Foul Drainage Report

For

Mr Andrew Morgan

Poultry Buildings Marlbrook Hall,

Leinthall Starkes

Client:

S R Morgan and Sons
Marlbook Hall
Leinthall Starkes
Ludlow
Shropshire
SY8 2HR

8th May 2021

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1 Introduction

William Stokes Consulting have been engaged by Mr A Morgan, to assess the surface and dirty water drainage associated with a new poultry houses and yard area at Marlbrook Hall, in support of a planning application for the new poultry houses.

2 The Site

2.1 The Location

The site is located approx. 1300m north of Leinthall Starkes village. The Grid Reference for the site is: SO438710

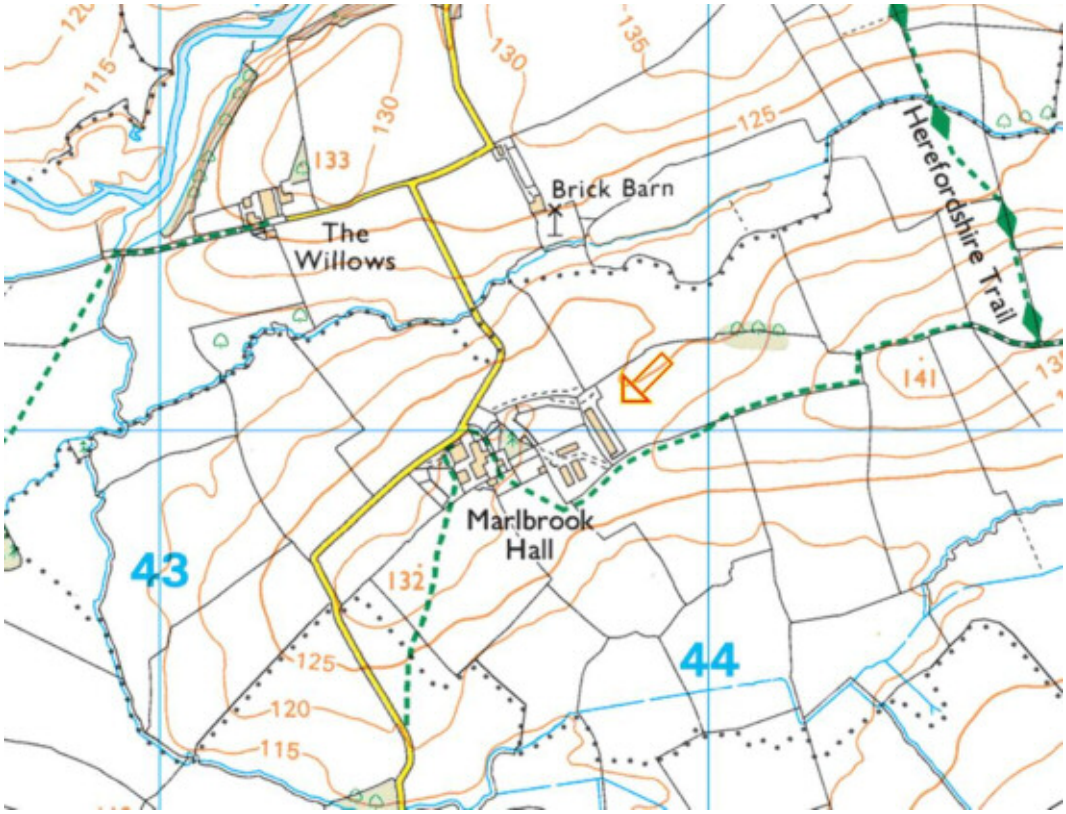


Figure 1 - Site Location

2.2 The Topography

The natural topography of the site falls gently from south west to north east. There is a ditch to the immediate north of the site which flows generally northwards, before entering the River Teme approx. 1 km to the north west. The level of the site is approximately 126m AOD.

2.3 The Soil Strata

The following data from the Soilscapes website (www.landis.org.uk/soilscapes) shows the underlying soil type for the site is a "Freely drainage slightly acid loamy soils", although the surrounding soils in all directions are clay based with impeded drainage.

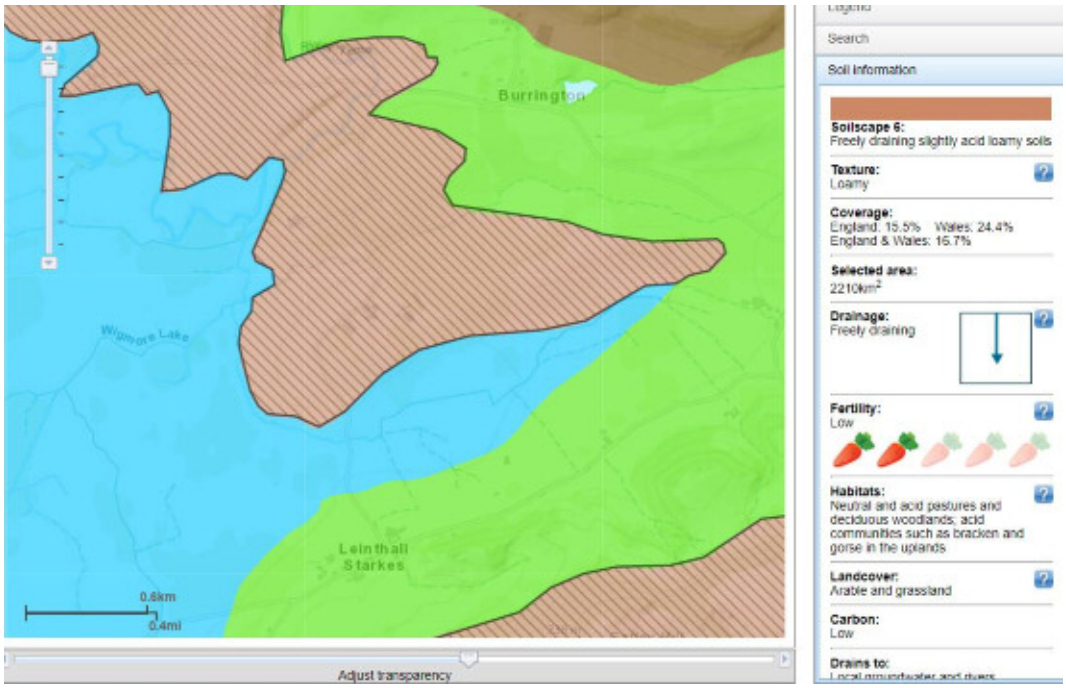


Figure 2 - Soilscapes screenshot

2.4 Environment Agency Flood Mapping

Information from the gov.uk flood mapping website (flood-map-for-planning.service.gov.uk) shows that the site is in 'Flood Zone 1', and so at a low risk of flooding.

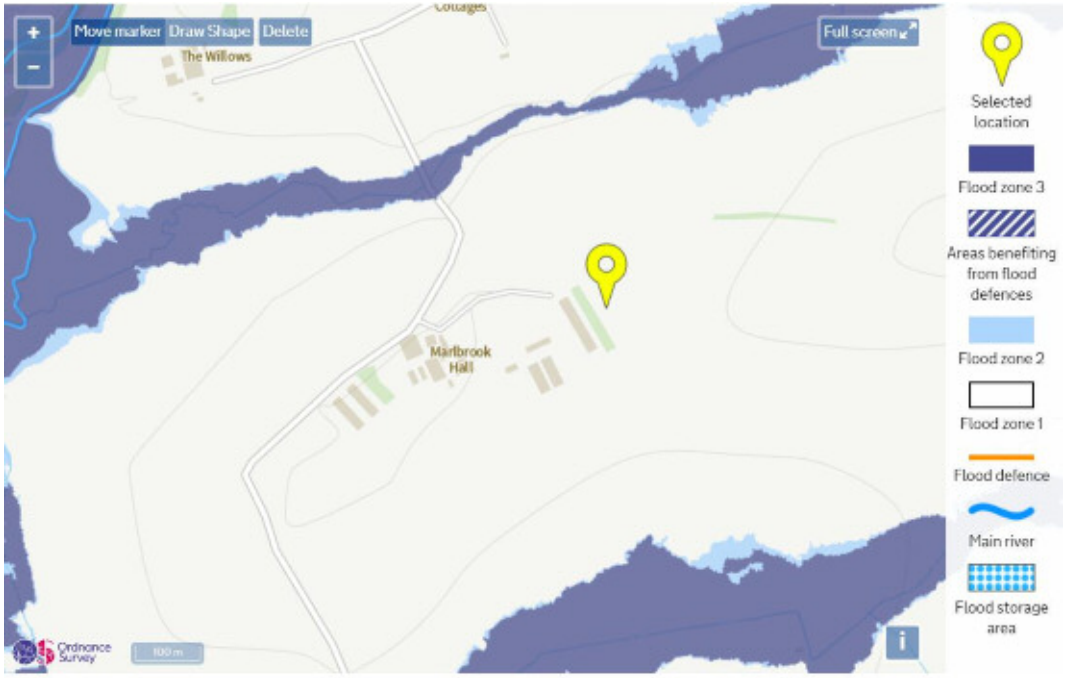


Figure 3 - Flood Risk

On further investigation, the Environment Agency moddelling shows the site is at low risk of surface flooding, as per the image below.

Figure 4 - Surface Water Flood Risk

3 Surface Drainage

3.1 Existing Drainage Installation

The existing site comprises of a grass pasture field. There is a shallow ditch to the north of the field, and the field topography is such that ay surface water migrates northwards.

3.2 Proposed Surface Water Drainage Installation

The primary route for clean surface water disposal (in accordance with the Herefordshire Council SuDS Handbook) is via infiltration into the ground. Contrary to section 2.3 above, the applicant's knowledge of ground conditions on his farm noted that the ground in the field was anticipated within the existing subsoil to contain a high level of clay and would offer very poor levels of infiltration.

On the 30th April 2021, a JCB 3CX was taken to site to undertake infiltration tests, and to confirm the subsoil present. As per the trial hole log (see Appendix A) and photo below, beyond an approximately 300mm layer of topsoil, clean red/brown clay was encountered with few stones all the way to 2.5m below ground level.

Figure 5 - GWLA

Two Infiltration Test holes were excavated, but as per the test results in Appendix A, offered negligible infiltration test results. Test Pit 1 dropped only 20mm in just over 8 hours, and Test Pit 2 dropped 125mm in 8 hours.

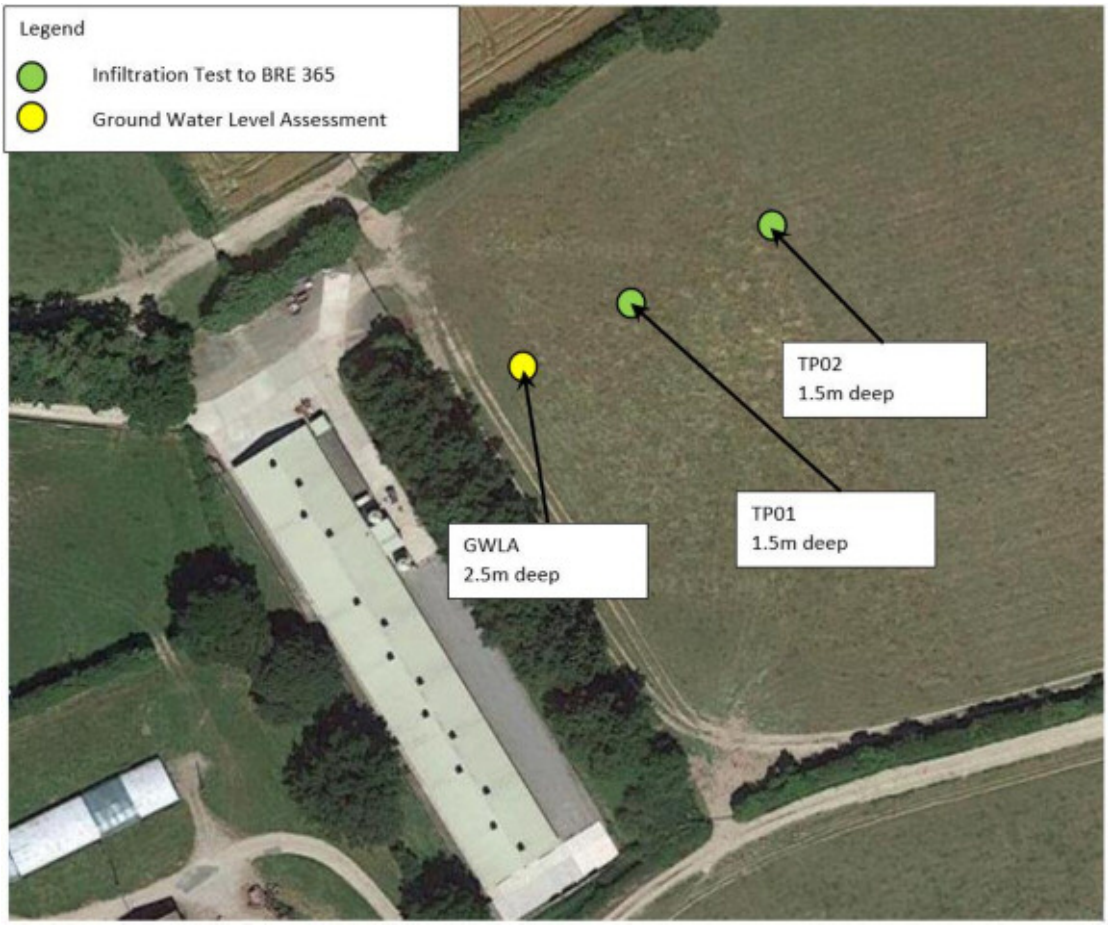


Figure 6 - Trial Pit Locations

These results, together with anecdotal information from the applicant effectively rules out infiltration as a method of disposal.

Figure 7 - Trial Pit 1

Figure 8 - Trial Pit 2

With the ditch to the north of the site, the means of surface water disposal is therefore chosen to be attenuated discharge.

Using FEH 2013 rainfall date for the site (Obtained from the FEH Web Service – Appendix B) input into the REFH Revitalised Flood Hydrograph modelling software (produced by Wallingford Hydro Solutions) the storm levels for a 1 in 100 year + 40% Climate Change 6 hr greenfield storm flow have been calculated (Appendix B). This generates a peak flow of 0.00556m3/s (5.56 l/s).

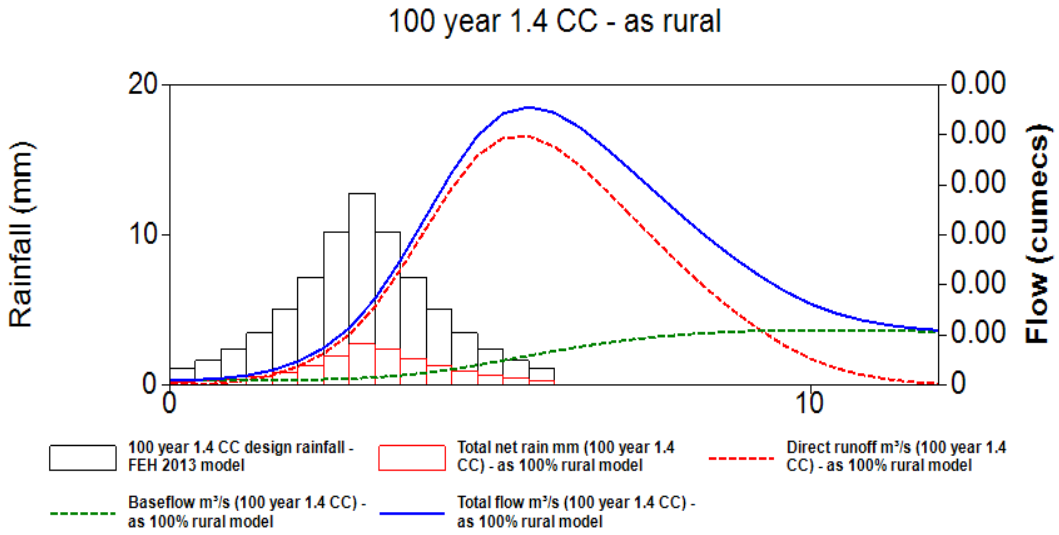


Figure 9 - Greenfield Hydrograph

The post development discharge will therefore be planned to be limited to 5.56 l/s.

