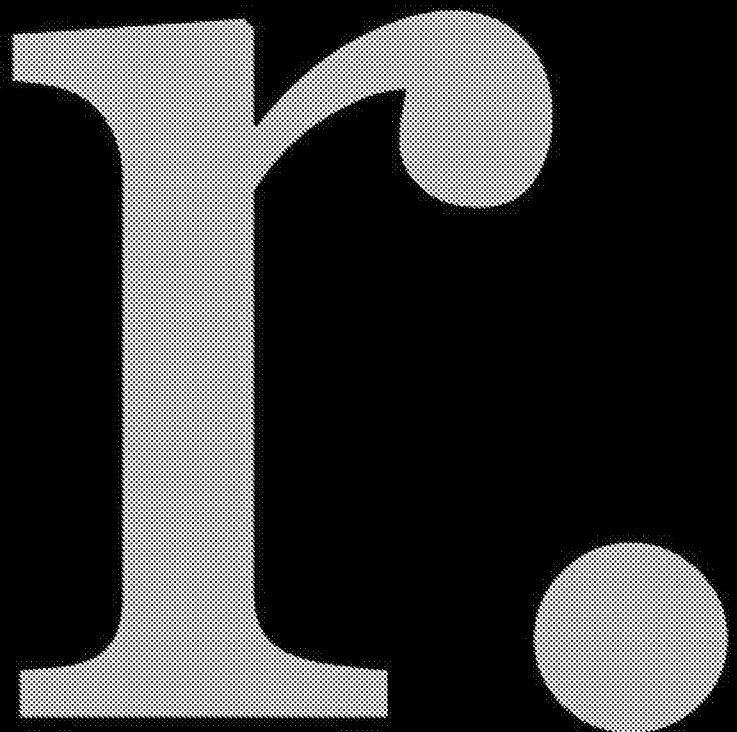


reside.

Land west of Fontwell Avenue, Eastergate

Factual Letter Report 18158/FLR Rev 1.02 February 2020



Reside Developments

E.A.O Andrew Munton

February 2020
Our Ref.: 18158/FLR Rev 1.02

Dear Andrew

Re: Land west of Fontwell Avenue, Eastergate, Chichester, West Sussex PO20 3RX

We are writing regarding the intrusive investigation undertaken at the above-named site.

Brief

Soils Limited quotation (Q22341/rev102, dated 17th January 2020) set the scope of the investigation. The investigation was to comprise the machine excavation of trial pits with subsequent infiltration testing in accordance with the principles of BRE DG 365:2016 and to produce a Factual Letter Report. 4No. rounds of soil gas and groundwater monitoring were also requested, undertaken using monitoring standpipes previously installed onsite in December 2017 (Soils Limited report ref.: 16695/LR, dated June 2018).

This letter report has been updated to include the final results of the soil gas and groundwater monitoring, which concluded March 2020.

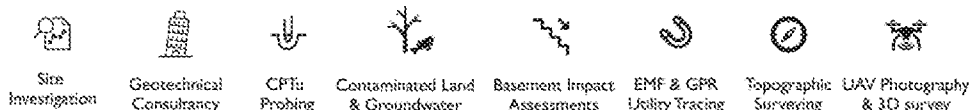
General

The site was located west of Fontwell Avenue, Eastergate, Chichester, West Sussex PO20 3RX and has an OS Land Ranger Grid Reference of SU 947 062.

A site location plan has been included as Figure 1.

Anticipated Geology

1:50 000 BGS geology maps showed the site to be located on Lambeth Group over undifferentiated Lewes Nodular, Seaford and Newhaven Chalk Formation, with superficial deposits of Head overlying.



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Head

Head deposit are drifts produced by solifluxion, the downslope movement of debris outwash during the periglacial period, and characteristically comprise poorly sorted sands gravels and chalk of local derivation

Lambeth Group

Woolwich and Reading Beds, occurs in the London and Hampshire Basins, where it directly overlies the Chalk or Thanet Sand Formation, and is succeeded by the Harwich and London Clay Formations. Although generally less than 50 metres thick, it's lithological variability and position beneath much of London has concerned tunnelling engineers since the early 19th century.

