Date: 11.06.2024
Project No: GEO2024-6348
Project: Scurgill Terrace, Egremont, Cumbria
Report Title: Supplementary Controlled Waters Risk Assessment

Introduction

Geo Environmental Engineering Ltd (GEO) were commissioned by the Client, Mr Lee Walker to carry out a Controlled Waters Risk Assessment for land at Scurgill Terrace in Egremont, Cumbria. A site location plan is attached.

The Client plans to develop the land for residential end use. A proposed site layout plan has been supplied and a copy is attached. It is understood that the Environment Agency have concerns regarding possible risks to groundwater associated with the presence of made ground on site and the potential for leaching of contaminants.

Previous Report Details and Summary

GEO have previously completed a Phase 1 Desk Top Study and a Phase 2 Ground Investigation Report for the site, details of which are included below:

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The DTS indicates that the site previously comprised domestic garages/lock-ups which had recently been demolished and the land cleared. Geological records indicated a potential for made ground on site and within the surrounding area, possibly associated with the nearby (historical) iron-ore mine (Florence Pit). The underlying drift is recorded as glacial till (firm and stiff sandy gravelly clay) overlying solid geology of the St Bees Sandstone. These are classified as Secondary and Principal Aquifers respectively. No significant risks were determined with respect to Controlled Waters, as the site was devoid of historical potentially contaminative land uses of significant concern.

The made ground on site had been insitu for a great number of years and no historical pollution incidents are recorded by the EA within a representative distance of the site that have been determined as attributable to the site. Consequently, the risk to the water environment from generic made ground on site was not considered to be of significant concern.

The GIR comprised boreholes and trial pits to depths of between c.0.50m and 4.00m bgl. Made ground was encountered to depths of between 0.47m and 1.50m bgl. This comprised grey silty loamy gravel of aggregate (waste stone from the nearby iron ore mine) with some clinker, brick, concrete, ash, shale, metal rebar, slag and sandstone. The made ground was underlain by natural stiff red brown sandy gravelly clay, silty gravelly sand and sandy gravel. No evidence of any fuel or oil was encountered.

Chemical laboratory screening was completed on samples of the made ground as part of a human health risk assessment. The report indicated elevated concentrations of metals (arsenic) and PAH compounds and recommended basic remediation within proposed gardens and areas of soft landscaping (Clean Cover System).

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Website: www.geoenvironmentalengineering.com
Company No.: 07180338
VAT No.: GB 986617072

Supplementary Intrusive Investigations

GEO attended site on the 10th May 2024 to recover samples of the made ground. It was noted that earthworks had recently been completed to reduce site levels within the proposed development area. A steep bank comprising mostly spoil (waste rock) was noted to the rear (NW) of the site.

Four hand dug pits (TP-A to TP-D) had been excavated by the Client at the locations specified by GEO. An exploratory hole location plan is attached.

The trial pits had been excavated to depths of between c.0.45m and c.0.70m bgl and encountered made ground to depths of between 0.20m and 0.60m bgl (due to the reduced level dig). Trial pit logs are attached. Trial pit TP-B was terminated within the made ground at a depth of c.0.45m bgl due to encountering a boulder. The made ground comprised silty sandy angular gravel and cobbles of aggregate (iron ore spoil - waste rock from the nearby iron ore mine) with occasional brick, clinker, tile, metal and shale. Firm gravelly silt was also encountered. The made ground was underlain by stiff gravelly clay.

The trial pits were dry with the exception of TP-D which had a small amount of water at the base (see photo on the trial pit log). This appears to be from a small pocket of perched water.

Chemical Laboratory Screening

Samples of the made ground were recovered in amber glass jars and plastic tubs from depths of between c.0.10m and c.0.40m bgl. The samples were scheduled to soil leachate screening at the following UKAS and MCERTS accredited laboratory:

- Normec DETS Limited (DETS), Consett, County Durham.

The samples were subjected to soil-leachate screening for the following range of potential contaminants:

- **Inorganic Soil Suite:** Dissolved Metals (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium and Zinc), pH, Sulphate, Sulphide and Cyanide (total).
- **Organic Soil Suite (Human Health Risk Assessment):** Speciated Polycyclic Aromatic Hydrocarbons (PAH – USEPA 16).

