

Land at Gynn Lane, Honley For Vivly Living

Report no: 4749/2

Date: September 2024



SUMMARY OF GEOENVIRONMENTAL ISSUES

Job No.	4749	Site area/ha	2.7ha
Client:	Vivly Living	NGR:	SE 145 121
Site:	Gynn Lane, Honley	Nearest postcode:	HD9 6LF

The site is located off Gynn Lane, approximately 4.7km south of Huddersfield town centre, and currently comprises a single parcel of grassed land used for grazing cattle. In the centre-north of site is a 2-storey stone built detached house with associated gardens and parking. Areas of woodland are present along the northern boundary.

Lithos were commissioned by Vivly to provide a geoenvironmental appraisal of the site, which it is understood is to be redeveloped with housing. Lithos' investigation included a review of the site's history and environmental setting, and a ground investigation comprising 34 trial pits, 4 trial trenches, a shaft search, two areas of topsoil strip and 36 probeholes (including 2 stitch drilling lines).

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

Issue	Remarks
Made ground	Made ground has only been encountered in one trial pit (TP23) as a localised area of Granular Made Ground between 0.3m and 0.9m depth and comprised a sandy slightly clayey Gravel of mudstone, coal and sandstone.
Natural ground	Typically comprises topsoil (c.300mm thick) over Cohesive and/or Granular Residual Soils. Bedrock was encountered in the majority of exploratory holes and comprised sandstone in the east and west with mudstone in the centre. Excavation of the sandstone proved difficult with holes refusing after 0.5m penetration in the west and 0.2m in the east. Two coal seam outcrops are present on site. The Middle Band Coal was encountered in the southeast of site from depths of between 0.9m and 2.2m with an average thickness of 0.3m. The Soft Bed coal was encountered in the centre of site from 0.8m depth, with an average thickness of 0.5m.
Contamination	Chemical testing has confirmed topsoil is considered suitable for re-use.
Mining & quarrying	The majority of the site lies within a CA Development High Risk Area. Shallow mineworkings associated with the Soft Bed Coal have been encountered beneath an area of approximately 4,000m ² in the centre of site. Two known adits run E-W and N-S across the site. The N-S adit appears to be linked to shallow mineworkings in the centre of site. Both the shallow mineworkings and adit will required consolidation via drilling and grouting. The E-W adit was found to contain ochreous mine water, which flooded adjacent property gardens c. 60m to the west during drilling. The depth of the E-W adit was found between 17.1m and 18.3m bgl, however the orientation of this adit across the site is unknown, and further drilling and remediation will be difficult. Mitigation measures comprising reinforced foundations is likely to be the most suitable option for development above the adit. A mine entry is recorded by the Coal Authority in the northwest of site. This shaft was not encountered during the shaft search, and therefore likely lies in the area of woodland to the north of the search area. Two areas of topsoil strip have been undertaken down dip of the coal seam outcrops, which did not encounter any evidence of bell pitting, therefore, whilst the possibility of bell pits elsewhere across the site cannot be entirely discounted, it is unlikely they are present across the site. There are no recorded quarries within 250m of the site.
Hazardous gas	The site lies in an area where 5-10% of homes are estimated to be above the radon action level, therefore basic radon protection measures are required in all new dwellings. The site is potentially at risk from migrating hazardous ground gas due to the presence of shallow mineworkings and other associated mining features on site, in addition there is a recorded refuse tip within 250m of the site. A period of gas monitoring is underway; a hazardous gas risk assessment incorporating the findings will be issued in February 2025.
Preparatory works	Topsoil strip & stockpile Demolition of 34 Gynn Lane Widening of the access road, with culverting of Ludhill Dyke De-vegetation works to allow widening of the access road, under supervision of an arboriculturist Consolidation of shallow mineworkings in the Soft Bed Coal and the N-S adit via drill and grouting

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Issue	Remarks
Foundations	<p>Foundation solutions will largely depend on the proposed earthworks regrade and remediation works associated with the shallow mineworkings in the centre of site, however, foundations may comprise one of the following:</p> <p>Foundation types:</p> <ul style="list-style-type: none"> • Strip footings: plots constructed outside areas underlain by shallow mineworkings. • Reinforced strip footings on engineered fill: Plots built in areas where relatively shallow made ground (<3m) is generated by the excavation of shallow mineworkings and the placement engineered fill. • Reinforced strip footings: Plots built following consolidation of shallow mineworkings where rock cover above treated workings is between >5 x seam thickness and 10m will need to be reinforced with B385 mesh top and bottom. This can be reduced to one layer of B385 mesh where there is >10m of rock cover and for plots potentially underlain by the E-W adit. • Raft foundations: where rock cover above treated workings is <5 x seam thickness.
Groundwater & excavations	<p>Groundwater was not encountered in any trial pits, however, groundwater was encountered within the sandstone in rotary probeholes between 10.3m and 21.0m depth.</p> <p>Groundwater has been encountered between 3.65m and 4.21m depth in monitoring wells to date.</p>
Flooding & drainage	<p>The site lies in Flood Zone 1 where risk of flooding from rivers or the sea is classified as low.</p> <p>Given existing topography (overall slope of 1 in 9, reducing to 1 in 5 in the centre-east), soakaways will not be suitable at this site, and an alternative drainage solution will be required.</p>
Highways	Natural soils at the site should yield a CBR of 3%.

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

- Two areas of woodland are present along the northern and northwestern boundaries. It is understood that Tree Protection Orders are present for some areas of this woodland, therefore careful management of the woodland will be required, particularly when designing and constructing the access road.
- Ludhill Dyke flows west along the northern boundary of site, which will require culverting to allow the construction of the new access road.
- Slopes of 1 in 5 are present in the east and west of site, in addition to an overall slope of 1 in 9 across the site. Retaining walls are also present along the eastern and southwestern boundaries, in addition to a retaining wall along the garden of 34 Gynn Lane. Significant earthworks will be required across the site to create level development platforms and provide suitable gradients for highways and gardens.
- Shallow mineworkings associated with the Soft Bed coal have been encountered beneath an area of approximately 4,000m² in the centre of site, which will require consolidation via drilling and grouting. Alternatively, where workings are shallow enough (<5m depth), Vivly may consider excavating the workings and replacement with engineered fill.
- Two known **adits** run E-W and N-S across the site (see Drawing 4749/9).
 - The N-S adit appears to be linked to the shallow mineworkings in the Soft Bed Coal and therefore both the adit and shallow mineworkings will require grouting.
 - The E-W adit was encountered in PH18F and was found to be flooded with **ochreous mine water**. Drilling the adit caused ochreous water to rise out of surface water drains in the back gardens of adjacent properties (18A & 18B Gynn Lane).
 - The orientation the E-W adit across the site is uncertain, and further investigation will prove difficult/costly. Therefore, it is recommended that plot foundations which may be underlain by the E-W adit are reinforced as a precaution.
- A **mine entry** is also recorded by the Coal Authority in the west of site. This was not encountered during the shaft search, and therefore likely lies within the woodland, to the north of its recorded location.
- A **Topsoil strip** (c. 200m²) undertaken in two locations down-dip of the two coal seam outcrops did not identify the presence of shallow mining via bell pitting. Therefore, whilst the possibility of bell pits elsewhere cannot be entirely discounted, they are considered unlikely to be present.

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.

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- A **railway embankment** and associated **gabion wall** is located along the eastern boundary of the site. Vivly Living will need to contact Network Rail to discuss the proposed development and gain approval for works within the vicinity of the railway line.

Some further work is required, most notably:

- Preparation of a Silt and Surface Water Management Plan
- Preparation of a Drill & Grout Specification
- Preparation of an Earthworks Specification
- Post-demolition investigation of 34 Gynn Lane
- If considered worthwhile, additional rotary openhole drilling could be undertaken to determine the location and depth of the E-W adit across the site, however, it should be noted that this may not prove beneficial and implementing mitigation measures such as reinforced foundations might prove to be a more economical and effective solution.
- Gas monitoring is underway. A risk assessment will be issued upon completion in February 2025.

CONTENTS

1	INTRODUCTION	1
1.1	THE COMMISSION AND BRIEF	1
1.2	THE PROPOSED DEVELOPMENT.....	1
1.3	REPORT FORMAT AND LIMITATIONS.....	1
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	UNRECORDED MINEWORKINGS	8
4.4	MINERAL SAFEGUARDED AREAS.....	8
4.5	LANDFILLS.....	9
5	PRELIMINARY CONCEPTUAL SITE MODEL	9
6	GROUND INVESTIGATION DESIGN.....	9
6.1	ANTICIPATED GROUND CONDITIONS & POTENTIAL ISSUES	9
6.2	GROUND INVESTIGATION DESIGN & STRATEGY	10
7	FIELDWORK	11
7.1	OBJECTIVES	11
7.2	EXPLORATORY HOLE LOCATION CONSTRAINTS	11
7.3	SCOPE OF WORKS	11
8	GROUND CONDITIONS.....	12
8.1	GENERAL	12
8.2	MADE GROUND	12
8.3	NATURAL GROUND	12
8.4	VISUAL & OLFACTORY EVIDENCE OF ORGANIC CONTAMINATION	18
8.5	GROUNDWATER	18
8.6	STABILITY.....	18
8.7	MINING INVESTIGATION.....	18
8.8	REVISED CONCEPTUAL GROUND MODEL (GROUND CONDITIONS)	23
9	CONTAMINATION (ANALYSIS).....	23
9.1	GENERAL	23
9.2	TESTING SCHEDULED.....	24
9.3	SOIL CONTAMINATION RESULTS.....	24
10	CONTAMINATION (QUALITATIVE RISK ASSESSMENT)	30
10.1	TOPSOIL	30
10.2	REVISED CONCEPTUAL GROUND MODEL (CONTAMINATION).....	30
10.3	WASTE CLASSIFICATION	30
11	HAZARDOUS GAS	30
11.1	GENERAL	30
11.2	SCOPE OF WORKS	31
11.3	MONITORING RESULTS	31
11.4	DISCUSSION (METHANE & CARBON DIOXIDE)	31
11.5	RADON.....	31
12	GEOTECHNICAL TESTING.....	32

12.1	GENERAL	32
12.2	ATTERBERG LIMITS	32
12.3	PARTICLE SIZE DISTRIBUTION	33
12.4	SOLUBLE SULPHATE AND PH.....	33
12.5	COMPACTION TESTS	34
12.6	UNDRAINED SHEAR STRENGTH TESTING	35
13	GEOTECHNICAL ISSUES	36
13.1	CONCEPTUAL SITE MODEL	36
13.2	MINING & QUARRYING	37
13.3	SITE REGRADE AND/OR GROUND IMPROVEMENT	39
13.4	FOUNDATION RECOMMENDATIONS.....	40
13.5	FLOOR SLABS	44
13.6	DESIGNATED CONCRETE MIXES.....	45
13.7	EXCAVATIONS.....	45
13.8	DRAINAGE	45
13.9	HIGHWAYS	46
13.10	EXTERNAL WORKS	47
14	REDEVELOPMENT ISSUES	47
14.1	GENERAL	47
14.2	REMEDICATION STRATEGY	47
14.3	CONTROL OF EXCAVATION ARISING.....	48
14.4	MANAGEMENT OF TOPSOIL.....	48
14.5	GOOD PRACTICE GUIDANCE.....	49
14.6	NEW UTILITIES.....	49
14.7	HEALTH & SAFETY ISSUES - CONSTRUCTION WORKERS.....	49
14.8	COAL EXTRACTION.....	50
14.9	SHALLOW COAL IN GARDEN AREAS	51
14.10	POTENTIAL DEVELOPMENT CONSTRAINTS.....	51
15	SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.....	52
15.1	GENERAL	52
15.2	MINING.....	53
15.3	HAZARDOUS GAS	53
15.4	CONTAMINATION & REMEDIATION.....	53
15.5	FOUNDATIONS	53
15.6	FLOODING	54
15.7	DRAINAGE	54
15.8	HIGHWAYS	54
15.9	FURTHER WORKS	54

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
4749/1	-	Site Location Plan
4749/2	-	Proposed Layout
4749/3	-	Site Features
4749/4	-	Site Photographs
4749/5	-	Preliminary Conceptual Site Model
4749/6	-	Exploratory Hole Locations (TPs & TTs)
4749/6A	-	Exploratory Hole Locations (Proboholes)
4749/7	-	Revised Conceptual Site Model
4749/8	-	CA Abandonment Plan M185 1 of 2
4749/9	-	Geology & Coal Mining Features
4749/10	-	Site Investigation Features
4749/11	-	E-W Adit Sketch
4749/12	-	Mining Features Requiring Mitigation/Remediation

Appendix C - Commission

Appendix D - Historical OS plans[#]

Appendix E - Search responses[#]

From	Date	Content
Landmark	17 05 2024	Environmental search data
Coal Authority	17 05 2024	Mining report

Appendix F to G - Exploratory records

Appendix F	TP01 to TP34, TT01 to TT04
Appendix G	PH01 to PH36

Appendix H - Chemical test results

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

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 but can be provided on request.

FOREWORD (GEOENVIRONMENTAL APPRAISAL REPORT)

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

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

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

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

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

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

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

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

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

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

Lithos standard terms and conditions apply to the report, a copy of the terms and conditions is available on request or can be found with our proposal in Appendix C.

GEOENVIRONMENTAL APPRAISAL
of land at
GYNN LANE, HONLEY

1 INTRODUCTION

1.1 The commission and brief

- 1.1.1 Lithos Consulting Limited were commissioned by Vivly Living to carry out a geoenvironmental appraisal of land at Gynn Lane, Honley.
- 1.1.2 Lithos have previously issued a Preliminary Investigation Report (Ref 4749/1, dated June 2024). The information contained in Report 4749/1 has been incorporated within this Report, which now supersedes Report 4749/1.
- 1.1.3 Correspondence regarding Lithos' appointment, including the brief for this investigation, is included in Appendix C. The agreed scope of works included:
- A site walkover and inspection.
 - An assessment of the land use history.
 - Determination of the site's environmental setting.
 - A mining risk assessment in accordance with Coal Authority guidance.
 - An intrusive ground investigation comprising 34 trial pits, 4 trial trenches, a shaft search, 2 areas of topsoil strip and 36 rotary openhole probeholes (including 2 lines of stitch drilling).
 - 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.
- 1.1.4 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 Vivly 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 50 traditional 2-3 storey domestic dwellings, associated gardens, POS, adoptable roads and sewers.
- 1.2.2 A site layout has been provided by Vivly Living (no drawing reference or date) which is reproduced as Drawing 4749/2 in Appendix B to this report.

1.3 Report format and limitations

- 1.3.1 All standard definitions, procedures and guidance are contained within Appendix A, which includes background, generic information on:
- Assessment of the site's environmental setting
 - Ground investigation fieldwork
 - Geotechnical testing
 - Contamination testing
 - Hazardous gas

- 1.3.2 General notes and limitations relevant to all Lithos geoenvironmental investigations are described in the Foreword and should be read in conjunction with this report. The text of the report draws specific attention to any modification to these procedures and to any other special techniques employed.
- 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 4749/1 presented in Appendix B to this report. Site details are summarised in the table below.

Detail	Remarks
Location	4.7 km south of Huddersfield town centre
NGR	SE 145 121
Approximate area	2.7ha (6.7 acres)
Known services	None known

2.2 Site features

- 2.2.1 Lithos completed a walkover survey of the site on the 23rd May 2024.
- 2.2.2 Existing salient features, at the time of the walkover are presented on Drawing 4749/3 in Appendix B to this report and summarised in the table below.

Feature	Remarks
Current access	Off Gynn Lane
Topography	Overall slope of 1 in 9 to the southwest Two steeper slopes of 1 in 5 in the east and west Gabion retaining wall c. 1.7m – 1.9m high along the eastern boundary Stone retaining wall c. 5m high in the southwest corner Stone retaining wall c. 1.5m high along the southern boundary of the house
Approximate areas	100m ² buildings 200m ² tarmac hardstand 200m ² concrete hardstand 3,800m ² woodland 22,700m ² grass
Nature of boundaries	North – Gynn Lane. Woodland separated by wooden post & wire fencing in the northeast and northwest. East – Gabion retaining wall with railway embankment & line behind. South – Stone walls with wooden post & wire fencing in front. West – Wooden post & wire fencing.
Surrounding land uses	North – Houses off Gynn Lane. East – Railway embankment with fields and woodland beyond. South – Fields. Houses off Marsh Platt Lane to the southwest. West – Houses off Marsh Platt Lane & Gynn Lane. Woodland in the northwest.

- 2.2.3 The site is located off Gynn Lane via an un-made track which leads to a two-storey detached, stone-built dwelling (no. 34 Gynn Lane) with concrete hardstanding and soft landscaping.
- 2.2.4 A 1.5m high stone retaining wall is present along the southern boundary of the garden of 34 Gynn Lane.
- 2.2.5 To the north and south of the access track is an area of dense woodland. Ludhill Dyke flows west through the centre of the woodland, and is culverted beneath the access track.
- 2.2.6 Ochreous sediment is present at the base of Ludhill Dyke, giving a distinct 'orange' colour, indicative of mine workings or water flowing through iron rich ground such as coal seams.
- 2.2.7 Access into the woodland was not possible due to dense vegetation and the presence of wooden post & wire fencing, however, the topography appears hummocky and variable, likely due to past coal mining activities.
- 2.2.8 Access into the fields to the south of the house is gained via a metal field gate, located to the west of the house.
- 2.2.9 The fields are currently grassed, used for the grazing of cattle and slope down towards the west at a gradient of 1 in 9.
- 2.2.10 A roughly T-shaped dilapidated stone wall runs north to south in the east of the site, and east to west in the centre of site. These walls appear to have previously formed field boundaries. Three mature trees are present in the east of site, along the former field boundaries.
- 2.2.11 A gabion retaining wall, c.1.7m – 1.9m high and 0.5m wide (where visible), which frequently steps by 0.5m to match the site topography, is present along the eastern boundary. Behind the gabion retaining wall is an area of dense overgrowth, which provides a screen for the railway line that runs north to south along the site's eastern boundary.
- 2.2.12 A stone wall is also present along the site's southern boundary, dividing the site from adjacent fields. Houses off Marsh Platt Lane to the south abut the site's southwestern boundary.
- 2.2.13 In the southwest of site, a stone retaining wall is located along Marsh Platt Lane, where the site lies c.5m higher than surrounding land.
- 2.2.14 A selection of site photographs are included on Drawing 4749/4.

3 SITE HISTORY

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

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

Date	Site	Surrounding land
1854	Open fields Road along northern boundary	Gynn House located c.100m north Railway embankment c.20m east
1892	House in north of site. Well in the gardens of the house	Marsh Platt Houses directly south of site Woodland directly northeast of site. Mill pond c.5m west Grove Mills (corn) & associated house c.5m west Slope directly along northwestern boundary Honley Dye Works c.150m northeast
1906	No significant changes	Grove Mills now a woollen mill
1918	Slopes along northern boundaries Watercourse along northern boundary	No significant changes
1963	Watercourse labelled Ludhill Dyke, flowing west	Works c.80m southwest Refuse Tip c.115m northeast Houses constructed directly north off Gynn Lane
1989	No significant changes	Refuse tip no longer shown
2000	No significant changes	Mill and Mill pond no longer shown

4 ENVIRONMENTAL SETTING

4.1 General

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

Issue	Data reviewed	Remarks
Geology	1:50,000 BGS map (Sheet 86) 1:10,000 BGS map (Sheet SE11SW)	Made ground – recorded along eastern boundary within the footprint of the railway line & embankment – likely located off site. Drift soils – None recorded. Solid (bedrock) – Soft Bed Flags – sandstone in the west. Pennine Lower Coal Measures in the east. Middle Band Rock – sandstone in the far east Shallowest coal seam – two coal seams (Halifax Soft & Middle Band coal) outcrop on site and dip to the east/southeast. Strata Dip - unknown. Faults – None recorded.
Mining	Coal Authority BGS maps	Further details in Section 4.2 below
Quarrying	Historical OS plans	None within 250m.
Landfills	Envirocheck	No recorded landfills within 250m, however, the 1963 and 1975 historical map shows a 'refuse tip' c. 115m northeast.
Radon	Public Health England	The site lies in an area where 5-10% of homes are estimated to be above the radon action level. Therefore, basic measures required.
Hydrogeology	Environment Agency electronic open data via QGIS	Source Protection Zone? None. Aquifer: Secondary A Aquifer (Solid). Groundwater abstractions? General industrial abstraction at Crossley Mills c.226m southwest from groundwater (unknown source and date). Soil leaching potential - High. Pollution incidents? None of significance.
Hydrology	Defra Catchment data explorer Envirocheck Report	Nearest watercourse(s) – Ludhill Dyke located in the north of site, flowing west. Within the Holme from New Mill Dyke to River Colne water body catchment. Water quality – chemical fail, moderate ecology. Pollution incidents? Nearest is cattle slurry c.117m north into Calder tributaries, March 1995. Fire water into Ludhill Brook 134m northeast in September 1997. Abstractions? General industrial abstraction from unknown surface water 282m northeast. Discharge consents? Sewage storm water overflow in the north of site into Ludhill Dyke between 1997 and 2011.
Flood risk	Environment Agency electronic open data via QGIS	The site lies in Flood Zone 1, where the risk of flooding from rivers or the sea is classified as low. In accordance with Chapter 14 of the National Planning Policy Framework, a site-specific flood risk assessment is required for proposals of 1 hectare or greater in Flood Zone 1, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency).

4.2 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 The majority of the site lies within a High Risk Area - an area with specific mining legacy risks to the surface, including mine entries; shallow coal workings etc.
- 4.2.3 Geological maps suggest that two coal seams underlie the site at shallow depth. These are the:
- Halifax Soft Bed coal, outcropping in the east/centre east and dipping east. Recorded thickness of 0.5m.
 - Middle Band coal, a thin coal, outcropping in the far east, dipping east.
- 4.2.4 It should be noted that seam outcrops plotted on geological maps have been known to be inaccurate by distances in excess of 100m.
- 4.2.5 The exact location of the two outcrops is unclear, as the location of the outcrops mapped by the Coal Authority on the Consultants Mining Report differs from the location of the outcrops shown on the 1:10,000 Geological map. It is likely that the true outcrop of the coal seams are somewhere in the middle of where they are currently recorded, and may follow the changes in bedrock, rather than cutting across rock types, as they are currently mapped. The locations of the recorded outcrops are shown on Drawing 4749/9.
- 4.2.6 Given dip and topography, shallow coal is expected to underlie an area of about 22,000m² across the east and southwest of the site. Both seams are underlain by >100m of Coal Measures bedrock within which there are no further significant coal seams recorded.
- 4.2.7 A CA mining report states that:
- There is **no past underground mining** recorded beneath the site.
 - The site may be underlain by **probable unrecorded shallow workings**.
 - There are **two spine roadways** recorded at shallow depth. The direction of the spine roadway is unknown. The spine roadways recorded are likely referring to the roadways extending from the two on site adits, and lead to workings/collieries off site.
 - There are **4 adits** and **one mine entry** recorded on or within 100m of the site boundary.
 - The **Halifax Soft** and the **Middle Band coal** both outcrop on site.
 - There are no geological faults, fissures or breaklines recorded beneath the site.
 - There are no recorded opencast mines within 500m of the site boundary.
 - There are no coal authority managed tips within 500m of the site boundary.
 - The Coal Authority has not received a damage notice or claim for the site, or for any property within 50m of the site since 31st October 1994.
 - There have been no incidences of mines gas within 500m of the site boundary.
 - 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 property is not in an area where notice to withdraw support has been given.
- 4.2.8 The mining reports suggests there are no known shallow workings (i.e. at less than 30m depth). However, it should be noted that it did not become a statutory requirement to maintain and preserve plans of abandoned mines until the Mine (Coal) Regulations Act of 1872 and consequently there may be mineworkings beneath the site for which the Coal Authority have no records.

4.2.9 Conversations with the Coal Authority have revealed there is no further information regarding the location, diameter, depth and treatment of the adits and mine entries.

4.2.10 Prior to finding recorded shafts/adits (i.e. those referenced in the CA mining report), the CA will expect Vivly Livings' layout to assume a potential no-build "zone of influence" around each shaft based on the following calculation:

$$(0.5 \times \text{assumed shaft diameter}) + \text{departure} + \text{drift depth} = \text{zone of influence}$$

4.2.11 It is worth noting that CA shaft positions are often only approximate, and in some cases the same shaft has been recorded in multiple locations, or some other feature such as a chimney has erroneously been recorded as a shaft.

4.2.12 The table below summarises the potential risks associated with coal mining legacy issues at this site.

Coal mining issue	Yes	No	Remarks
Underground coal mining (recorded at shallow depths)		x	
Underground coal mining (probable at shallow depths)	x		Probable unrecorded workings in the Halifax Soft Bed and Middle Band Coal. May pose a hazardous gas risk.
Mine entries (shafts and adits)	x		Two adits and a mine entry (drift pit) on site or close to the site boundary. May pose a risk of surface instability.
Coal mining geology (fissures)		x	
Record of past mine gas emissions or potential		x	
Recorded coal mining surface hazard		x	
Surface mining (opencast workings)		x	

4.2.13 For those issues identified as "yes" in the above table, a more detailed discussion and assessment of the risks, both individually and cumulatively, to the application site and the proposed development is provided below.

Abandonment Plan

4.2.14 Abandonment plan Ref. M185 1 of 2 has been obtained to gain more information on the potential for unrecorded shallow workings beneath the site. The plan shows the boundaries of mineworkings within the vicinity of the site, however, does not indicate the presence of mineworkings within the red line boundary.

4.2.15 There is however, two adits (also known as a spine roadways) shown that traverse the site N-S and E-W. The E-W trending adit appears to originate from the west of site, where an adit and drift shaft are located. Details on the plan suggest this adit extended from Grove House in the West to Woodroyd Colliery in the east. The N-S adit appears to start at 'Gynn Day Hole' located in the northeast of site, and extends off site to the south to an area of recorded workings.

4.2.16 Whilst no workings are recorded beneath the site, it is possible that coal was extracted from shallow depths beneath the site, using the adit systems as roadways, or alternatively via bell pits, as discussed below.

4.2.17 Upon overlaying the current site boundary on the plan, it appears there are some scaling issues. This is a common issue, given the age of the plan, and lack of surrounding surface features. Consequently, the site has been mapped on the abandonment plan using the location of the southern field boundary and the railway to the east of site. Given the difficulty scaling the map to fit the site boundary, the true location of the adits/roadways and mine entry may vary from what is shown on Drawing 4749/8 and 4749/9.

4.3 Unrecorded mineworkings

- 4.3.1 Coal has been mined in Yorkshire for centuries, and there are also likely to be unrecorded mineworkings which pre-date the requirement for abandonment plans (Coal Mines Regulation Act of 1872). Early mining methods included drifts or adits from outcrop. Where mining extended further from the crop, bell pits were often sunk, and as the coal got deeper still, shafts were used to access gallery workings (pillar & stall).
- 4.3.2 The shafts associated with bell pits are typically only about 1.2m in diameter, and the bell pit itself was typically 5m to 10m in diameter (bell pit size would have been constrained by roof stability). Consequently, bell pits are often closely spaced; the most intensive concentration of shafts recorded to date (66 per acre) was at the Middleton Broom Open-cast site.
- 4.3.3 As coal was removed during bell pitting, the unsupported strata above assumed an inverted slope of stability, generating a bee-hive shape around the base of the shaft which forms the characteristic vertical section. The depth limit of bell pit mining is almost certainly 15m, and this is considered a deep bell pit; the vast majority were probably less than half this depth.
- 4.3.4 At greater depths, pillar and stall workings appear to have been the preferred method, and such workings were often accessed via a single shaft. Consequently, shafts associated with such workings are more widely spaced; but rarely exceeded one quarter of a mile (400m) shaft to shaft, due to problems with ventilation and underground haulage. It was customary to view the life expectancy of an individual pit as about three to five years and at any one time several new pits would be sinking to replace those currently operating.
- 4.3.5 Up until the last decades of the eighteenth century, coal mining almost always represented a short-term interruption to ongoing use of land for agricultural. The right to sink shafts and extract coal was usually conditional upon restoration of the surface after coal extraction was complete. This not only involved filling the shaft, but also required that any subsequent settlement of shaft fill material did not result in depressions in the field surface. Consequently, it was usual to fill the shaft and heap excess arisings into a dome over the shaft eye. Over subsequent years, the dome supplied material to compensate for settlement of the shaft fill. In the normal course of events, at the conclusion of the recovery period, any remaining spoil accumulations above ground level would have been planed-off to leave a relatively stable, level surface where the shaft had been.
- 4.3.6 Bell pits may be present across the whole of the site near coal outcrops.

4.4 Mineral safeguarded areas

- 4.4.1 The site is underlain by **sandstone** and **coal** and might therefore be considered by the Local Authority to lie within a Mineral Safeguarding Area (MSA).
- 4.4.2 Indeed, review of Kirklees Council Mineral Safeguarding Plan suggests that due to the presence of Sandstone and/or Clay and Shale, the site lies within a 'safeguarding area'. Further advice should be sought from a Minerals Surveyor.
- 4.4.3 MSAs are areas of known mineral resources that are of sufficient economic or conservation value to warrant protection for generations to come. The purpose of MSAs is not to preclude automatically other forms of development, but to make sure that mineral resources are adequately and effectively considered in land-use planning decisions.
- 4.4.4 Specialist guidance on Mineral Safeguarding "A Guide to Mineral Safeguarding in England" has been produced by The Coal Authority and the British Geological Survey.
- 4.4.5 Chapter 17 of the National Planning Policy Framework (NPPF) requires Local Authorities to facilitate the sustainable use of minerals, and planning policies should:

- Safeguard mineral resources by defining Mineral Safeguarding Areas and Mineral Consultation Areas; and adopt appropriate policies so that known locations of specific minerals resources of local and national importance are not sterilised by non-mineral development where this should be avoided (whilst not creating a presumption that the resources defined will be worked).
- Set out policies to encourage the prior extraction of minerals, where practicable and environmentally feasible, if it is necessary for non-mineral development to take place.

4.4.6 NPPF Chapter 17 notes that when determining planning applications, local planning authorities should give great weight to the benefits of the mineral extraction.

4.4.7 As a consequence of the NPPF, and the presence of mineral reserves beneath the site, the Local Authority may require Vivly Living to consider the opportunity to recover (extract) the sandstone and/or shale.

4.4.8 Surface extraction of sandstone and/or shale here is considered **unlikely** to be viable based on the site's proximity to adjacent residential properties and railway. Prior extraction of minerals would have the potential to cause unacceptable impacts on neighbouring properties and infrastructure, including noise, air quality, traffic impacts and land stability. However, it would be prudent to seek further advice from a Minerals Surveyor.

4.5 Landfills

4.5.1 Whilst there are no landfills recorded in the Landmark report and QGIS, a 'refuse tip' is shown c.115m northeast on historical maps between 1963 and 1975.

4.5.2 The contents and nature of the refuse tip are therefore unknown, however, the land now appears to be the gardens of the 'Wood Royd' housing complex.

5 PRELIMINARY CONCEPTUAL SITE MODEL

5.1 A preliminary conceptual site model, presented as Drawing 4749/5 in Appendix B, has been prepared after consideration of all the data presented in Sections 2 to 4 inclusive of this report.

5.2 Potential contaminant linkages are shown on the preliminary conceptual site model.

5.3 The conceptual model will likely be subject to modification in light of data arising from the proposed intrusive ground investigation; see Section 12.2.

6 GROUND INVESTIGATION DESIGN

6.1 Anticipated ground conditions & potential issues

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

Anticipated condition	Remarks
Made ground	Possible made ground adjacent to the embankment. Localised made ground in the vicinity of mine entries/adits & within the footprint of the house on-site.
Natural soils	Residual soils (gravelly Clay) beneath topsoil.
Bedrock	Anticipated at shallow depth.
Mineworkings	Two adits and a mine entry recorded on site. In addition, there may be unrecorded shallow workings (including bell pits) down dip of the two coal seam outcrops.
Groundwater	Possible shallow groundwater in bedrock, may be in hydraulic continuity with adjacent watercourse in the north of site.

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

Type of issue	Specific issue	Remarks
Potential on-site contamination sources	<ol style="list-style-type: none"> 1. Reworked topsoil (inorganics, organics) 2. Buildings (house on site) 3. Shallow mine workings 	<ol style="list-style-type: none"> 1. Associated with farming 2. Asbestos & \or ACMs 3. Hazardous gas
Potential off-site contamination sources	<ol style="list-style-type: none"> 1. Railway line 	<ol style="list-style-type: none"> 1. Heavy metals/wind blow contaminants
Potential geotechnical hazards	<ol style="list-style-type: none"> 1. Steep slopes 2. Retaining walls 3. Shallow workings 4. Shafts/adits 	<ol style="list-style-type: none"> 1. Slope of 1 in 9 in to the west, becoming 1 in 5 in two areas (east and west) 2. Retaining wall along the eastern and southwestern boundary 3. Unrecorded shallow workings in the Halifax Soft and Middle Band coal 4. Recorded adits and 1 mine entry within 100m of the site
Other potential constraints	<ol style="list-style-type: none"> 1. Culverted watercourse 2. Woodland 	<ol style="list-style-type: none"> 1. Ludhill Dyke flows west in the north of site, and is culverted beneath the access road 2. Woodland in the north is likely to be retained

6.2 Ground investigation design & strategy

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

Exploratory holes	Purpose
3 days trial pitting (c.30 TPs)	To determine the nature, distribution and thickness of shallow natural soils, including suitability of the ground for founding structures and highways and to determine the general nature of localised areas of made ground soils, including the: Nature, distribution and thickness Nature, degree and extent of any contamination proportion of undesirable elements e.g. biodegradable matter, foundations etc
1 day trial trenching	To locate the recorded adits/mine entries on site
topsoil strip	Stripping of topsoil in 10m x 20m panels down dip of the two coal seams to determine the presence of bell pits.
18 probeholes	To check for the presence of voids or broken ground associated with possible unrecorded shallow mine workings. This includes an allowance for the following: 8 x PHs to determine the presence of shallow workings in the Halifax Soft Bed coal 4 x PHs to determine the presence of shallow workings in the Middle Band coal 3 x PHs along the line of each adit/roadway (6 in total)

6.2.2 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 4 above. A nominal 30m grid spacing was proposed. Additional exploratory locations might be scheduled by the site engineer in light of the ground conditions actually encountered.

6.2.3 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.

- 6.2.4 Review of the site's history (see Section 3) has confirmed the complete absence of any previous development or past potentially contaminative land uses (other than agriculture). Therefore, in accordance with the National Planning Policy Framework, this site is Greenfield rather than Brownfield.
- 6.2.5 The only potential sources of contamination identified are metals & asbestos (associated with windblown/background or illegal deposits) and organics (associated with leakage from farming machinery). If these contaminants are present, they will be found within near-surface soils (topsoil), rather than at depth (in natural soils) and consequently, contaminant analysis will (at least initially) be restricted to recovered samples of topsoil.
- 6.2.6 If made ground, or elevated concentrations of contaminants within topsoil, are recorded during the ground investigation, testing of subsoil samples may be necessary.

7 FIELDWORK

7.1 Objectives

- 7.1.1 The original investigation strategy is outlined in Section 6.2 above.
- 7.1.2 The additional exploratory holes listed below were advanced in light of ground conditions actually encountered.

Exploratory holes	Purpose
TP33	Undertaken where anecdotal evidence from the landowner suggests ground had recently collapsed and subsequently been infilled.
PHs 19 to 36	To enable better delineation of the depth and lateral extent of shallow mineworkings in the centre of site.

7.2 Exploratory hole location constraints

- 7.2.1 In accordance with Network Rail requirements, drilling of boreholes was not undertaken within 50m of the railway line along the eastern boundary.
- 7.2.2 No access was available within the vicinity of 34 Gynn Lane (on-site house) due to ongoing occupancy.

7.3 Scope of works

- 7.3.1 Fieldwork was supervised by Lithos between the 23rd July to the 7th August 2024 and comprised the exploratory holes listed below.

Technique	Exploratory holes	Final depth(s)	Remarks
Trial pitting (machine dug)	TPs 01 to 34	0.9m to 4.0m	Vane tests in cohesive soils
Trial trenching (machine dug)	TTs 01 to 04	0.9m to 5.0m	Undertaken in location of recorded adits
Topsoil strip	TS1 & TS2	-	Undertaken down dip of coal outcrops to determine the presence of bell pits.
Shaft search	'Shaft Search'	-	Undertaken in the vicinity of a recorded Mine Entry
Rotary openhole probeholes	PHs 1 to 36	4.5m to 33.0m	Monitoring wells installed in PHs 19 to 24.

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

7.3.3 Exploratory hole logs are presented in Appendices F & 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

7.3.4 Exploratory hole locations are shown on Drawing 4749/6 and 4749/6A presented in Appendix B; exploratory holes were picked-up by a surveyor and co-ordinates/ground levels are included on the logs.

8 GROUND CONDITIONS

8.1 General

8.1.1 A complete record of strata encountered beneath the proposed development site is given on the various exploratory hole records, presented in Appendices F & G.

8.1.2 Typical ground conditions encountered at the site are described below in Sections 8.2 (made ground) and 8.3 (natural ground), with a summary provided in the table on pages 14 to 17.

8.2 Made ground

8.2.1 Made Ground was only encountered in one trial pit (TP23) as a localised area of Granular Made Ground between 0.3m and 0.9m depth. The Granular Made Ground comprised a sandy slightly clayey Gravel of mudstone, coal and sandstone.

8.3 Natural ground

8.3.1 Natural ground was encountered in all exploratory holes, and typically comprised the following:

- **Topsoil:** encountered in all exploratory holes to an average depth of 300mm.
- **Cohesive Residual Soil:** encountered in all but 10 trial pits beneath the topsoil to depths of between 0.5m and 3.3m (average depth of base of 1.4m). Typically comprised a firm, light orangish brown mottled grey slightly sandy slightly gravelly Clay.
- **Granular Residual Soil:** encountered in all but 8 trial pits beneath the Topsoil/ Cohesive Residual Soil to depths of between 0.6m and 5.0m (average depth to base of 2.2m). Typically comprised a slightly sandy angular to subangular fine to coarse Gravel.

8.3.2 **Bedrock** was encountered in the base of the majority of the exploratory holes and comprised the following (in descending order):

- **Middle Band Coal:** encountered in 4 trial pits in the southeast of site from depths of between 0.9m and 2.2m depth. Average thickness of 0.3m.
- **Middle Band Rock (sandstone):** encountered in 3 trial pits in the east of site from depths of between 1.5m and 2.2m (average depth to top of 1.8m). Comprised a moderately strong light brown Sandstone. This rock was penetrated by between 0.1m and 0.2m before refusal, using a JCB 3CX.
- **Lower Coal Measures:** encountered in the centre of site within 12 trial pits from between 1.8m and 3.7m depth (average depth to top of 2.5m). Typically comprised interbedded light grey mudstone, dark grey (carbonaceous) mudstone and sandstone. This bedrock was highly weathered at surface where mudstone was present.

- **Soft Bed Coal:** encountered in three trial pits from between 0.8m and 3.7m depth. Also encountered in 7 probeholes from between 1.3m and 3.6m depth. Average thickness of 0.5m.
- **Soft Bed Flags Sandstone:** encountered at the base of most trial pits in the west, from between 0.8m to 3.7m depth (average depth to top of 2.1m). Comprised a moderately strong light brown Sandstone. This bedrock was penetrated by an average thickness of 0.5m before refusal, using a JCB 3CX machine.

Summary of ground conditions – trial pits

Hole	Final depth	Depth to Base				Depth to Top			Depth to Base	Depth to Top	Penetration *	
		Made Ground	Natural Soils									
		Granular Made Ground	Topsoil	Cohesive Residual Soil	Granular Residual Soil	Soft Bed COAL	Soft Bed Flags (sandstone)	Lower Coal Measures	Middle Band COAL	Middle Band Rock (sandstone)		
TP01	1.00	-	0.4	0.7	-	-	0.7	-	-	-	0.3	
TP02	1.9	-	0.3	0.5	1.5	-	1.5	-	-	-	0.4	
TP03	2.3	-	0.3	1.1	2.0	-	2.0	-	-	-	0.3	
TP04	2.0	-	0.3	0.8, 1.2	1.8	0.8	-	1.8	-	-	0.2	
TP05	3.10	-	0.3	0.5	2.1	-	-	2.1	-	-	1.0	
TP06	3.9	-	0.3	-	3.9	-	-	-	-	-	-	
TP07	2.8	-	0.3	1.4	2.3	-	-	2.3	-	-	0.5	
TP08	1.6	-	0.3	-	1.1	-	1.1	-	-	-	0.5	
TP09	2.2	-	0.3	-	1.9	-	1.9	-	-	-	0.3	
TP10	1.4	-	0.3	1.1	-	-	1.1	-	-	-	0.3	
TP11	2.7	-	0.3	-	2.0	-	-	2.0	-	-	0.7	
TP12	2.7	-	0.3	-	1.9	-	-	1.9	-	-	0.8	
TP13	1.7	-	0.3	0.6	1.6	-	-	-	0.9	1.6	0.1	
TP14	1.7	-	0.4	1.2	-	-	-	-	1.2	1.5	0.2	
TP15	2.2	-	0.3	1.6	1.9	-	-	-	2.2	-	-	
TP16	1.1	-	0.2	0.7	1.1	-	-	-	-	-	-	
TP17	1.2	-	0.2	0.9	1.2	-	-	-	-	-	-	
TP18	2.3	-	0.4	1.3	2.2	-	-	-	1.6	2.2	0.1	
TP19	3.7	-	0.4	1.2	2.6	-	-	2.6	-	-	0.9	
TP20	3.4	-	0.3	-	3.4	-	-	-	-	-	-	
TP21	3.4	-	0.4	1.8	3.4	-	-	-	-	-	-	
TP22	3.1	-	0.3	1.7	2.2	-	-	2.2	-	-	0.9	
TP23	4.0	0.9	0.3	3.3	-	3.7	-	3.7	-	-	0.3	

Hole	Final depth	Depth to Base				Depth to Top			Depth to Base	Depth to Top	Penetration *	
		Made Ground	Natural Soils									
		Granular Made Ground	Topsoil	Cohesive Residual Soil	Granular Residual Soil	Soft Bed COAL	Soft Bed Flags (sandstone)	Lower Coal Measures	Middle Band COAL	Middle Band Rock (sandstone)		
TP24	3.1	-	0.3	1.8	3.1	-	-	-	-	-	-	
TP25	3.2	-	0.3	-	3.2	-	-	-	-	-	-	
TP26	1.8	-	0.3	1.8	-	-	-	-	-	-	-	
TP27	2.0	-	0.3	1.7	-	1.9	1.9	-	-	-	0.1	
TP28	1.9	-	0.3	1.4	1.9	-	-	-	-	-	-	
TP29	2.4	-	0.3	-	1.3	-	1.3	-	-	-	1.1	
TP30	1.2	-	0.2	-	1.2	-	-	-	-	-	-	
TP31	1.8	-	0.3	-	-	-	0.3	-	-	-	1.5	
TP32	2.6	-	0.3	1.2	2.1	-	2.1	-	-	-	0.5	
TP33	0.9	-	0.3	0.9	-	-	-	-	-	-	-	
TP34	1.3	-	0.3	1.3	-	-	-	-	-	-	-	
TT01	0.9	-	0.2	-	0.7	-	0.7	-	-	-	0.2	
TT02A	0.9	-	0.2	-	0.6	-	0.6	-	-	-	0.3	
TT02B	1.5	-	0.2	0.7	1.2	-	1.2	-	-	-	0.3	
TT02C	1.7	-	0.2	0.9	1.3	-	1.3	-	-	-	0.4	
TT03A	5.0	-	0.2	1.0	5.0	-	-	-	-	-	-	
TT03B	3.5	-	0.3	2.6	3.2	-	-	3.2	-	-	0.3	
TT03C	3.2	-	0.2	0.7	1.9	-	-	1.9	-	-	1.3	
TT03D	3.2	-	0.3	2.0	2.9	-	-	2.9	-	-	0.3	
TT04A	3.5	-	0.3	2.5	3.2	-	-	3.2	-	-	0.3	
TT04B	3.5	-	0.2	2.3	2.1, 3.5	-	-	-	-	-	-	
TT04C	2.9	-	0.3	1.4	2.9	-	-	-	-	-	-	

Note: * TPs excavated using a JCB 3CX, TT excavated using an 8.5T tracked excavator.

Summary of ground conditions - probeholes

Hole	Final depth (m)	Depth to rockhead (m)	Depth to coal (m)	Thickness of coal (mm)	Depth to workings (m)	Thickness of workings (m)	Remarks
PH01	21.0	2.0	-	-	-	-	-
PH02	33.0	1.5	-	-	-	-	-
PH03	23.0	2.0	-	-	-	-	-
PH03A	9.0	2.0	-	-	-	-	-
PH04	24.0	2.0	-	-	-	-	-
PH04A	12.0	2.0	-	-	-	-	-
PH05	33.0	1.8	-	-	16.3	0.6	Loss of flush. Soft drilling. Likely broken/collapsed ground.
PH06	21.0	1.0	-	-	14.3	0.6	
PH07	18.0	1.0	-	-	13.6	1	
PH08	15.0	2.5	-	-	10.5	0.8	
PH09	12.0	5.0	-	-	5	0.7	
PH09A	9.0	2.5	-	-	4.5	2.4	Possible location of adit (N-S trending).
PH09B	12.0	3.0	-	-	5.8	1.3	Loss of flush. Soft drilling. Likely broken/collapsed ground.
PH09C	12.0	2.5	-	-	6	1.1	
PH09D	12.0	2.5	-	-	4.1	0.7	
PH10	12.0	2.8	-	-	6.6	1.7	
PH11	12.0	1.0	-	-	8.3	1.8	-
PH12	21.0	1.5	1.5	0.5	-	-	-
PH13	15.0	1.5	-	-	-	-	-
PH14	15.0	2.5	2.8	0.5	-	-	-
PH15	15.0	1.0	-	-	11.2	1.1	Loss of flush. Soft drilling. Likely broken/collapsed ground.
PH16	12.0	1.5	-	-	9.5	0.8	
PH17	9.0	1.8	-	-	6.7	1	
PH18	33.0	1.0	-	-	-	-	-
PH18A	27.0	1.0	-	-	-	-	-
PH18B	21.0	1.0	-	-	-	-	-
PH18C	21.0	1.0	-	-	-	-	-
PH18D	21.0	1.0	-	-	-	-	-
PH18E	21.0	1.0	-	-	-	-	-
PH18F	21.0	1.0	-	-	17.1	1.2	Possible location of adit (E-W trending). Iron Ochre mine water returns.

Hole	Final depth (m)	Depth to rockhead (m)	Depth to coal (m)	Thickness of coal (mm)	Depth to workings (m)	Thickness of workings (m)	Remarks
PH18G	21.0	1.0	-	-	-	-	-
PH18H	21.0	1.0	-	-	-	-	-
PH19	4.5	1.0	-	-	-	-	-
PH20	4.5	1.0	-	-	-	-	-
PH21	4.5	1.5	-	-	-	-	-
PH22	4.5	1.0	-	-	-	-	-
PH23	4.5	1.0	-	-	-	-	-
PH24	4.5	1.5	-	-	-	-	-
PH25	12.0	1.5	-	-	-	-	-
PH26	9.0	1.5	-	-	4.8	1	Loss of flush. Soft drilling. Likely broken/collapsed ground.
PH27	9.0	2.0	-	-	3.5	1.8	
PH28	6.0	2.0	2.3	0.9	-	-	-
PH29	6.0	2.0	3.6	0.8	-	-	-
PH30	9.0	2.0	-	-	4.9	0.8	Loss of flush. Soft drilling. Likely broken/collapsed ground.
PH31	15.0	1.5	-	-	11.6	0.7	
PH32	6.0	1.0	-	-	2.8	0.6	
PH33	4.5	1.9	1.9	0.5	-	-	-
PH34	4.5	1.3	1.3	0.2	-	-	-
PH35	12.0	1.6	-	-	-	-	-
PH36	9.0	1.5	1.7	0.3	-	-	-

8.4 Visual & olfactory evidence of organic contamination

8.4.1 No visual or olfactory evidence of organic contamination was encountered during the investigation.

8.5 Groundwater

8.5.1 Groundwater was not encountered within any trial pits. However, groundwater was encountered between 10.3m and 21.0m depth within probeholes.

8.5.2 Groundwater levels recorded in the monitoring wells are summarised below.

Hole	Response zone (depth range & strata)	Groundwater body	Typical standing water level	
			m bgl	m AoD#
PH19	1.5 – 4.5m (Sandstone)	Deep (solid)	ND	
PH20	1.5 – 4.5m (Sandstone)		3.65	112.64
PH21	1.5 – 4.5m (Mudstone)		ND	
PH22	1.5 – 4.5m (Sandstone & Mudstone)		4.21	126.15
PH23	1.5 – 4.5m (Sandstone & Mudstone)		ND	
PH24	1.5 – 4.5m (Mudstone & Coal)		ND	

levelled-in by survey to enable groundwater risk assessment

8.5.3 It is apparent from the above that the water table is situated deep in bedrock. Groundwater levels are considered to be reflective of the true water table (rather than “trapped” waters associated with drilling or surface water run-off).

8.5.4 These results will be required by the foundation designer, drainage designer, and groundworker (especially if/where deep excavation is required).

8.6 Stability

8.6.1 Stability of excavations within natural ground was generally good. However, it should be noted that instability was recorded within the vicinity of shallow mineworkings in the centre of site, and therefore some localised instability may occur within this area.

8.7 Mining investigation

Shallow workings (rotary probeholes)

8.7.1 It is clear from the desk study that the site is likely to be underlain by shallow mineworkings associated with the Halifax Soft Bed and Middle Band Coal.

8.7.2 The conjectured outcrops of the two coal seams are shown on Drawing No 4749/9 included in Appendix B to this report.

8.7.3 Consequently, a mining investigation has been undertaken, comprising the drilling of 36 rotary open-hole probeholes. The investigation identified coal, soft ground, broken ground and two adits, as summarised in the table below.

Summary of ground conditions - probeholes

Hole	Final depth (m)	Depth to rockhead (m)	Depth to coal (m)	Thickness of coal (mm)	Depth to workings (m)	Thickness of workings (m)	Remarks	
PH01	21.0	2.0	-	-	-	-	-	
PH02	33.0	1.5	-	-	-	-	-	
PH03	23.0	2.0	-	-	-	-	-	
PH03A	9.0	2.0	-	-	-	-	-	
PH04	24.0	2.0	-	-	-	-	-	
PH04A	12.0	2.0	-	-	-	-	-	
PH05	33.0	1.8	-	-	16.3	0.6	Loss of flush. Soft drilling. Likely broken/collapsed ground.	
PH06	21.0	1.0	-	-	14.3	0.6		
PH07	18.0	1.0	-	-	13.6	1.0		
PH08	15.0	2.5	-	-	10.5	0.8		
PH09	12.0	5.0	-	-	5.0	0.7	Possible location of adit (N-S trending).	
PH09A	9.0	2.5	-	-	4.5	2.4		
PH09B	12.0	3.0	-	-	5.8	1.3		
PH09C	12.0	2.5	-	-	6.0	1.1		
PH09D	12.0	2.5	-	-	4.1	0.7	Loss of flush. Soft drilling. Likely broken/collapsed ground.	
PH10	12.0	2.8	-	-	6.6	1.7	Loss of flush. Soft drilling. Likely broken/collapsed ground.	
PH11	12.0	1.0	-	-	8.3	1.8		
PH12	21.0	1.5	1.5	0.5	-	-		-
PH13	15.0	1.5	-	-	-	-		-
PH14	15.0	2.5	2.8	0.5	-	-	-	
PH15	15.0	1.0	-	-	11.2	1.1	Loss of flush. Soft drilling. Likely broken/collapsed ground.	
PH16	12.0	1.5	-	-	9.5	0.8		
PH17	9.0	1.8	-	-	6.7	1.0		
PH18	33.0	1.0	-	-	-	-		-
PH18A	27.0	1.0	-	-	-	-	-	
PH18B	21.0	1.0	-	-	-	-	-	
PH18C	21.0	1.0	-	-	-	-	-	
PH18D	21.0	1.0	-	-	-	-	-	
PH18E	21.0	1.0	-	-	-	-	-	
PH18F	21.0	1.0	-	-	17.1	1.2	Possible location of adit (E-W trending). Iron Ochre mine water returns.	



