Environmental
Geotechnical
Specialists

RGS

<ENVIRONMENTAL><GEOTECHNICAL>

PHASE 2

GEO-ENVIRONMENTAL REPORT

job number	C4272/24/E/6581
date	28/03/25
site address	Spa Fields Industrial Estata, Slaithwaite, Huddersfield
written by	I. Sakoor
checked by	R. A. Palmer
issued by	I. Sakoor

Please consider the environment before printing this report.

Constructionline
A UK GOVERNMENT CERTIFICATION SERVICE

QMS ISO 9001 : 2015 REGISTERED Cert No. 14123657

QMS ISO 14001 : 2015 REGISTERED Cert No. 14127804

QMS ISO 45001 : 2018 REGISTERED Cert No. 14130281

CITATION APPROVED HEALTH & SAFETY SYSTEM Registered Member

UKAS United Kingdom Accreditation Service

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

Contents

Appendices	
1.	Site Plan
2.	Borehole Records
3.	Dynamic Probing Records
4.	Gas Monitoring Sheets
5.	Laboratory Testing
6.	Fill Screening Values

Report on a Phase 2 Geo-environmental Investigation

Location:	Spa Fields Industrial Estate Slaithwaite, Huddersfield
For:	DM Textile Machinery Ltd.
Consultants:	Farrar Bamforth Associates Ltd.
Report No.	C4272/24/E/6581 Report date: March 2025

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

Imran Sakoor BEng FGS Geo-environmental Engineer	**Rob Palmer** MSc FGS ACIEH Engineering Director

Report Summary[1]

Item	Comments	Section
Development	Construction of a new commercial unit. Additionally, a retaining wall is to be constructed to the rear of the site.	1.
Geology	Artificial geology: Made ground. Superficial geology: Alluvium. Solid geology: Marsden Formation and Readycon Dean Flags.	5.
Strata Conditions	Significant thickness of granular and cohesive made ground to the base of WS01 to WS03. Underlain by 0.35m band of very gravelly clay, followed by very gravelly sand to 4m depth in WS04.	6.
Groundwater	Ground water strike encountered at 4.0m in WS04.	6.2
Foundation Design	It may be possible to construct shallow pad footings on compacted engineered fill. Alternatively, a piled solution could be adopted. Retaining wall could be constructed via gabion baskets or as a king-post embedded wall.	10.
Effect of Sulphates	DC-1 concrete.	10.
Contamination	No significant contamination revealed.	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 adjacent to Vanguard Processing Equipment Ltd is to be developed by the construction of a new commercial unit. As part of the works, it is understood that a new retaining wall will be constructed along the rear of the site. 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 Top Study has been undertaken by Arc Environmental Ltd and the results were presented as report number 21-789 in June 2022. This report has been used extensively during the current intrusive investigation.

4. Fieldworks

The fieldworks were undertaken on the 12th February 2025 and included the following:

- Four windowless sample boreholes.
- Standard penetration tests within two boreholes.
- Four dynamic probes.
- Installation of three gas monitoring standpipes.

The investigatory locations are shown on the site plan which is presented in Appendix 1 to this report.

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, 67mm and 57mm 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.

4.2 Standard Penetration Tests

Standard penetration tests (SPT) were undertaken at regular depth increments within windowless sample borehole BH01 and BH04. 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 Gas Monitoring Standpipes

Gas monitoring standpipes were installed to 4.0m depth within BH01, BH02 and BH03. The boreholes and 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 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]
Artificial Geology	Made Ground	-	Made ground is an area where the pre-existing (natural or artificial) land surface is raised by artificial deposits. The purpose of the made ground is unspecified.
Superficial Geology	Alluvium	-	Soft to firm normally consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. A stronger, desiccated surface zone may be present.
Solid Geology	Marsden Formation	Middle Grit	Fine to very coarse grained and pebbly feldspathic sandstone, interbedded with siltstone and mudstone, and subordinate marine black, thin coals and seatearths.
	Readycon Dean Flags	Readycon Dean Grit	Named sandstone unit of the Millstone Grit Group.

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	TOPSOIL.	BH03	None
0.2 – 0.4	MADE GROUND (Very gravelly SAND).	BH01, BH02, BH03	None
1.4 – 2.85	MADE GROUND (Slightly clayey very gravelly SAND with cobbles).	BH01, BH03, BH04	None
+1.5 – +4.0	MADE GROUND (Sandy, locally slightly sandy very gravelly to gravelly CLAY).	BH01, BH02, BH03	None
2.95	Sandy very gravelly CLAY.	BH04	None
+4.45	Clayey very gravelly SAND.	BH04	4.0m (BH04)

'+' 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.

[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*]

6.1 General Strata

In general, made ground described variably as very gravelly sand and slightly sandy very gravelly clay was revealed to the base of BH01 to BH03, and to 2.6m depth in BH04. The gravel was noted to comprise mudstone, siltstone, sandstone and occasional brick fragments.

Below the fill in BH04, slightly sandy very gravelly clay was revealed to 2.95m depth. Beneath this stratum, clayey very gravelly fine to medium sand was encountered to 4.0m below ground level. With respect to the local geology, it is considered that this material is representative of the superficial deposits of alluvium.

6.2 Groundwater

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. Notwithstanding this, a groundwater strike was encountered at 4m depth within BH04.

7. Insitu Testing

7.1 Standard Penetration Tests

The standard penetration tests carried out in BH01 and BH04 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	
MADE GROUND	1.0m 2.0m 3.0m 4.0m	6 & 20 41 *+50	 4 1 	Results within made ground noted to be variable. Loose to medium dense in granular fill and very cohesive within cohesive made ground.
ALLUVIUM	3.0m 4.0m	0 +50	–	SPT's indicate granular material is in a very loose in-situ condition. Unclear if result of N = 50 represent bedrock or cobble/boulder.

*No recovery for SPT test at 4.0m in BH01 – strata unknown.

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)				
DP1	2.2 6.0	1.7 3.0 6.1	0.7 7.3	Abrupt	Strong surface crust to 0.7m, followed by gradual reduction in results to 2.2m depth. Stronger zone then present to 3.0n, followed by very poor soils to 6.0m. Results thereafter consistently above 10 blows/100mm.
DP2	1.0	0.8 1.2	0.7 2.0	Abrupt	Strong surface crust to 0.8m, followed by poor results to 1.2m depth. Very high results thereafter.
DP3	1.0 2.8	0.3 2.0 5.7	6.3	Abrupt	Initial crust, followed by weaker zone to 1m depth. Then results of 3-4 blows/100mm recorded to 2m depth, whereupon a weaker zone to 2.8m was observed. The probe results were then noted to steadily increase with depth.
DP4	3.5	0.1 0.5 4.0	0.3 4.2	Abrupt	Relatively strong surface crust, followed by weak soils to 3.5m depth. Results then rapidly increased with depth.

7.3 Gas and Water Level Monitoring

The standpipes were monitored between the 12th and 19th March 2025. The results of the gas monitoring undertaken to date are tabulated below and full results are presented in Appendix 4.

Table 5: Gas Monitoring

Location	Date	CH_4 (%)	CO_2 (%)	O_2 (%)	Flow (l/h)	Barometric Pressure (mb)	Water Level (m)	Standpipe Depth (m)
BH01	12/03/2025	0.1	0.2	21.3	0.0	987↔	*	
	19/03/2025	0.1	0.3	21.3	0.0	1005↔	2.94	
	26/03/2025	0.1	0.4	20.5	0.0	1005↑	2.95	
BH02	12/03/2025	-	-	-	-	-	-	
	19/03/2025	-	-	-	-	-	-	
	26/03/2025	0.1	0.5	18.9	0.0	1005↑	*	
BH03	12/03/2025	0.0	0.1	21.2	0.0	987↔	*	
	19/03/2025	0.0	0.1	21.3	0.0	1005↔	DRY	
	26/03/2025	0.0	0.1	21.0	0.0	1005↑	DRY	

↑ - rising pressure ↓ - falling pressure ↔ - steady pressure. *Bung found to be stuck, thus unable to dip water level.

This work was undertaken using a Geotechnical Instruments (UK) Ltd. GA5000 (serial No G503524) which was last calibrated on the 25th October 2024.

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

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 5 and are summarised below:

Table 6: Summary of Geotechnical Test Results

Test type	Number of tests	Range of results		Comments
Water content determinations	3	22% to 32%		Generally, around the plastic limit.
Index properties (1 Point)	3	LL PL PI	37% to 51% 23% to 29% 14% to 23%	Clay of intermediate to high plasticity. Consistency index: 0.9 to 1.1. NHBC Class: Low.
Soluble sulphate & pH	3	SO_4 pH	22.2 to 28.7 mg/l 7.8 to 8.3	

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 23% could be employed, which suggests an f_1 value of 4.8 and an f_2 value of 0.48.

8.1 Geotechnical Properties

The idealised geotechnical properties employed in design are summarised below.

Table 7: Summary of Geotechnical Properties

Property	Range of values	Comments
Volume change potential (NHBC)	Low	MADE GROUND (Silty gravelly CLAY).
Concrete classification	DC-1	Brownfield locations (mobile water).

[5] See paragraph 6.2 'Index Property Tests'

Assumed Effective Stress Parameters			
Strata Description	**Bulk unit weight (kN/m^3)**	**Angle of friction[6] ϕ' (°)**	**Effective cohesion c'(kN/m^2)**
Retaining wall (assumed)	25	26	0
Granular backfill	20	30	0
MADE GROUND (Granular)	16	24	0
MADE GROUND (Cohesive)	17	24	0
Sandy gravelly CLAY	18	26	0
Clayey very gravelly SAND	16	24	0

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.

This testing was undertaken by i2 Analytical Ltd and the results of all of the chemical testing are presented in Appendix 5 of this report.

10. Discussion of Ground Conditions - Geotechnical

It is understood that the site is to be developed by the construction of a new commercial unit along with a new retaining wall adjacent to the canal. It is understood that settlements are not considered to be critical for the new building i.e. 50mm will be tolerable.

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. In general terms, it cannot be recommended that foundations be constructed directly within the made ground or weak near surface soils associated with the superficial deposits without ground improvement. At present, 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.

