

Project Title: Land at White Horse Business Park, North
Bradley, Trowbridge

Project No/ Document Reference: A201-R005

Date: 15 February 2024

Author: Emma Philpott

Planning Application 20 03641 OUT: Response to LLFA Consultation Response 3/10/23

1. Background

- 1.1. This Technical Note has been prepared by Abley Letchford Partnership Ltd (ALP), on behalf of Castlewood Properties Ventures Limited, in relation to the proposed development of their residential allocation site within North Bradley, Trowbridge.
- 1.2. The note addresses drainage consultation comments received from Wiltshire Council as Lead Local Flood Authority (LLFA) in their response dated 3rd October 2023.
- 1.3. The note has been prepared following a discussion with Megan Macpherson of Atkins Realis on behalf of the LLFA in December 2023, when the approach for addressing the comments was agreed.
- 1.4. The LLFA had 3 areas of concern and these are dealt with in turn below.

2. Hydraulic/Hydrological Assessment

- 2.1. The LLFA stated

It is noted that Watermans have carried out hydraulic modelling for the site to show more accurate surface water flood extents. However, given the prevalence of surface water flood risk around the existing ditches on the site, the applicant should carry out a wider hydraulic assessment to inform the following:

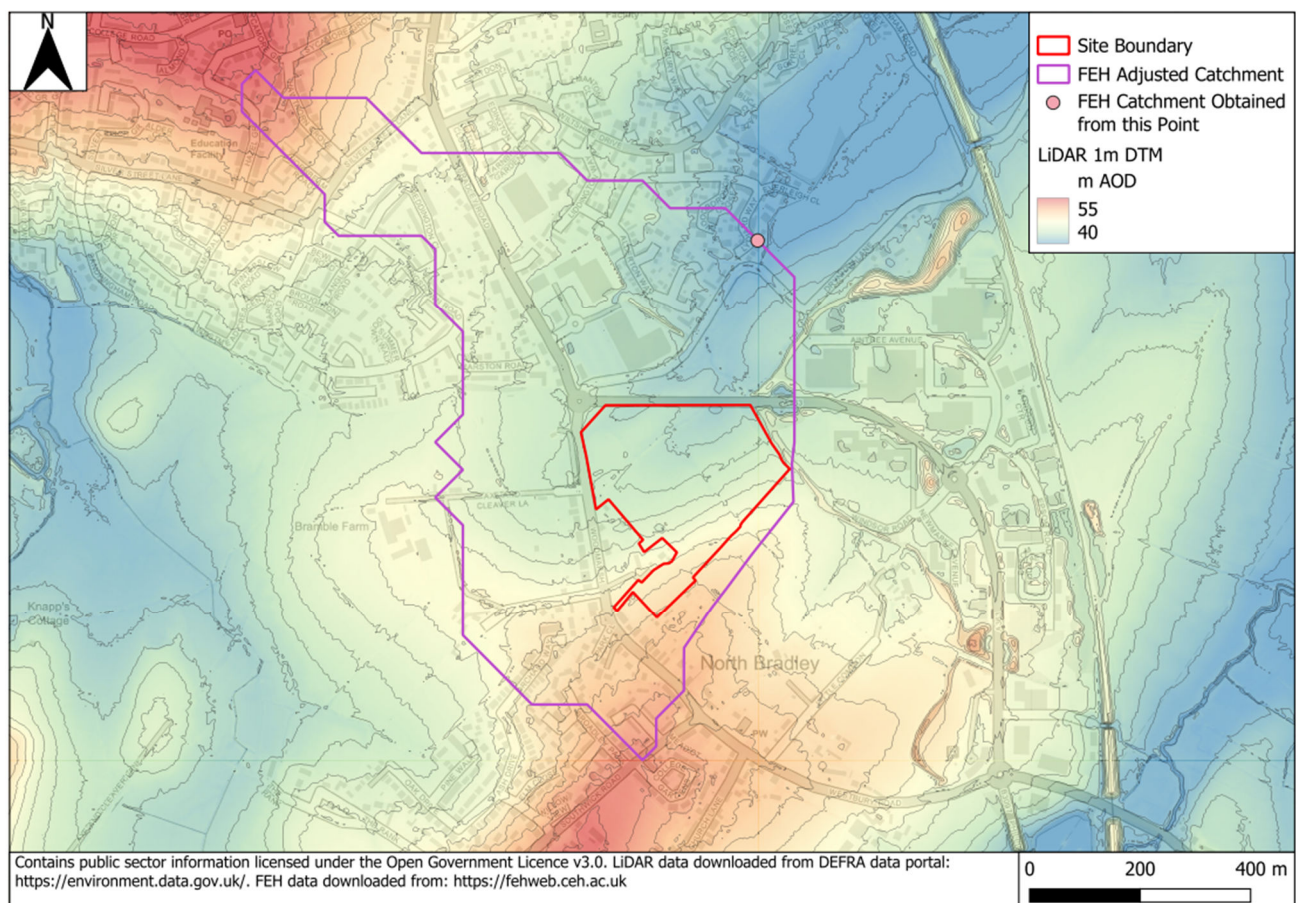
- *Whether the existing ditch and culvert have sufficient capacity to take existing flows and flows from the development*
- *How surface water flows from the development could affect flood extents*