Hole	Final depth (m)	Depth to rockhead (m)	Depth to coal (m)	Thickness of coal (mm)	Depth to workings (m)	Thickness of workings (m)	Remarks
PH18G	21.0	1.0	-	-	-	-	-
PH18H	21.0	1.0	-	-	-	-	-
PH19	4.5	1.0	-	-	-	-	-
PH20	4.5	1.0	-	-	-	-	-
PH21	4.5	1.5	-	-	-	-	-
PH22	4.5	1.0	-	-	-	-	-
PH23	4.5	1.0	-	-	-	-	-
PH24	4.5	1.5	-	-	-	-	-
PH25	12.0	1.5	-	-	-	-	-
PH26	9.0	1.5	-	-	4.8	1.0	Loss of flush. Soft drilling. Likely broken/collapsed ground.
PH27	9.0	2.0	-	-	3.5	1.8	Loss of flush. Soft drilling. Likely broken/collapsed ground.
PH28	6.0	2.0	2.3	0.9	-	-	-
PH29	6.0	2.0	3.6	0.8	-	-	-
PH30	9.0	2.0	-	-	4.9	0.8	-
PH31	15.0	1.5	-	-	11.6	0.7	Loss of flush. Soft drilling. Likely broken/collapsed ground.
PH32	6.0	1.0	-	-	2.8	0.6	-
PH33	4.5	1.9	1.9	0.5	-	-	-
PH34	4.5	1.3	1.3	0.2	-	-	-
PH35	12.0	1.6	-	-	-	-	-
PH36	9.0	1.5	1.7	0.3	-	-	-

8.7.4 Analysing the data obtained from the 36 mining investigation probeholes, it is apparent that:

- Two seams of coal underlie the site, these are the:
 - **Halifax Soft Bed Coal** – outcropping in the centre of site, dipping east. Underlies about 1.4 ha of the site in the east. This was found to outcrop approximately 15m further east than that shown on BGS plans.
 - **Middle Band Coal** – outcropping in the far east of site, dipping east. Underlies about 0.3ha of the site in the far east. This was found to outcrop approximately 30m northwest of the outcrop shown on BGS plans.
- The Halifax Soft Bed coal was found to be on average 0.5m thick. The Middle Band Coal was found to be on average 0.3m thick.
- Evidence of workings was encountered in the Halifax Soft Bed Coal from depths of between 2.8m and 17.1m. The thickness of workings/broken ground within the Halifax Soft Bed Coal ranged from 0.6m to 1.8m (average thickness of workings of 1.1m).
- The shallow mineworkings in the Halifax Soft Bed Coal appear to be linked to an adit trending N-S recorded by the Coal Authority (discussed further below).
- None of the holes (probeholes and trial pits) advanced through the Middle Band Coal seam encountered evidence of workings, and based on the encountered thickness (0.3m to 0.4m) and depth (0.6m to 1.9m), is very unlikely to have been worked, however, it should be noted that due to Network Rail restrictions, only one hole (PH05) was advanced through the Middle Band Coal, and therefore, the possibility of shallow workings within this seam cannot be entirely discounted.
- The thickness of competent rock cover is less than 10 times seam thickness across an area of c.4,000m² in the centre of site.
- Linear triangulation suggests the Soft Bed coal seam dips approximately 1.7° southeast.

Adit search

8.7.5 Two adits are recorded on site by the coal authority. These are:

- CA Ref – 414412-010 trending roughly E-W through the centre of site.
- CA Ref – 414412-011 trending roughly N-S in the east of site.

8.7.6 Soft/broken ground was identified in PH09A between 4.5m and 6.9m depth. This is likely to be associated with adit ref. 414412-011 (N-S trending adit). This location is c.7m west of the Coal Authority's position, and 11m west of the location recorded on the abandonment plan.

8.7.7 Mineworkings appear to extend from the line of the adit, making it difficult to confirm the depth and line of the adit, however, in any case, it is apparent that the both the adit and workings do not have enough competent cover, and therefore both will require drilling and grouting.

8.7.8 The approximate area of workings/the adit that will require treatment is shown on Drawing 4749/10 included in Appendix B.

8.7.9 Adit ref. 414412-010 (E-W trending adit) was encountered in PH18F between 17.1m and 18.3m depth. Upon drilling, ochreous mine water was flushed out of the hole. In addition, the mine water rose through the surface water drainage systems of properties 18A & 18B Gynn Lane located c.60m west, flooding their gardens with ochreous mine water.

8.7.10 Drilling of the adit 414412-010 was terminated to avoid further flooding, and gardens were cleaned.

- 8.7.11 The coal authority estimates the true height of the adit to be c. 2.0m, whereas PH18F encountered a height of 1.2m. It is therefore likely that the adit is circular, and PH18F drilled through the side of the adit, instead of its crest. Whilst an adit height of 1.2m would give enough competent cover, if the adit is c. 2.0m high, then there c. 9 times competent cover.
- 8.7.12 Given drilling of the E-W adit was terminated, the dip and orientation of the E-W adit is currently unknown, therefore trigonometry has been used in an attempt to establish the dip of the adit, and whether it poses a risk to surface stability across the site.
- 8.7.13 Adits typically enter a hill side and dip at a shallow angle towards a coal outcrop/workings. Using the distance from the recorded adit entrance, the difference in m AOD from the adit entrance and where it was encountered on site, the dip of the adit has been calculated to be approximately 5° east.
- 8.7.14 At a dip of 5° east, the adit would lie c.50m below workings recorded on the abandonment plan c.500m east. Similarly, the adit would lie c.10m below the shallow mineworkings encountered in the east of site.
- 8.7.15 Given the above, there appears to be no logic reason why the adit would dip 5° east. Lithos contacted the Coal Authority to assess possible explanations as to why the adit appears to dip steeply below the coal outcrop/workings. The Coal Authority did not find any reasonable conclusions, therefore several hypothesis and their likelihood are given below.

Hypothesis	Likelihood	Explanation
PH18F did not encounter the adit, and instead drilled through a fracture in bedrock.	Unlikely	PH18F found the adit at the location conjectured by the Coal Authority. In addition, given the presence of ochreous mine water in this borehole only, it is highly unlikely it is anything other than the adit.
The adit entrance lies c.10m lower than current ground levels, allowing the adit to dip up towards adjacent workings (following topography).	Unlikely	Gynn Lane is shown on abandonment plans and historical maps and therefore levels have not been raised since the adit was constructed. It is likely the adit entrance lies at c.108mAOD (just below present day ground levels).
The adit dips down at the entrance and then rises up towards the mineworkings.	Unlikely	Conversations with the Coal Authority revealed they have never known an adit to change dip direction (i.e. up to down, or down to up).
The adit was only exploratory and does not extend the full distance shown on the abandonment plan	Possible	Coal authority data shows the adit does not extend across the entire field, however, the reason for this is unknown. At the current dip rate encountered, the adit would not reach the workings, and therefore it is possible the adit was abandoned. However, the presence of ochreous mine water suggests the adit intersects mineworkings somewhere along its line.
The adit was used for drainage	Possible	Given the adit was found to contain ochreous mine water, it is likely the mine was flooded and required a drainage system, however, to drain mineworkings in the east, the adit would need to dip west and therefore current evidence of dip does not support this theory.
The adit serviced the adjacent mill	Possible	The adit entrance is located within the vicinity of the historical mill, however, current evidence of dip does not support the adit ever reaching the adjacent mineworkings.

- 8.7.16 Given the uncertainty regarding the dip, true height and orientation of the adit, further investigation may be required to determine whether the adit poses a risk to surface stability along its line.
- 8.7.17 Drilling of the adit was undertaken using air flush, and therefore, the method of investigation will need to be altered to avoid mine water flushing up residents' drainage systems.

- 8.7.18 At present, it appears the most suitable investigation method will be to drill with water flush, and have a watching brief in the gardens of 18A & 18B Gynn Lane. Prior approval and agreement will be required with neighbouring property owners. Further advice should be sought from the Coal Authority prior to commencement.
- 8.7.19 Alternatively, given the minimum likely competent cover of c. 9 times above the E-W adit (possibly c. 19 times, if the 1.2m adit height is the maximum), foundation solutions for plots likely to be within the vicinity of the E-W adit could be reinforced, which may prove more successful given further investigation of the adit will be difficult and may prove inconclusive. The extent of plots requiring reinforced foundations are shown on Drawing 4749/12 in Appendix B. Further details regarding proposed foundation solutions are given in section 13.4.
- 8.7.20 A further 6 probeholes were taken to shallow depth to enable the installation of gas monitoring wells.

Mine entry search

- 8.7.21 As discussed in Section 4.3 there is one known mine entry within the site's boundary. Prior to any excavation, each mine entry was set out by a surveyor, based on co-ordinates included within the CA's Consultant's Mining Report, and consideration was given to Desk Study data to ensure the pegged position was appropriate.
- 8.7.22 Topsoil and subsoil was stripped from about 400m² of land where the CA suggest that the recorded mine entry is located.
- 8.7.23 The area of excavation was restricted by mature trees and woodland in the north.
- 8.7.24 No evidence of the shaft was encountered, and therefore it is likely that the shaft lies beneath the tree canopy/within the area of woodland.
- 8.7.25 The areas of topsoil strip are shown on Drawing 4749/6 in Appendix B.

8.8 Revised conceptual ground model (ground conditions)

- 8.8.1 The Preliminary Conceptual Site Model has been revised in light of data obtained during the ground investigation, most notably with respect to:
- The nature and distribution of made ground, including the presence of significant buried obstructions
 - The strength, nature and depth of underlying natural strata
 - The presence of coal/shallow workings
 - The nature and distribution of contamination (based on visual/olfactory evidence only)
- 8.8.2 Further refinement of the Conceptual Site Model is presented in Sections 12.4, where the results of laboratory testing for contaminants have been considered.

9 CONTAMINATION (ANALYSIS)

9.1 General

- 9.1.1 The site has not been the subject of a past potentially contaminative industrial land use. However, historical mapping suggests the site is historically associated with the coal mining industry. Sampling of the topsoil has been undertaken to confirm its suitability for re-use.
- 9.1.2 An assessment of potential contaminants associated with the former uses has been undertaken; see Section 6.

- 9.1.3 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.
- 9.1.4 Where available, Category 4 Screening Levels (C4SL) have also been referenced.
- 9.1.5 Generic Note 04 in Appendix A provides further details with respect to current guidance and the interpretation of analytical data.

9.2 Testing scheduled

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

Type of sample	No. of samples	Determinands
Made ground	1	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) & Asbestos ID Water soluble sulphate, chloride, nitrate and magnesium TOC, Speciated Polycyclic Aromatic Hydrocarbons (PAH), Banded Total Petroleum Hydrocarbons (TPH)
Topsoil	11	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) & Asbestos ID Speciated Polycyclic Aromatic Hydrocarbons (PAH) Clay/sand/silt content and visible contaminants, sharps (glass etc) to check compliance with BS3882:2015
Coal	4	Calorific Value (CV), pH & water soluble sulphate

9.3 Soil contamination results

- 9.3.1 The soil contamination test results are summarised in the tables on pages 25 to 27.
- 9.3.2 Laboratory test certificates as received from the laboratory are presented in Appendix I to this report.

Summary of degree of soils contamination (topsoil)

Expl Hole	Depth (m)	Material	Concentrations in mg/kg unless otherwise stated. Trigger Level Concentrations are shown in BLUE and assume a residential with gardens end-use.															Asbestos I.D.
			pH	As ∞	B ~	Cd ∞	Cr x	Cu ♣ \$	Pb ∞	Hg *	Ni	Se	Vn	Zn \$	% TOC	PAH		
				37	5	26	4000	100	200	199	109	434	584	200		B(a)P ∞	Naphthalene	
TP01	0.2	Topsoil	6.3	18	0.4	0.3	21	28	51	1.2	20	< 0.5	34	76	4.0	< 0.03	< 0.03	N.D.
TP03	0.1	Topsoil	6.4	23	0.7	0.5	35	53	160	0.25	23	0.7	49	130	6.4	< 0.03	< 0.03	N.D.
TP05	0.2	Topsoil	5.3	23	0.6	0.5	30	52	76	0.31	26	0.6	48	99	6.4	0.12	< 0.03	N.D.
TP07	0.1	Topsoil	5.7	24	0.5	0.5	26	44	73	0.2	21	< 0.5	42	110	6.4	< 0.03	< 0.03	N.D.
TP10	0.2	Topsoil	5.5	38	0.9	1.7	32	65	100	3.4	41	1	50	280	8.5	< 0.03	< 0.03	N.D.
TP12	0.1	Topsoil	5.4	26	0.6	0.5	26	57	72	0.28	26	< 0.5	45	95	9.3	< 0.03	< 0.03	N.D.
TP14	0.2	Topsoil	5.9	29	0.9	0.6	33	48	78	3	19	1.3	55	97	6.6	< 0.03	< 0.03	N.D.
TP18	0.2	Topsoil	5.9	21	0.5	0.7	27	58	59	1.2	26	0.6	42	120	6.3	< 0.03	< 0.03	N.D.
TP22	0.2	Topsoil	6.3	28	0.7	0.6	32	50	75	3.1	25	1.3	50	93	9.9	< 0.03	< 0.03	N.D.
TP26	0.2	Topsoil	6.6	21	0.7	0.5	25	37	54	2	20	0.7	41	79	5.2	< 0.03	< 0.03	N.D.
TP30	0.1	Topsoil	5.9	14	0.3	0.3	26	25	39	0.58	21	0.5	35	76	4.4	< 0.03	< 0.03	N.D.

Summary of degree of soils contamination (inorganics)

Expl Hole	Depth (m)	Material	Concentrations in mg/kg unless otherwise stated. Trigger Level Concentrations are shown in BLUE and assume a residential with gardens end-use.												
			pH	As ∞	B~	Cd ∞	Cr x	Cu♣\$	Pb ∞	Hg*	Ni	Se	Vn	Zn\$	Asbestos
				37	5	26	4000	100	200	199	109	434	584	200	
TP23	0.7	Granular Made Ground	6.6	6.9	0.2	0.4	18	27	13	0.1	36	<0.5	23	62	N.D.

Key		Source of guidance trigger level	
36	Parameter tested for and found to be in excess of Tier 1 value.	With the exception of those annotated with one of the symbols below (∞, \$, ~), all Soil Screening Values in brackets above have been derived using CLEA v1.071.	
179	Parameter tested for and found to be > 5 x Tier 1 value.		
12	Parameter tested for but not found to be in excess of Tier 1 value.	∞	Category 4 Screening Level – SP1010, December 2013 (CL:AIRE/Defra).
	Parameter not tested for.	\$	MAFF. 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 Tier 1 would be 21mg/kg.		
ND	No fibres detected (asbestos screen)		
		*	Assumes mercury present as an inorganic compound (cf elemental metal or within organic compound). See Science Report SC050021/Mercury SGV.

Summary of degree of soils contamination (organics)

Expl Hole	Depth (m)	Material	Concentrations in mg/kg. Trigger Level Concentrations are shown in BLUE and assume a residential with gardens (and no cover) end use					
			% TOC	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
				5	6	22	215	3299
TP23	0.7	Granular Made Ground	30.0	<0.03	<0.03	<0.1	<30	<20

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 v1.071. 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 Of the 11 samples of topsoil and 1 sample of Granular Made Ground analysed for inorganic parameters, 1 sample of topsoil could be classified as contaminated. All other topsoil samples and the single sample of Granular Made Ground can be classified as uncontaminated.
- 9.3.4 These samples have been classified by comparison with Tier 1 Soil Screening Values for an end use including domestic gardens and any area where plants are to be grown (the most sensitive of proposed end-uses).
- 9.3.5 The most common contaminants are arsenic (38mg/kg) and Zinc (280mg/kg) encountered in TP10 at 0.2m depth.
- 9.3.6 **Zinc** is a phytotoxic metal; phytotoxicity describes the inhibitive and toxic effect high concentrations of some substances can have on plant growth.
- 9.3.7 Most substances are harmful to human health at lower concentrations than would be detrimental to plant growth. However, there are three notable exceptions - boron, copper and zinc. Plants are the more sensitive receptor to these elements i.e. detrimental effects are seen in plants at concentrations which do not present a risk to human health. Consequently, for zinc, consideration and protection of flora would also be protective of human health.
- 9.3.8 Allowable concentrations of heavy metals in arable soils are set out in Defra's Code of Good Agricultural Practice 2009¹. The value for zinc is 200mg/kg, and is based on a continued annual application of heavy metal rich fertiliser (sludge); as such it is not representative of activity in a standard UK garden.
- 9.3.9 Lithos have also derived a value for zinc in relation to risks to human health, using the CLEA model, assuming a residential end use with consumption of home grown produce in a sandy loam soil with 6% SOM. The reported value is 2,170mg/kg, ten times greater than the potential phytotoxic concentration.
- 9.3.10 On balance, given the context of a residential development and the relatively low concentrations recorded, zinc is not considered significant and no special remedial measures are considered necessary.
- 9.3.11 The concentration of arsenic encountered in TP10 and 0.2m depth is only 1mg/kg above the Screening Value, and is therefore not considered to be of significance.

Calorific value

- 9.3.12 The calorific value of 3 samples of coal, have yielded an average CV of 24.5 MJ/kg. Materials whose CVs exceed 10MJ/kg are almost certainly combustible, while those with values below 2MJ/kg are unlikely to burn.

Asbestos

- 9.3.13 No visual evidence of asbestos-containing materials (ACMs), such as broken fragments of asbestos-cement sheeting, was noted during the excavation of trial pits.
- 9.3.14 No asbestos fibres were identified in any of the 12 samples screened.

¹ Defra – Protecting our Water, Soil & Air – A Code of Good Agricultural Practice for farmers, growers and land managers. 2009

Organic determinands

9.3.15 This site 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).

Hydrocarbons (TPH & PAH)

9.3.16 Given the absence of visual/olfactory evidence of any hydrocarbon contamination, only a simple banded TPH (cf full speciation) was scheduled on 11 samples of topsoil and 1 sample of made ground.

9.3.17 Assessment of TPH associated with a fuel/oil source 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.

9.3.18 Consequently, no significant petroleum hydrocarbon concentrations have been identified, and there is no risk to human health from these hydrocarbons.

Polycyclic Aromatic Hydrocarbons (PAH)

9.3.19 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.

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

BS3882 Topsoil testing

9.3.21 The presence of visible contaminants, sharps (glass etc) was assessed by the Engineer in the field (inspection of initial trial pit arisings; none were identified. BS3882 considers visual contaminants to comprise 'undesirable potentially injurious foreign object(s) visible to the naked eye'.

9.3.22 The clay/sand/silt content of 4 topsoil samples have been determined to check compliance with BS3882² requirements.

9.3.23 It should be noted that this is a reduced suite of analysis, and no N-P-K etc. testing has been undertaken.

9.3.24 The results are summarised below:

Parameter	BS3882 Specification	TP01, 0.2m	TP10, 0.2m	TP22, 0.2m	TP26, 0.2m
Retained on 2mm sieve	< 30%	18	14	14	9
Retained on 20mm sieve	< 10%	4	5	0	1
Retained on 50mm sieve	0%	0	0	0	0
Clay content	5 to 35%	12	11	13	16
Silt content	0 to 65%	27	30	38	39
Sand content	0 to 90%	43	45	35	36

² BS3882:2015. Specification for topsoil. Published by BSI Standards Limited.

Parameter	BS3882 Specification	TP01, 0.2m	TP10, 0.2m	TP22, 0.2m	TP26, 0.2m
Visible contaminants	< 0.5%	< 0.5%	< 0.5%	< 0.5%	< 0.5%

9.3.25 The above results suggest that the topsoil at this site complies to the standards set out in BS3882. In terms of textural classification, the topsoil falls into the 'Sandy silt loam' class.

10 CONTAMINATION (QUALITATIVE RISK ASSESSMENT)

10.1 Topsoil

10.1.1 Topsoil, typically 300mm thick underlies the entire site. Testing suggests this material is chemically suitable for re-use.

10.1.2 Given the nature of the topsoil present on this site it would be expected to be suitable to support plant growth.

10.2 Revised conceptual ground model (contamination)

10.2.1 No plausible contaminant linkages have been identified during the investigation of the fields, however, contamination may still be present within the vicinity of 34 Gynn Lane.

10.3 Waste classification

10.3.1 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.

10.3.2 Off-site disposal of surplus clean naturally occurring soils to landfill is not recommended. In accordance with the CL:AIRE Code of Practice³ 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, without the need for waste legislation to be applied.

11 HAZARDOUS GAS

11.1 General

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

Source	Receptors	Hazard	Pathway	Initial risk
On-site made ground	Human health	Asphyxiation & explosion	Vertical migration, ingress & accumulation	Low: made ground likely to be inert, with little degradable matter
	Buildings	Explosion		
Off-site landfill (115m northeast)	Human health	Asphyxiation & explosion	Lateral migration, ingress & accumulation	Low: the landfill is only shown on historical maps, and is not recorded elsewhere. Landfill also likely lies topographically above the site
	Buildings	Explosion		
Shallow mineworkings	Human health	Asphyxiation & explosion	Vertical migration, ingress & accumulation	Moderate: no significant thickness of low permeability drift or bedrock above workings
	Buildings	Explosion		

³ The Definition of Waste: Development Industry Code of Practice. CL:AIRE, 2011.

- 11.1.2 Given the above gas monitoring wells have been installed in 6 boreholes across the site. Details of the installations are given on the probehole logs presented in Appendix G to this the report.
- 11.1.3 The generation potential of the gas source was initially considered to be Moderate. Consequently, in accordance with CIRIA Report C665⁴, given the proposed residential end use, 12 visits have been scheduled over a 6-month period.

11.2 Scope of works

- 11.2.1 To date, the wells have been monitored on 1 occasion for groundwater levels and soils-gases, and the results are presented in Appendix K.
- 11.2.2 A standard procedure was followed, in accordance with CIRIA guidance:
- Ambient oxygen concentration
 - Atmospheric temperature & pressure
 - Methane, oxygen and carbon dioxide concentrations and flow rates using a Gas Data GFM436 infra-red gas analyser
 - Standing water level using a dipmeter
 - Ambient oxygen concentration (check for instrument drift)

11.3 Monitoring results

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

Well	Response zone	Range of methane concentrations (% v/v)	Range of carbon dioxide concentrations (% v/v)	Range of steady flow rates (litre/hour)
PH19	1.5 – 4.5m (sandstone)	ND	0.6	ND
PH20	1.5 – 4.5m (sandstone)	ND	0.1	ND
PH21	1.5 – 4.5m (mudstone)	ND	4.7	ND
PH22	1.5 – 4.5m (sandstone & mudstone)	ND	0.7	ND
PH23	1.5 – 4.5m (sandstone & mudstone)	ND	0.1	ND
PH24	1.5 – 4.5m (mudstone & coal)	ND	ND	ND

11.4 Discussion (methane & carbon dioxide)

- 11.4.1 Generic Note 05 in Appendix A outlines how monitoring results are interpreted.
- 11.4.2 A hazardous gas risk assessment incorporating all of the results will be issued on completion of monitoring in February 2025.

11.5 Radon

- 11.5.1 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.

⁴ CIRIA C665: *Assessing risks posed by hazardous ground gases to buildings (2007)*.

- 11.5.2 At present Approved Document C advocates basic measures for the probability banding 3% to 10% (full measures if >10%). However, the UK Health Security Agency (HSA) would like to see all new build include basic measures.
- 11.5.3 In December 2022, the British Geological Survey (BGS), deployed a revised dataset which increased accuracy and also the number of properties falling within radon affected areas. This revised dataset is now referenced by maps on the HSA website.
- 11.5.4 The HSA website radon map indicates that the site is in an area where **5% to 10%** of homes are estimated to be above the action level, and **basic** radon protection measures are required in new dwellings.
- 11.5.5 Basic radon measures comprise a radon resistant barrier* (membrane) laid within the floor construction and across the wall cavity in accordance with BRE211:2023⁵. The joints between the sheets that form the membrane and cross the cavity **must** be sealed, along with all service penetrations, to make the construction as airtight as possible. A separate cavity tray should be installed in the cavity one brick course above the radon membrane. In order to withstand the installation and follow on construction process membranes should be no less than 400 microns thick.⁶
- 11.5.6 BRE211:2023 highlights the importance of good practice and a high standard of workmanship to ensure radon membranes are installed to a high standard.
- 11.5.7 A building site is a harsh environment and barriers can easily become damaged during construction by operatives or equipment moving across or working over a completed section of barrier. As a consequence, where there is a risk of puncturing the membrane, it should be ensured that the membrane is well protected with sand or lean mix concrete before advancing construction.
- 11.5.8 The radon protection system should be subject to inspection and verification by a third party inspector that has a full understanding of all elements of the radon protection system.
- 11.5.9 Verification should be carried out at a minimum frequency of 1 in 10 plots where groundworkers carry out installation, and 1 in 20 plots where accredited installers are used. Plots selected for inspection should be located across the development and not clustered.

12 GEOTECHNICAL TESTING

12.1 General

- 12.1.1 A total of 26 samples of natural soil were delivered to a suitably accredited laboratory with a schedule of geotechnical testing drawn up by Lithos.
- 12.1.2 The geotechnical laboratory test results are presented in Appendix 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.

⁵ BRE Report BR211, 2023: "Radon: guidance on protective measures for new buildings (including supplementary advice for extensions, conversions and refurbishment projects"

* Confirmation of resistance to radon must be obtained from the manufacturer.

⁶ BS8485:2015+A1:2019. Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings. January 2019.

Soil type	No. samples tested	Moisture content range % (average)	Range of Plasticity Indices % * (average)	Shrinkability
Cohesive Residual Soil	10	20 – 43 (29)	29 – 43 (36)	Medium

* 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 For the purposes of foundation design, it is recommended that all cohesive soils be regarded as being of **Medium** shrinkability.

12.3 Particle size distribution

12.3.1 The grading of 2 samples of Cohesive Residual Soil and 3 samples of Granular Residual soils 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)
TP03, 0.7m	Slightly sandy slightly gravelly CLAY.	100	100	95	86	Slightly sandy slightly gravelly CLAY.
TP26, 1.2m	Slightly sandy slightly gravelly CLAY.	100	100	99	91	Slightly sandy slightly gravelly CLAY.
TP01, 0.5m	Sandy slightly clayey GRAVEL of sandstone.	79	51	17	6	Slightly sandy slightly clayey GRAVEL with a low cobble content.
TP05, 0.9m	Clayey slightly sandy GRAVEL of sandstone and sandstone lithorelicts.	100	100	47	8	Sandy slightly clayey GRAVEL.
TP19, 1.5m	Slightly sandy GRAVEL of mudstone.	100	91	39	10	Sandy slightly clayey GRAVEL.

12.3.2 The results of the grading scheduled broadly confirm field descriptions.

12.3.3 NHBC Chapter 4.2 considers shrinkable soils to be those containing more than 35% fines and having a Modified Plasticity Index greater than 10%.

12.3.4 The Cohesive Residual Soil was found to comprise between 86% and 91% fines, and therefore can be regarded as shrinkable.

12.3.5 The Granular Residual Soils were found to comprise typically <10% fines and therefore the Granular Residual Soils encountered on this site can be regarded as non-shrinkable.

12.4 Soluble sulphate and pH

12.4.1 In accordance with BRE SD1⁷, this site has been classified as greenfield with a mobile groundwater regime.

12.4.2 It is envisaged foundations will extend to depths of about 1.0m into natural strata and 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 10 samples of natural soil were determined.

⁷ BRE Special Digest 1 (2005) – Concrete in aggressive ground.

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)
Cohesive Residual Soils	5	5.2	13
Granular Residual Soils	5	5.8	14

12.4.5 Only 1 of 5 samples of Cohesive Residual Soil yielded a pH value below 5.5, and therefore the slightly lower pH value of 5.2 is not considered significant.

12.4.6 In accordance with Tables C1 and C2 of SD1, sub-surface concrete should be Design Sulphate Class **DS-1**, with the site allocated an ACEC Classification of **AC-1**.

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 BS5930⁸ 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 1 sample of Cohesive Residual Soil and 4 samples of Granular Residual Soil (using a 4.5kg 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, that all but one of the 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 results are summarised in the tables below:

Sample location & depth	Material description	% passing 37.5mm sieve	% passing 20mm sieve
TP03, 0.7m	Slightly gravelly slightly sandy CLAY.	100	100
TP26, 1.2m	Slightly sandy slightly gravelly CLAY.	100	100

⁸ BS5930 (2015) - Code of practice for ground investigations.

Sample location & depth	Material description	% passing 37.5mm sieve	% passing 20mm sieve
TP01, 0.5m	Slightly sandy slightly clayey GRAVEL with a low cobble content.	79	51
TP05, 0.9m	Sandy slightly clayey GRAVEL.	100	100
TP19, 1.5m	Sandy slightly clayey GRAVEL.	100	91

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 (%)
TP03, 0.7m	Slightly gravelly slightly sandy CLAY.	2.63	1.53	25	24.3 – 30.4	29
TP26, 1.2m	Slightly sandy slightly gravelly CLAY.	2.64	1.46	29	27.8 – 34.1	
TP01, 0.5m	Slightly sandy slightly clayey GRAVEL with a low cobble content.	2.66	2.05	10	9.3 – 13.6	15
TP05, 0.9m	Sandy slightly clayey GRAVEL.	2.67	1.86	14	13.7 – 18.5	
TP19, 1.5m	Sandy slightly clayey GRAVEL.	2.67	1.83	15	14.4 – 19.2	

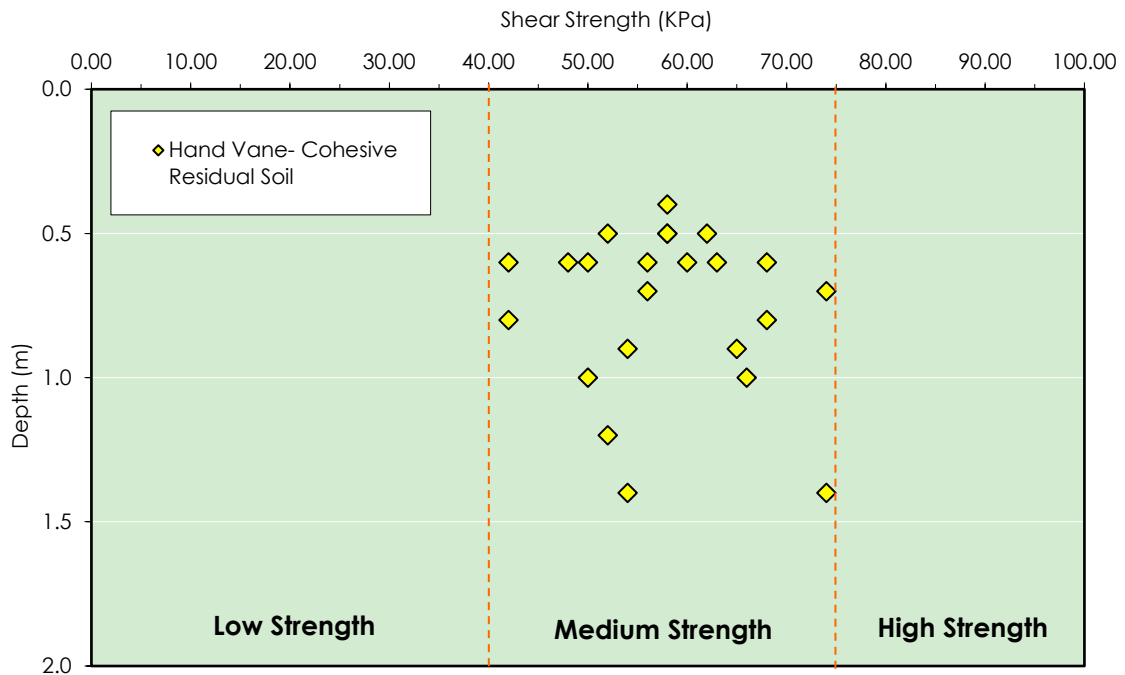
- 12.5.10 It is apparent that the in-situ moisture content of the is generally within the allowable moisture content range to achieve 95% MDD and <5% air voids. On this basis it is considered that both the Cohesive and Granular Residual Soils are generally suitable for re-engineering.
- 12.5.11 Acceptability of the natural soils for use in the proposed controlled earthworks will need detailed appraisal by the Earthworks Designer in light of the required performance characteristics.

12.6 Undrained shear strength testing

Hand shear vane testing

- 12.6.1 Hand shear vane testing was undertaken within trial pits in-situ to around 1.0m depth and from larger blocks of excavated clay below that depth.
- 12.6.2 The results are summarised within the plot below and illustrate that all Cohesive Residual Soil deposits had a strength of >40kPA and can therefore be classed as Medium Strength.
- 12.6.3 The plot below provides a summary of undrained shear strengths.

Hand Vane- Cohesive Residual Soil



13 GEOTECHNICAL ISSUES

13.1 Conceptual site model

- 13.1.1 Made ground has only been encountered in TP23 between 0.3m and 0.9m depth. Elsewhere natural strata (typically firm sandy Clay or sandy Gravel) is present directly beneath topsoil.
- 13.1.2 Bedrock was encountered in the majority of exploratory holes and comprises sandstone in the east and west, with interbedded Sandstone and Mudstone in the centre of site. Excavation of the sandstone proved difficult with holes refusing after 0.5m penetration in the west and 0.2m in the east.
- 13.1.3 Land rises to the east, with a typical gradient of 1 in 9, but up to 1 in 5 in the centre-east. Significant earthworks will be required across the site to create level development platforms and provide suitable gradients for highways and gardens.
- 13.1.4 A railway embankment is located along the eastern boundary of the site. Vivly Living will need to contact Network Rail to discuss the proposed development and obtain agreement for works to be undertaken within the vicinity of the railway.
- 13.1.5 A gabion retaining wall associated with the railway line is present along the sites eastern boundary. Two shallow pits were excavated adjacent to the gabion wall, which revealed the wall is founded on a 0.5m high gabion basket underlain by 0.2m to 0.4m of crushed stone onto granular residual soil.
- 13.1.6 Access to the site is currently restricted, therefore significant earthworks (including the culverting of Ludhill Dyke, removal of trees and the demolition of 34 Gynn Lane) will be required to create a suitable access road.

13.2 Mining & quarrying

- 13.2.1 The majority of the site lies within a Coal Mining Development High Risk Area.
- 13.2.2 Shallow mineworkings associated with the Soft Bed coal have been encountered beneath an area of approximately 4,000m² in the centre of site. These will require treatment via drilling and grouting.
- 13.2.3 In addition, two known adits run across the site:
- The N-S adit appears to be linked to the shallow mineworkings in the Soft Bed Coal and therefore both the adit and shallow mineworkings will require treatment via drilling and grouting.
 - The E-W adit was found to be flooded with ochreous mine water. Drilling of the adit caused the mine water to reach the surface via drains in the back gardens of adjacent properties (18A & 18b Gynn Lane). The flow path and connectivity between the adit and surface water drainage is unknown. Therefore, further drilling of the adit was terminated and areas of stained patios were cleaned. It is currently unclear whether the adit poses a risk to surface stability (likely minimum competent cover of c. 9 times, possibly c. 19 times if the 1.2m adit height is the maximum), and therefore further drilling (using a revised methodology) or reinforced foundations will be required.

Shallow mineworkings

- 13.2.4 CIRIA SP32⁹ suggests voids resulting from mineral extraction are unlikely to migrate more than 10 times the seam thickness through competent bedrock. CIRIA C758D¹⁰ notes that the use of this 10 times 'rule-of-thumb', as the design basis for treatment depth, has been observed to be successful over many years for a wide range of mineworkings and overlying rock/soil strata scenarios. However, consideration must always be given to site specifics such as nature of roof strata, strata dip, groundwater, extraction ratio etc.
- 13.2.5 Mitigation against the risk of subsidence associated with the shallow mineworkings and N-S adit will be required across about 15% of the site's total area (likely Plots 17 to 26 & 33 to 36), as shown on Drawing 4749/10 in Appendix B. This will likely involve consolidation by drilling and grouting, although consideration could also be given to coal extraction (see Section 17.8).
- 13.2.6 Due to the difficulty in undertaking further investigation of the E-W adit, and also the difficulty in undertaking any drilling and grouting given the apparent connectivity between the adit and surface drainage, Lithos recommends all plots along its proposed line are reinforced with one layer of mesh. The approximate area of houses requiring reinforcement if no further investigation is undertaken is shown on Drawing 4749/12.
- 13.2.7 Based on the findings of this investigation and the anticipated nature of the workings, it is considered that the necessary consolidation (grouting) would require drilling holes on a 3m grid. A viscous grout composed of appropriate proportions of OPC, PFA, sand or pea gravel would then be injected into the workings via these holes.
- 13.2.8 Further holes would need to be drilled in areas of high grout take (to confirm filling of void space), and in areas where several adjacent holes encountered solid coal (to confirm that the local area is underlain by no workings, rather than pillars).
- 13.2.9 Drilling and grouting operations should be carried out with engineering supervision and be undertaken in accordance with a revision of Lithos' "General Specification for the Treatment of Shallow Mineworkings" tailored to the site-specifics.

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

¹⁰ CIRIA C758D (2019) - Abandoned mine workings manual

Mine entries

- 13.2.10 As discussed in Section 4.3 there is a recorded mine entry in the northwest of site.
- 13.2.11 Topsoil and subsoil was stripped from about 400m² to the south of the CA recorded location of the mine entry. Areas of mature woodland restricted excavation to the north of the recorded adit location.
- 13.2.12 No evidence of a shaft was encountered, and therefore it is likely that the shaft lies within the area of woodland, north of the area of proposed housing. Consequently, for now the CA will expect Vivly's layout to assume potential no-build "zones of influence" around each shaft based on the following calculation:

Zone of influence = 0.5 x assumed shaft diameter + departure + drift/made ground depth

- 13.2.13 In essence, departure relates to the degree of certainty with respect to the entry's location; approximate co-ordinates are provided on the CA's mine entry data sheets; see Appendix E). In turn, departure is dictated by the "source" of the entry's location as provided by the CA's mine entry data sheets.
- 13.2.14 Consequently, at this stage the zones of influence associated with each shaft must be assumed to be:

Shaft Ref.	Source	Departure /m	Diameter /m	Depth to bedrock/m	Zone of influence (circle of radius)/m	Approx. location
414412-009	CA Report	5	2.0	1.0	7.0	Within woodland (outside the area of proposed housing)

- 13.2.15 In addition to a topsoil strip undertaken to locate the recorded mine entry, two areas of topsoil were stripped down dip of the two coal seam outcrops to determine the presence of bell pits across the site.
- 13.2.16 No evidence of bell pitting was encountered, and therefore it is unlikely they exist across the site.
- 13.2.17 The areas of topsoil strip are shown on Drawing 4749/6 in Appendix B.
- 13.2.18 Whilst the Coal Authority (and NHBC) discourage development over or adjacent to all mine entries, Lithos consider such features to pose a low risk to surface stability where they only extend to relatively shallow workings that require treatment (grouting). Consequently, we would not expect any (previously unrecorded) shallow shafts, encountered during site preparatory works and/or the subsequent construction phase, to result in the need for "no-build" zones and/or revision of the planning-approved layout although Vivly may choose to do this.
- 13.2.19 However, where build over a shaft(s) is proposed, Vivly will need to discuss proposed treatment (which is likely to include both grouting of the shaft backfill, and a cap at rockhead) and bespoke foundation design, by a suitably qualified structural engineer, with the Coal Authority. A Permit to Enter or Disturb Coal Authority Mining Interests will be required prior to construction of any shaft cap.
- 13.2.20 Proposals to treat the mineworkings and shafts will need to be discussed with both the Local Authority (most notably Highways), the Coal Authority and NHBC well in advance of starting works on site.

- 13.2.21 Any shafts encountered during the development of this site should be made safe by treatment in accordance with an appropriate Specification (Lithos can prepare this) and a Coal Authority Permit to Enter or Disturb Coal Authority Mining Interests.

Mitigation – shallow mineworkings

- 13.2.22 CIRIA SP32:1984 (Construction over abandoned mine workings) suggests voids resulting from mineral extraction are unlikely to migrate more than 10 times the seam thickness through competent bedrock. CIRIA C758D, 2019 (Abandoned mine workings manual) notes that the use of this 10 times 'rule-of-thumb', as the design basis for treatment depth, has been observed to be successful over many years for a wide range of mineworkings and overlying rock/soil strata scenarios. However, consideration must always be given to site specifics such as nature of roof strata, strata dip, groundwater, extraction ratio etc.
- 13.2.23 Mitigation against the risk of shallow workings will be required across about 15% of the site, as shown on Drawing 4749/10.
- 13.2.24 Mitigation of risks posed by shallow mineworkings will likely be achieved via a combination of:
- Where workings are very shallow (say <5m bgl) and closely spaced: excavation of collapsed ground, together with some surrounding natural ground and residual coal. Suitable arisings could then be replaced in engineered layers.
New dwellings might be built on trench fill (taken through the full thickness of replaced fill), reinforced strips on re-engineered fill (subject to fill being paced in accordance with an appropriate earthworks specification), or piles.
 - Where workings are 'deeper': consolidation (drill & grout) with holes drilled on a 3m grid. A viscous grout composed of appropriate proportions of OPC, PFA, sand or pea gravel would then be injected into the workings via these holes.
Further holes would need to be drilled in areas of high grout take (to confirm filling of void space), and in areas where several adjacent holes encountered solid coal (to confirm that the local area is underlain by no workings, rather than pillars).
Drilling and grouting operations should be carried out with engineering supervision and be undertaken in accordance with a revision of Lithos' "General Specification for the Treatment of Shallow Mineworkings" tailored to the site-specifics.
- 13.2.25 Determination of the most appropriate means of mitigation will require input from the appointed remediation & groundworks contractor (who could provide costed options), with approval then to be sought from NHBC and the Coal Authority.

13.3 Site regrade and/or ground improvement

- 13.3.1 Given existing topography (land rises to the east with a typical gradient of 1 in 9, but up to 1 in 5 in the centre east), significant site regrade is anticipated, with the need for underbuild and retaining walls.
- 13.3.2 As discussed in section 13.2.24 above, excavation of shallow mineworkings may be undertaken, with suitable arisings replaced in engineered layers.
- 13.3.3 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
- 13.3.4 Careful consideration will need to be given to earthworks design, and implications for slope stability, retaining walls, foundations, highway gradients and drainage.

- 13.3.5 Any digital terrain modelling undertaken, or commissioned, by Vivly should consider implications for the foundation recommendations outlined below.
- 13.3.6 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.
- 13.3.7 Wherever possible, Lithos recommend that excavated soils are retained on site. However, if this is not possible the comments in Section 12.9 should apply.

13.4 Foundation recommendations

General

- 13.4.1 Foundation recommendations assume that development will be two or three storey construction and that line loads will not exceed 90kN/m run. If this is not the case significant alteration to these recommendations will be required.
- 13.4.2 Further investigation should be commissioned if any apartment blocks with higher line loads (say >120kN/m run) are proposed. Such investigation would include cable percussion boreholes and geotechnical analysis (triaxial and oedometer testing) of recovered, undisturbed samples.
- 13.4.3 Given the steep topography of the site, it is anticipated that a significant site regrade and associated earthworks will be undertaken to create level development platforms. Consequently, the foundation depths (and types) will depend on thicknesses of fill following the anticipated earthworks regrade.
- 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 natural ground should be Design Sulphate Class DS-1, with the site allocated an ACEC Classification of AC-1.
- 13.4.6 As discussed in section 13.2.24 above, excavation of shallow mineworkings may be undertaken, with suitable arisings replaced in engineered layer.
- 13.4.7 At this stage it is anticipated that new dwellings will be built on one of the following foundation types:
- **Strip footings:** plots constructed outside areas underlain by shallow mineworkings
 - **Reinforced strip footings on engineered fill:** Plots built in areas where earthworks regrade has taken place, or where engineered fill is required to backfill excavations to remove shallow mine workings. Engineered fill will need to be placed to an End Product Specification.
 - **Reinforced strip footings:** Plots built following consolidation of shallow mineworkings where rock over above treated workings is between >5 x seam thickness and 10m will need to be reinforced with B385 mesh top and bottom. This can be reduced to one layer of B385 mesh where there is >10m of rock cover and for plots potentially underlain by the E-W adit.
 - **Raft foundations:** where rock cover above treated workings is <5 x seam thickness.

Strip/trench fill footings

- 13.4.8 It is considered that shallow strip or deepened trench fill footings will be the most suitable foundation solution for the majority of the two or three storey houses constructed at the site; where houses are **outside** the area of shallow mine workings/adits. Footings will be founded in firm clay, weathered bedrock or competent rock.
- 13.4.9 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.
- 13.4.10 Where existing buildings are to be demolished, all concrete slabs and service ducts will require breaking out prior to re-development. However, relict foundations could probably be left in-situ and an allowance made for local breaking out, or (probably better) chased-out and removed during the necessary site preparatory works; see Section 13.3.
- 13.4.11 Foundations of plots placed over relict foundations should be taken to greater depth than the relict foundations and into natural ground of adequate bearing capacity.
- 13.4.12 Foundations will be required to be placed below a line drawn up at 45° from the base of any service or similar excavation.
- 13.4.13 Deepened foundations should be stepped in accordance with NHBC Standards, Chapter 4.3.
- 13.4.14 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).
- 13.4.15 In addition to the above, Vivly 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). Vivly should supervise their groundworker to ensure footings are excavated in a controlled and safe manner.
- 13.4.16 Vivly 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.

Granular Residual Soils

- 13.4.17 The weathered in-situ sandstone and mudstone is assumed to have a relative density of at least medium dense (in accordance with BS5930).
- 13.4.18 A safe bearing capacity of at least 150kPa, allowing a maximum foundation line load of 90kN/m run, can be assumed if the following are true:
- A foundation length of 8m
 - A foundation breadth of 0.6m
 - A foundation thickness of 225mm
 - A foundation depth of 0.6m depth
 - An angle of shearing resistance of $\phi=34^\circ$ for the granular deposits
- 13.4.19 Assuming the foundation geometry detailed above, settlements in the order of minimal settlements would be anticipated. This is not considered likely to be acceptable. However, further advice should be sought from the Structural Engineer responsible for foundation design.

- 13.4.20 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).
- 13.4.21 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.
- 13.4.22 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).
- 13.4.23 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).

Cohesive Residual Soils

- 13.4.24 Atterberg tests suggest that natural cohesive soils at the site are of medium shrinkability. A minimum founding depth of 900mm (not accounting for any existing or proposed vegetation) is therefore required for all soils on the site where strip footings are proposed.
- 13.4.25 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.
- 13.4.26 Foundations should be deepened near trees in accordance with NHBC Standards Chapter 4.2. It is estimated that up to 30% of the site may be affected by trees.
- 13.4.27 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.
- 13.4.28 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); however, it is likely that the presence of bedrock will result in few, if any, foundations being deeper than 2.5m.
- 13.4.29 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 0.9m depth
 - An undrained shear strength of 55kPa for the firm clay (typical minimum recorded on site)
- 13.4.30 Assuming the foundation geometry detailed above, minimal settlements would be anticipated. However, further advice should be sought from the Structural Engineer responsible for foundation design.

Bedrock

- 13.4.31 The bedrock is generally considered to have a safe bearing capacity of at least 300kPa and minimal settlements would be anticipated.
- 13.4.32 Where rock is encountered at shallow depth foundations should be placed entirely on rock and not partially on rock and partially on soil. This may, depending on surface gradient, necessitate significant deepening of foundations.
- 13.4.33 Bedrock in the centre of 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.

Coal

- 13.4.34 Some excavations for foundations in the centre-west and southeast of the site may come into contact with coal. Care should be taken not to unnecessarily overdeepen foundations, in order to minimise the chance of encountering coal.
- 13.4.35 Where foundation excavations do come into contact with coal, the foundation should be taken through the coal seam, into underlying natural in-situ strata of adequate bearing. The full thickness of coal should then be sealed with concrete to create a trench fill foundation. To prevent the ingress of air, the mass concrete fill should be placed as soon as possible after exposing the seam.
- 13.4.36 By virtue of the provisions of the Coal Industry Act 1994 interests in unworked coal and coal mines previously vested in the British Coal Corporation are now vested in the Coal Authority. The developer will need to contact the Coal Authority to dig or carry away such coal as they encounter in connection with redevelopment of the site (this is often referred to as incidental coal).

E-W adit

- 13.4.37 Drawing 4749/12 shows the approximate line of the E-W adit superimposed on the proposed housing layout.
- 13.4.38 Given the difficulties associated with drilling and grouting works due to the adit being flooded, and the likelihood that the adit does not pose a significant risk to surface stability at the site, foundations of plots within the footprint of the adit (possible locations) will need to be thickened to 300mm and reinforced with one layer of B385 mesh placed 75mm above the base of the footing.

N-S adit and associated shallow workings

- 13.4.39 Where shallow workings and the N-S adit are present (and have been remediated via drilling and grouting), strip footings will need to be thickened to 300mm and reinforced. Where there is between $>5 \times$ seam thickness and 10m rock cover, foundations will need to be reinforced with B385 mesh top and bottom. This can be reduced to one layer of B385 mesh where there is $>10\text{m}$ of competent rock cover above the grouted workings.

Raft foundations

- 13.4.40 Raft foundations designed to span 3m over potential soft spots and cantilever 1.5m at corners will be required where grouted workings are at a depth of $<5 \times$ seam thickness.

- 13.4.41 Raft design should be in accordance with NHBC Standards, Chapter 4.4. Granular sub-base product should be placed in accordance with Table 8/1 of the Highways Agency Specification for Highway Works (1998).
- 13.4.42 NHBC generally recommend that rafts be founded on a minimum 150mm thickness of DoT granular sub-base product. Granular sub-base should extend laterally for at least 0.5m beyond the raft. The base of the granular sub-base must be at least 600mm below original or finished level, whichever is the lower. At most reclaimed brownfield sites, original level is generally equivalent to the top of engineered fill.
- 13.4.43 Where rafts are within the influence of mature trees, the depth of crushed stone placed should be equal to 50% of the trench fill foundation depth determined in accordance with NHBC Chapter 4.2.

13.5 Floor slabs

- 13.5.1 Where shallow foundations 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.
- 13.5.2 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.
- 13.5.3 Beyond the influence of existing or proposed trees, it is considered that the natural ground is generally suitable for the use of ground bearing floors. However, ground bearing slabs should not be cast on topsoil. Where plots are elevated for design reasons, the depth of engineered stone below a ground bearing slab should not exceed 600mm, in accordance with NHBC guidance.
- 13.5.4 The natural ground beneath this site includes cohesive soils and is therefore subject to seasonal variation in moisture content. If ground slabs were constructed on desiccated soil, heave of the slab would occur on re-hydration of the ground. If any significantly desiccated soil is present, a suspended floor slab, with sub-floor void will be required.
- 13.5.5 It should be noted that NHBC have suffered a significant number of claims resulting from the use of ground bearing floor slabs. Consequently, if ground bearing slabs are proposed, care should be taken to ensure correct and careful construction. For example, if fill to the internal face of the foundation excavation is not properly compacted, subsequent settlement can result in cracking of the slab.
- 13.5.6 In the 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 February 2025.

13.6 Designated concrete mixes

- 13.6.1 Designated mixes are considered in BRE SD1¹¹ and BS 8500¹². 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, Vivly should seek advice from their appointed Structural Engineer.

13.7 Excavations

- 13.7.1 Based on the results of the investigation it is considered unlikely that major groundwater flows will be encountered in shallow excavations.
- 13.7.2 Groundwater should be controlled in accordance with CIRIA Report R113¹³.
- 13.7.3 Excavations should remain stable in the short term but if left open for any significant period of time may require shoring most notably in granular soils and areas of collapsed ground.
- 13.7.4 Bedrock was encountered in the majority of exploratory holes. Based on the exploratory hole logs, excavation greater than 2.0m is likely to **prove difficult** across about the east and west 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 and the creation of retaining walls etc.

13.8 Drainage

- 13.8.1 Based on the steeply sloping nature of the site, 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.
- 13.8.2 Alternative SuDS options (see CIRIA C753¹⁴ for further details) include:
- 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).
 - Swales – linear grassed features in which surface water can be stored or conveyed. Where suitable, swales can be designed to allow infiltration.
 - Basins - a ground depression designed to store surface water that is normally dry, except during and immediately following a rainfall event. There are two types:
 - Infiltration – basin designed to store runoff and infiltrate it gradually into the ground.
 - Detention – an outlet restricts flows, so that the basin fills and provides attenuation.
 - Ponds – designed to have permanent pool of water, but with capacity to provide temporary storage-controlled discharge.

¹¹ BRE Special Digest 1 (2005) – Concrete in aggressive ground.

¹² BS 8500-1&2:2015+A2:2019. Concrete. Complementary British Standard to BS EN 206. Method of specifying and guidance for the specifier (1) & Specification for constituent materials and concrete (2).

¹³ CIRIA Report R113 (1986) - Control of Groundwater for Temporary Works.

¹⁴ CIRIA C753 (2015) – The SuDS Manual.

- 13.8.3 Yorkshire Water have published a guide¹⁵ for developers and designers outlining their design requirements for surface water attenuation assets. However, further to changes in drainage policy over recent years, independent water authorities (including IWNL, ICOSA, LEEF etc) now adopt more housing schemes than the traditional authorities such as Yorkshire Water. Consequently, the CIRIA C753 has become the more commonly used guidance for the design of SuDS features (including attenuation assets).
- 13.8.4 With respect to detention basins, which should normally be dry, water table levels should be taken from borehole monitoring wells over 4 consecutive seasons, for at least 3 points in the basin area. The detention basin should be designed to ensure that there is a minimum of 1m of unsaturated soil between the maximum groundwater level and the lowest part of the structure.
- 13.8.5 Ground conditions must be suitable to allow free drainage from the detention basin all year round by having regard to groundwater levels. It is Lithos' understanding that ground does not have to be free-draining (i.e. sands/gravels), but where clay is present the basin needs to be designed to prevent waterlogging - because this renders maintenance (grass cutting) difficult. It would be prudent to seek confirmation of this from the adopting Water Authority and/or the appointed drainage designer.
- 13.8.6 Impermeable liners are accepted where groundwater is recorded <1m below the base of the feature. However, depending upon the depth of groundwater this may need to be used in conjunction with an under drain (in which case a watercourse outfall for the under drain is typically required).
- 13.8.7 Appropriate design usually comprises a fall across the short axis (to centre of basin), and then along the long axis (possibly inclusive of a pipe in gravel trench) to the outfall. However, some Independent Authorities allow a flat base but usually with a controlled flow channel.
- 13.8.8 Whilst not required by most Independent Authorities, the Yorkshire Water guide also discusses required access to flow control chambers, large diameter (i.e. >900mm) surface water storage pipes, and surface water storage tanks.
- 13.8.9 It is recommended that the developer contact the traditional Water Authority with respect to capacity in existing foul and surface water sewers in the vicinity of the development area. However, surface water can go to watercourse and in terms of hierarchy should be before sewer. If that is the case, consultation may include the Environment Agency (Main River), or Internal Drainage Board (only limited UK coverage), or Local Authority as Lead Local Flood Authority. Landowner Rights (riparian) are always required for watercourse discharge.