Proposed Drainage Design

The REFH Revitalised Flood Hydrograph modelling software was then repeated for an urbanised model assuming 100% impervious surface for 5070m2. (Appendix D)

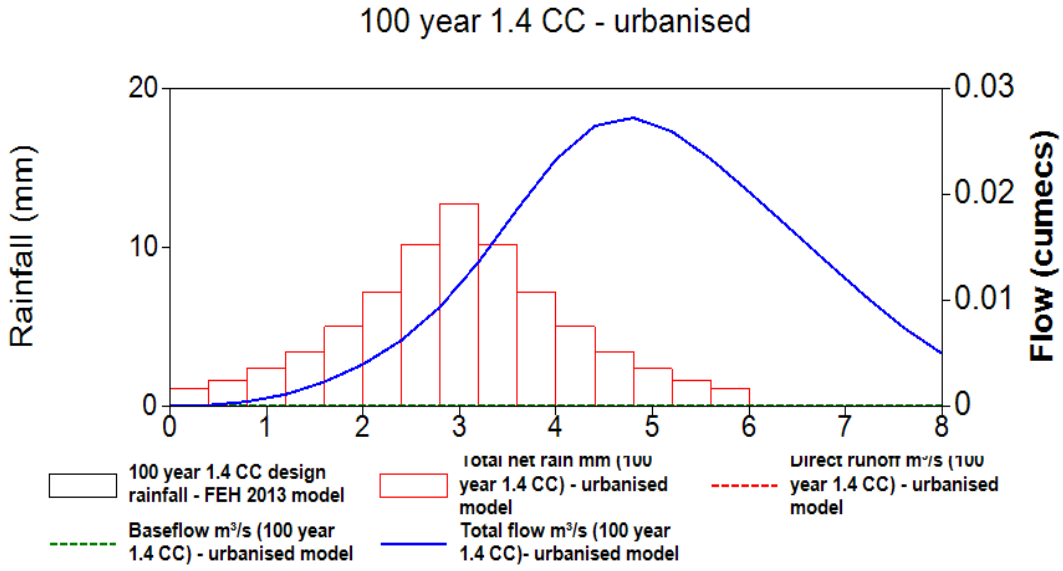
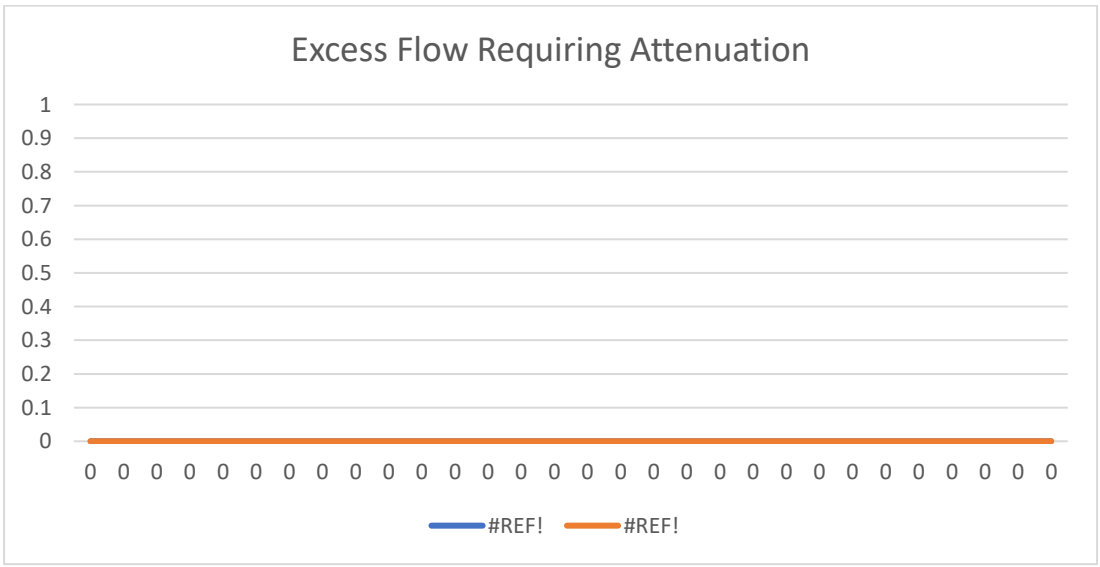


Figure 10 - Post Development Hydrograph

This generates a peak flow of 0.0272m3/s (27.2 l/s). It is therefore proposed to attenuate the flow to no greater than 5.56 l/s using a Hydrobrake® with the excess flow being held in a shallow attenuation pond.



Details of the drainage design is shown on drawing EMo/02/30 (Appendix C), and consists of drainage from

- Six lateral drains picking up roof drainage.
- two yard gullies (fed by surface level drainage channels)

Attenuation Pond

The peak level of storage required has been calculated at 237.84m3 after 7 hrs 36m. With 5.56 l/s (20 m3/hr) leaving the attenuation pond, it will have drained by 50% after 14 hrs 24m (Appendix E).

The proposed attenuation pond is 225m2 (at the base) x 1.0m deep. At ground level the attenuation pond would be 289m2. As per the detail on drawing EMo/02/31 it is proposed that the base of the pond is constructed level, approximately 1000mm below existing ground level. The design attenuation storage volume would be approximately at ground level. It is proposed to use some of the excavated material to create a surrounding bund of the excavated material to a level 500mm above existing ground level. Accounting for the sloping side of the pond, the overall volume would be 412m3, over 70% greater than the design volume.

It is proposed that the pond be seeded with grass, which is periodically mown. This will have the dual effect of reducing erosion as well as further reducing flowrates as the run-off drains through the pond.

It is proposed that a small concrete spillway be constructed in the south corner of the pond. This would be the overflow should the pond overfill and is constructed such that the bund around the pond is not eroded / at risk of collapse if the pond overfills.

Adjacent ditch

This has been allowed to fill with sediment over recent years, and so will be cleaned out as part of the proposed works – so ensuring free flow for the attenuated flow from the site.

4 Dirty Water Drainage

4.1 Existing dirty water installation

The current poultry site uses the existing methodology of capturing dirty water in a sealed underground tank, and then spreading it to land when the ground conditions permit.

4.2 Proposed Dirty Water Drainage Installation

It is proposed that outdoor yard area be drained to a new dirty water tank of 40m^3 (See Appendix F). Because the yard area are only occasionally trafficked, when the poultry houses are being cleaned between flocks, the majority of the time these can be considered to be clean for the purposes of rainwater disposal.

As a result, it is proposed to use manual diverter sluice valves (as per the applicant's existing poultry site) to direct the dirty water to the dirty water tank. If the yard gets dirty during operational activities, it is proposed to mechanically sweep it up. Once the operations have been completed, and the yard area has been cleaned down, the diverter valves can be reconfigured to allow clean water flows to drain to the attenuation pond. This method of controlling clean and dirty flows is common on a number of poultry throughout the UK, and previously accepted by Herefordshire Council.

It is recognised that there is a risk of human error with the use of manual valves, and so it is proposed to add an additional emergency sluice valve on the outlet pipe from the attenuation pond. Should dirty water be accidentally directed towards the attenuation pond, this can be isolated and removed through use of a vacuum tanker.

The contents of the dirty water tank will be spread to land, as per the existing operations for the wash water from the applicant's existing poultry site.

Appendix A

– Ground Water Level Assessment Log

– Test Pit Logs

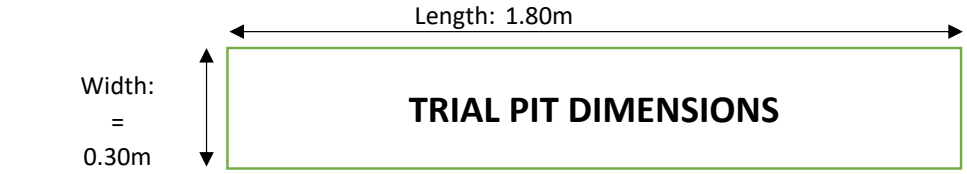
William Stokes Consulting

TRIAL PIT LOG

Trial Hole No. 1

Project:	Client:	Logged by:
Marlbrook Hall	Andrew Morgan	BS
Job No: EMo/02	Date: 30th April 2021	Ground Lvl (m): 126 AOD
		Checked By:

SAMPLES & TESTS			Water	STRATA			
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION
						(0.30) 0.30	TOPSOIL: Brown with Organic Matter
						(2.20)	Brown CLAY - damp with some small stones
Water Resting Level (2.0m)			>				
	Water Struck		>			2.50	
							End of hole at 2.5m bgl



Ground Water			General Remarks	Final Depth
Strike Depth	Rising To	Remarks		**2.5m bgl**
2.5m	**2.0m**			
Contractor: William Stokes Consulting			Method / Plant Used: JCB 3CX Excavator	

William Stokes Consulting

SOAKAWAY TEST SHEET TO BRE365
RESULT SHEET

Site Location: Marlbrook Hall

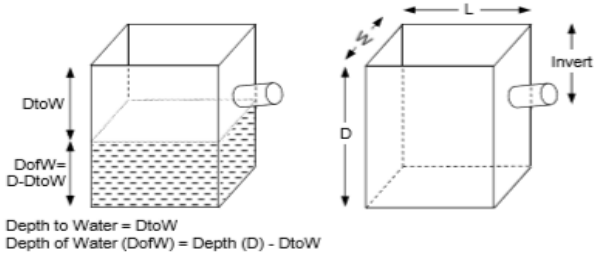
Weather: Cloudy with Sunny Spells

Position on Site: Nearest existing site

Hole Number: TP01

Hole Dimensions (m):

Length	1.4	L
Width	0.3	W
Depth	1.5	D



Proposed Depth to pipe invert (m): 1.000 Invert

Was hole filled with Granular Material: No

Dates:

1st Test: 30/04/2021 2nd Test: 3rd Test:

TEST 1			TEST 2			TEST 3		
Time (00:00Hrs)	Depth OF Water (DofW) (m)	Depth TO Water (DtoW) (m)	Time (00:00Hrs)	Depth OF Water (DofW) (m)	Depth TO Water (DtoW) (m)	Time (00:00Hrs)	Depth OF Water (DofW) (m)	Depth TO Water (DtoW) (m)
08:39:00	1.000	0.500						
09:00:00	0.990	0.510						
09:20:00	0.990	0.510						
11:55:00	0.985	0.515						
16:53:00	0.980	0.520						

William Stokes Consulting

SOAKAWAY TEST SHEET TO BRE365
RESULT SHEET

Site Location: Marlbrook Hall

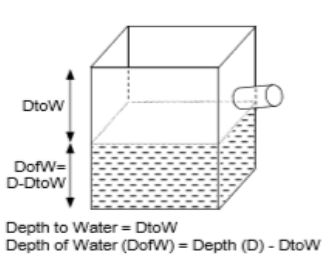
Weather: Cloudy with Sunny Spells

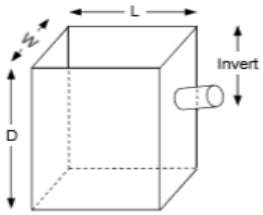
Position on Site: Furtherst from existing site

Hole Number: TP02

Hole Dimensions (m):

Length	1.8	L
Width	0.3	W
Depth	1.5	D





Proposed Depth to pipe invert (m): 1.000 Invert

Was hole filled with Granular Material: No

Dates:

1st Test: 30/04/2021 2nd Test: 3rd Test:

TEST 1			TEST 2			TEST 3		
Time (00:00Hrs)	Depth OF Water (DofW) (m)	Depth TO Water (DtoW) (m)	Time (00:00Hrs)	Depth OF Water (DofW) (m)	Depth TO Water (DtoW) (m)	Time (00:00Hrs)	Depth OF Water (DofW) (m)	Depth TO Water (DtoW) (m)
08:49:00	1.000	0.500						
09:00:00	1.000	0.500						
09:20:00	0.990	0.510						
11:55:00	0.940	0.560						
16:53:00	0.875	0.625						

Appendix B

– Raw FEH Rainfall Data

– ReFH2 Greenfield (Pre-development) Runoff Volume & Rate Calculations

VERSION "FEH Web Version 1.0.0 exported a 22:38:03 GMT Fri ########
Parameters
Rainfall mc FEH 2013
Calculatior Design rainfall
Calculatior For a point
Calculatior Point GB 343892 271042 SO 43892 71042
Fixed dura no
Annual ma yes

