



# Land at Penistone Road, Fenay Bridge For Newett Homes

Report no: 4526/1

Date: December 2024



## SUMMARY OF GEOENVIRONMENTAL ISSUES

<b>Job No.</b>	4526	<b>Site area/ha</b>	3.5
<b>Client:</b>	Newett Homes	<b>NGR:</b>	SE 185 150
<b>Site:</b>	Penistone Road, Fenay Bridge	<b>Nearest postcode:</b>	HD8 0AW

The site is located off Penistone Road, Fenay Bridge, approximately 4.6km southeast of Huddersfield town centre, and currently comprises an active construction site for a proposed housing development. The site was previously undeveloped and comprised agricultural fields.

Lithos were commissioned by Newett Homes to provide a geoenvironmental appraisal of the site, which it is understood is to be redeveloped with housing. Lithos' investigation included a review of 3<sup>rd</sup> party reports, the site's history and environmental setting, and a ground investigation comprising 8 trial pits.

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

Issue	Remarks
Made ground	Possible Reworked Natural Soil was encountered in TP208 to 0.5m, likely associated with regrade of the slope.
Natural ground	Comprises Cohesive and Granular Residual Soil. Coal Measures bedrock (typically mudstone) was encountered from c. 0.8m depth, sometimes from surface.
Contamination	No plausible contaminant linkages have been identified. Testing suggests that Topsoil is chemically suitable for re-use and would be expected to be suitable to support plant growth.
Mining & quarrying	The far east of this site is located within a Coal Mining Development High Risk Area due to the conjectured outcrop of the Better Bed Coal seam which dips to the east and is underlain by at least 100m of Coal Measures bedrock in which there are no further significant coal seams. WSP have previously drilled three rotary openhole probeholes in the east, none of which encountered the Better Bed Coal seams or any evidence of shallow mineworkings. None quarries recorded on site. Several former quarries and gravel pits within 250m.
Hazardous gas	The site is in an area where less than 1% of homes are estimated to be above the radon action level. No special precautions against radon are required on this site. The site is located within 250m of known backfilled features (quarries). However, a preliminary gas risk assessment was completed by WSP / Ecus, and determined that the gas risk at the site is low and no gas protection measures are necessary.
Preparatory works	Provision of 200mm thickness of topsoil in all garden and landscaped areas.
Foundations	Strips or deepened trench fill footings founding in Cohesive or Granular Residual soils are likely to be the most appropriate foundation solution for 2 to 3 storey houses constructed on this site.
Groundwater & excavations	Groundwater was not encountered within any of the exploratory holes. Shallow excavations should remain stable during the construction phase in the short term.
Flooding & drainage	The site lies in Flood Zone 1, where the risk of flooding from rivers or the sea is classified as low. Based on ground conditions and topography, soakaways will not provide a satisfactory solution for surface water drainage. It is understood that an attenuation tank is proposed in the far northwest of the site.
Highways	Based on visual inspection of the shallow natural materials and published guidance, the Cohesive Residual Soil should provide a CBR value of at least 3%. This value should be verified prior to or during construction.

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

- Topography at the site will require regrade to accommodate the proposed layout. Some regrade has already been completed.

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## APPENDICES

### Appendix A - General notes

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

### Appendix B - Drawings

Drawing	Revision	Title
4526/1	-	Site Location Plan
4526/2	-	Proposed Layout
4526/3	-	Site Features
4526/4	-	Site Photographs
4526/5	-	Preliminary Conceptual Site Model
4526/6	-	Exploratory Hole Locations
4526/7	-	Revised Conceptual Site Model
4526/8	-	BGS & CA Recorded Coal Outcrops

### Appendix C - Commission

### Appendix D - Historical OS plans<sup>#</sup>

### Appendix E - Search responses<sup>#</sup>

From	Date	Content
Landmark	11/11/2024	Environmental search data
Coal Authority	11/11/2024	Mining report

### Appendix F - Exploratory records

Appendix F	TP101 to 108, TP201 to TP208, TS201 & TS202
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### Appendix G - Chemical test results

### Appendix H - Contaminated land assessment for selection of water supply pipes

### Appendix I – Topsoil gradings

<sup>#</sup> 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.

**SUPPLEMENTARY GEOENVIRONMENTAL APPRAISAL**  
**of land at**  
**PENISTONE ROAD, FENAY BRIDGE**

**1 INTRODUCTION**

**1.1 The commission and brief**

- 1.1.1 Lithos Consulting Limited were commissioned by Newett Homes to carry out a geoenvironmental appraisal of land at Penistone Road, Fenay Bridge.
- 1.1.2 Lithos have previously issued a letter report for supplementary SI (Ref 009/4529/AG/ASw, dated 27<sup>th</sup> November 2023). The information contained in the letter report has been incorporated within this Report.
- 1.1.3 A copy of the following report for the site has been provided by Newett:
- ‘Summary Report on Previous Site Investigation of Land East of Penistone Road, Fenay Bridge, Huddersfield’, Report MM/12358/190107/P1, produced by Ecus Environmental Consultants, issued in January 2019.
- 1.1.4 The above report follows the general format of a Phase 1 geo-environmental desk study but uses an existing WSP report ‘Land at Fenay Bridge: Combined Phase I and Phase II Ground Risk Appraisal’ (Report Ref. 70035780-001, dated October 2017) as the primary source of information. No intrusive works were undertaken by Ecus.
- 1.1.5 Lithos understand that the Local Planning Authority have requested that the Ecus / WSP reports from 2019 be updated, in particular the preliminary risk assessment and conceptual site model be updated to incorporate any changes in the environment and updated guidance since the report was produced.
- 1.1.6 Correspondence regarding Lithos’ appointment, including the brief for this investigation, is included in Appendix C. The agreed scope of works included:
- A review of third party reports
  - A site walkover and inspection
  - An assessment of the land use history
  - Determination of the site's environmental setting
  - A mining risk assessment in accordance with Coal Authority guidance.
  - A supplementary intrusive ground investigation comprising 10 trial pits
  - 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 works
- 1.1.7 Primary aims of this supplementary phase of investigation were to identify salient geoenvironmental issues affecting the site, update any recommendations in line with current guidance, and satisfy the requirements of the Local Planning Authority.

## 1.2 The proposed development

- 1.2.1 It is understood that the proposed development will include 68 traditional 2 storey domestic dwellings, associated gardens, POS, adoptable roads and sewers.
- 1.2.2 A site layout has been produced by Bryan G Hall for Newett Homes (Drawing reference 22/491/100/001, Rev C, dated 6<sup>th</sup> February 2023) which is reproduced as Drawing 4526/2 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
- 1.3.2 General notes and limitations relevant to all Lithos geoenvironmental investigations are described in the Foreword and should be read in conjunction with this report. The text of the report draws specific attention to any modification to these procedures and to any other special techniques employed.

## 2 SITE DESCRIPTION

### 2.1 General

- 2.1.1 The site's location is shown on Drawing 4526/1 presented in Appendix B to this report. Site details are summarised in the table below.

Detail	Remarks
Location	4.6 km southeast of Huddersfield town centre
NGR	SE 185 150
Approximate area	3.5ha (8.6 acres)
Known services	Underground sewer Overhead electric

### 2.2 Site features

- 2.2.1 Lithos completed a walkover survey of the site on the 13<sup>th</sup> November 2024.
- 2.2.2 Existing salient features, at the time of the walkover are presented on Drawing 4526/3 in Appendix B to this report and summarised in the table below.

Feature	Remarks
Current access	Off Whitegates Grove
Topography	The site slopes down from east to west generally at a gradient between 1 in 10 and 1 in 15.
Approximate areas	28,600m <sup>2</sup> grass (mostly stripped) 5,000m <sup>2</sup> tarmac (Penistone Road, Whitegates Grove & new estate road) 1,100m <sup>2</sup> topsoil stockpile 500m <sup>2</sup> gravel surfacing
Nature of boundaries	Site secured with Heras fencing.

Feature	Remarks
Surrounding land uses	North & south – housing East – wooden embankment, with housing beyond West – grassed field

- 2.2.3 The site is currently undergoing preparatory and active construction for the proposed housing development.
- 2.2.4 A site cabin and gravel surfaced car parking is present in the north of the site close to the site access off Whitegates Grove. A tarmac road has been installed along the line of the proposed new estate road in the north.
- 2.2.5 To the west of the new tarmac road, construction has started on several new houses with many ready for the DPM to be installed.
- 2.2.6 A topsoil stockpile is present to the south of the houses and tarmac road. It is understood that topsoil has been stripped from across the entire site and placed in this stockpile.
- 2.2.7 A gravel surfaced running layer has been placed immediately south of the topsoil stockpile along the line of another proposed estate road.
- 2.2.8 The rest of the site has been stripped of topsoil and undergone some site regrade to allow for drainage to be installed along proposed roads.
- 2.2.9 Existing slopes are present in the east of the site and in the centre south. It is understood further regrade will be required prior to construction of houses in the east.
- 2.2.10 A selection of site photographs is included on Drawing 4526/4.

### 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	Undeveloped. Split into several fields.	Road along western boundary. Town of Rowley c. 250m east. Rowley Quarry (Sandstone) c. 250m east. Gravel Pit 250m south.
1893	No significant changes.	Railway on embankment along eastern boundary (Kirkburton Branch). <b>Air shaft</b> c. 150m southeast. Gravel Pit to south no longer shown. Rowley Quarry no longer shown, Fireworks Manufactory shown 250m east over former quarry. <b>Old Shaft</b> c. 180m north.
1906		No significant changes.
1916		Fireworks Manufactory no longer shown to east. Old Shaft no longer shown to north. <b>Victoria Colliery</b> c. 100m southeast with associated rail sidings.
1938		Fireworks Factories shown again 250m east. <b>Old Shaft</b> shown 250m northeast. Houses shown from c. 20m south. <b>Shafts</b> shown c. 250m southeast likely associated with Victoria Colliery.
1961		Continued residential development c. 20m south. Victoria Colliery no longer labelled and rail sidings no longer shown.

Date	Site	Surrounding land
		Shafts still shown c. 250m southeast. Road immediately west labelled as A629. Residential development shown from c. 10m north.
1971-1973		Railway immediately east shown as dismantled. Fireworks Factory no longer shown 250m east. Large residential development shown in place from c. 50m east.
1992-1993		Shafts no longer shown to the southeast.
2006		No significant changes.

3.3 No significant changes noted on any OS maps on or surrounding site from 2006 onwards.

## 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 responses received from Landmark and 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	Summary
Geology	1:50,000 BGS map (Sheet 77) 1:10,000 BGS map (Sheet SE11SE)	Drift soils – none recorded on site. Alluvium recorded immediately west. Solid (bedrock) – Grenoside Sandstone beneath majority of site. Lower Coal Measures in far east and far west. Shallowest coal seam – Better Bed Coal shown to outcrop in far east. See further details in Section 4.2 below. Strata dip – 3° to 5° to the northeast. Faults – none recorded beneath site.
Mining	Coal Authority	This site is mostly located within a Coal Mining Development Low Risk Area (within the defined coalfield, but no known defined risks have been recorded by the Coal Authority; there may still be unrecorded issues). The far east of the site is located within a High Risk Area. Past and present workings – none recorded. Opencast – none recorded. Mine entries – none recorded on site. Adit and shaft recorded c. 100m southeast. Further details in Section 4.2 below.
Quarrying	Historical OS plans	None recorded on site. Several former quarries and gravel pits within 250m.
Landfills	Envirocheck Report	No known landfills within 250m.
Radon	UK Health Security Agency	The site lies in an area where less than 1% of homes are estimated to be above the radon action level. Further details in Section 12.
Hydrogeology	Environment Agency electronic open data via QGIS	Not in a Groundwater Source Protection Zone. Aquifer: Secondary A (Solid). Groundwater abstractions? Closest is c. 400m southwest at Woodsome Golf Club used as spray irrigation. Groundwater vulnerability - High. Pollution incidents? None recorded.
Hydrology	Defra Catchment data explorer Envirocheck Report	Nearest watercourse(s) – Fenay Beck flowing north c. 100m west. Water quality – Moderate (Ecological – 2022), Fail (Chemical – 2019). Pollution incidents? None of significance. Abstractions? None of significance. Discharge consents? None of significance.
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).
UXO	Zetica website	Low Risk

## 4.2 Coal & mining

- 4.2.1 In July 2011 the Coal Authority (CA) formalised their requirements in relation to planning applications and introduced some new terminology relating to coal mining development areas. This Section provides the necessary mining risk assessment required by the proposed planning application.
- 4.2.2 This site is mostly located within a Coal Mining Development **Low Risk Area** - within the defined coalfield, but no known defined risks have been recorded by the Coal Authority; there may still be unrecorded issues.
- 4.2.3 The far east of the site (along the line of the coal outcrop) is located within a Coal Mining Development **High Risk Area** - an area with specific mining legacy risks to the surface, including mine entries; shallow coal workings etc).
- 4.2.4 Geological maps suggest that the Better Bed Coal seam (up to 0.45m thick) outcrops in the far east of the site, dipping to the east. This seam is underlain by at least 100m of Coal Measures bedrock within which there are no further significant coal seams.
- 4.2.5 Approximate outcrops are shown on Drawing 4526/8.
- 4.2.6 Given dip and topography, this seam is expected to underlie less than 1% of the site.
- 4.2.7 It should be noted that seam outcrops plotted on geological maps have been known to be inaccurate by distances in excess of 100m.
- 4.2.8 The majority of the site lies within a Low Risk Area - within the defined coalfield, but no known defined risks have been recorded by the CA; there may still be unrecorded issues.
- 4.2.9 However, those areas of the site conjectured to be underlain by the Better Bed Coal are shown to lie within High Risk Areas - areas with specific mining legacy risks to the surface, including mine entries; shallow coal workings etc.
- 4.2.10 A CA mining report states that:
- Known workings have taken place in two seams. These are the:
    - **Halifax Hard** at depths of between 202m and 217m, with an extraction thickness of 1.9m, and last worked between 1925 and 1929.
    - **Halifax Soft** at 242m depth, with an extraction thickness of 1.1m, and last worked in 1931.
  - The site is not underlain by probable unrecorded shallow workings.
  - There are no known spine roadways at shallow depth.
  - A total of one shaft and one adit are present in, or within 100m of, the site's boundary. **None are located within the site boundary; see Drawing 4526/8.**
  - There are no opencast mines recorded within 500m.
  - There are no CA managed tips within 500m.
  - The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50m of the site boundary, since 31<sup>st</sup> October 1994.
  - There are no mines gas emissions recorded within 500m.
  - No notices have been given, under Section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

4.2.11 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.

4.2.12 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)		✓	-
Underground coal mining (probable at shallow depths)		✓	Better Bed coal outcrop recorded in far east. Possible unrecorded shallow coal workings.
Mine entries (shafts and adits)		✓	-
Coal mining geology (fissures)		✓	-
Record of past mine gas emissions or potential		✓	-
Recorded coal mining surface hazard		✓	-
Surface mining (opencast workings)		✓	-

4.2.13 Whilst no issues have been identified, WSP completed three rotary openhole probeholes along the eastern edge of the site where the Better Bed coal is conjectured to outcrop to assess the potential for shallow abandoned mine workings.

4.2.14 The probeholes were taken to depths of between 21m and 24m bgl. Coal was not recorded in any of the 3 probeholes, and the site was not considered at risk from any potential shallow mineworkings.

### 4.3 Agriculture

4.3.1 Historical plans show that the site has been occupied by arable farmland. Generally farming is not considered likely to have caused significant ground contamination. However, activities such as slurry spreading, the discharge of chemicals to ground, and unregulated burial are known to have occurred on farmland. Potential contaminants associated with farming activity could include any of the following.

Agricultural activity	Potential contaminant
Sewage farming, slurry spreading	Methane, metals, nitrates, oxygen depletion
Field sports	Lead shot
Equipment maintenance	Hydrocarbons, metals
Waste burial, land levelling, backfilling ponds/quarries	Methane, metals, PAH etc
Naturally occurring contaminants	Arsenic, metals

4.3.2 Whilst it is likely that pesticides have been applied during arable use of the land, these are not likely to include the persistent organochloride pesticides such as Dieldrin, Aldrin, DDT etc. Pesticides routinely used on arable crops the UK (Phenoxy Acetic acid herbicide or PAAH) rapidly degrade in soils or leach via rainwater infiltration to groundwater. It is highly unlikely these would be detected by soil sampling and therefore it is not proposed to undertake analysis of these.

4.3.3 The generation of ground gas in quantities with the potential to impact upon the proposed development would only occur with the presence of significant quantities of organic matter. Ground gas monitoring is not considered necessary unless significant quantities of organic matter are identified during the ground investigation.

## 5 PREVIOUS INVESTIGATION FINDINGS

### 5.1 General

5.1.1 Newett Homes have provided Lithos with a copy of the following report:

- 'Summary Report on Previous Site Investigation of Land East of Penistone Road, Fenay Bridge, Huddersfield', Report MM/12358/190107/P1, produced by Ecus Environmental Consultants, issued in January 2019.

5.1.2 The above report follows the general format of a Phase 1 geo-environmental desk study but uses an existing WSP report 'Land at Fenay Bridge: Combined Phase I and Phase II Ground Risk Appraisal' (Report Ref. 70035780-001, dated October 2017) as the primary source of information. No intrusive works were undertaken by Ecus.

### 5.2 Summary of Ecus/WSP findings

5.2.1 The WSP report includes reference to 4 'plots' of land (Plots A to D). Plot D is relevant to the Ecus review, and this report.

5.2.2 WSP's ground investigation works comprised:

- Six trial pits (TPD01 to TPD06) excavated to between 1.2m to 2.7m depth.
- Three rotary openhole probeholes (BHD1 to BHD3) drilled to between 21m and 24m depth.
- Monitoring wells were installed in BHD1 to BHD3, with response zones sealed in Coal Measures.
- Geotechnical classification tests (Atterberg Limits, pH, soluble sulphate etc).
- Chemical laboratory tests (including metals, PAHs and asbestos).
- Gas monitoring; 2 visits in September 2017, with atmospheric pressures in range 1008mb to 1014mb. Steady flows of 0.0 l/h were recorded on both visits in all 3 wells.

5.2.3 Ground conditions encountered by WSP in the trial pits are summarised in the table below:

Hole	Final depth (m)	Depth to base of (m)				Depth to Coal Measures Bedrock (m)
		Topsoil	Granular Made Ground	Granular Residual Soil	Cohesive Residual Soil	
TPD01	2.7	0.15	-	-	> 2.7	-
TPD02	1.3	0.25	-	-	1.0	1.0
TPD03	1.4	0.20	-	0.4	1.1	1.1
TPD04	2.4	0.30	-	-	2.0	2.0
TPD05	1.2	0.25	0.5	-	> 1.2	-
TPD06	1.2	0.35	-	-	0.8	0.8
BHD1	21.0	-	-	-	0.7	0.7
BHD2	21.0	-	-	-	0.7	0.7
BHD3	24.0	-	-	-	2.3	2.3

5.2.4 Five samples of Topsoil and four samples of Residual Soil were tested for contamination. Two samples of Topsoil yielded slightly elevated arsenic. These exceedances were not considered to pose a significant risk to future site users or construction workers. However, further investigation was recommended.

5.2.5 None of the three rotary probeholes encountered the Better Bed Coal seam or any evidence of shallow mineworkings.

- 5.2.6 The gas monitoring visits were completed as an initial assessment of gas risk, and not for compliance with CIRIA C665 and planning regulations. WSP completed a preliminary gas risk assessment with the site classified as CS1 with no need for ground gas protection measures installed in new buildings.
- 5.2.7 Groundwater levels recorded in the wells were between 7.3mbgl and 16.75mbgl (78.5mAOD and 85.68mAOD).
- 5.2.8 Based on ground conditions and existing site levels, WSP anticipated that shallow spread foundations bearing within weathered Pennine Lower Coal Measures (Residual Soils) would likely be suitable for the proposed traditional low-rise housing. Ground bearing floor slabs were also anticipated to be suitable.
- 5.2.9 WSP record that concrete in contact with the ground should be a Design Sulphate Class of DS-1 and an ACEC class of between AC-1 and AC-3z. Ecus have determined this should be DS-1 and AC-2z on this site on review of the results.

### 5.3 Lithos comments

- 5.3.1 The WSP investigation is considered to be thin in terms of trial pits excavated across the site, with pits excavated at spacings between 50m and 100m. Trial pits excavated at spacings of about 50m would have been suitable.
- 5.3.2 The number of samples tested is considered low, particularly with respect to Topsoil testing. Further sampling of Topsoil is recommended.
- 5.3.3 The WSP and Ecus desk study 'front ends' are considered reasonably thorough. Ecus' recommendations based on the data provided by the WSP report are reasonable.

## 6 PRELIMINARY CONCEPTUAL SITE MODEL

- 6.1 A preliminary conceptual site model, presented as Drawing 4526/5 in Appendix B, has been prepared after consideration of all the data presented in Sections 2 to 5 inclusive of this report.
- 6.2 Potential contaminant linkages are shown on the preliminary conceptual site model.
- 6.3 The conceptual model will likely be subject to modification in light of data arising from the proposed intrusive ground investigation; see Section 9.7.

## 7 GROUND INVESTIGATION DESIGN

### 7.1 Anticipated ground conditions & potential issues

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

Anticipated condition	Remarks
Made ground	None anticipated (outside of any small amount related to new development).
Natural soils	No drift soils recorded. Residual Soils (gravelly clay & clayey gravel) likely present.
Bedrock	Grenoside Sandstone recorded beneath majority of site with Lower Coal Measures bedrock in far east and west.
Mineworkings	None recorded or anticipated.
Groundwater	Likely deep in bedrock.

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

Type of issue	Specific issue	Remarks
Potential on-site contamination sources	1. Reworked topsoil associated with farming	1. Inorganics & organics
Potential off-site contamination sources	1. Migrating gas from backfilled quarries	1. Preliminary gas monitoring previously completed by WSP / Ecus
Potential geotechnical hazards	1. Steep slopes	1. Site regrade required
Other potential constraints	1. underground and/or overhead utilities	1. May require diversion / incorporation into layout

## 7.2 Ground investigation design & strategy

7.2.1 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
10 Trial Pits	To determine the general nature of soils underlying the site, including the: <ul style="list-style-type: none"> <li>• Nature, distribution and thickness of shallow soils, including any made ground</li> <li>• Suitability of the ground for founding structures and highways</li> </ul>

7.2.2 Proposed exploratory hole locations were selected to provide a representative view of the strata beneath the site. A nominal 50m grid spacing was proposed. Additional exploratory locations might be scheduled by the site engineer in light of the ground conditions actually encountered.

7.2.3 The number of representative samples taken will be reflective of the geological complexity actually encountered.

7.2.4 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.

7.2.5 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.

7.2.6 If made ground, or elevated concentrations of contaminants within topsoil, are recorded during the ground investigation, testing of subsoil samples may be necessary.

7.2.7 Topsoil has been stripped from across the site and placed in a stockpile. Therefore, the stockpile will be sampled and tested.

## 8 FIELDWORK

### 8.1 Objectives

8.1.1 The original investigation strategy is outlined in Section 7.2 above.

### 8.2 Exploratory hole location constraints

8.2.1 Access across the site was limited due to the ongoing development. Trial pits were excavated in accessible locations and away from any proposed plots or roads.

### 8.3 Scope of works

8.3.1 Fieldwork was supervised by Lithos on the 13<sup>th</sup> November 2024 and comprised the exploratory holes listed below.

