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CONSULTING

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SUMMARY

SITE DETAILS

Site Location	The site is located circa 1km north of Penistone Town Centre, approximately centred on National Grid Reference 424447, 404290
Site Area	The site is irregular in shape covering an area of approximately 15 hectares. The topography across the site generally slopes down gradually from north to south. The overall change in elevation is c.22m.

GROUND MODEL

Made Ground Soils	Made Ground was only encountered within the north east corner of the site and consisted of reworked natural topsoil or clay with brick and sandstone inclusions.
Natural Soils	Natural Soils generally comprised firm to stiff high strength Clay which is considered to be residual mudstone bedrock.
Bedrock	Bedrock was encountered within all locations across the site and comprised the following: Extremely weak to weak Mudstone from (min) 0.90m to (max) 3.10m bgl. Extremely weak to weak Siltstone from (min) 0.20m to (max) 3.45m bgl. Extremely weak to moderately strong sandstone from (min) 0.05m to (max) 1.95m bgl. Very poor quality residually weathered coal was encountered within two locations (TP19 and TP31) from (min) 0.50m to (max) 0.85m bgl.
Groundwater	Perched groundwater was encountered within three locations across the site, TP03, TP05 and TP15 at 1.60m, 1.70m and 1.55m respectively.

SUPPLEMENTARY INVESTIGATION

Lower Penistone Coal	The Lower Penistone Coal outcrop was encountered within three trial pits across the site (TP19, TP30 and TP31). The seam is consistently low quality and appears to be non-continuous across the site. Therefore there is not considered to be a risk from shallow workings of the Lower Penistone coal. If coal is encountered within foundation or utility excavations, measures to isolate the foundations and utilities should be taken in accordance with ICRL guidance detailed in Section 6.2.
Mine Shaft	Three trenches (Trench01 – Trench03) were excavated in the vicinity of a mineshaft indicated to be in the north east corner of the site. The trenches were excavated to rockhead and revealed no evidence of a mineshaft on site. Minimal made ground was encountered within the area, however this was likely placed to create an access from the road into the field.
Culvert Investigation	Two trenches (Trench04 and Trench05) were excavated in the vicinity of a suspected culvert crossing the site. The investigation aimed to determine where the culvert entered and exited the site. Trench04 identified the depth (0.90m bgl) and where the culvert exits the site. Furthermore the water within the culvert was not flowing and appear to be stagnated, indicating that the culvert may be blocked or capped of somewhere. Trench05 was excavated in the vicinity of where the culvert is indicated to enter the site, however no evidence of the culvert was identified.

**Offsite Drainage
Excavation**

Two trial pits (TP33 and TP34) were excavated off site in the vicinity of the proposed main drainage run to assess the rippability of the bedrock and carry out geo-environmental testing on the soils.

The Mudstone in this vicinity is considered to be rippable, however the Siltstone encountered within TP34 may require breaking equipment or specialist plant to excavate to greater than 1.60m bgl.

This area is on a c.1/10 slope, therefore access is limited and excavating to depths greater than 3.50m bgl may require benching into the slope to create a platform.

TIER 1 (GQRA) ASSESSMENT AND REVISED (PL) ASSESSMENT

**Human Health/
Groundworkers**

The risk to human health and construction workers from soils off site to the south is considered to be low.

Permanent Ground Gas

Ground gas monitoring is still ongoing, however the site currently falls within the Green Traffic Light Zone and Characteristic Situation 1, therefore if this is consistent throughout the monitoring no ground gas precautions will be required.

FINAL APPRAISAL

Completion of the following is still required:

- Completion of ground gas monitoring program.
- Issue Ground Gas Risk Assessment.
- Approval of recommendations made within this report with the Local Authority and Coal Authority.

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PLANS		
<i>Plan Reference</i>	<i>Revision</i>	<i>Title</i>
18032 01	-	Project Location Plan
18032 02	-	Preliminary Development Constraints Plan
18032 03	-	Exploratory Hole Location Plan

any unauthorised third party comes into possession of the report, they rely on it at their own risk and Groundtech Consulting Limited will not be obliged to provide a duty of care.

2.0 SITE SETTING

2.1 Location

The site is located circa 1km north of Penistone Town Centre, as shown on the Project Location Plan 18032 01 and is approximately centred on National Grid Reference 424447, 404290.



Access to the site is gained off Halifax Road to the north.

2.2 Site Description

The site is irregular in shape covering an area of approximately 15 hectares. The topography across the site generally slopes down gradually from north to south. The overall change in elevation is c.22m.

The site consists of three grass covered fields separated by drystone walls and fences. Access between the fields is through metal or timber swing gates.

Southern Field

An animal trough is located within the north west corner of the southernmost field, cattle were also present within this field during the investigation.

North Eastern Field

Overhead powerlines cross the eastern area of the north eastern field.

North Western Field

There are no significant features associated with the north western field.

Boundaries and Surrounding Land Uses

The site is bound by drystone walls in the north and east, hedgerows in the south and post and rail fence in the west.

The surrounding area of the site comprises the following features/land uses:

- North - Halifax Road with additional fields and residential properties beyond.
- East - A railway line in a cutting c.15m below site level with associated electricity substation immediately east of the site and residential properties beyond the cutting.
- South - Fishing pond and residential properties.
- West - Works units, fishing pond, residential properties and fields.

Site photographs are presented in Appendix 2, and any relevant features are recorded on the Preliminary Development Constraints Plan 18032 02.

3.0 SUMMARY OF PREVIOUS INFORMATION

The following summary is based on information obtained from the Geo-Environmental Assessment Report (Report Ref: DV/C3260/6274) dated August 2016.

3.1 Site History and Environmental Setting

Geology

No Made Ground or superficial deposits are indicated to underlie the site. The bedrock underlying the site is indicated to be the Pennine Lower Coal Measures Formation.

The Lower Penistone Coal is indicated to outcrop on the south and south west of the site. Information on the Lower Penistone Coal indicates that it is generally considered to be of poor quality and is not likely to have been worked. The Lower Penistone Coal was encountered within the railway cutting immediately east of the site and was recorded as being 0.16m thick. The approximate dip of the coal seam in the south of the site is 2° to the north east.

A fault is running north west to south east in the eastern portion of the site which intersects the Lower Penistone Coal.

In addition, the Better Bed Coal Seam is indicated to underly the site at c.80m depth.

Past coal workings are shown to the north east of the site and a mine shaft is indicated to be located in the north east of the site.

The bedrock geology is classified by the Environment Agency as a Secondary A Aquifer.

Historical Setting

A small circular feature is present in the north east corner of the site on the earliest map of 1848, this feature is no longer present on the map of 1891. The remainder of the site is undeveloped and has remained undeveloped to the present day.

A railway cutting is shown to the east of the site and a quarry is shown abutting the site to the south on the map dated 1850. A sandstone quarry later labelled as an old coal pit is present c.250m north east of the site.

Westthorpe detonator works is shown immediately to the west of the site on the map of 1890, with associated tanks shown on later maps.

Environmental Setting

The nearest watercourse to the site is Scout Dyke 49m to the south west.

The site is not considered to be at risk from flooding in accordance with Environmental Agency flood risk parameters.

There are no surface water abstractions within 1000m of the site.

The nearest recorded landfill site is 535m to the south west of the site. A waste transfer site is located 67m south east of the site.

A pollution incident 121m south west of the site, relating to an unknown pollutant had a major impact to water.

The nearest discharge consent is 157m east of the site, and the nearest petrol filling station is 431m south west of the site.

The Coal Authority Mining Report indicates that a mine entry is present in the north east of the site, however the report also states that the site is not within a surface area that could be affected by past underground mining.

3.2 Conceptual Site model and Risk Assessment

A number of potential receptors were identified by the desk study, the receptors are detailed below along with associated pollution pathways which appear in brackets.

Potential Receptors

- Controlled water receptors – groundwater (vertical migration to Secondary A Aquifer) and surface water (lateral migration of groundwater).
- Future residential site users (dermal contact, inhalation, ingestion of soils and dust, consumption of produce from gardens).
- Development workers (dermal contact, inhalation, ingestion of soils and dusts).
- Future building structures and services (direct contact with contaminated soils, ingress of ground gases into buildings, notably carbon dioxide, via voids and service entries).
- Off-site human health receptors and building structures/services (lateral migration of groundwater and ground gas).

Risk Assessment

The risk assessment from the Desk Study can be divided into two parts - risk from Made Ground and risk from ground gases to the above relevant receptors. The risks associated with the Made Ground are highlighted below:

Potential Source	Pathway	Receptor	Potential Risk
Made Ground	Leaching and off-site migration	Controlled Waters	Moderate/Low
	Ingestion, inhalation, direct contact	Future site users/ development workers	Moderate
	Direct contact	Future building structures and service e.g. potable water supply pipes	Moderate
Ground gases	Ground gas migration/ inhalation	Future site users	Moderate
		Future building structure and services	Moderate

3.3 Previous Ground Investigation Summary

The previous Ground Investigation was previously carried out between 19th July and 21st July 2016. The ground investigation comprised the excavation of fifty-six trial pits to a maximum depth of 4.10m bgl using a JCB 3CX wheeled excavator.

Made Ground

Made Ground was encountered in one location (TP37) in the north east corner to a maximum depth of 0.60m bgl of the site and comprised sandy topsoil with gravel to boulder sized mudstone and rare brick.

Natural Strata

Natural ground conditions encountered across the site consisted of dark brown sandy topsoil to a maximum depth of 0.50m bgl underlain by firm to stiff sandy Clay to a maximum depth of 2.6m bgl.

Bedrock

Mudstone bedrock was generally encountered at between 1.0m and 2.0m bgl, becoming medium strong and partially weathered at less than 3.0m bgl in most locations.

Coal was noted within four trial pits (TP17, TP19, TP20 and TP54) at depths of between 0.80m and 2.80m bgl. The seam was generally 0.3m and 0.4m thick and was heavily weathered, being recovered as gravelly clay.

Groundwater was encountered within five locations (TP12, TP19, TP20, TP22 and TP49) between 1.0m and 2.8m bgl.

No visual or olfactory evidence of contamination was noted during the investigation.

3.4 Geotechnical Assessment

The geotechnical assessment highlighted that the most suitable foundations for the proposed development are considered to be traditional strip footings founded at 0.90m bgl within the firm to stiff clay. A bearing capacity of 125kN/m² has been provided for strip footings at this depth.

Ground bearing floor slabs may generally be adopted at the site.

A design CBR value of 4% to 5% can be assumed for undisturbed natural clay deposits unless proven otherwise by in situ geotechnical testing.

The use of soakaways is not considered to be feasible due to the presence of impermeable clay deposits across the site which are likely to exhibit poor drainage properties.

3.5 Coal Mining

The geological map inspected indicates that a coal seam outcrops at the site. It also indicates another seam may be present circa 86m or deeper below the site. The geological memoir consulted suggests that the two coal seams affecting the site are not of economic importance and as such are considered unlikely to have been worked.

Coal was encountered within several trial pits across the site generally trending from east to west. This is interpreted to be part of the Lower Pennine Coal that is shown to subcrop on the site. This was highly weathered, generally thin, inconsistent and not worked where observed.

However, within four trial pits (TP17, TP19, TP20 and TP54) a workable thickness (0.30m and 0.40m) of coal was encountered at shallow depths. Furthermore, this may have also been present in other nearby pits however excavation in these areas was terminated due to hard rock.

A mine shaft has been highlighted in the north west corner of the site by the Coal Authority search. No evidence of this was found during the site works.

3.6 Environmental Assessment

Thirty-four soil samples were tested for a suite of determinands including heavy metals and Polycyclic Aromatic Hydrocarbons (PAHs). None of the samples tested contained elevated concentrations of target determinands.

Revised Qualitative Risk Assessment

The risk assessment from the Geo-Environmental Assessment can be divided into two parts - risk from Made Ground and risk from ground gases to the relevant receptors. The risks associated with Made Ground are highlighted below:

Potential Source	Pathway	Receptor	Potential Risk
Made Ground	Leaching and off-site migration	Controlled Waters	Low
	Ingestion, inhalation, direct contact	Future site users/ development workers	Low
	Direct contact	Future building structures and service e.g. potable water supply pipes	Low
Ground gases	Ground gas migration/ inhalation	Future site users	Moderate
		Future building structure and services	Moderate

4.0 SCOPE OF INVESTIGATION AND RATIONALE

4.1 Project Objectives

The aim of the fieldwork was to:

Determine the stratification beneath the site.
Maintain a watching brief for visual and olfactory evidence of contamination.
Obtain samples using methodology in current guidance for contamination analysis.
Confirm the location of a mine shaft indicated to be on site.
Additional investigation to determine the extent of where the Lower Penistone Coal is of workable thickness.
Install monitoring standpipes for gas and groundwater monitoring in the vicinity of the mine shaft.
Determine the location of a culvert crossing the site.
Achieve better general coverage.
Investigation of access to south of site.

4.2 Scope of Works

The following scope of Ground Investigation was undertaken across the site between the 22nd August and 26th August 2019:

- Thirty-four machine excavated trial pits (TP01 to TP34) were excavated to depths of between 0.5m and 3.5m bgl using a 14-tonne tracked 360° excavator.
- Five trenches (Trench01 to Trench05) were excavated to depths of between 0.9m and 1.2m bgl using a 14-tonne tracked 360° excavator in the vicinity of the postulated mine shaft.
- Six window sample boreholes (WS01 to WS06) were drilled to depths of between 2.45m to 3.45m bgl using a Dando Terrier tracked window sample drilling rig.

The exploratory hole locations are presented on Groundtech Plan 18032 03 and the hole logs are presented in Appendix 3.

The trial pits and boreholes were positioned to establish the stratification beneath the site and target any area of concern including the mine shaft and coal seam. The exploratory holes were logged by a suitably experienced geo-environmental engineer in general accordance with the following current guidance:

- BS 5930 'Code of Practice for Site Investigations' 2015.
- BS EN 14688-1:2002 'Geotechnical Investigation and Testing – Identification and classification of soil'.
- BS EN ISO 14689:2002 'Geotechnical investigation and testing – Identification and classification of rock'.

