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PHASE 2

GEO-ENVIRONMENTAL REPORT

job number	C2960/22/E4487
date	15/12/2022
site address	Land off Highmoor Lane, Cleckheaton.
written by	I. Sakoor
checked by	S. Alexander
issued by	I. Sakoor

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Appendices

Report on a Phase 2 Geo-environmental Investigation

Location:	Land off Highmoor Lane, Cleckheaton.
For:	Thirteen Housing Group Ltd
Report No.	C2960/22/E/4487 Report date: December 2022

For and on behalf of **Rogers Geotechnical Services Ltd**

Imran Sakoor BEng FGS Geo-environmental Engineer	**Scott Alexander** BSc FGS Geo-environmental Engineer

Report Summary[1]

Item	Comments	Section
Development	Construction of a number of residential dwellings with gardens, driveways and an access road.	1.
Geology	Superficial geology: none. Solid geology: Pennine Lower Coal Measures Formation.	5.
Strata Conditions	Generally firm to stiff slightly gravelly silty clay present to depths of between 0.85m and 2.1m below ground level. Underlain by weathered rockhead of the Pennine Lower Coal Measures Formation.	6.
Groundwater	None encountered during investigation.	6.2
Foundation Design	Strip or spread foundations.	10.
Effect of Sulphates	DC-1 concrete.	10.
Contamination	No significant contamination revealed.	11.
Ground Gasses	Low levels of ground gasses and site is Characteristic Situation Level 1. Further readings recommended.	11.

[1] This summary should not be relied upon to provide a comprehensive review. All of the information contained in this document should be considered.

1. Introduction

It is understood that the land off Highmoor Lane, Cleckheaton is to be developed by the construction of number of residential dwellings with gardens, driveways and an access road. Consequently, a site investigation has been undertaken in accordance with the instruction from the client. This work was required in order to determine the nature of the underlying soils, to assess their engineering properties and to assist in the design of safe and economical foundations for the proposed development. This investigation also takes into consideration the risk of any contamination present. This report describes the work undertaken, presents the data obtained and discusses the ground conditions in relation to the proposed works.

2. Limitations

The recommendations made and opinions expressed in this report are based on the ground conditions revealed by the site works, together with an assessment of the site and of the laboratory test results. Whilst opinions may be expressed relating to sub-soil conditions in parts of the site not investigated, for example between borehole positions, these are for guidance only and no liability can be accepted for their accuracy.

This report has been prepared in accordance with our understanding of current best practice. However, new information or legislation, or changes to best practice may necessitate revision of the report after the date of issue.

3. Desk Study

A Phase 1 Desk Study has been undertaken by Rogers Geotechnical Services (RGS) and the results were presented as report number C2960/22/E/4473 in October 2022. This report has been used extensively during the current intrusive investigation.

4. Fieldworks

The fieldworks were undertaken between the 17th and 19th October 2022 and included the following:

- Seven windowless sample boreholes.
- Seven dynamic probes.
- Five machine excavated trial pits.
- Three soakaway tests.
- Eight TRL dynamic probes.
- Five gas monitoring standpipes.

The investigatory locations are shown on the site plan which is presented in Appendix 1 to this report. It should be appreciated that whilst it was intended to undertake a windowless sample borehole and adjacent dynamic probe at the location of WS08. However, as access could not be

gained with the drilling rig, a hand excavated trial pit was excavated to 1.2m in order to observe the soils.

4.1 Windowless Sample Boreholes

These boreholes were sunk using a drive-in windowless sampler. The cores were undertaken in 1m lengths and reduced in diameter from approximately 87mm for the first 1m through 77mm and 67mm for subsequent 1m increments. The recovered cores were sealed and returned to the laboratory for logging and subsequent testing. The soils were described in general accordance with BS5930: 2015 +A1: 2020 and full descriptions are given on the windowless sample records which are presented in Appendix 2. Also included on these records are the core diameters and percentages of core recovered. Additionally, the hand excavated trial pit undertaken at WS08 is also presented within Appendix 2.

4.2 Standard Penetration Tests

Standard penetration tests (SPT) were undertaken at regular depth increments within windowless sample borehole WS01 and WS03. The SPT was conducted in accordance with the procedures given in BS EN ISO 22476: Part 3: 2005 +A1: 2011, and the results are summarised on the borehole record. During this work an automatic trip hammer of 63.5kg falling through 750mm was employed to drive either a cone or split barrel sampler assembly into the ground and the recovered barrel samples were retained in air tight plastic containers.

4.3 Dynamic Probes

Dynamic penetration tests were undertaken adjacent to the windowless sample boreholes in accordance with the procedure given in BS EN ISO 22476: Part 2: 2005 +A1: 2011, using the super heavy penetrometer (DPSH). This probe consists of a 63.5kg mass falling through 750mm onto an anvil, which drives a 50mm diameter cone into the ground. The number of blows required to drive the cone through successive 100mm increments are recorded as the N_{100} values. The results of the dynamic penetration tests are tabulated and presented as bar charts of N_{100} values versus depth in Appendix 3.

4.4 Trial Pits (Machine Excavated)

A total of five trial pits were excavated in order to reveal the nature of the near surface soils and to undertake soakaway testing using a JCB 3CX. The soils were logged on site in general accordance with BS5930: 2015+A1: 2020, and full descriptions are given on the trial pit records which are presented in Appendix 4. Once excavations were completed, the trial pits were carefully re-instated with the arisings. Whilst every care was taken during the infilling process, including compacting of the infill at regular intervals with the back-acting arm of the excavator, it should be appreciated that some mounding of the surface may have resulted. Moreover, the infilled soils may be subjected to settlement over time, such that a depression in the surface may also occur. Therefore, the locations of any pits undertaken in this investigation should be conveyed to the current site user, as the mounds or depressions associated with the pits may present a risk to current site operations. Furthermore, it must be realised that the infilled pits represent an area of disturbance within the site soils, thus the soils at the pit locations may vary characteristically compared to the undisturbed ground. As such, foundations placed in this disturbed material may not perform as anticipated.

4.5 Soakaway Tests

Soakaway tests were conducted within the three of the trial pits excavated. At the elected test depths, the pit was trimmed and squared as much as practicable. Water was then pumped into the pit and the level monitored at timed intervals relative to a reference bar at ground level. These tests were conducted and calculated in general accordance with the method given by BRE Digest 365 and the results are presented in Appendix 5.

4.6 TRL Dynamic Probes

Eight TRL Dynamic Cone Penetrometer tests were undertaken adjacent to the trial pit. The penetrometer consists of an 8kg slide hammer falling through 575mm onto an anvil, which drives a 20mm diameter 60° cone into the ground. The depth of the cone driven per blow of the hammer is recorded. The results of the dynamic penetration tests are presented as Appendix 6 and include graphs of penetration blows and CBR values versus depth. The percentage CBR value has been obtained from the correlation provided in TRL Road Note 8 which is given below:

$$Log_{10}(CBR) = 2.48 – 1.057Log_{10}(mm/blow)$$

4.7 Gas Monitoring Standpipes

Gas monitoring standpipes were installed between 1.3m and 2.5m depth within WS01, WS02, WS05, WS06 and WS07. The installation details are shown on the appropriate borehole records. In all cases, the monitoring standpipe consisted of a perforated pipe from the base of the borehole to between 0.3m and 1.0m below surface, with a non-perforated pipe to ground level. The response zone was filled with pea gravel, with a bentonite seal above, and the installation was capped with a stop box cover in a concrete surround.

5. Geology

The available published geological data for the site has been examined and the following table presents the anticipated geology.

Table 1: Geological Data for the Site

Strata Type	Strata Name[2]	Previous Name[3]	Description[3]
Superficial Geology	None recorded below the site.		
Solid Geology	Pennine Lower Coal Measures Formation – sandstone	Lower Coal Measures Formation	Interbedded grey mudstone, siltstone and pale grey sandstone, commonly with mudstones containing marine fossils in the lower part, and more numerous and thicker coal seams in the upper part.

[2] Sources: British Geological Survey (NERC) Map Sheet 77; Huddersfield; Solid and Drift Edition, and Geology of Britain Viewer [*online resource from www.bgs.ac.uk*]
[3] Sources: British Geological Survey (NERC) Lexicon of Named Rock Units [*online resource from www.bgs.ac.uk*]

It should be appreciated that a northwest-southeast trending fault is indicated to bisect the western portion of the site.

6. Strata Conditions

In accordance with the geology of the area, the succession has been shown to include the following:

Table 2: Generalised Strata Profile

Depth m below ground level to underside of layer	**Strata Type**	**Positions Encountered**	**Groundwater Strikes** m below ground level
0.05	ASPHALT.	TP01	None
0.05 – 0.65	TOPSOIL.	WS01, WS02, WS03, WS04, WS05, WS06, WS07, WS08, TP02, TP03, TP04, TP05	None
0.65	Made ground (Brick fill).	TP01	None
0.3 – 0.45	MADE GROUND (Silty gravelly SAND).	WS04, WS06	None
0.7	MADE GROUND (Silty CLAY).	WS04	None
0.85 – 2.1	Slightly gravelly, locally slightly sandy silty CLAY. [RESIDUAL PENNINE LOWER COAL MEASURES FORMATION].	WS03, WS04, WS05, WS06, WS07, WS08, TP01, TP02, TP03, TP04, TP05	None
0.9 – 1.60	Very gravelly SAND. [COMPLETELY WEATHERED PENNINE LOWER COAL MEASURES FORMATION].	WS01, WS02	None
+0.9 – +1.3	Extremely weak thinly laminated SANDSTONE. [HIGHLY WEATHERED PENNINE LOWER COAL MEASURES FORMATION].	WS01, WS04	None
+1.2 – +2.6	Extremely weak thinly laminated clayey MUDSTONE. [HIGHLY WEATHERED PENNINE LOWER COAL MEASURES FORMATION].	WS02, WS03, WS05, WS06, WS07, TP01, TP03, TP05	None

'+' denotes that the strata extended below the termination depth of the investigated positions, thus the extent of the deposit is only proven to the depths indicated.

6.1 General Strata

In general, below the topsoil and asphalt, granular and cohesive made ground was revealed to between 0.3m and 0.7m depth within WS04, WS06 and TP01. Below the made ground and topsoil, firm to stiff slightly gravelly silty clay was revealed to depths of between 0.85m and 2.1m below ground level. Within WS02 and WS02, medium dense silty very gravelly sand was encountered to depths of between 0.9m and 1.6m. Bedrock described as extremely weak thinly laminated mudstone was then revealed to the base of TP01, TP03, TP05 and all boreholes except WS04 and WS08. Bedrock was not encountered in WS08, TP02 or TP04. With respect to the local geology, it is considered that this material is representative of the residual becoming highly weathered Pennine Lower Coal Measures Formation.

6.2 Groundwater

No groundwater strikes were observed during the site investigation. However, it should be appreciated that the normal rate of boring does not permit the recording of an equilibrium water level for any one strike, moreover, groundwater levels are subject to seasonal variation or changes on local drainage conditions.

7. Insitu Testing

7.1 Standard Penetration Tests

The standard penetration tests carried out in WS01 and WS03 are summarised in the following table:

Table 3: Summary of Standard Penetration Tests

Strata	Depth Range (m)	SPT 'N' (Blows/300mm)		Comments
		Granular soils	Cohesive soils	
MUDSTONE/SANDSTONE	1.0m to 2.0m	+77	34 to 68	SPT's typical of weathered bedrock.

7.2 Dynamic Penetration Tests

Dynamic penetration tests were undertaken adjacent to the windowless sample borehole positions. A summary of the results is presented below:

Table 4: Summary of Dynamic Penetration Tests

Position	Blows/100mm			Refusal type (Effective/ Abrupt)[4]	Comments
	0 - 2	3 - 10	10+		
	Depth to which blow count range was observed (m)				
DP01	0.2	0.9	1.3	Effective	Results of generally between 4 and 6 blows/100mm to 0.8m depth. Then rapid increase in results noted.
DP02	0.2	2.0	2.4	Effective	Results of generally between 3 and 5 blows/100mm to 1.6m depth. Then rapid increase in results noted.
DP03	1.2	1.9	1.6 2.1	Effective	Low results to 1.2m depth. Then variable but generally high results thereafter.
DP04	0.7	1.4	1.2 2.4	Effective	Low results to 0.7m depth. Then results varying generally between 5 and 22 blows/100mm.
DP05	0.6	1.7	2.2	Effective	Results of generally between 1 and 2 blows/100mm to 0.6m depth. Then blow counts gradually increasing with depth.

[4] Abrupt refusal: obstruction or bedrock encountered. Effective refusal: +25 blows/100mm.

DP06	1.8	0.5 2.2	2.5	Effective	Slightly stronger near surface crust, then results of generally between 2 and 3 blows/100mm to 1.8m depth. Then rapid increase to refusal.
DP07	1.4	2.0 2.5	2.3 2.7	Effective	Low blow counts to 1.4m depth. Then blow counts varying between 6 and 16 until refusal.

7.3 Soakaway Tests

The results obtained from the soakaway tests have been summarised below:

Table 5: Soakaway Test Results

Location	Dimensions (m)	Test Depth (m)	Soil Description	Infiltration Rate (m/sec)	Drainage Characteristics
TP01	0.6 x 2.7	2.3	Extremely weak MUDSTONE, recovered as sandy gravel.	-	Practically impermeable
TP02	0.4 x 1.8	1.65	Slightly sandy slightly gravelly silty CLAY.	-	Practically impermeable
TP03	0.3 x 2.3	1.20	Extremely weak MUDSTONE, recovered as tabular gravel.	-	Practically impermeable

It should be appreciated that within the trial pits, infiltration rates could not be obtained as negligible movement in water level was observed in each test. As a result, it is considered that at this site, the soils possess practically impermeable drainage characteristics.

7.4 TRL Dynamic Probes

TRL dynamic penetration tests were undertaken along the length of the proposed access road and the results are summarised below:

Table 6: Summary of TRL Dynamic Probes

Position	Depth Range (m)	Average CBR (%)	Comments
TRL1	0.25 – 0.40 0.40 – 0.50 0.50 – 0.58 0.60 – 0.70 0.78 – 0.90	18 14 9 21 35	Variable but generally high CBR values. Notable increase from 0.6m depth.
TRL2	0.23 – 0.45 0.46 – 0.52 0.54 – 0.59 0.60 – 0.67 0.70 – 0.78 0.80 – 0.86 0.88 – 0.94	8 21 28 20 14 24 43	Variable but generally high average CBR values.

TRL3	0.23 – 0.52 0.54 – 0.59 0.60 – 0.78 0.80 – 0.86 0.88 – 0.94	6 7 4 5 10	Average CBR values generally noted to vary between 4% and 6%.
TRL4	0.21 – 0.26 0.30 – 0.72 0.74 – 0.76 0.79 – 0.85 0.86 – 0.89 0.90 – 0.93	35 4 20 9 23 73	Stronger near surface, followed by average CBR value of 4% to about 0.7m depth. Then rapid increase in CBR results.
TRL5	0.10 – 0.18 0.19 – 0.23 0.24 – 0.25 0.25 – 0.30 0.30 – 0.39 0.42 – 0.95	10 25 42 42 133 23	Variable but generally high average CBR values throughout.
TRL6	0.06 – 0.16 0.16 – 0.44 0.48 – 0.64 0.65 – 0.94	13 49 40 10	Average CBR values of generally +40% to 0.64m depth. Results then reduce to an average of 10%.
TRL7	0.20 – 0.38 0.45 – 0.81 0.83 – 0.96	5 6 10	CBR values noted to average between 5% and 6% to 0.8m depth, before increasing to around 10%.
TRL8	0.08 – 0.11 0.15 – 0.36 0.50 – 0.78 0.86 – 0.95	25 43 6 17	High average CBR values to 0.36m depth, before reducing to around 5% about 0.8m depth. Results noted to increase thereafter.

7.5 Gas and Water Level Monitoring

The standpipes were monitored between the 17th October and the 27th November 2022. The results of the gas monitoring undertaken to date are tabulated below.

Table 7: Gas Monitoring

Location	Date	CH_4 (%)	CO_2 (%)	O_2 (%)	Flow (l/h)	Barometric Pressure (mb)	Water Level (m)	Standpipe Depth (m)
WS01	27/10/22 03/11/22 10/11/22 17/11/22	Monitoring well found to be damaged – unable to monitor.						1.3
WS02	27/10/22	0.0	1.1	20.3	0.0	994↔	1.62	2.0
	03/11/22	0.0	1.2	20.2	0.0	982↔	1.76	
	10/11/22	0.0	1.3	19.9	0.0	995↔	-	
	17/11/22	0.1	1.5	19.8	0.0	965↔	1.69	
WS05	27/10/22	0.0	2.3	19.5	0.0	994↔	-	2.0
	03/11/22	0.0	3.2	18.6	0.0	982↔	-	
	10/11/22	0.0	3.0	19.0	0.0	996↔	-	
	17/11/22	0.0	3.0	19.0	0.1	965↔	-	
WS06	27/10/22	0.0	2.0	19.9	1.4	995↔	1.17	2.25
	03/11/22	0.0	1.1	20.5	0.2	982↔	1.22	
	10/11/22	0.0	0.7	21.8	0.8	996↔	1.28	
	17/11/22	0.0	0.7	21.1	0.1	965↔	1.69	
WS07	27/10/22	0.1	2.3	17.0	0.0	985↔	-	2.5
	03/11/22	0.1	2.7	16.8	0.1	982↔	-	
	10/11/22	0.0	3.1	16.2	0.0	996↔	-	
	17/11/22	0.0	3.3	16.3	0.5	965↔	2.15	

↑ - rising pressure ↓ - falling pressure ↔ - steady pressure

This work was undertaken using a Geotechnical Instruments (UK) Ltd. GA5000 (serial No G503524) which was last calibrated on the 24th August 2022.

8. Laboratory Testing - Geotechnical

The following programme of laboratory testing has been undertaken on samples obtained during this investigation:

- Determination of water content — BS EN ISO 17892-1:2014
- Determination of liquid and plastic limits — BS EN ISO 17892-12:2018
- Soluble sulphate content — BS 1377-3:2018+A1:2021: Pt3: 7.3
- pH value — BS 1377-3:2018+A1:2021: Pt3: 12

The test results are presented in Appendix 7 and are summarised below:

Table 8: Summary of Geotechnical Test Results

Test type	Number of tests	Range of results		Comments
Water content determinations	5	17% to 28%		Generally close to or below the plastic limit.
Index properties (1 Point)	5	LL PL PI	39% to 66% 20% to 27% 19% to 39%	Clay of intermediate plasticity. One result of high. Consistency index: 1.0 to 1.2. NHBC Class: Predominantly Medium. One result of low.
Soluble sulphate & pH	6	SO_4 pH	<10 to 17mg/l 6.4 to 8.0	

In cohesive soil the approximate cohesion, c_u, and coefficient of consolidation, m_v, may be obtained from the equivalent SPT 'N' value using the following expressions (Stroud 1975).

$c_u = f_1 N$

$m_v = \frac{1}{f_2 N}$

where:

c = cohesion (kN/m^2).
m_v = Coefficient of consolidation (m^2/MN).
f_1 & f_2 = factors based on plasticity index.
N = SPT 'N_{300}' value.

For the cohesive soils revealed at this site the highest (worst case) plasticity index[5] of 39% could be employed, which suggests an f_1 value of 4.4 and an f_2 value of 0.44.

8.1 Geotechnical Properties

The idealised geotechnical properties employed in design are summarised below.

[5] See paragraph 6.2 'Index Property Tests'

Table 9: Summary of Geotechnical Properties		
Property	**Range of values**	**Comments**
Volume change potential (NHBC)	Medium	Slightly gravelly slightly sandy silty CLAY.
Concrete classification	DC-1	Brownfield locations (Static water)

9. Laboratory Testing - Environmental

A suite of testing was conducted on samples from across the site and the following regime was undertaken.

- Metals – Cd, Cr^{VI}, Cu, Hg, Ni, Pb, V and Zn.
- Semi and Non-Metals - As, Se, Free CN^- and Phenols.
- Polycyclic aromatic hydrocarbons (PAHs).
- Petroleum hydrocarbons (TPHs).
- Others – pH, organic content and total/soluble SO_4^{2-}.
- Asbestos identification.

This testing was undertaken by Eurofins Chemtest Ltd and the results of all of the chemical testing are presented in Appendix 7 of this report.

