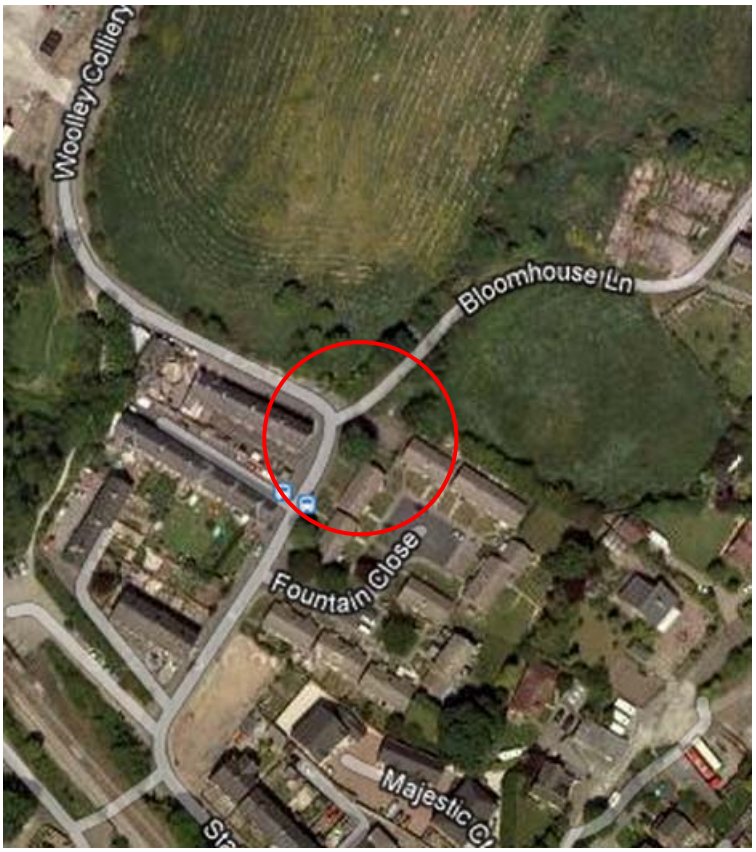


1. INTRODUCTION

This report describes the results of a Mining Risk Assessment undertaken on a site known as land west of 9 Fountain Close, Darton, Barnsley, South Yorkshire, S75 5JH. The work was undertaken on behalf of Mr J Blackburn of JRB Designs Ltd, the client. The assessment was carried out by this Consultancy, the Ashton Bennett Consultancy.

The purpose of this mining risk assessment was to assess the risk of past shallow underground mining being present beneath the site and potentially affecting proposals to construct a house on the site. The mining risk assessment involved the collation and assessment of available information on the site including geological maps, topographical maps, available borehole records and a Coal Authority report.

This report describes the research work carried out, presents the results of the mining risk assessment and assesses the risk to the site from deep and shallow underground mining.

2. THE SITE

The site is located on the west side of No 9 Fountain Close which lies east of Bloomhouse Lane extending north east from Darton, which lies between Kegworth and Mappleworth, North west of Barnsley in South Yorkshire.

The site lies as open ground at the present time. The site of the proposed new build house is bounded to the west by Bloomhouse Lane, to the east by No 9 Fountain Close and to the north by open ground. The site is bounded to the south by houses within Fountain Close.

The site is centred at National Grid Reference 431290^{E} 410290^{N} at a height of approximately 67.4m above Ordnance Datum.

Figure 1 Site Location Plan

Figure 2 Site Plan

3. REPORT OBJECTIVE AND REPORT SCOPE

The objective of this desk study is to examine the topographical, geological and mining data available for the site and determine the risk to the proposed development from past deep and shallow underground mining.

In addition to the above this study has used the extensive knowledge and experience of the staff of Ashton Bennett Consultancy to assess the data and to interpret the data findings.

