

Hollins Strategic Land

Drainage Strategy

Berry Hill Road Adderbury

Ironside Farrar Limited
3 Worsley Court
High Street
Worsley
Manchester
M28 3NJ

30394/SRG

November 2019

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BERRY HILL ROAD
ADDERBURY
DRAINAGE STRATEGY

1.0 Introduction

Hollins Strategic Land have applied for Outline Planning for a residential development at a site off Berry Hill Road, Adderbury, Oxfordshire. A Flood Risk Assessment, prepared by Betts Hydro, was submitted in support of the application but Oxfordshire County Council (OCC) as Lead Local Flood Authority required additional information in respect of the disposal of surface water drainage.

This Drainage Strategy has been compiled to provide the additional information required, reference has been made to the OCC document "Local Standards and Guidance for Surface Water Drainage on Major Development in Oxfordshire". The Appendix C checklist is included at the end of this document.

2.0 Non – Technical Summary

Infiltration tests have confirmed the site is suitable for infiltration techniques.

The drainage layout will therefore consist of the following elements:

- Soakaways for each house.
- Permeable Surfacing to house driveways.
- Adopted Site Access Roads to be drained using permeable surfacing.
- Swales and a basin to intercept overland flows in extreme events.

3.0 Site Details

The site extends to approximately 4ha and is located to the north of Berry Hill Road, close to the junction with Oxford Road (A4260) to the south west of Adderbury village centre; the Location Plan is included in Appendix A.

Currently, the site is largely undeveloped and is used for recreational purposes with existing stables and equestrian ménage present adjacent to the eastern boundary of the site.

There is a general fall from south to north with the northern portion falling more steeply to the boundary; beyond the northern boundary, across adjacent land, the River Cherwell runs from west to east. Levels on the site fall from approximately 109.00m at Berry Hill Road to 96.00m on the northern boundary, the northern portion of the site falls more steeply than the area adjacent to Berry Hill Road. The Existing Site layout and Topography are detailed on drawing no. 30394/101 in Appendix B.

The application is in Outline at present but development on the site will comprise up to 40no. houses with associated site access roads, driveways and open space to the east and north of the site. Appendix C includes the proposed development layout on drawing no. 30394/102.

4.0 Infiltration Test Results

The FRA proposed the surface water drainage of the site could be achieved using Infiltration based on reference to published data. To verify the validity of this assumption, on-site infiltration tests to BRE Digest 365 were undertaken by Brownfield Solutions during September 2019 and the full results are included in Appendix D.

A total of three test locations were included and the locations are shown on drawing no. 30394/102. Two locations were tested on the main development area to the north east and south west; a further test was undertaken in the northern area of the site.

Reference to the detailed results confirms the tests in the development area, SA101 and SA103 returned satisfactory results but SA102 in the northern area of the site did not return a successful test. The results are detailed in the table below:

Location	Infiltration Rate (m/s)			BRE 365 Compliant?
	TEST 1	TEST 2	TEST 3	
SA101	1.66x10 ⁻⁴	1.45x10 ⁻⁴	1.30x10 ⁻⁴	Yes
SA102	2.76x10 ⁻⁶	-	-	No
SA103	1.66x10 ⁻⁴	1.48x10 ⁻⁴	1.68x10 ⁻⁴	Yes

For design purposes, the minimum rate at each location has been used; 1.30 x 10⁻⁴ m/s for SA101 and 1.48 x 10⁻⁴ m/s for SA103.

The testing has therefore demonstrated Infiltration is a suitable method for the discharge of surface water from the proposed development on the site; for the detailed final design additional tests across the development area will be required.

5.0 Proposed Drainage and Maintenance

As detailed in the previous section, Infiltration is a suitable method of surface water drainage for the site. The drainage layout will therefore include the following SuDS elements as detailed on drawing no. 30394/102 in Appendix C:

- Individual Soakaways to each property.
- Permeable surfacing to each property.
- Adopted Site Access Roads to be provided with Permeable Surfacing.

Typical hydraulic calculations for the house soakaways are provided in Appendix E and assume a large and small house on each section of the development, an allowance of 10% has been made for Urban Creep. Full design calculations will be required for the final design.

In addition to the SuDS elements above, the highway corridor will fall in a northerly direction to a series of Swales and an Infiltration basin that will intercept overland flows in the event of extreme rainfall events.

The scheme is in Outline at present but the maintenance responsibilities are:

- Individual Soakaways and private drives will be the responsibility of the householder.
- Shared drives will be joint responsibility

- Adopted highways will be the responsibility of Oxfordshire CC under a S38 Agreement.
- The basin and swales will be maintained by a management company in conjunction with the wider public open space.

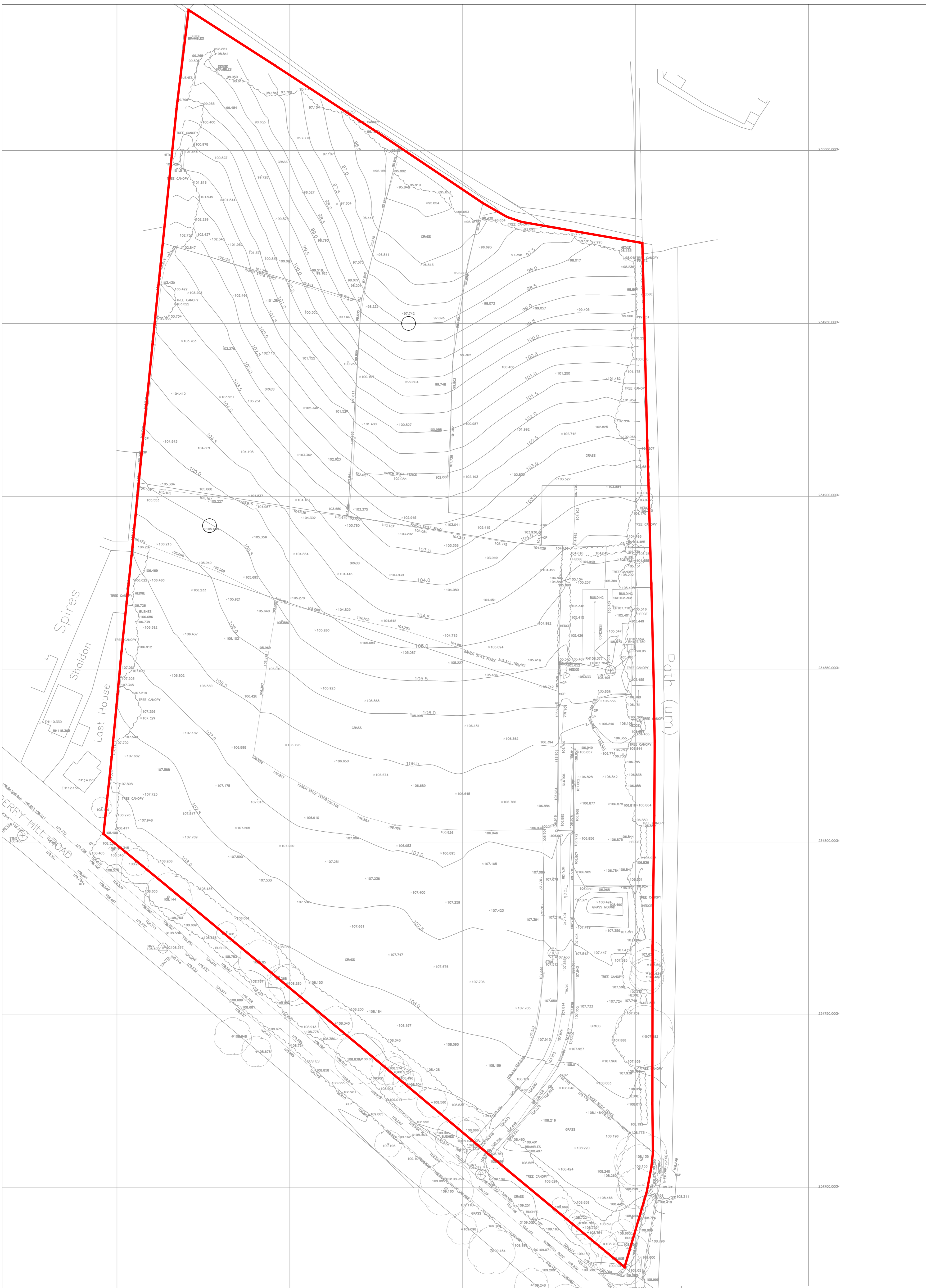
Maintenance regimes for the various elements will be in accordance with CIRIA Manual C753 – The SuDS Manual.

Appendix A
Location Plan
Drawing no. 30394/100



North Point Quality Ass. UKAS 005 Quality Assurance ISO 9001:2008 SGS Certificate GB0254539	Project Berry Hill Road Adderbury	IronsideFarrar Environmental Planners Engineers Architects Landscape Architects Graphic Design 3 Worsley Court MANCHESTER M28 3NJ Tel: 0161 703 8811 Fax: 0161 703 8279 manchester@ironsidefarrar.com	
	Client Hollins Strategic Land		Title Location Plan
A3	Design © Crown Copyright All rights reserved. Licence No. AL100017966	Drawn ME Date NOV 19	Checked By SRG Scale NTS
Drawing No. 30394/100		Revision	

Appendix B
Existing Site and Topography
Drawing no. 30394/101








North Point Quality Ass. UKAS 005 Quality Assurance ISO 9001:2008 SGS Certificate C800254539	Project Berry Hill Road Adderbury	IronsideFarrar Environmental Planners Civil Engineers Landscape Architects Graphic Design 3 Watbly Court MANCHESTER M20 3NJ Tel: 0161 703 8891 Fax: 0161 703 8279 manchester@ironsidefarrar.com EDINBURGH BELLSHILL
	Client Hollins Strategic Land	
Title Existing Site Layout and Topography	Drawn ME Date NOV 19	Checked By SRG Scale 1:500
Drawing No. 30394/101	Revision	

Appendix C
Proposed Development and Drainage
Drawing no. 30394/102



KEY

-  Proposed Domestic Soakaway
- 108.00** Proposed Plot Level
-  Proposed Road level
-  Existing Level
-  Soakaway Test Location
-  Proposed Swale

<p>North Point ↑</p> <p>Quality Ass. UKAS 005 Quality Assurance ISO 9001:2008 SOS Certificate 63820245309</p> <p>Original Size A1</p>	<p>Project Berry Hill Road Adderbury</p> <p>Client Hollins Strategic Land</p> <p>Title Proposed Development and Drainage</p> <p>Drawn ME</p> <p>Checked By SRG</p> <p>Date NOV 19</p> <p>Scale 1:500</p>	<p>IronsideFarrar Environmental Planners Civil Engineers Landscape Architects Graphic Design</p> <p>3 Watnaby Court MANCHESTER M28 3NJ Tel: 0161 703 8801 Fax: 0161 703 8279 manchester@ironsidefarrar.com</p> <p>EDINBURGH BELLSHILL</p> <p>Drawing No. 30394/102</p> <p>Revision</p>
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Appendix D
Infiltration Test
Results



SM/C4304/8800

24th September 2019

Hollins Strategic Land
Suite 4
1 King Street
Manchester
M2 6AW

For the attention of Matthew Symonds,

Dear Matthew,

Re: Berry Hill Road, Adderbury - Infiltration Testing

We are writing to report on the results of the soil infiltration tests undertaken at Berry Hill Road, Adderbury.

