Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ
t 01924 574074 e info@haighhuddleston.co.uk

Geo-environmental
Ground Investigation Report

ON

PROPOSED RESIDENTIAL DEVELOPMENT

AT

LAND EAST OF PENISTONE ROAD, FENAY BRIDGE

FOR

HOMES BY HONEY

JANUARY 2024
SEPTEMBER 2024 – Rev A

E23/8060/R001A

INDEX

1.0 INTRODUCTION

1.1 As requested by Homes by Honey, this practice carried out ground and contamination investigation works for a proposed development on land east of Penistone Road, Fenay Bridge.

1.2 A Combined Phase I and Phase II Ground Risk Appraisal was originally undertaken on three separate sites in the Fenay Bridge Area by WSP and is detailed in their report reference 70035780-01 dated October 2017. Following this, a site specific Phase 1 Geo-environmental Assessment was undertaken by Ecus Environmental Consultants and is detailed in their report reference 14699-P1 version 2.0 dated March 2021.

1.3 Further to these original investigation works, Kirklees Council have reviewed the information provided and requested more site specific investigation be undertaken due to the presence of landfill to the south east of the development. The above reports have been used to compile this report and guide the site investigation works undertaken.

1.4 The purpose of the report was to:-

- 1.4.1 Identify the nature of the near surface strata, in order to enable recommendations to be made as to the most economic foundation solution for the proposed residential development.
- 1.4.2 To identify any areas of contaminated ground.
- 1.4.3 Propose a suitable outline remediation strategy, which will enable the site to be developed safely, to the satisfaction of the overseeing regulators and in compliance with the current environmental standards.
- 1.4.4 Determine if ground gas migration from probable shallow mineworkings or infilled land in the vicinity would adversely affect the site.
- 1.4.5 Undertake boreholes to determine the presence of shallow mine workings within the site.
- 1.4.6 Determine if infiltration methods would be a suitable form of surface water disposal.

1.5 Soil sampling was undertaken via trial pits to determine the near surface strata. Distributed samples were taken for testing to ascertain the nature of the soils and fills present.

1.6 The conclusions and recommendations made in this report are limited to the findings of the preliminary Geotechnical Survey. The report is made on condition that Haigh Huddleston Associates will not in any circumstances be liable for loss, arising directly or indirectly from ground conditions encountered between trial pits and boreholes, which have not been revealed by the investigation.

1.7 Any opinion given on the possible configuration of strata between trial pit and borehole locations and below maximum depth of the investigation is for guidance only. Any remarks on groundwater conditions made are based solely on observations made at the time of investigation. Kindly note that levels may differ from those reported due to seasonal variations or other influences.

1.8 Furthermore, there is the possibility that any trial pits or boreholes undertaken as part of the investigatory works may be within the influence of existing or proposed foundations or excavations. Haigh Huddleston Associates cannot be held responsible for any failure of any excavations, foundations or structures within the influence of the trial pits or boreholes.

2.0 THE SITE

2.1 The site is located on land to the south east of the junction of Penistone Road and Rowley Lane, Fenay Bridge and lies around OS Grid Reference 418730, 414480. A site location plan is attached in Appendix A at the rear of the report.

2.2 The site is approximately rectangular in shape with the longer western edge fronting onto Penistone Road and the shorter northern edge onto Rowley Lane. The eastern boundary is formed by a former 3m high railway embankment. There are residential and commercial properties to the south and east of the development and beyond Rowley lane to the north. Beyond Penistone Road to the east there are open fields. The site area is approximately 3.2ha, including the proposed highway works to the western and southern boundaries. The proposed residential development occupies 2.1ha.

2.3 The site consists of a single field that was noted to contain rough grass at the time of the site investigation with areas of standing water noted on site, making the ground marshy. Mature tree growth was noted along the northern, eastern and southern boundaries with broken lies of trees on the western boundary.

2.4 The site boundary was formed by a dry stone wall to the north and west, that was noted to be overgrown and dilapidated in places. The southern and eastern boundaries are formed by a timber fence. There was a gated access to the site from Rowley Lane in the north western corner of the site.

2.5 The site falls from east to west at an approximate average grade of 1 in 10 with a high point in the south east of 99.45m AOD and a low point on the western boundary of 85.2m AOD.

2.6 It is understood that an approximately 30m wide strip of land adjacent the western and southern boundaries of the site are not part of the proposed residential development, and are to form part of the adopted highway access for future developments to the south east of the current site.

2.7 The previous site investigation works undertaken by WSP in 2017 generally proved a shallow depth of topsoil, clays and sand, with weathered sandstone bedrock encountered at 0.2-1.0m below existing ground levels in all but one of the seven trial

pits. This was located in the centre of the site and proved clay to the base of the trial pit at 1.5m below existing ground levels. Three boreholes were undertaken and proved sandstone, siltstone and mudstone to a depth of 21.0-21.5m below existing ground levels. No coal seams, or evidence of historic workings was encountered.

2.8 Ten samples were taken from the natural strata and submitted for chemical analysis, three from the topsoil and seven from the underlying Pennine Lower Coal Measures. There were no exceedances of the contaminants analysed recorded on this site.

2.9 Further to the site investigation works, WSP undertook two rounds of gas monitoring at three stations located in the east of the site due to the potential of ground gas migration from probable shallow mine workings to the east of the site along with large areas of infilled ground. Two sets of readings were carried out in September 2017 and recorded a single peak methane concentration of 2.5% on one occasion, with the remainder of the readings recording 0%. Carbon dioxide concentrations between 0 and 4.2% were recorded in the boreholes. No flow rates were recorded.

3.0 SITE HISTORY

3.1 The previous reports by WSP and ECUS have been consulted and below is a brief description outlining the significant developments that may affect future construction on the site.

3.2 The site itself has remained as open field with little change since 1854 save for the follow:

- In 1854 a small gravel pit was noted on the western boundary of the site with Rowley Lane and was noted to be infilled by 1893.
- Railway line shown to the eastern boundary from 1893 and shown as dismantled by 1992.

3.3 Notable features in the immediate vicinity of the site include:

- Rowley Mills shown 50m south of the site from 1854 to the current day.
- Victoria Colliery shown 50m north east of the site from 1916 to 1960, there were railway sidings associated with this colliery.
- Woodsome Colliery shown 100m east of the site from 1933 to 1960.
- Woodsome Brickworks shown 250m south east of the site in 1933 and shown as disused by 1973. No longer shown by 1992.
- Residential properties were constructed to the north of the site in 1960, to the north east in 1971 and to the east by 1993.

4.0 SITE GEOLOGY & MINING

4.1 The BGS Digital Geological map of Great Britain at 1:50,000 has been consulted and we would report as follows:-

4.2 Alluvial superficial deposits consisting of clay, silt sand and gravel are shown to encroach on the north western corner of the site.

4.3 No superficial strata is shown to overlie the site, however a large area of made ground is shown to the east of the development, This is associated with the former brickworks and railway line. Additionally, the former gravel pit on the western boundary will have been infilled.

4.3 The majority of the site is underlain by the Grenoside Formation consisting of Sandstone. The western edge of the area to be developed is underlain by the Pennine Lower Coal Measures group consisting of Mudstone, Siltstone and Sandstone.

4.4 There are no fault lines in the immediate vicinity of the site.

4.5 The previous site investigation works undertaken by WSP in 2017 generally proved a shallow depth of topsoil, clays and sand, with weathered sandstone bedrock encountered at 0.2-1.0m below existing ground levels in all but one of the seven trial pits. This was located in the centre of the site and proved clay to the base of the trial pit at 1.5m below existing ground levels.

4.6 The original SI by WSP in 2017 and the desk top study by ECUS identified a possible coal outcrop in the east of the site associated with probable shallow workings. Three boreholes were undertaken by WSP in the east of the site and proved sandstone, siltstone and mudstone to a depth of 21.0-21.5m below existing ground levels. No coal seams, or evidence of historic workings was encountered.

4.7 From the Coal Authority Online Interactive Map, A coal outcrop is shown to encroach on the north eastern corner of the site and is associated with probable shallow mine workings and being a development high risk area.

5.0 ENVIRONMENTAL CONSIDERATIONS

5.1 Radon

The UK Radon online maps indicate the property is in an area where less than 1% of properties are above the action level.

No Radon Protective Measures are required. However, a number of warranty providers consider it good practice to provide basic radon protective measures as standard and they should be consulted at an early stage to confirm their requirements.

5.2 Landfill Sites

There are no recorded historical landfill sites within 250m of the site indicated in the previous site investigation reports.

However, there is a large area of infilled land recorded to the south east of the site, associated with the historical brickworks, part of which is designated as landfill by Kirklees Council, a plan indicating the extent of the landfill is included in Appendix . In addition to this, a historical small gravel pit was located on the western boundary of the field adjacent Penistone Road. This is outside of the residential development area.

5.3 Flood Risk

The site is not located in a currently defined Environment Agency floodzone or at risk of flooding from rivers and the sea.

The flood risks to the development are discussed in more detail in Haigh Huddleston & Associates Flood Risk Assessment E23/8060/01 dated January 2024.

5.4 Groundwater

The groundwater vulnerability map for the area indicates that the superficial strata overlying the north western corner and the bedrock underlying the site are designated as a Secondary (A) aquifers. These are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

The site is not within a currently defined (Groundwater) Source Protection Zone (SPZ).

There is a single Licensed Discharge Consents within 250m of the site. This is a trade discharge to Beldon Brook via a mill pond located 190m south of the site.

There are seven recorded pollution incidents to controlled water within 250m of the site, none of which are associated with the site. The nearest was located 48m south of the sire and was a Category 2 (significant) incident involving raw sewage.

The nearest recorded surface water feature is Fenay Beck located approximately 120m west of the site and flows from south to north. This is classified as an Inland River.

6.0 PRELIMINARY CONCEPTUAL SITE MODEL

6.1 The initial stage in assessing the risks posed from contaminated land during the redevelopment of a site is to prepare a conceptual model. A generalised conceptual model can be developed highlighting the main pollutant linkages through a contaminant ► pathway ►receptor model for a residential development. In order to prepare the conceptual model for a particular site the following parameters need to be reviewed as discussed below.

6.2 Contamination of existing land can be caused by a number of factors, including:-

i) Possible historical/current industrial activities.
ii) Disposal of waste materials.
iii) Storage of materials.
iv) A number of natural processes can also lead to hazardous gases and elevated heavy metals.

6.3 Potential pathways can include ground and surface water, permeable strata, existing services providing a conduit and voided ground. Potential receptors can include human health, ecosystems, controlled waters and building structures. There are a number of ways that a receptor can be exposed to the contaminant these include, inhalation, direct contact, ingestion, dermal contact and uptake.

6.4 Sources of potential contamination, that could affect the proposed development, from either on or off site activities would include the following:-

i) Possible ground gas migration from infilled gravel pit located on the western boundary and made ground indicated to the east of the development.
ii) Possible ground gas migration from probable shallow mine workings to the east of the development.

Based on the above activities the potential for some contamination to exist on site is considered to be low.

6.5 Considering the proposed residential end use, there will be two possible human receptor groups exposed to the existing onsite contamination:-

a) Site operatives during development.
b) End users, future site residents (the critical receptor is a 6 year-old girl).

6.6 Human receptors may be exposed to site contamination by a number of possible pathways. These pathways are summarised in Table 1 below.

Table 1- Potential Human Exposure Pathways

Human Exposure Pathway	Site Residents	Construction Workers
Soil Ingestion	YES	YES
Consumption of Home Grown Vegetables	YES	NO
Dermal Contact	YES	YES
Dust Inhalation	YES	YES
Gases/Vapours	YES	NO

6.7 The construction workers will come into contact with any contaminated soil to a far greater extent than future residents. The exposure pathways are generally through dermal contact and indirect ingestion. However their exposure will be for a limited time and the provision and correct use of personnel protective equipment and adequate welfare facilities during construction should restrict their risks to acceptable levels.