As no evidence of any fuel or oil contamination was identified, the samples were not scheduled to petroleum hydrocarbon screening. The full catalogue of soil screening results and test detection limits can be seen in the DETS Test Report (ref: 24-09810) which is attached.

Chemical Test Results and Discussion

The results have been assessed against a range of published assessment criteria including Environmental Quality Standards (EQS) and the Water Framework Directive 2014 values. Where possible, assessment criteria values for freshwater environmental receptors have been adopted, however, environmental assessment criteria are not available for all potential contaminants such as PAH compounds. Therefore, where environmental assessment criteria values are absent, Drinking Water Standards (DWS) have been adopted instead. These values are very stringent, and exceedances of these values does not necessarily indicate a risk to environmental receptors.

A Chemical Assessment Sheet is attached which provides details of the GAC references and the values that have been adopted for the analysis. The results are highlighted where exceedances have been identified.

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The results of the leachate analysis indicate marginally elevated concentrations of PAH compounds within the sample of made ground from trial pit TP-B at c.0.30m bgl only. The results slightly exceed the assessment criteria values for stringent UK Drinking Water Standards (DWS) only. The concentrations of metals were below the GAC values in this sample, and the results from the other samples were all below the assessment criteria values.

The made ground in trial pit TP-B comprised aggregate with occasional clinker, brick, metal and shale.

Conclusions and Discussion

The results of the leachate screening indicate a potential for marginally elevated PAH compounds within some of the made ground material. However, on the whole, the potential for leaching of metals and PAH compounds from the made ground is very low.

The leachable PAH compounds could pose a potential minor risk to nearby drinking water down gradient, however, as no active potable abstraction licenses are noted downgradient of site (two are present up gradient, c.247m north), the risk is considered very low to negligible.

As the water table is below the made ground, the potential for leaching is very low. The laboratory leachate screening assumes a worst-case scenario with the made ground left to soak within water, however, this is very unlikely to occur on the site, particularly post development which will include a surface water management system and some impermeable surfacing (i.e., buildings). Some minor leaching may occur during percolation of rainwater; however, the exposure would be very brief, resulting in very low leachate concentrations.

The presence of firm/stiff clays beneath the site will significantly reduce or mitigate the risk of vertical migration to the underlying aquifer. There is a potential for some lateral migration of surface waters through the surface soils down gradient from the site, however, the nearest watercourse down gradient is c.190m south west. When considering the low concentrations and potential for dilution and dispersal, the risk to the surface waters is negligible.

Furthermore, the made ground on site appears to be associated with spoil (waste rock) from the former Florence Iron Ore Mine which was located to the north east of the site. The historical maps suggest that the made ground is likely to be extensive and potentially deep within the surrounding area. Therefore, removal of any made ground from the proposed development area, is unlikely to make a significant impact on overall leaching potential within the region, as much greater quantities of the same materials are in existence elsewhere and have been for a significant amount of time. As previously noted, no historical pollution incidents are recorded by the EA within a representative distance of the site that have been determined as attributable to the site.

Following development, it is likely that the made ground will be predominantly capped by a mixture of buildings, hardstand (driveways) and clay/loamy soils (gardens). This will further reduce the potential for leaching.

When considering the information presented above, the risk to environmental receptors (Principal Aquifer and surface waters) and human health associated with potable groundwater abstractions from potential leaching of contaminants from the made ground on site is considered negligible and remediation is not considered necessary in this respect.

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Consideration must be made for variations to occur in the ground conditions between the exploratory hole locations for which GEO holds no responsibility. It is therefore recommended that a "watching brief" be applied to ensure that if ground conditions vary from those identified during this investigation, then advice should be sought from a suitably qualified and experienced Geo-Environmental Engineer.

The recommendations and opinions expressed in this report are based on the ground conditions observed. Consequently, GEO takes no responsibility for conditions that have not been revealed or which occur between them.

The conclusions and recommendations presented within this report are considered reasonable based on the available information. However, these cannot be guaranteed to gain regulatory approval. Therefore, the report should be passed to the appropriate regulatory authorities and/ or other key stakeholders, including warranty providers in order to seek their approval of the findings prior to undertaking any site works or development on site.

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If there are any queries, please do not hesitate to contact Geo-Environmental Engineering Ltd.

