

Topping Engineers Ltd						Page 1	
Aire House 12 Victoria Avenue Harrogate, HG1 1ED							
Date 01/10/2021 12:30 File SOURCE 011021.SRCX				Designed by Rob Checked by			
Innovyze				Source Control 2020.1			
<u>Summary of Results for 100 year Return Period (+30%)</u> Half Drain Time : 1812 minutes.							
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	92.686	0.686	0.0	0.0	0.0	303.0	O K
30 min Summer	92.921	0.921	0.0	0.0	0.0	406.8	O K
60 min Summer	93.169	1.169	0.0	4.5	4.5	516.3	O K
120 min Summer	93.424	1.424	0.0	5.2	5.2	628.9	O K
180 min Summer	93.572	1.572	0.0	5.2	5.2	694.4	O K
240 min Summer	93.672	1.672	0.0	5.2	5.2	738.4	O K
360 min Summer	93.811	1.811	0.0	5.2	5.2	800.0	O K
480 min Summer	93.914	1.914	0.0	5.2	5.2	845.4	O K
600 min Summer	93.990	1.990	0.0	5.2	5.2	879.2	O K
720 min Summer	94.046	2.046	0.0	5.2	5.2	903.8	O K
960 min Summer	94.119	2.119	0.0	5.2	5.2	936.0	O K
1440 min Summer	94.179	2.179	0.0	5.2	5.2	962.7	O K
2160 min Summer	94.220	2.220	0.0	5.2	5.2	980.5	O K
2880 min Summer	94.238	2.238	0.0	5.2	5.2	988.6	O K
4320 min Summer	94.230	2.230	0.0	5.2	5.2	984.9	O K
5760 min Summer	94.185	2.185	0.0	5.2	5.2	965.0	O K
7200 min Summer	94.118	2.118	0.0	5.2	5.2	935.5	O K
8640 min Summer	94.038	2.038	0.0	5.2	5.2	900.2	O K
10080 min Summer	93.944	1.944	0.0	5.2	5.2	858.6	O K
15 min Winter	92.768	0.768	0.0	0.0	0.0	339.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
15 min Summer	116.077	0.0	0.0	27			
30 min Summer	77.924	0.0	0.0	42			
60 min Summer	49.937	0.0	77.5	70			
120 min Summer	30.911	0.0	201.2	130			
180 min Summer	23.009	0.0	276.1	190			
240 min Summer	18.531	0.0	329.0	248			
360 min Summer	13.610	0.0	407.0	368			
480 min Summer	10.932	0.0	466.5	488			
600 min Summer	9.215	0.0	514.3	606			
720 min Summer	8.010	0.0	554.0	724			
960 min Summer	6.415	0.0	615.5	962			
1440 min Summer	4.683	0.0	623.0	1374			
2160 min Summer	3.411	0.0	837.3	1696			
2880 min Summer	2.721	0.0	917.5	2072			
4320 min Summer	1.975	0.0	1026.2	2896			
5760 min Summer	1.571	0.0	1131.7	3696			
7200 min Summer	1.315	0.0	1204.0	4536			
8640 min Summer	1.137	0.0	1266.2	5360			
10080 min Summer	1.007	0.0	1320.2	6152			
15 min Winter	116.077	0.0	0.0	27			
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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>19.000</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.353</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+30</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 1.392 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0 4</td> <td>0.464</td> <td>4 8</td> <td>0.464</td> <td>8 12</td> <td>0.464</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)	19.000	Shortest Storm (mins)	15	Ratio R	0.353	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+30	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	From: To:	(ha)	0 4	0.464	4 8	0.464	8 12	0.464
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Model Details

Storage is Online Cover Level (m) 95.000

Cellular Storage Structure

Invert Level (m) 92.000 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	465.0	465.0	2.600	0.0	695.0
2.500	465.0	695.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0101-6000-2000-6000
 Design Head (m) 2.000
 Design Flow (l/s) 6.0
 Flush-Flo™ Calculated
 Objective Minimise upstream storage
 Application Surface
 Sump Available Yes
 Diameter (mm) 101
 Invert Level (m) 93.000
 Minimum Outlet Pipe Diameter (mm) 150
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	6.0
Flush-Flo™	0.438	5.2
Kick-Flo®	0.900	4.1
Mean Flow over Head Range	-	4.8

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	3.3	1.200	4.7	3.000	7.3	7.000	10.8
0.200	4.7	1.400	5.1	3.500	7.8	7.500	11.2
0.300	5.1	1.600	5.4	4.000	8.3	8.000	11.5
0.400	5.2	1.800	5.7	4.500	8.8	8.500	11.9
0.500	5.2	2.000	6.0	5.000	9.2	9.000	12.2
0.600	5.1	2.200	6.3	5.500	9.7	9.500	12.5
0.800	4.7	2.400	6.5	6.000	10.1		
1.000	4.3	2.600	6.8	6.500	10.5		

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