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Our ref: AG-7586-160307-EC-E

Your ref:

7th March 2016

Dear Sirs,

Coal Mining Risk Assessment for Proposed Development at Upper Hoyland Road, Barnsley

We have completed our desk-top assessment as detailed above and are pleased to report on the findings.

Introduction

Ecus Ltd was instructed by Eton Construction ltd to undertake an assessment of the stability of a site at Upper Hoyland Road, Barnsley, South Yorkshire, with respect to past coal mining activity.

The National Grid Reference of the site is 436100, 401425 (site centre).

Scope of Works

As part of this assessment, the following information sources have been examined:

- British Geological Survey (BGS) – Geological Map Sheet 87 - Barnsley, Bedrock and Superficial Deposits Edition, 1:50,000 scale. 2008.
- BGS – A Brief Explanation of the Geological Map Sheet 87 Barnsley. 2007.
- BGS Geology of Britain Viewer website: http://mapapps.bgs.ac.uk/geologyofbritain/home.html
- The Coal Authority's Interactive Map Viewer: http://mapapps2.bgs.ac.uk/coalauthority/home.html
- Coal Authority Non-Residential Mining Report, reference 51001103750001 (attached).
- Historical maps website: https://www.old-maps.co.uk

Proposed Development

It is understood that the proposed development comprises construction of 14no. houses on the site, as shown on Eton Construction Drawing No. EC02-22, dated 18.12.15.

Geological Assessment

The geological map shows that the site is underlain by rocks of the Carboniferous Middle Coal Measures Formation, which are described as undifferentiated mudstone and siltstone with sandstones, coal seams, seatearth beds and marine bands. An un-named sandstone unit within the Middle Coal Measures may be present in the north-western corner of the site. Rocks in this area are shown to dip towards the east, although there is no dip angle measurement shown in proximity to the site. However, the dip angle shown on the geological cross-section, the line of which runs close to the site, is shown to be approximately 5 degrees.

No superficial (drift) deposits are shown in the vicinity of the site.

No artificial (made) ground is shown to underlie the site.

No faults are shown to cross the site.

There are no borehole records on the BGS Open Geoscience website relating to the site or immediately surrounding area.

Shallow Coal Seam Assessment

The geological map shows that the shallowest coal seam that is likely to underlie the site is the Kent's Thin Coal, which outcrops approximately 40m to north-west of the site, on the opposite side of the Dearne Valley Parkway. Reference to both the geological map and the Coal Authority's on-line map viewer shows that the outcrop of the Kent's Thin Coal has been substantially altered by opencast coal mining immediately west and north-west of the site. The thickness of the Kent's Thin Coal in the Barnsley area given in the geological memoir is 0-1.9m, and it is stated that the seam was worked by opencast methods.

The next shallowest seam below the site is shown on the geological map as being the Kent's Thick (Mapplewell) Coal, which outcrops approximately 350m north-west of the site. The thickness of the Kent's Thick Coal in the Barnsley area given in the geological memoir is 0.3-2.6m, and that the seam was worked in mines, at outcrop and by opencast methods.

No further coal seams are illustrated on the geological map in such proximity to the site that they are considered likely to underlie the site at shallow depth.

Coal Authority Information

Mining Report

A site-specific Coal Mining Report was obtained from the Coal Authority and is included with this report. The pertinent points of the coal mining report are summarised below:

- The property is in the likely zone of influence from recorded workings in 16no. seams of coal at 100m to 450m depth, and last worked in 1975. Any ground movement from these coal workings should have stopped by now.
- In addition, the property is in an area where the Coal Authority believes there is coal at or close to the surface. This coal may have been worked at some point in the past. This refers to the Kent's Thin seam.
- There are no recorded coal mine workings in a shallow seam of coal (i.e., a coal seam that is less than 30m bgl).
- There are no known mine entries within the site or within 20m of the site.
- The site is not in an area of current or proposed future underground coal mining; however, reserves of coal exist in the local area which could be worked at some time in the future.
- The site is not within the boundary of a previous opencast coal mine.
- The site is not within 200m of a current opencast coal mine, or 800m of a future opencast coal mine.
- There are two claims for coal mining subsidence located within 50m of the property boundary, although none relate to the site itself.
- The Coal Authority is not aware of any evidence of damage arising due to geological faults or other lines of weakness that have been affected by coal mining.
- The site has not been subject to remedial works, by or on behalf of the Authority.
- There is no record of a mine gas emission requiring action by the Coal Authority within the boundary of the site.