4.3 Soil Sampling

During the intrusive investigation, representative samples were taken at regular intervals, changes of strata and where evidence of contamination existed. Laboratory analysis was scheduled on the samples obtained.

The samples obtained are summarised in the table below:

Soil Sample	Number
Environmental	46
Disturbed	47

The samples have been obtained in accordance with current environmental and geotechnical guidance. The sampling plan has been designed obtain samples from all required strata using the correct methodology.

Disturbed samples of soil for chemical analysis were placed in the correct sampling containers as required by the laboratory in accordance with their MCERTS and UKAS Accreditation. Transportation was arranged in a timely manner and the samples were at the correct temperature

The sample locations and depths are recorded on the exploratory logs.

4.4 Geo-Environmental Analysis

To inform the Tier I Generic Quantitative Risk Assessment, the following geo-environmental testing was scheduled to assess the risk from contamination on the site.

Determinand	Matrix	Number
Arsenic, cadmium, chromium (total and hexavalent), copper, lead, mercury, nickel, selenium and zinc.	Soil	3
TPH CWG	Soil	3
Speciated PAH16	Soil	3
Conductivity, Redox potential and pH.	Soil	3
VOCs	Soil	3
SVOCs	Soil	3

The Geo-Environmental Laboratory Testing Results are presented in Appendix 4.

4.5 Gas and Groundwater Monitoring

Gas and groundwater monitoring installations were constructed in the boreholes. The standpipes consisted of high-density polyethylene (HDPE) pipe - a bentonite seal was placed around the plain pipe and a clean gravel pack was placed around the slotted pipe. A summary of the installation construction is presented in the table below:

Location	Depth	Response Zone (m bgl)	Targeted Strata	Reason
WS01	2.00	0.50 – 2.00	Natural Strata	Ground Gas
WS02	2.00	0.50 – 2.00	Natural Strata	Ground Gas
WS03	3.00	0.50 – 3.00	Natural Strata	Ground Gas
WS04	2.00	0.50 – 2.00	Natural Strata	Ground Gas
WS05	2.00	0.50 – 2.00	Natural Strata	Ground Gas
WS06	3.00	0.50 – 3.00	Natural Strata	Ground Gas

Permanent gas and flow rate monitoring was carried out using GFM 436 infrared gas monitor with integral electronic flow analyser. The measurements taken are listed below:

- Oxygen (O₂), carbon dioxide (CO₂) and methane (CH₄) as the percentage volume in air (%v/v).
- Hydrogen sulphide (H₂S) and carbon monoxide (CO) as the percentage volume in air (%v/v).
- Lower Explosive Limit (%LEL) of methane.

- Atmospheric and borehole pressure, including pressure trend.
- Flow measurements (l/hr).
- Weather and ground surface conditions.

Both peak and steady state conditions were monitored to understand the behaviour of the permanent ground gas, the steady state conditions were recorded by allowing the gas monitor to run for a minimum of 3 minutes.

Interim permanent gas and groundwater monitoring results are presented in Appendix 5.

5.0 GROUND MODEL

5.1 Made Ground

Two main Made Ground strata were encountered during the investigation and are described below:

- Sandy topsoil with sandstone blocks and rare brick was encountered in Trench01 to Trench04, WS01 and WS06 from ground level to (max) 0.40m bgl.
- Soft to firm clay with sandstone blocks and rare brick, plastic and wood was encountered in Trench03 and WS01 from (min) 0.15m to (max) 0.90m bgl.

Made Ground was only encountered within the north east corner of the site.

5.2 Natural Ground

The natural strata encountered generally confirmed the published geological records.

Two main natural stratification were encountered during the investigation and are described below:

- Firm to stiff high strength brown mottled grey slightly sandy slightly gravelly Clay was encountered in TP01 to TP09, TP12, TP14, TP15, TP18 to TP21, TP23, TP28 to TP33, Trench01 to Trench03, Trench05 and WS01 to WS06.
- Light brown slightly gravelly Sand was encountered within WS03 from 0.14m to 0.80m bgl.

5.3 Bedrock

Three distinct bedrock strata were encountered during the investigation and are described below:

- Extremely weak to weak brown Mudstone, distinctly weathered recovered as gravel was encountered in TP01 to TP07, TP15, TP28, TP30, WS01, WS02 and WS06 from (min) 0.90m to (max) 3.10m bgl.
- Extremely weak to weak grey mottled orange sandy Siltstone, partially weathered recovered as gravel was encountered within TP19 to TP27, TP29, TP32, TP34 and WS03 to WS05 from (min) 0.20m to (max) 3.45m bgl.
- Extremely weak to moderately strong light brown Sandstone, recovered as sand and gravel was encountered within TP08 to TP13, TP16 to TP18, TP22, TP24 to TP27, TP30 and TP34 from (min) 0.05m to (max) 1.95m bgl.
- Extremely weak black sub bituminous Coal residually weathered to clay was encountered within TP19 and TP31 from (min) 0.50m to (max) 0.85m bgl.

5.4 Groundwater

Slight groundwater seepages were noted within TP03 at 1.60m bgl, TP05 at 1.70m bgl and TP15 at 1.55m bgl. This is likely to be perched groundwater as it is not consistent across the site and was encountered on the boundary between the Clay and residually weathered bedrock.

5.5 Watching Brief

A watching brief was maintained during the Ground Investigation for visual and olfactory evidence of contamination, no visual or olfactory evidence of contamination was noted.

5.6 Excavation Stability

Pit sides were noted to spall slightly within TP16, however excavations were stable during the remainder of the Ground Investigation.

5.7 Excavation Progress

Slow progress while excavating the trial pits was encountered within the weak to moderately strong bedrock deposits across the site.

6.0 SUPPLEMENTARY GROUND INVESTIGATION

6.1 Overview

The supplementary investigation included thirty-four trial pits across the site to improve general coverage and further delineate the area of the site where the Lower Penistone Coal outcrops and is considered to be a workable thickness. Furthermore, two of the trial pits (TP33 and TP34) were positioned off site to the south in the vicinity of the proposed main drainage to go off site to confirm the ground conditions, collect samples for geo-environmental testing and assess the rippability of the bedrock for future drainage excavations.

In addition to the above trial pits, five trenches were excavated. Three trenches (Trench01 – Trench03) were positioned in the vicinity of a former mine shaft which is highlighted on the Coal Authority search to be in the north east corner of the site. A further two trenches were positioned in the vicinity of a historic culvert shown to cross the site.

Six window sample boreholes were drilled in the vicinity of the suspected mine shaft to target any potential mine gases being generated.

6.2 Lower Penistone Coal Outcrop

Thirteen trial pits (TP19 to TP21 and TP23 to TP32) were excavated in the vicinity of where the Lower Penistone Coal Seam was encountered during the initial Ground Investigation. The trial pits were excavated to between 0.75m and 3.10m bgl.

Ground conditions generally comprised topsoil over firm to stiff Clay underlain by extremely weak to weak mudstone, siltstone or sandstone bedrock. In five of the locations (TP24, TP25, TP26, TP27 and TP30) topsoil was directly underlain by sandstone bedrock.

Coal was encountered in three locations (TP19, TP30 and TP31) excavated on the site. In TP19, a band of black gravelly Clay was encountered from 0.50m to 0.60m bgl, gravel was of sub bituminous coal. This band is likely to be the residually weathered Lower Penistone Coal, the coal appeared to be of very low quality and has not been worked. Similar coal was encountered within TP31 between 0.75m and 0.85m bgl, indicating that the seam is likely to be of low quality and unworked across the site based on it being weathered to residual soil.

Very weak black shale with coal veins was encountered within TP30 between 2.90m and 3.00m bgl. The stratum is considered to be a shale rather than a coal, however veins of coal were noted within the destructured rock recovered from the trial pit. Furthermore, no evidence of this being worked was noted.

Based on the poor quality of shallow coal encountered at the site and the apparent intact nature of the seam it is considered unlikely that the site was historically subject to shallow coal workings. The extrapolated strike of the Lower Penistone Coal is highlighted on Groundtech Plan 18032 03, the coal seam likely thins and pinches out across the strike as it is not encountered in all locations at depths which it would be expected. This is likely a result of faulting across the area.

A watching brief should be maintained during the soil strip, groundworks, and construction on southern and central areas of the site for evidence of shallow workings of the Lower Penistone Coal. Although unlikely, if any evidence of coal mining as described within this report are identified, work in that area should cease and Groundtech Consulting contacted for further guidance and recommendations.

If foundation excavations encounter coal strata, in accordance with ICRL Guidance Note 61/84 'Notes on the Fire Hazards of Contaminated Land' where foundations are progressed through potentially combustible colliery spoil and coal seams, the combustible material should be isolated from the foundations with non-combustible material to mitigate against structural damage to the proposed buildings. Furthermore, utilities (specifically utilities generating heat) should be completely isolated from these soils with non-combustible material, a utilities connections company should provide appropriate design and justification. The guidance states 1000mm of clay material should be placed either side of foundation excavations and excavations should be progressed 500mm below coal seams to isolate the combustible/potentially combustible material, the guidance is over 35 years old and if can be proven to be appropriate, a more advanced method of isolation may be proposed.

The specification of the isolating material used around foundations and utilities should be discussed and confirmed with Building Control and the utility connections consultants, and approval obtained prior to construction.

6.3 Mine Shaft Investigation

Three trenches (Trench01 to Trench03) were excavated in the vicinity of the mine shaft noted on the Coal Authority maps. The trenches were excavated down to weathered rock then extended over a length of c.15m crossing the area where the former mine shaft is indicated to be located.

Made Ground was encountered within all three trenches from ground level to a maximum of 0.90m bgl and comprised reworked topsoil and clay with anthropogenic inclusions of brick and sandstone cobbles. This Made Ground was likely placed to create an access into the field and construct the gate. The natural strata consisted of firm to stiff high strength brown mottled grey Clay which is considered to be weathered rockhead.

Trench03 was excavated directly adjacent to the site boundary where the historic shaft is indicated to be on the site. No evidence of the former mine shaft was noted for the full length of Trench03, Made Ground was slightly deeper in one area of the trench to a maximum of 0.90m bgl, however rockhead was encountered below the Made Ground consistently across the trench.

Trench01 and Trench02 were excavated adjacent to Trench03 further into the site. Made Ground was generally shallower in Trench01 and Trench02, where rockhead was encountered at 0.40m bgl.

The six window sample boreholes drilled in the vicinity of the historic mine shaft revealed Made Ground to a maximum depth of 0.40m bgl which was underlain by firm Clay and further underlain by Mudstone and Siltstone bedrock. No evidence of the presence of a historic mine shaft was noted within the window sample boreholes.

Based on the results of the trenching and window sampling it is considered unlikely that the recorded mine shaft is on site, the shaft may be off site to the east.

A watching brief should be maintained during the soil strip, groundworks and construction in the north east of the site for evidence of the historic mine shaft. If any evidence of the mine shaft is identified, work in that area should cease and Groundtech Consulting should be contacted for further guidance and recommendations. Information should be submitted to the Coal Authority as soon as possible for approval.

The location of the mineshaft relative to the trenches can be observed on Groundtech Plan 18032 03.

6.4 Historic Culvert Investigation

Trench04 was excavated along the eastern boundary of the site adjacent to Well House Lane to locate the position of a historic culvert which is indicated to cross the site. Made Ground of reworked clay with brick and pottery was encountered to 0.90m bgl where the historic culvert was encountered. The culvert was constructed of sandstone slabs and is 0.30m wide and 0.20m deep. The top of the culvert was removed and water within the culvert appeared to be stagnant, indicating the culvert is no longer in use.

Trench05 was excavated along the north eastern boundary adjacent to the site boundary where the culvert is indicated to enter the site. The excavation was taken to 0.90m bgl into the natural firm to stiff Clay and excavated over a length of c.80m. No evidence of the historic culvert was identified in this area of the site likely due to the culvert being removed historically or not following the anticipated course, the extrapolated location of the culvert is highlighted on Groundtech Plan 18032 03.

The location where the culvert was encountered has been surveyed in and coordinates are presented on the exploratory hole logs.

6.5 Off Site Drainage Excavation

Two trial pits (TP33 and TP34) were advanced off site to the south in the vicinity of proposed drainage runs to determine the rippability of the underlying strata and carry out geo-environmental testing on the soils. The area is access via a slope with an approximate 1/10 gradient slope, therefore tracked plant is required for excavation in this area.

TP33 comprised natural topsoil to 0.50m underlain by firm brown Clay to 3.4m bgl where weak brown Mudstone was encountered. The soils were generally easy to excavate to this depth, however due to the degree of slope on the site it was difficult to progress the excavation beyond this point. The trial pit remained stable throughout the excavation process, this may be reliant on dry weather conditions.

TP34 consisted of natural topsoil to 0.05m underlain by residually weathered sandy Siltstone to 1.5m which was further underlain by moderately strong Siltstone to the base depth of the pit at 1.6m bgl. The trial pit was terminated at 1.60m due the difficulty continuing the excavation beyond this point. The strength of the rock is considerably greater at 1.60m and heavy plant and possibly breaking equipment will be required to excavate beyond 1.60m bgl.

Generally, mudstone strata is considered to be rippable, however siltstone and sandstone strata where intact is considered to be marginally rippable. Therefore in areas where siltstone and sandstone is anticipated breaking equipment may be required.

7.0 LAND QUALITY

7.1 Geo-Environmental Testing Results - Soils

Samples of natural strata have been tested for a range of relevant determinands. In accordance with CLR11 (DEFRA & EA, 2004), a Generic Quantitative Risk Assessment (GQRA) has been undertaken to determine the significance of the concentrations as derived through Geo-Environmental analysis. Additional testing has been carried out as part of the supplementary investigation to assess the risk to groundworkers when excavating in this area.

The GQRA process comprises the comparison of the actual concentrations measured on site with Generic Assessment Criteria (GACs) for the protection of human health.

The GACs used for the assessment of soil concentrations have been derived using the CLEA model. The GACs used and their ranking of importance are listed below:

- Soil Guideline Values (SGVs) which demonstrate minimal risk,
- LQM/CIEH S4ULs which use the same toxicological data as the SGVs but different exposure criteria.
- C4SLs which demonstrate low risk.