Duration h	Duration d	2 year rain	5 year rain	10 year rai	20 year rai	30 year rai	50 year rai	75 year rai	100 year ra	150 year ra	200 year ra	500 year ra	1000 year	10000 year rainfall (mm)
0.25	0.010417	6.7	11.8	15.62	19.9	22.6	26.04	29.01	31.23	34.31	36.58	43.85	49.46	68.04
0.5	0.020833	8.8	15.37	20.62	26.42	30.05	34.76	38.81	41.85	46.24	49.42	59.75	67.66	94.86
0.75	0.03125	10.1	17.68	23.8	30.47	34.7	40.35	45.12	48.65	53.79	57.54	69.74	79.27	111.97
1	0.041667	11.1	19.41	26.12	33.48	38.16	44.49	49.82	53.75	59.44	63.59	77.25	87.87	124.47
1.25	0.052083	12.32	21.09	28.1	35.78	40.66	47.22	52.74	56.8	62.65	66.9	80.87	91.71	128.74
1.5	0.0625	13.54	22.58	29.79	37.63	42.62	49.3	54.91	59.03	64.95	69.24	83.35	94.27	131.43
1.75	0.072917	14.7	23.92	31.24	39.18	44.24	50.98	56.63	60.79	66.74	71.05	85.23	96.2	133.4
2	0.083333	15.79	25.11	32.51	40.51	45.61	52.38	58.07	62.24	68.22	72.54	86.75	97.75	134.97
2.25	0.09375	16.65	26.1	33.59	41.67	46.82	53.65	59.39	63.59	69.59	73.94	88.23	99.27	136.61
2.5	0.104167	17.43	27	34.56	42.7	47.88	54.77	60.54	64.76	70.79	75.15	89.5	100.59	138.03
2.75	0.114583	18.15	27.82	35.44	43.63	48.83	55.76	61.56	65.8	71.84	76.22	90.62	101.74	139.28
3	0.125	18.82	28.57	36.24	44.47	49.69	56.65	62.47	66.72	72.78	77.17	91.61	102.76	140.38
3.25	0.135417	19.44	29.27	36.98	45.24	50.47	57.46	63.29	67.55	73.62	78.02	92.49	103.67	141.37
3.5	0.145833	20.03	29.93	37.67	45.95	51.19	58.19	64.04	68.3	74.39	78.8	93.29	104.49	142.27
3.75	0.15625	20.58	30.54	38.31	46.61	51.85	58.87	64.72	68.98	75.08	79.5	94.02	105.23	143.08
4	0.166667	21.1	31.12	38.9	47.22	52.47	59.49	65.34	69.61	75.72	80.14	94.69	105.91	143.82
4.25	0.177083	21.59	31.67	39.46	47.79	53.04	60.06	65.91	70.17	76.29	80.73	95.29	106.52	144.49
4.5	0.1875	22.06	32.19	39.99	48.33	53.58	60.59	66.43	70.69	76.82	81.27	95.84	107.08	145.12
4.75	0.197917	22.51	32.69	40.49	48.83	54.08	61.09	66.92	71.17	77.32	81.78	96.36	107.59	145.69
5	0.208333	22.94	33.16	40.97	49.31	54.56	61.56	67.38	71.63	77.78	82.24	96.83	108.07	146.22
5.25	0.21875	23.36	33.61	41.43	49.77	55.01	62	67.81	72.05	78.21	82.68	97.28	108.52	146.71
5.5	0.229167	23.75	34.05	41.86	50.2	55.44	62.42	68.21	72.46	78.62	83.1	97.69	108.94	147.17
5.75	0.239583	24.13	34.47	42.28	50.62	55.85	62.82	68.6	72.84	79	83.48	98.08	109.33	147.6
6	0.25	24.5	34.87	42.68	51.01	56.25	63.2	68.97	73.2	79.37	83.85	98.45	109.7	148
6.25	0.260417	24.85	35.25	43.06	51.39	56.61	63.55	69.31	73.54	79.7	84.18	98.78	110.04	148.37
6.5	0.270833	25.19	35.62	43.42	51.75	56.96	63.88	69.64	73.87	80.03	84.5	99.1	110.37	148.72
6.75	0.28125	25.52	35.98	43.78	52.1	57.3	64.21	69.96	74.18	80.33	84.8	99.4	110.67	149.04
7	0.291667	25.84	36.32	44.12	52.44	57.63	64.52	70.26	74.48	80.62	85.09	99.68	110.97	149.35
7.25	0.302083	26.15	36.66	44.45	52.76	57.94	64.82	70.55	74.77	80.9	85.37	99.95	111.24	149.65
7.5	0.3125	26.46	36.98	44.77	53.08	58.25	65.1	70.83	75.05	81.17	85.63	100.21	111.51	149.92
7.75	0.322917	26.75	37.3	45.09	53.38	58.54	65.38	71.11	75.31	81.43	85.89	100.46	111.76	150.19
8	0.333333	27.03	37.61	45.39	53.68	58.83	65.65	71.37	75.57	81.68	86.13	100.69	112	150.44
8.25	0.34375	27.31	37.91	45.68	53.97	59.11	65.92	71.62	75.82	81.92	86.37	100.92	112.23	150.68
8.5	0.354167	27.58	38.2	45.97	54.24	59.38	66.17	71.87	76.07	82.16	86.59	101.14	112.45	150.91
8.75	0.364583	27.84	38.48	46.25	54.52	59.64	66.42	72.11	76.3	82.38	86.81	101.35	112.67	151.13
9	0.375	28.1	38.75	46.53	54.78	59.89	66.66	72.34	76.53	82.6	87.03	101.55	112.87	151.34
9.25	0.385417	28.35	39.02	46.79	55.04	60.14	66.9	72.57	76.75	82.81	87.23	101.75	113.07	151.54
9.5	0.395833	28.6	39.29	47.05	55.29	60.39	67.12	72.79	76.97	83.02	87.43	101.93	113.26	151.74
9.75	0.40625	28.84	39.54	47.31	55.54	60.62	67.35	73.01	77.18	83.22	87.62	102.12	113.44	151.92
10	0.416667	29.07	39.8	47.56	55.78	60.86	67.57	73.21	77.38	83.41	87.81	102.29	113.62	152.1
10.25	0.427083	29.3	40.04	47.8	56.02	61.08	67.78	73.42	77.58	83.6	87.99	102.47	113.79	152.27
10.5	0.4375	29.53	40.28	48.04	56.25	61.31	67.99	73.62	77.78	83.79	88.17	102.63	113.96	152.44
10.75	0.447917	29.75	40.52	48.28	56.48	61.52	68.19	73.82	77.97	83.97	88.34	102.79	114.12	152.6
11	0.458333	29.96	40.75	48.51	56.7	61.74	68.39	74.01	78.16	84.14	88.51	102.95	114.27	152.76
11.25	0.46875	30.18	40.98	48.73	56.92	61.95	68.59	74.2	78.34	84.31	88.68	103.1	114.42	152.91
11.5	0.479167	30.38	41.2	48.96	57.13	62.15	68.78	74.38	78.52	84.48	88.84	103.25	114.57	153.05
11.75	0.489583	30.59	41.42	49.18	57.34	62.36	68.97	74.56	78.69	84.65	89	103.4	114.71	153.19
12	0.5	30.79	41.63	49.39	57.54	62.55	69.16	74.74	78.86	84.81	89.15	103.54	114.85	153.33
12.25	0.510417	30.99	41.84	49.6	57.75	62.75	69.34	74.91	79.03	84.96	89.3	103.68	114.98	153.46
12.5	0.520833	31.18	42.05	49.81	57.95	62.95	69.53	75.08	79.19	85.12	89.45	103.81	115.1	153.58
12.75	0.53125	31.37	42.25	50.02	58.14	63.14	69.71	75.25	79.35	85.27	89.59	103.94	115.23	153.7
13	0.541667	31.55	42.45	50.22	58.34	63.33	69.89	75.42	79.51	85.42	89.73	104.07	115.35	153.82
13.25	0.552083	31.74	42.65	50.42	58.53	63.51	70.06	75.58	79.66	85.56	89.87	104.19	115.47	153.94
13.5	0.5625	31.92	42.84	50.62	58.71	63.7	70.23	75.74	79.81	85.71	90.01	104.32	115.58	154.05
13.75	0.572917	32.1	43.03	50.82	58.9	63.88	70.4	75.9	79.96	85.85	90.15	104.44	115.7	154.16
14	0.583333	32.27	43.22	51.01	59.08	64.06	70.57	76.06	80.11	85.99	90.28	104.56	115.81	154.27
14.25	0.59375	32.45	43.4	51.2	59.26	64.23	70.74	76.21	80.26	86.12	90.41	104.68	115.91	154.37
14.5	0.604167	32.62	43.59	51.38	59.44	64.41	70.9	76.36	80.4	86.26	90.54	104.79	116.02	154.47
14.75	0.614583	32.78	43.77	51.57	59.62	64.58	71.06	76.52	80.55	86.39	90.67	104.9	116.13	154.58
15	0.625	32.95	43.94	51.75	59.79	64.75	71.23	76.66	80.69	86.52	90.79	105.02	116.23	154.67
15.25	0.635417	33.11	44.12	51.93	59.96	64.92	71.38	76.81	80.82	86.66	90.92	105.12	116.33	154.77
15.5	0.645833	33.28	44.29	52.11	60.13	65.08	71.54	76.96	80.96	86.78	91.04	105.23	116.43	154.86
15.75	0.65625	33.43	44.46	52.28	60.3	65.25	71.69	77.1	81.1	86.91	91.16	105.34	116.53	154.96
16	0.666667	33.59	44.63	52.46	60.46	65.41	71.85	77.24	81.23	87.04	91.28	105.44	116.62	155.05
16.25	0.677083	33.75	44.8	52.63	60.63	65.57	72	77.38	81.37	87.16	91.4	105.55	116.72	155.14
16.5	0.6875	33.9	44.96	52.8	60.79	65.73	72.15	77.52	81.5	87.28	91.51	105.65	116.81	155.22
16.75	0.697917	34.05	45.13	52.96	60.95	65.89	72.3	77.66	81.63	87.41	91.63	105.75	116.9	155.31
17	0.708333	34.2	45.29	53.13	61.11	66.04	72.44	77.8	81.76	87.53	91.74	105.85	116.99	155.4
17.25	0.71875	34.35	45.45	53.29	61.27	66.2	72.59	77.94	81.89	87.65	91.86	105.95	117.08	155.48
17.5	0.729167	34.5	45.6	53.45	61.42	66.35	72.73	78.07	82.01	87.77	91.97	106.05	117.17	155.56
17.75	0.739583	34.64	45.76	53.61	61.58	66.5	72.88	78.2	82.14	87.88	92.08	106.14	117.26	155.64
18	0.75	34.79	45.91	53.77	61.73	66.65	73.02	78.33	82.26	88	92.19	106.24	117.34	155.72
18.25	0.760417	34.93	46.07	53.93	61.88	66.8	73.16	78.47	82.39	88.12	92.31	106.33	117.43	155.8
18.5	0.770833	35.07	46.22	54.08	62.03	66.95	73.3	78.6	82.52	88.24	92.42	106.43	117.51	155.88
18.75	0.78125	35.21	46.37	54.23	62.18	67.1	73.44	78.73	82.65	88.36	92.53	106.53	117.6	155.96
19	0.791667	35.35	46.52	54.39	62.33	67.24	73.58	78.87	82.77	88.47	92.64	106.62	117.68	156.03
19.25	0.802083	35.49	46.67	54.54	62.48	67.39	73.71	79	82.9	88.59	92.75	106.71	117.76	156.11
19.5	0.8125	35.62	46.82	54.69	62.63	67.53	73.85	79.13	83.02	88.71	92.86	106.81	117.85	156.18
19.75	0.822917	35.76	46.96	54.83	62.78	67.67	73.99	79.26	83.15	88.82	92.97	106.9	117.93	156.26
20	0.833333	35.89	47.11	54.98	62.92	67.82	74.12	79.38	83.27	88.94	93.08	106.99	118.01	156.33

20.25	0.84375	36.02	47.25	55.12	63.07	67.96	74.25	79.51	83.4	89.05	93.19	107.08	118.09	156.4
20.5	0.854167	36.15	47.39	55.27	63.21	68.1	74.39	79.64	83.52	89.16	93.3	107.17	118.17	156.47
20.75	0.864583	36.28	47.53	55.41	63.35	68.24	74.52	79.76	83.64	89.28	93.4	107.26	118.25	156.54
21	0.875	36.41	47.67	55.55	63.49	68.37	74.65	79.89	83.76	89.39	93.51	107.35	118.33	156.61
21.25	0.885417	36.54	47.81	55.69	63.63	68.51	74.78	80.01	83.88	89.5	93.62	107.44	118.41	156.68
21.5	0.895833	36.67	47.95	55.83	63.77	68.65	74.91	80.14	84	89.61	93.72	107.53	118.48	156.75
21.75	0.90625	36.79	48.09	55.97	63.91	68.78	75.04	80.26	84.12	89.72	93.83	107.61	118.56	156.82
22	0.916667	36.91	48.22	56.11	64.05	68.92	75.17	80.38	84.24	89.83	93.93	107.7	118.64	156.88
22.25	0.927083	37.04	48.35	56.24	64.18	69.05	75.29	80.51	84.36	89.94	94.03	107.79	118.71	156.95
22.5	0.9375	37.16	48.49	56.38	64.32	69.18	75.42	80.63	84.47	90.05	94.14	107.87	118.79	157.02
22.75	0.947917	37.28	48.62	56.51	64.45	69.31	75.54	80.75	84.59	90.16	94.24	107.96	118.86	157.08
23	0.958333	37.4	48.75	56.64	64.59	69.45	75.67	80.87	84.71	90.27	94.34	108.05	118.94	157.14
23.25	0.96875	37.52	48.88	56.78	64.72	69.58	75.79	80.99	84.82	90.38	94.45	108.13	119.01	157.21
23.5	0.979167	37.64	49.01	56.91	64.85	69.7	75.92	81.11	84.94	90.48	94.55	108.22	119.09	157.27
23.75	0.989583	37.75	49.14	57.04	64.98	69.83	76.04	81.23	85.05	90.59	94.65	108.3	119.16	157.33
24	1	37.87	49.26	57.17	65.11	69.96	76.16	81.34	85.17	90.7	94.75	108.39	119.24	157.39
24.25	1.010417	37.98	49.39	57.3	65.24	70.09	76.28	81.46	85.28	90.8	94.85	108.47	119.31	157.45
24.5	1.020833	38.09	49.51	57.42	65.37	70.21	76.41	81.58	85.39	90.91	94.95	108.55	119.38	157.5
24.75	1.03125	38.2	49.63	57.55	65.5	70.34	76.53	81.69	85.51	91.02	95.05	108.64	119.45	157.56
25	1.041667	38.31	49.75	57.67	65.62	70.46	76.65	81.81	85.62	91.12	95.15	108.72	119.53	157.61
25.25	1.052083	38.42	49.87	57.8	65.75	70.58	76.77	81.92	85.73	91.23	95.25	108.8	119.6	157.66
25.5	1.0625	38.52	49.99	57.92	65.87	70.71	76.89	82.04	85.84	91.33	95.35	108.89	119.67	157.72
25.75	1.072917	38.63	50.11	58.04	65.99	70.83	77	82.15	85.95	91.44	95.45	108.97	119.74	157.77
26	1.083333	38.74	50.23	58.16	66.12	70.95	77.12	82.27	86.06	91.54	95.55	109.05	119.81	157.82
26.25	1.09375	38.84	50.34	58.29	66.24	71.07	77.24	82.38	86.17	91.64	95.65	109.13	119.88	157.87
26.5	1.104167	38.94	50.46	58.41	66.36	71.19	77.36	82.49	86.28	91.75	95.75	109.21	119.95	157.92
26.75	1.114583	39.05	50.57	58.53	66.48	71.31	77.47	82.61	86.39	91.85	95.85	109.3	120.03	157.97
27	1.125	39.15	50.69	58.65	66.6	71.43	77.59	82.72	86.5	91.95	95.95	109.38	120.1	158.02
27.25	1.135417	39.25	50.8	58.76	66.72	71.55	77.7	82.83	86.61	92.06	96.05	109.46	120.17	158.07
27.5	1.145833	39.35	50.92	58.88	66.84	71.67	77.82	82.94	86.72	92.16	96.14	109.54	120.24	158.12
27.75	1.15625	39.45	51.03	59	66.96	71.78	77.94	83.06	86.82	92.26	96.24	109.62	120.31	158.17
28	1.166667	39.55	51.14	59.12	67.08	71.9	78.05	83.17	86.93	92.36	96.34	109.7	120.38	158.22
28.25	1.177083	39.65	51.25	59.23	67.2	72.02	78.16	83.28	87.04	92.46	96.44	109.78	120.45	158.27
28.5	1.1875	39.75	51.36	59.35	67.31	72.13	78.28	83.39	87.15	92.57	96.53	109.86	120.52	158.32
28.75	1.197917	39.85	51.47	59.46	67.43	72.25	78.39	83.5	87.25	92.67	96.63	109.94	120.59	158.37
29	1.208333	39.95	51.58	59.58	67.55	72.36	78.5	83.61	87.36	92.77	96.73	110.03	120.66	158.42
29.25	1.21875	40.04	51.69	59.69	67.66	72.48	78.62	83.72	87.46	92.87	96.82	110.11	120.73	158.47
29.5	1.229167	40.14	51.8	59.81	67.78	72.59	78.73	83.82	87.57	92.97	96.92	110.19	120.79	158.51
29.75	1.239583	40.24	51.91	59.92	67.89	72.71	78.84	83.93	87.68	93.07	97.01	110.27	120.86	158.56
30	1.25	40.33	52.02	60.03	68	72.82	78.95	84.04	87.78	93.17	97.11	110.35	120.93	158.61
30.25	1.260417	40.43	52.12	60.14	68.12	72.93	79.06	84.15	87.89	93.27	97.2	110.43	121	158.66
30.5	1.270833	40.52	52.23	60.26	68.23	73.05	79.17	84.26	87.99	93.37	97.3	110.51	121.07	158.7
30.75	1.28125	40.61	52.33	60.37	68.34	73.16	79.28	84.36	88.09	93.47	97.4	110.58	121.14	158.75
31	1.291667	40.71	52.44	60.48	68.46	73.27	79.39	84.47	88.2	93.57	97.49	110.66	121.21	158.8
31.25	1.302083	40.8	52.54	60.59	68.57	73.38	79.5	84.58	88.3	93.67	97.59	110.74	121.28	158.85
31.5	1.3125	40.89	52.65	60.7	68.68	73.49	79.61	84.68	88.41	93.77	97.68	110.82	121.35	158.89
31.75	1.322917	40.98	52.75	60.81	68.79	73.6	79.72	84.79	88.51	93.86	97.77	110.9	121.41	158.94
32	1.333333	41.07	52.85	60.91	68.9	73.71	79.83	84.9	88.61	93.96	97.87	110.98	121.48	158.98
32.25	1.34375	41.17	52.96	61.02	69.01	73.82	79.94	85	88.72	94.06	97.96	111.06	121.55	159.03
32.5	1.354167	41.26	53.06	61.13	69.12	73.93	80.05	85.11	88.82	94.16	98.06	111.14	121.62	159.08
32.75	1.364583	41.35	53.16	61.24	69.23	74.04	80.15	85.21	88.92	94.26	98.15	111.22	121.69	159.12
33	1.375	41.43	53.26	61.34	69.34	74.15	80.26	85.32	89.02	94.35	98.24	111.3	121.76	159.17
33.25	1.385417	41.52	53.36	61.45	69.45	74.26	80.37	85.42	89.12	94.45	98.34	111.38	121.82	159.21
33.5	1.395833	41.61	53.46	61.56	69.56	74.36	80.48	85.53	89.23	94.55	98.43	111.45	121.89	159.26
33.75	1.40625	41.7	53.56	61.66	69.66	74.47	80.58	85.63	89.33	94.65	98.53	111.53	121.96	159.31
34	1.416667	41.79	53.66	61.77	69.77	74.58	80.69	85.73	89.43	94.74	98.62	111.61	122.03	159.35
34.25	1.427083	41.87	53.76	61.87	69.88	74.69	80.79	85.84	89.53	94.84	98.71	111.69	122.1	159.4
34.5	1.4375	41.96	53.86	61.98	69.99	74.79	80.9	85.94	89.63	94.94	98.81	111.77	122.17	159.44
34.75	1.447917	42.05	53.96	62.08	70.09	74.9	81.01	86.04	89.73	95.03	98.9	111.85	122.23	159.49
35	1.458333	42.13	54.06	62.18	70.2	75	81.11	86.15	89.83	95.13	98.99	111.93	122.3	159.53
35.25	1.46875	42.22	54.15	62.29	70.3	75.11	81.22	86.25	89.93	95.23	99.08	112	122.37	159.58
35.5	1.479167	42.3	54.25	62.39	70.41	75.21	81.32	86.35	90.03	95.32	99.18	112.08	122.44	159.62
35.75	1.489583	42.39	54.35	62.49	70.51	75.32	81.43	86.45	90.13	95.42	99.27	112.16	122.51	159.67
36	1.5	42.47	54.44	62.6	70.62	75.42	81.53	86.56	90.23	95.51	99.36	112.24	122.57	159.71
36.25	1.510417	42.56	54.54	62.7	70.72	75.53	81.63	86.66	90.33	95.61	99.45	112.32	122.64	159.75
36.5	1.520833	42.64	54.64	62.8	70.83	75.63	81.74	86.76	90.43	95.71	99.55	112.39	122.71	159.8
36.75	1.53125	42.73	54.73	62.9	70.93	75.74	81.84	86.86	90.53	95.8	99.64	112.47	122.78	159.84
37	1.541667	42.81	54.83	63	71.03	75.84	81.94	86.96	90.63	95.9	99.73	112.55	122.85	159.89
37.25	1.552083	42.89	54.92	63.1	71.14	75.94	82.05	87.06	90.73	95.99	99.82	112.63	122.91	159.93
37.5	1.5625	42.97	55.02	63.2	71.24	76.05	82.15	87.17	90.83	96.09	99.91	112.71	122.98	159.98
37.75	1.572917	43.06	55.11	63.3	71.34	76.15	82.25	87.27	90.92	96.18	100.01	112.79	123.05	160.02
38	1.583333	43.14	55.2	63.4	71.45	76.25	82.36	87.37	91.02	96.28	100.1	112.86	123.12	160.07
38.25	1.59375	43.22	55.3	63.5	71.55	76.35	82.46	87.47	91.12	96.37	100.19	112.94	123.19	160.11
38.5	1.604167	43.3	55.39	63.6	71.65	76.46	82.56	87.57	91.22	96.47	100.28	113.02	123.25	160.15
38.75	1.614583	43.38	55.48	63.7	71.75	76.56	82.66	87.67	91.32	96.56	100.37	113.1	123.32	160.2
39	1.625	43.46	55.57	63.8	71.85	76.66	82.76	87.77	91.41	96.66	100.46	113.17	123.39	160.24
39.25	1.635417	43.54	55.67	63.9	71.95	76.76	82.86	87.87	91.51	96.75	100.55	113.25	123.46	160.29
39.5	1.645833	43.62	55.76	63.99	72.05	76.86	82.97	87.97	91.61	96.84	100.65	113.33	123.52	160.33
39.75	1.65625	43.7	55.85	64.09	72.15	76.96	83.07	88.07	91.71	96.94	100.74	113.41	123.59	160.37
40	1.666667	43.78	55.94	64.19	72.25	77.06	83.17	88.17	91.8	97.03	100.83	113.49	123.66	160.42
40.25	1.677083	43.86	56.03	64.28	72.35	77.16	83.27	88.26	91.9	97.13	100.92	113.56	123.73	160.46
40.5	1.6875	43.94	56.12	64.38	72.45	77.26	83.37	88.36	92	97.22	101.01	113.64	123.8	160.51
40.75	1.697917	44.02	56.21	64.48	72.55	77.36	83.47	88.46	92.1	97.32	101.1	113.72	123.87	160.55
41	1.708333	44.09	56.3	64.57	72.65	77.46	83.57	88.56	92.19	97.41	101.19	113.8	123.93	160.59
41.25	1.71875	44.17	56.39	64.67	72.75	77.56	83.67	88.66	92.29	97.5	101.28	113.88	124	160.64
41.5	1.729167	44.25	56.48	64.77	72.85	77.66	83.77	88.76	92.39	97.6	101.37	113.95	124.07	160.68
41.75	1.739583	44.33	56.57	64.86	72.95	77.76	83.87	88.86	92.48	97.69	101.46	114.03	124.14	160.72
42	1.75	44.4	56.66	64.96	73.05	77.86	83.97	88.95	92.58	97.78	101.55	114.11	124.21	160.77
42.25	1.760417	44.48	56.75	65.05	73.14	77.96	84.07	89.05	92.67	97.88	101.64	114.19	124.28	160.81

