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7 St James Crescent Swansea Wales SA1 6DP	100YRS SURFACE WATER CALCULATIONS C1941	
Date 04/01/2023 File STORM NETWORK CALCS2.MDX	Designed by AJ Checked by DH	
XP Solutions	Network 2019.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.400	Add Flow / Climate Change (%)	0
Ratio R	0.354	Minimum Backdrop Height (m)	0.650
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
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)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.321	4-8	0.226

Total Area Contributing (ha) = 0.547

Total Pipe Volume (m³) = 26.558

Network Design Table for Storm

- Indicates pipe length does not match coordinates

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	1.000	0.017	58.8	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	1.000	0.633	1.6	0.040	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	15.641	0.080	195.5	0.080	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	21.400	0.110	194.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	19.482	0.100	194.8	0.081	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)
1.000	50.00	5.01	133.900	0.000	0.0	0.0	0.0	1.71	67.9	0.0
1.001	50.00	5.01	133.883	0.040	0.0	0.0	0.0	10.49	417.2	5.4
1.002	50.00	5.24	133.000	0.120	0.0	0.0	0.0	1.12	79.2	16.2
1.003	50.00	5.56	132.920	0.120	0.0	0.0	0.0	1.12	79.4	16.2
1.004	50.00	5.85	132.810	0.201	0.0	0.0	0.0	1.12	79.4	27.2

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Network Design Table for Storm

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
1.005	45.751	0.230	198.9	0.053	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.006	18.422	0.090	204.7	0.030	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.007	6.356	0.040	158.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.008	24.488	0.120	204.1	0.016	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.009	19.050	0.505	37.7	0.022	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.010	17.512	0.450	38.9	0.016	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.011	11.521#	0.250	46.1	0.112	0.00	0.0	0.600	o	750	Pipe/Conduit	
2.000	21.386	0.100	213.9	0.015	5.00	0.0	0.600	o	300	Pipe/Conduit	
2.001	36.811	0.180	204.5	0.029	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.012	14.383	0.060	239.7	0.053	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.013	16.087	0.065	247.5	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.014	5.553	0.320	17.4	0.000	0.00	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)
1.005	50.00	6.54	132.710	0.254	0.0	0.0	0.0	1.11	78.5	34.4
1.006	50.00	6.82	132.405	0.284	0.0	0.0	0.0	1.10	77.4	38.5
1.007	50.00	6.90	132.315	0.284	0.0	0.0	0.0	1.24	88.0	38.5
1.008	50.00	7.27	132.275	0.300	0.0	0.0	0.0	1.10	77.5	40.6
1.009	50.00	7.40	132.155	0.322	0.0	0.0	0.0	2.57	181.5	43.6
1.010	50.00	7.51	131.650	0.338	0.0	0.0	0.0	2.53	178.7	45.8
1.011	50.00	7.56	131.200	0.450	0.0	0.0	0.0	4.13	1824.1	60.9
2.000	50.00	5.33	128.680	0.015	0.0	0.0	0.0	1.07	75.7	2.0
2.001	50.00	5.89	128.580	0.044	0.0	0.0	0.0	1.10	77.5	6.0
1.012	49.93	7.77	128.325	0.547	0.0	0.0	0.0	1.17	128.8	74.0
1.013	49.22	8.00	128.265	0.547	0.0	0.0	0.0	1.15	126.7	74.0
1.014	49.16	8.02	128.200	0.547	0.0	0.0	0.0	4.37	482.4	74.0

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Network Classifications for Storm

