

Banners Gate Ltd		Page 0
Cavendish House 10-11 Birmingham Street Halesowen W.Midlands B63 3HN		Littlehampton
Date 17/08/2019 File STORM NETWORK 2 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 2 20.05.14.SWS

Pipe Sizes NETWORK 2 20.05.13 Manhole Sizes NETWORK 2 20.05.13

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 2 20.05.14.SWS

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.109	4-8	0.051

Total Area Contributing (ha) = 0.160

Total Pipe Volume (m³) = 2.705

Network Design Table for NETWORK 2 20.05.14.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	14.508	0.090	161.2	0.090	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	6.24	5.670	0.090	0.0	0.0	0.0	1.03	40.8	12.2

©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 2 20.05.1...						Checked by																																																																																																																																															
XP Solutions						Network 2018.1.1																																																																																																																																															
<u>Network Design Table for NETWORK 2 20.05.14.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>3.402</td><td>0.460</td><td>7.4</td><td>0.000</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>5.637</td><td>0.040</td><td>140.9</td><td>0.000</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>S1.003</td><td>9.937</td><td>0.080</td><td>124.2</td><td>0.035</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>S1.004</td><td>17.137</td><td>0.075</td><td>228.5</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>S1.005</td><td>9.206</td><td>0.065</td><td>141.6</td><td>0.035</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>6.25</td><td>5.580</td><td>0.090</td><td>0.0</td><td>0.0</td><td>0.0</td><td>4.84</td><td>192.5</td><td>12.2</td></tr><tr><td>S1.002</td><td>50.00</td><td>6.33</td><td>5.120</td><td>0.090</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.10</td><td>43.7</td><td>12.2</td></tr><tr><td>S1.003</td><td>50.00</td><td>6.47</td><td>5.080</td><td>0.125</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.17</td><td>46.6</td><td>16.9</td></tr><tr><td>S1.004</td><td>50.00</td><td>6.75</td><td>4.925</td><td>0.125</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.04</td><td>73.2</td><td>16.9</td></tr><tr><td>S1.005</td><td>50.00</td><td>6.93</td><td>4.850</td><td>0.160</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.84</td><td>14.9«</td><td>21.7</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	3.402	0.460	7.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit		S1.002	5.637	0.040	140.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit		S1.003	9.937	0.080	124.2	0.035	0.00	0.0	0.600	o	225	Pipe/Conduit		S1.004	17.137	0.075	228.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit		S1.005	9.206	0.065	141.6	0.035	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	6.25	5.580	0.090	0.0	0.0	0.0	4.84	192.5	12.2	S1.002	50.00	6.33	5.120	0.090	0.0	0.0	0.0	1.10	43.7	12.2	S1.003	50.00	6.47	5.080	0.125	0.0	0.0	0.0	1.17	46.6	16.9	S1.004	50.00	6.75	4.925	0.125	0.0	0.0	0.0	1.04	73.2	16.9	S1.005	50.00	6.93	4.850	0.160	0.0	0.0	0.0	0.84	14.9«	21.7
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	3.402	0.460	7.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit																																																																																																																																											
S1.002	5.637	0.040	140.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit																																																																																																																																											
S1.003	9.937	0.080	124.2	0.035	0.00	0.0	0.600	o	225	Pipe/Conduit																																																																																																																																											
S1.004	17.137	0.075	228.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit																																																																																																																																											
S1.005	9.206	0.065	141.6	0.035	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	6.25	5.580	0.090	0.0	0.0	0.0	4.84	192.5	12.2																																																																																																																																											
S1.002	50.00	6.33	5.120	0.090	0.0	0.0	0.0	1.10	43.7	12.2																																																																																																																																											
S1.003	50.00	6.47	5.080	0.125	0.0	0.0	0.0	1.17	46.6	16.9																																																																																																																																											
S1.004	50.00	6.75	4.925	0.125	0.0	0.0	0.0	1.04	73.2	16.9																																																																																																																																											
S1.005	50.00	6.93	4.850	0.160	0.0	0.0	0.0	0.84	14.9«	21.7																																																																																																																																											
©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 2 20.05.1...		
Designed by TB		
Checked by		
XP Solutions		Network 2018.1.1

