

48 West End
Westbury
Wiltshire, BA13 3JG

LSHTM
Attenuation Tank



Date 05/10/2021
File Cascade.CASX

Designed by Peter White
Checked by

Innovyze

Source Control 2020.1.3

Cascade Summary of Results for Tank.SRCX

Upstream Structures Outflow To Overflow To

Bluerooft 1.SRCX (None) (None)
Bluerooft 2.SRCX

Half Drain Time : 41 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	22.912	0.737	0.0	4.7	4.7	14.7	O K
30 min Summer	23.042	0.867	0.0	4.7	4.7	17.3	O K
60 min Summer	23.045	0.870	0.0	4.7	4.7	17.4	O K
120 min Summer	22.959	0.784	0.0	4.7	4.7	15.6	O K
180 min Summer	22.837	0.662	0.0	4.7	4.7	13.2	O K
240 min Summer	22.721	0.546	0.0	4.7	4.7	10.9	O K
360 min Summer	22.537	0.362	0.0	4.7	4.7	7.2	O K
480 min Summer	22.408	0.233	0.0	4.7	4.7	4.7	O K
600 min Summer	22.322	0.147	0.0	4.5	4.5	2.9	O K
720 min Summer	22.264	0.089	0.0	4.3	4.3	1.8	O K
960 min Summer	22.198	0.023	0.0	4.0	4.0	0.5	O K
1440 min Summer	22.175	0.000	0.0	3.2	3.2	0.0	O K
2160 min Summer	22.175	0.000	0.0	2.5	2.5	0.0	O K
2880 min Summer	22.175	0.000	0.0	2.1	2.1	0.0	O K
4320 min Summer	22.175	0.000	0.0	1.6	1.6	0.0	O K
5760 min Summer	22.175	0.000	0.0	1.4	1.4	0.0	O K
7200 min Summer	22.175	0.000	0.0	1.2	1.2	0.0	O K
8640 min Summer	22.175	0.000	0.0	1.0	1.0	0.0	O K
10080 min Summer	22.175	0.000	0.0	0.9	0.9	0.0	O K
15 min Winter	23.027	0.852	0.0	4.7	4.7	17.0	O K
30 min Winter	23.187	1.012	0.0	4.7	4.7	20.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	148.305	0.0	34.7	18
30 min Summer	95.717	0.0	45.6	31
60 min Summer	58.745	0.0	60.3	54
120 min Summer	34.828	0.0	71.9	88
180 min Summer	25.326	0.0	78.6	120
240 min Summer	20.093	0.0	83.3	152
360 min Summer	14.471	0.0	90.2	212
480 min Summer	11.463	0.0	95.1	270
600 min Summer	9.561	0.0	99.2	326
720 min Summer	8.240	0.0	102.6	384
960 min Summer	6.513	0.0	107.8	498
1440 min Summer	4.670	0.0	115.2	0
2160 min Summer	3.343	0.0	128.3	0
2880 min Summer	2.635	0.0	134.7	0
4320 min Summer	1.882	0.0	143.2	0
5760 min Summer	1.481	0.0	153.3	0
7200 min Summer	1.230	0.0	158.8	0
8640 min Summer	1.056	0.0	163.1	0
10080 min Summer	0.928	0.0	166.4	0
15 min Winter	148.305	0.0	39.1	18
30 min Winter	95.717	0.0	51.5	31

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Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max E Outflow (l/s)	Max Volume (m³)	Status
60 min Winter	23.207	1.032	0.0	4.7	4.7	20.6	O K
120 min Winter	23.086	0.911	0.0	4.7	4.7	18.2	O K
180 min Winter	22.930	0.755	0.0	4.7	4.7	15.1	O K
240 min Winter	22.734	0.559	0.0	4.7	4.7	11.2	O K
360 min Winter	22.468	0.293	0.0	4.7	4.7	5.9	O K
480 min Winter	22.316	0.141	0.0	4.5	4.5	2.8	O K
600 min Winter	22.233	0.058	0.0	4.2	4.2	1.2	O K
720 min Winter	22.187	0.012	0.0	3.9	3.9	0.2	O K
960 min Winter	22.175	0.000	0.0	3.3	3.3	0.0	O K
1440 min Winter	22.175	0.000	0.0	2.5	2.5	0.0	O K
2160 min Winter	22.175	0.000	0.0	2.0	2.0	0.0	O K
2880 min Winter	22.175	0.000	0.0	1.7	1.7	0.0	O K
4320 min Winter	22.175	0.000	0.0	1.3	1.3	0.0	O K
5760 min Winter	22.175	0.000	0.0	1.1	1.1	0.0	O K
7200 min Winter	22.175	0.000	0.0	0.9	0.9	0.0	O K
8640 min Winter	22.175	0.000	0.0	0.8	0.8	0.0	O K
10080 min Winter	22.175	0.000	0.0	0.7	0.7	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	58.745	0.0	67.8	58
120 min Winter	34.828	0.0	81.0	94
180 min Winter	25.326	0.0	88.4	134
240 min Winter	20.093	0.0	93.5	164
360 min Winter	14.471	0.0	101.1	224
480 min Winter	11.463	0.0	106.8	278
600 min Winter	9.561	0.0	111.4	332
720 min Winter	8.240	0.0	115.1	384
960 min Winter	6.513	0.0	121.1	0
1440 min Winter	4.670	0.0	129.3	0
2160 min Winter	3.343	0.0	144.0	0
2880 min Winter	2.635	0.0	151.1	0
4320 min Winter	1.882	0.0	160.7	0
5760 min Winter	1.481	0.0	171.9	0
7200 min Winter	1.230	0.0	178.0	0
8640 min Winter	1.056	0.0	183.0	0
10080 min Winter	0.928	0.0	186.7	0

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Cascade Rainfall Details for Tank.SRCX

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)	20.700	Shortest Storm (mins)	15
Ratio R	0.440	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.068

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0	4 0.058	4	8 0.010

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Cascade Model Details for Tank.SRCX

Storage is Online Cover Level (m) 24.255

Cellular Storage Structure

Invert Level (m) 22.175 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)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	21.0	0.0	1.500	21.0	0.0	1.501	0.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0097-5000-1600-5000
 Design Head (m) 1.600
 Design Flow (l/s) 5.0
 Flush-Flo™ Calculated
 Objective Minimise upstream storage
 Application Surface
 Sump Available Yes
 Diameter (mm) 97
 Invert Level (m) 22.050
 Minimum Outlet Pipe Diameter (mm) 150
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	5.0	Kick-Flo®	0.865	3.8
Flush-Flo™	0.425	4.7	Mean Flow over Head Range	-	4.2

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)	Depth (m)	Flow (l/s)
0.100	3.1	0.800	4.1	2.000	5.5	4.000	7.7	7.000	10.0
0.200	4.3	1.000	4.0	2.200	5.8	4.500	8.1	7.500	10.3
0.300	4.6	1.200	4.4	2.400	6.0	5.000	8.5	8.000	10.7
0.400	4.7	1.400	4.7	2.600	6.3	5.500	8.9	8.500	11.0
0.500	4.7	1.600	5.0	3.000	6.7	6.000	9.3	9.000	11.3
0.600	4.6	1.800	5.3	3.500	7.2	6.500	9.7	9.500	11.6