The relationship between the different depositional environments is seen in central and south-east London, where deposits of fine-grained sand, flint gravel beds, mottled clay, shell beds and altered beds form a complex interdigitating sequence, which is divided into three formations, the Woolwich and the Reading Formation, depending on the local succession, both overlying the Upnor Formation.

Vertically and laterally variable sequences mainly of clay, some silty or sandy, with some sands and gravels, minor limestones and lignites and occasional sandstone and conglomerate.

The top of the Lambeth Group is marked by the eroded or interburrowed surface at the base of the overlying Thames Group. The uppermost part of the Lambeth Group can be the Reading Formation or the Woolwich Formation, depending on the local succession, or the Upnor Formation, depending on the depth of pre-Thames Group erosion. The Lambeth Group is overlain by sands, silts, clays or gravel beds of the Harwich Formation, depending on the local sequences, or gravelly sandy clays at the base of the London Clay Formation.

In the Hampshire Basin and the west of the London Basin, the Lambeth Group overlies the Chalk Group.

Lewes Nodular, Seaford and Newhaven Chalk Formation (undifferentiated)

Lewes Nodular Chalk Formation is composed of hard to very hard nodular chalks and hardgrounds (which resist scratching by finger-nail) with interbedded soft to medium hard chalks (some grainy) and marls; some griotte chalks. The softer chalks become more abundant towards the top. Nodular chalks are typically lumpy and iron-stained (usually marking sponges). Brash is rough and flaggy or rubbly, and tends to be dirty. First regular seams of nodular flint, some large, commence near the base and continue throughout

Seaford Chalk Formation can be described as firm white chalk with conspicuous semi-continuous nodular and tabular flint seams. Hardgrounds and thin marls are known from the lowest beds. Some flint nodules are large to very large.

The Newhaven Chalk Formation is a soft white friable microporous limestone composed of coccolith biomicrites with a varying proportion of larger shell fragments.

At various levels clay sized material occurs as marl seams and partings. Close to the surface the upper few metres are invariably discoloured brown, due to leaching from the overlying strata. The interface with any overlying stratum is invariably extremely irregular as a result of localised weathering and general solution. Weathering by frost action may extend to a depth of several metres.

Chalk is a weak rock and as such it should be noted that the drilling, excavating and sampling process is detrimental to its fabric and structure. Chalk samples that have been machine sampled will therefore appear to be of a lower descriptive grade, as given in CIRIA C574, than the in-situ chalk. Soil sampling and visual observations from open excavations i.e. trial pits would allow chalk description and classification in accordance with CIRIA 574 including commenting for any aperture and discontinuities in the chalk structure.

Occasional erosional features, such as pipes, swallow holes and solution cavities, usually in-filled with drift deposits, are found in the chalk. The features sometimes manifest themselves at the surface as shallow circular depressions. Solution features may be reactivated by the concentrated ingress of water from leaking drains or soakaways. Reactivation may lead to surface collapse.

Site Works

Site Works were undertaken on 3rd February 2020 and comprised the machine excavation of three trial pits (SA1 – SA3), using 5 tonne tracked 360 excavator, to depths ranging between 2.10m and 3.00m below ground level (bgl) at locations selected by the client.

Following construction of the trial holes, infiltration testing accordance with the principles of BRE DG 365:2016 were performed in each trial pit, with the exception of SA1, whereby pit wall instability rendered it unsafe to complete the testing.

On completion, all trial holes were backfilled with arisings with excess mounded over to allow for future settlement.

A trial hole location plan is included as Figure 2.

Ground Conditions

The ground conditions encountered during the site investigation have been summarised in Table 1. Please note that the chalk was not encountered within the test holes. Full field logs are presented in Appendix A.

Table 1 – Summary of Ground Conditions

Strata	Depth Encountered (m bgl)		Typical Description
	Top	Base	
Topsoil	0.00	0.30	Turf over light grey and brown slightly gravelly CLAY with frequent rootlets. Gravel was fine to medium subangular clasts of flint.
Head	0.30	2.10 ¹ – 3.00 ¹	Orange and brown slightly sandy gravelly CLAY over light grey and orange brown gravelly highly calcareous CLAY. Gravel was fine to medium angular to subangular clasts of flint and chalk.