The aim of the supplementary investigation was to provide infiltration rates in general accordance with BRE 365 in order to inform drainage design at the site.

Site Works

Three trial pits (SA101 to SA103) were excavated to depths of between 1.50m bgl and 2.10m bgl using a JCB 3CX between on the 10th September 2019. The locations of the trial pits are shown on the appended Exploratory Hole Location Plan (Drawing No. C4304/02).

Ground Conditions

The ground conditions on-site comprised an orange brown clayey sand topsoil, which was encountered from ground level to between 0.30mbgl and 0.40mbgl. The topsoil was underlain by orange brown very sandy clay to depths of 1.50mbgl (SA102). The gravel content increased gradually with depth in SA101 and SA103, becoming gravelly very sandy clay from 0.80m to depths of 2.10m bgl.

Gravel primarily comprises fine to medium angular light grey limestone (assumed to be weathered bedrock), with minor quantities of mudstone. The pits were stable throughout excavations.

Due to the increase in limestone gravel content with depth in SA101 and SA103, it is assumed the limestone bedrock is relatively shallow, therefore there is a potential for fractures present with the bedrock, resulting in fracture flow.

No groundwater was recorded during the excavation of the trial pits.

Results

The tests were undertaken within the very sandy clay, with increasing gravel content with depth in SA101 and SA103. Tests were repeated three times, where feasible, within the available timescales. The results of the infiltration tests indicate poor drainage conditions in the north of the site and good drainage conditions in the southern half of the site, as shown in the table below.

Location	Infiltration Rate (m/s)			BRE 365 Compliant?
	TEST 1	TEST 2	TEST 3	
SA101	1.66×10^{-4}	1.45×10^{-4}	1.30×10^{-4}	Yes
SA102	2.76×10^{-6}	-	-	No
SA103	1.66×10^{-4}	1.48×10^{-4}	1.68×10^{-4}	Yes

*Est. T = Estimated Time.

Discussion

The results show considerable variations in infiltration rate between the locations despite the soakaway tests apparently discharging into similar stratum. The tests in SA101 and SA103 were able to be repeated three times with infiltration rates ranging between 1.30×10^{-4} m/s to 1.68×10^{-4} m/s, indicating good drainage conditions and compliance with BRE 365.

In contrast, poor infiltration was recorded in SA102 over a 3.0 hour period and therefore by extrapolation would not be expected to drain to 25% of the maximum fill volume in 24 hours and therefore would not be compliant with BRE 365.

It is noted that both SA101 and SA103 were completed in the southern half of the site at a higher elevation to SA102, which was completed in a depression in the north of the site. It was also noted that there was an increase in gravel content with depth in SA103 and SA101, compared to SA102 which contained rare gravel fragments. The difference in infiltration rates may be at least partially accounted for by difference in gravel content and location on the site.

Due to the increasing presence of limestone gravel with depth in SA101 and SA103 it is reasonable to assume the limestone bedrock is relatively shallow. BGS borehole records approximately 40-50m north west of the site show the limestone bedrock has been encountered from 2.00mbgl, therefore it is possible that competent bedrock is present below at shallow depths below the tested depth. Based on the information available, the significantly higher infiltration rates measured in SA101 and SA103 may be a result of drainage directly into the underlying limestone bedrock by fracture flow.

In accordance with CIRIA C753 "The SUDS Manual", infiltration viability should be given full consideration where rates of 10^{-6} m/s or greater exist on the site. Where rates are less than this value, the soils can still usefully be used for interception delivery, but disposal of significant volumes of runoff may not be appropriate unless a large area is available, or some form of attenuation can be incorporated.

Based on the infiltration rates obtained, soakaway drainage is likely to be feasible at the site positioned within the tested strata or underlying bedrock, particularly in the vicinity of SA101 and SA103. Note that for soakaway construction purposes, breaking equipment may potentially require locally to penetrate intact rock quality strata. We recommend the design of soakaway drainage is carried out in accordance with BRE 365 and CIRIA C753. Consideration should also be given to future maintenance, where infiltration capacity can be reduced as a result of blinding through ingress of fines.

It is also suggested that the findings of this report are discussed with the Local Authority at the earliest opportunity, to confirm the adequacy of proposed testing and to allow their inspection of any test results.

We trust the above meets your requirements. However, if you have any queries, then please do not hesitate to contact the undersigned.

Yours sincerely

For Brownfield Solutions Ltd



S Murray MGeol (Hons)
Project Engineer
s.murray@brownfield-solutions.co.uk

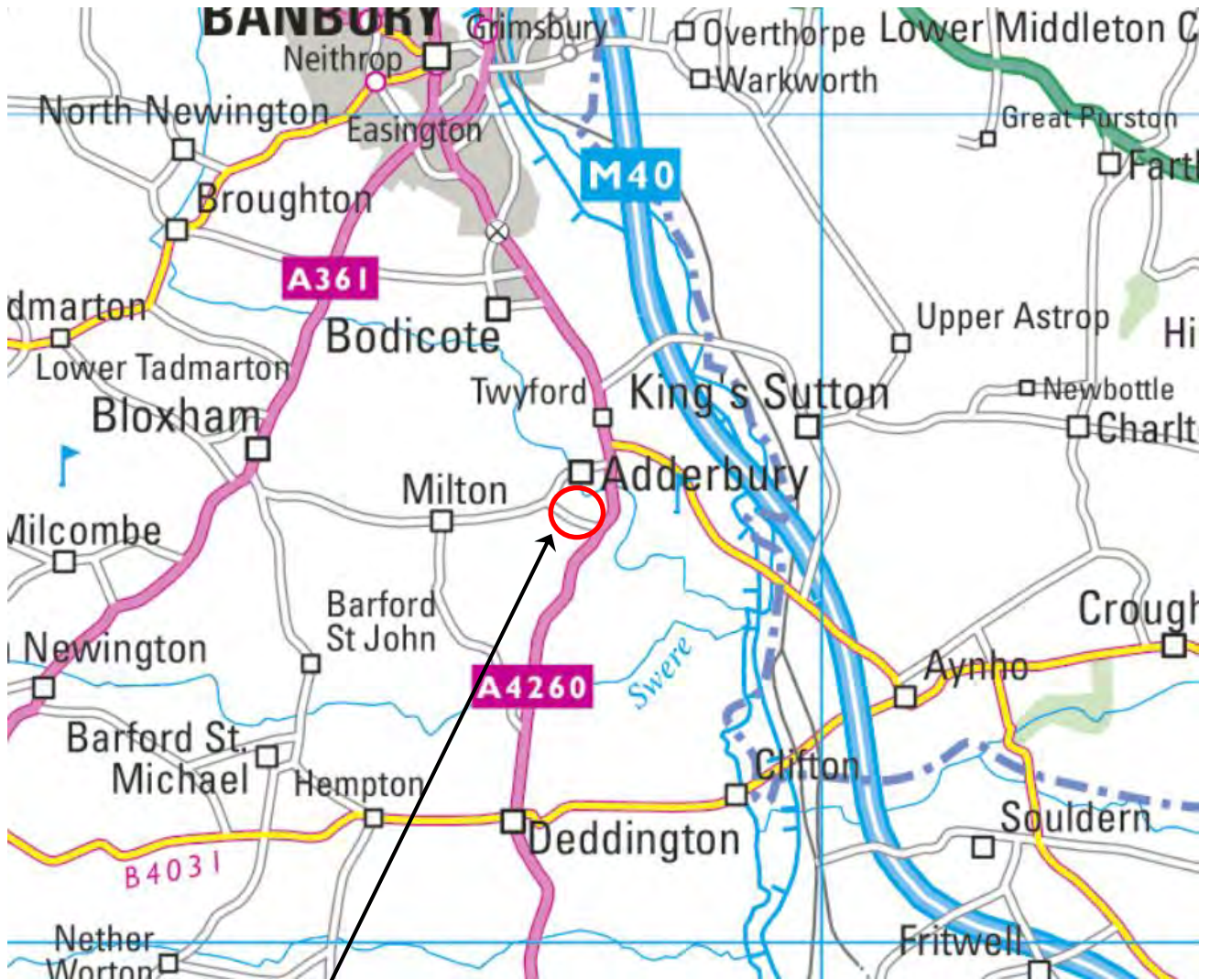
Checked and approved by



A J Stokoe
BSc (Hons) CSci MEnvSc FGS
Principal Project Engineer
a.stokoe@brownfield-solutions.co.uk

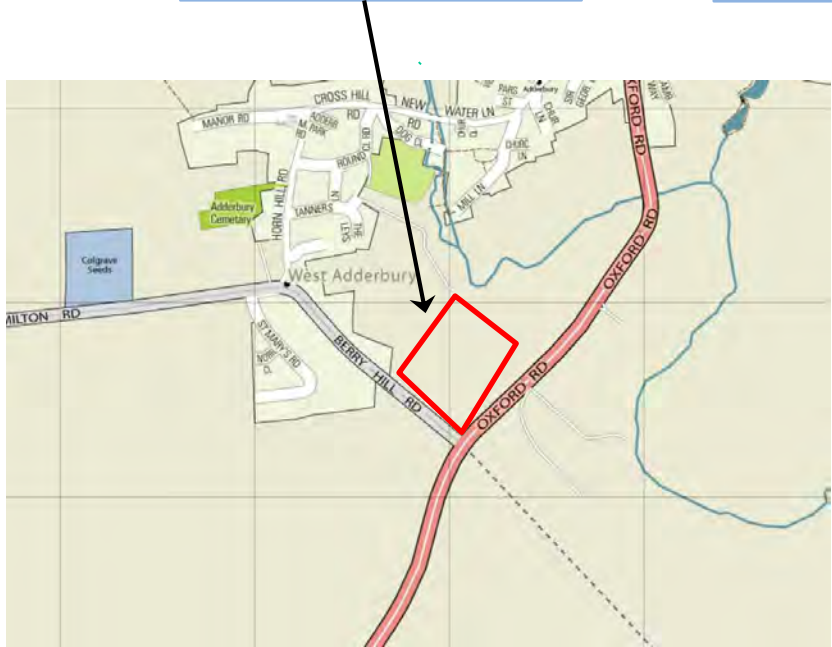
CSci
Chartered
Scientist

Enc C4304/01-Location Plan
C4304/02- Exploratory Location Plan
Infiltration test Results
Trial Pit Logs



