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Our Ref: HLEI50224/002L

Date: 28th March 2017

Mr. Andrew Holloway
Taylor Wimpey North Thames
Imperial Place 2
Maxwell Road
Borehamwood
Hertfordshire
WD6 1JN

Dear Mr. Holloway,

Re: Infiltration Testing – Chequersfield, Welwyn Garden City, Hertfordshire AL7 4TX

Please find below the results of infiltration testing recently undertaken at the above site. The purpose of the investigation was to confirm the suitability of the shallow geology beneath the site for soakaway drainage upon its redevelopment as residential dwellings.

Background

A Ground Investigation Report was issued for the site by Soiltechnics Limited in January 2016 (ref: STM3370A-G01). As part of the investigation, five window sample boreholes (DTS01 to DTS05) were advanced to a depth of 4.00m below ground level (bgl). Encountered ground conditions comprised Made Ground (ranging in thickness from 2.40m to an unproven thickness of 4.00m). The Kesgrave Catchment Subgroup was encountered beneath the Made Ground in three of the boreholes. This stratum was described as comprising sand and gravel.

As part of the investigation groundwater/ground gas monitoring wells were installed in boreholes DTS01 and DTS04. Monitoring well DTS01 was screened across the Made Ground and monitoring well DTS04 was screened across the Made Ground and Kesgrave Catchment Subgroup. Copies of the Soiltechnics borehole logs are provided in Appendix A.

In January 2010, RPS undertook two rounds of ground gas monitoring at the site (report ref: HLEI48353/001L). An additional monitoring well was observed adjacent to the west of well DTS04. This well was denoted by RPS as monitoring well BHA. No further information is available regarding the



drilling or installation of this monitoring well. Given this absence of information, it is not possible to determine infiltration rates in this monitoring well.

Aim

The purpose of the testing was to determine the permeability of shallow soils to assist in the design of infiltration drainage.

Methodology

The infiltration tests were carried out on 13th March 2017. The approximate locations of the two monitoring wells are shown on Figure 1. Three falling head tests were undertaken in each monitoring wells.

Each of the monitoring wells were filled with water (delivered via a bowser) to ground level, with the depth to water recorded at regular intervals using a dip meter.

Recorded Groundwater Levels

Prior to the start of each of the tests, the depth to groundwater was recorded using a dip meter. The following results were recorded:

- Monitoring well DTS01: The depth to groundwater was recorded at approximately 3.91m bgl. The base of the well was recorded at approximately 4.00m bgl; and
- Monitoring well DTS04: This monitoring well was dry. The base of the well was recorded at approximately 3.75m bgl.

In between each of the falling head tests for monitoring well DTS04, the base of the well appeared to have silted up. Prior to the third test, the base was recorded at approximately 3.43m bgl.

Infiltration Testing

The infiltration test calculations are presented in Appendix B. The calculated infiltration rates for each of the falling head tests are provided in Table 1 below:

Table 1: Calculated Infiltration Rates

Monitoring well	Infiltration rate (m/s)		
	Test 1	Test 2	Test 3
DTS01	1.09×10^{-4}	8.80×10^{-5}	5.16×10^{-5}
DTS04	4.56×10^{-5}	3.16×10^{-5}	3.48×10^{-5}



Conclusions

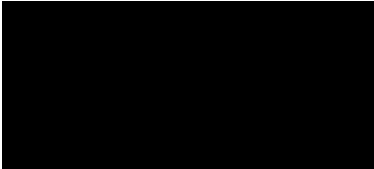
The testing indicates that infiltration rates were broadly consistent across the two monitoring wells.

Overall, the testing indicates that the ground in which the falling head testing was undertaken could potentially be suitable for soakaway drainage, however, the feasibility of this drainage, along with the size and type of soakaway should be assessed by a specialist drainage engineer.

I trust the above is satisfactory, however, please do not hesitate to contact me should you wish to discuss further.