6.8 Future site residents can be protected in the long term development of the site via a suitable remediation strategy that ensures any proposed contaminated materials remaining on-site are suitably isolated beneath an effective capping layer.

6.9 The risk of pollution to controlled waters by existing contamination is considered low. There have been no historical uses of the site, or in the immediate vicinity of the site, likely to cause contamination. There are no licensed ground water abstractions recorded within 250m of the development. There have been no recorded pollution incidents to controlled waters associated with the site.

6.10 No specific areas of ecological importance have been identified in the initial desk top study. Therefore the site is considered to be in a low risk environmental setting. The potential for phototoxic materials to exist at shallow depth should be considered, these could pose a potential risk to new planting and soft landscaping areas within the proposed development.

6.11 The proposed planning drawings indicate residential properties with private garden areas and hard paved site access and parking areas. The presence of elevated

sulphates and hydrocarbons could affect the long term integrity of buried concrete structures, including foundations and drainage pipes. Plastic water supply pipes can also be damaged by the presence of hydrocarbon contamination.

7.0 FIELDWORK

7.1 Trial pit excavations were undertaken on 5-6 December 2023 using an 8 tonne tracked excavator with 600mm wide bucket. Ten three trial pits were undertaken in total, with two of these used for soakaway testing. In addition to this, ten rotary boreholes were undertaken on site, to depths between 4 and 30m. Five of these boreholes were fitted with gas monitoring stations to determine if ground gas generation from probable shallow mine workings and infilled land recorded in the vicinity would adversely affect the site.

7.2 Materials encountered in the trial pits and boreholes were examined and categorised. Trial pit and borehole logs are contained within Appendix B of the report.

7.3 The soakaway tests were undertaken in accordance with the method specified in BRE Digest 365 Soakaway Design. An instantaneous supply of water was provided via a bowser. In general, the trial pits were filled and the water levels were recorded against time as the water permeated into the natural strata. The water level was monitored over an extended time period to determine the infiltration rate for the natural strata.

7.4 The site investigation works were designed to achieve comprehensive site coverage within the proposed development area. In particular, the deeper boreholes were undertaken in the east of the site where there was a risk of probable shallow mine workings, and monitoring stations installed in the south east at the closest point to the landfill indicated as part of the infilled land associated with the former brickworks.

7.5 Soil samples were removed from the natural ground deposits within the trial pits. The samples were removed by operatives wearing gloves and placed into airtight clean plastic containers and glass bottles for transportation to the laboratory.

7.6 A total of eight samples from the natural ground deposits were recovered from the trial holes for chemical analysis. The testing was carried out by a UKAS accredited laboratory to nationally or accredited in-house methods. The results of the contamination testing are contained within Appendix C of this report.

7.7 A suite of common potential contaminants consisting of heavy metals, phytotoxic metals, sulphates, sulphides and poly-aromatic hydrocarbons was analysed for, including a range of metals and inorganic substances and asbestos.

7.8 All samples were stored in airtight containers within cool boxes at approximately 4°c until delivery to the laboratory within 48 hours.

8.0 RESULTS OF THE INVESTIGATION

8.1 GEOTECHNICAL INVESTIGATION

8.1.1 A copy of the trial hole and borehole logs providing a complete record of strata encountered beneath the proposed development is presented in Appendix B.

8.1.2 The fieldwork generally proved a shallow depth of soils, clays overlying a sandstone bedrock.

8.1.3 At the surface of all the trial pits was rough grass over a dark brown sometimes loamy, topsoil. The topsoil varied in thickness between 0.25 and 0.35m across site.

8.1.4 Below the topsoil in all the trial pits there was a 0.35-1.4m thick layer of soft to firm sandy clay with occasional sandstone gravels. TP103 and TP105 were terminated in this strata at 0.8-0.9m below existing ground levels due to groundwater ingress.

8.1.5 At the base of all the trial pits, a moderately weak sandstone bedrock was encountered at 0.6-1.7m below existing ground levels. This was generally excavated as angular gravels, with occasional cobbles and boulders and became difficult to excavate with depth. In TP106 in the south eastern corner of the development, a 0.8m thick layer of weak dark brown shaley mudstone was excavated at 1.4-2.2m below existing ground levels.

8.1.6 The boreholes on site generally proved up to 2.2m of topsoils and clays overlying mudstones and sandstones that were encountered at 0.3-2.2m beneath existing ground levels. Alternating bands of mudstone and siltstone were recorded from 2.9-9.0m below existing ground levels to the base of the boreholes at 10-30m beneath existing ground levels.

8.1.7 A summary of the strata encountered within the boreholes is included in Table 2 below:

Table 2 - Summary of Strata Encountered in Boreholes

Borehole No.	Clay (m)	Mudstone (m)	Sandstone (m)	Mudstone/Siltstone (m)
1*	0.0-0.7	-	0.7-4.0	-
2*	0.0-0.5	0.5-4.0	-	-
3	0.0-0.7	0.7-3.2	3.2-9.0	9.0-30.0
4*	0.0-2.2	2.2-4.0	-	-
5	0.0-2.1	2.1-2.8	2.8-5.7	8.7-30.0
6*	0.0-2.0	-	2.0-4.0	-
7*	0.0-1.6	-	1.6-4.0	-
8	0.0-1.2	1.2-2.5	2.5-3.3	3.3-10.0
9	0.0-0.3	0.3-2.1	2.1-2.9	2.9-10.0
10	0.0-0.5	0.5-10.0	-	-

*Gas monitoring standpipe fitted in borehole

8.1.8 The results of the geotechnical analysis undertaken on the samples of clayey soil indicates the clay to be of medium-high plasticity (Plasticity Index 20-34%). If the modified results are calculated, taking into account the percentage of material retained on a 425micron sieve, the results correspond to a medium shrinkage clay. The test certificate is contained in Appendix C.

8.1.9 As discussed previously in the report, two of the trial pits were used to carry out soakaway tests in order to obtain an infiltration rate for the development. This was undertaken in TP101 and TP102 in the northern half of the site.

8.1.10 The infiltration rate has been calculated between the 75% and 25% full values as recommended in the BRE Digest 365. The soakaway result in included in Appendix B and is summarised Table 3 below:-

Table 3 Summary of infiltration rates

SOAKAWAY NUMBER	**INFILTRATION RATE m/s x10^{-6}**
TP101	WATER LEVELS ROSE
TP102	WATER LEVELS ROSE

8.1.11 The water levels rose during the soakaway tests in both trial pits.

8.2 GROUNDWATER

8.2.1 Groundwater was encountered at depths of 0.8-2.6m below existing ground levels in five of the ten trial pits undertaken. TP103 was terminated at 0.9m due to the constant ingress of ground water from a land drainage pipe. TP105 was terminated at 0.8m due to the rate of groundwater seepage encountered.

8.2.2 No groundwater strikes were recorded during the rotary borehole investigation.

8.2.3 It should be recognised that ground water levels may vary throughout the year. During periods of heavy rainfall the groundwater levels may be substantially higher than the results revealed in these investigations.

8.3 GAS MONITORING

8.3.1 As discussed previously, two rounds of gas monitoring were carried out in September 2017 by WSP and recorded a single peak methane concentration of 2.5% on one occasion, with the remainder of the readings recording 0%. Carbon dioxide concentrations between 0 and 4.2% were recorded in the boreholes. No flow rates were recorded.

8.3.2 During these site investigation works, five of the rotary boreholes were installed with gas standpipes and lockable covers, in particular to identify potential gas migration from the identified landfill to the south east. In addition to this, three of the original monitoring stations have been located on site and were monitored in addition to the new standpipes.

8.3.3 A standard gas monitoring procedure has been followed in accordance with CIRIA guidance, including measurement of the following:-

i) Methane, Oxygen and Carbon Dioxide concentrations.
ii) Atmospheric Pressure.
iii) Gas Flow Rate.
iv) Standing water level.

8.3.4 A complete set of the gas monitoring results are included in Appendix C to the rear of the report.

8.3.5 The monitoring has been undertaken during air pressures ranging from 979 to 1014 millibars, with five of the six visits undertaken during falling air pressures. It should be noted that on one occasion it was not possible to undertake a reading from BH02 due to the high perched water level within the standpipe.

8.3.6 During the monitoring, only the Existing Monitoring Station 3 has recorded methane on a single occasion. This was a peak concentration of 0.7% which dropped down to a steady reading of 0.0%.

8.3.7 All the monitoring stations have recorded low concentrations of carbon dioxide ranging from 0.1-3.5%.

8.3.8 Flow rates have only been detected within two of the stations on a single visit. These were peak flows of 1.9 and 10.8 l/hr in BH01 and BH02 respectively, and both flow rates dropped to below detection limits. These flow rates were associated with elevated water levels and are due to compression of the gases within the standpipe.

8.3.9 Due to the low levels of carbon dioxide levels and flow rates on site, we would recommend the gas regime on this site be currently classified **CS1** by BS 8485:2015+A1:2019 Table 2.

9.0 CONTAMINATION

9.1 HUMAN HEALTH RISK ASSESSMENT

9.1.1 The appraisal of contaminated land within the UK is based on a risk assessment approach. The method involves the principle of defining a source ► pathway ►receptor, linkage to establish a human health risk. For any risk to exist to a potential receptor from an identified contaminant there must be an unbroken source ► pathway ►target relationship.

9.1.2 In the first instance site data for the contaminant levels are compared against guidance such as the CLEA values published by DEFRA. Should the site values exceed the guidance criteria, the contamination levels are recognised to have the potential to pose a risk to human health. Two scenarios are then available:-

a) To break or remove one of the source ► pathway ►receptor linkages, by specifying an appropriate level of remedial work. Examples of remedial action may include the removal of the contaminated material or alternatively specifying a sufficient capping layer.

b) The alternative approach is to provide a more detailed human health site specific risk assessment. This will involve examining factors such as soil properties, exposure assumptions, groundwater flows and contamination composition.

9.2 CONTAMINATION RESULTS

9.2.1 As stated above, in order to put the analytical results into context, the data has in the first instance been assessed in relation to several sets of guidelines: -

9.2.2 The analytical results have been assessed via an initial screening assessment with regard to the current Contaminated Land Exposure Assessment model (CLEA UK) for human health, which has been produced for the Environment Agency and the Department of Environment, Food and Rural Affairs (DEFRA). The CLEA model provides Soil Guideline Values (SGVs) for a limited range of contaminants only, and these are based on risk to human health. As such they do not take into account potential risks to other receptors eg groundwater and third party land.

9.2.3 It is proposed to redevelop the site for residential properties with private garden areas. Soil results have therefore been assessed against Generic Assessment Criteria (GAC) based on guidelines from the Chartered Institute of Environmental Health (CIEH) and Land Quality Management Ltd (LQM) S4UL document. Where there is no GAC, guidance limits have been adopted from sources referenced in the table below.

9.2.4 In addition to the above, the calculation of SGVs based on an acceptably low level of risk is currently being undertaken. These Category 4 Screening Levels (C4SL) have been calculated for six substances to date by modifying the toxilogical/exposure parameters within CLEA. C4SLs have been used as tier 1 trigger levels within this assessment, superseding the previous CIEH and LQM SGVs.

9.2.5 Assessment of risk is considered as a tiered approach. Assessment based on non intrusive means is considered Tier 1 assessment, comparison against SGVs and GACs is a Tier 2 assessment, and the generation of and comparison with Site Specific Assessment Criteria (SSAC) is a Tier 3 assessment and is conducted where deemed appropriate following the Tier 2 assessment.

9.2.6 The sulphate and acid concentrations have been compared against the BRE digest “Concrete in Aggressive Ground” parts 1-4. This will enable the concrete class to be specified in relation to possible contact with aggressive soils.

9.2.7 The results of the chemical analysis of the samples are presented on the laboratory analysis sheets with Appendix C. A summary of the significance of the results is presented in Table 5.

