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Geo-Environmental Ltd

Consulting Geo-Environmental Engineers

Phase 2 Geo-environmental and Coal Mining Risk Assessment

Faith in Nature, Former Ashworth
Frazer Site, Higher Ainsworth
Road, Radcliffe

Report Ref:

21053-PWAG-00-XX-RP-G-7000-P02

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M Stone Property Development &
Management Ltd

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Executive Summary

PWA Geo-Environmental Ltd (PWAG) was commissioned by M Stone Property Development & Management Ltd to undertake a Phase 2 Geo-environmental and Coal Mining Risk Assessment for a proposed commercial development located off Faith in Nature, Former Ashworth Frazer Site, Higher Ainsworth Road, Radcliffe.

Key Findings	
Site	The site is accessed from Miller Street and comprises four large industrial and commercial buildings, of which one is derelict, two are in-use, and one was being demolished when the site walkover was undertaken. Concrete paved areas lie between the buildings and a concrete yard area is currently present where the fifth unit is proposed to be built. The in-use buildings are office cum warehouse units owned and used by Faith in Nature. The derelict building is built mostly of brick and is empty. It is unclear what the demolished building once was. The derelict building and one of the in-use buildings together form a 'U' shape in the northeast part of site and surround the concrete yard area. The site is surrounded by palisade steel fencing. Although three above ground storage tanks (AGSTs) were indicated on historic Ordnance Survey maps these were not observed during the site inspection and have been removed from site. No visual or olfactory evidence of contamination was observed on site. The former railway cutting (running along the southeast boundary of the site) is mapped as infilled ground. Superficial deposits comprise glacial till (diamicton) across much of the site and neighbouring land. Till is absent from a narrow northwest southeast trending strip and the infilled railway cutting. The six inch map identifies the abandoned mine shaft for Black Lane Colliery approximately 15m southeast of the site (identified as 377408-004). This records the thickness of superficial strata (logged as boulder clay) to be 8.23 m.
Geology	Bedrock comprises undifferentiated mudstone, siltstone and sandstone of the Pennine Lower Coal Measures Formation (PLCM) with named coal seams identified. However, this pattern is complicated by differences in mapped geology between the 1:10,000 and 1:50,000 maps. The geology is further complicated by a northwest southeast trending fault conjectured to run beneath the southwestern portion of the site. As the coal seam in this block (considered to be [1] & [6] Windmill and Lower Yard Mines) is conjectured to be underneath existing buildings where no development is proposed this is not considered further.
Site Investigation	Fieldwork undertaken in May 2022 comprised three rotary boreholes drilled to a maximum target depth of 25 m bgl and one borehole drilled to 4 m bgl. The target depth was based on records in the Coal Authority report indicating workings existed beneath the site in the Wigan Four Feet at a depth of 19.0 m. These works were undertaken to investigate for possible historic mine workings, and to install ground gas monitoring equipment to check for any landfill gas. The drilling identified one 50 cm void at a depth of 23.50 m bgl in BH03.
Ground Conditions Encountered	Made ground was encountered in all positions, varied between 0.3 m to 4.0 m thick, and was variable in composition too. In the vicinity of the proposed new building, made ground varied between 0.3 m and 1.2 m thick. Made ground was deeper in the railway cutting and still present at the bottom of the hole at 4.0 m bgl. Underlying glacial till deposits were encountered at all investigation locations and typically comprised soft to firm slightly gravelly clay, though there was one instance of granular glacial till. Bedrock was encountered in BH01, BH02, and BH03 between 1.5 m and 3.4 m bgl and comprised sandstone and mudstone. One void was encountered in BH03 at 23.5 m bgl measuring 500 mm.
Land Contamination	Potential sources of contamination were identified on site relating to made ground. However, chemical testing of five samples of made ground did not identify any analytes at concentrations above generic assessment criteria for commercial/ industrial land use. Therefore, remediation is not considered necessary. However, made ground containing fragments of anthropogenic material (such as glass, brick and concrete) is considered texturally unsuitable and should be sealed under the hardcover of the development (buildings, service yards and parking areas) or clean imported topsoil used in landscaped areas.
Ground Gas	A programme of gas monitoring is underway, and a risk assessment will be carried out once monitoring is completed.
Coal Mining Risk Assessment	Based on the information within this report and proven workings of the underlying coal seam, we consider that the risk to the proposed development from shallow mine workings is low and mitigation measures are not required. The depth of competent cover across the site was variable ranging from 19.5 m at BH03 to >23.5 m at BH02. Based on a 500 mm void encountered in BH03, this equates to at least 39 times seam thickness.

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Conclusions and Recommendations

This Phase 2 Geo-environmental and Coal Mining Risk Assessment has been performed at Faith in Nature, Radcliffe. It is understood that the proposed development comprises the construction of a one storey steel framed infill structure amongst existing buildings. For the purpose of this report, we have assumed that proposed levels will not be significantly different to those existing. If any of these assumptions are incorrect then the conclusions in this report may require reassessment.

Based on the information within this report and no significant shallow mineworkings or coal being detected, we consider that the risk to the proposed development from unrecorded shallow mine workings is low and mitigation measures are not required.

No exceedances of the commercial generic assessment criteria were recorded, and no remediation of soils is considered necessary.

Currently, four out of six ground gas monitoring visits have been completed. Once the monitoring programme has been completed a ground gas addendum will be submitted discussing these results.

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Appendices

Appendix A – Drawings

Drawing No.	Title
20.173.005B	Proposed Development
21053-PWA-00-XX-DR-G-2001 - P02	Exploratory Hole Plan

Appendix B – Coal Authority Report

Appendix C – Exploratory Hole Records

Appendix D – Geochemical Laboratory Report

Appendix E – Gas and Groundwater Monitoring Results

Appendix F – Risk Evaluation

1 FOREWORD

This report has been prepared for the sole use and reliance of M Stone Property Development & Management Ltd (the Client) and cannot be relied upon by any other parties without the express written authorisation of PWA Geo-Environmental Ltd. Any unauthorised third party relies on this report at their own risk and the authors owe them no duty of care.

The report presents observations and factual data obtained during our site walkover, along with information reviewed during the desk study and intrusive works and provides an assessment of geo-environmental issues with respect to information provided by the Client regarding the site. There may be other conditions on site not encountered during this investigation and which have not been examined. We cannot accept responsibility for any conditions not revealed by this investigation and confirmation of ground conditions between exploratory locations should be undertaken if considered necessary. Any spatial inference of ground conditions between investigation locations are for guidance only and no liability can be accepted for their accuracy.

The groundwater conditions encountered on site and recorded on exploratory records are those observed at the time of investigation. The normal rate of investigation does not enable the recording of an equilibrium water level. Furthermore, groundwater levels are subject to seasonal variation, changes in weather and changes in local drainage conditions. Therefore, this information is provided for guidance only and no liability can be accepted for their accuracy.

The report should be read in its entirety, including all associated drawings and appendices. PWA Geo-Environmental Ltd cannot be held responsible for any misinterpretations arising from the use of extracts that are taken out of context.

The findings and opinions conveyed in this report (including review of any third-party reports) are based on information obtained from the sources listed, which PWA Geo-Environmental Ltd understands are reliable. All reasonable skill, care and diligence has been applied in examining the information obtained. However, PWA Geo-Environmental Ltd accepts no responsibility for inaccuracies in the data supplied or for opinions based on any such inaccurate data.

PWA Geo-Environmental Ltd reserves the right to amend their conclusions and recommendations in the light of further information that may become available.

2 INTRODUCTION

2.1 The Commission and Brief

PWA Geo-Environmental Ltd (PWAG) was commissioned by M Stone Property Development & Management Ltd to undertake a Phase 2 Geo-environmental and Coal Mining Risk Assessment (CMRA) at a site located off Faith in Nature, Former Ashworth Frazer Site, Higher Ainsworth Road, Radcliffe. The overall objectives were to:

- Carry out rotary probehole drilling within an area of the site proposed for a new infill building. The objective is to ascertain the thickness of competent cover above shallow coal/ potential mine workings, if present and determine the risks associated with unrecorded shallow coal mining features.
- Investigate the potential ground gas risk associated with the shallow coal seams.
- Evaluate the potential ground gas risk associated with the nearby historic landfill to the south (an infilled railway cutting) and former reservoir.
- Outline recommendations for further works where necessary.

2.2 The Proposed Development

It is understood that the development proposal for the site comprises the construction of a one storey steel framed infill structure amongst existing buildings.

A copy of the proposed development is presented, Drawing No. 20.173.005B in **Appendix A**. Any changes to the proposed layout, site levels and/ or end use may require amendments to this report.

2.3 Scope of the Coal Mining Risk Assessment

Key tasks of this CMRA are summarised as follows:

- Drill three rotary open hole boreholes (BH01 to BH03) to evaluate the potential presence of shallow unrecorded mine workings.
- Use that information to identify and assess the risks to the proposed development from coal mining legacy, including the cumulative impact of such issues.
- Set out appropriate mitigation measures to address the coal mining legacy issues affecting the site, including any necessary remedial works and/or demonstrate how coal mining issues have influenced the proposed development.
- Demonstrate to the Local Planning Authority that the application site is, or can be made, safe and stable to meet the requirements of national planning policy with regard to development on unstable land.

A further one borehole (BH04) was drilled in the south of the site to install ground gas monitoring instrumentation to measure gas produced from the historic landfill. Boreholes BH01-03 were also installed in order to monitor for any landfill gas migration.

This report relied on published information and information provided by the client and other parties during the given time period.

2.4 Terms of Reference

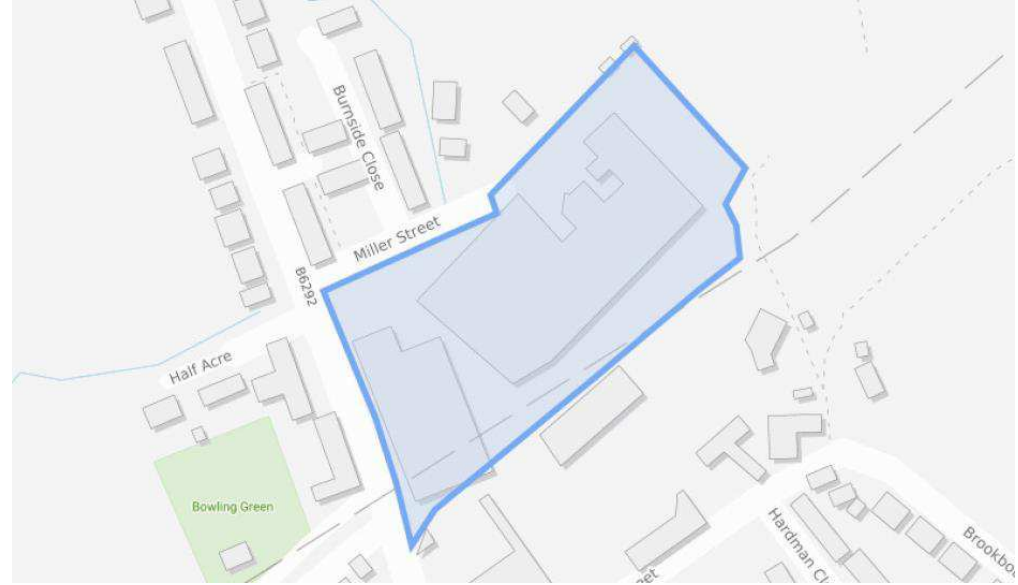
The information sources used in the preparation of this report include:

- PWA Geoenvironmental - Phase 2 Geo-Environmental Assessment (November 2021) – Faith in Nature – Ref: 21053-PWAG-00-XX-LTR-G-2000-P01
- PWA Geoenvironmental - Phase 1 Geo-Environmental Assessment (February 2022) – Faith in Nature – Ref: 21053-PWAG-00-XX-RP-G-1000-P01
- Geological information including Online British Geological Survey (BGS) published geological data, the Geo Insight report presented in the Phase 2 report, the BGS 1:50,000 Series Sheet and BGS Lancashire Sheet 87SE (six inches to one mile).
- The Coal Authority – Consultants Coal Mining Report (February 2022) – Faith in Nature, Miller Street, Radcliffe, Bury, M26 4AD – (Ref: 51002965362001).
- The Coal Authority online interactive map viewer.
- BGS historic borehole records.
- CIRIA C758D. Abandoned mine workings manual. 2019.