PN	USMH	Pipe	Min Cover	Max Cover	Pipe Type	MH	MH	MH Ring	MH Type
	Name	Dia	Depth	Depth		Dia	Width	Depth	
		(mm)	(m)	(m)		(mm)	(mm)	(m)	
1.000	1	225	0.875	0.892	Unclassified	1200	0	0.875	Unclassified
1.001	2	225	0.892	1.525	Unclassified	1200	0	0.892	Unclassified
1.002	S4	300	1.700	3.080	Unclassified	1200	0	1.700	Unclassified
1.003	S5	300	3.080	4.590	Unclassified	1200	0	3.080	Unclassified
1.004	S6	300	4.590	4.690	Unclassified	1200	0	4.590	Unclassified
1.005	S7	300	2.620	4.690	Unclassified	1200	0	4.690	Unclassified
1.006	S8	300	2.485	2.695	Unclassified	1200	0	2.695	Unclassified
1.007	S9	300	2.325	2.485	Unclassified	1200	0	2.485	Unclassified
1.008	S10	300	1.645	2.325	Unclassified	1200	0	2.325	Unclassified
1.009	S11	300	1.500	1.645	Unclassified	1200	0	1.645	Unclassified
1.010	S12	300	1.500	1.500	Unclassified	1200	0	1.500	Unclassified
1.011	S13	750	0.100	1.050	Unclassified	1800	0	1.050	Unclassified
2.000	S19	300	3.220	3.320	Unclassified	1200	0	3.220	Unclassified
2.001	S20	300	3.100	3.320	Unclassified	1200	0	3.320	Unclassified
1.012	S16	375	2.960	3.100	Unclassified	1800	0	3.100	Unclassified
1.013	S17	375	2.925	2.960	Unclassified	1350	0	2.960	Unclassified
1.014	S18	375	2.925	2.925	Unclassified	1350	0	2.925	Unclassified

Free Flowing Outfall Details for Storm

Outfall	Outfall	C. Level	I. Level	Min	D,L	W
Pipe Number	Name	(m)	(m)	I. Level	(mm)	(mm)
				(m)		

1.014	SEWER CONNECTION	131.180	127.880	0.000	0	0
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Simulation Criteria for Storm

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	3
Number of Online Controls	2	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)	18.400	Storm Duration (mins)	30
Ratio R	0.354		

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 2, DS/PN: 1.001, Volume (m³): 1.3

Unit Reference	MD-SHE-0053-1000-0550-1000
Design Head (m)	0.550
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	53
Invert Level (m)	133.883
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.550	1.0
Flush-Flo™	0.166	1.0
Kick-Flo®	0.358	0.8
Mean Flow over Head Range	-	0.9

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	1.0	1.200	1.4	3.000	2.2	7.000	3.2
0.200	1.0	1.400	1.5	3.500	2.3	7.500	3.3
0.300	0.9	1.600	1.6	4.000	2.5	8.000	3.4
0.400	0.9	1.800	1.7	4.500	2.6	8.500	3.5
0.500	1.0	2.000	1.8	5.000	2.7	9.000	3.6
0.600	1.0	2.200	1.9	5.500	2.8	9.500	3.7
0.800	1.2	2.400	1.9	6.000	3.0		
1.000	1.3	2.600	2.0	6.500	3.1		

Hydro-Brake® Optimum Manhole: S18, DS/PN: 1.014, Volume (m³): 6.4

Unit Reference	MD-SHE-0059-2700-3200-2700
Design Head (m)	3.200
Design Flow (l/s)	2.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	59
Invert Level (m)	128.200
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

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Hydro-Brake® Optimum Manhole: S18, DS/PN: 1.014, Volume (m³): 6.4

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	3.200	2.7
Flush-Flo™	0.261	1.5
Kick-Flo®	0.534	1.2
Mean Flow over Head Range	-	1.9

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	1.3	1.200	1.7	3.000	2.6	7.000	3.9
0.200	1.5	1.400	1.8	3.500	2.8	7.500	4.0
0.300	1.5	1.600	2.0	4.000	3.0	8.000	4.1
0.400	1.4	1.800	2.1	4.500	3.2	8.500	4.3
0.500	1.3	2.000	2.2	5.000	3.3	9.000	4.4
0.600	1.3	2.200	2.3	5.500	3.5	9.500	4.5
0.800	1.4	2.400	2.4	6.000	3.6		
1.000	1.6	2.600	2.5	6.500	3.8		

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Storage Structures for Storm

Cellular Storage Manhole: 2, DS/PN: 1.001

Invert Level (m) 133.933 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	40.0	40.0	0.501	0.0	52.7
0.500	40.0	52.6			

Cellular Storage Manhole: S19, DS/PN: 2.000

Invert Level (m) 128.700 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	95.0	95.0	2.501	0.0	192.5
2.500	95.0	192.5			

Cellular Storage Manhole: S18, DS/PN: 1.014

Invert Level (m) 128.200 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	65.0	65.0	2.501	0.0	145.6
2.500	65.0	145.6			