

4th March 2020

Our ref: GE18761/FG02/200304

Kieran McGuire
Linden Homes South (Vistry Homes Southern)
1A Guildford Business Park
Guildford
Surrey
GU2 8XG



Dear Kieran,

RE: WOODCROFT FARM (PHASE 2B), WOODCROFT LANE, LOVEDEAN – LEACHATE TESTING

Geo-Environmental Services Limited (Geo-Environmental) was instructed by Linden Homes to undertake the excavation of a single trial pit in the vicinity of previously located TP314 to collect soil samples for leachate testing in order to address concerns raised by the Local Authority with regards to contaminants identified within the natural soils in this area during the investigation works undertaken in May 2018 and reported in GE16943/RSVP-FY/JUN18 and to assess their leachability.

The purpose of this investigation was to collect environmental samples from the representative natural soils, where contaminants had previously been identified (1.60m bgl) to address concerns about possible leachability in order to progress the discharge of planning conditions on the site.

Scope of Works

The following scope of works was agreed with the Client:

- The excavation of 1No. machine dug trial pit to a provisional depths of 2.00m bgl. (Located in the vicinity of TP314);
- Collection of soil samples from depths representative of previously identified contaminants within the natural soils in this vicinity. (Contaminants previously identified at 1.60m bgl);
- Analysis of soil samples, leachate testing, for a suite of heavy metals as previously identified within the natural soils in the vicinity of TP314.

The intrusive investigation was undertaken on 19th February 2020 with the works being supervised by an engineer from Geo-Environmental.

Ground Conditions

In total, the intrusive investigation comprised the excavation of 1No. trial pit to a depth of 2.00m bgl. Figure 2 presents the exploratory hole location.

The ground conditions encountered during the investigation were broadly consistent with the anticipated published sequence of strata and previously encountered ground conditions. In summary, ground conditions typically comprised of soils inferred to be of the Lambeth Group overlying chalk inferred to be the highly weather upper profile of the Tarrant Chalk Member.

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Soils inferred to be Lambeth Group were encountered from ground level to 1.75m bgl. The deposits encountered comprised firm to stiff orange and grey mottled slightly sandy clay, becoming gravelly and flinty from 1.20m bgl.

Chalk inferred to be the highly weather upper profile of the Tarrant Chalk Member, was encountered from 1.75m bgl to the full extent of the investigation, i.e. 2.00m bgl. The chalk encountered comprised structureless putty like off white chalk with medium strength chalk clasts in a granular matrix (CIRIA class Dm/Dc).

Figure 2 presents the investigation locations along with the location of the previously undertaken TP314. For more detailed descriptions of the ground conditions, reference should be made to the exploratory hole logs enclosed in Appendix A.

Groundwater

Groundwater was not encountered within the investigation location undertaken.

Groundwater has not been encountered during any of the phases of investigation works undertaken by Geo-Environmental to date or during any subsequent monitoring rounds. Boreholes were constructed to a maximum depth of 25.00m bgl and therefore it is assumed that groundwater is present at a depth greater than 25.00m bgl, i.e. there is a substantial thickness of unsaturated zone beneath this site.

Visual and Olfactory Contamination

No visual or olfactory evidence of contamination was identified during the additional investigation.

Leachate Assessment

Three soil samples were collected from the trial pit for leachate testing. The samples were analysed for a suite of metal contaminants consistent with the previously identified contaminants within the natural soils at this location to address concerns regarding potential contaminant leachability.

The trial pit was located in the vicinity of TP314 so as to provide targeted coverage to address concerns relating to the leachability of previously identified elevated levels of Arsenic and Nickel within the natural soils at a depth of 1.60m bgl as part of the May 2018 investigation. Soil samples were collected from 1.40m, 1.60m and 1.80m bgl from within the Lambeth Group and the Chalk. These depths were selected so that samples were taken from above and below the previously identified contaminants and within the different strata so as to assess whether contaminants may have leached/may be leaching into the chalk. Analysis was undertaken on the soil samples collected from these depths.

The results of the leachate analyses undertaken were compared against the Water Supply (Water Quality) Regulations 2000.