SITE LOCATION

NEAREST POSTCODE: OX17 3HF



REV	DATE	DESCRIPTION	BY	CKD



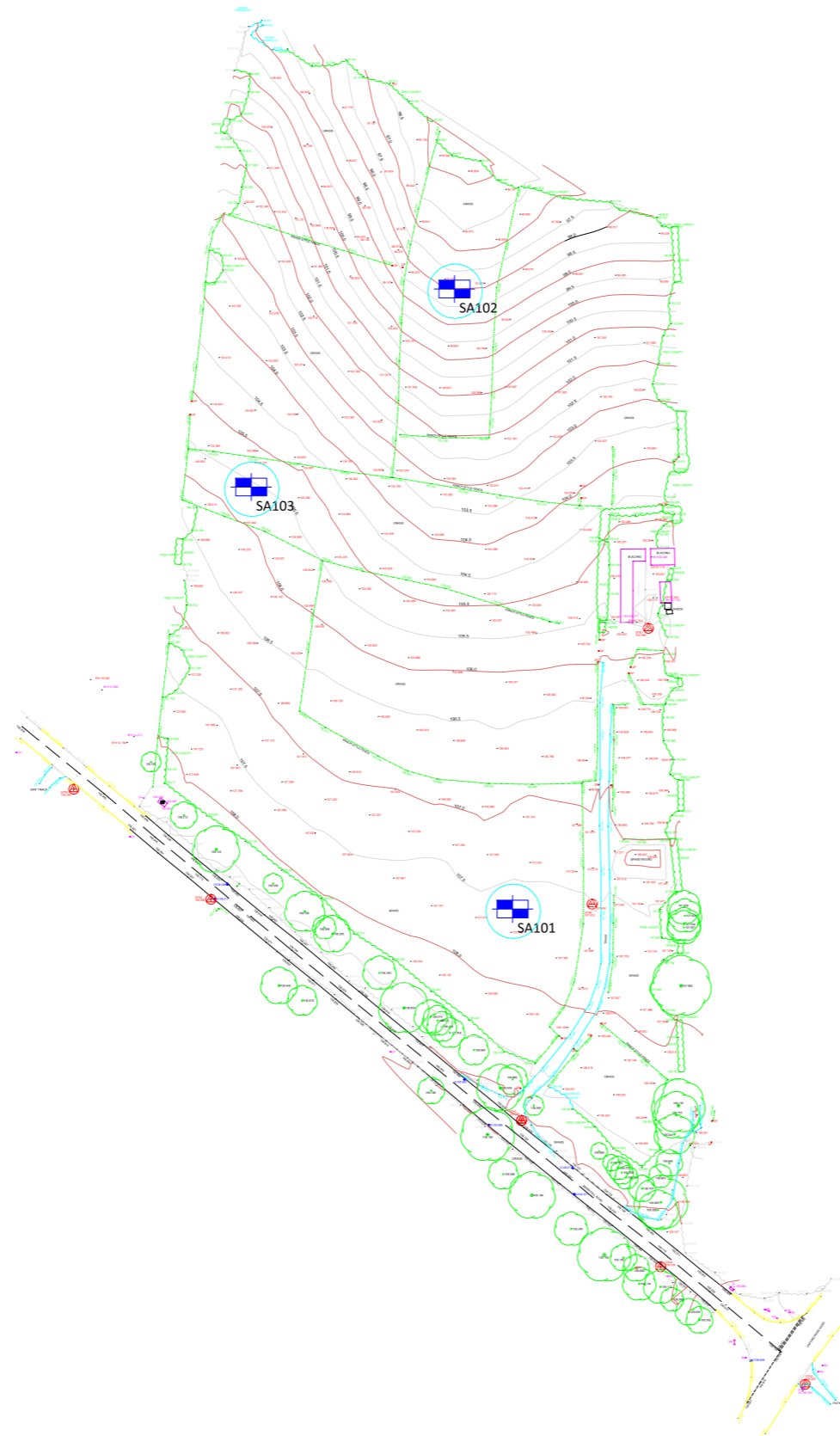
CLIENT
HOLLINS STRATEGIC LAND

PROJECT TITLE
BERRY HILL ROAD, ADDERBURY

DRAWING TITLE
SITE LOCATION PLAN

DRAWING No. C4304/01	REVISION -	SCALE NTS	DATE 24/09/19
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DRAWN BY SJD	CHECKED BY JCM
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KEY



TRIAL PIT



SOAKAWAY INFILTRATION TEST

NOTES

1. ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE COMMENCING WORKS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ARCHITECT & ENGINEER FOR VERIFICATION. FIGURED DIMENSIONS ONLY ARE TO BE TAKEN FROM THIS DRAWING.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS REPORTS. THIS DRAWING IS COPYRIGHT OF BSL.
3. DRAWING NOT FOR CONSTRUCTION PURPOSES.

REV	DATE	DESCRIPTION	BY	CKD



CLIENT

HOLLINS STRATEGIC LAND

PROJECT TITLE

BERRY HILL RD, ADDERBURY

DRAWING TITLE

EXPLORATORY HOLE PLAN

DRAWING No.	REVISION	SCALE	DATE
C4304/02	-	NTS	19/09/19
DRAWN BY		CHECKED BY	
SM		AJS	

Percolation Test **HOLLINS STRATEGIC LAND**

SA101
Test 1

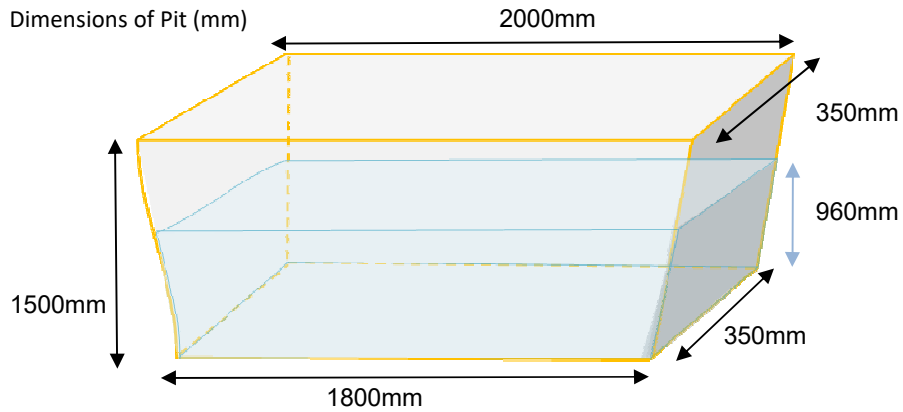
Berry Hill Road, Adderbury

C4304



BROWNFIELD SOLUTIONS LTD
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Test Pit Construction



Date of Test:
10/09/2019


Logged By:
SM

Checked By:
AJS

Strata Description	Orange brown very sandy CLAY underlain by orange brown slightly gravelly sandy CLAY. Gravel is fine to medium angular of limestone.		
Depth of Pit	1500mm		
Depth of Water (start)	960mm		
Pit Details	Open with no stone filling, Backfilled with arisings. See Associated Log for Stratum Details		
Void Ratio	1	Volume of Pit (m ³)	0.638
Infill Volume (m ³)	N/A	Water Volume (m ³)	0.638

Site Recorded Data

Time (mins)	Depth to water (mm)	Depth of water (mm)	Time (mins)	Depth to water (mm)	Depth of water (mm)
0.00	540	960	17.0	1500	0
0.20	660	840	End of Test	End of Test	End of Test
0.40	730	770			
1.00	790	710			
2.00	820	680			
3.00	850	650			
4.00	910	590			
5.00	970	530			
6.00	1030	470			
7.00	1090	410			
8.00	1120	380			
9.00	1150	350			
10.00	1180	320			
11.00	1200	300			

Percolation Test SA101 Test 1	HOLLINS STRATEGIC LAND			 BROWNFIELD SOLUTIONS LTD <small>GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE</small>		
	Berry Hill Road, Adderbury					
	C4304					
	12.00	1230	270			
	13.00	1310	190			
	15.00	1410	90			
	16.00	1460	40			

Percolation Test **HOLLINS STRATEGIC LAND**

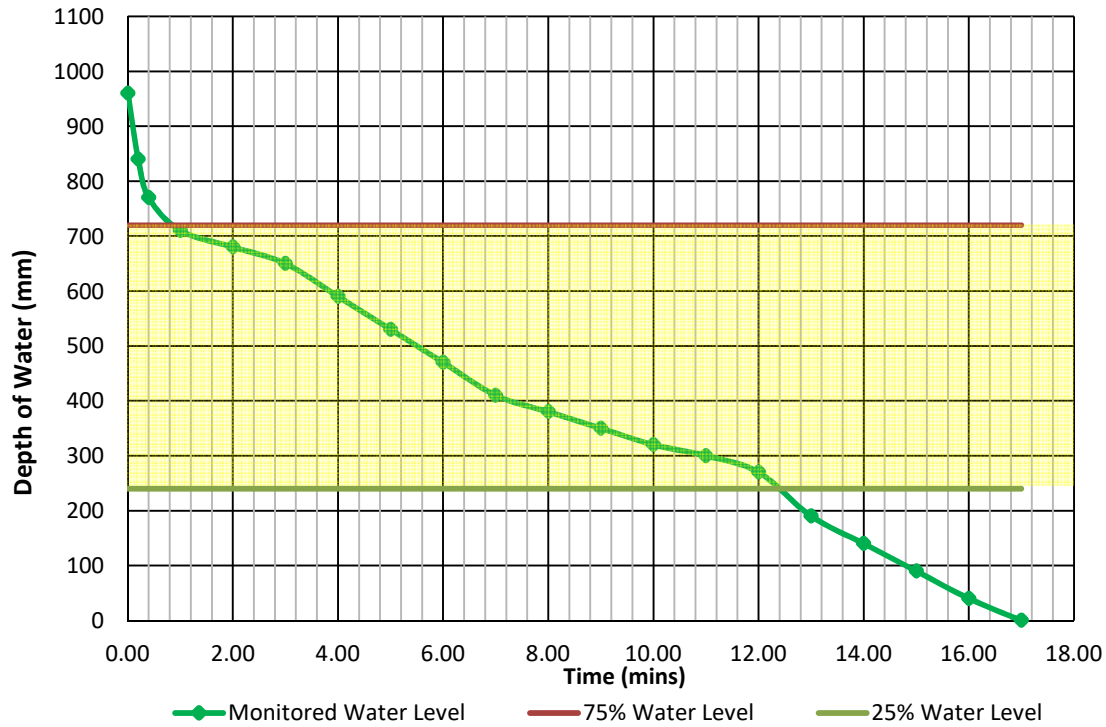
SA101
Test 1
Berry Hill Road, Adderbury
C4304



BROWNFIELD SOLUTIONS LTD
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Data Analysis

Graph of Depth vs Time




Soil Infiltration Rate Calculation

Water Level 1 (mm)	720
Water Level 2 (mm)	240
Time to Drain from Level 1 to Level 2 (mins)	11.5
Volume of water discharged (m ³)	0.3192
Discharge Area (m ²)	2.79
Soil Infiltration Rate (m/min)	0.009948574
Soil Infiltration Rate (m/sec)	1.66E-04