[6] Sources: Carter, M. and Bentley, S.P. (1991). Correlations of soil properties. London: Pentech Press.

10.1 Shallow Foundations

In order to limit settlements within the made ground, it may be possible to undertake partial depth ground improvement beneath the locations of shallow foundations. For instance, at foundation positions, the made ground could be excavated down and removed to a depth of say 2m below ground level, and then replaced with a compacted engineered fill, placed and compacted in layers of no more than 300mm. Pad foundations could then be constructed at a depth of say 0.5m depth. It should be appreciated that the compacted stone columns should be of sufficient size in order that the bulb of pressure arising from the footing remains within the column. It is strongly recommended that plate bearing tests are subsequently undertaken to confirm that potential settlements are tolerable.

10.2 Piled Foundations

As an alternative to the construction of foundations on engineered fill, piles could be adopted in order to transfer loads to competent strata at depth. There are a number of piling options that could be considered for use at this site, which include:

- Driven piles.
- Continuous flight auger bored piles.

In order to formulate a suitable design, it is recommended that the advice of specialist piling contractors be sought. However, for preliminary design and estimating purposes the following discussion is presented.

It is considered that driven pre-cast concrete piles could be adopted at this site, although, it would be prudent to utilise a driving shoe or a lead steel section to minimise the risk of pile breakages whilst penetrating through the made ground. In order to reduce the risk of pile breakage, steel tubular driven piles may be employed, which could include thin walled bottom drive piles or thick-walled top drive piles. It should be appreciated that thin walled piles will need to be concrete filled and possibly reinforced as the steel casing alone would not be sufficient to carry vertical or horizontal imposed loads. However, this is not necessarily the case with thick walled tubular piles. For both pile types care is required to ensure that the connection between the pile and pile cap is adequate.

Consideration may also be given to the use of bored cast-in-place piles using continuous flight augers (CFA). In this type of piling an auger borehole is formed and concrete placed via the hollow stem of the auger as they are withdrawn. A reinforcement cage is then placed into the fluid concrete filled hole to complete the pile. Moreover, should such piles encounter an obstruction or the underlying bedrock, a condition known as ‘flighting’ may occur. Flighting is where loose soils immediately adjacent to the pile borehole are pulled laterally into the drill string when the augers rotate quickly with little downward penetration.

Irrespective of the method of pile installation a working platform must be provided, the thickness of which will be determined by the type of piling rig employed and the strength of the near surface soils. The design of the platform should be undertaken in accordance with the procedures and specification given in the BRE publication entitled *Working platforms for tracked plant.*

It should also be appreciated that the chosen piling contractor may require further investigation to be undertaken in order to finalise their design. The depth of such investigations may be required to extend below estimated pile toe levels by 3 times the base width of the largest individual pile, the

largest pile group width or 5m, whichever the greater. However, this could be reduced to 2m below the estimated pile toe level if distinct competent strata are revealed.

10.3 Retaining Walls

It is considered that gabion basket retaining walls could be adopted along the canal present to the rear of the site. This form of retaining wall forms highly permeable flexible structures, so nominal foundations and settlements can often be tolerated without apparent distress. It should be appreciated that specialist sub-contractors should be sought and checks should be made to ensure settlements remain within tolerable limits.

Should it be deemed that excessive settlements are likely are gabion basket retaining walls, then embedded walls will be required. In this case, it is anticipated that a king-post wall will provide an economic solution. The advice of a specialist piling contractor should be sought; however, a typical rule of thumb is that the retain height will represent approximately a third of the total pile length i.e. for 4m to 5m retained, a total pile length of 12m to 15m should be anticipated.

10.4 General Comments for Excavations

The stability of 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.

Should the excavations be required to stand open, it is considered that a blinding layer of lean-mixed concrete be placed over the sub-grade. This expedient will reduce loosening or softening of the underling soil due to both physical disturbance and the ingress of surface water.

Should seepage of groundwater be encountered it is considered that it 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.

10.5 Ground-floors

In light of the made ground and weak near surface soils, it is not recommended that ground bearing ground floor slabs be employed unless ground improvement is undertaken. Without prior treatment, it would be necessary to suspend floors between foundation positions, such that the floor loads are transmitted via the foundations to competent soils at depth. A sufficient stone layer would need to be installed for a ground bearing slab to be viable.

10.6 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[7], 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 with Class DS-1 requirements. Assuming mobile groundwater, the table also indicates that the aggressive chemical environment for concrete (ACEC) classification is AC-1.

In order to evaluate the design chemical (DC) class for the buried concrete at this site reference should be made to Table D1[8], 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 new commercial unit. Consequently, the site may be classified as a commercial development.

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 range between 1.9% and 3.0%. 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[9] 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 5. These results indicate the following:

Table 8: Summary of Contaminated Areas

Location	Depth (m)	Contaminants found to be exceeding SSVs (Commercial)
BH01	0.6	PAHs [Benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, benzo(g,h,i)perylene].
BH02	0.6	PAHs [Chrysene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene].
BH04	0.6	PAHs [Benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, benzo(g,h,i)perylene].

[7] Table C2, *Aggressive Chemical Environment for Concrete (ACEC) classification for brownfield locations*
[8] 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.*
[9] http://www.atrisksoil.co.uk/pages/general/subscribers.asp

Concentrations of chromium(VI), mercury, free cyanide, phenols (total) and total petroleum hydrocarbons (aliphatic C5 to C10; aromatic C5 to C7 and C8 to C10) 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.

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[10]. 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 9: Summary of Areas Contaminated by PAHs & TPHs

Location	Depth (m)	Contaminants found to be exceeding SSVs (Commercial)
BH01	0.6	None
BH02	0.6	None
BH04	0.6	None

On the basis of the above information, the results of the investigation have concluded that the site is not significantly contaminated with respect to a commercial end use.

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 0.1% and 0.5%, in association with oxygen levels of between 18.9% and 21.3%. 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 0.1 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 987mb and 1005mb.

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 0.3% (0.003) carbon dioxide, in association with a flow rate of 0.1 l/hr. This results in a GSV of 0.0001 l/hr for methane and a GSV of 0.0005 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

[10] Ref: ATRISK soil, SSVs derived using CLEA v1.071 for 1% SOM, Commercial 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.

It should be appreciated that the above assessment is based upon the three gas monitoring visits undertaken to date, and will be revised when the full monitoring regime is completed.

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[11] advice on the assessment of risks arising from the presence of contamination in soils and using the source-pathway-receptor approach.[12] 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.'[13]

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 10. Sources of contamination include the following:

On-site – Made Ground.

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

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 10.

[11] 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'.
[12] 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.
[13] See 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990', appendix A.

Table 10: 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 found to be present, all determinands were found to be below the relevant SSVs.	Low	
	End User	Yes – whilst some contamination has been found to be present, all determinands were found to be below the relevant SSVs.	Low	
	Neighbours	Yes – whilst some contamination has been found to be present, all determinands were found to be below the relevant SSVs.	Low	
Inhalation of Dust/Vapours	Operative	Yes – whilst some contamination has been to be found present, all determinands were found to be below the relevant SSVs.	Low	
	End User	Yes – whilst some contamination has been to be found present, all determinands were found to be below the relevant SSVs.	Low	
	Neighbours	Yes – some contamination has been revealed and other commercial properties located within 250m radius of the site. However, all determinands were found to be below the relevant SSVs.	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	No – whilst some contamination has been revealed, all determinands were found to be below the relevant SSVs. Moreover, development is commercial in nature and gardens areas are not anticipated.	N/A	
	Neighbours	Yes – some contamination has been revealed and other commercial properties present within 250m. However, all determinands were found to be below the relevant SSVs.	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 (assuming *Characteristic Situation Level 1*).	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	Yes – known controlled waters within 250m. However, no significant contamination has been revealed.	Low	Some contamination is present underlying the site. Remediation will be required to either remove the contamination or break pathways. Old services to be removed or capped.
Migration via permeable unsaturated strata	Controlled Waters	Yes – a Secondary A aquifer is present within the superficial and solid geology. However, no significant contamination has been revealed.	Low	
Run off via drainage/sewers etc	Controlled Waters	Yes – existing services may be present on site.	Moderate	
Direct contact with contaminated soils	Plants	No – whilst some contamination has been revealed, garden/landscaped areas are not planned.	Low	
Uptake via root system			Low	
Direct contact with contaminated soils	Building Materials	Yes – TPH and minor PAH contamination revealed at the site may represent a risk to building materials or plastic water pipes. Moreover, testing indicates that the aggressive chemical environment for concrete classification is AC-1s.	Moderate (plastic services)	Please see section 11.3 for information on good building practice.
Direct contact with contaminated groundwater			Low (buried concrete)	
Exposure to Radon	Operative	Yes – site is within a radon affected area.	High	Between 3% and 5% of properties are above the action level. Basic radon protection measures required.
	End User			
UXO Risk	Operative	Yes – the site is located within a low risk area for unexploded ordnance.	Low	No further action required.
	End User		Low	

11.3 Indicative Remediation Strategy

In view of the site specific risk assessment it is considered that it will not be necessary to undertake any specific remediation at this site. It should be appreciated, however, that careful inspection of the subgrade should be made during the groundworks. Should areas of contamination be detected then further testing may become necessary.

General Approach to Construction

In order to fulfil the objectives defined above it is likely that the following remedial strategy could be utilised. It is recommended that a pragmatic approach be undertaken, with observational techniques being employed at each stage of the work.

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 levels 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 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 at all times.
- Where vehicles are transferring soil to landfill site they should be covered to prevent any potential contamination of the surrounding area by dust.
- Any stockpiles of soil should be sheeted over to prevent excessive amounts of airborne 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 any potential 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.

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[14] 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 11: 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).

[14] *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 12: Fill Screening Values

Contaminant	Screening Value (Commercial) (mg/kg)		Reference
	1% SOM	6% SOM	
As	635	635	Atrisk^{SOIL} SSVs
Cd	410	410	Atrisk^{SOIL} SSVs
Cr(VI)	19.7	19.7	Atrisk^{SOIL} SSVs
Cu	106000	106000	Atrisk^{SOIL} SSVs
Hg	350	405	Atrisk^{SOIL} SSVs
Ni	1770	1770	Atrisk^{SOIL} SSVs
Pb	2310	2310	Atrisk^{SOIL} SSVs
V	7490	7490	Atrisk^{SOIL} SSVs
Zn	1100000	1100000	Atrisk^{SOIL} SSVs

Please see summary sheet within Appendix 6 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.