42.5	1.770833	44.56	56.84	65.15	73.24	78.06	84.17	89.15	92.77	97.97	101.74	114.27	124.34	160.86
42.75	1.78125	44.63	56.92	65.24	73.34	78.15	84.26	89.25	92.87	98.06	101.83	114.34	124.41	160.9
43	1.791667	44.71	57.01	65.33	73.44	78.25	84.36	89.35	92.96	98.16	101.92	114.42	124.48	160.94
43.25	1.802083	44.78	57.1	65.43	73.53	78.35	84.46	89.44	93.06	98.25	102.01	114.5	124.55	160.99
43.5	1.8125	44.86	57.19	65.52	73.63	78.45	84.56	89.54	93.15	98.34	102.1	114.58	124.62	161.03
43.75	1.822917	44.94	57.27	65.61	73.73	78.55	84.66	89.64	93.25	98.44	102.19	114.66	124.69	161.07
44	1.833333	45.01	57.36	65.71	73.82	78.64	84.76	89.73	93.34	98.53	102.28	114.74	124.76	161.12
44.25	1.84375	45.09	57.45	65.8	73.92	78.74	84.85	89.83	93.44	98.62	102.37	114.81	124.82	161.16
44.5	1.854167	45.16	57.53	65.89	74.02	78.84	84.95	89.93	93.53	98.71	102.46	114.89	124.89	161.21
44.75	1.864583	45.23	57.62	65.99	74.11	78.93	85.05	90.02	93.63	98.81	102.55	114.97	124.96	161.25
45	1.875	45.31	57.7	66.08	74.21	79.03	85.15	90.12	93.72	98.9	102.64	115.05	125.03	161.29
45.25	1.885417	45.38	57.79	66.17	74.3	79.13	85.25	90.22	93.82	98.99	102.73	115.13	125.1	161.34
45.5	1.895833	45.46	57.88	66.26	74.4	79.22	85.34	90.31	93.91	99.09	102.82	115.21	125.17	161.38
45.75	1.90625	45.53	57.96	66.35	74.49	79.32	85.44	90.41	94.01	99.18	102.91	115.28	125.24	161.43
46	1.916667	45.6	58.05	66.44	74.59	79.41	85.54	90.51	94.1	99.27	103	115.36	125.31	161.47
46.25	1.927083	45.68	58.13	66.54	74.68	79.51	85.63	90.6	94.2	99.36	103.09	115.44	125.38	161.51
46.5	1.9375	45.75	58.21	66.63	74.78	79.61	85.73	90.7	94.29	99.45	103.18	115.52	125.45	161.56
46.75	1.947917	45.82	58.3	66.72	74.87	79.7	85.83	90.79	94.39	99.55	103.27	115.6	125.52	161.6
47	1.958333	45.89	58.38	66.81	74.97	79.8	85.92	90.89	94.48	99.64	103.36	115.68	125.58	161.65
47.25	1.96875	45.97	58.47	66.9	75.06	79.89	86.02	90.99	94.58	99.73	103.45	115.76	125.65	161.69
47.5	1.979167	46.04	58.55	66.99	75.16	79.99	86.12	91.08	94.67	99.82	103.54	115.83	125.72	161.73
47.75	1.989583	46.11	58.63	67.08	75.25	80.08	86.21	91.18	94.76	99.92	103.63	115.91	125.79	161.78
48	2	46.18	58.72	67.17	75.34	80.17	86.31	91.27	94.86	100.01	103.72	115.99	125.86	161.82
48.25	2.010417	46.25	58.8	67.26	75.44	80.27	86.41	91.37	94.96	100.1	103.81	116.08	125.94	161.88
48.5	2.020833	46.32	58.89	67.35	75.53	80.37	86.5	91.47	95.05	100.2	103.91	116.17	126.02	161.93
48.75	2.03125	46.4	58.97	67.44	75.63	80.46	86.6	91.57	95.15	100.3	104	116.25	126.1	161.99
49	2.041667	46.47	59.05	67.53	75.72	80.56	86.7	91.66	95.25	100.39	104.1	116.34	126.18	162.04
49.25	2.052083	46.54	59.14	67.62	75.82	80.66	86.8	91.76	95.34	100.49	104.19	116.43	126.26	162.1
49.5	2.0625	46.61	59.22	67.71	75.91	80.75	86.89	91.86	95.44	100.58	104.29	116.51	126.34	162.16
49.75	2.072917	46.68	59.3	67.8	76	80.85	86.99	91.96	95.54	100.68	104.38	116.6	126.42	162.21
50	2.083333	46.75	59.39	67.89	76.1	80.94	87.09	92.05	95.63	100.77	104.47	116.69	126.5	162.27
50.25	2.09375	46.83	59.47	67.98	76.19	81.04	87.19	92.15	95.73	100.87	104.57	116.78	126.58	162.33
50.5	2.104167	46.9	59.55	68.07	76.29	81.13	87.28	92.25	95.83	100.97	104.66	116.86	126.66	162.38
50.75	2.114583	46.97	59.63	68.15	76.38	81.23	87.38	92.34	95.92	101.06	104.76	116.95	126.75	162.44
51	2.125	47.04	59.72	68.24	76.47	81.32	87.48	92.44	96.02	101.16	104.85	117.04	126.83	162.5
51.25	2.135417	47.11	59.8	68.33	76.57	81.42	87.57	92.54	96.12	101.25	104.95	117.13	126.91	162.55
51.5	2.145833	47.18	59.88	68.42	76.66	81.51	87.67	92.64	96.21	101.35	105.04	117.21	126.99	162.61
51.75	2.15625	47.25	59.96	68.51	76.75	81.61	87.77	92.73	96.31	101.44	105.13	117.3	127.07	162.67
52	2.166667	47.32	60.05	68.6	76.85	81.7	87.86	92.83	96.41	101.54	105.23	117.39	127.15	162.72
52.25	2.177083	47.39	60.13	68.68	76.94	81.8	87.96	92.93	96.5	101.63	105.32	117.48	127.23	162.78
52.5	2.1875	47.46	60.21	68.77	77.03	81.89	88.06	93.02	96.6	101.73	105.42	117.57	127.31	162.84
52.75	2.197917	47.53	60.29	68.86	77.12	81.98	88.15	93.12	96.7	101.82	105.51	117.66	127.4	162.9
53	2.208333	47.6	60.37	68.95	77.22	82.08	88.25	93.22	96.79	101.92	105.61	117.74	127.48	162.96
53.25	2.21875	47.67	60.45	69.03	77.31	82.17	88.34	93.31	96.89	102.01	105.7	117.83	127.56	163.01
53.5	2.229167	47.73	60.53	69.12	77.4	82.27	88.44	93.41	96.98	102.11	105.79	117.92	127.64	163.07
53.75	2.239583	47.8	60.61	69.21	77.49	82.36	88.54	93.5	97.08	102.2	105.89	118.01	127.72	163.13
54	2.25	47.87	60.69	69.3	77.58	82.45	88.63	93.6	97.17	102.3	105.98	118.1	127.81	163.19
54.25	2.260417	47.94	60.77	69.38	77.68	82.55	88.73	93.7	97.27	102.4	106.08	118.19	127.89	163.25
54.5	2.270833	48.01	60.85	69.47	77.77	82.64	88.82	93.79	97.37	102.49	106.17	118.28	127.97	163.31
54.75	2.28125	48.08	60.93	69.56	77.86	82.73	88.92	93.89	97.46	102.59	106.27	118.36	128.06	163.37
55	2.291667	48.15	61.01	69.64	77.95	82.83	89.01	93.98	97.56	102.68	106.36	118.45	128.14	163.42
55.25	2.302083	48.21	61.09	69.73	78.04	82.92	89.11	94.08	97.65	102.78	106.45	118.54	128.22	163.48
55.5	2.3125	48.28	61.17	69.81	78.13	83.01	89.2	94.18	97.75	102.87	106.55	118.63	128.3	163.54
55.75	2.322917	48.35	61.25	69.9	78.22	83.11	89.3	94.27	97.84	102.97	106.64	118.72	128.39	163.6
56	2.333333	48.42	61.33	69.99	78.32	83.2	89.39	94.37	97.94	103.06	106.74	118.81	128.47	163.66
56.25	2.34375	48.48	61.41	70.07	78.41	83.29	89.49	94.46	98.04	103.16	106.83	118.9	128.55	163.72
56.5	2.354167	48.55	61.49	70.16	78.5	83.38	89.58	94.56	98.13	103.25	106.93	118.99	128.64	163.78
56.75	2.364583	48.62	61.57	70.24	78.59	83.48	89.68	94.65	98.23	103.35	107.02	119.08	128.72	163.84
57	2.375	48.69	61.65	70.33	78.68	83.57	89.77	94.75	98.32	103.44	107.11	119.17	128.81	163.9
57.25	2.385417	48.75	61.73	70.41	78.77	83.66	89.87	94.84	98.42	103.53	107.21	119.26	128.89	163.96
57.5	2.395833	48.82	61.81	70.5	78.86	83.75	89.96	94.94	98.51	103.63	107.3	119.35	128.97	164.02
57.75	2.40625	48.89	61.88	70.58	78.95	83.84	90.05	95.03	98.61	103.72	107.4	119.44	129.06	164.09
58	2.416667	48.95	61.96	70.67	79.04	83.94	90.15	95.13	98.7	103.82	107.49	119.53	129.14	164.15
58.25	2.427083	49.02	62.04	70.75	79.13	84.03	90.24	95.22	98.8	103.91	107.59	119.62	129.23	164.21
58.5	2.4375	49.09	62.12	70.84	79.22	84.12	90.34	95.32	98.89	104.01	107.68	119.71	129.31	164.27
58.75	2.447917	49.15	62.2	70.92	79.31	84.21	90.43	95.41	98.99	104.1	107.77	119.8	129.4	164.33
59	2.458333	49.22	62.27	71.01	79.4	84.3	90.52	95.51	99.08	104.2	107.87	119.89	129.48	164.39
59.25	2.46875	49.28	62.35	71.09	79.49	84.39	90.62	95.6	99.18	104.29	107.96	119.98	129.57	164.45
59.5	2.479167	49.35	62.43	71.17	79.58	84.49	90.71	95.7	99.27	104.39	108.06	120.07	129.65	164.51
59.75	2.489583	49.42	62.51	71.26	79.66	84.58	90.81	95.79	99.37	104.48	108.15	120.16	129.74	164.58
60	2.5	49.48	62.58	71.34	79.75	84.67	90.9	95.89	99.46	104.58	108.25	120.25	129.82	164.64
60.25	2.510417	49.55	62.66	71.43	79.84	84.76	90.99	95.98	99.56	104.67	108.34	120.34	129.91	164.7
60.5	2.520833	49.61	62.74	71.51	79.93	84.85	91.09	96.08	99.65	104.77	108.43	120.43	129.99	164.76
60.75	2.53125	49.68	62.82	71.59	80.02	84.94	91.18	96.17	99.75	104.86	108.53	120.52	130.08	164.83
61	2.541667	49.74	62.89	71.68	80.11	85.03	91.27	96.27	99.84	104.96	108.62	120.61	130.17	164.89
61.25	2.552083	49.81	62.97	71.76	80.2	85.12	91.37	96.36	99.93	105.05	108.72	120.7	130.25	164.95
61.5	2.5625	49.87	63.05	71.84	80.29	85.21	91.46	96.45	100.03	105.14	108.81	120.79	130.34	165.01
61.75	2.572917	49.94	63.12	71.93	80.38	85.3	91.55	96.55	100.12	105.24	108.91	120.88	130.42	165.08
62	2.583333	50	63.2	72.01	80.46	85.39	91.65	96.64	100.22	105.33	109	120.97	130.51	165.14
62.25	2.59375	50.07	63.28	72.09	80.55	85.48	91.74	96.74	100.31	105.43	109.09	121.07	130.6	165.2
62.5	2.604167	50.13	63.35	72.17	80.64	85.57	91.83	96.83	100.41	105.52	109.19	121.16	130.68	165.27
62.75	2.614583	50.2	63.43	72.26	80.73	85.66	91.93	96.93	100.5	105.62	109.28	121.25	130.77	165.33
63	2.625	50.26	63.5	72.34	80.82	85.75	92.02	97.02	100.6	105.71	109.38	121.34	130.86	165.4
63.25	2.635417	50.33	63.58	72.42	80.9	85.84	92.11	97.11	100.69	105.81	109.47	121.43	130.94	165.46
63.5	2.645833	50.39	63.66	72.5	80.99	85.93	92.2	97.21	100.78	105.9	109.57	121.52	131.03	165.52
63.75	2.65625	50.45	63.73	72.59	81.08	86.02	92.3	97.3	100.88	106	109.66	121.61	131.12	165.59
64	2.666667	50.52	63.81	72.67	81.17	86.11	92.39	97.39	100.97	106.09	109.75	121.71	131.21	165.65
64.25	2.677083	50.58	63.88	72.75	81.25	86.2	92.48	97.49	101.07	106.18	109.85	121.8	131.29	165.72
64.5	2.6875	50.64	63.96	72.83	81.34	86.29	92.57	97.58	101.16	106.28	109.94	121.89	131.38	165.78