In deriving the GACs for use on Brownfield sites, we have assumed a 1.0% Soil Organic Matter, unless the results indicate otherwise.

The proposed end-use for the site is a residential development comprising housing with private domestic gardens with associated driveways, pavements and access roads. We have undertake the following testing to assess any potential risk to groundworkers from contaminated soils in this area.

A summary of the Geo-Environmental Testing results is presented below and the GQRA Tier I screening Values are presented in Appendix 6.

Metals				
Contaminant	Range of Results (mg/kg unless stated)	Screening Value (mg/kg unless stated)	Number of Exceedances	Locations of Exceedances
Arsenic	6.8 – 11.0	32	0	-
Cadmium	<0.1 – 0.1	10	0	-
Chromium	35.5 – 37.6	910	0	-
Hexavalent Chromium	<0.3	21	0	-
Copper	21 – 22	2400	0	-
Lead	16 – 50	200	0	-
Mercury	<0.1	1	0	-
Nickel	29.5 – 35.9	130	0	-
Selenium	<1 – 1	350	0	-
Zinc	91 – 115	3700	0	-
Polycyclic Aromatic Hydrocarbons (PAHs)				
Contaminant	Range of Results (mg/kg unless stated)	Screening Value (mg/kg unless stated)	Number of Exceedances	Locations of Exceedances
Naphthalene	<0.04	2.3	0	-
Acenaphthylene	<0.03	170	0	-
Acenaphthene	<0.05	210	0	-
Fluorene	<0.04	170	0	-
Phenanthrene	0.09	95	0	-
Anthracene	<0.04	2400	0	-
Fluoranthene	<0.03 – 0.07	280	0	-
Pyrene	<0.03 – 0.05	620	0	-
Benzo(a)anthracene	<0.06	7.2	0	-
Chrysene	<0.02	15	0	-
Benzo(b)fluoranthene	<0.05	2.6	0	-
Benzo(k)fluoranthene	<0.02	77	0	-
Benzo(a)pyrene	<0.04	2.2	0	-
Indeno(123cd)pyrene	<0.04	27	0	-
Dibenzo(ah)anthracene	<0.04	0.24	0	-
Benzo(ghi)perylene	<0.04	320	0	-
TPH CWG - Aliphatics				
Contaminant	Range of Results (mg/kg unless stated)	Screening Value (mg/kg unless stated)	Number of Exceedances	Locations of Exceedances
>C5-C6	<0.10	42	0	-
>C6-C8	<0.10	100	0	-
>C8-C10	<0.10	27	0	-
>C10-C12	<0.20	130	0	-
>C12-C16	<4.00	1,100	0	-
>C16-C35	<7	65,000	0	-
Total aliphatics C5-35	<19	-	-	-
TPH CWG - Aromatics				
Contaminant	Range of Results (mg/kg unless stated)	Screening Value (mg/kg unless stated)	Number of Exceedances	Locations of Exceedances
>C5-EC7	<0.10	70	0	-
>EC7-EC8	<0.10	130	0	-
>EC8-EC10	<0.10	34	0	-
>EC10-EC12	<0.20	74	0	-
>EC12-EC16	<4.00	140	0	-

>EC16-EC21	<7	260	0	-
>EC21-EC35	<7	1,100	0	-
Total aromatics C5-35	<19	-	-	-
Total aliphatics and aromatics(C5-35)	<38	-	-	-
MTBE	<0.005	49	0	-
Benzene	<0.005	0.33	0	-
Toluene	<0.005	610	0	-
Ethylbenzene	<0.005	350	0	-
m/p-Xylene	<0.005	230	0	-
o-Xylene	<0.005	250	0	-
Others				
Organic Matter (%)			0.4 – 2.0	
Electrical Conductivity (uS/cm)			<100	
Redox Potential (mV)			380.7 – 419.3	

7.2 Tier I Generic Quantitative Risk Assessment - Soils

Three samples of natural strata collected in the vicinity of a proposed drainage run to the south of the site were tested for a range of determinands detailed in Section 4.4. No Made Ground was encountered in this area, therefore the testing was undertaken on the natural soils.

No elevated concentration of the target determinands were detected by the laboratory testing, furthermore no visual or olfactory evidence of contamination was noted in this area and the risk to human health and groundworkers is considered to be low.

Based on the above, no specific protection measures are required for groundworkers working in this area. General guidance on these matters is given in the Health and Safety Executive (HSE) document “Protection of Workers and the General Public during the Redevelopment of Contaminated Land”. In summary, the following measures are suggested to provide a minimum level of protection:

- All ground workers should be issued with the relevant protective clothing, footwear and gloves. These protective items should not be removed from the site and personnel should be instructed as to why and how they are to be used.
- Hand-washing and boot-washing facilities should be provided.
- Care should be taken to minimise the potential for off-site migration of contamination by the provision of dust suppression control and wheel cleaning equipment during the construction works.
- Good practices relating to personal hygiene should be adopted on the site.
- The contractor shall satisfy the Health and Safety Executive with regard to any other matters concerning the health, safety and welfare of persons on the site.

Furthermore, based on the site observations and testing results above, the material excavated from this area is considered to be natural and undisturbed, therefore the possibility of automatic inert classification of the natural soils should be explored in accordance with Section 4.3 of the EA guidance document. The Council Decision includes a list of wastes in Section 2.1.1 of the document that are assumed to be inert and therefore acceptable at a landfill for inert waste without testing, this is the case if:

- *They are single stream waste of a single waste type (although different waste types from the list may be accepted together if they are from a single source) and*

- *There is no suspicion of material or substances such as metals, asbestos, plastics, chemicals, etc to an extent which increases the risk associated with the waste sufficiently to justify contamination and they do not contain other their disposal in other classes of landfill.*

No further samples were screened as this was undertaken as part of the main investigation.

7.3 Permanent Ground Gases

Gas monitoring Results

Two ground gas monitoring visits have been carried out to date on 09 September and 16 October 2019. No methane (CH₄) has been recorded within the standpipes however, detectable concentrations of carbon dioxide (CO₂) were recorded up to a maximum level of 4.7%v/v together with associated oxygen (O₂) concentrations of 13.2%v/v.

In addition, flow rates of <0.1 to 1.5l/hr have been recorded during the monitoring visits. The visits were completed during periods of falling and steady barometric pressure and the atmospheric pressure ranged between 973mb and 983mb.

Groundwater was encountered within all the standpipes with the exception of WS05 during the monitoring visits at depths of between ground level and 3.19m bgl.

Characterisation of the Gas Screening Value (GSV)

In accordance with CIRIA Report C665, November 2007 it is felt that an adequate risk assessment can be undertaken based on the following limiting factors:

- The proposed development has been considered as **high sensitivity** based on the site being a proposed residential development with garden areas (Table 5.5 – Typical/Idealised frequency and period of monitoring, after Wilson et al, 2005).
- The risk associated with the generation potential of a source is considered as **moderate to low**, (assessment based on the environmental setting) however this has been reduced to **low** following the Ground Investigation and initial monitoring.
- Monitoring over a **minimum of three months** with **four recorded** readings (Table 5.5 – Typical /idealised frequency and period of monitoring after Wilson et al, 2005).
- **Negligible to low** flow rates have been recorded to date (Table 8.5 – Modified Wilson & Card classification). For this site, the monitoring visit undertaken correlated with a falling and steady atmospheric pressure trend. Future monitoring will be targeted to take place during falling, steady and rising atmospheric pressure as a comparison.

Based upon the results recorded, in accordance with CIRIA Report C665, the risk to the site from ground gases has been assessed by converting the results to gas screening values (GSVs), calculated by multiplying the typical maximum gas concentrations with the recorded maximum positive flow rates. In addition, individual “hazardous gas flow rates” (Q_{hg}) have been derived for each monitoring point. As no levels of methane have been recorded a GSV for carbon dioxide only has been calculated.

$$GSV (l/hr) = \text{max borehole flow rate (l/hr)} \times \text{max gas concentration (\%)}$$

For this assessment, the maximum recorded concentration of carbon dioxide of 4.7%v/v has been used with a maximum gas flow rate of 1.5l/hr to calculate the GSV. This is worst case at this stage and the scenario may be altered on completion of the monitoring.

As no methane has been detected, no GSV has been calculated for methane.

$$\text{Carbon Dioxide GSV} = 0.047 (3.1\%) \times 1.5 = 0.0705 \text{ l/hr}$$

Assessment

In order to assess the ground gas regime beneath the site and the need to incorporate ground gas precautions, guidance was taken from CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings'.

Based on the site being developed with low-rise housing, the Boyle and Witherington, 2006 method has been used to carry out the assessment. This is a risk-based approach that is designed to allow an identification of gas protection for a low-rise housing development by comparing the measured gas emission rates to generic 'traffic lights' scenarios. The traffic lights include 'typical maximum concentrations' and are provided for initial screening purposes and risk-based gas screening values for consideration in situations where the typical maximum concentrations are exceeded.

When considering the results, in accordance with CIRIA C665 (Situation B – Low-rise housing with a ventilated underfloor void (min 150mm) and Table 8.7 – NHBC Traffic light system for 150mm void) it can be seen that the GSV value for carbon dioxide is below the assessment GSV of <0.78l/hr and falls within the Green traffic light zone.

Due to the proposed earthworks being undertaken at the site, the ground profile will change considerably as part of the redevelopment. This should be considered within the final ground gas risk assessment and reflected appropriately within the recommendations.

NHBC - Green Traffic Light

An extract of the table is presented below.

Traffic Light Classification	Methane ¹		Carbon Dioxide ¹	
	Typical Maximum Concentration ³ (%v/v)	Gas Screening Value ^{2,4} (l/hr)	Typical Maximum Concentration ³ (%v/v)	Gas Screening Value ^{2,4} (l/hr)
Green	1	0.16	5	0.78
Amber 1	5	0.63	10	1.56
Amber 2	20	1.56	30	3.10
Red				

Notes:

1. The worst-case ground gas regime identified on the site, either methane or carbon dioxide, at the worst-case temporal conditions that the site may be expected to encounter will be the decider as to what Traffic Light is allocated;
2. Gas Screening Value is the Borehole Gas Volume Flow Rate, in litres per hour, as defined in Wilson and Card (1999), which is the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered;
3. The Typical Maximum Concentrations can be exceeded in certain circumstances should the Conceptual Site Model indicate it is safe to do so;
4. The Gas Screening Value thresholds should not generally be exceeded without the completion of a detailed ground gas risk assessment taking into account site-specific conditions.

Based on the results of gas monitoring to date, a negligible gas regime has been identified, the risk to human health is low and no gas precautions are required.

The geological records and Groundsure Report confirm the site is not in an area where radon protection measures are required.

Based on the initial monitoring visits, the following precautions are recommended.

No gas protection measures are required within the proposed residential development at the site.

No radon protective measures are required.

The full ground gas risk assessment will be compiled and issued upon completion of the ground gas monitoring programme.

8.0 FINAL APPRAISAL

The recommendations made within the main report are still considered to be relevant and have been addressed by the supplementary investigation.

8.1 Lower Penistone Coal Outcrop

The Lower Penistone Coal was encountered within three of the thirteen trial pits excavated across the area, the seam was indicated to outcrop on the site. The coal seam was of poor quality and highly weathered and was not indicated to have been worked. Furthermore, it was only encountered within three locations, which suggests it is not continuous beneath the site, this observation is likely due to faulting across the site.

It was determined that it is unlikely that this seam has been worked on site in the past and there is not considered to be a risk from unrecorded workings in the Lower Penistone Coal seam. The next seam in the sequence (c.86m or deeper below the site) is considered to be at a sufficient depth to not cause a risk to the stability of the site at the surface.

If coal seams are encountered within foundation or utility excavations, then appropriate precautions in accordance with ICRCL should be taken to prevent combustible and potentially combustible materials from impacting the integrity of the proposed structures.

8.2 Historic Mine Shaft

Three trenches and six window sample boreholes were excavated in the vicinity of a mine shaft indicated on the Coal Authority map to be on the north eastern corner of the site.

No evidence of the mine shaft was encountered within the trenches, furthermore no evidence of the mine shaft was encountered within six window sample boreholes drilled in the north east corner of the site.

Two ground gas monitoring visits have been carried out to date which indicate that the north east corner of the site is not affected by mine gases.

Based on the evidence collected during the supplementary investigation it has been determined unlikely that the mine shaft is on site, therefore the risk from recorded mine entries is considered to be low.

A watching brief should be maintained during the soil strip, groundworks and construction in the north east of the site for evidence of the historic mine shaft. If identified, work in that area should cease and Groundtech Consulting contacted immediately for further guidance and recommendations.

8.3 Historic Culvert and Off-Site Investigation

Two trenches were excavated in the vicinity of a historic culvert which is indicated to enter and exit the site along the eastern boundary.

The culvert was identified along the eastern site boundary adjacent to Well House Lane where it exits the site. However, it was not possible to locate the position of the culvert where it enters the site further to the north. This is likely due to the culvert being removed previously or not following the anticipated course.

The culvert was 0.9m bgl and constructed of sandstone slabs and is 0.3m wide by 0.2m deep. Water within the culvert was stagnant with no identified flow, indicating that it may be no longer functional.

A further two trial pits were excavated just off site to the south. No Made Ground was encountered at either location and natural strata was relatively easy to excavate in the vicinity of TP33 to the maximum depth of 3.50m bgl, however hard rock strata was encountered at the shallower depth of 1.60m bgl in TP34 and the trial pit was terminated due to the difficulty of the excavation. If drainage is to be placed at a greater depth than was possible during the Ground Investigation, the rock may become too strong and non-rippable, in this instance specialist plant may be required.

Three samples of natural strata were collected from TP33 and TP34 and screened for a range of contaminants. The testing results indicate that no elevated concentrations of target determinands were detected within the samples screened. No risk to site end users and groundworkers

8.4 Required Supplementary Investigation

The following further work is considered necessary to progress the site to construction phase:

Completion of gas monitoring programme.
Issue gas assessment.
Confirmation of recommendations made within this report with the Local Authority and Coal Authority.

9.0 RELEVANT INDUSTRY REFERENCES

British Standards Institution. *Investigation of Potentially Contaminated sites - code of practice*. BS 10175:2017.

