LITHOS

Preliminary Geoenvironmental Investigation

Land at Barugh Green

For Avant Homes Yorkshire

Report no: 3407/6

Date: October 2024

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

BARUGH GREEN SUMMARY OF GEOENVIRONMENTAL ISSUES

Job No.	3407	**Site area/ha**	4.9
Client:	Avant Homes Yorkshire	**NGR:**	SE 318 078
Site:	Barugh Green	**Nearest postcode:**	S75 1JY

The site is located off Barugh Green Road, approximately 3km northwest of Barnsley town centre, and currently comprises grassed fields used as grazing pasture.

Lithos were commissioned by Avant to provide a preliminary geoenvironmental appraisal of the site. It is understood that the site is to be redeveloped with two storey domestic dwellings, associated gardens, POS and adoptable roads and sewers; a proposed layout has been prepared.

Lithos' investigation included an inspection of historical and geological maps and information provided by the British Geological Survey, the Landmark Information Group, the Coal Authority, and QGIS. In addition, a site inspection has been carried out.

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

Issue	Remarks
Former uses	About 2.6 ha in the west was subject to opencast mining in the early 1950s.
Anticipated ground conditions	Beyond the opencast: residual soils (completely weathered bedrock) - firm or stiff gravelly clay/clayey gravel underlain by Coal Measures bedrock (mudstone, siltstone & sandstone). Within the opencast: deep made ground (up to c. 12m) of variable composition which is likely to include oversize material.
Anticipated contamination	It is considered likely that some (probably minor) ground contamination will be present in the opencast backfill.
Mining & quarrying	The majority of this site is located within a Coal Mining Development High Risk Area. There are no known shallow mineworkings, but unrecorded workings may be present both in the east and beneath the base of the opencast in the centre and west. Extensive opencast workings (Craven I) of the Swallow Wood and the Thin coals, are shown in the west of the site (c. 2.6ha; 55% of the site's total area), extending beyond the western boundary. Further opencast workings (Craven II) to the south of the site are shown to encroach slightly within the southern boundary (c. 300m^2; <1%). Opencast backfill is expected to be a maximum of c. 12m deep; deepest in the centre north.
Hazardous gas	The site is in an area where 3% to 5% of homes are estimated to be above the radon action level. Therefore, basic radon protection measures are required. There are known areas of landfilling within 250m, and the south and west of the site are underlain by areas of deep opencast backfill. As such, gas monitoring and risk assessment will be required.
Flooding & drainage	The site lies in Flood Zone 1, where the risk of flooding from rivers or the sea is classified as low. Given the presence of deep opencast backfill, soakaways will not provide a viable solution for the disposal of surface water.
Preparatory works	General site clearance including removal of vegetation, and a topsoil strip and stockpile. Turnover of made ground within the backfilled opencast.
Anticipated foundation solutions	Beyond the opencast area: plots likely to be founded on traditional strip/trench-fill foundations. Within the opencast area: anticipated fill thicknesses mean that consideration can be given to a piled foundation solution and/or grillage type/raft foundation. If piled foundations are adopted for plots underlain by opencast backfill there should be a reduced need for further significant geotechnical analysis / modelling. Conversely, if grillage type footings (or rafts) are preferred, more rigorous assessment will be required.
Recommendations for ground investigation	An appropriate ground investigation strategy has been designed. However, the proposed scope should be reviewed in light of the preferred foundation solution (shallow reinforced strips or piles) and more rigorous geotechnical review.

At this stage, anticipated significant abnormals relating to geoenvironmental issues at the site are:

- Deep made ground and buried highwalls associated with the former opencast
- Possible shallow mineworkings beyond and/or beneath the former opencast

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01	Environmental setting

Appendix B – Drawings

Drawing	Revision	Title
3407/101	-	Site Location Plan
3407/102	-	Proposed Layout
3407/103	-	Site Features
3407/104	-	Site Photographs
3407/105	-	Preliminary Conceptual Site Model
3407/108	-	Published Geology & Coal Outcrops
3407/109	-	Craven I & II Opencast Abandonment Plan
3407/110	-	Flockton Thick Coal Abandonment Plan

Appendix C - Commission

Appendix D – Historical OS plans*

Appendix E – Search responses*

From	Date	Content
Landmark	25th September 2024	Envirocheck report
Coal Authority	25th September 2024	Mining report

* Some of this data is not included within the paper or PDF copies of this report 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.

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

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

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

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

PRELIMINARY GEOENVIRONMENTAL INVESTIGATION OF LAND AT BARUGH GREEN

1 INTRODUCTION

1.1 The commission and brief

1.1.1 Lithos Consulting were commissioned by Avant Homes Yorkshire to carry out a Preliminary Geoenvironmental Investigation of land at Barugh Green.

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

- A site walkover and inspection
- An assessment of land use history
- Determination of the site's environmental setting
- A mining risk assessment in accordance with Coal Authority guidance
- Assessment of anticipated ground conditions, including potential contaminants
- Assessment of anticipated foundation and engineering issues associated with redevelopment for a residential end-use
- Provision of recommendations for an appropriate ground investigation

1.1.3 This Preliminary Investigation comprises an inspection of historical and geological maps and information provided by the British Geological Survey, the Landmark Information Group, the Coal Authority, and QGIS[1]. In addition, a site inspection has been carried out by Lithos.

1.1.4 Primary aims of this investigation were to identify salient geoenvironmental issues affecting the site to enable design and costing of an appropriate intrusive investigation, and to support the submission of a planning application.

1.2 The proposed development

1.2.1 It is understood that consideration is being given to redevelopment of the site with two storey domestic dwellings, associated gardens, POS and adoptable roads and sewers. A site layout has been provided by Avant (Drawing reference WY-BGB-130, dated 17th September 2024) which is reproduced as Drawing No. 3407/102 in Appendix B to this report.

1.3 Report format and limitations

1.3.1 Standard definitions, procedures and guidance are contained within Appendix A, which includes background, generic information on assessment of the site's environmental setting.

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

[1] *An Open Source Geographic Information System used by Lithos to access publicly available Government held digital data.*

2 SITE DESCRIPTION

2.1 General

2.1.1 The site's location is shown on Drawing 3407/101 presented in Appendix B to this report. Site details are summarised in the table below.

Detail	Remarks
Location	3.0 km northwest of Barnsley town centre
NGR	SE 318 078
Area	4.9 ha (12.1 acres)
Known services	Overhead electric.

2.2 Site features

2.2.1 Lithos completed a walkover survey of the site on 24th September 2024.

2.2.2 The site can be accessed off Barugh Green Road in the northeast and currently comprises a northern field and the northern extent of an adjoining field to the south, both used as grazing pasture. A herd of cows was present in the field at the time of the walkover.

2.2.3 A drainage ditch runs along the northern boundary adjacent to Barugh Green Road with access over the ditch in the northwest via a concrete 'bridge'. An area of waterlogged, boggy ground is present in the centre north with water appearing to issue from the ground and flow into the drainage ditch.

2.2.4 Hedgerows and (semi)mature trees form the northern, western and southern boundaries of the northern field, with gaps in the southern hedgerow allowing access into the southern field. A mature oak tree is present in the northeast corner of the northern field.

2.2.5 Two sets of overhead electric cables on wooden poles cross the southeast of the site orientated northeast-southwest. A number of monitoring wells were noted across the site.

2.2.6 Existing salient features, at the time of the walkover are presented on Drawing 3407/103 in Appendix B to this report, and summarised in the table below.

Feature	Remarks
Current access	Off Barugh Green Road in the northwest
Topography	Gently slopes down towards the northeast corner
Approximate areas	49,000m² grass
Nature of boundaries	North & west – hedgerow and trees East & south – post & wire fence
Surrounding land uses	North – Barugh Green Road with industrial units beyond East – Claycliffe avenue with housing beyond. South & west – open fields

2.2.7 A selection of site photographs is included on Drawing 3407/104.

3 SITE HISTORY

3.1 In order to investigate the development history and previous land uses at the site and immediate surrounding land, site centred extracts from Ordnance Survey (OS) plans dating back to 1855 have been examined. 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 with respect to the proposed end use. It is not the intention of this report to describe in detail all the changes that have occurred on or adjacent to the site. Significant former uses/operations are highlighted in **bold** text for ease of reference.

Date	Site	Surrounding land
1855	Open fields separated by hedgerows with a **stream** crossing the northwest corner orientated southwest-northeast	Open fields in all directions Unnamed road immediately beyond northern boundary Red Brook Bleach Works 150m east
1993	No significant changes	Houses immediately northwest and northeast
1906		Bleach works relabelled Linen Works
1931		Railway line 110m northeast **Barugh Coke & By-Product Works** (including chemical works and tanks) from 200m northeast
1938		Barugh Green Road labelled immediately north Claycliffe Avenue and Mawfield Road with housing development immediately east
1948		Expansion of residential area to the east
1956	Overhead electric cable crosses southeast corner orientated northeast-southwest	No significant changes
1962	Stream in northwest rerouted around the site's boundary Drain crosses southeast corner orientated northeast-southwest	Chemical works to the northeast no longer shown
1966	No significant changes	Land to the south and west labelled **Opencast Workings** Barugh Coke & By-Product Works no longer shown Slag heap/Tip shown from 150m east/northeast
1970	Electric cable and drain in the southeast no longer shown	Engineering Works and Garage shown beyond Barugh Green Road to the north
1973	No significant changes	Land to the south and west no longer shown as opencast workings Railway line to the northeast no longer shown Tip to the northeast shown to be disused
1983		Expansion of works building to the north
1993		Area of former tip 150m northeast labelled as Disused Workings
2000		New road constructed over former tip to the northeast
2024	Drain labelled on northern boundary	Significant expansion of the industrial estate to the north

3.3 Although none of the OS maps indicate opencast mining has taken place on site, it falls within the wider area of the Craven I and II opencasts (see Section 5.4).

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). The responses received from the Coal Authority, the BGS and extracts from the Landmark Report are presented in Appendix E.

Issue	Data reviewed	Remarks
Geology	1:50,000 BGS map (Sheet 87) 1:10,000 BGS map (Sheet SE30NW)	Made ground – 'Infilled Ground' (backfilled opencast coal site) shown in the centre, west and far southeast. Drift soils – None mapped. Solid (bedrock) – Pennine Middle Coal Measures (mudstone, siltstone & sandstone). Shallowest coal seam – Gawber Coal outcrops on the eastern boundary with a 'Thin' Coal outcropping in the centre. Swallow Wood Coal at about 15m depth. See further details in Section 5. Strata Dip – Gentle (5°) to the northeast. Faults – None mapped beneath the site. Cavities / Mineral Veins / Fissures – No known featres beneath the site.
Mining Quarrying	Coal Authority BGS maps Historical OS plans	The majority of the site is located within a Coal Mining Development High Risk Area. Further details in Section 4.3 below.
Radon	Public Health England	The site lies in an area where between 3% and 5% of homes are estimated to be above the radon action level. Therefore, basic radon protection measures are required.
Hydrogeology	Environment Agency electronic open data via QGIS	Source Protection Zone? No. Aquifer Secondary A (Solid). Groundwater abstractions? None within 1km. Soil leaching potential - Medium. Pollution incidents? None of significance.
Hydrology	Defra Catchment data explorer Envirocheck Report	Nearest watercourse(s) – Drainage ditch on northern boundary flowing east. Water quality – Located within River Dearne from Cawthorne Dyke to Lundwood STW catchment area currently achieving moderate ecological status. Pollution incidents? None of significance. Abstractions? None within 1km. Discharge consents? Nearest consent 190m east operated by Yorkshire Water Services Ltd with sewage effluent (storm effluent) discharging to an unspecified watercourse.
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 Local knowledge

4.2.1 Lithos have undertaken ground investigation on land within 250m of the current area of interest. Review of the geological plans shows similar geology, with Pennine Middle Coal Measures bedrock mapped and areas of backfilled opencast recorded by both the BGS and Coal Authority. Generalised findings are discussed below.

4.2.2 A programme of works including trial pits/trenches and boreholes were advanced across the site which encountered made ground (Opencast Backfill) up to 13.5m depth. The made ground was typically characterised as either cohesive or granular with variable cobble and boulder content. Boulders were described as mudstone and siltstone ranging in size from 0.4m to >1.2m.

4.2.3 Highwalls associated with the former opencast were located typically close to that recorded on the CA abandonment plan, with angles of up to 45° in residual soil and up to 80° through bedrock. An 'island' in the opencast was identified beneath 1m to 3.5m of made ground.

4.2.4 Beyond the former opencast, natural ground typically comprised residual soil (clay and gravel) underlain by Coal Measures bedrock (mudstone, siltstone and sandstone). Some made ground was identified beyond the former opencast associated with 'overspill' and regrade following restoration of the workings.

4.2.5 The above suggests that the abandonment plan for the opencast (which is also included in the current area of interest) may be reasonably accurate, and that deep made ground associated with former opencasting operations will be present in the west of the site as mapped by the CA and BGS.

4.2.6 Deep probeholes were advanced across the site, including through the opencast, to determine if mineworkings were present in any of the underlying shallow coal seams (including the Thin, Swallow Wood and Top Haigh Moor). No evidence of mineworkings was encountered in any of the 56 probeholes advanced.

4.3 Mineral safeguarded areas

4.3.1 The site is underlain by **coal** and might therefore be considered by the Local Authority to lie within a Mineral Safeguarding Area (MSA).

4.3.2 MSAs are areas of known mineral resources that are of sufficient economic or conservation value to warrant protection for generations to come. The purpose of MSAs is not to preclude automatically other forms of development, but to make sure that mineral resources are adequately and effectively considered in land-use planning decisions.

4.3.3 Specialist guidance on Mineral Safeguarding "A Guide to Mineral Safeguarding in England" has been produced by The Coal Authority and the British Geological Survey.

4.3.4 Chapter 17 of the National Planning Policy Framework (NPPF) requires Local Authorities to facilitate the sustainable use of minerals, and planning policies should:

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

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

4.3.6 As a consequence of the NPPF, and the presence of coal beneath the site, the Local Authority may require Avant to consider the opportunity to recover (extract) the coal.

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

4.3.8 Applicants submitting planning applications may need to demonstrate to the Local Authority that they will extract the coal, unless:

- It can be shown it is not economically viable to do so, or
- It is not environmentally acceptable to do so, or
- The need for the development outweighs the need to extract the coal, or
- The coal will not be sterilised by the development

4.3.9 Surface extraction of coal here is considered **very unlikely** to be viable given largescale removal of coal (opencast) has already taken place and the site is in close proximity to adjacent residential properties.

4.3.10 Prior extraction of minerals would have the potential to cause unacceptable impacts on neighbouring properties and infrastructure, including noise, air quality, traffic impacts and land stability. However, it would be prudent to seek further advice from a Minerals Surveyor.

4.4 Landfills

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

Location	NGR (proximity to site)	Remarks	Source of data
Cannon Way	SE 316 080 (100m northwest)	Accepted inert waste although dates of input are unknown. Currently occupied by retail units.	EA electronic open data via QGIS Envirocheck Report OS plans
South Yorkshire Industrial Estate	SE 321 079 (120m east)	Accepted inert and commercial waste between 1983 and 1990. Currently developed with retail unit and offices	
Wilthorpe Road	SE 322 078 (230m east)	Accepted inert waste between 1983 and 1988. Currently occupied by dense vegetation, gardens and residential properties	

4.5 Hazardous gas

Methane & carbon dioxide

4.5.1 The site might be affected by sources of hazardous gas generation as it is:

- Located within 250m of known former landfill sites
- Anticipated to be underlain by significant areas of deep opencast backfill

4.5.2 Consequently, monitoring is recommended in order to determine appropriate gas protection measures for the proposed dwellings.

Radon

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

4.5.4 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.

4.5.5 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.

4.5.6 The HSA website radon map indicates that the site is in an area where **3% to 5%** of homes are estimated to be above the action level, and **basic** radon protection measures are required in new dwellings.

4.5.7 Basic radon measures comprise a radon resistant barrier* (membrane) laid within the floor construction and across the wall cavity in accordance with BR211:2023[2]. The joints between the sheets that form the membrane and cross the cavity **must** be sealed, along with all service penetrations, to make the construction as airtight as possible. A separate cavity tray should be installed in the cavity one brick course above the radon membrane. In order to withstand the installation and follow on construction process membranes should be no less than 400 microns thick.[3]

4.5.8 BRE211:2023 highlights the importance of good practice and a high standard of workmanship to ensure radon membranes are installed to a high standard.

4.5.9 A building site is a harsh environment and barriers can easily become damaged during construction by operatives or equipment moving across or working over a completed section of barrier. As a consequence, where there is a risk of puncturing the membrane, it should be ensured that the membrane is well protected with sand or lean mix concrete before advancing construction.

4.5.10 The radon protection system should be subject to inspection and verification by a third party inspector that has a full understanding of all elements of the radon protection system.

4.5.11 Verification should be carried out at a minimum frequency of 1 in 10 plots where groundworkers carry out installation, and 1 in 20 plots where accredited installers are used. Plots selected for inspection should be located across the development and not clustered.

4.6 Agriculture

4.6.1 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.

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

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

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

Agricultural activity	Potential contaminant
Sewage farming, slurry spreading	Methane, metals, nitrates, oxygen depletion
Plant & animal protection	Pesticides & herbicides
Soil conditioners	Metals, sulphates, PAH
Field sports	Lead shot
Waste burial, land levelling, backfilling ponds/quarries	Methane, metals, PAH etc
Naturally occurring contaminants	Arsenic, metals

4.6.2 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.

4.6.3 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 GEOLOGY & MINING

5.1 General

5.1.1 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 preliminary mining risk assessment required by the proposed planning application.

5.1.2 About 70% of the site is located in a Coal Mining Development **High Risk Areas**; areas with specific mining legacy risks to the surface, including mine entries, shallow underground workings etc. The remaining c. 30% lies in Development **Low Risk Area**; within the Coalfield, but no defined risks have been identified to date but there might still be unrecorded issues.

5.2 BGS information

5.2.1 BGS mapping shows that solid geology beneath the site comprises Pennine Middle Coal Measures (undifferentiated mudstones, siltstones and sandstones). Strata typically dip at 5° to the northeast.

5.2.2 The 1:10,000 BGS map (SE30NW) suggests that the following coal seams underlie the site at shallow depth (youngest/shallowest first):

Seam name(s)	Approximate thickness/m	Approximate depth below Gawber/m*	Remarks
Gawber Coal	0.7	-	Outcrops in the far east, and only underlies land in the far east (c. 500m²)
Thin coal	-	10	Outcrops in the centre and underlies land in the eastern half (c. 2.3ha)
Swallow Wood Coal	1.2	15	Outcrops to the west, and underlies the entire site
Top Haigh Moor	1.2	45	This deep seam lies about 30m below the Swallow Wood, with strata between the two seams likely to comprise Haigh Moor Rock (sandstone)

5.2.3 Approximate coal **outcrops**, based on BGS information, are shown on Drawing 3407/108.

5.2.4 It should be noted that outcrops shown on BGS maps have been known to be inaccurate by distances in excess of 100m.

5.2.5 A BGS publication (Geology of the Barnsley district) suggests that all of the named seams at shallow depth beneath the site have been worked in the wider area.

5.3 CA Report

5.3.1 A Consultants Mining report has been obtained from the Coal Authority which states that:

- Known workings have taken place in 4 seams, the shallowest of which is the Flockton Thick Coal (0.7m thick) at c. 120m depth, last worked in 1960.
- The site is not underlain by probable unrecorded shallow workings.
- There are no known spine roadways at shallow depth.
- There are no mine entries within 100m of the site.
- Two areas of opencast coal extraction are present on site. Abandonment plans have been obtained; see Section 5.4 below
- There are no faults, fissures or breaklines recorded on site.
- There are no CA managed tips within 500m.
- There are no claims for subsidence damage within 50m of the site
- There are no mines gas emissions recorded within 500m.

5.3.2 All of the known (recorded) mineworkings beneath the site are within seams that are too deep to influence surface stability.

5.3.3 It should be noted that there may be mine entries located within the site's boundary which the Coal Authority have no record of. Implications associated with the presence of mine entries, and likely treatment requirements are discussed in Section 5.6.

5.4 CA abandonment plans

Underground workings

5.4.1 The shallowest recorded mineworkings beneath this site are in the **Flockton Thick** seam (c. 0.7m thick) at a depth of about 125m bgl. An abandonment plan has been obtained for these workings; see Drawing 3407/110.

5.4.2 As discussed above, these workings are not considered a risk to surface stability given the recorded thickness of these workings and the depth at which they lie.

Opencast workings

5.4.3 Extensive opencast workings (Craven I) of the **Swallow Wood** Coal and the **Thin** Coal, are shown in the north and west of the site on CA plans, extending beyond the western boundary. Further opencast workings (Craven II) to the south of the site are shown to encroach slightly within the southern boundary.

