



Coal Mining Risk Assessment

**Crossfield Coal Yard
9 St John's Cl
Cleator Moor CA25 5DD**

Date: 4th December 2023

Version 1

ENVIROSOLUTION LTD

Suite 53
3a Bridgewater Street
Liverpool
L1 0AB



EnviroSolution Ltd
Document Verification

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Report Title	Coal Mining Risk Assessment		
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Date Issued	4 th December 2023	Report Version	1
Prepared by	Angel Arantegui PhD MSc BSc FGS	Signature	
Checked by	Tom Craig MSc BSc (Hons) FGS	Signature	
Checked by	Phil Shelton PhD BSc CEng MIMMM FGS	Signature	

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1 Introduction

1.1 Site Location and Description

The site for a proposed new workshop is located at 9 St John's Cl, Cleator Moor CA25 5DD. The British National Grid Reference for the approximate site centre is GR: 301510, 515220.

The site is basically rectangular in shape and covers an approximate area of 2,285 square metres. The site is currently used as a plant service depot. An existing warehouse/workshop, which is proposed to be demolished, is located in the northwestern section of the site. Vehicles, shipping containers, spares and other materials are stored on site. The open ground surface is conventional hard standing – See **Figure 1** below.

The site is generally flat at an elevation of about 86m aOD and with no significant change in surface level.

A plan showing the location of the site is presented in **Figure 1**.



Figure 1) Site Location Map

1.2 Development Proposal

It is understood that the development proposal includes the demolition of the existing workshop and construction of a new unit.

At the time of writing this report, no formal development plans have been provided.

The development plans are included in **Appendix A**.

1.3 Scope of Coal Mining Risk Assessment

EnviroSolution Ltd (ES) has been commissioned to prepare a Coal Mining Risk Assessment Report (CMRA) for the proposed development site, in order to provide the Local Planning Authority with information on the coal mining legacy risk(s), an assessment of their potential

impact on land stability, and provide recommendations for the need to carry out any further investigations (including intrusive boreholes if necessary) to address these risk(s).

The CMRA has been undertaken in accordance with the principles of best practice including the Coal Authority's guidance document "Risk Based Approach to Development Management - Resources for Developers Version 3" (2014) (Ref. 1), CIRIA "SP32 Construction over Abandoned Mine Workings" (2002) (Ref. 2) and CIRIA "C758D Abandoned Mine Workings Manual" (2019) (Ref. 3), CIRIA, Publication C665, Assessing risks posed by hazardous ground gases to buildings (Ref. 4) and CL:AIRE "Good Practice for Risk Assessment for Coal Mine Gas Emissions", October 2021 (Ref. 5).

The purpose of the CMRA Report is to:

- present a desk-based review of available information on the coal mining issues that are relevant to the application site;
- use that information to identify and assess the risks to the proposed development from coal mining legacy, including the cumulative impact issues;
- set out appropriate mitigation measures to address the coal mining legacy issues affecting the site, including any necessary remedial works and/or demonstrate how coal mining issues have influenced the proposed development; and
- demonstrate to the Local Planning Authority that the application site is, or can be made, safe and stable to meet the requirements of National Planning Policy with regard to development on unstable land.

1.4 Sources of Information

This report is based on current information of past mining activities relevant to the site. The following information sources have been used:

- Consultants Mining Report dated 29th November 2023 (Ref: 51003392284001 **Appendix B**);
- BGS Geoindex geological map;
- BGS geological 1:50,000 England and Wales Sheet 28 Whitehaven;
- Geology of the west Cumbria district Memoir for 1:50 000 Geological Sheets 28 Whitehaven, 37 Gosforth and 47 Bootle (England and Wales). 1997;
- Coal Authority Interactive Website;
- Historical Ordnance Survey maps.

2 Environmental Setting

2.1 Historic Coal Mining Activity

The development site and surrounding area has been reviewed with reference to historical Ordnance Survey (OS) maps. The history of the site and immediate surrounding area are summarised in Table 1. Copies of the historical OS maps are included in **Appendix C**.

Table 1 - Historic Mapping Review

Date	Scale	Historic Mining Activity
1863	1:10,560	<ul style="list-style-type: none"> - The site is undeveloped, located on agricultural land. - Hematite ironworks approximately 200m north of the site. - Iron pits 85m east, 200m southeast, 300m southeast and 225m south - Old iron shaft 200m east.
1898	1:10,560	<ul style="list-style-type: none"> - Site appears sub-divided in plots with occasional outbuildings. - Minor residential development east and southwest of the site. - Hematite ironworks expanded to within 115m north of the site and re-labelled as Hematite, Iron and Steel Works. - Old shaft 20m southeast. - Nearby iron pits east and southeast of the site no longer identified on the map. - St. John's Pit 150m northwest of the site.
1923	1:10,560	<ul style="list-style-type: none"> - No significant change.
1938	1:10,560	<ul style="list-style-type: none"> - No significant change.

BGS Sheet 28 Whitehaven shows an abandoned pit or mineshaft located approximately 50m northwest of the site.

2.2 Geological Context

The BGS geological mapping (Geoindex and BGS Sheet 28 Whitehaven) show that the site is directly underlain by superficial diamicton (till) deposits, which are of Quaternary age. Diamicton generally consists of overconsolidated unsorted clays, silts, sand and gravels.

The underlying bedrock consists of the Pennine Middle Coal Measures Formation, which is of Carboniferous age. The Pennine Middle Coal Measures Formation generally consists of interbedded grey mudstones and siltstones with pale grey sandstones and ironstone and coal seams, some of which have been economically viable.

The BGS mapping does not show dip measurements around the site. Due to the intense faulting and folding in the area, existing dip measurements cannot be confidently extrapolated beneath the site. Relative stratigraphic position of named coal seams, as mapped on the BGS Sheet 28 Whitehaven southwest of the development site, suggests an overall dip of the bedrock between the northwest to southwest – **See Appendix D**.

Named coal seam expected to be present beneath the site include the Yard Coal. However, historical mapping indicates that the main local extractive industry was from shallow seams of ironstone.

The Coal Authority does not hold records of underground workings beneath the site.

The eastern corner of the site is intersected by a fault with an approximate trend of 170° (Whole Circle Bearing). The downthrow is interpreted as being towards the west given the older age of the Hensingham Formation east of the fault and the missing section (i.e., Pennine Lower Coal Measures Formation) between the two units.

One BGS borehole record (NY01NW235) has been obtained from BGS online records, located 20m southeast of the site. It penetrates to a depth of 91m bgl. and shows approximately 18m of stony clay overlying a succession of sandstones and shales with intercalated levels of ironstone and iron ore at 30m, 54m and 68m bgl.

The location of the borehole is shown in **Figure 2**.

Coal outcrops are shown to be located southwest of the site (see **Figure 2**). Due to the expected dip away from the site (possibly towards the southwest), shallow mine works of these seams are not expected beneath the site. However, the Yard Coal, which is stratigraphically lower may be present at shallow depths.

Spontaneous combustion of coal seams may happen where roof coal is left.

Historical records and BGS geological mapping show extensive hematite works, ironstone pits and shafts, mainly east and south of the site. Given the interpreted dip of the geology immediately around the site there is the possibility of shallow underground ironstone workings to be present underneath the site.

Nearby borehole records suggest an approximate thickness of superficial till deposits of between 15m to 28m.

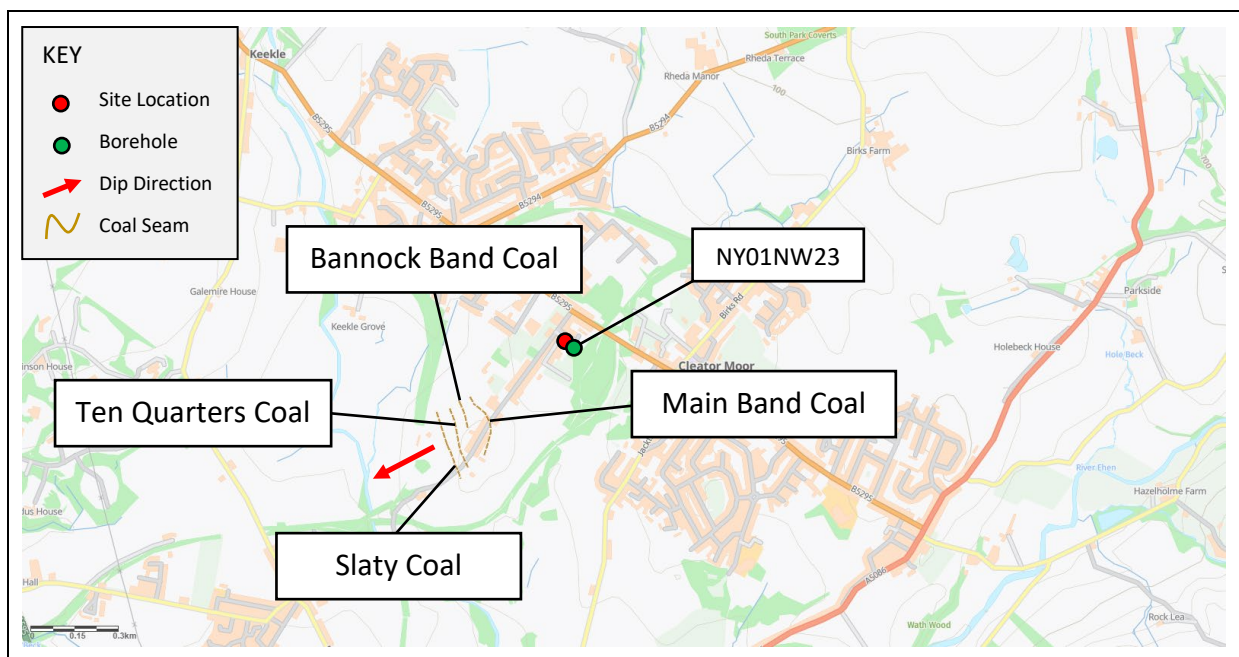


Figure 2) Coal Seam Location Map (Coal Authority Interactive Viewer)