British Standards Institution '*Code of Practice for Site Investigations*' BS 5930:2015

British Standards Institution "*Geotechnical investigation and testing – Identification and classification of soil*" BS EN ISO 14688:2002.

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UK Drinking Water Standards: Water Supply (Water Quality) Regulations 1989 (SI 1989/1147) and Water Supply (Water Quality) Regulations

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NHBC Standards 2016

CL:AIRE "*The Definition of Waste: Development Industry Code of Practice*" Version 2 March 2011.

CIRIA "*Asbestos in soil and made ground: a guide to understanding and managing risks*" C733 2014

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BRE Digest 365 "Soakaway Design" 2007.

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APPENDIX 1 - Plans



 GROUNDTECH CONSULTING	CLIENT	DATE			Status	Notes  Site Location
	BDW YORKSHIRE WEST	OCTOBER 2019			Preliminary	
	PROJECT TITLE	SCALE			Draft	
	WELL HOUSE LANE, PENISTONE	NTS			Issued	
	PLAN TITLE	PLAN NUMBER			For Comment	
	PROJECT LOCATION PLAN	18032 01	Rev.	Details	Approved	
				Date		



	CLIENT	DATE				Status		Notes
	BDW YORKSHIRE WEST	OCTOBER 2019				Preliminary		
	PROJECT TITLE	SCALE				Draft	☒	
	WELL HOUSE LANE, PENISTONE	NTS				Issued		
	PLAN TITLE	PLAN NUMBER				For Comment		
	PRELIMINARY DEVELOPMENT CONSTRAINTS PLAN	18032 02	Rev.	Details	Date	Approved		



CLIENT
BDW YORKSHIRE WEST
PROJECT TITLE
WELL HOUSE LANE, PENISTONE
PLAN TITLE
EXPLORATORY HOLE LOCATION PLAN

DATE
OCTOBER 2019
SCALE
NTS
PLAN NUMBER
18032 03

Rev.	Details	Date

Status
Preliminary
Draft
Issued
For Comment
Approved

Notes
Trial Pit Location
Window Sample Location
Trench Location
Extrapolated Lower Penistone Coal Outcrop
Approximate Location of Culvert Observed Within Trench04
Extrapolated Mudstone Rockhead
Extrapolated Siltstone Rockhead
Extrapolated Sandstone Rockhead

APPENDIX 2 – Site Photographs



1. Site access.



2. Looking west from the site entrance.



3. Looking southwest from the site entrance.



4. Looking south from the site entrance.



5. Electricity substation immediately east of the site.



6. Western portion of the site.



7. Southern Portion of the site looking north.



8. Culvert encountered within Trench04.

APPENDIX 3 – Exploratory Hole Logs

Trial Pit Log

Trialpit No

TP01

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424635.90 - 404526.72

Level: 229.15

Date

22/07/2019

Location: PENISTONE

Dimensions
(m):

3

Depth
1.80

0.5

Scale

1:25

Logged
SF

Client: BDW YORKSHIRE WEST

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.10	229.05		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Firm to stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.	
				1.70	227.45		Weak orange brown MUDSTONE distinctly weathered recovered as angular fine to coarse gravel.	
				1.80	227.35		End of pit at 1.80 m	

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No

TP02

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424612.66 - 404482.97
Level: 227.76

Date
22/07/2019

Location: PENISTONE

Dimensions
(m):

3

Scale
1:25

Client: BDW YORKSHIRE WEST

Depth
1.20

0.5

Logged
SF

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.10	227.66		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Firm to stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.	
				1.10	226.66		Weak orange brown MUDSTONE distinctly weathered recovered as angular fine to coarse gravel.	1
				1.20	226.56		End of pit at 1.20 m	2
								3
								4
								5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No

TP03

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424647.65 - 404489.54
Level: 225.89

Date
22/07/2019

Location: PENISTONE

Dimensions
(m):

3

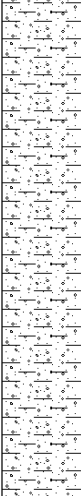
Scale
1:25

Client: BDW YORKSHIRE WEST

Depth
1.85

0.5

Logged
SF

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼				0.10	225.79		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Firm to stiff brown mottled grey slightly sandy gravelly CLAY with medium cobble content of mudstone. Gravel is angular to subangular fine to coarse of mudstone.	1
				1.80 1.85	224.09 224.04		Weak orange brown MUDSTONE distinctly weathered recovered as angular fine to coarse gravel. End of pit at 1.85 m	2
								3
								4
								5

Remarks: 1. Slight groundwater seepage at 1.60m bgl.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No
TP04
Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424663.98 - 404490.94
Level: 227.47

Date
23/07/2019

Location: PENISTONE

Dimensions (m):

3

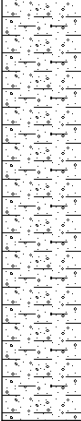
Scale
1:25

Client: BDW YORKSHIRE WEST

Depth
1.70

0.5

Logged
SF

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.15	227.32		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Firm to stiff high strength brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.	
	1.00	D	HVP=90					1
				1.60	225.87		Weak orange brown MUDSTONE distinctly weathered recovered as angular fine to coarse gravel.	
				1.70	225.77		End of pit at 1.70 m	2
								3
								4
								5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No

TP05

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424738.99 - 404292.82

Level: 217.14

Date

23/07/2019

Location: PENISTONE

Dimensions
(m):

3

Depth
2.10

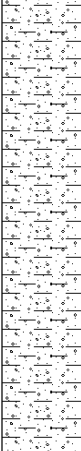
0.5

Scale

1:25

Logged
SF

Client: BDW YORKSHIRE WEST

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.15	216.99		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Firm to stiff high strength brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.	
	1.00	D	HVP=110					1
▼				1.70	215.44		Weak orange brown MUDSTONE distinctly weathered recovered as angular fine to coarse gravel.	2
				2.10	215.04		End of pit at 2.10 m	3
								4
								5

Remarks: 1. Slight groundwater seepage at 1.70m bgl.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No
TP06
Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424663.07 - 404347.99
Level: 220.57

Date
23/07/2019

Location: PENISTONE

Dimensions
(m):

3

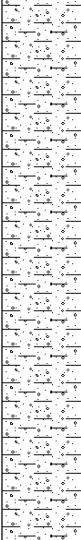
Scale
1:25

Client: BDW YORKSHIRE WEST

Depth
2.10

0.5

Logged
SF

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.15	220.42		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Firm to stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.	
	1.00	D	HVP=70					1
				2.00	218.57		Weak orange brown MUDSTONE distinctly weathered recovered as angular fine to coarse gravel.	2
				2.10	218.47		End of pit at 2.10 m	
								3
								4
								5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No

TP07

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424541.28 - 404399.19
Level: 229.07

Date
23/07/2019

Location: PENISTONE

Dimensions (m):

3

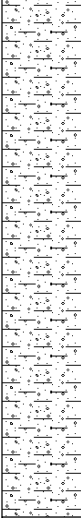
Scale
1:25

Client: BDW YORKSHIRE WEST

Depth
2.00

0.5

Logged
SF

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.15	228.92		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Firm to stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.	
	1.00	D	HVP=90 HVP=120					1
				1.90	227.17		Weak orange brown MUDSTONE distinctly weathered recovered as angular fine to coarse gravel.	2
				2.00	227.07		End of pit at 2.00 m	
								3
								4
								5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No

TP08

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424490.53 - 404408.85
Level: 229.84

Date
23/07/2019

Location: PENISTONE

Dimensions (m):

3

Depth
0.80

0.5

Scale
1:25

Logged
SF

Client: BDW YORKSHIRE WEST

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	ES		0.15	229.69		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone.
				0.70	229.14		Firm to stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.
				0.80	229.04		Weak to moderately strong yellow brown SANDSTONE partially weathered with occasional siltstone laminations recovered as angular fine to coarse gravel.
							End of pit at 0.80 m

1

2

3

4

5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No
TP09
Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424385.30 - 404439.43
Level: 229.07

Date
23/07/2019

Location: PENISTONE

Dimensions (m):

3

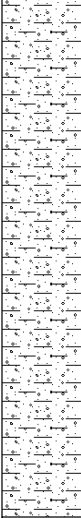
Scale
1:25

Client: BDW YORKSHIRE WEST

Depth
1.95

0.5

Logged
SF

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.15	228.92		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Firm to stiff high strength brown mottled grey slightly sandy slightly gravelly CLAY with occasional gravelly bands. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.	
	1.00	D	HVP=80					1
				1.90 1.95	227.17 227.12		Weak to moderately strong yellow brown SANDSTONE partially weathered with occasional siltstone laminations recovered as angular fine to coarse gravel. End of pit at 1.95 m	2
								3
								4
								5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No
TP10
Sheet 1 of 1

Project Name: WELL HOUSE LANE	Project No. 18032	Co-ords: 424383.49 - 404491.01 Level: 230.87	Date 23/07/2019
Location: PENISTONE		Dimensions (m): Depth 0.50	Scale 1:25 Logged SF
Client: BDW YORKSHIRE WEST		3 0.5	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.15	230.72		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone.	
				0.40	230.47		Extremely weak light brown SANDSTONE residually weathered recovered as slightly clayey slightly gravelly sand.	
				0.50	230.37		Weak to moderately strong yellow brown SANDSTONE partially weathered with occasional siltstone laminations recovered as angular fine to coarse gravel.	
							End of pit at 0.50 m	

Remarks: 1. No groundwater encountered.
Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No

TP11

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords:	424349.13 - 404544.34
----------	-----------------------

Level: 230.72

Date _____

23/07/2019

Location: PENISTONE

Dimensions
(m):

3

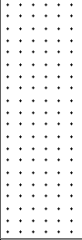
Depth
1.15

0.5

Scale
1:25

Logged
SF

Client: BDW YORKSHIRE WEST

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	ES		0.20	230.52		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone.
							Extremely weak light brown SANDSTONE residually weathered recovered as slightly clayey slightly gravelly sand.
	1.00	D		1.00	229.72		Weak to moderately strong yellow brown SANDSTONE partially weathered with occasional siltstone laminations recovered as angular fine to coarse gravel.
				1.15	229.57		End of pit at 1.15 m

Remarks:	1. No groundwater encountered.
----------	--------------------------------

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No

TP12

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424413.09 - 404540.76

Level: 231.55

Date

23/07/2019

Location: PENISTONE

Dimensions
(m):

3

Depth
0.70

0.5

Scale

1:25

Logged
SF

Client: BDW YORKSHIRE WEST

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	ES		0.20	231.35		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone.
	0.50	D		0.60	230.95		Firm to stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.
				0.70	230.85		Weak to moderately strong yellow brown SANDSTONE partially weathered with occasional siltstone laminations recovered as angular fine to coarse gravel.
							End of pit at 0.70 m

1

2

3

4

5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords:	424470.34 - 404505.51
----------	-----------------------

Level: 231.94

Date _____

24/07/2019

Location: PENISTONE

Dimensions
(m):

3

Depth
0.95

0.5

Scale
1:25

Logged
SF

Client: BDW YORKSHIRE WEST

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	ES		0.15	231.79		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Extremely weak light brown SANDSTONE residually weathered recovered as slightly clayey slightly gravelly sand with medium cobble content.
				0.90 0.95	231.04 230.99		Weak to moderately strong yellow brown SANDSTONE partially weathered with occasional siltstone laminations recovered as angular fine to coarse gravel. End of pit at 0.95 m

Remarks:	1. No groundwater encountered.
----------	--------------------------------

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No

TP14

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424543.71 - 404550.58

Level: 232.87

Date

24/07/2019

Location: PENISTONE

Dimensions
(m):

3

Depth
1.55

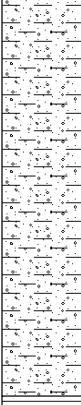
0.5

Scale

1:25

Logged
SF

Client: BDW YORKSHIRE WEST

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.15	232.72		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Firm to stiff high strength brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.	
	1.00	D	HVP=90	1.50 1.55	231.37 231.32		Weak grey brown sandy MUDSTONE distinctly weathered recovered as angular fine to coarse gravel. End of pit at 1.55 m	1 2 3 4 5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No
TP15
Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424694.36 - 404253.05
Level: 217.49

Date
24/07/2019

Location: PENISTONE

Dimensions
(m):

3

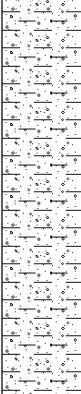
Scale
1:25

Client: BDW YORKSHIRE WEST

Depth
1.60

0.5

Logged
SF

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.15	217.34		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Firm to stiff high strength brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.	
	1.00	D	HVP=85					1
				1.55 1.60	215.94 215.89		Weak grey brown sandy MUDSTONE distinctly weathered recovered as angular fine to coarse gravel. End of pit at 1.60 m	2
								3
								4
								5

Remarks: 1. Slight groundwater seepage at 1.55m bgl.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No
TP16
Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424665.49 - 404137.81
Level: 218.12

Date
24/07/2019

Location: PENISTONE

Dimensions (m):

3

Scale
1:25

Client: BDW YORKSHIRE WEST

Depth
0.80

0.5

Logged
SF

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	ES		0.15	217.97		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Extremely weak light brown SANDSTONE residually weathered recovered as slightly clayey slightly gravelly sand with high cobble content.
				0.70	217.42		Weak to moderately strong yellow brown SANDSTONE partially weathered with occasional siltstone laminations recovered as angular fine to coarse gravel.
				0.80	217.32		End of pit at 0.80 m

1

2

3

4

5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides spalling slightly.



Trial Pit Log

Trialpit No

TP17

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424553.14 - 404146.33

Level: 212.39

Date

24/07/2019

Location: PENISTONE

Dimensions
(m):

3

Depth
0.75

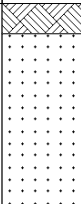
0.5

Scale

1:25

Logged
SF

Client: BDW YORKSHIRE WEST

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	ES		0.10	212.29		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Extremely weak light brown SANDSTONE residually weathered recovered as slightly clayey slightly gravelly sand with high cobble content.
				0.70 0.75	211.69 211.64		Weak to moderately strong yellow brown SANDSTONE partially weathered with occasional siltstone laminations recovered as angular fine to coarse gravel. End of pit at 0.75 m

1

2

3

4

5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.