If any materials are imported on to site, then RGS should be contacted for appropriate testing and subsequent certificates submitted to the local authority for review.

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 piling contractors regarding their method for installing piles.
- 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) (2025), 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.
- British Standard Institution (2005 +A1: 2011) BS EN ISO 22476-3: *Geotechnical investigation and testing – Field testing, Part 3: Standard penetration test,* B.S.I., London.
- British Standards Institution (2015 +A1: 2020) BS 5930: *Code of practice for ground investigations,* B.S.I., London.
- British Standards Institution (2011), BS 10175: *Investigation of potentially contaminated sites – Code of Practice,* British Standards Institute.
- British Standards Institution (2015 +A1:2019) BS8485: *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings,* B.S.I., London.
- British Standards Institution (2013), BS 8576 Guidance on Investigations for Ground Gas – Permanent Gases and Volatile Organic Compounds.
- British Standards Institution (2017) BS EN ISO 14688: *Geotechnical investigation and testing – Identification and classification of soil*, B.S.I., London.
- 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.

RGS Environmental Geotechnical Specialists

Rogers Geotechnical Services Ltd

Offices 1 & 2, Barncliffe Business Park,
Near Bank,
Shelley,
Huddersfield,
HD8 8LU

Telephone: 0843 50 66 87
www.rogersgeotech.co.uk

Client:

Farrar Bamfonrth Associates Ltd

Job Number:

C4272/24/E/6581

Project Details:

Spa Fields Industrial Estate,
Slaithwaite

Scale:	Not to scale - reference only

ENVIRONMENTAL GEOTECHNICAL GEOLOGICAL

Appendix 2

Borehole Records

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **BH01**

Sheet 1 of 1

Project Name:	Spa Fields Industrial Estate	Project No. C4272/24/E/6581	Co-ords:	Hole Type WLS
Location:	Slaithwaite, Huddersfield		Level:	Scale 1:50
Client:	Farrar Bamforth Associates Ltd		Dates: 12/02/2025	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	90		0.40			MADE GROUND (Greyish brown silty very gravelly fine to medium SAND. Gravel is sub-angular to sub-rounded, fine of sandstone, mudstone and occasional asphalt).
		1.00	SPT			N=20 (2,2/7,5,6,2)				MADE GROUND (Light brown slightly clayey very gravelly SAND with low cobble content. Cobbles are sub-angular to sub-rounded of sandstone. Gravel is sub-angular to sub-rounded, fine to medium and occasional coarse of sandstone). *1.4m - 1.7m: Occasional brick and asphalt gravel.*
				77	80					
		2.00	SPT			N=41 (1,5/10,15,10,6)	2.00			MADE GROUND (Light brown silty very gravelly fine medium SAND. Gravel is well rounded, medium of sandstone).
				67	80		2.35			MADE GROUND (Light brown slightly clayey very gravelly SAND. Sand is fine. Gravel is sub-angular to sub-rounded, fine to medium and occasional coarse of sandstone, occasional brick and dolostone).
		3.00	SPT			N=1 (0,0/0,0,0,1)	2.70 3.00			MADE GROUND (Very soft brown slightly sandy very gravelly CLAY. Sand is fine. Gravel is sub-angular to sub-rounded, fine to medium of sandstone, brick and rare other lithologies).
				57	0					NO RECOVERY.
		4.00	SPT			50 (50 for 75mm/50 for 75mm)	4.00			End of Borehole at 4.00m

1 2 3 4 5 6 7 8 9 10

Remarks

AGS

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **BH02**

Sheet 1 of 1

Project Name: Spa Fields Industrial Estate	Project No. C4272/24/E/6581	Co-ords:	Hole Type WLS
Location: Slaithwaite, Huddersfield		Level:	Scale 1:50
Client: Farrar Bamforth Associates Ltd		Dates: 12/02/2025	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		0.20			MADE GROUND (Dark grey silty very gravelly fine to medium SAND. Gravel is sub-angular to sub-rounded, fine to medium of asphalt and occasional brick).
		1.40	D	77	100		1.50			MADE GROUND (Stiff friable brown and greyish brown very gravelly slightly sandy CLAY. Sand is fine. Gravel is sub-angular to sub-rounded, fine to medium of mudstone, siltstone and rare brick. Gravel noted to be randomly oriented). *1.5m: Refusal - likely large cobble.* End of Borehole at 1.50m

Remarks

AGS

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **BH03**

Sheet 1 of 1

Project Name:	Spa Fields Industrial Estate	Project No. C4272/24/E/6581	Co-ords:	Hole Type WLS
Location:	Slaithwaite, Huddersfield		Level:	Scale 1:50
Client:	Farrar Bamforth Associates Ltd		Dates: 12/02/2025	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
				87	100		0.05			TOPSOIL (Dark brown clayey sandy SILT with frequent rootlets).1 MADE GROUND (Loose brown very gravelly clayey silty fine SAND with medium cobble content. Gravel is fine to coarse. Cobbles and gravel are sub-angular to sub-rounded of sandstone, concrete and aggregate).
				77	80		1.40			MADE GROUND (Loose brown very gravelly clayey silty fine SAND. Gravel is sub-angular to sub-rounded of brick, mortar, sandstone and occasional concrete).
				67	45		2.85			MADE GROUND (Very soft greyish brown silty slightly sandy gravelly CLAY. Sand is fine. Gravel is sub-angular to sub-rounded, fine to medium of brick and sandstone).
		3.70	D	57	85		4.00			End of Borehole at 4.00m

1 2 3 4 5 6 7 8 9 10

Remarks

AGS

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **BH04**

Sheet 1 of 1

Project Name:	Spa Fields Industrial Estate	Project No. C4272/24/E/6581	Co-ords:
Location:	Slaithwaite, Huddersfield		Level:
Client:	Farrar Bamforth Associates Ltd		Dates: 12/02/2025

Hole Type: WLS

Scale: 1:50

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			MADE GROUND (Dark brown and brown clayey very sandy, sub-angular to sub-rounded, fine to medium of sandstone and clinker).
		0.60	ES	87	100					
		1.00	SPT			N=6 (1,1/2,1,1,2)				MADE GROUND (Very loose brown slightly clayey very gravelly fine to medium SAND. Gravel is sub-angular to sub-rounded, fine to medium of sandstone, siltstone and mudstone).
				77	70		1.40			
		1.60	D							MADE GROUND (Very soft dark greyish brown slightly gravelly silty organic CLAY with much organic matter. Gravel is sub-angular to sub-rounded, fine of brick).
		2.00	SPT			N=4 (1,0/0,1,1,2)	2.00			MADE GROUND (Very soft greyish brown very gravelly slightly sandy CLAY. Sand is fine. Gravel is sub-angular to sub-rounded, fine to medium of brick and sandstone).
				67	60		2.60			Very soft brown slightly sandy very gravelly CLAY. Sand is medium. Gravel is sub-angular to well rounded, fine to medium and occasional coarse of sandstone. [ALLUVIUM].
		3.00	SPT			N=0 (0,0/0,0,0,0)	2.95			Very loose brown clayey very gravelly fine to medium SAND. Gravel is well rounded, fine to medium of sandstone and various other lithologies. [ALLUVIUM].
				57	20					*3.0m - 4.0m: Very poor recovery.*
		4.00	SPT			50 (50 for 75mm/50 for 75mm)	4.45			End of Borehole at 4.45m

Remarks

AGS

Appendix 3

Dynamic Probing Records

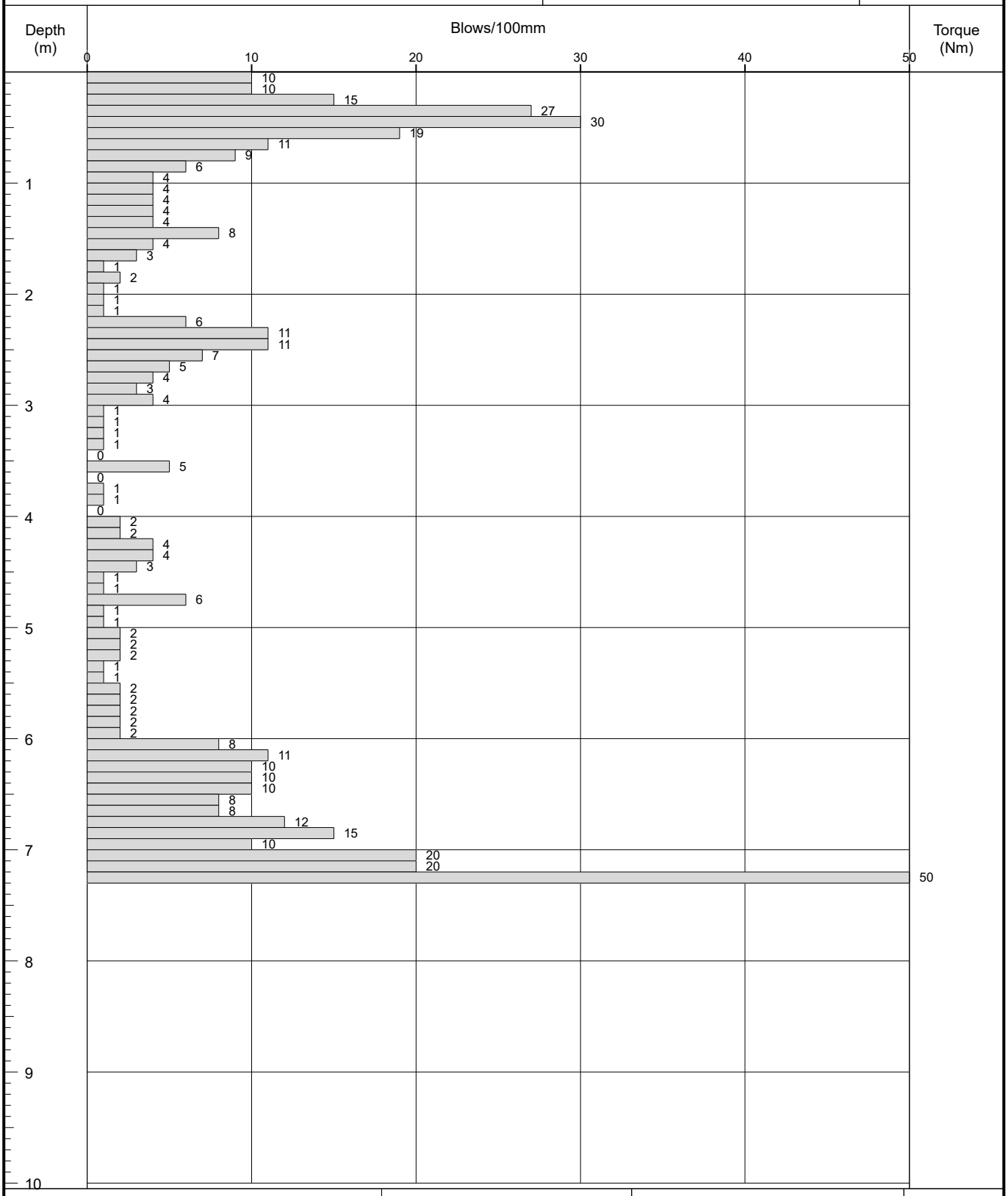
RGS Environmental Geotechnical Specialists