Yours sincerely

For RPS Health, Safety & Environment



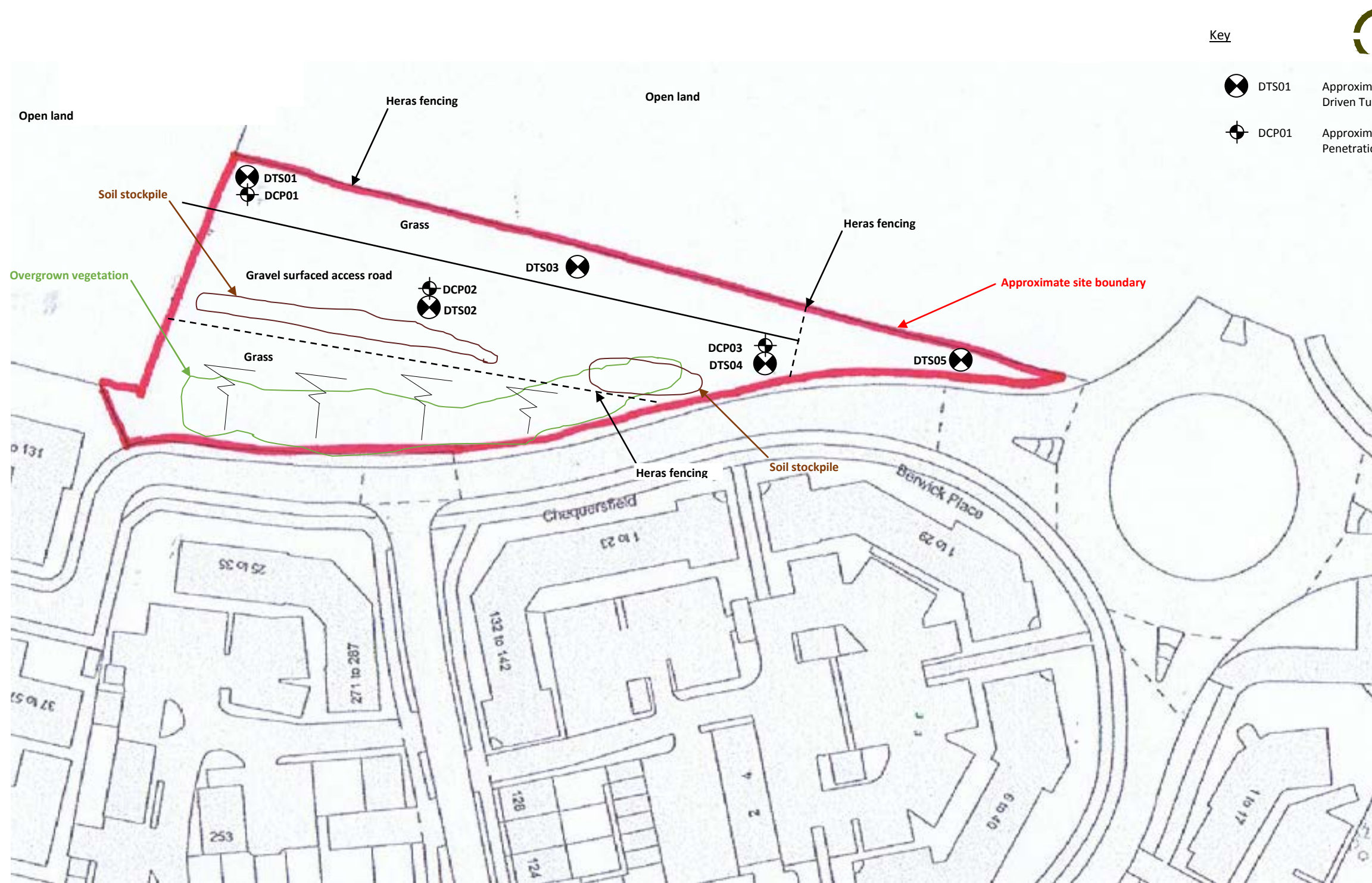
Liz Holland

Senior Consultant

Enc: Figure 1: Monitoring Well Location Plan
 Appendix A: Soiltechnics Borehole Logs
 Appendix B: Falling Head Test Calculations





FIGURES



Key



-  DTS01 Approximate location of borehole formed by Driven Tube Sampling techniques
-  DCP01 Approximate location of Dynamic Cone Penetration testing

Title	Scale	Drawing number
Plan showing existing site features and location of exploratory positions	Not to scale	02



APPENDIX A

Soiltechnics Borehole Logs

WELL	DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS		SAMPLING		
					TYPE/DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Soft low strength brown slightly gravelly sandy CLAY. Gravel consists of flint and railway ballast. MADE GROUND						0.10		ES
	Medium dense orange brown occasionally grey clayey silty gravelly SAND. Gravel consists of flint. MADE GROUND		0.35				0.40		ES
	Soft low strength orange brown slightly gravelly silty sandy CLAY. Gravel consists of flint and concrete. MADE GROUND		0.70						
					PP 0.90	25	0.90		D
					PP 1.10	50			
	Loose to medium dense brown, dark grey and orange brown slightly clayey gravelly SAND. Gravel consists of flint and concrete. MADE GROUND		1.20						
							1.50		D
	Soft low strength brown to dark brown slightly gravelly sandy CLAY. Gravel consists of flint and occasional coal. MADE GROUND		1.80		PP 1.90	25			
					PP 2.10	25			
					PP 2.30	50			
					PP 2.50	50			
	Soft low strength orange brown slightly gravelly very sandy CLAY. Gravel consists of flint. MADE GROUND		2.60		PP 2.70	50			
					PP 2.90	50	2.80		D
					PP 3.10	50			
					PP 3.30	25			
					PP 3.50	25			
					PP 3.70	25			
	Loose to medium dense orange brown slightly clayey silty SAND and GRAVEL. Gravel consists of flint. MADE GROUND		3.80				3.90		D
	BOREHOLE TERMINATED AT 4.00m		4.00						

Notes: Standpipe installed to 4m depth. For Dynamic Cone Penetration testing, refer to DCP01.