The site is situated within a Primary Opencast Coal Resource Area (**Appendix F**). The Primary Opencast Coal Resource Area is defined by the BGS as “an area that constitutes the main target for opencast coal extraction and comprises a relatively closely spaced succession of variable but generally thick coals. Notwithstanding this, it is considered to be very unlikely that there will be any interest in developing open cast coal mining operations at this location in the short or medium-term.

3 Identification and Assessment of Site-Specific Coal Mining Risks

Table 2 below summarises the potential risks associated with coal/ironstone mining legacy for the proposed development site, which have been identified from list sources of information.

Table 2 - Coal Mining Hazards Summary

Coal Mining Issues	Yes	No
Coal outcrops		X
Underground coal/ironstone mining (recorded at shallow depths)		X
Underground coal mining (probable at shallow depths)	X	
Recorded mine entries (shafts and adits)	X	
Unrecorded mine entries (shafts and adits)	X	
Coal mining geology (fault)	X	
Record of past gas emissions		X
Recorded coal mining surface hazard		X
Surface mining (opencast workings)		X

The Coal Authority Interactive Map Viewer (**Appendix G**) has identified that the site lies within a Development High Risk Area associated with the potential presence of a shallow unrecorded workings (likely ironstone) beneath the site.

The report obtained from the Coal Authority revealed the property is in a surface area that is not affected by recorded underground mining. However, The Coal Authority has drawn attention to the potential presence of unrecorded shallow workings related with extensive ironstone mining in the area. Ironstone levels have been recorded in nearby boreholes. It is considered that if shallow seams have been worked in the past, they could extend underneath the site and present a risk of surface instability.

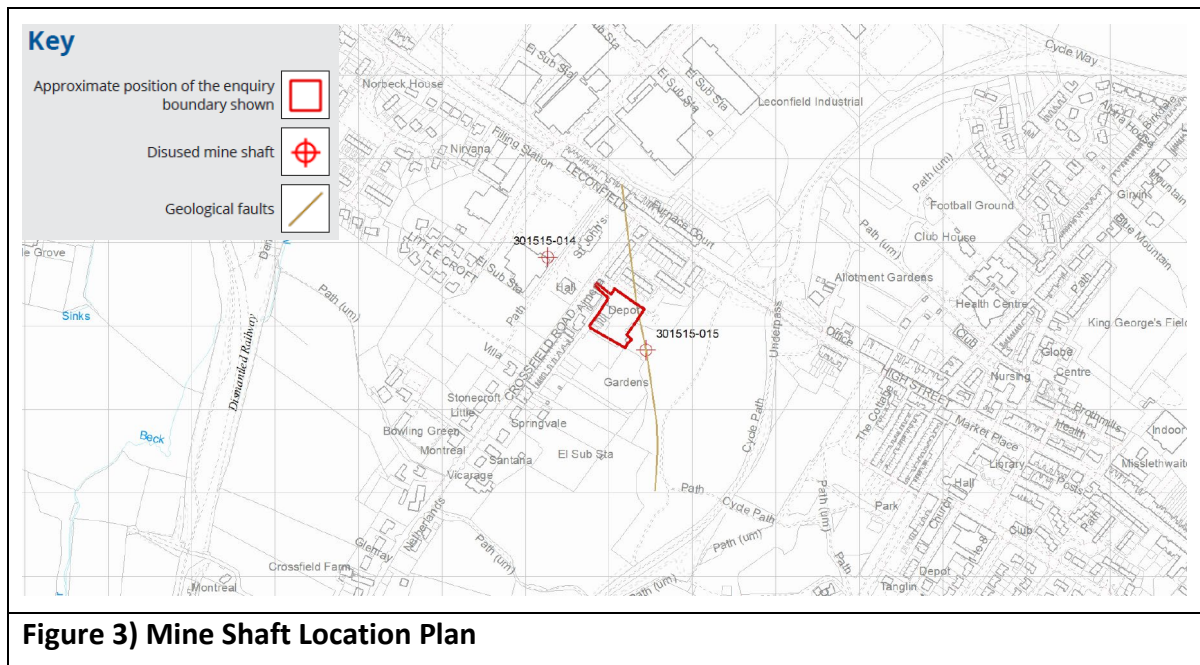
The Coal Authority report states that they are aware of 2 no. recorded mine entries within 100m of the development site boundary. The location of the shafts is shown in **Figure 3** below. The mine shaft information is summarised in **Table 3** below:

Table 3 - Mine Shaft Summary

Mine Shaft	Treatment	Departure	Assumed Shaft Diameter	Distance from Site
301515-015	No Information	5m	2m	25m SE
301515-014	Shaft filled to an unknown specification at an unknown date. During December 1991 the shaft was drilled to a depth of 30m on behalf of the site developers with no voids being found.	5m	2m	65m NW

The area of potential influence around the shafts can be calculated by the sum of the diameter, departure and depth to rockhead. According to nearby borehole records the maximum depth to rockhead is approximately 28m. The estimated area of influence around the closest shaft (i.e., 301515-015) is shown on **Figure 4**, which shows that the southern boundary is intersected by the area of influence. The area of influence does not intersect the area of the proposed workshop and therefore the risk is considered to be negligible. If the final position of the workshop is moved south-eastwards, this must be reassessed.

Shaft 301515-014 is considered to be at such a distance from the site that the area of influence around the shaft will not intersect the development site. Notwithstanding this, there may be mine entries in the vicinity that have not been recorded.



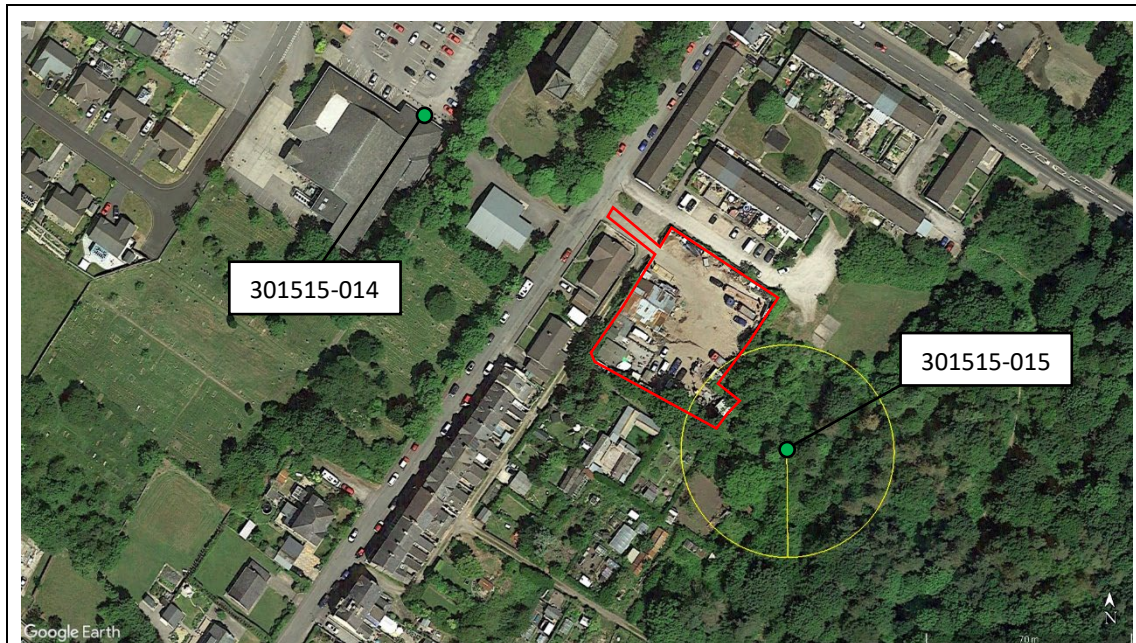


Figure 4) Area of influence of shafts around the site

The Coal Authority mining report states the property is not within the boundary of a historic or current opencast site, and there are no license requests outstanding to remove coal via this method in the future. The risk posed to the site from opencast mining methods is therefore considered to be negligible.