Notes: ¹ Encountered to base of trial hole. 0.00 denotes ground level.

Infiltration Testing

Infiltration testing comprised piping water via water tanker and bowser into an open trial hole, the drop in water level is measured over time was then recorded to give an indication of soakage potential.

BRE DG365, 2016 states that for an accurate infiltration rate to be obtained a soakage pit needs to be filled three times in quick succession. Each test was completed once 75% of the water present has drained away, in order to determine whether the underlying ground conditions may be suitable for surface water drainage.

Pit walls of all three trial pits were highly unstable and was observed to influence the head within each pit during the test.

The results from the infiltration testing are summarized in Table 2. Full results are presented in Appendix B.

Table 2 – Summary of Infiltration Test Results

Trial Hole (Test No.)	Test Stratum	Trial Pit Depth (m bgl)	Water Level Start of Test (m bgl)	Infiltration Rate (m/sec)	Comments
SA2(1)	HEAD	2.40	1.90	3.29×10^{-5}	Pit walls collapsing during test.
SA1(2)	HEAD	2.40	1.60	n/a	Pit walls collapsing during test. Test did not complete within observation period. 300mm fall in head observed over 78 minutes.
SA3(1)	HEAD	2.50	2.10	2.65×10^{-4}	Pit walls collapsing during test.
SA3(2)	HEAD	2.44	1.60	1.07×10^{-4}	Pit walls collapsing during test.
SA3(3)	HEAD	2.40	1.52	8.57×10^{-5}	Pit walls collapsing during test.

It should be noted that the Environment Agency must be consulted on any works which may impact groundwater sources.

Soil Gas and Groundwater Monitoring

Four rounds of soil gas and groundwater monitoring were requested, using monitoring standpipes (WS1 – WS3) installed onsite in December 2017. In addition to this, water levels were taken from each standpipe at the time of this intrusive investigation.

The locations of the standpipes are included within trial hole location plan in Figure 2.

The monitoring results have been presented in Table 3.

Table 2 – Soil Gas and Groundwater Monitoring Results to Date

Date	Trial Hole	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	H ₂ S (ppm)	CO (ppm)	LEL (%)	aP (mb)	Flow (l/h)	Dp (Pa)	H ₂ O (m bgl)	Base of well (m bgl)
27/01/20 ¹	ATM	0.0	0.0	19.7	0.0	0.0	0.0	996	0.0	0.0	-	-
	WS1	0.0	4.1	11.9	0.0	0.0	0.0	996	0.0	0.0	2.92	5.00
	WS2	0.0	3.6	17.7	0.0	0.0	0.0	998	0.0	0.0	3.96	5.00
	WS3	0.0	2.3	17.0	0.0	0.0	0.0	997	0.0	0.0	3.46	5.00
03/02/20	ATM	Only groundwater level measurements recorded at time of intrusive investigation.									-	-
	WS1										2.80	5.00
	WS2										3.87	5.00
	WS3										3.40	5.00
12/02/20	ATM	0.0	0.0	20.2	0.0	0.0	0.0	1013	0.0	0.0	-	-
	WS1	0.0	3.8	12.9	0.0	0.0	0.0	1013	0.0	0.0	2.90	5.00
	WS2	0.0	3.3	15.0	0.0	0.0	0.0	1013	0.0	0.0	3.92	5.00
	WS3	0.0	2.4	17.2	0.0	0.0	0.0	1013	0.0	0.0	3.43	5.00
27/02/20	ATM	0.0	0.0	20.7	0.0	0.0	0.0	1005	0.0	0.0	-	-
	WS1	0.0	2.0	15.6	0.0	0.0	0.0	1005	0.0	0.0	2.40	5.00
	WS2	0.0	2.1	16.3	0.0	0.0	0.0	1005	0.0	0.0	3.33	5.00
	WS3	0.0	1.8	16.8	0.0	0.0	0.0	1005	0.0	0.0	2.78	5.00
19/03/20	ATM	0.0	0.0	19.8	0.0	0.0	0.0	1023	0.0	0.0	-	-
	WS1	0.0	3.5	12.4	0.0	0.0	0.0	1023	0.0	0.0	2.43	5.00
	WS2	0.0	3.3	13.7	0.0	0.0	0.0	1022	0.0	0.0	3.25	5.00
	WS3	0.0	0.1	19.7	0.0	0.0	0.0	1022	0.0	0.0	2.67	5.00

Note: reading of 0.0 = not detected (below detection level). VOC=Volatile Organic Compounds. Dp=Pressure Difference. ¹ Strong wind conditions recorded.

