

WYG Group Limited		Page 0
.	EASTERN COMMAND CUSTODY	
.	FACILITY - A095257	
.	SURFACE WATER MODEL	
Date 29.09.16	Designed by RJ	
File SURFACE WATER MODEL	Checked by CD	
XP Solutions	Network 2014.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SURFACE WATER MODEL.SWS

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model	
Return Period (years)	2
Site Location GB 331550 356950 SJ 31550 56950	
C (1km)	-0.025
D1 (1km)	0.342
D2 (1km)	0.403
D3 (1km)	0.293
E (1km)	0.287
F (1km)	2.419
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
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 SURFACE WATER MODEL.SWS

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.332	4-8	0.724	8-12	0.003

Total Area Contributing (ha) = 1.059

Total Pipe Volume (m³) = 68.620

Network Design Table for SURFACE WATER MODEL.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)	Auto Design
S1.000	40.696	0.203	200.5	0.075	4.00	0.0	0.600	o	225	

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	4.74	93.700	0.075	0.0	0.0	0.0	0.92	36.6	10.2

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Network Design Table for SURFACE WATER MODEL.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)	Auto Design
S2.000	12.426	0.228	54.5	0.010	4.00	0.0	0.600	o	150	
S1.001	19.527	0.098	199.3	0.021	0.00	0.0	0.600	o	225	
S1.002	35.108	0.176	199.5	0.016	0.00	0.0	0.600	o	225	
S1.003	50.334	0.252	199.7	0.048	0.00	0.0	0.600	o	300	
S3.000	33.974	0.140	242.7	0.099	4.00	0.0	0.600	o	300	
S3.001	33.948	0.136	249.6	0.074	0.00	0.0	0.600	o	300	
S3.002	30.113	0.120	250.9	0.082	0.00	0.0	0.600	o	450	
S3.003	14.727	0.049	300.6	0.071	0.00	0.0	0.600	o	450	
S4.000	80.959	0.250	323.8	0.294	4.00	0.0	0.600	o	450	
S3.004	7.927	0.026	304.9	0.005	0.00	0.0	0.600	o	450	
S5.000	14.755	0.501	29.5	0.031	4.00	0.0	0.600	o	150	
S3.005	18.942	0.058	326.6	0.076	0.00	0.0	0.600	o	525	
S1.004	10.978	0.037	296.7	0.009	0.00	0.0	0.600	o	525	
S1.005	52.937	0.176	300.8	0.000	0.00	0.0	0.600	o	525	

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)
S2.000	50.00	4.15	93.800	0.010	0.0	0.0	0.0	1.37	24.1	1.4
S1.001	50.00	5.09	93.497	0.106	0.0	0.0	0.0	0.92	36.7	14.4
S1.002	50.00	5.72	93.399	0.122	0.0	0.0	0.0	0.92	36.7	16.5
S1.003	50.00	6.48	93.148	0.170	0.0	0.0	0.0	1.11	78.4	23.0
S3.000	50.00	4.56	93.425	0.099	0.0	0.0	0.0	1.00	71.0	13.4
S3.001	50.00	5.13	93.285	0.173	0.0	0.0	0.0	0.99	70.0	23.4
S3.002	50.00	5.53	92.999	0.255	0.0	0.0	0.0	1.28	203.4	34.5
S3.003	50.00	5.74	92.879	0.326	0.0	0.0	0.0	1.17	185.7	44.1
S4.000	50.00	5.20	93.080	0.294	0.0	0.0	0.0	1.12	178.8	39.8
S3.004	50.00	5.85	92.830	0.625	0.0	0.0	0.0	1.16	184.3	84.6
S5.000	50.00	4.13	93.605	0.031	0.0	0.0	0.0	1.86	32.9	4.2
S3.005	50.00	6.11	92.720	0.732	0.0	0.0	0.0	1.23	267.1	99.1
S1.004	50.00	6.62	92.671	0.911	0.0	0.0	0.0	1.30	280.4	123.4
S1.005	50.00	7.31	92.634	0.911	0.0	0.0	0.0	1.29	278.4	123.4

