

Westchurch Homes

REMEDIATION STRATEGY

for

Land at Radcliffe Moor Road, Bolton

October 2023

REPORT No: 20WCH011/RS

- *Desk Studies and Site Walkovers*
- *Intrusive Contaminated Land Investigations*
- *Geotechnical Appraisals and Ground Investigations*
- *Landfill Gas Assessments and Remedial Design*
- *Remediation Design and Implementation*
- *Remediation Project Management and Supervision*
- *Site Abnormal Assessments (Foundations and contaminated land)*
- *Ecological Surveys (Bats, Badgers, Newts, Japanese Knotweed etc)*

GEOTECHNICAL - CONTAMINATED LAND - FLOOD RISK

DOCUMENT ISSUE RECORD

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Checked by:

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1. INTRODUCTION

1.1 The Commission and Brief

Betts Geo has been commissioned by Westchurch Homes to prepare a Remediation Strategy for the remediation and preparatory works at their Land at Radcliffe Moor Road, Bolton site. The extract below shows the approximate area (red outline) extent;



Aerial Image of Site - extract from Groundsure Report.

This Remediation Strategy has been prepared for the purpose of demonstrating to the Local Planning Authority the remediation methodology going throughout the duration of the development.

Regulatory approval is advised prior to site commencement.

Betts reserves the right to amend this remedial strategy in the light of further information, such as site observations and unforeseen conditions.

1.2 Proposed Development

The proposed development at time of issue comprises the construction of new sports pitches with pavilion building and associated infrastructure.

1.3 Previous Reporting

Betts Geo have previously undertaken the following reports for the site which have been used to inform the remediation strategy:

- Rpt.; Desk Study Report for Land at Radcliffe Moor Road, Bury, Ref.; 20WCH011/DS, Dated; October 2020, By; Betts Geo, For; Westchurch Homes.
- Rpt.; Ground Investigation Report for Land at Radcliffe Moor Road, Bolton, Ref.; 20WCH011/GI, Dated; July 2021, By; Betts Geo, For; Westchurch Homes.
- Letter Response ref 20/WCH/011/MJF/GS/L1 to Coal Authority dated 5th January 2022 By; Betts Geo, For; Coal Authority

Whilst Betts Geo Environmental Ltd cannot be held liable for the third party, client furnished, results/data, it is suggested that it is reasonable to assume that the data provided in these reports have been undertaken with suitable care and due diligence by suitably experience consultants. As such the data is regarded as being of an appropriate standard to utilise within this report.

Where necessary the above reports have been used throughout this report and referenced accordingly. The following 'Site History Summary', 'Geology' and 'Environmental Data' has been summarised from the report.

2 Background

2.1 Site Description

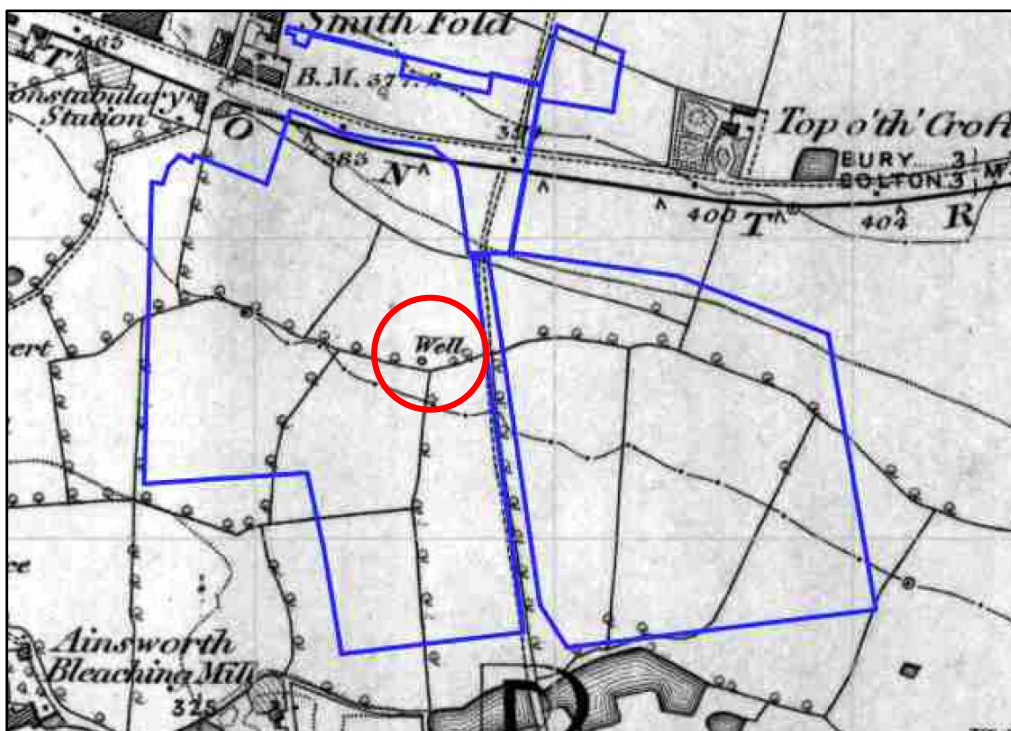
Site was visited by a geo-environmental engineer on 19th October 2020 and the following section outlines the main features identified.

The overall development site is split across two (2 No.) parcels of land and are located to the south of Bury New Road on both sides of Radcliffe Moor Road. The two parcels are irregular in plan form and comprise several fields. The section of the site of which application is required is the section in the west, therefore this section will be referred to as the “site” from now on and the “overall development site” when considering both parcels. The site is currently laid down to rough grass with a hedgerow dividing the parcel into two fields. The area in the south of the site was noted as being wet and soft underfoot and is generally lower at circa 100m AOD with the northern end lying at circa 115m AOD. Approximately halfway along the eastern boundary a small hump with bushes and rush/sedge vegetation was noted. This is where the former coal mine was located and is discussed in more detail in the sections below. A high-pressure gas pipeline was noted running across the middle of the site orientated east-west with marker posts close where it crosses hedges. In the north of the site an area of vehicular related rubbish was noted at the boundary with an adjacent garage and Himalayan Balsam also present here.

2.2 Site History and Surrounding Area

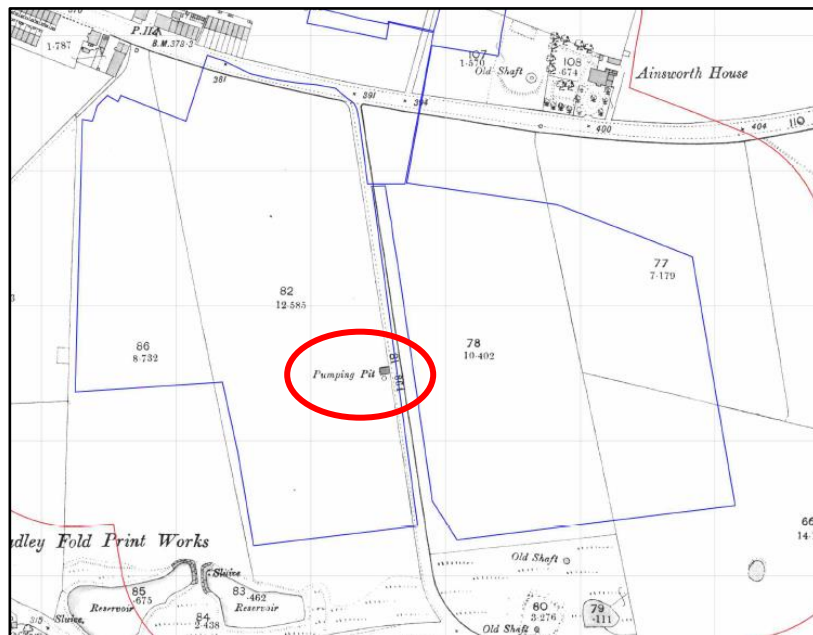
The earliest available map of site is the 1850 1:10,560 map which shows the site as undeveloped. A well is shown in the centre of site. An extract of this map is shown below;

1850 1:10,560 Map



On the next available map (the 1890 1:2,500 map), the well is no longer shown, and a 'pumping pit' is shown along the eastern boundary of the western parcel. The field boundaries have also altered slightly. An extract of this map is shown overleaf;

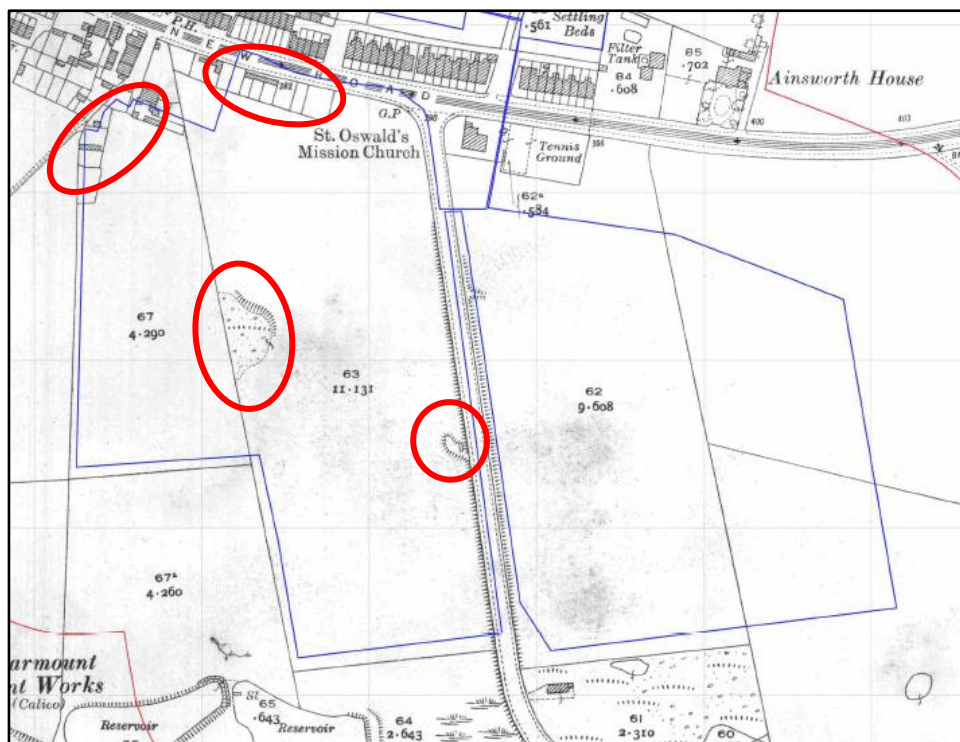
1890 1:1,250 Map



It is important to note that a 'pumping pit' was built for the purpose of draining coal mines and therefore it is highly likely that a shaft exists adjacent to site beyond the red edge. The former well in the middle of the development is also possibly a former shaft.

No further major changes are shown to occur onsite until the 1930 1:2,500 map where the pumping station is no longer shown and instead is just a hollow and a possible mound of made ground is shown in the centre of the western parcel. A number of buildings are also shown along the very northern boundary of the western parcel. An extract of this map is shown below:

1930 1:1,250 Map



The houses along the northern boundary are no longer shown circa 1937, and the refuse tip and former pumping station hollow are no longer shown circa 1955. No further changes occur across the remainder of the historic maps to present day.

2.3 Geology

The documented geology of the site is summarised on the British Geological Survey map principally, with further site-specific details detailed below.

Geology	Artificial Ground & Land Slip	Drift	Solid
1:10,000	Very southern area - Made Ground	Glacial Till – Sandy gravelly clay.	Very north and south - Pennine Lower Coal Measures Formation – Mudstone, Siltstone and Sandstone Centre of site - Cannel Rock (south Lancashire) – Sandstone and Trencherbone Rock - Sandstone

Artificial Ground & Land Slip

ID	Location	LEX Code	Description	Rock description
A	On site	MGR-ARTDP	Made Ground (Undivided)	Artificial Deposit



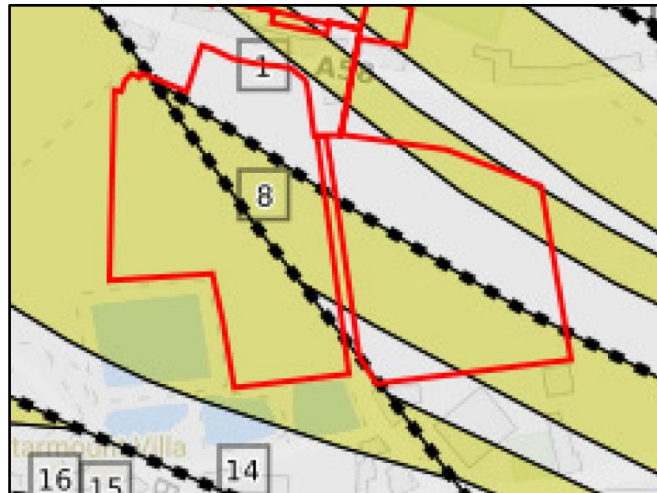
Superficial Geology

ID	Location	LEX Code	Description	Rock description
1	On site	TILLD-DMTN	Till, Devensian - Diamicton	Diamicton



Bedrock Geology

ID	Location	LEX Code	Description	Rock age
1	On site	PLCM-MDSS	Pennine Lower Coal Measures Formation - Mudstone, Siltstone And Sandstone	Langsettian Sub-age
2	On site	PLCM-MDSS	Pennine Lower Coal Measures Formation - Mudstone, Siltstone And Sandstone	Langsettian Sub-age
3	On site	CAR-SDST	Cannel Rock (south Lancashire) - Sandstone	Langsettian Sub-age
4	On site	TRBR-SDST	Trencherbone Rock - Sandstone	Langsettian Sub-age
5	On site	PLCM-MDSS	Pennine Lower Coal Measures Formation - Mudstone, Siltstone And Sandstone	Langsettian Sub-age
6	On site	CAR-SDST	Cannel Rock (south Lancashire) - Sandstone	Langsettian Sub-age



2.4 Coal Mining

The site lies within an area affected by historical coal mining and a Coal Authority Report was obtained; the full report is available in the Betts Geo Desk Study report however, extracts are shown below. The Coal Authority Report refers to the overall development, not the planning application site.