Leachable concentrations of both Arsenic and Nickel were found to be below the laboratory limit of detection for all samples tested, i.e. <5ug/l. The only recorded concentrations of any metals tested above the limit of detection were within the samples from 1.4m bgl for Copper and Zinc. When compared against the standards set out in the Water Supply Regulations for Water Intended for Human Consumption, the results for both of these metals are below the respective standards. In addition, Copper and Zinc were only identified with the sample from 1.4m bgl they were not identified within either sample analysed from depths below this (i.e. 1.60m and 1.80m bgl).

Based on the leachate analysis undertaken it is considered that the Arsenic and Nickel previously identified within the natural soils at 1.60m bgl in TP314 have a very low leachability and do not pose a risk to groundwater beneath

the site, which is likely to be at depths in excess of 25m bgl based on the investigation undertaken on the site to date.

The testing supports the original assessment put forward by Geo-Environmental that, the presence of clays and weathered structureless putty chalk encountered within the farmyard area provide a very low permeability layer, which would act as an aquitard that sits above the structured chalk of the Tarrant Chalk Member the Principal Aquifer. The soils encountered within the investigation locations beneath the farmyard area, to a maximum depth of 2.50m bgl, have been demonstrated to be of very low permeability and would likely inhibit any mobilisation or migration of contaminants identified within the shallow soils in this area. The identified contaminants, Arsenic and Nickel, within the natural soils within TP314, have been demonstrated to be bound to the soil matrix and are not considered to be mobile. In addition, groundwater is not in contact with these soils and there is a significant thickness of unsaturated zone (>25m) within which attenuation and degradation mechanisms would prevail together with dilution within the groundwater present at depth.

Given the depth at which Arsenic and Nickel were encountered and that the concentration appear to relate to one small/localised point on site (therefore of very limited volume), given their lack of apparent mobility and the lack of any pollutant pathways they are not considered to represent a risk to either human health or controlled waters.

Based on the above assessment and the results of the leachate analysis it is considered that the concerns relating to contaminant leachability have been addressed and that no remedial measures or further action are considered to be necessary in relation to the elevated concentrations of Arsenic and Nickel identified within TP314 as part of the May 2018 investigation.

Closure

We trust we have interpreted your request correctly and provided sufficient information for your current requirements. If you have any questions or queries in relation the information provided at this stage please let us know.