PWAG cannot accept responsibility for the reliability and authenticity of published information or reports prepared by third parties.

3 SITE LOCATION AND DETAILS

Table 1. Site Location and Details.	
Site Address	Former Ashworth Frazer Site, Higher Ainsworth Road, Radcliffe, Manchester M26 4AF.
National Grid Reference	SD 77673 08929
Area	Approximately 1.83 hectares.
Site Location	Figure 1 (from the Groundsure Report) is included as a site location plan.

Table 1. Site Location and Details.		
		
Ground Cover	Ground Cover	
	Landscaped grass	Landscaped grass
	Built units and hardstanding	Built units and hardstanding
Known services	Electricity and communications cables were identified on site. The positions of these services were traced on site by a competent and trained operator using a CAT scanner.	
Current Use	Industrial warehouse.	
Proposed Use ¹	Industrial warehouse and offices.	

4 PREVIOUS REPORT

In February 2022 a Phase 1 Geo-Environmental and Coal Mining Risk Assessment (CMRA) was undertaken by PWA Geoenvironmental (Ref: 21053-PWAG-00-XX-RP-G-1000-P01). Key findings of this are summarised below:

Table 2. Summary of Previous Report.	
Site Description	The site is accessed from Miller Street and comprises four large industrial and commercial buildings, of which one is derelict, two are in-use, and one was being demolished when the site walkover was undertaken. Concrete paved areas lie between the buildings and a concrete yard area is currently present where the fifth unit is proposed to be built. The in-use buildings are office cum warehouse units owned and used by Faith in Nature. The derelict building is built mostly of brick and is empty. It is unclear what the demolished building once was. The derelict building and one of the in-use buildings together form a 'U' shape in the northeast part of site and surround the concrete yard area. The site is surrounded by palisade steel fencing. Although three above ground storage tanks (AGSTs) were indicated on historic Ordnance Survey maps these were not observed during the site inspection and have been removed from site. No visual or olfactory evidence of contamination was observed on site.

¹ Different site uses may introduce changes to pollutant linkages that are not considered in this report.

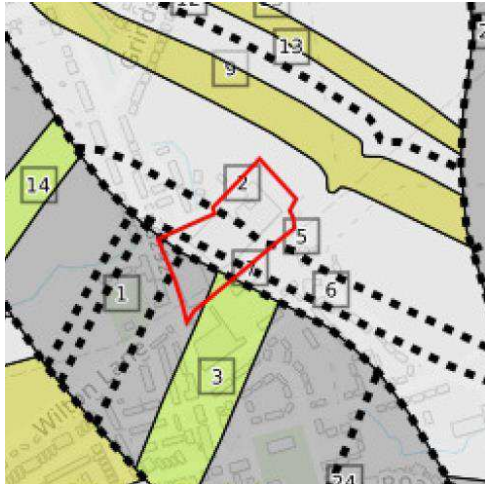
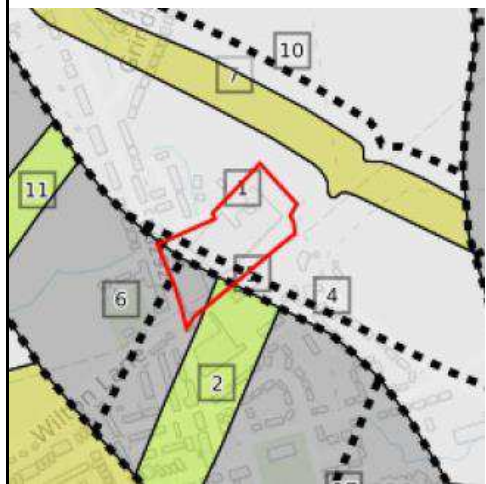
Table 2. Summary of Previous Report.	
Site History	The earliest map of 1850 shows the southeast of the site occupied by railway cutting and Black Lane Railway Station. Foundry Mill (cotton) and reservoir appears on site by 1890 and is joined by Black Lane Engineering Works by 1908. There is gradual expansion of these buildings and the railway is dismantled by the 1970s. In the 1980s a new building and tank appeared in the southwest of the site alongside Higher Ainsworth Road and covers the dismantled railway line. The remaining section of the railway cutting appears to have been infilled. Surrounding land use was mostly agricultural until development of Black Lane Mills to the south and gradual residential development.
Published Geology	The former railway cutting (running along the southeast boundary of the site) is mapped as infilled ground. Superficial deposits comprise glacial till (diamicton) across much of the site and neighbouring land. Till is absent from a narrow northwest southeast trending strip and the infilled railway cutting. The six inch map identifies the abandoned mine shaft for Black Lane Colliery approximately 15m southeast of the site (identified as 377408-004). This records the thickness of superficial strata (logged as boulder clay) to be 8.23 m. Bedrock comprises undifferentiated mudstone, siltstone and sandstone of the Pennine Lower Coal Measures Formation (PLCM) with named coal seams identified. However, this pattern is complicated by differences in mapped geology between the 1:10,000 and 1:50,000 maps. The geology is further complicated by a northwest southeast trending fault conjectured to run beneath the southwestern portion of the site. As the coal seam in this block (considered to be [1] & [6] Windmill and Lower Yard Mines) is conjectured to be underneath existing buildings where no development is proposed this is not considered further. Bedrock geology 1:10,000  Bedrock geology 1:50,000  Northeast of the fault the geological sequence from old to young strata comprises: [13] & [10] Hell Hole Mine [2], [9], [1] & [7] Undifferentiated PLCM and sandstone [5] Five Quarters Mine (shown on 1:10,000 sheet only) [6] & [4] Doe Mine [7] & [5] Fault These strata are indicated to dip at 8° to the southwest. Therefore, the Hell Hole Mine that is conjectured to subcrop 126 m to the northeast is expected to be at a depth of 17.7 m. Online records indicate this seam varied between 0.76 m and 1.22 m thick. The Coal Authority Consultants Report indicates that the site is underlain by workings in the Wigan Four Feet at a depth of 19 m: this depth corresponds to the Hell Hole Mine. This opinion is complicated by notes on the six inch map for the former Black Lane Colliery mine shaft. This records rockhead at 8.23 m and the first recorded coal seam it encounters is the Hell Hole Mine at a depth of 38.41 m. The vertical succession on the geological map records the separation between the Five Quarters Mine and Hell Hole Mine to vary between 24 m and 27.6 m. On this basis one would have expected the Five Quarters Mine to have been encountered in the shaft.

Table 2. Summary of Previous Report.	
	Online records and the geological map provides no indication of seam thickness for the Doe and Five Quarters, although named seams were typically considered to be workable.
Potential Sources of Contamination	Potential sources of contamination identified during the desk study include: • Made ground associated with development of the site and historical activities including a railway cutting; • Above ground tanks (presumed historic/removed as they were not observed during the site inspection); and • Ground gases associated with infilled railway cutting and former reservoir. Contaminants could include heavy metals, polycyclic aromatic hydrocarbons, total petroleum hydrocarbons and asbestos.
Contaminated Land Risk Assessment	Based on the information contained in the desk study report, and with due regard to the commercial development, the site was considered to represent a low risk with respect to contaminated land liability issues.
Coal Mining Risk Assessment	The Coal Authority identifies the whole site and much of the surrounding land as a development high risk area. A Coal Authority mining report (presented in Appendix B) indicates that the property is within an area where coal is at or close to the surface and has been worked in the past. The Wigan Four Feet is reportedly located 19 m beneath the site with an extraction thickness of 1.0 m. The mining report also identified records of known mine entries although none of these are located on site and are unlikely to affect the proposed development Based on a review of geological mapping, Coal Authority information and advice that buildings on site have not been adversely affected by ground movement, we consider the risk to existing buildings to be low. This situation should be monitored to determine if conditions change. However, potential risk associated with recorded and unrecorded shallow mine workings on new buildings cannot be ruled out entirely and further assessment would be required in order to demonstrate that this is negligible. The Coal Authority has records of four mine entries. None of these are located within the study site and the closest is approximately 30 m from the proposed infill office building. On this basis they are not considered to represent a risk to the proposed development.
Recommendations	Based on the desk study findings, the following recommendations were made: • To facilitate the proposed development a geo-environmental investigation should be undertaken to assess existing conditions and provide information for substructure design. • To determine the risks associated with unrecorded shallow coal mining features on the new building we recommend that a series of rotary boreholes are drilled. We also recommend that gas monitoring wells are installed to evaluate gas risk associated with the onsite infilled railway cutting and reservoir. • A management plan should be implemented to evaluate whether ground conditions change at the site and evidence of subsidence appears in existing buildings. • Subject to the findings of this assessment, further work may be required particularly with regards to unrecorded mine workings (if present) to make them safe to current Coal Authority standards.

5 FIELDWORK and GROUND CONDITIONS ENCOUNTERED

5.1 Scope of Fieldwork

Table 3. Scope of Fieldworks.			
Start date:		03/05/2022	End date: 06/05/2022
Site Works Summary Fieldwork undertaken in May 2022 comprised three rotary boreholes drilled to a maximum target depth of 25 m bgl and one borehole drilled to 4 m bgl. The target depth was based on records in the Coal Authority report indicating workings existed beneath the site in the Wigan Four Feet at a depth of 19.0 m. These works were undertaken to investigate for possible historic mine workings, and to install ground gas monitoring equipment to check for any landfill gas. The drilling identified one 50 cm void at a depth of 23.50 m bgl in BH03.			
Technique	Exploratory Holes	Depths	Comments
Rotary Open Holing with	BH01-BH03	24.0 – 25.0 m bgl	Investigate the risks associated with unrecorded shallow coal mining features and allow installation of monitoring wells to

Table 3. Scope of Fieldworks.			
water recirculation			investigate the potential gas risk associated with landfill gas migration.
Rotary Open Holing	BH04	4 m bgl	Install monitoring well to investigate the presence or otherwise of landfill gas coming directly from the landfill.

Descriptions of strata and ground conditions encountered during investigation works are presented on the exploratory hole logs presented in **Appendix C**.