Past underground mining

Colliery	Seam	Mineral	Coal Authority reference	Depth (m)	Direction to working	Dipping rate of seam worked (degrees)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
unnamed	CANNEL	Coal	3Y5I	16	Beneath Property	14.0	South	150	1900
unnamed	TRENCHERB ONE	Coal	3Y96	23	Beneath Property	14.0	South	160	1908
unnamed	CANNEL	Coal	3Y5L	32	Beneath Property	14.0	South	150	1870
unnamed	CANNEL	Coal	3Y5K	33	Beneath Property	14.0	South	150	1900

Probable unrecorded shallow workings

Yes.

Remediated sites

Distance to site remediation (m)	Direction
37.1	South

See Section 4 for further information.

Mine entries

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	375408-006	375761 408850		Coal	
Shaft	375408-007	375896 408720	This shaft was located in May 1989 by a prospective developer but there is no record of any treatment being afforded to the shaft.	Coal	
Shaft	375408-008	375873 408666	This shaft was located in May 1989 by a prospective developer but there is no record of any treatment being afforded to the shaft.	Coal	
Shaft	375409-001	375847 409128		Coal	
Shaft	375409-002	375871 409073	A visual inspection of the site in July 2002 revealed a shaft of about 3m in diameter filled with unknown material. A reinforced concrete cap was constructed in November 2002 by JMC Mining Services Ltd acting on behalf of the Coal Authority. The cap measures 5 metres square by 600mm thick and is sited 1.5 metres below ground level.	Coal	

Abandoned mine plan catalogue numbers

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

NW362	5419	NW1157
16820	P00	

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

Outcrops

Seam name	Mineral	Seam workable	Distance to outcrop (m)	Direction to outcrop	Bearing of outcrop
CANNEL	Coal	Yes	121.1	East	128
TRENCHBONE	Coal	Yes	Within	N/A	94
TRENCHBONE	Coal	Yes	Within	N/A	102
TRENCHBONE	Coal	Yes	Within	N/A	296
TRENCHBONE	Coal	Yes	Within	N/A	300

Geological faults, fissures and breaklines

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

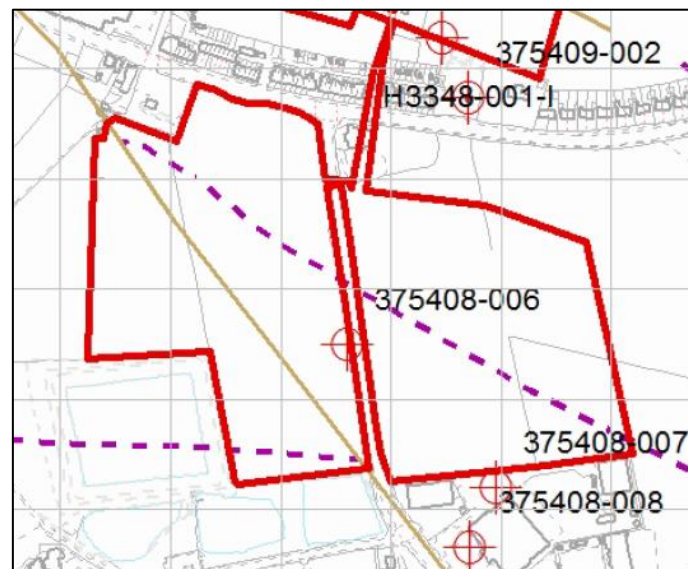
Opencast mines

None recorded within 500 metres of the enquiry boundary.

Coal Authority managed tips

None recorded within 500 metres of the enquiry boundary.

According to the Coal Authority records, there are one (1 No.) shaft located on site and a further four (4 No.) in the immediate area. An extract of this record is shown below.



A further coal seam is also shown on site on the Coal Authority plans which is not shown on the Geology maps in Section 4.1.

Adits and day holes indicate shallow workings, as they are horizontal/near horizontal mine entrances, the site is likely to have unknown adits, shallow bell pits and shafts that pre-date the recording of coal mine shafts in the area (pre 1850's).

2.5 Hydrogeology and Hydrology

- The superficial deposits of the Glacial Till are classed as a Secondary Aquifer – Undifferentiated.
- The bedrock deposits of the Sandstone and Pennine Coal Measure are classed as a Secondary A Aquifer – High Permeability.
- The site does not lie within Groundwater Source Protection Zone as defined by Natural Resources Wales.
- There are no current licenced groundwater water abstractions within 250m of site although there are four (4 No) historic licenses.
- The nearest surface water features are the reservoirs located immediately southwest of site.

2.6 Summary of Previous Ground Investigations

2.6.1 Scope of Works

The fieldwork was carried out between 6th April and 18th May on non-consecutive days, and comprised the below;

- Four (4 No.) window sample boreholes to depths of 3.00mbgl. Targeted to the new Clubhouse.
- Eight (8 No.) trial pits to depths between 2.00mbgl and 3.30mbgl (TP02). Coverage for pitches where cut is proposed – to assess material initially for suitability.
- Seven (7 No.) rotary boreholes to depths between 12.00mbgl and 30.00mbgl – targeted to new clubhouse.
- Chemical analysis (Metals, PAH's, TPH's) of six (6no) samples. Targeted to clubhouse.
- Screening of six (6 No.) samples for asbestos. Targeted to clubhouse.

Note: due to the Cadent Gas Pipeline access was restricted to ground investigation within 15m easement of the line (marked on site previously by Cadent).

2.6.2 Ground Conditions

Ground conditions can generally be summarised as TOPSOIL / MADE GROUND over shallow superficial deposits of both granular (sand and gravels) and cohesive (clay and silt) materials.

Superficial deposits were underlain by solid deposits of shale over sandstone.

MADE GROUND was recorded in TP01 only and was of CLAY with minor anthropogenic constituents.

Topsoil was recorded in all locations to a maximum depth of 0.40mbgl and was generally described as 'brown sandy CLAY'.

The rotary holes also had topsoil present but was not logged due to the drilling process.

Cohesive strata in the form of CLAY was generally recorded below the topsoil. CLAY was generally described as 'greyish orange grey / dark grey silty CLAY with occasional fine gravel'. Generally, the deeper grey clays were described as stiff to hard. Compared to the shallower firm to stiff strengths of the orangish grey CLAY.

Clay was recorded to a maximum depth of 9.40mbgl in rotary BH6.

SILT was only recorded in WS4 between 0.40mbgl and 1.50mbgl and was described as 'Compact greyish orange clayey SILT with occasional fine gravel of coal'.

Due to the rotary drilling process CLAY / SILT would have been very hard to determine any differences.

Granular strata were only observed in TP02-TP05 and were generally described as 'clayey silty SAND & GRAVEL with occasional cobbles' or 'cobbly sandy GRAVEL with occasional silt'.

The SAND & GRAVEL were observed from shallower depths between 0.30mbgl -1.50mbgl (TP02). The deeper GRAVEL was recorded between 1.80mbgl and 2.80mbgl (TP02).

Solid geology of SANDSTONE was recorded in TP02 and TP03 and all rotary locations (BH1-BH7) and was observed from 2.30mbgl.

The sandstone was generally described as 'brownish orange and red banded SANDSTONE' of firm drilling.

Sandstone was recorded to a maximum, unproven, depth of 30.00mbgl. No workings or coal was observed.

MADE GROUND was only observed in TP201. MADE GROUND was recorded from 0.30-1.80mbgl and was described as 'Cobbles with sand and gravel and occasional pockets of clay' reworked natural.

2.6.3 Groundwater

All exploratory holes were recorded as dry with the exception of the below:

Exploratory Hole	Depth (mbgl)	Strata	Remark
TP01	1.80	MADE GROUND / CLAY Interface	Slight seepage
TP03	2.60	SANDSTONE	Wet
TP08	0.40-2.00	CLAY	Damp
All window sample boreholes were deemed wet due to perched water at surface.			

The table below indicates groundwater encountered during the monitoring post fieldwork:

Exploratory Hole	Depth (mbgl)
WS01	0.82
WS02	0.90
WS03	0.72

2.6.4 Ground Gas

Six out of six (6/6) ground gas visits have been undertaken, and the results are summarised below (see Appendix F for full details).

Borehole Number	Peak Methane (%)	Peak Carbon Dioxide (%)	Min Oxygen (%)	Atmospheric Pressure (mB)	Peak Flow (l/hr)	GSV CH ₄	GSV CO ₂	No. of Visits
WS01	0.2	0.5	19.5	988 - 1020	0.3	0.001	0.002	6/6
WS02	0.1	2.6	18.2	988 - 1020	0.1	0.000	0.003	6/6
WS03	0.1	0.2	20.0	988 - 1020	0.2	0.000	0.000	6/6

No significantly elevated flows or concentrations have been identified.

The maximum Carbon Dioxide concentration was recorded in WS02 at 2.6% and the maximum Methane concentration of 0.2% was recorded in WS01.

The peak site flow was recorded at 0.3l/h.

Due to the desk study report identifying no significant ground gas sources and no elevated concentrations recorded within the gas wells, the site has been classified as CS1 – no specialist ground gas protection measures required.

Site Area	Site Classification	Recommended Ground Gas Protection Measures
Whole Site	CS1	No specialist ground gas protection measures required.

2.6.5 Soil Contamination Encountered

Topsoil

All determinants for TPH's, PAH's and Metals fell below the residential home grown produce guidance levels within the Topsoil, with the exception of WS1 at 0.30,mbgl.

The exceedance is detailed below;

Location	Depth (mbgl)	Strata	Determinant	Observed Concentration (mg/kg)	AtRisk 2017 Threshold Concentration (mg/kg)	DEFRA C4SL Threshold (mg/kg)
WS1	0.30	TOPSOIL	Lead	202	-	200

Natural Strata

All determinants for TPH's, PAH's and Metals fell below the residential home grown produce guidance levels within the natural, with the exception of WS2 at 0.30,mbgl.

The exceedance is detailed below;

Location	Depth (mbgl)	Strata	Determinant	Observed Concentration (mg/kg)	AtRisk 2017 Threshold Concentration (mg/kg)	DEFRA C4SL Threshold (mg/kg)
WS2	0.30	CLAY	Arsenic	35	32	37

Asbestos

No asbestos was identified in the samples analysed.

2.6.6 Contamination Assessment and Recommendations

Soil

Marginally elevated concentrations of Arsenic (35mg/kg) and Lead (202mg/kg) have been observed in WS2 and WS1 respectively. Further to this, statistical analysis, using a Mean Value Test (US₉₅), of the metals gives a US₉₅ value of 29.53mg/kg for Arsenic and 185.93mg/kg Lead, which are significantly lower than the residential thresholds, as detailed below;

Determinant	Observed Concentration (mg/kg)	US ₉₅ Value	AtRisk 2017 Threshold Concentration (mg/kg)	DEFRA C4SL Threshold (mg/kg)
Arsenic	32	29.53	32	37
Lead	202	185.93	-	200

On the basis of the above, both metals may be discounted as it poses negligible to risk to sensitive receptors and is not representative of the wider site soils.

Groundwater & Aquifer Risk

No significant contamination sources have been identified within the soils onsite and given the general presence of site-wide low permeability soils, the risk to groundwaters and the aquifer from site is considered very low.

Water monitoring has identified shallow perched water in the drift deposits – with levels between 0.5 – 0.8 typically between June and September at which point the subsequent monitoring recorded no ground water (dry wells).

Rotary Borehole Coal Mining Investigation Findings

The site lies at the lowest part on the Manchester Coalfield, part of the Carboniferous Pennine Upper Coal Measures of Langsettian Westphalian 'A' age. Successive Geological Surveys since 1836 inferred the presence of the Arley Mine (1836 to 1930), the Gingham Mine (1930), and currently the Trencherbone Mine at shallow depth in the north of the site and dipping south-east at 1 in 4.

A large fault with a calculated displacement of 80m is shown on Coal Authority records as possibly outcropping with a north-west orientation across the site. Coal mining in the Brightmet area is first recorded in 1246 when Adam de Radelclyve was fined for trespassing on coal workings.

There are no mineplans of any past shallow mining activity in the Trencherbone Mine under the site because any workings will have pre-dated the Mines Act of 1887, but there are detailed abandonment plans of workings in this seam dating from 1908 of Radcliffe Moor Colliery, 200m south-east of the proposed clubhouse. These workings were inspected and the plans annotated at the time by the Mines Inspector John Gerrard and show the strata to be heavily faulted, the workings towards outcrop terminating in 'bad coal' but with no evidence of older old workings although mining practice at this date could have involved in-seam drilling to probe ahead of proposed workings.