Yours sincerely

For and on Behalf of Geo-Environmental



FIONA GOODE BSc (Hons), MSc, FGS, MIEnvSc, RSoBRA

Senior Consultant Engineer

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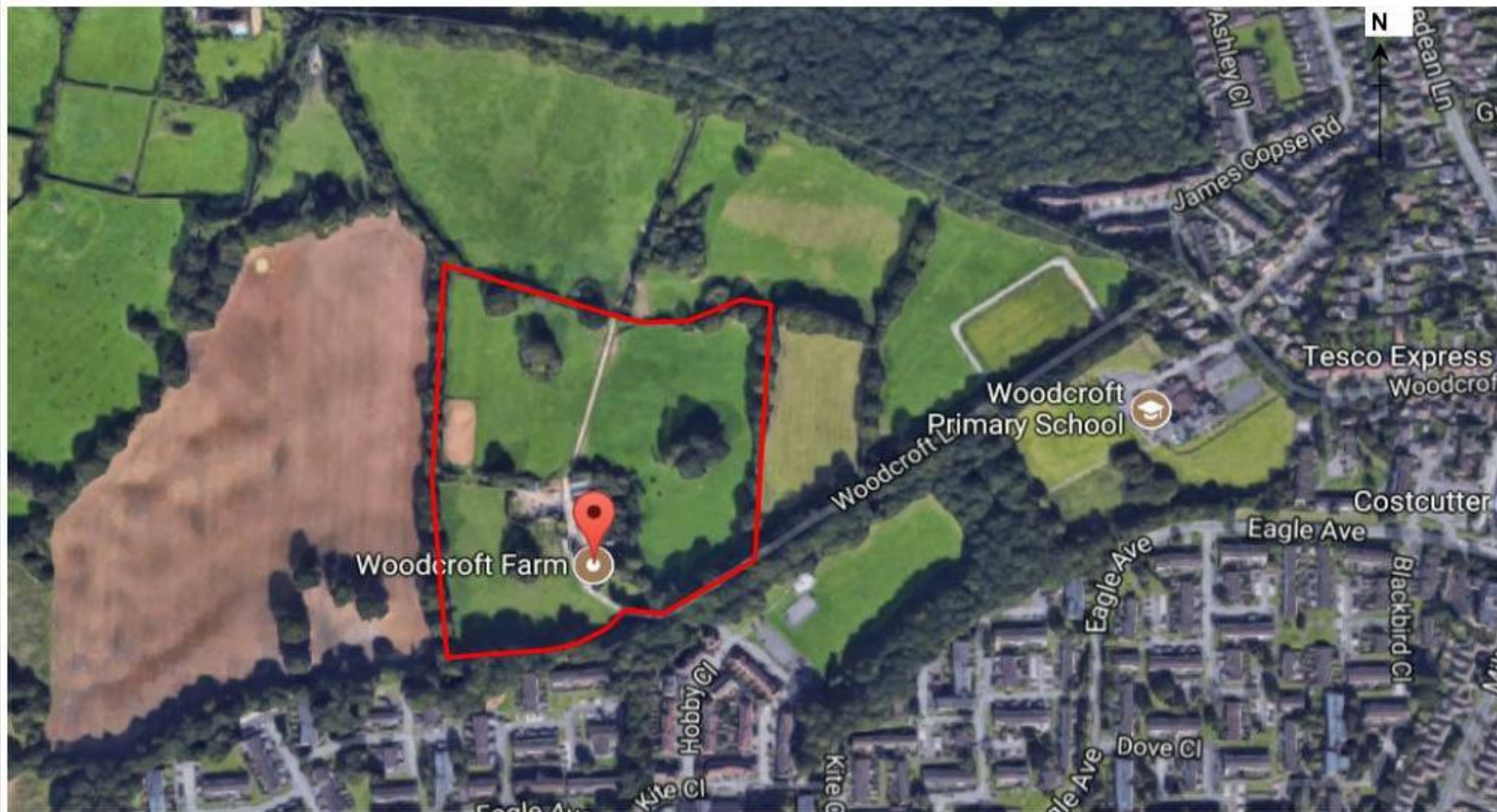
- Enc Figure 1 – Site Location Plan
 Figure 2 – Exploratory Location Plan
 Appendix A – Exploratory Hole Logs
 Appendix B – Geochemical Laboratory Test Results





Figures





Project:	Woodcroft Farm, Lovedean, PO8 9QA			Title	Site Location Plan		
Client:	Linden Homes South			Geo-Environmental Services Ltd Unit 7 Danworth Farm, Cuckfield Road Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net  Geo-Environmental			
Ref No:	GE18761	Revision:	0				
Drawn:	FG	Date:	11/05/2018				
Figure:	1	Scale:	Not To Scale				



Project:	Woodcroft Farm, Lovedean, PO8 9QA			Title	Exploratory Hole Location Plan	
Client:	Linden Homes South			Geo-Environmental Services Ltd Unit 7 Danworth Farm, Cuckfield Road Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net  Geo-Environmental		
Ref No:	GE18761	Revision:	0			
Drawn:	FG	Date:	04/03/2020			
Figure:	2	Scale:	Not To Scale			



Geo-Environmental



APPENDIX A

Exploratory Hole Logs





Unit 7, Danworth Farm
Hurstpierpoint
BN6 9GL

Geo-Environmental www.gesl.net

Trial Pit Log

Trial Pit No
TP414
Sheet 1 of 1

Project Name: Woodcroft Farm - Leachate Testing

Project No.
GE18761

Co-ords: 468120.00 - 112025.00
Level:

Date
19/02/2020

Location: Waterloooville

Dimensions
(m):

2.40

Scale
1:25

Client: Linden Homes South

Depth
2.00

0.40

Logged
FG

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
							Grass over firm to stiff orange and grey mottled slightly sandy CLAY with occasional rootlets. Sand is fine LAMBETH GROUP
	1.40	ES		1.20			Firm to stiff orange and grey mottled gravelly CLAY. Gravel is fine to medium sub angular to sub rounded of flint LAMBETH GROUP
	1.60	ES		1.50			Firm to stiff orange and grey mottled very gravelly CLAY. Gravel is fine to coarse sub angular to sub rounded of flint and chalk LAMBETH GROUP
	1.80	ES		1.60			Firm to stiff orange and off white mottled gravelly CLAY. Gravel is fine to medium of chalk LAMBETH GROUP
				1.75			Recovered as structureless off white putty like CHALK with medium strength chalk clasts in a granular matrix. TARRANT CHALK MEMBER
				2.00			End of Pit at 2.00m