Trial Pit Log

Trialpit No
TP19
Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424635.12 - 404281.96
Level: 217.76

Date
24/07/2019

Location: PENISTONE

Dimensions
(m):

3

Scale
1:25

Client: BDW YORKSHIRE WEST

Depth
1.70

0.5

Logged
SF

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.15	217.61		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Firm to stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.	
	0.50	D						
	1.00	D						1
				1.65	216.11		Weak grey mottled orange sandy SILTSTONE partially weathered recovered as angular fine to coarse gravel.	
				1.70	216.06		End of pit at 1.70 m	2
								3
								4
								5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No
TP20
Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424584.19 - 404319.69
Level: 222.42

Date
24/07/2019

Location: PENISTONE

Dimensions (m):

3

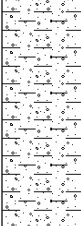
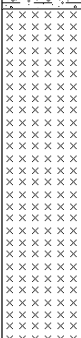
Depth
2.10

0.5

Scale
1:25

Logged
SF

Client: BDW YORKSHIRE WEST

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.20	222.22		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone.	
							Firm to stiff high strength brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.	
	1.00	D	HVP=100	1.00	221.42		Weak grey mottled orange sandy SILTSTONE partially weathered recovered as angular fine to coarse gravel.	1
				2.10	220.32		End of pit at 2.10 m	2
								3
								4
								5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No
TP21
Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424530.79 - 404259.57
Level: 215.60

Date
24/07/2019

Location: PENISTONE

Dimensions (m):

3

Depth
1.10

0.5

Scale
1:25

Logged
SF

Client: BDW YORKSHIRE WEST

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.10 0.20	215.50 215.40		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Firm to stiff high strength brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone. Weak grey mottled orange sandy SILTSTONE partially weathered recovered as angular fine to coarse gravel.	
	1.00	D	HVP=120	1.10	214.50		End of pit at 1.10 m	1 2 3 4 5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No

TP22

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424476.16 - 404204.02

Level: 211.65

Date

24/07/2019

Location: PENISTONE

Dimensions
(m):

3

Depth
0.90

0.5

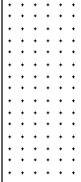
Scale

1:25

Logged

SF

Client: BDW YORKSHIRE WEST

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.20	211.45		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Extremely weak orange brown SANDSTONE residually weathered recovered as slightly gravelly clayey sand.	
	0.50	D		0.85 0.90	210.80 210.75		Weak grey mottled orange sandy SILTSTONE partially weathered recovered as angular fine to coarse gravel.	1
							End of pit at 0.90 m	
								2
								3
								4
								5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords:	424461.80 - 404277.86
----------	-----------------------

Level: 215.34

Date

24/07/2019

Location: PENISTONE

Dimensions
(m):

3

Depth
1.10

5

Scale
1:25

Logged
SF

Client: BDW YORKSHIRE WEST

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description				
	Depth	Type	Results								
	0.10	ES	HVP=90	0.20	215.14		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone.	1 -			
	0.90	D		1.00	214.34		Firm to stiff high strength brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.				
							1.10		214.24		Weak grey mottled orange sandy SILTSTONE partially weathered recovered as angular fine to coarse gravel.
											End of pit at 1.10 m

Remarks:	1. No groundwater encountered.
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Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No

TP24

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424549.70 - 404344.02

Level: 226.24

Date

25/07/2019

Location: PENISTONE

Dimensions
(m):

3

Scale

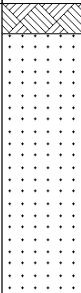
1:25

Client: BDW YORKSHIRE WEST

Depth
1.20

0.5

Logged
SF

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.05	ES		0.10	226.14		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Extremely weak orange brown SANDSTONE residually weathered recovered as slightly gravelly clayey sand.	
	1.00	D		1.00	225.24		Weak grey mottled orange sandy SILTSTONE partially weathered recovered as angular fine to coarse gravel.	1
				1.20	225.04		End of pit at 1.20 m	
								2
								3
								4
								5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No
TP25
Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424502.10 - 404372.69
Level: 227.70

Date
25/07/2019

Location: PENISTONE

Dimensions (m):

3

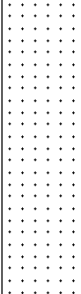
Scale
1:25

Client: BDW YORKSHIRE WEST

Depth
1.30

0.5

Logged
SF

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.15	227.55		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Extremely weak orange brown SANDSTONE residually weathered recovered as slightly gravelly clayey sand.	
	1.00	D		1.20	226.50			1
				1.30	226.40		Weak grey mottled orange sandy SILTSTONE partially weathered recovered as angular fine to coarse gravel. End of pit at 1.30 m	
								2
								3
								4
								5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No
TP26
Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424478.85 - 404352.04
Level: 226.77

Date
25/07/2019

Location: PENISTONE

Dimensions (m):

3

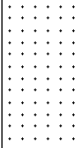
Depth
0.75

0.5

Scale
1:25

Logged
SF

Client: BDW YORKSHIRE WEST

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	ES		0.15	226.62		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Weak orange brown silty SANDSTONE distinctly weathered recovered as angular fine to coarse gravel.
	0.50	D		0.70 0.75	226.07 226.02		
							Weak to moderately strong grey mottled orange sandy SILTSTONE partially weathered recovered as angular fine to coarse gravel.
							End of pit at 0.75 m

1

2

3

4

5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424503.28 - 404336.87

Level: 225.61

Date
25/07/2019

Location: PENISTONE

Dimensions
(m):

3

Depth	1.20
-------	------

0.5

Scale
1:25

Logged
SF

Client: BDW YORKSHIRE WEST

[illegible]

Remarks:	1. No groundwater encountered.
----------	--------------------------------

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No
TP28
Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424511.18 - 404307.30
Level: 220.45

Date
25/07/2019

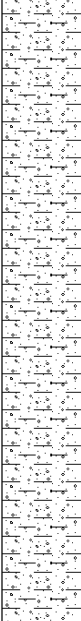
Location: PENISTONE

Dimensions (m):
Depth 2.60

3
0.5

Scale
1:25
Logged
SF

Client: BDW YORKSHIRE WEST

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.15	220.30		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Firm to stiff high strength brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.	
	1.00	D	HVP=80					1
	1.50	D	HVP=90					2
				2.30	218.15		Very weak to weak grey mottled orange MUDSTONE destructured recovered as angular fine to coarse gravel.	
				2.60	217.85		End of pit at 2.60 m	3
								4
								5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No

TP29

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424480.85 - 404312.14

Level: 220.03

Date

25/07/2019

Location: PENISTONE

Dimensions
(m):

3

Depth
2.40

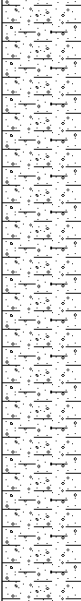
0.5

Scale

1:25

Logged
SF

Client: BDW YORKSHIRE WEST

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.15	219.88		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Firm to stiff high strength brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.	
	1.00	D	HVP=100					1
	2.00	D	HVP=100					2
				2.20	217.83		Weak grey mottled orange sandy SILTSTONE partially weathered recovered as angular fine to coarse gravel.	
				2.40	217.63		End of pit at 2.40 m	
								3
								4
								5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No

TP30

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424453.81 - 404320.50
Level: 220.02

Date
25/07/2019

Location: PENISTONE

Dimensions
(m):

3

Scale
1:25

Client: BDW YORKSHIRE WEST

Depth
3.10

0.5

Logged
SF

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.15	219.87		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Extremely weak orange brown silty SANDSTONE residually weathered recovered as slightly gravelly clayey sand.	1
	1.50	D	HVP=110	1.40	218.62		Firm to stiff high strength brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.	2
	2.90	D		2.90	217.12		Very weak black SHALE with thin coal veins distinctly weathered recovered as angular fine to coarse gravel.	3
				3.00	217.02		Very weak to weak grey mottled orange MUDSTONE destructured recovered as angular fine to coarse gravel.	
				3.10	216.92		End of pit at 3.10 m	

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No

TP31

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424419.18 - 404264.34

Level: 212.90

Date

25/07/2019

Location: PENISTONE

Dimensions
(m):

3

Depth
2.25

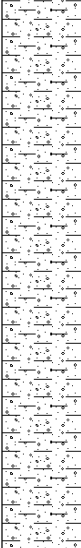
0.5

Scale

1:25

Logged
SF

Client: BDW YORKSHIRE WEST

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.10	212.80		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Firm to stiff high strength brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.	
	1.00	D	HVP=90 HVP=110					1
				2.00	210.90		Weak grey mottled orange sandy SILTSTONE partially weathered recovered as angular fine to coarse gravel.	2
				2.25	210.65		End of pit at 2.25 m	3
								4
								5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No
TP32
Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424435.37 - 404300.06
Level: 216.38

Date
25/07/2019

Location: PENISTONE

Dimensions (m):

3

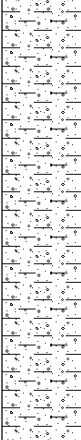
Scale
1:25

Client: BDW YORKSHIRE WEST

Depth
1.80

0.5

Logged
SF

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.15	216.23		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Firm to stiff brown high strength mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.	
	1.00	D	HVP=120					1
				1.70	214.68		Weak grey mottled orange sandy SILTSTONE partially weathered recovered as angular fine to coarse gravel.	
				1.80	214.58		End of pit at 1.80 m	2
								3
								4
								5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No

TP33

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424492.04 - 404132.77
Level: 202.39

Date
26/07/2019

Location: PENISTONE

Dimensions (m):

3

Depth
3.50

0.5

Scale
1:25

Logged
SF

Client: BDW YORKSHIRE WEST

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	ES					Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone.
	0.60	ES		0.50	201.89		Firm to stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.
	2.00	D					
				3.40	198.99		
				3.50	198.89		Very weak to weak grey mottled orange MUDSTONE destructured recovered as angular fine to coarse gravel. End of pit at 3.50 m

1

2

3

4

5

Remarks: 1. No groundwater encountered.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No
TP34
Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424495.86 - 404144.44
Level: 205.63

Date
26/07/2019

Location: PENISTONE

Dimensions (m):

3

Depth
1.60

0.5

Scale
1:25

Logged
SF

Client: BDW YORKSHIRE WEST

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.05			0.05	205.58		Brown slightly gravelly slightly sandy clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone. Extremely weak orange brown silty SANDSTONE residually weathered recovered as slightly gravelly clayey sand.
	0.20	ES					
	0.50	ES					
	1.50	D		1.50	204.13		Weak to moderately strong grey mottled orange sandy SILTSTONE partially weathered recovered as angular fine to coarse gravel.
				1.60	204.03		
							End of pit at 1.60 m

Remarks: 1. No groundwater encountered.

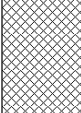
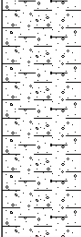
Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No
TRENCH01
Sheet 1 of 1

Project Name: WELL HOUSE LANE	Project No. 18032	Co-ords: 424608.82 - 404573.34 Level: 232.91	Date 22/07/2019
Location: PENISTONE		Dimensions (m): Depth 1.20	Scale 1:25
Client: BDW YORKSHIRE WEST			Logged SF

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.40	232.51		MADE GROUND: Brown slightly clayey slightly gravelly sandy topsoil. Gravel is angular to subangular fine to coarse of sandstone and rare brick.	
				1.20	231.71		Firm to stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.	1
							----- End of pit at 1.20 m -----	2
								3
								4
								5

Remarks: 1. No groundwater encountered. 2. No evidence of historic mine shaft.

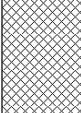
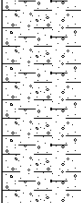
Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No
TRENCH02
Sheet 1 of 1

Project Name: WELL HOUSE LANE	Project No. 18032	Co-ords: 424603.77 - 404573.12 Level: 232.86	Date 22/07/2019
Location: PENISTONE		Dimensions (m): Depth 1.10	Scale 1:25
Client: BDW YORKSHIRE WEST			Logged SF

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.40	232.46		MADE GROUND: Brown slightly clayey slightly gravelly sandy topsoil. Gravel is angular to subangular fine to coarse of sandstone and rare brick.	
				1.10	231.76		Firm to stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.	1
							End of pit at 1.10 m	2
								3
								4
								5

Remarks: 1. No groundwater encountered. 2. No evidence of historic mine shaft.

Stability: 1. Pit sides stable.



Trial Pit Log

Trialpit No
TRENCH03
Sheet 1 of 1

Project Name:	WELL HOUSE LANE
---------------	-----------------

Project No.
18032

Co-ords: 424612.54 - 404577.54
Level: 232.88

Date
26/07/2019

Location: PENISTONE

Dimensions
(m):

Scale
1:25

Client: BDW YORKSHIRE WEST

Depth
1.00

Logged
SF

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.15	232.73		MADE GROUND: Brown slightly clayey slightly gravelly sandy topsoil. Gravel is angular to subangular fine to coarse of sandstone and rare brick.
							MADE GROUND: Soft to firm slightly sandy slightly gravelly clay with medium cobble content of sandstone. Gravel is angular to subangular fine to coarse of sandstone and rare brick.
				0.90	231.98		Firm to stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.
				1.10	231.78		End of pit at 1.00 m

Remarks: 1. No groundwater encountered. 2. No evidence of historic mine shaft.

Stability: 1. Pit sides stable.





GROUNDTECH
CONSULTING

Trial Pit Log

Trialpit No
TRENCH04
Sheet 1 of 1

Project Name:	WELL HOUSE LANE	Project No.	18032	Co-ords:	424754.07 - 404329.33	Date	26/07/2019
Location:	PENISTONE			Dimensions (m):		Scale	1:25
Client:	BDW YORKSHIRE WEST			Depth		0.90	Logged

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20	216.78		MADE GROUND: Brown slightly clayey slightly gravelly sandy topsoil. Gravel is angular to subangular fine to coarse of sandstone, brick and pottery. MADE GROUND: Soft to firm slightly sandy slightly gravelly clay with medium cobble content of sandstone. Gravel is angular to subangular fine to coarse of sandstone, brick and pottery.	
				0.90	216.08		End of pit at 0.90 m	1
								2
								3
								4
								5

Remarks:	1. No groundwater encountered. 2. Stone culvert encountered at 0.90m bgl, water within the culvert not flowing.	
Stability:	1. Pit sides stable.	