64.75	2.697917	50.71	64.03	72.91	81.43	86.38	92.67	97.68	101.26	106.37	110.04	121.98	131.47	165.85
65	2.708333	50.77	64.11	73	81.52	86.47	92.76	97.77	101.35	106.47	110.13	122.07	131.56	165.91
65.25	2.71875	50.84	64.18	73.08	81.6	86.56	92.85	97.86	101.44	106.56	110.23	122.17	131.65	165.98
65.5	2.729167	50.9	64.26	73.16	81.69	86.65	92.94	97.96	101.54	106.66	110.32	122.26	131.73	166.04
65.75	2.739583	50.96	64.33	73.24	81.78	86.74	93.03	98.05	101.63	106.75	110.42	122.35	131.82	166.11
66	2.75	51.03	64.41	73.32	81.87	86.83	93.13	98.14	101.73	106.85	110.51	122.44	131.91	166.17
66.25	2.760417	51.09	64.48	73.4	81.95	86.92	93.22	98.24	101.82	106.94	110.6	122.54	132	166.24
66.5	2.770833	51.15	64.56	73.48	82.04	87.01	93.31	98.33	101.91	107.03	110.7	122.63	132.09	166.31
66.75	2.78125	51.21	64.63	73.56	82.13	87.1	93.4	98.42	102.01	107.13	110.79	122.72	132.18	166.37
67	2.791667	51.28	64.71	73.65	82.21	87.19	93.49	98.52	102.1	107.22	110.89	122.81	132.26	166.44
67.25	2.802083	51.34	64.78	73.73	82.3	87.27	93.59	98.61	102.2	107.32	110.98	122.91	132.35	166.51
67.5	2.8125	51.4	64.86	73.81	82.39	87.36	93.68	98.7	102.29	107.41	111.08	123	132.44	166.57
67.75	2.822917	51.46	64.93	73.89	82.47	87.45	93.77	98.8	102.38	107.51	111.17	123.09	132.53	166.64
68	2.833333	51.53	65	73.97	82.56	87.54	93.86	98.89	102.48	107.6	111.27	123.18	132.62	166.71
68.25	2.84375	51.59	65.08	74.05	82.64	87.63	93.95	98.98	102.57	107.69	111.36	123.28	132.71	166.77
68.5	2.854167	51.65	65.15	74.13	82.73	87.72	94.04	99.08	102.66	107.79	111.46	123.37	132.8	166.84
68.75	2.864583	51.71	65.22	74.21	82.82	87.81	94.14	99.17	102.76	107.88	111.55	123.46	132.89	166.91
69	2.875	51.78	65.3	74.29	82.9	87.89	94.23	99.26	102.85	107.98	111.64	123.56	132.98	166.98
69.25	2.885417	51.84	65.37	74.37	82.99	87.98	94.32	99.36	102.95	108.07	111.74	123.65	133.07	167.04
69.5	2.895833	51.9	65.45	74.45	83.07	88.07	94.41	99.45	103.04	108.17	111.83	123.74	133.16	167.11
69.75	2.90625	51.96	65.52	74.53	83.16	88.16	94.5	99.54	103.13	108.26	111.93	123.84	133.25	167.18
70	2.916667	52.02	65.59	74.61	83.25	88.25	94.59	99.63	103.23	108.35	112.02	123.93	133.34	167.25
70.25	2.927083	52.09	65.67	74.69	83.33	88.34	94.68	99.73	103.32	108.45	112.12	124.02	133.43	167.32
70.5	2.9375	52.15	65.74	74.77	83.42	88.42	94.78	99.82	103.41	108.54	112.21	124.12	133.52	167.38
70.75	2.947917	52.21	65.81	74.85	83.5	88.51	94.87	99.91	103.51	108.64	112.31	124.21	133.61	167.45
71	2.958333	52.27	65.89	74.93	83.59	88.6	94.96	100.01	103.6	108.73	112.4	124.31	133.7	167.52
71.25	2.96875	52.33	65.96	75.01	83.67	88.69	95.05	100.1	103.69	108.83	112.5	124.4	133.79	167.59
71.5	2.979167	52.39	66.03	75.09	83.76	88.77	95.14	100.19	103.79	108.92	112.59	124.49	133.88	167.66
71.75	2.989583	52.45	66.1	75.17	83.84	88.86	95.23	100.28	103.88	109.02	112.69	124.59	133.98	167.73
72	3	52.51	66.18	75.25	83.93	88.95	95.32	100.38	103.97	109.11	112.78	124.68	134.07	167.8
72.25	3.010417	52.58	66.25	75.33	84.01	89.04	95.41	100.47	104.07	109.2	112.88	124.78	134.16	167.87
72.5	3.020833	52.64	66.32	75.41	84.1	89.13	95.5	100.56	104.16	109.3	112.97	124.87	134.25	167.94
72.75	3.03125	52.7	66.39	75.49	84.18	89.21	95.59	100.65	104.25	109.39	113.07	124.97	134.34	168.01
73	3.041667	52.76	66.47	75.56	84.27	89.3	95.68	100.75	104.35	109.49	113.16	125.06	134.43	168.08
73.25	3.052083	52.82	66.54	75.64	84.35	89.39	95.77	100.84	104.44	109.58	113.26	125.15	134.52	168.15
73.5	3.0625	52.88	66.61	75.72	84.44	89.47	95.87	100.93	104.53	109.68	113.35	125.25	134.62	168.22
73.75	3.072917	52.94	66.68	75.8	84.52	89.56	95.96	101.02	104.63	109.77	113.45	125.34	134.71	168.29
74	3.083333	53	66.76	75.88	84.61	89.65	96.05	101.12	104.72	109.86	113.54	125.44	134.8	168.36
74.25	3.09375	53.06	66.83	75.96	84.69	89.74	96.14	101.21	104.81	109.96	113.64	125.53	134.89	168.43
74.5	3.104167	53.12	66.9	76.04	84.78	89.82	96.23	101.3	104.91	110.05	113.73	125.63	134.99	168.5
74.75	3.114583	53.18	66.97	76.12	84.86	89.91	96.32	101.39	105	110.15	113.83	125.72	135.08	168.58
75	3.125	53.24	67.04	76.19	84.95	90	96.41	101.49	105.09	110.24	113.92	125.82	135.17	168.65
75.25	3.135417	53.3	67.11	76.27	85.03	90.08	96.5	101.58	105.19	110.34	114.02	125.91	135.26	168.72
75.5	3.145833	53.36	67.19	76.35	85.11	90.17	96.59	101.67	105.28	110.43	114.11	126.01	135.36	168.79
75.75	3.15625	53.42	67.26	76.43	85.2	90.26	96.68	101.76	105.37	110.52	114.21	126.11	135.45	168.86
76	3.166667	53.48	67.33	76.51	85.28	90.35	96.77	101.85	105.47	110.62	114.3	126.2	135.54	168.93
76.25	3.177083	53.54	67.4	76.59	85.37	90.43	96.86	101.95	105.56	110.71	114.4	126.3	135.64	169.01
76.5	3.1875	53.6	67.47	76.66	85.45	90.52	96.95	102.04	105.65	110.81	114.49	126.39	135.73	169.08
76.75	3.197917	53.66	67.54	76.74	85.54	90.61	97.04	102.13	105.75	110.9	114.59	126.49	135.82	169.15
77	3.208333	53.72	67.61	76.82	85.62	90.69	97.13	102.22	105.84	111	114.68	126.58	135.92	169.22
77.25	3.21875	53.78	67.69	76.9	85.7	90.78	97.22	102.31	105.93	111.09	114.78	126.68	136.01	169.3
77.5	3.229167	53.84	67.76	76.97	85.79	90.86	97.31	102.41	106.03	111.19	114.87	126.78	136.1	169.37
77.75	3.239583	53.9	67.83	77.05	85.87	90.95	97.4	102.5	106.12	111.28	114.97	126.87	136.2	169.44
78	3.25	53.96	67.9	77.13	85.95	91.04	97.49	102.59	106.21	111.37	115.06	126.97	136.29	169.52
78.25	3.260417	54.02	67.97	77.21	86.04	91.12	97.58	102.68	106.31	111.47	115.16	127.06	136.39	169.59
78.5	3.270833	54.08	68.04	77.29	86.12	91.21	97.67	102.77	106.4	111.56	115.25	127.16	136.48	169.67
78.75	3.28125	54.14	68.11	77.36	86.21	91.3	97.76	102.87	106.49	111.66	115.35	127.26	136.58	169.74
79	3.291667	54.2	68.18	77.44	86.29	91.38	97.85	102.96	106.59	111.75	115.44	127.35	136.67	169.81
79.25	3.302083	54.25	68.25	77.52	86.37	91.47	97.94	103.05	106.68	111.85	115.54	127.45	136.76	169.89
79.5	3.3125	54.31	68.32	77.59	86.46	91.56	98.03	103.14	106.77	111.94	115.63	127.55	136.86	169.96
79.75	3.322917	54.37	68.39	77.67	86.54	91.64	98.12	103.23	106.86	112.04	115.73	127.64	136.95	170.04
80	3.333333	54.43	68.46	77.75	86.62	91.73	98.21	103.33	106.96	112.13	115.83	127.74	137.05	170.11
80.25	3.34375	54.49	68.53	77.83	86.71	91.81	98.3	103.42	107.05	112.22	115.92	127.84	137.15	170.19
80.5	3.354167	54.55	68.6	77.9	86.79	91.9	98.39	103.51	107.14	112.32	116.02	127.93	137.24	170.26
80.75	3.364583	54.61	68.68	77.98	86.87	91.99	98.48	103.6	107.24	112.41	116.11	128.03	137.34	170.34
81	3.375	54.67	68.75	78.06	86.96	92.07	98.57	103.69	107.33	112.51	116.21	128.13	137.43	170.41
81.25	3.385417	54.72	68.82	78.13	87.04	92.16	98.65	103.79	107.42	112.6	116.3	128.22	137.53	170.49
81.5	3.395833	54.78	68.89	78.21	87.12	92.24	98.74	103.88	107.52	112.7	116.4	128.32	137.62	170.57
81.75	3.40625	54.84	68.96	78.29	87.2	92.33	98.83	103.97	107.61	112.79	116.49	128.42	137.72	170.64
82	3.416667	54.9	69.03	78.36	87.29	92.41	98.92	104.06	107.7	112.89	116.59	128.52	137.81	170.72
82.25	3.427083	54.96	69.1	78.44	87.37	92.5	99.01	104.15	107.79	112.98	116.69	128.61	137.91	170.8
82.5	3.4375	55.02	69.17	78.52	87.45	92.59	99.1	104.24	107.89	113.08	116.78	128.71	138.01	170.87
82.75	3.447917	55.08	69.24	78.59	87.54	92.67	99.19	104.34	107.98	113.17	116.88	128.81	138.1	170.95
83	3.458333	55.13	69.3	78.67	87.62	92.76	99.28	104.43	108.07	113.26	116.97	128.91	138.2	171.03
83.25	3.46875	55.19	69.37	78.75	87.7	92.84	99.37	104.52	108.17	113.36	117.07	129	138.3	171.1
83.5	3.479167	55.25	69.44	78.82	87.78	92.93	99.46	104.61	108.26	113.45	117.16	129.1	138.39	171.18
83.75	3.489583	55.31	69.51	78.9	87.87	93.01	99.55	104.7	108.35	113.55	117.26	129.2	138.49	171.26
84	3.5	55.37	69.58	78.98	87.95	93.1	99.64	104.79	108.45	113.64	117.36	129.3	138.59	171.34
84.25	3.510417	55.42	69.65	79.05	88.03	93.18	99.73	104.88	108.54	113.74	117.45	129.4	138.68	171.41
84.5	3.520833	55.48	69.72	79.13	88.11	93.27	99.82	104.98	108.63	113.83	117.55	129.49	138.78	171.49
84.75	3.53125	55.54	69.79	79.21	88.2	93.36	99.9	105.07	108.72	113.93	117.64	129.59	138.88	171.57
85	3.541667	55.6	69.86	79.28	88.28	93.44	99.99	105.16	108.82	114.02	117.74	129.69	138.98	171.65
85.25	3.552083	55.65	69.93	79.36	88.36	93.53	100.08	105.25	108.91	114.12	117.84	129.79	139.07	171.73
85.5	3.5625	55.71	70	79.43	88.44	93.61	100.17	105.34	109	114.21	117.93	129.89	139.17	171.81
85.75	3.572917	55.77	70.07	79.51	88.53	93.7	100.26	105.43	109.1	114.31	118.03	129.99	139.27	171.89
86	3.583333	55.83	70.14	79.59	88.61	93.78	100.35	105.53	109.19	114.4	118.12	130.08	139.37	171.96
86.25	3.59375	55.88	70.21	79.66	88.69	93.87	100.44	105.62	109.28	114.5	118.22	130.18	139.47	172.04
86.5	3.604167	55.94	70.28	79.74	88.77	93.95	100.53	105.71	109.38	114.59	118.32	130.28	139.56	172.12
86.75	3.614583	56	70.34	79.81	88.86	94.04	100.62	105.8	109.47	114.69	118.41	130.38	139.66	172.2