The Trencherbone Mine is a high quality seam, extensively mined throughout the coalfield and overlies the equally important Cannel Mine which will lie at a depth of over 30m here. The Cannel Mine was last mined from an adit and a 6m deep shaft by Bury Road Colliery, 1km east of the site from 1931 to 1949 but there are Cannel Mine workings under the site at depth from Red House Colliery dating from 1870 and accessed from shafts west of the site. The coal was totally extracted.

7 boreholes were drilled to up to 30m on the site last week in the location of the proposed clubhouse. Three holes were drilled to 30m depth and a further 4 shallow holes to prove rockhead depth and search for the outcrop of the Trencherbone Mine. The Cannel Rock was encountered in every hole and there was no evidence of any coal or old mine workings, therefore a Low Risk to the proposed development.

The Cannel Rock has a distinctive red colouration throughout the Manchester Coalfield and has a recorded thickness of up to 55m. A stiff grey glacial clay with a thickness varying from 7.2m to 9.4m overlies the red and orange sandstone rockhead.

The former well identified on the OS maps was targeted with TP1 – no evidence of the well / possible shaft. When the earthworks is undertaken in this area further inspection is required to prove absence.

Shaft 375408-006 is located 30m south-east of the proposed clubhouse. An overgrown colliery spoil heap with a central rubbish filled depression is visible here. The shaft is labelled as 'Pumping Pit' on the 1889 Ordnance Survey and is shown on the Cannel Mine workings plan of Red House Colliery as an isolated shaft east of their workings. The shaft was not investigated but Bhs 3 and 6 closest to the shaft show rockhead to lie at a depths of 8.5m to 9.4m. A 10m variance (accuracy of plotting) is allowed for the location of the shaft. This is a very conservative approach given that the shaft was clearly recorded on the OS historical plans so likely to be more accurate. It is noted that no variance has been given by the Coal Authority Shaft details.

A further 8m is added for cone of influence – depth to rockhead nearest the shaft is 8m – this is deemed conservative given the stiff clay geology encountered.

As such we do not feel it necessary to locate the shaft accurately with the above conservatism and no structures proposed in the zone of influence.

Whilst the risk of significant risk is deemed to be low, the parking bays in the zone of influence will have an open grid high strength geotextile placed beneath them to mitigate any catastrophic collapse (this has been agreed with the Coal Authority).

3 REMEDIAL ACTIONS

The following sections have been based on the investigation undertaken to date.

A phased approach of remediation is required across the site. The following is required in advance of earthworks on site to avoid spreading the contamination further.

1. Treatment of invasive species where/if required.
2. Removal of any geotechnically unsuitable material from beneath pitch and building/car park areas (if encountered).
3. Placement of cover system/growing medium to soft landscaped areas.
4. Placement of an open grid high strength geotextile at 10 – 18m away from recorded shaft to mitigate any ground movement in parking bays.
5. Erection of a post and wire fence at 10m all around the recorded shaft to prevent entry.
6. Remediation validation for sign-off.

3.1 Proposed Cover System

Due to the lack of contamination encountered from the site investigation works and sampling only a 300mm clean and inert growing medium has been recommended for installation with soft landscaped areas, depth validation of the cover system will be required.

150mm Topsoil
150mm Subsoil

The above is proposed to comply with NHBC Chapter 9 regulations regarding physical composition of cover (i.e. no coarse granular material within the first 300mm) and exceeds the minimum requirement of 100mm depth of topsoil – extract from Ch9 below:

'9.2 - S5 Garden areas shall be free from obstructions beneath the surface old foundations, concrete bases and similar obstructions occurring within 300mm of the finished ground surface should be removed.

9.2 - S6 Garden areas shall be adequately prepared for cultivation construction rubbish and debris should be removed from garden and other areas around the home. Garden areas should be provided with topsoil to a thickness of not less than 100mm. The topsoil should not contain contaminants which are likely to present a hazard to users of the garden area.'

The following guidance should also be referred to for details on additional thicknesses of growing mediums:

- BS3882 – Specification for Topsoil
- BS8601 – Specification for Subsoil.

The below plan shows where the 300mm growing medium is required in green polkadot hatch, it is anticipated that the construction layers of the playing pitches will likely be deeper;



3.2 Site Won Soils/Imported Soils

Site won soils suitable for reuse onsite are anticipated from the wider site therefore imported soils for use in gardens and soft landscaping is not anticipated. Imported soils maybe required to make up any short fall of material.

Imported soil from off site being brought to site should be tested for contamination to ensure it is suitable for the proposed use, and it is generally advisable to test a minimum of three samples per source, and to be in line the Local Authority's testing specification. The below testing frequencies are provided as a guide and should be confirmed with the local authority for approval prior to testing.

Intended End Use	Source / Origin of Material		
	Greenfield	Remediated	Brownfield / Unknown
Gardens	1:150m ³	1:100m ³	1:50m ³

Soft Landscaping	1:200m ³	1:150m ³	1:150m ³
Other	1:200m ³	1:200m ³	1:200m ³

Chemical analysis should be assessed using a desk study/details of historic use of the site where the imported soil originated. Chemical analysis is likely to include (but is not limited to); CLEA Metals (Arsenic, cadmium, chromium (Vi), lead, mercury, selenium, copper, nickel and zinc), pH values, Sulphate - soluble 2:1 extract, speciated polycyclic aromatic hydrocarbons (PAH), extractable petroleum hydrocarbons (EPH), TPH CWG, Asbestos screening and Organic matter and screened against S4ULs GAC.

This work may be undertaken as part of the contract for the preparatory & remedial works, in which case imported soils should be stockpiled in a location agreed with the Engineer. Alternatively, the Developer may choose to import soil at a later stage in the development.

A materials management plan is expected to be required.

3.3 Controlled Waters/Groundwaters

No significant contamination sources have been identified within the soils onsite and given the general presence of site-wide low permeability soils, the risk to groundwaters and the aquifer from site is considered very low.

Should any visual or olfactory evidence of contamination be encountered during site preparation works in either groundwater or surface waters during the site enablement works, the area will be investigated further by a Geo Environmental engineer and sampled as necessary. The Contaminated Land Officer at the Local Authority will also be notified if the material is deemed to represent a risk to environmental receptors or public health. Samples will be forwarded to a UKAS accredited laboratory for a suite of analytical testing deemed appropriate based upon a visual and olfactory appraisal of the material identified.

Once the results of any analysis are known, the required remedial action (if any) will be determined.

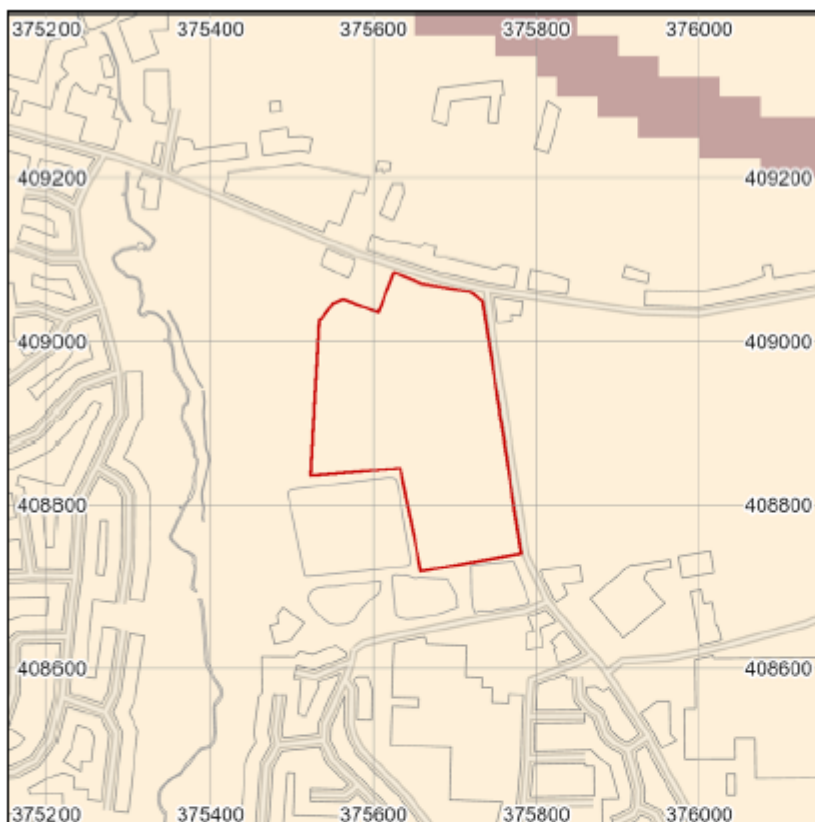
3.4 Gas Protection Measures

Radon

The site lies within a low-risk area of radon where less than 1% of homes are estimated to be above the action level however this guidance was updated by UKHSA in December 2022 and the site now lies within an area where 3-5% of homes are estimated to be above the action level therefore **basic radon protection measures are required for new dwellings or extensions.**

A site specific radon report was obtained for the site in June 2024 to confirm what Radon protection measures are required. **This report confirmed that no radon protection measures are required for the report area.** An extract of the report is provided below:

Radon Affected Area



% Homes estimated to be at or above the action level
0-1%
1-3%
3-5%
5-10%
10-30%
30-100%

Contains OS data © Crown Copyright and database right 2024

Scale: 1:10 000 (1cm = 100 m)

Search area indicated in red

Is the property in a radon Affected Area as defined by the UK Health Security Agency (UKHSA) and if so what percentage of homes are estimated to be at or above the Action Level? NO

Additional Information

THE PROPERTY IS IN AN AREA WHERE LESS THAN 1% OF HOMES ARE ESTIMATED TO BE AT OR ABOVE THE ACTION LEVEL. THE PROPERTY IS NOT IN A RADON AFFECTED AREA.

Ground Gas

Site Area	Site Classification	Recommended Ground Gas Protection Measures
Whole Site	CS1	No specialist ground gas protection measures required.

3.5 Construction / Maintenance Workers

In order to reduce potential risks associated with the determinants encountered on site, the following recommendations should be adhered to during site works:

- Any proposed imported soils should be tested for contamination to ensure that they are suitable for the proposed end use as per Section 3.3.
- Site workers should wear gloves, boots and overalls and wash their hands before eating, drinking and smoking. Excessive dust generation should be avoided. The site manager will inspect the risk assessments of the contractors on site/inspect on a regular basis to make sure this is upheld as per HSE / CDM guidance.
- Asbestos was not encountered on site during the site investigation sampling however vigilance should be adhered to. If any suspected asbestos containing material is encountered, a suitably qualified person should be notified and undertake appropriate sampling.
- It is recommended that during all excavations adequate ventilation should be maintained. If man entry is required, gas monitoring should be carried out as a precaution.
- Given the existence of Made Ground on the site it would be prudent to maintain vigilance during site clearance and construction, in case any areas of suspected contamination are encountered.
- If areas of suspected contamination are found then a suitably qualified person should undertake appropriate sampling, testing and further risk assessment.

3.6 Drinking Water Supplies

Pipeline risk assessment is unlikely to be required, however this maybe needed to confirm for regulatory approval.

3.7 Review of Conceptual Site Model

Target (Receptor)	Potential Source-Pathway Linkage	Remedial Action Required (where appropriate)	Est. Degree of Risk to Target Following Remedial Action Where Necessary
Site End Users	Inhalation of soil gases, odours or dust.	Site specific report confirmed no radon protection required. No specialist ground gas protection measures required.	Low
Site End Users	Ingestion of, and skin contact with, contaminated soil.	300mm growing medium to soft landscaped areas.	Low
Site End Users	Ingestion of contaminants in vegetables etc. or in soils adhering to vegetables, etc	300mm growing medium to soft landscaped areas.	Low
Construction/ Maintenance Workers	Inhalation of soil gases, odours or dust.	PPE	Low (assumed basic PPE is used)
Construction/ Maintenance Workers	Ingestion of, and skin contact with, contaminated soil	PPE	Low (assumed basic PPE is used)
Plants	Adverse effects on growth caused by presence of contaminants in soil	300mm growing medium to soft landscaped areas.	Low

Buildings and Structures	Flow of ground gas into buildings. Asphyxiation, toxicity, explosion and fire hazards	Site specific report confirmed no radon protection required. No specialist ground gas protection measures required.	Low
Foundations	Sulphate attack of foundations	Foundations to be designed as per section 16.4 of the Betts Geo Ground Investigation Report.	Low
Water Supplies	Hydrocarbons penetrating plastic water supply pipes.	Barrier pipe unlikely to be required however assessment may be needed to regulatory approval.	Low
Groundwater	Migration of soluble contaminants into groundwater on or off site	No contamination encountered onsite, no remedial measures required.	Low
Surface Water	Migration of soluble contaminants and/or direct run-off of contaminants	No remedial measures required.	Low

4 SITE PREPARATION AND ENABLING WORKS

5.1 Site Set-up, Organisation and Safety

Site works will be supervised during any delineation and removal of contaminated materials by a suitably qualified Engineer, who will report to the Project Manager.

It is understood that the Earthworks to be undertaken for pitch construction will be undertaken by a specialist earthworks contractor and specification / verification for geotechnical qualities is outside of the scope of this report and will be provided separately by a third party.

Site cabins and welfare facilities are to be established at a location to be agreed with the Engineer. All welfare facilities must be established in accordance with the relevant health & safety statutory requirements. Provision shall be provided on site for car parking for all site employees.

All site personnel will undergo a site-specific health and safety induction prior to commencement of work on site.

