

Stephen Daykin Consulting Ltd		Page 0
33 Beaumaris Drive Gedling Nottingham NG4 2RA		
Date 01/01/0001 File e970 network 2 v5 augus...	Designed by SteveDaykin Checked by	
Innovyze	Network 2018.1.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for E970 - NETWORK 2 (V2).SWS

Pipe Sizes E970 - NETWORK 2 (V2) Manhole Sizes E970 - NETWORK 2 (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.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for E970 - NETWORK 2 (V2).SWS

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.959	4-8	0.618

Total Area Contributing (ha) = 1.577

Total Pipe Volume (m³) = 90.762

Network Design Table for E970 - NETWORK 2 (V2).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	22.288	0.200	111.4	0.154	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	18.448	0.275	67.1	0.054	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	57.679	0.375	153.8	0.133	5.00	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	5.25	119.425	0.154	0.0	0.0	0.0	1.49	105.2	0.0
1.001	0.00	5.41	119.225	0.208	0.0	0.0	0.0	1.92	135.9	0.0
2.000	0.00	5.76	119.325	0.133	0.0	0.0	0.0	1.27	89.4	0.0

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Network Design Table for E970 - NETWORK 2 (V2).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
1.002	69.832	3.075	22.7	0.152	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	51.877	3.150	16.5	0.221	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.000	55.541#	0.450	123.4	0.171	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	46.198	2.596	17.8	0.151	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.000	43.103	0.181	238.1	0.161	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	63.100	2.429	26.0	0.176	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.006	27.815	0.100	278.2	0.142	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.007	11.291	0.075	150.5	0.062	0.00	0.0	0.600	ooo	49	Pipe/Conduit	
1.008	26.528	0.375	70.7	0.000	0.00	0.0	0.600	ooo	49	Pipe/Conduit	
1.009	9.759	0.400	24.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.010	5.000	0.050	100.0	0.000	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)
1.002	0.00	6.11	118.950	0.493	0.0	0.0	0.0	3.31	234.2	0.0
1.003	0.00	6.30	115.800	0.714	0.0	0.0	0.0	4.48	495.2	0.0
3.000	0.00	5.65	113.100	0.171	0.0	0.0	0.0	1.41	99.9	0.0
1.004	0.00	6.46	112.575	1.036	0.0	0.0	0.0	4.84	769.3	0.0
4.000	0.00	5.71	110.310	0.161	0.0	0.0	0.0	1.01	71.7	0.0
1.005	0.00	6.68	109.829	1.373	0.0	0.0	0.0	4.79	1354.5	0.0
1.006	0.00	7.00	107.400	1.515	0.0	0.0	0.0	1.46	411.4	0.0
1.007	0.00	7.10	107.300	1.577	0.0	0.0	0.0	1.98	1680.8	0.0
1.008	0.00	7.25	107.225	1.577	0.0	0.0	0.0	2.90	2457.0	0.0
1.009	0.00	7.30	106.775	1.577	0.0	0.0	0.0	3.20	225.9	0.0
1.010	0.00	7.35	106.375	1.577	0.0	0.0	0.0	1.57	111.1	0.0

Simulation Criteria for E970 - NETWORK 2 (V2).SWS

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	7.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
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	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

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Simulation Criteria for E970 - NETWORK 2 (V2).SWS

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 E970 - NETWORK 2 (V2).SWS

Hydro-Brake® Optimum Manhole: 209, DS/PN: 1.009, Volume (m³): 31.8

Unit Reference	MD-SHE-0139-1000-1450-1000
Design Head (m)	1.450
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	139
Invert Level (m)	106.850
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.450	10.0
Flush-Flo™	0.430	10.0
Kick-Flo®	0.911	8.0
Mean Flow over Head Range	-	8.7

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	5.0	1.200	9.1	3.000	14.1	7.000	21.2
0.200	9.1	1.400	9.8	3.500	15.2	7.500	21.9
0.300	9.8	1.600	10.5	4.000	16.2	8.000	22.6
0.400	10.0	1.800	11.1	4.500	17.1	8.500	23.2
0.500	10.0	2.000	11.6	5.000	18.0	9.000	23.9
0.600	9.8	2.200	12.2	5.500	18.8	9.500	24.5
0.800	9.1	2.400	12.7	6.000	19.6		
1.000	8.4	2.600	13.2	6.500	20.4		

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<u>Storage Structures for E970 - NETWORK 2 (V2).SWS</u> <u>Tank or Pond Manhole: 209, DS/PN: 1.009</u> Invert Level (m) 106.900 <table><tr><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td></tr><tr><td>0.000</td><td>658.0</td><td>1.500</td><td>1208.0</td><td>1.550</td><td>1431.0</td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	658.0	1.500	1208.0	1.550	1431.0
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)									
0.000	658.0	1.500	1208.0	1.550	1431.0									
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Summary of Critical Results by Maximum Level (Rank 1) for E970 - NETWORK 2 (V2).SWS

Simulation Criteria

Areal Reduction Factor 1.000

Additional Flow - % of Total Flow 7.000

Hot Start (mins) 0

MADD Factor * 10m³/ha Storage 0.000

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 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) 20.000

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	200	30 Summer	100	+40%	100/30 Summer			
1.001	201	30 Summer	100	+40%	100/30 Summer			
2.000	212	30 Summer	100	+40%	100/30 Summer	100/30 Summer		
1.002	202	30 Summer	100	+40%	100/30 Summer	100/30 Summer		
1.003	203	30 Summer	100	+40%				
3.000	214	30 Summer	100	+40%	100/30 Summer			
1.004	204	30 Summer	100	+40%				
4.000	216	30 Summer	100	+40%	100/30 Summer			
1.005	205	30 Summer	100	+40%				
1.006	206	30 Summer	100	+40%	100/30 Summer			
1.007	207	960 Summer	100	+40%	100/60 Summer			
1.008	208	960 Summer	100	+40%	100/60 Summer			
1.009	209	960 Summer	100	+40%	100/30 Summer			
1.010	14	4320 Winter	100	+40%	100/30 Summer			

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Summary of Critical Results by Maximum Level (Rank 1) for E970 - NETWORK 2 (V2).SWS

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	200	121.491	1.766	0.000	1.22	113.4	FLOOD RISK	
1.001	201	121.170	1.645	0.000	1.29	151.7	FLOOD RISK	
2.000	212	121.009	1.384	2.514	0.96	81.2	FLOOD	1
1.002	202	120.665	1.415	10.354	1.21	271.4	FLOOD	1
1.003	203	116.098	-0.077	0.000	0.97	445.2	OK	
3.000	214	113.811	0.411	0.000	1.35	127.7	SURCHARGED	
1.004	204	112.945	-0.080	0.000	1.00	691.6	OK	
4.000	216	111.032	0.422	0.000	1.79	120.1	SURCHARGED	
1.005	205	110.390	-0.039	0.000	0.76	929.4	OK	
1.006	206	108.949	0.949	0.000	3.12	1032.4	SURCHARGED	
1.007	207	108.423	0.523	0.000	0.12	122.8	SURCHARGED	
1.008	208	108.422	0.597	0.000	0.07	122.5	FLOOD RISK	
1.009	209	108.422	1.347	0.000	0.06	10.0	FLOOD RISK	
1.010	14	107.258	0.583	0.000	0.16	10.0	SURCHARGED	