



| Appendix B - WinDES Detention Calculations

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6150 Knights Court Solihull Parkway Birmingham, B37 7WY		
Catchment A		
Date 22/10/2021 14:15		Designed by Brookbanks
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Innovyze	Source Control 2019.1	

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	0.096	0.096	5.9	312.7	O K
30 min Summer	0.119	0.119	8.4	387.8	O K
60 min Summer	0.145	0.145	11.3	475.9	O K
120 min Summer	0.173	0.173	13.9	572.9	O K
180 min Summer	0.189	0.189	15.2	628.4	O K
240 min Summer	0.200	0.200	15.5	665.1	O K
360 min Summer	0.213	0.213	15.7	712.0	O K
480 min Summer	0.223	0.223	15.8	745.6	O K
600 min Summer	0.230	0.230	15.9	770.9	O K
720 min Summer	0.236	0.236	15.9	790.3	O K
960 min Summer	0.243	0.243	16.0	815.9	O K
1440 min Summer	0.249	0.249	16.0	836.0	O K
2160 min Summer	0.247	0.247	16.0	828.3	O K
2880 min Summer	0.239	0.239	16.0	801.4	O K
4320 min Summer	0.212	0.212	15.7	706.5	O K
5760 min Summer	0.190	0.190	15.3	632.3	O K
7200 min Summer	0.176	0.176	14.1	581.8	O K
8640 min Summer	0.164	0.164	13.1	541.5	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	30.107	0.0	205.4	26
30 min Summer	18.857	0.0	274.1	41
60 min Summer	11.811	0.0	423.8	70
120 min Summer	7.397	0.0	544.7	126
180 min Summer	5.626	0.0	628.9	184
240 min Summer	4.633	0.0	695.6	242
360 min Summer	3.524	0.0	799.9	322
480 min Summer	2.902	0.0	881.8	386
600 min Summer	2.496	0.0	950.0	452
720 min Summer	2.207	0.0	1008.9	520
960 min Summer	1.817	0.0	1106.3	658
1440 min Summer	1.380	0.0	1251.2	934
2160 min Summer	1.049	0.0	1531.7	1344
2880 min Summer	0.863	0.0	1677.6	1736
4320 min Summer	0.637	0.0	1831.2	2472
5760 min Summer	0.513	0.0	2039.8	3176
7200 min Summer	0.434	0.0	2150.6	3896
8640 min Summer	0.378	0.0	2240.0	4664

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Innovyze	Source Control 2019.1	

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	0.154	0.154	12.2	509.1	O K
15 min Winter	0.107	0.107	7.1	350.0	O K
30 min Winter	0.132	0.132	9.9	434.0	O K
60 min Winter	0.161	0.161	12.9	533.1	O K
120 min Winter	0.194	0.194	15.4	643.1	O K
180 min Winter	0.213	0.213	15.7	709.4	O K
240 min Winter	0.226	0.226	15.8	754.9	O K
360 min Winter	0.242	0.242	16.0	812.1	O K
480 min Winter	0.251	0.251	16.1	844.1	O K
600 min Winter	0.258	0.258	16.1	867.8	O K
720 min Winter	0.263	0.263	16.2	886.0	O K
960 min Winter	0.268	0.268	16.2	905.5	O K
1440 min Winter	0.269	0.269	16.2	907.0	O K
2160 min Winter	0.257	0.257	16.1	866.9	O K
2880 min Winter	0.241	0.241	16.0	809.1	O K
4320 min Winter	0.201	0.201	15.5	667.3	O K
5760 min Winter	0.176	0.176	14.1	582.0	O K
7200 min Winter	0.159	0.159	12.6	523.4	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.337	0.0	2306.1	5352
15 min Winter	30.107	0.0	238.0	26
30 min Winter	18.857	0.0	316.0	40
60 min Winter	11.811	0.0	481.6	68
120 min Winter	7.397	0.0	617.2	124
180 min Winter	5.626	0.0	711.6	180
240 min Winter	4.633	0.0	786.2	238
360 min Winter	3.524	0.0	902.9	348
480 min Winter	2.902	0.0	994.6	446
600 min Winter	2.496	0.0	1070.9	482
720 min Winter	2.207	0.0	1136.7	558
960 min Winter	1.817	0.0	1245.6	714
1440 min Winter	1.380	0.0	1407.0	1018
2160 min Winter	1.049	0.0	1720.8	1452
2880 min Winter	0.863	0.0	1885.2	1852
4320 min Winter	0.637	0.0	2060.8	2596
5760 min Winter	0.513	0.0	2288.3	3288
7200 min Winter	0.434	0.0	2413.4	4032

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
8640 min Winter	0.146	0.146	11.4	480.5	O K
10080 min Winter	0.136	0.136	10.3	447.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
8640 min Winter	0.378	0.0	2515.1	4752
10080 min Winter	0.337	0.0	2592.5	5456

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	1
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 5.610

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To: (ha)	From:	To: (ha)	From:	To: (ha)
0	4 1.870	4	8 1.870	8	12 1.870

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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)
0.000	3190.7	1.500	5541.3


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0180-1650-1200-1650
Design Head (m)	1.200
Design Flow (l/s)	16.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	180
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	16.5	Kick-Flo®	0.814	13.7
Flush-Flo™	0.370	16.5	Mean Flow over Head Range	-	14.1

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	6.3	1.200	16.5	3.000	25.5	7.000	38.4
0.200	15.5	1.400	17.7	3.500	27.5	7.500	39.7
0.300	16.4	1.600	18.9	4.000	29.3	8.000	41.0
0.400	16.5	1.800	20.0	4.500	31.0	8.500	42.2
0.500	16.3	2.000	21.0	5.000	32.7	9.000	43.4
0.600	15.9	2.200	22.0	5.500	34.2	9.500	44.5
0.800	14.0	2.400	23.0	6.000	35.7		
1.000	15.1	2.600	23.8	6.500	37.1		

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	0.276	0.276	16.2	933.4	O K
30 min Summer	0.323	0.323	16.4	1101.8	O K
60 min Summer	0.375	0.375	16.5	1294.0	O K
120 min Summer	0.431	0.431	16.5	1506.3	O K
180 min Summer	0.465	0.465	16.5	1635.2	O K
240 min Summer	0.488	0.488	16.5	1725.4	O K
360 min Summer	0.519	0.519	16.5	1844.9	O K
480 min Summer	0.538	0.538	16.5	1918.4	O K
600 min Summer	0.549	0.549	16.5	1964.6	O K
720 min Summer	0.556	0.556	16.5	1992.6	O K
960 min Summer	0.561	0.561	16.5	2012.4	O K
1440 min Summer	0.562	0.562	16.5	2016.8	O K
2160 min Summer	0.554	0.554	16.5	1982.4	O K
2880 min Summer	0.538	0.538	16.5	1921.4	O K
4320 min Summer	0.480	0.480	16.5	1693.7	O K
5760 min Summer	0.426	0.426	16.5	1484.7	O K
7200 min Summer	0.377	0.377	16.5	1300.4	O K
8640 min Summer	0.334	0.334	16.4	1141.9	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	90.095	0.0	763.5	26
30 min Summer	53.466	0.0	911.0	41
60 min Summer	31.728	0.0	1233.0	70
120 min Summer	18.829	0.0	1468.4	130
180 min Summer	13.876	0.0	1623.2	188
240 min Summer	11.174	0.0	1740.7	248
360 min Summer	8.234	0.0	1915.8	366
480 min Summer	6.631	0.0	2044.4	484
600 min Summer	5.605	0.0	2143.9	602
720 min Summer	4.887	0.0	2221.9	722
960 min Summer	3.933	0.0	2326.2	912
1440 min Summer	2.896	0.0	2356.4	1140
2160 min Summer	2.132	0.0	3139.9	1524
2880 min Summer	1.716	0.0	3356.0	1936
4320 min Summer	1.226	0.0	3547.5	2732
5760 min Summer	0.966	0.0	3866.7	3520
7200 min Summer	0.803	0.0	4010.7	4256
8640 min Summer	0.690	0.0	4124.6	5016

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	0.297	0.297	16.3	1008.2	O K
15 min Winter	0.308	0.308	16.4	1046.6	O K
30 min Winter	0.359	0.359	16.5	1236.2	O K
60 min Winter	0.417	0.417	16.5	1453.1	O K
120 min Winter	0.480	0.480	16.5	1694.4	O K
180 min Winter	0.518	0.518	16.5	1842.3	O K
240 min Winter	0.545	0.545	16.5	1947.1	O K
360 min Winter	0.580	0.580	16.5	2088.6	O K
480 min Winter	0.603	0.603	16.5	2178.9	O K
600 min Winter	0.617	0.617	16.5	2239.2	O K
720 min Winter	0.627	0.627	16.5	2279.5	O K
960 min Winter	0.637	0.637	16.5	2319.1	O K
1440 min Winter	0.635	0.635	16.5	2310.2	O K
2160 min Winter	0.619	0.619	16.5	2245.3	O K
2880 min Winter	0.595	0.595	16.5	2147.1	O K
4320 min Winter	0.510	0.510	16.5	1809.1	O K
5760 min Winter	0.429	0.429	16.5	1495.6	O K
7200 min Winter	0.357	0.357	16.5	1226.2	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.608	0.0	4205.8	5664
15 min Winter	90.095	0.0	859.9	26
30 min Winter	53.466	0.0	1018.4	41
60 min Winter	31.728	0.0	1385.4	70
120 min Winter	18.829	0.0	1646.4	128
180 min Winter	13.876	0.0	1816.8	186
240 min Winter	11.174	0.0	1945.1	244
360 min Winter	8.234	0.0	2132.9	360
480 min Winter	6.631	0.0	2266.0	476
600 min Winter	5.605	0.0	2362.5	590
720 min Winter	4.887	0.0	2430.0	704
960 min Winter	3.933	0.0	2488.3	926
1440 min Winter	2.896	0.0	2403.8	1336
2160 min Winter	2.132	0.0	3513.7	1660
2880 min Winter	1.716	0.0	3751.1	2112
4320 min Winter	1.226	0.0	3951.0	2984
5760 min Winter	0.966	0.0	4334.0	3760
7200 min Winter	0.803	0.0	4497.1	4536

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6150 Knights Court Solihull Parkway Birmingham, B37 7WY	Catchment A	
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Innovyze	Source Control 2019.1	

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
8640 min Winter	0.296	0.296	16.3	1006.6	O K
10080 min Winter	0.249	0.249	16.0	835.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
8640 min Winter	0.690	0.0	4627.0	5192
10080 min Winter	0.608	0.0	4723.2	5856

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 5.610

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To: (ha)	From:	To: (ha)	From:	To: (ha)
0	4 1.870	4	8 1.870	8	12 1.870

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6150 Knights Court Solihull Parkway Birmingham, B37 7WY	Catchment A	
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Innovyze	Source Control 2019.1	

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)
0.000	3190.7	1.500	5541.3


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0180-1650-1200-1650
Design Head (m)	1.200
Design Flow (l/s)	16.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	180
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	16.5	Kick-Flo®	0.814	13.7
Flush-Flo™	0.370	16.5	Mean Flow over Head Range	-	14.1

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	6.3	1.200	16.5	3.000	25.5	7.000	38.4
0.200	15.5	1.400	17.7	3.500	27.5	7.500	39.7
0.300	16.4	1.600	18.9	4.000	29.3	8.000	41.0
0.400	16.5	1.800	20.0	4.500	31.0	8.500	42.2
0.500	16.3	2.000	21.0	5.000	32.7	9.000	43.4
0.600	15.9	2.200	22.0	5.500	34.2	9.500	44.5
0.800	14.0	2.400	23.0	6.000	35.7		
1.000	15.1	2.600	23.8	6.500	37.1		

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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
15 min Summer	0.546	0.546	16.5	1949.7	O K
30 min Summer	0.623	0.623	16.5	2263.2	O K
60 min Summer	0.709	0.709	16.5	2619.3	O K
120 min Summer	0.802	0.802	16.5	3017.3	O K
180 min Summer	0.858	0.858	16.5	3266.1	O K
240 min Summer	0.898	0.898	16.5	3445.2	O K
360 min Summer	0.953	0.953	16.5	3694.4	O K
480 min Summer	0.989	0.989	16.5	3863.0	O K
600 min Summer	1.015	1.015	16.5	3984.1	O K
720 min Summer	1.034	1.034	16.5	4073.7	O K
960 min Summer	1.058	1.058	16.5	4188.0	O K
1440 min Summer	1.076	1.076	16.5	4274.0	O K
2160 min Summer	1.067	1.067	16.5	4230.4	O K
2880 min Summer	1.049	1.049	16.5	4146.6	O K
4320 min Summer	0.978	0.978	16.5	3812.9	O K
5760 min Summer	0.914	0.914	16.5	3516.4	O K
7200 min Summer	0.852	0.852	16.5	3236.6	O K
8640 min Summer	0.785	0.785	16.5	2945.5	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	187.006	0.0	1389.0	27
30 min Summer	108.845	0.0	1391.2	42
60 min Summer	63.353	0.0	2418.0	72
120 min Summer	36.874	0.0	2653.0	130
180 min Summer	26.867	0.0	2645.5	190
240 min Summer	21.462	0.0	2605.7	250
360 min Summer	15.638	0.0	2542.3	368
480 min Summer	12.492	0.0	2496.8	488
600 min Summer	10.494	0.0	2461.7	608
720 min Summer	9.102	0.0	2433.1	726
960 min Summer	7.267	0.0	2387.7	966
1440 min Summer	5.290	0.0	2330.6	1442
2160 min Summer	3.852	0.0	4923.3	2056
2880 min Summer	3.075	0.0	4747.4	2372
4320 min Summer	2.173	0.0	4339.7	3120
5760 min Summer	1.698	0.0	6792.5	3928
7200 min Summer	1.402	0.0	6999.4	4760
8640 min Summer	1.200	0.0	7167.0	5544