The claims for coal mining subsidence are illustrated on a map within the Coal Mining Report and appear to relate to two separate properties, located to the south-east of the site.

Coal Authority Interactive Map Viewer

Inspection of the Coal Authority hazard map shows that there is a short section of a coal seam outcrop in the north-western corner of the site; this is the only feature within the site that constitutes a Development High Risk Area; there are no recorded Past Shallow Coal Mine Workings, Surface (opencast) Workings or Probable (unrecorded) Shallow Coal Mine Workings within the site.

The short section of coal seam outcrop in the north-western part of the site is not identified and does not accord with the BGS map, which shows no coal outcrop on the site. Similarly, the Coal Authority's online viewer shows the outcrops of the Kent's Thin and Kent's Thick coal seams to the north-west of the site.

The hazard map also indicates that the site itself is not affected by other potential hazards, including mine entries, opencast mining, mine gas emissions, fissures and breaklines, surface hazards, etc.

The land immediately to the west of the site is shown as comprising an area of past opencast mining.

A Mine Gas Site is shown approximately 150m to the west of the site.

Historical Maps Information

Historical maps which are available to view online were accessed via www.old-maps.co.uk; these cover the time period from 1855 to 1989. These maps do not show any coal mining related features within the site or area immediately surrounding the site. The site appears to have remained undeveloped during this time.

Identification of Risks from Mining-related Features

From an assessment of the information summarised above, the following are considered to pose a risk to the stability of proposed development:

- Unrecorded shallow coal mine workings in the Kent's Thin Seam;
- Unrecorded shallow coal mine workings in the Kent's Thick Seam.

Risk from Unrecorded Shallow Coal Mine Workings in the Kent's Thin Seam
The Kent's Thin seam is shown to outcrop approximately 40m to the north-west of the site boundary on the geological map of the area. The maximum thickness of the seam is given as 1.9m thick and is clearly an economically extractable coal seam in the area, because it was extracted by opencast mining immediately west of the site.

Base on a simplistic trigonometric model, assuming a 5-degree dip angle, the Kent's Thin seam would be approximately 4m bgl at the site's north-western corner, adjusted to approximately 7m, bgl due to the coal outcrop being approximately 3m lower than the site. At the site's south-eastern corner, the seam would expected to lie at approximately 20m bgl, when adjusted for the rise in ground level across the site.

Based on these depths, the thickness of rock that could be expected to lie above the coal seam would be less than ten times the seam thickness across the site, which is the widely accepted rule of thumb when determining whether there is a risk of instability from shallow mine workings.

Accordingly, it is considered that there is a risk of instability within unrecorded shallow coal mine workings within the Kent's Thin coal seam.

Risk from Unrecorded Shallow Coal Mine Workings in the Kent's Thick Seam
The geological map shows that the seam is 0.3m to 2.6m thick and outcrops 350m north-west of the site at its closest point.

Based on a simplistic trigonometric model, assuming a 5 degree dip angle, the Kent's Thick seam would be approximately 30m below ground level at the lowest point of the site (northern boundary). However, the outcrop of the Kent's Thick seam lies at an elevation of approximately 125m above Ordnance Datum (AOD), with the lowest part of the site lying at approximately 140m AOD.

Therefore, the Kent's Thick seam would be expected to lie at a depth of approximately 45m bgl at the lowest point of the site. At this depth, the seam would not considered to be at 'shallow depth' and hence unrecorded shallow mine workings within the seam would pose a low risk of future instability at the site.

Coal Mining Risk Assessment

Underground coal mining (recorded at shallow depths)
There are no recorded shallow coal mine workings below the site.

Underground coal mining (probable at shallow depths)
There is a risk of instability at the site following development from unrecorded shallow mine workings within the Kent's Thin coal seam.

