

Banners Gate Ltd		Page 0
Cavendish House 10-11 Birmingham Street Halesowen W.Midlands B63 3HN	Littlehampton	
Date 17/08/2019 File STORM NETWORK 1 20.05.1...	Designed by TB Checked by	
XP Solutions Network 2018.1.1		

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for NETWORK 1 20.05.13.SWS

Pipe Sizes NETWORK 1 19.08.20 Manhole Sizes NETWORK 1 19.08.20

FEH Rainfall Model	
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 503220 103890
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
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 NETWORK 1 20.05.13.SWS

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.164	4-8	0.210	8-12	0.014

Total Area Contributing (ha) = 0.388

Total Pipe Volume (m³) = 10.118

Network Design Table for NETWORK 1 20.05.13.SWS

« - Indicates pipe capacity < flow

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
S1.000	30.491	0.182	167.5	0.100	6.00	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)
S1.000	50.00	6.50	5.911	0.100	0.0	0.0	0.0	1.01	40.1	13.5

©1982-2018 Innovyze

Banners Gate Ltd										Page 1																																																																																																																																																																																																																																							
Cavendish House 10-11 Birmingham Street Halesowen W.Midlands B63 3HN					Littlehampton																																																																																																																																																																																																																																												
Date 17/08/2019					Designed by TB																																																																																																																																																																																																																																												
File STORM NETWORK 1 20.05.1...					Checked by																																																																																																																																																																																																																																												
XP Solutions					Network 2018.1.1																																																																																																																																																																																																																																												
<u>Network Design Table for NETWORK 1 20.05.13.SWS</u> <table><tr><th>PN</th><th>Length (m)</th><th>Fall (m)</th><th>Slope (1:X)</th><th>I.Area (ha)</th><th>T.E. (mins)</th><th>Base Flow (l/s)</th><th>k (mm)</th><th>HYD SECT</th><th>DIA (mm)</th><th>Section Type</th><th>Auto Design</th></tr><tr><td>S1.001</td><td>25.593</td><td>0.153</td><td>167.3</td><td>0.080</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>225</td><td>Pipe/Conduit</td><td></td></tr><tr><td>S1.002</td><td>26.383</td><td>0.110</td><td>239.8</td><td>0.000</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>300</td><td>Pipe/Conduit</td><td></td></tr><tr><td>S2.000</td><td>28.200</td><td>0.178</td><td>158.4</td><td>0.045</td><td>6.00</td><td>0.0</td><td>0.600</td><td>o</td><td>225</td><td>Pipe/Conduit</td><td></td></tr><tr><td>S1.003</td><td>20.357</td><td>0.090</td><td>226.2</td><td>0.092</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>300</td><td>Pipe/Conduit</td><td></td></tr><tr><td>S3.000</td><td>28.334</td><td>0.902</td><td>31.4</td><td>0.045</td><td>6.00</td><td>0.0</td><td>0.600</td><td>o</td><td>150</td><td>Pipe/Conduit</td><td></td></tr><tr><td>S1.004</td><td>6.697</td><td>0.040</td><td>167.4</td><td>0.026</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>300</td><td>Pipe/Conduit</td><td></td></tr><tr><td>S1.005</td><td>21.960</td><td>0.060</td><td>366.0</td><td>0.000</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>300</td><td>Pipe/Conduit</td><td></td></tr><tr><td>S1.006</td><td>7.248</td><td>0.020</td><td>362.4</td><td>0.000</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>300</td><td>Pipe/Conduit</td><td></td></tr><tr><td>S1.007</td><td>23.992</td><td>0.180</td><td>133.3</td><td>0.000</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>150</td><td>Pipe/Conduit</td><td></td></tr></table> <u>Network Results Table</u> <table><tr><th>PN</th><th>Rain (mm/hr)</th><th>T.C. (mins)</th><th>US/IL (m)</th><th>Σ I.Area (ha)</th><th>Σ Base Flow (l/s)</th><th>Foul (l/s)</th><th>Add Flow (l/s)</th><th>Vel (m/s)</th><th>Cap (l/s)</th><th>Flow (l/s)</th></tr><tr><td>S1.001</td><td>50.00</td><td>6.93</td><td>5.729</td><td>0.180</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.01</td><td>40.1</td><td>24.4</td></tr><tr><td>S1.002</td><td>50.00</td><td>7.36</td><td>5.500</td><td>0.180</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.01</td><td>71.5</td><td>24.4</td></tr><tr><td>S2.000</td><td>50.00</td><td>6.45</td><td>5.643</td><td>0.045</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.04</td><td>41.2</td><td>6.1</td></tr><tr><td>S1.003</td><td>50.00</td><td>7.69</td><td>5.390</td><td>0.317</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.04</td><td>73.6</td><td>42.9</td></tr><tr><td>S3.000</td><td>50.00</td><td>6.26</td><td>6.352</td><td>0.045</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.80</td><td>31.9</td><td>6.1</td></tr><tr><td>S1.004</td><td>50.00</td><td>7.78</td><td>5.300</td><td>0.388</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.21</td><td>85.7</td><td>52.5</td></tr><tr><td>S1.005</td><td>50.00</td><td>8.23</td><td>5.260</td><td>0.388</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.82</td><td>57.7</td><td>52.5</td></tr><tr><td>S1.006</td><td>50.00</td><td>8.38</td><td>5.200</td><td>0.388</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.82</td><td>58.0</td><td>52.5</td></tr><tr><td>S1.007</td><td>50.00</td><td>8.84</td><td>5.180</td><td>0.388</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.87</td><td>15.4«</td><td>52.5</td></tr></table>												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	S1.001	25.593	0.153	167.3	0.080	0.00	0.0	0.600	o	225	Pipe/Conduit		S1.002	26.383	0.110	239.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit		S2.000	28.200	0.178	158.4	0.045	6.00	0.0	0.600	o	225	Pipe/Conduit		S1.003	20.357	0.090	226.2	0.092	0.00	0.0	0.600	o	300	Pipe/Conduit		S3.000	28.334	0.902	31.4	0.045	6.00	0.0	0.600	o	150	Pipe/Conduit		S1.004	6.697	0.040	167.4	0.026	0.00	0.0	0.600	o	300	Pipe/Conduit		S1.005	21.960	0.060	366.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit		S1.006	7.248	0.020	362.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit		S1.007	23.992	0.180	133.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit		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)	S1.001	50.00	6.93	5.729	0.180	0.0	0.0	0.0	1.01	40.1	24.4	S1.002	50.00	7.36	5.500	0.180	0.0	0.0	0.0	1.01	71.5	24.4	S2.000	50.00	6.45	5.643	0.045	0.0	0.0	0.0	1.04	41.2	6.1	S1.003	50.00	7.69	5.390	0.317	0.0	0.0	0.0	1.04	73.6	42.9	S3.000	50.00	6.26	6.352	0.045	0.0	0.0	0.0	1.80	31.9	6.1	S1.004	50.00	7.78	5.300	0.388	0.0	0.0	0.0	1.21	85.7	52.5	S1.005	50.00	8.23	5.260	0.388	0.0	0.0	0.0	0.82	57.7	52.5	S1.006	50.00	8.38	5.200	0.388	0.0	0.0	0.0	0.82	58.0	52.5	S1.007	50.00	8.84	5.180	0.388	0.0	0.0	0.0	0.87	15.4«	52.5
