



Geoenvironmental Appraisal

Land off Ashbourne Drive, Cleckheaton For Newett Homes

Report no: 1462/4

Date: January 2024



SUMMARY OF GEOENVIRONMENTAL ISSUES

Job No.	1462	Site area/ha	2.4ha
Client:	Newett Homes	NGR:	SE 184 246
Site:	Ashbourne Drive, Cleckheaton	Nearest postcode:	BD19 5HZ

The site is located off Ashbourne Drive, Ashbourne Way and Ashbourne View approximately 0.75km southwest of Cleckheaton, and comprises agricultural fields sloping down to the north, with steep sloped of around 1 in 6 towards the southern boundary.

Blacup Colliery is known to have been present in the centre in the late 19th Century, with extensive industrial use of land immediately to the north of the site.

Lithos was commissioned by Newett Homes to provide a geoenvironmental appraisal of the site, which it is understood is to be redeveloped with domestic dwellings. Lithos' investigation included a review of the site's history and environmental setting. Ground investigations were carried out by Lithos in 2012 and 2020, comprising 18 trial pits, 19 rotary probeholes and 6 trial trenches.

A summary of salient geoenvironmental issues is provided in the table below.

Issue	Remarks
Made ground	Made Ground is restricted to the centre of the site in the area of a former colliery, and comprises Colliery Spoil with Ash & Clinker and Burnt Shale, recorded to depths of up to 3.4m. The made ground forms a relatively level 'bulge', deepening from south to north.
Natural ground	Residual soils, typically firm or stiff clays (completely weathered bedrock) which grade into Mudstone, Siltstone or Sandstone with depth. Competent bedrock was encountered from depths of 0.9m to 3.4m. No drift deposits were encountered.
Contamination	Topsoil and Made Ground Topsoil are considered suitable for re-use. The Colliery Spoil and the Ash & Clinker at the site are potentially combustible with elevated concentrations of inorganic contaminants identified in the Colliery Spoil.
Mining & quarrying	The centre and south are located within a Coal Mining Development High Risk Area, with former workings recorded in the Shertcliffe Coal which outcrops in the north and dips to the south. A shaft and adit have been identified in the centre of the site. Within the 13 holes which encountered the Shertcliffe coal, evidence of workings was noted in 8 (60%). Mineworkings in the Shertcliffe coal are present beneath the southern half of the site, but mitigation against the risk of subsidence (likely consolidation by drilling and grouting) will be required across about 25% of the site's total area. Three further seams outcrop at the site, but no evidence of workings was recorded in any of these seams.
Hazardous gas	Radon protection is not required, but the Developer might consider providing new dwellings with basic measures in light of UK Health Security Agency advice. The current gas regime has been characterised in accordance with the Situation A (Wilson & Card) methodology outlined in CIRIA Report C665 and BS8485:2015+A1:2019, which shows that CS2 protection measures will be required for all plots.
Preparatory works	Some site regrade with the need for underbuild and retaining walls anticipated due to topography (much of the site is steeply sloping, with gradients of up to 1 in 6). Grouting of shallow underground coal workings identified in the Shertcliffe seam. Treatment of the known mine entries with capping of former air shaft and excavation, backfilling and sealing of the adit. Separate stripping and stockpiling of made ground and existing Topsoil/Made Ground Topsoil. Isolation of made ground beneath hardstand or a minimum 1,000mm thick soil cover in garden and landscaped areas.
Foundations	Foundation depths will be influenced by regrade proposals. However, it is considered that the majority of new dwellings will be founded on strip footings from a minimum 900mm depth, founding in natural Residual Soils (gravelly clay) or bedrock. Additional reinforcement will be required where treated mine workings underlie plots at shallow depth. Where deep made ground is encountered trench fill or possibly piled foundations will be required. This will be dependent on final levels, as such foundations should be confirmed once finished levels are known. Piled foundations should be taken below the base of treated workings, as such pre boring will be required.

SUMMARY OF GEOENVIRONMENTAL ISSUES

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Site:	Ashbourne Drive, Cleckheaton	Nearest postcode:	BD19 5HZ

Issue	Remarks
Groundwater & excavations	No significant inflows of groundwater were encountered in any of the exploratory holes. However, the site surface was notably wet with extensive hillside run-off. Excavations for foundation and service trenches are likely to be stable in the short term. Excavations greater than around 1.5m to 2.5m depth are likely to encounter bedrock, as such, some breaking out may be required.
Flooding & drainage	The site lies in Flood Zone 1, where the risk of flooding from rivers is classified as low. Soakaways will not provide a suitable drainage solution for surface water run-off at the site; as such, surface water balancing will be required.
Highways	The shallow natural soils should provide a CBR value of at least 2%, with a CBR value of 3% achievable where made ground is re-engineered. CBR values should be confirmed prior to, or during, redevelopment of the site.

Significant earthworks are anticipated due to the existing topography. Consequently, some of the recommendations provided in this Report may need to be reviewed once regrade proposals and finished ground levels are known.

Significant developer abnormalities relating to geoenvironmental issues at the site are:

- Site regrade to provide suitable development platforms, with likely requirement for underbuild and retaining walls.
- Consolidation of shallow underground coal workings in the Shertcliffe seam.
- Capping of former air shaft.
- Excavation, backfilling and sealing of former adit.
- Reinforced foundations of plots overlying consolidated shallow mine workings.
- Possible piled foundations for plots overlying deep made ground, dependant on re-grade proposals and final site levels.
- Isolation of made ground beneath hardstand or a minimum 1,000mm thick soil cover in garden and landscaped areas.

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APPENDICES

Appendix A – General notes

01	Environmental setting
02	Ground investigation fieldwork
03	Geotechnical testing
04	Contamination laboratory analysis & interpretation
05	Hazardous gas

Appendix B – Drawings

Drawing	Revision	Title
1462/1	-	Site Location Plan
1462/2	-	Proposed Layout
1462/3	-	Site Features
1462/4	-	Site Photographs
1462/5	-	Published Coal Outcrops & Faulting
1462/6	-	Preliminary Conceptual Site Model
1462/7	-	Coal Authority Abandonment Plan
1462/8	-	Exploratory Hole Locations
1462/8a	-	Shaft & Adit Investigation with Photographs
1462/9	-	Cross Section
1462/10	-	Revised Conceptual Site Model
1462/11	-	Approximate Extent of Made Ground
1462/12	-	Approximate Extent of Area Requiring Drill & Grout

Appendix C – Commission

Appendix D – Historical OS plans[#]

Appendix E – Search responses[#]

From	Date	Content
Landmark	10 th January 2024	Environmental search data
Coal Authority	10 th January 2024	Mining report
Coal Authority	19 th November 2007	Coal abandonment plan
Coal Authority	10 th December 2020	Coal outcrop data

Appendix F to H – Exploratory records

Appendix F	TP 01 to TP 18
Appendix G	PH 01 to PH 10 (incl. PH 04a & PH 07a to PH10a) & PH 101 to PH 109
Appendix H	TT 100A to TT 100E

Appendix I – Contaminated land assessment for selection of water supply pipes

Appendix J – Chemical test results

Appendix K – CLEA input / Output data sheets

Appendix L – Geotechnical test results

Appendix M – Gas monitoring results

[#] Some of this data is not included within the paper or PDF copies of this report but can be provided on request.

FOREWORD (GEOENVIRONMENTAL APPRAISAL REPORT)

This report has been prepared for the sole internal use and reliance of the Client named on page 1. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Lithos Consulting Limited (Lithos); such authorisation not to be unreasonably withheld. If any unauthorised third party comes into possession of this report, they rely on it at their peril and the authors owe them no duty of care and skill.

This report has been reviewed by a Competent Person, as defined in the National Planning Policy Framework. We ensure that all projects are managed by individuals with necessary experience, relevant qualifications, and current membership of a relevant professional organisation. Records of engineers, project managers and reviewers involved in this project are maintained by us. Lithos QA/QC procedures for all our work forms an integral part of our ISO9001 accreditation and as such is regularly audited.

The report presents observations and factual data obtained during our site investigation and provides an assessment of geoenvironmental issues with respect to information provided by the Client regarding the proposed development. Further advice should be sought from Lithos prior to significant revision of the development proposals.

The report should be read in its entirety, including all associated drawings and appendices. Lithos cannot be held responsible for any misinterpretations arising from the use of extracts that are taken out of context. However, it should be noted that in order to keep the number of pages to a minimum, some information (e.g. full copy of the Landmark/Groundsure Report) is not included in the PDF; by request it can be provided.

The findings and opinions conveyed in this report (including review of any third-party reports) are based on information obtained from a variety of sources as detailed within this report, and which Lithos believes are reliable. Reasonable care and skill has been applied in examining the information obtained. Nevertheless, Lithos cannot and does not guarantee the authenticity or reliability of the information it has relied upon.

Intrusive investigation can only investigate shallow ground beneath a small proportion of the total site area. It is possible therefore that the intrusive investigation undertaken by Lithos, whilst fully appropriate, may not have encountered all significant subsurface conditions. Consequently, no liability can be accepted for conditions not revealed by the exploratory holes. Any opinion expressed as to the possible configuration of strata between or below exploratory holes is for guidance only and no responsibility is accepted as to its accuracy.

It should be borne in mind that the timescale over which the investigation was undertaken may not allow the establishment of equilibrium groundwater levels. Particularly relevant in this context is that groundwater levels are susceptible to seasonal and other variations and may be higher during wetter periods than those encountered during this commission.

Where the report refers to the potential presence of invasive weeds such as Japanese Knotweed, or the presence of asbestos containing materials, it should be noted that the observations are for information only and should be verified by a suitably qualified expert.

Lithos cannot be responsible for the consequences of changing practices, revisions to waste management legislation etc that may affect the viability of proposed remediation options.

The report represents the findings and opinions of experienced geoenvironmental consultants. Lithos does not provide legal advice and the advice of lawyers may also be required.

GEOENVIRONMENTAL APPRAISAL
of land at
ASHBOURNE DRIVE, CLECKHEATON

1 INTRODUCTION

1.1 The commission and brief

1.1.1 Lithos Consulting Limited was commissioned by Newett Homes to carry out a geoenvironmental appraisal of land off Ashbourne Drive, Cleckheaton.

1.1.2 Lithos have previously issued the following reports:

- Geoenvironmental Appraisal Report (Ref 1462/2, dated September 2012)
- Gas Risk Assessment (letter ref 018/1462/ASw/REG, dated November 2012)
- Geoenvironmental Appraisal Report (Ref 1462/3, dated January 2021)

1.1.3 Information contained in the above reports has been incorporated within this Report, which now supersedes Report 1462/3 and letter 018/1462/ASw/REG.

1.1.4 Correspondence regarding Lithos' appointment, including the brief for this investigation, is included in Appendix C. The agreed scope of works included:

- A site walkover and inspection
- An assessment of the land use history
- Determination of the site's environmental setting
- A mining risk assessment in accordance with Coal Authority guidance.
- An intrusive ground investigation comprising 18 trial pits, 6 trial trenches, 19 deep probeholes and 6 shallow probeholes with monitoring well installations.
- Assessment of the geotechnical properties of the near surface deposits to enable provision of foundation and highway recommendations
- A qualitative assessment of contamination risks
- Recommendations for the necessary site preparatory and remediation works

1.1.5 Primary aims of this investigation were to identify salient geoenvironmental issues affecting the site to support the submission of a planning application, and also to enable Newett Homes to obtain budget costs for: foundations; gas protection measures; and site preparatory and remediation works.

1.2 The proposed development

1.2.1 It is understood that consideration is being given to redevelopment of the site with 67 no. 2 to 3 storey domestic dwellings, associated gardens, POS, adoptable roads and sewers.

1.2.2 A site layout has been provided by Newett Homes (Drawing reference Z168.002, dated 13th December 2023) which is reproduced as Drawing 1462/2 in Appendix B to this report.

1.3 Report format and limitations

1.3.1 All standard definitions, procedures and guidance are contained within Appendix A, which includes background, generic information on:

- Assessment of the site's environmental setting
- Ground investigation fieldwork
- Geotechnical testing
- Contamination testing
- Hazardous gas

1.3.2 General notes and limitations relevant to all Lithos geoenvironmental investigations are described in the Foreword and should be read in conjunction with this report. The text of the report draws specific attention to any modification to these procedures and to any other special techniques employed.

2 SITE DESCRIPTION

2.1 General

2.1.1 The site's location is shown on Drawing 1462/1 presented in Appendix B to this report. Site details are summarised in the table below:

Detail	Remarks
Location	0.75 km south-west of Cleckheaton town centre
NGR	SE 184 246
Approximate area	2.4ha (6 acres)
Known services	An abandoned water main crosses the site east-west, about 70m south of the farm access track. A foul sewer crosses the site east-west, just within the northern boundary. Lower Blacup Farm is fed by a 33kV electric supply, a low pressure gas main and Virgin Media telecoms; all running underground along the access track. There are also overhead BT telecom wires adjacent to the access track.

2.2 Site features

2.2.1 Lithos completed a walkover survey of the site on 12th January 2024.

2.2.2 Existing salient features, at the time of the walkover are presented on Drawing 1462/3 in Appendix B to this report and summarised in the table below:

Feature	Remarks
Current access	Off Ashbourne Way to the east which leads to Lower Blacup Farm. Further access available from Ashbourne Drive to the north-east (currently fenced off) and Ashbourne View to the south-east (currently gated) to the fields only.
Topography	Slopes steeply up to the south (gradients of up to 1 in 6). There is a relatively level platform 'bulge' in the centre of the site, which forms a steep embankment on its northern edge adjacent to the farm access track.
Approximate areas	2.4 ha grassed fields.
Nature of boundaries	Post and rail fences and hedgerows. Stream (Blacup Beck) flowing to east on northern boundary.

Feature	Remarks
Surrounding land uses	North – Quarry Road and Wharf Works (a former foundry, now derelict) East – Housing (Ashbourne View, Ashbourne Way & Ashbourne Drive). South – Housing (Penn Drive). West – Open fields, farm houses and associated outbuildings.

- 2.2.3 The site comprises several fields, predominantly used for the grazing of animals and storage of farming equipment.
- 2.2.4 The **southern** fields slope down to the north with gradients of up to around 1 in 6. The ground becomes particularly boggy down slope, along a post and wire fence line forming the boundary between the southernmost fields and the centre of the site.
- 2.2.5 Hedgerows, semi mature and mature trees are sporadically positioned along the southern boundary of the site. The field is divided through the centre with hedgerows and semi mature trees together with a post and wire fence running roughly north-south. A gate at the northern end of the fence provides access between the two southernmost fields.
- 2.2.6 A farm gate provides access from Ashbourne View to the eastern half of the southern field.
- 2.2.7 The **centre** of the site has been regraded to form a relatively level platform 'bulge', which is now used to store farm equipment. The northern extent of the bulge forms a steep embankment dropping down to the farm track running east to west across the site.
- 2.2.8 The central area is surrounded by sporadic semi mature and mature trees. Hedgerows form the northern side of the farm track.
- 2.2.9 The farm track terminates to the west at Lower Blacup Farm which comprises two-storey stone built residential dwellings with surrounding stone and brick-built outbuildings.
- 2.2.10 A newly constructed 2 storey residential dwelling has been built on land previously occupied by a pig sty, adjacent to the site. Anecdotal evidence suggests a well, comprising a circular brick lined shaft of at least 1m diameter, is located south of the former pig styes.
- 2.2.11 A gate to the side of the new residential dwelling provides access to the central field from the western boundary.
- 2.2.12 Land **north** of the farm track comprises grassed fields partitioned with electric fencing to form separate paddocks for the grazing of horses. The land slopes more gently down to Blacup Beck on the northern boundary at around 1 in 13 and is lined by mature trees. The ground appeared saturated, especially along the northern boundary adjacent to Blacup Beck.
- 2.2.13 The northern field can be accessed from Ashbourne Drive in the northeast though the boundary was closed with post and wire fencing together with hedgerows and brambles. A farm gate on the western boundary provides access from adjacent fields.
- 2.2.14 A selection of site photographs is included on Drawing 1462/4.

3 SITE HISTORY

3.1.1 Site centred extracts from Ordnance Survey (OS) plans dating back to 1854 have been examined. Some of these plans are presented in Appendix D to this report.

3.1.2 The table below provides a summary of the salient points relating to the history of the site. It is not the intention of this report to describe in detail all the changes that have occurred on or adjacent to the site. Significant former uses/operations are highlighted in bold text for ease of reference.

Date	Site	Surrounding land
1854	Open fields separated by field boundaries. Access track crossing centre of site east to west to Blacup Farm beyond western boundary.	Blacup Farm to the west with a Well shown. Predominantly open fields to west, east and south. Blacup Beck runs along northern boundary with Blacup Chemical Works beyond. Sandstone quarries 150m north and 200m to southwest.
1894	Spoil heaps , likely associated with Blacup Colliery in centre.	Area of extensive industrial use immediately to the north including Wharfe machine works, Iron Rolling Mill, several Quarries, Brickworks, Chemical works, Textile & Woollen Mills, millponds, reservoirs (see Sections below) Woodside Colliery 200m east.
1907	No significant changes	Expansion of industrial areas to the north, together with terraced residential dwellings.
1922		Pavilion beyond northeast boundary with field beyond labelled as 'cricket ground'.
1931		'Pits' around 200m to the west.
1958	Reprofiling of spoil area adjacent to farm, to form embankment south of the existing access track.	Steep embankments shown immediately to northwest adjacent to stream. Residential development along Hightown Road to south. Six oval features (mounds) 200m .
1971	No significant changes	Extensive residential development to south and southeast adjacent to site boundaries.
1981		Industrial area to north reduced in size, with Mill buildings absent, replaced by housing.
1994		Smaller individual industrial units (Industrial Estate) immediately to north.

3.1.3 Land immediately north of the site has a significant industrial history with key processes and operations discussed further in the following sections. However, it should be noted that the development site is on the opposite side of a valley and therefore the risk of impact on the development from these off-site sources is considered very low.

3.1.4 Westgate Chemical Works (also referred to as Cleckheaton Chemical Company) was established prior to 1894 and operated immediately to the north until its closure in the 1970s. There is very little data about the operations of the chemical works, although existing investigation reports for the area of the works reference the 1927 and 1936 Kelly Directories which lists the Cleckheaton Chemical Co, as an Acid Works.

3.1.5 Internet searches link Westgate Chemicals with Henry Ellison Limited, predominantly involved in manufacturing dyestuffs by distillation of timber products.

- 3.1.6 Anecdotal evidence suggests that Westgate Chemical Works also made sulphuric acid, most likely via the lead chamber process which involved sulphur dioxide and nitrogen dioxide introduced as steam into large chambers lined with lead. The gases would then be sprayed down with water. The sulphur and nitrogen dioxide would dissolve and sulphur dioxide is oxidised to sulphuric acid. It was also common for spent oxide, from gas works, to be used in the process.
- 3.1.7 Wharfe Works (textile engineering) was one of several textile mills in the area. These mills predominantly produced serviceable yarn from raw materials. This may have included shrinking of the yarn and dyeing. The location of the chemical works in relation to the textile mills is unlikely to be coincidental and may have provided chemicals to Wharfe Mill and numerous other mills surrounding the site.
- 3.1.8 Old Rolling Mill (Iron works) is likely to have included one or more blast furnaces to produce pig iron (or cast iron) and may have also included a number of puddling furnaces or a foundry where pig iron was further processed to form wrought iron. Furnaces were most commonly fuelled by coal. Further processing of the iron was usually carried out away from the iron works.
- 3.1.9 Lithos are aware from previous reports that the majority of central and western parts of the industrial areas to the north were occupied by Celette (Industrial Housing) Ltd during the late 1990s, with a metal scrap yard to the east. Celette (Industrial Housings) Ltd imported drums of resins, dyes and acetone, and rolls of glass fibre, required for the manufacture of glass reinforced buildings.
- 3.1.10 Later, post 2000, the land to the north was recorded as Celette Industrial Estate. Multiple businesses are recorded to operate from the industrial park. These are listed below:
- Ward Fabrication- auto parts store
 - Garnett Wire
 - Williams Automotive Engineering- vehicle repair shop
 - Lonsdale- precision engineer
 - Stables Garage- vehicle repair shop, authorised for respraying of vehicles
 - Wilkinson & Sons- scooter repair shop
 - Angels tyres- tyre shop
 - Shingleton J T & Sons- waste collection service
 - IPM Workshop services- educational supply shop

4 ENVIRONMENTAL SETTING

4.1 General

4.1.1 Notes describing how the site's environmental setting has been assessed are included in Appendix A to this report. Reference has been made to publicly available Government held digital data via QGIS (an Open Source Geographic Information System). Extracts from the response received from Landmark, and responses from the Coal Authority, Kirklees Council, the BGS and the Environment Agency are presented in Appendix E. These responses are summarised below, together with the findings of our own "desk study" investigation.

Issue	Data reviewed	Summary
Geology	1:50,000 BGS map (Sheet 70 Huddersfield) 1:10,000 BGS map (Sheet SE 12 SE)	Drift soils – None. Solid (bedrock) - Lower coal Measures (mudstone and sandstone with coal seams). Four coal seams are shown to outcrop at the site. Further details in Section 4.3 below. Strata dip – Not shown, but from stratigraphy dip is broadly to the south. Faults - crossing the northeast of the site, trending approximately northwest to southeast with a downthrow to the northeast.
Mining	Coal Authority CA Abandonment plan	The centre and south of the site are located within a Coal Mining Development High Risk Area. Further details in Section 4.3 below.
Quarrying	Historical OS plans	There is cartographic evidence of sandstone quarrying in the immediate vicinity of the site, beyond the development boundary. However, no quarries are shown at or adjacent to the site though this should be confirmed during intrusive investigation.
Radon	UK Health Security Agency	The site lies in an area where between 1% & 3% of homes are estimated to be above the action level. Further details in Section 11.6.
Hydrogeology	Environment Agency electronic open data via QGIS	Groundwater Source Protection Zone? None. Aquifer: Secondary A (Solid). Groundwater abstractions? Nearest is 593m to the southwest (Textile & Leather – General Use). No potable abstractions within 1km. Soil leaching potential - Low. Pollution incidents? None at or affecting the site.
Hydrology	Environment Agency Envirocheck Report	Nearest watercourse(s) – Blacup Beck adjacent to the northern boundary flowing east. Water quality – No details provided. Pollution incidents? Nearest 200m northwest, release of sewage to stream (Category 3 – minor incident). Abstractions? None within 1km of site. Discharge consents? Nearest 240m northeast discharging storm overflow to sewer.
Flood risk	Environment Agency electronic open data via QGIS	The site lies in Flood Zone 1, where the risk of flooding from rivers or the sea is classified as low. In accordance with Chapter 14 of the National Planning Policy Framework, a site-specific flood risk assessment is required for proposals of 1 hectare or greater in Flood Zone 1, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency).

4.2 Landfills

4.2.1 Known or suspected areas of landfill in the vicinity of the proposed development site are summarised below:

Location	NGR (proximity to site)	Remarks	Source of data
Not referenced	SE 180 248 (150m east)	No record of issue of licence for site referenced as Site 92. No information on nature/volume or depth of waste though the tip is believed to pre-date 1980. Tipped area monitored for gas between 1989 & 1992 (carbon dioxide 1.4% v/v, methane 0.1% v/v).	Kirklees Council
Not referenced	SE 198 244 (200m southeast)	Site reference 129, no information available	
Birkett & Sons	SE 188 250 (290m northeast)	Licence 420. Excavated natural materials and foundry site.	EA (from Landmark report)

4.2.2 Whilst the refuse tips referenced above are unlikely to pose a significant risk of hazardous ground gasses areas of deep made ground within the site's boundary together with shallow coal workings (see Section 4.3) may pose a more significant hazard.

4.2.3 The site is considered at risk of hazardous ground gasses and risk assessment is required (see Section 11).

4.3 Coal & mining

4.3.1 In July 2011 the Coal Authority (CA) formalised their requirements in relation to planning applications and introduced some new terminology relating to coal mining development areas. This Section (4.3 and Section 8.8) provides the necessary mining risk assessment required by the proposed planning application.

4.3.2 The centre and south of this site are located within a Coal Mining Development **High Risk Area** - an area with specific mining legacy risks to the surface, including mine entries; shallow coal workings etc).

4.3.3 The north is located within a Coal Mining Development **Low Risk Area** - within the defined coalfield, but no known defined risks have been recorded by the Coal Authority; there may still be unrecorded issues.

BGS data

4.3.4 Geological maps suggest that 4 coal seams underlie the site at shallow depth. These are the:

- Trub Coal (about 0.1m thick), outcropping in the far south
- Churwell Thin (about 0.3m thick), outcropping in the centre
- Shertcliffe (Whinmoor) Coal (about 0.3m to 0.7m thick), outcropping in the centre north
- Unnamed coal, a 'thin' seam, outcropping in the far north

4.3.5 It should be noted that seam outcrops plotted on geological maps have been known to be inaccurate by distances in excess of 100m.

4.3.6 A geological fault crosses the northeast of the site, trending approximately northwest to southeast with a downthrow to the northeast.

- 4.3.7 Faults are usually bordered by a shatter zone where the coal is degraded. The nature and extent of a shatter zone varies according to the intensity of the faulting. Early and modern mining practice was to leave the coal in the shatter zone untouched as it was of little economic value.
- 4.3.8 Thus, there is usually an unworked margin between the workings and the fault, which based on observations elsewhere might be about 60m wide (30m either side of the fault).
- 4.3.9 Approximate outcrops and the line of the geological fault are shown on Drawing 1462/5 in Appendix B.

CA mining report

- 4.3.10 A Coal Authority (CA) mining report states that:
- The property is in the likely zone of influence from shallow workings in the Shertcliffe Coal seam (extraction thickness 0.3m at c. 13m depth), last worked in 1885 and the Black Bed Coal 0.67m extraction thickness at c.67m depth), last worked in 1880.
 - There are probable unrecorded shallow workings beneath the site.
 - A spine roadway exists at shallow depth.
 - There are two known mine entries on site, which were located by Lithos in Dec 2020:
 - A shaft (Ref. 418424-002) located at NGR 418599 424809.
 - An adit (Ref. 418424-003) located at NGR 418639 424790.
 - There are no opencast mines recorded within 500 metres of the enquiry boundary.
 - There are no CA managed tips recorded within 500 metres of the enquiry boundary.
 - The property is not in an area for which the Coal Authority is determining whether to grant a licence to remove coal using underground methods.
 - The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31st October 1994.
 - The property is not in an area where a notice to withdraw support has been given.
- 4.3.11 Correspondence with the CA, copied to Appendix E, states that the Whinmoor Coal is known locally as the Shertcliffe Coal, as shown on BGS plans.
- 4.3.12 Workings within the Shertcliffe are considered likely to pose a risk to surface stability of the site where there is insufficient overlying competent cover, most notably near outcrop. Due to the rise in topography, the thickness of competent cover is likely to increase rapidly as the seam dips (around 3 degrees) down to the south.
- 4.3.13 Given dip and topography, the Shertcliffe Coal seam is expected to underlie an area of about 17,250m² (70% of the site) in the centre and south.
- 4.3.14 The next known worked seam, the Black Bed Coal lies at over 90m beneath the site and as such is not considered a risk to the site.
- 4.3.15 However, it should be noted that it did not become a statutory requirement to maintain and preserve plans of abandoned mines until the Mine (Coal) Regulations Act of 1872 and consequently there may be mineworkings beneath the site for which the Coal Authority have no records.
- 4.3.16 Of the two known mine entries on site, the CA only have mine entry data for the suspected air shaft Ref. 418424-002, reported to be 115.2m deep, down to the Low Moor Better Bed, as shown on abandoned mine plan Ref 1731.

- 4.3.17 This shaft is located in the centre of the levelled central area. Prior to Lithos' investigation in December 2020, the CA held no further detail regarding shaft diameter or treatment (e.g. filling/capping). Lithos located this shaft during the investigation in December 2020, further details in Section 8.8.
- 4.3.18 No details were provided for the adit (shaft Ref. 418424-003) which is shown to access workings in the Shertcliffe Coal (Low Stone Coal) on abandonment plan ref 1731. This adit was also located during Lithos' investigation in December 2020.

CA abandonment plans

- 4.3.19 A Coal Authority abandonment plan (Ref 1731) dated August 1885 shows workings in a shallow seam, referred to as the Low Stone coal (shown as the Shertcliffe Coal on BGS plans).
- 4.3.20 The abandonment plan shows Blacup Pit – a colliery comprising an adit, airshaft and several above ground features, including screens, offices, and an engine/boiler house. Workings in the Low Stone coal are shown to extend across the centre and the southern half of the site, extending west beyond the site boundary (see Drawing 1462/7), and the annotation "exhausted" suggests a high degree of extraction.
- 4.3.21 'Old Coal Workings' are also labelled to the north suggesting previous extraction of the Shertcliffe Coal prior to working from Blacup Colliery. The extent of these old workings is not shown but is likely to extend to the north of the farm access track towards the outcrop of the Shertcliffe Coal.
- 4.3.22 A section through the air shaft is shown on the abandonment plan which is summarised in the table below:

(from Shaft Section, CA plan ref 1731)			Probable Equivalent on 1:10,000 Geological Plan (Sheet SE 12 SE)	
Approx Depth below Ground Level (m)	Seam Name	Thickness (m)	Seam Name	Seam Thickness (m)
GL	Top Stone Coal	0.4	Shertcliffe Coal	0.3 to 0.7
5.5m	Low Stone Coal	0.3		
78m	Low Moor Black Bed	0.7	Black Bed Coal	0.8
115m	Low Moor Better Bed	0.5	Better Bed Coal	0.5

- 4.3.23 The Top Stone and Low Stone coals are considered to represent the Shertcliffe which is likely present as two leaves within the shaft section.
- 4.3.24 A mining investigation of the entire site will be required to check for the presence of recorded and unrecorded shallow mine workings (voids or broken ground).

4.4 Mineral safeguarded areas

- 4.4.1 The site is underlain by coal and might therefore be considered by the Local Authority to lie within a Mineral Safeguarding Area (MSA).
- 4.4.2 MSAs are areas of known mineral resources that are of sufficient economic or conservation value to warrant protection for generations to come. The purpose of MSAs is not to preclude automatically other forms of development, but to make sure that mineral resources are adequately and effectively considered in land-use planning decisions.
- 4.4.3 Specialist guidance on Mineral Safeguarding "A Guide to Mineral Safeguarding in England" has been produced by The Coal Authority and the British Geological Survey.

- 4.4.4 Chapter 17 of the National Planning Policy Framework (NPPF) requires Local Authorities to facilitate the sustainable use of minerals, and planning policies should:
- Safeguard mineral resources by defining Mineral Safeguarding Areas and Mineral Consultation Areas; and adopt appropriate policies so that known locations of specific minerals resources of local and national importance are not sterilised by non-mineral development where this should be avoided (whilst not creating a presumption that the resources defined will be worked).
 - Set out policies to encourage the prior extraction of minerals, where practicable and environmentally feasible, if it is necessary for non-mineral development to take place.
- 4.4.5 NPPF Chapter 17 notes that when determining planning applications, local planning authorities should give great weight to the benefits of the mineral extraction.
- 4.4.6 As a consequence of the NPPF, and the presence of coal beneath the site, the Local Authority may require Newett Homes to consider the opportunity to recover (extract) the coal. Applicants submitting planning applications may need to demonstrate to the Local Authority that they will extract the coal, unless:
- It can be shown it is not economically viable to do so, or
 - It is not environmentally acceptable to do so, or
 - The need for the development outweighs the need to extract the coal, or
 - The coal will not be sterilised by the development
- 4.4.7 The viability of coal extraction at this site is considered later in this Report (Section 14.7) in light of the findings of Lithos' intrusive mining investigation, which comprised the drilling of 19 rotary probeholes to depths of between 12m and 30m (see Section 8.8).

5 PRELIMINARY CONCEPTUAL SITE MODEL

- 5.1 A preliminary conceptual site model, presented as Drawing 1462/6 in Appendix B, has been prepared after consideration of all the data presented in Sections 2 to 4 inclusive of this report.
- 5.2 The majority of the site is greenfield with no known previous development. However, Blacup Colliery is known to have been present in the centre of the site in the late 19th Century with extensive industrial use of land immediately to the north of the site.
- 5.3 An assessment of potential contaminants associated with the former uses has been undertaken with reference to CLR8. As a consequence of this assessment, anticipated potential contaminants, within soil and/or groundwater include:
- Inorganics (metals, asbestos associated with made ground and the possible use of pesticides and fertilisers)
 - TPH & PAH (fuels, oils associated with machinery use and maintenance (former colliery and more recent farming activities))
- 5.4 However, in consideration of the likely extent and degree of such contamination, at this stage the risk to human health (end-users) and the environment (Coal Measures mudstone and sandstone) is considered to be very low.
- 5.5 Whilst it is likely that pesticides have been applied during arable use of the land, these are not likely to include the persistent organochloride pesticides such as Dieldrin, Aldrin, DDT etc. Pesticides routinely used on arable crops the UK (Phenoxy Acetic acid herbicide or PAAH) rapidly degrade in soils or leach via rainwater infiltration to groundwater. It is highly unlikely these would be detected by soil sampling and therefore these have not been included within the proposed sampling suite.
- 5.6 Potential pollutant linkages are shown on the preliminary conceptual site model, presented as Drawing 1462/6 in Appendix B to this report. Clearly the conceptual model will be subject to modification in light of data arising from the proposed intrusive ground investigation.

6 GROUND INVESTIGATION DESIGN

6.1 Anticipated ground conditions & potential issues

6.1.1 Based on the data reviewed in Section 4 (Environmental Setting), anticipated ground conditions are expected to comprise:

Anticipated condition	Remarks
Made ground	Colliery spoil in the centre of the site (former Blacup Colliery)
Natural soils	Residual soils (completely weathered bedrock) comprising clayey gravel, gravelly clay.
Bedrock	Coal Measures strata (sandstones and mudstones) at shallow depth. Coal likely to be encountered near outcrop.
Mineworkings	Workings recorded in at least one seam of coal (Shertcliffe Coal) which outcrops through the centre and dips to the south. Possible further unrecorded shallow workings in additional seams of coal which outcrop across the site.
Groundwater	Likely to lie at depth within the Coal Measures strata.

6.1.2 Based on the data above and that in Sections 2 (Site Description) and 3 (History), potential ground-related issues associated with this site are likely to include:

Type of issue	Specific issue	Remarks
Potential on-site contamination sources	<ol style="list-style-type: none"> made ground farming activities 	<ol style="list-style-type: none"> colliery spoil and reworked ground in the centre of the site (former Blacup Colliery). spillage, leakage, spreading of soil conditioners
Potential off-site contamination sources	<ol style="list-style-type: none"> landfills within 250m of the site boundary former industrial works to the north 	<ol style="list-style-type: none"> hazardous gas windblown dust, emissions
Potential geotechnical hazards	<ol style="list-style-type: none"> deep made ground localised steep slopes coal mining adits & shafts 	<ol style="list-style-type: none"> localised re-grade (former Blacup Colliery). site topography rises steeply to the south recorded shallow coal workings recorded mine entries
Other potential constraints	<ol style="list-style-type: none"> underground and/or overhead utilities 	<ol style="list-style-type: none"> drainage in far north, services to existing farmhouses

6.2 Ground investigation design & strategy

6.2.1 The preliminary conceptual site model was used as a basis for design of an appropriate ground investigation, the scope of which is summarised below. The first phase of ground investigation was completed in August 2012.

Exploratory holes	Purpose
TPs 1 to 18	<p>To determine the general nature of soils underlying the site, including the:</p> <ul style="list-style-type: none"> Nature, distribution and thickness of made ground Nature, degree and extent of contamination (unlikely) Proportion of undesirable elements e.g. biodegradable matter, foundations etc Suitability of the ground for founding structures and highways To locate the mine adit
PHs 1 to 10	<p>To check for the presence of voids or broken ground associated with shallow mine workings. To allow the installation of monitoring wells across the site in order to monitor for hazardous gas.</p>

6.2.2 In light of findings from the initial investigation the following supplementary exploratory holes were completed in December 2020.

Exploratory holes	Purpose
PHs 101 to 109	To delineate the area affected by shallow mineworkings more accurately.
Trial trenching	To locate the air shaft.
Hand pits (T1 to T19)	To recover additional samples of Topsoil for arsenic and bio-availability testing.

6.2.3 Proposed exploratory hole locations were selected to provide a representative view of the strata beneath the site. Additional exploratory locations might be scheduled by the site engineer in light of the ground conditions actually encountered.

6.2.4 The number of representative samples taken will be reflective of the geological complexity actually encountered. However, in general about 3 samples will be taken from most trial pits.

7 FIELDWORK

7.1 Objectives

7.1.1 The original investigation strategy is outlined in Section 6.2 above.

7.2 Exploratory hole location constraints

7.2.1 Trafficking around the site was significantly constrained both in 2012 and 2020 by the wet and boggy nature of the ground, together with the steep slopes in the south.

7.2.2 No machine access was available to the north of the farm access track during the December 2020 works due to the overgrown nature of the field boundaries. The gate to the northern field lies on the western boundary which is accessed across third party land.

7.3 Scope of works

7.3.1 Fieldwork was supervised by Lithos on 19th & 20th July and 23rd August 2012 and between the 2nd & 4th December 2020, and comprised the exploratory holes listed below:

Technique	Exploratory holes	Completed	Final depth(s)	Remarks
Trial pitting (machine dug)	TPs 1 to 18	2012	2.1m to 3.6m	Vane tests in cohesive soils
Rotary open-hole probeholes	PHs 1 to 10	2012	12m to 30m	Monitoring wells installed in PH02, remainder of holes backfilled with arisings and bentonite seals
	PHs 101 to 109	2020	15m to 30m	
	PHs 4a, 7a, 8a, 9a & 10a	2012	3.0m to 6.0m	Monitoring wells installed in each hole
Trial Trenching	TTs 100A to 100E	2020	1.8m to 3.2m	Shaft located in TT100E (see Section 7.8)
Hand dug pits	Ts 01 to 19	2020	<0.3m	To recover samples of Topsoil for laboratory testing

7.3.2 Notes describing ground investigation techniques, in-situ testing and sampling are included in Appendix A to this report.

- 7.3.3 Exploratory hole logs are presented in Appendices F to H to this Report. These logs include details of the:
- Samples taken
 - Descriptions of the solid strata, and any groundwater encountered.
 - Results of the in-situ testing
 - The monitoring wells installed
- 7.3.4 Exploratory hole locations are shown on Drawing 1462/8 presented in Appendix B; exploratory holes were picked-up by a surveyor and co-ordinates/ground levels are included on the logs.

8 GROUND CONDITIONS

8.1 General

- 8.1.1 A complete record of strata encountered beneath the proposed development site is given on the various exploratory hole records, presented in Appendices F to H.
- 8.1.2 Typical ground conditions encountered at the site are described below in Sections 8.2 (made ground) and 8.4 (natural ground), with a summary provided in the tables on pages 17 & 18.

8.2 Made ground

- 8.2.1 Made ground is restricted to the centre of the site, in the area of a topographic 'bulge', associated with former use of this part of the site as a colliery (late 19th century); see Drawing 1462/11.
- 8.2.2 Made ground in this area extends to a maximum depth of 3.4m and can be categorised as one of 5 broad types:
- **Reworked Topsoil:** Typically, slightly sandy clay (topsoil) overlying made ground, with occasional gravel of brick. Sporadic distribution, identified in the centre-north of the site in TP11 & TP12, up to 0.4m depth.
 - **Granular Colliery Spoil:** Gravel of mudstone in clay matrix. Sporadic distribution; identified within TP12 on the line of the former adit to 3.4m depth and in TP15 within the embankment immediately south of the farm access track.
 - **Cohesive Colliery Spoil:** Gravelly clay interbedded with overlying Burnt Shale. Sporadic distribution; identified to 3.3m depth in TP8 within the embankment immediately south of the farm access track.
 - **Burnt Shale:** Gravel of burnt shale, interbedded with underlying Cohesive Colliery Spoil. Sporadic distribution; identified between 2.2m and 2.7m depth in TP8 within the embankment immediately south of the farm access track.
 - **Ash & Clinker:** Gravel of mixed lithologies including clinker in an ashy matrix, identified to 2.2m depth (TP8) and 1.5m depth (TP15), within the embankment immediately south of the farm access track.
- 8.2.3 It is considered that the Granular Made Ground identified in TP12 comprises backfill material within the former adit identified on Coal Authority abandonment plans. Natural strata could be observed at the western and eastern ends of the pit.
- 8.2.4 TPs 13 & 14, excavated immediately to the west and east respectively of TP12, encountered shallow natural strata.

8.2.5 Review of the trial pit logs suggest made ground thicknesses beneath the central area vary between 0.4m and 3.4m; average 3.1m. The thickest made ground was encountered in the embankment immediately south of the farm access track (TPs 8 & 15) and on the line of the former adit (TP12), becoming shallower towards the south as natural topography rises. Made ground in excess of 2.6m deep was only encountered in 3 of the 18 exploratory holes.

8.2.6 The approximate distribution of deep made ground is shown on Drawing 1462/11.

8.2.7 The base of the made ground backfill within the air shaft (TT100E) was not proved but, in the absence of any intermediate staging, is assumed to extend to the base of the shaft.

8.3 Obstructions

8.3.1 It is apparent from a review of Coal Authority abandonment plans and historical OS Plans (see Section 3) that the centre of the site has been formerly occupied by a colliery. Although trial pits excavated within this area did not encounter any man-made obstructions, the possibility of former foundations etc cannot be discounted.

8.4 Natural ground

8.4.1 Natural ground was encountered in all of the exploratory holes, and typically comprised:

- **Topsoil:** Brown slightly sandy clay across the site to a typical depth of 200mm.
- **Cohesive Residual soil (completely weathered bedrock):** Firm and stiff sandy, gravelly Clay identified from 0.20m to depths >3.6m; average 1.9m. Extensive lateral distribution; recorded in 16 of 18 trial pits.
- **Granular Residual soil (completely weathered bedrock):** Clayey, slightly sandy, angular fine to coarse gravel of sandstone. Sporadic distribution; identified within TP3 between 0.3m & 2.0m depth.
- **Coal Measures Bedrock:** Sandstone, Mudstone and Siltstone recovered as angular tabular fine to coarse gravel. Encountered at between 1.1m & 3.3m depth; average 1.9m. Encountered in the majority of holes.

8.5 Visual & olfactory evidence of organic contamination

8.5.1 No visual or olfactory evidence of significant organic contamination was noted in any of the exploratory holes at the site.

8.5.2 However, selected samples of made ground have been analysed to determine the extent of any contamination. In addition, samples of topsoil have been tested to determine its suitability for re-use; see Section 9.3.

8.6 Groundwater

8.6.1 No significant inflows of groundwater were encountered during the investigation, with only a slight seepage recorded in TP9.

8.6.2 Groundwater levels recorded in the monitoring wells installed in selected probeholes are summarised below.

Hole ID (GL m AoD)	Response zone (depth range & strata)	Groundwater body	Range of standing water levels	
			m bgl	m AoD#
PH2 (124.2)	3.0 – 6.0m (Mudstone)	Solid	Typically >6.0, one occasion 4.4	<118.2, one occasion 119.8
PH4a (121.8)	1.0 – 3.0m (Mudstone & Sandstone)	Solid	2.8 to >3.0	119 to 118.8
PH7a (107.8)	1.0 – 3.0m (Mudstone & Sandstone)	Solid	0.5 to 1.5	107.3 to 106.3
PH8a (105.4)	1.0 – 3.0m (Residual Soils)	Shallow	2.1 to 3.7	103.3 to 101.7
PH9a (112.1)	2.0 – 6.0 (Mudstone & Sandstone)	Solid	3.5 to 4.7	108.7 to 107.4
PH10a (97.3)	1.0 – 3.0m (Mudstone)	Solid	0.73 to 1.9	96.6 to 95.4

levelled-in by survey

8.6.3 Dip data suggests a shallow water table. Groundwater was particularly shallow (within 1.5m of ground level) in PHs 7a & 10a.

8.6.4 These results should be of interest to the drainage designer and groundworker (especially if/where deep excavation is required).

8.7 Stability

8.7.1 Stability of excavations within the natural ground was generally good, but some instability was noted within the made ground in the centre of the site.

Summary of ground conditions

Site Area	Hole ID	Final depth (m)	Depth to Base of (m)								Coal Measures		Remarks
			Made Ground (m)					Natural Ground (m)			Depth to Bedrock (m)	Penetration (m)	
			Reworked Topsoil	Ash & Clinker	Granular Colliery Spoil	Burnt Shale	Cohesive Colliery Spoil	Topsoil	Residual Soils				
									Clay	Gravel			
South	TP01	2.50	-	-	-	-	-	0.2	0.9	-	0.9	1.6	Difficult to excavate below 2.0m
South	TP02	2.70	-	-	-	-	-	0.2	1.9	-	1.9	0.8	Difficult to excavate below 1.9m
South	TP03	2.50	-	-	-	-	-	0.3	-	2.0	2.0	0.5	Difficult to excavate below 2.0m
South	TP04	2.50	-	-	-	-	-	0.2	1.7	-	1.7	0.8	Difficult to excavate below 2.0m
South	TP05	2.30	-	-	-	-	-	0.2	1.1	-	1.1	1.2	-
South	TP06	2.90	-	-	-	-	-	0.2	1.7	-	1.7	1.2	Difficult to excavate below 2.8m
South	TP07	2.30	-	-	-	-	-	0.2	1.4	-	1.4	0.9	Difficult to excavate below 2.0m
Centre	TP08	3.60	-	2.2	-	2.7	3.3	-	>3.6	-	-	-	Sides of the trial pit were unstable to 3.3m
Centre	TP09	2.90	-	-	-	-	-	0.2	1.7	-	1.7	1.2	Groundwater seepage at 1.4m
Centre	TP10	3.00	-	-	-	-	-	0.3	1.6	-	1.6	1.4	Difficult to excavate below 2.8m
Centre	TP11	3.60	0.4	-	-	-	-	-	2.5	-	2.5	1.1	Slight spalling of trial pit sides below 2.5m
Centre	TP12	3.60	0.2	-	3.4	-	-	-	-	-	3.4	0.2	Constant spalling of trial pit sides from ground level to 3.4m. Backfilled Adit identified.
Centre	TP13	3.60	-	-	-	-	-	0.2	3.0	-	3.0	0.6	Difficult to excavate below 3.0m
Centre	TP14	3.60	-	-	-	-	-	0.3	3.3	-	3.3	0.3	Difficult to excavate below 3.3m
Centre	TP15	3.40	-	1.5	2.6	-	-	-	>3.4	-	-	-	Sides of trial pit were unstable to 1.5m.
North	TP16	2.40	-	-	-	-	-	0.2	1.9	-	1.9	0.5	Difficult to excavate below 1.9m
North	TP17	2.10	-	-	-	-	-	0.2	>2.1	-	-	-	Difficult to excavate below 2.0m
North	TP18	2.30	-	-	-	-	-	0.3	2.0	-	2.0	0.3	Difficult to excavate below 2.0m

Summary of Ground Conditions (Trial Trenches – Shaft Investigation)

Hole ID	Final depth (m)	Depth to base of: (m)					Remarks
		Made Ground				Natural Ground	
		Made Ground Topsoil	Reworked Natural Ground	Granular Made Ground	Colliery Spoil	Residual Soil	
						Clay	
TT100A (North)	2.8	0.25	1.0	1.8	2.2	>2.8	The sides of the trial pit were unstable between 0.25m & 2.2m with some spalling in made ground. Slight natural organic odour from 2.4m to 2.7m in firm dark grey organic clay.
TT100A (South)	1.8	0.25	-	-	0.9	>1.8	The sides of the trial pit were unstable between 0.25m & 0.9m depth with some spalling in made ground.
TT100B	2.0	0.20	0.4	-	1.7	>2.0	The sides of the trial pit were unstable between 0.25m & 1.7m depth with some spalling in made ground.
TT100C	3.0	0.30	0.5	-	2.2	>3.0	The sides of the trial pit were unstable between 0.25m & 2.2m depth with some spalling in made ground.
TT100D	3.2	0.20	0.4	-	1.9	>3.2	The sides of the trial pit were unstable between 0.25m & 1.9m depth with some spalling in made ground.
TT100E	3.2	0.20	0.4	-	1.7	>3.2	The sides of the trial pit were unstable between 0.25m & 1.7m depth with some spalling in made ground. At 1.7m, brick lined shaft with colliery spoil infill in north of the trench. Shaft is around 2.0m in diameter. Ground level prior to excavation at 106.3 mAOD.

8.8 Mining investigation

Shallow workings (rotary probeholes)

- 8.8.1 It is clear from the desk study and Coal Authority Report that the site is likely to be underlain by recorded shallow mineworkings associated with the Shertcliffe Coal. Further unrecorded workings may also be present in 3 further seams which outcrop on the site.
- 8.8.2 The conjectured outcrops of the Shertcliffe Coal together with an unnamed Thin Coal, Churwell Thin and Trub Coal seam are shown on Drawing 1462/5 in Appendix B to this report.
- 8.8.3 Consequently, a mining investigation has been undertaken, comprising the drilling of 19 rotary open-hole probeholes. The investigation identified coal, soft ground, broken ground and voids as summarised in the table on pages 21 & 22.
- 8.8.4 Analysing the data obtained from the mining investigation probeholes it is apparent that:

Trub Coal

- The Trub coal underlies about 0.4 ha of the site in the far south outcropping approximately 35m further north than that shown on BGS plans.
- None of the 3 holes advanced through the Trub seam encountered evidence of workings.
- The Trub coal is between 0.2m & 0.3m thick.
- The thickness of competent (rock) cover above the Trub coal is always less than 6 times seam thickness.

Churwell Thin Coal

- The Churwell Thin underlies the south of the site (c. 1.4 ha). It is shallowest at outcrop in the centre, becoming deeper towards the south, typically around 17m on the southern boundary.
- Typical seam thickness of the Churwell Thin is 0.8m; maximum recorded was 1.4m.
- None of the 11 holes advanced through the Churwell Thin encountered evidence of workings.
- The thickness of competent (rock) cover is typically less than 10 times seam thickness beneath an area of approximately 0.75ha in the centre and south. A competent cover of greater than 10 times seam thickness is present towards the south as topography rises up steeply.

Shertcliffe Coal

- The Shertcliffe coal underlies about 1.7ha (70%) of the site from outcrop in the north to the southern boundary.
- Typical seam thickness of the Shertcliffe Coal is 0.9m; maximum recorded was 1.0m.
- 8 of the 13 holes (60%) advanced through the Shertcliffe Coal encountered evidence of workings including voids, broken ground and soft ground (up to 1.7m thick, typically <1.0m). Voids (up to 0.5m) were encountered in PHs 101, 104, 105 & 107.
- The thickness of competent (rock) cover is typically greater than 10 times seam thickness in the south of the site. Competent cover of less than 10 times seam thickness was recorded in two probeholes (PHs 107 & 108) in the centre of the site.

- 8.8.5 PH109 drilled to the north of the recorded workings, towards the outcrop of the Shertcliffe seam recorded coal, 0.8m thick, at 21.1m depth. This was not as expected with the Shertcliffe anticipated from around 7m based on dip, topography and nearby holes. A Carbonaceous Mudstone was encountered between 6.7m & 7.6m depth which may represent the Shertcliffe, with the deeper seam representing the Un-named Coal which outcrops further north.
- 8.8.6 However it is possible that the coal has been downthrown due to faulting, although some broken ground/fault breccia would have been expected.
- 8.8.7 The Shertcliffe Coal was absent in PHs 06 & 07, but would have been expected at around 11m depth here. It is possible that the seam has been extracted with workings packed out with mining waste, giving the impression of solid ground.
- 8.8.8 Within PH05 the workings in the Shertcliffe Coal were shallower (16.5m) than expected (c. 24m), possibly due to minor localised faulting.
- 8.8.9 Given the annotation on the CA abandonment plan recording 'old workings' to the north, together with the restricted access north of the farm access track it is highly likely that the Shertcliffe Coal has been worked towards outcrop where the thickness of competent cover will be less than 10x seam thickness.

Un-named Coal

- A thin Un-named Coal is shown to outcrop towards the northern boundary, underlying the majority of the site.
 - None of the probeholes drilled at the site encountered the Un-named Coal, likely as a consequence of topography as land rises to the south, with the Un-named Coal lying at depths greater than the drilled depths of the majority of the probeholes.
 - PH10 drilled to 30m depth near the outcrop of the Un-named seam did not encounter coal, it is likely that the Un-named seam was too thin and/or of poor quality to be recorded during drilling.
- 8.8.10 A further 5 probeholes were taken to shallow depth to allow the installation of gas/groundwater monitoring wells.



