

Stephen Daykin Consulting Ltd		Page 0
33 Beaumaris Drive Gedling Nottingham NG4 2RA		
Date 01/01/0001 File E970 NETWORK 4 V5AUG 26...	Designed by SteveDaykin Checked by	
Innovyze	Network 2018.1.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for NETWORK 4 STORM REV A.SWS

Pipe Sizes NETWORK 3 STORM Manhole Sizes NETWORK 3 STORM

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 4 STORM REV A.SWS

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	1.921	4-8	2.329	8-12	0.034

Total Area Contributing (ha) = 4.284

Total Pipe Volume (m³) = 418.441

Network Design Table for NETWORK 4 STORM REV A.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	30.959	0.225	137.6	0.142	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	27.031	0.114	237.1	0.195	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.002	67.228	0.405	166.0	0.134	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.003	32.467	0.345	94.1	0.275	0.00	0.0	0.600	o	525	Pipe/Conduit	
2.000	60.158	0.950	63.3	0.243	5.00	0.0	0.600	o	375	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	5.39	122.414	0.142	0.0	0.0	0.0	1.34	94.6	0.0
1.001	0.00	5.77	122.114	0.337	0.0	0.0	0.0	1.17	129.5	0.0
1.002	0.00	6.42	121.850	0.471	0.0	0.0	0.0	1.74	375.8	0.0
1.003	0.00	6.65	121.445	0.746	0.0	0.0	0.0	2.31	499.9	0.0
2.000	0.00	5.44	122.200	0.243	0.0	0.0	0.0	2.28	251.8	0.0

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Network Design Table for NETWORK 4 STORM REV A.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
1.004	17.304	0.464	37.3	0.097	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.005	34.071	1.111	30.7	0.376	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.006	34.063	1.250	27.3	0.061	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.007	62.646	2.300	27.2	0.226	0.00	0.0	0.600	o	675	Pipe/Conduit	
1.008	28.410	1.225	23.2	0.174	0.00	0.0	0.600	o	675	Pipe/Conduit	
1.009	30.026	1.200	25.0	0.091	0.00	0.0	0.600	o	675	Pipe/Conduit	
3.000	34.320	0.206	166.6	0.072	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.010	49.856	1.950	25.6	0.102	0.00	0.0	0.600	o	675	Pipe/Conduit	
4.000	12.010	0.148	81.1	0.135	5.00	0.0	0.600	o	375	Pipe/Conduit	
1.011	19.167	0.225	85.2	0.025	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.012	58.420	1.700	34.4	0.043	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.013	33.503	0.925	36.2	0.089	0.00	0.0	0.600	o	825	Pipe/Conduit	
1.014	9.954	0.200	49.8	0.077	0.00	0.0	0.600	o	825	Pipe/Conduit	
1.015	13.191	0.175	75.4	0.049	0.00	0.0	0.600	o	825	Pipe/Conduit	
1.016	51.598	0.125	412.8	0.000	0.00	0.0	0.600	ooo	-1	Pipe/Conduit	
5.000	60.597	0.625	97.0	0.088	5.00	0.0	0.600	o	300	Pipe/Conduit	
5.001	7.893	0.175	45.1	0.104	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)
1.004	0.00	6.72	121.025	1.086	0.0	0.0	0.0	4.00	1129.9	0.0
1.005	0.00	6.85	120.561	1.462	0.0	0.0	0.0	4.41	1246.4	0.0
1.006	0.00	6.97	119.450	1.523	0.0	0.0	0.0	4.68	1322.4	0.0
1.007	0.00	7.18	118.125	1.749	0.0	0.0	0.0	5.03	1801.5	0.0
1.008	0.00	7.27	115.825	1.923	0.0	0.0	0.0	5.46	1952.7	0.0
1.009	0.00	7.36	114.600	2.014	0.0	0.0	0.0	5.25	1879.8	0.0
3.000	0.00	5.47	113.829	0.072	0.0	0.0	0.0	1.22	85.9	0.0
1.010	0.00	7.52	113.400	2.188	0.0	0.0	0.0	5.20	1859.6	0.0
4.000	0.00	5.10	111.898	0.135	0.0	0.0	0.0	2.01	222.3	0.0
1.011	0.00	7.63	111.375	2.348	0.0	0.0	0.0	3.03	1340.1	0.0
1.012	0.00	7.83	111.150	2.391	0.0	0.0	0.0	4.78	2113.2	0.0
1.013	0.00	7.94	109.375	2.480	0.0	0.0	0.0	4.94	2642.0	0.0
1.014	0.00	7.98	108.450	2.557	0.0	0.0	0.0	4.21	2252.8	0.0
1.015	0.00	8.05	108.250	2.606	0.0	0.0	0.0	3.42	1829.3	0.0
1.016	0.00	8.67	108.075	2.606	0.0	0.0	0.0	1.37	1817.2	0.0
5.000	0.00	5.63	118.825	0.088	0.0	0.0	0.0	1.60	112.9	0.0
5.001	0.00	5.69	118.200	0.192	0.0	0.0	0.0	2.35	165.9	0.0

