Environmental
Geotechnical
Specialists



COAL RISK ASSESSMENT

job number C1800/21/E/2782	date June 2021

site address
23 Fall Lane,
Hartshead,
Liversedge,
WF15 8AP

written by S.Alexander	checked by R. Palmer

issued by S. Alexander

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GEOTECHNICAL ENVIRONMENTAL

QMS ISO 9001 : 2015 REGISTERED
QMS ISO 14001 : 2015 REGISTERED
QMS ISO 45001 : 2018 REGISTERED
Registered Member
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Report on a Coal Mining Risk Assessment

Location:	23 Fall Lane Hartshead, Liversedge, WF15 8AP
For:	Richard Blakey
Report No.	C1800/21/E/2782
Report date:	June 2021

For and on behalf of **Rogers Geotechnical Services Ltd**

Redacted

Scott Alexander BSc FGS
Geo-Environmental Engineer

Rob Palmer MSc FGS ACIEH
Senior Geo-environmental Engineer

1. Introduction

It is understood that as part of the planning application at the site, a Coal Mining Risk Assessment has been requested by the planning authority. Consequently, a desktop study was commissioned in order to assess the risk to the development from coal mining. This report presents the findings of the study.

2. Geological Desk Study

The geological desk study has been undertaken using the following sources of information.

- British Geological Survey map sheet[1].
- British Geological Survey *Geology of Britain Viewer*[2].
- Coal Authority Consultants Coal Mining Report[3].
- British Geological Survey *Borehole Records*[4].

2.1 British Geological Survey Maps and Viewer

The appropriate map sheet for the site and the geology viewer has been examined and the following table presents the indicated geology:

[1] Sources: British Geological Survey (NERC) Map Sheet 77; Huddersfield Solid and Drift Editions
[2] Sources: British Geological Survey (NERC) Geology of Britain Viewer [*online resource from www.bgs.ac.uk*]
[3] Coal Authority Reference: 51002537497001 dated 3rd June 2021.
[4] Sources: British Geological Survey (NERC) Borehole Records [*online resource from* http://www.bgs.ac.uk//]

Table 1: Geological Data for the Site			
Strata Type	**Strata Name[5]**	**Previous Name[6]**	**Description[3]**
Superficial Geology	None recorded	-	-
Solid Geology	Pennine Lower Coal Measures Formation	Grey Measures Of Yorkshire And Nottingham Lower Coal Measures Formation Lower Coal Measures	Interbedded grey mudstone, siltstone and pale grey sandstone, commonly with mudstones containing marine fossils in the lower part, and more numerous and thicker coal seams in the upper part.

On the geological map, there are two dip indicators relevant to the site (i.e. within 500m of the site or within the same fault block) that suggests the solid geology beneath the site dips to the south at shallow angle between 3° and 5°.

There are three local coal seams that are shown to outcrop within the local area. This seam is summarised as follows:

Table 2: Summary of Coal Seams Within the Vicinity of the Site.			
Seam Name	**Seam thickness[5]***	**Outcrop distance from site[5]***	**Anticipated depth below site**
Top Lousey (TL) (Low Silkstone)	Thin	35m south-west	At or near to surface.
^Trub (Tr) or Linfit Lousey Coal (LFT)	0-0.5m 0-1.30m	340m south-west	Expected at depth between 20 and 30m below the site level.
Shertcliffe Coal (SH)	0-0.80m	340m south-west	Expected at depth between 40 and 50m below site level.

*All distances are given as approximations only. It should be noted that coal seam thicknesses vary over relatively short distances. ^ It should be noted that there is an unnamed subordinate coal seam shown on the geological maps which is inferred to subcrop beneath the site. This is inferred to be one of two coal seams as named in the table above. There exists the possibility that both seams may be present beneath the site.

Given the information above, which takes into consideration the local topography and the expected geology beneath the site, at least one coal seam deemed to be economically viable for mining is likely to be present at a shallow depth (<30m) beneath the site.