An Exploratory Hole Plan, Drawing No. 21053-PWAG-00-XX-DR-G-2001-P02 is presented in **Appendix A**.

5.2 Chemical Laboratory Testing

Selected samples of the made ground were tested for a range of potential contaminants under subcontract with a UKAS and MCERTS accredited laboratory. Chemical test reports, as received from the laboratory, are presented in **Appendix D**.

Based on the desk study and observations from the site walkover, there was a potential that historical land use could have given rise to localised ground contamination. The potential contaminants of concern identified by the preliminary conceptual site model were selected as the analytes for the samples recovered from site and included:

Table 4. Chemical Laboratory Testing		
Type of sample	No. of samples	Determinands
Made ground	2	Asbestos identification.
	1	Heavy metals, metalloids, polycyclic aromatic hydrocarbons (PAHs), free & total cyanide, phenols, sulphide, soil organic matter, total organic carbon, acid soluble sulphate and asbestos identification.
	2	Heavy metals, metalloids, polycyclic aromatic hydrocarbons (PAHs), free & total cyanide, phenols, sulphide, soil organic matter, total organic carbon and acid soluble sulphate.

5.3 Summary of Ground Conditions

Natural ground conditions encountered across the site generally reflects the published geology. A summary of the ground conditions encountered is presented in **Table 6**.

Table 5. Summary of Ground Conditions Encountered.		
Made ground was encountered in all positions, varied between 0.3 m to 4.0 m thick, and was variable in composition too. In the vicinity of the proposed new building, made ground varied between 0.3 m and 1.2 m thick. Made ground was deeper in the railway cutting and still present at the bottom of the hole at 4.0 m bgl. Underlying glacial till deposits were encountered at all investigation locations and typically comprised soft to firm slightly gravelly clay, though there was one instance of granular glacial till. Bedrock was encountered in BH01, BH02, and BH03 between 1.5 m and 3.4 m bgl and comprised sandstone and mudstone. One void was encountered in BH03 at 23.5 m bgl measuring 500 mm.		
Strata	Depth Encountered (Thickness)	Description
Made Ground	Ground level (0.30 to 4.0 m)	Highly variable layers, comprising mixed amounts of granular and cohesive material. Anthropogenic material encountered includes brick, coal, and plastic. Encountered in all boreholes.
Glacial Till	0.30 – 1.20 m bgl (0.60 to 3.10 m)	Generally described as soft to firm with varying colour, slightly gravelly CLAY. There was one instance of granular glacial till described as light greyish brown clayey very sandy GRAVEL of sandstone and coal.
Mudstone	1.50 - 3.40 m bgl (1.5 to 15.1 m)	Generally described as grey MUDSTONE with occasional silty and sandy horizons. Encountered in BH01, BH02, and BH03.
Sandstone	4.0 m – 18.50 m bgl (unproven)	Described as red sandstone. Encountered in BH01, BH02, and BH03.
Void	23.50 m bgl (0.5 m)	Encountered in BH03. Thickness of void measured, however, drilling ceased due to loss of flush in void.

5.4 Material Properties

5.4.1 Standard Penetration Tests (SPTs)

A total of four SPT values were collected from the glacial till and the uncorrected values range between 8 and 29. There appeared to be an increase in value with depth although this should be treated with caution because the dataset was quite small.

One SPT was collected from within the weathered mudstone bedrock, this was stopped after 50 blows with 170 mm of penetration.

5.4.2 Water Soluble Sulphate

Sulphate concentrations and pH values measured after the first intrusive investigation in November 2021 indicated a Design Sulphate Class of DS-1 and ACEC Class of AC-1s is appropriate.

5.5 Groundwater

No groundwater strikes were recorded. This was primarily down to the fact that water was used as the drilling flush. Therefore, the possibility of groundwater existing at shallow depth cannot be ruled out.

5.6 Ground Gas Monitoring

The working environment was monitored for methane, carbon dioxide and oxygen during drilling works as detailed by the Coal Authority Permit. No concentrations above background levels were detected.

A ground gas monitoring program for the site is underway which includes six visits at fortnightly intervals. So far four monitoring visits have been completed, the results of which are documented in **Appendix E**.

Looking at the data so far, no methane has been detected, the highest concentration of CO₂ recorded is 3.7 % v/v, and the highest flow recorded has been -2.4 l/hr on the first visit in BH01. This flow equalised within 1 second.

A full evaluation of the results will be carried out once the monitoring programme is completed. However, subject to the findings of the ground gas monitoring programme it is likely that any risk (if present) can be mitigated by appropriate control measures or remedial measures.

6 RESULTS OF CHEMICAL TESTING

6.1 Assessment Criteria

All laboratory test data were reviewed for completeness and consistency. Those determinants that indicate potential contamination were subject to further evaluation.

For each potential contaminant of concern, analytical data for soil samples were compared to the relevant Generic Assessment Criterion (GAC), taking account of the Soil Organic Matter (SOM) content. For this site, the most appropriate generic criteria against which to screen the soils analysis Category 4 Screening Levels (C4SL) from DEFRA and the Atkins ATRISK SSVs commercial for a 1% Soil Organic Matter content. The benzo(a)pyrene C4SL has been published in lieu of other genotoxic PAH constituents based on the adoption of the surrogate marker approach. The analysis of the PAH profile falls within the upper and lower ratios as published by the DEFRA C4SL Project Methodology showing that the surrogate marker approach is a valid approach for the dataset.

Where there are no applicable generic assessment criteria (GAC) for a given contaminant / parameter, it has been excluded from the table. Where analysis returned a concentration in excess of the GAC, the relevant sample is highlighted orange.

In the cases where all the samples tested for a given substance were below the GAC, no further consideration is necessary for that substance.

Usually, statistical analysis of the results is undertaken in accordance with CL:AIRE statistics guidance. The purpose is to determine whether there is enough evidence that the true mean concentration of each determinant is less than the relevant GAC for that substance. On this occasion, statistical analysis has not been carried out due to the small data set and variability of made ground.

6.2 Chemical Analysis - Soils

The chemical analysis certificates as received from the laboratory are presented in **Appendix D**. This information for the seventeen made ground samples analysed is summarised in **Table 6**.

Table 6. Summary of Soils Analysis (Made Ground)							
Determinand	Unit	GAC for Commercial End Use 1% SOM (Sand)	Source Reference	Made Ground 0.20 m – 0.80 m bgl		No. of samples	No. of exceedances
				Min	Max		
Metals and inorganics							
Phenol Index	mg/kg	685	SSV	<0.6	<0.6	3	0
Total Cyanide	mg/kg	373 (Free Cyanide)	SSV	<0.6	<0.6	3	0
Arsenic	mg/kg	635	C4SL	11	48.5	3	0
Cadmium	mg/kg	410	C4SL	0.2	0.5	3	0
Copper	mg/kg	106,000	SSV	36.5	261.5	3	0
Lead	mg/kg	2,310	C4SL	26.1	365.4	3	0
Mercury, elemental	mg/kg	7.95	SSV	<0.5	<0.5	3	0
Nickel	mg/kg	1,770	SSV	21.5	110.8	3	0
Selenium	mg/kg	13,000	SSV	<0.5	<0.5	3	0
Chromium VI	mg/kg	49.1	C4SL	<0.1	<0.1	3	0
Zinc	mg/kg	1,100,000	SSV	87.5	114.1	3	0
Organics – Polycyclic aromatic hydrocarbons							
Acenaphthene	mg/kg	83,600	SSV	<0.09	<0.10	3	0
Acenaphthylene^	mg/kg	76.3	SMA	<0.09	<0.09	3	0
Anthracene	mg/kg	535,000	SSV	<0.09	0.12	3	0
Benzo[a]anthracene^	mg/kg	76.3	SMA	<0.09	0.36	3	0
Benzo[a]pyrene^	mg/kg	76.3	C4SL	<0.09	0.32	3	0
Benzo[b]fluoranthene^	mg/kg	76.3	SMA	<0.09	0.37	3	0
Benzo[g,h,i]perylene^	mg/kg	76.3	SMA	<0.09	0.16	3	0
Benzo[k]fluoranthene^	mg/kg	76.3	SMA	<0.09	0.16	3	0
Chrysene^	mg/kg	76.3	SMA	<0.09	0.35	3	0
Dibenzo[a,h]anthracene^	mg/kg	76.3	SMA	<0.09	<0.10	3	0
Fluoranthene	mg/kg	72,200	SSV	<0.09	0.58	3	0
Fluorene	mg/kg	66,500	SSV	<0.09	<0.10	3	0
Indeno[1,2,3-cd]pyrene^	mg/kg	76.3	SMA	<0.09	0.18	3	0
Naphthalene	mg/kg	90.1 (75 (sol))	C4SL	<0.09	0.2	3	0
Phenanthrene^	mg/kg	76.3	SMA	<0.09	0.51	3	0
Pyrene	mg/kg	54,100	SSV	<0.09	0.55	3	0
Asbestos Identification							
Asbestos	NA	NAIS	NA	NAIIS	NAIIS	3	0

Note: SSVs = Atkins Soil Screening Values
 ^ PAHs assessed using surrogate marker approach (SMA)
 C4SL = Category 4 Screening Levels
 NAIIS = No asbestos identified in sample

Five samples were taken from the made ground to a maximum depth 0.8 m bgl.

Metals and inorganic analytes

No metals, metalloids or cyanide exceeded the relevant GAC in the samples analysed.

Organics

No organics exceeded the relevant GAC in the samples analysed.

Asbestos

No asbestos was identified in any of the three samples inspected.

7 RISK ASSESSMENT AND REVISED CONCEPTUAL SITE MODEL

7.1 Revised Conceptual Site Model (Contamination)

The preliminary conceptual site model has been revised in light of the ground investigation and associated chemical analysis results, updating our understanding of surface and sub-surface features and contaminant sources. This determined that made ground does not contain potential contaminants at concentrations above generic assessment criteria for commercial/ industrial land use.

Contaminated materials and their sources identified on site present concern on the condition, that a potential impermissible risk exists. The possibility for harm to occur on site requires the fulfilment of three conditions:

- **Source:** The presence of substances (potential contaminants/pollutants), that may cause harm or pollution.
- **Pathway:** A route that the Source takes to reach the Receptor.
- **Receptor:** The existence of an entity that may become harmed from the Source.

In order to assess the risk posed by contamination at the site, the above rationale was applied in the Phase 1 report and is summarised below in Table 7:

Table 7. Source, Pathway and Receptors		
Potential Sources of Contamination	Potential Transport Pathways and Pollutant Linkages	Potential Receptors
On-site sources Potential sources of contamination identified include: • Ground gases associated with infilled railway cutting and former reservoir.	• Inhalation of hazardous ground gases (asphyxiation). • Accumulation of hazardous ground gases in confined spaces (explosion).	Human Health • Current site users. • Future site users. • Construction workers during redevelopment works.

7.2 Qualitative Risk Assessment

A qualitative risk assessment is undertaken of potential pollutant linkages following the guidance presented in **Appendix F**, and is based on consideration of both:

- The likelihood of an event (probability – considers both the presence of the hazard and receptor and the integrity of the pathway); and
- The severity of the potential consequence (considers both the potential severity of the hazard and the sensitivity of the receptor).