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																																																																																																																																																																																																																																						
S1.001	25.593	0.153	167.3	0.080	0.00	0.0	0.600	o	225	Pipe/Conduit																																																																																																																																																																																																																																							
S1.002	26.383	0.110	239.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit																																																																																																																																																																																																																																							
S2.000	28.200	0.178	158.4	0.045	6.00	0.0	0.600	o	225	Pipe/Conduit																																																																																																																																																																																																																																							
S1.003	20.357	0.090	226.2	0.092	0.00	0.0	0.600	o	300	Pipe/Conduit																																																																																																																																																																																																																																							
S3.000	28.334	0.902	31.4	0.045	6.00	0.0	0.600	o	150	Pipe/Conduit																																																																																																																																																																																																																																							
S1.004	6.697	0.040	167.4	0.026	0.00	0.0	0.600	o	300	Pipe/Conduit																																																																																																																																																																																																																																							
S1.005	21.960	0.060	366.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit																																																																																																																																																																																																																																							
S1.006	7.248	0.020	362.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit																																																																																																																																																																																																																																							
S1.007	23.992	0.180	133.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit																																																																																																																																																																																																																																							
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)																																																																																																																																																																																																																																							
S1.001	50.00	6.93	5.729	0.180	0.0	0.0	0.0	1.01	40.1	24.4																																																																																																																																																																																																																																							
S1.002	50.00	7.36	5.500	0.180	0.0	0.0	0.0	1.01	71.5	24.4																																																																																																																																																																																																																																							
S2.000	50.00	6.45	5.643	0.045	0.0	0.0	0.0	1.04	41.2	6.1																																																																																																																																																																																																																																							
S1.003	50.00	7.69	5.390	0.317	0.0	0.0	0.0	1.04	73.6	42.9																																																																																																																																																																																																																																							
S3.000	50.00	6.26	6.352	0.045	0.0	0.0	0.0	1.80	31.9	6.1																																																																																																																																																																																																																																							
S1.004	50.00	7.78	5.300	0.388	0.0	0.0	0.0	1.21	85.7	52.5																																																																																																																																																																																																																																							
S1.005	50.00	8.23	5.260	0.388	0.0	0.0	0.0	0.82	57.7	52.5																																																																																																																																																																																																																																							
S1.006	50.00	8.38	5.200	0.388	0.0	0.0	0.0	0.82	58.0	52.5																																																																																																																																																																																																																																							
S1.007	50.00	8.84	5.180	0.388	0.0	0.0	0.0	0.87	15.4«	52.5																																																																																																																																																																																																																																							
©1982-2018 Innovyze																																																																																																																																																																																																																																																	