From information held by the Coal Authority it suggests that the local names and national seam names vary and that the Top Lousey appears to correlate with the Low Silkstone seam. The overlying coal seam named as the Blocking (Silkstone) coal is also named as the Silkstone seam in Coal Authority terminology.

[5] Sources: British Geological Survey (NERC) Map Sheets 77; Huddersfield; Solid and Drift Edition, and Geology of Britain Viewer [*online resource from www.bgs.ac.uk*]
[6] Sources: British Geological Survey (NERC) Lexicon of Named Rock Units [*online resource from www.bgs.ac.uk*]

2.2 Coal Authority Mines Report

As part of this study a Coal Authority Consultants Coal Mining Report has been obtained. The report is presented as Appendix 2 and for the purposes of discussion has been summarised below:

Table 3: Summary of the Consultant's Coal Mining Report

Has the report highlighted evidence or potential of:			
Ref	**Mining Feature**	**Yes/No**	**Comments**
1	Underground Coal Mining	Yes	2 recorded seam workings within the Si kstone at a depth of 27-28mbgl with seam thicknesses of 0.90m and 0.48m last worked pre1895. Black Bed at a depth of 122mbgl with a worked seam thickness of 0.82m last worked pre1934. Better Bed at a depth of 174mbgl with a worked seam thickness of 0.46m last worked pre 1923.
2	Probable Unrecorded Shallow Workings	No	None expected.
3	Spine Roadways at Shallow Depth	No	No spine roadway recorded at shallow depth.
4	Mine Entries	Yes	Two mine entries are located within 100m of the site. 418422-017 - Common Side Pit Upcast Shaft, depth 13.7m 418422-018 - Common Side Pit Downcast Shaft, depth 13.7m
5	Abandoned mine plans	Yes	Plans of abandoned mine workings below the site are suggested to be available by the Coal Authority.
6	Outcrops	No	No outcrops recorded.
7	Geological Faults	No	No faults, fissures or breaklines recorded.
8	Opencast Mines	No	None recorded within 500 metres of the enquiry boundary.
9	Coal Authority Managed Tips	No	None recorded within 500 metres of the enquiry boundary.
10	Site Investigations	No	None recorded within 50 metres of the enquiry boundary
11	Remediated Sites	No	None recorded within 50 metres of the enquiry boundary.
12	Coal Mining Subsidence	No	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 31st 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.
13	Mine Gas	No	None recorded within 500 metres of the enquiry boundary.
14	Mine Water Treatment Schemes	No	None recorded within 500 metres of the enquiry boundary.
15	Future underground mining	No	For further information please see section 3 of the Consultant's Coal Mining Report (ref 51002537497001).
16	Coal mining licensing	No	
17	Court orders	No	
18	Section 46 notices	No	
19	Withdrawal of support notices	No	
20	Payments to owners of former copyhold land	No	

2.3 Geological Survey Borehole Records

The British Geological Survey (NERC) keeps borehole records from across Britain which are available for public viewing through their website[7]. As part of this study, the records in the area around the site have been reviewed in order to assist in establishing the geological conditions.

Based upon records provided by the British Geological Survey (NERC) the following table has been produced as a summary for the most applicable features of note in relation to this study, the logs of the boreholes are presented as Appendix 3:

Table 4: Notable Geological Features

Borehole	Approx. Distance from Site	Depth of borehole (m)	Notable features
SE12SE313	1120m NW	152	Ten recorded coal seams to the base of the black bed coal within shaft record. Shertcliffe Coal recorded at ca.56.8mbgl Black Bed Coal recorded at ca. 130.5mbgl.

The shallowest coal seam at a depth of 11mbgl is unnamed however this is likely to represent the Top Lousey (TL) seam, as it should be appreciated that certain seams have localised names. With reference to Table 2 above, this seam is inferred to be the shallowest seam beneath the development site. Within the above mentioned borehole, this seam is shown to be a total of 1.02m in thickness, with a band of 0.43m thick of "chat" comprising mudstone and sandstone.