5.4.4 A summary of each opencast site is provided in the table below:

Opencast Site	Seams Worked	Dates of Working	Completion of re-soiling & handing back to agriculture	Total Area Worked/ Coal Removed	Approximate area of site underlain by opencast backfill
Craven I	Swallow Wood Thin Coal (far northeast)	10th July 1950 to 20th Nov 1951	July 1952	11.9 ha (29.3 acres) 80,697 tons	1.9 ha (c. 40%)

Opencast Site	Seams Worked	Dates of Working	Completion of re-soiling & handing back to agriculture	Total Area Worked/ Coal Removed	Approximate area of site underlain by opencast backfill
Craven II	Low Haigh Moor Top Haigh Moor Swallow Wood Thin Coal Gawber (far east)	29th April 1957 to 7th Feb 1963	Not provided	33.1 ha (81.9 acres) 775,929 tons	300m² (<1%)

5.4.5 The abandonment plans include base contours for each seam worked (at 10' intervals) and occasional original ground levels; review of these suggest that in the Craven I opencast (within the area of current interest), excavations were:

- Between around 6m and 10m deep for the Swallow Wood Coal
- Between around 1m and 5m deep for the Thin Coal

5.4.6 The above suggests there could be an internal high wall, or step, between the majority of the opencast where both the Thin and Swallow Wood seams were extracted and the far northeast where only the shallower Thin Coal was removed.

5.4.7 Within the Craven II (area underlying the far southeast of the proposed development) excavations are likely less than 5m deep (but deepening quickly to the south, beyond the site's southern boundary).

5.4.8 Abandonment plan NE.498 includes a vertical section (copied on Drawing 3407/109) which is summarised below.

Seam name(s)	Approximate thickness/m	Approximate depth below Gawber/m	Remarks	Coal quality
Gawber Coal	0.91	-	Comprises two beds of coal (each 0.25m thick), separated by a 0.4m dirt parting.	Top leaf: Good Bottom leaf: Moderate (high sulphur content)
Thin coal	0.34	7	Underlain by 0.6m of Fireclay.	Excellent
Swallow Wood Coal	0.91	15	Comprises two beds of coal (0.2m & 0.4m thick), separated by a 0.3m dirt parting.	Top leaf: Excellent Bottom leaf: Good, but numerous pockets of pyrites
Top Haigh Moor	1.12	29	Comprises three beds of coal (0.36m, 0.2m, & 0.25m thick), separated by two thin dirt parting. Underlain by 0.3m of Fireclay.	Top leaf: Moderate Middle leaf: Inferior, with high ash. Bottom leaf: Good
Low Haigh Moor	0.89	37	Comprises two beds of coal (0.25m & 0.4m thick), separated by a 0.25m dirt parting.	Top leaf: Good Bottom leaf: Good

5.4.9 Given the dip of underlying strata, existing topography and information in the table above, the Swallow Wood Coal is anticipated to lie at depths of between c. 6m in the centre west and c. 15m in the northeast.

5.4.10 The Craven I opencast did not extend across the entire site to the eastern boundary and therefore the maximum depth of backfill is likely to be less than 15m deep. Indeed, the abandonment plan suggests the excavation was about 11.5m deep at its lowest point.

5.4.11 The vertical section summarised above is considered to be more accurate/reliable than the more generic information provided on the 1:10,000 BGS map (SE30NW). The most notable difference between the two is that the Top Haigh Moor is shallower than indicated on the BGS map legend.

5.4.12 Consequently, any unrecorded mineworkings within the Top Haigh Moor seam are likely to be around 15m below the base of the opencast (i.e. c. 25m depth), compared to 30m as indicated on the geological map stratigraphic column.

5.4.13 Depths in the above table are based on ground levels prior to opencast works. Ground levels post remediation are not known as no current topographical survey has been provided, but they are likely to be similar to original levels.

5.4.14 High walls associated with the opencast workings are shown in the north and centre of the site, along with a narrow 'spur' located in the west, extending off site to the west (Craven I). High walls associated of Craven II opencast are shown just within the southern site boundary, extending off site to the south. The location, height and slope angle of the high walls will have implications for any proposed layout and foundations of proposed plots.

5.4.15 Abandonment plans showing the extent of opencast obtained from the CA are reproduced as Drawing 3407/109 in Appendix B to this report. These plans provide a record of the mine prior to backfilling and are therefore likely to provide a good approximation of the extent of operations, as well as the location of any high walls present.

5.4.16 Whilst the centre of the site is indicated by the CA to be Low Risk, and there are no known workings, the possibility of unrecorded workings cannot be entirely discounted. Consequently, an intrusive mining investigation in this area would be prudent and will be required in the east and west anyway.

5.5 Unrecorded mineworkings

5.5.1 Coal has been mined in Yorkshire for centuries, and there are also likely to be unrecorded mineworkings which pre-date the requirement for abandonment plans (Coal Mines Regulation Act of 1872). Early mining methods included drifts or adits from outcrop. Where mining extended further from the crop, bell pits were often sunk, and as the coal got deeper still, shafts were used to access gallery workings (pillar & stall).

5.5.2 The shafts associated with bell pits are typically only about 1.2m in diameter, and the bell pit itself was typically 5m to 10m in diameter (bell pit size would have been constrained by roof stability). Consequently, bell pits are often closely spaced; the most intensive concentration of shafts recorded to date (66 per acre) was at the Middleton Broom Opencast site.

5.5.3 As coal was removed during bell pitting, the unsupported strata above assumed an inverted slope of stability, generating a bee-hive shape around the base of the shaft which forms the characteristic vertical section. The depth limit of bell pit mining is almost certainly 15m, and this is considered a deep bell pit; the vast majority were probably less than half this depth.

5.5.4 At greater depths, pillar and stall workings appear to have been the preferred method, and such workings were often accessed via a single shaft. Consequently, shafts associated with such workings are more widely spaced; but rarely exceeded one quarter of a mile (400m) shaft to shaft, due to problems with ventilation and underground haulage. It was customary to view the life expectancy of an individual pit as about three to five years and at any one time several new pits would be sinking to replace those currently operating.

5.5.5 Up until the last decades of the eighteenth century, coal mining almost always represented a short-term interruption to ongoing use of land for agricultural. The right to sink shafts and extract coal was usually conditional upon restoration of the surface after coal extraction was complete. This not only involved filling the shaft, but also required that any subsequent settlement of shaft fill material did not result in depressions in the field surface. Consequently, it was usual to fill the shaft and heap excess arisings into a dome over the shaft eye. Over subsequent years, the dome supplied material to compensate for settlement of the shaft fill. In the normal course of events, at the conclusion of the recovery period, any remaining spoil

accumulations above ground level would have been planed-off to leave a relatively stable, level surface where the shaft had been.

5.5.6 Bell pits may be present at Barugh Green. If they are, given the likely depth constraints discussed above, it seems likely they will be limited to workings in the Thin and Swallow Wood seams beneath about 2.5 ha (6 acres) of land in the east.

5.5.7 Given the absence of loose superficial deposits, it is considered unlikely that mine entries at would have been lined.

5.6 Mining risks

Mining risks – Summary

5.6.1 The table below summarises the potential risks associated with coal mining legacy for the proposed development site, identified from list sources of information.

Coal mining issue	Yes	No	Remarks
Coal outcrop(s)	X		Combustion risk
Coal mining geology (fissures)		X	-
Record of past mine gas emissions or potential	X		Possible gas risk from unrecorded workings and/or backfilled opencast
Mine entries (shafts and adits)	X		Possible unrecorded bell pits
Underground coal mining (**recorded** at shallow depths)		X	**-**
Underground coal mining (**probable** at shallow depths)	X		Surface instability from collapse of workings
Surface mining (opencast workings)	X		Deep made ground with high walls at the opencast boundary
Recorded coal mining surface hazard		X	-

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

5.6.3 Risks include:

- Mines gas
- Combustion
- Unrecorded, mine entries
- Collapse of shallow mineworkings, with consequent subsidence affecting surface stability
- Unrecorded workings beneath the opencast backfill
- Potential issues associated with deep opencast backfill
- High walls

5.6.4 Current UK guidance, CIRIA C758D[4], provides information and guidance for engineers and geologists with respect to the design of: mining investigations; foundations; and remedial measures.

Mining risks – gas

5.6.5 Gas monitoring and a hazardous gas risk assessment will be required and is proposed (see Section 8.1).

[4] *CIRIA C758D:2019. Abandoned mine workings manual*

Mining risks – combustion

5.6.6 Where coal is exposed during any site preparatory earthworks, or within excavations, care should be taken to avoid the potential for spontaneous coal combustion.

5.6.7 If any foundation excavation comes into contact with coal, the foundation should be taken through the coal seam, into underlying natural in-situ strata of adequate bearing. The full thickness of coal should then be sealed with mass concrete fill placed as soon as possible after exposing the seam to prevent the ingress of air.

5.6.8 Any ground investigation and\or drilling for grouting purposes should be carried out to HSE and Coal Authority guidelines to minimise the risk of coal combustion and potential for migration of mine gases into neighbouring properties.

Mining risks – mine entries

5.6.9 The Coal Authority does not hold any records of known mine entries on site. However, it is possible that unrecorded "shallow" shafts (possibly bell pits) are present in the east.

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

5.6.11 A topsoil strip will be required prior to construction and the exposed surface should be carefully inspected for evidence of unrecorded mine entries.

5.6.12 The Coal Authority discourage development over or adjacent to shafts. However, such features are typically of less concern where they only extend to relatively shallow seams. The recommended no build zone around deep shafts is usually defined by a line drawn up at 45^{o} from the top of the shaft, where it intercepts rock head.

5.6.13 Once located, each shaft should be accurately located by grid co-ordinates, proved to its base, pressure grouted and then be capped off at rockhead level. A shaft cap is generally required to be twice the shaft diameter and designed to support the depth of fill above plus any surcharge loads. Detailed cap design is beyond the scope of this report but should also include gas venting measures.

5.6.14 At all shaft locations bedrock is likely lie within 3m of ground level. Consequently, these shafts should be capped at or below rockhead. The cap should be a least twice the internal diameter of the shaft and be designed by a competent structural engineer.

Mining risks – shallow underground mineworkings

5.6.15 As noted in Section 5.3 above, all **known** mineworkings beneath the site are at sufficient depth as to not affect surface stability.

5.6.16 However, there may also have been earlier, **unrecorded** mineworkings via bell pits and/or pillar and stall methods at shallow depth, and if present these could result in unpredictable subsidence.

5.6.17 Individual pillars may collapse at any time, leading to settlement in the overlying strata. As the mine roof degrades and collapse the void migrates upwards, sometimes causing a surface collapse or crown hole.

5.6.18 The vertical distance through which a void can migrate is difficult to assess. Made ground and superficial deposits are considered to have no inherent strength and the assumption is

generally made that if a void reaches the base of these formations, it will reach the surface.

5.6.19 CIRIA C758D[5] notes that given the limited evidence of structural damage caused by pillar failure, compared with that resulting from roof collapses, engineering assessment of the potential for surface instability has focused on the latter. Failure of roof strata results in the progressive transmission of the void upwards through overlying rock. The extent of 'void migration' can be influenced by factors such as: strata dip; bulking characteristics of the collapsed rock or soil; capability for arching of the collapsed zone; groundwater flow and the presence of strong and intact rock layers with the ability to span that may attenuate the upward movement.

5.6.20 The limit height on the void migration, where no appreciable surface subsidence results, is often termed 'acceptable cover', with its determination based upon a criterion reflecting the worked thickness of the seam and the rock cover. The acceptable cover criterion is generally represented as ht, where 'h' is the thickness of rock above the workings expressed as a multiple of t, the worked thickness. This has been a popular approach because the two elements can be reasonably well determined via conventional ground investigation.

5.6.21 Most evaluations of required bedrock cover come from the examination of Coal Measures mines. In these, it has been observed that the height of migration in bedrock might, exceptionally, extend to 10 times the height of the original extraction. Consequently, the 10t criterion has, for over 30 years, been adopted by the industry as providing reasonable assurance against surface subsidence resultant from roof collapse in old, room and pillar mines. However, collapses might attenuate within a lesser cover and there will be circumstances where using the 10t criterion could be considered overly conservative.

5.6.22 That said, a Coal Authority Technical Guidance Note[6] which describes a subsidence event that affected a number of properties on a housing estate in north-east England in 2016, concluded that the 10 times rock cover guidance is only a 'rule of thumb' for crown hole collapses. Other subsidence mechanisms can occur, such as pillar failure, for which the 10 times rock cover rule of thumb is not an appropriate guide.

5.6.23 Mitigation of the risks posed by the shallow mineworkings will be required, and this could be achieved in one of two ways:

- Extraction of the remaining coal
- Consolidation, via drilling & grouting

Unrecorded workings beneath the opencast backfill

5.6.24 The Top Haigh Moor Coal (c. 1.2 m thick) is expected to lie about 14m below the base of the opencast. There are no recorded mineworkings in this seam, but the possibility of unrecorded workings cannot yet be discounted.

5.6.25 Whilst there might be in excess of 10 times rock cover above any mineworkings in the Top Haigh Moor, the presence of workings below pile toes can become a concern, especially for end-bearing pile groups. Piling over shallow mineworkings (even after grouting) is not common practice.

5.6.26 Founding piles above a system of **untreated** workings is not recommended because collapsed workings are rarely in a permanently stable condition and so have some form of residual settlement potential. Thus, either creep settlement, strata relaxation or collapse migration remain intermittent subsidence possibilities.

5.6.27 CIRIA C758D provides advice:

[5] *CIRIA C758D:2019. Abandoned mine workings manual*

[6] *Coal Authority, TGN01/2019. Findings from a large subsidence event on a residential estate.*

- If workings occur within 20m of surface it would be unusual to find a satisfactorily thick and rigid founding stratum for highly-loaded piles above, and sufficiently isolated from, the workings. When loadings are light (e.g. for houses), a suitable horizon might be available, but often piles will need to penetrate the workings to found in a stable stratum adequately below the disrupted floor of the workings.
- Whatever the depth of workings, even if they are thought to be fully filled or the roof strata to be rigid, piles should not be terminated immediately above an untreated worked horizon because this could concentrate load on a potentially unstable stratum which may initiate eventual collapse.
- The objective of a conventionally spaced, over-site grout treatment grid is to ensure against surface settlements. It will not adequately serve below ground support for individual piles. Grid separations exceeding 3m in partially collapsed or back-stowed workings are prone to uneven grout distribution and leaving isolated untreated areas or discrete void pockets.
- It should be recognised that pressurised grout treatments (even if enhanced) are unlikely to achieve full closure or permeation of randomly distributed or occluded voids, especially if water-filled. This consequence of earthworks treatments is well known, but also it is industry wisdom that grout acceptance maximises at about 90-95% of voidage).
- When there is a continuing risk of subsidence or residual movements, piles should be taken into competent strata below any seam floor disruption and heave consequential on the workings. Ground treatments should be scheduled to mitigate both installation effects and future settlements.
- Piling above workings might be possible where sufficiently reliable strata (e.g. a substantial massive and competent bed of sandstone) are present to enable a detachment zone to be defined, or created by enhanced ground treatment. The thickness of this zone will depend on the pile installation method and the size and loading of the pile group.

5.6.28 When a prospective horizon is present, the following key issues, should be examined before deciding if the proposal is viable:

- depths, dip and thickness of the subsidence restricting horizon
- geotechnical and geomechanical properties of the restricting horizon
- separation between pile toe level and the restricting horizon (i.e. the detachment zone)
- establishing that past collapses have arrested at the restricting horizon
- specific connectivity arrangements at pile heads/caps.

5.6.29 To enable piles to found at a higher level than a significantly stressed worked seam, bulk filling of open workings or grout treatment should be carried out beforehand as standard practice. If grouting, a more comprehensive treatment regime than for spread foundations will be required to produce reliable higher strength characteristics in the intensely stressed zones. These strengths should be specified via the grout mix and validated afterwards.

Mining risks – Potential issues associated with deep opencast backfill

5.6.30 It is considered likely that the backfill within the Craven I and Craven II opencasts was placed without systematic mechanical compaction in irregular and thick layers, without any screening to remove oversized materials or degradable waste etc. Such material poses a risk to any proposed development due to the potential for differential settlement and long term 'creep' settlement.

5.6.31 It is understood that the backfill has been in place for c. 70 years at Craven I and c. 60 years at Craven II opencasts.

5.6.32 Settlement of deep made ground is initially (first 5 years or so) predominantly associated with immediate settlement and inundation (caused by changes in the water table depth and/or surface water infiltration) as groundwater levels return to equilibrium (i.e. pre opencasting).

5.6.33 Consolidation settlement is associated with a reduction in volume caused by expulsion of water from soil pores and transfer of load from excess porewater pressure to the soil particles.

5.6.34 Creep compression occurs as the particles of fill become more closely packed, under conditions of constant effective stress (arising from self-weight of the fill). Although the movements caused by creep are relatively small, often it is these long-term movements that are of most interest to foundation performance. Many coarse fills show a linear relationship between settlement and the logarithm of the time that has elapsed since the fill was placed (i.e. settlement that occurs during the first 10 years (log cycle 1) is similar to that from years 10 to 100 (log cycle 2).

5.6.35 Where development on deep fill takes place, in addition to any ongoing creep associated with self-weight, settlement is caused by the imposed foundation loads and load as a result of any ground level increases. This leads to some immediate compression and consolidation within stressed zones.

5.6.36 The strength/density of the backfill materials is likely to vary over relatively short distances, especially across the line of buried high walls.

5.6.37 At this stage, and subject to the findings of an intrusive ground investigation it is considered likely that the presence of deep opencast backfill beneath this site will have implications for:

- Foundations – likely grillage type foundations (or possibly rafts) following ground improvement; possibly piled if backfill is less than c. 10m thick.
- Drainage – likely need for placement at maximum possible gradients using flexible connections to prevent any backfalls should differential settlement of the fill occur. Potential need for piling of manholes
- New utilities – should be constructed of flexible materials. Electricity and communications cabling should also be laid with sufficient 'slack' to accommodate a degree of movement. The use of flexible joints is recommended where possible, particularly where service connections extend across a rigid/flexible structure interface (e.g. from a piled foundation into a garden area)
- Highways - a specification will need to be agreed with the adopting authority, but reinforcement of the road construction over high walls will probably be required.

5.6.38 Geotechnical characteristics of opencast backfill are related to the nature of the excavated overburden, how it becomes mixed, how it is placed, and any compaction applied.

5.6.39 All opencast backfill is subject to some settlement caused by self-weight which is partly governed by initial thickness. The characteristics of each backfill will be unique and its potential capabilities, at the time of development, depend on many factors.

5.6.40 The foundation solution should allow for the consequences of recovery of internal groundwater levels within the opencast backfill. Precautions may also be required to avoid detrimental effects from surface water infiltration. The location and detailing of drains and other trenches, and the provision of hardstanding aprons, requires attention to prevent extraneous waters deteriorating the fill.

5.6.41 However, in the context of land that has been subject to opencast coal extraction, this site can be considered relatively low risk given the limited depths of fill (c. 12m) anticipated. Fill thicknesses mean that consideration can be given to a piled foundation solution and/or a heavily reinforced strip footing.

5.6.42 If piled foundations are adopted for plots underlain by opencast backfill there should be a reduced need for further significant geotechnical analysis / modelling, although specialist piling contractors will require more data (i.e. cable percussion boreholes, possibly with rotary

core follow-on).

5.6.43 Conversely, if grillage type foundations (or rafts) are preferred, significant further investigation and assessment will be required. This should commence with a review of case study data relating to other deep backfill sites, to enable preliminary estimates of anticipated settlement.

Mining risks – High walls

5.6.44 It is generally considered wise not to build over high walls and such areas are usually reserved for non-critical uses such as landscaping. Utility routes in the vicinity of high walls need careful selection.

5.6.45 However, building in the crest region might be possible if split foundation types are used to reach undisturbed natural ground.

5.6.46 It will be necessary to ensure the construction of a reliable rock socket at the high wall. This could be problematic if there are concerns about slope strata integrity (which can occur where a fault has determined the extraction boundary).

5.6.47 Furthermore, if there are unrecorded workings in the coals that were extracted, these could influence surface stability in the vicinity of the high wall.

5.6.48 Away from the crest, and over the buried slope, it should be expected that shallow foundations on opencast backfill will tilt due to differential settlement. The zone of potential unacceptably large tilt of foundations will be dependent upon:

- the angle of the opencast slope
- depth below development level at which the crest is buried
- depth below development level to the toe of the slope
- the mass modulus of the fill/made ground.