Table 5

Comparison of contaminant against accepted guidance values for residential use with plant uptake

CONTAMINANT	SGV MG/KG	CONCENTRATION IN ALL SOILS. MG/KG	No. OF SAMPLES EXCEEDING GUIDANCE VALUES	PERCENTAGE OF SAMPLES EXCEEDING GUIDELINE VALUE
Arsenic	37 (4)	12-39	1/8	12.5%
Cadmium	22 (4)	<0.1-0.4	0/8	
Chromium (Total)	130 (2)	6.3-52	0/8	
Lead	200 (4)	7.8-110	0/8	
Mercury (Total)	40 (1,5)	<0.05-0.19	0/8	
Selenium	250 (1)	<0.5-0.9	0/8	
Copper	2400 (1)	9.3-130	0/8	
Nickel	180 (1)	5.0-76	0/8	
Zinc	3700 (1)	59-1000	0/8	
Sulphate	0.24 (3)	0.04-0.12	0/8	
Thiocyanate	50	0.9-6.2	0/8	
Sulphide	250	<10-28	0/8	
Naphthalene	2.3 (1)	<0.1	0/8	
Benzo(a)pyrene	5 (4)	<0.1-1.0	0/8	
Dibenzo(a,h)anthracene	0.24(1)	<0.1-0.5	3/8	37.5%
PAH (Total)	40	<1.6-9.2	0/8	
Phenols	760 (1)	0.6-1.7	0/8	
Asbestos	No fibres	None	0/8	
pH	6-8	5.7-8.4	2/8	25.0%

(1) Copyright Land Quality Management Ltd reproduced with permission; Publication Number S4UL3499. All rights reserved.

(2) DEFRA CLR SGV's withdrawn used for initial comparison

(3) BS 8110 1985 Table 6.1

(4) Category 4 Screening Levels

(5) Unless there is considered to be historical site usage that would result in elemental and methylmercury compounds to be present, the inorganic mercury SGV is used as this is the most prevalent for of mercury present in the natural environment.

9.2.8 Only the topsoil sample from TP101 in the north west of the site recorded marginally elevated levels of Arsenic of 39 mg/kg. This is only a 2 mg/kg exceedance of the tier 1 trigger level, and would need 95% bio-availability for the amount of Arsenic free for absorption to be above the tier 1 trigger level.

9.2.9 No other elevated levels of heavy metals or phytotoxic metals were recorded in the samples taken from site.

9.2.10 Three of the seven samples of topsoil proved marginally elevated levels of dibenzo(a,h)anthracene (0.3-0.5 mg/kg). The site has remained undeveloped since 1854 and this is considered to be natural levels representative of the area.

9.2.11 No asbestos was recorded in the samples taken from site.

9.2.12 No elevated levels of sulphate were recorded in the samples taken from site, however, pH values as low as 5.7 were recorded. This corresponds to a design sulphate class DS-1, ACEC class AC-1, when compared against the BRE Special Digest 1 “Concrete in aggressive ground” for natural ground locations.

9.3 QUALITATIVE RISK ASSESSMENT

9.3.1 The Qualitative Risk Assessment is based upon the previously discussed source ► pathway ►receptor principle. In relation to the proposed site these may be described as follows:-

9.3.2 **SOURCE**

i) Marginally elevated levels of Arsenic and dibenzo(a,h)anthracene.
ii) No elevated levels of ground gas.

9.3.3 **PATHWAYS**

i) Ingestion of contamination material.
ii) Inhalation of contaminated particles.
iii) Dermal contact with the known contamination.
iv) Leaching to controlled waters.

9.3.4 **RECEPTORS**

i) Residential site users.
ii) Construction and maintenance workers.
iii) Controlled waters.
iv) The building structure.

9.3.5 Each of the receptors will now be appraised and attribute the likely risks involved.

i) Residential site users.

Based on the chemical results obtained it is considered that there is currently a **low/negligible** risk to end users from localised ground contamination on-site.

Previously, WSP took ten samples from the natural strata and submitted them for chemical analysis, three from the topsoil and seven from the underlying Pennine Lower Coal Measures. There were no exceedances of the contaminants analysed recorded on this site.

Only the topsoil sample from TP101 in the north west of the site recorded marginally elevated levels of Arsenic of 39 mg/kg. This is only a 2 mg/kg exceedance of the tier 1 trigger level, and would need 95% bio-availability for the amount of Arsenic free for absorption to be above the tier 1 trigger level.

Three of the seven samples of topsoil proved marginally elevated levels of dibenzo(a,h)anthracene (0.3-0.5 mg/kg), the remaining four topsoil samples recorded levels of below the limit of detection of <0.1 mg/kg. In addition to this, three samples of topsoil were taken during the original site investigation work by WSP and recorded dibenzo(a,h)anthracene concentrations of 0.084, 0.033 and 0.11 mg/kg, all below the tier 1 trigger level. Taking a value of 0.1 mg/kg for the four topsoil samples below the limit of detection, we get an average value of 1.73/10 = 0.17 mg/kg as a conservative estimate. As the topsoil is to be scraped and stockpiled, these samples will be mixed and the average value would be considered a fair representative of the stockpile as opposed to the individual values. As the average value is below the tier 1 trigger level of 0.24 mg/kg, we would consider the topsoil to be of minimal risk to the future site residents and could be considered suitable for re-use on site.

Based on approximately 50% of the site to be soft landscaping within private curtilage, and a 200mm topsoil depth to the soft landscaping, the volume of topsoil required is 21000 x 0.5 x 0.2 = 2100m^3. We would therefore consider that there are sufficient samples of the topsoil, including the original site investigation, to categorise the material as suitable for re-use.

There were no other levels of heavy or phytotoxic metals or PAH compounds recorded in the samples taken from site.

No asbestos recorded in the samples taken from site.

The minor exceedances of contaminants recorded in the samples of topsoil on site are not considered to be a significant risk to future site residents. It is recommended that the existing topsoil on site should be stockpiled and fenced off prior to developing the site to prevent cross contamination. The topsoil should be screened prior to being re-laid in garden areas to remove any deleterious materials.

Historically, a maximum carbon dioxide concentration of 4.2% has been recorded on site by WSP in September 2017. During the current monitoring to date, a maximum steady carbon dioxide concentration of 3.5% has been recorded on site. A peak methane concentration of 0.7% has been recorded on a single occasion, which quickly dropped to a steady state of 0%. Due to the low levels of carbon dioxide levels and flow rates on site, we would recommend the gas regime on this site be currently classified as **CS1** by BS 8485:2015+A1:2019 Table 2.

ii) Construction and Maintenance Workers.

It is considered that there is a **low** risk to construction and maintenance workers from the redevelopment of the site.

Construction workers should always wear PPE including overalls, boots and gloves when handling the contaminated materials onsite. In addition eating, drinking and smoking should be restricted to designated areas where the above hygiene facilities are available.

iii) Controlled Waters

The chemical analysis undertaken on samples of the natural strata from site have proved a limited area of contaminated topsoil on site. The excavation work undertaken has proven the site to be underlain by relatively impermeable clays. It is therefore considered that there is a negligible risk to groundwater and controlled waters from existing contamination on site.

Due to the presence of the watercourse crossing the development site, a temporary works plan should be prepared to ensure no surface water run-off during development on site causes pollution to the watercourse.

iv) Building Structures.

Service providers should be forwarded the final validated chemical levels in order for them to provide an accurate specification for the apparatus to be provided. New services should be surrounded and backfilled with clean material to afford some protection to the apparatus and allow any future maintenance work to be undertaken in clean material.

No elevated levels of sulphate were recorded in the samples taken from site, however, pH values as low as 5.7 were recorded. This corresponds to a design sulphate class DS-1, ACEC class AC-1, when compared against the BRE Special Digest 1 “Concrete in aggressive ground” for natural ground locations.

10.0 CONCLUSIONS AND RECOMMENDATIONS

10.1 GEOTECHNICAL ASSESSMENT

10.1.1 The fieldwork generally proved varying depths of superficial clays overlying weathered mudstone or sandstone. For initial design purposes we would envisage a safe bearing capacity of 100kN/m2 where foundations are cited into the clay strata and 200kN/m2 where foundations are extended onto the solid sandstone or mudstone strata.

10.1.2 Due to the steep nature of the site, and varying depth of the underlying clays, we would initially suggest that the proposed two/three storey residential constructions should be constructed on foundations taken through the superficial clay strata and founded entirely onto the underlying mudstone or sandstone strata. The foundation widths will vary dependent upon the line loadings calculated and bearing strata.

10.1.3 However, it should be noted that the site is likely to undergo significant cut/fill to suit the proposed adopted highway and finished floor levels to the properties. The design of the foundations will need to take into consideration the proposed finished floor levels in relation to the depth to suitable load bearing strata.

10.1.4 All foundations should be placed below a line of 45˚ drawn up from the base of any services or other structures.

10.1.5 Where existing foundations or structures are encountered during construction, these should be totally removed from the excavations to enable the new foundations to be constructed without obstructions.

10.1.6 At present it is not anticipated that excessive ground water control measures will be required, however land drains were noted entering the site from the eastern boundary. It is therefore recommended that a land drainage scheme is established early in the development to prevent overland groundwater flow affecting the lower site areas once the topsoil is stripped. Please note that ground water flows can vary throughout the year and a further assessment should be undertaken if construction work is proposed following a prolonged rainfall event.

10.1.7 No elevated levels of sulphate were recorded in the samples taken from site, however, pH values as low as 5.7 were recorded. This corresponds to a design sulphate class DS-1, ACEC class AC-1, when compared against the BRE Special Digest 1 “Concrete in aggressive ground” for natural ground locations.

10.1.8 Wherever any foundations are located near existing or proposed new trees, their foundations must be sited below the root growth zone. Reference should be made to the NHBC standards Chapter 4.2 “Building Near Trees” which provides guidance on foundation criteria, depths and construction. All services should be similarly protected. Plasticity testing of the clays on site has shown them to be of medium volume change potential. Additionally, due to the regrading works required, it is recommended that the foundations are taken down to the underlying bedrock.

10.2 MINING AND QUARRYING

10.2.1 An inferred coal seam is shown outcropping in the eastern half of the site, with probable shallow mine workings indicated extending from the seam to the eastern boundary.

10.2.2 Historically, WSP undertook three boreholes in 2017 to confirm the presence of shallow coal or workings in the eastern half of the site. Three boreholes were undertaken and proved sandstone, siltstone and mudstone to a depth of 21.0-21.5m below existing ground levels.

10.2.3 The recent boreholes on site generally proved up to 2.2m of topsoils and clays overlying mudstones and sandstones that were encountered at 0.3-2.2m beneath existing ground levels. Alternating bands of mudstone and siltstone were recorded from 2.9-9.0m below existing ground levels to the base of the boreholes at 10-30m beneath existing ground levels.

10.2.4 None of the trial pits or boreholes undertaken on site have encountered shallow coal during the current investigation works or during the previous investigation works by WSP.

10.2.5 The site is therefore considered to be at a negligible risk from shallow coal mining and no additional investigation or remedial works are required for the development.

10.3 GROUND FLOOR SLAB – GAS MEASURES

10.3.1 As discussed previously, gas monitoring stations were installed in five of the borehole locations on site due to the possibility of ground gas migration from probable shallow mine workings and infilled land in the vicinity of the site. In addition to this, there were three existing monitoring stations from previous site investigation works extant.

10.3.2 A maximum steady carbon dioxide concentration of 3.5% was recorded during the current gas monitoring. A peak methane concentration of 0.7% has been recorded on a single occasion, which quickly dropped to a steady state of 0%. No flow rates have been detected on site.

10.3.3 The proposed development consists of low rise residential housing and therefore the gas regime has been characterised in accordance with the traffic light methodology as outlined in *CIRIA Report C665*. Due to the low carbon dioxide levels on site, we would recommend the gas regime on this site be currently classified as **CS1** by BS 8485:2015+A1:2019 Table 2.

10.3.4 No Radon Protection measures are required for the site. However, a number of warranty providers consider it good practice to provide basic radon protective measures as standard and they should be consulted at an early stage to confirm their requirements.