Potential risks related to these plausible linkages are based on redevelopment of the site with a proposed commercial end use assuming no mitigation is implemented. These are summarised in Table 8.

Table 8. Preliminary Environmental Risk Assessment					
Source	Pathways to Receptor	Receptors	Associated Hazard [Potential severity]	Likelihood / Potential Mitigation	Potential Risk
Ground gases.	Inhalation of hazardous ground gases (asphyxiation). Accumulation of hazardous ground gases in confined spaces (explosion).	Current and future site users.	Asphyxiation/ explosion [Medium]	Low likelihood: The former reservoir was built over in the 1970s. The railway cutting was landfilled by the late 1980s and the licenses surrendered by the 1990s. Given that the buildings have been in occupation since this date with no adverse issues noted it would seem that this is not a significant source of ground gas. A programme of ground gas monitoring is underway and a risk assessment will be carried out once this is completed.	Moderate/ low

Table 8. Preliminary Environmental Risk Assessment					
Source	Pathways to Receptor	Receptors	Associated Hazard [Potential severity]	Likelihood / Potential Mitigation	Potential Risk
		Construction workers.		Low likelihood: Access to confined spaces must be prevented unless undertaken in accordance with a standard operating procedure.	Moderate/low

8 ENVIRONMENTAL RISK ASSESSMENT AND RECOMMENDATIONS

The conceptual site model has not identified potential pollutant linkages associated with contaminated made ground.

8.1 Human Health

Ground contamination has not been observed and the soils are considered suitable for reuse.

However, made ground containing fragments of anthropogenic material (such as glass, brick and concrete) is considered texturally unsuitable and should be sealed under the hardcover of the development (buildings, service yards and parking areas) or clean imported topsoil used in landscaped areas.

8.2 Controlled Waters

Given the absence of any significant on site sources of contaminants, the site is not considered to pose a significant risk to controlled waters.

8.3 Radon

The Phase 1 report concluded that radon protection measures are not required for this development, this should be confirmed with local building control.

8.4 Ground Gas

A programme of ground gas monitoring is underway. Subject to the findings of the ground gas monitoring programme it is likely that any risk (if present) can be mitigated by appropriate control measures or remedial measures.

8.5 New Utilities and Water Supply Pipes

Water supply pipes should be specified and laid in accordance with the regional water supply company's specifications and should be confirmed with the service provider. Made ground and glacial till was encountered. The use of 'standard' polyethylene water supply pipes may be acceptable. However, we recommend that this is discussed with the water supply company before development starts.

8.6 Waste Management

The handling, re-use or disposal of waste is regulated by the Environment Agency. Any material excavated on-site may be classified as waste and it is the responsibility of the holder of a material to form their own view on whether or not it is waste. One of the ways this can be achieved is set out in the Definition of Waste: Development Industry Code of Practice (DoWCoP). This builds on the Environment Agency guidance document Definition of waste: developing greenfield and brownfield sites (2006). The Agency will consider the use of the DoWCoP in deciding whether to regulate materials as waste. If materials are dealt with in accordance with the DoWCoP, the Agency considers that those materials are unlikely to be waste at the point when they are to be used for the purpose of land development.

Good practice has three basic elements:

- Ensuring that an adequate Materials Management Plan (MMP) is in place, covering the use of materials on a specific site.
- Ensuring that the MMP is based on an appropriate risk assessment, concluding that the objectives of preventing harm to human health and pollution of the environment will be met if materials are used in the proposed manner.

- Ensuring that the requirements of the MMP are met.

All material proposed for off-site disposal (e.g. during future construction works) should be given a proper description and waste classification as required by the Environmental Protection Duty of Care Regulations, and in accordance with WM3 and the Environment Agency Technical Guidance on the assessment and classification of Hazardous Waste. Advice on the classification of wastes containing asbestos is provided in Chapter 3 of Environment Agency document 'Guidance on the classification and assessment of waste Technical Guidance WM3'.

8.7 Reuse of Site Won Material

This project is likely to require the reuse of natural soils and made ground on site as part of the proposed earthworks. Therefore, the contractor will need to prepare a Materials Management Plan (MMP) in accordance with the CL:AIRE Code of Practice (v2, March 2011). Alternatively, where quantities are small, a suitable exemption may be more appropriate.

The MMP will document how all of the materials to be excavated during the proposed site preparatory earthworks are to be dealt with. The MMP should also detail how materials will be tracked throughout the earthworks in order that the subsequent Verification Report can provide an auditable trail. Finally, the MMP will have to set out a Verification Plan that identifies how the placement of materials is to be recorded and the quantities of material to be used. It will contain a statement on how the use of the materials relate to the remediation or design objectives.

In the event that materials from this site are required to be transferred to other locations, or material is imported for landscaping, the MMP will assist with verification for regulatory authorities.

Once completed, the MMP will need to be reviewed by a Qualified Person (QP), who will sign a Declaration for submission to CL:AIRE and send a copy to the Client.

8.8 Unexpected finding protocol

If unexpected potentially contaminated materials (such as those with an unusual colour, odour or containing drums, chemicals or asbestos, etc) are encountered at any time during redevelopment then work should stop, and a suitably qualified environmental consultant contacted to provide advice on the appropriate course of action.

9 ASSESSMENT OF SITE-SPECIFIC COAL MINING RISKS

The potential risk associated with coal mining for the proposed development is posed by shallow mineworkings. There are no mine entries considered to be within influencing distance of the site and this was discounted as a risk in the Phase 1 report (PWAG, February 2022).

Notes on the six inch geological map for the former Black Lane Colliery mine shaft (located south of the site) records rockhead at 8.23 m. According to the Coal Authority report, the site is underlain by workings in the Wigan Four Feet at a depth of 19.0 m. This seam is recorded as having an extraction thickness of 1.0 m, was last mined in 1900 and dips at a rate of 8°. On the basis of this information, these workings were considered to represent a risk as there was approximately 10 times seam thickness of rock cover. Therefore, potential risk associated with the Wigan Four Feet has been reviewed in light of the information within this report and summarised below:

- Three rotary boreholes were advanced to depths of 24.0 m to 25.0 m bgl.
- No indication of workings, or coal, was encountered in two of the boreholes (BH01 and BH02).
- BH01 encountered made ground to 0.3 m, glacial till to 3.4 m and competent mudstone bedrock with sandstone bands from 3.4 – 25 m bgl.
- BH02 encountered made ground to 0.9 m, glacial till to 1.5 m, mudstone to 7.5 m and mudstone with sandstone bands from 7.5 – 25 m bgl.
- The only indication of shallow mineworkings was a 500 mm void encountered in BH03 at 23.5 m bgl. BH03 encountered made ground to 1.2 m, glacial till to 4.0 m and mudstone bedrock with sandstone bands to 23.5 m bgl. This indicates 39 times seam thickness of competent cover.
- The void in BH03 is believed to be associated with the Wigan Four Feet, which was recorded by the Coal Authority to be present at a depth of 19.0 m bgl on site. It is not clear if this depth is based on a particular location or is indicative for the site as a whole. Based on a dip of 8° and assuming BH01 is approximately 18.0 m down dip of BH03, then the Wigan Four Feet may be present at 26.0 m at this location. However, BH02 is across strike from BH03 and did not encounter coal or a void. Given that the void is less than the

reported extraction thickness and its absence at BH02, the seam may have thinned and could indicate a washout.

- Given the proven depth of rock cover of 19.5 m in BH03, the workings are not considered to represent a significant risk of instability to the proposed development. Furthermore, the rock cuttings returned whilst drilling indicated the presence of relatively stronger sandstone bands. Assuming a worst case scenario that coal is slightly deeper in the other two boreholes then you still have a significant depth of competent rock cover (at least 23.5 m at BH02 and 21.6 m at BH01).

10 MITIGATION STRATEGY PROPOSED

It is generally accepted as a rule of thumb for crown hole collapse, ten times the seam thickness of competent rock cover is assumed to provide adequate protection for new developments from workings in underground coal. This is based on guidance given in CIRIA Special Publication 32, reprinted 2002. However, this publication has been superseded and the Coal Authority recently released Technical Guidance Note TGN01/2019 produced findings from a large subsidence event on a residential estate. In this note they advised that 'other subsidence mechanisms can occur, such as pillar failure, for which the 10 times rock cover rule of thumb is not an appropriate guide'.

Based on the information within this report and proven workings of the underlying coal seam, we consider that the risk to the proposed development from shallow mine workings is low and mitigation measures are not required. The depth of competent cover across the site was variable ranging from 19.5 m at BH03 to >23.5 m at BH02. Based on a 500 mm void encountered in BH03, this equates to at least 39 times seam thickness.

11 CONCLUSIONS AND RECOMMENDATIONS

This Phase 2 Geo-environmental and Coal Mining Risk Assessment has been performed at Faith in Nature, Radcliffe. It is understood that the proposed development comprises the construction of a one storey steel framed infill structure amongst existing buildings. For the purpose of this report, we have assumed that proposed levels will not be significantly different to those existing. If any of these assumptions are incorrect then the conclusions in this report may require reassessment.

Based on the information within this report and no significant shallow mineworkings or coal being detected, we consider that the risk to the proposed development from shallow mine workings is low and mitigation measures are not required.

Geological conditions are highly variable and the ground model upon which our conclusions are based was developed from three borehole records. The possibility of actual conditions being different to those indicated from drilling activities cannot be completely ruled out. Nonetheless, the conclusions presented in this report are considered reasonable based on the information available. However, if at any stage, conditions are observed on site to indicate otherwise then this should be brought to our attention for further evaluation.

Chemical testing of five samples of made ground did not identify any analytes at concentrations above generic assessment criteria for commercial/ industrial land use. Therefore, remediation is not considered necessary. However, made ground containing fragments of anthropogenic material (such as glass, brick and concrete) is considered texturally unsuitable and should be sealed under the hardcover of the development (buildings, service yards and parking areas) or clean imported topsoil used in landscaped areas.