13.9 Highways

- 13.9.1 This site is greenfield and the routes, formation level and total length, of proposed estate roads are not currently known. Consequently, there is no merit in obtaining CBR values at this stage.
- 13.9.2 The natural soils present at shallow depth (anticipated formation) comprise Granular and Cohesive Residual Soils. Based on visual inspection of the natural materials and the recorded plasticity indices of cohesive at the site, published guidance¹⁶ and tables¹⁷ indicate that the residual soil deposits would be expected to provide a CBR value of at least 3%. These values should be verified prior to or during construction.

¹⁵ *Design Requirements for Surface Water Attenuation Assets, February 2017.*

¹⁶ *CD225 Design for new pavement foundations Revision 1 (Design Manual for Roads and Bridges)*

¹⁷ *The Structural Design of Bituminous Road, TRRL Laboratory Report 1132 (Table C1, page 36)*

13.9.3 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.

13.10 External works

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

13.10.2 When designing retaining walls, consideration should be given to Clause 10.2.3 of NHBC standards which states that flexible retaining walls such as gabion and timber structures should not be used to provide support to homes, garages, roads, drives, car parking areas or drainage systems.

13.10.3 Modelling should take account of the presence of shallow mineworkings and the adits as these may have an impact on proposed layout and earthworks design.

14 REDEVELOPMENT ISSUES

14.1 General

14.1.1 This report has presented options with respect to foundation solutions, 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 construction phase.

14.1.3 If unexpected ground is encountered during the construction phase, the Contractor should immediately seek further advice from the Engineer.

14.2 Remediation strategy

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

- Demolition of the existing residential property (34 Gynn Lane)
- General site clearance of surface materials and vegetation
- De-vegetation (tree removal) where appropriate, under the supervision of an arboriculturist
- Topsoil strip & stockpile
- Break-up of slabs and hardstand
- Removal of any old foundations, concrete bases and similar obstructions within 450mm of the finished ground surface in proposed garden areas
- Cut and fill earthworks

- Culverting of the watercourse to allow for construction of an access road
- Drilling and grouting of shallow mineworkings and the N-S adit.

14.2.2 It is strongly recommended that the demolition contractor should chase-out all significant buried structures associated with 34 Gynn Lane, and survey-in the resultant excavations before making them safe by backfilling. At the very least, relevant features should be surveyed-in before "hiding" them beneath a veneer of rubble. Similarly, it would be prudent to complete a drainage survey prior to blading rubble across the site to leave it safe and secure.

14.2.3 No areas of gross contamination were encountered during the site investigation. However, if any buried drums, "oily", odorous, brightly coloured etc. materials are encountered, further advice should be sought from Lithos. Further advice should also be sought if deep foundations etc associated with the former house are encountered during the preparatory works; such obstructions might necessitate revised foundation design.

14.3 Control of excavation arisings

14.3.1 The groundworker should appreciate 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; grubbed-up concrete hardstand; tarmac; excess clean, natural soil arisings; general construction waste etc.

14.3.2 Further characterisation of stockpiled materials is likely to be required if off-site disposal is proposed. See also comments in Section 10.3 regarding asbestos.

14.3.3 Made ground arisings from the demolition of 34 Gynn Lane 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
- Isolated beneath an appropriate cover layer in garden or landscaped areas
- Exported from site to a suitably licensed landfill facility

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

14.4 Management of topsoil

14.4.1 In order to manage surface water and silt it is recommended that a phased approach is taken to site clearance and construction; prior to construction, topsoil and vegetation form a natural barrier and limit surface water (and silt) run off. This is a large site, and it would be prudent to retain topsoil and vegetation until construction is due to commence in a given sub-area (other than along the line of proposed roads & sewers).

14.4.2 NHBC Conditions require garden areas to be provided with topsoil to a thickness of not less than 100mm. Topsoil thicknesses in excess of 400mm should generally be avoided.

14.4.3 Prior to placement of topsoil, the underlying subsoil should be loosened by ripping or rotovating. Stones and other objects greater than 50mm should be removed from the prepared surface, and the loosened subsoil should be roughly levelled so that an even depth of topsoil can be achieved.

14.4.4 Subsequent trafficking over the loosened subsoil should be minimised.

14.4.5 Topsoil should not be placed during or immediately after heavy rain.

14.4.6 After spreading, any large compacted lumps should be broken down to produce a fine tilth suitable for planting, turfing and seeding (< 10mm maximum aggregate size).

14.5 Good practice guidance

14.5.1 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 C741¹⁸
- EA Pollution Prevention Guidelines¹⁹:
 - PPG6 - Working at construction and demolition sites
 - PPG2 - Above ground oil storage tank
 - PPG7 – The safe operation of refuelling facilities
 - PPG21 – Incident Response Planning

14.5.2 Site preparatory works associated with this project are likely to involve the re-use of both natural and made ground soils on site. Therefore, the Contractor should prepare a Materials Management Plan (MMP) in accordance with the CL:AIRE Code of Practice (v2, March 2011)²⁰.

14.5.3 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.

14.6 New utilities

14.6.1 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.

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

14.6.3 This site 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.

14.6.4 Consequently, the use of 'standard' polyethylene water supply pipes should be acceptable, although Vivly should consult the adopting Water Authority at the earliest opportunity to confirm this.

14.6.5 This site investigation has enabled completion of a Contaminated Land Assessment Form²¹, a copy of which is included in Appendix H.

14.7 Health & safety issues - construction workers

14.7.1 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.

¹⁸ CIRIA C741 (2015) - Environmental Good Practice on Site

¹⁹ Whilst this has formally been withdrawn it can still be accessed via the EA archives and provides useful information on managing risks.

²⁰ The Definition of Waste: Development Industry Code of Practice. CL:AIRE, 2011.

²¹ Contaminated Land Assessment Guidance. Protocols published by agreement between Water UK and the Home Builders Federation. January 2014

- 14.7.2 Before site operations are started, the necessary COSHH statements and Health & Safety Plan should be drafted in accordance with the CDM regulations.
- 14.7.3 To date no significant contamination has been identified, however, made ground is likely present in the far north of site within the vicinity of 34 Gynn Lane.
- 14.7.4 Consequently, during the remediation and construction phases of the site development it will be necessary to protect the health and safety of site personnel. General guidance on these matters is given in the Health and Safety Executive (HSE) document "Protection of Workers and the General Public during the Redevelopment of Contaminated Land".

14.8 Coal extraction

- 14.8.1 The Halifax Soft Bed Coal outcrops in the centre of site and dips to the east. The Middle Band coal also outcrops in the far east and dips to the east.
- 14.8.2 Prior extraction of coal is encouraged by both the Coal Authority and Planning Authorities, largely because a potential mineral resource will not be sterilised by the development. However, it is worth noting that the UK market for coal is changing (driven by government carbon emission targets) – most notably very few power stations are still burning coal. Consequently, prior extraction of coal has become less attractive in recent times.
- 14.8.3 There can be financial benefits to extraction, since the extraction contractor would pay the landowner a disturbance allowance for the coal (likely to be between £2 and £4 per tonne), and there would be a saving because grouting would not be required.
- 14.8.4 Furthermore, any unrecorded mine entries would also be found and removed. Traffic movements (associated with coal export) are expected to be similar to those associated with grouting (import of PFA and cement).
- 14.8.5 However, coal extraction is not without drawbacks; these include:
- The creation of 'high-walls' around the margins of the extraction area (essentially the whole of the site's perimeter).
 - The time required to ensure significant settlement of the replaced overburden (anticipated residual settlement must be less than 25mm) is typically at least 12 months. However, the actual delay to build programme might be longer, since it is impossible to predict the actual time required for ongoing creep settlements to fall to tolerable levels. Prediction is hampered by uncertainties associated with groundwater rebound and the nature of the excavated material with respect to suitability for compaction.
 - Local environmental issues associated with noise and dust.
 - Public perception issues.
 - Concerns that once an initial excavation has been opened, the coal extraction contractor might decide there is insufficient coal remaining and abort further work, or even run into financial difficulties, leaving Vivly with increased foundation abnormalities and no royalties.
- 14.8.6 It is worth noting that the UK market for coal is changing (driven by government carbon emission targets) – most notably very few power stations (if any) are still burning coal. Consequently, prior extraction of coal has become less attractive in recent times.
- 14.8.7 Assuming the above factors do not preclude further consideration at the 'first hurdle', the viability of extraction is influenced by physical factors, most notably:
- The presence (or not) of old mineworkings
 - Seam thickness (greater the better)
 - Seam depth (shallower the better)

- 14.8.8 As discussed in Section 8.7, old mineworkings exist beneath about 4,000m² of this site, with solid coal only encountered in 7 probeholes.
- 14.8.9 This suggests that significant extraction has already occurred, reducing the potential yield from further extraction prior to redevelopment.
- 14.8.10 Extraction is generally considered possible where the overburden above a seam is less than 12 times the seam's thickness.
- 14.8.11 Consequently, it is **considered unlikely** that prior extraction of coal from this site would be economically viable.

14.9 Shallow coal in garden areas

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

14.10 Potential development constraints

- 14.10.1 Topography will require significant regrade earthworks, most notably in the centre of site where a slope of 1 in 5 to the west is present.
- 14.10.2 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.
- 14.10.3 Consideration could also be given to flexibility in the groundworks programme to take advantage of any prolonged dry/warm weather (typically between May and September) to enable footings to be cast and blockwork brought up to DPC level well in advance of the build programme (i.e. so it is never necessary to dig deep footings in winter/early spring, when the groundwater table is likely to be higher).
- 14.10.4 Sterile 'no build' zones will be required around the mine shaft in the northwest of site. The no-build zone should be derived by assuming a 45° line from the outer edge of the shaft cap at rockhead, running up to the finished ground level. However, given that the shaft is likely located within the woodland, it is likely that this will not significantly affect the proposed layout.
- 14.10.5 The orientation and depth of the E-W adit across the site is unknown due to ochreous mine water flushing out of adjacent surface water drainage systems. Therefore, there is a possibility that an area of c.3,400m² in the centre of site is underlain by the adit. Whilst the adit is currently believed to be dipping down towards the east, there is a remote possibility it dips up and may pose a slight risk to surface stability.

- 14.10.6 Further drilling of the adit would typically be recommended, with a programme of drilling and grouting works to follow if required. However, due to the presence of mine water, further works are likely to be unfeasible and pose a high risk of damaging adjacent properties, therefore reinforced foundations are likely to be a more suitable mitigation measure for any potential risks to surface stability at the site.
- 14.10.7 Ludhill Dyke flows west along the northern boundary of site and is culverted beneath the existing access road. It is understood the access road will require widening, and therefore Ludhill Dyke will need additional culverting.
- 14.10.8 Given the presence of the watercourse on site, it is recommended that a Silt and Surface Water Management Plan be developed prior to construction activities commencing.
- 14.10.9 Two areas of woodland are present along the northern and northwestern boundaries. It is understood that Tree Protection Orders are present for some areas of this woodland. Careful management will be required when undertaking de-vegetation works to create the access road.
- 14.10.10 Vivly Living will need to contact Network Rail to discuss the proposed development adjacent to the railway embankment and gabion retaining wall.
- 14.10.11 Shallow mineworkings have been encountered across an area of approximately 4,000m² in the centre of site. These will require drilling and grouting, however, due to anticipated earthworks, the area requiring drilling and grouting may need to be revised if the amount of cover above the workings will be reduced, or if it is considered more feasible to dig out the workings (if they are at <5m depth) with replacement using engineered fill.

15 SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

15.1 General

- 15.1.1 The site is located off Gynn Lane, approximately 4.7km south of Huddersfield town centre, and currently comprises a single parcel of grassed land used for grazing cattle. In the centre-north of site is a 2-storey stone built detached house with associated gardens and parking. Areas of woodland are present along the northern boundary.
- 15.1.2 It is understood Vivly Living are considering acquiring the site for redevelopment with approximately 50 houses with associated gardens, adoptable road and sewers and areas of POS.
- 15.1.3 Ground conditions typically comprise Topsoil over Granular or Cohesive Residual Soils. Bedrock was encountered in the majority of exploratory holes and comprised Sandstone in the east and west, with interbedded Sandstone and Mudstone in the centre of site. Excavation of the sandstone proved difficult with holes refusing after 0.5m in the west and 0.2m in the east.
- 15.1.4 A railway embankment and associated gabion retaining wall is present along the eastern boundary of the site. Two shallow pits excavated adjacent to the gabion wall revealed the wall is founded on a 0.5m gabion basket underlain by 0.2m to 0.4m of crushed stone.
- 15.1.5 Groundwater was not encountered in any trial pits, however, it was encountered between 10.3m and 21.0m within the probeholes drilling through sandstone bedrock.
- 15.1.6 Land rises to the east, with a typical gradient of 1 in 9, but up to 1 in 5 in the centre east. Significant earthworks will be required across the site to create level development platforms and provide suitable gradients for highways and gardens.

15.2 Mining

- 15.2.1 The majority of the site is located within a Coal Mining Development High Risk Area.
- 15.2.2 Shallow mineworkings associated with the Soft Bed coal have been encountered beneath an area of approximately 4,000m² in the centre of site. These will require treatment via drilling and grouting.
- 15.2.3 Two known adits run E-W and N-S across the site. The N-S adit appears to be linked to the shallow mineworkings and therefore both the adit and shallow mineworkings will require grouting. The E-W adit was found to contain ochreous mine water that flooded gardens upon drilling. Further drilling and remediation of this adit is likely to prove difficult, and therefore alternative mitigation measures will be required (i.e. reinforced foundations).
- 15.2.4 An area of c.400m² was stripped of topsoil and shallow subsoil in an attempt to locate a recorded mine entry in the northwest of site. To date, no mine entry has been encountered, and therefore it is likely the mine entry is located within the area of woodland, directly north of the search area.
- 15.2.5 Two panels (c.200m²) were stripped of topsoil and shallow subsoil to search for evidence of bell pitting down dip of the two coal seam outcrops. No evidence of bell pitting was encountered, and therefore whilst their existence cannot be entirely ruled out, it is unlikely they are present beneath the site.

15.3 Hazardous gas

- 15.3.1 The site is in an area where between 5% and 10% of homes are estimated to be above the radon action level and therefore basic radon protection measures are required.
- 15.3.2 The site is located within 250m of a historical 'refuse tip' and is underlain by shallow mining features (2 x adits, 1 x mine entry and shallow workings) and is therefore potentially at risk from migrating hazardous ground gas.
- 15.3.3 Consequently, gas monitoring wells have been installed at 6 locations and a period of gas monitoring is underway. A Hazardous Gas Risk Assessment will be issued upon completion of monitoring in February 2025.

15.4 Contamination & remediation

- 15.4.1 Topsoil is present across the site. Testing suggests that this material is chemically suitable for re-use.
- 15.4.2 It should be noted that no investigation has been undertaken on land within the vicinity of 34 Gynn Lane due to ongoing occupancy.

15.5 Foundations

- 15.5.1 Decisions regarding foundation design will be influenced by the measures taken to mitigate risks posed by shallow mineworkings and proposed earthworks.
- 15.5.2 At this stage, it is anticipated that new dwellings will be built on one of the following foundation types:
- **Strip footings:** plots constructed outside areas underlain by shallow mineworkings.
 - **Reinforced strip footings on engineered fill:** Plots built in areas where earthworks re-grade has taken place, or where engineered fill is required to backfill excavations to remove shallow mine workings. Engineered fill will need to be placed to an End Product Specification.

- **Reinforced strip footings:** Plots built following consolidation of shallow mineworkings where rock over above treated workings is between >5 x seam thickness and 10m will need to be reinforced with B385 mesh top and bottom. This can be reduced to one layer of B385 mesh where there is >10 m of rock cover and for plots potentially underlain by the E-W adit.
- **Raft foundations:** where rock cover above treated workings is <5 x seam thickness.

15.6 Flooding

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

15.7 Drainage

- 15.7.1 Due to the sites topography, 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 residual soils should provide a CBR value of at least 3%. This value should be verified prior to or during construction.

15.9 Further works

- 15.9.1 Given the constraints discussed in Section 7.2 (occupancy of 34 Gynn Lane) a simple post-demolition trial pit investigation will be required in the vicinity of the existing property and access road order to remove residual uncertainties with respect to ground.
- 15.9.2 If deep infrastructure is proposed rotary cored boreholes may be required to provide further information (spacing of bedding, fractures, strength etc).
- 15.9.3 If considered worthwhile, additional rotary openhole drilling could be undertaken to determine the location and depth of the E-W adit across the site, however, it should be noted that this may not prove beneficial and implementing mitigation measure (reinforced foundations) might prove to be a more economical and effective solution.
- 15.9.4 Preparation of a Silt and Surface Water Management Plan.
- 15.9.5 Preparation of a Drill & Grout Specification.
- 15.9.6 Preparation of an Earthworks Specification.
- 15.9.7 Gas monitoring is underway. A risk assessment will be issued upon completion in February 2025.

Appendix A
General Notes

General

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

Geology, mining & quarrying

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

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

Landfills

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

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

Radon

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

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

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

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

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

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

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

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

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

Hydrogeology

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

- Groundwater quality
- Recorded pollution incidents
- Licensed groundwater abstractions

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

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

The maps display the following aquifer designations:

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

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

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

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

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

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

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

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

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

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

Hydrology

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

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

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

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

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

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

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

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

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

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

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

COMAH & explosive sites

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

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

Preliminary conceptual site model

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

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

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

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

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

General

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

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

Exploratory hole locations

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

Investigation techniques

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

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

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

In-situ testing

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

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

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

Sampling

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

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

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

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

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

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

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

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

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

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

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

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

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

Groundwater

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

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

Description of strata

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

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

General

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

- Atterberg limits & moisture contents
- Soluble sulphate & pH

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

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

- Grading
- Compaction tests
- Particle density

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

Atterberg limits & moisture content

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

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

$$I_p = I_p * (\% < 425\mu\text{m} / 100)$$

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

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

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

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

Soluble sulphate and pH

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

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

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

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

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

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

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

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

Oedometer (Consolidation) tests

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

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

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

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

Triaxial tests

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

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

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

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

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

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

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

Determination of analytical suite

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

Common contaminants

Common **Inorganic** Contaminants include:

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

With respect to the terminology used by most analytical laboratories:

Total cyanide = Free cyanide + Complex cyanide

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Methods of analysis (organic compounds)

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

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

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

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

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

Current UK guidance

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

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

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

Soil screening values used by Lithos

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

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

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

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

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

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

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

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

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

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

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

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

04 - Contamination analysis & interpretation (including WAC)

Generic notes – geoenvironmental investigations



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

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

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

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

Inorganic Tier 1 values for scenarios A to E

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

Organic Tier 1 values for scenarios A to E

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

* For a residential end use

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

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

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

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

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

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

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

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

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

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

Statistical Assessment

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

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

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

Current guidance requires that:

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

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

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

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

However, broadly speaking the following applies:

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

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

Other screening values used by Lithos

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

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

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

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

With respect to the interpretation of the **calorific values**, at present there are no accepted methods to assess whether a sample is combustible and under what circumstances it might smoulder. Some guidance is given in 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 always site specific and compare leachate or groundwater concentrations with the appropriate water quality standard based on the CSM and consideration of relevant water quality impacts and assessments.

Waste classification & WAC

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

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

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

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

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

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

Possible action in event of Tier 1 exceedance

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

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

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

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

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

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

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

General

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

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

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

Sources

Potential sources of hazardous gas include:

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

Generation

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

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

Migration

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

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

Gas monitoring procedure

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

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

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

Current guidance

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

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

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

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

Other relevant UK guidance includes:

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

A – All developments except low rise housing

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

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

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

B – Low rise housing.

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

Table 8.7 NHBC Traffic light system for 150 mm void

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

Notes:

1. 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.
2. 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.
3. A leak of gas from the sub-floor void into a small room (e.g. downstairs toilet with soil pipe potentially passing into sub-floor void) of dimensions 1.50m x 1.50m x 2.50m, with a total room volume of 5.63m³ has been considered.
4. 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.
5. 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.
6. 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

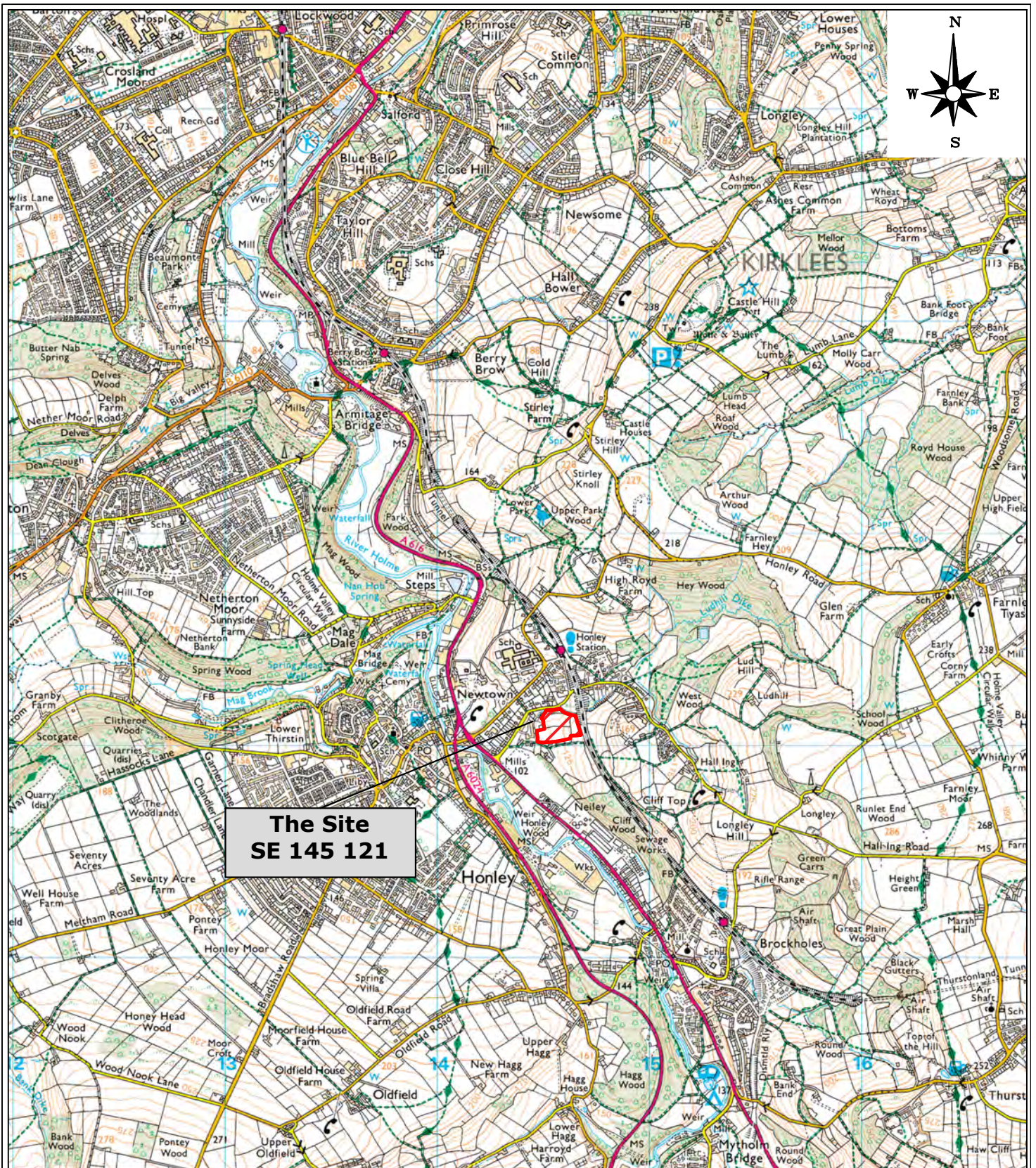
ⁱⁱ CIRIA (2007) – Assessing risks posed by hazardous ground gases to buildings.

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 145 121**

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CLIENT

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JOB TITLE

GYNN LANE,
HONLEY

DRAWING TITLE

SITE LOCATION
PLAN

DRAWN

CC

23 05 2024

CHECKED

AG

23 05 2024

STATUS

FOR COMMENT

DRAFT

FOR APPROVAL

FINAL

SCALE

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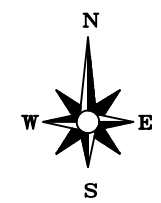
SHEET

A4

DRAWING NO.

4749/1

REVISION



NOTES

— APPROXIMATE SITE BOUNDARY

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JOB TITLE

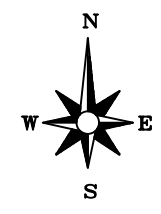
GYNN LANE, HONLEY

DRAWING TITLE

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NOTES

- WOODLAND/DENSE OVERGROWTH
- GRASS AREAS
- BUILDING
- UN-MADE GROUND
- WALL
- CONCRETE HARDSTAND
- GABION RETAINING WALL
- SURFACE WATER
- APPROXIMATE SITE BOUNDARY
- SLOPE

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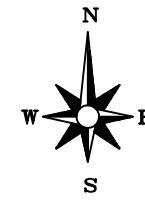
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DRAWING TITLE

SITE FEATURES

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				REVISION	



NOTES

- WOODLAND/DENSE OVERGROWTH
- GRASS AREAS
- BUILDING
- UN-MADE GROUND
- WALL
- CONCRETE HARDSTAND
- GABION RETAINING WALL
- SURFACE WATER
- APPROXIMATE SITE BOUNDARY
- LOCATION & ORIENTATION OF PHOTOGRAPH
- SLOPE

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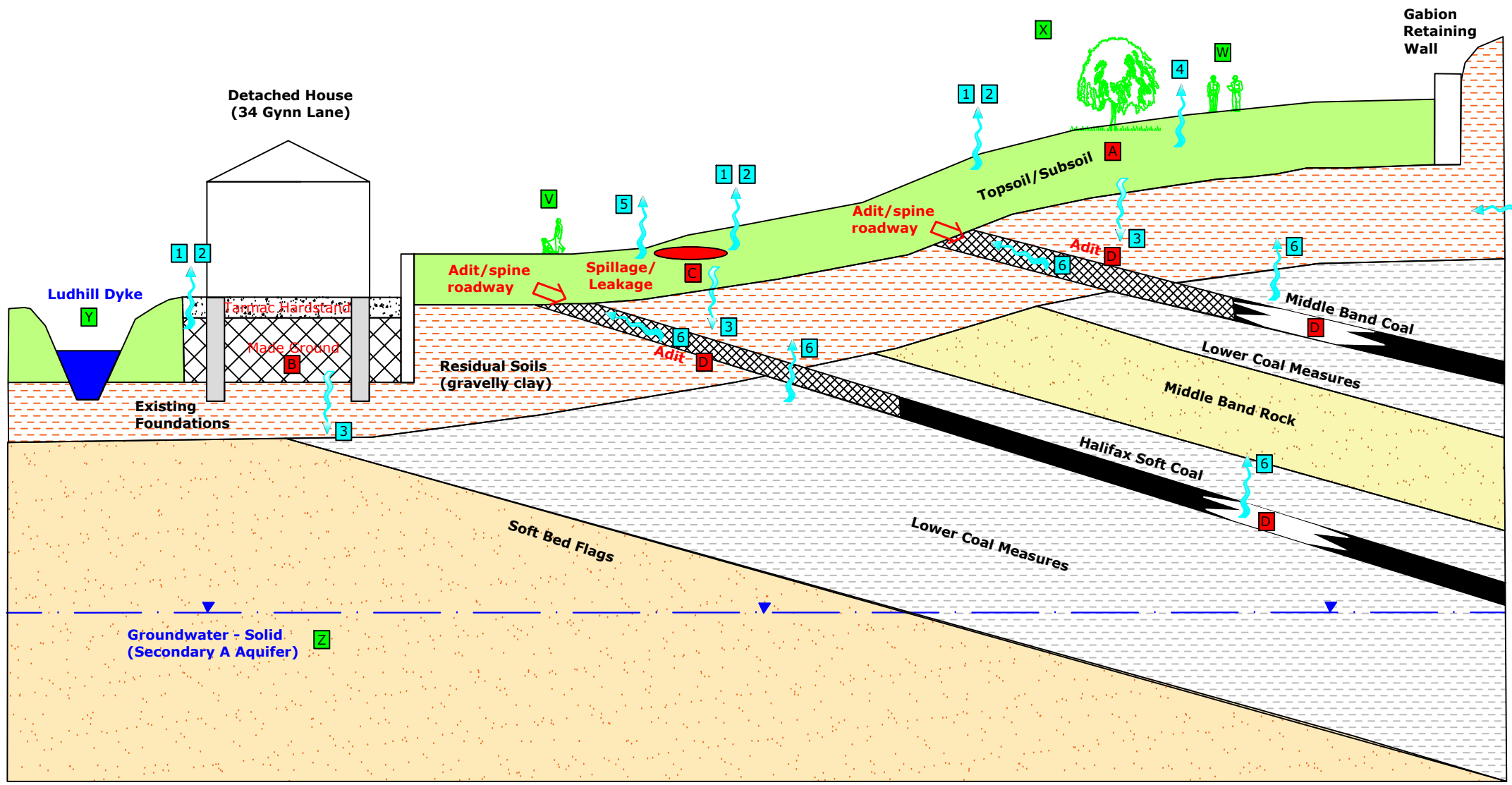
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SITE PHOTOGRAPHS

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SOURCES	
A	REWORKED TOPSOIL (INORGANICS)
B	MADE GROUND (INORGANICS)
C	LEAKAGE/SPILLAGE (ORGANICS)
D	MINEWORKINGS/ADITS (HAZARDOUS GAS)

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

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

NOTES

REV.	DESCRIPTION	DATE



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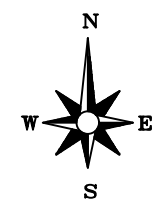
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				REVISION	



- NOTES
-  TRIAL PIT
 -  TRIAL TRENCH
 -  TOPSOIL STRIP/SHAFT SEARCH
 -  PROBEHOLE
 -  APPROXIMATE SITE BOUNDARY
- EXPLORATORY HOLE LOCATIONS HAVE BEEN SURVEYED IN (COORDINATES & GROUND LEVEL) ON COMPLETION

REV.	DESCRIPTION	DATE



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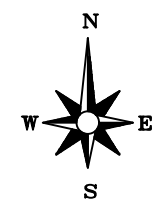
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- NOTES
-  TRIAL PIT
 -  TRIAL TRENCH
 -  TOPSOIL STRIP/SHAFT SEARCH
 -  PROBEHOLE
 -  APPROXIMATE SITE BOUNDARY
- EXPLORATORY HOLE LOCATIONS HAVE BEEN SURVEYED IN (COORDINATES & GROUND LEVEL) ON COMPLETION

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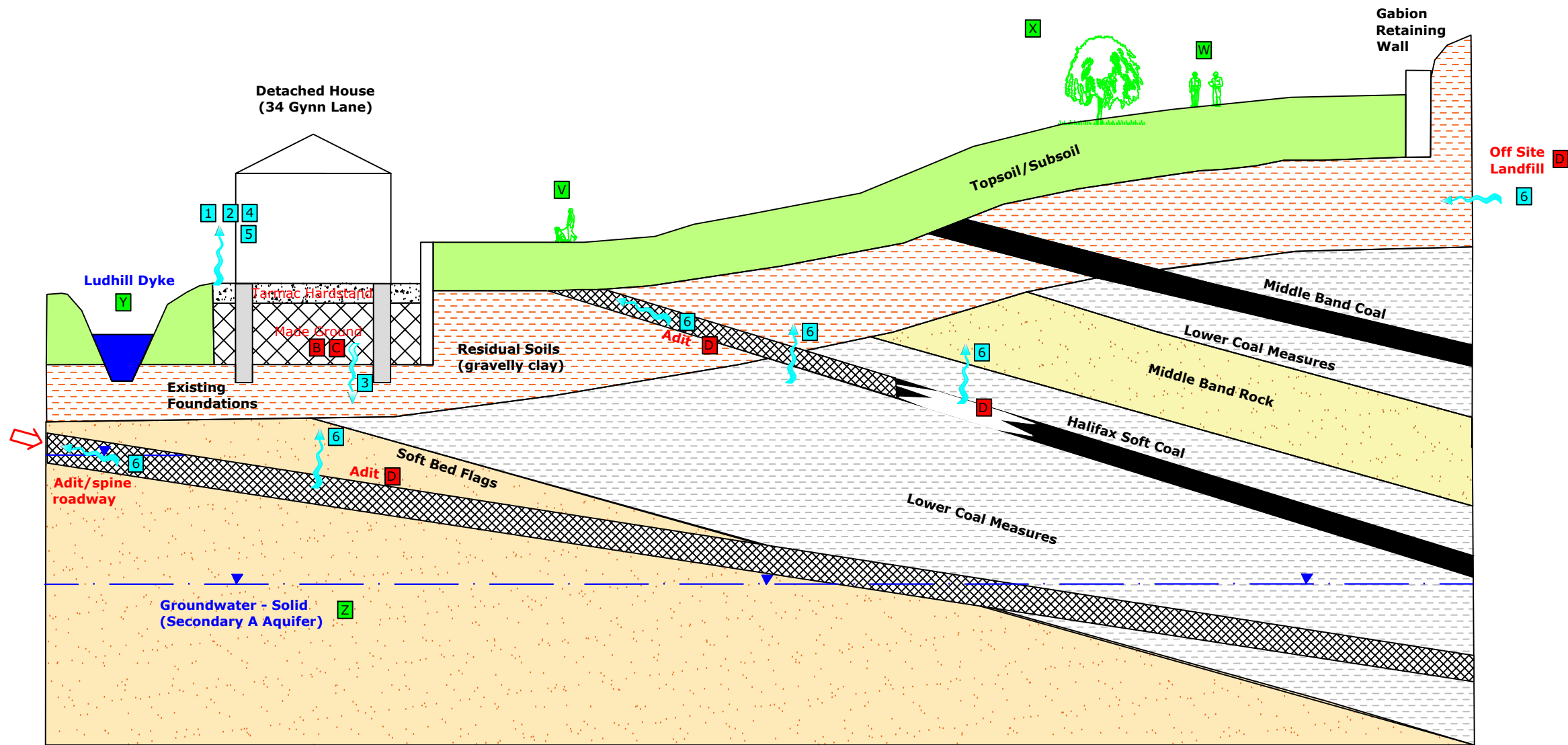
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SOURCES	
B	MADE GROUND (INORGANICS)
C	LEAKAGE/SPILLAGE (ORGANICS)
D	MINERWORKINGS/ADITS (HAZARDOUS GAS)

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

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

NOTES		
REV.	DESCRIPTION	DATE



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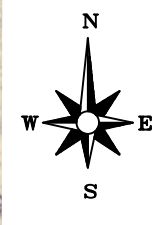
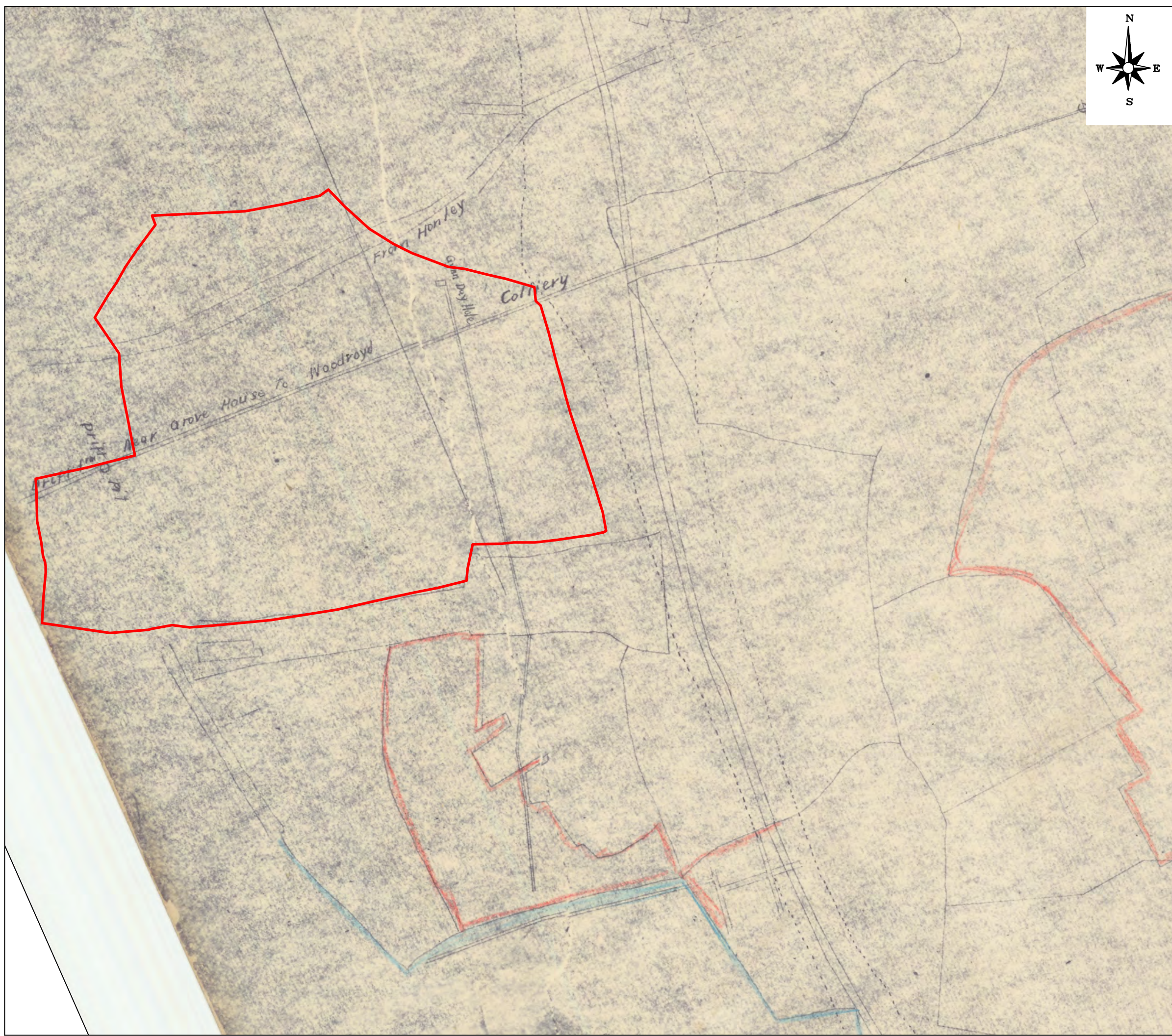
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JOB TITLE
GYNN LANE, HONLEY

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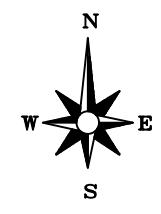
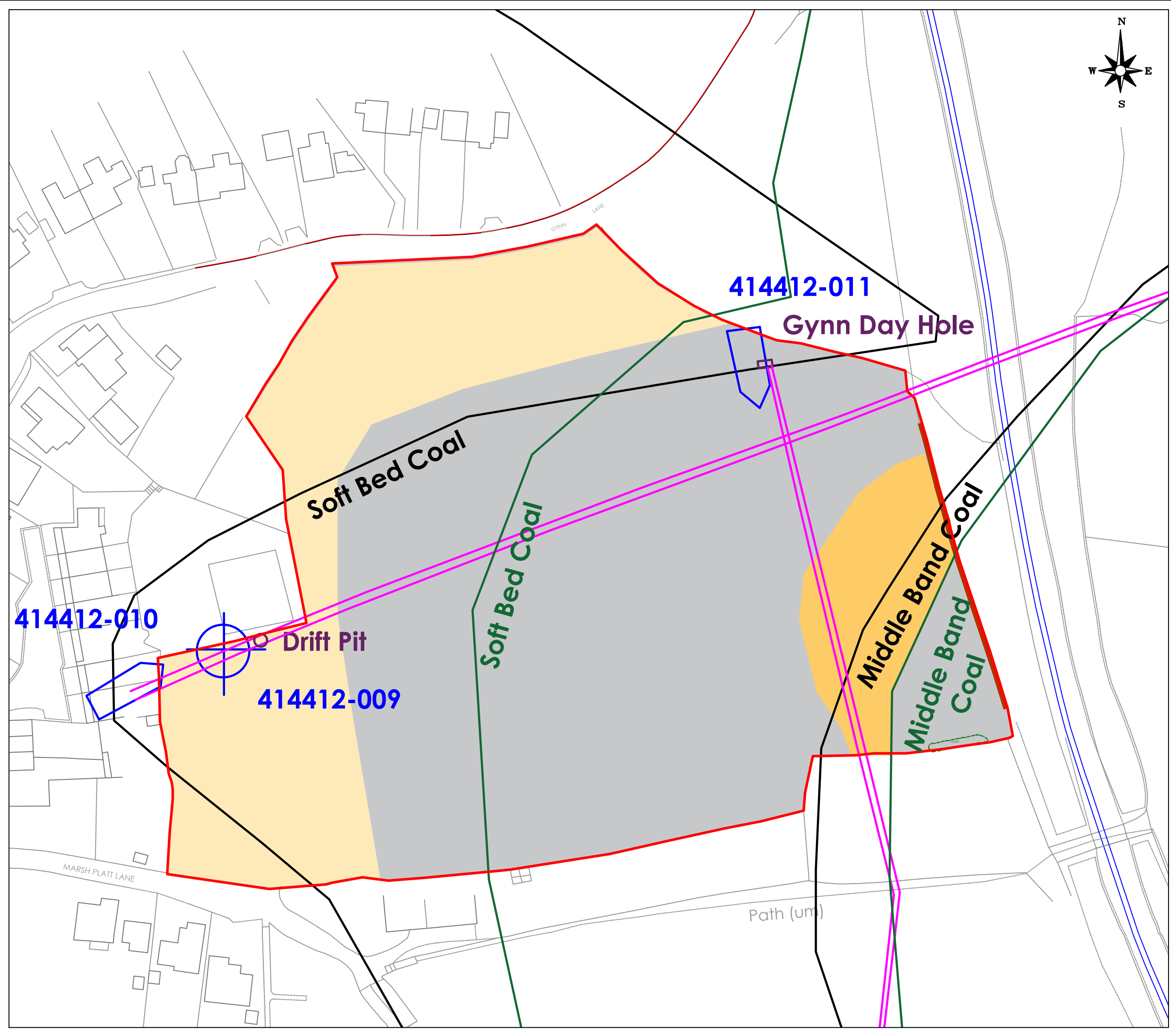
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CA ABANDONMENT PLAN M185
1 OF 2

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- NOTES
- LOWER COAL MEASURES
 - SOFT BED FLAGS (SANDSTONE)
 - MIDDLE BAND ROCK (SANDSTONE)
 - ADIT (TAKEN FROM ABANDONMENT PLAN)
 - ADIT (TAKEN FROM CA MINING REPORT)
 - ROADWAY (TAKEN FROM ABANDONMENT PLAN)
 - COAL OUTCROP (TAKEN FROM CA REPORT)
 - COAL OUTCROP (TAKEN FROM BGS MAP)
 - APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE



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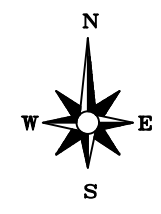
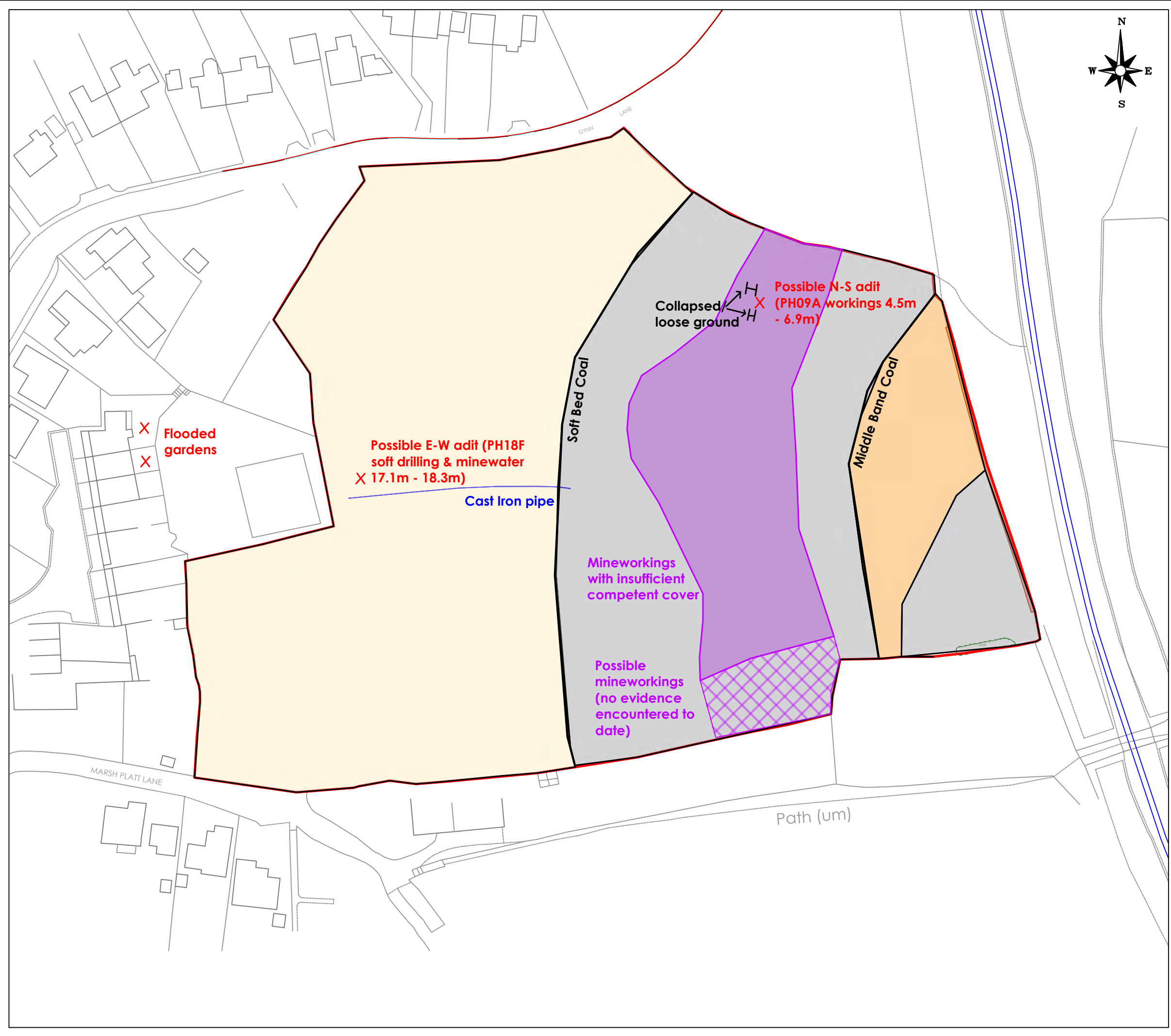
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GYNN LANE, HONLEY

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- NOTES
- LOWER COAL MEASURES
 - SOFT BED FLAGS (SANDSTONE)
 - MIDDLE BAND ROCK (SANDSTONE)
 - WORKINGS REQUIRING GROUTING
 - AREA OF POSSIBLE WORKINGS
 - COAL OUTCROP
 - APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE



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JOB TITLE
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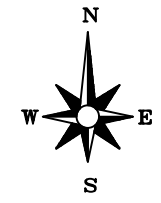
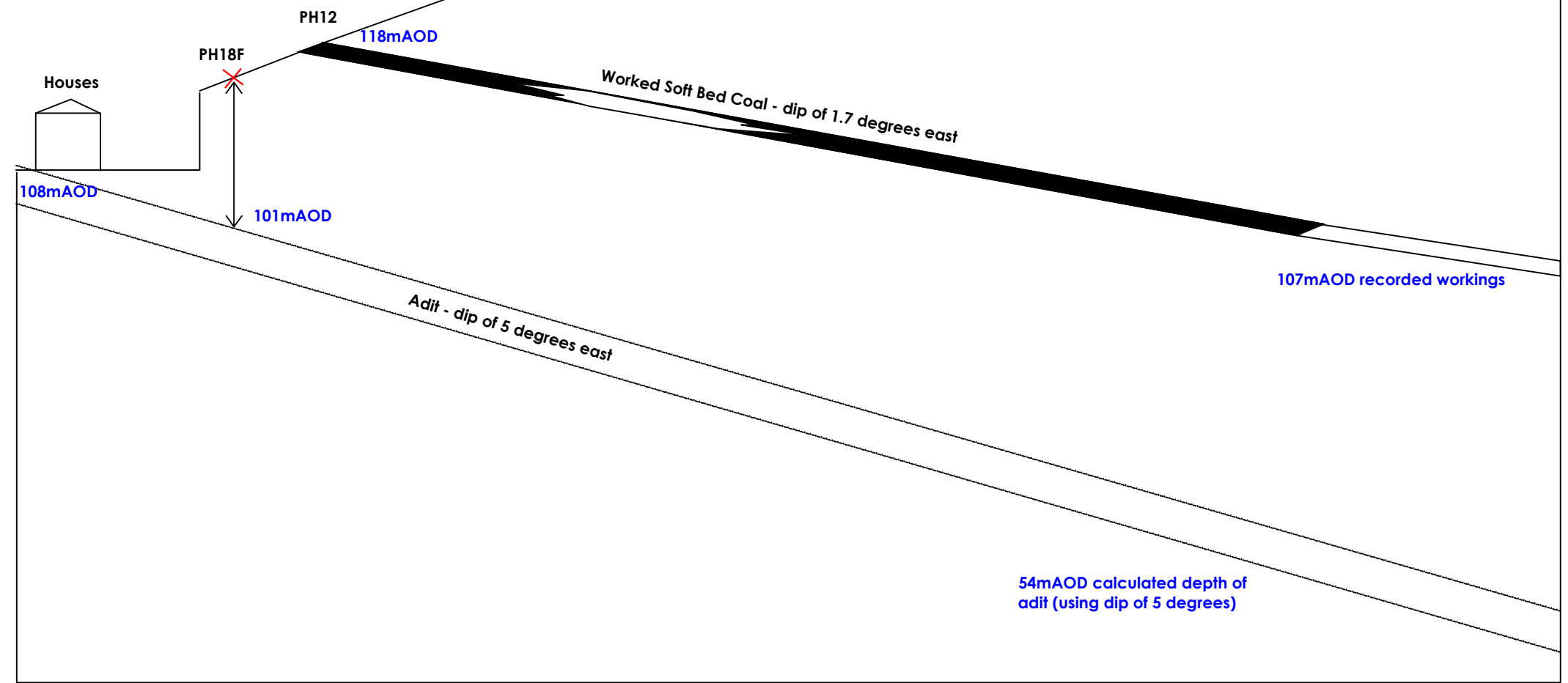
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WEST

EAST



NOTES

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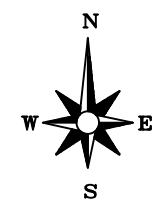
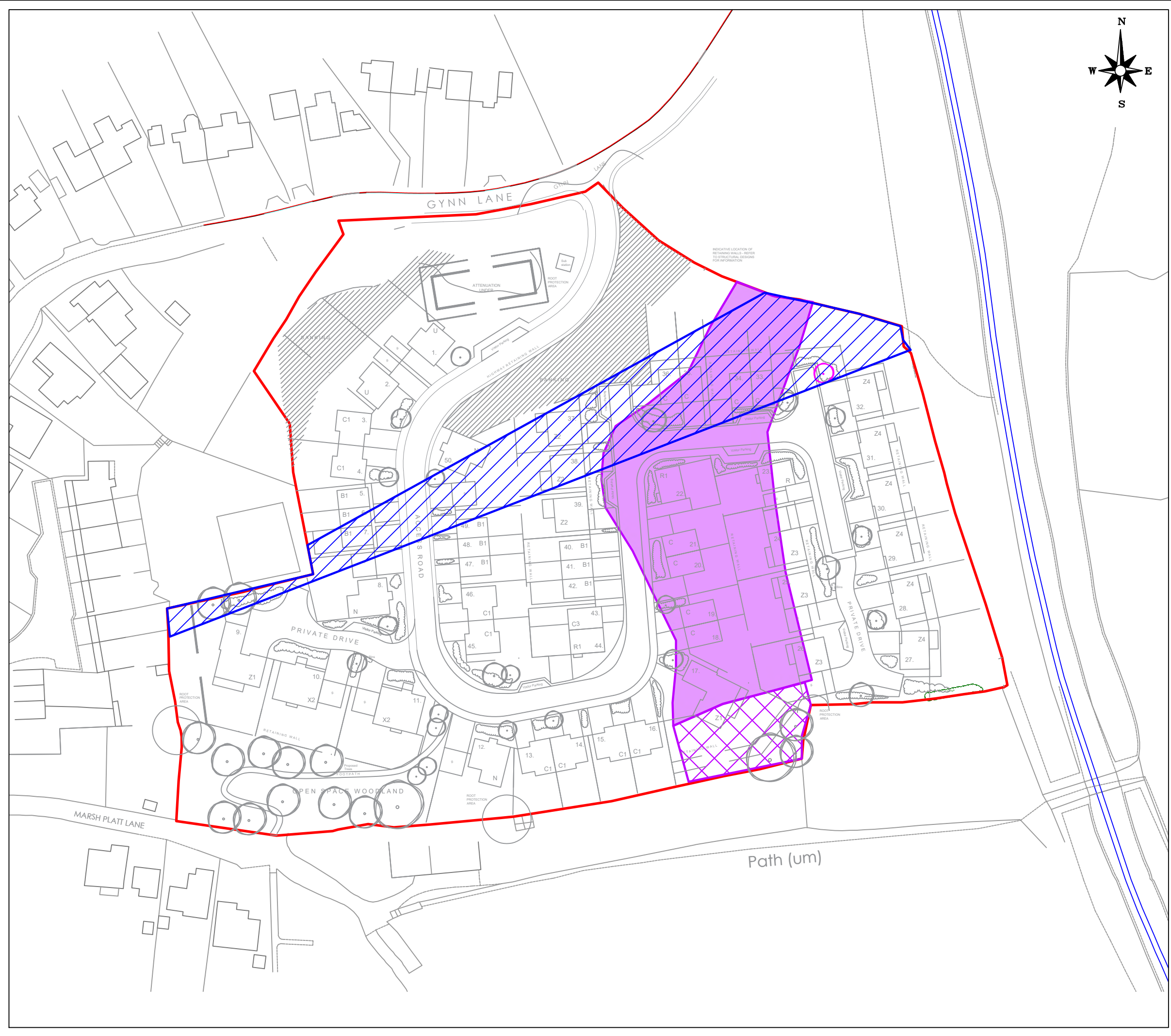
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JOB TITLE
 GYNN LANE,
 HONLEY

DRAWING TITLE
 E-W ADIT SKETCH

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SCALE NOT TO SCALE	SHEET A3	DRAWING NO. 4749/11	REVISION
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- NOTES
- POSSIBLE AREA UNDERLAIN BY E-W ADIT
 - WORKINGS REQUIRING GROUTING
 - AREA OF POSSIBLE WORKINGS
 - APPROXIMATE SITE BOUNDARY

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HONLEY

DRAWING TITLE

MINING FEATURES REQUIRING
MITIGATION/REMEDIATION

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Appendix C
Commission

009/4749/AG/cc

17th June 2024



Registered in England 07068066

Parkhill
Wetherby
West Yorkshire
LS22 5DZ

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Mr O Bottomley
Yorkshire Countryside Properties
Tandem Industrial Estate
Wakefield Road
Huddersfield
HD5 0AL

Dear Oliver

Gynn Lane, Honley

Further to your recent invitation, please find attached our proposal for undertaking a site investigation on the above land. We understand that proposed development will include traditional 2 storey domestic dwellings with associated gardens, POS and adoptable roads and sewers; a layout showing 50 units has been provided.