Compliance Check

Water Level at 75% effective depth (mm)	720
Water Level at 25% effective	240

Percolation Test	HOLLINS STRATEGIC LAND		 BROWNFIELD SOLUTIONS LTD <small>GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE</small>
	SA101 Test 1	Berry Hill Road, Adderbury	
	C4304		
	depth (mm)		240
	Compliant with BRE 365		

Percolation Test **HOLLINS STRATEGIC LAND**

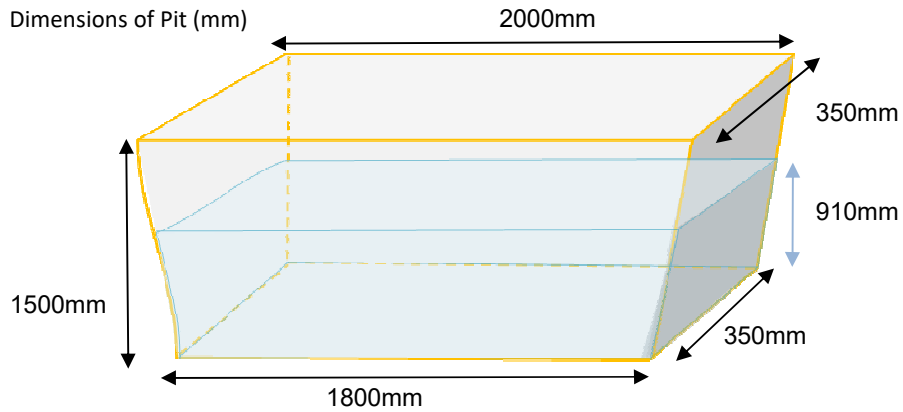
SA101
Test 2

Berry Hill Road, Adderbury
C4304



BROWNFIELD SOLUTIONS LTD
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Test Pit Construction



Date of Test:
10/09/2019

Logged By:
SM

Checked By:
AJS

Strata Description	Orange brown very sandy CLAY underlain by orange brown slightly gravelly sandy CLAY. Gravel is fine to medium angular of limestone.		
Depth of Pit	1500mm		
Depth of Water (start)	910mm		
Pit Details	Open with no stone filling, Backfilled with arisings. See Associated Log for Stratum Details		
Void Ratio	1	Volume of Pit (m ³)	0.605
Infill Volume (m ³)	N/A	Water Volume (m ³)	0.605

Site Recorded Data

Time (mins)	Depth to water (mm)	Depth of water (mm)	Time (mins)	Depth to water (mm)	Depth of water (mm)
0.00	590	910	17.0	1430	70
0.20	670	830	18.0	1500	0
0.40	750	750	End of Test	End of Test	End of Test
1.00	800	700			
2.00	840	660			
3.00	890	610			
4.00	930	570			
5.00	970	530			
6.00	1010	490			
7.00	1050	450			
8.00	1090	410			
9.00	1120	380			
10.00	1150	350			

Percolation Test

HOLLINS STRATEGIC LAND

SA101
Test 2

Berry Hill Road, Adderbury

C4304



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11.00	1170	330
12.00	1200	300
13.00	1240	260
15.00	1330	170
16.00	1380	120

Percolation Test **HOLLINS STRATEGIC LAND**

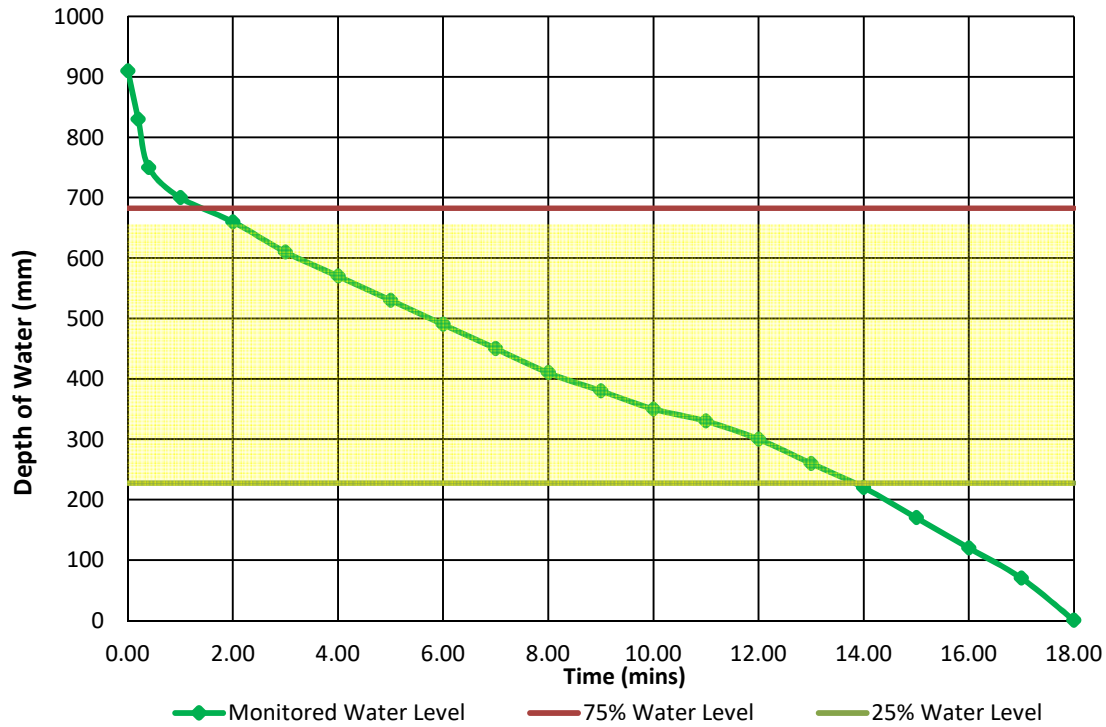
SA101
Test 2
Berry Hill Road, Adderbury
C4304



BROWNFIELD SOLUTIONS LTD
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Data Analysis

Graph of Depth vs Time




Soil Infiltration Rate Calculation

Water Level 1 (mm)	680
Water Level 2 (mm)	227
Time to Drain from Level 1 to Level 2 (mins)	13
Volume of water discharged (m ³)	0.301245
Discharge Area (m ²)	2.67075
Soil Infiltration Rate (m/min)	0.008676474
Soil Infiltration Rate (m/sec)	1.45E-04

Compliance Check

Water Level at 75% effective depth (mm)	682.5
Water Level at 25% effective	227.5

Percolation Test	HOLLINS STRATEGIC LAND	 BROWNFIELD SOLUTIONS LTD <small>GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE</small>
SA101 Test 2	Berry Hill Road, Adderbury	
	C4304	
	depth (mm)	<input type="text" value="227.5"/>
<input type="text" value="Compliant with BRE 365"/>		

Percolation Test **HOLLINS STRATEGIC LAND**

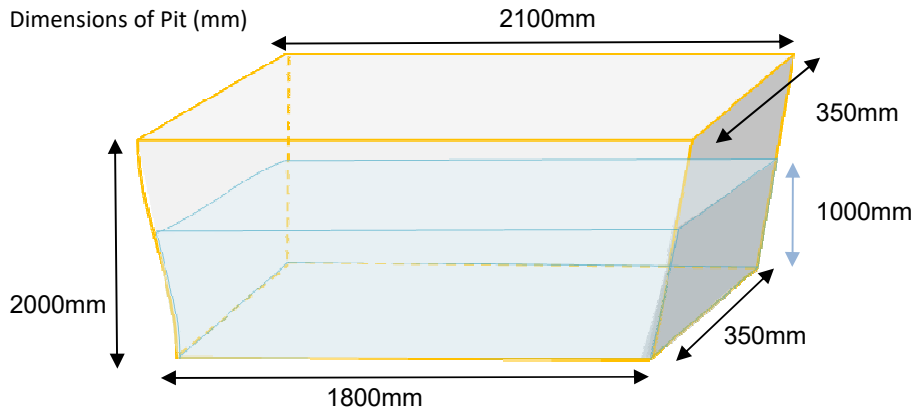
SA102
Test 1

Berry Hill Road, Adderbury
C4304



BROWNFIELD SOLUTIONS LTD
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Test Pit Construction



Date of Test:
10/09/2019

Logged By:
SM

Checked By:
AJS

Strata Description	Orange brown very sandy CLAY.		
Depth of Pit	2000mm		
Depth of Water (start)	1000mm		
Pit Details	Open with no stone filling, Backfilled with arisings. See Associated Log for Stratum Details		
Void Ratio	1	Volume of Pit (m ³)	0.683
Infill Volume (m ³)	N/A	Water Volume (m ³)	0.683

Site Recorded Data

Time (mins)	Depth to water (mm)	Depth of water (mm)	Time (mins)	Depth to water (mm)	Depth of water (mm)
0.00	1000	1000	45.0	1200	800
0.20	1030	970	55.0	1210	790
0.40	1060	940	60.0	1230	770
1.00	1070	930	75.0	1240	760
2.00	1070	930	90.0	1260	740
3.00	1080	920	105.0	1270	730
4.00	1090	910	120.0	1290	710
5.00	1100	900	136.0	1300	700
6.00	1100	900	152.0	1310	690
7.00	1110	890	165.0	1310	690
8.00	1120	880	180.0	1320	680
9.00	1120	880	1700.0	1750	250
10.00	1130	870	End of Test	End of Test	End of Test
15.00	1150	850			

Percolation Test

HOLLINS STRATEGIC LAND

SA102
Test 1

Berry Hill Road, Adderbury

C4304



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GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

