

A photograph of a cross-section of a stream bed, showing a mix of green mossy rocks and brown soil, with the title "Geoenvironmental Appraisal" overlaid in white text.

Geoenvironmental Appraisal

Land at Goldthorpe Colliery For Countryside Properties

Report no: 1750/2A

Date: September 2019



SUMMARY OF GEOENVIRONMENTAL ISSUES

Job No.	1750	Site area/ha	4.3ha
Client:	Countryside Properties	NGR:	SE 467 043
Site:	Goldthorpe Colliery	Nearest postcode:	S63 9HT

The site is located off Kingsmark Way, approximately 10km east of Barnsley town centre, and currently comprises a single parcel of land overgrown with shrubs and immature trees. Recent clearance of immature trees/shrubs has been carried out and stumps were noted in sporadic clusters. A soil bund, up to 2m in height, is present in the south of the site; the north of the site has remained undeveloped.

The centre and south of the site were previously used as a spoil heap 'tip' for the adjacent Goldthorpe Colliery between 1930 and 1976. Railway sidings were also present in the far south until 1994. The spoil heap was removed from the site in 2005.

Lithos were commissioned by Countryside to provide a geoenvironmental appraisal of the site, which it is understood is to be redeveloped with housing. Lithos' investigation included a review of 3rd party reports, the site's history and environmental setting, and a ground investigation comprising 25 trial pits and 10 window sample boreholes.

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

Issue	Remarks
Made ground	The site can be divided into 2 areas based on ground conditions: - Area A - Previously undeveloped in the centre and north (1.9ha). No made ground encountered. - Area B - Former colliery spoil heap and railway sidings in the centre and south (2.1 ha). Made ground encountered in 22 exploratory holes; average thickness of 1.8m, max. of 4.2m predominantly comprising: Ash & Clinker and Colliery Spoil; some Red Shale was also encountered. Made ground is thickest in the southwest; average 3.0m, across an area of c. 4,500m². To the north and east of this, but still within Area B, thicknesses of 0.5m to 2.0m were encountered.
Natural ground	Natural ground was identified from surface in Area A and beneath the Made Ground in Area B and comprised the following strata: Granular Residual Soils comprising light brown gravelly Sand, with gravel size lithorelicts. Cohesive Residual Soils comprising light brown mottled grey Clay and Clay with gravel size lithorelicts. Bedrock encountered from an average depth of 2.3m (min. 0.9m) and comprised weathered Ackworth Rock (Sandstone) in the northeast and interbedded Mudstone, Siltstone and Sandstone elsewhere. Bedrock was encountered between 4m and 5m depth beneath the area of deep made ground in the southwest.
Contamination & remediation	No contamination was identified in Area A. The Ash & Clinker and Colliery Spoil are considered potentially combustible and require isolation beneath a minimum 1,000mm thickness of inert soil. This cover will suffice to mitigate risks associated with other contaminants (most notably arsenic) encountered in made ground. Made Ground Topsoil encountered locally in Area B is considered poor quality and unsuitable for re-use. Reference should be made to the Remediation Strategy prepared by Lithos and issued in June 2019.
Mining & quarrying	The site lies within a Coal Authority Low Risk Area, but no significant risks have been identified and an intrusive mining investigation is not required. No quarries on or within 50m of the site boundary.
Hazardous gas	The site is underlain by mineworkings (at about 45m bgl) and significant thicknesses of made ground. Consequently, monitoring wells were installed in 10 locations to monitor for hazardous gas. No measures are required in the north, but plots in the south are classified as GREEN & CS2. A hazardous gas risk assessment was issued as a separate letter report in July 2019 and has been included within this report.
Preparatory works	Vegetation clearance and removal of tree stumps. Separation of the site into two areas (Area A & B). Topsoil strip and stockpile – Area A.
Foundations	Within Area A, the Cohesive Residual soil is suitable for traditional strip/trenchfill footings at a minimum of 0.9m. However, the majority of plots will require deepening due to the influence of trees. Granular Residual soil within the northeast of Area A is suitable for traditional strips/trenchfill at a minimum depth of 0.6m. Within Area B, deep trench fill foundations are suitable in areas where the made ground is less than about 2m thick. Foundations should be taken through the entire of the made ground and placed in natural strata. Where made ground is deeper than about 2m, piles are likely to be required. Reference should be made to the detailed foundation schedule provided by Lithos.

This brief summary should not be assumed to represent a complete account of all the potential geo-environmental issues that may exist at the site. As such it is strongly recommended that the report be read in its entirety.

SUMMARY OF GEOENVIRONMENTAL ISSUES

Job No.	1750	Site area/ha	4.3ha
Client:	Countryside Properties	NGR:	SE 467 043
Site:	Goldthorpe Colliery	Nearest postcode:	S63 9HT

Issue	Remarks
Groundwater & excavations	Groundwater was only encountered within 3 pits as slow seepages between 0.8m and 3.3m. This is either perched water in made ground or discontinuous perched water on bedrock. Groundwater has been recorded in WS01 at 2.3m. Shallow excavations in natural ground should remain stable during the construction phase in the short term although shoring is likely to be required in deep excavations within the made ground. Where shallow rock is encountered in the north, breaking out may be required for any deep excavations for drainage.
Flooding & drainage	The EA indicate that the site is not located within an indicative floodplain. Soakaways are highly unlikely to provide a suitable means of surface water disposal at the site. Consequently, there is a need for surface water balancing.
Highways	Based on visual inspection of the shallow natural materials and published guidance, the natural soils should provide a CBR value of at least 3%. Providing further field trials prove satisfactory results, re-engineered made ground at the site should provide a CBR value of at least 3%. These values should be verified prior to or during construction.

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

- Deep made ground (Area B), requiring deepened trench fill or piles.
- Ground improvement – turnover of made ground and re-engineering for highways
- Provision of a 1,000mm 'clean' cover in gardens and areas of POS.

CONTENTS

1	INTRODUCTION	1
1.1	THE COMMISSION AND BRIEF	1
1.2	THE PROPOSED DEVELOPMENT.....	1
1.3	REPORT FORMAT AND LIMITATIONS	2
2	SITE DESCRIPTION.....	2
2.1	GENERAL	2
2.2	SITE FEATURES	2
3	SITE HISTORY	4
4	ENVIRONMENTAL SETTING.....	5
4.1	GENERAL	5
4.2	COAL & MINING	6
4.3	MINERAL SAFEGUARDED AREAS.....	7
5	PREVIOUS INVESTIGATION FINDINGS	8
5.1	GENERAL	8
5.2	SUMMARY OF 3 RD PARTY FINDINGS	8
5.3	LITHOS COMMENTS.....	9
6	GROUND INVESTIGATION DESIGN.....	9
6.1	ANTICIPATED GROUND CONDITIONS & POTENTIAL ISSUES	9
6.2	PRELIMINARY CONCEPTUAL SITE MODEL.....	10
6.3	GROUND INVESTIGATION DESIGN & STRATEGY	10
7	FIELDWORK	11
7.1	OBJECTIVES	11
7.2	SCOPE OF WORKS	11
8	GROUND CONDITIONS.....	12
8.1	GENERAL	12
8.2	MADE GROUND	12
8.3	OBSTRUCTIONS.....	13
8.4	NATURAL GROUND	13
8.5	PROPOSED RETAINING WALL	14
8.6	VISUAL & OLFACTORY EVIDENCE OF ORGANIC CONTAMINATION	14
8.7	STABILITY.....	14
8.8	GROUNDWATER.....	14
8.9	REVISED CONCEPTUAL GROUND MODEL (GROUND CONDITIONS)	15
9	CONTAMINATION (ANALYSIS).....	19
9.1	GENERAL	19
9.2	TESTING SCHEDULED.....	19
9.3	SOIL CONTAMINATION RESULTS	20
10	CONTAMINATION (QUALITATIVE RISK ASSESSMENT & REMEDIATION)	30
10.1	TOPSOIL	30
10.2	SUMMARY OF SIGNIFICANT CONTAMINATION	30
10.3	REVISED CONCEPTUAL GROUND MODEL (CONTAMINATION).....	31
10.4	ENVIRONMENTAL SETTING & END USE	31
10.5	POLLUTANT LINKAGES.....	31
10.6	POTENTIAL REMEDIATION OPTIONS	32
10.7	SUMMARY OF POTENTIAL POLLUTANT LINKAGES & MITIGATION	34
10.8	WASTE CLASSIFICATION	34

11	HAZARDOUS GAS	36
11.1	GENERAL	36
11.2	DISCUSSION	36
11.3	RADON	39
12	GEOTECHNICAL TESTING	39
12.1	GENERAL	39
12.2	ATTERBERG LIMITS	39
12.3	PARTICLE SIZE DISTRIBUTION	40
12.4	SOLUBLE SULPHATE AND PH.....	40
12.5	COMPACTION TESTS	41
12.6	EXPANSION (EMERY) TESTING	42
12.7	UNDRAINED SHEAR STRENGTH TESTING	43
12.8	STANDARD PENETRATION TEST (SPT)	43
13	GEOTECHNICAL ISSUES	44
13.1	CONCEPTUAL SITE MODEL	44
13.2	MINING & QUARRYING	45
13.3	SITE REGRADE AND/OR GROUND IMPROVEMENT	45
13.4	FOUNDATION RECOMMENDATIONS.....	45
13.5	FLOOR SLABS	50
13.6	DESIGNATED CONCRETE MIXES	51
13.7	EXCAVATIONS.....	51
13.8	DRAINAGE	51
13.9	HIGHWAYS	52
13.10	EXTERNAL WORKS	53
14	REDEVELOPMENT ISSUES.....	53
14.1	GENERAL	53
14.2	REMEDICATION STRATEGY	53
14.3	CONTROL OF EXCAVATION ARISING	54
14.4	GOOD PRACTICE GUIDANCE	55
14.5	NEW UTILITIES.....	55
14.6	HEALTH & SAFETY ISSUES - CONSTRUCTION WORKERS	56
14.7	POTENTIAL DEVELOPMENT CONSTRAINTS	57
15	SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.....	57
15.1	GENERAL	57
15.2	MINING.....	57
15.3	HAZARDOUS GAS	58
15.4	CONTAMINATION & REMEDIATION.....	58
15.5	FOUNDATIONS	58
15.6	FLOODING	59
15.7	DRAINAGE	59
15.8	HIGHWAYS	59

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
1750/1	-	Site location plan
1750/2	A	Proposed site layout
1750/3	-	Site features
1750/4	-	Site photographs
1750/5	-	Preliminary conceptual site model
1750/6	A	Exploratory hole locations
1750/7	-	Site areas
1750/8	-	Revised conceptual site model
1750/9	A	Made ground thicknesses

Appendix C - Commission

Appendix D - Historical OS plans#

Appendix E - Search responses#

From	Date	Content
Landmark	30 th September 2013	Environmental search data
Coal Authority	1 st April 2019	Mining report

Appendix F to H - Exploratory records

Appendix F	TP01 to TP33
Appendix G	WS01 to WS10
Appendix H	BH01 to BH05

Appendix I - Chemical test results

Appendix J - Geotechnical test results

Appendix K - Gas monitoring results

Some of this data is not included within the paper or PDF copies of this report; by request, it can be provided on a CD.

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 sheets of paper in the hard copy 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 on a CD.

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.

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.

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.

This report assumes that ground levels will not change significantly from those existing at present and that houses will be of two storey construction. If this is not to be the case, then some modification to this report may be required.

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.

Lithos reserve the right to amend their conclusions and recommendations in the light of further information that may become available.

GEOENVIRONMENTAL APPRAISAL
of land at
GOLDTHORPE COLLIERY

1 INTRODUCTION

1.1 The commission and brief

- 1.1.1 Lithos Consulting Limited were commissioned by Countryside Properties to carry out a geoenvironmental appraisal of land at Goldthorpe Colliery.
- 1.1.2 Lithos have previously issued a the following reports relating to this site:
- Preliminary Investigation Report (Ref 1750/1, dated October 2013)
 - Geoenvironmental Appraisal (Report 1750/2, dated May 2019)
 - Remediation Strategy (Report 1750/3, dated June 2019)
- 1.1.3 Information within Report 1750/1 has been incorporated into this report. This document is a revision of the Geoenvironmental Appraisal (Report 1750/2) issued by Lithos in May 2019; Report 1750/2 is now superseded. This document now includes the findings of additional trial pitting and cable percussion boreholes undertaken at the site, with the only significant revisions to 1750/2 having been made in Sections 6.3, 7.2, 8, 11, 12, 13.4 & 14.2 and Drawings 1750/2, 1750/6 & 1760/9.
- 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 review of third party reports
 - 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 25 trial pits and 10 window sample boreholes
 - 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 phase of investigation were to identify salient geoenvironmental issues affecting the site to support the submission of a planning application, and also to enable Countryside 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 119 no. 2 & 3 storey domestic dwellings, associated gardens, POS and adoptable roads and sewers. A site layout has been provided by Countryside (Drawing reference SK656-DL-01, dated August 2019) which is reproduced as Drawing 1750/2 (rev.A) 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.
- 1.3.3 In accordance with the agreed scope of works, the ground investigation reported here is not fully compliant with Eurocode 7 (EC7) and this report does not purport to be a Ground Investigation Report, nor a Geotechnical Design Report as defined by EC7. The ground appraisal, parametric assessment and preliminary design guidance presented are intended to assist others as they prepare the design of the proposed works.

2 SITE DESCRIPTION

2.1 General

- 2.1.1 The site's location is shown on Drawing 1750/1 presented in Appendix B to this report. Site details are summarised in the table below.

Detail	Remarks
Location	10 km east of Barnsley town centre
NGR	SE 469 043
Approximate area	4.3 ha (11 acres)
Known services	Underground electric & sewer Overhead telecom

2.2 Site features

- 2.2.1 Lithos completed a walkover survey of the site on 6th April 2019.
- 2.2.2 Existing salient features, at the time of the walkover are presented on Drawing 1750/3 in Appendix B to this report and summarised in the table below.

Feature	Remarks
Current Access	Off Kingsmark Way
Topography	Relatively flat, with gentle slope towards south. A railway cutting runs along the site's southern boundary, the base of the cutting is roughly 5m lower than the site and slopes up to the site at 45°.
Approximate areas	400m ² tarmac hardstand 39,800m ² grass
Nature of boundaries	North – Wire fencing and hedgerows. East – Tall trees and no physical boundary. South – Steep slope to railway cutting. West – 2.5m metal security fencing and soil bund.

Feature	Remarks
Surrounding land uses	North – Allotment gardens with residential housing beyond. East – Kingsmark Way, sports ground and residential housing. South – Disused railway cutting with allotments beyond. West – Beever Street, telephone exchange and building aggregate supply yard.

- 2.2.3 The site comprises a single overgrown parcel of land covered with long grass, brambles, shrubs and immature trees.
- 2.2.4 Recent clearance of immature trees/shrubs has been carried and stumps (typically 50mm to 200mm in diameter) were noted in sporadic clusters across the entire area, but especially the centre and south of Area A (see Drawing 1750/7).
- 2.2.5 A disused railway cutting borders the south with the base of the railway cutting approximately 3 to 5m below the site boundary.
- 2.2.6 Access to the site is off Kingsmark Way to the east, with secondary access for pedestrians from Beever Street to the west and northwest. There is also a footbridge over the cutting to the southeast. A macadam footpath is present along the southeast boundary between Kingsmark Way and the footbridge.
- 2.2.7 A number of unmarked footpaths are visible crossing site that pedestrians frequently use. Mature trees border the northeast and the northwest corner is severely overgrown and inaccessible in places.
- 2.2.8 A 2m high soil bund is present within the south.
- 2.2.9 A small amount of macadam is present adjacent to Kingsmark Way likely left over from the road construction.
- 2.2.10 A selection of site photographs is included on Drawing 1750/4.

3 SITE HISTORY

- 3.1 Site centred extracts from Ordnance Survey (OS) plans dating back to 1855 have been examined. Some of these plans are presented in Appendix D to this report.
- 3.2 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
1855	Open fields.	Open fields Pond on western boundary Road 200m north
1892	Wooded areas in centre and on the southeast boundary.	No significant changes.
1906	No significant changes.	Development of Goldthorpe to northwest. Road to north labelled Doncaster Road. Railway under construction along southern boundary. Allotments and sports fields north and northeast respectively.
1930	Colliery spoil heap in centre. Single railway siding in far south.	Further development of housing in Goldthorpe to north, south, and northwest boundary. Goldthorpe Colliery shown immediately east of site, includes buildings, chimneys, engine house, locomotive loading structure, and shaft. Access road for colliery along northeast boundary. Allotments to west.
1956	Colliery spoil heap extends to cover approximately 30% of site.	No significant changes.
1962	Railway sidings expanded in south. Allotments in northwest corner.	Housing development to south of railway cutting. Expansion of colliery buildings to west.
1976	Spoil heap now labelled as ' Tip (disused) ' Railway sidings further expanded in south.	Warehouse developed adjacent to western boundary.
1981	No significant changes.	Colliery building layout changed.
1993		Telephone exchange developed 20m west.
1994	Railway sidings in south no longer shown.	No significant changes
1995	No significant changes.	Colliery and associated buildings no longer shown
2005	Colliery Spoil heap moved to main tip 400m east.	No significant changes
2013	Colliery spoil heap no longer shown and site unoccupied.	Railway line now dismantled. New residential housing development to the west

- 3.3 Review of reports issued by AIG\Encia (see Section 5) suggests that Goldthorpe Colliery Shafts Nos 1 & 2 were sunk in 1910.
- 3.4 Goldthorpe Colliery was closed in 1994.
- 3.4 The Colliery spoil heap at the site was approximately 10m high and in 2005 was relocated to the main heap approximately 400m to the east.

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. Extracts from the response received from Landmark, and response from the Coal Authority is 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 87) 1:10,000 BGS map (Sheet SE40SE) BGS Memoir/Technical Report BGS Logs (SE40SE27)	Drift – None recorded. Solid – Ackworth Rock (sandstone) part of the Upper Coal Measures formation in the north. Undifferentiated Middle Coal Measures (mudstones, siltstones and sandstones) in the south. The Cambriense (top) marine band crosses the centre of the site separating the two units and is an important marker layer for the change from Middle to Upper coal measures. Shallowest coal seam – Highgate Coal (c. 0.5m thick) at c.40m depth; see further details in Section 4.2 below. Strata dip – 5° to northeast. Faults – None within 250m.
Mining	Coal Authority	This site 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). Further details in Section 4.2 below.
Quarrying	Historical OS plans	No known quarries within 250m.
Landfills	Envirocheck Report	No known landfills within 250m.
Radon	Public Health England	The site lies in an area where 1% to 3% of homes are estimated to be above the action level. Therefore, no radon measures are required.
Hydrogeology	Environment Agency	Groundwater Source Protection Zone? No. Aquifer: Secondary A aquifer (Solid). Groundwater abstractions? One for fishing pond maintenance 840m southwest Soil leaching potential - High. Pollution incidents? None recorded.
Hydrology	Envirocheck Report	Nearest watercourse(s) – Open Beck 180m south flowing southwards. Water quality – The site lies within the Dearne Darfield STW to River Don river catchment rated ecologically moderate and chemically good. Pollution incidents? None of significance to site. Abstractions? One for Thomas black Limited for general industrial use. Discharge consents? One for British Coal issued in 1995.
Flood risk	Environment Agency	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 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).

4.2 Coal & mining

- 4.2.1 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 provides the necessary mining risk assessment required by the proposed planning application.
- 4.2.2 This site 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.
- 4.2.3 Geological maps suggest that two coal seams underlie the site at shallow depth (<50m). These are the:
- The Highgate Coal (about 0.5m thick) at approximately 30m depth.
 - The Shafton Coal (up to 1.9m thick) at about 45m
- 4.2.4 A CA mining report states that:
- *There are known mineworkings in 5 seams (Shafton, Newhill, Meltonfield, Top Hard Barnsley & Parkgate) beneath the property between 44m and 663m.*
 - *There are no probable unrecorded shallow workings or spine roads at shallow depth.*
 - *There is one mine shaft located within 100m of the site's boundary. The shaft (Ref:446404-001) is 70m to the east of site. The shaft is filled and capped with reinforced concrete (9.4mx9.4mx0.4m) at rockhead. A vent pipe is installed through the cap to surface. Capping of the shaft was supervised by Encia Consulting Ltd in 2006. The location of the shaft is shown on a Coal Authority plan in Appendix E.*
 - *There are no outcrops recorded.*
 - *There are no geological faults, fissures or breaklines recorded.*
 - *There are no recorded opencast mines or Coal Authority managed tips within 500m of the site's boundary.*
 - *There are 3 claims within 50m of the property boundary that do not match the properties address to the west, southwest and south. However, no notices have been given under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence. The locations are shown on the coal authority plan in Appendix E.*
 - *There are no recorded incidents of mine gas or mine water treatment within 500m of the property.*
 - *The property is in an area where notices to withdraw support were given in 1946 and 1982.*
- 4.2.5 The mining reports suggests there are no known shallow workings (i.e. at less than 30m depth).
- 4.2.6 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. However, based on anticipated depth and published seam thickness, even if worked, these seams should not affect surface stability of the site (i.e. solid cover is >10x seam thickness).

4.3 Mineral safeguarded areas

- 4.3.1 The site is underlain by coal and might therefore be considered by the Local Authority to lie within a Mineral Safeguarding Area (MSA).
- 4.3.2 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.
- 4.3.3 Specialist guidance on Mineral Safeguarding "A Guide to Mineral Safeguarding in England" has been produced by The Coal Authority and the British Geological Survey.
- 4.3.4 Paragraph 204 of the National Planning Policy Framework (NPPF) requires Local Authorities, when preparing Local Plans to:
- Define Minerals Safeguarding Areas and adopt appropriate policies in order that known locations of specific minerals resources of local and national importance are not needlessly sterilised by non-mineral development, whilst not creating a presumption that resources defined will be worked; and define Minerals Consultation Areas based on these Minerals Safeguarding Areas.
 - 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.
- 4.3.5 NPPF Paragraph 144 notes that when determining planning applications, local planning authorities should give weight to the benefits of the mineral extraction.
- 4.3.6 As a consequence of the NPPF, and the presence of coal beneath the site, the Local Authority may require Countryside 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

5 PREVIOUS INVESTIGATION FINDINGS

5.1 General

5.1.1 Lithos have reviewed extracts of the following reports:

- Geoenvironmental Report for Goldthorpe Colliery. Report 2500/1 issued by AIG Consultants to Ben Bailey Homes in June 2002.
- Addendum Geoenvironmental Report for Goldthorpe Colliery. Report 2500/2 issued by AIG Consultants to Ben Bailey Homes in June 2002.
- Summary Geoenvironmental Appraisal for Goldthorpe Colliery. Report 2500/3 issued by Encia Consulting to the Ogden Group of Companies in June 2003.
- Remediation Strategy for Goldthorpe Colliery. Report 9060/1 issued by Encia Consulting to Ben Bailey Homes in March 2005.
- Verification Report for the Remediation & Site Preparatory Works at Goldthorpe Colliery. Report 9060/2 issued by Encia Consulting to Ben Bailey Homes in July 2006.

5.1.2 The above reports considered the main colliery site (adjacent to, and east of, the area of current interest), and also the southern third of the current area of interest; a total area of about 15 ha. The former main colliery site has now been developed with housing.

5.2 Summary of 3rd party findings

5.2.1 The key findings of the above AIG\Encia Reports were:

- AIG's ground investigation in April & May 2002 comprised 111 trial pits, 5 cable percussion boreholes, and 10 rotary probe holes.
- Report 2500/1 considered the former main colliery site (c. 10 ha) which had outline planning consent for residential development.
 - o Trial pits typically encountered 1m to 3m of made ground over stiff clay, over weathered bedrock.
 - o Probeholes PH101 to PH107 were drilled to determine the presence of shallow mineworkings and encountered a sequence of interbedded mudstones and sandstones with sporadic thin coal seams. AIG concluded that the site was not underlain at shallow depth by any workable seams of coal.
- Report 2500/2 considered the southern third (c. 1.5 ha) of the current area of interest, and a plateau of colliery spoil to the east of the former main colliery site (about 400m east of the area current interest).
 - o AIG Exploratory holes located in the southern third of the current area of interest, were: TPs 101 to 103, 161, 162, 173 to 177; BHs 101 & 102 (drilled through the 8m high spoil tip present in 2002); and PHs 107 & 108.
 - o Trial pits typically encountered Colliery Spoil comprising red shale, coal to between 1.7m and 3.9m.
 - o The cable percussion boreholes encountered Colliery Spoil to between 9.5m and 11.7m. However, these boreholes were situated on top of the spoil heap (now removed) which was approximately 8m above current ground level. Beneath Colliery Spoil, Weathered Coal Measures and bedrock were encountered to the base of the exploratory holes.
 - o Detailed exploratory hole logs have not been seen, but PH107 is likely to have been taken to c. 30m depth and encountered no coal. PH108 was only taken to 10m to allow installation of a monitoring well.
- Report 2500/3 considered the restoration of the site to a 'soft-end' use (Moyhihan).
- Encia Remediation carried out remediation and preparatory works, on behalf of Ben Bailey Homes, between January and July 2006.

5.3 Lithos Comments

- 5.3.1 The Encia/AIG reports provide a good overview of the wider Goldthorpe Colliery site and anticipated ground conditions in the southern section of the current site.
- 5.3.2 However, since that investigation, the land profile has changed considerably with the removal of a colliery spoil heap (c. 2005) and consequently current ground conditions are relatively unknown.
- 5.3.3 Furthermore, there has been no previous investigation across the northern section of the site.
- 5.3.4 Based on the above a more detailed intrusive investigation is required to confirm ground conditions and provide foundation recommendations across the whole site.

6 GROUND INVESTIGATION DESIGN

6.1 Anticipated ground conditions & potential issues

- 6.1.1 Based on the data reviewed in Section 4 (Environmental Setting) and 5 (Previous Investigation Findings), anticipated ground conditions are expected to comprise:

Anticipated condition	Remarks
Made ground	Potentially deep made ground (c. 1 to 3m thick) in the centre and south associated with the former colliery spoil heap and railway sidings.
Natural soils	Residual soils (gravelly clays/clayey gravels) beneath made ground.
Bedrock	Ackworth Rock sandstone in north and undifferentiated Middle Coal Measures in south. Likely to be encountered at shallow depths (c. 2 to 4m) where made ground is not present.
Mineworkings	Shallowest worked coal seam (Shafton) at 44m depth
Groundwater	Possibility of discontinuous water in made ground (perched) Likely to be at depth in bedrock and residual soils.

- 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	1. made ground (colliery spoil) 2. rail sidings	1. inorganics, organics & asbestos. 2. asbestos & organics
Potential off-site contamination sources	1. former colliery	1. migration of organic/leachable contaminants.
Potential geotechnical hazards	1. deep made ground 2. steep slopes on south boundary	1. piled foundation solution 2. significant earthworks
Other potential constraints	1. underground and/or overhead utilities 2. Japanese Knotweed	1. may require diversion/easement 2. removal/treatment

6.2 Preliminary conceptual site model

- 6.2.1 A preliminary conceptual site model, presented as Drawing 1750/5 in Appendix B, has been prepared after consideration of all the data presented in Sections 2 to 6.1 inclusive of this report.
- 6.2.2 An assessment of potential contaminants associated with the former uses has been undertaken with reference to CLR8.
- 6.2.3 As a consequence of this assessment, anticipated potential contaminants, within soil and/or groundwater include:
- Hydrocarbons (refuelling at railway sidings, colliery spoil made ground)
 - Asbestos (dust from engine brakes at railway sidings)
 - Metals (lead and arsenic within colliery spoil made ground)
 - Ash & Clinker (waste by-product from the colliery)
- 6.2.4 Potential pollutant linkages are shown on the preliminary conceptual site model. The most significant receptors are likely to be the end-users (future residents) and groundwater at depth beneath the site. The pathways to these receptors are likely to be vertical and lateral leaching of contaminants from the potential contaminant sources listed above.
- 6.2.5 Historical plans indicate that centre of the site was used as a colliery spoil heap between 1930 and 1976.

6.3 Ground investigation design & strategy

- 6.3.1 The preliminary conceptual site model was used as a basis for design of an appropriate ground investigation, the scope of which is summarised below.

Exploratory holes	Purpose
Twenty five trial pits	To determine the general nature of soils underlying the site, including the: • Nature, distribution and thickness of made ground • Nature, degree and extent of contamination • Proportion of undesirable elements e.g. biodegradable matter, foundations etc • Suitability of the ground for founding structures and highways
Twelve window sample boreholes	To install monitoring wells across the site in order to: • Monitor for hazardous gas • Determine groundwater levels and assess flow direction • Determine groundwater levels and assess flow direction

- 6.3.2 Proposed exploratory hole locations were selected to provide a representative view of the strata beneath the site and to target potential areas of interest identified in Section 3 above. A nominal 50m grid spacing was proposed.
- 6.3.3 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.
- 6.3.4 In light of the findings from the initial investigation, supplementary ground investigation was undertaken in September 2019; the scope of works is summarised below:

Exploratory holes	Purpose
5 cable percussion boreholes	To obtain geotechnical data from depth (including depth to bedrock) and inform pile design where deep made ground is present in Area B
Eight trial pits	• To identify ground conditions in the vicinity of a the proposed retaining wall • To enable better coverage for a preparation of a detailed foundation schedule

7 FIELDWORK

7.1 Objectives

7.1.1 The original investigation strategy is outlined in Section 6.3 above.

7.2 Scope of works

7.2.1 Initial fieldwork (trial pitting and window sampling) was supervised by Lithos between 9th and 10th April 2019. Supplementary investigation (boreholes and trial pitting) were completed on the 2nd & 3rd September 2019. All exploratory holes are summarised below.

Date	Technique	Exploratory holes	Final depth(s)	Remarks
April 2019	Trial pitting (machine dug)	TPs 01 to 25	1.0m to 4.5m	Vane tests in cohesive strata
	Window sample boreholes	WSs 01 to 10	1.45m to 4.45m	SPTs in natural strata Monitoring well installed in each hole
September 2019	Cable percussive boreholes	BHs 01 to 05	5.12m to 5.28m	SPTs/U100s undertaken at 1.0m intervals Monitoring wells installed in each hole
	Trial pitting (machine dug)	TPs 25 to 33	1.7m to 3.7m	Vane tests in cohesive strata

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

7.2.3 Exploratory hole logs are presented in Appendices F and G 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

7.2.4 Exploratory hole locations are shown on Drawing 1750/6 (rev. A) presented in Appendix B; hole positions (TPs 01 to 25 and WSs 01 to 10) are based on data from a hand-held GPS (typically +/- 3m accuracy) and have not been surveyed in. Boreholes (BHs 01 to 05) and supplementary trial pits (TPs 26 to 33) have been surveyed in to obtain accurate locations and ground levels.

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 The site can be divided into 2 areas based on ground conditions. These areas are shown on Drawing 1750/7 and are summarised below:

Site area	General location	Area (m ²)
A	Previously undeveloped in the centre and north	19,200
B	Former colliery spoil heap and railway sidings in the centre and south	21,000

- 8.1.3 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 table on page 16 to 18.

8.2 Made ground

- 8.2.1 No made ground was encountered in Area A, other than some Made Ground Topsoil in TP09 & WS04 – a poor quality topsoil with occasional gravel-sized fragments of red shale and brick.
- 8.2.2 Made Ground was encountered in 29 exploratory holes across Area B.
- 8.2.3 The made ground on site is a heterogeneous mixture of granular materials and it is unlikely, even with a huge amount of sampling, that it could be accurately characterised. Nonetheless, the bulk of the made ground can be categorised as one of 5 broad types:
- **Made Ground Topsoil (clayey, gravelly sand):** 0.2m to 0.5m thick, identified at surface in the far south and west in 6 exploratory holes. Comprising dark brown, clayey Sand with gravel of brick, coal and shale (poor quality topsoil).
 - **Granular Made Ground:** Encountered from surface across much of Area B (22 exploratory holes), with a “patchy” covering of grass. Comprising dark brown, Sand with gravel of brick, coal, sandstone and burnt shale
 - **Ash & Clinker (gravelly ash & ashy gravel):** Encountered in 10 exploratory holes to a maximum depth of 1.8m (TP24) (average 1.2m). Comprising black and dark grey, gravelly Ash and ashy Gravel of clinker, slag, coal and mudstone/burnt shale.
 - **Colliery Spoil (sandy gravel):** Encountered in 20 exploratory holes to a maximum depth of 3.7m (WS07) (average 2.2m). Comprising reddish brown, sandy Gravel of burnt shale and slag and dark grey, sandy Gravel of mudstone and coal.
 - **Red Shale:** Reddish brown, very sandy angular to subangular fine to coarse Gravel. Encountered in 17 exploratory holes to a maximum depth of 4.2m (BH02).
- 8.2.4 Review of the trial pit logs suggest made ground thicknesses beneath Area B vary between 1.0m and 4.2m.
- 8.2.5 The thickest made ground (TPs 15 to 18, 24 to 26 & 28, WSs 06, 07 & 09 & BHs 01 to 05) was encountered in the southwest; average 3.0m across an area of c. 4,500m². To the north and east of this very deep made ground, but still within Area B, thicknesses of 0.5m to 2.0m were encountered. The approximate distribution of made ground thicknesses is shown on Drawing 1750/9.
- 8.2.6 Gravel and occasional cobbles of **slag** were encountered within both Colliery Spoil and Ash & Clinker, with many cobbles noted in TP15 at 2.3m.

- 8.2.7 Gravel of **Red Shale** was encountered within both Colliery Spoil and Ash & Clinker. Burnt Colliery Spoil or Red Shale is the product of former combustion of colliery spoil. This may have occurred due to spontaneous combustion associated with Pyrite and /or Coal content of the spoil. Combustion may have been incomplete. Red Shale is relatively inert and granular. It may contain high concentrations of sulphates along with low pH. It may also be frost susceptible.
- 8.2.8 Distinction between Granular Made Ground, Colliery Spoil and Ash & Clinker was often difficult when ground types were dark brown/grey or black. It would be difficult for a groundworker to accurately delineate areas of Ash & Clinker and Colliery Spoil and as such the made ground within Area B should all be treated as the same material during earthworks.
- 8.2.9 A 2m high soil bund is present in the south of Area B. The bund covers an area of approximately 770m² and contains **Made Ground Topsoil** - a dark brown, clayey, gravelly Sand, with occasional gravel of brick & shale. This is likely to have been surplus topsoil from the adjacent housing development.
- 8.2.10 A small amount of **Macadam Hardstanding** was encountered adjacent to the roundabout. This is likely surplus macadam from the adjacent road construction.
- 8.2.11 Whilst not encountered during this investigation, the possibility of 'burial pits', and/or asbestos sheeting (used as shuttering), and/or fragments of asbestos sheeting within the made ground cannot be entirely discounted.

8.3 Obstructions

- 8.3.1 WS06 encountered an obstruction at 2.4m within Colliery Spoil and was unable to be advanced beyond that depth and prove the base of the made ground. Given the size of a window sample barrel, this is likely due to a cobble or boulder of burnt shale or slag. No obstructions were encountered with any of the trial pits.
- 8.3.2 Based on observations made during the pitting, significant obstructions are unlikely to be encountered during groundworks

8.4 Natural ground

- 8.4.1 Natural ground was encountered in every exploratory hole (except WS06), and typically comprised:
- **Topsoil (clayey sand):** Typically, 300mm thick, encountered at surface in 16 exploratory holes in the north (Area A); comprising dark brown, clayey Sand.
 - **Relict Topsoil (silty clay):** Encountered in 12 exploratory holes beneath made ground in Area B (typically 0.2 to 0.4m thick). Comprising dark brown and dark grey, silty Clay with rootlets and natural organic odour.
 - **Granular Residual Soils (gravelly sand):** Encountered in 18 exploratory holes to an average depth of 2.3m (max 4.0m). Comprising light brown, gravelly, Sand with gravel size lithorelicts of sandstone (Area A) and as grey, angular, Gravel size lithorelicts of siltstone mudstone and sandstone (Area A & B).
 - **Cohesive Residual Soils (gravelly clay):** Encountered in 40 exploratory holes to an average depth of 2.5m (max 4.5m). Comprising light brown mottled grey Clay and Clay with gravel size lithorelicts.
- 8.4.2 **Bedrock** was encountered in 32 exploratory holes at an average depth of 2.3m (min. 0.9m) and comprised weathered Ackworth Rock (weak light brown fine and medium Sandstone) in the north east (Area A) and weathered Coal Measures (very weak grey Mudstone, brown Siltstone and Sandstone) elsewhere (Area A & B)

8.4.3 Bedrock was absent shallowest (<2.5m) in the north of the site (Area A), and deepest (between 4m and 5m) in the centre and south, beneath areas of deep made ground (Area B).

8.4.4 The in-situ relative density of granular deposits on site was established by carrying out Standard Penetration Tests (SPTs) during the drilling of the boreholes; see Section 12.8.

8.5 Proposed retaining wall

8.5.1 As per Countryside's request, two no. trial pits (TPs 26 & 27) were excavated on the western boundary adjacent to proposed Plots 51 and 52 where a retaining wall is to be placed.

8.5.2 Ground conditions comprise 2m to 2.5m of made ground with Cohesive Residual Soil underlying to the base of each trial pit. The made ground was particularly loose in the excavation of TP26.

8.6 Visual & olfactory evidence of organic contamination

8.6.1 No visual/olfactory evidence of hydrocarbon contamination.

8.6.2 Natural organic odours were recorded in Relict Topsoil beneath made ground.

8.7 Stability

8.7.1 Stability of excavations within natural ground and made ground was generally good for the limited time excavations where 'open' (<0.5 hours).

8.8 Groundwater

8.8.1 Groundwater was encountered within two exploratory holes (TPs 12 & 17) in made ground as slow seepages between 0.8m and 2.5m depth. One seepage was recorded in TP23 at 3.3m depth as discontinuous perched water on weathered coal measures bedrock.

8.8.2 Groundwater levels recorded in the monitoring wells between April and July 2019 are summarised below.

Area	Hole ID	Response zone (depth range & strata)	Groundwater body	Typical standing water level	
				m bgl	m AoD#
A	WS01	1.5m to 2.5m (coal measures)	shallow	2.30 to 2.42	49.18 to 49.08
	WS02	0.5m to 1.5m (granular residual soil)		Not detected	-
	WS03	0.5m to 1.6m (cohesive residual soil & coal measures)			
	WS04	1.0m to 2.0m (cohesive residual soil & coal measures)			
B	WS05	0.5m to 1.3m (colliery spoil & ash & clinker)	perched	1.21	48.29
	WS06	1.0m to 2.5m (colliery spoil & ash & clinker)		Not detected	-
	WS07	0.8m to 2.8m (colliery spoil & ash & clinker)			
	WS08	0.5m to 1.0m (colliery spoil)			
	WS09	1.0m to 2.7m (colliery spoil)			
	WS10	0.5m to 1.0m (colliery spoil)			
	BH01	3.5m to 5.0m (cohesive residual soil & coal measures)	shallow	4.32	43.18
	BH02	4.2m to 5.2m (cohesive residual soil & coal measures)		3.20	44.99

Area	Hole ID	Response zone (depth range & strata)	Groundwater body	Typical standing water level	
				m bgl	m AoD [#]
	BH03	3.3m to 4.8m (cohesive residual soil & coal measures)		3.15	44.78
	BH04	3.5m to 5.0m (cohesive residual soil & coal measures)		3.41	42.27
	BH05	3.5m to 5.0m (cohesive residual soil & coal measures)		3.36	41.66

[#] estimated from topo survey data for WSs 01 to 10, taken from surveyed levels for BHs 01 to 05

8.8.3 Dip data suggests that groundwater lies at around 3m to 4mbgl in natural strata.

8.8.4 Bailing of BHs 03, 04 & 05 involved removal of 6 to 8 litres from each hole resulted in lowering the water level by about 1m within the slotted response zone. Recharge was slow; the water level recovered by around 0.1m to 0.3m after an hour.

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 absence of significant buried obstructions
- The strength, nature and depth of underlying natural strata
- The nature and distribution of contamination (based on visual/olfactory evidence only)

8.9.2 Further refinement of the Conceptual Site Model is presented in Sections 0, where the results of laboratory testing for contaminants have been considered.

Summary of Ground Conditions

Area	Hole	Final depth (mbgl)	Depth to Base of Made Ground (mbgl)	Depth to Base of: (mbgl)									Depth to Rockhead (mbgl)	Penetration (m)	Remarks
				Made Ground					Natural Soils						
				Made Ground Topsoil	Granular Made Ground	Ash & Clinker	Colliery Spoil	Red Shale	Relict Topsoil	Topsoil	Cohesive Residual Soil	Granular Residual Soil			
A	TP01	2.3	-	-	-	-	-	-	-	0.3	-	1.8	1.8	0.5	2.3m: Refusal on bedrock.
	TP02	2.2	-	-	-	-	-	-	-	0.3	-	1.8	1.8	0.4	2.2m: Refusal on bedrock.
	TP03	2.1	-	-	-	-	-	-	-	0.2	-	1.5	1.5	0.6	2.1m: Refusal on bedrock.
	TP04	2.7	-	-	-	-	-	-	-	0.2	1.9	0.9, then 2.4	2.4	0.3	2.7m: Refusal on bedrock.
	TP05	2.8	-	-	-	-	-	-	-	0.2	1.8	2.6	2.6	0.2	2.8m: Refusal on bedrock.
	TP06	2.6	-	-	-	-	-	-	-	0.3	1.9	2.6	-	-	2.5m: Difficult to excavate beyond.
	TP07	2.0	-	-	-	-	-	-	-	0.3	-	1.5	1.5	0.5	2.0m: Refusal on bedrock.
	TP08	3.0	-	-	-	-	-	-	-	0.3	2.2	0.6, then 2.7	2.7	0.3	3.0m: Refusal on bedrock.
	TP09	3.2	0.5	0.5	-	-	-	-	-	-	2.3	2.5	2.5	0.7	3.2m: Refusal on bedrock
	TP10	1.7	-	-	-	-	-	-	-	0.2	1.1	1.4	1.4	1.7	1.7m: Refusal on bedrock
	TP11	2.8	-	-	-	-	-	-	-	0.3	1.7	1.9	1.9	0.9	2.8m: Refusal on bedrock.
	TP31	2.8	-	-	-	-	-	-	-	0.3	2.1	0.8, then 2.5	2.5	0.3	-
	TP32	2.7	-	-	-	-	-	-	-	0.3	2.5	1.6	2.5	0.2	-
	TP33	1.7	-	-	-	-	-	-	-	0.3	-	1.4	1.4	0.3	-
B	TP12	1.9	0.8	-	-	0.8	-	-	-	-	1.8	-	1.9	0.1	0.8m: water seepage.1.9m: Refusal on bedrock
	TP13	3.6	1.4	-	0.4	-	-	1.4	1.7	-	2.6	3.3	3.3	0.3	3.6m: Refusal on bedrock.
	TP14	3.6	1.9	-	0.3	-	1.0, then 1.9	1.5	2.3	-	3.4	3.6	-	-	3.5m: Difficult to excavate beyond.
	TP15	4.0	3.0	-	0.2	-	3.0	-	3.4	-	>4.0	-	-	-	-
	TP16	4.1	3.1	-		1.3	-	3.1	3.4	-	4.0	-	4.0	4.1	4.1m: Refusal on bedrock.
	TP17	4.0	2.9	-		-	2.9	1.9	-	-	3.6	>4.0	-	-	2.5m: water seepage.
	TP18	3.5	2.5	-	0.2	1.1	-	2.5	2.9	-	>3.5	-	-	-	-
	TP19	3.6	2.4	-	0.2	-	2.4	0.9	2.6	-	3.6	-	-	-	3.6m: Difficult to excavate beyond.

Area	Hole	Final depth (mbgl)	Depth to Base of Made Ground (mbgl)	Depth to Base of: (mbgl)									Depth to Rockhead (mbgl)	Penetration (m)	Remarks
				Made Ground					Natural Soils						
				Made Ground Topsoil	Granular Made Ground	Ash & Clinker	Colliery Spoil	Red Shale	Relict Topsoil	Topsoil	Cohesive Residual Soil	Granular Residual Soil			
	TP20	2.8	0.9	-	0.2	-	0.9	-	-	-	2.4	-	2.4	0.4	2.8m: Refusal on bedrock.
	TP21	3.0	0.6	-	0.2	-	0.6	-	-	-	1.7	2.6	2.6	0.4	3.0m: Refusal on bedrock.
	TP22	1.0	0.6	0.2	-	0.6	-	-	-	-	>1.0	-	-	-	0.9m: cable, trial pit abandoned.
	TP23	1.9	1.9	0.3	-	-	1.9	-	-	-	3.3	-	3.3	0.3	3.3m water seepage. 3.6m: Refusal on bedrock.
	TP24	4.2	3.2	0.5	-	1.8	3.2	-	-	-	4.0	-	4.0	0.2	4.2m: Difficult to excavate.
	TP25	4.5	3.0	-	0.5	1.4	3.0	-	0.2	-	>4.5	-	-	-	-
	TP26	3.7	2.5	-	0.5	-	-	2.5	2.7	-	>3.7	-	-	-	Spalling of sidewalls during excavation
	TP27	3.4	2.0	-	0.8	-	1.2	2.0	-	-	>3.4	-	-	-	-
	TP28	3.3	2.5	-	0.4	-	2.5	2.2	-	-	>3.3	-	-	-	-
	TP29	3.1	2.3	-	0.3	-	-	2.3	2.5	-	>3.1	-	-	-	-
TP30	3.1	2.3	-	0.1	-	2.3	0.9	-	-	>3.1	-	-	-	-	
A	WS01	2.9	-	-	-	-	-	-	-	0.3	1.6	0.6	1.6	1.3	2.5m: Refusal on SPT.
	WS02	2.0	-	-	-	-	-	-	-	0.4	-	1.5	1.5	0.5	2.0m: Refusal on SPT.
	WS03	1.6	-	-	-	-	-	-	-	0.3	0.9	-	0.9	0.7	1.6m: Refusal of sample barrel on bedrock.
	WS04	2.1	0.3	0.3	-	-	-	-	-	-	1.4	-	1.4	0.7	2.0m: Refusal on SPT.
B	WS05	3.3	2.5	0.1	-	1.1	0.9	0.6, then 1.3	-	-	2.5	-	2.5	0.8	3.3m: Refusal on SPT.
	WS06	2.5	>2.5	-	0.1	0.6, then 1.6	0.9, then >2.5	-	-	-	-	-	-	-	2.5m: Refusal of sample barrel on made ground obstruction.
	WS07	4.5	3.7	-	0.2	1.4	0.8, then 3.7	2.0	3.9	-	-	-	3.9	0.6	4.5m: Hole collapsed back to 2.8m
	WS08	1.5	0.9	0.2	-	-	0.9	-	-	-	>1.5	-	-	-	-
	WS09	4.5	3.4	-	0.1	-	1.9, then 3.4	2.2	3.6	-	>4.5	-	-	-	-
	WS10	2.5	1.0	-	0.1	0.8	-	1.0	-	-	2.0	-	2.0	0.5	-

Area	Hole	Final depth (mbgl)	Depth to Base of Made Ground (mbgl)	Depth to Base of: (mbgl)									Depth to Rockhead (mbgl)	Penetration (m)	Remarks
				Made Ground					Natural Soils						
				Made Ground Topsoil	Granular Made Ground	Ash & Clinker	Colliery Spoil	Red Shale	Relict Topsoil	Topsoil	Cohesive Residual Soil	Granular Residual Soil			
	BH01	5.1	3.2	-	0.2	-	3.2	-	3.5	-	4.2	-	4.2	0.9	5.1m: Refusal on SPT. Monitoring well installed
	BH02	5.2	4.2	-	0.3	-	-	4.2	-	-	5.0	-	5.0	0.2	5.2m: Refusal on SPT. Monitoring well installed
	BH03	5.3	3.2	-	0.1	-	1.7	3.2	-	-	4.0	-	4.0	1.3	5.3m: Refusal on SPT. Monitoring well installed
	BH04	5.3	3.3	-	0.2	-	-	3.3	-	-	4.0	-	4.0	1.3	5.3m: Refusal on SPT. Monitoring well installed
	BH05	5.2	3.0	-	0.2	-	3.0	-	-	-	3.9	-	3.9	1.3	5.2m: Refusal on SPT. Monitoring well installed

Notes: Values in red indicate made ground of 2.0m or more in thickness, therefore piled foundations may be required dependant on final site levels.

9 CONTAMINATION (ANALYSIS)

9.1 General

- 9.1.1 Area A has been previously undeveloped throughout history. Furthermore, no significant made ground was encountered during the ground investigation. However, samples of topsoil have been recovered in order to confirm its suitability for re-use.
- 9.1.2 Area B has been formerly used as:
- Colliery Spoil heap/tip for the former Goldthorpe Colliery
 - Railway sidings
- 9.1.3 Former usage in Area B is likely to have given rise to some ground contamination. Furthermore, significant thicknesses of made ground were encountered in the exploratory locations during the ground investigation. Samples have also been recovered from the Made Ground Topsoil bund.
- 9.1.4 An assessment of potential contaminants associated with the former uses has been undertaken; see Section 6.2.
- 9.1.5 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.
- 9.1.6 Where available, Category 4 Screening Levels (C4SL) have also been referenced.
- 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.

Area	Type of sample	No. of samples	Determinands
A	Topsoil	7	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) & Asbestos ID Speciated Polycyclic Aromatic Hydrocarbons (PAH) Total Organic Carbon (TOC)
B	Red Shale	3	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) Calorific Value (CV) & Asbestos ID Water soluble sulphate, chloride, nitrate and magnesium Speciated PAH
		2	Total Phenols
		1	Leachable metals: arsenic, boron, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc Banded Total Petroleum Hydrocarbons (TPH)

Area	Type of sample	No. of samples	Determinands
B	Ash & Clinker	6	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) & Asbestos ID Calorific Value (CV) Leachable metals: arsenic, boron, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc Water soluble sulphate, chloride, nitrate and magnesium Speciated PAH & TOC
		4	Total Phenols
		3	Banded Total Petroleum Hydrocarbons (TPH)
		2	Total & Free Cyanide
	Colliery Spoil	6	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc)
		5	Calorific Value (CV) & Asbestos ID Water soluble sulphate, chloride, nitrate and magnesium Speciated PAH & TOC
		2	Total Phenols
		3	Banded TPH Total & Free Cyanide
	Granular Made Ground	4	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) & Asbestos ID Speciated PAH & TOC
	Made Ground Topsoil	5	
	Relict Topsoil	4	
	Macadam	3	

9.2.2 Account was taken of previous uses in Area B, with calorific value and organic analysis concentrated on samples recovered from the vicinity of former colliery spoil heap, and leachability analysis concentrated on samples recovered from Ash & Clinker deposits.

9.2.3 Difficulty in distinguishing between made ground types for a groundworker during earthworks in Area B will require Ash & Clinker and Colliery Spoil to be treated together as **Granular Made Ground**.