Ground level (mAOD)

Co-ordinates
523575, 211330

Title

Driven tube sampler borehole record

Surface breaking

No

Groundwater observations

No groundwater encountered.

Date of excavation (range if applicable)

24/11/2015

Appendix

B

Location plan on drawing number

01

DTS01

WELL	DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS		SAMPLING		
					TYPE/DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Vegetation onto soft low strength brown sandy gravelly CLAY. Gravel consist of brick, concrete, flint and ash. MADE GROUND						0.20		ES
	Firm medium strength light brown slightly gravelly sandy CLAY. Gravel consists of chalk and flint. MADE GROUND		0.45		PP 0.50	50	0.50		ES
	Medium dense to very dense brown slightly clayey gravelly SAND. Gravel consists of flint, clinker and brick. MADE GROUND		0.70				0.90		D
	Very dense becoming medium dense orange brown slightly clayey gravelly SAND. Gravel consists of flint. MADE GROUND		1.20				1.50		D
	Medium dense dark grey silty clayey gravelly SAND. Gravel consists of flint. MADE GROUND		1.80				2.30		D
	Medium dense orange brown silty SAND and GRAVEL. Gravel consists of rounded to angular medium to coarse flint. KESGRAVE CATCHMENT SUBGROUP		2.40				3.50		D
	BOREHOLE TERMINATED AT 4.00m		4.00						

Notes: Standpipe installed to 4m depth. For Dynamic Cone Penetration testing, refer to DCP03.

Ground level (mAOD)

Co-ordinates

523636, 211296

Title

Driven tube sampler borehole record

Surface breaking

No

Groundwater observations

No groundwater encountered.

Date of excavation (range if applicable)

