

REF: 2481/GFPnly/RepLet/ES

26th Feb 2021

Dear Nigel

RE: Green Farm, Penley.

We are pleased to present the ground investigation report for the above site.

1.0 Introduction.

Erlas Developments (ED) are proposing to develop a site located off Ellesmere Lane, Penley. It is proposed to construct thirteen new houses, comprising four terraced houses, eight semi-detached houses and one detached house, with gardens and parking facilities also available.

An initial site investigation was carried out where infiltration testing was carried out to determine if the use of soakaways for drainage was feasible, see Appendix A.

Therefore, ED appointed Groundsolve Ltd (GSL) to excavate and log trial pits to confirm the ground conditions. In addition, ED requested chemical testing of the ground.

2.0 Site Location and Description

The site is located off Ellesmere Lane, Penley at National Grid Reference SJ 416, 395, see Figure 1.

The site is currently unoccupied after recent demolishing of old farm buildings which occupied the site previously. The site is bounded to the east by Ellesmere Lane, with residential housing located just off the site access from this road, and bounded to the north, west and south by open fields.

3.0 Site Investigation

The recent site investigation undertaken by GSL was carried out on 10th February 2021 and comprised:

Four trial pits excavated to a maximum depth of 1.70m in roughly similar locations to the initial site investigation.

Samples taken from the ground and glacial till in soakaway area for chemical testing.

The trial pits were supervised and logged by a GSL Geotechnical Engineer in general accordance with BS 5930, with the Trial Pit Logs presented in Appendix B. The locations of the trial pits are presented in Figure 2.

Samples for chemical testing were taken from the made ground and glacial till, placed in the appropriate containers and a cool box, and taken immediately to the laboratories of Derwentside Environmental Testing Services (DETS) Limited for the following testing:

Metals & Non-metals - Arsenic (As), Boron (B), Cadmium (Cd), Chromium (hexavalent), Chromium (Trivalent), Copper (Cu), Lead (Pb), Mercury (Hg), Nickel (Ni), Phenol, Selenium (Se), and Zinc (Zn).

Petroleum Hydrocarbons - Benzene, Toluene, Ethylbenzene, o-xylene, m-xylene, p-xylene, Aliphatics >C5 – C44, Aromatics >EC5 – EC44.

Polyaromatic Hydrocarbons (PAH) – Acenaphthene, Acenaphthylene, Anthracene, Benz (a) anthracene, Benzo (a) pyrene, Benzo (b) fluoranthene, Benzo (g, h, I) perylene, Benzo (k) fluoranthene, Chrysene, Dibenzo (a, h) anthracene, Fluorene, Fluoranthene, Indeno (1,2,3-cd) pyrene, Naphthalene, Phenanthrene, Pyrene.

Other Contaminants – Sulphide (easily liberated), Water soluble Sulphate (2:1 extract), Cyanide, pH, Soil Organic Matter (SOM).

In addition, asbestos screening was carried out on all samples.

4.0 Ground Conditions

The ground conditions encountered on site typically comprised made ground overlying glacial till, A summary of ground conditions are presented in Table 4.1 below:

Table 4.1: Summary of Ground Conditions

TP No.	Made Ground	Glacial Till
TP 01	0.00 - 0.40	0.40 – 1.70
TP02	0.00 – 0.10	0.10 – 1.70
TP03	0.00 – 0.10	0.10 – 1.70
TP 04	0.00 – 0.30	0.30 – 1.70

Made ground was encountered near the surface in all trial pits and generally comprised loose to medium dense clayey, sandy, subangular to angular, fine to course gravel.

Glacial tilt was encountered in all trial pits and generally comprised firm to stiff light brown, mottled grey, very sandy, gravelly clay, with the gravel comprising subangular to angular course sandstone.

5.0 Chemical Testing.

The results of the soil analyses are presented below, where they have been compared to suitable generic assessment criteria (GACs) . Full results are presented in Appendix C.

The samples tested are presented in Table 5.1 below:

Table 5.1: Chemical Testing analysis.

TP No.	Test Depth	Material Tested
TP01	1.1	Glacial Till
TP04	0.2	Made Ground

The Category 4 Screening Levels (C4SLs) published by DEFRA (2014) have been adopted in the first instance, which have been published for six substances to date. Where a C4SL is unavailable, the “Suitable 4 Use Levels” (S4ULs) published by LQM/CIEH (2015) have been adopted.

