

Jubb Consulting Engineers Ltd (Bristol)							Page 1																																																																																																																																																																																																																																																																																	
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Date 07/08/2020 15:17 File 20200807 Attenuation.SRCX			Designed by TJayne Checked by																																																																																																																																																																																																																																																																																					
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<u>Summary of Results for 100 year Return Period (+40%)</u> Half Drain Time : 28 minutes. <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Control (l/s)</th><th>Max Σ Outflow (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>49.229</td><td>0.729</td><td>0.0</td><td>16.0</td><td>16.0</td><td>36.0</td><td>O K</td></tr><tr><td>30 min Summer</td><td>49.351</td><td>0.851</td><td>0.0</td><td>16.0</td><td>16.0</td><td>42.0</td><td>O K</td></tr><tr><td>60 min Summer</td><td>49.378</td><td>0.878</td><td>0.0</td><td>16.0</td><td>16.0</td><td>43.4</td><td>O K</td></tr><tr><td>120 min Summer</td><td>49.286</td><td>0.786</td><td>0.0</td><td>16.0</td><td>16.0</td><td>38.8</td><td>O K</td></tr><tr><td>180 min Summer</td><td>49.139</td><td>0.639</td><td>0.0</td><td>16.0</td><td>16.0</td><td>31.6</td><td>O K</td></tr><tr><td>240 min Summer</td><td>49.005</td><td>0.505</td><td>0.0</td><td>16.0</td><td>16.0</td><td>25.0</td><td>O K</td></tr><tr><td>360 min Summer</td><td>48.819</td><td>0.319</td><td>0.0</td><td>16.0</td><td>16.0</td><td>15.8</td><td>O K</td></tr><tr><td>480 min Summer</td><td>48.720</td><td>0.220</td><td>0.0</td><td>15.6</td><td>15.6</td><td>10.9</td><td>O K</td></tr><tr><td>600 min Summer</td><td>48.680</td><td>0.180</td><td>0.0</td><td>14.5</td><td>14.5</td><td>8.9</td><td>O K</td></tr><tr><td>720 min Summer</td><td>48.661</td><td>0.161</td><td>0.0</td><td>12.8</td><td>12.8</td><td>7.9</td><td>O K</td></tr><tr><td>960 min Summer</td><td>48.637</td><td>0.137</td><td>0.0</td><td>10.5</td><td>10.5</td><td>6.8</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>48.612</td><td>0.112</td><td>0.0</td><td>7.7</td><td>7.7</td><td>5.5</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>48.593</td><td>0.093</td><td>0.0</td><td>5.6</td><td>5.6</td><td>4.6</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>48.582</td><td>0.082</td><td>0.0</td><td>4.5</td><td>4.5</td><td>4.0</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>48.568</td><td>0.068</td><td>0.0</td><td>3.2</td><td>3.2</td><td>3.4</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>48.560</td><td>0.060</td><td>0.0</td><td>2.6</td><td>2.6</td><td>3.0</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>48.555</td><td>0.055</td><td>0.0</td><td>2.1</td><td>2.1</td><td>2.7</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>48.551</td><td>0.051</td><td>0.0</td><td>1.9</td><td>1.9</td><td>2.5</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>48.548</td><td>0.048</td><td>0.0</td><td>1.7</td><td>1.7</td><td>2.4</td><td>O K</td></tr><tr><td>15 min Winter</td><td>49.330</td><td>0.830</td><td>0.0</td><td>16.0</td><td>16.0</td><td>41.0</td><td>O K</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Discharge Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 min Summer</td><td>140.607</td><td>0.0</td><td>46.1</td><td>16</td></tr><tr><td>30 min Summer</td><td>93.846</td><td>0.0</td><td>61.6</td><td>27</td></tr><tr><td>60 min Summer</td><td>59.609</td><td>0.0</td><td>78.2</td><td>44</td></tr><tr><td>120 min Summer</td><td>36.437</td><td>0.0</td><td>95.6</td><td>78</td></tr><tr><td>180 min Summer</td><td>26.865</td><td>0.0</td><td>105.8</td><td>112</td></tr><tr><td>240 min Summer</td><td>21.572</td><td>0.0</td><td>113.2</td><td>142</td></tr><tr><td>360 min Summer</td><td>15.825</td><td>0.0</td><td>124.6</td><td>198</td></tr><tr><td>480 min Summer</td><td>12.681</td><td>0.0</td><td>133.1</td><td>252</td></tr><tr><td>600 min Summer</td><td>10.670</td><td>0.0</td><td>140.0</td><td>308</td></tr><tr><td>720 min Summer</td><td>9.261</td><td>0.0</td><td>145.8</td><td>368</td></tr><tr><td>960 min Summer</td><td>7.400</td><td>0.0</td><td>155.4</td><td>490</td></tr><tr><td>1440 min Summer</td><td>5.384</td><td>0.0</td><td>169.6</td><td>734</td></tr><tr><td>2160 min Summer</td><td>3.909</td><td>0.0</td><td>184.7</td><td>1100</td></tr><tr><td>2880 min Summer</td><td>3.110</td><td>0.0</td><td>195.9</td><td>1468</td></tr><tr><td>4320 min Summer</td><td>2.250</td><td>0.0</td><td>212.6</td><td>2168</td></tr><tr><td>5760 min