87	3.625	56.06	70.41	79.89	88.94	94.12	100.71	105.89	109.56	114.78	118.51	130.48	139.76	172.28
87.25	3.635417	56.11	70.48	79.96	89.02	94.21	100.79	105.98	109.65	114.87	118.6	130.58	139.86	172.36
87.5	3.645833	56.17	70.55	80.04	89.1	94.29	100.88	106.07	109.75	114.97	118.7	130.68	139.96	172.44
87.75	3.65625	56.23	70.62	80.12	89.18	94.38	100.97	106.17	109.84	115.06	118.8	130.78	140.06	172.52
88	3.666667	56.29	70.69	80.19	89.27	94.46	101.06	106.26	109.93	115.16	118.89	130.88	140.16	172.61
88.25	3.677083	56.34	70.76	80.27	89.35	94.55	101.15	106.35	110.03	115.25	118.99	130.98	140.26	172.69
88.5	3.6875	56.4	70.83	80.34	89.43	94.63	101.24	106.44	110.12	115.35	119.09	131.07	140.35	172.77
88.75	3.697917	56.46	70.89	80.42	89.51	94.72	101.33	106.53	110.21	115.44	119.18	131.17	140.45	172.85
89	3.708333	56.51	70.96	80.49	89.59	94.8	101.42	106.62	110.3	115.54	119.28	131.27	140.55	172.93
89.25	3.71875	56.57	71.03	80.57	89.67	94.89	101.5	106.71	110.4	115.63	119.37	131.37	140.65	173.01
89.5	3.729167	56.63	71.1	80.64	89.76	94.97	101.59	106.8	110.49	115.73	119.47	131.47	140.75	173.09
89.75	3.739583	56.68	71.17	80.72	89.84	95.06	101.68	106.9	110.58	115.82	119.57	131.57	140.85	173.18
90	3.75	56.74	71.24	80.79	89.92	95.14	101.77	106.99	110.68	115.92	119.66	131.67	140.95	173.26
90.25	3.760417	56.8	71.3	80.87	90	95.22	101.86	107.08	110.77	116.01	119.76	131.77	141.05	173.34
90.5	3.770833	56.85	71.37	80.94	90.08	95.31	101.95	107.17	110.86	116.11	119.86	131.87	141.15	173.42
90.75	3.78125	56.91	71.44	81.02	90.16	95.39	102.04	107.26	110.95	116.2	119.95	131.97	141.25	173.51
91	3.791667	56.97	71.51	81.09	90.25	95.48	102.12	107.35	111.05	116.3	120.05	132.07	141.35	173.59
91.25	3.802083	57.02	71.58	81.17	90.33	95.56	102.21	107.44	111.14	116.39	120.15	132.17	141.45	173.67
91.5	3.8125	57.08	71.65	81.24	90.41	95.65	102.3	107.53	111.23	116.49	120.24	132.27	141.55	173.76
91.75	3.822917	57.14	71.71	81.32	90.49	95.73	102.39	107.63	111.33	116.58	120.34	132.37	141.65	173.84
92	3.833333	57.19	71.78	81.39	90.57	95.82	102.48	107.72	111.42	116.68	120.44	132.47	141.76	173.92
92.25	3.84375	57.25	71.85	81.47	90.65	95.9	102.57	107.81	111.51	116.77	120.53	132.57	141.86	174.01
92.5	3.854167	57.31	71.92	81.54	90.73	95.99	102.66	107.9	111.61	116.87	120.63	132.68	141.96	174.09
92.75	3.864583	57.36	71.98	81.62	90.82	96.07	102.74	107.99	111.7	116.97	120.73	132.78	142.06	174.18
93	3.875	57.42	72.05	81.69	90.9	96.15	102.83	108.08	111.79	117.06	120.82	132.88	142.16	174.26
93.25	3.885417	57.47	72.12	81.77	90.98	96.24	102.92	108.17	111.88	117.16	120.92	132.98	142.26	174.34
93.5	3.895833	57.53	72.19	81.84	91.06	96.32	103.01	108.26	111.98	117.25	121.02	133.08	142.36	174.43
93.75	3.90625	57.59	72.26	81.92	91.14	96.41	103.1	108.36	112.07	117.35	121.11	133.18	142.46	174.51
94	3.916667	57.64	72.32	81.99	91.22	96.49	103.19	108.45	112.16	117.44	121.21	133.28	142.57	174.6
94.25	3.927083	57.7	72.39	82.07	91.3	96.58	103.27	108.54	112.26	117.54	121.31	133.38	142.67	174.69
94.5	3.9375	57.75	72.46	82.14	91.38	96.66	103.36	108.63	112.35	117.63	121.41	133.48	142.77	174.77
94.75	3.947917	57.81	72.53	82.21	91.46	96.74	103.45	108.72	112.44	117.73	121.5	133.59	142.87	174.86
95	3.958333	57.87	72.59	82.29	91.55	96.83	103.54	108.81	112.54	117.82	121.6	133.69	142.97	174.94
95.25	3.96875	57.92	72.66	82.36	91.63	96.91	103.63	108.9	112.63	117.92	121.7	133.79	143.08	175.03
95.5	3.979167	57.98	72.73	82.44	91.71	97	103.72	108.99	112.72	118.01	121.79	133.89	143.18	175.12
95.75	3.989583	58.03	72.8	82.51	91.79	97.08	103.8	109.09	112.81	118.11	121.89	133.99	143.28	175.2
96	4	58.09	72.86	82.59	91.87	97.16	103.89	109.18	112.91	118.2	121.99	134.09	143.39	175.29

Project: Marlbrook Farm Poultry Site Drainage

Greenfield Runoff Rate and Runoff Volume Calculation

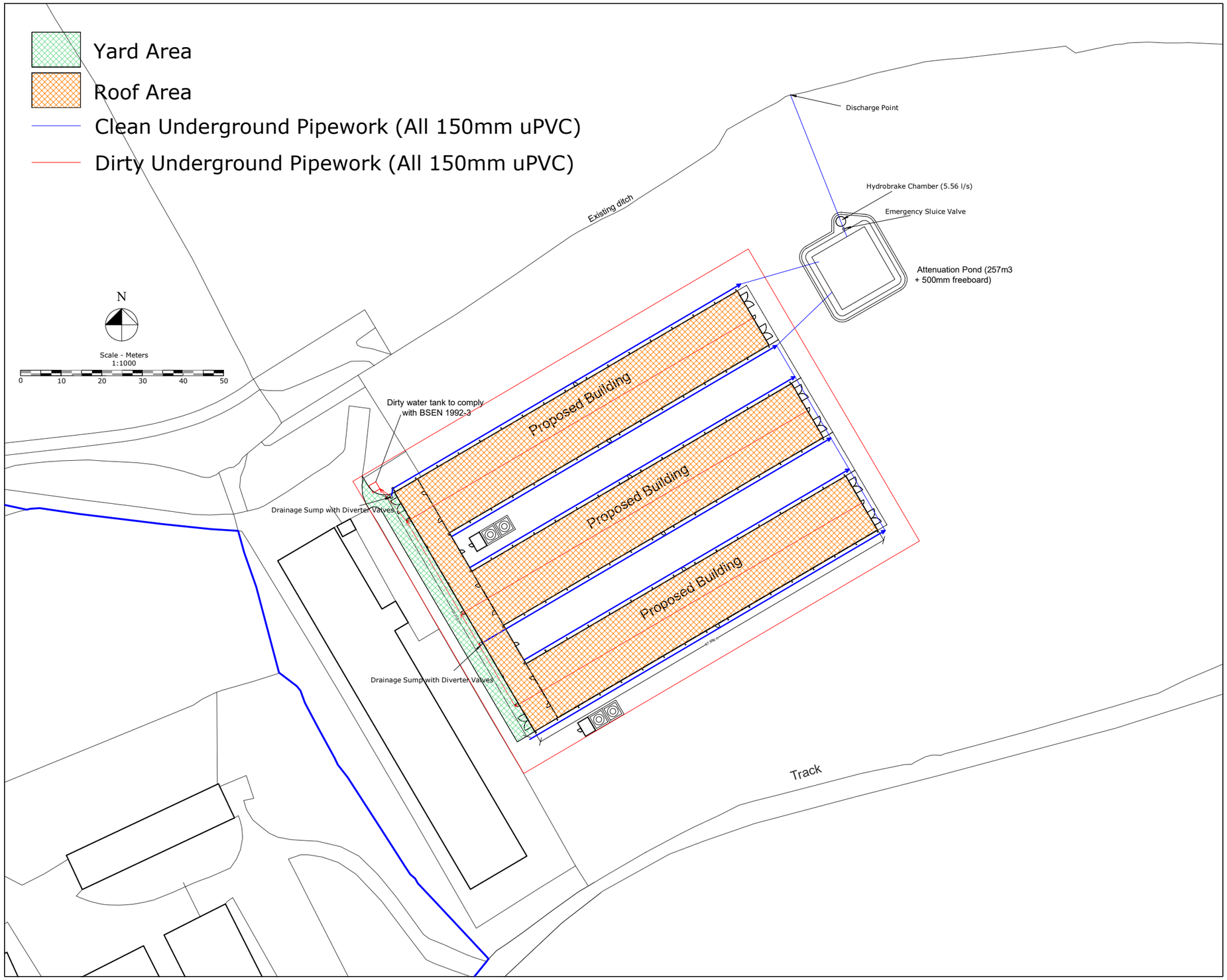
Time	100 year 1.4 CC design rainfall - FEH 2013 model	Urban net rain mm (100 year 1.4 CC) - as 100% rural model	Rural net rain mm (100 year 1.4 CC) - as 100% rural model	Sewer loss m3/s (100 year 1.4 CC) - as 100% rural model	Total net rain mm (100 year 1.4 CC) - as 100% rural model	Direct runoff m3/s (100 year 1.4 CC) - as 100% rural model	Baseflow m3/s (100 year 1.4 CC) - as 100% rural model	Total flow m3/s (100 year 1.4 CC) - as 100% rural model
00:00:00	1.116832352	0	0.1644076	0	0.1644076	0.000000000	0.000095388	0.000095388
00:24:00	1.632052339	0	0.244263887	0	0.244263887	0.000008098	0.000094644	0.000102742
00:48:00	2.379182775	0	0.364617511	0	0.364617511	0.000036324	0.000094274	0.000130597
01:12:00	3.45761111	0	0.54793489	0	0.54793489	0.000094539	0.000094781	0.000189320
01:36:00	5.003546744	0	0.830776182	0	0.830776182	0.000197701	0.000096915	0.000294616
02:00:00	7.192949207	0	1.272739763	0	1.272739763	0.000368352	0.000101800	0.000470152
02:24:00	10.19894573	0	1.963228404	0	1.963228404	0.000625365	0.000110967	0.000736332
02:48:00	12.74684244	0	2.715201625	0	2.715201625	0.001007506	0.000126516	0.001134023
03:12:00	10.19894573	0	2.381721204	0	2.381721204	0.001568994	0.000151472	0.001720467
03:36:00	7.192949207	0	1.786935276	0	1.786935276	0.00230487	0.000189329	0.002494198
04:00:00	5.003546744	0	1.297589616	0	1.297589616	0.003130411	0.000242635	0.003373046
04:24:00	3.45761111	0	0.922834067	0	0.922834067	0.003934945	0.000311935	0.004246881
04:48:00	2.379182775	0	0.647418851	0	0.647418851	0.004584183	0.000395289	0.004979472
05:12:00	1.632052339	0	0.449964538	0	0.449964538	0.004938375	0.000488008	0.005426383
05:36:00	1.116832352	0	0.310660966	0	0.310660966	0.004975649	0.000583817	0.005559466
06:00:00	0	0	0	0	0	0.004767049	0.000677008	0.005444057
06:24:00	0	0	0	0	0	0.004385707	0.000763396	0.005149103
06:48:00	0	0	0	0	0	0.003901226	0.000840278	0.004741504
07:12:00	0	0	0	0	0	0.003384006	0.000906382	0.004290388
07:36:00	0	0	0	0	0	0.002868212	0.000961498	0.003829709
08:00:00	0	0	0	0	0	0.002364353	0.001005861	0.003370214
08:24:00	0	0	0	0	0	0.001898404	0.001040069	0.002938473
08:48:00	0	0	0	0	0	0.001479289	0.001065062	0.002544351
09:12:00	0	0	0	0	0	0.001105696	0.00108185	0.002187546
09:36:00	0	0	0	0	0	0.000783409	0.00109148	0.001874889
10:00:00	0	0	0	0	0	0.000524898	0.001095176	0.001620074
10:24:00	0	0	0	0	0	0.00033497	0.001094326	0.001429296
10:48:00	0	0	0	0	0	0.000203106	0.001090249	0.001293355
11:12:00	0	0	0	0	0	0.000115052	0.001084	0.001199052
11:36:00	0	0	0	0	0	0.000058782	0.001076356	0.001135138
12:00:00	0	0	0	0	0	0.000025104	0.001067875	0.001092979
12:24:00	0	0	0	0	0	0.000007269	0.001058951	0.00106622
12:48:00	0	0	0	0	0	0.000000442	0.001049856	0.001050299
13:12:00	0	0	0	0	0	0.000000000	0.001040768	0.001040768
13:36:00	0	0	0	0	0	0	0.001031753	0.001031753
14:00:00	0	0	0	0	0	0	0.001022817	0.001022817
14:24:00	0	0	0	0	0	0	0.001013958	0.001013958
14:48:00	0	0	0	0	0	0	0.001005176	0.001005176
15:12:00	0	0	0	0	0	0	0.00099647	0.00099647
15:36:00	0	0	0	0	0	0	0.000987839	0.000987839
16:00:00	0	0	0	0	0	0	0.000979283	0.000979283
16:24:00	0	0	0	0	0	0	0.000970801	0.000970801
16:48:00	0	0	0	0	0	0	0.000962393	0.000962393
17:12:00	0	0	0	0	0	0	0.000954057	0.000954057
17:36:00	0	0	0	0	0	0	0.000945794	0.000945794
18:00:00	0	0	0	0	0	0	0.000937602	0.000937602
18:24:00	0	0	0	0	0	0	0.000929481	0.000929481
18:48:00	0	0	0	0	0	0	0.00092143	0.00092143
19:12:00	0	0	0	0	0	0	0.00091345	0.00091345
19:36:00	0	0	0	0	0	0	0.000905538	0.000905538
20:00:00	0	0	0	0	0	0	0.000897695	0.000897695
20:24:00	0	0	0	0	0	0	0.000889919	0.000889919
20:48:00	0	0	0	0	0	0	0.000882212	0.000882212
21:12:00	0	0	0	0	0	0	0.00087457	0.00087457
21:36:00	0	0	0	0	0	0	0.000866995	0.000866995
22:00:00	0	0	0	0	0	0	0.000859486	0.000859486
22:24:00	0	0	0	0	0	0	0.000852042	0.000852042
22:48:00	0	0	0	0	0	0	0.000844662	0.000844662
23:12:00	0	0	0	0	0	0	0.000837346	0.000837346
23:36:00	0	0	0	0	0	0	0.000830094	0.000830094
24:00:00	0	0	0	0	0	0	0.000822904	0.000822904
24:24:00	0	0	0	0	0	0	0.000815776	0.000815776
24:48:00	0	0	0	0	0	0	0.000808711	0.000808711
25:12:00	0	0	0	0	0	0	0.000801706	0.000801706
25:36:00	0	0	0	0	0	0	0.000794762	0.000794762
26:00:00	0	0	0	0	0	0	0.000787879	0.000787879
26:24:00	0	0	0	0	0	0	0.000781055	0.000781055
26:48:00	0	0	0	0	0	0	0.00077429	0.00077429
27:12:00	0	0	0	0	0	0	0.000767583	0.000767583
27:36:00	0	0	0	0	0	0	0.000760935	0.000760935
28:00:00	0	0	0	0	0	0	0.000754344	0.000754344
28:24:00	0	0	0	0	0	0	0.000747811	0.000747811
28:48:00	0	0	0	0	0	0	0.000741334	0.000741334
29:12:00	0	0	0	0	0	0	0.000734913	0.000734913
29:36:00	0	0	0	0	0	0	0.000728547	0.000728547
30:00:00	0	0	0	0	0	0	0.000722237	0.000722237