These criteria have been derived using the CLEA model for a range of standard end-use scenarios and a range of soil organic matter (SOM) contents. It should be noted that the C4SL values are derived on the basis of a “low level of toxicological concern”, while the S4UL values are based on a “tolerable” or “minimal” level of risk. As such, the S4ULs describe a lower level of risk than the C4SLs, and are equivalent to the former Soil Guideline Values (SGVs, published by the Environment Agency) and the previous editions of the LQM/CIEH GAC values.

The final end use of the land is regarded as “Residential with Gardens”.

Note: the S4UL values presented below are Copyright Land Quality Management Limited, reproduced with permission; Publication Number S4UL3668. All rights reserved.

	TP01	TP04			
	1.10	0.20	Adopted Guideline (mg/kg)	Source	Exceedances
Metals & Non-Metals					
Arsenic	7.60	7.10	37	C4SL	0
Boron, Water Soluble	3.00	0.50	290	S4UL	0
Cadmium	0.50	0.30	22	C4SL	0
Chromium III	20.00	10.00	910	S4UL	0
Chromium, Hexavalent	< 1.0	< 1.0	21	C4SL	0
Copper	42.00	28.00	2400	S4UL	0
Lead	52.00	27.00	200	C4SL	0
Mercury	0.26	0.23	1.2	S4UL	0
Nickel	20.00	12.00	130	S4UL	0
Phenol - Monohydric	< 0.3	< 0.3	120	S4UL	0
Selenium	0.80	< 0.5	250	S4UL	0
Zinc	130.00	41.00	3700	S4UL	0

No exceedances recorded against SGV values for 'Residential With Gardens'.

	TP01	TP04			
	1.10	0.20	Adopted Guideline (mg/kg)	Source	Exceedances
Petroleum Hydrocarbons					
Aliphatic C5-C6	< 0.01	< 0.01	42	S4UL	0
Aliphatic C6-C8	< 0.01	< 0.01	100	S4UL	0
Aliphatic C8-C10	< 0.01	< 0.01	27	S4UL	0
Aliphatic C10-C12	< 1.5	< 1.5	130	S4UL	0
Aliphatic C12-C16	< 1.2	< 1.2	1100	S4UL	0
Aliphatic C16-C21	< 1.5	< 1.5	65000	S4UL	0
Aliphatic C21-C35	< 3.4	< 3.4	65000	S4UL	0
Aliphatic C35-C40	< 3.4	< 3.4	70	S4UL	0
Aromatic C5-C7	< 0.01	< 0.01	70	S4UL	0
Aromatic C7-C8	< 0.01	< 0.01	130	S4UL	0
Aromatic C8-C10	< 0.01	< 0.01	34	S4UL	0
Aromatic C10-C12	< 0.9	< 0.9	74	S4UL	0
Aromatic C12-C16	< 0.5	< 0.5	140	S4UL	0
Aromatic C16-C21	< 0.6	< 0.6	260	S4UL	0
Aromatic C21-C35	< 1.4	< 1.4	1100	S4UL	0

No exceedances recorded against SGV values for 'Residential With Gardens'.

Polyaromatic Hydrocarbons (PAH)	TP01	TP04	Adopted Guideline (mg/kg)	Source	Exceedances
	1.10	0.20			
Acenaphthene	< 0.03	< 0.03	210	S4UL	0
Acenaphthylene	< 0.03	< 0.03	170	S4UL	0
Anthracene	< 0.03	0.03	2400	S4UL	0
Benzo(a)anthracene	0.03	0.14	7.2	S4UL	0
Benzo(a)pyrene	0.04	0.28	5	C4SL	0
Benzo(b)fluoranthene	0.05	0.31	2.6	S4UL	0
Benzo(g,h,i)perylene	< 0.03	0.15	320	S4UL	0
Benzo(k)fluoranthene	< 0.03	0.10	77	S4UL	0
Chrysene	0.04	0.18	15	S4UL	0
Dibenzo(a,h)anthracene	< 0.03	< 0.03	0.24	S4UL	0
Fluoranthene	0.05	0.32	280	S4UL	0
Fluorene	< 0.03	< 0.03	170	S4UL	0
Indeno(1,2,3-c,d)pyrene	< 0.03	0.12	27	S4UL	0
Naphthalene	< 0.03	< 0.03	2.3	S4UL	0
Phenanthrene	< 0.03	0.19	95	S4UL	0
Pyrene	0.05	0.29	620	S4UL	0