10. Discussion of Ground Conditions - Geotechnical

It is understood that the land off Highmoor Lane, Cleckheaton is to be developed by the construction of a number of residential dwellings with gardens, driveways and an access road. At the time of writing this report the precise layout and method of construction is not known, thus the discussion below is of a generalised nature.

10.1 Foundations

It cannot be recommended that foundations be constructed directly within the topsoil, made ground or weak near surface soils revealed at this site. These soils are present in a weak and variable condition such that excessive total and or differential settlement could occur under moderately light surface loading.

The results of this investigation indicate that the weathered fraction of the Pennine Lower Coal Measures Formation, generally present as a slightly sandy slightly gravelly silty clay will be present below the site. It is considered that this material will provide a suitable bearing stratum, provided that the foundations are placed within soil generally described as being present in a firm insitu condition. It is considered that strip or spread foundations could be constructed within these soils, at a minimum depth of say 1.0m below ground level.

However, it should be appreciated that extremely weak mudstone or sandstone may be encountered within the foundation depth. As such, a pragmatic approach to foundation construction will be required. It will be necessary to ensure that all foundations are placed on soils of similar types and consistencies. Placing foundations on a mixture of cohesive soils and rock for the same

building could result in differential movements due to the dissimilar settlement characteristics of the two soil types.

Notwithstanding this, an allowable increase in stress given in the following table could be assumed for the plots founded entirely on cohesive soils:

Table 10: Allowable Increase in Stress

Foundation Type		Strip Footings			Spread Footings		
Foundation Breadth	B (m)	0.6	1.0	1.5	1.0	1.5	2.0
Foundation Depth	D (m)	1.0			1.0		
Allowable increase in stress	(kN/m²)	100	95	90	115	105	105

The allowable increase in stress given above assumes a factor of safety of 3 against general shear failure, based on firm clay with cohesion of 45kN/m^2 at the foundation depths. Where the foundations are placed on extremely weak sandstone or mudstone, this material would possess a significant bearing capacity, probably being in excess of 250kN/m^2. In this case, factor of safety against general shear failure will be high, probably exceeding 10.

Settlements at the above loading intensities should remain within tolerable limits for the type of structure proposed provided that the underlying soils are carefully inspected immediately final trimming has taken place. Should any soft or weak material be encountered they should be locally removed and replaced with lean-mix concrete or compacted granular soil. In addition, if the excavations are required to stand open for any period of time then a blinding layer of lean-mix concrete should be placed in the excavation bases. This expedient will reduce softening or loosening of the sub-grade due to the ingress of surface water.

Should seepages of groundwater be encountered it is considered that they could be dealt with using a simple form of de-watering. Such a system could include the excavation of sumps from which the water could be pumped.

The stability of the excavation faces cannot be guaranteed thus temporary support to the excavation faces may become necessary unless the foundations are constructed using trench-fill techniques. In this method the foundation trenches should be excavated, inspected and backfilled with concrete as a continuous operation. Under no circumstances should operatives be allowed to enter unsupported excavations.

10.2 Historic Pond

It should be appreciated that the Phase 1 Desk study indicated the presence of a historic infilled pond towards the south-western corner of the site. Whilst no evidence of the pond has been noted within any of the boreholes or trial pits, a willow tree was observed on site. Given that willow trees are noted for their preference for moist soils, it is possible that the historic pond was formerly located close to this tree.

In view of the above, it should be appreciated that the infill material within this pond is likely to be variable in both strength and composition. Therefore, footings in this area will need to be deepened such that they are founded upon competent natural soils. As noted above foundations should not be placed on a mixture of soil types due to the potential for differential settlements.

10.3 Soakaways

The results of the soakaway testing indicated that the soils below the site have poor drainage characteristics. Therefore, it is not recommended that soakaways be utilised in this instance and a another of form of surface water drainage should be sought.

10.4 Volume Change Potential

It should be appreciated that the cohesive soils revealed at this site possess a medium volume change potential under the guidance of the NHBC standards. Therefore, it is will be necessary to ensure that heave protection is provided against the side of footings in accordance with the Chapter 4.2 of the NHBC standards[6]. The methodology provided in the guidance will require the identification of any trees, still present at, or recently removed from, the site and the distance from the proposed foundations. In addition, heave protection should be extended to below the underside of the floors and beams.

However, for the plots where the foundations are to be to constructed on rock head, heave/shrink potential of the underlying will not represent a significant issue.

10.5 Ground-floors

It should be appreciated that a number of trees are present and the soils underlying the site possess a medium volume change potential. Therefore, it is anticipated that it will be necessary to adopt fully suspended floor slabs in this instance. In addition, Table 10 from Chapter 4.2 of the NHBC Standards indicates that for soils with medium volume change potential, a minimum void thickness of 175mm should be provided beneath precast concrete ground floors.

10.6 Hard-standing Areas

It is considered that any hard-standing at the site could be constructed employing traditional pavement design. A design California Bearing Ratio (CBR) of 3% could be employed in the pavement design[7]. However, it is recommended that proof rolling of the sub-grade be undertaken to establish the suitability of the soils, to expose any soft or weak ground and to ensure the sub-grade is well compacted prior to construction. Any areas of soft or weak ground should be remediated by increasing the sub-base thickness. Alternatively, weak material could be locally removed and replaced with a compacted granular capping layer. If construction were to be undertaken during the winter or after periods of prolonged rainfall, it may be prudent to employ a geotextile and/or a geogrid between the sub-base and sub-grade.

10.7 Effect of Sulphates

In view of the nature of the underlying soils it is considered that the design sulphate class be assessed with reference to Table C2[8], which is provided in BRE Special Digest 1, *Concrete in aggressive ground*: Part C. On the basis of this table and considering the soluble sulphate contents recorded, it can be shown that well compacted buried concrete should be designed in accordance

[6] NHBC Standards, Chapter 4.2, *Building near trees*
[7] Table 11.1, *Reproduction of TRRL Report LR1132 (1984)*, Smith (2006), Smith's Elements of Soil Mechanics, 8th ed.
[8] Table C2, *Aggressive Chemical Environment for Concrete (ACEC) classification for brownfield locations*

with Class DS-1 requirements. Assuming static groundwater, the table also indicates that the aggressive chemical environment for concrete (ACEC) classification is AC-1s.

In order to evaluate the design chemical (DC) class for the buried concrete at this site reference should be made to Table D1[9], which can be found in Part D, *Specifying concrete for general cast-in-situ use,* of BRE Special Digest 1. From this table it may be shown that for an intended working life of at least 50 years the concrete design class DC-1 is required.

11. Discussion of Ground Conditions - Environmental

11.1 Discussion of Test Results

It is understood that the site is to be developed by the construction of a number of residential dwellings with gardens, driveways and an access road. Consequently, the site may be classified as residential with plant uptake.

11.1.1 Soil Samples

The results of the chemical testing undertaken on soil samples obtained during this investigation have been compared to the ATRISK soil screening values (SSVs) as compiled by WS Atkins plc. With respect to the results it should be appreciated that the soil organic matter (SOM) content for the samples tested was found to be <1.0% for all samples tested. On this basis, it is considered that the screening values associated with 1% SOM should be adopted. These values have been derived in such a way as to adhere to the principles within the revised CLEA model and include the most current release of the SGVs. A list of subscribers is provided within the website[10] and these include many local authorities.

A comparison of the results of the testing, together with the data given above, can be found within Appendix 7. These results indicate the following:

Table 11: Summary of Contaminated Areas

Location	Depth (m)	Contaminants found to be exceeding SSVs (Residential with plant uptake)
WS01	0.5	PAH [Chrysene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, benzo(g,h,i)perylene].
WS02	0.65	None.
WS03	0.4	None.
WS05	0.6	None.
WS06	0.6	None.
WS08	0.4 – 0.8	PAH [Chrysene].

Concentrations of chromium(VI), mercury, free cyanide, phenols (total) and total petroleum hydrocarbons (aliphatic C5 to C35; aromatic C5 to C35) were below the detection limits for the tests. Detectable levels of all other contaminants were recorded, but these fell below the associated Atrisk Soil Screening Values. In addition, no asbestos was detected within the soils samples tested.

[9] Table D1, *Selection of the DC Class and the number of APMs for concrete elements where the hydraulic gradient due to groundwater is 5 or less: for general in-situ use of concrete.*
[10] http://www.atrisksoil.co.uk/pages/general/subscribers.asp

It should be appreciated that the soil screening values for PAHs and TPHs (where appropriate) represents vapour saturation limits. The inhalation of vapour pathway contributes less than 10% of total exposure, which is unlikely to significantly affect the combined assessment criterion[11]. In view of this, the ATRISK soil SSVs notes that the users may wish to consider using a combined assessment criterion if free product is not observed, the values for which are also provided on the summary of contamination analysis. It is therefore considered that the criteria for no free product should be adopted for the PAHs and TPHs at this site. The results of the contaminants found to exceed these screening values are tabulated below:

Table 12: Summary of Areas Contaminated by PAHs & TPHs

Location	Depth (m)	Contaminants found to be exceeding SSVs (Residential with Plant Uptake)
WS01	0.5	None.
WS02	0.65	None.
WS03	0.4	None.
WS05	0.6	None.
WS06	0.6	None.

On the basis of the above information, the results of the investigation have concluded that the site is generally uncontaminated.

11.1.2 Gas Concentrations

With respect to ground gas, the results of the monitoring visits indicated a maximum concentration of 0.1% methane, with concentrations of carbon dioxide ranging between 0.7% and 3.3%, in association with oxygen levels of between 16.2% and 20.5%. It should be appreciated that on non-contaminated sites there is generally about 20% by volume of oxygen, associated with low levels of carbon dioxide. In addition, a maximum flow rate of 1.4 litres per hour was recorded and will be employed in the following calculations.

The principal driving force for initiating the movement of gas in the ground is a change in barometric pressure. The most onerous gas condition on a site is usually observed on days of low or falling barometric pressure, preferably below 1000mb. It has been noted that measurements undertaken solely during high pressure conditions may be of lesser value. At this site the readings undertaken to date were at atmospheric pressures of between 965mb and 996mb.

In order to establish the gas screening value (GSV) for carbon dioxide or methane, the maximum gas concentration (expressed as a decimal) is multiplied by the borehole flow rate (l/hr). In this case 0.1% (0.001) methane was recorded along with 3.3% (0.033) carbon dioxide, in association with a maximum flow rate of 1.4 l/hr. This results in a GSV of 0.0014 l/hr for methane and a GSV of 0.0462 l/hr for carbon dioxide.

In accordance with Table 2 of BS8485: 2015*, Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings,* the site may be characterised as *Characteristic Situation Level 1*. It is therefore considered that there is a very low

[11] Ref: ATRISK soil, SSVs derived using CLEA v1.071 for 1% SOM, Residential with home grown produce land use, 23.06.17.

risk of harm to end users and site operatives and no special precautionary measures are required in accordance to Table 8.6, *Typical scope of gas protection measures,* of CIRIA report C665.

With regard to the number of monitoring visits required reference is made to Tables 5.5a and 5.5b of CIRIA report C665 (2007)[12]. Accepting that the proposed development is of high sensitivity and that the generation potential is very low, these tables suggest that 6 readings could be undertaken over a period of 3 months. However, C665 notes that *not all sites will require gas monitoring for the period and frequency indicated in Tables 5.5a and 5.5b.*

In this case, a total of 4 monitoring visits were undertaken over a four-week time period and for the purpose of this assessment, it is considered that the site can be provisionally classified as Characteristic Situation Level 1. Therefore, it is recommended that two further monitoring visits are undertaken within the next two months as recommended by the CIRIA report C665 (2007), during a period when the barometric pressure is low, but not necessarily below 1000mb) or falling, which represents a more onerous condition.

In light of the above, it is considered that following the additional monitoring visits, should there be no significant change in ground gas conditions, the site can be provisionally classified as Characteristic Situation Level 1.

11.2 Site Specific Risk Assessment

11.2.1 Approach

The presence of contamination hazards and the risks associated with them should be assessed in accordance with industry practice and the 'suitable for use' approach. This has been conducted with reference to The Department for Environment, Food and Rural Affairs (DEFRA) and The Environment Agency[13] advice on the assessment of risks arising from the presence of contamination in soils and using the source-pathway-receptor approach.[14] This method dictates that there must be a risk of contaminant produced at a 'source' in sufficient concentration to cause harm and there must be a 'pathway' for the contaminant to reach an identifiable 'receptor' for the linkage to be proved and a contamination hazard to be considered present. Not all substances are contaminants and not all contaminants are considered to be a risk. Indeed DEFRA and The Environment Agency state that 'a contaminant is a substance which has the potential to cause harm, while a risk itself is considered to exist if such a substance is present in sufficient concentration to cause harm and a pathway exists for a receptor to be exposed to the substance.'[15]

11.2.2 Conceptual Ground Model and Risk Assessment

In view of the results of the chemical testing undertaken the conceptual site model is presented accordingly as Table 13. Sources of contamination include the following:

On-site – none.

The preliminary risk assessment has been evaluated with reference to the following ratings and definitions:

[12] Adapted from tables 5.5a and 5.5b of CIRIA C665, 2007, *Assessing risks posed by hazardous ground gas to buildings, p60.*
[13] R&D Publication CLR 8, 'Assessment of Risks to Human Health from Land Contamination: An overview of the Development of Soil Guideline Values and Related Research'.
[14] The pollution linkage approach was developed by 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990' which provides meanings for the terms contained in The Environmental Protection Act 1990 Part IIA, the primary legislation for addressing the issues of contaminated land.
[15] See 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990', appendix A.

N/A - A source-pathway-receptor linkage is not considered to exist and therefore a risk assessment is not required.

Low - A pollution linkage is unlikely and/or the likelihood of harm occurring is low and of minor consequence.

Moderate - The linkage exists but the likelihood of harm occurring is not considered to be significant although remedial action may be necessary

High - The linkage exists and the available data indicates that significant harm may be caused and remedial action could be necessary.

The results of the risk assessment are presented in Table 13.

Table 13: Conceptual Site Model and Site-Specific Risk Assessment [Contamination: none]				
Conceptual Site Model			**Site Specific Risk Assessment**	
Pathways	**Receptor**	**Linkage Present?**	**Risk Rating**	**Notes**
Direct contact/dermal absorption/soil ingestion	Operative	Yes – whilst some contamination has been revealed, the concentrations are not significant. In addition, the majority of determinands were below detection limits.	Low	
	End User	Yes – whilst some contamination has been revealed, the concentrations are not significant. In addition, the majority of determinands were below detection limits.	Low	
	Neighbours	Yes – whilst some contamination has been revealed, the concentrations are not significant. In addition, the majority of determinands were below detection limits.	Low	
Inhalation of Dust/Vapours	Operative	Yes – whilst some contamination has been revealed, the concentrations are not significant. In addition, the majority of determinands were below detection limits.	Low	
	End User	Yes – whilst some contamination has been revealed, the concentrations are not significant. In addition, the majority of determinands were below detection limits.	Low	
	Neighbours	Yes – whilst some contamination has been revealed, the concentrations are not significant. In addition, the majority of determinands were below detection limits.	Low	
Ingestion of fruit/vegetables and/or waters	Operative	No – no edible plants or contained water sources in the area of the proposed new works.	N/A	
	End User	Yes – whilst some contamination has been revealed, the concentrations are not significant. In addition, the majority of determinands were below detection limits.	Low	
	Neighbours	Yes – whilst some contamination has been revealed, the concentrations are not significant. In addition, the majority of determinands were below detection limits.	Low	
Migration of hazardous gases via permeable strata or shallow mining activity	Operative	No – low concentrations of methane and carbon dioxide have been found to be present at the site to date (assuming *Characteristic Situation Level 1*). Further 2 monitoring visits recommended.	Low	Low concentrations of harmful gases (methane and carbon dioxide) were detected at the site. If ground gas conditions remain the same, no special precautionary measures are deemed to be required.
	End User		Low	
	Neighbours	No – whilst concentrations of ground gas have been found to be present at the site (assuming *Characteristic Situation Level 1*), no structures directly adjoin the site, therefore gases migrating from the site would vent to atmosphere before reaching neighbouring structures.	N/A	

Spillage/loss/run off direct to receiving water	Controlled Waters	No – receiving waters are not present within 250m and no significant contamination has been revealed.	N/A	
Migration via permeable unsaturated strata	Controlled Waters	Yes – whilst there is a Secondary A aquifer beneath the site, no significant contamination has been revealed.	Low	
Run off via drainage/sewers etc	Controlled Waters	Yes – old services may be present on site. However, no significant contamination has been revealed. Indeed, the majority of the determinands were found to be below detection limits.	Low	
Direct contact with contaminated soils	Plants	Yes – whilst some contamination has been revealed, the concentrations are not significant. In addition, the majority of determinands were below detection limits.	Low	
Uptake via root system			Low	
Direct contact with contaminated soils	Building Materials	Yes – whilst some contamination has been revealed, the concentrations are not significant. In addition, the majority of the determinands were below detection limits. Moreover, testing indicates that the aggressive chemical environment for concrete classification is AC-1s.	Moderate (plastic services) Low (buried concrete)	Please see section 11.3.3 for information on good building practice.
Direct contact with contaminated groundwater				
Exposure to Radon	Operative	Yes– site is within a radon affected area.	Low	Between 1% and 3% of properties are above the action level. No radon protection measures required.
	End User			
UXO Risk	Operative	Yes – according to the Zetica online UXO maps, the site is at low risk from unexploded ordnance.	Low	No further action required.
	End User		Low	

11.3 Indicative Remediation Strategy

Whilst no significant chemical contamination was revealed, good practices should still be maintained. In addition, careful inspection of the sub-grade should be made during the ground-works. Should areas of contamination be detected then further testing may become necessary.

11.3.1 General Approach to Construction

Ground-works

During the ground-works phase of the development, protection to the site operatives is required. The risk to site operatives is considered under the Health and Safety at Work Act 1974, together with regulations made under the act, which includes the Control of Substances Hazardous to Health (COSHH) regulations. Therefore, the risks to site personnel must be considered under the Construction Design and Management (CDM) regulations at the planning stage and be included in the contractor's Health and Safety Plan and site-specific Method Statements. These documents should include the following main elements.

- Site operatives at all should be made aware of the fundamental principles of identifying potentially contaminated soils and the hazards of working with such soils not identified by the ground investigation.
- Personal hygiene facilities, including washing and messing, must be provided and site operatives be encouraged to use them.
- Where work is undertaken in dry weather the site should be dampened down to avoid dust. In addition, dust masks must be provided to all site operatives for use in dry weather.
- In order for potentially contaminated soils to be disposed of to an appropriate landfill, it may be necessary to carry out Waste Acceptance Criteria (WAC) testing in accordance with BS EN 12457.
- Any stockpiles of potentially contaminated soil on site should be sheeted over to prevent excessive amounts of airborne dust and cross contamination of imported fill.
- Where vehicles are transferring soil to the landfill site they should be covered to prevent contamination of the surrounding area by dust.
- Where work is undertaken in wet weather, vehicle and wheel washing facilities are required to ensure that the vehicles leaving the site do not transfer contamination to surrounding areas.

On completion of the ground-works a careful site inspection of the sub-grade would be required. Should visual or olfactory evidence of contamination be revealed then further testing may become necessary.

Construction

During the construction phase of the contract the following items are required to protect the end user from the potential contaminants revealed at this site.

- Beneath buildings, pavements and hard-standings clean inert granular sub-base should be employed.
- Any redundant services revealed at this site should be de-commissioned and piped services sealed. Any existing services that are to be employed in the new development should be carefully inspected to ensure that they are serviceable.
- New plastic services should be constructed in a surround of clean inert material and selected in accordance with the recommendation given in the United Kingdom Water Industry Research (UKWIR) website under Report Ref. No. 10/WM/03/21 - 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites'. The statutory water authority for the area in which

site is located may have a risk assessment form to complete which allows these recommendations to be met. However, further determinand specification contamination testing may be necessary.
- For buried concrete the results of the sulphate and pH testing indicate that the design sulphate class for the site should be DS-1.
- Until the two extra gas monitoring visits are completed, it is recommended that gas protection measures are budgeted for.

11.4 Fill Materials

It should also be appreciated that any fill material, either site-won or imported, to be employed at the site should be subjected to the following assessment to determine its suitability.

Fill materials should be initially screened, by a suitably qualified engineer to establish that:

- It is a suitable growing media if it is to be employed as such, including compliance with BS3882 (2015)
- It is free from obvious contamination i.e. visual or olfactory evidence
- It has not come from areas where Japanese Knotweed or other invasive or injurious plants are suspected to be growing
- It is not a statutory nuisance, such as being odorous
- It is free from unsuitable material i.e. whole bricks, brick ties, timber or glass.