The following attachments make up the remainder of this letter report.

Figure 1. Site Location Plan

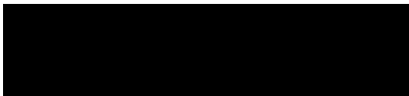
Figure 2. Trial Hole Location Plan

Appendix A. Field Logs

Appendix B. Field Data.

Should you have any further questions, please do not hesitate to contact the undersigned.

Yours sincerely



T. Rudkin BSc. (Hons.), MSc., FGS.

Geo-Environmental Engineer



For and on behalf of Soils Limited.
Enc.



Figure number

2

Title

Trial Hole Location Plan

Project

Land west of Fontwell Avenue

Date

February 2020

Client

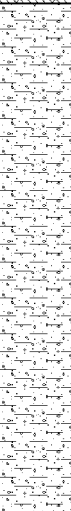
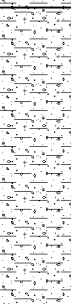
Reside Developments

Reference

I8158/FLR

Appendix A. Field Logs

		Soils Limited Newton House, Cross Road, Tadworth KT20 5SR 			Trial Pit Log		Trial Pit No. SA2 Sheet 1 of 1	
Project Name: Northfield Cottages				Project No.: 18158		Method:		Hole Type TP
Location: Fontwell Avenue, Eastergate, Chichester, West Sussex, PO20 3RX				Support:		Plant: 5t		
Client: Reside Developments Ltd				Trial Pit Length: 1.80m		Trial Pit Width: 0.60m		Scale 1:25
Dates: 03-02-2020			Level:		Co-ords:			Logged By GB
Water Strike	Samples & In Situ Testing			Depth (m)	Level (mAOD)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	D		0.30			Turf over light grey and brown slightly gravelly CLAY with frequent rootlets. Gravel is fine to medium subangular clasts of flint.	
	0.50	D					Orange and brown slightly sandy gravelly CLAY. Gravel is fine to medium angular to subangular clasts of flint.	
	1.00	D						
	1.50	D		2.10				
	2.00	D						
	2.50	D					Light grey and orange brown gravelly calcareous CLAY. Gravel is fine to medium angular to subangular clasts of flint and chalk.	
				2.70			End of Pit at 2.700m	
								1
								2
								3
								4
								5
General Remarks: Pit walls unstable								Sample Type D: Disturbed B: Bulk J: Jar W: Water
Groundwater Remarks:								

		Soils Limited Newton House, Cross Road, Tadworth KT20 5SR 			Trial Pit Log		Trial Pit No. SA3	
Project Name: Northfield Cottages		Project No.: 18158		Method:		Sheet 1 of 1		
Location: Fontwell Avenue, Eastergate, Chichester, West Sussex, PO20 3RX				Plant: 5t		Hole Type TP		
Client: Reside Developments Ltd		Trial Pit Length: 2.50m		Trial Pit Width: 0.60m		Scale 1:25		
Dates: 03-02-2020		Level:		Co-ords:		Logged By GB		
Water Strike	Samples & In Situ Testing			Depth (m)	Level (mAOD)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	D		0.30			Turf over light grey and brown slightly gravelly CLAY with frequent rootlets. Gravel is fine to medium subangular clasts of flint.	
	0.50	D					Orange and brown slightly sandy gravelly CLAY. Gravel is fine to medium angular to subangular clasts of flint.	
	1.00	D						
	1.50	D		2.00			Light grey and orange brown gravelly calcareous CLAY. Gravel is fine to medium angular to subangular clasts of flint and chalk.	
	2.00	D						
	2.50	D		3.00			End of Pit at 3.000m	
	3.00	D						
General Remarks: Pit walls unstable							Sample Type D: Disturbed B: Bulk J: Jar W: Water	
Groundwater Remarks:								