30:24:00	0	0	0	0	0	0	0.000715982	0.000715982
30:48:00	0	0	0	0	0	0	0.00070978	0.00070978
31:12:00	0	0	0	0	0	0	0.000703633	0.000703633
31:36:00	0	0	0	0	0	0	0.000697538	0.000697538
32:00:00	0	0	0	0	0	0	0.000691497	0.000691497
32:24:00	0	0	0	0	0	0	0.000685507	0.000685507
32:48:00	0	0	0	0	0	0	0.00067957	0.00067957
33:12:00	0	0	0	0	0	0	0.000673684	0.000673684
33:36:00	0	0	0	0	0	0	0.000667849	0.000667849
34:00:00	0	0	0	0	0	0	0.000662065	0.000662065
34:24:00	0	0	0	0	0	0	0.00065633	0.00065633
34:48:00	0	0	0	0	0	0	0.000650645	0.000650645
35:12:00	0	0	0	0	0	0	0.00064501	0.00064501
35:36:00	0	0	0	0	0	0	0.000639423	0.000639423
36:00:00	0	0	0	0	0	0	0.000633885	0.000633885
36:24:00	0	0	0	0	0	0	0.000628395	0.000628395
36:48:00	0	0	0	0	0	0	0.000622952	0.000622952
37:12:00	0	0	0	0	0	0	0.000617557	0.000617557
37:36:00	0	0	0	0	0	0	0.000612208	0.000612208
38:00:00	0	0	0	0	0	0	0.000606905	0.000606905
38:24:00	0	0	0	0	0	0	0.000601649	0.000601649
38:48:00	0	0	0	0	0	0	0.000596437	0.000596437
39:12:00	0	0	0	0	0	0	0.000591271	0.000591271
39:36:00	0	0	0	0	0	0	0.00058615	0.00058615
40:00:00	0	0	0	0	0	0	0.000581073	0.000581073
40:24:00	0	0	0	0	0	0	0.000576041	0.000576041
40:48:00	0	0	0	0	0	0	0.000571051	0.000571051
41:12:00	0	0	0	0	0	0	0.000566105	0.000566105
41:36:00	0	0	0	0	0	0	0.000561202	0.000561202
42:00:00	0	0	0	0	0	0	0.000556341	0.000556341
42:24:00	0	0	0	0	0	0	0.000551523	0.000551523
42:48:00	0	0	0	0	0	0	0.000546746	0.000546746
43:12:00	0	0	0	0	0	0	0.00054201	0.00054201
43:36:00	0	0	0	0	0	0	0.000537316	0.000537316
44:00:00	0	0	0	0	0	0	0.000532662	0.000532662
44:24:00	0	0	0	0	0	0	0.000528048	0.000528048
44:48:00	0	0	0	0	0	0	0.000523475	0.000523475
45:12:00	0	0	0	0	0	0	0.000518941	0.000518941
45:36:00	0	0	0	0	0	0	0.000514446	0.000514446
46:00:00	0	0	0	0	0	0	0.00050999	0.00050999
46:24:00	0	0	0	0	0	0	0.000505573	0.000505573
46:48:00	0	0	0	0	0	0	0.000501194	0.000501194
47:12:00	0	0	0	0	0	0	0.000496853	0.000496853
47:36:00	0	0	0	0	0	0	0.00049255	0.00049255
48:00:00	0	0	0	0	0	0	0.000488283	0.000488283
48:24:00	0	0	0	0	0	0	0.000484054	0.000484054
48:48:00	0	0	0	0	0	0	0.000479862	0.000479862
49:12:00	0	0	0	0	0	0	0.000475705	0.000475705
49:36:00	0	0	0	0	0	0	0.000471585	0.000471585
50:00:00	0	0	0	0	0	0	0.000467501	0.000467501
50:24:00	0	0	0	0	0	0	0.000463451	0.000463451
50:48:00	0	0	0	0	0	0	0.000459437	0.000459437
51:12:00	0	0	0	0	0	0	0.000455458	0.000455458
51:36:00	0	0	0	0	0	0	0.000451513	0.000451513
52:00:00	0	0	0	0	0	0	0.000447602	0.000447602
52:24:00	0	0	0	0	0	0	0.000443726	0.000443726
52:48:00	0	0	0	0	0	0	0.000439882	0.000439882
53:12:00	0	0	0	0	0	0	0.000436072	0.000436072
53:36:00	0	0	0	0	0	0	0.000432295	0.000432295
54:00:00	0	0	0	0	0	0	0.000428551	0.000428551
54:24:00	0	0	0	0	0	0	0.000424839	0.000424839
54:48:00	0	0	0	0	0	0	0.00042116	0.00042116
55:12:00	0	0	0	0	0	0	0.000417512	0.000417512
55:36:00	0	0	0	0	0	0	0.000413896	0.000413896
56:00:00	0	0	0	0	0	0	0.000410311	0.000410311
56:24:00	0	0	0	0	0	0	0.000406757	0.000406757
56:48:00	0	0	0	0	0	0	0.000403234	0.000403234
57:12:00	0	0	0	0	0	0	0.000399741	0.000399741
57:36:00	0	0	0	0	0	0	0.000396279	0.000396279
58:00:00	0	0	0	0	0	0	0.000392847	0.000392847
58:24:00	0	0	0	0	0	0	0.000389444	0.000389444
58:48:00	0	0	0	0	0	0	0.000386071	0.000386071
59:12:00	0	0	0	0	0	0	0.000382727	0.000382727
59:36:00	0	0	0	0	0	0	0.000379412	0.000379412
60:00:00	0	0	0	0	0	0	0.000376126	0.000376126
60:24:00	0	0	0	0	0	0	0.000372868	0.000372868
60:48:00	0	0	0	0	0	0	0.000369639	0.000369639
61:12:00	0	0	0	0	0	0	0.000366437	0.000366437
61:36:00	0	0	0	0	0	0	0.000363263	0.000363263
62:00:00	0	0	0	0	0	0	0.000360117	0.000360117
62:24:00	0	0	0	0	0	0	0.000356998	0.000356998
62:48:00	0	0	0	0	0	0	0.000353906	0.000353906

63:12:00	0	0	0	0	0	0	0.000350841	0.000350841
63:36:00	0	0	0	0	0	0	0.000347802	0.000347802
64:00:00	0	0	0	0	0	0	0.000344789	0.000344789
64:24:00	0	0	0	0	0	0	0.000341803	0.000341803
64:48:00	0	0	0	0	0	0	0.000338843	0.000338843
65:12:00	0	0	0	0	0	0	0.000335908	0.000335908
65:36:00	0	0	0	0	0	0	0.000332998	0.000332998
66:00:00	0	0	0	0	0	0	0.000330114	0.000330114
66:24:00	0	0	0	0	0	0	0.000327255	0.000327255
66:48:00	0	0	0	0	0	0	0.00032442	0.00032442
67:12:00	0	0	0	0	0	0	0.000321611	0.000321611
67:36:00	0	0	0	0	0	0	0.000318825	0.000318825
68:00:00	0	0	0	0	0	0	0.000316064	0.000316064
68:24:00	0	0	0	0	0	0	0.000313326	0.000313326
68:48:00	0	0	0	0	0	0	0.000310612	0.000310612
69:12:00	0	0	0	0	0	0	0.000307922	0.000307922
69:36:00	0	0	0	0	0	0	0.000305255	0.000305255
70:00:00	0	0	0	0	0	0	0.000302611	0.000302611
70:24:00	0	0	0	0	0	0	0.00029999	0.00029999
70:48:00	0	0	0	0	0	0	0.000297392	0.000297392
71:12:00	0	0	0	0	0	0	0.000294816	0.000294816
71:36:00	0	0	0	0	0	0	0.000292262	0.000292262
72:00:00	0	0	0	0	0	0	0.000289731	0.000289731
72:24:00	0	0	0	0	0	0	0.000287221	0.000287221
72:48:00	0	0	0	0	0	0	0.000284734	0.000284734
73:12:00	0	0	0	0	0	0	0.000282268	0.000282268
73:36:00	0	0	0	0	0	0	0.000279823	0.000279823
74:00:00	0	0	0	0	0	0	0.000277399	0.000277399
74:24:00	0	0	0	0	0	0	0.000274996	0.000274996
74:48:00	0	0	0	0	0	0	0.000272615	0.000272615
75:12:00	0	0	0	0	0	0	0.000270253	0.000270253
75:36:00	0	0	0	0	0	0	0.000267913	0.000267913
76:00:00	0	0	0	0	0	0	0.000265592	0.000265592
76:24:00	0	0	0	0	0	0	0.000263292	0.000263292
76:48:00	0	0	0	0	0	0	0.000261011	0.000261011
77:12:00	0	0	0	0	0	0	0.000258751	0.000258751
77:36:00	0	0	0	0	0	0	0.00025651	0.00025651
78:00:00	0	0	0	0	0	0	0.000254288	0.000254288
78:24:00	0	0	0	0	0	0	0.000252085	0.000252085
78:48:00	0	0	0	0	0	0	0.000249902	0.000249902
79:12:00	0	0	0	0	0	0	0.000247737	0.000247737
79:36:00	0	0	0	0	0	0	0.000245592	0.000245592
80:00:00	0	0	0	0	0	0	0.000243465	0.000243465
80:24:00	0	0	0	0	0	0	0.000241356	0.000241356
80:48:00	0	0	0	0	0	0	0.000239265	0.000239265
81:12:00	0	0	0	0	0	0	0.000237193	0.000237193
81:36:00	0	0	0	0	0	0	0.000235139	0.000235139
82:00:00	0	0	0	0	0	0	0.000233102	0.000233102
82:24:00	0	0	0	0	0	0	0.000231083	0.000231083
82:48:00	0	0	0	0	0	0	0.000229082	0.000229082
83:12:00	0	0	0	0	0	0	0.000227097	0.000227097
83:36:00	0	0	0	0	0	0	0.00022513	0.00022513
84:00:00	0	0	0	0	0	0	0.000223181	0.000223181
84:24:00	0	0	0	0	0	0	0.000221247	0.000221247
84:48:00	0	0	0	0	0	0	0.000219331	0.000219331
85:12:00	0	0	0	0	0	0	0.000217431	0.000217431
85:36:00	0	0	0	0	0	0	0.000215548	0.000215548
86:00:00	0	0	0	0	0	0	0.000213681	0.000213681
86:24:00	0	0	0	0	0	0	0.000211831	0.000211831
86:48:00	0	0	0	0	0	0	0.000209996	0.000209996
87:12:00	0	0	0	0	0	0	0.000208177	0.000208177
87:36:00	0	0	0	0	0	0	0.000206374	0.000206374
88:00:00	0	0	0	0	0	0	0.000204586	0.000204586
88:24:00	0	0	0	0	0	0	0.000202814	0.000202814
88:48:00	0	0	0	0	0	0	0.000201058	0.000201058
89:12:00	0	0	0	0	0	0	0.000199316	0.000199316
89:36:00	0	0	0	0	0	0	0.00019759	0.00019759
90:00:00	0	0	0	0	0	0	0.000195879	0.000195879
90:24:00	0	0	0	0	0	0	0.000194182	0.000194182
90:48:00	0	0	0	0	0	0	0.0001925	0.0001925
91:12:00	0	0	0	0	0	0	0.000190833	0.000190833
91:36:00	0	0	0	0	0	0	0.00018918	0.00018918
92:00:00	0	0	0	0	0	0	0.000187541	0.000187541
92:24:00	0	0	0	0	0	0	0.000185917	0.000185917
92:48:00	0	0	0	0	0	0	0.000184307	0.000184307
93:12:00	0	0	0	0	0	0	0.00018271	0.00018271
93:36:00	0	0	0	0	0	0	0.000181128	0.000181128
94:00:00	0	0	0	0	0	0	0.000179559	0.000179559
94:24:00	0	0	0	0	0	0	0.000178004	0.000178004
94:48:00	0	0	0	0	0	0	0.000176462	0.000176462
95:12:00	0	0	0	0	0	0	0.000174934	0.000174934
95:36:00	0	0	0	0	0	0	0.000173419	0.000173419

96:00:00	0	0	0	0	0	0	0.000171917	0.000171917
96:24:00	0	0	0	0	0	0	0.000170428	0.000170428
96:48:00	0	0	0	0	0	0	0.000168951	0.000168951
97:12:00	0	0	0	0	0	0	0.000167488	0.000167488
97:36:00	0	0	0	0	0	0	0.000166037	0.000166037
98:00:00	0	0	0	0	0	0	0.000164599	0.000164599
98:24:00	0	0	0	0	0	0	0.000163174	0.000163174
98:48:00	0	0	0	0	0	0	0.00016176	0.00016176
99:12:00	0	0	0	0	0	0	0.000160359	0.000160359
99:36:00	0	0	0	0	0	0	0.00015897	0.00015897
100:00:00	0	0	0	0	0	0	0.000157593	0.000157593
100:24:00	0	0	0	0	0	0	0.000156229	0.000156229
100:48:00	0	0	0	0	0	0	0.000154875	0.000154875
101:12:00	0	0	0	0	0	0	0.000153534	0.000153534
101:36:00	0	0	0	0	0	0	0.000152204	0.000152204
102:00:00	0	0	0	0	0	0	0.000150886	0.000150886
102:24:00	0	0	0	0	0	0	0.000149579	0.000149579
102:48:00	0	0	0	0	0	0	0.000148283	0.000148283
103:12:00	0	0	0	0	0	0	0.000146999	0.000146999
103:36:00	0	0	0	0	0	0	0.000145726	0.000145726
104:00:00	0	0	0	0	0	0	0.000144464	0.000144464
104:24:00	0	0	0	0	0	0	0.000143212	0.000143212
104:48:00	0	0	0	0	0	0	0.000141972	0.000141972
105:12:00	0	0	0	0	0	0	0.000140742	0.000140742
105:36:00	0	0	0	0	0	0	0.000139523	0.000139523
106:00:00	0	0	0	0	0	0	0.000138315	0.000138315
106:24:00	0	0	0	0	0	0	0.000137117	0.000137117
106:48:00	0	0	0	0	0	0	0.000135929	0.000135929
107:12:00	0	0	0	0	0	0	0.000134752	0.000134752
107:36:00	0	0	0	0	0	0	0.000133585	0.000133585
108:00:00	0	0	0	0	0	0	0.000132428	0.000132428

Appendix C
– Proposed Drainage Network
– Attenuation Pond Cross Section



Rev	Date	Chkd	Description
	08-05-21		First Draft

William Stokes Consulting
Newbury, Shobdon, Leominster, Herefordshire HR6 9LX
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Client
S R Morgan & Sons

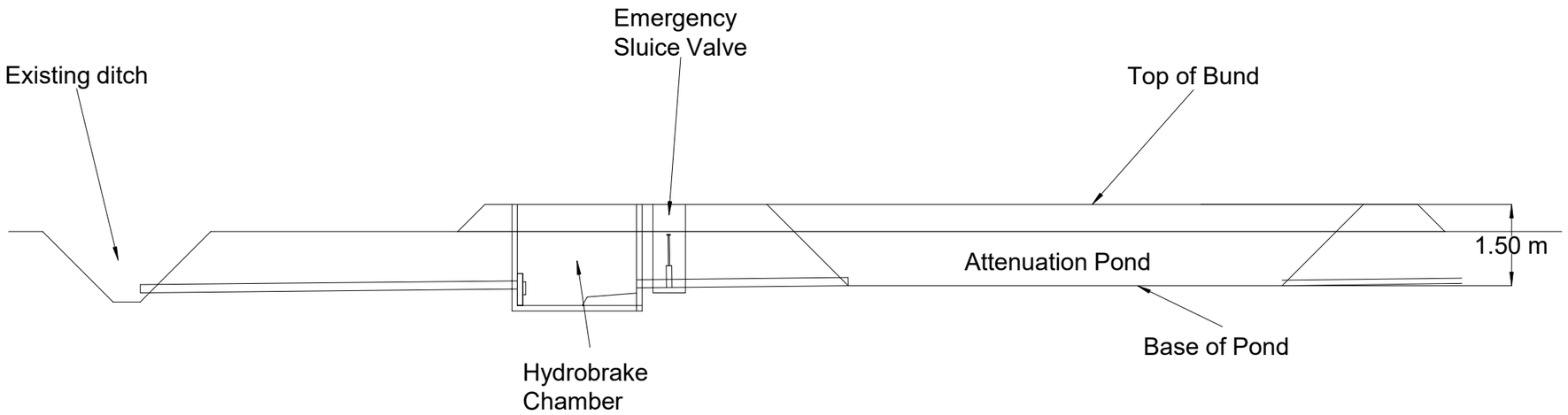
Project
Marlbrook Hall,
Leithall Starkes