Trial Pit Log

Trialpit No
TRENCH05
Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424658.57 - 404510.73
Level: 228.00

Date
26/07/2019

Location: PENISTONE

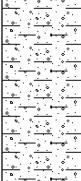
Dimensions
(m):

Depth
0.90

Scale
1:25

Logged
SF

Client: BDW YORKSHIRE WEST

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.15	227.85		Brown slightly gravelly slightly sandy gravelly clayey TOPSOIL. Gravel is subangular to subrounded fine to medium of mixed lithology including mudstone and sandstone.	
				0.90	227.10		Firm to stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone.	
							End of pit at 0.90 m	1
								2
								3
								4
								5

Remarks: 1. No groundwater encountered. 2. No evidence of stone culvert encountered.

Stability: 1. Pit sides stable.







GROUNDTECH
CONSULTING

Borehole Log

Borehole No.

WS02

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424607.91 - 404585.03

Hole Type
WS

Location: PENISTONE

Level: 233.09

Scale
1:25

Client: BDW YORKSHIRE WEST

Dates: 23/07/2019 - 23/07/2019

Logged By
CH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.20	232.89		Grass over brown slightly sandy very clayey TOPSOIL with frequent rootlets. Sand is fine to medium.	1
		0.50	D					Firm orange brown mottled grey slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse of sandstone.	
		1.20		N=17 (1,2/2,4,5,6)					
		1.50	D					Becoming grey friable and very gravelly of mudstone at 1.40m bgl.	
		2.00 2.00	D	N=51 (6,8/10,12,12,17)	1.90	231.19		Extremely weak grey MUDSTONE, highly weathered recovered as angular fine to coarse gravel.	
					2.45	230.64		End of borehole at 2.45 m	2
									3
									4
									5

Remarks

1. Hand dug pit excavated to 1.20m bgl prior to drilling works. 2. No groundwater encountered. 3. Position terminated on bedrock at 2.45m bgl. 4. Standpipe installed to 2.00m bgl, 0.50m plain, 1.50m slotted.





GROUNDTECH
CONSULTING

Borehole Log

Borehole No.

WS03

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424616.77 - 404571.14

Hole Type
WS

Location: PENISTONE

Level: 232.93

Scale
1:25

Client: BDW YORKSHIRE WEST

Dates: 23/07/2019 - 23/07/2019

Logged By
CH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.14	232.79		MADE GROUND: Grass over grey slightly gravelly very sandy topsoil. Sand is fine to medium. Gravel is angular to subrounded fine to coarse of brick and sandstone.	
		0.50	D					Light brown slightly gravelly fine to medium SAND. Gravel is subangular fine to coarse of sandstone.	
		0.80			0.80	232.13			
		1.00	D					Firm grey mottled brown slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is subangular fine to medium of sandstone.	1
		1.20		N=7 (1,1/1,2,2,2)					
		2.00						Becoming stiff grey and very gravelly of angular fine to medium siltstone at 1.60m bgl.	
		2.00	D	N=21 (3,3/4,5,6,6)	2.00	230.93		Extremely weak grey SILTSTONE, residually weathered recovered as stiff very gravelly clay. Gravel is angular to subangular fine to medium.	2
		2.60			2.60	230.33			
		3.00							
		3.00	D	50 (8,10/50 for 225mm)				Weak dark grey SILTSTONE, highly weathered recovered as angular fine to coarse gravel.	3
					3.45	229.48		End of borehole at 3.45 m	4
									5

Remarks

1. Hand dug pit excavated to 1.20m bgl prior to drilling works. 2. No groundwater encountered. 3. Position terminated on bedrock at 3.45m bgl. 4. Standpipe installed to 3.00m bgl, 0.50m plain, 2.50m slotted.





GROUNDTECH
CONSULTING

Borehole Log

Borehole No.

WS04

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424623.39 - 404559.18

Hole Type
WS

Location: PENISTONE

Level: 231.37

Scale
1:25

Client: BDW YORKSHIRE WEST

Dates: 23/07/2019 - 23/07/2019

Logged By
CH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.22	231.15		Grass over grey brown slightly sandy slightly gravelly clayey topsoil with frequent rootlets. Sand is fine to medium. Gravel is subangular fine to coarse of sandstone.	
		0.50	D					Firm brown mottled grey slightly sandy CLAY with rare ironstone nodules. Sand is fine to medium.	
		0.80			0.80	230.57		Extremely weak dark grey SILTSTONE, residually weathered recovered as angular to subangular fine to coarse gravel.	1
		1.00	D						
		1.20		N=21 (3,4/4,5,5,7)					
		1.50	D						
		2.00		50 (10,12/50 for 225mm)	2.45	228.92		End of borehole at 2.45 m	2
									3
									4
									5

Remarks

1. Hand dug pit excavated to 1.20m bgl prior to drilling works. 2. No groundwater encountered. 3. Position terminated on bedrock at 2.45m bgl. 4. Standpipe installed to 2.00m bgl, 0.50m plain, 1.50m slotted.





GROUNDTECH
CONSULTING

Borehole Log

Borehole No.

WS05

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424632.20 - 404550.67

Hole Type
WS

Location: PENISTONE

Level: 230.69

Scale
1:25

Client: BDW YORKSHIRE WEST

Dates: 23/07/2019 - 23/07/2019

Logged By
CH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.25	230.44		Grass over grey brown slightly sandy slightly gravelly clayey TOPSOIL with frequent rootlets. Sand is fine to medium. Gravel is subangular fine to coarse of sandstone.	
								Firm brown mottled grey slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is angular fine to coarse of siltstone.	
		1.00	D		1.00	229.69		Extremely weak dark grey SILTSTONE, residually weathered recovered as slightly clayey angular fine to coarse gravel.	1
		1.20		N=38 (3,5/6,8,12,12)	1.40	229.29		Extremely weak dark grey SILTSTONE, residually weathered recovered as angular fine to coarse gravel with rare ironstone nodules.	2
		2.00 2.00	D	50 (8,10/50 for 200mm)	2.45	228.24		End of borehole at 2.45 m	3
									4
									5

Remarks

1. Hand dug pit excavated to 1.20m bgl prior to drilling works. 2. No groundwater encountered. 3. Position terminated on bedrock at 2.45m bgl. 4. Standpipe installed to 2.00m bgl, 0.50m plain, 1.50m slotted.





GROUNDTECH
CONSULTING

Borehole Log

Borehole No.

WS06

Sheet 1 of 1

Project Name: WELL HOUSE LANE

Project No.
18032

Co-ords: 424640.53 - 404539.48

Hole Type
WS

Location: PENISTONE

Level: 230.14

Scale
1:25

Client: BDW YORKSHIRE WEST

Dates: 23/07/2019 - 23/07/2019

Logged By
CH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.27	229.87		MADE GROUND: Grass over grey slightly sandy slightly gravelly very clayey topsoil with frequent rootlets. Sand is fine to medium. Gravel is subangular fine to coarse of sandstone and brick.	
		0.80	D		0.90	229.24		Firm orange brown mottled grey slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is subangular fine to medium of sandstone.	
		1.20		N=17 (1,2/4,4,4,5)				Extremely weak grey brown MUDSTONE, residually weathered recovered as stiff friable very gravelly clay. Gravel is angular fine to coarse.	1
		1.50	D						
		2.00		N=34 (6,6/6,8,8,12)					2
		3.00 3.00	D	50 (25 for 25mm/50 for 35mm)	2.70 3.45	227.44 226.69		Extremely weak grey brown MUDSTONE, residually weathered recovered as angular fine to coarse gravel.	3
								End of borehole at 3.45 m	4
									5

Remarks

1. Hand dug pit excavated to 1.20m bgl prior to drilling works. 2. No groundwater encountered. 3. Position terminated on bedrock at 3.45m bgl. 4. Standpipe installed to 3.0m bgl, 0.50m plain, 2.50m slotted.



APPENDIX 4 – Geo-Environmental Laboratory Test Results

Groundtech Consulting Limited
PO Box 499
Manchester
M28 8EE



Attention :	Sam Flaherty
Date :	7th August, 2019
Your reference :	18032
Our reference :	Test Report 19/12395 Batch 1
Location :	Well House Lane, Penistone
Date samples received :	1st August, 2019
Status :	Final report
Issue :	1

Forty samples were received for analysis on 1st August, 2019 of which three were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

A handwritten signature in black ink, appearing to read 'Lucas Halliwell'.

Lucas Halliwell
Project Co-ordinator

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: Groundtech Consulting Limited
Reference: 18032
Location: Well House Lane, Penistone
Contact: Sam Flaherty
EMT Job No: 19/12395

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	41-43	44-46	48-50								Please see attached notes for all abbreviations and acronyms		
Sample ID	TP33	TP33	TP34										
Depth	0.20	0.60	0.20										
COC No / misc													
Containers	V J T	V J T	V J T										
Sample Date	26/07/2019	26/07/2019	26/07/2019										
Sample Type	Soil	Soil	Soil										
Batch Number	1	1	1										
Date of Receipt	01/08/2019	01/08/2019	01/08/2019										
Arsenic #	11.0	6.9	6.8								<0.5	mg/kg	TM30/PM15
Cadmium #	0.1	<0.1	<0.1								<0.1	mg/kg	TM30/PM15
Chromium #	37.6	35.5	36.3								<0.5	mg/kg	TM30/PM15
Copper #	21	22	21								<1	mg/kg	TM30/PM15
Lead #	50	23	16								<5	mg/kg	TM30/PM15
Mercury #	<0.1	<0.1	<0.1								<0.1	mg/kg	TM30/PM15
Nickel #	29.5	32.4	35.9								<0.7	mg/kg	TM30/PM15
Selenium #	1	<1	<1								<1	mg/kg	TM30/PM15
Zinc #	115	91	102								<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04	<0.04	<0.04								<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03								<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	<0.05								<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04	<0.04								<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	<0.03	<0.03								<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04	<0.04								<0.04	mg/kg	TM4/PM8
Fluoranthene #	0.07	0.05	<0.03								<0.03	mg/kg	TM4/PM8
Pyrene #	0.05	0.03	<0.03								<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	<0.06	<0.06								<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.02	<0.02								<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	<0.07	<0.07								<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	<0.04	<0.04								<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene	<0.04	<0.04	<0.04								<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.04	<0.04								<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	<0.04	<0.04								<0.04	mg/kg	TM4/PM8
PAH 16 Total	<0.6	<0.6	<0.6								<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	<0.05								<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	<0.02								<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	106	104	100								<0	%	TM4/PM8
Methyl Tertiary Butyl Ether #	<2	<2	<2								<2	ug/kg	TM15/PM10
Benzene #	<3	<3	<3								<3	ug/kg	TM15/PM10
Toluene #	<3	<3	<3								<3	ug/kg	TM15/PM10
Ethylbenzene #	<3	<3	<3								<3	ug/kg	TM15/PM10
m/p-Xylene #	<5	<5	<5								<5	ug/kg	TM15/PM10
o-Xylene #	<3	<3	<3								<3	ug/kg	TM15/PM10
Surrogate Recovery Toluene D8	87	92	84								<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	72	85	76								<0	%	TM15/PM10

Element Materials Technology

Client Name: Groundtech Consulting Limited
Reference: 18032
Location: Well House Lane, Penistone
Contact: Sam Flaherty
EMT Job No: 19/12395

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	41-43	44-46	48-50								Please see attached notes for all abbreviations and acronyms		
Sample ID	TP33	TP33	TP34										
Depth	0.20	0.60	0.20										
COC No / misc													
Containers	V J T	V J T	V J T										
Sample Date	26/07/2019	26/07/2019	26/07/2019										
Sample Type	Soil	Soil	Soil										
Batch Number	1	1	1										
Date of Receipt	01/08/2019	01/08/2019	01/08/2019								LOD/LOR	Units	Method No.
TPH CWG													
Aliphatics													
>C5-C6 #	<0.1	<0.1	<0.1								<0.1	mg/kg	TM36/PM12
>C6-C8 #	<0.1	<0.1	<0.1								<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1	<0.1	<0.1								<0.1	mg/kg	TM36/PM12
>C10-C12 #	<0.2	<0.2	<0.2								<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 #	<4	<4	<4								<4	mg/kg	TM5/PM8/PM16
>C16-C21 #	<7	<7	<7								<7	mg/kg	TM5/PM8/PM16
>C21-C35 #	<7	<7	<7								<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-35	<19	<19	<19								<19	mg/kg	TM5/PM8/PM16/PM12/PM10
Aromatics													
>C5-EC7 #	<0.1	<0.1	<0.1								<0.1	mg/kg	TM36/PM12
>EC7-EC8 #	<0.1	<0.1	<0.1								<0.1	mg/kg	TM36/PM12
>EC8-EC10 #	<0.1	<0.1	<0.1								<0.1	mg/kg	TM36/PM12
>EC10-EC12 #	<0.2	<0.2	<0.2								<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 #	<4	<4	<4								<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 #	<7	<7	<7								<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 #	<7	<7	<7								<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-35 #	<19	<19	<19								<19	mg/kg	TM5/PM8/PM16/PM12/PM10
Total aliphatics and aromatics(C5-35)	<38	<38	<38								<38	mg/kg	TM5/PM8/PM16/PM12/PM10
Total Phenols HPLC	<0.15	<0.15	<0.15								<0.15	mg/kg	TM26/PM21
Natural Moisture Content	31.2	13.3	12.4								<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3	<0.3								<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	0.0088	0.0069	0.0025								<0.0015	g/l	TM38/PM20
Total Cyanide #	<0.5	<0.5	<0.5								<0.5	mg/kg	TM89/PM45
Organic Matter	2.0	1.3	0.4								<0.2	%	TM21/PM24
Electrical Conductivity @25C (5:1 ext)	<100	<100	<100								<100	uS/cm	TM76/PM58
pH #	5.95	6.11	6.68								<0.01	pH units	TM73/PM11
Redox Potential	419.3	401.2	380.7									mV	TM139/PM0