24/11/2015

Appendix

B

Location plan on drawing number

01

DTS04



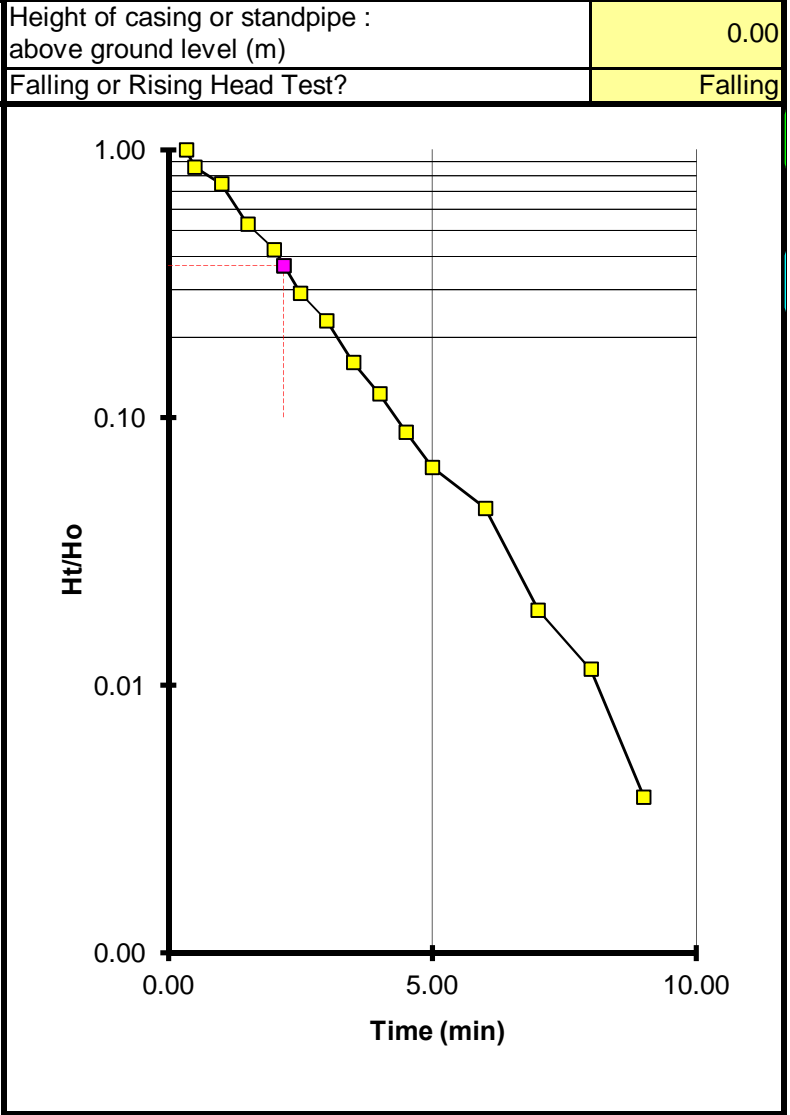
APPENDIX B

Falling Test Calculations


Variable Head Permeability Test

Project No.:	HLEI50224	TEST RESPONSE ZONE DETAILS:	
Project Name:	Chequersfield	Top (mbgl):	1.00
Client:	Taylor Wimpey	Bottom (mbgl):	4.00
Borehole No.:	DTS01 - Test 1	Length (m):	3.00
Compiled By:	MA	Diameter (m):	0.050
Date:	13/03/2017	Initial Standing Water Level (m below top of casing):	3.91
Checked By:	LH	Height of casing or standpipe : above ground level (m)	0.00
Date:	21/03/2017	Falling or Rising Head Test?	Falling

Elapsed Time (mins)	Depth to Water* (m)	Ht/Ho
0.333333333	1.3	1.00
0.5	1.66	0.86
1	1.96	0.75
1.5	2.53	0.53
2	2.8	0.43
2.5	3.15	0.29
3	3.31	0.23
3.5	3.49	0.16
4	3.59	0.12
4.5	3.68	0.09
5	3.74	0.07
6	3.79	0.05
7	3.86	0.02
8	3.88	0.01
9	3.9	0.01
10	3.91	0.00



Cross Sectional Area of Test Zone	A=	0.00196
Shape Factor (Case B)	F=	0.13750
Time to reach Ht/Ho = 0.37 (sec)	T=	131
Permeability (m/s)	K=	1.09E-04



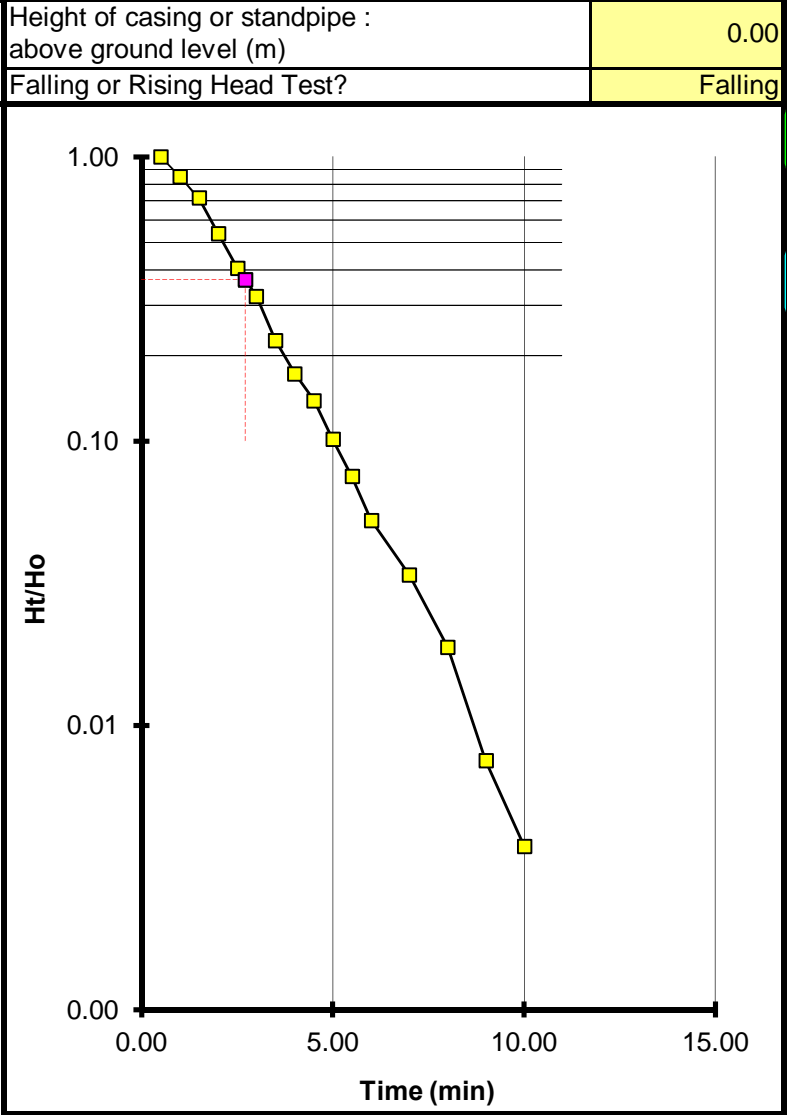
35 New Bridge Street
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EC4V 6BW

