STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for 30571 SW NET 2 240205.SWS

Pipe Sizes 30571 SW NET 2 240205 Manhole Sizes 30571 SW NET 2 240205

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.359	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Maximum Backdrop Height (m)	0.000
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)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for 30571 SW NET 2 240205.SWS

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	52.862	0.132	400.5	0.116	5.00	0.0	0.600	o	1050	Pipe/Conduit	
1.001	47.905	0.120	399.2	0.081	0.00	0.0	0.600	o	1050	Pipe/Conduit	
1.002	23.992	0.060	399.9	0.170	0.00	0.0	0.600	o	1050	Pipe/Conduit	
2.000	50.007	0.125	400.1	0.143	5.00	0.0	0.600	o	1050	Pipe/Conduit	
1.003	58.607	0.147	398.7	0.056	0.00	0.0	0.600	o	1050	Pipe/Conduit	
1.004	55.780	0.139	401.3	0.174	0.00	0.0	0.600	o	1050	Pipe/Conduit	
1.005	13.822	0.035	394.9	0.103	0.00	0.0	0.600	o	1050	Pipe/Conduit	
1.006	11.522	0.077	149.6	0.000	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	0.00	5.51	59.692	0.116	0.0	0.0	0.0	1.72	1485.7	0.0
1.001	0.00	5.98	59.560	0.197	0.0	0.0	0.0	1.72	1488.1	0.0
1.002	0.00	6.21	59.440	0.367	0.0	0.0	0.0	1.72	1486.9	0.0
2.000	0.00	5.49	59.505	0.143	0.0	0.0	0.0	1.72	1486.5	0.0
1.003	0.00	6.78	59.380	0.566	0.0	0.0	0.0	1.72	1489.1	0.0
1.004	0.00	7.32	59.233	0.740	0.0	0.0	0.0	1.71	1484.2	0.0
1.005	0.00	7.45	59.094	0.843	0.0	0.0	0.0	1.73	1496.2	0.0
1.006	0.00	7.63	59.059	0.843	0.0	0.0	0.0	1.07	42.4	0.0

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Network Design Table for 30571 SW NET 2 240205.SWS

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
1.007	3.456	0.023	150.3	0.000	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)
1.007	0.00	7.69	58.982	0.843	0.0	0.0	0.0	1.06	42.3	0.0

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Online Controls for 30571 SW NET 2 240205.SWS

Hydro-Brake® Optimum Manhole: 30, DS/PN: 1.006, Volume (m³): 23.9

Unit Reference	MD-SHE-0124-1000-2500-1000
Design Head (m)	2.500
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	124
Invert Level (m)	59.059
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.500	10.0	Kick-Flo®	1.107	6.8
Flush-Flo™	0.539	8.6	Mean Flow over Head Range	-	8.0

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	4.4	1.200	7.1	3.000	10.9	7.000	16.3
0.200	7.4	1.400	7.6	3.500	11.7	7.500	16.9
0.300	8.1	1.600	8.1	4.000	12.5	8.000	17.4
0.400	8.5	1.800	8.6	4.500	13.2	8.500	17.9
0.500	8.6	2.000	9.0	5.000	13.9	9.000	18.4
0.600	8.6	2.200	9.4	5.500	14.5	9.500	18.9
0.800	8.3	2.400	9.8	6.000	15.2		
1.000	7.6	2.600	10.2	6.500	15.7		

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Storage Structures for 30571 SW NET 2 240205.SWS

Cellular Storage Manhole: 31, DS/PN: 1.005

Invert Level (m) 60.050 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	123.5	0.0	0.801	0.0	0.0
0.800	123.5	0.0			

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 30571 SW NET 2 240205.SWS

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	Ratio R	0.359
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	150.0
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, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 40, 45