However, the risk can be mitigated by intrusive investigation, and if shown to be necessary by the intrusive investigation, stabilisation, e.g., by drilling and grouting prior to construction.

Mine entries (shafts and adits)
There are no recorded mine entries on or near the site.

The Kent's Thin coal seam is likely to be present at shallow depth beneath much of the site, which may have been worked by unrecorded bell pits in the past. In addition, because the Coal Authority's

records of shafts are incomplete, there is potential for unrecorded mine shafts into unrecorded 'pillar and stall' workings within the Kent's Thin seam.

However, if found to be present, the risk of instability from unrecorded mine shafts can be mitigated by filling, stabilisation and capping at rockhead. If shallow coal mine workings are found not to be present below the site, it would be considered unlikely that unrecorded mine shafts are present.

Coal mining geology (fissures)
No faults are known to cross the site. There are no records of the site being affected by damage arising due to a fault or other line of weakness. Therefore the risk to site stability at this stage is considered to be low.

Record of past mine gas emissions or potential
There are no recorded shallow coal mine workings or mine entries at the site. Furthermore the Coal Authority has no records of mine gas emissions having occurred at the site. However, as noted above, the presence of unrecorded shallow mine workings below the site cannot be discounted at this stage and a mine gas site is recorded approximately 150m west of the site. Therefore, it is possible that the proposed development at the site could be affected by mine gas emissions in the future.

However, the risk can be mitigated by installation of ground gas monitoring wells at the site, followed by a programme of ground gas monitoring, and if shown to be necessary, installation of ground gas protection measures within the housing.

Recorded coal mining surface hazard
There are no recorded coal mining surface hazards at or near the site.

Surface mining (opencast workings)
The site itself has not been subject to opencast coal mining. Therefore the risk to site stability from opencast mining is considered to be low at this stage.

Summary and Recommendations
In summary, the proposed development is potentially at risk from unrecorded shallow coal mine workings within the Kent's Thin coal seam and coal mine gas emissions from shallow mine workings

However, the risk from instability can be mitigated prior to development by undertaking an intrusive investigation to determine whether shallow coal mine workings are present, and if so by undertaking stabilisation works if necessary.

Similarly, the risk from mine gas emissions can be mitigated prior to development by undertaking ground gas monitoring, with provision of gas protection measures within the proposed housing, if found to be necessary.

It is recommended that approximately 8no. rotary open-hole boreholes are drilled across the site to a depth of 22m bgl (ten x the seam thickness and an assumption of 3m of overlying subsoils). Permission from the Coal Authority will be required to undertake the intrusive investigation, and due to the proximity to occupied housing, water flush will be required for the drilling to mitigate the risk from spontaneous combustion of coal, as per the Coal Authority's regulations.

If shallow mine workings are identified, gas monitoring wells should be installed, with a programme of ground gas monitoring undertaken to determine whether gas protection measures are required within the proposed houses.

We trust that the above meets with your satisfaction. However, please do not hesitate to contact the undersigned should you require any further information.

Yours faithfully,

A M Grant BSc (Hons) MSc CGeol
Team Manager: Geoscience
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Enc: Coal Authority Mining Report

The Coal Authority

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Our reference:	**51001103750001**
Your reference:	**80451266_1|**
Date of your enquiry:	**17 February 2016**
Date we received your enquiry:	**17 February 2016**
Date of issue:	**17 February 2016**

This report is for the property described in the address below and the attached plan.

Non-Residential Coal Authority Mining Report

SITE AT UPPER HOYLAND ROAD, HOYLAND, BARNSLEY, SOUTH YORKSHIRE

This report is based on and limited to the records held by, the Coal Authority, and the Cheshire Brine Subsidence Compensation Board's records, at the time we answer the search.

Coal mining	See comments below
Brine Compensation District	No

Information from the Coal Authority

Underground coal mining

Past

The property is in the likely zone of influence from workings in 16 seams of coal at 100m to 450m depth, and last worked in 1975.

Any ground movement from these coal workings should have stopped by now.

In addition the property is in an area where the Coal Authority believe there is coal at or close to the surface. This coal may have been worked at some time in the past. The potential presence of coal workings at or close to the surface should be considered prior to any site works or future development activity. Your attention is drawn to the Comments on Coal Authority Information section of the report.