Appendix B. Field Data

Soakaway Calculations

Soakaway Test No.	SA2 Test 1
Contract:	Northfield Cottages
Contract No.	18158

Field Test

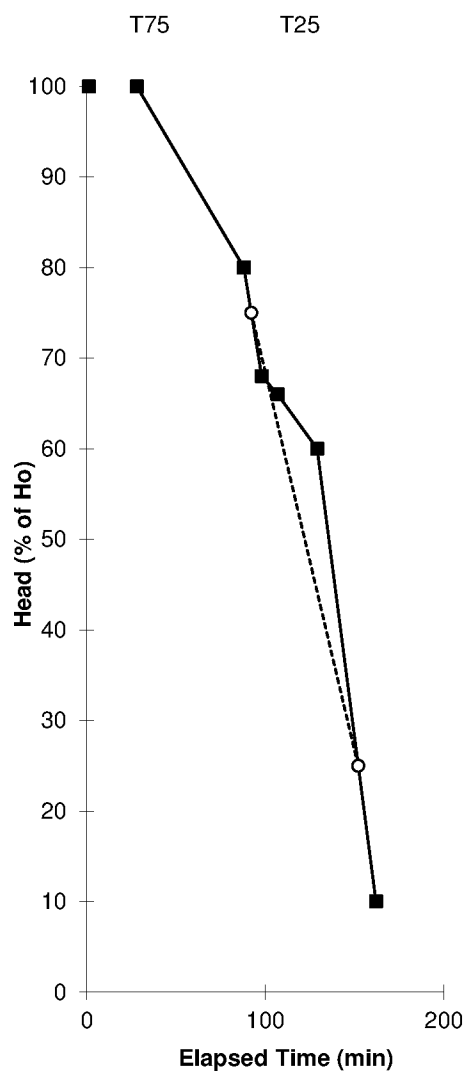
Trial Pit Log (include details of groundwater):
See trial Pit record

Depth of Pit	2.40 m
Width of Pit	0.60 m
Length of Pit	1.80 m
Depth of Pit Soaked	0.50 m
$ap50$	2.28 m ²
$Vp75-25$	0.27 m ³
$t75-25$	59.9 min
water used	0.5400 m ³
f	$3.293E-05$ m/sec.

Field Data

[illegible]

T75	92.167	75
T25	152.100	25
T75-25	59.933	Derived from Best Fit



Comments

Pit walls collapsing resulting in raise in head

SOILS LIMITED

Newton House, Cross Road, Tadworth
Surrey, KT20 5SR

Soakaway Calculations

Soakaway Test No.	SA2 Test 2
Contract:	Northfield Cottages
Contract No.	18158

Field Test

Trial Pit Log (include details of groundwater):

See trial Pit record

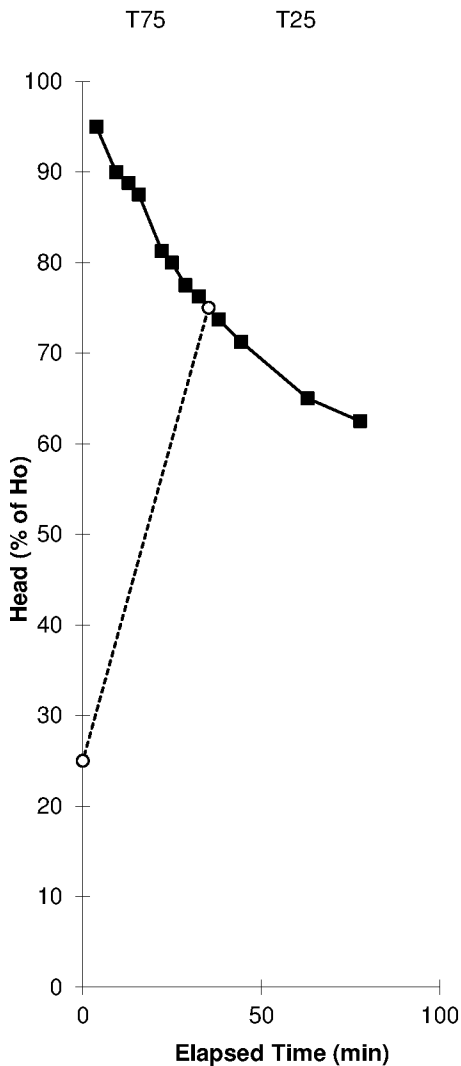
Depth of Pit	2.40 m
Width of Pit	0.60 m
Length of Pit	1.80 m
Depth of Pit Soaked	0.80 m