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Network Design Table for NETWORK 4 STORM REV A.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
6.000	30.367	0.325	93.4	0.064	5.00	0.0	0.600	o	300	Pipe/Conduit	
6.001	13.173	0.100	131.7	0.066	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.002	51.406	1.904	27.0	0.065	0.00	0.0	0.600	o	375	Pipe/Conduit	
7.000	29.736	0.154	193.1	0.112	5.00	0.0	0.600	o	300	Pipe/Conduit	
7.001	33.660	0.175	192.3	0.097	0.00	0.0	0.600	o	375	Pipe/Conduit	
5.003	41.926	1.346	31.1	0.155	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.004	19.038	0.651	29.2	0.098	0.00	0.0	0.600	o	525	Pipe/Conduit	
5.005	24.947	0.520	48.0	0.025	0.00	0.0	0.600	o	525	Pipe/Conduit	
5.006	32.715	0.682	48.0	0.077	0.00	0.0	0.600	o	525	Pipe/Conduit	
5.007	15.540	0.247	62.9	0.140	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.008	13.284	0.275	48.3	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.009	29.746	0.600	49.6	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.010	46.230	0.600	77.1	0.099	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.011	23.312	0.450	51.8	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.012	36.333	1.300	27.9	0.073	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.013	44.602	1.075	41.5	0.090	0.00	0.0	0.600	o	600	Pipe/Conduit	
5.014	49.736	0.125	397.9	0.000	0.00	0.0	0.600	ooo	49	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)
6.000	0.00	5.31	118.450	0.064	0.0	0.0	0.0	1.63	115.0	0.0
6.001	0.00	5.47	118.125	0.130	0.0	0.0	0.0	1.37	96.7	0.0
5.002	0.00	5.93	117.950	0.387	0.0	0.0	0.0	3.50	386.5	0.0
7.000	0.00	5.44	116.450	0.112	0.0	0.0	0.0	1.13	79.7	0.0
7.001	0.00	5.87	116.221	0.209	0.0	0.0	0.0	1.30	143.9	0.0
5.003	0.00	6.12	115.971	0.751	0.0	0.0	0.0	3.65	581.0	0.0
5.004	0.00	6.20	114.550	0.849	0.0	0.0	0.0	4.15	899.1	0.0
5.005	0.00	6.33	113.899	0.874	0.0	0.0	0.0	3.24	701.3	0.0
5.006	0.00	6.50	113.379	0.951	0.0	0.0	0.0	3.24	701.4	0.0
5.007	0.00	6.58	112.622	1.091	0.0	0.0	0.0	3.07	869.1	0.0
5.008	0.00	6.64	112.375	1.091	0.0	0.0	0.0	3.51	992.3	0.0
5.009	0.00	6.79	112.100	1.091	0.0	0.0	0.0	3.46	979.5	0.0
5.010	0.00	7.07	111.500	1.190	0.0	0.0	0.0	2.78	785.0	0.0
5.011	0.00	7.18	110.900	1.190	0.0	0.0	0.0	3.39	958.1	0.0
5.012	0.00	7.31	110.450	1.263	0.0	0.0	0.0	4.62	1305.8	0.0
5.013	0.00	7.51	109.150	1.353	0.0	0.0	0.0	3.79	1071.0	0.0
5.014	0.00	8.19	108.075	1.353	0.0	0.0	0.0	1.21	1029.8	0.0

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Online Controls for NETWORK 4 STORM REV A.SWS