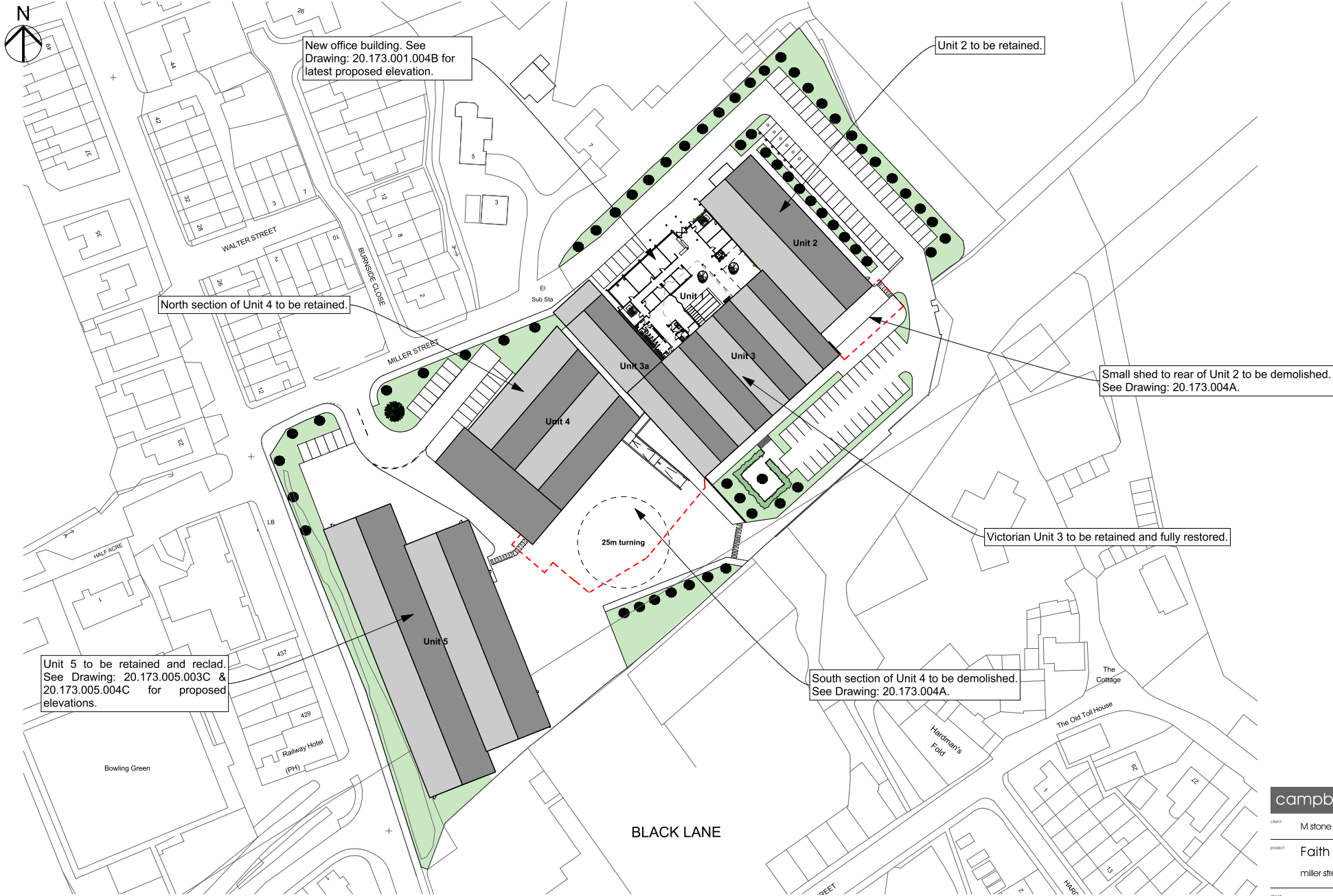
Currently, four out of six ground gas monitoring visits have been completed. Once the monitoring programme has been completed a ground gas addendum will be submitted discussing these results.

12 REGULATORY APPROVALS

The conclusions and recommendations presented in this report are considered reasonable based on the information that was available. However, these are not guaranteed to gain approval from regulatory authorities. Therefore, we recommend that copies of this report are passed to the appropriate regulator for review and comment before undertaking any additional work.

Appendix A

Drawings



proposed site plan 1:500





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KEY:

ROTARY BOREHOLE LOCATION

Rev

Date

Remarks

Drawn

Chk'd

Appendix B

Coal Authority Report



Consultants

Coal Mining Report

Faith In Nature
Miller Street
Radcliffe
Bury
M26 4AD

Date of enquiry: 14 February 2022
Date enquiry received: 14 February 2022
Issue date: 14 February 2022

Our reference: 51002965362001
Your reference: 21053.G.02



Consultants

Coal Mining Report

This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

PAUL WAITE ASSOCIATES

Enquiry address

Faith In Nature
Miller Street
Radcliffe
Bury
M26 4AD

How to contact us

0345 762 6848 (UK)
+44 (0)1623 637 000 (International)

200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

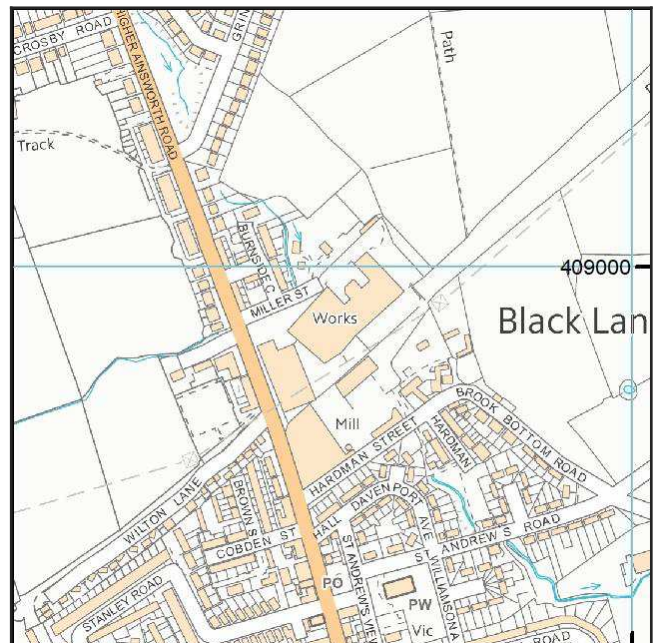
www.groundstability.com

 @coalauthority

 /company/the-coal-authority

 /thecoalauthority

 /thecoalauthority



Approximate position of property



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Section 1 – Mining activity and geology

Past underground mining

Colliery	Seam	Mineral	Coal Authority reference	Depth (m)	Direction to working	Dipping rate of seam worked (degrees)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
unnamed	WIGAN FOUR FEET	Coal	3Y8M	19	Beneath Property	8.0	South-West	100	1900
unnamed	CANNEL	Coal	3Y5Q	141	Beneath Property	8.0	South	150	1908
unnamed	CANNEL	Coal	3Y5R	165	South-East	8.0	South	150	1908

Probable unrecorded shallow workings

Yes.

Spine roadways at shallow depth

No spine roadway recorded at shallow depth.

Mine entries

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	377408-003	377757 408918		Coal	
Shaft	377408-004	377776 408903	May 2017 shaft found filled and capped at rockhead with 8.8m diameter, 0.6m thick cap of reinforced concrete by REFA Consulting Engineers.	Coal	
Shaft	377408-005	377802 408890		Coal	
Shaft	377409-007	377712 409051		Coal	

Abandoned mine plan catalogue numbers

The following abandoned mine plan catalogue numbers intersect with some, or all, of the enquiry boundary:

NW1148	16820	PO0
1200	NW1150	

Please contact us on 0345 762 6848 to determine the exact abandoned mine plans you require based on your needs.

Outcrops

Seam name	Mineral	Seam workable	Distance to outcrop (m)	Direction to outcrop	Bearing of outcrop
BULLDOG	Coal	Yes	Within	N/A	122
DOE	Coal	Yes	Within	N/A	115
PARK	Coal	Yes	Within	N/A	26
WHITE	Coal	Yes	32.9	North-West	27

Geological faults, fissures and breaklines

Please refer to the 'Summary of findings' map (on separate sheet) for details of any geological faults, fissures or breaklines either within or intersecting the enquiry boundary.

Fault under or close to the property recorded.

Opencast mines

None recorded within 500 metres of the enquiry boundary.

Coal Authority managed tips

None recorded within 500 metres of the enquiry boundary.

Section 2 – Investigative or remedial activity

Please refer to the 'Summary of findings' map (on separate sheet) for details of any activity within the area of the site boundary.

Site investigations

Distance to site investigation (m)	Direction
20.0	South-East

See Section 4 for further information.

Remediated sites

None recorded within 50 metres of the enquiry boundary.

Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

Mine gas

None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.

Section 3 – Licensing and future mining activity

Future underground mining

None recorded.

Coal mining licensing

None recorded within 200 metres of the enquiry boundary.

Court orders

None recorded.

Section 46 notices

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

Withdrawal of support notices

The property is not in an area where a notice to withdraw support has been given.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

Payments to owners of former copyhold land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Section 4 – Further information

The following potential risks have been identified and as part of your risk assessment should be investigated further.

Development advice

The site is within an area of historical coal mining activity. Should you require advice and/or support on understanding the mining legacy, its risks to your development or what next steps you need to take, please contact us.

Site investigations

The site is within an area of previous interest. It is close to where the Coal Authority has received information relating to past site investigations.

The site requires further investigation and may influence how you approach your risk assessment.

For further information on specific site or ground investigations in relation to any issues raised in Section 4, please call us on 0345 762 6848 or email us at groundstability@coal.gov.uk.

Section 5 – Data definitions

The datasets used in this report have limitations and assumptions within their results. For more guidance on the data and the results specific to the enquiry boundary, please **call us on 0345 762 6848** or **email us at groundstability@coal.gov.uk**.

Past underground coal mining

Details of all recorded underground mining relative to the enquiry boundary. Only past underground workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination, will be included.

Probable unrecorded shallow workings

Areas where the Coal Authority believes there to be unrecorded coal workings that exist at or close to the surface (less than 30 metres deep).

Spine roadways at shallow depth

Connecting roadways either, working to working, or, surface to working, both in-seam and cross measures that exist at or close to the surface (less than 30 metres deep), either within or within 10 metres of the enquiry boundary.

Mine entries

Details of any shaft or adit either within, or within 100 metres of the enquiry boundary including approximate location, brief treatment details where known, the mineral worked from the mine entry and conveyance details where the mine entry has previously been sold by the Authority or its predecessors British Coal or the National Coal Board.

Abandoned mine plan catalogue numbers

Plan numbers extracted from the abandoned mines catalogue containing details of coal and other mineral abandonment plans deposited via the Mines Inspectorate in accordance with the Coal Mines Regulation Act and Metalliferous Mines Regulation Act 1872. A maximum of 9 plan extents that intersect with the enquiry boundary will be included. This does not infer that the workings and/or mine entries shown on the abandonment plan will be relevant to the site/property boundary.

Outcrops

Details of seam outcrops will be included where the enquiry boundary intersects with a conjectured or actual seam outcrop location (derived by either the British Geological Survey or the Coal Authority) or intersects with a defined 50 metres buffer on the coal (dip) side of the outcrop. An indication of whether the Coal Authority believes the seam to be of sufficient thickness and/or quality to have been worked will also be included.

Geological faults, fissures and breaklines

Geological disturbances or fractures in the bedrock. Surface fault lines (British Geological Survey derived data) and fissures and breaklines (Coal Authority derived data) intersecting with the enquiry boundary will be included. In some circumstances faults, fissures or breaklines have been known to contribute to surface subsidence damage as a consequence of underground coal mining.

Opencast mines

Opencast coal sites from which coal has been removed in the past by opencast (surface) methods and where the enquiry boundary is within 500 metres of either the licence area, site boundary, excavation area (high wall) or coaling area.

Coal Authority managed tips

Locations of disused colliery tip sites owned and managed by the Coal Authority, located within 500 metres of the enquiry boundary.

Site investigations

Details of site investigations within 50 metres of the enquiry boundary where the Coal Authority has received information relating to coal mining risk investigation and/or remediation by third parties.

Remediated sites

Sites where the Coal Authority has undertaken remedial works either within or within 50 metres of the enquiry boundary following report of a hazard relating to coal mining under the Coal Authority's Emergency Surface Hazard Call Out procedures.