Yours Faithfully

[redacted]

……

James Brock *BSc (Hons), MSc*
Associate - Geo Environmental Engineering Ltd

[redacted]

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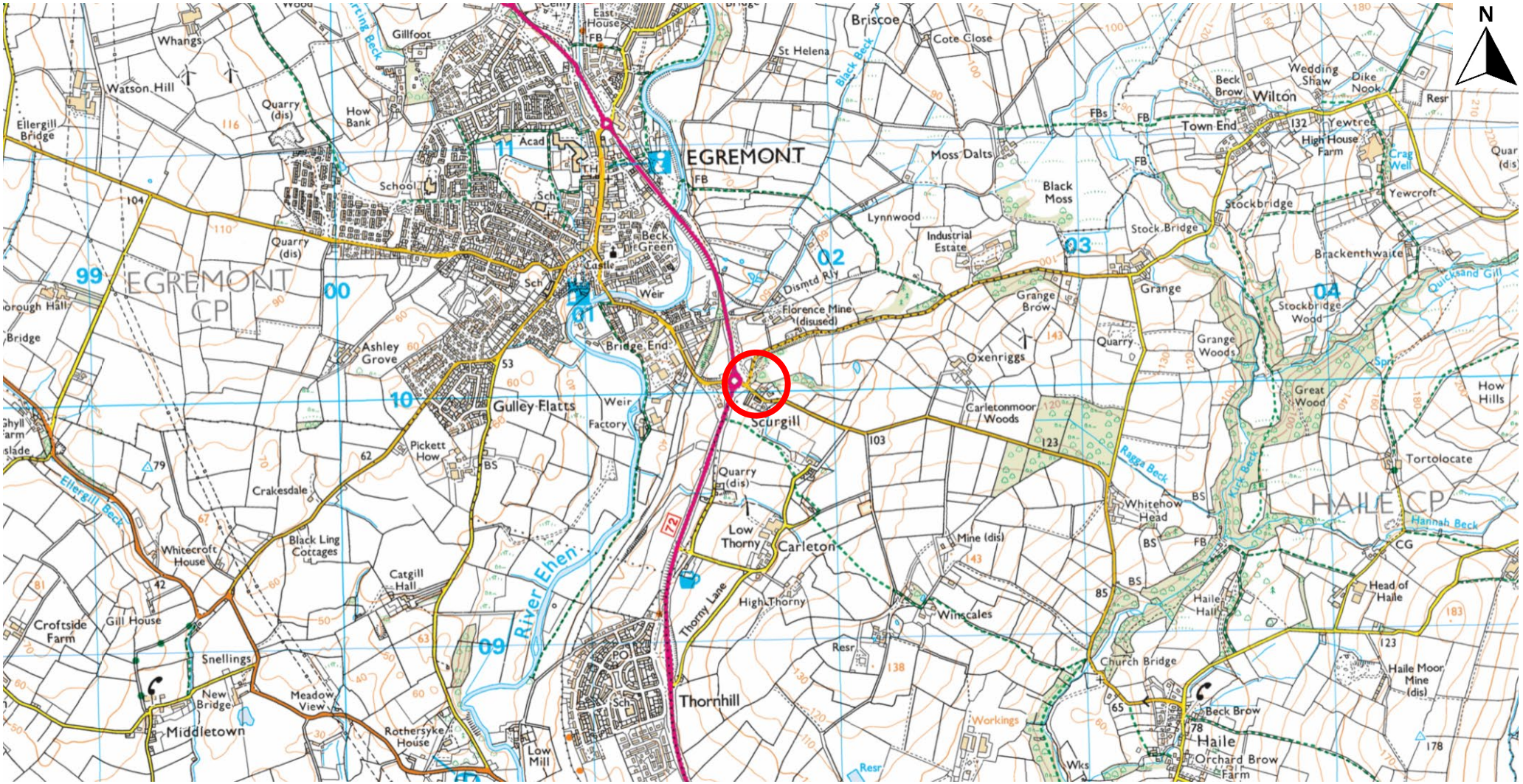
GEO Environmental Engineering