It should also be appreciated that any fill should be subjected to validation testing to assess its suitability. The following table has been taken from YALPAG[16] documentation and may be used as a guide. Depending on the origin and nature of the material, not all fill will require the sampling frequency and testing indicated, although this should be in agreement with any regulatory bodies (such as the Local Authority).

Table 14: Validation Sampling and Testing

Fill Type	Frequency	Minimum Determinands
Virgin Quarried Material	1 or 2 depending on the type of stone utilised, to confirm the inert nature of the material.	Standard metals/metalloids (should include as a minimum As, Cd, Cr, CrVI, Cu, Hg, Ni, Pb, Se, Zn)
Crushed Hardcore, Stone, Brick	Minimum 1 per 500m³	Standard metals/metalloids (as above), PAH (16 USEPA speciation), asbestos, total TPH. Any additional analysis dependant on the history of the donor site (e.g. phenol, total cyanide, BTEX, MTBE).
Greenfield/ Manufactured Soils	Minimum 3 Dependent on source and receptor, between 1 per 50m³ and 1 per 250m³	Standard metals/metalloids (as above), PAH (16 USEPA speciation), asbestos, pH and soil organic matter (SOM) (or calculated from total organic carbon (TOC)).
Brownfield/ Screened Soils	Minimum 6 Dependent on source and receptor, between 1 per 50m³ and 1 per 100m³	Standard metals/ metalloids (as above), PAH (16 USEPA speciation), TPH (CWG banded), asbestos, pH and SOM (or calculated from TOC).

[16] *YALPAG Technical Guidance for Developers, Landowners and Consultants – Verification Requirements for Cover Systems V4 .1* Appendix 1a, June 2021

		Any additional analysis dependant on the history of the donor site (e.g. phenol, total cyanide, BTEX, MTBE).

The screening values for the above regime should also be agreed with any regulatory bodies; however, the following is recommended in the first instance.

Table 15: Fill Screening Values

Contaminant	Screening Value (Residential with Plant Uptake) (mg/kg)		Reference
	1% SOM	6% SOM	
As	37	37	Atrisk^{SOIL} SSVs
Cd	22.1	22.1	Atrisk^{SOIL} SSVs
Cr(VI)	3.62	3.63	Atrisk^{SOIL} SSVs
Cu	4730	4790	Atrisk^{SOIL} SSVs
Hg	8.81	15.8	Atrisk^{SOIL} SSVs
Ni	136	136	Atrisk^{SOIL} SSVs
Pb	200	200	Atrisk^{SOIL} SSVs
V	136	138	Atrisk^{SOIL} SSVs
Zn	20000	20300	Atrisk^{SOIL} SSVs

Please see summary sheet within Appendix 8 for full screening values including PAHs & TPHs.

The above screening values should be considered with respect to the Soil Organic Matter (SOM) of the subject material i.e. 1% SOM would be typical for granular fill and 6% SOM for topsoil. Testing should comply with UKAS and MCERTS, where applicable, and undertaken by an accredited laboratory.

Where the material has been derived from a commercial company, certificates or other industry quality protocol compliance i.e. WRAP should be obtained. However, it will be necessary to ensure that this documentation specifically related to the material being imported, it is no more than two months old and complies with the screening and frequency requirements given above.

Suitable fill materials should be either placed immediately or sufficiently quarantined to prevent cross-contamination. If it is necessary, the quarantined material should be placed on appropriate sheeting and covered to prevent it becoming mixed with contaminated soils or dust, or penetrated by mobile contaminants.

12. Recommendations for Further Work

- This report should be forwarded to the relevant authorities as soon as practicable to ensure they have sufficient time to review and discuss any issues.
- Completion and reporting of recommended additional gas monitoring.
- Discussions with ground work contractors in relation to the requirement for testing of materials to be disposed off-site (Waste Acceptance Criteria) and the suitability of imported materials.
- Discussions with service providers regarding suitable materials for pipe work given the nature of chemical determinands found within the soils on site.
- Detailed design of the sub-structure.

Clearly Rogers Geotechnical Services Ltd would be happy to offer advice with respect to the above and assist where necessary.

13. References

- British Geological Survey (NERC) (2022), BGS, Keyworth.
  - Geology of Britain Viewer: (*http://maps.bgs.ac.uk/geologyviewer_google/googleviewer.html)*
  - Lexicon of Named Rock Units:
  - (*http://www.bgs.ac.uk/lexicon/)*
- British Standards Institution (1990) BS1377: *British standard methods of test for soils for civil engineering purposes,* B.S.I., London.
- British Standard Institution (2005 +A1: 2011) BS EN ISO 22476-2: *Geotechnical investigation and testing – Field testing, Part 2: Dynamic Probing,* B.S.I., London.
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- Building Research Establishment (BRE) Special Digest 1 (2005), Third Edition: Concrete in aggressive ground, BRE Press, Garston.
  - Part C: *Assessing the aggressive chemical environment.*
  - Part D: *Specifying concrete for general cast-in-situ use.*
- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – Final SC050021/SR2, *Human Health toxicological assessment of contaminants in soil*. Environment Agency, Bristol.
- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – SC050021/SR3, *Updated technical background to the CLEA model*. Environment Agency, Bristol.
- Department for Environment, Food and Rural Affairs (2014) SP1010: *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document*.
- Wilson S, Oliver S, Mallet H, Hutchings H, Card G, *Assessing risks posed by ground gasses to buildings,* CIRIA Report C665.

Appendix 1

Site Plan

Notes:

Investigation positions approximated from site operative's notes.

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Client:

Thirteen Housing Group

Job Number:

C2960/22/E/4487

Project Details:

Highmoor Lane, Cleckheaton

Scale:	Not to scale - reference only

ground investigation | drilling & excavation | insitu testing
laboratory testing & gas monitoring | engineering consultancy
surveying & flood risk assessments | training, CPD & expert witness
... delivered using our own drilling rigs / crews / soils lab / engineers

Appendix 2

Borehole Records

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WS01**

Sheet 1 of 1

Project Name: Highmoor Lane	Project No. C2960/22/E/4487	Co-ords:	Hole Type WLS
Location: Cleckheaton		Level:	Scale 1:50
Client: 13 Group		Dates: 17/10/2022	Logged By IMY

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.50	ES	87	100		0.45			TOPSOIL (Dark brown slightly gravelly SAND with frequent rootlets).
		1.00	SPT			77 (11,13/77 for 225mm)	0.90			Medium dense light brown silty very gravelly SAND. Gravel is sub-angular to sub-rounded, tabular, fine to medium of sandstone. [COMPLETELY WEATHERED SANDSTONE].
							1.30			Extremely weak thinly laminated light brown SANDSTONE.
										End of Borehole at 1.30m

Remarks

AGS

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WS02**

Sheet 1 of 1

Project Name: Highmoor Lane	Project No. C2960/22/E/4487	Co-ords:	Hole Type WLS
Location: Cleckheaton		Level:	Scale 1:50
Client: 13 Group		Dates: 17/10/2022	Logged By IMY

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.65	ES	87	95		0.40			TOPSOIL (Dark brown clayey SILT with frequent rootlets).
							0.65			RELICT TOPSOIL (Dark brown slightly gravelly silty SAND with frequent rootlets. Gravel is sub-angular to sub-rounded, fine to medium of sandstone and occasional mudstone).
				87	95		1.60			Medium dense brown becoming light brown slightly clayey silty very gravelly SAND. Gravel is sub-angular to sub-rounded, fine to medium of sandstone. [RESIDUAL SANDSTONE].
							2.00			Extremely weak thinly laminated brown clayey MUDSTONE.
										End of Borehole at 2.00m

1 2 3 4 5 6 7 8 9 10

Remarks

AGS

RGS Environmental Geotechnical Specialists

Borehole Log

Borehole No. **WS03**

Sheet 1 of 1

Project Name: Highmoor Lane	Project No. C2960/22/E/4487	Co-ords:	Hole Type WLS
Location: Cleckheaton		Level:	Scale 1:50
Client: 13 Group		Dates: 17/10/2022	Logged By IMY

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.40	ES	87	100		0.30			TOPSOIL (Dark brown slightly gravelly silty CLAY with frequent rootlets. Gravel is sub-angular to sub-rounded, fine to medium of brick, sandstone and occasional concrete).
		0.60	D				0.70			Firm yellowish brown mottled grey silty CLAY with occasional orangish staining.
		1.00	SPT			N=34 (6,7/8,9,7,10)	0.90			Firm yellowish brown mottled grey slightly gravelly sandy CLAY with occasional orangish staining. Gravel is sub-angular to sub-rounded, fine to medium of sandstone.
				57	90					Extremely weak thinly laminated greyish brown clayey MUDSTONE, with local bands of very stiff thinly laminated clay.
		2.00	SPT			68 (16,17/68 for 150mm)	2.00			End of Borehole at 2.00m

Remarks

AGS

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WS04**

Sheet 1 of 1

Project Name: Highmoor Lane	Project No. C2960/22/E/4487	Co-ords:	Hole Type WLS
Location: Cleckheaton		Level:	Scale 1:50
Client: 13 Group		Dates: 17/10/2022	Logged By IMY

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
							0.15			TOPSOIL (Dark brown slightly gravelly silty CLAY with frequent rootlets. Gravel is sub-angular to sub-rounded, fine to medium of sandstone).
				57	90		0.30			MADE GROUND (Brown silty gravelly SAND. Gravel is sub-angular to sub-rounded, fine to medium of sandstone and asphalt fragments).
		0.90	SPT			50 (24,29/50 for 75mm)	0.70			MADE GROUND (Soft brown and brown mottled grey silty CLAY).
							0.85			Soft yellowish brown slightly gravelly silty CLAY. Grave; is sub-angular to sub-rounded, fine to medium of sandstone.
							0.90			Extremely weak thinly laminated light brown clayey SANDSTONE.
										End of Borehole at 0.90m

1 2 3 4 5 6 7 8 9 10

Remarks

AGS

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WS05**

Sheet 1 of 1

Project Name: Highmoor Lane	Project No. C2960/22/E/4487	Co-ords:	Hole Type WLS
Location: Cleckheaton		Level:	Scale 1:50
Client: 13 Group		Dates: 17/10/2022	Logged By IMY

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.60 0.70	ES D	87 57	100 95		0.30 0.95 1.60 2.00			TOPSOIL (Dark brown slightly clayey silty SAND with frequent rootlets). Firm to stiff friable light brown mottled grey slightly gravelly silty CLAY with occasional orangish staining. Gravel is sub-angular to sub-rounded, fine to medium of mudstone. [Dry]. Stiff light brown mottled grey slightly gravelly silty CLAY with occasional orangish staining. Gravel is sub-angular to sub-rounded, tabular, fine to medium of mudstone. Extremely weak thinly laminated brown MUDSTONE. End of Borehole at 2.00m

Remarks

AGS

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WS06**

Sheet 1 of 1

Project Name: Highmoor Lane	Project No. C2960/22/E/4487	Co-ords:	Hole Type WLS
Location: Cleckheaton		Level:	Scale 1:50
Client: 13 Group		Dates: 17/10/2022	Logged By IMY

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.60	ES	87	100		0.05			TOPSOIL (Dark brown clayey SILT with frequent rootlets).
		0.80	D				0.45			MADE GROUND (Creamish brown silty very gravelly SAND. Gravel is sub-angular to sub-rounded, fine to medium of dolomitic limestone).
				87	95		0.95			Firm yellowish brown mottled grey slightly gravelly silty CLAY with occasional orangish staining. Gravel is sub-angular to sub-rounded, fine to medium of mudstone. Rare well rounded to sub-angular, medium gravel sized nodules of ferruginous siltstone.
				57	100		1.80			Firm to stiff brown mottled grey slightly gravelly silty CLAY with occasional orangish staining and rare carbonaceous staining.
							2.34			Extremely weak thinly laminated brown MUDSTONE with occasional carbonaceous staining and grey mottling.
										End of Borehole at 2.34m

Remarks

AGS

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WS07**

Sheet 1 of 1

Project Name: Highmoor Lane	Project No. C2960/22/E/4487	Co-ords:	Hole Type WLS
Location: Cleckheaton		Level:	Scale 1:50
Client: 13 Group		Dates: 18/10/2022	Logged By IMY

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.80	D	87	100		0.40			TOPSOIL (Soft dark brown silty CLAY with frequent rootlets).
				87	97		1.65			Firm becoming firm to stiff light brown becoming brown mottled grey slightly gravelly silty CLAY. Gravel is sub-angular to sub-rounded, fine to medium of mudstone.
				77	100		2.60			Extremely weak thinly laminated brown clayey MUDSTONE with occasional carbonaceous staining.
										End of Borehole at 2.60m

Remarks

AGS

Trial Pit Log

Trialpit No **WS08**

Sheet 1 of 1

Project Name: Highmoor Lane	Project No. C2960/22/E/4487	Co-ords: - Level:	Date 18/10/2022
Location: Cleckheaton		Dimensions (m): Depth 1.20	Scale 1:50
Client: 13 Group			Logged IMY

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.00 - 0.40	D					TOPSOIL (Dark brown sandy SILT with frequent rootlets).
	0.40 - 0.80	D		0.40			Stiff yellowish brown mottled grey slightly gravelly silty CLAY with occasional orangish staining. Gravel is sub-angular to sub-rounded, fine to medium of mudstone.
	0.40 - 0.80	ES					
	0.80 - 1.20	D					
				1.20			End of pit at 1.20 m

Remarks:

Stability:

Appendix 3

Dynamic Probing Records

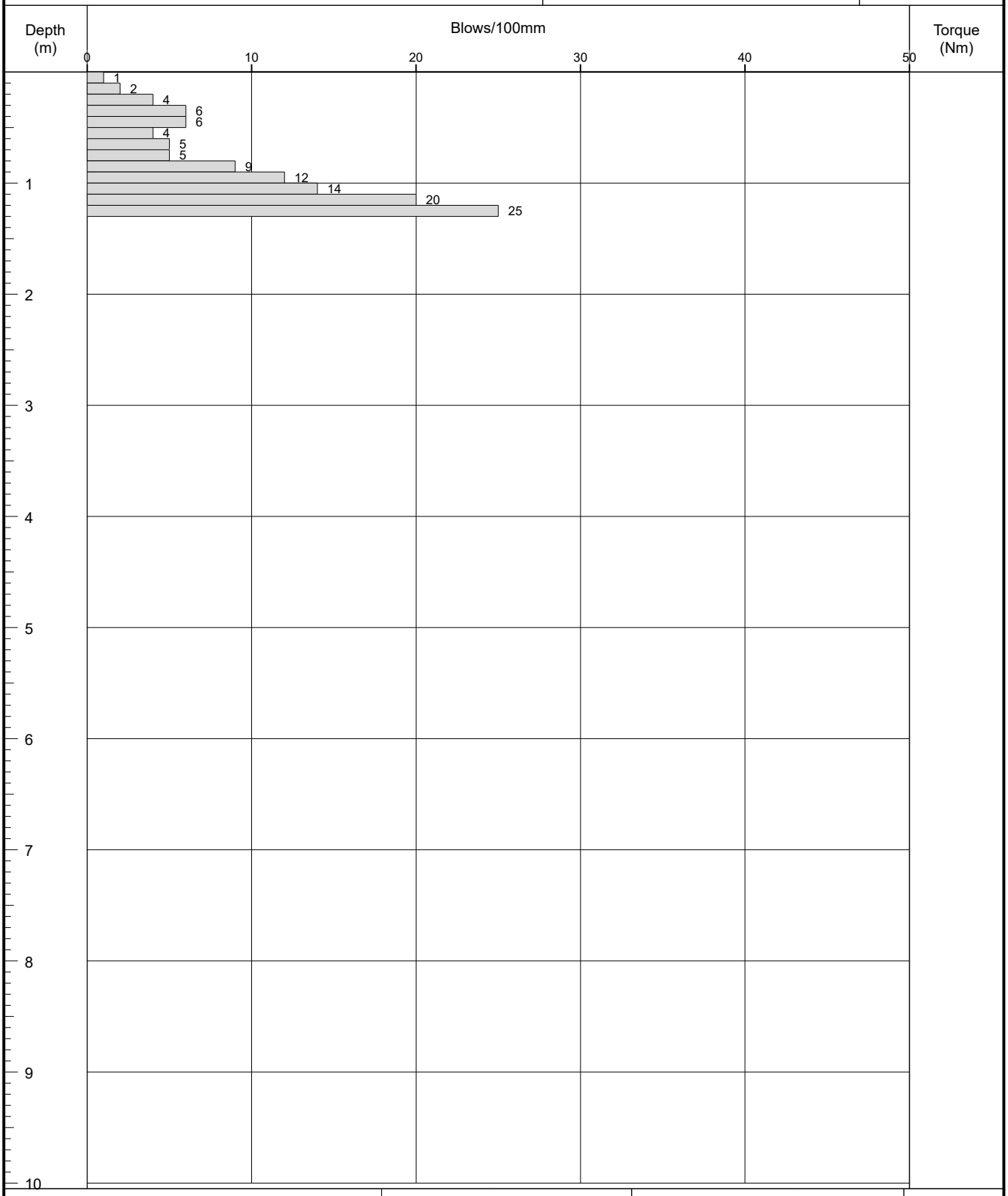
Probe Log

Environmental Geotechnical Specialists

Probe No. **DP01**

Sheet 1 of 1

Project Name: Highmoor Lane	Project No. C2960/22/E/4487	Co-ords:	Hole Type DCP
Location: Cleckheaton		Level:	Scale 1:50
Client: 13 Group		Dates: 17/10/2022	Logged By BM



Remarks:

Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	1.3m
Probe Type	DPSH-B		

AGS

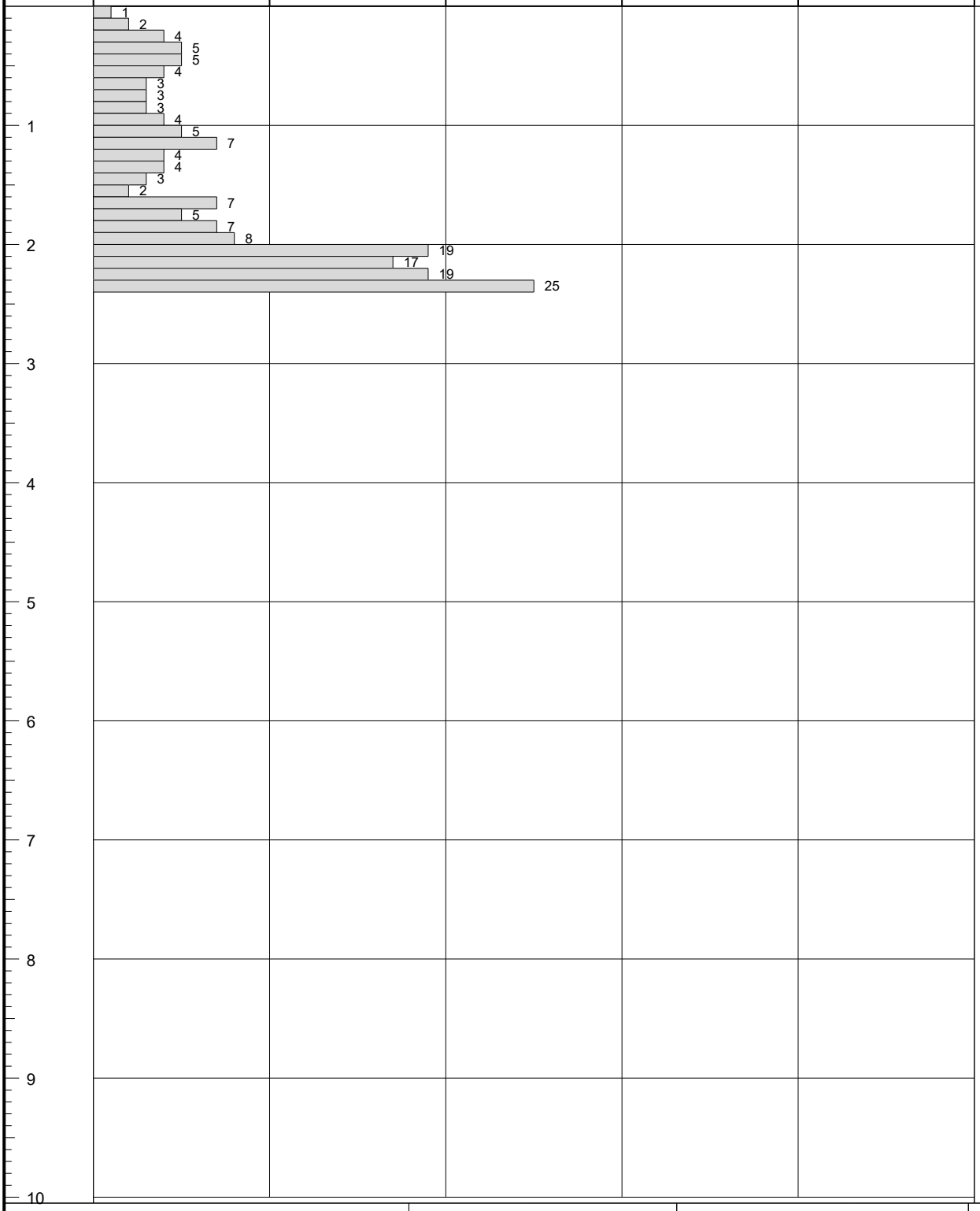
Probe Log

Environmental Geotechnical Specialists

Probe No. **DP02**

Sheet 1 of 1

Project Name: Highmoor Lane	Project No. C2960/22/E/4487	Co-ords:	Hole Type DCP
Location: Cleckheaton		Level:	Scale 1:50
Client: 13 Group		Dates: 17/10/2022	Logged By BM