9.3 Soil contamination results

9.3.1 The soil contamination test results are summarised in the tables on pages 21 to 26.

9.3.2 Laboratory test certificates as received from the laboratory are presented in Appendix H to this report.

Summary of degree of soils contamination (Area A - topsoil)

Area	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	Zn \$	% TOC	PAH		Asbestos I.D.
																B(a)P ∞	Naphthalene	
					37	5	26	3000	200	200	169	127	350	200		4	4	
A	TP01	0.1	Topsoil	7.4	17	0.6	0.4	16	23	43	0.1	18	0.9	91	< 0.1	< 0.03	< 0.03	N.D.
	TP02	0.1	Topsoil	7.0	17	0.3	0.4	16	21	38	0.1	17	0.8	140	1.9	0.05	0.04	N.D.
	TP04	0.1	Topsoil	7.3	23	0.5	0.5	16	33	67	0.1	19	0.9	220	1.9	< 0.03	< 0.03	N.D.
	TP05	0.1	Topsoil	7.6	22	0.2	0.4	20	30	68	0.1	22	0.7	130	1.9	< 0.03	< 0.03	N.D.
	TP07	0.1	Topsoil	7.5	16	0.3	0.3	14	20	38	0.1	16	0.9	77	2.6	< 0.03	< 0.03	N.D.
	TP08	0.1	Topsoil	7.5	21	0.3	0.4	18	24	42	0.1	19	1.2	110	2.3	< 0.03	< 0.03	N.D.
	TP11	0.1	Topsoil	7.4	24	0.4	0.4	20	31	1,300	0.1	21	0.6	110	2.1	< 0.03	< 0.03	N.D.
	TP11 (A)	0.1	Topsoil	-	-	-	-	-	-	52	-	-	-	-	-	-	-	-
	TP11 (B)	0.1	Topsoil	-	-	-	-	-	-	61	-	-	-	-	-	-	-	-
	TP11 (C)	0.1	Topsoil	-	-	-	-	-	-	49	-	-	-	-	-	-	-	-

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.		
		N.D.	Not detected, applicable to asbestos I.D. screen only

Summary of degree of soils contamination (Inorganics)

Area	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	Zn\$	CV	Asbestos
					37	5	26	3000	200	200	169	127	350	200	2	
S/pile	STK01	-	Made Ground Topsoil	6.3	26	0.7	0.3	26	46	37	0.1	32	0.8	91	-	N.D.
	STK02	-	Made Ground Topsoil	5.9	58	1	0.1	23	55	31	< 0.1	32	1	54	-	N.D.
	STK03	-	Made Ground Topsoil	7.0	29	1.4	0.2	24	48	45	0.1	31	1	99	-	N.D.
A	TP09	0.3	Made Ground Topsoil	6.6	38	0.8	0.2	23	74	38	0.1	36	2.1	79	-	N.D.
B	TP22	0.1	Made Ground Topsoil	8.5	20	0.5	0.5	27	49	59	0.1	39	1.3	180	-	N.D.
	TP19	0.2	Granular Made Ground	7.7	8.7	1.4	0.3	34	87	34	< 0.1	43	0.7	92	-	N.D.
	TP20	0.1	Granular Made Ground	6.2	37	1.2	0.2	24	44	44	< 0.1	30	1.5	83	-	N.D.
	TP21	0.1	Granular Made Ground	7.1	21	1.1	0.2	24	44	33	< 0.1	27	1.2	58	-	N.D.
	TP13	0.3	Granular Made Ground	6.2	27	1	< 0.1	21	60	26	0.1	31	1.3	55	-	N.D.
	TP14	2.0	Relict Topsoil	7.0	21	1.4	0.4	28	28	38	0.01	28	1	120	-	N.D.
	TP15	3.1	Relict Topsoil	6.6	11	1.2	0.2	23	24	41	0.1	27	< 0.5	110	-	N.D.
	TP19	2.5	Relict Topsoil	7.1	13	1.9	0.2	24	26	48	0.1	22	< 0.5	97	-	N.D.
	TP25	3.1	Relict Topsoil	6.9	11	0.6	< 0.1	22	19	17	< 0.1	19	< 0.5	53	-	N.D.
	TP12	0.4	Ash & Clinker	6.2	73	0.9	< 0.1	18	160	13	< 0.1	36	1.7	22	6.1	N.D.
	TP16	0.4	Ash & Clinker	4.4	63	0.7	< 0.1	25	39	27	< 0.1	38	0.5	58	1.2	N.D.
	TP16	1.1	Ash & Clinker	4.2	65	0.9	< 0.1	16	77	24	< 0.1	21	1	30	12.4	N.D.
	TP18	0.7	Ash & Clinker	5.9	65	2	< 0.1	26	65	28	0.1	34	1.8	51	4.6	N.D.
	TP24	1.0	Ash & Clinker	6.9	45	1.6	0.5	46	93	58	0.2	52	1.5	130	5.3	N.D.
	TP25	0.7	Ash & Clinker	7.4	36	1.2	0.6	34	170	32	0.2	42	1	130	5.6	N.D.
	TP17	2.0	Colliery Spoil	6.9	26	1	< 0.1	26	39	27	< 0.1	39	< 0.5	83	< 1.0	N.D.
	TP20	0.6	Colliery Spoil	6.5	43	1.9	0.1	21	50	28	0.1	34	1.4	72	3	N.D.
	TP21	0.5	Colliery Spoil	5.9	31	2.7	0.3	22	110	77	0.4	47	1.6	120	9.4	N.D.
	TP23	0.9	Colliery Spoil	11.8	20	0.8	0.8	81	120	130	0.2	180	< 0.5	270	5.3	Amosite
	TP24	2.4	Colliery Spoil	4.6	120	2.8	< 0.1	11	82	28	0.2	19	3.3	35	18.3	N.D.
	WS08	0.5	Colliery Spoil	9.0	36	2.1	16	960	9,500	1,200	0.9	1,500	2.4	3,300	-	-

Area	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	Zn\$	CV	Asbestos
					37	5	26	3000	200	200	169	127	350	200	2	
B	TP13	0.6	Red Shale	7.0	220	0.5	< 0.1	13	61	10	< 0.1	21	< 0.5	16	< 1.0	N.D.
	TP14	0.8	Red Shale	6.3	24	1.4	0.6	22	56	23	0.1	44	0.9	100	1.7	N.D.
	TP17	0.9	Red Shale	7.4	21	0.7	0.3	29	28	26	< 0.1	50	0.9	100	< 1.0	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	N.D.	Not detected, applicable to asbestos I.D. screen only
♣	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.	\$	Ministry of Agriculture, Fisheries & Food. Code of Practice for Agricultural Practice for the Protection of Soil. 1998

Summary of the leachability testing (Area B)

Area	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 *	Zn ~
					10	1000	5	50	2000	10	1	20	10	-
B	TP12	0.4	Ash & Clinker	8.3	< 0.2	< 12	< 0.1	< 0.3	< 0.4	< 0.1	< 0.1	< 0.5	< 0.3	4.4
	TP13	0.6	Ash & Clinker	8.2	30	< 12	< 0.1	< 0.3	< 0.4	< 0.1	< 0.1	< 0.5	< 0.3	1.7
	TP16	0.4	Ash & Clinker	8.0	1.2	< 12	< 0.1	< 0.3	< 0.4	< 0.1	< 0.1	< 0.5	< 0.3	2.3
	TP16	1.1	Ash & Clinker	7.7	< 0.2	< 12	< 0.1	< 0.3	< 0.4	< 0.1	< 0.1	0.8	< 0.3	5.9
	TP18	0.7	Ash & Clinker	7.7	0.3	27	< 0.1	0.4	< 0.4	< 0.1	< 0.1	< 0.5	< 0.3	< 1.3
	TP24	1.0	Ash & Clinker	7.4	0.3	18	< 0.1	< 0.3	0.9	< 0.1	< 0.1	< 0.5	< 0.3	3.4
	TP25	0.7	Ash & Clinker	7.6	0.3	14	< 0.1	< 0.3	0.8	0.1	< 0.1	< 0.5	0.3	1.9

Key			Source of guidance trigger level	
36	Parameter tested for and 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)
0.3	Parameter tested for but not found to be in excess of Tier 1 concentration		*	Water Supply (Water Quality) Regulations 1989, as amended in 2000

Summary of degree of soils contamination (Organics)

Area	Expl Hole	Depth (m)	Material	Concentrations in mg/kg. 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 and 600mm cover end use						
				% TOC	Phenols	PAH		TPH - C6 to C40		
						B(a)P ∞	Naphthalene	GRO~ C ₆ to C ₁₀	DRO Δ C ₁₀ to C ₂₁	LRO C ₂₁ to C ₄₀
						25	7	34	156	5000
B	Tarmac sample	-	Macadam	-	-	0.1	< 0.1	-	-	-
	Tarmac sample	-	Macadam	-	-	0.1	< 0.1	-	-	-
	Tarmac sample	-	Macadam	-	-	< 0.1	< 0.1	-	-	-
S/pile	STK01	-	Made Ground Topsoil	3.6	-	< 0.1	< 0.1	-	-	-
	STK02	-	Made Ground Topsoil	3.0	-	< 0.1	< 0.1	-	-	-
	STK03	-	Made Ground Topsoil	2.8	-	0.1	< 0.1	-	-	-
A	TP09	0.3	Made Ground Topsoil	4.2	-	< 0.1	< 0.1	-	-	-
B	TP22	0.1	Made Ground Topsoil	2.5	-	< 0.1	< 0.1	-	-	-
	TP19	0.2	Granular Made Ground	0.3	-	< 0.1	< 0.1	-	-	-
	TP20	0.1	Granular Made Ground	2.8	-	< 0.1	< 0.1	-	-	-
	TP21	0.1	Granular Made Ground	5.5	-	< 0.1	< 0.1	-	-	-
	TP13	0.3	Granular Made Ground	6.8	-	< 0.1	0.1	-	-	-
	TP14	2.0	Relict Topsoil	1.4	-	< 0.1	< 0.1	-	-	-
	TP15	3.1	Relict Topsoil	2.7	-	< 0.1	< 0.1	-	-	-
	TP19	2.5	Relict Topsoil	2.7	-	< 0.1	< 0.1	-	-	-
	TP25	3.1	Relict Topsoil	0.4	-	< 0.1	< 0.1	-	-	-
	TP12	0.4	Ash & Clinker	4.8	< 0.3	< 0.1	< 0.1	< 0.1	< 10	< 10
	TP16	0.4	Ash & Clinker	2.8	< 0.3	< 0.1	< 0.1	-	-	-
	TP16	1.1	Ash & Clinker	2.0	-	< 0.1	< 0.1	< 0.1	< 10	< 10
	TP18	0.7	Ash & Clinker	6.9	-	< 0.1	< 0.1	< 0.1	< 10	< 10
	TP24	1.0	Ash & Clinker	6.1	0.5	< 0.1	0.1	-	-	-
	TP25	0.7	Ash & Clinker	3.3	0.4	0.1	< 0.1	-	-	-
	TP15	0.8	Colliery Spoil	-	-	-	-	-	-	-

Area	Expl Hole	Depth (m)	Material	Concentrations in mg/kg. 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 and 600mm cover end use						
				% TOC	Phenols	PAH		TPH - C6 to C40		
						B(a)P ∞	Naphthalene	GRO~ C ₆ to C ₁₀	DRO◇ C ₁₀ to C ₂₁	LRO C ₂₁ to C ₄₀
					2,400	25	7	34	156	5000
B	TP17	2.0	Colliery Spoil	0.5	-	< 0.1	< 0.1	-	-	-
	TP19	0.8	Colliery Spoil	-	-	-	-	-	-	-
	TP20	0.6	Colliery Spoil	4.7	0.5	< 0.1	0.1	< 0.1	< 10	< 10
	TP21	0.5	Colliery Spoil	13	-	< 0.1	< 0.1	< 0.1	< 10	15
	TP23	0.9	Colliery Spoil	3.2	< 0.3	0.1	0.1	< 0.1	< 10	61
	TP24	2.4	Colliery Spoil	> 15	-	< 0.1	0.1	-	-	-
	WS08	0.5	Colliery Spoil	-	-	-	-	-	-	-
	TP13	0.6	Red Shale	0.7	-	< 0.1	< 0.1	< 0.1	< 10	< 10
	TP14	0.8	Red Shale	4.1	1	< 0.1	< 0.1	-	-	-
	TP17	0.9	Red Shale	0.2	< 0.3	< 0.1	< 0.1	-	-	-

Key		Source of guidance trigger level	
60	Parameter tested for and in excess of Tier 1 concentration.	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).	
0.3	Parameter tested for but not in excess of Tier 1 concentration.	~	Assumes all GRO is aromatic fraction C7 to C8.
	Contaminant not tested for.	◇	Assumes all DRO is aliphatic fraction C10 to C12.
		∞	Category 4 Screening Level – SP1010, December 2013 (CL:AIRE/Defra).

Inorganic determinands

- 9.3.3 Samples of made ground and natural ground 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 the proposed end-uses).

Area A (Topsoil)

- 9.3.4 Of the 7 samples of natural topsoil analysed for inorganic parameters, 5 can be classified as uncontaminated and 2 could be classified as potentially contaminated.
- 9.3.5 The most common contaminants are lead (TP11) and zinc (TP04). The elevated concentration of Zinc is only a slight exceedance (220) of the Tier 1 screening value (200) and is not considered significant.
- 9.3.6 The Lead result is significantly elevated (1,200 mg/kg) above the Tier 1 screening value (200). Consequently, 3 sub-samples have been taken from the original sample to see if the elevated concentration is representative of the sample. The results of the sub-samples have provided lead concentrations between 49 and 61 mg/kg. The original elevated concentration can be attributed to a piece of foreign matter within the laboratory sub-sample and not considered representative of the original sample or topsoil in Area A.

Area B

- 9.3.7 Of the 3 samples of Made Ground **Topsoil** from the **stockpile**, one yielded an elevated concentration of arsenic.
- 9.3.8 Two samples of "in-situ" Made Ground Topsoil were also tested and both were essentially clean, although this topsoil is considered to be of poor quality.
- 9.3.9 Of the 4 samples of **Relict Topsoil** analysed for inorganic parameters, all 4 can be classified as uncontaminated.
- 9.3.10 Of the 19 samples of Granular Made Ground, Ash & Clinker, Red Shale and Colliery Spoil analysed for inorganic parameters, 11 can be classified as contaminated.
- 9.3.11 The most common contaminants are arsenic (8 samples), nickel (2 samples), zinc (2 samples), copper (1 sample) and lead (1 sample). One sample (WS08, 0.5m) returned significantly elevated concentrations of several metals (>5 times above the Tier 1 screening values).

Asbestos

- 9.3.12 No Asbestos fibres were identified in any 7 of the topsoil samples screened within Area A.
- 9.3.13 Screening for asbestos identified amosite fibres in 1 of the 34 samples tested within Area B (Colliery Spoil from TP23 @0.9m).
- 9.3.14 Supplementary analysis (asbestos quantification) of this sample has been undertaken and confirmed an amount of 0.003%.

Cyanide

- 9.3.15 Inorganic 'free' cyanide is typically found in compounds with elements such as hydrogen, calcium and potassium. Inorganic cyanide can also be bound into 'complex' compounds such as ferric ferrocyanide, a less toxic form of cyanide, often associated with gas works sites. Organic cyanide is found in nitrile compounds.

- 9.3.16 Laboratory analysis is generally for 'free' or total cyanide (total includes free and complex inorganic compounds). Lithos typically test for total and compare this result against the Screening Value calculated for 'free' cyanide (150mg/kg). As 'free' inorganic cyanide is the more toxic form, this approach provides a conservative assessment.
- 9.3.17 Concentrations of total Cyanide above the limit of detection (LOD) of 0.1mg/kg were recorded in 3 out of 5 samples of Granular Made Ground from Area B.
- 9.3.18 One sample (WS08) recorded a concentration of 11mg/kg.
- 9.3.19 Concentrations of free Cyanide were all below the LOD of 0.1mg/kg.

Calorific value

- 9.3.20 The calorific value of 14 samples of Ash & Clinker and Colliery Spoil, have yielded an average CV of 5.1 MJ/kg (Ash & Clinker) and 5.6MJ/kg (Colliery Spoil).
- 9.3.21 Materials whose CVs exceed 10MJ/kg are almost certainly combustible, while those with values below 2MJ/kg are unlikely to burn. Whilst 5 samples yielded results below 2MJ/kg, maximum values recorded were 12.4MJ/kg (Ash & Clinker) and 18.3MJ/kg (Colliery Spoil).

Leachables

- 9.3.22 Of the leachability tests conducted on 7 samples of Ash & Clinker, one yielded concentrations of a leachable contaminant (arsenic) above the maximum permissible concentrations as defined in the Water Supply (Water Quality) Regulations 1989, as amended in 2000.
- 9.3.23 However, made ground at the site is underlain by low permeable cohesive residual soils so there is no plausible pathway for such contaminants to enter groundwater and therefore the result is not considered significant.

Organic determinands

Area A

- 9.3.24 Area A is essentially greenfield and 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).
- 9.3.25 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.
- 9.3.26 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.
- 9.3.27 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.

Strata	Typical TOC (%)	Revised Screening Values		Comparison of soil results with revised screening value necessary?
		Benzo[a]pyrene	Naphthalene	
Topsoil	1.8	4	4	Yes, revised screening values adopted

Area B

- 9.3.28 Area B is brownfield and underlain by made ground which has yielded elevated concentrations of a number of inorganic determinands. Consequently, for organic compounds, the Tier 1 Soil Screening Values used in this report have been derived with reference to a CSM that assumes a minimum 600mm of clean soil cover will be placed in gardens/landscaped areas (Lithos Scenario B).
- 9.3.29 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.
- 9.3.30 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.
- 9.3.31 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.

Strata	Typical TOC (%)	Revised Screening Values		Comparison of soil results with revised screening value necessary?
		Benzo[a]pyrene	Naphthalene	
Made Ground Topsoil	3.5	25	7	No
Ash & Clinker	3.1	25	7	
Colliery Spoil	4.2	25	7	
Relict Topsoil	1.8	25	7	Yes, revised screening values adopted

Hydrocarbons (TPH & PAH)

- 9.3.32 Given the absence of visual/olfactory evidence of any hydrocarbon contamination, only a simple banded TPH (cf full speciation) was initially scheduled on 7 samples of Collier Spoil and Ash & Clinker.
- 9.3.33 Assessment of TPH would normally be undertaken in accordance with a 3-step approach, (outlined in Generic Note 04 in Appendix A) on fully speciated TPH results. However, although only banded TPH analysis has been scheduled here, none of the fractions exceed their respective Tier 1 criteria, even if it is conservatively assumed all of each fraction is either aliphatic or aromatic.
- 9.3.34 Consequently, no significant petroleum hydrocarbon concentrations have been identified, and there is no risk to human health from these hydrocarbons.

Polycyclic Aromatic Hydrocarbons (PAH)

- 9.3.35 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.
- 9.3.36 The analytical data for this site has been compared against Tier 1 screening values for the most problematic (16 USEPA) PAHs. All concentrations are below Tier 1 screening values, therefore whilst a range of PAHs may be present, these are not considered to pose a risk to health.
- 9.3.37 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).

- 9.3.38 Speciated analysis has confirmed the absence of significant concentrations of both benzo(a)pyrene and naphthalene in the soils beneath Area A & B.

10 CONTAMINATION (QUALITATIVE RISK ASSESSMENT & REMEDIATION)

10.1 Topsoil

Area A

- 10.1.1 Topsoil, typically 300mm thick is present across the entire area. Testing suggests this material is chemically suitable for re-use. Given the nature of the topsoil present on this site it would be expected to be suitable to support plant growth.

Area B

- 10.1.2 Made Ground Topsoil, between 0.2m and 0.5m thick is present in the far south and west of Area B. Whilst testing has only shown this topsoil to be essentially clean, it is considered to be of poor quality and contains a significant proportion of anthropogenic material (brick, coal, mudstone and clinker etc.). Furthermore, the Topsoil is immediately underlain by made ground with segregation likely to prove difficult. Consequently, Made Ground Topsoil should be considered unsuitable for re-use.

Stockpiled Made Ground Topsoil

- 10.1.3 Stockpiled Made Ground Topsoil in the south-east of Area B might be suitable for re-use, but further testing would be required.

10.2 Summary of significant contamination

- 10.2.1 No contamination was identified in Area A.
- 10.2.2 Made Ground underlies the majority of Area B, which is typically between 0.5m and 3.5m thick and predominantly comprises Ash & Clinker and Colliery Spoil; some Red Shale was also encountered.
- 10.2.3 This made ground has yielded elevated concentrations of a number of inorganic determinands and contains materials (e.g. arsenic, lead, copper, nickel and zinc), which would generally be considered undesirable as a near-surface material in garden areas.
- 10.2.4 Furthermore, one sample of made ground contained bundles of Amosite fibres and the average calorific values of Ash & Clinker and Colliery Spoil were 5.1MJ/kg and 5.6MJ/kg suggesting that the made ground is potentially combustible.
- 10.2.5 A low concentration (11mg/kg) of cyanide was recorded within WS08 associated with brightly coloured material. At the concentration reported to date, cyanide is not a significant contaminant, but dark blue, fine gravel sized fragments of a platy mineral were noted on the exploratory hole log for WS08, and this might suggest the presence of localised areas of more significant contamination than has been encountered to date. A watching brief and further testing during the anticipated turnover works (see Section 13.3) would be prudent.

10.3 Revised conceptual ground model (contamination)

- 10.3.1 The Preliminary Conceptual Site Model has been amended in light of data obtained during the ground investigation, most notably with respect to the distribution of made ground and contaminants.
- 10.3.2 A revised Conceptual Site Model is presented as Drawing 1750/7 in Appendix B. The Model includes the contaminants described in Section 10.1.2 above, and potential pollutant linkages (summarised below in Section 10.3) to receptors.

10.4 Environmental setting & end use

- 10.4.1 As discussed in Section 10.2 above, contamination exists in the soil beneath Area B. 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 bedrock is classified as a Secondary A aquifer however overlying Residual soils are cohesive and have a low permeability. The nearest surface watercourse is the Open Beck, which flows in a southerly direction, approximately 180m beyond the site's southern boundary. Therefore, the site's environmental setting is considered to be of low sensitivity and not a receptor.
- 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 Pollutant linkages

- 10.5.1 In terms of a proposed redevelopment of this site, plausible pollutant 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

Receptors

- 10.5.4 Potential contaminant receptors include:
- 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 10.1.2 above and potential receptors (end users). 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.

Combustibility

- 10.6.2 The Ash & Clinker and Colliery Spoil are considered potentially 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.
- 10.6.3 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

- 10.6.4 CL:AIRE has published a Joint Industry Working Group (JIWG) guidance¹ 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.
- 10.6.5 As discussed in Section 9.3, an asbestos ID (screen) was scheduled on 34 samples of made ground, with asbestos identified in one sample. Supplementary analysis (asbestos quantification) of that sample yielded a result of 0.003%.
- 10.6.6 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).

¹ Control of Asbestos Regulations 2012: Interpretation for Managing and Working with Asbestos in Soil and Construction & Demolition materials: Industry Guidance

- 10.6.7 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.
- 10.6.8 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%).
- 10.6.9 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'.
- 10.6.10 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.
- 10.6.11 Made ground where asbestos has been positively identified and considered representative of near-surface soils, should ultimately be isolated beneath a 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. The suggested 1,000mm cover of "clean soil" for the potentially combustible made ground is likely to be sufficient.
- 10.6.12 New utilities should be laid in trenches reinstated with 'clean' backfill in order to prevent exposure to maintenance workers in the future.
- 10.6.13 See also comments in the 'Waste Classification' Section below.

Made Ground Topsoil

- 10.6.14 Given the compressible nature and gas-generating potential of Made Ground Topsoil (encountered locally in the south/east of Area B), if buried at depth, it is recommended that it is placed in garden areas and/or POS, immediately beneath the proposed 1,000mm cover, and that it is overlain by no more than 1.5m of soil.

Other contaminants

- 10.6.15 The proposed 1,000mm cover in garden areas will suffice to mitigate risks associated with other contaminants (most notably arsenic) encountered in made ground.

10.7 Summary of potential pollutant linkages & mitigation

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

Receptors	Pathways	Contaminants	Plausible pollutant linkage? (and remediation options where required)
Human health (Future residents) ♦	Consumption of contaminated vegetables	Metals in the made ground	Yes, Isolation beneath at least 1000mm clean soil cover in garden and landscaped areas
	Ingestion		
	Dermal contact		
	Inhalation (dust and/or vapours)	Asbestos	
	Combustion	Combustible material in made ground	
Buildings	Migration & accumulation of explosive gas	Methane & carbon dioxide	To be assessed on completion of monitoring and gas risk assessment

♦ 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

Area A

10.8.1 Some excess arisings (topsoil & subsoil) may be generated by excavations for foundations, sewers etc. If these are intended for retention and reuse on the site, they would be classed as clean naturally occurring soils and would not be considered waste, under the Waste Framework Directive.

10.8.2 Off-site disposal of surplus clean naturally occurring soils to landfill is not recommended. In accordance with the CL:AIRE Code of Practice² any excess natural soil arisings should be suitable for Direct Transfer to another development site, for use either as clean cover material, or bulk fill for use, without the need for waste legislation to be applied.

Area B

10.8.3 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.

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

10.8.5 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 WM3³. 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.

² The Definition of Waste: Development Industry Code of Practice. CL:AIRE, 2011.

³ Technical Guidance WM3 – Guidance on the classification and assessment of waste. Environment Agency 2015

- 10.8.6 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.
- 10.8.7 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.
- 10.8.8 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 site), to ensure that the waste is handled and disposed of appropriately.
- 10.8.9 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 9 but will often need supplementing with further testing after soils have been stockpiled (see also advice in Section 14.3).
- 10.8.10 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.
- 10.8.11 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%).
- 10.8.12 As discussed in Section 8.2, tarmac hardstand is present in Area B adjacent to the roundabout.
- 10.8.13 This tarmac could be recycled and crushed to yield a 6F3 selected granular material, provided the recovered bitumen content is less than 10% (determined in accordance with BS598-1:2011). Crushed tarmac could also be blended with crushed concrete etc to generate 6F2 graded material. 6F2 can contain up to 50% recycled tarmac/asphalt (provided it does not pose a contamination risk to controlled waters and, if the proportion of asphalt is greater than 20%, the recovered bitumen content is less than 2%).
- 10.8.14 However, if off-site disposal is anticipated, tarmac assessment is based on the amount of coal tar present, this will vary depending on the age of the tarmac. The assessment is based on the amount of benzo(a)pyrene and has a concentration limit of 50mg/kg.
- 10.8.15 Tarmac is likely to fall within waste code 17 03 02:
- 17 - Construction and Demolition wastes,
 - 03 – bituminous mixtures, coal tar and tarred products
 - 02 – bituminous mixtures other than those mentioned in 17 03 01

- 10.8.16 This is a mirror non-hazardous entry. This code along with this supporting report, in particular the laboratory results, should be used to complete a paper trail documenting disposal routes for tarmac.
- 10.8.17 Contractors exporting waste from the site should review the site investigation data and make their own assessment. Alternatively, Lithos could undertake this assessment once exported waste streams have been identified.

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	Very Low: made ground essentially inert, with little degradable matter
	Buildings	Explosion		
Deep mineworkings (c. 45m bgl)	Human health	Asphyxiation & explosion	Vertical migration, ingress & accumulation	Very Low: 1m to 2m thickness of low permeability drift and shallow mineworkings unlikely to be beneath the site.
	Buildings	Explosion		

- 11.1.2 Given the above gas monitoring wells were installed in 10 boreholes (WSs 01 to 10) across the site. Details of the installations are given on the window sample borehole logs presented in Appendix G to this the report.
- 11.1.3 The generation potential of the gas source was initially considered to be Very Low. Consequently, in accordance with CIRIA Report C665, given the proposed residential end use, 6 visits over a 3-month period have been completed.

11.2 Discussion

- 11.2.1 A hazardous gas risk assessment incorporating all of the results and outline the gas protection measures required was issued in July 2019 (Letter ref:023/1750/LIZ/at).
- 11.2.2 The gas monitoring results are presented in Appendix K and are summarised below.

Monitoring well	Response zone	Range of methane concentrations (% v/v)	Range of carbon dioxide concentrations (% v/v)	Range of steady flow rates (litre/hour)
Area A				
WS01	1.5m to 2.5m (coal measures)	N.D	0.3 to 1.6	N.D
WS02	0.5m to 1.5m (granular residual soil)		0.5 to 2.2	
WS03	0.5m to 1.6m (cohesive residual soil & coal measures)		0.5 to 0.9	
WS04	1.0m to 2.0m (cohesive residual soil & coal measures)		0.2 to 1.5	

Area B				
WS05	0.5m to 1.3m (colliery spoil & ash & clinker)	N.D	0.7 to 3.5	N.D
WS06	1.0m to 2.5m (colliery spoil & ash & clinker)		0.0 to 3.1	
WS07	0.8m to 2.8m (colliery spoil & ash & clinker)		0.6*	
WS08	0.5m to 1.0m (colliery spoil)		0.7 to 2.5	
WS09	1.0m to 2.7m (colliery spoil)		0.0 to 1.8	
WS10	0.5m to 1.0m (colliery spoil)		0.3 to 0.9	

Note: Atmospheric pressures varied between 989mb and 1017mb. * Well destroyed after first visit

- 11.2.3 The proposed development comprises low rise residential housing. Consequently, the gas regime has been characterized in accordance with the Situation B (traffic light) methodology outlined in CIRIA Report C665.
- 11.2.4 In accordance with the DETR approach, a default value of 0.1 litres/hour has been used in the absence of any recorded sustained flows; i.e. the limit of detection of the flow rate equipment.
- 11.2.5 During 3 of the 6 monitoring visits, atmospheric pressure was falling. Plots of atmospheric pressure versus time, with the monitoring visits indicated, are appended to this letter report.

Current gas regime

- 11.2.6 Based on worst-case (peak) gas concentrations and steady flows, Gas Screening Values (GSVs) for methane and carbon dioxide are both 0.0. This GSV equates to a Green gas regime (traffic light) for this site.
- 11.2.7 Where Green, Lithos also consider the site in accordance with Situation A methodology (which does not assume a ventilated sub-floor) to check whether or not it lies within Characteristic Situation 1 (in which case no measures would be appropriate), or Characteristic Situation 2 (in which case a ventilated sub-floor void and membrane should be required).
- 11.2.8 The gas regime for this site is connected to the ground conditions and as such, the gas regime can be considered separately for Area A and Area B.

Area A

- 11.2.9 No elevations of methane or carbon dioxide were recorded, and no ground gas flows detected. The area is directly underlain by natural strata.
- 11.2.10 Area A can be classed as Green / Characteristic Situation 1.

Area B

- 11.2.11 No elevations of methane were recorded, low concentrations of carbon dioxide (max 3.5%v/v) were detected, but no concentration exceeded the Amber 1 lower threshold (5%). No sustained ground gas flows were detected.

11.2.12 The area is underlain by up to 3.7m of made ground and logs indicate made ground is directly underlain by relict topsoil. Relict topsoil typically has a high organic content and can produce low concentrations of carbon dioxide. Whilst neither the made ground, relict topsoil, or potential for shallow mine workings in the area present a significant gas risk, increased protection is recommended.

11.2.13 Area B can be classed as Green / Characteristic Situation 2.

Scope of protection measures

11.2.14 Based on the site characterisation discussed above, Lithos consider that the following protective measures should be incorporated in all new dwellings:

Traffic light classificn and “score” req’d by BS8485#	Floor slab (BS8485 “score”)	Protective measures	
		Sub-floor ventilation (BS8485 “score”)	Membrane
			Type (BS8485 “score”)
Area A			
Green & CS1 (Wilson & Card) 0	Well constructed ground-bearing or suspended	Not required for ground bearing slab, otherwise to comply with Building Regulations (Part C).	Waterproof DPM
Area B			
Green & CS2 (Wilson & Card) 2.5*	Select one from: i. Block & Beam – (0). ii. Reinforced ground bearing slab – (0.5). iii. Reinforced, cast in-situ suspended slab (with minimal and suitably sealed service penetrations & joints) – (1.5). iv. 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).	Select one from: Passive sub-floor ventilation; venting layer could be: i. A min. 150mm clear void (2.5), or ii. A proprietary void former providing an equivalent clear void depth of 60mm; see Section B7 in BS8485 (2.5), or iii. Min. 300mm thick blanket of min. 20mm single size gravel (1.0). Min. ventilation = 1,500 mm ² /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.	Waterproof DPM (2000 gauge polyethylene). Lapped & sealed in accordance with BR 414. (0)

Footnotes:

Scores are broadly based on those outlined in BS8485:2015+A1:2019 (for Characteristic Situations 2 & 3, and Building Type A).

* Modified from BS8485:2015+A1:2019 by Lithos. Monitoring data has also been reviewed using Wilson & Card methodology and found to be Characteristic Situation 2; consequently a lapped/sealed membrane & ventilation are recommended.

1. A combination of two or more of the three types of protection measures (slab, ventilation & membrane) should be used to achieve the BS8485 score.
2. The membrane should always be lapped and sealed in accordance with BRE\Environment Agency Report BR 414 (2001) – "Protective Measures for housing on gas-contaminated land". The membrane should be **continuous** across internal walls & the cavity, and there should be a **cavity tray** in external walls.
3. In all cases there should be minimum penetration of floor slab by **services**; any penetrations should be suitably sealed.
4. Integral **garages** with occupied rooms above, or direct access through a doorway from the garage to the house, should be provided with the same protective measures as the rest of the dwelling. Buildings with basement car parks (with ventilation in accordance with Building Regulations) may not require gas resistant membranes.

11.2.15 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.

11.3 Radon

- 11.3.1 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.
- 11.3.2 At present Approved Document C advocates basic measures for the probability banding 3% to 10% (full measures if >10%). However, Public Health England would like to see all new build include basic measures.
- 11.3.3 The Public Health England UK radon map and the Landmark report indicate that the site is in an area where between 1% and 3% of homes are estimated to be above the action level.
- 11.3.4 Consequently, basic radon protection measures are not required. However, in light of Public Health England advice, the Developer might consider providing all new dwellings with basic radon protection measures.

12 GEOTECHNICAL TESTING

12.1 General

- 12.1.1 A total of 27 samples of natural soil from were delivered to a suitably accredited laboratory with a schedule of geotechnical testing drawn up by Lithos (21 initially, then a further 6 from the supplementary investigation).
- 12.1.2 The geotechnical laboratory test results are presented in Appendix I to this report.

12.2 Atterberg limits

- 12.2.1 The plasticity indices of 10 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 Soil (trial pitting)	14	15 to 26 (22)	21 to 29 (25)	Medium
Weathered Coal Measures – mudstone	2	12 to 16 (14)	18.1 to 19.7 (18.9)	Low

* 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 Although weathered mudstone bedrock falls in the low shrinkability range, for the purposes of foundation design, it is recommended that cohesive residual soils be regarded as being of medium shrinkability.
- 12.2.3 One sample (TP06, 0.9m) was recorded as non-plastic.

12.3 Particle size distribution

12.3.1 The grading of 4 samples of Colliery Spoil and 2 samples of Ash & Clinker has been determined by wet sieving and the results are summarised in the table below:

Sample & depth	Field description	% passing 37.5mm sieve	% passing 20mm sieve	% passing 2mm sieve	% fines	Material description (based on grading & plasticity)
TP12, 0.60m	Very gravelly SAND	93	79	33	10	Very sandy clayey GRAVEL
TP13, 1.20m	Very gravelly SAND	100	72	18	6	Sandy clayey GRAVEL
TP15, 1.30m	Very sandy GRAVEL	100	83	45	14	Very sandy clayey GRAVEL
TP18, 1.60m	Sandy GRAVEL	100	75	28	12	Sandy clayey GRAVEL
TP19, 1.60m	Sandy GRAVEL	90	66	20	14	Clayey sandy GRAVEL
TP23, 1.20m	Very gravelly SAND	95	85	55	27	Very sandy very clayey GRAVEL

12.3.2 Fines (silt and clay) were found to comprise between 6% and 27% (average 14%) of the material sampled. NHBC Chapter 4.2 considers shrinkable soils to be those containing more than 35% fines and having a Modified Plasticity Index greater than 10%. The granular made ground encountered on this site can therefore be regarded as non-shrinkable.

12.4 Soluble sulphate and pH

12.4.1 In accordance with BRE Special Digest 1:2005, this site has been classified as brownfield with a mobile groundwater regime.

12.4.2 It is envisaged foundations will extend to depths of about 1m through natural ground in Area A and to depths of about 3m to 4m through made ground and natural strata in Area B. Samples taken from this depth range have been submitted for pH and water-soluble sulphate (2:1 soil/water extract).

12.4.3 The concentrations of sulphate in the aqueous natural soil extracts of 17 samples were determined. In addition, 14 samples of made ground were tested as part of the contamination suite. The pH value of each sample has also been determined.

12.4.4 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	6	4.2	660
Colliery Spoil	6	4.6	980
Red Shale	6	5.5	1,100
Cohesive Residual Soil	11	5.8	1,300
Granular Residual Soil	5	5.2	92
Weathered Coal Measures	5	5.5	130

12.4.5 Two samples of Ash & Clinker and one sample of Colliery Spoil yielded pH values below 5.5. Consequently, equivalent sulphate concentrations were calculated from concentrations of magnesium, chloride and nitrate. The samples yielded chloride and nitrate concentrations below 10mg/l and magnesium concentrations below 25mg/l and consequently equivalent sulphate concentrations are negligible.

- 12.4.6 Given that Colliery Spoil is present at the site, total sulphur and sulphides concentrations were added to the suite of testing for made ground. Sulphide concentrations ranged between <10mg/l and 120mg/l. Total sulphur concentrations ranged from 0.05% and 0.65%.
- 12.4.7 One sample of Granular Residual yielded a pH value below 5.5, therefore supplementary analysis to determine the concentrations of magnesium, chloride and nitrate was scheduled. The sample yielded magnesium, chloride and nitrate results of less than 10mg/l, and consequently the equivalent sulphate concentrations are negligible.
- 12.4.8 In accordance with Tables C1 and C2 of SD1, sub-surface concrete should be Design Sulphate Class DS-2, with the site allocated an ACEC Classification of AC-5z.

12.5 Compaction tests

- 12.5.1 Laboratory compaction tests are useful wherever ground improvement is anticipated, for example to provide a satisfactory CBR beneath proposed highways.
- 12.5.2 In accordance with BS5930:2015 engineered fill is defined as material which is selected, placed and compacted to an appropriate specification so that it will exhibit the required engineering behaviour.
- 12.5.3 Grading and moisture content control the degree to which materials can be effectively compacted. If the grading or moisture content of an in-situ material is not suitable to facilitate its compaction then screening, wetting, or lime addition may be required.
- 12.5.4 Laboratory compaction testing was scheduled on 6 samples of granular made ground (using a 2.5kg rammer) to determine their suitability for re-engineering.
- 12.5.5 Laboratory compaction tests are only appropriate if:
- At least 90% of the material passes the 37.5mm sieve; and/or
 - At least 70% of the material passes the 20mm sieve
- 12.5.6 It is apparent from the gradings tabulated above, that 5 out of the 6 samples scheduled for compaction tests are suitable (i.e. at least 70% of the material is finer than 20mm).
- 12.5.7 If particle sizes are only slightly in excess of the above limits, compaction tests can be useful in order to indicate target densities, but the results should be treated with caution and used for guidance only. However, if a particular material type is significantly coarser than the above limits allow, the results of laboratory compaction testing would be meaningless and a field trial would be necessary.
- 12.5.8 The material particle density (Gs) is required in order to plot the 0, 5 and 10% air voids lines on the compaction graph for each material type.
- 12.5.9 The grading results are summarised in Section 12.3.

Sample location & depth	Material description	Gs (Mg/m ³)	MDD (Mg/m ³)	OMC (%)	Allowable mc range for 95% MDD & <5% air voids	Typical in-situ moisture content (%)
TP12, 0.6m	Very sandy clayey GRAVEL (Ash & Clinker)	2.2	1.13	40	39 to 44.25	18.8
TP13, 1.2m	Sandy clayey GRAVEL (Ash & Clinker)	2.2	1.46	30	28.25 to 33.5	
TP15, 1.3m	Very sandy clayey GRAVEL (Colliery Spoil)	2.2	1.21	34	33.5 to 37.25	15.4

Sample location & depth	Material description	G _s (Mg/m ³)	MDD (Mg/m ³)	OMC (%)	Allowable mc range for 95% MDD & <5% air voids	Typical in-situ moisture content (%)
TP18, 1.6m	Sandy clayey GRAVEL (Colliery Spoil)	2.65	1.67	20	19.5 to 24	
TP19, 1.6m	Clayey sandy GRAVEL (Colliery Spoil)	2.65	1.93	13	12 to 16.5	
TP23, 1.2m	Very sandy very clayey GRAVEL (Colliery Spoil)	2.25	1.29	31	29.5 to 34.5	

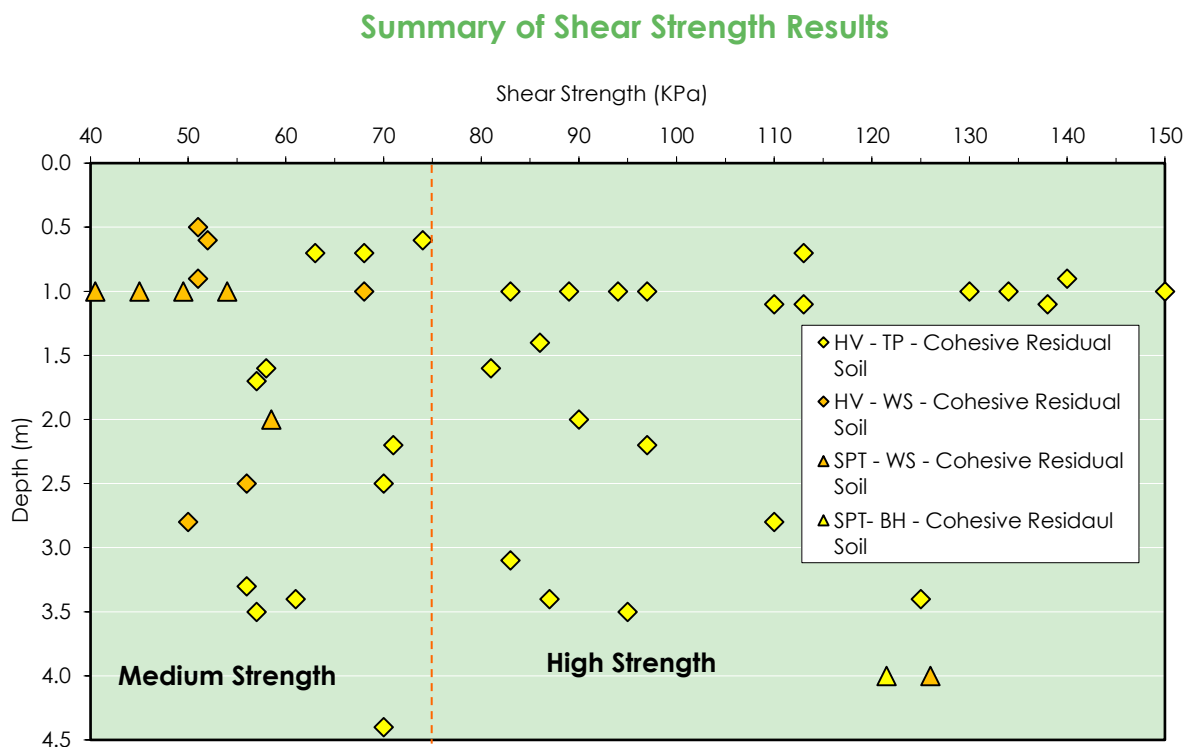
- 12.5.10 It is apparent that the in-situ moisture content of the Ash & Clinker and Colliery Spoil is lower than the allowable moisture content range to achieve 95% MDD. Consequently, wetting of the Ash & Clinker and Colliery Spoil may be advisable during any proposed earthworks.

12.6 Expansion (Emery) testing

- 12.6.1 The Colliery Spoil contained some **slag**, as gravel and occasional cobble.
- 12.6.2 One sample was sent to PSL to determine expansion potential of the slag via the Emery Expansion test. The testing period took 7 hours and within that time 21mm of movement was recorded, suggesting potential for expansion. Further advice could be sought from BRE in Garston.
- 12.6.3 It would be prudent to segregate\remove of expansive slag from made ground during the proposed turnover of made ground (see Section 13.3) where it occurs in larger pockets\bands (cf isolated cobbles).
- 12.6.4 **Red Shale** was also encountered both Colliery Spoil and Ash & Clinker. Whilst Red Shale itself is not expansive, where it contains high concentrations of leachable sulphate, it may cause other material (e.g. concrete) to degrade and expand. Consequently, if Red Shale is mixed with material that is vulnerable to sulphate attack (e.g. crushed concrete), then the whole fill may be deemed expansive.
- 12.6.5 If Red Shale is to be used for structural fill then the mechanical properties should be checked first (there may be problems with achieving a satisfactory maximum air voids etc).
- 12.6.6 NHBC do not recommend the use of Red Shale below houses. This appears to be due to the risks of sulphate attack on concrete/mortar.
- 12.6.7 Highways Authorities may question of Red Shale but have accepted its use on some sites.

12.7 Undrained shear strength testing

- 12.7.1 Hand shear vane testing was undertaken within trial pits in-situ to around 1m depth and from larger blocks of excavated clay below that depth.
- 12.7.2 The results are summarised within the plot below and do not typically illustrate a clear pattern. The SPT and shear vane results in the window samples are less reliable than shear vanes undertaken in-situ within trial pit walls. Below approximately 1m depth S_u is typically greater than 55kPa.
- 12.7.3 The plot below provides a summary of undrained shear strengths



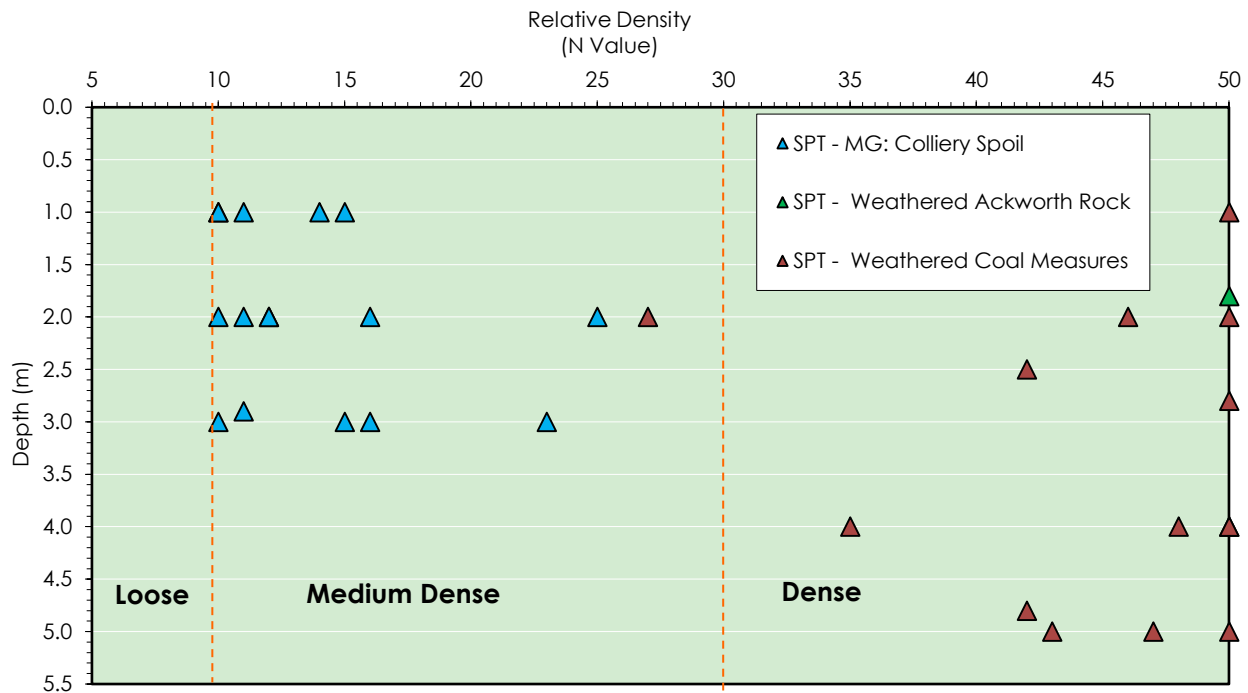
12.8 Standard penetration test (SPT)

- 12.8.1 The in-situ relative density of weathered bedrock was established by carrying out Standard Penetration Tests (SPTs) during the drilling of the cable percussion boreholes.
- 12.8.2 The SPT results are summarised in the table below and plot on page 44.

Stratum	Ave. SPT 'N' value	Estimated strength or density	Remarks
Made Ground: Colliery Spoil, Red Shale etc.	14	Medium dense	Results between 11 and 26
Weathered Ackworth Rock	>50	Very Dense	Refused on bedrock
Weathered Coal Measures	42	Dense	Results between 27 and 48 Six results refused on bedrock.

- 12.8.3 The reported blow count suggests the made ground is medium dense.
- 12.8.4 The reported blow counts suggest the densities ranging from medium dense to very dense for weathered Coal Measures and weathered Ackworth Rock. Seven tests refused on bedrock between 1.8m and 2.5m (Area A) and at 5m (Area B).

Summary of SPT Results



- 12.8.5 The above results confirm observations made during the trial pitting, that the weathered bedrock is at least medium dense.

13 GEOTECHNICAL ISSUES

13.1 Conceptual site model

- 13.1.1 A revised conceptual site model is present as Drawing 1750/8 in Appendix B to this report.
- 13.1.2 Within Area A, made ground is absent with natural underlying soils comprising Cohesive and Granular Residual soils. In the northeast only Granular Residual soils (gravelly sands) were present.
- 13.1.3 Area B is underlain by made ground, predominantly comprising Colliery Spoil and Ash & Clinker; some Red Shale was also encountered.
- 13.1.4 The thickest made ground was encountered in the southwest; up to 4.2m, (average 3.0m) across an area of c. 4,500m². To the north and east of this deep made ground, but still within Area B, thicknesses of 0.5m to 2.0m were encountered. The approximate distribution of made ground thicknesses is shown on Drawing 1750/9 (rev. A).
- 13.1.5 Gravel and occasional cobbles of slag were encountered within both Colliery Spoil and Ash & Clinker, with many slag cobbles noted in TP15 at 2.3m.
- 13.1.6 Gravel of Red Shale was also encountered within both Colliery Spoil and Ash & Clinker, with more significant beds of Red Shale in 10 exploratory holes.
- 13.1.7 Preliminary testing suggests the slag has the potential to be expansive.
- 13.1.8 Underlying the made ground, a thin layer of Relict Topsoil (c. 0.3m thick) was identified with Cohesive and Granular Residual soil beneath.

- 13.1.9 Coal Measures bedrock (sandstone, siltstone & mudstone) underlies the majority of the site, with Ackworth Rock (sandstone) underlying the northeast. Beyond areas of deep made ground, bedrock was encountered from as shallow as 0.9m, but typically around 2.0m in Area A.

13.2 Mining & quarrying

- 13.2.1 Whilst the site lies within a Coal Mining Development Low Risk Area, no significant risks have been identified and an intrusive mining investigation will not be required.
- 13.2.2 There are no known quarries on, or within 50m of the site.

13.3 Site regrade and/or ground improvement

- 13.3.1 Made ground within Area B is of variable and poor strength and is therefore not considered a suitable foundation material. It has also yielded elevated concentrations of a number of inorganic determinands and contains potentially combustible/ undesirable materials (e.g. burnt shale, clinker, coal, slag etc).
- 13.3.2 Given the substantial volume of made ground present, export to landfill is not considered economically viable.
- 13.3.3 Consideration should be given to turnover (excavation, screening and replacement in engineered layers) of the uppermost 2m or so of made ground.
- 13.3.4 Because turnover enables inspection of the fill, the developer and their prospective property purchasers, are provided with the reassurance that no significant hazard is left undetected. This is considered advantageous from a perception viewpoint. Furthermore, any potential for surface water infiltration, which would drive potential leaching of contaminants, should be reduced by compaction.
- 13.3.5 Screened and engineered fill should yield CBR values in excess of 3%, thereby reducing abnormalities associated with the construction of estate roads and car parking areas. Excavations through the engineered fill, for drainage etc and foundations will not encounter significant obstructions or grossly contaminated ground and should be stable with little overbreak.
- 13.3.6 Turnover works should be undertaken in accordance with the CL:AIRE Code of Practice (v2, March 2011), and a Materials Management Plan (MMP) should be prepared prior to commencement.
- 13.3.7 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.
- 13.3.8 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 119 no. 2 & 3 storey domestic dwellings. A site layout has been provided by Countryside which is reproduced as Drawing 1750/2 (rev.A).
- 13.4.2 Foundation recommendations assume that development will be of 2 or 3 storey constructions 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 Countryside 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 Sub-surface concrete in contact with the made and natural ground should be Design Sulphate Class DS-2, with the site allocated an ACEC Classification of AC-5z.
- 13.4.6 There are a number of foundation solution options for two or three storey residential properties constructed on this site and these are discussed below.

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 houses constructed within Area A and the north/east of Area B where the made ground is less than about 2m thick. Footings will be founded in firm clay and weathered or competent rock.
- 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 Foundations will be required to be placed below a line drawn up at 45° from the base of any service or similar excavation.
- 13.4.10 Overdeepened foundations should be stepped in accordance with NHBC Standards, Chapter 4.4.
- 13.4.11 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).
- 13.4.12 Whilst strip or trench fill footings generally represent a simple and inexpensive foundation solution, there are a number of potential disadvantages associated with their use in Area B:
- The made ground contains elevated concentrations of some inorganic contaminants and is potentially combustible. A 1,000mm thick cover of clean subsoil (see Section 10.6) has been recommended. Subject to final remediated development levels, this cover is likely to increase footing depth/underbuild.
 - Disposal of arisings will be required.
 - Foundation and drainage excavations may encounter significant obstructions resulting in significant overbreak.
 - Foundation and drainage excavations will almost certainly require shoring in made ground.
- 13.4.13 In addition to the above, Countryside should review proposed plot designs and layouts, since deeper excavations for trench fill are likely to be unstable where the centre-lines of parallel trenches are closer than about 2m (assuming 600mm widths). Countryside should supervise their groundworker to ensure footings are excavated in a controlled and safe manner.

- 13.4.14 Countryside 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.