There are no recorded past mining gas emissions recorded in the surrounding area. However, coal seams and coal mine workings pose a potential gas risk which should be considered in any future investigations and development. At development sites with shallow coal workings, probable shallow coal mine workings, or pathway features such as mine entries and geological disturbances on or nearby the site, it is recommended that a detailed gas risk assessment is undertaken in accordance with relevant guidance.

4 Proposed Mitigation Strategy

- The possibility of unrecorded mine shafts has been highlighted in the Coal Authority report. Historical maps do not show evidence of shafts within the site boundary. The potential risk can be dealt with through vigilance during the earthworks stage of construction.
- The possibility of unrecorded shallow workings (likely ironstone) has been highlighted in the Coal Authority report. The available geological information is not sufficient to rule out this possibility. It is therefore recommended that up to 3 no. rotary boreholes are advanced to a minimum depth of 50m below ground level. Water flush should be used to safeguard against oxidation and potential spontaneous combustion of shallow coal. In order to undertake these works it will be necessary to obtain a drilling permit from The Coal Authority.

5 Conclusions

The Coal Mining Risk Assessment for the site at Crossfield Coal Yard in Cleator Moor has concluded that the potential risk associated with coal mining related issues are significant based on information from the Coal Authority and geological interpretation.

The principal risks to the development arise from:

- the potential presence of unrecorded shallow mine workings associated with ironstone seams of workable thickness that are expected to be present beneath the site area;
- unrecorded mine entries.

It is therefore recommended that further intrusive ground investigations are undertaken. These might include the drilling of up to 3 no. rotary probe borehole(s) to a minimum depth of 50m bgl, located close to the proposed development to determine the superficial thickness along with obtaining evidence of potential unrecorded coal mine workings.

Prior to the commencement of intrusive works, a Coal Authority Permit will be required for drilling activities, that will disturb or enter any coal seams, coal mine workings or coal mine entries (shafts and adits). The scope of works for the investigation will need to be submitted and approved by the local authority prior to the commencement of the intrusive works.

6 References

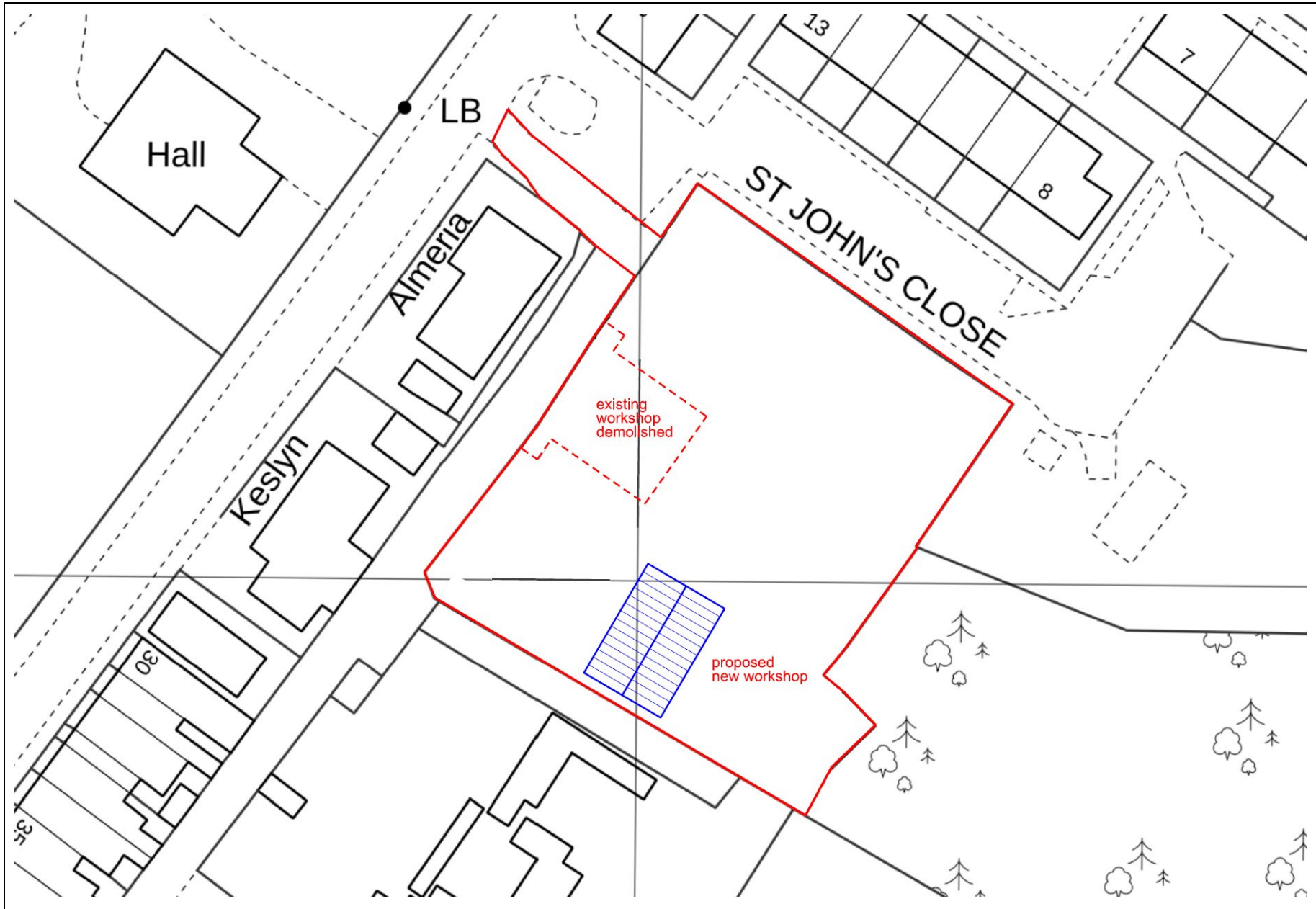
1. Coal Authority, 2014, Risk Based Approach to Development Management Resources for Developers, Version 3.
2. CIRIA, 2002, SP32 Construction over Abandoned Mine Workings.
3. CIRIA, 2019, C758D Abandoned Mine Workings Manual.
4. CIRIA, Publication C665, Assessing risks posed by hazardous ground gases to buildings.
5. CL:AIRE, 2021, Good Practice for Risk Assessment for Coal Mine Gas Emissions.
6. Geology of the west Cumbria district Memoir for 1:50 000 Geological Sheets 28 Whitehaven, 37 Gosforth and 47 Bootle (England and Wales). 1997.

Appendix A – Site Location



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Site Location Map



Appendix B – Coal Authority Report



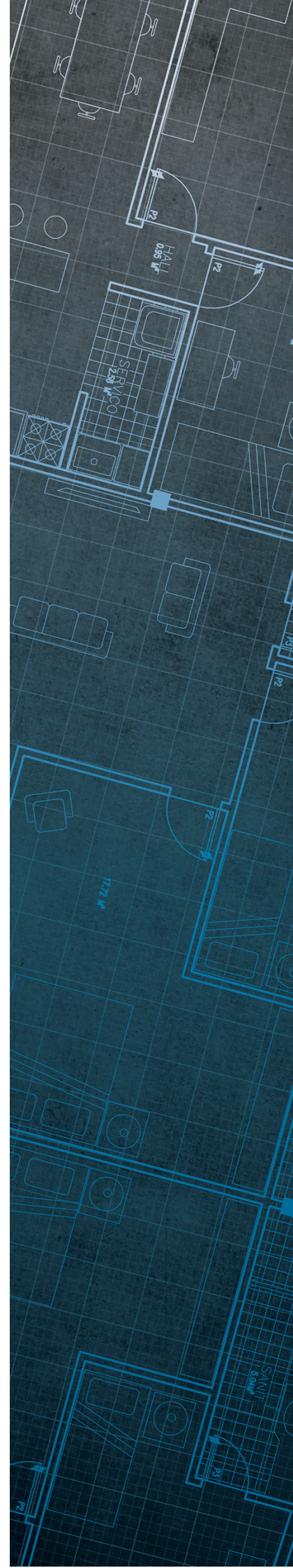
The Coal
Authority

Consultants Coal Mining Report

9 St Johns Close
Cleator Moor
Cumberland
CA25 5DD

Date of enquiry: 29 November 2023
Date enquiry received: 29 November 2023
Issue date: 29 November 2023