The Engineer will be informed prior to any proposed entry of a confined space or deep excavation. Entry must be restricted to suitably qualified and equipped personnel.

Works will be carried out with proper regard to current statutory requirements.

During the remediation works, all personnel on site will comply with guidance provided 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 shall be provided:

- Protective clothing, footwear and gloves (Personnel should be instructed in why and how they are to be used).
- Hand-washing and boot-washing facilities.
- Smoking shall be limited to designated areas.

If at any time during the works, personnel begin to feel unwell, they are to inform the Engineer or Site Manager, who will determine appropriate action.

All visitors to site must enter and register at the main Site Office.

4.1.1 Responsibilities

Prior to the commencement of any works, in agreement with the Engineer, The Client will:

- Establish the boundaries of the site and the working areas.
- Undertake a dilapidation survey of site boundaries, adjacent properties and highways, via dated photographs or video footage.
- Liaise with the Local Authority regarding working hours, noise\dust\odour control, and protected trees.
- Liaise with the Local Water Company regarding any proposed discharge to sewer.
- Complete a full services search and liaise with all relevant utility companies regarding work in close proximity to their apparatus.
- Inform the Engineer of any risk, identified and assessed, which could impact upon the Engineer's activities.

- Prepare the necessary COSHH statements and Health & Safety Plan in accordance with CDM regulations.

The contractor will ensure that:

- Secure the full site boundary (if necessary, provide and erect herras-type fence to protect members of the public from the works).
- Personnel, plant, materials and other equipment related to the contract are confined within the boundaries of the site.
- Any live services lying within the site boundary are marked and protected, or appropriate arrangements made to truncate them.
- Good practices relating to personal hygiene are adopted.
- Suitable precautions are implemented at all times to prevent off-site migration of pollutants via airborne dust and vapours.
- Suitable precautions are taken to prevent the spread of mud and debris on public highways.
- Refuelling of mobile plant is undertaken in a designated area. Above ground oil storage tanks shall comply with the requirements of Pollution Prevention Guideline PPG2. A spill kit shall be kept on site, adjacent to the designated refuelling area.

4.1.2 Engineering Supervision and Validation

The responsibilities of the Engineer shall include, but not be limited to, the following:

- Ensuring that all site personnel are suitably qualified and given an appropriate induction at the beginning of their first day.
- Supervision of the remedial and ground preparatory works by a competent and independent consultancy.
- Advice on the correct handling of materials and conditions encountered.
- Guidance on the appropriate protective clothing and safety equipment that is to be made available and used.
- Ensuring that personal hygiene arrangements are adequate.
- Retrieval of soil and water samples and the subsequent scheduling of appropriate laboratory analysis to enable validation of various aspects of the works, and to advise the Project Manager of progress.
- Liaison with statutory authorities as required.

The Engineer will maintain records of the works to include the following:

- Daily record sheets to include a summary of the day's activities.
- Date and weather conditions.
- Plant, personnel and visitors present.
- Aspects relating to Health and Safety, Environmental Control, or non-compliance with this RS.
- Site surveys as necessary to record the locations of demolition, excavation and filling activity.
- Test results.

On satisfactory completion of all the works the Engineer will prepare a Validation Report. Copies of the Validation Report will be issued to the Client and the Local Authority.

The Validation Report will stand as certification that the ground preparatory works (and remediation works if appropriate) have been carried out in accordance with this Remediation Strategy.

The **Validation Report** will include:

- A summary of the preparatory & remedial works undertaken, including any works associated with unforeseen ground conditions.
- Geotechnical test results associated with ground improvement or re-engineering beneath proposed highways and buildings.
- Copies of any correspondence with Regulators relating to specific aspects of the remedial works.
- Waste transfer notes are to be provided as part of the validation report to show an audit trail of where soil has been deposited.

For reasons of practicality, detailed daily records prepared by the Engineer during the works will not be appended to the Validation Report, but copies can be viewed at Betts offices if required.

The above recommendations will take account of the actual remedial works undertaken and may differ significantly from recommendations originally presented in the site investigation report and remedial strategy.

4.2 Site Clearance

Some limited site clearance maybe required along boundaries. Any trees, bushes and shrubs that are required to be removed as part of the redevelopment of the site will be undertaken.

4.3 Excavation of Hardstanding and Foundations

Any foundations/obstructions will be broken out. Where obstructions exist, they will be chased to full depth where possible. If this proves not possible in agreement with the engineer the location will be surveyed in by the contractor as part of the built plan.

Foundation arisings will need to be carefully managed to not contaminate natural soils with the overlying made ground, arisings should be segregated as they are dug out of foundation trenches/roadways etc. Arisings are physically different and as such should be able to be segregated accordingly. Subsoils will be physically assessed upon placement within landscaped/garden areas, should any suspected made ground be encountered within the subsoil material placed then additional chemical validation will be required to confirm the suitability of the material placed.

A Materials Management Plan is to be put in place by both the contractor and developer to ensure soils are not deemed as waste / landfill and subject to HMRC taxes or fines.

4.4 Excavation of Footings

Heavy plant is generally operated between the hours of 8:00am and 6:00pm Monday to Friday, 8:00am and 1:00 pm Saturday, depending on light levels.

Noise levels will generally be less than the 80 – 85 dB range, with occasional breaches in excess of 85 db. Periods of noise generation in excess of 85 dB are anticipated as being during the initial enabling works and slab removal stage and thereafter for short periods. All construction plant will be selected from well maintained and silenced stock.

Site vigilance for unforeseen hotspots will be undertaken with the method of dealing with unforeseen briefed to site management.

4.5 Arisings

Site space is unlikely to be limited, however wherever possible, retention of arisings for reuse on site will be made. Foundation arisings of natural strata may be deemed chemically suitable for clean cover system and may be feasible to use in the lower capping layers. Chemical testing will be required.

Any material that is deemed to be unsuitable for re-use will be removed from the site to licensed landfill.

4.6 Dust, Vapour & Odour Control

The control of dust vapour and odour should be controlled as per the CEMP.

4.7 Export to Landfill

Any material exported from site to landfill will be hauled by a registered waste carrier in accordance with the requirements of the Duty of Care Regulations, 1991 and the Landfill (England & Wales) Regulations 2002.

A transfer note shall be completed, signed and retained by the parties involved. The transfer note shall include the volume of waste, the nature of the material and a statement of its chemical composition, details of the source and destination sites, and details of the haulier.

In order to protect the general public from dust, wagons that are to be used for the haulage of the contaminated material from the site will be sheeted. In addition, the Contractor must ensure that no fluids seep from the wagons.

In order to provide the landfill facility with information regarding chemical composition of the waste, analysis results from the ground investigation and the desk study will be supplied to the site prior to removal for classification.

As of 16th July 2005 the Waste Acceptance Criteria of the Landfill Regulations 2002 were fully implemented, which will result in the enforcement of a more stringent approach to waste assessment and its disposal to landfill.

All hazardous waste going for disposal at landfills must be classified according to the new European Waste Catalogue (EWC).

Contaminated soils are “Mirror entries” in the EWC. Waste contaminated soils may be classified as either *hazardous* or non-hazardous depending on the concentrations of “dangerous substances” in the waste soil. An assessment of the composition of the waste soil will therefore be undertaken to determine if it is hazardous waste.

The WAC set threshold concentrations for leachable components of the waste stream and landfill operators will have waste acceptance procedures in place to ensure that only compliant waste is landfilled. Most waste will need to be treated before it can be landfilled to reduce its quantity and the hazard it presents. Leaching compliance testing will be required in accordance with BS EN 12457-3:2002.

In addition, the site will be operating under a Site Waste Management Plan recording both import and export of materials.

4.8 Backfill of Excavations

Excavations (to remove relict structures, contamination etc) are to be “surveyed in” and backfilled as necessary to achieve the desired levels, with suitable materials and subjected to compaction specification, to be agreed with the Engineer.

However, where an excavation conflicts with the footprint of a proposed adopted highway, compaction in accordance with the Specification for Highway Works Table 6/1 will be undertaken.

4.9 Boundary Issues

The Client’s Designer should ensure that proposed levels tie in with the surrounding infrastructure, and ground levels of adjacent properties.

4.10 Highways

The contractor will agree acceptable performance criteria, and an appropriate Specification for any necessary ground improvement, with the Client and the adopting authority where necessary.

The Contractor will arrange for the necessary compliance testing to be undertaken at formation level on road alignments, as required by the adopting authority and Engineer.

4.11 Protection of Buried Concrete

The Betts Geo site investigation report recommends that concrete classification will be DS-1, AC-1, DC-1 across site.

4.12 Contingency for Unknown

Should any suspicious material be encountered during the site enablement/remediation works, the area will be investigated further by a Betts Geo Environmental engineer and sampled as necessary. The Contaminated Land Officer at the Local Authority will also be notified if the material is deemed to represent a risk to environmental receptors or public health. Samples will be forwarded to a UKAS accredited laboratory for a suite of analytical testing deemed appropriate based upon a visual and olfactory appraisal of the material identified.

Once the results of any analysis are known, the required remedial action (if any) will be determined.

4.13 Site Certification

Once the remediation works have been undertaken, a 'completion' report will be prepared. This will comprise relevant site records and stand as certification that the appropriate remediation works have been carried out in accordance with the agreed redevelopment strategy. Reports will be submitted to the Local Authority for their approval, thereby enabling the release of the site for subsequent development.

Notes on Limitations

This report does not consider ecological impacts (e.g. bats) or botanical risks (e.g. Japanese knotweed). It is recommended that these are considered as part of the assessment of development constraints for the site.

The assessment and judgements given in this report are directed by both the finite data on which they are based and the proposed works to which they are addressed. The data essentially comprised a study of available documented information from various sources (including Client Furnished reports) together with discussions with relevant authorities and other interested parties. There may also be circumstances at the site that are not documented. The information reviewed is not exhaustive and has been accepted in good faith as providing representative and true data pertaining to site conditions. If additional information becomes available which might impact our environmental conclusions, we request the opportunity to review the information, reassess the potential concerns and modify our opinion if warranted.

It should be noted that any risks identified in this report are perceived risks based on the available information. Actual risks can only be assessed following a physical investigation of the site.

The site investigation has been carried out to provide information concerning the type and degree of contamination, and ground and groundwater conditions to allow a reasonable risk assessment to be made. Betts Geo Environmental Ltd undertake to exercise all reasonable skill, care and due diligence in the exercise of the investigation with respect to sampling techniques, sample storage and report interpretation.

The assessments and judgement given in this report are directed by both the finite data on which they are based and the proposed works to which they are addressed. Data acquisition is subject to the limitations of the methods of investigation used. Exploratory holes undertaken during fieldwork investigate small a small volume of ground in relation to the size of the site and as such can only provide an indication of site conditions. There may be conditions pertaining to the site and the proposed development i.e. localised "hotspots" of contamination, which have not been disclosed by the investigations.

The findings and opinions are relevant to the dates of our site works and should not be relied upon to represent conditions at substantially later dates. Conditions at the site will change over time due to natural variations and anthropogenic activities. Groundwater, surface water and soil gas conditions should be anticipated to change with diurnal, seasonal and meteorological variations.

The opinions expressed in this report regarding any contamination are based on simple statistical analysis and comparison with available guidance values. No liability can be accepted for the retrospective effects of any changes or amendments to these values.

This report was prepared by Betts Geo Environmental Ltd for the sole and exclusive use of the client. In response to particular instructions, any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

(i)

This document has been prepared for the titled project only and should any third party wish to use or rely upon the contents of the report, written approval from Betts Geo Environmental Ltd must be sought.

Betts Geo Environmental Ltd accepts no responsibility or liability

- a) for the consequences of this document being used for the purpose other than that for which it was commissioned
- b) and for this document to any other party other than the person by whom it was commissioned.