Summer</td><td>1.786</td><td>0.0</td><td>225.1</td><td>2936</td></tr><tr><td>7200 min Summer</td><td>1.495</td><td>0.0</td><td>235.5</td><td>3656</td></tr><tr><td>8640 min Summer</td><td>1.293</td><td>0.0</td><td>244.4</td><td>4360</td></tr><tr><td>10080 min Summer</td><td>1.144</td><td>0.0</td><td>252.2</td><td>5128</td></tr><tr><td>15 min Winter</td><td>140.607</td><td>0.0</td><td>51.6</td><td>16</td></tr></table>								Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status	15 min Summer	49.229	0.729	0.0	16.0	16.0	36.0	O K	30 min Summer	49.351	0.851	0.0	16.0	16.0	42.0	O K	60 min Summer	49.378	0.878	0.0	16.0	16.0	43.4	O K	120 min Summer	49.286	0.786	0.0	16.0	16.0	38.8	O K	180 min Summer	49.139	0.639	0.0	16.0	16.0	31.6	O K	240 min Summer	49.005	0.505	0.0	16.0	16.0	25.0	O K	360 min Summer	48.819	0.319	0.0	16.0	16.0	15.8	O K	480 min Summer	48.720	0.220	0.0	15.6	15.6	10.9	O K	600 min Summer	48.680	0.180	0.0	14.5	14.5	8.9	O K	720 min Summer	48.661	0.161	0.0	12.8	12.8	7.9	O K	960 min Summer	48.637	0.137	0.0	10.5	10.5	6.8	O K	1440 min Summer	48.612	0.112	0.0	7.7	7.7	5.5	O K	2160 min Summer	48.593	0.093	0.0	5.6	5.6	4.6	O K	2880 min Summer	48.582	0.082	0.0	4.5	4.5	4.0	O K	4320 min Summer	48.568	0.068	0.0	3.2	3.2	3.4	O K	5760 min Summer	48.560	0.060	0.0	2.6	2.6	3.0	O K	7200 min Summer	48.555	0.055	0.0	2.1	2.1	2.7	O K	8640 min Summer	48.551	0.051	0.0	1.9	1.9	2.5	O K	10080 min Summer	48.548	0.048	0.0	1.7	1.7	2.4	O K	15 min Winter	49.330	0.830	0.0	16.0	16.0	41.0	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	15 min Summer	140.607	0.0	46.1	16	30 min Summer	93.846	0.0	61.6	27	60 min Summer	59.609	0.0	78.2	44	120 min Summer	36.437	0.0	95.6	78	180 min Summer	26.865	0.0	105.8	112	240 min Summer	21.572	0.0	113.2	142	360 min Summer	15.825	0.0	124.6	198	480 min Summer	12.681	0.0	133.1	252	600 min Summer	10.670	0.0	140.0	308	720 min Summer	9.261	0.0	145.8	368	960 min Summer	7.400	0.0	155.4	490	1440 min Summer	5.384	0.0	169.6	734	2160 min Summer	3.909	0.0	184.7	1100	2880 min Summer	3.110	0.0	195.9	1468	4320 min Summer	2.250	0.0	212.6	2168	5760 min Summer	1.786	0.0	225.1	2936	7200 min Summer	1.495	0.0	235.5	3656	8640 min Summer	1.293	0.0	244.4	4360	10080 min Summer	1.144	0.0	252.2	5128	15 min Winter	140.607	0.0	51.6	16
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<u>Summary of Results for 100 year Return Period (+40%)</u>							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	49.474	0.974	0.0	16.0	16.0	48.1	O K
60 min Winter	49.492	0.992	0.0	16.0	16.0	49.0	O K
120 min Winter	49.340	0.840	0.0	16.0	16.0	41.5	O K
180 min Winter	49.107	0.607	0.0	16.0	16.0	30.0	O K
240 min Winter	48.910	0.410	0.0	16.0	16.0	20.2	O K
360 min Winter	48.702	0.202	0.0	15.4	15.4	10.0	O K
480 min Winter	48.661	0.161	0.0	12.9	12.9	8.0	O K
600 min Winter	48.642	0.142	0.0	11.0	11.0	7.0	O K
720 min Winter	48.629	0.129	0.0	9.5	9.5	6.4	O K
960 min Winter	48.612	0.112	0.0	7.6	7.6	5.5	O K
1440 min Winter	48.593	0.093	0.0	5.6	5.6	4.6	O K
2160 min Winter	48.577	0.077	0.0	4.0	4.0	3.8	O K
2880 min Winter	48.568	0.068	0.0	3.2	3.2	3.4	O K
4320 min Winter	48.557	0.057	0.0	2.3	2.3	2.8	O K
5760 min Winter	48.551	0.051	0.0	1.9	1.9	2.5	O K
7200 min Winter	48.546	0.046	0.0	1.6	1.6	2.3	O K
8640 min Winter	48.543	0.043	0.0	1.3	1.3	2.1	O K
10080 min Winter	48.540	0.040	0.0	1.2	1.2	2.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
30 min Winter	93.846	0.0	68.9	29			
60 min Winter	59.609	0.0	87.6	46			
120 min Winter	36.437	0.0	107.1	84			
180 min Winter	26.865	0.0	118.4	118			
240 min Winter	21.572	0.0	126.8	146			
360 min Winter	15.825	0.0	139.5	194			
480 min Winter	12.681	0.0	149.1	250			
600 min Winter	10.670	0.0	156.8	308			
720 min Winter	9.261	0.0	163.3	368			
960 min Winter	7.400	0.0	174.0	490			
1440 min Winter	5.384	0.0	189.9	732			
2160 min Winter	3.909	0.0	206.8	1104			
2880 min Winter	3.110	0.0	219.4	1444			
4320 min Winter	2.250	0.0	238.2	2144			
5760 min Winter	1.786	0.0	252.1	2864			
7200 min Winter	1.495	0.0	263.7	3648			
8640 min Winter	1.293	0.0	273.7	4328			
10080 min Winter	1.144	0.0	282.4	5016			
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<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>21.000</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.361</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.175 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.175</td> </tr> </tbody> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	21.000	Shortest Storm (mins)	15	Ratio R	0.361	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+40	Time (mins)		Area	From:	To:	(ha)	0	4	0.175
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Jubb Consulting Engineers Ltd (Bristol)		Page 4
St James's Court, Suite B Ground Floor West, St James ... Bristol, BS1 3LH		
Date 07/08/2020 15:17 File 20200807 Attenuation.SRCX	Designed by TJayne Checked by	
Innovyze Source Control 2019.1		