Comments


Variable Head Permeability Test

Project No.:	HLEI50224	TEST RESPONSE ZONE DETAILS:	
Project Name:	Chequersfield	Top (mbgl):	1.00
Client:	Taylor Wimpey	Bottom (mbgl):	4.00
Borehole No.:	DTS01 - Test 2	Length (m):	3.00
Compiled By:	MA	Diameter (m):	0.050
Date:	13/03/2017	Initial Standing Water Level (m below top of casing):	3.91
Checked By:	LH	Height of casing or standpipe : above ground level (m)	0.00
Date:	21/03/2017	Falling or Rising Head Test?	Falling

Elapsed Time (mins)	Depth to Water* (m)	Ht/Ho
0.5	1.25	1.00
1	1.64	0.85
1.5	2	0.72
2	2.48	0.54
2.5	2.83	0.41
3	3.05	0.32
3.5	3.31	0.23
4	3.45	0.17
4.5	3.54	0.14
5	3.64	0.10
5.5	3.71	0.08
6	3.77	0.05
7	3.82	0.03
8	3.86	0.02
9	3.89	0.01
10	3.9	0.01
11	3.91	0.00



Cross Sectional Area of Test Zone	A=	0.00196
Shape Factor (Case B)	F=	0.13750
Time to reach Ht/Ho = 0.37 (sec)	T=	162
Permeability (m/s)	K=	8.80E-05



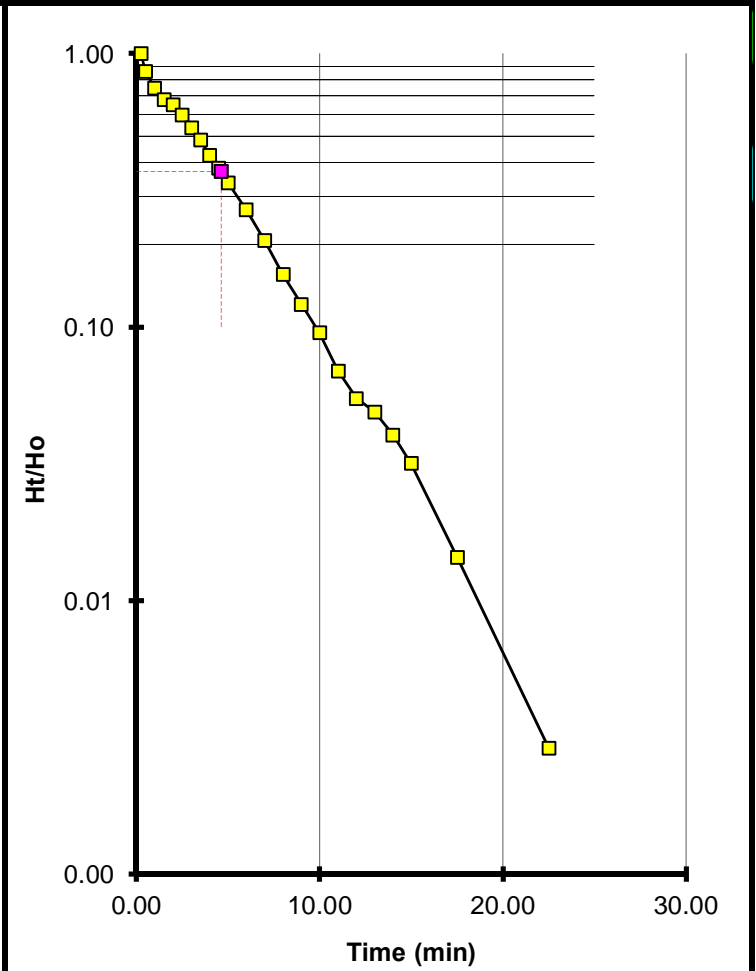
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Comments

Variable Head Permeability Test

Project No.:	HLEI50224	TEST RESPONSE ZONE DETAILS:	
Project Name:	Chequersfield	Top (mbgl):	1.00
Client:	Taylor Wimpey	Bottom (mbgl):	4.00
Borehole No.:	DTS01 - Test 3	Length (m):	3.00
Compiled By	MA	Diameter (m):	0.050
Date	13/03/2017	Initial Standing Water Level (m below top of casing):	3.91
Checked By	LH	Height of casing or standpipe : above ground level (m)	0.00
Date	21/03/2017	Falling or Rising Head Test?	Falling

