

Stephen Daykin Consulting Ltd		Page 0
33 Beaumaris Drive Gedling Nottingham NG4 2RA		
Date 01/01/0001 File E970 STORM SYSTEM 1 V5 ...	Designed by SteveDaykin Checked by	
Innovyze	Network 2018.1.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for NETWORK 1.SWS

Pipe Sizes E970 - NETWORK 4 (V2) Manhole Sizes E970 - NETWORK 4 (V2)

FSR Rainfall Model - England and Wales			
Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	10
Ratio R	0.400	Minimum Backdrop Height (m)	0.200
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.	1.000	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for NETWORK 1.SWS

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.396	4-8	0.185

Total Area Contributing (ha) = 0.581

Total Pipe Volume (m³) = 30.736

Network Design Table for NETWORK 1.SWS

- Indicates pipe length does not match coordinates

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	35.155	0.800	43.9	0.100	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	25.851	0.650	39.8	0.132	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	34.194	1.750	19.5	0.038	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	68.361	4.775	14.3	0.069	0.00	0.0	0.600	o	300	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	5.30	117.625	0.100	0.0	0.0	0.0	1.98	78.7	0.0
1.001	0.00	5.47	116.750	0.232	0.0	0.0	0.0	2.50	176.8	0.0
1.002	0.00	5.63	116.100	0.270	0.0	0.0	0.0	3.57	252.6	0.0
1.003	0.00	5.90	114.350	0.339	0.0	0.0	0.0	4.18	295.2	0.0

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Network Design Table for NETWORK 1.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
2.000	31.145	1.175	26.5	0.083	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	38.261	1.619	23.6	0.113	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.005	9.572	0.331	28.9	0.046	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.006	22.613#	0.750	30.2	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.007	28.872#	0.275	105.0	0.000	0.00	0.0	0.600	oo	43	Pipe/Conduit	
1.008	7.507	0.050	150.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.009	5.000	0.050	100.0	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)
2.000	0.00	5.20	110.825	0.083	0.0	0.0	0.0	2.55	101.4	0.0
1.004	0.00	6.07	109.500	0.535	0.0	0.0	0.0	3.74	413.2	0.0
1.005	0.00	6.11	107.806	0.581	0.0	0.0	0.0	3.79	603.1	0.0
1.006	0.00	6.21	107.475	0.581	0.0	0.0	0.0	3.71	590.6	0.0
1.007	0.00	6.46	106.725	0.581	0.0	0.0	0.0	1.98	630.8	0.0
1.008	0.00	6.57	106.450	0.581	0.0	0.0	0.0	1.06	42.3	0.0
1.009	0.00	6.64	106.400	0.581	0.0	0.0	0.0	1.31	52.0	0.0

Simulation Criteria for NETWORK 1.SWS

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	7.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	1.000
Hot Start (mins)	0	Inlet Coefficient	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 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	Profile Type	Winter
Return Period (years)	5	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.000	Storm Duration (mins)	30
Ratio R	0.400		

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Online Controls for NETWORK 1.SWS

Hydro-Brake® Optimum Manhole: 107, DS/PN: 1.008, Volume (m³): 17.8

Unit Reference	MD-SHE-0102-5000-1250-5000
Design Head (m)	1.250
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	102
Invert Level (m)	106.450
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	5.0
Flush-Flo™	0.370	5.0
Kick-Flo®	0.772	4.0
Mean Flow over Head Range	-	4.4

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	3.4	1.200	4.9	3.000	7.5	7.000	11.2
0.200	4.7	1.400	5.3	3.500	8.1	7.500	11.6
0.300	5.0	1.600	5.6	4.000	8.6	8.000	12.0
0.400	5.0	1.800	5.9	4.500	9.1	8.500	12.3
0.500	4.9	2.000	6.2	5.000	9.6	9.000	12.7
0.600	4.7	2.200	6.5	5.500	10.0	9.500	13.0
0.800	4.1	2.400	6.8	6.000	10.4		
1.000	4.5	2.600	7.0	6.500	10.9		

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<u>Storage Structures for NETWORK 1.SWS</u> <u>Tank or Pond Manhole: 107, DS/PN: 1.008</u> Invert Level (m) 106.500 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>337.0</td><td>1.200</td><td>687.0</td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	337.0	1.200	687.0
Depth (m)	Area (m²)	Depth (m)	Area (m²)							
0.000	337.0	1.200	687.0							
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Summary of Critical Results by Maximum Level (Rank 1) for NETWORK 1.SWS

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 7.000
 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 1.000
 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 0.400
 Region England and Wales Cv (Summer) 1.000
 M5-60 (mm) 19.900 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status OFF
 Inertia Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 30, 60, 120, 180, 240, 360, 480, 600, 720,
 960, 1440, 2160, 2880, 4320, 5760, 7200,
 8640, 10080
 Return Period(s) (years) 100
 Climate Change (%) 40

										Water
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.		Level (m)
1.000	100	30 Summer	100	+40%	100/30 Summer					118.017
1.001	101	30 Summer	100	+40%	100/30 Summer					117.201
1.002	102	30 Summer	100	+40%						116.321
1.003	103	30 Summer	100	+40%						114.578
2.000	110	30 Summer	100	+40%						110.960
1.004	104	30 Summer	100	+40%	100/30 Summer					110.437
1.005	109	30 Summer	100	+40%	100/30 Summer					108.516
1.006	105	30 Summer	100	+40%						107.809
1.007	106	600 Winter	100	+40%	100/60 Summer					107.446
1.008	107	600 Winter	100	+40%	100/30 Summer					107.445
1.009	11	600 Winter	100	+40%	100/360 Summer					106.814

		Surcharged Flooded				Pipe			
PN	US/MH Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded	
1.000	100	0.167	0.000	1.02		75.4	SURCHARGED		

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Summary of Critical Results by Maximum Level (Rank 1) for NETWORK 1.SWS

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Pipe Flow	Status	Level Exceeded
		Depth (m)	Volume (m ³)	Cap.	(l/s)	(l/s)		
1.001	101	0.151	0.000	1.11		176.4	SURCHARGED	
1.002	102	-0.079	0.000	0.89		206.1	OK	
1.003	103	-0.072	0.000	0.92		260.2	OK	
2.000	110	-0.090	0.000	0.67		63.4	OK	
1.004	104	0.562	0.000	1.07		401.1	SURCHARGED	
1.005	109	0.260	0.000	1.34		435.5	FLOOD RISK	
1.006	105	-0.116	0.000	0.90		437.1	OK	
1.007	106	0.271	0.000	0.08		41.6	SURCHARGED	
1.008	107	0.770	0.000	0.16		5.0	SURCHARGED	
1.009	11	0.189	0.000	0.16		5.0	SURCHARGED	