4. SITE GEOLOGY

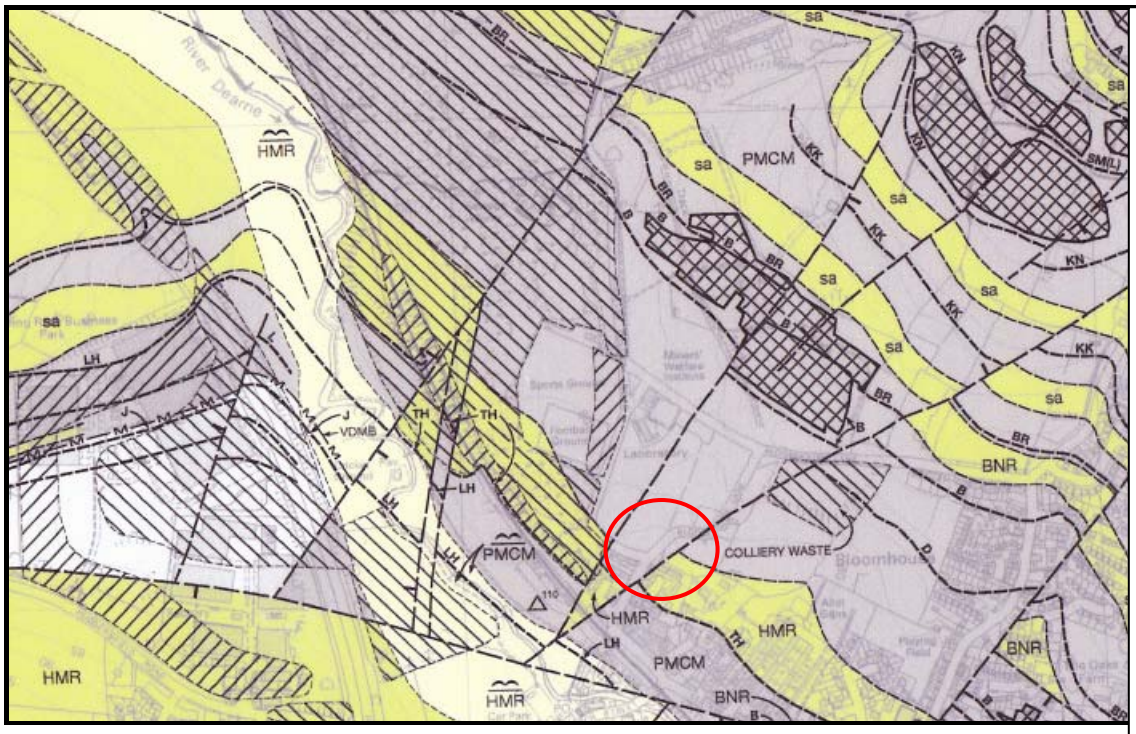
4.1 Geology

The published British Geological Survey (BGS) maps at a scale of 1:10,000 (SE31SW) show the site area to be underlain by the sandstones, mudstones and interbedded coal seams of the Westphalian B or Pennine Middle Coal Measures. The strata beneath the site are shown to be mudstones underlain by the Haigh Moor Rock Sandstone and the Top and Low Haigh Moor Coal seams. Further coal seams underlie the site at depth including the Lidget Coal, Joan Coal,

Tankersley Ironstone, Flockton Thick Coal, Flockton Thin Coal, and deeper seams. The coal seams are discussed further in Section 5.

The strata are shown to dip to the north east indicating that the Top and Low Haigh Moor Coal seams are likely to underlie the site at shallow (<30m depth) bgl.

A geological fault crosses the east part of the site and sandstone may be encountered east of the fault with the Top Haigh Moor Coal at the base of the sandstone, circa 12m bgl. West of the fault the site will be immediately underlain by mudstone underlain by circa 18m of sandstone with the Top Haigh Moor Coal immediately under the sandstone and the Low Haigh Moor less than 10m beneath the Top Haigh Moor Coal.



PMCM= Middle Coal Measures, mainly mudstone

Pale yellow=alluvium

Green = Sandstone
BNR=Barnsley Rock
HMR=Haigh Moor Rock

Grey = Mudstone

Single hatching = worked ground
Double hatching = Infilled ground

Coal seams in descending order

KK=Kents Thick
BR=Barnsley Rider
B=Barnsley
D=Dunsil
SW=Swallow Wood
TH=Top Haigh Moor
LM=Low Haigh Moor
L=Lidget
I=Ioan

Figure 3 Geology of the Site

4.2 Geological Faults

The geological maps indicate the presence of several faults close to the site. One fault trending SW to NE passes through the east side of the site and has downthrown strata to the NW compared to older strata to the SE. As the fault downthrows to the NW it is expected to dip to the NW and the Top Haigh Moor is expected to underlie the site at shallow (<30m dept) bgl.

A second geological fault trends SSW to NNE to the north west of the site and has downthrown strata to the SE compared to older strata to the NW. The two faults converge immediately south west of the site, where the Haigh Moor Rock Sandstone is shown to outcrop between the faults.

The faults are unlikely to detrimentally affect the stability of the site unless shallow mined ground is present beneath the site or unless the building is developed over strata of differing compaction such as sandstone and mudstone.