20.00	1160	840
25.00	1170	830
35.00	1190	810
40.00	1200	800

Percolation Test **HOLLINS STRATEGIC LAND**

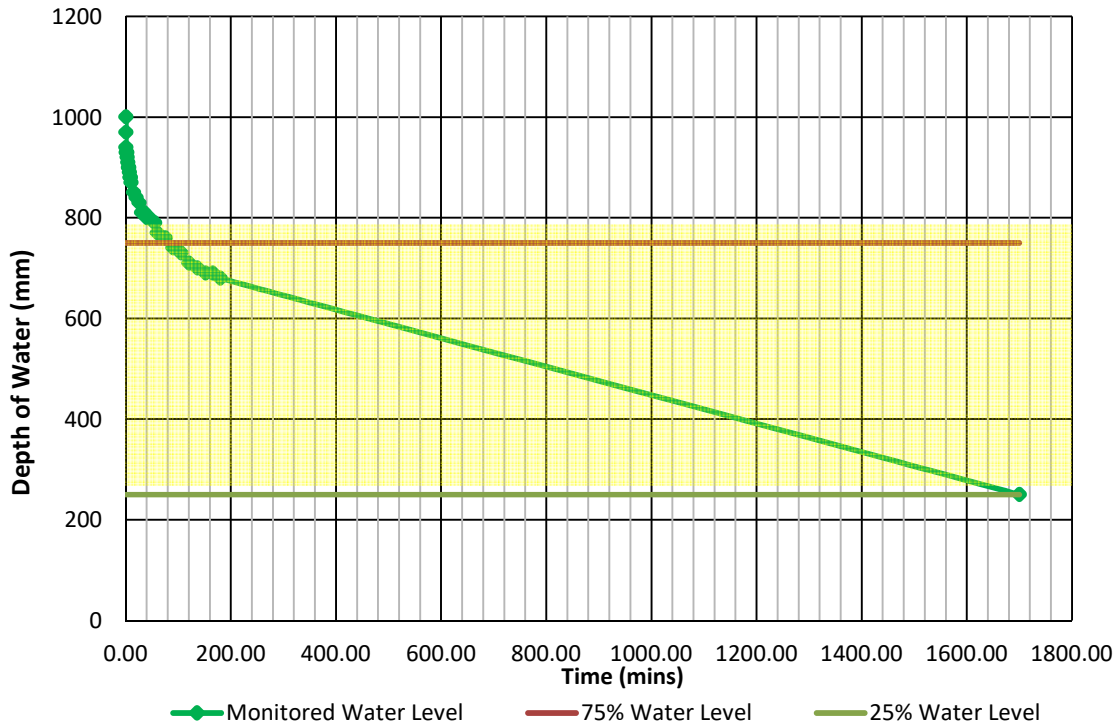
SA102
Test 1
Berry Hill Road, Adderbury
C4304



BROWNFIELD SOLUTIONS LTD
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Data Analysis

Graph of Depth vs Time



Soil Infiltration Rate Calculation


Water Level 1 (mm)	840
Water Level 2 (mm)	680
Time to Drain from Level 1 to Level 2 (mins)	160
Volume of water discharged (m ³)	0.1092
Discharge Area (m ²)	4.126
Soil Infiltration Rate (m/min)	0.000165414

Soil Infiltration Rate (m/sec)	2.76E-06
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Compliance Check

Water Level at 75% effective

750

Percolation Test	HOLLINS STRATEGIC LAND		 BROWNFIELD SOLUTIONS LTD <small>GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE</small>
	SA102	Berry Hill Road, Adderbury	
Test 1	C4304		
	depth (mm)		750
	Water Level at 25% effective depth (mm)		250
Test not BRE 365 compliant - insufficient time to drain past 25% effective depth			

Percolation Test **HOLLINS STRATEGIC LAND**

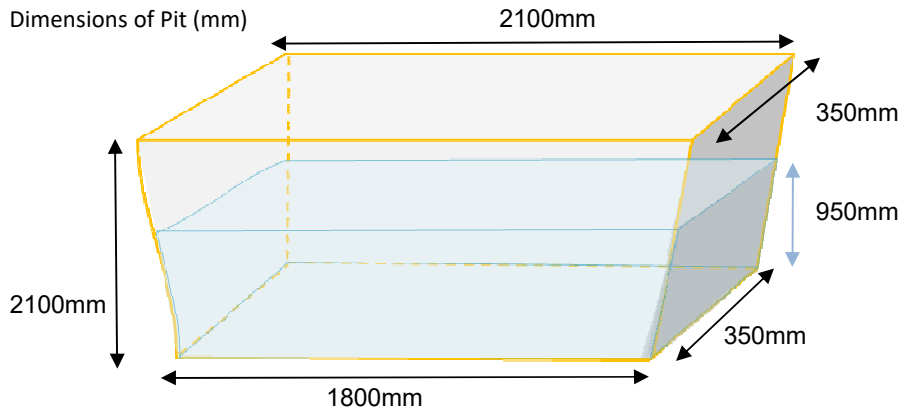
SA103
Test 1

Berry Hill Road, Adderbury
C4304



BROWNFIELD SOLUTIONS LTD
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Test Pit Construction



Date of Test:
10/09/2019


Logged By:
SM

Checked By:
AJS

Strata Description	Orange brown very sandy CLAY underlain by orange brown slightly gravelly sandy CLAY. Gravel is fine to medium angular of limestone.		
Depth of Pit	2100mm		
Depth of Water (start)	950mm		
Pit Details	Open with no stone filling, Backfilled with arisings. See Associated Log for Stratum Details		
Void Ratio	1	Volume of Pit (m ³)	0.648
Infill Volume (m ³)	N/A	Water Volume (m ³)	0.648

Site Recorded Data

Time (mins)	Depth to water (mm)	Depth of water (mm)	Time (mins)	Depth to water (mm)	Depth of water (mm)
0.00	1150	950			
0.20	1260	840			
0.40	1320	780			
1.00	1400	700			
2.00	1460	640			
3.00	1580	520			
4.00	1630	470			
5.00	1660	440			
6.00	1710	390			
7.00	1740	360			
8.00	1760	340			
9.00	1820	280			
10.00	1860	240			
11.00	1910	190			

Percolation Test SA103 Test 1	HOLLINS STRATEGIC LAND			 BROWNFIELD SOLUTIONS LTD <small>GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE</small>
	Berry Hill Road, Adderbury			
	C4304			
	12.00	1960	140	
	13.00	1990	110	
	15.00	2100	0	
	End of Test	End of Test	End of Test	

Percolation Test **HOLLINS STRATEGIC LAND**

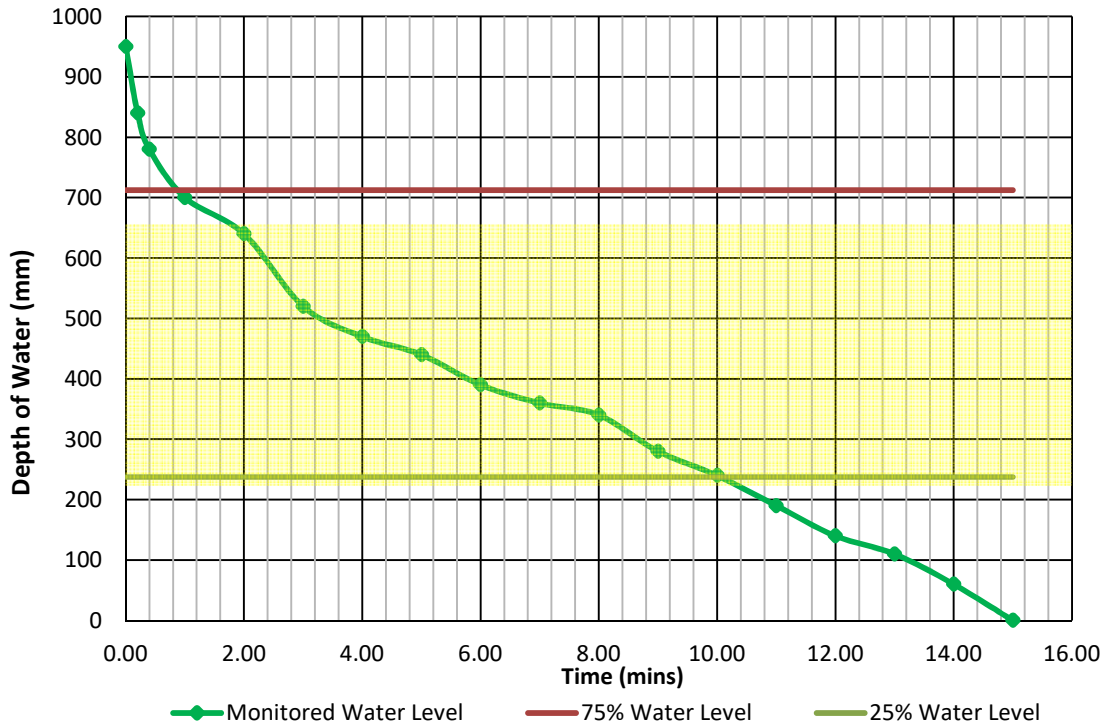
SA103
Test 1
Berry Hill Road, Adderbury
C4304



BROWNFIELD SOLUTIONS LTD
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Data Analysis

Graph of Depth vs Time




Soil Infiltration Rate Calculation

Water Level 1 (mm)	712
Water Level 2 (mm)	240
Time to Drain from Level 1 to Level 2 (mins)	11.5
Volume of water discharged (m ³)	0.32214
Discharge Area (m ²)	2.8196
Soil Infiltration Rate (m/min)	0.009934804
Soil Infiltration Rate (m/sec)	1.66E-04

Compliance Check

Water Level at 75% effective depth (mm)	712.5
Water Level at 25% effective	237.5

Percolation Test	HOLLINS STRATEGIC LAND		 BROWNFIELD SOLUTIONS LTD <small>GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE</small>
	SA103	Berry Hill Road, Adderbury	
	Test 1	C4304	
	depth (mm)	237.5	
	Compliant with BRE 365		

Percolation Test **HOLLINS STRATEGIC LAND**

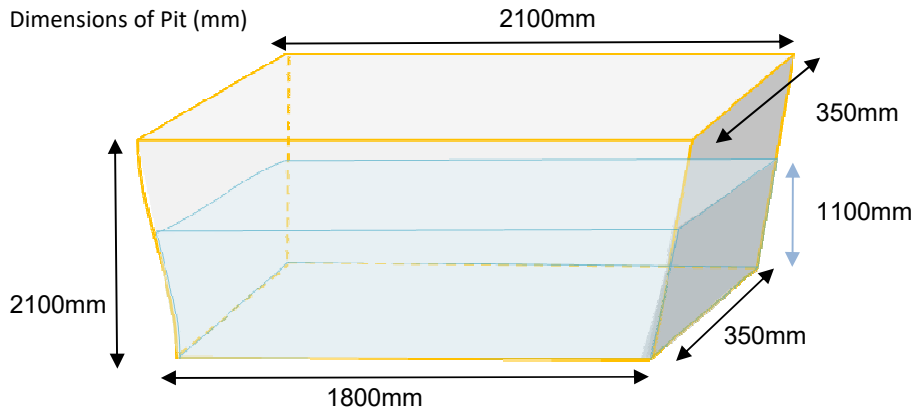
SA103
Test 2

Berry Hill Road, Adderbury
C4304



BROWNFIELD SOLUTIONS LTD
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Test Pit Construction



Date of Test:
10/09/2019

Logged By:
SM

Checked By:
AJS

Strata Description	Orange brown very sandy CLAY underlain by orange brown slightly gravelly sandy CLAY. Gravel is fine to medium angular of limestone.		
Depth of Pit	2100mm		
Depth of Water (start)	1100mm		
Pit Details	Open with no stone filling, Backfilled with arisings. See Associated Log for Stratum Details		
Void Ratio	1	Volume of Pit (m ³)	0.751
Infill Volume (m ³)	N/A	Water Volume (m ³)	0.751