Model Details

Storage is Online Cover Level (m) 51.650

Cellular Storage Structure

Invert Level (m) 48.500 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	52.0	0.0	1.010	0.0	0.0
1.000	52.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0180-1600-1000-1600
Design Head (m) 1.000
Design Flow (l/s) 16.0
Flush-Flo™ Calculated
Objective Minimise upstream storage
Application Surface
Sump Available Yes
Diameter (mm) 180
Invert Level (m) 48.500
Minimum Outlet Pipe Diameter (mm) 225
Suggested Manhole Diameter (mm) 1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	16.0
Flush-Flo™	0.324	16.0
Kick-Flo®	0.706	13.6
Mean Flow over Head Range	-	13.6

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	6.3	1.200	17.4	3.000	27.0	7.000	40.7
0.200	15.4	1.400	18.8	3.500	29.1	7.500	42.1
0.300	16.0	1.600	20.0	4.000	31.0	8.000	43.4
0.400	15.9	1.800	21.2	4.500	32.9	8.500	44.7
0.500	15.6	2.000	22.3	5.000	34.6	9.000	45.9
0.600	15.0	2.200	23.3	5.500	36.2	9.500	47.2
0.800	14.4	2.400	24.3	6.000	37.7		
1.000	16.0	2.600	25.2	6.500	39.2		

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