APPENDIX A

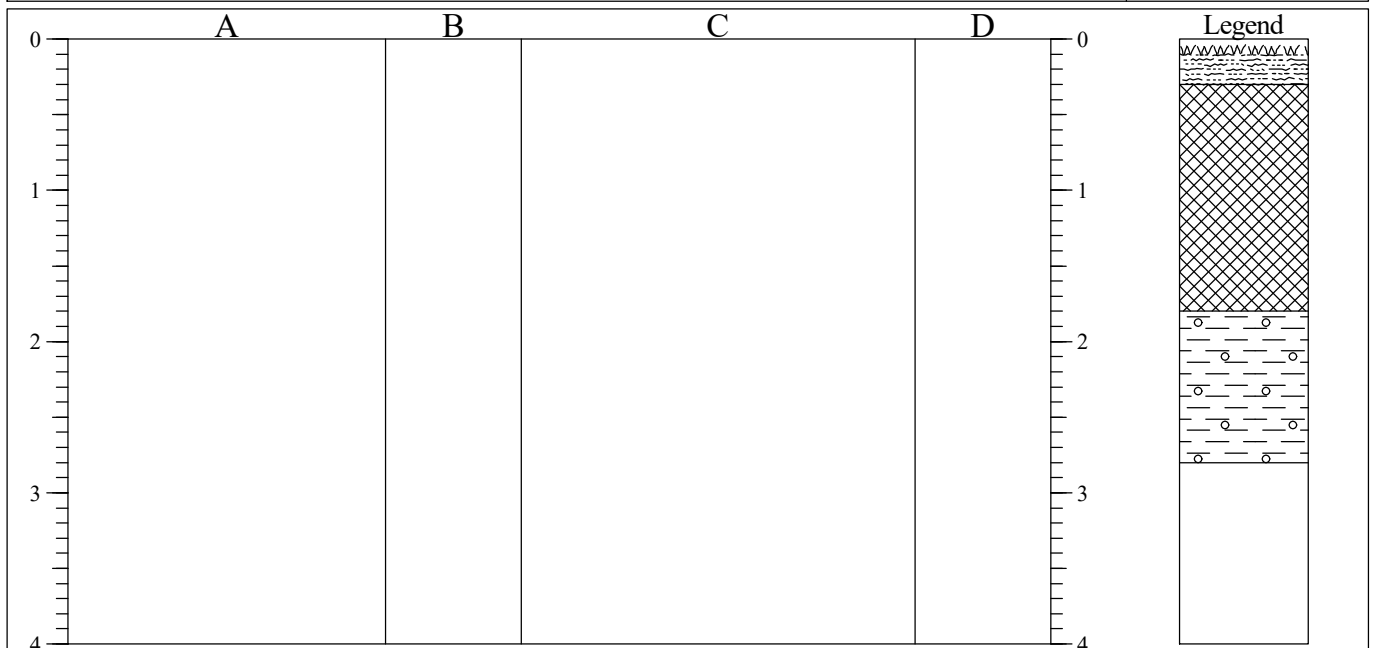
- (i) Betts Exploratory Hole Location Plan

APPENDIX B

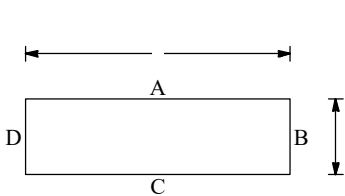
- (i) Betts Exploratory Hole Logs
- (ii) Gas Monitoring Data

TRIAL PIT LOG

Project Land at Radcliffe Moor Road				TRIAL PIT No TP01
Job No 20WCH011	Date 06-04-21 06-04-21	Ground Level (m)	Co-Ordinates ()	
Contractor				Sheet 1 of 1



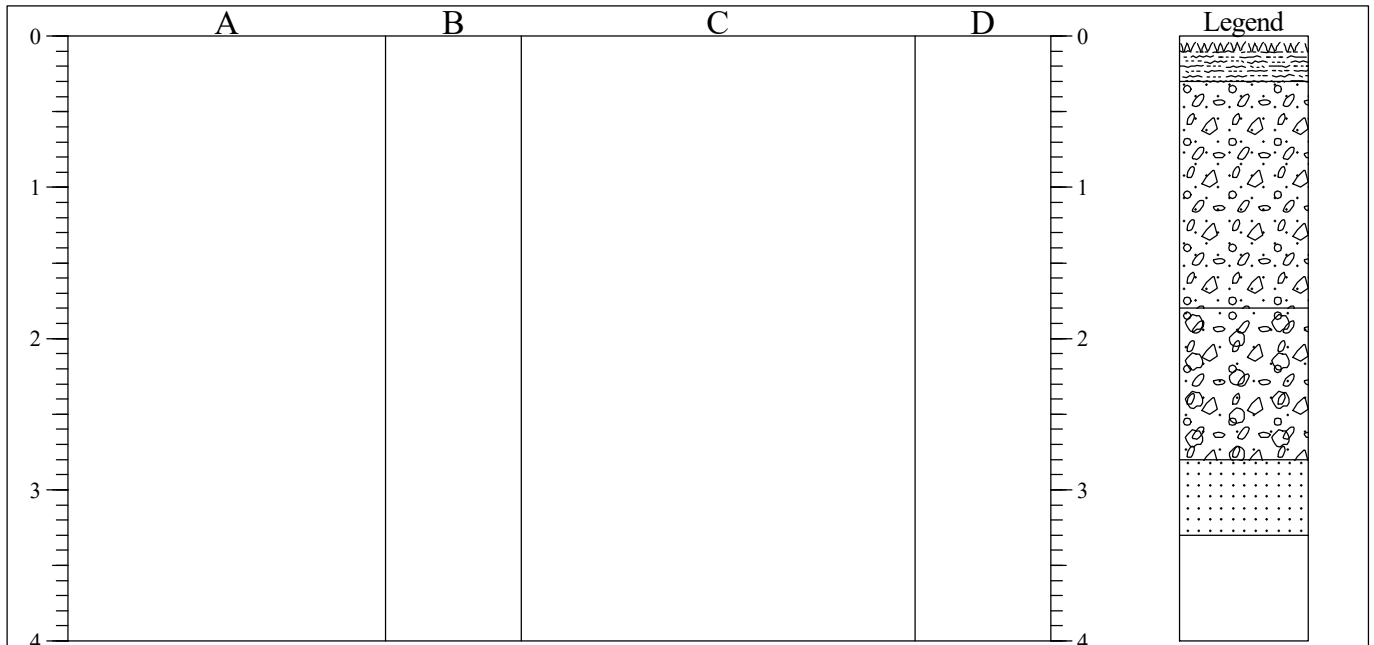
STRATA				SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests	
0.00-0.30		TOPSOIL: Brown sandy clay				
0.30-1.80		MADE GROUND: Cobbles with sand and gravel and occasional pockets of clay				
1.80-2.80		Stiff cobbly gravelly CLAY				

Shoring/Support: Stability: 	GENERAL REMARKS
	Stable. Slight seepage at 1.8 m bgl.

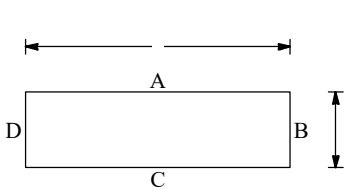
All dimensions in metres Scale 1:50	Client Westchurch Homes	Method/ Plant Used 13t tracked excavator	Logged By
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TRIAL PIT LOG

Project Land at Radcliffe Moor Road				TRIAL PIT No TP02
Job No 20WCH011	Date 06-04-21 06-04-21	Ground Level (m)	Co-Ordinates ()	
Contractor				Sheet 1 of 1



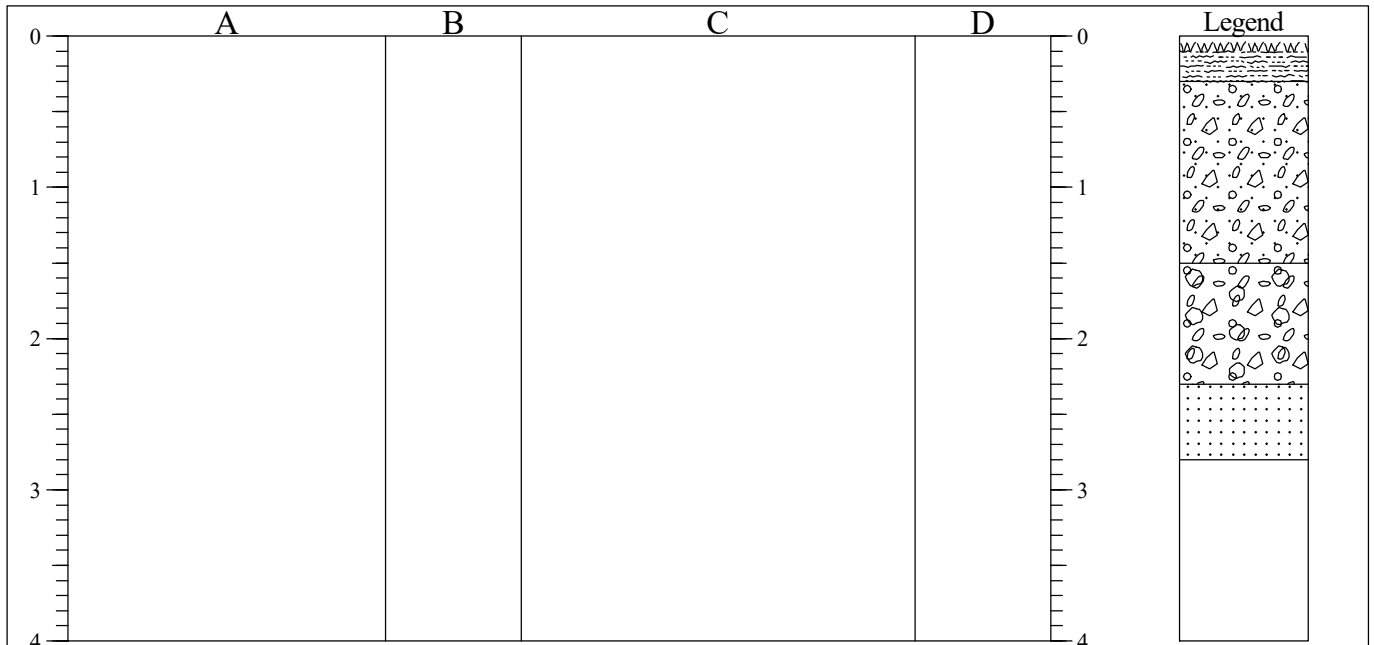
STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.30		TOPSOIL: Brown sandy clay			
0.30-1.80		Slightly clayey, silty SAND & GRAVEL with occasional cobble			
1.80-2.80		Cobbly sandy GRAVEL with occasional clay pockets			
2.80-3.30		Weathered sand/ siltstone recovered as plates (cobble size)			

Shoring/Support: Stability: 	GENERAL REMARKS Stable. Dry. Difficult to dig at 2.8 m bgl.
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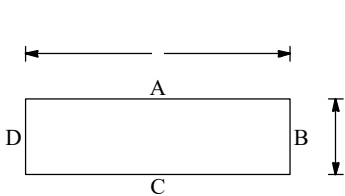
All dimensions in metres Scale 1:50	Client Westchurch Homes	Method/ Plant Used 13t tracked excavator	Logged By
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TRIAL PIT LOG

Project Land at Radcliffe Moor Road				TRIAL PIT No TP03
Job No 20WCH011	Date 06-04-21 06-04-21	Ground Level (m)	Co-Ordinates ()	
Contractor				Sheet 1 of 1



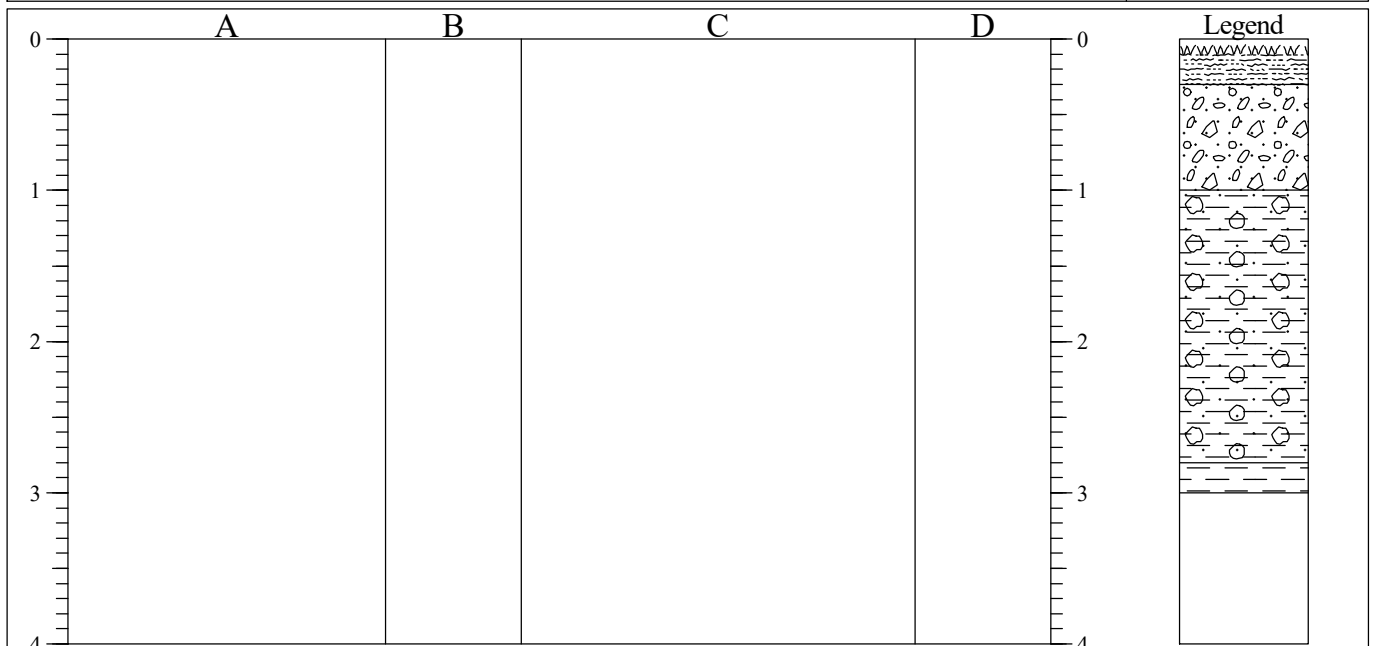
STRATA				SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests	
0.00-0.30		TOPSOIL: Brown sandy clay				
0.30-1.50		Slightly clayey silty SAND & GRAVEL with occasional cobbles.				
1.50-2.30		Cobbly sandy GRAVEL with occasional silt				
2.30-2.80		Weathered sand/ siltstone recovered as plates (cobble size)				

Shoring/Support: Stability: 	GENERAL REMARKS
	Stable. Wet at 2.6 m bgl. Difficult to dig at 2.8 m bgl.