Our reference: 51003392284001
Your reference: ES291123



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

EnviroSolution Limited

Enquiry address

9 St Johns Close
Cleator Moor
Cumberland
CA25 5DD


How to contact us

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

200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

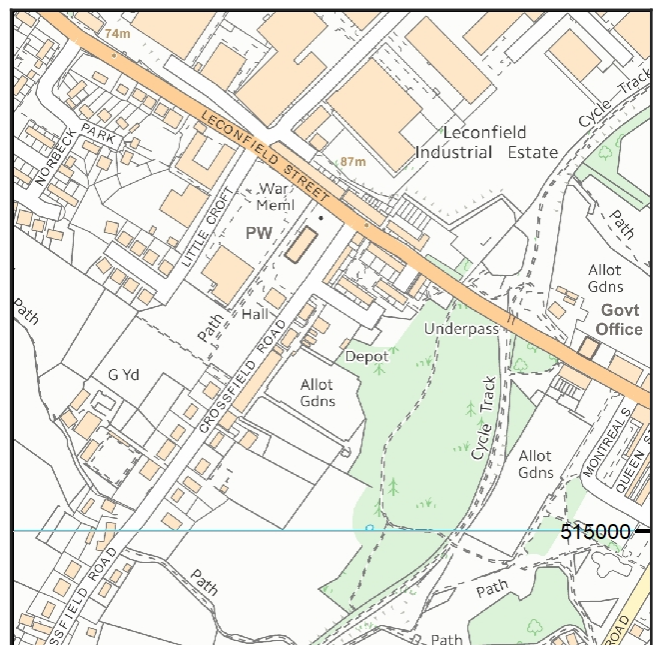
www.groundstability.com

 @coalauthority

 /company/the-coal-authority

 /thecoalauthority

 /thecoalauthority



Approximate position of property



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Section 1 – Mining activity and geology

Past underground mining

No past mining recorded.

Probable unrecorded shallow workings

Yes.

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	301515-014	301427 515282	Shaft filled to an unknown specification at an unknown date. During December 1991 the shaft was drilled to a depth of 30m on behalf of the site developers with no voids being found.	Ironstone	
Shaft	301515-015	301545 515170		Ironstone	

Abandoned mine plan catalogue numbers

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

NC176	OM15143	OM15072
NW1393	OM3324	om8476
OM15138	PO0	NW1390

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

No outcrops recorded.

Geological faults, fissures and breaklines

Please refer to the 'Summary of findings' map (on separate sheet) for details of any geological faults, fissures or breaklines either within or intersecting the enquiry boundary.

Faults under or close to the property recorded.

Opencast mines

None recorded within 500 metres of the enquiry boundary.

Coal Authority managed tips

None recorded within 500 metres of the enquiry boundary.

Section 2 – Investigative or remedial activity

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

Site investigations

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.

Section 3 – Licensing and future mining activity

Future underground mining

None recorded.

Coal mining licensing

None recorded within 200 metres of the enquiry boundary.

Court orders

None recorded.

Section 46 notices

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

Withdrawal of support notices

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

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

Payments to owners of former copyhold land

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

Section 4 – Further information

Based on the responses in this report, no further information has been highlighted.

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.

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

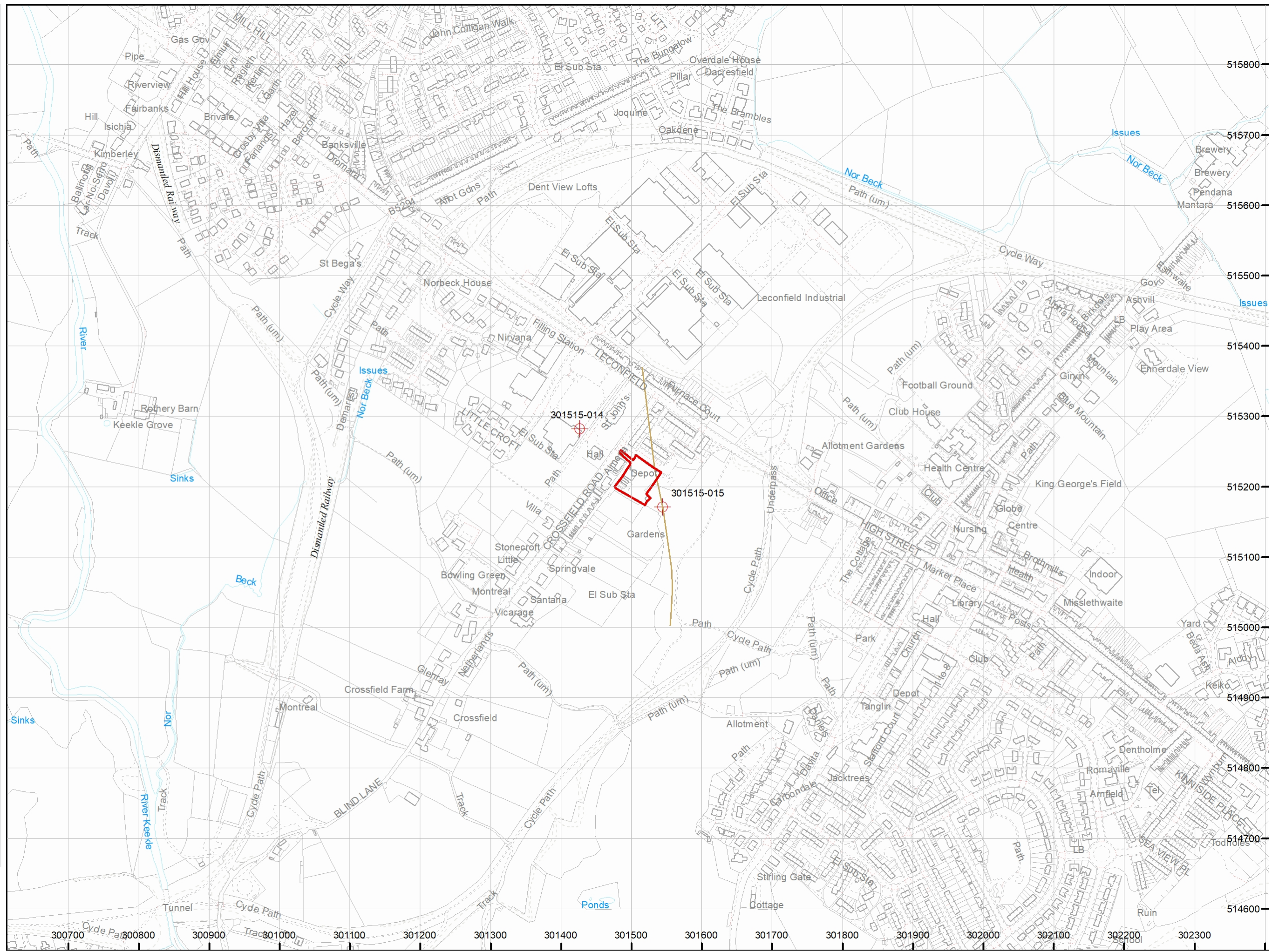
Relevant notices which may affect the property and any subsequent notice of retained interests in coal and coal mines, acceptance or rejection notices and whether any compensation has been paid to a claimant.