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Date 29.09.16 File SURFACE WATER MODEL		
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XP Solutions		Network 2014.1

Area Summary for SURFACE WATER MODEL.SWS

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.075	0.075	0.075
2.000	-	-	100	0.010	0.010	0.010
1.001	-	-	100	0.021	0.021	0.021
1.002	-	-	100	0.016	0.016	0.016
1.003	-	-	100	0.048	0.048	0.048
3.000	-	-	100	0.099	0.099	0.099
3.001	-	-	100	0.074	0.074	0.074
3.002	-	-	100	0.082	0.082	0.082
3.003	-	-	100	0.071	0.071	0.071
4.000	-	-	100	0.294	0.294	0.294
3.004	-	-	100	0.005	0.005	0.005
5.000	-	-	100	0.031	0.031	0.031
3.005	-	-	100	0.076	0.076	0.076
1.004	-	-	100	0.009	0.009	0.009
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
6.000	-	-	100	0.090	0.090	0.090
6.001	-	-	100	0.044	0.044	0.044
1.007	-	-	100	0.014	0.014	0.014
1.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.059	1.059	1.059

Free Flowing Outfall Details for SURFACE WATER MODEL.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	S20	94.400	92.000	92.000	0	0

Simulation Criteria for SURFACE WATER MODEL.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
Return Period (years)	2