Probe Log

Probe No. **DP01**

Sheet 1 of 1

Project Name: Spa Fields Industrial Estate	Project No. C4272/24/E/6581	Co-ords:	Hole Type DCP
Location: Slaithwaite, Huddersfield		Level:	Scale 1:50
Client: Farrar Bamforth Associates Ltd		Dates: 12/02/2025	Logged By AB



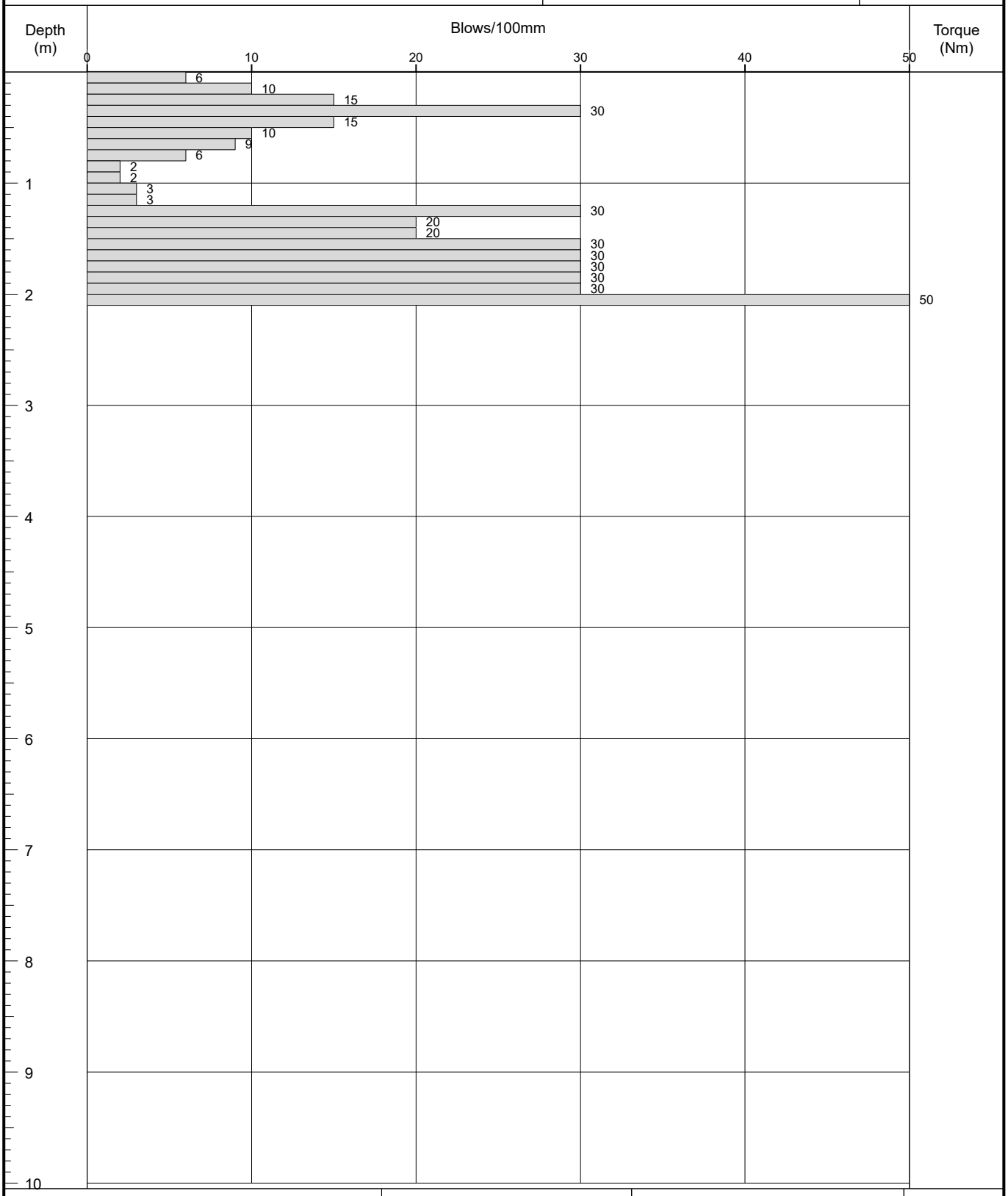
Remarks:	Fall Height	750mm	Cone Base Diameter 50.5mm
	Hammer Wt	63.5kg	Final Depth 7.3m
	Probe Type	DPSH-B	

AGS

Probe Log

Environmental Geotechnical Specialists

Probe No. **DP02** Sheet 1 of 1			
Project Name: Spa Fields Industrial Estate	Project No. C4272/24/E/6581	Co-ords:	Hole Type DCP
Location: Slaithwaite, Huddersfield		Level:	Scale 1:50
Client: Farrar Bamforth Associates Ltd		Dates: 12/02/2025	Logged By AB



Remarks:

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

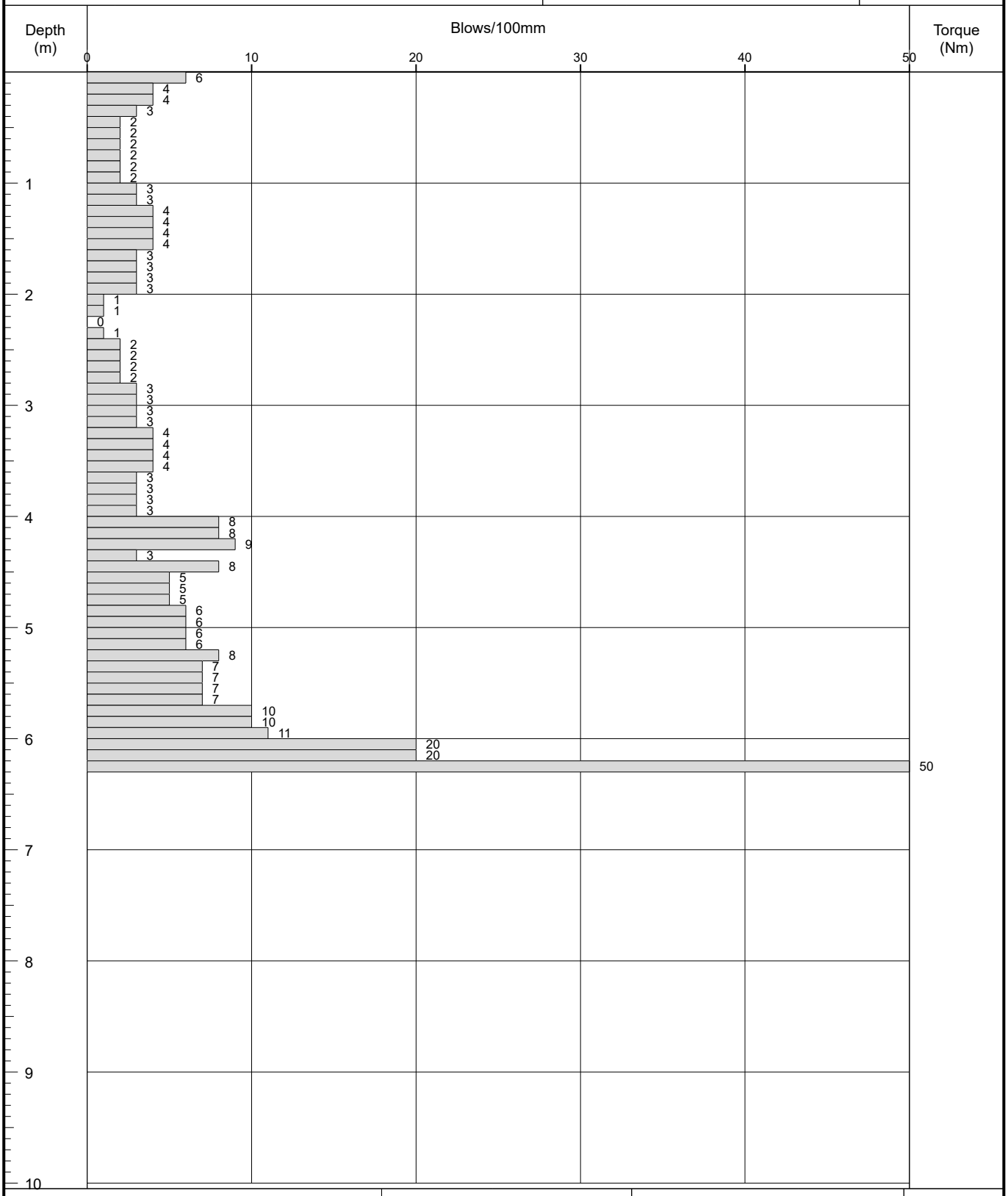
AGS

Probe Log

Probe No. **DP03**

Sheet 1 of 1

Project Name: Spa Fields Industrial Estate	Project No. C4272/24/E/6581	Co-ords:	Hole Type DCP
Location: Slaithwaite, Huddersfield		Level:	Scale 1:50
Client: Farrar Bamforth Associates Ltd		Dates: 12/02/2025	Logged By AB



