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)	100	Add Flow / Climate Change (%)	0
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.000
Ratio R	0.352	Maximum Backdrop Height (m)	2.000
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	0.600
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

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)	Auto Design
1.000	39.660	0.276	143.7	0.080	5.00	0.0	0.600	o	225	
1.001	39.305	0.238	165.0	0.000	0.00	0.0	0.600	o	225	
2.000	35.439	0.694	51.1	0.066	5.00	0.0	0.600	o	225	
1.002	18.621	0.112	166.3	0.013	0.00	0.0	0.600	o	225	
3.000	29.834	0.273	109.3	0.103	5.00	0.0	0.600	o	225	
1.003	2.860	0.012	238.3	0.000	0.00	0.0	0.600	o	300	

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	5.61	48.966	0.080	0.0	0.0	0.0	1.09	43.3	10.9
1.001	50.00	6.25	48.690	0.080	0.0	0.0	0.0	1.02	40.4	10.9
2.000	50.00	5.32	49.146	0.066	0.0	0.0	0.0	1.83	72.9	8.9
1.002	50.00	6.56	48.452	0.159	0.0	0.0	0.0	1.01	40.2	21.6
3.000	50.00	5.40	48.613	0.103	0.0	0.0	0.0	1.25	49.7	14.0
1.003	50.00	6.61	48.340	0.262	0.0	0.0	0.0	1.01	71.7	35.5

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Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.003		49.765	48.328	0.000	0	0

Simulation Criteria for Storm

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 Coeffiecient	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	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.352		

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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 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	0
Number of Online Controls	0	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 0.352
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	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, 30

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	1	+0%	100/15 Summer				49.042
1.001	2	15 Winter	1	+0%	100/15 Summer				48.768
2.000	3	15 Winter	1	+0%					49.198
1.002	4	15 Winter	1	+0%	30/15 Summer				48.568
3.000	INT A	15 Winter	1	+0%	100/15 Summer				48.695
1.003	EXS1	15 Winter	1	+0%	30/15 Summer				48.509

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.149	0.000	0.24		10.0	OK	
1.001	2	-0.147	0.000	0.25		9.7	OK	
2.000	3	-0.173	0.000	0.12		8.2	OK	
1.002	4	-0.109	0.000	0.52		18.8	OK	
3.000	INT A	-0.143	0.000	0.28		12.8	OK	
1.003	EXS1	-0.131	0.000	0.60		31.0	OK	

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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	0
Number of Online Controls	0	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 0.352
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	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, 30

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	30	+0%	100/15 Summer				49.094
1.001	2	15 Winter	30	+0%	100/15 Summer				48.903
2.000	3	15 Winter	30	+0%					49.230
1.002	4	15 Winter	30	+0%	30/15 Summer				48.827
3.000	INT A	15 Winter	30	+0%	100/15 Summer				48.801
1.003	EXS1	15 Winter	30	+0%	30/15 Summer				48.687

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.097	0.000	0.59		24.4	OK	
1.001	2	-0.012	0.000	0.56		21.4	OK	
2.000	3	-0.141	0.000	0.29		20.1	OK	
1.002	4	0.150	0.000	1.11		40.3	SURCHARGED	
3.000	INT A	-0.037	0.000	0.66		30.6	OK	
1.003	EXS1	0.047	0.000	1.33		68.3	SURCHARGED	

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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 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	0
Number of Online Controls	0	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 0.352
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	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, 30

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	+30%	100/15 Summer				49.543
1.001	2	15 Winter	100	+30%	100/15 Summer				49.357
2.000	3	15 Winter	100	+30%					49.296
1.002	4	15 Winter	100	+30%	30/15 Summer				49.173
3.000	INT A	15 Winter	100	+30%	100/15 Summer				49.139
1.003	EXS1	15 Winter	100	+30%	30/15 Summer				48.816

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.352	0.000	0.84		34.3	SURCHARGED	
1.001	2	0.442	0.000	0.87		33.2	SURCHARGED	
2.000	3	-0.075	0.000	0.49		33.8	OK	
1.002	4	0.496	0.000	1.79		64.6	SURCHARGED	
3.000	INT A	0.301	0.000	1.09		50.7	SURCHARGED	
1.003	EXS1	0.176	0.000	2.18		112.6	SURCHARGED	

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