5.7 Ironstone

5.7.1 As well as containing valuable coal seams, the Coal Measures include bands of ferrous rich ironstone which have historically been extracted by both underground and surface methods as a raw material for the production of iron and steel.

5.7.2 The BGS memoir notes that iron ore extraction and smelting took place in the surrounding area since the roman period, reaching its peak between the 12th and 17th century.

5.7.3 The major ironstone horizons of the general area are associated with coals which are not present beneath this site, however the Swallow Wood Mine (an ironstone band) which lies stratigraphically above the Swallow Wood Coal has been subject to localised extraction.

5.7.4 Consequently, it cannot be discounted that ironstone may have been extracted in underground workings located just above the Swallow Wood Coal.

5.7.5 In Lithos' experience ironstone extraction usually takes place alongside coal extraction (often within the same mine) and therefore it may be the case that underground workings of the Swallow Wood Coal could have also removed ironstone. This often results in ironstone workings being mistakenly identified as coal extraction, and with the total possible thickness of workings being under-estimated.

6 PRELIMINARY CONCEPTUAL SITE MODEL

6.1 Potential contaminants

6.1.1 An assessment of potential contaminants associated with the former uses has been undertaken with reference to CLR8. As a consequence of this assessment, anticipated potential contaminants, within soil and/or groundwater include:

- Inorganics (metals associated with made ground and the possible use of pesticides and fertilisers)
- Asbestos &/or ACMs within the made ground
- PAH (associated with opencast backfill
- Sulphates

6.1.2 Beyond the former opencast, the site is essentially greenfield, although farming activities may have given rise to some (likely minor) contamination; see Section 4.6.

6.1.3 A preliminary conceptual site model, presented as Drawing 3407/105 in Appendix B, has been prepared after consideration of all the data presented in Sections 2 to 5 inclusive of this report.

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

6.1.5 The most significant potential contaminant **pathways** include:

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

6.1.6 The most significant potential contaminant **receptors** include:

- The environment – Secondary A aquifer and field drain leading to offsite watercourse
- End users of the site (residents)

6.1.7 Clearly, the conceptual model will be subject to modification in light of data arising from the proposed intrusive ground investigation.

6.2 Anticipated ground conditions & potential issues

6.2.1 Based on the data reviewed in Section 4 (Environmental Setting) and 5 (Geology & Mining), anticipated ground conditions are expected to comprise:

Anticipated condition	Remarks
Made ground	Deep made ground (up to c. 12m) of variable composition anticipated within areas of former opencast which is likely to include oversize material and obstructions
Natural soils	Topsoil over residual soils (gravelly clay/clayey gravel) from weathering of bedrock
Bedrock	Mudstone, siltstone and sandstone at shallow depth beyond areas of former opencast with bedrock at c. 5m to 12m depth 'inside' opencast area
Mineworkings	Possible unrecorded workings at shallow depth beyond areas of former opencast with deeper workings possible beneath the opencast
Groundwater	Perched water likely present in made ground with 'true' groundwater likely at depth in bedrock

6.2.2 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. Naturally occurring contaminants 2. Farming related activities 1. Opencast backfill	1. Metals in topsoil 2. See Section 4.6 3. Backfill material may include asbestos and be potentially combustible
Potential off-site contamination sources	1. Landfill 2. Backfilled opencast	1. Generation and migration of hazardous gas 2. Generation and migration of hazardous gas
Potential geotechnical hazards	1. Below ground obstructions (boulders) 2. Deep made ground 3. Opencast high walls 4. Shallow workings	1. Opencast backfill likely to contain oversize material 2. Unsuitable founding stratum 3. Layout should take account of high walls to ensure plots do not span these 4. Possible unrecorded workings leading to surface instability
Other potential constraints	1. Overhead utilities	1. Overhead electric (11kV) cables

7 LAND CONTAMINATION – PART IIA & PLANNING

7.1 Local Authorities have responsibilities with respect to land contamination in the context both of Part IIA of the Environmental Protection Act 1990, and Planning.

7.2 The contaminated land regime in Part IIA was introduced specifically to address the historical legacy of land contamination. It applies where there is unacceptable risk, assessed on the basis of the **current** use and the relevant circumstances of the land. It is not directed to assessing risks in relation to a future use of the land that would require a specific grant of planning permission. This is primarily a task for the planning system, which aims to control development and land use in the **future**.

Planning

7.3 As of March 2012, Planning Policy Statement (PPS23) was replaced by the National Planning Policy Framework (NPPF), supported by web-based planning practice guidance. The NPPF (updated in December 2023) includes the following with respect to contamination and site investigation:

"*Where a site is affected by contamination or land stability issues, responsibility for securing safe development rests with the developer and/or landowner*".

7.4 Planning policies and decisions should ensure that:

- The site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses, and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation
- After remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the environmental protection act 1990
- Adequate site investigation information, prepared by a competent person, is presented'

7.5 Annex 2 of the NPPF states that 'all investigations of land potentially affected by contamination should be carried out in accordance with established procedures (such as BS10175[7])'.

[7] *BS10175 (2011) - Code of practice for the investigation of potentially contaminated sites*

This site

7.6 The underlying bedrock is classified as a Secondary A aquifer. The nearest surface watercourse is a drainage ditch on the northern boundary which flows in an easterly direction. Therefore, the site's environmental setting is considered to be of moderate sensitivity.

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

7.8 Whilst current use of the site is considered unlikely to have given rise to any significant ground and groundwater contamination, former use as an opencast mine may well have.

7.9 However, it is considered that the site should be suitable for the proposed use subject to implementation of appropriate preparatory works.

8 GROUND INVESTIGATION DESIGN

8.1 Ground investigation design & strategy

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

Exploratory holes	Purpose
20 trial pits	To determine the general nature of made ground underlying the site, including the: • Nature, distribution and thickness • Nature, degree and extent of contamination • Proportion of undesirable elements e.g. biodegradable matter, foundations etc • Suitability of the ground for founding structures and highways
10 trial trenches	To delineate the line and geometry of buried opencast high walls
7 lines of stitch drilling	
6 cable percussion boreholes	To retrieve geotechnical data from depth including confirming the strength (density) of opencast backfill via SPTs
3 rotary cored boreholes	To retrieve rock samples from the base of the opencast for geotechnical testing
25 probeholes	To check for the presence of voids or broken ground associated with possible unrecorded shallow mine workings
12 boreholes	To install monitoring wells across the site in order to: • Monitor for hazardous gas • Determine groundwater levels and assess flow direction • Inform foundation design

8.1.2 Proposed exploratory hole locations should be selected to provide a representative view of the strata beneath the site and to target potential areas of interest identified in Section 6.2 above. A nominal 40m grid spacing should be appropriate, with additional exploratory locations scheduled as necessary in light of the ground conditions actually encountered.

8.1.3 Parts of the site were noted to be **wet and soft** during the site walkover. If ground investigation is not undertaken during drier summer months, it may be necessary to use a tracked excavator.

8.1.4 Representative soil samples of natural and any man-made ground should be taken during the works. The number of soil samples taken should be reflective of the geological complexity actually encountered, but in general about 3 samples should be taken from most exploratory holes.

8.1.5 The investigation should be undertaken in general accordance with:

- BS5930:2015 "Code of practice for site investigation"
- BS10175:2017 "Code of practice for the investigation 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)

8.1.6 **Trial pitting / trenching** will enable determination of:

- Nature, distribution and thickness of shallow soils beyond the former opencasts
- Nature of made ground (uppermost 3m to 4m), including:
  - visual/olfactory evidence of potential contamination and the proportion of undesirable elements e.g. biodegradable matter, relict foundations etc
  - the proportion of "oversize", boulder-sized material
  - the location and extent of the opencasts, with some trenching to locate the quarry high wall
- Suitability of the ground for founding structures and highways

8.1.7 The in-situ shear strengths of any cohesive soils encountered should be determined by use of a hand-held shear vane.

8.1.8 Deep made ground is anticipated across much of the site, and consequently **soakaways** will not provide a viable solution for the disposal of surface water.

8.1.9 **Cable percussion boreholes** should be advanced to the base of the opencast backfill (depths of up to 12m), to refusal in underlying bedrock, in order to retrieve geotechnical data from depth. Boreholes will also allow the installation of gas/groundwater monitoring wells.

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

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

8.1.12 SPT's should be performed in made ground, granular soils and firm/stiff cohesive soils on striking (i.e. change of stratum) and then at intervals of 1m to 1.5m. SPTs allow assessment of the in-situ density of granular soils, enabling determination of allowable bearing capacity and thereby definitive foundation advice.

8.1.13 Where possible, undisturbed, thin wall open-tube samples (UT100) should be obtained from the opencast backfill on striking and then alternate with SPTs (except in soft clays where only UT100s will be recovered) at intervals of 1m to 1.5m.

8.1.14 Given the anticipated nature and thickness of the made ground here, piles (if adopted) are likely to be end-bearing in bedrock. In accordance with BS 8004[8] and EC7[9], piling contractors may request that boreholes be extended a minimum 5m into competent bedrock using rotary coring techniques. Consequently, about 3 **rotary cored boreholes** should be extended into underlying bedrock to obtain rock samples for geotechnical testing.

[8] *BS 8004 (2015) - Code of practice for foundations.*

[9] *BS EN 1997-1:2007. Eurocode 7: Geotechnical design – Part 2: Ground investigation & testing*

8.1.15 Approximately 20 **probeholes** should be sufficient to determine whether or not old mineworkings are present in the underlying shallow coal seams. If present, 20 probeholes should also be sufficient to determine whether or not mineworkings pose a significant risk to surface stability of the site (via assessment of seam depths, thicknesses and thicknesses of overlying competent bedrock). However, if a potential risk is perceived to exist, further probeholes may be required to delineate the extent of workings in order to obtain fixed price quotations for the necessary consolidation works.

8.1.16 In addition to the above, about 7 lines of **stitch drilling** should be carried out perpendicular to the opencast high walls to determine deeper geometry (beyond that which can be reached with an excavator).

8.1.17 It will be necessary to submit an application (with the associated fee) to the Coal Authority (CA) for '*Permission to enter CA mining interests*'.

8.1.18 Given the proximity of surrounding housing (within 50m of the north and east), and in accordance with CA requirements it should be assumed that some of the probeholes will need to be advanced using water as the flushing medium.

8.1.19 Routine **geotechnical soils analysis** (moisture content, Atterberg limits, pH, water soluble sulphate) should be scheduled on about 45 samples, with some compaction testing on samples of made ground to assess suitability for use in earthworks ground improvement.

8.1.20 Given the likely presence of potentially compressible made ground, it would be prudent to schedule at least 6 unconsolidated total strength laboratory tests, with one-dimensional analysis to assess the effects of down-drag (negative skin friction) scheduled on 6 undisturbed samples. About 10 pH and soluble sulphate should also be scheduled on deep samples of made ground to assess concrete classification for deeply embedded piles.

8.1.21 Given the possibility of a piled foundation solution been adopted for plots over the backfilled opencast, 6 samples of bedrock should be scheduled for uniaxial compressive strength tests. Determination of point load strength (axial & diametral) should be carried out on a further 18 samples of rock.

8.1.22 Appropriate **chemical analyses** based on the findings of this Report should be allowed for. This is likely to comprise 35 samples for a suite including heavy metals, asbestos ID, TOC, banded TPH (with supplementary speciation where appropriate), and speciated PAH. In the event that ground contamination is more significant or different to that anticipated, it might be necessary to carry out additional chemical testing.

8.1.23 It would also be prudent to analyse about 5 topsoil samples to check compliance with BS3882[10] requirements, via testing for visible contaminants, sharps and clay/sand/silt content.

8.1.24 Monitoring wells should be installed in about 12 shallower probeholes. The generation potential of potential **gas** sources (made ground and possibly mineworkings) is considered likely to be Low. Therefore, in accordance with CIRIA Report C665[11], it would be prudent to initially allow for 9 visits over a 6-month period. A hazardous gas risk assessment should be issued on completion of monitoring.

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

[10] *BS3882:2015. Specification for topsoil. Published by BSI Standards Limited.*

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

9 CONCLUSIONS & RECOMMENDATIONS

9.1 General

9.1.1 The site comprises c. 4.9 hectares of land located in Barugh Green about 3km northwest of Barnsley town centre. The site has essentially remained undeveloped but the west and far southeast were subject to opencast mining between 1950 and 1963.

9.1.2 It is understood that Avant are considering acquisition of the site with a view to redevelopment with housing.

9.1.3 The main issues considered in this report, and in particular in Sections 3 to 5 are based on a review of historical maps and available geological/environmental data. This report provides an assessment of geoenvironmental issues and implications associated with the proposed residential redevelopment of the site.

9.2 Mining and quarrying

9.2.1 The majority (c. 70%) of this site 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).

9.2.2 The remainder of the site is located within a 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).

9.2.3 Extensive opencast workings (Craven I) of the Swallow Wood and the Thin coals, are shown in the west of the site on CA plans, extending beyond the western boundary. Further opencast workings (Craven II) to the south of the site are shown to encroach within the southern boundary.

9.2.4 A summary of each opencast site is provided in the table below:

Opencast Site	Seams Worked	Dates of Working	Approximate area of site underlain by opencast backfill
Craven I	Swallow Wood Thin Coal (far north-east)	10th July 1950 to 20th Nov 1951	2.6 ha (c. 55%)
Craven II	Low Haigh Moor Top Haigh Moor Swallow Wood Thin Coal Gawber (far east)	29th April 1957 to 7th Feb 1963	340m^2 (<1%)

9.2.5 A maximum opencast depth of 12m is anticipated based on information obtained from the Coal Authority. However, intrusive investigation is required to confirm this.

9.2.6 Although there are no known shallow mineworkings beneath the site, unrecorded workings may be present both in the east and beneath the base of the opencast in the centre and west.

9.2.7 It is possible that unrecorded "shallow" shafts (possibly bell pits) may be present in the east (beyond areas of opencast), and consideration could be given to a geophysical survey, although success would be dependent on the "contrast" between shaft backfill and the surrounding ground (i.e. the survey is likely to be more successful if shaft backfill is significantly different material or less dense than the surrounding ground). Follow-up intrusive investigation (pitting) would be recommended to determine the cause of any anomalies identified by the geophysics.

9.2.8 If bell pits are present, given the likely depth constraints discussed in Section 5.5, it seems likely they will be limited to the east; perhaps about 45% of the total site area.

9.2.9 Given the absence of loose superficial deposits, it is considered unlikely that such mine entries would have been lined.

9.2.10 Whilst the Coal Authority (and NHBC) discourage development over or adjacent to all mine entries, Lithos consider such features to pose a low risk to surface stability where they only extend to relatively shallow workings that require treatment (grouting). Consequently, we would not expect any (previously unrecorded) shallow shafts, encountered during site preparatory works and/or the subsequent construction phase, to result in the need for "no-build" zones and/or revision of the planning-approved layout although Avant may choose to do this.

9.2.11 However, where build over a shaft(s) is proposed, Avant will need to discuss proposed treatment (which is likely to include both grouting of the shaft backfill, and a cap at rockhead) and bespoke foundation design, by a suitably qualified structural engineer, with the Coal Authority. A Permit to Enter or Disturb Coal Authority Mining Interests will be required prior to construction of any shaft cap.

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

9.2.13 If old mineworkings are present in the Thin and/or Swallow Wood coals, and are considered to pose a significant risk to surface stability, mitigation of the risks posed will be required; this could be achieved in one of two ways:

- Extraction of the remaining coal
- Consolidation, via drilling & grouting

9.3 Hazardous gas

9.3.1 The site is in an area where 3% to 5% of homes are estimated to be above the radon action level. Consequently, basic radon protection is required in all new dwellings.

9.3.2 The west of the site is anticipated to be underlain by deep made ground and there are known areas of landfilling within 250m. Additionally, shallow mineworkings may be present beneath the site with any unrecorded shafts/bell pits acting as a preferential pathway for hazardous gas migration to the surface.

9.3.3 Consequently, the site is considered to be at potential risk from migrating landfill gas and gas generated on site within the opencast backfill. As such, wells should be installed in boreholes to allow subsequent monitoring for hazardous gas in order to determine appropriate gas protection measures for the proposed dwellings.

9.4 Foundations

9.4.1 At present, no geotechnical ground investigation data is available and consequently it is only possible to estimate the ground conditions. Before firm foundation recommendations can be given, it will be necessary to undertake an appropriate ground investigation. However, tentative recommendations are provided below.

9.4.2 Made ground is not generally considered a suitable founding material and foundations should be taken through it, into underlying natural in-situ strata of adequate bearing capacity.

9.4.3 The published geological data suggests that weathered bedrock (likely comprising clay and gravel) will be present at shallow depth in the east of the site. Coal Measures bedrock (mudstone, siltstone and sandstone) is likely to be encountered at <3m depth. Some localised made ground may be present associated with 'overspill' from the opencast.

9.4.4 Deep made ground associated with the former opencast is likely to be present in the west and centre which may contain a significant proportion of oversize material (mudstone/siltstone boulders). Based on the CA abandonment plan, made ground is likely to be shallowest in the west (c. 6m) and deepest in the north (c. 12m).

9.4.5 Highwalls associated with the opencast should be anticipated and may be variable in geometry with differing angles through residual soil and bedrock. Additionally, ramps and/or steps may be present in the highwalls especially in the centre north where it is expected only the Thin Coal was extracted.

Beyond opencast workings

9.4.6 At this stage, it is likely that plots situated beyond the former opencast workings will be founded on traditional strip/trench-fill foundations, deepened where necessary due to tree influence and/or presence of made ground.

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

9.4.8 If shallow mineworkings are present beyond the opencast and require treatment (i.e. consolidation by drilling & grouting), NHBC typically require foundations to be at least 300mm thick and reinforced. If the workings are at a depth of less than 5 times the seam thickness, then raft foundations may be required.

Within opencast workings

9.4.9 In the context of land that has been subject to opencast coal extraction, this site can be considered relatively low risk given the limited depths of fill (c. 12m) anticipated. Fill thicknesses mean that consideration can be given to both a piled solution and/or grillage type/raft foundation.

9.4.10 If **piled** foundations are adopted for plots underlain by opencast backfill there should be a reduced need for further significant geotechnical analysis / modelling, although specialist piling contractors will require more data (i.e. cable percussion boreholes, possibly with rotary core follow-on).

9.4.11 Ground conditions at this site are considered likely to require provision of a piling mat (working platform) and further advice should be sought from the appointed specialist-piling contractor regarding the proposed plant loadings and resulting pressures.

9.4.12 However, it should be noted that the Top Haigh Moor coal (c. 1.2m thick) is expected to lie about 15m below the base of the opencast. There are no recorded mineworkings in this seam, but the possibility of unrecorded workings cannot yet be discounted.

9.4.13 Founding piles above a system of untreated workings is not recommended because collapsed workings are rarely in a permanently stable condition and so have some form of residual settlement potential. Consequently, intrusive investigation should include rotary probing to establish whether or not there are any unrecorded mineworkings below the opencast.

9.4.14 Conversely, if a **grillage type foundation** (or rafts) are preferred, significant further investigation and assessment will be required. This should commence with a review of the data obtained during Lithos' earlier exploratory investigation, and case study data relating to other deep backfill sites, to enable preliminary estimates of anticipated settlement.

9.4.15 Determination of an appropriate foundation solution requires input from specialist geotechnical and structural engineers capable of assessing the risks and designing accordingly.

9.4.16 For shallow foundation solutions, assessments can be complex, involving characterisation of the ground, optimising building size, structural performance criteria and an assessment of the mechanisms involved.

Adjacent to high walls

9.4.17 It is generally considered wise not to build over high walls and such areas are usually reserved for landscaping. However, building in the crest region might be possible if split foundation types are used to reach undisturbed natural ground.

9.4.18 It will be necessary to ensure the construction of a reliable rock socket at the high wall. This could be problematic if there are concerns about slope strata integrity (which can occur where a fault has determined the extraction boundary).

9.4.19 Furthermore, if there are unrecorded workings in the Swallow Wood or Thin coals these could influence surface stability in the vicinity of the highwall where there could be less than 10 times competent rock cover

9.4.20 Any plot layout for this site should take account of the known high walls. Most notably, the foundations of plots just beyond the area of deep backfill should ideally be placed below a line drawn up at 45º from the base of the high wall.

9.4.21 Plots in the vicinity of steep high walls should ideally be set-back at least 3m from the high wall and founded entirely on bedrock.

9.5 Highways and external works

9.5.1 Given existing topography, there should be no significant requirement for retaining walls, underbuild, tanking etc.

9.5.2 Beyond the opencast backfill, natural soils should yield a CBR of at least 3%. This value should be verified prior to or during construction.