Summary of Ground Conditions (Rotary Probeholes)

Hole ID	Final depth (m)	Depth to Rock head (m)	Trub Coal				Churwell Thin Coal				Shertcliffe Coal				Un-named (Thin) Coal				Remarks	
			Depth to base	Thick-ness	Worked ?	Cover Ratio	Depth to base	Thick-ness	Worked ?	Cover Ratio	Depth to base	Thick-ness	Worked ?	Cover Ratio	Depth to base	Thick-ness	Worked ?	Cover Ratio		
PH01	20.0	2.5	3.5	0.30	no	3	17.0	0.30	no	18	-	-	-	-	-	-	-	-	-	
PH02	12.0	1.0	2.9	0.20	no	6	-	-	-	-	-	-	-	-	-	-	-	-	-	
PH03	21.0	1.8	-	-	-	-	8.2	0.70	no	8	19.5	0.90	no	18	-	-	-	-	-	
PH04	18.0	1.5	1.8	0.30	no	1	16.8	0.30	no	19	-	-	-	-	-	-	-	-	-	
PH05	21.0	1.1	-	-	-	-	7.0	0.50	no	7	18.2	1.70 ¹	Broken ground 16.5m to 18.2m	17	-	-	-	-	-	
PH06	21.0	2.4	-	-	-	-	6.2	1.40	no	5	-	-	-	-	-	-	-	-	-	
PH07	30.0	2.5	-	-	-	-	5.2	1.20	no	3	-	-	-	-	-	-	-	-	-	
PH08	24.0	4.2	-	-	-	-	-	-	-	-	7.8	1.00	Soft ground 6.8m to 7.8m.	-	-	-	-	-	-	
PH09	21.0	1.8	-	-	-	-	11.2	0.90	no	12	17.5	1.00	Broken ground 16.5m to 17.5m	16	-	-	-	-	-	
PH10	30.0	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PH101	30.0	1.8	-	-	-	-	-	-	-	-	24.0	0.90	Void 23.1m to 23.6m, soft ground 23.6m to 24.0m	22	-	-	-	-	-	Thin Coal 6.0m to 6.2m
PH102	18.3	1.5	-	-	-	-	-	-	-	-	15.3	1.00	no	14	-	-	-	-	-	Thin Coal 3.5m to 3.8m
PH103	21.3	1.8	-	-	-	-	11.2	0.80	no	12	17.9	0.70	no	16	-	-	-	-	-	
PH104	21.0	1.3	-	-	-	-	11.0	0.70	no	12	17.6	0.80	Void 16.8m to 17.0m, soft ground 17.0m to 17.6m	16	-	-	-	-	-	



Hole ID	Final depth (m)	Depth to Rock head (m)	Trub Coal				Churwell Thin Coal				Shertcliffe Coal				Un-named (Thin) Coal				Remarks
			Depth to base	Thick-ness	Worked ?	Cover Ratio	Depth to base	Thick-ness	Worked ?	Cover Ratio	Depth to base	Thick-ness	Worked ?	Cover Ratio	Depth to base	Thick-ness	Worked ?	Cover Ratio	
PH105	18.0	1.2	-	-	-	-	-	-	-	-	12.8	0.80	Void 12.0m to 12.3m, soft ground 12.3m to 12.8m	12	-	-	-	-	
PH106	18.0	1.7	-	-	-	-	-	-	-	-	13.3	0.60	Soft ground 12.7m to 13.3m.	12	-	-	-	-	
PH107	15.0	1.8	-	-	-	-	-	-	-	-	11.1	0.70	Void 10.4m to 10.7m, soft ground 10.7m to 11.1m	9	-	-	-	-	
PH108	15.0	1.6	-	-	-	-	4.1	0.80	no	3	10.8	0.80	no	9	-	-	-	-	
PH109	30.0	3.6	-	-	-	-	-	-	-	-	7.6	0.80	no	4	21.9	0.8	no	18	Carbonaceous Mudstone 6.7m to 7.6m

Notes: Cover ratio calculated on maximum thickness of solid coal recorded
 Cover ratio in red with competent cover of less than 10x seam thickness
¹ thickness of broken ground, actual seam thickness likely <1.0m based on holes where intact coal was encountered

Mine entry search

- 8.8.11 As discussed in Section 4.3 there are two known mine entries (air shaft & adit) within the site's boundary. Prior to excavation, each mine entry was set out by a surveyor, based on co-ordinates included within the CA's Consultant's Mining Report (2020 version), with consideration given to Desk Study data to ensure the pegged positions were appropriate.
- 8.8.12 Topsoil and subsoil were stripped from panels 1.2m wide at 0.5m spacing (TTs 100A to 100E) where the CA suggest that the recorded airshaft was located. A circular mine entry with a diameter of approximately 2.0m was located approximately 8m west of the CA recorded position.
- 8.8.13 Excavation encountered Shaft Backfill (Colliery Spoil comprising gravelly clay and clayey gravel of mudstone) to greater than 3.2m depth. The shaft was found to have a brick lining.
- 8.8.14 The shaft has been surveyed-in; co-ordinates are: 418598.91E, 424809.15N.
- 8.8.15 The areas of topsoil strip, along with illustrative photographs, are shown on Drawing 1462/8a in Appendix B.
- 8.8.16 Three trial trenches (TPs 12, 13 & 14) were excavated across a line perpendicular to the line of the adit to prove underlying natural soils.
- 8.8.17 Within TP12 Colliery Spoil backfill was encountered to 3.4m depth, with TPs 13 & 14 immediately to the east and west recording natural soils from ground level.
- 8.8.18 The adit has been surveyed-in; co-ordinates are: 418639.01E, 424789.66N.

8.9 Revised conceptual ground model (ground conditions)

- 8.9.1 The Preliminary Conceptual Site Model has been revised in light of data obtained during the ground investigation, most notably with respect to:
- The nature and distribution of made ground, including the presence of significant buried obstructions
 - The strength, nature and depth of underlying natural strata
 - The presence of coal/shallow workings
 - Constraints/difficulties associated with sewers, slopes etc
- 8.9.2 Geological cross-sections are presented as Drawing 1462/9 in Appendix B, with the revised Conceptual Site Model presented as Drawing No. 1462/10.
- 8.9.3 Further refinement of the Conceptual Site Model is presented in Section 10.3, where the results of laboratory testing for contaminants have been considered.

9 CONTAMINATION (ANALYSIS)

9.1 General

- 9.1.1 The majority of the site is greenfield with an agricultural use. However, the centre of the site was occupied by Blacup Colliery during the late 19th century.
- 9.1.2 No potentially contaminative raw materials are known to have been stored at the site although the **site's former usage** (Blacup Colliery) may have given rise to some ground contamination. Furthermore, significant thicknesses of made ground associated with the colliery were encountered in this area; most notably, TPs 8 & 15.
- 9.1.3 An assessment of potential contaminants associated with the former uses has been undertaken; see Section 5.
- 9.1.4 In the context of risks to human health associated with residential redevelopment, the Tier 1 Soil Screening Values referenced in this report have been derived via the CLEA default conceptual site model (CSM) used for generating SGVs, but amended, where appropriate, to be more specific to redevelopment within the planning process.
- 9.1.5 This site is essentially greenfield, and therefore the Tier 1 Soil Screening Values for organic compounds used in this report have been derived with reference to a CSM that assumes no clean soil cover will be placed in gardens/landscaped areas (Lithos Scenario A).
- 9.1.6 In the event that some determinands exceed these Tier 1 Values, the results will be reassessed with reference to values derived using a CSM with 600mm soil cover (Lithos Scenario B).
- 9.1.7 Generic Note 04 in Appendix A provides further details with respect to current guidance and the interpretation of analytical data.

9.2 Testing scheduled

- 9.2.1 Based on the above assessment, Lithos submitted a test schedule (summarised in the table below) to a UKAS accredited laboratory.

Type of sample	No. of samples	Determinands
Made ground	11	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc)
	8	Calorific Value (CV)
	11	Asbestos ID
	4	Leachable metals: arsenic, boron, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc
	6	Total Organic Carbon (TOC), Speciated Polycyclic Aromatic Hydrocarbons (PAH)
	11	Water soluble sulphate, chloride, nitrate and magnesium
	7	Total sulphate and total sulphur
Topsoil and Made Ground Topsoil	13	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc)
	11	Total metals (arsenic only)
	12	Asbestos ID
	6	Total Organic Carbon (TOC), Speciated Polycyclic Aromatic Hydrocarbons (PAH)
	4	Bio-available arsenic

9.3 Soil contamination results

- 9.3.1 The soil contamination test results are summarised in the tables on pages 29 to 33.
- 9.3.2 Laboratory test certificates as received from the laboratory are presented in Appendix J to this report.

Inorganic determinands

- 9.3.3 Of the 11 samples of made ground, 11 samples of Topsoil and 4 samples of Made Ground Topsoil analysed for inorganic parameters, 9 can be classified as uncontaminated and 16 could be classified as contaminated.
- 9.3.4 These samples have been classified by comparison with Tier 1 Soil Screening Values for an end use including domestic gardens and any area where plants are to be grown (the most sensitive of proposed end-uses).
- 9.3.5 The most common contaminants are arsenic in the Topsoil and Made Ground Topsoil (up to 71mg/kg) and in the Made Ground (up to 210mg/kg).
- 9.3.6 Elevated concentrations of arsenic were identified in 5 of 11 samples of Topsoil and 2 of 4 samples of Made Ground Topsoil.
- 9.3.7 Given the elevated concentrations of arsenic a further 8 samples of Topsoil and 3 samples of Made Ground Topsoil were analysed for arsenic only. Of these 11 samples, 7 had elevated concentrations above the Lithos Tier 1 value of 37mg/kg.
- 9.3.8 A slightly elevated concentrations of copper (130mg/kg) was identified in one sample of Topsoil.
- 9.3.9 One sample of Made Ground Topsoil identified an elevated concentration of lead (320mg/kg) along with Copper (460mg/kg) and Zinc (240mg/kg).
- 9.3.10 Elevated copper, lead and zinc were also identified in one sample of Colliery Spoil.
- 9.3.11 Copper and zinc are phytotoxic metals; phytotoxicity describes the inhibitive and toxic effect high concentrations of some substances can have on plant growth.
- 9.3.12 Most substances are harmful to human health at lower concentrations than would be detrimental to plant growth. However, there are three notable exceptions - boron, copper and zinc. Plants are the more sensitive receptor to these elements i.e. detrimental effects are seen in plants at concentrations which do not present a risk to human health. Consequently, for copper, consideration and protection of flora would also be protective of human health.
- 9.3.13 **Allowable concentrations of heavy metals in arable soils are set out in Defra's Code of Good Agricultural Practice 20091.** The value for copper is 100mg/kg with a value for zinc of 200mg/kg, based on a continued annual application of heavy metal rich fertiliser (sludge); as such it is not representative of activity in a standard UK garden.
- 9.3.14 Lithos have derived value for copper and zinc in relation to risks to human health, using the CLEA model, assuming a residential end use with consumption of home grown produce in a sandy loam soil with 6% SOM. The reported value for copper is 2,400mg/kg, circa twenty times greater than the potential phytotoxic concentration with the reported value for zinc of 2,170mg/kg, ten times greater.
- 9.3.15 On balance, given the context of a residential development and the relatively low concentrations recorded, copper and zinc are not considered significant.

- 9.3.16 Current UK guidance regarding the statistical analysis of soil contamination data obtained during a site investigation is provided by CL:AIRE¹, and uses two-way confidence intervals and graphical summaries, to assist assessors when determining whether or not a dataset is adequate to answer the question posed; e.g. "is existing site topsoil suitable for retention & re-use?". To answer such a question, it is necessary to recover and test a large number of samples (a minimum of 10; ideally 20+) in order to undertake meaningful statistical analysis.
- 9.3.17 The difference between the old and new approaches, including how Lithos apply the statistical assessment is detailed in Generic Note 04, included as Appendix A to this report.
- 9.3.18 Lithos can confirm that statistical assessment of Made Ground Topsoil, Ash & Clinker and Colliery Spoil is not appropriate because:
- Made Ground is considered too heterogenous
 - Sampling locations were clustered around a source area
 - There are insufficient samples to allow representative statistical assessment to be undertaken.
- 9.3.19 However, statistical assessment of Topsoil is appropriate because:
- There is a well understood, robust CSM which identifies possible source areas
 - Sampling locations are relatively evenly spread across the site and only random sample data has been included in the assessment
 - All targeted data has been removed from the data set and assessed separately
 - Samples are considered by strata type
 - A minimum of 10 samples have been taken from each strata
- 9.3.20 Statistical analysis assumes that a given stratum is reasonably homogenous in terms of composition, the distribution of contaminants and the degree of contamination; the CSM indicates that this is a reasonable assumption at this site.
- 9.3.21 The Dot and Box Plots are presented in Appendix J and the results are summarised below.

Topsoil

Contaminant	Critical concentration	Mean	Upper confidence level (95%)	Lower confidence level (5%)	Range of 'true' mean	Mean lies above critical concentration (Y/N)
Arsenic	37	41	47	36	21 - 71	Y
Copper	100	66	86	48	31 - 130	N

All concentrations are in mg/kg

Notes: Values in bold indicate that the true mean range exceeds the relevant Tier 1 value.

n/a = none of the samples retrieved from this made ground type yielded a concentration in excess of the relevant Tier 1 value.

- 9.3.22 Where there is 95% confidence or greater that the true mean concentration of a given contaminant within a particular soil type is less than the Tier 1 value, it can be concluded that the contaminant does not pose a significant risk to human health.
- 9.3.23 Elevated concentrations of arsenic were identified in 12 of 19 samples of Topsoil and 2 of 7 samples of Made Ground Topsoil.
- 9.3.24 Given that the Mean value for arsenic in topsoil is 41mg/kg, further analysis is required.

¹ CL:AIRE, 2020. Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration.

Arsenic bioaccessibility assessment

- 9.3.25 Laboratory analysis has indicated that concentrations of arsenic, in the topsoil proposed for use at the above site, are in excess of its Tier 1 value of 37mg/kg (for a residential, with plant uptake end use). Consequently, bioaccessibility analysis has been undertaken using a physiologically based extraction test (PBET).
- 9.3.26 The PBET assessment considers the bioaccessible fraction of arsenic within soils in the stomach and intestinal tract, and reports a gastric percentage value. The laboratory results are included within Appendix J to this letter, along with all CLEA inputs and outputs in Appendix K.
- 9.3.27 Before undertaking any bioaccessibility assessment it is important to understand the lines of evidence that support the assessment. Lines of evidence on this site have been described in the table below:

Line of evidence	Relevance	Site specific assessment
Source of the arsenic contamination	The arsenic compounds will be reflective of the source	Whilst the site was predominantly used for agriculture, it is adjacent to a former colliery and colliery spoil was reportedly stockpiled and spread across the centre of the site. Therefore, it is probable that elevated arsenic is present due to naturally occurring arsenic in colliery spoil extracted from the underlying coal measures which has subsequently been mixed with topsoil. It is not possible to identify the actual compound present as analytical techniques are not readily available. Given the absence of any recognised source this cannot be predicted or the significance assessed as a line of evidence. Therefore, laboratory analysis is required to determine the bioaccessible fraction.
Characterisation of material	A total of 4 bioaccessibility tests have been undertaken on samples that yielded the highest total arsenic concentrations	A total of 26 samples have been taken from the topsoil. These have all shown similar concentrations of arsenic and characteristic soil properties, i.e. pH & organic matter. Given the degree of sampling the topsoil has been well defined. Additionally, statistical analysis also confirmed these results can be assumed to be from the same sample population.
Soil properties & use	pH & Soil Organic Matter (SOM) can affect the bioaccessibility of arsenic, these can change post development.	Total Organic Carbon was recorded at 4% to 9% (average 5%, equivalent to SOM c. 6%). This is above the SOM considered for a good quality topsoil within CLEA. Arsenic can bind to organic carbon within soil and this can reduce the bioaccessible fraction. The soil had a typical reported pH of about 6.7%, and should not result in any increased bioaccessible fraction.

- 9.3.28 A key assumption of the calculation of any arsenic screening value is that 100% of the arsenic present in the soil is accessible to be absorbed by the digestive tract, i.e, 100% of the arsenic in the soil could be absorbed and metabolised in the body.
- 9.3.29 In reality, arsenic may either be strongly bound to the surface of the soil within the crystalline lattice of soil minerals, or be present in an insoluble form. Consequently, not all of the "total" arsenic identified within a soil sample may be in the bioaccessible or potentially harmful form.
- 9.3.30 The total concentration of arsenic detected within the bioaccessibility test results is consistent with concentrations detected on site i.e. concentrations exceeding 37mg/kg, with low bioaccessibility being recorded in gastro intestinal results (all below 1%).
- 9.3.31 The results indicate a maximum bioaccessible percentage of 1% which strongly supports the likely source being Colliery Spoil, where metals are bound within the matrix of the strata.

- 9.3.32 It is accepted however, that although bioaccessibility testing is considered the most appropriate test available for this assessment at present, there is still some variation and uncertainty associated with bioaccessibility testing, and consequently, Lithos usually assume a value which is 150% of the maximum bioaccessible percentage.
- 9.3.33 However, in this case as the gastric fraction is so low, we have assumed a bioaccessible fraction of 0.05% (500% increased on the reported value).
- 9.3.34 This bioaccessible fraction of 0.05%, has been input into the CLEA software (v 1.071) in site-specific mode to derive a Site Specific Screening Value (SSSV) of 140 to 376 mg/kg. The range in values reflects the incorporation, or not, of the Category 4 Screening Value (C4SL) revised land use and receptor exposure assumptions.
- 9.3.35 The bioaccessible fraction was only applied to the exposure from soil and direct contact pathways. The bioavailable² fraction of 1 proposed by the C4SL project was retained for ingestion of dust.
- 9.3.36 However, it should be noted that the inhalation assessment criteria, that includes potential risks from dust inhalation is 85mg/kg. As this value is lower than the oral site-specific value based on bioaccessibility, this lower value should be adopted as the screening value for the site and has been included in the contamination summary table below. Concentrations of arsenic in topsoil do however fall below 85mg/kg, which indicates the topsoil does not present a risk to future site users.
- 9.3.37 This assessment is only applicable to the reuse of topsoil on the site of origin, it is unlikely surplus topsoil could be used on a different construction site under direct transfer (see Section 14.4 below regarding the application of DoWCoP).
- 9.3.38 Elevated concentrations of arsenic were also recorded in samples of Colliery Spoil and this further supports the likelihood that contamination in the topsoil has arisen from mixing with Colliery Spoil.
- 9.3.39 Whilst bioaccessibility testing of Colliery Spoil has not been undertaken, as the likely source of arsenic, it can be considered highly plausible that the accessibility of arsenic in the Colliery Spoil will be similar to that recorded in the topsoil.
- 9.3.40 The concentration in Colliery Spoil does exceed the inhalation target concentration of 85mg/kg, but as Colliery Spoil would be below topsoil there is a very low likelihood of dust generation post construction. In this instance the oral site-specific target of 140 mg/kg (lower value) is considered more appropriate.
- 9.3.41 The mean concentration of arsenic in colliery spoil is 104mg/kg based on the 8 samples analysed.

² Bioavailability is the amount available at the target organ to cause an affect. Bioaccessibility is the amount that could be absorbed in the digestive tract. Assuming all available is absorbed and transported to the target organ this would represent a worse case assessment.

Summary of degree of soils contamination – Topsoil

Expl Hole	Depth (m)	Material	Concentrations in mg/kg unless otherwise stated. Results are quoted to 1 decimal place if <10, and whole numbers if >10. Trigger Level Concentrations are shown in BLUE and assume a residential with gardens end-use.															
			pH	As ∞	B ~	Cd ∞	Cr x	Cu ♣ \$	Pb ∞	Hg *	Ni	Se	Vn	Zn \$	% TOC	PAH		Asbestos I.D.
				**85	5	26	4000	100	200	199	109	434	584	200		B(a)P ∞	Naphthalene	
																	5	
TP01	0.1	Topsoil	6.9	21	<1.0	<1.0	15	31	63	<1.0	15	<3.0	-	74	4.2	0.2	<0.1	-
TP05	0.1	Topsoil	6.0	31	<1.0	<1.0	17	43	68	<1.0	13	<3.0	-	78	5.7	1.3	0.2	-
TP09	0.1	Topsoil	6.3	21	<1.0	<1.0	15	39	51	<1.0	18	<3.0	-	70	5.4	0.2	<0.1	-
TP10	0.1	Topsoil	6.1	36	<1.0	<1.0	19	40	80	<1.0	23	<3.0	-	97	5.3	0.5	<0.1	-
TP16	0.1	Topsoil	6.1	44	<1.0	<1.0	20	80	120	<1.0	26	<3.0	-	150	9.0	2.7	0.6	-
TP17	0.1	Topsoil	6.0	39	<1.0	<1.0	20	68	110	<1.0	21	<3.0	-	110	7.9	1.3	0.2	-
T1	0.1	Topsoil	-	44	-	-	-	-	-	-	-	-	-	-	-			N.D.
T2	0.1	Topsoil	6.3	71	0.7	0.4	<1.0	130	170	0.4	30	1.4	-	150	-			-
T3	0.1	Topsoil	-	53	-	-	-	-	-	-	-	-	-	-	-			N.D.
T9	0.1	Topsoil	-	40	-	-	-	-	-	-	-	-	-	-	-			-
T10	0.1	Topsoil	-	38	-	-	-	-	-	-	-	-	-	-	-			N.D.
T11	0.1	Topsoil	5.6	37	0.7	0.4	<1.0	76	110	0.3	19	1	-	140	-			-
T12	0.1	Topsoil	-	42	-	-	-	-	-	-	-	-	-	-	-			N.D.
T13	0.1	Topsoil	5.5	35	0.9	0.3	<1.0	60	78	0.1	16	1.2	-	110	-			-
T14	0.1	Topsoil	-	28	-	-	-	-	-	-	-	-	-	-	-			N.D.
T15	0.1	Topsoil	5.6	46	1.0	0.3	<1.0	56	82	0.2	15	0.7	-	100	-			-
T16	0.1	Topsoil	-	50	-	-	-	-	-	-	-	-	-	-	-			N.D.
T17	0.1	Topsoil	5.8	55	0.9	0.3	<1.0	100	150	0.4	24	0.8	-	120	-			-
T18	0.1	Topsoil	-	50	-	-	-	-	-	-	-	-	-	-	-			N.D.
T4	0.1	Made Ground Topsoil	-	33	-	-	-	-	-	-	-	-	-	-	-			-
T5	0.1	Made Ground Topsoil	5.8	55	0.6	0.5	<1.0	460	320	0.5	30	0.6	-	240	-			N.D.

Expl Hole	Depth (m)	Material	Concentrations in mg/kg unless otherwise stated. Results are quoted to 1 decimal place if <10, and whole numbers if >10. Trigger Level Concentrations are shown in BLUE and assume a residential with gardens end-use.															
			pH	As ∞	B ~	Cd ∞	Cr x	Cu ♣	Pb ∞	Hg *	Ni	Se	Vn	Zn \$	% TOC	PAH		Asbestos I.D.
				**85	5	26	4000	100	200	199	109	434	584	200		B(α)P ∞	Naphthalene	
T6	0.1	Made Ground Topsoil	-	28	-	-	-	-	-	-	-	-	-	-	-			N.D.
T7	0.1	Made Ground Topsoil	5.8	42	0.7	0.4	< 1.0	84	100	0.2	19	1.0	-	130	-			N.D.
T8	0.1	Made Ground Topsoil	-	30	-	-	-	-	-	-	-	-	-	-	-			-
TP11	0.3	Made Ground Topsoil	6.0	33	1.0	1.0	18	39	50	1.0	25	3.0	-	95	5.0	< 0.5	< 0.1	-
TP12	0.1	Made Ground Topsoil	5.7	15	1.0	1.0	15	31	38	1.0	21	3.0	-	65	4.0	< 0.1	< 0.1	-

Key		Source of Guidance Trigger Level	
36	Parameter tested for and found to be in excess of Tier 1 concentration	With the exception of those annotated with one of the symbols below (∞, \$, ~), all Soil Screening Values in brackets above have been derived using CLEA v1.06. Values assume contaminants located in a sandy loam, with 6% soil organic matter (SOM).	
179	Parameter tested for and found to be > 5 x Tier 1 concentration		
12	Parameter tested for but not found to be in excess of Tier 1 concentration	∞	Category 4 Screening Level – SP1010, December 2013 (CL:AIRE/Defra)
	Parameter not tested for	\$	Ministry of Agriculture, Fisheries & Food. Code of Practice for Agricultural Practice for the Protection of Soil. 1998
♣	Tier 1 Value is pH dependent	~	Engineering judgement (Lithos). Boron is a phytotoxic, although most phytotoxic compounds can pose a risk to human health if sufficient concentrations are present. However, plants represent the most sensitive receptor, and a Tier 1 value which is protective of flora is therefore also protective of human health.
x	Assumes Cr is CrIII. If demonstrated Cr is CrVI screen would be 21mg/kg		
*	Assumes mercury present as an inorganic compound (cf elemental metal or within organic compound). See Science Report SC050021/Mercury SGV.		
**	Site specific screening value derived for after bioaccessibility testing and risk assessment (dust inhalation)	N.D.	Not detected, applicable to asbestos I.D. screen only

Summary of degree of soils contamination – Made Ground (inorganics)

Expl Hole	Depth (m)	Material	Concentrations in mg/kg unless otherwise stated. Results are quoted to 1 decimal place if <10, and whole numbers if >10. Trigger Level Concentrations are shown in BLUE and assume a residential with gardens end-use.													
			pH	As ∞	B~	Cd ∞	Cr x	Cu♣\$	Pb ∞	Hg*	Ni	Se	Vn	Zn\$	CV	Asbestos
				**140	5	26	4000	100	200	199	109	434	584	200	2	
TP08	0.5	Ash & Clinker	5.9	79	1.0	1.0	18	55	79	1.0	20	3.0	-	59	1.3	N.D.
TP08	1.5	Ash & Clinker	5.2	72	1.0	1.0	21	59	95	1.0	21	3.0	-	61	1.9	N.D.
TP15	0.5	Ash & Clinker	7.0	29	1.0	1.0	16	70	140	1.0	23	3.0	-	87	7.7	N.D.
TP12	0.5	Colliery Spoil	6.2	10	1.0	1.0	11	31	26	1.0	24	3.0	-	56	1.4	N.D.
TT100A	0.5	Colliery Spoil	7.9	210	0.9	4.5	21	490	810	1.6	43	2.6	-	600	5.5	Chrysotile
TT100A	0.4	Colliery Spoil	5.6	100	0.5	0.2	14	43	44	0.2	15	1.0	-	49	-	N.D.
TT100B	0.6	Colliery Spoil	7.2	91	0.5	0.2	13	46	40	0.2	14	1.1	-	51	9.2	N.D.
TT100C	0.6	Colliery Spoil	5	100	0.5	0.2	12	40	31	0.2	13	0.8	-	39	-	N.D.
TT100D	0.6	Colliery Spoil	5.3	120	0.6	0.2	14	64	35	0.2	14	1.6	-	45	11	N.D.
TT100E	0.6	Colliery Spoil	5.4	100	0.5	0.2	12	40	37	0.2	15	1.1	-	42	-	N.D.
TT100E	0.8	Colliery Spoil	6	100	0.5	0.2	11	44	37	0.2	12	1.1	-	84	14	N.D.

Key		Source of Guidance Trigger Level	
36	Parameter tested for and found to be in excess of Tier 1 concentration	With the exception of those annotated with one of the symbols below (∞ , \$, ~), all Soil Screening Values in brackets above have been derived using CLEA v1.06. Values assume contaminants located in a sandy loam, with 6% soil organic matter (SOM).	
179	Parameter tested for and found to be > 5 x Tier 1 concentration		
12	Parameter tested for but not found to be in excess of Tier 1 concentration	∞	Category 4 Screening Level – SP1010, December 2013 (CL:AIRE/Defra)
	Parameter not tested for	\$	Ministry of Agriculture, Fisheries & Food. Code of Practice for Agricultural Practice for the Protection of Soil. 1998
♣	Tier 1 Value is pH dependent	~	Engineering judgement (Lithos). Boron is a phytotoxic, although most phytotoxic compounds can pose a risk to human health if sufficient concentrations are present. However, plants represent the most sensitive receptor, and a Tier 1 value which is protective of flora is therefore also protective of human health.
x	Assumes Cr is CrIII. If demonstrated Cr is CrVI screen would be 21mg/kg	**	Site specific screening value derived after bioaccessibility testing and risk assessment (oral ingestion)
*	Assumes mercury present as an inorganic compound (cf elemental metal or within organic compound). See Science Report SC050021/Mercury SGV.	N.D.	Not detected, applicable to asbestos I.D. screen only

Summary of the leachability testing

Expl Hole	Depth (m)	Material	Concentration in µg/litre unless otherwise Shown. Results are quoted to 1 decimal place if <10, and whole numbers if >10. Tier 1 Screening Concentrations are shown in BLUE.											
			pH	As ~	B *	Cd ~	Cr ~	Cu ~	Pb ~	Hg ~	Ni ~	Se *	Vn	Zn ~
				50	1	5	5	5	50	1	50	10		30
TP08	0.5	Ash & Clinker	5.9	0.6	0.1	0.3	1.0	3.4	0.3	0.1	26	0.5	-	96
TP08	1.5	Ash & Clinker	5.2	0.3	0.1	0.1	1.0	1.8	0.3	0.1	3.0	0.5	-	11
TP15	0.5	Ash & Clinker	6.0	6.9	0.1	0.1	2.0	17	2.0	0.1	2.0	0.6	-	7
TP12	0.5	Colliery Spoil	6.2	0.3	0.1	0.1	3.0	2.5	0.5	0.1	1.0	0.5	-	8

Key		Source of Guidance Trigger Level	
0.3	Parameter tested for but not found to be in excess of Tier 1 concentration	~	Directive (2000/60/EC) establishing a framework for Community action in the field of water policy (Water Framework Directive)
36	Parameter tested for and found to be in excess of Tier 1 concentration	*	Water Supply (Water Quality) Regulations 1989, as amended in 2000

Calorific value

- 9.3.42 The calorific value of three samples of Ash & Clinker and 5 samples of Colliery Spoil have yielded an average CV of 6.5 MJ/kg; maximum 13.5MJ/kg.
- 9.3.43 Materials whose CVs exceed 10MJ/kg are almost certainly combustible, while those with values below 2MJ/kg are unlikely to burn.

Asbestos

- 9.3.44 Screening for asbestos identified fibres (Chrysotile as bundles) in one sample of Colliery Spoil (TT100A, at 0.5m depth). Further analysis (asbestos quantification) yielded an asbestos concentration of 0.003%.
- 9.3.45 No fibres were detected in any of the remaining 10 samples of made ground screened or any of the 11 samples of Topsoil and Made Ground Topsoil.

Leachables

- 9.3.46 Of the leachability tests conducted on 4 samples of made ground, two samples of Ash & Clinker had concentrations of leachable zinc (96 µg/litre) and leachable copper (17 µg/litre) slightly above the maximum permissible concentrations as defined in the Water Supply (Water Quality) Regulations 1989, as amended in 2000.

Organic determinands

- 9.3.47 This site is essentially greenfield, although some made ground associated with the former Blacup Colliery was identified in the centre. Therefore for organic compounds, the Tier 1 Values used in this report have been derived with reference to a CSM that assumes a residential with gardens end use, with no clean soil cover will be placed in gardens/landscaped areas (Lithos Scenario A) where made ground exists.
- 9.3.48 Lithos have used the CLEA model to derive risk-based screening values for hydrocarbons, in accordance with the methodology detailed by the TPHCWG, and reviewed by a UK workshop of experts with respect to UK adoption of the method.
- 9.3.49 However, these screening values assume a Soil Organic Matter (SOM) of 6% (equivalent to a TOC of 3.5%). Many organic contaminants are more mobile when the SOM is lower, and consequently comparison of soil results with lower screening values may be required.
- 9.3.50 In order to check the validity of Lithos' Tier 1 Soil Screening Values, the average TOC for each common fill type (beyond any areas of obvious hydrocarbon impact) have been determined.

Fill type	Typical TOC (%)	Comparison of soil results with revised screening value necessary?
Ash & Clinker	>6%	No
Colliery Spoil	>4%	
Made Ground Topsoil	>4%	
Topsoil	>5%	

Polycyclic Aromatic Hydrocarbons (PAH)

- 9.3.51 There are numerous PAH compounds. The USEPA identified 16 PAHs that are considered to represent the most problematic in terms of toxicology, fate and behaviour. The UK have also focused on these 16 and these are included in the laboratory report where speciated PAH analysis has been scheduled.

9.3.52 Speciated PAH analysis has been undertaken in order to determine concentrations of the key "marker" compounds: benzo(a)pyrene (considered the most toxic of the PAHs); and naphthalene (the most mobile and volatile of the PAHs).

9.3.53 Speciated analysis has confirmed the absence of significant concentrations of both benzo(a)pyrene and naphthalene in the soils beneath this site.

10 CONTAMINATION (QUALITATIVE RISK ASSESSMENT & REMEDIATION)

10.1 Topsoil

10.1.1 Topsoil, typically 200mm thick, is present across the site, with Made Ground Topsoil present in the centre. Testing suggests this material is chemically suitable for re-use.

10.1.2 A single elevated concentration of lead (320mg/kg) was identified in one sample of Made Ground Topsoil, this result is almost certainly associated with an isolated fragment of foreign matter and not of significance.

10.1.3 Given the nature of the topsoil present on this site it would be expected to be suitable to support plant growth. However, no testing in accordance with BS3882 Specification for Topsoil has been undertaken to date.

10.2 Summary of significant contamination

10.2.1 No areas of significant organic contamination have been encountered during this ground investigation.

10.2.2 Made ground underlies about 0.2 ha of land in the centre of the site (see Drawing 1462/11). This made ground contains elevated concentrations of inorganic contaminants and is also considered potentially combustible with rare traces of asbestos fibres.

10.3 Revised conceptual ground model (contamination)

10.3.1 A revised Conceptual Site Model is presented as Drawing 1462/10 in Appendix B. The Model includes the contaminants described in Section 10.2 above, and potential contaminant linkages (summarised below in Section 10.5) to receptors.

10.4 Environmental setting & end use

10.4.1 As discussed in Section 10.2 above, contamination exists in the soil beneath this site. In order to assess the significance of this contamination, consideration must be given to the site's environmental setting and the proposed end use.

10.4.2 The underlying Coal Measures strata is classified as a Secondary A aquifer. The nearest surface watercourse, Blacup Beck, flows to the east along the northern boundary. Therefore, the site's environmental setting is considered to be of moderate sensitivity.

10.4.3 With respect to human health, the proposed end use (residential) is considered sensitive.

10.4.4 Transient risks to construction workers can be addressed by the adoption of appropriate health and safety measures, see Section 14.6.

10.5 Contaminant linkages

10.5.1 In terms of a proposed redevelopment of this site, plausible contaminant linkages can be summarised as follows.

Contaminants

10.5.2 Contaminants have been summarised in Section 10.2 above.

Pathways

10.5.3 Potential contaminant pathways include:

- Ingestion
- Dermal contact
- Inhalation of contaminated particulates
- Surface water run-off, including existing drainage infrastructure
- Downward infiltration of leachable/mobile contaminants to groundwater

Receptors

10.5.4 Potential contaminant receptors include:

- The environment - Blacup Beck, Secondary A aquifer
- End users of the site (residents)

10.5.5 It can be concluded that there are plausible pathways between the soil contaminants summarised in Section 10.2 above and potential receptors. Consequently, some remediation will be required; either treatment/removal of the contaminant, or "breakage" of the pathway.

10.6 Potential remediation options

General

10.6.1 Approval of the recommendations given below should be sought from the appropriate regulatory authorities prior to commencement of site redevelopment.

10.6.2 These recommendations should be reviewed once regrade proposals have been finalised.

Combustibility

10.6.3 The Colliery Spoil and the Ash & Clinker are considered combustible and, in accordance with current guidance, the following remediation measures should be adopted if it is left on site:

- Garden areas: isolate beneath a minimum 1,000mm thickness of inert soil, comprising 850mm of "clean" subsoil plus 150mm topsoil.
- Services: utility trenches (especially those carrying potential heat sources e.g. electric cables) should be cut oversize and backfilled with clean, inert material. This applies to any utility trenches that run beneath estate roads or extend under houses. It is strongly recommended that further advice be sought from all statutory service bodies with respect to the ground conditions within which they will lay services.
- Estate roads: no action required (although generally less than 1,000mm thick, the road construction is considered to provide adequate isolation as there will be no heat source). Local Authority Highways approval should be sought.
- Houses: no action required (the floor slab will include insulation and therefore heat transfer into the ground will be negligible). Local Authority Building Control and Warranty Provider approval should be sought.

10.6.4 As further mitigation against the risk of spontaneous combustion, the ash could be excavated, replaced in approximate 300mm thick layers, wetted and subjected to nominal compaction, comprising at least 2 passes with a towed vibratory roller of at least 2,900 kg per metre width. Compaction will help to prevent the material drying out and reduce the ingress of oxygen.

Asbestos

10.6.5 CL:AIRE has published a Joint Industry Working Group (JIWG) guidance³ document with the support of the Health & Safety Executive which provides an explanation of how legal requirements of the Control of Asbestos Regulations 2012 have been interpreted to be more directly applicable to the risks associated with asbestos contaminated soil and construction & demolition materials.

10.6.6 As discussed in Section 9.3, an asbestos ID (screen) was scheduled on 11 samples of made ground, with asbestos identified in one sample. Supplementary analysis (asbestos quantification) of this sample yielded only trace fibres (0.003%), slightly above the limit of measurement (0.001%).

10.6.7 Nonetheless, made ground soils with only a trace of asbestos still have the potential to be hazardous to human health. This is because soil with a low asbestos content of say 0.001% may contain thousands, possibly hundreds of thousands, of potentially respirable asbestos fibres per gram of soil. However, asbestos fibres only pose a risk if they are allowed to become airborne, and release from soil to air can only occur if the soil is dry and then agitated (e.g. by vehicle movement, excavation, wind etc).

10.6.8 Provided soils are kept damp the risk of airborne fibre release, even during disturbance associated with excavation, should be negligible, and certainly below the control limit (as set by the Control of Asbestos Regulations 2012) of 0.1 f/cm³ airborne fibres averaged over a 4-hour period.

10.6.9 In our experience, damp soils do not allow the release of asbestos fibres, even from soils that contain concentrations in excess of the hazardous waste threshold (0.1%).

10.6.10 There may be transient risks during the excavation of made ground soils. Exposure to asbestos of personnel involved in these excavation works is considered likely to be sporadic and of low intensity (provided soils are kept damp). Therefore in accordance with Regulation 3(2) of the Control of Asbestos Regulations (2012), exemption from Regulations: 9 (notification of work with asbestos); 18(1)(a) (asbestos areas); and 22 (health records and medical surveillance) should apply, provided it is 'clear from a suitable and sufficient risk assessment that the control limit of 0.1 f/cm³ airborne fibres averaged over a 4-hour period will not be exceeded'.

10.6.11 Nonetheless, risks must be mitigated by appropriate measures (principally damping down), working procedures, and PPE. Method Statements and Risk Assessments should be prepared by the Contractor, and then be reviewed by the Client and Lithos.

10.6.12 Any fragments of asbestos cement sheeting encountered during the excavation works, should be gathered by hand and placed in double sealed bags. Personnel involved in this activity must be equipped with an appropriate respirator (i.e. a FFP3 or better), in addition to their "standard" PPE. The bags of asbestos waste should be placed in a sealed skip for off-site disposal at a suitably licensed landfill site; such material will be classified as hazardous waste.

³ Control of Asbestos Regulations 2012: Interpretation for Managing and Working with Asbestos in Soil and Construction & Demolition materials: Industry Guidance. CL:AIRE, 2016.

- 10.6.13 Made ground where asbestos has been positively identified and considered representative of near-surface soils, should ultimately be isolated beneath a minimum 1,000mm thick surface cover of "clean" soil (garden/landscaped areas), or hardstand (parking areas), or floor slabs (buildings) and therefore there will be no risk of release of asbestos fibres from the ground.
- 10.6.14 Consequently, in line with the principles of sustainable development, there should be no need to export any soil from site.
- 10.6.15 New utilities should be laid in trenches reinstated with 'clean' backfill in order to prevent exposure to maintenance workers in the future.
- 10.6.16 See also comments in the 'Waste Classification' Section below.

Inorganic contamination (Made Ground)

- 10.6.17 Elevated concentrations of inorganic contaminants (arsenic, copper, lead and zinc) have been identified within the Made Ground underlying the centre of the site. Furthermore, the made ground is considered potentially combustible with trace asbestos fibres.
- 10.6.18 Therefore, where Made Ground remains beneath garden and landscaped areas (i.e. not beneath hardstanding), the proposed 1,000mm thick surface cover of "clean" soil will be sufficient to break potential pollutant linkages between the contaminated made ground and future end-users.
- 10.6.19 The approximate extent of the area requiring soil cover is shown on Drawing 1462/11.
- 10.6.20 Alternatively, the Made Ground is considered suitable for redistribution beneath concrete oversite or areas of hardstanding, where it would be satisfactorily isolated from end users.

Leachables

- 10.6.21 The slightly elevated concentrations of leachable copper and zinc are not considered significant given:
- Concentrations are only slightly elevated.
 - Extensive areas of hardstand, together with placement of 1,000mm clean soil cover in gardens will reduce surface water infiltration and as such the leaching of contaminants.
 - Underlying coal measures strata is classified as a Secondary A aquifer, with no significant groundwater abstractions at or within 250m of the site.

Organic contamination

- 10.6.22 No areas of gross organic contamination were encountered during the site works. However, localised areas of more onerous contamination than that identified to date may be present on site. If any buried drums, "oily", odorous, brightly coloured etc. materials are encountered, further advice should be sought from Lithos.

10.7 Summary of potential contaminant linkages & mitigation

10.7.1 In terms of the proposed redevelopment plausible contaminant linkages, and feasible remediation options, can be summarised as follows:

Receptors	Pathways	Contaminants	Plausible contaminant linkage? (and remediation options where required)
Human health (Future residents) ◇	Consumption of contaminated vegetables	Metals in the made ground	Made Ground: Isolation beneath at least 1,000mm clean soil cover in gardens and landscaped areas.
	Ingestion		
	Dermal contact		
	Inhalation (dust and/or vapours)		
Buildings	Migration & accumulation of explosive gas	Methane and Carbon Dioxide	Amber 1 protection measures required for all plots
	Contact with "aggressive soil and/or groundwater	Sulphate and oxidisable sulphides in the made ground.	Design Sulphate Class DS-3 , ACEC Classification of AC-2s , for sub-surface concrete in contact with the made ground. Design Sulphate Class DS-1 , ACEC Classification of AC-1 in natural soils.
Groundwater Blacup Beck	Surface water run-off	Metals, and leachable metals in the made ground	Made Ground: Isolation beneath at least 1,000mm clean soil cover in gardens and landscaped areas.

◇ transient risks to construction workers will be addressed by the adoption of appropriate health and safety measures in accordance with the Health and Safety at Work Act 1974 and regulations made under the Act including for example the COSHH Regulations.

10.8 Waste classification

10.8.1 Disposal of the made ground off site is generally not considered appropriate, economically viable, nor in line with current Government philosophy regarding sustainable development. However, some excess arisings may be generated by excavations for foundations, sewers etc. Disposal to landfill (or an appropriate soil / aggregate transfer station) may be the most practical solution, if redistribution and retention on site is not feasible.

10.8.2 Following excavation and stockpiling, sampling will be required prior to disposal.

10.8.3 As there is no WRAP protocol for soils, the characterisation, sampling and classification of soils arising from brownfield sites has been incorporated within the Environment Agency's Technical Guidance WM3⁴. Classification of soils as non-hazardous or hazardous in accordance with WM3 is quite a complex process, although it ultimately results in a simple classification as hazardous or non-hazardous. Note: inert is not a class under WM3; WAC testing is required to determine whether a waste soil can be considered inert.

10.8.4 If waste soil is classed as hazardous following classification under WM3, and destined for landfill, waste acceptance criteria (WAC) leachate testing will need to be undertaken. Similarly, if waste soil destined for landfill is classed as non-hazardous under WM3, and suspected to be inert, WAC leachate testing will need to be undertaken. However, non-hazardous soil waste can go to a non-hazardous landfill facility; no further testing (e.g. WAC) is required.

⁴ Technical Guidance WM3 – Guidance on the classification and assessment of waste. Environment Agency 2015

- 10.8.5 WAC analysis is different to the 'routine' laboratory testing (such as that included earlier in this Section) undertaken in order to determine hazardous properties. Lithos typically only include WAC analysis if significant off-site disposal (of soil classified as hazardous waste) is anticipated.
- 10.8.6 It is critical if material is to be exported from site that this is allocated an appropriate waste code, following the steps within WM3. Waste carriers transporting, and sites accepting, this material should have a corresponding code within their permits. It is the responsibility of those generating the waste (i.e. the Developer), to ensure that the waste is handled and disposed of appropriately.
- 10.8.7 Soil treatment facilities (STFs) provide an alternative to landfill. STFs are regulated by the Environment Agency and allow soils to be treated and screened (effectively recycled to be used at other sites). Export to an STF does not require WAC testing and suitability of various soil types will be dependent on material waste codes, which may be allocated after consideration of the data in Section 10 but will often need supplementing with further testing after soils have been stockpiled (see also advice in Section 14.3).
- 10.8.8 Most STFs are permitted to accept soils with waste code 17 05 04 (i.e. soils which do not exhibit hazardous properties). Lithos has a list of permitted STFs and can help identify one local to this development site.
- 10.8.9 With respect to **asbestos**, waste soils will be classed hazardous if the soil mass contains more than 0.1% asbestos fibres that are free and dispersed. However, WM3 states that where the waste contains identifiable pieces of asbestos (i.e. any particle of a size that can be identified as potentially being asbestos by a competent person if examined by the naked eye), then the waste is hazardous if the concentration of asbestos in the pieces alone is 0.1%. If a stockpile of soil contained rare fragments of broken asbestos-cement sheeting, the whole stockpile would be classed as hazardous unless all the fragments could be picked-out (even though the concentration of asbestos in the soil mass might be orders of magnitude less than 0.1%).

11 HAZARDOUS GAS

11.1 General

- 11.1.1 Consideration of the conceptual site model and potential linkages has enabled a preliminary qualitative assessment of risks associated with gas:

Source	Receptors	Hazard	Pathway	Initial risk
On-site made ground	Human health	Asphyxiation & explosion	Vertical migration, ingress & accumulation	Low: made ground essentially inert, with little degradable matter
	Buildings	Explosion		
Off-site landfill	Human health	Asphyxiation & explosion	Lateral migration, ingress & accumulation	Low: natural strata to at least 5m depth are generally of low permeability
	Buildings	Explosion		
Shallow mineworkings	Human health	Asphyxiation & explosion	Vertical migration, ingress & accumulation	Moderate: recorded workings at relatively shallow depth with two mine entries shown on site
	Buildings	Explosion		

- 11.1.2 Given the above, gas monitoring wells were installed in 6 boreholes across the site. Details of the installations are given on the probehole logs presented in Appendix G to this report.

11.1.3 The generation potential of the gas source was initially considered to be Moderate, but this was revised to Low in light of the initial monitoring results obtained. Consequently, in accordance with CIRIA Report C665, given the proposed residential end use, 6 visits have been scheduled over a 3-month period.

11.2 Scope of works

11.2.1 The wells have been monitored on 6 occasions between 6th September and 27th November 2012 for groundwater levels and soils-gases, and the results are presented in Appendix M.

11.2.2 A standard procedure was followed, in accordance with CIRIA guidance:

- Ambient oxygen concentration
- Atmospheric temperature & pressure
- Methane, oxygen and carbon dioxide concentrations and flow rates using a Gas Data GFM436 infra-red gas analyser
- Standing water level using a dipmeter
- Ambient oxygen concentration (check for instrument drift)

11.3 Monitoring results

11.3.1 The results of the monitoring completed to date are summarised below.

Well	Response zone	Range of methane concentrations (% v/v)	Range of carbon dioxide concentrations (% v/v)	Range of steady flow rates (litre/hour)
PH2	Coal, Sandstone & Mudstone (2.0m to 12.0m)	0.0	0.0 to 2.4	0.0 to 0.7
PH4a	Coal & Sandstone/Mudstone (1.0m to 3.0m)	0.0	0.0 to 2.4	0.0 to 8.5
PH7a	Sandstone/Mudstone (1.0m to 3.0m)	0.0	0.0 to 6.8	0.0 to 0.6
PH8a	Made Ground (1.0m to 3.0m)	0.0	0.0 to 4.6	0.0 to 0.9
PH9a	Sandstone/Mudstone (2.0m to 6.0m)	0.0	0.0 to 1.7	0.0 to 0.4
PH10a	Mudstone (1.0m to 3.0m)	0.0	0.0 to 5.1	0.0 to 0.8

Notes: Atmospheric pressures varied between 981mb and 1009mb.

In accordance with the DETR approach, a default value of 0.1 litres/hour has been used in the absence of any recorded flows; i.e. the limit of detection of the flow rate equipment.

Values in bold exceed steady concentrations of carbon dioxide for the CS2 lower threshold (5%)

11.4 Current Gas Regime

11.4.1 Generic Note 05 in Appendix A outlines how monitoring results are interpreted.

11.4.2 The proposed residential development comprises low rise residential housing. Consequently, the gas regime has been characterised in accordance with the Situation A (Wilson & Card) methodology outlined in CIRIA Report C665 and BS8485:2015+A1:2019.

11.4.3 Based on worst-case (peak) gas concentrations and flows, Gas Screening Values (GSVs) for Methane and Carbon Dioxide are 0.0 and 0.6 respectively. These GSVs equate to Characteristic Situation 2.

11.4.4 Steady concentrations of carbon dioxide have been recorded slightly in excess of the CS₂ threshold (5%) in two boreholes on only three occasions, and are therefore not considered "Typical Maximum Concentrations". However, regular occurrences of depleted oxygen concentrations (often around 13% to 16%) were recorded in all of the boreholes.

11.4.5 Consequently, on the basis of GSVs derived from peak concentrations at steady flows (GSV for Carbon Dioxide of 0.6), a classification of CS₂ is considered appropriate given the nature of the source (shallow mine workings) and the results of the monitoring.

11.5 Scope of Protection Measures

11.5.1 Based on the site characterisation discussed above, the proposed foundation solution, and with reference to the gas protection "scoring" system outlined in BS8485:2015+A1:2019, Lithos consider that the following protective measures should be incorporated in all new buildings:

Charac. situation (Wilson & Card, '99)	Gas "score" req'd by BS8485	Protective measures		
		Floor slab (BS8485 "score")	Sub-floor ventilation (BS8485 "score")	Membrane
				Type (BS8485 score)
2	3.5	<p>Select one from: Block & Beam – (0). Reinforced ground bearing slab – (0.5). Reinforced, cast in-situ suspended slab (with minimal and suitably sealed service penetrations & joints) – (1.5). Reinforced ground bearing raft (with limited service penetrations cast into slab). Note: the venting area through any downstand beam should be 3 times greater than that provided by the side ventilation (air bricks) – (1.5).</p>	<p>Select one from: Passive sub-floor ventilation; venting layer could be: A min. 150mm clear void (2.5), or A proprietary void former providing an equivalent clear void depth of 60mm; see Section B7 in BS8485 (2.5), or Min. 300mm thick blanket of min. 20mm single size rounded or sub-angular gravel (1.0). Min. ventilation = 1,500 mm²/m run of external wall (via air bricks on each of 2 opposite sides), with 100mm pipes at 1.75m centres or honeycombing of any sub-floor sleeper walls.</p>	<p>Gas resistant membrane meeting all of the following criteria:</p> <ul style="list-style-type: none"> sufficiently impervious to gases with a methane gas transmission rate <40.0 ml/day/m²/atm (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method); sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions; sufficiently strong to withstand in-service stresses (e.g. settlement if placed below a floor slab); sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc); capable, after installation, of providing a complete barrier to the entry of the relevant gas; a minimum 0.4 mm thickness (1600g polyethylene) reinforced membrane (virgin polymer); and verified in accordance with CIRIA C735[∞] (2.0)

Footnotes:

- [∞] In accordance with CIRIA C735, a Verification Plan should be prepared which outlines the activities (inspection and testing), the relevant personnel, and the type of records to be collected. Gas membranes need to be visually inspected to establish possible damage. Inspection & verification should be carried out by an independent third party. The verifier should be competent, experienced and suitably trained.
- Building Types are defined in Table 3 and Section 7 of BS8485:2015+A1:2019. B = Property with central building management control of structural alterations, but not building maintenance. C = Property with central building management control of structural alterations and building maintenance. D = Industrial building with well ventilated, large internal space(s).
 - A combination of two or more of the three types of protection measures (slab, ventilation & membrane) should be used to achieve the BS8485 score.

3. The membrane should be continuous across internal walls & the cavity, and there should be a cavity tray in external walls.
4. In all cases there should be minimum penetration of floor slab by services; any penetrations should be suitably sealed.

11.5.2 In general accordance with CIRIA⁵, YALPAG guidance⁶ and NHBC guidance⁷ a Gas Protection Strategy and Verification Plan (Design Report and Construction Drawings) should be prepared which detail site specific requirements for the gas protection system with respect to the development.

11.5.3 This should address how the gas protection measures will be installed and what verification information will be provided to demonstrate the installation has been carried out in accordance with the appropriate guidance. As a minimum the report should include (but not be limited to):

- A summary of the gas risk assessment.
- The gas protection measures proposed and confirmation they will meet the gas protection requirements for the lifetime of the development.
- Technical drawings showing how the gas protection measures will be incorporated.
- Formal qualifications/experience/training of the person carrying out the installation.
- Formal qualifications/experience/training of the person carrying out the verification.
- Clear demonstration of the independence of the person carrying out the verification.
- **The manufacturer's specification of the gas protection membrane to be used.**
- Full details of what the verification process will comprise and at what stage verification will be carried out.
- Details of how any non-conformance will be dealt with.
- Details of the number of plots to be validated.
- Timeline of when during the build, each of the gas protection measures will be installed.
- Details of management measures proposed to ensure how damage to the membrane will be prevented prior to the floor being installed, post installation.
- Details of how all site personnel (including follow-on trades) will be made aware of the presence of the membrane and that damage to the membrane must be prevented.
- Details of the extent of overlap and method of sealing.

11.5.4 BRE/Environment Agency Report BR 414 (2001) – “*Protective Measures for housing on gas-contaminated land*” provides a practical guide to good practice for the detailing and construction of passive soil gas protection measures for new residential development. Of particular relevance are a list of ‘Watchpoints’, which offer practical information for installation and buildability.

11.6 Radon

11.6.1 Requirements with respect radon measures are set out in Building Regulations Approved Document C. Probability bandings (based on the proportion of properties in a given area that exceed the Action Level; currently 200 Bq.m⁻³) are used to determine whether a property requires no, basic or full measures.

11.6.2 At present Approved Document C advocates basic measures for the probability banding 3% to 10% (full measures if >10%). However, the UK Health Security Agency (HSA) would like to see all new build include basic measures.

⁵ *Good practice on the testing and verification of protection systems for buildings against hazardous ground gases.* CIRIA C735, 2014.

⁶ *Verification Requirements for Gas Protection Systems - Technical Guidance for Developers, Landowners and Consultants.* Yorkshire and Lincolnshire Pollution Advisory Group, December 2016.

⁷ *Hazardous ground gas – as essential guide for housebuilders.* NHBC Foundation, April 2023

- 11.6.3 In December 2022, the British Geological Survey (BGS), deployed a revised dataset which increased accuracy and also the number of properties falling within radon affected areas. This revised dataset is now referenced by maps on the HSA website.
- 11.6.4 The HSA website indicates that the site is in an area where **between 1% and 3%** of homes are estimated to be above the action level.
- 11.6.5 Consequently, basic radon protection measures are not required. However, provision of the CS2 gas protection measures outlined above meets the requirement for basic radon protection.
- 11.6.6 in light of HSA advice, the Developer should consider providing all new dwellings with basic radon protection measures.