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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 (m³)	Status
10080 min Summer	0.721	0.721	16.5	2670.4	O K
15 min Winter	0.604	0.604	16.5	2185.5	O K
30 min Winter	0.690	0.690	16.5	2537.9	O K
60 min Winter	0.784	0.784	16.5	2939.2	O K
120 min Winter	0.886	0.886	16.5	3389.1	O K
180 min Winter	0.947	0.947	16.5	3669.8	O K
240 min Winter	0.991	0.991	16.5	3873.3	O K
360 min Winter	1.052	1.052	16.5	4159.7	O K
480 min Winter	1.093	1.093	16.5	4356.3	O K
600 min Winter	1.122	1.122	16.5	4500.1	O K
720 min Winter	1.144	1.144	16.5	4608.7	O K
960 min Winter	1.174	1.174	16.5	4753.8	O K
1440 min Winter	1.200	1.200	16.5	4885.7	Flood Risk
2160 min Winter	1.201	1.201	16.5	4889.0	Flood Risk
2880 min Winter	1.180	1.180	16.5	4785.2	O K
4320 min Winter	1.094	1.094	16.5	4364.2	O K
5760 min Winter	1.013	1.013	16.5	3973.6	O K
7200 min Winter	0.930	0.930	16.5	3591.9	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.051	0.0	7294.6	6272
15 min Winter	187.006	0.0	1397.8	27
30 min Winter	108.845	0.0	1378.7	41
60 min Winter	63.353	0.0	2617.8	70
120 min Winter	36.874	0.0	2649.5	128
180 min Winter	26.867	0.0	2599.8	188
240 min Winter	21.462	0.0	2563.9	246
360 min Winter	15.638	0.0	2518.9	364
480 min Winter	12.492	0.0	2492.0	480
600 min Winter	10.494	0.0	2474.7	598
720 min Winter	9.102	0.0	2464.3	714
960 min Winter	7.267	0.0	2459.5	946
1440 min Winter	5.290	0.0	2453.7	1404
2160 min Winter	3.852	0.0	4989.3	2064
2880 min Winter	3.075	0.0	4847.5	2684
4320 min Winter	2.173	0.0	4525.7	3332
5760 min Winter	1.698	0.0	7600.4	4264
7200 min Winter	1.402	0.0	7822.7	5184

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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
8640 min Winter	0.845	0.845	16.5	3208.4	O K
10080 min Winter	0.747	0.747	16.5	2779.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
8640 min Winter	1.200	0.0	7992.1	6064
10080 min Winter	1.051	0.0	8123.6	6864

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 5.610

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:
0	4 1.870	4	8 1.870	8	12 1.870

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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)
0.000	3190.7	1.500	5541.3


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0180-1650-1200-1650
Design Head (m)	1.200
Design Flow (l/s)	16.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	180
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	16.5	Kick-Flo®	0.814	13.7
Flush-Flo™	0.370	16.5	Mean Flow over Head Range	-	14.1

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	6.3	1.200	16.5	3.000	25.5	7.000	38.4
0.200	15.5	1.400	17.7	3.500	27.5	7.500	39.7
0.300	16.4	1.600	18.9	4.000	29.3	8.000	41.0
0.400	16.5	1.800	20.0	4.500	31.0	8.500	42.2
0.500	16.3	2.000	21.0	5.000	32.7	9.000	43.4
0.600	15.9	2.200	22.0	5.500	34.2	9.500	44.5
0.800	14.0	2.400	23.0	6.000	35.7		
1.000	15.1	2.600	23.8	6.500	37.1		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	0.088	0.088	5.6	435.9	O K
30 min Summer	0.109	0.109	8.2	542.2	O K
60 min Summer	0.134	0.134	11.6	668.8	O K
120 min Summer	0.162	0.162	15.5	811.1	O K
180 min Summer	0.178	0.178	17.6	895.2	O K
240 min Summer	0.189	0.189	18.9	951.3	O K
360 min Summer	0.202	0.202	20.2	1017.7	O K
480 min Summer	0.211	0.211	21.1	1063.2	O K
600 min Summer	0.218	0.218	21.7	1099.2	O K
720 min Summer	0.223	0.223	21.8	1129.1	O K
960 min Summer	0.232	0.232	21.9	1171.4	O K
1440 min Summer	0.240	0.240	22.0	1212.9	O K
2160 min Summer	0.241	0.241	22.1	1220.3	O K
2880 min Summer	0.237	0.237	22.0	1197.8	O K
4320 min Summer	0.216	0.216	21.7	1090.7	O K
5760 min Summer	0.200	0.200	20.1	1008.5	O K
7200 min Summer	0.187	0.187	18.6	940.4	O K
8640 min Summer	0.176	0.176	17.4	884.4	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	30.107	0.0	239.1	27
30 min Summer	18.857	0.0	325.9	41
60 min Summer	11.811	0.0	543.6	70
120 min Summer	7.397	0.0	707.1	128
180 min Summer	5.626	0.0	821.4	184
240 min Summer	4.633	0.0	911.8	242
360 min Summer	3.524	0.0	1053.5	342
480 min Summer	2.902	0.0	1164.7	392
600 min Summer	2.496	0.0	1257.1	454
720 min Summer	2.207	0.0	1336.3	522
960 min Summer	1.817	0.0	1466.3	660
1440 min Summer	1.380	0.0	1655.6	936
2160 min Summer	1.049	0.0	2085.4	1344
2880 min Summer	0.863	0.0	2282.1	1736
4320 min Summer	0.637	0.0	2479.2	2476
5760 min Summer	0.513	0.0	2808.2	3232
7200 min Summer	0.434	0.0	2957.8	3968
8640 min Summer	0.378	0.0	3075.7	4672

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	0.167	0.167	16.2	838.0	O K
15 min Winter	0.098	0.098	6.9	487.9	O K
30 min Winter	0.122	0.122	10.0	606.7	O K
60 min Winter	0.150	0.150	13.8	748.4	O K
120 min Winter	0.181	0.181	17.9	908.4	O K
180 min Winter	0.199	0.199	20.0	1004.3	O K
240 min Winter	0.212	0.212	21.2	1068.9	O K
360 min Winter	0.228	0.228	21.8	1150.8	O K
480 min Winter	0.237	0.237	22.0	1199.8	O K
600 min Winter	0.244	0.244	22.1	1236.3	O K
720 min Winter	0.250	0.250	22.2	1265.9	O K
960 min Winter	0.257	0.257	22.2	1301.7	O K
1440 min Winter	0.260	0.260	22.3	1319.9	O K
2160 min Winter	0.253	0.253	22.2	1285.4	O K
2880 min Winter	0.241	0.241	22.1	1222.6	O K
4320 min Winter	0.210	0.210	21.1	1060.9	O K
5760 min Winter	0.189	0.189	18.9	951.3	O K
7200 min Winter	0.173	0.173	17.0	868.5	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.337	0.0	3158.3	5440
15 min Winter	30.107	0.0	280.2	26
30 min Winter	18.857	0.0	379.7	40
60 min Winter	11.811	0.0	621.8	68
120 min Winter	7.397	0.0	806.0	124
180 min Winter	5.626	0.0	934.5	182
240 min Winter	4.633	0.0	1036.1	238
360 min Winter	3.524	0.0	1195.1	348
480 min Winter	2.902	0.0	1319.4	448
600 min Winter	2.496	0.0	1422.6	484
720 min Winter	2.207	0.0	1511.1	560
960 min Winter	1.817	0.0	1656.4	716
1440 min Winter	1.380	0.0	1868.0	1018
2160 min Winter	1.049	0.0	2346.8	1452
2880 min Winter	0.863	0.0	2569.0	1852
4320 min Winter	0.637	0.0	2795.1	2600
5760 min Winter	0.513	0.0	3152.9	3344
7200 min Winter	0.434	0.0	3322.1	4104

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
8640 min Winter	0.161	0.161	15.4	805.7	O K
10080 min Winter	0.151	0.151	14.0	756.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
8640 min Winter	0.378	0.0	3456.8	4840
10080 min Winter	0.337	0.0	3554.3	5552

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	1
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 7.790

Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)
0	4	2.597	4	8	2.597	8	12	2.597

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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)
0.000	4910.9	1.500	6971.5


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0208-2290-1200-2290
Design Head (m)	1.200
Design Flow (l/s)	22.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	208
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	22.9	Kick-Flo®	0.840	19.3
Flush-Flo™	0.387	22.9	Mean Flow over Head Range	-	19.5

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	7.1	1.200	22.9	3.000	35.5	7.000	53.5
0.200	20.0	1.400	24.6	3.500	38.3	7.500	55.3
0.300	22.6	1.600	26.3	4.000	40.8	8.000	57.1
0.400	22.9	1.800	27.8	4.500	43.2	8.500	58.8
0.500	22.7	2.000	29.2	5.000	45.5	9.000	60.5
0.600	22.2	2.200	30.6	5.500	47.6	9.500	62.1
0.800	20.3	2.400	31.9	6.000	49.7		
1.000	21.0	2.600	33.2	6.500	51.6		

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	0.256	0.256	22.2	1297.8	O K
30 min Summer	0.300	0.300	22.6	1532.0	O K
60 min Summer	0.351	0.351	22.8	1799.7	O K
120 min Summer	0.406	0.406	22.9	2096.6	O K
180 min Summer	0.439	0.439	22.9	2277.8	O K
240 min Summer	0.462	0.462	22.9	2405.3	O K
360 min Summer	0.493	0.493	22.9	2575.6	O K
480 min Summer	0.512	0.512	22.9	2681.9	O K
600 min Summer	0.524	0.524	22.9	2750.2	O K
720 min Summer	0.532	0.532	22.9	2793.1	O K
960 min Summer	0.538	0.538	22.9	2829.0	O K
1440 min Summer	0.542	0.542	22.9	2852.0	O K
2160 min Summer	0.538	0.538	22.9	2825.4	O K
2880 min Summer	0.525	0.525	22.9	2756.8	O K
4320 min Summer	0.472	0.472	22.9	2462.5	O K
5760 min Summer	0.422	0.422	22.9	2185.3	O K
7200 min Summer	0.376	0.376	22.9	1938.3	O K
8640 min Summer	0.336	0.336	22.8	1724.4	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	90.095	0.0	976.2	26
30 min Summer	53.466	0.0	1176.7	41
60 min Summer	31.728	0.0	1650.6	70
120 min Summer	18.829	0.0	1971.9	130
180 min Summer	13.876	0.0	2182.6	188
240 min Summer	11.174	0.0	2342.0	248
360 min Summer	8.234	0.0	2578.7	366
480 min Summer	6.631	0.0	2751.8	484
600 min Summer	5.605	0.0	2885.3	602
720 min Summer	4.887	0.0	2990.0	722
960 min Summer	3.933	0.0	3132.3	902
1440 min Summer	2.896	0.0	3200.5	1138
2160 min Summer	2.132	0.0	4300.8	1520
2880 min Summer	1.716	0.0	4590.1	1936
4320 min Summer	1.226	0.0	4829.7	2728
5760 min Summer	0.966	0.0	5341.9	3520
7200 min Summer	0.803	0.0	5537.0	4256
8640 min Summer	0.690	0.0	5687.3	5016

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	0.302	0.302	22.7	1542.9	O K
15 min Winter	0.286	0.286	22.5	1454.9	O K
30 min Winter	0.335	0.335	22.8	1718.4	O K
60 min Winter	0.392	0.392	22.9	2020.6	O K
120 min Winter	0.453	0.453	22.9	2357.8	O K
180 min Winter	0.491	0.491	22.9	2565.3	O K
240 min Winter	0.517	0.517	22.9	2712.8	O K
360 min Winter	0.553	0.553	22.9	2913.2	O K
480 min Winter	0.576	0.576	22.9	3042.4	O K
600 min Winter	0.591	0.591	22.9	3129.6	O K
720 min Winter	0.602	0.602	22.9	3189.0	O K
960 min Winter	0.613	0.613	22.9	3250.8	O K
1440 min Winter	0.613	0.613	22.9	3251.6	O K
2160 min Winter	0.601	0.601	22.9	3184.3	O K
2880 min Winter	0.580	0.580	22.9	3065.0	O K
4320 min Winter	0.501	0.501	22.9	2622.8	O K
5760 min Winter	0.426	0.426	22.9	2206.1	O K
7200 min Winter	0.359	0.359	22.9	1844.6	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.608	0.0	5786.9	5664
15 min Winter	90.095	0.0	1107.2	26
30 min Winter	53.466	0.0	1323.7	41
60 min Winter	31.728	0.0	1859.1	70
120 min Winter	18.829	0.0	2215.0	128
180 min Winter	13.876	0.0	2446.7	186
240 min Winter	11.174	0.0	2620.5	244
360 min Winter	8.234	0.0	2874.6	360
480 min Winter	6.631	0.0	3054.8	476
600 min Winter	5.605	0.0	3187.0	590
720 min Winter	4.887	0.0	3282.7	702
960 min Winter	3.933	0.0	3382.6	924
1440 min Winter	2.896	0.0	3301.7	1332
2160 min Winter	2.132	0.0	4813.7	1652
2880 min Winter	1.716	0.0	5130.5	2112
4320 min Winter	1.226	0.0	5377.3	2984
5760 min Winter	0.966	0.0	5989.9	3760
7200 min Winter	0.803	0.0	6211.7	4536

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
8640 min Winter	0.303	0.303	22.7	1547.6	O K
10080 min Winter	0.259	0.259	22.3	1314.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
8640 min Winter	0.690	0.0	6384.3	5192
10080 min Winter	0.608	0.0	6504.2	5856

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 7.790

Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)
0	4	2.597	4	8	2.597	8	12	2.597

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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)
0.000	4910.9	1.500	6971.5


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0208-2290-1200-2290
Design Head (m)	1.200
Design Flow (l/s)	22.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	208
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	22.9	Kick-Flo®	0.840	19.3
Flush-Flo™	0.387	22.9	Mean Flow over Head Range	-	19.5

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	7.1	1.200	22.9	3.000	35.5	7.000	53.5
0.200	20.0	1.400	24.6	3.500	38.3	7.500	55.3
0.300	22.6	1.600	26.3	4.000	40.8	8.000	57.1
0.400	22.9	1.800	27.8	4.500	43.2	8.500	58.8
0.500	22.7	2.000	29.2	5.000	45.5	9.000	60.5
0.600	22.2	2.200	30.6	5.500	47.6	9.500	62.1
0.800	20.3	2.400	31.9	6.000	49.7		
1.000	21.0	2.600	33.2	6.500	51.6		

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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
15 min Summer	0.517	0.517	22.9	2708.2	O K
30 min Summer	0.594	0.594	22.9	3143.7	O K
60 min Summer	0.680	0.680	22.9	3638.9	O K
120 min Summer	0.775	0.775	22.9	4192.4	O K
180 min Summer	0.833	0.833	22.9	4539.5	O K
240 min Summer	0.875	0.875	22.9	4792.2	O K
360 min Summer	0.932	0.932	22.9	5145.3	O K
480 min Summer	0.971	0.971	22.9	5385.4	O K
600 min Summer	0.999	0.999	22.9	5558.9	O K
720 min Summer	1.020	1.020	22.9	5688.4	O K
960 min Summer	1.047	1.047	22.9	5856.7	O K
1440 min Summer	1.068	1.068	22.9	5993.2	O K
2160 min Summer	1.062	1.062	22.9	5954.1	O K
2880 min Summer	1.046	1.046	22.9	5853.9	O K
4320 min Summer	0.975	0.975	22.9	5411.4	O K
5760 min Summer	0.910	0.910	22.9	5006.1	O K
7200 min Summer	0.844	0.844	22.9	4608.6	O K
8640 min Summer	0.776	0.776	22.9	4199.3	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	187.006	0.0	1893.5	27
30 min Summer	108.845	0.0	1936.4	42
60 min Summer	63.353	0.0	3272.0	72
120 min Summer	36.874	0.0	3640.3	130
180 min Summer	26.867	0.0	3718.4	190
240 min Summer	21.462	0.0	3667.1	250
360 min Summer	15.638	0.0	3569.6	370
480 min Summer	12.492	0.0	3495.0	488
600 min Summer	10.494	0.0	3435.7	608
720 min Summer	9.102	0.0	3386.0	726
960 min Summer	7.267	0.0	3303.9	966
1440 min Summer	5.290	0.0	3180.5	1442
2160 min Summer	3.852	0.0	6796.4	2056
2880 min Summer	3.075	0.0	6537.1	2388
4320 min Summer	2.173	0.0	5940.5	3120
5760 min Summer	1.698	0.0	9385.8	3928
7200 min Summer	1.402	0.0	9666.0	4768
8640 min Summer	1.200	0.0	9889.1	5536