Coal mining subsidence

Details of alleged coal mining subsidence claims made since 31 October 1994 either within or within 50 metres of the enquiry boundary. Where the claim relates to the enquiry boundary confirmation of whether the claim was accepted, rejected or whether liability is still being determined will be given. Where the claim has been discharged, whether this was by repair, payment of compensation or a combination of both, the value of the claim, where known, will also be given.

Details of any current 'Stop Notice' deferring remedial works or repairs affecting the property/site, and if so the date of the notice.

Details of any request made to execute preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. If yes, whether any person withheld consent or failed to comply with any request to execute preventative works.

Mine gas

Reports of alleged mine gas emissions received by the Coal Authority, either within or within 500 metres of the enquiry boundary that subsequently required investigation and action by the Coal Authority to mitigate the effects of the mine gas emission.

Mine water treatment schemes

Locations where the Coal Authority has constructed or operates assets that remove pollutants from mine water prior to the treated mine water being discharged into the receiving water body.

These schemes are part of the UK's strategy to meet the requirements of the Water Framework Directive. Schemes fall into 2 basic categories: Remedial – mitigating the impact of existing pollution or Preventative – preventing a future pollution incident.

Mine water treatment schemes generally consist of one or more primary settlement lagoons and one or more reed beds for secondary treatment. A small number are more specialised process treatment plants.

Future underground mining

Details of all planned underground mining relative to the enquiry boundary. Only those future workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination will be included.

Coal mining licensing

Details of all licenses issued by the Coal Authority either within or within 200 metres of the enquiry boundary in relation to the under taking of surface coal mining, underground coal mining or underground coal gasification.

Court orders

Orders in respect of the working of coal under the Mines (Working Facilities and Support) Acts of 1923 and 1966 or any statutory modification or amendment thereof.

Section 46 notices

Notice of proposals relating to underground coal mining operations that have been given under section 46 of the Coal Mining Subsidence Act 1991.

Withdrawal of support notices

Published notices of entitlement to withdraw support and the date of the notice. Details of any revocation notice withdrawing the entitlement to withdraw support given under Section 41 of the Coal Industry Act 1994.

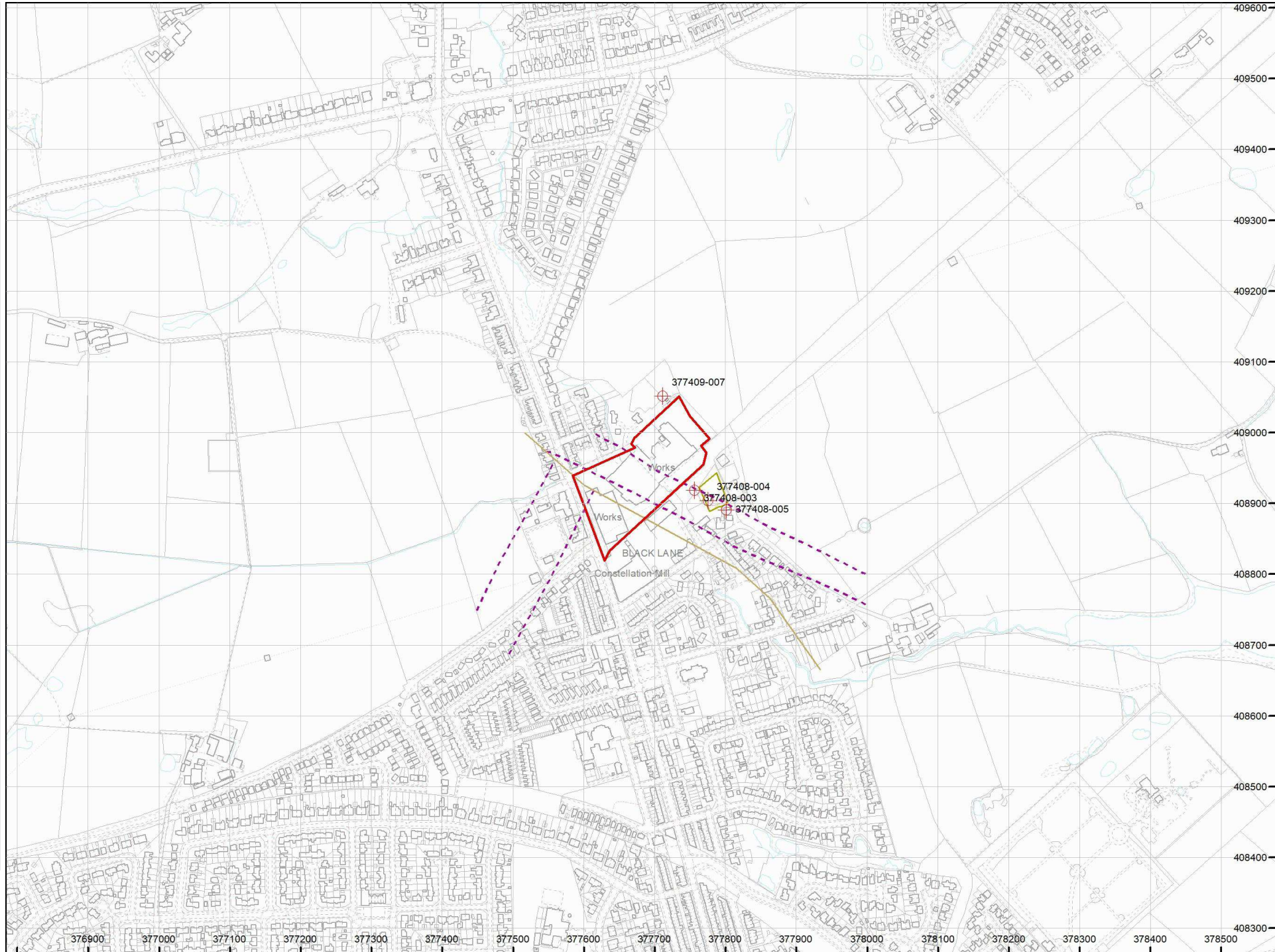
Payment to owners of former copyhold land

Relevant notices which may affect the property and any subsequent notice of retained interests in coal and coal mines, acceptance or rejection notices and whether any compensation has been paid to a claimant.

The map highlights any specific surface or subsurface features within or near to the boundary of the site.

Key

- Approximate position of the enquiry boundary shown 
- Disused mine shaft 
- Outcrop (Conjectured) 
- Geological faults 
- Site investigations 



How to contact us

0345 762 6848 (UK)
+44 (0)1623 637 000 (International)
www.groundstability.com

Appendix C

Exploratory Hole Logs

		PWA Geo-Environmental Ltd Summit House, Riparian Way BD20 7BW		BOREHOLE LOG				Borehole ID: BH01 Sheet 2 of 3			
Project Name:		Radcliffe				Project Number: 21053		Elevation:		Hole Type: RO	
Project Location:		Faith in Nature, Radcliffe				Coordinates: E377697, N408971				Scale: 1:50	
Client Name:		Stone Build				Dates: 04/05/2022				Logged By: AP	
Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description				
		Depth (m)	Type	Results							
					18.50		Grey MUDSTONE with occasional clay and reddish sandstone bands. MUDSTONE	11			
									12		
								13			
								14			
								15			
								16			
								17			
							18.00 - 18.075 m: slow drilling (possibly hard mudstone).	18			
							Grey MUDSTONE with reddish sandstone bands. MUDSTONE	19			
								20			
Remarks: Geological descriptions based on drillers descriptions. Hole terminated at target depth of 25 m bgl. Upon completion the borehole was installed with a 50 mm standpipe to a depth of 2.50 m bgl									ES - Environmental sample B - Bulk sample D - Disturbed sample SPT - Std. Penetration Test Approved by: IP		

		PWA Geo-Environmental Ltd Summit House, Riparian Way BD20 7BW		BOREHOLE LOG				Borehole ID: BH01 Sheet 3 of 3			
Project Name:		Radcliffe				Project Number: 21053		Elevation:		Hole Type: RO	
Project Location:		Faith in Nature, Radcliffe				Coordinates: E377697, N408971				Scale: 1:50	
Client Name:		Stone Build				Dates: 04/05/2022				Logged By: AP	
Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description				
		Depth (m)	Type	Results							
					25.00		Grey MUDSTONE with reddish sandstone bands. MUDSTONE	21			
								22			
								23			
								24			
								25			
								26			
								27			
								28			
								29			
								30			
Remarks: Geological descriptions based on drillers descriptions. Hole terminated at target depth of 25 m bgl. Upon completion the borehole was installed with a 50 mm standpipe to a depth of 2.50 m bgl								ES - Environmental sample B - Bulk sample D - Disturbed sample SPT - Std. Penetration Test			
								Approved by: IP			

		PWA Geo-Environmental Ltd Summit House, Riparian Way BD20 7BW		BOREHOLE LOG			Borehole ID: BH02 Sheet 1 of 3			
Project Name:		Radcliffe			Project Number: 21053		Elevation:		Hole Type: RO	
Project Location:		Faith in Nature, Radcliffe			Coordinates: E377696, N408986				Scale: 1:50	
Client Name:		Stone Build			Dates: 05/05/2022				Logged By: AP	
Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale		
		Depth (m)	Type	Results						
		0.20	ES	N=22 (1,2/2,4,8,8)	0.30		Dark brown slightly clayey sandy sub-angular to rounded fine to coarse GRAVEL sized fragments of sandstone, brick and coal. MADE GROUND	1		
		1.00 1.00	SPT(S) SPTLS		0.90					
		2.00 2.00	SPT(S) SPTLS		1.50					
							Light greyish brown clayey very sandy angular to sub-rounded GRAVEL of coal and sandstone. GLACIAL TILL Light grey weathered MUDSTONE. MUDSTONE	2		
								3		
								4		
								5		
								6		
							Light grey very clayey MUDSTONE. MUDSTONE <u>6.00 - 6.10 m: reddish sandstone band.</u>	7		
							Grey MUDSTONE with sandstone bands. MUDSTONE	8		
								9		
								10		

Remarks:

Geological descriptions based on drillers descriptions.
Hole terminated at target depth of 25 m bgl.
Upon completion the borehole was installed with a 50 mm standpipe to a depth of 1.50 m bgl

ES - Environmental sample
B - Bulk sample
D - Disturbed sample
SPT - Std. Penetration Test

Approved by: IP

		PWA Geo-Environmental Ltd Summit House, Riparian Way BD20 7BW		BOREHOLE LOG			Borehole ID: BH02 Sheet 2 of 3			
Project Name:		Radcliffe			Project Number: 21053		Elevation:		Hole Type: RO	
Project Location:		Faith in Nature, Radcliffe			Coordinates: E377696, N408986			Scale: 1:50		
Client Name:		Stone Build			Dates: 05/05/2022			Logged By: AP		
Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale		
		Depth (m)	Type	Results						
							Grey MUDSTONE with sandstone bands. MUDSTONE			
								11		
								12		
								13		
								14		
								15		
								16		
								17		
								18		
								19		
								20		
Remarks: Geological descriptions based on drillers descriptions. Hole terminated at target depth of 25 m bgl. Upon completion the borehole was installed with a 50 mm standpipe to a depth of 1.50 m bgl ES - Environmental sample B - Bulk sample D - Disturbed sample SPT - Std. Penetration Test Approved by: IP										