The 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 
- Geological faults 

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



Appendix C – Historic Maps



Date: 1863



Date: 1898



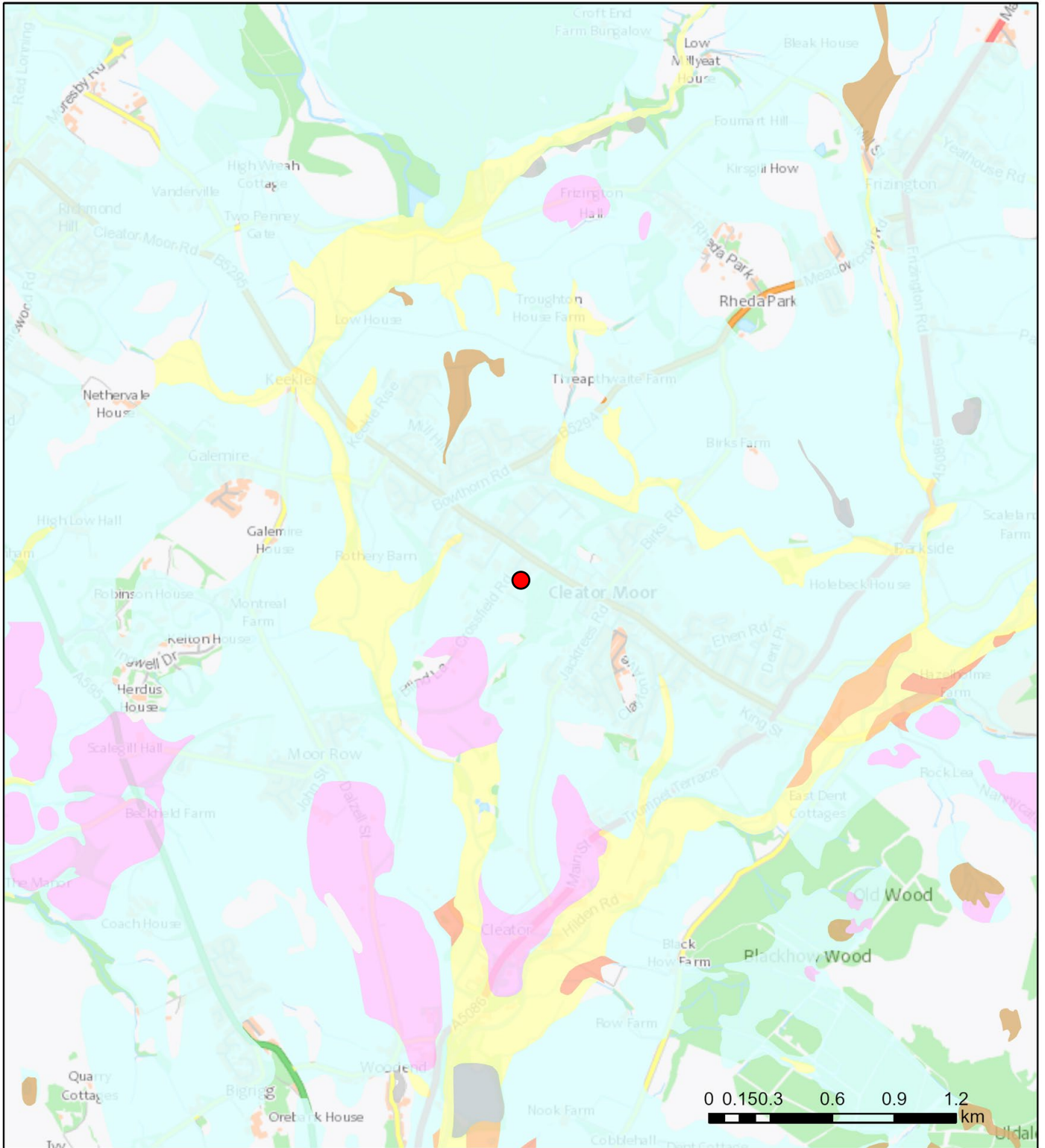
Date: 1923

















Date: 1938

Appendix D – Geological Maps

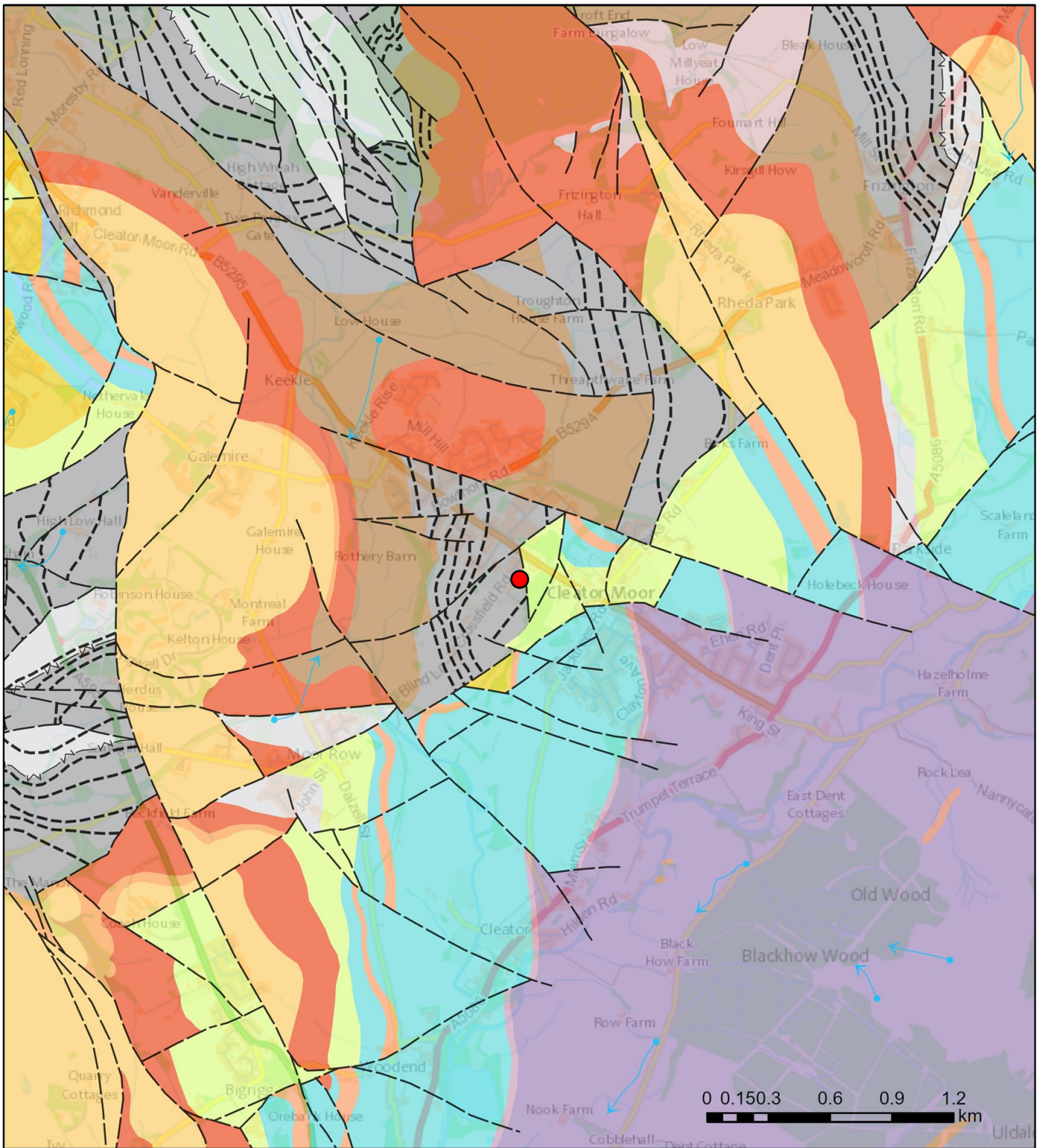
Superficial Geology










Superficial deposits 1:50,000 scale

	<u>GLACIOFLUVIAL DEPOSITS, DEVENSIAN - SAND AND GRAVEL</u>
	<u>GLACIOFLUVIAL ICE CONTACT DEPOSITS, DEVENSIAN - SAND AND GRAVEL</u>
	<u>TILL, DEVENSIAN - DIAMICTON</u>
	<u>HUMMOCKY (MOUNDY) GLACIAL DEPOSITS, DEVENSIAN - CLAY, SAND AND GRAVEL</u>
	<u>ALLUVIUM - CLAY, SILT, SAND AND GRAVEL</u>
	<u>HEAD - CLAY, SILT, SAND AND GRAVEL</u>
	<u>RIVER TERRACE DEPOSITS, 1 - CLAY, SAND AND GRAVEL</u>
	<u>RIVER TERRACE DEPOSITS, 2 - CLAY, SAND AND GRAVEL</u>
	<u>RIVER TERRACE DEPOSITS (UNDIFFERENTIATED) - CLAY, SAND AND GRAVEL</u>
	<u>ALLUVIAL FAN DEPOSITS - SAND AND GRAVEL</u>
	<u>MARINE BEACH DEPOSITS - SAND AND GRAVEL</u>
	<u>PEAT - PEAT</u>
	<u>SUPERFICIAL THEME NOT MAPPED [FOR DIGITAL MAP USE ONLY] - UNKNOWN/UNCLASSIFIED ENTRY</u>
	<u>SUPERFICIAL THEME NOT MAPPED [FOR DIGITAL MAP USE ONLY] - WATER, TYPE UNSPECIFIED</u>