Technique	Exploratory holes	Final depth(s)	Remarks
Trial pitting (machine dug)	TPs 201 to 208	0.7m to 2.5m	Hand vanes undertaken in cohesive soil where possible
Stockpile sampling (machine dug)	TSs 201 to 202	0.8m	Samples taken from topsoil stockpile
Stockpile sampling (hand excavated)	TSs 203 to 212	0.2m	

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

8.3.3 Exploratory hole logs are presented in Appendix F 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

8.3.4 Exploratory hole locations are shown on Drawing 4526/6 presented in Appendix B; hole positions are based on data from a hand-held GPS (typically +/- 3m accuracy) and have not been surveyed in.

## 9 GROUND CONDITIONS

### 9.1 General

9.1.1 A complete record of strata encountered beneath the proposed development site is given on the various exploratory hole records, presented in Appendix F.

9.1.2 Typical ground conditions encountered at the site are described below in Sections 9.2 (made ground) and 9.3 (natural ground), with a summary provided in the table on page 13.

### 9.2 Made ground

9.2.1 Possible Reworked Natural Soil was encountered in TP208 to 0.5m, likely associated with regrade of the slope.

### 9.3 Natural ground

9.3.1 Natural ground was encountered in all exploratory holes, and typically comprised:

- **Cohesive Residual Soil:** encountered in 4 pits to maximum 2.1m depth comprising stiff, slightly sandy, slightly gravelly Clay.
- **Granular Residual Soil:** encountered in 3 pits below Cohesive Residual Soil or from surface to maximum 2.5m depth comprising very clayey Gravel of mudstone.
- **Coal Measures bedrock:** encountered in the majority of pits below Residual Soil, or occasionally from surface. Mudstone typically encountered, but bed of Sandstone possibly encountered in TP208 (this may have been a boulder associated with Reworked Natural Soils).

9.3.2 **Topsoil** had been stripped from across the site and placed into a stockpile. Topsoil typically comprises slightly sandy, slightly gravelly Clay.

### Summary of ground conditions

Hole	Final depth (m)	Depth to Base of Made Ground (m)	Depth to Base of (m)			Depth to Coal Measures Bedrock (m)	
			Made Ground	Natural Soils		Sandstone	Mudstone
			Possible Reworked Natural Ground	Cohesive Residual Soil	Granular Residual Soil		
TP201	2.5	-	-	2.1	> 2.5	-	-
TP202	1.2	-	-	-	1.0	-	1.0
TP203	1.4	-	-	0.9	-	-	0.9
TP204	0.7	-	-	-	-	-	0.0
TP205	2.2	-	-	1.0	2.0	-	2.0
TP206	1.6	-	-	0.8	-	-	0.8
TP207	1.0	-	-	-	-	-	0.0
TP208	1.6	0.5	0.5	-	-	0.5	0.9

## 9.4 Visual & olfactory evidence of organic contamination

- 9.4.1 No visual or olfactory evidence of organic contamination was encountered.
- 9.4.2 Selected samples of topsoil were scheduled for chemical testing to confirm the suitability of existing topsoil for re-use; see Section 10.

## 9.5 Groundwater

- 9.5.1 No significant inflows of groundwater were encountered during the investigation.

## 9.6 Stability

- 9.6.1 Stability of excavations within natural ground was generally good.

## 9.7 Revised conceptual ground model (ground conditions)

- 9.7.1 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
  - The strength, nature and depth of underlying natural strata
- 9.7.2 Further refinement of the Conceptual Site Model is presented in Section 11.2, where the results of laboratory testing for contaminants have been considered.

# 10 CONTAMINATION (ANALYSIS)

## 10.1 General

- 10.1.1 The site has not been the subject of a past potentially contaminative industrial land use. However, historical mapping suggests arable farming has been carried out on the site. Sampling of the topsoil has been undertaken to confirm its suitability for re-use.
- 10.1.2 An assessment of potential contaminants associated with the former uses has been undertaken; see Section 6.
- 10.1.3 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.
- 10.1.4 Where available, Category 4 Screening Levels (C4SL) have also been referenced.
- 10.1.5 Generic Note 04 in Appendix A provides further details with respect to current guidance and the interpretation of analytical data.

## 10.2 Testing scheduled

10.2.1 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
Topsoil	10	pH, water soluble boron, and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc) & Asbestos ID Speciated Polycyclic Aromatic Hydrocarbons (PAH)
	3	Clay/sand/silt content and visible contaminants, sharps (glass etc) to check compliance with BS3882:2015

## 10.3 Soil contamination results

10.3.1 The soil contamination test results are summarised in the tables on page 16.

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

## Summary of degree of soils contamination

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 \$	% TOC	PAH		Asbestos I.D.
				37	5	26	4000	100	200	199	109	434	584	200		B(a)P ∞	Naphthalene	
															5	10		
TP201	0.5	Topsoil	6.5	32	0.2	0.3	35	48	67	1.7	26	< 0.5	43	100	5.2	< 0.03	< 0.03	N.D.
TP202	0.5	Topsoil	6.9	31	0.6	0.3	31	49	66	0.68	25	< 0.5	39	110	6.0	< 0.03	< 0.03	N.D.
TP203	0.1	Topsoil	6.4	29	0.5	0.3	31	44	60	0.67	26	< 0.5	39	93	5.6	< 0.03	< 0.03	N.D.
TP205	0.1	Topsoil	6.8	31	0.7	0.3	31	46	63	0.72	25	< 0.5	40	95	5.2	< 0.03	< 0.03	N.D.
TP206	0.1	Topsoil	6.6	34	0.7	0.3	37	52	68	1.1	30	0.5	45	110	5.0	< 0.03	< 0.03	N.D.
TP207	0.1	Topsoil	6.7	25	0.6	0.2	31	42	54	0.52	27	< 0.5	37	89	4.6	< 0.03	< 0.03	N.D.
TP209	0.1	Topsoil	6.7	31	0.8	0.3	33	47	65	0.8	25	< 0.5	40	96	6.0	< 0.03	< 0.03	N.D.
TP210	0.1	Topsoil	6.3	29	0.5	0.3	29	43	61	0.59	23	< 0.5	37	90	6.1	< 0.03	< 0.03	N.D.
TP211	0.1	Topsoil	6.5	31	0.7	0.3	35	51	64	0.69	30	< 0.5	42	100	5.4	< 0.03	< 0.03	N.D.
TP212	0.1	Topsoil	6.4	29	0.5	0.3	29	45	60	0.69	24	< 0.5	37	88	6.2	< 0.03	< 0.03	N.D.

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

### Inorganic determinands

- 10.3.3 Of the 10 samples of Topsoil analysed for inorganic parameters, all 10 can be classified as uncontaminated.
- 10.3.4 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).
- 10.3.5 Current UK guidance regarding the statistical analysis of soil contamination data obtained during a site investigation is provided by CL:AIRE<sup>1</sup>, 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.
- 10.3.6 The difference between the old and new approaches, including how Lithos apply the statistical assessment is detailed in Generic Note 04, included as Appendix A to this report.

### Asbestos

- 10.3.7 No visual evidence of asbestos-containing materials (ACMs), such as broken fragments of asbestos-cement sheeting, was noted during the excavation of trial pits.
- 10.3.8 No asbestos fibres were identified in any of the 10 samples screened.

### Organic determinands

- 10.3.9 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).

### Polycyclic Aromatic Hydrocarbons (PAH)

- 10.3.10 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.
- 10.3.11 Speciated PAH analysis has been undertaken in order to determine concentrations of the key "marker" compounds: benzo(a)pyrene (considered the most toxic of the PAHs); and naphthalene (the most mobile and volatile of the PAHs).
- 10.3.12 Speciated analysis has confirmed the absence of significant concentrations of both benzo(a)pyrene and naphthalene in the soils beneath this site.

## 10.4 Topsoil

- 10.4.1 Topsoil has been stripped from across the site and placed in a stockpile. Testing suggests this material is chemically suitable for re-use.
- 10.4.2 Given the nature of the topsoil present on this site it would be expected to be suitable to support plant growth. However, see also the advice in Section 15.3.

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<sup>1</sup> CL:AIRE, 2020. *Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration*.

## BS3882 Topsoil testing

- 10.4.3 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'.
- 10.4.4 The clay/sand/silt content of 3 topsoil samples have been determined to check compliance with BS3882<sup>2</sup> requirements.
- 10.4.5 The results are summarised below:

Parameter	BS3882 Specification	TS201	TS204	TS204
Retained on 2mm sieve	< 30%	10	12	8
Retained on 20mm sieve	< 10%	0	0	0
Retained on 50mm sieve	0%	0	0	0
Clay content	5 to 35%	27	27	33
Silt content	0 to 65%	48	41	48
Sand content	0 to 90%	26	32	20

- 10.4.6 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 'clay loam' class. A ternary plot of the above results is provided in Appendix I.
- 10.4.7 Consequently, topsoil here is expected to be suitable to support plant growth, although only a reduced BS3882 suite of testing has been undertaken (i.e. there has been no analysis for N-P-K etc.).

## 11 CONTAMINATION (QUALITATIVE RISK ASSESSMENT)

### 11.1 Topsoil

- 11.1.1 Topsoil has been stripped from across the site and placed in a stockpile. Testing (as detailed in the Section above) suggests this material is chemically suitable for re-use and would be expected to be suitable to support plant growth.

### 11.2 Revised conceptual ground model (contamination)

- 11.2.1 No plausible contaminant linkages have been identified.

### 11.3 Waste classification

- 11.3.1 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.
- 11.3.2 Off-site disposal of surplus clean naturally occurring soils to landfill is not recommended. In accordance with the CL:AIRE Code of Practice<sup>3</sup> 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.

<sup>2</sup> BS3882:2015. Specification for topsoil. Published by BSI Standards Limited.

<sup>3</sup> The Definition of Waste: Development Industry Code of Practice. CL:AIRE, 2011.

## 12 HAZARDOUS GAS

### 12.1 Methane & carbon dioxide

12.1.1 The site is not believed to be affected by sources of hazardous gas generation as it is:

- Not located within 250m of a known former or current landfill site
- Neither underlain by shallow mineworkings nor located in an area considered susceptible to mines gas emissions
- Not underlain by a significant thickness of made ground
- Not underlain by peat or shallow chalk deposits

12.1.2 The site is located within 250m of known backfilled features (quarries). However, a preliminary gas risk assessment was completed by WSP / Ecus, and determined that the gas risk at the site is low and **no gas protection** measures are necessary.

12.1.3 Consequently, no further gas monitoring is proposed.

### 12.2 Radon

12.2.1 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<sup>-3</sup>) are used to determine whether a property requires no, basic or full measures.

12.2.2 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.

12.2.3 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.

12.2.4 Information from the HSA website indicates that the site lies in an area where **less than 1%** of homes are estimated to be above the action level.

12.2.5 As such, **no** special precautions against radon are required on this site.

## 13 GEOTECHNICAL TESTING

### 13.1 General

13.1.1 Geotechnical testing was not included in the scope of Lithos' supplementary investigation.

13.1.2 Testing has previously been completed by WSP. The results have been tabulated and reviewed in the sections below.

### 13.2 Atterberg limits

13.2.1 The plasticity indices of 4 samples of Cohesive Residual Soil have been determined by WSP; results are summarised below.

Soil type	No. samples tested	Moisture content range % (average)	Range of Plasticity Indices % * (average)	Shrinkability
Cohesive Residual Soil	4	15-27 (22)	10-41 (24)	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.

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

### 13.3 Soluble sulphate and pH

13.3.1 In accordance with BRE SD1<sup>4</sup>, this site has been classified as greenfield with a mobile groundwater regime.

13.3.2 It is envisaged foundations will extend to depths of about 1m through natural strata and samples taken from this depth range were submitted for pH and water-soluble sulphate (2:1 soil/water extract) by WSP.

13.3.3 The concentrations of sulphate in the aqueous natural soil extracts of 2 samples were determined.

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

Soil type	No. samples tested	Lowest pH values	Highest soluble sulphate concentration (mg/l)
Cohesive Residual Soil	2	5.5	49

13.3.5 pH values were all above 5.5, therefore concentrations of chloride and nitrate are considered insignificant.

13.3.6 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-2z**.

### 13.4 Undrained shear strength testing

#### Hand shear vane testing

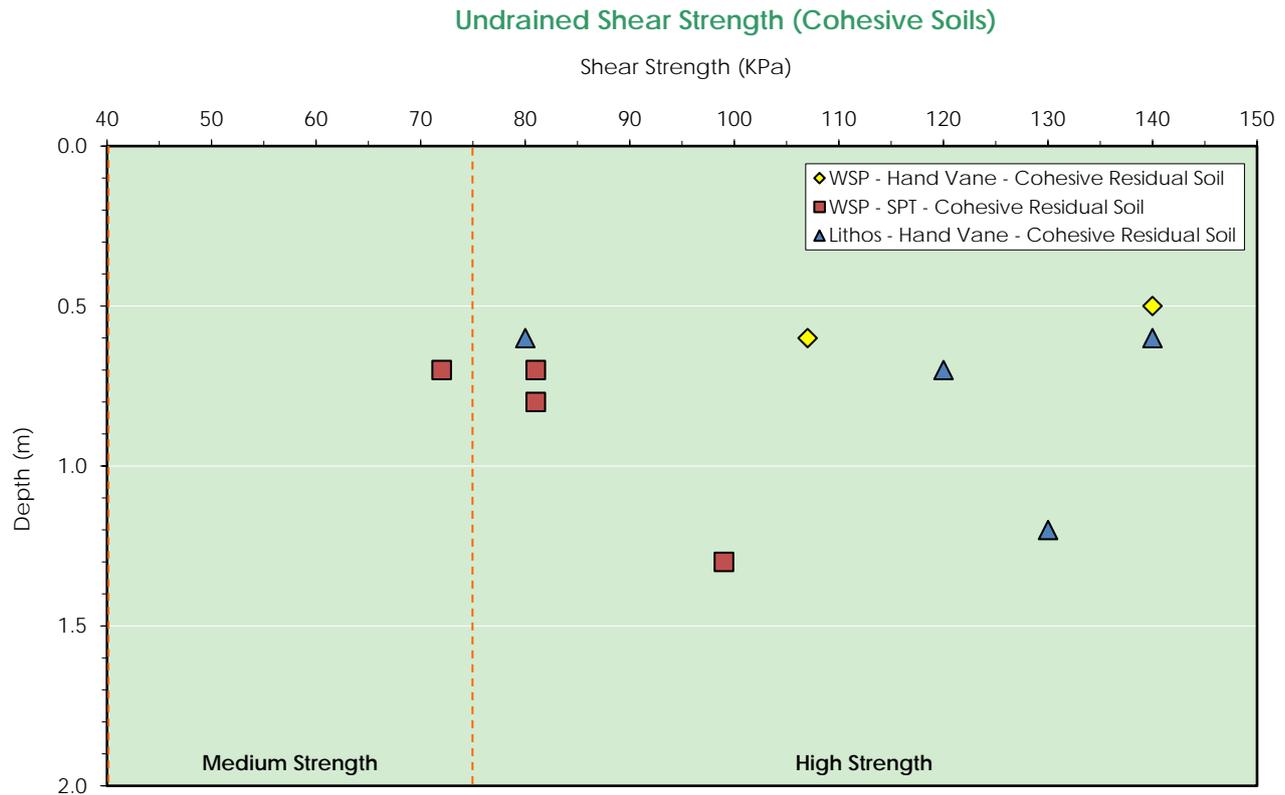
13.4.1 Hand shear vane testing was undertaken within trial pits in-situ to around 1.0m depth and from larger blocks of excavated clay below that depth.

13.4.2 Hand shear vane testing was also undertaken within trial pits by WSP. SPT testing was undertaken within boreholes by WSP. Lithos have converted the recorded N values to shear strength by multiplying the N value by 4.5.

13.4.3 The results are summarised within the plot below. Below approximately 0.5m depth  $S_u$  is typically greater than 80kPa.

13.4.4 The plot below provides a summary of undrained shear strengths.

<sup>4</sup> BRE Special Digest 1 (2005) – Concrete in aggressive ground.



## 14 GEOTECHNICAL ISSUES

### 14.1 Conceptual site model

- 14.1.1 Topsoil has been stripped from across the site. Natural ground comprises Cohesive and Granular Residual Soil. Coal Measures bedrock (typically mudstone) was encountered from c. 0.8m depth, sometimes from surface.
- 14.1.2 Topography at the site will require regrade to accommodate the proposed layout. Some regrade has already been completed.

### 14.2 Mining & quarrying

- 14.2.1 The far east of this site is located within a Coal Mining Development High Risk Area due to the conjectured outcrop of the Better Bed Coal seam. The Better Bed Coal dips to the east and is underlain by at least 100m of Coal Measures bedrock in which there are no further significant coal seams.
- 14.2.2 The rest of the site lies within a Coal mining Development Low Risk Area.
- 14.2.3 There are no known quarries on, or within 50m of the site.
- 14.2.4 WSP have previously drilled three rotary openhole probeholes in the east of the site to between 21m and 24m depth. None of the probeholes encountered the Better Bed Coal seam or any evidence of shallow mineworkings.

### 14.3 Site regrade and/or ground improvement

- 14.3.1 Given existing topography, site regrade is anticipated (some is understood to have already been completed), with the need for underbuild and retaining walls.
- 14.3.2 Careful consideration will need to be given to earthworks design, and implications for slope stability, retaining walls, foundations, highway gradients and drainage. Assessment of temporary and permanent slope stability is beyond the scope of this investigation and has not been considered.
- 14.3.3 Any digital terrain modelling undertaken, or commissioned, by Newett Homes should consider implications for the foundation recommendations outlined below.
- 14.3.4 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.
- 14.3.5 Wherever possible, Lithos recommend that excavated soils are retained on site. However, if this is not possible the comments in Section 11.3 should apply.

### 14.4 Foundation recommendations

#### General

- 14.4.1 It is understood that the proposed development will include 68 traditional 2 storey domestic dwellings, associated gardens, POS, adoptable roads and sewers.
- 14.4.2 A site layout has been produced by Bryan G Hall for Newett Homes (Drawing reference 22/491/100/001, Rev C, dated 6<sup>th</sup> February 2023) which is reproduced as Drawing 4526/2 in Appendix B to this report.
- 14.4.3 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.
- 14.4.4 It is understood that final development levels may differ significantly from ground levels existing at the time of investigation. Any digital terrain modelling undertaken, or commissioned, by Newett Homes should consider implications for the foundation recommendations outlined below.
- 14.4.5 Foundation depths (and types) may depend on thicknesses of fill following the anticipated earthworks regrade.
- 14.4.6 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.
- 14.4.7 Sub-surface concrete in contact with natural ground should be Design Sulphate Class DS-1, with the site allocated an ACEC Classification of AC-2z.
- 14.4.8 There are a number of foundation solution options for two or three storey residential properties constructed on this site and these are discussed below.

### Strip/trench fill footings

- 14.4.9 It is considered that shallow strip or deepened trench fill footings will be the most suitable foundation solution for the two or three storey houses constructed at the site. Footings will be founded in Residual Soils or competent rock. This solution is viable where the thickness of any fill is less than about 2.5m thick, and Residual Soils or competent rock is the founding material.
- 14.4.10 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.
- 14.4.11 Foundations will be required to be placed below a line drawn up at 45° from the base of any service or similar excavation.
- 14.4.12 Deepened foundations should be stepped in accordance with NHBC Standards, Chapter 4.3.
- 14.4.13 In order to minimise softening and swelling of cohesive soils or loosening of granular soils, it is recommended that footings are cast as soon as formation level is reached (or alternatively formation could be blinded using concrete with as low a water:cement ratio as possible).
- 14.4.14 In addition to the above, Newett Homes 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). Newett Homes should supervise their groundworker to ensure footings are excavated in a controlled and safe manner.
- 14.4.15 Newett Homes or their groundworker should seek further advice from Lithos if unexpected ground conditions are encountered in foundation or sewer excavations, including any conflict between soft ground associated with a backfilled trial pit excavation and the line of a proposed footing.

### Granular soils (completely weathered bedrock)

- 14.4.16 The weathered in-situ mudstone (clayey gravel) is assumed to have a relative density of at least medium dense (in accordance with BS5930).
- 14.4.17 A safe bearing capacity of at least 150kPa, allowing a maximum foundation line load of 150kN/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 0.75m depth
  - An angle of shearing resistance of  $\phi=32^\circ$  for the granular deposits
- 14.4.18 Assuming the foundation geometry detailed above, settlements less than 25mm would be anticipated. This is considered likely to be acceptable. However, further advice should be sought from the Structural Engineer responsible for foundation design.
- 14.4.19 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).

- 14.4.1 However, founding at shallow depth (450mm), whilst desirable from an excavation stability viewpoint, may not provide sufficient bearing capacity due to the lesser depth of (resisting) overburden. Consequently, a minimum founding depth of **750mm** is recommended in granular soils.
- 14.4.2 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.
- 14.4.3 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).
- 14.4.4 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).

#### Clay/cohesive soils

- 14.4.5 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.
- 14.4.6 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.
- 14.4.7 Foundations should be deepened near trees in accordance with NHBC Standards Chapter 4.2. It is estimated that up to 25% of the site may be affected by trees depending on the required site regrade.
- 14.4.8 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.
- 14.4.9 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).
- 14.4.10 It would therefore be prudent to prepare a detailed foundation schedule and seek approval from NHBC in order to determine likely foundation abnormalities.
- 14.4.11 A safe bearing capacity of at least 150kPa, allowing a maximum foundation line load of 90kN/m run, can be assumed if the following are true
- A foundation length of 8m
  - A foundation breadth of 0.6m
  - A foundation thickness of 225mm
  - A foundation depth of 0.9m depth
  - An undrained shear strength of 80kPa for the stiff clay (typical minimum recorded on site)
- 14.4.12 Assuming the foundation geometry detailed above, settlements less than 25mm would be anticipated. This is considered likely to be acceptable. However, further advice should be sought from the Structural Engineer responsible for foundation design.

## Bedrock

- 14.4.13 The Coal Measures mudstone bedrock is generally considered to have a safe bearing capacity of at least 250kPa and minimal settlements would be anticipated.
- 14.4.14 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.
- 14.4.15 Bedrock at the site comprises mudstone which can be easily excavated using a backhoe excavator and will be recovered as a tabular gravel. Where in-situ mudstone is encountered at founding depth (**minimum of 450mm**), it will provide a suitable founding stratum for two or three storey dwellings and need only be penetrated by the proposed foundation thickness. Note: any overlying residual soil (typically clay with gravel-sized lithorelicts of mudstone) is likely to be a shrinkable soil; Mudstone is not.

## Summary of foundation recommendations

- 14.4.16 In summary, strips or deepened trench fill footings are likely to be most appropriate solution (subject to Newett Homes preferences regarding site preparatory works, final levels & costs associated with each foundation option).
- 14.4.17 Lithos could prepare a detailed Foundation Schedule if provided with: an External Works Drawing (with proposed FFLs & infrastructure details); a topographic survey; a tree survey; data from a 'tighter' grid of pits (due to the variable ground conditions encountered).
- 14.4.18 The foundation solutions outlined in the above table assume that ground levels will not change significantly from those existing at present. If this is not to be the case, further advice should be sought from Lithos.

## 14.5 Floor slabs

- 14.5.1 Suspended floor slabs should be utilised where the depth of made ground or engineered stone exceeds 600mm in accordance with NHBC Standards Chapter 5.1 (to negate potential settlement problems).
- 14.5.2 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.
- 14.5.3 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.
- 14.5.4 Ventilation should be provided to precast and timber suspended floors in accordance with NHBC Standards Chapter 5.2.
- 14.5.5 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.