Banners Gate Ltd		Page 2
Cavendish House 10-11 Birmingham Street Halesowen W.Midlands B63 3HN		
Littlehampton		
Date 17/08/2019 File STORM NETWORK 1 20.05.1... XP Solutions		
Designed by TB		
Checked by		
Network 2018.1.1		

Area Summary for NETWORK 1 20.05.13.SWS

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.100	0.100	0.100
1.001	-	-	100	0.080	0.080	0.080
1.002	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.045	0.045	0.045
1.003	-	-	100	0.092	0.092	0.092
3.000	-	-	100	0.045	0.045	0.045
1.004	-	-	100	0.026	0.026	0.026
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.388	0.388	0.388

Free Flowing Outfall Details for NETWORK 1 20.05.13.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.007	SSWA2_01	6.900	5.000	0.000	1200	0

Simulation Criteria for NETWORK 1 20.05.13.SWS

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/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	FEH	Summer Storms	Yes
Return Period (years)	2	Winter Storms	Yes
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location GB	503220 103890	Cv (Winter)	0.840
Data Type	Point Storm Duration (mins)		30

©1982-2018 Innovyze

Banners Gate Ltd		Page 3
Cavendish House 10-11 Birmingham Street Halesowen W.Midlands B63 3HN	Littlehampton	
Date 17/08/2019	Designed by TB	
File STORM NETWORK 1 20.05.1...	Checked by	
XP Solutions		Network 2018.1.1

Online Controls for NETWORK 1 20.05.13.SWS

Hydro-Brake® Optimum Manhole: SHB1, DS/PN: S1.007, Volume (m³): 7.4

Unit Reference	MD-SHE-0093-5000-1891-5000
Design Head (m)	1.891
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	93
Invert Level (m)	5.180
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.891	5.0
Flush-Flo™	0.408	4.3
Kick-Flo®	0.832	3.4
Mean Flow over Head Range	-	4.0

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	2.9	1.200	4.0	3.000	6.2	7.000	9.3
0.200	3.9	1.400	4.3	3.500	6.7	7.500	9.6
0.300	4.2	1.600	4.6	4.000	7.1	8.000	9.9
0.400	4.3	1.800	4.9	4.500	7.5	8.500	10.2
0.500	4.2	2.000	5.1	5.000	7.9	9.000	10.4
0.600	4.1	2.200	5.4	5.500	8.3	9.500	10.7
0.800	3.6	2.400	5.6	6.000	8.6		
1.000	3.7	2.600	5.8	6.500	8.9		

©1982-2018 Innovyze

ARUN DISTRICT COUNCIL LU/90/20/DOC

Banners Gate Ltd		Page 5
Cavendish House 10-11 Birmingham Street Halesowen W.Midlands B63 3HN		Littlehampton
Date 17/08/2019 File STORM NETWORK 1 20.05.1...		Designed by TB Checked by
XP Solutions		Network 2018.1.1



Summary of Critical Results by Maximum Level (Rank 1) for NETWORK 1
20.05.13.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 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	FEH	Data Type	Point
FEH Rainfall Version	2013 Cv (Summer)		0.750
Site Location	GB 503220 103890 Cv (Winter)		0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
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)	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)
S1.000	S2	15 Winter	2	+0%					6.014
S1.001	S4	15 Winter	2	+0%					5.874
S1.002	S6	15 Winter	2	+0%					5.643
S2.000	S8	15 Winter	2	+0%					5.709
S1.003	S10	15 Winter	2	+0%					5.599
S3.000	S12	15 Winter	2	+0%					6.401
S1.004	S14	15 Winter	2	+0%					5.555
S1.005	SCP1	15 Winter	2	+0%					5.519
S1.006	SCS1	180 Winter	2	+0%	2/120 Winter				5.513
S1.007	SHB1	180 Winter	2	+0%	2/15 Summer				5.511

PN	US/MH Name	Depth (m)	Surcharged Volume (m³)	Flooded Volume (m³)	Flow / Cap. (l/s)	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S2	-0.122	0.000	0.42		15.9		OK	
S1.001	S4	-0.080	0.000	0.73		27.0		OK	

©1982-2018 Innovyze

Banners Gate Ltd					Page 6	
Cavendish House 10-11 Birmingham Street Halesowen W.Midlands B63 3HN				Littlehampton		
Date 17/08/2019				Designed by TB		
File STORM NETWORK 1 20.05.1...				Checked by		
XP Solutions				Network 2018.1.1		

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

PN	US/MH Name	Surcharged		Flooded	Flow / Cap.	Overflow (l/s)	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow (l/s)					
S1.002	S6	-0.157	0.000	0.42		26.7		OK	
S2.000	S8	-0.159	0.000	0.19		7.2		OK	
S1.003	S10	-0.091	0.000	0.68		43.7		OK	
S3.000	S12	-0.101	0.000	0.24		7.2		OK	
S1.004	S14	-0.045	0.000	0.84		51.8		OK	
S1.005	SCP1	-0.041	0.000	1.00		50.8		OK	
S1.006	SCS1	0.013	0.000	0.12		4.5	SURCHARGED		
S1.007	SHB1	0.181	0.000	0.29		4.2	SURCHARGED		

©1982-2018 Innovyze