GEO2024-6348: Scurgill Terrace, Egremont – Site Location



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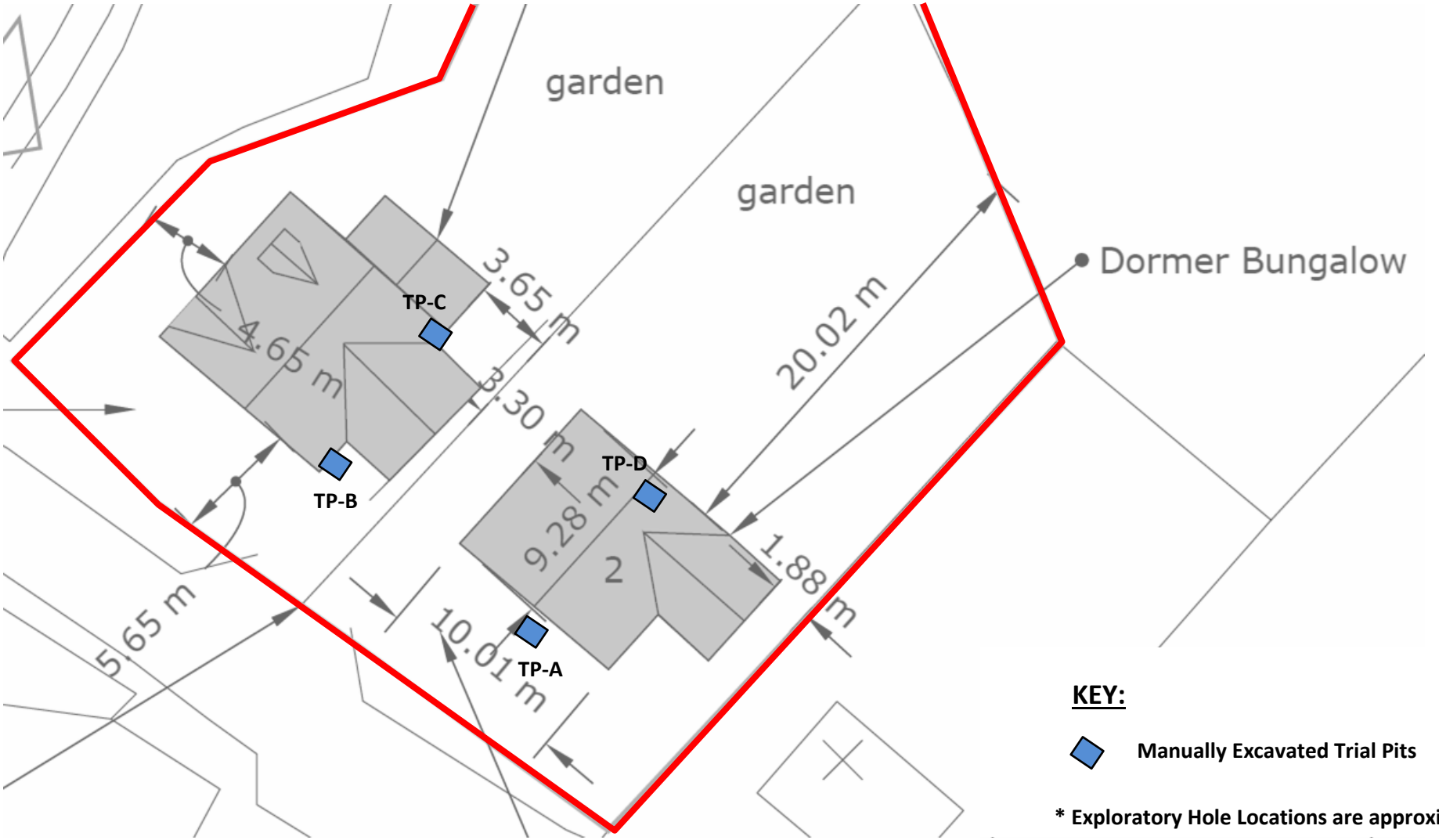
GEO Environmental Engineering

GEO2024-6348: Scurgill Terrace, Egremont – Exploratory Hole Location Plan*



KEY:

Manually Excavated Trial Pits

*** Exploratory Hole Locations are approximate. Do Not Scale.**

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GEO2024-6348: Scurgill Terrace, Egremont – TP-A

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.10	MADE GROUND: Dark grey brown silty sandy angular GRAVEL of aggregate (ironstone spoil).		
0.10	0.30	MADE GROUND: Firm dark grey sandy gravelly SILT with occasional roots. Occasional cobbles.		0.20 – J&T
0.30	0.45	Stiff brown sandy gravelly CLAY.		
		Trial hole remained open and dry on completion. Trial hole backfilled with arisings on completion.		