Although limited coal seams are named within the borehole/shaft record detailed above, this record is located within the same fault block and upon the same sandstone outcrop as the site. Whilst the thicknesses of coal seams can vary laterally, the thicknesses between strata is generally relatively uniform and extrapolation of this information is deemed to be suitably reliable. Therefore, there remains the possibility that coal seams of economic value may be present below the site surface.

3. Risk Assessment

The risk to the stability of the proposed residential development has been evaluated from the data obtained and with reference to the following ratings and definitions:

Low - The possibility of instability is unlikely therefore no further action is necessary.

Moderate - The possibility of instability is likely and further investigation or remedial action may be required.

High - The possibility of instability is highly likely and further investigation or remedial action will be necessary.

Table 5: Development Specific Risk Assessment			
Item	**Risk attributed to**	**Coal Seam(s) Considered**	**Risk Rating**
3.1	Shallow coal workings	Recorded workings in Top Lousey (TL)	Moderate
3.2	Coal workings at depth	Trub and/or Linfit Lousey maye be present at moderate depth (between 30m and 50m) beneath the site. Recorded workings in the Black bed at 122mbgl Recorded workings in the Better Bed at 174mbgl.	Low
3.3	Mine gas	Shallow coal workings	Moderate
3.4	Mine shafts	418422-017 - Common Side Pit Upcast Shaft, depth 13.7m 418422-018 - Common Side Pit Downcast Shaft, depth 13.7m	Low

3.1 Risks Posed by Shallow Coal Workings

On the basis of all of the information provided above, the shallowest coal seam beneath the site is likely to be the Top Lousey (TL). It is assumed that the Silkstone coal seam mentioned within the mining report equates to the Top Lousey (TL). It is anticipated that based on the information available within the published geological records, it is likely that the Coal Authority may have over-estimated the depth to the underground coal workings. Indeed, such workings may be present at a significantly shallower depth than those indicated within the Consultant's report.

It may be noted that guidance available from both the NHBC and the CIRIA publication, SP32 - *construction over abandoned mine workings,* suggests that competent overburden thickness above a coal seam should be greater than 10 times the thickness of a seam plus seam thickness in order that the collapse of workings would pose a low risk to surface structures.

Given the lack of superficial strata recorded for the site it can be assumed that bedrock is likely to be shallow. Based on a worst case worked seam thickness of 0.90m at an assumed depth of 13.70m from nearby depth of mine entries, a rockhead overburden h-ratio of 14 has been calculated for the site. Based on these worst case assumptions it is possible that there may be a low risk for the site, should the seam have been worked at this depth.

However, given the variable information, lack of nearby underground evidence, complex structural geology and inaccurate information, there may still exist a risk to the surface of the site from coal mining workings for which no accurate or reliable records exist. As such, it is strongly recommended that the true thickness and depth of this seam is investigated to validate this opinion.

3.2 Risks Posed by Shallow Workings in Minerals Other Than Coal

It should be borne in mind that the Silkstone coal seam, which is likely to be present at a shallow depth beneath the site, is commonly encountered with ironstone deposits which may be of a workable thickness. As such there may exist further workings in minerals other than coal for which no accurate or reliable records exist.

3.3 Risks Posed by Coal Workings at Depth

In regard to deeper mining which could affect the site, the property is not within a surface area that could be affected by deeper past underground mining.

3.4 Risks Posed by Mine Shafts

The Consultants Mining Report indicates there are two shafts located approximately 60m to the south-east of the boundary of the property. The shafts are recoded as 418422-017 - Common Side Pit Upcast Shaft, depth 13.7m, and 418422-018 - Common Side Pit Downcast Shaft, depth 13.7m. Neither of the mine entries are shown to have been treated. Nonetheless, given the significant distance from the site, it is not anticipated that these features represent a risk of surface instability to the development site. It should be borne in mind that given the potential shallow depth to coal workings other mine entries may exist for which for accurate or reliable records exist.