- 2.2. In the discussion in December 2023 it was agreed that detailed modelling was not required but that an analysis of the hydrological catchment could be completed. If this confirmed that the development lies entirely within the natural catchment for the watercourse then this would demonstrate that the drainage strategy for the proposed development would not result in an increase to the catchment and,

therefore, that development flows (once attenuated) would not constitute any increase to the natural flows within the watercourse.

- 2.3. The FEH catchment to the nearest location has been assessed. This is a point approximately 400m north of the site but it does clearly define the catchment in the vicinity of the site.
- 2.4. This catchment boundary has been reviewed against LiDAR data for the area and the boundary has been slightly modified to represent the local topography more accurately.
- 2.5. Figure 1 shows the adjusted FEH boundary and the site boundary.

Figure 1: Hydrological Catchment and Site Boundary



- 2.6. From Figure 1 it is clear that the site lies entirely within the natural hydrological catchment for the watercourse that runs through the site. Therefore the proposed development including the proposed drainage strategy will not increase the flows entering the watercourse.

3. Modelled Flood Levels and Proposed Development

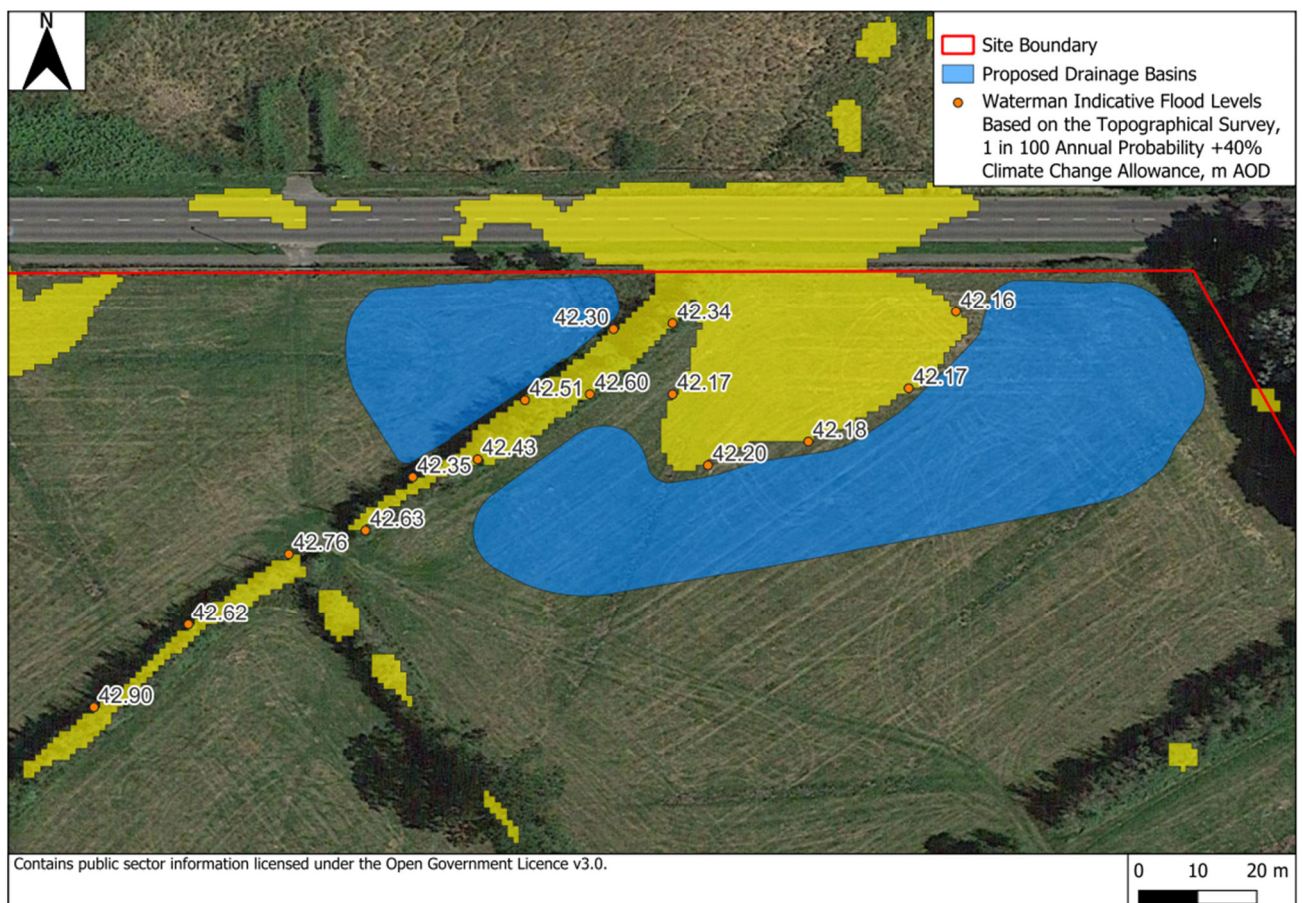
3.1. The LLFA stated

The applicant should also determine modelled flood levels for the site to demonstrate the following:

- Any crossings over existing ditches can be set above the 1 in 100 year + climate change flood level.
- Any access roads that are predicted to flood can be set above the 1 in 100 year + climate change flood level.
- There is no possibility of surface water flows entering the attenuation basins.

3.2. The modelled flood extent for the 1 in 100 year +40% climate change scenario is shown in Figure 2.

Figure 2: Model Flood Levels



3.3. The flood levels shown in Figure 2 have been estimated from the LiDAR data and/or detailed topographical data at the edge of the floodplain.



