

Stephen Daykin Consulting Ltd		Page 0
33 Beaumaris Drive Gedling Nottingham NG4 2RA		
Date 01/01/0001	Designed by EthanNichol	
File E795-STORM NETWORK 2 (V1...	Checked by	
Innovyze	Network 2018.1.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for E795-STORM NETWORK 2 (V1).SWS

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2
M5-60 (mm)	20.000
Ratio R	0.400
Maximum Rainfall (mm/hr)	0
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	10
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	0.75
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for E795-STORM NETWORK 2 (V1).SWS

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.589	4-8	1.127	8-12	0.051

Total Area Contributing (ha) = 1.767

Total Pipe Volume (m³) = 116.215

Network Design Table for E795-STORM NETWORK 2 (V1).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	23.851	0.059	404.3	0.140	5.00	0.0	0.600	o	450	Pipe/Conduit	
1.001	49.152	0.121	406.2	0.090	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.002	7.243	0.018	402.4	0.072	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	0.00	5.40	52.668	0.140	0.0	0.0	0.0	1.00	159.8	0.0
1.001	0.00	6.21	52.609	0.230	0.0	0.0	0.0	1.00	159.4	0.0
1.002	0.00	6.33	52.488	0.302	0.0	0.0	0.0	1.01	160.2	0.0

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Network Design Table for E795-STORM NETWORK 2 (V1).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
1.003	33.532	0.083	404.0	0.094	0.00	0.0	0.600	o	450	Pipe/Conduit	
2.000	21.163	0.126	168.0	0.076	5.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	28.089	0.069	407.1	0.087	0.00	0.0	0.600	o	450	Pipe/Conduit	
2.002	7.975	0.020	398.8	0.039	0.00	0.0	0.600	o	450	Pipe/Conduit	
2.003	9.906	0.025	396.2	0.019	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.004	51.877	0.128	405.3	0.106	0.00	0.0	0.600	o	450	Pipe/Conduit	
3.000	19.312	0.048	402.3	0.156	5.00	0.0	0.600	o	450	Pipe/Conduit	
1.005	9.711	0.024	404.6	0.024	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.006	20.055	0.050	401.1	0.017	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.000	28.086	0.069	407.0	0.073	5.00	0.0	0.600	o	450	Pipe/Conduit	
4.001	6.471	0.016	404.4	0.054	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.002	11.150	0.028	398.2	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.000	16.481	0.098	168.2	0.094	5.00	0.0	0.600	o	225	Pipe/Conduit	
4.003	30.040	0.074	405.9	0.019	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.004	14.210	0.035	406.0	0.074	0.00	0.0	0.600	o	450	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)
1.003	0.00	6.89	52.470	0.396	0.0	0.0	0.0	1.01	159.9	0.0
2.000	0.00	5.35	52.852	0.076	0.0	0.0	0.0	1.01	40.0	0.0
2.001	0.00	5.82	52.501	0.163	0.0	0.0	0.0	1.00	159.3	0.0
2.002	0.00	5.95	52.432	0.202	0.0	0.0	0.0	1.01	160.9	0.0
2.003	0.00	6.11	52.412	0.221	0.0	0.0	0.0	1.02	161.5	0.0
1.004	0.00	7.75	52.387	0.723	0.0	0.0	0.0	1.00	159.6	0.0
3.000	0.00	5.32	52.307	0.156	0.0	0.0	0.0	1.01	160.2	0.0
1.005	0.00	7.91	52.259	0.903	0.0	0.0	0.0	1.00	159.8	0.0
1.006	0.00	8.24	52.235	0.920	0.0	0.0	0.0	1.01	160.5	0.0
4.000	0.00	5.47	52.469	0.073	0.0	0.0	0.0	1.00	159.3	0.0
4.001	0.00	5.57	52.400	0.127	0.0	0.0	0.0	1.00	159.8	0.0
4.002	0.00	5.76	52.384	0.127	0.0	0.0	0.0	1.01	161.1	0.0
5.000	0.00	5.27	52.679	0.094	0.0	0.0	0.0	1.01	40.0	0.0
4.003	0.00	6.26	52.356	0.240	0.0	0.0	0.0	1.00	159.5	0.0
4.004	0.00	6.49	52.282	0.314	0.0	0.0	0.0	1.00	159.5	0.0