Bedrock Geology



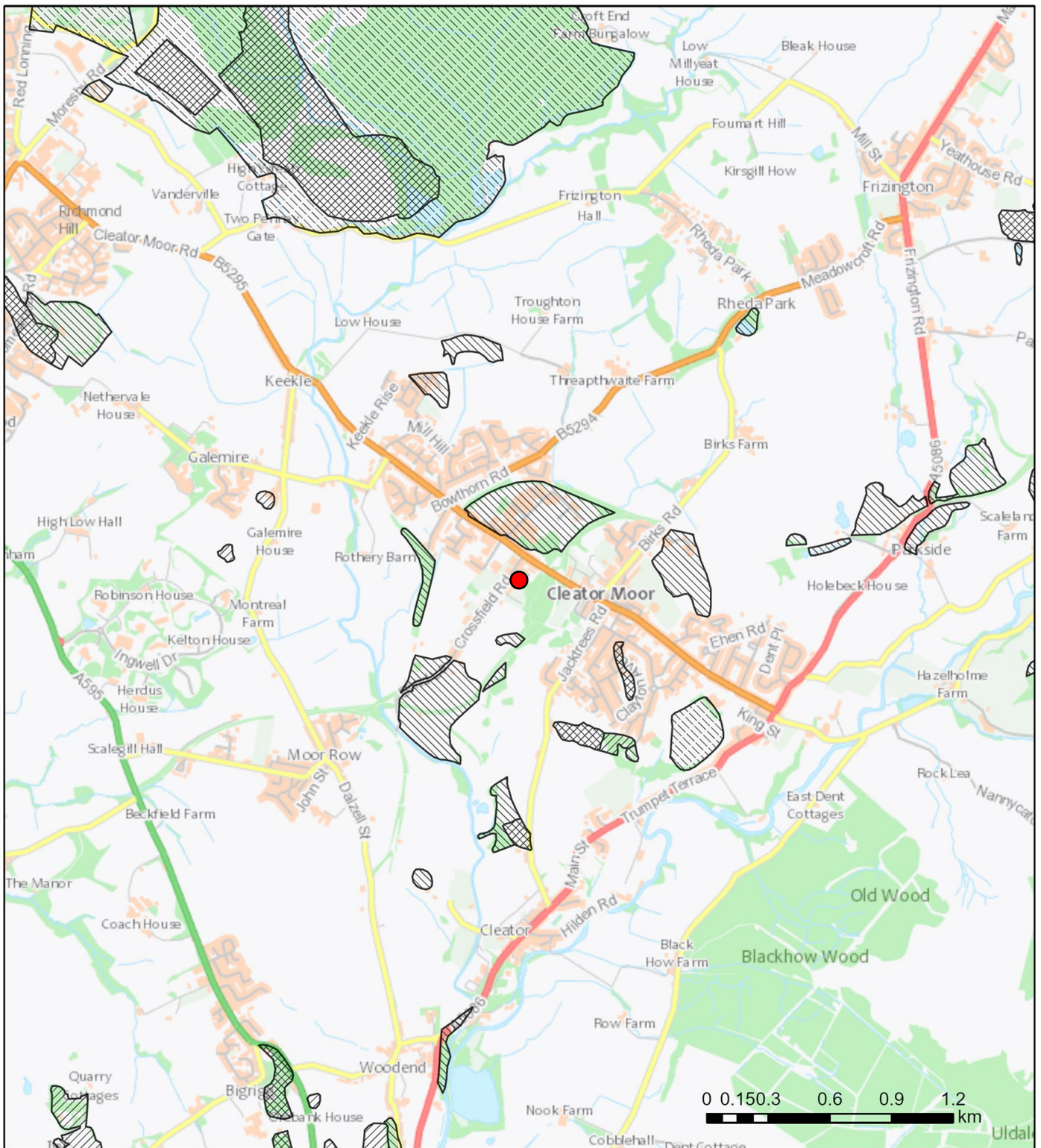
Bedrock geology 1:50,000 scale

	<u>LAKE DISTRICT DEVONIAN MINOR INTRUSION SUITE - MICRODIORITE</u>
	<u>KIRK STILE FORMATION - MUDSTONE AND SILTSTONE</u>
	<u>FIRST SHALE MEMBER - SANDSTONE, SILTSTONE AND MUDSTONE</u>
	<u>PENNINE LOWER COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE</u>
	<u>FIRST LIMESTONE (CUMBRIA) - LIMESTONE</u>
	<u>SECOND LIMESTONE (CUMBRIA) - LIMESTONE</u>
	<u>FIFTH LIMESTONE (CUMBRIA) - LIMESTONE</u>
	<u>ESKETT LIMESTONE FORMATION - LIMESTONE</u>
	<u>FRIZINGTON LIMESTONE FORMATION - LIMESTONE</u>
	<u>LOWESWATER FORMATION - WACKE</u>
	<u>MILLYEAT MEMBER - MUDSTONE, SANDSTONE AND LIMESTONE</u>
	<u>MARSETT SANDSTONE FORMATION - CONGLOMERATE</u>
	<u>DEVOKE WATER TUFF MEMBER - VOLCANICLASTIC-BRECCIA</u>
	<u>BUTTERMERE FORMATION - MUDSTONE AND SANDSTONE</u>
	<u>PENNINE MIDDLE COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE</u>
	<u>STAINMORE FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE</u>
	<u>ST BEES SANDSTONE MEMBER - SANDSTONE</u>
	<u>OREBANK SANDSTONE - SANDSTONE</u>
	<u>LAKE DISTRICT DEVONIAN MINOR INTRUSION SUITE - FELSITE</u>
	<u>LAKE DISTRICT DEVONIAN MINOR INTRUSION SUITE - ANDESITE</u>
	<u>ST BEES SHALE FORMATION - SILTSTONE AND MUDSTONE, INTERBEDDED</u>
	<u>PENNINE MIDDLE COAL MEASURES FORMATION - SANDSTONE</u>
	<u>WHITEHAVEN SANDSTONE FORMATION - SANDSTONE</u>
	<u>ST BEES EVAPORITE FORMATION - DOLOMITIC LIMESTONE, MUDSTONE AND ANHYDRITE-STONE</u>
	<u>LATTERBARROW SANDSTONE FORMATION - SANDSTONE</u>
	<u>HENSINGHAM GRIT - SANDSTONE</u>
	<u>BROCKRAM - BRECCIA</u>





Linear features 1:50,000 scale

	Backfeature_terrace
	Coal_seam_Inf
	Fault_Inf_Downthrow_unspecified
	Fault_Thrust_Inf_Triangle_on_hangingwall_side
	Glacial_meltwater_channel_Centre_Undiff
	Limit_Metamorphic_Aureole
	Marine_band
	Mineral_Vein_Inf