Clay/cohesive soils

- 13.4.15 Clay classification tests suggest that natural cohesive soils at the site should be regarded as being of medium shrinkability. A minimum founding depth of 900mm is therefore recommended 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 80% of the site may be affected by trees. A number of immature (likely self-seeded) trees were noted across much of the site during the site walkover, and these will require removal prior to construction.
- 13.4.18 Furthermore, the site has undergone significant clearance, with many tree stumps (typically 50mm to 200mm in diameter) noted in sporadic clusters across the entire site, but especially the centre and south of Area A. It would be prudent to arrange for a surveyor to pick-up the location of all stumps (and stump diameters) prior to development.
- 13.4.19 A Preliminary Tree Survey and Arboricultural Impact Assessment (ref. R-2908-02) was issued in June 2017 (presumably pre-felling), along with a Tree Survey (ref. AR-4145-01) in June 2019, both by Brooks Ecological.
- 13.4.20 A number of felled trees (stumps) lie within the footprint of proposed plots, which will have a significant impact on proposed plots.
- 13.4.21 Trench fill foundations should be designed in accordance with NHBC Standards, Chapter 4.2. Heave precautions (a suitable approved compressible void former) should be used on the internal face of all external walls where the foundation is within the zone of influence of trees and greater than 1.5m deep.
- 13.4.22 Any trench fill foundation deeper than 2.5m will need to be designed by a Chartered Engineer, whose status is accepted by NHBC (NHBC Standards, Technical Requirement R5).
- 13.4.23 A detailed foundation schedule has been produced by Lithos (ref. 1750/FS01 dated September 2019) which should be reviewed in conjunction with this report. It is recommended that Countryside seek approval from NHBC in order to determine likely foundation abnormalities.
- 13.4.24 A safe bearing capacity of around 150kPa, allowing a maximum foundation line load of 90kN/m run, can be assumed if the following are true
- A foundation length of 10m
 - A foundation breadth of 0.6m
 - A foundation thickness of 225mm
 - A foundation depth of 0.9m
 - An undrained shear strength of 55kPa for the firm clay (typical minimum recorded on site)
- 13.4.25 Assuming the foundation geometry detailed above, settlements less than 25mm would be anticipated. This is considered likely to be acceptable. However, further advice should be sought from the Structural Engineer responsible for foundation design.

Granular soils (completely weathered bedrock)

- 13.4.26 The weathered in-situ sandstone, siltstone and mudstone (clayey gravel and gravelly sand) is assumed to have a relative density of at least medium dense (in accordance with BS5930:2015).
- 13.4.27 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 10m
 - A foundation breadth of 0.6m
 - A foundation thickness of 225mm
 - A foundation depth of 0.6m
 - An angle of shearing resistance of $\phi=32^\circ$ for the granular deposits
- 13.4.28 Assuming the foundation geometry detailed above, settlements less than 25mm would be anticipated. This is considered likely to be acceptable. However, further advice should be sought from the Structural Engineer responsible for foundation design.
- 13.4.29 In accordance with NHBC Standards, a minimum founding depth of 450mm (due to potential frost susceptibility) is required in granular soils. This depth should be taken from finished ground level to the underside of the footing. If finished ground level is to be above existing ground level, then the foundation excavation simply needs to ensure that there is sufficient depth of excavation to allow casting of the footing entirely within natural ground (not made ground or topsoil).
- 13.4.30 It should be noted that founding at shallow depth (450mm), whilst desirable from an excavation stability viewpoint, may not provide sufficient bearing capacity due to the lesser depth of (resisting) overburden. Consequently, a minimum founding depth of 600mm is recommended.
- 13.4.31 However, if the excavation is dug from original ground level in cold conditions when freezing is expected, then foundation depth should be taken from the existing, not finished, ground level.
- 13.4.32 Where ground level is being raised, it would be prudent to proof roll the exposed granular soils after stripping topsoil (to mitigate any near-surface disturbance), and ideally fill should be placed prior to construction (otherwise the Developer will need to consider the potential for movement associated with placement of the fill).
- 13.4.33 It should also be noted that the footing may require deepening or stepping in order to allow plot drainage to exit the plot footprint (either over or under the footing).

Bedrock

- 13.4.34 The bedrock (Coal Measures & Ackworth Rock) is generally considered to have a safe bearing capacity of at least 300kPa and minimal settlements would be anticipated.
- 13.4.35 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 overdeepening of foundations.
- 13.4.36 Bedrock at the site comprises mudstone which can be easily excavated using a backhoe excavator and will be recovered as a tabular gravel. 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

- 13.4.37 Deep made ground (>2m; ave. c. 3m) was encountered in the southwest across an area of c. 4,500m²; see Drawing 1750/9. Trench fill foundations could be considered, but piles are likely to provide a more economic founding solution for plots built in this area.
- 13.4.38 In addition, for plots where tree influence exceeds 2.5m and granular soils/bedrock lie beyond around 3m depth, piling may provide more economical than engineer-designed trench-fill foundations of >3m depth.
- 13.4.39 The following general comments relating to piling are provided for guidance, and further advice should be sought from a specialist-piling contractor.
- 13.4.40 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 might also require design of foundations able to span and/or cantilever as necessary).
- 13.4.41 Warranty providers generally require pile lengths to be at least 3m.
- 13.4.42 Piled foundations should extend into the underlying bedrock; boreholes drilled in the area of deep made ground suggest bedrock is between 4m and 5mbgl in the southwest of Area B. 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.
- 13.4.43 As piles would be founded in bedrock, they will be essentially end bearing, although there may also be some shaft adhesion in the made ground and Cohesive Residual soil.
- 13.4.44 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.
- 13.4.45 Driven piles may lessen the volume of potentially contaminated 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.
- 13.4.46 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.
- 13.4.47 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".
- 13.4.48 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

- 13.4.49 Piles can provide an enhanced pathway for the vertical migration of mobile contaminants. The Environment Agency may therefore object to the adoption of piles as a foundation solution. However, objection is considered unlikely given the nature of the contamination encountered, and the fact that colliery spoil and Ash & Clinker is currently resting directly on the underlying Cohesive Residual soil.
- 13.4.50 Pile design should be undertaken in accordance with the Environment Agency's guidance booklet "Piling into Contaminated Sites".

Summary of foundation recommendations

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

Area	Foundation solution(s)	Remarks (influencing factors)
A	Strips at a minimum 0.9m	Medium shrinkability Cohesive Residual soil Deepened where necessary due to trees and hedgerows
	Strips at a minimum 0.6m	Where Granular Residual soil is encountered in northeast
B	Deepened trenchfill up to 2.5m	Where made ground is present and less than 2.5m depth
	Piles into bedrock	Where made ground is deeper than 2.5m depth, or where tree influence exceeds 2.5m and granular soils/rock lie beyond around 3m depth.

- 13.4.52 A 'simple' made ground zoning plan showing the depths to natural strata is presented as Drawing 1750/9 in Appendix B.
- 13.4.53 The foundation solutions outlined in the above table assume that ground levels will not change significantly from those existing at present. If this is not to be the case, further advice should be sought from Lithos.
- 13.4.54 Reference should be made to the detailed foundation schedule prepared by Lithos (ref. 1750/FS01 dated September 2019), which takes into account liaison with Brooks Ecological regarding tree heights and species at the time of their 2017 report.

13.5 Floor slabs

- 13.5.1 Floors for low rise housing (2-3 storeys) constructed on piled foundations typically utilise reinforced concrete ground beams which rest on pre-cast or in-situ pile caps. A suspended 'Beam and Block' ground floor is then usually constructed using concrete or polystyrene blocks placed between further concrete beams suspended across the ring beams.
- 13.5.2 Suspended floor slabs should be utilised where the depth of made ground or engineered stone exceeds 600mm in accordance with NHBC Standards Chapter 5.1 (to negate potential settlement problems). The made ground on this site is non-shrinkable, therefore the slabs could be cast in-situ.
- 13.5.3 It is estimated that the thickness of made ground is likely to exceed 600mm beneath at least 50% of the plots (including all plots to be built within Area B).
- 13.5.4 Where foundations in Area A (and the margins of Area B) are within the influence of existing or proposed trees (and are underlain by shrinkable soils), NHBC require a suspended floor slab, with sub-floor void. The floor slab is most commonly a precast block and beam construction, but alternatively could comprise a suspended timber floor, or a slab cast on a suitable compressible void former. Ground-bearing and cast in-situ suspended slabs (other than those cast on a void former) are not acceptable where foundations are within the influence of trees.

- 13.5.5 In accordance with NHBC Standards Chapter 4.2, a minimum void height of 250mm should be adopted for a precast block and beam (or suspended timber) floor; this includes a 150mm ventilation allowance. If a suspended, cast in-situ slab (on a void former) is proposed, a minimum clear void height of 100mm should be adopted; of course, the actual thickness of the void former will be significantly greater.
- 13.5.6 In the unlikely event that coal is exposed beneath the floor void, it would be prudent to prevent air ingress and the potential for spontaneous combustion by blinding with concrete or removing the coal.
- 13.5.7 Floor slab design should be finalised/take account of the results of the gas monitoring and protection measures required, which will be detailed in Lithos' gas risk assessment, to be issued on completion of monitoring in late July 2019.

13.6 Designated concrete mixes

- 13.6.1 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.
- 13.6.2 Consequently, Countryside should seek advice from their appointed Structural Engineer.

13.7 Excavations

- 13.7.1 Groundwater should be controlled in accordance with CIRIA report 113 "Control of Groundwater for Temporary Works".
- 13.7.2 Based on the results of the investigation it is considered unlikely that major groundwater flows will be encountered in shallow excavations.
- 13.7.3 Excavations should remain stable in the short term in natural ground but if left open for any significant period of time may require shoring most notably in granular soils and made ground.
- 13.7.4 The stability of even shallow excavations is likely to be poor in made ground and therefore allowance should be made for shoring.
- 13.7.5 Bedrock was encountered in several exploratory holes, especially in Area A. Based on the exploratory hole logs, excavation greater than 2.5m is likely to prove difficult across about 50% of the site. 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.

13.8 Drainage

- 13.8.1 Given the significant thicknesses of made ground encountered on-site soakaway construction will be highly problematic. It should be noted that soakaways cannot be allowed to infiltrate into made ground due to the risk of settlement caused by wash out of fine soil particles.
- 13.8.2 Based on observations of the natural strata encountered during the investigation, soakaways are very unlikely to 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.
- 13.8.3 Alternative SUDS options (see CIRIA C753:2015 for further details) include:
- Swales – linear grassed features in which surface water can be stored or conveyed. Where suitable, swales can be designed to allow infiltration.

- Infiltration basins – vegetated depressions designed to store runoff and infiltrate it gradually into the ground.
- Pervious Pavements – provide a surface suitable for pedestrian and/or vehicular traffic, while allowing rainwater to infiltrate into subsurface storage, with subsequent infiltration or controlled discharge. Pavement could be porous (water able to infiltrate across entire surface material; e.g. reinforced grass), or permeable (water infiltrates via joints between concrete blocks).
- Ponds – designed to have permanent pool of water, but with capacity to provide temporary storage-controlled discharge.

13.8.4 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.

13.9 Highways

13.9.1 Within Area A, the natural soils present at shallow depth (anticipated formation) are predominantly cohesive. Based on visual inspection of the natural materials and the recorded plasticity indices at the site, published tables⁴ indicate that the Cohesive Residual deposits would be expected to provide a CBR value of at least 3%. This value should be verified prior to or during construction.

13.9.2 Whilst the CBRs estimated above should be achievable, significant deterioration during/after periods of significant rainfall and/or site trafficking is likely. Consequently, it would be prudent to consider flexibility in the groundworks programme to enable highway construction during prolonged dry/warm weather (typically between May and September) when formation will be least vulnerable to deterioration. Alternatively, a minimum 200mm thickness of suitable granular fill (i.e. a “blanket” of 6F2) could be placed along the line of proposed highways to protect formation during the construction phase.

13.9.3 Area B is underlain by made ground which is likely to be subject to re-engineering prior to the construction of new estate roads. Consequently, there was no merit in obtaining CBR values at this stage. Consultation with the adopting authority, regarding the specification of the highways constructed in Area B, is strongly recommended.

13.9.4 The made ground present beneath Area B is highly variable in terms of both composition, and strength/density. Furthermore, the moisture content does not fall in the allowable range for re-engineering.

13.9.5 Where made ground is present its full thickness (up to a maximum of 2m - from existing ground level or proposed highway formation, whichever is the lower) should be excavated and either:

- replaced with suitable aggregate in accordance with Series 600 (Earthworks) of The Highways Agency (HA) “Specification for Highway Works” 1998; or
- (subject to on-site field trials), screened, to allow selection of suitable material, before being replaced in engineered layers (in accordance with Series 600). Unsuitable materials include any soft or wet materials, biodegradables including topsoil, wood, scrap metal, frozen material and oversize.

13.9.6 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.

⁴ Interim Advice Note 73/06 Revision 1 (2009), Chapter 5. Characterisation of Materials Design Guidance for Road Pavement Foundations - Draft HD25

- 13.9.7 Any residual made ground materials in the base of the excavation should be inspected and (where necessary) any soft spots removed and replaced with suitable engineered fill.
- 13.9.8 Where the made ground is suitably re-engineered it is considered that a CBR value of at least 3% should be achievable. However, this should be verified by field trials.

13.10 External works

- 13.10.1 Any digital terrain modelling undertaken, or commissioned, by Countryside should be made available to their Engineering Designer prior to issue of an External Works Drawing.

14 REDEVELOPMENT ISSUES

14.1 General

- 14.1.1 This report has presented options with respect to foundation solutions, treatment of contamination, re-use of topsoil 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 site preparatory works.
- 14.1.3 If unanticipated ground is encountered during the site preparatory works, 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 for Area A. Nonetheless, some preparatory works will be required, most notably:
- Removal of vegetation and site clearance.
 - Topsoil strip and stockpile
- 14.2.2 Redevelopment of Area B will almost certainly be subject to planning conditions relating to remediation and validation. A remediation strategy for the site was prepared by Lithos (Report No: 1750/3) and issued in June 2019.
- 14.2.3 The Remediation Strategy document included:
- General background information, including site location, site description and a summary of ground investigation data
 - An overview of existing constraints on development and the aims of the proposed remediation works
 - Specific details of the anticipated site remediation/preparatory works
 - Details of site supervision and verification
 - A summary of implications for redevelopment

- 14.2.4 The Remediation Strategy describes what is required, but not how it is achieved; the appointed Contractor would normally be expected to undertake an Options Appraisal, and then prepare a Method Statement.
- 14.2.5 The anticipated remediation works are summarised below:
- Treatment of Japanese Knotweed
 - General site clearance of surface materials and vegetation
 - Turnover (excavation, screening and replacement in engineered layers, with nominal compaction) of the uppermost 2m of made ground to enable:
 - o Inspection of the made ground
 - o Removal of below ground obstructions
 - o Preparation of the ground for highway construction
 - o Segregation\removal of expansive slag where this occurs in larger pockets\bands (cf isolated cobbles)
 - o Inspection for, and further testing of, any brightly coloured material encountered (see Section 10.2)
 - Excavation of natural soils from beneath made ground to source 'clean' subsoil for use in gardens and landscaped areas
 - Backfill of all resultant excavations, with appropriate compaction
 - Excavation of up to a maximum depth of 2m beneath proposed adoptable road footprints and controlled re-engineering of selected materials in layers to approximately 650mm below final road levels
 - Provision of a minimum 1,000mm thick cover layer of 'clean' soils in all garden and landscaped areas
- 14.2.6 The remediation contractor should survey reduced levels during the proposed turnover, prior to the placement of any fill.
- 14.2.7 Subsoil excavated during the site preparatory works for subsequent use as cover in gardens and landscaped areas, would be best placed during the construction phase; i.e. it should be left in stockpile(s) on completion of the site preparatory works.
- 14.2.8 A minimum 200mm thickness of suitable granular fill (i.e. a "blanket" of 6F2) could be placed along the line of proposed haul roads to provide a firm and stable running layer for the subsequent construction works.

14.3 Control of excavation arisings

- 14.3.1 Excavations into made ground in Area B is 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 would be prudent to segregate groundworker activities in Areas A & B during the construction phase in order to minimise chances of 'accidental' cross-contamination.
- 14.3.3 It should be ensured that the groundworker 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; tarmac; Granular Made Ground; excess clean, natural soil arisings; general construction waste etc.
- 14.3.4 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.
- 14.3.5 Made ground arisings could be:

- Placed in area deliberately left low on completion of the remediation works in order to accommodate construction arisings
- Redistributed beneath concrete oversite, or areas of hardstanding, where they would be satisfactorily isolated from end users; only if suitable (i.e. not compressible, rich in deleterious matter etc)
- Isolated beneath the 1,000mm thick cover layer in garden or landscaped areas
- Exported from site to a suitably licensed landfill facility

14.3.6 Natural ground arisings generated by foundation/sewer excavations in Area A should be suitable for use as subsoil in the proposed soil cover required in Area B.

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 C502 'Environmental Good Practice on Site'
- EA Pollution Prevention Guidelines⁵:
 - o PPG6 - Working at construction and demolition sites
 - o PPG2 - Above ground oil storage tank
 - o PPG7 – The safe operation of refuelling facilities.
 - o 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 possibly 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).

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 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 Report⁶.

14.5.3 Area A is greenfield, and no previous or current usage of the site or its immediate surroundings is likely to have resulted in ground contamination. Furthermore, no significant made ground was encountered in any of the exploratory holes during the ground investigation.

14.5.4 Consequently, the use of 'standard' polyethylene water supply pipes should be acceptable, although Countryside should consult Yorkshire Water at the earliest opportunity to confirm this.

⁵ Whilst this has formally been withdrawn it can still be accessed via the EA archives and provides useful information on managing risks.

⁶ UKWIR Report 10/WM/03/21 – 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites'.

- 14.5.5 Area B is brownfield, 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 At the time of writing, the proposed route(s), and total length, of pipeline were unknown. Consequently, to date laboratory testing of soil samples in line with UKWIR guidance has not been undertaken.
- 14.5.7 However, given the site's history, the absence of significant organic contamination and the relatively consistent ground conditions reported, the use of 'standard' polyethylene water supply pipes should be acceptable providing no organic contamination is encountered during the turnover of made ground. Countryside should consult Yorkshire Water at the earliest opportunity to confirm this.
- 14.5.8 Within Area B, 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.

14.6 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 Before site operations are started, the necessary COSHH statements and Health & Safety Plan should be drafted in accordance with the CDM regulations.
- 14.6.3 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.
- 14.6.4 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 personnel protective equipment. See also comments in Section 10.8 regarding asbestos.
- 14.6.5 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". In summary, the following measures are suggested to provide a minimum level of protection:
- All ground workers should be issued with protective clothing, footwear and gloves. Personnel should be instructed in why and how they are to be used.
 - Hand-washing and boot-washing facilities.
 - Care should be taken to minimise the potential for off-site migration of contamination by the provision of dust suppression control and wheel cleaning equipment during the construction works.
 - Good practices relating to personal hygiene should be adopted on the site.
 - The contractor should satisfy the Health & Safety Executive with regard to any other matters concerning the health, safety and welfare of persons on the site.

14.7 Potential development constraints

- 14.7.1 Some deterioration of the surface is likely to be caused by trafficking, especially after topsoil has been stripped and during/after periods of significant rainfall. Consequently, it would be prudent to consider placement of a minimum 200mm thickness of suitable granular fill (i.e. a “blanket” of 6F2) along the line of proposed highways and any temporary haul roads to protect formation during the construction phase.
- 14.7.2 It is almost certain that Yorkshire water will have restrictions with respect to development in the vicinity of the sewer along the southern boundary; an easement will probably be required.

15 SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

15.1 General

- 15.1.1 The site is located 10km east of Barnsley town centre and comprises a single parcel of land overgrown with immature trees, shrubs and brambles.
- 15.1.2 It is understood that considerations are being given to redevelopment of the site with 138 no. traditional 2 & 3 storey domestic dwellings, associated gardens, POS and adoptable roads and sewers.
- 15.1.3 The site can be divided into two areas based on ground conditions:
- Area A (north) – veneer of topsoil overlying Cohesive and Granular Residual soils with weathered Coal Measures and Ackworth Rock bedrock encountered from around 1.9m
 - Area B (south) – Made Ground (predominantly Colliery Spoil and Ash & Clinker), over a veneer of Relict Topsoil (c. 0.3m thick), with Cohesive and Granular Residual soils beneath. Weathered Coal Measures bedrock was encountered in some initial exploratory holes from between 3.3m and 4.0m (but within the majority of holes bedrock was not encountered and lies at depths in excess of 4.5m). Supplementary boreholes indicate weathered bedrock lies between 3.9m and 5m.
- 15.1.4 The thickest made ground was encountered in the southwest (up to 4.2m, average 3.0m), across an area of c. 4,500m². To the north and east of this deep made ground, but still within Area B, thicknesses of 0.5m to 2.0m were encountered. The approximate distribution of made ground thicknesses is shown on Drawing 1750/9.
- 15.1.5 Gravel and occasional cobbles of slag were encountered within both Colliery Spoil and Ash & Clinker, with many slag cobbles noted in TP15 at 2.3m.
- 15.1.6 Gravel of Red Shale was also encountered within both Colliery Spoil and Ash & Clinker, with more significant beds of Red Shale in 10 exploratory holes.

15.2 Mining

- 15.2.1 This site is underlain at depth by Coal Measures bedrock, and the shallowest coal seams lies at least 40m below the surface. Whilst the site lies within a Coal Authority Low Risk area, no significant risks have been identified, and an intrusive mining investigation will not be required.

15.3 Hazardous gas

- 15.3.1 The site is in an area where less than 1% to 3% of homes are estimated to be above the radon action level. Radon protection is not required, but the Developer might consider providing new dwellings with basic measures in light of Public Health England advice.
- 15.3.2 The site is underlain by significant thicknesses of made ground (>2m) and potentially underlain by mineworkings (at around 45m bgl). Consequently 10 monitoring wells were installed across the site to monitor for gas, which has resulted in the north (Area A) being classified as GREEN & CS1, whereas Area B is classified as GREEN & CS2.
- 15.3.3 A hazardous gas risk assessment was issued as a separate letter report in July 2019 and is included in Section 11.

15.4 Contamination & remediation

- 15.4.1 No contamination was identified in Area A.
- 15.4.2 Made Ground underlies Area B, which is typically between 0.5m and 2.5m thick and predominantly comprises Colliery Spoil and Ash & Clinker; some Red Shale was also encountered.
- 15.4.3 The Ash & Clinker and Colliery Spoil are considered potentially combustible and require isolation beneath a minimum 1,000mm thickness of inert soil. This cover will suffice to mitigate risks associated with other contaminants (most notably arsenic) encountered in made ground.
- 15.4.4 Made Ground Topsoil is present in the far south and west of Area B. Whilst testing has shown this topsoil to be essentially clean, it is considered to be of poor quality and contains a significant proportion of anthropogenic material. Furthermore, the Topsoil is immediately underlain by made ground with segregation likely to prove difficult. Consequently, Made Ground Topsoil should be considered unsuitable for re-use.
- 15.4.5 Stockpiled Made Ground Topsoil in the south-east of Area B might be suitable for re-use, but further testing would be required.
- 15.4.6 It would be prudent to segregate groundworker activities in Areas A & B during the construction phase in order to minimise chances of 'accidental' cross-contamination.

15.5 Foundations

- 15.5.1 The Cohesive Residual soil within Area A is suitable for adoption of strip/trenchfill footings at a minimum of 0.9m. However, the majority of plots will require over deepening due to the influence of trees. Tree stumps (typically 50mm to 200mm in diameter) were noted in sporadic clusters across the entire area, but especially the centre and south of Area A.
- 15.5.2 The Granular Residual soil within the northeast of Area A is suitable for strips/trench fill at a minimum depth of 0.6m.
- 15.5.3 Within Area B, deepened trench fill foundations are suitable in areas where the made ground is less than about 2m thick. Foundations should be taken through the entire of the made ground and placed in natural strata.
- 15.5.4 Where made ground is deeper than about 2m, piles are likely to be required. Beneath areas of deep made ground competent bedrock was encountered in boreholes at around 5m depth below current ground levels.
- 15.5.5 Reference should be made to the detailed foundation schedule prepared by Lithos (ref. 1750/FS01 dated September 2019).

15.6 Flooding

- 15.6.1 The EA indicate that the site is not located within an indicative floodplain.

15.7 Drainage

- 15.7.1 Given the significant thicknesses of made ground encountered on-site soakaway construction will be highly problematic. It should be noted that soakaways cannot be allowed to infiltrate into made ground due to the risk of settlement caused by wash out of fine soil particles.
- 15.7.2 Based on observations of the natural strata encountered during the investigation, soakaways are very unlikely to 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.

15.8 Highways

- 15.8.1 Based on visual inspection of the shallow natural materials and published guidance, the natural soils in Area A should provide a CBR value of at least 3%. This value should be verified prior to or during construction.
- 15.8.2 However, made ground is present across the entire of Area B, 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

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 (eg 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 more than two 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).

04 - Contamination analysis & interpretation (including WAC)

Generic notes – geoenvironmental investigations



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 Contaminated Land Report No. 11 (2004) "Model Procedures for the Management of Land Contamination". 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 and 10) outlining the UK approach to the assessment of risk to human health from land contamination. In 2008 CLR 7, 9 and 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 (Version 1.071), Science report: SC050021/SR4
- Compilation of data for priority organic pollutants for derivation of Soil Guideline Values - Science Report: SC050021/SR7

The approach set out in these documents represents current scientific knowledge and thinking; and includes the Contaminated Land Exposure Model (CLEAv1.06). The Environment Agency are in the process of using this updated approach to regenerate a selection of Soil Guideline Values (SGVs).

CLEA SGVs were derived for standard land use scenarios predominantly in the context of Part IIA, using a conceptual site model (CSM) defined in SR3. Lithos have incorporated amendments to the CSM used to derive SGVs, that more accurately reflect redevelopment within the planning regime; consequently, Lithos have not adopted any published SGV as a screening value.

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, where the average TOC value for a particular soil type is significantly lower than the 3.5%, evaluation of Lithos Screening Values should be undertaken and a site specific risk assessment will usually 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 four 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)	• 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	• 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	• 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.
D	Commercial/ industrial with landscaped areas no cover	• 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	• 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.

04 - Contamination analysis & interpretation (including WAC)

Generic notes – geoenvironmental investigations



Lithos have assumed the source of contamination is directly below the building foundations; i.e. a depth of 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. This adjustment has been included to account for sites where made ground is re-engineered to enable new buildings to be established on raft foundations. In such situations contamination may lie directly beneath the foundation.

The Soil Screening Values referred to in this document are **not** intended to be used when considering potential risks associated with:

- Existing land uses in the context of Part IIA of the Environment Protection Act 1990;
- End uses such as allotments, sports fields, children's playgrounds, care homes, hospitals etc; and
- Controlled waters.

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 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 new 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).

The Part 2A Statutory Guidance was developed on the basis that C4SLs could be used under the planning regime. However, policy responsibility for the National Planning Policy Framework falls to the Department for Communities and Local Government. 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 YAHPAC (collection of Yorkshire & Humberside local authorities) and received confirmation that they are satisfied with this approach.

With respect to **inorganic** determinands, Lithos derived Tier 1 values for the five Scenarios A to E are presented below:

Inorganic contaminant	Tier 1 assessment criteria (mg/kg) for Scenarios A to D							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			3,000		3,000	30,000	3,000	Assumes Cr is CrIII
Pb	450	200	200		310	2,330	200	C4SL adopted
Ni	130		127		127	1,700	127	Assessment of health risk only
Se	350		350		595	13,000	434	
Hg	170		169		238	3,640	199	Assumes in an inorganic compound
B			5		5	5	5	
Cu			80-200		80-200	80-200	80-200	Based on phytotoxic risks as plants are the more sensitive receptor (Cu is pH dependant)
Zn			200		200	200	200	

With respect to **organic** determinands, Lithos derived Tier 1 values for the five Scenarios A to E are presented below:

Organic contaminant (all sourced via CLEA)	Tier 1 assessment criteria (mg/kg) for Scenarios A to D							Comments/notes
	SGV*	C4SL*	A	B	C	D	E	
Benzene	0.33	0.87	0.9	0.9	3.3	98	N/A	C4SL adopted
Toluene	610		600	3,000	2,700	5,000	N/A	Calculated value over 10,000
Ethyl Benzene	350		350	932	843	5,000	N/A	
Xylenes	240		246	327	321	5,000	N/A	
Phenol	420		412	2,400	519	5,000	N/A	
PCBs			2	8	2	38	N/A	Based on toxicity of EC7
Benzo(a)pyrene		5	5	25	5.3	76	5	C4SL adopted. Where source is not a coal tar
Naphthalene			8	9	9	1,000	12	
Gasoline Range Organics			30	34	34	5,000	45	See 3-step assessment of TPH below
Diesel Range Organics			151	156	154	5,000	219	
Lubricating Range Org			1,000	5,000	2,000	5,000	1,000	

* 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

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

04 - Contamination analysis & interpretation (including WAC)

Generic notes – geoenvironmental investigations



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.

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 physiochemical 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

Step 1 - Assessing indicator compounds

TPH fraction Indicator compound	End use specific screening value (mg/kg)			
	A: Residential no cover	B: Residential with 600mm cover	C: Residential no gardens	D: Commercial\ industrial
Benzene	0.9	0.9	3.3	98
Toluene	600	3,000	2,700	5,000
Ethyl Benzene	350	932	843	5,000
Xylenes	246	327	321	5,000
Naphthalene	8	9	9	1,000
Benzo[a]pyrene	5	25	5.3	76

Step 2 - Assessing individual TPH fractions

TPH fraction		End use specific screening value (mg/kg)			
		A: Residential no cover	B: Residential with 600mm cover	C: Residential with no gardens	D: Commercial/ industrial
Aliphatic 5-6	GRO	41	41	42	5,000 [^] per fraction
Aliphatic 6-8	GRO	125	125	125	
Aliphatic 8-10	GRO	31	31	32	
Aliphatic 10-12	DRO	151	156	154	
Aliphatic 12-16	DRO	500 [^]	500 [^]	500 [^]	
Aliphatic 16-21	DRO	1,000 [^]	5,000 [#]	1,000 [^]	
Aliphatic 21-35	LRO	1,000 [^]	5,000 [#]	1,000 [^]	
Aromatic 5-7	GRO	100	123	122	
Aromatic 7-8	GRO	30	34	34	
Aromatic 8-10	GRO	47	50	50	
Aromatic 10-12	DRO	215	287	266	
Aromatic 12-16	DRO	689	1,000 [*]	1,000 [*]	
Aromatic 16-21	DRO	1,000 [^]	5,000 [#]	1,000 [^]	
Aromatic 21-35	LRO	1,000 [^]	5,000 [#]	1,000 [^]	

* Calculated Screening Value exceeded soil saturation limit and could indicate free product, therefore calculated soil saturation limit adopted as a target

[^] Calculated Screening Value close to soil saturation limit, screening value selected by Lithos considering visual and olfactory impacts.

[#] Five times the screening value for Scenario A.

Step 3 - Assessing Cumulative Effects

$$HI = \sum_{i=1}^{12} HQ F_i = \frac{\text{Measured concentration } F_i (\mu\text{g kg}^{-1})}{SGV F_i (\mu\text{g kg}^{-1})}$$

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

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 Soil Code” (MAFF, 1998) for copper and zinc. The CLEA SGV 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 ICRC 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 undertaken by comparing leachate or groundwater concentrations with the appropriate water quality standard. Tier 1 Screening Values have been discussed with the Environment Agency, and typically those in **bold** below are adopted.

Analyte	Source of Tier 1 Screening Value (µg/l)			
	Surface water (Abstraction for drinking) 1996	Water Supply Regulations 2000	Water Framework Directive	EA Advice
Arsenic	50	10	50	
Selenium	10	10		
Cadmium	5	5	1.5	
Chromium	50	50	32	
Copper	50	2,000	28	
Lead	50	10	7.2	
Nickel		20	20	
Zinc	3,000		125	
Boron		1,000		
Mercury	1	1	0.07	
Petroleum Hydrocarbons				10
1,1,1-Trichloroethane			100	
1,1 Dichloroethane				100
1,2-Dichloroethane		3	10	
1,1-Dichloroethene				100
Benzene		1	10	
Ethylbenzene				10
Tetrachloroethene		10	10	
Toluene			50	
Trichloroethene		10	10	
Vinyl Chloride		0.5		
Trichloromethane			2.5	
Xylenes			30	
Chloroethane				100

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**, and such waste must have been subjected to pre-treatment. 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 (eg 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 (eg 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 "*Guidance on Comparing Soil Contamination Data with a Critical Concentration - CL:AIRE and CIEH, May 2008*" in order to determine whether contaminant concentrations of inorganic contaminants within soil\fill 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. The CL:AIRE\CIEH document still refers to CLR 7, which suggests averaging area should reflect receptor behaviour and therefore might be a single garden, or an open area used by the local community as a play area. This approach to averaging areas is considered applicable within the context of Part IIA of the Environmental Protection Act (EPA) 1990, in terms of an existing residential development.

However, Lithos consider the concept of a single garden as an averaging area to be inappropriate with respect to brownfield redevelopment, which is regulated by the planning regime. In this context, contamination across 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; ie 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, ie 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.

A – All developments except low rise housing

(Wilson & Card, 1999)^v revised Table 28 of CIRIA 149^{iv} 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 ² (%v/v)	Gas Screening Value ^{3,4,5} (l/hr)	Typical Maximum Concentration ² (%v/v)	Gas Screening Value ^{3,4,5} (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 × 1.50m × 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



**The Site
SE 467 043**

Reproduced from OS Explorer map 1:25,000 scale by permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationery Office. Crown copyright. All rights reserved. Licence number 100049696.



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

CLIENT

**COUNTRYSIDE
PROPERTIES**

JOB TITLE

**GOLDTHORPE
COLLIERY**

DRAWING TITLE

**SITE LOCATION
PLAN**

DRAWN

JBR

DATE

04/04/2019

CHECKED

ASw

DATE

04/04/2019

STATUS

FOR COMMENT ☐

DRAFT ☐

FOR APPROVAL ☐

FINAL ☒

SCALE

1:25,000

SHEET

A4

DRAWING NO.

1750/1

REVISION



NOTES

— APPROXIMATE SITE BOUNDARY

REPRODUCED FROM COUNTRYSIDE PROPERTIES DRAFT LAYOUT DRAWING REFERENCE SK656-DL-01 DATED AUGUST 2019

REV.	DESCRIPTION	DATE
A	UPDATED LAYOUT	05/09/2019

LITHOS CONSULTING

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

Tel 01937 545330

CLIENT

COUNTRYSIDE PROPERTIES

JOB TITLE

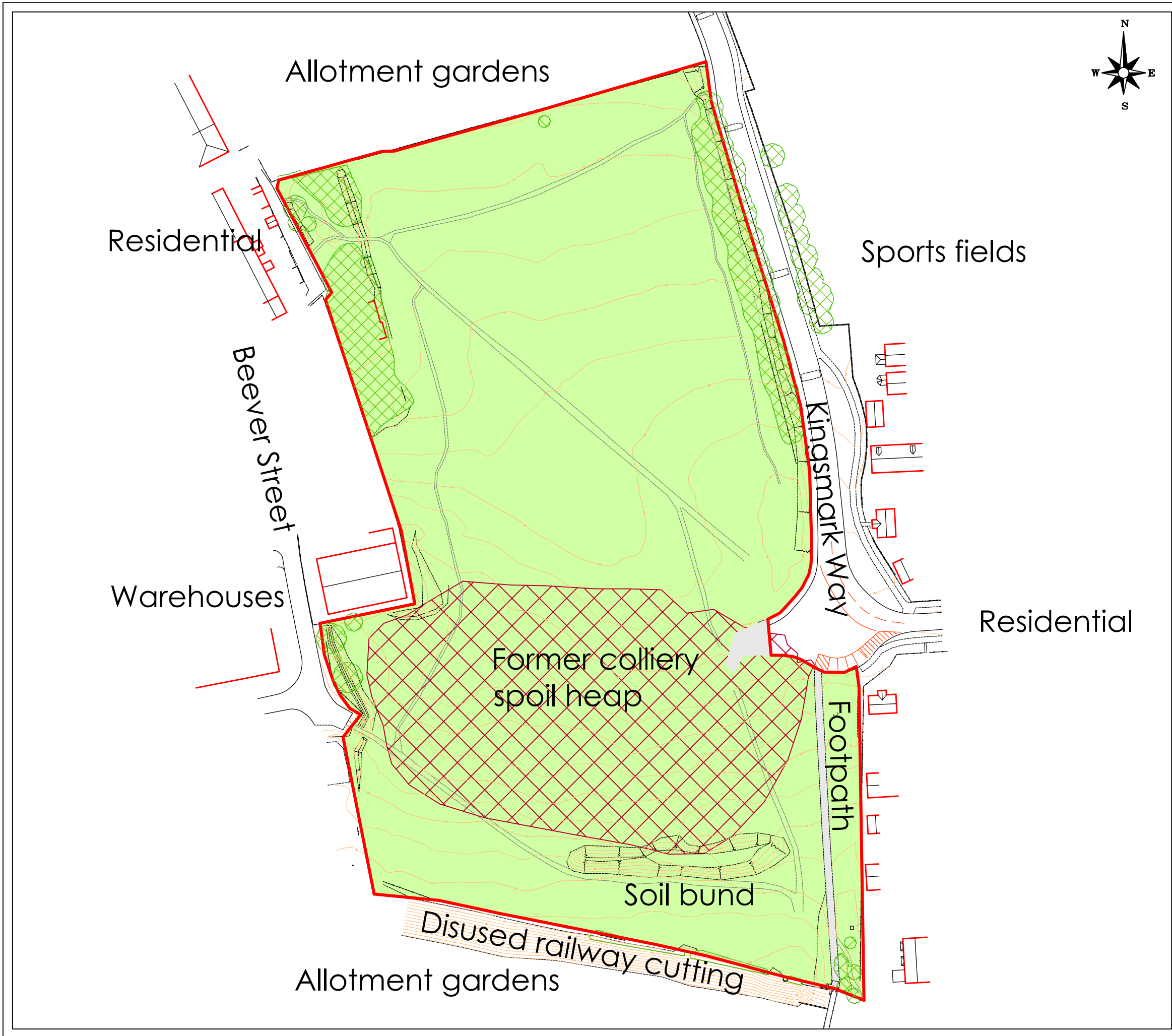
GOLDTHORPE COLLIERY

DRAWING TITLE

PROPOSED SITE LAYOUT

DRAWN	DATE	STATUS
JBR	05/09/2019	FOR COMMENT ☐
ASw	05/09/2019	FOR APPROVAL ☐
		DRAFT ☐
		FINAL ☒

SCALE	SHEET	DRAWING NO.	REVISION
1:1250	A3	1750/2	A



NOTES

- GRASS & OVERGROWN AREAS
- TARMAC HARDSTAND
- TREES & HEDGEROWS
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE
------	-------------	------

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

CLIENT

COUNTRYSIDE PROPERTIES

JOB TITLE

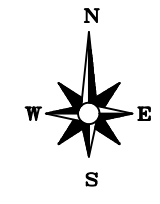
GOLDTHORPE COLLIERY

DRAWING TITLE

SITE FEATURES

DRAWN	DATE	STATUS
JBR	12/04/2019	FOR COMMENT ☐
ASw	12/04/2019	FOR APPROVAL ☐
		DRAFT ☒
		FINAL ☐

SCALE	SHEET	DRAWING NO.	REVISION
1:1250	A3	1750/3	



NOTES

- GRASS & OVERGROWN AREAS
- TARMAC HARDSTAND
- TREES AND HEDGEROWS
- APPROXIMATE SITE BOUNDARY
- LOCATION & ORIENTATION OF PHOTOGRAPH

REV.	DESCRIPTION	DATE



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

CLIENT

COUNTRYSIDE PROPERTIES

JOB TITLE

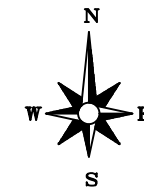
GOLDTHORPE COLLIERY

DRAWING TITLE

SITE PHOTOGRAPHS

DRAWN	JBR	DATE	15/04/2019	STATUS	FOR COMMENT	☐
CHECKED	ASw	DATE	15/04/2019	FOR APPROVAL	DRAFT	☐
				FINAL		☒

SCALE	NOT TO SCALE	SHEET	A3	DRAWING NO.	1750/4	REVISION	
-------	--------------	-------	----	-------------	--------	----------	--



NOTES		
LITHOS INVESTIGATION (APRIL 2019)		
	TRIAL PIT LOCATION	
	WINDOW SAMPLE LOCATION	
	STOCKPILE SAMPLE LOCATION	
LITHOS INVESTIGATION (SEPTEMBER 2019)		
	TRIAL PIT LOCATION	
	BOREHOLE LOCATION	
	APPROXIMATE SITE BOUNDARY	
A	SUPPLEMENTARY BOREHOLES AND TRIAL PITS	05/09/2019
REV.	DESCRIPTION	DATE

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

CLIENT

COUNTRYSIDE PROPERTIES

JOB TITLE

GOLDTHORPE COLLIERY

DRAWING TITLE

EXPLORATORY HOLE LOCATIONS

DRAWN	JBR	DATE	27/09/2019	STATUS	FOR COMMENT	☐	
CHECKED	ASw	DATE	27/09/2019	FOR APPROVAL	DRAFT	☐	
				FINAL		☒	
SCALE	1:1250	SHEET	A3	DRAWING NO.	1750/6	REVISION	A



NOTES

- GRASS & OVERGROWN AREAS
- TARMAC HARDSTAND
- TREES & HEDGEROWS
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

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

CLIENT

COUNTRYSIDE PROPERTIES

JOB TITLE

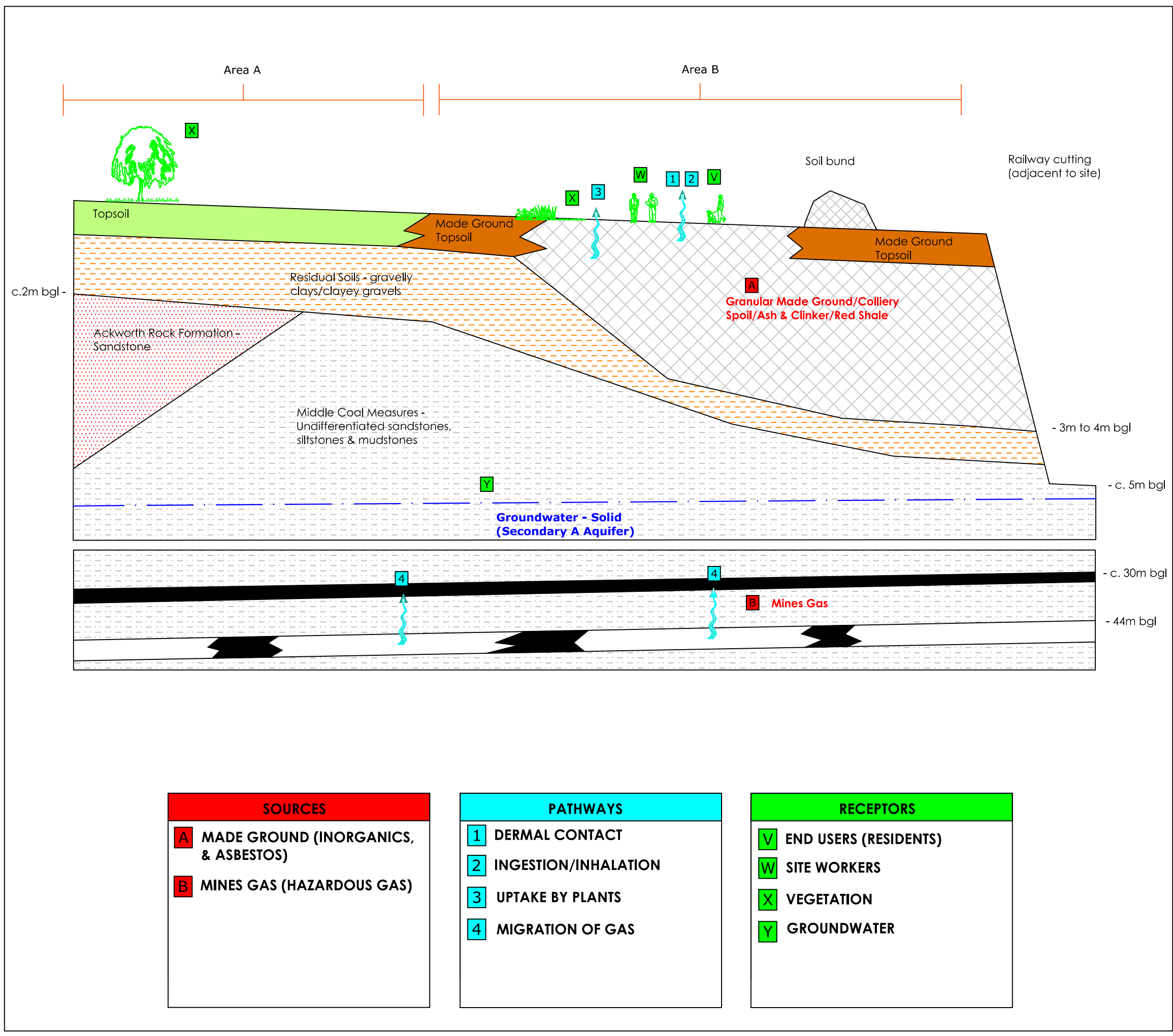
GOLDTHORPE COLLIERY

DRAWING TITLE

SITE AREAS

DRAWN	JBR	DATE	12/04/2019	STATUS	FOR COMMENT	☐
CHECKED	ASw	DATE	12/04/2019	FOR APPROVAL	DRAFT	☐
				FINAL	☒	

SCALE	1:1250	SHEET	A3	DRAWING NO.	1750/7	REVISION	
-------	--------	-------	----	-------------	--------	----------	--



NOTES

REV.	DESCRIPTION	DATE

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

CLIENT

COUNTRYSIDE PROPERTIES

JOB TITLE

GOLDTHORPE COLLIERY

DRAWING TITLE

REVISED CONCEPTUAL SITE MODEL

DRAWN	DATE	STATUS
JBR	14/05/2019	FOR COMMENT ☐
ASw	14/05/2019	FOR APPROVAL ☐
		DRAFT ☐
		FINAL ☒

SCALE	SHEET	DRAWING NO.	REVISION
Not to scale	A3	1750/8	



NOTES

EXPLORATORY HOLE WITH NO OR LIMITED MADE GROUND (<1.0m)

TRIAL PIT LOCATION

WINDOW SAMPLE LOCATION

EXPLORATORY HOLE WITH SHALLOW MADE GROUND (1.0m to 2.0m)

TRIAL PIT LOCATION

WINDOW SAMPLE LOCATION

EXPLORATORY HOLE WITH DEEP MADE GROUND (>2.1m)

TRIAL PIT LOCATION

WINDOW SAMPLE LOCATION

ANTICIPATED EXTENT OF DEEP MADE GROUND

NOTE: Extent of deep made ground approximate only, based on extrapolation between exploratory holes. Further deep made ground may be identified on site.

EXISTING TREES

APPROXIMATE SITE BOUNDARY

A REFINEMENT OF DEEP MADE GROUND ZONE

30/09/19

REV.	DESCRIPTION	DATE

LITHOS CONSULTING

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

Tel 01937 545330

CLIENT

COUNTRYSIDE PROPERTIES

JOB TITLE

GOLDTHORPE COLLIERY

DRAWING TITLE

MADE GROUND THICKNESSES

DRAWN	JBR	DATE	30/09/2019	STATUS	FOR COMMENT	☐
CHECKED	ASw	DATE	12/04/2019	FOR APPROVAL	DRAFT	☐
				FINAL	☒	

SCALE	1:1250	SHEET	A3	DRAWING NO.	1750/9	REVISION	A
-------	--------	-------	----	-------------	--------	----------	---

Appendix C

Commission

010/1750/GLM

18th January 2019

Mr M Bray
Countryside Properties
3200 Thorp Park
Century Way
Leeds
LS15 8ZB



Registered in England 07068066

Parkhill
Wetherby
West Yorkshire
LS22 5DZ

T 01937 545 330

www.lithos.co.uk

Dear Mark

Goldthorpe Colliery

Further to your recent invitation, please find attached our proposal for undertaking a site investigation on the above land. We understand that your proposed development will include 'traditional 2 storey domestic dwellings with associated gardens, POS and adoptable roads and sewers; although no layout is available yet.

Lithos has already issued a desk study covering the site (Report ref. 1750-1, dated October 2013) to Sir Robert Ogden CBE LLD. In addition, Lithos are aware of previous investigations undertaken by AIG Consultants Ltd (June 2002) and Encia Consulting (July 2016).

Review of the information supplied suggests that the site consists of a single parcel of land of approximately 4.3 hectares off Kingsmark Way. Review of Google Maps and Lithos' desk study suggests that the site comprises a single parcel of rough grassland with shrubbery and areas of fly tipping. A railway cutting runs along the southern edge of the site; the track has been dismantled, probably shortly after the colliery closed in 1994. Land falls at about 45° from the boundary, and the cutting is about 5m lower than the site.

Review of historical information suggests that the site was formerly part of the Goldthorpe Colliery (which operated from c. 1930 up until 1994); the southern third of the site was occupied by railway sidings and colliery spoil heaps. The centre and north of the site are essentially greenfield, having previously been occupied by allotment gardens.

Material within a colliery spoil tip (c. 10m high) that occupied an area of approximately 1 hectare in the south was relocated to the Main Tip (about 400m to the east, beyond the adjacent Ben Bailey development) in 2005.

Review of Environment Agency data suggests the site:

- Is not located within 250m of a known landfill site; and,
- Is not within a groundwater source protection zone.

The site is underlain by the Ackworth Rock Sandstone (north) and undifferentiated Middle Coal Measures (south). This site is located within a Coal Mining Development Low Risk Area, but an intrusive mining investigation should not be required).

The scope of works outlined in this letter should enable us to assess abnormal development issues, associated with ground. However, the nature of site investigation is such that it is not always possible to foresee all the potential issues. Consequently, it is sometimes necessary to recommend additional work, but where this occurs we will inform you immediately, provide costs, and seek your further instruction. We have visited site and reviewed available internet data and our geological maps in order to minimise the likelihood of further work.



Our site investigation will be undertaken in accordance with UK good practice (as outlined in BS5930, BS10175, CLR11 etc). Our Report may not be fully compliant with Eurocode 7 (EC7) and will not purport to be a Ground Investigation Report, nor a Geotechnical Design Report as defined by EC7. Our ground appraisal is intended to assist others as they proceed with design of the proposed development.

This proposal allows for the following works:

Desk study: We will update our 2013 report, include a more detailed review of the AIG / Encia reports, and obtain a 'new' Consultant's mining report.

Fieldwork: We have allowed for two day's trial pitting and the drilling of 12 dynamic sample boreholes using a mini percussion drilling rig. All trial pits and boreholes will be supervised and logged by an experienced geoenvironmental engineer.

The boreholes are primarily intended to enable the installation of gas monitoring wells but will also allow the retrieval of geotechnical data from depth.

Based on anticipated ground and topography (railway cutting immediately south), soakaways are considered unlikely to provide a satisfactory solution for surface water drainage, but testing would remove any ambiguity with respect to Yorkshire Water queries. However, no allowance has been made for soakaway testing at this stage. If required, or considered feasible based on the ground actually encountered, soakaway tests could be undertaken for an additional fee of about £

Representative soil samples of natural and man-made ground, including any contaminated samples, will be taken during the works. In-situ shear strengths of any cohesive soils encountered will be determined by the use of a hand-held shear vane.

We will make every effort to compact arisings and 'sweep' them over each pit. However, you should be aware that on completion of the investigation, "graves" of spoil (each about 3m long by 1m wide) unsuitable for trafficking, will be left up to 400mm proud at each trial pit location. At this stage, no allowance has been made for any further reinstatement such as removal of excess arisings or replacement of turf.

If the pitting encounters significant thicknesses of made ground or very soft/loose deposits (the former is possible), cable percussion boreholes may be required to obtain geotechnical data from greater depth. We will advise you of the need for boreholes within 2 days of completion of the pitting.

This investigation should yield sufficient data to enable a foundation zoning plan, and possibly a detailed Foundation Schedule. However, if ground conditions are found to be more variable than anticipated, a 'tighter' grid of pits will be necessary prior to preparation of a detailed Foundation Schedule. This proposal does not allow for the preparation of a detailed Foundation Schedule, but we will provide a quote on completion of the site investigation if requested.

This site is brownfield and therefore likely to be underlain by made ground. However, the rate of gas generation within most made ground tends to be low, resulting in small concentrations and flows. In addition known mineworkings are located beneath the site.

Consequently, we have allowed for the installation of wells in 12 boreholes and monitoring for hazardous gas (and any shallow groundwater).

The generation potential of this gas source is considered likely to be very low. Therefore, in accordance with CIRIA Report C665, we have initially allowed for 6 visits over a 3-month period. A hazardous gas risk assessment will be issued on completion of monitoring.

Testing: This will comprise routine geotechnical soils analysis, including moisture content & Atterberg limits, and pH & water-soluble sulphate. We will also schedule compaction tests on samples of made ground to assess suitability for use in earthworks ground improvement.

This site is brownfield and therefore likely to be underlain by made ground which in turn is likely to be subject to re-engineering prior to the construction of new estate roads. Consequently, there is no merit in obtaining CBR values at this stage.

Appropriate chemical analyses, based on our review of existing SI report and knowledge of the site's history, have been allowed for; this will comprise 25 samples for a suite including heavy metals, speciated PAH, and banded TPH (with supplementary speciation as/where appropriate). In the event that ground contamination is more significant or different to that anticipated, it might be necessary to carry out additional chemical testing.

Within in our proposal we have allowed for the screening (ID) of 25 samples for asbestos. In the event that positive IDs are reported, it is likely that we will need to schedule further analysis (asbestos quantification), in order to determine the significance of the results. Asbestos quantification is currently a relatively expensive test and consequently we have not allowed for it at this stage. We will inform you immediately after receipt of results if we consider asbestos quantification is required.

Reporting & timescales: In order to provide you with sufficient information to enable assessment of abnormal costs at the earliest opportunity we will issue a concise overview report within 3 days of fieldwork completion.