ap50	3	m2
q _{p75-25}	0.432	m3
t ₇₅₋₂₅	-35.2	min
water used	0.8640	m3
f	n/a	m/sec.

Field Data

[illegible]

T75	35.215	75
T25	0.000	25
T75-25	-35.215	Derived from Best Fit



Comments

Pit walls collapsing. Test not complete within observation period.

SOILS LIMITED

**Newton House, Cross Road, Tadworth
Surrey, KT20 5SR**

Soakaway Calculations

Soakaway Test No.	SA3 Test 1
Contract:	Northfield Cottages
Contract No.	18158

Field Test

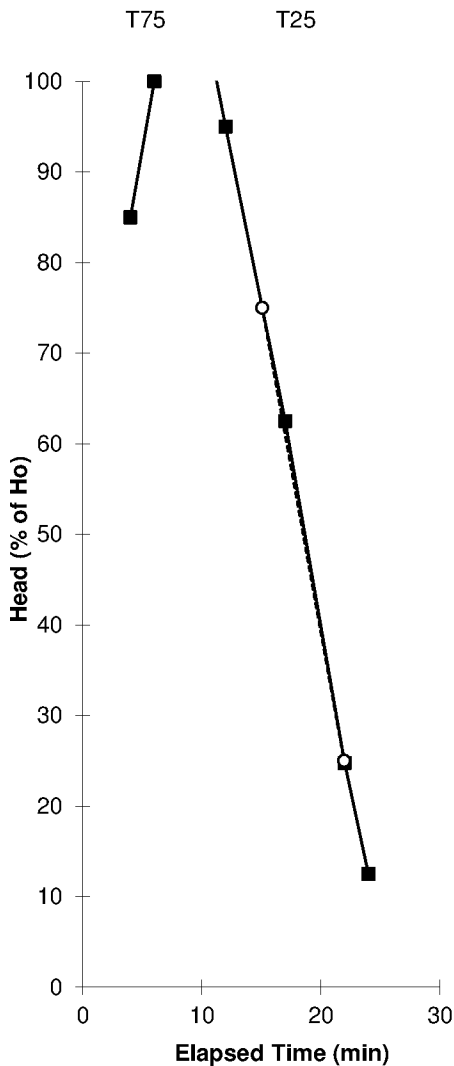
Trial Pit Log (include details of groundwater):
See trial Pit record

Depth of Pit	2.50 m
Width of Pit	0.60 m
Length of Pit	2.50 m
Depth of Pit Soaked	0.40 m
ap50	2.74 m2
q _{p75-25}	0.3 m3
t ₇₅₋₂₅	6.9 min
water used	0.6000 m3
f	2.649E-04 m/sec.

Field Data

[illegible]