- 3.4. From a review of these levels, there is some variation across the area near the SuDS basins and the highest level has been assumed for the purposes of checking the levels of the crossing, access roads and basins. The highest flood level is 42.60mAOD in the vicinity of the basins and 42.76mAOD near the crossing and access road.
- 3.5. Proposed levels for the access road vary from approximately 42.8mOD at the A363 Bradley Road up to 44.20mAOD on the access road in front of the first dwelling. The access road is therefore above the estimated flood level for the 1 in 100 year with climate change scenario.
- 3.6. The level of the road at the crossing is likely to be approximately 43.5mAOD, allowing for the proposed crossing of the watercourse to be set above the estimated flood level for the 1 in 100 year with climate change scenario.
- 3.7. The SuDS basins have been designed with a base level of 42.146mAOD and top of bank level of 43.1mAOD. There is, therefore, no flow route for floodwater into the basins in the 1 in 100 year with climate change scenario.

4. Allowable Discharge rate from Attenuation Basins

- 4.1. The LLFA stated

The applicant states that discharge rates from the site will provide 20% betterment on Qbar. This does not satisfy Wiltshire Council's betterment policy. The applicant should provide calculations that demonstrate that the required betterment against greenfield rates has been achieved for all storm events between the 1 in 1 year and 1 in 100 year return period storm events.

- 4.2. The basin design has been updated to use a discharge rate of the 1 in 1 year greenfield rate (5.1 l/s) reduced by 20% (to give 4.1 l/s). With this reduced rate of 4.1 l/s being applied to all storm events, the basins have been confirmed to be adequately sized to accommodate the 1 in 100 year event with climate change event maintaining freeboard of more than 250mm in that event and with freeboard of more than 300mm in all other events.
- 4.3. Calculations showing the basin design are provided in Appendix 1.

5. Conclusion

- 5.1. In conclusion, we believe that the 3 key points have now been adequately addressed.