Present

The property is not in the likely zone of influence of any present underground coal workings.

Future

The property is not in an area for which the Coal Authority is determining whether to grant a licence to remove coal using underground methods.

The property is not in an area for which a licence has been granted to remove or otherwise work coal using underground methods.

The property is not in an area that is likely to be affected at the surface from any planned future workings.

However, reserves of coal exist in the local area which could be worked at some time in the future.

No notice of the risk of the land being affected by subsidence has been given under section 46 of the Coal Mining Subsidence Act 1991.

Mine entries

There are no known coal mine entries within, or within 20 metres of, the boundary of the property.

Coal mining geology

The Authority is not aware of any evidence of damage arising due to geological faults or other lines of weakness that have been affected by coal mining.

Opencast coal mining

Past

The property is not within the boundary of an opencast site from which coal has been removed by opencast methods.

Present

The property does not lie within 200 metres of the boundary of an opencast site from which coal is being removed by opencast methods.

Future

The property is not within 800 metres of the boundary of an opencast site for which the Coal Authority is determining whether to grant a licence to remove coal by opencast methods.

The property is not within 800 metres of the boundary of an opencast site for which a licence to remove coal by opencast methods has been granted.

Coal mining subsidence

There are 2 claim(s) within 50 metres of the property boundary that do not match the property address. These are shown on the attached plan.

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

If further subsidence damage claims information is required in addition to that provided in this report, the Authority need to manually search their records. For further advice on how to order this additional information visit www.groundstability.com or telephone 0345 7626 848.

Mine gas

There is no record of a mine gas emission requiring action by the Coal Authority within the boundary of the property.

Hazards related to coal mining

The property has not been subject to remedial works, by or on behalf of the Authority, under its Emergency Surface Hazard Call Out procedures.

Withdrawal of support

The property is not in an area for which a notice of entitlement to withdraw support has been published.

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

Working facilities orders

The property is not in an area for which an Order has been made under the provisions of the Mines (Working Facilities and Support) Acts 1923 and 1966 or any statutory modification or amendment thereof.

Payments to owners of former copyhold land

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

Comments on Coal Authority information

In view of the mining circumstances a prudent developer would seek appropriate technical advice before any works are undertaken.

Therefore 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 good engineering practice developed for mining areas. No development should be undertaken that intersects, disturbs or interferes with any coal or mines of coal without the permission of the Coal Authority. Developers should be aware that the investigation of coal seams/former mines of coal may have the potential to generate and/or displace underground gases and these risks both under and adjacent to the development should be fully considered in developing any proposals. The need for effective measures to prevent gases entering into public properties either during investigation or after development also needs to be assessed and properly addressed. This is necessary due to the public safety implications of any development in these circumstances.

Information from the Cheshire Brine Subsidence Compensation Board

The property lies outside the Cheshire Brine Compensation District.

Additional Remarks

Information provided by the Coal Authority in this report is compiled in response to the Law Society's Con29M Coal Mining and Brine Subsidence Claim enquiries. The said enquiries are protected by copyright owned by the Law Society of 113 Chancery Lane, London WC2A 1PL. Please note that Brine Subsidence Claim enquiries are only relevant for England and Wales. This report is prepared in accordance with the Law Society's Guidance Notes 2006, the User Guide 2006 and the Coal Authority and Cheshire Brine Board's Terms and Conditions applicable at the time the report was produced.