Element Materials Technology

Client Name: Groundtech Consulting Limited
Reference: 18032
Location: Well House Lane, Penistone
Contact: Sam Flaherty
EMT Job No: 19/12395

VOC Report : Solid

EMT Sample No.	41-43	44-46	48-50								Please see attached notes for all abbreviations and acronyms		
Sample ID	TP33	TP33	TP34										
Depth	0.20	0.60	0.20										
COC No / misc													
Containers	V J T	V J T	V J T										
Sample Date	26/07/2019	26/07/2019	26/07/2019										
Sample Type	Soil	Soil	Soil										
Batch Number	1	1	1										
Date of Receipt	01/08/2019	01/08/2019	01/08/2019								LOD/LOR	Units	Method No.
VOC MS													
Dichlorodifluoromethane	<2	<2	<2								<2	ug/kg	TM15/PM10
Methyl Tertiary Butyl Ether #	<2	<2	<2								<2	ug/kg	TM15/PM10
Chloromethane #	7	<3	<3								<3	ug/kg	TM15/PM10
Vinyl Chloride	<2	<2	<2								<2	ug/kg	TM15_A/PM10
Bromomethane	<1	<1	<1								<1	ug/kg	TM15/PM10
Chloroethane #	<2	<2	<2								<2	ug/kg	TM15/PM10
Trichlorofluoromethane #	<2	<2	<2								<2	ug/kg	TM15/PM10
1,1-Dichloroethene (1,1 DCE) #	<6	<6	<6								<6	ug/kg	TM15/PM10
Dichloromethane (DCM) #	<30	<30	<30								<30	ug/kg	TM15/PM10
trans-1-2-Dichloroethene #	<3	<3	<3								<3	ug/kg	TM15/PM10
1,1-Dichloroethane #	<3	<3	<3								<3	ug/kg	TM15/PM10
cis-1-2-Dichloroethene #	<3	<3	<3								<3	ug/kg	TM15/PM10
2,2-Dichloropropane	<4	<4	<4								<4	ug/kg	TM15/PM10
Bromochloromethane #	<3	<3	<3								<3	ug/kg	TM15/PM10
Chloroform #	<3	<3	<3								<3	ug/kg	TM15/PM10
1,1,1-Trichloroethane #	<3	<3	<3								<3	ug/kg	TM15/PM10
1,1-Dichloropropene #	<3	<3	<3								<3	ug/kg	TM15/PM10
Carbon tetrachloride #	<4	<4	<4								<4	ug/kg	TM15/PM10
1,2-Dichloroethane #	<4	<4	<4								<4	ug/kg	TM15/PM10
Benzene #	<3	<3	<3								<3	ug/kg	TM15/PM10
Trichloroethene (TCE) #	<3	<3	<3								<3	ug/kg	TM15/PM10
1,2-Dichloropropane #	<6	<6	<6								<6	ug/kg	TM15/PM10
Dibromomethane #	<3	<3	<3								<3	ug/kg	TM15/PM10
Bromodichloromethane #	<3	<3	<3								<3	ug/kg	TM15/PM10
cis-1-3-Dichloropropene	<4	<4	<4								<4	ug/kg	TM15/PM10
Toluene #	<3	<3	<3								<3	ug/kg	TM15/PM10
trans-1-3-Dichloropropene	<3	<3	<3								<3	ug/kg	TM15/PM10
1,1,2-Trichloroethane #	<3	<3	<3								<3	ug/kg	TM15/PM10
Tetrachloroethene (PCE) #	<3	<3	<3								<3	ug/kg	TM15/PM10
1,3-Dichloropropane #	<3	<3	<3								<3	ug/kg	TM15/PM10
Dibromochloromethane #	<3	<3	<3								<3	ug/kg	TM15/PM10
1,2-Dibromoethane #	<3	<3	<3								<3	ug/kg	TM15/PM10
Chlorobenzene #	<3	<3	<3								<3	ug/kg	TM15/PM10
1,1,1,2-Tetrachloroethane #	<3	<3	<3								<3	ug/kg	TM15/PM10
Ethylbenzene #	<3	<3	<3								<3	ug/kg	TM15/PM10
m/p-Xylene #	<5	<5	<5								<5	ug/kg	TM15/PM10
o-Xylene #	<3	<3	<3								<3	ug/kg	TM15/PM10
Styrene	<3	<3	<3								<3	ug/kg	TM15_A/PM10
Bromoform	<3	<3	<3								<3	ug/kg	TM15/PM10
Isopropylbenzene #	<3	<3	<3								<3	ug/kg	TM15/PM10
1,1,2,2-Tetrachloroethane #	<3	<3	<3								<3	ug/kg	TM15/PM10
Bromobenzene	<2	<2	<2								<2	ug/kg	TM15/PM10
1,2,3-Trichloropropane #	<4	<4	<4								<4	ug/kg	TM15/PM10
Propylbenzene #	<4	<4	<4								<4	ug/kg	TM15/PM10
2-Chlorotoluene	<3	<3	<3								<3	ug/kg	TM15/PM10
1,3,5-Trimethylbenzene #	<3	<3	<3								<3	ug/kg	TM15/PM10
4-Chlorotoluene	<3	<3	<3								<3	ug/kg	TM15/PM10
tert-Butylbenzene #	<5	<5	<5								<5	ug/kg	TM15/PM10
1,2,4-Trimethylbenzene #	<6	<6	<6								<6	ug/kg	TM15/PM10
sec-Butylbenzene #	<4	<4	<4								<4	ug/kg	TM15/PM10
4-Isopropyltoluene #	<4	<4	<4								<4	ug/kg	TM15/PM10
1,3-Dichlorobenzene #	<4	<4	<4								<4	ug/kg	TM15/PM10
1,4-Dichlorobenzene #	<4	<4	<4								<4	ug/kg	TM15/PM10
n-Butylbenzene #	<4	<4	<4								<4	ug/kg	TM15/PM10
1,2-Dichlorobenzene #	<4	<4	<4								<4	ug/kg	TM15/PM10
1,2-Dibromo-3-chloropropane #	<4	<4	<4								<4	ug/kg	TM15/PM10
1,2,4-Trichlorobenzene #	<7	<7	<7								<7	ug/kg	TM15/PM10
Hexachlorobutadiene	<4	<4	<4								<4	ug/kg	TM15/PM10
Naphthalene	<27	<27	<27								<27	ug/kg	TM15/PM10
1,2,3-Trichlorobenzene #	<7	<7	<7								<7	ug/kg	TM15/PM10
Surrogate Recovery Toluene D8	87	92	84								<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	72	85	76								<0	%	TM15/PM10

Client Name: Groundtech Consulting Limited

Reference: 18032

Location: Well House Lane, Penistone

Contact: Sam Flaherty

Matrix : Solid

[illegible]

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 19/12395

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

Please include all sections of this report if it is reproduced

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

EMT Job No: 19/12395

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details	Yes		AR	Yes
TM15	Modified USEPA 8260. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM15	Modified USEPA 8260. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.			AD	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21	As received solid or water samples are extracted in Methanol: Sodium Hydroxide (0.1M NaOH) (60:40) by orbital shaker.			AR	Yes

EMT Job No: 19/12395

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GC/FID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results can be confirmed using GC/MS.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GC/FID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results can be confirmed using GC/MS.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM76	Modified US EPA method 120.1. Determination of Specific Conductance by Metrohm automated probe analyser.	PM58	Dried and ground solid samples are extracted with water in a 5:1 water to solid ratio, the samples are shaken on an orbital shaker.			AD	Yes
TM89	Modified USEPA method OIA-1667. Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide and Thiocyanate analysis.	Yes		AR	Yes
TM139	ASTM G200-09 Oxidation-Reduction potential of soil samples removed from the ground, using Redox probe and meter.	PM0	No preparation is required.			AR	No
TM15_A	Modified USEPA 8260. Quantitative Determination of Volatile Organic Compounds, Vinyl Chloride & Styrene by Headspace GC-MS.	PM10	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes

APPENDIX 5 – Interim Permanent Ground Gas Results

GROUNDTECH
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SITE NAME:	WELL HOUSE LANE, PENISTONE	ENGINEER:	Callum Holden
CLIENT:	BDW YORKSHIRE WEST	DATE:	09/09/2019
JOB NO:	18032		

Pressure Trend:	Falling	Weather:	Overcast			Equipment:	GFM 436
Ambient:	O ₂ (%v/v)	CH ₄ (%v/v)	CO ₂ (%v/v)	LEL	H ₂ S (ppm)	CO (ppm)	
Start	20.2	0.0	0.0	0.0	0.0	0.0	
Finish	20.2	0.0	0.0	0.0	0.0	0.0	

BH Ref.	Gas Flow Rate (l/hr)		Borehole Pressure (mb)	Methane (%v/v)			Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)		Carbon Monoxide (ppm)		Q _{hg} CO ₂ (l/hr)	Q _{hg} CH ₄ (l/hr)	Atmos Press (mb)	PID (ppm)	Sheen (Y/N)	Depth to Water (m bgl)
	Peak	Steady		Peak	Steady	LEL	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady						
WS01	0.0	0.0	0.00	0.0	0.0	0.0	1.2	1.4	18.8	18.6	0.0	0.0	0.0	0.0	0.0	0.0	983	-	N	1.89
WS02	0.0	0.0	0.00	0.0	0.0	0.0	2.1	2.9	17.3	16.4	0.0	0.0	0.0	0.0	0.0	0.0	983	-	N	NGW
WS03	0.0	0.0	0.00	0.0	0.0	0.0	1.7	1.8	18.0	17.8	0.0	0.0	0.0	0.0	0.0	0.0	982	-	N	3.19
WS04	0.0	0.0	0.00	0.0	0.0	0.0	3.0	7.1	15.9	9.5	0.0	0.0	0.0	0.0	0.0	0.0	981	-	N	NGW
WS05	0.0	0.0	0.00	0.0	0.0	0.0	3.5	3.5	16.8	16.9	0.0	0.0	0.0	0.0	0.0	0.0	982	-	N	NGW
WS06	0.0	0.0	0.00	0.0	0.0	0.0	4.7	4.5	13.2	13.9	0.0	0.0	0.0	0.0	0.0	0.0	981	-	N	NGW

Notes:

GROUNDTECH
CONSULTING

Pressure Trend:	Steady	Weather:	Clear			Equipment:	GFM 436	
Ambient:	O ₂ (%v/v)	CH ₄ (%v/v)	CO ₂ (%v/v)	LEL	H ₂ S (ppm)	CO (ppm)		
Start	20.4	0.0	0.0	0.0	0.0	0.0		
Finish	20.5	0.0	0.0	0.0	0.0	0.0		

APPENDIX 6 – Tier I Generic Screening Values



Proposed End Use	Unit	Residential with Plant Uptake			Commercial		Source	
SOM	%	1	2.5	6	1	2.5	6	
Arsenic	mg/kg	32	32	32	640	640	640	SGVs
Beryllium	mg/kg	1.7	1.7	1.7	12	12	12	LQM S4ULs
Boron (water soluble)	mg/kg	290	290	290	240000	240000	240000	LQM S4ULs
Cadmium	mg/kg	10	10	10	230	230	230	SGVs
Chromium (Total)	mg/kg	910	910	910	8600	8600	8600	LQM S4ULs
Chromium (VI)	mg/kg	21	21	21	49	49	49	DEFRA C4SLs
Copper	mg/kg	2400	2400	2400	68000	68000	68000	LQM S4ULs
Lead	mg/kg	200	200	200	2300	2300	2300	DEFRA C4SLs
Organic Mercury	mg/kg	1.2	1.2	1.2	26	26	26	LQM S4ULs
Nickel	mg/kg	130	130	130	1800	1800	1800	SGVs
Selenium	mg/kg	350	350	350	13000	13000	13000	SGVs
Vanadium	mg/kg	410	410	410	9000	9000	9000	LQM S4ULs
Zinc	mg/kg	3700	3700	3700	730000	730000	730000	LQM S4ULs
Aliphatic EC 5 - 6	mg/kg	42	78	160	3200 (304) ^{sol}	5900 (558) ^{sol}	12000 (1150) ^{sol}	LQM S4ULs
Aliphatic EC 6 - 8	mg/kg	100	230	530	7800 (144) ^{sol}	17000 (322) ^{sol}	40000 (736) ^{sol}	LQM S4ULs
Aliphatic EC 8 - 10	mg/kg	27	65	150	2000 (78) ^{sol}	4800 (190) ^{sol}	11000 (451) ^{vap}	LQM S4ULs
Aliphatic EC 10 - 12	mg/kg	130 (48) ^{vap}	330 (118) ^{vap}	760 (283) ^{vap}	9700 (48) ^{sol}	23000 (118) ^{vap}	47000 (283) ^{vap}	LQM S4ULs
Aliphatic EC 12 - 16	mg/kg	1100 (24) ^{sol}	2400 (59) ^{sol}	4300 (142) ^{sol}	59000 (24) ^{sol}	82000 (59) ^{sol}	90000 (142) ^{sol}	LQM S4ULs
Aliphatic EC 16 - 35	mg/kg	65000 (8.48) ^{f, sol}	92000 (21) ^{f, sol}	110000 ^f	1600000 ^f	1700000 ^f	1800000 ^f	LQM S4ULs
Aliphatic EC 35 - 44	mg/kg	65000 (8.48) ^{f, sol}	92000 (21) ^{f, sol}	110000 ^f	1600000 ^f	1700000 ^f	1800000 ^f	LQM S4ULs
Aromatic EC 5 - 7	mg/kg	70	140	300	26000 (1220) ^{sol}	46000 (2260) ^{sol}	86000 (4710) ^{sol}	LQM S4ULs
Aromatic EC 7 - 8	mg/kg	130	290	660	56000 (869) ^{vap}	110000 (1920)	180000 (4360)	LQM S4ULs
Aromatic EC 8 - 10	mg/kg	34	83	190	3500 (613) ^{vap}	8100 (1500) ^{vap}	17000 (3580) ^{vap}	LQM S4ULs
Aromatic EC 10 - 12	mg/kg	74	180	380	16000 (364) ^{sol}	28000 (899) ^{sol}	34000 (2150) ^{sol}	LQM S4ULs
Aromatic EC 12 -16	mg/kg	140	330	660	36000 (169) ^{sol}	37000	38000	LQM S4ULs
Aromatic EC 16 - 21	mg/kg	260 ^f	540 ^f	930 ^f	28000 ^f	28000 ^f	28000 ^f	LQM S4ULs
Aromatic EC 21 - 35	mg/kg	1100 ^f	1500 ^f	1700 ^f	28000 ^f	28000 ^f	28000 ^f	LQM S4ULs
Aromatic EC 35 - 44	mg/kg	1100 ^f	1500 ^f	1700 ^f	28000 ^f	28000 ^f	28000 ^f	LQM S4ULs
Benzene	mg/kg	0.33	0.33	0.33	95	95	95	SGVs
Toluene	mg/kg	610	610	610	4400	4400	4400	SGVs
Ethyl Benzene	mg/kg	350	350	350	2800	2800	2800	SGVs
Xylene - o	mg/kg	250	250	250	2600	2600	2600	SGVs
Xylene - m	mg/kg	240	240	240	3500	3500	3500	SGVs
Xylene - p	mg/kg	230	230	230	3200	3200	3200	SGVs
MTBE (methyl tert-butyl)	mg/kg	49	84	160	7900	13000	24000	CL:AIRE 2010
Acenaphthene	mg/kg	210	510	1100	84000 (57) ^{sol}	97000 (141) ^{sol}	100000	LQM SAULs
Acenaphthylene	mg/kg	170	420	920	83000 (86.1) ^{sol}	97000 (212) ^{sol}	100000	LQM S4ULs
Anthracene	mg/kg	2400	5400	11000	520000	540000	540000	LQM S4ULs
Benzo(a)anthracene	mg/kg	7.2	11	13	170	170	180	LQM S4ULs
Benzo(a)pyrene	mg/kg	2.2	2.7	5*	35	35	77*	DEFRA C4SL*/LQM
Benzo(b)fluoranthene	mg/kg	2.6	3.3	3.7	44	44	45	LQM S4ULs
Benzo(ghi)perylene	mg/kg	320	340	350	3900	4000	4000	LQM S4ULs
Benzo(k)fluoranthene	mg/kg	77	93	100	1200	1200	1200	LQM S4ULs
Chrysene	mg/kg	15	22	27	350	350	350	LQM S4ULs
Dibenz(ah)anthracene	mg/kg	0.24	0.28	0.3	3.5	3.6	3.6	LQM S4ULs
Fluoranthene	mg/kg	280	560	890	23000	23000	23000	LQM S4ULs
Fluorene	mg/kg	170	400	860	63000 (30.9) ^{sol}	68000	71000	LQM S4ULs
Indeno(123-cd)pyrene	mg/kg	27	36	41	500	510	510	LQM S4ULs
Naphthalene	mg/kg	2.3 ^f	5.6 ^f	13 ^f	190 ^f (76.4) ^{sol}	460 ^f (183) ^{sol}	1100 ^f (432) ^{sol}	LQM S4ULs
Phenanthrene	mg/kg	95	220	440	22000	22000	23000	LQM S4ULs
Pyrene	mg/kg	620	1200	2000	54000	54000	54000	LQM S4ULs