10.4 CONTAMINATION ASSESSMENT

10.4.1 Previously, WSP took ten samples from the natural strata and submitted them for chemical analysis, three from the topsoil and seven from the underlying Pennine Lower Coal Measures. There were no exceedances of the contaminants analysed recorded on this site.

10.4.2 During these investigation works, only the topsoil sample from TP101 in the north west of the site recorded marginally elevated levels of Arsenic of 39 mg/kg. This is only a 2 mg/kg exceedance of the tier 1 trigger level, and would need 95% bio-availability for the amount of Arsenic free for absorption to be above the tier 1 trigger level.

10.4.3 Three of the seven samples of topsoil proved marginally elevated levels of dibenzo(a,h)anthracene (0.3-0.5 mg/kg), the remaining four topsoil samples recorded levels of below the limit of detection of <0.1 mg/kg. In addition to this, three samples of topsoil were taken during the original site investigation work by WSP and recorded dibenzo(a,h)anthracene concentrations of 0.084, 0.033 and 0.11 mg/kg, all below the tier 1 trigger level. Taking a value of 0.1 mg/kg for the four topsoil samples below the limit of detection, we get an average value of 1.73/10 = 0.17 mg/kg as a conservative estimate. As the topsoil is to be scraped and stockpiled, these samples will be mixed and the average value would be considered a fair representative of the stockpile as opposed to the individual values. As the average value is below the tier 1 trigger level of 0.24 mg/kg, we would consider the topsoil to be of minimal risk to the future site residents and could be considered suitable for re-use on site.

10.4.4 Based on approximately 50% of the site to be soft landscaping within private curtilage, and a 200mm topsoil depth to the soft landscaping, the volume of topsoil required is 21000 x 0.5 x 0.2 = 2100m^3. We would therefore consider that there are sufficient samples of the topsoil, including the original site investigation, to categorise the material as suitable for re-use.

10.4.5 There were no other levels of heavy or phytotoxic metals or PAH compounds recorded in the samples taken from site.

10.4.6 No asbestos recorded in the samples taken from site.

10.4.7 The existing topsoil on site is considered suitable for re-use and is not considered to be a significant risk to future site residents. It is recommended that the existing topsoil on site should be stockpiled and fenced off prior to developing the site to prevent cross contamination. The topsoil should be screened prior to being re-laid in garden areas to remove any deleterious materials.

10.4.8 Should any suspected areas of contamination be exposed during site strip/construction, an engineer should be contacted to determine if additional chemical testing should be undertaken. The on-site staff should maintain a photographic record and dates of any exposed contaminated material.

10.4.7 It is not currently anticipated that any topsoil will be required to be imported to site based on the currently available information. However, should any material need to

be imported, all imported material should be tested for the range of contaminants listed previously in Table 4. Only material found to be below published trigger levels should be deemed uncontaminated and accepted for use on site.

10.4.9 If the imported material is from a Greenfield site, a minimum of 3 samples or 1 per 250m3 of imported material should be taken for testing, whichever is greater. If it is from a brownfield site, a minimum of 6 samples, or 1 per 100m3 of imported material should be taken for testing, whichever is greater. Material provided by a commercial supplier should be certified to the same level of testing, with the certificate less than two months old.

10.4.10 All imported certified material should be placed immediately. If this is not possible, or the material is not certified and sampling is to be carried out prior to being laid, it should be securely stored on site prior to use to prevent possible contamination from any materials on site.

10.4.11 If any areas of made ground are removed off site, they should be taken to a licensed waste site and full documentation should be obtained. Any material to be taken off-site should be suitably quarantined prior to removal to prevent cross contamination. Any relevant chemical test results should be given to the landfill operator, so that they can determine if this material is suitable to be disposed of in their licensed landfill.

10.5 SURFACE WATER DRAINAGE

10.5.1 The two soak-a-way tests undertaken on site proved rising water levels for the duration of the test.

10.5.2 Additionally, due to the steep nature of the site there is the possibility for re-emergence of water downhill from the soakaways. Finally, due to the re-levelling required to develop the site, it may prove impractical to construct soakaways through the re-engineered ground to the underlying natural strata.

10.5.3 We would therefore not consider infiltration methods a suitable long term drainage solution for the development.

10.5.4 A discharge rate and point of connection to the will need to be agreed with Kirklees Council Lead Local Flood Authority and Yorkshire Water.

11.0 SUGGESTED FURTHER WORK

11.1 Temporary works to be agreed to prevent surface water run-off from site during development. It is recommended that the topsoil strip on site is phased to suit the build program where possible to help alleviate the surface water run-off. A land drainage system should be established early in the development during the regrading works.

12.0 APPROVALS

12.1 Proposals for the remediation of contaminated land may require the approval of numerous bodies.

These include:

a) Kirklees Council Environmental Health Department as required by the building and planning regulations.

b) The NHBC or similar as they will provide the insurance costs to cover the property.

c) The Environment Agency if there are risks of contamination to ground or surface water systems. They will also require notification if material is removed from site and taken to an appropriate tip.

d) Relevant highways and drainage authorities and other service companies may also wish to know about the level of contaminants.

Prepared by

M.Dean. BSc(Hons) HND

Checked by

M. Huddleston. MEng

September 2024

APPENDIX A

Site Location Plan

Landfill Location Plan

Site Investigation Plan

Typical Site Conceptual Model

Haigh Huddleston & Associates
Civil Structural Engineering Consultants
t 01924 547074
e martin@haighhuddleston.co.uk

UNIT 4
MIDGLEY BUSINESS
PARK
BAR LANE
MIDGLEY
WF4 4JJ

Client : Homes By Honey

Job Title: Penistone Road, Fenay Bridge

Job Number : E20/8060

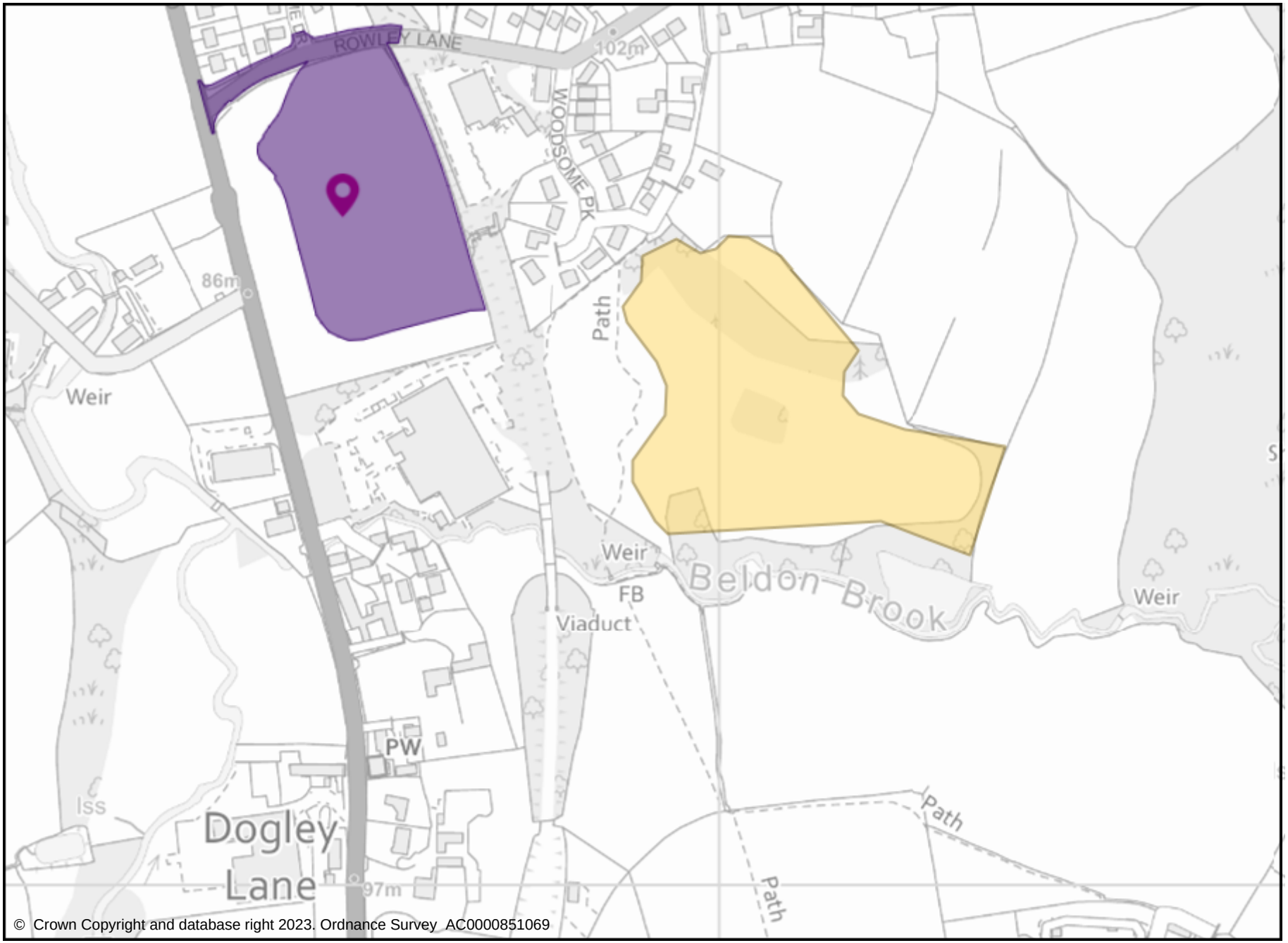
LOCATION PLAN

OS Grid Reference : SE187144
Easting : 418748
Northing : 414489

Topographical Survey carried out using GPS.