On completion of the desk study, fieldwork and laboratory testing a comprehensive bound, factual and interpretative report will be issued. This will contain detailed engineering records, laboratory test results, copies of all relevant correspondence and drawings of the site. The report will include qualitative risk assessment with respect to both controlled waters and human health. The report will also include consideration of foundation types.

Fieldwork could be commenced within 3 weeks of receipt of your written instruction to proceed. Our comprehensive geoenvironmental appraisal report will be issued within 4 weeks of fieldwork completion. This report will comment on issues associated with hazardous gas, but the gas risk assessment will not be issued until monitoring is completed.

A copy of the final report will be issued to the relevant regulatory authorities on receipt of written instruction from yourselves.

Invoicing: The attached proposal provides a breakdown of the costs associated with this project. This breakdown is for information only and the proposal can be regarded as a lump sum price of £ plus VAT. Variation will only occur in the event that a given item is not undertaken or that substantial additional works are recommended, in which case we will inform you immediately, provide costs for the required works, and seek your prior consent.

Our proposal allows for submission of the report to the Local Authority and NHBC, and for submission of a single piece of subsequent correspondence with each regulator to address any queries they may have. Any further meetings, correspondence etc, would be chargeable.

We will submit invoices for this project at the milestones defined below:

- 1st milestone invoice (Items A, B & C) within 5 days of fieldwork completion, with exploratory hole logs and an interim letter report outlining our initial findings
- 2nd milestone invoice (Items D, E & F) on issue of the final SI report
- 3rd milestone invoice (Item G) on completion of monitoring and issue of the hazardous gas risk assessment

Health, safety & welfare: The works outlined above will be carried out in accordance with Lithos' task- and site- specific Risk Assessments and Method Statements.

Details of welfare will be included within the Method Statements; however, this investigation is expected to be completed within 3 working days and therefore it is not considered reasonably practicable to provide formal welfare facilities, and our proposal makes no allowance for so doing.

Utility plans are required in order to protect operatives from the hazards associated with striking buried services and avoid potentially substantial disruption\repair costs. We will make every effort not to damage any services (including review of utility plans and use of a CAT detector). However, Lithos cannot accept liability for damage to any underground services that are not accurately marked on plans made available to us prior to commencement of our field investigation, or have not been accurately marked on the ground by a responsible third party (e.g. utility company, site owner).

Most developers have copies of the necessary utility plans (including electricity, gas, water, drainage & telecom), and it would be appreciated if you could forward these prior to the proposed fieldworks. However, if you do not have the necessary plans, Lithos will obtain them direct from each of the utility companies.

Under the CDM Regulations 2015, Lithos must be provided with pre-construction information already in your possession, or information that can reasonably be obtained through sensible enquiry. This information must be relevant to the project, have an appropriate level of detail, and be proportionate to the nature of the risks.

Terms & conditions: This work 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



George Morton
Senior Engineer
for and on behalf of
LITHOS CONSULTING LIMITED

From: [David Bridges](#)
To: [Reg](#)
Subject: SI Acceptance at Goldthorpe Colliery
Date: 02 April 2019 10:24:30
Attachments: [image001.png](#)

Reg, could you pass this onto George as I don't have his email.

Further to your quotation for the above, attached, we confirm that this meets with our approval. Please take this email as an instruction to proceed and we agree to pay for the works upon receipt of the final report and invoice.

Please note our invoice procedure below.

We would be grateful if you could inform us of your start date so we can sort access and arrange to visit site.

We have arranged for an existing services search and this will be available in around 7 days.

I attach our latest sketch layout and it should be noted Knotweed is present on site (treated and regrown areas), a plan of the area in question is attached.

Invoice details

Please state the site clearly on the invoice.

They may ask you for your bank details/address etc. So if you could send them in the same email please.

Could you please email any future invoices to invoicesnonmat@cpplc.com. This particular invoice however needs to be re-addressed to-

*Countryside Properties (UK) Ltd
Countryside House
The Drive
Brentwood
Essex
CM13 3AT*

It also would need a delivery address before it can be processed for payment.

Delivery;

**Countryside Properties
2nd Floor
3200 Century Way
Thorpe Park
Leeds
LS15 8ZB**

F.a.o Dave Bridges

Regards

Dave Bridges
Snr Development Manager
Mob: 07920 765762

Countryside Properties
2nd Floor
3200 Century Way
Thorpe Park
Leeds
LS15 8ZB



This email and any files transmitted with it are confidential and may contain privileged material intended solely for the recipient(s) named above. If you are not the intended recipient of this email please contact the sender immediately and destroy this email. Any views or opinions presented in this email are solely those of the author and might not represent those of Countryside Properties plc or any of its subsidiaries. Countryside Properties plc and its subsidiaries will not accept any liability in respect of any statements made in this email. Warning: Although Countryside has taken reasonable precautions to ensure no viruses are present in this email, the company cannot accept responsibility for any loss or damage arising from the use of this email or attachments.

Countryside Properties plc. Registered in England No. 09878920
Registered Office: Countryside House, The Drive, Brentwood, Essex, CM13 3AT. Telephone: 01277 260000

021/1750/REG

5th July 2019

Mr A Clarke
Countryside Properties
3200 Thorp Park
Century Way
Leeds
LS15 8ZB



Registered in England 07068066

Parkhill
Wetherby
West Yorkshire
LS22 5DZ

T 01937 545 330
www.lithos.co.uk

Dear Adam

Goldthorpe Colliery – boreholes & foundation schedule

Further to your recent request, please find attached our proposal for the further works recommended in our earlier SI Report (1750/2, dated May '19), namely:

- Cable percussive boreholes to advise piling contractors (we understand that this will be your foundation solution in areas of deep made ground).
- Further trial pitting to tighten grid to enable you to produce a foundation schedule.
- Production of foundation schedule.

Fieldwork: We have allowed for the drilling of 5 cable percussion boreholes to "refusal" in bedrock, likely at depths of around 6m.

The boreholes will be advanced by a conventional trailer mounted, diesel powered cable percussion rig, using temporary steel casing tubes and appropriate boring / sampling tools. The rig will be towed between locations by a four-wheel drive vehicle.

The ability to use temporary steel casing to line the borehole, during drilling of using a cable percussion rig, enables the recovery of more reliable geotechnical data, and the installation of better/deeper monitoring wells (cf dynamic or window sampling BHs using a mini-percussive drill rig).

SPT's will be performed in made ground, granular soils and firm\stiff cohesive soils on striking (i.e. change of stratum) and then at intervals of 1m.

Undisturbed, thin wall open-tube samples (UT100) will be obtained from natural in-situ cohesive soils on striking and then alternate with SPTs (except in soft clays where only UT100s will be recovered) at intervals of 1m.

The borehole will be cased-off during drilling to at least rock head, in order to reduce the possibility of blowing sands, groundwater ingress, mis-sampling etc.

The boreholes are primarily intended to enable the retrieval of geotechnical data from depth, but will also allow the installation of groundwater wells (50mm ID, HDPE pipework with bentonite seals and a gravel filter pack). Well headworks will comprise 150mm diameter steel security helmet which will extend about 300mm above ground level. On completion of the works we will dip the monitoring wells monthly for 3 months.

The need for further trial pitting will be reviewed after we have made some progress with the foundation schedule in order that pits can be targeted in areas where they are required. Item A provides a day rate for the pitting; but it is likely that one day will suffice.



Representative soil samples of natural and man-made ground, including any contaminated samples, will be taken during the works. In-situ shear strengths of any cohesive soils encountered will be determined by the use of a hand-held shear vane.

We have allowed for all exploratory holes to be picked-up by a surveyor (co-ordinates/ground levels will be included on the logs).

We will make every effort to compact arisings and 'sweep' them over each pit. However, you should be aware that on completion of the investigation, "graves" of spoil (each about 3m long by 1m wide) unsuitable for trafficking, will be left up to 400mm proud at each trial pit location. At this stage, no allowance has been made for any further reinstatement such as removal of excess arisings, replacement of turf.

Testing: This will comprise routine geotechnical soils analysis, including 8 moisture content & Atterberg limits, and 8 pH & water-soluble sulphate.

Reporting & timescales: On completion of the fieldwork and laboratory testing, we will update & re-issue Report 1750/2.

Fieldwork could be commenced within 3 weeks of receipt of your written instruction to proceed. Our comprehensive geoenvironmental appraisal report will be issued within 4 weeks of fieldwork completion.

Foundation schedule. We could prepare a Foundation Schedule for about 140 units, which will take account of proposed final levels, trees, and ground conditions. The schedule will be in a similar format to the attached, depersonalised example.

It should be noted that we have assumed that proposed planting does not require consideration (i.e. tree species, and distance from plot, will not require deepening of foundations); if this is not the case, our fee for preparation of a foundation schedule will need to be revised in light of review of a detailed plan showing proposed planting.

In order to complete this work we will need to know the maximum line load for each house type, and be provided with copies of the following drawings (in AutoCAD format):

- Proposed housing layout
- Tree survey (and details of any significant proposed planting)
- Topographical survey
- External works drawing (showing FFLs etc)

Our foundation schedule will include the following for each plot:

- Foundation type
- Founding strata
- Safe bearing capacity
- Founding depth (after consideration of tree influence)
- Foundation width (see comment below)
- Floor type

You may also require some input from your Structural Engineer, most notably with respect to:

- Foundation widths: we will compute these on the assumption that all house types will exert a maximum line load of 90kN/m run, given the allowable bearing capacity here of 150kPa. Whilst we could compute foundation widths for higher line loads, these are probably best provided by your appointed structural engineer as the various walls may require footings of differing width which would be best shown on a structural drawing for each house type.

- Reinforcement: but recommended only where foundation excavations encounter significant lateral and vertical variations in strata.
- Designated mixes: these 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.

Invoicing: The attached proposal provides a breakdown of the costs associated with this project.

We will submit our invoice for this project with the final report and foundation schedule.

Health, safety & welfare: The works outlined above will be carried out in accordance with Lithos' task- and site- specific Risk Assessments and Method Statements.

Details of welfare will be included within the Method Statements, however, this investigation is expected to be completed within 3 working days and therefore it is not considered reasonably practicable to provide formal welfare facilities, and our proposal makes no allowance for so doing.

Under the CDM Regulations 2015, Lithos must be provided with pre-construction information already in your possession, or information that can reasonably be obtained through sensible enquiry. This information must be relevant to the project, have an appropriate level of detail, and be proportionate to the nature of the risks.

Terms & conditions: This work 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



Mark Perrin
Director

for and on behalf of
LITHOS CONSULTING LIMITED

James Brown

Subject: FW: Goldthorpe - further works

From: Adam Clarke <AdamC@cpplc.com>

Sent: 15 August 2019 11:15

To: Reg <Reg@lithos.co.uk>

Subject: RE: Goldthorpe - further works

Morning Reg

Hope you're well

Please could you programme the additional site work in & let me know when the findings will likely be available?

Thanks

Adam

Adam Clarke
Development Engineer, Partnerships Yorkshire

Countryside Properties
Aeris, 3200 Century Way, Thorpe Park, Leeds, LS15 8ZB

T: 0113 5324484 | M: 07468 702603 | countrysideproperties.com



From: Reg <Reg@lithos.co.uk>

Sent: 05 July 2019 12:33

To: Adam Clarke <AdamC@cpplc.com>

Subject: [EXTERNAL] Goldthorpe - further works

This message originated from outside Countryside Properties

Morning Adam

Quote for BHs & Foundation Schedule attached. I've also attached a depersonalised example of the type of Schedule we usually produce.

Any queries, please call.

Regards

Mark Perrin
Director
Lithos Consulting Ltd
M 07703 396 635
DD 01937 545 331



www.lithos.co.uk

Appendix D

Historical OS Plans



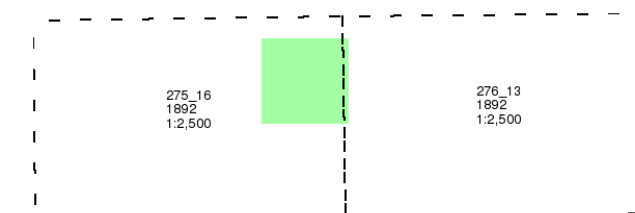
Yorkshire

Published 1892

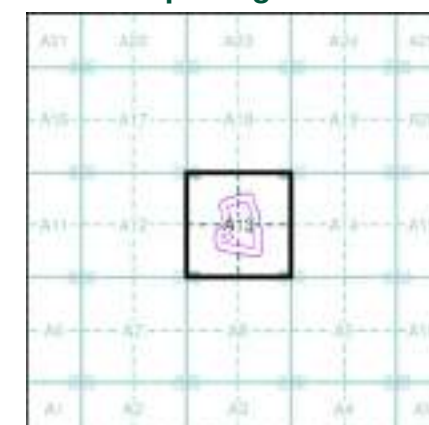
Source map scale - 1:2,500

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

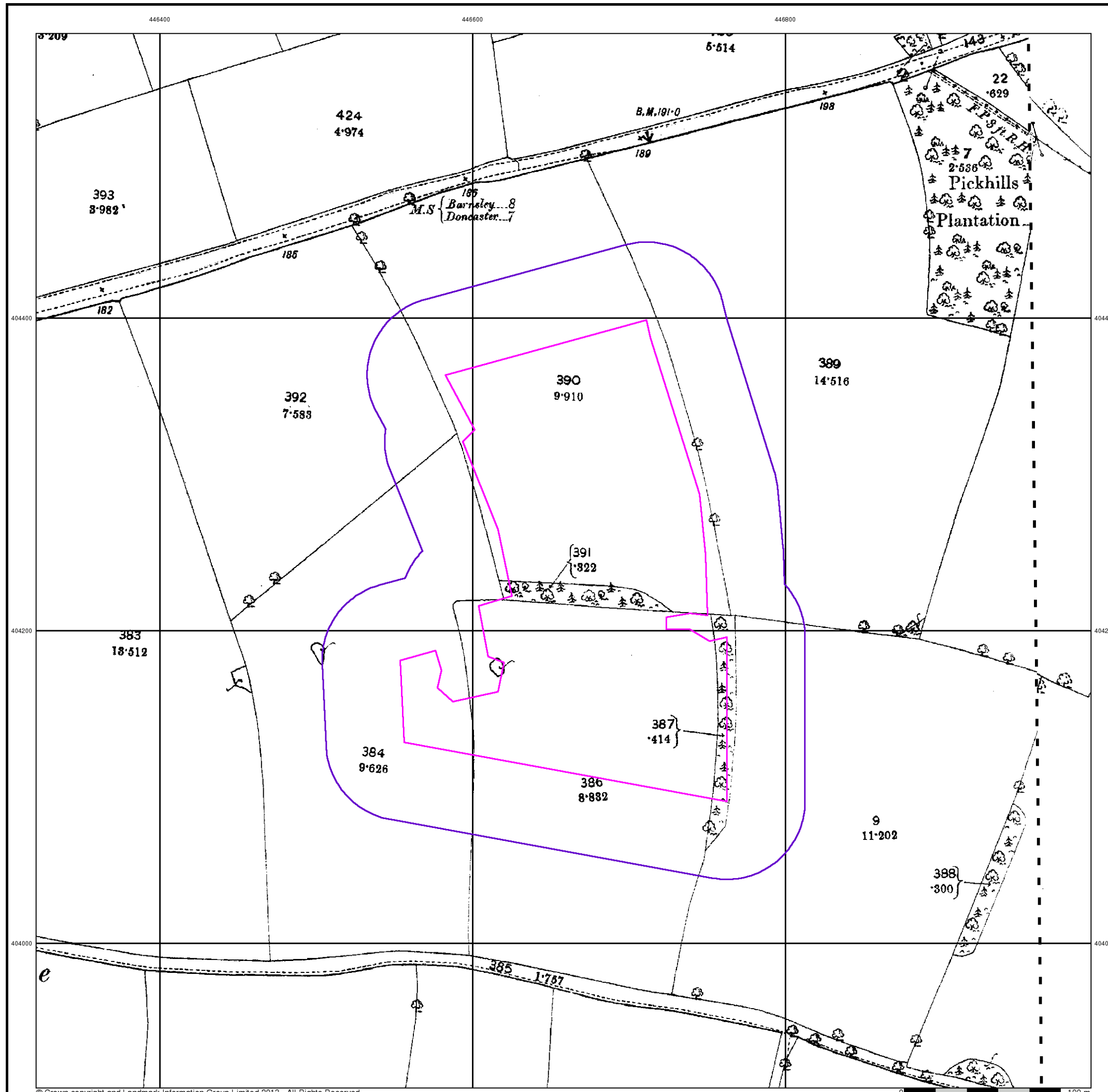
Order Number: 49600160_1_1
Customer Ref: 1750/1/GLM
National Grid Reference: 446670, 404230
Slice: A
Site Area (Ha): 4.11
Search Buffer (m): 50

Site Details

Site at 447000, 404300



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk





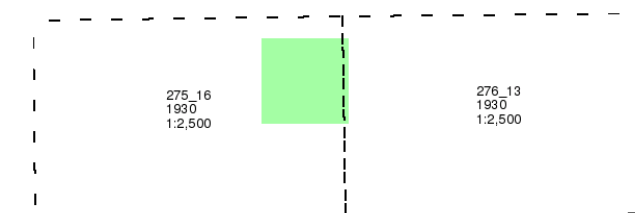
Yorkshire

Published 1930

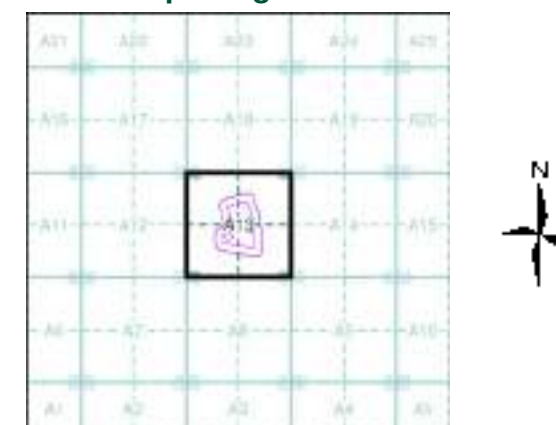
Source map scale - 1:2,500

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

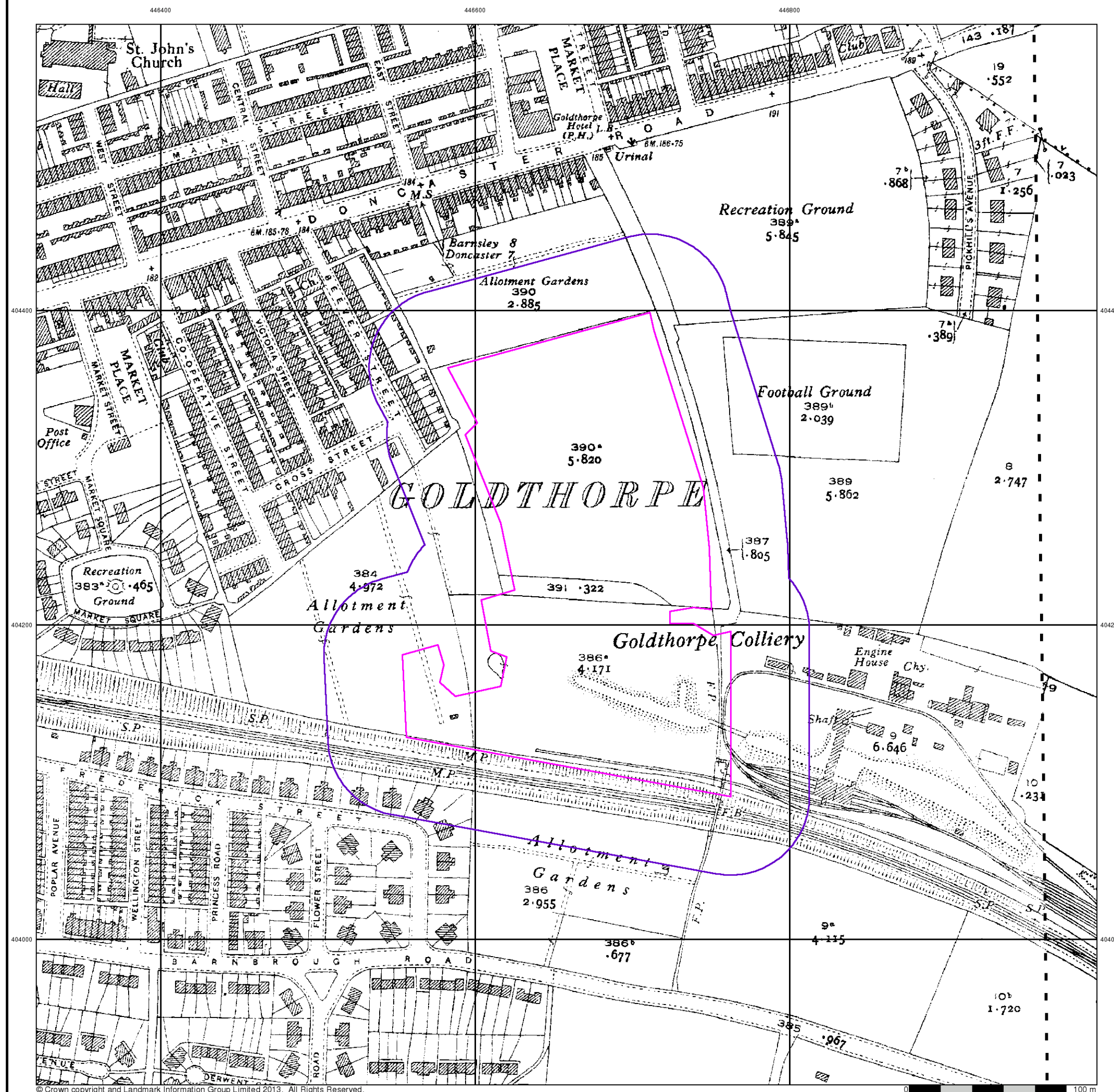
Order Number: 49600160_1_1
Customer Ref: 1750/1/GLM
National Grid Reference: 446670, 404230
Slice: A
Site Area (Ha): 4.11
Search Buffer (m): 50

Site Details

Site at 447000, 404300



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk





Ordnance Survey Plan

Published 1962

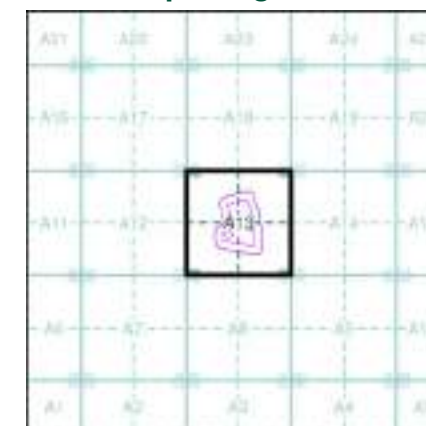
Source map scale - 1:2,500

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)

SE4604
1962
1:2,500
SE4603
1962
1:2,500

Historical Map - Segment A13



Order Details

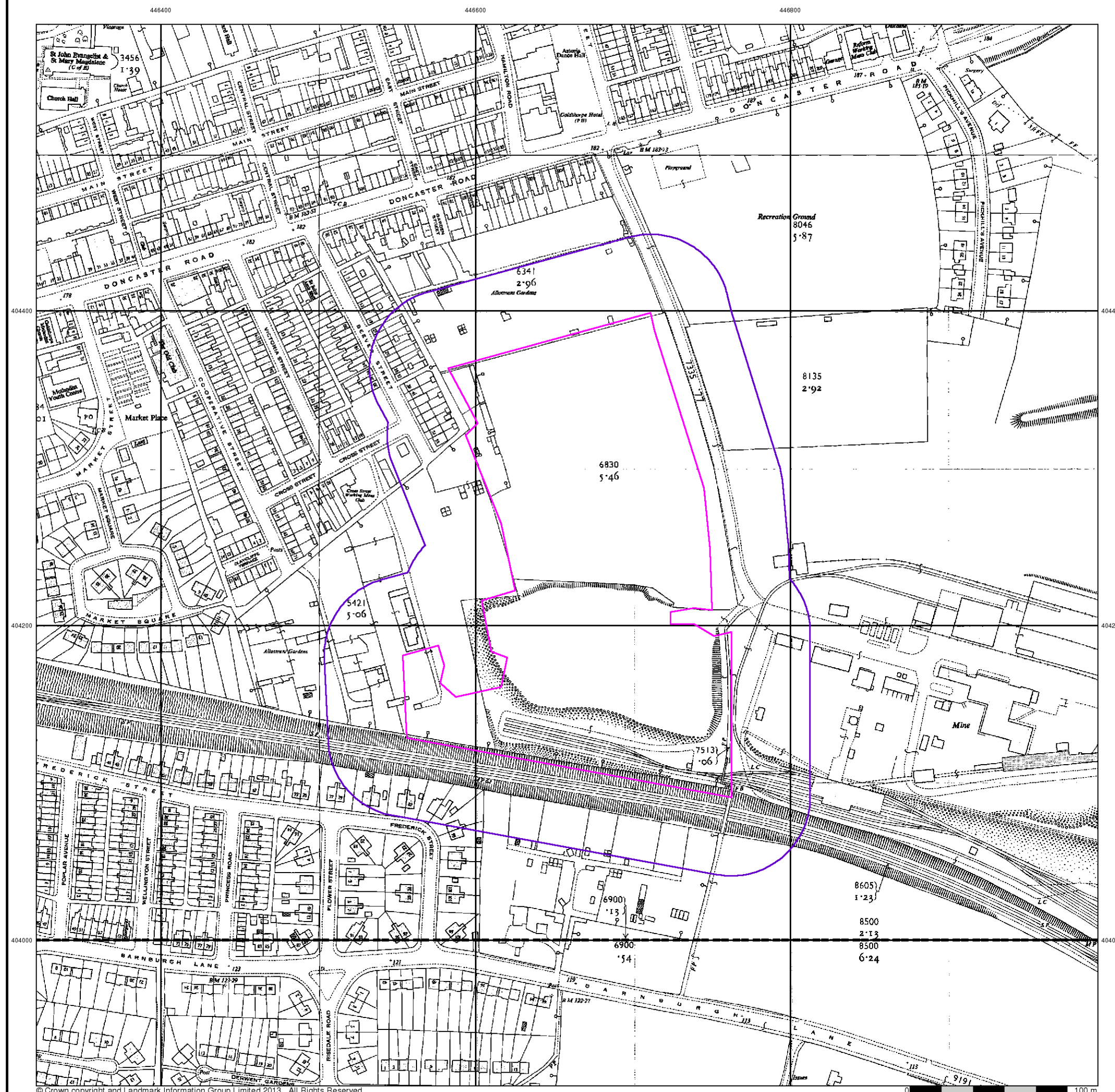
Order Number: 49600160_1_1
Customer Ref: 1750/1/GLM
National Grid Reference: 446670, 404230
Slice: A
Site Area (Ha): 4.11
Search Buffer (m): 50

Site Details

Site at 447000, 404300



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



Appendix E

Search Responses & other Correspondence

Envirocheck[®] Report:

Datasheet

Order Details:

Order Number:

49600160_1_1

Customer Reference:

1750/1/GLM

National Grid Reference:

446670, 404230

Slice:

A

Site Area (Ha):

4.11

Search Buffer (m):

500

Site Details:

Site at 447000, 404300

Client Details:

Mr G Morton
Lithos Consulting Ltd
45 High Street
South Milford
North Yorkshire
LS25 5AF

Prepared For:

Lithos Consulting
Job no.1750
Goldthorpe Colliery

Report Section	Page Number
Summary	-
Agency & Hydrological	1
Waste	4
Hazardous Substances	-
Geological	5
Industrial Land Use	10
Sensitive Land Use	11
Data Currency	12
Data Suppliers	16
Useful Contacts	17

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 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 the attached datasheet the National Grid References (NGRs) are rounded to the nearest 10m in accordance with Landmark's agreements with a number of Data Suppliers.

Copyright Notice

© Landmark Information Group Limited 2013. The Copyright on the information and data and its format as contained in this Envirocheck® Report ("Report") is the property of Landmark Information Group Limited ("Landmark") and several other Data Providers, including (but not limited to) Ordnance Survey, British Geological Survey, the Environment Agency and Natural England, and must not be reproduced in whole or in part by photocopying or any other method. The Report is supplied under Landmark's Terms and Conditions accepted by the Customer. A copy of Landmark's Terms and Conditions can be found with the Index Map for this report. Additional copies of the Report may be obtained from Landmark, subject to Landmark's charges in force from time to time. The Copyright, design rights and any other intellectual rights shall remain the exclusive property of Landmark and /or other Data providers, whose Copyright material has been included in this Report.

Natural England Copyright Notice

Site of Special Scientific Interest, National Nature Reserve, Ramsar, Special Protection Area, Special Conservation Area, Marine Nature Reserve data (derived from Ordnance Survey 1:10000 raster) is provided by, and used with the permission of, Natural England who retain the copyright and Intellectual Property Rights for the data.

Ove Arup Copyright Notice

The Data provided in this report was obtained on Licence from Ove Arup & Partners Limited (for further information, contact mining.review@arup.com). No reproduction or further use of such Data is to be made without the prior written consent of Ove Arup & Partners Limited. The information and data supplied in the product are derived from publicly available records and other third party sources and neither Ove Arup & Partners nor Landmark warrant the accuracy or completeness of such information or data.

Peter Brett Associates Copyright Notice

The cavity data presented has been extracted from the PBA enhanced version of the original DEFRA national cavity databases. PBA/DEFRA retain the copyright & intellectual property rights in the data. Whilst all reasonable efforts are made to check that the information contained in the cavity databases is accurate we do not warrant that the data is complete or error free. The information is based upon our own researches and those collated from a number of external sources and is continually being augmented and updated by PBA. In no event shall PBA/DEFRA or Landmark be liable for any loss or damage including, without limitation, indirect or consequential loss or damage arising from the use of this data.

Radon Potential dataset Copyright Notice

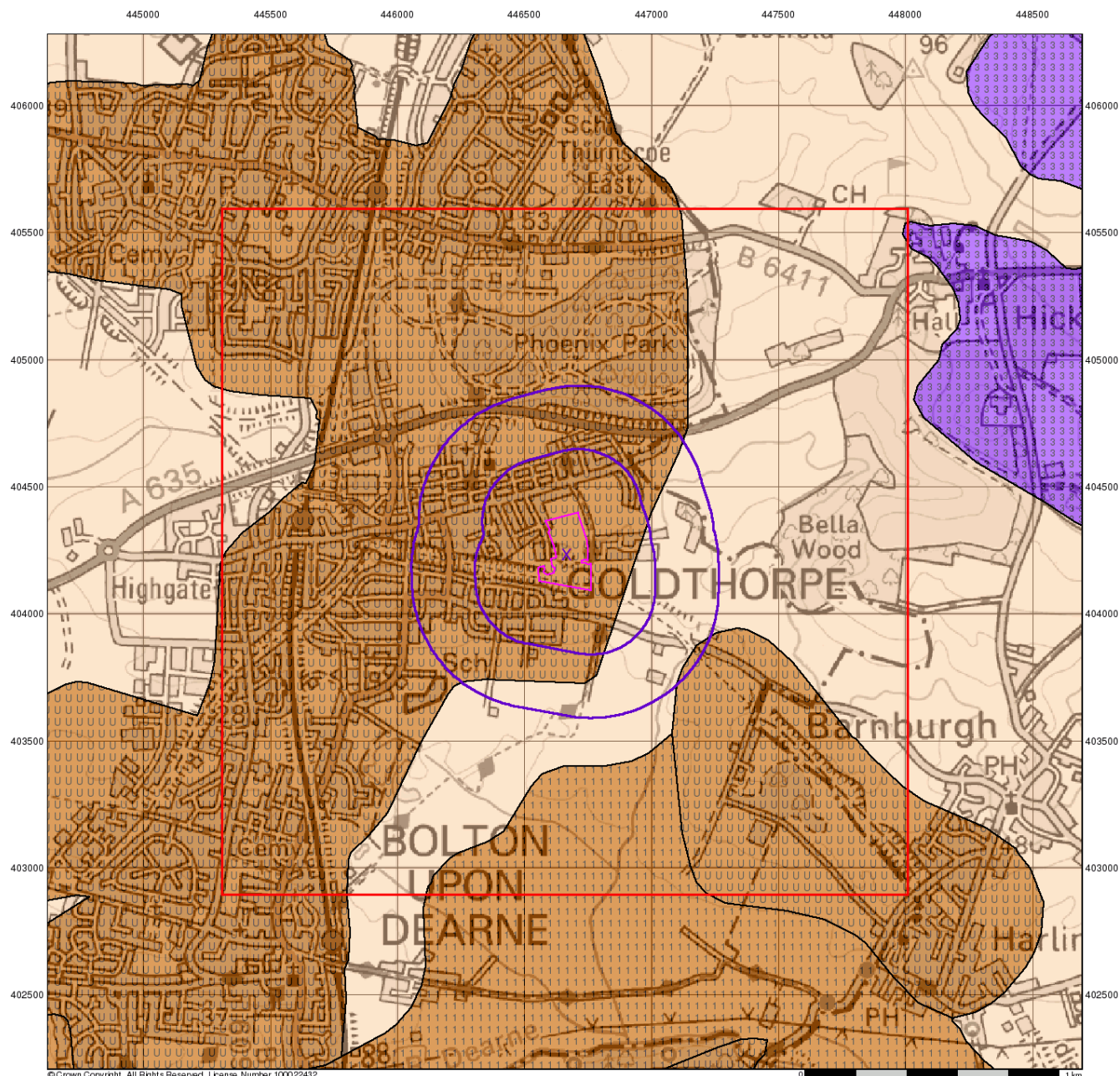
Information supplied from a joint dataset compiled by The British Geological Survey and the Health Protection Agency.

Report Version v47.0

Data Type	Page Number	On Site	0 to 250m	251 to 500m (*up to 1000m)
Agency & Hydrological				
Contaminated Land Register Entries and Notices				
Discharge Consents	pg 1			1
Enforcement and Prohibition Notices				
Integrated Pollution Controls				
Integrated Pollution Prevention And Control				
Local Authority Integrated Pollution Prevention And Control				
Local Authority Pollution Prevention and Controls	pg 1		1	1
Local Authority Pollution Prevention and Control Enforcements				
Nearest Surface Water Feature	pg 1		Yes	
Pollution Incidents to Controlled Waters	pg 1			1
Prosecutions Relating to Authorised Processes				
Prosecutions Relating to Controlled Waters				
Registered Radioactive Substances				
River Quality	pg 1			1
River Quality Biology Sampling Points				
River Quality Chemistry Sampling Points				
Substantiated Pollution Incident Register				
Water Abstractions	pg 2			(*3)
Water Industry Act Referrals				
Groundwater Vulnerability	pg 2	Yes	n/a	n/a
Bedrock Aquifer Designations	pg 2	Yes	n/a	n/a
Superficial Aquifer Designations			n/a	n/a
Source Protection Zones				
Extreme Flooding from Rivers or Sea without Defences				n/a
Flooding from Rivers or Sea without Defences				n/a
Areas Benefiting from Flood Defences				n/a
Flood Water Storage Areas				n/a
Flood Defences				n/a
Waste				
BGS Recorded Landfill Sites				
Historical Landfill Sites				
Integrated Pollution Control Registered Waste Sites				
Licensed Waste Management Facilities (Landfill Boundaries)				
Licensed Waste Management Facilities (Locations)	pg 4			1
Local Authority Recorded Landfill Sites	pg 4			1
Registered Landfill Sites				
Registered Waste Transfer Sites				
Registered Waste Treatment or Disposal Sites				

Data Type	Page Number	On Site	0 to 250m	251 to 500m (*up to 1000m)
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				
Geological				
BGS 1:625,000 Solid Geology	pg 5	Yes	n/a	n/a
BGS Estimated Soil Chemistry	pg 5	Yes	Yes	Yes
BGS Recorded Mineral Sites	pg 8		2	
BGS Urban Soil Chemistry				
BGS Urban Soil Chemistry Averages				
Brine Compensation Area			n/a	n/a
Coal Mining Affected Areas	pg 8	Yes	n/a	n/a
Mining Instability	pg 8	Yes	n/a	n/a
Man-Made Mining Cavities				
Natural Cavities				
Non Coal Mining Areas of Great Britain				n/a
Potential for Collapsible Ground Stability Hazards	pg 8	Yes		n/a
Potential for Compressible Ground Stability Hazards	pg 8	Yes		n/a
Potential for Ground Dissolution Stability Hazards				n/a
Potential for Landslide Ground Stability Hazards	pg 8	Yes	Yes	n/a
Potential for Running Sand Ground Stability Hazards	pg 9	Yes		n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 9	Yes		n/a
Radon Potential - Radon Affected Areas			n/a	n/a
Radon Potential - Radon Protection Measures			n/a	n/a
Industrial Land Use				
Contemporary Trade Directory Entries (50m)	pg 10		2	n/a
Fuel Station Entries				

Data Type	Page Number	On Site	0 to 250m	251 to 500m (*up to 1000m)
Sensitive Land Use				
Areas of Adopted Green Belt	pg 11		2	1
Areas of Unadopted Green Belt				
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 11	1		
Ramsar Sites				
Sites of Special Scientific Interest				
Special Areas of Conservation				
Special Protection Areas				



© Crown Copyright. All Rights Reserved. License Number 100022432.

0 1 km



Groundwater Vulnerability

General

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

Agency and Hydrological

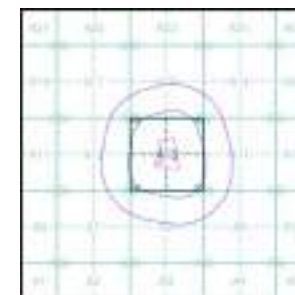
Geological Classes

- Major Aquifer (Highly Permeable)**
- Minor Aquifer (Variably Permeable)**
- Non Aquifer (Negligibly Permeable)**
- Water or Sea**
- Drift Deposit**

Soil Classes

- High (H) 1, 2, 3, U
- Intermediate (I) 1, 2
- Low
- High (H) 1, 2, 3, U
- Intermediate (I) 1, 2
- Low
- Water or Sea
- Drift Deposit

Site Sensitivity Context Map - Slice A



Order Details

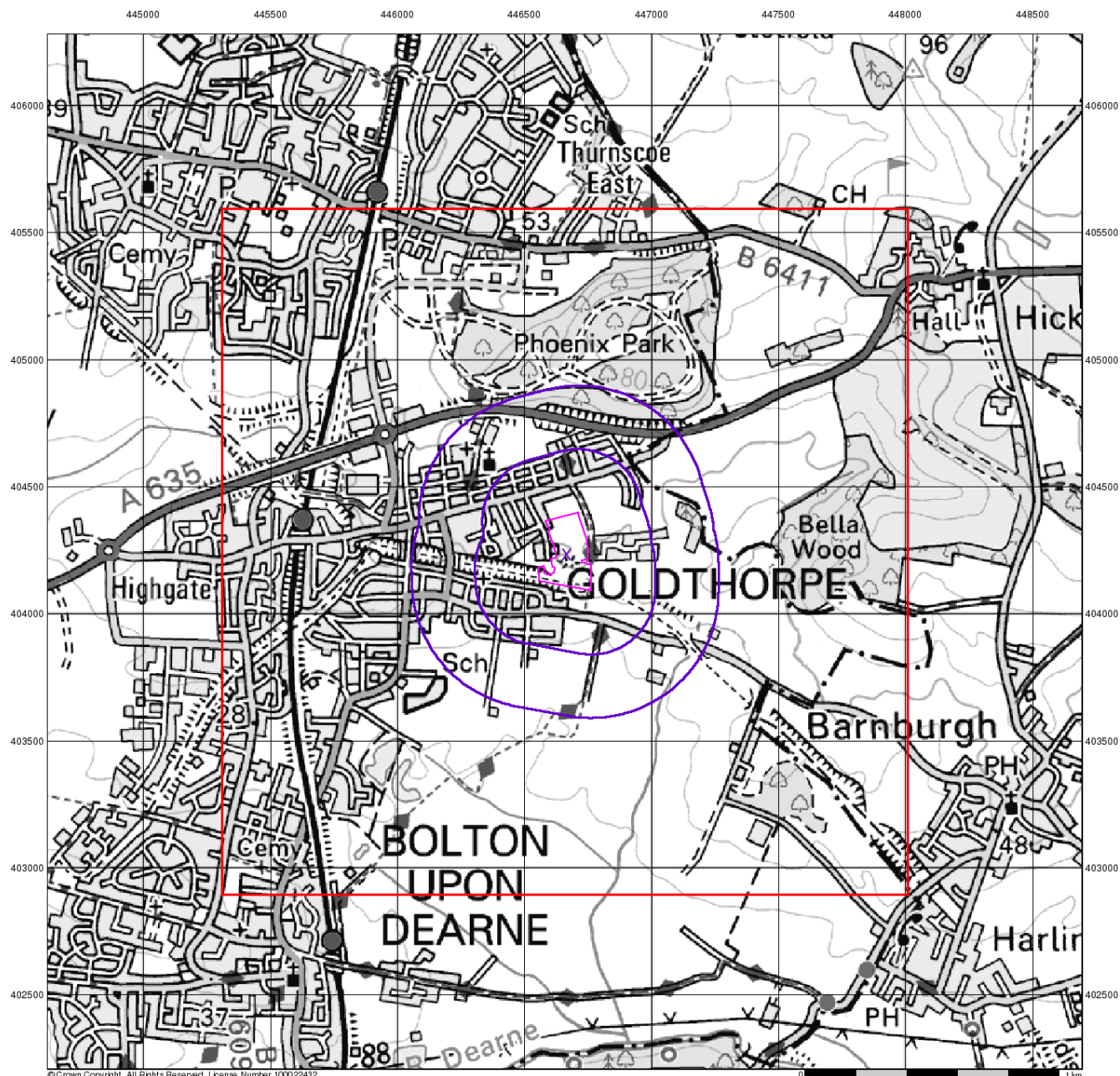
Order Number: 49600160_1_1
 Customer Ref: 1750/1/GLM
 National Grid Reference: 446670, 404230
 Slice: A
 Site Area (Ha): 4.11
 Search Buffer (m): 500

Site Details

Site at 447000, 404300



Tel: 0844 844 9952
 Fax: 0844 844 9951
 Web: www.envirocheck.co.uk



© Crown Copyright. All Rights Reserved. License Number 100022432.



Source Protection Zones

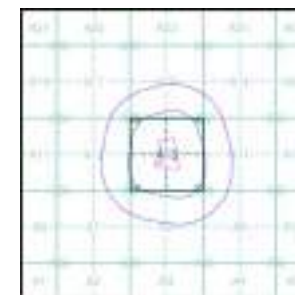
General

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

Agency and Hydrological

- Source Protection Zone I
- Source Protection Zone II
- Source Protection Zone III
- Zone of Special Interest
- Source Protection Zone Borehole

Site Sensitivity Context Map - Slice A



Order Details

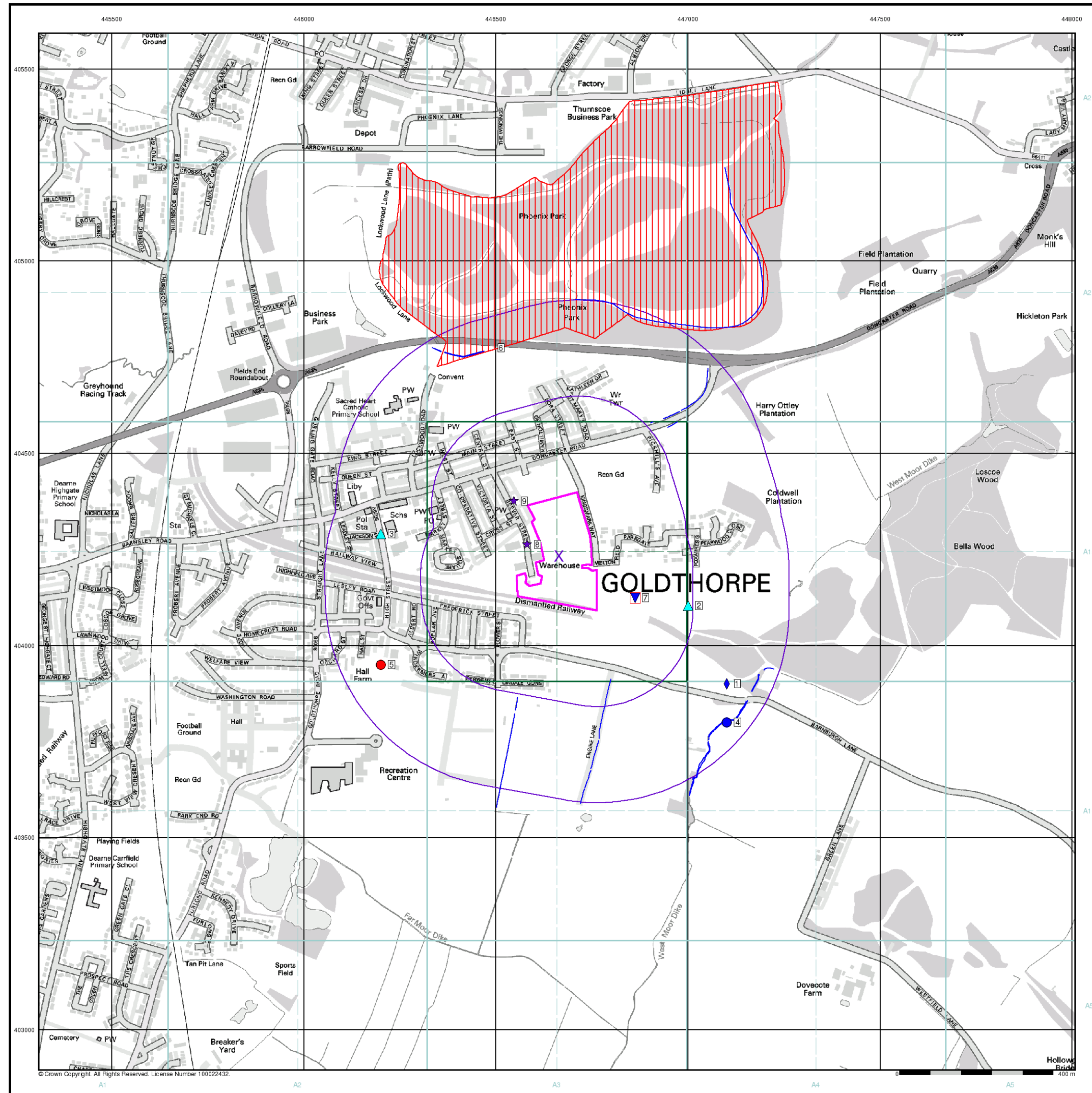
Order Number: 49600160_1_1
 Customer Ref: 1750/1/GLM
 National Grid Reference: 446670, 404230
 Slice: A
 Site Area (Ha): 4.11
 Search Buffer (m): 500

Site Details

Site at 447000, 404300

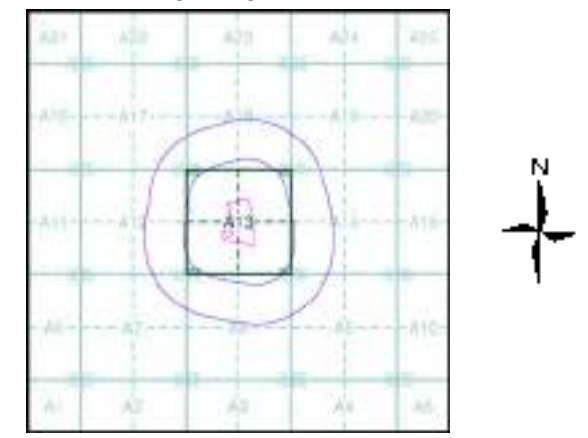


Tel: 0844 844 9952
 Fax: 0844 844 9951
 Web: www.envirocheck.co.uk



- General**
- Specified Site
 - Specified Buffer(s)
 - Bearing Reference Point
 - Map ID
 - Several of Type at Location
- 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 Control
 - Local Authority Integrated Pollution Prevention and Control
 - Local Authority Pollution Prevention and Control
 - 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
 - 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
- Geological**
- BGS Recorded Mineral Site
- Industrial Land Use**
- Contemporary Trade Directory Entry
 - Fuel Station Entry

Site Sensitivity Map - Slice A

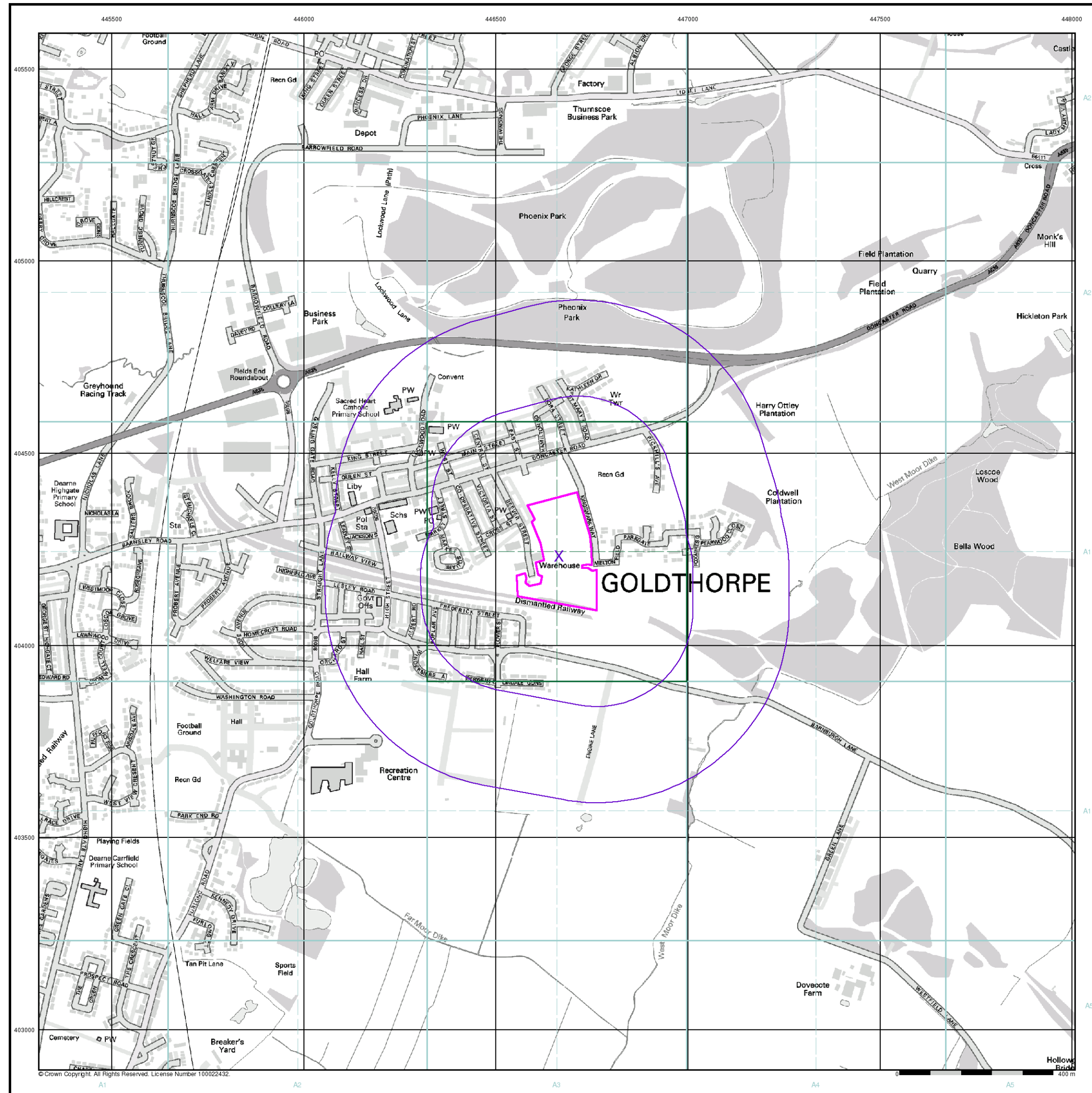


Order Details

Order Number: 49600160_1_1
Customer Ref: 1750/1/GLM
National Grid Reference: 446670, 404230
Slice: A
Site Area (Ha): 4.11
Search Buffer (m): 500

Site Details

Site at 447000, 404300



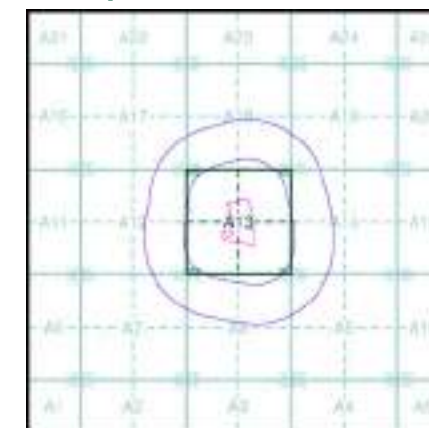
General

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

Agency and Hydrological (Flood)

- Extreme Flooding from Rivers or Sea without Defences (Zone 2)
- Flooding from Rivers or Sea without Defences (Zone 3)
- Area Benefiting from Flood Defence
- Flood Water Storage Areas
- Flood Defence

Flood Map - Slice A



Order Details

Order Number: 49600160_1_1
Customer Ref: 1750/1/GLM
National Grid Reference: 446670, 404230
Slice: A
Site Area (Ha): 4.11
Search Buffer (m): 500

Site Details

Site at 447000, 404300



Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

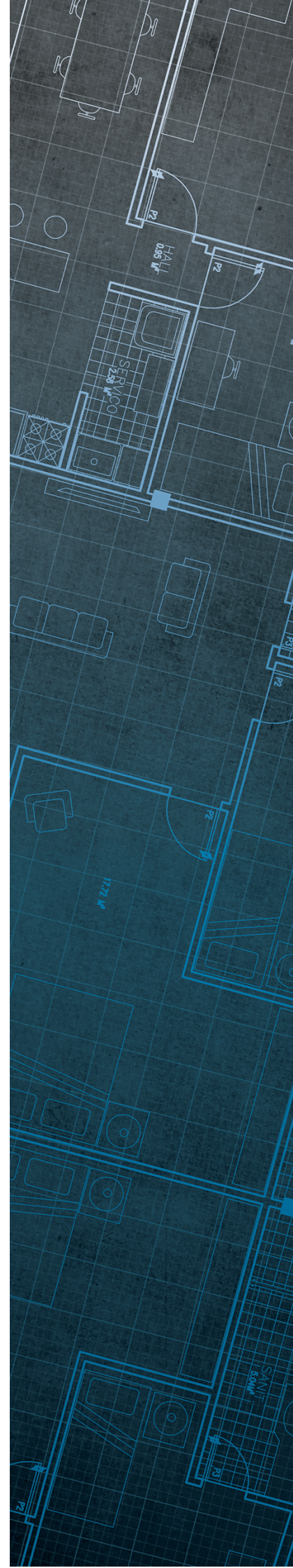


The Coal
Authority

Consultants Coal Mining Report

Goldthorpe
S63 9HT

Date of enquiry:	1 April 2019
Date enquiry received:	1 April 2019
Issue date:	1 April 2019
Our reference:	51002073604001
Your reference:	PO14374/JW/1750



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

Goldthorpe
S63 9HT

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



Reproduced by permission of Ordnance Survey on behalf of HMSO. © Crown copyright and database right 2018. All rights reserved.

