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73 Howard Street North Shields Tyne & Wear, NE30 1AF		
Date 25/11/2024 07:13 File Microdrainage Calcs-202...	Designed by alexe Checked by	
Innovyze	Network 2020.1.3	

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)	1	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
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	0.160	4-8	0.097

Total Area Contributing (ha) = 0.257

Total Pipe Volume (m³) = 10.289

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
1.000	16.430	0.207	79.4	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit	
1.001	14.250	0.692	20.6	0.039	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.002	10.705	0.085	125.9	0.041	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	26.044	0.819	31.8	0.050	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	20.001	0.575	34.8	0.038	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	25.932	0.675	38.4	0.035	5.00	0.0	0.600	o	150	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	47.41	5.32	218.053	0.000	0.0	0.0	0.0	0.86	6.8	0.0
1.001	46.89	5.46	217.846	0.039	0.0	0.0	0.0	1.71	13.4	5.0
1.002	46.16	5.66	217.104	0.080	0.0	0.0	0.0	0.89	15.8	10.0
1.003	45.50	5.84	216.944	0.130	0.0	0.0	0.0	2.33	92.6	16.0
1.004	44.99	5.99	216.125	0.168	0.0	0.0	0.0	2.23	88.5	20.5
2.000	47.61	5.27	216.625	0.035	0.0	0.0	0.0	1.63	28.8	4.5

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Synthetic Rainfall Details Storm Duration (mins) 10080		
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Online Controls for Storm

Hydro-Brake® Optimum Manhole: fc, DS/PN: 1.007, Volume (m³): 5.2

Unit Reference	MD-SHE-0076-3500-2055-3500
Design Head (m)	2.055
Design Flow (l/s)	3.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	76
Invert Level (m)	214.175
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.055	3.5
Flush-Flo™	0.331	2.6
Kick-Flo®	0.673	2.1
Mean Flow over Head Range	-	2.7

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	2.1	1.200	2.7	3.000	4.2	7.000	6.2
0.200	2.5	1.400	2.9	3.500	4.5	7.500	6.4
0.300	2.6	1.600	3.1	4.000	4.8	8.000	6.6
0.400	2.6	1.800	3.3	4.500	5.0	8.500	6.8
0.500	2.5	2.000	3.5	5.000	5.3	9.000	7.0
0.600	2.3	2.200	3.6	5.500	5.5	9.500	7.2
0.800	2.3	2.400	3.8	6.000	5.8		
1.000	2.5	2.600	3.9	6.500	6.0		

Hydro-Brake® Optimum Manhole: sw2, DS/PN: 1.009, Volume (m³): 8.2

Unit Reference	MD-SHE-0075-3100-1680-3100
Design Head (m)	1.680
Design Flow (l/s)	3.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	213.886
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

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Storage Structures for Storm Cellular Storage Manhole: 7, DS/PN: 1.006 Invert Level (m) 214.270 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>133.0</td><td>0.0</td><td>1.201</td><td>0.0</td><td>0.0</td></tr><tr><td>1.200</td><td>133.0</td><td>0.0</td><td></td><td></td><td></td></tr></tbody></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	133.0	0.0	1.201	0.0	0.0	1.200	133.0	0.0			
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