Site Recorded Data

Time (mins)	Depth to water (mm)	Depth of water (mm)	Time (mins)	Depth to water (mm)	Depth of water (mm)
0.00	1000	1100	17.0	2050	50
0.20	1150	950	18.0	2100	0
0.40	1210	890	End of Test	End of Test	End of Test
1.00	1300	800			
2.00	1400	700			
3.00	1480	620			
4.00	1530	570			
5.00	1580	520			
6.00	1620	480			
7.00	1680	420			
8.00	1720	380			
9.00	1790	310			
10.00	1840	260			
11.00	1880	220			

Percolation Test

HOLLINS STRATEGIC LAND

SA103
Test 2

Berry Hill Road, Adderbury

C4304



**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

12.00	1900	200
13.00	1920	180
15.00	1970	130
16.00	1990	110

Percolation Test **HOLLINS STRATEGIC LAND**

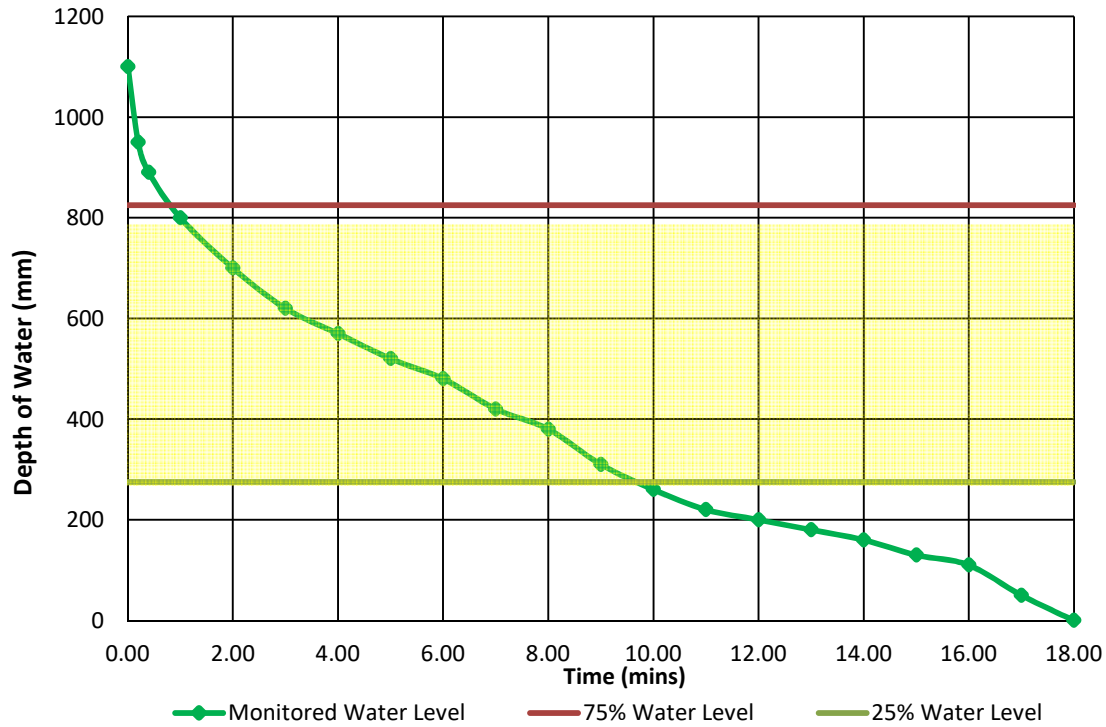
SA103
Test 2
Berry Hill Road, Adderbury
C4304



BROWNFIELD SOLUTIONS LTD
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Data Analysis

Graph of Depth vs Time




Soil Infiltration Rate Calculation

Water Level 1 (mm)	800
Water Level 2 (mm)	275
Time to Drain from Level 1 to Level 2 (mins)	13
Volume of water discharged (m ³)	0.3583125
Discharge Area (m ²)	3.1025
Soil Infiltration Rate (m/min)	0.008883965
Soil Infiltration Rate (m/sec)	1.48E-04

Compliance Check

Water Level at 75% effective depth (mm)	825
Water Level at 25% effective	275

Percolation Test	HOLLINS STRATEGIC LAND	 BROWNFIELD SOLUTIONS LTD <small>GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE</small>
SA103	Berry Hill Road, Adderbury	
Test 2	C4304	
	depth (mm)	275
<div data-bbox="321 373 1286 415" style="border: 1px solid black; padding: 5px; display: inline-block;">Compliant with BRE 365</div>		

Trial Pit Log

No.
SA101
Sheet 1 of 1

PROJECT NO: C4304

CO-ORDS:

Hole Type
TP

PROJECT NAME: BERRY HILL ROAD, ADDERBURY

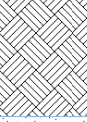

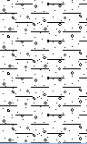
LEVEL:

Scale
1:25

CLIENT: HOLLINS STRATEGIC LAND

DATES: -

Logged **Checked**
SM AIS

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	D		0.40		Orange brown clayey SAND with rootlets (TOPSOIL).	
							Firm to stiff orange brown very sandy CLAY.	
		0.80	D		1.00		Stiff to very stiff orange brown slightly gravelly very sandy CLAY. Gravel is fine to medium angular of limestone and rare mudstone. <i>Gravel content gradually increases with depth.</i>	
					1.50		End of Borehole at 1.50m	

Remarks
1. No Groundwater encountered.
2. Backfilled with arisings.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

Trial Pit Log

No. **SA102**
Sheet 1 of 1

PROJECT NO: C4304

CO-ORDS:

Hole Type
TP

PROJECT NAME: BERRY HILL ROAD, ADDERBURY



LEVEL:

Scale
1:25

CLIENT: HOLLINS STRATEGIC LAND

DATES: -

Logged **Checked**
SM AIS

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	D		0.30		Orange brown clayey SAND with rootlets (TOPSOIL).	
		1.50	D		2.00		Stiff orange brown very sandy CLAY.	
							End of Borehole at 2.00m	

1.0
2.0
3.0
4.0
5.0

Remarks

1. No Groundwater encountered.
2. Backfilled with arisings.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB=Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

Trial Pit Log

No.
SA103
Sheet 1 of 1

PROJECT NO: C4304

CO-ORDS:

Hole Type
TP

PROJECT NAME: BERRY HILL ROAD, ADDERBURY

LEVEL:

Scale
1:25

CLIENT: HOLLINS STRATEGIC LAND

DATES: -

Logged **Checked**
SM AIS


Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Orange brown clayey SAND with rootlets (TOPSOIL).		
				0.40			Stiff orange brown very sandy CLAY.		
				0.80			Stiff to very stiff orange brown slightly gravelly very sandy CLAY. Gravel is fine to medium angular of limestone and rare mudstone. <i>Gravel content gradually increases with depth.</i>	1.0	
		1.80	D						
				2.10			End of Borehole at 2.10m	2.0	
								3.0	
								4.0	
								5.0	

Remarks

1. No Groundwater encountered.
2. Backfilled with arisings.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB=Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

Appendix E
Proposed Hydraulic
Calculations

Ironsides Farrar Ltd		Page 1
3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury Large House Site Left Side	
Date 20/11/2019 File Berry Hill Road Large	Designed by srg Checked by	


Micro Drainage Source Control 2019.1

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

Half Drain Time : 123 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
15 min Summer	98.611	0.611	0.4	3.5	O K
30 min Summer	98.757	0.757	0.4	4.3	O K
60 min Summer	98.851	0.851	0.4	4.8	O K
120 min Summer	98.830	0.830	0.4	4.7	O K
180 min Summer	98.793	0.793	0.4	4.5	O K
240 min Summer	98.754	0.754	0.4	4.3	O K
360 min Summer	98.669	0.669	0.4	3.8	O K
480 min Summer	98.580	0.580	0.4	3.3	O K
600 min Summer	98.493	0.493	0.4	2.8	O K
720 min Summer	98.413	0.413	0.4	2.3	O K
960 min Summer	98.274	0.274	0.4	1.5	O K
1440 min Summer	98.101	0.101	0.4	0.6	O K
2160 min Summer	98.043	0.043	0.4	0.2	O K
2880 min Summer	98.034	0.034	0.3	0.2	O K
4320 min Summer	98.024	0.024	0.2	0.1	O K
5760 min Summer	98.019	0.019	0.2	0.1	O K
15 min Winter	98.692	0.692	0.4	3.9	O K
30 min Winter	98.865	0.865	0.4	4.9	O K
60 min Winter	98.989	0.989	0.4	5.6	O K
120 min Winter	98.983	0.983	0.4	5.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
15 min Summer	147.224	0.0	18
30 min Summer	96.292	0.0	32
60 min Summer	60.186	0.0	60
120 min Summer	35.833	0.0	102
180 min Summer	26.390	0.0	132
240 min Summer	21.172	0.0	166
360 min Summer	15.400	0.0	234
480 min Summer	12.203	0.0	302
600 min Summer	10.147	0.0	366
720 min Summer	8.709	0.0	428
960 min Summer	6.813	0.0	548
1440 min Summer	4.792	0.0	764
2160 min Summer	3.361	0.0	1100
2880 min Summer	2.620	0.0	1468
4320 min Summer	1.864	0.0	2156
5760 min Summer	1.478	0.0	2872
15 min Winter	147.224	0.0	18
30 min Winter	96.292	0.0	32
60 min Winter	60.186	0.0	60
120 min Winter	35.833	0.0	114

3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury Large House Site Left Side	
Date 20/11/2019 File Berry Hill Road Large	Designed by srg Checked by	

Micro Drainage Source Control 2019.1

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
180 min Winter	98.930	0.930	0.4	5.3	O K
240 min Winter	98.874	0.874	0.4	5.0	O K
360 min Winter	98.745	0.745	0.4	4.2	O K
480 min Winter	98.609	0.609	0.4	3.4	O K
600 min Winter	98.479	0.479	0.4	2.7	O K
720 min Winter	98.360	0.360	0.4	2.0	O K
960 min Winter	98.169	0.169	0.4	0.9	O K
1440 min Winter	98.045	0.045	0.4	0.2	O K
2160 min Winter	98.031	0.031	0.3	0.2	O K
2880 min Winter	98.025	0.025	0.2	0.1	O K
4320 min Winter	98.018	0.018	0.2	0.1	O K
5760 min Winter	98.014	0.014	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
180 min Winter	26.390	0.0	144
240 min Winter	21.172	0.0	182
360 min Winter	15.400	0.0	256
480 min Winter	12.203	0.0	326
600 min Winter	10.147	0.0	392
720 min Winter	8.709	0.0	454
960 min Winter	6.813	0.0	560
1440 min Winter	4.792	0.0	734
2160 min Winter	3.361	0.0	1100
2880 min Winter	2.620	0.0	1460
4320 min Winter	1.864	0.0	2196
5760 min Winter	1.478	0.0	2880

3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury Large House Site Left Side
Date 20/11/2019 File Berry Hill Road Large	Designed by srg Checked by