- 14.5.6 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.
- 14.5.7 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.

## 14.6 Designated concrete mixes

- 14.6.1 Designated mixes are considered in BRE SD1<sup>5</sup> and BS 8500<sup>6</sup>. 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.
- 14.6.2 Consequently, Newett Homes should seek advice from their appointed Structural Engineer.

## 14.7 Excavations

- 14.7.1 Based on the results of the investigation it is considered unlikely that major groundwater flows will be encountered in shallow excavations.
- 14.7.2 Groundwater should be controlled in accordance with CIRIA Report R113<sup>7</sup>.
- 14.7.3 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 made ground.
- 14.7.4 Bedrock was encountered in several exploratory holes. Based on the exploratory hole logs, excavation greater than 0.8m may prove difficult across the site. Bedrock typically comprised Mudstone which should be relatively easy to excavate.

## 14.8 Drainage

- 14.8.1 Based on ground conditions and topography, soakaways will not provide a satisfactory solution for surface water drainage.
- 14.8.2 It is understood that an attenuation tank is proposed in the far northwest of the site.
- 14.8.3 Yorkshire Water have published a guide<sup>8</sup> 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).
- 14.8.4 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.

<sup>5</sup> BRE Special Digest 1 (2005) – Concrete in aggressive ground.

<sup>6</sup> 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).

<sup>7</sup> CIRIA Report R113 (1986) - Control of Groundwater for Temporary Works.

<sup>8</sup> Design Requirements for Surface Water Attenuation Assets, February 2017.

14.8.5 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.

## 14.9 Highways

14.9.1 The natural soils present at shallow depth (anticipated formation) are predominantly cohesive. Based on visual inspection of the natural materials and the recorded plasticity indices at the site, published guidance<sup>9</sup> and tables<sup>10</sup> indicate that the Cohesive Residual Soil deposits would be expected to provide a CBR value of at least 3%. This value should be verified prior to or during construction.

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

## 14.10 External works

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

14.10.2 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.

# 15 REDEVELOPMENT ISSUES

## 15.1 General

15.1.1 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.

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

## 15.2 Remediation strategy

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

- Provision of 200mm thickness of topsoil in all garden and landscaped areas

<sup>9</sup> CD225 Design for new pavement foundations Revision 1 (Design Manual for Roads and Bridges)

<sup>10</sup> The Structural Design of Bituminous Road, TRRL Laboratory Report 1132 (Table C1, page 36)

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

### 15.3 Management of topsoil

15.3.1 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.

15.3.2 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.

15.3.3 Subsequent trafficking over the loosened subsoil should be minimised.

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

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

### 15.4 Good practice guidance

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

- CIRIA C741<sup>11</sup>
- EA Pollution Prevention Guidelines<sup>12</sup>:
  - PPG6 - Working at construction and demolition sites
  - PPG2 - Above ground oil storage tank
  - PPG7 – The safe operation of refuelling facilities
  - PPG21 – Incident Response Planning

### 15.5 New utilities

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

15.5.2 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.

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

15.5.4 This site investigation has enabled completion of a Contaminated Land Assessment Form<sup>13</sup>, a copy of which is included in Appendix H.

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<sup>11</sup> CIRIA C741 (2015) - Environmental Good Practice on Site

<sup>12</sup> Whilst this has formally been withdrawn it can still be accessed via the EA archives and provides useful information on managing risks.

<sup>13</sup> Contaminated Land Assessment Guidance. Protocols published by agreement between Water UK and the Home Builders Federation. January 2014

## 15.6 Health & safety issues - construction workers

- 15.6.1 Access into excavations etc. must be controlled and undertaken in accordance with the CDM Regulations 2015, most notably Regulation 22, to mitigate risk of collapse or asphyxiation.
- 15.6.2 Before site operations are started, the necessary COSHH statements and Health & Safety Plan should be drafted in accordance with the CDM regulations.

## 15.7 Potential development constraints

- 15.7.1 Topography will require significant regrade earthworks, most notably in the east.

# 16 SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

## 16.1 General

- 16.1.1 The site is located off Penistone Road, Fenay Bridge, approximately 4.6km southeast of Huddersfield town centre, and currently comprises an active construction site for a proposed housing development. The site was previously undeveloped and comprised agricultural fields.
- 16.1.2 It is understood that the proposed development will include 68 traditional 2 storey domestic dwellings, associated gardens, POS, adoptable roads and sewers.
- 16.1.3 Topsoil has been stripped from across the site. Natural ground comprises Cohesive and Granular Residual Soil. Coal Measures bedrock (typically mudstone) was encountered from c. 0.8m depth, sometimes from surface.
- 16.1.4 Topography at the site will require regrade to accommodate the proposed layout. Some regrade has already been completed.

## 16.2 Mining

- 16.2.1 The far east of this site is located within a Coal Mining Development High Risk Area due to the conjectured outcrop of the Better Bed Coal seam. The Better Bed Coal dips to the east and is underlain by at least 100m of Coal Measures bedrock in which there are no further significant coal seams.
- 16.2.2 The rest of the site lies within a Coal mining Development Low Risk Area.
- 16.2.3 WSP have previously drilled three rotary openhole probeholes in the east of the site to between 21m and 24m depth. None of the probeholes encountered the Better Bed Coal seam or any evidence of shallow mineworkings.

## 16.3 Hazardous gas

- 16.3.1 The site is in an area where less than 1% of homes are estimated to be above the radon action level. No special precautions against radon are required on this site.
- 16.3.2 The site is located within 250m of known backfilled features (quarries). However, a preliminary gas risk assessment was completed by WSP / Ecus, and determined that the gas risk at the site is low and no gas protection measures are necessary.

## 16.4 Contamination

- 16.4.1 No plausible contaminant linkages have been identified.
- 16.4.2 Testing suggests that Topsoil is chemically suitable for re-use and would be expected to be suitable to support plant growth.

## 16.5 Foundations

- 16.5.1 Strips or deepened trench fill footings founding in Cohesive or Granular Residual soils are likely to be the most appropriate foundation solution for 2 to 3 storey houses constructed on this site.
- 16.5.2 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.

## 16.6 Flooding

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

## 16.7 Drainage

- 16.7.1 Based on ground conditions and topography, soakaways will not provide a satisfactory solution for surface water drainage.
- 16.7.2 It is understood that an attenuation tank is proposed in the far northwest of the site.

## 16.8 Highways

- 16.8.1 Based on visual inspection of the shallow natural materials and published guidance, the Cohesive Residual Soil should provide a CBR value of at least 3%. This value should be verified prior to or during construction.

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 BR211<sup>1</sup>, 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 2010<sup>2</sup>.

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<sup>-3</sup> and 100 Bqm<sup>-3</sup> 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<sup>-3</sup> 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.

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

<sup>2</sup> 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 stones<sup>1</sup> – some crush and test the “as received” soil, whilst others sieve out stones and analyse only the residual soil (the sieve size used varies depending on the laboratory).

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

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

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

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

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

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

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

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

## Groundwater

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

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

## Description of strata

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

<sup>1</sup> 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 SO<sub>4</sub> 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<sup>-2</sup>) = depth (m) x soil bulk unit weight (kNm<sup>-3</sup>)

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 ( $\text{kNm}^{-2}$ ).

Foundations on granular soils would use effective shear strength parameters ( $c'$  and  $\phi'$ ) 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  $\phi'$ ) 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 (SO<sub>4</sub>), 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 C<sub>6</sub> to C<sub>10</sub>). Also referred to as PRO – Petroleum Range Organics
- DRO – Diesel Range Organics (typically C<sub>10</sub> to C<sub>28</sub>)
- LRO - Lubricating Oil Range Organics (typically C<sub>28</sub> to C<sub>40</sub>)
- MRO – Mineral Oil Range Organics (typically C<sub>18</sub> to C<sub>44</sub>)

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 C<sub>5</sub>-C<sub>40</sub>, whereas others define TPH as C<sub>10</sub>-C<sub>30</sub>.

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 C<sub>4</sub> to C<sub>5</sub> 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 C<sub>10</sub> to C<sub>40</sub> (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 C<sub>6</sub> to C<sub>8</sub>, aromatic C<sub>10</sub> to C<sub>12</sub> 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 physicochemical properties (solubilities, toxicities etc) of compounds in order to model their behaviour in the environment. These physicochemical 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"> <li>• Direct ingestion of soil</li> <li>• Dermal contact</li> <li>• Consumption of vegetables &amp; soil attached to vegetables</li> <li>• Inhalation of indoor vapours and dust</li> <li>• Inhalation of outdoor vapours and dust</li> </ul>	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"> <li>• Inhalation of indoor vapours</li> <li>• Inhalation of outdoor vapours</li> </ul>	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"> <li>• Direct ingestion of soil</li> <li>• Dermal contact</li> <li>• Inhalation of indoor vapours and dust</li> <li>• Inhalation of outdoor vapours and dust</li> </ul>	All pathways applicable due to possible exposure from landscaped areas. However consumption of home grown produce not included as unlikely to be grown in landscaped areas. Where vegetables are to be grown site specific QRA may be required.

Scenario	Land use	Pathways	Justification
D	Commercial/ industrial with landscaped areas no cover	<ul style="list-style-type: none"> <li>Direct ingestion of soil</li> <li>Dermal contact</li> <li>Inhalation of indoor vapours and dust</li> <li>Inhalation of outdoor vapours and dust</li> </ul>	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"> <li>Direct ingestion of soil</li> <li>Dermal contact</li> <li>Consumption of vegetables &amp; soil attached to vegetables</li> <li>Inhalation of outdoor vapours and dust</li> </ul>	Material used as cover to break existing pathways therefore all direct and indirect pathways relevant; however cover is <b>not</b> 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 <sup>^</sup>	<1 <sup>^</sup>	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 study<sup>1</sup>

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.

<sup>1</sup> 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<sub>i</sub> = Fraction<sub>i</sub>  
 SGV = Soil Guideline Value

### Statistical Assessment

Current UK guidance is provided by CL:AIRE<sup>2</sup>, 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.

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

#### Other screening values used by Lithos

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

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

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

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

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

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

#### Waste classification & WAC

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

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

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

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

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

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

#### Possible action in event of Tier 1 exceedance

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

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

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

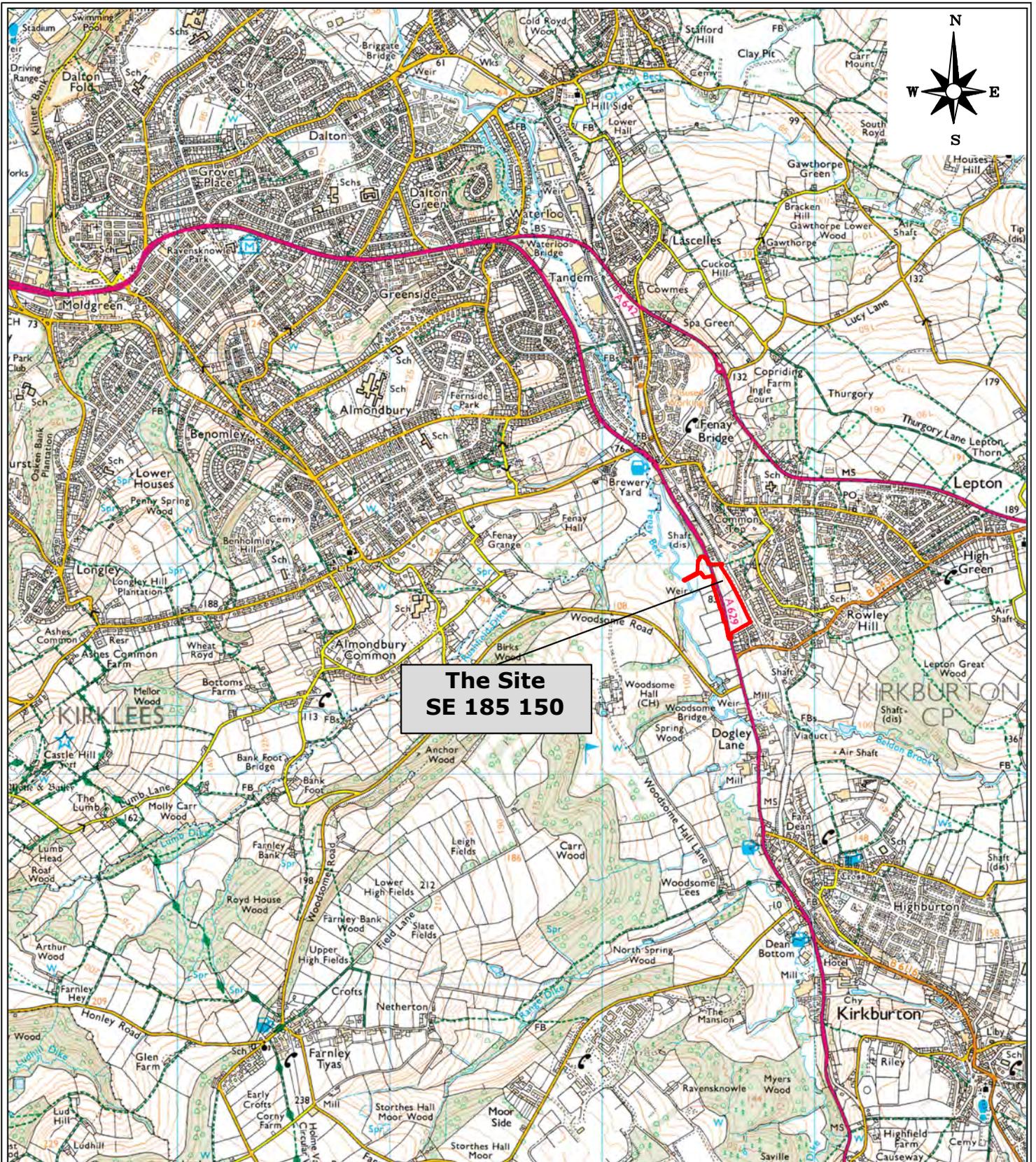
Lithos consider the entire site needs to be characterised by reference to the Conceptual Site Model. Consequently, Lithos gather and analyse sample results by fill type, and/or by former use in a given sub-area of the site, before undertaking statistical analysis; i.e. the averaging area is associated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

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

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

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

Appendix B  
Drawings



**The Site  
SE 185 150**

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CLIENT

NEWETT HOMES

JOB TITLE

PENISTONE  
ROAD, FENAY  
BRIDGE

DRAWING TITLE

SITE LOCATION  
PLAN

DRAWN

LB

DATE

20 11 23

CHECKED

ASw

DATE

20 11 23

STATUS

FOR COMMENT

DRAFT

FOR APPROVAL

FINAL

SCALE

1:25,000

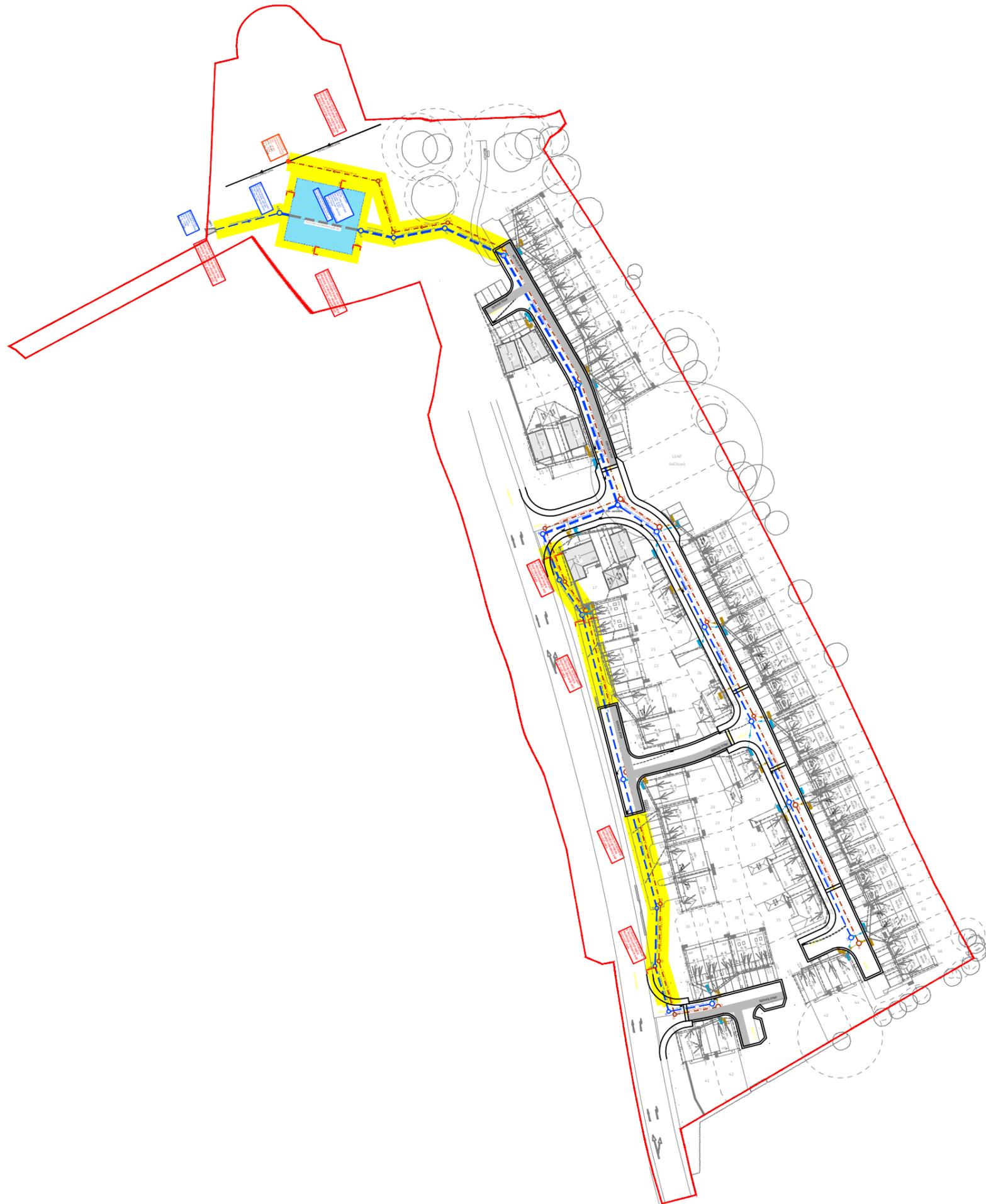
SHEET

A4

DRAWING NO.

4526/1

REVISION



NOTES

— APPROXIMATE SITE BOUNDARY

REPRODUCED FROM BRYAN G HALL LAYOUT  
DRAWING NO 22/491/100/001 REV C,  
DATED 6<sup>th</sup> FEBRUARY 2023

REV.	DESCRIPTION	DATE



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CLIENT

NEWETT HOMES

JOB TITLE

PENISTONE ROAD, FENAY BRIDGE

DRAWING TITLE

PROPOSED SITE LAYOUT

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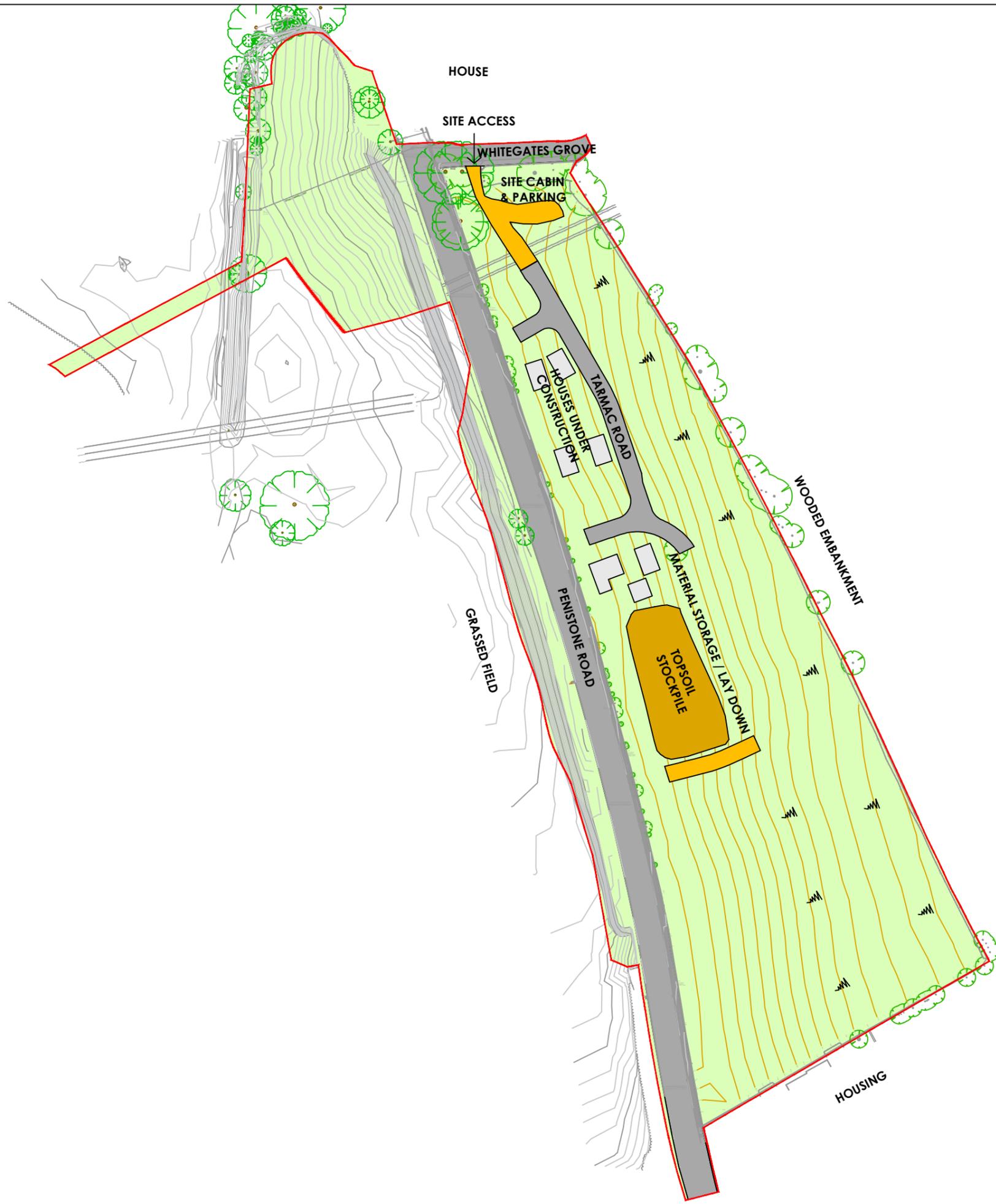
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NOTES

- GRASS / SUBSOIL (TOPSOIL STRIP)
- TOPSOIL STOCKPILE
- GRAVEL OR HARDCORE SURFACING
- TARMAC HARDSTAND
- PLOT FOOTPRINTS
- SLOPE
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE



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CLIENT  
 NEWETT HOMES

JOB TITLE  
 PENISTONE ROAD, FENAY BRIDGE

DRAWING TITLE  
 SITE FEATURES

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SCALE 1:1,500	SHEET A3	DRAWING NO. 4526/3	REVISION
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- NOTES
- GRASS / SUBSOIL (TOPSOIL STRIP)
  - TOPSOIL STOCKPILE
  - GRAVEL OR HARDCORE SURFACING
  - TARMAC HARDSTAND
  - PLOT FOOTPRINTS
  - SLOPE
  - APPROXIMATE SITE BOUNDARY
  - LOCATION & ORIENTATION OF PHOTOGRAPH