Remarks:

Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	6.3m
Probe Type	DPSH-B		

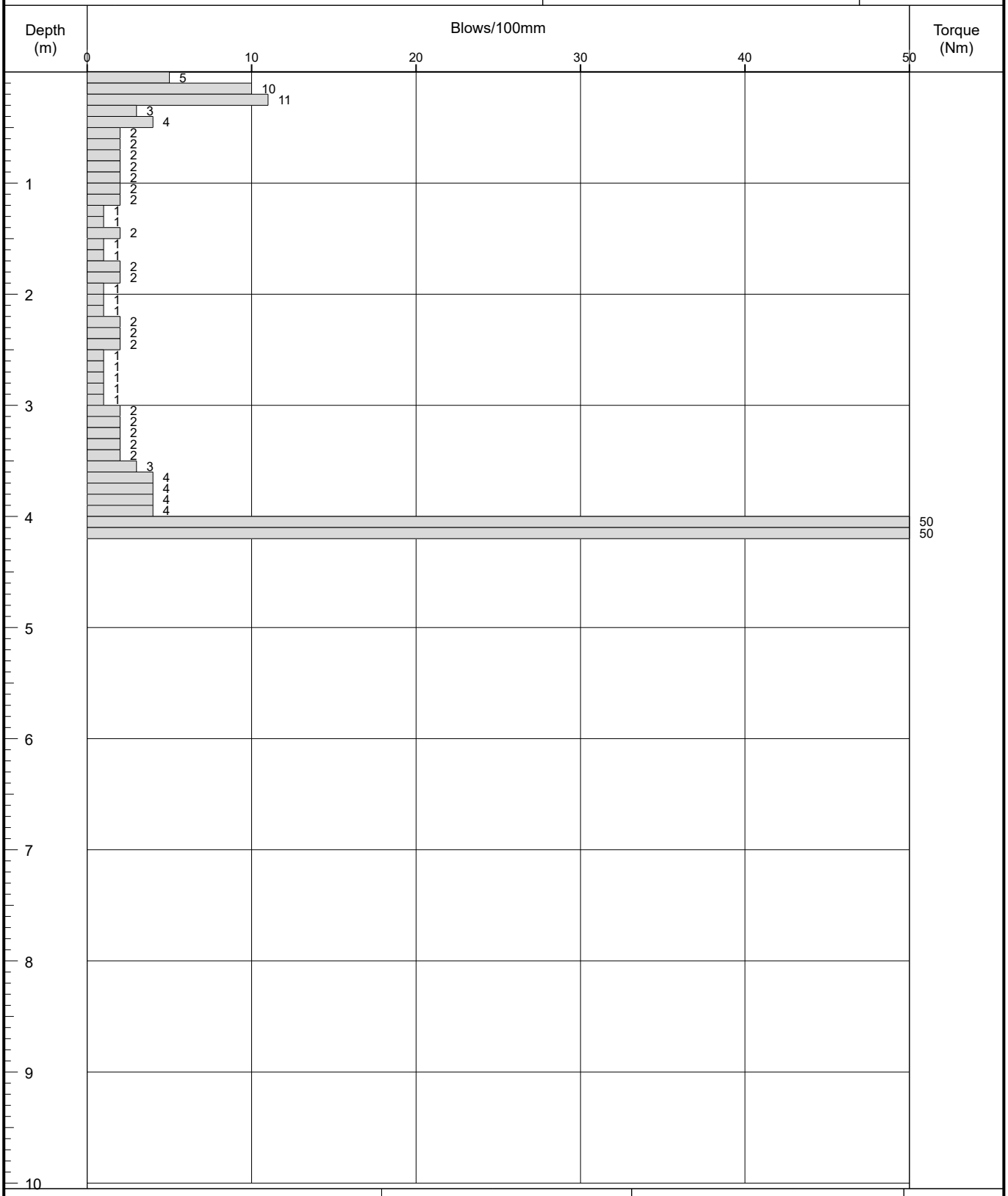
Probe Log

Environmental Geotechnical Specialists

Probe No. **DP04**

Sheet 1 of 1

Project Name: Spa Fields Industrial Estate	Project No. C4272/24/E/6581	Co-ords:	Hole Type DCP
Location: Slaithwaite, Huddersfield		Level:	Scale 1:50
Client: Farrar Bamforth Associates Ltd		Dates: 12/02/2025	Logged By AB



Remarks:

Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	4.2m
Probe Type	DPSH-B		

AGS

Appendix 4

Gas Monitoring Sheets

Post Fieldworks Discrete Well Monitoring Site Record

Job No:	C/4272/24/E/6581	Client:	Farrar Bamforth Associates Ltd.	Visit:	1	Of	4
Site:	SpaFieldsInd.EstateSlaithwaiteHD7 5BB	Date:	12.03.2025				

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

Tel: 01484 604 354
enquiries@rogersgeotech.co.uk

Location ID	Methane (%)		Carbon Dioxide (%)		Carbon Monoxide (ppm)		Hydrogen Sulphide (ppm)		Oxygen (%)		VOCs (ppm)		Flowrate (l/hr)		Water Depth (m)	Well Depth (m)	Installed Depth (m)	Comments
	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Minimum	Steady	Peak	Steady	Peak				
WS01	0.1	0.1	0.1	0.2	0	0	0	0	21.3	21.3			0	0	N/A		N/A	Bung Stuck, could not remove
WS02																		Could not locate, under mud/puddle
WS03	0	0	0.1	0.1	0	0	0	0	21.5	21.2			0	0	N/A		N/A	Bung Stuck, could no remove
Max.	0.1	0.1	0.1	0.2	0	0	0	0	21.5	21.3	0	0	0	0	0			
Min.	0	0	0.1	0.1	0	0	0	0	21.3	21.2	0	0	0	0	0			

ND - Not detected

DRY - No water in well

NM - Not Monitored (State Reason in comments)

Meteorological & Site Information	
General Ground Condition	1 and 3Dry Install 2, mud/puddle
Precipitation	0l/m2 in last 6 hours
Wind	14
Temperature	6
Barometric Pressure	
Pressure Trend	

Monitor Technical Specifications								
Gas Monitor Used:	GA5000							
Serial No:	G503524							
Monitor Gas Range	CH_4	5>60	CO_2	5<40	O_2	21.2		
Gas Flow Range	0-10 l/hr							
Date of Calibration	25.10.2024							
PID Monitor (If used)								
PID Monitor Serial No.								
Calibration Date.								

Monitoring Period Summary (All Visits)	Peak	Steady
Max CH_4	0	0
Max CO_2	0	0
Max CO		
Max H_2S		
Max O_2	22	21
Min O_2	21	21
Flow rate		

	Start	End
Barometric Pressure	987	987

Operative Details.	M.Tuck

Post Fieldworks Discrete Well Monitoring Site Record

Job No:	C/4272/24/E/6581	Client:	Farrar Bamforth Associates Ltd.	Visit:	2	Of	4
Site:	SpaFieldsInd.EstateSlaithwaiteHD7 5BB	Date:	19.02.2025				

RGS Environmental Geotechnical Specialists

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

Tel: 01484 604 354
enquiries@rogersgeotech.co.uk

Location ID	Methane (%)		Carbon Dioxide (%)		Carbon Monoxide (ppm)		Hydrogen Sulphide (ppm)		Oxygen (%)		VOCs (ppm)		Flowrate (l/hr)		Water Depth (m)	Well Depth (m)	Installed Depth (m)	Comments
	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Minimum	Steady	Peak	Steady	Peak				
WS01	0.1	0.1	0.3	0.3	0	0	0	0	21.3	21.3			0	0	2.94		4.02	
WS02																		Install could not be located
WS03	0	0	0.1	0.1	0	0	0	0	21.3	21.3			0	0	DRY		3.78	
Max.	0.1	0.1	0.3	0.3	0	0	0	0	21.3	21.3	0	0	0	0	2.94			
Min.	0	0	0.1	0.1	0	0	0	0	21.3	21.3	0	0	0	0	2.94			

ND - Not detected DRY - No water in well NM - Not Monitored (State Reason in comments)

Meteorological & Site Information	
General Ground Condition	DRY
Precipitation	0l/m2 over last 6 hours
Wind	2
Temperature	4
Barometric Pressure	
Pressure Trend	

Monitor Technical Specifications								
Gas Monitor Used:	GA5000							
Serial No:	G503524							
Monitor Gas Range	CH_4	5>60	CO_2	5<40	O_2	21.2		
Gas Flow Range	0-10 l/hr							
Date of Calibration	25.10.2024							
PID Monitor (If used)								
PID Monitor Serial No.								
Calibration Date.								

Monitoring Period Summary (All Visits)	Peak	Steady
Max CH_4	0	0
Max CO_2	0	0
Max CO		
Max H_2S		
Max O_2	21	21
Min O_2	21	21
Flow rate		

	Start	End
Barometric Pressure	1004	1005

Operative Details.	M.Tuck

Post Fieldworks Discrete Well Monitoring Site Record

Job No:	C/4272/24/E/6581	Client:	Farrar Bamforth Associates Ltd.	Visit:	3	Of	4
Site:	SpaFieldsInd.EstateSlaithwaiteHD7 5BB	Date:	26.03.2025				

RGS Environmental Geotechnical Specialists

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

Tel: 01484 604 354
enquiries@rogersgeotech.co.uk

Location ID	Methane (%)		Carbon Dioxide (%)		Carbon Monoxide (ppm)		Hydrogen Sulphide (ppm)		Oxygen (%)		VOCs (ppm)		Flowrate (l/hr)		Water Depth (m)	Well Depth (m)	Installed Depth (m)	Comments
	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Minimum	Steady	Peak	Steady	Peak				
WS01	0.1	0.1	0.4	0.4	0	0	0	0	20.5	20.5			0	0	2.95		4.02	
WS02	0.1	0.1	0.5	0.5	0	0	0	0	18.9	18.9			0	0	No data		No data	Stuck bung, irremoveable.
WS03	0	0	0.1	0.1	0	0	0	0	21	21			0	0	DRY		3.78	
Max																		
Min.																		