Micro Drainage Source Control 2019.1


Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 446944 234772 SP 46944 34772
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	5760
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.014

Time (mins)	Area
From:	To: (ha)
0	4 0.014

Ironside Farrar Ltd		Page 4
3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury Large House Site Left Side	
Date 20/11/2019 File Berry Hill Road Large	Designed by srg Checked by	


Micro Drainage Source Control 2019.1

Model Details

Storage is Online Cover Level (m) 100.000

Trench Soakaway Structure

Infiltration Coefficient Base (m/hr)	0.53280	Trench Width (m)	1.5
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	4.0
Safety Factor	2.0	Slope (1:X)	500.0
Porosity	0.95	Cap Volume Depth (m)	1.600
Invert Level (m)	98.000	Cap Infiltration Depth (m)	0.000

Ironsides Farrar Ltd		Page 1
3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury Large House Site Right Side	
Date 20/11/2019 File Berry Hill Road Small	Designed by srg Checked by	

Micro Drainage Source Control 2019.1

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

Half Drain Time : 136 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
15 min Summer	98.619	0.619	0.4	3.5	O K
30 min Summer	98.772	0.772	0.4	4.4	O K
60 min Summer	98.881	0.881	0.4	5.0	O K
120 min Summer	98.877	0.877	0.4	5.0	O K
180 min Summer	98.844	0.844	0.4	4.8	O K
240 min Summer	98.808	0.808	0.4	4.6	O K
360 min Summer	98.731	0.731	0.4	4.1	O K
480 min Summer	98.650	0.650	0.4	3.7	O K
600 min Summer	98.569	0.569	0.4	3.2	O K
720 min Summer	98.493	0.493	0.4	2.8	O K
960 min Summer	98.355	0.355	0.4	2.0	O K
1440 min Summer	98.159	0.159	0.4	0.9	O K
2160 min Summer	98.049	0.049	0.4	0.3	O K
2880 min Summer	98.038	0.038	0.3	0.2	O K
4320 min Summer	98.027	0.027	0.2	0.1	O K
5760 min Summer	98.022	0.022	0.2	0.1	O K
15 min Winter	98.701	0.701	0.4	4.0	O K
30 min Winter	98.881	0.881	0.4	5.0	O K
60 min Winter	99.018	1.018	0.4	5.8	O K
120 min Winter	99.039	1.039	0.4	5.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
15 min Summer	147.224	0.0	18
30 min Summer	96.292	0.0	32
60 min Summer	60.186	0.0	62
120 min Summer	35.833	0.0	110
180 min Summer	26.390	0.0	140
240 min Summer	21.172	0.0	172
360 min Summer	15.400	0.0	240
480 min Summer	12.203	0.0	306
600 min Summer	10.147	0.0	374
720 min Summer	8.709	0.0	436
960 min Summer	6.813	0.0	560
1440 min Summer	4.792	0.0	782
2160 min Summer	3.361	0.0	1100
2880 min Summer	2.620	0.0	1468
4320 min Summer	1.864	0.0	2200
5760 min Summer	1.478	0.0	2912
15 min Winter	147.224	0.0	18
30 min Winter	96.292	0.0	32
60 min Winter	60.186	0.0	60
120 min Winter	35.833	0.0	116

3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury Large House Site Right Side
Date 20/11/2019 File Berry Hill Road Small	Designed by srg Checked by




Micro Drainage Source Control 2019.1

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
180 min Winter	98.992	0.992	0.4	5.6	O K
240 min Winter	98.945	0.945	0.4	5.4	O K
360 min Winter	98.832	0.832	0.4	4.7	O K
480 min Winter	98.708	0.708	0.4	4.0	O K
600 min Winter	98.586	0.586	0.4	3.3	O K
720 min Winter	98.472	0.472	0.4	2.7	O K
960 min Winter	98.273	0.273	0.4	1.5	O K
1440 min Winter	98.051	0.051	0.4	0.3	O K
2160 min Winter	98.036	0.036	0.3	0.2	O K
2880 min Winter	98.028	0.028	0.2	0.1	O K
4320 min Winter	98.020	0.020	0.2	0.1	O K
5760 min Winter	98.016	0.016	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
180 min Winter	26.390	0.0	150
240 min Winter	21.172	0.0	186
360 min Winter	15.400	0.0	262
480 min Winter	12.203	0.0	334
600 min Winter	10.147	0.0	404
720 min Winter	8.709	0.0	468
960 min Winter	6.813	0.0	586
1440 min Winter	4.792	0.0	748
2160 min Winter	3.361	0.0	1100
2880 min Winter	2.620	0.0	1484
4320 min Winter	1.864	0.0	2124
5760 min Winter	1.478	0.0	2920

Ironsides Farrar Ltd		Page 3
3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury Large House Site Right Side	
Date 20/11/2019 File Berry Hill Road Small	Designed by srg Checked by	

Micro Drainage Source Control 2019.1

Rainfall Details


Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 446944 234772 SP 46944 34772
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	5760
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.014

Time (mins) Area
From: To: (ha)

0 4 0.014

Ironside Farrar Ltd		Page 4
3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury Large House Site Right Side	
Date 20/11/2019 File Berry Hill Road Small	Designed by srg Checked by	


Micro Drainage Source Control 2019.1

Model Details

Storage is Online Cover Level (m) 100.000

Trench Soakaway Structure

Infiltration Coefficient Base (m/hr)	0.46800	Trench Width (m)	1.5
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	4.0
Safety Factor	2.0	Slope (1:X)	500.0
Porosity	0.95	Cap Volume Depth (m)	1.600
Invert Level (m)	98.000	Cap Infiltration Depth (m)	0.000

Ironsides Farrar Ltd		Page 1
3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury Small House Site Left Side	
Date 20/11/2019 File Berry Hill Road Small	Designed by srg Checked by	


Micro Drainage Source Control 2019.1

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

Half Drain Time : 124 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
15 min Summer	98.657	0.657	0.1	1.2	O K
30 min Summer	98.818	0.818	0.1	1.5	O K
60 min Summer	98.927	0.927	0.1	1.8	O K
120 min Summer	98.913	0.913	0.1	1.7	O K
180 min Summer	98.876	0.876	0.1	1.7	O K
240 min Summer	98.836	0.836	0.1	1.6	O K
360 min Summer	98.749	0.749	0.1	1.4	O K
480 min Summer	98.659	0.659	0.1	1.2	O K
600 min Summer	98.569	0.569	0.1	1.1	O K
720 min Summer	98.485	0.485	0.1	0.9	O K
960 min Summer	98.336	0.336	0.1	0.6	O K
1440 min Summer	98.135	0.135	0.1	0.3	O K
2160 min Summer	98.046	0.046	0.1	0.1	O K
2880 min Summer	98.036	0.036	0.1	0.1	O K
4320 min Summer	98.026	0.026	0.1	0.0	O K
5760 min Summer	98.021	0.021	0.1	0.0	O K
15 min Winter	98.745	0.745	0.1	1.4	O K
30 min Winter	98.934	0.934	0.1	1.8	O K
60 min Winter	99.074	1.074	0.1	2.0	O K
120 min Winter	99.083	1.083	0.1	2.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
15 min Summer	147.224	0.0	18
30 min Summer	96.292	0.0	32
60 min Summer	60.186	0.0	62
120 min Summer	35.833	0.0	106
180 min Summer	26.390	0.0	136
240 min Summer	21.172	0.0	170
360 min Summer	15.400	0.0	238
480 min Summer	12.203	0.0	304
600 min Summer	10.147	0.0	368
720 min Summer	8.709	0.0	434
960 min Summer	6.813	0.0	552
1440 min Summer	4.792	0.0	778
2160 min Summer	3.361	0.0	1100
2880 min Summer	2.620	0.0	1460
4320 min Summer	1.864	0.0	2188
5760 min Summer	1.478	0.0	2928
15 min Winter	147.224	0.0	18
30 min Winter	96.292	0.0	32
60 min Winter	60.186	0.0	60
120 min Winter	35.833	0.0	116

3 Worsley Court Walkden Manchester M28 3NJ	Berry Hill Road Adderbury Small House Site Left Side	
Date 20/11/2019 File Berry Hill Road Small	Designed by srg Checked by	

Micro Drainage Source Control 2019.1

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
180 min Winter	99.029	1.029	0.1	2.0	O K
240 min Winter	98.974	0.974	0.1	1.8	O K
360 min Winter	98.845	0.845	0.1	1.6	O K
480 min Winter	98.706	0.706	0.1	1.3	O K
600 min Winter	98.571	0.571	0.1	1.1	O K
720 min Winter	98.446	0.446	0.1	0.8	O K
960 min Winter	98.235	0.235	0.1	0.4	O K
1440 min Winter	98.048	0.048	0.1	0.1	O K
2160 min Winter	98.034	0.034	0.1	0.1	O K
2880 min Winter	98.026	0.026	0.1	0.0	O K
4320 min Winter	98.019	0.019	0.1	0.0	O K
5760 min Winter	98.015	0.015	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
180 min Winter	26.390	0.0	146
240 min Winter	21.172	0.0	184
360 min Winter	15.400	0.0	258
480 min Winter	12.203	0.0	330
600 min Winter	10.147	0.0	398
720 min Winter	8.709	0.0	462
960 min Winter	6.813	0.0	576
1440 min Winter	4.792	0.0	734
2160 min Winter	3.361	0.0	1100
2880 min Winter	2.620	0.0	1432
4320 min Winter	1.864	0.0	2164
5760 min Winter	1.478	0.0	2840

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Date 20/11/2019 File Berry Hill Road Small	Designed by srg Checked by



Micro Drainage	Source Control 2019.1
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 446944 234772 SP 46944 34772
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	5760
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.005

Time (mins)	Area
From:	To: (ha)
0	4 0.005

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Model Details

Storage is Online Cover Level (m) 100.000

Trench Soakaway Structure

Infiltration Coefficient Base (m/hr)	0.53280	Trench Width (m)	1.0
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	2.0
Safety Factor	2.0	Slope (1:X)	500.0
Porosity	0.95	Cap Volume Depth (m)	1.600
Invert Level (m)	98.000	Cap Infiltration Depth (m)	0.000

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Micro Drainage Source Control 2019.1