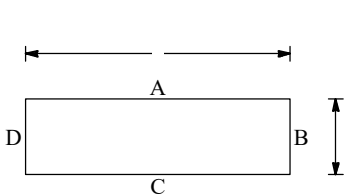
All dimensions in metres Scale 1:50	Client Westchurch Homes	Method/ Plant Used 13t tracked excavator	Logged By
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TRIAL PIT LOG

Project Land at Radcliffe Moor Road				TRIAL PIT No TP04
Job No 20WCH011	Date 06-04-21 06-04-21	Ground Level (m)	Co-Ordinates ()	
Contractor				Sheet 1 of 1



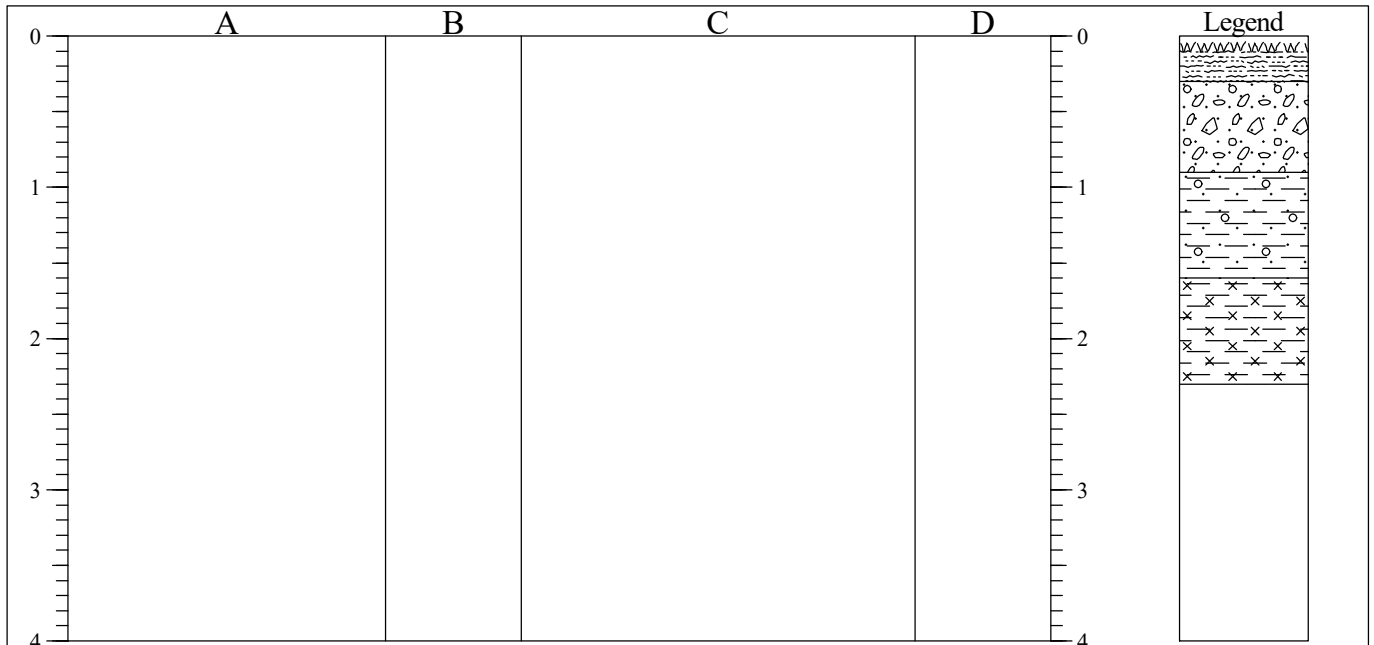
STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.30		TOPSOIL: Brown sandy clay			
0.30-1.00		Slightly clayey silty SAND & GRAVEL with occasional cobbles			
1.00-2.80		Stiff silty cobbly sandy gravelley CLAY			
2.80-3.00		Hard friable silty CLAY with rare specs of coal, possible decomposed mudstone			

Shoring/Support: Stability: 	GENERAL REMARKS Stable. Dry. Difficult to dig at 2.8 m bgl.
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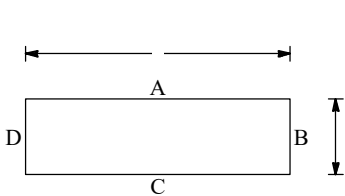
All dimensions in metres Scale 1:50	Client Westchurch Homes	Method/ Plant Used 13t tracked excavator	Logged By
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TRIAL PIT LOG

Project Land at Radcliffe Moor Road				TRIAL PIT No TP05
Job No 20WCH011	Date 06-04-21 06-04-21	Ground Level (m)	Co-Ordinates ()	
Contractor				Sheet 1 of 1



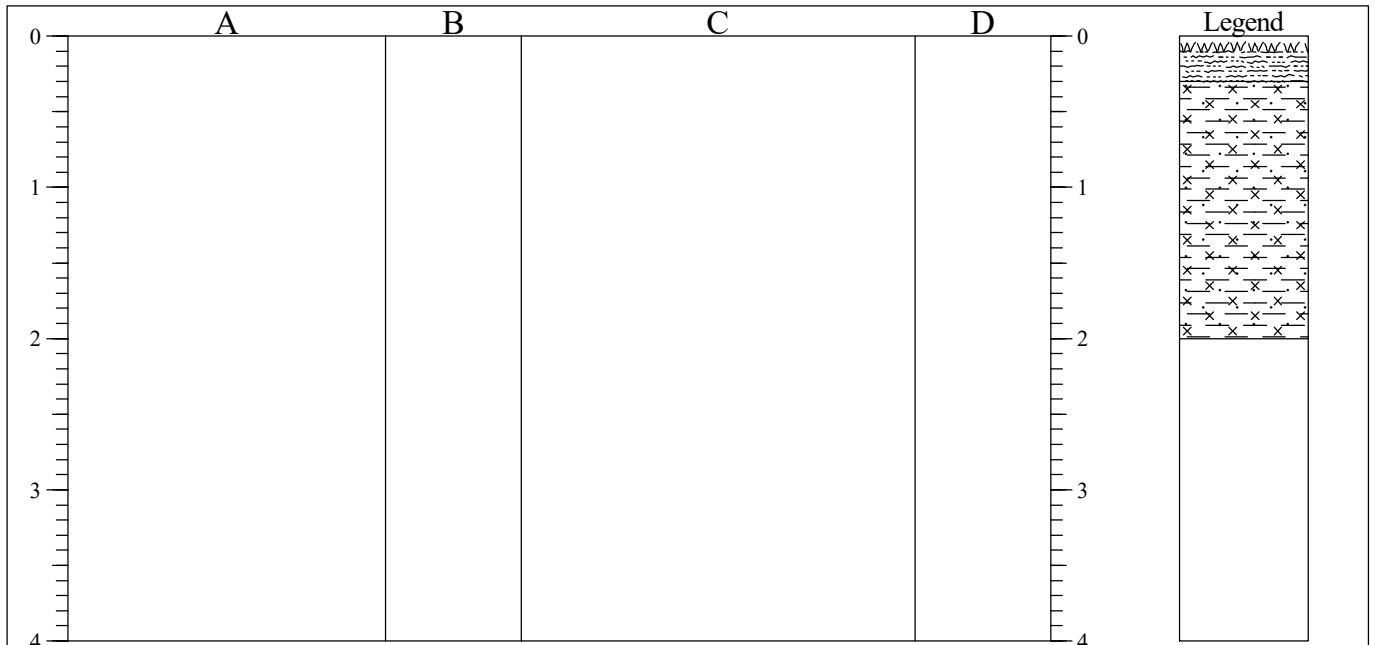
STRATA				SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests	
0.00-0.30		TOPSOIL: Brown sandy clay				
0.30-0.90		Silty SAND & GRAVEL with occasional cobbles				
0.90-1.60		Stiff silty cobbly gravelly sandy CLAY				
1.60-2.30		Hard friable silty CLAY with occasional coal (possible decomposed mudstone)				

Shoring/Support: Stability: 	GENERAL REMARKS
	Stable. Dry. Reeds at surface.

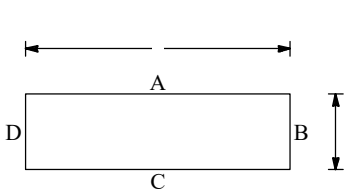
All dimensions in metres Scale 1:50	Client Westchurch Homes	Method/ Plant Used 13t tracked excavator	Logged By
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TRIAL PIT LOG

Project Land at Radcliffe Moor Road				TRIAL PIT No TP06
Job No 20WCH011	Date 06-04-21 06-04-21	Ground Level (m)	Co-Ordinates ()	
Contractor				Sheet 1 of 1



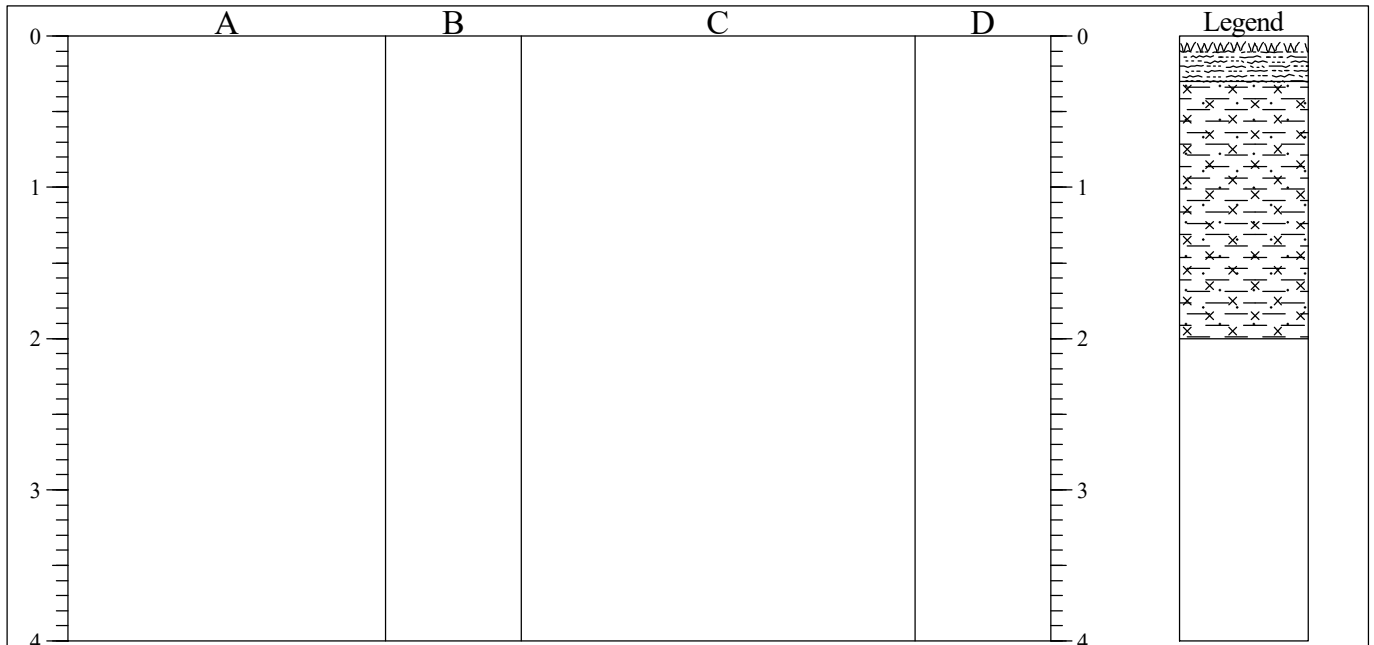
STRATA				SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests	
0.00-0.30		TOPSOIL: Brown sandy clay				
0.30-2.00		Firm to stiff grey and orange silty sandy CLAY				

Shoring/Support: Stability: 	GENERAL REMARKS Stable. Dry.
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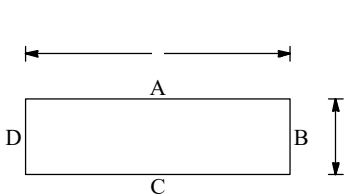
All dimensions in metres Scale 1:50	Client Westchurch Homes	Method/ Plant Used 13t tracked excavator	Logged By
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TRIAL PIT LOG

Project Land at Radcliffe Moor Road				TRIAL PIT No TP07
Job No 20WCH011	Date 06-04-21 06-04-21	Ground Level (m)	Co-Ordinates ()	
Contractor				Sheet 1 of 1