Remarks:

Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	2.4m
Probe Type	DPSH-B		

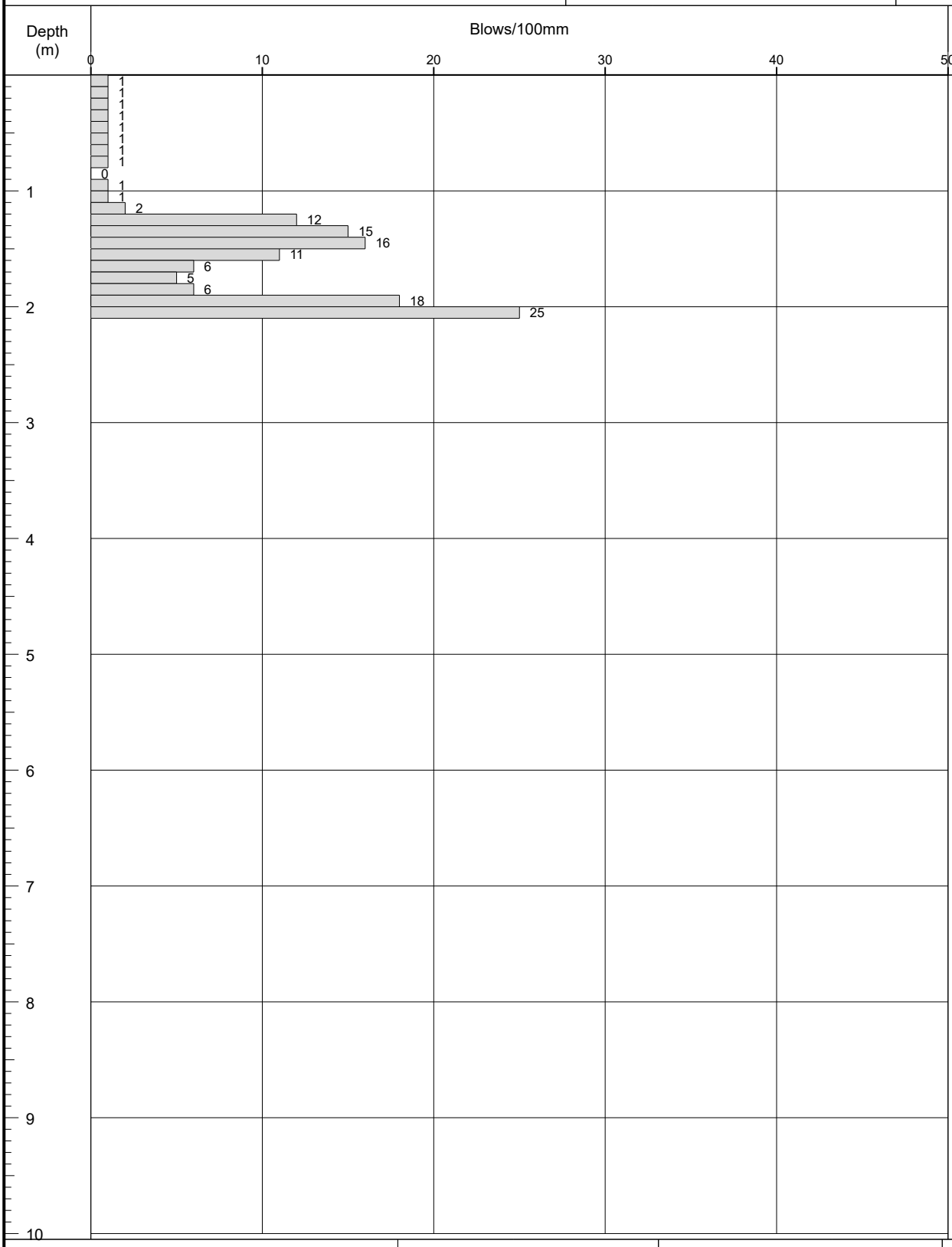
AGS

Probe Log

Probe No. **DP03**

Sheet 1 of 1

Project Name: Highmoor Lane	Project No. C2960/22/E/4487	Co-ords:	Hole Type DCP
Location: Cleckheaton		Level:	Scale 1:50
Client: 13 Group		Dates: 17/10/2022	Logged By BM



Remarks:

Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	2.1m
Probe Type	DPSH-B		

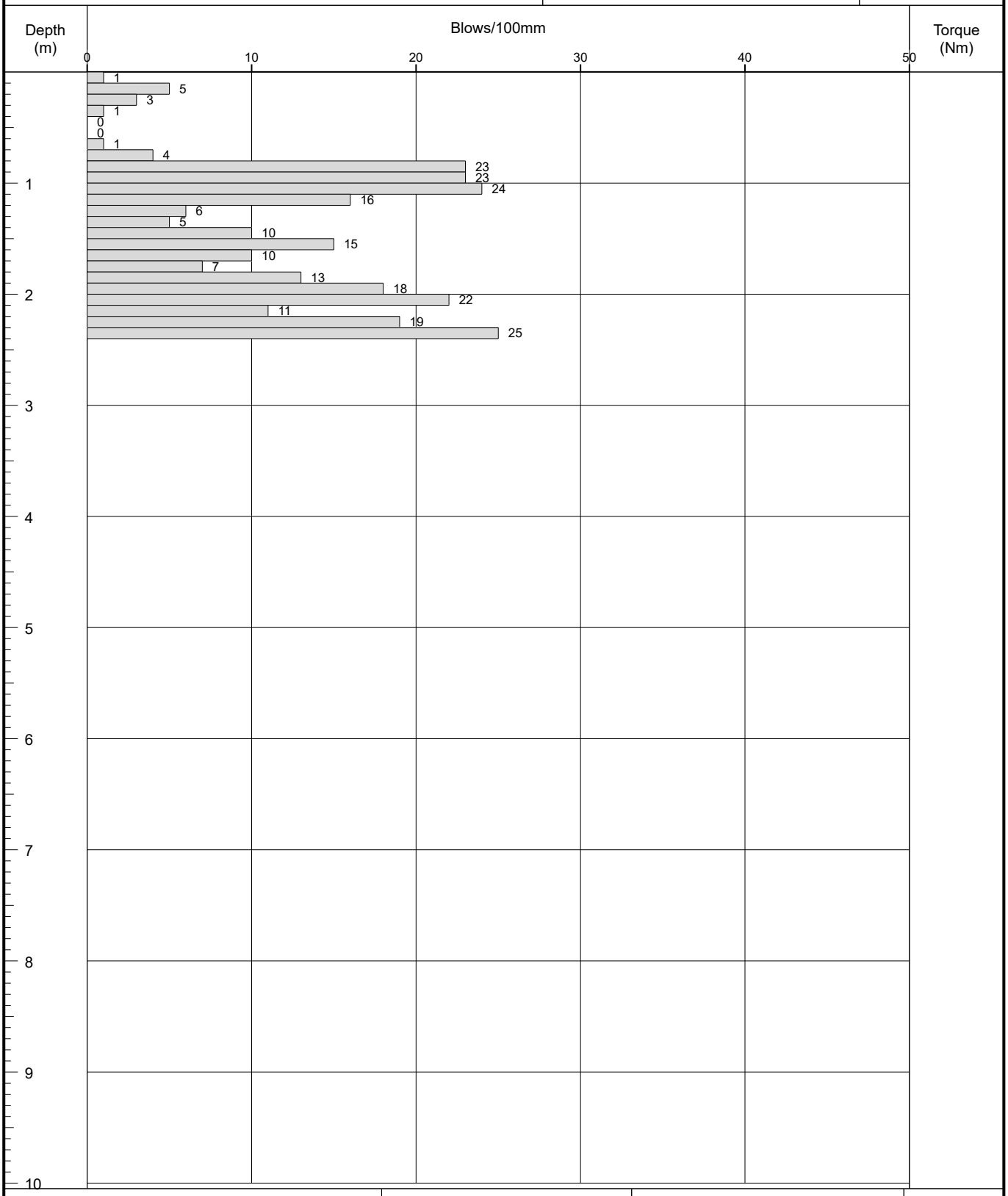
Probe Log

Environmental Geotechnical Specialists

Probe No. **DP04**

Sheet 1 of 1

Project Name: Highmoor Lane	Project No. C2960/22/E/4487	Co-ords:	Hole Type DCP
Location: Cleckheaton		Level:	Scale 1:50
Client: 13 Group		Dates: 17/10/2022	Logged By BM



Remarks:

Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	2.4m
Probe Type	DPSH-B		

AGS

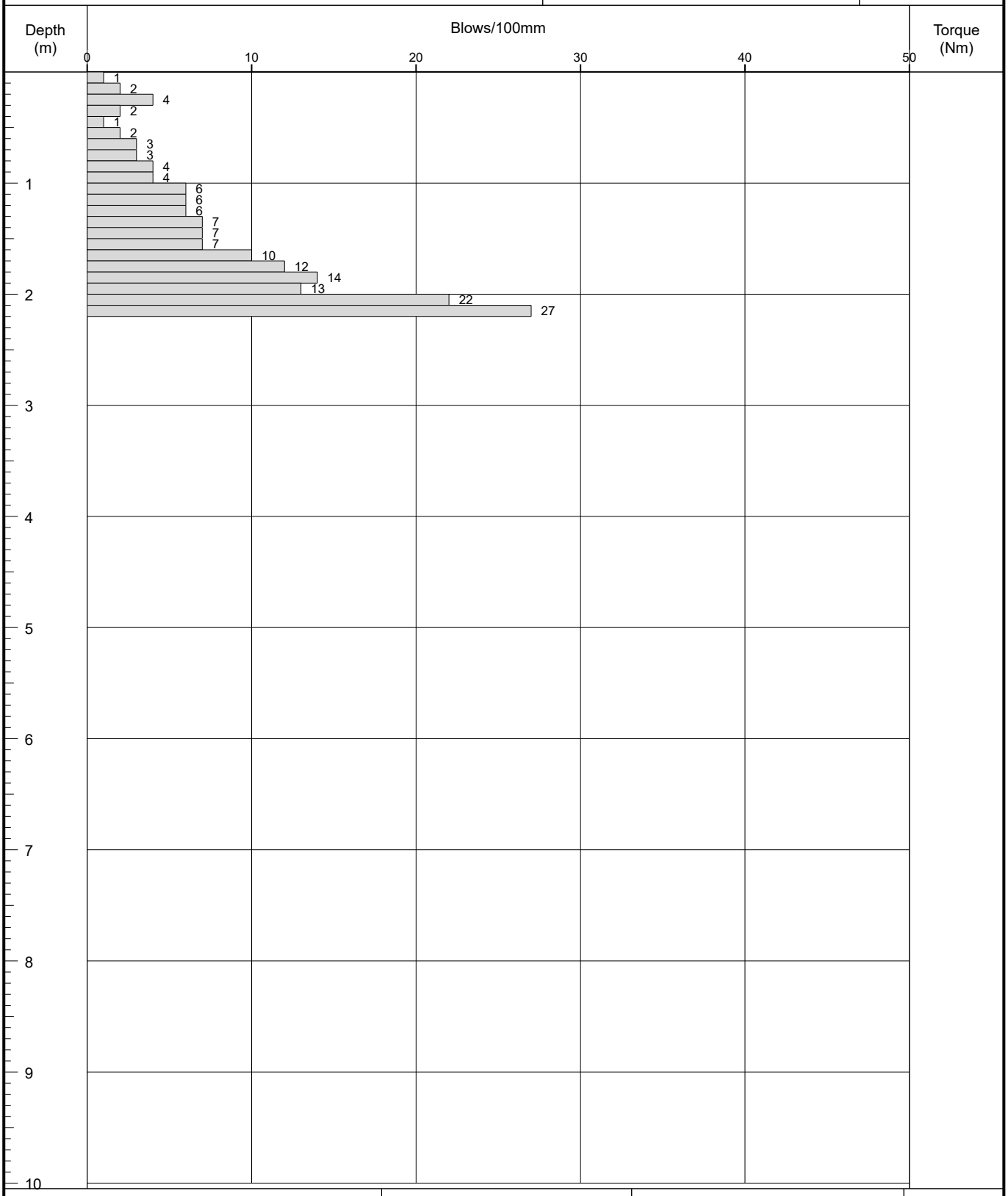
Probe Log

Environmental Geotechnical Specialists

Probe No. **DP05**

Sheet 1 of 1

Project Name: Highmoor Lane	Project No. C2960/22/E/4487	Co-ords:	Hole Type DCP
Location: Cleckheaton		Level:	Scale 1:50
Client: 13 Group		Dates: 17/10/2022	Logged By BM



Remarks:		Fall Height	750mm	Cone Base Diameter	50.5mm
		Hammer Wt	63.5kg	Final Depth	2.2m
		Probe Type	DPSH-B		

AGS

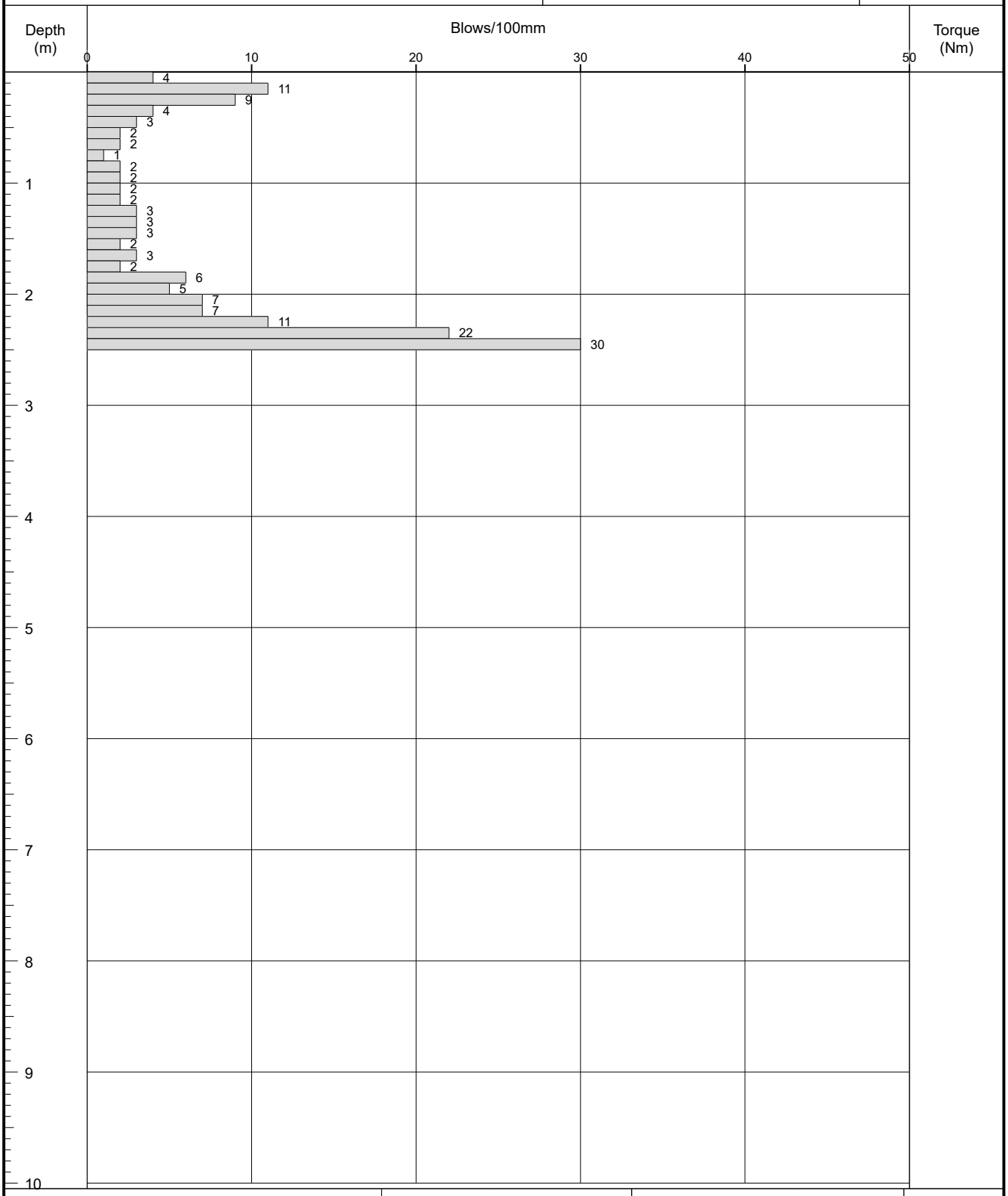
Probe Log

Environmental Geotechnical Specialists

Probe No. **DP06**

Sheet 1 of 1

Project Name: Highmoor Lane	Project No. C2960/22/E/4487	Co-ords:	Hole Type DCP
Location: Cleckheaton		Level:	Scale 1:50
Client: 13 Group		Dates: 17/10/2022	Logged By BM



Remarks:		Fall Height	750mm	Cone Base Diameter	50.5mm
		Hammer Wt	63.5kg	Final Depth	2.5m
		Probe Type	DPSH-B		

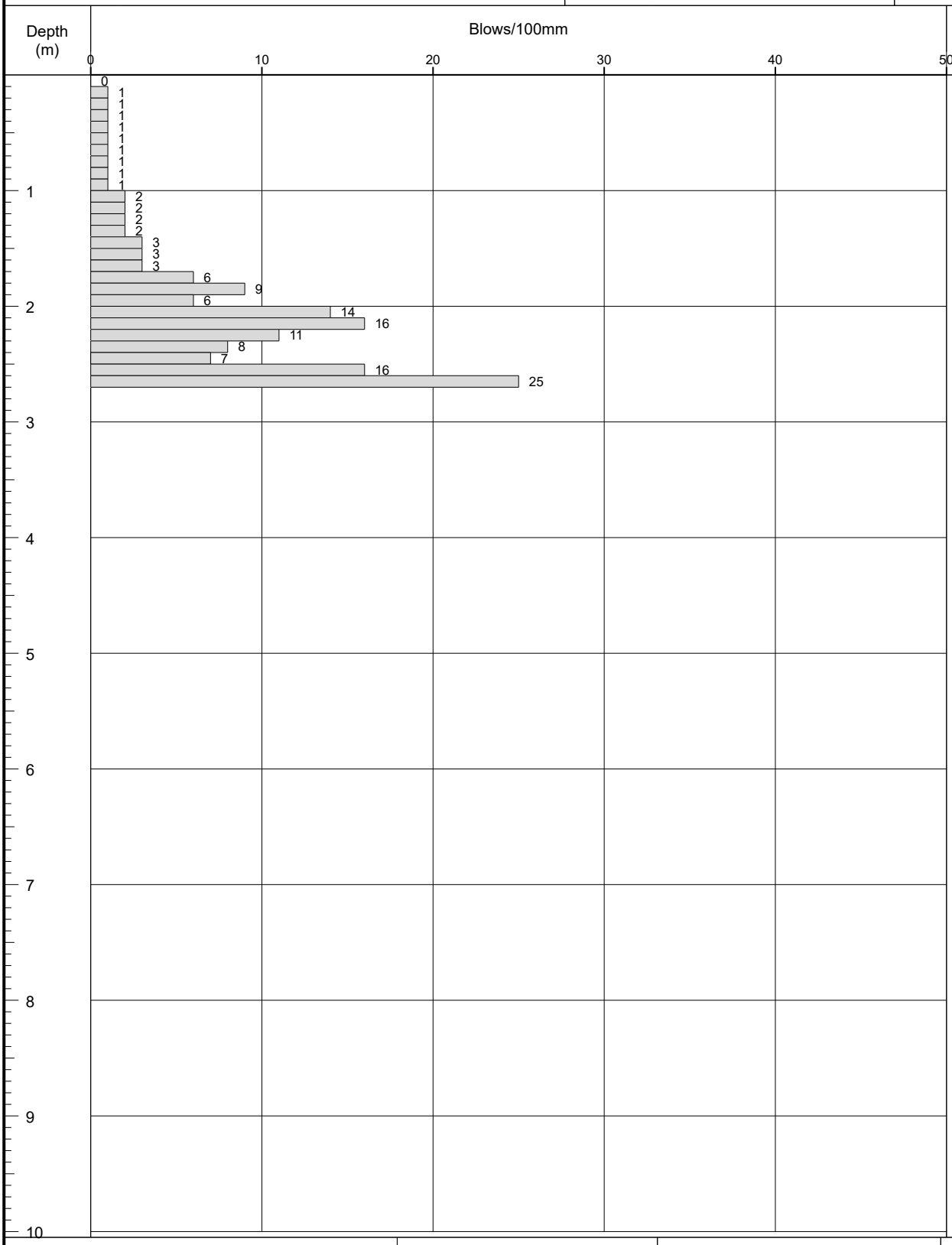
AGS

RGS Environmental Geotechnical Specialists

Probe Log

Probe No.
DP07
Sheet 1 of 1

Project Name: Highmoor Lane	Project No. C2960/22/E/4487	Co-ords:	Hole Type DCP
Location: Cleckheaton		Level:	Scale 1:50
Client: 13 Group		Dates: 18/10/2022	Logged By BM