Ordnance Survey Licence number: 100020315

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
HIGHGATE	SHAFTON	Coal	4Q4V	44	Beneath Property	3.3	North-East	160	1918
BARNBURGH	NEWHILL	Coal	4R09	261	South	1.7	East	168	1979
BARNSBURGH	NEWHILL	Coal	4Q50	270	Beneath Property	2.7	North-East	150	1978
BARNBURGH	NEWHILL	Coal	4R82	270	South-West	0.0	East	168	1979
BARNBURGH	MELTONFIELD	Coal	4R04	287	South	1.6	East	123	1970
WATH	MELTONFIELD	Coal	4Q4Y	291	Beneath Property	1.9	North-East	127	1968
WATH	TOP HARD BARNLEY	Coal	4R0C	427	South	2.9	East	183	1936
WATH / HICKLETON	TOP HARD BARNLEY	Coal	4Q53	431	Beneath Property	3.7	North-East	218	1916
BARNBURGH	PARKGATE	Coal	4R6R	650	West	0.0	East	137	1937
HICKLETON	PARKGATE	Coal	4MR8	663	Beneath Property	3.6	North-East	157	1946
BARNBURGH	PARKGATE	Coal	4R6S	664	South	2.6	East	145	1954
HICKLETON	PARKGATE	Coal	4MRB	664	South	0.0	East	153	1953

Probable unrecorded shallow workings

None.

Spine roadways at shallow depth

No spine roadway recorded at shallow depth.

Mine entries

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	446404-001	446841 404140	is filled and capped with reinforced concrete (9.4m x 9.4m x 0.4m) at rockhead. A vent. pipe is installed through the cap to the surface. The shaft was capped by Encia Consulting Ltd. in 2006	Coal	

Abandoned mine plan catalogue numbers

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

NE1053	NE1054	16528
NE957	M130	NE684
13930	NE1024	16529

Our records show we have more plans than those shown above which could affect the enquiry boundary.

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

Outcrops

No outcrops recorded.

Geological faults, fissures and breaklines

No faults, fissures or breaklines 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

None recorded within 50 metres of the enquiry boundary.

Remediated sites

None recorded within 50 metres of the enquiry boundary.

Coal mining subsidence

There are 3 claim(s) within 50 metres of the property boundary that do not match the property address. These are shown on the enquiry boundary plot.

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.

If further subsidence damage claims information is required, please visit www.groundstability.com.

See Section 4 for further information.

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 in an area where notices to withdraw support were given in 1946 and 1982.

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

Payments to owners of former copyhold land

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

Section 4 – Further information

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

Development advice

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

Coal mining subsidence

The site is within an area of previous interest. It is close to where the Coal Authority or licensed mine operator has investigated and where necessary remediated issues relating to coal mining subsidence.

The site requires further investigation and may influence your risk assessment. We recommend that you order the appropriate **Coal Authority Subsidence Claims Report**, which will include more information about the hazard.

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

Section 5 – Data definitions

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

Past underground coal mining

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

Probable unrecorded shallow workings

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

Spine roadways at shallow depth

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

Mine entries

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

Abandoned mine plan catalogue numbers

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

Outcrops

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

Geological faults, fissures and breaklines

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

Opencast mines

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

Coal Authority managed tips

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

Site investigations

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

Remediated sites

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

Coal mining subsidence

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

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

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

Mine gas

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

Mine water treatment schemes

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

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

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

Future underground mining

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

Coal mining licensing

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

Court orders

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

Section 46 notices

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

Withdrawal of support notices

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

Payment to owners of former copyhold land

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

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

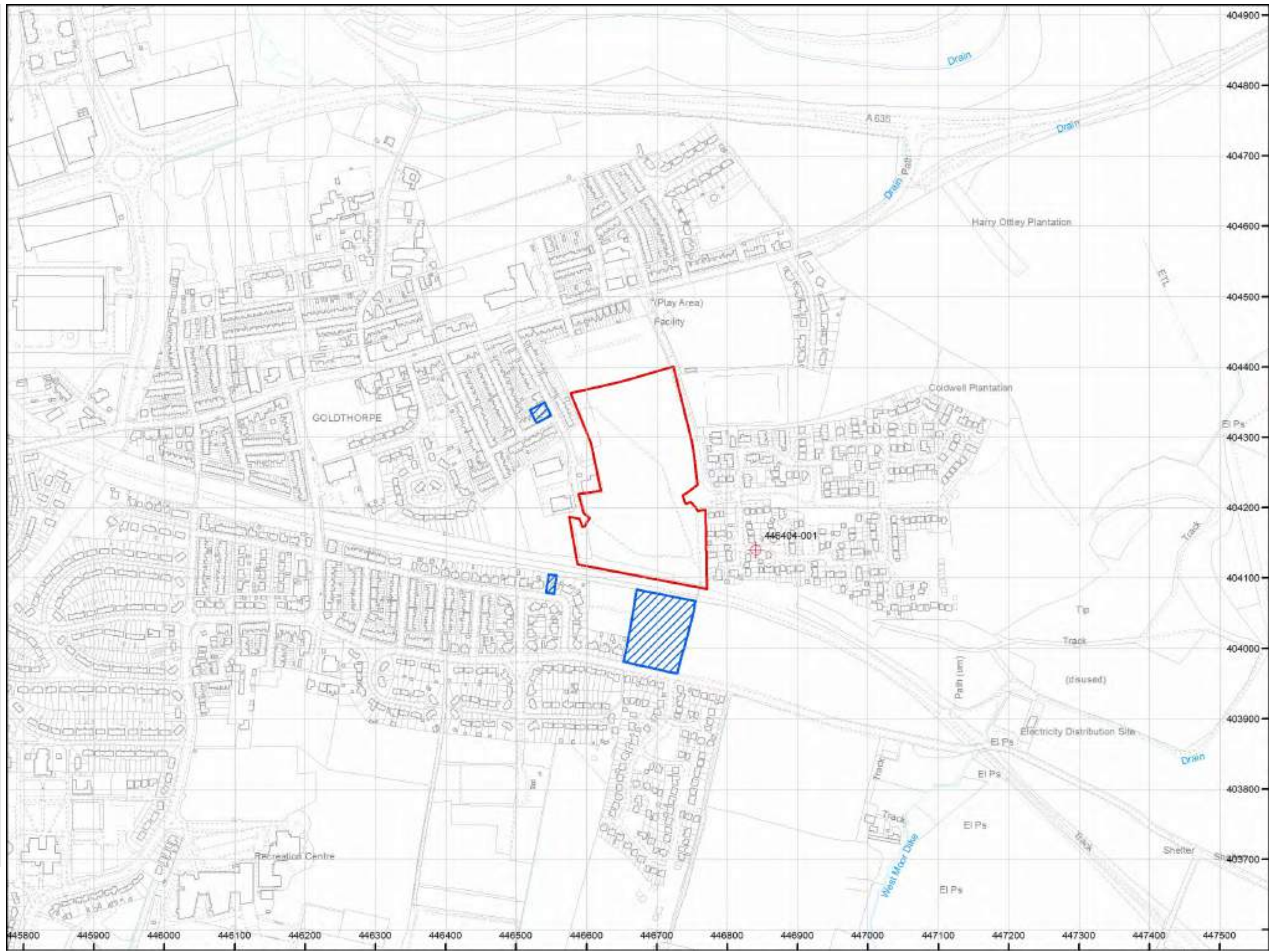
Key

Approximate position of the enquiry boundary shown 

Disused mine shaft 

Coal claim 

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



RECORD OF SHAFT

MINERALS
87
36Name and Number of Shaft ~~number~~ given by Geological Survey:

Goldthorpe Colliery

Name and Number given by owner (if different from above):

Town or Village Goldthorpe Date of sinking 1910

Exact loc. 200 yds N 25° E of Middleton Chapel
1.50' 1.50' 1.50' 1.50' 1.50' 1.50' 1.50' 1.50' 1.50' 1.50'

Purpose for which made

Level at which first encountered relative to U.T.M. 160-161 if not down here, state if horizontal or up

Made by Geo. Smith & Co. 1927 p. 102

Information from

Date received

Dip of axis 1 in 17 NE

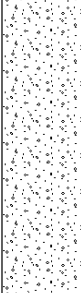
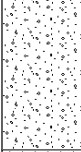
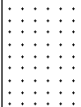
Specimens

Geological Classification	DESCRIPTION	Thickness		Gains	
		ft.	in.	ft.	in.
Unaltered bed metres from top flashes inside off.	Summary of polished section	1.02	4	1.02	4
	clay	0.43	7	0.43	28
	Sandstone	3.36	11	3.36	88
	Sandstone	1.53	8	1.53	14

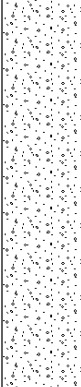
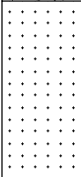
Sinks
Analysis 515 attached

Appendix F

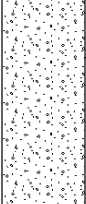
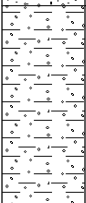
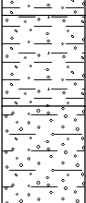
Trial Pit Logs

				Trial Pit Log			Trialpit No TP02 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446683.00 - 404348.00 Level:		Date 09/04/2019	
Location: Goldthorpe				Dimensions (m):		3 		Scale 1:25	
Client: Countryside Properties				Depth 2.20		0.6 		Logged JB	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.10	J&T		0.30			Dark brown very clayey fine to medium SAND. (TOPSOIL)		
	1.00	T					Brown gravelly slightly clayey fine to medium SAND. Gravel is subangular to subrounded fine to coarse lithorelicts of sandstone. (GRANULAR RESIDUAL SOIL)		
							Light brown gravelly fine to medium SAND. Gravel is subangular to subrounded fine to coarse lithorelicts of sandstone. (GRANULAR RESIDUAL SOIL)		
							Weak light brown fine to medium SANDSTONE. Recovered as sandy gravel and cobbles. (WEATHERED ACKWORTH ROCK)		
				2.20			2.2m: Refusal on sandstone bedrock. End of pit at 2.20 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. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									



				Trial Pit Log			Trialpit No TP03 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446634.00 - 404369.00 Level:		Date 09/04/2019	
Location: Goldthorpe				Dimensions (m):		3 		Scale 1:25	
Client: Countryside Properties				Depth 2.10		0.6 		Logged JB	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	1.30	T		0.20			Dark brown clayey fine to medium SAND. (TOPSOIL)		
				1.50			Light brown gravelly slightly clayey fine to medium SAND. Gravel is subangular to subrounded fine to coarse lithorelicts of sandstone. (GRANULAR RESIDUAL SOIL)		
				2.10			Weak light yellowish brown fine to medium SANDSTONE. Recovered as sandy gravel and cobbles. (WEATHERED ACKWORTH ROCK)		
							1.9m to 2.1m: Stained black on fractures. 2.1m: Refusal on bedrock.		
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. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									



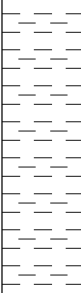
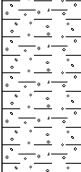
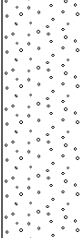
LITHOS CONSULTING				Trial Pit Log			Trialpit No TP04 Sheet 1 of 1	
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446594.00 - 404349.00 Level:		Date 09/04/2019
Location: Goldthorpe				Dimensions (m):		3		Scale 1:25
Client: Countryside Properties				Depth 2.70		0.6		Logged JB
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J&T		0.20			Dark brown very clayey SAND with rare fragments of wood (up to 0.2m). (TOPSOIL)	
							Brown clayey slightly gravelly fine to medium SAND. Gravel is angular to subangular fine to coarse lithorelicts of sandstone. (GRANULAR RESIDUAL SOIL) <i>0.4m to 0.7m: Stone land drain.</i>	
	1.20	D	HVP=113	0.90			Firm light grey mottled orangish brown gravelly CLAY. Gravel is angular to subangular fine to coarse lithorelicts of sandstone. (COHESIVE RESIDUAL SOIL)	1
	1.80	D	HVP=57	1.60			Firm grey gravelly CLAY. Gravel is angular to subangular fine to medium lithorelicts of mudstone. (COHESIVE RESIDUAL SOIL)	
				1.90			Dark grey clayey angular to subangular fine to medium lithorelict GRAVEL of mudstone. (GRANULAR RESIDUAL SOIL)	2
				2.40			Very weak dark grey MUDSTONE. Recovered as angular gravel. (WEATHERED COAL MEASURES) <i>At 2.7m, refusal on bedrock</i>	
				2.70		End of pit at 2.70 m		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. Co-ordinates from hand held GPS, hole not surveyed in.

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

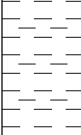
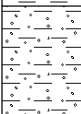
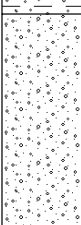


				Trial Pit Log			Trialpit No TP05 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446628.00 - 404309.00 Level:		Date 09/04/2019	
Location: Goldthorpe				Dimensions (m):		3 		Scale 1:25	
Client: Countryside Properties				Depth 2.80		0.6 		Logged JB	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J&T		0.20			Dark brown slightly sandy CLAY. (TOPSOIL)	
			HVP=63				Firm orangish brown mottled light grey CLAY. (COHESIVE RESIDUAL SOIL)	1
	1.00	D	HVP=94	1.20			Firm to stiff brown gravelly CLAY. Gravel is angular to subangular fine to coarse lithorelicts of mudstone. (COHESIVE RESIDUAL SOIL) <i>1.25m: Too gravelly for vanes.</i>	
				1.80			Grey stained orangish brown angular to subangular fine to coarse lithorelict GRAVEL of mudstone with rare orangish brown ironstone nodules (up to 0.1m diameter). (GRANULAR RESIDUAL SOIL)	2
	2.70	T		2.60			Very weak dark grey MUDSTONE. Recovered as angular gravel. (WEATHERED COAL MEASURES) <i>2.8m: Refusal on bedrock.</i>	3
				2.80			End of pit at 2.80 m	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. Co-ordinates from hand held GPS, hole not surveyed in.	
Stability:	1. The sides of the trial pit remained stable during excavation.	

				Trial Pit Log			Trialpit No TP06 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446667.00 - 404306.00 Level:		Date 09/04/2019	
Location: Goldthorpe				Dimensions (m):		3 		Scale 1:25	
Client: Countryside Properties				Depth 2.60		0.6 		Logged JB	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30			Dark brown sandy CLAY. (TOPSOIL)	
	0.90	D	HVP=74				Firm becoming stiff light brown mottled orangish brown and light grey CLAY. (COHESIVE RESIDUAL SOIL)	1
	1.10	T	HVP=97					
			HVP=86	1.50			Stiff brown mottled light grey very gravelly CLAY. Gravel is angular to subangular fine to medium lithorelicts of mudstone. (COHESIVE RESIDUAL SOIL) <i>1.55m: Too gravelly for vanes.</i>	
				1.90			Grey stained reddish brown angular to subangular fine to coarse lithorelict GRAVEL of mudstone. (GRANULAR RESIDUAL SOIL)	2
				2.60			<i>Difficult to excavate beyond 2.5m.</i> End of pit at 2.60 m	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. Co-ordinates from hand held GPS, hole not surveyed in.

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

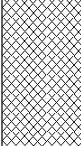
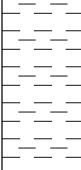
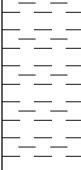
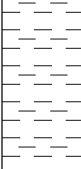
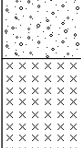


				Trial Pit Log			Trialpit No TP08 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446703.00 - 404277.00 Level:		Date 09/04/2019	
Location: Goldthorpe				Dimensions (m):		3 		Scale 1:25	
Client: Countryside Properties				Depth 2.70		0.6 		Logged JB	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J&T					Dark brown very clayey fine to medium SAND. (TOPSOIL)	
				0.30			Light brown clayey gravelly fine to medium SAND. Gravel is subangular fine to medium lithorelicts of sandstone. (GRANULAR RESIDUAL SOIL)	
				0.60			Stiff orangish brown mottled light grey slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to medium lithorelicts of sandstone. (COHESIVE RESIDUAL SOIL)	
	1.00	T	HVP=134	1.10			Stiff brown mottled light grey slightly gravelly CLAY. Gravel is subangular fine to medium lithorelicts of siltstone. (COHESIVE RESIDUAL SOIL)	1
	1.30	D	HVP=116				Grey gravelly CLAY. Gravel is angular to subangular fine to medium lithorelicts of mudstone. (COHESIVE RESIDUAL SOIL)	
			HVP=90	1.80			Grey angular to subangular fine to coarse lithorelict GRAVEL of mudstone. (GRANULAR RESIDUAL SOIL)	
				2.20			Very weak dark grey MUDSTONE. Recovered as clayey angular to subangular fine to coarse gravel. (WEATHERED COAL MEASURES)	
				2.70			3.0m: Refusal on bedrock.	
				3.00			End of pit at 2.70 m	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. Co-ordinates from hand held GPS, hole not surveyed in.		
Stability: 1. The sides of the trial pit remained stable during excavation.		

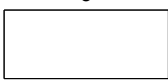
				Trial Pit Log			Trialpit No TP09 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446642.00 - 404250.00 Level:		Date 09/04/2019	
Location: Goldthorpe				Dimensions (m):		3 		Scale 1:25	
Client: Countryside Properties				Depth 3.20		0.6 		Logged JB	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	J&T		0.50			MADE GROUND: Dark brown very gravelly slightly clayey fine to medium SAND. Gravel is angular to subangular fine to coarse of brick, coal, sandstone and red shale. (MADE GROUND TOPSOIL)	
	0.90	D	HVP=89	1.10			Firm becoming stiff orangish brown mottled light brown slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)	1
	1.50	D	HVP=81	2.30			Stiff brown mottled light grey slightly gravelly CLAY. Gravel is angular to subangular fine to medium lithorelicts of mudstone. (COHESIVE RESIDUAL SOIL) <i>1.15m: Locally too gravelly for vane in places.</i>	
				2.50			<i>1.7m to 1.8m: Cobble sized pocket of black gravelly clay.</i>	2
				3.00			Brown angular to subangular fine to coarse lithorelict GRAVEL of mudstone. (GRANULAR RESIDUAL SOIL)	
				3.20			Weak grey SILTSTONE. Recovered as angular to subangular gravel and cobbles. (WEATHERED COAL MEASURES)	
							Very weak dark grey MUDSTONE. Recovered as angular gravel. (WEATHERED COAL MEASURES) <i>3.15m: Refusal on bedrock.</i>	3
							End of pit at 3.20 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. Co-ordinates from hand held GPS, hole not surveyed in.

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



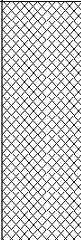
				Trial Pit Log			Trialpit No TP10 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446684.00 - 404242.00 Level:		Date 09/04/2019	
Location: Goldthorpe				Dimensions (m):		3		Scale 1:25	
Client: Countryside Properties				Depth 1.70				Logged JB	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.20			Dark brown slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse coal and sandstone. (TOPSOIL)		
	0.80	D	HVP=68				Firm becoming stiff gravelly CLAY. Gravel is angular to subangular fine to coarse lithorelicts of siltstone. (COHESIVE RESIDUAL SOIL)		
			HVP=150				0.7m to 0.8m: Firm slightly gravelly black clay. Gravel is angular coal.		
	1.20	T		1.10			Light grey clayey angular to subangular fine to coarse lithorelict GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)		
				1.40			Weak light brown fine to medium SANDSTONE. Recovered as subangular gravel and cobbles. (WEATHERED COAL MEASURES)		
				1.70			1.7m: Refusal on bedrock. End of pit at 1.70 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. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									



				Trial Pit Log			Trialpit No TP11 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446738.00 - 404234.00 Level:		Date 09/04/2019	
Location: Goldthorpe				Dimensions (m):		3 		Scale 1:25	
Client: Countryside Properties				Depth 2.80		0.6 		Logged JB	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.10	J&T	HVP=113	0.30			Dark brown very clayey fine to medium SAND. (TOPSOIL)		
							Stiff orangish brown mottled light grey slightly sandy slightly gravelly CLAY. Gravel is angular to subangular lithorelicts of sandstone. (COHESIVE RESIDUAL SOIL)		
	1.00	D	HVP=138	1.20			Stiff orangish brown very gravelly CLAY. Gravel is angular to subangular lithorelicts of siltstone. (COHESIVE RESIDUAL SOIL)		
	1.30	T					Brown slightly clayey angular to subangular lithorelict GRAVEL of siltstone. (GRANULAR RESIDUAL SOIL)		
				1.70		Very weak brown SILTSTONE. Recovered as angular to subangular gravel and cobbles. (WEATHERED COAL MEASURES)			
				1.90		2.8m: Refusal on bedrock.			
			2.80		End of pit at 2.80 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. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit remained stable during excavation.									

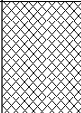
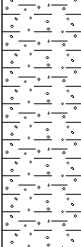
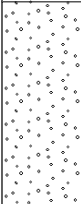


				Trial Pit Log			Trialpit No TP12 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446734.00 - 404200.00 Level:		Date 09/04/2019	
Location: Goldthorpe				Dimensions (m):		3 		Scale 1:25	
Client: Countryside Properties				Depth 1.90		0.6 		Logged JB	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.40	J&T	HVP=110	0.80			MADE GROUND: Dark brown very gravelly fine to coarse ASH. Gravel is angular to subangular fine to coarse of coal, clinker, chalk and burnt shale. (ASH & CLINKER) <u>0.05m: layer of chalk sub-base.</u>	1	
	0.60	B					Stiff orangish brown mottled light grey slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to medium lithorelicts of sandstone. (COHESIVE RESIDUAL SOIL) <u>0.8m: Groundwater seepage.</u>		
	1.20	D					Stiff very gravelly CLAY. Gravel is angular to subangular fine to medium lithorelicts of sandstone. (COHESIVE RESIDUAL SOIL)		
							Weak brown fine SANDSTONE. Recovered as clayey gravel and cobbles. (WEATHERED COAL MEASURES) <u>1.9m: Refusal on bedrock.</u> End of pit at 1.90 m		
				1.80					2
				1.90					
									3
									4
									5

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was apparent at 0.8m 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 remained stable during excavation.		

				Trial Pit Log				Trialpit No TP13 Sheet 1 of 1	
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446693.00 - 404213.00 Level:		Date 09/04/2019	
Location: Goldthorpe						Dimensions (m): 3 0.6		Scale 1:25	
Client: Countryside Properties						Depth 3.60		Logged JB	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
▼	0.30	J&T	HVP=71	0.40			MADE GROUND: Dark brown very gravelly fine to coarse SAND. Gravel is angular to subangular of coal, red shale, mudstone and sandstone. (GRANULAR MADE GROUND)	1	
	0.60	J&T					MADE GROUND: Reddish brown very gravelly fine to coarse ASH. Gravel is angular and subangular fine to coarse shale, clinker and slag. (BURNT RED SHALE)		
	1.20	B		1.40			Soft dark brown slightly sandy silty clay. (RELICT TOPSOIL)		
	1.60	J&T					1.70		
	2.10	D		2.60			Brown stained grey angular to subangular fine to coarse lithorelict GRAVEL of siltstone. (GRANULAR RESIDUAL SOIL)		
	3.30						3.60		
					3.6m: refusal on bedrock. End of pit at 3.60 m	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. Co-ordinates from hand held GPS, hole not surveyed in.		
Stability: 1. The sides of the trial pit were unstable in made ground during excavation.		

				Trial Pit Log			Trialpit No TP14 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446649.00 - 404216.00 Level:		Date 09/04/2019	
Location: Goldthorpe				Dimensions (m):		3 		Scale 1:25	
Client: Countryside Properties				Depth 3.60		0.6 		Logged JB	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.80	J&T		0.30		 MADE GROUND: Dark brown very sandy and to subangular fine to coarse GRAVEL of shale, coal, brick and sandstone. (GRANULAR MADE GROUND)	1	
			1.00		 MADE GROUND: Dark grey very sandy angular to subangular fine to coarse GRAVEL of mudstone, shale and coal. (COLLIERY SPOIL)			
			1.50					 MADE GROUND: Light brown and reddish brown angular to subangular fine to coarse GRAVEL of shale and mudstone. (BURNT RED SHALE)
			1.90		 MADE GROUND: Dark grey angular to subangular fine to coarse GRAVEL of mudstone and shale. (COLLIERY SPOIL)			
	2.00	J&T		2.30		 Firm greyish brown speckled grey slightly sandy CLAY. Faint natural organic odour. (RELICT TOPSOIL)	2	
				3.40		 Firm light grey mottled light brown gravelly CLAY. Gravel is angular to subangular fine to coarse lithorelicts of sandstone. (COHESIVE RESIDUAL SOIL)	3	
	3.50	T		3.60		 Light grey slightly clayey and to subangular fine to coarse GRAVEL of siltstone. (GRANULAR RESIDUAL SOIL)	4	
Difficult to excavate beyond 3.5m. End of pit at 3.60 m								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. Co-ordinates from hand held GPS, hole not surveyed in.		
Stability: 1. The sides of the trial pit were unstable in made ground during excavation.		

				Trial Pit Log			Trialpit No TP15 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446622.00 - 404199.00 Level:		Date 10/04/2019	
Location: Goldthorpe				Dimensions (m):		3 		Scale 1:25	
Client: Countryside Properties				Depth 4.00		0.6 		Logged JB	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.80	J&T		0.20			MADE GROUND: Dark brown very sandy angular to subangular fine to coarse GRAVEL of burnt shale, coal and mudstone. (GRANULAR MADE GROUND) MADE GROUND: Dark grey and reddish brown clayey sandy angular to subangular fine to coarse GRAVEL of mudstone, coal, burnt shale and slag with a low cobble content. (COLLIERY SPOIL)	1
	1.30	B		1.10			MADE GROUND: Dark grey very sandy angular to subangular fine to coarse GRAVEL of coal and mudstone. (COLLIERY SPOIL)	2
	3.10	J&T		3.00			Firm greenish grey slightly sandy silty CLAY. Faint natural organic odour. (RELICT TOPSOIL)	3
	3.50	D	HVP=57	3.40			Firm greenish brown mottled light grey and orangish brown sandy slightly gravelly CLAY. Gravel is angular to subangular fine to medium lithorelicts of siltstone. (COHESIVE RESIDUAL SOIL)	4
				4.00			End of pit at 4.00 m	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. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit were unstable in made ground during excavation.

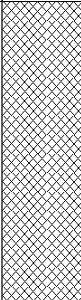
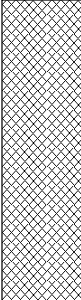
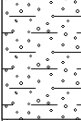


				Trial Pit Log			Trialpit No TP16 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446640.00 - 404173.00 Level:		Date 10/04/2019	
Location: Goldthorpe				Dimensions (m):		3 		Scale 1:25	
Client: Countryside Properties				Depth 4.10		0.6 		Logged JB	

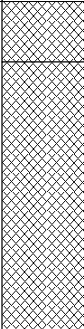
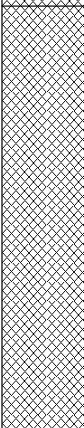
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.40	J&T					MADE GROUND: Dark grey very ashy angular to subangular fine to coarse GRAVEL of clinker, coal, mudstone and burnt shale. (ASH & CLINKER)	1
	1.10	J&T		0.80			MADE GROUND: Black very ashy angular to subangular fine to coarse GRAVEL of clinker, coal and mudstone. (ASH & CLINKER)	
				1.30			MADE GROUND: Reddish brown very sandy angular to subangular fine to coarse GRAVEL of burnt shale. (BURNT RED SHALE)	
	3.20	J&T		3.10			Firm dark grey and greenish grey slightly sandy silty CLAY. (RELICT TOPSOIL)	2
				3.40			Stiff greenish brown slightly sandy silty CLAY. Faint natural organic odour. (COHESIVE RESIDUAL SOIL)	
	3.60	D	HVP=95					
				4.00			Weak greenish brown stained orangish brown fine to medium SANDSTONE. Recovered as clayey sandy gravel and cobbles. (WEATHERED COAL MEASURES)	3
				4.10			4.1m: Refusal on bedrock.	
							End of pit at 4.10 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. Co-ordinates from hand held GPS, hole not surveyed in.		
Stability: 1. The sides of the trial pit were unstable in made ground during excavation.		

				Trial Pit Log			Trialpit No TP17 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446670.00 - 404186.00 Level:		Date 10/04/2019	
Location: Goldthorpe				Dimensions (m):		3 		Scale 1:25	
Client: Countryside Properties				Depth 4.00		0.6 		Logged JB	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼	0.40	B	HVP=87	1.00			MADE GROUND: Reddish brown sandy angular to subangular fine to coarse GRAVEL of slag, burnt shale, coal and mudstone. (BURNT RED SHALE)	1
	0.90	J&T					MADE GROUND: Light brown locally reddish brown clayey angular to subangular fine to coarse GRAVEL of mudstone and shale. (BURNT RED SHALE)	
	2.00	J&T		1.90			MADE GROUND: Orangish grey very clayey angular to subangular fine to coarse GRAVEL of mudstone. (COLLIERY SPOIL)	2
				2.90			Stiff greenish grey mottled orangish brown slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)	3
				3.60			Light grey very clayey angular to subangular fine to coarse lithorelict GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)	4
		4.00		End of pit at 4.00 m				

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was apparent at 2.50m 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 in made ground during excavation.		

				Trial Pit Log			Trialpit No TP18 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446690.00 - 404159.00 Level:		Date 10/04/2019	
Location: Goldthorpe				Dimensions (m):		3 		Scale 1:25	
Client: Countryside Properties				Depth 3.50		0.6 		Logged JB	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.70	J&T		0.20			MADE GROUND: Dark brown gravelly angular to subangular fine to coarse GRAVEL of brick, burnt shale and coal. (GRANULAR MADE GROUND)		
				1.10			MADE GROUND: Black very ashy angular to subangular fine to coarse GRAVEL of clinker, coal, burnt shale and mudstone. (ASH & CLINKER)		
	1.60	B					MADE GROUND: Reddish brown sandy angular to subangular fine to coarse GRAVEL of burnt shale and slag. (BURNT RED SHALE)		
	2.80	J&T	HVP=34	2.50			Soft greenish brown silty CLAY. (RELICT TOPSOIL)		
			HVP=83	2.90			Firm becoming stiff light grey mottled greenish brown slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)		
	3.50	T	HVP=125	3.50		End of pit at 3.50 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. Co-ordinates from hand held GPS, hole not surveyed in.									
Stability: 1. The sides of the trial pit were unstable in made ground during excavation.									

				Trial Pit Log			Trialpit No TP19 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446703.00 - 404186.00 Level:		Date 10/04/2019	
Location: Goldthorpe				Dimensions (m):		3 		Scale 1:25	
Client: Countryside Properties				Depth 3.50		0.6 		Logged JB	

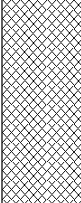
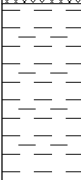
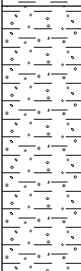
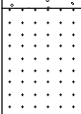
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	J&T		0.30			MADE GROUND: Orangish brown gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of burnt shale, coal and mudstone. (GRANULAR MADE GROUND)	1
	0.80	J&T		0.90			MADE GROUND: Reddish brown sandy angular to subangular fine to coarse GRAVEL of burnt shale, slag and mudstone. (BURNT RED SHALE)	
	1.60	B					MADE GROUND: Dark grey sandy angular to subangular fine to coarse GRAVEL of mudstone and shale. (COLLIERY SPOIL)	
	2.50	J&T		2.40 2.60			Soft dark grey locally greenish grey and black silty CLAY with relict rootlets. Strong organic odour. (RELICT TOPSOIL)	2
	3.00	D	HVP=110				Stiff light grey mottled orangish brown slightly gravelly CLAY. Gravel is angular to subangular lithorelicts of sandstone. (COHESIVE RESIDUAL SOIL)	
				3.50 3.60			Grey gravelly CLAY. Gravel is angular to subangular fine to coarse lithorelicts of mudstone. (COHESIVE RESIDUAL SOIL) <i>Difficult to excavate beyond 3.6m.</i> End of pit at 3.50 m	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. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit were unstable in made ground during excavation.

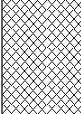
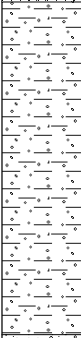


				Trial Pit Log			Trialpit No TP20 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446725.00 - 404162.00 Level:		Date 10/04/2019	
Location: Goldthorpe				Dimensions (m):		3 		Scale 1:25	
Client: Countryside Properties				Depth 2.80		0.6 		Logged JB	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J&T		0.20			MADE GROUND: Orangish brown very gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of brick, coal and burnt shale. (GRANULAR MADE GROUND)	
	0.60	J&T					MADE GROUND: Dark grey sandy slightly clayey angular to subangular fine to coarse GRAVEL of burnt shale, coal, clinker, sandstone and mudstone. (COLLIERY SPOIL)	
	1.20	D	HVP=83	0.90			Stiff light grey mottled orangish brown slightly sandy slightly gravelly CLAY. Gravel is subangular fine to coarse lithorelicts of sandstone. (COHESIVE RESIDUAL SOIL)	1
			HVP=58	1.50			Stiff light grey mottled orangish brown gravelly CLAY. Gravel is angular to subangular fine to coarse lithorelicts of sandstone. (COHESIVE RESIDUAL SOIL)	2
	2.70	T		2.40			Very weak brown fine SANDSTONE. Recovered as gravel and cobbles. (WEATHERED COAL MEASURES)	
				2.80			2.8m: Refusal on bedrock.	
						End of pit at 2.80 m		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. Co-ordinates from hand held GPS, hole not surveyed in.		
Stability: 1. The sides of the trial pit remained stable during excavation.		

				Trial Pit Log			Trialpit No TP21 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446745.00 - 404153.00 Level:		Date 10/04/2019	
Location: Goldthorpe				Dimensions (m):		3 		Scale 1:25	
Client: Countryside Properties				Depth 3.00		0.6 		Logged JB	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.10	J&T	HVP=140	0.20			MADE GROUND: Orangish brown very sandy angular to subangular fine to coarse GRAVEL of brick, shale, coal and slag. (GRANULAR MADE GROUND)	1	
	0.50	J&T		0.60					MADE GROUND: Black very sandy angular to subangular fine to coarse GRAVEL of coal, burnt shale and mudstone. (COLLIERY SPOIL)
	1.10	T		1.70			Stiff light brown mottled orangish brown and light grey slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse lithorelicts of sandstone. (COHESIVE RESIDUAL SOIL)		
	1.50	D							
				3.00		Very weak light grey fine to medium SANDSTONE. Recovered as sandy gravel and cobbles. (WEATHERED COAL MEASURES)	3		
								1.1m: Too gravelly for vanes.	
							3.0m: Refusal on bedrock.		
							End of pit at 3.00 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. Co-ordinates from hand held GPS, hole not surveyed in.

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



				Trial Pit Log			Trialpit No TP22 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446739.00 - 404118.00 Level:		Date 10/04/2019	
Location: Goldthorpe				Dimensions (m):		3 		Scale 1:25	
Client: Countryside Properties				Depth 1.00		0.6 		Logged JB	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	J&T		0.20			MADE GROUND: Dark brown clayey gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of mudstone and shale. (MADE GROUND TOPSOIL)	
				0.60			MADE GROUND: Black gravelly fine to coarse ASH. Gravel is angular to subangular fine to coarse clinker. (ASH & CLINKER)	
	0.90	D	HVP=130	1.00			Stiff orangish brown slightly gravelly CLAY. Gravel is angular to subangular fine to coarse lithorelicts of sandstone. (COHESIVE RESIDUAL SOIL)	
							0.85m: Brick marker tile. 0.90m: 20mm diameter black cable. 1.0m: Trial pit abandoned due to black cable. End of pit at 1.00 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. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit were unstable in made ground during excavation.



				Trial Pit Log			Trialpit No TP23 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446701.00 - 404133.00 Level:		Date 10/04/2019	
Location: Goldthorpe				Dimensions (m):		3 		Scale 1:25	
Client: Countryside Properties				Depth 3.60		0.6 		Logged JB	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼				0.30			MADE GROUND: Brown clayey gravelly fine to coarse SAND. (MADE GROUND TOPSOIL)	1
	0.90	J&T					MADE GROUND: Dark brown very gravelly fine to coarse ASH. Gravel is angular to subangular fine to coarse of clinker, coal, and shale. (COLLIERY SPOIL)	
	1.20	B						
	1.90						Stiff light grey mottled orangish brown slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)	2
	2.30	D	HVP=97					
2.80						Stiff gravelly CLAY. Gravel is angular to subangular fine to coarse lithorelicts of siltstone. (COHESIVE RESIDUAL SOIL) <i>2.8m: Too gravelly for vanes.</i>	3	
3.30								
	3.50	T		3.60			Very weak light grey SILTSTONE. Recovered as gravel and cobbles. (WEATHERED COAL MEASURES) <i>3.3m: Slow groundwater seepage.</i> <i>3.6m: Refusal on bedrock.</i> End of pit at 3.60 m	4

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater seepage was apparent at 3.3m 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 in made ground during excavation.		

				Trial Pit Log			Trialpit No TP24 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446661.00 - 404135.00 Level:		Date 10/04/2019	
Location: Goldthorpe				Dimensions (m):		3 		Scale 1:25	
Client: Countryside Properties				Depth 4.20		0.6 		Logged JB	

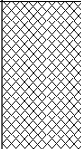
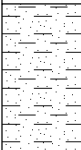
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.50			MADE GROUND: Dark brown very clayey gravelly fine to coarse SAND. Gravel is angular to subangular of brick and coal. (MADE GROUND TOPSOIL)	1	
	1.00	J&T			MADE GROUND: Dark grey locally reddish brown very gravelly fine to coarse ASH. Gravel is angular to subangular fine to coarse of coal, clinker, burnt shale and mudstone. (ASH & CLINKER)				
				1.80				MADE GROUND: Dark grey very sandy slightly clayey angular to subangular fine to coarse GRAVEL of mudstone and coal. (COLLIERY SPOIL)	2
	2.40	J&T							
				3.20				Firm light greenish brown mottled orangish brown and light grey gravelly CLAY. Gravel is angular to subangular lithorelicts of sandstone. (COHESIVE RESIDUAL SOIL) <i>3.4m: Too gravelly for vanes.</i>	3
	3.50	D	HVP=56						
				4.00				Very weak brown fine to medium SANDSTONE. Recovered as clayey gravel and cobbles. (WEATHERED COAL MEASURES) <i>4.2m: Difficult to excavate.</i>	4
				4.20					
End of pit at 4.20 m									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. Co-ordinates from hand held GPS, hole not surveyed in.

Stability: 1. The sides of the trial pit were unstable in made ground during excavation.

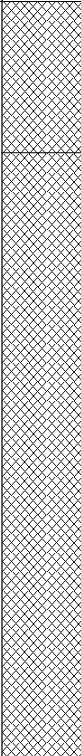
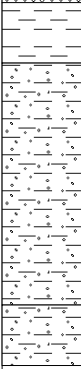


				Trial Pit Log			Trialpit No TP25 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446616.00 - 404148.00 Level:		Date 10/04/2019	
Location: Goldthorpe				Dimensions (m):		3 		Scale 1:25	
Client: Countryside Properties				Depth 4.50		0.6 		Logged JB	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.70	J&T		0.50			MADE GROUND: Orangish brown gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of brick, burnt shale and coal. (GRANULAR MADE GROUND)	1	
			MADE GROUND: Black very ashy fine to coarse GRAVEL of coal, clinker and burnt shale. (ASH & CLINKER)						
			MADE GROUND: Dark grey sandy angular to subangular fine to coarse GRAVEL of burnt shale, mudstone and coal. (COLLIERY SPOIL)						
	3.10	J&T		3.00			Firm dark grey CLAY. Faint natural organic odour. (RELICT TOPSOIL)	3	
									Light brown mottled light grey CLAY. (COHESIVE RESIDUAL SOIL)
									Soft locally firm light brown mottled grey sandy silty CLAY. (COHESIVE RESIDUAL SOIL)
	3.60	D		3.50				4	
			HVP=61						
			HVP=37						
				4.20			Firm light brown mottled light grey slightly gravelly CLAY. Gravel is angular to subangular fine to coarse lithorelicts of siltstone. (COHESIVE RESIDUAL SOIL)	5	
				4.50					

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 in made ground during excavation.		

				Trial Pit Log			Trialpit No TP26 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446607.38 - 404168.38 Level: 46.10		Date 03/09/2019	
Location: Goldthorpe				Dimensions (m): 3.5 0.6 		Scale 1:25		Logged JBR	
Client: Countryside Properties				Depth 3.70					

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.50	45.60		MADE GROUND: Dark brown gravelly clayey fine to coarse SAND. Gravel is angular to subangular fine to coarse of brick, sandstone and mudstone. Rare glass bottles and leather boots. (GRANULAR MADE GROUND)	1	
							MADE GROUND: Reddish brown very sandy angular to subangular fine to coarse GRAVEL of red shale and mudstone. (BURNT RED SHALE)		
				2.50	43.60		Dark greyish brown silty CLAY. Strong natural organic odour. (RELICT TOPSOIL)	3	
				2.70	43.40		Stiff light grey mottled orangish brown slightly gravelly CLAY. Gravel is subangular fine to medium lithorelicts of sandstone. (COHESIVE RESIDUAL SOIL)		
				3.50	42.60				Stiff light grey mottled orangish brown very gravelly CLAY. Gravel is subangular fine to medium lithorelicts of sandstone. (COHESIVE RESIDUAL SOIL)
				3.70	42.40				
			HVP=78				End of pit at 3.70 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. Spalling of both sides of the trial pit during excavation.



				Trial Pit Log			Trialpit No TP27 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446606.71 - 404203.99 Level: 47.75		Date 03/09/2019	
Location: Goldthorpe				Dimensions (m): 3.5 0.6 		Scale 1:25		Logged JBR	
Client: Countryside Properties				Depth 3.40					

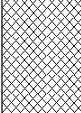
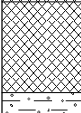
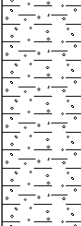
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.80	46.95		MADE GROUND: Dark brown slightly gravelly slightly sandy CLAY. Gravel is angular to subangular fine to coarse of red shale, mudstone, brick and coal. Rare glass fragments upto 50mm. (GRANULAR MADE GROUND)	1
				1.20	46.55		MADE GROUND: Dark grey, locally reddish brown very sandy clayey GRAVEL of mudstone and red shale. (COLLIERY SPOIL)	
							MADE GROUND: Reddish brown locally light grey very sandy angular to subangular fine to coarse GRAVEL of red shale. (BURNT RED SHALE)	
				2.00	45.75		At 1.6m: Black 200mm cobble sized pocket of shale.	2
							Stiff light grey mottled orangish brown slightly gravelly CLAY. Gravel is subangular fine to medium lithorelicts of sandstone. (COHESIVE RESIDUAL SOIL)	
				3.40	44.35		End of pit at 3.40 m	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 were unstable in made ground during excavation.



				Trial Pit Log			Trialpit No TP28 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446643.34 - 404203.95 Level: 48.85		Date 03/09/2019	
Location: Goldthorpe				Dimensions (m): Depth 3.30 0.6 3.5		Scale 1:25		Logged JBR	
Client: Countryside Properties									

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.40	48.45		MADE GROUND: Dark brown very gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of red shale, brick and mudstone. (GRANULAR MADE GROUND)	1
							MADE GROUND: Light reddish brown, locally black very clayey angular to subangular fine to coarse GRAVEL. Gravel is angular to subangular fine to coarse of mudstone and red shale. (BURNT RED SHALE)	
				2.20	46.65		MADE GROUND: Black, locally light grey very clayey angular to subangular fine to coarse GRAVEL of coal and mudstone. (COLLIERY SPOIL)	2
				2.50	46.35		Stiff light grey mottled orangish brown slightly gravelly CLAY. Gravel is angular to subangular fine to coarse lithorelicts of sandstone. (COHESIVE RESIDUAL SOIL)	
			HVP=77					3
		HVP=79		3.30	45.55		End of pit at 3.30 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 in made ground during excavation.



				Trial Pit Log			Trialpit No TP29 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446696.19 - 404194.74 Level: 48.80		Date 03/09/2019	
Location: Goldthorpe				Dimensions (m): 3.5		Scale 1:25		Logged JBR	
Client: Countryside Properties				Depth 3.10					

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.30	48.50		MADE GROUND: Dark brown sandy very gravelly clayey fine to coarse SAND. Gravel is angular to subangular fine to coarse of mudstone, coal and brick. (GRANULAR MADE GROUND)	1	
							MADE GROUND: Reddish brown very gravelly fine to medium SAND. Gravel is angular to subangular fine to coarse of red shale. (BURNT RED SHALE)		
				1.30	47.50			MADE GROUND: Light brown and dark grey ashy angular to subangular fine to coarse GRAVEL of clinker, red shale and mudstone. (BURNT RED SHALE)	2
				1.90	46.90			MADE GROUND: Reddish brown very sandy angular to subangular fine to coarse GRAVEL of red shale. (BURNT RED SHALE)	
				2.30	46.50				
				2.50	46.30		Stiff light grey mottled orangish brown slightly gravelly CLAY. Gravel is subangular fine to medium of sandstone lithorelicts. (COHESIVE RESIDUAL SOIL)		
				3.00	45.80				Stiff light grey mottled orangish brown gravelly CLAY. Gravel is subangular fine to medium of sandstone lithorelicts. (COHESIVE RESIDUAL SOIL)
				3.10	45.70	End of pit at 3.10 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 in made ground during excavation.		

				Trial Pit Log			Trialpit No TP30 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446713.94 - 404161.23 Level: 46.95		Date 03/09/2019	
Location: Goldthorpe				Dimensions (m): 3.5 0.6 		Scale 1:25		Logged JBR	
Client: Countryside Properties				Depth 3.10					

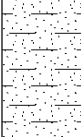
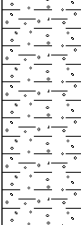
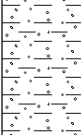
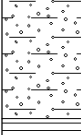
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.10	46.85		MADE GROUND: Dark brown very gravelly fine to coarse SAND. Gravel is subangular fine to coarse of mudstone and red shale. (GRANULAR MADE GROUND) MADE GROUND: Reddish brown sandy angular to subangular fine to coarse GRAVEL of red shale and mudstone. (BURNT RED SHALE)	
				0.90	46.05		MADE GROUND: Dark grey clayey slightly sandy angular to subangular fine to coarse GRAVEL of mudstone and coal. (COLLIERY SPOIL)	1
			HVP=106	2.30	44.65		Stiff light grey mottled orangish brown slightly gravelly CLAY. Gravel is subangular fine to medium lithorelicts of sandstone. (COHESIVE RESIDUAL SOIL)	2
			HVP=97	3.10	43.85		End of pit at 3.10 m	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 were unstable in made ground during excavation.



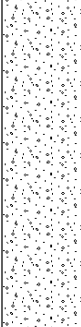
				Trial Pit Log			Trialpit No TP31 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446733.17 - 404277.85 Level: 49.50		Date 03/09/2019	
Location: Goldthorpe				Dimensions (m):		3.5 		Scale 1:25	
Client: Countryside Properties				Depth 2.80		0.6 		Logged JBR	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30	49.20		Dark brown clayey fine to medium SAND. (TOPSOIL)	
				0.80	48.70		Light brown very clayey gravelly fine to medium SAND with a low lithorelict cobble content. Gravel is subangular fine to coarse lithorelicts of sandstone. (GRANULAR RESIDUAL SOIL)	
			HVP=90	1.60	47.90		Stiff light grey mottled orangish brown gravelly CLAY. Gravel is subangular fine to coarse lithorelicts of siltstone. (COHESIVE RESIDUAL SOIL)	1
			HVP=81	2.10	47.40		Stiff light grey mottled orangish brown gravelly CLAY. Gravel is subangular fine to coarse lithorelicts of siltstone. (COHESIVE RESIDUAL SOIL)	2
				2.50	47.00		Stiff grey clayey GRAVEL of mudstone. (GRANULAR RESIDUAL SOIL)	
				2.80	46.70		Extremely weak grey stained orangish brown MUDSTONE. Recovered as clayey gravel. (WEATHERED COAL MEASURES)	
							End of pit at 2.80 m	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.		

LITHOS CONSULTING				Trial Pit Log			Trialpit No TP32 Sheet 1 of 1	
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446701.69 - 404299.29 Level: 50.25		Date 03/09/2019
Location: Goldthorpe				Dimensions (m):		3.5		Scale 1:25
Client: Countryside Properties				Depth 2.70		0.5		Logged JBR
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30	49.95		Dark brown very clayey fine to medium SAND. (TOPSOIL)	
							Light brown very gravelly clayey fine to medium SAND with a low lithorelict cobble content. Gravel is subangular fine to coarse lithorelicts of sandstone. (GRANULAR RESIDUAL SOIL)	1
			HVP=76 HVP=92 HVP=100	1.60	48.65		Stiff light grey mottled orangish brown slightly gravelly CLAY. Gravel is subangular fine to medium lithorelicts of siltstone. (COHESIVE RESIDUAL SOIL)	2
				2.20	48.05		Stiff grey very gravelly CLAY. Gravel is angular to subangular lithorelicts of mudstone. (COHESIVE RESIDUAL SOIL)	
				2.50	47.75		From 2.2m: Too gravelly for vanes. Extremely weak grey MUDSTONE. Recovered as clayey gravel.	
				2.70	47.55		(WEATHERED COAL MEASURES) End of pit at 2.70 m	3
								4
								5

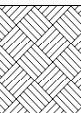
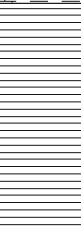
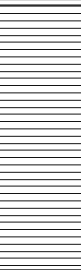
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.
Stability: 1. The sides of the trial pit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

				Trial Pit Log			Trialpit No TP33 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446635.65 - 404341.47 Level: 51.60		Date 03/09/2019	
Location: Goldthorpe				Dimensions (m):		3.5		Scale 1:25	
Client: Countryside Properties				Depth 1.70				Logged JBR	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.30	51.30		Dark brown very clayey fine to medium SAND. (TOPSOIL)		
							Light brown gravelly fine to medium SAND. Gravel is subangular fine to coarse lithorelicts of sandstone. (GRANULAR RESIDUAL SOIL)		
				1.40	50.20		Very weak light brown stained black fine to medium SANDSTONE. Recovered as sandy gravel and cobbles. (WEATHERED ACKWORTH ROCK)		
				1.70	49.90	At 1.7m: Refusal on bedrock. End of pit at 1.70 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.									