Engineer: J.Brock
Site Works Date: 10.05.2024
Plant: Hand digging equipment

Log Notes:
HSV = Hand Shear Vane (kN/m^2)
LP = Limited Penetration (HSV/CBR)
B = Bulk Bag, J = Amber Glass Jar, T = Plastic Tub

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GEO Environmental Engineering

GEO2024-6348: Scurgill Terrace, Egremont – TP-B

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.45	MADE GROUND: Dark grey brown very silty sandy fine to coarse angular GRAVEL of aggregate (ironstone spoil) with occasional brick, clinker, metal and shale. Refusal on boulder at 0.45m bgl.		0.30 – J&T
		Trial hole remained open and dry on completion. Trial hole backfilled with arisings on completion.		

Engineer: J.Brock
Site Works Date: 10.05.2024
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GEO Environmental Engineering

GEO2024-6348: Scurgill Terrace, Egremont – TP-C

Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.16	MADE GROUND: Grey silty sandy angular GRAVEL of aggregate (ironstone spoil) with occasional clinker, tile, metal and clinker.		
0.16	0.60	MADE GROUND: Dark grey brown silty/clayey sandy fine to coarse angular GRAVEL and COBBLES of aggregate (ironstone spoil) with occasional clinker and brick.		0.40 – J&T
0.60	0.70	Stiff brown gravelly CLAY.		
		Trial hole remained open and dry on completion. Trial hole backfilled with arisings on completion.		

Engineer: J.Brock
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Depth From (m)	Depth To (m)	Strata Description	Legend	Testing / Samples
0.00	0.20	MADE GROUND: Grey silty sandy angular GRAVEL of aggregate (ironstone spoil) with occasional shale, clinker and brick.		0.10 – J&T
0.20	0.50	Stiff brown gravelly CLAY.		
		Pocket of perched water at 0.20m bgl. Standing water at 0.40m bgl on completion. Trial hole backfilled with arisings on completion.		

Engineer: J.Brock
Site Works Date: 10.05.2024
Plant: Hand digging equipment

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Certificate of Analysis

Certificate Number	24-09810	*Issued:*	21-May-24

Client GEO Environmental Engineering
NW Office
31 Casshow Way
Cockermouth
Cumbria
CA13 9FY

Our Reference 24-09810

Client Reference ~ GEO2023-6348

Order No ~ (not supplied)

Contract Title ~ Scurgill, Egremont

Description 4 Leachate prepared by DETS samples.

Date Received 14-May-24

Date Started 14-May-24

Date Completed 21-May-24

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 [redacted]
Kirk Bridgewood
General Manager