APPENDIX 1

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.101	0.055	1.4	108.2	O K
30 min Summer	99.116	0.070	2.1	138.7	O K
60 min Summer	99.132	0.086	2.8	170.7	O K
120 min Summer	99.160	0.114	3.8	226.7	O K
180 min Summer	99.176	0.130	4.0	259.3	O K
240 min Summer	99.187	0.141	4.0	281.5	O K
360 min Summer	99.200	0.154	4.1	308.6	O K
480 min Summer	99.207	0.161	4.1	322.4	O K
600 min Summer	99.210	0.164	4.1	329.5	O K
720 min Summer	99.213	0.167	4.1	334.2	O K
960 min Summer	99.215	0.169	4.1	339.2	O K
1440 min Summer	99.216	0.170	4.1	340.8	O K
2160 min Summer	99.214	0.168	4.1	336.3	O K
2880 min Summer	99.210	0.164	4.1	328.9	O K
4320 min Summer	99.202	0.156	4.1	312.0	O K
5760 min Summer	99.194	0.148	4.0	295.7	O K
7200 min Summer	99.187	0.141	4.0	281.8	O K
8640 min Summer	99.181	0.135	4.0	270.0	O K
10080 min Summer	99.176	0.130	4.0	259.9	O K
15 min Winter	99.101	0.055	1.4	108.2	O K
30 min Winter	99.116	0.070	2.1	138.7	O K
60 min Winter	99.132	0.086	2.8	170.9	O K
120 min Winter	99.160	0.114	3.8	227.2	O K
180 min Winter	99.176	0.130	4.0	260.0	O K
240 min Winter	99.187	0.141	4.0	282.3	O K
360 min Winter	99.200	0.154	4.1	309.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	34.327	0.0	60.3	23
30 min Summer	22.161	0.0	85.1	37
60 min Summer	13.838	0.0	140.1	66
120 min Summer	9.461	0.0	200.5	126
180 min Summer	7.397	0.0	239.2	184
240 min Summer	6.153	0.0	267.5	244
360 min Summer	4.684	0.0	307.5	362
480 min Summer	3.820	0.0	334.9	480
600 min Summer	3.247	0.0	355.4	562
720 min Summer	2.835	0.0	371.5	614
960 min Summer	2.280	0.0	395.4	740
1440 min Summer	1.670	0.0	423.8	1000
2160 min Summer	1.228	0.0	530.0	1408
2880 min Summer	0.995	0.0	570.2	1820
4320 min Summer	0.751	0.0	634.0	2600
5760 min Summer	0.623	0.0	742.2	3400
7200 min Summer	0.544	0.0	808.5	4112
8640 min Summer	0.490	0.0	870.3	4848
10080 min Summer	0.451	0.0	925.4	5640
15 min Winter	34.327	0.0	60.3	23
30 min Winter	22.161	0.0	85.1	37
60 min Winter	13.838	0.0	140.1	66
120 min Winter	9.461	0.0	200.5	122
180 min Winter	7.397	0.0	239.2	180
240 min Winter	6.153	0.0	267.5	238
360 min Winter	4.684	0.0	307.5	352

Summary of Results for 2 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
480 min Winter	99.207	0.161	4.1	323.6	O K
600 min Winter	99.211	0.165	4.1	330.8	O K
720 min Winter	99.212	0.166	4.1	334.0	O K
960 min Winter	99.213	0.167	4.1	336.2	O K
1440 min Winter	99.212	0.166	4.1	332.6	O K
2160 min Winter	99.205	0.159	4.1	319.0	O K
2880 min Winter	99.197	0.151	4.0	302.8	O K
4320 min Winter	99.182	0.136	4.0	272.1	O K
5760 min Winter	99.169	0.123	3.9	246.6	O K
7200 min Winter	99.161	0.115	3.8	229.0	O K
8640 min Winter	99.155	0.109	3.6	216.3	O K
10080 min Winter	99.149	0.103	3.5	206.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	3.820	0.0	334.9	464
600 min Winter	3.247	0.0	355.5	572
720 min Winter	2.835	0.0	371.8	672
960 min Winter	2.280	0.0	395.8	760
1440 min Winter	1.670	0.0	424.8	1066
2160 min Winter	1.228	0.0	530.2	1512
2880 min Winter	0.995	0.0	570.6	1936
4320 min Winter	0.751	0.0	635.0	2728
5760 min Winter	0.623	0.0	742.3	3464
7200 min Winter	0.544	0.0	808.7	4184
8640 min Winter	0.490	0.0	870.7	4928
10080 min Winter	0.451	0.0	926.5	5656

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 385742 155746 ST 85742 55746	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.270