3.5 Risks Posed by Mine Gas

This assessment has concluded that there is potential for shallow mine workings to be present beneath the site, albeit the risks of instability posed by these features can be considered low. Nonetheless, it should be appreciated the shallow mine workings represent a potential source of ground gas.. As such, a moderate risk rating has been assigned, and a detailed ground gas risk assessment should be commissioned (usually undertaken as part of a Phase 1 Desk Study). Such assessments may stipulate that a regime of gas monitoring is undertaken to quantify the risks posed by mine gas. Alternatively, in a scenario where gas monitoring has not been considered, suitable gas protection measures may be required. It should be appreciated that such measures could be designed in accordance with BS8485: 2015 +A1: 2019: *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings.* It should be noted that in any event, the above will need to be agreed with the local authority prior to construction, as they are the final arbiters on these matters.

4. Conclusions

In light of the potential risks of instability at the site from the working of shallow coal within the Top Lousey (TL)/Silkstone, it cannot be recommended that development takes place without further investigation to conclusively determine the presence of such workings. This work should include a minimum of 3no open hole boreholes drilled to a depth of ca.30mbgl. There may also exist shallow workings in minerals other than coal that may be present beneath the site at a shallow depth.

General practice is to undertake rotary openhole boreholes at three locations across the site to mitigate against the potential for drilling through intact columns associated with pillar and stall workings. Furthermore, it is normal to investigate the ground to 30m below ground level; any workings below this depth are unlikely to result in significant instability. However, in this case, the risk of instability is due to shallow workings, therefore, drilling to these depths may not be necessary and the objective should be to ensure that the shallow seams are un-worked or have sufficient competent cover. It may therefore be possible, in the first instance, to undertake one borehole to 30m below the top of the rockhead, with the remaining boreholes proving the depth and continuity of the coal seam(s). In any event, it is considered that approval should be sought with the Local Authority as to the efficacy of this approach.

It is of note that Rogers Geotechnical Services would be happy to assist in any further intrusive investigation that may be required.

Appendix 1

Site Plan



Plan not to scale and investigation positions approximated from site operative's notes.

Title: **Investigation Location Plan**

Rogers Geotechnical Services Ltd	Site Name: **Fall Lane, Hartshead, Liversedge**	Job No: **C1800**

Appendix 2

Coal Authority Report

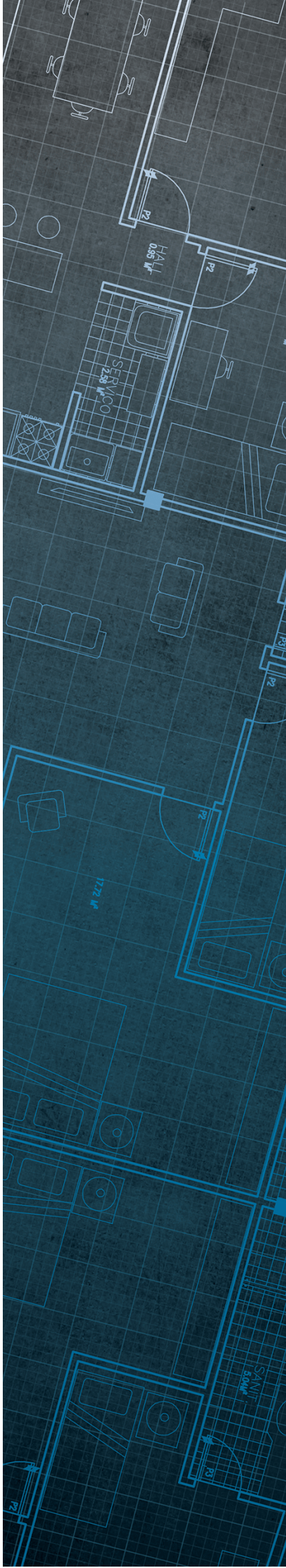
The Coal Authority

Consultants

Coal Mining Report

23 Fall Lane
Hartshead
Liversedge
Kirklees
WF15 8AP

Date of enquiry:	**3 June 2021**
Date enquiry received:	**3 June 2021**
Issue date:	**3 June 2021**
Our reference:	**51002537497001**
Your reference:	**C/1800/21/E/2782**



