STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	29.805	0.300	99.4	0.063	5.00	0.0	0.600		o	225	Pipe/Conduit	
1.001	26.984	0.200	134.9	0.020	0.00	0.0	0.600		o	225	Pipe/Conduit	
2.000	14.663	0.080	183.3	0.071	5.00	0.0	0.600		o	300	Pipe/Conduit	
2.001	17.174	0.001	17174.0	0.000	0.00	0.0		0.050	→_/		Pond/Tank	
3.000	6.438	0.975	6.6	0.005	5.00	0.0	0.600		o	150	Pipe/Conduit	
1.002	27.150	0.095	285.8	0.000	0.00	0.0	0.600		o	375	Pipe/Conduit	
4.000	25.153	0.250	100.6	0.067	5.00	0.0	0.600		o	225	Pipe/Conduit	
4.001	22.228	0.170	130.8	0.020	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.003	9.942	0.035	284.1	0.048	0.00	0.0	0.600		o	375	Pipe/Conduit	
5.000	23.913	0.240	99.6	0.059	5.00	0.0	0.600		o	225	Pipe/Conduit	
1.004	3.694	0.040	92.4	0.011	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	50.00	5.38	47.850	0.063	0.0	0.0	0.0	1.31	52.2	11.4
1.001	50.00	5.78	47.550	0.083	0.0	0.0	0.0	1.12	44.7	15.0
2.000	50.00	5.21	47.355	0.071	0.0	0.0	0.0	1.16	81.9	12.8
2.001	50.00	8.92	47.276	0.071	0.0	0.0	0.0	0.08	345.1	12.8
3.000	50.00	5.03	48.400	0.005	0.0	0.0	0.0	3.95	69.8	0.9
1.002	50.00	9.35	47.200	0.159	0.0	0.0	0.0	1.07	117.8	28.7
4.000	50.00	5.32	47.645	0.067	0.0	0.0	0.0	1.30	51.8	12.1
4.001	50.00	5.65	47.395	0.087	0.0	0.0	0.0	1.14	45.4	15.7
1.003	50.00	9.50	47.075	0.294	0.0	0.0	0.0	1.07	118.2	53.1
5.000	50.00	5.30	47.310	0.059	0.0	0.0	0.0	1.31	52.1	10.7
1.004	50.00	9.55	47.070	0.364	0.0	0.0	0.0	1.36	54.1«	65.7

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.063	0.063	0.063
1.001	-	-	100	0.020	0.020	0.020
2.000	-	-	100	0.071	0.071	0.071
2.001	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.005	0.005	0.005
1.002	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.067	0.067	0.067
4.001	-	-	100	0.020	0.020	0.020
1.003	-	-	100	0.048	0.048	0.048
5.000	-	-	100	0.059	0.059	0.059
1.004	-	-	100	0.011	0.011	0.011
				Total	Total	Total
				0.364	0.364	0.364

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)
1.004		49.420	47.030	47.030	225	0

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Online Controls for Storm

Orifice Manhole: S104, DS/PN: 1.004, Volume (m³): 5.4

Diameter (m) 0.150 Discharge Coefficient 0.600 Invert Level (m) 47.070

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Storage Structures for Storm

Tank or Pond Pipe: 2.001

Manning's N 0.050 Invert Level (m) 47.276

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	64.0	0.600	64.0	1.200	64.0	1.800	0.0	2.400	0.0
0.100	64.0	0.700	64.0	1.201	0.0	1.900	0.0	2.500	0.0
0.200	64.0	0.800	64.0	1.400	0.0	2.000	0.0		
0.300	64.0	0.900	64.0	1.500	0.0	2.100	0.0		
0.400	64.0	1.000	64.0	1.600	0.0	2.200	0.0		
0.500	64.0	1.100	64.0	1.700	0.0	2.300	0.0		

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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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 1.000
Region England and Wales Ratio R 0.360 Cv (Winter) 1.000