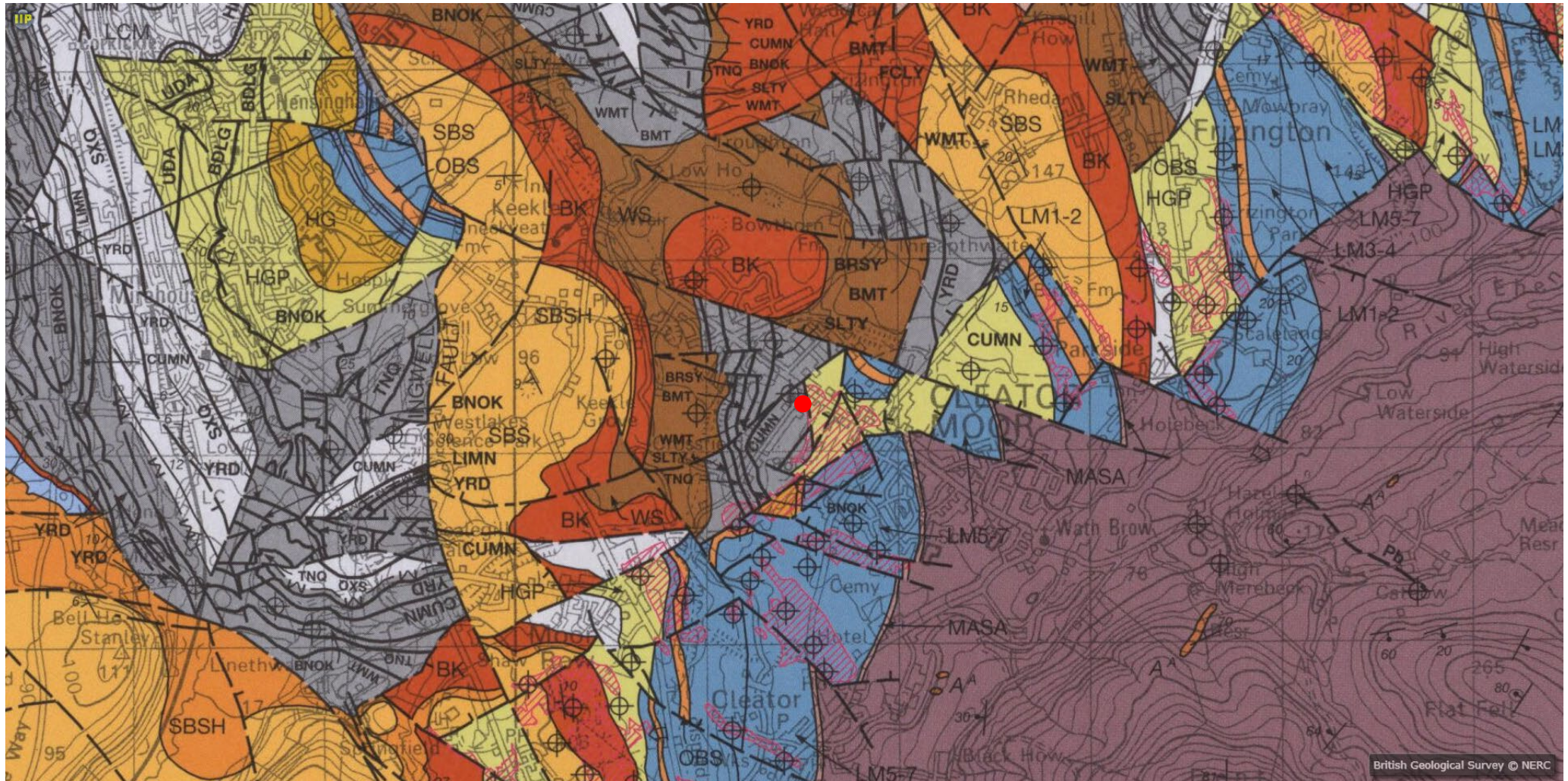
Artificial Geology



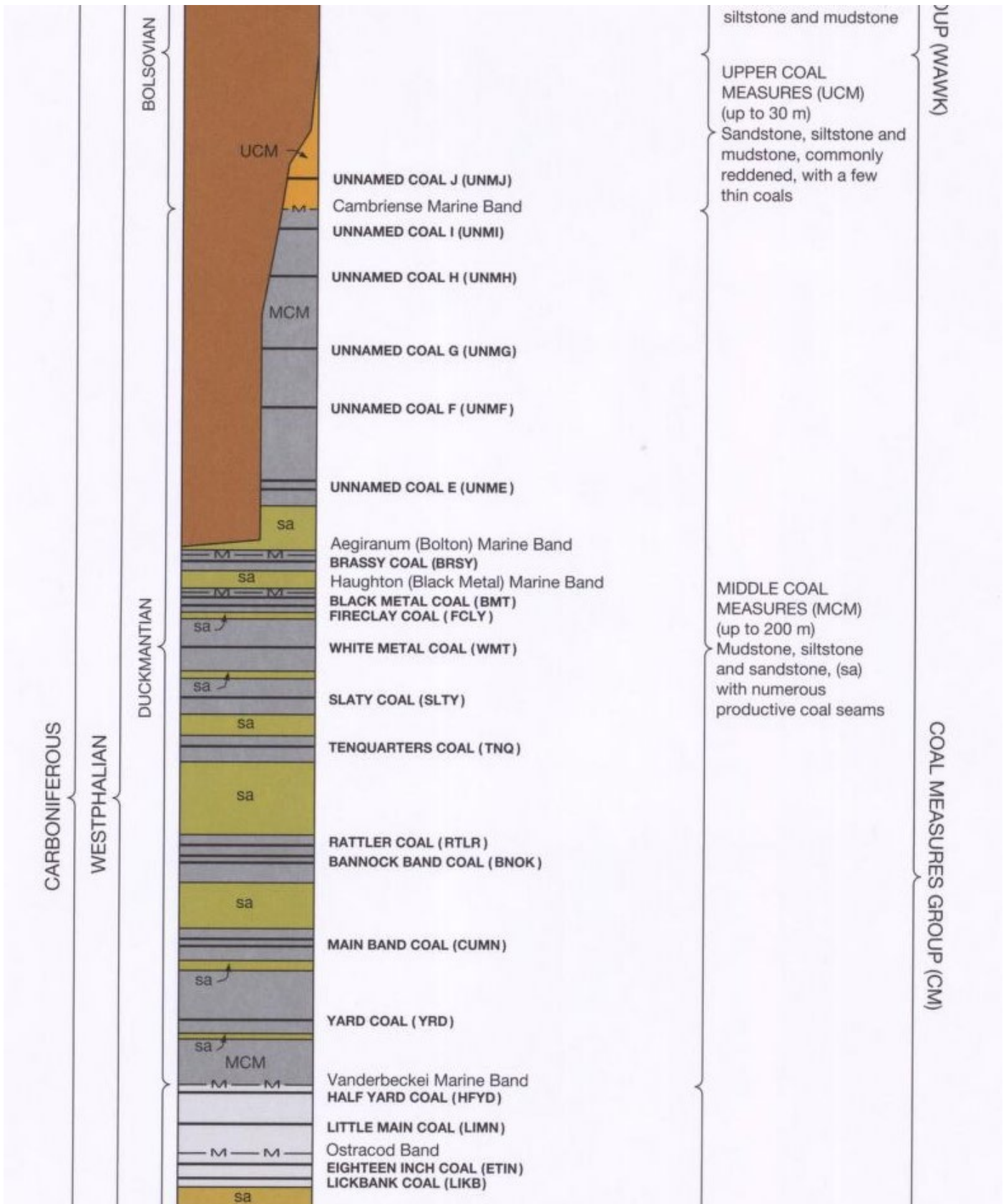
Artificial ground 1:50,000 scale

-  LANDSCAPED GROUND (UNDIVIDED) - ARTIFICIALLY MODIFIED GROUND
-  MADE GROUND (UNDIVIDED) - ARTIFICIAL DEPOSIT
-  WORKED GROUND (UNDIVIDED) - VOID
-  INFILLED GROUND - ARTIFICIAL DEPOSIT