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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 (m³)	Status
10080 min Summer	0.714	0.714	22.9	3833.9	O K
15 min Winter	0.575	0.575	22.9	3035.5	O K
30 min Winter	0.661	0.661	22.9	3525.0	O K
60 min Winter	0.756	0.756	22.9	4082.4	O K
120 min Winter	0.861	0.861	22.9	4709.3	O K
180 min Winter	0.925	0.925	22.9	5102.2	O K
240 min Winter	0.972	0.972	22.9	5387.4	O K
360 min Winter	1.036	1.036	22.9	5789.9	O K
480 min Winter	1.080	1.080	22.9	6067.2	O K
600 min Winter	1.112	1.112	22.9	6271.1	O K
720 min Winter	1.136	1.136	22.9	6425.8	O K
960 min Winter	1.168	1.168	22.9	6635.0	O K
1440 min Winter	1.198	1.198	22.9	6832.1	O K
2160 min Winter	1.202	1.202	22.9	6854.9	Flood Risk
2880 min Winter	1.182	1.182	22.9	6726.4	O K
4320 min Winter	1.095	1.095	22.9	6165.6	O K
5760 min Winter	1.011	1.011	22.9	5635.7	O K
7200 min Winter	0.926	0.926	22.9	5108.2	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.051	0.0	10046.6	6264
15 min Winter	187.006	0.0	1942.1	27
30 min Winter	108.845	0.0	1930.7	41
60 min Winter	63.353	0.0	3569.0	70
120 min Winter	36.874	0.0	3729.7	128
180 min Winter	26.867	0.0	3659.2	188
240 min Winter	21.462	0.0	3603.5	246
360 min Winter	15.638	0.0	3527.6	364
480 min Winter	12.492	0.0	3478.3	480
600 min Winter	10.494	0.0	3442.6	598
720 min Winter	9.102	0.0	3415.6	714
960 min Winter	7.267	0.0	3379.6	946
1440 min Winter	5.290	0.0	3349.9	1404
2160 min Winter	3.852	0.0	6903.5	2064
2880 min Winter	3.075	0.0	6685.3	2684
4320 min Winter	2.173	0.0	6193.7	3332
5760 min Winter	1.698	0.0	10498.8	4264
7200 min Winter	1.402	0.0	10794.2	5184

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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
8640 min Winter	0.835	0.835	22.9	4553.4	O K
10080 min Winter	0.737	0.737	22.9	3973.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
8640 min Winter	1.200	0.0	11021.3	6056
10080 min Winter	1.051	0.0	11183.2	6848

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 7.790

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To: (ha)	From:	To: (ha)	From:	To: (ha)
0	4 2.597	4	8 2.597	8	12 2.597

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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)
0.000	4910.9	1.500	6971.5


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0208-2290-1200-2290
Design Head (m)	1.200
Design Flow (l/s)	22.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	208
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	22.9	Kick-Flo®	0.840	19.3
Flush-Flo™	0.387	22.9	Mean Flow over Head Range	-	19.5

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	7.1	1.200	22.9	3.000	35.5	7.000	53.5
0.200	20.0	1.400	24.6	3.500	38.3	7.500	55.3
0.300	22.6	1.600	26.3	4.000	40.8	8.000	57.1
0.400	22.9	1.800	27.8	4.500	43.2	8.500	58.8
0.500	22.7	2.000	29.2	5.000	45.5	9.000	60.5
0.600	22.2	2.200	30.6	5.500	47.6	9.500	62.1
0.800	20.3	2.400	31.9	6.000	49.7		
1.000	21.0	2.600	33.2	6.500	51.6		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	0.090	0.090	5.1	281.0	O K
30 min Summer	0.112	0.112	7.3	348.7	O K
60 min Summer	0.137	0.137	9.8	428.1	O K
120 min Summer	0.164	0.164	12.2	515.8	O K
180 min Summer	0.180	0.180	13.4	566.2	O K
240 min Summer	0.190	0.190	13.8	599.2	O K
360 min Summer	0.203	0.203	14.0	641.6	O K
480 min Summer	0.212	0.212	14.1	672.0	O K
600 min Summer	0.219	0.219	14.2	694.9	O K
720 min Summer	0.225	0.225	14.2	712.7	O K
960 min Summer	0.232	0.232	14.3	736.3	O K
1440 min Summer	0.238	0.238	14.3	755.5	O K
2160 min Summer	0.236	0.236	14.3	750.0	O K
2880 min Summer	0.229	0.229	14.3	726.9	O K
4320 min Summer	0.203	0.203	14.0	643.0	O K
5760 min Summer	0.183	0.183	13.7	577.0	O K
7200 min Summer	0.169	0.169	12.6	531.5	O K
8640 min Summer	0.158	0.158	11.7	495.1	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	30.107	0.0	181.3	26
30 min Summer	18.857	0.0	242.6	41
60 min Summer	11.811	0.0	377.9	70
120 min Summer	7.397	0.0	486.3	126
180 min Summer	5.626	0.0	561.8	184
240 min Summer	4.633	0.0	621.5	242
360 min Summer	3.524	0.0	715.0	324
480 min Summer	2.902	0.0	788.5	388
600 min Summer	2.496	0.0	849.6	452
720 min Summer	2.207	0.0	902.3	520
960 min Summer	1.817	0.0	989.4	660
1440 min Summer	1.380	0.0	1118.8	936
2160 min Summer	1.049	0.0	1373.5	1344
2880 min Summer	0.863	0.0	1504.2	1736
4320 min Summer	0.637	0.0	1641.3	2476
5760 min Summer	0.513	0.0	1831.0	3176
7200 min Summer	0.434	0.0	1930.3	3904
8640 min Summer	0.378	0.0	2010.2	4664

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	0.148	0.148	10.9	465.8	O K
15 min Winter	0.101	0.101	6.2	314.6	O K
30 min Winter	0.125	0.125	8.6	390.2	O K
60 min Winter	0.153	0.153	11.3	479.5	O K
120 min Winter	0.184	0.184	13.7	578.8	O K
180 min Winter	0.202	0.202	14.0	638.5	O K
240 min Winter	0.215	0.215	14.1	679.8	O K
360 min Winter	0.231	0.231	14.3	731.7	O K
480 min Winter	0.239	0.239	14.3	760.9	O K
600 min Winter	0.246	0.246	14.4	782.3	O K
720 min Winter	0.251	0.251	14.4	799.1	O K
960 min Winter	0.257	0.257	14.5	817.3	O K
1440 min Winter	0.257	0.257	14.5	820.1	O K
2160 min Winter	0.247	0.247	14.4	785.9	O K
2880 min Winter	0.232	0.232	14.3	735.3	O K
4320 min Winter	0.193	0.193	13.8	609.5	O K
5760 min Winter	0.169	0.169	12.6	532.6	O K
7200 min Winter	0.153	0.153	11.3	479.5	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.337	0.0	2069.0	5352
15 min Winter	30.107	0.0	210.4	26
30 min Winter	18.857	0.0	280.1	40
60 min Winter	11.811	0.0	429.7	68
120 min Winter	7.397	0.0	551.3	124
180 min Winter	5.626	0.0	636.0	180
240 min Winter	4.633	0.0	702.8	238
360 min Winter	3.524	0.0	807.5	348
480 min Winter	2.902	0.0	889.7	448
600 min Winter	2.496	0.0	958.0	482
720 min Winter	2.207	0.0	1016.9	560
960 min Winter	1.817	0.0	1114.3	716
1440 min Winter	1.380	0.0	1258.4	1018
2160 min Winter	1.049	0.0	1543.2	1452
2880 min Winter	0.863	0.0	1690.6	1852
4320 min Winter	0.637	0.0	1847.4	2596
5760 min Winter	0.513	0.0	2054.3	3296
7200 min Winter	0.434	0.0	2166.4	4040

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
8640 min Winter	0.141	0.141	10.2	440.3	O K
10080 min Winter	0.131	0.131	9.3	410.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
8640 min Winter	0.378	0.0	2257.3	4752
10080 min Winter	0.337	0.0	2326.2	5448

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	1
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 5.040

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To: (ha)	From:	To: (ha)	From:	To: (ha)
0	4 1.680	4	8 1.680	8	12 1.680

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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)
0.000	3071.6	1.500	4524.4


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0171-1480-1200-1480
Design Head (m)	1.200
Design Flow (l/s)	14.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	171
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	14.8	Kick-Flo®	0.805	12.3
Flush-Flo™	0.366	14.8	Mean Flow over Head Range	-	12.7

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	6.1	1.200	14.8	3.000	22.9	7.000	34.4
0.200	13.9	1.400	15.9	3.500	24.7	7.500	35.6
0.300	14.7	1.600	17.0	4.000	26.3	8.000	36.7
0.400	14.8	1.800	17.9	4.500	27.8	8.500	37.8
0.500	14.6	2.000	18.9	5.000	29.3	9.000	38.9
0.600	14.2	2.200	19.7	5.500	30.6	9.500	39.9
0.800	12.4	2.400	20.6	6.000	32.0		
1.000	13.6	2.600	21.4	6.500	33.2		

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	0.263	0.263	14.5	838.7	O K
30 min Summer	0.309	0.309	14.7	990.1	O K
60 min Summer	0.360	0.360	14.8	1162.8	O K
120 min Summer	0.416	0.416	14.8	1353.7	O K
180 min Summer	0.449	0.449	14.8	1469.7	O K
240 min Summer	0.472	0.472	14.8	1550.9	O K
360 min Summer	0.503	0.503	14.8	1658.7	O K
480 min Summer	0.522	0.522	14.8	1725.0	O K
600 min Summer	0.534	0.534	14.8	1766.9	O K
720 min Summer	0.541	0.541	14.8	1792.4	O K
960 min Summer	0.546	0.546	14.8	1810.9	O K
1440 min Summer	0.547	0.547	14.8	1816.1	O K
2160 min Summer	0.539	0.539	14.8	1786.9	O K
2880 min Summer	0.524	0.524	14.8	1733.3	O K
4320 min Summer	0.467	0.467	14.8	1530.5	O K
5760 min Summer	0.413	0.413	14.8	1343.8	O K
7200 min Summer	0.365	0.365	14.8	1179.4	O K
8640 min Summer	0.323	0.323	14.7	1037.9	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	90.095	0.0	680.6	26
30 min Summer	53.466	0.0	812.6	41
60 min Summer	31.728	0.0	1103.8	70
120 min Summer	18.829	0.0	1314.9	130
180 min Summer	13.876	0.0	1453.7	188
240 min Summer	11.174	0.0	1559.0	248
360 min Summer	8.234	0.0	1715.8	366
480 min Summer	6.631	0.0	1830.9	484
600 min Summer	5.605	0.0	1919.8	602
720 min Summer	4.887	0.0	1989.5	722
960 min Summer	3.933	0.0	2082.4	912
1440 min Summer	2.896	0.0	2109.5	1140
2160 min Summer	2.132	0.0	2817.1	1524
2880 min Summer	1.716	0.0	3010.6	1936
4320 min Summer	1.226	0.0	3180.6	2732
5760 min Summer	0.966	0.0	3472.1	3520
7200 min Summer	0.803	0.0	3601.2	4256
8640 min Summer	0.690	0.0	3703.0	5016

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	0.287	0.287	14.6	918.2	O K
15 min Winter	0.294	0.294	14.7	940.4	O K
30 min Winter	0.344	0.344	14.8	1110.7	O K
60 min Winter	0.402	0.402	14.8	1305.7	O K
120 min Winter	0.464	0.464	14.8	1522.7	O K
180 min Winter	0.502	0.502	14.8	1655.7	O K
240 min Winter	0.529	0.529	14.8	1750.1	O K
360 min Winter	0.565	0.565	14.8	1877.5	O K
480 min Winter	0.587	0.587	14.8	1959.1	O K
600 min Winter	0.602	0.602	14.8	2013.6	O K
720 min Winter	0.612	0.612	14.8	2050.1	O K
960 min Winter	0.622	0.622	14.8	2086.4	O K
1440 min Winter	0.621	0.621	14.8	2079.6	O K
2160 min Winter	0.605	0.605	14.8	2023.1	O K
2880 min Winter	0.581	0.581	14.8	1936.3	O K
4320 min Winter	0.496	0.496	14.8	1635.0	O K
5760 min Winter	0.416	0.416	14.8	1355.2	O K
7200 min Winter	0.346	0.346	14.8	1115.0	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.608	0.0	3775.2	5664
15 min Winter	90.095	0.0	766.8	26
30 min Winter	53.466	0.0	908.8	41
60 min Winter	31.728	0.0	1240.5	70
120 min Winter	18.829	0.0	1474.5	128
180 min Winter	13.876	0.0	1627.3	186
240 min Winter	11.174	0.0	1742.2	244
360 min Winter	8.234	0.0	1910.4	360
480 min Winter	6.631	0.0	2029.3	476
600 min Winter	5.605	0.0	2115.6	590
720 min Winter	4.887	0.0	2175.9	704
960 min Winter	3.933	0.0	2228.3	926
1440 min Winter	2.896	0.0	2154.0	1336
2160 min Winter	2.132	0.0	3152.4	1660
2880 min Winter	1.716	0.0	3364.9	2112
4320 min Winter	1.226	0.0	3541.9	2984
5760 min Winter	0.966	0.0	3891.8	3760
7200 min Winter	0.803	0.0	4038.1	4536

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
8640 min Winter	0.287	0.287	14.6	918.9	O K
10080 min Winter	0.241	0.241	14.4	765.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
8640 min Winter	0.690	0.0	4154.4	5192
10080 min Winter	0.608	0.0	4239.9	5856

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 5.040

Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)
0	4	1.680	4	8	1.680	8	12	1.680

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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)
0.000	3071.6	1.500	4524.4