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
Return Period(s) (years) 1, 2, 5, 30, 100
Climate Change (%) 0, 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	S100	15 Summer	1	+0%	100/15 Summer				47.918	-0.157	0.000
1.001	S101	15 Summer	1	+0%	100/15 Summer				47.633	-0.142	0.000
2.000	S200	15 Summer	1	+0%	30/30 Summer				47.435	-0.220	0.000
2.001	Tank	30 Summer	1	+0%					47.377	-1.973	0.000
3.000	S300	15 Summer	1	+0%					48.409	-0.141	0.000
1.002	S102	30 Summer	1	+0%	30/15 Summer				47.377	-0.198	0.000
4.000	S400	15 Summer	1	+0%	100/15 Summer				47.716	-0.154	0.000
4.001	S401	15 Summer	1	+0%	30/15 Summer				47.481	-0.139	0.000
1.003	S103	30 Summer	1	+0%	5/15 Summer				47.371	-0.079	0.000
5.000	S500	15 Summer	1	+0%	30/15 Summer				47.378	-0.157	0.000
1.004	S104	30 Summer	1	+0%	1/15 Summer				47.364	0.069	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S100	0.20			9.5	OK	
1.001	S101	0.29			12.2	OK	
2.000	S200	0.16			10.9	OK	
2.001	Tank	0.01			7.5	OK	
3.000	S300	0.01			0.8	OK	
1.002	S102	0.13			13.1	OK	
4.000	S400	0.21			10.1	OK	
4.001	S401	0.31			12.7	OK	
1.003	S103	0.21			18.6	OK	
5.000	S500	0.19			8.9	OK	
1.004	S104	0.73			21.9	SURCHARGED	

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2 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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 1.000
Region England and Wales Ratio R 0.360 Cv (Winter) 1.000

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
Return Period(s) (years)	1, 2, 5, 30, 100
Climate Change (%)	0, 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	S100	15 Summer	2	+0%	100/15 Summer				47.927	-0.148	0.000
1.001	S101	15 Summer	2	+0%	100/15 Summer				47.646	-0.129	0.000
2.000	S200	15 Summer	2	+0%	30/30 Summer				47.447	-0.208	0.000
2.001	Tank	30 Summer	2	+0%					47.429	-1.921	0.000
3.000	S300	15 Summer	2	+0%					48.412	-0.138	0.000
1.002	S102	30 Summer	2	+0%	30/15 Summer				47.429	-0.146	0.000
4.000	S400	15 Summer	2	+0%	100/15 Summer				47.726	-0.144	0.000
4.001	S401	15 Summer	2	+0%	30/15 Summer				47.494	-0.126	0.000
1.003	S103	30 Summer	2	+0%	5/15 Summer				47.422	-0.028	0.000
5.000	S500	30 Summer	2	+0%	30/15 Summer				47.424	-0.111	0.000
1.004	S104	30 Summer	2	+0%	1/15 Summer				47.414	0.119	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S100	0.25			12.3	OK	
1.001	S101	0.38			15.7	OK	
2.000	S200	0.21			14.1	OK	
2.001	Tank	0.01			9.6	OK	
3.000	S300	0.02			1.0	OK	
1.002	S102	0.15			15.1	OK	
4.000	S400	0.27			13.1	OK	
4.001	S401	0.40			16.5	OK	
1.003	S103	0.24			20.6	OK	
5.000	S500	0.22			10.3	OK	
1.004	S104	0.81			24.4	SURCHARGED	

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5 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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 1.000
Region England and Wales Ratio R 0.360 Cv (Winter) 1.000

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
Return Period(s) (years) 1, 2, 5, 30, 100
Climate Change (%) 0, 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	S100	15 Summer	5	+0%	100/15 Summer				47.940	-0.135	0.000
1.001	S101	15 Summer	5	+0%	100/15 Summer				47.662	-0.113	0.000
2.000	S200	30 Summer	5	+0%	30/30 Summer				47.502	-0.153	0.000
2.001	Tank	30 Summer	5	+0%					47.497	-1.853	0.000
3.000	S300	15 Summer	5	+0%					48.415	-0.135	0.000
1.002	S102	30 Summer	5	+0%	30/15 Summer				47.497	-0.078	0.000
4.000	S400	15 Summer	5	+0%	100/15 Summer				47.738	-0.132	0.000
4.001	S401	15 Summer	5	+0%	30/15 Summer				47.511	-0.109	0.000
1.003	S103	30 Summer	5	+0%	5/15 Summer				47.490	0.040	0.000
5.000	S500	15 Summer	5	+0%	30/15 Summer				47.496	-0.039	0.000
1.004	S104	30 Summer	5	+0%	1/15 Summer				47.481	0.186	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S100	0.33			15.9	OK	
1.001	S101	0.49			20.3	OK	
2.000	S200	0.24			16.5	OK	
2.001	Tank	0.01			11.9	OK	
3.000	S300	0.02			1.3	OK	
1.002	S102	0.17			17.7	OK	
4.000	S400	0.36			17.0	OK	
4.001	S401	0.51			21.3	OK	
1.003	S103	0.27			23.3	SURCHARGED	
5.000	S500	0.29			13.9	OK	
1.004	S104	0.91			27.2	SURCHARGED	