Remarks:

Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	2.7m
Probe Type	DPSH-B		

AGS

Appendix 4

Trial Pit Records

Trial Pit Log

Trialpit No **TP01** Sheet 1 of 1

Project Name: Highmoor Lane	Project No. C2960/22/E/4487	Co-ords: - Level:	Date 19/10/2022
Location: Cleckheaton		Dimensions (m): 2.7 × 0.6, Depth 2.30	Scale 1:50
Client: 13 Group			Logged IMY

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.05			ASPHALT. MADE GROUND (Brick fill).
				0.65			Very stiff brown mottled grey slightly gravelly silty CLAY with occasional orangish staining. Gravel is sub-angular to sub-rounded, tabular, fine to medium of mudstone and siltstone. Noted to be very dry.
				2.10			Extremely weak thinly laminated greyish brown MUDSTONE, recovered as sandy gravel.
				2.30			End of pit at 2.30 m

Remarks:

Stability:

Trial Pit Log

Trialpit No **TP02**

Sheet 1 of 1

Project Name: Highmoor Lane	Project No. C2960/22/E/4487	Co-ords: - Level:	Date 19/10/2022
Location: Cleckheaton		Dimensions (m): 1.9 × 0.3, Depth 1.65	Scale 1:50
Client: 13 Group			Logged IMY

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			TOPSOIL (Dark brown brown silty slightly gravelly CLAY with occasional partial brick fragments and frequent rootlets. Gravel is sub angular to sub rounded fine to medium of brick, sandstone, mudstone and mortar).
				1.20			Soft to firm yellowish brown mottled grey slightly gravelly silty CLAY with occasional orangish staining and rare rootlets. Gravel is sub-angular to sub-rounded fine to medium of mudstone and siltstone.
				1.65			Firm thinly laminated friable, brown mottled grey slightly sandy slightly gravelly silty CLAY with occasional orangish straining. Gravel is sub-angular to sub-rounded, tabular, fine to medium of mudstone. Rare fine root remains noted.
							End of pit at 1.65 m

Remarks:

Stability:

Trial Pit Log

Trialpit No **TP03** Sheet 1 of 1

Project Name: Highmoor Lane	Project No. C2960/22/E/4487	Co-ords: - Level:	Date 19/10/2022
Location: Cleckheaton		Dimensions (m): Depth 1.20 — 0.3 × 1.8	Scale 1:50
Client: 13 Group			Logged IMY

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			TOPSOIL (Dark brown sandy SILT with frequent rootlets).
				1.05			Stiff friable light brown slightly gravelly slightly sandy CLAY with occasional orangish staining. Gravel is sub-angular to sub-rounded fine to medium of mudstone.
				1.20			Extremely weak thinly laminated greyish brown MUDSTONE with occasional carbonaceous staining. Recovered as sub-angular to sub rounded fine to medium, tabular gravel.
							End of pit at 1.20 m

Remarks:

Stability:

Trial Pit Log

Trialpit No **TP04**

Sheet 1 of 1

Project Name: Highmoor Lane	Project No. C2960/22/E/4487	Co-ords: - Level:	Date 19/10/2022
Location: Cleckheaton		Dimensions (m): 2.1 × 0.3, Depth 1.40	Scale 1:50
Client: 13 Group			Logged IMY

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			TOPSOIL (Dark brown sandy SILT with frequent rootlets).
	1.00	D		1.10			Firm yellowish brown mottled grey silty CLAY with occasional orangish staining.
				1.40			Firm thinly laminated light brown mottled grey silty sandy CLAY with occasional orangish staining.
							End of pit at 1.40 m

Remarks:

Stability:

Trial Pit Log

Trialpit No **TP05** Sheet 1 of 1

Project Name: Highmoor Lane	Project No. C2960/22/E/4487	Co-ords: - Level:	Date 19/10/2022
Location: Cleckheaton		Dimensions (m): Depth 2.00 — 2.5 × 0.3	Scale 1:50
Client: 13 Group			Logged

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20			TOPSOIL (Dark brown clayey SILT with occasional partial brick fragments and frequent rootlets).
				1.10			Firm yellowish brown mottled grey silty CLAY with occasional orangish staining.
				1.80			Firm thinly laminated light brown slightly gravelly sandy CLAY with occasional orangish staining. Gravel is sub-angular to sub-rounded, fine to medium of mudstone.
				2.00			Extremely weak thinly laminated greyish brown MUDSTONE, recovered as sandy sub angular to sub rounded, tabular, fine to medium gravel. Occasional orangish staining.
							End of pit at 2.00 m

Remarks:

Stability:

Appendix 5

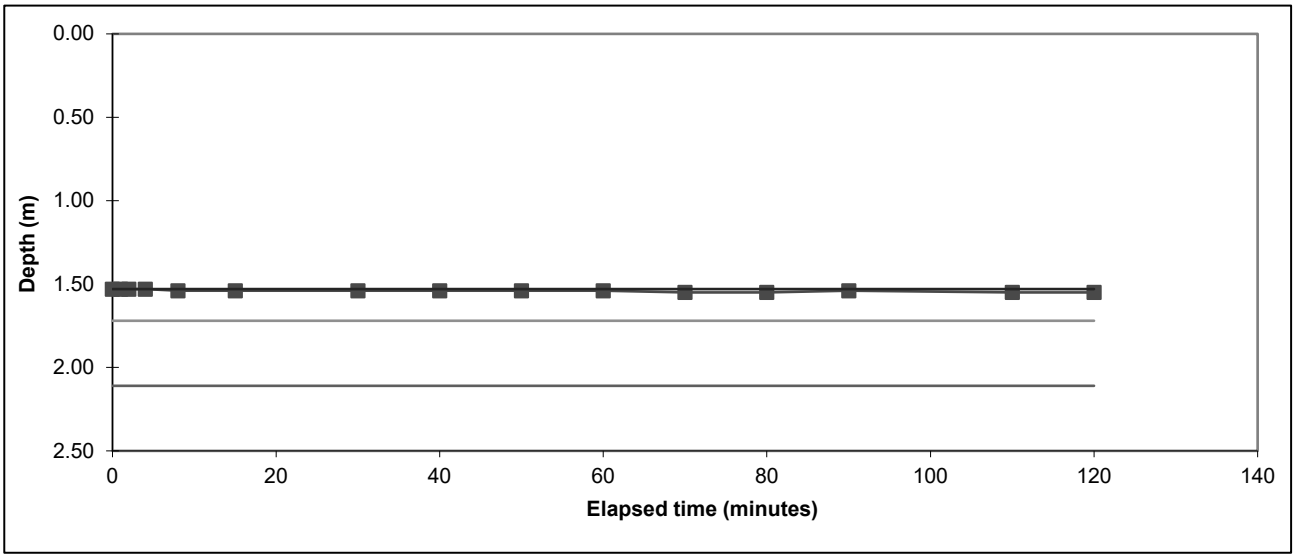
Soakaway Test Results

Rogers Geotechnical Services Ltd

Soakaway Test

Trial Pit No:	TP01	Test No:	1	Date:	19/10/2022
Length (m):	2.700		Datum Height:	0.00	m agl
Width (m):	0.60		Granular infill:	None	
Depth (m):	2.30		Porosity of infill:	1	(assumed)

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.530	60	1.540
1	1.530	70	1.550
2	1.530	80	1.550
4	1.530	90	1.540
8	1.540	110	1.550
15	1.540	120	1.550
30	1.540		
40	1.540		
50	1.540		



Start water depth for analysis (mbgl):	1.53		
75% effective depth (mbgl):	1.72	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	1.92		
25% effective depth (mbgl):	2.11	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	2.30		
Volume outflow between 75% and 25% effective depth (m^3):			
Mean surface area of outflow (m^2):		4.13	
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			

Soil infiltration rate (m/s):	**Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.**

Remarks Results processed following BRE 365 (2007).

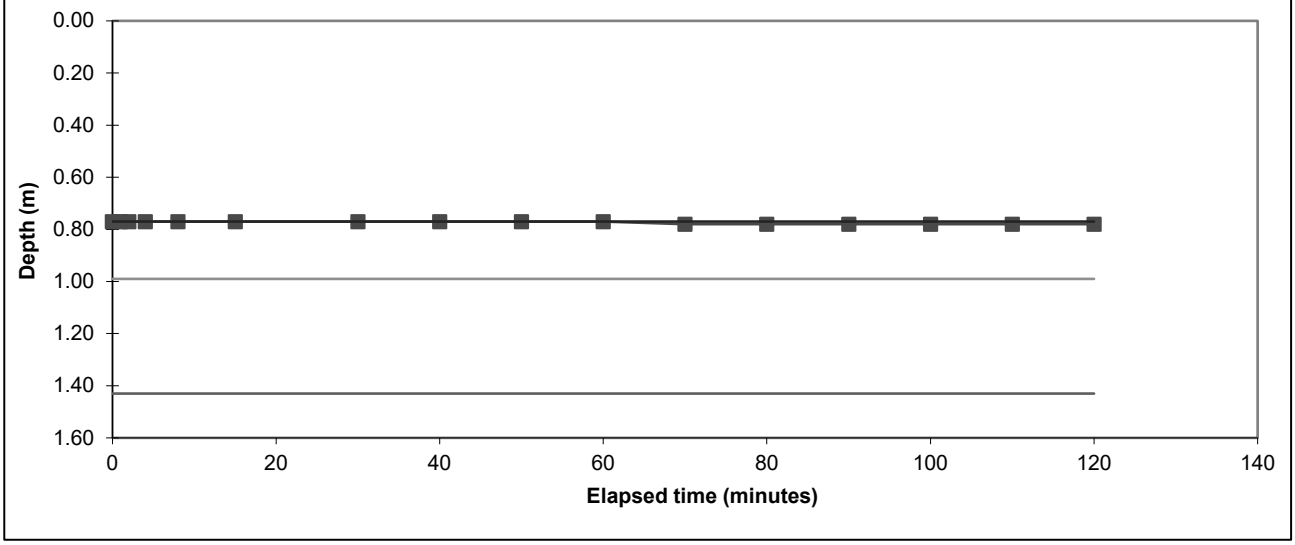
Client:	Thirteen Group	**Job No:**
Site:	Highmoor Lane, Cleckheaton	C2960/22/E/4487

Rogers Geotechnical Services Ltd

Soakaway Test

Trial Pit No:	TP02	Test No:	1	Date:	19/10/2022
Length (m):	1.800		Datum Height:	0.00	m agl
Width (m):	0.40		Granular infill:	None	
Depth (m):	1.65		Porosity of infill:	1	(assumed)

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.770	60	0.770
1	0.770	70	0.780
2	0.770	80	0.780
4	0.770	90	0.780
8	0.770	100	0.780
15	0.770	110	0.780
30	0.770	120	0.780
40	0.770		
50	0.770		



Start water depth for analysis (mbgl):	0.77		
75% effective depth (mbgl):	0.99	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	1.21		
25% effective depth (mbgl):	1.43	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	1.65		
Volume outflow between 75% and 25% effective depth (m^3):			
Mean surface area of outflow (m^2):			2.66
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			

Soil infiltration rate (m/s):	**Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.**

Remarks Results processed following BRE 365 (2007).

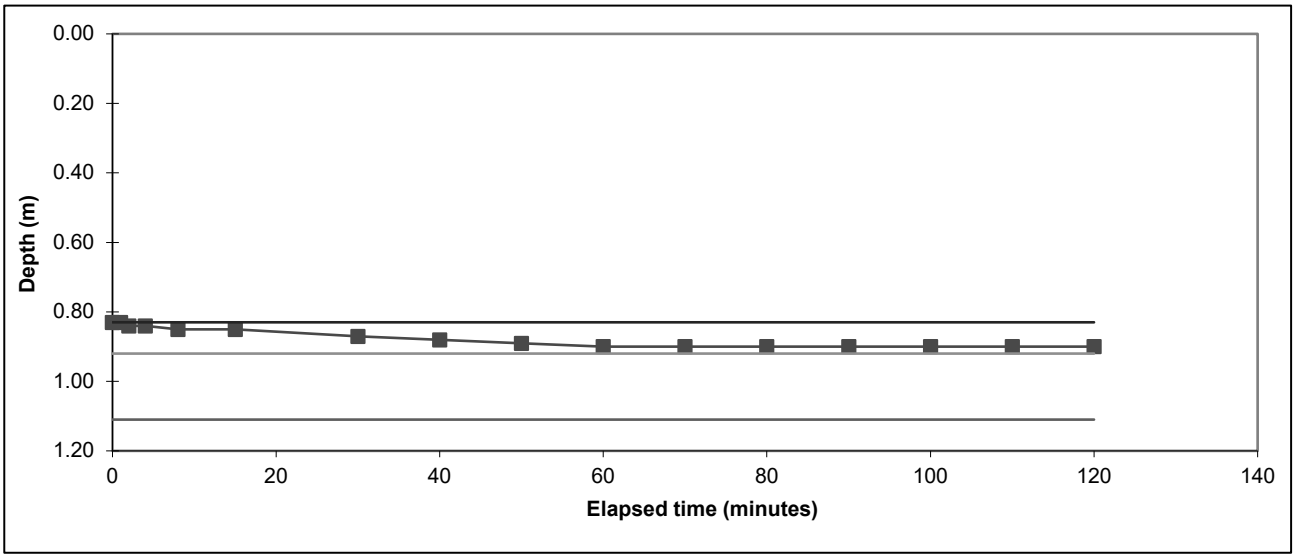
Client:	Thirteen Group	**Job No:**
Site:	Highmoor Lane, Cleckheaton	C2960/22/E/4487

Rogers Geotechnical Services Ltd

Soakaway Test

Trial Pit No:	TP03	Test No:	1	Date:	19/10/2022
Length (m):	2.30		Datum Height:	0.00	m agl
Width (m):	0.30		Granular infill:	None	
Depth (m):	1.20		Porosity of infill:	1	(assumed)

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.830	60	0.900
1	0.830	70	0.900
2	0.840	80	0.900
4	0.840	90	0.900
8	0.850	100	0.900
15	0.850	110	0.900
30	0.870	120	0.900
40	0.880		
50	0.890		



Start water depth for analysis (mbgl):	0.83		
75% effective depth (mbgl):	0.92	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	1.02		
25% effective depth (mbgl):	1.11	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	1.20		
Volume outflow between 75% and 25% effective depth (m^3):			
Mean surface area of outflow (m^2):		1.63	
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			

Soil infiltration rate (m/s):	**Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.**

Remarks Results processed following BRE 365 (2007).

Client:	Thirteen Group	**Job No:**
Site:	Highmoor Lane, Cleckheaton	C2960/22/E/4487

Appendix 6

TRL Probe Records

Rogers Geotechnical Services Ltd
Offices 1&2, Barncliffe Business Park,
Near Bank, Shelley,
Huddersfield
HD8 8LU

www.rogersgeotech.co.uk

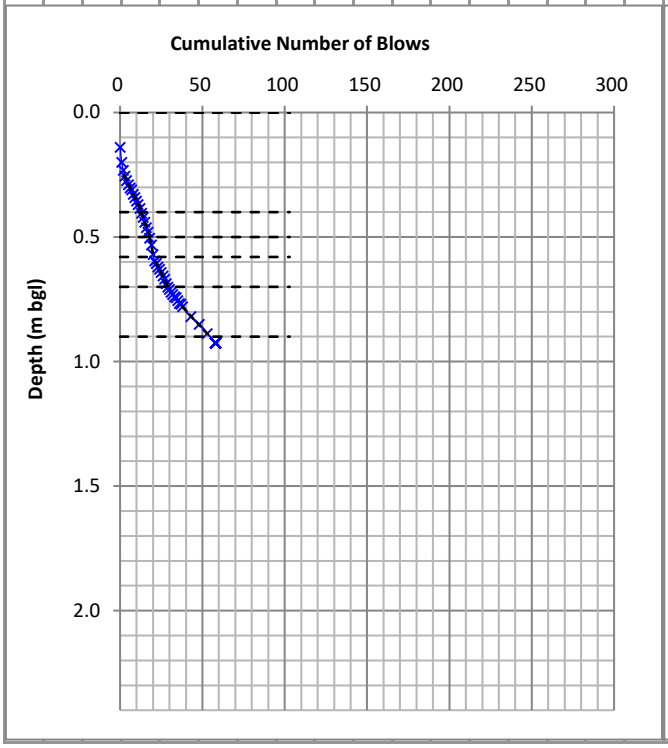
Tel : 0843 50 66687 **Fax : 0843 51 59930**

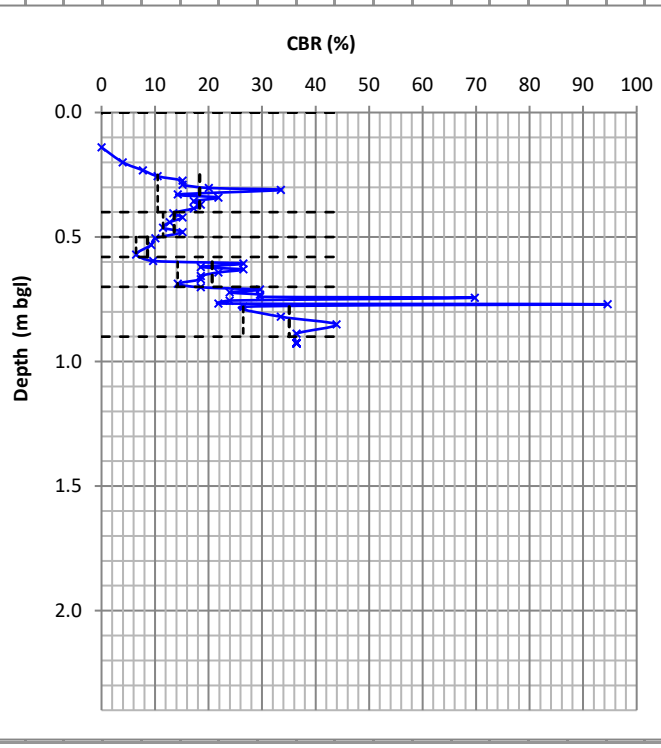
Job No:	Location:
C2960/22/E/4487	TRL DCP 1
Site: Highmoor Lane, Cleckheaton	Client: 13 Group
Test Date: 18/10/2022	Tested By: BM

IMPACT (TRL) Dynamic Cone Penetrometer

SL970, TRL Road Note 8, 60° cone.