ND - Not detected DRY - No water in well NM - Not Monitored (State Reason in comments)

Meteorological & Site Information	
General Ground Condition	DRY
Precipitation	0l/m2 in last 6 hours
Wind	7
Temperature	11
Barometric Pressure	1010
Pressure Trend	Rising

Monitor Technical Specifications								
Gas Monitor Used:	GA5000							
Serial No:	G503524							
Monitor Gas Range	CH_4	5>60	CO_2	5<40	O_2	21.2		
Gas Flow Range	0-10 l/hr							
Date of Calibration	25.10.2024							
PID Monitor (If used)								
PID Monitor Serial No.								
Calibration Date.								

Monitoring Period Summary (All Visits)	Peak	Steady
Max CH_4	0	0
Max CO_2	0	0
Max CO		
Max H_2S		
Max O_2	21	21
Min O_2	21	21
Flow rate		

	Start	End
Barometric Pressure	1005	1008

Operative Details.	M.Tuck

CERTIFICATION OF CALIBRATION

PJLA Calibration
No. 66916

Date Of Calibration: 20-Apr-2024

Certificate Number: G503524_2/35282

Issued by: QED Environmental Systems Inc.

Customer: **QED ENVIRONMENTAL SYSTEMS LIMITED**
QED ENVIRONMENTAL SYSTEMS LTD CYAN PARK - UNIT 3 JIMMY HILL WAY COVENTRY, WEST MIDLA CV2 4QP GB

Description:

Model: GA5000

Serial Number: G503524

Accredited Results:

Methane (CH4)

Certified Gas (%)	Instrument Reading (%)	Uncertainty (%)
5.1	5.0	0.42
15.0	14.9	0.66
60.0	59.7	1.03

Carbon Dioxide (CO2)

Certified Gas (%)	Instrument Reading (%)	Uncertainty (%)
5.0	5.0	0.43
15.0	15.0	0.71
40.0	40.0	1.19

Oxygen (O2)

Certified Gas (%)	Instrument Reading (%)	Uncertainty (%)
20.9	21.0	0.25

Gas cylinders are traceable and details can be provided if requested.

CH4, CO2 readings recorded at: 31.2 °C/88.1 °F

O2 readings recorded at: 22.1 °C/71.7 °F

Barometric Pressure: 0987 mbar/29.15 "Hg

Method of Test : The analyzer is calibrated in a temperature controlled chamber using a series of reference gases, in compliance with procedure ISP17.

Instrument has passed calibration as the measurement result is within the specification limit. The specification limit takes into account the measurement uncertainty.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with NIST requirements.

Calibration Instance: 118 IGC Instance: 118

CERTIFICATION OF CALIBRATION

PJLA Calibration

No. 66916

QED™

Date Of Calibration: 20-Apr-2024

Certificate Number: G503524_2/35282

Issued by: QED Environmental Systems Inc.

Non Accredited results:

Pressure Transducers (inches of water column)					
Transducer	**Certified (Low)**	**Reading (Low)**	**Certified (High)**	**Reading (High)**	**Accuracy**
Relative	0"	0"	40"	40.33"	2.0"

Barometer (mbar)	
Reference	**Instrument Reading**
0987 mbar / 29.15 "Hg	0987 mbar / 29.16 "Hg

As received gas check readings are only recorded if the instrument is received in a working condition. Where the instrument is received damaged no reading can be taken.

Date of Issue : 24 Apr 2024

Approved By Signatory

Linda Ostrowski

Laboratory Inspection

www.qedenv.com (800) 624-2026 info@qedenv.com

QED Environmental Systems Inc. 2355 Bishop Circle West, Dexter, MI 48130

CERTIFICATION OF CALIBRATION

PJLA Calibration
No. 66916

Date Of Calibration: 25-Oct-2024

Certificate Number: G503524_10/36927

Issued by: QED Environmental Systems Inc.

As received Barometric Pressure recorded at: 23.2 °C/73.7 °F

As received gas check readings are only recorded if the instrument is received in a working condition. Where the instrument is received damaged no reading can be taken

Date of Issue : 26 Oct 2024 Approved By Signatory

www.qedenv.com (800) 624-2026 info@qedenv.com

QED Environmental Systems Inc. 2355 Bishop Circle West, Dexter, MI 48130

CERTIFICATION OF CALIBRATION

PJLA Calibration
No. 66916

Date Of Calibration: 25-Oct-2024

Certificate Number: G503524_10/36927

Issued by: QED Environmental Systems Inc.

The calibration results published in this certificate were obtained using equipment capable of producing results that are traceable through NIST to the International System of Units (SI). Certification only applies to results shown. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

www.qedenv.com (800) 624-2026 info@qedenv.com

QED Environmental Systems Inc. 2355 Bishop Circle West, Dexter, MI 48130

Appendix 5

Laboratory Testing

Environmental
Geotechnical
Specialists

LABORATORY REPORT

job number	C/4272/24/E/6581
date	11/03/2025
site address	Spa Fields Industrial Estate Slaithwaite, Huddersfield, West Yorkshire, HD7 5BB
date scheduled	17/02/2025
date issued	11/03/2025
issued by	H J Letch

Please consider the environment before printing this report.

Constructionline
A UK GOVERNMENT CERTIFICATION SERVICE

QMS ISO 9001 : 2015 REGISTERED Cert No. 14123657

QMS ISO 14001 : 2015 REGISTERED Cert No. 14127804

QMS ISO 45001 : 2018 REGISTERED Cert No. 14130281

CITATION APPROVED Registered Member

UKAS United Kingdom Accreditation Service

<ENVIRONMENTAL> <GEOTECHNICAL>

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

Blank Page

Schedule of Accreditation

issued by

United Kingdom Accreditation Service

2 Pine Trees, Chertsey Lane, Staines-upon-Thames, TW18 3HR, UK

8948

Accredited to ISO/IEC 17025:2017

Rogers Geotechnical Services Ltd

Issue No: 007 **Issue date:** 31 May 2024

Offices 1 & 2
Barncliffe Business Park
Near Bank
Shelley
HD8 8LU
United Kingdom

Contact: Emma Pearce
Tel: +44 (0)1484 607977
E-Mail: emma.pearce@rogersgeotech.co.uk
Website: www.rogersgeotech.co.uk

Testing performed at the above address only

DETAIL OF ACCREDITATION

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
SOILS for civil engineering purposes	Water content	BS 1377-2:2022
	Liquid limit - cone penetrometer (definitive)	BS 1377-2:2022
	Liquid limit - one point cone penetrometer	BS 1377-2:2022
	Plastic limit	BS 1377-2:2022
	Plasticity index and liquidity index	BS 1377-2:2022
	Linear Shrinkage	BS 1377-2:2022
	Density - linear measurement	BS 1377-2:2022
	Particle size distribution - wet sieving	BS 1377-2:2022
	Particle size distribution - dry sieving	BS 1377-2:2022
	Particle size distribution - sedimentation - pipette method	BS 1377-2:2022
	Uniformity coefficient	Specification for Highway Works Series 600 Table 6/1 footnote 5
	Particle density - gas jar	BS 1377-2:2022
	Dry density/water content relationship (2.5 kg rammer)	BS 1377-2:2022

8948

Accredited to ISO/IEC 17025:2017

Schedule of Accreditation

issued by

United Kingdom Accreditation Service

2 Pine Trees, Chertsey Lane, Staines-upon-Thames, TW18 3HR, UK

Rogers Geotechnical Services Ltd

Issue No: 007 **Issue date:** 31 May 2024

Testing performed at main address only

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
SOILS for civil engineering purposes (continued)	Dry density/ water content relationship (4.5 kg rammer)	BS 1377-2:2022
	Dry density/water content relationship (vibrating hammer)	BS 1377-2:2022
	California Bearing Ratio (CBR)	BS 1377-2:2022
	One-dimensional consolidation properties	BS 1377-2:2022
	Unconsolidated undrained triaxial test	BS 1377-2:2022
GEOTECHNICAL INVESTIGATION and TESTING - Laboratory testing of soil	Water content	BS EN ISO 17892-1:2014 +A1:2022
	Bulk density - linear measurement method	BS EN ISO 17892-2:2014
	Determination of particle density – fluid pycnometer method	BS EN ISO 17892-3:2015
	Determination of particle size distribution -sieving method -pipette method	BS EN ISO 17892-4:2016
	Incremental loading oedometer test	BS EN ISO 17892-5: 2017
	Unconsolidated undrained triaxial test	BS EN ISO 17892-8:2018
	Determination of liquid limit by the fall cone method	BS EN ISO 17892-12 2018 +A2:2022
	Determination of plastic limit	BS EN ISO 17892-12 2018 +A2:2022
	Plasticity Index and Liquidity Index	BS EN ISO 17892-12 2018 +A2:2022
END		

Disclaimer

The results reported herein relate only to the material supplied to the laboratory.

-

This report may not be reproduced other than in full, unless with prior written approval of the issuing laboratory.