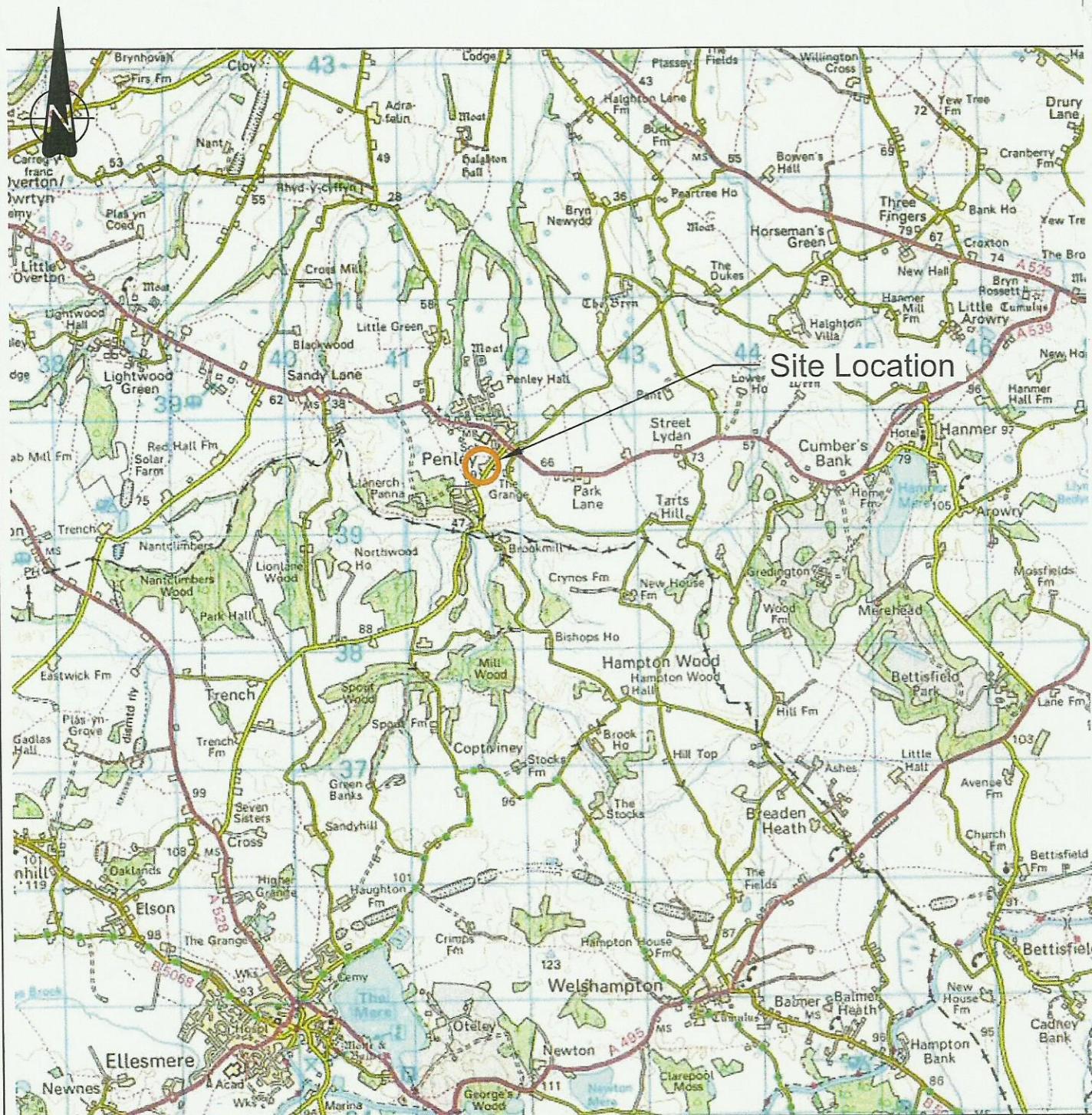
No exceedances recorded against SGV values for 'Residential With Gardens'.