9.5.3 Within the former opencast ground improvement will be required; likely excavation of the uppermost 2m of colliery spoil and replacement in engineered layers. A specification will need to be agreed with the adopting authority, but at this stage, where any new highway spans an opencast 'high-wall', precautions to protect highway and drainage infrastructure from damage due to differential settlement will likely comprise:

- Excavation of colliery spoil over the full width of the adoptable highway to at least 1.0m below deepest sewer invert
- Reinforcement of the excavation base, 5m either side of the high wall, with two layers of Tensar Triax TX160 (or equivalent) geogrid sandwiched within at least 300mm of suitable aggregate

9.6 Soakaways & drainage

9.6.1 Given anticipated presence of deep made ground, soakaways will not provide a viable solution for the disposal of surface water. Consequently, there may be a need for surface water balancing.

9.6.2 Alternative SuDS options (see CIRIA C753[12] for further details) include:

- Pervious Pavements – provide a surface suitable for pedestrian and/or vehicular traffic, while allowing rainwater to infiltrate into subsurface storage, with subsequent infiltration or controlled discharge. Pavement could be porous (water able to infiltrate across entire surface material; e.g. reinforced grass), or permeable (water infiltrates via joints between concrete blocks).
- Swales – linear grassed features in which surface water can be stored or conveyed. Where suitable, swales can be designed to allow infiltration.
- Basins - a ground depression designed to store surface water that is normally dry, except during and immediately following a rainfall event. There are two types:
  - Infiltration – basin designed to store runoff and infiltrate it gradually into the ground.
  - Detention – an outlet restricts flows, so that the basin fills and provides attenuation.
- Ponds – designed to have permanent pool of water, but with capacity to provide temporary storage-controlled discharge.

9.6.3 Yorkshire Water have published a guide[13] 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).

9.6.4 With respect to detention basins, which should normally be dry, water table levels should be taken from borehole monitoring wells over 4 consecutive seasons, for at least 3 points in the basin area. The detention basin should be designed to ensure that there is a minimum of 1m of unsaturated soil between the maximum groundwater level and the lowest part of the structure.

9.7 Contamination

9.7.1 The site's environmental setting is considered to be of moderate sensitivity. With respect to human health, the proposed end use (residential) is also sensitive.

9.7.2 Based on observations made during the site walkover, and given site's former and recent uses, deep made ground is anticipated in the west and southeast, and it is considered likely that some (probably minor) ground contamination will be present in shallow soils.

9.7.3 Consequently, a ground investigation is required in order to assess the degree and extent of any ground contamination, and enable the preparation of a Remediation Strategy.

9.8 Potential development constraints

9.8.1 Deep opencast backfill and high walls present a potential development constraint. Ideally, buildings should not span any high wall. The final layout should consider the location of high walls, with areas of POS located over the opencast wherever possible to reduce abnormals associated with piled foundations etc.

9.8.2 The area of boggy ground in the centre north could indicate the issuing of perched water or shallow groundwater.

[12] *CIRIA C753 (2015) – The SuDS Manual.*
[13] *Design Requirements for Surface Water Attenuation Assets, February 2017.*

9.8.3 The overhead electric cables present a potential development constraint unless they can be relocated. Additional enquiries are required to ascertain the feasibility of such diversionary works and the particular easement required by each service undertaker if they remain in-situ.

9.9 Further investigation

9.9.1 Whilst the site is considered suitable for its current and proposed use, the proposed change in use will require intrusive investigation.

9.9.2 This would include:

- Machine-excavated trial pits to determine near surface ground conditions including depth to bedrock, the presence of obstructions, groundwater and stability
- Machine-excavated trial trenches and lines of stich drilling to delineate opencast high walls and determine their geometry
- Boreholes to obtain geotechnical data from depth, confirm the strength (density) of made ground via SPTs and allow the installation of monitoring wells
- Rotary cored boreholes to recover rock samples for geotechnical testing
- Rotary probeholes to confirm depths and seam thicknesses in order to assess risks associated with possible old mineworkings and surface stability
- Gas monitoring and risk assessment
- Geotechnical soils analysis with grading and compaction testing to assess the suitability of made ground for use in earthworks ground improvement, and to enable foundation recommendations
- Chemical testing on soil and if necessary groundwater, samples to assess the significance of contamination, if any, as a result of former industrial land use

9.9.3 An appropriate ground investigation strategy is presented in Section 8.

Appendix A

General Notes

01 - Environmental setting
Generic notes – geoenvironmental investigations

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 though 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[1], 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[2].

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

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

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

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

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

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

Hydrogeology

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

- Groundwater quality
- Recorded pollution incidents
- Licensed groundwater abstractions

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

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

The maps display the following aquifer designations:

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

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

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

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

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

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

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

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

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

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

Hydrology

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

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

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

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

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

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

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

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

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

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

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

COMAH & explosive sites

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

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

Preliminary conceptual site model

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

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

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

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

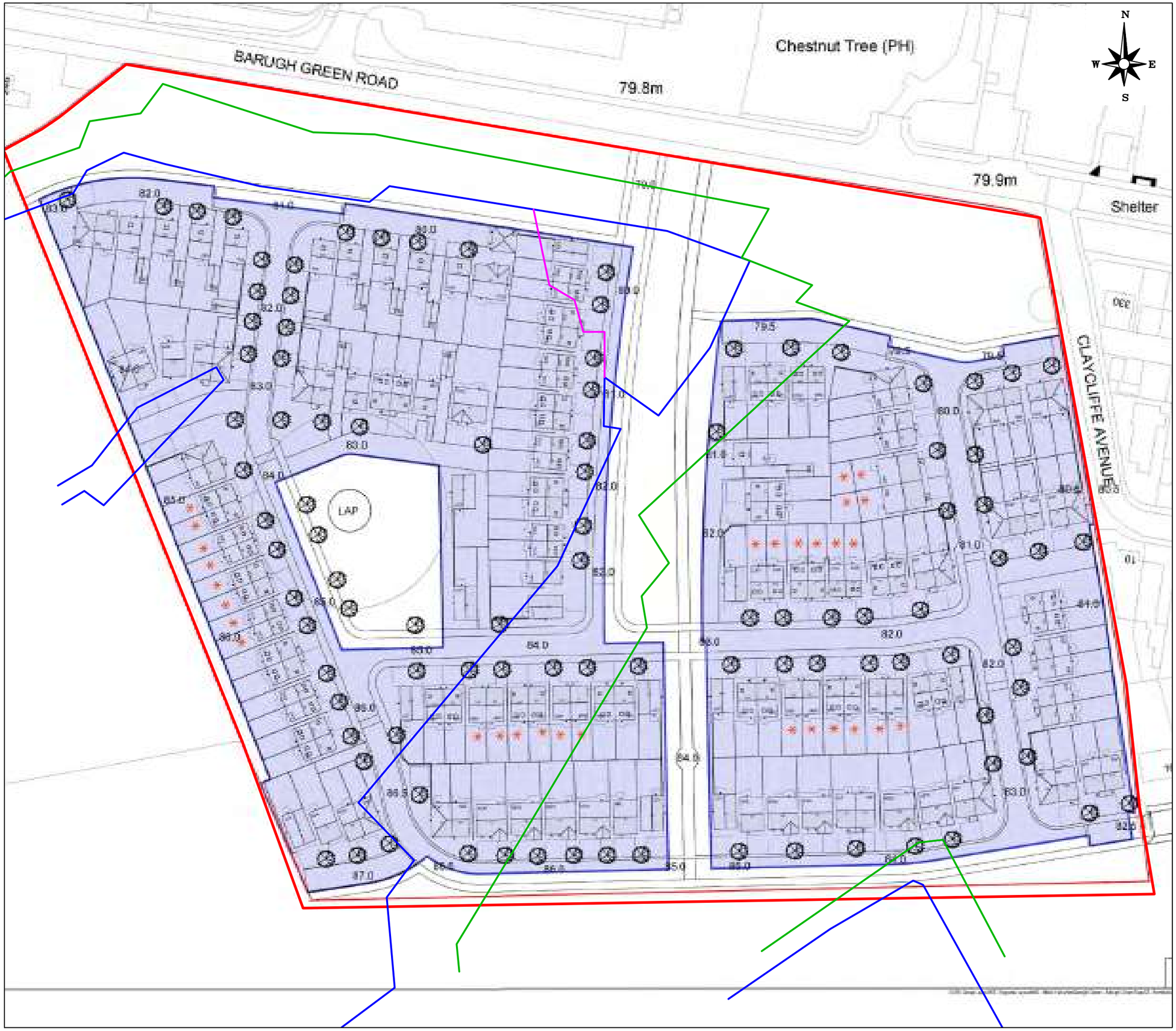
The revised CSM takes account of data obtained during the ground investigation, including the distribution of made ground, the nature and distribution of contamination etc.

Appendix B

Drawings

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

LITHOS CONSULTING info@lithos.co.uk www.lithos.co.uk Tel 01937 545330	CLIENT AVANT HOMES YORKSHIRE	JOB TITLE BARUGH GREEN	DRAWING TITLE SITE LOCATION PLAN	DRAWN: LEW CHECKED: AG STATUS: FOR COMMENT ☐ FOR APPROVAL ☐ DRAFT ☐ FINAL ☑ SCALE: 1:25,000 SHEET: A4	DATE: 25 09 24 DATE: 25 09 24 DRAWING NO.: 3407/101 REVISION:



NOTES

- APPROXIMATE LINE OF HIGHWALL (ABANDONMENT PLAN)
- POSSIBLE LINE OF INTERNAL HIGHWALL (ABANDONMENT PLAN)
- APPROXIMATE LINE OF HIGHWALL (COAL AUTHORITY REPORT)
- APPROXIMATE SITE BOUNDARY

REPRODUCED FROM AVANT HOMES DRAWING REFERENCE WY-BGB-130, DATED 17TH SEPTEMBER 2024

REV.	DESCRIPTION	DATE

LITHOS CONSULTING

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

Tel 01937 545330

CLIENT

AVANT HOMES YORKSHIRE

JOB TITLE

BARUGH GREEN

DRAWING TITLE

PROPOSED SITE LAYOUT

DRAWN	DATE	STATUS
LEW	27 09 24	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
AG	27 09 24	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
1:1000	A3	3407/102	

NOTES

GRASS & OVERGROWN AREAS

AREAS OF BOGGY GROUND/STANDING WATER

APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

LITHOS CONSULTING

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

Tel 01937 545330

CLIENT

AVANT HOMES YORKSHIRE

JOB TITLE

BARUGH GREEN

DRAWING TITLE

SITE FEATURES

DRAWN	DATE	STATUS
LEW	26 09 24	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
AG	26 09 24	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
1:1250	A3	3407/103	

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NOTES

GRASS & OVERGROWN AREAS

APPROXIMATE SITE BOUNDARY

LOCATION & ORIENTATION OF PHOTOGRAPH

REV.	DESCRIPTION	DATE

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

Tel 01937 545330

CLIENT

AVANT HOMES
YORKSHIRE

JOB TITLE

BARUGH GREEN

DRAWING TITLE

SITE PHOTOGRAPHS

DRAWN	DATE	STATUS
LEW	26 09 24	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
AG	26 09 24	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
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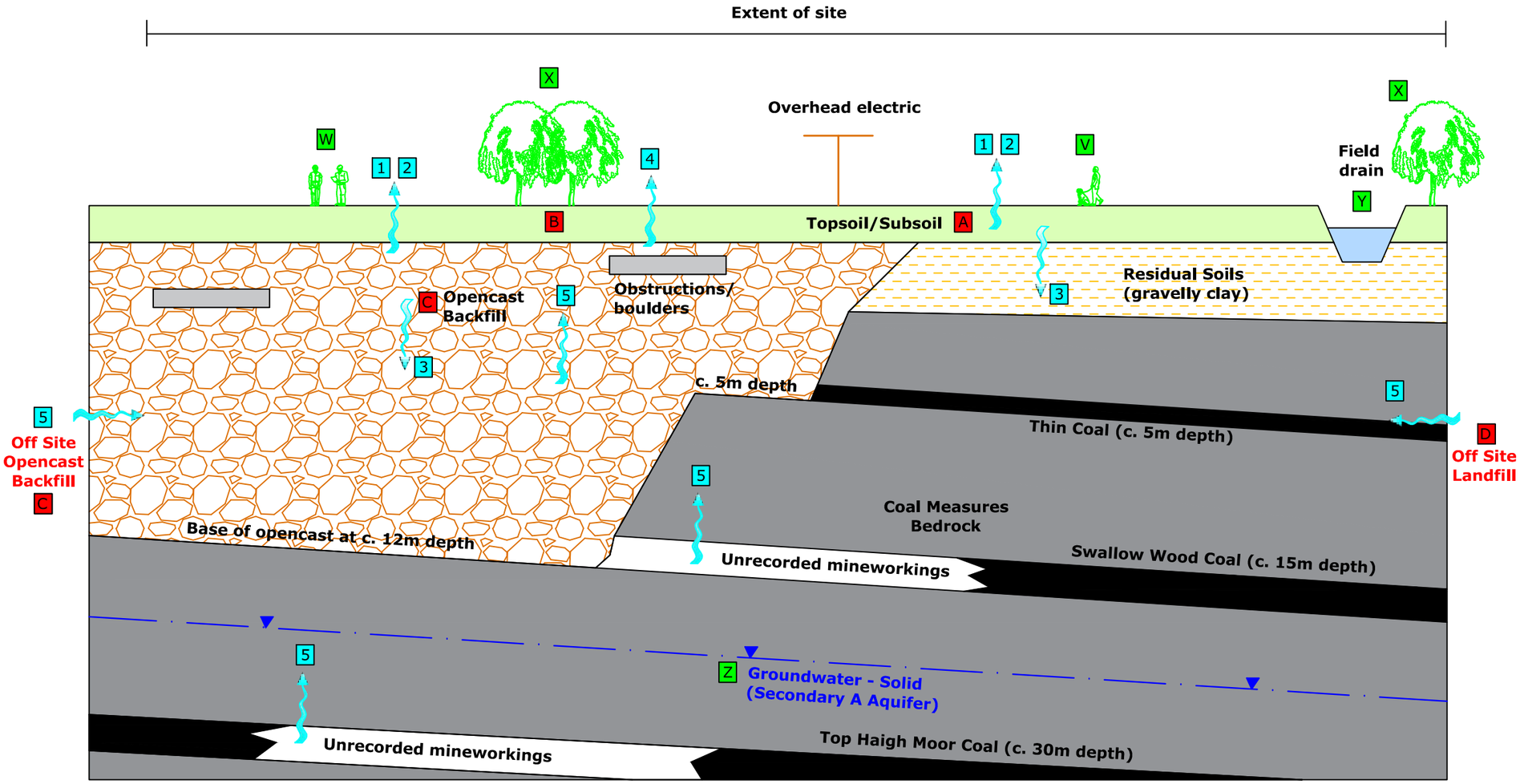

SOURCES	PATHWAYS	RECEPTORS
A NATURALLY OCCURRING CONTAMINANTS (INORGANICS)	1 DERMAL CONTACT	V END USERS (RESIDENTS)
B FARMING RELATED ACTIVITIES (INORGANICS & ORGANICS)	2 INGESTION/INHALATION	W SITE WORKERS
C OPENCAST BACKFILL (INORGANICS & ORGANICS)	3 LEACHING OF CONTAMINANTS	X VEGETATION
D OFFSITE LANDFILL (HAZARDOUS GAS)	4 UPTAKE BY PLANTS	Y SURFACE WATERS
	5 MIGRATION OF GAS	Z GROUNDWATER

NOTES

REV.	DESCRIPTION	DATE

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

Tel 01937 545330

CLIENT

AVANT HOMES YORKSHIRE

JOB TITLE

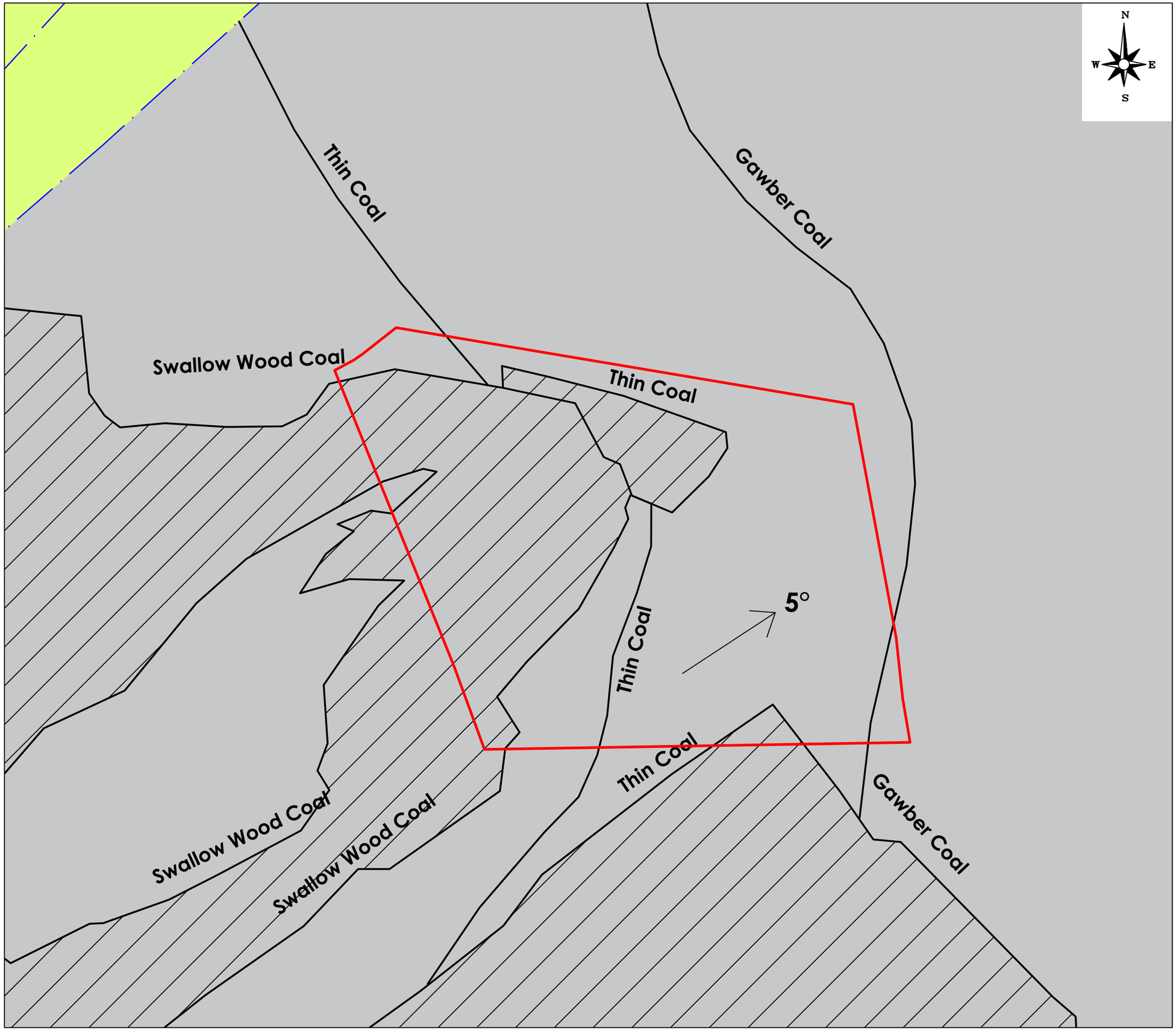
BARUGH GREEN

DRAWING TITLE

PRELIMINARY CONCEPTUAL SITE MODEL

DRAWN	DATE	STATUS
LEW	26 09 24	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
AG	26 09 24	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
Not to scale	A3	3407/105	



NOTES

- PENNINE MIDDLE COAL MEASURES (MUDSTONE, SILTSTONE & SANDSTONE)
- HIGH MOOR ROCK (SANDSTONE)
- WORKED GROUND (BACKFILLED OPENCAST)
- COAL OUTCROP
- GEOLOGICAL FAULT
- DIP DIRECTION
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