Consultants

Coal Mining Report

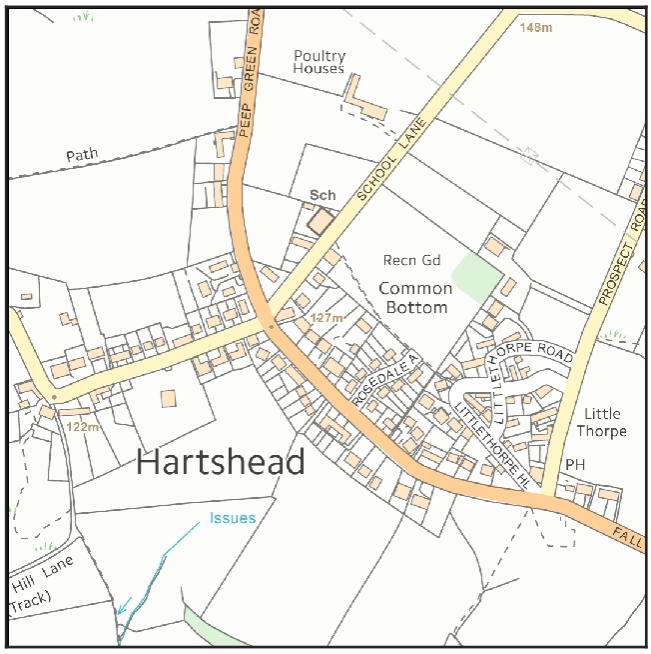
This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

ROGERS GEOTECHNICAL SERVICES LTD

Enquiry address

23 Fall Lane
Hartshead
Liversedge
Kirklees
WF15 8AP



Approximate position of property

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/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
unnamed	SILKSTONE	Coal	6H8Q	27	Beneath Property	0.0	East	90	1895
unnamed	SILKSTONE	Coal	6H97	28	Beneath Property	2.9	East	48	1895
unnamed	BLACK BED	Coal	6H9E	122	Beneath Property	2.5	South	82	1934
unnamed	BETTER BED	Coal	6H9H	174	South-West	2.4	South	46	1923

Probable unrecorded shallow workings

None.

Spine roadways at shallow depth

No spine roadway recorded at shallow depth.

Mine entries

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	418422-017	418571 422523		Coal	
Shaft	418422-018	418559 422517		Coal	

Abandoned mine plan catalogue numbers

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

GCR202	454	M134
LM39	LM2	GCR131
FGB162	M31	LM1

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.

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Outcrops
No outcrops recorded.

Geological faults, fissures and breaklines
No faults, fissures or breaklines recorded.

Opencast mines
None recorded within 500 metres of the enquiry boundary.

Coal Authority managed tips
None recorded within 500 metres of the enquiry boundary.

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Section 2 – Investigative or remedial activity

Please refer to the 'Summary of findings' map (on separate sheet) for details of any activity within the area of the site boundary.

Site investigations
None recorded within 50 metres of the enquiry boundary.

Remediated sites
None recorded within 50 metres of the enquiry boundary.

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

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

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

Mine gas
None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes
None recorded within 500 metres of the enquiry boundary.

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Section 3 – Licensing and future mining activity

Future underground mining
None recorded.

Coal mining licensing
None recorded within 200 metres of the enquiry boundary.

Court orders
None recorded.

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

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

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

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

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Section 4 – Further information

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

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.

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.

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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.

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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.

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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.