Other Contaminants / Testing	TP01	TP04	Adopted Guideline (mg/kg)	Source	Exceedances
	1.10	0.20			
Organic matter	4.40	1.30	-	-	-
pH	7.60	7.50	-	-	-
Sulphide	53.00	24.00	-	-	-
Cyanide, Total	0.30	0.30	-	-	-
Sulphur (free)	< 0.75	< 0.75	-	-	-
Sulphate Aqueous Extract as SO4	1000.00	280.00	-	-	-

Yours Sincerely

Elizabeth Smith

Figures

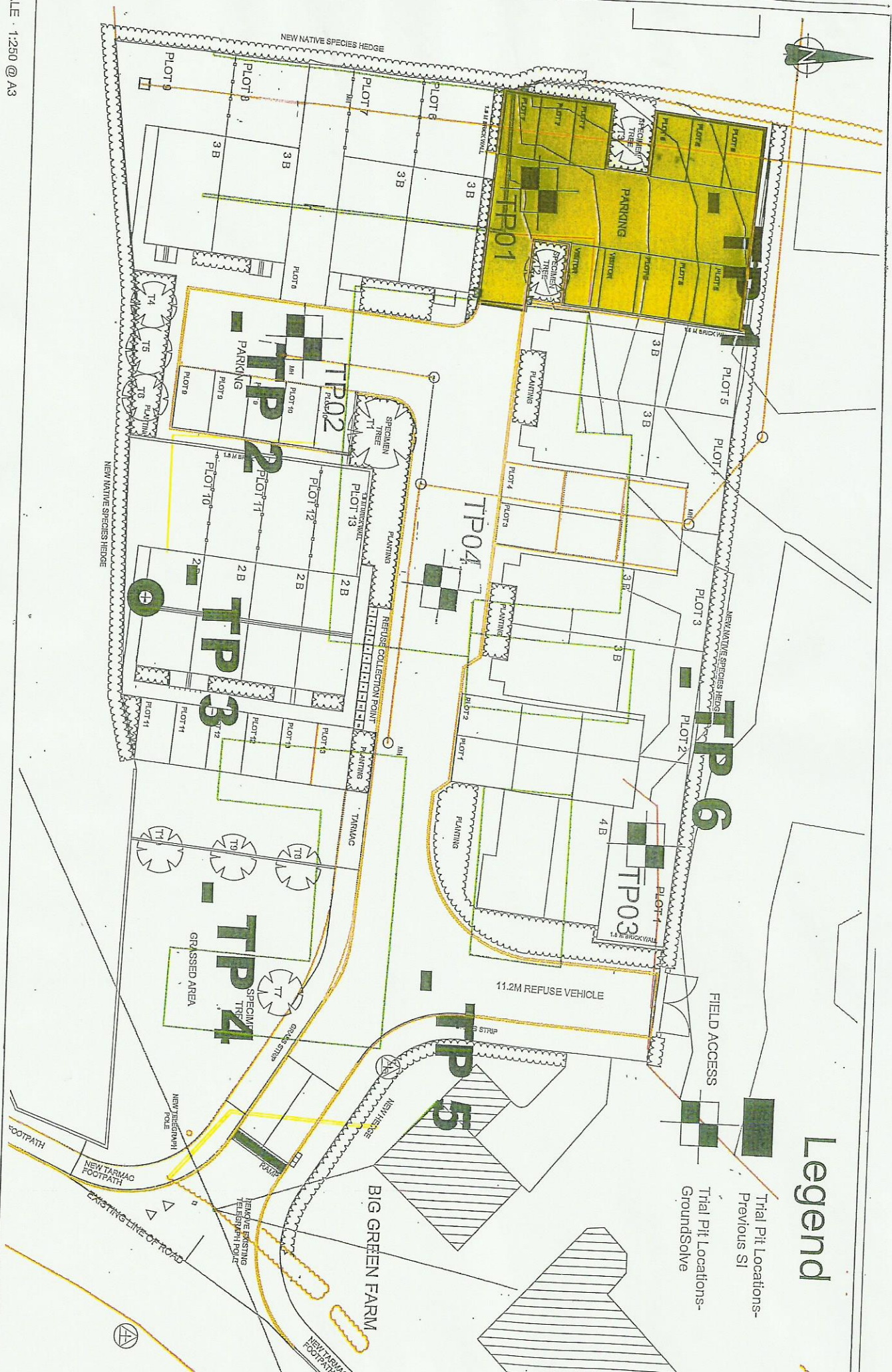


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Figure Title

SITE LOCATION



Appendix A

Soakaway Test Results

PERCOLATION TEST RESULTS SHEET

Test Pit 1				
Length(mm)	Width(mm)	Depth(mm)	Groundwater Depth	
1500	800	1700	None encountered	
Percolation Test (date/start time)	Time taken to drain from 75% to 25%	Calculated Infiltration coefficient (m/hr)		
1:-27/05/18 -08:08am	41			
2:-27/05/18 -10:00am	40			
3:-27/05/18 -13:00pm	42			
Average Time Taken(mins)	41			0.2366

