



Base Energy Services Limited		Page 1
44 Canal Street Bootle Liverpool L20 8QU	1 St James' Road 100yr 40CC 0.2ls Green Roof to Storage	
Date 13/04/2020 File Green roof and attenuat...	Designed by CC Checked by PK	
Micro Drainage	Source Control 2019.1	

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	0.304	0.304	0.1	4.6	O K
30 min Summer	0.431	0.431	0.1	6.5	O K
60 min Summer	0.564	0.564	0.2	8.5	O K
120 min Summer	0.693	0.693	0.2	10.4	O K
180 min Summer	0.758	0.758	0.2	11.4	O K
240 min Summer	0.793	0.793	0.2	11.9	O K
360 min Summer	0.826	0.826	0.2	12.4	O K
480 min Summer	0.835	0.835	0.2	12.5	O K
600 min Summer	0.832	0.832	0.2	12.5	O K
720 min Summer	0.827	0.827	0.2	12.4	O K
960 min Summer	0.813	0.813	0.2	12.2	O K
1440 min Summer	0.776	0.776	0.2	11.6	O K
2160 min Summer	0.712	0.712	0.2	10.7	O K
2880 min Summer	0.651	0.651	0.2	9.8	O K
4320 min Summer	0.545	0.545	0.2	8.2	O K
5760 min Summer	0.457	0.457	0.1	6.9	O K
7200 min Summer	0.384	0.384	0.1	5.8	O K
8640 min Summer	0.322	0.322	0.1	4.8	O K
10080 min Summer	0.269	0.269	0.1	4.0	O K
15 min Winter	0.353	0.353	0.1	5.3	O K
30 min Winter	0.496	0.496	0.1	7.4	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	138.153	0.0	5.1	82
30 min Summer	90.705	0.0	7.1	93
60 min Summer	56.713	0.0	9.3	112
120 min Summer	34.246	0.0	11.5	156
180 min Summer	25.149	0.0	12.7	202
240 min Summer	20.078	0.0	13.6	254
360 min Summer	14.585	0.0	14.9	366
480 min Summer	11.622	0.0	15.9	482
600 min Summer	9.738	0.0	16.6	552
720 min Summer	8.424	0.0	17.3	610
960 min Summer	6.697	0.0	18.3	734
1440 min Summer	4.839	0.0	19.7	1002
2160 min Summer	3.490	0.0	21.2	1412
2880 min Summer	2.766	0.0	22.1	1820
4320 min Summer	1.989	0.0	23.3	2616
5760 min Summer	1.573	0.0	24.0	3400
7200 min Summer	1.311	0.0	24.5	4144
8640 min Summer	1.129	0.0	24.7	4904
10080 min Summer	0.994	0.0	24.8	5656
15 min Winter	138.153	0.0	5.9	83
30 min Winter	90.705	0.0	8.2	94

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
60 min Winter	0.644	0.644	0.2	9.7	O K
120 min Winter	0.790	0.790	0.2	11.8	O K
180 min Winter	0.864	0.864	0.2	13.0	O K
240 min Winter	0.906	0.906	0.2	13.6	O K
360 min Winter	0.949	0.949	0.2	14.2	O K
480 min Winter	0.964	0.964	0.2	14.5	O K
600 min Winter	0.965	0.965	0.2	14.5	O K
720 min Winter	0.957	0.957	0.2	14.3	O K
960 min Winter	0.936	0.936	0.2	14.0	O K
1440 min Winter	0.886	0.886	0.2	13.3	O K
2160 min Winter	0.796	0.796	0.2	11.9	O K
2880 min Winter	0.708	0.708	0.2	10.6	O K
4320 min Winter	0.557	0.557	0.2	8.3	O K
5760 min Winter	0.436	0.436	0.1	6.5	O K
7200 min Winter	0.340	0.340	0.1	5.1	O K
8640 min Winter	0.261	0.261	0.1	3.9	O K
10080 min Winter	0.187	0.187	0.1	2.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
60 min Winter	56.713	0.0	10.6	114
120 min Winter	34.246	0.0	13.0	156
180 min Winter	25.149	0.0	14.4	204
240 min Winter	20.078	0.0	15.4	254
360 min Winter	14.585	0.0	16.9	362
480 min Winter	11.622	0.0	18.0	474
600 min Winter	9.738	0.0	18.8	582
720 min Winter	8.424	0.0	19.5	678
960 min Winter	6.697	0.0	20.7	774
1440 min Winter	4.839	0.0	22.0	1080
2160 min Winter	3.490	0.0	24.0	1528
2880 min Winter	2.766	0.0	25.1	1960
4320 min Winter	1.989	0.0	26.6	2784
5760 min Winter	1.573	0.0	27.5	3584
7200 min Winter	1.311	0.0	28.1	4360
8640 min Winter	1.129	0.0	28.4	5136
10080 min Winter	0.994	0.0	28.7	5968

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Rainfall Details

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)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Green Roof

Area (m ³)	250	Evaporation (mm/day)	3
Depression Storage (mm)	5	Decay Coefficient	0.050

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From:	To:	From:	To:	From:	To:	From:	To:
0	4	32	36	64	68	96	100
4	8	36	40	68	72	100	104
8	12	40	44	72	76	104	108
12	16	44	48	76	80	108	112
16	20	48	52	80	84	112	116
20	24	52	56	84	88	116	120
24	28	56	60	88	92		
28	32	60	64	92	96		

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Model Details

Storage is Online Cover Level (m) 1.500

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	15.0	0.700	15.0	1.400	15.0	2.100	15.0
0.100	15.0	0.800	15.0	1.500	15.0	2.200	15.0
0.200	15.0	0.900	15.0	1.600	15.0	2.300	15.0
0.300	15.0	1.000	15.0	1.700	15.0	2.400	15.0
0.400	15.0	1.100	15.0	1.800	15.0	2.500	15.0
0.500	15.0	1.200	15.0	1.900	15.0		
0.600	15.0	1.300	15.0	2.000	15.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SCL-0019-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	0.2
Flush-Flo™	Calculated
Objective	Minimise blockage risk
Application	Surface
Sump Available	Yes
Diameter (mm)	19
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	0.2
Flush-Flo™	0.082	0.1
Kick-Flo®	0.167	0.1
Mean Flow over Head Range	-	0.1

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	0.1	1.200	0.2	3.000	0.3	7.000	0.5
0.200	0.1	1.400	0.2	3.500	0.3	7.500	0.5
0.300	0.1	1.600	0.2	4.000	0.4	8.000	0.5
0.400	0.1	1.800	0.3	4.500	0.4	8.500	0.5
0.500	0.1	2.000	0.3	5.000	0.4	9.000	0.5
0.600	0.2	2.200	0.3	5.500	0.4	9.500	0.5
0.800	0.2	2.400	0.3	6.000	0.4		
1.000	0.2	2.600	0.3	6.500	0.4		