REV.	DESCRIPTION	DATE



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CLIENT

NEWETT HOMES

JOB TITLE

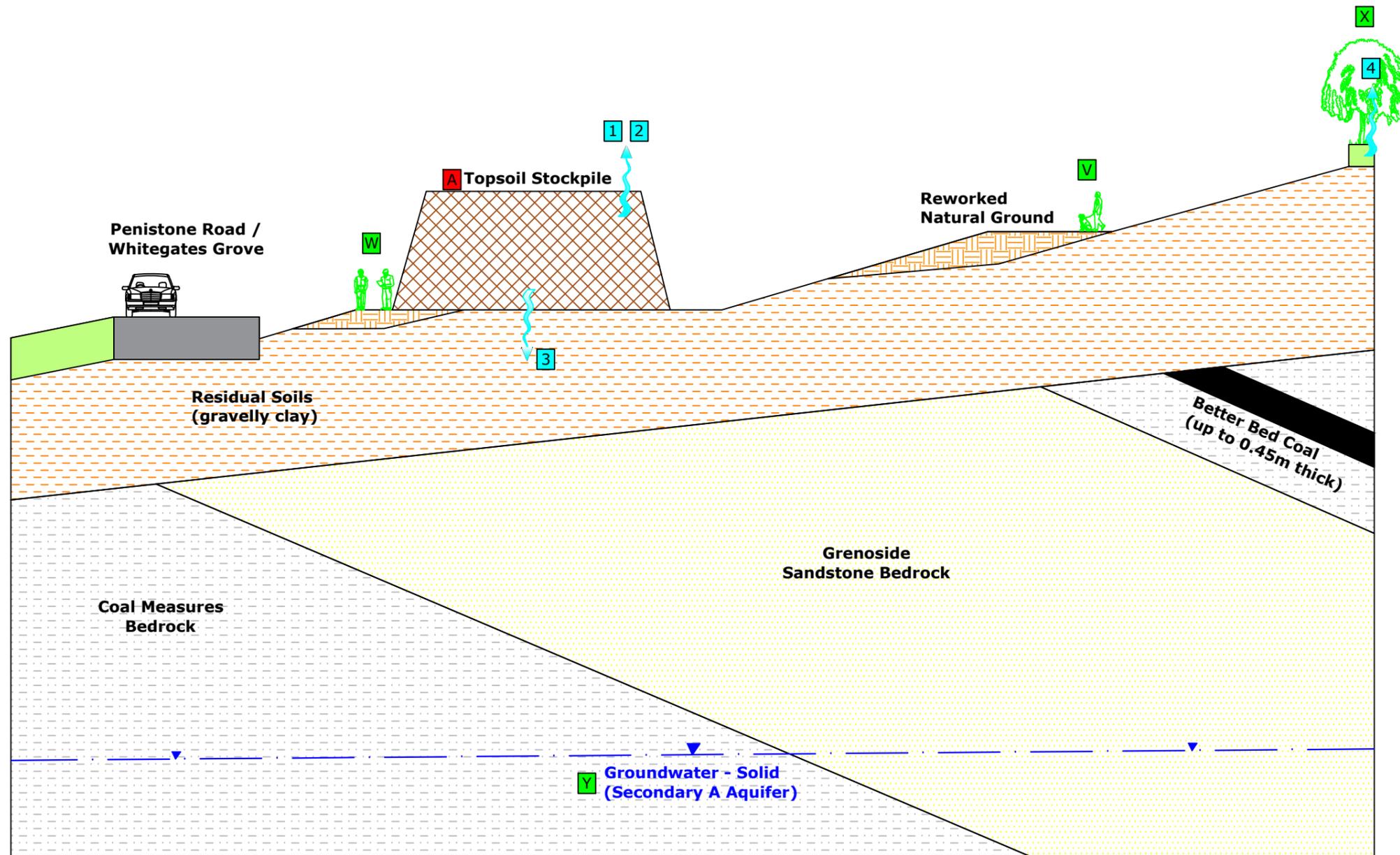
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ROAD, FENAY  
BRIDGE

DRAWING TITLE

SITE PHOTOGRAPHS

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NOT TO SCALE	A3	4526/4	



SOURCES	
<b>A</b>	<b>FARMING ACTIVITIES (INORGANICS &amp; ORGANICS)</b>

PATHWAYS	
<b>1</b>	<b>DERMAL CONTACT</b>
<b>2</b>	<b>INGESTION/INHALATION</b>
<b>3</b>	<b>LEACHING OF CONTAMINANTS</b>
<b>4</b>	<b>UPTAKE BY PLANTS</b>

RECEPTORS	
<b>V</b>	<b>END USERS (RESIDENTS)</b>
<b>W</b>	<b>SITE WORKERS</b>
<b>X</b>	<b>VEGETATION</b>
<b>Y</b>	<b>GROUNDWATER</b>

NOTES

REV.	DESCRIPTION	DATE



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NEWETT HOMES

JOB TITLE

PENISTONE ROAD, FENAY BRIDGE

DRAWING TITLE

PRELIMINARY CONCEPTUAL SITE MODEL

DRAWN	CR	DATE	26/11/24	STATUS	FOR COMMENT <input type="checkbox"/>
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SCALE	Not to scale	SHEET	A3	DRAWING NO.	4526/5	REVISION	
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NOTES

**PREVIOUS SI HOLE LOCATIONS**

- LITHOS TRIAL PIT LOCATIONS (OCTOBER 2023)
- WSP BOREHOLE LOCATIONS (AUGUST 2017)
- WSP TRIAL PIT LOCATIONS (AUGUST 2017)

**LITHOS NOVEMBER 2024**

- TRIAL PIT LOCATION
- TOPSOIL SAMPLE LOCATION

LITHOS EXPLORATORY HOLE LOCATIONS BASED ON DATA FROM A HAND-HELD GPS (+/- 3M ACCURACY)

— APPROXIMATE SITE BOUNDARY

REPRODUCED FROM BRYAN G HALL LAYOUT DRAWING NO 22/491/100/001 REV C, DATED 6<sup>th</sup> FEBRUARY 2023

A	ADDED 2024 TP LOCATIONS	13/11/24
REV.	DESCRIPTION	DATE



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**NEWETT HOMES**

JOB TITLE  
  
**PENISTONE ROAD, FENAY BRIDGE**

DRAWING TITLE  
  
**EXPLORATORY HOLE LOCATIONS**

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NOTES

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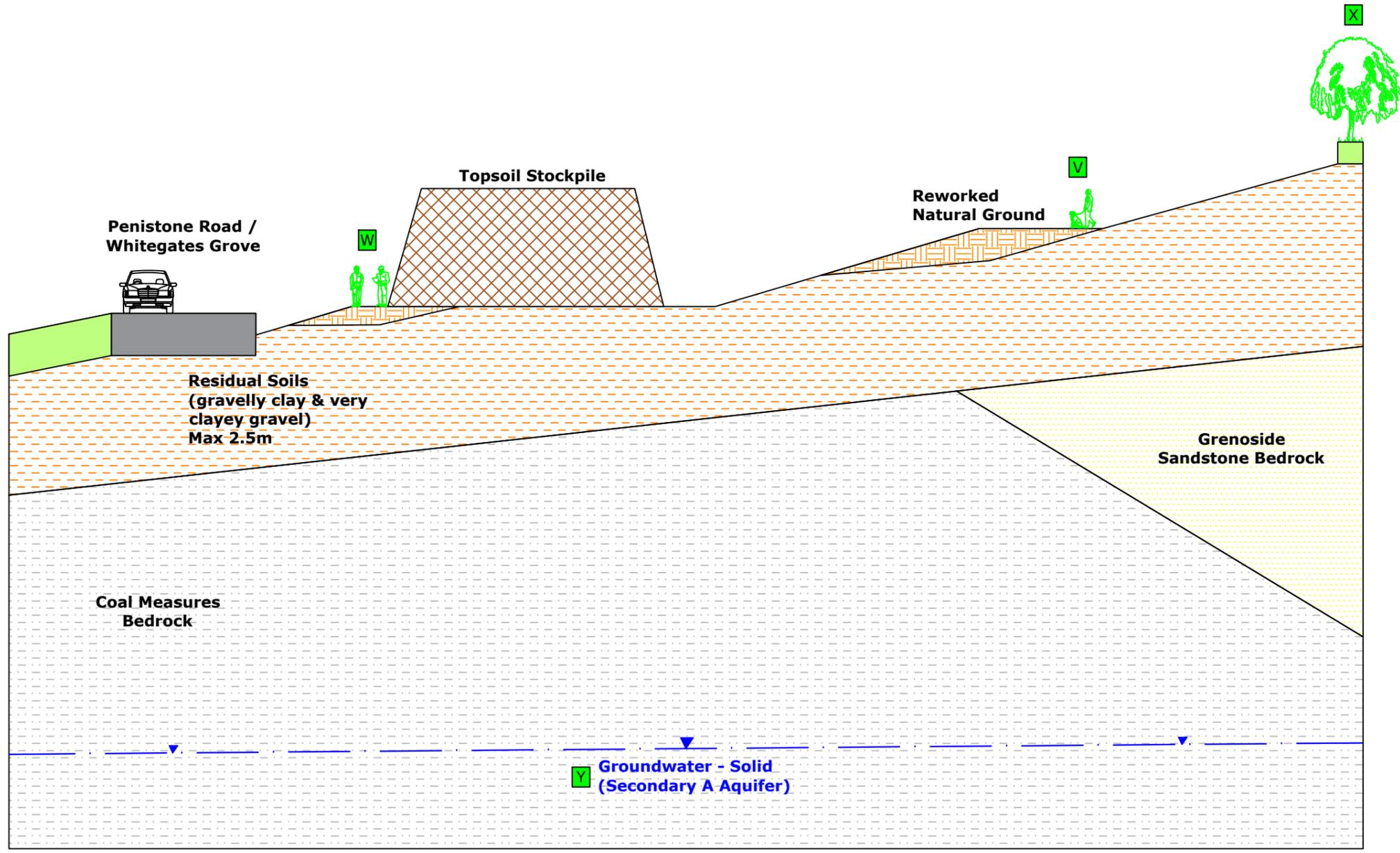
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**NEWETT HOMES**

JOB TITLE  
**PENISTONE ROAD, FENAY BRIDGE**

DRAWING TITLE  
**REVISED CONCEPTUAL SITE MODEL**

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**SOURCES**  
NO SOURCES

**PATHWAYS**  
NO PATHWAYS

- RECEPTORS**
- V** END USERS (RESIDENTS)
  - W** SITE WORKERS
  - X** VEGETATION
  - Y** GROUNDWATER



- NOTES
- BETTER BED COAL OUTCROP (BGS - SE11SE)
  - BETTER BED COAL OUTCROP (CA REPORT)
  - ◆ MINE SHAFT (CA REPORT)
  - ↗ ADIT (CA REPORT)
  - APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE



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**NEWETT HOMES**

JOB TITLE  
**PENISTONE ROAD, FENAY BRIDGE**

DRAWING TITLE  
**BGS & CA RECORDED COAL OUTCROPS**

DRAWN CR	DATE 26/11/24	STATUS FOR COMMENT <input type="checkbox"/>
CHECKED AG	DATE 27/11/24	FOR APPROVAL <input type="checkbox"/>
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**418414-004**  
↗  
**418414-005**

Appendix C  
Commission

016/4526/AG

28<sup>th</sup> October 2024

Mr K Mawson  
Thorpe Arch Grange  
Walton Road  
Thorpe Arch  
Wetherby  
LS23 7BA



Registered in England 07068066

Parkhill  
Wetherby  
West Yorkshire  
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Dear Kenny

### Penistone Road, Fenay Bridge – SI report update

Further to your recent invitation, please find attached our proposal for updating the existing Ecus SI report, along with undertaking a supplementary site investigation on the above land. We understand that proposed development will include 68 traditional 2 storey domestic dwellings with associated gardens, POS and adoptable roads and sewers; with a layout provided.

We understand that the LPA have requested that the Ecus / WSP reports from 2019 be updated, in particular the LPA have requested that the preliminary risk assessment and conceptual site model be updated to incorporate any changes in the environment and updated guidance since the report was produced.

The proposal below allows for the report to be updated, along with some additional investigation to confirm no changes to the environment since the original reports were produced. Lithos understands that Newett have reliance on the Ecus/WSP data. The proposal does not include any slope stability assessment, nor sufficient investigation to inform a slope stability assessment.

As you know, Lithos carried out some pitting which was reported in November 2023 (Ref. 009/4529/AG/ASw), which had the primary aim of informing the attenuation tank design and proposed earthworks. Laboratory testing was not undertaken as part of this investigation.

Review of the information supplied suggests that the site consists of a single parcel of land of (c. 3 ha). Review of Google Maps suggests the site is a grassed field, located on the east side of Penistone Road, with a tree belt along the north and eastern boundary. Topography slopes from the east, down to the west, with a change in topography of c. 12m.

Brief review of the report supplied (and our own research) suggests that land to the west of Penistone Road:

- Appears to have remained undeveloped throughout its history;
- Is not located within 250m of a known landfill site;
- Is not within a groundwater source protection zone;
- Is in an area where the risk of encountering UXO is considered low
- Is located within a Coal Mining Development Low Risk Area.

Brief examination of the relevant geological map suggests the site is underlain by Alluvial drift (Clay, Silt, Sands & Gravels), over Grenoside Sandstone and Lower Coal Measures bedrock (likely weathered to a clay near surface)

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 reviewed available internet data and our geological maps in order to minimise the likelihood of further work.

Our site investigation will be undertaken in accordance with UK good practice (as outlined in BS5930, BS10175, 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:** Environmental search data and historical maps (obtained from Landmark or Groundsure), will be reviewed in order to determine whether past land uses have had any effect on the proposed development. In addition, published geological plans of the area will be examined.

We will also visit site to undertake a walkover survey.

Given the site's location within a Coal Mining Low Risk Area, a Consultant's mining report will be obtained.

**Fieldwork:** We have allowed for a day's trial pitting, with all pits to be supervised and logged by an experienced geoenvironmental engineer.

**Trial pitting** will enable us to determine the:

- Nature of any made ground , including:
- Nature, distribution and thickness of shallow natural soils
- Suitability of the ground for founding structures and highways
- Sample any stockpiles of topsoil present on site

Given nature of the land and the time of year, we have allowed for pits to be dug using a tracked 360° excavator.

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.

Based on anticipated ground and topography, **soakaways** are considered unlikely to provide a satisfactory solution for surface water drainage, with no allowance made for testing.

Exploratory holes will be positioned a hand-held GPS (typically +/- 3m accuracy); if required we could arrange for a **surveyor** to pick-up exploratory holes (and provide co-ordinates/ground levels) for an E\O cost of £\*\*\*.

This site is greenfield and therefore highly unlikely to be underlain by significant thicknesses of made ground. Furthermore, we are not aware of any other sources of hazardous **gas** (shallow mine workings, landfill sites etc) within influencing distance of the site.

Consequently, at this stage, we have not allowed for undertaking a hazardous gas risk assessment but we will review the need for this in light of desk study data and the ground conditions actually encountered.

**Testing:** At this stage, additional **geotechnical** testing has not been allowed for, existing Ecus/WSP data will be utilised as part of the SI report update.

The site is understood to be essentially Greenfield, and therefore testing of potentially **contaminated** samples should only be required if made ground is encountered in the exploratory holes. However, we have allowed for analysis of topsoil (10 samples) to confirm its suitability for re-use. The test suite will include heavy metals and speciated PAH.

Within in our proposal we have allowed for the screening (ID) of 10 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 3 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 2 weeks of receipt of your written instruction to proceed. Our comprehensive geoenvironmental appraisal report will be issued within 4 weeks of fieldwork completion.

This report will 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, this site is greenfield, and therefore consideration of soil contaminant concentrations should not be required (as stated in the UKWIR guidance) and the use of 'standard' polyethylene water supply pipes should be acceptable.

**Invoicing:** The attached proposal provides a breakdown of the costs associated with this project. This breakdown is for information only and the proposal can be regarded as a lump sum price of **£\*\*\*** plus VAT. Variation will only occur in the event that a given item is not undertaken or that substantial additional works are recommended, in which case we will inform you immediately, provide costs for the required works, and seek your prior consent. 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 be completed within 1 working day and therefore it is not considered reasonably practicable to provide formal welfare facilities, and our proposal makes no allowance for so doing.

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

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

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

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

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

Yours sincerely



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 Quantities, 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](http://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.

**Chris Ryan**

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**Subject:** FW: 4526 - Penistone Road, Fenay Bridge - SI Quote

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**From:** Kenny Mawson <[kenny.mawson@newetthomes.co.uk](mailto:kenny.mawson@newetthomes.co.uk)>

**Sent:** Friday, November 8, 2024 2:55 PM

**To:** Adam Gombocz <[Adam.Gombocz@lithos.co.uk](mailto:Adam.Gombocz@lithos.co.uk)>

**Cc:** Scott Bellerby <[scott.bellerby@newetthomes.co.uk](mailto:scott.bellerby@newetthomes.co.uk)>; Reg <[reg@lithos.co.uk](mailto:reg@lithos.co.uk)>; Kevin Atkinson <[kevin@newetthomes.co.uk](mailto:kevin@newetthomes.co.uk)>

**Subject:** Re: 4526 - Penistone Road, Fenay Bridge - SI Quote

Spot on appreciate this, please proceed and the guys will follow up with a PO.

Please confirm attendance date.

Thanks

Sent from my iPad

On 8 Nov 2024, at 13:26, Adam Gombocz <[Adam.Gombocz@lithos.co.uk](mailto:Adam.Gombocz@lithos.co.uk)> wrote:

**Appendix D**  
**Historical OS Plans**



### Yorkshire

Published 1854 - 1855

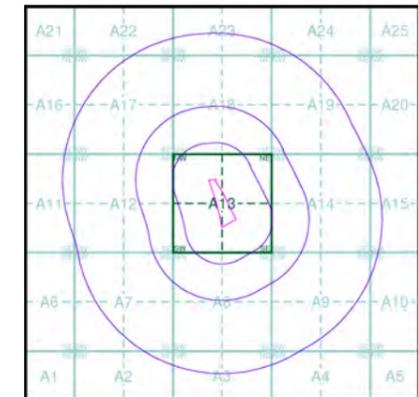
Source map scale - 1:10,560

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; these maps were used to update the 1:10,560 maps. The published date given therefore 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. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

### Map Name(s) and Date(s)

24600 1854 1:10,560	24700 1855 1:10,560
26000 1854 1:10,560	26100 1854 1:10,560

### Historical Map - Slice A



### Order Details

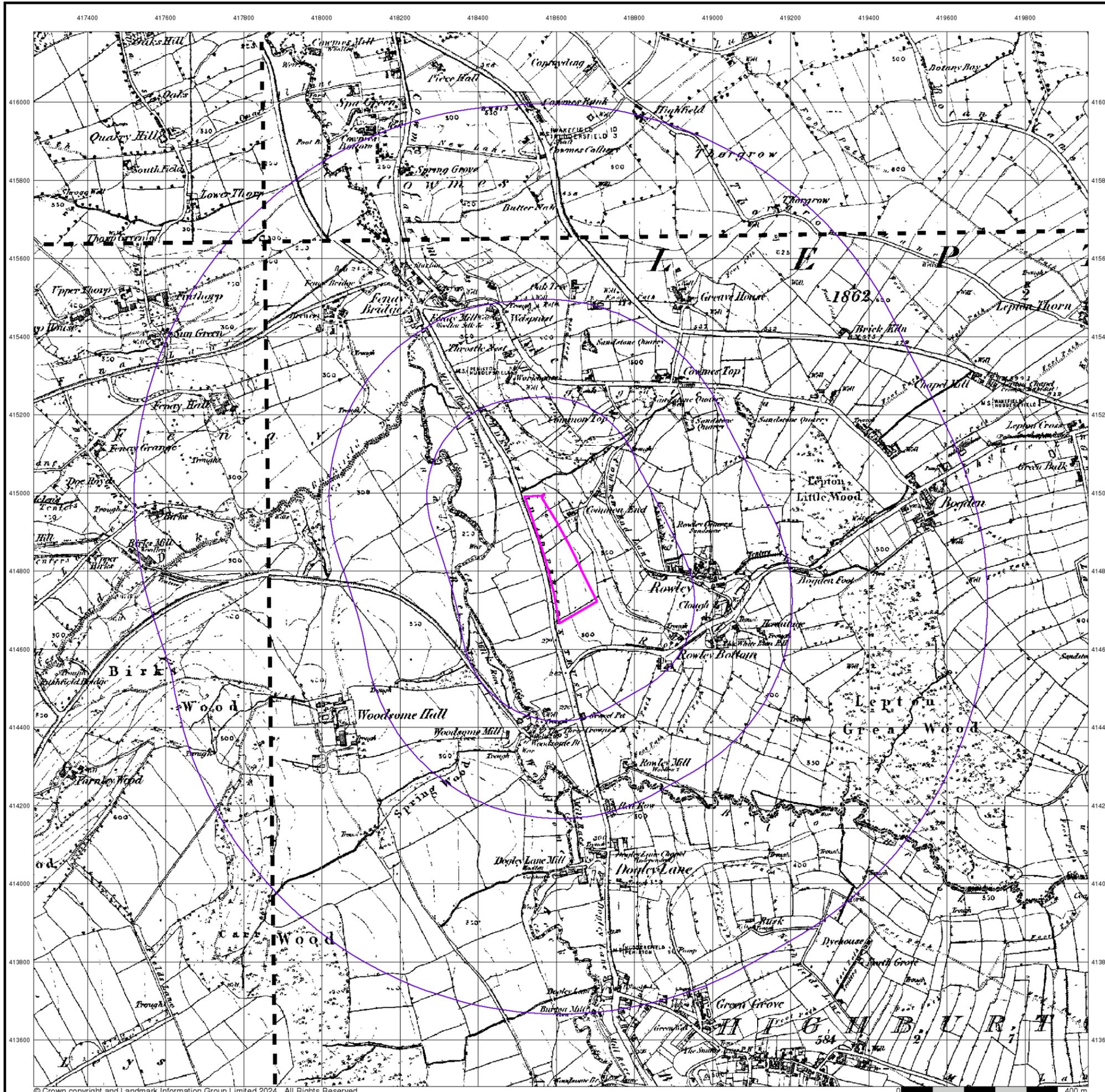
Order Number: 363083030\_1\_1  
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 National Grid Reference: 418600, 414830  
 Slice: A  
 Site Area (Ha): 2.32  
 Search Buffer (m): 1000