		PWA Geo-Environmental Ltd Summit House, Riparian Way BD20 7BW		BOREHOLE LOG				Borehole ID: BH03 Sheet 2 of 3			
Project Name:		Radcliffe				Project Number: 21053		Elevation:		Hole Type: RO	
Project Location:		Faith in Nature, Radcliffe				Coordinates: E377713, N408987				Scale: 1:50	
Client Name:		Stone Build				Dates: 03/05/2022				Logged By: AP	
Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description				
		Depth (m)	Type	Results							
							Grey MUDSTONE with sandstone bands. MUDSTONE				
								11			
								12			
								13			
								14			
								15			
								16			
								17			
								18			
								19			
								20			
Remarks: Geological descriptions based on drillers descriptions. Void encountered at 23.50 - 24.0 m bgl. Hole terminated at target depth of 25 m bgl. Upon completion the borehole was installed with a 50 mm standpipe to a depth of 3.0 m bgl									ES - Environmental sample B - Bulk sample D - Disturbed sample SPT - Std. Penetration Test		
									Approved by: IP		

		PWA Geo-Environmental Ltd Summit House, Riparian Way BD20 7BW		BOREHOLE LOG				Borehole ID: BH03 Sheet 3 of 3			
Project Name:		Radcliffe				Project Number: 21053		Elevation:		Hole Type: RO	
Project Location:		Faith in Nature, Radcliffe				Coordinates: E377713, N408987				Scale: 1:50	
Client Name:		Stone Build				Dates: 03/05/2022				Logged By: AP	
Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale			
		Depth (m)	Type	Results							
					23.50		Grey MUDSTONE with sandstone bands. MUDSTONE	21			
								22			
								23			
								24			
					24.00	VOID 23.50 m: Loss of flush.	Loss of flush and no returns. Presumed Mudstone. MUDSTONE	24			
					25.00			25			
								26			
								27			
								28			
								29			
								30			

Remarks: Geological descriptions based on drillers descriptions.
Void encountered at 23.50 - 24.0 m bgl.
Hole terminated at target depth of 25 m bgl.
Upon completion the borehole was installed with a 50 mm standpipe to a depth of 3.0 m bgl

ES - Environmental sample
B - Bulk sample
D - Disturbed sample
SPT - Std. Penetration Test

Approved by: IP

		PWA Geo-Environmental Ltd Summit House, Riparian Way BD20 7BW		BOREHOLE LOG			Borehole ID: BH04 Sheet 1 of 1			
Project Name:		Radcliffe			Project Number: 21053		Elevation:		Hole Type: RO	
Project Location:		Faith in Nature, Radcliffe			Coordinates: E377703, N408901				Scale: 1:50	
Client Name:		Stone Build			Dates: 06/05/2022				Logged By: AP	
Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale		
		Depth (m)	Type	Results						
					0.60		Dark brown slightly clayey sandy angular to sub-rounded fine to coarse GRAVEL sized fragments of brick, coal and sandstone. Frequent wood and plastic fragments. MADE GROUND	1		
					1.00					
							Grey slightly sandy slightly gravelly CLAY. Gravel sized fragments are sub-angular to rounded fine to coarse brick, sandstone and coal. Frequent wood and plastic fragments. MADE GROUND	2		
							Brown sandy very clayey sub-angular to rounded fine to coarse GRAVEL sized fragments of sandstone and brick. MADE GROUND	3		
					4.00		1.00 - 4.00 m: becomes clayey with depth.	4		
								5		
								6		
								7		
								8		
								9		
								10		
Remarks: Geological descriptions based on drillers descriptions. Hole terminated at target depth of 4 m bgl. Upon completion the borehole was installed with a 50 mm standpipe to a depth of 3.0 m bgl ES - Environmental sample B - Bulk sample D - Disturbed sample SPT - Std. Penetration Test Approved by: IP										

Appendix D

Laboratory Results

Certificate of Analysis

Client: PWA Geo-Environmental

Project: 22051468

Quote: BEC220123956 V1.2

Project Ref: Faith in Nature

Site: 21053

Contact: Ben Chapman

Address: Summit House
Riparian Way, The Crossings Cross Hills
Keighley
West Yorkshire
BD20 7BW

E-Mail: BenC@pwageo.co.uk

Phone: 01535 633350

No. Samples Received: 6

Date Received: 19/05/2022

Analysis Date: 01/06/2022

Date Issued: 06/06/2022

Report Type: Final Version 01

This report supercedes any versions previously issued by the laboratory



Account Manager
Martin Elliott-Palmer
01283 554137



Authorised by the Operations Manager
Becky Batham



Client: PWA Geo-Environmental
Project Name: Faith in Nature
Project No: 22051468
Date Issued: 06/06/2022

Samples Analysed

<u>Sample Reference</u>	<u>Text ID</u>	<u>Sample Date</u>	<u>Sample Type</u>
BH03-0-ES-0.20	22051468-001	03/05/2022 00:00:00	SOLID
BH03-0-ES-0.40	22051468-002	03/05/2022 00:00:00	SOLID
BH02-0-ES-0.20	22051468-004	05/05/2022 00:00:00	SOLID
BH04-0-ES-0.20	22051468-005	06/05/2022 00:00:00	SOLID
BH04-0-ES-0.80	22051468-006	06/05/2022 00:00:00	SOLID

Analysis Results

Analysis	Method Code	MDL	Units	Accred.	Sample ID	001	002	004	005	006
					Customer ID	BH03-0-ES-0.20	BH03-0-ES-0.40	BH02-0-ES-0.20	BH04-0-ES-0.20	BH04-0-ES-0.80
					Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID
					Sampling Date	03/05/2022	03/05/2022	05/05/2022	06/05/2022	06/05/2022
pH (2.5:1 extraction)	PHSOIL	1	pH units	UM			8.2	8.5		7.9
Chromium (VI) as Cr	KONENS	0.1	mg/kg^	N			<0.1	<0.1		<0.1
Free Cyanide	SFAPI	0.5	mg/kg^	UM			<0.6	<0.6		<0.6
Phenol Index	SFAPI	0.5	mg/kg^	U			<0.6	<0.6		<0.6
Thiocyanate	SFAPI	2	mg/kg^	UM			<2.3	<2.4		<2.5
Sulphide as S	SFAPI	0.5	mg/kg^	N			<0.6	<0.6		0.9
Total Cyanide	SFAPI	0.5	mg/kg^	UM			<0.6	<0.6		<0.6
Soil Organic Matter	WSLM59	0.04	% m/m^	U			1.86	17.7		2.77
Total Organic Carbon	WSLM59	0.02	% m/m^	U			1.08	10.3		1.61
Arsenic as As	ICPMSS	0.3	mg/kg^	UM			14.2	48.5		11.0
Cadmium as Cd	ICPMSS	0.2	mg/kg^	UM			0.2	0.5		0.2
Copper as Cu	ICPMSS	1.6	mg/kg^	UM			36.5	261.5		38.7
Lead as Pb	ICPMSS	0.7	mg/kg^	UM			26.1	365.4		99.7
Mercury as Hg	ICPMSS	0.5	mg/kg^	UM			<0.5	<0.5		<0.5
Nickel as Ni	ICPMSS	2	mg/kg^	UM			21.5	110.8		25.6
Selenium as Se	ICPMSS	0.5	mg/kg^	UM			<0.5	<0.5		<0.5
Total Chromium as Cr	ICPMSS	1.2	mg/kg^	UM			19.1	51.9		34.0
Zinc as Zn	ICPMSS	16	mg/kg^	UM			87.5	105.2		114.1
Boron as B	ICPBOR	0.5	mg/kg^	UM			<0.5	<0.5		1.2

Analysis Results

Analysis	Method Code	MDL	Units	Accred.	Sample ID	001	002	004	005	006
					Customer ID	BH03-0-ES-0.20	BH03-0-ES-0.40	BH02-0-ES-0.20	BH04-0-ES-0.20	BH04-0-ES-0.80
					Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID
					Sampling Date	03/05/2022	03/05/2022	05/05/2022	06/05/2022	06/05/2022
Water Soluble Sulphate as SO4 by Mass	ICPWSS	20	mg/kg^	UM			171	102		1110
Acid Soluble Sulphate as SO4	ICPACIDS	20	mg/kg^	UM			289	588		1500
Acenaphthene	PAHMSUS	0.08	mg/kg^	UM			<0.09	<0.09		<0.10
Acenaphthylene	PAHMSUS	0.08	mg/kg^	U			<0.09	<0.09		<0.10
Anthracene	PAHMSUS	0.08	mg/kg^	U			<0.09* _B	0.12* _B		<0.10* _B
Benzo[a]anthracene	PAHMSUS	0.08	mg/kg^	UM			<0.09	0.36		0.15
Benzo[a]pyrene	PAHMSUS	0.08	mg/kg^	UM			<0.09	0.32		0.15
Benzo[b]fluoranthene	PAHMSUS	0.08	mg/kg^	UM			<0.09	0.37		0.18
Benzo[g,h,i]perylene	PAHMSUS	0.08	mg/kg^	UM			<0.09	0.16		<0.10
Benzo[k]fluoranthene	PAHMSUS	0.08	mg/kg^	UM			<0.09	0.16		<0.10
Chrysene	PAHMSUS	0.08	mg/kg^	UM			<0.09	0.35		0.16
Dibenzo[a,h]anthracene	PAHMSUS	0.08	mg/kg^	UM			<0.09	<0.09		<0.10
Fluoranthene	PAHMSUS	0.08	mg/kg^	UM			<0.09	0.58		0.28
Fluorene	PAHMSUS	0.08	mg/kg^	UM			<0.09	<0.09		<0.10
Indeno[1,2,3-cd]pyrene	PAHMSUS	0.08	mg/kg^	UM			<0.09	0.18		<0.10
Naphthalene	PAHMSUS	0.08	mg/kg^	UM			<0.09	0.20		<0.10
Phenanthrene	PAHMSUS	0.08	mg/kg^	UM			<0.09	0.51		0.20
Pyrene	PAHMSUS	0.08	mg/kg^	UM			<0.09	0.55		0.25
Total PAH 16	PAHMSUS	1.28	mg/kg^	U			<1.45	4.26		2.26

Analysis Results

Analysis	Method Code	MDL	Units	Accred.	Sample ID	001	002	004	005	006
					Customer ID	BH03-0-ES-0.20	BH03-0-ES-0.40	BH02-0-ES-0.20	BH04-0-ES-0.20	BH04-0-ES-0.80
					Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID
					Sampling Date	03/05/2022	03/05/2022	05/05/2022	06/05/2022	06/05/2022
Total Moisture at 35°C	CLANDPREP	0.1	%	N			11.5	15.1		20.3
Description of Solid Material	CLANDPREP		-	N			SILT	SILT		CLAY
Asbestos Identification	SUB020		-	N		NAIIS		NAIIS	NAIIS	

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: SOCOTEC UK Ltd
Environmental Chemistry
PO Box 100
Burton upon Trent
Staffordshire
DE15 0XD

CONTRACT NO: S25774-12

DATE OF ISSUE: 01.06.22

DATE SAMPLES RECEIVED: 25.05.22

DATE ANALYSIS COMPLETED: 01.06.22

DESCRIPTION: Three soil/loose aggregate samples each weighing approximately 0.4-0.7kg.