GEOTECHNICAL TESTING RESULTS

Please consider the environment before printing this 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

Blank Page

Summary of Classification Test Results

Project No.	Project Name
C4272/24/E/6581	Spa Fields Industrial Estate

Hole No.	Sample				Soil Description	Density		*w*	Passing 425µm	LL	PL	PI	Particle density	1pt/4pt	Date	Increase/Decrease
	Ref	Top	Base	Type		bulk	dry									
						Mg/m^3		%	%	%	%	%	Mg/m^3			
BH02	1	1.40		D	MG (Greyish brown very gravelly CLAY)			22	74	37	23	14		1pt	17-Feb	Increase
BH03	1	3.70		D	MG (Greyish brown silty very gravelly CLAY).			28	52	51	28	23		1pt	17-Feb	Increase
BH04	1	1.60		D	MG (Greyish brown organic CLAY)			32	58	50	29	21		1pt	17-Feb	Increase

All tests performed in accordance with BS1377-2:2022 and BS EN ISO 17892-12 2018+A2:2022 unless specified otherwise
All Liquid Limit Tests performed on a 80g/30 Degree Cone unless specified otherwise

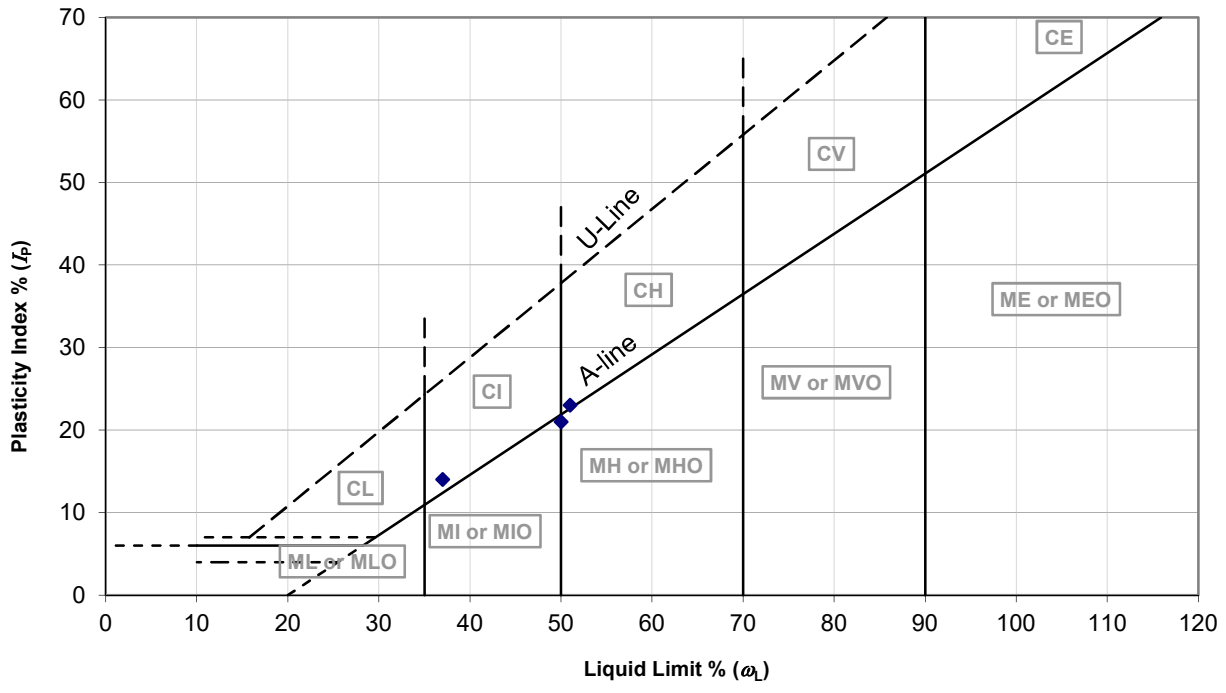
Key

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed	Approved By	Table
11/03/2025	Harry	1
		sheet 1

Rogers Geotechnical Services Ltd. Offices 1&2, Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU	**Classification of Index Properties**	**C4272/24/E/6581**
Project Name: Spa Fields Industrial Estate	**BS EN ISO 17892-12 2018+A2:2022**	Fig. 2 / Sheet. 1
Location:		Input By: Harry
Client: Farrar Bamforth Associates Ltd		Check By: Harry

Location	Depth	Water Content (ω)	Liquid Limit (ω_L)	Plastic Limit (ω_P)	Plasticity Index (I_P)	Retained by 0.425mm	Modified (ω)	Modified (I_P)	Liquidity/ Consistency		Casagrande Class	N.H.B.C Class
							(ω')	(I_P')	(I_L)	(I_C)		
	(m)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)		(%)
BH02	1.40	22	37	23	14	26	30	10	-0.1	1.1	C I	LOW
BH03	3.70	28	51	28	23	48	54	12	0.0	1.0	C H	LOW
BH04	1.60	32	50	29	21	42	55	12	0.1	0.9	M H	LOW



Blank Page

ENVIRONMENTAL TESTING RESULTS

<ENVIRONMENTAL><GEOTECHNICAL>

Please consider the environment before printing this report.

Constructionline
A UK GOVERNMENT CERTIFICATION SERVICE

QMS ISO 9001 : 2015 REGISTERED Cert No. 14123657

QMS ISO 14001 : 2015 REGISTERED Cert No. 14127804

QMS ISO 45001 : 2018 REGISTERED Cert No. 14130281

CITATION APPROVED HEALTH & SAFETY SYSTEMS Registered Member

UKAS United Kingdom Accreditation Service

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

Blank Page

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

t: 01484 604354

e: harry.letch@rogersgeotech.co.uk
Imran.Sakoor@rogersgeotech.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 25-008065

Project / Site name:	Spa Fields, Slaithwaite	**Samples received on:**	19/02/2025
Your job number:	C4272 24 E 6581	**Samples instructed on/ Analysis started on:**	19/02/2025
Your order number:		**Analysis completed by:**	26/02/2025
Report Issue Number:	1	**Report issued on:**	26/02/2025
Samples Analysed:	3 soil samples		

Signed: _____

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting
air	- once the analysis is complete

Excel copies of reports are only valid when accompanied by this PDF certificate.

Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 25-008065
Project / Site name: Spa Fields, Slaithwaite

Lab Sample Number				458252	458253	458254
Sample Reference				BH01	BH02	BH04
Sample Number				None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A
Depth (m)				0.60	0.60	0.60
Date Sampled				14/02/2025	14/02/2025	14/02/2025
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**			
Stone Content	%	0.1	NONE	< 0.1	8	26.6
Moisture Content	%	0.01	NONE	22	11	9.1
Total mass of sample received	kg	0.1	NONE	0.6	0.6	0.6
Asbestos						
Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	MUA	MUA	MUA
Analysis completed	N/A	N/A	N/A	24/02/2025	24/02/2025	24/02/2025
General Inorganics						
pH (L099)	pH Units	N/A	MCERTS	7.8	8.2	8.3
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Total Sulphate as SO_4	%	0.005	MCERTS	0.062	0.026	0.038
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	44	53	57
Water Soluble SO_4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	22.2	26.4	28.7
Organic Matter (automated)	%	0.1	MCERTS	3	2.3	1.9
Total Phenols						
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Speciated PAHs						
Naphthalene	mg/kg	0.05	MCERTS	5	0.09	3.8
Acenaphthylene	mg/kg	0.05	MCERTS	1.3	< 0.05	0.27
Acenaphthene	mg/kg	0.05	MCERTS	1.5	0.07	2.3
Fluorene	mg/kg	0.05	MCERTS	2.5	0.08	2.6
Phenanthrene	mg/kg	0.05	MCERTS	14	0.68	15
Anthracene	mg/kg	0.05	MCERTS	4.2	0.15	3.1
Fluoranthene	mg/kg	0.05	MCERTS	21	0.9	21
Pyrene	mg/kg	0.05	MCERTS	21	0.81	17
Benzo(a)anthracene	mg/kg	0.05	MCERTS	13	0.41	9.3
Chrysene	mg/kg	0.05	MCERTS	14	0.54	8.1
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	12	0.4	9.2
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	4.5	0.22	4.4
Benzo(a)pyrene	mg/kg	0.05	MCERTS	11	0.34	9.7
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	4.2	0.14	4.4
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	1.4	< 0.05	0.92
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	4.6	0.19	5
Total PAH						
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	135	5	117

Analytical Report Number: 25-008065
Project / Site name: Spa Fields, Slaithwaite

Lab Sample Number				458252	458253	458254
Sample Reference				BH01	BH02	BH04
Sample Number				None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A
Depth (m)				0.60	0.60	0.60
Date Sampled				14/02/2025	14/02/2025	14/02/2025
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Test Limit of detection**	**Test Accreditation Status**			
Heavy Metals / Metalloids						
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	8.9	5.3	7.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.3	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	26	34	35
Copper (aqua regia extractable)	mg/kg	1	MCERTS	37	29	25
Lead (aqua regia extractable)	mg/kg	1	MCERTS	100	34	19
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	19	37	29
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	1.2	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	26	29	29
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	80	72	65
Petroleum Hydrocarbons						
TPHCWG - Aliphatic >EC5 - EC6 $_{HS\_1D\_AL}$	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC6 - EC8 $_{HS\_1D\_AL}$	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC8 - EC10 $_{HS\_1D\_AL}$	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC10 - EC12 $_{EH\_CU\_1D\_AL}$	mg/kg	1	MCERTS	< 1.0	< 1.0	3.6
TPHCWG - Aliphatic >EC12 - EC16 $_{EH\_CU\_1D\_AL}$	mg/kg	2	MCERTS	2.6	< 2.0	9.2
TPHCWG - Aliphatic >EC16 - EC21 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	< 8.0	< 8.0	10
TPHCWG - Aliphatic >EC21 - EC35 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	8.1	< 8.0	45
TPHCWG - Aliphatic >EC5 - EC35 $_{EH\_CU+HS\_1D\_AL}$	mg/kg	10	NONE	11	< 10	68
TPHCWG - Aromatic >EC5 - EC7 $_{HS\_1D\_AR}$	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC7 - EC8 $_{HS\_1D\_AR}$	mg/kg	0.01	MCERTS	0.013	< 0.010	< 0.010
TPHCWG - Aromatic >EC8 - EC10 $_{HS\_1D\_AR}$	mg/kg	0.02	MCERTS	< 0.020	< 0.020	< 0.020
TPHCWG - Aromatic >EC10 - EC12 $_{EH\_CU\_1D\_AR}$	mg/kg	1	MCERTS	4.9	< 1.0	4
TPHCWG - Aromatic >EC12 - EC16 $_{EH\_CU\_1D\_AR}$	mg/kg	2	MCERTS	18	< 2.0	15
TPHCWG - Aromatic >EC16 - EC21 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	94	< 10	77
TPHCWG - Aromatic >EC21 - EC35 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	130	< 10	100
TPHCWG - Aromatic >EC5 - EC35 $_{EH\_CU+HS\_1D\_AR}$	mg/kg	10	NONE	240	< 10	200
VOCs						
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Toluene	µg/kg	5	MCERTS	13	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
p & m-Xylene	µg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0
o-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 25-008065
Project / Site name: Spa Fields, Slaithwaite