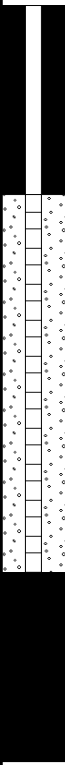
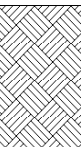
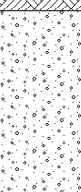
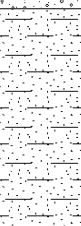
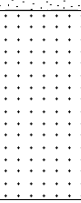
Appendix G

Window Sample Borehole Logs

				Borehole Log			Borehole No. WS01 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446653.00 - 404335.00		Hole Type WS	
Location: Goldthorpe				Level:		Scale 1:20			
Client: Countryside Properties				Dates: 10/04/2019 - 10/04/2019		Logged By CC			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30		 Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of mixed lithologies including mudstone and coal. (TOPSOIL)	1	
					0.60		 Light brown clayey SAND. (GRANULAR RESIDUAL SOIL)		
				HVP=51 N=10 (2,2/2,2,2,4)	1.00		 Firm light orangish brown sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mixed lithologies including sandstone, mudstone and coal. (COHESIVE RESIDUAL SOIL)		
				N=42 (4,5/6,9,12,15)	1.60		 Weak dark orangish grey MUDSTONE recovered as a slightly clayey angular to sub angular gravel. (WEATHERED COAL MEASURES)	2	
				50 (10,10/50 for 226mm)	2.20		 Moderately strong dark grey and orange MUDSTONE recovered as angular fine to coarse gravel. (WEATHERED COAL MEASURES)		
					2.50				
					2.90		End of borehole at 2.90 m	3	
								4	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.

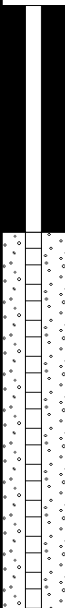
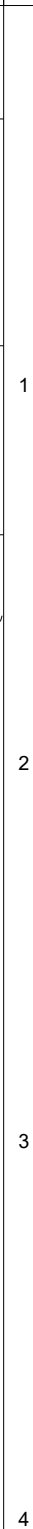


				Borehole Log			Borehole No. WS02 Sheet 1 of 1		
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446705.00 - 404323.00		Hole Type WS	
Location: Goldthorpe				Level:		Scale 1:20		Logged By CC	
Client: Countryside Properties				Dates: 10/04/2019 - 10/04/2019					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.40			Dark grey sandy CLAY with occasional rootlets. (TOPSOIL)	
					0.90			Light brown sandy subangular to subrounded fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)	
	1.00			N=9 (3,2/2,2,2,3)	1.50			Light orangish grey clayey SAND. (GRANULAR RESIDUAL SOIL)	1
	1.80			26 (9,12/26 for 103mm)	2.00			Moderately strong light brown SANDSTONE recovered as angular to subangular fine to coarse gravel. (WEATHERED ACKWORTH ROCK)	
							End of borehole at 2.00 m		2
									3
									4

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.



				Borehole Log				Borehole No. WS03 Sheet 1 of 1	
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446714.00 - 404247.00		Hole Type WS	
Location: Goldthorpe				Level:		Scale 1:20			
Client: Countryside Properties				Dates: 10/04/2019 - 10/04/2019		Logged By CC			

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		1.00		HVP=52	0.30		Dark grey slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to coarse of mixed lithologies including sandstone. (TOPSOIL)		
				N=27 (3,2/3,4,7,13)	0.90		Firm light orange and grey mottled slightly sandy CLAY with occasional rootlets. (COHESIVE RESIDUAL SOIL) <i>From 0.3m to 0.9m, 1 no. subvertical fissure, undulating, grey non-penetrative staining with occasional rootlets.</i>		
					1.40		Weak dark greyish brown MUDSTONE recovered as angular, tabular fine to medium gravel. (WEATHERED COAL MEASURES)		
				1.60		Moderatley strong light greyish brown fine grained SANDSTONE recovered as angular to subangular fine to coarse gravel. (WEATHERED COAL MEASURES) <i>Refusal at 1.6m.</i> End of borehole at 1.60 m			

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.



LITHOS CONSULTING					Borehole Log			Borehole No. WS04 Sheet 1 of 1	
Project Name: Goldthorpe Colliery					Project No. 1750		Co-ords: 446669.00 - 404272.00		Hole Type WS
Location: Goldthorpe					Level:		Scale 1:20		Logged By CC
Client: Countryside Properties					Dates: 10/04/2019 - 10/04/2019				
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30			MADE GROUND: Dark greyish brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of mixed lithologies including burnt shale and coal. (MADE GROUND TOPSOIL)	1
								Firm light orange and grey mottled slightly sandy CLAY with occasional rootlets. (COHESIVE RESIDUAL SOIL)	
	1.00			N=11 (2,2/2,2,3,4)	1.40			Weak dark greyish brown MUDSTONE recovered as angular, tabular, fine to medium gravel. (WEATHERED COAL MEASURES) <i>Thin laminations within mudstone 3mm spacing.</i>	
					1.80			Black COAL recovered as angular to subangular fine to medium gravel. (WEATHERED COAL MEASURES)	
					1.90			Weak light orangish grey SILTSTONE recovered as sandy, angular to subangular fine to medium gravel. (WEATHERED COAL MEASURES)	2
					2.13			End of borehole at 2.13 m	
									3
									4

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.

LITHOS CONSULTING					Borehole Log			Borehole No. WS05 Sheet 1 of 1	
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446678.00 - 404221.00		Hole Type WS	
Location: Goldthorpe				Level:		Scale 1:20		Logged By CC	
Client: Countryside Properties				Dates: 10/04/2019 - 10/04/2019					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		2.00		N=13 (2,2/2,3,3,5)	0.10			MADE GROUND: Dark brown slightly clayey slightly gravelly SAND. Gravel is subangular to subrounded fine to coarse of mixed lithologies including burnt shale and mudstone. (MADE GROUND TOPSOIL) MADE GROUND: Orangish red sandy angular to subrounded fine to coarse GRAVEL of burnt shale. (BURNT RED SHALE) MADE GROUND: Dark grown and black clayey, slightly sandy angular to subangular fine to coarse GRAVEL of coal and mudstone. (COLLIERY SPOIL) MADE GROUND: Black ashy subangular to subrounded fine to coarse GRAVEL of clinker, burnt shale and coal. (ASH & CLINKER) MADE GROUND: Orangish red and black gravelly ASH. Gravel is subangular to subrounded fine to coarse of burnt shale and coal. (BURNT RED SHALE) Firm light brown and grey mottled slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to medium of sandstone. (COHESIVE RESIDUAL SOIL)	1
					0.60				
					0.90				
					1.10				
					1.30				
		2.80		N=35 (6,7/9,9,8,9)	2.50		Weak light grey SILTSTONE recovered as slightly clayey angular fine to coarse gravel. (WEATHERED COAL MEASURES) <i>From 2.7m, clay becoming more gravelly with depth.</i>	2	
					3.25				<i>Refusal at 3.25m.</i> End of borehole at 3.25 m
									4

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.

LITHOS CONSULTING					Borehole Log			Borehole No. WS06 Sheet 1 of 1	
Project Name: Goldthorpe Colliery					Project No. 1750		Co-ords: 446640.00 - 404188.00		Hole Type WS
Location: Goldthorpe					Level:		Scale 1:20		
Client: Countryside Properties					Dates: 10/04/2019 - 10/04/2019		Logged By CC		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		2.00		N=25 (4,5/7,5,6,7)	0.10		MADE GROUND: Dark brown slightly clayey gravelly SAND with occasional rootlets. Gravel is subangular to subrounded fine to coarse of mixed lithologies including coal and burnt shale. (GRANULAR MADE GROUND)	1 2 3 4	
					0.60		MADE GROUND: Black ashy, subangular to subrounded fine to medium GRAVEL of coal, burnt shale and clinker. (ASH & CLINKER)		
					0.90		MADE GROUND: Dark grey and orange slightly ashy, angular to subangular fine to coarse GRAVEL of mixed lithologies including mudstone, slag and coal. (COLLIERY SPOIL)		
					1.60		MADE GROUND: Black ashy, subangular to subrounded fine to coarse GRAVEL of mixed lithologies including coal, clinker and burnt shale. (ASH & CLINKER)		
					2.50		MADE GROUND: Light orangish brown and black ashy, angular to subangular fine to coarse GRAVEL of mixed lithologies including burnt shale, coal and slag. (COLLIERY SPOIL)		
							At 2.4m, unable to drill further due to obstruction.		
							End of borehole at 2.50 m		

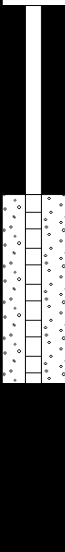
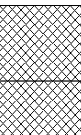
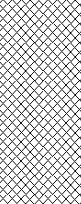
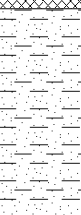
Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.

LITHOS CONSULTING					Borehole Log			Borehole No. WS07 Sheet 1 of 2	
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446644.00 - 404140.00		Hole Type WS	
Location: Goldthorpe				Level:		Scale 1:20		Logged By CC	
Client: Countryside Properties				Dates: 10/04/2019 - 10/04/2019					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			MADE GROUND: Dark brown gravelly SAND with occasional rootlets. Gravel is subangular to subrounded fine to coarse of mixed lithologies including mudstone, clinker and coal. (GRANULAR MADE GROUND)	
					0.80			MADE GROUND: Firm light brown mottled black sandy CLAY. Gravel is subangular to subrounded fine to coarse of mixed lithologies including mudstone, coal and burnt shale. (COLLIERY SPOIL)	1
					1.40			MADE GROUND: Black ashy subangular to subrounded fine to medium GRAVEL of mixed lithologies including coal, burnt shale and clinker. (ASH & CLINKER)	
					2.00			MADE GROUND: Orangish red sandy angular to subangular fine to coarse GRAVEL of burnt shale. (BURNT RED SHALE)	2
					2.90			MADE GROUND: Orange and black ashy, angular to subangular fine to coarse GRAVEL of mixed lithologies including coal, mudstone, slag and burnt shale. (COLLIERY SPOIL)	3
					3.70			From 3.3m to 3.7m, strata becomes wet.	
					3.90			Soft dark grey mottled orange sandy slightly gravelly SILT. Gravel is subangular to subrounded fine to medium of mixed lithologies including coal, mudstone and sandstone.	4
				4.00				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. Co-ordinates from hand held GPS, hole not surveyed in.

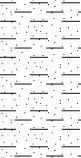
				Borehole Log			Borehole No. WS08 Sheet 1 of 1	
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446729.00 - 404131.00		Hole Type WS
Location: Goldthorpe				Level:		Scale 1:20		
Client: Countryside Properties				Dates: 10/04/2019 - 10/04/2019		Logged By CC		

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20		 MADE GROUND: Dark grey slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to coarse of mixed lithologies including mudstone and coal. (MADE GROUND TOPSOIL)		
		0.50 0.50	K T				 MADE GROUND: Dark brown, blue and black slightly clayey ashy GRAVEL of mixed lithologies including burnt shale, glass, coal, mudstone, dark blue material, and friable pale blue platy mineral. (COLLIERY SPOIL)		
		1.00		N=12 (2,2/3,2,3,4) HVP=68	0.90		 Firm light orange and grey mottled slightly sandy slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded of mixed lithologies including sandstone and mudstone. (COHESIVE RESIDUAL SOIL)	1	
					1.45		End of borehole at 1.45 m	4	

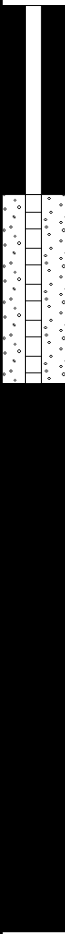
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.		
---	--	---

LITHOS CONSULTING					Borehole Log			Borehole No. WS09 Sheet 1 of 2	
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446681.00 - 404167.00		Hole Type WS	
Location: Goldthorpe				Level:		Scale 1:20		Logged By CC	
Client: Countryside Properties				Dates: 10/04/2019 - 10/04/2019					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.10			MADE GROUND: Dark grey gravelly SAND with occasional rootlets. Gravel is angular to subangular fine to coarse of mixed lithologies including mudstone and burnt shale. (GRANULAR MADE GROUND) MADE GROUND: Orangish red slightly clayey gravelly SAND. Gravel is angular to subangular fine to coarse of burnt shale. (COLLIERY SPOIL)	
					1.90				
				HVP=20	2.20			MADE GROUND: Light orange and grey clayey slight ashy angular to subangular fine to coarse GRAVEL of mixed lithologies including burnt shale, mudstone and coal. (COLLIERY SPOIL)	
				HVP=50					
							3.40		
					3.60				
					4.00				4
					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. Co-ordinates from hand held GPS, hole not surveyed in.

					Borehole Log			Borehole No. WS09 Sheet 2 of 2	
Project Name: Goldthorpe Colliery					Project No. 1750		Co-ords: 446681.00 - 404167.00		Hole Type WS
Location: Goldthorpe					Level:		Scale 1:20		
Client: Countryside Properties					Dates: 10/04/2019 - 10/04/2019		Logged By CC		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					4.45			End of borehole at 4.45 m	
									5
									6
									7
									8
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.									

					Borehole Log			Borehole No. WS10 Sheet 1 of 1	
Project Name: Goldthorpe Colliery					Project No. 1750		Co-ords: 446735.00 - 404171.00		Hole Type WS
Location: Goldthorpe					Level:		Scale 1:20		Logged By CC
Client: Countryside Properties					Dates: 10/04/2019 - 10/04/2019				

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.10		 MADE GROUND: Dark grey gravelly SAND. Gravel is subangular to subrounded fine to coarse of mixed lithologies including mudstone, burnt shale and coal. (GRANULAR MADE GROUND)	1	
					0.80		 MADE GROUND: Black and orange ashy subangular to subrounded fine to medium GRAVEL of mixed lithologies including clinker, coal and burnt shale. (ASH & CLINKER)		
					1.00		 MADE GROUND: Dark orangish red clayey slightly sandy GRAVEL of mixed lithologies including mudstone, coal and burnt shale. (BURNT RED SHALE)		
							 Firm light orange and grey mottled slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone. (COHESIVE RESIDUAL SOIL)	2	
					2.00	N=43 (7,8/8,9,12,14)	 Moderately strong light grey SILTSTONE recovered as angular to subangular fine to coarse gravel. (WEATHERED COAL MEASURES)		
					2.45		 End of borehole at 2.45 m	3	
								4	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.



Appendix H
Cable Percussion Borehole Logs

LITHOS CONSULTING					Borehole Log			Borehole No. BH01 Sheet 1 of 1	
Project Name: Goldthorpe Colliery					Project No. 1750		Co-ords: 446652.39 - 404170.65		Hole Type CP
Location: Goldthorpe					Level: 47.50		Scale 1:50		
Client: Countryside Properties					Dates: 02/09/2019 - 02/09/2019		Logged By JBR		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20	47.30		MADE GROUND: Grass over dark brown very gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of mudstone and red shale. (GRANULAR MADE GROUND)	
		1.00		N=15 (3,4/4,4,3,4)				MADE GROUND: Dark grey, locally light grey and black, slightly sandy gravelly CLAY. Gravel is angular to subangular fine to medium of mudstone with occasional rare red shale and coal. (COLLIERY SPOIL)	1
		2.00		N=12 (2,3/3,3,3,3)	1.90	45.60		MADE GROUND: Black very clayey angular to subangular fine to medium GRAVEL of mudstone and coal. (COLLIERY SPOIL)	2
		3.00		N=16 (3,4/3,4,4,5)					3
					3.20	44.30		Light grey slightly sandy CLAY. Faint natural organic odour. (RELICT TOPSOIL)	
		3.70	D		3.50	44.00		Stiff orangish brown mottled light grey slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)	4
		4.00	U	HVP=136				Very weak light grey MUDSTONE. Recovered as clay with lithorelicts. (WEATHERED COAL MEASURES)	
		4.60	D		4.20	43.30			
		5.00	D		5.00	42.50		Weak to medium strong light brown fine to medium SANDSTONE. Recovered as sand with lithorelicts. (WEATHERED COAL MEASURES)	5
		5.00		50 (26 for 145mm/50 for 275mm)	5.12	42.38		At 5.12m, refusal on bedrock. End of borehole at 5.12 m	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. Exploratory hole surveyed in (level and co-ordinates) on completion. 4. The borehole was advanced by chiselling from 4.3m to 5.0m.

LITHOS CONSULTING					Borehole Log			Borehole No. BH02 Sheet 1 of 1	
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446619.49 - 404183.83		Hole Type CP	
Location: Goldthorpe				Level: 47.95		Scale 1:50		Logged By JBR	
Client: Countryside Properties				Dates: 02/09/2019 - 02/09/2019					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30	47.65		MADE GROUND: Dark brown gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of sandstone, mudstone and red shale. (GRANULAR MADE GROUND)	1
	1.00 1.00 - 1.45	D	N=10 (3,3/3,2,2,3)			MADE GROUND: Red and orangish red very sandy clayey angular to subangular fine to coarse GRAVEL of red shale. (BURNT RED SHALE)			
	2.00 2.00 - 2.45	D	N=12 (3,4/4,3,3,2)	1.80	46.15		MADE GROUND: Dark greyish brown and reddish brown sandy clayey angular to subangular fine to coarse GRAVEL of coal, red shale and mudstone. (BURNT RED SHALE)	2	
	3.00		N=15 (6,6/5,4,3,3)				At 2.7m, angular cobble.	3	
	4.00		N=27 (5,5/5,6,8,8)				At 3.8m, metal wire (50mm diameter).	4	
		4.50	D		4.20	43.75		Stiff light brown, mottled light grey sandy slightly gravelly CLAY. Gravel is subrounded lithorelicts of sandstone. (COHESIVE RESIDUAL SOIL)	5
5.00 5.00	D	50 (25,/50 for 285mm)	5.00 5.20	42.95 42.75	Weak light brown fine to medium SANDSTONE. Recovered as sand with lithorelicts. (WEATHERED COAL MEASURES)				
At 5.2m, refusal on bedrock. End of borehole at 5.20 m									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. Exploratory hole surveyed in (level and co-ordinates) on completion.

LITHOS CONSULTING					Borehole Log			Borehole No. BH03 Sheet 1 of 1	
Project Name: Goldthorpe Colliery					Project No. 1750		Co-ords: 446685.97 - 404178.92		Hole Type CP
Location: Goldthorpe					Level: 48.20		Scale 1:50		
Client: Countryside Properties					Dates: 02/09/2019 - 02/09/2019		Logged By JBR		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.10	48.10		MADE GROUND: Dark brown very gravelly fine to coarse SAND. Gravel is angular fine to medium of mudstone and red shale. (GRANULAR MADE GROUND)	1
								MADE GROUND: Dark brown and dark grey gravelly slightly sandy CLAY. Gravel is angular to subangular fine to medium of mudstone, coal and rare red shale. (COLLIERY SPOIL)	
					1.70	46.50		MADE GROUND: Light brown and reddish brown clayey sandy angular to subangular fine to coarse GRAVEL of mudstone and red shale. (BURNT RED SHALE)	2
	2.00			N=16 (5,5/4,5,4,3)					
	2.00 - 2.45	D							3
	3.00			N=23 (3,4/5,5,5,8)					
	3.20				45.00		Stiff light grey mottled orangish brown gravelly CLAY. Gravel is subangular lithorelicts of mudstone. (COHESIVE RESIDUAL SOIL)	4	
	3.50	D							
	3.70	D						4	
	3.90	D							
4.00			N=42 (8,8/10,10,10,12)	44.20		Very weak light brown fine to medium SANDSTONE. Recovered as sand with lithorelicts. (WEATHERED COAL MEASURES)	5		
4.80			N=48 (10,12/10,12,12,14)						
				5.25	42.95	At 5.25m, refusal on bedrock. End of borehole at 5.25 m			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. Exploratory hole surveyed in (level and co-ordinates) on completion. 4. The borehole was advanced by chiselling from 4.3m to 5.2m.





Appendix I
Chemical Results



Certificate of Analysis

Certificate Number 19-06973-1

08-May-19

Client Lithos Consulting Ltd
Parkhill
Walton Rd
Wetherby
LS22 5DZ

Our Reference 19-06973-1

Client Reference 1750

Order No 14426/1750/JBR

Contract Title Goldthorpe Colliery

Description 56 Soil samples, 7 Leachate samples.

Date Received 15-Apr-19

Date Started 15-Apr-19

Date Completed 08-May-19

Test Procedures Identified by prefix DETSn (details on request).

Notes This test supersedes 19-06973, extra testing.

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

A handwritten signature in black ink, appearing to read "A Fenwick", is positioned above the printed name and title.

Adam Fenwick
Contracts Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1488381	1488382	1488383	1488384	1488385	1488386
Sample ID	TARMAC 1	TARMAC 2	TARMAC 3	STOCKPIL E 1	STOCKPIL E 2	STOCKPIL E 3
Depth						
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Asbestos Quantification	DETSC 1102	0							
Preparation									
Moisture Content	DETSC 1004	0.1	%						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg				26	58	29
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg				0.7	1.0	1.4
Cadmium	DETSC 2301#	0.1	mg/kg				0.3	0.1	0.2
Chromium	DETSC 2301#	0.15	mg/kg				26	23	24
Chromium III	DETSC 2301*	0.15	mg/kg				26	23	24
Chromium, Hexavalent	DETSC 2204*	1	mg/kg				< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg				46	55	48
Lead	DETSC 2301#	0.3	mg/kg				37	31	45
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l						
Mercury	DETSC 2325#	0.05	mg/kg				0.10	< 0.05	0.07
Nickel	DETSC 2301#	1	mg/kg				32	32	31
Selenium	DETSC 2301#	0.5	mg/kg				0.8	1.0	1.0
Zinc	DETSC 2301#	1	mg/kg				91	54	99
Inorganics									
Loss on Ignition at 440oC	DETSC 2003#	0.01	%						
pH	DETSC 2008#						6.3	5.9	7.0
Calorific Value	DETSC 5008	1	MJ/kg						
Cyanide, Total	DETSC 2130#	0.1	mg/kg						
Cyanide, Free	DETSC 2130#	0.1	mg/kg						
Total Organic Carbon	DETSC 2002	0.1	%				3.6	3.0	2.8
Chloride Aqueous Extract	DETSC 2055	1	mg/l						
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l						
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l						
Sulphide	DETSC 2024*	10	mg/kg						
Sulphur as S, Total	DETSC 2320	0.01	%						
Petroleum Hydrocarbons									
EPH (C6-C10)	DETSC 3321*	0.1	mg/kg						
EPH (C10-C12)	DETSC 3311	10	mg/kg						
EPH (C12-C16)	DETSC 3311	10	mg/kg						
EPH (C16-C21)	DETSC 3311	10	mg/kg						
EPH (C21-C35)	DETSC 3311	10	mg/kg						
EPH (C35-C40)	DETSC 3311	10	mg/kg						
EPH (C10-C40)	DETSC 3311#	10	mg/kg						
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03

Summary of Chemical Analysis

Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1488381	1488382	1488383	1488384	1488385	1488386
Sample ID	TARMAC 1	TARMAC 2	TARMAC 3	STOCKPIL E 1	STOCKPIL E 2	STOCKPIL E 3
Depth						
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.03	0.03	< 0.03	< 0.03	< 0.03	0.08
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.05	0.04	< 0.03	0.05	< 0.03	0.18
Pyrene	DETSC 3303#	0.03	mg/kg	0.07	0.07	0.05	0.05	< 0.03	0.15
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.03	0.03	< 0.03	< 0.03	< 0.03	0.06
Chrysene	DETSC 3303	0.03	mg/kg	0.10	0.10	0.08	< 0.03	< 0.03	0.06
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.08	0.07	0.05	< 0.03	< 0.03	0.07
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.06	0.05	0.04	< 0.03	< 0.03	0.05
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	0.03	0.03	0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.12	0.12	0.10	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.58	0.56	0.36	< 0.10	< 0.10	0.65
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg						

Summary of Chemical Analysis

Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1488387	1488388	1488389	1488390	1488391	1488392
Sample ID	TP12	TP13	TP16	TP16	TP18	TP24
Depth	0.40	0.60	0.40	1.10	0.70	1.00
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Asbestos Quantification	DETSC 1102	0							
Preparation									
Moisture Content	DETSC 1004	0.1	%	21	15	11	14	14	17
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	73	220	63	65	65	45
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.9	0.5	0.7	0.9	2.0	1.6
Cadmium	DETSC 2301#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.5
Chromium	DETSC 2301#	0.15	mg/kg	18	13	25	16	26	46
Chromium III	DETSC 2301*	0.15	mg/kg	18	13	25	16	26	46
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	160	61	39	77	65	93
Lead	DETSC 2301#	0.3	mg/kg	13	10	27	24	28	58
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l	46	13	< 10	< 10	15	23
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	0.07	0.22
Nickel	DETSC 2301#	1	mg/kg	36	21	38	21	34	52
Selenium	DETSC 2301#	0.5	mg/kg	1.7	< 0.5	0.5	1.0	1.8	1.5
Zinc	DETSC 2301#	1	mg/kg	22	16	58	30	51	130
Inorganics									
Loss on Ignition at 440oC	DETSC 2003#	0.01	%						
pH	DETSC 2008#			6.2	7.0	4.4	4.2	5.9	6.9
Calorific Value	DETSC 5008	1	MJ/kg	6.1	< 1.0	1.2	12.4	4.6	5.3
Cyanide, Total	DETSC 2130#	0.1	mg/kg			< 0.1			0.2
Cyanide, Free	DETSC 2130#	0.1	mg/kg			< 0.1			< 0.1
Total Organic Carbon	DETSC 2002	0.1	%	4.8	0.7	2.8	2.0	6.9	6.1
Chloride Aqueous Extract	DETSC 2055	1	mg/l	8.9	3.5	2.6	5.7	4.2	7.2
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l	7.8	1.2	1.0	11	7.1	1.9
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	270	180	150	110	160	660
Sulphide	DETSC 2024*	10	mg/kg	56	< 10	< 10	< 10	36	36
Sulphur as S, Total	DETSC 2320	0.01	%	0.30	0.06	0.18	0.65	0.24	0.23
Petroleum Hydrocarbons									
EPH (C6-C10)	DETSC 3321*	0.1	mg/kg	< 0.1	< 0.1		< 0.1	< 0.1	
EPH (C10-C12)	DETSC 3311	10	mg/kg	< 10	< 10		< 10	< 10	
EPH (C12-C16)	DETSC 3311	10	mg/kg	< 10	< 10		< 10	< 10	
EPH (C16-C21)	DETSC 3311	10	mg/kg	< 10	< 10		< 10	< 10	
EPH (C21-C35)	DETSC 3311	10	mg/kg	< 10	< 10		< 10	< 10	
EPH (C35-C40)	DETSC 3311	10	mg/kg	< 10	< 10		< 10	< 10	
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10	< 10		< 10	< 10	
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.05
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03

Summary of Chemical Analysis

Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1488387	1488388	1488389	1488390	1488391	1488392
Sample ID	TP12	TP13	TP16	TP16	TP18	TP24
Depth	0.40	0.60	0.40	1.10	0.70	1.00
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.05
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.06
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.06
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.04
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.04
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.29
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3		< 0.3			0.5

Summary of Chemical Analysis

Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1488393	1488394	1488395	1488396	1488397	1488398
Sample ID	TP25	TP14	TP15	TP17	TP17	TP19
Depth	0.70	0.80	0.80	0.90	2.00	0.80
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Asbestos Quantification	DETSC 1102	0							
Preparation									
Moisture Content	DETSC 1004	0.1	%	16	12		11	9.0	
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	36	24		21	26	
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	1.2	1.4		0.7	1.0	
Cadmium	DETSC 2301#	0.1	mg/kg	0.6	0.6		0.3	< 0.1	
Chromium	DETSC 2301#	0.15	mg/kg	34	22		29	26	
Chromium III	DETSC 2301*	0.15	mg/kg	34	22		29	26	
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0		< 1.0	< 1.0	
Copper	DETSC 2301#	0.2	mg/kg	170	56		28	39	
Lead	DETSC 2301#	0.3	mg/kg	32	23		26	27	
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l	< 10	< 10		< 10	17	
Mercury	DETSC 2325#	0.05	mg/kg	0.16	0.09		< 0.05	< 0.05	
Nickel	DETSC 2301#	1	mg/kg	42	44		50	39	
Selenium	DETSC 2301#	0.5	mg/kg	1.0	0.9		0.9	< 0.5	
Zinc	DETSC 2301#	1	mg/kg	130	100		100	83	
Inorganics									
Loss on Ignition at 440oC	DETSC 2003#	0.01	%						
pH	DETSC 2008#			7.4	6.3		7.4	6.9	
Calorific Value	DETSC 5008	1	MJ/kg	5.6	1.7		< 1.0	< 1.0	
Cyanide, Total	DETSC 2130#	0.1	mg/kg			0.2			< 0.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg			< 0.1			< 0.1
Total Organic Carbon	DETSC 2002	0.1	%	3.3	4.1		0.2	0.5	
Chloride Aqueous Extract	DETSC 2055	1	mg/l	4.2	3.0		3.1	3.0	
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l	1.9	1.2		1.3	< 1.0	
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	70	120		24	94	
Sulphide	DETSC 2024*	10	mg/kg	88	< 10		< 10	< 10	
Sulphur as S, Total	DETSC 2320	0.01	%	0.18	0.15		0.05	0.11	
Petroleum Hydrocarbons									
EPH (C6-C10)	DETSC 3321*	0.1	mg/kg						
EPH (C10-C12)	DETSC 3311	10	mg/kg						
EPH (C12-C16)	DETSC 3311	10	mg/kg						
EPH (C16-C21)	DETSC 3311	10	mg/kg						
EPH (C21-C35)	DETSC 3311	10	mg/kg						
EPH (C35-C40)	DETSC 3311	10	mg/kg						
EPH (C10-C40)	DETSC 3311#	10	mg/kg						
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03		< 0.03	< 0.03	
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03		< 0.03	< 0.03	
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03		< 0.03	< 0.03	

Summary of Chemical Analysis Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1488393	1488394	1488395	1488396	1488397	1488398
Sample ID	TP25	TP14	TP15	TP17	TP17	TP19
Depth	0.70	0.80	0.80	0.90	2.00	0.80
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03		< 0.03	< 0.03	
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.15	< 0.03		< 0.03	< 0.03	
Anthracene	DETSC 3303	0.03	mg/kg	0.04	< 0.03		< 0.03	< 0.03	
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.21	< 0.03		< 0.03	< 0.03	
Pyrene	DETSC 3303#	0.03	mg/kg	0.19	< 0.03		< 0.03	< 0.03	
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.10	< 0.03		< 0.03	< 0.03	
Chrysene	DETSC 3303	0.03	mg/kg	0.11	< 0.03		< 0.03	< 0.03	
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.12	< 0.03		< 0.03	< 0.03	
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.05	< 0.03		< 0.03	< 0.03	
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.08	< 0.03		< 0.03	< 0.03	
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.06	< 0.03		< 0.03	< 0.03	
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03		< 0.03	< 0.03	
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.06	< 0.03		< 0.03	< 0.03	
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	1.2	< 0.10		< 0.10	< 0.10	
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	0.4	1.0		< 0.3		

Summary of Chemical Analysis

Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1488399	1488400	1488401	1488402	1488403	1488404
Sample ID	TP20	TP21	TP23	TP24	WS08	TP09
Depth	0.60	0.50	0.90	2.40	0.50	0.30
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Asbestos Quantification	DETSC 1102	0				Y			
Preparation									
Moisture Content	DETSC 1004	0.1	%	13	14	12	16		
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	43	31	20	120	36	38
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	1.9	2.7	0.8	2.8	2.1	0.8
Cadmium	DETSC 2301#	0.1	mg/kg	0.1	0.3	0.8	< 0.1	16	0.2
Chromium	DETSC 2301#	0.15	mg/kg	21	22	81	11	960	23
Chromium III	DETSC 2301*	0.15	mg/kg	21	22	81	11	960	23
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	50	110	120	82	9500	74
Lead	DETSC 2301#	0.3	mg/kg	28	77	130	28	1200	38
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l	47	29	< 10	17		
Mercury	DETSC 2325#	0.05	mg/kg	0.06	0.43	0.16	0.21	0.87	0.13
Nickel	DETSC 2301#	1	mg/kg	34	47	180	19	1500	36
Selenium	DETSC 2301#	0.5	mg/kg	1.4	1.6	< 0.5	3.3	2.4	2.1
Zinc	DETSC 2301#	1	mg/kg	72	120	270	35	3300	79
Inorganics									
Loss on Ignition at 440oC	DETSC 2003#	0.01	%				65		
pH	DETSC 2008#			6.5	5.9	11.8	4.6	9.0	6.6
Calorific Value	DETSC 5008	1	MJ/kg	3.0	9.4	5.3	18.3		
Cyanide, Total	DETSC 2130#	0.1	mg/kg					11	
Cyanide, Free	DETSC 2130#	0.1	mg/kg					< 0.1	
Total Organic Carbon	DETSC 2002	0.1	%	4.7	13	3.2	> 15		4.2
Chloride Aqueous Extract	DETSC 2055	1	mg/l	4.1	14	9.7	7.8		
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l	< 1.0	1.5	4.1	74		
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	980	360	80	170		
Sulphide	DETSC 2024*	10	mg/kg	16	< 10	120	< 10		
Sulphur as S, Total	DETSC 2320	0.01	%	0.28	0.22	0.12	0.50		
Petroleum Hydrocarbons									
EPH (C6-C10)	DETSC 3321*	0.1	mg/kg	< 0.1	< 0.1	< 0.1			
EPH (C10-C12)	DETSC 3311	10	mg/kg	< 10	< 10	< 10			
EPH (C12-C16)	DETSC 3311	10	mg/kg	< 10	< 10	< 10			
EPH (C16-C21)	DETSC 3311	10	mg/kg	< 10	< 10	< 10			
EPH (C21-C35)	DETSC 3311	10	mg/kg	< 10	15	51			
EPH (C35-C40)	DETSC 3311	10	mg/kg	< 10	< 10	11			
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10	27	71			
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	0.06	< 0.03	0.08	0.06		0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03		< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.05	< 0.03		< 0.03

Summary of Chemical Analysis Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1488399	1488400	1488401	1488402	1488403	1488404
Sample ID	TP20	TP21	TP23	TP24	WS08	TP09
Depth	0.60	0.50	0.90	2.40	0.50	0.30
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	0.03	< 0.03		< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.05	< 0.03	0.29	0.06		0.05
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	0.07	< 0.03		< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.05	0.03	0.35	0.04		0.05
Pyrene	DETSC 3303#	0.03	mg/kg	0.05	0.03	0.30	0.04		0.05
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.14	< 0.03		< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	0.16	0.04		< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.16	< 0.03		< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.06	< 0.03		< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.10	< 0.03		< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.07	< 0.03		< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03		< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.07	< 0.03		< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.19	< 0.10	1.9	0.23		0.17
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	0.5		< 0.3			

Summary of Chemical Analysis

Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1488405	1488406	1488407	1488408	1488409	1488410
Sample ID	TP19	TP20	TP21	TP22	TP13	TP14
Depth	0.20	0.10	0.10	0.10	0.30	2.00
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Asbestos Quantification	DETSC 1102	0							
Preparation									
Moisture Content	DETSC 1004	0.1	%						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	8.7	37	21	20	27	21
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	1.4	1.2	1.1	0.5	1.0	1.4
Cadmium	DETSC 2301#	0.1	mg/kg	0.3	0.2	0.2	0.5	< 0.1	0.4
Chromium	DETSC 2301#	0.15	mg/kg	34	24	24	27	21	28
Chromium III	DETSC 2301*	0.15	mg/kg	34	24	24	27	21	28
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	87	44	44	49	60	28
Lead	DETSC 2301#	0.3	mg/kg	34	44	33	59	26	38
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l						
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05	0.06	0.11	0.06
Nickel	DETSC 2301#	1	mg/kg	43	30	27	39	31	28
Selenium	DETSC 2301#	0.5	mg/kg	0.7	1.5	1.2	1.3	1.3	1.0
Zinc	DETSC 2301#	1	mg/kg	92	83	58	180	55	120
Inorganics									
Loss on Ignition at 440oC	DETSC 2003#	0.01	%						
pH	DETSC 2008#			7.7	6.2	7.1	8.5	6.2	7.0
Calorific Value	DETSC 5008	1	MJ/kg						
Cyanide, Total	DETSC 2130#	0.1	mg/kg						
Cyanide, Free	DETSC 2130#	0.1	mg/kg						
Total Organic Carbon	DETSC 2002	0.1	%	0.3	2.8	5.5	2.5	6.8	1.4
Chloride Aqueous Extract	DETSC 2055	1	mg/l						
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l						
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l						
Sulphide	DETSC 2024*	10	mg/kg						
Sulphur as S, Total	DETSC 2320	0.01	%						
Petroleum Hydrocarbons									
EPH (C6-C10)	DETSC 3321*	0.1	mg/kg						
EPH (C10-C12)	DETSC 3311	10	mg/kg						
EPH (C12-C16)	DETSC 3311	10	mg/kg						
EPH (C16-C21)	DETSC 3311	10	mg/kg						
EPH (C21-C35)	DETSC 3311	10	mg/kg						
EPH (C35-C40)	DETSC 3311	10	mg/kg						
EPH (C10-C40)	DETSC 3311#	10	mg/kg						
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.04	0.06	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03

Summary of Chemical Analysis

Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1488405	1488406	1488407	1488408	1488409	1488410
Sample ID	TP19	TP20	TP21	TP22	TP13	TP14
Depth	0.20	0.10	0.10	0.10	0.30	2.00
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.03	< 0.03	0.04	0.09	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	0.06	< 0.03	0.05	0.06	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.05	< 0.03	0.04	0.04	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	0.20	< 0.10	0.15	0.25	< 0.10
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg						

Summary of Chemical Analysis

Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1488411	1488412	1488413	1488414	1488415	1488416
Sample ID	TP15	TP19	TP25	TP01	TP02	TP04
Depth	3.10	2.50	3.10	0.10	0.10	0.10
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Asbestos Quantification	DETSC 1102	0							
Preparation									
Moisture Content	DETSC 1004	0.1	%						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	11	13	11	17	17	23
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	1.2	1.9	0.6	0.6	0.3	0.5
Cadmium	DETSC 2301#	0.1	mg/kg	0.2	0.2	< 0.1	0.4	0.4	0.5
Chromium	DETSC 2301#	0.15	mg/kg	23	24	22	16	16	16
Chromium III	DETSC 2301*	0.15	mg/kg	23	24	22	16	16	16
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	24	26	19	23	21	33
Lead	DETSC 2301#	0.3	mg/kg	41	48	17	43	38	67
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l						
Mercury	DETSC 2325#	0.05	mg/kg	0.09	0.06	< 0.05	0.07	0.07	0.10
Nickel	DETSC 2301#	1	mg/kg	27	22	19	18	17	19
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	0.9	0.8	0.9
Zinc	DETSC 2301#	1	mg/kg	110	97	53	91	140	220
Inorganics									
Loss on Ignition at 440oC	DETSC 2003#	0.01	%						
pH	DETSC 2008#			6.6	7.1	6.9	7.4	7.0	7.3
Calorific Value	DETSC 5008	1	MJ/kg						
Cyanide, Total	DETSC 2130#	0.1	mg/kg						
Cyanide, Free	DETSC 2130#	0.1	mg/kg						
Total Organic Carbon	DETSC 2002	0.1	%	2.7	2.7	0.4	< 0.1	1.9	1.9
Chloride Aqueous Extract	DETSC 2055	1	mg/l						
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l						
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l						
Sulphide	DETSC 2024*	10	mg/kg						
Sulphur as S, Total	DETSC 2320	0.01	%						
Petroleum Hydrocarbons									
EPH (C6-C10)	DETSC 3321*	0.1	mg/kg						
EPH (C10-C12)	DETSC 3311	10	mg/kg						
EPH (C12-C16)	DETSC 3311	10	mg/kg						
EPH (C16-C21)	DETSC 3311	10	mg/kg						
EPH (C21-C35)	DETSC 3311	10	mg/kg						
EPH (C35-C40)	DETSC 3311	10	mg/kg						
EPH (C10-C40)	DETSC 3311#	10	mg/kg						
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.04	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03

Summary of Chemical Analysis

Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1488411	1488412	1488413	1488414	1488415	1488416
Sample ID	TP15	TP19	TP25	TP01	TP02	TP04
Depth	3.10	2.50	3.10	0.10	0.10	0.10
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.06	0.12	0.05
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.14	0.27	0.09
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.12	0.25	0.08
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.05	0.08	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.06	0.11	0.04
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.06	0.09	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.04	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.05	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.04	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.04	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	< 0.10	< 0.10	0.47	1.1	0.26
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg						

Summary of Chemical Analysis

Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1488417	1488418	1488419	1488420	1488421	1488422
Sample ID	TP05	TP07	TP08	TP11	TP08	TP11
Depth	0.10	0.10	0.10	0.10	1.00	1.30
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Asbestos Quantification	DETSC 1102	0							
Preparation									
Moisture Content	DETSC 1004	0.1	%						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	22	16	21	24		
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	0.2	0.3	0.3	0.4		
Cadmium	DETSC 2301#	0.1	mg/kg	0.4	0.3	0.4	0.4		
Chromium	DETSC 2301#	0.15	mg/kg	20	14	18	20		
Chromium III	DETSC 2301*	0.15	mg/kg	20	14	18	20		
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0		
Copper	DETSC 2301#	0.2	mg/kg	30	20	24	31		
Lead	DETSC 2301#	0.3	mg/kg	68	38	42	1300		
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l						
Mercury	DETSC 2325#	0.05	mg/kg	0.06	0.06	0.07	0.09		
Nickel	DETSC 2301#	1	mg/kg	22	16	19	21		
Selenium	DETSC 2301#	0.5	mg/kg	0.7	0.9	1.2	0.6		
Zinc	DETSC 2301#	1	mg/kg	130	77	110	110		
Inorganics									
Loss on Ignition at 440oC	DETSC 2003#	0.01	%						
pH	DETSC 2008#			7.6	7.5	7.5	7.4	7.6	7.6
Calorific Value	DETSC 5008	1	MJ/kg						
Cyanide, Total	DETSC 2130#	0.1	mg/kg						
Cyanide, Free	DETSC 2130#	0.1	mg/kg						
Total Organic Carbon	DETSC 2002	0.1	%	1.9	2.6	2.3	2.1		
Chloride Aqueous Extract	DETSC 2055	1	mg/l						
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l						
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l					82	22
Sulphide	DETSC 2024*	10	mg/kg						
Sulphur as S, Total	DETSC 2320	0.01	%						
Petroleum Hydrocarbons									
EPH (C6-C10)	DETSC 3321*	0.1	mg/kg						
EPH (C10-C12)	DETSC 3311	10	mg/kg						
EPH (C12-C16)	DETSC 3311	10	mg/kg						
EPH (C16-C21)	DETSC 3311	10	mg/kg						
EPH (C21-C35)	DETSC 3311	10	mg/kg						
EPH (C35-C40)	DETSC 3311	10	mg/kg						
EPH (C10-C40)	DETSC 3311#	10	mg/kg						
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03		
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03		
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03		

Summary of Chemical Analysis Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1488417	1488418	1488419	1488420	1488421	1488422
Sample ID	TP05	TP07	TP08	TP11	TP08	TP11
Depth	0.10	0.10	0.10	0.10	1.00	1.30
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03		
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.10	0.06	0.06	0.04		
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03		
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.21	0.10	0.13	0.06		
Pyrene	DETSC 3303#	0.03	mg/kg	0.19	0.09	0.11	0.06		
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.05	0.03	0.04	< 0.03		
Chrysene	DETSC 3303	0.03	mg/kg	0.07	0.05	0.05	< 0.03		
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.05	0.03	0.04	< 0.03		
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03		
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03		
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03		
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03		
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03		
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.67	0.37	0.42	0.15		
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg						

Summary of Chemical Analysis

Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1488423	1488424	1488425	1488426	1488427	1488428
Sample ID	TP18	TP21	TP02	TP03	TP07	TP10
Depth	3.50	1.10	1.00	1.30	0.90	1.20
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Asbestos Quantification	DETSC 1102	0							
Preparation									
Moisture Content	DETSC 1004	0.1	%						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg						
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg						
Cadmium	DETSC 2301#	0.1	mg/kg						
Chromium	DETSC 2301#	0.15	mg/kg						
Chromium III	DETSC 2301*	0.15	mg/kg						
Chromium, Hexavalent	DETSC 2204*	1	mg/kg						
Copper	DETSC 2301#	0.2	mg/kg						
Lead	DETSC 2301#	0.3	mg/kg						
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l						< 10
Mercury	DETSC 2325#	0.05	mg/kg						
Nickel	DETSC 2301#	1	mg/kg						
Selenium	DETSC 2301#	0.5	mg/kg						
Zinc	DETSC 2301#	1	mg/kg						
Inorganics									
Loss on Ignition at 440oC	DETSC 2003#	0.01	%						
pH	DETSC 2008#			7.0	5.8	7.3	7.4	7.6	5.2
Calorific Value	DETSC 5008	1	MJ/kg						
Cyanide, Total	DETSC 2130#	0.1	mg/kg						
Cyanide, Free	DETSC 2130#	0.1	mg/kg						
Total Organic Carbon	DETSC 2002	0.1	%						
Chloride Aqueous Extract	DETSC 2055	1	mg/l						4.8
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l						< 1.0
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	140	220	11	15	< 10	62
Sulphide	DETSC 2024*	10	mg/kg						
Sulphur as S, Total	DETSC 2320	0.01	%						
Petroleum Hydrocarbons									
EPH (C6-C10)	DETSC 3321*	0.1	mg/kg						
EPH (C10-C12)	DETSC 3311	10	mg/kg						
EPH (C12-C16)	DETSC 3311	10	mg/kg						
EPH (C16-C21)	DETSC 3311	10	mg/kg						
EPH (C21-C35)	DETSC 3311	10	mg/kg						
EPH (C35-C40)	DETSC 3311	10	mg/kg						
EPH (C10-C40)	DETSC 3311#	10	mg/kg						
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg						
Acenaphthylene	DETSC 3303#	0.03	mg/kg						
Acenaphthene	DETSC 3303#	0.03	mg/kg						

Summary of Chemical Analysis Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1488423	1488424	1488425	1488426	1488427	1488428
Sample ID	TP18	TP21	TP02	TP03	TP07	TP10
Depth	3.50	1.10	1.00	1.30	0.90	1.20
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Fluorene	DETSC 3303	0.03	mg/kg						
Phenanthrene	DETSC 3303#	0.03	mg/kg						
Anthracene	DETSC 3303	0.03	mg/kg						
Fluoranthene	DETSC 3303#	0.03	mg/kg						
Pyrene	DETSC 3303#	0.03	mg/kg						
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg						
Chrysene	DETSC 3303	0.03	mg/kg						
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg						
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg						
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg						
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg						
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg						
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg						
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg						
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg						

Summary of Chemical Analysis

Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1488429	1488430	1488431	1488432	1488433	1494148
Sample ID	TP14	TP01	TP05	TP20	TP23	TP11 A
Depth	3.50	1.00	2.70	2.70	3.50	0.10
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19	n/s
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Asbestos Quantification	DETSC 1102	0							
Preparation									
Moisture Content	DETSC 1004	0.1	%						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg						
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg						
Cadmium	DETSC 2301#	0.1	mg/kg						
Chromium	DETSC 2301#	0.15	mg/kg						
Chromium III	DETSC 2301*	0.15	mg/kg						
Chromium, Hexavalent	DETSC 2204*	1	mg/kg						
Copper	DETSC 2301#	0.2	mg/kg						
Lead	DETSC 2301#	0.3	mg/kg						52
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l						
Mercury	DETSC 2325#	0.05	mg/kg						
Nickel	DETSC 2301#	1	mg/kg						
Selenium	DETSC 2301#	0.5	mg/kg						
Zinc	DETSC 2301#	1	mg/kg						
Inorganics									
Loss on Ignition at 440oC	DETSC 2003#	0.01	%						
pH	DETSC 2008#			5.9	7.7	5.5	6.6	6.8	
Calorific Value	DETSC 5008	1	MJ/kg						
Cyanide, Total	DETSC 2130#	0.1	mg/kg						
Cyanide, Free	DETSC 2130#	0.1	mg/kg						
Total Organic Carbon	DETSC 2002	0.1	%						
Chloride Aqueous Extract	DETSC 2055	1	mg/l						
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l						
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	92	10	57	67	71	
Sulphide	DETSC 2024*	10	mg/kg						
Sulphur as S, Total	DETSC 2320	0.01	%						
Petroleum Hydrocarbons									
EPH (C6-C10)	DETSC 3321*	0.1	mg/kg						
EPH (C10-C12)	DETSC 3311	10	mg/kg						
EPH (C12-C16)	DETSC 3311	10	mg/kg						
EPH (C16-C21)	DETSC 3311	10	mg/kg						
EPH (C21-C35)	DETSC 3311	10	mg/kg						
EPH (C35-C40)	DETSC 3311	10	mg/kg						
EPH (C10-C40)	DETSC 3311#	10	mg/kg						
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg						
Acenaphthylene	DETSC 3303#	0.03	mg/kg						
Acenaphthene	DETSC 3303#	0.03	mg/kg						

Summary of Chemical Analysis Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1488429	1488430	1488431	1488432	1488433	1494148
Sample ID	TP14	TP01	TP05	TP20	TP23	TP11 A
Depth	3.50	1.00	2.70	2.70	3.50	0.10
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19	n/s
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Fluorene	DETSC 3303	0.03	mg/kg						
Phenanthrene	DETSC 3303#	0.03	mg/kg						
Anthracene	DETSC 3303	0.03	mg/kg						
Fluoranthene	DETSC 3303#	0.03	mg/kg						
Pyrene	DETSC 3303#	0.03	mg/kg						
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg						
Chrysene	DETSC 3303	0.03	mg/kg						
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg						
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg						
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg						
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg						
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg						
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg						
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg						
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg						

Summary of Chemical Analysis

Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1494149	1494150
Sample ID	TP11 B	TP11 C
Depth	0.10	0.10
Other ID		
Sample Type	SOIL	SOIL
Sampling Date	n/s	n/s
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
Asbestos Quantification	DETSC 1102	0			
Preparation					
Moisture Content	DETSC 1004	0.1	%		
Metals					
Arsenic	DETSC 2301#	0.2	mg/kg		
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg		
Cadmium	DETSC 2301#	0.1	mg/kg		
Chromium	DETSC 2301#	0.15	mg/kg		
Chromium III	DETSC 2301*	0.15	mg/kg		
Chromium, Hexavalent	DETSC 2204*	1	mg/kg		
Copper	DETSC 2301#	0.2	mg/kg		
Lead	DETSC 2301#	0.3	mg/kg	61	49
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l		
Mercury	DETSC 2325#	0.05	mg/kg		
Nickel	DETSC 2301#	1	mg/kg		
Selenium	DETSC 2301#	0.5	mg/kg		
Zinc	DETSC 2301#	1	mg/kg		
Inorganics					
Loss on Ignition at 440oC	DETSC 2003#	0.01	%		
pH	DETSC 2008#				
Calorific Value	DETSC 5008	1	MJ/kg		
Cyanide, Total	DETSC 2130#	0.1	mg/kg		
Cyanide, Free	DETSC 2130#	0.1	mg/kg		
Total Organic Carbon	DETSC 2002	0.1	%		
Chloride Aqueous Extract	DETSC 2055	1	mg/l		
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l		
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l		
Sulphide	DETSC 2024*	10	mg/kg		
Sulphur as S, Total	DETSC 2320	0.01	%		
Petroleum Hydrocarbons					
EPH (C6-C10)	DETSC 3321*	0.1	mg/kg		
EPH (C10-C12)	DETSC 3311	10	mg/kg		
EPH (C12-C16)	DETSC 3311	10	mg/kg		
EPH (C16-C21)	DETSC 3311	10	mg/kg		
EPH (C21-C35)	DETSC 3311	10	mg/kg		
EPH (C35-C40)	DETSC 3311	10	mg/kg		
EPH (C10-C40)	DETSC 3311#	10	mg/kg		
PAHs					
Naphthalene	DETSC 3303#	0.03	mg/kg		
Acenaphthylene	DETSC 3303#	0.03	mg/kg		
Acenaphthene	DETSC 3303#	0.03	mg/kg		

Summary of Chemical Analysis

Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1494149	1494150
Sample ID	TP11 B	TP11 C
Depth	0.10	0.10
Other ID		
Sample Type	SOIL	SOIL
Sampling Date	n/s	n/s
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
Fluorene	DETSC 3303	0.03	mg/kg		
Phenanthrene	DETSC 3303#	0.03	mg/kg		
Anthracene	DETSC 3303	0.03	mg/kg		
Fluoranthene	DETSC 3303#	0.03	mg/kg		
Pyrene	DETSC 3303#	0.03	mg/kg		
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg		
Chrysene	DETSC 3303	0.03	mg/kg		
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg		
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg		
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg		
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg		
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg		
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg		
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg		
Phenols					
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg		

Summary of Chemical Analysis

Leachate Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1488434	1488435	1488436	1488437	1488438	1488439	1488440
Sample ID	TP12	TP13	TP16	TP16	TP18	TP24	TP25
Depth	0.40	0.60	0.40	1.10	0.70	1.00	0.70
Other ID							
Sample Type	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE
Sampling Date	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19	09/04/19
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units							
Preparation										
NRA Leachate Preparation	DETSC 1009*			Y	Y	Y	Y	Y	Y	Y
Metals										
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	< 0.16	30	1.2	< 0.16	0.31	0.29	0.34
Boron, Dissolved	DETSC 2306*	12	ug/l	< 12	< 12	< 12	< 12	27	18	14
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chromium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25	< 0.25	< 0.25	< 0.25	0.43	< 0.25	< 0.25
Copper, Dissolved	DETSC 2306	0.4	ug/l	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	0.9	0.8
Lead, Dissolved	DETSC 2306	0.09	ug/l	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	0.12
Mercury, Dissolved	DETSC 2306	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Nickel, Dissolved	DETSC 2306	0.5	ug/l	< 0.5	< 0.5	< 0.5	0.8	< 0.5	< 0.5	< 0.5
Selenium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	0.27
Zinc, Dissolved	DETSC 2306	1.3	ug/l	4.4	1.7	2.3	5.9	< 1.3	3.4	1.9
Inorganics										
pH	DETSC 2008			8.3	8.2	8.0	7.7	7.7	7.4	7.6