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0171-1480-1200-1480
Design Head (m)	1.200
Design Flow (l/s)	14.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	171
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	14.8	Kick-Flo®	0.805	12.3
Flush-Flo™	0.366	14.8	Mean Flow over Head Range	-	12.7

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	6.1	1.200	14.8	3.000	22.9	7.000	34.4
0.200	13.9	1.400	15.9	3.500	24.7	7.500	35.6
0.300	14.7	1.600	17.0	4.000	26.3	8.000	36.7
0.400	14.8	1.800	17.9	4.500	27.8	8.500	37.8
0.500	14.6	2.000	18.9	5.000	29.3	9.000	38.9
0.600	14.2	2.200	19.7	5.500	30.6	9.500	39.9
0.800	12.4	2.400	20.6	6.000	32.0		
1.000	13.6	2.600	21.4	6.500	33.2		

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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
15 min Summer	0.529	0.529	14.8	1751.7	O K
30 min Summer	0.608	0.608	14.8	2033.3	O K
60 min Summer	0.695	0.695	14.8	2353.3	O K
120 min Summer	0.790	0.790	14.8	2711.2	O K
180 min Summer	0.849	0.849	14.8	2935.1	O K
240 min Summer	0.890	0.890	14.8	3096.4	O K
360 min Summer	0.948	0.948	14.8	3320.9	O K
480 min Summer	0.986	0.986	14.8	3472.9	O K
600 min Summer	1.013	1.013	14.8	3582.1	O K
720 min Summer	1.033	1.033	14.8	3663.0	O K
960 min Summer	1.059	1.059	14.8	3766.6	O K
1440 min Summer	1.078	1.078	14.8	3845.3	O K
2160 min Summer	1.069	1.069	14.8	3808.2	O K
2880 min Summer	1.051	1.051	14.8	3734.4	O K
4320 min Summer	0.977	0.977	14.8	3437.3	O K
5760 min Summer	0.910	0.910	14.8	3172.5	O K
7200 min Summer	0.845	0.845	14.8	2922.0	O K
8640 min Summer	0.777	0.777	14.8	2660.4	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	187.006	0.0	1243.9	27
30 min Summer	108.845	0.0	1248.7	42
60 min Summer	63.353	0.0	2166.1	72
120 min Summer	36.874	0.0	2377.5	130
180 min Summer	26.867	0.0	2371.9	190
240 min Summer	21.462	0.0	2335.9	250
360 min Summer	15.638	0.0	2277.9	368
480 min Summer	12.492	0.0	2235.9	488
600 min Summer	10.494	0.0	2203.6	608
720 min Summer	9.102	0.0	2177.3	726
960 min Summer	7.267	0.0	2135.8	966
1440 min Summer	5.290	0.0	2084.2	1442
2160 min Summer	3.852	0.0	4408.6	2056
2880 min Summer	3.075	0.0	4249.7	2376
4320 min Summer	2.173	0.0	3880.0	3120
5760 min Summer	1.698	0.0	6099.1	3928
7200 min Summer	1.402	0.0	6284.1	4760
8640 min Summer	1.200	0.0	6434.0	5544

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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 (m³)	Status
10080 min Summer	0.711	0.711	14.8	2412.5	O K
15 min Winter	0.589	0.589	14.8	1963.5	O K
30 min Winter	0.675	0.675	14.8	2280.2	O K
60 min Winter	0.772	0.772	14.8	2640.8	O K
120 min Winter	0.877	0.877	14.8	3045.3	O K
180 min Winter	0.942	0.942	14.8	3297.7	O K
240 min Winter	0.988	0.988	14.8	3480.8	O K
360 min Winter	1.052	1.052	14.8	3738.6	O K
480 min Winter	1.095	1.095	14.8	3915.5	O K
600 min Winter	1.126	1.126	14.8	4045.0	O K
720 min Winter	1.150	1.150	14.8	4142.9	O K
960 min Winter	1.181	1.181	14.8	4273.7	O K
1440 min Winter	1.210	1.210	14.9	4393.2	Flood Risk
2160 min Winter	1.211	1.211	14.9	4397.6	Flood Risk
2880 min Winter	1.189	1.189	14.8	4305.8	O K
4320 min Winter	1.099	1.099	14.8	3931.5	O K
5760 min Winter	1.013	1.013	14.8	3583.4	O K
7200 min Winter	0.928	0.928	14.8	3242.6	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.051	0.0	6547.5	6344
15 min Winter	187.006	0.0	1254.1	27
30 min Winter	108.845	0.0	1238.4	41
60 min Winter	63.353	0.0	2345.5	70
120 min Winter	36.874	0.0	2375.6	128
180 min Winter	26.867	0.0	2330.4	188
240 min Winter	21.462	0.0	2297.6	246
360 min Winter	15.638	0.0	2256.2	364
480 min Winter	12.492	0.0	2231.5	480
600 min Winter	10.494	0.0	2215.7	598
720 min Winter	9.102	0.0	2206.3	714
960 min Winter	7.267	0.0	2202.6	946
1440 min Winter	5.290	0.0	2199.3	1402
2160 min Winter	3.852	0.0	4472.0	2064
2880 min Winter	3.075	0.0	4343.2	2684
4320 min Winter	2.173	0.0	4051.0	3332
5760 min Winter	1.698	0.0	6824.3	4264
7200 min Winter	1.402	0.0	7022.6	5184

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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
8640 min Winter	0.840	0.840	14.8	2899.6	O K
10080 min Winter	0.738	0.738	14.8	2513.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
8640 min Winter	1.200	0.0	7172.4	6064
10080 min Winter	1.051	0.0	7289.0	6864

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 5.040

Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)
0	4	1.680	4	8	1.680	8	12	1.680

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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)
0.000	3071.6	1.500	4524.4


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0171-1480-1200-1480
Design Head (m)	1.200
Design Flow (l/s)	14.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	171
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	14.8	Kick-Flo®	0.805	12.3
Flush-Flo™	0.366	14.8	Mean Flow over Head Range	-	12.7

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	6.1	1.200	14.8	3.000	22.9	7.000	34.4
0.200	13.9	1.400	15.9	3.500	24.7	7.500	35.6
0.300	14.7	1.600	17.0	4.000	26.3	8.000	36.7
0.400	14.8	1.800	17.9	4.500	27.8	8.500	37.8
0.500	14.6	2.000	18.9	5.000	29.3	9.000	38.9
0.600	14.2	2.200	19.7	5.500	30.6	9.500	39.9
0.800	12.4	2.400	20.6	6.000	32.0		
1.000	13.6	2.600	21.4	6.500	33.2		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	0.090	0.090	5.3	326.1	O K
30 min Summer	0.111	0.111	7.6	404.9	O K
60 min Summer	0.136	0.136	10.5	497.9	O K
120 min Summer	0.163	0.163	13.4	600.9	O K
180 min Summer	0.179	0.179	14.8	660.9	O K
240 min Summer	0.190	0.190	15.7	699.8	O K
360 min Summer	0.202	0.202	16.2	747.5	O K
480 min Summer	0.212	0.212	16.3	783.2	O K
600 min Summer	0.219	0.219	16.4	810.5	O K
720 min Summer	0.224	0.224	16.5	831.8	O K
960 min Summer	0.232	0.232	16.5	860.6	O K
1440 min Summer	0.238	0.238	16.6	885.7	O K
2160 min Summer	0.238	0.238	16.6	883.0	O K
2880 min Summer	0.231	0.231	16.5	859.2	O K
4320 min Summer	0.207	0.207	16.2	766.6	O K
5760 min Summer	0.188	0.188	15.6	695.6	O K
7200 min Summer	0.175	0.175	14.4	643.3	O K
8640 min Summer	0.164	0.164	13.4	601.5	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	30.107	0.0	200.1	26
30 min Summer	18.857	0.0	269.4	41
60 min Summer	11.811	0.0	428.7	70
120 min Summer	7.397	0.0	553.4	126
180 min Summer	5.626	0.0	640.4	184
240 min Summer	4.633	0.0	709.3	242
360 min Summer	3.524	0.0	817.1	324
480 min Summer	2.902	0.0	901.7	388
600 min Summer	2.496	0.0	972.0	454
720 min Summer	2.207	0.0	1032.5	520
960 min Summer	1.817	0.0	1132.4	660
1440 min Summer	1.380	0.0	1280.0	936
2160 min Summer	1.049	0.0	1583.3	1344
2880 min Summer	0.863	0.0	1733.6	1736
4320 min Summer	0.637	0.0	1889.1	2476
5760 min Summer	0.513	0.0	2116.9	3224
7200 min Summer	0.434	0.0	2231.1	3960
8640 min Summer	0.378	0.0	2322.3	4672

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	0.154	0.154	12.5	567.0	O K
15 min Winter	0.100	0.100	6.5	365.0	O K
30 min Winter	0.124	0.124	9.1	453.1	O K
60 min Winter	0.152	0.152	12.2	557.4	O K
120 min Winter	0.183	0.183	15.1	674.0	O K
180 min Winter	0.201	0.201	16.1	743.0	O K
240 min Winter	0.214	0.214	16.3	791.0	O K
360 min Winter	0.230	0.230	16.5	851.9	O K
480 min Winter	0.239	0.239	16.6	886.7	O K
600 min Winter	0.245	0.245	16.7	912.4	O K
720 min Winter	0.251	0.251	16.7	932.7	O K
960 min Winter	0.257	0.257	16.8	955.6	O K
1440 min Winter	0.258	0.258	16.8	961.9	O K
2160 min Winter	0.249	0.249	16.7	926.3	O K
2880 min Winter	0.235	0.235	16.6	871.1	O K
4320 min Winter	0.198	0.198	16.1	731.8	O K
5760 min Winter	0.175	0.175	14.5	646.6	O K
7200 min Winter	0.159	0.159	13.0	585.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.337	0.0	2388.5	5352
15 min Winter	30.107	0.0	233.0	26
30 min Winter	18.857	0.0	311.9	40
60 min Winter	11.811	0.0	488.3	68
120 min Winter	7.397	0.0	628.5	124
180 min Winter	5.626	0.0	726.1	180
240 min Winter	4.633	0.0	803.2	238
360 min Winter	3.524	0.0	923.9	348
480 min Winter	2.902	0.0	1018.5	448
600 min Winter	2.496	0.0	1097.1	482
720 min Winter	2.207	0.0	1164.8	560
960 min Winter	1.817	0.0	1276.5	716
1440 min Winter	1.380	0.0	1441.0	1018
2160 min Winter	1.049	0.0	1779.8	1452
2880 min Winter	0.863	0.0	1949.3	1852
4320 min Winter	0.637	0.0	2127.3	2596
5760 min Winter	0.513	0.0	2375.5	3304
7200 min Winter	0.434	0.0	2504.5	4040

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
8640 min Winter	0.147	0.147	11.7	539.2	O K
10080 min Winter	0.137	0.137	10.7	503.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
8640 min Winter	0.378	0.0	2608.5	4760
10080 min Winter	0.337	0.0	2686.2	5464

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	1
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 5.840

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To: (ha)	From:	To: (ha)	From:	To: (ha)
0	4 1.947	4	8 1.947	8	12 1.947

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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)
0.000	3598.2	1.500	5214.4


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0183-1720-1200-1720
Design Head (m)	1.200
Design Flow (l/s)	17.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	183
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	17.2	Kick-Flo®	0.818	14.3
Flush-Flo™	0.373	17.2	Mean Flow over Head Range	-	14.7

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	6.4	1.200	17.2	3.000	26.6	7.000	40.1
0.200	16.1	1.400	18.5	3.500	28.7	7.500	41.4
0.300	17.0	1.600	19.7	4.000	30.6	8.000	42.7
0.400	17.2	1.800	20.9	4.500	32.4	8.500	44.0
0.500	17.0	2.000	21.9	5.000	34.1	9.000	45.3
0.600	16.6	2.200	23.0	5.500	35.7	9.500	46.5
0.800	14.7	2.400	23.9	6.000	37.2		
1.000	15.8	2.600	24.9	6.500	38.7		

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Innovyze	Source Control 2019.1	

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	0.261	0.261	16.8	972.1	O K
30 min Summer	0.306	0.306	17.1	1147.6	O K
60 min Summer	0.357	0.357	17.2	1347.9	O K
120 min Summer	0.413	0.413	17.2	1569.4	O K
180 min Summer	0.446	0.446	17.2	1704.3	O K
240 min Summer	0.469	0.469	17.2	1798.8	O K
360 min Summer	0.500	0.500	17.2	1924.4	O K
480 min Summer	0.519	0.519	17.2	2002.0	O K
600 min Summer	0.531	0.531	17.2	2051.2	O K
720 min Summer	0.538	0.538	17.2	2081.4	O K
960 min Summer	0.544	0.544	17.2	2104.4	O K
1440 min Summer	0.546	0.546	17.2	2113.9	O K
2160 min Summer	0.539	0.539	17.2	2084.3	O K
2880 min Summer	0.525	0.525	17.2	2025.2	O K
4320 min Summer	0.468	0.468	17.2	1794.2	O K
5760 min Summer	0.415	0.415	17.2	1580.2	O K
7200 min Summer	0.368	0.368	17.2	1391.0	O K
8640 min Summer	0.327	0.327	17.1	1228.0	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	90.095	0.0	771.4	26
30 min Summer	53.466	0.0	923.6	41
60 min Summer	31.728	0.0	1266.7	70
120 min Summer	18.829	0.0	1510.1	130
180 min Summer	13.876	0.0	1670.1	188
240 min Summer	11.174	0.0	1791.4	248
360 min Summer	8.234	0.0	1971.9	366
480 min Summer	6.631	0.0	2104.3	484
600 min Summer	5.605	0.0	2206.6	602
720 min Summer	4.887	0.0	2286.9	722
960 min Summer	3.933	0.0	2395.1	902
1440 min Summer	2.896	0.0	2435.9	1140
2160 min Summer	2.132	0.0	3252.6	1520
2880 min Summer	1.716	0.0	3474.7	1936
4320 min Summer	1.226	0.0	3666.9	2728
5760 min Summer	0.966	0.0	4017.9	3520
7200 min Summer	0.803	0.0	4166.5	4256
8640 min Summer	0.690	0.0	4282.8	5016

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Innovyze	Source Control 2019.1	