2139

Summary of Chemical Analysis
Leachate Samples

Our Ref 24-09810
Client Ref ~ GEO2023-6348
Contract Title ~ Scurgill, Egremont

			Lab No	2336886	2336887	2336888	2336889
			Sample ID ~	TP-A	TP-B	TP-C	TP-D
			Depth ~	0.20	0.30	0.40	0.10
			Other ID ~				
			Sample Type ~	LEACHATE	LEACHATE	LEACHATE	LEACHATE
			Sampling Date ~	13/05/2024	13/05/2024	13/05/2024	13/05/2024
			Sampling Time ~	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
Preparation							
BS EN 12457 10:1	DETSC 1009*			Y	Y	Y	Y
Metals							
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	3.0	8.8	3.7	19
Boron, Dissolved	DETSC 2306*	12	ug/l	30	23	< 12	< 12
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03	< 0.03	0.09	< 0.03
Chromium, Dissolved	DETSC 2306	0.25	ug/l	0.53	0.54	0.30	< 0.25
Copper, Dissolved	DETSC 2306	0.4	ug/l	2.6	4.2	2.0	2.1
Lead, Dissolved	DETSC 2306	0.09	ug/l	1.3	0.58	0.55	0.11
Mercury, Dissolved	DETSC 2306	0.01	ug/l	< 0.01	0.02	0.03	0.10
Nickel, Dissolved	DETSC 2306	0.5	ug/l	< 0.5	0.6	< 0.5	< 0.5
Selenium, Dissolved	DETSC 2306	0.25	ug/l	0.58	0.60	0.59	< 0.25
Zinc, Dissolved	DETSC 2306	1.3	ug/l	5.9	1.3	2.5	< 1.3
Inorganics							
pH	DETSC 2008		pH	6.3	7.6	7.2	7.7
Cyanide, Total	DETSC 2130	40	ug/l	< 40	< 40	< 40	< 40
Total Hardness as CaCO3	DETSC 2303	0.1	mg/l	8.53	39.9	27.5	24.3
Sulphate as SO4	DETSC 2055	0.1	mg/l	4.8	23	4.2	2.0
Sulphide	DETSC 2208	10	ug/l	< 10	< 10	< 10	< 10
PAHs							
Naphthalene	DETSC 3304	0.05	ug/l	< 0.05	0.06	< 0.05	< 5.00
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	0.02	< 0.01	< 1.00
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.01	0.07	0.01	< 1.00
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	0.04	< 0.01	< 1.00
Phenanthrene	DETSC 3304	0.01	ug/l	0.02	0.14	0.01	< 1.00
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	0.07	< 0.01	< 1.00
Fluoranthene	DETSC 3304	0.01	ug/l	0.03	0.42	0.02	< 1.00
Pyrene	DETSC 3304	0.01	ug/l	0.03	0.37	0.02	< 1.00
Benzo(a)anthracene	DETSC 3304*	0.01	ug/l	0.02	0.22	< 0.01	< 1.00
Chrysene	DETSC 3304	0.01	ug/l	0.02	0.16	< 0.01	< 1.00
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	0.03	0.32	0.01	< 1.00
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	0.01	0.12	< 0.01	< 1.00
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	0.02	0.26	< 0.01	< 1.00
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	0.01	0.17	< 0.01	< 1.00
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	0.04	< 0.01	< 1.00
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	0.02	0.18	< 0.01	< 1.00
PAH Total	DETSC 3304	0.2	ug/l	0.22	2.7	< 0.20	< 20.00

Information in Support of the Analytical Results

Our Ref 24-09810
Client Ref ~ GEO2023-6348
Contract ~ Scurgill, Egremont

Containers Received & Deviating Samples

Lab No	Sample ID ~	Date Sampled ~	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2336886	TP-A 0.20 LEACHATE	13/05/24	GJ 250ml, PT 1L		
2336887	TP-B 0.30 LEACHATE	13/05/24	GJ 250ml, PT 1L		
2336888	TP-C 0.40 LEACHATE	13/05/24	GJ 250ml, PT 1L		
2336889	TP-D 0.10 LEACHATE	13/05/24	GJ 250ml, PT 1L		

Key: G-Glass P-Plastic J-Jar 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.

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

Key:

~ Sample details are provided by the client and can affect the validity of the results
***** -not accredited.
# -MCERTS (accreditation only applies if report carries the MCERTS logo).
$ -subcontracted.
n/s -not supplied.
I/S -insufficient sample.
U/S -unsuitable sample.
t/f -to follow.
nd -not detected.