Blow Count	Total Blows	Depth (mm)	CBR (%)	Blow Count	Total Blows	Depth (mm)	CBR (%)	Blow Count	Total Blows	Depth (mm)	CBR (%)
0	0	140	-	1	20	570	6	5	48	851	44
1	1	200	4	1	21	596	10	5	53	888	36
1	2	232	8	1	22	606	26	5	58	926	36
1	3	256	10	1	23	620	19				
1	4	273	15	1	24	630	26				
1	5	290	15	1	25	642	22				
1	6	303	20	1	26	656	19				
1	7	311	34	1	27	670	19				
1	8	329	14	1	28	688	14				
1	9	341	22	1	29	702	19				
1	10	356	17	1	30	711	30				
1	11	370	19	1	31	722	24				
1	12	385	17	1	32	731	30				
1	13	404	13	1	33	740	30				
1	14	421	15	1	34	744	70				
1	15	441	13	1	35	755	24				
1	16	463	12	1	36	767	22				
1	17	480	15	1	37	770	95				
1	18	505	10	1	38	780	26				
1	19	532	9	5	43	820	34				





Rogers Geotechnical Services Ltd
Offices 1&2, Barncliffe Business Park,
Near Bank, Shelley,
Huddersfield
HD8 8LU

www.rogersgeotech.co.uk

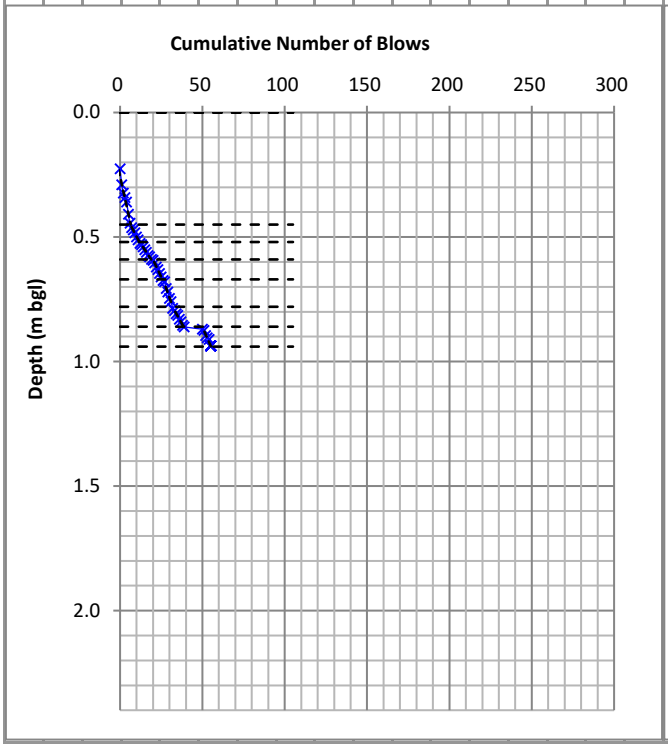
Tel : 0843 50 66687 **Fax : 0843 51 59930**

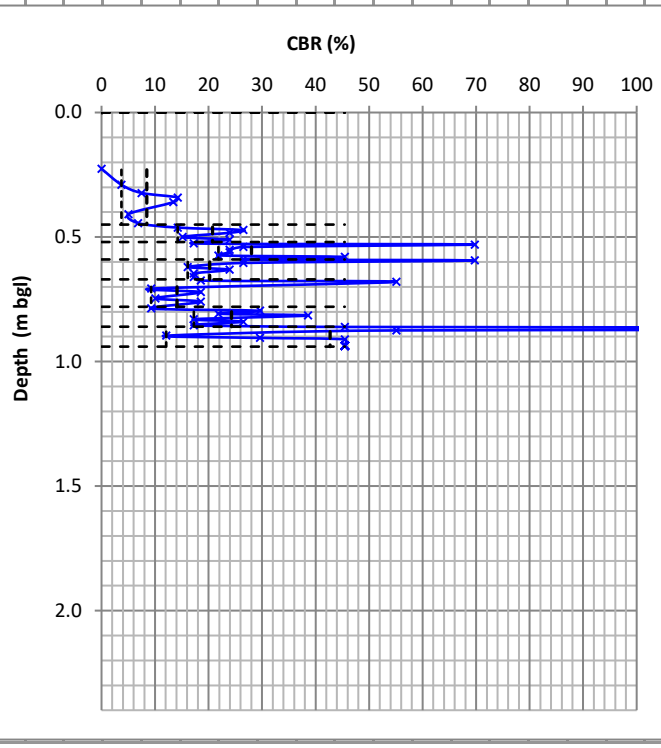
Job No:	Location:
C2960/22/E/4487	TRL DCP 2
Site: Highmoor Lane, Cleckheaton	Client: 13 Group
Test Date: 18/10/2022	Tested By: BM

IMPACT (TRL) Dynamic Cone Penetrometer

SL970, TRL Road Note 8, 60° cone.

Blow Count	Total Blows	Depth (mm)	CBR (%)	Blow Count	Total Blows	Depth (mm)	CBR (%)	Blow Count	Total Blows	Depth (mm)	CBR (%)
0	0	226	-	1	20	594	70	11	50	870	373
1	1	290	4	1	21	604	26	1	51	875	55
1	2	323	7	1	22	620	16	1	52	896	12
1	3	341	14	1	23	631	24	1	53	905	30
1	4	360	13	1	24	646	17	1	54	911	45
1	5	408	5	1	25	661	17	1	55	937	45
1	6	444	7	1	26	675	19				
1	7	462	14	1	27	680	55				
1	8	472	26	1	28	707	9				
1	9	483	24	1	29	721	19				
1	10	500	15	1	30	746	10				
1	11	511	24	1	31	760	19				
1	12	526	17	1	32	787	9				
1	13	530	70	1	33	796	30				
1	14	540	26	1	34	808	22				
1	15	551	24	1	35	815	39				
1	16	562	24	1	36	830	17				
1	17	574	22	1	37	840	26				
1	18	580	45	1	38	855	17				
1	19	590	26	1	39	861	45				





Rogers Geotechnical Services Ltd
Offices 1&2, Barncliffe Business Park,
Near Bank, Shelley,
Huddersfield
HD8 8LU

www.rogersgeotech.co.uk

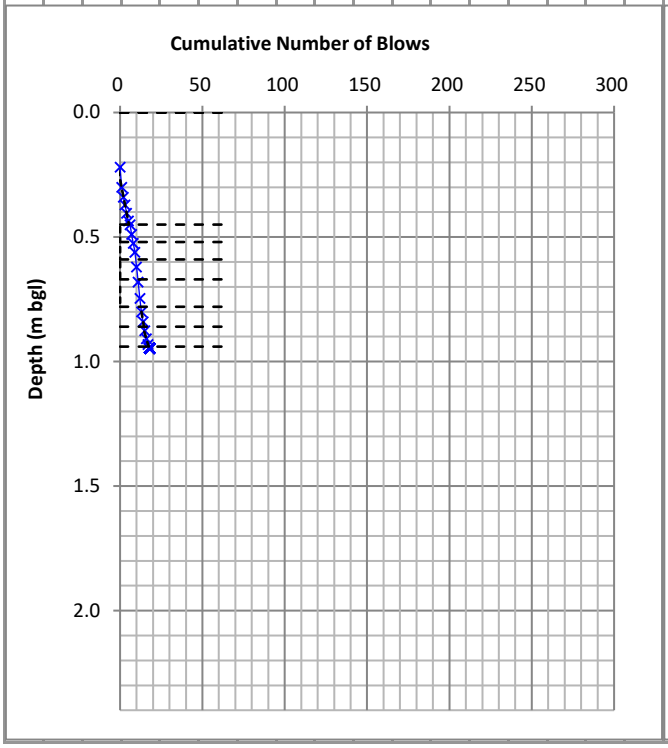
Tel : 0843 50 66687 **Fax : 0843 51 59930**

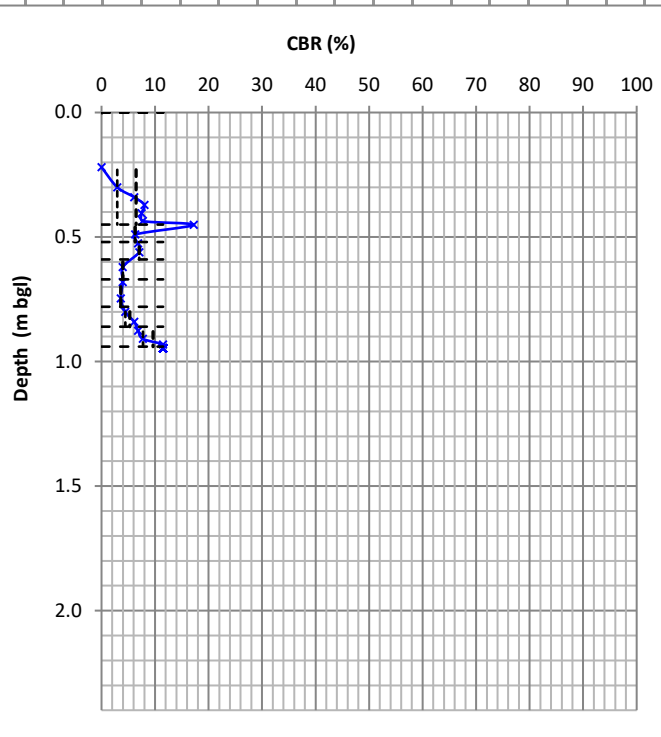
Job No:	Location:
C2960/22/E/4487	TRL DCP 3
Site: Highmoor Lane, Cleckheaton	Client: 13 Group
Test Date: 18/10/2022	Tested By: BM

IMPACT (TRL) Dynamic Cone Penetrometer

SL970, TRL Road Note 8, 60° cone.

Blow Count	Total Blows	Depth (mm)	CBR (%)	Blow Count	Total Blows	Depth (mm)	CBR (%)	Blow Count	Total Blows	Depth (mm)	CBR (%)
0	0	220	-								
1	1	300	3								
1	2	340	6								
1	3	371	8								
1	4	404	7								
1	5	436	8								
1	6	451	17								
1	7	490	6								
1	8	526	7								
1	9	561	7								
1	10	621	4								
1	11	681	4								
1	12	747	4								
1	13	801	4								
1	14	841	6								
1	15	877	7								
1	16	909	8								
1	17	931	12								
1	18	947	12								





Rogers Geotechnical Services Ltd
Offices 1&2, Barncliffe Business Park,
Near Bank, Shelley,
Huddersfield
HD8 8LU

www.rogersgeotech.co.uk

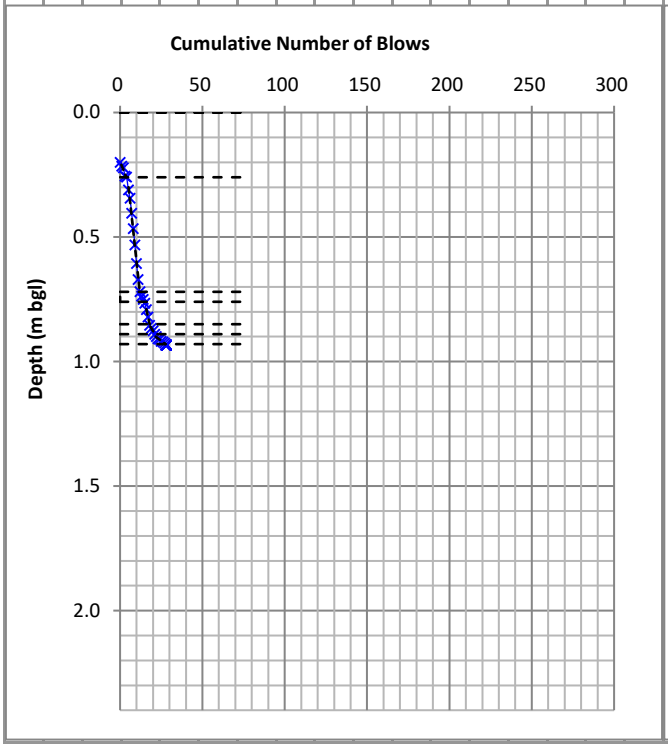
Tel : 0843 50 66687 **Fax : 0843 51 59930**

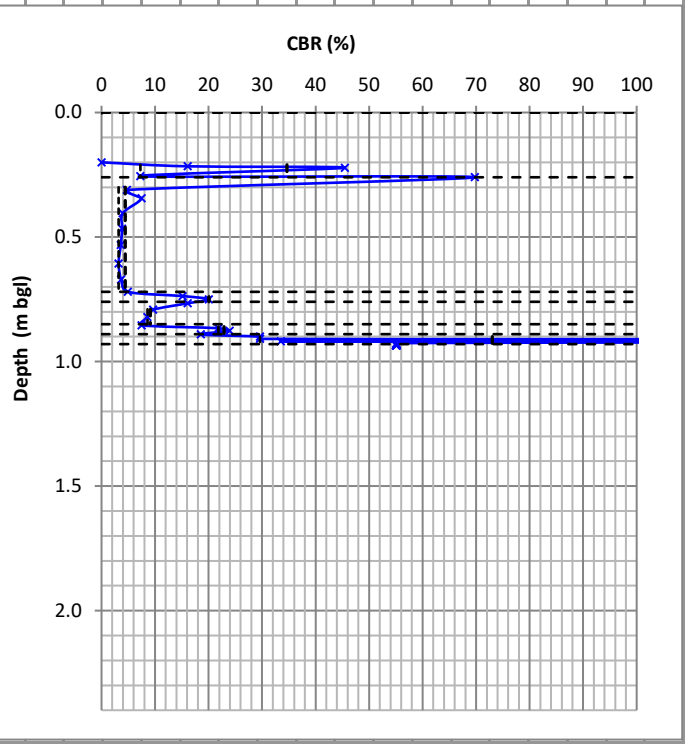
Job No:	Location:
C2960/22/E/4487	TRL DCP 4
Site: Highmoor Lane, Cleckheaton	Client: 13 Group
Test Date: 18/10/2022	Tested By: BM

IMPACT (TRL) Dynamic Cone Penetrometer

SL970, TRL Road Note 8, 60° cone.

Blow Count	Total Blows	Depth (mm)	CBR (%)	Blow Count	Total Blows	Depth (mm)	CBR (%)	Blow Count	Total Blows	Depth (mm)	CBR (%)
0	0	200	-	1	20	877	24				
1	1	216	16	1	21	891	19				
1	2	222	45	1	22	900	30				
1	3	256	7	1	23	909	30				
1	4	260	70	1	24	911	145				
1	5	311	5	1	25	919	34				
1	6	344	7	1	26	921	145				
1	7	404	4	1	27	926	55				
1	8	466	4	1	28	934	55				
1	9	532	4								
1	10	606	3								
1	11	671	4								
1	12	720	5								
1	13	737	15								
1	14	750	20								
1	15	766	16								
1	16	792	10								
1	17	821	9								
1	18	854	7								
1	19	866	22								





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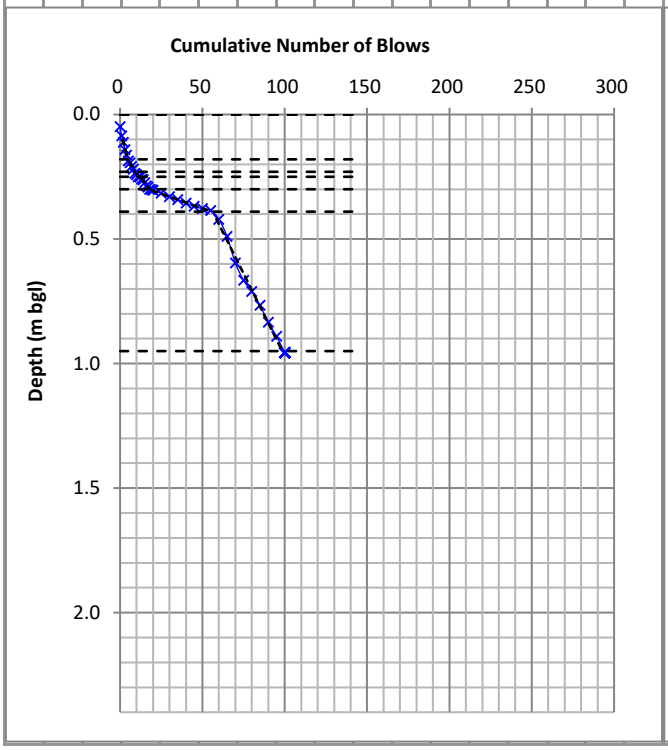
Tel : 0843 50 66687 **Fax : 0843 51 59930**

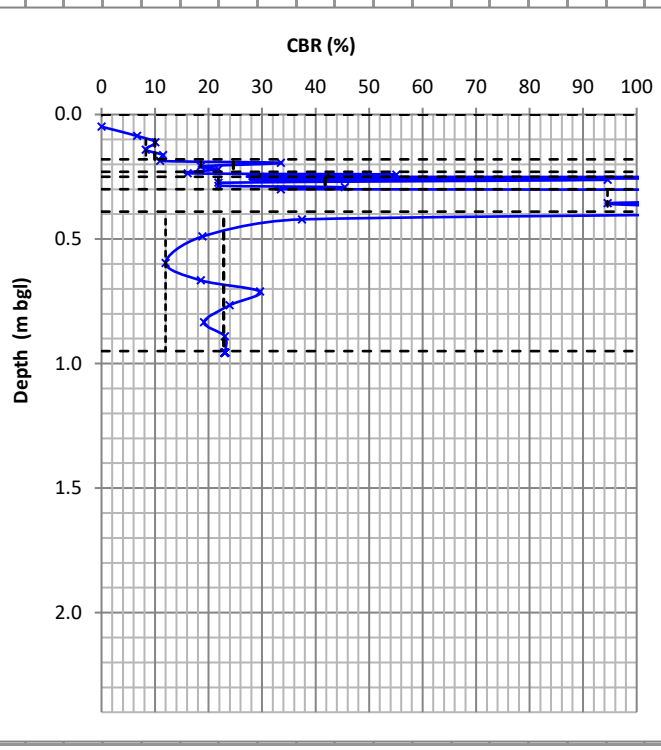
Job No:	Location:
C2960/22/E/4487	TRL DCP 5
Site: Highmoor Lane, Cleckheaton	Client: 13 Group
Test Date: 18/10/2022	Tested By: BM

IMPACT (TRL) Dynamic Cone Penetrometer

SL970, TRL Road Note 8, 60° cone.

Blow Count	Total Blows	Depth (mm)	CBR (%)	Blow Count	Total Blows	Depth (mm)	CBR (%)	Blow Count	Total Blows	Depth (mm)	CBR (%)
0	0	49	-	1	20	304	145				
1	1	86	7	5	25	316	120				
1	2	111	10	5	30	330	102				
1	3	141	8	5	35	341	131				
1	4	163	12	5	40	356	95				
1	5	186	11	5	45	369	110				
1	6	194	34	5	50	378	162				
1	7	208	19	5	55	385	212				
1	8	220	22	5	60	421	37				
1	9	236	16	5	65	490	19				
1	10	241	55	5	70	596	12				
1	11	250	30	5	75	666	19				
1	12	251	302	5	80	711	30				
1	13	259	34	5	85	766	24				
1	14	262	95	5	90	834	19				
1	15	274	22	5	95	891	23				
1	16	286	22	5	100	956	23				
1	17	292	45								
1	18	300	34								
1	19	302	145								





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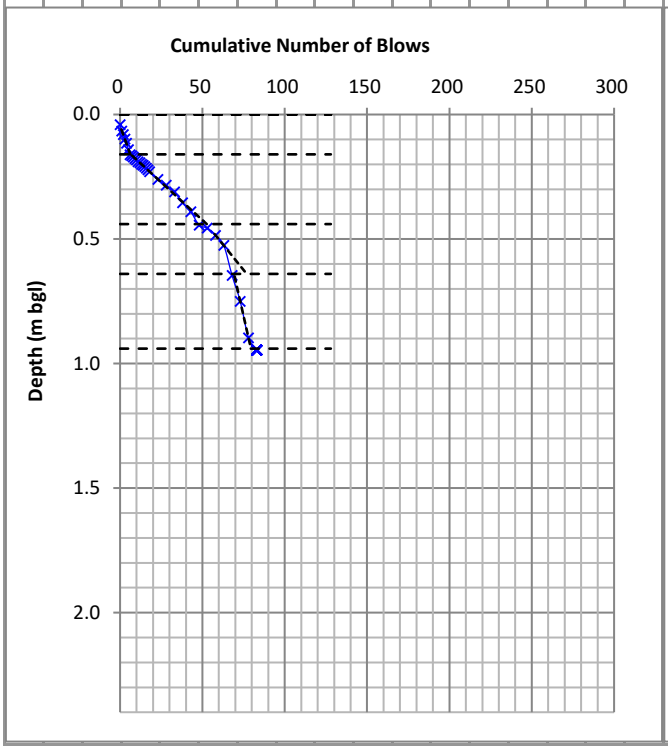
Tel : 0843 50 66687 **Fax : 0843 51 59930**

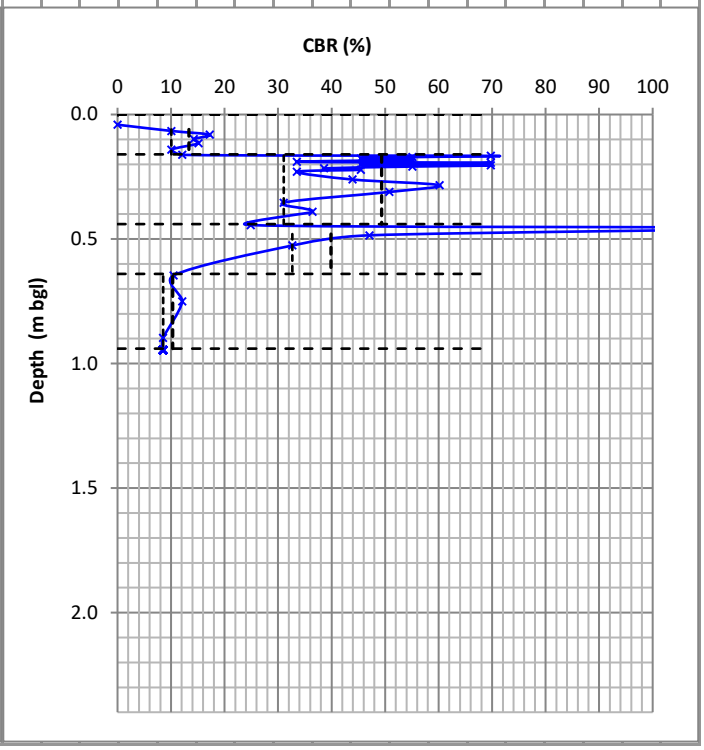
Job No:	Location:
C2960/22/E/4487	TRL DCP 6
Site: Highmoor Lane, Cleckheaton	Client: 13 Group
Test Date: 18/10/2022	Tested By: BM

IMPACT (TRL) Dynamic Cone Penetrometer

SL970, TRL Road Note 8, 60° cone.