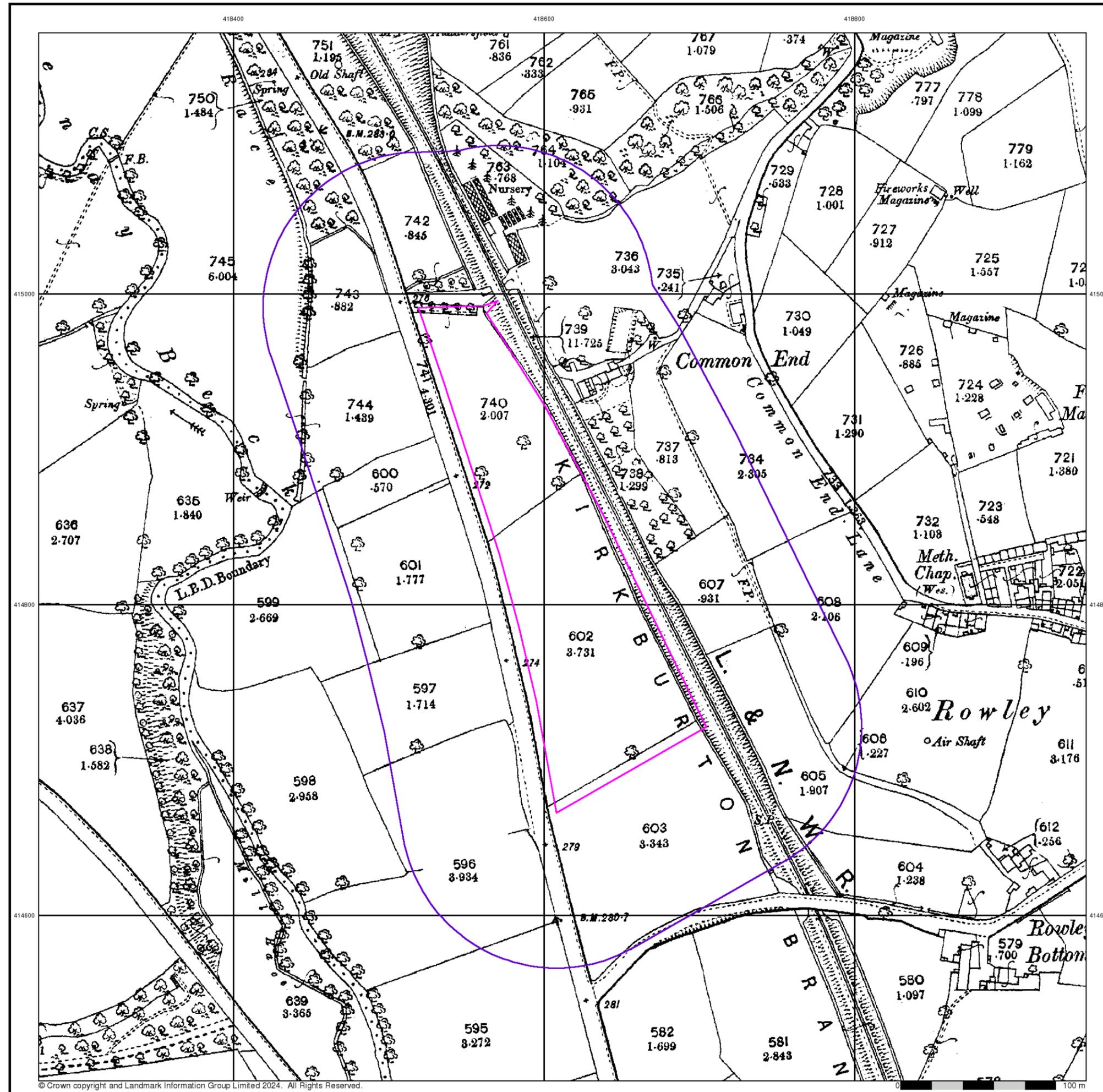
### Site Details

Penistone Road, Fenay Bridge



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





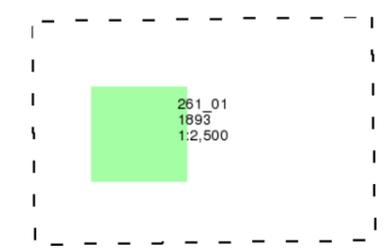
**Yorkshire**

**Published 1893**

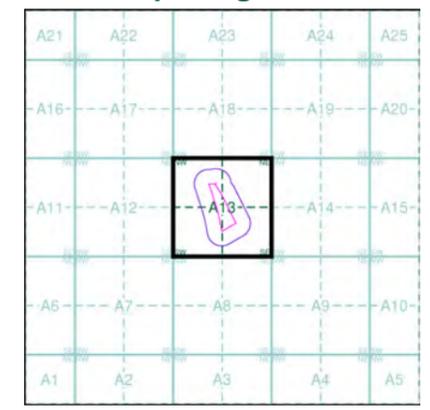
**Source map scale - 1:2,500**

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

**Map Name(s) and Date(s)**



**Historical Map - Segment A13**



**Order Details**

Order Number: 363083030\_1\_1  
 Customer Ref: PO23320/DP/4526  
 National Grid Reference: 418600, 414830  
 Slice: A  
 Site Area (Ha): 2.32  
 Search Buffer (m): 100

**Site Details**

Penistone Road, Fenay Bridge



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



### Ordnance Survey Plan

Published 1961

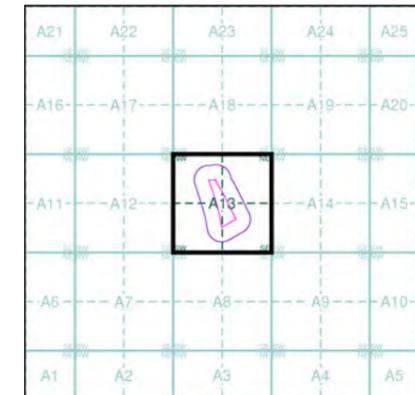
Source map scale - 1:2,500

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)

SE1815
1961
1:2,500
SE1814
1961
1:2,500

### Historical Map - Segment A13



### Order Details

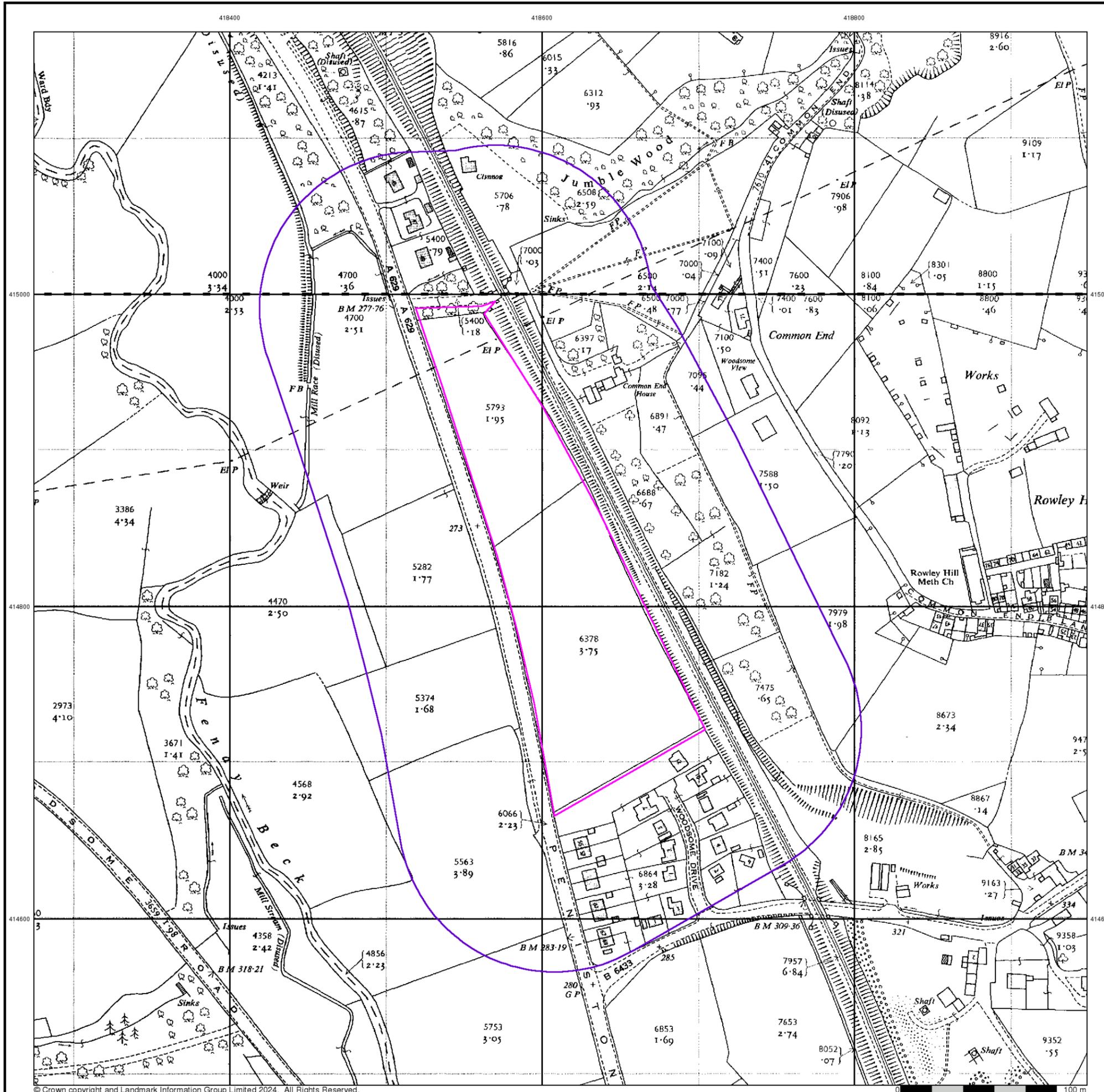
Order Number: 363083030\_1\_1  
 Customer Ref: PO23320/DP/4526  
 National Grid Reference: 418600, 414830  
 Slice: A  
 Site Area (Ha): 2.32  
 Search Buffer (m): 100

### Site Details

Penistone Road, Fenay Bridge



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





### Large-Scale National Grid Data

Published 1992 - 1993

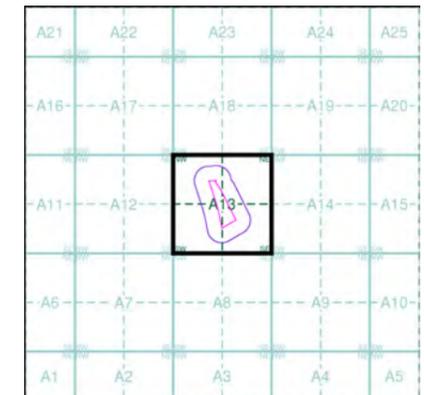
Source map scale - 1:1,250

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

### Map Name(s) and Date(s)

E1815SW	E1815SE
993	993
1:1,250	1:1,250
E1814NW	E1814NE
992	992
1:1,250	1:1,250
E1814SW	E1814SE
992	992
1:1,250	1:1,250

### Historical Map - Segment A13



### Order Details

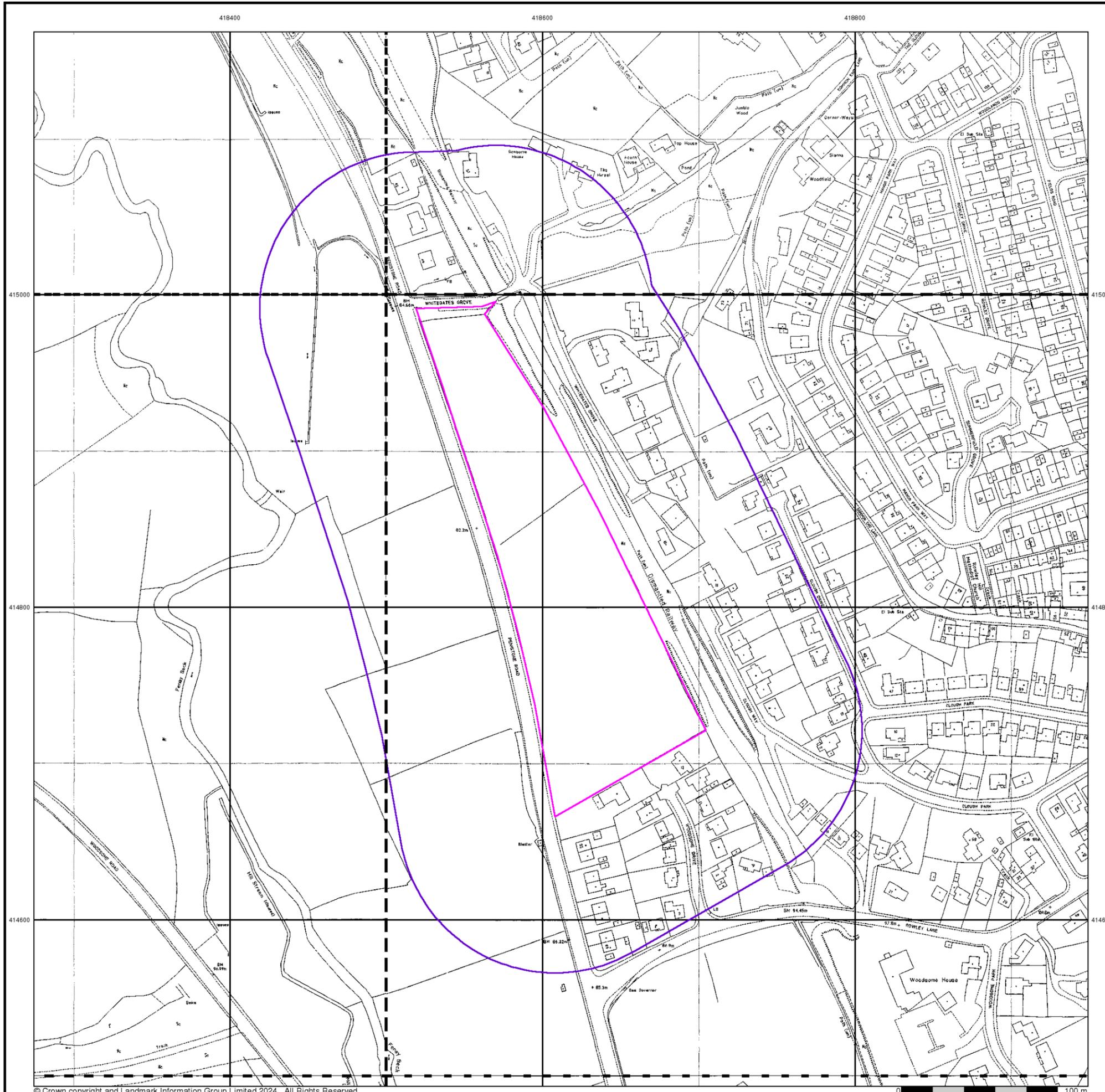
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 Customer Ref: PO23320/DP/4526  
 National Grid Reference: 418600, 414830  
 Slice: A  
 Site Area (Ha): 2.32  
 Search Buffer (m): 100

### Site Details

Penistone Road, Fenay Bridge



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



## Appendix E

### Search Responses & other Correspondence



## Envirocheck<sup>®</sup> Report:

### Datasheet

#### Order Details:

**Order Number:**

363083030\_1\_1

**Customer Reference:**

PO23320/DP/4526

**National Grid Reference:**

418600, 414830

**Slice:**

A

**Site Area (Ha):**

2.32

**Search Buffer (m):**

1000

#### Site Details:

Penistone Road

Fenay Bridge

#### Client Details:

Mr M Perrin

Lithos Consulting Ltd

Parkhill

Walton Road

Wetherby

LS22 5DZ

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
<b>Agency &amp; Hydrological</b>					
BGS Groundwater Flooding Susceptibility	pg 1	Yes	Yes	Yes	n/a
Contaminated Land Register Entries and Notices					
Discharge Consents	pg 5			1	14
Prosecutions					
Enforcement and Prohibition Notices					
Integrated Pollution Controls					
Integrated Pollution Prevention And Control					
Local Authority Integrated Pollution Prevention And Control					
Local Authority Pollution Prevention and Controls	pg 8				4
Local Authority Pollution Prevention and Control Enforcements					
Nearest Surface Water Feature	pg 9		Yes		
Pollution Incidents to Controlled Waters	pg 9		5	7	10
Historical Prosecutions					
Registered Radioactive Substances					
Substantiated Pollution Incident Register	pg 13				1
Water Abstractions	pg 13			8	7 (*37)
Water Industry Act Referrals					
Groundwater Vulnerability Map	pg 26	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 26	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 26		Yes	n/a	n/a
Flooding from Rivers or Sea without Defences	pg 26		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 26		16	10	55
Water Framework Directive - Catchment	pg 35	Yes			
Water Framework Directive - Groundwater	pg 35	Yes			
Water Framework Directive - Surface Waters					

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
<b>Waste</b>					
BGS Recorded Landfill Sites					
Historical Landfill Sites	pg 36				1
Integrated Pollution Control Registered Waste Sites					
Licensed Waste Management Facilities (Landfill Boundaries)					
Licensed Waste Management Facilities (Locations)					
Local Authority Landfill Coverage	pg 36	1	n/a	n/a	n/a
Local Authority Recorded Landfill Sites					
Potentially Infilled Land (Non-Water)	pg 36		6	4	6
Potentially Infilled Land (Water)	pg 37				2
Registered Landfill Sites					
Registered Waste Transfer Sites					
Registered Waste Treatment or Disposal Sites					
<b>Hazardous Substances</b>					
Control of Major Accident Hazards Sites (COMAH)					
Explosive Sites					
Notification of Installations Handling Hazardous Substances (NIHHS)	pg 38				1
Planning Hazardous Substance Consents					
Planning Hazardous Substance Enforcements					

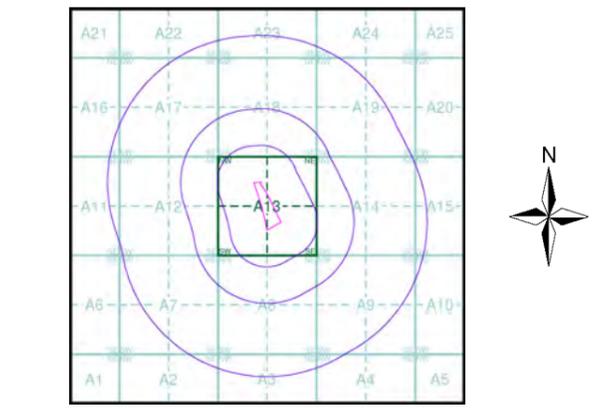
Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
<b>Geological</b>					
BGS 1:625,000 Solid Geology	pg 39	Yes	n/a	n/a	n/a
BGS Estimated Soil Chemistry	pg 39	Yes	Yes	Yes	Yes
BGS Recorded Mineral Sites	pg 50		3	5	7
BGS Urban Soil Chemistry					
BGS Urban Soil Chemistry Averages					
CBSCB Compensation District			n/a	n/a	n/a
Coal Mining Affected Areas	pg 52	Yes	n/a	n/a	n/a
Mining Instability	pg 53	Yes	n/a	n/a	n/a
Man-Made Mining Cavities	pg 53		1		1
Natural Cavities					
Non Coal Mining Areas of Great Britain				n/a	n/a
Potential for Collapsible Ground Stability Hazards	pg 53	Yes	Yes	n/a	n/a
Potential for Compressible Ground Stability Hazards	pg 53		Yes	n/a	n/a
Potential for Ground Dissolution Stability Hazards				n/a	n/a
Potential for Landslide Ground Stability Hazards	pg 54	Yes	Yes	n/a	n/a
Potential for Running Sand Ground Stability Hazards	pg 55		Yes	n/a	n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 55	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
<b>Industrial Land Use</b>					
Contemporary Trade Directory Entries	pg 57		1	10	15
Fuel Station Entries	pg 59				1
Points of Interest - Commercial Services	pg 59				9
Points of Interest - Education and Health					
Points of Interest - Manufacturing and Production	pg 60			1	12
Points of Interest - Public Infrastructure	pg 61		2	1	13
Points of Interest - Recreational and Environmental	pg 62				9
Underground Electrical Cables					

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
<b>Sensitive Land Use</b>					
Ancient Woodland	pg 64				2
Areas of Adopted Green Belt	pg 64	1			
Areas of Unadopted Green Belt	pg 64	1			
Areas of Outstanding Natural Beauty					
Environmentally Sensitive Areas					
Forest Parks					
Local Nature Reserves					
Marine Nature Reserves					
National Nature Reserves					
National Parks					
Nitrate Sensitive Areas					
Nitrate Vulnerable Zones					
Ramsar Sites					
Sites of Special Scientific Interest					
Special Areas of Conservation					
Special Protection Areas					
World Heritage Sites					



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

**Site Sensitivity Map - Slice A**



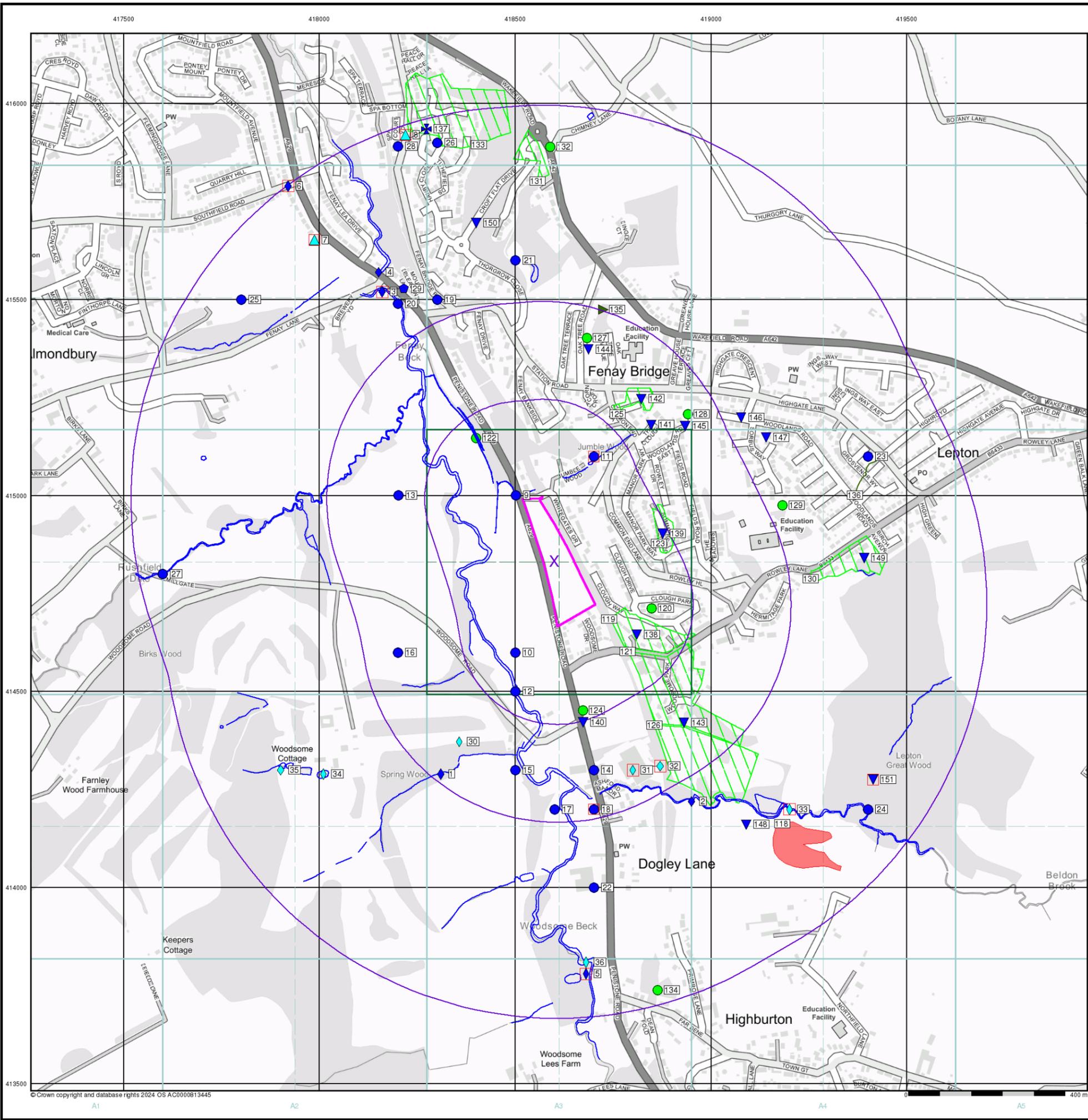
**Order Details**

Order Number: 363083030\_1\_1  
 Customer Ref: PO23320/DP/4526  
 National Grid Reference: 418600, 414830  
 Slice: A  
 Site Area (Ha): 2.32  
 Search Buffer (m): 1000