12 GEOTECHNICAL TESTING

12.1 General

- 12.1.1 A total of 9 samples of natural soil were delivered to a suitably accredited laboratory with a schedule of geotechnical testing drawn up by Lithos.
- 12.1.2 The geotechnical laboratory test results are presented in Appendix L to this report.

12.2 Atterberg limits

- 12.2.1 The plasticity indices of 8 samples of cohesive soil have been determined; results are summarised below.

Soil type	No. samples tested	Moisture content range % (average)	Range of Plasticity Indices % * (average)	Shrinkability
Cohesive Residual Soils (Clay)	8	17-32 (22)	10-43 (26)	Medium to high

* Modified where appropriate in accordance with Chapter 4.2 of the NHBC Standards

Note. The term Shrinkability is equivalent to the term Volume Change Potential used in Chapter 4.2.

- 12.2.2 Only two of the samples recorded a modified PI slightly in excess of 40%. As such, for the purposes of foundation design, it is recommended that all cohesive soils be regarded as being of **medium** shrinkability.

12.3 Soluble sulphate and pH

- 12.3.1 In accordance with BRE SD1⁸, this site has been classified as brownfield with a mobile groundwater regime.
- 12.3.2 It is envisaged foundations will extend to depths of about 1m through made ground and natural strata and samples taken from this depth range have been submitted for pH and water-soluble sulphate (2:1 soil/water extract).
- 12.3.3 The concentrations of sulphate in the aqueous natural soil extracts of 8 samples were determined. In addition, 4 samples of made ground were tested as part of the contamination suite. The pH value of each sample has also been determined.

⁸ BRE Special Digest 1 (2005) – Concrete in aggressive ground.

12.3.4 The highest water-soluble sulphate concentration and the lowest pH value for each soil type analysed are shown in the table below.

Soil type	No. samples tested	Lowest pH values	Highest soluble sulphate concentration (mg/l)
Ash & Clinker	1	7.0	<0.1
Colliery Spoil	3	5.2	0.1
Cohesive Residual Soils	8	4.9	<0.1

12.3.5 In addition, a further 7 samples of made ground were tested for Total Sulphate and Total Sulphur due to the potential for sulphides (e.g. pyrite) within the Colliery Spoil. The results are summarised below.

Soil type	Sample	Total Sulphur (TS % S)	Total Sulphate (AS % SO ₄)	Total Potential Sulphate (TPS% SO ₄)	Oxidisable Sulphides (OS as % SO ₄)
Colliery Spoil	TT100A @ 0.5m	0.3	0.4	0.8	0.4
Colliery Spoil	TT100A @ 0.4m	0.4	0.7	1.2	0.6
Colliery Spoil	TT100B @ 0.6m	0.4	0.6	1.1	0.5
Colliery Spoil	TT100C @ 0.6m	0.4	0.6	1.1	0.5
Colliery Spoil	TT100D @ 0.6m	0.4	0.6	1.3	0.7
Colliery Spoil	TT100E @ 0.6m	0.5	0.7	1.4	0.7
Colliery Spoil	TT100E @ 0.8m	0.5	0.7	1.4	0.7

Notes: Total Potential Sulphate, TPS% SO₄ = 3 x TS % S
Oxidisable Sulphides, OS as % SO₄ = TPS% SO₄ – AS% SO₄

12.3.6 Concentrations of Oxidisable Sulphides are typically around 0.6%. BRE Special Digest 1:2005 states that where Oxidisable Sulphides are greater than 0.3% then pyrite is probably present.

12.3.7 Consequently, in accordance with Tables C1 and C2 of SD1, sub-surface concrete in contact with the made ground should be Design Sulphate Class **DS-3**, ACEC Classification of **AC-2s**, with the remainder of the site Design Sulphate Class **DS-1**, ACEC Classification of **AC-1**.

12.4 Undrained shear strength testing

Hand shear vane testing

12.4.1 Hand shear vane testing was undertaken within trial pits in-situ to around 1.2m depth and from larger blocks of excavated clay below that depth.

12.4.2 The results are summarised within the table below and typically show an undrained shear strength (Su) of at least 60kPa, typically >90kPa.

12.4.3 The table below provides a summary of undrained shear strengths.

Strata	Range of Hand Vane readings (kPa)	Strength term	Remarks
Cohesive Residual Soil (Clay)	60 to 130 (92 avg.)	Medium to High Strength	Majority of results suggest High Strength clays

13 GEOTECHNICAL ISSUES

13.1 Conceptual site model

- 13.1.1 A Geological Cross Section is presented as Drawing 1462/9, with a revised Conceptual Ground Model presented as Drawing 1462/10.
- 13.1.2 Made ground is restricted to the centre of the site, in the area of a topographic 'bulge' (see Drawing 1462/11), associated with a former colliery worked during the late 19th century (Blacup Colliery). The made ground is up to 3.4m thick and deepens northwards.
- 13.1.3 Natural strata typically comprise Cohesive Residual Soils (completely weathered bedrock) recovered as gravelly clay.
- 13.1.4 Bedrock was encountered at between 0.9m & 3.3m depth in the majority of holes and comprised Mudstone, Sandstone, and Siltstone.
- 13.1.5 At least four coal seams are shown to outcrop across the site although these were not exposed during trial pitting.
- 13.1.6 A geological fault is shown in the northeast, trending northwest to southeast with a downthrow to the northeast.

13.2 Mining & quarrying

- 13.2.1 The majority of the site is located within a Coal Mining Development High Risk Area.
- 13.2.2 As discussed in Section 4.3, a Coal Authority abandonment plan shows Blacup Colliery in the centre of the site. Associated mineworkings in the Shertcliffe coal are shown to extend across almost all of the southern half of the site (see Drawing 1462/7) extending beyond the western boundary. The annotation "exhausted" suggests a high degree of extraction. The abandonment plan shows 'old workings' to the north of Blacup Colliery that likely extend to the outcrop of the Shertcliffe coal.
- 13.2.3 The abandonment plan also shows two mine entries (adit & air shaft) in the centre of the site.
- 13.2.4 Consequently, an intrusive mining investigation, comprising 19 rotary probeholes together with trenching to locate the mine entries has been completed; see Section 8.8. The probeholes were drilled to depths of between 12m and 30m to check for the presence of mine workings.

Mine Entries

- 13.2.5 Proposals to treat the mineworkings and shafts will need to be discussed with both the Local Authority (most notably Highways), the Coal Authority and NHBC well in advance of starting works on site.
- 13.2.6 The mine entries encountered at this site should be made safe by treatment in accordance with an appropriate Specification (Lithos can prepare this) and a Coal Authority Permit to Enter or Disturb Coal Authority Mining Interests.

Adit

- 13.2.7 The adit was encountered in TP12 with deep Colliery Spoil recorded to 3.4m depth. TPs 13 & 14, excavated immediately to the west and east of TP12, encountered shallow natural strata.

13.2.8 Treatment of the known adit will be required with excavation until there is at least 3m of competent cover above its roof. The entry should then be sealed with a masonry/concrete wall, and the resultant excavation backfilled.

Shaft

13.2.9 The shaft is assumed to be deep (>50m) based on the section provided on the CA abandonment plan, but there should be no need to investigate the nature of backfill by drilling provided the shaft is capped at rockhead.

13.2.10 The Coal Authority (and NHBC) discourage development over or adjacent to shafts regardless of treatment. The recommended no build zone is usually defined by a line drawn up at 45° from the top of the shaft, where it intercepts rock head.

13.2.11 It is recommended that any proposed development layout takes account of the location of the shaft and adit.

13.2.12 The possibility of further, unrecorded mine entries cannot be discounted. Unrecorded mine entries such as 'bell pits' may be present.

13.2.13 It is possible that unrecorded "shallow" shafts (possibly bell pits) may be present at this site, most notably to the north where the depth to coal is shallow near outcrop and 'old workings' are labelled on the CA abandonment plan.

13.2.14 Consideration should therefore be given to a geophysical survey, although success would be dependent on the "contrast" between shaft backfill and the surrounding ground (i.e. the survey is likely to be more successful if shaft backfill is significantly different material or less dense than the surrounding ground). Follow-up intrusive investigation (pitting) would be recommended to determine the cause of any anomalies identified by the geophysics.

13.2.15 A topsoil strip could also be considered and will be required anyway across the proposed build footprints prior to construction. Proposals to treat the mineworkings and shafts will need to be discussed with both the Local Authority (most notably Highways), the Coal Authority and NHBC well in advance of starting works on site.

Shallow mineworkings

13.2.16 CIRIA SP32⁹ suggests voids resulting from mineral extraction are unlikely to migrate more than 10 times the seam thickness through competent bedrock. CIRIA C758D¹⁰ notes that the use of this 10 times 'rule-of-thumb', as the design basis for treatment depth, has been observed to be successful over many years for a wide range of mineworkings and overlying rock/soil strata scenarios. However, consideration must always be given to site specifics such as nature of roof strata, strata dip, groundwater, extraction ratio etc.

13.2.17 Mitigation against the risk of subsidence associated with the shallow mineworkings will be required across <15% of the site's total area, as shown on Drawing 1462/12 in Appendix B. This will likely involve consolidation by drilling and grouting, although consideration could also be given to coal extraction (see Section 14.7).

13.2.18 Based on the findings of this investigation and the anticipated nature of the workings, it is considered that the necessary consolidation (grouting) would require drilling holes on a 3m grid. A viscous grout composed of appropriate proportions of OPC, PFA, sand or pea gravel would then be injected into the workings via these holes.

⁹ CIRIA SP32 (1984) - Construction over abandoned mine workings

¹⁰ CIRIA C758D (2019) - Abandoned mine workings manual

- 13.2.19 Further holes would need to be drilled in areas of high grout take (to confirm filling of void space), and in areas where several adjacent holes encountered solid coal (to confirm that the local area is underlain by no workings, rather than pillars).
- 13.2.20 Drilling and grouting operations should be carried out with engineering supervision and be undertaken in accordance with a revision of Lithos' "General Specification for the Treatment of Shallow Mineworkings" tailored to the site-specifics.
- 13.2.21 If bell pits are present, given the likely depth constraints, it seems likely they will be limited to the north of the existing farm access track near to the conjectured outcrop of the Shertcliffe seam; perhaps <5% of the total site area.
- 13.2.22 Drawing 1462/12 shows the anticipated extent of workings requiring treatment based on review of the CA abandonment plan and the exploratory hole logs (area of around 3,000m²). However, further proof drilling should be undertaken immediately beyond the area of known workings (further area of around 4,000m²) to prove the absence of unrecorded workings given localised faulting, CA records and access restrictions at the time of the investigation works.
- 13.2.23 Whilst the Coal Authority (and NHBC) discourage development over or adjacent to all mine entries, Lithos consider such features to pose a low risk to surface stability where they only extend to relatively shallow workings that require treatment (grouting). Consequently, we would not expect any (previously unrecorded) shallow shafts, encountered during site preparatory works and/or the subsequent construction phase, to result in the need for "no-build" zones and/or revision of the planning-approved layout although Newett Homes may choose to do this.
- 13.2.24 However, where build over a shaft(s) is proposed, the developer will need to discuss proposed treatment (which is likely to include both grouting of the shaft backfill, and a cap at rockhead) and bespoke foundation design, by a suitably qualified Structural Engineer, with the Coal Authority. A Permit to Enter or Disturb Coal Authority Mining Interests will be required prior to construction of any shaft cap.
- 13.2.25 Proposals to treat the mineworkings and shafts will need to be discussed with both the Local Authority (most notably Highways), the Coal Authority and NHBC well in advance of starting works on site.
- 13.2.26 Any shafts encountered during the development of this site should be made safe by treatment in accordance with an appropriate Specification (Lithos can prepare this) and a Coal Authority Permit to Enter or Disturb Coal Authority Mining Interests.

13.3 Site regrade and/or ground improvement

- 13.3.1 Given existing topography (much of the site is steeply sloping, with gradients of up to 1 in 6 in the south and a steep embankment adjacent to the existing farm access), some site regrade is anticipated, with the need for underbuild and retaining walls considered likely.
- 13.3.2 Careful consideration will need to be given to earthworks design, and implications for slope stability, retaining walls, foundations, highway gradients and drainage.
- 13.3.3 Re-grade should also consider the requirement for clean soil cover in garden and landscaped areas (see Section 10, together with Drawing 1462/11 in Appendix B) which will result in higher levels than those of existing.
- 13.3.4 Any digital terrain modelling undertaken, or commissioned, should consider implications for the foundation recommendations outlined below.

- 13.3.5 Natural ground underlying this site is often clayey, therefore consideration should be given to the implication of undertaking earthworks in poor/wet weather when the ground surface is likely to become difficult to cross with heavy machinery.
- 13.3.6 Wherever possible, Lithos recommend that excavated soils are retained on site. However, if this is not possible the comments in Section 10.8 should apply.

13.4 Foundation recommendations

General

- 13.4.1 It is understood that consideration is being given to redevelopment of the site with 2 to 3 storey domestic dwellings, associated gardens, POS and adoptable roads and sewers.
- 13.4.2 Foundation recommendations assume that development will be two or three storey construction and that line loads will not exceed 90kN/m run. If this is not the case significant alteration to these recommendations will be required.
- 13.4.3 We have assumed that final development levels will not differ significantly from ground levels existing at the time of investigation. Any digital terrain modelling undertaken, or commissioned, by Newett Homes should consider implications for the foundation recommendations outlined below.
- 13.4.4 Made ground is not considered a suitable foundation material and foundations should therefore be taken through these materials into underlying natural strata of adequate bearing capacity.
- 13.4.5 A suspended floor construction should be used wherever the depth of made ground or infill beneath a plot exceeds 600mm. This is likely to affect plots located in the centre of the site, although post regrade other plots may be affected.
- 13.4.6 Sub-surface concrete in contact with the made ground should be Design Sulphate Class DS-3, ACEC Classification of AC-2s, with the remainder of the site Design Sulphate Class DS-1, ACEC Classification of AC-1.

Strip/trench fill footings

- 13.4.7 It is considered that shallow strip or deepened trench fill footings will be the most suitable foundation solution for the majority of two or three storey houses constructed at the site. This solution is viable where the made ground is less than about 2.5m thick, and firm clay or competent rock is the founding material.
- 13.4.8 Reinforcement, as a precaution against differential settlement, is recommended only where foundation excavations encounter significant lateral and vertical variations in strata. One layer of B385 mesh placed 75mm above the base of the footing is likely to provide suitable reinforcement, but further advice should be sought from the Structural Engineer.
- 13.4.9 Where underlying coal workings are present at shallow depth, even after consolidation, foundations should be "beefed-up" to accommodate any potential time dependant differential settlement.

13.4.10 Further advice regarding reinforcement should be sought from the appointed Structural Engineer, but in the meantime reference should be made to the table below.

Rock cover above grouted seam	Preferred Foundation
<5 x seam thickness ¹¹	Raft - designed to span 3m over potential soft spots and cantilever 1.5m at corners. Either stiffened, flat-bottomed rafts a minimum of 300mm thick, on 450mm of compacted Type 1 material, with reinforcement top and bottom. Or, rafts could be of 300mm concrete with a 150mm upstand to allow for wall construction provided that the base of compacted type 1 material lies at a depth of at least 600mm
>5 x seam thickness and <10m	Strip footing OK, but thickened (300mm), and reinforced top and bottom
>10m	Strip footing OK, but needs to be 300mm thick reinforced with one layer of mesh

13.4.11 Foundations will be required to be placed below a line drawn up at 45° from the base of any service or similar excavation.

13.4.12 Deepened foundations should be stepped in accordance with NHBC Standards, Chapter 4.3.

13.4.13 In order to minimise softening and swelling of cohesive soils or loosening of granular soils, it is recommended that footings are cast as soon as formation level is reached (or alternatively formation could be blinded using concrete with as low a water:cement ratio as possible).

13.4.14 Newett Homes or their groundworker should seek further advice from Lithos if unexpected ground conditions are encountered in foundation or sewer excavations, including any conflict between soft ground associated with a backfilled trial pit excavation and the line of a proposed footing.

Cohesive Residual Soils (clay)

13.4.15 Atterberg tests suggest that natural cohesive soils at the site are of medium shrinkability. A minimum founding depth of 900mm (not accounting for any existing or proposed vegetation) is therefore required for all soils on the site where strip footings are proposed.

13.4.16 In accordance with NHBC Standards, founding depths in cohesive soils should be taken from original or finished ground level, whichever is the lower, to the underside of the footing.

13.4.17 Foundations should be deepened near trees in accordance with NHBC Standards Chapter 4.2. It is estimated that up to 20% of the site may be affected by trees.

13.4.18 The Cohesive Residual Soils (completely weathered bedrock) is generally considered to have a safe bearing capacity of at least 150kN/m².

13.4.19 A safe bearing capacity of at least 150kPa, allowing a maximum foundation line load of 90kN/m run, can be assumed if the following are true

- A foundation length of 8m
- A foundation breadth of 0.6m
- A foundation thickness of 225mm
- A foundation depth of 0.9m depth
- An undrained shear strength of 60kPa for the firm clay (typical minimum recorded on site)

¹¹ See s5.6 of *Structural Foundations Manual* (M F Atkinson) 2nd Ed.

13.4.20 Assuming the foundation geometry detailed above, minimum settlements would be anticipated. This is considered likely to be acceptable, however, further advice should be sought from the Structural Engineer responsible for foundation design.

Bedrock

13.4.21 The Coal Measures bedrock is generally considered to have a safe bearing capacity of at least 250kPa and minimal settlements would be anticipated.

13.4.22 Where rock is encountered at shallow depth foundations should be placed entirely on rock and not partially on rock and partially on soil. This may, depending on surface gradient, necessitate significant deepening of foundations.

13.4.23 Where in-situ mudstone is encountered at founding depth (minimum of 450mm), it will provide a suitable founding stratum for two or three storey dwellings, and need only be penetrated by the proposed foundation thickness. Note: any overlying residual soil (typically clay with gravel-sized lithorelicts of mudstone) is likely to be a shrinkable soil; mudstone is not.

Piled foundations

13.4.24 Piled foundations may be an option for dwellings constructed in areas of deeper made ground (centre of site). The depths of made ground post site regrade should be reviewed prior to redevelopment to determine the need for piled foundations.

13.4.25 The following general comments relating to piling are provided for guidance, and further advice should be sought from a specialist-piling contractor.

13.4.26 Should any impenetrable shallow obstructions be encountered, i.e. boulders etc, they should either be grubbed-up, or alternatively the piling layout could be re-designed (although this might also require design of foundations able to span and/or cantilever as necessary).

13.4.27 Piled foundations should extend into the underlying bedrock. The safe working load that may be supported on a pile is dependent on the pile diameter, its founding depth and the method of installation.

13.4.28 Boreholes indicate that competent Coal Measures bedrock lies at up to 4.2m depth below current ground levels.

13.4.29 As piles would be founded in bedrock, they will be essentially end bearing, although there may also be some shaft adhesion in the overlying residual soils.

13.4.30 Given the presence of made ground, it is essential that pile design allows for down-drag (negative skin friction).

13.4.31 It is recommended that flexible service connections are used on this site, especially where they enter the buildings, in order to avoid any possible damage due to self-settlement of the weak strata once the site is developed.

13.4.32 Driven piles may lessen the volume of made ground requiring off-site disposal (cf arisings associated with say trench fill). However, driving can induce some ground vibration. Assessment of any vibration risk to adjacent structures and/or existing site features should be undertaken by pile designer.

13.4.33 Should any impenetrable shallow obstructions be encountered, i.e. old foundation, they should either be grubbed-up, or alternatively the piling layout could be re-designed (although might also require design of foundations able to span and/or cantilever as necessary).

- 13.4.34 New houses can be built off ring beams designed to span the piles. In order to bond them to the piles, the tops of the piles must be broken out to expose the reinforcement, which can then be tied to that of the beams.
- 13.4.35 For piled foundations suspended floor slabs should be utilised. A pre-cast 'Beam and Block' concrete ground floor construction could be utilised, and suspended across the ring beams.
- 13.4.36 Ground conditions at this site are considered likely to require provision of a piling mat (working platform) and further advice should be sought from the appointed specialist-piling contractor regarding the proposed plant loadings and resulting pressures. This data, together with a knowledge of the strength and variability of the near-surface ground conditions is required in order that design of a mat can be undertaken in accordance with guidance provided in the 2004 BRE document, "BR 470: Working platforms for tracked plant".
- 13.4.37 The design of working platforms for tracked plant is a geotechnical design process and should be carried out by a competent person. The following parties should have input into the design:
- Permanent works designer, to consider additional uses for platform material as part of the overall development
 - Principal contractor, to define any other purposes for which the platform might be used
 - Contractor or subcontractor, to specify requirements for the platform, including gradients, ramps and edges
- 13.4.38 The number of plots affected by piling will depend on layout proposals, however, it is considered unlikely to exceed 20% of the total number.
- 13.4.39 However, piling over shallow mineworkings (even after grouting) is not common practice, and consequently further advice is provided below.
- 13.4.40 Current UK guidance is provided in CIRIA C758D¹², which provides information and guidance for engineers and geologists with respect to the design of: mining investigations; foundations; and remedial measures. It describes: past methods of mining employed in the UK; their short and long-term effects on surface stability; techniques for the consolidation of old mine workings; and remedial measures for mine shafts.
- 13.4.41 If workings occur within 20m of surface it would be unusual to find a satisfactorily thick and rigid founding stratum for highly-loaded piles above, and sufficiently isolated from, the workings. When loadings are light (e.g. for houses), a suitable horizon might be available, but often piles will need to penetrate the workings to found in a stable stratum adequately below the disrupted floor of the workings. This would require pre-boring of piles.
- 13.4.42 Whatever the depth of workings, even if they are thought to be fully filled or the roof strata to be rigid, piles should not be terminated immediately above an untreated worked horizon because this could concentrate load on a potentially unstable stratum which may initiate eventual collapse.
- 13.4.43 The objective of a conventionally spaced, over-site grout treatment grid is to ensure against surface settlements. It will not adequately serve below ground support for individual piles. Experience shows that grid separations exceeding 3m in partially collapsed or back-stowed workings are prone to uneven grout distribution and leaving isolated untreated areas or discrete void pockets. These circumstances heighten the risks of pile construction defects and differential performance which need to be minimised by enhanced treatment.

¹² CIRIA C758D:2019. Abandoned mine workings manual

- 13.4.44 It should be recognised that pressurised grout treatments (even if enhanced) are unlikely to achieve full closure or permeation of randomly distributed or occluded voids, especially if water-filled. This consequence of earthworks treatments is well known, but also it is industry wisdom that grout acceptance maximises at about 90-95% of voidage). Therefore, the pile designer may need to examine additional means to negate residual voids, perhaps by the pile-head detailing and group interconnection measures.
- 13.4.45 It is recommended that all improvements to the workings themselves, whether by grouting or other filling takes place before piling. All improvement work should be allowed to attain the requisite strength before piling.
- 13.4.46 When there is a continuing risk of subsidence or residual movements, piles should be taken into competent strata below any seam floor disruption and heave consequential on the workings. Ground treatments should be scheduled to mitigate both installation effects and future settlements.
- 13.4.47 Particular attention should be given in design to accommodating consequential loads and down-drag generated from ongoing consolidation or reactivated subsidence potential.
- 13.4.48 Founding piles above a system of **untreated** workings is not recommended because collapsed workings are rarely in a permanently stable condition and so have some form of residual settlement potential. Thus, either creep settlement, strata relaxation or collapse migration remain intermittent subsidence possibilities. In which case, structure vulnerability can be an issue if its settlement performance and distortion criteria are too restrictive.
- 13.4.49 Piling above workings might be possible where sufficiently reliable strata (e.g. a substantial massive and competent bed of sandstone) are present to enable a detachment zone to be defined, or created by enhanced ground treatment. The thickness of this zone will depend on the pile installation method and the size and loading of the pile group.
- 13.4.50 When a prospective horizon is present, the following key issues, should be examined before deciding if the proposal is viable:
- Depths, dip and thickness of the subsidence restricting horizon
 - Geotechnical and geomechanical properties of the restricting horizon
 - Separation between pile toe level and the restricting horizon (ie the detachment zone)
 - Establishing that past collapses have arrested at the restricting horizon
 - Specific connectivity arrangements at pile heads/caps.
- 13.4.51 To enable piles to found at a higher level than a significantly stressed worked seam, bulk filling of open workings or grout treatment should be carried out beforehand as standard practice. If grouting, a more comprehensive treatment regime than for spread foundations will be required to produce reliable higher strength characteristics in the intensely stressed zones. These strengths should be specified via the grout mix and validated afterwards.
- 13.4.52 As such further advice should be sought from a specialist piling contractor(s), and discussions held with the pile designer before committing to a contract to grout mineworkings beneath the proposed new build.

Coal

- 13.4.53 Some excavations for foundations in the areas of conjectured coal outcrops at the site may come into contact with coal. Care should be taken not to unnecessarily overdeepen foundations, in order to minimise the chance of encountering coal.

- 13.4.54 Where foundation excavations do come into contact with coal, the foundation should be taken through the coal seam, into underlying natural in-situ strata of adequate bearing. The full thickness of coal should then be sealed with concrete to create a trench fill foundation. To prevent the ingress of air, the mass concrete fill should be placed as soon as possible after exposing the seam.
- 13.4.55 By virtue of the provisions of the Coal Industry Act 1994 interests in unworked coal and coal mines previously vested in the British Coal Corporation are now vested in the Coal Authority. The developer will need to contact the Coal Authority to dig or carry away such coal as they encounter in connection with redevelopment of the site (this is often referred to as incidental coal).

Geological fault

- 13.4.56 Drawing 1462/5 shows the approximate line of the fault superimposed on the proposed housing layout; the fault crosses the north-east corner site.
- 13.4.57 It should be noted that the line of a fault on a geological map is often very approximate, and it may be inaccurate by 10m or more. Furthermore, the presence of a fault is usually 'masked' by overlying drift or residual soils; they can only be seen where long trenches are excavated into bedrock.
- 13.4.58 At this site, no movement associated with past, present or future mining is anticipated, therefore building can take place over the fault. However, even after treatment, given that known workings lie adjacent to the geological fault which crosses the site it is recommended that special precautions such as reinforcement in the footings of those plots suspected to lie in the vicinity of the fault are adopted.
- 13.4.59 The NHBC like to see reinforcement of footings with one layer of B385 mesh placed 75mm above the base of the footing. Given the uncertainty regarding the precise line of the fault, it would be prudent to reinforce the footings of all plots within 25m of its assumed line (i.e. likely plots 1 to 11, 15, & 17 to 27).
- 13.4.60 Further advice should be sought if a significant weak zone is encountered (e.g. ground comprising loose, broken or soft 'gouge' material) during the excavation of footings. If associated with a fault, the weak zone is likely to form a fairly continuous "linear belt", rather than a localised "pocket", and be anything from a few centimetres to a few metres in width.

Summary of foundation recommendations

- 13.4.61 In summary, the following foundation solutions are likely to be most appropriate (subject to Newett Homes preferences regarding site preparatory works, final levels & costs associated with each foundation option).

Plot nos	Foundation solution(s)	Remarks (influencing factors)
1 – 18 & 24 – 57	Reinforced strips from 0.9m	Founded in natural clay soils or competent rock. Additional reinforcement required where plots are underlain by treated shallow coal workings.
19 – 23	Deep Strips up to 2.5m or piled foundations	Existing localised areas of deep made ground. Final foundation design will be dependent on finished levels post site re-grade. Piled foundations may need to be taken to a depth below treated workings and as such would require pre-boring.

- 13.4.62 However, the above table does not take any account of trees or proposed regrade and retaining walls which will likely be required to create reasonably level platforms for development. Foundation types will also be influenced by the actual extent of drill and grout works.

13.5 Designated concrete mixes

- 13.5.1 Designated mixes are considered in BRE Special Digest SD1 and BS 8500 -1:2015+A1:2016. However, in addition to soil chemistry (sulphate class), there are a number of other considerations relating to structural design that need to be taken into account when determining an appropriate concrete mix.
- 13.5.2 Consequently, Newett Homes should seek advice from their appointed Structural Engineer.

13.6 Excavations

- 13.6.1 Groundwater should be controlled in accordance with CIRIA report 113 "Control of Groundwater for Temporary Works".
- 13.6.2 Based on the results of the investigation it is considered unlikely that major groundwater flows will be encountered in shallow excavations.
- 13.6.3 Excavations should remain stable in the short term but if left open for any significant period of time may require shoring most notably in granular soils and made ground.
- 13.6.4 Bedrock was encountered in several exploratory holes across the site from 0.9m depth. Based on the exploratory hole logs, excavation greater than 1.5m to 2.5m depth is likely to prove difficult across the majority of the site.
- 13.6.5 It would therefore be prudent to allow for excavation of hard rock in any deep excavations such as those that may be required for drainage etc.

13.7 Drainage

- 13.7.1 Groundwater is likely to lie at depth within the Coal Measures strata.
- 13.7.2 Based on observations made during the investigation, soakaways will not provide a suitable drainage solution for surface water run-off at the site. Consequently, it will be necessary to consider alternative sustainable drainage systems (SUDS), and there may be a need for surface water balancing.
- 13.7.3 Any damage to the existing land drainage system caused by foundation or sewer excavations should be made good; this may require diversion and re-connection.
- 13.7.4 It is recommended that the developer contact Yorkshire Water Services with respect to capacity in existing foul and surface water sewers in the vicinity of the development area.

13.8 Highways

- 13.8.1 Based on visual inspection of the natural materials and the recorded plasticity indices at the site, published tables (Interim Advice Note 73/06 Revision 1 (2009). Chapter 5. Characterisation of Materials Design Guidance For Road Pavement Foundations - Draft HD25) indicate that the natural cohesive deposits will have a CBR value of at least 2%. This value should be verified prior to or during construction.
- 13.8.2 Made ground is present in the centre of the site and it is strongly recommended that consultation regarding the specification of the highways should be made with the adopting authority.

- 13.8.3 Where made ground is present the following options are considered suitable. Excavation of the full thickness (up to a maximum of 2m) of made ground and either:
- Replacement with suitable aggregate in accordance with Series 600 (Earthworks) of The Highways Agency (HA) "Specification for Highway Works" 1998, or
 - Screening, selection and replacement (in accordance with Series 600) of suitable material in engineered layers. Unsuitable materials include any soft or wet materials, biodegradables including topsoil, wood, scrap metal, frozen material and oversize.
- 13.8.4 Some refinement of the above advice might be possible after highways design (with consideration of the proposed formation level cf existing ground level), and via inspection (and usually CBR testing) of the proposed formation during site preparatory groundworks.
- 13.8.5 Any residual made ground materials in the base of the excavation (ie in areas where the thickness of made ground exceeds 2m) should be inspected and (where necessary) any soft spots removed and replaced with suitable engineered fill.
- 13.8.6 Where the made ground is re-engineered it is considered that a CBR value of 3% should be achievable, however, this should be verified by field trials.

13.9 External works

- 13.9.1 Any digital terrain modelling undertaken, or commissioned, by Newett Homes should be made available to their Engineering Designer prior to issue of an External Works Drawing.
- 13.9.2 Given the site's topography (much of the site is steeply sloping, with gradients of up to 1 in 6), there is likely to be a requirement for significant regrade, retaining walls, underbuild, tanking etc.

14 REDEVELOPMENT ISSUES

14.1 General

- 14.1.1 This report has presented options with respect to foundation solutions, treatment of contamination etc that are considered technically feasible and in line with current good practice. Consequently, we would expect to obtain regulatory approval for whichever option is adopted, although this cannot be guaranteed. Copies of this report should be forwarded to the relevant regulatory authorities (Warranty Provider & Local Authority) for their comment/approval.
- 14.1.2 Even after an appropriate preliminary investigation and ground investigation, with exploratory holes on a closely spaced grid (say trial pits at 30m centres), a geoenvironmental appraisal is typically based on inspection of the ground underlying less than 0.5% of the total site area (and much less at depths in excess of about 3.5m). Consequently, there is always a possibility that unanticipated ground conditions will be encountered during the construction phase.
- 14.1.3 If unexpected ground is encountered during the construction phase, the Contractor should immediately seek further advice from the Engineer.

14.2 Remediation strategy

14.2.1 Given the absence of any significant contamination, a remediation strategy is not considered necessary. Nonetheless, some preparatory works will be required, most notably:

- Earthworks regrade to create suitable development platform.
- Consolidation of shallow mineworkings, and treatment of mine entries.
- Provision of 1,000mm thickness of topsoil in all garden and landscaped areas underlain by made ground.

14.3 Control of excavation arisings

14.3.1 Excavations into made ground are likely to yield contaminated arisings. The groundworker should carefully segregate (and stockpile separately) made ground arisings from arisings of "clean" natural soils, in order that an excessive volume of unsuitable material is not generated.

14.3.2 It should be ensured that the groundwater understands the need for good materials management. Most notably the importance of not mixing different materials within a given stockpile; i.e. there should be separate stockpiles of: topsoil; made ground; excess clean, natural soil arisings; general construction waste etc.

14.3.3 Further characterisation of stockpiled materials is likely to be required if off-site disposal is proposed. See also comments in Section 10.8 regarding asbestos.

14.3.4 Made ground arisings could be:

- Redistributed beneath concrete oversite, or areas of hardstanding, where they would be satisfactorily isolated from end users;
- Isolated beneath the 1,000mm thick cover layer in garden or landscaped areas
- Exported from site to a suitably licensed landfill facility

14.3.5 Natural ground arisings should be suitable for use as subsoil in the proposed soil cover.

14.4 Good practice guidance

14.4.1 The construction phase groundworker should follow good environmental practice to minimise the risks of spillage, leakage etc with reference, but not limited, to the following documents:

- CIRIA C741¹³
- EA Pollution Prevention Guidelines¹⁴:
 - PPG6 - Working at construction and demolition sites
 - PPG2 - Above ground oil storage tank
 - PPG7 – The safe operation of refuelling facilities
 - PPG21 – Incident Response Planning

14.4.2 Site preparatory works associated with this project are likely to involve the re-use of both natural and made ground soils on site and the import of natural soils from another development site. Therefore, the Contractor should prepare a Materials Management Plan (MMP) in accordance with the CL:AIRE Code of Practice (v2, March 2011)¹⁵.

¹³ CIRIA C741 (2015) - Environmental Good Practice on Site

¹⁴ Whilst this has formally been withdrawn it can still be accessed via the EA archives and provides useful information on managing risks.

¹⁵ The Definition of Waste: Development Industry Code of Practice. CL:AIRE, 2011.

14.4.3 The MMP will document how all of the materials to be excavated during the proposed site preparatory and remediation earthworks are to be dealt with.

14.5 New utilities

14.5.1 It is strongly recommended that all statutory service bodies are consulted at an early stage with respect to the ground conditions within which they will lay services in order to enable them to assess at an early stage any potential abnormal costs.

14.5.2 Drainage and other utilities should not be placed within any coal seam; the seam should either be removed to below the base of the lowest service, or services should be placed in oversized trenches cut into the seam & backfilled with inert material.

14.5.3 It is recommended that trenches for services including site drainage and water supply are cut over size in order to isolate pipe materials from potential contaminants and to enable maintenance to be conducted in "clean" material.

14.5.4 Water Companies have a statutory duty to supply wholesome water, which could be compromised by the selection of an inappropriate pipe material. For example, compounds such as petroleum hydrocarbons and solvents can permeate commonly used plastics pipes, and/or corrosive chemicals can reduce the service life of metallic pipes. Guidance has been developed for the selection of pipes in brownfield sites and is contained in a UKWIR Report¹⁶.

14.5.5 Some localised made ground is present, and therefore consideration of soil contaminant concentrations is required. Samples taken must be representative of the soil conditions in which the water pipes are proposed to be laid; normally water pipes are laid 0.7m to 1.3m below finished ground level.

14.5.6 However, this site is essentially greenfield and as such, this site investigation has enabled completion of Yorkshire Water's Contaminated Land Assessment Form, a copy of which is included in Appendix I.

14.5.7 Given the site's history and the relatively consistent ground conditions reported, the use of 'standard' polyethylene water supply pipes should be acceptable, although the Developer should consult Yorkshire Water at the earliest opportunity to confirm this.

14.6 Health & safety issues - construction workers

14.6.1 Access into excavations etc. must be controlled and undertaken in accordance with the CDM Regulations 2015, most notably Regulation 22, to mitigate risk of collapse or asphyxiation.

14.6.2 The atmosphere in shored trenches in excess of 1.2m should be monitored for oxygen and hazardous gas (methane & carbon dioxide), prior to personnel entering such excavations. Monitoring should continue whilst personnel are working in deep excavations.

14.6.3 Before site operations are started, the necessary COSHH statements and Health & Safety Plan should be drafted in accordance with the CDM regulations.

14.6.4 The bulk of the made ground will be retained on site. This made ground contains contaminants at concentrations above the guidance threshold values for an end use that includes domestic gardens. Workers involved in excavations for foundations, drainage, utilities etc are likely to come into direct contact with the made ground.

¹⁶ UKWIR Report 10/WM/03/21 – 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites'.

14.6.5 Although workers will only be exposed to the contaminated soil for a relatively short time, the contaminants represent a risk, and simple precautionary measures are required, i.e. good personal hygiene and basic personal protective equipment.

14.6.6 Consequently, during the remediation and construction phases of the site development it will be necessary to protect the health and safety of site personnel. 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".

14.7 Coal extraction

14.7.1 Four seams of coal are shown to outcrop on the site on BGS plans, including: a thin un-named coal outcrops in the north; overlain by the Churwell Thin Coal (typically around 0.8m thick); the Shertcliffe coal (typically around 0.9m thick); and, in the south, the Trub coal (0.2m to 0.3m thick).

14.7.2 Prior extraction of coal is encouraged by both the Coal Authority and Planning Authorities, largely because a potential mineral resource will not be sterilised by the development. However, it is worth noting that the UK market for coal is changing (driven by government carbon emission targets) – most notably very few power stations are still burning coal. Consequently, prior extraction of coal has become less attractive in recent times.

14.7.3 There can be financial benefits to extraction, since the extraction contractor would pay the landowner a disturbance allowance for the coal (likely to be between £2 and £4 per tonne), and there would be a saving because grouting would not be required.

14.7.4 Furthermore, any unrecorded mine entries would also be found and removed. Traffic movements (associated with coal export) are expected to be similar to those associated with grouting (import of PFA and cement).

14.7.5 However, coal extraction is not without drawbacks; these include:

- The creation of 'high-walls' around the margins of the extraction area (essentially the whole of the site's perimeter).
- The time required to ensure significant settlement of the replaced overburden (anticipated residual settlement must be less than 25mm) is typically at least 12 months. However, the actual delay to build programme might be longer, since it is impossible to predict the actual time required for ongoing creep settlements to fall to tolerable levels. Prediction is hampered by uncertainties associated with groundwater rebound and the nature of the excavated material with respect to suitability for compaction.
- Local environmental issues associated with noise and dust.
- Public perception issues.
- Concerns that once an initial excavation has been opened, the coal extraction contractor might decide there is insufficient coal remaining and abort further work, or even run into financial difficulties, leaving Newett Homes with increased foundation abnormalities and no royalties.

14.7.6 It is worth noting that the UK market for coal is changing (driven by government carbon emission targets) – most notably very few power stations are still burning coal. Consequently, prior extraction of coal has become less attractive in recent times.

14.7.7 Assuming the above factors do not preclude further consideration at the 'first hurdle', the viability of extraction is influenced by physical factors, most notably:

- The presence (or not) of old mineworkings
- Seam thickness (greater the better)
- Seam depth (shallower the better)

- 14.7.8 As discussed in Sections 4.3 and 8.8, known old mineworkings exist beneath about 50% of this site in the Shertcliffe coal, with solid coal only encountered in 8 (60%) of the probeholes located within the areas shown as worked on CA abandonment plans.
- 14.7.9 This suggests that significant extraction has already occurred, reducing the potential yield from further extraction prior to redevelopment.
- 14.7.10 No workings were recorded in the un-named Coal, Churwell Thin Coal or the Trub Coal. However, of these seams only the Churwell Thin is of sufficient thickness to be considered for extraction.
- 14.7.11 Extraction is generally considered possible where the overburden above a seam is less than **12 times the seam's thickness**. Typically, this is not the case at this site as topography rises steeply to the south therefore increasing the thickness of overburden over relatively short distances as the coal also dips down towards the south.
- 14.7.12 In addition, the site is steeply sloping with residential properties adjacent to the eastern and southern boundaries and Lower Blacup Farm to the west. This will severely restrict excavation sizes with lorry movements through residential areas unlikely to be without strong objection.
- 14.7.13 Consequently, it is considered unlikely that prior extraction of coal from this site would be economically viable.

14.8 Shallow coal in garden areas

- 14.8.1 Whilst there is no explicit guidance in NHBC Standards, liaison with NHBC suggests their stance is essentially the same as that they would apply to potentially combustible fills (such as Ash & Clinker). So where significant coal is present at very shallow depth in garden areas (uppermost 1m), it should either be removed, or covered with inert subsoil/topsoil so that it lies at greater than 1m depth.
- 14.8.2 In theory this could be an issue down dip from outcrop of each of the 4 seams shown to underlie the site. However, given seam dip and topography it seems likely that coal will only be present at such shallow depth beneath less than 10% of the area.
- 14.8.3 The most pragmatic way of dealing with shallow coal in gardens will be to inspect foundation excavations, and where coal is recorded within the uppermost 1m or so then excavate an inspection pit in the rear garden. Further advice should be sought from Lithos during the construction phase.
- 14.8.4 As with foundation arisings, the developer will need to contact the Coal Authority to dig or carry away excavated (incidental) coal.

14.9 Potential development constraints

- 14.9.1 The site is steeply sloping, with topography in the south rising up towards the southern boundary (gradients of up to 1 in 6) which is likely to pose issues during the design and construction phases of the proposed development.
- 14.9.2 Some re-grade will also likely be required in the centre of the site where a steep embankment drops down to the farm access track.
- 14.9.3 The mine shaft and adit, located in the centre of the site (see Drawing 1462/8a), present potential development constraints even after treatment and consolidation.
- 14.9.4 NHBC and the Coal Authority discourage development over or adjacent to shafts, regardless of treatment.

- 14.9.5 Workings identified in the Shertcliffe Coal will require consolidation through grouting prior to redevelopment.
- 14.9.6 The sewer located in the far north of the site (see Drawing 1462/3) presents a potential development constraint unless it can be relocated or incorporated into the proposed layout. Additional enquiries are required to ascertain the feasibility of such diversionary works or the easement required by Yorkshire Water should it remain in-situ

15 SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

15.1 General

- 15.1.1 The site is located off Ashbourne Drive, Ashbourne Way and Ashbourne View approximately 0.75km south-west of Cleckheaton, and currently comprises farmland sloping down from south to north.
- 15.1.2 It is understood that consideration is being given to redevelopment of the site with 2 to 3 storey domestic dwellings, associated gardens, POS and adoptable roads and sewers. A site layout has been provided by Newett Homes (Drawing reference Z168.002, dated 13th December 2023) which is reproduced as Drawing 1462/2 in Appendix B to this report.
- 15.1.3 Significant earthworks will be necessary with regrade and retaining walls required due to existing topography. Consequently, some of the recommendations provided below may need to be reviewed once regrade proposals have been finalised.
- 15.1.4 Made ground is restricted to the centre of the site, **in the area of a topographic 'bulge'** (see Drawing 1462/11), associated with a former colliery worked during the late 19th century (Blacup Colliery). The made ground is up to 3.4m thick and deepens northwards.
- 15.1.5 Natural ground was encountered in the majority of the exploratory holes, and typically comprised firm/stiff gravelly clay (completely weathered coal measures).
- 15.1.6 Underlying bedrock encountered from 0.9m depth, typically from 1.5m, comprises Coal Measures sandstone, mudstone and siltstone. Four seams of coal are shown to outcrop on the site, dipping down to the south.

15.2 Mining

- 15.2.1 The centre and south of the site is located within a Coal Mining Development High Risk Area, with former workings recorded in the Shertcliffe Coal.
- 15.2.2 An intrusive mining investigation comprising the drilling of 19 deep rotary probeholes has been completed. The Shertcliffe Coal (c. 0.9 thick) underlies about 17,250m² (70% of the site).
- 15.2.3 Within the 13 holes which encountered the Shertcliffe coal, evidence of workings was noted in 8 (60%) of the probeholes.
- 15.2.4 Drawing 1462/7 shows the approximate extent of shallow workings in the Shertcliffe Coal seam based on probehole findings and the CA's abandonment plan.
- 15.2.5 The thickness of competent (rock) cover above the Shertcliffe Seam is typically greater than 10 times seam thickness due to the steep rise in topography towards the south. However, closer to outcrop the thickness of cover is less than 10 times seam thickness and as such consolidation through grouting will be required.
- 15.2.6 No evidence of workings was identified in any of the other coal seams which underlie the site at shallow depth.

15.2.7 There are two mine entries located on site:

- An **adit** was encountered in TP12. Treatment of the adit will probably require excavation until there is at least 3m of competent cover above its roof.
- A 2m diameter brick lined **air shaft** with Colliery Spoil infill. The air shaft will treatment comprising a reinforced concrete cap placed at rockhead.

15.3 Hazardous gas

15.3.1 The site is underlain by shallow mineworkings, therefore wells were installed in 6 probeholes with monitoring undertaken over 3 months.

15.3.2 The current gas regime has been characterised in accordance with the Situation A (Wilson & Card) methodology outlined in CIRIA Report C665 and BS8485:2015+A1:2019, which shows that **CS2** protection measures will be required for all plots.

15.4 Contamination & remediation

15.4.1 Elevated concentrations of inorganic contaminants were identified in the made ground located in the centre of the site. This made ground is also considered potentially combustible and contained traces of asbestos fibres.

15.4.2 As such, where made ground remains beneath garden or landscaped areas a minimum 1,000mm clean soil cover is recommended.

15.4.3 Alternatively, the Made Ground is considered suitable for redistribution beneath concrete oversite or areas of hardstanding, where it would be satisfactorily isolated from end users.

15.4.4 Testing suggests that the Topsoil and Made Ground Topsoil are suitable for re-use.

15.5 Foundations

15.5.1 Foundation depths will be influenced by regrade proposals.

15.5.2 However, it is considered that the majority of new dwellings will be founded on strip footings from a minimum 900mm depth, founding in natural Residual Soils (gravelly clay) or bedrock.

15.5.3 Footings within the influence of trees will require deepening in accordance with NHBC Standards (Chapter 4.2).

15.5.4 Additional reinforcement will be required where treated mine workings underlie the footing at shallow depth.

15.5.5 Where deep made ground is encountered trench fill or possibly piled foundations will be required. This will depend on final levels, as such foundations should be confirmed once finished levels are known.

15.5.6 Piled foundations should be taken below the base of treated workings, as such pre boring will be required.

15.6 Flooding

15.6.1 The site lies in Flood Zone 1, where the risk of flooding from rivers or the sea is classified as low.

15.7 Drainage

15.7.1 Soakaways will not provide a suitable drainage solution for surface water run-off at the site; consequently, surface water balancing will be required.

15.8 Highways

- 15.8.1 Based on visual inspection of the shallow natural materials and published guidance, the Residual Soils should provide a CBR value of at least 2%. This value should be verified prior to or during construction.
- 15.8.2 However, made ground is present in the centre of the site, up to 3.4m depth, typically less than 1.0m, and consultation with the adopting authority, regarding the specification of the highways, is strongly recommended.
- 15.8.3 Where made ground is present it should be excavated and either replaced with suitable aggregate, or screened, to allow selection of suitable material, before being replaced in engineered layers. Where the made ground is re-engineered it is considered that a CBR value of at least 3% should be achievable. However, this should be verified by field trials.

Appendix A

General Notes

General

Third party information obtained from the British Geological Survey (BGS), the Coal Authority, the Local Authority etc is presented in the "Search Responses" Appendix of this Geoenvironmental Report.

Geology, mining & quarrying

In order to establish the geological setting of a site, Lithos refer to BGS maps for the area, and the relevant geological memoir. Further information is sourced by reference to current and historical OS plans.

In July 2011, the Coal Authority (CA) formalised their requirements in relation to planning applications and introduced some new terminology. The CA, using its extensive records has prepared plans for all coalfield Local Planning Authorities, which effectively refines the defined coalfield areas into High Risk and Low Risk areas. **High Risk** areas are likely to be affected by a range of legacy issues that pose a risk to surface stability, including: mine entries; shallow coal workings; workable coal seam outcrops; mines gas; and previous surface mining sites. **Low Risk** areas comprise the remainder of the defined coalfield, and are areas where no known defined risks have been recorded; although there may still be unrecorded issues. Where a site lies within either a High or Low Risk area, a mining report is obtained from the CA.

Landfills

Reference is made to publicly available Government held digital data via QGIS (an Open Source Geographic Information System), data from Landmark or Groundsure, and sometimes the Environment Agency and the Local Authority with respect to known areas of landfilling within 250m of the proposed development site.

Historical OS plans are also inspected for evidence of backfilled quarries, railway cuttings, colliery spoil tips etc.

Radon

Radon is a colourless, odourless gas, which is radioactive. It is formed in strata that contain uranium and radium (most notably granite), and can move through fissures eventually discharging to atmosphere, or the spaces under and within buildings. Where radon occurs in high concentrations, it can pose a risk to health.

In order to assess potential risks associated with radon gas, Lithos refer to BRE Report BR211¹, and the UK Health Protection Agency (HPA) website. In December 2022, the British Geological Survey (BGS), deployed a revised dataset which increased accuracy and also the number of properties falling within radon affected areas. This revised dataset is now referenced by maps on the HSA website.

Advice on the limitation of exposure of the population to radon in buildings was originally published in 1990 by the National Radiological Protection Board (NRPB), which joined the HPA in 2005; the HPA updated NRPB advice in July 2010².

The HPA recommended that the NRPB radon Action Level for homes be retained, and a new Target Level for radon in homes be introduced. The values of the Action Level and Target Level, expressed as the annual average radon concentration in the home, are 200 Bqm⁻³ and 100 Bqm⁻³ respectively. The Target Level was to provide an objective for remedial action in existing homes and preventive action in new homes.

The term 'radon Affected Area' is defined as those parts of the country with >1% of homes estimated to be above the Action Levels. The level of protection needed is site-specific and can be determined by reference to this mapping on the Public Health England website, which indicates the highest radon potential within each 1km grid square. Each 1km grid square is classified on the basis of the percentage of existing homes within that grid square estimated to have radon concentrations above the Action Level. **There are 6 'bands': <1%; 1 to 3%; 3 to 5%; 5 to 10%; 10 to 30%; and >30%.**

The NRPB advised that action should be taken to reduce radon concentrations in existing homes if the radon concentration exceeded the Action Level of 200 Bqm⁻³ in room air averaged over a year; ten times the average UK domestic radon concentration. NRPB advice informed changes in the requirements for radon protection in new buildings.

- **Basic** preventive measures are required in new buildings, extensions, conversions and refurbishments if the probability of exceeding the Action Level is >3% in England and Wales, and >1% in Scotland and Northern Ireland.
- Provision for further preventive (**Full**) measures is required in new buildings if the probability of exceeding the Action Level is >10%.

At present Building Regulations Approved Document C advocates basic measures for the probability banding 3% to 10%, and full measures if >10%. However, HPA would like to see all new build include basic measures.

Action & Target Levels should also be applied to non-domestic buildings with public occupancy exceeding 2,000 hrs/yr and to all schools.

Hydrogeology

Reference is made to publicly available Government held digital data via QGIS, and Landmark or Groundsure with respect to:

- Groundwater quality
- Recorded pollution incidents
- Licensed groundwater abstractions

From April 2010 the EA's Groundwater Protection Policy uses aquifer designations that are consistent with the Water Framework Directive. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply), but also their role in supporting surface water flows and wetland ecosystems. The aquifer designation data is based on geological mapping provided by the British Geological Survey. The maps are split into two different types of aquifer designation:

- Superficial (Drift) - permeable unconsolidated (loose) deposits. For example, sands and gravels
- Bedrock - solid permeable formations e.g. sandstone, chalk and limestone

The maps display the following aquifer designations:

Principal aquifers: These are layers of rock or superficial deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

Secondary aquifers: These include a wide range of rock layers or superficial deposits with an equally wide range of water permeability and storage. Secondary aquifers are subdivided into three types:

- **Secondary A** - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
- **Secondary B** - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers
- **Secondary undifferentiated** - In most cases, this is because the rock type in question has previously been designated as both a minor and non-aquifer in different locations due to the variable characteristics.

¹ BRE Report BR211, 2023: "Radon: guidance on protective measures for new buildings (including supplementary advice for extensions, conversions and refurbishment projects)".

² Limitation of Human Exposure to Radon, Documents of the Health Protection Agency - Radiation, Chemical and Environmental Hazards, RCE-15. July 2010.

Unproductive strata: These are rock layers or superficial deposits with low permeability that have negligible significance for water supply or river base flow.

The EA maps only display the principal and secondary aquifers as coloured areas. All uncoloured areas on the map will be unproductive strata. However, for uncoloured areas on the superficial (drift) designation map it is not possible to distinguish between areas of unproductive strata and areas where no superficial deposits are present; to do this, it is necessary to consult the published geological survey maps.

For the purposes of the EA's Groundwater Protection Policy the following default position applies, unless there is site specific information to the contrary:

- If no superficial (drift) aquifers are shown, the bedrock designation is adopted
- In areas where the bedrock designation shows unproductive strata (the uncoloured areas) the superficial designation is adopted
- In all other areas, the more sensitive of the two designations is used (e.g. If secondary superficial overlies principal bedrock, an overall designation of principal is assumed)

The EA have also designated groundwater Source Protection Zones, which are based on proximity to a groundwater source (springs, wells and abstraction boreholes). The size of a Source Protection Zone is a function of the aquifer, volume of groundwater abstracted and the effective rainfall, and may vary from tens to several thousand hectares.

Hydrology

Reference is made to publicly available Government held digital data via QGIS, and Landmark or Groundsure with respect to:

- Surface water quality
- Recorded pollution incidents
- Licensed abstractions (groundwater & surface waters)
- Licensed discharge consents
- Site susceptibility to flooding

The EA have set **water quality** targets for all rivers. These targets are known as River Quality Objectives (RQOs). The water quality classification scheme used to set RQO planning targets is known as the River Ecosystem scheme. The scheme comprises five classes (RE1 to RE5) which reflect the chemical quality requirements of communities of plants and animals occurring in our rivers.