Elapsed Time (mins)	Depth to Water* (m)	Ht/Ho
0.25	0.44	1.00
0.5	0.92	0.86
1	1.32	0.75
1.5	1.55	0.68
2	1.66	0.65
2.5	1.84	0.60
3	2.05	0.54
3.5	2.23	0.48
4	2.44	0.42
4.5	2.59	0.38
5	2.74	0.34
6	2.98	0.27
7	3.19	0.21
8	3.37	0.16
9	3.49	0.12
10	3.58	0.10
11	3.67	0.07
12	3.72	0.05
13	3.74	0.05
14	3.77	0.04
15	3.8	0.03
17.5	3.86	0.01
22.5	3.9	0.00
25	3.91	



Cross Sectional Area of Test Zone	A=	0.00196
Shape Factor (Case B)	F=	0.13750
Time to reach Ht/Ho = 0.37 (sec)	T=	277
Permeability (m/s)	K=	5.16E-05



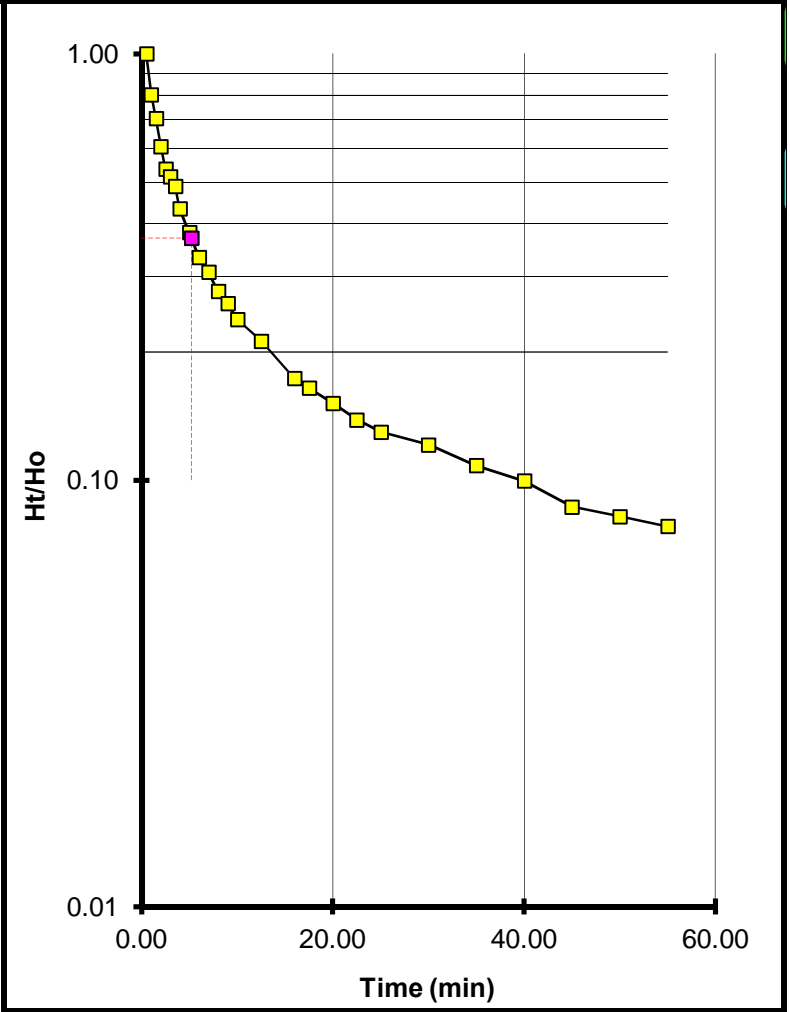
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Comments

Variable Head Permeability Test

Project No.:	HLEI50224	TEST RESPONSE ZONE DETAILS:	
Project Name:	Chequersfield	Top (mbgl):	1.00
Client:	Taylor Wimpey	Bottom (mbgl):	4.00
Borehole No.:	DTS04 - Test 1	Length (m):	3.00
Compiled By:	MA	Diameter (m):	0.050
Date:	13/03/2017	Initial Standing Water Level (m below top of casing):	3.75
Checked By:	LH	Height of casing or standpipe : above ground level (m)	0.00
Date:	21/03/2017	Falling or Rising Head Test?	Falling

Elapsed Time (mins)	Depth to Water* (m)	Ht/Ho
0.5	1.44	1.00
1	1.9	0.80
1.5	2.12	0.71
2	2.35	0.61
2.5	2.51	0.54
3	2.56	0.52
3.5	2.62	0.49
4	2.75	0.43
5	2.87	0.38
6	2.98	0.33
7	3.04	0.31
8	3.11	0.28
9	3.15	0.26
10	3.2	0.24
12.5	3.26	0.21
16	3.35	0.17
17.5	3.37	0.16
20	3.4	0.15
22.5	3.43	0.14
25	3.45	0.13
30	3.47	0.12
35	3.5	0.11
40	3.52	0.10
45	3.55	0.09
50	3.56	0.08
55	3.57	0.08