Depth (m)	Time (min)

Remarks

Stability Sides Stable





APPENDIX B

Geochemical Laboratory Results





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THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number: 20-27168

Issue: 1

Date of Issue: 27/02/2020

Contact: Fiona Goode

Customer Details: GESL
Unit 7
Danworth Farm
Hurstpierpoint
West Sussex BN6 9GL

Quotation No: Q19-01488

Order No: PO-2514

Customer Reference: GE18761

Date Received: 21/02/2020

Date Approved: 27/02/2020

Details: Woodcroft Farm

Approved by:

Mike Varley, Technical Manager

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683)

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Sample Summary

Report No.: 20-27168, issue number 1

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
197872	TP414 1.40	19/02/2020	21/02/2020	Sandy silty loam	
197873	TP414 1.60	19/02/2020	21/02/2020	Silty loam	
197874	TP414 1.80	19/02/2020	21/02/2020	Chalk	

Results Summary

Report No.: 20-27168, issue number 1

ELAB Reference				197872	197873	197874
Customer Reference						
Sample ID						
Sample Type				SOIL	SOIL	SOIL
Sample Location				TP414	TP414	TP414
Sample Depth (m)				1.40	1.60	1.80
Sampling Date				19/02/2020	19/02/2020	19/02/2020
Determinand	Codes	Units	LOD			
Metals						
Arsenic 10:1 extract	N	ug/l	5	< 5	< 5	< 5
Cadmium 10:1 extract	N	ug/l	1	< 1	< 1	< 1
Chromium 10:1 extract	N	ug/l	5	< 5	< 5	< 5
Copper 10:1 extract	N	ug/l	5	8	< 5	< 5
Lead 10:1 extract	N	ug/l	5	< 5	< 5	< 5
Mercury 10:1 extract	N	ug/l	0.1	< 0.1	< 0.1	< 0.1
Nickel 10:1 extract	N	ug/l	5	< 5	< 5	< 5
Selenium 10:1 extract	N	ug/l	5	< 5	< 5	< 5
Zinc 10:1 extract	N	ug/l	5	5	< 5	< 5
Inorganics						
Hexavalent chromium	N	ug/l	100	< 100	< 100	< 100

Method Summary

Report No.: 20-27168, issue number 1

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
Leachate metals 10:1 extract	N		25/02/2020	101	ICPMS

Tests marked N are not UKAS accredited

Report Information

Report No.: 20-27168, issue number 1

Key

U	hold UKAS accreditation
M	hold MCERTS and UKAS accreditation
N	do not currently hold UKAS accreditation
^	MCERTS accreditation not applicable for sample matrix
*	UKAS accreditation not applicable for sample matrix
S	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
NS	Subcontracted to approved laboratory. UKAS accreditation is not applicable.
I/S	Insufficient Sample
U/S	Unsuitable sample
n/t	Not tested
<	means "less than"
>	means "greater than"

Soil sample results are expressed on an air dried basis (dried at < 30°C), and are uncorrected for inert material removed.

ELAB are unable to provide an interpretation or opinion on the content of this report.

The results relate only to the sample received.

PCB congener results may include any coeluting PCBs

Uncertainty of measurement for the determinands tested are available upon request

Unless otherwise stated, sample information has been provided by the client. This may affect the validity of the results.

Deviation Codes

a	No date of sampling supplied
b	No time of sampling supplied (Waters Only)
c	Sample not received in appropriate containers
d	Sample not received in cooled condition
e	The container has been incorrectly filled
f	Sample age exceeds stability time (sampling to receipt)
g	Sample age exceeds stability time (sampling to analysis)

Where a sample has a deviation code, the applicable test result may be invalid.

Sample Retention and Disposal

All soil samples will be retained for a period of one month

All water samples will be retained for 7 days following the date of the test report

Charges may apply to extended sample storage