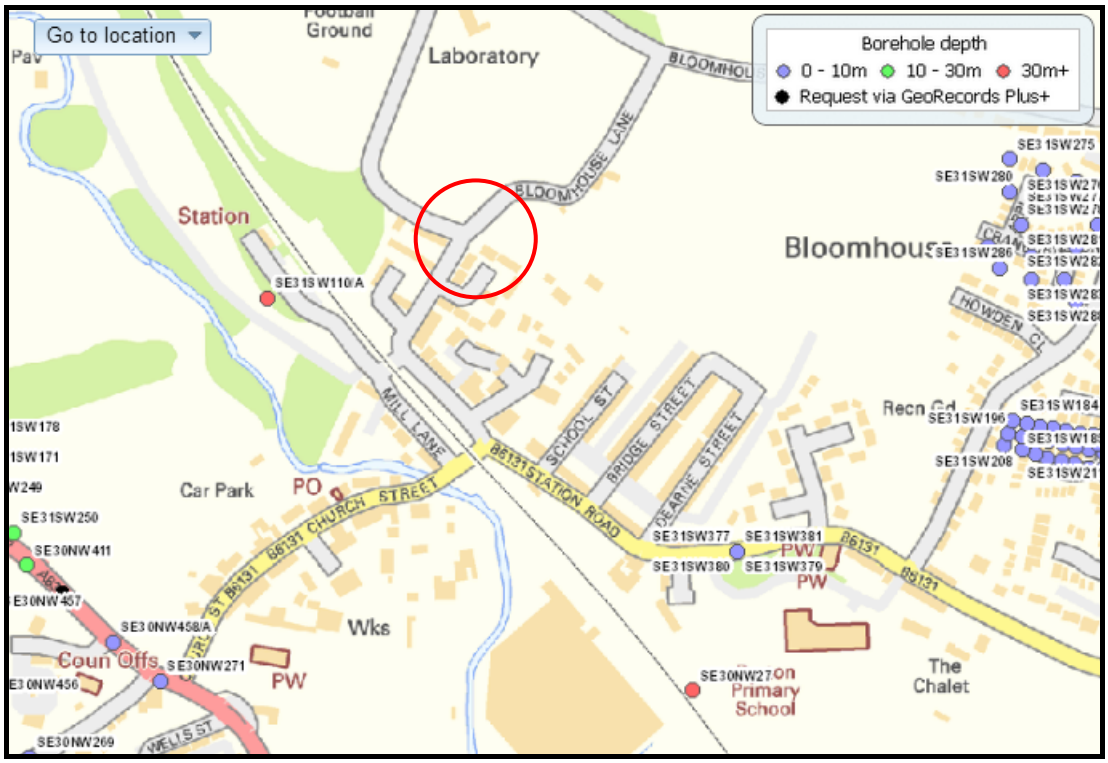


Figure 4 Local Boreholes to site

A borehole sunk by the National Coal Board in 1976 (SW30NW27) at the location of Darton Primary School, was sunk to check the depth of coal seams and the relative depth of the coal seams has been extracted from this borehole log and are presented in Table 1, Shallow Coal Seams beneath the Site.

4.3 Coal seams

Based on the geological maps and local boreholes it is likely that at least 2 and possibly 3 coal seams lie at shallow depth, less than 30m, beneath the site.

If these seams have been worked and if voids remain in the seams there is a possibility that over time the voids could migrate to the ground surface by successive roof collapse and cause ground subsidence at the surface.

TABLE 1
Shallow Coal Seams beneath the Site

Strata	Thickness in m	Approximate Depth in m
Swallow Wood Coal	0.30	0
Mudstone	18	0 to 5
Haigh Moor Rock	12 to 18	5 to 23
Top Haigh Moor Coal	1.20	23 to 24.2
Mudstone	10	24.2 to 25.2
Low Haigh Moor Coal	0.80	25.2 to 26
Mudstone	20	26 to 46
Lidget Coal	0.80	46 to 46.8
Thornhill Rock	10	46.8 to 56.8
Joan Coal	0.60	56.8 to 57.4

5. MINING

5.1 The Coal Authority Report

The Mining Report obtained from The Coal Authority for the site states that according to their records the property is in the likely zone of influence from workings in 3 seams of coal at 150m to 230m depth and last worked in 1977.

The property is not in the likely zone of influence of any present underground coal workings. 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 however, reserves of coal do exist in the local area which could be worked at some time in the future.

The property is not in an area for which a notice of entitlement to withdraw support was published in 1945 and 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.

Ground subsidence from this deep mining is expected to have stopped by now.

The Coal Authority Report is presented in Appendix A and should be read in full. The Coal Authority (CA) report is based solely on the records the CA hold, which date from 1872 when it became law to deposit mine abandonment plans with the then Ministry of Power. Earlier mining and shallow mining during the Depression generally went unrecorded.