Test Pit 2				
Length(mm)	Width(mm)	Depth(mm)	Groundwater Depth	
1500	800	1700	None encountered	
Percolation Test (date/start time)	Time taken to drain from 75% to 25%	Calculated Infiltration coefficient (m/hr)		
1:-27/05/18 -15:00pm	42			
2:-27/05/18 -16:00pm	39			
3:-27/05/18 -17:00pm	45			
Average Time Taken(mins)	42			0.2309

Test Pit 3				
Length(mm)	Width(mm)	Depth(mm)	Groundwater Depth	
1500	800	1700	None encountered	
Percolation Test (date/start time)	Time taken to drain from 75% to 25%	Calculated Infiltration coefficient (m/hr)		
1:-28/05/18 -08:00am	56			
2:-28/05/18 -10:30am	55			
3:-28/05/18 -12:30pm	57			
Average Time Taken(mins)	56			0.1732

Test Pit 4				
Length(mm)	Width(mm)	Depth(mm)	Groundwater Depth	
1500	800	1700	None encountered	
Percolation Test (date/start time)	Time taken to drain from 75% to 25%	Calculated Infiltration coefficient (m/hr)		
1:-28/05/18 -13:30pm	60			
2:-28/05/18 -14:00pm	59			
3:-28/05/18 -15:30pm	61			
Average Time Taken(mins)	60			0.1616

Test Pit 5				
Length(mm)	Width(mm)	Depth(mm)	Groundwater Depth	
1500	800	1700	None encountered	
Percolation Test (date/start time)	Time taken to drain from 75% to 25%	Calculated Infiltration coefficient (m/hr)		
1:-29/05/18 -08:00am	45			
2:-29/05/18 -10:00am	44			
3:-29/05/18 -13:00pm	46			
Average Time Taken(mins)	45			0.2155

Test Pit 6				
Length(mm)	Width(mm)	Depth(mm)	Groundwater Depth	
1500	800	1700	None encountered	
Percolation Test (date/start time)	Time taken to drain from 75% to 25%	Calculated Infiltration coefficient (m/hr)		
1:-29/05/18 -14:00pm	41			
2:-29/05/18 -15:00pm	40			
3:-29/05/18 -16:00pm	42			
Average Time Taken(mins)	41			0.2366

Appendix B
Trial Pit Logs

TRIAL PIT 01

Depth (m)	Strata
0.00-0.40	Grass over loose to medium dense dark brown gravelly very sandy CLAY. Gravel is subangular to angular fine to coarse of brick and concrete (MADE GROUND)
0.40-1.00	Loose reddish brown gravelly SAND. Gravel is subangular to angular fine to coarse sandstone (GLACIAL TILL)
1.00-1.70	Loose to medium dense dark brown sandy slightly clayey subangular to angular fine to coarse Gravel of sandstone. (GLACIAL TILL).

Notes

1. Pit sides stable
2. No groundwater encountered.

TP01-Side walls



TP01- Spoil Heap



TRIAL PIT 02

Depth (m)	Strata
0.00-0.10	Very dense light grey sandy subangular to angular fine to coarse GRAVEL of concrete (SUB-BASE).
0.10-0.40	Firm brown gravelly very sandy GRAVEL. Gravel is subangular to angular fine to coarse of sandstone. (GLACIAL TILL)
0.40-1.70	Soft to firm dark brown blackish sandy very gravelly CLAY. Gravel is subangular to angular fine to coarse of sandstone.(GLACIAL TILL)

Notes

1. Pit sides stable
2. No groundwater encountered.

TP02- Pit walls



TRIAL PIT 03

Depth (m)	Strata
0.00-0.10	Loose brown sandy subangular to angular fine to coarse GRAVEL of brick and concrete (MADE GROUND).
0.10-0.50	Loose to medium dense dark brown sandy slightly clayey subangular to angular fine to coarse GRAVEL of sandstone. (GLACIAL TILL)
0.50-1.70	Firm to stiff light brown mottled grey gravelly very sandy CLAY. Gravel is subangular to subrounded fine to coarse of sandstone (GLACIAL TILL).