Time (mins)	Area	Time (mins)	Area
From:	To: (ha)	From:	To: (ha)
0	4 0.635	4	8 0.635

Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 99.046

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1967.4	0.400	2160.6	0.800	2362.9
0.200	2062.9	0.600	2260.6	0.954	2443.2

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0101-4100-0654-4100
Design Head (m)	0.654
Design Flow (l/s)	4.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	101
Invert Level (m)	99.046
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.654	4.1	Kick-Flo®	0.450	3.5
Flush-Flo™	0.199	4.1	Mean Flow over Head Range	-	3.5

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)	Depth (m)	Flow (l/s)
0.100	3.4	0.800	4.5	2.000	6.9	4.000	9.6	7.000	12.5
0.200	4.1	1.000	5.0	2.200	7.2	4.500	10.1	7.500	12.9
0.300	4.0	1.200	5.4	2.400	7.5	5.000	10.6	8.000	13.3
0.400	3.8	1.400	5.8	2.600	7.8	5.500	11.1	8.500	13.7
0.500	3.6	1.600	6.2	3.000	8.3	6.000	11.6	9.000	14.1
0.600	3.9	1.800	6.6	3.500	9.0	6.500	12.0	9.500	14.5

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.171	0.125	4.0	249.0	O K
30 min Summer	99.208	0.162	4.1	325.0	O K
60 min Summer	99.247	0.201	4.1	405.8	O K
120 min Summer	99.287	0.241	4.1	488.8	O K
180 min Summer	99.312	0.266	4.1	541.0	O K
240 min Summer	99.330	0.284	4.1	578.1	O K
360 min Summer	99.353	0.307	4.1	626.9	O K
480 min Summer	99.367	0.321	4.1	656.7	O K
600 min Summer	99.376	0.330	4.1	675.2	O K
720 min Summer	99.381	0.335	4.1	686.6	O K
960 min Summer	99.385	0.339	4.1	695.3	O K
1440 min Summer	99.380	0.334	4.1	683.3	O K
2160 min Summer	99.367	0.321	4.1	656.8	O K
2880 min Summer	99.355	0.309	4.1	630.9	O K
4320 min Summer	99.332	0.286	4.1	581.6	O K
5760 min Summer	99.311	0.265	4.1	537.4	O K
7200 min Summer	99.293	0.247	4.1	501.0	O K
8640 min Summer	99.278	0.232	4.1	469.9	O K
10080 min Summer	99.265	0.219	4.1	443.1	O K
15 min Winter	99.171	0.125	4.0	249.0	O K
30 min Winter	99.208	0.162	4.1	325.1	O K
60 min Winter	99.247	0.201	4.1	405.9	O K
120 min Winter	99.287	0.241	4.1	488.7	O K
180 min Winter	99.312	0.266	4.1	540.8	O K
240 min Winter	99.330	0.284	4.1	577.8	O K
360 min Winter	99.353	0.307	4.1	626.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	79.260	0.0	176.4	23
30 min Summer	51.956	0.0	236.8	37
60 min Summer	32.705	0.0	363.8	68
120 min Summer	19.976	0.0	445.4	126
180 min Summer	14.936	0.0	497.2	186
240 min Summer	12.120	0.0	534.0	246
360 min Summer	8.975	0.0	581.8	364
480 min Summer	7.216	0.0	608.8	484
600 min Summer	6.073	0.0	622.7	604
720 min Summer	5.265	0.0	627.3	722
960 min Summer	4.186	0.0	619.3	962
1440 min Summer	3.003	0.0	583.5	1288
2160 min Summer	2.142	0.0	925.1	1624
2880 min Summer	1.688	0.0	961.8	2020
4320 min Summer	1.214	0.0	995.8	2812
5760 min Summer	0.969	0.0	1161.3	3632
7200 min Summer	0.821	0.0	1228.3	4400
8640 min Summer	0.722	0.0	1290.9	5192
10080 min Summer	0.651	0.0	1345.9	5952
15 min Winter	79.260	0.0	176.4	23
30 min Winter	51.956	0.0	236.8	37
60 min Winter	32.705	0.0	363.8	66
120 min Winter	19.976	0.0	445.4	124
180 min Winter	14.936	0.0	497.3	182
240 min Winter	12.120	0.0	534.3	242
360 min Winter	8.975	0.0	582.3	358