5.2 Shallow Coal Mining

The geological maps and evidence from local boreholes indicates that the site may be within the influence of shallow mining in the Top Haigh Moor and Low Haigh Moor Coal seams. If voids remain in the mined seams and if insufficient competent strata lies above the voids, then the voids may migrate by successive roof collapse over the years producing subsidence at ground level.

Evidence indicates that at least two coal seams lie at shallow depth, within 30m bgl and the record of a mine shaft within 20m from the site indicates that there is a high risk that mining may have taken place in shallow seams beneath the site.

It is possible that pillars were left in the mines to support the roof and that voids remain in the mined seams between pillars. Such voids are likely over the years to migrate by successive roof collapse to the ground surface and cause ground settlement and structural damage to overlying properties. Due to the thin cover over the workings the risk of this occurring is **medium to high risk.**

5.3 Mine Shafts

The Coal Authority Report states that the Coal Authority have records of one mine entry, 431410-042, within or within 20m of the site boundary. The location is shown on the plan attached to the Coal Authority Report and on Figure 5 below.

Figure 5 Mine Shaft Location

The shallow coal seams may have been mined from areas local to the pit and the extent of mining needs to be ascertained before construction of the proposed house. The risk of the mine shaft detrimentally affecting the site can only be determined once the ground conditions beneath the site are ascertained.

6. RISK ASSESSMENT

The Mining Risk Assessment undertaken has indicated that the site is underlain by the Middle Coal Measures comprising mudstones, sandstones and interbedded coal seams. Based on the BGS geological maps and records of boreholes drilled in the area, the site is expected to be underlain by mudstones and the Haigh Moor Rock Sandstone with two shallow interbedded coal seams in turn underlain by thin sandstones and further mudstones and interbedded coal seams.

The shallowest coal seams, the Top and Low Haigh Moor Coal seams are likely to have been mined beneath or in close vicinity to the site, evidenced by the mine shaft within 20m and the high level of extraction of these seams in the area. These coal seams may contain voids and if there is insufficient strata overlying the coal seams, then voids may migrate by successive roof collapse and cause ground settlement and structural damage to overlying properties in the future. The **shallow coal** workings therefore pose a **medium to high risk** to future development.

There are records of three deeper coal seams being mined, and they have sufficient competent strata overlying any remaining voids to prevent ground settlement. Any ground subsidence from the mining of these deep seams should be completed by now. The risk of the site being detrimentally affected by mining of **deep coal** (>30m bgl) is **low**.

The risk that collapse of shallow underground coal workings could cause subsidence at the ground surface above is normally empirically assessed using the T10 rule (developed by the National Coal Board and based on experience) whereby if a thickness of 10 x the worked seam thickness of competent cover (i.e. rock) is present over the worked seam then it is deemed sufficient to be able to choke the voided ground without giving rise to surface settlement.

Given the upper bound expected thickness of extraction of the worked coal seams and the estimated depth below ground level it is considered **a medium to high risk** that the proposed development could be affected by past underground shallow coal mining.

7. CONCLUSIONS AND RECOMMENDATIONS

The evidence gathered in this mining risk assessment report suggests that there is a medium to high risk to the proposed development from shallow coal mining causing ground subsidence in the future. It is thus recommended that the footprint of the proposed development is proof drilled to investigate the ground sequence down to a depth of 30m prior to any construction taking place. It is recommended that the proposed investigation follows the following course:

- Initially, four boreholes taken down to prove the depth and condition of the coal seams, the thickness of competent strata bedrock and to assess the presence of any voids in the ground.
- If insufficient cover of competent strata is found over any mined coal seams then additional boreholes will be required over the footprint of the structure to confirm the extent of workings (on the basis that the boreholes encountering coal could have struck a pillar).
- If underground workings are proved and there is insufficient competent cover then ground treatment is likely to be required prior to proceeding with construction.

Ashton Bennett would be able to design, tender, procure and supervise the proposed drilling works together with any follow-on ground treatment work that may be necessary and provide an updated risk assessment report for issue to the regulatory authorities as required. A Permit will be required from the Coal Authority to drill through the coal seams.

Following the mining investigation it will be necessary to confirm a suitable founding stratum for the proposed structure.

8. GENERAL REMARKS

This report truly reflects the conditions found during the mining risk assessment study. Whilst the mining risk assessment was undertaken in a professional manner taking due regard of additional information which became available as a result of ongoing research, the results portrayed only pertain to the information attained and the ground and mining conditions expected. It is possible that other undetected information, undetected ground conditions and undetected mining conditions may exist. The mining risk assessment was only undertaken within the site boundaries and should not be used for interpretation purposes elsewhere. The conclusions are only a brief summary of the report, and it is recommended that the report is read in full to ensure that all recommendations have been understood.

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