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The Coal Authority

Summary of findings

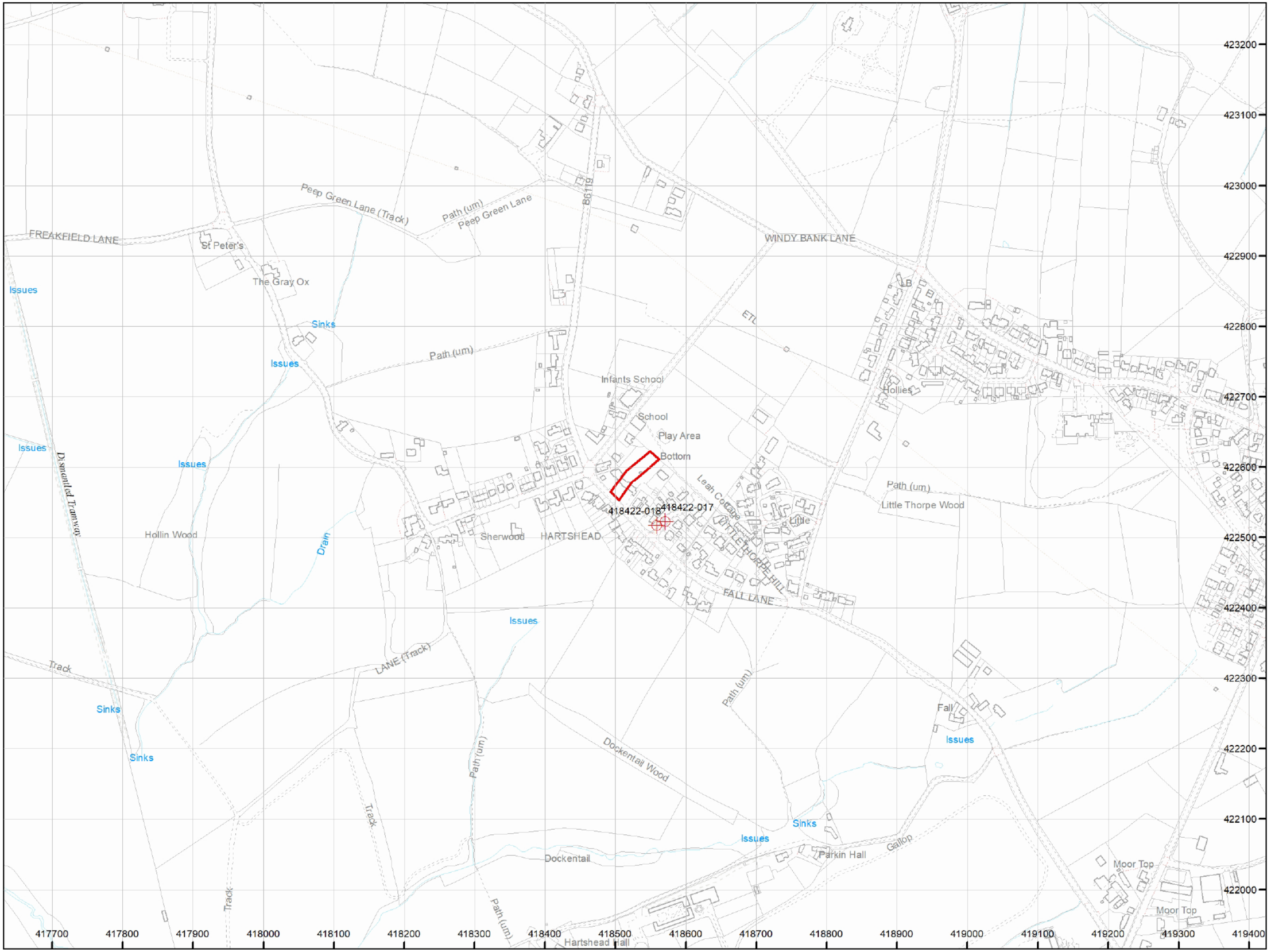
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Map data

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

Key

Approximate position of the enquiry boundary shown

Disused mine shaft



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Appendix 3

BGS Borehole Records

British Geological Survey

77

LANE PIT)