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
480 min Winter	99.367	0.321	4.1	656.0	O K
600 min Winter	99.376	0.330	4.1	674.5	O K
720 min Winter	99.381	0.335	4.1	685.9	O K
960 min Winter	99.385	0.339	4.1	694.9	O K
1440 min Winter	99.379	0.333	4.1	682.6	O K
2160 min Winter	99.362	0.316	4.1	645.7	O K
2880 min Winter	99.345	0.299	4.1	610.5	O K
4320 min Winter	99.311	0.265	4.1	538.9	O K
5760 min Winter	99.280	0.234	4.1	473.3	O K
7200 min Winter	99.254	0.208	4.1	418.9	O K
8640 min Winter	99.231	0.185	4.1	373.1	O K
10080 min Winter	99.213	0.167	4.1	335.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	7.216	0.0	609.8	476
600 min Winter	6.073	0.0	624.2	590
720 min Winter	5.265	0.0	629.6	706
960 min Winter	4.186	0.0	623.4	932
1440 min Winter	3.003	0.0	590.2	1358
2160 min Winter	2.142	0.0	926.1	1688
2880 min Winter	1.688	0.0	963.9	2136
4320 min Winter	1.214	0.0	1003.9	3024
5760 min Winter	0.969	0.0	1161.7	3856
7200 min Winter	0.821	0.0	1229.0	4616
8640 min Winter	0.722	0.0	1291.9	5368
10080 min Winter	0.651	0.0	1347.9	6144

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 385742 155746 ST 85742 55746	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.270

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	0.635	4 8	0.635

Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 99.046

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1967.4	0.400	2160.6	0.800	2362.9
0.200	2062.9	0.600	2260.6	0.954	2443.2

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0101-4100-0654-4100
Design Head (m)	0.654
Design Flow (l/s)	4.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	101
Invert Level (m)	99.046
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.654	4.1	Kick-Flo®	0.450	3.5
Flush-Flo™	0.199	4.1	Mean Flow over Head Range	-	3.5

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)	Depth (m)	Flow (l/s)
0.100	3.4	0.800	4.5	2.000	6.9	4.000	9.6	7.000	12.5
0.200	4.1	1.000	5.0	2.200	7.2	4.500	10.1	7.500	12.9
0.300	4.0	1.200	5.4	2.400	7.5	5.000	10.6	8.000	13.3
0.400	3.8	1.400	5.8	2.600	7.8	5.500	11.1	8.500	13.7
0.500	3.6	1.600	6.2	3.000	8.3	6.000	11.6	9.000	14.1
0.600	3.9	1.800	6.6	3.500	9.0	6.500	12.0	9.500	14.5

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.276	0.230	4.1	465.8	O K
30 min Summer	99.349	0.303	4.1	618.8	O K
60 min Summer	99.425	0.379	4.1	780.6	O K
120 min Summer	99.497	0.451	4.1	936.5	O K
180 min Summer	99.545	0.499	4.1	1040.7	O K
240 min Summer	99.580	0.534	4.1	1119.5	O K
360 min Summer	99.632	0.586	4.1	1234.8	O K
480 min Summer	99.667	0.621	4.1	1315.2	O K
600 min Summer	99.692	0.646	4.1	1372.1	O K
720 min Summer	99.710	0.664	4.1	1413.2	Flood Risk
960 min Summer	99.732	0.686	4.2	1463.1	Flood Risk
1440 min Summer	99.745	0.699	4.2	1492.6	Flood Risk
2160 min Summer	99.729	0.683	4.2	1457.2	Flood Risk
2880 min Summer	99.703	0.657	4.1	1396.3	Flood Risk
4320 min Summer	99.655	0.609	4.1	1288.2	O K
5760 min Summer	99.617	0.571	4.1	1202.2	O K
7200 min Summer	99.589	0.543	4.1	1138.3	O K
8640 min Summer	99.565	0.519	4.1	1085.3	O K
10080 min Summer	99.545	0.499	4.1	1041.2	O K
15 min Winter	99.276	0.230	4.1	465.8	O K
30 min Winter	99.349	0.303	4.1	618.7	O K
60 min Winter	99.425	0.379	4.1	780.4	O K
120 min Winter	99.497	0.451	4.1	936.3	O K
180 min Winter	99.544	0.498	4.1	1040.5	O K
240 min Winter	99.580	0.534	4.1	1119.3	O K
360 min Winter	99.632	0.586	4.1	1234.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	147.775	0.0	321.9	23
30 min Summer	98.350	0.0	347.6	38
60 min Summer	62.306	0.0	654.3	68
120 min Summer	37.667	0.0	669.7	128
180 min Summer	28.108	0.0	649.0	188
240 min Summer	22.841	0.0	636.4	246
360 min Summer	17.035	0.0	624.1	366
480 min Summer	13.795	0.0	620.1	486
600 min Summer	11.669	0.0	620.2	606
720 min Summer	10.150	0.0	623.0	726
960 min Summer	8.091	0.0	627.7	964
1440 min Summer	5.800	0.0	619.9	1442
2160 min Summer	4.089	0.0	1235.0	2160
2880 min Summer	3.176	0.0	1193.5	2624
4320 min Summer	2.215	0.0	1106.6	3328
5760 min Summer	1.721	0.0	2046.4	4088
7200 min Summer	1.428	0.0	2098.4	4904
8640 min Summer	1.233	0.0	2112.0	5712
10080 min Summer	1.096	0.0	2031.3	6560
15 min Winter	147.775	0.0	321.9	23
30 min Winter	98.350	0.0	347.6	37
60 min Winter	62.306	0.0	654.4	66
120 min Winter	37.667	0.0	670.2	126
180 min Winter	28.108	0.0	649.7	184
240 min Winter	22.841	0.0	637.2	244
360 min Winter	17.035	0.0	624.9	362