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Network Design Table for E795-STORM NETWORK 2 (V1).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				
4.005	25.262	0.062	407.5	0.064	0.00	0.0	0.600	o	450	Pipe/Conduit					
1.007	15.776	0.039	404.5	0.064	0.00	0.0	0.600	o	450	Pipe/Conduit					
1.008	35.488	0.225	157.7	0.000	0.00	0.0	0.600	ooo	47	Pipe/Conduit					
6.000	26.311	0.065	404.8	0.075	5.00	0.0	0.600	o	450	Pipe/Conduit					
6.001	28.796	0.071	405.6	0.065	0.00	0.0	0.600	o	450	Pipe/Conduit					
6.002	16.697	0.041	407.2	0.028	0.00	0.0	0.600	o	450	Pipe/Conduit					
6.003	49.528	0.123	402.7	0.076	0.00	0.0	0.600	o	450	Pipe/Conduit					
7.000	16.532	0.047	351.7	0.062	5.00	0.0	0.600	o	450	Pipe/Conduit					
6.004	28.819	0.072	400.3	0.031	0.00	0.0	0.600	o	450	Pipe/Conduit					
8.000	10.315	0.061	169.1	0.027	5.00	0.0	0.600	o	225	Pipe/Conduit					
6.005	10.455	0.032	326.7	0.041	0.00	0.0	0.600	o	450	Pipe/Conduit					
6.006	10.046	0.225	44.6	0.000	0.00	0.0	0.600	ooo	47	Pipe/Conduit					
1.009	29.981	0.121	247.8	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)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)					
4.005	0.00	6.91	52.247	0.378	0.0	0.0	0.0	1.00	159.2	0.0					
1.007	0.00	8.50	52.185	1.362	0.0	0.0	0.0	1.00	159.8	0.0					
1.008	0.00	8.87	52.146	1.362	0.0	0.0	0.0	1.62	770.9	0.0					
6.000	0.00	5.44	52.550	0.075	0.0	0.0	0.0	1.00	159.7	0.0					
6.001	0.00	5.92	52.485	0.140	0.0	0.0	0.0	1.00	159.6	0.0					
6.002	0.00	6.19	52.414	0.168	0.0	0.0	0.0	1.00	159.2	0.0					
6.003	0.00	7.01	52.373	0.244	0.0	0.0	0.0	1.01	160.1	0.0					
7.000	0.00	5.26	52.297	0.062	0.0	0.0	0.0	1.08	171.5	0.0					
6.004	0.00	7.49	52.250	0.337	0.0	0.0	0.0	1.01	160.6	0.0					
8.000	0.00	5.17	52.464	0.027	0.0	0.0	0.0	1.00	39.9	0.0					
6.005	0.00	7.64	52.178	0.405	0.0	0.0	0.0	1.12	178.0	0.0					
6.006	0.00	7.70	52.146	0.405	0.0	0.0	0.0	3.05	1454.2	0.0					
1.009	0.00	9.37	51.921	1.767	0.0	0.0	0.0	0.99	70.3	0.0					
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Free Flowing Outfall Details for E795-STORM NETWORK 2 (V1).SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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1.009	90	52.670	51.800	0.000	0	0
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Simulation Criteria for E795-STORM NETWORK 2 (V1).SWS

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha	Storage 2.000
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	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.371		

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Online Controls for E795-STORM NETWORK 2 (V1).SWS

Hydro-Brake® Optimum Manhole: 89, DS/PN: 1.009, Volume (m³): 29.5

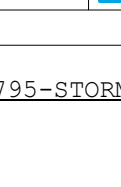
Unit Reference	MD-SHE-0105-5000-1000-5000
Design Head (m)	1.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	105
Invert Level (m)	51.921
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	5.0
Flush-Flo™	0.296	5.0
Kick-Flo®	0.637	4.1
Mean Flow over Head Range	-	4.3

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	3.6	1.200	5.4	3.000	8.4	7.000	12.5
0.200	4.8	1.400	5.8	3.500	9.0	7.500	12.9
0.300	5.0	1.600	6.2	4.000	9.6	8.000	13.3
0.400	4.9	1.800	6.6	4.500	10.1	8.500	13.7
0.500	4.7	2.000	6.9	5.000	10.6	9.000	14.1
0.600	4.3	2.200	7.2	5.500	11.1	9.500	14.5
0.800	4.5	2.400	7.5	6.000	11.6		
1.000	5.0	2.600	7.8	6.500	12.1		