ANALYSIS REQUESTED: Qualitative and quantitative analysis of soil/loose aggregate samples for mass determination of asbestos.

METHODS:

Qualitative - The samples were analysed qualitatively for asbestos by polarised light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative - The analysis was carried out using our documented in-house method based on HSE Contract Research Report No. 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies *et al*, 1996) and HSG 248. Our method includes initial examination of the entire sample, detailed analysis of a representative sub-sample and quantification by hand picking/weighing and/or fibre counting/sizing as appropriate.

RESULTS:

Initial Screening

No asbestos was detected in any of the soil samples by stereo-binocular and polarised light microscopy.

A summary of the results is given in Table 1.





CONTRACT NO: S25774-12
DATE OF ISSUE: 01.06.22

RESULTS: (cont.)

Table 1: Qualitative Results

SOCOTEC Job I.D: 22051468

IOM sample number	SOCOTEC Sample ID	Client Sample ID	ACM type detected	PLM result
S25774-27	22051468-001	BH03-0-ES-0.20	-	No Asbestos Detected
S25774-28	22051468-004	BH02-0-ES-0.20	-	No Asbestos Detected
S25774-29	22051468-005	BH04-0-ES-0.20	-	No Asbestos Detected

Our detection limit for this method is 0.001%.

COMMENTS:

IOM Consulting cannot accept responsibility for samples that have been incorrectly collected or despatched by external clients.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

J Simpson

AUTHORISED BY:

J Simpson

Senior Laboratory Analyst

Deviating Sample Report

Sample Reference	Text ID	Reported Name	Incorrect Container	Incorrect Label	Headspace	Incorrect/No Preservative	No Sampling Date	Holding Time
BH03-0-ES-0.40	22051468-002	PHSOIL						✓
BH03-0-ES-0.40	22051468-002	SFAPI						✓
BH03-0-ES-0.40	22051468-002	SFAPI						✓
BH03-0-ES-0.40	22051468-002	SFAPI						✓
BH03-0-ES-0.40	22051468-002	SFAPI						✓
BH03-0-ES-0.40	22051468-002	PAHMSUS						✓
BH02-0-ES-0.20	22051468-004	PHSOIL						✓
BH02-0-ES-0.20	22051468-004	SFAPI						✓
BH02-0-ES-0.20	22051468-004	SFAPI						✓
BH02-0-ES-0.20	22051468-004	SFAPI						✓
BH02-0-ES-0.20	22051468-004	SFAPI						✓
BH02-0-ES-0.20	22051468-004	PAHMSUS						✓
BH04-0-ES-0.80	22051468-006	PHSOIL						✓
BH04-0-ES-0.80	22051468-006	SFAPI						✓
BH04-0-ES-0.80	22051468-006	SFAPI						✓
BH04-0-ES-0.80	22051468-006	SFAPI						✓
BH04-0-ES-0.80	22051468-006	SFAPI						✓
BH04-0-ES-0.80	22051468-006	PAHMSUS						✓

Analysis Method

Analysis

CLANDPREP
ICPACIDS
ICPBOR
ICPMSS
ICPWSS
KONENS
PAHMSUS
PHSOIL
SFAPI
SUB020
WSLM59

Analysis Type

PHYS
METALS
METALS
METALS
METALS
INORGANIC
ORGANIC
INORGANIC
INORGANIC
SUBCON
INORGANIC

Analysis Method

As Received
Air Dried & Ground
Air Dried & Ground
Air Dried & Ground
Air Dried & Ground
Air Dried & Ground
As Received
As Received
As Received
As Received
Air Dried & Ground

Result Report Notes

Letters alongside results signify that the result has associated report notes.
 The report notes are as follows:

<u>Letter</u>	<u>Note</u>
A	Due to the matrix of the sample the laboratory has had to deviate from our standard protocols to be able to process the sample and provide a result. Where applicable the accreditation has been removed and this should be taken into consideration when utilising the data.
B	The QC associated with this result has not wholly met the QMS requirements, the accreditation has therefore been removed. However, the Laboratory has confidence in the performance of the method as a whole and that the integrity of the data has not been significantly compromised.
C	Due to matrix interference the internal standard and/or surrogate has not met the QMS requirements. This should be taken into consideration when utilising the data.
D	A non-standard volume or mass has been used for this test which has resulted in a raised detection limit.
E	Due to recoveries beyond our calibration range and following the maximum size of dilution allowed, the result cannot be quantified and as such the result will appear as a greater than symbol (>) with the accreditation removed. This data should be used for indicative purposes only.
F	Based on the sample history, appearance and smell a dilution was applied prior to testing. Unfortunately, the result is either above (>) or below (<) our calibration range. Results above our calibration range have accreditation removed. The data should be used for indicative purposes only.
G	The day 5 oxygen reading was below the capability of the instrument to detect, and therefore the calculated BOD has been reported unaccredited for guidance purposes only.

HWOL Acronym Key

<u>Acronym</u>	<u>Description</u>
HS	Headspace Analysis
EH	Extractable Hydrocarbons - i.e everything extracted by the solvent(s)
CU	Clean up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
+	Operator to indicate cumulative e.g. EH_CU+HS_1D_Total

Additional Information

This report refers to samples as received, and SOCOTEC UK Ltd takes no responsibility for accuracy or competence of sampling by others.

Results within this report relate only to the samples tested.

In the accreditation column of analysis report the codes are as follows:

U = UKAS accredited analysis
M = MCERT accredited analysis
N = Unaccredited analysis

Any units marked with ^ signify results are reported on a dry weight basis of 35° c.

All Air Dried and Ground Samples (ADG) are oven dried at less than 35° c.

This report shall not be reproduced except in full and with approval from the laboratory.

Opinions and interpretations given are outside the scope of our UKAS accreditation.

Any samples marked with * are not covered by our scope of UKAS accreditation. If applicable, further report notes have been added.

Any solid samples where the Major Constituents are not one of the following (Sand, Silt, Clay, Made Ground) are not one of our accredited matrix types.

Any samples marked with ‡ have had MCERTS accreditation removed for this result

Any samples marked with a tick in the deviant table is deviant for the specific reason.

Any samples reported as IS, NA, ND mean the following:

IS = Insufficient Sample to complete analysis
NA = Sample is not amenable for the required analysis
ND = Results cannot be determined

Our deviating sample report does not include deviancy information for Subcontracted analysis. Please see the report from the Subcontracted lab for information regarding any deviancies for this analysis.

End of Certificate of Analysis

Appendix E

Gas and Groundwater Monitoring Results

pwa
Geo Environmental

Job No: 21053
Visit No: 1 of 6
Operator: Alice Paine **Project Manager:** Ian Parkinson

ND - Not detected
NR - Not recorded

MG - Made ground
ALV - Alluvium
RTD - River Terrace Deposits
WB - Weathered Bedrock

State of ground:		Dry		Moist
Wind:	x	Calm		Light
Cloud cover:		None	x	Slight
Precipitation:	x	None		Slight
Time monitoring performed:			08:58	Start
Barometric pressure (mbar):			1016	Start
Pressure trend (Daily):				Falling
Source:		wunderground.com		
Air Temperature (Deg. C):			14	Before

Ground gas meter:	GFM436					
Gas Range:	CH₄	0 - 100%	CO₂	0 - 100%	O₂	0 - 25%
Gas Flow range:	+100/-50 l/hour					
Differential Pressure:	(±) 1000 Pa					
Date of last calibration:	12/08/2019					
Date of next calibration:	12/08/2020					

Page 1 of 14

pwa
Geo Environmental

Job No: 21053
Visit No: 2 of 6
Operator: Alice Paine **Project Manager:** Ian Parkinson

Where no flow (ND) recorded, Qhg values are calculated using equipment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of Qhg.

(Select correct box with X or enter data, as applicable)

ALV - Alluvium
RTD - River Terrace Deposits
WB - Weathered Bedrock

Ambient air check: CH₄ CO₂ O₂

pwa
Geo Environmental

Client: M Stone Build
Site: Faith in Nature
Date: 31st January 2020

Job No: 21053
Visit No: 3 of 6
Operator: Project Manager: Ian Parkinson

ND - Not detected
NR - Not recorded

MG - Made ground
ALV - Alluvium
RTD - River Terrace Deposits
WB - Weathered bedrock

NB: Where no flow (ND) recorded, Qhg values are calculated using equipment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of Qhg.

(Select correct box with X or enter data, as applicable)

State of ground:	☐ Dry	☐ Moist	☒ Wet	☐ Snow	☐ Frozen
Wind:	☐ Calm	☒ Light	☐ Moderate	☐ Strong	
Cloud cover:	☐ None	☐ Slight	☐ Cloudy	☒ Overcast	
Precipitation:	☐ None	☐ Slight	☒ Moderate	☐ Heavy	
Time monitoring performed:		12:50	Start	13:50	End
Barometric pressure (mbar):		1013	Start	1013	End
Pressure trend (Daily):		Falling	☐ Steady	☒ Rising	
Source:	wunderground.com				
Air Temperature (Deg. C):		16	Before	16	After

Ground gas meter:	GFM400				
Gas Range:	CH₄	0 - 100%	CO₂	0 - 100%	O₂ 0 - 25%
Gas Flow range:	+100/-50 l/hour				
Differential Pressure:	(±) 1000 Pa				
Date of last calibration:	12/08/2019				
Date of next calibration:	12/08/2020				

Ambient air check: CH₄ CO₂ O₂

Ground Gas and Groundwater Monitoring Record Sheet



JOB DETAILS:

Client: M Stone Build
Site: Faith in Nature
Date: 17/06/2022

Job No: 21053
Visit No: 4 of 6
Operator: Alice Smith
Project Manager: Ian Parkinson

Monitoring Point	GAS CONCENTRATIONS												VOLATILES		FLOW DATA				Qhg per borehole		WELL AND WATER DATA							Comments
	Methane (%v/v)		Carbon dioxide (%v/v)		Oxygen (%v/v)		% LEL		Hydrogen sulphide (ppmv)		Carbon monoxide (ppmv)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Methane (l/hr)	CO2 (l/hr)	Water level (mbgl)	Depth of well (m)	Top of BH (mAOD)	Water level (mAOD)	Response Zone			
	Peak	Steady	Peak	Steady	Min.	Steady	Peak	Steady	Peak	Steady	Peak	Steady			Peak	Steady												
	PWA Geo-Environmental Installed Wells																											
BH01	ND	ND	ND	ND	18.3	19.2	ND	ND	ND	ND	ND	ND			ND	ND	ND	ND	0.0001	0.0001	3.06	3.06						
BH02	ND	ND	2.0	2.0	13.1	13.4	ND	ND	ND	ND	ND	ND			ND	ND	ND	ND	0.0001	0.0020	DRY	1.62						
BH03	ND	ND	2.8	2.8	ND	ND	ND	ND	ND	ND	ND	ND			ND	ND	ND	ND	0.0001	0.0028	DRY	2.83						
BH04	ND	ND	1.9	1.9	14.9	14.9	ND	ND	ND	ND	ND	ND			ND	ND	ND	ND	0.0001	0.0019	2.35	2.78						



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