Drawing Title

Proposed Drainage

Scale	Date	Drawn By
1:1000 (A3)	May 2021	WS

Drawing Number	REV
EMo/02/30	-



Cross Section through Attenuation Pond / Hydrobrake Chamber

Rev	Date	Chkd	Description
	08-05-21		First Draft

William Stokes Consulting

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Client
S R Morgan & Sons

Project
Marlbrook Hall,
Leithall Starkes

Drawing Title

Proposed Drainage Cross Section

Scale	Date	Drawn By
1:100 (A3)	May 2021	WS

Drawing Number	REV
EMo/02/31	-

Appendix D
– ReFH2 Post Development Runoff Volume & Rate Calculations

Project: Marlbrook Farm Poultry Site Drainage

Post Development Runoff Rate and Runoff Volume Calculation

Time	100 year 1.4 CC design rainfall - FEH 2013 model	Urban net rain mm (100 year 1.4 CC) - urbanised model	Rural net rain mm (100 year 1.4 CC) - urbanised model	Sewer loss m3/s (100 year 1.4 CC) - urbanised model	Total net rain mm (100 year 1.4 CC) - urbanised model	Direct runoff m3/s (100 year 1.4 CC) - urbanised model	Baseflow m3/s (100 year 1.4 CC) - urbanised model	Total flow (100 year 1.4 CC)- urbanised model	
								m3/s	l/s
00:00:00	1.116832352	1.116832352	0	0	1.116832352	0.000000000	0	0.000000000	0
00:24:00	1.632052339	1.632052339	0	0	1.632052339	0.000097791	0	0.000097791	0.097791298
00:48:00	2.379182775	2.379182775	0	0	2.379182775	0.000436279	0	0.000436279	0.436278527
01:12:00	3.45761111	3.45761111	0	0	3.45761111	0.001125995	0	0.001125995	1.125994736
01:36:00	5.003546744	5.003546744	0	0	5.003546744	0.002303811	0	0.002303811	2.303810792
02:00:00	7.192949207	7.192949207	0	0	7.192949207	0.003960494	0	0.003960494	3.960493649
02:24:00	10.19894573	10.19894573	0	0	10.19894573	0.006243734	0	0.006243734	6.243733711
02:48:00	12.74684244	12.74684244	0	0	12.74684244	0.009406401	0	0.009406401	9.406400947
03:12:00	10.19894573	10.19894573	0	0	10.19894573	0.013662063	0	0.013662063	13.66206308
03:36:00	7.192949207	7.192949207	0	0	7.192949207	0.018644651	0	0.018644651	18.64465066
04:00:00	5.003546744	5.003546744	0	0	5.003546744	0.02331123	0	0.02331123	23.3112297
04:24:00	3.45761111	3.45761111	0	0	3.45761111	0.026472516	0	0.026472516	26.47251647
04:48:00	2.379182775	2.379182775	0	0	2.379182775	0.027243761	0	0.027243761	27.24376115
05:12:00	1.632052339	1.632052339	0	0	1.632052339	0.025942608	0	0.025942608	25.94260837
05:36:00	1.116832352	1.116832352	0	0	1.116832352	0.023365786	0	0.023365786	23.36578567
06:00:00	0	0	0	0	0	0.020239592	0	0.020239592	20.23959178
06:24:00	0	0	0	0	0	0.016962943	0	0.016962943	16.96294342
06:48:00	0	0	0	0	0	0.013651485	0	0.013651485	13.65148498
07:12:00	0	0	0	0	0	0.010428196	0	0.010428196	10.4281963
07:36:00	0	0	0	0	0	0.007430565	0	0.007430565	7.43056481
08:00:00	0	0	0	0	0	0.004951144	0	0.004951144	4.951143537
08:24:00	0	0	0	0	0	0.003118404	0	0.003118404	3.118404151
08:48:00	0	0	0	0	0	0.001893224	0	0.001893224	1.893224043
09:12:00	0	0	0	0	0	0.001109362	0	0.001109362	1.109361701
09:36:00	0	0	0	0	0	0.000604733	0	0.000604733	0.604732561
10:00:00	0	0	0	0	0	0.00029265	0	0.00029265	0.292650436
10:24:00	0	0	0	0	0	0.000113394	0	0.000113394	0.11339383
10:48:00	0	0	0	0	0	0.000025419	0	0.000025419	0.025419280
11:12:00	0	0	0	0	0	0.000000000	0	0.000000000	0.000000000

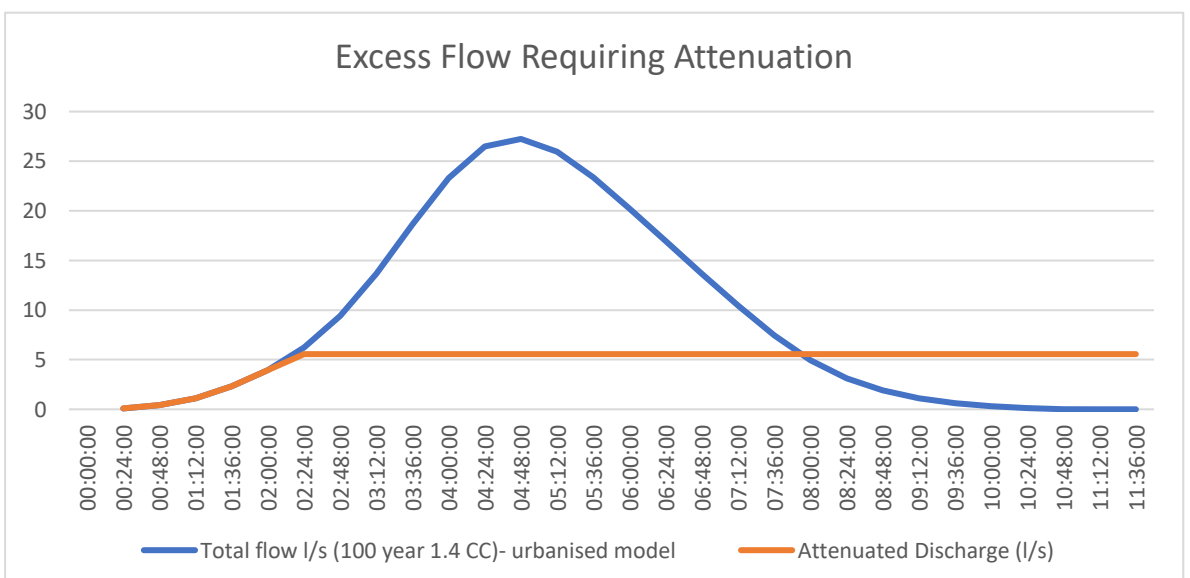
Appendix E
– Peak Flow Attenuation Calculation

Project: Marlbrook Hall

Post Development Runoff Rate and Runoff Volume Calculation

Time	Total flow l/s (100 year 1.4 CC)- urbanised model	Attenuated Discharge (l/s)	Restricted flow (l/s)	Restricted Volume (m3)
00:00:00				
00:24:00	0.09779130	0.09779130	0.00000000	0.00000000
00:48:00	0.43627853	0.43627853	0.00000000	0.00000000
01:12:00	1.12599474	1.12599474	0.00000000	0.00000000
01:36:00	2.30381079	2.30381079	0.00000000	0.00000000
02:00:00	3.96049365	3.96049365	0.00000000	0.00000000
02:24:00	6.24373371	5.56000000	0.68373371	0.98457654
02:48:00	9.40640095	5.56000000	3.84640095	6.52339391
03:12:00	13.66206308	5.56000000	8.10206308	18.19036474
03:36:00	18.64465066	5.56000000	13.08465066	37.03226169
04:00:00	23.31122970	5.56000000	17.75122970	62.59403246
04:24:00	26.47251647	5.56000000	20.91251647	92.70805618
04:48:00	27.24376115	5.56000000	21.68376115	123.93267223
05:12:00	25.94260837	5.56000000	20.38260837	153.28362828
05:36:00	23.36578567	5.56000000	17.80578567	178.92395964
06:00:00	20.23959178	5.56000000	14.67959178	200.06257180
06:24:00	16.96294342	5.56000000	11.40294342	216.48281033
06:48:00	13.65148498	5.56000000	8.09148498	228.13454870
07:12:00	10.42819630	5.56000000	4.86819630	235.14475137
07:36:00	7.43056481	5.56000000	1.87056481	237.83836469
08:00:00	4.95114354	5.56000000	-0.60885646	236.96161139
08:24:00	3.11840415	5.56000000	-2.44159585	233.44571336
08:48:00	1.89322404	5.56000000	-3.66677596	228.16555599
09:12:00	1.10936170	5.56000000	-4.45063830	221.75663684
09:36:00	0.60473256	5.56000000	-4.95526744	214.62105172
10:00:00	0.29265044	5.56000000	-5.26734956	207.03606835
10:24:00	0.11339383	5.56000000	-5.44660617	199.19295547
10:48:00	0.02541928	5.56000000	-5.53458072	191.22315923
11:12:00	0.00000000	5.56000000	-5.56000000	183.21675923
11:36:00	0.00000000	5.56000000	-5.56000000	175.21035923

Peak Storage Requirement = 237.83836469 m3



Appendix F
– Hydrobrake Details

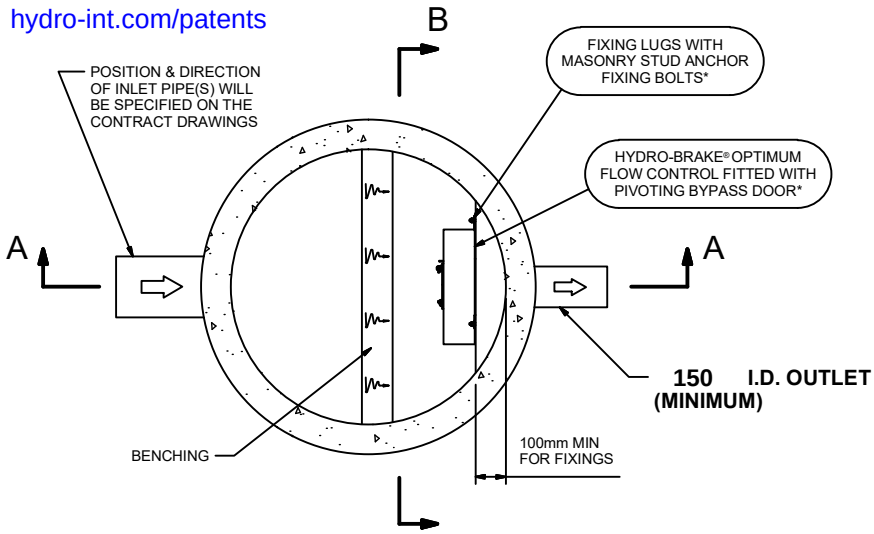
Technical Specification

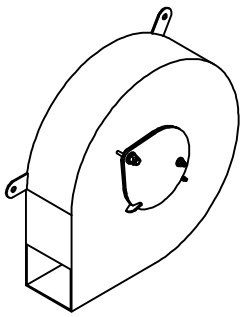
Control Point	Head (m)	Flow (l/s)
Primary Design	1.000	5.560
Flush-Flo™	0.297	5.533
Kick-Flo®	0.642	4.526
Mean Flow		4.811

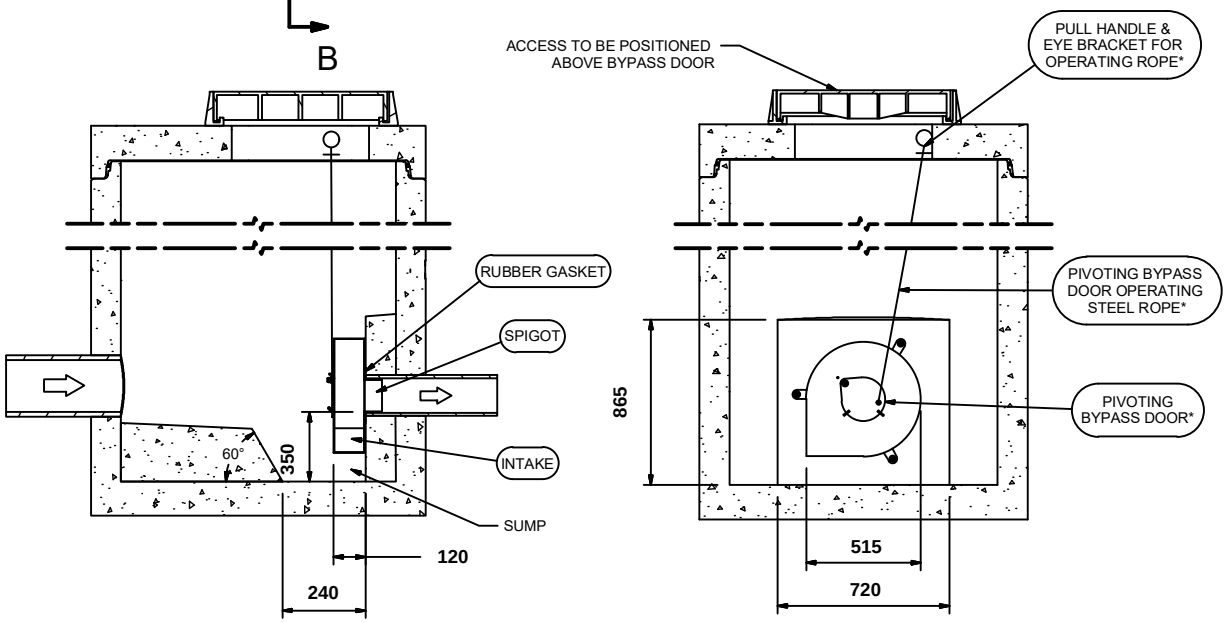
Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet

hydro-int.com/patents







SECTION A-A SECTION B-B

IMPORTANT: ⬭ LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS
* WHERE SUPPLIED
HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE

The head/flow characteristics of this SHE-0111-5560-1000-5560 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International®

DATE	5/11/2021 9:04 AM
SITE	Marlbrook Hall
DESIGNER	Bill Stokes
REF	EMO01

SHE-0111-5560-1000-5560
Hydro-Brake® Optimum

bill@billstokes.co.uk

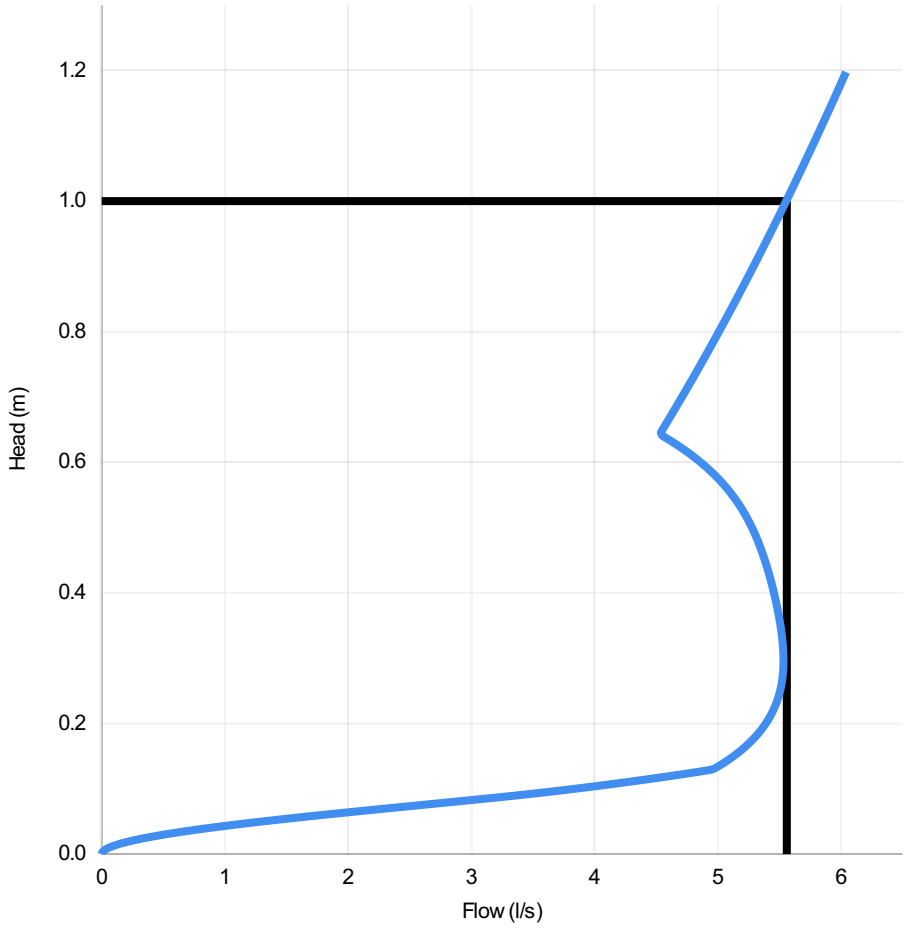
Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.000	5.560
Flush-Flo	0.297	5.533
Kick-Flo®	0.642	4.526
Mean Flow		4.811

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4596

WRc APPROVED
PT/329/0412

hydro-int.com/patents



Head (m)	Flow (l/s)
0.000	0.000
0.034	0.659
0.069	2.261
0.103	3.985
0.138	5.034
0.172	5.268
0.207	5.412
0.241	5.493
0.276	5.528
0.310	5.531
0.345	5.513
0.379	5.480
0.414	5.437
0.448	5.385
0.483	5.318
0.517	5.230
0.552	5.110
0.586	4.944
0.621	4.716
0.655	4.568
0.690	4.677
0.724	4.784
0.759	4.887
0.793	4.989
0.828	5.088
0.862	5.185
0.897	5.280
0.931	5.373
0.966	5.465
1.000	5.555

DESIGN ADVICE

The head/flow characteristics of this SHE-0111-5560-1000-5560 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

! **The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.**

Hydro International®

DATE	11/05/2021 09:04
Site	Marlbrook Hall
DESIGNER	Bill Stokes
Ref	EMO01

SHE-0111-5560-1000-5560

Hydro-Brake Optimum®