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
458252	BH01	None Supplied	0.6	Brown loam and clay with vegetation
458253	BH02	None Supplied	0.6	Brown clay and sand with stones
458254	BH04	None Supplied	0.6	Brown clay and sand with gravel and stones

Analytical Report Number : 25-008065
Project / Site name: Spa Fields, Slaithwaite

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in Soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques	In-house method based on HSG 248, 2021	A001B	D	ISO 17025
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L038B	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES	In-house method	L038B	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Sulphate, water soluble, in soil (16hr extraction)	In-house method	L038B	D	MCERTS
Speciated PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
BTEX and/or Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS	In-house method based on USEPA 8260	L073B	W	MCERTS
Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS with carbon banding aliphatic and aromatic	In-house method	L076B/L088-PL	D/W	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry	In-house method	L080-PL	W	MCERTS
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	MCERTS
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	MCERTS

Analytical Report Number : 25-008065
Project / Site name: Spa Fields, Slaithwaite

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099-PL	D	MCERTS

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

Rogers Geotechnical Services: Soil Screening Values Comparison Sheet

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

Job Number	C4272/24/E/6581
Job Name	Spa Fields Industrial Estate, Slaithwaite
Date	20/03/2025
Client	Farrar Bamforth Associates Ltd

A = WS Atkins PLC, Atrisk Soil Screening Values.
A+ = Values updated June 2017.
A* = Atrisk's SSV is lower than i2'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	Commercial 1%		Sample Location	BH01	BH02	BH04
				Atrisk 2015 (No Free Product	Atrisk 2017	Depth Top	0.60	0.60	0.60
						Depth Base			
Cadmium	mg/kg	C	0.2		410		0.3	< 0.2	< 0.2
Chromium (Hexavalent)	mg/kg	B/C	1.8	49.1	19.7		< 1.8	< 1.8	< 1.8
Copper	mg/kg	A+	1.0		106000		37	29	25
Mercury	mg/kg	A/D	0.3		350		< 0.3	< 0.3	< 0.3
Nickel	mg/kg	A+	1.0		1770		19	37	29
Lead	mg/kg	C	1.0		2310		100	34	19
Zinc	mg/kg	A+	1.0		1100000		80	72	65
Vanadium	mg/kg	A+	1.0		7490		26	29	29
Arsenic	mg/kg	C	1.0		635		8.9	5.3	7.3
Selenium	mg/kg	A	1.0		13000		1.2	< 1.0	< 1.0
Cyanide (Free)	mg/kg	A	1.0		373		< 1.0	< 1.0	< 1.0
Total Phenols	mg/kg	A	1.0		685		< 1.0	< 1.0	< 1.0
Naphthalene	mg/kg	A+	0.05	90.1	75		5	0.09	3.8
Acenaphthylene	mg/kg		0.05				1.3	< 0.05	0.27
Acenaphthene	mg/kg	A+	0.05	83600	156.8		1.5	0.07	2.3
Fluorene	mg/kg	A+	0.05		66500		2.5	0.08	2.6
Phenanthrene	mg/kg		0.05				14	0.68	15
Anthracene	mg/kg	A+	0.05		535000		4.2	0.15	3.1
Fluoranthene	mg/kg	A+	0.05		72200		21	0.9	21
Pyrene	mg/kg	A+	0.05		54100		21	0.81	17
Benzo[a]anthracene	mg/kg	A	0.05	131	1.71		13	0.41	9.3
Chrysene	mg/kg	A	0.05	14000	0.44		14	0.54	8.1
Benzo[b]fluoranthene	mg/kg	A	0.05	142	1.22		12	0.4	9.2
Benzo[k]fluoranthene	mg/kg	A	0.05	1430	0.686		4.5	0.22	4.4
Benzo[a]pyrene	mg/kg	B/C	0.05	76.3	26.1		11	0.34	9.7
Indeno(1,2,3-c,d)Pyrene	mg/kg	A*	0.05	142	0.0614		4.2	0.14	4.4
Dibenz(a,h)Anthracene	mg/kg	A	0.05	14.3	0.00393		1.4	< 0.05	0.92
Benzo[g,h,i]perylene	mg/kg	A	0.05	1440	0.0187		4.6	0.19	5
Total Of 16 PAH's	mg/kg		0.8				135	5	117
Aliphatic TPH >C5-C6	mg/kg	A+	0.02	4490	327		< 0.010	< 0.010	< 0.010
Aliphatic TPH >C6-C8	mg/kg	A+	0.02	10400	157		< 0.010	< 0.010	< 0.010
Aliphatic TPH >C8-C10	mg/kg	A+	0.05	1370	82.4		< 0.010	< 0.010	< 0.010
Aliphatic TPH >C10-C12	mg/kg	A+	1.0	7900	49.9		< 1.0	< 1.0	3.6
Aliphatic TPH >C12-C16	mg/kg	A+	2.0	34000	20.9		2.6	< 2.0	9.2
Aliphatic TPH >C16-C21	mg/kg	A+	8.0		3620000		< 8.0	< 8.0	10
Aliphatic TPH >C21-C35	mg/kg	A+	8.0		3620000		8.1	< 8.0	45
Aliphatic TPH >C35-C44	mg/kg		10.0						
Total Aliphatic Hydrocarbons	mg/kg		10.0				11	< 10	68
Aromatic TPH >C5-C7	mg/kg	A+	0.01		12.5		< 0.010	< 0.010	< 0.010

Rogers Geotechnical Services: Soil Screening Values Comparison Sheet

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

Job Number	C4272/24/E/6581
Job Name	Spa Fields Industrial Estate, Slaithwaite
Date	20/03/2025
Client	Farrar Bamforth Associates Ltd

A = WS Atkins PLC, Atrisk Soil Screening Values.
A+ = Values updated June 2017.
A* = Atrisk's SSV is lower than i2'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	Commercial 1%		BH01	BH02	BH04
Sample Location						BH01	BH02	BH04
Depth Top						0.60	0.60	0.60
Depth Base								
Aromatic TPH >C7-C8	mg/kg	A+	0.01	27900	834	0.013	< 0.010	< 0.010
Aromatic TPH >C8-C10	mg/kg	A+	0.05	2210	613	< 0.020	< 0.020	< 0.020
Aromatic TPH >C10-C12	mg/kg	A+	1.0	12300	369	4.9	< 1.0	4
Aromatic TPH >C12-C16	mg/kg	A+	2.0	41300	155	18	< 2.0	15
Aromatic TPH >C16-C21	mg/kg	A+	10.0		28400	94	< 10	77
Aromatic TPH >C21-C35	mg/kg	A+	10.0		28400	130	< 10	100
Aromatic TPH >C35-C44	mg/kg		10.0					
Total Aromatic Hydrocarbons	mg/kg		10.0			240	< 10	200
Total Petroleum Hydrocarbons	mg/kg		10.0					
pH			N/A			**7.8**	8.2	**8.3**
Sulphate (2:1 Water Soluble) as SO4	mg/l		1.25			**22.20**	26.40	**28.70**
ACM Type			N/A			-	-	-
Asbestos Identification	%					None	None	None
ACM Detection Stage			N/A			-	-	-
Sulphate (Total)	%		0.005			0.062	0.026	0.038
Organic Matter	%		0.1			**3**	2.3	**1.9**

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 6

Fill Screening Values

Rogers Geotechnical Services Ltd.

Atkins ATRISK Soil Screening Values (SSVs) - Commercial Landuse

Tox Data Report No.	Compound	Commercial (mg/kg)				Reference
	Metals	1% SOM		6% SOM		
3	Cadmium	410		410		C
4	Chromium VI	19.7	49.1	19.7	49.1	B/C
	Copper	106000		106000		A+
7	Mercury	350.00		405.00		A/D
8	Nickel	1770		1770		A+
	Lead	2310		2310		C
	Zinc	1100000		1100000		A+
	Vanadium	7490		7490		A+
	Semi and Non Metals					
1	Arsenic	635		635		C
10	Selenium	13000		13000		A
	Free Cyanide	373		373		A
9	Phenols (total)	685		3170		A
	Poly Aromatic Hydrocarbons	Free product	No free produc	Free product	No free product	
20	Naphthalene	75	90.1	432	1050	A+
	Acenaphthene	156.8	83600	106000		A+
	Fluorene	66500		72000		A+
	Anthracene	535000		544000		A+
	Fluoranthene	72200		72600		A+
	Pyrene	54100		54400		A+
	Benzo(a)anthracene	1.71	131	10.3	142	A
2	Chrysene	0.44	14000	2.64	14300	A
2	Benzo(b)fluoranthene	1.22	142	7.29	144	A
2	Benzo(k)fluoranthene	0.686	1430	4.12	1440	A
2	Benzo(a)pyrene	26.1	76.3	26.2	76.3	B/C
2	Dibenz(a,h)anthracene	0.00393	14.3	0.0236	14.4	A*
2	Indeno(1,2,3-cd)pyrene	0.0614	142	0.368	144	A*
2	Benzo(g,h,i)perylene	0.0187	1440	0.112	1450	A*
	Petroleum Hydrocarbons					
	Aliphatic C5-C6	327	4490	1100	29400	A+
	Aliphatic C6-C8	157	10400	769	98200	A+
	Aliphatic C8-C10	82.4	1370	476	14800	A+
	Aliphatic C10-C12	49.9	7900	297	69500	A+
	Aliphatic C12-C16	20.9	34000	126	139000	A+
	Aliphatic C16-C21	3620000		3620000		A+
	Aliphatic C21-C35	3620000		3620000		A+
	Aromatic C5-C7 (Benzene)	12.5		98		A+
	Aromatic C7-C8 (Toluene)	834	27900	4360	183000	A+
	Aromatic C8-C10	613	2210	3600	20800	A+
	Aromatic C10-C12	369	12300	2190	53800	A+
	Aromatic C12-C16	155	41300	65400		A+
	Aromatic C16-C21	28400		28400		A+
	Aromatic C21-C35	28400		28400		A+
	Others					
Asbestos						

A = WS ATKINS PLC, ATRISK SOIL SCREENING VALUES BASED ON 1% SOIL ORGANIC MATTER

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 1% 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 7.95 should be used.