**Site Details**  
 Penistone Road, Fenay Bridge

**Landmark**  
 INFORMATION GROUP

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



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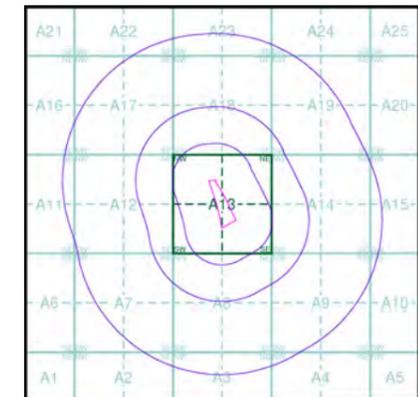
**General**

- 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**

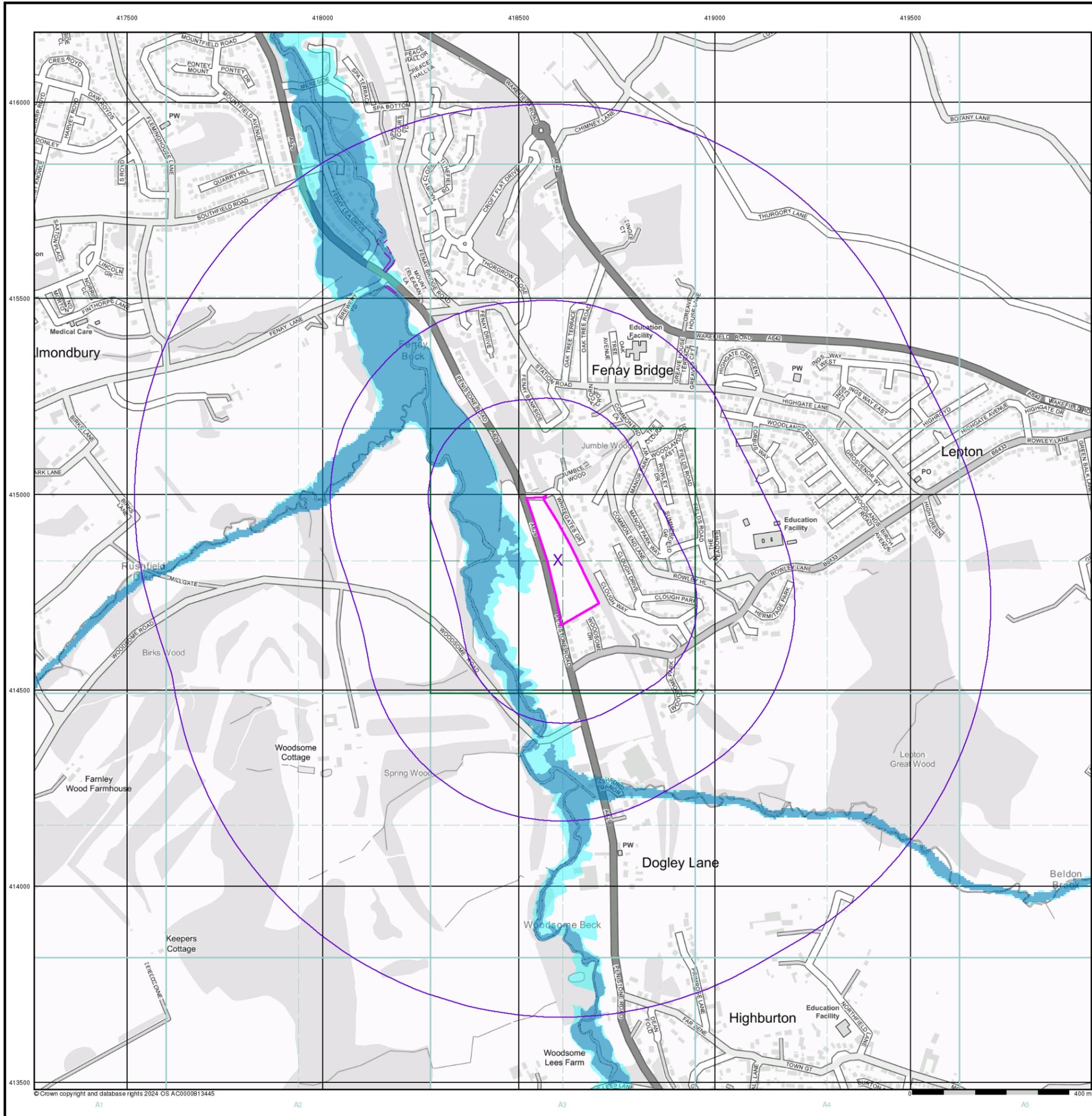
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 National Grid Reference: 418600, 414830  
 Slice: A  
 Site Area (Ha): 2.32  
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**Site Details**

Penistone Road, Fenay Bridge



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**General**

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

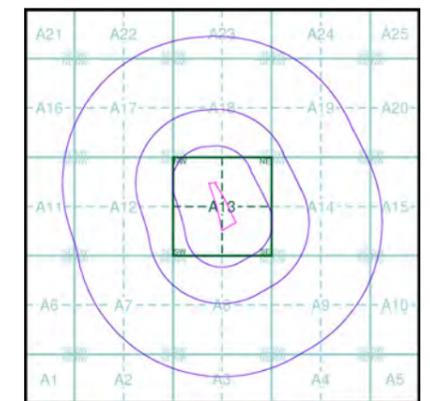
**OS Water Network Data**

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

**Contours (height in meters)**

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

**OS Water Network Map - Slice A**



**Order Details**

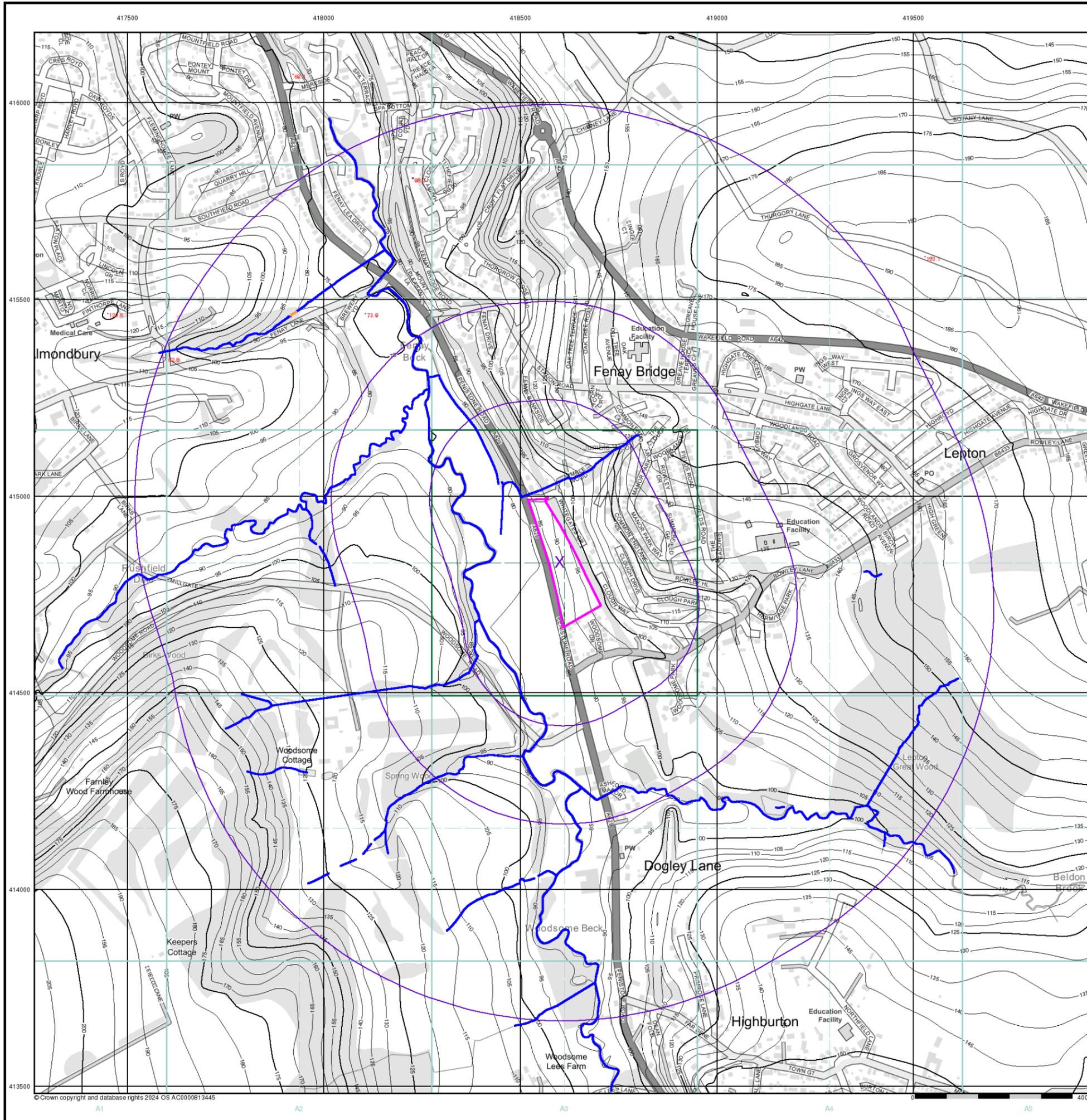
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 Slice: A  
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 Search Buffer (m): 1000

**Site Details**

Penistone Road, Fenay Bridge

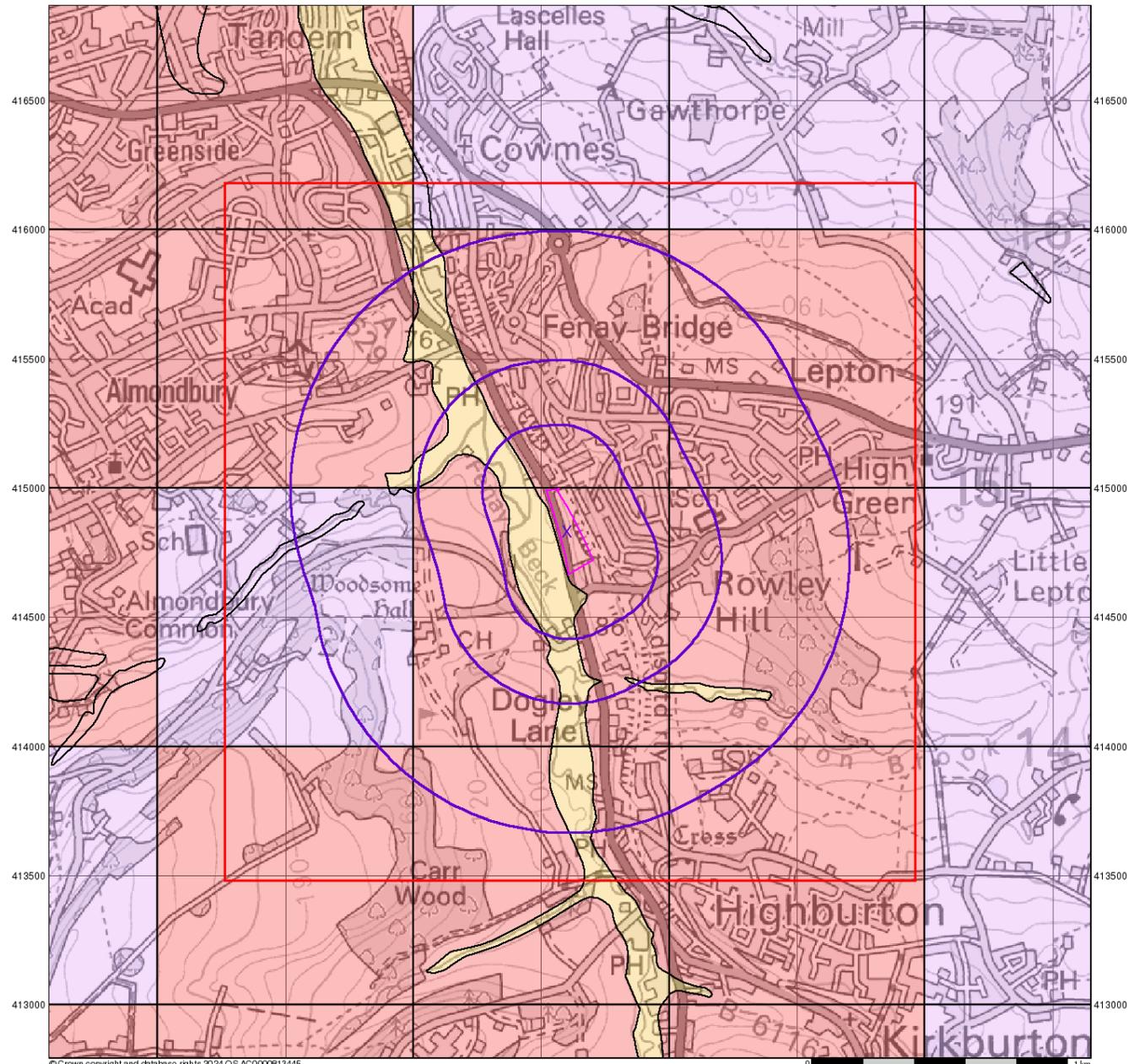


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417000 417500 418000 418500 419000 419500 420000 420500



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0 1 km



## Groundwater Vulnerability

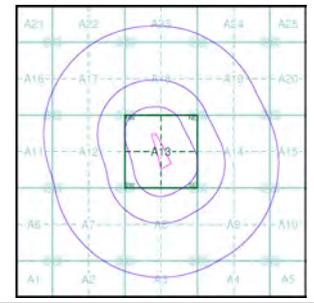
### General

- 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

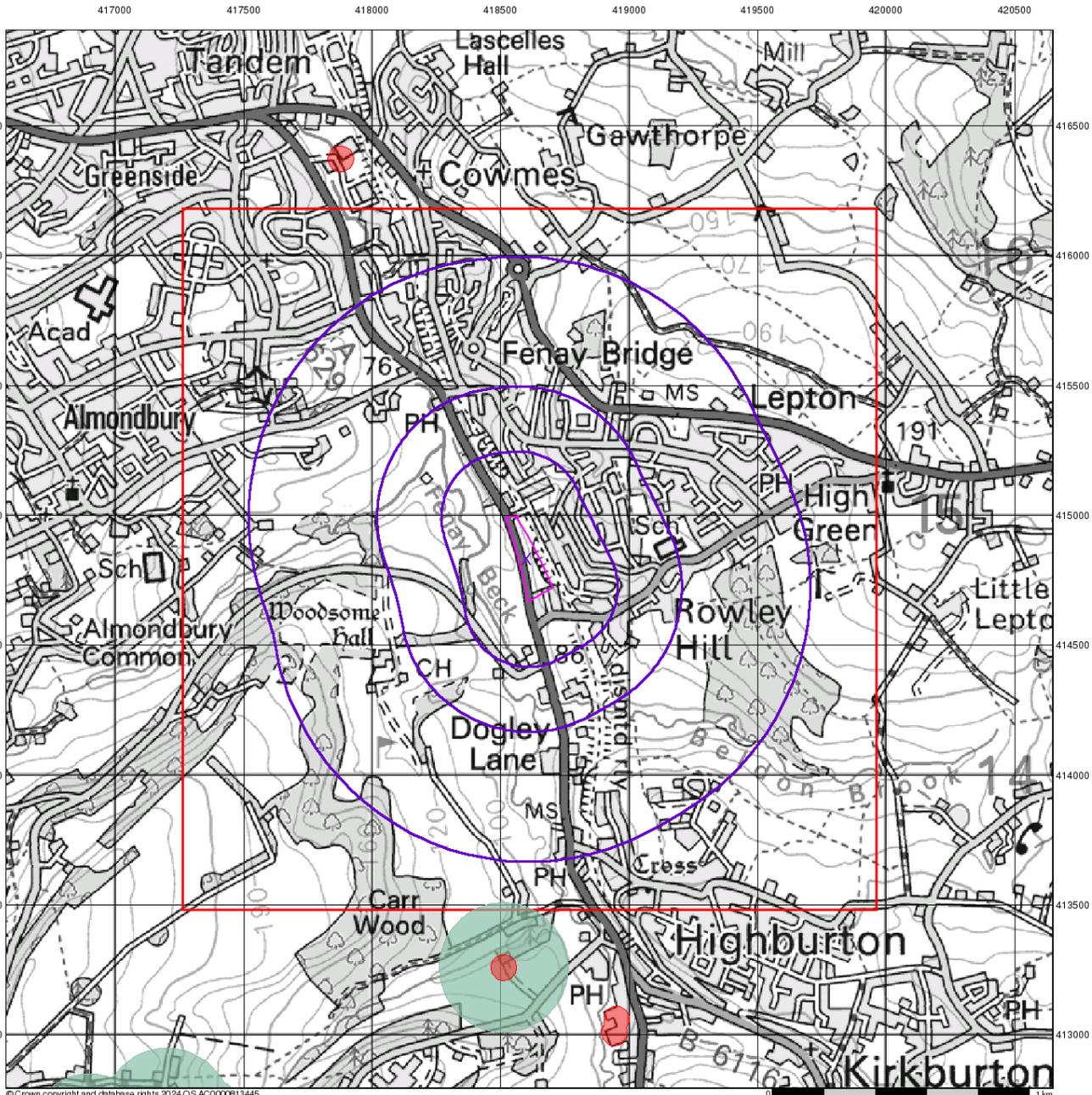
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 Customer Ref: PO23320/DP/4526  
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 Slice: A  
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### Site Details

Penistone Road, Fenay Bridge



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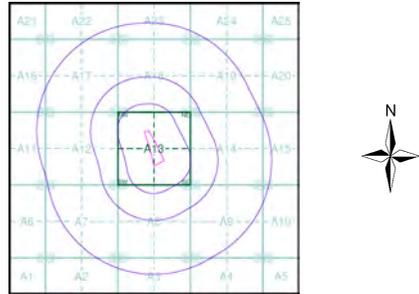
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### Source Protection Zones

- 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**

Order Number: 363083030\_1\_1  
 Customer Ref: PO23320/DP/4526  
 National Grid Reference: 418600, 414830  
 Slice: A  
 Site Area (Ha): 2.32  
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**Site Details**  
 Penistone Road, Fenay Bridge

**Landmark**  
 INFORMATION GROUP

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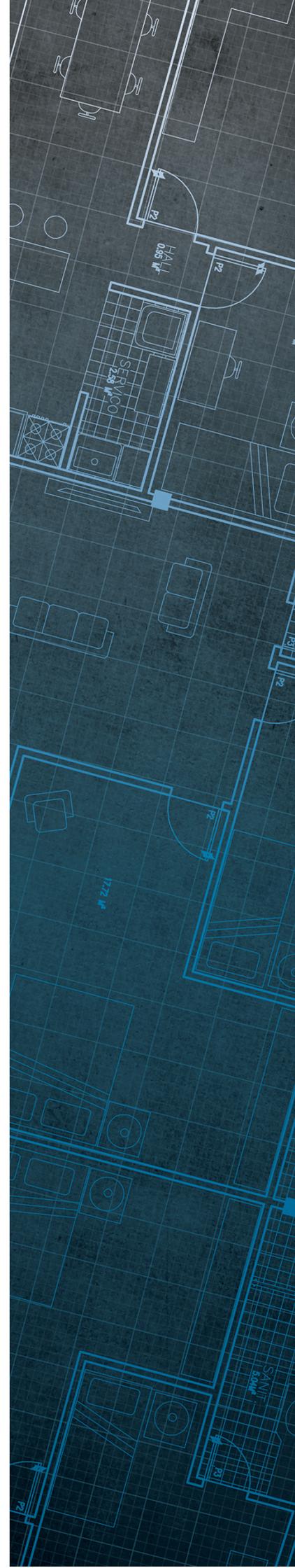
The Coal  
Authority

# Consultants Coal Mining Report

Penistone Road  
Fenay Bridge  
Huddersfield  
Kirklees  
HD8 0AW

Date of enquiry: 11 November 2024  
Date enquiry received: 11 November 2024  
Issue date: 11 November 2024

Our reference: 51003462184001  
Your reference: PO23321/DP/4526



# 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

Penistone Road  
Fenay Bridge  
Huddersfield  
Kirklees  
HD8 0AW

## How to contact us

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

200 Lichfield Lane  
Mansfield  
Nottinghamshire  
NG18 4RG

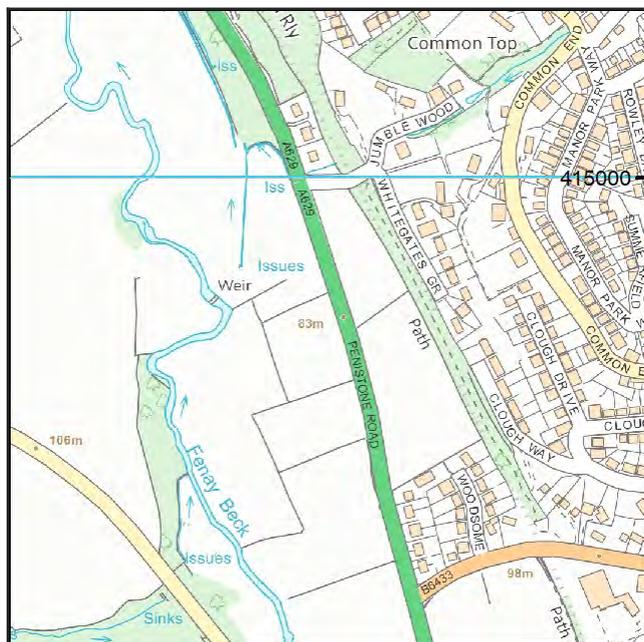
[www.groundstability.com](http://www.groundstability.com)

 @coalauthority

 /company/the-coal-authority

 /thecoalauthority

 /thecoalauthority



Approximate position of property



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# Section 1 – Mining activity and geology

## Past underground mining

Colliery	Seam	Mineral	Coal Authority reference	Depth (m)	Direction to working	Dipping rate of seam worked (degrees)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
unnamed	HALIFAX HARD	Coal	6ZH9	202	South-East	1.0	South-West	191	1929
unnamed	HALIFAX HARD	Coal	6ZHA	215	East	1.0	South-West	191	1929
unnamed	HALIFAX HARD	Coal	6ZH8	217	South-East	1.0	South-West	191	1925
unnamed	HALIFAX SOFT	Coal	6ZHE	242	Beneath Property	1.3	South-West	109	1931

## Probable unrecorded shallow workings

None.

## Spine roadways at shallow depth

No spine roadway recorded at shallow depth.

## Mine entries

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Adit	418414-004	418762 414687		Coal	
Shaft	418414-005	418775 414676		Coal	

## Abandoned mine plan catalogue numbers

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

7332	13104	11932
PO0	OM11932	FGB849
FGB191	12328	

**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
BETTER BED	Coal	Yes	Within	N/A	170

## 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

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

See Section 4 for further information.

### Remediated sites

None recorded within 50 metres of the enquiry boundary.

### Coal mining subsidence

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

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

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

### Mine gas

None recorded within 500 metres of the enquiry boundary.

### Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.

## Section 3 – Licensing and future mining activity

### Future underground mining

None recorded.

### Coal mining licensing

None recorded within 200 metres of the enquiry boundary.

### Court orders

None recorded.

### Section 46 notices

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

### Withdrawal of support notices

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

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

### Payments to owners of former copyhold land

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

## Section 4 – Further information

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

### Future development

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

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

### Development advice

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

### Site investigations

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

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

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

## Section 5 – Data definitions

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

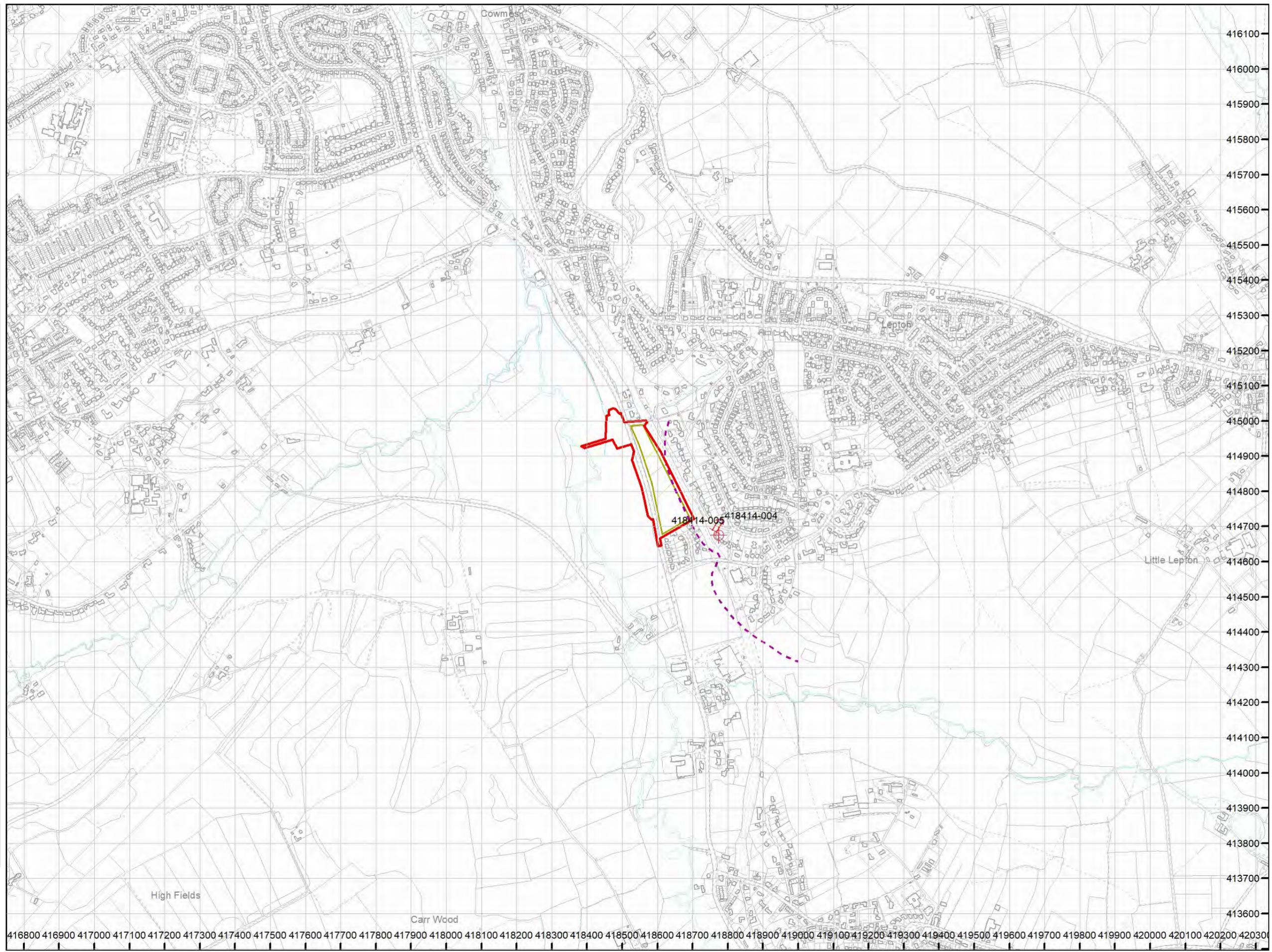
### **Payment to owners of former copyhold land**

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 (Conjectured) 
- Site investigations 



**How to contact us**  
0345 762 6848 (UK)  
+44 (0)1623 637 000 (International)  
[www.groundstability.com](http://www.groundstability.com)

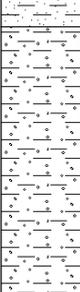
## Appendix F

### Trial Pit Logs

Project Name: Penistone Road      Project No. 4526      Co-ords: 418691.00 - 414732.00      Date 17/10/2023

Location: Fenay Bridge      Dimensions (m):       Scale 1:25

Client: Newett Homes      Depth 3.00      Logged LB

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
			HVP=65	0.15			Brown sandy CLAY with abundant rootlets. (TOPSOIL)	
							Firm orangish brown mottled grey sandy CLAY. (COHESIVE RESIDUAL SOIL)	
				1.20			At 1.2m, band of weathered coal in clay. Stiff brown gravelly CLAY with rare gravel of coal. Gravel is fine to medium angular of mudstone lithorelicts (COHESIVE RESIDUAL SOIL)	1
				2.10			Very weak thinly laminated grey MUDSTONE recovered as clayey fine to coarse angular gravel. (COAL MEASURES)	2
				2.60			Weak thinly laminated grey MUDSTONE recovered as coarse angular gravel. (COAL MEASURES)	
				3.00			Very difficult to excavate below 2.7m. Bucket scraping on base of the pit at 2.7m.	
							End of pit at 3.00 m	3
								4
								5

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

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



Project Name: Penistone Road	Project No. 4526	Co-ords: 418665.00 - 414789.00 Level:	Date 17/10/2023
Location: Fenay Bridge	Dimensions (m): Depth 4.30		Scale 1:25
Client: Newett Homes			Logged LB

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼			HVP=75	0.20			Brown sandy CLAY with abundant rootlets. (TOPSOIL)	
				1.50			Firm orangish brown mottled grey sandy CLAY. (COHESIVE RESIDUAL SOIL)	1
				2.10			Stiff orangish brown mottled grey gravelly CLAY. Gravel is fine to coarse angular of mudstone lithorelicts. (COHESIVE RESIDUAL SOIL)	2
				3.10			Very stiff thinly laminated black mottled dark grey gravelly CLAY. Gravel is fine to medium angular of mudstone lithorelicts. (COHESIVE RESIDUAL SOIL)	3
				3.90			Very weak thinly laminated grey MUDSTONE recovered as clayey fine to coarse angular gravel. (COAL MEASURES) <i>Very difficult to excavate below 3.1m. Bucket scraping on base of the pit at 3.1m. At 3.3m, groundwater.</i>	
				4.30			Weak thinly laminated dark grey MUDSTONE recovered as coarse angular gravel. (COAL MEASURES)	4
				4.30		----- End of pit at 4.30 m	5	

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater encountered at 3.3m during excavation. 3. Backfilled with materials arising upon completion. 4. Co-ordinates from hand held GPS, hole not surveyed in.

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



Project Name: Penistone Road	Project No. 4526	Co-ords: 418644.00 - 414831.00 Level:	Date 17/10/2023
Location: Fenay Bridge	Dimensions (m): Depth 4.30		Scale 1:25
Client: Newett Homes			Logged LB

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
			HVP=72	0.20			Brown sandy CLAY with abundant rootlets. (TOPSOIL)	
				1.60			Firm orangish brown mottled grey slightly gravelly sandy CLAY with rare lenses of weathered coal. Gravel is fine to medium angular to subangular of mudstone lithorelicts. (COHESIVE RESIDUAL SOIL)	1
				2.90			Firm locally stiff thinly laminated grey mottled black and brown gravelly CLAY. Gravel is fine to medium angular of mudstone lithorelicts. (COHESIVE RESIDUAL SOIL)	2
				3.30			Very weak thinly laminated grey MUDSTONE recovered as clayey fine to coarse angular gravel. (COAL MEASURES) <u>Below 3.1m, pit sides unstable.</u> <u>Difficult to excavate below 3.2m.</u>	3
				4.30			Weak thinly laminated dark grey MUDSTONE recovered as coarse angular gravel. (COAL MEASURES)	4
							End of pit at 4.30 m	5

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

Stability: 1. The sides of the trial pit were unstable between 3.1m and 4.3m depth during excavation.



Project Name: Penistone Road	Project No. 4526	Co-ords: 418626.00 - 414871.00 Level:	Date 17/10/2023
Location: Fenay Bridge	Dimensions (m): Depth 2.75		Scale 1:25 Logged LB
Client: Newett Homes			

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
			HVP=71	0.20			Brown sandy CLAY with abundant rootlets. (TOPSOIL)
			HVP=75	1.00			Firm orangish brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to medium angular of mudstone lithorelicts. (COHESIVE RESIDUAL SOIL)
				1.40			Stiff light grey mottled brown gravelly CLAY. Gravel is fine to medium angular of mudstone lithorelicts. (COHESIVE RESIDUAL SOIL)
				2.20			Firm thinly laminated greyish brown mottled orangish brown very gravelly CLAY. Gravel is fine to medium angular of mudstone lithorelicts. (COHESIVE RESIDUAL SOIL)
				2.70			Very weak thinly laminated grey MUDSTONE recovered as clayey fine to coarse angular gravel. (COAL MEASURES) <i>Difficult to excavate below 2.2m.</i>
				2.75			Weak thinly laminated dark grey MUDSTONE recovered as coarse angular gravel. (COAL MEASURES) <i>Very difficult to excavate below 2.7m, terminated at 2.75m due to scraping on base of pit.</i> End of pit at 2.75 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: Penistone Road	Project No. 4526	Co-ords: 418601.00 - 414907.00 Level:	Date 17/10/2023
Location: Fenay Bridge		Dimensions (m): Depth 3.60	Scale 1:25 Logged LB
Client: Newett Homes			

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20			Brown sandy CLAY with abundant rootlets. (TOPSOIL)
							Very stiff brownish grey gravelly CLAY. Gravel is fine to medium angular of mudstone lithorelicts. (COHESIVE RESIDUAL SOIL) <i>From 0.2m to 2.0m, too stiff for hand vanes (sample crumbling).</i>
				2.00			Very weak thinly laminated grey mottled brown MUDSTONE recovered as clayey fine to coarse angular gravel. (COAL MEASURES) <i>Difficult to excavate below 2.0m.</i>
				2.80			Weak thinly laminated dark grey MUDSTONE recovered as coarse angular gravel. (COAL MEASURES) <i>Very difficult to excavate below 2.8m.</i>
				3.60			<i>Pit terminated at 3.6m due to bucket scraping on bedrock.</i> End of pit at 3.60 m

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

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



Project Name: Penistone Road	Project No. 4526	Co-ords: 418587.00 - 414940.00 Level:	Date 17/10/2023
Location: Fenay Bridge	Dimensions (m): Depth 3.30		Scale 1:25
Client: Newett Homes			Logged LB

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30			Brown sandy CLAY with abundant rootlets. (TOPSOIL)
				0.80			Firm orangish brown sandy CLAY. (COHESIVE RESIDUAL SOIL)
				2.10			Very weak thinly laminated orangish brown mottled black MUDSTONE recovered as fine to coarse angular gravel. (COAL MEASURES)
				3.30			Weak thinly laminated dark grey MUDSTONE recovered as coarse angular gravel and cobbles. (COAL MEASURES) <i>Difficult to excavate below 2.1m.</i>
							End of pit at 3.30 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: Penistone Road	Project No. 4526	Co-ords: 418497.00 - 414957.00 Level:	Date 17/10/2023
Location: Fenay Bridge		Dimensions (m): Depth 2.40	Scale 1:25 Logged LB
Client: Newett Homes			

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
▼			HVP=80	0.20			Brown sandy CLAY with abundant rootlets. (TOPSOIL)
							Firm locally soft orangish brown slightly gravelly sandy CLAY. Gravel is fine to medium angular to subrounded of mudstone, sandstone and coal. (COHESIVE ALLUVIUM)
							Plastic land drain at 0.6m.
					1.90		
				2.30			Weak grey SANDSTONE recovered as coarse gravel. (COAL MEASURES)
				2.40			Pit terminated at 2.4m due to bucket scraping on bedrock. At 2.4m, slight groundwater seepage. End of pit at 2.40 m

Remarks: 1. Prior to excavation a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater encountered at 2.4m 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: Penistone Road	Project No. 4526	Co-ords: 418485.00 - 414971.00 Level:	Date 17/10/2023
Location: Fenay Bridge	Dimensions (m): Depth 4.20		Scale 1:25
Client: Newett Homes			Logged LB

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			Brown sandy CLAY with abundant rootlets. (TOPSOIL)	
			HVP=50				Firm locally soft orangish brown slightly gravelly sandy CLAY. Gravel is fine to medium angular to subrounded of mudstone, sandstone and coal. (COHESIVE ALLUVIUM)	
			HVP=55				Plastic land drain at 0.6m.	
				2.70			Orangish brown sandy clayey fine to coarse subangular GRAVEL of sandstone lithorelicts. (GRANULAR RESIDUAL SOIL) <i>Difficult to excavate below 2.7m, bucket starting to scrape on base of pit.</i>	1
				3.20			Stiff grey mottled black gravelly CLAY. Gravel is fine to medium angular of mudstone lithorelicts. (COHESIVE RESIDUAL SOIL)	2
				3.80			Weak thinly laminated grey mottled brown SANDSTONE recovered as coarse gravel. (COAL MEASURES)	3
				4.20			End of pit at 4.20 m	4
								5

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

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





# Trial Pit Log

Trialpit No

**TP201**

Sheet 1 of 1

Project Name: Penistone Road

Project No. 4526

Co-ords: 418550.00 - 414966.00

Level:

Date

13/11/2024

Location: Fenay Bridge

Dimensions (m):

2.5

Scale

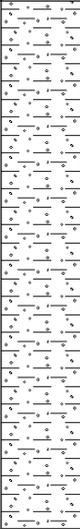
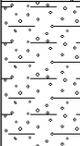
1:20

Client: Newett Homes

Depth 2.50

0.5

Logged CR

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.70	D	HVP=120				Stiff orangish-brown and light grey mottled slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone and siltstone. (COHESIVE RESIDUAL SOIL)
			HVP=130	1.40			Stiff brown with grey and orange mottling slightly sandy slightly gravelly CLAY. Gravel is angular fine to medium of mudstone lithorelicts. (COHESIVE RESIDUAL SOIL)
				2.10			Brown and grey very clayey angular fine to coarse GRAVEL of mudstone. (GRANULAR RESIDUAL SOIL)
				2.50			End of pit at 2.50 m

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

**TP202**

Sheet 1 of 1

Project Name: Penistone Road

Project No. 4526

Co-ords: 418584.00 - 414912.00  
Level:Date  
13/11/2024

Location: Fenay Bridge

Dimensions (m): 2.5  
Depth 1.20Scale  
1:20  
Logged  
CR

Client: Newett Homes

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.60	D					Grey very clayey very angular to angular fine to coarse GRAVEL of mudstone, siltstone and sandstone. Low cobble content of sandstone. (GRANULAR RESIDUAL SOIL)
				1.00			Weak grey MUDSTONE recovered as very angular to angular fine to coarse tabular gravel with low cobble content.
				1.20			(COAL MEASURES) 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

**TP203**

Sheet 1 of 1

Project Name: Penistone Road

Project No. 4526

Co-ords: 418570.00 - 414878.00  
Level:Date  
13/11/2024

Location: Fenay Bridge

Dimensions (m): 2.5  
Depth 1.40Scale  
1:20  
Logged  
CR

Client: Newett Homes

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	1.20	D		0.90			Stiff brown with orange mottling slightly sandy gravelly CLAY. Gravel is very angular to angular fine to coarse of sandstone, mudstone and siltstone. (COHESIVE RESIDUAL SOIL)
				1.40			Weak grey MUDSTONE recovered as slightly clayey very angular to angular fine to coarse tabular gravel with low cobble content. (COAL MEASURES)
							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

**TP204**

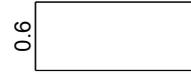
Sheet 1 of 1

Project Name: Penistone Road

Project No. 4526

Co-ords: 418610.00 - 414859.00  
Level:Date  
13/11/2024

Location: Fenay Bridge

Dimensions (m): 2.5  
Depth 0.70Scale  
1:20  
Logged  
CR

Client: Newett Homes

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.70			Weak grey and orange MUDSTONE recovered as slightly sandy slightly clayey very angular to angular fine to coarse gravel. (COAL MEASURES)
							End of pit at 0.70 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

**TP205**

Sheet 1 of 1

Project Name: Penistone Road

Project No. 4526

Co-ords: 418582.00 - 414842.00

Level:

Date

13/11/2024

Location: Fenay Bridge

Dimensions (m):

2.5

Scale

1:20

Client: Newett Homes

Depth 2.20

0.6

Logged CR

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.60	D	HVP=80				Stiff brown slightly sandy slightly gravelly CLAY. Gravel is angular fine to medium of mudstone and siltstone. (COHESIVE RESIDUAL SOIL)
				1.00			Brown and orange slightly sandy very clayey very angular to angular fine to coarse GRAVEL of mudstone and siltstone with occasional pockets of gravelly clay. (GRANULAR RESIDUAL SOIL)
				2.00			Weak grey MUDSTONE recovered as slightly sandy slightly clayey very angular to angular fine to coarse gravel with low cobble content. (COAL MEASURES)
				2.20			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: Penistone Road	Project No. 4526	Co-ords: 418623.00 - 414764.00 Level:	Date 13/11/2024
Location: Fenay Bridge	Dimensions (m): Depth 1.60		Scale 1:20 Logged CR
Client: Newett Homes		2.5	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.60	D	HVP=140	0.80			Stiff orangish-brown and light grey mottled slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone and siltstone. (COHESIVE RESIDUAL SOIL)
				1.60			Weak grey MUDSTONE recovered as slightly sandy slightly clayey very angular to angular fine to coarse tabular gravel. (COAL MEASURES)
							End of pit at 1.60 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

**TP207**

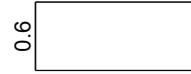
Sheet 1 of 1

Project Name: Penistone Road

Project No. 4526

Co-ords: 418641.00 - 414712.00  
Level:Date  
13/11/2024

Location: Fenay Bridge

Dimensions (m): 2.5  
Depth 1.00Scale  
1:20  
Logged  
CR

Client: Newett Homes

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.80	D		1.00			Weak grey MUDSTONE recovered as slightly sandy slightly clayey very angular to angular fine to coarse tabular gravel with low cobble content. (COAL MEASURES)
							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  
**TP208**  
Sheet 1 of 1

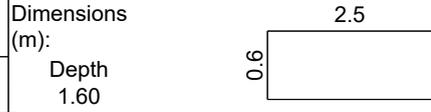
Project Name: Penistone Road

Project No. 4526

Co-ords: 418658.00 - 414759.00  
Level:

Date  
13/11/2024

Location: Fenay Bridge



Scale  
1:20  
Logged  
CR

Client: Newett Homes

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	1.20	D		0.50			Possible MADE GROUND: Stiff greyish-brown with orange mottling slightly sandy slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of sandstone, siltstone and mudstone. (POSSIBLE REWORKED NATURAL GROUND)
				0.90			Strong SANDSTONE. Possible boulder in reworked natural ground. (COAL MEASURES)
				1.60			Weak grey MUDSTONE recovered as slightly sandy slightly clayey very angular to angular fine to coarse tabular gravel with low cobble content. (COAL MEASURES)
							End of pit at 1.60 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

**TS201**

Sheet 1 of 1

Project Name: Penistone Road

Project No.  
4526Co-ords: -  
Level:Date  
13/11/2024

Location: Fenay Bridge

Dimensions (m):

1.5

Depth  
0.80

0.6

Scale  
1:20Logged  
CR

Client: Newett Homes

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50	J&T		0.80			Brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is angular to subangular fine to coarse of mudstone and siltstone. (TOPSOIL)
	0.60	B					
	----- End of pit at 0.80 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

**TS202**

Sheet 1 of 1

Project Name: Penistone Road

Project No. 4526

Co-ords: -  
Level:Date  
13/11/2024

Location: Fenay Bridge

Dimensions (m):

1.5

Depth  
0.80

0.6

Scale  
1:20Logged  
CR

Client: Newett Homes

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50	J&T		0.80			Brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is angular to subangular fine to coarse of mudstone and siltstone. (TOPSOIL)
	0.60	B					
	----- End of pit at 0.80 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.



**Appendix G**  
**Chemical Results**



# DETS

## Certificate of Analysis

*Certificate Number* 24-24743

*Issued:* 21-Nov-24

*Client* Lithos Consulting Ltd  
Parkhill  
Walton Rd  
Wetherby  
LS22 5DZ

*Our Reference* 24-24743

*Client Reference* ~ 4526

*Order No* ~ PO23346/4526/CR

*Contract Title* ~ Penistone Road, Fenay Bridge

*Description* 10 Soil samples.