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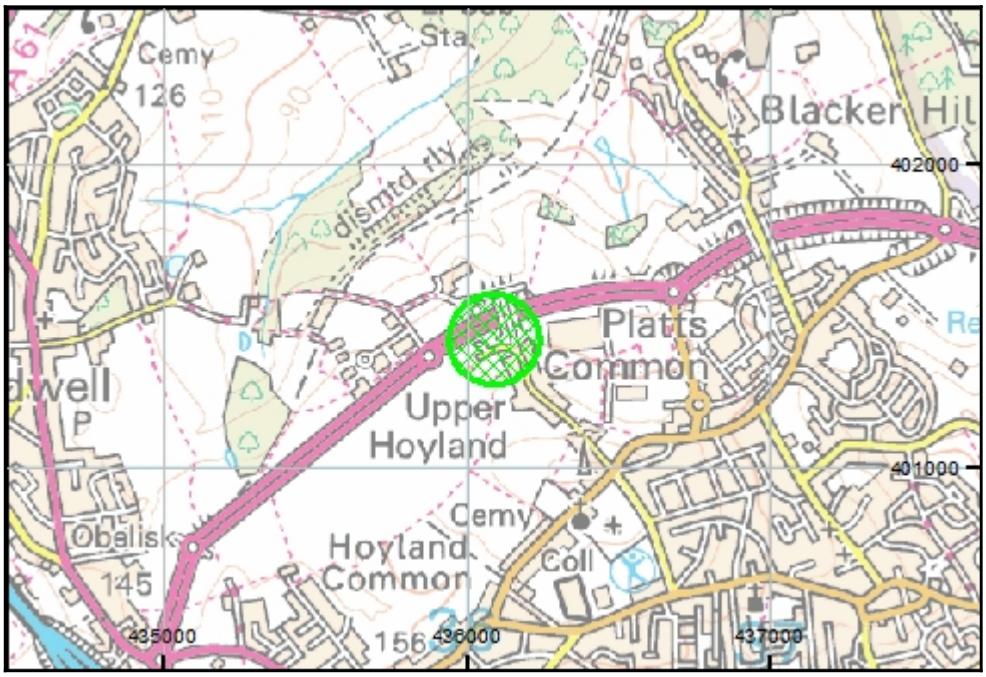
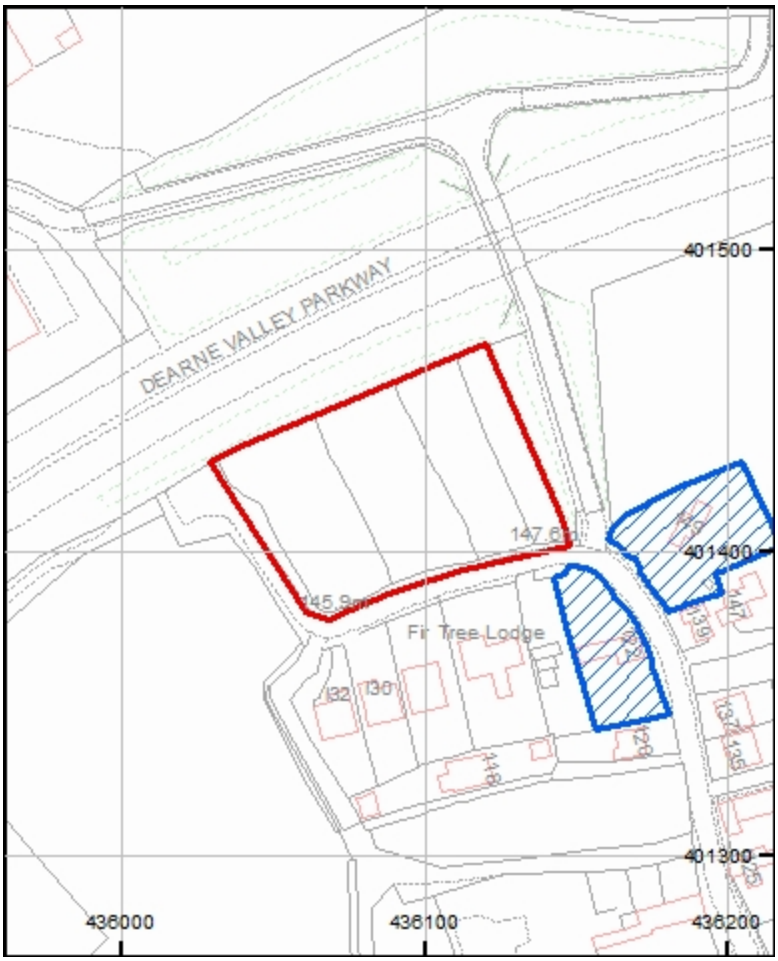
Location map

Approximate position of property



Enquiry boundary



Key

Approximate position of enquiry boundary shown

Coal Claims

Mapping sourced from Ordnance Survey