Hydro-Brake® Optimum Manhole: 415, DS/PN: 1.017, Volume (m³): 121.0

Unit Reference	MD-SHE-0227-2900-1450-2900
Design Head (m)	1.450
Design Flow (l/s)	29.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	227
Invert Level (m)	107.950
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.450	29.0
Flush-Flo™	0.448	29.0
Kick-Flo®	0.987	24.1
Mean Flow over Head Range	-	24.8

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	7.6	1.200	26.5	3.000	41.1	7.000	62.0
0.200	22.7	1.400	28.5	3.500	44.3	7.500	64.1
0.300	28.2	1.600	30.4	4.000	47.2	8.000	66.1
0.400	28.9	1.800	32.2	4.500	50.0	8.500	68.1
0.500	28.9	2.000	33.8	5.000	52.6	9.000	70.0
0.600	28.6	2.200	35.4	5.500	55.1	9.500	71.9
0.800	27.4	2.400	36.9	6.000	57.5		
1.000	24.3	2.600	38.4	6.500	59.8		

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Summary of Critical Results by Maximum Level (Rank 1) for NETWORK 4 STORM

REV A.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 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)

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) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	400 30 Summer	100	+40%	100/30 Summer					123.534
1.001	420 30 Summer	100	+40%	100/30 Summer					123.220
1.002	401 30 Summer	100	+40%	100/30 Summer					122.670
1.003	452 30 Summer	100	+40%	100/30 Summer					122.252
2.000	418 30 Summer	100	+40%						122.453
1.004	402 30 Summer	100	+40%	100/30 Summer					121.710
1.005	450 30 Summer	100	+40%						121.049
1.006	403 30 Summer	100	+40%						119.923
1.007	405 30 Summer	100	+40%						118.574
1.008	406 30 Summer	100	+40%	100/30 Summer					116.798
1.009	407 30 Summer	100	+40%	100/30 Summer					115.782
3.000	421 30 Summer	100	+40%	100/30 Summer					114.758
1.010	408 30 Summer	100	+40%	100/30 Summer					114.685
4.000	453 30 Summer	100	+40%	100/30 Summer					113.178
1.011	409 30 Summer	100	+40%	100/30 Summer					113.136
1.012	410 30 Summer	100	+40%	100/30 Summer					112.206
1.013	411 30 Summer	100	+40%	100/30 Summer					111.011

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Summary of Critical Results by Maximum Level (Rank 1) for NETWORK 4 STORM
REV A.SWS

PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
1.000	400	0.820	0.000	1.22		105.1	FLOOD RISK	
1.001	420	0.731	0.000	2.21		249.6	SURCHARGED	
1.002	401	0.295	0.000	0.98		338.8	SURCHARGED	
1.003	452	0.282	0.000	1.23		521.9	SURCHARGED	
2.000	418	-0.122	0.000	0.79		186.0	OK	
1.004	402	0.085	0.000	1.12		761.8	SURCHARGED	
1.005	450	-0.112	0.000	0.97		1007.9	OK	
1.006	403	-0.127	0.000	0.96		1051.0	OK	
1.007	405	-0.226	0.000	0.76		1215.4	OK	
1.008	406	0.298	0.000	0.93		1304.7	SURCHARGED	
1.009	407	0.507	0.000	0.96		1337.5	SURCHARGED	
3.000	421	0.629	0.000	0.60		47.6	SURCHARGED	
1.010	408	0.610	0.000	0.89		1425.2	SURCHARGED	
4.000	453	0.905	0.000	0.65		98.5	FLOOD RISK	
1.011	409	1.011	0.000	2.04		1511.4	FLOOD RISK	
1.012	410	0.306	0.000	0.84		1531.3	SURCHARGED	
1.013	411	0.811	0.000	0.86		1569.4	SURCHARGED	