*Date Received* 15-Nov-24

*Date Started* 15-Nov-24

*Date Completed* 21-Nov-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*



Kirk Bridgewood  
General Manager



2139

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](mailto:info@dets.co.uk) • [www.dets.co.uk](http://www.dets.co.uk)

Page 1 of 5

# Summary of Chemical Analysis

## Soil Samples

Our Ref 24-24743

Client Ref ~ 4526

Contract Title ~ Penistone Road, Fenay Bridge

Lab No	2424362	2424363	2424364	2424365	2424366	2424367
Sample ID ~	TP201	TP202	TP203	TP205	TP206	TP207
Depth ~	0.50	0.50	0.10	0.10	0.10	0.10
Other ID ~						
Sample Type ~	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date ~	13/11/2024	13/11/2024	13/11/2024	13/11/2024	13/11/2024	13/11/2024
Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
<b>Preparation</b>									
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	%	27	26	25	25	26	23
<b>Metals</b>									
Arsenic	DETSC 2301#	0.2	mg/kg	32	31	29	31	34	25
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.2	0.6	0.5	0.7	0.7	0.6
Cadmium	DETSC 2301#	0.1	mg/kg	0.3	0.3	0.3	0.3	0.3	0.2
Chromium	DETSC 2301#	0.15	mg/kg	35	31	31	31	37	31
Chromium III	DETSC 2301*	0.15	mg/kg	35	31	31	31	37	31
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	48	49	44	46	52	42
Lead	DETSC 2301#	0.3	mg/kg	67	66	60	63	68	54
Mercury	DETSC 2325#	0.05	mg/kg	1.7	0.68	0.67	0.72	1.1	0.52
Nickel	DETSC 2301#	1	mg/kg	26	25	26	25	30	27
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	0.5	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	43	39	39	40	45	37
Zinc	DETSC 2301#	1	mg/kg	100	110	93	95	110	89
<b>Inorganics</b>									
pH	DETSC 2008#		pH	6.5	6.9	6.4	6.8	6.6	6.7
Total Organic Carbon	DETSC 2084#	0.5	%	5.2	6.0	5.6	5.2	5.0	4.6
<b>PAHs</b>									
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	0.04	< 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	0.06	< 0.03	0.03	< 0.03	0.04
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	0.06	0.09	0.06	0.07	0.05	0.08
Pyrene	DETSC 3303#	0.03	mg/kg	0.05	0.07	0.05	0.06	0.04	0.07
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	0.03	< 0.03	< 0.03	< 0.03	0.04
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.11	0.21	0.11	0.13	< 0.10	0.19

# Summary of Chemical Analysis

## Soil Samples

Our Ref 24-24743

Client Ref ~ 4526

Contract Title ~ Penistone Road, Fenay Bridge

Lab No	2424368	2424369	2424370	2424371
Sample ID ~	TP209	TP210	TP211	TP212
Depth ~	0.10	0.10	0.10	0.10
Other ID ~				
Sample Type ~	SOIL	SOIL	SOIL	SOIL
Sampling Date ~	13/11/2024	13/11/2024	13/11/2024	13/11/2024
Sampling Time ~	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
<b>Preparation</b>							
Stones >10mm	DETSC 1003*	1	% m/m	< 1.0	< 1.0	< 1.0	< 1.0
Moisture Content	DETSC 1004	0.1	%	24	22	22	110
<b>Metals</b>							
Arsenic	DETSC 2301#	0.2	mg/kg	31	29	31	29
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.8	0.5	0.7	0.5
Cadmium	DETSC 2301#	0.1	mg/kg	0.3	0.3	0.3	0.3
Chromium	DETSC 2301#	0.15	mg/kg	33	29	35	29
Chromium III	DETSC 2301*	0.15	mg/kg	33	29	35	29
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	47	43	51	45
Lead	DETSC 2301#	0.3	mg/kg	65	61	64	60
Mercury	DETSC 2325#	0.05	mg/kg	0.80	0.59	0.69	0.69
Nickel	DETSC 2301#	1	mg/kg	25	23	30	24
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	40	37	42	37
Zinc	DETSC 2301#	1	mg/kg	96	90	100	88
<b>Inorganics</b>							
pH	DETSC 2008#		pH	6.7	6.3	6.5	6.4
Total Organic Carbon	DETSC 2084#	0.5	%	6.0	6.1	5.4	6.2
<b>PAHs</b>							
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.03	0.04	0.09	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.06	0.08	0.12	0.04
Pyrene	DETSC 3303#	0.03	mg/kg	0.05	0.07	0.10	0.04
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.04	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	0.03	0.05	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	0.03	0.04	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.12	0.19	0.35	< 0.10

## Summary of Asbestos Analysis

### Soil Samples

Our Ref ~ 24-24743

Client Ref ~ 4526

Contract Title ~ Penistone Road, Fenay Bridge

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2424362	TP201 0.50	SOIL	NAD	none	Michael Kay
2424363	TP202 0.50	SOIL	NAD	none	Michael Kay
2424364	TP203 0.10	SOIL	NAD	none	Michael Kay
2424365	TP205 0.10	SOIL	NAD	none	Michael Kay
2424366	TP206 0.10	SOIL	NAD	none	Michael Kay
2424367	TP207 0.10	SOIL	NAD	none	Michael Kay
2424368	TP209 0.10	SOIL	NAD	none	Michael Kay
2424369	TP210 0.10	SOIL	NAD	none	Michael Kay
2424370	TP211 0.10	SOIL	NAD	none	Michael Kay
2424371	TP212 0.10	SOIL	NAD	none	Michael Kay

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 24-24743  
 Client Ref ~ 4526  
 Contract ~ Penistone Road, Fenay Bridge

### Containers Received & Deviating Samples

Lab No	Sample ID ~	Date Sampled ~	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2424362	TP201 0.50 SOIL	13/11/24	GJ 250ml, PT 1L		
2424363	TP202 0.50 SOIL	13/11/24	GJ 250ml, PT 1L		
2424364	TP203 0.10 SOIL	13/11/24	GJ 250ml, PT 1L		
2424365	TP205 0.10 SOIL	13/11/24	GJ 250ml, PT 1L		
2424366	TP206 0.10 SOIL	13/11/24	GJ 250ml, PT 1L		
2424367	TP207 0.10 SOIL	13/11/24	GJ 250ml, PT 1L		
2424368	TP209 0.10 SOIL	13/11/24	GJ 250ml, PT 1L		
2424369	TP210 0.10 SOIL	13/11/24	GJ 250ml, PT 1L		
2424370	TP211 0.10 SOIL	13/11/24	GJ 250ml, PT 1L		
2424371	TP212 0.10 SOIL	13/11/24	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 H

### Contaminated land assessment for selection of water supply pipes

**The Risk assessment (RA)**

<b>Section 1: Development Details</b>	
Development Name <i>(if it has one)</i>	
Development Address	Penistone Road, Fenay Bridge, HD8 0AW
OS Grid Reference <i>(mid point)</i>	SE 185 150
Developers Name	Newett Homes
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>	
Site has remained undeveloped. Section 3 of Lithos Report 4526/1 provides further detail.	
<b>Section 2: Preliminary Risk Assessment</b>	
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>	
N/A – SI completed.	
<b>Section 3: Intrusive Site Investigation</b>	
Have you completed any intrusive site investigation?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Date(s) when the site investigation(s) undertaken	13/11/2024
At what level has groundwater been encountered?	metres below ground level or <input checked="" 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 greenfield and no sources of contamination have been identified. No evidence of contamination was encountered during the site investigation. Testing of Topsoil confirms the absence of any contamination in any of the samples tested. Testing in line with UKWIR not considered necessary due to consistent ground conditions encountered and site history.	
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. <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>	
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.*

Some site regrade due to natural topography has been completed, with further regrade expected.

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 is proposed. No sources of contamination identified, and no evidence of contamination encountered during the site investigation.

#### 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.*

Residential development is proposed and so no significant quantity of chemicals or fuel expected following redevelopment. Good practice guidance provided in Section 15.4 of Lithos Report 4526/1 for the construction phase groundworker to follow.

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.*

Section 15.5 of Lithos Report 4526/1 provides additional detail on construction of new utilities on site.

#### Section 7: Risk Assessor

Name and relevant qualifications of person directing the risk assessment for water pipes

Mark Perrin: MSc CGEOL

Name and address of risk assessor's company

Lithos Consulting

Date risk assessment performed

04/12/2024

**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	Chris Ryan	Company	Lithos Consulting
Phone Number	01937 545 330	Date	04/12/2024

**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

To date laboratory testing of soil samples in line with UKWIR guidance has not been undertaken.

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	Not tested	-
Total BTEX & MTBE		0.1	Pass	-	-	Not tested	Not tested	-
Total SVOCs (excluding PAHs and those substances marked with an *)		2	Pass	-	-	Not tested	Not tested	-
EC5-EC10 aliphatic and aromatic hydrocarbons		2	Pass	-	-	Not tested	Not tested	-
EC10-EC16 aliphatic and aromatic hydrocarbons		10	Pass	-	-	Not tested	Not tested	-
EC16-EC40 aliphatic and aromatic hydrocarbons		500	Pass	-	-	Not tested	Not tested	-
Phenols* (from SVOC analysis)		2	Pass	-	-	Not tested	Not tested	-
Cresols and chlorinated phenols* (from SVOC analysis)		2	Pass	-	-	Not tested	Not tested	-
Ethers*	Only where identified	0.5	Pass	-	-	Not tested	Not tested	-
Nitrobenzene*		0.5	Pass	-	-	Not tested	Not tested	-
Ketones*		0.5	Pass	-	-	Not tested	Not tested	-
Aldehydes*		0.5	Pass	-	-	Not tested	Not tested	-
Amines		Fail	Pass	-	-	Not tested	Not tested	-
Corrosive	Conductivity, Redox and pH	Pass	See Note [1]	-	-	Not tested	Not tested	-

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  
Topsoil Gradings



# LABORATORY REPORT



**Contract Number: PSL24/8451**

Report Date: 02 December 2024

Client's Reference: 4526

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

**For the attention of: Chris Ryan**

Contract Title: Penistone Road, Fenay Bridge

Date Received: 14/11/2024

Date Commenced: 14/11/2024

Date Completed: 2/12/2024

**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)

S Royle  
(Laboratory Manager)

  
L Knight  
(Assistant Laboratory Manager)

S Eyre  
(Senior Technician)

T Watkins  
(Senior Technician)

5 – 7 Hexthorpe Road,  
Hexthorpe,  
Doncaster,  
DN4 0AR  
Tel: 01302 768098  
Email: rberriman@prosoils.co.uk  
awatkins@prosoils.co.uk

Page 1 of



# PARTICLE SIZE DISTRIBUTION TEST

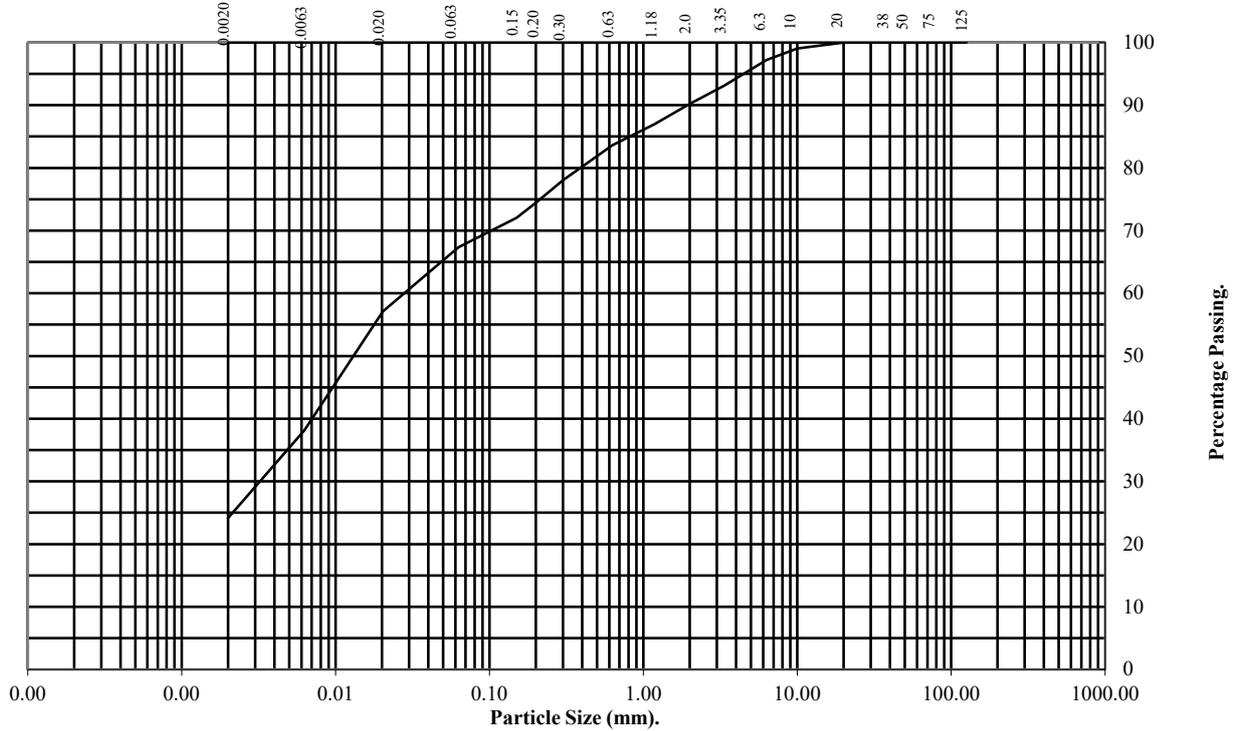
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2 & Pipette Method, Clause 5.4

Hole Number: TS201 Top Depth (m): 0.60

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	99
6.3	97
3.35	93
2	90
1.18	87
0.63	84
0.3	78
0.2	74
0.15	72
0.063	67

Particle Diameter	Percentage Passing
0.020	57
0.0063	38
0.0020	24
<i>Particle Density - 2.65 Mg/m3 assumed</i>	

Soil Fraction	Total Percentage
Cobbles	0
Gravel	10
Sand	23
Silt	43
Clay	24

**Remarks:**

See Summary of Soil Descriptions



Penistone Road, Fenay Bridge

<b>Contract No:</b>
<b>PSL24/8451</b>
<b>Client Ref:</b>
<b>4526</b>

# PARTICLE SIZE DISTRIBUTION TEST

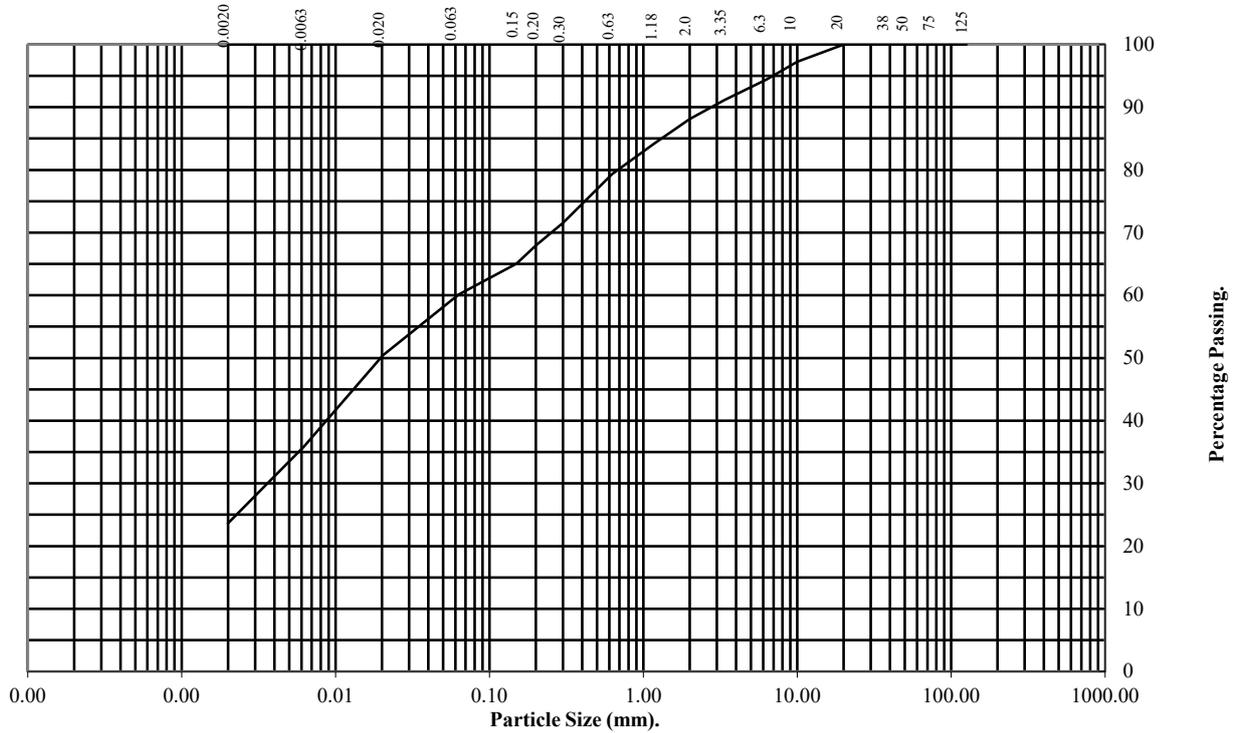
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2 & Pipette Method, Clause 5.4

Hole Number: TS202 Top Depth (m): 0.60

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	97
6.3	94
3.35	91
2	88
1.18	84
0.63	79
0.3	72
0.2	68
0.15	65
0.063	60

Particle Diameter	Percentage Passing
0.020	50
0.0063	36
0.0020	24
<i>Particle Density - 2.65 Mg/m<sup>3</sup> assumed</i>	

Soil Fraction	Total Percentage
Cobbles	0
Gravel	12
Sand	28
Silt	36
Clay	24

**Remarks:**

See Summary of Soil Descriptions



Penistone Road, Fenay Bridge

<b>Contract No:</b>
<b>PSL24/8451</b>
<b>Client Ref:</b>
<b>4526</b>

# PARTICLE SIZE DISTRIBUTION TEST

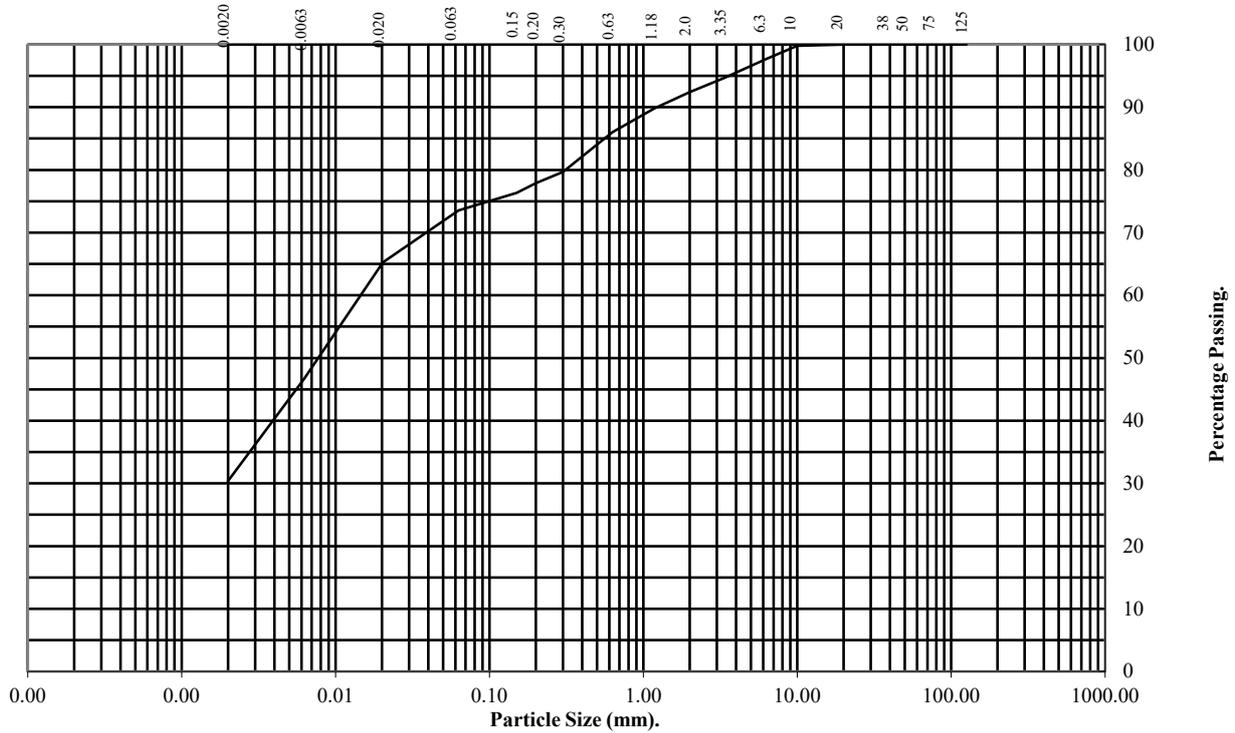
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2 & Pipette Method, Clause 5.4

Hole Number: TS204 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	100
6.3	98
3.35	95
2	92
1.18	90
0.63	86
0.3	80
0.2	78
0.15	76
0.063	74

Particle Diameter	Percentage Passing
0.020	65
0.0063	47
0.0020	30
<i>Particle Density - 2.65 Mg/m3 assumed</i>	

Soil Fraction	Total Percentage
Cobbles	0
Gravel	8
Sand	18
Silt	44
Clay	30

**Remarks:**

See Summary of Soil Descriptions



Penistone Road, Fenay Bridge

Contract No:

PSL24/8451

Client Ref:

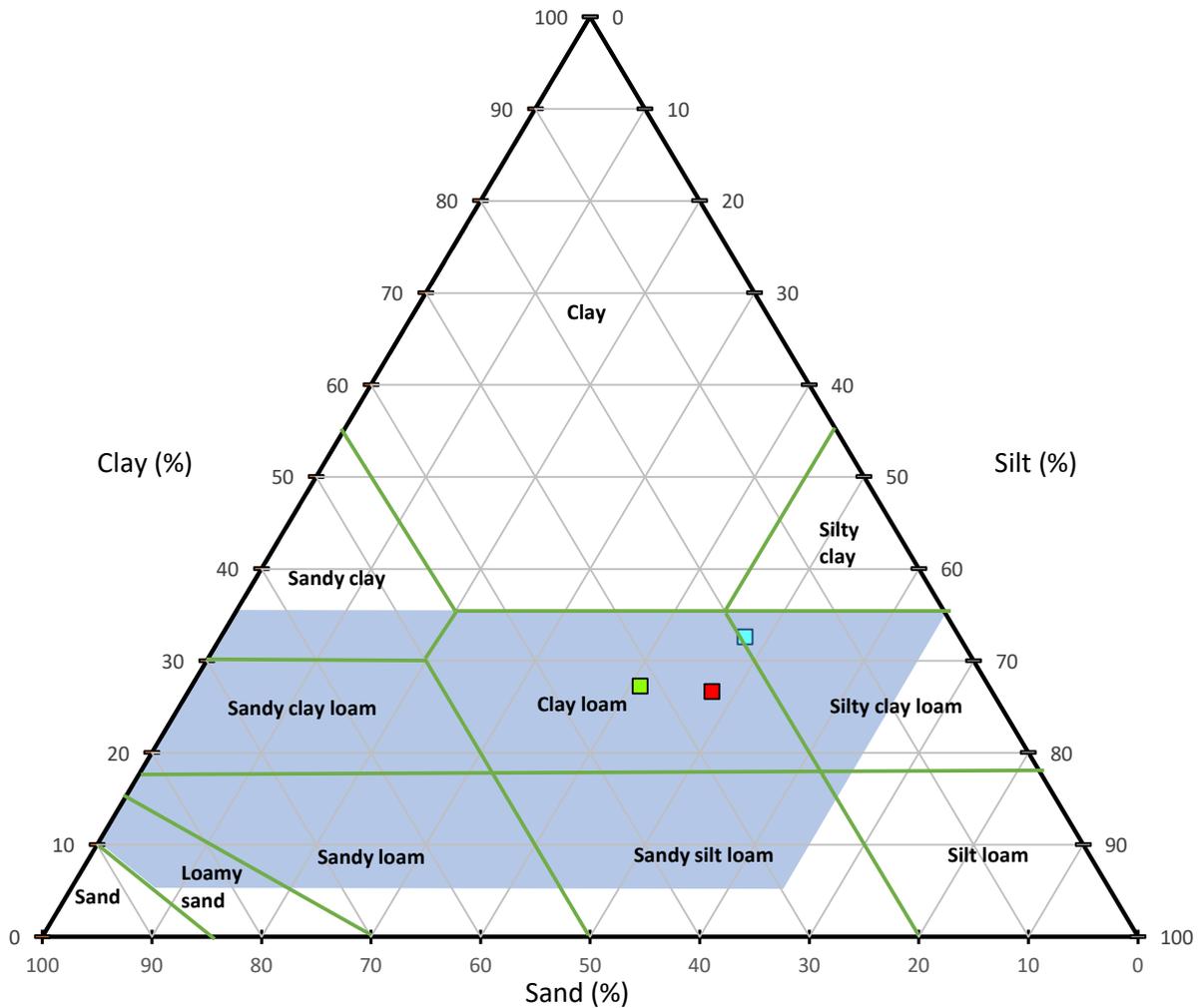
4526

Site:	Penistone Road, Fenay Bridge
Lithos Job Number:	4526
Client:	Newett Homes
Lab Results Rpt Ref.	PSL24/8451
Date Report Issued:	02/12/2024



### Topsoil Classification

(Testing undertaken in accordance with BS3882:2015)



■ TS201

■ TS202

■ TS204



= Area within which the texture of Topsoil is required to fall



= Texture Group Boundary