Area Summary for NETWORK 2 20.05.14.SWS

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.090	0.090	0.090
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.035	0.035	0.035
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.035	0.035	0.035
				Total	Total	Total
				0.160	0.160	0.160

Free Flowing Outfall Details for NETWORK 2 20.05.14.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.005	SSWB6_01	6.900	4.785	0.000	1200	0

Simulation Criteria for NETWORK 2 20.05.14.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
Number of Online Controls		1	Number of Time/Area Diagrams
Number of Offline Controls		0	Number of Real Time Controls

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 2 20.05.1...	Checked by	
XP Solutions		Network 2018.1.1

Online Controls for NETWORK 2 20.05.14.SWS

Hydro-Brake® Optimum Manhole: SHB2, DS/PN: S1.005, Volume (m³): 4.9

Unit Reference	MD-SHE-0101-5000-1290-5000
Design Head (m)	1.290
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	101
Invert Level (m)	4.850
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.290	5.0
Flush-Flo™	0.387	5.0
Kick-Flo®	0.802	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	4.8	3.000	7.4	7.000	11.1
0.200	4.6	1.400	5.2	3.500	8.0	7.500	11.4
0.300	4.9	1.600	5.5	4.000	8.5	8.000	11.8
0.400	5.0	1.800	5.8	4.500	9.0	8.500	12.1
0.500	4.9	2.000	6.1	5.000	9.4	9.000	12.5
0.600	4.8	2.200	6.4	5.500	9.9	9.500	12.8
0.800	4.0	2.400	6.7	6.000	10.3		
1.000	4.4	2.600	6.9	6.500	10.7		