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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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 1.000
Region England and Wales Ratio R 0.360 Cv (Winter) 1.000

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
Return Period(s) (years) 1, 2, 5, 30, 100
Climate Change (%) 0, 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	S100	15 Summer	30	+0%	100/15 Summer				47.961	-0.114	0.000
1.001	S101	30 Summer	30	+0%	100/15 Summer				47.701	-0.074	0.000
2.000	S200	30 Summer	30	+0%	30/30 Summer				47.688	0.033	0.000
2.001	Tank	30 Summer	30	+0%					47.681	-1.669	0.000
3.000	S300	15 Summer	30	+0%					48.417	-0.133	0.000
1.002	S102	30 Summer	30	+0%	30/15 Summer				47.681	0.106	0.000
4.000	S400	15 Summer	30	+0%	100/15 Summer				47.769	-0.101	0.000
4.001	S401	60 Summer	30	+0%	30/15 Summer				47.707	0.087	0.000
1.003	S103	60 Summer	30	+0%	5/15 Summer				47.723	0.273	0.000
5.000	S500	60 Summer	30	+0%	30/15 Summer				47.724	0.189	0.000
1.004	S104	60 Summer	30	+0%	1/15 Summer				47.721	0.426	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S100	0.48			23.2	OK	
1.001	S101	0.68			28.4	OK	
2.000	S200	0.35			23.6	SURCHARGED	
2.001	Tank	0.02			14.1	OK	
3.000	S300	0.03			1.9	OK	
1.002	S102	0.25			25.7	SURCHARGED	
4.000	S400	0.52			24.8	OK	
4.001	S401	0.48			19.8	SURCHARGED	
1.003	S103	0.31			27.0	SURCHARGED	
5.000	S500	0.29			13.8	SURCHARGED	
1.004	S104	1.01			30.3	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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 1.000
Region England and Wales Ratio R 0.360 Cv (Winter) 1.000

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
Return Period(s) (years) 1, 2, 5, 30, 100
Climate Change (%) 0, 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	S100	60 Summer	100	+40%	100/15 Summer				48.310	0.235	0.000
1.001	S101	60 Summer	100	+40%	100/15 Summer				48.289	0.514	0.000
2.000	S200	60 Summer	100	+40%	30/30 Summer				48.273	0.618	0.000
2.001	Tank	60 Summer	100	+40%					48.266	-1.084	0.000
3.000	S300	15 Summer	100	+40%					48.423	-0.127	0.000
1.002	S102	60 Summer	100	+40%	30/15 Summer				48.267	0.692	0.000
4.000	S400	30 Summer	100	+40%	100/15 Summer				48.373	0.503	0.000
4.001	S401	120 Summer	100	+40%	30/15 Summer				48.471	0.851	0.000
1.003	S103	120 Summer	100	+40%	5/15 Summer				48.583	1.133	0.000
5.000	S500	120 Summer	100	+40%	30/15 Summer				48.359	0.824	0.000
1.004	S104	120 Summer	100	+40%	1/15 Summer				48.579	1.284	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S100	0.58			28.1	SURCHARGED	
1.001	S101	0.76			31.6	SURCHARGED	
2.000	S200	0.44			30.4	SURCHARGED	
2.001	Tank	0.02			19.6	OK	
3.000	S300	0.06			3.4	OK	
1.002	S102	0.31			31.4	SURCHARGED	
4.000	S400	0.78			37.3	SURCHARGED	
4.001	S401	0.53			22.0	SURCHARGED	
1.003	S103	0.45			38.9	SURCHARGED	
5.000	S500	0.31			14.8	SURCHARGED	
1.004	S104	1.38			41.1	SURCHARGED	

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