The site consists of a single parcel of land c. 2.7ha in size used for grazing cattle. In the centre-north of site is a 2-storey stone built detached house and associated gardens and parking. Areas of woodland are present along the northern boundary.

As you know we have already issued a Desk Study report (Ref. 4749/1, dated June 2024), key findings of which were that the site:

- Has remained essentially undeveloped throughout its history. However, the surrounding area was associated with the coal mining industry, with records of 4 adits and 1 mine entry within 100m of the site (of which, 1 mine entry and 2 adits are recorded on-site).
- Lies within a Coal Authority Development High Risk Area due to the likely presence of unrecorded shallow mineworkings associated with outcrops of the Halifax Soft and Middle Band coal seams on site.
- May be affected by source of hazardous gas due to the presence of unrecorded shallow mineworkings and a possible unrecorded landfill c.115m northeast.
- Has slopes of 1 in 5 in the east and west of site, in addition to an overall slope of 1 in 9 across the site. Retaining walls are also present along the eastern and southwestern boundaries, in addition to a retaining wall along the garden of 34 Gynn Lane.

Examination of the relevant geological map suggests the site is underlain by Soft Bed Flags (sandstone) in the west, Pennine Lower Coal Measures in the centre-east and Middle Band Rock (sandstone) in the far east.

The scope of works outlined in this letter should enable us to assess abnormal development issues, associated with the 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.

Redevelopment of this site will almost certainly be subject to planning conditions relating to ground investigation, remediation and validation. Recent experience suggests that a single phase of ground investigation may not be sufficient to obtain regulatory approval and enable discharge of all relevant planning conditions. Nonetheless, useful data can be obtained at this time and we will certainly aim to resolve as much uncertainty relating to ground as possible.



Our site investigation will be undertaken in accordance with UK good practice (as outlined in BS5930, BS10175, LCRM 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: Information from Lithos' Desk Study Report 4749/1, issued in June 2024 will be incorporated into the front-end of the Site Investigation Report.

Fieldwork: We have allowed for 3 day's trial pitting, 1 day trial trenching, 2 day topsoil strip and the drilling of about 18 rotary probeholes to check for the presence of mineworkings. All trial pits and boreholes will be supervised and logged by an experienced geoenvironmental engineer.

Trial pitting will enable us to determine the:

- Nature of any made ground, including:
 - visual/olfactory evidence of potential contamination and the proportion of undesirable elements e.g. biodegradable matter, relict foundations etc
 - the proportion of "oversize", boulder-sized material
- Nature, distribution and thickness of shallow soils
- Suitability of the ground for founding structures and highways
- Suitability of the ground for retaining walls
- Nature of the base of the existing gabion wall supporting the railway embankment along the eastern boundary

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 trial 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 etc.

If the pitting encounters significant thicknesses of made ground or very soft/loose deposits (neither considered likely), boreholes may be required to obtain geotechnical data from greater depth. We will advise you of any need for boreholes within 2 days of completion of the pitting.

Mine entry search: CA conjectured positions will be set-out by survey prior to commencement.

Given the expected absence of significant made ground in the vicinity of the mine entries, the search will be conducted by stripping of topsoil, and a nominal 300mm of subsoils working in panels about 4m wide and 20m to 40m in length. We will search a minimum radius of 25m from the CA's conjectured position.

Prior to backfilling of the first trench, each of the four corners of the excavation will be clearly marked with a peg/flag, to ensure the extent of excavation is not confused with areas where arisings have been temporarily stockpiled.

Once satisfied that a mine entry does not lie within a particular panel, Lithos will instruct the excavator operator to backfill the panel with arisings from an adjacent panel. Further panels will be excavated until the mine entry has either: (a) been located; or (b) been confirmed absent following strip and inspection of the exposed subsoil within a minimum 25m radius of the plotted location.

If located, photographs will be taken, and the mine entry's location will be taped in from three salient points, the position will be marked on the surface to allow subsequent surveying. We will also recover samples of any backfill for sulphate analysis to assist with specification of the anticipated concrete cap.

However, it is impossible to say how long it will take to find each mine entry, although we should be able to search an area within 25m of the CA's plotted position within 3 days. Consequently, a day rate of £**** should be allowed for the shaft search (day 1 is included in Item B).

A **topsoil strip** will be undertaken in 10m x 10m panels parallel to the coal seam outcrops (down dip of the coal seam) to determine the presence of bell pits across the site. This will be undertaken after trial pitting, once the location of the outcrops has been identified. It is likely that one 10m x 10m panel will be completed in a day, with two days allowed for in Item B.

Based on topography, **soakaways** are considered unlikely to provide a satisfactory solution for surface water drainage, and therefore no allowance has been made for soakaway testing at this stage. If required, or considered feasible based on the ground actually encountered, soakaway

The site is located within a Coal Authority High Risk Development Area due to the likely presence of unrecorded shallow workings within the Halifax Soft and Middle Band coal seams that outcrop on site. Furthermore 1 mine entry and two adits are recorded on site. Consequently, we have allowed for the drilling of 18 **rotary probeholes** to check whether old mineworkings are present and pose a significant risk to surface stability of the site. This number of boreholes allows for:

- 8 probeholes to determine the presence of shallow workings within the Halifax Soft Bed coal
- 4 probeholes to determine the presence of shallow workings in the Middle Band coal
- 3 probeholes along the line of each adit/roadway (6 in total)

If a potential risk is perceived to exist, further probeholes may be required to delineate the extent of workings in order to obtain fixed price quotations for the necessary consolidation works. Furthermore, we have assumed that it will be possible to advance the probeholes within 6 days but there is a chance that it may take longer in which case we will inform you before leaving site, and seek your further instruction. Each day of additional drilling would cost £**** (inclusive of supervision) provided it were instructed whilst the drilling rig was still on site.

It will be necessary to submit an application (with the associated fee) to the Coal Authority (CA) for 'Permission to enter CA mining interests'; and we have allowed for this. You should note that the CA have updated the application process and as of 4th October 2021, developers (clients) must submit a signed copy of the **CA's T&Cs** (copy enclosed) before the CA will commence work on permit issue which can take up to 4 weeks. Lithos can perform the role of Agent.

Given the proximity of surrounding housing (within 50m of much of the general site area), and in accordance with CA requirements we have had to assume that around half of the probeholes will need to be advanced using water as the flushing medium (as reinforced by recent CA guidance on managing the risk of hazardous gas). Our drilling sub-contractor will need to locate the wash outs close to the site, and procure a standpipe and licence from Yorkshire Water.

With reference to the control, management and disposal of surplus water and flush arising from the works, (and in order to avoid additional costs associated with the provision of a telehandler to transfer a weir tank between boreholes, and the provision of a pump to transfer surplus water from the weir tank to an approved disposal point), we have made provision for a sand bag bund at the foot of the drilling mast, at each borehole to contain the majority of the drill cuttings. However, we have assumed that potentially discoloured surplus water will be allowed to flow and settle into the field.

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

Given the likely presence of shallow mineworkings and an unrecorded landfill c.115m northeast, we have allowed for the installation of wells in 6 holes and monitoring for hazardous **gas** (and any shallow groundwater).

The generation potential of this gas source is considered likely to be Moderate. Therefore, in accordance with CIRIA Report C665, we have initially allowed for 12 visits over a 6-month period. A hazardous gas risk assessment will be issued on completion of monitoring.

We strongly recommend that groundwater / gas wells be decommissioned after monitoring has been completed. Decommissioning involves removal of the metal covers, unscrewing the upper 1m to 2 m of pipework and filling the void / remaining well with bentonite.

Decommissioning of monitoring wells removes the potential for groundwater pollution caused by accidental spillages during the construction phase and prevents gas migration into sub-floor voids. Subject to your instruction, we will decommission accessible wells after the last monitoring visit for an E\O price of £**** +VAT. We will contact you to seek instruction following issue of our gas risk assessment / groundwater dip results.

Testing: This will comprise routine **geotechnical** soils analysis, including 10 moisture content & Atterberg limits, and 10 pH & water-soluble sulphate. We will also schedule 5 compaction tests and 5 gradings on samples of natural ground to assess suitability for use in earthworks ground improvement.

This site is essentially greenfield and therefore we could obtain in-situ CBR values from plate tests on site. However, at this stage, we will simply estimate CBR values from strata descriptions and classification test results.

At this stage, we have no reason to expect wide areas of the site to be underlain by significant thicknesses of made ground. Consequently, we have only allowed for **contaminant** testing of up to 6 made ground samples, plus a further 10 samples of topsoil to confirm its suitability for re-use. The test suite will include heavy metals, speciated PAH, and banded TPH (with supplementary speciation as/where appropriate).

If more significant made ground is encountered, we will inform you immediately and provide costs for the recommended chemical testing.

Within in our proposal we have allowed for the screening (ID) of 16 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.

Visible contaminants, sharps and the clay/sand/silt content of 4 topsoil samples will be determined to check compliance with BS3882 requirements.

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, factual and interpretative report will be issued. This will contain exploratory hole logs, 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.

At the time of writing, fieldwork could be commenced within 4 weeks of receipt of your written instruction to proceed (CA permit takes 4 weeks). 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.

This report will include a **mining risk assessment** in accordance with Coal Authority guidance.

A completed copy of the **HBF** Contaminated Land Assessment Form will be included in an Appendix to our Report. However, the proposed route(s), and total length, of water supply pipes are not currently known and no allowance has been made for laboratory testing of soil samples in line with UKWIR guidance.

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 (includes 1 day shaft search & 2 days topsoil strip for bell pits). 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. Revision of the costings provided may be required if works are not instructed within **3 months** of the date this proposal was issued.

Our proposal allows for submission of a single piece of correspondence with NHBC and/or the local authority to address any queries they may have. Any further meetings, correspondence etc, would be chargeable.

We will submit invoices for this project on completion of each Item(s) instructed.

Please note if following instruction of the works outlined in this proposal, it is necessary to subsequently **postpone or cancel**, this should be done at least 3 working days before Lithos are due to commence intrusive investigation on site. We reserve the right to charge a cancellation fee in the event of later notification to cover plant / drill rig costs and abortive consultancy time. The cancellation fee will not exceed **£****** plus VAT.

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 last for at least 12 working days and therefore this proposal includes for provision of a Welfare Unit, with the benefit of full canteen facilities, hot water with full size sink, toilet and drying room.

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.

If no other designers or contractors have been appointed, Lithos could perform the role of Principal Contractor but only for the duration of the site investigation outlined in this proposal. If you require us to perform the role of Principal Contractor, please make this clear in your instruction. It should be

noted that we are not suitably qualified to perform this role where other designers or contractors are also appointed.

Whilst it is anticipated that the site investigation outlined in this proposal will be undertaken several months before any development is commenced, our works may be considered to constitute part of 'the construction works' and consequently you may need to notify the HSE that works which involve breaking ground are being commissioned. It would be appreciated if you could forward a copy of the **F10** prior to commencement of investigation fieldwork.

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

REDACTED

Adam Gombocz
Director
for and on behalf of
LITHOS CONSULTING LIMITED

1 DEFINITIONS AND INTERPRETATION

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

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

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

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

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

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

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

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

- 1.2 Words importing the singular only shall also include the plural and vice versa, where the context requires.
- 1.3 Words importing persons or parties shall include firms, corporations and any organisation having legal capacity and vice versa, where the context requires; and words importing a particular gender include all genders.
- 1.4 The sub-headings to the clauses of these Terms are for convenience only and shall not affect the construction of the Agreement.
- 1.5 A reference to legislation includes that legislation as from time to time amended, re-enacted or substituted and any Orders in Council, orders, rules, regulations, schemes, warrants, by-laws, directives or codes of practice issued under any such legislation.
- 1.6 In the event of conflict between the documents forming part of the Agreement, the Proposal shall prevail, followed by the Terms.

2 APPOINTMENT

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

3 OUR OBLIGATIONS

- 3.1 We shall perform the Services using the reasonable standard of skill and care normally exercised by qualified members of our profession, performing similar services under similar conditions.
- 3.2 We shall use all reasonable endeavours to perform the Services in accordance with relevant environmental and safety legislation.

4 YOUR OBLIGATIONS

- 4.1 Throughout the period of this Agreement you shall afford to us, or procure for our benefit, access to any site where access is required for the performance of the Services.
- 4.2 You accept responsibility for ensuring that we are notified in writing of all special site and/or plant conditions, including without prejudice to the generality of the foregoing, the existence and precise location of all underground services, cables, pipes, drains or underground buildings, constructions or any hazards, which you shall clearly mark on the ground or identify on accurate location plans supplied to us prior to the commencement of the Services. You shall also inform us in writing of any relevant operating procedures including any site safe operating procedures and any other regulations relevant to the carrying out of the Services. You shall indemnify us against all costs, losses, claims, demands and expenses arising as a result of any non-disclosure in this respect, including but not limited to indemnification against any action brought by the owner of the land or otherwise.
- 4.3 If you discover any conflict, defect or other fault in the information or designs provided by us pursuant to the Agreement, you will advise us in writing of such defect, conflict or other fault and we shall have the right to rectify the same or where necessary, to design the solution for rectification of any works carried out by others pursuant to the conflicting, defective or in any other way faulty information or designs.

5 COPYRIGHT

- 5.1 The copyright in all Intellectual Property prepared by or on behalf of us in connection with the Project for delivery to you shall remain vested in us.
- 5.2 You shall have a non-exclusive licence to copy and use such Intellectual Property for purposes directly related to the Project. Such licence shall enable you to copy and use the Intellectual Property but solely for your own purposes in connection with the Project and such use shall not include any licence to reproduce any conceptual designs or professional opinions contained therein nor shall it include any licence to amend any drawing, design or other Intellectual Property produced by us.
- 5.3 Should you wish to use such Intellectual Property in connection with any other works or for any other purpose not directly related to the Project or wish to pass any Intellectual Property to any third party, you must obtain our prior written consent. The giving of such consent shall be at our absolute discretion and shall be upon such terms as we may require. We shall not be liable to you for the use by any person of such Intellectual Property for any purpose other than that for which the same were prepared by or on our behalf.
- 5.4 Ownership of any proposals submitted to you that are not subsequently confirmed as part of the Services to be provided for you remain with us and such proposals must not be used as the basis for any future work undertaken by you or a third party and no liability can be accepted howsoever arising from such proposals.
- 5.5 In the event of you being in default of payment of any fees or other amounts due, we may suspend further use of the licence on giving no less than 2 calendar days' notice of the intention to do so. Use of the licence may be resumed on receipt of the outstanding amounts.

6 CONFIDENTIALITY

- 6.1 Neither you nor we shall at any time disclose to any person any confidential information concerning the business, affairs, customers, clients or suppliers of the other party or of any member of the group of companies to which the other party belongs, except as permitted by clauses 6.2 and 6.4.
- 6.2 Each party may disclose the other party's confidential information:
- (a) to its employees, officers, representatives, contractors, sub-contractors or advisers who need to know such information for the purposes of exercising the party's rights or carrying out its obligations under or in connection with this Agreement. Each party shall ensure that its employees, officers, representatives, contractors, sub-contractors or advisers to whom it discloses the other party's confidential information comply with this paragraph 6; and
- (b) as may be required by law, to a court of competent jurisdiction or any governmental or regulatory authority.
- 6.3 Neither you nor we shall use any other party's confidential information for any purpose other than to exercise our rights or perform our respective obligations under or in connection with this Agreement.
- 6.4 Subject to the above and our privacy policy which can be found on www.lithos.co.uk, we shall be permitted to use information related to the Services we provide in connection with the Project for the purposes of marketing its services and in proposals for work of a similar type.

7 ASSIGNMENT

- 7.1 You may assign the benefit of this Agreement on two occasions with our prior written consent (not to be unreasonably withheld) and any additional assignments shall be with our prior consent.
- 7.2 We may at any time assign, mortgage, charge, subcontract, delegate, declare a trust over or deal in any other manner with any or all of our rights and obligations under this Agreement.

8 INSURANCE

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

9 PAYMENT

- 9.1 Invoices for services rendered will be submitted for payment in accordance with the Proposal.
- 9.2 You shall pay you any VAT properly chargeable on the Services and any amount expressed as payable to us under this Agreement is exclusive of VAT unless stated otherwise.
- 9.3 The due date for payment is the date of the invoice and the final date for payment is 28 days from the date of the invoice.
- 9.4 If you dispute the amount included for payment in an invoice then you must serve a written notice on us no later than 14 calendar days before the final date for payment. If no notice is given within the required timeframe the amount due shall be the amount stated in the invoice.
- 9.5 If you fail to pay any monies in accordance with the foregoing payment provisions, we shall be entitled to charge interest on any monies owed to us, such interest to be at a rate of 4% above the base rate of a clearing bank from time to time calculated from the final date for payment to the date of actual payment on a compound basis. The parties acknowledge that our liability under this clause 10.5 is a substantial remedy for the purposes of section 9(1) of the Late Payment of Commercial Debts (Interest) Act 1998.

10 LIMITATIONS ON LIABILITY

- 10.1 Unless otherwise agreed in writing, our total liability under or in connection with this Agreement whether in contract, tort, negligence, breach of statutory duty or otherwise (other than in respect of personal injury or death) shall be limited to and shall not exceed the lesser of either the level of insurance cover referred to within clause 8.1 above, or 20 times the total value of invoices issued to you for the Services.
- 10.2 No action or proceedings under or in respect of the Agreement whether in contract, tort, negligence, under statute or otherwise shall be commenced against us after the expiry of a period of six years from the date of the completion (or termination) of the Services under this Agreement.
- 10.3 Whilst we usually scan for potential exploratory locations with a Cable Avoidance Tool, we shall not be liable for any damage to underground services, cables, pipes, drains or underground buildings, constructions and the like which were either not marked on site or for which accurate plans were not provided.
- 10.4 We shall not be liable for the cost of rectifying any defect, conflict or other fault in the information or designs provided by us or for the cost of designing a solution for and rectifying any subsequent works carried out by others pursuant to the conflicting, defective or in any other way faulty information or designs, unless we have been advised in writing of the same by you and have been given the opportunity to rectify the same or where necessary, to design the solution for rectification of any subsequent works carried out by others pursuant to the same.

11 DELAY

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

12 TERMINATION

- 12.1 The Agreement may be terminated by either of us in the event of the other making a composition or arrangement with its creditors, becoming bankrupt, or being a company, making a proposal for a voluntary arrangement for a composition of debts, or has a provisional liquidator appointed, or has a winding-up order made, or passes a resolution for voluntary winding-up (except for the purposes of a bona fide scheme of amalgamation or reconstruction), or has an administrator or an administrative receiver appointed to the whole or any part of its assets. Notice of termination must be given to the party which is insolvent by the other party.
- 12.2 If for any reason our Services are suspended for a period in excess of three calendar months then we shall be entitled to terminate our appointment under this Agreement in respect of the Services by no less than seven days written notice to you.
- 12.3 If you fail to pay in full any sum due under the terms of this Agreement by the final date for payment for that sum and no effective pay less notice is issued, we may serve written notice to you demanding payment within 14 days of such notice. If you fail to comply with such notice, we shall be entitled to terminate our employment under this Agreement forthwith.
- 12.4 Any termination of our appointment howsoever caused shall be without prejudice to our rights to require payment for all Services performed up to the date of such termination including but not limited to payment of a fair and reasonable proportion of any figure identified in the Proposal or otherwise for fees in respect of a particular service which Lithos has started, but not completed.

13 THIRD PARTY RIGHTS

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

14 COLLATERAL WARRANTIES & LETTERS OF RELIANCE

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

15 NOTICES

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

16 ENTIRE AGREEMENT

- 16.1 The Agreement constitutes the complete and entire agreement between us with respect to the Services and supersedes any prior oral and/or written warranties, terms, conditions, communications and representations, whether express or implied and any claim against us in respect of the Services can only be made in contract under the provisions of this Agreement and not otherwise under the law or tort or otherwise.
- 16.2 No amendments, modifications or variation of this Agreement shall be valid unless made in writing and agreed to by us; such agreement must be recorded in writing by at least one of us.
- 16.3 We shall not be bound by any standard or printed terms or conditions furnished by you in any of your documents unless we specifically state in writing separately from such documents that we intend such terms and conditions to apply.

17 DISPUTES, JURISDICTION AND GOVERNING LAW

- 17.1 This Agreement shall be governed by and construed in accordance with English law and we irrevocably and unconditionally submit to the jurisdiction of the English Courts.
- 17.2 Where the Housing Grants, Construction and Regeneration Act 1996 applies, any dispute between us may be referred to adjudication in accordance with the Scheme for Construction Contracts Regulations 1998 or any amendment or modification thereof being in force at the time of the dispute, as applicable to England, Wales, Scotland and Northern Ireland.

Appendix D
Historical OS Plans



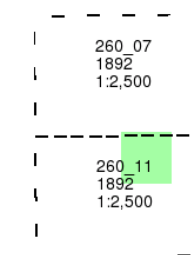
Yorkshire

Published 1892

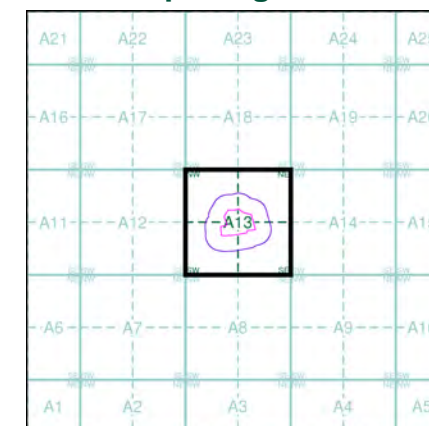
Source map scale - 1:2,500

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

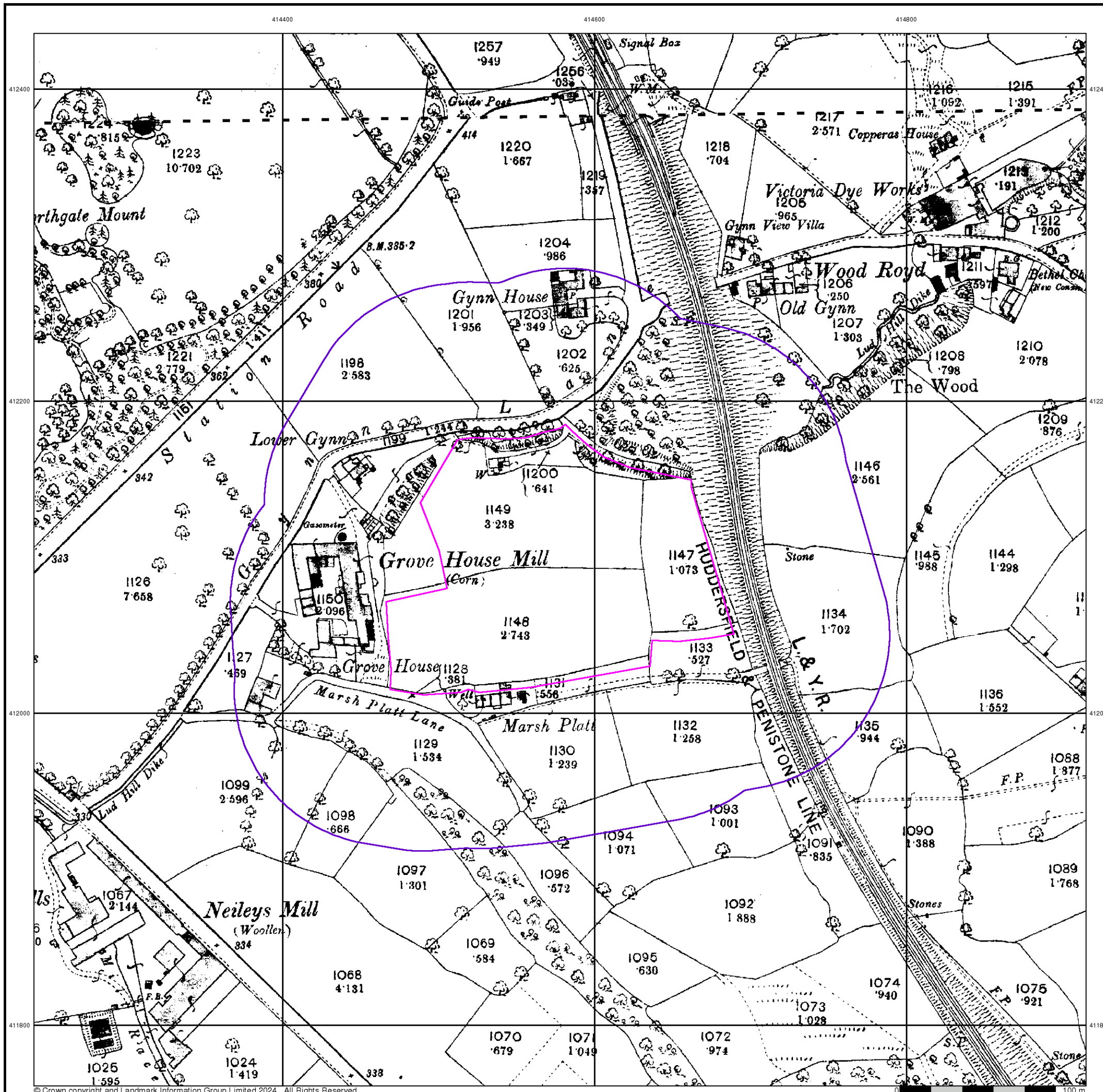
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Customer Ref: 4749
National Grid Reference: 414570, 412090
Slice: A
Site Area (Ha): 2.71
Search Buffer (m): 100

Site Details

Gyn Lane, Honley, HD9 6LF



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





Yorkshire

Published 1918 - 1932

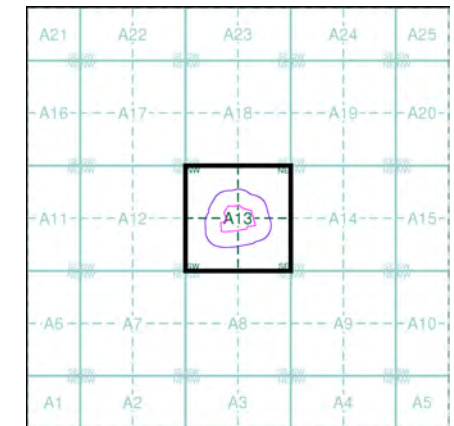
Source map scale - 1:2,500

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)

260 07	1932	1:2,500
260 11	1918	1:2,500

Historical Map - Segment A13



Order Details

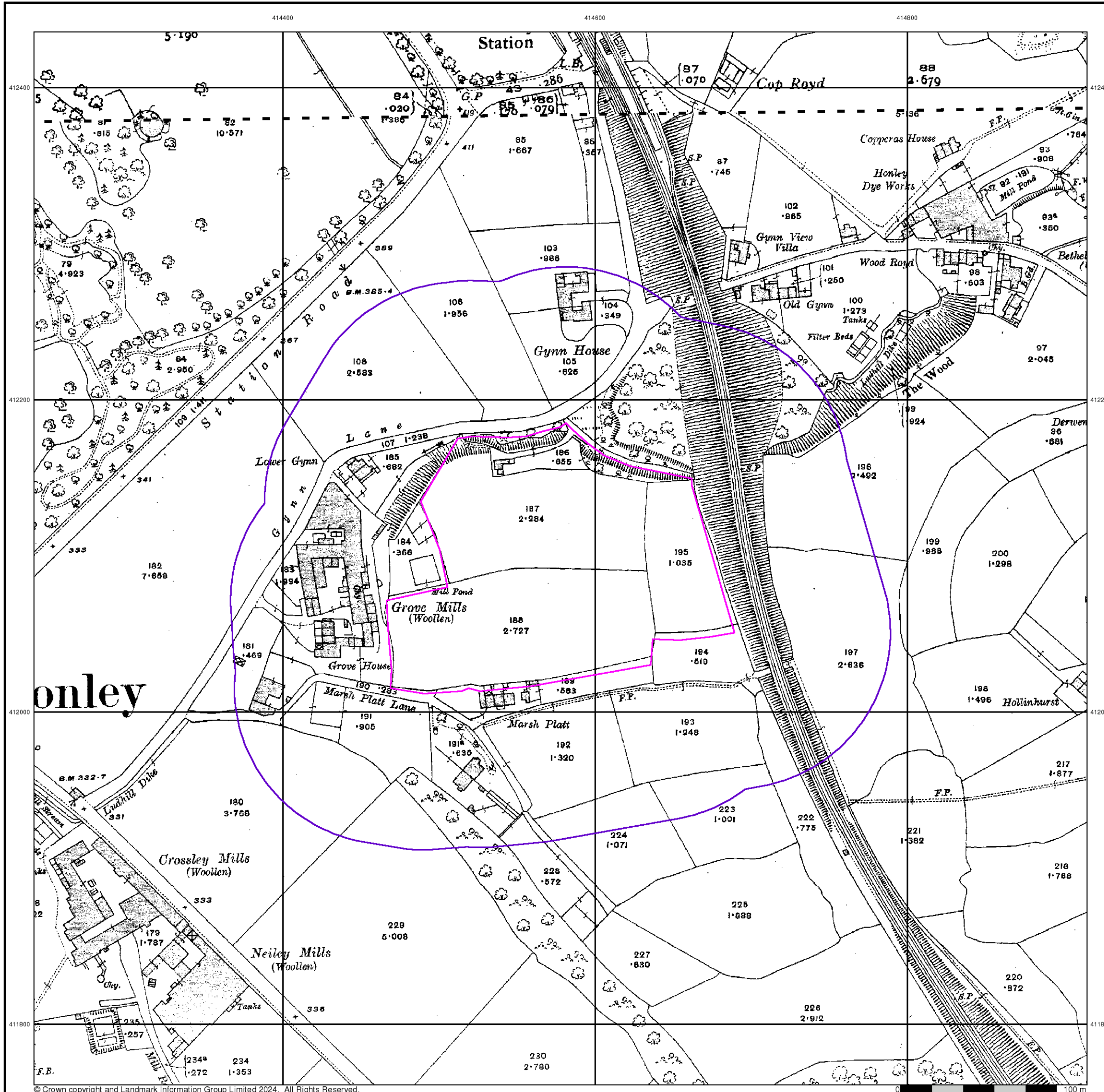
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 Customer Ref: 4749
 National Grid Reference: 414570, 412090
 Slice: A
 Site Area (Ha): 2.71
 Search Buffer (m): 100

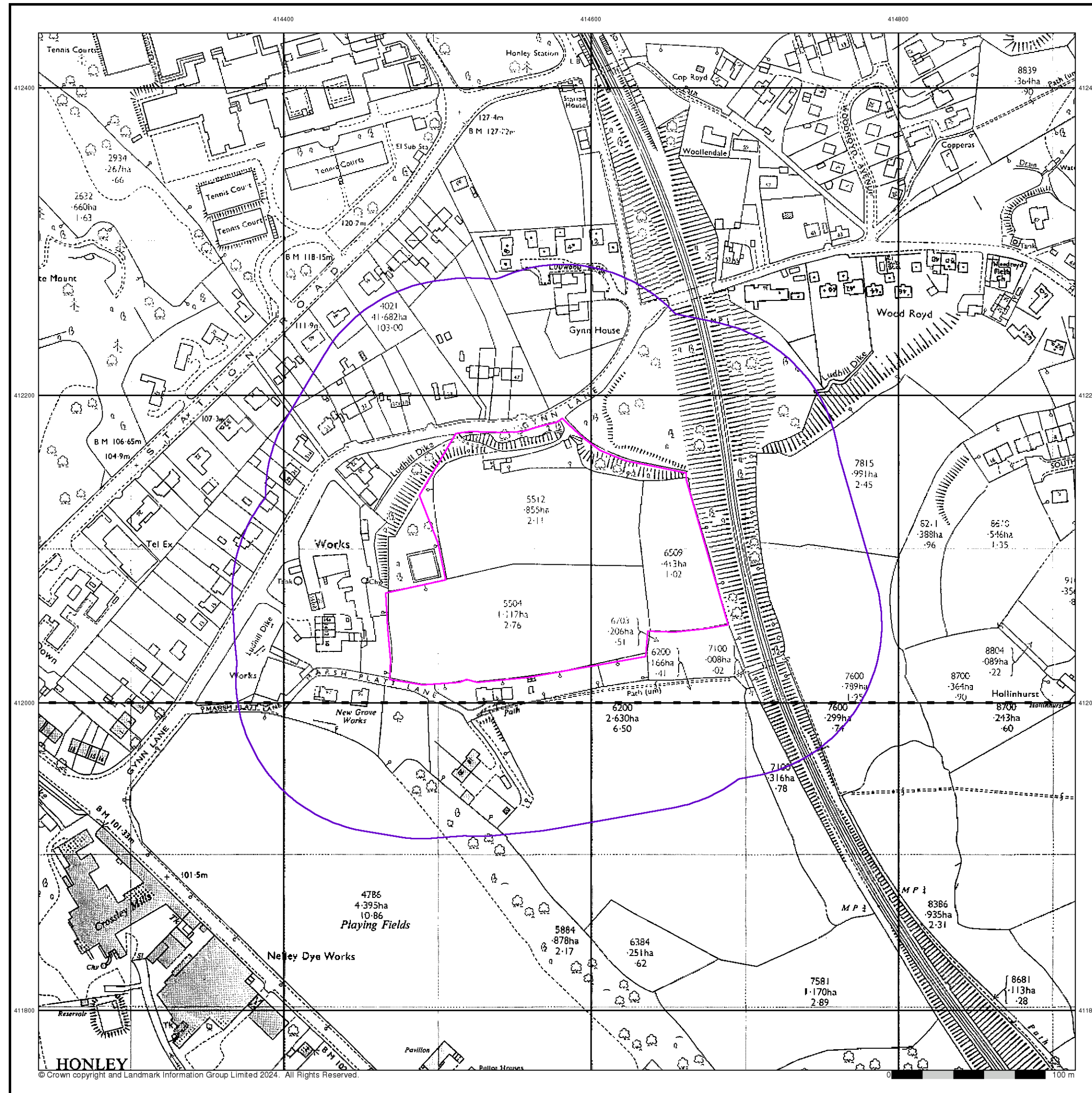
Site Details

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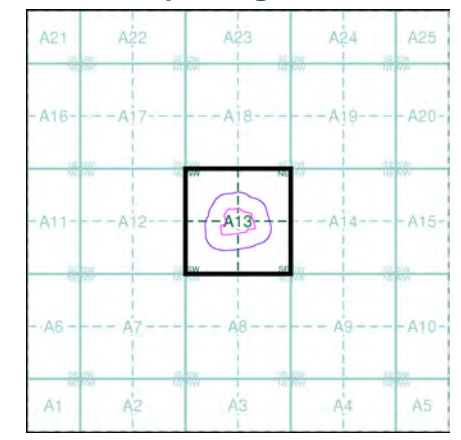
Additional SIMs
Published 1966 - 1989
Source map scale - 1:2,500

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

Map Name(s) and Date(s)

SE1412	1989	1:2,500
SE1411	1966	1:2,500

Historical Map - Segment A13



Order Details

Order Number: 347024450_1_1
 Customer Ref: 4749
 National Grid Reference: 414570, 412090
 Slice: A
 Site Area (Ha): 2.71
 Search Buffer (m): 100

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414400 414600 414800



412400
412200
412000
411800

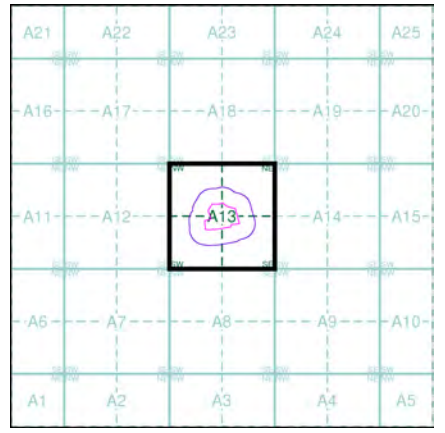


Historical Aerial Photography

Published 2000

This aerial photography was produced by Getmapping, these vertical aerial photographs provide a seamless, full colour survey of the whole of Great Britain

Historical Aerial Photography - Segment A13



Order Details

Order Number: 347024450_1_1
Customer Ref: 4749
National Grid Reference: 414570, 412090
Slice: A
Site Area (Ha): 2.71
Search Buffer (m): 100

Site Details

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Appendix E

Search Responses & other Correspondence



Envirocheck[®] Report:

Datasheet

Order Details:

Order Number:

347024450_1_1

Customer Reference:

4749

National Grid Reference:

414570, 412090

Slice:

A

Site Area (Ha):

2.71

Search Buffer (m):

1000

Site Details:

Gyn Lane

Honley

HD9 6LF

Client Details:

Mr M Perrin

Lithos Consulting Ltd

Parkhill

Walton Road

Wetherby

LS22 5DZ

Report Section	Page Number
Summary	-
Agency & Hydrological	1
Waste	50
Hazardous Substances	-
Geological	53
Industrial Land Use	62
Sensitive Land Use	87
Data Currency	88
Data Suppliers	93
Useful Contacts	94

Introduction

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

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Report Version v53.0

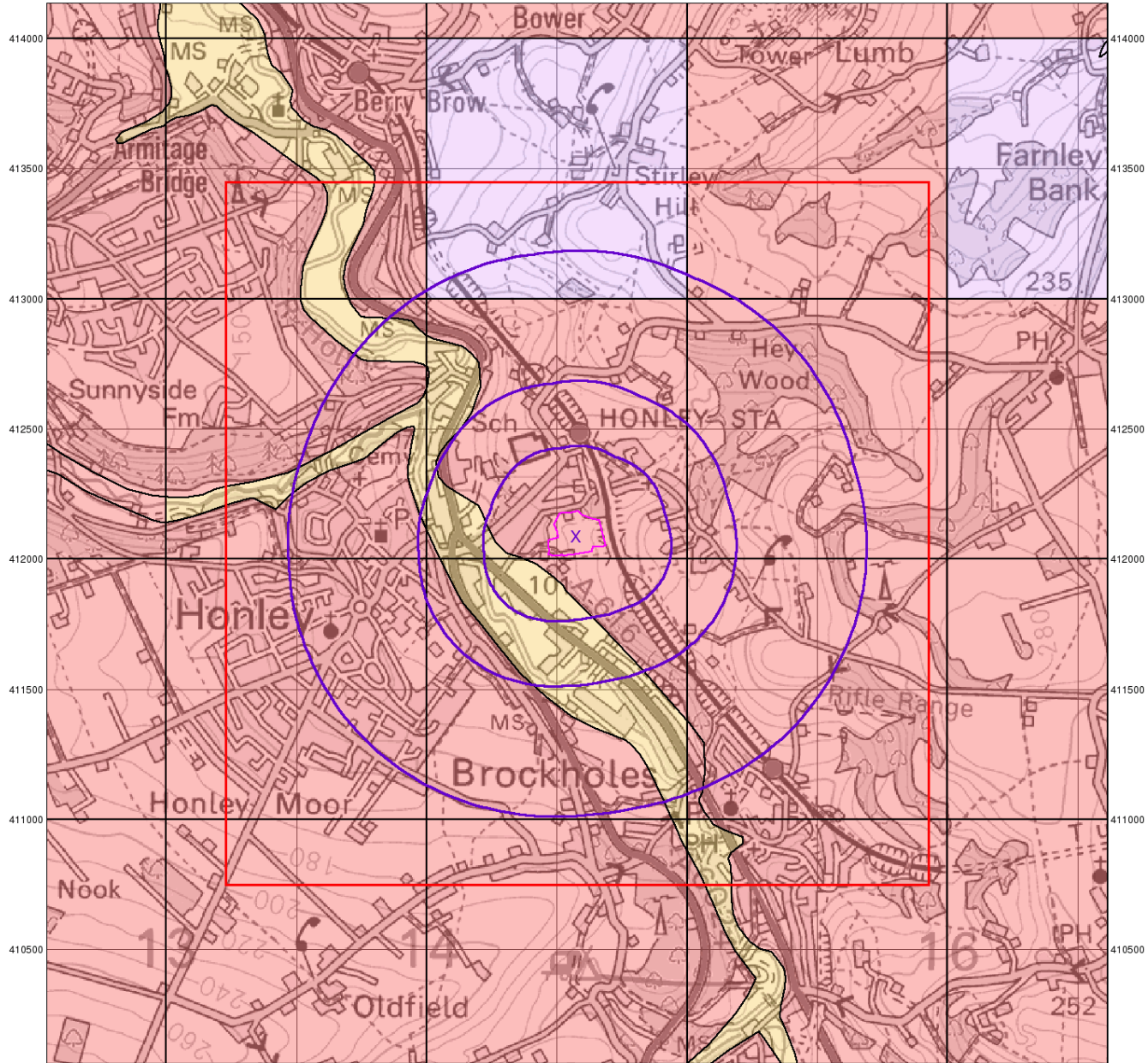
Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Agency & Hydrological					
BGS Groundwater Flooding Susceptibility	pg 1	Yes	Yes	Yes	n/a
Contaminated Land Register Entries and Notices					
Discharge Consents	pg 3	1	2	42	19
Prosecutions Relating to Controlled Waters			n/a	n/a	n/a
Enforcement and Prohibition Notices					
Integrated Pollution Controls					
Integrated Pollution Prevention And Control	pg 19			3	
Local Authority Integrated Pollution Prevention And Control					
Local Authority Pollution Prevention and Controls	pg 20		1	4	7
Local Authority Pollution Prevention and Control Enforcements					
Nearest Surface Water Feature	pg 21	Yes			
Pollution Incidents to Controlled Waters	pg 22		3	25	33
Prosecutions Relating to Authorised Processes	pg 32			1	
Registered Radioactive Substances					
River Quality	pg 32			2	3
River Quality Biology Sampling Points	pg 33			1	2
River Quality Chemistry Sampling Points					
Substantiated Pollution Incident Register	pg 34			4	5
Water Abstractions	pg 35		1	5	11 (*6)
Water Industry Act Referrals					
Groundwater Vulnerability Map	pg 40	Yes	n/a	n/a	n/a
Groundwater Vulnerability - Soluble Rock Risk			n/a	n/a	n/a
Groundwater Vulnerability - Local Information			n/a	n/a	n/a
Bedrock Aquifer Designations	pg 40	Yes	n/a	n/a	n/a
Superficial Aquifer Designations			n/a	n/a	n/a
Source Protection Zones					
Extreme Flooding from Rivers or Sea without Defences	pg 41		Yes	n/a	n/a
Flooding from Rivers or Sea without Defences	pg 41		Yes	n/a	n/a
Areas Benefiting from Flood Defences				n/a	n/a
Flood Water Storage Areas				n/a	n/a
Flood Defences				n/a	n/a
OS Water Network Lines	pg 41	5	7	9	57

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Waste					
BGS Recorded Landfill Sites					
Historical Landfill Sites	pg 50				1
Integrated Pollution Control Registered Waste Sites					
Licensed Waste Management Facilities (Landfill Boundaries)					
Licensed Waste Management Facilities (Locations)	pg 50			1	1
Local Authority Landfill Coverage	pg 50	1	n/a	n/a	n/a
Local Authority Recorded Landfill Sites					
Potentially Infilled Land (Non-Water)	pg 50		2	4	10
Potentially Infilled Land (Water)	pg 51		1	7	6
Registered Landfill Sites	pg 52				1
Registered Waste Transfer Sites					
Registered Waste Treatment or Disposal Sites					
Hazardous Substances					
Control of Major Accident Hazards Sites (COMAH)					
Explosive Sites					
Notification of Installations Handling Hazardous Substances (NIHHS)					
Planning Hazardous Substance Consents					
Planning Hazardous Substance Enforcements					

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Geological					
BGS 1:625,000 Solid Geology	pg 53	Yes	n/a	n/a	n/a
BGS Estimated Soil Chemistry	pg 53	Yes	Yes	Yes	Yes
BGS Recorded Mineral Sites	pg 57		1	5	9
BGS Urban Soil Chemistry					
BGS Urban Soil Chemistry Averages					
CBSCB Compensation District			n/a	n/a	n/a
Coal Mining Affected Areas	pg 59	Yes	n/a	n/a	n/a
Mining Instability	pg 60	Yes	n/a	n/a	n/a
Man-Made Mining Cavities					
Natural Cavities					
Non Coal Mining Areas of Great Britain	pg 60		Yes	n/a	n/a
Potential for Collapsible Ground Stability Hazards	pg 60	Yes		n/a	n/a
Potential for Compressible Ground Stability Hazards	pg 60	Yes	Yes	n/a	n/a
Potential for Ground Dissolution Stability Hazards				n/a	n/a
Potential for Landslide Ground Stability Hazards	pg 60	Yes	Yes	n/a	n/a
Potential for Running Sand Ground Stability Hazards	pg 61	Yes	Yes	n/a	n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 61	Yes	Yes	n/a	n/a
Radon Potential - Radon Affected Areas			n/a	n/a	n/a
Radon Potential - Radon Protection Measures			n/a	n/a	n/a
Industrial Land Use					
Contemporary Trade Directory Entries	pg 62		24	32	75
Fuel Station Entries	pg 73			3	1
Points of Interest - Commercial Services	pg 74		10	8	21
Points of Interest - Education and Health					
Points of Interest - Manufacturing and Production	pg 77		4	18	30
Points of Interest - Public Infrastructure	pg 81		3	19	25
Points of Interest - Recreational and Environmental	pg 85				6
Gas Pipelines					
Underground Electrical Cables					

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Sensitive Land Use					
Ancient Woodland	pg 87			2	3
Areas of Adopted Green Belt	pg 87	1			
Areas of Unadopted Green Belt	pg 87	1			
Areas of Outstanding Natural Beauty					
Environmentally Sensitive Areas					
Forest Parks					
Local Nature Reserves	pg 87				1
Marine Nature Reserves					
National Nature Reserves					
National Parks					
Nitrate Sensitive Areas					
Nitrate Vulnerable Zones					
Ramsar Sites					
Sites of Special Scientific Interest	pg 87			1	
Special Areas of Conservation					
Special Protection Areas					
World Heritage Sites					

413000 413500 414000 414500 415000 415500 416000 416500



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Groundwater Vulnerability

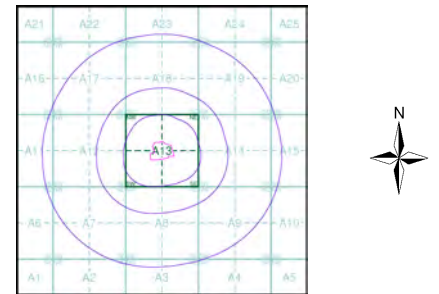
General

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

Agency and Hydrological

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

Site Sensitivity Context Map - Slice A



Order Details

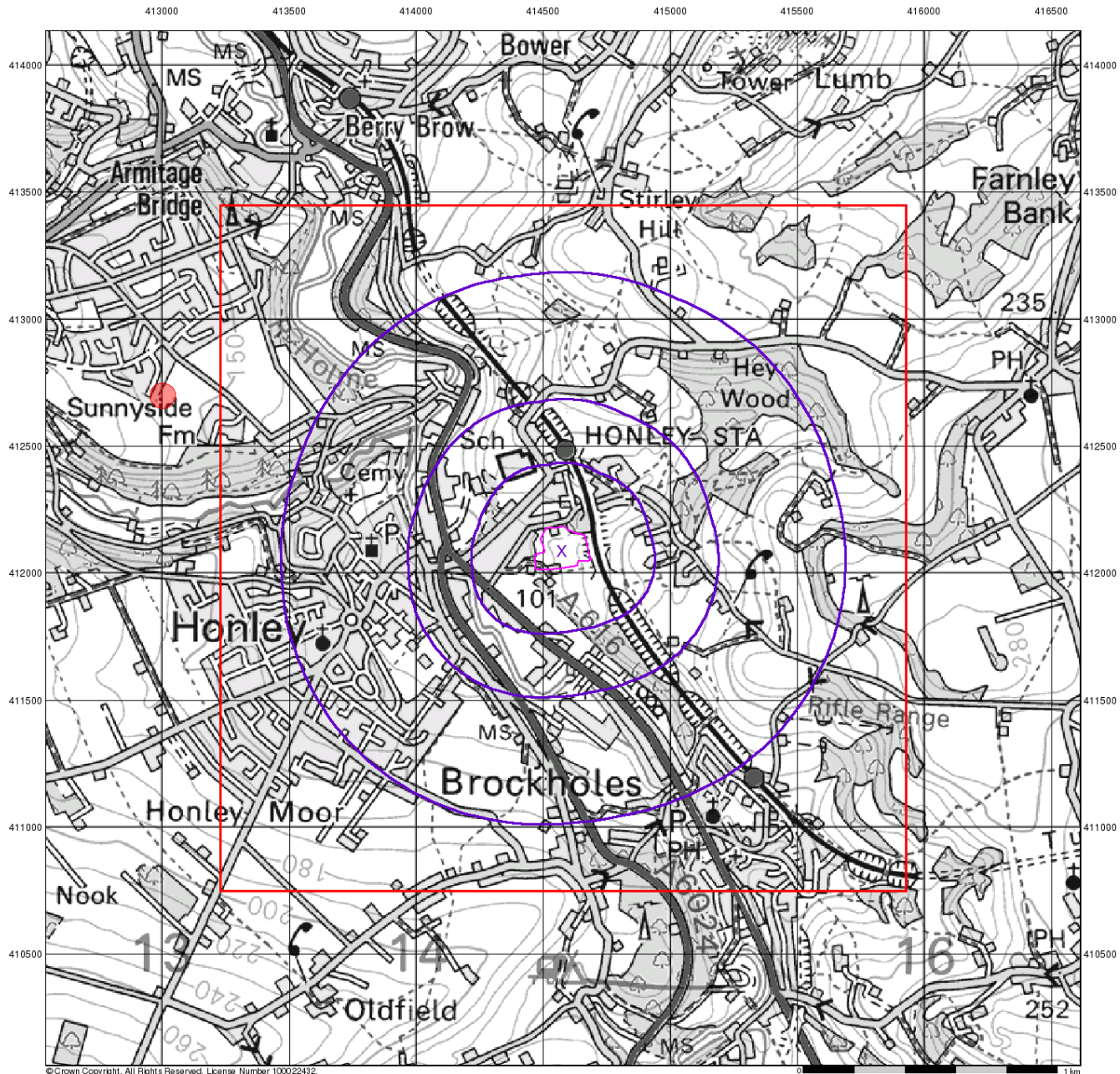
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 Customer Ref: 4749
 National Grid Reference: 414570, 412090
 Slice: A
 Site Area (Ha): 2.71
 Search Buffer (m): 1000

Site Details

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Source Protection Zones

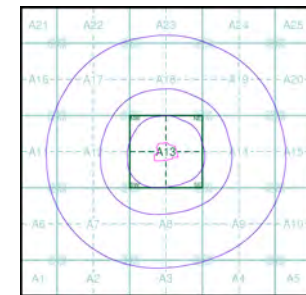
General

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

Agency and Hydrological

-  Inner zone (Zone 1)
-  Inner zone - subsurface activity only (Zone 1c)
-  Outer zone (Zone 2)
-  Outer zone - subsurface activity only (Zone 2c)
-  Total catchment (Zone 3)
-  Total catchment - subsurface activity only (Zone 3c)
-  Special interest (Zone 4)