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

Half Drain Time : 149 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
15 min Summer	98.665	0.665	0.1	1.3	O K
30 min Summer	98.833	0.833	0.1	1.6	O K
60 min Summer	98.958	0.958	0.1	1.8	O K
120 min Summer	98.964	0.964	0.1	1.8	O K
180 min Summer	98.930	0.930	0.1	1.8	O K
240 min Summer	98.894	0.894	0.1	1.7	O K
360 min Summer	98.816	0.816	0.1	1.5	O K
480 min Summer	98.733	0.733	0.1	1.4	O K
600 min Summer	98.650	0.650	0.1	1.2	O K
720 min Summer	98.570	0.570	0.1	1.1	O K
960 min Summer	98.424	0.424	0.1	0.8	O K
1440 min Summer	98.206	0.206	0.1	0.4	O K
2160 min Summer	98.058	0.058	0.1	0.1	O K
2880 min Summer	98.041	0.041	0.1	0.1	O K
4320 min Summer	98.029	0.029	0.1	0.1	O K
5760 min Summer	98.023	0.023	0.1	0.0	O K
15 min Winter	98.753	0.753	0.1	1.4	O K
30 min Winter	98.949	0.949	0.1	1.8	O K
60 min Winter	99.104	1.104	0.1	2.1	O K
120 min Winter	99.140	1.140	0.1	2.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
15 min Summer	147.224	0.0	18
30 min Summer	96.292	0.0	32
60 min Summer	60.186	0.0	62
120 min Summer	35.833	0.0	116
180 min Summer	26.390	0.0	144
240 min Summer	21.172	0.0	176
360 min Summer	15.400	0.0	244
480 min Summer	12.203	0.0	310
600 min Summer	10.147	0.0	378
720 min Summer	8.709	0.0	442
960 min Summer	6.813	0.0	568
1440 min Summer	4.792	0.0	794
2160 min Summer	3.361	0.0	1104
2880 min Summer	2.620	0.0	1464
4320 min Summer	1.864	0.0	2200
5760 min Summer	1.478	0.0	2904
15 min Winter	147.224	0.0	18
30 min Winter	96.292	0.0	32
60 min Winter	60.186	0.0	60
120 min Winter	35.833	0.0	116

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
180 min Winter	99.098	1.098	0.1	2.1	O K
240 min Winter	99.048	1.048	0.1	2.0	O K
360 min Winter	98.936	0.936	0.1	1.8	O K
480 min Winter	98.811	0.811	0.1	1.5	O K
600 min Winter	98.685	0.685	0.1	1.3	O K
720 min Winter	98.566	0.566	0.1	1.1	O K
960 min Winter	98.353	0.353	0.1	0.7	O K
1440 min Winter	98.078	0.078	0.1	0.1	O K
2160 min Winter	98.038	0.038	0.1	0.1	O K
2880 min Winter	98.030	0.030	0.1	0.1	O K
4320 min Winter	98.021	0.021	0.1	0.0	O K
5760 min Winter	98.017	0.017	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
180 min Winter	26.390	0.0	168
240 min Winter	21.172	0.0	188
360 min Winter	15.400	0.0	264
480 min Winter	12.203	0.0	338
600 min Winter	10.147	0.0	408
720 min Winter	8.709	0.0	476
960 min Winter	6.813	0.0	596
1440 min Winter	4.792	0.0	782
2160 min Winter	3.361	0.0	1084
2880 min Winter	2.620	0.0	1424
4320 min Winter	1.864	0.0	2128
5760 min Winter	1.478	0.0	2936

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Micro Drainage	Source Control 2019.1
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Rainfall Details


Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 446944 234772 SP 46944 34772
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	5760
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.005

Time (mins)	Area
From: To:	(ha)

0	4	0.005
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Micro Drainage Source Control 2019.1

Model Details

Storage is Online Cover Level (m) 100.000

Trench Soakaway Structure

Infiltration Coefficient Base (m/hr)	0.46800	Trench Width (m)	1.0
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	2.0
Safety Factor	2.0	Slope (1:X)	500.0
Porosity	0.95	Cap Volume Depth (m)	1.600
Invert Level (m)	98.000	Cap Infiltration Depth (m)	0.000

Appendix F
Oxfordshire CC
Appendix C
Checklist

APPENDIX C: INFORMATION REQUIRED FOR OUTLINE PLANNING APPLICATIONS

The following information should be provided for every drainage strategy submitted to the LLFA for consideration as part of an **Outline Planning Application**.

Detail required for Outline Applications	Provided?
<p>Non-Technical Summary Non-technical summary of the proposed drainage strategy.</p>	
<p>Description of the type of development Description of the type of development proposed and where it will be located. Include whether it is new development, an extension to existing development or change of use etc. State the area of the development site itself, how much of the site is currently hard standing, the proposed area to be hard standing post-development, and any proposed areas of public open space.</p> <p>Note that in calculations proposed values of impermeable area should include a 10% allowance for Urban Creep, as taken from CIRIA C753 (version 6) paragraph 24.7.2.</p>	
<p>A location plan Location plan at an appropriate scale should be provided with the application, showing site outline and other adjacent land under the applicant's control.</p>	
<p>Plans Plans showing the existing site layout, its topography, any water features, and how the site currently drains. Plans should also be provided of the proposed layout if available and demonstration that the proposed drainage system and other mitigation measures are achievable and that adequate space has been made for water.</p>	
<p>Assessment of all flooding risks to the site This should include groundwater, overland surface water flows, sewer flooding, infrastructure flooding (from reservoirs/ponds/canals), watercourse flooding and the risk posed by the proposed development.</p>	
<p>Explanation of how each of these flood risks will be mitigated This may require modelling of some sources where significant flood risk is shown on high level datasets. It might mean applying the sequential approach to the site by avoiding building on one part of the site where there is known flooding.</p>	
<p>Explanation of how the drainage discharge hierarchy has been followed, providing evidence why any are inappropriate:</p> <ul style="list-style-type: none"> • Firstly, to infiltration/soakaway • Secondly, to a watercourse or highway ditch (with permission) • Thirdly, to a surface water sewer or highway drain (with permission) • Lastly, to a combined sewer (with permission) 	
<p>Evidence that the site has an agreed point of discharge</p> <ul style="list-style-type: none"> - If a significant portion of surface water is to be infiltrated on site, provide a BRE365 infiltration assessment to prove that this will work effectively. At outline stage it may be acceptable to base infiltration values on typical values for the local geology, as long as an alternative drainage design and agreed point of discharge is provided should infiltration 	

Detail required for Outline Applications	Provided?
<p>rates prove to be unsuitable.</p> <ul style="list-style-type: none"> - If discharge is to an ordinary watercourse, evidence will need to be provided to ensure that the system can accept the proposed flows to an acceptable downstream point without increasing risk to others. If the watercourse is not within the boundary of the site, evidence will be required that the developer has a right to cross 3rd party land. - If discharge is to a surface water or combined sewer, or highways ditch or drain, letter of confirmation from the Water Company or responsible body will be required, stating their required discharge maximum rates and confirmation that there is adequate capacity in the existing system. This information is generally provided by going through the relevant water company's "Pre-Planning Service". This is a formal process that all developers are expected to go through to inform their planning applications. There is normally an associated cost for this service and a minimum timescale of 15 working days to obtain a response. The advice is then usually valid for a one year period. This process will provide assurance that there are no capacity issues with third party assets, as we as the LLFA are not able to make this type of assumption on behalf of a Water and Sewerage provider. - Thames Water: https://my.thameswater.co.uk/dynamic/cps/rde/xchg/corp/hs.xsl/18710.htm - Anglian Water: http://www.anglianwater.co.uk/developers/pre-planning-service-.aspx - Severn Trent Water: https://www.stwater.co.uk/developers/application-forms-and-guidance-notes/ (> application forms > Development enquiry application form) 	
<p>Calculations of current runoff from site</p> <ul style="list-style-type: none"> • For greenfield sites, existing greenfield runoff rates and volumes can be produced through the UK SuDS website http://www.ukSuDS.com/, or by using the Institute of Hydrology loH124 method. • If brownfield sites, clearly state the existing impermeable area and calculate the rates of runoff from the site. If a piped drainage system already exists within the site, the existing capacity of these pipes will need to be estimated. 	
<p>Calculations of allowable runoff from site</p> <p>Clearly state the proposed impermeable areas for the site and how this compares to existing values.</p> <p>In all calculations, proposed values of impermeable area should include a 10% allowance for Urban Creep, as taken from CIRIA C753 (version 6) paragraph 24.7.2. The Modified Rational Method is considered acceptable only for initial design estimates (i.e. at Outline planning) or for very simple sites (i.e. Minor developments).</p> <ul style="list-style-type: none"> • Greenfield sites should discharge at no greater than the current greenfield rate so that the site behaves like the original site across the range of events. • Brownfield sites are strongly encouraged to discharge at the greenfield rate wherever possible. As a minimum, brownfield sites should reduce the discharge by 40% to account for the impacts of climate change, from the existing site runoff OR from the original un-surcharged pipe-full capacity of the existing system, whichever is the lowest. • Developers have the option to limit discharge for all events to the QBAR flow rate; or install a complex discharge control which reflects the original discharge for run-off rates from the site across the range of storm events. E.g. QBAR, 3.3% (1in30), 1% (1in100), and provide Long Term Storage for all runoff volume greater than the greenfield volume (as set out in 'Calculation of Storage Volume' below). <p>It is understood that some guidance recommends minimum discharge rates of 5 l/s, to minimise use of small orifice openings that could be at risk of blockages. However, appropriate</p>	

Detail required for Outline Applications	Provided?
<p>consideration of filtration features to remove suspended matter and suitable maintenance regimes should minimise this risk and therefore the minimum limit of 5l/s does not apply in Oxfordshire.</p> <ul style="list-style-type: none"> Due to the additional datasets that have been added to the Flood Estimation Handbook (FEH) since design rainfall events were developed originally in the Flood Studies Report (FSR) (NERC, 1975), rainfall depths obtained using FEH show significant differences from those obtained from FSR in some parts of the country. Within Oxfordshire, rainfall depths are often greater using more up to date FEH datasets than those using FSR, therefore for various storm events, greater run-off is produced and additional attenuation is likely to be required. As FEH rainfall data is more up to date, calculations should use FEH data for surface water drainage design, except where the critical storm duration is less than 60 minutes, as it is recognised that FEH data is less robust for short duration storms. If FEH rainfall data is not used as described above, then sensitivity testing to assess the implications of FEH rainfall must be provided. This should demonstrate that the development proposals remain safe and do not increase flood risk to third parties. 	
<p>A calculation of storage volume Volume of storage required on site for the 1% (1in100) plus climate change storm, in order to meet the controlled discharge rate or available infiltration rate. Where appropriate this should specify the volumes of both attenuation storage and Long Term storage. See also note above about use of FEH rainfall data. An estimation of storage (acceptable only for outline applications) can be produced through the UK SuDS website http://www.ukSuDS.com/, or using the WinDes Quick Storage Estimate tool.</p>	
<p>Plans showing a logical location of storage within the proposed development Attenuation storage within areas at risk of flooding will not be acceptable.</p>	
<p>Explanation of likely forms of SuDS for the site and reasons for the use of these features. If no SuDS methods are proposed then justification and evidence will need to be provided as to why they are not appropriate for the site.</p>	
<p>Explanation of who will maintain the drainage system over the lifetime of the development and evidence that all elements of the drainage system will be fully accessible for maintenance without entering 3rd party land. Ideally, SuDS features should be located within public space.</p>	
<p>Phasing An explanation of how the site will adequately consider flood risk at all stages of the development.</p>	