N

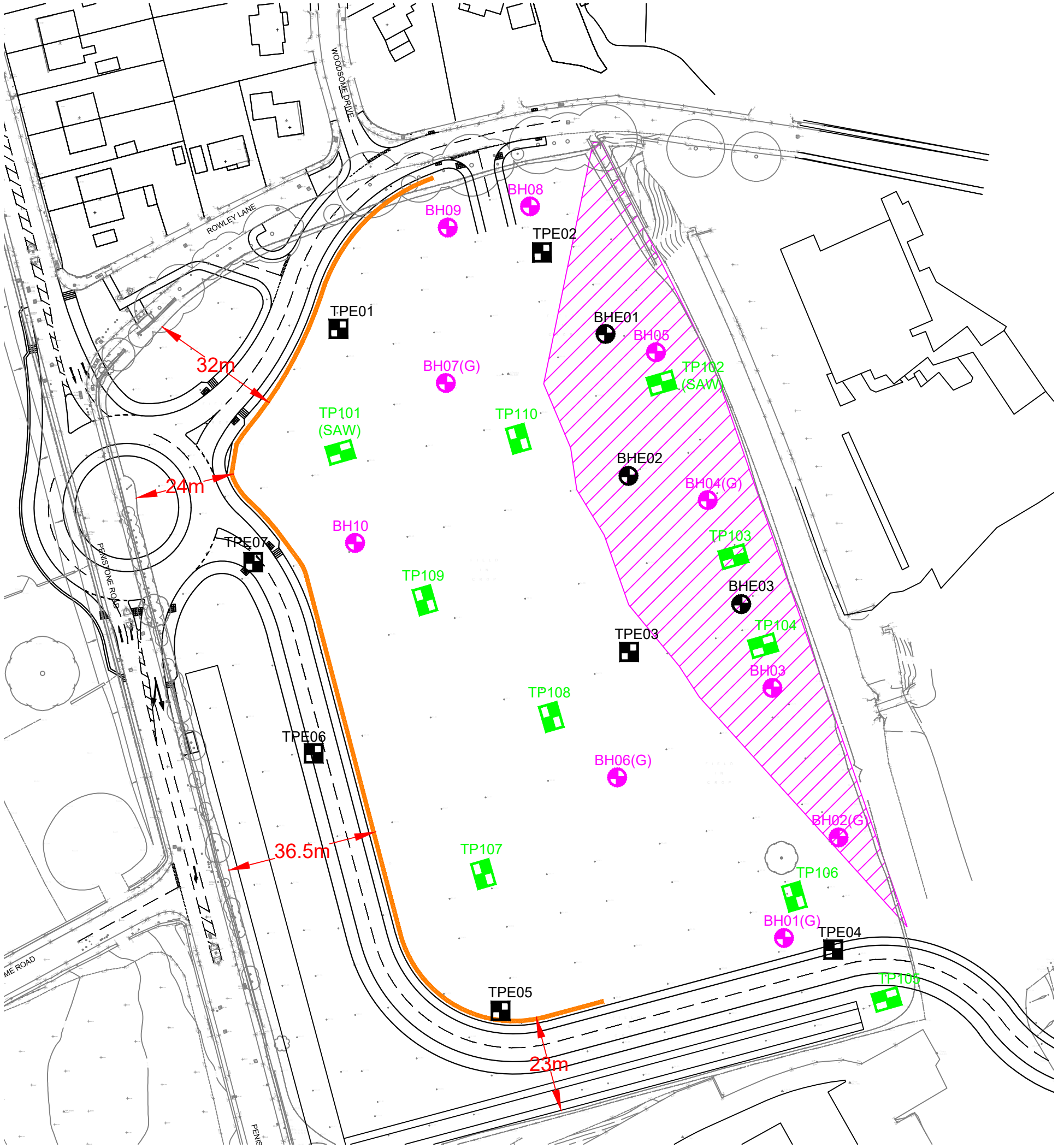
Land off Penistone Road



Kirklees COUNCIL

Scale = 1:3806.460

maps@kirklees.gov.uk



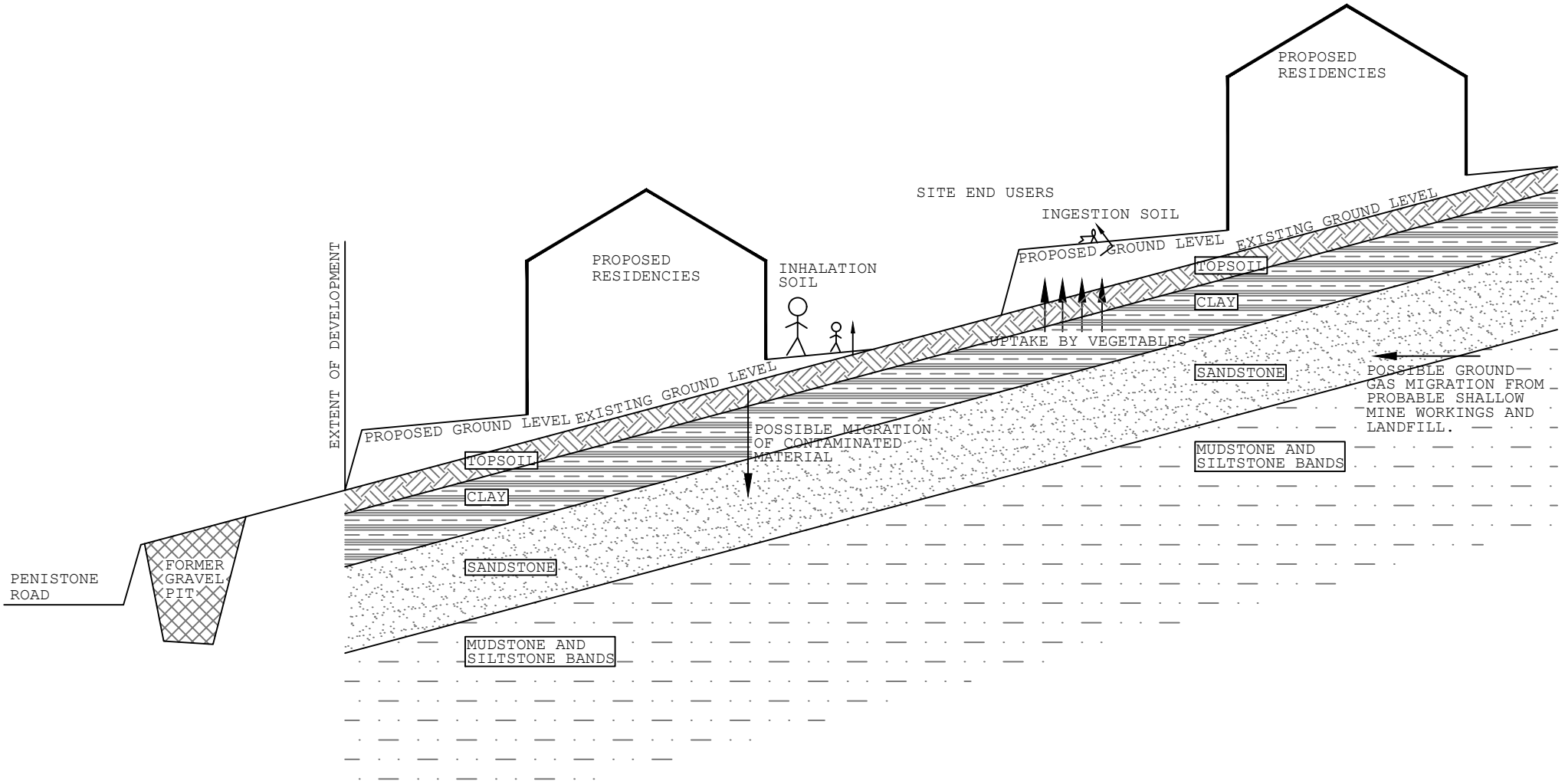
KEY:

- WSP TRIAL PIT (Sep 2017)
- WSP BOREHOLE (Sep 2017)
- HHA TRIAL PIT (Dec 2023)
- HHA BOREHOLE (Dec 2023)
- PROBABLE SHALLOW MINE WORKINGS

Haigh Huddleston & Associates
Civil Structural Engineering Consultants
Unit 4, Midgley Business Park, Bar Lane, Midgley, WF4 4JJ
t 01924 574074
e martin@haighhuddleston.co.uk

Client	HOMES BY HONEY
Project	PENISTONE ROAD, FENAY BRIDGE
Detail	SITE INVESTIGATION PLAN

Scale	Dwn	Chkd	Date	Dwg No.
1:1000@A3	JF		Jan'24	E23/8060/003



Haigh Huddleston & Associates

Civil Structural Engineering Consultants

Unit 4, Midgley Business Park, Bar Lane, Midgley, WF4 4JJ
t 01924 574074
e martin@haighhuddleston.co.uk

Client
HOMES BY HONEY

Project
PENISTONE ROAD, FENAY BRIDGE

Detail
TYPICAL SITE CONCEPTUAL MODEL

Scale	Dwn	Chkd	Date	Dwg No.
NTS@A3	JF		Jan'24	E23/8060/032

APPENDIX B

Trial Hole Logs

Borehole Logs

Soakaway Tests

TRIAL HOLE NO. 101

Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ
t 01924 574074 e info@haighhuddleston.co.uk

Client :	**Homes By Honey**	**Job No :**	**8060**
Site :	**Penistone Road, Fenay Bridge**	**Date :**	**5 December 2023**

0.0		
	0.3	Rough grass over dark brown loamy topsoil (Sample a 0.15m)
0.5 **1.0**	**1.4**	Soft/ firm very sandy clay with numerous sandstone gravels
1.5	**1.7**	Firm dark brown clay with occasional sandstone gravels
2.0 **2.5**	**2.7**	Highly weathered sandstone within a sandy clay matrix. Sandstone excavated as angular gravels, cobbles and occasional boulders
3.0 **3.5** **4.0**		Difficult to excavate further

REMARKS:

Ground water encountered during excavation	YES at 2.3m
Sample taken	YES (topsoil 0.15m)
Sides of excavation remained stable	YES
Level	……

NOTES:

……

……

TRIAL HOLE NO. 102

Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ
t 01924 574074 e info@haighhuddleston.co.uk

Client :	**Homes By Honey**	**Job No :**	**8060**
Site :	**Penistone Road, Fenay Bridge**	**Date :**	**December 2023**

0.0		
	0.25	Rough grass over dark brown TOPSOIL (sample @0.2m)
0.5	**0.90**	Soft to firm light brown mottled grey very sandy CLAY with occasional sandstone gravels
1.0 **1.5** **2.0** **2.5**	**2.60**	Moderately weak dark brown / grey highly weathered SANDSTONE excavated as angular gravels in a slightly clayey matrix. Becoming difficult to excavate with depth. Ground water seepage at base of trial pit.
3.0 **3.5** **4.0**		

REMARKS:

Ground water encountered during excavation	YES
Sample taken	YES – 0.2m Topsoil
Sides of excavation remained stable	YES
Level	……

NOTES:

……

……

TRIAL HOLE NO. 103

Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ
t 01924 574074 e info@haighhuddleston.co.uk

Client :	**Homes By Honey**	**Job No :**	**8060**
Site :	**Penistone Road, Fenay Bridge**	**Date :**	**December 2023**

0.0		
	0.30	Rough grass over dark brown TOPSOIL
0.5		Soft to firm light brown mottled grey very sandy CLAY with occasional sandstone gravels
	0.90	Land drain encountered with consistent flow. Trial pit terminated at 0.90m
1.0		
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation	YES
Sample taken	NO
Sides of excavation remained stable	YES
Level	……

NOTES:

……

……

TRIAL HOLE NO. 104

Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ
t 01924 574074 e info@haighhuddleston.co.uk

Client :	**Homes By Honey**	**Job No :**	**8060**
Site :	**Penistone Road, Fenay Bridge**	**Date :**	**December 2023**

0.0		
	0.30	Rough grass over dark brown TOPSOIL
0.5	**0.70**	Soft to firm light brown mottled grey very sandy CLAY with occasional sandstone gravels (Sample @ 0.6m)
1.0	**1.20**	Moderately weak dark brown / grey highly weathered SANDSTONE excavated as angular gravels in a slightly clayey matrix
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation	NO
Sample taken	YES – 0.6m Clay
Sides of excavation remained stable	YES
Level	……

NOTES:

……

……

TRIAL HOLE NO. 105

Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ
t 01924 574074 e info@haighhuddleston.co.uk

Client :	**Homes By Honey**	**Job No :**	**8060**
Site :	**Penistone Road, Fenay Bridge**	**Date :**	**December 2023**

0.0			
	0.25	Rough grass over dark brown topsoil (Sample @0.15m)	
0.5	**0.80**	**Eastern/upper Half of TP** Loose angular sandstone gravels with constant ground water seepage from all sides.	**Western /Lower Half of TP** Soft to firm light brown mottled clay with occasional sandstone gravels.
1.0		Trial pit terminated at 0.80m due to extent and rate of ground water seepage.	
1.5			
2.0			
2.5			
3.0			
3.5			
4.0			

REMARKS:

Ground water encountered during excavation	YES
Sample taken	YES - @0.15m Topsoil
Sides of excavation remained stable	YES
Level	……

NOTES:

……

……

TRIAL HOLE NO. 106

Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ
t 01924 574074 e info@haighhuddleston.co.uk

Client :	**Homes By Honey**	**Job No :**	**8060**
Site :	**Penistone Road, Fenay Bridge**	**Date :**	**December 2023**

0.0		
	0.25	Rough grass over dark brown TOPSOIL
0.5	**0.60**	Soft light brown very sandy CLAY with occasional small angular sandstone gravels
1.0	**1.40**	Moderately weak dark brown / grey highly weathered SANDSTONE excavated as angular gravels in a clayey/ sandy matrix
1.5		
2.0	**2.20**	Weak dark brown MUDSTONE excavated as shale in a slightly clayey matrix
	2.40	Weak becoming strong dark brown SANDSTONE excavated as angular gravels.
2.5		Trial pit becoming difficult to excavate at 2.40m.
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation	NO
Sample taken	NO
Sides of excavation remained stable	YES
Level	……

NOTES:

……

……

TRIAL HOLE NO. 107

Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ
t 01924 574074 e info@haighhuddleston.co.uk

Client :	**Homes By Honey**	**Job No :**	**8060**
Site :	**Penistone Road, Fenay Bridge**	**Date :**	**December 2023**

0.0		
	0.35	Rough grass over dark brown TOPSOIL (Sample @ 0.2m)
0.5	**0.70**	Soft dark brown very sandy CLAY with numerous small angular sandstone gravels
1.0 **1.5**	**1.70**	Weak light brown SANDSTONE excavated as angular gravels with occasional large sandstone boulders. Water seepage from multiple locations at 1.30m depth. Sides unstable with numerous collapses.
	1.95	Moderately strong becoming strong light brown SANDSTONE becoming difficult to excavate with depth.
2.0 **2.5** **3.0** **3.5** **4.0**		

REMARKS:

Ground water encountered during excavation	YES
Sample taken	YES – @ 0.2m Topsoil
Sides of excavation remained stable	YES
Level	……..