Blow Count	Total Blows	Depth (mm)	CBR (%)	Blow Count	Total Blows	Depth (mm)	CBR (%)	Blow Count	Total Blows	Depth (mm)	CBR (%)
0	0	41	-	5	28	284	60				
1	1	66	10	5	33	311	51				
1	2	81	17	5	38	354	31				
1	3	99	14	5	43	391	36				
1	4	116	15	5	48	444	25				
1	5	141	10	5	53	456	120				
1	6	162	12	5	58	485	47				
1	7	166	70	5	63	526	33				
1	8	171	55	5	68	646	10				
1	9	177	45	5	73	751	12				
1	10	182	55	5	78	897	9				
1	11	190	34	5	83	946	9				
1	12	194	70								
1	13	200	45								
1	14	204	70								
1	15	209	55								
1	16	216	39								
1	17	222	45								
1	18	230	34								
5	23	261	44								





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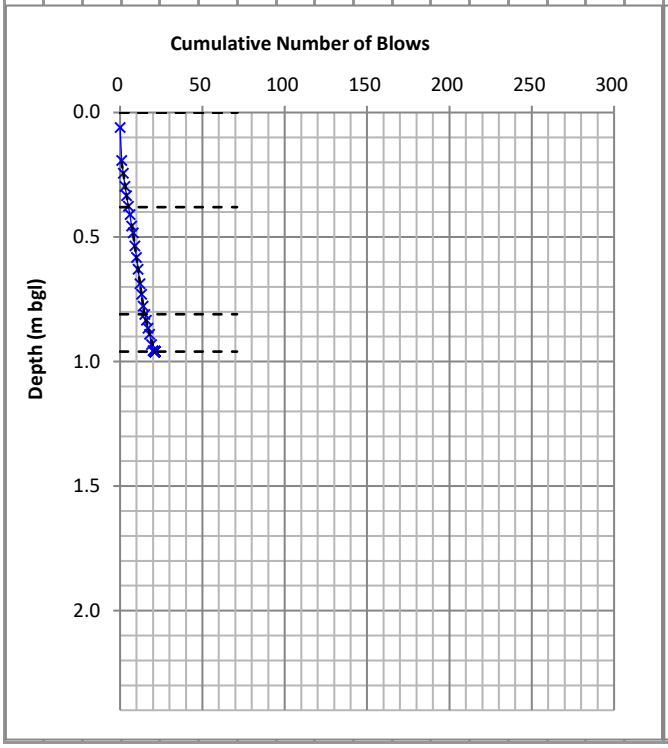
Tel : 0843 50 66687 **Fax : 0843 51 59930**

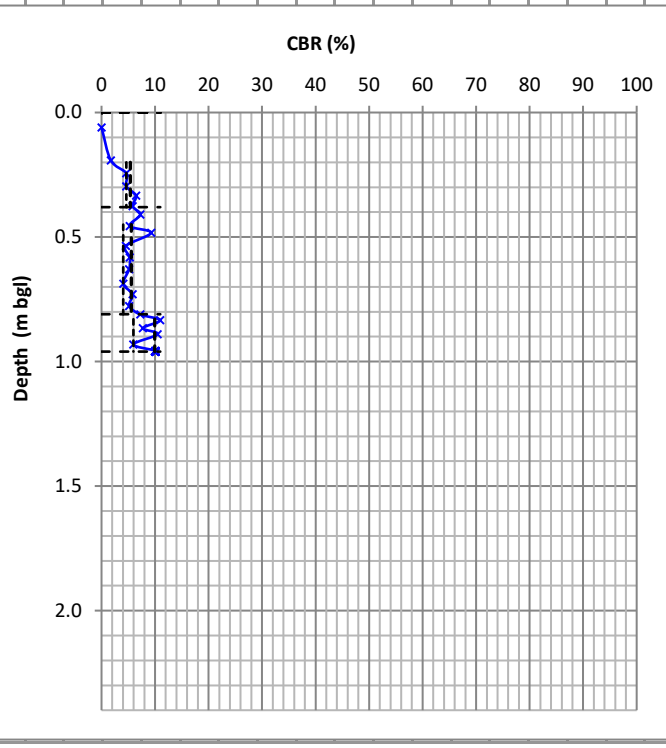
Job No:	Location:
C2960/22/E/4487	TRL DCP 7
Site: Highmoor Lane, Cleckheaton	Client: 13 Group
Test Date: 18/10/2022	Tested By: BM

IMPACT (TRL) Dynamic Cone Penetrometer

SL970, TRL Road Note 8, 60° cone.

Blow Count	Total Blows	Depth (mm)	CBR (%)	Blow Count	Total Blows	Depth (mm)	CBR (%)	Blow Count	Total Blows	Depth (mm)	CBR (%)
0	0	60	-	1	20	956	10				
1	1	192	2	1	21	960	10				
1	2	244	5								
1	3	296	5								
1	4	334	6								
1	5	376	6								
1	6	410	7								
1	7	456	5								
1	8	483	9								
1	9	536	5								
1	10	582	5								
1	11	629	5								
1	12	688	4								
1	13	730	6								
1	14	777	5								
1	15	811	7								
1	16	834	11								
1	17	866	8								
1	18	890	10								
1	19	931	6								





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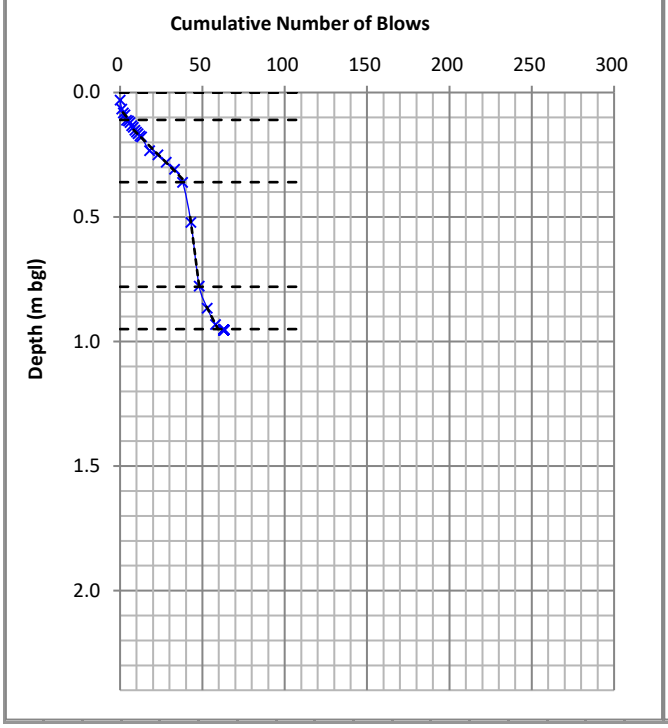
Tel : 0843 50 66687 **Fax : 0843 51 59930**

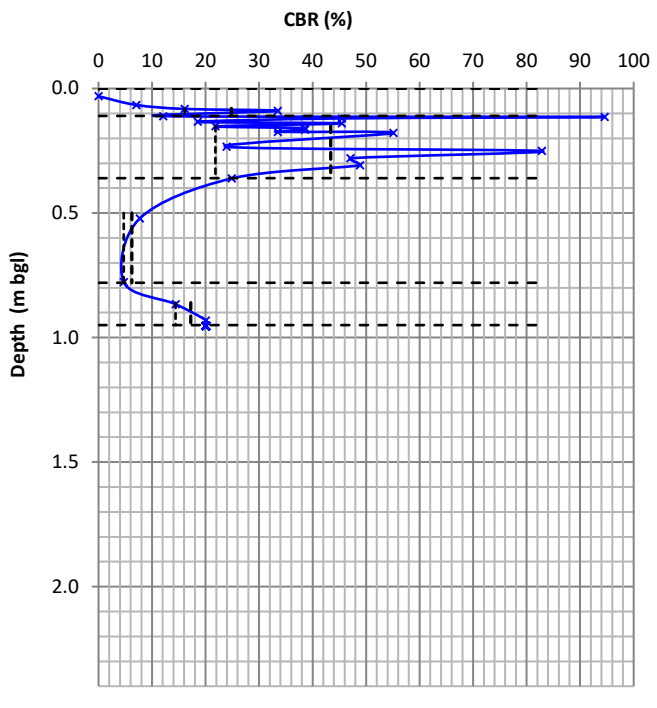
Job No:	Location:
C2960/22/E/4487	TRL DCP 8
Site: Highmoor Lane, Cleckheaton	Client: 13 Group
Test Date: 18/10/2022	Tested By: BM

IMPACT (TRL) Dynamic Cone Penetrometer

SL970, TRL Road Note 8, 60° cone.

Blow Count	Total Blows	Depth (mm)	CBR (%)
0	0	31	-
1	1	66	7
1	2	82	16
1	3	90	34
1	4	111	12
1	5	114	95
1	6	120	45
1	7	134	19
1	8	140	45
1	9	152	22
1	10	159	39
1	11	166	39
1	12	174	34
1	13	179	55
5	18	234	24
5	23	251	83
5	28	280	47
5	33	308	49
5	38	361	25
5	43	521	8
5	48	777	5
5	53	866	14
5	58	931	20
5	63	954	20





Appendix 7

Laboratory Testing

Environmental
Geotechnical
Specialists

LABORATORY REPORT

job number	C/2960/22/E/4487
date	08/11/2022
site address	Highmoor Lane Cleckheaton, West Yorkshire, BD19 6LW
date scheduled	24/10/2022
date issued	08/11/2022
issued by	H J Letch

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Rogers Geotechnical Services Ltd
Offices 1 & 2 Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU
01484 604354 Company No. 5130864

UKAS
United Kingdom Accreditation Service

8948

Schedule of UKAS Accredited Laboratory Tests

RGS

1. CLASSIFICATION OF SOIL	BS 1377-2:1990	BS EN 150 17892	Accredited (A)	Unaccredited (U)
1.1 Moisture / Water content determination				
i. Oven drying	Pt 2 : 3.2	Pt 1 : 2014 Pt 12 : 2018 : 5.3 / 5.5	A	
ii. Saturation m/c of chalk	Pt 2 : 3.3			U
1.2 Index Properties				
i. Liquid limit – cone penetrometer	Pt 2 : 4.3		A	
ii. Plastic limit	Pt 2 : 5.3		A	
iii. Shrinkage limit	Pt 2 : 6.3			U
iv. Linear shrinkage	Pt 2 : 6.5		A	
1.3 Particle Density				
i. Gas jar	Pt 2 : 8.2			U
ii. Large pyknometer	Pt 2 : 8.3			U
iii. Small pyknometer	Pt 2 : 8.4	Pt 3 : 2015 : 5.1		U
1.4 Density Tests				
i. Linear measurement	Pt 2 : 7.2	Pt 2 : 2014 : 5.1	A	
ii. Immersion in water	Pt 2 : 7.3	Pt 2 : 2014 : 5.2		U
iii. Fluid / Water displacement	Pt 2 : 7.4	Pt 2 : 2014 : 5.3		U
iv. Sand replacement	Pt 9 : 2.1, 2.2			U
v. Core cutter	Pt 9 : 2.4			U
1.5 Particle Size Distribution				
i. Dry Sieve	Pt 2 : 9.2	Pt 4 : 2016 : 5.2	A	
ii. Wet Sieve	Pt 2 : 9.3	Pt 4 : 2016 : 5.2	A	
iii. Sedimentation by pipette	Pt 2 : 9.4	Pt 4 : 2016 : 5.3 / 5.4	A	
iv. Sedimentation by hydrometer	Pt 2 : 9.5			U
2. CHEMICAL TESTS	**BS 1377-3:2018**			
ii. Mass loss on ignition	Pt 3 : 4			U
3. COMPACTION RELATED TESTS	**BS 1377-4:1990**			
3.1 Dry density/moisture relationship				
i. 2.5kg rammer – 1 litre mould	Pt 4 : 3			U
- CBR mould	Pt 4 : 3			U
ii. 4.5kg rammer – 1 litre mould	Pt 4 : 3			U
- CBR mould	Pt 4 : 3			U
3.2 Moisture Condition Value				
i. Single point test	Pt 4 : 5.4			U
ii. MCV/moisture content relationship	Pt 4 : 5.5			U
3.3 California Bearing Ratio				
i. Undisturbed sample	Pt 5 : 7			U
ii. Recompacted sample	Pt 5 : 7			U
iii. Soaked, inc measurement of swell	Pt 5 : 7			U
4. COMPRESSIBILITY OF SOIL	**BS 1377-5:1990**			
i. One dimensional consolidation	Pt 5 : 3			U
ii. Swelling pressure test	Pt 5 : 3			U
5. SHEAR STRENGTH OF SOIL	**BS 1377-7:1990**			
i. Hand shear vane	Makers instructions			U
ii. Shear box (100mm square sample)	BS 1377 : Pt 7 : 4			U
iii. Triaxial – quick undrained	BS 1377 : Pt 7 : 8, 9			U
6. PERMEABILITY				
i. Falling head	K. H. Head Vol 2			U
ii. Constant head	BS 1377 : Pt 6 : 6			U
iii Triaxial cell	BS 1377 : Pt 6 : 6			U
7. ROCK TESTS				
7.1 Classification Tests				
i. Natural moisture content	-			U
ii. Saturated moisture content	-			U
iii. Natural density	-			U
iv. Porosity	-			U
7.2 Strength Tests				
i. Point load index	ISRM '85			U
ii. Uniaxial compression test	ISRM '81			U

GEOTECHNICAL TESTING RESULTS

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RGS Environmental Geotechnical Specialists

Rogers Geotechnical Services Ltd
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Summary of Classification Test Results

Project No.: C2960/22/E/4487

Project Name: Highmoor Lane

Hole No.	Sample Ref	Top	Base	Type	Soil Description	Density bulk Mg/m3	Density dry Mg/m3	w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Cone 80g/30° 60g/60°	Water Increase Decrease	Date
WS03	2	0.60		D	Yellowish brown sillty CLAY.			28.0	100	66 -1pt	27	39		80g/30deg	increacing	24/10/2022
WS05	2	0.70		D	Light brown silty CLAY			17.0	100	44 -1pt	21	23		80g/30deg	increacing	24/10/2022
WS06	2	0.80		D	Light brown silty CLAY			21.0	100	46 -1pt	21	25		80g/30deg	increacing	24/10/2022
WS06	3	1.30		D	Soft orangeish brown mottled greyish brown slightly sandy silty CLAY.			18.0	100	39 -1pt	20	19		80g/30deg	increacing	24/10/2022
WS07	1	0.80		D	Light brown silty CLAY.			19.0	95	48 -1pt	23	25		80g/30deg	increacing	24/10/2022

All tests performed in accordance with BS EN ISO 17892 unless specified otherwise

Key

Density test: Linear measurement unless : wd - water displacement; wi - immersion in water

Liquid Limit: 4pt cone unless : cas - Casagrande method; 1pt - single point test

Particle density: sp - small pyknometer; gj - gas jar

Date Printed: 01/11/2022

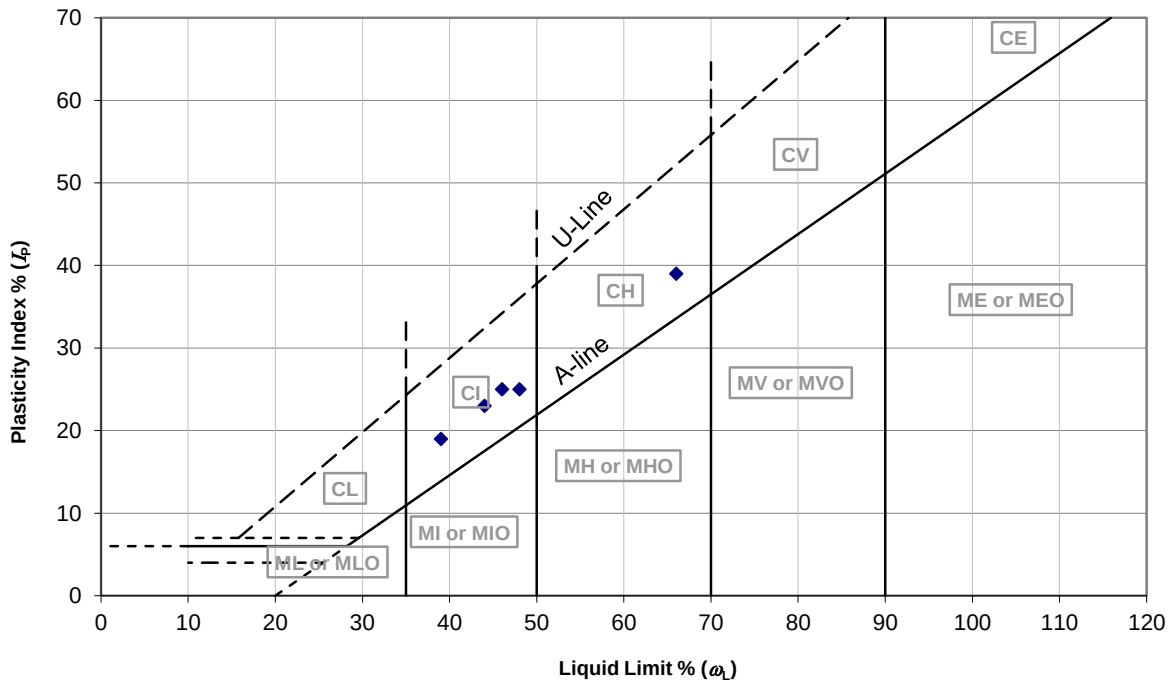
Approved By: Harry

Table 1

sheet 1

Rogers Geotechnical Services Ltd. Offices 1&2, Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU	**Classification of Index Properties**	**C2960/22/E/4487**
Project Name: Highmoor Lane	**BS EN ISO: 17892: Parts 1, 12**	Fig. 2 / Sheet. 1
Location:		Input By: Harry
Client: 13 Group		Check By: Harry