End of Report

Geo Environnmental Engineering Ltd
Chemical Assessment Sheet - Leachates

Lab Ref 24-09810
GEO Ref ~ GEO2023-6348
Contract Title ~ Scurgill, Egremont

				Sample ID ~	TP-A	TP-B	TP-C	TP-D	GAV Value	GAC Exceeded?	GAC Ref:
				Depth ~	0.20	0.30	0.40	0.10			
				Sample Type ~	LEACHATE	LEACHATE	LEACHATE	LEACHATE			
				Soil Type ~	MG	MG	MG	MG			
Preparation	**Method**	**LOD**	**Units**								
BS EN 12457 10:1	DETSC 1009*				Y	Y	Y	Y			
Metals											
Arsenic, Dissolved	DETSC 2306	0.16	ug/l		3.0	8.8	3.7	19	50.0	No	WFD
Boron, Dissolved	DETSC 2306*	12	ug/l		30	23	< 12	< 12	1000	No	EQS Fresh
Cadmium, Dissolved	DETSC 2306	0.03	ug/l		< 0.03	< 0.03	0.09	< 0.03	5	No	EQS Fresh
Chromium, Dissolved	DETSC 2306	0.25	ug/l		0.53	0.54	0.30	< 0.25	50	No	UK DWS
Copper, Dissolved	DETSC 2306	0.4	ug/l		2.6	4.2	2.0	2.1	10	No	EQS Fresh
Lead, Dissolved	DETSC 2306	0.09	ug/l		1.3	0.58	0.55	0.11	25	No	UK DWS
Mercury, Dissolved	DETSC 2306	0.01	ug/l		< 0.01	0.02	0.03	0.10	1	No	EQS Fresh
Nickel, Dissolved	DETSC 2306	0.5	ug/l		< 0.5	0.6	< 0.5	< 0.5	20	No	UK DWS
Selenium, Dissolved	DETSC 2306	0.25	ug/l		0.58	0.60	0.59	< 0.25	10	No	UK DWS
Zinc, Dissolved	DETSC 2306	1.3	ug/l		5.9	1.3	2.5	< 1.3	30	No	EQS Fresh
Inorganics											
pH	DETSC 2008		pH		6.3	7.6	7.2	7.7	N/A	No	N/A
Cyanide, Total	DETSC 2130	40	ug/l		< 40	< 40	< 40	< 40	40	No	TDL
Total Hardness as CaCO3	DETSC 2303	0.1	mg/l		8.53	39.9	27.5	24.3	N/A	No	N/A
Sulphate as SO4	DETSC 2055	0.1	mg/l		4.8	23	4.2	2.0	250	No	UK DWS
Sulphide	DETSC 2208	10	ug/l		< 10	< 10	< 10	< 10			
PAHs											
Naphthalene	DETSC 3304	0.05	ug/l		< 0.05	0.06	< 0.05	< 5.00	2.0	No	EU EQS
Acenaphthylene	DETSC 3304	0.01	ug/l		< 0.01	0.02	< 0.01	< 1.00	0.1	No	UK DWS
Acenaphthene	DETSC 3304	0.01	ug/l		< 0.01	0.07	0.01	< 1.00	0.1	No	UK DWS
Fluorene	DETSC 3304	0.01	ug/l		< 0.01	0.04	< 0.01	< 1.00	0.1	No	UK DWS
Phenanthrene	DETSC 3304	0.01	ug/l		0.02	0.14	0.01	< 1.00	1.9	No	ERL
Anthracene	DETSC 3304	0.01	ug/l		< 0.01	0.07	< 0.01	< 1.00	0.1	No	UK DWS
Fluoranthene	DETSC 3304	0.01	ug/l		0.03	0.42	0.02	< 1.00	0.1	YES	UK DWS
Pyrene	DETSC 3304	0.01	ug/l		0.03	0.37	0.02	< 1.00	0.1	YES	UK DWS
Benzo(a)anthracene	DETSC 3304*	0.01	ug/l		0.02	0.22	< 0.01	< 1.00	0.1	YES	UK DWS
Chrysene	DETSC 3304	0.01	ug/l		0.02	0.16	< 0.01	< 1.00	0.1	YES	UK DWS
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l		0.03	0.32	0.01	< 1.00	0.1	YES	UK DWS
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l		0.01	0.12	< 0.01	< 1.00	170	No	EU EQS
Benzo(a)pyrene	DETSC 3304	0.01	ug/l		0.02	0.26	< 0.01	< 1.00	170	No	EU EQS
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l		0.01	0.17	< 0.01	< 1.00	170	No	EU EQS
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l		< 0.01	0.04	< 0.01	< 1.00	0.1	No	UK DWS
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l		0.02	0.18	< 0.01	< 1.00	170	No	EU EQS
PAH Total	DETSC 3304	0.2	ug/l		0.22	2.7	< 0.20	< 20.00	-	-	-

Notes:
EQS Fresh = Environmental Quality Standards for Freshwater
EU EQS - EU Environmental Quality Standards for Freshwater
WFD = Water Framework Directive 2014: standards to protect the water environment
UK DWS = UK Drinking Water Standards
WHO DWS = World Health Organisation Drinking Water Standards
TDL - Test Detection Limits
ERL - Envrionmental Risk Limits (Netherlands National Institute for Public Health and the Environment).