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Summary of Critical Results by Maximum Level (Rank 1) for NETWORK 4 STORM
REV A.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.014	412	30 Summer	100	+40%	100/30 Summer			
1.015	413	30 Summer	100	+40%	100/30 Summer			
1.016	414	720 Winter	100	+40%	100/60 Summer			
5.000	423	30 Summer	100	+40%				
5.001	424	30 Summer	100	+40%	100/30 Summer			
6.000	442	30 Summer	100	+40%				
6.001	443	30 Summer	100	+40%	100/30 Summer			
5.002	425	30 Summer	100	+40%				
7.000	480	30 Summer	100	+40%	100/30 Summer			
7.001	481	30 Summer	100	+40%	100/30 Summer			
5.003	455	30 Summer	100	+40%	100/30 Summer			
5.004	426	30 Summer	100	+40%	100/30 Summer			
5.005	427	30 Summer	100	+40%	100/30 Summer			
5.006	429	30 Summer	100	+40%	100/30 Summer			
5.007	431	30 Summer	100	+40%	100/30 Summer			
5.008	432	30 Summer	100	+40%	100/30 Summer			
5.009	433	30 Summer	100	+40%	100/30 Summer			
5.010	435	30 Summer	100	+40%	100/30 Summer			
5.011	436	30 Summer	100	+40%	100/30 Summer			
5.012	437	30 Summer	100	+40%				
5.013	439	30 Summer	100	+40%				
5.014	440	720 Winter	100	+40%	100/30 Summer			
8.000	445	30 Summer	100	+40%	100/30 Summer			
8.001	446	30 Summer	100	+40%	100/30 Summer			
8.002	451	30 Summer	100	+40%	100/30 Summer			
8.003	447	30 Summer	100	+40%	100/30 Summer			
8.004	448	720 Winter	100	+40%	100/30 Summer			
1.017	415	720 Winter	100	+40%	100/30 Summer			
1.018	49	10080 Summer	100	+40%	100/1440 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.014	412	110.324	1.049	0.000	1.89		1604.1	FLOOD RISK	
1.015	413	109.605	0.530	0.000	2.05		1626.0	SURCHARGED	
1.016	414	109.165	0.340	0.000	0.11		163.2	FLOOD RISK	
5.000	423	118.998	-0.127	0.000	0.62		66.6	OK	
5.001	424	118.660	0.160	0.000	1.41		147.4	SURCHARGED	
6.000	442	118.594	-0.156	0.000	0.47		49.1	OK	
6.001	443	118.481	0.056	0.000	1.29		102.1	SURCHARGED	
5.002	425	118.240	-0.085	0.000	0.83		298.6	OK	
7.000	480	117.426	0.676	0.000	1.09		79.1	SURCHARGED	
7.001	481	117.248	0.652	0.000	1.10		141.6	SURCHARGED	
5.003	455	117.044	0.623	0.000	1.01		525.3	SURCHARGED	
5.004	426	115.707	0.632	0.000	0.93		577.2	SURCHARGED	
5.005	427	115.147	0.723	0.000	1.06		588.2	SURCHARGED	

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Summary of Critical Results by Maximum Level (Rank 1) for NETWORK 4 STORM
REV A.SWS

PN	US/MH Name	Water	Surcharged	Flooded	Flow / Overflow		Pipe	Status	Level Exceeded
		Level (m)	Depth (m)	Volume (m³)			Flow (l/s)		
5.006	429	114.557	0.653	0.000	1.07		632.9	SURCHARGED	
5.007	431	113.772	0.550	0.000	1.44		715.6	SURCHARGED	
5.008	432	113.260	0.285	0.000	1.36		712.0	SURCHARGED	
5.009	433	112.771	0.071	0.000	0.91		704.1	SURCHARGED	
5.010	435	112.289	0.189	0.000	1.09		743.3	SURCHARGED	
5.011	436	111.570	0.070	0.000	1.10		742.4	SURCHARGED	
5.012	437	110.824	-0.226	0.000	0.70		768.3	OK	
5.013	439	109.587	-0.163	0.000	0.87		801.2	OK	
5.014	440	109.165	0.490	0.000	0.09		85.5	SURCHARGED	
8.000	445	111.795	0.270	0.000	0.97		122.7	SURCHARGED	
8.001	446	111.401	0.351	0.000	1.00		142.3	SURCHARGED	
8.002	451	110.550	0.362	0.000	0.96		142.3	SURCHARGED	
8.003	447	109.745	0.495	0.000	1.13		211.9	SURCHARGED	
8.004	448	109.166	0.641	0.000	0.14		19.9	FLOOD RISK	
1.017	415	109.165	0.915	0.000	0.17		28.8	FLOOD RISK	
1.018	49	108.093	0.318	0.000	0.48		29.3	SURCHARGED	