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Synthetic Rainfall Details Site Location GB 331550 356950 SJ 31550 56950 C (1km) -0.025 D1 (1km) 0.342 D2 (1km) 0.403 D3 (1km) 0.293 E (1km) 0.287 F (1km) 2.419 Summer Storms Yes Winter Storms Yes Cv (Summer) 0.750 Cv (Winter) 0.840 Storm Duration (mins) 30		
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<u>Online Controls for SURFACE WATER MODEL.SWS</u> <u>Hydro-Brake Optimum® Manhole: S20, DS/PN: S1.008, Volume (m³): 9.5</u> <table><tr><td>Unit Reference</td><td>MD-SHE-0387-1000-1500-1000</td></tr><tr><td>Design Head (m)</td><td>1.500</td></tr><tr><td>Design Flow (l/s)</td><td>100.0</td></tr><tr><td>Flush-Flo™</td><td>Calculated</td></tr><tr><td>Objective</td><td>Minimise upstream storage</td></tr><tr><td>Diameter (mm)</td><td>387</td></tr><tr><td>Invert Level (m)</td><td>92.278</td></tr><tr><td>Minimum Outlet Pipe Diameter (mm)</td><td>450</td></tr><tr><td>Suggested Manhole Diameter (mm)</td><td>Site Specific Design (Contact Hydro International)</td></tr></table> <table><tr><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td></tr><tr><td>Design Point (Calculated)</td><td>1.500</td><td>99.3</td><td>Kick-Flo®</td><td>1.136</td><td>86.8</td></tr><tr><td>Flush-Flo™</td><td>0.610</td><td>99.1</td><td>Mean Flow over Head Range</td><td>-</td><td>81.3</td></tr></table> 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 <table><tr><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td></tr><tr><td>0.100</td><td>10.8</td><td>1.200</td><td>89.1</td><td>3.000</td><td>139.2</td><td>7.000</td><td>210.6</td></tr><tr><td>0.200</td><td>38.4</td><td>1.400</td><td>96.1</td><td>3.500</td><td>150.0</td><td>7.500</td><td>217.9</td></tr><tr><td>0.300</td><td>73.4</td><td>1.600</td><td>102.5</td><td>4.000</td><td>160.2</td><td>8.000</td><td>224.9</td></tr><tr><td>0.400</td><td>95.9</td><td>1.800</td><td>108.5</td><td>4.500</td><td>169.7</td><td>8.500</td><td>231.7</td></tr><tr><td>0.500</td><td>98.4</td><td>2.000</td><td>114.2</td><td>5.000</td><td>178.6</td><td>9.000</td><td>238.3</td></tr><tr><td>0.600</td><td>99.1</td><td>2.200</td><td>119.7</td><td>5.500</td><td>187.2</td><td>9.500</td><td>244.7</td></tr><tr><td>0.800</td><td>97.6</td><td>2.400</td><td>124.8</td><td>6.000</td><td>195.3</td><td></td><td></td></tr><tr><td>1.000</td><td>93.3</td><td>2.600</td><td>129.8</td><td>6.500</td><td>203.1</td><td></td><td></td></tr></table>			Unit Reference	MD-SHE-0387-1000-1500-1000	Design Head (m)	1.500	Design Flow (l/s)	100.0	Flush-Flo™	Calculated	Objective	Minimise upstream storage	Diameter (mm)	387	Invert Level (m)	92.278	Minimum Outlet Pipe Diameter (mm)	450	Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)	Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.500	99.3	Kick-Flo®	1.136	86.8	Flush-Flo™	0.610	99.1	Mean Flow over Head Range	-	81.3	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	10.8	1.200	89.1	3.000	139.2	7.000	210.6	0.200	38.4	1.400	96.1	3.500	150.0	7.500	217.9	0.300	73.4	1.600	102.5	4.000	160.2	8.000	224.9	0.400	95.9	1.800	108.5	4.500	169.7	8.500	231.7	0.500	98.4	2.000	114.2	5.000	178.6	9.000	238.3	0.600	99.1	2.200	119.7	5.500	187.2	9.500	244.7	0.800	97.6	2.400	124.8	6.000	195.3			1.000	93.3	2.600	129.8	6.500	203.1		
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<u>Storage Structures for SURFACE WATER MODEL.SWS</u>							
<u>Tank or Pond Manhole: S20, DS/PN: S1.008</u>							
Invert Level (m) 92.278							
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	85.0	0.400	128.7	0.800	181.5	1.200	243.4
0.100	95.1	0.500	141.1	0.900	196.1	1.300	260.2
0.200	105.7	0.600	154.0	1.000	211.3	1.400	277.7
0.300	117.0	0.700	167.5	1.100	227.1	1.500	295.7

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Summary of Critical Results by Maximum Level (Rank 1) for SURFACE WATER MODEL.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 FEH								
Site Location GB 331550 356950 SJ 31550 56950								
C (1km) -0.025								
D1 (1km) 0.342								
D2 (1km) 0.403								
D3 (1km) 0.293								
E (1km) 0.287								
F (1km) 2.419								
Cv (Summer) 0.750								
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) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080								
Return Period(s) (years) 1, 30, 100								
Climate Change (%) 0, 0, 30								
PN	Storm	Return Period	Climate Change	First X Surchage	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.000	15 Winter	100	+30%	100/15 Summer	100/15 Winter			1
S2.000	15 Winter	100	+30%	100/15 Summer				
S1.001	15 Winter	100	+30%	30/15 Summer				
S1.002	15 Winter	100	+30%	30/15 Summer				
S1.003	15 Winter	100	+30%	100/15 Summer				
S3.000	15 Winter	100	+30%	100/15 Summer	100/15 Winter			1
S3.001	15 Winter	100	+30%	100/15 Summer	100/15 Winter			1
S3.002	15 Winter	100	+30%	30/15 Winter				
S3.003	15 Winter	100	+30%	30/15 Summer				
S4.000	15 Winter	100	+30%	100/15 Summer				
S3.004	15 Winter	100	+30%	30/15 Summer				
S5.000	15 Winter	100	+30%	100/15 Summer				
S3.005	15 Winter	100	+30%	30/15 Summer				
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