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	0.291	0.291	17.0	1090.2	O K
15 min Winter	0.291	0.291	17.0	1090.0	O K
30 min Winter	0.342	0.342	17.2	1287.4	O K
60 min Winter	0.399	0.399	17.2	1513.5	O K
120 min Winter	0.461	0.461	17.2	1765.2	O K
180 min Winter	0.499	0.499	17.2	1919.7	O K
240 min Winter	0.526	0.526	17.2	2029.4	O K
360 min Winter	0.561	0.561	17.2	2177.7	O K
480 min Winter	0.584	0.584	17.2	2272.7	O K
600 min Winter	0.599	0.599	17.2	2336.4	O K
720 min Winter	0.609	0.609	17.2	2379.2	O K
960 min Winter	0.620	0.620	17.2	2422.2	O K
1440 min Winter	0.618	0.618	17.2	2416.3	O K
2160 min Winter	0.604	0.604	17.2	2355.6	O K
2880 min Winter	0.581	0.581	17.2	2257.9	O K
4320 min Winter	0.497	0.497	17.2	1913.6	O K
5760 min Winter	0.418	0.418	17.2	1592.7	O K
7200 min Winter	0.349	0.349	17.2	1316.4	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.608	0.0	4363.6	5664
15 min Winter	90.095	0.0	870.9	26
30 min Winter	53.466	0.0	1034.9	41
60 min Winter	31.728	0.0	1424.4	70
120 min Winter	18.829	0.0	1694.3	128
180 min Winter	13.876	0.0	1870.4	186
240 min Winter	11.174	0.0	2002.7	244
360 min Winter	8.234	0.0	2196.5	360
480 min Winter	6.631	0.0	2333.8	476
600 min Winter	5.605	0.0	2434.1	590
720 min Winter	4.887	0.0	2505.4	704
960 min Winter	3.933	0.0	2573.2	924
1440 min Winter	2.896	0.0	2496.1	1334
2160 min Winter	2.132	0.0	3640.1	1652
2880 min Winter	1.716	0.0	3883.9	2112
4320 min Winter	1.226	0.0	4083.6	2984
5760 min Winter	0.966	0.0	4504.1	3760
7200 min Winter	0.803	0.0	4672.6	4536

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
8640 min Winter	0.291	0.291	17.0	1090.7	O K
10080 min Winter	0.246	0.246	16.7	914.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
8640 min Winter	0.690	0.0	4805.7	5192
10080 min Winter	0.608	0.0	4902.0	5856

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 5.840

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To: (ha)	From:	To: (ha)	From:	To: (ha)
0	4 1.947	4	8 1.947	8	12 1.947

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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)
0.000	3598.2	1.500	5214.4


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0183-1720-1200-1720
Design Head (m)	1.200
Design Flow (l/s)	17.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	183
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	17.2	Kick-Flo®	0.818	14.3
Flush-Flo™	0.373	17.2	Mean Flow over Head Range	-	14.7

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	6.4	1.200	17.2	3.000	26.6	7.000	40.1
0.200	16.1	1.400	18.5	3.500	28.7	7.500	41.4
0.300	17.0	1.600	19.7	4.000	30.6	8.000	42.7
0.400	17.2	1.800	20.9	4.500	32.4	8.500	44.0
0.500	17.0	2.000	21.9	5.000	34.1	9.000	45.3
0.600	16.6	2.200	23.0	5.500	35.7	9.500	46.5
0.800	14.7	2.400	23.9	6.000	37.2		
1.000	15.8	2.600	24.9	6.500	38.7		

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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
15 min Summer	0.526	0.526	17.2	2029.9	O K
30 min Summer	0.604	0.604	17.2	2356.2	O K
60 min Summer	0.691	0.691	17.2	2727.0	O K
120 min Summer	0.786	0.786	17.2	3141.7	O K
180 min Summer	0.845	0.845	17.2	3401.6	O K
240 min Summer	0.886	0.886	17.2	3589.1	O K
360 min Summer	0.944	0.944	17.2	3850.4	O K
480 min Summer	0.982	0.982	17.2	4027.5	O K
600 min Summer	1.010	1.010	17.2	4155.0	O K
720 min Summer	1.030	1.030	17.2	4249.5	O K
960 min Summer	1.056	1.056	17.2	4371.0	O K
1440 min Summer	1.076	1.076	17.2	4464.7	O K
2160 min Summer	1.067	1.067	17.2	4424.9	O K
2880 min Summer	1.050	1.050	17.2	4342.6	O K
4320 min Summer	0.977	0.977	17.2	4001.8	O K
5760 min Summer	0.910	0.910	17.2	3695.1	O K
7200 min Summer	0.845	0.845	17.2	3402.0	O K
8640 min Summer	0.775	0.775	17.2	3094.0	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	187.006	0.0	1439.4	27
30 min Summer	108.845	0.0	1452.5	42
60 min Summer	63.353	0.0	2494.2	72
120 min Summer	36.874	0.0	2754.8	130
180 min Summer	26.867	0.0	2770.4	190
240 min Summer	21.462	0.0	2729.2	250
360 min Summer	15.638	0.0	2660.2	368
480 min Summer	12.492	0.0	2609.2	488
600 min Summer	10.494	0.0	2569.5	608
720 min Summer	9.102	0.0	2536.7	726
960 min Summer	7.267	0.0	2483.6	966
1440 min Summer	5.290	0.0	2410.9	1442
2160 min Summer	3.852	0.0	5120.3	2056
2880 min Summer	3.075	0.0	4932.5	2372
4320 min Summer	2.173	0.0	4495.9	3120
5760 min Summer	1.698	0.0	7058.5	3928
7200 min Summer	1.402	0.0	7271.8	4760
8640 min Summer	1.200	0.0	7444.2	5536

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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
10080 min Summer	0.711	0.711	17.2	2812.0	O K
15 min Winter	0.585	0.585	17.2	2275.3	O K
30 min Winter	0.671	0.671	17.2	2642.2	O K
60 min Winter	0.768	0.768	17.2	3059.9	O K
120 min Winter	0.873	0.873	17.2	3529.0	O K
180 min Winter	0.938	0.938	17.2	3822.1	O K
240 min Winter	0.984	0.984	17.2	4034.7	O K
360 min Winter	1.048	1.048	17.2	4334.0	O K
480 min Winter	1.092	1.092	17.2	4539.8	O K
600 min Winter	1.123	1.123	17.2	4690.4	O K
720 min Winter	1.147	1.147	17.2	4804.4	O K
960 min Winter	1.179	1.179	17.2	4957.1	O K
1440 min Winter	1.208	1.208	17.3	5097.5	Flood Risk
2160 min Winter	1.209	1.209	17.3	5105.0	Flood Risk
2880 min Winter	1.188	1.188	17.2	5000.7	O K
4320 min Winter	1.098	1.098	17.2	4570.8	O K
5760 min Winter	1.013	1.013	17.2	4168.1	O K
7200 min Winter	0.927	0.927	17.2	3771.9	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
10080 min Summer	1.051	0.0	7572.0	6264
15 min Winter	187.006	0.0	1458.0	27
30 min Winter	108.845	0.0	1443.6	41
60 min Winter	63.353	0.0	2709.8	70
120 min Winter	36.874	0.0	2775.5	128
180 min Winter	26.867	0.0	2723.3	188
240 min Winter	21.462	0.0	2684.2	246
360 min Winter	15.638	0.0	2633.3	364
480 min Winter	12.492	0.0	2601.8	480
600 min Winter	10.494	0.0	2580.4	598
720 min Winter	9.102	0.0	2565.8	714
960 min Winter	7.267	0.0	2552.5	946
1440 min Winter	5.290	0.0	2543.7	1402
2160 min Winter	3.852	0.0	5196.9	2064
2880 min Winter	3.075	0.0	5042.1	2680
4320 min Winter	2.173	0.0	4690.2	3332
5760 min Winter	1.698	0.0	7897.3	4264
7200 min Winter	1.402	0.0	8125.0	5184

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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
8640 min Winter	0.837	0.837	17.2	3368.3	O K
10080 min Winter	0.736	0.736	17.2	2920.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
8640 min Winter	1.200	0.0	8298.5	6064
10080 min Winter	1.051	0.0	8432.0	6856

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 5.840

Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)
0	4	1.947	4	8	1.947	8	12	1.947

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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)
0.000	3598.2	1.500	5214.4


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0183-1720-1200-1720
Design Head (m)	1.200
Design Flow (l/s)	17.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	183
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	17.2	Kick-Flo®	0.818	14.3
Flush-Flo™	0.373	17.2	Mean Flow over Head Range	-	14.7

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	6.4	1.200	17.2	3.000	26.6	7.000	40.1
0.200	16.1	1.400	18.5	3.500	28.7	7.500	41.4
0.300	17.0	1.600	19.7	4.000	30.6	8.000	42.7
0.400	17.2	1.800	20.9	4.500	32.4	8.500	44.0
0.500	17.0	2.000	21.9	5.000	34.1	9.000	45.3
0.600	16.6	2.200	23.0	5.500	35.7	9.500	46.5
0.800	14.7	2.400	23.9	6.000	37.2		
1.000	15.8	2.600	24.9	6.500	38.7		

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Innovyze	Source Control 2019.1	

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	0.095	0.095	4.6	175.3	O K
30 min Summer	0.117	0.117	6.2	216.7	O K
60 min Summer	0.142	0.142	7.7	265.1	O K
120 min Summer	0.170	0.170	8.5	318.0	O K
180 min Summer	0.186	0.186	8.7	349.4	O K
240 min Summer	0.197	0.197	8.8	370.1	O K
360 min Summer	0.210	0.210	8.9	395.5	O K
480 min Summer	0.219	0.219	8.9	413.1	O K
600 min Summer	0.225	0.225	9.0	426.0	O K
720 min Summer	0.230	0.230	9.0	435.5	O K
960 min Summer	0.236	0.236	9.0	447.3	O K
1440 min Summer	0.239	0.239	9.0	453.8	O K
2160 min Summer	0.234	0.234	9.0	443.7	O K
2880 min Summer	0.224	0.224	9.0	424.2	O K
4320 min Summer	0.194	0.194	8.7	365.2	O K
5760 min Summer	0.170	0.170	8.5	318.2	O K
7200 min Summer	0.153	0.153	8.2	285.2	O K
8640 min Summer	0.141	0.141	7.6	262.4	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	30.107	0.0	131.3	26
30 min Summer	18.857	0.0	172.3	40
60 min Summer	11.811	0.0	251.4	68
120 min Summer	7.397	0.0	320.4	126
180 min Summer	5.626	0.0	368.4	184
240 min Summer	4.633	0.0	406.4	242
360 min Summer	3.524	0.0	465.9	322
480 min Summer	2.902	0.0	512.9	386
600 min Summer	2.496	0.0	552.1	452
720 min Summer	2.207	0.0	586.0	518
960 min Summer	1.817	0.0	642.5	658
1440 min Summer	1.380	0.0	727.6	934
2160 min Summer	1.049	0.0	873.4	1344
2880 min Summer	0.863	0.0	957.2	1736
4320 min Summer	0.637	0.0	1048.4	2476
5760 min Summer	0.513	0.0	1155.0	3184
7200 min Summer	0.434	0.0	1218.7	3896
8640 min Summer	0.378	0.0	1270.9	4592

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	0.132	0.132	7.1	244.5	O K
15 min Winter	0.106	0.106	5.4	196.1	O K
30 min Winter	0.131	0.131	7.0	242.7	O K
60 min Winter	0.159	0.159	8.4	297.3	O K
120 min Winter	0.191	0.191	8.7	358.9	O K
180 min Winter	0.210	0.210	8.9	395.7	O K
240 min Winter	0.223	0.223	8.9	420.6	O K
360 min Winter	0.238	0.238	9.0	451.1	O K
480 min Winter	0.246	0.246	9.1	467.6	O K
600 min Winter	0.252	0.252	9.1	479.4	O K
720 min Winter	0.257	0.257	9.1	488.2	O K
960 min Winter	0.261	0.261	9.1	496.3	O K
1440 min Winter	0.259	0.259	9.1	492.1	O K
2160 min Winter	0.244	0.244	9.1	463.4	O K
2880 min Winter	0.225	0.225	9.0	426.2	O K
4320 min Winter	0.181	0.181	8.6	339.1	O K
5760 min Winter	0.151	0.151	8.1	282.4	O K
7200 min Winter	0.135	0.135	7.3	250.0	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.337	0.0	1311.0	5344
15 min Winter	30.107	0.0	150.8	26
30 min Winter	18.857	0.0	197.1	40
60 min Winter	11.811	0.0	284.3	68
120 min Winter	7.397	0.0	361.6	124
180 min Winter	5.626	0.0	415.3	180
240 min Winter	4.633	0.0	457.8	238
360 min Winter	3.524	0.0	524.5	348
480 min Winter	2.902	0.0	577.1	446
600 min Winter	2.496	0.0	620.9	482
720 min Winter	2.207	0.0	658.9	558
960 min Winter	1.817	0.0	721.9	714
1440 min Winter	1.380	0.0	816.7	1018
2160 min Winter	1.049	0.0	980.2	1452
2880 min Winter	0.863	0.0	1074.4	1852
4320 min Winter	0.637	0.0	1178.3	2596
5760 min Winter	0.513	0.0	1295.1	3280
7200 min Winter	0.434	0.0	1366.8	3968

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
8640 min Winter	0.122	0.122	6.5	226.6	O K
10080 min Winter	0.113	0.113	5.9	209.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
8640 min Winter	0.378	0.0	1426.0	4680
10080 min Winter	0.337	0.0	1472.7	5360

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	1
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 3.160

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From:	To:	From:	To:	From:	To:
0	4	4	8	8	12
	1.053		1.053		1.053

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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)
0.000	1809.9	1.500	3028.8


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0138-9300-1200-9300
Design Head (m)	1.200
Design Flow (l/s)	9.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	138
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	9.3	Kick-Flo®	0.773	7.6
Flush-Flo™	0.356	9.3	Mean Flow over Head Range	-	8.1

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	5.0	1.200	9.3	3.000	14.3	7.000	21.5
0.200	8.8	1.400	10.0	3.500	15.4	7.500	22.2
0.300	9.2	1.600	10.6	4.000	16.5	8.000	22.9
0.400	9.3	1.800	11.3	4.500	17.4	8.500	23.6
0.500	9.1	2.000	11.8	5.000	18.3	9.000	24.3
0.600	8.9	2.200	12.4	5.500	19.2	9.500	24.9
0.800	7.7	2.400	12.9	6.000	20.0		
1.000	8.5	2.600	13.4	6.500	20.8		