Cross Sectional Area of Test Zone	A=	0.00196
Shape Factor (Case B)	F=	0.13750
Time to reach Ht/Ho = 0.37 (sec)	T=	313
Permeability (m/s)	K=	4.56E-05



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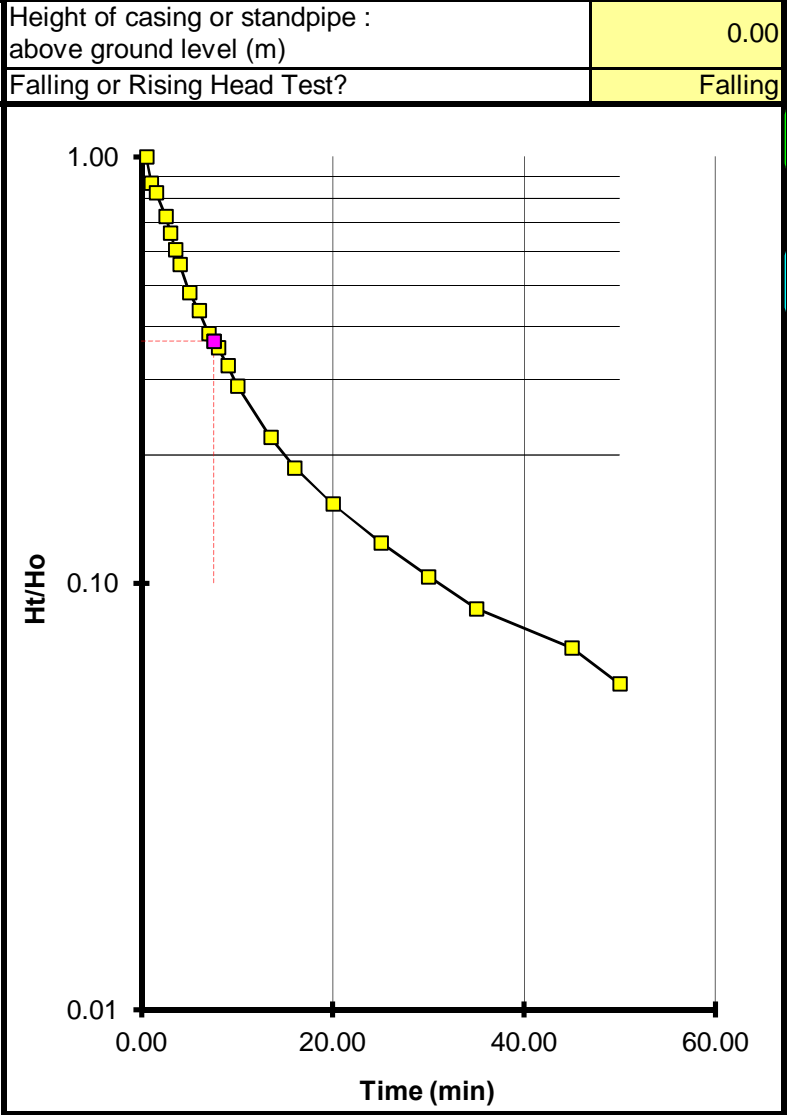
Comments

Monitoring well silted up to 3.57m bgl during test.

Variable Head Permeability Test

Project No.:	HLEI50224	TEST RESPONSE ZONE DETAILS:	
Project Name:	Chequersfield	Top (mbgl):	1.00
Client:	Taylor Wimpey	Bottom (mbgl):	4.00
Borehole No.:	DTS04 - Test 2	Length (m):	3.00
Compiled By:	MA	Diameter (m):	0.050
Date:	13/03/2017	Initial Standing Water Level (m below top of casing):	3.57
Checked By:	LH	Height of casing or standpipe : above ground level (m)	0.00
Date:	21/03/2017	Falling or Rising Head Test?	Falling

Elapsed Time (mins)	Depth to Water* (m)	Ht/Ho
0.5	1.16	1.00
1	1.48	0.87
1.5	1.58	0.83
2.5	1.82	0.73
3	1.97	0.66
3.5	2.11	0.61
4	2.22	0.56
5	2.41	0.48
6	2.52	0.44
7	2.64	0.39
8	2.71	0.36
9	2.79	0.32
10	2.87	0.29
13.5	3.04	0.22
16	3.12	0.19
20	3.2	0.15
25	3.27	0.12
30	3.32	0.10
35	3.36	0.09
45	3.4	0.07
50	3.43	0.06