30 S.W.

	YD. FT. IN.	YD. FT. IN.
	0 0 8	
	0 0 2	
		88 0 0
	0 2 0	
	0 0 2	
	0 1 6	
iron-		
m	0 1 6	
	0 1 3	
iron-		
	4 0 0	
	1 0 9	
	2 2 0	
FT.IN.		
1 0		
1 10		
0 6		
0 4		
0 6		
0 5		
0 3		
0 6		
0 6 1	2 10	
		109 0 1
	0 2 9	
iron-		
	1 1 7	
	2 0 10	
	2 1 8	
	1 1 0	
	4 0 0	
bed	0 2 9	
		113 1 7

British Geological Survey

SE12SE
1758 2324.

SE12SE 513

4175S
42324

B.2.—CLIFTON. (HARTSHEAD PIT).

Date of Sinking, 1882—1884.

Lat. 53° 42′ 10″ N. Long. 1° 44′ 10″ W.

Height above O.D., 500 ft. Dip of Strata, 1 in 24 S.W.

	YD. FT. IN.	YD. FT. IN.
1 Rag and stone	4 1 6	
2 Rag with bands of brown shale	4 2 3	
3 Blue shale	3 0 7	
4 Black shale	0 1 1	
5 Seam of Coal—		
FT.IN.		
COAL 1 5		
Chat 1 7		
COAL 0 4	1 0 4	
		13 2 9
6 Seat and seat stone	2 2 10	
7 Rag	3 0 11	
8 Blue shale	2 0 3	
9 Black shale	0 0 8	
10 COAL	0 0 5	
		22 1 10
11 Seat and seat stone	1 1 6	
12 Rag	3 1 0	
13 Blue shale	1 1 8	
14 Black shale	1 0 6	
15 COAL	0 0 4	
		30 0 10
16 Black and white seat	1 1 4	
17 Black shale	0 0 5	
18 Seat	1 0 9	
19 Rag	1 0 0	
20 Blue shale	4 2 1	
21 Parting	0 0 2	
22 Seat	1 0 0	
23 Rag	1 1 3	
24 Blue bind	3 0 1	
25 Black shale	0 2 1	
26 COAL	0 1 1	
		45 1 1
27 Seat	1 1 6	
28 Rag	0 2 11	
29 Johnny COAL	0 0 3	
		47 2 9
30 Seat	0 2 9	
31 Stone	1 0 4	
32 Blue shale	7 1 1	
33 Black shale	0 1 6	
34 Bassett	0 0 6	

	YD. FT. IN.	YD. FT. IN.
35 Stone Coal (Shertcliffe Bed)—		
FT.IN.		
Tops 1 1½		
Best 0 10		
Johnny 0 4½	2 4	
		58 2 3
38 Seat	0 1 5	
37 Blue shale	2 2 2	
38 Black shale	0 0 7	
39 COAL	0 1 0	
		62 1 7
40 Seat	0 2 4	
41 Stone	1 1 3	
42 Bind	3 2 8	
43 Rag	3 1 4	
44 Black shale	0 1 6	
45 Seat	2 0 5	
46 Rag	8 2 4	
47 Stone (Top Delph)	4 1 3	Oakenshaw Rock
48 Rag and stone	14 2 10	
49 Stone (Bottom Delph)	4 1 3	
50 Blue shale	4 1 8	
51 Black shale	0 0 2	
52 Seat	2 1 5	
53 Dark bind	7 0 3	
54 COAL	0 0 3	
		121 1 6
55 Seat	2 1 4	
56 Shale	3 1 1	
57 Black shale	0 0 4	
58 Seam of Coal		
FT.IN.		
COAL 0 2		
Muck 0 7		
COAL 0 9		
Muck 0 8		
COAL 0 4	0 2 6	
		128 0 9
59 Seat	0 1 4	
60 Stone	0 0 10	
61 Shale with ironstone	1 0 10	
62 Blue shale	2 1 9	
63 Stone	2 0 3	
64 Shale	6 2 10	
65 Black Bed Coal	0 2 6	
		142 2 1