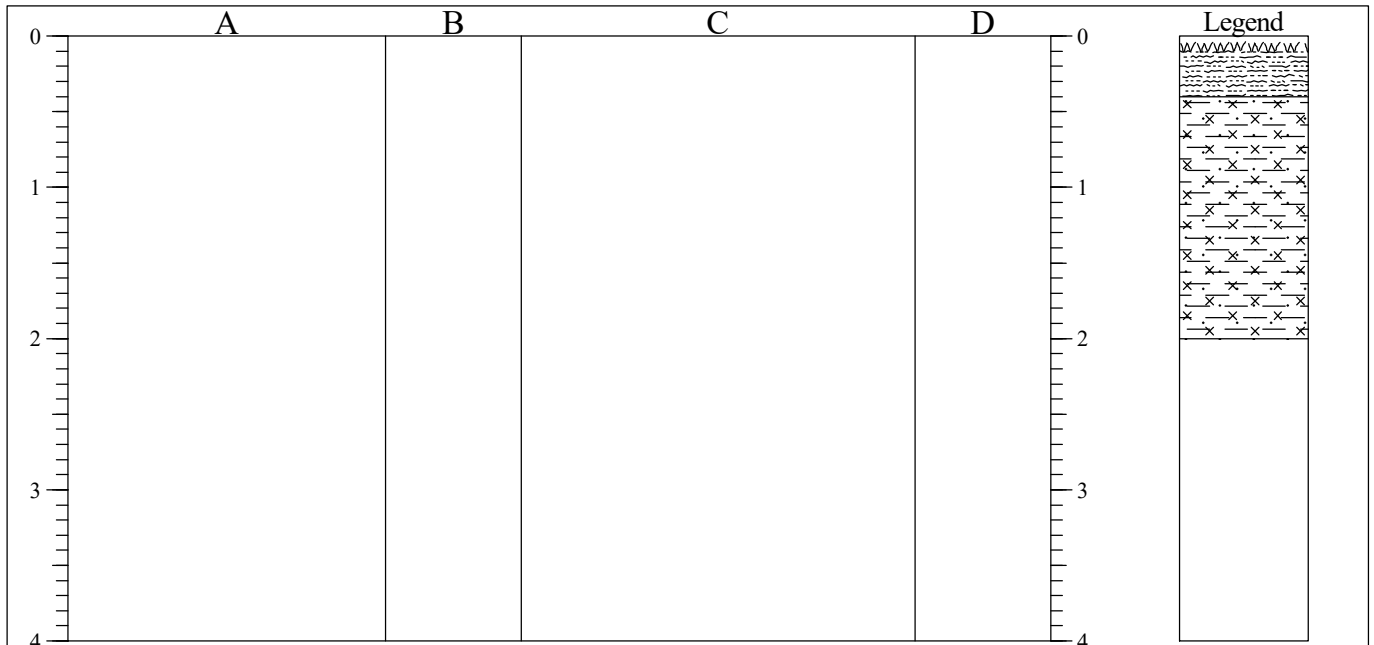
STRATA				SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests	
0.00-0.30		TOPSOIL: Brown sandy clay				
0.30-2.00		Firm to stiff grey and orange silty sandy CLAY				

Shoring/Support: Stability: 	GENERAL REMARKS Stable. Dry. Reeds at surface.
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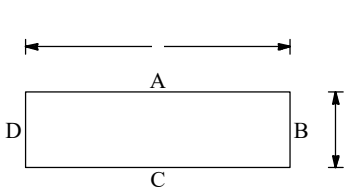
All dimensions in metres Scale 1:50	Client Westchurch Homes	Method/ Plant Used 13t tracked excavator	Logged By
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TRIAL PIT LOG

Project Land at Radcliffe Moor Road				TRIAL PIT No TP08
Job No 20WCH011	Date 06-04-21 06-04-21	Ground Level (m)	Co-Ordinates ()	
Contractor				Sheet 1 of 1



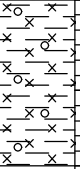
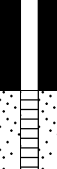
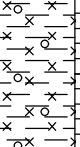
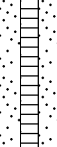
STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	No	Remarks/Tests
0.00-0.40		TOPSOIL: Brown sandy clay			
0.40-2.00		Firm grey and orange silty sandy CLAY with occasional sand partings			

Shoring/Support: Stability: 	GENERAL REMARKS Stable. Damp.
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All dimensions in metres Scale 1:50	Client Westchurch Homes	Method/ Plant Used 13t tracked excavator	Logged By
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BOREHOLE LOG

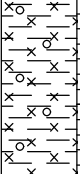
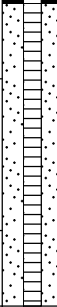
Project Land at Radcliffe Moor Road				BOREHOLE No WS1	
Job No 20WCH011	Date 18-05-21 18-05-21	Ground Level (m)	Co-Ordinates ()		
Contractor				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.30	ES1	N16				(0.40) 0.40	TOPSOIL: Brown sandy CLAY		
1.00 1.00	ES2					(1.10) 1.50	Firm greyish orange silty CLAY with occasional fine gravel of coal		
2.00	CBR1	N31				(1.00) 2.50	Firm to stiff greyish orange silty CLAY with occasional fine gravel of coal		
2.50		N12				(0.50) 3.00	Stiff dark grey silty CLAY with occasional fine gravel		
3.00									

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
											Wet from perched water at topsoil interface
All dimensions in metres Scale 1:50			Client Westchurch Homes			Method/ Plant Used Competitor Rig			Logged By		

BOREHOLE LOG

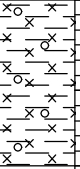
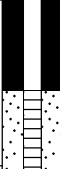
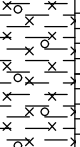
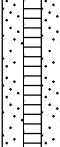
Project Land at Radcliffe Moor Road				BOREHOLE No WS2	
Job No 20WCH011	Date 18-05-21 18-05-21	Ground Level (m)	Co-Ordinates ()		
Contractor				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.30	ES1	N15				0.30	TOPSOIL: Brown sandy CLAY		
1.00						(1.20)	Firm greyish orange silty CLAY with occasional fine gravel of coal		
1.50	ES2					1.50	Stiff greyish orange silty CLAY with occasional fine gravel of coal		
2.00		N27				(1.00)	Stiff dark grey silty CLAY with occasional fine gravel		
2.50	CBR1					2.50	Stiff dark grey silty CLAY with occasional fine gravel		
3.00		N13				(0.50) 3.00	Stiff dark grey silty CLAY with occasional fine gravel		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
											Wet from perched water at topsoil interface
All dimensions in metres Scale 1:50			Client Westchurch Homes			Method/ Plant Used Competitor Rig			Logged By		

BOREHOLE LOG

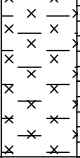
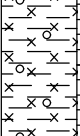
Project Land at Radcliffe Moor Road				BOREHOLE No WS3	
Job No 20WCH011	Date 18-05-21 18-05-21	Ground Level (m)	Co-Ordinates ()		
Contractor				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.30	ES1	N17				(0.40) 0.40	TOPSOIL: Brown sandy CLAY		
1.00 1.00	ES2					(1.10) 1.50	Firm greyish orange silty CLAY with occasional fine gravel of coal		
2.00	CBR1	N24				(1.00) 2.50	Firm to stiff greyish orange silty CLAY with occasional fine gravel of coal		
2.50 3.00						(0.50) 3.00	Stiff dark grey silty CLAY with occasional fine gravel		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
											Wet from perched water at topsoil interface
All dimensions in metres Scale 1:50			Client Westchurch Homes			Method/ Plant Used Competitor Rig			Logged By		

BOREHOLE LOG

Project Land at Radcliffe Moor Road				BOREHOLE No WS4	
Job No 20WCH011	Date 18-05-21 18-05-21	Ground Level (m)	Co-Ordinates ()		
Contractor				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.30	ES1					(0.40) 0.40	TOPSOIL: Brown sandy CLAY		
1.00	ES2					(1.10) 1.50	Compact greyish orange clayey SILT with occasional fine gravel of coal		
2.50	CBR1					(1.00) 2.50	Firm to stiff greyish orange silty CLAY with occasional fine gravel of coal		
						(0.50) 3.00	Stiff to hard dark grey silty CLAY with occasional fine gravel		
	</								

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
											Wet from perched water at topsoil interface
All dimensions in metres Scale 1:50			Client Westchurch Homes			Method/ Plant Used Competitor Rig			Logged By		

ROTARY TEST DRILLING Marshes Farm, Coach Road, off Wigan Road, Hart Common, West Houghton, Bolton BL5 2BT Tel: 01942 - 810348 Fax: 01942 - 840543				Site Radcliffe Moor Road, Radcliffe				Job No. 25/23			
				Client Betts GEO				Borehole BH101			
				Date 08/11/23 - 09/11/23		O.D. Level		Page 1 of 1			

Day	Casing Depth	Strata Depth	Description of Strata	Leg- end	Inst.	Reduced Level	Flush Returns	Core Depths	TCR %	SCR %	RQD %
		G.L.	GRASS/TOPSOIL Over yellow/brown CLAYS, DRIFT (2.30)								
	3M	2.30	Clayey grey MUDSTONE/Very shaley CLAY (1.30)								
		3.60	Grey MUDSTONE (3.20)								
		6.80	Red SANDSTONE (3.30)								
		10.10	Brown SANDSTONE (1.90)								
		12.00	Red SANDSTONE & MUDSTONE, bands of red/brown MARL (4.50)				100%				
		16.50	Brown SANDSTONE & MUDSTONE, bands of red MARL (4.50)								
		21.00	As above with bands of very broken/ fissured SANDSTONE (5.50)				100%				
		26.50	Dark grey MUDSTONE (0.40)								
		26.90	Red MARL/SANDSTONE (0.10)								
		27.00	Dark grey MUDSTONE/Red MARL/MUDSTONE (3.00)								
		30.00	Base of Drillhole				100%				

Symbols

TCR - TOTAL ROCK RECOVERY

SCR - SOLID ROCK RECOVERY

RQD - ROCK QUALITY DESIGNATION

Drilling Methods

Water flush

Remarks

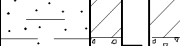
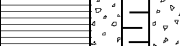
Set up water supply/pumping from angling club water

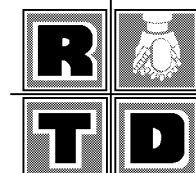
Very bad/slow moving

NOTE - Re-drilling from 21.0 - 30.0m bgl on 9/11/23 due to unstable rock/BH

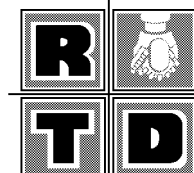
100% Flush

Gas = normal throughout

ROTARY TEST DRILLING Marshes Farm, Coach Road, off Wigan Road, Hart Common, West Houghton, Bolton BL5 2BT Tel: 01942 - 810348 Fax: 01942 - 840543				Site Radcliffe Moor Road, Radcliffe				Job No. 25/23			
				Client Betts GEO				Borehole			
				Date 09/11/23		O.D. Level		WS04 Page 1 of 1			
Day	Casing Depth	Strata Depth	Description of Strata	Leg- end	Inst.	Reduced Level	Flush Returns	Core Depths	TCR %	SCR %	RQD %
		G.L.	GRASS/TOPSOIL over yellow/brown CLAY/ DRIFT (2.70)								
		2.70 3.00	Very shaley grey CLAY/clayey MUDSTONE (0.30)								
			Grey MUDSTONE (2.00)								
		5.00	Base of Drillhole								
Symbols TCR - TOTAL ROCK RECOVERY SCR - SOLID ROCK RECOVERY RQD - ROCK QUALITY DESIGNATION											
Drilling Methods water flush											
Remarks Open hole rotary/water flush											

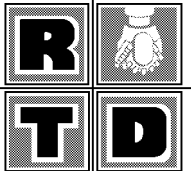


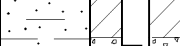
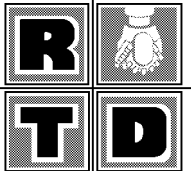
ROTARY TEST DRILLING Marshes Farm, Coach Road, off Wigan Road, Hart Common, West Houghton, Bolton BL5 2BT Tel: 01942 - 810348 Fax: 01942 - 840543				Site Radcliffe Moor Road, Radcliffe				Job No. 25/23			
				Client Betts GEO				Borehole			
				Date 09/11/23		O.D. Level		WS05 Page 1 of 1			
Day	Casing Depth	Strata Depth	Description of Strata	Leg- end	Inst.	Reduced Level	Flush Returns	Core Depths	TCR %	SCR %	RQD %
		G.L.	GRASS/TOPSOIL over yellow/brown CLAY/ DRIFT (2.60)								
		2.60	Grey shaley CLAY/clayey MUDSTONE								
		2.90	Grey MUDSTONE (2.10)								
		5.00	Base of Drillhole								
Symbols TCR - TOTAL ROCK RECOVERY SCR - SOLID ROCK RECOVERY RQD - ROCK QUALITY DESIGNATION											
Drilling Methods Water flush											
Remarks Site surface saturated											



ROTARY TEST DRILLING Marshes Farm, Coach Road, off Wigan Road, Hart Common, West Houghton, Bolton BL5 2BT Tel: 01942 - 810348 Fax: 01942 - 840543				Site Radcliffe Moor Road, Radcliffe				Job No. 25/23			
				ClientBetts GEO				Borehole WS06 Page 1 of 1			
				Date 13/11/23		O.D. Level					
Day	Casing Depth	Strata Depth	Description of Strata	Leg- end	Inst.	Reduced Level	Flush Returns	Core Depths	TCR %	SCR %	RQD %
		G.L.	GRASS/TOPSOIL over yellow CLAYS/DRIFT (3.60)								
		3.60	Grey clayey MUDSTONE (1.40)								
		5.00	Base of Drillhole								
Symbols TCR - TOTAL ROCK RECOVERY SCR - SOLID ROCK RECOVERY RQD - ROCK QUALITY DESIGNATION											
Drilling Methods Water flush											
Remarks											