General Quality Assessment (GQA) grades reflect actual water quality. They are based on the most recent analytical testing undertaken by the EA. There are 6 GQA grades (denoted A to F) defined by the concentrations of biochemical oxygen demand, total ammonia and dissolved oxygen.

The susceptibility of a site to **flooding** is assessed by reference to a Flood Map on the Environment Agency's website. These maps show natural floodplains - areas potentially at risk of flooding if a river rises above its banks, or high tides and stormy seas cause flooding in coastal areas. There are two different kinds of area shown on the Flood Map:

1. Dark blue areas (Flood Zone 3) could be flooded by the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year, or by a river by a flood that has a 1% (1 in 100) or greater chance of happening each year
2. Light blue areas (Flood Zone 2) show the additional extent of an extreme flood from rivers or the sea. These outlying areas are likely to be affected by a major flood, with up to a 0.1% (1 in 1000) chance of occurring each year

These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements. Where there is no blue shading (Flood Zone 1), there is less than a 0.1% (1 in 1000) chance of flooding occurring each year.

The maps also show all flood defences built in the last five years to protect against river floods with a 1% (1 in 100) chance of happening each year, or floods from the sea with a 0.5% (1 in 200) chance of happening each year, together with some, but not all, older defences and defences which protect against smaller floods.

The Agency's assessment of the likelihood of flooding from rivers and the sea at any location is based on the presence and effect of all flood defences, predicted flood levels, and ground levels.

It should also be noted that as the floodplain shown is the 1 in 100 year, areas outside this may be flooded by more extreme floods (e.g. the 1 in 1000 year flood). Also, parts of the areas shown at risk of flooding will be flooded by lesser floods (e.g. the 1 in 5 year flood). In some places due to the shape of the river valley, the smaller floods will flood a very similar extent to larger floods but to a lesser depth.

If a site falls within a floodplain, it is recommended that a flood survey be undertaken by a specialist who can advise on appropriate mitigating measures: i.e. raising slab levels, provision of storage etc. In accordance with Chapter 10 of the National Planning Policy Framework, a site-specific flood risk assessment is required for: proposals of 1 hectare or greater in Flood Zone 1, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency); and any new development in Flood Zones 2 and 3.

COMAH & explosive sites

Lithos obtain information from Landmark or Groundsure with respect to Control of Major Accident Hazards (COMAH) or explosive sites within 1km of the proposed development site. Lithos' report refers to any that are present, and recommends that the Client seeks further advice from the HSE.

Areas around COMAH sites (chemical plants etc) are zoned with respect to the implementation of emergency plans. The HSE are a statutory consultee to the local planning authority for all COMAH sites. The COMAH site may have to revise its emergency action plan if development occurs. This might be quite straightforward or could entail significant expenditure. Consequently, the COMAH site may object to a proposed development (although it is the Local Authority who have final say, and they are likely to place more weight on advice from the HSE).

Preliminary conceptual site model

The site's environmental setting (and proposed end use) is used by Lithos to assess the significance of any contamination encountered during the subsequent ground investigation.

Assessment of contaminated land is based on an evaluation of pollutant linkages (source-pathway-receptor). Contaminants within the near surface strata represent a potential source of pollution. The environment (most notably groundwater), site workers and end users are potential receptors.

Potential pollutant linkages are shown on a preliminary conceptual site model (pCSM). A CSM is essentially a cross-section through a site that reflects both the surface topography and underlying geology, and shows surface features of interest. The most significant sources of contamination are then superimposed onto this cross-section together with potential receptors (human health & controlled waters), and plausible pathways between the two. In addition to environmental issues, the CSM should also highlight geotechnical issues.

A pCSM is prepared after consideration of all available "desk study" data, and before design of the ground investigation. Data reviewed should include historical plans (with superimposition on a current-day plan), previous SI reports, geological maps etc. The pCSM, in conjunction with knowledge of site constraints (buildings, services, slopes etc) is used to design the ground investigation.

The revised CSM takes account of data obtained during the ground investigation, including the distribution of made ground, the nature and distribution of contamination etc.

General

Lithos Ground Investigations are undertaken in accordance with current UK guidance including:

- BS5930:2015 "Code of practice for site investigation"
- Eurocode 7: BS EN 1997-1:2004. Geotechnical design - Part 1: General rules
- Eurocode 7: BS EN 1997-2:2007. Geotechnical design - Part 2: Ground investigation and testing
- BS10175:2013 "Code of practice for the identification of potentially contaminated sites"
- "Technical Aspects of Site Investigation" – EA R&D Technical Report P5-065/TR (2000)
- "Development of appropriate soil sampling strategies for land contamination" – EA R&D Technical Report P5-066/TR (2001)
- Contaminated Land Reports 1 to 6, most notably CLR Report No. 4 "Sampling strategies for contaminated land"
- "Guidance on the protection of housing on contaminated land" – NHBC & EA R&D Publication 66 (2000)
- AGS: 1996 "Guide to the selection of Geotechnical Soil Laboratory Testing"

Exploratory hole locations

Exploratory hole locations are selected by Lithos, prior to commencement of fieldwork, to provide a representative view of the strata beneath the site and to target potential contaminant sources identified during the preliminary investigation (desk study). Additional exploratory locations are often determined by the site engineer in light of the ground conditions actually encountered; this enables better delineation of the depth and lateral extent of organic contamination, poor ground, relict structures etc.

Investigation techniques

Ground conditions can be investigated by a number of techniques; the procedures used are in general accordance with BS5930: 2015 and BS1377: 1990. Techniques most commonly used by Lithos include:

- Machine excavated **trial pits**, usually equipped with a backactor and a 0.6m wide bucket. Allows a thorough inspection of the ground; especially the uppermost 1m or so (but able to reach depths of up to c. 4m), with the recovery of representative, disturbed samples. Also used to conduct soakaway testing.
- **Window or windowless** sampling boreholes (**dynamic sampling**). Constraints associated with existing buildings, operations and underground service runs can render some sites partly or wholly inaccessible to a mechanical excavator. In such circumstances, window sampling is often the most appropriate technique. A window sampling drilling rig can be manoeuvred in areas of restricted access and results in minimal disturbance of the ground (a 150mm diameter tarmac/concrete core can be lifted and put to one side). However, it should be noted that window sampling allows only a limited inspection of the ground (especially made ground with a significant proportion of coarse material).
- **Cable percussive** (Shell & Auger) boreholes, typically using 150mm diameter tools and casing. Enables the recovery of soil samples and data from greater depth than is possible via trial pitting or a mini-percussive drill rig. Also enables the installation of better/deeper monitoring wells (cf use of a mini-percussive drill rig) due to the utilisation of temporary steel casing during drilling.
- **Rotary percussive** open-hole probeholes are typically drilled using a tri-cone rock roller or polycrystalline diamond compact (PDC) bit with air as the flushing medium. Probeholes are generally lined through made ground with temporary steel casing to prevent hole collapse. Often used to penetrate bedrock to investigate abandoned shallow mineworkings
- **Rotary cored** boreholes. A rock core is cut by a bit, passes up into the inner barrel and, at the end of the coring run, the core barrel assembly is lifted to the surface. Core drilling is relatively expensive, but essential if quality data is required to assess issues associated with deep excavation, rock slope stability etc.

Where installed, gas\groundwater monitoring **wells** typically comprise a lower slotted section, surrounded by a filter pack of 10 mm non-calcareous gravel and an upper plain section surrounded in part by a bentonite seal and in part by gravel or arisings. The top of the plain pipe is cut off below ground level and the monitoring well protected by a square, stopcock type manhole cover set in concrete, or the plain pipe is cut off just above ground level and the well protected by 100mm diameter steel borehole helmet set in concrete. Monitoring well details, including the location of the response zone and bentonite seal are presented on the relevant exploratory hole logs.

In-situ testing

Relative densities of granular materials given on the trial pit logs are based on visual inspection only, they do not relate to any specific bearing capacities.

The relative densities of granular materials encountered in cable percussive boreholes are based on Standard Penetration Test (SPT) results. SPTs are carried out boreholes, in accordance with BS 1377 1990, Part 9 Section 3.3. Where full penetration (600mm) is not possible, N values are calculated by linear extrapolation and are shown on the logs as $N^* = x$. The strength of cohesive deposits is determined using a hand shear vane.

Shear strength test results (hand vane readings) reported on trial pit logs are considered to be more reliable than those reported on window sample logs. Significant sample disturbance occurs during window sampling and consequently shear strength results on disturbed window samples are generally lower than results obtained during trial pitting, in-situ or in large excavated blocks.

Sampling

Typically Lithos collect at least three soil samples from each exploratory hole, although in practice a greater number are often taken. The collection of a sufficient number of samples provides a sound basis upon which to schedule laboratory analysis, ensuring:

- A sufficient number of samples from each (common) site material are tested
- Horizontal and vertical coverage of the site is adequate, thereby providing a robust data set for use in the conceptual ground model
- Any localised, significant, but non-pervasive conditions are considered

Made ground and natural soils encountered in the field during a ground investigation often contain a significant proportion of coarse grained material (e.g. brick etc). Soil samples obtained during most investigations are often only truly representative of the in-situ soil mass where there is an absence of particles coarser than medium gravel; i.e the entire soil mass would pass a 20mm sieve.

Representative bulk samples of the **soil mass** are retrieved from coarse soils for specific geotechnical tests (most notably grading and compaction); this typically requires the collection of at least 10kg of soil, and occasionally >50kg. However, in the context of assessing land contamination, it is generally accepted that samples should be representative of the **soil matrix** of the stratum from which they are taken. Consequently, truly representative samples of coarse soils for subsequent contaminant analysis are not obtained - only the finer fraction is placed in sample containers. Coarse constituents not sampled would typically comprise any 'particles' with an average diameter greater than about 20mm (i.e. coarse gravel, cobble and boulder).



At present, neither ISO/IEC 17025 nor MCERTS specify sample pre-treatment with respect to stone removal. Unsurprisingly therefore UKAS accredited testing laboratories do not adopt the same approach to stones¹ – some crush and test the “as received” soil, whilst others sieve out stones and analyse only the residual soil (the sieve size used varies depending on the laboratory).

In essence, samples taken from coarser soils for contaminant analysis are “screened” by the geoenvironmental engineer in the field, and often sieved again by the laboratory during sample preparation. Geoenvironmental engineers do not typically re-calculate soil mass contaminant concentrations by taking account of the unsampled coarse fraction. Likewise, laboratories that remove stones typically report contaminant concentrations based on the dry weight of soil passing the sieve. In the context of land contamination and human health risk assessment, this is considered reasonable, because it is the soil matrix which is of greatest concern. Stones are unlikely to:

- Provide a significant source for plant uptake (consumption of vegetables)
- Remain on vegetables after washing (consumption of vegetables)
- Be eaten (accidentally by an adult, or deliberately by a child)
- Be whipped-up by the wind for dust generation (inhalation)
- Stick to the skin for any length of time (dermal contact)
- Yield toxic vapour (inhalation)

Consequently, Lithos instruct labs to remove all stones >10mm, and to report the results as dry-weight based on the mass of matrix tested. However, the laboratory are given site-specific instruction where coarse stones are coated in say oil, or impregnated with mobile contaminants such as diesel. Where the stones are predominantly natural, or inert (e.g. brick, concrete etc), removal will clearly result in higher reported concentrations, than if the stones were crushed and added to the matrix.

Where the stones include a significant proportion of contaminant-rich material (e.g. slag, fragments of galvanised metal etc) an argument could be made for crushing and analysing. However, provided the stones are stable (i.e. unlikely to disintegrate or degrade) they should not pose a significant risk to human health for the reasons stated above.

Sometimes it is necessary to obtain samples that are not representative of the wider soil matrix, for example when investigating localised, significant, but non-pervasive conditions. Any such unrepresentative samples are annotated with the suffix ‘*’ (eg 2D*, or 4G*). Lithos’ site engineer describes both the unrepresentative sample, and the soil mass from which it was taken.

Sample Containers (for contaminant analysis). Samples of soil for contaminant testing are placed into appropriate containers (see below). Soil samples for organic analysis are stored in cool boxes, at a temperature of approximately 4°C, until delivery to the selected laboratory.

Anticipated testing	Container(s)
Asbestos identification	1000ml plastic tub
pH & metals	1000ml plastic tub or 250ml glass jars
non-volatile organics	250ml glass jars
Speciated TPH	250ml & 50ml glass jars
VOCs (incl. naphthalene and/or GRO)	50ml glass jar

Sample Containers (for geotechnical analysis). The majority of samples are only scheduled for PI and sulphate testing, for which 500g of sample is required (a full 0.5-litre plastic tub). However, bulk bags are taken where scheduling of compaction or grading tests is proposed.

Groundwater

Where encountered during fieldwork, groundwater is recorded on exploratory hole logs. If monitoring wells are installed, groundwater levels are also recorded on one or more occasions after completion of the fieldwork. Long-term monitoring of standpipes or piezometers is always recommended if water levels are likely to have a significant effect on earthworks or foundation design.

It should be borne in mind that the rapid excavation rates used during a ground investigation may not allow the establishment of equilibrium water levels. Water levels are likely to fluctuate with season/rainfall and could be substantially higher at wetter times of the year than those found during this investigation.

Description of strata

Soils encountered during a Lithos investigation are described (logged) in general accordance with BS 5930:2015. The descriptions and depth of strata encountered are presented on the exploratory hole logs and summarised in the Ground Conditions section within the main body of text. The materials encountered in the trial pits are logged, samples taken, and tests performed on the in-situ materials in the excavation faces, to depths of up to 1.2m; below this depth these operations are conducted at the surface on disturbed samples recovered from the excavation.

¹ Mark Perrin. Stoned – Sample Preparation for Soils Analysis. Ground Engineering, April 2007.

General

Soil samples are delivered to the laboratory for testing along with a schedule of testing drawn up by Lithos. All tests are carried out in accordance with BS 1377:1990. The following laboratory testing is routinely carried out on a selection of samples:

- Atterberg limits & moisture contents
- Soluble sulphate & pH

Where soft, cohesive soils are encountered, one-dimensional consolidation tests are scheduled in order to assess settlement characteristics, and unconsolidated undrained triaxial compression tests to assess shear strength.

The additional tests are typically only scheduled where significant earthworks regrade is anticipated:

- Grading
- Compaction tests
- Particle density

Test results are presented as received in an Appendix to the Geoenvironmental Report.

Atterberg limits & moisture content

The Liquid and Plastic Limits of samples of natural in-situ clay are determined using the cone penetrometer method and the rolling thread test. These tests enable determination of an average Plasticity Index (PI) for each "type" of clay, although judgement is applied where variable results are reported.

PI can be related to shrinkability (low, medium or high) and then to minimum founding depth. Lithos typically only consider a soil to be shrinkable if the proportion finer than 63µm is >35%. PI results are compared against guidance given in the NHBC Standards, Chapter 4.2 (revised April 2003), which advocates the use of modified Plasticity Index (I'p), defined as:

$$I'p = Ip * (\% < 425\mu\text{m}/100)$$

i.e. if PI is 30%, but the soil contains 80% < 425µm, then: $I'p = 30 * 80/100 = 24\%$.

It should be noted that in accordance with the requirements of BS 1377, the % passing the 425µm sieve is routinely reported by testing labs. Lithos apply engineering judgment where PI results are spread over a range of classifications. Consideration is given to:

- The average values for each particular soil type (ie differentiate between residual soil and alluvium)
- The number of results in each class and
- The actual values

Unless the judgment strongly indicates otherwise, Lithos typically adopts a conservative approach and recommends assumption of the higher classification.

Soluble sulphate and pH

Sulphates in soil and groundwater are the chemical agents most likely to attack sub-surface concrete, resulting in expansion and softening of the concrete to a mush. Another common cause of concrete deterioration is groundwater acidity.

The rate of chemical attack depends on the concentration of aggressive ions and their replenishment at the reaction surface. The rate of replenishment is related to the presence and mobility of groundwater.

Lithos refer to BRE Special Digest 1 (SD1) "Concrete in aggressive ground. Part 1: Assessing the aggressive chemical environment" (2005). SD 1 provides definitions of:

- The nature of the site (greenfield, brownfield or pyritic)
- The groundwater regime (static, mobile or highly mobile)
- The design sulphate class (DS class) and
- The aggressive chemical environment for concrete (ACEC class)

Lithos reports clearly state each of the above for the site being considered.

The concentrations of sulphate in aqueous soil/fill extracts are determined in the laboratory using the gravimetric method. The results are expressed in terms of SO₄ for direct comparison with BS 5328:1997. The pH value of each sample was determined by the electrometric method.

SD1 also discusses determination of "representative" sulphate concentration from a number of tests. Essentially if <10 samples of a given soil-type have been tested, the highest measured sulphate concentration should be taken. If >10 samples have been tested, the mean of the highest 20% of the sulphate test results can be taken. With respect to groundwater, the highest sulphate concentration should always be taken.

With respect to pH (soil & groundwater) the value used is the lowest value if <10 samples have been tested and the mean of the lowest 20% if >10 samples have been tested.

Oedometer (Consolidation) tests

Oedometer tests measure a soil's consolidation properties, and are performed by applying different loads to a soil sample and measuring the deformation response. Typically the sample is subject to 5 incremental pressures (4 loading & 1 unloading), and the convention is for each subsequent pressure to be double the previous pressure. BS1377 suggests the initial pressure should be:

- a) For stiff soils the effective overburden pressure*
- b) For firm soils "somewhat less" than the effective overburden pressure
- c) For soft soils "appreciably less" than the effective overburden pressure, usually 25 kPa or less
- d) For very soft soils very low, typically 5 kPa or 10 kPa

* Effective overburden pressure (kNm⁻²) = depth (m) x soil bulk unit weight (kNm⁻³)

Results from these tests are used to predict how a soil in the field will deform in response to a change in effective stress.

Triaxial tests

This test measures the mechanical properties of a soil by placing the sample between two parallel platens which apply stress in one (usually vertical) direction, with fluid used to apply a confining pressure in the perpendicular directions. During the test, the surrounding fluid is pressurized, and then stress on the platens is increased until the material in the cylinder fails.

From triaxial test data, it is possible to extract fundamental material parameters, including its angle of shearing resistance, apparent cohesion, and dilatancy angle. These parameters are then used in computer models to predict how the material will behave in a larger-scale engineering application.

Quick (single stage, Unconsolidated, Undrained tests) are most appropriate for foundation design. This is because load is applied relatively quickly, and shear strength of the clay will be lowest initially; after the applied load causes some consolidation of the ground (after drainage results in dissipation of short-term excess pore water pressure), the in-situ clays will become progressively stronger and hence the factor of safety will increase. Confining pressure is specified as equivalent to overburden pressure (kNm^{-2}).

Foundations on granular soils would use effective shear strength parameters (c' and ϕ_i') to assess safe bearing capacity, as the soil would fully drain quickly. These effective shear strength parameters could be determined from Consolidated Undrained (or sometimes the more expensive Consolidated Drained) triaxial tests, but often correlations to the SPT are used.

Unconsolidated Undrained triaxial tests are most appropriate for assessment of the stability of fill slopes on clays. Similar to foundations, the application of load gradually increases the strength of the clays and hence the critical case is the short term undrained condition.

Consolidated Undrained (or sometimes **Consolidated Drained**) triaxial tests are most appropriate for assessment of the stability of cut slopes in clays. This is because unloading of the ground leads to short term reduction in pore pressures that approximately balance the unloading, hence the soil strength is largely unchanged. Over time the reduced pore pressures suck water in, which leads in to the progressive increase in pore pressure and loss of strength. The fully drained state is critical, which must be modelled using effective strength parameters and a reasonable estimate of the long term water table conditions.

Slopes formed in granular soils would use effective shear strength parameters (c' and ϕ_i') to assess safe bearing capacity, as the soil would fully drain quickly. These effective shear strength parameters could be determined from Consolidated Undrained (or sometimes the more expensive Consolidated Drained) triaxial tests, but often correlations to the SPT are used.

Determination of analytical suite

An assessment of potential contaminants associated with the former usages of the site is undertaken with reference to CLR 8 "Potential contaminants for the assessment of land" and the relevant DETR Industry Profile(s).

Common contaminants

Common Inorganic Contaminants include:

- Metals, most notably cadmium, copper, chromium, mercury, lead, nickel, and zinc
- Semi-metals, most notably arsenic, selenium, and (water soluble) boron
- Non-metals, most notably sulphur
- Inorganic anions, most notably cyanides (free & complex), sulphates, sulphides, and nitrates

With respect to the terminology used by most analytical laboratories:

Total cyanide = Free cyanide + Complex cyanide

Total cyanide (CN) is determined by acid extraction; whereas free cyanide is the water soluble fraction. Complex cyanide is "bound" in compounds and is hard to breakdown. Laboratory determination of complex CN involves subjecting the sample to UV digestion for determination of both free and total CN.

Thiocyanate (SCN) is a different species combined with sulphur.

Elemental sulphur (S) and free sulphur are the same. Total sulphur is all forms, including that present in sulphates (SO₄), sulphides etc.

There are 2 forms of chromium (Cr), chromium VI and chromium III. Chromium VI is the more toxic of these. In soils, total chromium is determined by a strong aqua regia acid digestion. Chromium VI is an empirical method based on a water extract test.

Common Organic Contaminants include hydrocarbons, phenols, and polychlorinated biphenyls.

Petroleum is a mixture of hydrocarbons produced from the distillation of crude oil, and includes aliphatics (alkanes, alkenes and cycloalkanes), aromatics (benzene and derivatives) and hydrocarbon-like compounds containing minor amounts of oxygen, sulphur or nitrogen. Petroleum hydrocarbons can be grouped based on the carbon number range:

- GRO – Gasoline Range Organics (typically C₆ to C₁₀). Also referred to as PRO – Petroleum Range Organics
- DRO – Diesel Range Organics (typically C₁₀ to C₂₈)
- LRO - Lubricating Oil Range Organics (typically C₂₈ to C₄₀)
- MRO – Mineral Oil Range Organics (typically C₁₈ to C₄₄)

However, it should be borne in mind that the terms "GRO" and "DRO" analysis are purely descriptive terms, the exact definition of which varies. Total Petroleum Hydrocarbons (TPH) is also a poorly defined term; some testing laboratories regard TPH as hydrocarbons ranging from C₅-C₄₀, whereas others define TPH as C₁₀-C₃₀.

The composition of a TPH plume migrating through the ground can vary significantly; this is primarily dictated by the nature of the source (e.g. petrol, diesel, engine oil etc). Furthermore, different hydrocarbons are affected differently by weathering processes, and this can result in further variation in the chemical composition of the TPH.

Gasoline contains light aliphatic hydrocarbons (especially within the C₄ to C₅ range) that are volatile. The aromatic hydrocarbons in gasoline are primarily benzene, toluene, ethylbenzene and xylenes, referred to as BTEX. Small amounts of polycyclic aromatic hydrocarbons (PAHs) such as benzo(a)pyrene may also be present. Diesel and light fuel oils have higher molecular weights than gasoline. Consequently, they are less volatile and less water soluble. About 25 to 35% is composed of aromatic hydrocarbons. BTEX concentrations are generally low.

Heavy Fuel Oils are typically dark in colour and considerably more viscous than water. They contain 15 to 40% aromatic hydrocarbons. Polar nitrogen, sulphur and oxygen-containing compounds (NSO) compounds are also present. Lubricating Oils are relatively viscous and insoluble in groundwater. They may contain 10 to 30% aromatics, including the heavier PAHs. NSO compounds are also common.

Polycyclic Aromatic Hydrocarbons (PAHs) have two or more fused benzene rings as a structural characteristic. PAH compounds are present in both petrol and diesel, although in significantly lower concentrations than in coal tars. Certain PAH compounds are carcinogenic (benzo(a)pyrene) and/or mobile in the environment (naphthalene).

Volatile Organic Compounds (VOCs) are organic chemicals, and most are liquids that readily evaporate on exposure to air. Examples include benzene, toluene, xylene, chloroform etc. Semi-Volatile Organic Compounds (sVOCs) include phenol and benzo(a)pyrene, and have relatively low boiling points. Both groups of chemicals are readily absorbed through skin and some, such as benzene, are believed to be linked to tumour growth.

Phenols are compounds that have a hydroxyl group (-OH) attached to an aromatic ring (ie include a benzene ring and an -OH group). Most are colourless solids. A solution of phenol in water is known as carbolic acid, and is a powerful antiseptic. However, phenol vapour is toxic, and skin contact can result in burns.

Polychlorinated Biphenyls (PCBs) were used in pre-1974 transformers as dielectric fluids. PCB's are of increasing toxicity relative to the degree of chlorination. Acute symptoms of PCB poisoning are irritation of the respiratory tract leading to coughing and shortness of breath. Nausea, vomiting and abdominal pain are caused by ingestion of PCB's.

Dioxins and furans (polychlorinated dibenzodioxins and polychlorinated dibenzofurans) are some of the most toxic chemicals known; in the environment, they tend to bio-accumulate in the food chain. Dioxin is a general term that describes a group of hundreds of chemicals that are highly persistent in the environment. The most toxic compound is 2,3,7,8-tetrachlorodibenzo-p-dioxin or TCDD.

Dioxin is formed by burning chlorine-based chemical compounds with hydrocarbons. The major source of dioxin in the environment comes from waste-burning incinerators and also from backyard burn-barrels. Dioxin pollution is also affiliated with paper mills which use chlorine bleaching in their process and with the production of Polyvinyl Chloride (PVC) plastics and with the production of certain chlorinated chemicals (like many pesticides).

Methods of analysis (organic compounds)

TPH by GC-FID is an analytical technique which only detects hydrocarbons (aliphatic and aromatic) in the range C₁₀ to C₄₀ (volatiles, heavy tars, humic material and sulphur are not detected). The laboratory can provide a broad, 'banded' breakdown of the TPH results into gasoline range organics (GRO), diesel range organics (DRO) and heavier lubricating oil range organics (LRO), or fully speciated results with the reporting of hydrocarbon concentrations in 14 specific carbon bandings based upon behavioural characteristics, e.g. aliphatic C₆ to C₈, aromatic C₁₀ to C₁₂ etc.

Speciated VOC (by GC-MS) analysis quantifies the concentrations of 30 USA-EPA priority compounds. These include chlorinated alkanes and alkenes (in the molecular weight range chloroethane to tetrachloroethane); trimethylbenzenes; dichlorobenzenes; and the 4 BTEX compounds (benzene, ethyl-benzene, toluene & xylene).

Speciated sVOC by (GC-MS) analysis quantifies the concentrations of a variety of organic compounds, including the 16 USA-EPA priority PAHs, phenols, 7 USA EPA priority PCB congeners, herbicides & pesticides.

Note: PAHs are hydrocarbons and consequently (where present) will be picked-up when scheduling TPH by GC-FID.

Note: Risk assessment models require physiochemical properties (solubilities, toxicities etc) of compounds in order to model their behaviour in the environment. These physiochemical properties cannot be derived from a single "TPH", "GRO" or "DRO" value. However, the carbon banded fractions can be used in risk assessment models.

Current UK guidance

The UK approach to contaminated land is set out in Land Contamination Risk Management (2020). The approach is based upon risk assessment, where risk is defined as the combination of the probability of occurrence of a defined hazard and the magnitude of the consequences of the occurrence.

In the context of land contamination, there are three essential elements to any risk: (1) a contaminant source; (2) a receptor (eg controlled water or people); and (3) a pathway linking (1) and (2). Risk can only exist where all three elements combine to create a pollutant linkage. Risk assessment requires the formulation of a conceptual model which supports the identification and assessment of pollutant linkages.

Lithos adopt a tiered approach to risk assessment, consistent with UK guidance and best practice. The initial step of such a risk assessment (or Tier 1) is the comparison of site data with appropriate UK guidance levels. Lithos risk-derived screening values, or remedial targets. It should be noted that exceedance of Tier 1 does not necessarily mean that remedial action will be required.

Soil screening values used by Lithos

In March 2002 DEFRA and the Environment Agency published a series of technical papers (R&D Publications CLR 7, 8, 9 & 10) outlining the UK approach to the assessment of risk to human health from land contamination. In 2008 CLR 7, 9 & 10 and all corresponding SGV and Tox reports were withdrawn and superseded by new guidance including:

- Guidance on Comparing Soil Contamination Data with a Critical Concentration - CL:AIRE and CIEH, May 2008
- Evaluation of models for predicting plant uptake of chemicals from soil - Science Report – SC050021/SR
- Human health toxicological assessment of contaminants in soil - Science Report: SC050021/SR2
- Updated technical background to the CLEA model - Science Report: SC050021/SR3
- CLEA Software Handbook, Science report: SC050021/SR4
- Compilation of data for priority organic pollutants for derivation of Soil Guideline Values - Science Report: SC050021/SR7

In December 2013 Defra published the results of research project SP1010 – Development of Category 4 Screening Levels (C4SLs) for Assessment of Land Affected by Contamination. The objective of this project was to provide technical guidance in support of Defra's revised Statutory Guidance for Part 2A of the Environmental Protection Act 1990 (Part 2A). The revised Statutory Guidance, published in April 2012, introduced a new four-category system for classifying land under Part 2A, where Category 1 includes land where the level of risk is clearly unacceptable, and Category 4 includes land where the level of risk posed is acceptably low. Project SP1010 aimed to deliver:

- A methodology for deriving C4SLs for four generic land-uses comprising residential, commercial, allotments and public open space; and
- Demonstration of the methodology, via derivation of C4SLs for 6 substances – arsenic, cadmium, chromium IV, lead, benzene & benzo(a)pyrene.

The methodology for deriving both the previous Soil Guideline Values and the Category 4 Screening Levels is based on the Environment Agency's Contaminated Land Exposure Assessment (CLEA) methodology. Development of C4SLs has been achieved by modifying the toxicological and/or exposure parameters used within CLEA (while maintaining current exposure parameters).

Part 2A Statutory Guidance was developed on the basis that C4SLs could be used under the planning regime. Defra anticipate that, where they exist, C4SLs will be used as generic screening criteria, and Lithos consider C4SLs to be suitable for use as Tier 1 Screening Values. Lithos have discussed this matter with both NHBC and YALPAG (collection of Yorkshire & Lincolnshire local authorities) and received confirmation that they are satisfied with this approach.

The CLEA conceptual site model assumes a source located in a sandy loam, with 6% soil organic matter (SOM) - equivalent to 3.5% total organic carbon (TOC). However, many organic contaminants are more mobile when the SOM is lower, and consequently comparison of soil results with revised, lower screening values may be required. Other CLEA default characteristics adopted by Lithos are:

Sandy Loam characteristics (source)	Default values adopted
Total porosity (fraction)	0.53
Water filled porosity (fraction)	0.33
Air filled porosity (fraction)	0.2

Lithos have derived Screening Values for five different CSMs (scenarios); these are:

- A - Residential with gardens, but no cover (or only up to 300mm)
- B - Residential with gardens and 600mm 'clean' cover
- C - Residential apartments with landscaping (i.e. no home grown produce)
- D - Commercial/industrial with landscaping
- E – Importation of soil cover

The exposure pathways considered for each scenario are detailed in the table below.

Scenario	Land use	Pathways	Justification
A	Residential with garden, but no cover (or only up to 300mm)	<ul style="list-style-type: none"> • Direct ingestion of soil • Dermal contact • Consumption of vegetables & soil attached to vegetables • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust 	Minimal cover – insufficient to break any pathways therefore all exposure pathways are relevant.
B	Residential with garden minimum 600mm cover	<ul style="list-style-type: none"> • Inhalation of indoor vapours • Inhalation of outdoor vapours 	The 600mm cover removes the risk from all pathways other than inhalation.
C	Residential apartments with landscaped areas and minimum 300mm cover	<ul style="list-style-type: none"> • Direct ingestion of soil • Dermal contact • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust 	All pathways applicable due to possible exposure from landscaped areas. However consumption of home grown produce not included as unlikely to be grown in landscaped areas. Where vegetables are to be grown site specific QRA may be required.

Scenario	Land use	Pathways	Justification
D	Commercial/ industrial with landscaped areas no cover	<ul style="list-style-type: none"> Direct ingestion of soil Dermal contact Inhalation of indoor vapours and dust Inhalation of outdoor vapours and dust 	All pathways applicable due to possible exposure from landscaped areas. Assumed the commercial development consists of offices to provide a conservative assessment.
E	Importation of soil for cover in garden and landscaped areas	<ul style="list-style-type: none"> Direct ingestion of soil Dermal contact Consumption of vegetables & soil attached to vegetables Inhalation of outdoor vapours and dust 	Material used as cover to break existing pathways therefore all direct and indirect pathways relevant; however cover is not placed below plots therefore indoor inhalation is not relevant.

Lithos have assumed the source of contamination is directly below the building foundation; i.e. a depth to source of 0.15m as opposed to the CLEA default of 0.65m. This assumption provides for a more conservative approach than the UK default.

Lithos have derived Tier 1 values for a number of inorganic and organic determinands in the context of the five Scenarios A to E. The Tier 1 values are *not* intended to be used when considering potential risks associated with:

- Existing land uses in the context of Part 2A of the Environment Protection Act 1990;
- End uses such as allotments, sports fields, children's playgrounds, care homes, hospitals etc; or
- Groundwater and surface water

Inorganic Tier 1 values for scenarios A to E

Inorganic contaminant	Tier 1 assessment criteria (mg/kg) for Scenarios A to E							Comments/notes
	SGV*	C4SL*	A	B	C	D	E	
As	32	37	37	Use (A) in SI Report for initial "screen" If >5 x A, then consider increase of cover to 1,000mm	40	640	37	C4SL adopted
Cd	10	26	26		149	410	26	C4SL adopted
Cr			4,000		4,000	28,767	4,000	Assumes Cr is CrIII
Pb	450	200	200		314	2,330	200	C4SL adopted
Ni	130		109		123	892	109	Assessment of health risk only
Se	350		434		596	13,018	434	
Hg	170		199		244	3,603	199	Assumes in an inorganic compound
Vn			584		586	4,994	584	
B			5		5	5	5	
Cu			100		100	100	100	Based on phytotoxic risks as plants are the more sensitive receptor (Cu is pH dependant)
Zn			200	200	200	200		

Organic Tier 1 values for scenarios A to E

Organic contaminant (all sourced via CLEA)	Tier 1 assessment criteria (mg/kg) for Scenarios A to E							Comments/notes
	SGV*	C4SL*	A	B	C	D	E	
Benzene	0.33	0.87	0.7	<1 [^]	<1 [^]	63	<1	<1 based on professional judgement and lower than calculated value.
Toluene	610		836	2,048	1,912	5,000	<1	Scenario D based on professional judgement and lower than calculated value.
Ethyl Benzene	350		379	592	566	5,000	<10	Scenario E based on professional judgement and lower than calculated value.
Xylenes	240		535	590	585	5,000	<10	Scenario E based on professional judgement and lower than calculated value.
Phenol	420		1,434	3,360	2,264	5,000	<10	
PCBs			2	8	2	38	N/A	Based on toxicity of EC7
Benzo(a)pyrene		5	5	25	5	76	5	C4SL adopted. Scenario B 5 times scenario A
Naphthalene			6	6	6	619	<10	Scenario E based on professional judgement and lower than calculated value
Gasoline Range Organics			22	23	23	2178	626	See 3-step assessment of TPH below
Diesel Range Organics			215	218	215	^5,000	1,429	^Based on professional judgement and lower than calculated value
Lubricating Range Org			3,299	5,000	3,829	^5,000	3,299	

* For a residential end use

The significance of PAHs can be determined by considering indicator compounds. In most cases benzo(a)pyrene (BaP) is adopted as an indicator due to the amount of toxicological data available and has been used by various authoritative bodies to assess the carcinogenic risk of PAHs in food. A surrogate marker approach can be used to estimate the toxicity of a mixture of PAHs in soil using toxicity data for individual indicator compounds within that mixture. Exposure to the surrogate marker is assumed to represent exposure to all PAHs in that matrix. The surrogate marker approach relies on a number of assumptions:

- Surrogate marker (BaP) must be present in all soil samples
- Profile of the different PAH relative to BaP should be similar in all samples
- PAH profile in the soil samples should be similar to that used in the pivotal toxicity study¹

To assess the PAH profile in a soil sample, the ratio of the seven genotoxic PAHs (benz[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, chrysene, dibenz[a,h]anthracene and indeno[1,2,3-c,d]pyrene), relative to BaP, should be calculated. The ratio relative to BaP should lie within an order of magnitude above and below the mean ratio to BaP.

¹ SP1010 Appendix E, Provisional C4SLs for benzo(a)pyrene as a surrogate marker for PAHs, CL:AIRE 2013

Naphthalene should also be considered separately against its generic screen. Whilst classed as a PAH, naphthalene is more volatile and mobile in the environment than most other PAHs. As such the significance of naphthalene cannot be considered within the surrogate marker approach. Similarly, TPH cannot be assessed as a single "total" value, and reference has been made to the Environment Agency's document P5-080/TR3, "The UK approach for evaluating human health risks from petroleum hydrocarbons in soils". This document supports the assumptions and recommendations made by the US Total Petroleum Hydrocarbons Criteria Working Group (TPHCWG). The TPHCWG have broken down "TPH" into representative constituent fractions or "EC Bandings". The TPHCWG have derived a series of physicochemical and toxicological parameters for each of the bandings.

The significance of speciated TPH results can be assessed by following the 3 steps outlined in the tables below.

Step	Result	Action
1. Consider indicator compounds: Are BTEX, naphthalene, benzo(a)pyrene above their respective Tier 1 values?	Yes	Remediation or dQRA required
	No	Proceed to Step 2
2. Consider individual TPH fractions: are they above respective screening values?	Yes	Remediation or dQRA required
	No	Proceed to Step 3
3. Assess Cumulative effects: Is the calculated Hazard Index for each source >1	Yes	Remediation or dQRA required
	No	TPH compounds pose no significant risk

The equation used to assess cumulative effects in step 3 is shown below.

$$HI = \sum_{i=1}^{16} HQ F_i = \frac{\text{Measured concentration } F_i \text{ (mg kg}^{-1}\text{)}}{SGV F_i \text{ (mg kg}^{-1}\text{)}}$$

where HI = Hazard Index
 HQ = Hazard Quotient
 F_i = Fraction i
 SGV = Soil Guideline Value

Statistical Assessment

Current UK guidance is provided by CL:AIRE², and uses two-way confidence intervals and graphical summaries, to assist assessors when determining whether or not a dataset is adequate to answer the question posed; e.g. "is existing site topsoil suitable for retention & re-use?". To answer such a question, it is necessary to recover and test a large number of samples (a minimum of 10; ideally 20+) in order to undertake meaningful statistical analysis.

However, in the context of site investigation to assess the significance of contamination on brownfield sites which are typically underlain by heterogeneous made ground, some remediation is almost always required (placement of soil cover, excavation of gross contamination etc). Consequently, in such circumstances, it is not necessary to demonstrate that made ground soils are "clean" and therefore there is no need to test large numbers of samples and undertake statistical analysis. Sample results can simply be compared directly with appropriate screening values (e.g. Lithos Tier 1 values).

The CL:AIRE (2020) guidance replaces the withdrawn "Guidance on Comparing Soil Contamination Data with a Critical Concentration" (2008). The old approach to statistical analysis was based on a definitive yes/no answer which required limited consideration of the dataset and Conceptual Site Model. It was widely accepted that this did not allow sites or risk to be adequately assessed. The updated approach requires a comprehensive understanding of the datasets within the context of the Conceptual Site Model.

Current guidance requires that:

- A robust CSM is in place which identifies source areas, averaging areas and averaging zones
- Sampling locations are relatively evenly spread across the site and were selected using simple or stratified random sampling with no targeting being undertaken
- The field data and CSM do not suggest the presence of a hotspot of contamination which should be treated as a separate zone
- The samples are all taken from a similar same depth and within the same material type across the zone being assessed
- A minimum of 10 samples have been taken. It should be appreciated that confidence in a dataset increases as the number of samples obtained and tested from a zone increases.

The statistical analysis assumes a homogenous distribution of strata and contamination and therefore the dataset will be normally distributed (symmetric, log symmetric or fat tailed).

A normally distributed dataset is assessed using a number of statistical tools to generate a Dot and Box Plot which includes summary statistics and confidence intervals. The review of statistical data enables the assessor to make a decision, with an associated level of confidence, where the true mean of the sample population lies in relation to the critical concentration.

It is essential when using statistics to assess sample data that all decisions relate back to the conceptual site model. Statistics cannot indicate if contamination on a site is likely to present a risk to the end user, this is the role of the 'competent person' i.e. Lithos.

However, broadly speaking the following applies:

- Mean and UCL below the critical concentration – no further assessment required.
- Mean below the critical concentration, but UCL above – consider the CSM and likely sources.
- Mean and UCL above the critical concentration – further assessment required, remediation likely depending on the CSM.
- LCL, Mean & UCL above the critical concentration – further assessment required, remediation likely.

² CL:AIRE, 2020. Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration.

Other screening values used by Lithos

Tier 1 risk assessment of **hazardous gas** is undertaken through reference to the following documents (and further information is presented in Generic Note No. 5 – Hazardous Gas):

- Approved Document C, Building Regulations 2000
- Boyle & Witherington (2007) – Guidance on evaluation on development proposals on sites where methane and carbon dioxide are present, incorporating “traffic lights”. Report Ref. 10627-R01-(02), for NHBC
- CIRIA C665 (2007) – Assessing risks posed by hazardous ground gases to buildings
- BS 8485:2015 – Code of Practice for the characterisation & remediation from ground gas in affected developments

With respect to the assessment of potential **phytotoxic effects** of contaminants, Lithos refer to The Sewage Sludge in Agriculture: Code of Practice 2018 for copper and zinc (at pH 5.5 to 6.0). The CLEA derived Tier 1 value is adopted for nickel due to its human health effects.

The potential risk to **building materials** is considered through reference to relevant BRE Digests, with particular emphasis on BRE Special Digest 1, ‘Concrete in aggressive ground’, 2005.

With respect to the interpretation of the **calorific values**, at present there are no accepted methods to assess whether a sample is combustible and under what circumstances it might smoulder. Some guidance is given in ICRCCL Note 61/84 “Notes on the fire hazards of contaminated land” which states that: “In general ... it seems likely that materials whose CV's exceed 10MJ/kg are almost certainly combustible, while those with values below 2MJ/kg are unlikely to burn”.

Tier 1 **groundwater risk assessments** are always site specific and compare leachate or groundwater concentrations with the appropriate water quality standard based on the CSM and consideration of relevant water quality impacts and assessments.

Waste classification & WAC

In the context of waste soils generated by remediation and/or groundworks activities on brownfield sites, the following definitions (from the Landfill Regulations 2002) apply:

- Inert (e.g. uncontaminated ‘natural’ soil, bricks, concrete, tiles & ceramics)
- Non-Hazardous (e.g. soil excavated from a contaminated site which contains dangerous substances, but at concentrations below prescribed thresholds)
- Hazardous (e.g. soil excavated from a contaminated site which contains dangerous substances at concentrations above prescribed thresholds)

Dangerous substances include compounds containing a variety of determinants commonly found in contaminated soils on brownfield sites, for example arsenic, lead, chromium, benzene etc.

Landfill operators require Waste Acceptance Criteria (WAC) laboratory data, if soil waste is classified as **hazardous**. However, subject to WAC testing it may be possible to classify it as stable, non-reactive hazardous waste, which can be placed within a dedicated cell within the non-hazardous landfill.

Lithos typically only include WAC analysis in site investigation proposals and reports, if significant off-site disposal (of soil classified as hazardous waste) is anticipated, for example where redevelopment proposals include basement construction etc. If off-site disposal of soils classified as hazardous waste during redevelopment is anticipated, then WAC analysis should be scheduled at an early stage in the remediation programme. However, organic compounds (BTEX, TPH, PAH etc) are the most common contaminants that result in soils being classed as hazardous, and these contaminants can often be dealt with by alternative technologies (e.g. by bioremediation or stabilisation) and consequently retention on site is often possible.

It should be noted that **non-hazardous** soil waste can go to a non-hazardous landfill facility; no further testing (e.g. WAC) is required.

Possible action in event of Tier 1 exceedance

Should any of the Tier 1 criteria detailed above be exceeded, then three potential courses of action are available. (The first is only applicable in terms of human health, but the second and third could also be applied to groundwater or landfill gas).

1. Undertake further statistical analysis following the approach set out in Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration, 2020 (see above) in order to determine whether contaminant concentrations of inorganic contaminants within soil actually present a risk (only applicable to assessing the risk to human health).
2. Carry out a more detailed quantitative risk assessment in order to determine whether contamination risks actually exist.
3. Based on a qualitative risk assessment, advocate an appropriate level of remediation to “break” the pollutant linkage - for example the removal of the contaminated materials or the provision of a clean cover.

Prior to undertaking any statistical analysis the issue of the **averaging area** requires further consideration. Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration, 2020 provides some guidance on averaging areas noting that they are the area within which a receptor may be exposed to contamination but leaving the site assessor to determine the appropriate averaging area for their site.

Lithos consider the entire site needs to be characterised by reference to the Conceptual Site Model. Consequently, Lithos gather and analyse sample results by fill type, and/or by former use in a given sub-area of the site, before undertaking statistical analysis; i.e. the averaging area is associated with the extent of a particular fill type, or an area affected by spillage/leakage.

In terms of brownfield redevelopment, this is considered a more appropriate methodology which provides a more representative sample population for statistical analysis. As such the entire site is considered in terms of the proposed end use, be this residential with, or without gardens.

Analysis by soil fill type is appropriate for essentially immobile contaminants associated with a particular fill type, for example arsenic in colliery spoil, metals in ash & clinker, sulphate in plaster-rich demolition rubble etc.

Analysis by former use is appropriate where more mobile contaminants have entered the ground, for example diesel associated with leakage from a former fuel tank, downward migration of leachable metals through granular materials, various soluble contaminants present in a wastewater leaking into the ground via a fractured sewer etc. In these circumstances, it may be appropriate to undertake statistical analysis of sample results from a variety of different soil fill types. However, consideration would have to be given to factors such as porosity which might influence impregnation of a mobile contaminant into the soil mass, i.e. contamination would normally be more pervasive and significant in granular soils than cohesive soils

General

Hazardous gas is considered to be any mixture of potentially explosive, toxic or asphyxiating gases, most notably methane, carbon dioxide and oxygen (deficiency). In addition, radon, a naturally occurring radioactive gas is also considered. Further information about radon is included in Notes 01 – Environmental Setting.

Assessment of potential risks associated with hazardous gas are based on a review of data obtained from the Landmark Information Group, the Environment Agency and the Local Authority and the British Geological Survey. Reference is also made to historical OS plans, which are inspected for evidence of backfilled quarries, railway cuttings, colliery spoil tips etc.

Where landfilling has occurred within 250m of the site boundary, the Local Planning Authority may request a landfill gas investigation in accordance with the Town and Country Planning General Development Order, 1988.

Sources

Potential sources of hazardous gas include:

- Landfill sites
- Made ground, especially where significant depths are present
- Shallow mineworkings associated with coal extraction
- Geological strata, including peat, organic silts, coal and limestone (reaction with acidic waters), granite (radon)
- Groundwater can sometimes act as a "carrier" for hazardous gas
- Leakages from pipelines or storage tanks
- Sewers, septic tanks and cess pits

Generation

Wherever biodegradable material is deposited, landfill gas (principally a mixture of methane and carbon dioxide) is likely to be generated by microbial activity. Carbon dioxide is an asphyxiant and toxic; methane is flammable and a mixture containing between 5% and 15% methane by volume in air is explosive. Landfill gas in the ground is unlikely in itself to pose a significant risk, though it may damage vegetation. However, infiltration of landfill gas into confined spaces (e.g. cellars, services, etc) may give rise to considerable risk.

There is no typical figure for the length of time that landfill gas will be evolved, but at many sites significant gas generation continues for at least 15 years after the last deposit of waste.

Migration

Gas migration from a landfill site may occur in several ways. It may migrate through adjacent strata; the distance of migration being dependent on the pressure gradients, volume of gas and permeability of the strata. Where there are faults, cavities and fissures within the strata, gas may move considerable distances. Other migration pathways for gas include man-made features such as mine shafts, roadways and underground services.

Gas migration is influenced by a number of climatic factors, such as atmospheric pressure variations, water table level variations and the influence of a covering of snow or ice over the surface of the site and surrounding area.

Gas monitoring procedure

Lithos adopt a standard gas monitoring procedure, in accordance with CIRIA guidance. This procedure involves the measurement, in the following order of:

- Atmospheric temperature, pressure and ambient oxygen concentration
- Gas emission rate
- Methane, oxygen and carbon dioxide concentrations using an infra-red gas analyser
- Standing water level using a dipmeter.

In addition, ground conditions at each sampling location are recorded together with prevailing weather conditions and any other observations such as any vandalism. Where samples of gas are required for laboratory analysis, Gresham Tubes or multi-layer Tedlar / ALTEF sampling bags are used. Gas concentrations in the well are typically recorded immediately before and after retrieval of a sample.

Current guidance

CIRIA Report 151 (1995)ⁱ identified that there was inadequate guidance on trigger concentrations for ground gases. CIRIA concluded that the most important aspect of a gas regime below or adjacent to a site was the surface emission rate, i.e. how quickly the gas is coming out of the ground. The lower the surface emission rate the lower the risk. CIRIA Report C665 (2007)ⁱⁱ advocates two methodologies for characterising sites:

A – All developments except low rise housing. The advocated methodology is that proposed by Wilson & Card, 1999ⁱⁱⁱ

B – Low rise housing. An alternative (traffic light) methodology, derived by Boyle and Witherington, 2006^{iv} for NHBC

Both methodologies refer to Gas Screening Values (GSV); previously referred to as limiting borehole gas volume flow.

Other relevant UK guidance includes:

- BS8485:2015+A1:2019 – Code of Practice for the characterisation & remediation from ground gas in affected developments.
- BS8576:2013 Guidance on investigations for ground gas – permanent gases and volatile organic compounds
- Boyle & Witherington (2007) – Guidance on evaluation on development proposals on sites where methane and carbon dioxide are present, incorporating "traffic lights". Report Ref. 10627-R01-(02), for NHBC
- Wilson, Card & Haines (CIEH, 2008) The Local Authority Guide to Ground Gas
- CL:AIRE Research Bulletin RB17 (November 2012) A Pragmatic Approach to Ground Gas Risk Assessment
- CL:AIRE Research Bulletin RB13 (February 2011) The Utility of Continuous Monitoring in Detection & Prediction of 'Worst-Case' Ground Gas Concentration
- BRE\Environment Agency Report BR 414 (2001) – "Protective Measures for housing on gas-contaminated land".
- YALPAG (December 2016) - Verification Requirements for Gas Protection Systems - Technical Guidance for Developers, Landowners and Consultants.
- Environment Agency Report LFTGN 03 - Guidance on the management of landfill gas, June 2014

A – All developments except low rise housing

(Wilson & Card, 1999)^v revised Table 28 of CIRIA 149^v in terms of borehole gas volume flow rate (now GSV) in order to achieve a more consistent design of protection measures. This was done to reflect the importance of recognising the gas surface emission rate. Wilson & Card then developed a method for classifying gassing sites (Table 1 below), which took into account the combined gas concentration and GSV.

Characteristic Situation	Gas Screening Value, CH ₄ or CO ₂ (l/hr)	Additional limiting factors	Typical source of generation
1	<0.07	Methane not to exceed 1% v/v and carbon dioxide not to exceed 5% v/v	Natural soils with low organic content
2	<0.7	Borehole air flow rate not to exceed 70 litre/hr otherwise increase to Characteristic Situation 3	Natural soil, high peat/organic content
3	<3.5		Old landfill, inert waste, mineworkings flooded.
4	<15	Quantitative Risk Assessment required to evaluate scope of protection measures.	Mineworkings – susceptible to flooding, completed landfill, inert waste
5	<70		Mineworkings unflooded, inactive
6	>70		Recent landfill site

Notes: Borehole flow rate = volume of gas (regardless of composition) which is escaping from well (l/hr). Gas Screening Value (litre/hour) = gas concentration (%) / 100 x borehole flow rate (l/hr). To facilitate design implementation, the limiting values for both methane and carbon dioxide are identical.

B – Low rise housing.

NHBC have developed a characterisation system similar to that of Wilson & Card above, but specific to low-rise housing development (Boyle and Witherington) (Table 8.7). This approach compares measured gas emission rates with generic "Traffic Lights". The Traffic Lights include "Typical Maximum Concentrations" for initial screening, and risk-based Gas Screening Values (GSVs) for consideration of situations where the Typical Maximum Concentrations are exceeded. Calculations are carried out for both methane and carbon dioxide and the worst case adopted in order to establish the appropriate protection measures.

Table 8.7 NHBC Traffic light system for 150 mm void

Traffic Light Classification	Methane ¹		Carbon Dioxide ¹	
	Typical Maximum Concentration ⁵ (%v/v)	Gas Screening Value ^{2,4,6} (l/hr)	Typical Maximum Concentration ⁵ (%v/v)	Gas Screening Value ^{2,3,4,6} (l/hr)
Green	1	0.16	5	0.78
Amber 1	5	0.63	10	1.56
Amber 2	20	1.56	30	3.13
Red				

Notes:

- The worst gas-regime identified at the site, either methane or carbon dioxide, recorded from monitoring in the worst temporal conditions, will be the decider for which Traffic Light and GSV is allocated.
- Generic GSVs are based on guidance contained within "The Building Regulations: Approved Document C" (2004) and assume a sub-floor void of 150 mm thickness.
- A leak of gas from the sub-floor void into a small room (e.g. downstairs toilet with soil pipe potentially passing into sub-floor void) of dimensions 1.50m x 1.50m x 2.50m, with a total room volume of 5.63m³ has been considered.
- The GSV, in litres per hour, is as defined in Wilson and Card (1999) as the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered.
- The Typical Maximum Concentrations can be exceeded in certain circumstances should the conceptual site model indicate it is safe to do so. This is where professional judgment will be required, based on a thorough understanding of the gas regime identified at the site where monitoring in the worst temporal conditions has occurred.
- The GSV thresholds should not generally be exceeded without completion of a detailed gas risk assessment taking into account site-specific conditions.

ⁱ Harries CR, Witherington PJ and McEntee JM (1995). Interpreting measurements of gas in the ground. CIRIA Report 151

ⁱⁱ CIRIA (2007) – Assessing risks posed by hazardous ground gases to buildings.