Site Sensitivity Context Map - Slice A



Order Details

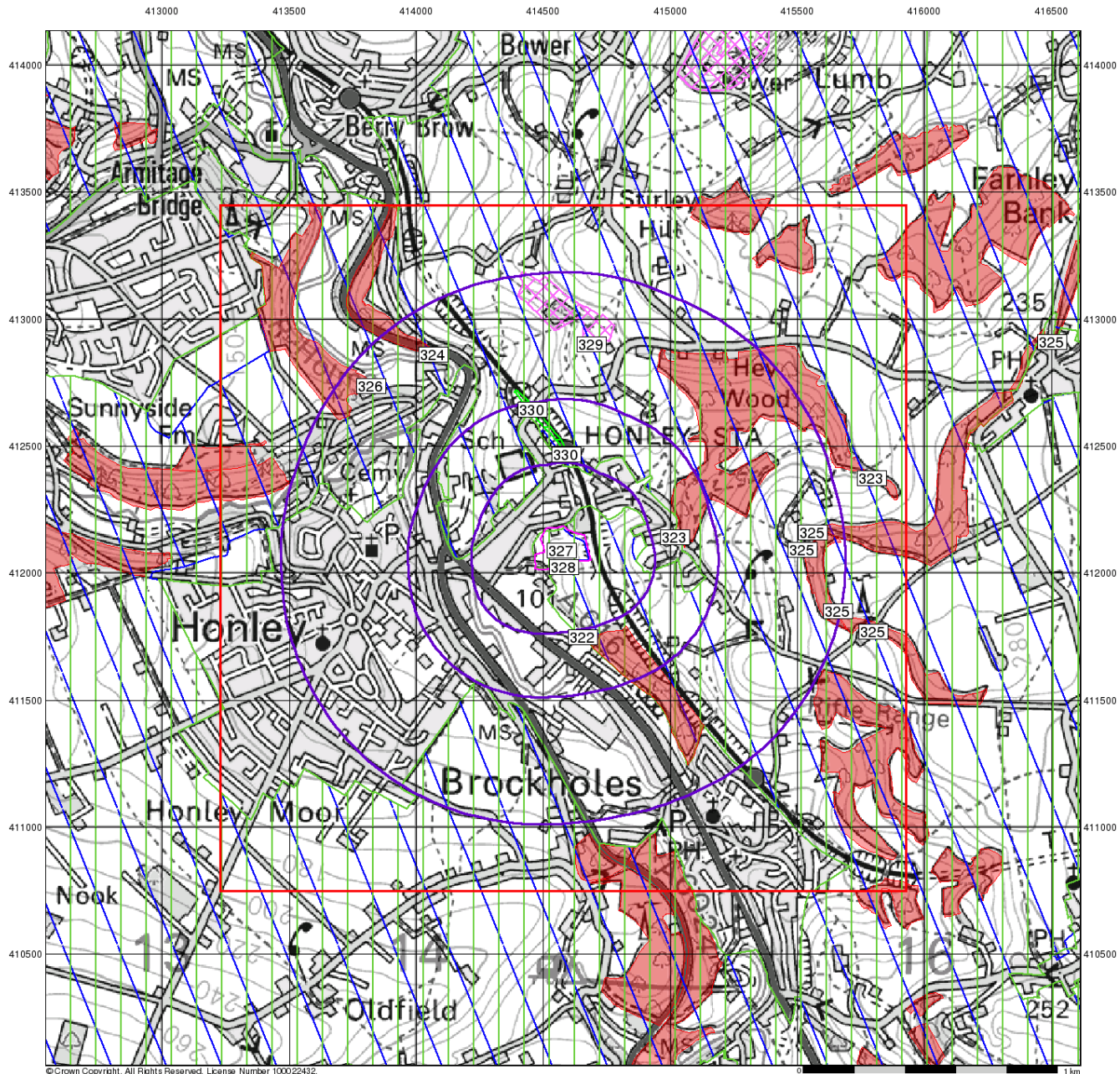
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 Customer Ref: 4749
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 Site Area (Ha): 2.71
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Sensitive Land Uses

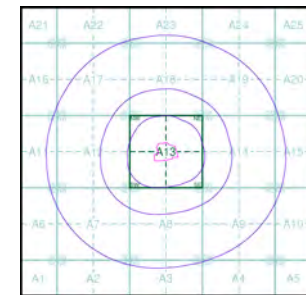
General

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

Sensitive Land Uses

- Ancient Woodland
- Area of Adopted Green Belt
- Area of Unadopted Green Belt
- Area of Outstanding Natural Beauty
- Environmentally Sensitive Area
- Forest Park
- Local Nature Reserve
- Marine Nature Reserve
- National Nature Reserve
- National Park
- Nitrate Sensitive Area
- Nitrate Vulnerable Zone
- Ramsar Site
- Site of Special Scientific Interest
- Special Area of Conservation
- Special Protection Area
- World Heritage Sites

Site Sensitivity Context Map - Slice A



Order Details

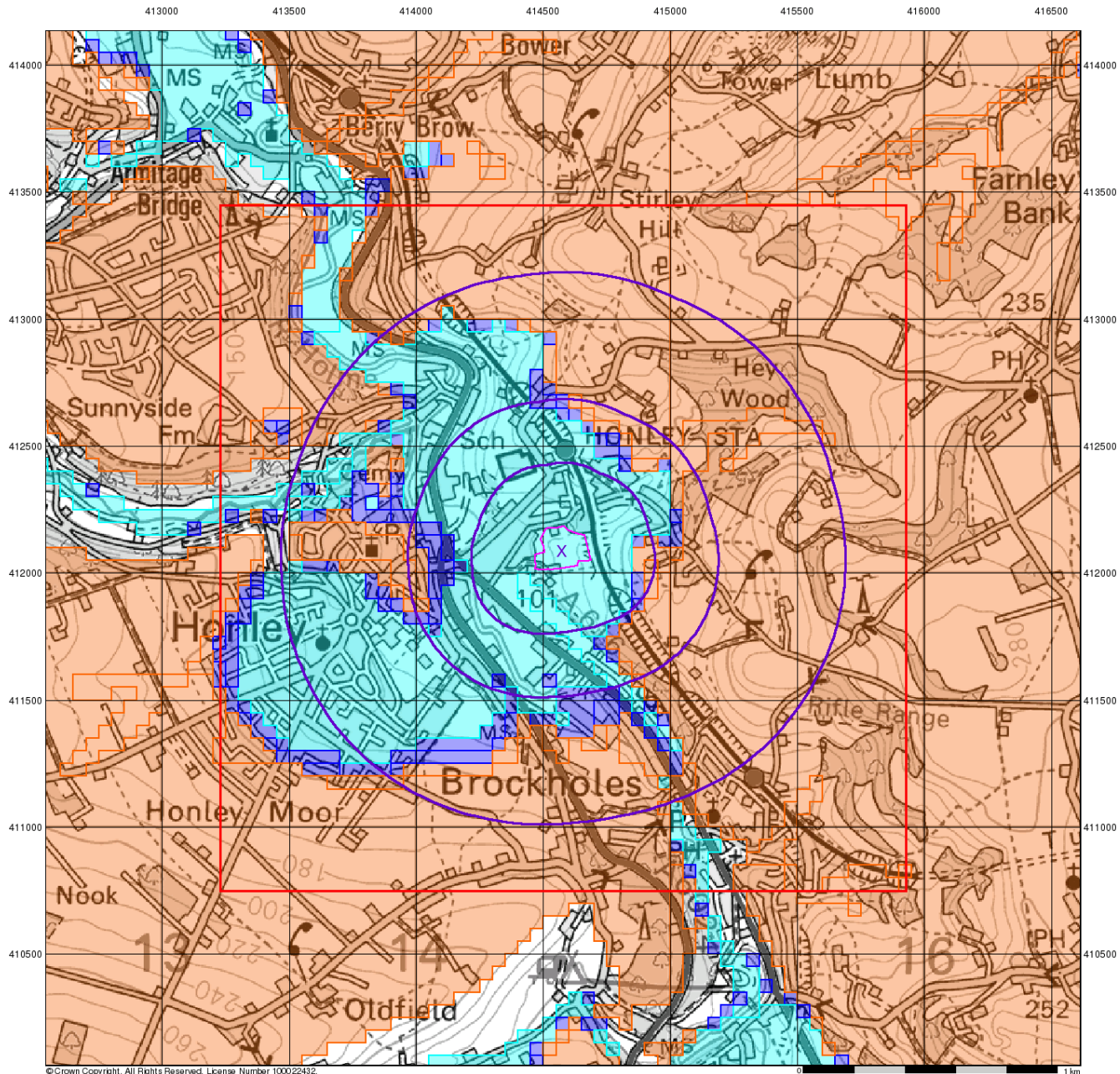
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 Customer Ref: 4749
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BGS Flood GFS Data

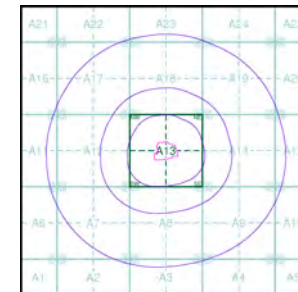
General

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

Agency and Hydrological (Flood)

- Limited Potential for Groundwater Flooding to Occur
- Potential for Groundwater Flooding of Property Situated Below Ground Level
- Potential for Groundwater Flooding to Occur at Surface

Site Sensitivity Context Map - Slice A



Order Details

Order Number: 347024450_1_1
 Customer Ref: 4749
 National Grid Reference: 414570, 412090
 Slice: A
 Site Area (Ha): 2.71
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Site Details

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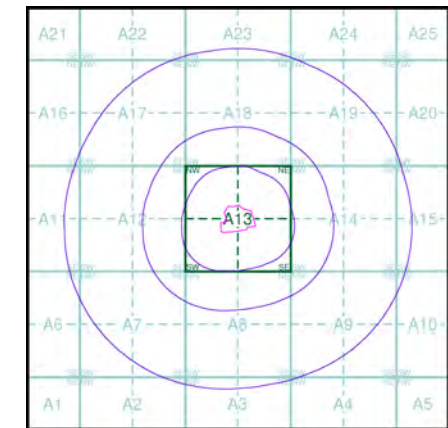
General

- 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

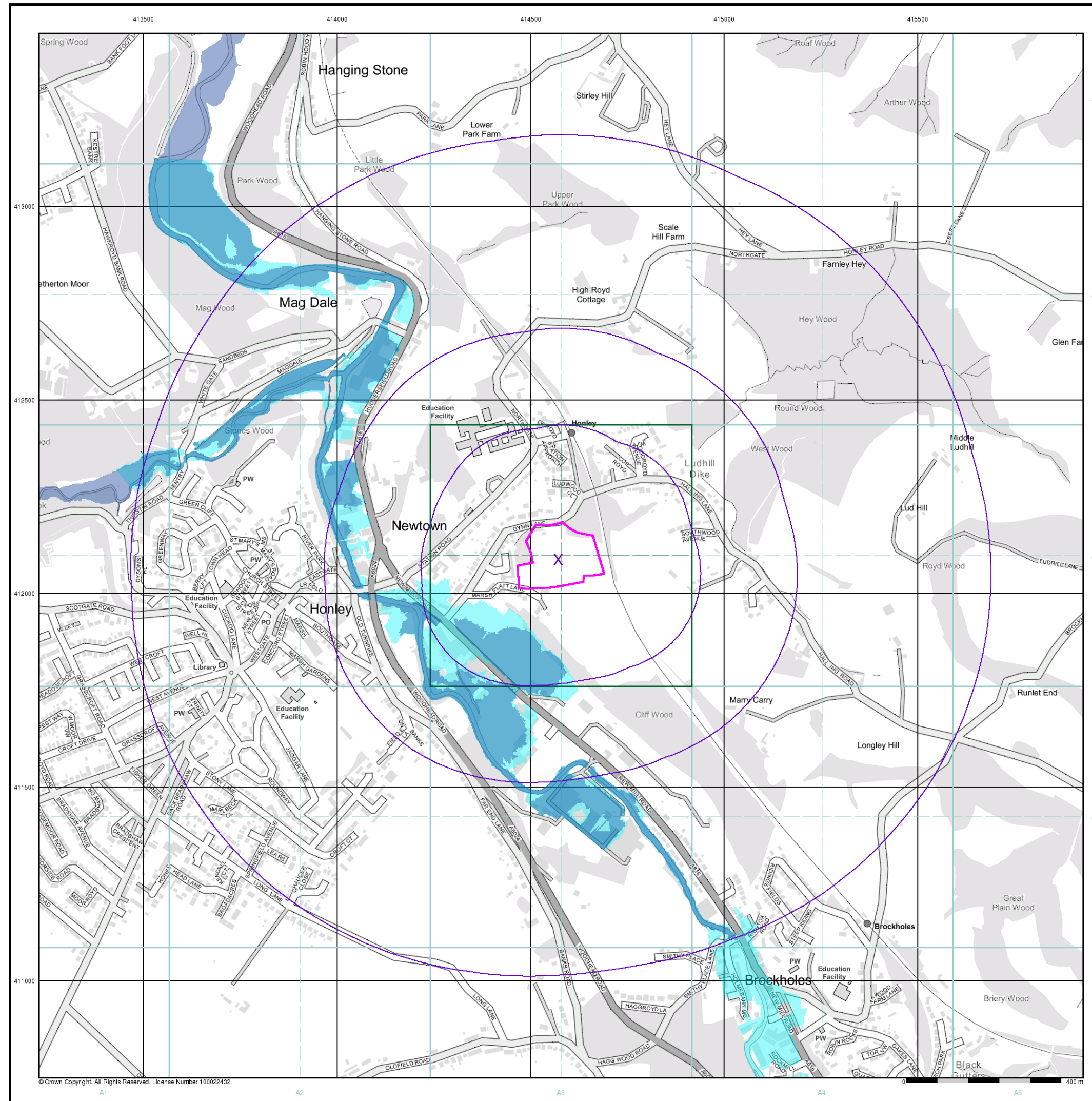
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General

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

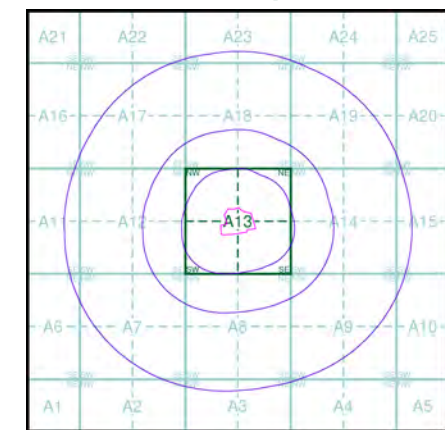
OS Water Network Data

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

Contours (height in meters)

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

OS Water Network Map - Slice A



Order Details

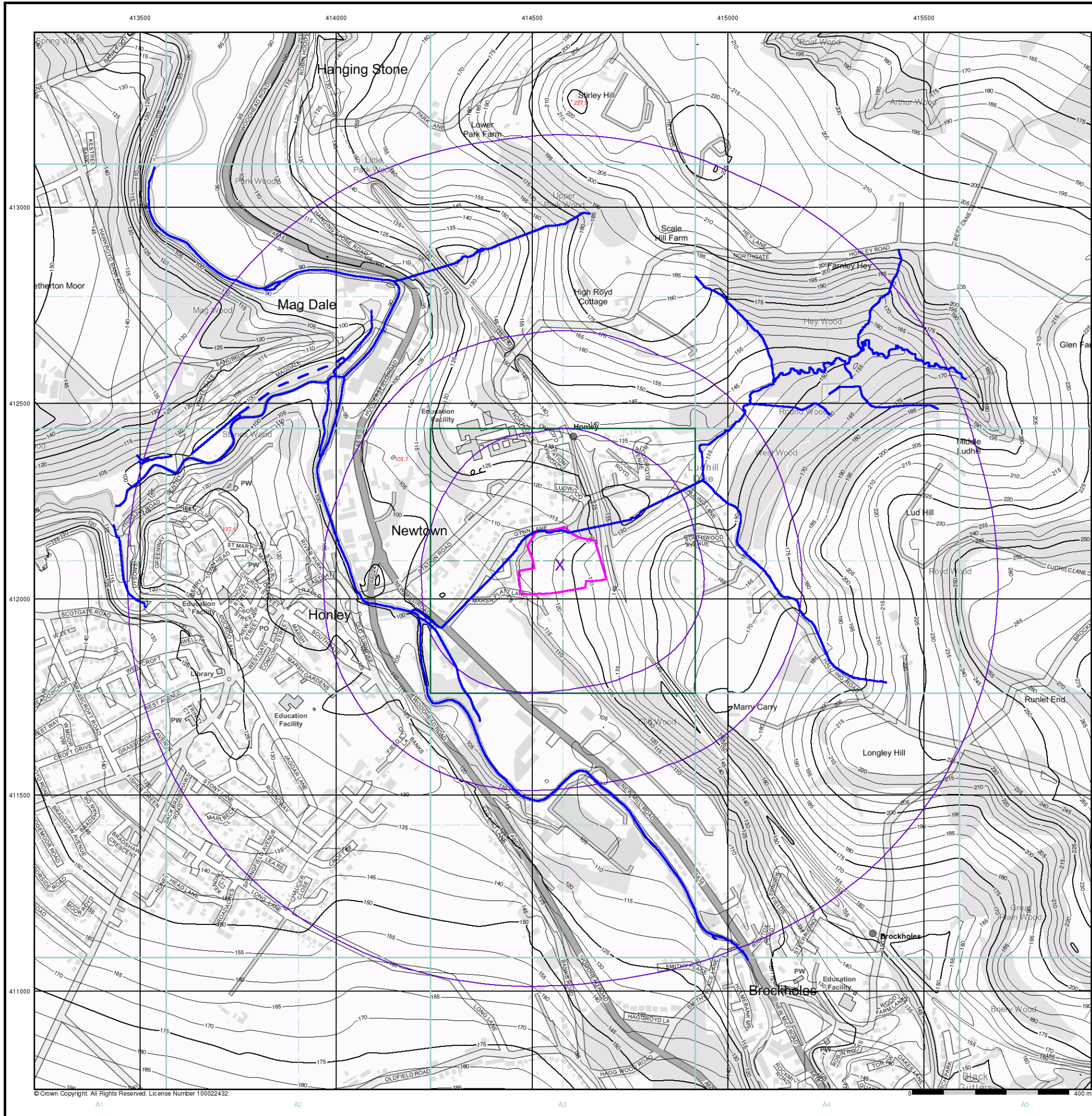
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 Customer Ref: 4749
 National Grid Reference: 414570, 412090
 Slice: A
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General

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

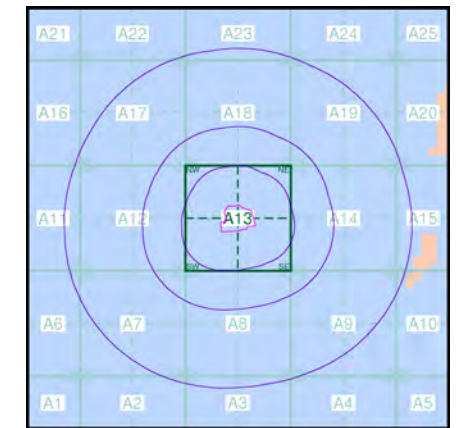
Risk of Flooding from Surface Water

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

Suitability

- See the suitability map below
- National to county
 - County to town
 - Town to street
 - Street to parcels of land
 - Property

EANRW Suitability Map - Slice A



Order Details

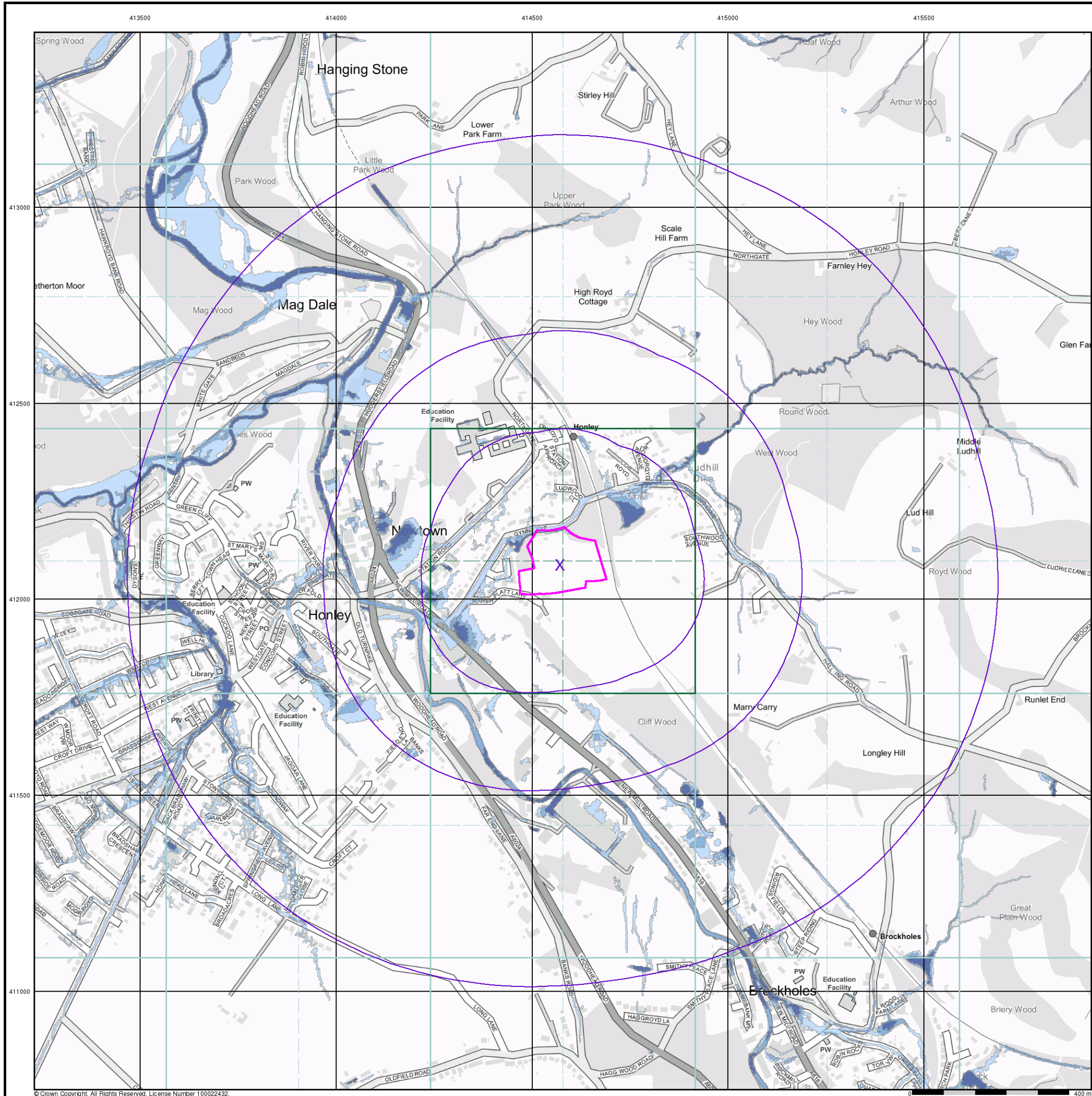
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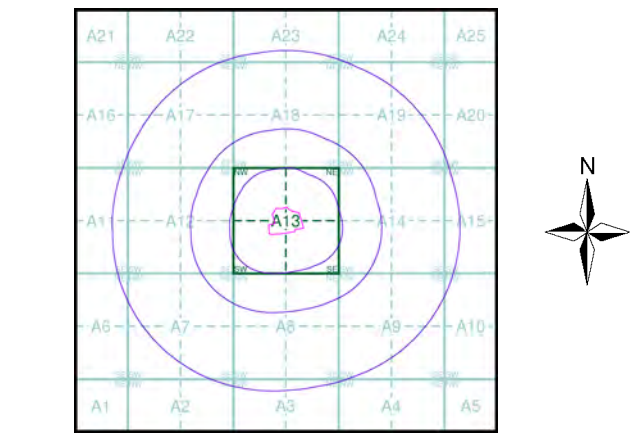
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- General**
- Specified Site
 - Specified Buffer(s)
 - Bearing Reference Point
 - Map ID
 - Several of Type at Location
- Agency and Hydrological**
- Contaminated Land Register Entry or Notice (Location)
 - Contaminated Land Register Entry or Notice
 - Discharge Consent
 - Enforcement or Prohibition Notice
 - Integrated Pollution Control
 - Integrated Pollution Prevention and Control
 - Local Authority Integrated 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
- Hazardous Substances**
- COMAH Site
 - Explosive Site
 - NIHS Site
 - Planning Hazardous Substance Consent
 - Planning Hazardous Substance Enforcement
 - BGS Recorded Mineral Site
- Waste**
- BGS Recorded Landfill Site (Location)
 - BGS Recorded Landfill Site
 - EA Historic Landfill (Buffered Point)
 - EA Historic Landfill (Polygon)
 - Integrated Pollution Control Registered Waste Site
 - Licensed Waste Management Facility (Landfill Boundary)
 - Licensed Waste Management Facility (Location)
 - Local Authority Recorded Landfill Site (Location)
 - Local Authority Recorded Landfill Site
 - Potentially Infilled Land (Non-water)
 - Potentially Infilled Land (Non-water)
 - Potentially Infilled Land (Non-water)
 - Potentially Infilled Land (Water)
 - Potentially Infilled Land (Water)
 - Potentially Infilled Land (Water)
 - Registered Landfill Site (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

Site Sensitivity Map - Slice A



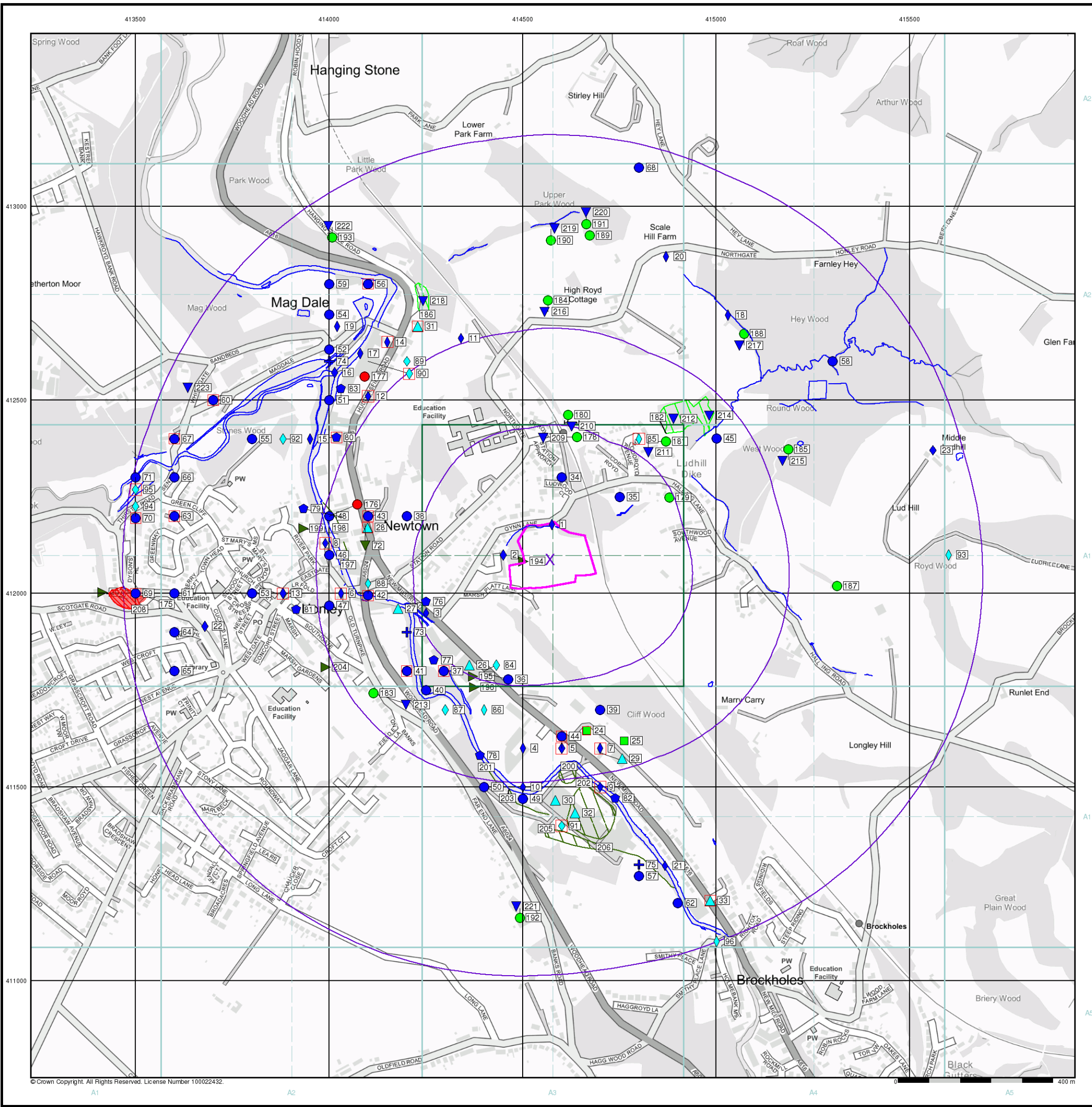
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Site Details
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Landmark
 INFORMATION GROUP

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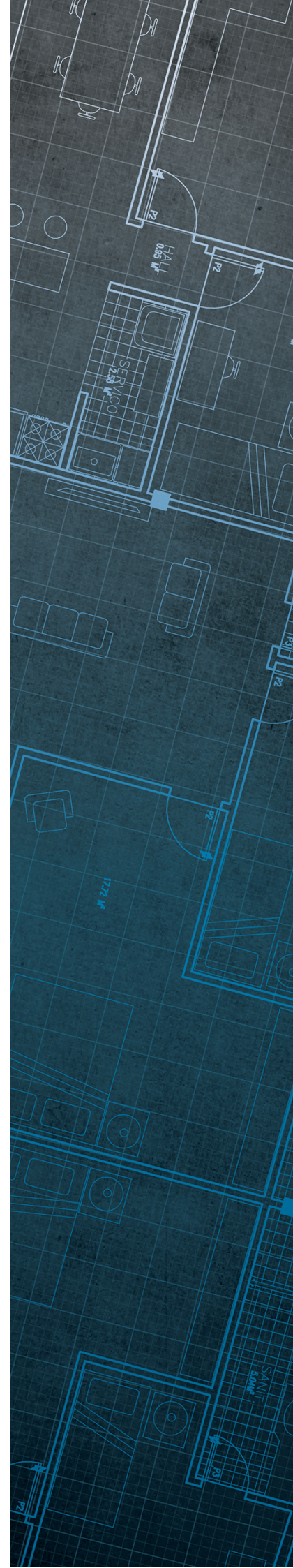
The Coal
Authority

Consultants Coal Mining Report

Gynn Lane
Honley
HD9 6LF

Date of enquiry: 16 May 2024
Date enquiry received: 16 May 2024
Issue date: 16 May 2024

Our reference: 51003425103001
Your reference: PO22395/4749/CH



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

Enquiry address

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Honley
HD9 6LF

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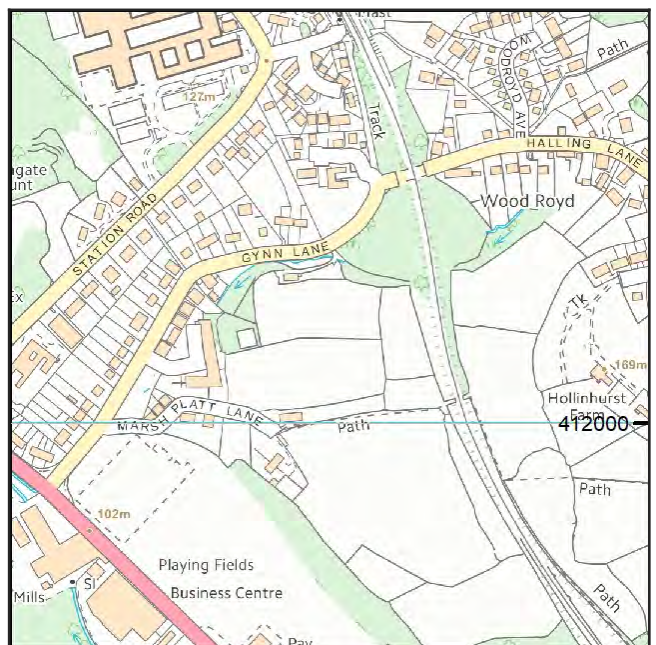
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Approximate position of property



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Section 1 – Mining activity and geology

Past underground mining

No past mining recorded.

Probable unrecorded shallow workings

Yes.

Spine roadways at shallow depth

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

Mine entries

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Adit	414411-001	414581 411939		Coal	
Shaft	414412-009	414483 412074		Coal	
Adit	414412-010	414450 412060		Coal	
Adit	414412-011	414618 412157		Coal	
Adit	414412-014	414755 412031		Coal	

Abandoned mine plan catalogue numbers

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

POO	M185	
-----	------	--

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

Outcrops

Seam name	Mineral	Seam workable	Distance to outcrop (m)	Direction to outcrop	Bearing of outcrop
HALIFAX SOFT	Coal	Yes	Within	N/A	309
MIDDLE BAND	Coal	Yes	Within	N/A	180

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

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

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

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

Mine gas

None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.

Section 3 – Licensing and future mining activity

Future underground mining

None recorded.

Coal mining licensing

None recorded within 200 metres of the enquiry boundary.

Court orders

None recorded.

Section 46 notices

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

Withdrawal of support notices

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

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

Payments to owners of former copyhold land

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

Section 4 – Further information

Based on the responses in this report, no further information has been highlighted.

Future development

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

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

Section 5 – Data definitions

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

Past underground coal mining

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

Probable unrecorded shallow workings

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

Spine roadways at shallow depth

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

Mine entries

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

Abandoned mine plan catalogue numbers

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

Outcrops

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

Geological faults, fissures and breaklines

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

Opencast mines

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

Coal Authority managed tips

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

Site investigations

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

Remediated sites

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

Coal mining subsidence

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

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

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

Mine gas

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

Mine water treatment schemes

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

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

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

Future underground mining

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

Coal mining licensing

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

Court orders

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

Section 46 notices

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

Withdrawal of support notices





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

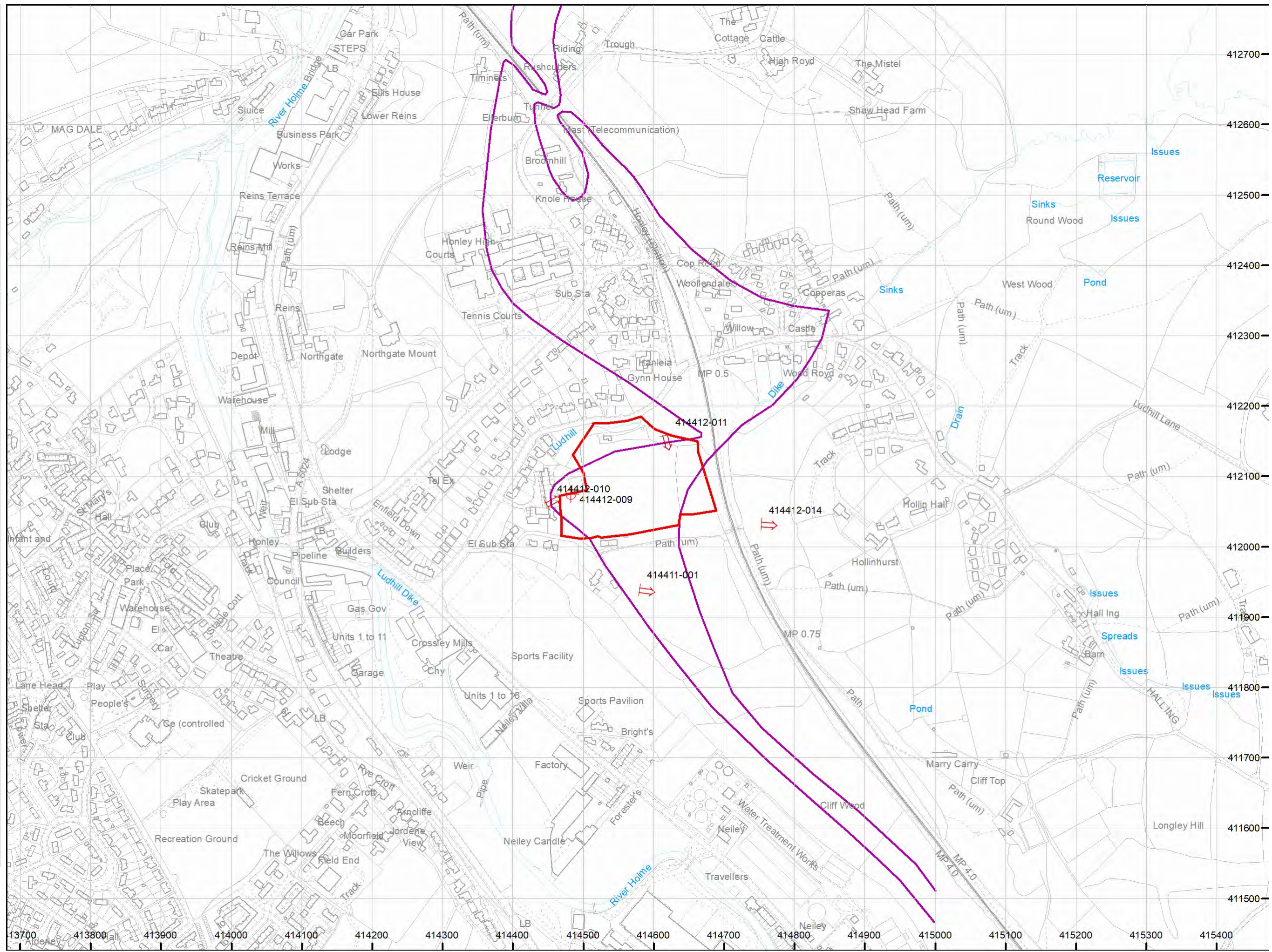
Payment to owners of former copyhold land

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

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

Key

- Approximate position of the enquiry boundary shown 
- Disused mine shaft 
- Disused adit 
- Outcrop (Proven) 



How to contact us
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 +44 (0)1623 637 000 (International)
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Appendix F

Trial Pit Logs

Project Name: Gynn Lane, Honley Project No. 4749 Co-ords: 414507.37 - 412128.96 Date 22/07/2024
 Level: 118.40

Location: Honley Dimensions (m): 2.5 Scale 1:20
 Client: Vivly Living Depth 1.00 Logged CC

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20 0.20	B J&T					Dark brown gravelly slightly clayey SAND with occasional rootlets. Gravel is subangular to subrounded fine to coarse of sandstone. (TOPSOIL)
	0.50	D&B		0.40	118.00		Light brown sandy slightly clayey angular to subangular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)
				0.70	117.70		Moderately strong light brown SANDSTONE. Recovered as sandy angular to subangular tabular fine to coarse gravel with a medium cobble content. Cobbles are angular, tabular of sandstone. (SOFT BED FLAGS)
				1.00	117.40		At 1.0m, unable to excavate further. End of pit at 1.00 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

TP02

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No.
4749Co-ords: 414533.95 - 412125.12
Level: 118.60Date
22/07/2024

Location: Honley

Dimensions (m): 2.1
Depth 1.90Scale
1:20
Logged
CC

Client: Vivly Living

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	118.30		Dark brown clayey slightly gravelly SAND with occasional rootlets. Gravel is angular to subangular fine to coarse of sandstone. (TOPSOIL)
	0.40	D	HVP=58	0.50	118.10		Firm light orangish brown gravelly slightly sandy CLAY. Gravel is angular to subrounded fine to medium of sandstone. (COHESIVE RESIDUAL SOIL)
	0.70	D					Light greyish brown clayey slightly sandy angular to subangular fine to medium GRAVEL of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)
				1.50	117.10		Moderately strong light brown SANDSTONE. Recovered as sandy angular to subangular, tabular fine to coarse gravel with a low cobble content. Cobbles are angular of sandstone. (SOFT BED FLAGS)
				1.90	116.70		End at 1.9m, unable to excavate further. End of pit at 1.90 m

1
2
3
4

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: Gynn Lane, Honley

Project No.
4749Co-ords: 414566.42 - 412138.74
Level: 118.20Date
22/07/2024

Location: Honley

Dimensions (m):
Depth 2.30
2.5
Scale
1:20

Client: Vivly Living

Logged
CC

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&T	HVP=60	0.30	117.90		Dark brown slightly gravelly slightly sandy CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone. (TOPSOIL)
	0.70	D&B		1.10	117.10		Firm light orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone. (COHESIVE RESIDUAL SOIL)
				2.00	116.20		Light greyish brown clayey slightly sandy angular to subangular, tabular fine to coarse GRAVEL of sandstone and sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)
				2.30	115.90		Moderately strong light brown SANDSTONE. Recovered as sandy angular tabular fine to coarse gravel of sandstone with a low cobble content. Cobbles are angular of sandstone. (SOFT BED FLAGS)
							At 2.3m, unable to dig further. End of pit at 2.30 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. 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

TP04

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No.
4749Co-ords: 414581.72 - 412127.58
Level: 119.90Date
22/07/2024

Location: Honley

Dimensions (m): 2.4
Depth 2.00Scale
1:20
Logged
CC

Client: Vivly Living

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
			HVP=63	0.30	119.60		Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is angular to subangular fine to medium of sandstone. (TOPSOIL)
				0.80	119.10		Firm light orangish brown mottled grey slightly sandy slightly gravelly CLAY. (COHESIVE RESIDUAL SOIL)
	1.00	T		1.20	118.70		Black slightly clayey angular to subangular fine to medium GRAVEL of coal. (SOFT BED COAL)
	1.30	D		1.40	118.50		Firm light grey slightly sandy CLAY. (COHESIVE RESIDUAL SOIL)
				1.80	118.10		Light orangish brown clayey slightly sandy angular to subangular, tabular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)
				2.00	117.90		Moderately strong light brown SANDSTONE. Recovered as sandy angular to subangular fine to coarse gravel with a medium cobble content. Cobbles are angular of sandstone. (COAL MEASURES)
				At 2.0m, unable to excavate further. End of pit at 2.00 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.



Project Name: Gynn Lane, Honley Project No. 4749 Co-ords: 414609.87 - 412133.68 Date 22/07/2024
 Level: 122.95

Location: Honley Dimensions (m): 2.3 Scale 1:20
 Client: Vivly Living Depth 3.10 Logged CC

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	J&T		0.30	122.65		Dark brown slightly clayey slightly gravelly SAND. Gravel is subangular to subrounded fine to medium of sandstone. (TOPSOIL)
			HVP=58	0.50	122.45		Firm light orangish brown gravelly slightly sandy CLAY. Gravel is angular to subangular fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)
	0.90	D&B					Light greyish brown clayey slightly sandy angular to subangular, tabular GRAVEL of sandstone and sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)
				2.10	120.85		Dark grey carbonaceous MUDSTONE. Recovered as slightly sandy angular to subangular fine to coarse gravel. (COAL MEASURES)
				3.10	119.85		End of pit at 3.10 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.



Project Name: Gynn Lane, Honley Project No. 4749 Co-ords: 414640.76 - 412129.01 Date 22/07/2024
 Level: 128.05

Location: Honley Dimensions (m): 3.5 Scale 1:20
 Client: Vivly Living Depth 3.90 Logged CC

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
			HVP=50	0.30	127.75		Dark brown sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (TOPSOIL)
							Light greyish brown clayey slightly sandy angular to subangular, tabular fine to coarse GRAVEL of carbonaceous mudstone. Pockets of very gravelly clay. (GRANULAR RESIDUAL SOIL)
				3.90	124.15		End of pit at 3.90 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

TP07

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No.
4749Co-ords: 414552.46 - 412116.53
Level: 119.30Date
22/07/2024

Location: Honley

Dimensions (m): 3.2
Depth 2.80Scale
1:20
Logged
CC

Client: Vivly Living

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&T		0.30	119.00		Dark grey clayey slightly gravelly SAND with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone. (TOPSOIL)
	1.10	D	HVP=66	1.40	117.90		Firm light orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone. (COHESIVE RESIDUAL SOIL)
				2.30	117.00		Light greyish brown sandy slightly clayey angular to subangular, tabular fine to coarse GRAVEL of sandstone and mudstone with a low cobble content. Cobbles are angular of sandstone. (GRANULAR RESIDUAL SOIL)
				2.80	116.50		Very weak light grey MUDSTONE. Recovered as slightly sandy angular, tabular fine to coarse gravel with a low cobble content. (COAL MEASURES) <i>From 2.3m, becoming difficult to excavate.</i>
							End of pit at 2.80 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

TP08

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No.
4749Co-ords: 414507.51 - 412097.40
Level: 118.65Date
22/07/2024

Location: Honley

Dimensions (m):
Depth 1.60
2.1
Scale
1:20
Logged
CC

Client: Vivly Living

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	J&T		0.30	118.35		Dark brown clayey slightly gravelly SAND. Gravel is subangular to subrounded fine to medium of sandstone. (TOPSOIL)
	0.60	D&B		1.10	117.55		Light brown slightly clayey sandy angular to subrounded fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)
				1.10	117.55		Moderately strong light brown SANDSTONE. Recovered as slightly sandy angular, tabular fine to coarse gravel and cobbles. (SOFT BED FLAGS)
				1.60	117.05		At 1.6m, unable to excavate further. End of pit at 1.60 m

1
2
3
4

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.



Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414530.55 - 412099.56 Level: 119.05	Date 22/07/2024
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Location: Honley	Dimensions (m): 2.3	Scale 1:20
Client: Vivly Living	Depth 2.20	Logged CC

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
1.60	D			0.30	118.75		Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone. (TOPSOIL)	
							Light greyish brown clayey slightly sandy angular to subangular, tabular fine to coarse GRAVEL of sandstone and sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)	
					1.90	117.15		Weak light brown SANDSTONE. Recovered as a slightly sandy angular, tabular fine to coarse GRAVEL with a low cobble content. (SOFT BED FLAGS)
					2.20	116.85		End at 2.2m, unable to excavate further. 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

TP10

Sheet 1 of 1

Project Name: Gynn Lane, Honley Project No. 4749 Co-ords: 414558.09 - 412094.55 Date 22/07/2024
 Level: 120.05

Location: Honley Dimensions (m): 2.3 Scale 1:20
 Client: Vivly Living Depth 1.40 Logged CC

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20 0.20	B J&T		0.30	119.75		Dark brown sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone. (TOPSOIL)
			HVP=65	1.10	118.95		Firm light brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)
				1.40	118.65		Moderately strong light brown SANDSTONE. Recovered as slightly sandy slightly clayey angular to subangular, tabular fine to coarse gravel with a low cobble content. (SOFT BED FLAGS)
							At 1.4m, unable to excavate further. End of pit at 1.40 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. 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: Gynn Lane, Honley Project No. 4749 Co-ords: 414591.90 - 412102.61 Date 22/07/2024
 Level: 122.70

Location: Honley Dimensions (m): 2.4 Scale 1:20
 Client: Vivly Living Depth 2.70 Logged CC

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	122.40		Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (TOPSOIL)
	0.80	D		0.90	121.80		Light orangish brown clayey slightly sandy angular to subangular, tabular fine to coarse GRAVEL of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)
				2.00	120.70		Light greyish brown slightly sandy angular, tabular sandstone and mudstone. (GRANULAR RESIDUAL SOIL)
				2.70	120.00		Weak light brown SANDSTONE interbedded with carbonaceous MUDSTONE. Recovered as slightly sandy angular, tabular fine to coarse gravel with a low cobble content. (COAL MEASURES)
							End of pit at 2.70 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. 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: Gynn Lane, Honley

Project No.
4749Co-ords: 414620.44 - 412106.67
Level: 128.15Date
22/07/2024

Location: Honley

Dimensions (m): 2.5
Depth 2.70Scale
1:20
Logged
CC

Client: Vivly Living

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&T		0.30	127.85		Dark brown slightly clayey slightly gravelly SAND. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (TOPSOIL)
	1.40	D&B		1.90	126.25		Light greyish brown slightly sandy angular to subangular, tabular fine to coarse GRAVEL of carbonaceous MUDSTONE. (GRANULAR RESIDUAL SOIL)
				2.70	125.45		Weak dark grey carbonaceous MUDSTONE. Recovered as slightly sandy angular, tabular fine to coarse GRAVEL with a low cobble content. (COAL MEASURES)
							At 2.7m, struggling to excavate further. End of pit at 2.70 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

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



Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414644.72 - 412103.86 Level: 130.55	Date 22/07/2024
Location: Honley	Dimensions (m): Depth 1.70		Scale 1:20 Logged CC
Client: Vivly Living		2.5	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.70	T	HVP=52	0.30	130.25		Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (TOPSOIL)
				0.60	129.95		Firm light orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to medium of sandstone and mudstone. (COHESIVE RESIDUAL SOIL)
				0.90	129.65		Black COAL. Recovered as slightly sandy angular fine to coarse gravel. (MIDDLE BAND COAL)
				1.60	128.95		Moderately strong light brown SANDSTONE. Recovered as slightly sandy angular, tabular fine to coarse gravel with a low cobble content. (MIDDLE BAND ROCK)
				1.70	128.85		At 1.7m, unable to excavate further. 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.



Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414648.01 - 412072.62 Level: 130.85	Date 22/07/2024
Location: Honley	Client: Vivly Living	Dimensions (m): 2.3 Depth 1.70	Scale 1:20 Logged CC

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	J&T		0.40	130.45		Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (TOPSOIL)
	0.90	D	HVP=50	1.20	129.65		Firm light orangish brown slightly sandy slightly gravelly CLAY. Gravel is subangular fine to medium of sandstone, mudstone and coal. (COHESIVE RESIDUAL SOIL)
	1.40	T		1.50	129.35		Black COAL. Recovered as angular fine to medium gravel. (MIDDLE BAND COAL)
				1.70	129.15		Moderately strong light brown SANDSTONE. Recovered as slightly sandy angular to subangular fine to coarse gravel with a low cobble content. (MIDDLE BAND ROCK)
<p><i>At 1.7m, unable to excavate further.</i> End of pit at 1.70 m</p>							

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. 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

TP15

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No.
4749Co-ords: 414656.28 - 412056.28
Level: 131.40Date
23/07/2024

Location: Honley

Dimensions (m): 2.2
Depth 2.20Scale
1:20Logged
CC

Client: Vivly Living

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
			HVP=42	0.30	131.10		Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone, mudstone and coal. (TOPSOIL)
				1.60	129.80		Firm light orangish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (COHESIVE RESIDUAL SOIL)
	2.00	T		1.90	129.50		Dark greyish brown slightly sandy slightly clayey angular, tabular fine to coarse GRAVEL of carbonaceous mudstone. (GRANULAR RESIDUAL SOIL)
				2.20	129.20		Black COAL. Recovered as angular fine to coarse gravel. (MIDDLE BAND COAL)
							At 2.2m, unable to excavate further. 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.



Project Name: Gynn Lane, Honley Project No. 4749 Co-ords: 414682.63 - 412067.41 Date 23/07/2024
 Level: 133.50

Location: Honley Dimensions (m): 1.6 Scale 1:20
 Client: Vivly Living Depth 1.10 Logged CC

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
			HVP=1	0.20	133.30		Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (TOPSOIL)
				0.70	132.80		Firm light orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (COHESIVE RESIDUAL SOIL)
				1.10	132.40		Dark greyish brown slightly sandy slightly clayey angular to subangular, tabular fine to coarse GRAVEL of mudstone. (GRANULAR RESIDUAL SOIL)
							Gabion basket 0.5m high beneath retaining wall. Underlain by 0.2m of limestone hardcore. ----- End of pit at 1.10 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.




Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414669.47 - 412110.42 Level: 131.70	Date 23/07/2024
Location: Honley	Client: Vivly Living	Dimensions (m): Depth 1.20	Scale 1:20 Logged CC

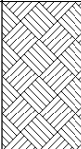




Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
			HVP=68	0.20	131.50		Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (TOPSOIL)
				0.90	130.80		Firm light orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (COHESIVE RESIDUAL SOIL)
				1.20	130.50		Dark brown slightly sandy slightly clayey angular to subangular fine to coarse GRAVEL of carbonaceous mudstone. (GRANULAR RESIDUAL SOIL)
							Gabion wall in east of pit 2.0m above ground level, 0.5m basket beneath on limestone gravel sub base 0.4m thick. End of pit at 1.20 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.



Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414663.09 - 412125.23 Level: 130.25	Date 23/07/2024
Location: Honley	Dimensions (m): 2.3		Scale 1:20
Client: Vivly Living	Depth 2.30		Logged CC

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	J&T	HVP=68	0.40	129.85		Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (TOPSOIL)
	0.60	D		1.30	128.95		Firm light orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone, mudstone and coal. (COHESIVE RESIDUAL SOIL)
				1.60	128.65		Black COAL. Recovered as slightly sandy angular fine to coarse gravelly. (MIDDLE BAND COAL)
				2.20	128.05		Moderately strong light brown SANDSTONE. Recovered as sandy angular to subangular fine to coarse gravel. (MIDDLE BAND ROCK)
				2.30	127.95		At 2.3m, unable to excavate further. End of pit at 2.30 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

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



Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414671.73 - 412087.52 Level: 132.45	Date 23/07/2024
Location: Honley	Dimensions (m): Depth 3.70		Scale 1:20 Logged CC
Client: Vivly Living		2.1	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
			HVP=42	0.40	132.05		Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone, mudstone and coal. (TOPSOIL)
				1.20	131.25		Firm light orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to medium of sandstone, mudstone and coal. (COHESIVE RESIDUAL SOIL)
	1.50	D&B		2.60	129.85		Dark grey clayey slightly sandy angular, tabular fine to coarse GRAVEL of carbonaceous mudstone. (GRANULAR RESIDUAL SOIL)
				3.70	128.75		Weak dark grey carbonaceous MUDSTONE. Recovered as sandy angular tabular fine to coarse gravel. (COAL MEASURES)
							End of pit at 3.70 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

TP20

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No. 4749

Co-ords: 414616.31 - 412080.17
Level: 128.25

Date 23/07/2024

Location: Honley

Dimensions (m): 2.5
Depth 3.40

0.6

Scale 1:20
Logged CC

Client: Vivly Living

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	127.95		Dark brown sandy slightly gravelly SAND with occasional rootlets. Gravel is angular to subangular fine to medium of sandstone and mudstone. (TOPSOIL)
	0.80	D					Light greyish brown slightly sandy slightly clayey angular to subangular, tabular fine to coarse GRAVEL of carbonaceous mudstone. (GRANULAR RESIDUAL SOIL)
				3.40	124.85		End of pit at 3.40 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

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



Project Name: Gynn Lane, Honley Project No. 4749 Co-ords: 414617.51 - 412053.22 Date 23/07/2024
 Level: 126.60

Location: Honley Dimensions (m): 2.4 Scale 1:20
 Client: Vivly Living Depth 3.40 Logged CC

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	J&T	HVP=58	0.40	126.20		Dark brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (TOPSOIL)
				1.80	124.80		Firm light orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone, mudstone and coal. (COHESIVE RESIDUAL SOIL)
				3.40	123.20		Light greyish brown clayey slightly sandy angular to subangular, tabular fine to coarse GRAVEL of carbonaceous mudstone. (GRANULAR RESIDUAL SOIL)
						----- End of pit at 3.40 m -----	

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

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



Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414608.72 - 412032.94 Level: 125.60	Date 23/07/2024
Location: Honley	Dimensions (m): Depth 3.10 2.4		Scale 1:20
Client: Vivly Living			Logged CC

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20 0.20	B J&T	HVP=48	0.30	125.30		Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone, mudstone and coal. (TOPSOIL)
				1.70	123.90		Firm light orangish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone, mudstone and coal. (COHESIVE RESIDUAL SOIL)
				2.20	123.40		Light greyish brown clayey slightly sandy angular, tabular fine to coarse GRAVEL of sandstone and mudstone. (GRANULAR RESIDUAL SOIL)
				3.10	122.50		Dark grey slightly sandy slightly clayey angular, tabular fine to coarse GRAVEL of carbonaceous mudstone. (COAL MEASURES)
							End of pit at 3.10 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.



Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414575.22 - 412026.04 Level: 121.70	Date 23/07/2024
Location: Honley	Client: Vivly Living	Dimensions (m): Depth 4.00	Scale 1:20 Logged CC

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.70	J&T	HVP=54	0.30	121.40		Dark brown sandy slightly gravelly CLAY with occasional rootlets. Gravel is angular to subrounded fine to medium of sandstone and mudstone. (TOPSOIL)
				0.90	120.80		MADE GROUND: Light greyish brown sandy slightly clayey angular to subangular fine to coarse GRAVEL of mudstone, coal and sandstone. (GRANULAR MADE GROUND)
				3.30	118.40		Firm light orangish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (COHESIVE RESIDUAL SOIL)
				3.70	118.00		Black COAL. Recovered as slightly sandy angular to subangular fine to coarse gravel. (SOFT BED COAL)
				4.00	117.70		Medium strong light brown SANDSTONE. Recovered as slightly sandy angular to subangular fine to coarse gravel. (COAL MEASURES)
End of pit at 4.00 m							

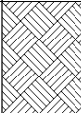

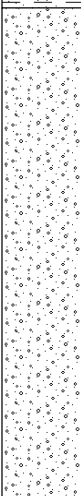
Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

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



Project Name: Gynn Lane, Honley Project No. 4749 Co-ords: 414586.43 - 412048.77 Date 23/07/2024
 Level: 122.50

Location: Honley Dimensions (m): 2.4 Scale 1:20
 Client: Vivly Living Depth 3.10 Logged CC

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	J&T	HVP=52	0.30	122.20		Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (TOPSOIL)
							Firm light orangish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (COHESIVE RESIDUAL SOIL)
	1.60	D		1.80	120.70		Light greyish brown slightly sandy angular and tabular fine to coarse GRAVEL of sandstone and mudstone. (GRANULAR RESIDUAL SOIL)
				3.10	119.40	End of pit at 3.10 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.





Trial Pit Log

Trialpit No

TP25

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No.
4749Co-ords: 414587.44 - 412075.50
Level: 122.65Date
23/07/2024

Location: Honley

Dimensions (m): 2.5
Depth 3.20Scale
1:20
Logged
CC

Client: Vivly Living

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	122.35		Dark brown slightly gravelly SAND with occasional rootlets. Gravel is angular to subangular fine to medium of sandstone and mudstone. (TOPSOIL)
							Light orangish brown clayey angular, tabular fine to coarse GRAVEL of mudstone with pockets of firm clay. (GRANULAR RESIDUAL SOIL)
				3.20	119.45		End of pit at 3.20 m



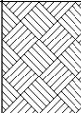

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

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



Project Name: Gynn Lane, Honley Project No. 4749 Co-ords: 414554.10 - 412070.43 Date 23/07/2024
 Level: 120.15

Location: Honley Dimensions (m): 2.5 Scale 1:20
 Client: Vivly Living Depth 1.80 Logged CC

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20 0.20	B J&T		0.30	119.85		Dark brown sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (TOPSOIL)
	1.20	D	HVP=56				Firm light orangish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (COHESIVE RESIDUAL SOIL)
				1.80	118.35		At 1.8m, unable to excavate further. End of pit at 1.80 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.



Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414554.75 - 412042.62 Level: 120.20	Date 24/07/2024
Location: Honley	Dimensions (m): Depth 2.00		Scale 1:20 Logged CC
Client: Vivly Living			

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	119.90		Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to coarse of sandstone and mudstone. (TOPSOIL)
			HVP=54	1.00	119.20		Firm light orangish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (COHESIVE RESIDUAL SOIL)
			HVP=74	1.70	118.50		Firm dark greyish brown mottled orange gravelly slightly sandy CLAY. Gravel is angular to subangular fine to medium of coal, sandstone and mudstone. (COHESIVE RESIDUAL SOIL)
				1.90	118.30		Black COAL. Recovered as angular fine to medium gravel. (SOFT BED COAL)
				2.00	118.20		Medium strong light brown SANDSTONE. Recovered as angular to subangular fine to coarse gravel and cobbles. (SOFT BED FLAGS)
				<p style="text-align: center;"><i>At 2.0m, unable to excavate further.</i></p> <p style="text-align: center;">End of pit at 2.00 m</p>			

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

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



Project Name: Gynn Lane, Honley Project No. 4749 Co-ords: 414533.56 - 412019.01 Date 24/07/2024
 Level: 117.75

Location: Honley Dimensions (m): 2.1 Scale 1:20
 Client: Vivly Living Depth 1.90 Logged CC

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	J&T	HVP=74	0.30	117.45		Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone, mudstone and coal. (TOPSOIL)
	1.00	D		1.40	116.35		Firm light orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (COHESIVE RESIDUAL SOIL)
	1.60	D&B		1.90	115.85		Light grey clayey slightly sandy angular to subangular fine to coarse GRAVEL of sandstone and sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)
							At 1.9m, unable to excavate further. End of pit at 1.90 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

TP29

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414509.49 - 412028.79

Level: 116.00

Date

24/07/2024

Location: Honley

Dimensions
(m):

2.2

Depth
2.40

0.6

Scale

1:20

Logged

CC

Client: Vivly Living

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	115.70		Dark brown sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone. (TOPSOIL)
				1.30	114.70		Light orangish brown clayey slightly sandy angular to subangular fine to coarse GRAVEL of sandstone with a low cobble content. Cobbles are angular of sandstone. (GRANULAR RESIDUAL SOIL)
	1.50	D		2.40	113.60		Very weak light brown SANDSTONE. Recovered as sandy angular to subangular fine to coarse gravel and cobbles. (SOFT BED FLAGS)
							At 2.4m, unable to excavate further. End of pit at 2.40 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

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



Project Name: Gynn Lane, Honley Project No. 4749 Co-ords: 414482.48 - 412036.35 Date 24/07/2024
 Level: 114.90

Location: Honley Dimensions (m): 2.3 Scale 1:20
 Client: Vivly Living Depth 1.20 Logged CC

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	J&T		0.20	114.70		Dark brown gravelly SAND with occasional rootlets. Gravel is angular to subrounded fine to coarse of sandstone. (TOPSOIL)
				1.20	113.70		Light brown sandy angular to subangular, tabular fine to coarse GRAVEL of sandstone with a medium cobble content. Cobbles are angular, tabular of sandstone. (GRANULAR RESIDUAL SOIL)
							At 1.2m, unable to excavate further. End of pit at 1.20 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

TP31

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No.
4749Co-ords: 414509.49 - 412058.38
Level: 117.65Date
24/07/2024

Location: Honley

Dimensions (m): 2.3
Depth 1.80Scale
1:20
Logged
CC

Client: Vivly Living

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	117.35		Dark brown gravelly SAND with occasional rootlets. Gravel is angular to subangular fine to coarse of sandstone. (TOPSOIL)
				1.30	116.35		Strong light brown fine to medium grained SANDSTONE. Recovered as angular tabular cobbles with much sandy angular tabular fine to coarse gravel and low boulder content. (GRANULAR RESIDUAL SOIL)
				1.80	115.85		Moderately strong light brown SANDSTONE . Recovered as sandy angular, tabular fine to coarse gravel with a low cobble content. (SOFT BED FLAGS)
							At 1.8m, unable to excavate further. End of pit at 1.80 m

1
2
3
4

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.



Project Name: Gynn Lane, Honley Project No. 4749 Co-ords: 414533.83 - 412069.10 Date 24/07/2024
 Level: 119.20

Location: Honley Dimensions (m): 2.3 Scale 1:20
 Client: Vivly Living Depth 2.60 Logged CC

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	J&T	HVP=56	0.30	118.90		Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (TOPSOIL)
	0.90	D		1.20	118.00		Firm light orangish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (COHESIVE RESIDUAL SOIL)
				2.10	117.10		Light greyish brown clayey angular to subangular, tabular fine to coarse GRAVEL of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL)
				2.60	116.60		Dark grey sandy angular tabular fine to coarse GRAVEL of carbonaceous mudstone. (SOFT BED FLAGS)
							End of pit at 2.60 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during excavation. 3. Backfilled with materials arising upon completion. 4. 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

TP33

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No. 4749

Co-ords: 414585.08 - 412112.35
Level: 121.25

Date 24/07/2024

Location: Honley

Dimensions (m):
Depth 0.90
3.5
1.2

Scale 1:20

Logged CC

Client: Vivly Living

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	120.95		Dark brown sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (TOPSOIL)
				0.90	120.35		Firm light orangish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (COHESIVE RESIDUAL SOIL)
							End of pit at 0.90 m

1
2
3
4

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

TP34

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No. 4749

Co-ords: 414584.00 - 412164.00
Level:Date
24/07/2024

Location: Honley

Dimensions (m): 1.5
Depth 1.30Scale
1:20
Logged
CC

Client: Vivly Living

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30			Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is subangular to subrounded fine to medium of sandstone and mudstone. (TOPSOIL)
				1.30			Firm light orangish brown gravelly slightly sandy CLAY. Gravel is angular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)
							End of pit at 1.30 m

1
2
3
4

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

TT01

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No. 4749

Co-ords: 414476.19 - 412067.95
Level:Date
23/07/2024

Location: Honley


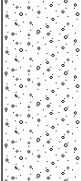

Dimensions (m):

Depth
0.90

0.90

Scale
1:20Logged
LEW

Client: Vivly Living

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20			Dark brown gravelly clayey fine to coarse SAND with frequent rootlets. Gravel is subangular to subrounded fine to coarse of sandstone. (TOPSOIL)
				0.70			Brown sandy slightly clayey angular to subangular tabular fine to coarse GRAVEL of sandstone with high cobble content. (GRANULAR RESIDUAL SOIL)
				0.90			Strong light brown fine to medium grained SANDSTONE. Recovered as angular tabular cobbles with much sandy angular tabular fine to coarse gravel and low boulder content. (SOFT BED FLAGS)
							Unable to excavate beyond 0.9m. End of pit at 0.90 m

1
2
3
4

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


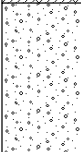
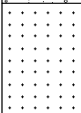
Stability: 1. The sides of the trial pit remained stable during excavation.



Project Name: Gynn Lane, Honley Project No. 4749 Co-ords: 414508.06 - 412090.47 Date 23/07/2024

Location: Honley Dimensions (m): Scale 1:20

Client: Vivly Living Depth 0.90 Logged LEW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20			Dark brown slightly gravelly clayey fine to coarse SAND with occasional rootlets. Gravel is subangular to subrounded fc of sandstone. (TOPSOIL)
				0.60			Light brown sandy clayey angular to subangular fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL) <i>At 0.2m, cast iron pipe.</i>
				0.90			Moderately strong light brown fine to medium grained SANDSTONE. Recovered as angular tabular cobbles with much sandy angular to subangular fine to coarse gravel. (SOFT BED FLAGS) <i>Unable to excavate beyond 0.9m.</i> End of pit at 0.90 m

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

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



Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: - Level:	Date 23/07/2024
Location: Honley	Dimensions (m): Depth 1.50		Scale 1:20 Logged LEW
Client: Vivly Living			

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20			Dark brown slightly gravelly clayey fine to coarse SAND with occasional rootlets. Gravel is subangular to subrounded fc of sandstone. (TOPSOIL)
				0.70			Firm brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)
				1.20			Light brown sandy clayey angular to subangular fine to coarse GRAVEL of sandstone and siltstone. (GRANULAR RESIDUAL SOIL)
				1.50			Moderately weak brown SILTSTONE interbedded with medium strong light brown SANDSTONE. Recovered as sandy angular tabular fine to coarse gravel with medium cobble content. (SOFT BED FLAGS)
							Unable to excavate beyond 1.5m. End of pit at 1.50 m

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


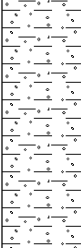
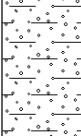

Stability: 1. The sides of the trial pit remained stable during excavation.



Project Name: Gynn Lane, Honley Project No. 4749 Co-ords: 414510.56 - 412075.75 Date 23/07/2024

Location: Honley Dimensions (m): Scale 1:20

Client: Vivly Living Depth 1.70 Logged LEW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20			Dark brown slightly gravelly clayey fine to coarse SAND with occasional rootlets. Gravel is subangular to subrounded fc of sandstone. (TOPSOIL)
				0.90			Firm orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone. (COHESIVE RESIDUAL SOIL)
				1.30			Orangish brown sandy very clayey subangular fine to coarse GRAVEL of sandstone and siltstone. (GRANULAR RESIDUAL SOIL)
				1.70			Weak dark grey SILTSTONE interbedded with moderately weak light brown SANDSTONE. Recovered as sandy angular tabular fine to coarse gravel with medium cobble content. (SOFT BED FLAGS)
							Unable to excavate beyond 1.7m. 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. 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
TT03A
Sheet 1 of 2

Project Name: Gynn Lane, Honley Project No. 4749 Co-ords: 414611.25 - 412143.54 Date 23/07/2024

Location: Honley Dimensions (m): Scale 1:20

Client: Vivly Living Depth 5.00 Logged LEW

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 with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone. (TOPSOIL)
				1.00			Firm light brown slightly sandy gravelly CLAY. Gravel is subangular fine to coarse of siltstone. (COHESIVE RESIDUAL SOIL)
							Light brown clayey angular to subangular fine to coarse GRAVEL of siltstone. (GRANULAR RESIDUAL SOIL)
							<i>Between 1.0m and 2.0m, significant spalling of trial pit walls.</i>
				2.00			Dark brown and greyish brown sandy slightly clayey angular to subangular fine to coarse GRAVEL of carbonaceous mudstone. (GRANULAR RESIDUAL SOIL)
							<i>From 2.0m, significant spalling of trial pit walls leading to continuous collapse trending approximately north-south.</i>
							Continued on next sheet

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 from 1.0m depth during excavation leading to continuous collapse from 2.0m depth.





Trial Pit Log

Trialpit No

TT03A

Sheet 2 of 2

Project Name: Gynn Lane, Honley

Project No. 4749

Co-ords: 414611.25 - 412143.54
Level:

Date 23/07/2024

Location: Honley

Dimensions (m):

Depth 5.00

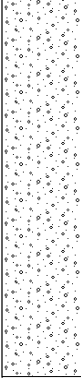
0.9

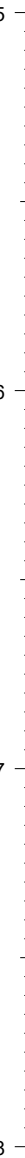


Scale 1:20

Logged LEW

Client: Vivly Living

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				5.00			End of pit at 5.00 m



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

Stability: 1. The sides of the trial pit were unstable from 1.0m depth during excavation leading to continuous collapse from 2.0m depth.



Project Name: Gynn Lane, Honley Project No. 4749 Co-ords: - Date 23/07/2024
 Level: Level:

Location: Honley Dimensions (m): Scale 1:20
 Depth 3.50 Logged LEW

Client: Vivly Living

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30			Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone. (TOPSOIL)
							Firm light brown slightly sandy gravelly CLAY. Gravel is subangular fine to coarse of siltstone. (COHESIVE RESIDUAL SOIL)
							<i>Locally very clayey gravel.</i>
				1.50			Firm orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone. (COHESIVE RESIDUAL SOIL)
				2.60			Dark grey and orangish brown sandy very clayey angular to subangular fine to coarse Gravel of carbonaceous mudstone. (GRANULAR RESIDUAL SOIL)
				3.20			Extremely weak dark grey carbonaceous MUDSTONE. Recovered as sandy angular tabular fine to coarse gravel. (COAL MEASURES)
				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. 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

TT03C

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No.
4749Co-ords: -
Level:Date
23/07/2024

Location: Honley

Dimensions
(m):Depth
3.20

0.6

Scale
1:20Logged
LEW

Client: Vivly Living

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 with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone. (TOPSOIL)
				0.70			Firm brown slightly sandy gravelly CLAY. Gravel is subangular to subrounded fine to coarse of siltstone. (COHESIVE RESIDUAL SOIL)
				1.90			Brown sandy clayey angular to subangular fine to coarse GRAVEL of siltstone. (GRANULAR RESIDUAL SOIL)
				2.40			Extremely weak brown SILTSTONE. Recovered as sandy angular tabular fine to coarse gravel. (COAL MEASURES)
				3.20			Weak dark grey carbonaceous MUDSTONE. Recovered as sandy angular tabular fine to coarse gravel. (COAL MEASURES)
							End of pit at 3.20 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. Exploratory hole surveyed in (level and co-ordinates) on completion.

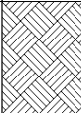
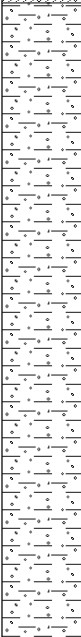
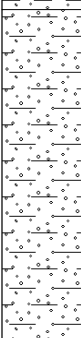


Stability: 1. The sides of the trial pit remained stable during excavation.



Project Name: Gynn Lane, Honley Project No. 4749 Co-ords: 414630.53 - 412139.87 Date 23/07/2024

Location: Honley Dimensions (m): Scale 1:20

Client: Vivly Living Depth 3.20 Logged LEW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30			Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of sandstone. (TOPSOIL)
							Firm orangish brown mottled dark grey slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of siltstone. (COHESIVE RESIDUAL SOIL)
				2.00			Brown and dark grey sandy clayey angular to subangular fine to coarse GRAVEL of mudstone. (GRANULAR RESIDUAL SOIL)
				2.90			Extremely weak grey mudstone recovered as sandy angular tabular fine to coarse gravel. (COAL MEASURES)
				3.20			End of pit at 3.20 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. Exploratory hole surveyed in (level and co-ordinates) on completion.

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



Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414616.08 - 412136.08 Level:	Date 24/07/2024
Location: Honley	Dimensions (m): Depth 3.50		Scale 1:20 Logged LEW
Client: Vivly Living			

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30			Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to coarse of sandstone. (TOPSOIL)
				1.40			Firm brown slightly sandy gravelly CLAY. Gravel is subangular to subrounded fine to coarse of siltstone. (COHESIVE RESIDUAL SOIL)
				2.50			Firm orangish brown mottled dark grey CLAY. (COHESIVE RESIDUAL SOIL)
				3.20			Brown sandy clayey angular to subangular fine to coarse GRAVEL of carbonaceous mudstone. (GRANULAR RESIDUAL SOIL)
				3.50			Extremely weak dark grey carbonaceous MUDSTONE. Recovered as sandy slightly clayey angular to subangular fine to coarse gravel. (COAL MEASURES)
							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. Exploratory hole surveyed in (level and co-ordinates) on completion.

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



Project Name: Gynn Lane, Honley Project No. 4749 Co-ords: - Date 24/07/2024
 Level: Level:

Location: Honley Dimensions (m): Scale 1:20
 Depth 3.50 0.5 Logged LEW

Client: Vivly Living

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 with occasional rootlets. Gravel is subangular to subrounded fine to coarse of sandstone. (TOPSOIL)
							Greyish brown sandy clayey angular to subangular fine to coarse GRAVEL of siltstone. (GRANULAR RESIDUAL SOIL)
							<i>Between 0.5m and 2.1m, spalling of trial pit walls.</i>
				2.10			Firm orangish brown mottled dark grey CLAY. (COHESIVE RESIDUAL SOIL)
				2.30			Dark grey sandy clayey angular to subangular fine to coarse GRAVEL of carbonaceous mudstone. (GRANULAR RESIDUAL SOIL)
							<i>Between 2.3m and 3.5m, spalling of trial pit walls.</i>
				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. Exploratory hole surveyed in (level and co-ordinates) on completion.

Stability: 1. The sides of the trial pit were unstable from 0.5m depth during excavation.



Project Name: Gynn Lane, Honley Project No. 4749 Co-ords: 414609.83 - 412137.55 Date 24/07/2024

Location: Honley Dimensions (m): Scale 1:20

Client: Vivly Living Depth 2.90 Logged LEW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30			Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to coarse of sandstone. (TOPSOIL)
				1.40			Firm orangish brown mottled dark grey CLAY. (COHESIVE RESIDUAL SOIL)
				2.10			Brown sandy clayey angular to subangular fine to coarse Gravel of carbonaceous mudstone. (GRANULAR RESIDUAL SOIL)
				2.90			Dark grey sandy clayey angular to subangular fine to coarse GRAVEL of carbonaceous mudstone. (GRANULAR RESIDUAL SOIL)
							End of pit at 2.90 m

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

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



Appendix G
Borehole Logs

Borehole Log

Borehole No.

PH01

Sheet 1 of 3

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414562.13 - 412132.51	Hole Type PH
Location: Honley		Level: 118.55	Scale 1:50
Client: Vivly Living		Dates: 29/07/2024 - 29/07/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		1
					2.00	116.55		Light brown SANDSTONE and MUDSTONE. (COAL MEASURES)	2
									3
									4
									5
									6
					7.00	111.55		Light brown SANDSTONE. (COAL MEASURES)	7
									8
									9
									10

Continued on next sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH01

Sheet 2 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414562.13 - 412132.51

Hole Type
PH

Location: Honley

Level: 118.55

Scale
1:50

Client: Vivly Living

Dates: 29/07/2024 - 29/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
(Well casing pattern)								
					12.00	106.55	(Sandstone pattern)	Interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)
					15.00	103.55	(Mudstone pattern)	Dark grey MUDSTONE. (COAL MEASURES)
					18.50	100.05	(Drilling pattern)	Solid drilling, loss of flush. No returns. (COAL MEASURES)

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Project Name: Gynn Lane, Honley

 Project No.
4749

Co-ords: 414562.13 - 412132.51

 Hole Type
PH

Location: Honley

Level: 118.55

 Scale
1:50

Client: Vivly Living

Dates: 29/07/2024 - 29/07/2024

 Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					21.00	97.55		End of borehole at 21.00 m	21
									22
									23
									24
									25
									26
									27
									28
									29
									30

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

Borehole Log

Borehole No.

PH02

Sheet 2 of 4

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414506.69 - 412053.54

Hole Type
PH

Location: Honley

Level: 117.35

Scale
1:50

Client: Vivly Living

Dates: 29/07/2024 - 29/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								11 12 13 14 15 16 17 18 19 20

Continued on next sheet

Remarks

- Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out.
- Groundwater encountered at 21.0m depth.
- Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH02

Sheet 3 of 4

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414506.69 - 412053.54

Hole Type
PH

Location: Honley

Level: 117.35

Scale
1:50

Client: Vivly Living

Dates: 29/07/2024 - 29/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
	▼								
							Water at 21.0m.		21
									22
									23
									24
									25
									26
									27
									28
									29
					30.00	87.35			30

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out.
2. Groundwater encountered at 21.0m depth.
3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH02

Sheet 4 of 4

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414506.69 - 412053.54

Hole Type
PH

Location: Honley

Level: 117.35

Scale
1:50

Client: Vivly Living

Dates: 29/07/2024 - 29/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Dark grey carbonaceous MUDSTONE. (COAL MEASURES)		
					33.00	84.35		End of borehole at 33.00 m	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater encountered at 21.0m depth.
 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

Borehole Log

Borehole No.

PH03

Sheet 1 of 3

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414593.02 - 412066.89	Hole Type PH
Location: Honley		Level: 123.40	Scale 1:50
Client: Vivly Living		Dates: 29/07/2024 - 29/07/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		1
					2.00	121.40		Dark grey MUDSTONE. (COAL MEASURES)	2
					5.50	117.90		Dark grey carbonaceous MUDSTONE. (COAL MEASURES)	6
					6.30	117.10		Light brown SANDSTONE. (COAL MEASURES)	7
									8
									9
									10

Continued on next sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH03

Sheet 2 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414593.02 - 412066.89

Hole Type
PH

Location: Honley

Level: 123.40

Scale
1:50

Client: Vivly Living

Dates: 29/07/2024 - 29/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								11
								12
								13
								14
								15
								16
								17
					17.50	105.90		18
							Light grey MUDSTONE. (COAL MEASURES)	19
								20

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH03

Sheet 3 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414593.02 - 412066.89

Hole Type
PH

Location: Honley

Level: 123.40

Scale
1:50

Client: Vivly Living

Dates: 29/07/2024 - 29/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					24.00	99.40		
								End of borehole at 24.00 m

21
22
23
24
25
26
27
28
29
30

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH03a

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414597.52 - 412066.70

Hole Type
PH

Location: Honley

Level: 124.10

Scale
1:50

Client: Vivly Living

Dates: 01/08/2024 - 01/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		1
					2.00	122.10		Dark grey MUDSTONE. (COAL MEASURES)	2
									3
									4
									5
					6.60	117.50		Dark grey carbonaceous MUDSTONE. Limited flush. (WORKED SOFT BED COAL)	7
					7.30	116.80		Light greyish brown SANDSTONE. Flush returned. (COAL MEASURES)	8
					9.00	115.10		End of borehole at 9.00 m	9
									10

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH04

Sheet 1 of 3

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414620.16 - 412044.38	Hole Type PH
Location: Honley		Level: 126.50	Scale 1:50
Client: Vivly Living		Dates: 30/07/2024 - 30/07/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)	1	
					2.00	124.50	Dark grey carbonaceous MUDSTONE. (COAL MEASURES)	2	
								3	
								4	
								5	
								6	
								7	
					7.50	119.00	Light greyish brown SANDSTONE. (COAL MEASURES)	8	
								9	
								10	

Continued on next sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater encountered at 19.8m depth.
 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH04

Sheet 3 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414620.16 - 412044.38

Hole Type
PH

Location: Honley

Level: 126.50

Scale
1:50

Client: Vivly Living

Dates: 30/07/2024 - 30/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					24.00	102.50		
								End of borehole at 24.00 m

21
22
23
24
25
26
27
28
29
30

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out.
2. Groundwater encountered at 19.8m depth.
3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH04a

Sheet 1 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414615.06 - 412044.05

Hole Type
PH

Location: Honley

Level: 125.65

Scale
1:50

Client: Vivly Living

Dates: 01/08/2024 - 01/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)	1	
					2.00	123.65	Dark grey MUDSTONE. (COAL MEASURES)	2	
					4.50	121.15	Light grey MUDSTONE. (COAL MEASURES)	5	
					9.00	116.65	Light greyish brown SANDSTONE. (COAL MEASURES)	9	
							Continued on next sheet	10	

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH04a

Sheet 2 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414615.06 - 412044.05

Hole Type
PH

Location: Honley

Level: 125.65

Scale
1:50

Client: Vivly Living

Dates: 01/08/2024 - 01/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.00	113.65		
								End of borehole at 12.00 m

11
12
13
14
15
16
17
18
19
20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.





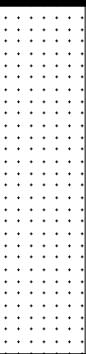
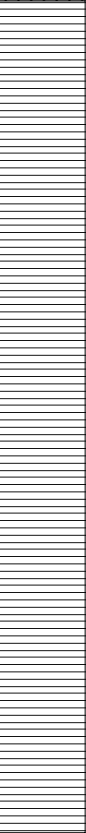
Borehole Log

Borehole No.

PH05

Sheet 1 of 4

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414655.36 - 412051.77	Hole Type PH
Location: Honley		Level: 131.20	Scale 1:50
Client: Vivly Living		Dates: 30/07/2024 - 30/07/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)	1	
				1.80	129.40		Black COAL. (MIDDLE BAND COAL)	2	
				2.20	129.00		Light brown SANDSTONE. (COAL MEASURES)	3	
				4.50	126.70		Dark grey MUDSTONE. (COAL MEASURES)	4	
								5	
								6	
								7	
								8	
								9	
								10	

Continued on next sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 16.3m to 16.9m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH05

Sheet 2 of 4

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414655.36 - 412051.77

Hole Type
PH

Location: Honley

Level: 131.20

Scale
1:50

Client: Vivly Living

Dates: 30/07/2024 - 30/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
(Well casing pattern)									
								11	
								12	
								13	
								14	
								15	
					16.30	114.90	(Worked soft bed coal pattern)	Loss of flush - soft / broken ground. (WORKED SOFT BED COAL)	16
					16.90	114.30	(Coal measures pattern)	Dark grey MUDSTONE. Flush returned. (COAL MEASURES)	17
					18.30	112.90	(Coal measures pattern)	Light grey MUDSTONE. (COAL MEASURES)	18
					20.00	111.20	(Coal measures pattern)		19
								20	

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 16.3m to 16.9m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH05

Sheet 3 of 4

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414655.36 - 412051.77

Hole Type
PH

Location: Honley

Level: 131.20

Scale
1:50

Client: Vivly Living

Dates: 30/07/2024 - 30/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Light greyish brown SANDSTONE. (COAL MEASURES)		
								21	
								22	
								23	
								24	
								25	
								26	
								27	
								28	
								29	
								30	

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. Flush returns were lost from 16.3m to 16.9m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH05

Sheet 4 of 4

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414655.36 - 412051.77

Hole Type
PH

Location: Honley

Level: 131.20

Scale
1:50

Client: Vivly Living

Dates: 30/07/2024 - 30/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					33.00	98.20		
								End of borehole at 33.00 m

31
32
33
34
35
36
37
38
39
40

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 16.3m to 16.9m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH06

Sheet 1 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414636.98 - 412073.16

Hole Type
PH

Location: Honley

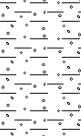
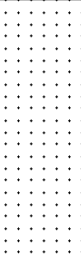
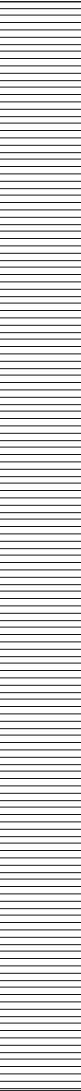
Level: 130.35

Scale
1:50

Client: Vivly Living

Dates: 30/07/2024 - 30/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		
				1.00	129.35		Light brown SANDSTONE. (COAL MEASURES)	1	
				2.80	127.55		Dark grey MUDSTONE. (COAL MEASURES)	3	
								4	
								5	
								6	
								7	
								8	
								9	
								10	

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 14.3m to 14.9m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH06

Sheet 2 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414636.98 - 412073.16

Hole Type
PH

Location: Honley

Level: 130.35

Scale
1:50

Client: Vivly Living

Dates: 30/07/2024 - 30/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					14.30	116.05		Loss of flush - broken ground / soft drilling. (WORKED SOFT BED COAL)
					14.90	115.45		

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. Flush returns were lost from 14.3m to 14.9m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH06

Sheet 3 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414636.98 - 412073.16

Hole Type
PH

Location: Honley

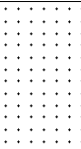
Level: 130.35

Scale
1:50

Client: Vivly Living

Dates: 30/07/2024 - 30/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					21.00	109.35		End of borehole at 21.00 m <div style="text-align: right;"> 21 22 23 24 25 26 27 28 29 30 </div>

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 14.3m to 14.9m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Borehole Log

Borehole No.

PH07

Sheet 1 of 2

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414638.38 - 412108.21	Hole Type PH
Location: Honley		Level: 130.05	Scale 1:50
Client: Vivly Living		Dates: 30/07/2024 - 30/07/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		
					1.00	129.05		Light brown SANDSTONE. (COAL MEASURES)	1
					2.30	127.75		Dark grey carbonaceous MUDSTONE. (COAL MEASURES)	2
									3
									4
									5
									6
									7
									8
									9
									10

Continued on next sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 13.6m to 14.6m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH07

Sheet 2 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414638.38 - 412108.21

Hole Type
PH

Location: Honley

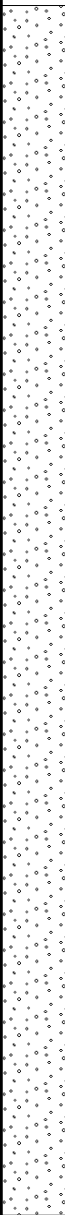
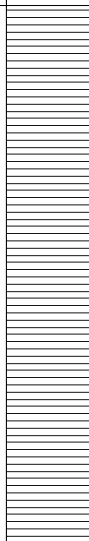
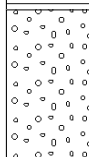
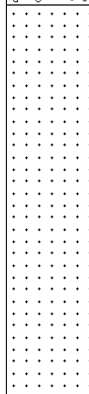
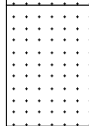
Level: 130.05

Scale
1:50

Client: Vivly Living

Dates: 30/07/2024 - 30/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								11
				13.60	116.45		Loss of flush. Broken ground / soft drilling. (WORKED SOFT BED COAL)	14
				14.60	115.45		Light grey SANDSTONE. Flush returned. (COAL MEASURES)	15
				17.20	112.85		Dark grey SANDSTONE. (COAL MEASURES)	17
			18.00	112.05	End of borehole at 18.00 m			18
								19
								20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 13.6m to 14.6m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH08

Sheet 1 of 2

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414614.49 - 412095.61	Hole Type PH
Location: Honley		Level: 127.65	Scale 1:50
Client: Vivly Living		Dates: 30/07/2024 - 30/07/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		1
					2.50	125.15		Dark grey carbonaceous MUDSTONE. (COAL MEASURES)	2
									3
									4
									5
									6
									7
									8
									9
									10

Continued on next sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 10.5m to 11.3m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH08

Sheet 2 of 2

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414614.49 - 412095.61	Hole Type PH
Location: Honley		Level: 127.65	Scale 1:50
Client: Vivly Living		Dates: 30/07/2024 - 30/07/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
[Pattern]					10.50	117.15	[Pattern]	Loss of flush. Broken ground / fast drilling. (WORKED SOFT BED COAL)	11
					11.30	116.35	[Pattern]	Light greyish brown SANDSTONE. Return of flush. (COAL MEASURES)	12
					13.80	113.85	[Pattern]	Light grey MUDSTONE. (COAL MEASURES)	14
					15.00	112.65	[Pattern]	End of borehole at 15.00 m	15

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 10.5m to 11.3m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH09

Sheet 1 of 2

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414614.49 - 412140.36	Hole Type PH
Location: Honley		Level: 122.65	Scale 1:50
Client: Vivly Living		Dates: 30/07/2024 - 30/07/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		1
									2
									3
									4
					5.00	117.65		Loss of flush. Broken / soft ground. (WORKED SOFT BED COAL)	5
					5.70	116.95		Light greyish brown SANDSTONE. Return of flush. (COAL MEASURES)	6
									7
									8
									9
									10

Continued on next sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 5.0m to 5.7m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH09

Sheet 2 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414614.49 - 412140.36

Hole Type
PH

Location: Honley

Level: 122.65

Scale
1:50

Client: Vivly Living

Dates: 30/07/2024 - 30/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.00	110.65		
								End of borehole at 12.00 m

11
12
13
14
15
16
17
18
19
20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 5.0m to 5.7m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414616.44 - 412139.85	Hole Type PH
Location: Honley		Level: 123.00	Scale 1:50
Client: Vivly Living		Dates: 30/07/2024 - 30/07/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
							Overburden. (RESIDUAL SOIL)		1	
					2.50	120.50		Dark grey carbonaceous MUDSTONE. (COAL MEASURES)		2
					4.50	118.50		Loss of flush, fast drilling, soft push. (ADIT)		3
					6.90	116.10		Solid drilling. No flush. (COAL MEASURES)		4
					9.00	114.00		End of borehole at 9.00 m		5
										6
										7
										8
										9
										10

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 4.5m to 6.9m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH09b

Sheet 1 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414618.22 - 412139.38

Hole Type
PH

Location: Honley

Level: 123.25

Scale
1:50

Client: Vivly Living

Dates: 31/07/2024 - 31/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		
					3.00	120.25			
							Dark grey carbonaceous MUDSTONE. (COAL MEASURES)		
					5.80	117.45			
							Loss of flush. Soft drilling, broken / collapsed ground. (WORKED SOFT BED COAL)		
					7.10	116.15			
							Light greyish brown SANDSTONE. Return of flush. (COAL MEASURES)		
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. Flush returns were lost from 5.8m to 7.1m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH09b

Sheet 2 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414618.22 - 412139.38

Hole Type
PH

Location: Honley

Level: 123.25

Scale
1:50

Client: Vivly Living

Dates: 31/07/2024 - 31/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.00	111.25		
								End of borehole at 12.00 m

11
12
13
14
15
16
17
18
19
20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 5.8m to 7.1m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH09c

Sheet 1 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414620.03 - 412139.06

Hole Type
PH

Location: Honley

Level: 123.55

Scale
1:50

Client: Vivly Living

Dates: 31/07/2024 - 31/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		1
					2.50	121.05		Dark grey carbonaceous MUDSTONE. (COAL MEASURES)	2
									3
									4
									5
					6.00	117.55		Loss of flush. Broken / collapsed ground. Soft drilling. (WORKED SOFT BED COAL)	6
									7
					7.10	116.45		Light greyish brown SANDSTONE. (COAL MEASURES)	8
									9
									10

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 6.0m to 7.1m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH09c

Sheet 2 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414620.03 - 412139.06

Hole Type
PH

Location: Honley

Level: 123.55

Scale
1:50

Client: Vivly Living

Dates: 31/07/2024 - 31/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.00	111.55		
								End of borehole at 12.00 m

11
12
13
14
15
16
17
18
19
20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 6.0m to 7.1m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH09d

Sheet 1 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414628.11 - 412138.04

Hole Type
PH

Location: Honley

Level: 124.85

Scale
1:50

Client: Vivly Living

Dates: 31/07/2024 - 31/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		
					2.50	122.35			
					4.10	120.75	Dark grey MUDSTONE. (COAL MEASURES)		
					4.80	120.05	Loss of flush. Soft ground. (WORKED SOFT BED COAL)		
							Dark grey MUDSTONE. (COAL MEASURES)		
					8.70	116.15	Light greyish brown SANDSTONE. (COAL MEASURES)		

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. Flush returns were lost from 4.1m to 4.8m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Project Name: Gynn Lane, Honley

 Project No.
4749

Co-ords: 414628.11 - 412138.04

 Hole Type
PH

Location: Honley

Level: 124.85

 Scale
1:50

Client: Vivly Living

Dates: 31/07/2024 - 31/07/2024

 Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.00	112.85		
								End of borehole at 12.00 m

 11
12
13
14
15
16
17
18
19
20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 4.1m to 4.8m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Borehole Log

Borehole No.

PH10

Sheet 1 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414613.42 - 412125.31

Hole Type
PH

Location: Honley

Level: 124.70

Scale
1:50

Client: Vivly Living

Dates: 31/07/2024 - 31/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
							Overburden. (RESIDUAL SOIL)		1	
					2.80	121.90		Dark grey MUDSTONE. (COAL MEASURES)		2
					6.60	118.10		Loss of flush. Soft drilling, broken / soft ground. (WORKED SOFT BED COAL)		3
					8.30	116.40		Solid ground. No flush. (COAL MEASURES)		4
										5
										6
										7
										8
										9
										10

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 6.6m to 8.3m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH10

Sheet 2 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414613.42 - 412125.31

Hole Type
PH

Location: Honley

Level: 124.70

Scale
1:50

Client: Vivly Living

Dates: 31/07/2024 - 31/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.00	112.70		
								End of borehole at 12.00 m

11
12
13
14
15
16
17
18
19
20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 6.6m to 8.3m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH11

Sheet 1 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414612.99 - 412113.23

Hole Type
PH

Location: Honley

Level: 126.10

Scale
1:50

Client: Vivly Living

Dates: 31/07/2024 - 31/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		
					1.00	125.10		Interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	1
					2.80	123.30		Dark grey carbonaceous MUDSTONE. (COAL MEASURES)	3
					8.30	117.80		Loss of flush. Soft drilling, broken / soft ground. (WORKED SOFT BED COAL)	9
									10

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 8.3m to 10.1m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH11

Sheet 2 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414612.99 - 412113.23

Hole Type
PH

Location: Honley

Level: 126.10

Scale
1:50

Client: Vivly Living

Dates: 31/07/2024 - 31/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					10.10	116.00	 Solid ground. No returns. (COAL MEASURES)	
					12.00	114.10		
End of borehole at 12.00 m								

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 8.3m to 10.1m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Borehole Log

Borehole No.

PH12

Sheet 1 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414588.29 - 412131.04

Hole Type
PH

Location: Honley

Level: 120.15

Scale
1:50

Client: Vivly Living

Dates: 31/07/2024 - 31/07/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)	1	
				1.50	118.65		Black COAL. (SOFT BED COAL)	2	
				2.00	118.15		Light greyish brown SANDSTONE. (COAL MEASURES)	3	
								4	
								5	
								6	
								7	
								8	
								9	
								10	

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 15.0m. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH13

Sheet 1 of 2

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414549.75 - 412064.29	Hole Type PH
Location: Honley		Level: 120.00	Scale 1:50
Client: Vivly Living		Dates: 01/08/2024 - 01/08/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
							Overburden. (RESIDUAL SOIL)		1	
					1.50	118.50		Light brown SANDSTONE. (COAL MEASURES)		2
					3.00	117.00		Dark grey MUDSTONE. (COAL MEASURES)		3
					5.00	115.00		Light greyish brown SANDSTONE. (COAL MEASURES)		5
					8.80	111.20		Light grey MUDSTONE. (COAL MEASURES)		9
					9.50	110.50		Light greyish brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)		10

Continued on next sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH13

Sheet 2 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414549.75 - 412064.29

Hole Type
PH

Location: Honley

Level: 120.00

Scale
1:50

Client: Vivly Living

Dates: 01/08/2024 - 01/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					15.00	105.00		End of borehole at 15.00 m

11
12
13
14
15
16
17
18
19
20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH14

Sheet 2 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414573.10 - 412065.81

Hole Type
PH

Location: Honley

Level: 121.40

Scale
1:50

Client: Vivly Living

Dates: 01/08/2024 - 01/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
	▼						Water at 10.30m.	
					15.00	106.40	End of borehole at 15.00 m	

11
12
13
14
15
16
17
18
19
20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 10.3m. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH15

Sheet 1 of 2

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414619.00 - 412071.61	Hole Type PH
Location: Honley		Level: 128.45	Scale 1:50
Client: Vivly Living		Dates: 01/08/2024 - 01/08/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.00	127.45		Overburden. (RESIDUAL SOIL)	
								Dark grey MUDSTONE. (COAL MEASURES)	1
									2
									3
									4
									5
									6
									7
									8
									9
									10

Continued on next sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 11.2m to 12.3m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH15

Sheet 2 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414619.00 - 412071.61

Hole Type
PH

Location: Honley

Level: 128.45

Scale
1:50

Client: Vivly Living

Dates: 01/08/2024 - 01/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
[Pattern]					11.20	117.25	[Pattern]	
					12.30	116.15	[Pattern]	Loss of flush. Soft push. (WORKED SOFT BED COAL)
					15.00	113.45	[Pattern]	Light greyish brown SANDSTONE. Flush returned. (COAL MEASURES)
							End of borehole at 15.00 m	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 11.2m to 12.3m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

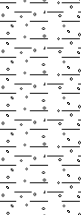

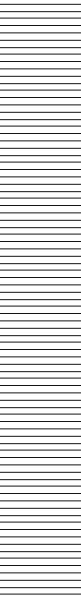
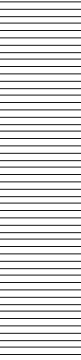

Borehole Log

Borehole No.

PH16

Sheet 1 of 2

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414613.35 - 412061.45	Hole Type PH
Location: Honley		Level: 126.65	Scale 1:50
Client: Vivly Living		Dates: 01/08/2024 - 01/08/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)	1	
				1.50	125.15		Light brown SANDSTONE. (COAL MEASURES)	2	
				3.00	123.65		Dark grey MUDSTONE. (COAL MEASURES)	3	
				7.00	119.65		Light grey MUDSTONE. (COAL MEASURES)	7	
				9.50	117.15		Loss of flush. Broken / soft ground (WORKED SOFT BED COAL)	10	

Continued on next sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 9.5m to 10.3m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH16

Sheet 2 of 2

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414613.35 - 412061.45	Hole Type PH
Location: Honley		Level: 126.65	Scale 1:50
Client: Vivly Living		Dates: 01/08/2024 - 01/08/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					10.30	116.35		Light greyish brown SANDSTONE. Return of flush. (COAL MEASURES)	11
					12.00	114.65		End of borehole at 12.00 m	12
									13
									14
									15
									16
									17
									18
									19
									20

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 9.5m to 10.3m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH17

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414603.45 - 412055.10

Hole Type
PH

Location: Honley

Level: 124.50

Scale
1:50

Client: Vivly Living

Dates: 01/08/2024 - 01/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		
					1.80	122.70		Light brown SANDSTONE. (COAL MEASURES)	1
					2.80	121.70		Dark grey MUDSTONE. (COAL MEASURES)	2
					5.20	119.30		Light grey MUDSTONE. (COAL MEASURES)	3
					6.70	117.80		Loss of flush. Broken / soft ground. (WORKED SOFT BED COAL)	4
					7.70	116.80		Light greyish brown SANDSTONE. (COAL MEASURES)	5
					9.00	115.50		End of borehole at 9.00 m	6

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 6.7m to 7.7m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH18

Sheet 1 of 4

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414512.86 - 412084.96

Hole Type
PH

Location: Honley

Level: 118.55

Scale
1:50

Client: Vivly Living

Dates: 01/08/2024 - 01/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		
					1.00	117.55	Light brown SANDSTONE. (COAL MEASURES)	1	
								2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								10	

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 17.8m. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH18

Sheet 2 of 4

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414512.86 - 412084.96

Hole Type
PH

Location: Honley

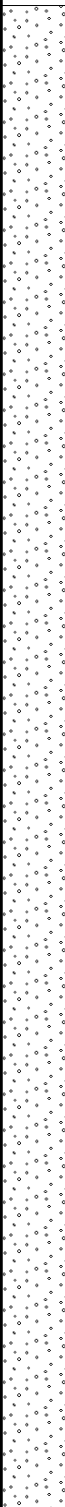

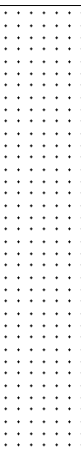
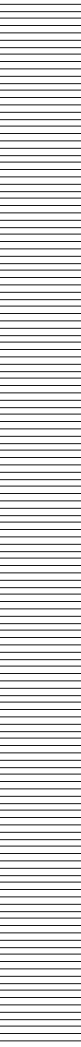
Level: 118.55

Scale
1:50

Client: Vivly Living

Dates: 01/08/2024 - 01/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					13.00	105.55		11	
								12	
								Dark grey MUDSTONE. (COAL MEASURES)	13
									14
									15
									16
									17
								Water at 17.8m.	18
									19
									20

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 17.8m. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH18

Sheet 3 of 4

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414512.86 - 412084.96

Hole Type
PH

Location: Honley

Level: 118.55

Scale
1:50

Client: Vivly Living

Dates: 01/08/2024 - 01/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								21 22 23 24 25 26 27 28 29 30

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 17.8m. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.





Borehole Log

Borehole No.

PH18

Sheet 4 of 4

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414512.86 - 412084.96

Hole Type
PH

Location: Honley

Level: 118.55

Scale
1:50

Client: Vivly Living

Dates: 01/08/2024 - 01/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					33.00	85.55		
								31
								32
								33
								34
								35
								36
								37
								38
								39
								40

End of borehole at 33.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 17.8m. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH18a

Sheet 1 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414514.91 - 412083.11

Hole Type
PH

Location: Honley

Level: 118.65

Scale
1:50

Client: Vivly Living

Dates: 02/08/2024 - 02/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		
					1.00	117.65		Light brown SANDSTONE. (COAL MEASURES)	1
									2
									3
									4
									5
									6
									7
									8
					8.60	110.05		Dark grey MUDSTONE. (COAL MEASURES)	9
									10

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 18.0m. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH18a

Sheet 3 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414514.91 - 412083.11

Hole Type
PH

Location: Honley

Level: 118.65

Scale
1:50

Client: Vivly Living

Dates: 02/08/2024 - 02/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								21 22 23 24 25 26 27 28 29 30
					27.00	91.65	Unable to drill further at 27.0m. No flush due to water.	End of borehole at 27.00 m

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 18.0m. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.

Borehole Log

Borehole No.

PH18b

Sheet 1 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414512.19 - 412086.90

Hole Type
PH

Location: Honley

Level: 118.55

Scale
1:50

Client: Vivly Living

Dates: 02/08/2024 - 02/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		
					1.00	117.55		Light brown SANDSTONE. (COAL MEASURES)	1
									2
									3
									4
									5
					6.00	112.55		Dark grey MUDSTONE. (COAL MEASURES)	6
									7
									8
									9
									10

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH18b

Sheet 2 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414512.19 - 412086.90

Hole Type
PH

Location: Honley

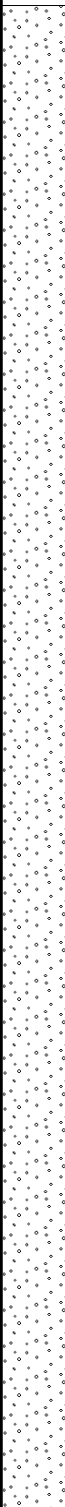
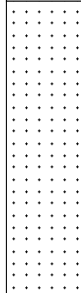
Level: 118.55

Scale
1:50

Client: Vivly Living

Dates: 02/08/2024 - 02/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								11	
								12	
								13	
								14	
								15	
								16	
								17	
					18.00	100.55		Light brown SANDSTONE. (COAL MEASURES)	18
									19
									20

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414511.48 - 412087.89

Hole Type
PH

Location: Honley

Level: 118.55

Scale
1:50

Client: Vivly Living

Dates: 02/08/2024 - 02/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.00	117.55		Overburden. (RESIDUAL SOIL)	
								Light brown SANDSTONE. (COAL MEASURES)	1
									2
									3
									4
									5
					6.00	112.55		Dark grey MUDSTONE. (COAL MEASURES)	6
									7
									8
									9
									10

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 18.0m. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH18c

Sheet 2 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414511.48 - 412087.89

Hole Type
PH

Location: Honley

Level: 118.55

Scale
1:50

Client: Vivly Living

Dates: 02/08/2024 - 02/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
▼								
					18.00	100.55		Light brown SANDSTONE. (COAL MEASURES) <i>At 18.0m, water.</i>

11
12
13
14
15
16
17
18
19
20

Continued on next sheet

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 18.0m. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH18d

Sheet 1 of 3

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414512.10 - 412089.96	Hole Type PH
Location: Honley		Level: 118.55	Scale 1:50
Client: Vivly Living		Dates: 02/08/2024 - 02/08/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		
					1.00	117.55		Light brown SANDSTONE. (COAL MEASURES)	1
									2
									3
									4
									5
									6
									7
					7.50	111.05		Dark grey MUDSTONE. (COAL MEASURES)	8
									9
									10

Continued on next sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 21.0m. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH18d

Sheet 2 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414512.10 - 412089.96

Hole Type
PH

Location: Honley

Level: 118.55

Scale
1:50

Client: Vivly Living

Dates: 02/08/2024 - 02/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								11 12 13 14 15 16 17 18 19 20

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 21.0m. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH18d

Sheet 3 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414512.10 - 412089.96

Hole Type
PH

Location: Honley

Level: 118.55

Scale
1:50

Client: Vivly Living

Dates: 02/08/2024 - 02/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
	▼				21.00	97.55	End of borehole at 21.00 m	21
								22
								23
								24
								25
								26
								27
								28
								29
								30

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 21.0m. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH18e

Sheet 1 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414512.19 - 412092.29

Hole Type
PH

Location: Honley

Level: 118.55

Scale
1:50

Client: Vivly Living

Dates: 02/08/2024 - 02/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		
					1.00	117.55		Light brown SANDSTONE. (COAL MEASURES)	1
									2
									3
									4
									5
									6
									7
					8.00	110.55		Dark grey MUDSTONE. (COAL MEASURES)	8
									9
									10

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 19.0m. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH18e

Sheet 2 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414512.19 - 412092.29

Hole Type
PH

Location: Honley

Level: 118.55

Scale
1:50

Client: Vivly Living

Dates: 02/08/2024 - 02/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
								11		
									12	
										13
										14
										15
										16
										17
										18
										19
										20

At 19.0m, water.