Notes

1. Pit sides stable
2. No groundwater encountered.

TP03- Pit Walls



TP03- Spoil Heap



TRIAL PIT 04

Depth (m)	Strata
0.00-0.30	Loose to medium dense sandy clayey subangular to angular fine to coarse GRAVEL of brick and concrete (MADE GROUND).
0.30-0.80	Dark brown very gravelly sandy CLAY. Gravel is subangular to angular fine to coarse of sandstone (GLACIAL TILL).
0.80-1.25	Loose reddish brown gravelly SAND. Gravel is subangular to subrounded fine to coarse of sandstone (GLACIAL TILL).
1.25-1.70	Firm light brown mottled grey gravelly very sandy CLAY. Gravel is subangular to subrounded fine to coarse of sandstone (GLACIAL TILL).

Notes

1. Pit sides stable.
2. No groundwater encountered.

TP04- Pit Walls



TP04- Spoil Heap



Appendix C

Chemical Test Results



Certificate of Analysis

Certificate Number 21-03360

Issued: 24-Feb-21

Client GroundSolve Limited
Unit 1
Well House Barns
Bretton
Flintshire
FAO Adam Fenwick
CH4 0DH

Our Reference 21-03360

Client Reference 2485

Order No (not supplied)

Contract Title Penley

Description 2 Soil samples.

Date Received 17-Feb-21

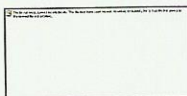
Date Started 17-Feb-21

Date Completed 24-Feb-21

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By



Adam Fenwick
Contracts Manager





Summary of Chemical Analysis

Soil Samples

Our Ref 21-03360

Client Ref 2485

Contract Title Penley

Lab No	1803359	1803360
Sample ID	TP01	TP04
Depth	1.1	0.20
Other ID	Glacial Till	MG
Sample Type	SOIL	SOIL
Sampling Date	10/02/2021	10/02/2021
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
Metals					
Arsenic	DETSC 2301#	0.2	mg/kg	7.6	7.1
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	3.0	0.5
Cadmium	DETSC 2301#	0.1	mg/kg	0.5	0.3
Chromium	DETSC 2301#	0.15	mg/kg	20	10
Chromium III	DETSC 2301*	0.15	mg/kg	20	10
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	42	28
Lead	DETSC 2301#	0.3	mg/kg	52	27
Mercury	DETSC 2325#	0.05	mg/kg	0.26	0.23
Nickel	DETSC 2301#	1	mg/kg	20	12
Selenium	DETSC 2301#	0.5	mg/kg	0.8	< 0.5
Zinc	DETSC 2301#	1	mg/kg	130	41
Inorganics					
pH	DETSC 2008#		pH	7.6	7.5
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.3	0.3
Organic matter	DETSC 2002#	0.1	%	4.4	1.3
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	1000	280
Sulphide	DETSC 2024*	10	mg/kg	53	24
Sulphur (free)	DETSC 3049#	0.75	mg/kg	< 0.75	< 0.75
Petroleum Hydrocarbons					
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4
Aliphatic C35-C40	DETSC 3072*	3.4	mg/kg	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4
Aromatic C35-C40	DETSC 3072*	1.4	mg/kg	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10



Summary of Chemical Analysis

Soil Samples

Our Ref 21-03360
Client Ref 2485
Contract Title Penley

Lab No	1803359	1803360
Sample ID	TP01	TP04
Depth	1.1	0.20
Other ID	Glacial Till	MG
Sample Type	SOIL	SOIL
Sampling Date	10/02/2021	10/02/2021
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
PAHs					
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.19
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.05	0.32
Pyrene	DETSC 3303#	0.03	mg/kg	0.05	0.29
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.03	0.14
Chrysene	DETSC 3303	0.03	mg/kg	0.04	0.18
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.05	0.31
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	0.10
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.04	0.28
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.12
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	0.15
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.23	2.1
Phenols					
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3



Summary of Asbestos Analysis

Soil Samples

Our Ref 21-03360

Client Ref 2485

Contract Title Penley

Lab No	Sample ID	Material Type	Result	Comment	Analyst
1803359	TP01 1.10	SOIL	NAD	none	Darryl Fletcher
1803360	TP04 0.20	SOIL	NAD	none	Darryl Fletcher

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documents in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.



Information in Support of the Analytical Results

Our Ref 21-03360

Client Ref 2485

Contract Penley

Containers Received & Deviating Samples

Lab No	Sample ID	Date		Holding time exceeded for tests	Inappropriate container for tests
		Sampled	Containers Received		
1803359	TP01 1.00 SOIL	10/02/21	GJ 60ml		
1803360	TP04 0.20 SOIL	10/02/21	GJ 250ml, GJ 60ml x2, PT 1L		

Key: G-Glass J-Jar P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report