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	0.275	0.275	9.2	525.3	O K
30 min Summer	0.322	0.322	9.3	620.0	O K
60 min Summer	0.374	0.374	9.3	728.0	O K
120 min Summer	0.430	0.430	9.3	846.6	O K
180 min Summer	0.464	0.464	9.3	918.3	O K
240 min Summer	0.487	0.487	9.3	968.2	O K
360 min Summer	0.517	0.517	9.3	1033.8	O K
480 min Summer	0.535	0.535	9.3	1073.5	O K
600 min Summer	0.546	0.546	9.3	1097.9	O K
720 min Summer	0.553	0.553	9.3	1112.2	O K
960 min Summer	0.556	0.556	9.3	1120.4	O K
1440 min Summer	0.555	0.555	9.3	1117.0	O K
2160 min Summer	0.543	0.543	9.3	1090.9	O K
2880 min Summer	0.525	0.525	9.3	1051.7	O K
4320 min Summer	0.464	0.464	9.3	918.1	O K
5760 min Summer	0.408	0.408	9.3	798.0	O K
7200 min Summer	0.357	0.357	9.3	693.2	O K
8640 min Summer	0.314	0.314	9.3	603.4	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	90.095	0.0	455.0	26
30 min Summer	53.466	0.0	539.6	41
60 min Summer	31.728	0.0	711.5	70
120 min Summer	18.829	0.0	845.9	130
180 min Summer	13.876	0.0	934.5	188
240 min Summer	11.174	0.0	1002.0	248
360 min Summer	8.234	0.0	1103.0	366
480 min Summer	6.631	0.0	1177.5	484
600 min Summer	5.605	0.0	1235.3	602
720 min Summer	4.887	0.0	1280.7	722
960 min Summer	3.933	0.0	1340.2	916
1440 min Summer	2.896	0.0	1346.3	1142
2160 min Summer	2.132	0.0	1784.6	1524
2880 min Summer	1.716	0.0	1909.5	1936
4320 min Summer	1.226	0.0	2025.4	2732
5760 min Summer	0.966	0.0	2184.8	3520
7200 min Summer	0.803	0.0	2267.3	4256
8640 min Summer	0.690	0.0	2333.7	5016

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	0.276	0.276	9.2	527.8	O K
15 min Winter	0.307	0.307	9.2	589.1	O K
30 min Winter	0.359	0.359	9.3	695.7	O K
60 min Winter	0.417	0.417	9.3	817.5	O K
120 min Winter	0.480	0.480	9.3	952.6	O K
180 min Winter	0.518	0.518	9.3	1035.2	O K
240 min Winter	0.544	0.544	9.3	1093.4	O K
360 min Winter	0.579	0.579	9.3	1171.8	O K
480 min Winter	0.601	0.601	9.3	1221.4	O K
600 min Winter	0.616	0.616	9.3	1254.1	O K
720 min Winter	0.625	0.625	9.3	1275.7	O K
960 min Winter	0.634	0.634	9.3	1295.9	O K
1440 min Winter	0.630	0.630	9.3	1286.6	O K
2160 min Winter	0.611	0.611	9.3	1242.2	O K
2880 min Winter	0.584	0.584	9.3	1181.5	O K
4320 min Winter	0.494	0.494	9.3	983.8	O K
5760 min Winter	0.410	0.410	9.3	803.8	O K
7200 min Winter	0.337	0.337	9.3	651.0	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.608	0.0	2383.6	5664
15 min Winter	90.095	0.0	510.3	26
30 min Winter	53.466	0.0	600.8	41
60 min Winter	31.728	0.0	798.3	70
120 min Winter	18.829	0.0	947.5	128
180 min Winter	13.876	0.0	1045.3	186
240 min Winter	11.174	0.0	1119.1	244
360 min Winter	8.234	0.0	1227.4	360
480 min Winter	6.631	0.0	1304.1	476
600 min Winter	5.605	0.0	1358.9	590
720 min Winter	4.887	0.0	1395.5	704
960 min Winter	3.933	0.0	1418.0	926
1440 min Winter	2.896	0.0	1365.8	1342
2160 min Winter	2.132	0.0	1997.0	1664
2880 min Winter	1.716	0.0	2134.8	2112
4320 min Winter	1.226	0.0	2257.2	2984
5760 min Winter	0.966	0.0	2448.2	3760
7200 min Winter	0.803	0.0	2541.4	4536

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
8640 min Winter	0.276	0.276	9.2	527.4	O K
10080 min Winter	0.228	0.228	9.0	431.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
8640 min Winter	0.690	0.0	2616.8	5192
10080 min Winter	0.608	0.0	2675.2	5856

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 3.160

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From:	To:	From:	To:	From:	To:
0	4 1.053	4	8 1.053	8	12 1.053

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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)
0.000	1809.9	1.500	3028.8


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0138-9300-1200-9300
Design Head (m)	1.200
Design Flow (l/s)	9.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	138
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	9.3	Kick-Flo®	0.773	7.6
Flush-Flo™	0.356	9.3	Mean Flow over Head Range	-	8.1

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	5.0	1.200	9.3	3.000	14.3	7.000	21.5
0.200	8.8	1.400	10.0	3.500	15.4	7.500	22.2
0.300	9.2	1.600	10.6	4.000	16.5	8.000	22.9
0.400	9.3	1.800	11.3	4.500	17.4	8.500	23.6
0.500	9.1	2.000	11.8	5.000	18.3	9.000	24.3
0.600	8.9	2.200	12.4	5.500	19.2	9.500	24.9
0.800	7.7	2.400	12.9	6.000	20.0		
1.000	8.5	2.600	13.4	6.500	20.8		

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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
15 min Summer	0.546	0.546	9.3	1098.0	O K
30 min Summer	0.625	0.625	9.3	1274.5	O K
60 min Summer	0.711	0.711	9.3	1474.8	O K
120 min Summer	0.805	0.805	9.3	1698.8	O K
180 min Summer	0.862	0.862	9.3	1837.7	O K
240 min Summer	0.902	0.902	9.3	1937.4	O K
360 min Summer	0.957	0.957	9.3	2075.9	O K
480 min Summer	0.993	0.993	9.3	2169.1	O K
600 min Summer	1.019	1.019	9.3	2235.7	O K
720 min Summer	1.037	1.037	9.3	2284.6	O K
960 min Summer	1.061	1.061	9.3	2346.1	O K
1440 min Summer	1.077	1.077	9.3	2389.3	O K
2160 min Summer	1.065	1.065	9.3	2358.3	O K
2880 min Summer	1.046	1.046	9.3	2306.2	O K
4320 min Summer	0.971	0.971	9.3	2112.9	O K
5760 min Summer	0.905	0.905	9.3	1945.2	O K
7200 min Summer	0.842	0.842	9.3	1790.0	O K
8640 min Summer	0.779	0.779	9.3	1636.5	O K
10080 min Summer	0.710	0.710	9.3	1472.9	O K
15 min Winter	0.605	0.605	9.3	1230.8	O K
30 min Winter	0.692	0.692	9.3	1429.3	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	187.006	0.0	784.1	27
30 min Summer	108.845	0.0	781.4	42
60 min Summer	63.353	0.0	1387.0	72
120 min Summer	36.874	0.0	1490.5	130
180 min Summer	26.867	0.0	1471.2	190
240 min Summer	21.462	0.0	1449.4	250
360 min Summer	15.638	0.0	1416.2	368
480 min Summer	12.492	0.0	1393.3	488
600 min Summer	10.494	0.0	1376.5	608
720 min Summer	9.102	0.0	1363.4	726
960 min Summer	7.267	0.0	1345.0	966
1440 min Summer	5.290	0.0	1331.2	1442
2160 min Summer	3.852	0.0	2779.4	2056
2880 min Summer	3.075	0.0	2685.1	2376
4320 min Summer	2.173	0.0	2462.5	3120
5760 min Summer	1.698	0.0	3837.9	3928
7200 min Summer	1.402	0.0	3956.7	4760
8640 min Summer	1.200	0.0	4053.0	5624
10080 min Summer	1.051	0.0	4130.8	6352
15 min Winter	187.006	0.0	785.9	27
30 min Winter	108.845	0.0	769.7	41

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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	0.787	0.787	9.3	1655.4	O K
120 min Winter	0.890	0.890	9.3	1907.7	O K
180 min Winter	0.952	0.952	9.3	2064.9	O K
240 min Winter	0.997	0.997	9.3	2178.8	O K
360 min Winter	1.058	1.058	9.3	2338.7	O K
480 min Winter	1.099	1.099	9.3	2448.0	O K
600 min Winter	1.129	1.129	9.3	2527.6	O K
720 min Winter	1.151	1.151	9.3	2587.5	O K
960 min Winter	1.180	1.180	9.3	2666.8	O K
1440 min Winter	1.205	1.205	9.3	2736.6	Flood Risk
2160 min Winter	1.204	1.204	9.3	2732.6	Flood Risk
2880 min Winter	1.181	1.181	9.3	2669.5	O K
4320 min Winter	1.091	1.091	9.3	2426.7	O K
5760 min Winter	1.007	1.007	9.3	2204.9	O K
7200 min Winter	0.923	0.923	9.3	1991.0	O K
8640 min Winter	0.838	0.838	9.3	1779.6	O K
10080 min Winter	0.740	0.740	9.3	1542.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
60 min Winter	63.353	0.0	1484.3	70
120 min Winter	36.874	0.0	1472.5	128
180 min Winter	26.867	0.0	1445.1	188
240 min Winter	21.462	0.0	1426.5	246
360 min Winter	15.638	0.0	1404.6	364
480 min Winter	12.492	0.0	1393.4	480
600 min Winter	10.494	0.0	1388.5	598
720 min Winter	9.102	0.0	1388.5	714
960 min Winter	7.267	0.0	1398.4	946
1440 min Winter	5.290	0.0	1399.2	1402
2160 min Winter	3.852	0.0	2813.5	2064
2880 min Winter	3.075	0.0	2739.6	2684
4320 min Winter	2.173	0.0	2574.4	3332
5760 min Winter	1.698	0.0	4295.4	4264
7200 min Winter	1.402	0.0	4424.5	5184
8640 min Winter	1.200	0.0	4523.3	6064
10080 min Winter	1.051	0.0	4600.4	6952

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.160

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:
0	4	4	8	8	12
	1.053		1.053		1.053

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6150 Knights Court Solihull Parkway Birmingham, B37 7WY	Catchment E1	
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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)
0.000	1809.9	1.500	3028.8


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0138-9300-1200-9300
Design Head (m)	1.200
Design Flow (l/s)	9.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	138
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	9.3
Flush-Flo™	0.356	9.3
Kick-Flo®	0.773	7.6
Mean Flow over Head Range	-	8.1

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	5.0	1.200	9.3	3.000	14.3	7.000	21.5
0.200	8.8	1.400	10.0	3.500	15.4	7.500	22.2
0.300	9.2	1.600	10.6	4.000	16.5	8.000	22.9
0.400	9.3	1.800	11.3	4.500	17.4	8.500	23.6
0.500	9.1	2.000	11.8	5.000	18.3	9.000	24.3
0.600	8.9	2.200	12.4	5.500	19.2	9.500	24.9
0.800	7.7	2.400	12.9	6.000	20.0		
1.000	8.5	2.600	13.4	6.500	20.8		

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6150 Knights Court Solihull Parkway Birmingham, B37 7WY	Catchment E2	
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Innovyze	Source Control 2019.1	

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	0.095	0.095	4.6	177.5	O K
30 min Summer	0.117	0.117	6.2	219.5	O K
60 min Summer	0.142	0.142	7.7	268.5	O K
120 min Summer	0.170	0.170	8.6	322.2	O K
180 min Summer	0.186	0.186	8.7	354.1	O K
240 min Summer	0.197	0.197	8.8	375.2	O K
360 min Summer	0.210	0.210	8.9	401.1	O K
480 min Summer	0.219	0.219	9.0	418.9	O K
600 min Summer	0.225	0.225	9.0	432.1	O K
720 min Summer	0.230	0.230	9.0	441.8	O K
960 min Summer	0.236	0.236	9.1	453.9	O K
1440 min Summer	0.240	0.240	9.1	460.8	O K
2160 min Summer	0.235	0.235	9.1	450.9	O K
2880 min Summer	0.225	0.225	9.0	431.5	O K
4320 min Summer	0.195	0.195	8.8	371.8	O K
5760 min Summer	0.171	0.171	8.6	324.1	O K
7200 min Summer	0.154	0.154	8.3	290.3	O K
8640 min Summer	0.142	0.142	7.7	267.2	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	30.107	0.0	132.5	26
30 min Summer	18.857	0.0	174.0	40
60 min Summer	11.811	0.0	254.3	68
120 min Summer	7.397	0.0	324.1	126
180 min Summer	5.626	0.0	372.7	184
240 min Summer	4.633	0.0	411.1	242
360 min Summer	3.524	0.0	471.4	324
480 min Summer	2.902	0.0	518.9	388
600 min Summer	2.496	0.0	558.6	452
720 min Summer	2.207	0.0	592.9	520
960 min Summer	1.817	0.0	650.0	658
1440 min Summer	1.380	0.0	736.0	936
2160 min Summer	1.049	0.0	884.2	1344
2880 min Summer	0.863	0.0	969.0	1736
4320 min Summer	0.637	0.0	1061.2	2504
5760 min Summer	0.513	0.0	1169.5	3184
7200 min Summer	0.434	0.0	1233.9	3896
8640 min Summer	0.378	0.0	1286.7	4592

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	0.132	0.132	7.2	249.0	O K
15 min Winter	0.106	0.106	5.5	198.7	O K
30 min Winter	0.131	0.131	7.1	245.9	O K
60 min Winter	0.159	0.159	8.4	301.2	O K
120 min Winter	0.191	0.191	8.8	363.7	O K
180 min Winter	0.210	0.210	8.9	401.1	O K
240 min Winter	0.223	0.223	9.0	426.4	O K
360 min Winter	0.238	0.238	9.1	457.6	O K
480 min Winter	0.246	0.246	9.1	474.4	O K
600 min Winter	0.252	0.252	9.2	486.4	O K
720 min Winter	0.257	0.257	9.2	495.4	O K
960 min Winter	0.261	0.261	9.2	503.8	O K
1440 min Winter	0.259	0.259	9.2	500.0	O K
2160 min Winter	0.245	0.245	9.1	471.4	O K
2880 min Winter	0.226	0.226	9.0	434.0	O K
4320 min Winter	0.182	0.182	8.7	345.8	O K
5760 min Winter	0.152	0.152	8.2	287.6	O K
7200 min Winter	0.135	0.135	7.3	254.7	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.337	0.0	1327.3	5344
15 min Winter	30.107	0.0	152.3	26
30 min Winter	18.857	0.0	199.0	40
60 min Winter	11.811	0.0	287.6	68
120 min Winter	7.397	0.0	365.8	124
180 min Winter	5.626	0.0	420.2	180
240 min Winter	4.633	0.0	463.2	238
360 min Winter	3.524	0.0	530.7	348
480 min Winter	2.902	0.0	583.9	448
600 min Winter	2.496	0.0	628.2	482
720 min Winter	2.207	0.0	666.6	560
960 min Winter	1.817	0.0	730.4	716
1440 min Winter	1.380	0.0	826.2	1018
2160 min Winter	1.049	0.0	992.3	1452
2880 min Winter	0.863	0.0	1087.7	1852
4320 min Winter	0.637	0.0	1192.8	2600
5760 min Winter	0.513	0.0	1311.3	3280
7200 min Winter	0.434	0.0	1383.9	3968