ⁱⁱⁱ Wilson SA and Card GB (February 1999). Reliability and Risk in Gas Protection Design. Ground Engineering.

^{iv} Boyle & Witherington (2006) – Guidance on evaluation on development proposals on sites where methane and carbon dioxide are present, incorporating "traffic lights". Report Ref. 10627-R01-(02), for NHBC

^v Wilson SA and Card GB (February 1999). Reliability and Risk in Gas Protection Design. Ground Engineering.

Appendix B
Drawings



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CLIENT

NEWETT HOMES

JOB TITLE

LOWER BLACUP
FARM,
CLECKHEATON

DRAWING TITLE

SITE LOCATION
PLAN

DRAWN

WN

DATE

18 01 2024

CHECKED

REG

DATE

20 01 2024

STATUS

FOR COMMENT

DRAFT

FOR APPROVAL

FINAL

SCALE

1:25,000

SHEET

A4

DRAWING NO.

1462/1

REVISION



NOTES

— APPROXIMATE SITE BOUNDARY

REPRODUCED FROM NEWETT HOMES
DRAWING REFERENCE Z168.002, DATED 13th
DECEMBER 2023)

REV.	DESCRIPTION	DATE



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CLIENT

NEWETT HOMES

JOB TITLE

LOWER BLACUP
FARM,
CLECKHEATON

DRAWING TITLE

PROPOSED LAYOUT

DRAWN	WN	DATE	18 01 2024	STATUS	FOR COMMENT <input type="checkbox"/>
CHECKED	REG	DATE	20 01 2024	FOR APPROVAL	<input type="checkbox"/>
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				FINAL	<input checked="" type="checkbox"/>

SCALE	1:1500	SHEET	A3	DRAWING NO.	1462/2	REVISION	
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- NOTES
- GRASS & OVERGROWN AREAS
 - BUILDING
 - GRAVEL OR HARDCORE SURFACING
 - APPROXIMATE SITE BOUNDARY
 - EXISTING FOUL SEWER
 - ABANDONED WATER MAIN
 - OVERHEAD TELECOM
- NOTE: LIST OF SERVICES NOT EXTENSIVE, LOCATIONS APPROXIMATE ONLY.

REV.	DESCRIPTION	DATE



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CLIENT
NEWETT HOMES

JOB TITLE
LOWER BLACUP FARM, CLECKHEATON

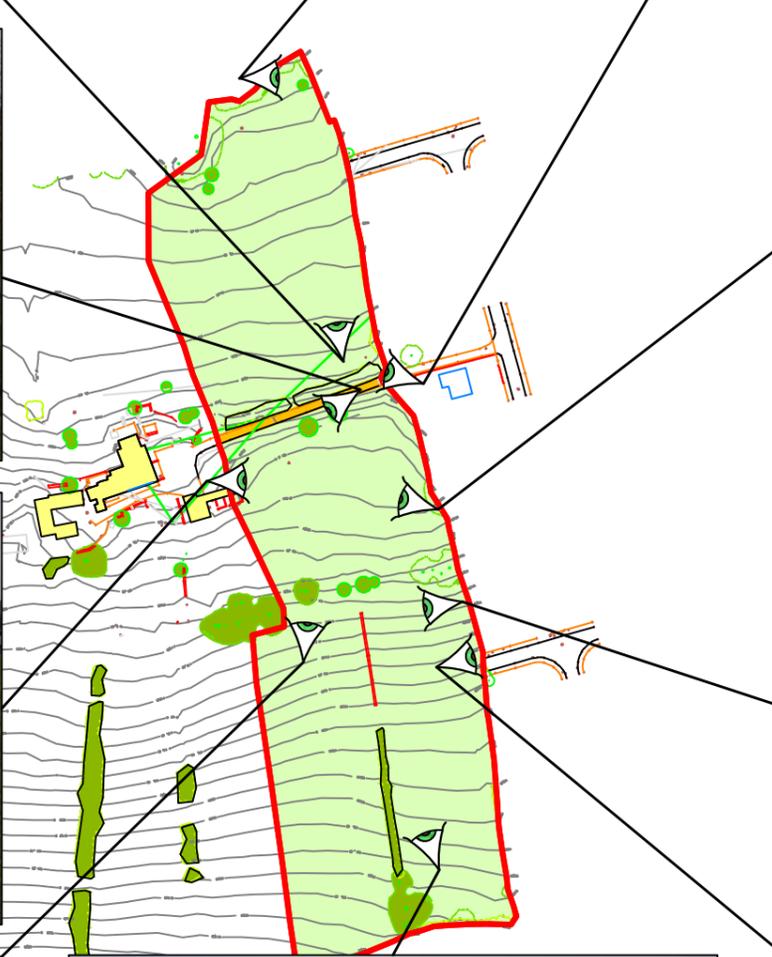
DRAWING TITLE
SITE FEATURES

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CHECKED REG	DATE 20 01 2024	

SCALE 1:1500	SHEET A3	DRAWING NO. 1462/3	REVISION
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- NOTES
- GRASS & OVERGROWN AREAS
 - BUILDING
 - GRAVEL OR HARDCORE SURFACING
 - APPROXIMATE SITE BOUNDARY
 - LOCATION & ORIENTATION OF PHOTOGRAPH



REV.	DESCRIPTION	DATE



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CLIENT

NEWETT HOMES

JOB TITLE

LOWER BLACUP FARM,
CLECKHEATON

DRAWING TITLE

SITE PHOTOGRAPHS

DRAWN	WN	DATE	18 01 2024	STATUS	FOR COMMENT <input type="checkbox"/>
CHECKED	REG	DATE	20 01 2024	FOR APPROVAL	<input type="checkbox"/>
				DRAFT	<input type="checkbox"/>
				FINAL	<input checked="" type="checkbox"/>

SCALE	NOT TO SCALE	SHEET	A3	DRAWING NO.	1462/4	REVISION	
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- NOTES
- GRASS & OVERGROWN AREAS
 - BUILDING
 - GRAVEL OR HARDCORE SURFACING
 - APPROXIMATE SITE BOUNDARY
 - APPROXIMATE COAL OUTCROP
 - APPROXIMATE GEOLOGICAL FAULT

NOTES: OUTCROPS AND LINE OF GEOLOGICAL FAULT INFERRED FROM BGS 1:10,000 SCALE PLAN SE 12 SE

REV.	DESCRIPTION	DATE



info@lithos.co.uk
www.lithos.co.uk
Tel 01937 545330

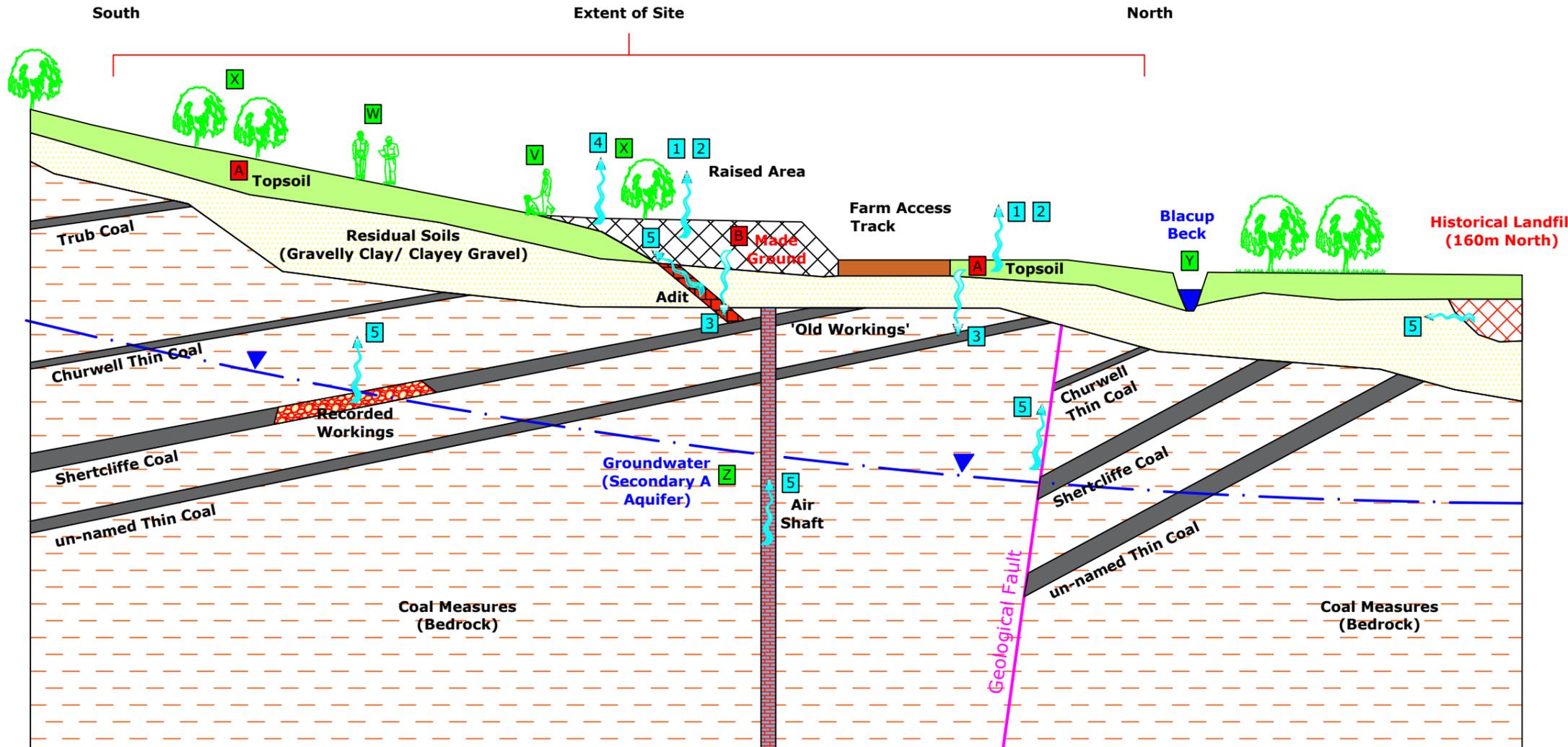
CLIENT
NEWETT HOMES

JOB TITLE
LOWER BLACUP FARM, CLECKHEATON

DRAWING TITLE
PUBLISHED COAL OUTCROPS & FAULTING

DRAWN WN	DATE 18 01 2024	STATUS FOR COMMENT <input type="checkbox"/> FOR APPROVAL <input type="checkbox"/> DRAFT <input type="checkbox"/> FINAL <input checked="" type="checkbox"/>
CHECKED REG	DATE 20 01 2024	

SCALE 1:1500	SHEET A3	DRAWING NO. 1462/5	REVISION
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SOURCES	
A	TOPSOIL (INORGANICS/ ORGANICS)
B	MADE GROUND (INORGANICS/ ORGANICS)

PATHWAYS	
1	DERMAL CONTACT
2	INGESTION/INHALATION
3	LEACHING OF CONTAMINANTS
4	UPTAKE BY PLANTS
5	MIGRATION OF GAS

RECEPTORS	
V	END USERS (RESIDENTS)
W	SITE WORKERS
X	VEGETATION
Y	SURFACE WATERS
Z	GROUNDWATER

NOTES		
REV.	DESCRIPTION	DATE



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www.lithos.co.uk
Tel 01937 545330

CLIENT
NEWETT HOMES

JOB TITLE
LOWER BLACUP FARM, CLECKHEATON

DRAWING TITLE
PRELIMINARY CONCEPTUAL SITE MODEL

DRAWN WN	DATE 18 01 2024	STATUS FOR COMMENT <input type="checkbox"/>
CHECKED REG	DATE 18 01 2024	FOR APPROVAL DRAFT <input type="checkbox"/>
		FINAL <input checked="" type="checkbox"/>

SCALE Not to scale	SHEET A3	DRAWING NO. 1462/6	REVISION
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NOTES

- FORMER BLACUP COLLIERY FEATURE
- APPROXIMATE EXTENT OF RECORDED WORKINGS IN SHERTCLIFFE COAL

NOTES: EXTENT OF RECORDED WORKINGS TAKEN FROM CA ABANDONMENT PLAN CATALOGUE NO. 1731. EXTENT OF WORKINGS APPROXIMATE DUE TO SOME DISTORTION FROM COPYING AND SCALING OF ORIGINAL DRAWING. EXTENT OF 'OLD WORKINGS' LABELED IN NORTH ARE NOT MAPPED.

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE COAL OUTCROP
- APPROXIMATE GEOLOGICAL FAULT

NOTES: OUTCROPS AND LINE OF GEOLOGICAL FAULT INFERRED FROM BGS 1:10,000 SCALE PLAN SE12SE

REV.	DESCRIPTION	DATE



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www.lithos.co.uk

Tel 01937 545330

CLIENT

NEWETT HOMES

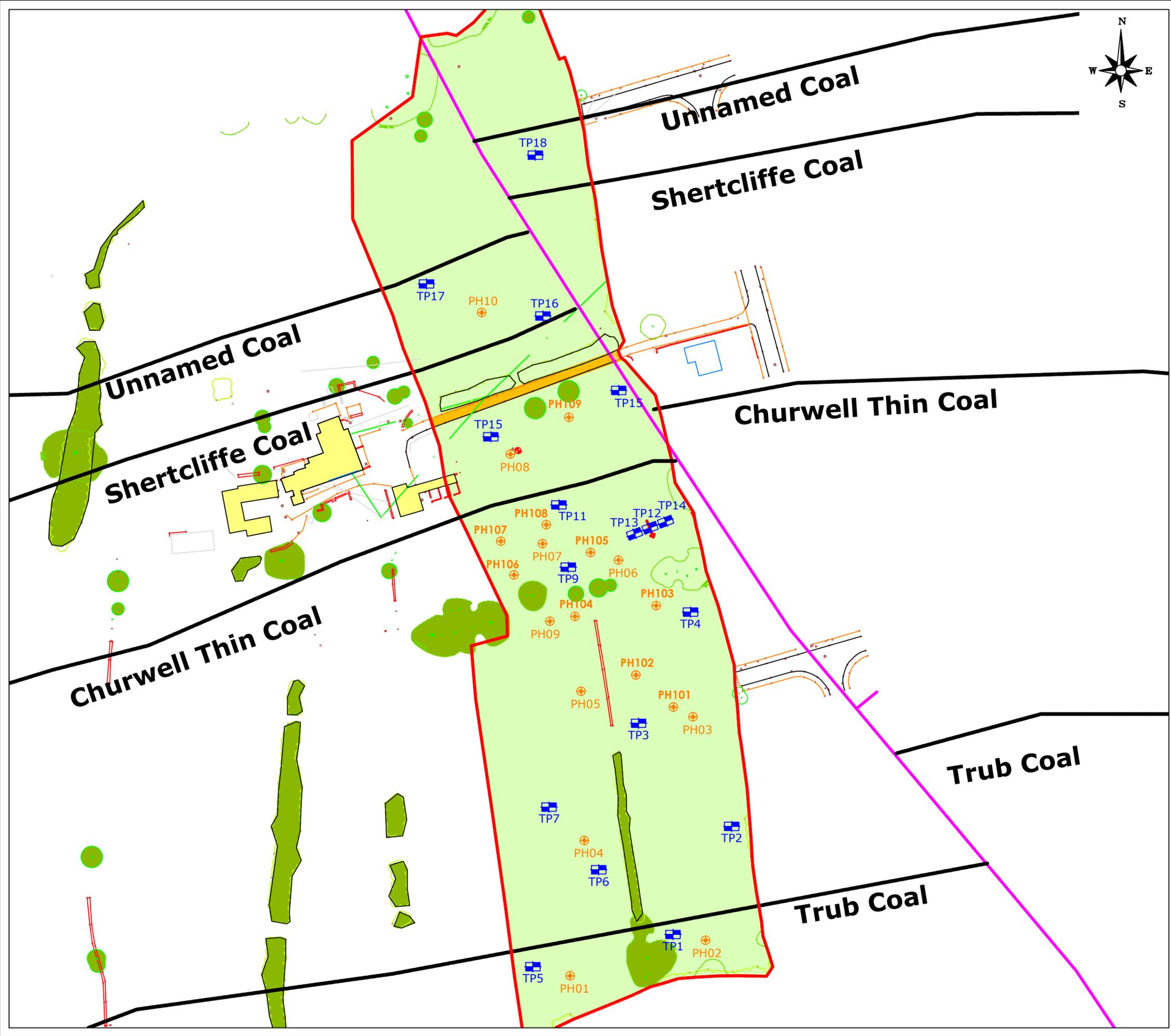
JOB TITLE

LOWER BLACUP FARM,
CLECKHEATON

DRAWING TITLE

COAL AUTHORITY ABANDONMENT PLAN

DRAWN	WN	DATE	18 01 2024	STATUS	FOR COMMENT <input type="checkbox"/>
CHECKED	REG	DATE	20 01 2024	FOR APPROVAL	<input type="checkbox"/>
				DRAFT	<input checked="" type="checkbox"/>
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SCALE	1:1500	SHEET	A3	DRAWING NO.	1462/7
				REVISION	



NOTES

- 2012 TRIAL PIT LOCATION (TPs 01 TO 18)
- 2012 PROBEHOLE LOCATION (PHs 01 TO 10)
- 2020 PROBEHOLE LOCATION (PHs 101 TO 109)
- APPROXIMATE SITE BOUNDARY
- SHAFT LOCATION (E 418598.91, N 424809.15)
- ADIT LOCATION (E 418639.01, N 424789.66)
- APPROXIMATE LINE OF FAULT (FROM BGS PLANS)
- APPROXIMATE OUTCROP OF COAL SEAM (FROM BGS PLANS)

TRIAL TRENCH LOCATIONS FOR SHAFT INVESTIGATION SHOWN ON DRAWING 1462/8a

REV.	DESCRIPTION	DATE

info@lithos.co.uk
www.lithos.co.uk
Tel 01937 545330

CLIENT

NEWETT HOMES

JOB TITLE

LOWER BLACUP FARM, CLECKHEATON

DRAWING TITLE

EXPLORATORY HOLE LOCATIONS

DRAWN	WN	DATE	18 01 2024	STATUS	FOR COMMENT <input type="checkbox"/>
CHECKED	REG	DATE	20 01 2024	FOR APPROVAL	<input type="checkbox"/>
				DRAFT	<input type="checkbox"/>
				FINAL	<input checked="" type="checkbox"/>
SCALE	1:1250	SHEET	A3	DRAWING NO.	1462/8
				REVISION	



- NOTES
- 2012 TRIAL PIT LOCATION
 - 2020 TRIAL TRENCH LOCATION
 - APPROXIMATE SITE BOUNDARY
 - SHAFT LOCATION
(E 418598.91, N 424809.15)
 - ADIT LOCATION
(E 418639.01, N 424789.66)
 - LOCATION & ORIENTATION OF PHOTOGRAPH

REV.	DESCRIPTION	DATE



info@lithos.co.uk
www.lithos.co.uk
Tel 01937 545330

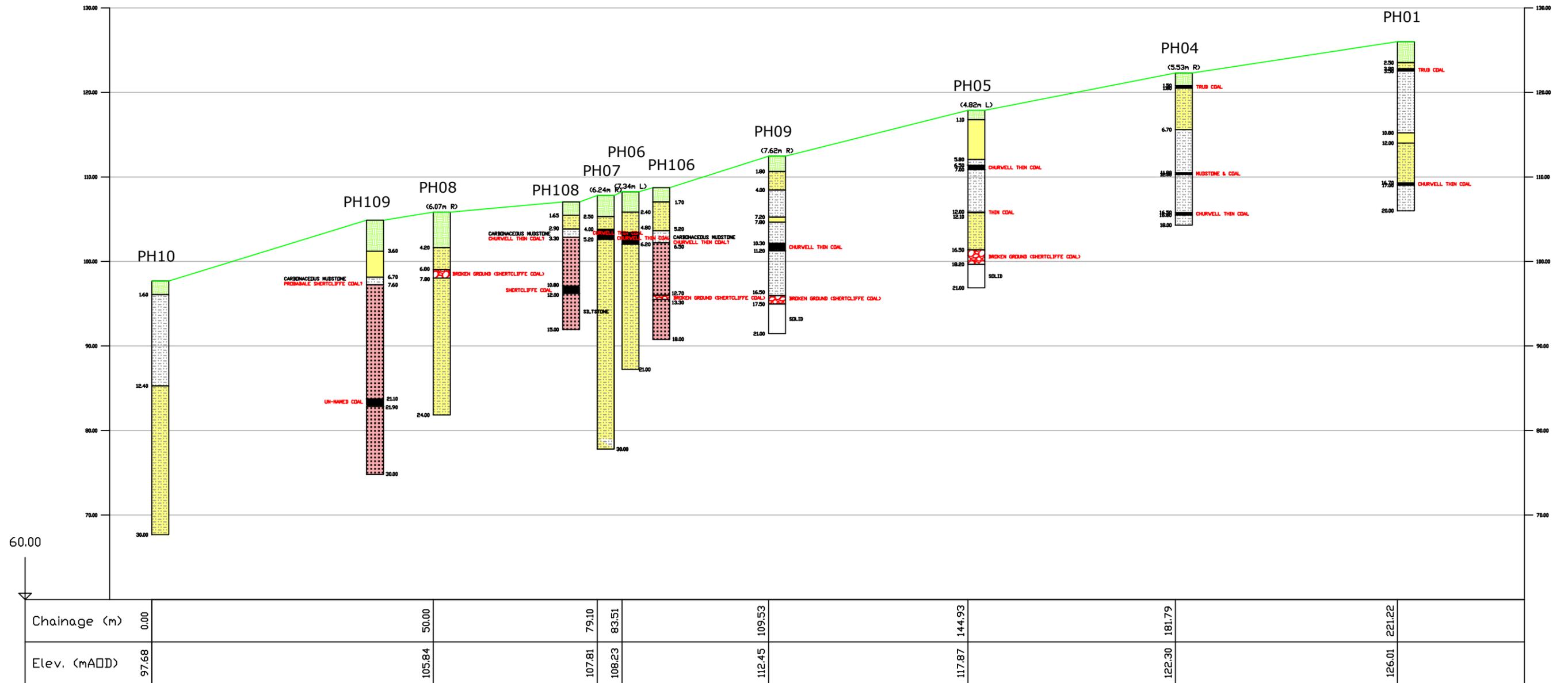
CLIENT
NEWETT HOMES

JOB TITLE
LOWER BLACUP FARM, CLECKHEATON

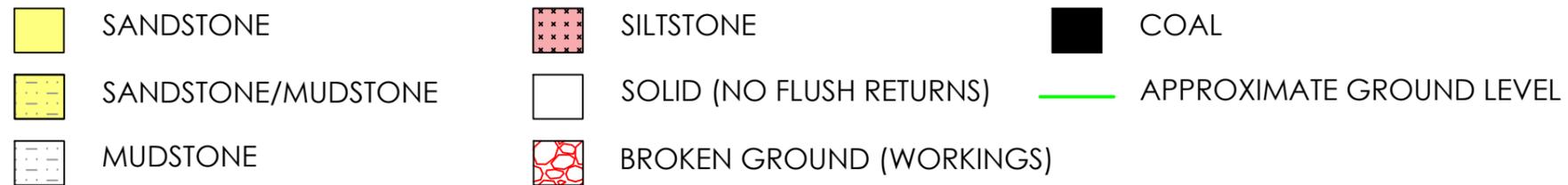
DRAWING TITLE
SHAFT & ADIT INVESTIGATION WITH PHOTOGRAPHS

DRAWN WN	DATE 18 01 2024	STATUS FOR COMMENT <input type="checkbox"/>
CHECKED REG	DATE 20 01 2024	FOR APPROVAL <input type="checkbox"/>
		DRAFT <input type="checkbox"/>
		FINAL <input checked="" type="checkbox"/>

SCALE NOT TO SCALE	SHEET A3	DRAWING NO. 1462/8a	REVISION
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SCALE: Horizontal 1:750 Vertical 1:500
(Plotted to Scale for paper size A3)



info@lithos.co.uk
www.lithos.co.uk
Tel 01937 545330

CLIENT
NEWETT HOMES

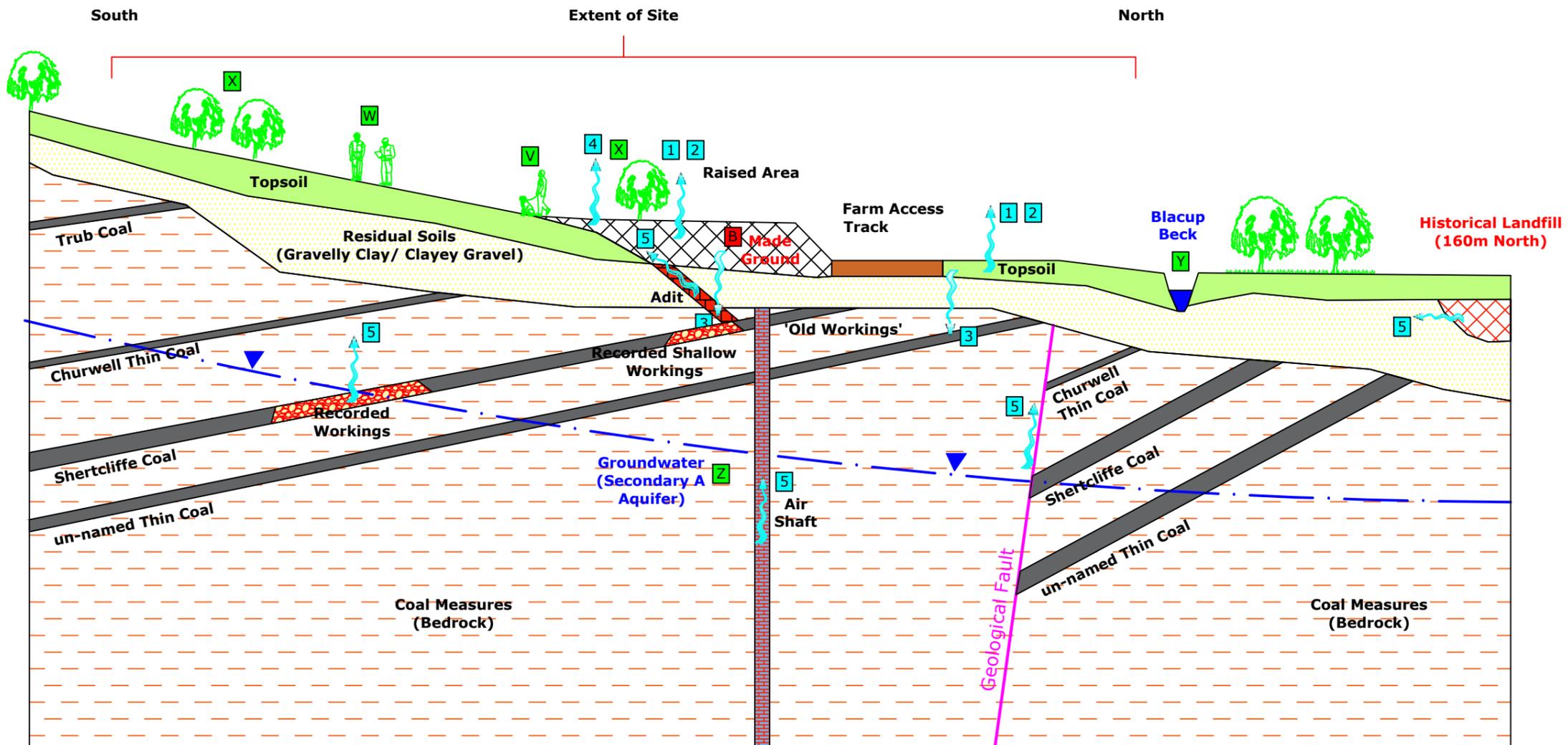
JOB TITLE
LOWER BLACUP FARM, CLECKHEATON

DRAWING TITLE
CROSS SECTION

NOTES

REV.	DESCRIPTION	DATE

STATUS FOR COMMENT <input type="checkbox"/> FOR APPROVAL <input type="checkbox"/> DRAFT <input type="checkbox"/> FINAL <input checked="" type="checkbox"/>	
DRAWN WN	DATE 18 01 2024
APPROVED REG	DATE 20 01 2024
SCALE NOT TO SCALE	SHEET A3
DRAWING NO. 1462/9	REVISION



SOURCES	
B	MADE GROUND (INORGANICS)

PATHWAYS	
1	DERMAL CONTACT
2	INGESTION/INHALATION
3	LEACHING OF CONTAMINANTS
4	UPTAKE BY PLANTS
5	MIGRATION OF GAS

RECEPTORS	
V	END USERS (RESIDENTS)
W	SITE WORKERS
X	VEGETATION
Y	SURFACE WATERS
Z	GROUNDWATER

NOTES		
REV.	DESCRIPTION	DATE



info@lithos.co.uk
www.lithos.co.uk
Tel 01937 545330

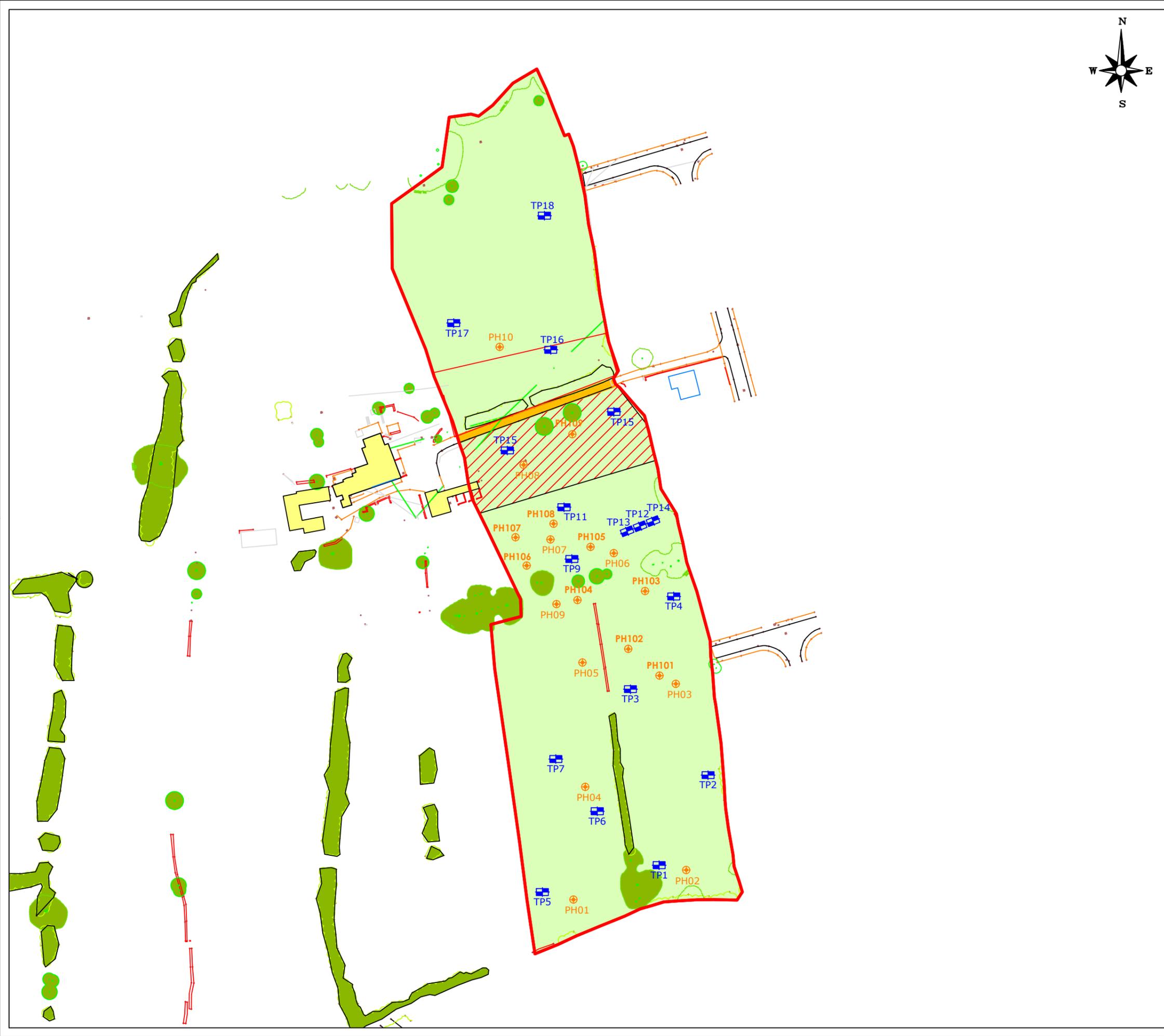
CLIENT
NEWETT HOMES

JOB TITLE
LOWER BLACUP FARM, CLECKHEATON

DRAWING TITLE
REVISED CONCEPTUAL SITE MODEL

DRAWN WN	DATE 18 01 2024	STATUS FOR COMMENT <input type="checkbox"/>
CHECKED REG	DATE 20 01 2024	FOR APPROVAL DRAFT <input type="checkbox"/>
		FINAL <input checked="" type="checkbox"/>

SCALE Not to scale	SHEET A3	DRAWING NO. 1462/10	REVISION
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- NOTES
- 2012 TRIAL PIT LOCATION (TPs 01 TO 18)
 - 2012 PROBEHOLE LOCATION (PHs 01 TO 10)
 - 2020 PROBEHOLE LOCATION (PHs 101 TO 109)
 - APPROXIMATE SITE BOUNDARY
 - APPROXIMATE EXTENT OF MADE GROUND
- MINIMUM 1,000mm CLEAN SOIL COVER REQUIRED IN GARDENS UNDERLAIN BY RESIDUAL MADE GROUND

REV.	DESCRIPTION	DATE



info@lithos.co.uk
www.lithos.co.uk

Tel 01937 545330

CLIENT

NEWETT HOMES

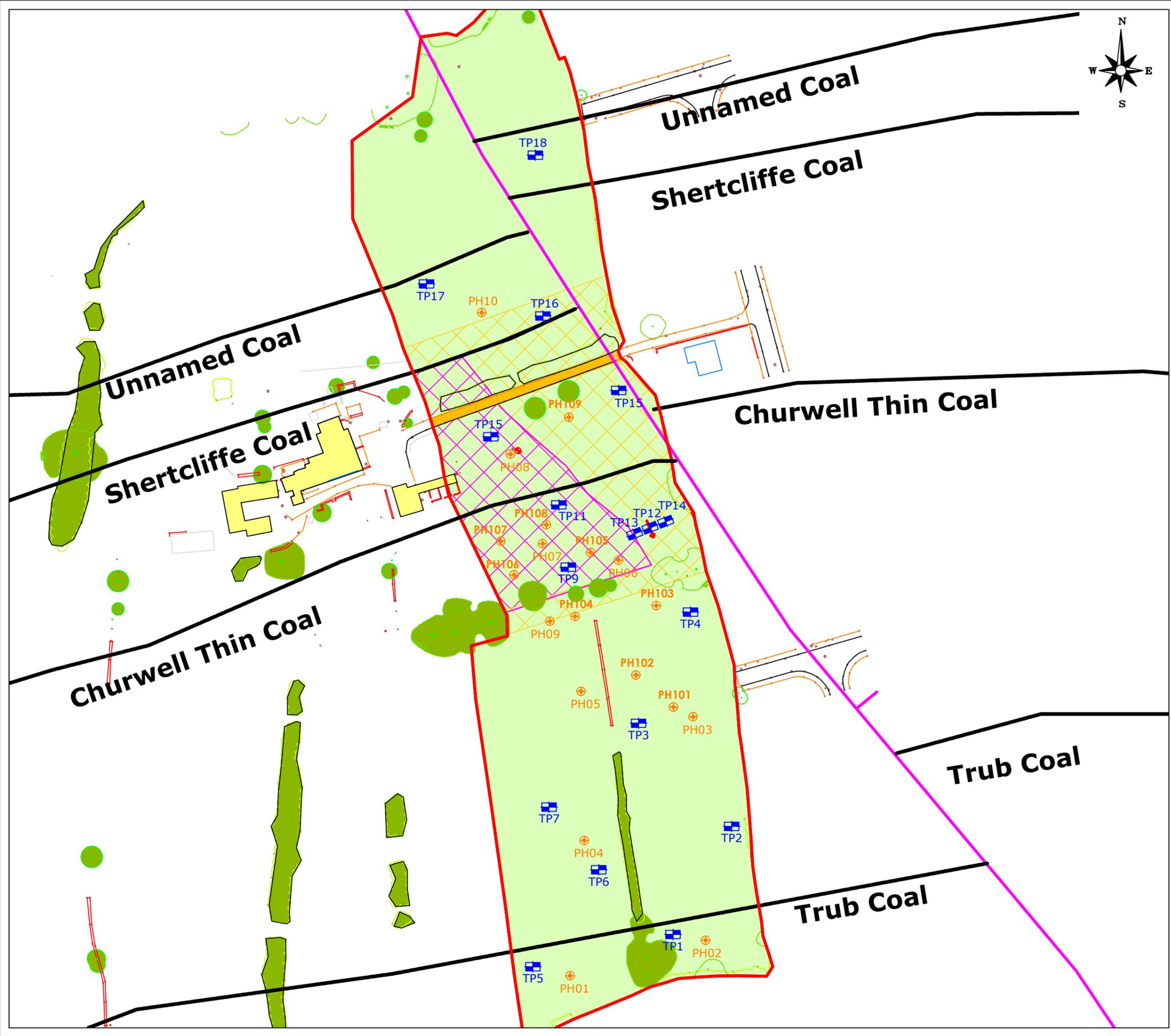
JOB TITLE

LOWER BLACUP FARM,
CLECKHEATON

DRAWING TITLE

APPROXIMATE EXTENT OF MADE GROUND

DRAWN	WN	DATE	18 01 2024	STATUS	FOR COMMENT <input type="checkbox"/>
CHECKED	REG	DATE	20 01 2024	FOR APPROVAL	<input type="checkbox"/>
				DRAFT	<input type="checkbox"/>
				FINAL	<input checked="" type="checkbox"/>
SCALE	1:1500	SHEET	A3	DRAWING NO.	1462/11
				REVISION	



NOTES

- 2012 TRIAL PIT LOCATION (TPs 01 TO 18)
- 2012 PROBEHOLE LOCATION (PHs 01 TO 10)
- 2020 PROBEHOLE LOCATION (PHs 101 TO 109)
- APPROXIMATE SITE BOUNDARY
- SHAFT LOCATION (E 418598.91, N 424809.15)
- ADIT LOCATION (E 418639.01, N 424789.66)
- APPROXIMATE LINE OF FAULT (FROM BGS PLANS)
- APPROXIMATE OUTCROP OF COAL SEAM (FROM BGS PLANS)
- APPROXIMATE AREA REQUIRING DRILL & GROUT (KNOWN WORKINGS) (ie COMPETENT COVER < 10x SEAM THICKNESS)
- APPROXIMATE AREA REQUIRING PROOF DRILLING (POSSIBLE WORKINGS) (COMPETENT COVER < 10x SEAM THICKNESS)

REV.	DESCRIPTION	DATE

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www.lithos.co.uk
Tel 01937 545330

CLIENT
NEWETT HOMES

JOB TITLE
LOWER BLACUP FARM, CLECKHEATON

DRAWING TITLE
EXPLORATORY HOLE LOCATIONS

DRAWN WN	DATE 18 01 2024	STATUS FOR COMMENT <input type="checkbox"/> FOR APPROVAL <input type="checkbox"/> DRAFT <input type="checkbox"/> FINAL <input checked="" type="checkbox"/>
CHECKED REG	DATE 20 01 2024	
SCALE 1:1250	SHEET A3	DRAWING NO. 1462/8
		REVISION

Appendix C

Commission

037/1462/REG

9th January 2024

Mr B Botham
Newett Homes
Thorpe Arch Grange
Walton Road
Thorp Arch
Wetherby
West Yorkshire
LS23 7BA



Registered in England 07068066

Parkhill
Wetherby
West Yorkshire
LS22 5DZ

T 01937 545 330

www.lithos.co.uk

Dear Ben

Lower Blacup Farm, Cleckheaton

Further to your recent request regarding our SI Report (Ref. 1462/3) issued to Together Commercial Limited in January 2021. Given the Report is already 3 years old, you would like Lithos to issue a new Report, in line with current UK guidance, with reference to the original ground investigation data and the development now being proposed.

We can confirm that we are able to do this for a fee of £*** plus VAT and would expect it to be drafted within 3 weeks of your instruction to proceed. However, we will require formal, written confirmation that Report 1462/3 has been assigned to Newett Homes. You will understand that whilst we prepared the original Report, it does not 'belong' to Lithos; ownership rests with Together Commercial Limited since they paid for all the work.

A 'fresh' site walkover will be undertaken to check for any significant changes (in site operations, stockpiled materials etc) since January 2021. We will also obtain 'new' environmental search data will be obtained from Landmark and a Consultant's mining report from the Coal Authority.

Of course, any action or occurrence on site since January 2021 that could have resulted in a change to ground conditions (e.g. laying of a new utility, land spreading by the farmer, spillage / leakage of fuel etc) could not have been considered by Report 1462/3 and (in the absence of further intrusive investigation) may not be picked-up by this proposed update.

Newett and Lithos have an agreed Appointment document, and this work will be undertaken in accordance with that. However, if the Appointment term expires or remains unsigned, works will be undertaken in accordance with our Standard Terms and Conditions, a copy of which are enclosed.

It is hoped the above is sufficient for your present needs. However, should you require any further information, please contact the undersigned.

Yours sincerely

A handwritten signature in black ink, appearing to read "Mark Perrin".

Mark Perrin
Director
for and on behalf of
LITHOS CONSULTING LIMITED



1 DEFINITIONS AND INTERPRETATION

1.1 In this Agreement, unless the context otherwise requires, the following words and expressions have the following meanings:

"Agreement" means these Terms (entitled "Terms and Conditions for the Appointment of Lithos Consulting"), the Proposal, any document recording your unequivocal acceptance of the Proposal and any other documents or parts of other documents expressly referred to in any of the foregoing;

"Documents" means all documents of any kind and includes plans, drawings, reports, programmes, specifications, Bills of Materials, calculations, letters, e-mails, faxes, memoranda, films and photographs (including negatives), or any other form of record prepared or provided or received by, or on behalf of us, and whether in paper form or stored electronically or on disk, or otherwise;

"Intellectual Property" includes all rights to, and any interests in, any patents, designs, trade marks, copyright, know-how, trade secrets and any other proprietary rights or forms of intellectual property (protectable by registration or not) in respect of any technology, concept, idea, data, programme or other software (including source and object codes), specification, plan, drawing, schedule, minutes, correspondence, scheme, programme, design, system, process logo, mark, style, or other matter or thing, existing or conceived, used, developed or produced by any person;

"Project" means the project described in the Proposal and any enquiry from you on which we have based our Proposal;

"Proposal" means the offer document prepared by us in response to an enquiry or otherwise, in connection with the proposed provision of the Services;

"Services" means the work and services relating to the Project to be provided by us pursuant to the Agreement and as set out in the Proposal and includes any additions or amendments thereto made in accordance with these Terms;

"Terms" means these terms entitled "Lithos Consulting Terms of Appointment" as amended from time to time.

1.2 Words importing the singular only shall also include the plural and vice versa, where the context requires.

1.3 Words importing persons or parties shall include firms, corporations and any organisation having legal capacity and vice versa, where the context requires; and words importing a particular gender include all genders.

1.4 The sub-headings to the clauses of these Terms are for convenience only and shall not affect the construction of the Agreement.

1.5 A reference to legislation includes that legislation as from time to time amended, re-enacted or substituted and any Orders in Council, orders, rules, regulations, schemes, warrants, by-laws, directives or codes of practice issued under any such legislation.

1.6 In the event of conflict between the documents forming part of the Agreement, the Proposal shall prevail, followed by the Terms.

2 APPOINTMENT

2.1 You agree to engage us and we agree to provide the Services in accordance with the provisions of this Agreement.

3 OUR OBLIGATIONS

3.1 We shall perform the Services using the reasonable standard of skill and care normally exercised by qualified members of our profession, performing similar services under similar conditions.

3.2 We shall use all reasonable endeavours to perform the Services in accordance with relevant environmental and safety legislation.

4 YOUR OBLIGATIONS

4.1 Throughout the period of this Agreement you shall afford to us, or procure for our benefit, access to any site where access is required for the performance of the Services.

4.2 You accept responsibility for ensuring that we are notified in writing of all special site and/or plant conditions, including without prejudice to the generality of the foregoing, the existence and precise location of all underground services, cables, pipes, drains or underground buildings, constructions or any hazards, which you shall clearly mark on the ground or identify on accurate location plans supplied to us prior to the commencement of the Services. You shall also inform us in writing of any relevant operating procedures including any site safe operating procedures and any other regulations relevant to the carrying out of the Services. You shall indemnify us against all costs, losses, claims, demands and expenses arising as a result of any non-disclosure in this respect, including but not limited to indemnification against any action brought by the owner of the land or otherwise.

4.3 If you discover any conflict, defect or other fault in the information or designs provided by us pursuant to the Agreement, you will advise us in writing of such defect, conflict or other fault and we shall have the right to rectify the same or where necessary, to design the solution for rectification of any works carried out by others pursuant to the conflicting, defective or in any other way faulty information or designs.

5 COPYRIGHT

5.1 The copyright in all Intellectual Property prepared by or on behalf of us in connection with the Project for delivery to you shall remain vested in us.

5.2 You shall have a non-exclusive licence to copy and use such Intellectual Property for purposes directly related to the Project. Such licence shall enable you to copy and use the Intellectual Property but solely for your own purposes in connection with the Project and such use shall not include any licence to reproduce any conceptual designs or professional opinions contained therein nor shall it include any licence to amend any drawing, design or other Intellectual Property produced by us.

5.3 Should you wish to use such Intellectual Property in connection with any other works or for any other purpose not directly related to the Project or wish to pass any Intellectual Property to any third party, you must obtain our prior written consent. The giving of such consent shall be at our absolute discretion and shall be upon such terms as we may require. We shall not be liable to you for the use by any person of such Intellectual Property for any purpose other than that for which the same were prepared by or on our behalf.

5.4 Ownership of any proposals submitted to you that are not subsequently confirmed as part of the Services to be provided for you remain with us and such proposals must not be used as the basis for any future work undertaken by you or a third party and no liability can be accepted howsoever arising from such proposals.

5.5 In the event of you being in default of payment of any fees or other amounts due, we may suspend further use of the licence on giving no less than 2 calendar days' notice of the intention to do so. Use of the licence may be resumed on receipt of the outstanding amounts.

6 CONFIDENTIALITY

6.1 Neither you nor we shall at any time disclose to any person any confidential information concerning the business, affairs, customers, clients or suppliers of the other party or of any member of the group of companies to which the other party belongs, except as permitted by clauses 6.2 and 6.4.

6.2 Each party may disclose the other party's confidential information:

(a) to its employees, officers, representatives, contractors, sub-contractors or advisers who need to know such information for the purposes of exercising the party's rights or carrying out its obligations under or in connection with this Agreement. Each party shall ensure that its employees, officers, representatives, contractors, sub-contractors or advisers to whom it discloses the other party's confidential information comply with this paragraph 6; and

(b) as may be required by law, to a court of competent jurisdiction or any governmental or regulatory authority.

6.3 Neither you nor we shall use any other party's confidential information for any purpose other than to exercise our rights or perform our respective obligations under or in connection with this Agreement.

6.4 Subject to the above and our privacy policy which can be found on www.lithos.co.uk, we shall be permitted to use information related to the Services we provide in connection with the Project for the purposes of marketing its services and in proposals for work of a similar type.

7 ASSIGNMENT

7.1 You may assign the benefit of this Agreement on two occasions with our prior written consent (not to be unreasonably withheld) and any additional assignments shall be with our prior consent.

7.2 We may at any time assign, mortgage, charge, subcontract, delegate, declare a trust over or deal in any other manner with any or all of our rights and obligations under this Agreement.

8 INSURANCE

8.1 We shall maintain a professional indemnity insurance policy covering our liabilities for negligence under this Agreement, with a limit of indemnity of £5,000,000 (FIVE MILLION POUNDS) any one claim, save for pollution and contamination claims and asbestos claims both of which carry £2,000,000 (TWO MILLION POUNDS) in the aggregate cover. This policy is annually renewable and whilst renewal is not automatic, We shall maintain such insurance at all times until six years from the date of the completion (or termination) of the Services under this Agreement, provided such insurance is available at commercially reasonable rates and terms.

8.2 If for any period such insurance is not available at commercially reasonable rates and terms, we shall inform you and shall obtain in respect of such period such reduced level of professional indemnity insurance as is available and as would be fair and reasonable in the circumstances for us to obtain.

9 PAYMENT

9.1 Invoices for services rendered will be submitted for payment in accordance with the Proposal.

9.2 You shall pay you any VAT properly chargeable on the Services and any amount expressed as payable to us under this Agreement is exclusive of VAT unless stated otherwise.

9.3 The due date for payment is the date of the invoice and the final date for payment is 28 days from the date of the invoice.

9.4 If you dispute the amount included for payment in an invoice then you must serve a written notice on us no later than 14 calendar days before the final date for payment. If no notice is given within the required timeframe the amount due shall be the amount stated in the invoice.

9.5 If you fail to pay any monies in accordance with the foregoing payment provisions, we shall be entitled to charge interest on any monies owed to us, such interest to be at a rate of 4% above the base rate of a clearing bank from time to time calculated from the final date for payment to the date of actual payment on a compound basis. The parties acknowledge that our liability under this clause 10.5 is a substantial remedy for the purposes of section 9(1) of the Late Payment of Commercial Debts (Interest) Act 1998.

10 LIMITATIONS ON LIABILITY

10.1 Unless otherwise agreed in writing, our total liability under or in connection with this Agreement whether in contract, tort, negligence, breach of statutory duty or otherwise (other than in respect of personal injury or death) shall be limited to and shall not exceed the lesser of either the level of insurance cover referred to within clause 8.1 above, or 20 times the total value of invoices issued to you for the Services.

10.2 No action or proceedings under or in respect of the Agreement whether in contract, tort, negligence, under statute or otherwise shall be commenced against us after the expiry of a period of six years from the date of the completion (or termination) of the Services under this Agreement.

10.3 Whilst we usually scan for potential exploratory locations with a Cable Avoidance Tool, we shall not be liable for any damage to underground services, cables, pipes, drains or underground buildings, constructions and the like which were either not marked on site or for which accurate plans were not provided.

10.4 We shall not be liable for the cost of rectifying any defect, conflict or other fault in the information or designs provided by us or for the cost of designing a solution for and rectifying any subsequent works carried out by others pursuant to the conflicting, defective or in any other way faulty information or designs, unless we have been advised in writing of the same by you and have been given the opportunity to rectify the same or where necessary, to design the solution for rectification of any subsequent works carried out by others pursuant to the same.

11 DELAY

We shall comply with any timescale agreed for completion of the Services unless delayed or prevented by circumstances beyond our reasonable control and in the event of any such circumstances arising we undertake to complete the Services within a reasonable period, but will not be liable to you for any delay as a result.

12 TERMINATION

12.1 The Agreement may be terminated by either of us in the event of the other making a composition or arrangement with its creditors, becoming bankrupt, or being a company, making a proposal for a voluntary arrangement for a composition of debts, or has a provisional liquidator appointed, or has a winding-up order made, or passes a resolution for voluntary winding-up (except for the purposes of a bona fide scheme of amalgamation or reconstruction), or has an administrator or an administrative receiver appointed to the whole or any part of its assets. Notice of termination must be given to the party which is insolvent by the other party.

12.2 If for any reason our Services are suspended for a period in excess of three calendar months then we shall be entitled to terminate our appointment under this Agreement in respect of the Services by no less than seven days written notice to you.

12.3 If you fail to pay in full any sum due under the terms of this Agreement by the final date for payment for that sum and no effective pay less notice is issued, we may serve written notice to you demanding payment within 14 days of such notice. If you fail to comply with such notice, we shall be entitled to terminate our employment under this Agreement forthwith.

12.4 Any termination of our appointment howsoever caused shall be without prejudice to our rights to require payment for all Services performed up to the date of such termination including but not limited to payment of a fair and reasonable proportion of any figure identified in the Proposal or otherwise for fees in respect of a particular service which Lithos has started, but not completed.

13 THIRD PARTY RIGHTS

The Agreement shall not confer and shall not purport to confer on any third party any benefit or any right to enforce any term of this Agreement for the purposes of the Contracts (Rights of Third Parties) Act 1999 or otherwise.

14 COLLATERAL WARRANTIES & LETTERS OF RELIANCE

We shall consider and may consent to a request from you for us to enter into a collateral warranty or letter of reliance with a third party with regard to the Services provided under this Agreement. The giving of such consent shall be at our absolute discretion and providing we agree to our standard form of collateral warranty or letter of reliance (subject to any reasonable changes to be approved by us at our absolute discretion) and in return for payment of a fee (to be notified at the time of the request).

15 NOTICES

15.1 Any notice provided for in the Agreement shall be in writing and shall be deemed to be properly given if delivered by hand or sent by pre-paid first class post to the address of the relevant party as may have been notified by each party to the other or, in the absence of notification, to our respective registered office addresses.

15.2 Such notice shall be deemed to have been received on the day of delivery if delivered by hand or on the second working day after the day of posting if sent by pre-paid first class post.

16 ENTIRE AGREEMENT

16.1 The Agreement constitutes the complete and entire agreement between us with respect to the Services and supersedes any prior oral and/or written warranties, terms, conditions, communications and representations, whether express or implied and any claim against us in respect of the Services can only be made in contract under the provisions of this Agreement and not otherwise under the law or tort or otherwise.

16.2 No amendments, modifications or variation of this Agreement shall be valid unless made in writing and agreed to by us: such agreement must be recorded in writing by at least one of us.

16.3 We shall not be bound by any standard or printed terms or conditions furnished by you in any of your documents unless we specifically state in writing separately from such documents that we intend such terms and conditions to apply.

17 DISPUTES, JURISDICTION AND GOVERNING LAW

17.1 This Agreement shall be governed by and construed in accordance with English law and we irrevocably and unconditionally submit to the jurisdiction of the English Courts.

17.2 Where the Housing Grants, Construction and Regeneration Act 1996 applies, any dispute between us may be referred to adjudication in accordance with the Scheme for Construction Contracts Regulations 1998 or any amendment or modification thereof being in force at the time of the dispute, as applicable to England, Wales, Scotland and Northern Ireland.