Continued on next sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 19.0m. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH18e

Sheet 3 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414512.19 - 412092.29

Hole Type
PH

Location: Honley

Level: 118.55

Scale
1:50

Client: Vivly Living

Dates: 02/08/2024 - 02/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					21.00	97.55		End of borehole at 21.00 m <div style="text-align: right;"> 21 22 23 24 25 26 27 28 29 30 </div>

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 19.0m. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH18f

Sheet 1 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414511.65 - 412093.85

Hole Type
PH

Location: Honley

Level: 118.50

Scale
1:50

Client: Vivly Living

Dates: 02/08/2024 - 02/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		
					1.00	117.50		Light brown SANDSTONE. (COAL MEASURES)	1
									2
									3
									4
									5
									6
									7
					8.00	110.50		Dark grey MUDSTONE. (COAL MEASURES)	8
									9
									10

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 17.1 m to 18.3m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH18f

Sheet 2 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414511.65 - 412093.85

Hole Type
PH

Location: Honley

Level: 118.50

Scale
1:50

Client: Vivly Living

Dates: 02/08/2024 - 02/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
(Well casing pattern)								
					17.10	101.40	(ADIT pattern)	Soft drilling. Orange (iron ochre) minewater flushing back. (ADIT)
					18.30	100.20	(COAL MEASURES pattern)	Solid ground. Iron ochre water returns. (COAL MEASURES)
								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. Flush returns were lost from 17.1 m to 18.3m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH18f

Sheet 3 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414511.65 - 412093.85

Hole Type
PH

Location: Honley

Level: 118.50

Scale
1:50

Client: Vivly Living

Dates: 02/08/2024 - 02/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					21.00	97.50		End of borehole at 21.00 m <div style="text-align: right;"> 21 22 23 24 25 26 27 28 29 30 </div>

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 17.1 m to 18.3m. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414511.01 - 412095.73

Hole Type
PH

Location: Honley

Level: 118.55

Scale
1:50

Client: Vivly Living

Dates: 02/08/2024 - 02/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		
					1.00	117.55		Light brown SANDSTONE. (COAL MEASURES)	1
									2
									3
									4
									5
									6
									7
					7.50	111.05		Dark grey MUDSTONE. (COAL MEASURES)	8
									9
									10

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH18g

Sheet 2 of 3

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414511.01 - 412095.73	Hole Type PH
Location: Honley		Level: 118.55	Scale 1:50
Client: Vivly Living		Dates: 02/08/2024 - 02/08/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
									11
									12
									13
									14
									15
									16
									17
									18
									19
									20

Continued on next sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.





Borehole Log

Borehole No.

PH18g

Sheet 3 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414511.01 - 412095.73

Hole Type
PH

Location: Honley

Level: 118.55

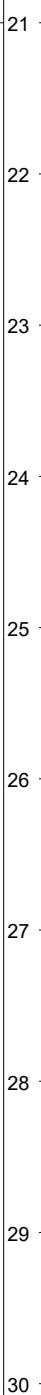
Scale
1:50

Client: Vivly Living

Dates: 02/08/2024 - 02/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					21.00	97.55		
								End of borehole at 21.00 m



Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH18h

Sheet 1 of 3

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414511.47 - 412094.58

Hole Type
PH

Location: Honley

Level: 118.55

Scale
1:50

Client: Vivly Living

Dates: 02/08/2024 - 02/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		
					1.00	117.55		Light brown SANDSTONE. (COAL MEASURES)	1
									2
									3
									4
									5
									6
									7
					8.00	110.55		Dark grey MUDSTONE. (COAL MEASURES)	8
									9
									10

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 19.0m. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH18h

Sheet 2 of 3

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414511.47 - 412094.58	Hole Type PH
Location: Honley		Level: 118.55	Scale 1:50
Client: Vivly Living		Dates: 02/08/2024 - 02/08/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								11
								12
								13
								14
								15
								16
								17
								18
	▼						At 19.0m, orange ochreous water.	19
								20

Continued on next sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was encountered at 19.0m. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH19

Sheet 1 of 1

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: -	Hole Type PH
Location: Honley	Level:		Scale 1:50
Client: Vivly Living	Dates: 03/08/2024 - 03/08/2024		Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
[Well ID]					1.00		Overburden. (RESIDUAL SOIL)	1	
					4.50		Light brown SANDSTONE. (COAL MEASURES)	2 3 4	
							End of borehole at 4.50 m	5 6 7 8 9 10	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



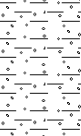
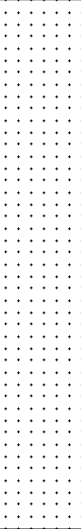
Borehole Log

Borehole No.

PH20

Sheet 1 of 1

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414508.26 - 412034.42	Hole Type PH
Location: Honley		Level: 116.30	Scale 1:50
Client: Vivly Living		Dates: 03/08/2024 - 03/08/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
[Well ID]					1.00	115.30		Overburden. (RESIDUAL SOIL)	1
					4.50	111.80		Light brown SANDSTONE. (COAL MEASURES)	2 3 4
							End of borehole at 4.50 m		5 6 7 8 9 10

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH21

Sheet 1 of 1

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414584.62 - 412038.52	Hole Type PH
Location: Honley		Level: 122.50	Scale 1:50
Client: Vivly Living		Dates: 03/08/2024 - 03/08/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
[Well ID]					1.50	121.00		Overburden. (RESIDUAL SOIL)	1
					4.50	118.00		Light grey MUDSTONE. (COAL MEASURES)	2 3 4
							End of borehole at 4.50 m	5 6 7 8 9 10	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH22

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414641.30 - 412069.08

Hole Type
PH

Location: Honley

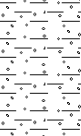
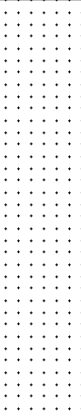

Level: 130.35

Scale
1:50

Client: Vivly Living

Dates: 03/08/2024 - 03/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
[Well ID]					1.00	129.35		Overburden. (RESIDUAL SOIL)	1
								Light brown SANDSTONE. (COAL MEASURES)	2
					3.80	126.55		Dark grey MUDSTONE. (COAL MEASURES)	3
					4.50	125.85	End of borehole at 4.50 m		
									5
									6
									7
									8
									9
									10

Remarks
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH23

Sheet 1 of 1

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414633.61 - 412114.77	Hole Type PH
Location: Honley		Level: 129.45	Scale 1:50
Client: Vivly Living		Dates: 03/08/2024 - 03/08/2024	Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
[Well ID]					1.00	128.45	[Pattern]	Overburden. (RESIDUAL SOIL)	1
					2.80	126.65	[Pattern]	Light brown SANDSTONE. (COAL MEASURES)	2
					4.50	124.95	[Pattern]	Dark grey MUDSTONE. (COAL MEASURES)	3
							End of borehole at 4.50 m	4	
								5	
								6	
								7	
								8	
								9	
								10	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH24

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414596.66 - 412120.49

Hole Type
PH

Location: Honley

Level: 122.30

Scale
1:50

Client: Vivly Living

Dates: 03/08/2024 - 03/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
Well	Water Strikes							Overburden. (RESIDUAL SOIL)	1
					1.50	120.80		Light grey MUDSTONE. (COAL MEASURES)	2
					4.00	118.30		Black COAL. (SOFT BED COAL)	4
					4.50	117.80		End of borehole at 4.50 m	5
								6	
								7	
								8	
								9	
								10	

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH25

Sheet 1 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414606.51 - 412122.05

Hole Type
PH

Location: Honley

Level: 123.85

Scale
1:50

Client: Vivly Living

Dates: 06/08/2024 - 06/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					1.50	122.35	Overburden. (RESIDUAL SOIL)	1
							Light grey MUDSTONE. (COAL MEASURES)	2
								3
								4
								5
								6
					7.30	116.55	Dark grey MUDSTONE. (COAL MEASURES)	7
					7.50	116.35	Light grey SANDSTONE. (COAL MEASURES)	8
								9
								10

Continued on next sheet

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH25

Sheet 2 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414606.51 - 412122.05

Hole Type
PH

Location: Honley

Level: 123.85

Scale
1:50

Client: Vivly Living

Dates: 06/08/2024 - 06/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.00	111.85		
								End of borehole at 12.00 m

11
12
13
14
15
16
17
18
19
20

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Borehole Log

Borehole No.

PH26

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414598.00 - 412112.00

Hole Type
PH

Location: Honley

Level:

Scale
1:50

Client: Vivly Living

Dates: 06/08/2024 - 06/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)	1	
					1.50		Light grey MUDSTONE. (COAL MEASURES)	2	
								3	
								4	
					4.80		Loss of flush. Broken/soft ground. (WORKED SOFT BED COAL)	5	
					5.80		Solid ground. No flush. (COAL MEASURES)	6	
					6.20		Light greyish brown SANDSTONE. (COAL MEASURES)	7	
								8	
								9	
					9.00		End of borehole at 9.00 m	10	

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 4.8m to 5.8M. 4. Co-ordinates from hand held GPS, hole not surveyed in. n.



Borehole Log

Borehole No.

PH27

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414600.00 - 412123.00

Hole Type
PH

Location: Honley

Level:

Scale
1:50

Client: Vivly Living

Dates: 06/08/2024 - 06/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		
					2.00		Light grey MUDSTONE. (COAL MEASURES)		
					3.50		Loss of flush. Soft drilling. Soft/broken ground. (WORKED SOFT BED COAL)		
					5.30		Solid ground. No flush. (COAL MEASURES)		
					9.00		End of borehole at 9.00 m		

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 3.5m to 5.3m. 4. Co-ordinates from hand held GPS, hole not surveyed in.

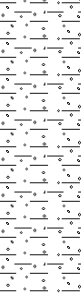

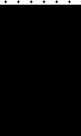
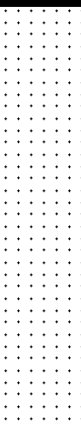
Borehole Log

Borehole No.

PH28

Sheet 1 of 1

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414604.00 - 412147.00	Hole Type PH
Location: Honley	Level:		Scale 1:50
Client: Vivly Living	Dates: 06/08/2024 - 06/08/2024		Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)	1	
					2.00		Light brown SANDSTONE. (COAL MEASURES)	2	
					2.30		Black COAL. (SOFT BED COAL)	3	
					3.20		Light brown SANDSTONE. (COAL MEASURES)	4	
					6.00		End of borehole at 6.00 m	6	
								7	
								8	
								9	
								10	

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



Borehole Log

Borehole No.

PH29

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414605.00 - 412141.00

Hole Type
PH

Location: Honley

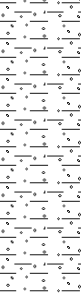
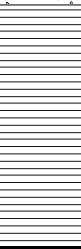
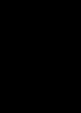
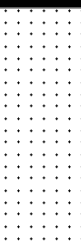
Level:

Scale
1:50

Client: Vivly Living

Dates: 06/08/2024 - 06/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
							Overburden. (RESIDUAL SOIL)	1
					2.00		Light grey MUDSTONE. (COAL MEASURES)	2
					3.60		Black COAL. (SOFT BED COAL)	4
					4.40		Light greyish brown SANDSTONE. (COAL MEASURES)	5
					6.00		End of borehole at 6.00 m	6
								7
								8
								9
								10

Remarks

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



Borehole Log

Borehole No.

PH30

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414609.00 - 412138.00

Hole Type
PH

Location: Honley

Level:

Scale
1:50

Client: Vivly Living

Dates: 06/08/2024 - 06/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
							Overburden. (RESIDUAL SOIL)	1
					2.00		Light grey MUDSTONE. (COAL MEASURES)	2
					4.90		Loss of flush. Soft/broken ground. (WORKED SOFT BED COAL)	5
					5.70		Light greyish brown SANDSTONE. (COAL MEASURES)	6
					9.00		End of borehole at 9.00 m	9

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 4.9m to 5.7m. 4. Co-ordinates from hand held GPS, hole not surveyed in.

Borehole Log

Borehole No.

PH31

Sheet 1 of 2

Project Name: Gynn Lane, Honley	Project No. 4749	Co-ords: 414629.00 - 412119.00	Hole Type PH
Location: Honley	Level:		Scale 1:50
Client: Vivly Living	Dates: 07/08/2024 - 07/08/2024		Logged By CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.50		Overburden. (RESIDUAL SOIL)	1	
							Light grey MUDSTONE. (COAL MEASURES)	2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								10	

Continued on next sheet

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 11.6m to 12.3m. 4. Co-ordinates from hand held GPS, hole not surveyed in.



Borehole Log

Borehole No.

PH31

Sheet 2 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414629.00 - 412119.00

Hole Type
PH

Location: Honley

Level:

Scale
1:50

Client: Vivly Living

Dates: 07/08/2024 - 07/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
[Pattern]								
					11.60			
					12.30		Loss of flush. Soft/broken ground. (WORKED SOFT BED COAL)	
							Light greyish brown SANDSTONE. (COAL MEASURES)	
					15.00		End of borehole at 15.00 m	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Flush returns were lost from 11.6m to 12.3m. 4. Co-ordinates from hand held GPS, hole not surveyed in.



Borehole Log

Borehole No.

PH32

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414587.00 - 412112.00

Hole Type
PH

Location: Honley

Level:

Scale
1:50

Client: Vivly Living

Dates: 07/08/2024 - 07/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Overburden. (RESIDUAL SOIL)		
					1.00		Light brown SANDSTONE. (COAL MEASURES)	1	
					2.00		Light grey MUDSTONE. (COAL MEASURES)	2	
					2.80		Loss of flush. Soft/broken ground. (WORKED SOFT BED COAL)	3	
					3.40		Light greyish brown SANDSTONE. (COAL MEASURES)	4	
					6.00		End of borehole at 6.00 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. Flush returns were lost from 2.8m to 3.4m. 4. Co-ordinates from hand held GPS, hole not surveyed in.



Borehole Log

Borehole No.

PH33

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414578.00 - 412110.00

Hole Type
PH

Location: Honley

Level:

Scale
1:50

Client: Vivly Living

Dates: 07/08/2024 - 07/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
							Overburden. (RESIDUAL SOIL)	1
					1.90		Black COAL. (SOFT BED COAL)	2
					2.40		Light greyish brown SANDSTONE. (COAL MEASURES)	3
							<i>Poor flush from 3.0m, rods stuck.</i>	4
					4.50		End of borehole at 4.50 m	5
								6
								7
								8
								9
								10

Remarks

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

Project Name: Gynn Lane, Honley

 Project No.
4749

Co-ords: 414572.00 - 412107.00

 Hole Type
PH

Location: Honley

Level:

 Scale
1:50

Client: Vivly Living

Dates: 07/08/2024 - 07/08/2024

 Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
							Overburden. (RESIDUAL SOIL)	
					1.30			
					1.50		Black COAL. (SOFT BED COAL)	
							Light greyish brown SANDSTONE. (COAL MEASURES)	
							End of borehole at 4.50 m	
					9.00			

Remarks

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

Borehole Log

Borehole No.

PH35

Sheet 1 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414549.00 - 412101.00

Hole Type
PH

Location: Honley

Level:

Scale
1:50

Client: Vivly Living

Dates: 07/08/2024 - 07/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.60		Overburden. (RESIDUAL SOIL)	1	
							Light brown SANDSTONE. (COAL MEASURES)	2	
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								10	

Continued on next sheet

Remarks

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





Borehole Log

Borehole No.

PH35

Sheet 2 of 2

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414549.00 - 412101.00

Hole Type
PH

Location: Honley

Level:

Scale
1:50

Client: Vivly Living

Dates: 07/08/2024 - 07/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.00		End of borehole at 12.00 m	

11
12
13
14
15
16
17
18
19
20

Remarks

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



Borehole Log

Borehole No.

PH36

Sheet 1 of 1

Project Name: Gynn Lane, Honley

Project No.
4749

Co-ords: 414556.50 - 412028.71

Hole Type
PH

Location: Honley

Level: 120.08

Scale
1:50

Client: Vivly Living

Dates: 07/08/2024 - 07/08/2024

Logged By
CC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
							Overburden. (RESIDUAL SOIL)	1
					1.50	118.58		
					1.70	118.38	Light grey MUDSTONE. (COAL MEASURES)	
					2.00	118.08	Black COAL. (SOFT BED COAL)	2
							Light brown SANDSTONE. (COAL MEASURES)	3
					4.50	115.58	Dark grey MUDSTONE. (COAL MEASURES)	4
					5.50	114.58	Light brown interbedded SANDSTONE and MUDSTONE. (COAL MEASURES)	5
					9.00	111.08		6
								7
								8
								9
							End of borehole at 9.00 m	10

Remarks

1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.



Appendix H

Contaminated land assessment for selection of water supply pipes

The Risk assessment (RA)

Section 1: Development Details	
Development Name <i>(if it has one)</i>	
Development Address	Gynn Lane, Honley, HD9 6LF
OS Grid Reference <i>(mid point)</i>	SE 145 121
Developers Name	Vivly Living
Water Company reference number <i>(for UU use only)</i>	
Please provide details below of the current and historical use of the site and adjacent sites. <i>If your supporting information has details of the current and historical site use, please reference below the relevant sections of your report.</i>	
<p>The site has remained essentially undeveloped throughout its history. However, the site has historically been associated with the coal mining industry, with unrecorded shallow mineworkings, two adits and a mine shaft present on site. Currently, the site comprises a single parcel of grassed land used for grazing cattle. A two storey detached dwelling (34 Gynn Lane) with an associated access road is present to the north. Two areas of woodland are present along the northern and northwestern boundaries of the site.</p>	
Section 2: Preliminary Risk Assessment	
Has your desk study and site walkover identified any land potentially affected by contamination?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
If the site is potentially affected by contamination but you have not completed any intrusive site investigation please provide details below of the rationale behind the intended pipe selection. <i>If your supporting information has details of the rationale behind the intended pipe selection, please reference below the relevant sections of your report.</i>	
Site investigation has been undertaken, see below.	
Section 3: Intrusive Site Investigation	
Have you completed any intrusive site investigation?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Date(s) when the site investigation(s) undertaken	23/07/24 – 07/08/24
At what level has groundwater been encountered?	>10 metres below ground level or <input type="checkbox"/> Not encountered
Table 1 (Pipeline Selection Risk Assessment Summary (PSRAS)) below classifies testing required where the preliminary risk assessment has identified land potentially affected by contamination. Please provide details below of any test groups which have not been tested and the rationale for not testing. <i>If your supporting information has details of the rationale behind not testing any particular test groups, please reference below the relevant sections of your report.</i>	

The site is essentially greenfield, therefore extensive chemical testing has not been undertaken (i.e. no testing for BTEX, Speciated TPH etc as no significant contamination was not likely to be present on site, referring to the Conceptual Site Model.

If the intrusive site investigation has identified concentrations above the PE threshold (see PSRAS) and your intended pipe selection is PE please provide details below of the rationale behind the intended pipe selection. *If your supporting information has details of the rationale behind the intended pipe selection, please reference below the relevant sections of your report.*

N/A

Section 4: Site Remediation

Please provide details below of any site remediation (which may include a change in site levels) already completed. *If your supporting information has details of the site remediation already completed, please reference below the relevant sections of your report.*

None completed to date.

Has the PSRAS (Table 1) been completed using appropriate data after remediation?

Yes No
 N/A

Please provide details below of any proposed site remediation and an analysis of whether this will affect your intended pipe selection. *If your supporting information has details of any proposed site remediation and whether this will affect your intended pipe selection, please reference below the relevant sections of your report.*

No remediation considered necessary. However, site levels will require significant regrade to create suitable development platforms. In addition, shallow mineworkings have been encountered across an area of c.4,000m² in the centre of site, which will require remediation via drilling and grouting. However, no contamination has been identified, and therefore the intended pipe selection will not be affected.

Section 5: Final Use of Site

Please provide details below of any chemicals (including fuel) to be stored on site and any other future contamination risks which may affect your intended pipe selection. *If your supporting information has details of potential contamination risks which may affect your intended pipe selection, please reference below the relevant sections of your report.*

At the time of writing, fuel storage is unknown.

What water pipe materials are intended to be used on site?

PE PE Barrier Pipe Type A PE Barrier Pipe Type B

Other (please specify):

Section 6: Additional Information

Please use the section below to provide any additional details to support your intended pipe selection. *If your supporting information has additional information to support your intended pipe selection, please reference below the relevant sections of your report.*

The site is greenfield. No contamination has been encountered to date.

Section 7: Risk Assessor

Name and relevant qualifications of person directing the risk assessment for water pipes

Charlotte Copley; BSc, MSc

Name and address of risk assessor's company

Lithos Consulting,
Parkhill,
Walton Road,
Wetherby,
LS22 5DZ

Date risk assessment performed

30th August 2024

Section 8: Declaration

I confirm I have completed this form and provided supporting information in accordance with 'UKWIR Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' and water company's Supplementary Guidance. I also confirm that if any further site investigation is needed and carried out, I will be required to submit an additional Risk Assessment for Water Pipes with the relevant supporting information. I understand that failure to supply any of the required information may delay my application being processed.

Name

Charlotte Copley

Company

Lithos Consulting

Phone Number

01937 545 330

Date

30 08 2024

Table 1 - Pipe Selection Risk Assessment Summary (PSRAS)

- 1) Testing must be undertaken on the materials within which the pipes are to be laid, whether that be existing ground materials, remediated materials or imported capping materials. Please use the appropriate testing data to complete Table 1 below.
- 2) If more than one pipe selection is being made, for example, for pipes in different areas of a large site, a completed PSRAS is required for each selection.

What materials have been tested to populate Table 1 below?

Existing ground materials Remediated materials Imported capping materials

At the time of investigation, the proposed route(s), and total length, of pipeline were unknown. Consequently, to date laboratory testing of soil samples in line with UKWIR guidance was not undertaken. Sampling within 15m of proposed water supply pipes could be undertaken, once infrastructure design has been completed. However, given the site's history and the relatively consistent ground conditions reported, the use of 'standard' polyethylene water supply pipes should be acceptable.

All concentrations in mg/kg

Test Group	Testing Required?	PE threshold	Metal Pipes/ Barrier Pipe	Laboratory Detection Limit	Testing UKAS accredited Y/N	Maximum concentration at proposed pipeline depth See Note [2]	Maximum site concentration See Note [3]	Locations and depths where concentrations exceed proposed pipeline threshold
Total VOCs	Where Preliminary Risk Assessment (PRA) has identified land potentially affected by contamination	0.5	Pass	Not tested				
Total BTEX & MTBE		0.1	Pass	Not tested				
Total SVOCs (excluding PAHs and those substances marked with an *)		2	Pass	Not tested				
EC5-EC10 aliphatic and aromatic hydrocarbons		2	Pass	0.1	Y	<0.1	<0.1	N/A
EC10-EC16 aliphatic and aromatic hydrocarbons		10	Pass	20	Y	<10	<10	N/A
EC16-EC40 aliphatic and aromatic hydrocarbons		500	Pass	20	Y	<10	<10	N/A
Phenols* (from SVOC analysis)		2	Pass	Not tested				
Cresols and chlorinated phenols* (from SVOC analysis)		2	Pass	Not tested				
Ethers*	Only where identified	0.5	Pass	Not tested				
Nitrobenzene*		0.5	Pass	Not tested				
Ketones*		0.5	Pass	Not tested				
Aldehydes*		0.5	Pass	Not tested				
Amines		Fail	Pass	Not tested				
Corrosive	Conductivity, Redox and pH	Pass	See Note [1]	-	Y	pH of 5.2 – 7.0 recorded across site	TP08 at 0.6m	N/A

Note [1] Threshold: For wrapped steel, corrosive if $\text{pH} < 7$ and conductivity $> 400 \mu\text{S}/\text{cm}$. For copper, corrosive if $\text{pH} < 5$ or > 8 and Eh positive.

Note [2] Water pipes are normally laid at 0.75-1.35m below finished ground level.

Note [3] Also state if liquid free product is present in soil or groundwater.



wrapped ductile iron corrosive if $\text{pH} < 5$, Eh not neutral and conductivity $>$

Appendix I
Chemical Results



DETS

Certificate of Analysis

Certificate Number 24-15601

Issued: 05-Aug-24

Client Lithos Consulting Ltd
Parkhill
Walton Rd
Wetherby
LS22 5DZ

Our Reference 24-15601

Client Reference ~ 4749

Order No ~ PO22791

Contract Title ~ Gynn Lane, Honley

Description 15 Soil samples.

Date Received 29-Jul-24

Date Started 29-Jul-24

Date Completed 05-Aug-24

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

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

Approved By REDACTED

Kirk Bridgewood
General Manager



Normec DETS Limited

Unit 2, Park Road Industrial Estate South, Consett, Co Durham, DH8 5PY

Symbol key at end of report Tel: 01207 582333 • email: info@dets.co.uk • www.dets.co.uk

Page 1 of 9

Summary of Chemical Analysis

Soil Samples

Our Ref 24-15601

Client Ref ~ 4749

Contract Title ~ Gynn Lane, Honley

Lab No	2370308	2370309	2370310	2370311	2370312	2370313
Sample ID ~	TP01	TP03	TP05	TP07	TP10	TP12
Depth ~	0.20	0.10	0.20	0.10	0.20	0.10
Other ID ~						
Sample Type ~	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date ~	23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Preparation									
Stones >10mm	DETSC 1003*	1	% m/m	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Moisture Content	DETSC 1004	0.1	%	17	23	17	21	28	22
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	18	23	23	24	38	26
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.4	0.7	0.6	0.5	0.9	0.6
Cadmium	DETSC 2301#	0.1	mg/kg	0.3	0.5	0.5	0.5	1.7	0.5
Chromium	DETSC 2301#	0.15	mg/kg	21	35	30	26	32	26
Chromium III	DETSC 2301*	0.15	mg/kg	21	35	30	26	32	26
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	28	53	52	44	65	57
Lead	DETSC 2301#	0.3	mg/kg	51	160	76	73	100	72
Mercury	DETSC 2325#	0.05	mg/kg	1.2	0.25	0.31	0.20	3.4	0.28
Nickel	DETSC 2301#	1	mg/kg	20	23	26	21	41	26
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	0.7	0.6	< 0.5	1.0	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	34	49	48	42	50	45
Zinc	DETSC 2301#	1	mg/kg	76	130	99	110	280	95
Inorganics									
pH	DETSC 2008#		pH	6.3	6.4	5.3	5.7	5.5	5.4
Calorific Value	DETSC 5008	1	MJ/kg						
Total Organic Carbon	DETSC 2084#	0.5	%	4.0	6.4	6.4	6.4	8.5	9.3
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l						
Petroleum Hydrocarbons									
VPH (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
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	0.07	< 0.03	0.06	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	0.03	0.03	0.30	0.05	0.09	0.13
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.28	0.04	0.08	0.12
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.14	< 0.03	0.03	0.05
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	0.12	< 0.03	0.04	0.06
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.17	< 0.03	0.04	0.06



Summary of Chemical Analysis

Soil Samples

Our Ref 24-15601

Client Ref ~ 4749

Contract Title ~ Gynn Lane, Honley

Lab No	2370308	2370309	2370310	2370311	2370312	2370313
Sample ID ~	TP01	TP03	TP05	TP07	TP10	TP12
Depth ~	0.20	0.10	0.20	0.10	0.20	0.10
Other ID ~						
Sample Type ~	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date ~	23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024	23/07/2024
Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.07	< 0.03	0.04	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.12	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	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	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.06	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	< 0.10	1.4	< 0.10	0.32	0.50

Summary of Chemical Analysis

Soil Samples

Our Ref 24-15601

Client Ref ~ 4749

Contract Title ~ Gynn Lane, Honley

Lab No	2370314	2370315	2370316	2370317	2370318	2370319
Sample ID ~	TP13	TP14	TP14	TP15	TP18	TP22
Depth ~	0.70	0.20	1.40	2.00	0.20	0.20
Other ID ~						
Sample Type ~	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date ~	23/07/2024	23/07/2024	23/07/2024	23/07/2024	24/07/2024	24/07/2024
Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Preparation									
Stones >10mm	DETSC 1003*	1	% m/m		< 1.0			< 1.0	< 1.0
Moisture Content	DETSC 1004	0.1	%		27			24	27
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg		29			21	28
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg		0.9			0.5	0.7
Cadmium	DETSC 2301#	0.1	mg/kg		0.6			0.7	0.6
Chromium	DETSC 2301#	0.15	mg/kg		33			27	32
Chromium III	DETSC 2301*	0.15	mg/kg		33			27	32
Chromium, Hexavalent	DETSC 2204*	1	mg/kg		< 1.0			< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg		48			58	50
Lead	DETSC 2301#	0.3	mg/kg		78			59	75
Mercury	DETSC 2325#	0.05	mg/kg		3.0			1.2	3.1
Nickel	DETSC 2301#	1	mg/kg		19			26	25
Selenium	DETSC 2301#	0.5	mg/kg		1.3			0.6	1.3
Vanadium	DETSC 2301#	0.8	mg/kg		55			42	50
Zinc	DETSC 2301#	1	mg/kg		97			120	93
Inorganics									
pH	DETSC 2008#		pH	5.3	5.9	5.8	5.4	5.9	6.3
Calorific Value	DETSC 5008	1	MJ/kg	19.6		28.0	26.0		
Total Organic Carbon	DETSC 2084#	0.5	%		6.6			6.3	9.9
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l	50		38	26		
Petroleum Hydrocarbons									
VPH (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
Acenaphthylene	DETSC 3303#	0.03	mg/kg		< 0.03			< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg		< 0.03			< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg		< 0.03			< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg		< 0.03			< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg		< 0.03			< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg		0.04			< 0.03	0.05
Pyrene	DETSC 3303#	0.03	mg/kg		0.04			< 0.03	0.04
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg		< 0.03			< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg		< 0.03			< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg		< 0.03			< 0.03	< 0.03



Summary of Chemical Analysis Soil Samples

Our Ref 24-15601

Client Ref ~ 4749

Contract Title ~ Gynn Lane, Honley

Lab No	2370314	2370315	2370316	2370317	2370318	2370319
Sample ID ~	TP13	TP14	TP14	TP15	TP18	TP22
Depth ~	0.70	0.20	1.40	2.00	0.20	0.20
Other ID ~						
Sample Type ~	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date ~	23/07/2024	23/07/2024	23/07/2024	23/07/2024	24/07/2024	24/07/2024
Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg		< 0.03			< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg		< 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
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg		< 0.03			< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg		< 0.03			< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg		< 0.10			< 0.10	< 0.10

Summary of Chemical Analysis

Soil Samples

Our Ref 24-15601

Client Ref ~ 4749

Contract Title ~ Gynn Lane, Honley

Lab No	2370320	2370321	2370322
Sample ID ~	TP23	TP26	TP30
Depth ~	0.70	0.20	0.10
Other ID ~			
Sample Type ~	SOIL	SOIL	SOIL
Sampling Date ~	24/07/2024	24/07/2024	25/07/2024
Sampling Time ~	n/s	n/s	n/s

Test	Method	LOD	Units			
Preparation						
Stones >10mm	DETSC 1003*	1	% m/m	17	< 1.0	24
Moisture Content	DETSC 1004	0.1	%	12	23	13
Metals						
Arsenic	DETSC 2301#	0.2	mg/kg	6.9	21	14
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.2	0.7	0.3
Cadmium	DETSC 2301#	0.1	mg/kg	0.4	0.5	0.3
Chromium	DETSC 2301#	0.15	mg/kg	18	25	26
Chromium III	DETSC 2301*	0.15	mg/kg	18	25	26
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	27	37	25
Lead	DETSC 2301#	0.3	mg/kg	13	54	39
Mercury	DETSC 2325#	0.05	mg/kg	0.10	2.0	0.58
Nickel	DETSC 2301#	1	mg/kg	36	20	21
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	0.7	0.5
Vanadium	DETSC 2301#	0.8	mg/kg	23	41	35
Zinc	DETSC 2301#	1	mg/kg	62	79	76
Inorganics						
pH	DETSC 2008#		pH	6.6	6.6	5.9
Calorific Value	DETSC 5008	1	MJ/kg			
Total Organic Carbon	DETSC 2084#	0.5	%	30	5.2	4.4
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l			
Petroleum Hydrocarbons						
VPH (C6-C10)	DETSC 3321*	0.1	mg/kg	< 0.1		
EPH (C10-C12)	DETSC 3311	10	mg/kg	< 10		
EPH (C12-C16)	DETSC 3311	10	mg/kg	< 10		
EPH (C16-C21)	DETSC 3311	10	mg/kg	< 10		
EPH (C21-C35)	DETSC 3311	10	mg/kg	< 10		
EPH (C35-C40)	DETSC 3311	10	mg/kg	< 10		
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10		
PAHs						
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.05	0.04
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	0.11	0.06
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	0.09	0.06
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	0.04	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	0.04	0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	0.04	0.03

Summary of Chemical Analysis Soil Samples

Our Ref 24-15601

Client Ref ~ 4749

Contract Title ~ Gynn Lane, Honley

Lab No	2370320	2370321	2370322
Sample ID ~	TP23	TP26	TP30
Depth ~	0.70	0.20	0.10
Other ID ~			
Sample Type ~	SOIL	SOIL	SOIL
Sampling Date ~	24/07/2024	24/07/2024	25/07/2024
Sampling Time ~	n/s	n/s	n/s

Test	Method	LOD	Units			
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 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
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	0.29	0.16

Summary of Asbestos Analysis

Soil Samples

Our Ref ~ 24-15601

Client Ref ~ 4749

Contract Title ~ Gynn Lane, Honley

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2370308	TP01 0.20	SOIL	NAD	none	Ben Rose
2370309	TP03 0.10	SOIL	NAD	none	Ben Rose
2370310	TP05 0.20	SOIL	NAD	none	Ben Rose
2370311	TP07 0.10	SOIL	NAD	none	Ben Rose
2370312	TP10 0.20	SOIL	NAD	none	Ben Rose
2370313	TP12 0.10	SOIL	NAD	none	Ben Rose
2370315	TP14 0.20	SOIL	NAD	none	Ben Rose
2370318	TP18 0.20	SOIL	NAD	none	Ben Rose
2370319	TP22 0.20	SOIL	NAD	none	Ben Rose
2370320	TP23 0.70	SOIL	NAD	none	Ben Rose
2370321	TP26 0.20	SOIL	NAD	none	Ben Rose
2370322	TP30 0.10	SOIL	NAD	none	Ben Rose

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

Information in Support of the Analytical Results

Our Ref 24-15601
 Client Ref ~ 4749
 Contract ~ Gynn Lane, Honley

Containers Received & Deviating Samples

Lab No	Sample ID ~	Date Sampled ~	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2370308	TP01 0.20 SOIL	23/07/24	GJ 250ml, PT 1L		
2370309	TP03 0.10 SOIL	23/07/24	GJ 250ml, PT 1L		
2370310	TP05 0.20 SOIL	23/07/24	GJ 250ml, PT 1L		
2370311	TP07 0.10 SOIL	23/07/24	GJ 250ml, PT 1L		
2370312	TP10 0.20 SOIL	23/07/24	GJ 250ml, PT 1L		
2370313	TP12 0.10 SOIL	23/07/24	GJ 250ml, PT 1L		
2370314	TP13 0.70 SOIL	23/07/24	PT 1L		
2370315	TP14 0.20 SOIL	23/07/24	GJ 250ml, PT 1L		
2370316	TP14 1.40 SOIL	23/07/24	PT 1L		
2370317	TP15 2.00 SOIL	23/07/24	PT 1L		
2370318	TP18 0.20 SOIL	24/07/24	GJ 250ml, PT 1L		
2370319	TP22 0.20 SOIL	24/07/24	GJ 250ml, PT 1L		
2370320	TP23 0.70 SOIL	24/07/24	GJ 250ml, PT 1L		BTEX / C5-C10
2370321	TP26 0.20 SOIL	24/07/24	GJ 250ml, PT 1L		
2370322	TP30 0.10 SOIL	25/07/24	GJ 250ml, PT 1L		

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

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.
 Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.
 The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
 Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

- Key:
- ~ Sample details are provided by the client and can affect the validity of the results
 - * -not accredited.
 - # -MCERTS (accreditation only applies if report carries the MCERTS logo).
 - \$ -subcontracted.
 - n/s -not supplied.
 - I/S -insufficient sample.
 - U/S -unsuitable sample.
 - t/f -to follow.
 - nd -not detected.

End of Report

Appendix J
Geotechnical Test Results



LABORATORY REPORT



Contract Number: PSL24/5602

Report Date: 29 August 2024

Client's Reference: 4749

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

For the attention of: Charlotte Copley

Contract Title: Gynn Lane, Honley

Date Received: 1/8/2024

Date Commenced: 1/8/2024

Date Completed: 29/8/2024

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:

A Watkins
(Managing Director)

R Berriman
(Associate Director)

REDACTED
S Royle
(Laboratory Manager)

L Knight
(Assistant Laboratory Manager)

S Eyre
(Senior Technician)

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Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP02	1	D	0.40		Brown slightly gravelly slightly sandy CLAY.
TP03	2	D&B	0.70		Brown slightly gravelly slightly sandy CLAY.
TP04	2	D	1.30		Brown slightly gravelly slightly sandy CLAY.
TP07	2	D	1.10		Brown slightly gravelly slightly sandy CLAY.
TP14	2	D	0.90		Brown slightly gravelly CLAY.
TP18	2	D	0.60		Brown mottled grey CLAY.
TP24	2	D	1.60		Brown mottled grey CLAY.
TP26	3	D&B	1.20		Brown mottled grey slightly gravelly slightly sandy CLAY.
TP28	2	D	1.00		Brown mottled grey slightly sandy CLAY.
TP32	2	D	0.90		Brown mottled grey CLAY.
TP01	2	D&B	0.50		Brown sandy silty GRAVEL with some cobbles.
TP05	2	D&B	0.90		Brown very sandy clayey GRAVEL.
TP19	1	D&B	1.50		Brown very sandy clayey GRAVEL.
TP01	2	B	0.20		Brown TOPSOIL.
TP10	2	B	0.20		Brown TOPSOIL.
TP22	2	B	0.20		Brown TOPSOIL.
TP26	2	B	0.20		Brown TOPSOIL.



Gynn Lane, Honley

Contract No:

PSL24/5602

Client Ref:

4749

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
TP02	1	D	0.40		22			63	27	36	98	High Plasticity CH
TP03	2	D&B	0.70		25		2.63	64	27	37	92	High Plasticity CH
TP04	2	D	1.30		20			53	22	31	96	High Plasticity CH
TP07	2	D	1.10		23			54	25	29	99	High Plasticity CH
TP14	2	D	0.90		43			72	30	42	98	Very High Plasticity CV
TP18	2	D	0.60		36			70	30	40	100	Very High Plasticity CV
TP24	2	D	1.60		32			73	30	43	100	Very High Plasticity CV
TP26	3	D&B	1.20		36		2.64	71	30	41	97	Very High Plasticity CV
TP28	2	D	1.00		25			54	24	30	100	High Plasticity CH
TP32	2	D	0.90		30			67	28	39	100	High Plasticity CH
TP01	2	D&B	0.50				2.66					
TP05	2	D&B	0.90				2.67					
TP19	1	D&B	1.50				2.67					

SYMBOLS : NP : Non Plastic

* : Liquid Limit and Plastic Limit Wet Sieved.



Gynn Lane, Honley

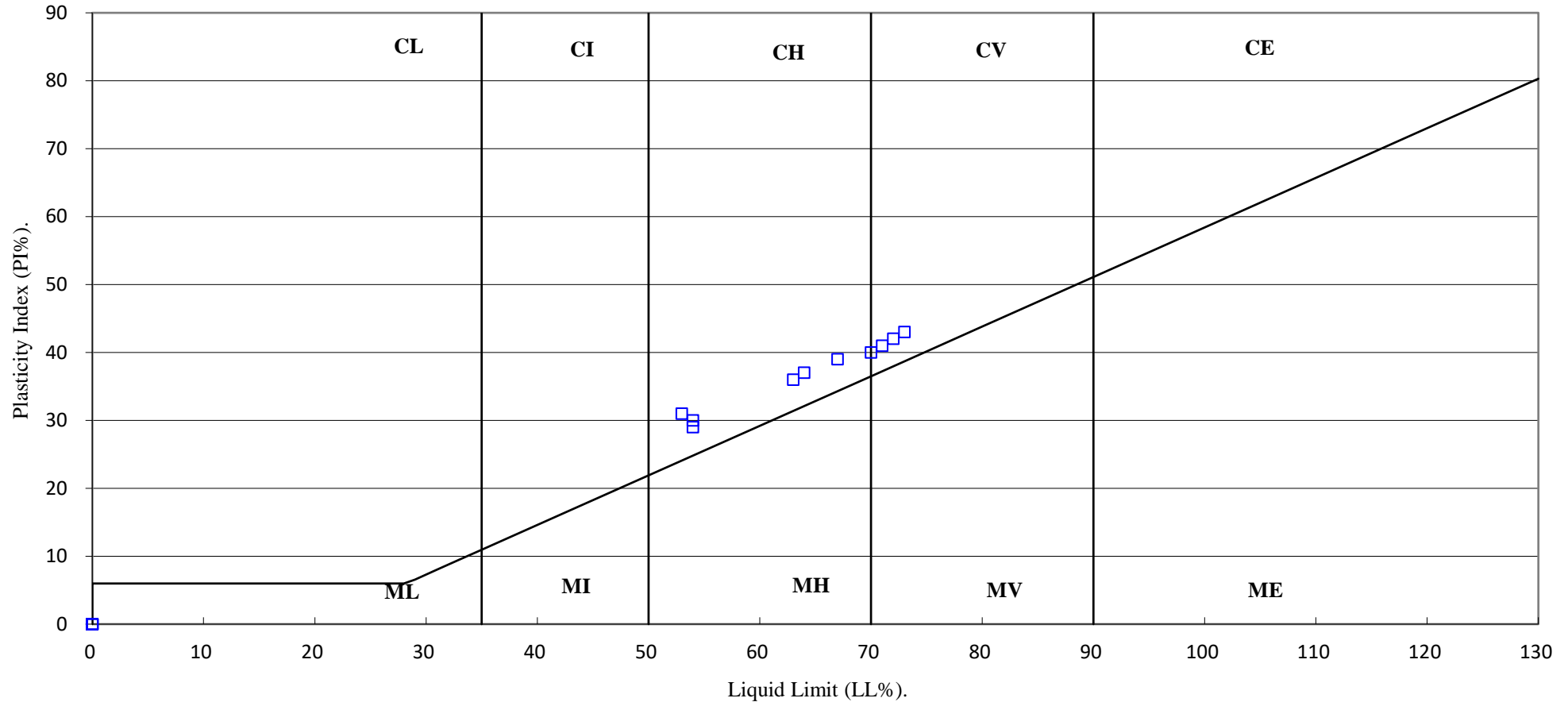
Contract No:

PSL24/5602

Client Ref:

4749

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



Gynn Lane, Honley

Contract No:

PSL24/5602

Client Ref:

4749

PARTICLE SIZE DISTRIBUTION TEST

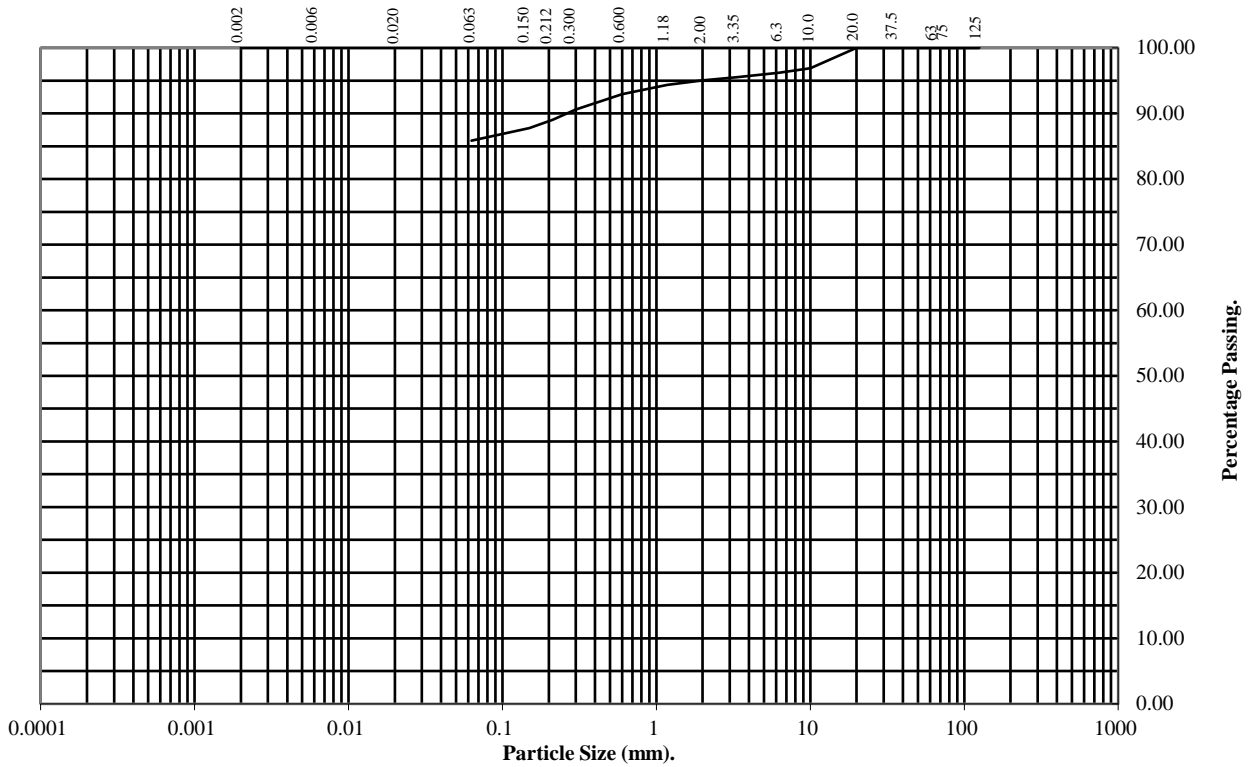
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP03 **Top Depth (m):** 0.70

Sample Number: 2 **Base Depth(m):**

Sample Type: D&B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	97
6.3	96
3.35	96
2	95
1.18	94
0.6	93
0.3	91
0.212	89
0.15	88
0.063	86

Soil Fraction	Total Percentage
Cobbles	0
Gravel	5
Sand	9
Silt/Clay	86

Remarks:
See Summary of Soil Descriptions



Gynn Lane, Honley

Contract No:
PSL24/5602
Client Ref:
4749

PARTICLE SIZE DISTRIBUTION TEST

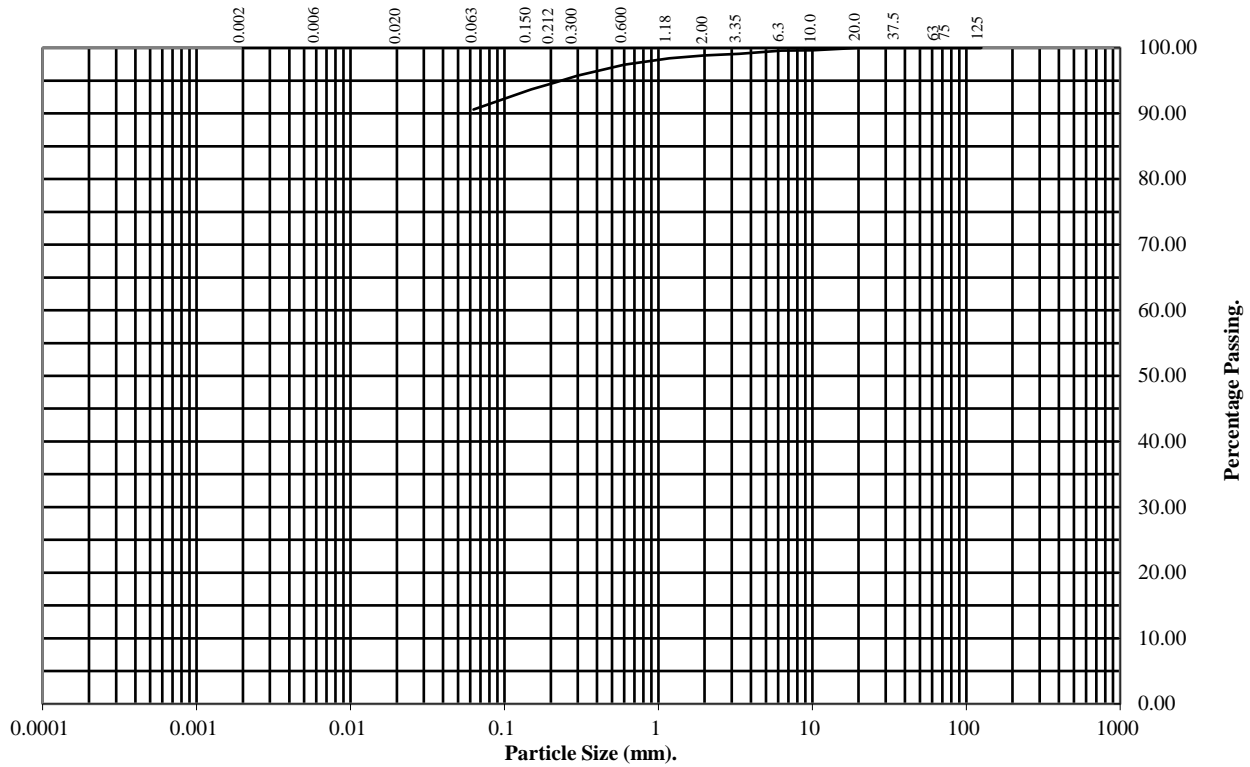
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **TP26** Top Depth (m): **1.20**

Sample Number: **3** Base Depth(m):

Sample Type: **D&B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	99
2	99
1.18	98
0.6	97
0.3	96
0.212	95
0.15	94
0.063	91

Soil Fraction	Total Percentage
Cobbles	0
Gravel	1
Sand	8
Silt/Clay	91

Remarks:
See Summary of Soil Descriptions



Gynn Lane, Honley

Contract No:
PSL24/5602
Client Ref:
4749

PARTICLE SIZE DISTRIBUTION TEST

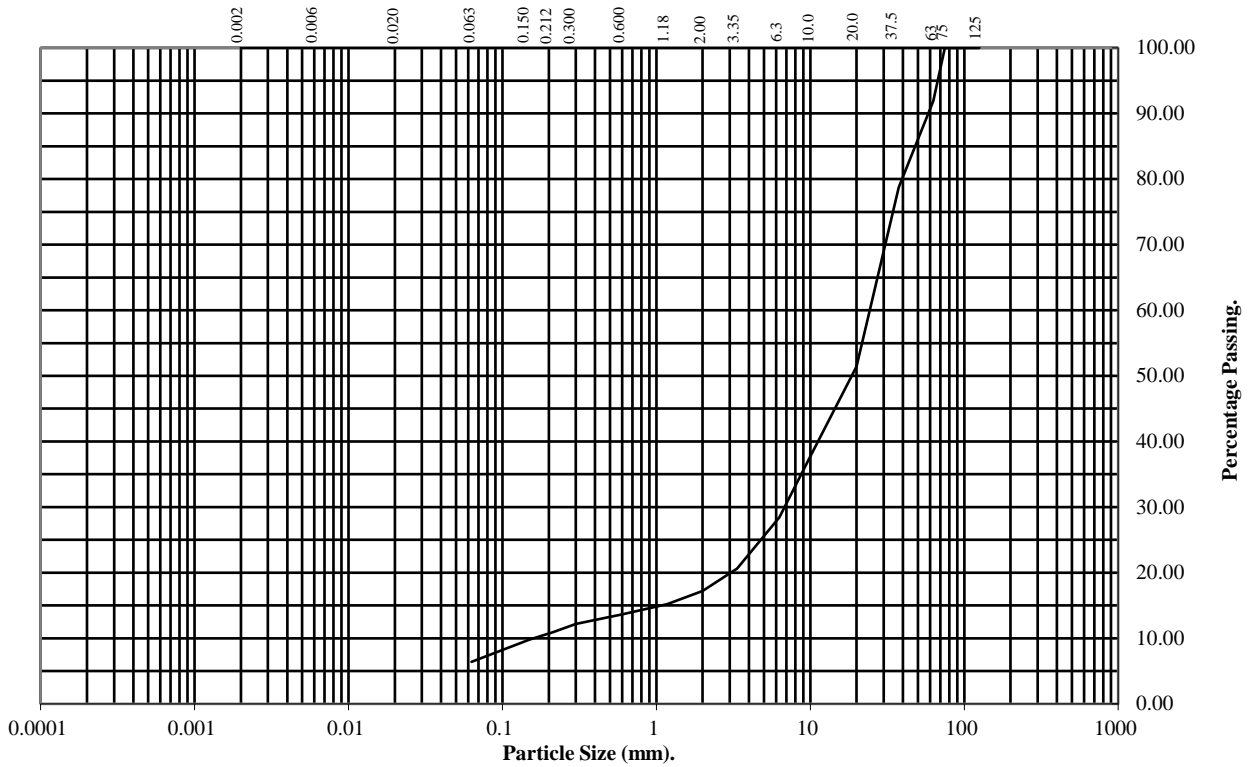
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **TP01** Top Depth (m): **0.50**