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
8640 min Winter	0.123	0.123	6.6	230.9	O K
10080 min Winter	0.114	0.114	6.0	213.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
8640 min Winter	0.378	0.0	1443.8	4680
10080 min Winter	0.337	0.0	1491.0	5440

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	1
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 3.200

Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)
0	4	1.067	4	8	1.067	8	12	1.067

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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)
0.000	1834.6	1.500	3070.1


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0139-9400-1200-9400
Design Head (m)	1.200
Design Flow (l/s)	9.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	139
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	9.4	Kick-Flo®	0.769	7.6
Flush-Flo™	0.355	9.3	Mean Flow over Head Range	-	8.1

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	5.0	1.200	9.4	3.000	14.5	7.000	21.7
0.200	8.8	1.400	10.1	3.500	15.6	7.500	22.5
0.300	9.3	1.600	10.8	4.000	16.6	8.000	23.2
0.400	9.3	1.800	11.4	4.500	17.6	8.500	23.9
0.500	9.2	2.000	12.0	5.000	18.5	9.000	24.5
0.600	8.9	2.200	12.5	5.500	19.4	9.500	25.2
0.800	7.8	2.400	13.0	6.000	20.2		
1.000	8.6	2.600	13.5	6.500	21.0		

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6150 Knights Court Solihull Parkway Birmingham, B37 7WY	Catchment E2	
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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	0.275	0.275	9.2	532.0	O K
30 min Summer	0.322	0.322	9.3	628.0	O K
60 min Summer	0.374	0.374	9.3	737.3	O K
120 min Summer	0.430	0.430	9.3	857.7	O K
180 min Summer	0.464	0.464	9.3	930.4	O K
240 min Summer	0.487	0.487	9.3	981.1	O K
360 min Summer	0.517	0.517	9.3	1047.8	O K
480 min Summer	0.535	0.535	9.3	1088.4	O K
600 min Summer	0.546	0.546	9.3	1113.5	O K
720 min Summer	0.553	0.553	9.3	1128.2	O K
960 min Summer	0.557	0.557	9.3	1137.0	O K
1440 min Summer	0.555	0.555	9.3	1133.9	O K
2160 min Summer	0.544	0.544	9.3	1107.9	O K
2880 min Summer	0.526	0.526	9.3	1068.8	O K
4320 min Summer	0.465	0.465	9.3	934.1	O K
5760 min Summer	0.409	0.409	9.3	812.8	O K
7200 min Summer	0.359	0.359	9.3	706.7	O K
8640 min Summer	0.316	0.316	9.3	615.8	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	90.095	0.0	459.9	26
30 min Summer	53.466	0.0	545.3	41
60 min Summer	31.728	0.0	719.9	70
120 min Summer	18.829	0.0	855.9	130
180 min Summer	13.876	0.0	945.6	188
240 min Summer	11.174	0.0	1013.8	248
360 min Summer	8.234	0.0	1115.7	366
480 min Summer	6.631	0.0	1190.9	484
600 min Summer	5.605	0.0	1249.0	602
720 min Summer	4.887	0.0	1294.4	722
960 min Summer	3.933	0.0	1353.1	918
1440 min Summer	2.896	0.0	1354.8	1144
2160 min Summer	2.132	0.0	1806.5	1532
2880 min Summer	1.716	0.0	1932.8	1940
4320 min Summer	1.226	0.0	2049.4	2732
5760 min Summer	0.966	0.0	2212.3	3520
7200 min Summer	0.803	0.0	2295.8	4256
8640 min Summer	0.690	0.0	2363.0	5016

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	0.278	0.278	9.2	538.7	O K
15 min Winter	0.306	0.306	9.3	596.6	O K
30 min Winter	0.358	0.358	9.3	704.6	O K
60 min Winter	0.416	0.416	9.3	828.1	O K
120 min Winter	0.480	0.480	9.3	965.0	O K
180 min Winter	0.517	0.517	9.3	1048.8	O K
240 min Winter	0.544	0.544	9.3	1107.9	O K
360 min Winter	0.579	0.579	9.3	1187.6	O K
480 min Winter	0.601	0.601	9.3	1238.1	O K
600 min Winter	0.616	0.616	9.3	1271.6	O K
720 min Winter	0.626	0.626	9.3	1293.8	O K
960 min Winter	0.635	0.635	9.3	1314.9	O K
1440 min Winter	0.631	0.631	9.3	1306.6	O K
2160 min Winter	0.612	0.612	9.3	1262.1	O K
2880 min Winter	0.585	0.585	9.3	1201.3	O K
4320 min Winter	0.497	0.497	9.3	1002.3	O K
5760 min Winter	0.413	0.413	9.3	820.4	O K
7200 min Winter	0.340	0.340	9.3	665.5	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.608	0.0	2413.4	5664
15 min Winter	90.095	0.0	515.7	26
30 min Winter	53.466	0.0	607.0	41
60 min Winter	31.728	0.0	807.8	70
120 min Winter	18.829	0.0	958.7	128
180 min Winter	13.876	0.0	1057.5	186
240 min Winter	11.174	0.0	1132.0	244
360 min Winter	8.234	0.0	1241.2	360
480 min Winter	6.631	0.0	1318.2	476
600 min Winter	5.605	0.0	1372.7	590
720 min Winter	4.887	0.0	1408.5	704
960 min Winter	3.933	0.0	1427.9	928
1440 min Winter	2.896	0.0	1373.4	1344
2160 min Winter	2.132	0.0	2021.4	1668
2880 min Winter	1.716	0.0	2160.5	2116
4320 min Winter	1.226	0.0	2283.0	2984
5760 min Winter	0.966	0.0	2479.0	3800
7200 min Winter	0.803	0.0	2573.3	4536

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Innovyze	Source Control 2019.1	

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
8640 min Winter	0.279	0.279	9.2	539.7	O K
10080 min Winter	0.230	0.230	9.0	441.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
8640 min Winter	0.690	0.0	2649.7	5200
10080 min Winter	0.608	0.0	2708.7	5856

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 3.200

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To: (ha)	From:	To: (ha)	From:	To: (ha)
0	4 1.067	4	8 1.067	8	12 1.067

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Innovyze	Source Control 2019.1	

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)
0.000	1834.6	1.500	3070.1


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0139-9400-1200-9400
Design Head (m)	1.200
Design Flow (l/s)	9.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	139
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	9.4	Kick-Flo®	0.769	7.6
Flush-Flo™	0.355	9.3	Mean Flow over Head Range	-	8.1

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	5.0	1.200	9.4	3.000	14.5	7.000	21.7
0.200	8.8	1.400	10.1	3.500	15.6	7.500	22.5
0.300	9.3	1.600	10.8	4.000	16.6	8.000	23.2
0.400	9.3	1.800	11.4	4.500	17.6	8.500	23.9
0.500	9.2	2.000	12.0	5.000	18.5	9.000	24.5
0.600	8.9	2.200	12.5	5.500	19.4	9.500	25.2
0.800	7.8	2.400	13.0	6.000	20.2		
1.000	8.6	2.600	13.5	6.500	21.0		

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Innovyze	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	0.546	0.546	9.3	1112.0	O K
30 min Summer	0.624	0.624	9.3	1290.7	O K
60 min Summer	0.711	0.711	9.3	1493.7	O K
120 min Summer	0.805	0.805	9.3	1720.7	O K
180 min Summer	0.861	0.861	9.3	1861.3	O K
240 min Summer	0.901	0.901	9.3	1962.4	O K
360 min Summer	0.956	0.956	9.3	2102.9	O K
480 min Summer	0.993	0.993	9.3	2197.5	O K
600 min Summer	1.018	1.018	9.3	2265.1	O K
720 min Summer	1.037	1.037	9.3	2314.9	O K
960 min Summer	1.061	1.061	9.3	2377.6	O K
1440 min Summer	1.077	1.077	9.3	2422.1	O K
2160 min Summer	1.066	1.066	9.3	2391.7	O K
2880 min Summer	1.046	1.046	9.3	2339.4	O K
4320 min Summer	0.972	0.972	9.3	2144.6	O K
5760 min Summer	0.907	0.907	9.3	1975.7	O K
7200 min Summer	0.845	0.845	9.3	1819.6	O K
8640 min Summer	0.783	0.783	9.3	1666.8	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	187.006	0.0	789.1	27
30 min Summer	108.845	0.0	785.9	42
60 min Summer	63.353	0.0	1401.6	72
120 min Summer	36.874	0.0	1500.6	130
180 min Summer	26.867	0.0	1480.1	190
240 min Summer	21.462	0.0	1458.4	250
360 min Summer	15.638	0.0	1425.7	368
480 min Summer	12.492	0.0	1403.3	488
600 min Summer	10.494	0.0	1386.8	608
720 min Summer	9.102	0.0	1374.1	726
960 min Summer	7.267	0.0	1356.6	966
1440 min Summer	5.290	0.0	1344.1	1442
2160 min Summer	3.852	0.0	2800.4	2056
2880 min Summer	3.075	0.0	2706.1	2388
4320 min Summer	2.173	0.0	2483.4	3120
5760 min Summer	1.698	0.0	3886.0	3928
7200 min Summer	1.402	0.0	4005.9	4760
8640 min Summer	1.200	0.0	4102.7	5624

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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
10080 min Summer	0.714	0.714	9.3	1502.3	O K
15 min Winter	0.605	0.605	9.3	1246.5	O K
30 min Winter	0.691	0.691	9.3	1447.5	O K
60 min Winter	0.787	0.787	9.3	1676.5	O K
120 min Winter	0.889	0.889	9.3	1932.1	O K
180 min Winter	0.952	0.952	9.3	2091.5	O K
240 min Winter	0.996	0.996	9.3	2206.9	O K
360 min Winter	1.057	1.057	9.3	2369.0	O K
480 min Winter	1.099	1.099	9.3	2479.9	O K
600 min Winter	1.128	1.128	9.3	2560.8	O K
720 min Winter	1.150	1.150	9.3	2621.7	O K
960 min Winter	1.180	1.180	9.3	2702.3	O K
1440 min Winter	1.205	1.205	9.4	2773.9	Flood Risk
2160 min Winter	1.204	1.204	9.4	2771.0	Flood Risk
2880 min Winter	1.182	1.182	9.3	2708.1	O K
4320 min Winter	1.092	1.092	9.3	2463.3	O K
5760 min Winter	1.009	1.009	9.3	2240.0	O K
7200 min Winter	0.926	0.926	9.3	2024.8	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
10080 min Summer	1.051	0.0	4180.7	6352
15 min Winter	187.006	0.0	790.5	27
30 min Winter	108.845	0.0	773.9	41
60 min Winter	63.353	0.0	1496.4	70
120 min Winter	36.874	0.0	1481.5	128
180 min Winter	26.867	0.0	1454.5	188
240 min Winter	21.462	0.0	1436.4	246
360 min Winter	15.638	0.0	1415.3	364
480 min Winter	12.492	0.0	1404.8	480
600 min Winter	10.494	0.0	1400.7	598
720 min Winter	9.102	0.0	1401.5	714
960 min Winter	7.267	0.0	1412.3	946
1440 min Winter	5.290	0.0	1412.7	1402
2160 min Winter	3.852	0.0	2836.3	2064
2880 min Winter	3.075	0.0	2763.1	2684
4320 min Winter	2.173	0.0	2599.0	3332
5760 min Winter	1.698	0.0	4349.0	4264
7200 min Winter	1.402	0.0	4479.2	5184

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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
8640 min Winter	0.842	0.842	9.3	1813.0	O K
10080 min Winter	0.746	0.746	9.3	1578.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
8640 min Winter	1.200	0.0	4577.6	6064
10080 min Winter	1.051	0.0	4651.3	6960

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.200

Time (mins)		Area	Time (mins)		Area	Time (mins)		Area
From:	To:	(ha)	From:	To:	(ha)	From:	To:	(ha)
0	4	1.067	4	8	1.067	8	12	1.067

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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)
0.000	1834.6	1.500	3070.1


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0139-9400-1200-9400
Design Head (m)	1.200
Design Flow (l/s)	9.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	139
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	9.4	Kick-Flo®	0.769	7.6
Flush-Flo™	0.355	9.3	Mean Flow over Head Range	-	8.1

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	5.0	1.200	9.4	3.000	14.5	7.000	21.7
0.200	8.8	1.400	10.1	3.500	15.6	7.500	22.5
0.300	9.3	1.600	10.8	4.000	16.6	8.000	23.2
0.400	9.3	1.800	11.4	4.500	17.6	8.500	23.9
0.500	9.2	2.000	12.0	5.000	18.5	9.000	24.5
0.600	8.9	2.200	12.5	5.500	19.4	9.500	25.2
0.800	7.8	2.400	13.0	6.000	20.2		
1.000	8.6	2.600	13.5	6.500	21.0		

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	0.088	0.088	5.0	305.9	O K
30 min Summer	0.109	0.109	7.2	379.9	O K
60 min Summer	0.134	0.134	9.9	467.1	O K
120 min Summer	0.161	0.161	12.6	563.7	O K
180 min Summer	0.176	0.176	13.9	619.8	O K
240 min Summer	0.187	0.187	14.7	656.2	O K
360 min Summer	0.199	0.199	15.1	701.4	O K
480 min Summer	0.208	0.208	15.2	734.9	O K
600 min Summer	0.216	0.216	15.3	760.5	O K
720 min Summer	0.221	0.221	15.4	780.4	O K
960 min Summer	0.228	0.228	15.5	807.3	O K
1440 min Summer	0.235	0.235	15.6	830.8	O K
2160 min Summer	0.234	0.234	15.5	828.1	O K
2880 min Summer	0.228	0.228	15.5	805.6	O K
4320 min Summer	0.204	0.204	15.2	718.4	O K
5760 min Summer	0.185	0.185	14.6	650.9	O K
7200 min Summer	0.171	0.171	13.5	601.7	O K
8640 min Summer	0.160	0.160	12.6	562.4	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	30.107	0.0	188.6	26
30 min Summer	18.857	0.0	253.7	41
60 min Summer	11.811	0.0	402.9	70
120 min Summer	7.397	0.0	520.0	126
180 min Summer	5.626	0.0	601.7	184
240 min Summer	4.633	0.0	666.4	242
360 min Summer	3.524	0.0	767.6	326
480 min Summer	2.902	0.0	847.0	388
600 min Summer	2.496	0.0	913.0	454
720 min Summer	2.207	0.0	969.8	520
960 min Summer	1.817	0.0	1063.7	660
1440 min Summer	1.380	0.0	1202.2	936
2160 min Summer	1.049	0.0	1486.3	1344
2880 min Summer	0.863	0.0	1627.4	1736
4320 min Summer	0.637	0.0	1773.6	2476
5760 min Summer	0.513	0.0	1986.7	3224
7200 min Summer	0.434	0.0	2093.9	3960
8640 min Summer	0.378	0.0	2179.7	4672