Will Newton

Subject: RE: 1462, Cleckheaton

From: Ben Botham <ben@newetthomes.co.uk>

Sent: Tuesday, January 9, 2024 2:29 PM

To: Reg <reg@lithos.co.uk>; Sherwood, Daniel (Daniel.Sherwood@carterjonas.co.uk)
<Daniel.Sherwood@carterjonas.co.uk>

Subject: FW: 1462, Cleckheaton

Reg,

Please proceed with this.

Dan – can you get something from Together, please (see email below)?

As background and from discussing further with Reg, this proposal i.e. getting our own report done off the back of the existing investigations, gives us the security we require.

Kind regards,

Ben Botham

Head of Land

NEWETT HOMES

Thorp Arch Grange
Walton Road
Thorp Arch
Wetherby
West Yorkshire
LS23 7BA

Tel: 01937 545120

Mobile: 07542 848152

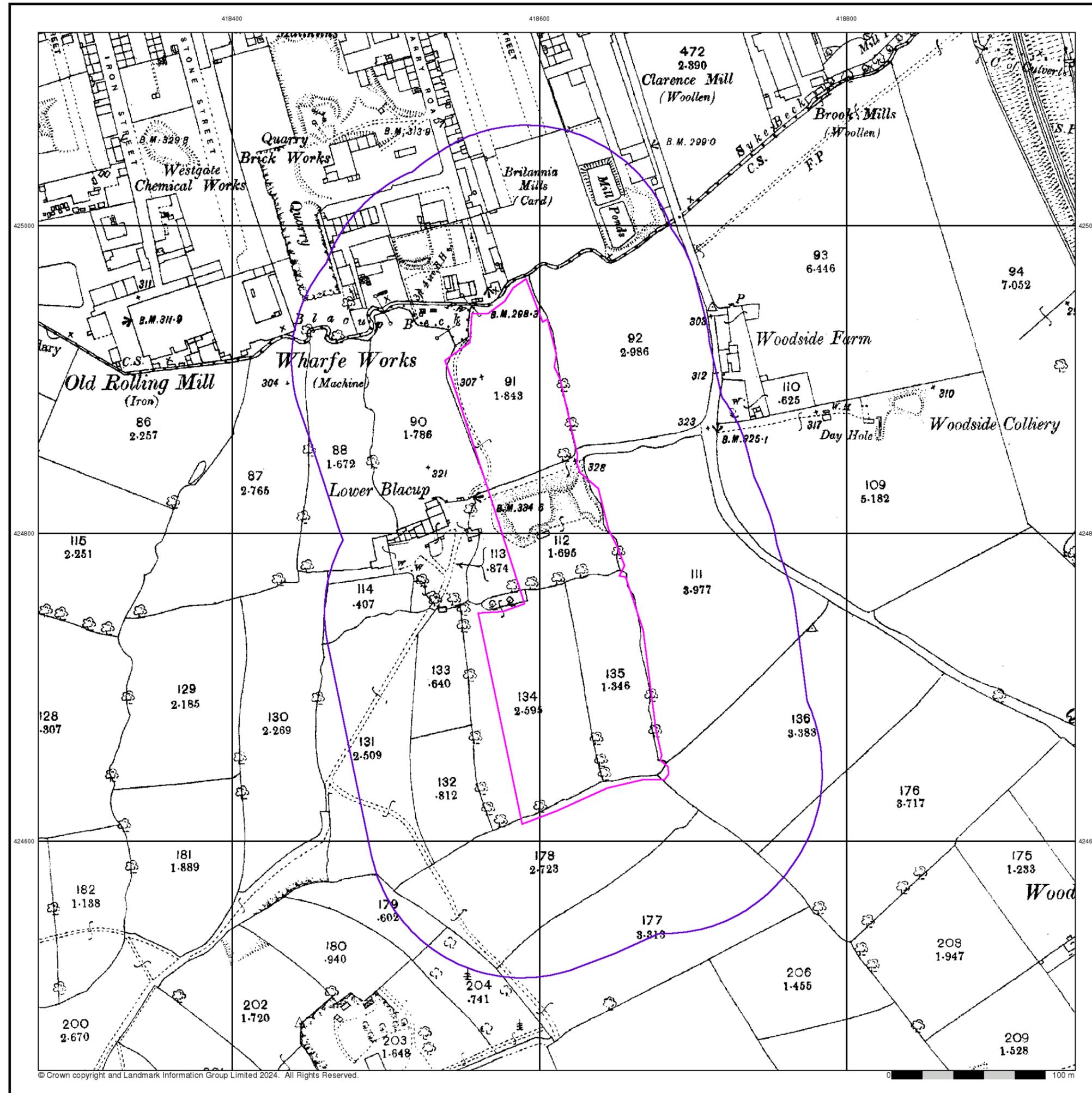
Email: ben@newetthomes.co.uk

Web: www.newetthomes.co.uk



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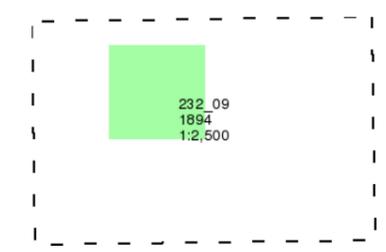
Appendix D
Historical OS Plans



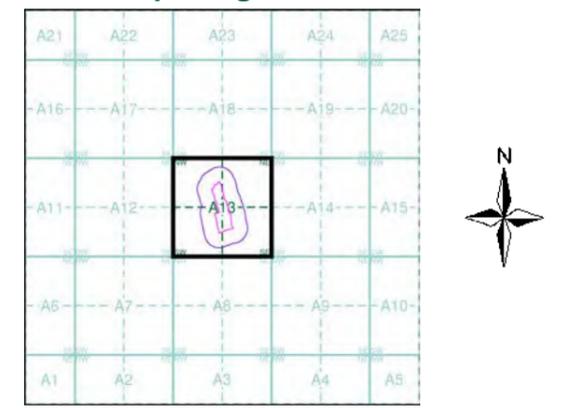
Yorkshire
Published 1894
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number: 330598559_1_1
 Customer Ref: PO21772/CH/1462
 National Grid Reference: 418600, 424780
 Slice: A
 Site Area (Ha): 2.58
 Search Buffer (m): 100

Site Details

Lower Blacup Farm, Lower Blacup, CLECKHEATON, BD19 5JB



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Additional SIMs

Published 1958 - 1981

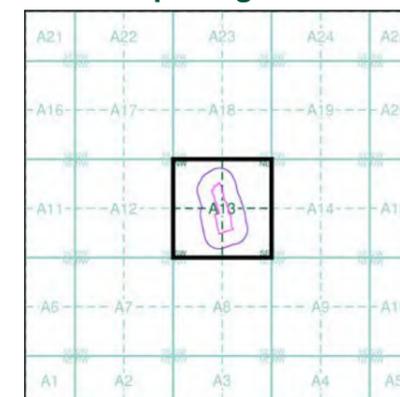
Source map scale - 1:1,250

The SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in between the main editions as an area was updated. They date from 1947 to 1994, and contain detailed information on buildings, roads and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)

E1825SW	E1825SE
979	1981
1:1,250	1:1,250
E1824NW	E1824NE
958	1978
1:1,250	1:1,250
E1824SE	
1978	
1:1,250	

Historical Map - Segment A13



Order Details

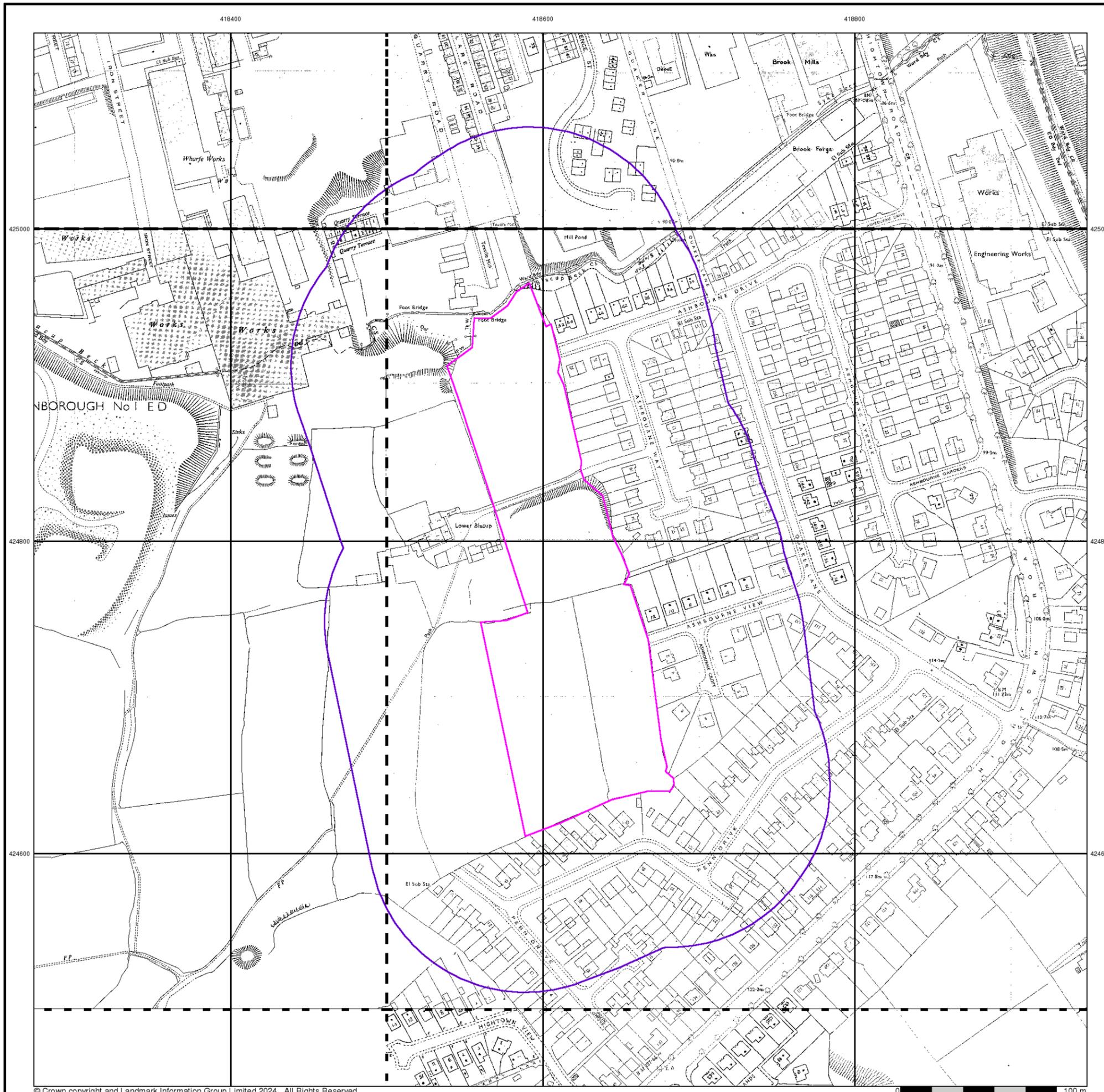
Order Number: 330598559_1_1
 Customer Ref: PO21772/CH/1462
 National Grid Reference: 418600, 424780
 Slice: A
 Site Area (Ha): 2.58
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Site Details

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Appendix E

Search Responses & other Correspondence



Envirocheck[®] Report:

Datasheet

Order Details:

Order Number:

330598559_1_1

Customer Reference:

PO21772/CH/1462

National Grid Reference:

418600, 424780

Slice:

A

Site Area (Ha):

2.58

Search Buffer (m):

1000

Site Details:

Lower Blacup Farm, Lower Blacup

CLECKHEATON

BD19 5JB

Client Details:

Mr M Perrin

Lithos Consulting Ltd

Parkhill

Walton Road

Wetherby

LS22 5DZ

Report Section	Page Number
Summary	-
Agency & Hydrological	1
Waste	37
Hazardous Substances	-
Geological	46
Industrial Land Use	57
Sensitive Land Use	95
Data Currency	96
Data Suppliers	102
Useful Contacts	103

Introduction

The Environment Act 1995 has made site sensitivity a key issue, as the legislation pays as much attention to the pathways by which contamination could spread, and to the vulnerable targets of contamination, as it does the potential sources of contamination. For this reason, Landmark's Site Sensitivity maps and Datasheet(s) place great emphasis on statutory data provided by the Environment Agency/Natural Resources Wales and the Scottish Environment Protection Agency; it also incorporates data from Natural England (and the Scottish and Welsh equivalents) and Local Authorities; and highlights hydrogeological features required by environmental and geotechnical consultants. It does not include any information concerning past uses of land. The datasheet is produced by querying the Landmark database to a distance defined by the client from a site boundary provided by the client. In this datasheet the National Grid References (NGRs) are rounded to the nearest 10m in accordance with Landmark's agreements with a number of Data Suppliers.

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Report Version v53.0

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Agency & Hydrological					
BGS Groundwater Flooding Susceptibility	pg 1	Yes	Yes	Yes	n/a
Contaminated Land Register Entries and Notices					
Discharge Consents	pg 2		1	1	8
Prosecutions Relating to Controlled Waters			n/a	n/a	n/a
Enforcement and Prohibition Notices					
Integrated Pollution Controls	pg 5				1
Integrated Pollution Prevention And Control	pg 5			3	6
Local Authority Integrated Pollution Prevention And Control					
Local Authority Pollution Prevention and Controls	pg 7		4		10
Local Authority Pollution Prevention and Control Enforcements					
Nearest Surface Water Feature	pg 9	Yes			
Pollution Incidents to Controlled Waters	pg 9		3	6	56
Prosecutions Relating to Authorised Processes					
Registered Radioactive Substances					
River Quality	pg 20				2
River Quality Biology Sampling Points					
River Quality Chemistry Sampling Points					
Substantiated Pollution Incident Register	pg 20				12
Water Abstractions	pg 22				3 (*8)
Water Industry Act Referrals					
Groundwater Vulnerability Map	pg 24	Yes	n/a	n/a	n/a
Groundwater Vulnerability - Soluble Rock Risk			n/a	n/a	n/a
Groundwater Vulnerability - Local Information			n/a	n/a	n/a
Bedrock Aquifer Designations	pg 24	Yes	n/a	n/a	n/a
Superficial Aquifer Designations			n/a	n/a	n/a
Source Protection Zones					
Extreme Flooding from Rivers or Sea without Defences	pg 25	Yes		n/a	n/a
Flooding from Rivers or Sea without Defences	pg 25	Yes	Yes	n/a	n/a
Areas Benefiting from Flood Defences				n/a	n/a
Flood Water Storage Areas				n/a	n/a
Flood Defences				n/a	n/a
OS Water Network Lines	pg 25		10	26	62

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Waste					
BGS Recorded Landfill Sites	pg 37				1
Historical Landfill Sites	pg 37			1	2
Integrated Pollution Control Registered Waste Sites					
Licensed Waste Management Facilities (Landfill Boundaries)					
Licensed Waste Management Facilities (Locations)	pg 37		2	3	
Local Authority Landfill Coverage	pg 38	1	n/a	n/a	n/a
Local Authority Recorded Landfill Sites					
Potentially Infilled Land (Non-Water)	pg 38		3	3	4
Potentially Infilled Land (Water)	pg 39		13	15	24
Registered Landfill Sites	pg 42			1	
Registered Waste Transfer Sites	pg 42		2		1
Registered Waste Treatment or Disposal Sites	pg 43			4	1
Hazardous Substances					
Control of Major Accident Hazards Sites (COMAH)					
Explosive Sites					
Notification of Installations Handling Hazardous Substances (NIHHS)					
Planning Hazardous Substance Consents					
Planning Hazardous Substance Enforcements					

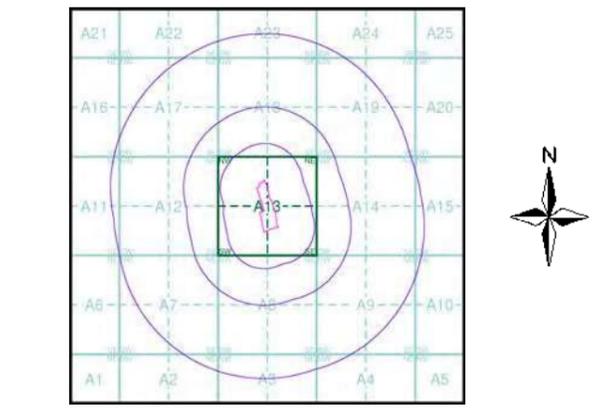
Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Geological					
BGS 1:625,000 Solid Geology	pg 46	Yes	n/a	n/a	n/a
BGS Estimated Soil Chemistry	pg 46	Yes	Yes	Yes	Yes
BGS Recorded Mineral Sites	pg 53		3		
BGS Urban Soil Chemistry					
BGS Urban Soil Chemistry Averages					
CBSCB Compensation District			n/a	n/a	n/a
Coal Mining Affected Areas	pg 54	Yes	n/a	n/a	n/a
Mining Instability	pg 54	Yes	n/a	n/a	n/a
Man-Made Mining Cavities					
Natural Cavities					
Non Coal Mining Areas of Great Britain	pg 54	Yes	Yes	n/a	n/a
Potential for Collapsible Ground Stability Hazards	pg 54	Yes	Yes	n/a	n/a
Potential for Compressible Ground Stability Hazards	pg 54	Yes	Yes	n/a	n/a
Potential for Ground Dissolution Stability Hazards				n/a	n/a
Potential for Landslide Ground Stability Hazards	pg 55	Yes	Yes	n/a	n/a
Potential for Running Sand Ground Stability Hazards	pg 55	Yes	Yes	n/a	n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 55	Yes		n/a	n/a
Radon Potential - Radon Affected Areas	pg 56	Yes	n/a	n/a	n/a
Radon Potential - Radon Protection Measures			n/a	n/a	n/a
Industrial Land Use					
Contemporary Trade Directory Entries	pg 57		44	57	148
Fuel Station Entries	pg 78				4
Points of Interest - Commercial Services	pg 79		11	24	31
Points of Interest - Education and Health					
Points of Interest - Manufacturing and Production	pg 84		9	22	59
Points of Interest - Public Infrastructure	pg 92		5	3	10
Points of Interest - Recreational and Environmental	pg 93			1	12
Gas Pipelines					
Underground Electrical Cables					

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Sensitive Land Use					
Ancient Woodland					
Areas of Adopted Green Belt	pg 95		1		
Areas of Unadopted Green Belt	pg 95		1		
Areas of Outstanding Natural Beauty					
Environmentally Sensitive Areas					
Forest Parks					
Local Nature Reserves					
Marine Nature Reserves					
National Nature Reserves					
National Parks					
Nitrate Sensitive Areas					
Nitrate Vulnerable Zones	pg 95	1			
Ramsar Sites					
Sites of Special Scientific Interest					
Special Areas of Conservation					
Special Protection Areas					
World Heritage Sites					



- General**
- Specified Site
 - Specified Buffer(s)
 - Bearing Reference Point
 - Map ID
- Agency and Hydrological**
- Contaminated Land Register Entry or Notice (Location)
 - Contaminated Land Register Entry or Notice
 - Discharge Consent
 - Enforcement or Prohibition Notice
 - Integrated Pollution Control
 - Integrated Pollution Prevention and Control
 - Local Authority Integrated Pollution Prevention and Control
 - Local Authority Pollution Prevention and Control Enforcement
 - Local Authority Pollution Prevention and Control Enforcement
 - Pollution Incident to Controlled Waters
 - Prosecution Relating to Authorised Processes
 - Prosecution Relating to Controlled Waters
 - Registered Radioactive Substance
 - River Network or Water Feature
 - River Quality Sampling Point
 - Substantiated Pollution Incident Register
 - Water Abstraction
 - Water Industry Act Referral
- Waste**
- BGS Recorded Landfill Site (Location)
 - BGS Recorded Landfill Site
 - EA Historic Landfill (Buffered Point)
 - EA Historic Landfill (Polygon)
 - Integrated Pollution Control Registered Waste Site
 - Licensed Waste Management Facility (Landfill Boundary)
 - Licensed Waste Management Facility (Location)
 - Local Authority Recorded Landfill Site (Location)
 - Local Authority Recorded Landfill Site
 - Potentially Infilled Land (Non-water)
 - Potentially Infilled Land (Non-water)
 - Potentially Infilled Land (Non-water)
 - Potentially Infilled Land (Water)
 - Potentially Infilled Land (Water)
 - Potentially Infilled Land (Water)
 - Registered Landfill Site
 - Registered Landfill Site (Location)
 - Registered Landfill Site (Point Buffered to 100m)
 - Registered Landfill Site (Point Buffered to 250m)
 - Registered Waste Transfer Site (Location)
 - Registered Waste Transfer Site
 - Registered Waste Treatment or Disposal Site (Location)
 - Registered Waste Treatment or Disposal Site
- Hazardous Substances**
- COMAH Site
 - Explosive Site
 - NIHS Site
 - Planning Hazardous Substance Consent
 - Planning Hazardous Substance Enforcement
 - BGS Recorded Mineral Site

Site Sensitivity Map - Slice A



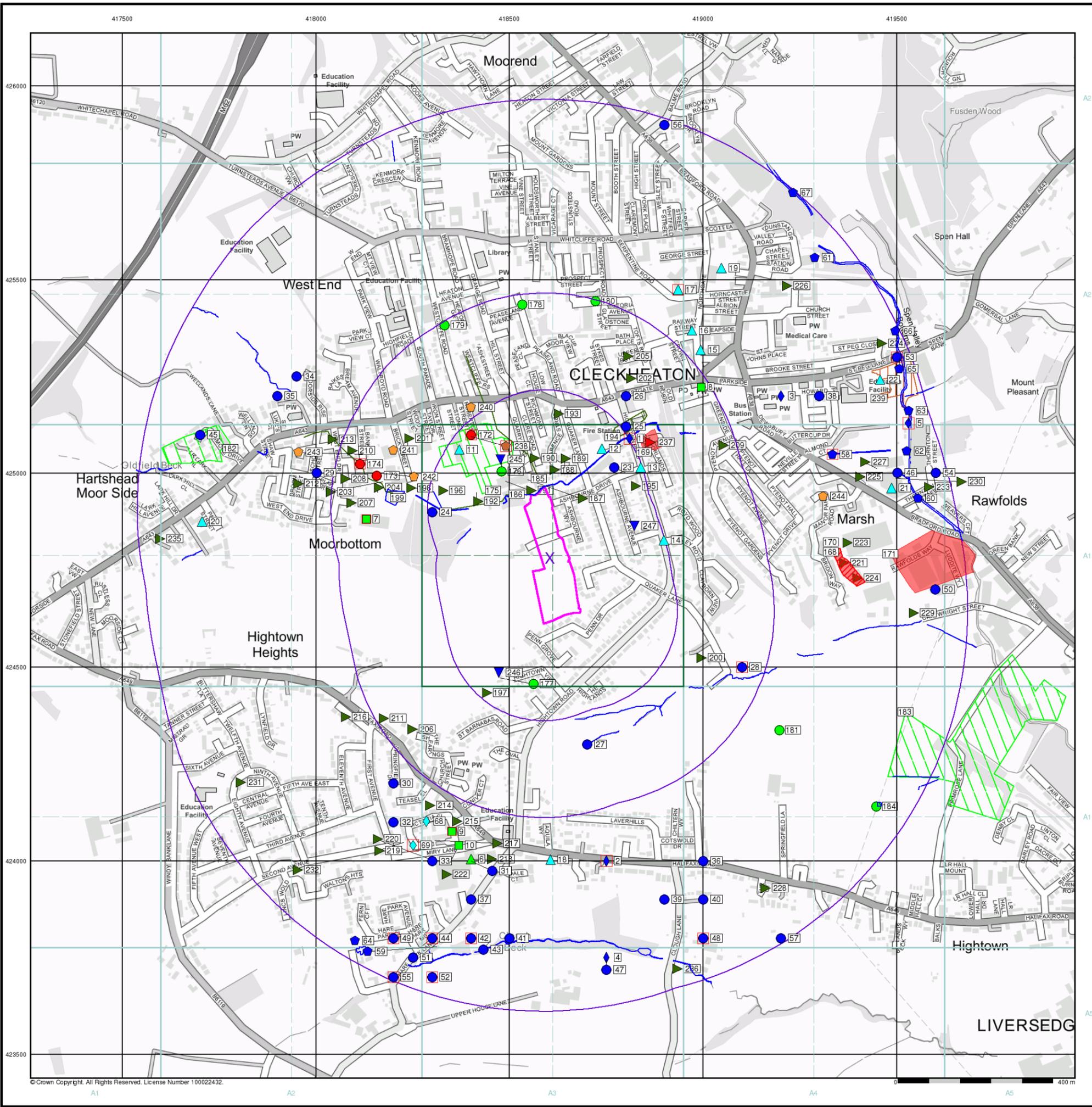
Order Details

Order Number: 330598559_1_1
 Customer Ref: PO21772/CH/1462
 National Grid Reference: 418600, 424780
 Slice: A
 Site Area (Ha): 2.58
 Search Buffer (m): 1000

Site Details

Lower Blacup Farm, Lower Blacup, CLECKHEATON, BD19 5JB

Landmark INFORMATION GROUP
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General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

Risk of Flooding from Surface Water

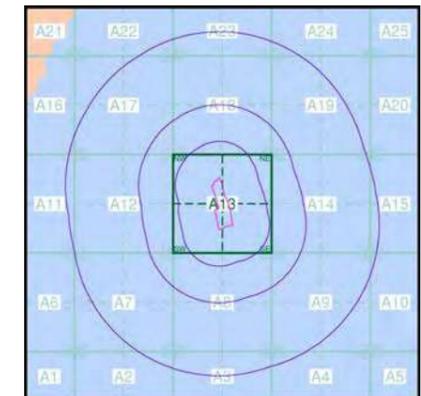
- High - 30 Year Return
- Medium - 100 Year Return
- Low - 1000 Year Return

Suitability

See the suitability map below

- National to county
- County to town
- Town to street
- Street to parcels of land
- Property

EANRW Suitability Map - Slice A



Order Details

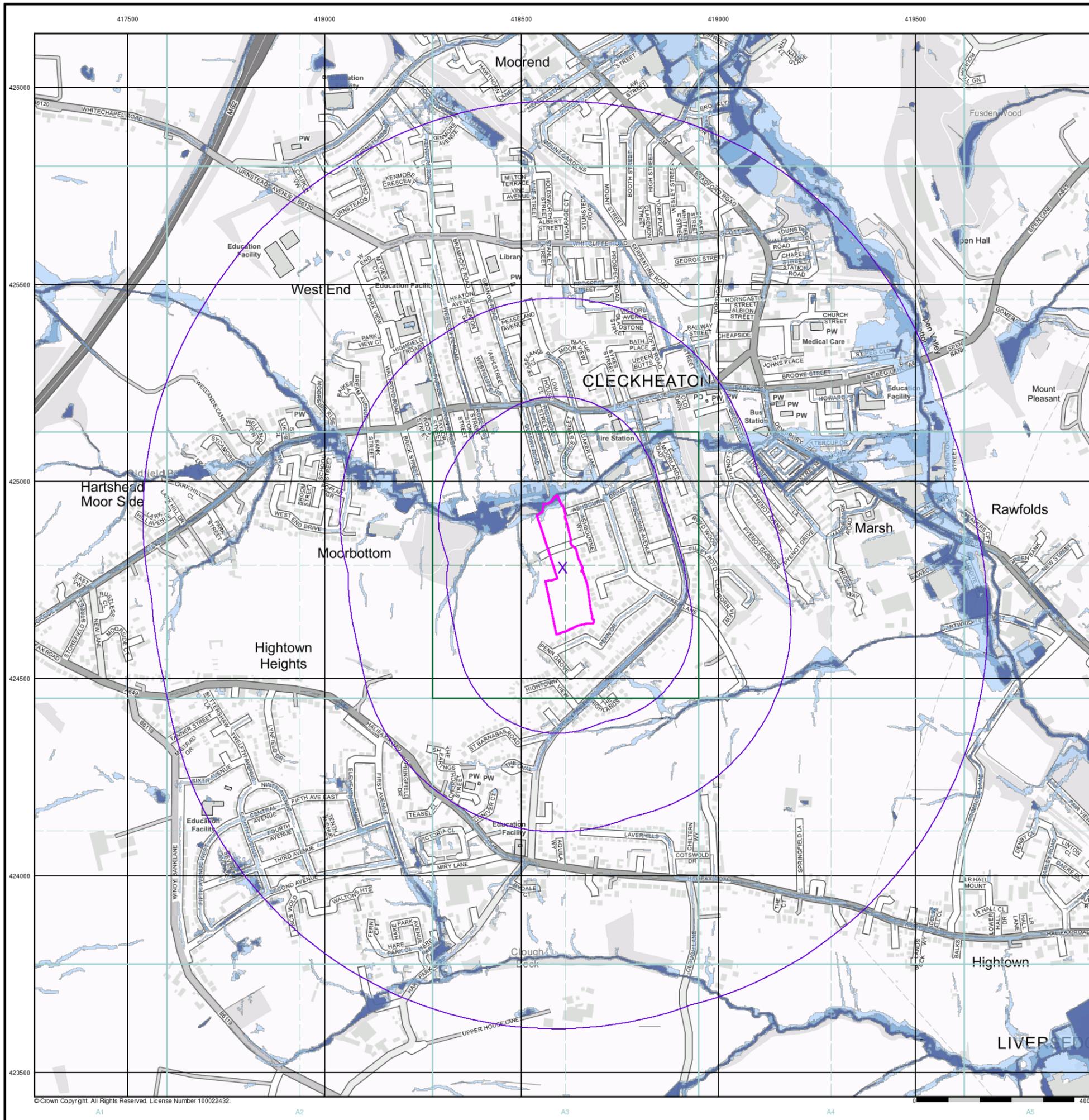
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General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

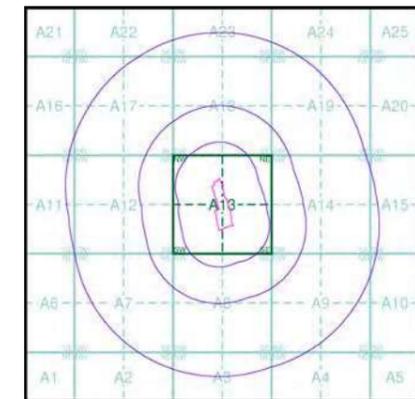
OS Water Network Data

- Canal
- Reservoir
- Foreshore
- Marsh
- Tidal River
- Inland River
- Drain
- Other
- Lake
- Transfer
- Lock Or Flight Of Locks
- Sea

Contours (height in meters)

- Standard Contour
- Master Contour
- Spot Height
- MLW Mean Low Water
- MHW Mean High Water

OS Water Network Map - Slice A



Order Details

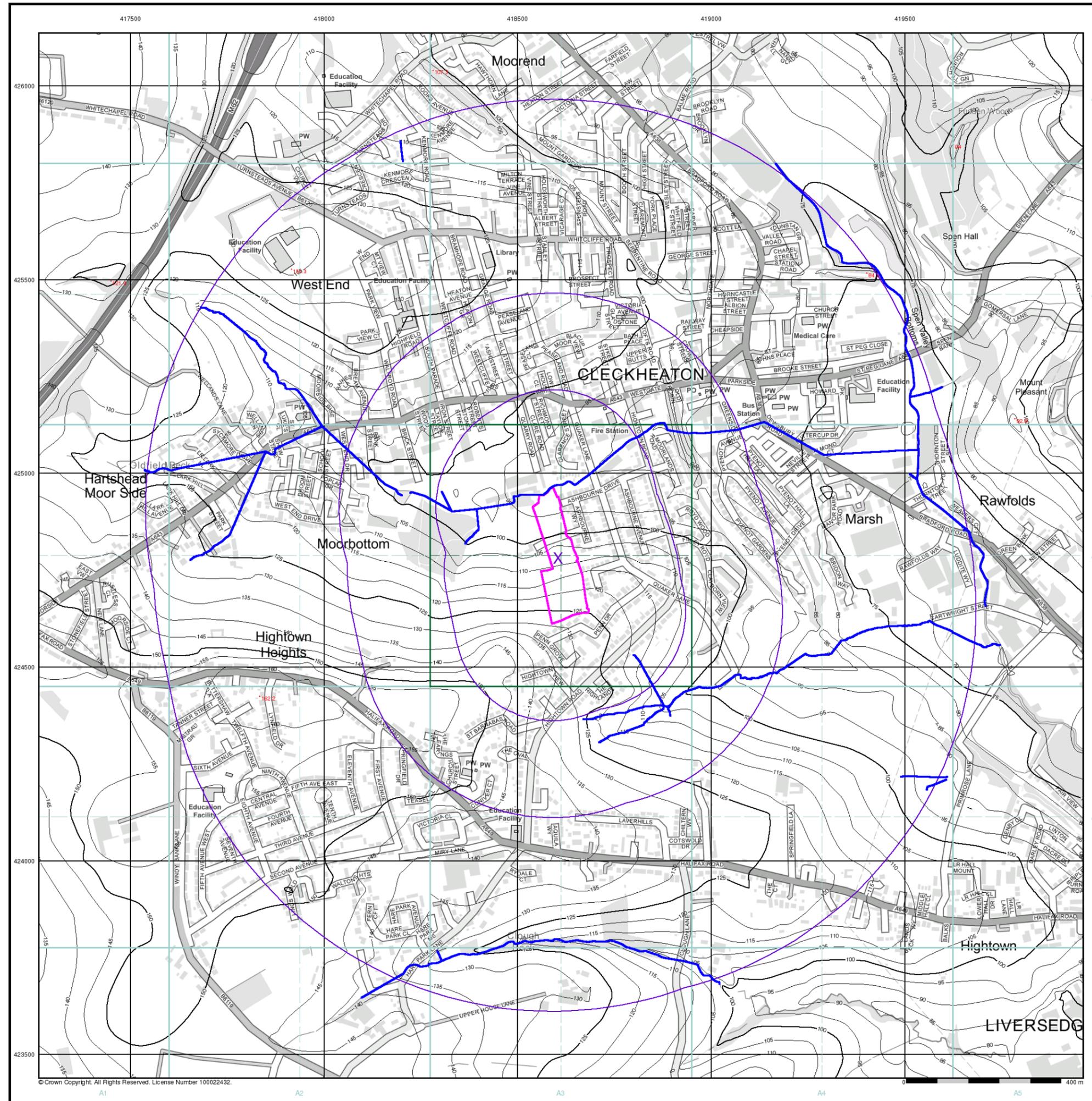
Order Number: 330598559_1_1
 Customer Ref: PO21772/CH/1462
 National Grid Reference: 418600, 424780
 Slice: A
 Site Area (Ha): 2.58
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Site Details

Lower Blacup Farm, Lower Blacup, CLECKHEATON, BD19 5JB

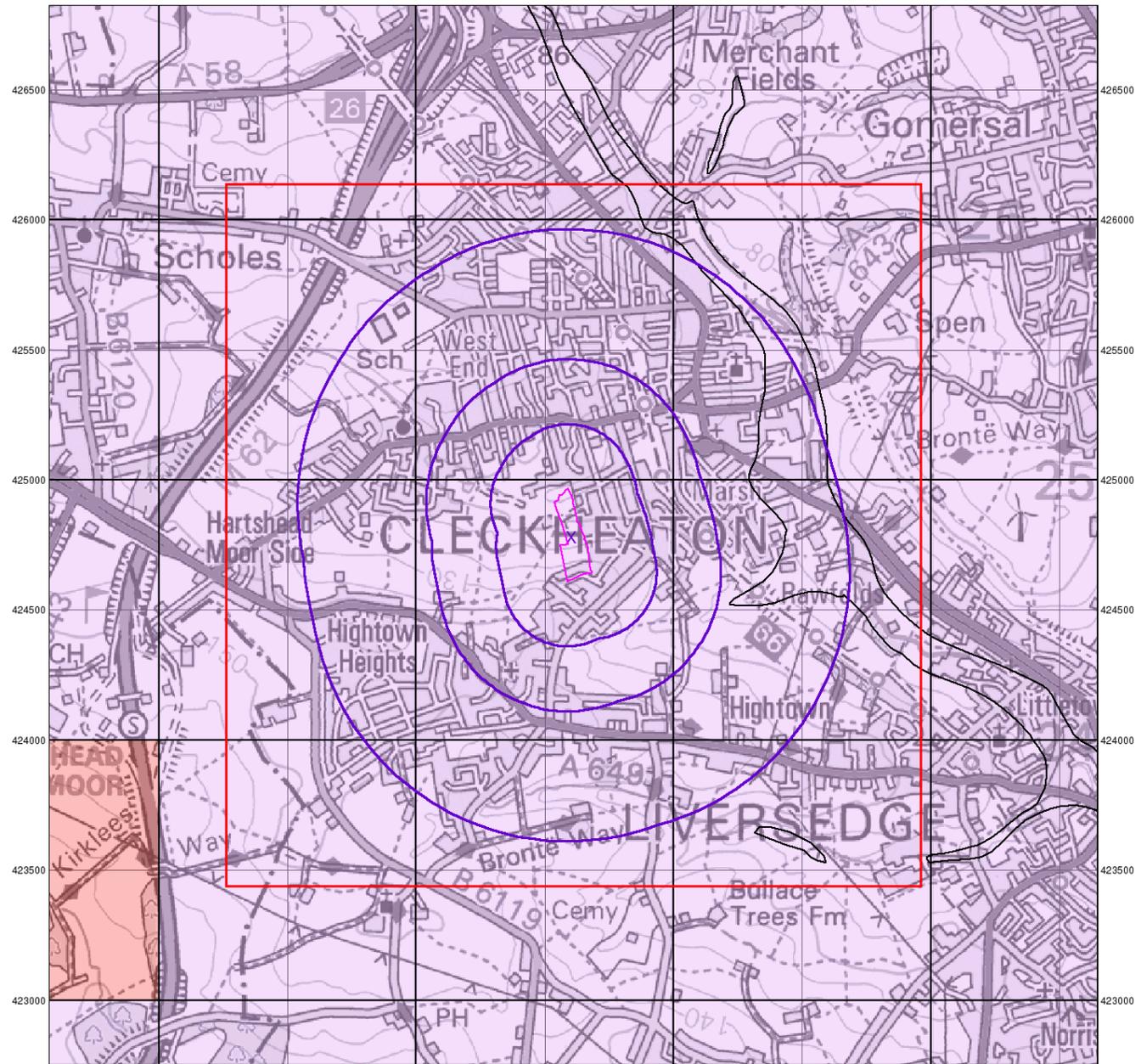


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417000 417500 418000 418500 419000 419500 420000 420500



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Groundwater Vulnerability

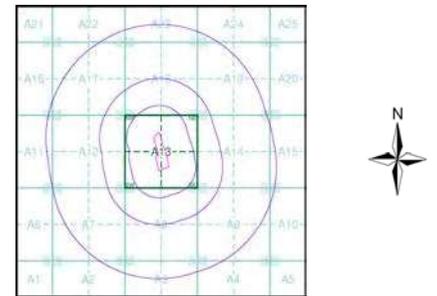
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Agency and Hydrological

- | Bedrock Aquifers | Superficial Aquifers |
|-----------------------------------------|-----------------------------------------|
| High Vulnerability, Principal Aquifer | High Vulnerability, Principal Aquifer |
| High Vulnerability, Secondary Aquifer | High Vulnerability, Secondary Aquifer |
| Medium Vulnerability, Principal Aquifer | Medium Vulnerability, Principal Aquifer |
| Medium Vulnerability, Secondary Aquifer | Medium Vulnerability, Secondary Aquifer |
| Low Vulnerability, Principal Aquifer | Low Vulnerability, Principal Aquifer |
| Low Vulnerability, Secondary Aquifer | Low Vulnerability, Secondary Aquifer |
| Unproductive Aquifer | |
| Soluble Rock | |

Site Sensitivity Context Map - Slice A



Order Details

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 Customer Ref: PO21772/CH/1462
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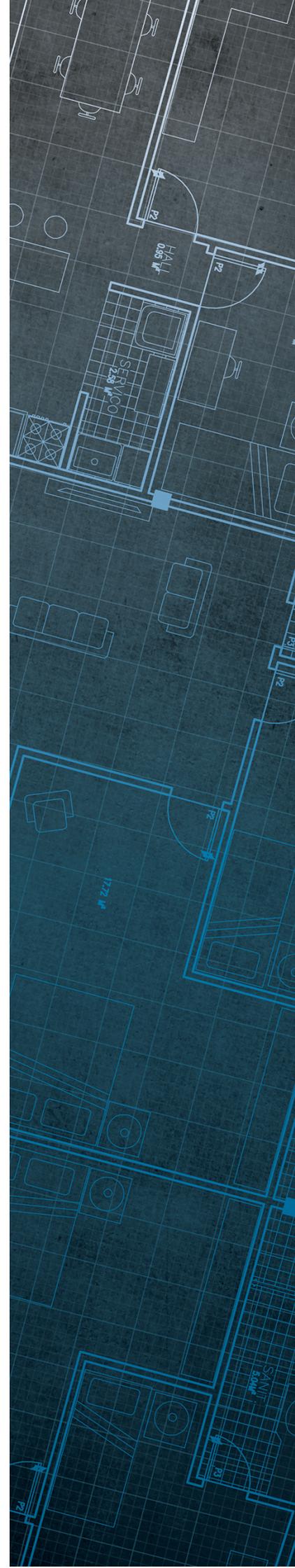
The Coal
Authority

Consultants Coal Mining Report

Lower Blacup Farm
Lower Blacup
Cleckheaton
Kirklees
BD19 5JB

Date of enquiry: 10 January 2024
Date enquiry received: 10 January 2024
Issue date: 10 January 2024

Our reference: 51003398290001
Your reference: PO21771/1462



Consultants Coal Mining Report

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

Client name

LITHOS CONSULTING LTD

Enquiry address

Lower Blacup Farm
Lower Blacup
Cleckheaton
Kirklees
BD19 5JB

How to contact us

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

200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

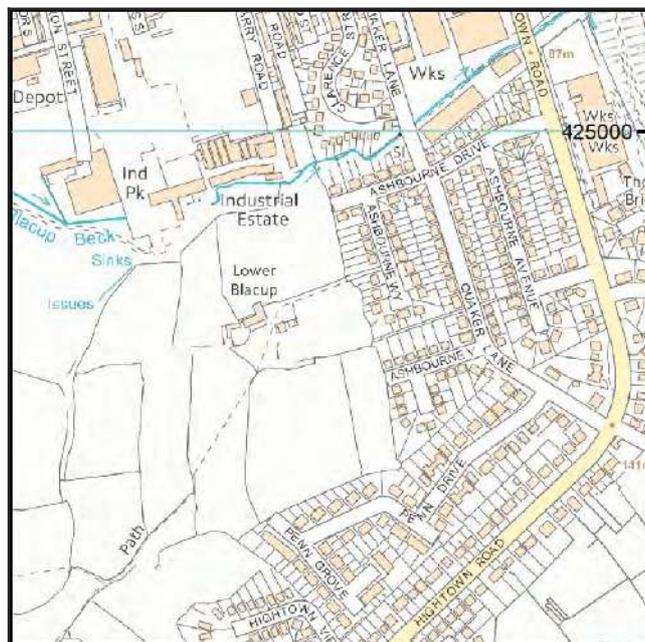
www.groundstability.com

 @coalauthority

 /company/the-coal-authority

 /thecoalauthority

 /thecoalauthority



Approximate position of property



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Section 1 – Mining activity and geology

Past underground mining

Colliery	Seam	Mineral	Coal Authority reference	Depth (m)	Direction to working	Dipping rate of seam worked (degrees)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
unnamed	WHINMOOR	Coal	6NC1	13	Beneath Property	0.0	East	30	1885
unnamed	BLACK BED	Coal	6NG1	64	Beneath Property	3.2	South	67	1880

Probable unrecorded shallow workings

Yes.

Spine roadways at shallow depth

Distance to spine roadway (m)	Direction to spine roadway
Within	N/A

Mine entries

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	418424-002	418599 424809	Shaft located by Lithos Consulting under Permit 21027, in Dec 2022	Coal	
Adit	418424-003	418639 424790	Shaft located by Lithos Consulting under Permit 21027, in Dec 2022	Coal	

Abandoned mine plan catalogue numbers

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

M31	8420	12674
M49	PO0	9069
1731		

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
Churwell Thin	Coal	Yes	Within	N/A	70
Churwell Thin	Coal	Yes	Within	N/A	84
LOW SILKSTONE	Coal	Yes	Within	N/A	250
TRUB	Coal	Yes	Within	N/A	86
WHINMOOR	Coal	Yes	Within	N/A	249

Geological faults, fissures and breaklines

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

Fault under or close to the property recorded.

Opencast mines

None recorded within 500 metres of the enquiry boundary.

Coal Authority managed tips

None recorded within 500 metres of the enquiry boundary.

Section 2 – Investigative or remedial activity

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

Site investigations

Distance to site investigation (m)	Direction
Within	N/A
Within	N/A

See Section 4 for further information.

Remediated sites

None recorded within 50 metres of the enquiry boundary.

Coal mining subsidence

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

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

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

Mine gas

None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.

Section 3 – Licensing and future mining activity

Future underground mining

None recorded.

Coal mining licensing

None recorded within 200 metres of the enquiry boundary.

Court orders

None recorded.

Section 46 notices

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

Withdrawal of support notices

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

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

Payments to owners of former copyhold land

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

Section 4 – Further information

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

Future development

If development proposals are being considered, technical advice relating to both the investigation of coal and former coal mines and their treatment should be obtained before beginning work on site. All proposals should apply specialist engineering practice required for former mining areas. No development should be undertaken that intersects, disturbs or interferes with any coal or coal mines without first obtaining the permission of the Coal Authority.

MINE GAS: Please note, if there are no recorded instances of mine gas within 500m of the enquiry boundary, this does not mean that mine gas is not present within the vicinity. The Coal Authority Mine Gas data is limited to only those sites where a Mine Gas incident has been recorded. Developers should be aware that the investigation of coal seams, mine workings or mine entries may have the potential to generate and/or displace underground gases. Associated risks both to the development site and any neighbouring land or properties should be fully considered when undertaking any ground works. The need for effective measures to prevent gases migrating onto any land or into any properties, either during investigation or remediation work, or after development must also be assessed and properly addressed. In these instances, the Coal Authority recommends that a more detailed Gas Risk Assessment is undertaken by a competent assessor.

Development advice

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

Site investigations

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

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

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

Section 5 – Data definitions

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

Past underground coal mining

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

Probable unrecorded shallow workings

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

Spine roadways at shallow depth

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

Mine entries

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

Abandoned mine plan catalogue numbers

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

Outcrops

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

Geological faults, fissures and breaklines

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

Opencast mines

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

Coal Authority managed tips

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

Site investigations

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

Remediated sites

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

Coal mining subsidence

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

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

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

Mine gas

Reports of alleged mine gas emissions received by the Coal Authority, either within or within 500 metres of the enquiry boundary that subsequently required investigation and action by the Coal Authority to mitigate the effects of the mine gas emission. Please note, if there are no recorded instances of mine gas reported, this does not mean that mine gas is not present within the vicinity. The Coal Authority Mine Gas data is limited to only those sites where a Mine Gas incident has been recorded.

Mine water treatment schemes

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

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

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

Future underground mining

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

Coal mining licensing

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

Court orders

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

Section 46 notices

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

Withdrawal of support notices

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

Payment to owners of former copyhold land

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

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

Key

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

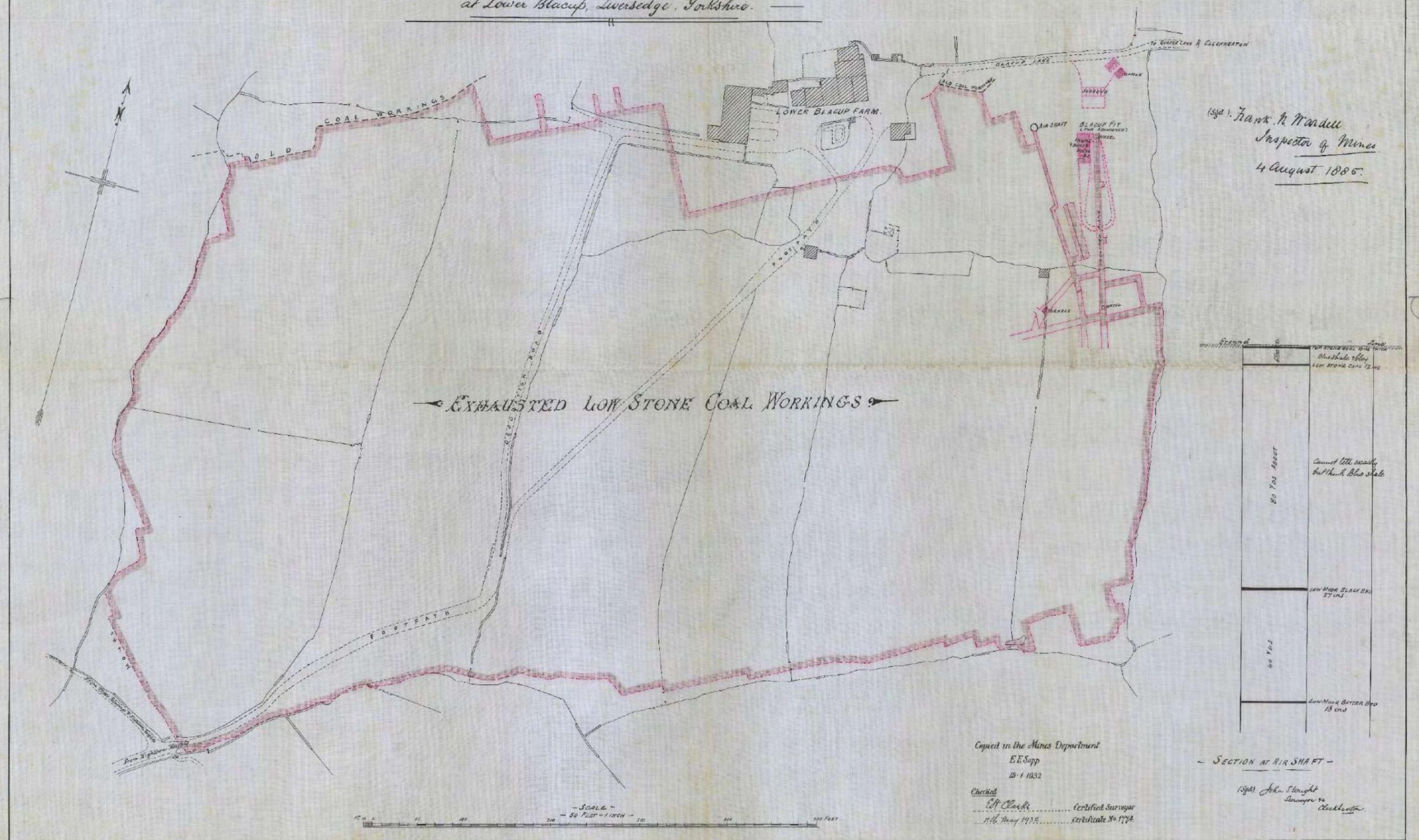


How to contact us
0345 762 6848 (UK)
+44 (0)1623 637 000 (International)
www.groundstability.com

The Executrix of Joseph Wright

*Plan showing exhausted Low Stone Coal workings (as Coloured Pink)
at Lower Blacup, Liversedge, Yorkshire.*

1871 PLAN NO. 1731



(Sgd) Frank H. Maddell
Inspector of Mines
4 August 1885.

Distance	Description
80 Yds Above	Blue shale 16 in Low stone coal 12 in
40 Yds	Low stone coal 27 in
	Low stone coal 18 in

Copied in the Mines Department
E.E. Supp
10-1-1932
Checked
E.H. Clarke
11th May 1932
Certified Surveyor
Certificate No 177A

SECTION AT AIR SHAFt -
(Sgd) John Stoughton
Surveyor to
Executrix

Alan Swales

Subject: FW: [External] Consultants Mining Report Query

From: Darren Moody <DarrenMoody@coal.gov.uk>
Date: 10/12/2020 15:46 (GMT+00:00)
To: Ashley Taylor <Ashley.Taylor@lithos.co.uk>
Subject: RE: [External] Consultants Mining Report Query

Hi Ashley

Thank you for your email.

It is not uncommon for Coal Authority outcrop data to differ to the latest BGS information. Our outcrop dataset is primarily an inherited dataset from the former British Coal which was compiled from whatever records they had in their possession at the time. In this case this was limited to the 1931 Ed. 1/10560 Geological Map Yorkshire 232SW which shows only the two coal seams outcropping through your site. The Whinmoor (or Shertcliffe) and the Low Silkstone (or Lousey) are both shown 'proven' within your site.

The recorded depth of Shaft 418424-002 (115.2m) is taken from the only recorded source (abandoned mine plan 1731). This plan shows a 126 Yard 'Section at Air Shaft' down to the 'Low Moor Better Bed' although there is no certainty that this section directly correlates to the shaft depth.

I hope this is of assistance.

Kind regards
Darren

Darren Moody
Mining Consultant & Information Manager



☎ 01623 637 161
✉ 200 Lichfield Lane, Mansfield, Nottinghamshire, NG18 4RG
✉ darrenmoody@coal.gov.uk
🌐 www.gov.uk/coalauthority

From: Ashley Taylor <Ashley.Taylor@lithos.co.uk>
Sent: 08 December 2020 16:29
To: MIM Work-Tray <MIMWork-Tray@coal.gov.uk>
Cc: Alan Swales <Alan.Swales@lithos.co.uk>
Subject: [External] Consultants Mining Report Query

Hi There,

We have purchased a coal mining report (Ref: 51002327535001 our reference: PO16705/JW/1462) for land in Cleckheaton. I have a couple of queries about the data contained within the report.

Firstly, the report states the **Low Silkstone Seam** outcrops on the site, as well as Whinmoor/Shertcliffe. However BGS data suggests only the Trub, Churwell Thin, Shertcliffe and Unnamed Seam outcrop on site.

Secondly, there is no data given for the shaft depth in the coal mining report, however the interactive viewer states the shaft (Ref.418424-002) is 115.2m deep, which seems extremely accurate.

Would you be able to confirm if the Low Silkstone does outcrop (or does it fall under another name?) and the depth of the shaft?

