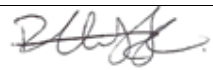




BELL MUNRO CONSULTING LTD.

**Proposed Development at
Osbourne's Yard,**

**Drainage Calculations
Rev. B
March 2022**

	Initials	Signature	Date
Prepared by:	R.C		03/22
Checked by:	S.J.B		03/22
Approved by:	S.J.B		03/22

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Bell Munro Consulting Ltd										Page 1			
Turing House 5 Archway Manchester M15 5RL													
Date 11/03/2022 09:45										Designed by RichardCliffe			
File J7119 NETWORK 27 09 21.MDX										Checked by			
XP Solutions						Network 2020.1.3							
<u>STORM SEWER DESIGN by the Modified Rational Method</u>													
<u>Design Criteria for Storm</u>													
Pipe Sizes STANDARD Manhole Sizes STANDARD													
FSR Rainfall Model - England and Wales													
Return Period (years)		100						PIMP (%)		100			
M5-60 (mm)		18.000				Add Flow / Climate Change (%)				0			
Ratio R		0.361				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													
<u>Network Design Table for Storm</u>													
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	22.376	0.373	60.0	0.024	4.00	0.0	0.600	o	150	Pipe/Conduit			
1.001	37.605	0.627	60.0	0.039	0.00	0.0	0.600	o	150	Pipe/Conduit			
1.002	18.651	0.186	100.0	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit			
1.003	4.691	0.255	18.4	0.054	0.00	0.0	0.600	o	225	Pipe/Conduit			
2.000	48.517	0.485	100.0	0.028	4.00	0.0	0.600	o	150	Pipe/Conduit			
2.001	2.650	0.031	85.5	0.055	0.00	0.0	0.600	o	150	Pipe/Conduit			
1.004	48.699	0.110	442.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit			
1.005	2.694	0.034	80.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit			
<u>Network Results Table</u>													
PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)			
1.000	50.00	4.29	57.300	0.024	0.0	0.0	0.0	1.30	23.0	3.2			
1.001	50.00	4.77	56.927	0.063	0.0	0.0	0.0	1.30	23.0	8.5			
1.002	50.00	5.01	56.225	0.078	0.0	0.0	0.0	1.31	52.0	10.5			
1.003	50.00	5.03	56.039	0.131	0.0	0.0	0.0	3.07	121.9	17.8			
2.000	50.00	4.80	57.100	0.028	0.0	0.0	0.0	1.00	17.8	3.8			
2.001	50.00	4.85	56.615	0.084	0.0	0.0	0.0	1.09	19.2	11.3			
1.004	50.00	6.13	55.709	0.215	0.0	0.0	0.0	0.74	52.4	29.1			
1.005	50.00	6.15	55.599	0.215	0.0	0.0	0.0	1.76	124.4	29.1			
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XP Solutions		Network 2020.1.3																																																																																													
Online Controls for Storm Hydro-Brake® Optimum Manhole: SW08, DS/PN: 1.005, Volume (m³): 7.1 Unit Reference MD-SHE-0132-8000-1000-8000 Design Head (m)1.000 Design Flow (l/s)8.0 Flush-Flo™Calculated ObjectiveMinimise upstream storage ApplicationSurface Sump AvailableYes Diameter (mm)132 Invert Level (m)55.599 Minimum Outlet Pipe Diameter (mm)150 Suggested Manhole Diameter (mm)1200 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>1.000</td><td>8.0</td><td>Kick-Flo®</td><td>0.664</td><td>6.6</td></tr><tr><td>Flush-Flo™</td><td>0.302</td><td>8.0</td><td>Mean Flow over Head Range</td><td>-</td><td>6.9</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><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>4.7</td><td>1.200</td><td>8.7</td><td>3.000</td><td>13.4</td><td>7.000</td><td>20.1</td></tr><tr><td>0.200</td><td>7.8</td><td>1.400</td><td>9.4</td><td>3.500</td><td>14.5</td><td>7.500</td><td>20.8</td></tr><tr><td>0.300</td><td>8.0</td><td>1.600</td><td>10.0</td><td>4.000</td><td>15.4</td><td>8.000</td><td>21.5</td></tr><tr><td>0.400</td><td>7.9</td><td>1.800</td><td>10.5</td><td>4.500</td><td>16.3</td><td>8.500</td><td>22.1</td></tr><tr><td>0.500</td><td>7.7</td><td>2.000</td><td>11.1</td><td>5.000</td><td>17.1</td><td>9.000</td><td>22.7</td></tr><tr><td>0.600</td><td>7.2</td><td>2.200</td><td>11.6</td><td>5.500</td><td>17.9</td><td>9.500</td><td>23.3</td></tr><tr><td>0.800</td><td>7.2</td><td>2.400</td><td>12.1</td><td>6.000</td><td>18.7</td><td></td><td></td></tr><tr><td>1.000</td><td>8.0</td><td>2.600</td><td>12.6</td><td>6.500</td><td>19.4</td><td></td><td></td></tr></table> <tr><td colspan="3">©1982-2020 Innovyze</td></tr>			Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.000	8.0	Kick-Flo®	0.664	6.6	Flush-Flo™	0.302	8.0	Mean Flow over Head Range	-	6.9	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	4.7	1.200	8.7	3.000	13.4	7.000	20.1	0.200	7.8	1.400	9.4	3.500	14.5	7.500	20.8	0.300	8.0	1.600	10.0	4.000	15.4	8.000	21.5	0.400	7.9	1.800	10.5	4.500	16.3	8.500	22.1	0.500	7.7	2.000	11.1	5.000	17.1	9.000	22.7	0.600	7.2	2.200	11.6	5.500	17.9	9.500	23.3	0.800	7.2	2.400	12.1	6.000	18.7			1.000	8.0	2.600	12.6	6.500	19.4			©1982-2020 Innovyze		
Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)																																																																																										
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XP Solutions		Network 2020.1.3																		
<u>Storage Structures for Storm</u> <u>Cellular Storage Manhole: SW07, DS/PN: 1.004</u> Invert Level (m) 55.709 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table border="1"> <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>136.0</td> <td>68.0</td> <td>0.801</td> <td>0.0</td> <td>101.6</td> </tr> <tr> <td>0.800</td> <td>136.0</td> <td>101.6</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>			Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	136.0	68.0	0.801	0.0	101.6	0.800	136.0	101.6			
Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)															
0.000	136.0	68.0	0.801	0.0	101.6															
0.800	136.0	101.6																		
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Turing House 5 Archway Manchester M15 5RL									
Date 11/03/2022 09:46 File J7119 NETWORK 27 09 21.MDX								Designed by RichardCliffe Checked by	
XP Solutions					Network 2020.1.3				
<u>Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>									
<u>Simulation Criteria</u>									
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 Offline Controls 0 Number of Time/Area Diagrams 0									
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0									
<u>Synthetic Rainfall Details</u>									
Rainfall Model FSR Ratio R 0.361									
Region England and Wales Cv (Summer) 0.750									
M5-60 (mm) 18.000 Cv (Winter) 0.840									
Margin for Flood Risk Warning (mm) 300.0									
Analysis Timestep 2.5 Second Increment (Extended)									
DTS Status ON									
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, 2160, 2880, 4320, 5760, 7200, 8640, 10080									
Return Period(s) (years) 100									
Climate Change (%) 40									
</									