NOTES:

……

……

TRIAL HOLE NO. 108

Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ
t 01924 574074 e info@haighhuddleston.co.uk

Client :	**Homes By Honey**	**Job No :**	**8060**
Site :	**Penistone Road, Fenay Bridge**	**Date :**	**December 2023**

0.0		
	0.30	Rough grass over dark brown TOPSOIL (Sample @0.15m)
0.5		Soft to firm dark brown very sandy CLAY with occasional sandstone gravels.
1.0	**1.10**	
1.50	**1.70**	Moderately weak becoming strong light brown SANDSTONE excavated as angular gravels. Becoming difficult to excavate with depth.
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation	NO
Sample taken	YES – @ 0.15m
Sides of excavation remained stable	YES
Level	……

NOTES:

……

……

TRIAL HOLE NO. 109

Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ
t 01924 574074 e info@haighhuddleston.co.uk

Client :	**Homes By Honey**	**Job No :**	**8060**
Site :	**Penistone Road, Fenay Bridge**	**Date :**	**December 2023**

0.0		
	0.35	Rough grass over dark brown TOPSOIL (Sample @0.2m)
0.5		
1.0		Soft to firm dark brown very sandy CLAY with numerous sandstone gravels.
	1.20	
1.50		Moderately weak becoming strong light brown SANDSTONE. Becoming difficult to excavate with depth.
2.0		
	2.10	
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation	NO
Sample taken	YES - @ 0.2m Topsoil
Sides of excavation remained stable	YES
Level	……

NOTES:

……

……

TRIAL HOLE NO. 110

Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ
t 01924 574074 e info@haighhuddleston.co.uk

Client :	**Homes By Honey**	**Job No :**	**8060**
Site :	**Penistone Road, Fenay Bridge**	**Date :**	**December 2023**

0.0		
	0.30	Rough grass over dark brown TOPSOIL (Sample @0.2m)
0.5		Soft to firm dark brown very sandy CLAY with occasional sandstone gravels.
1.0	**1.10**	
1.50		Moderately weak becoming strong light brown SANDSTONE excavated as angular gravels. Becoming difficult to excavate with depth.
2.0	**2.40**	
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation	NO
Sample taken	YES - @ 0.2m
Sides of excavation remained stable	YES
Level	……

NOTES:

……

……

Unit 4, Midgley Business Park,
Bar Lane
Midgley
WF4 4JJ

Tel: 01924 574074

Haigh Huddleston & Associates
Civil Structural Engineering Consultants

Equipment & Methods	**Client: Homes By Honey** **Site: Penistone Road, Fenay Bridge**
BOREHOLE No. 1	**Ground Level** **Date: 05/12/23**

Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample Type	Sample No.	Test	
Topsoil			0.20 (0.20)					
Clay			0.70 (0.50)					
Sandstone			4.00 (3.70)					

Remarks	Logged by
	Scale
	FIG

Unit 4, Midgley Business Park,
Bar Lane
Midgley
WF4 4JJ

Tel: 01924 574074

Haigh Huddleston & Associates
Civil Structural Engineering Consultants

Equipment & Methods	**Client: Homes By Honey** **Site: Penistone Road, Fenay Bridge**
BOREHOLE No. 2	**Ground Level** **Date: 05/12/23**

Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample Type	Sample No.	Test	
Topsoil			0.20 (0.20)					
Clay			0.50 (0.30)					
Mudstone			4.00 (3.50)					

Remarks	Logged by
	Scale
	FIG

Unit 4, Midgley Business Park,
Bar Lane
Midgley
WF4 4JJ

Tel: 01924 574074

Haigh Huddleston & Associates
Civil Structural Engineering Consultants

Equipment & Methods	**Client: Homes By Honey** **Site: Penistone Road, Fenay Bridge**
BOREHOLE No. 3	**Ground Level** **Date: 05/12/23**

Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample Type	Sample No.	Test	
Topsoil			0.20 (0.20)					
Clay			0.70 (0.50)					
Mudstone			3.20 (2.50)					
Sandstone			9.00 (5.80)					
Siltstone			10.20 (1.20)					
Mudstone/ Siltstone			30.00 (19.80)					

Remarks	Logged by
	Scale
	FIG

Unit 4, Midgley Business Park,
Bar Lane
Midgley
WF4 4JJ

Tel: 01924 574074

Haigh Huddleston & Associates
Civil Structural Engineering Consultants

Equipment & Methods	**Client: Homes By Honey** **Site: Penistone Road, Fenay Bridge**
BOREHOLE No. 4	**Ground Level** **Date: 05/12/23**

Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample Type	Sample No.	Test	
Topsoil			0.20 (0.20)					
Clay			2.20 (2.00)					
Sandstone			4.00 (2.00)					

Remarks	Logged by
	Scale
	FIG

Unit 4, Midgley Business Park,
Bar Lane
Midgley
WF4 4JJ

Tel: 01924 574074

Haigh Huddleston & Associates
Civil Structural Engineering Consultants

Equipment & Methods	**Client: Homes By Honey** **Site: Penistone Road, Fenay Bridge**
BOREHOLE No. 5	**Ground Level** **Date: 05/12/23**

Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample Type	Sample No.	Test	
Topsoil			0.20 (0.20)					
Clay			2.10 (1.90)					
Mudstone			2.80 (0.70)					
Sandstone			8.70 (5.90)					
Mudstone/ Siltstone			30.00 (21.30)					

Remarks	Logged by
	Scale
	FIG

Unit 4, Midgley Business Park,
Bar Lane
Midgley
WF4 4JJ

Tel: 01924 574074

Haigh Huddleston & Associates
Civil Structural Engineering Consultants

Equipment & Methods	**Client: Homes By Honey** **Site: Penistone Road, Fenay Bridge**
BOREHOLE No. 6	**Ground Level** **Date: 05/12/23**

Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample Type	Sample No.	Test	
Topsoil			0.20 (0.20)					
Clay			2.00 (1.80)					
Sandstone			4.00 (2.00)					

Remarks	Logged by
	Scale
	FIG

Unit 4, Midgley Business Park,
Bar Lane
Midgley
WF4 4JJ

Tel: 01924 574074

Haigh Huddleston & Associates
Civil Structural Engineering Consultants

Equipment & Methods	**Client: Homes By Honey** **Site: Penistone Road, Fenay Bridge**
BOREHOLE No. 7	**Ground Level** **Date: 05/12/23**

Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample Type	Sample No.	Test	
Topsoil			0.20 (0.20)					
Clay			1.60 (1.40)					
Sandstone			4.00 (2.40)					

Remarks	Logged by
	Scale
	FIG

Unit 4, Midgley Business Park,
Bar Lane
Midgley
WF4 4JJ

Tel: 01924 574074

Haigh Huddleston & Associates
Civil Structural Engineering Consultants

Equipment & Methods	**Client: Homes By Honey** **Site: Penistone Road, Fenay Bridge**
BOREHOLE No. 8	**Ground Level** **Date: 06/12/23**

Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample Type	Sample No.	Test	
Topsoil			0.20 (0.20)					
Clay			1.20 (1.00)					
Mudstone			2.50 (1.30)					
Sandstone			3.30 (0.80)					
Mudstone			10.00 (6.70)					

Remarks	Logged by
	Scale
	FIG

Unit 4, Midgley Business Park,
Bar Lane
Midgley
WF4 4JJ

Tel: 01924 574074

Haigh Huddleston & Associates
Civil Structural Engineering Consultants

Equipment & Methods	**Client: Homes By Honey** **Site: Penistone Road, Fenay Bridge**
BOREHOLE No. 9	**Ground Level** **Date: 06/12/23**

Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample Type	Sample No.	Test	
Topsoil			0.15 (0.15)					
Clay			0.45 (0.30)					
Mudstone			2.10 (1.65)					
Sandstone			2.90 (0.80)					
Mudstone			10.00 (7.10)					

Remarks	Logged by
	Scale
	FIG

Unit 4, Midgley Business Park,
Bar Lane
Midgley
WF4 4JJ

Tel: 01924 574074

Haigh Huddleston & Associates
Civil Structural Engineering Consultants

Equipment & Methods	**Client: Homes By Honey** **Site: Penistone Road, Fenay Bridge**
BOREHOLE No. 10	**Ground Level** **Date: 06/12/23**

Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample Type	Sample No.	Test	
Topsoil			0.20 (0.20)					
Clay			0.70 (0.50)					
Mudstone			10.00 (9.30)					

Remarks	Logged by
	Scale
	FIG

Soil Permeability test

TP101

Site **Penistone Road, Fenay Bridge** **Date** Dec-23

Client **Homes By Honey** **Job No.** E23/8060

Pit dimensions m

Length	1.8
Width	0.65
Depth	2.7

Time	Time into Test Mlns	Dip Reading mm	Vol cu.m	Vol Change cu.m	Contact area Avge sq.m	Permeability lit/ sq.m/sec
12.53	0	1800	1.05300		5.58000	
13.37	44	1790	1.06470	-0.01170	5.62900	-0.00079
14.24	91	1725	1.14075	-0.07605	5.94750	-0.00466
15.05	132	1665	1.21095	-0.07020	6.24150	-0.00468

ABANDONED DUE TO RISE IN WATER LEVELS

Average Permeabilty Value: -0.003377407 lit/ sq.m/sec

Soil Permeability test

TP102

Site **Penistone Road, Fenay Bridge** **Date** Dec-23

Client **Homes By Honey** **Job No.** E23/8060

Pit dimensions m

Length	1.65
Width	0.65
Depth	2.6

Time	Time into Test Mlns	Dip Reading mm	Vol cu.m	Vol Change cu.m	Contact area Avge sq.m	Permeability lit/ sq.m/sec
11.13	0	1800	0.85800		4.75250	
11.20	7	1790	0.86873	-0.01073	4.79850	-0.00535
12.58	105	1725	0.93844	-0.06971	5.09750	-0.00240
13.43	153	1665	1.00279	-0.06435	5.37350	-0.00427
14.31	198	1620	1.05105	-0.04826	5.58050	-0.00326
15.09	236	1600	1.07250	-0.02145	5.67250	-0.00167

ABANDONED DUE TO RISE IN WATER LEVELS

Average Permeabilty Value: -0.003389357 lit/ sq.m/sec

APPENDIX C

Chemical Analysis of Samples

Geotechnical Analysis of Samples

Gas Monitoring Results

Certificate of Analysis

Certificate Number	23-29257	*Issued:*	02-Jan-24

Client Haigh Huddleston & Associates Ltd
Firth Buildings
99-101 Leeds Road
Dewsbury
WF12 7BU

Our Reference	23-29257
Client Reference	8060
Order No	(not supplied)
Contract Title	Penistone Road
Description	8 Soil samples.
Date Received	12-Dec-23
Date Started	12-Dec-23
Date Completed	02-Jan-24
Test Procedures	Identified by prefix DETSn (details on request).
Notes	Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Kirk Bridgewood
General Manager

MCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

ilac-MRA

UKAS TESTING
2139

Summary of Chemical Analysis
Matrix Descriptions

Our Ref 23-29257
Client Ref 8060
Contract Title Penistone Road

Sample ID	Depth	Lab No	Completed	Matrix Description
TP101	0.15	2275787	02/01/2024	Dark brown slightly gravelly, sandy CLAY including odd rootlets
TP102	0.2	2275788	02/01/2024	Dark brown slightly gravelly, sandy CLAY including odd rootlets
TP104	0.6	2275789	02/01/2024	Brown slightly gravelly, sandy CLAY
TP105	0.15	2275790	02/01/2024	Dark brown slightly gravelly, sandy CLAY including odd rootlets
TP107	0.2	2275791	02/01/2024	Dark brown slightly gravelly, sandy CLAY including odd rootlets
TP108	0.15	2275792	02/01/2024	Dark brown slightly gravelly, sandy CLAY including odd rootlets
TP109	0.2	2275793	02/01/2024	Dark brown slightly gravelly, sandy CLAY including odd rootlets
TP110	0.2	2275794	02/01/2024	Dark brown slightly gravelly, sandy CLAY including odd rootlets

Summary of Chemical Analysis
Soil Samples

Our Ref 23-29257
Client Ref 8060
Contract Title Penistone Road

				Lab No	2275787	2275788	2275789	2275790	2275791	2275792
				.Sample ID	TP101	TP102	TP104	TP105	TP107	TP108
				Depth	0.15	0.20	0.60	0.15	0.20	0.15
				Other ID						
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Sampling Date	05/12/2023	05/12/2023	05/12/2023	06/12/2023	06/12/2023	06/12/2023
				Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**							
Metals										
Arsenic	DETSC 2301#	0.2	mg/kg	39	25	30	28	8.4	33
Cadmium	DETSC 2301#	0.1	mg/kg	1.4	0.2	0.4	0.3	< 0.1	0.3
Chromium	DETSC 2301#	0.15	mg/kg	37	6.3	27	21	19	23
Copper	DETSC 2301#	0.2	mg/kg	29	7.7	48	47	18	47
Lead	DETSC 2301#	0.3	mg/kg	110	7.8	75	69	15	59
Mercury	DETSC 2325#	0.05	mg/kg	0.08	< 0.05	0.19	0.10	< 0.05	0.13
Nickel	DETSC 2301#	1	mg/kg	76	5.0	25	19	15	25
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	0.9	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	1000	59	130	100	59	86
Inorganics										
pH	DETSC 2008#		pH	7.7	8.4	6.6	6.5	6.6	6.4
Thiocyanate	DETSC 2130#	0.6	mg/kg	2.0	2.1	5.3	6.2	2.9	3.9
Total Organic Carbon	DETSC 2084#	0.5	%	1.2	4.2	5.9	5.7	< 0.5	5.3
Sulphide	DETSC 2024*	10	mg/kg	20	28	20	< 10	24	12
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.09	0.08	0.10	0.12	0.04	0.07
PAHs										
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	0.4	0.2	< 0.1	0.2	< 0.1	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	0.2	0.3	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	0.7	0.7	< 0.1	0.6	0.1	0.2
Pyrene	DETSC 3301	0.1	mg/kg	0.7	0.9	< 0.1	0.7	0.2	0.2
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	0.3	0.5	< 0.1	0.8	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	0.3	2.8	< 0.1	0.7	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	0.2	0.4	< 0.1	0.5	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	0.2	0.2	< 0.1	0.2	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	0.5	1.0	< 0.1	0.8	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	1.0	1.3	< 0.1	1.0	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.3	0.5	< 0.1	0.3	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	0.5	0.4	< 0.1	0.4	< 0.1	< 0.1
PAH 16 Total	DETSC 3301	1.6	mg/kg	5.2	9.2	< 1.6	6.4	< 1.6	< 1.6
Phenols										
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	0.7	0.6	1.3	1.3	0.9	1.3

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 23-29257
Client Ref 8060
Contract Title Penistone Road

			Lab No	2275793	2275794
			.Sample ID	TP109	TP110
			Depth	0.20	0.20
			Other ID		
			Sample Type	SOIL	SOIL
			Sampling Date	06/12/2023	06/12/2023
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Metals					
Arsenic	DETSC 2301#	0.2	mg/kg	12	25
Cadmium	DETSC 2301#	0.1	mg/kg	0.2	0.3
Chromium	DETSC 2301#	0.15	mg/kg	25	26
Copper	DETSC 2301#	0.2	mg/kg	21	52
Lead	DETSC 2301#	0.3	mg/kg	30	62
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	0.11
Nickel	DETSC 2301#	1	mg/kg	19	26
Selenium	DETSC 2301#	0.5	mg/kg	0.7	< 0.5
Zinc	DETSC 2301#	1	mg/kg	86	99
Inorganics					
pH	DETSC 2008#		pH	6.2	5.7
Thiocyanate	DETSC 2130#	0.6	mg/kg	0.9	6.1
Total Organic Carbon	DETSC 2084#	0.5	%	1.8	4.6
Sulphide	DETSC 2024*	10	mg/kg	24	< 10
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.06	0.12
PAHs					
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	0.2
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	0.2	0.5
Pyrene	DETSC 3301	0.1	mg/kg	0.1	0.4
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
PAH 16 Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6
Phenols					
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	1.3	1.7

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Asbestos Analysis
Soil Samples

Our Ref 23-29257
Client Ref 8060
Contract Title Penistone Road

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2275787	TP101 0.15	SOIL	NAD	none	Ben Barsby
2275788	TP102 0.20	SOIL	NAD	none	Ben Barsby
2275789	TP104 0.60	SOIL	NAD	none	Ben Barsby
2275790	TP105 0.15	SOIL	NAD	none	Ben Barsby
2275791	TP107 0.20	SOIL	NAD	none	Ben Barsby
2275792	TP108 0.15	SOIL	NAD	none	Ben Barsby
2275793	TP109 0.20	SOIL	NAD	none	Ben Barsby
2275794	TP110 0.20	SOIL	NAD	none	Ben Barsby

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

Information in Support of the Analytical Results

Our Ref 23-29257
Client Ref 8060
Contract Penistone Road

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2275787	TP101 0.15 SOIL	05/12/23	GJ 250ml, PT 1L		
2275788	TP102 0.20 SOIL	05/12/23	GJ 250ml, PT 1L		
2275789	TP104 0.60 SOIL	05/12/23	GJ 250ml, PT 1L		
2275790	TP105 0.15 SOIL	06/12/23	GJ 250ml, PT 1L		
2275791	TP107 0.20 SOIL	06/12/23	GJ 250ml, PT 1L		
2275792	TP108 0.15 SOIL	06/12/23	GJ 250ml, PT 1L		
2275793	TP109 0.20 SOIL	06/12/23	GJ 250ml, PT 1L		
2275794	TP110 0.20 SOIL	06/12/23	GJ 250ml, PT 1L		

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

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

Soil Analysis Notes

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

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

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

Disposal

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

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

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 2002	Organic matter	%	0.1	Air Dried	No	Yes	Yes
DETSC 2003	Loss on ignition	%	0.01	Air Dried	No	Yes	Yes
DETSC 2008	pH	pH Units	1	Air Dried	No	Yes	Yes
DETSC 2076	Sulphate Aqueous Extract as SO4	mg/l	10	Air Dried	No	Yes	Yes
DETSC 2084	Total Organic Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2119	Ammoniacal Nitrogen as N	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide free	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide total	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Phenol - Monohydric	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC 2130	Thiocyanate	mg/kg	0.6	Air Dried	No	Yes	Yes
DETSC 2301	Arsenic	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC 2301	Barium	mg/kg	1.5	Air Dried	No	Yes	Yes
DETSC 2301	Beryllium	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC 2301	Cadmium Available	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2301	Cadmium	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2301	Cobalt	mg/kg	0.7	Air Dried	No	Yes	Yes
DETSC 2301	Chromium	mg/kg	0.15	Air Dried	No	Yes	Yes
DETSC 2301	Copper	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC 2301	Manganese	mg/kg	20	Air Dried	No	Yes	Yes
DETSC 2301	Molybdenum	mg/kg	0.4	Air Dried	No	Yes	Yes
DETSC 2301	Nickel	mg/kg	1	Air Dried	No	Yes	Yes
DETSC 2301	Lead	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC 2301	Selenium	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC 2301	Zinc	mg/kg	1	Air Dried	No	Yes	Yes
DETSC 2311	Boron (water soluble)	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC 2321	Total Sulphate as SO4	%	0.01	Air Dried	No	Yes	Yes
DETSC 2325	Mercury	mg/kg	0.05	Air Dried	No	Yes	Yes
DETSC 3049	Sulphur (free)	mg/kg	0.75	As Received	No	Yes	Yes
DETSC 3072	Ali/Aro C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	1.2	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	0.9	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	0.5	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	0.6	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETSC 3303	Acenaphthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Acenaphthylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(b)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(k)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(g,h,i)perylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Dibenzo(a,h)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 3303	Indeno(1,2,3-c,d)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Naphthalene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Phenanthrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3311	C10-C24 Diesel Range Organics (DRO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	C24-C40 Lube Oil Range Organics (LORO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	EPH (C10-C40)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3321	Benzene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3321	Ethylbenzene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3321	Toluene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3321	Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3321	m+p Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3321	o Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 28 + PCB 31	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 52	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 101	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 118	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 153	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 138	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 180	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB Total	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3521	Ali/Aro C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3521	Aliphatic C10-C12	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3521	Aliphatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3521	Aliphatic C12-C16	mg/kg	1.2	As Received	No	Yes	Yes
DETSC 3521	Aliphatic C16-C21	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3521	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3521	Aromatic C10-C12	mg/kg	0.9	As Received	No	Yes	Yes
DETSC 3521	Aromatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3521	Aromatic C12-C16	mg/kg	0.5	As Received	No	Yes	Yes
DETSC 3521	Aromatic C16-C21	mg/kg	0.6	As Received	No	Yes	Yes
DETSC 3521	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes

Method details are shown only for those determinands listed in Annex A of the MCERTS standard. Anything not included on this list falls outside the scope of MCERTS. No Recovery Factors are used in the determination of results. Results reported assume 100% recovery. Full method statements are available on request.

End of Report

Environmental
Geotechnical
Specialists

LABORATORY REPORT

job number	C/4023/23/L/6111
date	12/12/2023
site address	Penistone Road Fenay Bridge, Huddersfield, West Yorkshire, HD8 0AS
date scheduled	08/12/2023
date issued	12/12/2023
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 HEALTH & SAFETY SYSTEMS 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

UKAS
United Kingdom Accreditation Service

8948

Schedule of UKAS Accredited Laboratory Tests

RGS

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

Disclaimer

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

GEOTECHNICAL TESTING RESULTS

Please consider the environment before printing this report.