Many Thanks,

Ashley

Ashley Taylor
Graduate Engineer
Lithos Consulting Ltd

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Appendix F

Trial Pit Logs

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418647.05 - 424652.45 Level: 124.10	Date 23/08/2012
Location: Cleckheaton	Dimensions (m): Depth 2.50		Scale 1:25 Logged ASw
Client: Together Commercial Limited		2	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&K	HVP=130	0.20	123.90		Brown slightly sandy CLAY with occasional roots and rootlets. (TOPSOIL)
	0.60	D		0.90	123.20		Stiff orangish brown and grey mottled CLAY. (WEATHERED COAL MEASURES)
				2.20	121.90		Strong(?) light brown coarse grained SANDSTONE. Recovered as gravelly angular tabular cobbles. (COAL MEASURES - SANDSTONE)
				2.50	121.60		Weak(?) grey MUDSTONE. Recovered as angular fine to coarse gravel. (COAL MEASURES - MUDSTONE)
							<i>Below 2.0m depth, becoming difficult to excavate.</i> End of pit at 2.50 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418665.11 - 424692.35 Level: 119.65	Date 23/08/2012
Location: Cleckheaton	Dimensions (m): Depth 2.70		Scale 1:25 Logged ASw
Client: Together Commercial Limited			

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.70	D	HVP=70 HVP=60	0.20	119.45	 	Brown slightly sandy CLAY with occasional rootlets. (TOPSOIL) Firm orangish brown and grey mottled CLAY. (WEATHERED COAL MEASURES)
				1.90	117.75		Weak(?) grey MUDSTONE. Recovered as angular fine to coarse gravel. (COAL MEASURES - MUDSTONE)
				2.70	116.95		Below 1.9m depth, becoming difficult to excavate. End of pit at 2.70 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

Trialpit No

TP03

Sheet 1 of 1

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418630.84 - 424723.20 Level: 116.35	Date 23/08/2012
-------------------------------	------------------	-------------------------------------------------	--------------------

Location: Cleckheaton	Dimensions (m): Depth 2.50	2 	Scale 1:25 Logged ASw
Client: Together Commercial Limited			

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&K		0.30	116.05		Brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)
	0.80	D		2.00	114.35		orangish brown and grey clayey slightly sandy angular fine to coarse GRAVEL of sandstone. (WEATHERED COAL MEASURES)
				2.50	113.85		Weak? light grey SILTSTONE with very closely spaced thin laminations of sandstone. Recovered as angular tabular fine to coarse gravel. (COAL MEASURES - SILTSTONE)
							<i>Below 2.0m depth, becoming difficult to excavate.</i> ----- End of pit at 2.50 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.



Project Name: Ashbourne Drive Project No. 1462 Co-ords: 418652.08 - 424761.89 Date 23/08/2012
 Level: 110.90

Location: Cleckheaton Dimensions (m): 2 Scale 1:25
 Depth 2.50 0.9

Client: Together Commercial Limited Logged ASw

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.90	D	HVP=95	0.20	110.70		Brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)
				1.70	109.20		Stiff orangish brown and grey slightly gravelly CLAY. Gravel is angular fine to coarse of sandstone. (WEATHERED COAL MEASURES)
				2.50	108.40		Weak(?) light grey SILTSTONE with very closely spaced thin laminations of sandstone. Recovered as angular tabular fine to coarse gravel. (COAL MEASURES - SILTSTONE) <i>Below 2.0m depth, becoming difficult to excavate.</i>
							End of pit at 2.50 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.





Trial Pit Log

Trialpit No

TP05

Sheet 1 of 1

Project Name: Ashbourne Drive

Project No. 1462

Co-ords: 418603.34 - 424638.94

Level: 125.95

Date

23/08/2012

Location: Cleckheaton

Dimensions (m):

2

Depth 2.30

0.6

Scale

1:25

Logged

ASw

Client: Together Commercial Limited

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&K		0.20	125.75		Brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)
							Firm orangish brown and grey mottled CLAY. (WEATHERED COAL MEASURES)
				1.10	124.85		Strong(?) light brown thinly laminated fine to coarse grained SANDSTONE. Recovered as slightly clayey gravelly angular cobbles. (COAL MEASURES - SANDSTONE)
				1.90	124.05		Strong(?) light brown thinly laminated fine to coarse grained SANDSTONE. Recovered as angular cobbles and boulders (up to 400mm diameter). (COAL MEASURES - SANDSTONE)
				2.30	123.65		End of pit at 2.30 m

1

2

3

4

5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.



Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418624.48 - 424677.87 Level: 121.40	Date 23/08/2012
Location: Cleckheaton	Dimensions (m): Depth 2.90		Scale 1:25 Logged ASw
Client: Together Commercial Limited			

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50	D	HVP=95	0.20	121.20		Brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)
				0.80	120.60		Firm orangish brown and light grey mottled very sandy CLAY. (WEATHERED COAL MEASURES)
				1.70	119.70		Stiff brown and grey mottled CLAY. (WEATHERED COAL MEASURES)
				2.00	119.40		Weak(?) black carbonaceous MUDSTONE. Recovered as very clayey angular tabular fine to medium gravel. (COAL MEASURES - MUDSTONE)
				2.90	118.50		Weak(?) grey with much orangish brown iron staining SILTSTONE. Recovered as clayey angular fine to coarse gravel. (COAL MEASURES - SILTSTONE)
	<p>Between 0.8m and 0.9m depth, discontinuous lenses of slightly clayey angular fine to coarse gravel of coal.</p> <p>Below 2.8m depth, becoming difficult to excavate.</p> <p>End of pit at 2.90 m</p>						

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.



Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418605.33 - 424701.45 Level: 119.00	Date 23/08/2012
Location: Cleckheaton	Dimensions (m): Depth 2.30		Scale 1:25 Logged ASw
Client: Together Commercial Limited			

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&K		0.20	118.80		Brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)
	0.80	D		1.40	117.60		Firm brown and grey slightly gravelly CLAY. Gravel is angular fine to coarse of mudstone. (WEATHERED COAL MEASURES)
				2.30	116.70		Strong(?) light grey fine to coarse grained SANDSTONE. Recovered as angular fine to coarse gravel with occasional cobbles. (COAL MEASURES - SANDSTONE) <i>Between 1.4m and 1.5m depth, discontinuous lenses of slightly clayey angular fine to coarse gravel of coal.</i> <i>Below 2.0m depth, becoming difficult to excavate.</i>
							End of pit at 2.30 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.



Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418625.47 - 424825.36 Level: 104.40	Date 23/08/2012
Location: Cleckheaton	Dimensions (m): Depth 3.60		Scale 1:25 Logged ASw
Client: Together Commercial Limited			

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.50	J&K					MADE GROUND: Loose(?) angular to subrounded fine to coarse GRAVEL of mixed lithologies including sandstone, brick and clinker with occasional bricks, half bricks and flagstones in a very clayey ashy matrix. (ASH & CLINKER)	
	1.50	D					Constant collapse of sides from ground level to 3.3m depth.	1
				2.20	102.20		MADE GROUND: Light red/pink angular fine to coarse GRAVEL of burnt shale with occasional pockets of orangish brown gravelly clay. (BURNT SHALE)	
				2.70	101.70		MADE GROUND: Orangish brown gravelly CLAY with occasional pockets of burnt shale. Gravel is angular fine to coarse of mudstone. (COLLIERY SPOIL)	3
				3.30	101.10		Stiff orangish brown gleyed grey slightly gravelly CLAY. Gravel is angular fine to coarse of mudstone. (WEATHERED COAL MEASURES)	
				3.60	100.80		End of pit at 3.60 m	4
								5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit were unstable to 3.3m depth during excavation.



Project Name: Ashbourne Drive	Project No. 1462	Co-ords: - Level:	Date 23/08/2012
Location: Cleckheaton	Dimensions (m): Depth 2.90		Scale 1:25 Logged ASw
Client: Together Commercial Limited			

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
▼	0.10	J&K		0.20			Brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)
				1.70			Firm orangish brown and grey mottled CLAY. (WEATHERED COAL MEASURES)
				2.90			Strong(?) grey with some orangish brown iron staining thinly laminated SILTSTONE. Recovered as angular tabular fine to coarse gravel. (COAL MEASURES - SILTSTONE)
							Seepage at 1.4m depth in west face from pocket of dark grey/black tabular gravel of mudstone (possible made ground).
							End of pit at 2.90 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage at 1.4m depth in west face during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418630.46 - 424776.49 Level: 107.90	Date 23/08/2012
Location: Cleckheaton	Dimensions (m): Depth 3.00		Scale 1:25
Client: Together Commercial Limited			Logged ASw

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&K					Brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)
			HVP=60	0.30	107.60		Firm orangish brown CLAY. (WEATHERED COAL MEASURES)
	0.50	D					Stiff orangish brown and grey slightly gravelly CLAY. Gravel is angular fine to coarse of sandstone. (WEATHERED COAL MEASURES)
			HVP=90	0.70	107.20		
				1.60	106.30		Strong? grey fine to coarse grained SANDSTONE. Recovered as angular tabular fine to coarse gravel and cobbles. (COAL MEASURES - SANDSTONE)
				3.00	104.90		<p><i>Below 2.8m depth, becoming difficult to excavate.</i></p> <p>End of pit at 3.00 m</p>

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418604.88 - 424788.69 Level: 106.75	Date 23/08/2012
Location: Cleckheaton	Dimensions (m): Depth 3.60		Scale 1:25 Logged ASw
Client: Together Commercial Limited			

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.30	J&K	HVP=90	0.20	106.55		MADE GROUND: Brown slightly sandy CLAY with occasional rootlets. (MADE GROUND TOPSOIL)
				0.40	106.35		MADE GROUND: Brown slightly sandy slightly gravelly CLAY with rare half bricks. Gravel is angular fine to coarse of brick. (MADE GROUND TOPSOIL)
							Stiff orangish brown and grey mottled slightly gravelly CLAY. Gravel is angular fine to coarse of sandstone. (WEATHERED COAL MEASURES)
				2.50	104.25		Moderately weak(?) dark grey and black thinly laminated, locally carbonaceous, MUDSTONE. Recovered as angular tabular fine to coarse gravel. (COAL MEASURES - MUDSTONE)
							<i>Below 2.5m depth, slight spalling of trial pit sides.</i>
				3.60	103.15		End of pit at 3.60 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit were unstable below 2.5m depth during excavation.



Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418639.01 - 424789.66 Level: 106.05	Date 23/08/2012
Location: Cleckheaton	Dimensions (m): Depth 3.60		Scale 1:25 Logged ASw
Client: Together Commercial Limited			

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&K		0.20	105.85		MADE GROUND: Brown slightly sandy CLAY with occasional rootlets. (MADE GROUND TOPSOIL)
	0.50	D					MADE GROUND: Loose(?) dark grey/black, with occasional orangish brown iron staining, clayey angular tabular fine to coarse GRAVEL of mudstone. (COLLIERY SPOIL)
							<i>From 0.2m depth in west face, stiff brown slightly sandy CLAY.</i>
							<i>Constant collapse of sides from ground level to 3.4m depth.</i>
				3.40	102.65		Moderately strong? dark grey and black with some orangish brown iron staining thinly laminated MUDSTONE. Recovered as angular tabular fine to coarse gravel. (COAL MEASURES - MUDSTONE)
				3.60	102.45		<i>Below 3.4m depth, becoming difficult to excavate.</i> End of pit at 3.60 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit were unstable to 3.4m depth during excavation.



Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418635.20 - 424788.92 Level: 106.20	Date 23/08/2012
Location: Cleckheaton	Dimensions (m): Depth 3.60		Scale 1:25 Logged ASw
Client: Together Commercial Limited			

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
			HVP=95	0.20	106.00		Brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)
							Stiff orangish brown and grey mottled slightly gravelly CLAY. Gravel is angular fine to coarse of sandstone. (WEATHERED COAL MEASURES)
				3.00	103.20		Moderately strong? dark grey and black with some orangish brown iron staining thinly laminated MUDSTONE. Recovered as angular tabular fine to coarse gravel with rare coarse gravel of coal. (COAL MEASURES - MUDSTONE)
				3.60	102.60		<i>Below 3.0m depth, becoming difficult to excavate.</i> End of pit at 3.60 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.



Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418643.30 - 424790.74 Level: 106.30	Date 23/08/2012
Location: Cleckheaton	Dimensions (m): Depth 3.60		Scale 1:25 Logged ASw
Client: Together Commercial Limited			

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&K		0.30	106.00		Brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)
	0.90	D					Stiff orangish brown and grey mottled slightly gravelly CLAY. Gravel is angular fine to coarse of sandstone. (WEATHERED COAL MEASURES)
				3.30	103.00		Moderately strong? dark grey and black with some orangish brown iron staining thinly laminated MUDSTONE. Recovered as angular tabular fine to coarse gravel with rare coarse gravel of coal. (COAL MEASURES - MUDSTONE)
				3.60	102.70		Below 3.3m depth, becoming difficult to excavate. End of pit at 3.60 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.



Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418590.95 - 424807.30 Level: 105.40	Date 23/08/2012
Location: Cleckheaton	Dimensions (m): Depth 3.40		Scale 1:25 Logged ASw
Client: Together Commercial Limited			

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50	J&K					MADE GROUND: Loose(?) dark grey angular to subrounded fine to coarse GRAVEL of mixed lithologies including brick, sandstone and clinker in a clayey ashy matrix. Rare bricks and half bricks. (ASH & CLINKER)
				1.50	103.90		MADE GROUND: Dark grey/black clayey angular tabular fine to coarse GRAVEL of mudstone with occasional pockets of stiff greyish green clay. (COLLIERY SPOIL)
			HVP=90	2.60	102.80		Stiff light brown and grey mottled CLAY. (WEATHERED COAL MEASURES)
				3.40	102.00		End of pit at 3.40 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit were unstable to 1.5m depth during excavation.



Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418596.47 - 424861.07 Level: 97.10	Date 23/08/2012
Location: Cleckheaton	Dimensions (m): Depth 2.40		Scale 1:25 Logged ASw
Client: Together Commercial Limited			

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&K		0.20	96.90		Brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)
	1.20	D	HVP=115				Stiff orangish brown and grey mottled slightly gravelly CLAY. Gravel is angular fine to coarse of mudstone. (WEATHERED COAL MEASURES)
				1.90	95.20		Moderately strong(?) brown with some reddish brown iron staining SILTSTONE. Recovered as angular tabular fine to coarse gravel. (COAL MEASURES - SILTSTONE)
				2.40	94.70		Below 1.9m depth, becoming difficult to excavate. End of pit at 2.40 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.



Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418585.13 - 424885.24 Level: 95.60	Date 23/08/2012
Location: Cleckheaton		Dimensions (m): Depth 2.10	Scale 1:25 Logged ASw
Client: Together Commercial Limited			

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&K		0.20	95.40		Brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)
	1.00	D		1.70	93.90		Stiff orangish brown and grey mottled CLAY. (WEATHERED COAL MEASURES)
				2.10	93.50		Stiff grey CLAY with many angular fine to coarse gravel size lithorelicts of mudstone. (WEATHERED COAL MEASURES)
							<i>Below 2.0m depth, becoming difficult to excavate.</i> End of pit at 2.10 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.



Project Name: Ashbourne Drive Project No. 1462 Co-ords: 418595.71 - 424915.01 Date 23/08/2012
 Level: 93.45

Location: Cleckheaton Dimensions (m): 2 Scale 1:25
 Depth 2.30

Client: Together Commercial Limited Logged ASw

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	93.15		Brown slightly sandy CLAY with occasional rootlets. (TOPSOIL)
			HVP=70				Stiff light brown gleyed grey slightly gravelly CLAY. Gravel is angular fine to coarse of mudstone. (WEATHERED COAL MEASURES)
			HVP=120				
			HVP=120				
				2.00	91.45		Strong(?) light brown with occasional dark brown iron staining SILTSTONE. Recovered as angular tabular fine to coarse gravel. (COAL MEASURES - SILTSTONE)
				2.30	91.15		<i>Below 2.0m depth, becoming difficult to excavate.</i> End of pit at 2.30 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit remained stable during excavation.



Appendix G
Rotary Probehole Logs

Borehole Log

Borehole No.

PH01

Sheet 1 of 2

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418616E - 424637N	Hole Type PH
Location: Cleckheaton		Level: 126.00 m AOD	Scale 1:50
Client: Together Commercial Limited		Dates: 23/08/2012	Logged By SAM

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					126.00		Overburden. (OVERBURDEN)		
					2.50	123.50		Sandstone/Mudstone. (LOWER COAL MEASURES)	1
					3.20	122.80		Coal. (TRUB COAL)	2
					3.50	122.50		Mudstone. (LOWER COAL MEASURES)	3
									4
									5
									6
									7
									8
									9
									10

Continued on Next Sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Borehole backfilled on completion.



Borehole Log

Borehole No.

PH01

Sheet 2 of 2

Project Name: Ashbourne Drive

 Project No.
1462

Co-ords: 418616E - 424637N

 Hole Type
PH

Location: Cleckheaton

Level: 126.00 m AOD

 Scale
1:50

Client: Together Commercial Limited

Dates: 23/08/2012

 Logged By
SAM

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					10.80	115.20		Mudstone. (LOWER COAL MEASURES)	
								Sandstone. (LOWER COAL MEASURES)	11
					12.00	114.00		Mudstone/Sandstone bands. (LOWER COAL MEASURES)	12
									13
									14
									15
									16
					16.70	109.30		Coal. (CHURWELL THIN COAL)	17
					17.00	109.00		Mudstone. (LOWER COAL MEASURES)	18
									19
				20.00			End of Borehole at 20.00m	20	

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Borehole backfilled on completion.

Borehole Log

Borehole No.

PH02

Sheet 1 of 2

Project Name: Ashbourne Drive

Project No.
1462

Co-ords: 418663E - 424650N

Hole Type
PH

Location: Cleckheaton

Level: 124.20 m AOD

Scale
1:50

Client: Together Commercial Limited

Dates: 19/07/2012

Logged By
ASw

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					124.20		Overburden. (OVERBURDEN)		
					1.00 123.20		Sandstone. (LOWER COAL MEASURES)	1	
					2.20 122.00		Mudstone. (LOWER COAL MEASURES)	2	
					2.70 121.50		Coal. (TRUB COAL)	3	
					2.90 121.30		Mudstone. (LOWER COAL MEASURES)		
								4	
								5	
								6	
								7	
								8	
								9	
								10	

Continued on Next Sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Gas/groundwater monitoring standpipe installed on completion of hole.





Borehole Log

Borehole No.

PH02

Sheet 2 of 2

Project Name: Ashbourne Drive

Project No.
1462

Co-ords: 418663E - 424650N

Hole Type
PH

Location: Cleckheaton

Level: 124.20 m AOD

Scale
1:50

Client: Together Commercial Limited

Dates: 19/07/2012

Logged By
ASw

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					10.50	113.70		Mudstone. (LOWER COAL MEASURES)	11
					12.00			End of Borehole at 12.00m	12
									13
									14
									15
									16
									17
									18
									19
									20

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Gas/groundwater monitoring standpipe installed on completion of hole.



Borehole Log

Borehole No.

PH03

Sheet 1 of 3

Project Name: Ashbourne Drive

Project No.
1462

Co-ords: 418652E - 424731N

Hole Type
PH

Location: Cleckheaton

Level: 115.80 m AOD

Scale
1:50

Client: Together Commercial Limited

Dates: 19/07/2012

Logged By
ASw

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					115.80		Overburden. (OVERBURDEN)		1	
					1.80	114.00		Sandstone. (LOWER COAL MEASURES)		2
					3.50	112.30		Sandstone/Mudstone. (LOWER COAL MEASURES)		3
										4
										5
										6
					7.50	108.30		Coal. (CHURWELL THIN COAL)		7
					8.20	107.60		Mudstone. (LOWER COAL MEASURES)		8
										9
										10

Continued on Next Sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Water flush returns lost from 16.5m depth. 4. Borehole backfilled on completion.



Borehole Log

Borehole No.

PH03

Sheet 2 of 3

Project Name: Ashbourne Drive

Project No.
1462

Co-ords: 418652E - 424731N

Hole Type
PH

Location: Cleckheaton

Level: 115.80 m AOD

Scale
1:50

Client: Together Commercial Limited

Dates: 19/07/2012

Logged By
ASw

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Mudstone. (LOWER COAL MEASURES)	
					11.00	104.80		Sandstone. (LOWER COAL MEASURES)	11
					11.70	104.10		Mudstone. (LOWER COAL MEASURES)	12
					12.90	102.90		Dark Mudstone with coal traces. (LOWER COAL MEASURES)	13
					13.10	102.70		Sandstone/Mudstone. (LOWER COAL MEASURES)	14
									15
									16
									17
									18
					18.60	97.20		Coal. (SHERTCLIFFE COAL)	19
				19.50	96.30		Mudstone. (LOWER COAL MEASURES)	20	

Continued on Next Sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Water flush returns lost from 16.5m depth. 4. Borehole backfilled on completion.





Borehole Log

Borehole No.

PH03

Sheet 3 of 3

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418652E - 424731N	Hole Type PH
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Location: Cleckheaton	Level: 115.80 m AOD	Scale 1:50
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Client: Together Commercial Limited	Dates: 19/07/2012	Logged By ASw
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Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					21.00		Mudstone. (LOWER COAL MEASURES)		
							End of Borehole at 21.00m	21	
								22	
								23	
								24	
								25	
								26	
								27	
								28	
								29	
								30	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Water flush returns lost from 16.5m depth. 4. Borehole backfilled on completion.



Borehole Log

Borehole No.

PH04

Sheet 1 of 2

Project Name: Ashbourne Drive

 Project No.
1462

Co-ords: 418607E - 424676N

 Hole Type
PH

Location: Cleckheaton

Level: 122.30 m AOD

 Scale
1:50

Client: Together Commercial Limited

Dates: 23/08/2012

 Logged By
SAM

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					122.30		Overburden. (OVERBURDEN)		
					1.50		Coal. (TRUB COAL)	1	
				1.80	120.50		Mudstone/Sandstone. (LOWER COAL MEASURES)	2	
								3	
								4	
								5	
								6	
				6.70	115.60		Mudstone. (LOWER COAL MEASURES)	7	
								8	
								9	
								10	

Continued on Next Sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Borehole backfilled on completion.



Borehole Log

Borehole No.

PH04

Sheet 2 of 2

Project Name: Ashbourne Drive

 Project No.
1462

Co-ords: 418607E - 424676N

 Hole Type
PH

Location: Cleckheaton

Level: 122.30 m AOD

 Scale
1:50

Client: Together Commercial Limited

Dates: 23/08/2012

 Logged By
SAM

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Mudstone. (LOWER COAL MEASURES)		
					11.80	110.50			
					12.00	110.30	Mudstone with coal traces. (LOWER COAL MEASURES)		
							Mudstone. (LOWER COAL MEASURES)		
					16.50	105.80	Coal. (CHURWELL THIN COAL)		
					16.80	105.50	Mudstone. (LOWER COAL MEASURES)		
					18.00				
							End of Borehole at 18.00m		

Remarks

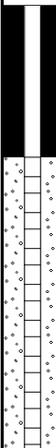
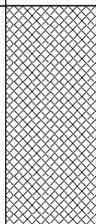
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Borehole backfilled on completion.



Borehole Log

Borehole No.
PH04a
Sheet 1 of 1
Hole Type
PH
Scale
1:50
Logged By
SAM

Project Name: Ashbourne Drive Project No. 1462 Co-ords: 418608E - 424676N
Location: Cleckheaton Level: 121.85 m AOD
Client: Together Commercial Limited Dates: 23/08/2012

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					121.85		Overburden. (OVERBURDEN)	1	
				1.50	120.35		Coal. (TRUB COAL)	2	
				1.80	120.05		Mudstone/Sandstone. (LOWER COAL MEASURES)	2	
				3.00			End of Borehole at 3.00m	3	

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Gas/groundwater monitoring standpipe installed on completion of hole.



Borehole Log

Borehole No.

PH05

Sheet 1 of 3

Project Name: Ashbourne Drive

Project No.
1462

Co-ords: 418615E - 424713N

Hole Type
PH

Location: Cleckheaton

Level: 117.85 m AOD

Scale
1:50

Client: Together Commercial Limited

Dates: 23/08/2012

Logged By
SAM

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					117.85		Overburden. (OVERBURDEN)		
				1.10	116.75		Sandstone. (LOWER COAL MEASURES)	1	
								2	
								3	
								4	
								5	
				5.80	112.05		Mudstone. (LOWER COAL MEASURES)	6	
				6.50	111.35		Coal. (UN-NAMED COAL)	7	
				7.00	110.85		Mudstone. (LOWER COAL MEASURES)	8	
								9	
								10	

Continued on Next Sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Air flush returns lost from 16.5m depth. 4. Borehole backfilled on completion.



Borehole Log

Borehole No.

PH05

Sheet 2 of 3

Project Name: Ashbourne Drive

 Project No.
1462

Co-ords: 418615E - 424713N

 Hole Type
PH

Location: Cleckheaton

Level: 117.85 m AOD

 Scale
1:50

Client: Together Commercial Limited

Dates: 23/08/2012

 Logged By
SAM

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
							Mudstone. (LOWER COAL MEASURES)		11	
					12.00 12.10	105.85 105.75		Coal. (CHURWELL THIN COAL) Mudstone/Sandstone bands. (LOWER COAL MEASURES)		12
									13	
									14	
									15	
					16.50	101.35		Broken Ground, no flush returns (SHERTCLIFFE COAL) <i>Loss of flush returns between 16.5m and 21.0m.</i>		17
									18	
					18.20	99.65		Solid Ground, no flush returns (LOWER COAL MEASURES)		19
									20	

Continued on Next Sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Air flush returns lost from 16.5m depth. 4. Borehole backfilled on completion.



Borehole Log

Borehole No.

PH05

Sheet 3 of 3

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418615E - 424713N	Hole Type PH
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Location: Cleckheaton	Level: 117.85 m AOD	Scale 1:50
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Client: Together Commercial Limited	Dates: 23/08/2012	Logged By SAM
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Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					21.00		Solid Ground, no flush returns (LOWER COAL MEASURES)		
							End of Borehole at 21.00m	21	
								22	
								23	
								24	
								25	
								26	
								27	
								28	
								29	
								30	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Air flush returns lost from 16.5m depth. 4. Borehole backfilled on completion.



Borehole Log

Borehole No.

PH06

Sheet 1 of 3

Project Name: Ashbourne Drive

Project No.
1462

Co-ords: 418612E - 424775N

Hole Type
PH

Location: Cleckheaton

Level: 108.25 m AOD

Scale
1:50

Client: Together Commercial Limited

Dates: 23/08/2012

Logged By
SAM

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					108.25		Overburden. (OVERBURDEN)		
				2.40	105.85		Sandstone/Mudstone. (LOWER COAL MEASURES)	1 2 3 4	
				4.80	103.45		Coal. (SHERTCLIFFE COAL)	5	
				6.20	102.05		Mudstone/Sandstone bands. (LOWER COAL MEASURES)	6 7 8 9	
								10	

Continued on Next Sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Borehole backfilled on completion.





Borehole Log

Borehole No.

PH06

Sheet 2 of 3

Project Name: Ashbourne Drive

Project No.
1462

Co-ords: 418612E - 424775N

Hole Type
PH

Location: Cleckheaton

Level: 108.25 m AOD

Scale
1:50

Client: Together Commercial Limited

Dates: 23/08/2012

Logged By
SAM

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Mudstone/Sandstone bands. (LOWER COAL MEASURES)		
								11	
								12	
								13	
								14	
								15	
								16	
								17	
								18	
								19	
								20	

Continued on Next Sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Borehole backfilled on completion.





Borehole Log

Borehole No.

PH06

Sheet 3 of 3

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418612E - 424775N	Hole Type PH
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Location: Cleckheaton	Level: 108.25 m AOD	Scale 1:50
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Client: Together Commercial Limited	Dates: 23/08/2012	Logged By SAM
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Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					21.00		Mudstone/Sandstone bands. (LOWER COAL MEASURES)		
							End of Borehole at 21.00m	21	
								22	
								23	
								24	
								25	
								26	
								27	
								28	
								29	
								30	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Borehole backfilled on completion.



Borehole Log

Borehole No.

PH07

Sheet 1 of 3

Project Name: Ashbourne Drive

 Project No.
1462

Co-ords: 418598E - 424778N

 Hole Type
PH

Location: Cleckheaton

Level: 107.80 m AOD

 Scale
1:50

Client: Together Commercial Limited

Dates: 23/08/2012

 Logged By
SAM

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					107.80		Overburden. (OVERBURDEN)		
					2.50	105.30		Sandstone/Mudstone. (LOWER COAL MEASURES)	1
					4.00	103.80		Coal. (SHERTCLIFFE COAL)	2
					5.20	102.60		Mudstone/Sandstone bands. (LOWER COAL MEASURES)	3
									4
									5
									6
									7
									8
									9
									10

Continued on Next Sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 28.8m. 3. Borehole backfilled on completion.



Borehole Log

Borehole No.

PH07

Sheet 2 of 3

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418598E - 424778N	Hole Type PH
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Location: Cleckheaton	Level: 107.80 m AOD	Scale 1:50
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Client: Together Commercial Limited	Dates: 23/08/2012	Logged By SAM
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Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Mudstone/Sandstone bands. (LOWER COAL MEASURES)		
									11
									12
									13
									14
									15
									16
									17
									18
									19
									20

Continued on Next Sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 28.8m. 3. Borehole backfilled on completion.





Borehole Log

Borehole No.

PH07

Sheet 3 of 3

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418598E - 424778N	Hole Type PH
Location: Cleckheaton		Level: 107.80 m AOD	Scale 1:50
Client: Together Commercial Limited		Dates: 23/08/2012	Logged By SAM

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
▼								Mudstone/Sandstone bands. (LOWER COAL MEASURES)	21
									22
									23
									24
									25
									26
									27
									28
								Water strike at 28.8m.	29
					30.00			End of Borehole at 30.00m	30

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 28.8m. 3. Borehole backfilled on completion.





Borehole Log

Borehole No.
PH07a
Sheet 1 of 1
Hole Type
PH
Scale
1:50
Logged By
SAM

Project Name: Ashbourne Drive Project No. 1462 Co-ords: 418598E - 424778N
Location: Cleckheaton Level: 107.80 m AOD
Client: Together Commercial Limited Dates: 23/08/2012

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					107.80		Overburden. (OVERBURDEN)	1	
					2.50	105.30		Sandstone/Mudstone. (LOWER COAL MEASURES)	2
					3.00			End of Borehole at 3.00m	3
								4	
								5	
								6	
								7	
								8	
								9	
								10	

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Gas/groundwater monitoring standpipe installed on completion of hole.



Borehole Log

Borehole No.

PH08

Sheet 1 of 3

Project Name: Ashbourne Drive

 Project No.
1462

Co-ords: 418596E - 424807N

 Hole Type
PH

Location: Cleckheaton

Level: 105.85 m AOD

 Scale
1:50

Client: Together Commercial Limited

Dates: 23/08/2012

 Logged By
SAM

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					105.85		Overburden. (OVERBURDEN)		
					4.20	101.65		Sandstone/Mudstone. (LOWER COAL MEASURES)	1 2 3 4
					6.80	99.05		Soft Ground, partial flush returns. (SHERTCLIFFE COAL)	5 6 7
					7.80	98.05		<i>Partial flush returns between 6.8m and 7.8m.</i>	8
								Sandstone/Mudstone. (LOWER COAL MEASURES)	9 10
Continued on Next Sheet									

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 28.8m. 3. Air flush partial returns between 6.8m and 7.8m depth. 4. Borehole backfilled on completion.



Borehole Log

Borehole No.

PH08

Sheet 2 of 3

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418596E - 424807N	Hole Type PH
Location: Cleckheaton		Level: 105.85 m AOD	Scale 1:50
Client: Together Commercial Limited		Dates: 23/08/2012	Logged By SAM

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Sandstone/Mudstone. (LOWER COAL MEASURES)		11
									12
									13
									14
									15
									16
									17
									18
									19
									20

Continued on Next Sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 28.8m. 3. Air flush partial returns between 6.8m and 7.8m depth. 4. Borehole backfilled on completion.





Borehole Log

Borehole No.

PH08

Sheet 3 of 3

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418596E - 424807N	Hole Type PH
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Location: Cleckheaton	Level: 105.85 m AOD	Scale 1:50
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Client: Together Commercial Limited	Dates: 23/08/2012	Logged By SAM
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Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Sandstone/Mudstone. (LOWER COAL MEASURES)		
					24.00				
							End of Borehole at 24.00m		

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 28.8m. 3. Air flush partial returns between 6.8m and 7.8m depth. 4. Borehole backfilled on completion.

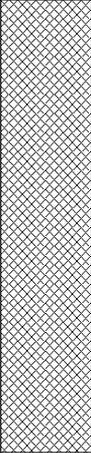




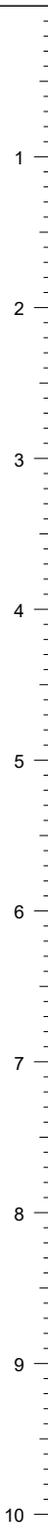
Borehole Log

Borehole No.
PH08a
Sheet 1 of 1
Hole Type
PH
Scale
1:50
Logged By
SAM

Project Name: Ashbourne Drive Project No. 1462 Co-ords: 418595E - 424807N
Location: Cleckheaton Level: 105.45 m AOD
Client: Together Commercial Limited Dates: 23/08/2012

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					105.45		Overburden. (OVERBURDEN)	
				3.00			End of Borehole at 3.00m	

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Gas/groundwater monitoring standpipe installed on completion of hole.



Borehole Log

Borehole No.

PH09

Sheet 1 of 3

Project Name: Ashbourne Drive

 Project No.
1462

Co-ords: 418599E - 424748N

 Hole Type
PH

Location: Cleckheaton

Level: 112.45 m AOD

 Scale
1:50

Client: Together Commercial Limited

Dates: 19/07/2012

 Logged By
ASw

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					112.45		Overburden. (OVERBURDEN)		
				1.80	110.65		Sandstone/Mudstone. (LOWER COAL MEASURES)	1 2 3	
				4.00	108.45		Mudstone. (LOWER COAL MEASURES)	4 5 6	
				7.20	105.25		Sandstone. (LOWER COAL MEASURES)	7	
				7.80	104.65		Mudstone. (LOWER COAL MEASURES)	8 9	
							Continued on Next Sheet	10	

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Borehole backfilled on completion.

Borehole Log

Borehole No.

PH09

Sheet 2 of 3

Project Name: Ashbourne Drive

 Project No.
1462

Co-ords: 418599E - 424748N

 Hole Type
PH

Location: Cleckheaton

Level: 112.45 m AOD

 Scale
1:50

Client: Together Commercial Limited

Dates: 19/07/2012

 Logged By
ASw

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					10.30	102.15		Mudstone. (LOWER COAL MEASURES) Coal. (CHURWELL THIN COAL)	11
					11.20	101.25		Mudstone. (LOWER COAL MEASURES)	12
									13
									14
									15
									16
						16.50	95.95	Broken Ground, no flush returns (SHERTCLIFFE COAL)	17
								<i>Loss of flush returns between 16.5m and 17.5m.</i>	
						17.50	94.95	Solid Ground, no flush returns (LOWER COAL MEASURES)	18
									19
								20	

Continued on Next Sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Borehole backfilled on completion.



Borehole Log

Borehole No.

PH09

Sheet 3 of 3

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418599E - 424748N	Hole Type PH
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Location: Cleckheaton	Level: 112.45 m AOD	Scale 1:50
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Client: Together Commercial Limited	Dates: 19/07/2012	Logged By ASw
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Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					21.00		Solid Ground, no flush returns (LOWER COAL MEASURES)		
							End of Borehole at 21.00m	21	
								22	
								23	
								24	
								25	
								26	
								27	
								28	
								29	
								30	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Borehole backfilled on completion.





Borehole Log

Borehole No.
PH09a
Sheet 1 of 1
Hole Type
PH
Scale
1:50
Logged By
ASw

Project Name: Ashbourne Drive Project No. 1462 Co-ords: 418600E - 424748N
Location: Cleckheaton Level: 112.10 m AOD
Client: Together Commercial Limited Dates: 19/07/2012

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					112.10		Overburden. (OVERBURDEN)	1
					1.60	110.50		Sandstone/Mudstone. (LOWER COAL MEASURES)
					6.00		End of Borehole at 6.00m	6

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Gas/groundwater monitoring standpipe installed on completion of hole.





Borehole Log

Borehole No.
PH10
Sheet 1 of 3
Hole Type
PH
Scale
1:50
Logged By
SAM

Project Name: Ashbourne Drive Project No. 1462 Co-ords: 418597E - 424857N
Location: Cleckheaton Level: 97.70 m AOD
Client: Together Commercial Limited Dates: 23/08/2012

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					97.70		Overburden (OVERBURDEN)		
				1.60	96.10		Grey Mudstone (LOWER COAL MEASURES)		
								1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								10	

Continued on Next Sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 28.8m. 3. Borehole backfilled with arisings on completion.





Borehole Log

Borehole No.

PH10

Sheet 2 of 3

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418597E - 424857N	Hole Type PH
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Location: Cleckheaton	Level: 97.70 m AOD	Scale 1:50
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Client: Together Commercial Limited	Dates: 23/08/2012	Logged By SAM
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Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					12.40	85.30		Grey Mudstone (LOWER COAL MEASURES)	11
								Dark Mudstone/Sandstone bands (LOWER COAL MEASURES)	12
									13
									14
									15
									16
									17
									18
									19
									20

Continued on Next Sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 28.8m. 3. Borehole backfilled with arisings on completion.





Borehole Log

Borehole No.

PH10

Sheet 3 of 3

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418597E - 424857N	Hole Type PH
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Location: Cleckheaton	Level: 97.70 m AOD	Scale 1:50
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Client: Together Commercial Limited	Dates: 23/08/2012	Logged By SAM
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Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Dark Mudstone/Sandstone bands (LOWER COAL MEASURES)		
								21	
								22	
								23	
								24	
								25	
								26	
								27	
								28	
								29	
					30.00			30	
								End of Borehole at 30.00m	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 28.8m. 3. Borehole backfilled with arisings on completion.





Borehole Log

Borehole No.
PH10a
Sheet 1 of 1
Hole Type
PH
Scale
1:50
Logged By
SAM

Project Name: Ashbourne Drive Project No. 1462 Co-ords: 418597E - 424858N
Location: Cleckheaton Level: 97.30 m AOD
Client: Together Commercial Limited Dates: 23/08/2012

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					97.30		Overburden (OVERBURDEN)		
					1.60	95.70		Grey Mudstone (LOWER COAL MEASURES)	
					3.00		End of Borehole at 3.00m		

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Gas/groundwater monitoring standpipe installed on completion of hole.





Borehole Log

Borehole No.

PH101

Sheet 1 of 3

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418650E - 424725N	Hole Type PH
Location: Cleckheaton		Level: 116.65 m AOD	Scale 1:50
Client: Together Commercial Limited		Dates: 02/12/2020	Logged By AT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					116.65		Overburden (OVERBURDEN)		1
				1.80	114.85		Brown Sandstone (LOWER COAL MEASURES)		2
									3
									4
									5
				5.80	110.85		Grey Siltstone (LOWER COAL MEASURES)		6
				6.00	110.65		Coal		6
				6.20	110.45		Grey Siltstone (LOWER COAL MEASURES)		7
									8
									9
				10.00	106.65				10

Continued on Next Sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Flush returns were lost from 23.1m to 30.0m.



Borehole Log

Borehole No.

PH101

Sheet 2 of 3

Project Name: Ashbourne Drive

Project No.
1462

Co-ords: 418650E - 424725N

Hole Type
PH

Location: Cleckheaton

Level: 116.65 m AOD

Scale
1:50

Client: Together Commercial Limited

Dates: 02/12/2020

Logged By
AT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description					
		Depth (m)	Type	Results									
					11.50	105.15	[Horizontal lines pattern]	Dark grey Mudstone (LOWER COAL MEASURES)	11				
									Black carbonaceous Mudstone (LOWER COAL MEASURES)				
					12.00	104.65	[X pattern]	Grey Siltstone (LOWER COAL MEASURES)	12				
					12.20	104.45		Black carbonaceous Mudstone (LOWER COAL MEASURES)					
					12.50	104.15	[X pattern]	Grey Siltstone (LOWER COAL MEASURES)	13				
													14
													15
													16
													17
								18					
								19					
					16.70	99.95	[Solid black]	Coal (CHURWELL THIN COAL)	17				
					17.50	99.15	[Horizontal lines pattern]	Black carbonaceous Mudstone (LOWER COAL MEASURES)	18				
					19.50	97.15	[X pattern]	Grey Siltstone (LOWER COAL MEASURES)	20				
Continued on Next Sheet													

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Flush returns were lost from 23.1m to 30.0m.





Borehole Log

Borehole No.

PH102

Sheet 1 of 2

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418638E - 424736N	Hole Type PH
Location: Cleckheaton		Level: 115.00 m AOD	Scale 1:50
Client: Together Commercial Limited		Dates: 02/12/2020	Logged By AT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
						115.00		Overburden (OVERBURDEN)	1
					1.50	113.50		Grey Siltstone (LOWER COAL MEASURES)	2
					3.50	111.50		Coal (LOWER COAL MEASURES)	3
					3.80	111.20		Grey Siltstone (LOWER COAL MEASURES)	4
									5
									6
									7
					8.00	107.00		Black carbonaceous Mudstone (LOWER COAL MEASURES)	8
									9
									10

Continued on Next Sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out.



Borehole Log

Borehole No.

PH102

Sheet 2 of 2

Project Name: Ashbourne Drive

Project No.
1462

Co-ords: 418638E - 424736N

Hole Type
PH

Location: Cleckheaton

Level: 115.00 m AOD

Scale
1:50

Client: Together Commercial Limited

Dates: 02/12/2020

Logged By
AT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					11.00	104.00		Black carbonaceous Mudstone (LOWER COAL MEASURES)	11
								Grey Siltstone (LOWER COAL MEASURES)	12
									13
									14
					14.30	100.70		Coal (SHERTCLIFFE COAL)	15
					15.30	99.70		Black carbonaceous Mudstone (LOWER COAL MEASURES)	16
					16.00	99.00		Grey Siltstone (LOWER COAL MEASURES)	17
									18
					18.30			End of Borehole at 18.30m	19
									20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out.





Borehole Log

Borehole No.

PH103

Sheet 1 of 3

Project Name: Ashbourne Drive Project No. 1462 Co-ords: 418644E - 424758N Hole Type PH

Location: Cleckheaton Level: 111.30 m AOD Scale 1:50

Client: Together Commercial Limited Dates: 03/12/2020 Logged By AT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					111.30		Overburden (OVERBURDEN)	1	
					1.80	109.50	Brown Sandstone (LOWER COAL MEASURES)	2	
					4.00	107.30	Black carbonaceous Mudstone (LOWER COAL MEASURES)	4	
					5.50	105.80	Grey Siltstone (LOWER COAL MEASURES)	6	
							Continued on Next Sheet	10	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out.





Borehole Log

Borehole No.

PH104

Sheet 1 of 3

Project Name: Ashbourne Drive

Project No.
1462

Co-ords: 418618E - 424755N

Hole Type
PH

Location: Cleckheaton

Level: 111.50 m AOD

Scale
1:50

Client: Together Commercial Limited

Dates: 03/12/2020

Logged By
AT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
						111.50		Overburden (OVERBURDEN)	1
					1.30	110.20		Brown Sandstone (LOWER COAL MEASURES)	2
					3.00	108.50		Black carbonaceous Mudstone with possible coal (LOWER COAL MEASURES)	3
					4.00	107.50		Grey Siltstone (LOWER COAL MEASURES)	4
									5
									6
									7
									8
									9
									10



Water strike at 9.0m

Continued on Next Sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 9.0m. 3. Flush returns were lost from 17.6m to 21.0m.



Borehole Log

Borehole No.

PH104

Sheet 2 of 3

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418618E - 424755N	Hole Type PH
Location: Cleckheaton		Level: 111.50 m AOD	Scale 1:50
Client: Together Commercial Limited		Dates: 03/12/2020	Logged By AT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description					
		Depth (m)	Type	Results									
					10.30	101.20		Grey Siltstone (LOWER COAL MEASURES)	11				
								Coal (CHURWELL THIN COAL)					
								11.00		100.50		Grey Siltstone (LOWER COAL MEASURES)	12
												13	
												14	
												15	
												16	
												17	
												18	
												19	
					20								
							Continued on Next Sheet						

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 9.0m. 3. Flush returns were lost from 17.6m to 21.0m.





Borehole Log

Borehole No.

PH105

Sheet 1 of 2

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418623E - 424776N	Hole Type PH
Location: Cleckheaton		Level: 108.15 m AOD	Scale 1:50
Client: Together Commercial Limited		Dates: 03/12/2020	Logged By AT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
						108.15		Overburden (OVERBURDEN)	
					1.20	106.95		Brown Sandstone (LOWER COAL MEASURES)	1
									2
									3
					4.90	103.25		Black carbonaceous Mudstone (LOWER COAL MEASURES)	4
									5
	▼				6.10	102.05		Water strike at 6.00m Grey Siltstone (LOWER COAL MEASURES)	6
									7
									8
									9
									10

Continued on Next Sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 6.0m. 3. Flush returns were lost from 12.0m to 18.0m.





Borehole Log

Borehole No.

PH106

Sheet 1 of 2

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418598E - 424768N	Hole Type PH
Location: Cleckheaton		Level: 108.80 m AOD	Scale 1:50
Client: Together Commercial Limited		Dates: 03/12/2020	Logged By AT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					108.80		Overburden (OVERBURDEN)		1	
					1.70	107.10		Brown Sandstone (LOWER COAL MEASURES)		2
					5.20	103.60		Black carbonaceous Mudstone (LOWER COAL MEASURES)		5
					6.50	102.30		Grey Siltstone (LOWER COAL MEASURES)		7
								Continued on Next Sheet		10

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Flush returns were lost from 12.7m to 13.3m.



Borehole Log

Borehole No.

PH107

Sheet 1 of 2

Project Name: Ashbourne Drive

Project No.
1462

Co-ords: 418593E - 424779N

Hole Type
PH

Location: Cleckheaton

Level: 107.75 m AOD

Scale
1:50

Client: Together Commercial Limited

Dates: 03/12/2020

Logged By
AT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					107.75		Overburden (OVERBURDEN)		
					1.80	105.95		Brown Sandstone (LOWER COAL MEASURES)	1
	▼				3.00	104.75		Black carbonaceous Mudstone (LOWER COAL MEASURES) <i>Water strike between 3.0m and 6.0m.</i>	2
					4.00	103.75		Grey Siltstone (LOWER COAL MEASURES)	3
									4
									5
									6
									7
									8
									9
									10

Continued on Next Sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 6.0m. 3. Flush returns were lost from 10.4m to 15.0m.





Borehole Log

Borehole No.

PH108

Sheet 1 of 2

Project Name: Ashbourne Drive

Project No.
1462

Co-ords: 418608E - 424785N

Hole Type
PH

Location: Cleckheaton

Level: 107.10 m AOD

Scale
1:50

Client: Together Commercial Limited

Dates: 04/12/2020

Logged By
AT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					107.10		Overburden (OVERBURDEN)		
				1.60	105.50		Brown Sandstone (LOWER COAL MEASURES)	1	
				2.90	104.20		Black carbonaceous Mudstone (LOWER COAL MEASURES)	2	
				3.30	103.80		Coal (CHURWELL THIN COAL)	3	
				4.10	103.00		Grey Siltstone (LOWER COAL MEASURES)	4	
								5	
								6	
								7	
								8	
								9	
								10	
				10.00	97.10				

Continued on Next Sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out.





Borehole Log

Borehole No.

PH108

Sheet 2 of 2

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418608E - 424785N	Hole Type PH
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Location: Cleckheaton	Level: 107.10 m AOD	Scale 1:50
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Client: Together Commercial Limited	Dates: 04/12/2020	Logged By AT
-------------------------------------	-------------------	--------------

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					10.80	96.30		Coal (SHERTCLIFFE COAL)	
							xxxxxxx	Grey Siltstone (LOWER COAL MEASURES)	11
					15.00			End of Borehole at 15.00m	15
									16
									17
									18
									19
									20

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out.



Borehole Log

Borehole No.

PH109

Sheet 1 of 3

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418616E - 424820N	Hole Type PH
Location: Cleckheaton		Level: 104.85 m AOD	Scale 1:50
Client: Together Commercial Limited		Dates: 04/12/2020	Logged By AT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					104.85		Overburden (OVERBURDEN)		1
				3.60	101.25		Brown Sandstone (LOWER COAL MEASURES)		2
				6.70	98.15		Black carbonaceous Mudstone (LOWER COAL MEASURES)		3
				7.60	97.25		Grey Siltstone (LOWER COAL MEASURES)		4
									5
									6
									7
									8
									9
									10

Continued on Next Sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 27.0m.





Borehole Log

Borehole No.

PH109

Sheet 3 of 3

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: 418616E - 424820N	Hole Type PH
Location: Cleckheaton		Level: 104.85 m AOD	Scale 1:50
Client: Together Commercial Limited		Dates: 04/12/2020	Logged By AT

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
	▼				21.10	83.75	xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx	Grey Siltstone (LOWER COAL MEASURES)	21	
					21.90	82.95		Coal (UN-NAMED COAL)		
								xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx	Grey Siltstone (LOWER COAL MEASURES)	22
								xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx		23
								xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx		24
								xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx		25
								xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx		26
								xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx	<u>Water strike at 27.0m.</u>	27
								xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx		28
								xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx xxxxxxx		29
				30.00				End of Borehole at 30.00m	30	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 27.0m.



Appendix H
Trial Trench Logs



Trial Pit Log

TrialPit No
TT100A
(North)
Sheet 1 of 1

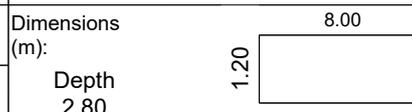
Project Name: Ashbourne Drive

Project No.
1462

Co-ords: -
Level:

Date
03/12/2020

Location: Cleckheaton



Scale
1:25
Logged
CR

Client: Together Commercial Limited

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.25			MADE GROUND: Brown clayey very gravelly SAND with occasional rootlets. Gravel is angular to subangular fine to coarse of mixed lithologies including coal, tile and brick. (MADE GROUND TOPSOIL)
	0.40	J&T					MADE GROUND: Firm to stiff light brown with orange and light grey mottling gravelly CLAY with low cobble content of siltstone and sandstone. Gravel is angular fine to coarse of sandstone, siltstone and mudstone. Depth of made ground reduces from 1.0m to 0.25m approximately 1.7m from northern end of trench. (REWORKED NATURAL GROUND)
	0.50	J&T					MADE GROUND: Reddish-brown gravelly SAND with medium cobble content of brick, coal and mudstone. In north of trench, depth of made ground reduces from 1.8m to 0.25m approximately 3.1m from northern end of trench. (GRANULAR MADE GROUND)
				1.00			MADE GROUND: Grey and reddish-brown slightly sandy very angular fine to coarse GRAVEL of mudstone, siltstone and coal. (COLLIERY SPOIL)
				1.80			Stiff light brown with orangish brown and light grey mottling slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone and siltstone. (WEATHERED COAL MEASURES) <i>From 2.4m to 2.7m, lense of firm dark grey organic CLAY with strong organic odour.</i>
				2.20			
				2.80			End of Pit at 2.80m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit were unstable between 0.25m and 2.2m depth during excavation with some spalling in made ground.





Trial Pit Log

TrialPit No
TT100A
(South)
Sheet 1 of 1

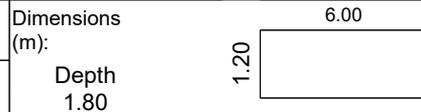
Project Name: Ashbourne Drive

Project No.
1462

Co-ords: -
Level:

Date
03/12/2020

Location: Cleckheaton



Scale
1:25

Logged
CR

Client: Together Commercial Limited

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.25			MADE GROUND: Brown clayey very gravelly SAND with occasional rootlets. Gravel is angular to subangular fine to coarse of mixed lithologies including coal, tile and brick. (MADE GROUND TOPSOIL)
				0.90			MADE GROUND: Grey slightly sandy very angular fine to coarse GRAVEL of mudstone, siltstone and coal. (COLLIERY SPOIL) <i>Colliery spoil 'dips' to 1.5m in eastern wall of trench but stays at 0.9m in western wall of trench.</i>
				1.80			Firm to stiff light brown with orangish brown and light grey mottling slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone and siltstone. (WEATHERED COAL MEASURES)
							End of Pit at 1.80m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit were unstable between 0.25m and 0.9m depth during excavation with some spalling in made ground.





Trial Pit Log

TrialPit No
TT100B
Sheet 1 of 1

Project Name: Ashbourne Drive

Project No.
1462

Co-ords: -
Level:

Date
03/12/2020

Location: Cleckheaton

Dimensions (m): 5.50

Scale
1:25

Client: Together Commercial Limited

Depth
2.00

1.20

Logged
CR

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.60	J&T		0.20			MADE GROUND: Brown clayey very gravelly SAND with occasional rootlets. Gravel is angular to subangular fine to coarse of mixed lithologies including coal and mudstone. (MADE GROUND TOPSOIL)
				0.40			MADE GROUND: Firm orange and light grey mottled slightly gravelly CLAY. Gravel is angular to subangular fine to medium of siltstone and mudstone. (REWORKED NATURAL GROUND)
							MADE GROUND: Grey slightly sandy very angular to angular fine to coarse GRAVEL of mudstone, siltstone, coal, brick and sandstone with high cobble content and rare lenses of ashy sand. (COLLIERY SPOIL) <i>In north of trench, Reworked Natural Ground depth extends to 0.5m.</i>
							<i>In north of trench, Colliery Spoil depth is reduced to 1.1m.</i>
				1.70			Firm light brown with light grey mottling slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone and siltstone. (WEATHERED COAL MEASURES)
				2.00			End of Pit at 2.00m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit were unstable between 0.25m and 1.7m depth during excavation with some spalling in made ground.