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	36	15 Winter	1	+0%	100/120 Winter				59.769
1.001	35	15 Winter	1	+0%	100/120 Winter				59.671
1.002	34	120 Winter	1	+0%	100/60 Winter				59.646
2.000	37	120 Winter	1	+0%	100/120 Summer				59.645
1.003	33	120 Winter	1	+0%	100/60 Winter				59.645
1.004	32	120 Winter	1	+0%	30/120 Winter				59.645
1.005	31	120 Winter	1	+0%	30/60 Winter				59.643
1.006	30	120 Winter	1	+0%	1/15 Summer				59.642
1.007	29	120 Winter	1	+0%					59.067

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 30571 SW NET 2 240205.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	36	-0.973	0.000	0.01		13.5	OK	
1.001	35	-0.939	0.000	0.02		20.7	OK	
1.002	34	-0.844	0.000	0.01		14.2	OK	
2.000	37	-0.910	0.000	0.00		5.8	OK	
1.003	33	-0.785	0.000	0.02		19.3	OK	
1.004	32	-0.638	0.000	0.02		18.4	OK	
1.005	31	-0.501	0.000	0.02		11.5	OK	
1.006	30	0.358	0.000	0.24		8.6	SURCHARGED	
1.007	29	-0.140	0.000	0.31		8.6	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 30571 SW NET 2 240205.SWS

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	Ratio R	0.359
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	150.0
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, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 40, 45

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	36	240 Winter	30	+40%	100/120 Winter				60.382
1.001	35	240 Winter	30	+40%	100/120 Winter				60.382
1.002	34	240 Winter	30	+40%	100/60 Winter				60.382
2.000	37	240 Winter	30	+40%	100/120 Summer				60.381
1.003	33	240 Winter	30	+40%	100/60 Winter				60.381
1.004	32	240 Winter	30	+40%	30/120 Winter				60.376
1.005	31	240 Winter	30	+40%	30/60 Winter				60.376
1.006	30	240 Winter	30	+40%	1/15 Summer				60.391
1.007	29	1440 Summer	30	+40%					59.067

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 30571 SW NET 2 240205.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	36	-0.360	0.000	0.01		8.9	OK	
1.001	35	-0.228	0.000	0.01		9.0	OK	
1.002	34	-0.108	0.000	0.01		13.4	OK	
2.000	37	-0.174	0.000	0.01		11.1	OK	
1.003	33	-0.049	0.000	0.01		15.0	OK	
1.004	32	0.093	0.000	0.02		19.5	SURCHARGED	
1.005	31	0.232	0.000	0.02		12.2	SURCHARGED	
1.006	30	1.107	0.000	0.24		8.6	SURCHARGED	
1.007	29	-0.140	0.000	0.31		8.6	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 30571 SW NET 2 240205.SWS

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	Ratio R	0.359
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	150.0
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, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 40, 45

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	36	240 Winter	100	+45%	100/120 Winter				61.563
1.001	35	240 Winter	100	+45%	100/120 Winter				61.563
1.002	34	240 Winter	100	+45%	100/60 Winter				61.563
2.000	37	240 Winter	100	+45%	100/120 Summer				61.563
1.003	33	240 Winter	100	+45%	100/60 Winter				61.563
1.004	32	240 Winter	100	+45%	30/120 Winter				61.563
1.005	31	240 Winter	100	+45%	30/60 Winter				61.564
1.006	30	240 Winter	100	+45%	1/15 Summer				61.563
1.007	29	240 Winter	100	+45%					59.074

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 30571 SW NET 2 240205.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	36	0.821	0.000	0.01		12.0	SURCHARGED	
1.001	35	0.953	0.000	0.01		13.6	SURCHARGED	
1.002	34	1.073	0.000	0.03		27.3	SURCHARGED	
2.000	37	1.008	0.000	0.01		15.0	SURCHARGED	
1.003	33	1.133	0.000	0.03		35.7	SURCHARGED	
1.004	32	1.280	0.000	0.04		45.5	FLOOD RISK	
1.005	31	1.420	0.000	0.03		24.3	SURCHARGED	
1.006	30	2.279	0.000	0.28		10.0	SURCHARGED	
1.007	29	-0.133	0.000	0.36		10.0	OK	

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