ROTARY TEST DRILLING Marshes Farm, Coach Road, off Wigan Road, Hart Common, West Houghton, Bolton BL5 2BT Tel: 01942 - 810348 Fax: 01942 - 840543					Site Radcliffe Moor Road, Radcliffe			Job No. 25/23			
					Client Betts GEO			Borehole			
					Date 13/11/23		O.D. Level	WS07 Page 1 of 1			
Day	Casing Depth	Strata Depth	Description of Strata	Leg- end	Inst.	Reduced Level	Flush Returns	Core Depths	TCR %	SCR %	RQD %
		G.L.	GRASS/TOPSOIL over brown/grey CLAY (3.10)								
		3.10	Grey very clayey MUDSTONE (1.90)								
		5.00	Base of Drillhole								
Symbols TCR - TOTAL ROCK RECOVERY SCR - SOLID ROCK RECOVERY RQD - ROCK QUALITY DESIGNATION											
Drilling Methods water flush											
Remarks											

ROTARY TEST DRILLING Marshes Farm, Coach Road, off Wigan Road, Hart Common, West Houghton, Bolton BL5 2BT Tel: 01942 - 810348 Fax: 01942 - 840543				Site Radcliffe Moor Road, Radcliffe				Job No. 25/23			
				Client Betts GEO				Borehole			
				Date 13/11/23		O.D. Level		WS08 Page 1 of 1			
Day	Casing Depth	Strata Depth	Description of Strata	Legend	Inst.	Reduced Level	Flush Returns	Core Depths	TCR %	SCR %	RQD %
		G.L.	GRASS/TOPSOIL over brown CLAY/DRIFT (3.00)								
		3.00	Grey clayey MUDSTONE (2.00)								
		5.00	Base of Drillhole								
Symbols TCR - TOTAL ROCK RECOVERY SCR - SOLID ROCK RECOVERY RQD - ROCK QUALITY DESIGNATION											
Drilling Methods Water flush											
Remarks 											

ROTARY TEST DRILLING Marshes Farm, Coach Road, off Wigan Road, Hart Common, West Houghton, Bolton BL5 2BT Tel: 01942 - 810348 Fax: 01942 - 840543				Site Radcliffe Moor Road, Radcliffe				Job No. 25/23			
				Client Betts GEO				Borehole			
				Date 13/11/23		O.D. Level		WS09 Page 1 of 1			
Day	Casing Depth	Strata Depth	Description of Strata	Leg-end	Inst.	Reduced Level	Flush Returns	Core Depths	TCR %	SCR %	RQD %
		G.L.	GRASS/TOPSOIL over yellow CLAY/DRIFT (3.00)								
		3.00	Grey clayey MUDSTONE (2.00)								
		5.00	Base of Drillhole								
Symbols TCR - TOTAL ROCK RECOVERY SCR - SOLID ROCK RECOVERY RQD - ROCK QUALITY DESIGNATION											
Drilling Methods water flush											
Remarks 											

Date of Monitoring: 16/06/21



Relevant Information at the Time of Monitoring	
Monitored by:	TM
Weather:	Warm, sunny.
Equipment Used:	GA5000
	Solinst Mini Interface Meter
Visible signs of damage/stress:	N/A
Other Comments/Observations:	Pressure falling.

Date of Monitoring: 25/06/21

BETTS GEO
CONSULTING ENGINEERS

Relevant Information at the Time of Monitoring	
Monitored by:	tm/rd
Weather:	raining mild
Equipment Used:	GA5000
	Solinst Mini Interface Meter
Visible signs of damage/stress:	n/a
Other Comments/Observations:	

Date of Monitoring: 15/07/21

Relevant Information at the Time of Monitoring	
Monitored by:	Tommy
Weather:	warm and dry
Equipment Used:	GA5000
	Solinst Mini Interface Meter
Visible signs of damage/stress:	
Other Comments/Observations:	

Site: Radcliffe Moor Road
Job Number: 20wch011
Date of Monitoring: 11/08/2021



Ground Gas Monitoring Round 4

Borehole	Gas Flow (l/hr)	Atmospheric Pressure (mB)	Methane CH ₄ (%v/v)		Carbon Dioxide CO ₂ (% v/v)		Oxygen (%v/v)		Other Gases			Depth to Water	
			Peak	Steady	Peak	Steady	Min	Steady	PID	H ₂ S	CO	(mbgl)	BH depth
ws01	0	1004	0.2	0.1	0.1	0.1	19.5	21.3	-	-	1	0.50	2.85
ws02	0	1004	0.1	0.1	0.3	0.3	21.1	21.1	-	-	1	0.60	2.55
ws03	0	0.1	0.1	0.1	0.1	0.1	21.2	21.2	-	1	1	0.45	2.70

Notes:

Monitoring order is left to right across the table

Monitoring should be for not less than 3 minutes. However, if high concentrations of gases are initially recorded, monitoring should be for up to 10 minutes

Relevant Information at the Time of Monitoring	
Monitored by:	Tommy
Weather:	Warm and Dry
Equipment Used:	GA5000
	Solinst Mini Interface Meter
Visible signs of damage/stress:	
Other Comments/Observations:	

Site:Radcliffe Moor Bolton
Job Number: 20WCH011
Date of Monitoring: 09/09/2011



Ground Gas Monitoring Round 5

Borehole	Gas Flow (l/hr)	Atmospheric Pressure (mB)	Methane CH ₄ (%v/v)		Carbon Dioxide CO ₂ (% v/v)		Oxygen (%v/v)		Other Gases			Depth to Water	
			Peak	Steady	Peak	Steady	Min	Steady	PID	H ₂ S	CO	(mbgl)	BH depth
WS01	0	988	0.1	0.1	0.1	0.1	20.8	20.0	-	-	-	DRY	2.70
WS02	0	988	0	0	0.3	0.3	20.6	20.6	-	1	1	DRY	2.50
WS03	0	988	0	0	0.1	0.1	20.8	19	-	1	1	DRY	2.75

Notes:

Monitoring order is left to right across the table

Monitoring should be for not less than 3 minutes. However, if high concentrations of gases are initially recorded, monitoring should be for up to 10 minutes

Relevant Information at the Time of Monitoring	
Monitored by:	TOMMY
Weather:	DRY WARM
Equipment Used:	GA5000
	Solinst Mini Interface Meter
Visible signs of damage/stress:	
Other Comments/Observations:	

Date of Monitoring: 27/09/2021



Relevant Information at the Time of Monitoring	
Monitored by:	TOMMY
Weather:	MILD WET
Equipment Used:	GA5000
	Solinst Mini Interface Meter
Visible signs of damage/stress:	
Other Comments/Observations:	

Site: Radcliffe Moor Road
 Job Number: 20WCH011
 Date of Monitoring: 16/11/2023

Water Level Monitoring Round 1



Borehole	Gas Flow (l/hr)	Atmospheric Pressure (mB)	Methane CH ₄ (%v/v)		Carbon Dioxide CO ₂ (% v/v)		Oxygen (%v/v)		Other Gases			Depth to Water	
			Peak	Steady	Peak	Steady	Min	Steady	PID	H ₂ S	CO	(mbgl)	BH depth
WS01	-	-	-	-	-	-	-	-	-	-	-	0.15	2.82
WS02	-	-	-	-	-	-	-	-	-	-	-	0.42	2.81
WS03	-	-	-	-	-	-	-	-	-	-	-	0.08	2.90
WS04	-	-	-	-	-	-	-	-	-	-	-	0.71	4.82
WS05	-	-	-	-	-	-	-	-	-	-	-	0.35	4.86
WS06	-	-	-	-	-	-	-	-	-	-	-	0.15	4.82
WS07	-	-	-	-	-	-	-	-	-	-	-	0.14	4.83
WS08	-	-	-	-	-	-	-	-	-	-	-	0.17	4.85
WS09	-	-	-	-	-	-	-	-	-	-	-	0.11	4.81
BH101	-	-	-	-	-	-	-	-	-	-	-	12.51	29.44

Notes:
 Monitoring order is left to right across the table
 Monitoring should be for not less than 3 minutes. However, if high concentrations of gases are initially recorded, monitoring should be for up to 10 minutes

Relevant Information at the Time of Monitoring	
Monitored by:	GC
Weather:	Overcast, damp, cold, moderate breeze
Equipment Used:	GA5000
	Solinst Mini Interface Meter
Visible signs of damage/stress:	None
Other Comments/Observations:	None

Site: Radcliffe Moor Road
 Job Number: 20WCH011
 Date of Monitoring: 21/11/2023

Water Level Monitoring Round 2



Borehole	Gas Flow (l/hr)	Atmospheric Pressure (mB)	Methane CH ₄ (%v/v)		Carbon Dioxide CO ₂ (% v/v)		Oxygen (%v/v)		Other Gases			Depth to Water	
			Peak	Steady	Peak	Steady	Min	Steady	PID	H ₂ S	CO	(mbgl)	BH depth
WS01	-	-	-	-	-	-	-	-	-	-	-	0.11	2.79
WS02	-	-	-	-	-	-	-	-	-	-	-	0.27	2.84
WS03	-	-	-	-	-	-	-	-	-	-	-	0.09	2.88
WS04	-	-	-	-	-	-	-	-	-	-	-	0.61	4.84
WS05	-	-	-	-	-	-	-	-	-	-	-	0.22	4.83
WS06	-	-	-	-	-	-	-	-	-	-	-	0.08	4.85
WS07	-	-	-	-	-	-	-	-	-	-	-	0.11	4.81
WS08	-	-	-	-	-	-	-	-	-	-	-	0.14	4.87
WS09	-	-	-	-	-	-	-	-	-	-	-	0.07	4.82
BH101	-	-	-	-	-	-	-	-	-	-	-	10.08	29.51

Notes:
 Monitoring order is left to right across the table
 Monitoring should be for not less than 3 minutes. However, if high concentrations of gases are initially recorded, monitoring should be for up to 10 minutes

Relevant Information at the Time of Monitoring	
Monitored by:	GC
Weather:	Partial cloud, damp, cold, slight breeze
Equipment Used:	GA5000
	Solinst Mini Interface Meter
Visible signs of damage/stress:	None
Other Comments/Observations:	None

Site: Radcliffe Moor Road
 Job Number: 20WCH011
 Date of Monitoring: 30/11/2023

Water Level Monitoring Round 3



Borehole	Gas Flow (l/hr)	Atmospheric Pressure (mB)	Methane CH ₄ (%v/v)		Carbon Dioxide CO ₂ (% v/v)		Oxygen (%v/v)		Other Gases			Depth to Water	
			Peak	Steady	Peak	Steady	Min	Steady	PID	H ₂ S	CO	(mbgl)	BH depth
WS01	-	-	-	-	-	-	-	-	-	-	-	0.09	2.83
WS02	-	-	-	-	-	-	-	-	-	-	-	0.16	2.81
WS03	-	-	-	-	-	-	-	-	-	-	-	0.07	3.91
WS04	-	-	-	-	-	-	-	-	-	-	-	0.43	4.79
WS05	-	-	-	-	-	-	-	-	-	-	-	0.26	4.88
WS06	-	-	-	-	-	-	-	-	-	-	-	0.11	4.81
WS07	-	-	-	-	-	-	-	-	-	-	-	0.13	4.85
WS08	-	-	-	-	-	-	-	-	-	-	-	0.12	4.92
WS09	-	-	-	-	-	-	-	-	-	-	-	0.09	4.84
BH101	-	-	-	-	-	-	-	-	-	-	-	9.16	29.41

Notes:

Monitoring order is left to right across the table

Monitoring should be for not less than 3 minutes. However, if high concentrations of gases are initially recorded, monitoring should be for up to 10 minutes

Relevant Information at the Time of Monitoring	
Monitored by:	GC
Weather:	Sunny, damp, cold, slight breeze
Equipment Used:	GA5000
	Solinst Mini Interface Meter
Visible signs of damage/stress:	None
Other Comments/Observations:	None

Site: Radcliffe Moor Road
 Job Number: 20WCH011
 Date of Monitoring: 04/01/2024

Water Level Monitoring Round 4



Borehole	Gas Flow (l/hr)	Atmospheric Pressure (mB)	Methane CH ₄ (%v/v)		Carbon Dioxide CO ₂ (% v/v)		Oxygen (%v/v)		Other Gases			Depth to Water	
			Peak	Steady	Peak	Steady	Min	Steady	PID	H ₂ S	CO	(mbgl)	BH depth
WS01	-	-	-	-	-	-	-	-	-	-	-	0.00	2.79
WS02	-	-	-	-	-	-	-	-	-	-	-	0.27	2.72
WS03	-	-	-	-	-	-	-	-	-	-	-	0.00	2.84
WS04	-	-	-	-	-	-	-	-	-	-	-	0.58	4.73
WS05	-	-	-	-	-	-	-	-	-	-	-	0.22	4.79
WS06	-	-	-	-	-	-	-	-	-	-	-	0.00	4.71
WS07	-	-	-	-	-	-	-	-	-	-	-	0.06	4.80
WS08	-	-	-	-	-	-	-	-	-	-	-	0.09	4.77
WS09	-	-	-	-	-	-	-	-	-	-	-	0.00	4.75
BH101	-	-	-	-	-	-	-	-	-	-	-	11.86	29.24

Notes:
 Monitoring order is left to right across the table
 Monitoring should be for not less than 3 minutes. However, if high concentrations of gases are initially recorded, monitoring should be for up to 10 minutes

Relevant Information at the Time of Monitoring	
Monitored by:	GC
Weather:	Overcast, damp, cold, slight breeze
Equipment Used:	GA5000
	Solinst Mini Interface Meter
Visible signs of damage/stress:	None
Other Comments/Observations:	None