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
480 min Winter	99.667	0.621	4.1	1315.6	O K
600 min Winter	99.692	0.646	4.1	1372.9	O K
720 min Winter	99.711	0.665	4.1	1414.5	Flood Risk
960 min Winter	99.733	0.687	4.2	1465.3	Flood Risk
1440 min Winter	99.747	0.701	4.2	1497.2	Flood Risk
2160 min Winter	99.733	0.687	4.2	1466.2	Flood Risk
2880 min Winter	99.707	0.661	4.1	1407.0	Flood Risk
4320 min Winter	99.651	0.605	4.1	1279.8	O K
5760 min Winter	99.605	0.559	4.1	1176.1	O K
7200 min Winter	99.567	0.521	4.1	1089.5	O K
8640 min Winter	99.531	0.485	4.1	1011.1	O K
10080 min Winter	99.497	0.451	4.1	935.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
480 min Winter	13.795	0.0	620.8	480
600 min Winter	11.669	0.0	620.7	596
720 min Winter	10.150	0.0	623.4	714
960 min Winter	8.091	0.0	628.0	946
1440 min Winter	5.800	0.0	620.1	1410
2160 min Winter	4.089	0.0	1235.8	2080
2880 min Winter	3.176	0.0	1195.5	2716
4320 min Winter	2.215	0.0	1113.3	3412
5760 min Winter	1.721	0.0	2047.9	4320
7200 min Winter	1.428	0.0	2103.6	5256
8640 min Winter	1.233	0.0	2133.9	6144
10080 min Winter	1.096	0.0	2106.2	7064

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
FEH Rainfall Version	2013	Cv (Winter)	1.000
Site Location	GB 385742 155746 ST 85742 55746	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+45

Time Area Diagram

Total Area (ha) 1.270

Time (mins)	Area	Time (mins)	Area
From:	To: (ha)	From:	To: (ha)
0	4 0.635	4	8 0.635

Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 99.046

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1967.4	0.400	2160.6	0.800	2362.9
0.200	2062.9	0.600	2260.6	0.954	2443.2

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0101-4100-0654-4100
Design Head (m)	0.654
Design Flow (l/s)	4.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	101
Invert Level (m)	99.046
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.654	4.1	Kick-Flo®	0.450	3.5
Flush-Flo™	0.199	4.1	Mean Flow over Head Range	-	3.5

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)	Depth (m)	Flow (l/s)
0.100	3.4	0.800	4.5	2.000	6.9	4.000	9.6	7.000	12.5
0.200	4.1	1.000	5.0	2.200	7.2	4.500	10.1	7.500	12.9
0.300	4.0	1.200	5.4	2.400	7.5	5.000	10.6	8.000	13.3
0.400	3.8	1.400	5.8	2.600	7.8	5.500	11.1	8.500	13.7
0.500	3.6	1.600	6.2	3.000	8.3	6.000	11.6	9.000	14.1
0.600	3.9	1.800	6.6	3.500	9.0	6.500	12.0	9.500	14.5