LITHOS CONSULTING

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

Tel 01937 545330

CLIENT

AVANT HOMES
YORKSHIRE

JOB TITLE

BARUGH GREEN

DRAWING TITLE

PUBLISHED GEOLOGY & COAL OUTCROPS

DRAWN	DATE	STATUS
LEW	26 09 24	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
AG	26 09 24	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
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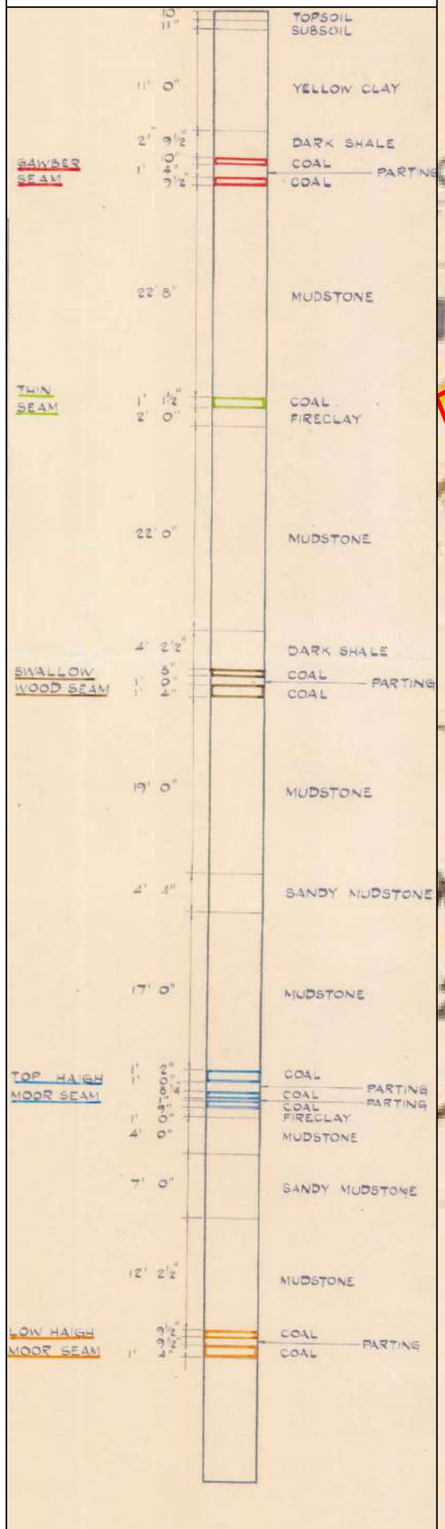
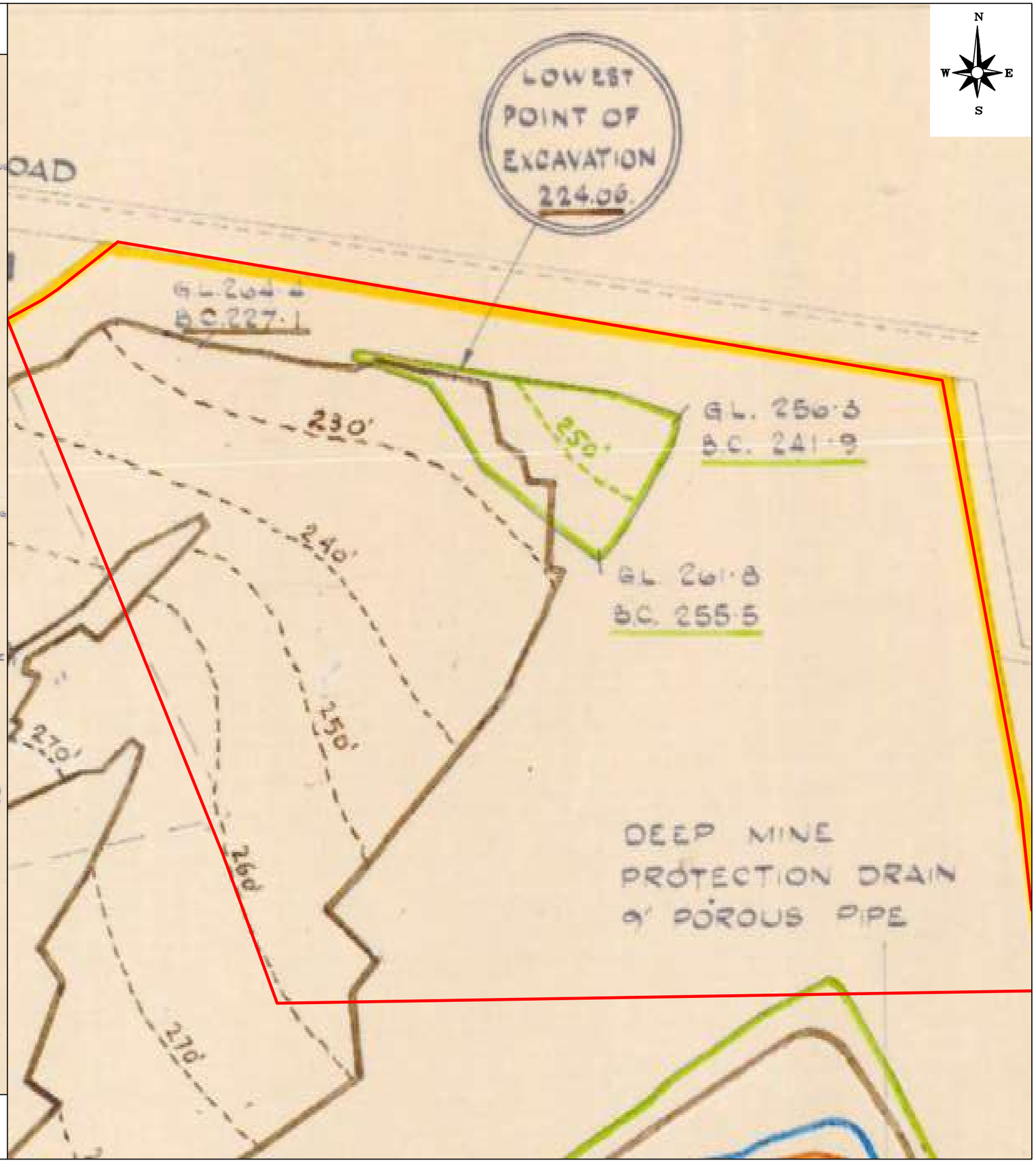
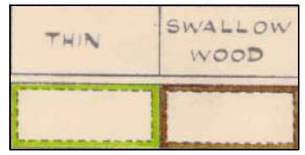




NOTES



APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

LITHOS CONSULTING

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

Tel 01937 545330

CLIENT

AVANT HOMES
YORKSHIRE

JOB TITLE

BARUGH GREEN

DRAWING TITLE

CRAVEN I & II OPENCAST
ABANDONMENT PLAN

DRAWN	DATE	STATUS
LEW	26 09 24	FOR COMMENT ☐
		FOR APPROVAL ☐
CHECKED	DATE	DRAFT ☐
AG	26 09 24	FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
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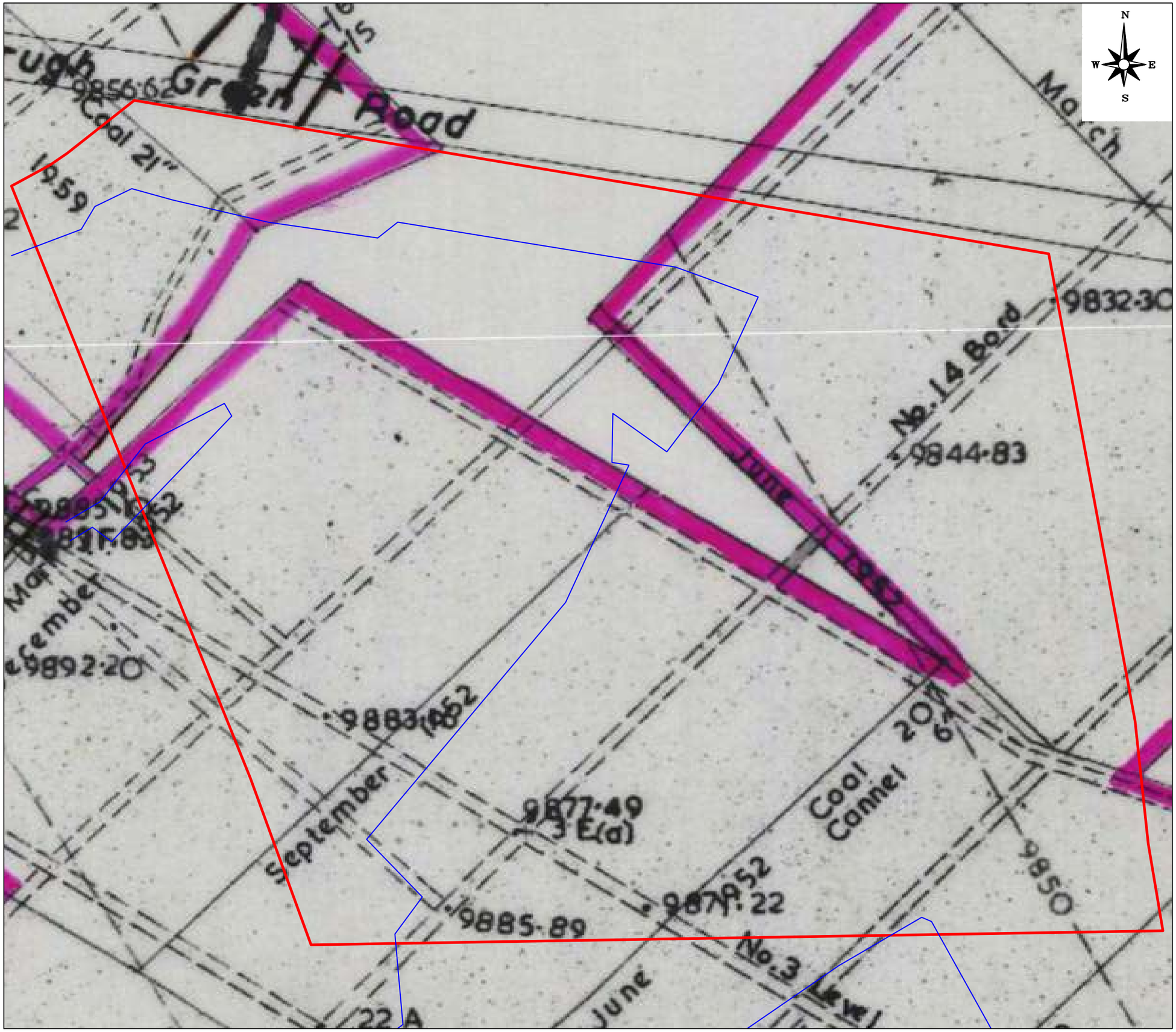


NOTES

APPROXIMATE LINE OF HIGHWALL (ABANDONMENT PLAN)

APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

LITHOS CONSULTING

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

Tel 01937 545330

CLIENT

AVANT HOMES
YORKSHIRE

JOB TITLE

BARUGH GREEN

DRAWING TITLE

FLOCKTON THICK COAL
ABANDONMENT PLAN

DRAWN	DATE	STATUS
LEW	26 09 24	FOR COMMENT ☐
CHECKED	DATE	FOR APPROVAL ☐
AG	26 09 24	DRAFT ☐
		FINAL ☑

SCALE	SHEET	DRAWING NO.	REVISION
1:1000	A3	3407/110	

Appendix C

Commission

044/3407/AG

08th April 2024

Registered in England 07068066

Parkhill
Wetherby
West Yorkshire
LS22 5DZ

T 01937 545 330
www.lithos.co.uk

Mr A Clarke
Avant Homes Yorkshire
Unit 2
Mariner Court
Peel Avenue
Durkar
Wakefield
WF4 3FL

Dear Adam

Barugh Green Road, Barnsley

Further to your recent invitation, please find attached our proposal for undertaking a site investigation on the above land. We understand that proposed development will include c. 120 traditional 2 storey domestic dwellings with associated gardens, POS and adoptable roads and sewers; although no layout is available yet.

Review of the information supplied suggests that the site consists of a single parcel of land of (c. 5 ha). Review of Google Maps suggests the site is currently unoccupied, use for grazing.

Brief review of internet data suggests the site:

- Appears to have remained undeveloped throughout its history, however the north and western parts of the site were subject to coal opencasting;
- Is 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 High Risk Area associated with the backfilled opencast called Craven I (Swallow Wood Coal).
- There is the potential for unrecorded shallow workings in the Swallow Wood Coal outside the footprint of the opencast.

Brief examination of the relevant geological map suggests the site is directly underlain by Coal Measures bedrock. This site is located within a Coal Mining Development High Risk Area, therefore a Consultant's mining report and opencast abandonment plans will be obtained.

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

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

We will need a Promap or topo survey in CAD format, to provide a base plan for technical drawings etc. If you do not have one, we could obtain for an E\O of £**.

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 review current operations and undertake a walkover survey.

Given the site's location within a Coal Mining High Risk Area, a Consultant's mining report will be obtained. Review of the CA's interactive viewer suggests abandonment plans should be available for an area of former opencast and we will obtain copies of these plans.

Fieldwork: We have allowed for

- 4 day's trial pitting / trenching to excavated pits on a c. 40m grid across the site, as well as to allow trial trenching to accurately locate the Craven I perimeter highwall.
- The drilling of 6 cable percussion boreholes within the footprint of the opencast.
- The drilling of about 25 rotary probeholes to depths between c. 25m and 35m bgl, to check for the presence of shallow mine workings across the site.
- 3 day's of rotary openhole stitch drilling to record the geometry of the buried highwall where this cannot be accurately determined using an excavator.
- Rotary coring at 3 locations advanced 6m beyond the base of the Craven I opencast, to prove rockhead and obtain rock core to facilitate pile design.

All trial pits, trenches and boreholes will be supervised and logged by an experienced geoenvironmental engineer.

This proposal has been put together without a recent site visit. If ground conditions are found to be significantly wet/boggy at the time of the investigation, it may be necessary to hire additional resources (bog mats, tracked excavators, tractors, stone etc) in order for works to continue. We will discuss the requirement for any such items and associated costs with you prior to ordering.

Trial pitting / trenching will enable us to determine the:

- Nature of any made ground , including:
  - visual/olfactory evidence of potential contamination and the proportion of undesirable elements e.g. biodegradable matter, relict foundations etc
  - the proportion of "oversize", boulder-sized material
  - the location and extent of the opencast, with some trenching to locate the quarry high wall
- Nature, distribution and thickness of shallow soils beyond the former opencast
- Suitability of the ground for founding structures and highways

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

Based on anticipated ground, **soakaways** are considered unlikely to provide a satisfactory solution for surface water drainage.

The **cable percussion boreholes** will be advanced to depths of c. 10m or refusal in bedrock, whichever is the shallower, and are primarily intended to enable the retrieval of geotechnical data from depth to inform pile design and to obtain geotechnical parameters to inform earthworks design and settlement (consolidation & creep) assessment.

The boreholes will also allow the installation of 12 gas and groundwater wells (50mm ID, HDPE pipework with bentonite seals and a gravel filter pack). Well headworks will comprise a 100mm diameter steel security helmet which will extend about 150mm above ground level (if required, the position of each helmet could be "marked" with a 1.5m high fence post to reduce the likelihood of damage by farm machinery). The groundwater **wells** will be developed and purged (twice each) shortly after completion of drilling.

Given the anticipated presence of deep made ground, SPTs will be undertaken at approximate 1m to 1.5m intervals as the boreholes are advanced. SPTs allow assessment of the in-situ density of granular soils, enabling determination of allowable bearing capacity and thereby definitive foundation advice.

Undisturbed, thin wall open-tube samples (UT100) will be obtained from cohesive made ground (where suitable) to enable total stress and consolidation testing to take place to further inform pile design and settlement assessment.

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

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

The site is underlain by several shallow coal seams, and therefore we have allowed for the drilling of c. 20 **rotary probeholes** (5 days of drilling) to check whether old mine workings are present and pose a significant risk to surface stability of the site. Rotary openhole **stitch drilling** (3 days) will also be undertaken to record the geometry and orientation of the buried highwall, where this cannot be accurately determined using an excavator.

If a potential risk is perceived to exist, further probeholes may be required to delineate the extent of workings in order to obtain fixed price quotations for the necessary consolidation works. Furthermore, we have assumed that it will be possible to advance the 25 probeholes within 5 days but there is a chance that it may take longer in which case we will inform you before leaving site, and seek your further instruction. Each day of additional drilling would cost £** (inclusive of supervision) provided it were instructed whilst the drilling rig was still on site.

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

Given the Swallow Wood coal has a history of spontaneous combustion and proximity of surrounding housing (within 50m of much of the general site area), and in accordance with CA requirements we have had to assume that the probeholes will need to be advanced using water as the flushing

medium (as reinforced by recent CA guidance on managing the risk of hazardous gas). Our drilling sub-contractor will need to locate the wash outs close to the site, and procure a standpipe and licence from Yorkshire Water.

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

We have allowed for the set up of a site compound, including a welfare cabin through the duration of the site works. The site compound will be secured with Heras fencing, however, at this stage, we have assumed that overnight security will not be required, but this will be reviewed following a site visit. If required, security would be an E\O of £** per night.

Given the potential for boulders to be present within the opencast backfill, **rotary cored** holes will be advanced through the base of the Craven I opencast, to allow recovery of 6m of core to confirm the full depth of backfill has been proven. The coring will also allow the recovery of rock samples to enable compressive strength testing to take place, which will inform pile / rock socket design.

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

Given the presence of backfilled opencast, the potential presence of shallow mine workings and adjacent areas of landfill within 250m of the site, we have allowed for the installation of gas wells in 12 holes and monitoring for hazardous **gas** (and any shallow groundwater).

The generation potential of this gas source is considered likely to be Low. Therefore, in accordance with CIRIA Report C665, we have initially allowed for 9 visits over a 6-month period. If extensive shallow mine workings are encountered the number of visits may have to be extended to 12 over a 6-month period. A hazardous gas risk assessment will be issued on completion of monitoring.

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

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

Testing: This will comprise routine **geotechnical** soils analysis, including:

- 45 moisture content;
- 45 Atterberg limits
- 40 pH & water-soluble sulphate
- 12 Gradings by wet sieve
- 12 Compaction tests (4.5kg) on samples of made ground to assess suitability for use in earthworks ground improvement
- 12 Particle density
- 6 Uniaxial compressive strength tests (rock)
- 18 Determination of point load strength (axial & diametral)

Appropriate **chemical analyses**, based on our review of existing SI report and knowledge of the site's history, have been allowed for; this will comprise 35 samples for a suite including heavy metals, speciated PAH, and banded TPH (with supplementary speciation as/where appropriate). In the

event that ground contamination is more significant or different to that anticipated, it might be necessary to carry out additional chemical testing.

Within in our proposal we have allowed for the screening (ID) of 35 samples for asbestos. In the event that positive IDs are reported, it is likely that we will need to schedule further analysis (asbestos quantification), in order to determine the significance of the results. Asbestos quantification is currently a relatively expensive test and consequently we have not allowed for it at this stage. We will inform you immediately after receipt of results if we consider asbestos quantification is required.

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

On completion of the desk study, fieldwork and laboratory testing a comprehensive, 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 a settlement assessment and consideration of foundation types.

This proposal also allows for a detailed review of the ground investigation findings (boreholes, trial pits and laboratory testing) and **preliminary settlement** assessment (Item M) including:

- A detailed review of the GI findings, site photographs and plans
- Appraisal of the geometry of the quarry based on the available data
- Appraisal of the nature of the backfill and its properties
- Assessment of the likely sources of backfill movement and the likely range of settlements that the backfilled area could be subject to
- Discussion of the findings and the main development implications

At the time of writing, fieldwork could be commenced within 4 weeks of receipt of your written instruction to proceed. Our comprehensive geoenvironmental appraisal report will be issued within 6 weeks of fieldwork completion. This report will comment on issues associated with hazardous gas, but the gas risk assessment will not be issued until monitoring is completed.

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

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

Given previous usage of this land, it is considered highly likely that a **Remediation Strategy** report will be required by the Local Authority, and our proposal allows for this (Item O).

It should be noted that a Remediation Strategy outlines the remediation objectives necessary to protect environmental receptors and render a site suitable for the proposed end use. A Remediation Strategy is not the same as a Method Statement; the latter should be prepared subsequently, usually by a Contractor, in order to detail how the objectives will be achieved.

It is considered likely that an **Earthworks Specification** will be required, which should be written in accordance with NHBC Ch. 4.6, our proposal allows for this (Item N).

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 last for at least 10 working days and therefore this proposal includes for provision of a Welfare Unit, with the benefit of full canteen facilities, hot water with full size sink, toilet and drying room.

Immediately prior to commencement of fieldwork, a site compound will be established in a location to be agreed with Avant, comprising a storage container, and a welfare cabin for site staff, secured with eras fencing; equipment and plant will be stored here overnight. Given the wet nature of the field, a **layer of natural stone** will be placed across the surface if the compound to limit surface damage, with the intention that this stays on site.

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.

It is anticipated that the site investigation outlined in this proposal will be undertaken several months before any construction is commenced on site. Consequently, our works can be considered in isolation and, given the anticipated number of person days on site, this site investigation is not notifiable to the HSE.

Further work: In addition to the investigation outlined above, further work that might be required, in light of initial findings and EA feedback, could include:

- Further cable percussion boreholes within the opencast backfill.

