 10m<sup>3</sup>/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 0.341  
Region England and Wales Cv (Summer) 0.750  
M5-60 (mm)    19.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm)    300.0  
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) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1 15	Winter	1	+0%	100/15	Summer	100/15	Winter
1.001	2 15	Winter	1	+0%	30/15	Summer		
2.000	3 60	Winter	1	+0%	100/15	Summer		
1.002	3 15	Winter	1	+0%	30/15	Summer		
1.003	5 15	Winter	1	+0%	1/15	Summer		

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m <sup>3</sup> )	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	106.937	-0.063	0.000	0.29	1.9	OK	1
1.001	2	106.784	-0.066	0.000	0.25	1.9	OK	
2.000	3	106.900	-0.100	0.000	0.00	0.0	OK	
1.002	3	106.631	-0.051	0.000	0.47	3.5	OK	
1.003	5	106.603	0.058	0.000	0.21	2.9	SURCHARGED	

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 \* 10m<sup>3</sup>/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

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Margin for Flood Risk Warning (mm)    300.0  
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	Winter
1.001	2 15	Winter	30	+0%	30/15	Summer		
2.000	3 60	Winter	30	+0%	100/15	Summer		
1.002	3 15	Winter	30	+0%	30/15	Summer		
1.003	5 15	Winter	30	+0%	1/15	Summer		

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m <sup>3</sup> )	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Pipe Status	Level Exceeded
								Level Exceeded
1.000	1	106.985	-0.015	0.000	0.71	4.5	OK	1
1.001	2	106.921	0.071	0.000	0.55	4.1	SURCHARGED	
2.000	3	106.900	-0.100	0.000	0.00	0.0	OK	
1.002	3	106.874	0.192	0.000	1.10	8.1	SURCHARGED	
1.003	5	106.793	0.248	0.000	0.22	3.0	SURCHARGED	

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 \* 10m<sup>3</sup>/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 0.341  
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Margin for Flood Risk Warning (mm)    300.0  
Analysis Timestep 2.5 Second Increment (Extended)  
DTS Status    ON  
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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) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1 15	Winter	100	+30%	100/15	Summer	100/15	Winter
1.001	2 15	Winter	100	+30%	30/15	Summer		
2.000	3 30	Winter	100	+30%	100/15	Summer		
1.002	3 30	Winter	100	+30%	30/15	Summer		
1.003	5 30	Winter	100	+30%	1/15	Summer		

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m <sup>3</sup> )	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Pipe Status	Level Exceeded
1.000	1	107.450	0.450	0.037	0.96	6.1	FLOOD	1
1.001	2	107.329	0.479	0.000	0.84	6.2	FLOOD RISK	
2.000	3	107.299	0.299	0.000	0.02	0.1	FLOOD RISK	
1.002	3	107.300	0.618	0.000	1.41	10.3	SURCHARGED	
1.003	5	107.279	0.734	0.000	0.22	3.0	SURCHARGED	