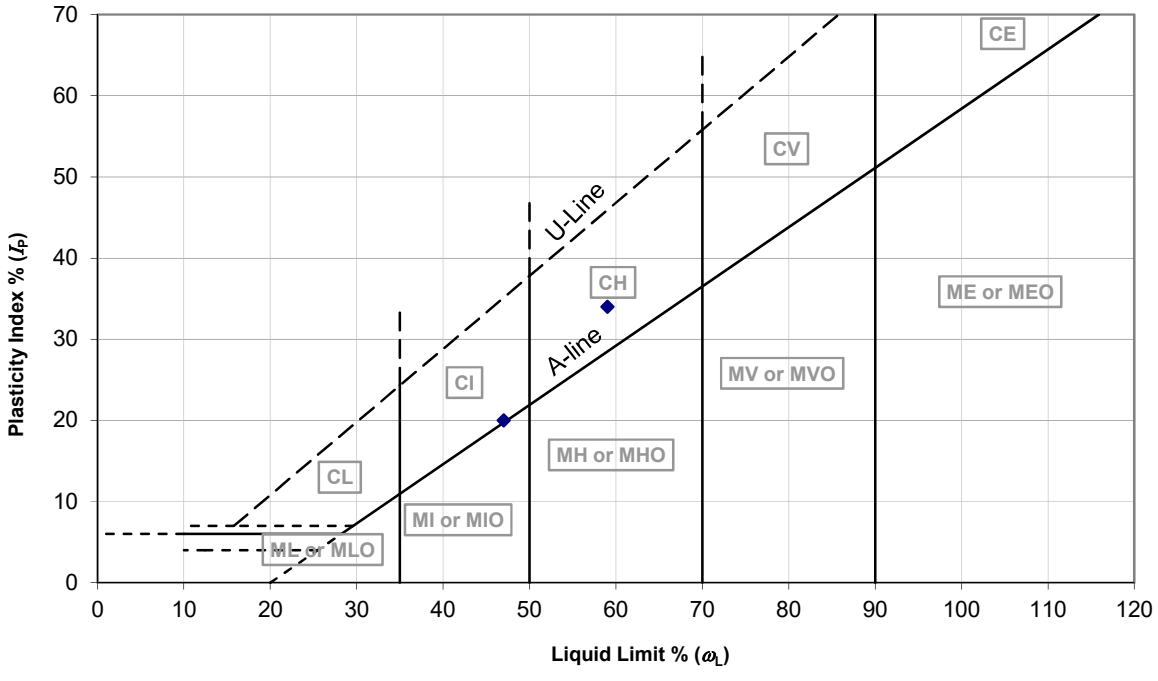
RGS Environmental Geotechnical Specialists

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

Blank Page

Rogers Geotechnical Services Ltd. Offices 1&2, Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU	**Classification of Index Properties**	**C/4023/23/L/6111**
Project Name: Penistone Road,	**BS EN ISO: 17892: Parts 1, 12**	Fig. 1 / Sheet. 1
Location: Fenay Bridge		Input By: Harry
Client: Haigh Huddleston & Associates		Check By: Harry

Location	Depth (m)	Water Content (ω) (%)	Liquid Limit (ω_L) (%)	Plastic Limit (ω_P) (%)	Plasticity Index (I_P) (%)	Retained by 0.425mm (%)	Modified (ω) (ω') (%)	Modified (I_P) (I_P') (%)	Liquidity/ Consistency (I_L) (%)	Liquidity/ Consistency (I_C) (%)	Casagrande Class	N.H.B.C Class (%)
TP102	0.75		47	27	20	0		20			C I	MEDIUM
TP106	0.50		59	25	34	22		27			C H	MEDIUM



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

Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ
t 01924 574074 e info@haighhuddleston.co.uk

SITE:	Penistone Road, Fennay Bridge
CLIENT:	Homes By Honey
JOB NO:	8060
SHEET NO:	1

GAS MONITORING RESULTS

	GAS CONCENTRATIONS												FLOW DATA				Qhg per borehole		WELL AND WATER DATA				Comments
Monitoring Point	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Oxygen (%v/v)		H2S (ppm)	CO (ppm)	Hex (%)	PIDCf ()	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)	Response Zone	A Pressure (mB)	
	Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady					Steady	Peak									
AIR	ND	ND	ND	ND	ND	ND	20.6	20.6	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	NR	NR	NR	NR	1006	Time: 8:00 Date: 14.12.23
BH01	ND	ND	ND	ND	1.2	1.2	17.7	17.7	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0012	4.00	4.00	1.0-4.00	1005	
BH02	ND	ND	ND	ND	1.9	0.8	19.1	19.8	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0019	0.85	4.00	N/A	1004	**Cloudy, Wet, Cold**
BH04	ND	ND	ND	ND	0.2	0.2	20.3	20.3	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0002	0.80	4.00	N/A	1004	
BH06	ND	ND	ND	ND	1.3	1.3	18.0	18.0	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0013	2.00	4.00	1.0-2.00	1004	**Falling A.P**
BH07	ND	ND	ND	ND	1.0	1.0	20.1	20.1	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.001	3.90	4.00	1.0-3.90	1004	
EXISTING 1	ND	ND	ND	ND	0.6	0.1	19.8	20.3	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0006	1.30	4.00	1.0-1.30	1004	
EXISTING 2	ND	ND	ND	ND	2.2	0.2	19.5	20.2	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0022	0.80	4.00	N/A	1005	
EXISTING 3	ND	ND	ND	ND	1.6	1.2	17.0	18.6	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0016	4.00	4.00	1.0-4.00	1004	
AIR	ND	ND	ND	ND	ND	ND	20.2	20.2	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	NR	NR	NR	NR	989	Time: 10:15 Date: 04.01.24
BH01	ND	ND	ND	ND	2.9	2.9	15.1	15.1	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0029	3.70	4.00	1.0-3.70	989	
BH02	Unable to monitor due to high water level - Water level 0.40 & pulling water into machine																						**Sunny, Wet, Cold**
BH04	ND	ND	ND	ND	0.2	0.2	20.1	20.1	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0002	0.70	4.00	N/A	988	
BH06	ND	ND	ND	ND	2.0	2.0	15.9	15.9	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.002	1.80	4.00	1.0-1.80	989	**Falling A.P**
BH07	ND	ND	ND	ND	1.3	1.3	18.4	18.4	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0013	3.60	4.00	1.0-3.60	989	
EXISTING 1	ND	ND	ND	ND	0.1	0.1	20.3	20.3	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0001	1.20	4.00	1.0-1.20	989	
EXISTING 2	ND	ND	ND	ND	0.2	0.2	20.2	20.2	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0002	0.70	4.00	N/A	990	
EXISTING 3	ND	ND	ND	ND	1.2	1.2	18.6	18.6	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0012	3.80	4.00	1.0-3.80	989	
AIR	ND	ND	ND	ND	ND	ND	20.3	20.3	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	NR	NR	NR	NR	1014	Time: 11:45 Date: 31.01.24
BH01	ND	ND	ND	ND	3.1	3.1	15.5	15.5	ND	ND	0.000	1.0	ND	1.9	0.09	ND	NR	0.0031	3.80	4.00	1.0-3.80	1012	
BH02	ND	ND	ND	ND	1.5	1.5	17.0	17.0	ND	ND	0.000	1.0	ND	10.8	ND	30	NR	0.0015	0.70	4.00	N/A	1012	**Cloudy, Windy, Cold**
BH04	ND	ND	ND	ND	0.5	0.5	19.9	19.9	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0005	0.60	4.00	N/A	1010	
BH06	ND	ND	ND	ND	2.1	2.1	17.5	17.5	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0021	2.90	4.00	1.0-2.90	1012	
BH07	ND	ND	ND	ND	1.6	1.6	18.9	18.9	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0016	3.70	4.00	1.0-3.70	1010	
EXISTING 1	ND	ND	ND	ND	0.5	0.5	19.6	19.6	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0005	1.85	4.00	1.0-1.85	1011	
EXISTING 2	ND	ND	ND	ND	0.3	0.3	20.2	20.2	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0003	1.10	4.00	1.0-1.10	1012	
EXISTING 3	0.7	0.0	17.9	0.0	0.9	0.7	15.1	19.0	ND	14.0	0.083	1.3	ND	ND	ND	ND	0.0007	0.0009	3.80	4.00	1.3-3.80	1009	

ND - Not detected

NR - Not recorded

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

Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
Unit 4, Midgley Business Park, Bar Lane, Midgley WF4 4JJ
t 01924 574074 e info@haighhuddleston.co.uk

SITE:	Penistone Road, Fennay Bridge
CLIENT:	Homes By Honey
JOB NO:	8060
SHEET NO:	2

GAS MONITORING RESULTS

	GAS CONCENTRATIONS												FLOW DATA				Qhg per borehole		WELL AND WATER DATA				Comments
Monitoring Point	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Oxygen (%v/v)		H2S (ppm)	CO (ppm)	Hex (%)	PIDCf ()	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)	Response Zone	A Pressure (mB)	
	Peak	Steady	Peak	Steady	Peak	Steady	Min	Steady					Steady	Peak									
AIR	ND	ND	ND	ND	ND	ND	20.3	20.3	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	NR	NR	NR	NR	1004	Time: 15:00 Date: 27.02.24
BH01	ND	ND	ND	ND	3.5	3.5	14.4	14.4	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0035	3.80	4.00	1.0-3.80	1004	
BH02	ND	ND	ND	ND	1.2	1.2	17.0	17.0	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0012	0.70	4.00	N/A	1004	**Cloudy, Windy, Cold**
BH04	ND	ND	ND	ND	0.7	0.7	19.9	19.9	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0007	0.70	4.00	N/A	1005	
BH06	ND	ND	ND	ND	2.8	2.8	16.1	16.1	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0028	2.90	4.00	1.0-2.90	1004	**Falling A.P**
BH07	ND	ND	ND	ND	1.4	1.4	19.1	19.1	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0014	3.70	4.00	1.0-3.70	1004	
EXISTING 1	ND	ND	ND	ND	2.3	2.3	17.2	17.2	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0023	1.90	4.00	1.0-1.90	1005	
EXISTING 2	ND	ND	ND	ND	0.4	0.4	20.1	20.1	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0004	1.60	4.00	1.0-1.60	1005	
EXISTING 3	ND	ND	ND	ND	1.2	1.2	19.1	19.1	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0012	3.90	4.00	1.0-3.90	1004	
AIR	ND	ND	ND	ND	ND	ND	20.3	20.3	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	NR	NR	NR	NR	998	Time: 15:00 Date: 12.03.24
BH01	ND	ND	ND	ND	3.4	3.4	15.1	15.1	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0034	4.00	4.00	1.0-4.00	996	
BH02	ND	ND	ND	ND	1.0	1.0	17.1	17.1	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.001	0.60	4.00	N/A	997	**Cloudy, Wet, Cold**
BH04	ND	ND	ND	ND	0.8	0.8	19.7	19.7	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0008	1.10	4.00	1.0-1.10	997	
BH06	ND	ND	ND	ND	2.8	2.8	16.9	16.9	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0028	2.10	4.00	1.0-2.10	997	**Falling A.P**
BH07	ND	ND	ND	ND	0.5	0.5	19.9	19.9	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0005	4.00	4.00	1.0-4.00	997	
EXISTING 1	ND	ND	ND	ND	1.7	1.7	18.6	18.6	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0017	1.80	4.00	1.0-1.80	997	
EXISTING 2	ND	ND	ND	ND	0.4	0.4	20.3	20.3	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0004	0.90	4.00	N/A	997	
EXISTING 3	ND	ND	ND	ND	1.3	1.3	19.0	19.0	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0013	4.00	4.00	1.0-4.00	996	
AIR	ND	ND	ND	ND	ND	ND	20.6	20.6	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	NR	NR	NR	NR	982	Time: 8:45 Date: 26.03.24
BH01	ND	ND	ND	ND	3.5	3.5	14.3	14.3	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0035	4.00	4.00	1.0-4.00	981	
BH02	ND	ND	ND	ND	1.0	1.0	17.4	17.4	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.001	0.40	4.00	N/A	981	**Cloudy, Dry, Cold**
BH04	ND	ND	ND	ND	0.5	0.5	19.9	19.9	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0005	1.40	4.00	1.0-1.40	980	
BH06	ND	ND	ND	ND	3.4	3.4	15.9	15.9	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0034	2.25	4.00	1.0-2.25	980	**Falling A.P**
BH07	ND	ND	ND	ND	1.6	1.6	18.4	18.4	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0016	4.00	4.00	1.0-4.00	980	
EXISTING 1	ND	ND	ND	ND	0.6	0.6	20.0	20.0	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0006	2.00	4.00	1.0-2.00	979	
EXISTING 2	ND	ND	ND	ND	0.1	0.1	20.4	20.4	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0001	1.10	4.00	1.0-1.10	981	
EXISTING 3	ND	ND	ND	ND	1.3	1.3	18.7	18.7	ND	ND	0.000	1.0	ND	ND	ND	ND	NR	0.0013	4.00	4.00	1.0-4.00	979	

ND - Not detected -

NR - Not recorded -

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