- Installation of a grid of survey stations, and subsequent surveying to determine whether ground levels are changing.
- Zone tests via construction of a shallow test pad (only if ground bearing foundation were to be considered in the backfilled opencast).

Terms & conditions: This work will be undertaken in accordance with our Standard Terms and Conditions, a copy of which are enclosed.

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

Yours sincerely

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 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 license to amend any drawing, design or other Intellectual Property produced by us.

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

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

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

6 CONFIDENTIALITY

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

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

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

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

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

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

7 ASSIGNMENT

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

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

8 INSURANCE

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

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

9 PAYMENT

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

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

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

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

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

10 LIMITATIONS ON LIABILITY

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

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

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

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

11 DELAY

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

12 TERMINATION

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

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

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

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

13 THIRD PARTY RIGHTS

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

14 COLLATERAL WARRANTIES & LETTERS OF RELIANCE

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

15 NOTICES

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

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

16 ENTIRE AGREEMENT

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

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

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

17 DISPUTES, JURISDICTION AND GOVERNING LAW

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

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

Lewis Whiteley

Subject: RE: 3407, Barugh Green

From: Chris Cammidge <Chris.Cammidge@avanthomes.co.uk>
Sent: Wednesday, September 18, 2024 11:48 AM
To: Adam Gombocz <Adam.Gombocz@lithos.co.uk>
Cc: Reg <reg@lithos.co.uk>; Jon Tate <Jon.tate@avanthomes.co.uk>
Subject: RE: 3407, Barugh Green

Hi Adam,

Thanks for sending this through. I'll try and review and get my head around what you have sent as soon as I can. I'm sure our preference will be to get it all done in one hit too once we have an application in.

In the meantime, please can you progress with the stage 1 desktop report so that I can ensure we have something to validate the planning application? Once its in and ticking a long we can look at progressing the intrusive.

Can you confirm timescales for issuing so I can make sure it won't clash with the intended submission date?

Any queries please let me know.

Regards

Chris Cammidge
Senior Engineer

Tel: 01924 675295
Chris.Cammidge@avanthomes.co.uk

Avant Homes Yorkshire, Unit 2, Mariner Court, Peel Avenue, Durkar, Wakefield, WF4 3FL

From: Adam Gombocz <Adam.Gombocz@lithos.co.uk>
Sent: 13 September 2024 17:53
To: Chris Cammidge <Chris.Cammidge@avanthomes.co.uk>
Cc: Reg <reg@lithos.co.uk>
Subject: RE: 3407, Barugh Green

Afternoon Chris,

I provided Adam Clarke a quote for a 'fresh' SI back in April, for the above site (c. £**k).

The attached assumes that the entire investigation will be done in one hit to avoid multiple rig mobilisations, if you decided to instruct in piecemeal then there would be some increase in costs.

The attached Coal Authority T+Cs would also need to be signed and returned, once received we can apply for the permit, which will take c. 4 weeks.

Once we have applied for the CA permit, this starts the clock ticking for our mobilisation period.

If you have any questions, please drop me a line. I am happy to come across to your offices to discuss if that helps.

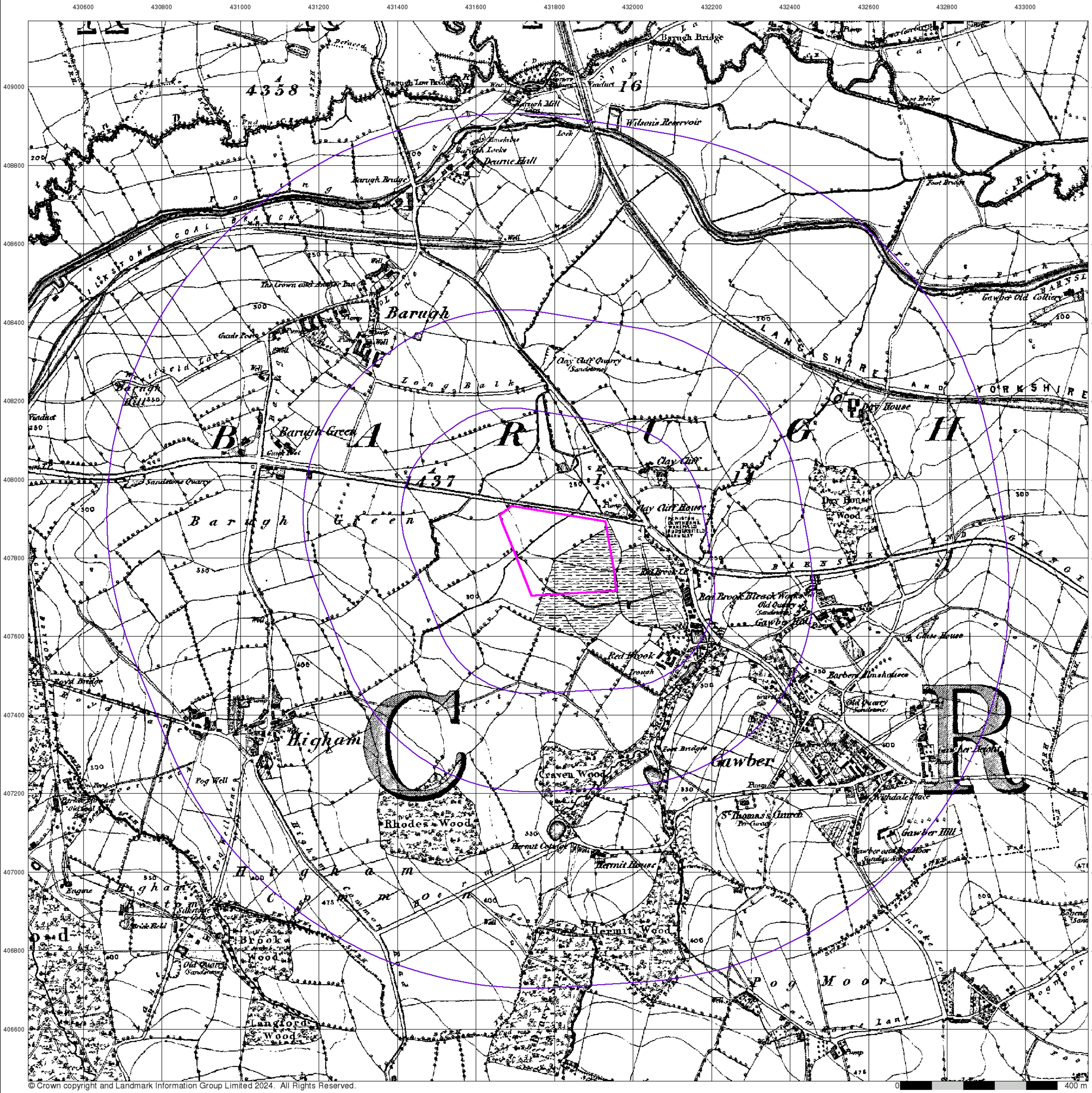
Have nice weekend,

Kind regards,

Adam Gombocz
Director
Lithos Consulting Ltd
M 07951 497021
DD 01937 543353
www.lithos.co.uk

Appendix D

Historical OS Plans



LITHOS CONSULTING

Yorkshire

Published 1855

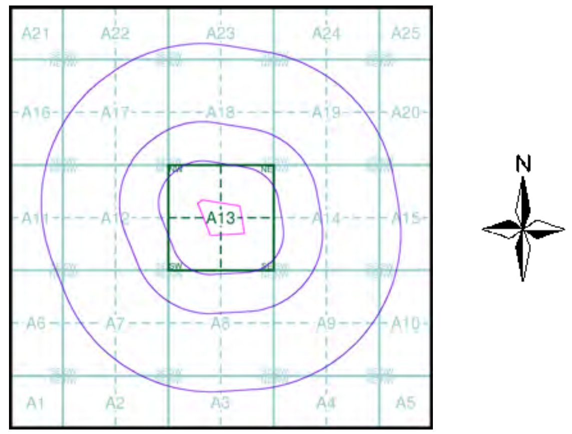
Source map scale - 1:10,560

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)

27400
1855
1:10,560

Historical Map - Slice A



Order Details

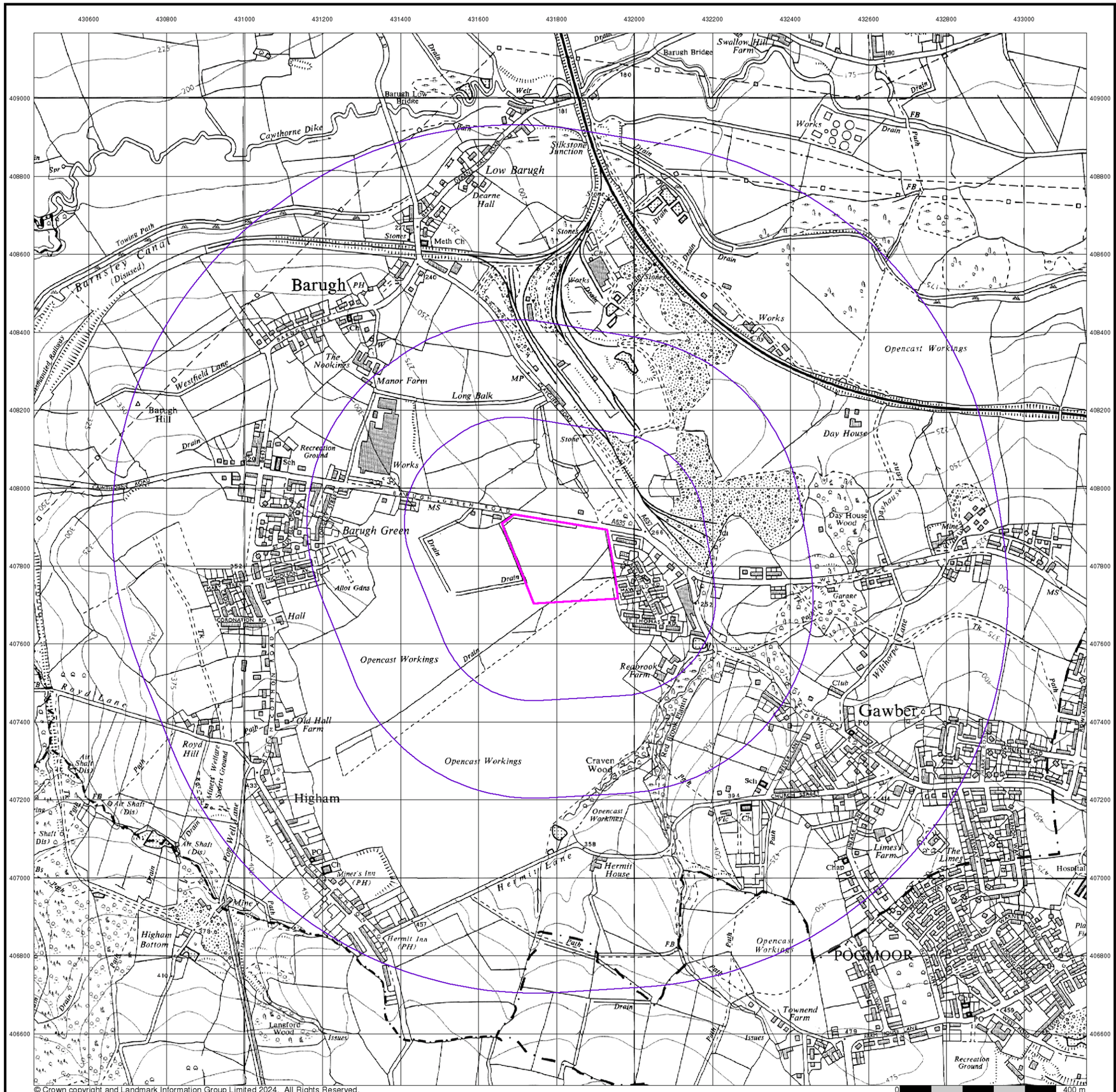
Order Number:	359111613_1_1
Customer Ref:	3407
National Grid Reference:	431810, 407820
Slice:	A
Site Area (Ha):	4.96
Search Buffer (m):	1000

Site Details

Barugh Green, S75 1HR

Landmark INFORMATION GROUP

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



LITHOS CONSULTING

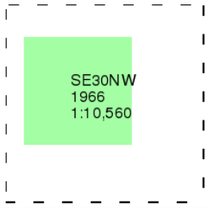
Ordnance Survey Plan

Published 1966

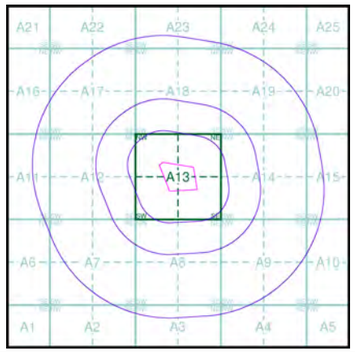
Source map scale - 1:10,000

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)



Historical Map - Slice A



Order Details

Order Number:	359111613_1_1
Customer Ref:	3407
National Grid Reference:	431810, 407820
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Site Area (Ha):	4.96
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Site Details

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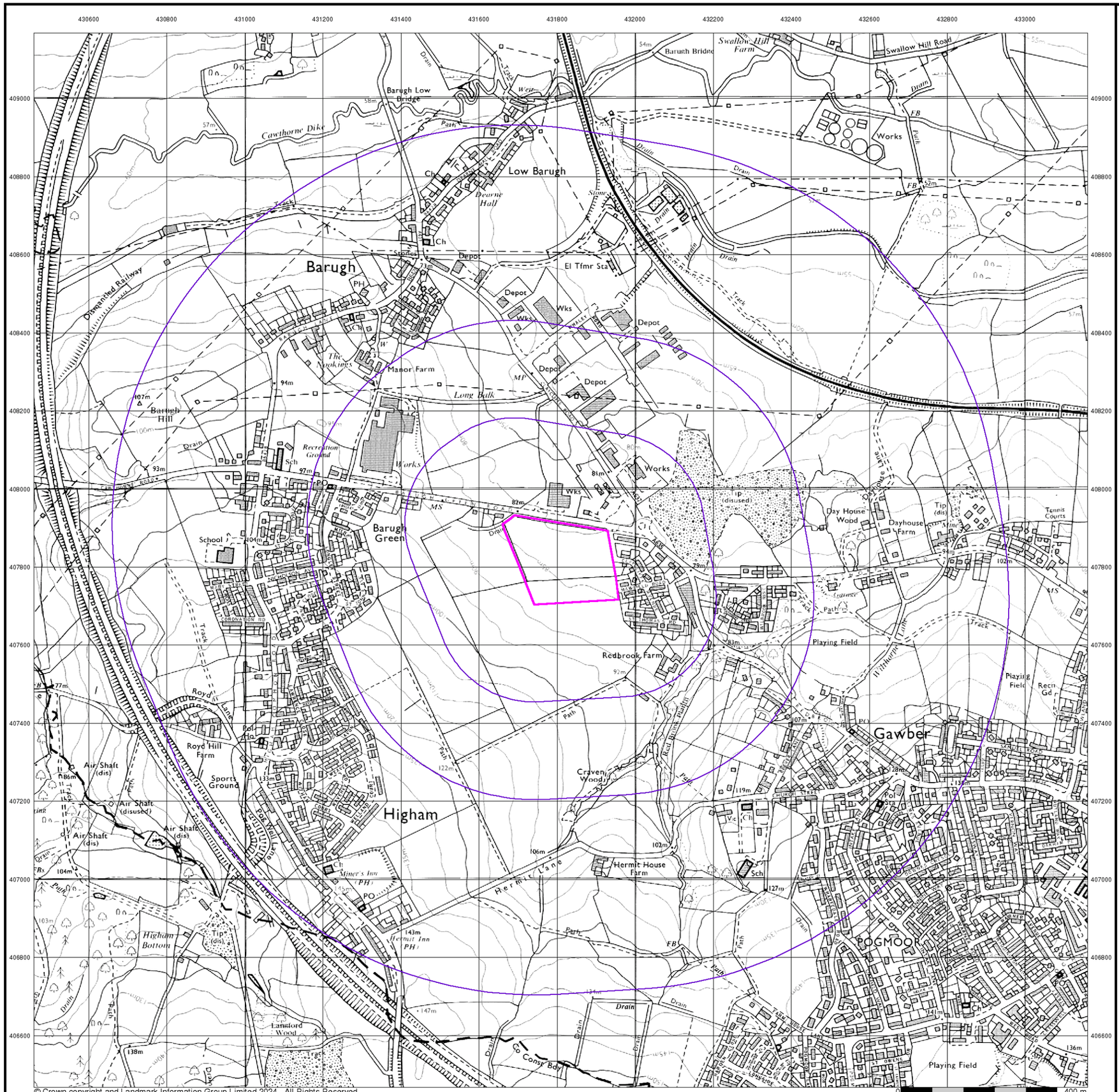


LITHOS CONSULTING

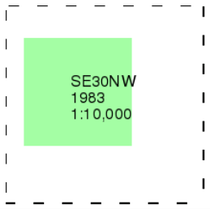
Ordnance Survey Plan

Published 1983

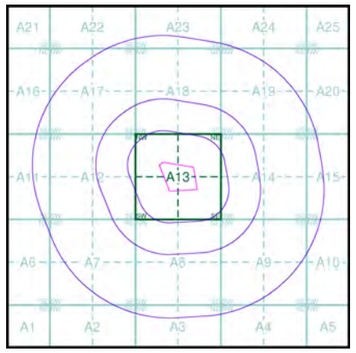
Source map scale - 1:10,000

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)



Historical Map - Slice A



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National Grid Reference:	431810, 407820
Slice:	A
Site Area (Ha):	4.96
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Site Details

Barugh Green, S75 1HR

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

Appendix E

Search Responses & other Correspondence

Envirocheck® Report:

Datasheet

Order Details:

Order Number:
359111613_1_1

Customer Reference:
3407

National Grid Reference:
431810, 407820

Slice:
A

Site Area (Ha):
4.96

Search Buffer (m):
1000

Site Details:

Barugh Green
S75 1HR

Client Details:

Mr M Perrin
Lithos Consulting Ltd
Parkhill
Walton Road
Wetherby
LS22 5DZ

Contents

Report Section	Page Number
Summary	-
Agency & Hydrological	1
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Hazardous Substances	-
Geological	31
Industrial Land Use	38
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Useful Contacts	67

Introduction

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

Report Version v53.0

LITHOS CONSULTING

Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Agency & Hydrological					
BGS Groundwater Flooding Susceptibility	pg 1	Yes	Yes	Yes	n/a
Contaminated Land Register Entries and Notices					
Discharge Consents	pg 2		4	2	4
Prosecutions Relating to Controlled Waters			n/a	n/a	n/a
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 5		4	8	5
Local Authority Pollution Prevention and Control Enforcements	pg 7			1	1
Nearest Surface Water Feature	pg 8	Yes			
Pollution Incidents to Controlled Waters	pg 8			1	12
Prosecutions Relating to Authorised Processes					
Registered Radioactive Substances	pg 10			1	
River Quality					
River Quality Biology Sampling Points					
River Quality Chemistry Sampling Points					
Substantiated Pollution Incident Register	pg 10				1
Water Abstractions	pg 10				(*1)
Water Industry Act Referrals					
Groundwater Vulnerability Map	pg 11	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 11	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 11		Yes	n/a	n/a
Flooding from Rivers or Sea without Defences				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 11	4	10	18	37

Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Waste					
BGS Recorded Landfill Sites	pg 20				1
Historical Landfill Sites	pg 20		3	5	8
Integrated Pollution Control Registered Waste Sites					
Licensed Waste Management Facilities (Landfill Boundaries)					
Licensed Waste Management Facilities (Locations)	pg 23			1	
Local Authority Landfill Coverage	pg 23	1	n/a	n/a	n/a
Local Authority Recorded Landfill Sites	pg 23		1	7	6
Potentially Infilled Land (Non-Water)	pg 25		1	3	5
Potentially Infilled Land (Water)	pg 26		2	4	32
Registered Landfill Sites	pg 28			6	1
Registered Waste Transfer Sites					
Registered Waste Treatment or Disposal Sites					
Hazardous Substances					
Control of Major Accident Hazards Sites (COMAH)					
Explosive Sites					
Notification of Installations Handling Hazardous Substances (NIHHS)					
Planning Hazardous Substance Consents					
Planning Hazardous Substance Enforcements					

Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Geological					
BGS 1:625,000 Solid Geology	pg 31	Yes	n/a	n/a	n/a
BGS Estimated Soil Chemistry	pg 31	Yes	Yes	Yes	Yes
BGS Recorded Mineral Sites	pg 34			3	5
BGS Urban Soil Chemistry					
BGS Urban Soil Chemistry Averages					
CBSCB Compensation District			n/a	n/a	n/a
Coal Mining Affected Areas	pg 36	Yes	n/a	n/a	n/a
Mining Instability	pg 36	Yes	n/a	n/a	n/a
Man-Made Mining Cavities					
Natural Cavities					
Non Coal Mining Areas of Great Britain	pg 36	Yes		n/a	n/a
Potential for Collapsible Ground Stability Hazards	pg 36	Yes		n/a	n/a
Potential for Compressible Ground Stability Hazards	pg 36	Yes	Yes	n/a	n/a
Potential for Ground Dissolution Stability Hazards				n/a	n/a
Potential for Landslide Ground Stability Hazards	pg 36	Yes	Yes	n/a	n/a
Potential for Running Sand Ground Stability Hazards	pg 36	Yes	Yes	n/a	n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 37	Yes		n/a	n/a
Radon Potential - Radon Affected Areas	pg 37	Yes	n/a	n/a	n/a
Radon Potential - Radon Protection Measures			n/a	n/a	n/a
Industrial Land Use					
Contemporary Trade Directory Entries	pg 38		38	46	73
Fuel Station Entries	pg 52		1		1
Points of Interest - Commercial Services	pg 52		6	9	14
Points of Interest - Education and Health					
Points of Interest - Manufacturing and Production	pg 55		6	6	11
Points of Interest - Public Infrastructure	pg 57			2	2
Points of Interest - Recreational and Environmental	pg 57		2	1	11
Gas Pipelines					
Underground Electrical Cables					

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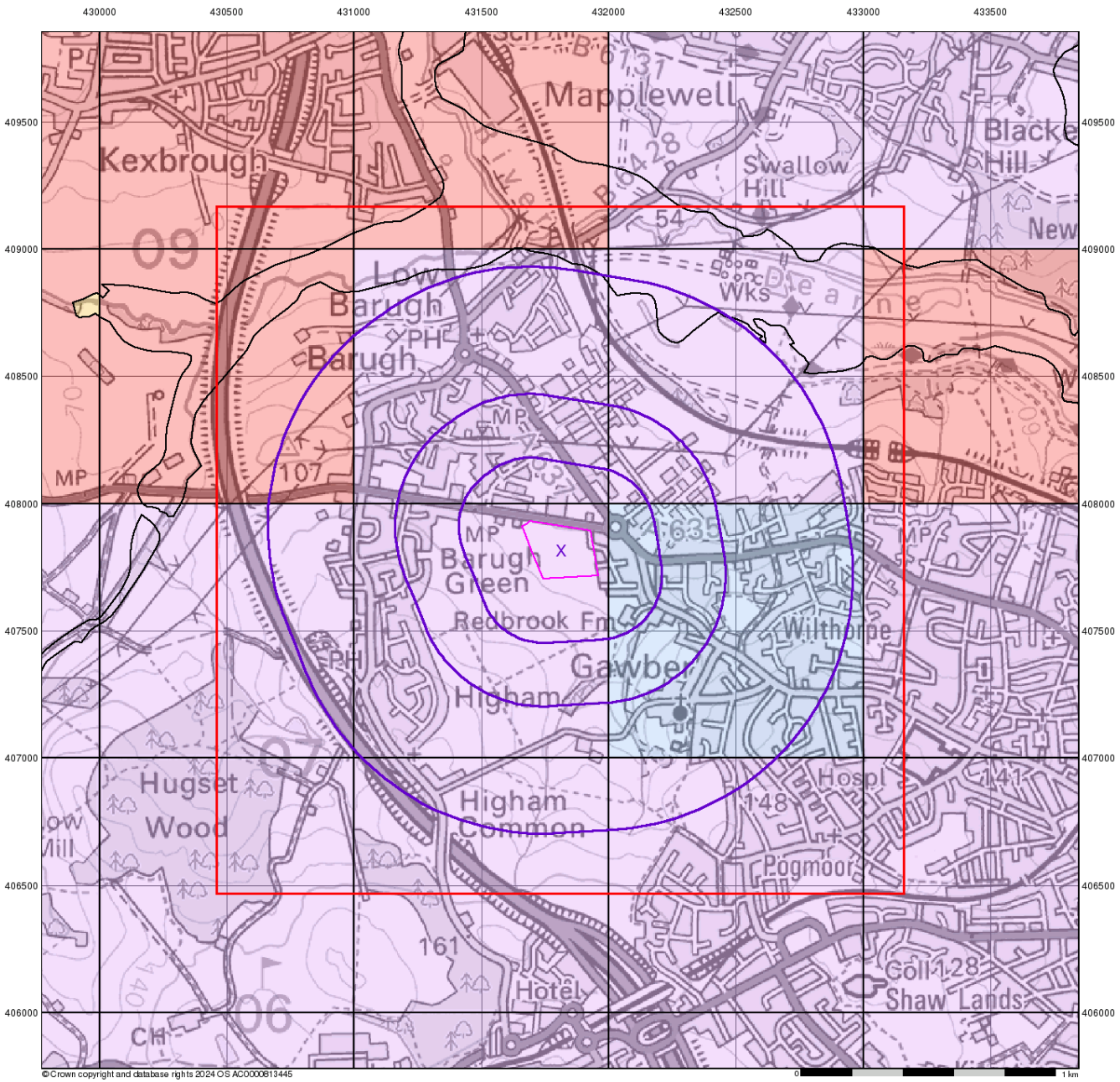
Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Sensitive Land Use					
Ancient Woodland					
Areas of Adopted Green Belt	pg 59				1
Areas of Unadopted Green Belt					
Areas of Outstanding Natural Beauty					
Environmentally Sensitive Areas					
Forest Parks					
Local Nature Reserves					
Marine Nature Reserves					
National Nature Reserves					
National Parks					
Nitrate Sensitive Areas					
Nitrate Vulnerable Zones	pg 59	1			
Ramsar Sites					
Sites of Special Scientific Interest					
Special Areas of Conservation					
Special Protection Areas					
World Heritage Sites					



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Groundwater Vulnerability

General

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

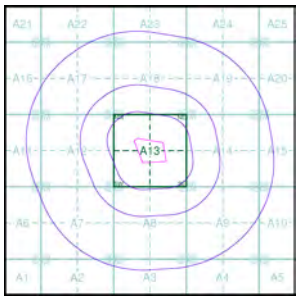
Agency and Hydrological

Bedrock Aquifers	Superficial Aquifers
High Vulnerability, Principal Aquifer	High Vulnerability, Principal Aquifer
High Vulnerability, Secondary Aquifer	High Vulnerability, Secondary Aquifer
Medium Vulnerability, Principal Aquifer	Medium Vulnerability, Principal Aquifer
Medium Vulnerability, Secondary Aquifer	Medium Vulnerability, Secondary Aquifer
Low Vulnerability, Principal Aquifer	Low Vulnerability, Principal Aquifer
Low Vulnerability, Secondary Aquifer	Low Vulnerability, Secondary Aquifer

Unproductive Aquifer

Soluble Rock

Site Sensitivity Context Map - Slice A



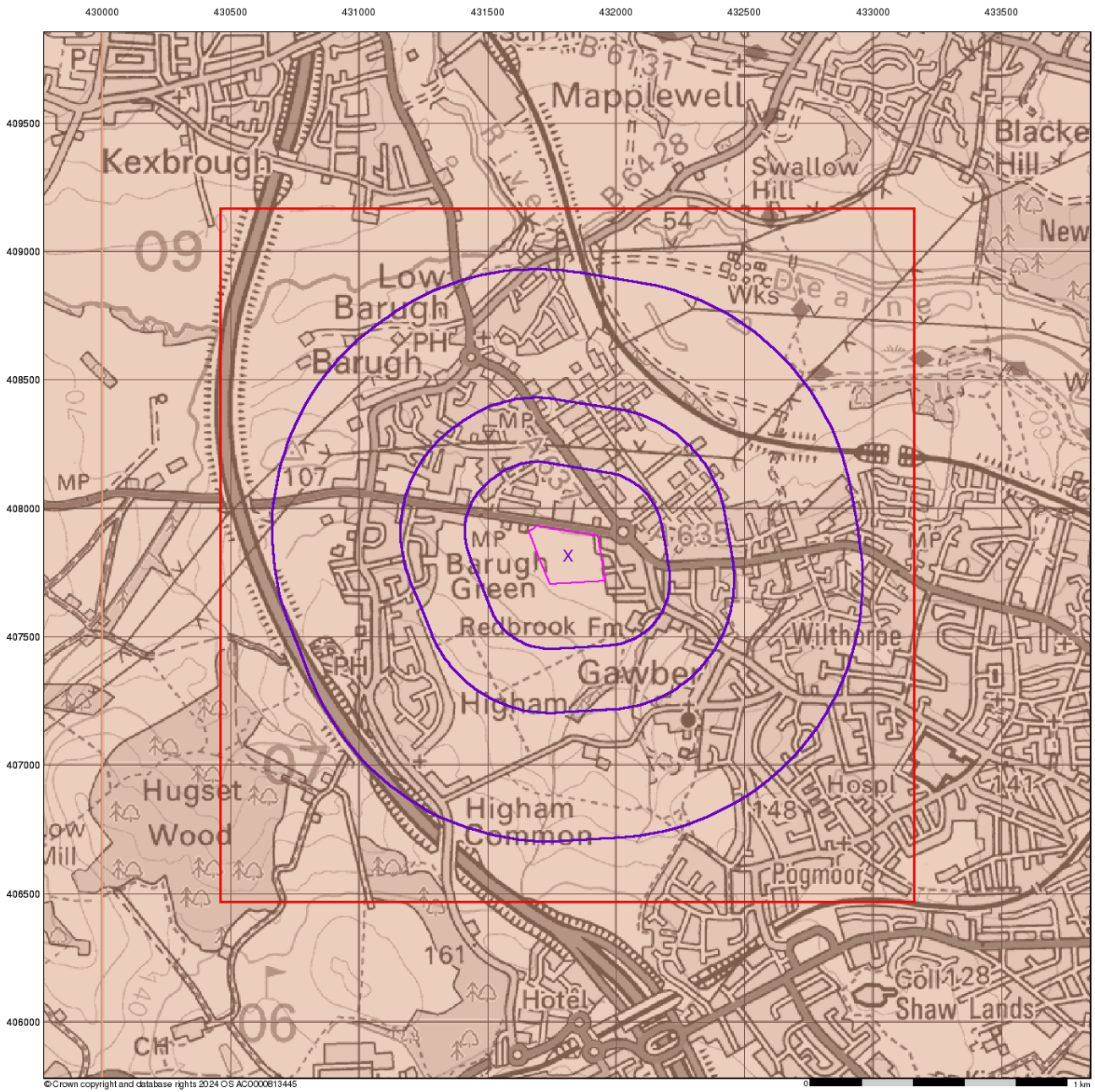
Order Details

Order Number:	359111613_1_1
Customer Ref:	3407
National Grid Reference:	431810, 407820
Slice:	A
Site Area (Ha):	4.96
Search Buffer (m):	1000

Site Details

Barugh Green, S75 1HR

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



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Bedrock Aquifer Designation

General

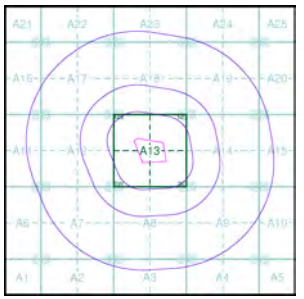
Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landslip)

Site Sensitivity Context Map - Slice A



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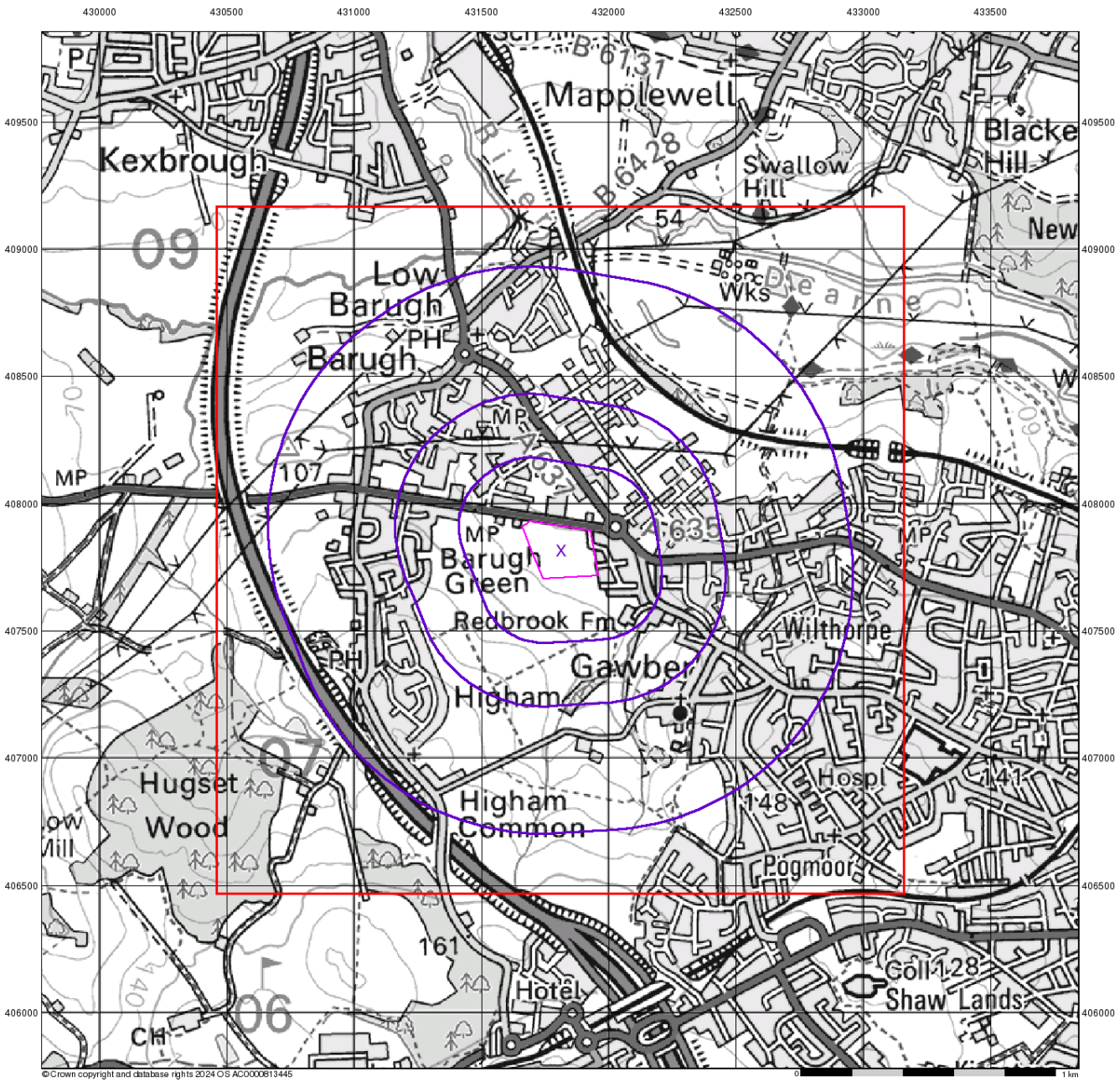

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Source Protection Zones

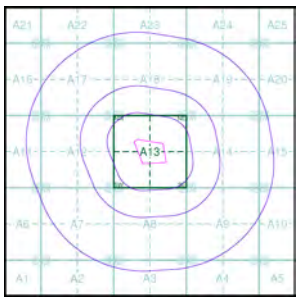
General

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



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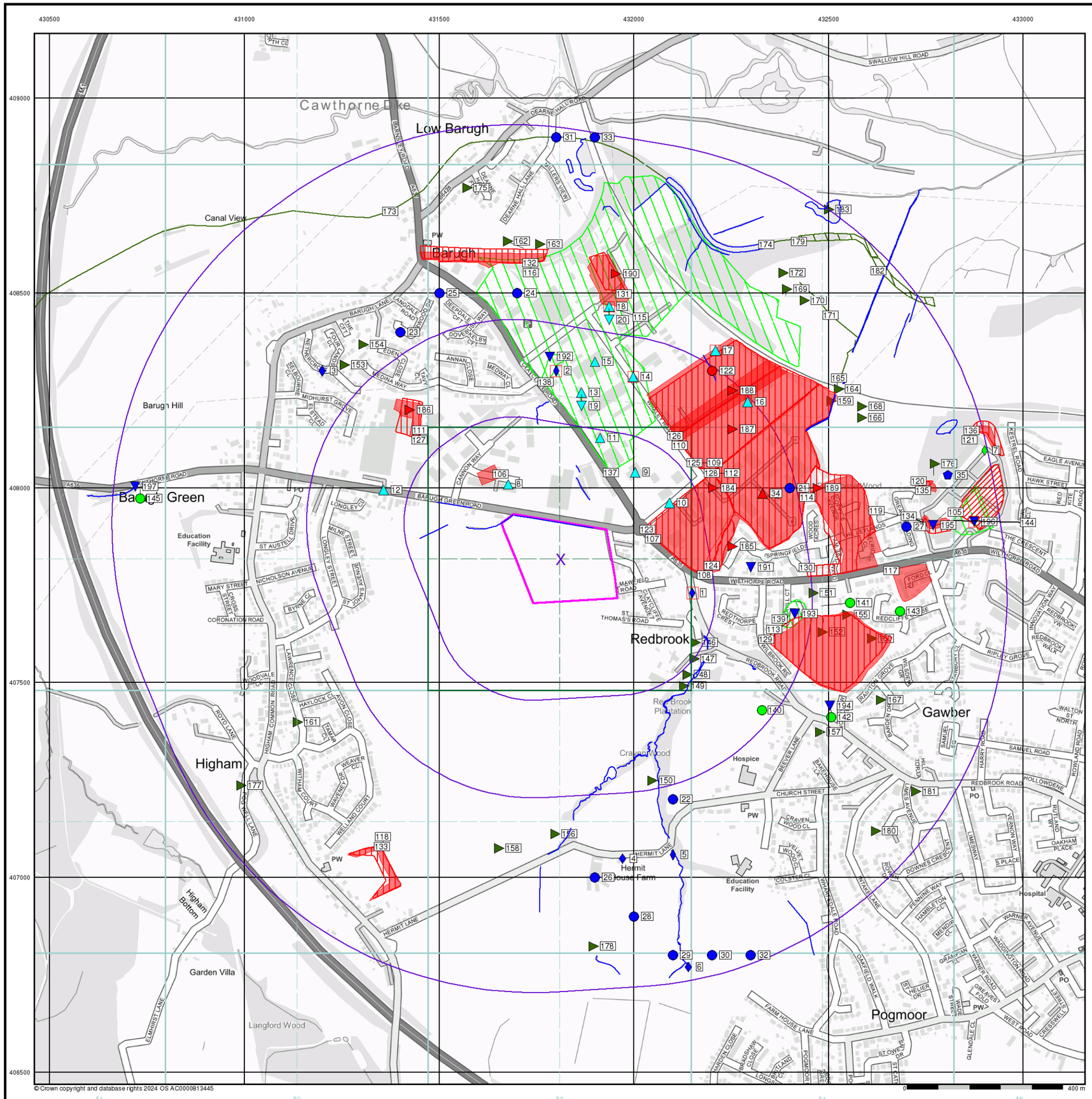

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General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Map ID

Several of Type at Location

Agency and Hydrological

- Contaminated Land Register Entry or Notice (Location)
- Contaminated Land Register Entry or Notice
- Discharge Consent
- Enforcement or Prohibition Notice
- Integrated Pollution Control
- Integrated Pollution Prevention Control
- Local Authority Integrated Pollution Prevention and Control
- Local Authority Pollution Prevention and Control
- Local Authority Pollution Prevention and Control Enforcement
- Pollution Incident to Controlled Waters
- Prosecution Relating to Authorised Processes
- Prosecution Relating to Controlled Waters
- Registered Radioactive Substance
- River Network or Water Feature
- River Quality Sampling Point
- Substantiated Pollution Incident Register
- Water Abstraction
- Water Industry Act Referral

Waste

- BGS Recorded Landfill Site (Location)
- BGS Recorded Landfill Site
- EA Historic Landfill (Buffered Point)
- EA Historic Landfill (Polygon)
- Integrated Pollution Control Registered Waste Site
- Licensed Waste Management Facility (Landfill Boundary)
- Licensed Waste Management Facility (Location)
- Local Authority Recorded Landfill Site (Location)
- Local Authority Recorded Landfill Site
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Water)
- Potentially Infilled Land (Water)
- Potentially Infilled Land (Water)
- Registered Landfill Site
- Registered Landfill Site (Location)
- Registered Landfill Site (Point Buffered to 100m)
- Registered Landfill Site (Point Buffered to 250m)
- Registered Waste Transfer Site (Location)
- Registered Waste Transfer Site
- Registered Waste Treatment or Disposal Site (Location)
- Registered Waste Treatment or Disposal Site