T75	15.077	75
T25	21.967	25
T75-25	6.890	Derived from Best Fit



Comments

Pit walls collapsing resulting in raise in head

SOILS LIMITED

**Newton House, Cross Road, Tadworth
Surrey, KT20 5SR**

Soakaway Calculations

Soakaway Test No.	SA3 Test 2
Contract:	Northfield Cottages
Contract No.	18158

Field Test

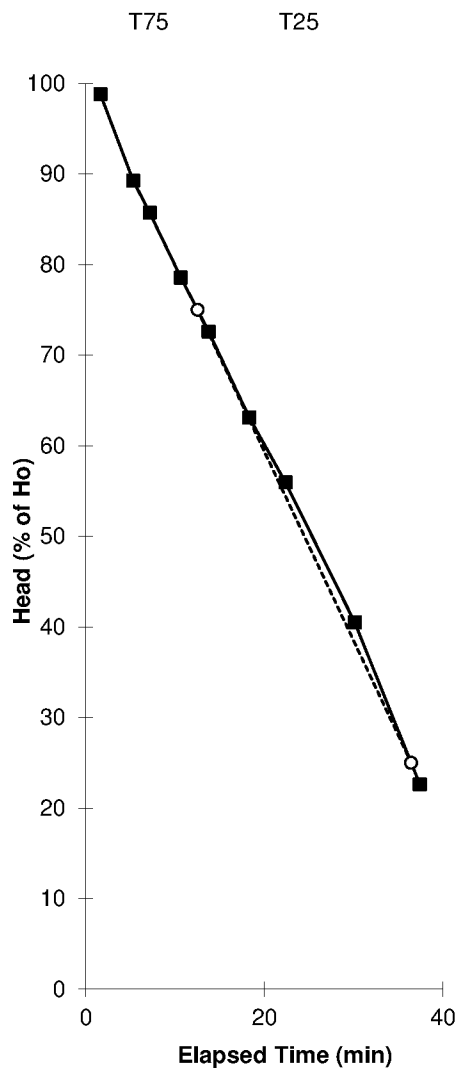
Trial Pit Log (include details of groundwater):
See trial Pit record

Depth of Pit	2.44 m
Width of Pit	0.60 m
Length of Pit	2.50 m
Depth of Pit Soaked	0.84 m
ap50	4.104 m ²
q _p 75-25	0.63 m ³
e75-25	23.9 min
water used	1.2600 m ³
i	1.068E-04 m/sec.

Field Data

[illegible]

T75	12.510	75
T25	36.455	25
T75-25	23.945	Derived from Best Fit



Comments

SOILS LIMITED

**Newton House, Cross Road, Tadworth
Surrey, KT20 5SR**

Soakaway Calculations

Soakaway Test No.	SA3 Test 3
Contract:	Northfield Cottages
Contract No.	18158

Field Test

Trial Pit Log (include details of groundwater):
See trial Pit record

Depth of Pit	2.40 m
Width of Pit	0.60 m
Length of Pit	2.50 m
Depth of Pit Soaked	0.88 m

ap50	4.228 m2
v _{p75-25}	0.66 m3
t ₇₅₋₂₅	30.3 min
water used	1.3200 m3
i	8.573E-05 m/sec.

Field Data

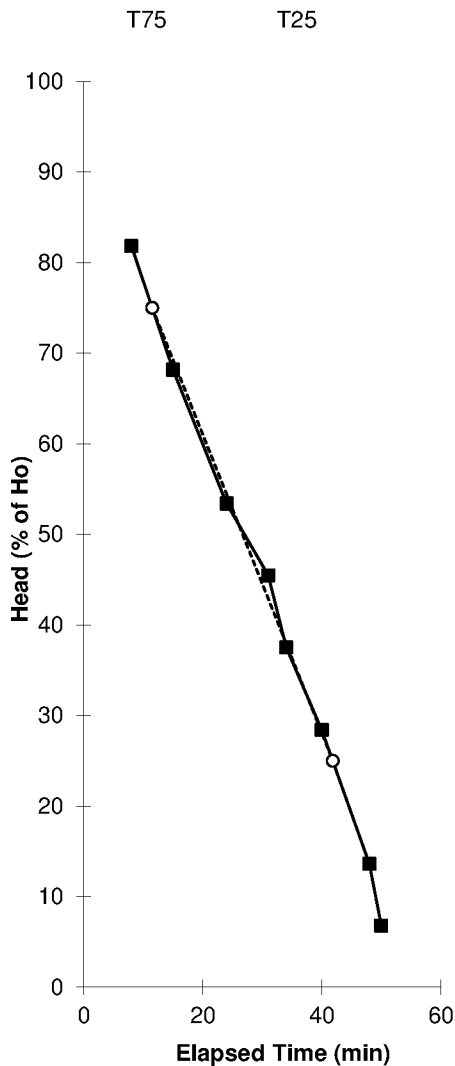
[illegible]

T75	11.500	75
T25	41.846	25
T75-25	30.346	Derived from Best Fit

Comments

SOILS LIMITED

**Newton House, Cross Road, Tadworth
Surrey, KT20 5SR**



Report presented by

soils
LIMITED

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