Summary of Asbestos Analysis

Soil Samples

Our Ref 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1488384	STOCKPILE 1	SOIL	NAD	none	Colin Patrick
1488385	STOCKPILE 2	SOIL	NAD	none	Colin Patrick
1488386	STOCKPILE 3	SOIL	NAD	none	Colin Patrick
1488387	TP12 0.40	SOIL	NAD	none	Colin Patrick
1488388	TP13 0.60	SOIL	NAD	none	Colin Patrick
1488389	TP16 0.40	SOIL	NAD	none	Colin Patrick
1488390	TP16 1.10	SOIL	NAD	none	Colin Patrick
1488391	TP18 0.70	SOIL	NAD	none	Colin Patrick
1488392	TP24 1.00	SOIL	NAD	none	Colin Patrick
1488393	TP25 0.70	SOIL	NAD	none	Colin Patrick
1488394	TP14 0.80	SOIL	NAD	none	Colin Patrick
1488396	TP17 0.90	SOIL	NAD	none	Colin Patrick
1488397	TP17 2.00	SOIL	NAD	none	Colin Patrick
1488399	TP20 0.60	SOIL	NAD	none	Colin Patrick
1488400	TP21 0.50	SOIL	NAD	none	Colin Patrick
1488401	TP23 0.90	SOIL	Amosite	bundle of Amosite fibres	Colin Patrick
1488402	TP24 2.40	SOIL	NAD	none	Colin Patrick
1488404	TP09 0.30	SOIL	NAD	none	Colin Patrick
1488405	TP19 0.20	SOIL	NAD	none	Colin Patrick
1488406	TP20 0.10	SOIL	NAD	none	Colin Patrick
1488407	TP21 0.10	SOIL	NAD	none	Colin Patrick
1488408	TP22 0.10	SOIL	NAD	none	Colin Patrick
1488409	TP13 0.30	SOIL	NAD	none	Colin Patrick
1488410	TP14 2.00	SOIL	NAD	none	Colin Patrick
1488411	TP15 3.10	SOIL	NAD	none	Colin Patrick
1488412	TP19 2.50	SOIL	NAD	none	Colin Patrick
1488413	TP25 3.10	SOIL	NAD	none	Colin Patrick
1488414	TP01 0.10	SOIL	NAD	none	Colin Patrick
1488415	TP02 0.10	SOIL	NAD	none	Colin Patrick
1488416	TP04 0.10	SOIL	NAD	none	Colin Patrick
1488417	TP05 0.10	SOIL	NAD	none	Colin Patrick
1488418	TP07 0.10	SOIL	NAD	none	Colin Patrick
1488419	TP08 0.10	SOIL	NAD	none	Colin Patrick
1488420	TP11 0.10	SOIL	NAD	none	Colin Patrick

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 19-06973-1

Client Ref 1750

Contract Title Goldthorpe Colliery

Lab No	1488401
Sample ID	TP23
Depth	0.90
Other ID	
Sample Type	SOIL
Sampling Date	09/04/19
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	578.69
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 %	0.003
% Chrysotile bundles in sample		Mass %	na

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 19-06973-1
 Client Ref 1750
 Contract Goldthorpe Colliery

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1488381	TARMAC 1 SOIL	09/04/19	PT 1L		Naphthalene, PAH MS
1488382	TARMAC 2 SOIL	09/04/19	PT 1L		Naphthalene, PAH MS
1488383	TARMAC 3 SOIL	09/04/19	PT 1L		Naphthalene, PAH MS
1488384	STOCKPILE 1 SOIL	09/04/19	GJ 250ml, PT 1L		
1488385	STOCKPILE 2 SOIL	09/04/19	GJ 250ml, PT 1L		
1488386	STOCKPILE 3 SOIL	09/04/19	GJ 250ml, PT 1L		
1488387	TP12 0.40 SOIL	09/04/19	GJ 250ml, PT 1L		
1488388	TP13 0.60 SOIL	09/04/19	GJ 250ml, PT 1L		
1488389	TP16 0.40 SOIL	09/04/19	GJ 250ml, PT 1L		
1488390	TP16 1.10 SOIL	09/04/19	GJ 250ml, PT 1L		
1488391	TP18 0.70 SOIL	09/04/19	GJ 250ml, PT 1L		
1488392	TP24 1.00 SOIL	09/04/19	GJ 250ml, PT 1L		
1488393	TP25 0.70 SOIL	09/04/19	GJ 250ml, PT 1L		
1488394	TP14 0.80 SOIL	09/04/19	GJ 250ml, PT 1L		
1488395	TP15 0.80 SOIL	09/04/19	GJ 250ml, PT 1L		
1488396	TP17 0.90 SOIL	09/04/19	GJ 250ml, PT 1L		
1488397	TP17 2.00 SOIL	09/04/19	GJ 250ml, PT 1L		
1488398	TP19 0.80 SOIL	09/04/19	GJ 250ml, PT 1L		
1488399	TP20 0.60 SOIL	09/04/19	GJ 250ml, PT 1L		
1488400	TP21 0.50 SOIL	09/04/19	GJ 250ml, PT 1L		
1488401	TP23 0.90 SOIL	09/04/19	GJ 250ml, PT 1L		
1488402	TP24 2.40 SOIL	09/04/19	GJ 250ml, PT 1L		
1488403	WS08 0.50 SOIL	09/04/19	GJ 250ml, PT 1L		
1488404	TP09 0.30 SOIL	09/04/19	GJ 250ml, PT 1L		
1488405	TP19 0.20 SOIL	09/04/19	GJ 250ml, PT 1L		
1488406	TP20 0.10 SOIL	09/04/19	GJ 250ml, PT 1L		
1488407	TP21 0.10 SOIL	09/04/19	GJ 250ml, PT 1L		
1488408	TP22 0.10 SOIL	09/04/19	GJ 250ml, PT 1L		
1488409	TP13 0.30 SOIL	09/04/19	GJ 250ml, PT 1L		
1488410	TP14 2.00 SOIL	09/04/19	GJ 250ml, PT 1L		
1488411	TP15 3.10 SOIL	09/04/19	GJ 250ml, PT 1L		
1488412	TP19 2.50 SOIL	09/04/19	GJ 250ml, PT 1L		
1488413	TP25 3.10 SOIL	09/04/19	GJ 250ml, PT 1L		
1488414	TP01 0.10 SOIL	09/04/19	GJ 250ml, PT 1L		
1488415	TP02 0.10 SOIL	09/04/19	GJ 250ml, PT 1L		
1488416	TP04 0.10 SOIL	09/04/19	GJ 250ml, PT 1L		
1488417	TP05 0.10 SOIL	09/04/19	GJ 250ml, PT 1L		
1488418	TP07 0.10 SOIL	09/04/19	GJ 250ml, PT 1L		
1488419	TP08 0.10 SOIL	09/04/19	GJ 250ml, PT 1L		
1488420	TP11 0.10 SOIL	09/04/19	GJ 250ml, PT 1L		
1488421	TP08 1.00 SOIL	09/04/19	PT 1L		
1488422	TP11 1.30 SOIL	09/04/19	PT 1L		
1488423	TP18 3.50 SOIL	09/04/19	PT 1L		
1488424	TP21 1.10 SOIL	09/04/19	PT 1L		
1488425	TP02 1.00 SOIL	09/04/19	PT 1L		
1488426	TP03 1.30 SOIL	09/04/19	PT 1L		
1488427	TP07 0.90 SOIL	09/04/19	PT 1L		
1488428	TP10 1.20 SOIL	09/04/19	PT 1L		
1488429	TP14 3.50 SOIL	09/04/19	PT 1L		

Information in Support of the Analytical Results

Our Ref 19-06973-1
 Client Ref 1750
 Contract Goldthorpe Colliery

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1488430	TP01 1.00 SOIL	09/04/19	PT 1L		
1488431	TP05 2.70 SOIL	09/04/19	PT 1L		
1488432	TP20 2.70 SOIL	09/04/19	PT 1L		
1488433	TP23 3.50 SOIL	09/04/19	PT 1L		
1488434	TP12 0.40 LEACHATE	09/04/19	GJ 250ml, PT 1L		
1488435	TP13 0.60 LEACHATE	09/04/19	GJ 250ml, PT 1L		
1488436	TP16 0.40 LEACHATE	09/04/19	GJ 250ml, PT 1L		
1488437	TP16 1.10 LEACHATE	09/04/19	GJ 250ml, PT 1L		
1488438	TP18 0.70 LEACHATE	09/04/19	GJ 250ml, PT 1L		
1488439	TP24 1.00 LEACHATE	09/04/19	GJ 250ml, PT 1L		
1488440	TP25 0.70 LEACHATE	09/04/19	GJ 250ml, PT 1L		
1494148	TP11 A 0.10 SOIL		GJ 250ml, PT 1L	Sample date not supplied, Metals ICP (365 days), Metals ICP Prep (365 days)	
1494149	TP11 B 0.10 SOIL		GJ 250ml, PT 1L	Sample date not supplied, Metals ICP (365 days), Metals ICP Prep (365 days)	
1494150	TP11 C 0.10 SOIL		GJ 250ml, PT 1L	Sample date not supplied, Metals ICP (365 days), Metals ICP Prep (365 days)	

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

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

Soil Analysis Notes

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

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

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

Disposal

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

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

Appendix J
Geotechnical Test Results



LABORATORY REPORT



4043

Contract Number: PSL19/2414

Report Date: 02 May 2019

Client's Reference:

Client Name: Lithos Consulting
Parkhill
Walton Road
Wetherby
North Yorkshire
LS22 5DZ

For the attention of: James Brown/Alan Swales

Contract Title: Goldthorpe Colliery

Date Received: 12/4/2019

Date Commenced: 12/4/2019

Date Completed: 2/5/2019

Notes: Opinions 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 other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson
(Director)

S Royle
(Laboratory Manager)

A Watkins
(Director)

S Eyre
(Senior Technician)

R Berriman
(Quality Manager)

L Knight
(Senior Technician)

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

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP12	2	B	0.60		MADE GROUND dark greyish brown very sandy silty gravel.
TP13	3	B	1.20		MADE GROUND reddish brown sandy silty gravel.
TP15	2	B	1.30		MADE GROUND dark grey very sandy silty gravel.
TP17	1	B	0.40		MADE GROUND reddish brown gravel of cobbles.
TP18	2	B	1.60		MADE GROUND reddish brown sandy silty gravel.
TP19	3	B	1.60		MADE GROUND dark brown slightly sandy silty gravel of mudstone.
TP23	2	B	1.20		MADE GROUND dark grey very sandy very silty gravel.
TP04	2	D	1.20		Brown mottled grey slightly sandy very silty CLAY.
TP06	1	D	0.90		Reddish brown very gravelly SAND.
TP09	2	D	0.90		Brown mottled grey sandy very silty CLAY.
TP09	3	D	1.50		Brown mottled grey slightly gravelly sandy very silty CLAY.
TP12	3	D	1.20		Brown mottled grey slightly gravelly sandy very silty CLAY.
TP15	4	D	3.50		Brown sandy very silty CLAY.
TP19	5	D	3.00		Grey mottled brown slightly sandy very silty CLAY.
TP20	3	D	1.20		Grey mottled brown slightly sandy very silty CLAY.
TP21	4	D	1.50		Brown sandy very silty CLAY.
TP23	3	D	2.30		Brown mottled grey slightly sandy very silty CLAY.



Goldthorpe Collery

Contract No:

PSL19/2414

Client Ref:

1750

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m ³ Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
TP12	2	B	0.60		36							
TP13	3	B	1.20		26							
TP15	2	B	1.30		30							
TP18	2	B	1.60		17							
TP19	3	B	1.60		9.1							
TP23	2	B	1.20		27							
TP04	2	D	1.20		25			58	29	29	100	High plasticity CH.
TP06	1	D	0.90		15				NP			
TP09	2	D	0.90		22			42	21	21	100	Intermediate plasticity CI.
TP09	3	D	1.50		19			47	24	23	98	Intermediate plasticity CI.
TP12	3	D	1.20		17			49	25	24	98	Intermediate plasticity CI.
TP15	4	D	3.50		24			44	23	21	100	Intermediate plasticity CI.
TP19	5	D	3.00		21			54	28	26	100	High plasticity CH.
TP20	3	D	1.20		26			56	27	29	100	High plasticity CH.
TP21	4	D	1.50		22			48	26	22	100	Intermediate plasticity CI.
TP23	3	D	2.30		25			55	27	28	100	High plasticity CH.

SYMBOLS : NP : Non Plastic

* : Liquid Limit and Plastic Limit Wet Sieved.



Goldthorpe Collery

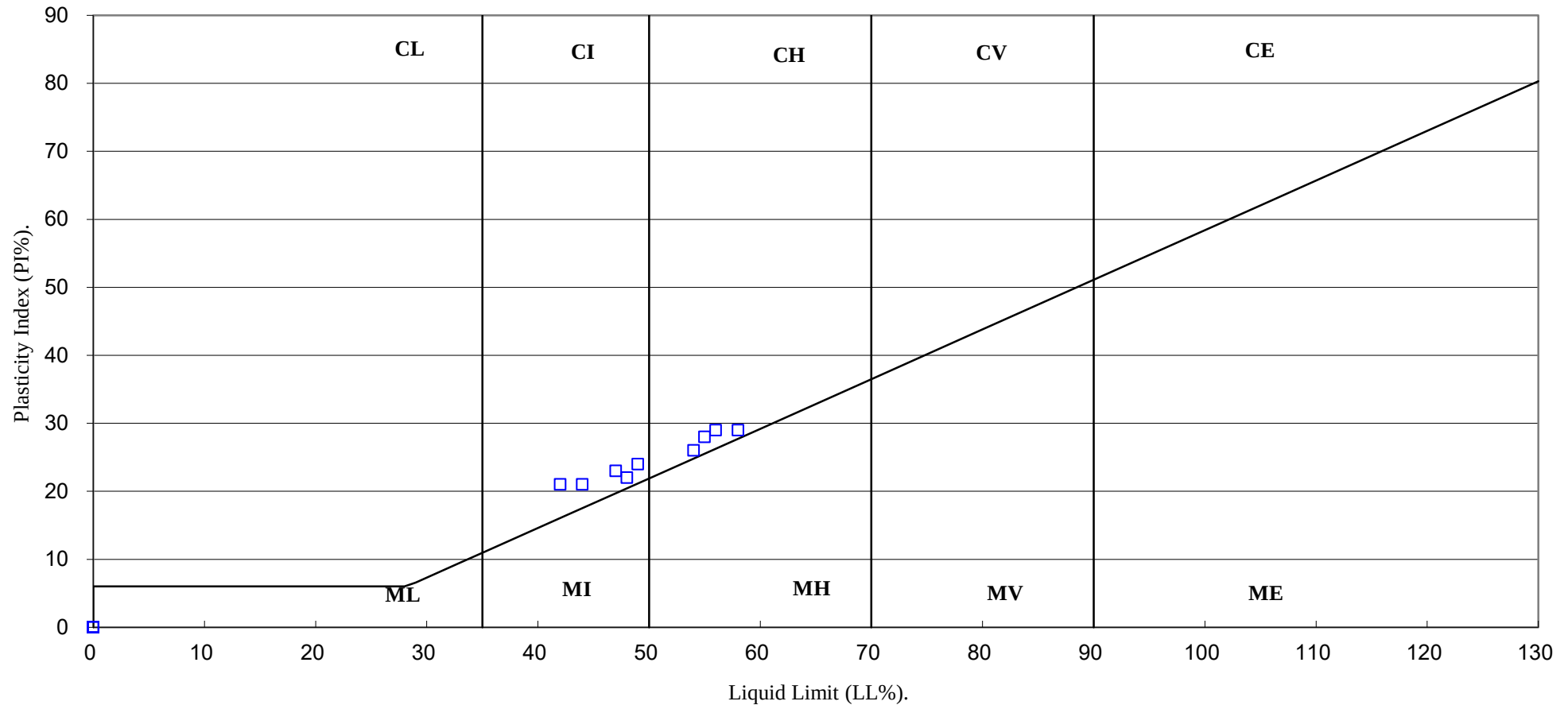
Contract No:

PSL19/2414

Client Ref:

1750

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

PSL
Professional Soils Laboratory

Goldthorpe Collery

Contract No:

PSL19/2414

Client Ref:

1750

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

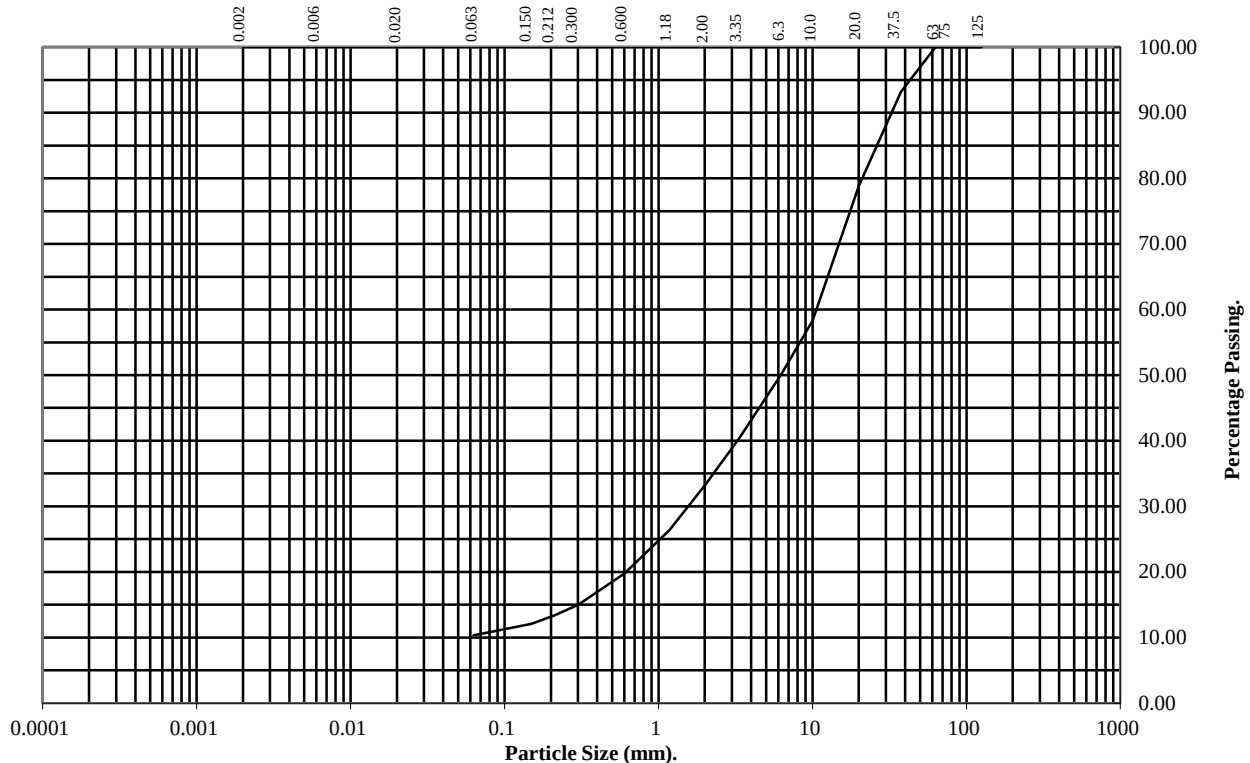
Hole Number: TP12

Top Depth (m): 0.60

Sample Number: 2

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	93
20	79
10	58
6.3	50
3.35	40
2	33
1.18	26
0.6	20
0.3	15
0.212	13
0.15	12
0.063	10

Soil Fraction	Total Percentage
Cobbles	0
Gravel	67
Sand	23
Silt/Clay	10

Remarks:

See Summary of Soil Descriptions



Goldthorpe Collery

Contract No:
PSL19/2414
Client Ref:
1750

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

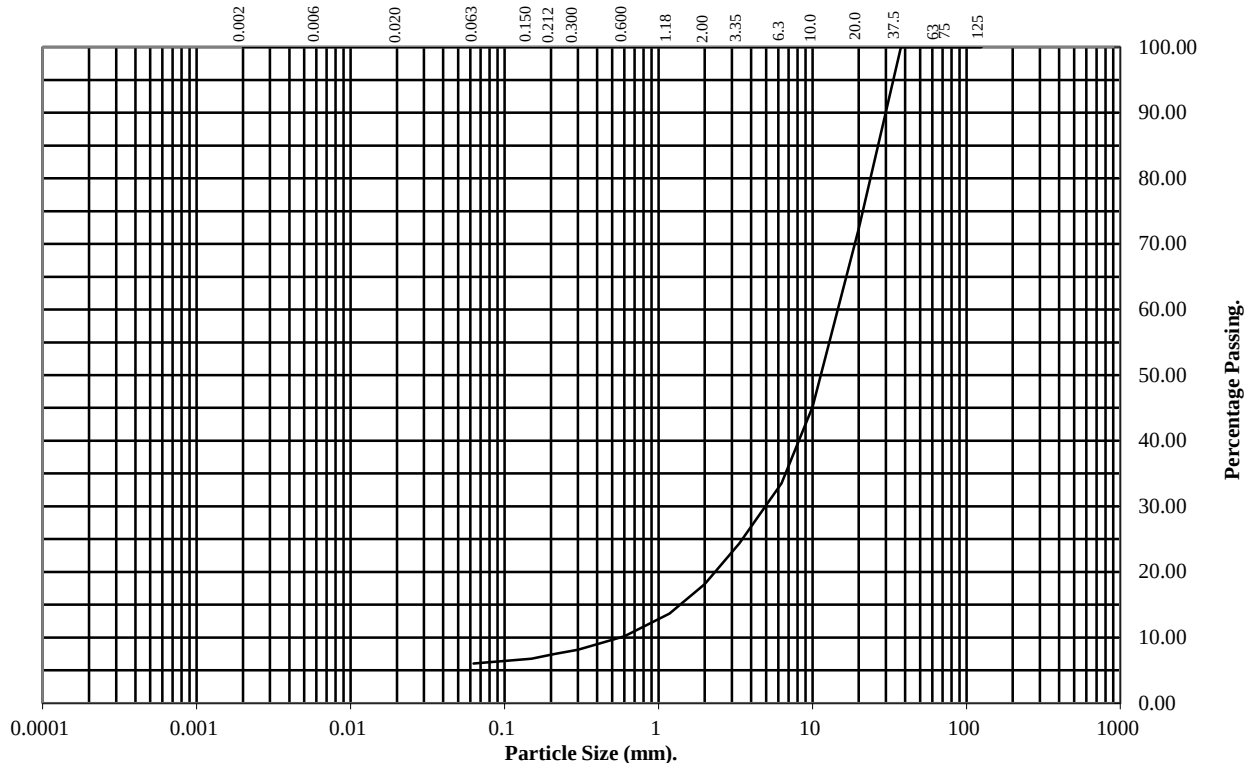
Hole Number: TP13

Top Depth (m): 1.20

Sample Number: 3

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	72
10	45
6.3	33
3.35	24
2	18
1.18	14
0.6	10
0.3	8
0.212	7
0.15	7
0.063	6

Soil Fraction	Total Percentage
Cobbles	0
Gravel	82
Sand	12
Silt/Clay	6

Remarks:

See Summary of Soil Descriptions



Goldthorpe Collery

Contract No:
PSL19/2414
Client Ref:
1750

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

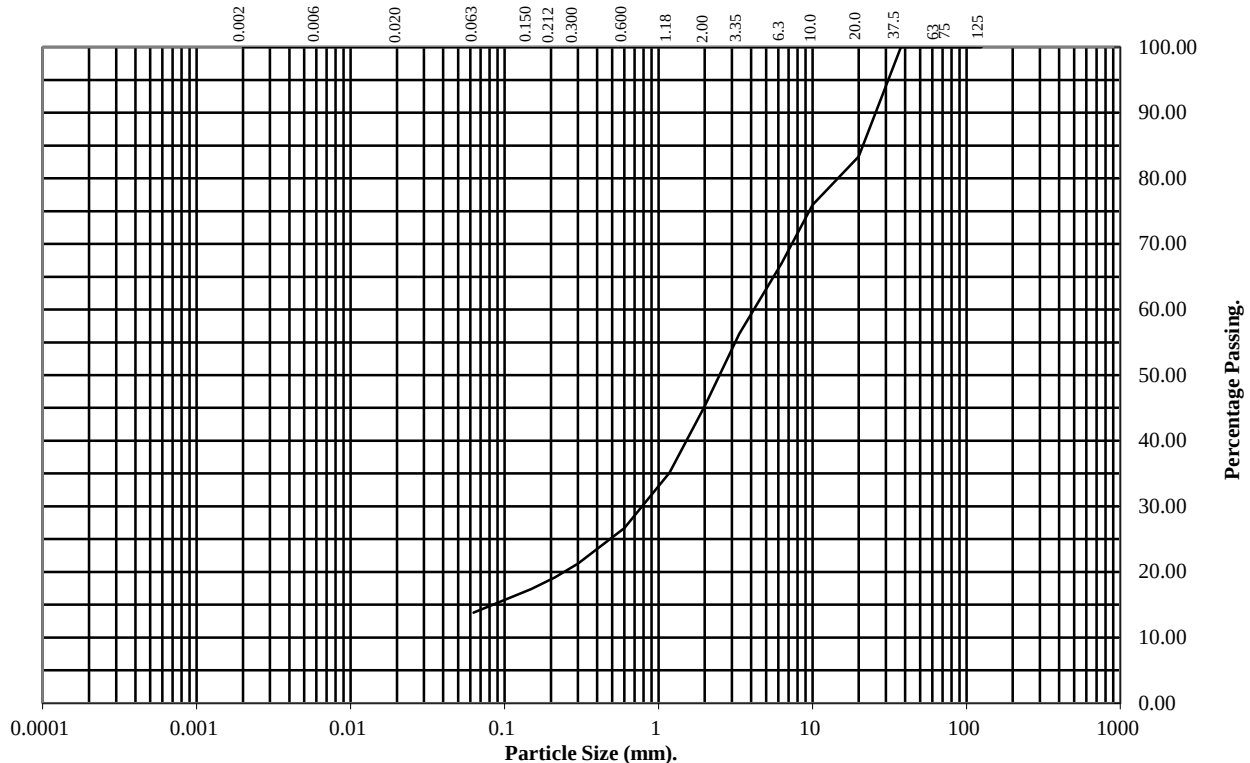
Hole Number: TP15

Top Depth (m): 1.30

Sample Number: 2

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	83
10	76
6.3	67
3.35	56
2	45
1.18	35
0.6	27
0.3	21
0.212	19
0.15	17
0.063	14

Soil Fraction	Total Percentage
Cobbles	0
Gravel	55
Sand	31
Silt/Clay	14

Remarks:

See Summary of Soil Descriptions



Goldthorpe Collery

Contract No:
PSL19/2414
Client Ref:
1750

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

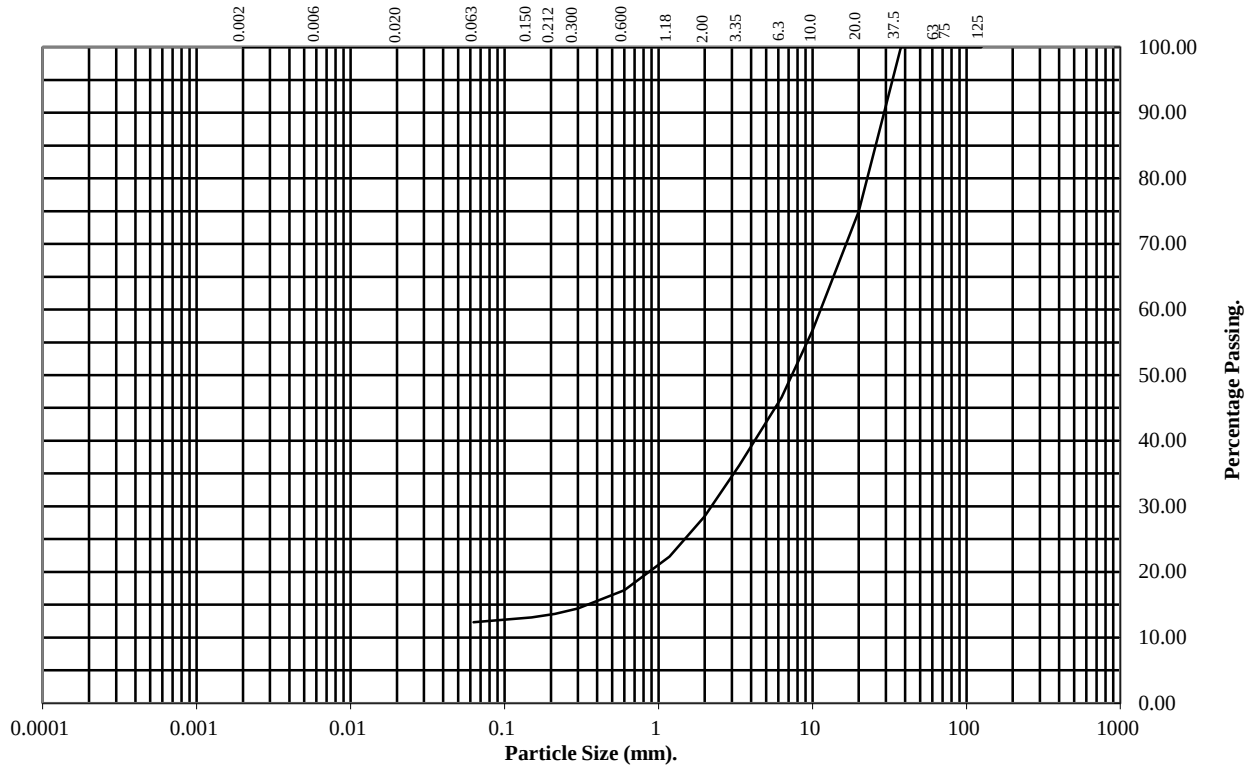
Hole Number: TP18

Top Depth (m): 1.60

Sample Number: 2

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	75
10	57
6.3	47
3.35	36
2	28
1.18	22
0.6	17
0.3	14
0.212	14
0.15	13
0.063	12

Soil Fraction	Total Percentage
Cobbles	0
Gravel	72
Sand	16
Silt/Clay	12

Remarks:

See Summary of Soil Descriptions



Goldthorpe Collery

Contract No:
PSL19/2414
Client Ref:
1750

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

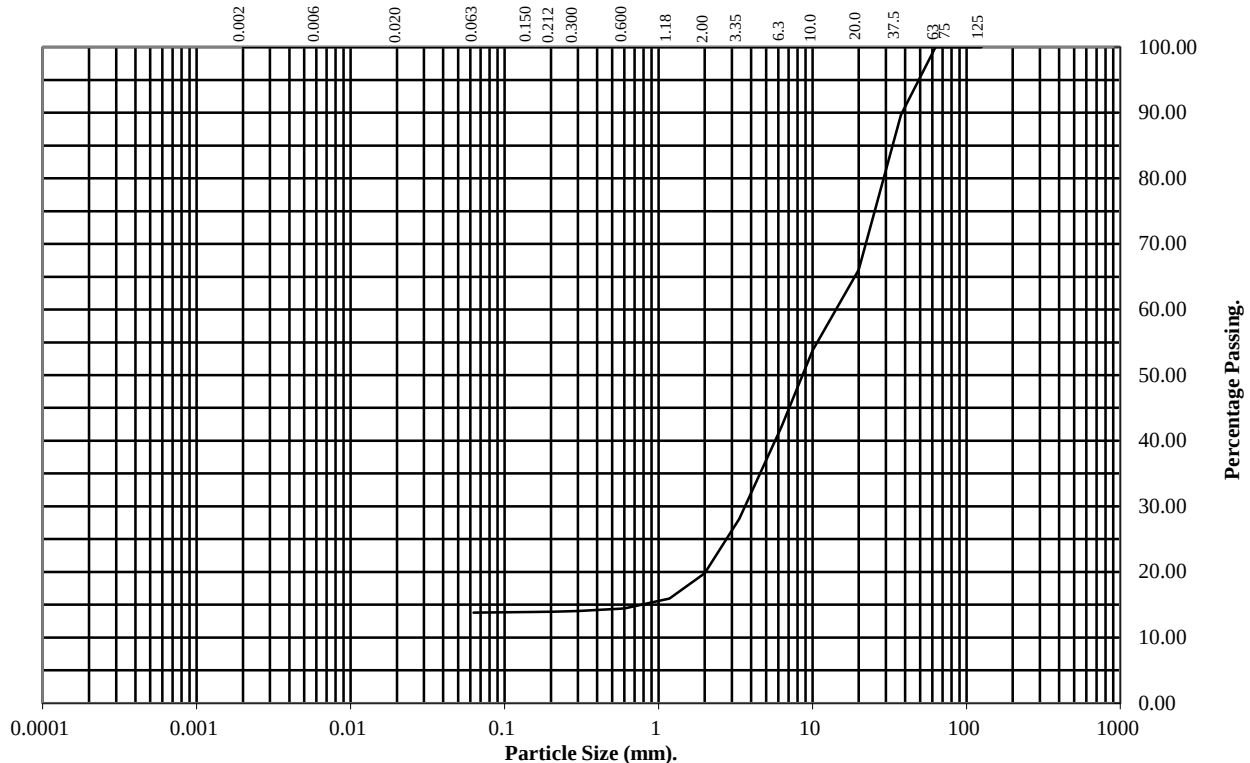
Hole Number: TP19

Top Depth (m): 1.60

Sample Number: 3

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	90
20	66
10	54
6.3	42
3.35	28
2	20
1.18	16
0.6	14
0.3	14
0.212	14
0.15	14
0.063	14

Soil Fraction	Total Percentage
Cobbles	0
Gravel	80
Sand	6
Silt/Clay	14

Remarks:

See Summary of Soil Descriptions



Goldthorpe Collery

Contract No:
PSL19/2414
Client Ref:
1750

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

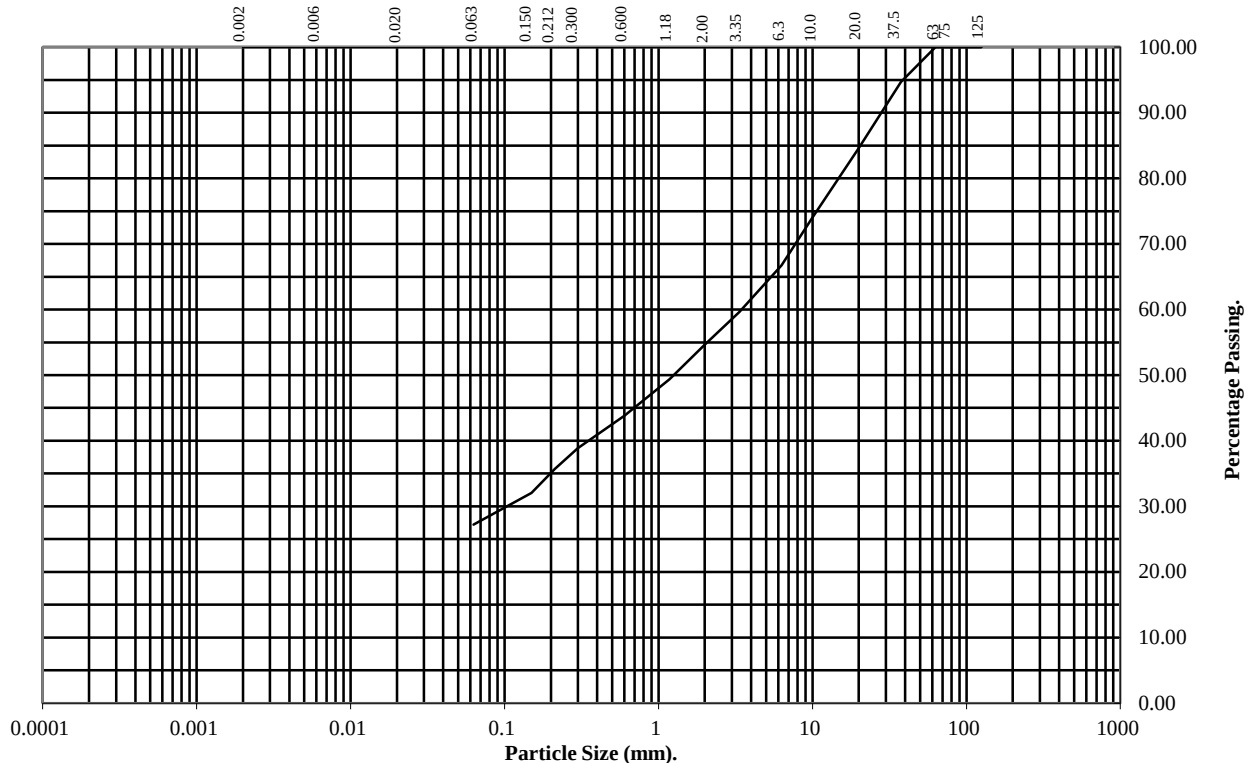
Hole Number: TP23

Top Depth (m): 1.20

Sample Number: 2

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	95
20	85
10	74
6.3	67
3.35	60
2	55
1.18	49
0.6	44
0.3	39
0.212	36
0.15	32
0.063	27

Soil Fraction	Total Percentage
Cobbles	0
Gravel	45
Sand	28
Silt/Clay	27

Remarks:

See Summary of Soil Descriptions



Goldthorpe Collery

Contract No:
PSL19/2414
Client Ref:
1750

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : 1990

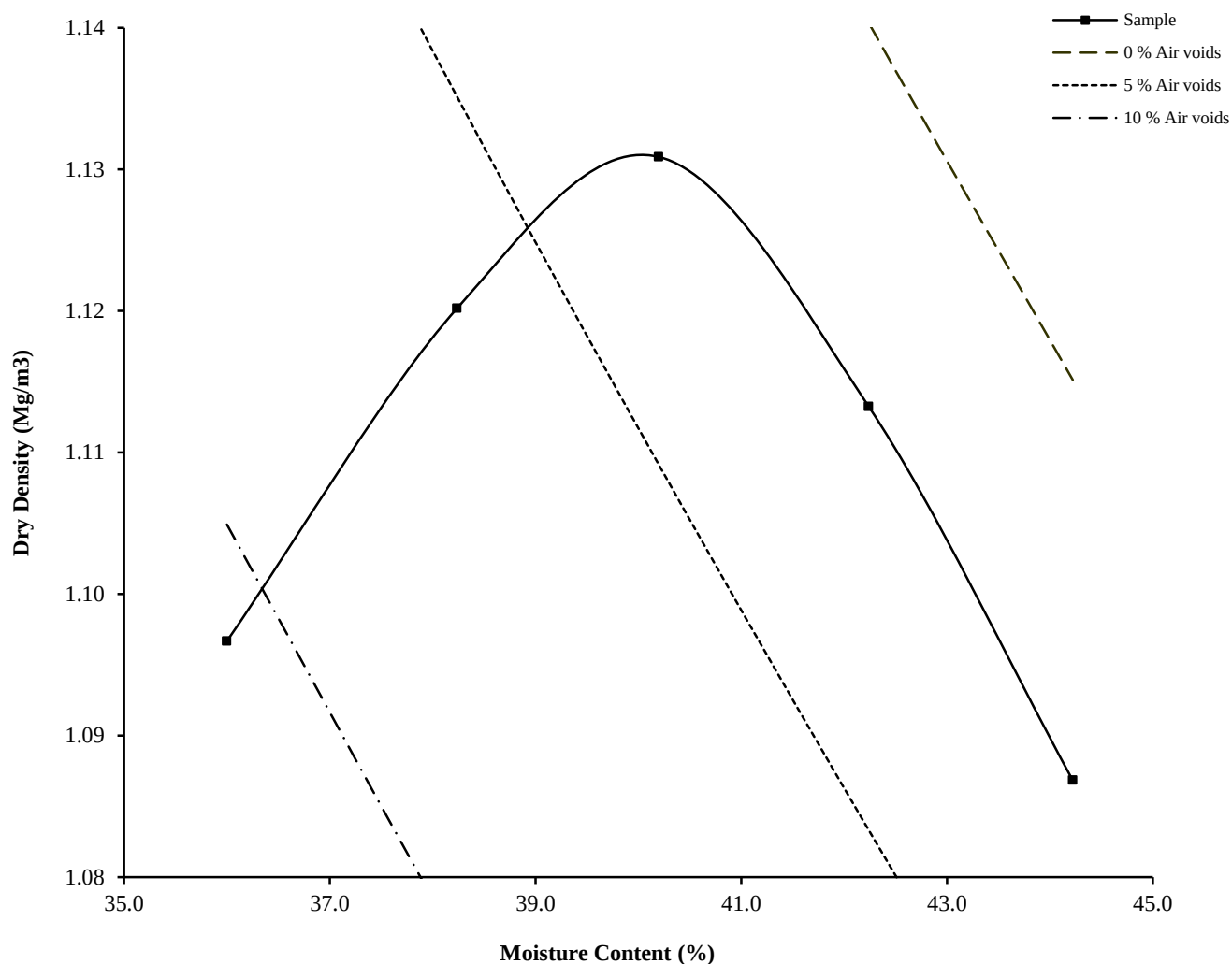
Hole Number: TP12

Top Depth (m) : 0.60

Sample Number: 2

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	36	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.2	Assumed	Material Retained on 37.5 mm Test Sieve (%):	7
Maximum Dry Density (Mg/m ³):	1.13		Material Retained on 20.0 mm Test Sieve (%):	14
Optimum Moisture Content (%):	40			
Remarks				
See summary of soil descriptions.				



Goldthorpe Colliery

Contract
PSL19/2414
Client Ref
1750

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : 1990

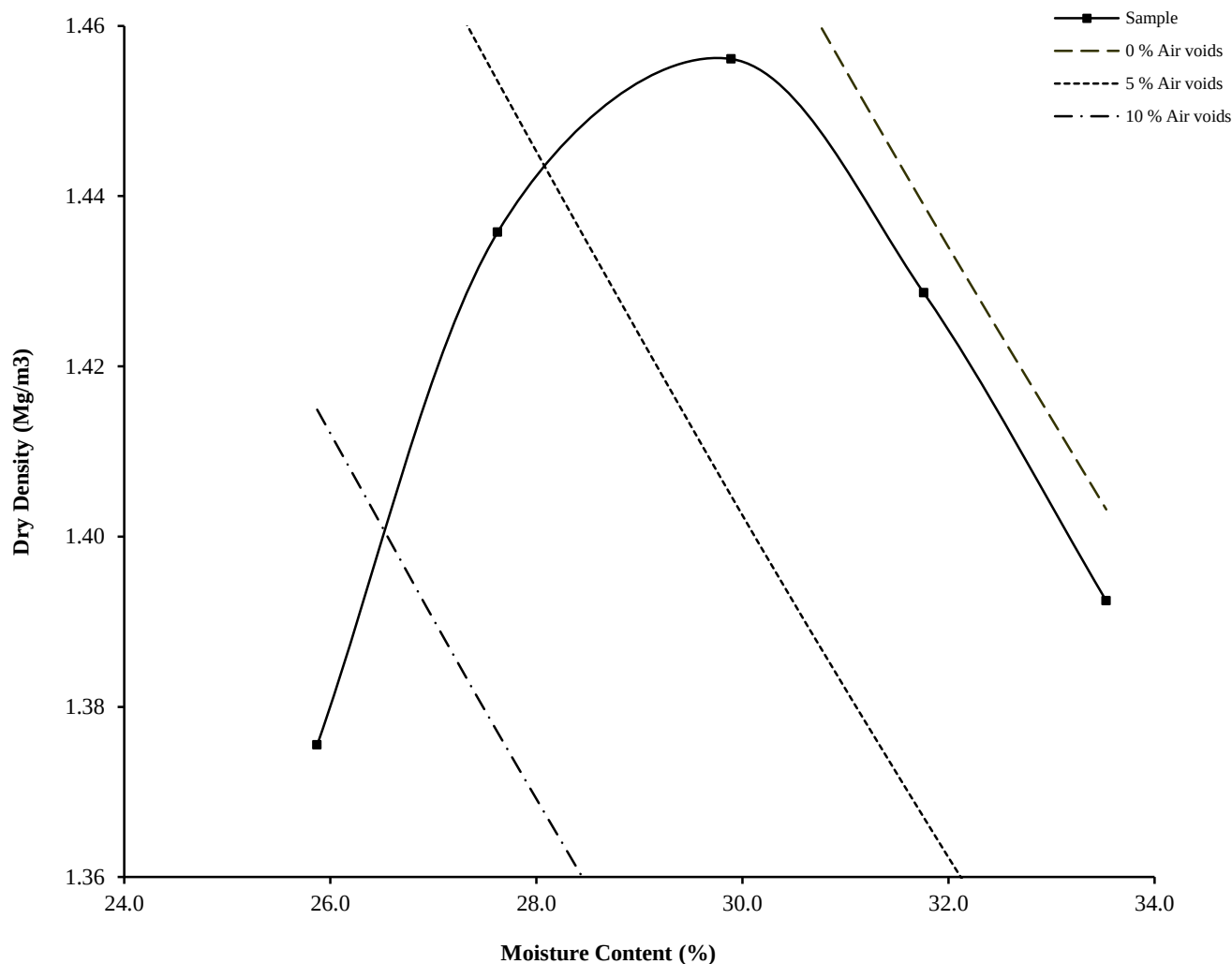
Hole Number: TP13

Top Depth (m) : 1.20

Sample Number: 3

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	26	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.65	Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m ³):	1.46		Material Retained on 20.0 mm Test Sieve (%):	28
Optimum Moisture Content (%):	30			
Remarks				
See summary of soil descriptions.				



Goldthorpe Colliery

Contract
PSL19/2414
Client Ref
1750

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : 1990

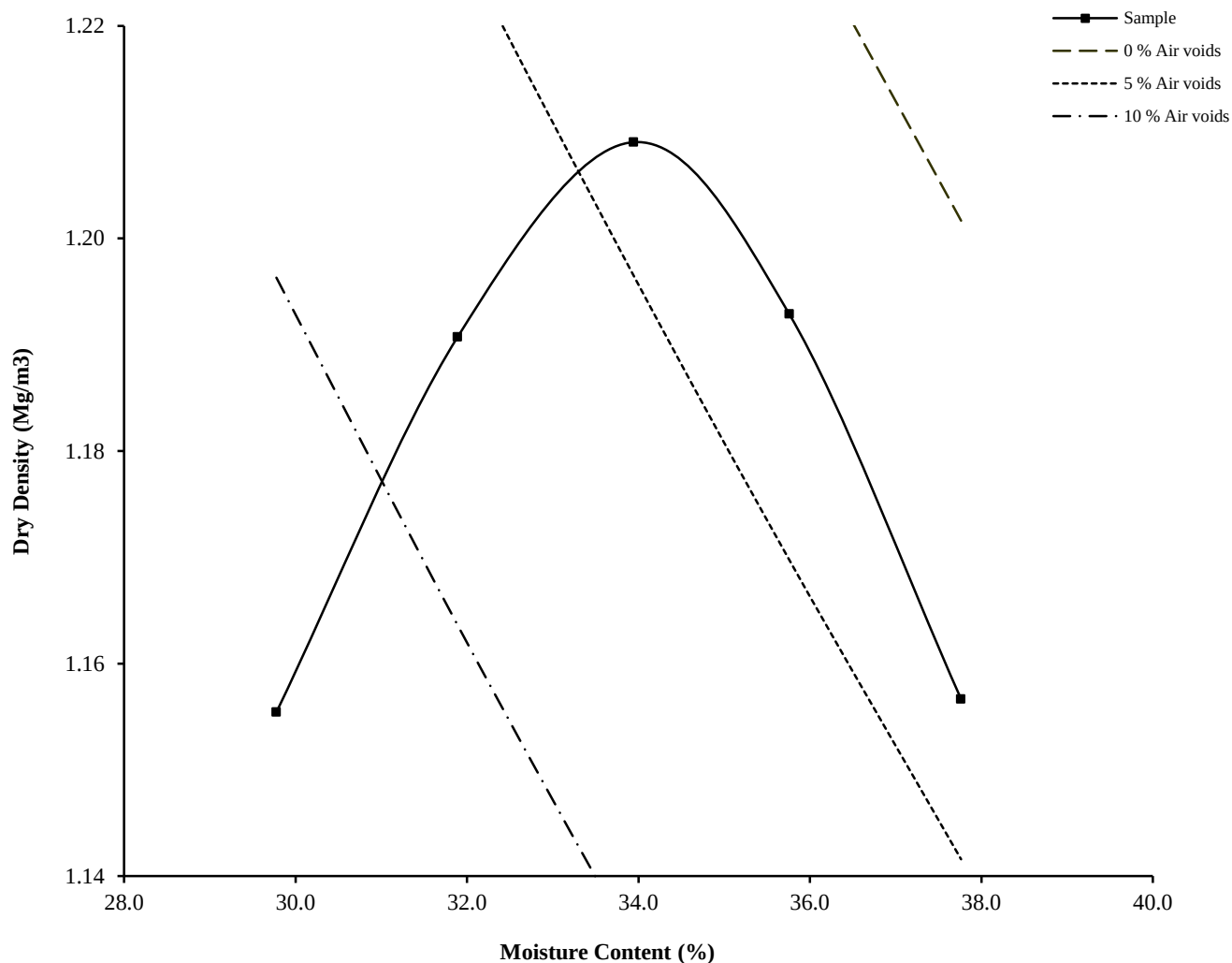
Hole Number: TP15

Top Depth (m) : 1.30

Sample Number: 2

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	30	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.2	Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m ³):	1.21		Material Retained on 20.0 mm Test Sieve (%):	17
Optimum Moisture Content (%):	34			
Remarks				
See summary of soil descriptions.				



Goldthorpe Colliery

Contract
PSL19/2414
Client Ref
1750

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : 1990

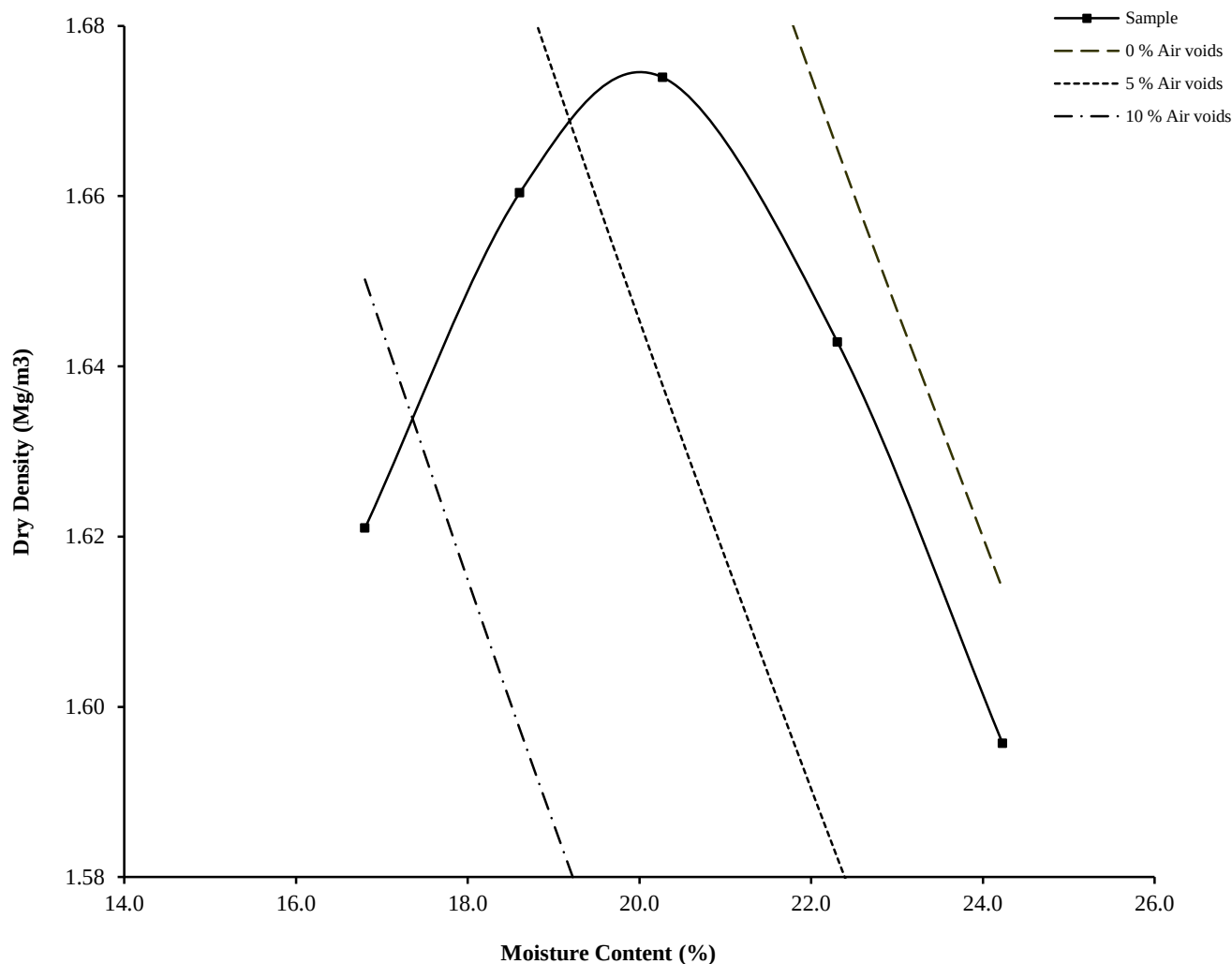
Hole Number: TP18

Top Depth (m) : 1.60

Sample Number: 2

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	17	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.65	Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m ³):	1.67		Material Retained on 20.0 mm Test Sieve (%):	25
Optimum Moisture Content (%):	20			
Remarks				
See summary of soil descriptions.				