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<u>Storage Structures for E795-STORM NETWORK 2 (V1).SWS</u> <u>Tank or Pond Manhole: 89, DS/PN: 1.009</u> Invert Level (m) 51.921 <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>687.0</td><td>1.500</td><td>1132.0</td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	687.0	1.500	1132.0
Depth (m)	Area (m²)	Depth (m)	Area (m²)							
0.000	687.0	1.500	1132.0							
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Summary of Critical Results by Maximum Level (Rank 1) for E795-STORM NETWORK 2 (V1).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 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	0.371
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

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)	30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	2
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	80 30	Summer	2	+0%					52.805
1.001	81 30	Summer	2	+0%					52.763
1.002	82 30	Winter	2	+0%					52.711
1.003	83 30	Winter	2	+0%					52.702
2.000	92 30	Summer	2	+0%					52.936
2.001	93 30	Winter	2	+0%					52.692
2.002	94 30	Winter	2	+0%					52.685
2.003	95 30	Winter	2	+0%					52.681
1.004	84 30	Winter	2	+0%					52.676
3.000	97 30	Winter	2	+0%					52.644
1.005	85 30	Winter	2	+0%					52.640
1.006	86 30	Winter	2	+0%					52.619
4.000	99 30	Winter	2	+0%					52.619
4.001	100 30	Winter	2	+0%					52.617
4.002	101 30	Winter	2	+0%					52.616
5.000	106 30	Summer	2	+0%					52.775
4.003	102 30	Winter	2	+0%					52.614
4.004	103 30	Winter	2	+0%					52.607
4.005	104 30	Winter	2	+0%					52.600
1.007	87 30	Winter	2	+0%					52.589

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Summary of Critical Results by Maximum Level (Rank 1) for E795-STORM NETWORK 2 (V1).SWS

PN	US/MH Name	Surcharged Flooded		Pipe		Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Status
1.000	80	-0.313	0.000	0.15	19.8	OK
1.001	81	-0.296	0.000	0.20	29.0	OK
1.002	82	-0.227	0.000	0.33	32.8	OK
1.003	83	-0.218	0.000	0.30	42.2	OK
2.000	92	-0.141	0.000	0.30	11.0	OK
2.001	93	-0.259	0.000	0.15	19.8	OK
2.002	94	-0.197	0.000	0.23	21.0	OK
2.003	95	-0.181	0.000	0.22	22.0	OK
1.004	84	-0.161	0.000	0.49	70.6	OK
3.000	97	-0.113	0.000	0.15	18.4	OK
1.005	85	-0.069	0.000	0.83	79.0	OK
1.006	86	-0.066	0.000	0.61	79.1	OK
4.000	99	-0.300	0.000	0.07	9.2	OK
4.001	100	-0.233	0.000	0.12	13.0	OK
4.002	101	-0.218	0.000	0.12	12.1	OK
5.000	106	-0.129	0.000	0.38	13.6	OK
4.003	102	-0.192	0.000	0.18	24.8	OK
4.004	103	-0.125	0.000	0.26	27.4	OK
4.005	104	-0.097	0.000	0.24	31.7	OK
1.007	87	-0.046	0.000	1.00	109.2	OK

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Summary of Critical Results by Maximum Level (Rank 1) for E795-STORM NETWORK 2 (V1).SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.008	88	600 Winter	2	+0%					52.326
6.000	108	30 Summer	2	+0%					52.651
6.001	109	30 Summer	2	+0%					52.609
6.002	110	30 Summer	2	+0%					52.554
6.003	111	30 Summer	2	+0%					52.514
7.000	116	30 Winter	2	+0%					52.431
6.004	112	30 Winter	2	+0%					52.428
8.000	117	30 Summer	2	+0%					52.515
6.005	113	30 Winter	2	+0%					52.365
6.006	114	600 Winter	2	+0%					52.326
1.009	89	600 Winter	2	+0%	2/120 Winter				52.326

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.008	88	-0.270	0.000	0.04		23.9	OK	
6.000	108	-0.349	0.000	0.08		10.6	OK	
6.001	109	-0.326	0.000	0.13		17.9	OK	
6.002	110	-0.310	0.000	0.18		20.7	OK	
6.003	111	-0.309	0.000	0.19		28.2	OK	
7.000	116	-0.316	0.000	0.06		7.7	OK	
6.004	112	-0.272	0.000	0.27		36.8	OK	
8.000	117	-0.174	0.000	0.12		3.9	OK	
6.005	113	-0.263	0.000	0.36		43.5	OK	
6.006	114	-0.270	0.000	0.01		7.0	OK	
1.009	89	0.105	0.000	0.08		5.0	SURCHARGED	