Sample Number: **2** Base Depth(m):

Sample Type: **D&B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	92
37.5	79
20	51
10	38
6.3	28
3.35	21
2	17
1.18	15
0.6	14
0.3	12
0.212	11
0.15	10
0.063	6

Soil Fraction	Total Percentage
Cobbles	8
Gravel	75
Sand	11
Silt/Clay	6

Remarks:
See Summary of Soil Descriptions



Gynn Lane, Honley

Contract No:
PSL24/5602
Client Ref:
4749

PARTICLE SIZE DISTRIBUTION TEST

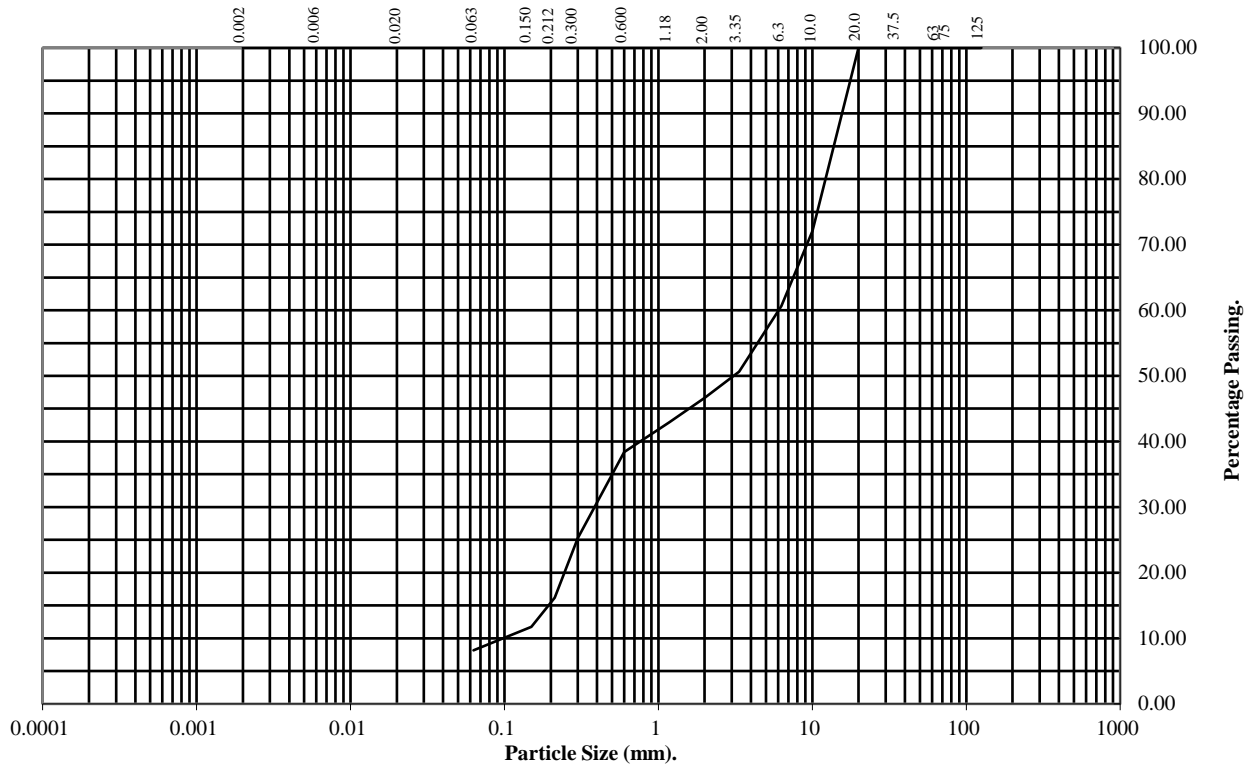
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **TP05** Top Depth (m): **0.90**

Sample Number: **2** Base Depth(m):

Sample Type: **D&B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	72
6.3	61
3.35	51
2	47
1.18	43
0.6	38
0.3	25
0.212	16
0.15	12
0.063	8

Soil Fraction	Total Percentage
Cobbles	0
Gravel	53
Sand	39
Silt/Clay	8

Remarks:
See Summary of Soil Descriptions



Gynn Lane, Honley

Contract No:
PSL24/5602
Client Ref:
4749

PARTICLE SIZE DISTRIBUTION TEST

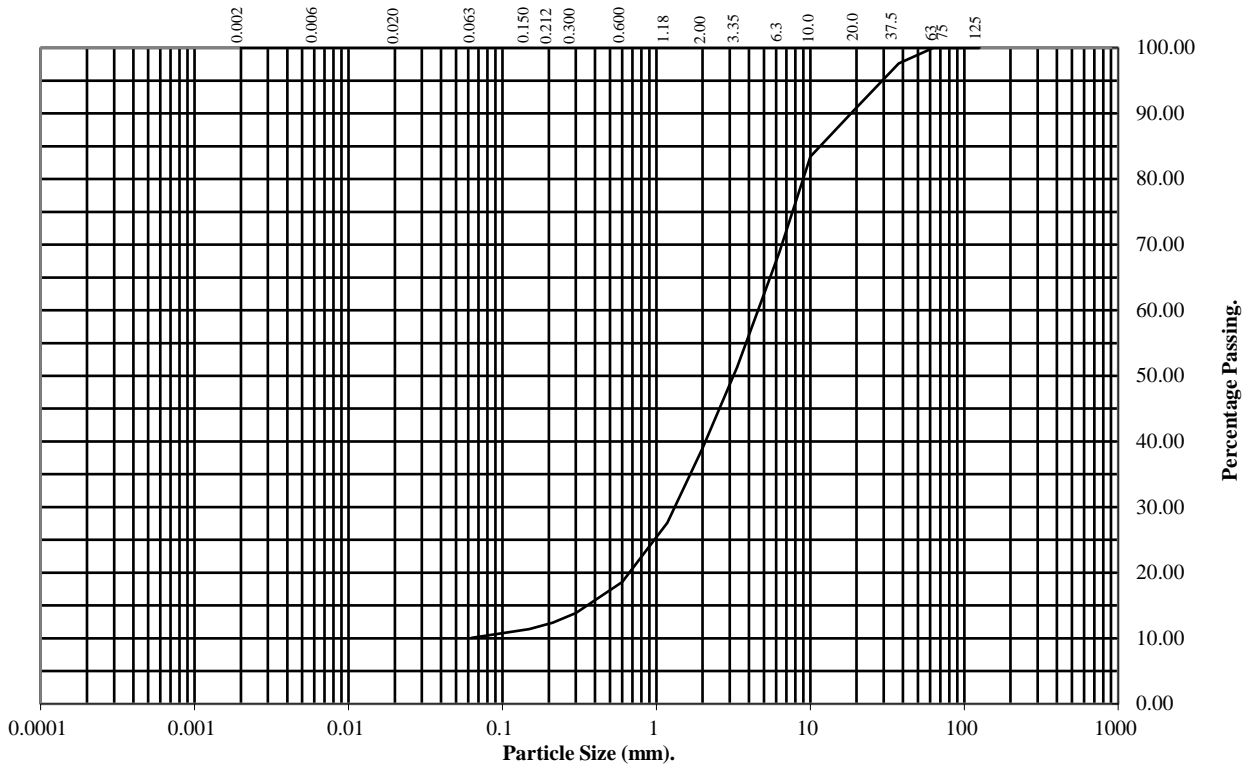
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **TP19** Top Depth (m): **1.50**

Sample Number: **1** Base Depth(m):

Sample Type: **D&B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	98
20	91
10	83
6.3	69
3.35	51
2	39
1.18	28
0.6	19
0.3	14
0.212	12
0.15	11
0.063	10

Soil Fraction	Total Percentage
Cobbles	0
Gravel	61
Sand	29
Silt/Clay	10

Remarks:
See Summary of Soil Descriptions



Gynn Lane, Honley

Contract No:
PSL24/5602
Client Ref:
4749

PARTICLE SIZE DISTRIBUTION TEST

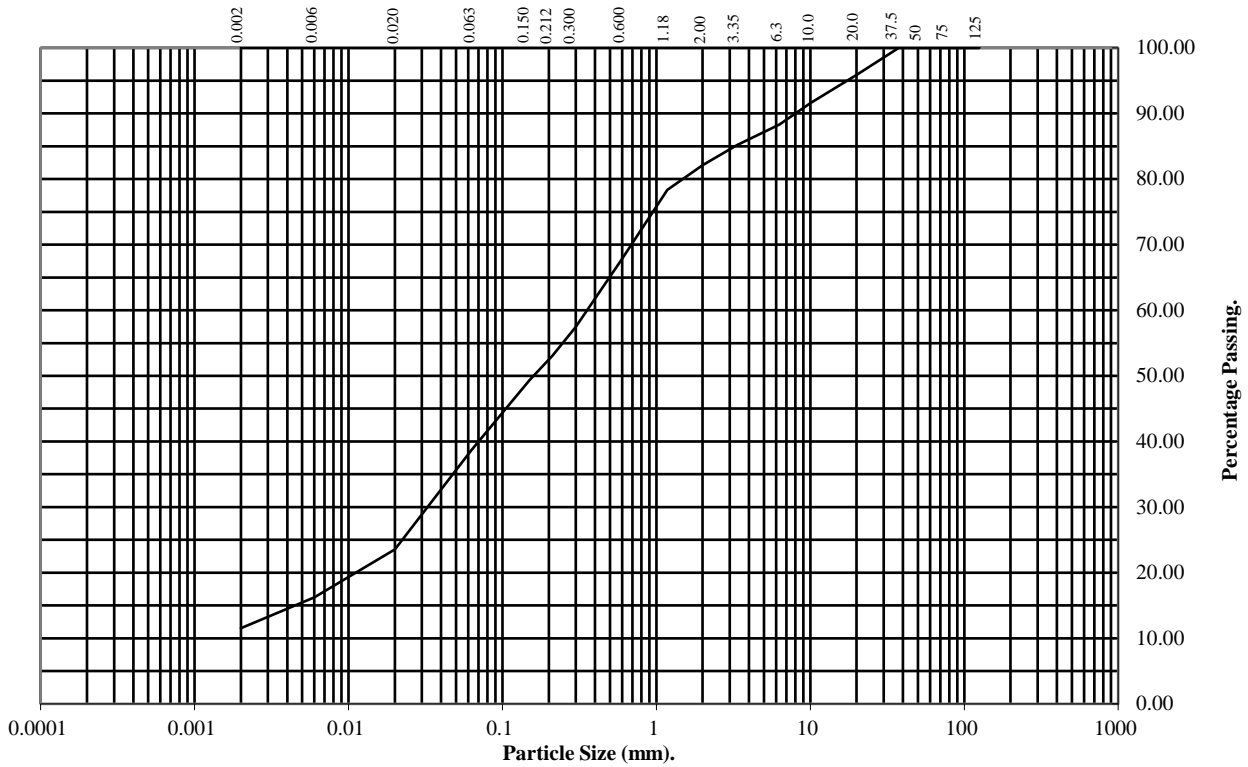
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **TP01** Top Depth (m): **0.20**

Sample Number: **2** Base Depth(m):

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
50	100
37.5	100
20	96
10	92
6.3	88
3.35	85
2	82
1.18	78
0.6	68
0.3	57
0.212	53
0.15	49
0.063	39

Particle Diameter	Percentage Passing
0.02	24
0.006	16
0.002	12

Soil Fraction	Total Percentage
Cobbles	0
Gravel	18
Sand	43
Silt	27
Clay	12

Remarks:
See Summary of Soil Descriptions



Gynn Lane, Honley

Contract No:
PSL24/5602
Client Ref:
4749

PARTICLE SIZE DISTRIBUTION TEST

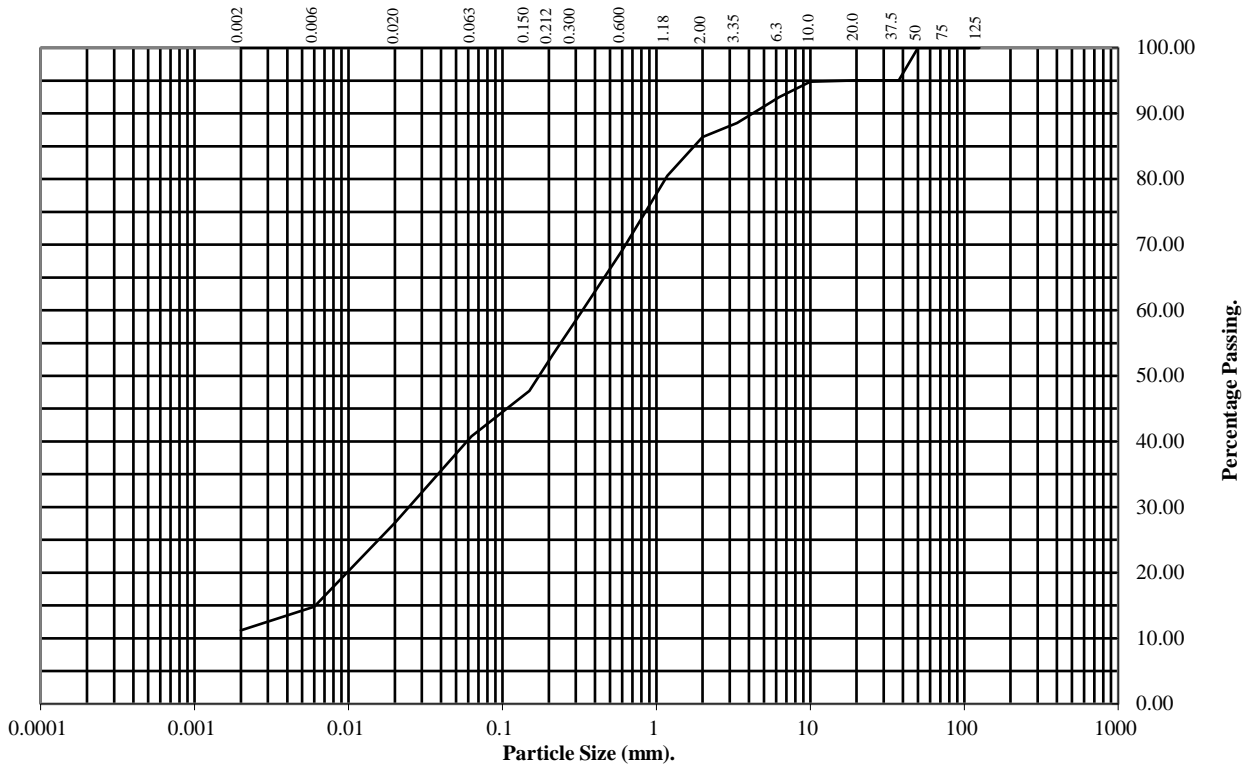
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **TP10** Top Depth (m): **0.20**

Sample Number: **2** Base Depth(m):

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
50	100
37.5	95
20	95
10	95
6.3	93
3.35	89
2	86
1.18	80
0.6	69
0.3	58
0.212	53
0.15	48
0.063	41

Particle Diameter	Percentage Passing
0.02	28
0.006	15
0.002	11

Soil Fraction	Total Percentage
Cobbles	0
Gravel	14
Sand	45
Silt	30
Clay	11

Remarks:
See Summary of Soil Descriptions



Gynn Lane, Honley

Contract No:
PSL24/5602
Client Ref:
4749

PARTICLE SIZE DISTRIBUTION TEST

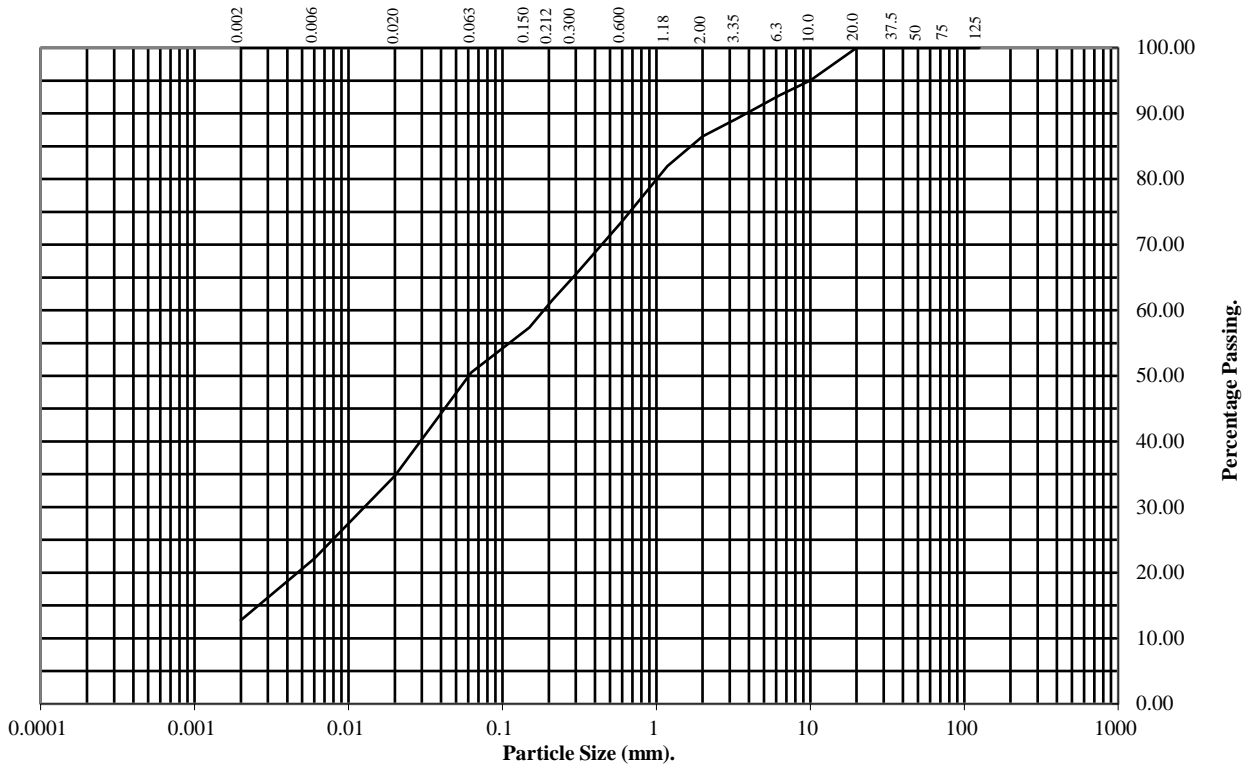
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: TP22 **Top Depth (m):** 0.20

Sample Number: 2 **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
50	100
37.5	100
20	100
10	95
6.3	93
3.35	89
2	86
1.18	82
0.6	74
0.3	65
0.212	62
0.15	57
0.063	51

Particle Diameter	Percentage Passing
0.02	35
0.006	22
0.002	13

Soil Fraction	Total Percentage
Cobbles	0
Gravel	14
Sand	35
Silt	38
Clay	13

Remarks:
See Summary of Soil Descriptions



Gynn Lane, Honley

Contract No:
PSL24/5602
Client Ref:
4749

PARTICLE SIZE DISTRIBUTION TEST

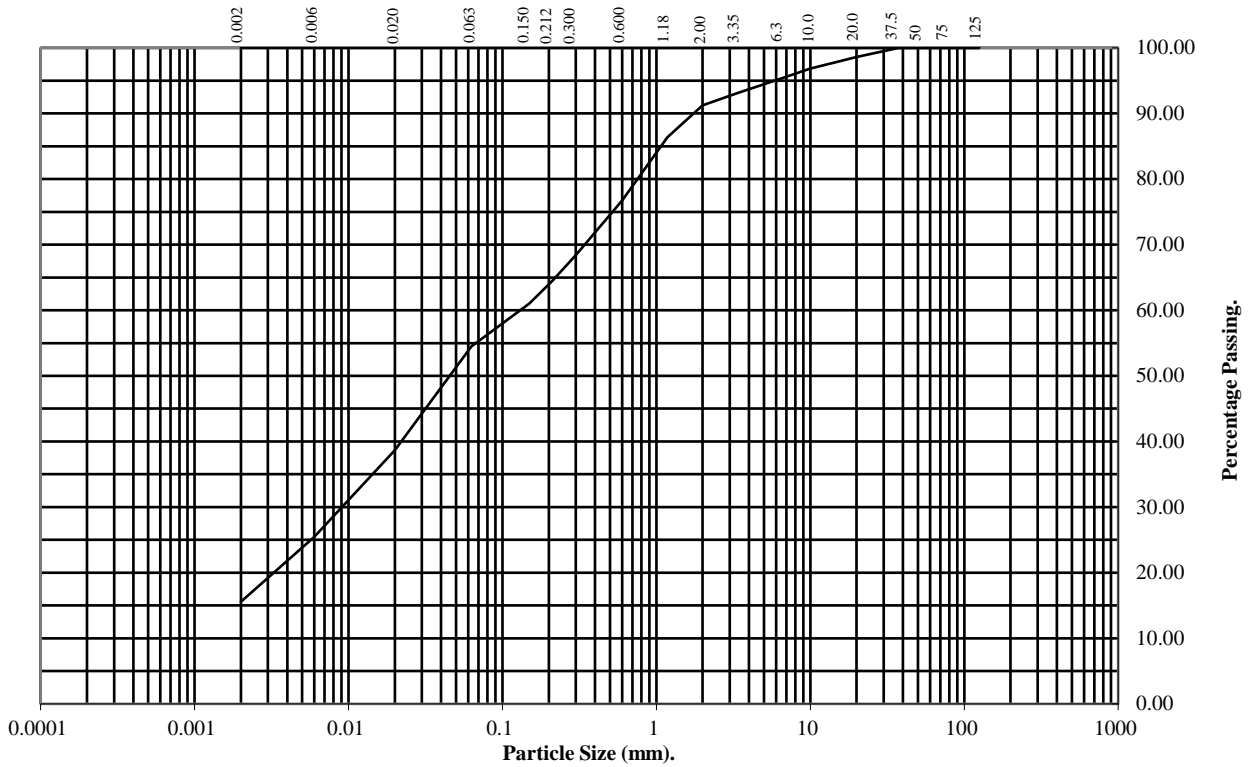
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **TP26** Top Depth (m): **0.20**

Sample Number: **2** Base Depth(m):

Sample Type: **B**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
50	100
37.5	100
20	99
10	97
6.3	95
3.35	93
2	91
1.18	86
0.6	77
0.3	68
0.212	65
0.15	61
0.063	55

Particle Diameter	Percentage Passing
0.02	39
0.006	25
0.002	16

Soil Fraction	Total Percentage
Cobbles	0
Gravel	9
Sand	36
Silt	39
Clay	16

Remarks:
See Summary of Soil Descriptions



Gynn Lane, Honley

Contract No:
PSL24/5602
Client Ref:
4749

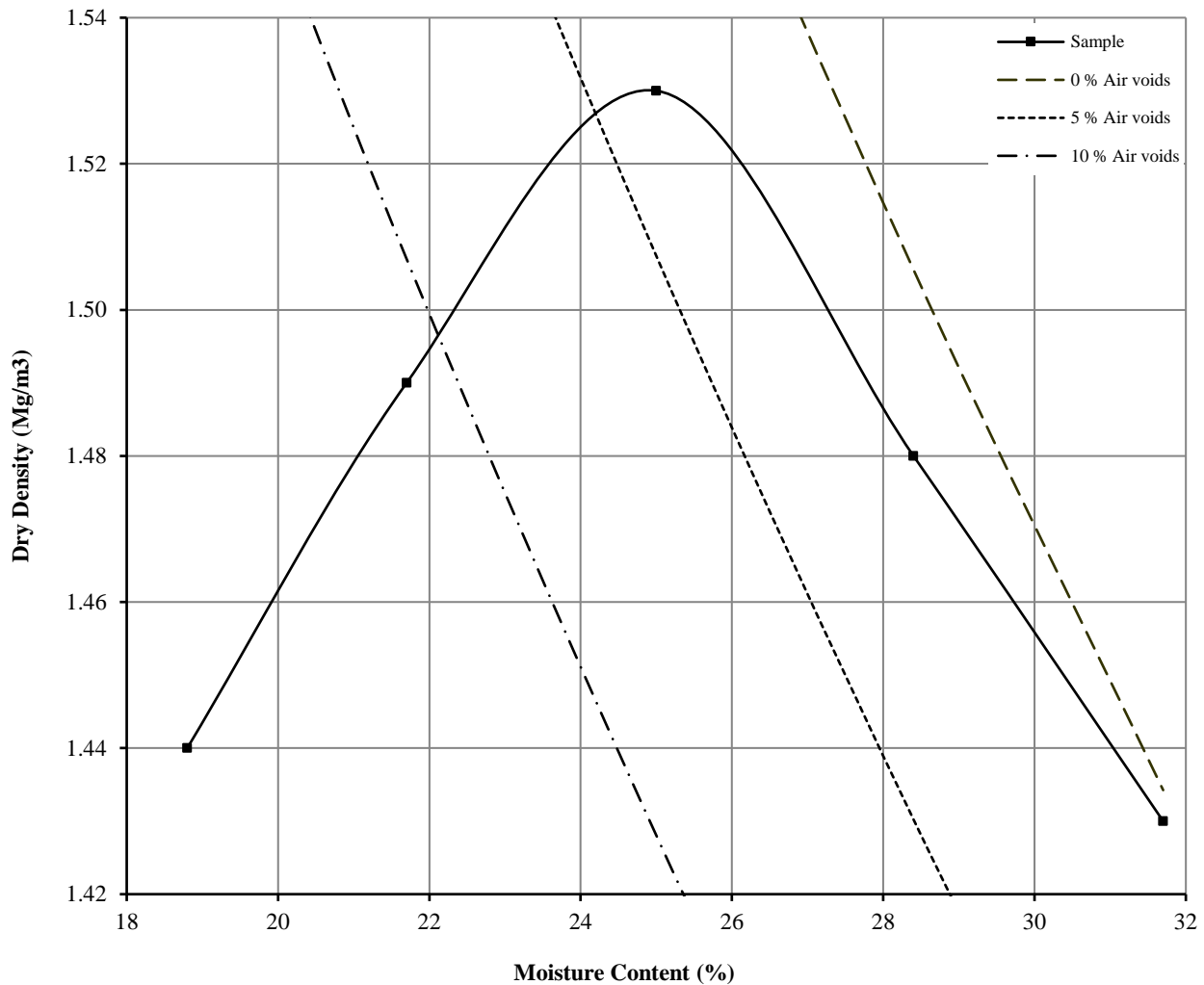
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.5 : 1990

Hole Number: TP03 Top Depth (m) : 0.70

Sample Number: 2 Base Depth (m) :

Sample Type: D&B



Initial Moisture Content:	25	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m ³):	2.63	Measured	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m ³):	1.53		Material Retained on 20.0 mm Test Sieve (%):	0
Optimum Moisture Content (%):	25			
Remarks See summary of soil descriptions				



Gynn Lane, Honley

Contract
PSL24/5602
Client Ref
4749

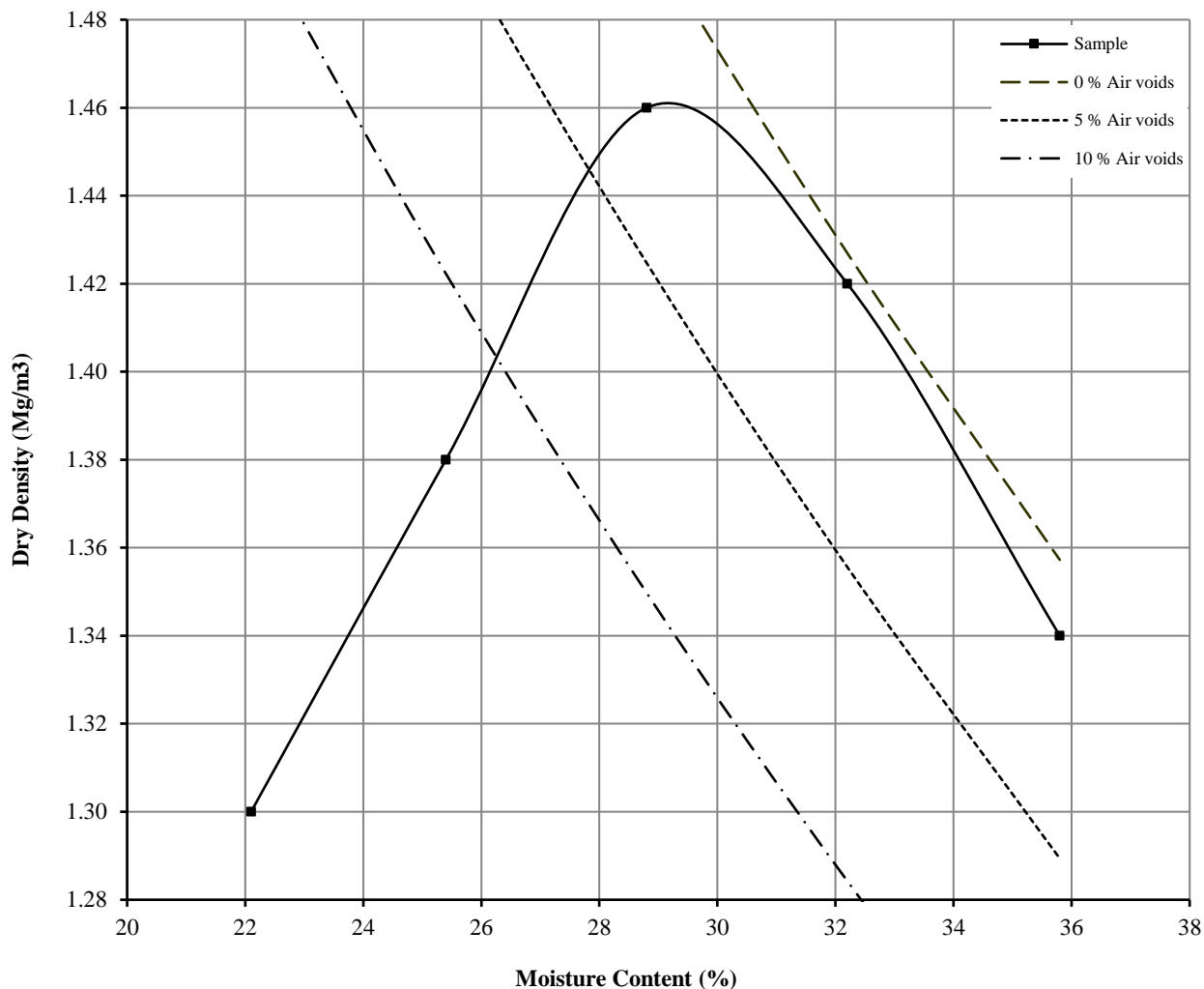
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.5 : 1990

Hole Number: TP26 Top Depth (m) : 1.20

Sample Number: 3 Base Depth (m) :

Sample Type: D&B



Initial Moisture Content:	36	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m ³):	2.64	Measured	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 (%):	0
Optimum Moisture Content (%):	29			
Remarks See summary of soil descriptions				



Gynn Lane, Honley

Contract
PSL24/5602
Client Ref
4749

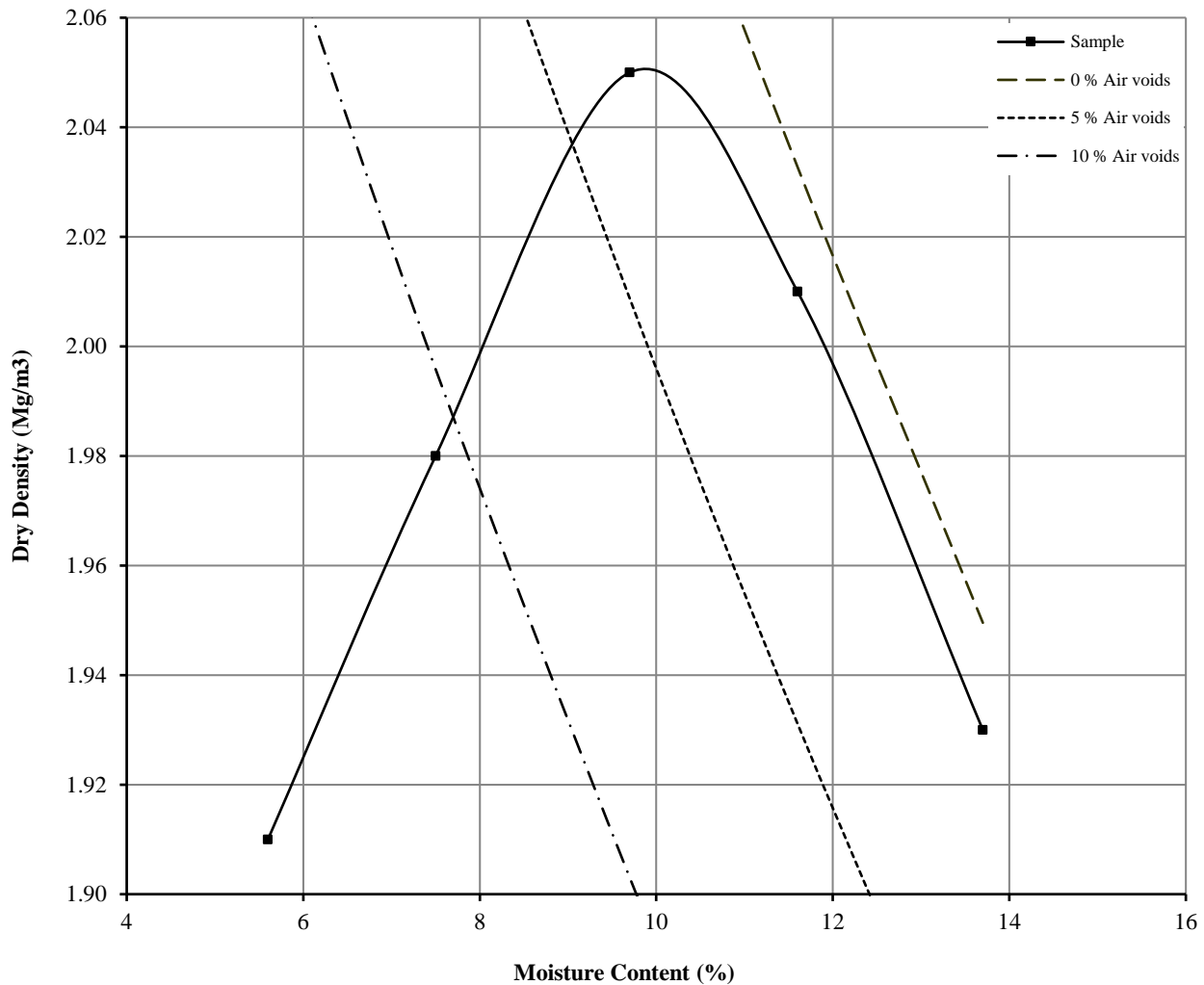
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

Non compliance with BS 1377 : Part 4 : Clause 3.6 : 1990



Hole Number: TP01 Top Depth (m) : 0.50

Sample Number: 2 Base Depth (m) :

Sample Type: D&B



Initial Moisture Content:	12	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m ³):	2.66	Measured	Material Retained on 37.5 mm Test Sieve (%):	21
Maximum Dry Density (Mg/m ³):	2.05	Material Retained on 20.0 mm Test Sieve (%):	28	
Optimum Moisture Content (%):	10			
Remarks See summary of soil descriptions				

 	<p>Gynn Lane, Honley</p>	Contract
		PSL24/5602
		Client Ref
		4749

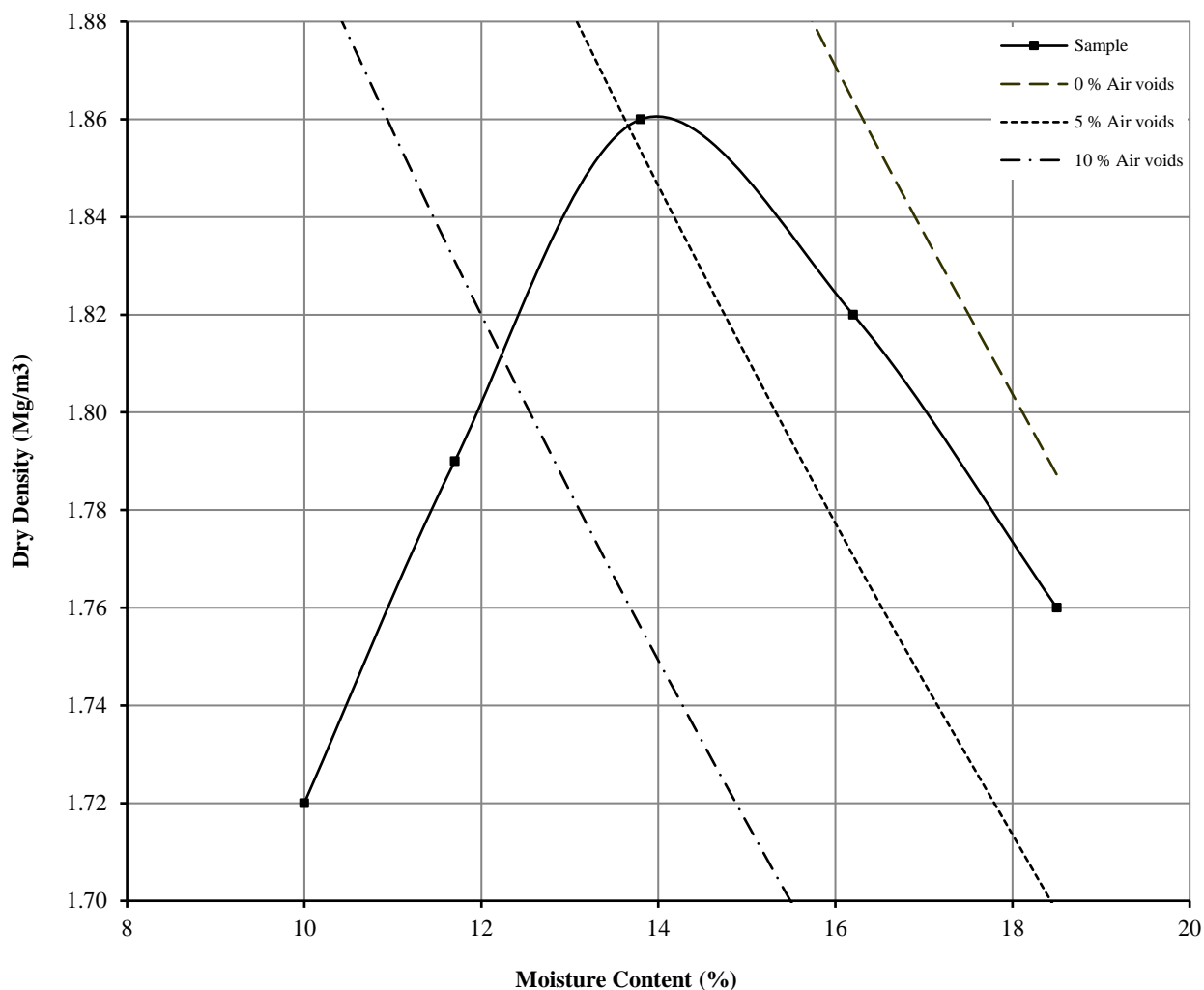
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.5 : 1990

Hole Number: TP05 Top Depth (m) : 0.90

Sample Number: 2 Base Depth (m) :

Sample Type: D&B



Initial Moisture Content:	16	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m ³):	2.67	Measured	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m ³):	1.86		Material Retained on 20.0 mm Test Sieve (%):	0
Optimum Moisture Content (%):	14			
Remarks See summary of soil descriptions				



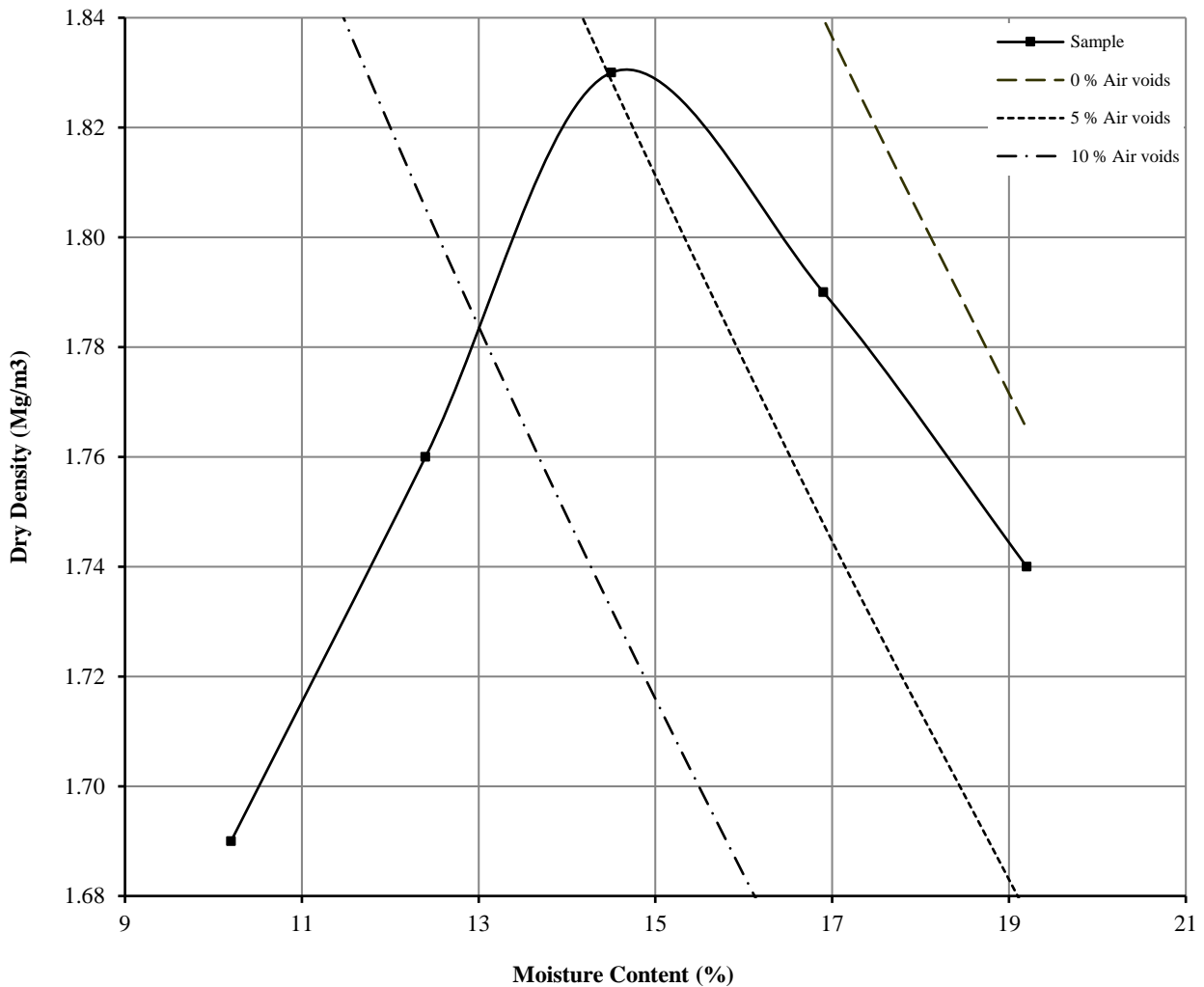
Gynn Lane, Honley

Contract
PSL24/5602
Client Ref
4749



DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.6 : 1990

Hole Number: TP19 Top Depth (m) : 1.50
 Sample Number: 1 Base Depth (m) :
 Sample Type: D&B



Initial Moisture Content:	17	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m ³):	2.67	Measured	Material Retained on 37.5 mm Test Sieve (%):	2
Maximum Dry Density (Mg/m ³):	1.83		Material Retained on 20.0 mm Test Sieve (%):	7
Optimum Moisture Content (%):	15			
Remarks See summary of soil descriptions				

 	<p>Gynn Lane, Honley</p>	Contract
		PSL24/5602
		Client Ref
		4749



Professional Soils Laboratory
 5/7 Hexthorpe Road
 Hexthorpe
 Doncaster
 DN4 0AR

7 - 11 Harding Street
 Leicester
 LE1 4DH

Analytical Test Report: L24/07375/PSL - 24-48537

Your Project Reference:	PSL24/5602 Gynn Lane, Honley		
Your Order Number:	PSL24/5602	Samples Received / Instructed:	12/08/2024 / 12/08/2024
Report Issue Number:	1	Sample Tested:	12/08 to 19/08/2024
Samples Analysed:	10 samples	Report issued:	19/08/2024

Si **REDACTED**

James Gane
 Analytical Services Manager
 CTS Group

Notes:

General

Please refer to Methodologies page for details pertaining to the analytical methods undertaken.
 Samples will be retained for 14 days after issue of this report unless otherwise requested.
 Moisture Content was determined in accordance with CTS method statement MS - CL - Sample Prep, oven dried at <30°C.
 Moisture Content is reported as a percentage of the dry mass of soil, this calculation is in accordance with BS1377, Part 2, 1990, Clause 3.2
Where specification limits are included these are for guidance only. Where a measured value has been highlighted this is not implying acceptance or failure and certainty of measurement values have not been taken into account.
Uncertainty of measurement values are available on request.
 Samples were supplied by customer, results apply to the samples as received.

Deviating Samples

On receipt samples are compared against our sample holding and handling protocols, where any deviations have been noted these are reported on our deviating sample page (if present)

Accreditation Key

UKAS = UKAS Accreditation, MCERTS = MCERTS Accreditation, u = Unaccredited, subUKAS - Subcontracted to a laboratory UKAS accredited for this test, subMCERTS - Subcontracted to a laboratory MCERTS accredited for this test
 MCERTS Accreditation only covers the SAND, CLAY and LOAM matrices

Date of Issue: 08.08.2024
 Issued by: J. Gane
 Issue No: 4
 Rev No: 11



L24/07375/PSL - 24-48537

Project Reference - PSL24/5602 Gynn Lane, Honley

7 - 11 Harding Street
Leicester
LE1 4DH

Analytical Test Results - Chemical Analysis

Lab Reference	389049	389050	389051	389052	389053	389054		
Client Sample ID	-	-	-	-	-	-		
Client Sample Location	TP03	TP04	TP14	TP24	TP28	TP02		
Client Sample Type	D&B	D	D	D	D	D		
Client Sample Number	2	2	2	2	2	2		
Depth - Top (m)	0.70	1.30	0.90	1.60	1.00	0.70		
Depth - Bottom (m)	0.70	1.30	0.90	1.60	1.00	0.70		
Date of Sampling	25/07/2024	25/07/2024	25/07/2024	25/07/2024	25/07/2024	25/07/2024		
Time of Sampling	-	-	-	-	-	-		
Sample Matrix	Clay	Clay	Clay	Clay	Clay	Clay		
Determinant	Units	Accreditation						
Water soluble sulphate (as SO ₄)	(mg/l)	u	< 10	< 10	< 10	13	< 10	
pH Value	pH Units	MCERTS	6.8	5.8	6.8	6.5	5.2	6.5



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Leicester
LE1 4DH

Analytical Test Results - Chemical Analysis

Lab Reference	389055	389056	389057	389058
Client Sample ID	-	-	-	-
Client Sample Location	TP11	TP03	TP08	TP19
Client Sample Type	D	D&B	D&B	D&B
Client Sample Number	1	3	2	1
Depth - Top (m)	0.80	1.60	0.60	1.50
Depth - Bottom (m)	0.80	1.60	0.60	1.50
Date of Sampling	25/07/2024	25/07/2024	25/07/2024	25/07/2024
Time of Sampling	-	-	-	-
Sample Matrix	Clay	Other	Sand	Other
Determinant	Units	Accreditation		
Water soluble sulphate (as SO ₄)	(mg/l)	u	< 10	< 10
pH Value	pH Units	MCERTS	6.7	6.7
			7.0	5.8



L24/07375/PSL - 24-48537

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Sample Descriptions

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Description	Moisture Content (%)	Stone Content (%)	Passing 2mm test sieve (%)
389049	-	TP03	D&B	2	Brown slightly sandy silty clay	-	-	100
389050	-	TP04	D	2	Brown slightly sandy silty clay	-	-	100
389051	-	TP14	D	2	Brown slightly sandy silty clay	-	-	100
389052	-	TP24	D	2	Brown slightly sandy silty clay	-	-	100
389053	-	TP28	D	2	Brown slightly sandy silty clay	-	-	100
389054	-	TP02	D	2	Brown slightly sandy silty clay	-	-	100
389055	-	TP11	D	1	Brown slightly sandy silty clay with rare mudstone	-	-	100
389056	-	TP03	D&B	3	Brown clayey mudstone	-	-	100
389057	-	TP08	D&B	2	Brown gravelly silty sand	-	-	100
389058	-	TP19	D&B	1	Brown clayey mudstone	-	-	100



L24/07375/PSL - 24-48537

Project Reference - PSL24/5602 Gynn Lane, Honley

Sample Comments

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Comments
389049	-	TP03	D&B	2	
389050	-	TP04	D	2	
389051	-	TP14	D	2	
389052	-	TP24	D	2	
389053	-	TP28	D	2	
389054	-	TP02	D	2	
389055	-	TP11	D	1	
389056	-	TP03	D&B	3	
389057	-	TP08	D&B	2	
389058	-	TP19	D&B	1	



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L24/07375/PSL - 24-48537

Project Reference - PSL24/5602 Gynn Lane, Honley

Analysis Methodologies

Test Code	Test Name / Reference	Sample condition for analysis	Sample Preparation	Test Details
ANIONSS	MS - CL - Anions by Aquakem (2:1Extract)	Oven dried	Passing 2mm test sieve	Determination of Anions (inc Sulphate, chloride etc.) in soils by Aquakem. Analysis is based on a 2:1 water to soil extraction ratio
PHS	MS - CL - pH in Soils	As received	Passing 10mm test sieve	Determination of pH in soils using a pH probe (using a 1:3 soil to water extraction)
SAMPLEPREP	MS - CL - Sample Preparation	-	-	Preparation of samples (including determination of moisture content) to allow for subsequent analysis



L24/07375/PSL - 24-48537

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Sample Deviations

Deviations are listed below against each sample and associated test method, where deviation(s) are noted it means data may not be representative of the sample at the time of sampling and it is possible that results provided may be compromised.

Observations on receipt

A - No date of sampling provided

C - Received in inappropriate container

H - Contains headspace

T - Temperature on receipt exceeds storage temperature

R - Sample(s) received with less than 96 hours for testing to commence/complete, any result formally classed as deviating will be marked with an X against the applicable test (i.e. RX)

Observations whilst in laboratory

X - Exceeds sampling to extraction or analysis timescales

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Test	Deviations
389049	-	TP03	D&B	2	MS - CL - pH in Soils	RX
389050	-	TP04	D	2	MS - CL - pH in Soils	RX
389051	-	TP14	D	2	MS - CL - pH in Soils	RX
389052	-	TP24	D	2	MS - CL - pH in Soils	RX
389053	-	TP28	D	2	MS - CL - pH in Soils	RX
389054	-	TP02	D	2	MS - CL - pH in Soils	RX
389055	-	TP11	D	1	MS - CL - pH in Soils	RX
389056	-	TP03	D&B	3	MS - CL - pH in Soils	RX
389057	-	TP08	D&B	2	MS - CL - pH in Soils	RX
389058	-	TP19	D&B	1	MS - CL - pH in Soils	RX

Appendix K
Gas Monitoring Results

Visit 1			
Job Title:			Job No:
Gynn Lane, Honley			4749
Client:			Sheet :
Vivly Living (YCP)			1 of 1
Date:	Arrival Time:	Depart Time:	Operator:
21/08/2024	09:30	10:30	George Costley



Gas Monitoring Results:							
Ambient Concentration (% Volume):		CH₄:	ND	CO₂:	ND	O₂:	19.2

Monitoring Point	Groundwater level (m) bgl	Concentrations					Gas Flow Rates			Bottom of well m	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	(%)	(%)	litre/hr	litre/hr	secs		
PH19	ND	ND	0.6	ND	0.6	19.1	0.7	ND	200.0	4.16	Bung Tap left open
PH20	3.65	ND	0.1	ND	0.1	18.4	ND	ND	200.0	4.17	Bung Tap left open
PH21	ND	ND	4.7	ND	4.7	12.4	ND	ND	200.0	4.20	Bung Tap left open
PH22	4.21	ND	0.7	ND	0.7	18.8	0.3	ND	200.0	4.24	Bung Tap left open
PH23	ND	ND	0.1	ND	0.1	19.2	ND	ND	200.0	4.15	Bung Tap left open
PH24	ND	ND	ND	ND	ND	19.2	ND	ND	200.0	4.10	Bung Tap left open

Equipment Used:	Next Calibration Date
Gas Data GFM436 Infrared Gas Analyser Geotechnical Instruments Dipmeter	27/03/2025

Key	ND	None Detected
	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 (Slaithwaite Station)							
	Temp (°C):	12.9 > 15.2			Barometric Pressure Trend:				Rising
Time:	09:30	10:00	10:30	01:00	07:30	09:30	10:00	10:30	12:30
Pressure (mb):	999	997	997	1010	1012	1013	1013	1013	1013

	CH₄	CO₂	O₂
Trigger level 1	1.0	5.0	16.0
Trigger level 2	5.0	10.0	10.0

Weather Conditions:	Sunny, Mild
Surface Ground Conditions:	Damp

Remarks: Slaithwaite weather station located approximately 5 miles west from the site (Gynn Lane, Honley).