©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					Designed by TB																																																																																														
File STORM NETWORK 2 20.05.1...					Checked by																																																																																														
XP Solutions					Network 2018.1.1																																																																																														
Summary of Critical Results by Maximum Level (Rank 1) for NETWORK 2 20.05.14.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) 100 Climate Change (%) 30																																																																																																			
<table><tr><th colspan="2"></th><th colspan="2"></th><th colspan="2"></th><th colspan="2"></th><th colspan="2"></th></tr><tr><th colspan="2"></th><th>US/MH</th><th>Return</th><th>Climate</th><th>First (X)</th><th>First (Y)</th><th>First (Z)</th><th>Overflow</th><th>Water</th></tr><tr><th>PN</th><th>Name</th><th>Storm</th><th>Period</th><th>Change</th><th>Surcharge</th><th>Flood</th><th>Overflow</th><th>Act.</th><th>Level</th></tr><tr><td>S1.000</td><td>S18</td><td>15 Winter</td><td>100</td><td>+30%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>5.986</td></tr><tr><td>S1.001</td><td>SCP2</td><td>60 Winter</td><td>100</td><td>+30%</td><td>100/60 Winter</td><td></td><td></td><td></td><td>5.876</td></tr><tr><td>S1.002</td><td>SCS2</td><td>60 Winter</td><td>100</td><td>+30%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>5.874</td></tr><tr><td>S1.003</td><td>S20</td><td>60 Winter</td><td>100</td><td>+30%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>5.872</td></tr><tr><td>S1.004</td><td>S22</td><td>60 Winter</td><td>100</td><td>+30%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>5.867</td></tr><tr><td>S1.005</td><td>SHB2</td><td>60 Winter</td><td>100</td><td>+30%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>5.864</td></tr></table>																						US/MH	Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Water	PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	Level	S1.000	S18	15 Winter	100	+30%	100/15 Summer				5.986	S1.001	SCP2	60 Winter	100	+30%	100/60 Winter				5.876	S1.002	SCS2	60 Winter	100	+30%	100/15 Summer				5.874	S1.003	S20	60 Winter	100	+30%	100/15 Summer				5.872	S1.004	S22	60 Winter	100	+30%	100/15 Summer				5.867	S1.005	SHB2	60 Winter	100	+30%	100/15 Summer				5.864
		US/MH	Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Water																																																																																										
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	Level																																																																																										
S1.000	S18	15 Winter	100	+30%	100/15 Summer				5.986																																																																																										
S1.001	SCP2	60 Winter	100	+30%	100/60 Winter				5.876																																																																																										
S1.002	SCS2	60 Winter	100	+30%	100/15 Summer				5.874																																																																																										
S1.003	S20	60 Winter	100	+30%	100/15 Summer				5.872																																																																																										
S1.004	S22	60 Winter	100	+30%	100/15 Summer				5.867																																																																																										
S1.005	SHB2	60 Winter	100	+30%	100/15 Summer				5.864																																																																																										
<table><tr><th colspan="2"></th><th colspan="2"></th><th colspan="2"></th><th colspan="2"></th><th colspan="2"></th></tr><tr><th colspan="2"></th><th>US/MH</th><th>Depth</th><th>Volume</th><th>Flow / Overflow</th><th>Pipe</th><th colspan="2"></th><th>Level</th></tr><tr><th>PN</th><th>Name</th><th></th><th>(m)</th><th>(m³)</th><th>Cap. (l/s)</th><th>Flow (l/s)</th><th>Status</th><th>Exceeded</th><th></th></tr><tr><td>S1.000</td><td>S18</td><td></td><td>0.091</td><td>0.000</td><td>1.45</td><td>51.9</td><td>SURCHARGED</td><td></td><td></td></tr><tr><td>S1.001</td><td>SCP2</td><td></td><td>0.071</td><td>0.000</td><td>0.31</td><td>30.0</td><td>SURCHARGED</td><td></td><td></td></tr><tr><td>S1.002</td><td>SCS2</td><td></td><td>0.529</td><td>0.000</td><td>0.14</td><td>4.2</td><td>SURCHARGED</td><td></td><td></td></tr><tr><td>S1.003</td><td>S20</td><td></td><td>0.567</td><td>0.000</td><td>0.18</td><td>6.8</td><td>SURCHARGED</td><td></td><td></td></tr><tr><td>S1.004</td><td>S22</td><td></td><td>0.642</td><td>0.000</td><td>0.08</td><td>4.8</td><td>SURCHARGED</td><td></td><td></td></tr><tr><td>S1.005</td><td>SHB2</td><td></td><td>0.864</td><td>0.000</td><td>0.38</td><td>5.0</td><td>SURCHARGED</td><td></td><td></td></tr></table>																						US/MH	Depth	Volume	Flow / Overflow	Pipe			Level	PN	Name		(m)	(m³)	Cap. (l/s)	Flow (l/s)	Status	Exceeded		S1.000	S18		0.091	0.000	1.45	51.9	SURCHARGED			S1.001	SCP2		0.071	0.000	0.31	30.0	SURCHARGED			S1.002	SCS2		0.529	0.000	0.14	4.2	SURCHARGED			S1.003	S20		0.567	0.000	0.18	6.8	SURCHARGED			S1.004	S22		0.642	0.000	0.08	4.8	SURCHARGED			S1.005	SHB2		0.864	0.000	0.38	5.0	SURCHARGED		
		US/MH	Depth	Volume	Flow / Overflow	Pipe			Level																																																																																										
PN	Name		(m)	(m³)	Cap. (l/s)	Flow (l/s)	Status	Exceeded																																																																																											
S1.000	S18		0.091	0.000	1.45	51.9	SURCHARGED																																																																																												
S1.001	SCP2		0.071	0.000	0.31	30.0	SURCHARGED																																																																																												
S1.002	SCS2		0.529	0.000	0.14	4.2	SURCHARGED																																																																																												
S1.003	S20		0.567	0.000	0.18	6.8	SURCHARGED																																																																																												
S1.004	S22		0.642	0.000	0.08	4.8	SURCHARGED																																																																																												
S1.005	SHB2		0.864	0.000	0.38	5.0	SURCHARGED																																																																																												
©1982-2018 Innovyze																																																																																																			