Goldthorpe Colliery

Contract
PSL19/2414
Client Ref
1750

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

Non compliance with BS 1377 : Part 4 : 1990

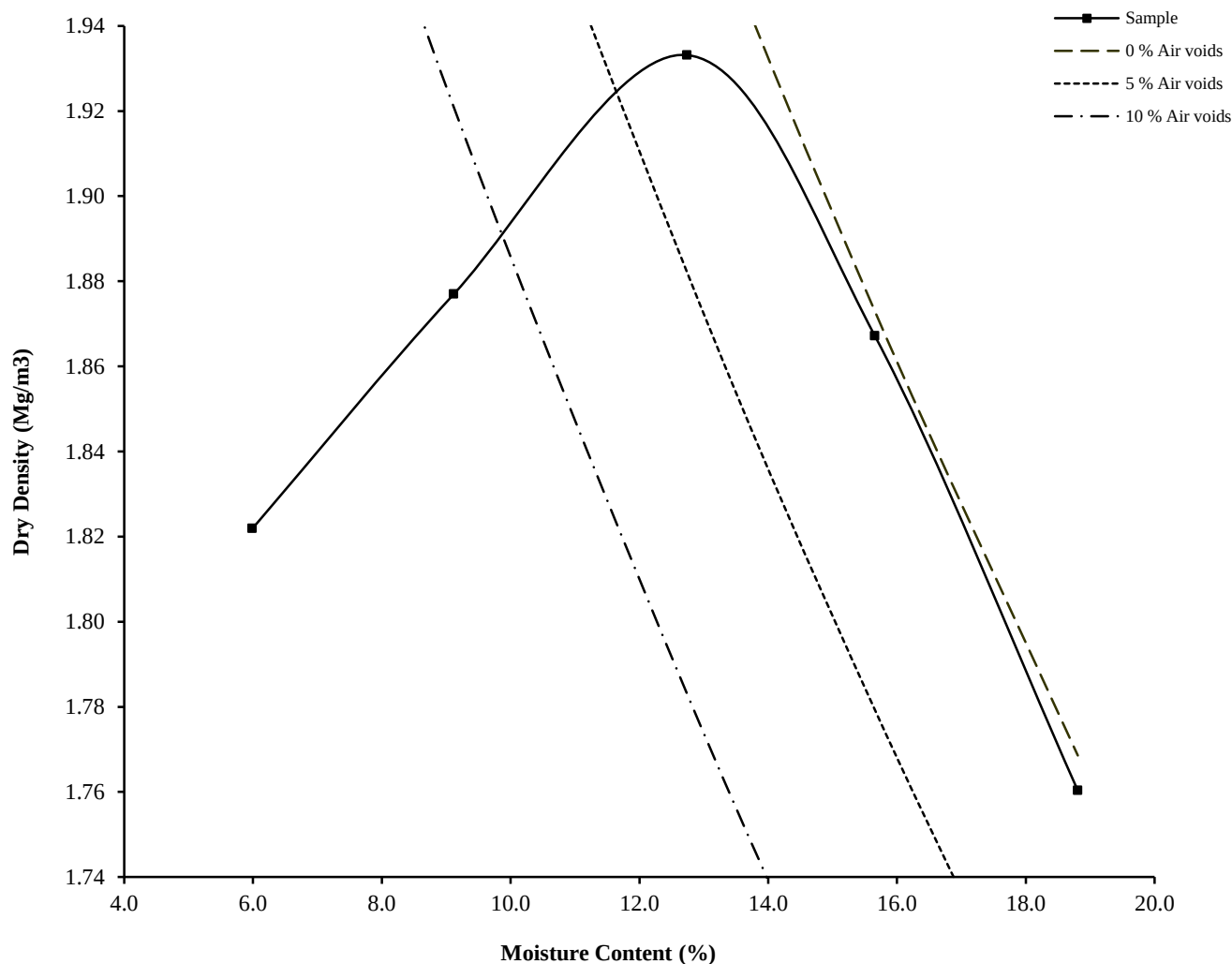
Hole Number: TP19

Top Depth (m) : 1.60

Sample Number: 3

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	9.1	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.65	Assumed	Material Retained on 37.5 mm Test Sieve (%):	10
Maximum Dry Density (Mg/m ³):	1.93		Material Retained on 20.0 mm Test Sieve (%):	24
Optimum Moisture Content (%):	13			
Remarks				
See summary of soil descriptions.				



Goldthorpe Colliery

Contract
PSL19/2414
Client Ref
1750

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : 1990

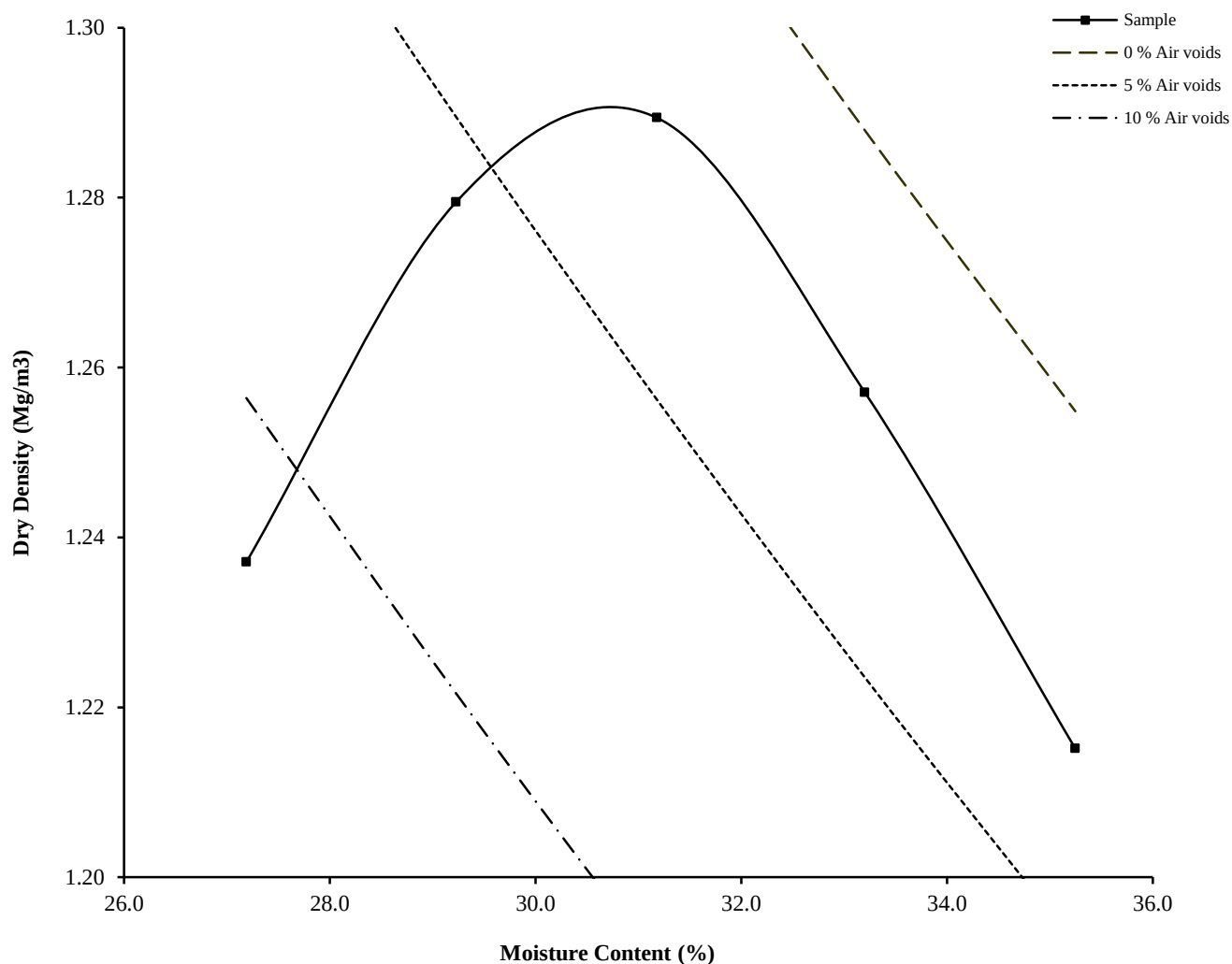
Hole Number: TP23

Top Depth (m) : 1.20

Sample Number: 2

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	27	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.25	Assumed	Material Retained on 37.5 mm Test Sieve (%):	5
Maximum Dry Density (Mg/m ³):	1.29		Material Retained on 20.0 mm Test Sieve (%):	10
Optimum Moisture Content (%):	31			
Remarks				
See summary of soil descriptions.				



Goldthorpe Colliery

Contract
PSL19/2414
Client Ref
1750

EMERY EXPANSION TEST.

Road and Transport Association of Canada 1974.

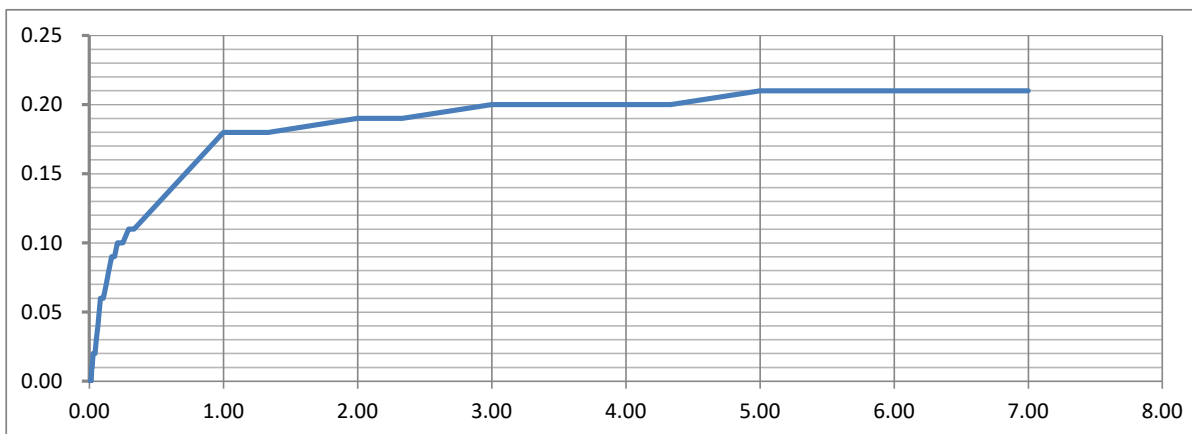
Hole Number: TP17 Top Depth (m): 0.40

Sample Number: 1 Base Depth(m):

Sample Type: B

INITIAL CONDITIONS.		FINAL CONDITIONS.	
Initial Height - mm:	127.14	Final Height - mm:	127.35
Initial Diameter - mm:	151.00	Final Mass - g:	4645.00
Initial Mass - g:	4433.00	Final Volume - cm3:	2280.86
Initial Volume - cm3:	2277.10	Dry Mass - g:	3909.00
Dry Mass - g:	3909.00	Final Moisture Content - %:	18.8
Initial Moisture Content - %:	13.4	Final Bulk Density - Mg/m3:	2.04
Initial Bulk Density - Mg/m3:	1.95	Final Dry Density - Mg/m3:	1.71
Initial Dry Density - Mg/m3:	1.72	Test Temperature oC:	82

Elapsed Time Min	Dial Gauge Reading Div	Change In Height mm	Elapsed Time Min	Dial Gauge Reading Div	Change In Height mm	Elapsed Time Min	Dial Gauge Reading Div	Change In Height mm
0	0	0.00	120	6	0.06	2880	19	0.19
5	0	0.00	150	6	0.06	3120	19	0.19
10	0	0.00	180	7	0.07	3360	19	0.19
15	0	0.00	210	8	0.08	4320	20	0.20
20	0	0.00	240	9	0.09	4560	20	0.20
25	1	0.01	270	9	0.09	4800	20	0.20
30	1	0.01	300	10	0.10	5760	20	0.20
40	2	0.02	360	10	0.10	6240	20	0.20
50	2	0.02	420	11	0.11	7200	21	0.21
60	2	0.02	480	11	0.11	7680	21	0.21
75	3	0.03	1440	18	0.18	8640	21	0.21
90	4	0.04	1680	18	0.18	9120	21	0.21
105	5	0.05	1920	18	0.18	10080	21	0.21



Goldthorpe Colliery

Contract No:

PSL19/2414

Client Ref:

1750



Certificate of Analysis

Certificate Number 19-07193

25-Apr-19

Client Professional Soils Laboratory Ltd
5/7 Hexthorpe Road
Hexthorpe
DN4 0AR

Our Reference 19-07193

Client Reference PSL19/2414

Order No (not supplied)

Contract Title Goldthorpe Colliery

Description 4 Soil samples.

Date Received 17-Apr-19

Date Started 17-Apr-19

Date Completed 25-Apr-19

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read "A Fenwick", is written over a light grey circular stamp.

Adam Fenwick
Contracts Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 19-07193

Client Ref PSL19/2414

Contract Title Goldthorpe Colliery

Lab No	1489678	1489679	1489680	1489681
Sample ID	TP04	TP10	TP16	TP22
Depth	1.80	0.80	3.60	0.90
Other ID	3	1	4	2
Sample Type	D	D	D	D
Sampling Date	n/s	n/s	n/s	n/s
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
Inorganics							
pH	DETSC 2008#			7.3	6.7	6.7	6.8
Sulphate Aqueous Extract as SO ₄	DETSC 2076#	10	mg/l	50	240	1300	100

Information in Support of the Analytical Results

Our Ref 19-07193
 Client Ref PSL19/2414
 Contract Goldthorpe Colliery

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1489678	TP04 1.80 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1489679	TP10 0.80 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1489680	TP16 3.60 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1489681	TP22 0.90 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	

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



LABORATORY REPORT



4043

Contract Number: PSL19/5406

Report Date: 23 September 2019

Client's Reference: 1750

Client Name: Lithos Consulting
Parkhill
Walton Road
Wetherby
North Yorkshire
LS22 5DZ

For the attention of: James Brown/Alan Swales

Contract Title: Goldthorpe Colliery

Date Received: 9/9/2019

Date Commenced: 9/9/2019

Date Completed: 23/9/2019

Notes: Opinions 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 other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson
(Director)

A Watkins
(Director)

R Berriman
(Quality Manager)

L Knight
(Senior Technician)


S Eyre
(Senior Technician)

R Cowles
(Senior Technician)

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

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

PSL
Professional Soils Laboratory

Goldthorpe Colliery

Contract No:

PSL19/5406

Client Ref:

1750

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

[illegible]

SYMBOLS : NP : Non Plastic

*** : Liquid Limit and Plastic Limit Wet Sieved.**



4043

PSL
Professional Soils Laboratory

Goldthorpe Colliery

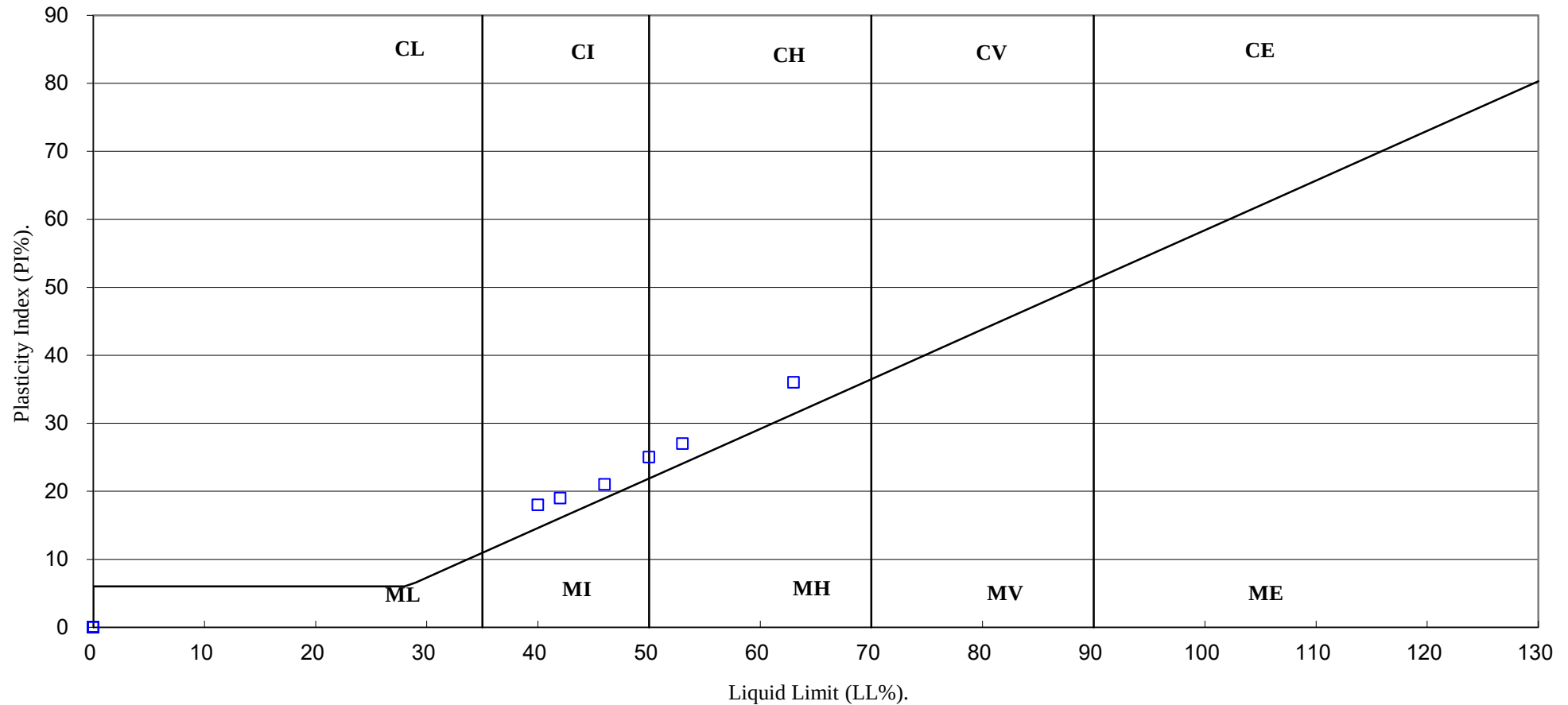
Contract No:

PSL19/5406

Client Ref:

1750

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

PSL
Professional Soils Laboratory

Goldthorpe Colliery

Contract No:

PSL19/5406

Client Ref:

1750



Certificate of Analysis

Certificate Number 19-18270

20-Sep-19

Client Professional Soils Laboratory Ltd
5/7 Hexthorpe Road
Hexthorpe
DN4 0AR

Our Reference 19-18270

Client Reference PSL19/5406

Order No (not supplied)

Contract Title Goldthorpe Colliery

Description 9 Soil samples.

Date Received 17-Sep-19

Date Started 17-Sep-19

Date Completed 20-Sep-19

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read "A Fenwick", is placed over a faint, larger signature.

Adam Fenwick
Contracts Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 19-18270

Client Ref PSL19/5406

Contract Title Goldthorpe Colliery

Lab No	1564399	1564400	1564401	1564402	1564403	1564404	1564405	1564406	1564407
Sample ID	BH01	BH02	BH03	BH04	BH04	BH05	BH05	BH05	BH05
Depth	4.00	2.00	3.90	1.00	3.00	2.00	3.00	4.00	5.00
Other ID	2	2	4	1	3	2	3	5	7
Sample Type	U	D	D	D	D	D	U	D	D
Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units									
Inorganics												
pH	DETSC 2008#		pH	7.1	5.5	7.1	7.2	6.2	6.6	6.5	6.4	6.9
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	550	1100	190	270	250	97	160	130	120

Information in Support of the Analytical Results

Our Ref 19-18270
 Client Ref PSL19/5406
 Contract Goldthorpe Colliery

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1564399	BH01 4.00 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1564400	BH02 2.00 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1564401	BH03 3.90 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1564402	BH04 1.00 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1564403	BH04 3.00 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1564404	BH05 2.00 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1564405	BH05 3.00 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1564406	BH05 4.00 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1564407	BH05 5.00 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	

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

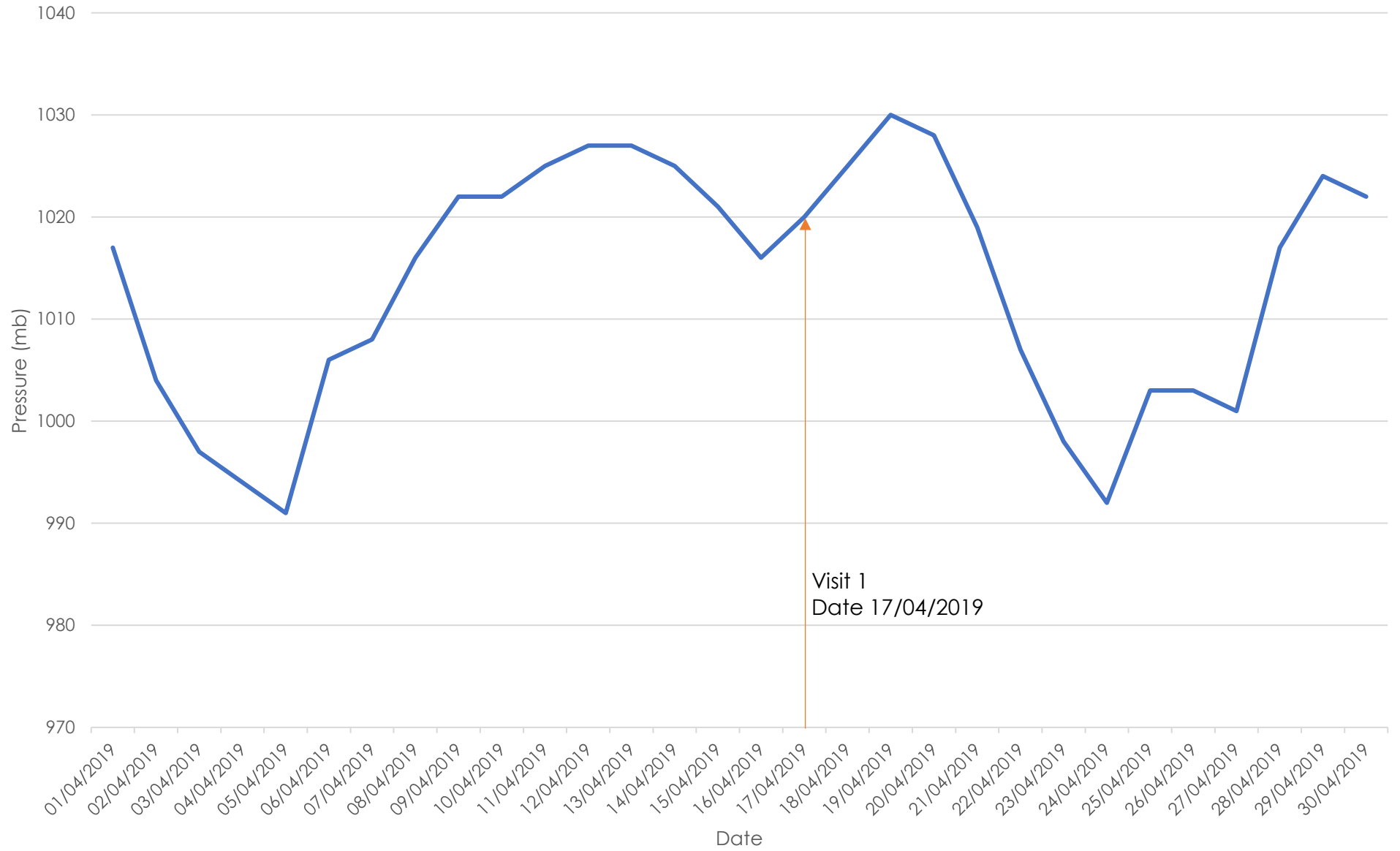
From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

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

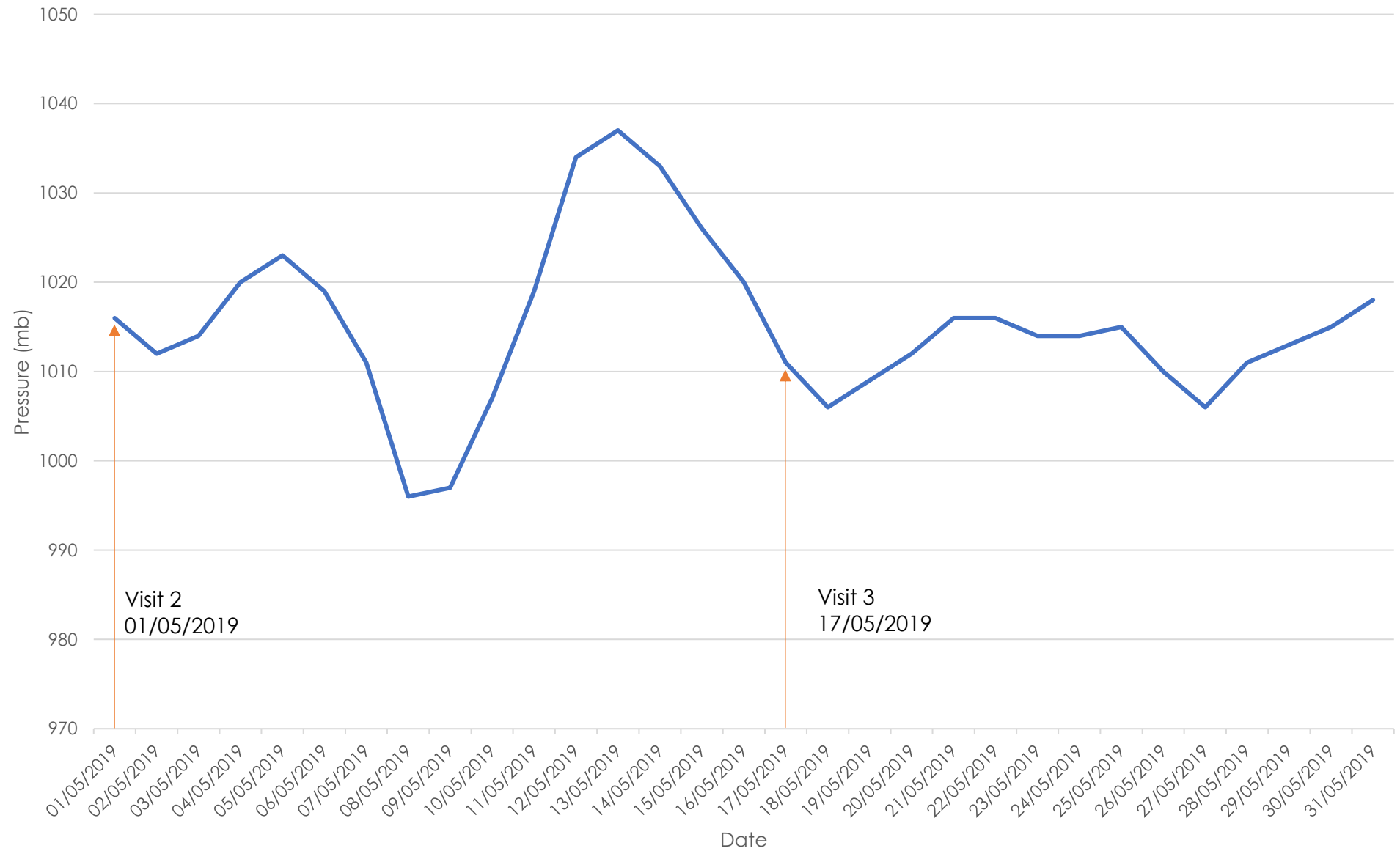
Appendix K

Gas Monitoring Results

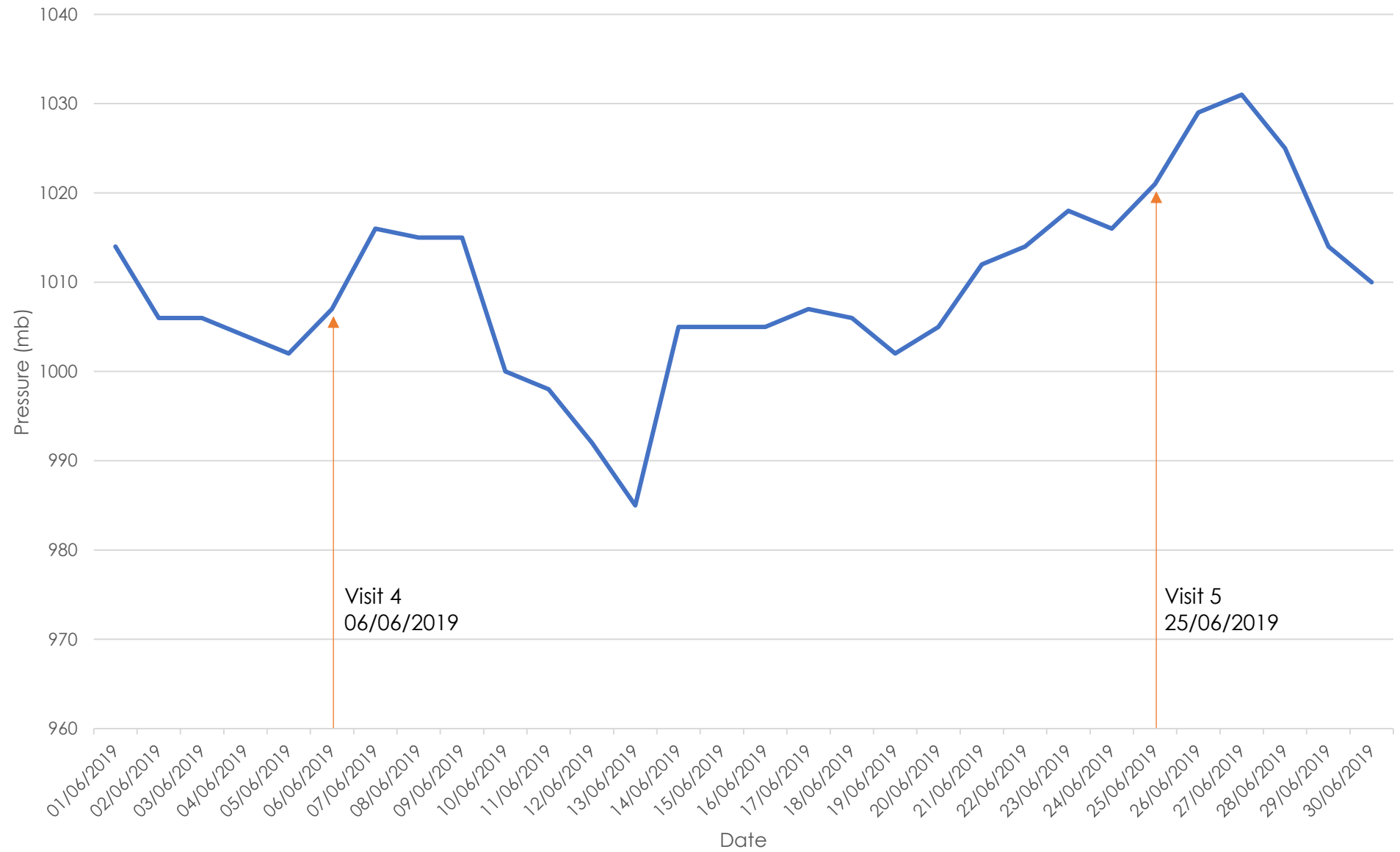
April 2019 Atmospheric Pressure Graph



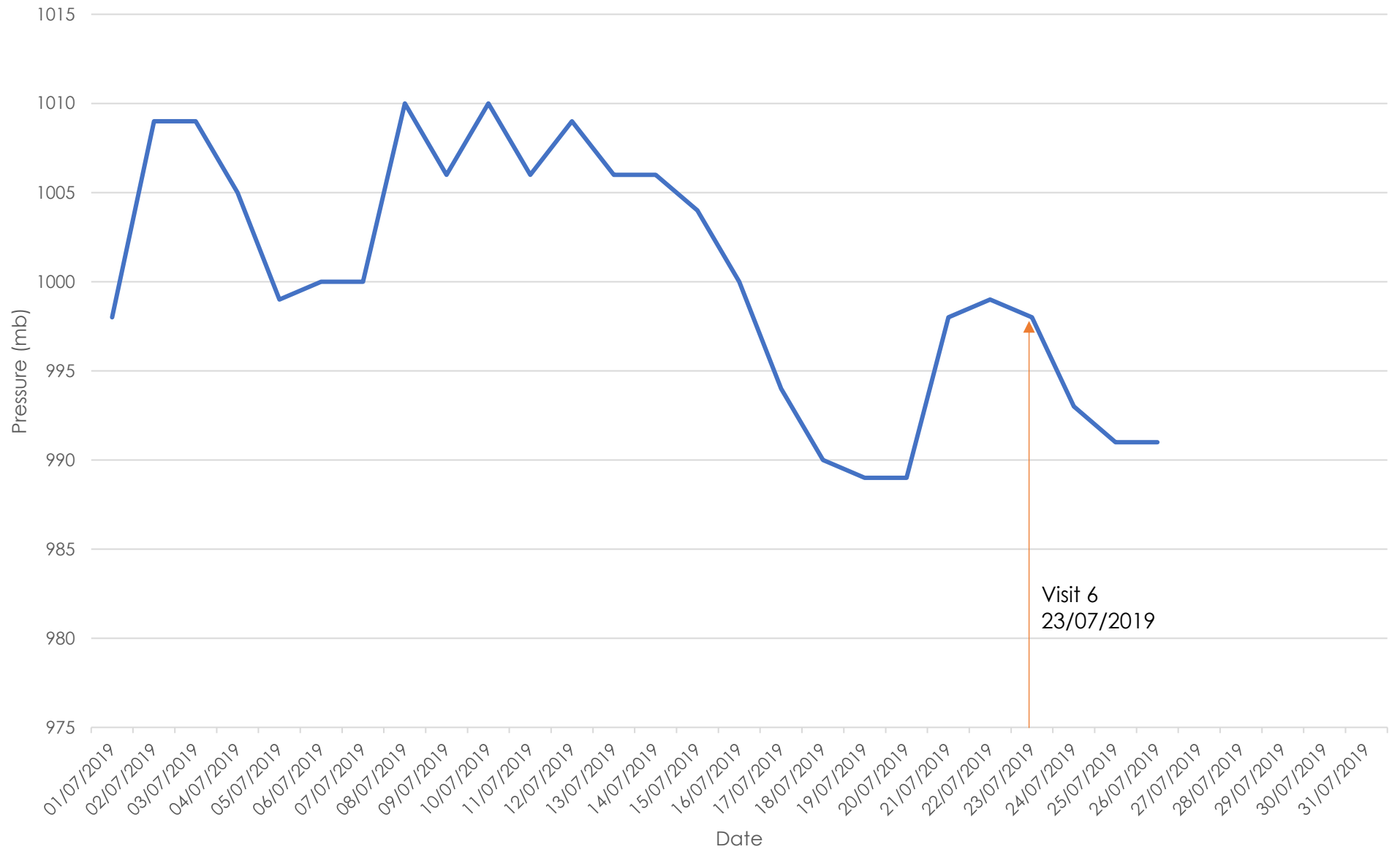
May 2019 Atmospheric Pressure Graph



June 2019 Atmospheric Pressure Graph



July 2019 Atmospheric Pressure Graph



Job Title:							Job No:																				
Goldthorpe Colliery							1750																				
Client:							Sheet :																				
Countryside Properties.							1 of 1																				
Date:		Arrival Time:		Depart Time:		Operator:																					
17/04/2019		09:20		10:25		A Taylor																					
Gas Monitoring Results:																											
Ambient Concentration (% Volume):				CH ₄ :		0.0		CO ₂ :		0.0		O ₂ :		20.0													
Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks																
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady																		
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂																					
		(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr			secs	m														
WS01	ND	ND	0.5	ND	0.5	18.5	ND	ND	ND	2.49																	
WS02	ND	ND	1.5	ND	1.5	19.0	ND	ND	ND	1.53																	
WS03	ND	ND	0.5	ND	0.5	19.7	ND	ND	ND	1.62																	
WS04	ND	ND	0.8	ND	0.8	19.5	ND	ND	ND	2.04																	
WS05	ND	ND	0.7	ND	0.7	19.5	ND	ND	ND	1.19	Casing removed on arrival - Bung reinstalled 10:03. Remonitored 10:25																
WS06	ND	ND	2.8	ND	2.8	17.2	ND	ND	ND	2.43																	
WS07	ND	ND	0.6	ND	0.6	19.5	ND	ND	ND	2.65																	
WS08	ND	ND	1.9	ND	1.9	17.6	ND	ND	ND	0.88																	
WS09	ND	ND	0.7	ND	0.7	19.8	ND	ND	ND	2.58																	
WS10	ND	ND	0.5	ND	0.4	19.9	ND	ND	ND	1.00																	
Notes																											
Equipment Used:						Next Calibration Date			Key																		
Gas Data GFM436 Infrared Gas Analyser						12/02/2020			ND		None Detected																
Geotechnical Instruments Dipmeter									NR		Not Recorded																
									1.0		Recorded value does not breach trigger levels																
									5.0		Recorded value breaches trigger level 1																
									10.0		Recorded value breaches trigger level 2																
		Site Data:		Weather Station Data (Kilnhurst Weather Station)																							
		Temp (°C):		9 to 11.		Barometric Pressure Trend:			Steady																		
Time:		09:20		10:15		10:25		00:04		05:04		09:19		10:14		10:24		17:04		Trigger level 1		1.0		5.0		16.0	
Pressure (mb):		1015		1014		1014		1003		1002		1004		1004		1004		1003		Trigger level 2		5.0		10.0		10.0	
		Weather Conditions:		Overcast.																							
		Surface Ground Conditions:		Dry.																							
Remarks:																											

Job Title:							Job No:																				
Goldthorpe Colliery							1750																				
Client:							Sheet :																				
Countryside Properties.							1 of 1																				
Date:		Arrival Time:		Depart Time:		Operator:																					
17/04/2019		09:20		10:25		A Taylor																					
Gas Monitoring Results:																											
Ambient Concentration (% Volume):				CH ₄ :		0.0		CO ₂ :		0.0		O ₂ :		20.0													
Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks																
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady																		
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂																					
		(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr			secs	m														
WS01	ND	ND	0.5	ND	0.5	18.5	ND	ND	ND	2.49																	
WS02	ND	ND	1.5	ND	1.5	19.0	ND	ND	ND	1.53																	
WS03	ND	ND	0.5	ND	0.5	19.7	ND	ND	ND	1.62																	
WS04	ND	ND	0.8	ND	0.8	19.5	ND	ND	ND	2.04																	
WS05	ND	ND	0.7	ND	0.7	19.5	ND	ND	ND	1.19	Casing removed on arrival - Bung reinstalled 10:03. Remonitored 10:25																
WS06	ND	ND	2.8	ND	2.8	17.2	ND	ND	ND	2.43																	
WS07	ND	ND	0.6	ND	0.6	19.5	ND	ND	ND	2.65																	
WS08	ND	ND	1.9	ND	1.9	17.6	ND	ND	ND	0.88																	
WS09	ND	ND	0.7	ND	0.7	19.8	ND	ND	ND	2.58																	
WS10	ND	ND	0.5	ND	0.4	19.9	ND	ND	ND	1.00																	
Notes																											
Equipment Used:						Next Calibration Date			Key																		
Gas Data GFM436 Infrared Gas Analyser						12/02/2020			ND		None Detected																
Geotechnical Instruments Dipmeter									NR		Not Recorded																
									1.0		Recorded value does not breach trigger levels																
									5.0		Recorded value breaches trigger level 1																
									10.0		Recorded value breaches trigger level 2																
		Site Data:		Weather Station Data (Kilnhurst Weather Station)																							
		Temp (°C):		9 to 11.		Barometric Pressure Trend:			Steady																		
Time:		09:20		10:15		10:25		00:04		05:04		09:19		10:14		10:24		17:04		Trigger level 1		1.0		5.0		16.0	
Pressure (mb):		1015		1014		1014		1003		1002		1004		1004		1004		1003		Trigger level 2		5.0		10.0		10.0	
		Weather Conditions:		Overcast.																							
		Surface Ground Conditions:		Dry.																							
Remarks:																											

Visit 2

Job Title:							Job No:								
Goldthorpe Colliery							1750								
Client:							Sheet :								
Countryside Properties.							1 of 1								
Date:		Arrival Time:		Depart Time:		Operator:									
01/05/2019		11:20		13:40		A Taylor									
Gas Monitoring Results:															
Ambient Concentration (% Volume):				CH ₄ :		0.0		CO ₂ :		0.0		O ₂ :		20.3	
Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks				
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady						
		CH₄	CO₂	CH₄	CO₂	O₂									
		(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr			secs	m		
WS01	2.31	ND	0.3	ND	0.3	20.1	ND	ND	ND	2.43	Case and bung missing on arrival. Bung replaced 11:53. Remonitored 13:17.				
WS02	ND	ND	0.5	ND	0.5	20.0	ND	ND	ND	1.52	Case and bung missing on arrival. Bung replaced 11:54. Remonitored 13:20.				
WS03	ND	ND	0.6	ND	0.6	19.9	ND	ND	ND	1.61					
WS04	ND	ND	0.2	ND	0.2	20.2	ND	ND	ND	2.03	Case and bung missing on arrival. Bung replaced 11:51. Remonitored 13:24.				
WS05	ND	ND	0.9	ND	0.9	19.3	ND	ND	ND	1.19	Case and bung missing on arrival. Bung replaced 12:23. Remonitored 13:26.				
WS06	ND	ND	ND	ND	ND	20.4	ND	ND	ND	2.50	Case and bung missing on arrival. Bung replaced 12:24. Remonitored 13:28.				
WS07	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Case and inner well completely removed. Unable to monitor.				
WS08	ND	ND	0.7	ND	0.7	19.6	ND	ND	ND	0.88	Case and bung missing on arrival. Bung replaced 12:28. Remonitored 13:31.				
WS09	ND	ND	0.6	ND	0.6	20.1	ND	ND	ND	2.58					
WS10	ND	ND	0.6	ND	0.3	20.2	0.8	ND	10.0	1.00					
Notes															
Equipment Used:						Next Calibration Date			Key						
Gas Data GFM436 Infrared Gas Analyser						12/02/2020			ND None Detected						
Geotechnical Instruments Dipmeter									NR Not Recorded						
									1.0 Recorded value does not breach trigger levels						
									5.0 Recorded value breaches trigger level 1						
									10.0 Recorded value breaches trigger level 2						
		Site Data:		Weather Station Data (Near Castle Weather Station)											
		Temp (°C):		16 to 17.		Barometric Pressure Trend:			Falling						
Time:	11:20	13:18	13:40	00:04	05:29	11:19	13:19	13:39	16:59	Trigger level 1	1.0	5.0	16.0		
Pressure (mb):	1012	1011	1011	1009	1006	1006	1005	1005	1004	Trigger level 2	5.0	10.0	10.0		
		Weather Conditions:		Overcast.											
		Surface Ground Conditions:		Dry.											
Remarks:															

Visit 3

Job Title:							Job No:								
Goldthorpe Colliery							1750								
Client:							Sheet :								
Countryside Properties.							1 of 1								
Date:		Arrival Time:		Depart Time:		Operator:									
17/05/2019		15:04		15:45		A Taylor									
Gas Monitoring Results:															
Ambient Concentration (% Volume):				CH ₄ :		0.0		CO ₂ :		0.0		O ₂ :		20.2	
Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks				
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady						
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂									
		% v/v	(%)	% v/v	(%)	(%)									
	(m) bgl						litre/hr	litre/hr	secs	m					
WS01	2.42	ND	0.5	ND	0.4	19.9	ND	ND	ND	2.56					
WS02	ND	ND	0.8	ND	0.8	19.6	ND	ND	ND	1.56					
WS03	ND	ND	0.7	ND	0.7	19.7	ND	ND	ND	1.61					
WS04	ND	ND	0.7	ND	0.7	19.7	ND	ND	ND	2.02					
WS05	ND	ND	2.0	ND	2.0	18.2	ND	ND	ND	1.24					
WS06	ND	ND	0.7	ND	0.7	19.5	ND	ND	ND	2.47					
WS07	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Case and inner well completely removed. Unable to monitor.				
WS08	ND	ND	1.8	ND	1.8	18.0	ND	ND	ND	0.92					
WS09	ND	ND	0.3	ND	0.3	20.2	ND	ND	ND	2.58					
WS10	ND	ND	0.6	ND	0.4	20.1	ND	ND	ND	1.02					
Notes															
Equipment Used:						Next Calibration Date			Key						
Gas Data GFM436 Infrared Gas Analyser						12/02/2020			ND None Detected						
Geotechnical Instruments Dipmeter									NR Not Recorded						
									1.0 Recorded value does not breach trigger levels						
									5.0 Recorded value breaches trigger level 1						
									10.0 Recorded value breaches trigger level 2						
		Site Data:		Weather Station Data (Worsbrough Weather Station)											
		Temp (°C):		18		Barometric Pressure Trend:			Falling.						
Time:	15:04	15:30	15:45	00:04	06:04	15:04	15:30	15:44	20:04	Trigger level 1	1.0	5.0	16.0		
Pressure (mb):	1005	1005	1004	1017	1014	1010	1009	1009	1008	Trigger level 2	5.0	10.0	10.0		
		Weather Conditions:		Sunny.											
		Surface Ground Conditions:		Dry.											
Remarks:															
Wells WS01,02,04,05,06,08 were repaired using flush covers and postcrete.															

Visit 4

Job Title:							Job No:								
Goldthorpe Colliery							1750								
Client:							Sheet :								
Countryside Properties.							1 of 1								
Date:		Arrival Time:		Depart Time:		Operator:									
06/06/2019		13:20		14:25		J Brown									
Gas Monitoring Results:															
Ambient Concentration (% Volume):				CH ₄ :		0.0		CO ₂ :		0.0		O ₂ :		20.5	
Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks				
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady						
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂									
		% v/v	(%)	% v/v	(%)	(%)									
	(m) bgl						litre/hr	litre/hr	secs	m					
WS01	2.30	ND	0.9	ND	0.9	19.3	ND	ND	ND	2.55					
WS02	ND	ND	0.9	ND	0.9	19.8	ND	ND	ND	1.56					
WS03	MD	ND	0.5	ND	0.5	20.2	ND	ND	ND	1.61					
WS04	ND	ND	1.3	ND	1.3	19.4	ND	ND	ND	2.00					
WS05	1.21	ND	2.1	ND	2.1	18.7	ND	ND	ND	1.23					
WS06	ND	ND	3.1	ND	3.1	17.9	ND	ND	ND	2.47					
WS07	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Case and inner well completely removed. Unable to monitor.				
WS08	ND	ND	0.0	ND	0.0	20.5	ND	ND	ND	0.93					
WS09	ND	ND	1.8	ND	1.8	19.0	ND	ND	ND	2.59					
WS10	ND	ND	0.8	ND	0.8	19.9	0.2	ND	5.0	1.27	Fluctuating flow between 0.2 and ND.				
Notes															
Equipment Used:						Next Calibration Date			Key						
Gas Data GFM436 Infrared Gas Analyser						12/02/2020			ND None Detected						
Geotechnical Instruments Dipmeter									NR Not Recorded						
									1.0 Recorded value does not breach trigger levels						
									5.0 Recorded value breaches trigger level 1						
									10.0 Recorded value breaches trigger level 2						
		Site Data:		Weather Station Data (Kiln Hurst Weather Station)											
		Temp (°C):		20		Barometric Pressure Trend:			Rising						
Time:	13:20	13:50	14:25	00:04	06:04	13:19	13:49	14:24	18:04	Trigger level 1	1.0	5.0	16.0		
Pressure (mb):	1002	1001	1001	989.2	989.8	990.8	990.8	990.8	990.5	Trigger level 2	5.0	10.0	10.0		
		Weather Conditions:		Sunny with intermittent cloud.											
		Surface Ground Conditions:		Dry.											
Remarks:															

Visit 5

Job Title:							Job No:						
Goldthorpe Colliery							1750						
Client:							Sheet :						
Countryside Properties.							1 of 1						
Date:		Arrival Time:		Depart Time:		Operator:							
25/06/2019		09:50		11:50		Mawgan Naylor							
Gas Monitoring Results:													
Ambient Concentration (% Volume):				CH ₄ :		ND		ND		O ₂ :		20.2	
Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks		
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady				
		CH₄	CO₂	CH₄	CO₂	O₂							
		% v/v	(%)	% v/v	(%)	(%)							
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m			
WS01	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR			
WS02	ND	ND	2.2	ND	2.2	17.8	ND	ND	ND	1.56			
WS03	ND	ND	0.9	ND	0.9	18.7	ND	ND	ND	1.60			
WS04	ND	ND	1.5	ND	1.5	18.3	ND	ND	ND	1.96			
WS05	ND	ND	3.4	ND	3.4	15.2	ND	ND	ND	1.21			
WS06	ND	ND	2.9	ND	2.9	16.7	1.6	ND	5.0	2.45			
WS07	ND	NR	NR	NR	NR	NR	NR	NR	NR	1.40	Well pulled out. Could not monitor for gas but dipped well.		
WS08	ND	ND	2.5	ND	2.5	16.0	ND	ND	ND	0.90			
WS09	ND	ND	0.0	ND	0.0	20.2	ND	ND	ND	2.55	No bung on arrival. Monitored with bung off.		
WS10	ND	ND	0.9	ND	0.9	19.3	ND	ND	ND	1.02			
Notes													
Equipment Used:						Next Calibration Date			Key				
Gas Data GFM436 Infrared Gas Analyser						12/02/2020			ND None Detected				
Geotechnical Instruments Dipmeter									NR Not Recorded				
									1.0 Recorded value does not breach trigger levels				
									5.0 Recorded value breaches trigger level 1				
									10.0 Recorded value breaches trigger level 2				
		Site Data:		Weather Station Data (Near Doncaster Weather Station)									
		Temp (°C):		14		Barometric Pressure Trend:			Steady				
Time:	09:50	11:00	11:50	00:04	06:59	09:49	10:59	11:49	18:04	Trigger level 1	1.0	5.0	16.0
Pressure (mb):	1015	1014	1014	1007	1007	1009	1009	1009	1011	Trigger level 2	5.0	10.0	10.0
		Weather Conditions:		Rainy, windy									
		Surface Ground Conditions:											
Remarks:													

Visit 6

Job Title:							Job No:					
Goldthorpe Colliery							1750					
Client:							Sheet :					
Countryside Properties.							1 of 1					
Date:		Arrival Time:		Depart Time:		Operator:						
23/07/2019		14:10		15:30		A Taylor						
Gas Monitoring Results:												
Ambient Concentration (% Volume):				CH ₄ :	0.0	CO ₂ :	0.0	O ₂ :	20.6			
Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks	
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady			
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂						
		% v/v	(%)	% v/v	(%)	(%)						
	(m) bgl						litre/hr	litre/hr	secs	m		
WS01	2.42	ND	1.6	ND	1.6	19.0	ND	ND	ND	2.55		
WS02	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Not recorded - Well lost under thick vegetation.	
WS03	ND	ND	0.5	ND	0.5	20.3	ND	ND	ND	1.58		
WS04	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Not recorded - Well lost under thick vegetation.	
WS05	ND	ND	3.5	ND	3.5	17.3	ND	ND	ND	1.22		
WS06	ND	ND	0.1	ND	ND	20.8	ND	ND	ND	2.47		
WS07	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Well destroyed.	
WS08	ND	ND	0.9	ND	0.9	19.9	ND	ND	ND	0.92		
WS09	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Not recorded - unable to find well amongst vegetation. Possibly destroyed.	
WS10	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Well destroyed. Soil forced down bung.	
Notes												
Equipment Used:						Next Calibration Date			Key			
Gas Data GFM436 Infrared Gas Analyser						12/02/2020			ND None Detected			
Geotechnical Instruments Dipmeter									NR Not Recorded			
									1.0 Recorded value does not breach trigger levels			
									5.0 Recorded value breaches trigger level 1			
									10.0 Recorded value breaches trigger level 2			
		Site Data:		Weather Station Data (Near Doncaster Weather Station)								
		Temp (°C):		28 to 29.		Barometric Pressure Trend:		Falling.				
Time:	14:10	15:00	15:30	00:04	08:04	14:09	14:59	15:29	19:59	Trigger level 1	1.0 5.0 16.0	
Pressure (mb):	1012	1011	1011	1008	1008	1005	1004	1004	1002	Trigger level 2	5.0 10.0 10.0	
		Weather Conditions:		Sunny.								
		Surface Ground Conditions:		Dry.								
Remarks:												