Cross Sectional Area of Test Zone	A=	0.00196
Shape Factor (Case B)	F=	0.13750
Time to reach Ht/Ho = 0.37 (sec)	T=	452
Permeability (m/s)	K=	3.16E-05



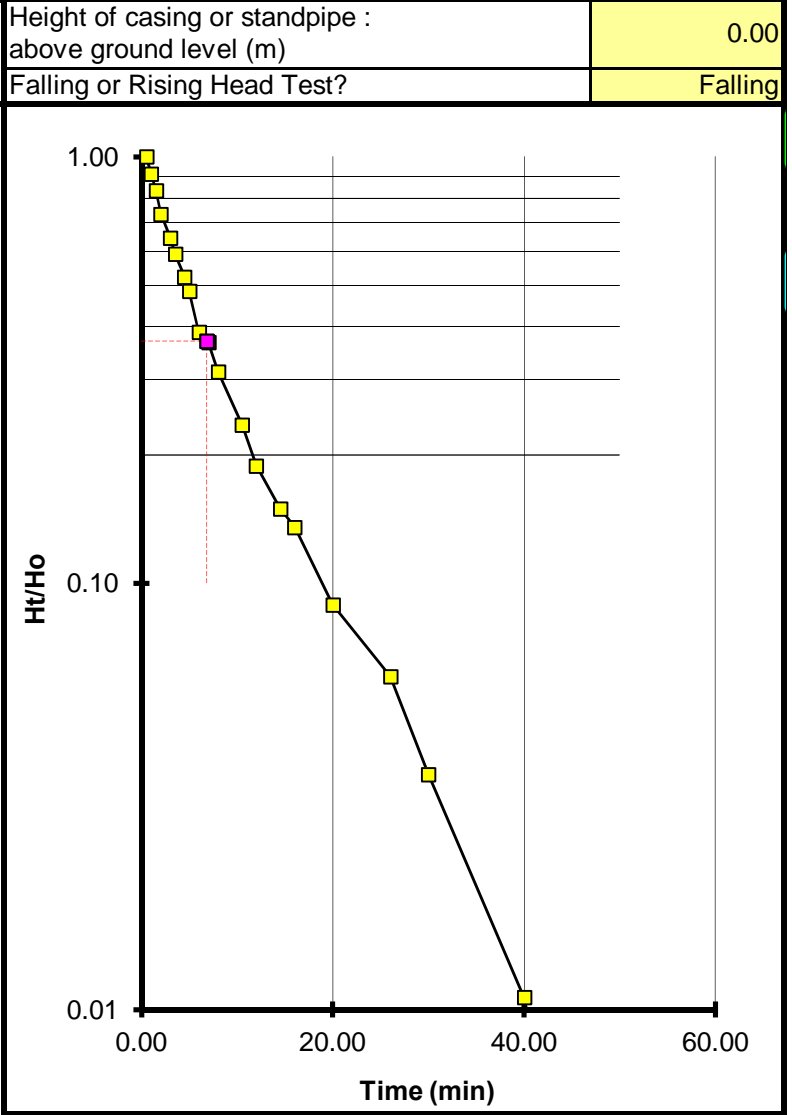
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Comments
Monitoring well silted up to 3.43m bgl during the test.

Variable Head Permeability Test

Project No.:	HLEI50224	TEST RESPONSE ZONE DETAILS:	
Project Name:	Chequersfield	Top (mbgl):	1.00
Client:	Taylor Wimpey	Bottom (mbgl):	4.00
Borehole No.:	DTS04 - Test 3	Length (m):	3.00
Compiled By:	MA	Diameter (m):	0.050
Date:	13/03/2017	Initial Standing Water Level (m below top of casing):	3.43
Checked By:	LH	Height of casing or standpipe : above ground level (m)	0.00
Date:	21/03/2017	Falling or Rising Head Test?	Falling

Elapsed Time (mins)	Depth to Water* (m)	Ht/Ho
0.5	0.62	1.00
1	0.87	0.91
1.5	1.09	0.83
2	1.37	0.73
3	1.62	0.64
3.5	1.77	0.59
4.5	1.96	0.52
5	2.07	0.48
6	2.34	0.39
7	2.4	0.37
8	2.55	0.31
10.5	2.77	0.23
12	2.9	0.19
14.5	3.01	0.15
16	3.05	0.14
20	3.18	0.09
26	3.26	0.06
30	3.33	0.04
40	3.4	0.01
45	3.42	0.00
50	3.43	0.00



Cross Sectional Area of Test Zone	A=	0.00196
Shape Factor (Case B)	F=	0.13750
Time to reach Ht/Ho = 0.37 (sec)	T=	410
Permeability (m/s)	K=	3.48E-05



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Comments