BGS Geological Survey 1:50,000 Series England and Wales Sheet 28, Whitehaven



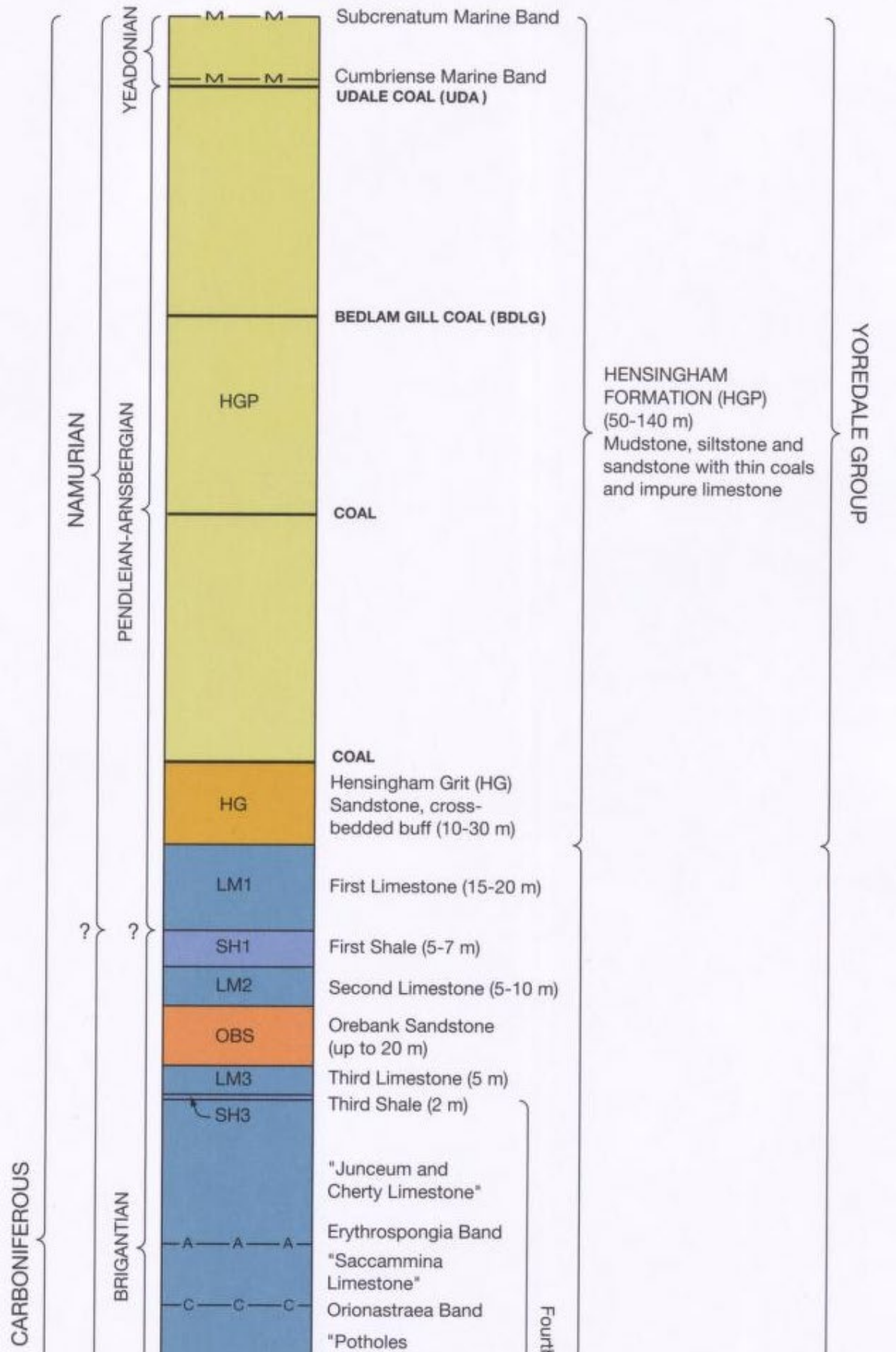
Generalised Vertical Section



Pit or mineshaft, abandoned



Area of Haematite undermining



Appendix E – BGS Borehole Logs

NY01NW235

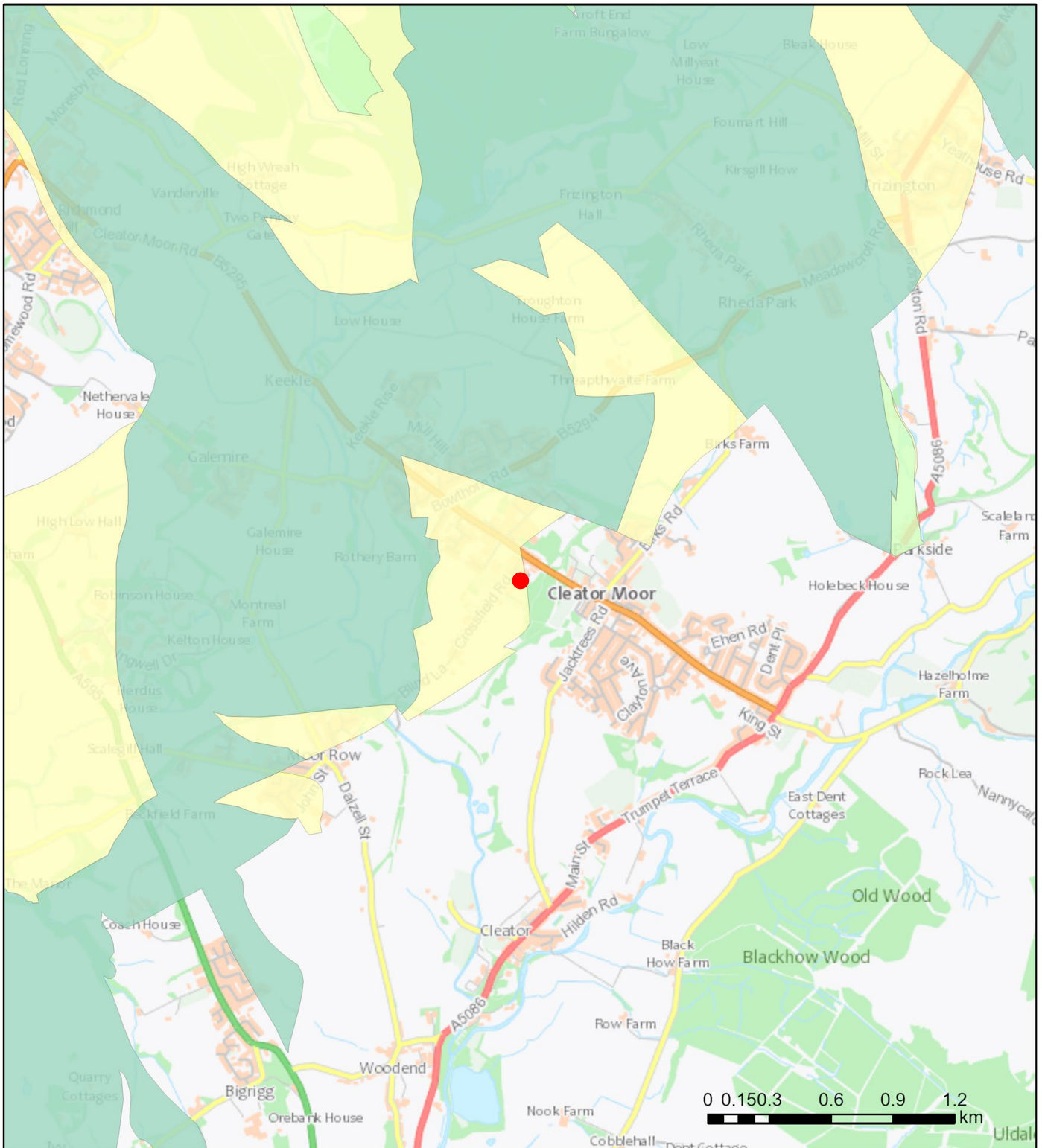


~~CUMBERLAND~~ SECTION OF **67SE2** at ⁹⁶ ~~Widdowson J.E.~~ ~~Longworth Mine, Cleator Moor~~
COUNTY Cumberland
Communicated by C. Davidson Esq. (D. Thompson's gas) Date of sinking Commenced 22 Aug 1891.
One-inch Map (N.S.) NY 01 NW 235
HEIGHT ABOVE O.D. _____ DIP OF STRATA _____

	Thickness.			Depth from Surface.		
	Yards.	feet.	ins.	Yards.	feet.	ins.
Soil		1	0		1	0
Clay, stony		5	5		5	5
Grey sandstone		3	5		9	7
Wharfedale (flinty)		1	0		9	5
Black shale		1	8		11	6
Grey sandstone		7	0		12	3
Sandstone		2	6		14	9
Black shale		1	2		16	2
Sandstone		1	6		16	9
Shale		4	0		17	9
Sandstone		1	0		17	9
Wharfedale		4	7		22	5
Iron Ore		6	0		23	5
Sandstone shale mixed with sulphur		1	3		24	8
<i>Sum to total 299' 7"</i>						

1891 Aug. 1917.

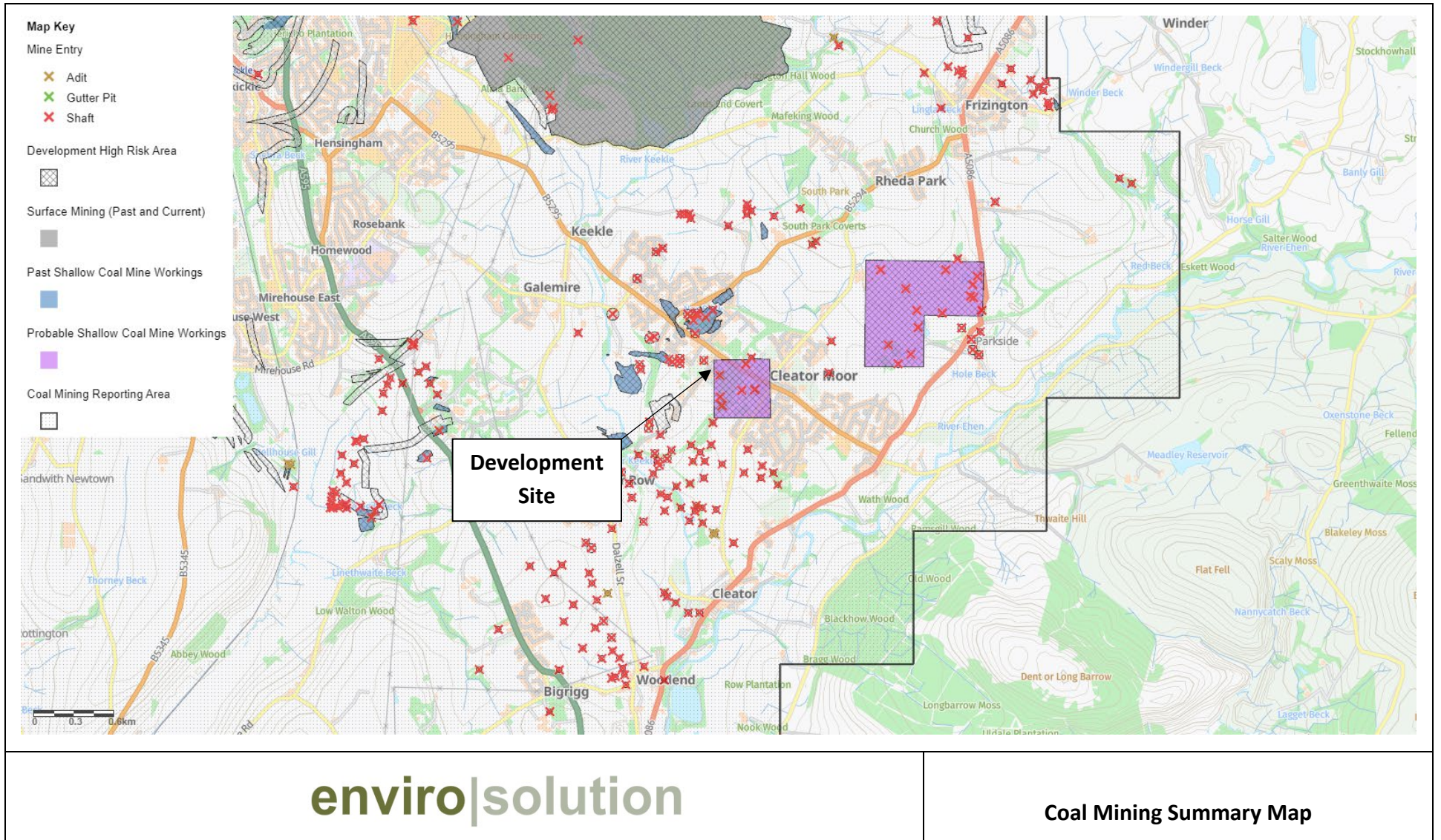
Appendix F – Coal Resource Map



Shallow Coal

- Buried coal resource overlain by up to 50m overburden
- Primary opencast coal resource area
- Secondary opencast coal resource area
- Tertiary opencast coal resource area

Appendix G – Coal Mining Summary Map



enviro|solution

Coal Mining Summary Map