Trial Pit Log

TrialPit No
TT100C
Sheet 1 of 1

Project Name: Ashbourne Drive	Project No. 1462	Co-ords: - Level:	Date 03/12/2020
Location: Cleckheaton		Dimensions (m): 1.20 x 6.00	Scale 1:25
Client: Together Commercial Limited		Depth 3.00	Logged CR

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30			MADE GROUND: Brown clayey very gravelly SAND with occasional rootlets. Gravel is angular to subangular fine to coarse of mixed lithologies including coal and mudstone. (MADE GROUND TOPSOIL)
				0.50			MADE GROUND: Firm orange and light grey mottled slightly gravelly CLAY. Gravel is angular to subangular fine to medium of siltstone and mudstone. (REWORKED NATURAL GROUND)
	0.60	J&T					MADE GROUND: Loose(?) grey slightly sandy very angular to angular fine to coarse GRAVEL of mudstone, siltstone, coal, brick and sandstone with medium cobble content. (COLLIERY SPOIL)
							<i>In south of trench, Colliery Spoil depth reduced to 1.0m.</i>
							<i>In south of trench, between 1.6m and 2.8m, black slightly clayey slightly sandy angular fine to coarse GRAVEL of mixed lithologies including brick.</i>
				2.20			Firm light brown with light grey mottling gravelly CLAY with low cobble content. Gravel is angular to subangular fine to coarse of mudstone and siltstone. (WEATHERED COAL MEASURES)
							<i>In south of trench, from 2.8m, light brown and grey very angular to angular fine to coarse GRAVEL of mudstone and siltstone.</i>
				3.00			End of Pit at 3.00m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit were unstable between 0.25m and 2.2m depth during excavation with some spalling in made ground.





Trial Pit Log

TrialPit No
TT100D
Sheet 1 of 1

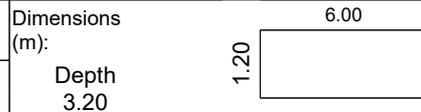
Project Name: Ashbourne Drive

Project No.
1462

Co-ords: -
Level:

Date
03/12/2020

Location: Cleckheaton



Scale
1:25

Client: Together Commercial Limited

Logged
CR

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.60	J&T		0.20			MADE GROUND: Brown clayey very gravelly SAND with occasional rootlets. Gravel is angular to subangular fine to coarse of mixed lithologies including coal and mudstone. (MADE GROUND TOPSOIL)
				0.40			MADE GROUND: Firm orange and light grey mottled slightly gravelly CLAY. Gravel is angular to subangular fine to medium of siltstone and mudstone. (REWORKED NATURAL GROUND)
							MADE GROUND: Grey slightly clayey slightly sandy very angular to angular fine to coarse GRAVEL of mudstone, siltstone, coal and brick with medium cobble content. (COLLIERY SPOIL)
							<i>In south of trench, Colliery Spoil depth reduced to 0.9m.</i>
							<i>In south of trench, between 1.1m and 3.0m, lenses and pockets and black carbonaceous Gravel of mudstone noted.</i>
				1.90			Firm light brown with light grey mottling slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone and siltstone. (WEATHERED COAL MEASURES)
				3.20			End of Pit at 3.20m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit were unstable between 0.25m and 1.9m depth during excavation with some spalling in made ground.





Trial Pit Log

TrialPit No
TT100E
Sheet 1 of 1

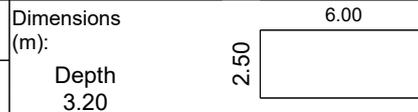
Project Name: Ashbourne Drive

Project No.
1462

Co-ords: -
Level:

Date
03/12/2020

Location: Cleckheaton



Scale
1:25

Client: Together Commercial Limited

Logged
CR

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20			MADE GROUND: Brown clayey very gravelly SAND with occasional rootlets. Gravel is angular to subangular fine to coarse of mixed lithologies including coal and mudstone. (MADE GROUND TOPSOIL)
				0.40			MADE GROUND: Firm orange and light grey mottled slightly gravelly CLAY. Gravel is angular to subangular fine to medium of siltstone and mudstone. (REWORKED NATURAL GROUND)
	0.60	J&T					
	0.80	J&T					
				1.70			Firm light brown with light grey mottling slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone and siltstone. (WEATHERED COAL MEASURES)
				2.20			At 1.7m, brick lined shaft with Colliery Spoil infill in north of the trench. Shaft is around 2.0m in width (cannot be accurately measured as is deep in trench). Shaft Co-ordinates (E 418598.9T, N 424809.15), Ground Level prior to excavation (105.33 mAOD).
							In centre of trench, at 1.5m, 0.1m thick lenses of reddish-brown gravelly SAND. Gravel is angular fine to medium of brick.
							End of Pit at 3.20m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit were unstable between 0.25m and 1.7m depth during excavation with some spalling in made ground.



Appendix I

Contaminated land assessment for selection of water supply pipes



Contaminated Land Assessment Form

Introduction

In January 2011, UK Water Industry Research (UKWIR) published "Guidance for the selection of Water Supply Pipes to be used in Brownfield Sites" (UKWIR 2010 Ref 10/WM/03/21). The aim of this publication is to ensure that the correct materials are selected for Water Pipes to be used below ground in Brownfield Sites. It supersedes the Water Regulations Advisory Scheme (WRAS) Information and Guidance Note 9-04-03 "Laying Pipes in Contaminated Land" which has now been withdrawn.

The UKWIR guidance is for use by Water Companies, Self Lay Organisations, Developers and Consultants during the planning, designing and construction of water mains and/or services in Brownfield Sites. The guidance defines a Brownfield Site as "Land or premises that have not previously been used or developed. They may also be vacant or derelict. However, they are not necessarily contaminated." UKWIR state the guidance does not apply to Greenfield Sites, however YW reserve the right to apply relevant sections of the publication to Greenfield Sites that may potentially be contaminated.

Contamination Risk Assessment

Please complete the form below to allow us to assess the risk of contamination of the drinking water supply from chemicals within the soil. Yorkshire Water now lays all its water mains and service pipes in plastic. Many organic compounds (i.e. Phenols, Fuels and other hydrocarbons) can either permeate through the walls of plastic pipes into the water supply or dissolve and weaken the pipe causing water leaks.

As a minimum a desk top study (Preliminary Risk Assessment) shall be provided to YW that sets out whether the land through which the Water Pipes are to be laid may be affected by contamination. For those sites where land contamination may be present, appropriate testing shall be undertaken on existing ground materials and remediated materials. The testing requirements are as described below:

Testing Requirements

The tests that are required on all sites where the potential for contamination has been established through the desk top study and where water pipes are proposed to be laid must be undertaken by bodies with accreditation from UKAS (United Kingdom Accreditation Service) and where possible MCERTS (Environment Agency's Monitoring Certification Service).

The tests on soil/water samples shall be those to detect and report on the levels of the following contaminant groups and chemical characteristics: **VOC's, SVOC's, Mineral Oil compounds C10-C40, Conductivity, pH and Redox potential** (as stipulated in the UKWIR guidance Appendix G). If the previous function of the site involved the use, storage, manufacture or disposal of any of the following elements, appropriate testing for these substances will be required:

Ethers, Nitrobenzene, Ketones, Aldehydes and Amines. Please note UKWIR guidance states the presence of Amines on any site precludes the use of Polyethylene pipework.

Sufficiency of Testing

Samples taken must be representative of the soil conditions in which the Water Pipes are proposed to be laid (normally Water Pipes are laid at a depth between 0.7m and 1.3m below finished ground level). As a result samples must be taken at least 500mm below the base of the proposed pipe where the proposed location is known. If the proposed location is unknown then samples must be taken at intervals between the surface level and 1.5m from below finished ground level as a minimum. Where appropriate groundwater sampling and groundwater monitoring will also be necessary (see UKWIR guidance).

Further guidance on representative sampling is contained within BS10175:2011 "Code of practice for the Investigation of Potentially Contaminated Sites".

The table in section 3 lists the contaminants and their respective levels which can permeate or damage plastic water pipes with consequent risk to the water supply. Where soil analysis results indicate levels of these contaminants above the maximum allowable concentration shown, then Yorkshire Water will determine that all mains and service pipes are laid in suitable materials resistant to the risks posed by those contaminants. Where sites have been used for any of the activities listed in Section 2 all mains and services shall be laid in suitable permeation resistant pipe systems due to the high risk of these contaminants being present.

Health & Safety Assessment

The UKWIR guidance does not cover Health & Safety considerations as part of any operational activities undertaken on Brownfield Sites. In order to maintain the safety of our staff, service partners and customers YW will also assess the site based on the EA CLEA (Contaminated Land Exposure Assessment) guidelines.

In order to comply with Yorkshire Water's Health & safety requirements please review the following information relating to trigger values for Health & Safety considerations when laying Water Pipes in contaminated Land.

	Contaminant	Mg/Kg		Contaminant	Mg/Kg
Inorganic	Arsenic	32	Organic	Benzene	0.33
	Nickel	130		Toulene	610
	Mercury	170		Ethylbenzene	350
	Selenium	35		Xylene	230
	Cadmium	10		Phenol	420

Values in green not exceeded in any of the samples tested.

Values in red, exceedances recorded, further detail below.

Arsenic between 15mg/kg & 71mg/kg (in 26 samples of Topsoil/Made Ground Topsoil)

Arsenic between 10mg/kg & 210mg/kg (in 11 samples of Made Ground)

Values in black, no source identified on Conceptual Site Model therefore parameter not tested for.

1. Your Details

Company Name	Contact Name
Lithos Consulting	A Swales

Site Address	Contact Number
Land off Ashbourne Drive, Lower Blacup, Cleckheaton	01937 545 330

2. The Previous Use of the Site

Please indicate below the previous uses of the site being developed

Majority of site recorded as agricultural since earliest edition OS plan of 1854. Former Blacup Colliery shown in centre of site in late 1800s.

Please indicate if the site (or part of it) has previously been used for any of the following activities:

<input type="checkbox"/> no	Chemicals Manufacture	<input type="checkbox"/> no	Paint or Ink Manufacture
<input type="checkbox"/> no	Explosives / Ordnance Manufacture	<input type="checkbox"/> no	Railway Land / Railway Engineering
<input type="checkbox"/> no	Fuel Filling Stations / Storage	<input type="checkbox"/> no	Scrap metals
<input type="checkbox"/> no	Metal Finishing / Treating	<input type="checkbox"/> no	Shipbuilding & Repair
<input type="checkbox"/> no	Mechanical Engineering Works	<input type="checkbox"/> no	Vehicle Repair Garages
<input type="checkbox"/> no	Oil & Gas Refineries / Storage	<input type="checkbox"/> no	Vehicle Manufacturing

3. Contaminants

Please complete the table below with the highest concentrations in mg/kg of each or any of the contaminants listed. The information should be extracted from your soil reports already undertaken, if any of the contaminants were not tested for, this should be declared on the form along with the reasons for this. If you have any difficulty interpreting the results of your soil sample analyses and transposing them into the table, then you should consult the body who undertook the sampling and reporting. If there are more than 3 sample locations with associated test results please copy the table for each location and label each with the sample reference and its location on a site plan.

Laboratory Name:		Date	Depth (m)	
Group No.	Parameter group	Unit	Concentration	Detection Limit
1	Extended VOC suite (with TIC)	mg/kg	Not tested	0.5
1a	BTEX & MTBE	mg/kg	Not tested	0.1
2	Extended SVOC suite (with TIC)	mg/kg	Not tested	2
2e	Phenols	mg/kg	Not tested	2
2f	Cresols and chlorinated phenols	mg/kg	Not tested	2
3	Mineral Oils C ₁₁ -C ₂₀	mg/kg	Not tested	10
4	Mineral Oils C ₂₁ -C ₄₀	mg/kg	Not tested	500
5	Corrosive (Conductivity, Redox & pH)		Not tested	
	Conductivity	µS/cm	Not tested	
	Redox	Volt	Not tested	
	pH	pH	7.9 (in TT100A)	
2a	Ethers	mg/kg	Not tested	0.5
2b	Nitrobenzene	mg/kg	Not tested	0.5
2c	Ketones	mg/kg	Not tested	0.5
2d	Aldehydes	mg/kg	Not tested	0.5
6	Amines	mg/kg	Not tested	Any presence

DO NOT include a copy of your soil report with your application, if you do not complete the table above your application will be returned to you.

Please include a site plan highlighting the locations of the above sample points.
 Drawings 1462/8 & 1462/8A show the locations of exploratory holes.

Note: Conceptual Site Model did not identify a source for the majority of contaminants listed above. No visual or olfactory evidence of gross organic contamination noted during the ground investigation. As such, majority of parameters have not been tested for.

4. Remediation of the site

Please indicate below any remediation work that will be undertaken on the site to remove / mitigate the effect of any contaminants identified in the soil report. Please include the nature and depth of any remediation work.

Made Ground (predominantly Colliery Spoil) identified in the centre of the site is to be isolated beneath a minimum 600mm soil cover where it remains below garden areas.

5. Can I use plastic pipe if I undertake remediation works?

Yes, as long as the remediation work either removes the contaminated soil or reduces the level of contaminants below trigger levels. Moving contaminated material so that it is under roads and footpaths is not acceptable as this is the likely location of the water mains.

As water mains are laid to a depth of 0.9m to the top of the pipe, any contaminated soil to a depth of 1.3m must be removed. We will require post remediation sampling results confirming contamination has fallen below the trigger levels prior to releasing any works to our Service Partners.

If contamination is found all water mains and services on the site must be laid in a suitable barrier pipe. Yorkshire Water will not change the agreed mains material after the agreement has been signed by all parties. So please ensure your remediation proposals are made clear at this stage.

6. Declaration

I hereby confirm that the information provided in this form is true and I understand that should the site conditions change from those indicated in this report that I may incur additional costs.

Your Signature

Date

A Swales

26th January 2021

Your Name & Title (PLEASE PRINT)

Role in organisation

Mr Alan Swales

Associate Director

Please return this completed form with your application to Developer Services, Yorkshire Water Services Ltd, PO Box 52, Bradford BD3 7YD

References

BS10175:2011 "Investigation of Potentially Contaminated Sites Code of Practice

UK Water Industry Research (UKWIR) "Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites" (Ref 10/WM/03/21)

Appendix J
Chemical Test Results



Scientific Analysis Laboratories Ltd

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Scientific Analysis Laboratories is a
limited company registered in England and
Wales (No 2514788) whose address is at
Hadfield House, Hadfield Street, Manchester M16 9FE

Report Number: 293186-1

Date of Report: 12-Sep-2012

Customer: Lithos Consulting Ltd.
45 High Street
South Milford
Leeds
LS25 5AF

Customer Contact: Mr Alan Swales

Customer Job Reference: 1462/CHEM/1

Customer Purchase Order: 6717/1462/ASW

Customer Site Reference: Lower Blackup Farm, Cleckheaton

Date Job Received at SAL: 28-Aug-2012

Date Analysis Started: 30-Aug-2012

Date Analysis Completed: 12-Sep-2012

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs



Report checked
and authorised by :
Caroline Haworth
Assistant Customer Service
Manager

Issued by :
Caroline Haworth
Assistant Customer Service
Manager

SAL Reference: 293186										
Project Site: Lower Blackup Farm, Cleckheaton										
Customer Reference: 1462/CHEM/1										
Soil Analysed as Soil										
MCERTS Preparation										
SAL Reference					293186 001	293186 003	293186 005	293186 006	293186 008	293186 009
Customer Sample Reference					TP01 0.1	TP05 0.1	TP09 0.1	TP10 0.1	TP16 0.1	TP17 0.1
Date Sampled					24-AUG-2012	24-AUG-2012	24-AUG-2012	24-AUG-2012	24-AUG-2012	24-AUG-2012
Bottom Depth					0.1	0.1	0.1	0.1	0.1	0.1
Type					Sandy Soil					
Determinand	Method	Test Sample	LOD	Units						
Moisture	T277	AR	0.1	%	19	18	20	20	23	23
Moisture @ 105 C	T162	AR	0.1	%	23	22	16	26	30	26

SAL Reference: 293186										
Project Site: Lower Blackup Farm, Cleckheaton										
Customer Reference: 1462/CHEM/1										
Soil Analysed as Soil										
MCERTS Preparation										
SAL Reference					293186 010	293186 011	293186 012	293186 013	293186 014	293186 015
Customer Sample Reference					TP08 0.5	TP08 1.5	TP12 0.5	TP11 0.3	TP12 0.1	TP15 0.5
Date Sampled					24-AUG-2012	24-AUG-2012	24-AUG-2012	24-AUG-2012	24-AUG-2012	24-AUG-2012
Bottom Depth					0.5	1.5	0.5	0.3	0.1	0.5
Type					Clay	Clay	Sandy Soil	Clay	Clay	Clay
Determinand	Method	Test Sample	LOD	Units						
Moisture	T277	AR	0.1	%	16	15	13	19	17	15
Moisture @ 105 C	T162	AR	0.1	%	16	18	15	23	21	16

SAL Reference: 293186										
Project Site: Lower Blackup Farm, Cleckheaton										
Customer Reference: 1462/CHEM/1										
Soil Analysed as Soil										
Miscellaneous										
SAL Reference					293186 001	293186 003	293186 005	293186 006	293186 008	293186 009
Customer Sample Reference					TP01 0.1	TP05 0.1	TP09 0.1	TP10 0.1	TP16 0.1	TP17 0.1
Date Sampled					24-AUG-2012	24-AUG-2012	24-AUG-2012	24-AUG-2012	24-AUG-2012	24-AUG-2012
Bottom Depth					0.1	0.1	0.1	0.1	0.1	0.1
Type					Sandy Soil					
Determinand	Method	Test Sample	LOD	Units						
Total Organic Carbon	T21	M40	0.1	%	4.2	5.7	5.4	5.3	9.0	7.9

SAL Reference: 293186										
Project Site: Lower Blackup Farm, Cleckheaton										
Customer Reference: 1462/CHEM/1										
Soil Analysed as Soil										
Miscellaneous										
SAL Reference					293186 010	293186 011	293186 012	293186 013	293186 014	293186 015
Customer Sample Reference					TP08 0.5	TP08 1.5	TP12 0.5	TP11 0.3	TP12 0.1	TP15 0.5
Date Sampled					24-AUG-2012	24-AUG-2012	24-AUG-2012	24-AUG-2012	24-AUG-2012	24-AUG-2012
Bottom Depth					0.5	1.5	0.5	0.3	0.1	0.5
Type					Clay	Clay	Sandy Soil	Clay	Clay	Clay
Determinand	Method	Test Sample	LOD	Units						
Asbestos ID	T27	AR			N.D.	N.D.	N.D.	-	-	N.D.
Calorific value	T40	AR	0.1	MJ/kg	1.3	1.9	1.4	-	-	7.7
Total Organic Carbon	T21	M40	0.1	%	4.1	4.6	3.4	5.0	4.0	6.6

SAL Reference: 293186										
Project Site: Lower Blackup Farm, Cleckheaton										
Customer Reference: 1462/CHEM/1										
Soil										
Analysed as Soil										
Lithos Speciated PAH										
SAL Reference					293186 001	293186 003	293186 005	293186 006	293186 008	293186 009
Customer Sample Reference					TP01 0.1	TP05 0.1	TP09 0.1	TP10 0.1	TP16 0.1	TP17 0.1
Date Sampled					24-AUG-2012	24-AUG-2012	24-AUG-2012	24-AUG-2012	24-AUG-2012	24-AUG-2012
Bottom Depth					0.1	0.1	0.1	0.1	0.1	0.1
Type					Sandy Soil					
Determinand	Method	Test Sample	LOD	Units						
Naphthalene	T207	M105	0.1	mg/kg	<0.1	0.2	<0.1	<0.1	0.6	0.2
Acenaphthylene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	<0.1	0.1	<0.1	<0.1	0.6	0.1
Fluorene	T207	M105	0.1	mg/kg	<0.1	0.1	<0.1	<0.1	0.4	0.1
Phenanthrene	T207	M105	0.1	mg/kg	0.2	1.5	0.3	1.5	4.5	1.5
Anthracene	T207	M105	0.1	mg/kg	<0.1	0.4	<0.1	0.4	1.4	0.4
Fluoranthene	T207	M105	0.1	mg/kg	0.5	3.0	0.7	2.0	7.4	3.1
Pyrene	T207	M105	0.1	mg/kg	0.6	2.9	0.7	1.8	7.0	3.0
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	0.3	1.5	0.3	0.9	3.3	1.5
Chrysene	T207	M105	0.1	mg/kg	0.3	1.7	0.4	1.0	3.4	1.7
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	0.2	1.4	0.2	0.6	2.4	1.2
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	0.3	1.6	0.3	0.7	3.1	1.7
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	0.2	1.3	0.2	0.5	2.7	1.3
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	<0.1	0.5	0.1	0.2	1.1	0.5
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	<0.1	0.2	<0.1	0.1	0.6	0.2
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	0.1	0.6	0.1	0.2	1.2	0.6
PAH(total)	T207	M105	0.1	mg/kg	2.7	17	3.3	9.9	40	17

SAL Reference: 293186										
Project Site: Lower Blackup Farm, Cleckheaton										
Customer Reference: 1462/CHEM/1										
Soil										
Analysed as Soil										
Lithos Speciated PAH										
SAL Reference					293186 010	293186 011	293186 012	293186 013	293186 014	293186 015
Customer Sample Reference					TP08 0.5	TP08 1.5	TP12 0.5	TP11 0.3	TP12 0.1	TP15 0.5
Date Sampled					24-AUG-2012	24-AUG-2012	24-AUG-2012	24-AUG-2012	24-AUG-2012	24-AUG-2012
Bottom Depth					0.5	1.5	0.5	0.3	0.1	0.5
Type					Clay	Clay	Sandy Soil	Clay	Clay	Clay
Determinand	Method	Test Sample	LOD	Units						
Naphthalene	T207	M105	0.1	mg/kg	0.2	0.1	<0.1	<0.1	<0.1	0.4
Acenaphthylene	T207	M105	0.1	mg/kg	<0.1	0.3	<0.1	<0.1	<0.1	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	0.1	0.3	<0.1	<0.1	<0.1	0.2
Fluorene	T207	M105	0.1	mg/kg	0.1	0.5	<0.1	<0.1	<0.1	0.2
Phenanthrene	T207	M105	0.1	mg/kg	1.6	4.2	0.1	0.6	0.1	3.0
Anthracene	T207	M105	0.1	mg/kg	0.4	1.9	<0.1	0.1	<0.1	0.8
Fluoranthene	T207	M105	0.1	mg/kg	2.7	4.9	0.2	1.5	0.2	4.9
Pyrene	T207	M105	0.1	mg/kg	2.7	4.5	0.1	1.7	0.3	4.9
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	1.6	2.3	<0.1	0.6	0.1	2.0
Chrysene	T207	M105	0.1	mg/kg	1.8	2.5	<0.1	0.9	0.1	2.7
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	1.5	1.8	<0.1	0.5	0.1	2.1
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	1.5	1.8	<0.1	0.7	<0.1	1.8
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	1.5	1.8	<0.1	0.5	<0.1	1.8
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	0.7	0.8	<0.1	0.2	<0.1	0.5
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	0.3	0.3	<0.1	0.1	<0.1	0.2
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	0.8	0.8	<0.1	0.3	<0.1	0.6
PAH(total)	T207	M105	0.1	mg/kg	18	29	0.4	7.7	0.9	26

SAL Reference: 293186								
Project Site: Lower Blackup Farm, Cleckheaton								
Customer Reference: 1462/CHEM/1								
Soil					Analysed as Soil			
Lithos BRE suite								
SAL Reference		293186 010	293186 011	293186 012	293186 015			
Customer Sample Reference		TP08 0.5	TP08 1.5	TP12 0.5	TP15 0.5			
Date Sampled		24-AUG-2012	24-AUG-2012	24-AUG-2012	24-AUG-2012			
Bottom Depth		0.5	1.5	0.5	0.5			
Type		Clay	Clay	Sandy Soil	Clay			
Determinand	Method	Test Sample	LOD	Units				
(Water soluble) Cl-	T426	AR	0.01	g/l	⁽⁶⁴⁾ <0.01	⁽⁶⁴⁾ <0.01	⁽⁶⁴⁾ <0.01	⁽⁶⁴⁾ <0.01
(Water soluble) Mg	T251	AR	0.1	g/l	<0.1	<0.1	<0.1	<0.1
(Water soluble) NO3	T426	AR	0.01	g/l	⁽⁶⁴⁾ 0.02	⁽⁶⁴⁾ <0.01	⁽⁶⁴⁾ <0.01	⁽⁶⁴⁾ 0.01
(Water Soluble) SO4 expressed as SO4	T242	AR	0.01	g/l	0.11	0.10	<0.01	0.02

SAL Reference: 293186								
Project Site: Lower Blackup Farm, Cleckheaton								
Customer Reference: 1462/CHEM/1								
Leachate to BS EN 12457-2 (10:1)					Analysed as Water			
Lithos pH and metals								
SAL Reference		293186 010	293186 011	293186 012	293186 015			
Customer Sample Reference		TP08 0.5	TP08 1.5	TP12 0.5	TP15 0.5			
Date Sampled		24-AUG-2012	24-AUG-2012	24-AUG-2012	24-AUG-2012			
Bottom Depth		0.5	1.5	0.5	0.5			
Type		Clay	Clay	Sandy Soil	Clay			
Determinand	Method	Test Sample	LOD	Units				
Hg (Dissolved)	T281	10:1	0.05	µg/l	<0.05	<0.05	<0.05	<0.05
Zn (Dissolved)	T281	10:1	2	µg/l	96	11	8	7
Pb (Dissolved)	T281	10:1	0.3	µg/l	<0.3	<0.3	0.5	2.0
Se (Dissolved)	T281	10:1	0.5	µg/l	<0.5	<0.5	<0.5	0.6
Boron	T6	10:1	0.01	mg/l	0.02	0.03	0.02	0.02
Cu (Dissolved)	T281	10:1	0.5	µg/l	3.4	1.8	2.5	17
Cr (Dissolved)	T281	10:1	1	µg/l	<1	<1	3	2
Ni (Dissolved)	T281	10:1	1	µg/l	26	3	1	2
Cd (Dissolved)	T281	10:1	0.02	µg/l	0.27	0.08	0.05	0.06
pH	T7	10:1			5.0	5.2	5.3	6.9
As (Dissolved)	T281	10:1	0.2	µg/l	0.6	0.3	0.3	6.9

Index to symbols used in 293186-1

Value	Description
M105	Analysis conducted on an "as received" aliquot. Results are reported on a dry weight basis where moisture content was determined by assisted drying of sample at 105C
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
10:1	Leachate to BS EN 12457-2 (10:1)
AR	As Received
N.D.	Not Detected
64	Analysis was performed by an alternative technique
S	Analysis was subcontracted
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Method Index

Value	Description
T21	OX/IR
T281	ICP/MS (Filtered)
T27	PLM
T251	2:1 Extraction/ICP/OES
T40	Bomb calorimetry

T162	Grav (1 Dec) (105 C)
T426	2:1 Extraction / IC
T277	Grav (1 Dec) (40 C)
T207	GC/MS(MCERTS)
T6	ICP/OES
T7	Probe
T85	Calc
T242	2:1 Extraction/ICP/OES (TRL 447 T1)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
pH	T7	AR			M	001,003,005-006,008-015
Arsenic	T6	M40	2	mg/kg	M	001,003,005-006,008-015
Boron (water-soluble)	T6	M40	1	mg/kg	N	001,003,005-006,008-015
Cadmium	T6	M40	1	mg/kg	M	001,003,005-006,008-015
Chromium	T6	M40	1	mg/kg	M	001,003,005-006,008-015
Chromium (trivalent)	T85	AR	2	mg/kg	N	001,003,005-006,008-015
Chromium VI	T6	AR	1	mg/kg	N	001,003,005-006,008-015
Copper	T6	M40	1	mg/kg	M	001,003,005-006,008-015
Lead	T6	M40	1	mg/kg	M	001,003,005-006,008-015
Mercury	T6	M40	1	mg/kg	M	001,003,005-006,008-015
Nickel	T6	M40	1	mg/kg	M	001,003,005-006,008-015
Selenium	T6	M40	3	mg/kg	M	001,003,005-006,008-015
Zinc	T6	M40	1	mg/kg	M	001,003,005-006,008-015
As (Dissolved)	T281	10:1	0.2	µg/l	U	010-012,015
Boron	T6	10:1	0.01	mg/l	N	010-012,015
Cd (Dissolved)	T281	10:1	0.02	µg/l	U	010-012,015
Cr (Dissolved)	T281	10:1	1	µg/l	U	010-012,015
Cu (Dissolved)	T281	10:1	0.5	µg/l	U	010-012,015
Pb (Dissolved)	T281	10:1	0.3	µg/l	U	010-012,015
Hg (Dissolved)	T281	10:1	0.05	µg/l	U	010-012,015
Ni (Dissolved)	T281	10:1	1	µg/l	U	010-012,015
Se (Dissolved)	T281	10:1	0.5	µg/l	U	010-012,015
Zn (Dissolved)	T281	10:1	2	µg/l	U	010-012,015
pH	T7	10:1			U	010-012,015
Asbestos ID	T27	AR			SU	010-012,015
Calorific value	T40	AR	0.1	MJ/kg	SN	010-012,015
Total Organic Carbon	T21	M40	0.1	%	N	001,003,005-006,008-015
Naphthalene	T207	M105	0.1	mg/kg	M	001,003,005-006,008-015
Acenaphthylene	T207	M105	0.1	mg/kg	U	001,003,005-006,008-015
Acenaphthene	T207	M105	0.1	mg/kg	M	001,003,005-006,008-015
Fluorene	T207	M105	0.1	mg/kg	M	001,003,005-006,008-015
Phenanthrene	T207	M105	0.1	mg/kg	M	001,003,005-006,008-015
Anthracene	T207	M105	0.1	mg/kg	U	001,003,005-006,008-015
Fluoranthene	T207	M105	0.1	mg/kg	M	001,003,005-006,008-015
Pyrene	T207	M105	0.1	mg/kg	M	001,003,005-006,008-015
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	M	001,003,005-006,008-015
Chrysene	T207	M105	0.1	mg/kg	M	001,003,005-006,008-015
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	M	001,003,005-006,008-015
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	M	001,003,005-006,008-015
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	M	001,003,005-006,008-015
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	M	001,003,005-006,008-015
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	M	001,003,005-006,008-015
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	M	001,003,005-006,008-015
PAH(total)	T207	M105	0.1	mg/kg	U	001,003,005-006,008-015
(Water soluble) Cl-	T426	AR	0.01	g/l	N	010-012,015
(Water soluble) Mg	T251	AR	0.1	g/l	N	010-012,015
(Water soluble) NO3	T426	AR	0.01	g/l	N	010-012,015
(Water Soluble) SO4 expressed as SO4	T242	AR	0.01	g/l	N	010-012,015
Moisture	T277	AR	0.1	%	N	001,003,005-006,008-015
Moisture @ 105 C	T162	AR	0.1	%	N	001,003,005-006,008-015



DETS

Certificate of Analysis

Certificate Number 20-25073-1

Issued: 13-Jan-21

Client Lithos Consulting Ltd
Parkhill
Walton Rd
Wetherby
LS22 5DZ

Our Reference 20-25073-1

Client Reference 1462

Order No 16960/1462/ASw

Contract Title Lower Blacup Farm

Description 7 Soil samples.

Date Received 08-Dec-20

Date Started 08-Dec-20

Date Completed 13-Jan-21

Test Procedures Identified by prefix DETSn (details on request).

Notes **This report supersedes 20-25073, extra testing added.**

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager



2139

Summary of Chemical Analysis Soil Samples

Our Ref 20-25073-1

Client Ref 1462

Contract Title Lower Blacup Farm

Lab No	1773335	1773336	1773337	1773338	1773339	1773340	1773341
.Sample ID	TT100A	TT100A	TT100B	TT100C	TT100D	TT100E	TT100E
Depth	0.50	0.40	0.60	0.60	0.60	0.60	0.80
Other ID							
Sample Type	SOIL						
Sampling Date	03/12/2020	03/12/2020	03/12/2020	03/12/2020	03/12/2020	03/12/2020	03/12/2020
Sampling Time	n/s						

Test	Method	LOD	Units							
Asbestos Quantification	DETSC 1102	0.001	%	0.003						
Preparation										
Stones >10mm	DETSC 1003*	1	% m/m	5.0	7.0	8.0	5.0	6.0	5.0	72
Moisture Content	DETSC 1004	0.1	%	21	15	13	13	13	14	13
Metals										
Arsenic	DETSC 2301#	0.2	mg/kg	210	100	91	100	120	100	100
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.9	0.5	0.5	0.5	0.6	0.5	0.5
Cadmium	DETSC 2301#	0.1	mg/kg	4.5	0.2	0.2	0.2	0.2	0.2	0.2
Chromium	DETSC 2301#	0.15	mg/kg	21	14	13	12	14	12	11
Chromium III	DETSC 2301*	0.15	mg/kg	21	14	13	12	14	12	11
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	490	43	46	40	64	40	44
Lead	DETSC 2301#	0.3	mg/kg	810	44	40	31	35	37	37
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Mercury	DETSC 2325#	0.05	mg/kg	1.6	0.17	0.17	0.18	0.22	0.18	0.16
Nickel	DETSC 2301#	1	mg/kg	43	15	14	13	14	15	12
Selenium	DETSC 2301#	0.5	mg/kg	2.6	1.0	1.1	0.8	1.6	1.1	1.1
Vanadium	DETSC 2301#	0.8	mg/kg	92	21	20	18	22	20	20
Zinc	DETSC 2301#	1	mg/kg	600	49	51	39	45	42	84
Inorganics										
pH	DETSC 2008#		pH	7.9	5.6	7.2	5.0	5.3	5.4	6.0
Calorific Value	DETSC 5008	1	MJ/kg	5.5		9.2		11.3		13.5
Chloride Aqueous Extract	DETSC 2055	1	mg/l	4.4	4.0	2.9	4.6	2.3	2.3	2.8
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l	3.5	4.6	2.4	9.5	3.4	4.2	6.0
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	54	94	97	50	97	140	190
Sulphur as S, Total	DETSC 2320	0.01	%	0.28	0.41	0.36	0.38	0.42	0.46	0.47
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.40	0.68	0.58	0.60	0.61	0.70	0.67

Summary of Asbestos Analysis

Soil Samples

Our Ref 20-25073-1

Client Ref 1462

Contract Title Lower Blacup Farm

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1773335	TT100A 0.50	SOIL	Chrysotile	Chrysotile found in the form of bundles	Deborah Milburn
1773336	TT100A 0.40	SOIL	NAD	none	Deborah Milburn
1773337	TT100B 0.60	SOIL	NAD	none	Deborah Milburn
1773338	TT100C 0.60	SOIL	NAD	none	Deborah Milburn
1773339	TT100D 0.60	SOIL	NAD	none	Deborah Milburn
1773340	TT100E 0.60	SOIL	NAD	none	Deborah Milburn
1773341	TT100E 0.80	SOIL	NAD	none	Deborah Milburn

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

Summary of Asbestos Quantification Analysis

Soil Samples

Our Ref 20-25073-1

Client Ref 1462

Contract Title Lower Blacup Farm

Lab No	1773335
Sample ID	TT100A
Depth	0.50
Other ID	
Sample Type	SOIL
Sampling Date	03/12/2020
Sampling Time	

Test	Method	Units	
Total Mass% Asbestos (a+b+c)	DETSC 1102	Mass %	0.003
Gravimetric Quantification (a)	DETSC 1102	Mass %	na
Detailed Gravimetric Quantification (b)	DETSC 1102	Mass %	0.003
Quantification by PCOM (c)	DETSC 1102	Mass %	na
Potentially Respirable Fibres (d)	DETSC 1102	Fibres/g	na

Breakdown of Gravimetric Analysis (a)

Mass of Sample		g	463.12
ACMs present*		type	
Mass of ACM in sample		g	
% ACM by mass		%	
% asbestos in ACM		%	
% asbestos in sample		%	

Breakdown of Detailed Gravimetric Analysis (b)

% Amphibole bundles in sample		Mass %	na
% Chrysotile bundles in sample		Mass %	0.003

Breakdown of PCOM Analysis (c)

% Amphibole fibres in sample		Mass %	na
% Chrysotile fibres in sample		Mass %	na

Breakdown of Potentially Respirable Fibre Analysis (d)

Amphibole fibres		Fibres/g	na
Chrysotile fibres		Fibres/g	na

* Denotes test or material description outside of UKAS accreditation.
 % asbestos in Asbestos Containing Materials (ACMs) is determined by
 by reference to HSG 264.
 Recommended sample size for quantification is approximately 1kg
 # denotes deviating sample

Information in Support of the Analytical Results

Our Ref 20-25073-1
 Client Ref 1462
 Contract Lower Blacup Farm

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1773335	TT100A 0.50 SOIL	03/12/20	GJ 250ml, PT 500ml		
1773336	TT100A 0.40 SOIL	03/12/20	GJ 250ml, PT 500ml		
1773337	TT100B 0.60 SOIL	03/12/20	GJ 250ml, PT 500ml		
1773338	TT100C 0.60 SOIL	03/12/20	PT 500ml		
1773339	TT100D 0.60 SOIL	03/12/20	GJ 250ml, PT 500ml		
1773340	TT100E 0.60 SOIL	03/12/20	GJ 250ml, PT 500ml		
1773341	TT100E 0.80 SOIL	03/12/20	GJ 250ml, PT 500ml		

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

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

Soil Analysis Notes

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

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

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

Disposal

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

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

End of Report



DETS

Certificate of Analysis

Certificate Number 20-22561-1

Issued: 15-Dec-20

Client Lithos Consulting Ltd
Parkhill
Walton Rd
Wetherby
LS22 5DZ

Our Reference 20-22561-1

Client Reference 1462

Order No PO16719

Contract Title Lower Blacup Farm

Description 18 Soil samples.

Date Received 09-Nov-20

Date Started 09-Nov-20

Date Completed 15-Dec-20

Test Procedures Identified by prefix DETSn (details on request).

Notes **This report supersedes 20-22561, extra testing added**

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager



2139



Summary of Chemical Analysis Soil Samples

Our Ref 20-22561-1

Client Ref 1462

Contract Title Lower Blacup Farm

Lab No	1757378	1757379	1757380	1757381	1757382	1757383
Sample ID	T1	T2	T3	T4	T5	T6
Depth	0.10	0.10	0.10	0.10	0.10	0.10
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	06/11/2020	06/11/2020	06/11/2020	06/11/2020	06/11/2020	06/11/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Preparation									
Stones >10mm	DETSC 1003*	1	% m/m		< 1.0			< 1.0	
Moisture Content	DETSC 1004	0.1	%		36			31	
Metals									
Arsenic Gastric % Bioaccessible (% of Total As)	DETSC 2400*	0	%		1.0			0.8	
Arsenic Gastric mg/kg Bioaccessible	DETSC 2400*	0.5	mg/kg		0.7			< 0.5	
Arsenic	DETSC 2301#	0.2	mg/kg	44	71	53	33	55	28
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg		0.7			0.6	
Cadmium	DETSC 2301#	0.1	mg/kg		0.4			0.5	
Chromium	DETSC 2301#	0.15	mg/kg		26			27	
Chromium III	DETSC 2301*	0.15	mg/kg		26			27	
Chromium, Hexavalent	DETSC 2204*	1	mg/kg		< 1.0			< 1.0	
Copper	DETSC 2301#	0.2	mg/kg		130			460	
Lead	DETSC 2301#	0.3	mg/kg		170			320	
Mercury	DETSC 2325#	0.05	mg/kg		0.39			0.48	
Nickel	DETSC 2301#	1	mg/kg		30			30	
Selenium	DETSC 2301#	0.5	mg/kg		1.4			0.6	
Vanadium	DETSC 2301#	0.8	mg/kg		63			52	
Zinc	DETSC 2301#	1	mg/kg		150			240	
Inorganics									
pH	DETSC 2008#		pH		6.3			5.8	



Summary of Chemical Analysis Soil Samples

Our Ref 20-22561-1

Client Ref 1462

Contract Title Lower Blacup Farm

Lab No	1757384	1757385	1757386	1757387	1757388	1757389
Sample ID	T7	T8	T9	T10	T11	T12
Depth	0.10	0.10	0.10	0.10	0.10	0.10
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	06/11/2020	06/11/2020	06/11/2020	06/11/2020	06/11/2020	06/11/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Preparation									
Stones >10mm	DETSC 1003*	1	% m/m	< 1.0				< 1.0	
Moisture Content	DETSC 1004	0.1	%	33				35	
Metals									
Arsenic Gastric % Bioaccessible (% of Total As)	DETSC 2400*	0	%						
Arsenic Gastric mg/kg Bioaccessible	DETSC 2400*	0.5	mg/kg						
Arsenic	DETSC 2301#	0.2	mg/kg	42	30	40	38	37	42
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.7				0.7	
Cadmium	DETSC 2301#	0.1	mg/kg	0.4				0.4	
Chromium	DETSC 2301#	0.15	mg/kg	23				21	
Chromium III	DETSC 2301*	0.15	mg/kg	23				21	
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0				< 1.0	
Copper	DETSC 2301#	0.2	mg/kg	84				76	
Lead	DETSC 2301#	0.3	mg/kg	100				110	
Mercury	DETSC 2325#	0.05	mg/kg	0.24				0.25	
Nickel	DETSC 2301#	1	mg/kg	19				19	
Selenium	DETSC 2301#	0.5	mg/kg	1.0				1.0	
Vanadium	DETSC 2301#	0.8	mg/kg	37				44	
Zinc	DETSC 2301#	1	mg/kg	130				140	
Inorganics									
pH	DETSC 2008#		pH	5.8				5.6	



Summary of Chemical Analysis Soil Samples

Our Ref 20-22561-1

Client Ref 1462

Contract Title Lower Blacup Farm

Lab No	1757390	1757391	1757392	1757393	1757394	1757395
Sample ID	T13	T14	T15	T16	T17	T18
Depth	0.10	0.10	0.10	0.10	0.10	0.10
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	06/11/2020	06/11/2020	06/11/2020	06/11/2020	06/11/2020	06/11/2020
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Preparation									
Stones >10mm	DETSC 1003*	1	% m/m	< 1.0		< 1.0		< 1.0	
Moisture Content	DETSC 1004	0.1	%	36		36		36	
Metals									
Arsenic Gastric % Bioaccessible (% of Total As)	DETSC 2400*	0	%			0.9		0.9	
Arsenic Gastric mg/kg Bioaccessible	DETSC 2400*	0.5	mg/kg			< 0.5		< 0.5	
Arsenic	DETSC 2301#	0.2	mg/kg	35	28	46	50	55	50
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.9		1.0		0.9	
Cadmium	DETSC 2301#	0.1	mg/kg	0.3		0.3		0.3	
Chromium	DETSC 2301#	0.15	mg/kg	20		19		21	
Chromium III	DETSC 2301*	0.15	mg/kg	20		19		21	
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0		< 1.0		< 1.0	
Copper	DETSC 2301#	0.2	mg/kg	60		56		100	
Lead	DETSC 2301#	0.3	mg/kg	78		82		150	
Mercury	DETSC 2325#	0.05	mg/kg	0.13		0.17		0.37	
Nickel	DETSC 2301#	1	mg/kg	16		15		24	
Selenium	DETSC 2301#	0.5	mg/kg	1.2		0.7		0.8	
Vanadium	DETSC 2301#	0.8	mg/kg	38		40		48	
Zinc	DETSC 2301#	1	mg/kg	110		100		120	
Inorganics									
pH	DETSC 2008#		pH	5.5		5.6		5.8	

Summary of Asbestos Analysis Soil Samples

Our Ref 20-22561-1

Client Ref 1462

Contract Title Lower Blacup Farm

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1757378	T1 0.10	SOIL	NAD	none	Keith Wilson
1757380	T3 0.10	SOIL	NAD	none	Keith Wilson
1757381	T4 0.10	SOIL	NAD	none	Keith Wilson
1757382	T5 0.10	SOIL	NAD	none	Keith Wilson
1757383	T6 0.10	SOIL	NAD	none	Keith Wilson
1757384	T7 0.10	SOIL	NAD	none	Keith Wilson
1757387	T10 0.10	SOIL	NAD	none	Keith Wilson
1757389	T12 0.10	SOIL	NAD	none	Keith Wilson
1757391	T14 0.10	SOIL	NAD	none	Keith Wilson
1757393	T16 0.10	SOIL	NAD	none	Keith Wilson
1757395	T18 0.10	SOIL	NAD	none	Keith Wilson

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

Information in Support of the Analytical Results

Our Ref 20-22561-1
 Client Ref 1462
 Contract Lower Blacup Farm

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Hold time exceeded for tests	Inappropriate container for tests
1757378	T1 0.10 SOIL	06/11/20	PT 1L		
1757379	T2 0.10 SOIL	06/11/20	PT 1L		
1757380	T3 0.10 SOIL	06/11/20	PT 1L		
1757381	T4 0.10 SOIL	06/11/20	PT 1L		
1757382	T5 0.10 SOIL	06/11/20	PT 1L		
1757383	T6 0.10 SOIL	06/11/20	PT 1L		
1757384	T7 0.10 SOIL	06/11/20	PT 1L		
1757385	T8 0.10 SOIL	06/11/20	PT 1L		
1757386	T9 0.10 SOIL	06/11/20	PT 1L		
1757387	T10 0.10 SOIL	06/11/20	PT 1L		
1757388	T11 0.10 SOIL	06/11/20	PT 1L		
1757389	T12 0.10 SOIL	06/11/20	PT 1L		
1757390	T13 0.10 SOIL	06/11/20	PT 1L		
1757391	T14 0.10 SOIL	06/11/20	PT 1L		
1757392	T15 0.10 SOIL	06/11/20	PT 1L		
1757393	T16 0.10 SOIL	06/11/20	PT 1L		
1757394	T17 0.10 SOIL	06/11/20	PT 1L		
1757395	T18 0.10 SOIL	06/11/20	PT 1L		

Key: P-Plastic T-Tub

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

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.
 Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.
 The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
 Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report

Lwr Blacup Farm



Job No: 1462
 Engineer: WN
 Date: 17 January 2024

Topsoil: Dataset for As - Dot & Box Plots and Summary Statistics

Determinant	As
Critical concentration	37.00
No. samples	19.00
Max	71.00
Mean	41.11
Min	21.00
Median	40.00
Standard Deviation	12.03
Standard Error	2.76
T value	2.10
Upper Confidence Level (95%)	46.90
Upper Confidence Level (80%)	44.78
Lower Confidence Level (5%)	35.70
Transform data	Normal
Upper Confidence Level for chart	95%



Lwr Blacup Farm

Job No: 1462
 Engineer: WN
 Date: 17 January 2024



Topsoil: Dataset for Cu - Dot & Box Plots and Summary Statistics

Determinant	Cu
Critical concentration	100.00
No. samples	11.00
Max	130.00
Mean	65.73
Min	31.00
Median	60.00
Standard Deviation	29.74
Standard Error	8.97
T value	2.23
Upper Confidence Level (95%)	85.71
Upper Confidence Level (80%)	78.03
Lower Confidence Level (5%)	48.15
Transform data	Normal
Upper Confidence Level for chart	95%



Appendix K
CLEA Input/Output Data Sheets

LIT_10166

CLEA Software Version 1.071

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Report generated 14-Jan-21

Report title Ashbourne Drive Cleckheaton

Created by LH at Lithos



RESULTS



	Average Daily Exposure (mg kg ⁻¹ bw day ⁻¹)							Distribution by Pathway (%)							
	Direct soil ingestion	Consumption of homegrown produce and attached soil	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour	Background (oral)	Background (inhalation)	Direct soil ingestion	Consumption of homegrown produce	Dermal contact with soil and dust	Inhalation of dust	Inhalation of vapour (indoor)	Inhalation of vapour (outdoor)	Background (oral)	Background (inhalation)
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															

CLEA Software Version 1.071

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Report generated 14-Jan-21

Report title Ashbourne Drive Cleckheaton

Created by LH at Lithos



RESULTS



	Assessment Criterion (mg kg ⁻¹)			Ratio of ADE to HCV			Saturation Limit (mg kg ⁻¹)	50% rule?		Top Two applied?	Apply Top 2 Approach to Produce Group					
	oral	inhalation	combined	oral	inhalation	combined		Oral	Inhal		Green vegetables	Root vegetables	Tuber vegetables	Herbaceous fruit	Shrub fruit	Tree fruit
21																
22																
23																
24																
25																
26																
27																
28																
29																
30																

Appendix L
Geotechnical Test Results



LABORATORY REPORT



4043

Contract Number: PSL12/2908

Client's Reference:

Report Date: 05 September 2012

Client Name: Lithos Consulting
45 High Street
South Milford

North Yorkshire
LS25 5AF

For the attention of: Alan Swales

Contract Title: Lower Blacup Farm, Cleckheaton

Date Received: 29-Aug-12

Date Commenced: 29-Aug-12

Date Completed: 5-Sep-12

Notes: Observations and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson
(Director)

A Watkins
(Director)

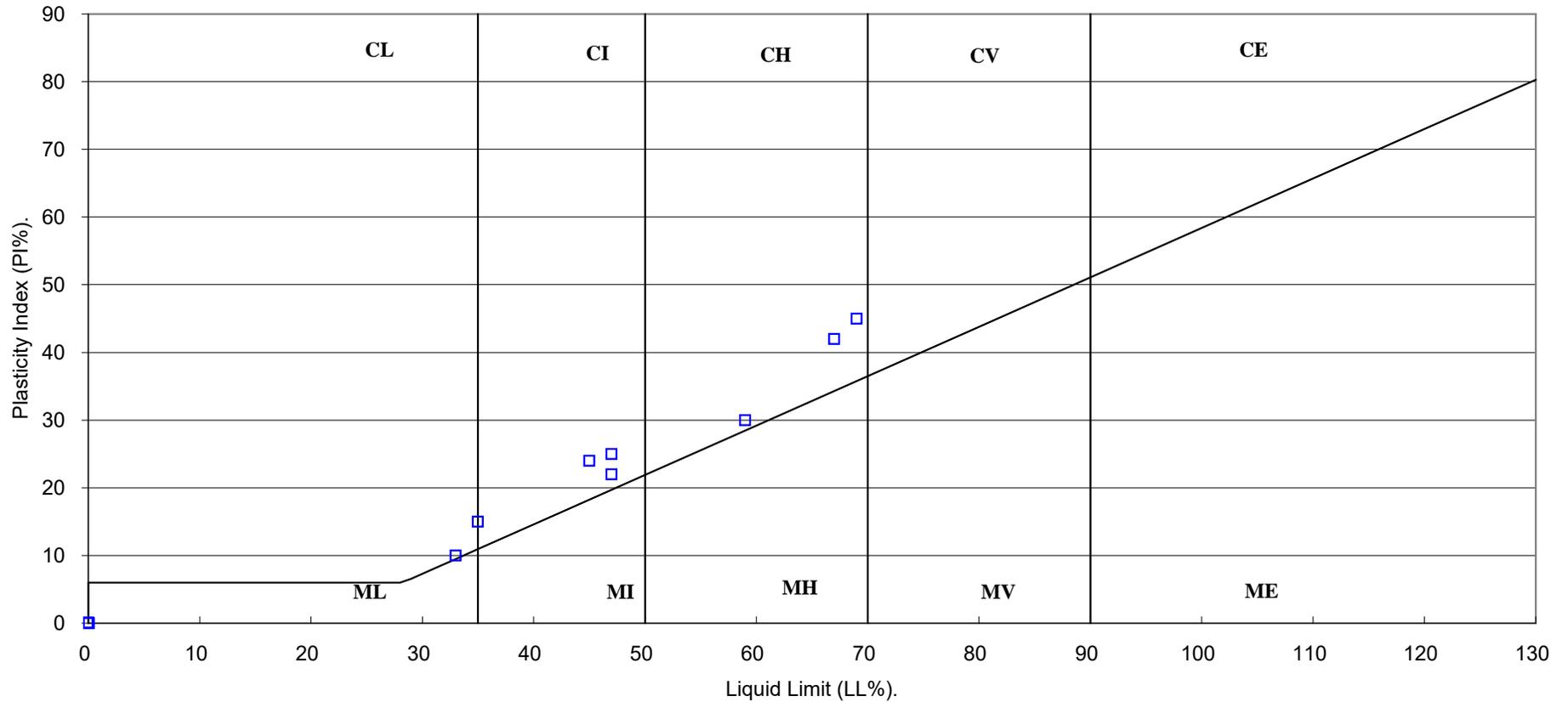
M Beastall
(Laboratory Manager)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

Page 1 of

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(B.S.5930 : 1999)



Compiled by	Date	Checked by	Date	Approved by	Date
<i>[Signature]</i>	05/09/12	<i>[Signature]</i>	05/09/12	<i>[Signature]</i>	05/09/12
LOWER BLACUP FARM, CLECKHEATON.				Contract No:	PSL12/2908
				Client Ref:	1462



2531



ANALYTICAL TEST REPORT

Contract no: 45954
Contract name: Lower Blacup Farm, Cleckheaton
Client reference: PSL12/2908
Clients name: Professional Soils Laboratory
Clients address: 5-7 Hexthorpe Road
Doncaster
DN4 0AR

Samples received: 04 September 2012

Analysis started: 04 September 2012

Analysis completed: 07 September 2012

Report issued: 10 September 2012

Notes: Opinions and interpretations expressed herein are outside the UKAS accreditation scope. Unless otherwise stated, Chemtech Environmental Ltd were not responsible for sampling. Methods, procedures and performance data are available on request. Results reported herein relate only to the material supplied to the laboratory. This report shall not be reproduced except in full, without prior written approval. Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

Key: U UKAS accredited test
M MCERTS & UKAS accredited test
\$ Test carried out by an approved subcontractor
I/S Insufficient sample to carry out test
N/S Sample not suitable for testing

Approved by:

Karan Campbell	John Campbell
Director	Director

Chemtech Environmental Limited

SOILS

Lab number			45954-1	45954-2	45954-3	45954-4	45954-5	45954-6
Sample id			TP 1	TP 2	TP 3	TP 4	TP 7	TP 14
Depth (m)			0.60	0.70	0.80	0.90	0.80	0.90
Date sampled			-	-	-	-	-	-
Test	Method	Units						
pH	CE004 ^M	units	6.3	4.9	6.7	5.3	6.7	5.3
Sulphate (2:1 water soluble)	CE061 ^M	g/l SO ₄	0.01	0.04	<0.01	0.01	0.03	<0.01

Chemtech Environmental Limited

SOILS

Lab number			45954-7	45954-8
Sample id			TP 16	TP 17
Depth (m)			1.20	1.00
Date sampled			-	-
Test	Method	Units		
pH	CE004 ^M	units	5.4	5.2
Sulphate (2:1 water soluble)	CE061 ^M	g/l SO ₄	0.01	<0.01

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	Wet	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	M	0.01	g/l SO ₄

Appendix M
Gas Monitoring Results