Location	Depth (m)	Water Content (w) (%)	Liquid Limit (wL) (%)	Plastic Limit (wP) (%)	Plasticity Index (IP) (%)	Retained by 0.425mm (%)	Modified (w) (w') (%)	Modified (IP) (IP') (%)	Liquidity/ Consistency (IL) (%)	Liquidity/ Consistency (IC) (%)	Casagrande Class	N.H.B.C Class (%)
WS03	0.60	28	66	27	39	0	28	39	0.0	1.0	C H	MEDIUM
WS05	0.70	17	44	21	23	0	17	23	-0.2	1.2	C I	MEDIUM
WS06	0.80	21.1	46	21	25	0	21	25	0.0	1.0	C I	MEDIUM
WS06	1.30	18	39	20	19	0	18	19	-0.1	1.1	C I	LOW
WS07	0.80	18.7	48	23	25	5	20	24	-0.2	1.2	C I	MEDIUM



ENVIRONMENTAL TESTING RESULTS

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Offices 1 & 2 Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU
01484 604354 Company No. 5130864

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Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	22-40976-1		
Initial Date of Issue:	02-Nov-2022		
Client	Rogers Geotechnical Services Ltd		
Client Address:	Offices 1&2, Barncliffe Business Park Near Bank Shelley Huddersfield West Yorkshire HD8 8LU		
Contact(s):	Harry Letch		
Project	C2960/22/E Highmoor Lane, Cleckheaton		
Quotation No.:	Q21-25205	**Date Received:**	26-Oct-2022
Order No.:	PO-2353	**Date Instructed:**	26-Oct-2022
No. of Samples:	6		
Turnaround (Wkdays):	5	**Results Due:**	01-Nov-2022
Date Approved:	02-Nov-2022		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - Soil

Project: C2960/22/E Highmoor Lane, Cleckheaton

Client: Rogers Geotechnical Services Ltd		**Chemtest Job No.:**			22-40976	22-40976	22-40976	22-40976	22-40976	22-40976
Quotation No.: Q21-25205		**Chemtest Sample ID.:**			1532459	1532460	1532461	1532462	1532463	1532464
				Sample Location:	WS1	WS2	WS3	WS5	WS6	WS8
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.50	0.65	0.40	0.60	0.60	0.40
				Bottom Depth (m):						0.80
				Date Sampled:	24-Oct-2022	24-Oct-2022	24-Oct-2022	24-Oct-2022	24-Oct-2022	24-Oct-2022
				Asbestos Lab:	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Cadmium	M	2455	mg/kg	0.10	0.18	0.14	< 0.10	< 0.10	< 0.10	< 0.10
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Copper	M	2455	mg/kg	0.50	16	8.1	9.3	21	9.4	15
Mercury	M	2455	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05
Nickel	M	2455	mg/kg	0.50	25	10	9.7	28	11	9.5
Lead	M	2455	mg/kg	0.50	15	13	12	20	12	30
Zinc	M	2455	mg/kg	0.50	120	53	38	74	27	36
Vanadium	U	2455	mg/kg	0.5	21	16	16	26	11	19
Arsenic	M	2455	mg/kg	0.5	5.8	5.8	2.9	3.9	2.4	14
Selenium	M	2455	mg/kg	0.25	0.71	0.55	0.45	0.72	0.34	0.63
Cyanide (Free)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Naphthalene	M	2700	mg/kg	0.10	0.63	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10	0.40	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.10	0.46	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	M	2700	mg/kg	0.10	0.45	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.10	0.51	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	M	2700	mg/kg	0.10	0.47	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	M	2700	mg/kg	0.10	0.51	< 0.10	< 0.10	< 0.10	< 0.10	0.73
Pyrene	M	2700	mg/kg	0.10	0.57	< 0.10	< 0.10	< 0.10	< 0.10	0.76
Benzo[a]anthracene	M	2700	mg/kg	0.10	0.66	< 0.10	< 0.10	< 0.10	< 0.10	0.79
Chrysene	M	2700	mg/kg	0.10	0.61	< 0.10	< 0.10	< 0.10	< 0.10	0.78
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	0.51	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	0.50	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10	0.47	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	0.56	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	0.47	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	0.50	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	M	2700	mg/kg	2.0	8.3	< 2.0	< 2.0	< 2.0	< 2.0	3.1
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: C2960/22/E Highmoor Lane, Cleckheaton

Client: Rogers Geotechnical Services Ltd		**Chemtest Job No.:**			22-40976	22-40976	22-40976	22-40976	22-40976	22-40976
Quotation No.: Q21-25205		**Chemtest Sample ID.:**			1532459	1532460	1532461	1532462	1532463	1532464
			Sample Location:		WS1	WS2	WS3	WS5	WS6	WS8
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.50	0.65	0.40	0.60	0.60	0.40
			Bottom Depth (m):							0.80
			Date Sampled:		24-Oct-2022	24-Oct-2022	24-Oct-2022	24-Oct-2022	24-Oct-2022	24-Oct-2022
			Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10	< 10	< 10	< 10
pH	M	2010		4.0	6.4	7.4	6.1	8.0	7.5	7.6
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.017	< 0.010
ACM Type	U	2192		N/A	-	-	-	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	6.7	7.5	22	14	19	14
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones and Roots	Roots and Stones	Stones	Stones	Stones	Stones
Soil Texture	N	2040		N/A	Sand	Sand	Clay	Clay	Clay	Sand
Sulphate (Total)	U	2430	%	0.010	0.074	0.053	0.053	0.032	0.030	0.032
Organic Matter	M	2625	%	0.40	1.2	2.4	0.99	0.91	1.1	19
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	22-40976-1		
Initial Date of Issue:	02-Nov-2022		
Client	Rogers Geotechnical Services Ltd		
Client Address:	Offices 1&2, Barncliffe Business Park Near Bank Shelley Huddersfield West Yorkshire HD8 8LU		
Contact(s):	Harry Letch		
Project	C2960/22/E Highmoor Lane, Cleckheaton		
Quotation No.:	Q21-25205	**Date Received:**	26-Oct-2022
Order No.:	PO-2353	**Date Instructed:**	26-Oct-2022
No. of Samples:	6		
Turnaround (Wkdays):	5	**Results Due:**	01-Nov-2022
Date Approved:	02-Nov-2022		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - Soil

Project: C2960/22/E Highmoor Lane, Cleckheaton

Client: Rogers Geotechnical Services Ltd		**Chemtest Job No.:**			22-40976	22-40976	22-40976	22-40976	22-40976	22-40976
Quotation No.: Q21-25205		**Chemtest Sample ID.:**			1532459	1532460	1532461	1532462	1532463	1532464
				Sample Location:	WS1	WS2	WS3	WS5	WS6	WS8
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.50	0.65	0.40	0.60	0.60	0.40
				Bottom Depth (m):						0.80
				Date Sampled:	24-Oct-2022	24-Oct-2022	24-Oct-2022	24-Oct-2022	24-Oct-2022	24-Oct-2022
				Asbestos Lab:	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Cadmium	M	2455	mg/kg	0.10	0.18	0.14	< 0.10	< 0.10	< 0.10	< 0.10
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Copper	M	2455	mg/kg	0.50	16	8.1	9.3	21	9.4	15
Mercury	M	2455	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05
Nickel	M	2455	mg/kg	0.50	25	10	9.7	28	11	9.5
Lead	M	2455	mg/kg	0.50	15	13	12	20	12	30
Zinc	M	2455	mg/kg	0.50	120	53	38	74	27	36
Vanadium	U	2455	mg/kg	0.5	21	16	16	26	11	19
Arsenic	M	2455	mg/kg	0.5	5.8	5.8	2.9	3.9	2.4	14
Selenium	M	2455	mg/kg	0.25	0.71	0.55	0.45	0.72	0.34	0.63
Cyanide (Free)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Naphthalene	M	2700	mg/kg	0.10	0.63	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10	0.40	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.10	0.46	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	M	2700	mg/kg	0.10	0.45	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.10	0.51	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	M	2700	mg/kg	0.10	0.47	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	M	2700	mg/kg	0.10	0.51	< 0.10	< 0.10	< 0.10	< 0.10	0.73
Pyrene	M	2700	mg/kg	0.10	0.57	< 0.10	< 0.10	< 0.10	< 0.10	0.76
Benzo[a]anthracene	M	2700	mg/kg	0.10	0.66	< 0.10	< 0.10	< 0.10	< 0.10	0.79
Chrysene	M	2700	mg/kg	0.10	0.61	< 0.10	< 0.10	< 0.10	< 0.10	0.78
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	0.51	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	0.50	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10	0.47	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	0.56	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	0.47	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	0.50	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	M	2700	mg/kg	2.0	8.3	< 2.0	< 2.0	< 2.0	< 2.0	3.1
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: C2960/22/E Highmoor Lane, Cleckheaton

Client: Rogers Geotechnical Services Ltd		**Chemtest Job No.:**			22-40976	22-40976	22-40976	22-40976	22-40976	22-40976
Quotation No.: Q21-25205		**Chemtest Sample ID.:**			1532459	1532460	1532461	1532462	1532463	1532464
			Sample Location:		WS1	WS2	WS3	WS5	WS6	WS8
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.50	0.65	0.40	0.60	0.60	0.40
			Bottom Depth (m):							0.80
			Date Sampled:		24-Oct-2022	24-Oct-2022	24-Oct-2022	24-Oct-2022	24-Oct-2022	24-Oct-2022
			Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10	< 10	< 10	< 10
pH	M	2010		4.0	6.4	7.4	6.1	8.0	7.5	7.6
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.017	< 0.010
ACM Type	U	2192		N/A	-	-	-	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	6.7	7.5	22	14	19	14
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones and Roots	Roots and Stones	Stones	Stones	Stones	Stones
Soil Texture	N	2040		N/A	Sand	Sand	Clay	Clay	Clay	Sand
Sulphate (Total)	U	2430	%	0.010	0.074	0.053	0.053	0.032	0.030	0.032
Organic Matter	M	2625	%	0.40	1.2	2.4	0.99	0.91	1.1	19
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Rogers Geotechnical Services: Soil Screening Values Comparison Sheet

Rogers Geotechnical Services Ltd: Soil Screening Value (SSV) Comparison Sheet

Job Number	C2960/22/E/4487
Job Name	High Moor Lane, Cleckheaton
Date	November 2022
Client	Thirteen Housing Group Ltd

A = WS Atkins PLC, Atrisk Soil Screening Values.
A+ = Values updated June 2017.
A* = Atrisk's SSV is lower than Chemtest's detectable limit for this compound.
B = health criterion values, which are available from toxicological reviews published in the C4SL project methodology report.
C = Category 4 Screening Levels (C4SLs) based on 6% soil organic matter.
D = Value provided is based on Methyl Mercury. Should elemental mercury be observed or a source be known then a limit of 102 should be used.

KEY
- Exceeds SSV
- Exceeds 2017, Below 2015
- Below limit of detection (LOD)

Determinand	Units	Ref	LOD	Residential With Plant Uptake 1%		Sample Location	WS1	WS2	WS3	WS5	WS6	WS8				
				Atrisk 2015 (No Free Product	Atrisk 2017	Depth Top	0.50	0.65	0.40	0.60	0.60	0.40				
						Depth Base						0.80				
Cadmium	mg/kg	C	0.10		22.1		0.18	0.14	< 0.10	< 0.10	< 0.10	< 0.10				
Chromium (Hexavalent)	mg/kg	B/C	0.5	20.5	3.62		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50				
Copper	mg/kg	A+	0.50		4730		16	8.1	9.3	21	9.4	15				
Mercury	mg/kg	A/D	0.10		8.81		< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05				
Nickel	mg/kg	A+	0.50		136		25	10	9.7	28	11	9.5				
Lead	mg/kg	C	0.50		200		15	13	12	20	12	30				
Zinc	mg/kg	A+	0.50		20000		120	53	38	74	27	36				
Vanadium	mg/kg	A+	5.0		136		21	16	16	26	11	19				
Arsenic	mg/kg	C	1.0		37		5.8	5.8	2.9	3.9	2.4	14				
Selenium	mg/kg	A	0.20		375		0.71	0.55	0.45	0.72	0.34	0.63				
Cyanide (Free)	mg/kg	A	0.50		34		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50				
Total Phenols	mg/kg	A	0.1		267		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10				
Naphthalene	mg/kg	A+	0.10	0	0.829		0.63	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10				
Acenaphthylene	mg/kg		0.10				0.40	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10				
Acenaphthene	mg/kg	A+	0.10	608	157		0.46	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10				
Fluorene	mg/kg	A+	0.10	0	735		0.45	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10				
Phenanthrene	mg/kg		0.10				0.51	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10				
Anthracene	mg/kg	A+	0.10	0	10200		0.47	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10				
Fluoranthene	mg/kg	A+	0.10		983		0.51	< 0.10	< 0.10	< 0.10	< 0.10	0.73				
Pyrene	mg/kg	A+	0.10		668		0.57	< 0.10	< 0.10	< 0.10	< 0.10	0.76				
Benzo[a]anthracene	mg/kg	A	0.10	4.52	1.71		0.66	< 0.10	< 0.10	< 0.10	< 0.10	0.79				
Chrysene	mg/kg	A	0.10	585	0.44		0.61	< 0.10	< 0.10	< 0.10	< 0.10	0.78				
Benzo[b]fluoranthene	mg/kg	A	0.10	7.72	1.22		0.51	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10				
Benzo[k]fluoranthene	mg/kg	A	0.10	84.4	0.686		0.50	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10				
Benzo[a]pyrene	mg/kg	B/C	0.10	4.95	1.51		0.47	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10				
Indeno(1,2,3-c,d)Pyrene	mg/kg	A*	0.10	7.31	0.0614		0.56	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10				
Dibenz(a,h)Anthracene	mg/kg	A	0.10	0.838	0.00393		0.47	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10				
Benzo[g,h,i]perylene	mg/kg	A	0.10	96.2	0.0187		0.50	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10				
Total Of 16 PAH's	mg/kg		2.0				8.3	< 2.0	< 2.0	< 2.0	< 2.0	3.1				
Aliphatic TPH >C5-C6	mg/kg	A+	1.0	0	42.7		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0				
Aliphatic TPH >C6-C8	mg/kg	A+	1.0	0	99.3		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0				
Aliphatic TPH >C8-C10	mg/kg	A+	1.0	0	13.9		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0				
Aliphatic TPH >C10-C12	mg/kg	A+	1.0	81.7	49.9		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0				
Aliphatic TPH >C12-C16	mg/kg	A+	1.0	385	20.9		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0				
Aliphatic TPH >C16-C21	mg/kg	A+	1.0		210000		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0				
Aliphatic TPH >C21-C35	mg/kg	A+	1.0		210000		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0				
Aliphatic TPH >C35-C44	mg/kg		1.0				< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0				
Total Aliphatic Hydrocarbons	mg/kg		5.0				< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0				
Aromatic TPH >C5-C7	mg/kg	A+	1.0		0.137		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0				
Aromatic TPH >C7-C8	mg/kg	A+	1.0	0	113		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0				

Rogers Geotechnical Services: Soil Screening Values Comparison Sheet

Rogers Geotechnical Services Ltd: Soil Screening Value (SSV) Comparison Sheet																
Job Number	C2960/22/E/4487			A = WS Atkins PLC, Atrisk Soil Screening Values. A+ = Values updated June 2017. A* = Atrisk's SSV is lower than Chemtest's detectable limit for this compound. B = health criterion values, which are available from toxicological reviews published in the C4SL project methodology report. C = Category 4 Screening Levels (C4SLs) based on 6% soil organic matter. D = Value provided is based on Methyl Mercury. Should elemental mercury be observed or a source be known then a limit of 102 should be used.											KEY Exceeds SSV Exceeds 2017, Below 2015 Below limit of detection (LOD)
Job Name	High Moor Lane, Cleckheaton															
Date	November 2022			Sample Location		WS1	WS2	WS3	WS5	WS6	WS8					
Client	Thirteen Housing Group Ltd			Depth Top		0.50	0.65	0.40	0.60	0.60	0.40					
				Depth Base							0.80					
Determinand	**Units**	**Ref**	**LOD**	**Residential With Plant Uptake 1%**												
Aromatic TPH >C8-C10	mg/kg	A+	1.0	0	20.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0					
Aromatic TPH >C10-C12	mg/kg	A+	1.0	0	70	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0					
Aromatic TPH >C12-C16	mg/kg	A+	1.0	165	155	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0					
Aromatic TPH >C16-C21	mg/kg	A+	1.0		319	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0					
Aromatic TPH >C21-C35	mg/kg	A+	1.0		1120	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0					
Aromatic TPH >C35-C44	mg/kg		1.0			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0					
Total Aromatic Hydrocarbons	mg/kg		5.0			< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0					
Total Petroleum Hydrocarbons	mg/kg		10.0			< 10	< 10	< 10	< 10	< 10	< 10					
pH			N/A			6.4	7.4	**6.1**	**8.0**	7.5	7.6					
Sulphate (2:1 Water Soluble) as SO4	g/l		0.010			< 0.010	< 0.010	< 0.010	< 0.010	**0.017**	< 0.010					
ACM Type			N/A			-	-	-	-	-	-					
Asbestos Identification	%		0.001			No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected					
ACM Detection Stage			N/A			6.7	7.5	22	14	19	14					
Moisture	%		0.020			Brown	Brown	Brown	Brown	Brown	Brown					
Soil Colour			N/A			Stones and	Roots and	Stones	Stones	Stones	Stones					
Other Material			N/A			Sand	Sand	Clay	Clay	Clay	Sand					
Soil Texture			N/A			0.074	0.053	0.053	0.032	0.030	0.032					
Sulphate (Total)	%		0.010			1.2	2.4	0.99	0.91	1.1	19					
Organic Matter	%		0.40			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0					

End of Report

RGS Environmental Geotechnical Specialists
Rogers Geotechnical Services Ltd
Offices 1 & 2 Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU
01484 604354 Company No. 5130864

Appendix 8

Fill Screening Values

Rogers Geotechnical Services Ltd.

Atkins ATRISK Soil Screening Values (SSVs) - Residential With Plant Uptake Landuse

Tox Data Report No.	Compound	Residential with Homegrown Produce Landuse (mg/kg)				Reference
	Metals	**SOM: 1%**		**SOM: 6%**		
3	Cadmium	22.1		22.1		C
4	Chromium VI	3.62	20.5	3.62	20.5	B/C
	Copper	4730		4790		A+
7	Mercury	8.81		15.80		A/D
8	Nickel	136		136		A+
	Lead	200		200		C
	Zinc	20000		20300		A+
	Vanadium	136		138		A+
	Semi and Non Metals					
1	Arsenic	37		37		C
10	Selenium	375		375		A
	Free Cyanide	34		34		A
9	Phenols (total)	267		1200		A
	Poly Aromatic Hydrocarbons	Free product	No free product	Free product	No free product	
20	Napthalene	0.829		12.2		A+
	Acenaphthene	157	608	2760		A+
	Fluorene	735		2610		A+
	Anthracene	10200		26200		A+
	Fluoranthene	983		2980		A+
	Pyrene	668		2120		A+
	Benzo(a)anthracene	1.71	4.52	8.54		A
2	Chrysene	0.44	585	2.64	927	A
2	Benzo(b)fluoranthene	1.22	7.72	7.29	9.86	A
2	Benzo(k)fluoranthene	0.686	84.4	4.12	100	A
2	Benzo(a)pyrene	1.51	4.95	0.998	5	B/C
2	Dibenzo(a,h)anthracene	0.00393	0.838	2.05	4.95	A*
2	Indeno(1,2,3-cd)pyrene	0.0614	7.31	0.368	9.75	A
2	Benzo(g,h,i)perylene	0.0187	96.2	0.112	103	A
	Petroleum Hydrocarbons					
	Aliphatic C5-C6	42.7		369		A+
	Aliphatic C6-C8	99.3		768	1240	A+
	Aliphatic C8-C10	13.9		204		A+
	Aliphatic C10-C12	49.9	81.7	297	1180	A+
	Aliphatic C12-C16	20.9	385	125	4130	A+
	Aliphatic C16-C21	210000		210100		A+
	Aliphatic C21-C35	210000		210100		A+
	Aromatic C5-C7 (Benzene)	0.137		0.871		A+
	Aromatic C7-C8 (Toluene)	113		780		A+
	Aromatic C8-C10	20.5		232		A+
	Aromatic C10-C12	70		468		A+
	Aromatic C12-C16	155	165	830		A+
	Aromatic C16-C21	319		1040		A+
	Aromatic C21-C35	1120		1710		A+

A+ = Values update June 2017.

A* Atrisk's SSV is lower than Chemtest's detectable limit for this compound.

B = Health Criterion Values (available from toxicological reviews published in the C4SL project methodology report).

C = Catergory 4 Screening Levels (C4SLs).

D = SSV provided is for Methyl Mercury.