Proposed End Use	Unit	Residential with Plant Uptake			Commercial			Source
SOM	%	1	2.5	6	1	2.5	6	
Phenol	mg/kg	420	420	420	3200	3200	3200	SGVs
Chlorophenols	mg/kg	0.87 ^s	2	4.5	3500	4000	4300	LQM S4ULs
Pentachlorophenol	mg/kg	0.22	0.52	1.2	400	400	400	LQM S4ULs
Carbon disulphide	mg/kg	0.14	0.29	0.62	11	22	47	LQM S4ULs
Hexachlorobutadiene	mg/kg	0.29	0.7	1.6	31	66	120	LQM S4ULs
1,1,1,2-Tetrachloroethane	mg/kg	1.6	3.4	7.5	270	550	1100	LQM S4ULs
1,1,1-Trichloroethane	mg/kg	8.8	18	39	660	1300	3000	LQM S4ULs
Trichloroethene	mg/kg	0.016	0.034	0.075	1.2	2.6	5.7	LQM S4ULs
Tetrachloromethane	mg/kg	0.026	0.056	0.13	2.9	6.3	14	LQM S4ULs
1,2-Dichloroethane	mg/kg	0.0071	0.011	0.019	0.67	0.97	1.7	LQM S4ULs
Chloroethene (Vinyl)	mg/kg	0.00064	0.00087	0.0014	0.059	0.077	0.12	LQM S4ULs
Trichloromethane	mg/kg	0.91	1.7	3.4	99	170	350	LQM S4ULs
Tetrachloroethene	mg/kg	0.18	0.39	0.9	19	42	95	LQM S4ULs
Hexachlorobenzene	mg/kg	1.8 (0.2) ^{vap}	3.3 (0.5) ^{vap}	4.9	110 (0.2) ^{vap}	120	120	LQM S4ULs
Pentachlorobenzene	mg/kg	5.8	12	22	640 (43) ^{sol}	770 (107) ^{sol}	830	LQM S4ULs
1,2,4,5-Tetrachlorobenzene	mg/kg	0.33	0.77	1.6	42 (19.7) ^{sol}	72 (49.1) ^{sol}	96	LQM S4ULs
1,2,3,5-Tetrachlorobenzene	mg/kg	0.66	1.69	3.7	49 (39.4) ^{vap}	120 (98.1) ^{vap}	240 (235) ^{vap}	LQM S4ULs
1,2,3,4-Tetrachlorobenzene	mg/kg	15	36	78	1700 (122) ^{vap}	3080 (304) ^{vap}	4400 (728) ^{vap}	LQM S4ULs
1,3,5-Trichlorobenzene	mg/kg	0.33	0.81	1.9	23	55	130	LQM S4ULs
1,2,4-Trichlorobenzene	mg/kg	2.6	6.4	15	220	530	1300	LQM S4ULs
1,2,3-Trichlorobenzene	mg/kg	1.5	3.6	8.6	102	250	590	LQM S4ULs
1,4-dichlorobenzene	mg/kg	61 ^f	150 ^f	350 ^f	4400 ^f (224) ^{vap}	10000 ^f (540) ^{vap}	25000 ^f (1280) ^{vap}	LQM S4ULs
1,3-dichlorobenzene	mg/kg	0.4	1	2.3	30	73	170	LQM S4ULs
1,2-Dichlorobenzene	mg/kg	23	55	130	2000 (571) ^{sol}	4800 (1370) ^{sol}	11000 (3240) ^{sol}	LQM S4ULs
Chlorobenzene	mg/kg	0.46	1	2.4	56	130	290	LQM S4ULs
Gamma-	mg/kg	0.06	0.14	0.33	67	69	70	LQM S4ULs
Beta-	mg/kg	0.085	0.2	0.46	65	65	65	LQM S4ULs
Alpaha -	mg/kg	0.23	0.55	1.2	170	180	180	LQM S4ULs
Beta -Endosulfan	mg/kg	7	17	39	6300 (0.00007) ^{vap}	7800 (0.0002) ^{vap}	8700	LQM S4ULs
Alpha-Endosulfan	mg/kg	7.4	18	41	5600 (0.003) ^{vap}	7400 (0.007) ^{vap}	8400 (0.016) ^{vap}	LQM S4ULs
Dichlorvos	mg/kg	0.032	0.066	0.14	140	140	140	LQM S4ULs
Atrazine	mg/kg	3.3	7.6	17.4	9300	9400	9400	LQM S4ULs
Dieldrin	mg/kg	0.97	2	3.5	170	170	170	LQM S4ULs
Aldrin	mg/kg	5.7	6.6	7.1	170	170	170	LQM S4ULs
HMX	mg/kg	5.7	13	26	110000	110000	110000	LQM S4ULs
2,4,6-Trinitrotoulene	mg/kg	1.6	3.7	8.1	1000	1000	1000	LQM S4ULs
RDX	mg/kg	120	250	540	210000	210000	210000	LQM S4ULs

^{sol} S4UL exceeds the solubility saturation limit (which is presented in brackets)

^{vap} S4ULs presented exceeds the vapour saturation limit, which is presented in brackets

^f For naphthalene, the S4UL is based on a comparison of inhalation exposure with the TDI_{inhal} for localised effects

^f S4UL based on comparison of inhalation exposure with inhalation TDI for localised effects

^{dir} S4ULs based on a threshold protective direct skin contact with phenol (guideline in brackets based on health effects following long term exposure provided for illustration only)

APPENDIX 7 – Legislative Background

Legislative Background

Environmental liabilities and risks have been evaluated in terms of a source -pathway - target relationship in accordance with the approach set out in:

- The 1995 Environment Act;
- The Contaminated Land (England) Regulations 2000;
- The DETR circular 02/2000 Environmental Protection Act 1990: Part IIA Contaminated Land.

Contaminated land is defined within the legislative framework as land which is in such condition by reason of substances in, on or under the land that:

- 1) Significant harm is being caused or there is a significant possibility of such harm being caused;
- 2) Significant pollution of controlled waters is being or is likely to be caused.

The potential for harm is based on the presence of three factors:

- **Source** - substances that are potential contaminants or pollutants that may cause harm;
- **Pathway** - a potential route by which contaminants can move from the source to the receptor;
- **Receptor** - a receptor that may be harmed, for example the water environment, humans and water.

Where a source, pathway and target are all present a pollutant linkage exists and there is potential for harm to be caused. The presence of a source does not automatically imply that a contamination problem exists, since contamination must be defined in terms of pollutant linkages and unacceptable risk of harm. The nature and importance of both pathways and receptors are site specific and will vary according to the intended end use of the site, its characteristics and its surroundings.

The key principle which supports the SPR approach is 'suitable for use' criteria. This requires remedial action only where contamination is considered to pose unacceptable actual or potential risks to health or the environment and, taking into account the proposed use of the site.

Relevant Guidance Documents

This report has been prepared in accordance with the list of guidance below however the list is not exhaustive:

- CLR11 – Model Procedures;
- Contamination and Environmental Matters - Their implications for Property Professionals (2nd Edition RICS Nov 2003);
- Brownfields – Managing the development of previously developed land – A client's guide, CIRIA 2002;
- DEFRA and Environment Agency publications CLR7 – 10, supported by the TOX guides and SGV guides, dated March 2002;
- DETR Circular 02/2000, Contaminated Land: Implementation of Part IIA of the Environmental Protection Act 1990;
- Environment Agency technical advice to third parties on Pollution of Controlled Waters for Part IIA of the EPA1990, May 2002;

Relevant Legislative Documents

The following is a non-exhaustive list of legislative framework documents that has been considered in the production of this report:

- The Environment Act (1995);
- The Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (2012);
- The Environment Protection Act (1990);
- The Contaminated Land (England) Act (2000);
- Contaminated Land (England) Regulations (2012);
- The Water Resources Act (1991);
- The Pollution Prevention and Control (England and Wales) Regulations (2000);
- The Landfill Regulations (England and Wales) Regulations (2002);
- The Landfill (England and Wales) (Amendment) Regulations (2004);
- Health and Safety at Work Act;

APPENDIX 8 - Limitations

Limitations

This contract was completed by Groundtech Consulting on the basis of a defined programme and scope of works and terms and conditions agreed with the client. This report was compiled with due skill and care, taking into consideration the project brief provided, project objectives, agreed scope of works, prevailing site conditions and budget allocation.

Other than that defined in the paragraph above, Groundtech Consulting provides no other accountability or warranty whether express or implied, is made in relation to the services. Unless otherwise agreed this report has been prepared exclusively for the use and reliance of the client in accordance with generally accepted industry practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon, or transferred to, by any other party without the written agreement of a Director of Groundtech Consulting. A third party who relies on this report, does so at their own and sole risk and no liability to such parties is provided by Groundtech Consulting.

It is the understanding of Groundtech Consulting that this report is to be used for the intended purpose as set out in the introduction. The purpose was instrumental in determining the scope and level of the services provided. Should the purpose of the report or the proposed end use of the site change, this report will no longer be directly applicable, and its validity readdressed. No reliance upon the report in the revised situation should be assumed by the client without the permission of Groundtech Consulting.

The report was written in 2019, later changes in legislation, statutory requirements and industry best practices have not been considered and this should be allowed for. Ground conditions can also change and should be investigated if there is any significant delay in acting on the findings of this report. The period of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions in this report should not be relied upon in the future without the written confirmation from Groundtech Consulting that it is safe to do so.

The observations and conclusions outlined in this report are based exclusively on the services that were provided as set out in the agreement between the client and Groundtech Consulting.

Groundtech Consulting are not liable for the existence of any condition, the discovery of which would require additional investigation outside the agreed scope of works or core competency. The services provided are based upon Groundtech Consulting observations of existing physical conditions at the site gained from site reconnaissance together with interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The findings and recommendations contained in this report are based in part upon information provided by third parties, and Groundtech Consulting assume the information to be correct.

No responsibility can be accepted for errors for third party information presented in this report. Groundtech Consulting were not authorised to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the services. Groundtech Consulting are not liable for any inaccurate information, misrepresentation of data or conclusions, which may inform the scope of investigation undertaken by Groundtech Consulting and forms the contract with the client.

Where field investigations have been carried out these have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions can also be variable due to its heterogeneous properties and as investigation exploratory locations only allow examination of the ground at discrete

locations. The potential exists for ground conditions to be encountered which are different to those considered in this report, particularly between exploratory holes. The extent of the limited area depends on the soil and groundwater conditions, together with other constraints such as the position of any existing structures and underground utilities. Geo-Environmental testing was carried out for a limited number of parameters [as stipulated in the contract] based on an understanding of the available operational and historical information, and it should not be inferred that other chemical species are not present.

The groundwater conditions entered on the exploratory hole records are those observed at the time of investigation. The groundwater level often has not had time to reach equilibrium and a monitoring period is required. Furthermore, groundwater levels are subject to seasonal variation or changes in local drainage conditions and higher groundwater levels may occur at other times of the year than were recorded during this investigation.

Any site drawings provided in this report are not meant to be an accurate base plan, but are preliminary and used to present the general relative locations of features on, and surrounding, the site.