Hazardous Substances

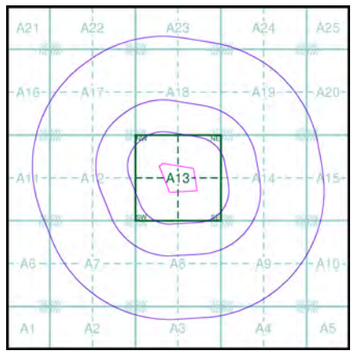
COMAH Site | Explosive Site | NIHHS Site

- Planning Hazardous Substance Consent
- Planning Hazardous Substance Enforcement

Geological

- BGS Recorded Mineral Site

Site Sensitivity Map - Slice A



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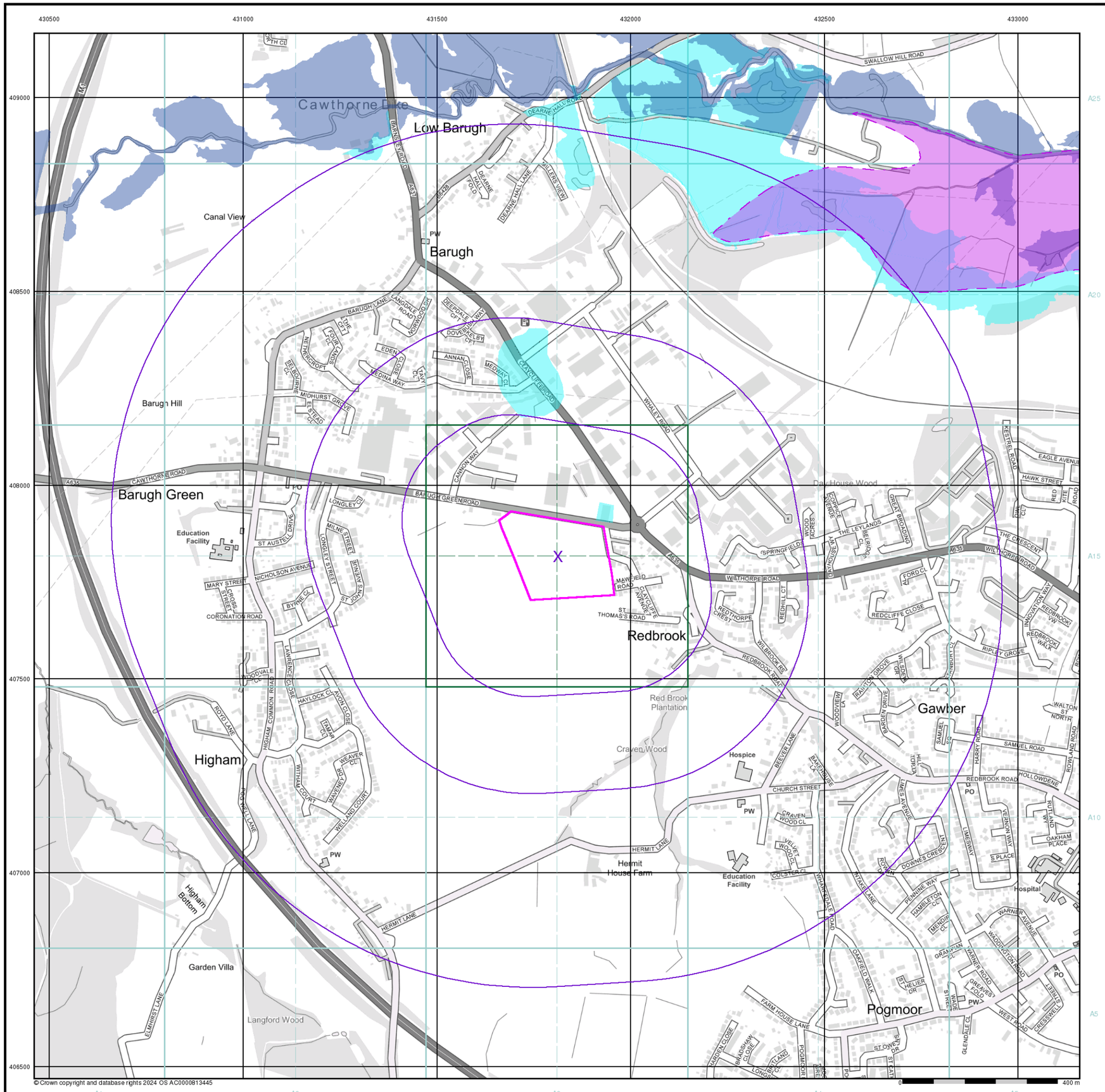

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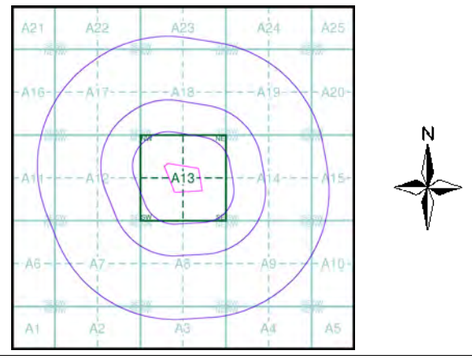
General

- 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



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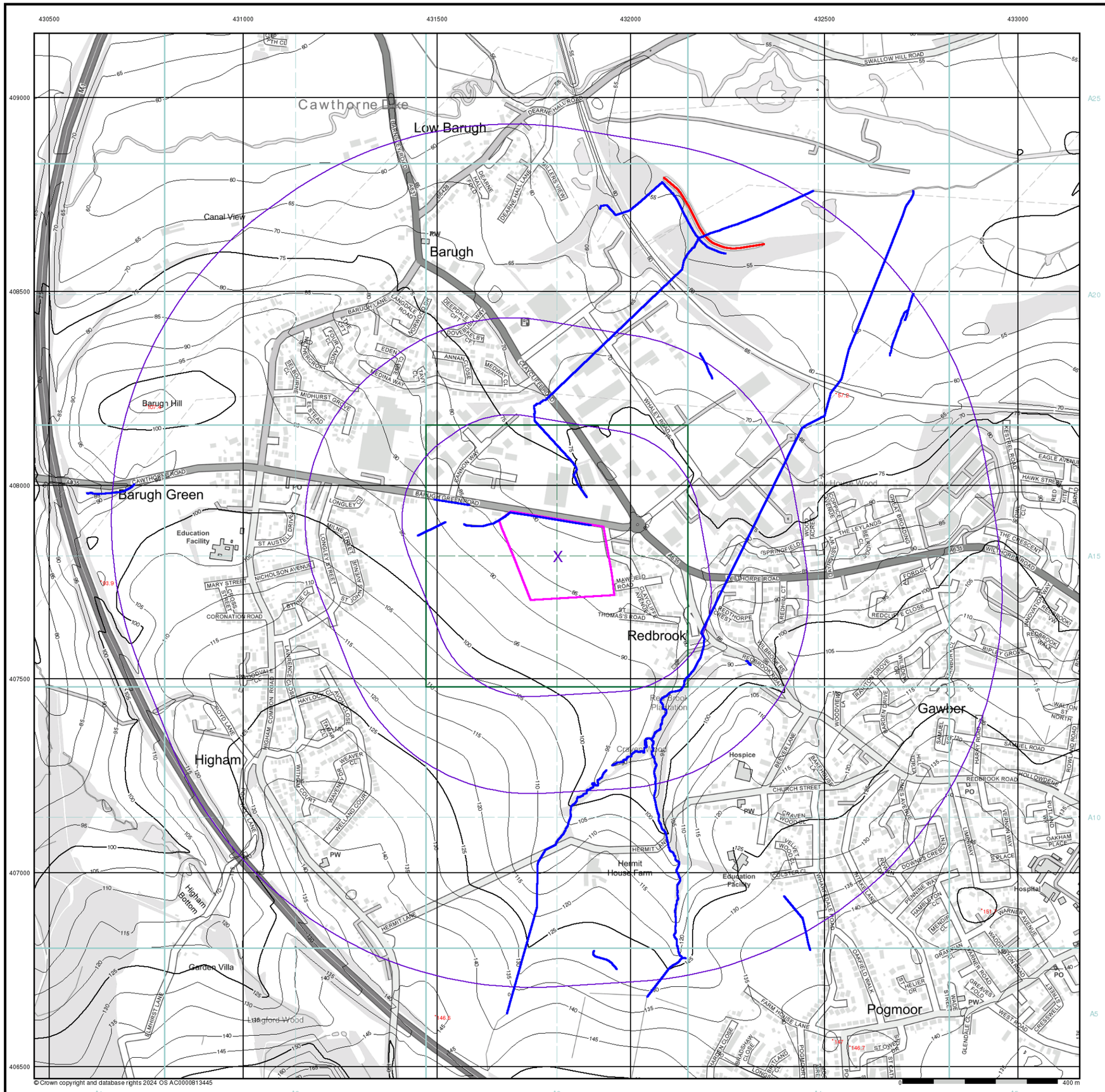

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0 400 m

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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)

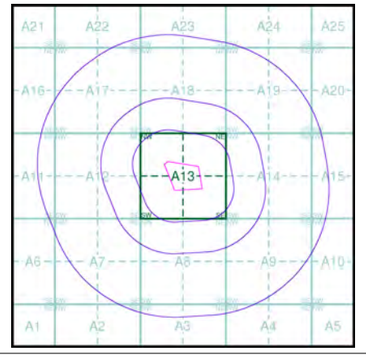
Standard Contour 105 100 95

Master Contour

Spot Height 167.3

- MLW Mean Low Water
- MHW Mean High Water

OS Water Network Map - Slice A



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Barugh Green, S75 1HR

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

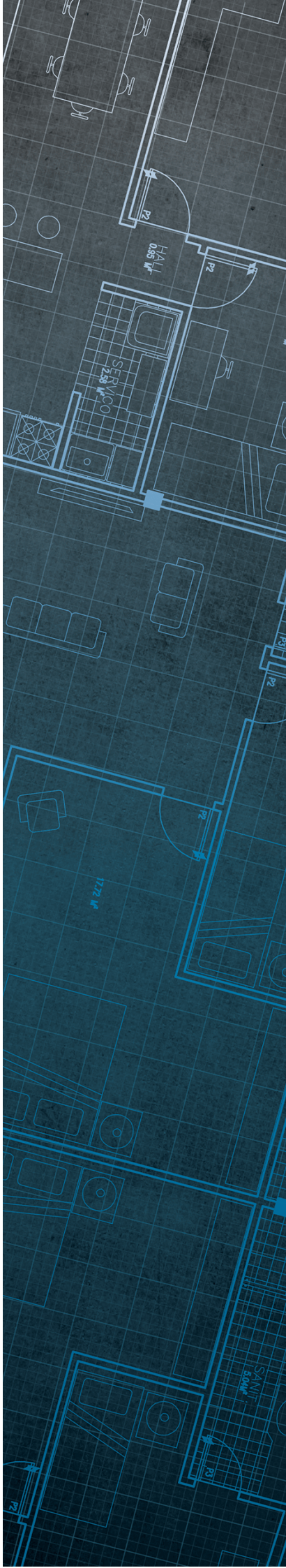
The Coal Authority

Consultants

Coal Mining Report

Barugh Green Road
Barugh Green
Barnsley
Barnsley
S75 1HR

Date of enquiry:	**25 September 2024**
Date enquiry received:	**25 September 2024**
Issue date:	**25 September 2024**
Our reference:	**51003452371001**
Your reference:	**PO23112/3407**



Consultants

Coal Mining Report

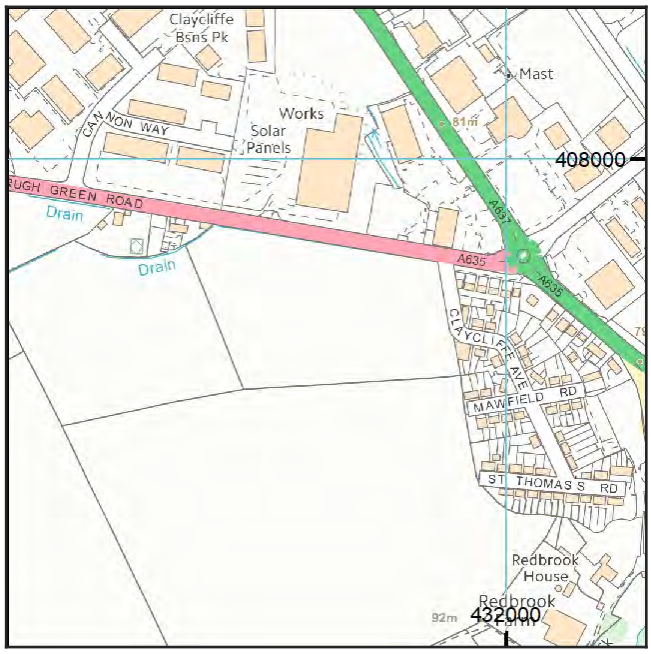
This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

LITHOS CONSULTING

Enquiry address

Barugh Green Road
Barugh Green
Barnsley
Barnsley
S75 1HR



Approximate position of property

How to contact us

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

200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

www.groundstability.com

@coalauthority
/company/the-coal-authority
/thecoalauthority
/thecoalauthority

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
DODWORTH	FLOCKTON THICK	Coal	6NKR	119	Beneath Property	3.8	North-East	68	1952
DODWORTH	FLOCKTON THICK	Coal	6NJR	127	Beneath Property	3.8	North-East	71	1959
DODWORTH	FLOCKTON THICK	Coal	6NFT	128	North	4.2	North-East	56	1960
DODWORTH	FLOCKTON THICK	Coal	6Z6U	133	East	4.1	North-East	76	1950
DODWORTH	TOP FENTON	Coal	6NCR	153	South-West	2.7	North-East	79	1933
DODWORTH	SILKSTONE	Coal	6NHS	253	Beneath Property	3.9	North-East	105	1977
STANHOPE SILKSTONE	SILKSTONE	Coal	6NDS	254	North-West	4.4	North-East	107	1928
STANHOPE SILKSTONE	SILKSTONE	Coal	6NCV	258	North-West	3.9	North-East	107	1928
unnamed	SILKSTONE	Coal	6NFS	268	Beneath Property	4.7	North-East	107	1928
DODWORTH	SILKSTONE	Coal	6NGS	269	Beneath Property	4.0	North-East	105	1979
DODWORTH	SILKSTONE	Coal	6Z70	274	East	4.3	North-East	105	1976
DODWORTH	SILKSTONE	Coal	6NDW	274	North	3.0	North-East	100	1978
DODWORTH	SILKSTONE	Coal	6YNG	279	North-East	3.9	North-East	90	1978
WOOLLEY	WHINMOOR	Coal	6NLS	309	Beneath Property	4.3	North-East	107	1978
WOOLLEY	WHINMOOR	Coal	6NEV	321	North	4.8	North-East	115	1978
WOOLLEY	WHINMOOR	Coal	Z89	323	Beneath Property	5.2	North-East	107	1980
WOOLLEY/REDBROOK	WHINMOOR	Coal	6Z72	323	East	4.8	North-East	107	1977
WOOLLEY	WHINMOOR	Coal	6NFV	327	North	4.4	North-East	115	1979
WOOLLEY/REDBROOK	WHINMOOR	Coal	6Z74	329	North-East	4.7	North-East	117	1979
WOOLLEY/REDBROOK	WHINMOOR	Coal	6YNH	329	North-East	4.4	East	109	1979

Probable unrecorded shallow workings

None.

Spine roadways at shallow depth

No spine roadway recorded at shallow depth.

Mine entries

None recorded within 100 metres of the enquiry boundary.

Abandoned mine plan catalogue numbers

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

7197	7196	NE498
NE919	9534	NE584
7195	NE3	NE1034

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

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

Outcrops

Seam name	Mineral	Seam workable	Distance to outcrop (m)	Direction to outcrop	Bearing of outcrop
GAWBER	Coal	Yes	Within	N/A	12
Unnamed	Coal	Yes	Within	N/A	328

Geological faults, fissures and breaklines

No faults, fissures or breaklines recorded.

Opencast mines

Please refer to the “Summary of findings” map (on separate sheet) for details of any opencast areas 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
2.2	West

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 in an area where notices to withdraw support were given in 1956, 1977 and 1987.

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

Payments to owners of former copyhold land
The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Section 4 – Further information

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

Future development

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

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

Development advice

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

Site investigations

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

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

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

Section 5 – Data definitions

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

Past underground coal mining

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

Probable unrecorded shallow workings

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

Spine roadways at shallow depth

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

Mine entries

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

Abandoned mine plan catalogue numbers

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

Outcrops

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

Geological faults, fissures and breaklines

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

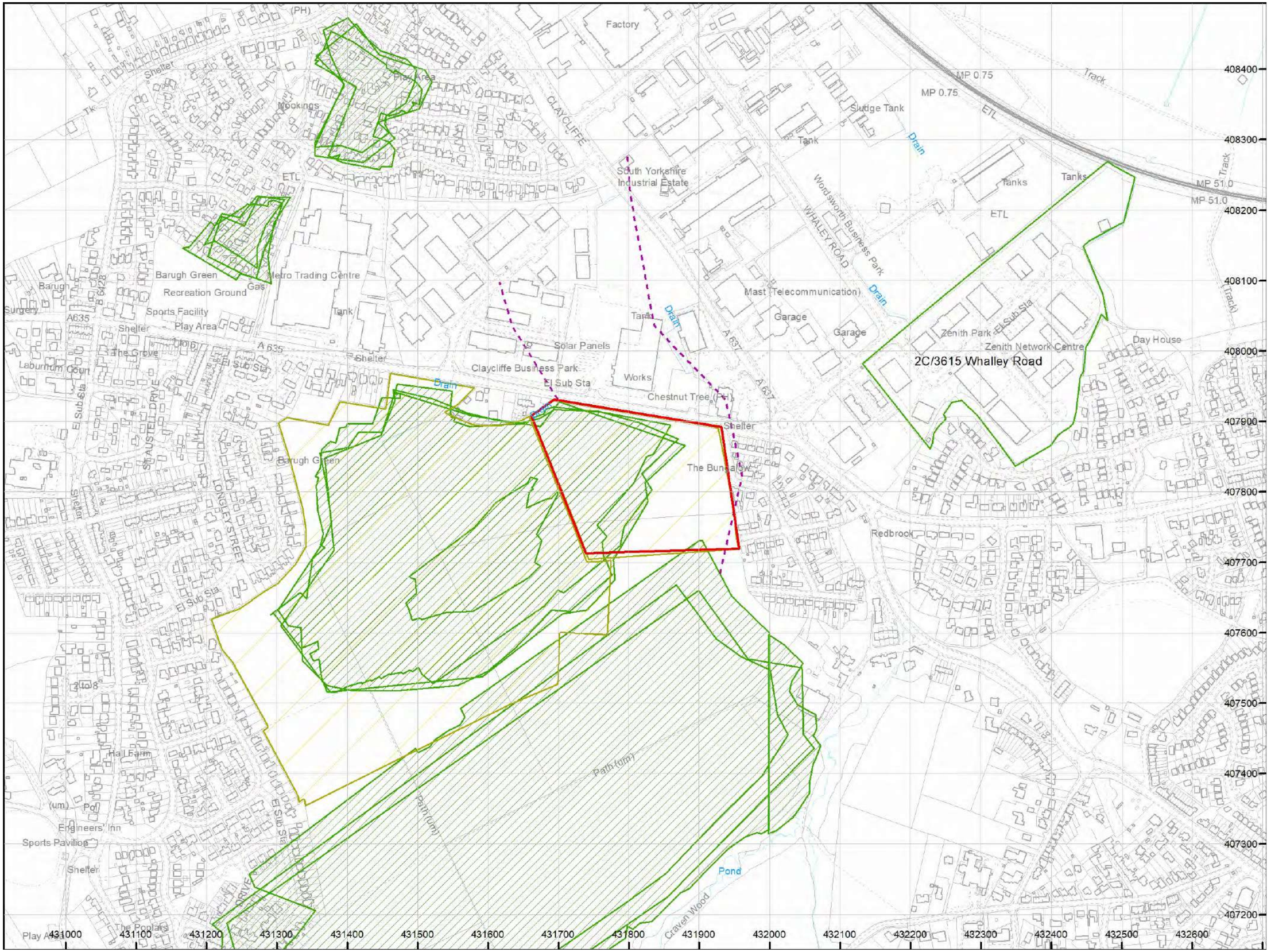
The Coal Authority

Summary of findings

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
- Outcrop (Conjectured)
- Opencast mine licence area
- Unlicensed opencast site
- Site investigations



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