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	0.151	0.151	11.7	529.9	O K
15 min Winter	0.098	0.098	6.1	342.4	O K
30 min Winter	0.122	0.122	8.6	425.1	O K
60 min Winter	0.149	0.149	11.6	522.9	O K
120 min Winter	0.180	0.180	14.2	632.2	O K
180 min Winter	0.198	0.198	15.1	697.1	O K
240 min Winter	0.210	0.210	15.3	742.2	O K
360 min Winter	0.226	0.226	15.5	799.4	O K
480 min Winter	0.235	0.235	15.6	832.1	O K
600 min Winter	0.242	0.242	15.6	856.1	O K
720 min Winter	0.247	0.247	15.7	875.1	O K
960 min Winter	0.253	0.253	15.7	896.5	O K
1440 min Winter	0.255	0.255	15.7	902.4	O K
2160 min Winter	0.245	0.245	15.6	869.0	O K
2880 min Winter	0.231	0.231	15.5	817.0	O K
4320 min Winter	0.195	0.195	15.1	685.6	O K
5760 min Winter	0.172	0.172	13.6	604.6	O K
7200 min Winter	0.156	0.156	12.2	546.8	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.337	0.0	2241.9	5352
15 min Winter	30.107	0.0	219.4	26
30 min Winter	18.857	0.0	293.6	40
60 min Winter	11.811	0.0	458.9	68
120 min Winter	7.397	0.0	590.5	124
180 min Winter	5.626	0.0	682.2	180
240 min Winter	4.633	0.0	754.6	238
360 min Winter	3.524	0.0	867.8	348
480 min Winter	2.902	0.0	956.6	448
600 min Winter	2.496	0.0	1030.4	484
720 min Winter	2.207	0.0	1094.0	560
960 min Winter	1.817	0.0	1198.8	716
1440 min Winter	1.380	0.0	1353.3	1018
2160 min Winter	1.049	0.0	1670.6	1452
2880 min Winter	0.863	0.0	1829.9	1852
4320 min Winter	0.637	0.0	1997.2	2596
5760 min Winter	0.513	0.0	2229.4	3304
7200 min Winter	0.434	0.0	2350.5	4040

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Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
8640 min Winter	0.144	0.144	11.0	503.6	O K
10080 min Winter	0.135	0.135	10.1	470.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
8640 min Winter	0.378	0.0	2448.3	4760
10080 min Winter	0.337	0.0	2521.3	5456

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	1
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 5.480

Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)
0	4	1.827	4	8	1.827	8	12	1.827

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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)
0.000	3444.0	1.500	4708.0


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0178-1610-1200-1610
Design Head (m)	1.200
Design Flow (l/s)	16.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	178
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	16.1	Kick-Flo®	0.814	13.4
Flush-Flo™	0.370	16.1	Mean Flow over Head Range	-	13.8

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	6.3	1.200	16.1	3.000	24.9	7.000	37.5
0.200	15.1	1.400	17.3	3.500	26.8	7.500	38.7
0.300	16.0	1.600	18.5	4.000	28.6	8.000	40.0
0.400	16.1	1.800	19.5	4.500	30.3	8.500	41.2
0.500	15.9	2.000	20.5	5.000	31.8	9.000	42.3
0.600	15.5	2.200	21.5	5.500	33.3	9.500	43.4
0.800	13.7	2.400	22.4	6.000	34.8		
1.000	14.8	2.600	23.3	6.500	36.1		

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	0.257	0.257	15.7	912.2	O K
30 min Summer	0.302	0.302	16.0	1076.8	O K
60 min Summer	0.353	0.353	16.1	1264.8	O K
120 min Summer	0.409	0.409	16.1	1472.7	O K
180 min Summer	0.442	0.442	16.1	1599.2	O K
240 min Summer	0.465	0.465	16.1	1687.9	O K
360 min Summer	0.496	0.496	16.1	1805.7	O K
480 min Summer	0.515	0.515	16.1	1878.6	O K
600 min Summer	0.527	0.527	16.1	1924.8	O K
720 min Summer	0.534	0.534	16.1	1953.2	O K
960 min Summer	0.540	0.540	16.1	1974.7	O K
1440 min Summer	0.542	0.542	16.1	1983.4	O K
2160 min Summer	0.535	0.535	16.1	1955.4	O K
2880 min Summer	0.521	0.521	16.1	1900.0	O K
4320 min Summer	0.464	0.464	16.1	1683.1	O K
5760 min Summer	0.411	0.411	16.1	1482.4	O K
7200 min Summer	0.364	0.364	16.1	1305.0	O K
8640 min Summer	0.323	0.323	16.0	1152.2	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	90.095	0.0	725.1	26
30 min Summer	53.466	0.0	868.0	41
60 min Summer	31.728	0.0	1189.5	70
120 min Summer	18.829	0.0	1418.0	130
180 min Summer	13.876	0.0	1568.2	188
240 min Summer	11.174	0.0	1682.0	248
360 min Summer	8.234	0.0	1851.4	366
480 min Summer	6.631	0.0	1975.6	484
600 min Summer	5.605	0.0	2071.5	602
720 min Summer	4.887	0.0	2146.8	722
960 min Summer	3.933	0.0	2247.9	904
1440 min Summer	2.896	0.0	2284.1	1140
2160 min Summer	2.132	0.0	3052.9	1520
2880 min Summer	1.716	0.0	3261.4	1936
4320 min Summer	1.226	0.0	3441.8	2728
5760 min Summer	0.966	0.0	3770.6	3520
7200 min Summer	0.803	0.0	3910.1	4256
8640 min Summer	0.690	0.0	4019.4	5016

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
10080 min Summer	0.288	0.288	15.9	1023.0	O K
15 min Winter	0.288	0.288	15.9	1022.8	O K
30 min Winter	0.338	0.338	16.1	1208.0	O K
60 min Winter	0.395	0.395	16.1	1420.2	O K
120 min Winter	0.457	0.457	16.1	1656.4	O K
180 min Winter	0.495	0.495	16.1	1801.4	O K
240 min Winter	0.522	0.522	16.1	1904.3	O K
360 min Winter	0.558	0.558	16.1	2043.5	O K
480 min Winter	0.580	0.580	16.1	2132.7	O K
600 min Winter	0.596	0.596	16.1	2192.5	O K
720 min Winter	0.606	0.606	16.1	2232.7	O K
960 min Winter	0.616	0.616	16.1	2273.2	O K
1440 min Winter	0.615	0.615	16.1	2267.9	O K
2160 min Winter	0.600	0.600	16.1	2210.6	O K
2880 min Winter	0.577	0.577	16.1	2119.0	O K
4320 min Winter	0.494	0.494	16.1	1796.0	O K
5760 min Winter	0.414	0.414	16.1	1495.0	O K
7200 min Winter	0.345	0.345	16.1	1235.9	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	0.608	0.0	4095.5	5664
15 min Winter	90.095	0.0	818.4	26
30 min Winter	53.466	0.0	972.3	41
60 min Winter	31.728	0.0	1337.6	70
120 min Winter	18.829	0.0	1590.8	128
180 min Winter	13.876	0.0	1756.1	186
240 min Winter	11.174	0.0	1880.3	244
360 min Winter	8.234	0.0	2062.1	360
480 min Winter	6.631	0.0	2190.8	476
600 min Winter	5.605	0.0	2284.6	590
720 min Winter	4.887	0.0	2351.1	704
960 min Winter	3.933	0.0	2413.2	926
1440 min Winter	2.896	0.0	2339.4	1334
2160 min Winter	2.132	0.0	3416.5	1652
2880 min Winter	1.716	0.0	3645.3	2112
4320 min Winter	1.226	0.0	3832.7	2984
5760 min Winter	0.966	0.0	4226.8	3760
7200 min Winter	0.803	0.0	4385.0	4536

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
8640 min Winter	0.288	0.288	15.9	1024.3	O K
10080 min Winter	0.243	0.243	15.6	858.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
8640 min Winter	0.690	0.0	4510.1	5192
10080 min Winter	0.608	0.0	4600.6	5856

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 5.480

Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)	Time (mins) From:	Time (mins) To:	Area (ha)
0	4	1.827	4	8	1.827	8	12	1.827

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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)
0.000	3444.0	1.500	4708.0


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0178-1610-1200-1610
Design Head (m)	1.200
Design Flow (l/s)	16.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	178
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	16.1	Kick-Flo®	0.814	13.4
Flush-Flo™	0.370	16.1	Mean Flow over Head Range	-	13.8

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	6.3	1.200	16.1	3.000	24.9	7.000	37.5
0.200	15.1	1.400	17.3	3.500	26.8	7.500	38.7
0.300	16.0	1.600	18.5	4.000	28.6	8.000	40.0
0.400	16.1	1.800	19.5	4.500	30.3	8.500	41.2
0.500	15.9	2.000	20.5	5.000	31.8	9.000	42.3
0.600	15.5	2.200	21.5	5.500	33.3	9.500	43.4
0.800	13.7	2.400	22.4	6.000	34.8		
1.000	14.8	2.600	23.3	6.500	36.1		

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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
15 min Summer	0.522	0.522	16.1	1904.8	O K
30 min Summer	0.600	0.600	16.1	2211.0	O K
60 min Summer	0.688	0.688	16.1	2559.0	O K
120 min Summer	0.785	0.785	16.1	2948.2	O K
180 min Summer	0.844	0.844	16.1	3192.1	O K
240 min Summer	0.886	0.886	16.1	3368.1	O K
360 min Summer	0.945	0.945	16.1	3613.4	O K
480 min Summer	0.984	0.984	16.1	3779.6	O K
600 min Summer	1.012	1.012	16.1	3899.2	O K
720 min Summer	1.033	1.033	16.1	3988.0	O K
960 min Summer	1.059	1.059	16.1	4102.1	O K
1440 min Summer	1.080	1.080	16.1	4190.2	O K
2160 min Summer	1.071	1.071	16.1	4153.1	O K
2880 min Summer	1.053	1.053	16.1	4075.9	O K
4320 min Summer	0.979	0.979	16.1	3756.4	O K
5760 min Summer	0.911	0.911	16.1	3469.3	O K
7200 min Summer	0.845	0.845	16.1	3195.2	O K
8640 min Summer	0.774	0.774	16.1	2906.9	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	187.006	0.0	1349.3	27
30 min Summer	108.845	0.0	1360.9	42
60 min Summer	63.353	0.0	2341.0	72
120 min Summer	36.874	0.0	2582.6	130
180 min Summer	26.867	0.0	2592.8	190
240 min Summer	21.462	0.0	2553.9	250
360 min Summer	15.638	0.0	2489.0	368
480 min Summer	12.492	0.0	2441.2	488
600 min Summer	10.494	0.0	2404.0	608
720 min Summer	9.102	0.0	2373.4	726
960 min Summer	7.267	0.0	2324.2	966
1440 min Summer	5.290	0.0	2258.3	1442
2160 min Summer	3.852	0.0	4795.0	2056
2880 min Summer	3.075	0.0	4619.3	2372
4320 min Summer	2.173	0.0	4210.0	3120
5760 min Summer	1.698	0.0	6623.7	3928
7200 min Summer	1.402	0.0	6823.8	4768
8640 min Summer	1.200	0.0	6985.5	5536

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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
10080 min Summer	0.709	0.709	16.1	2640.9	O K
15 min Winter	0.581	0.581	16.1	2135.0	O K
30 min Winter	0.668	0.668	16.1	2479.3	O K
60 min Winter	0.766	0.766	16.1	2871.4	O K
120 min Winter	0.873	0.873	16.1	3311.7	O K
180 min Winter	0.939	0.939	16.1	3586.7	O K
240 min Winter	0.986	0.986	16.1	3786.1	O K
360 min Winter	1.051	1.051	16.1	4067.1	O K
480 min Winter	1.096	1.096	16.1	4260.2	O K
600 min Winter	1.128	1.128	16.1	4401.6	O K
720 min Winter	1.153	1.153	16.1	4508.6	O K
960 min Winter	1.185	1.185	16.1	4652.0	O K
1440 min Winter	1.215	1.215	16.2	4783.7	Flood Risk
2160 min Winter	1.217	1.217	16.2	4790.9	Flood Risk
2880 min Winter	1.195	1.195	16.1	4693.3	O K
4320 min Winter	1.103	1.103	16.1	4290.8	O K
5760 min Winter	1.016	1.016	16.1	3914.1	O K
7200 min Winter	0.928	0.928	16.1	3543.4	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
10080 min Summer	1.051	0.0	7105.7	6264
15 min Winter	187.006	0.0	1366.0	27
30 min Winter	108.845	0.0	1352.4	41
60 min Winter	63.353	0.0	2541.8	70
120 min Winter	36.874	0.0	2597.4	128
180 min Winter	26.867	0.0	2548.1	188
240 min Winter	21.462	0.0	2511.3	246
360 min Winter	15.638	0.0	2463.6	364
480 min Winter	12.492	0.0	2434.4	480
600 min Winter	10.494	0.0	2414.9	598
720 min Winter	9.102	0.0	2401.8	714
960 min Winter	7.267	0.0	2391.2	946
1440 min Winter	5.290	0.0	2385.0	1402
2160 min Winter	3.852	0.0	4867.9	2064
2880 min Winter	3.075	0.0	4723.3	2680
4320 min Winter	2.173	0.0	4394.5	3332
5760 min Winter	1.698	0.0	7410.9	4264
7200 min Winter	1.402	0.0	7624.3	5184

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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
8640 min Winter	0.838	0.838	16.1	3166.7	O K
10080 min Winter	0.735	0.735	16.1	2745.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
8640 min Winter	1.200	0.0	7786.0	6064
10080 min Winter	1.051	0.0	7911.3	6856

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 457650 224000 SP 57650 24000
C (1km)	-0.023
D1 (1km)	0.325
D2 (1km)	0.323
D3 (1km)	0.249
E (1km)	0.292
F (1km)	2.469
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 5.480

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From:	To:	From:	To:	From:	To:
0	4 1.827	4	8 1.827	8	12 1.827

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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)
0.000	3444.0	1.500	4708.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0178-1610-1200-1610
Design Head (m)	1.200
Design Flow (l/s)	16.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	178
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	16.1	Kick-Flo®	0.814	13.4
Flush-Flo™	0.370	16.1	Mean Flow over Head Range	-	13.8

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	6.3	1.200	16.1	3.000	24.9	7.000	37.5
0.200	15.1	1.400	17.3	3.500	26.8	7.500	38.7
0.300	16.0	1.600	18.5	4.000	28.6	8.000	40.0
0.400	16.1	1.800	19.5	4.500	30.3	8.500	41.2
0.500	15.9	2.000	20.5	5.000	31.8	9.000	42.3
0.600	15.5	2.200	21.5	5.500	33.3	9.500	43.4
0.800	13.7	2.400	22.4	6.000	34.8		
1.000	14.8	2.600	23.3	6.500	36.1		