

Geoffrey Wallace Limited.
11 St Bridgets Close
Brigham, Cumbria
CA13 0DJ

Date: 27.06.2024

Project No: GEO2024-6313

Project: Land at Brewery Brow, Parton, Cumbria

Report Title: Coal Mining Risk Assessment

Dear Geoff,

Geo Environmental Engineering Ltd (GEO) were commissioned by the Consultant, Geoffrey Wallace Limited, to carry out a 'Coal Mining Risk Assessment' for land at Brewery Brow in Parton, Cumbria. A site location plan is attached.

The site comprises a steep embankment covered with dense scrub vegetation. A track cuts through the centre of the site with an adjacent retaining wall. The Consultant indicates that the retaining wall is currently collapsing.

It is understood that the Client is constructing a new retaining wall on site and plans to develop the land for residential end use. A proposed site layout plan has not been provided.

Geological Assessment

The following information has been used for the assessment:

- British Geological Survey (BGS)
 - Geological Map, 1:10,000 scale, Sheet: NX92SE.
 - Geological Map, 1:50,000 scale, Sheet 28 Whitehaven.
 - Historical Borehole Records.
- The Coal Authority (CA)
 - Online database.
 - Consultants Coal Mining Report (51003433728001, dated: 27th June 2024).

Geological records indicate that the site is underlain by Glacial Till deposits (typically firm and stiff clays with bands of sand and gravels) overlying solid strata of the Lower and Middle Coal Measure Formations which typically comprise cycles of sandstone, mudstones, siltstones and thick, potentially workable coal seams.

The 1:10,000 scale geological map indicates a complex geological setting with several fault blocks conjectured to intersect beneath or within close proximity to the site. The Ten Quarter (TNQ) Coal Seam is conjectured to sub-crop to the west / south west of the site with a dip to the east. The seam has a recorded thickness of between 0.30m and 0.50m and is, therefore, potentially workable. The seam may be present beneath the site at shallow depth and could have been worked.

Given the complex faulting within this area, the depth of any seams is difficult to determine. Furthermore, the coal may be heavily faulted and therefore difficult to extract, or of poor quality where it may not be economically viable. However, this would need to be determined as part of an intrusive mining investigation.

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BGS historical borehole logs are not available for the site or immediate area. The nearest historical borehole is located c.170m south east adjacent to the A595. The borehole was drilled for the construction of the A595 and encountered firm and stiff sandy gravelly clay to its terminal depth of 4.50m bgl. Bedrock was not encountered.

A historical borehole is also located c.195m south west. This was drilled to a depth of c.55m bgl in 1815. The borehole log is difficult to read due to its age, but appears to indicate sandy clay to a depth of 2m overlying coal measure strata. The 'Bannock Band Coal' is recorded from a depth of c.25m bgl.

Coal Authority Information

The Coal Authority online database indicates that the western parts of the site are within a 'Development High Risk Area' associated with sub-cropping coal seam (Ten Quarters). An area of 'Probable Shallow Coal Mine Workings' is located immediately south which is probably associated with workings within the Ten Quarters seam.

The database indicates a second seam, possibly the Slaty coal seam sub-cropping on or adjacent to the eastern site boundary. However, given the dip angle to the east, it is likely that the seam will dip away from the site and is unlikely to be present beneath the proposed development area.

The Coal Authority Consultants Coal Mining Report indicates known mine workings at depths of between 83m and 254m bgl within the Six Quarters and Harrington Four Feet coal seams. Given the depth of these workings, the risk to the proposed development from any ground movements is considered negligible.

The CA report does not indicate any 'Probable Unrecorded Shallow Workings' or 'Spine Roadways at Shallow Depth' beneath the site and there are no mine entries recorded within 100m. However, the report indicates that the Brick Coal seam sub-crops across the western parts of the site and may, therefore have been mined before records were maintained. The location of the sub-cropping 'Brick' seam is the same as the 'Ten Quarters' as recorded by the BGS. It is possible that these names are interchangeable.

Conclusions and Recommendations

Available information indicates a complex geological setting with a conjectured sub-cropping coal seam (Ten Quarters / Brick coal seam) within the western part of the site. Given the dip direction, it is possible that the seam may have been worked beneath the site at shallow depth. The Coal Authority indicate that the seam has probably been worked at shallow depth to the south of the site and, therefore shallow workings within the proposed development area are also possible.

Intrusive ground investigation works are recommended within the vicinity of the proposed development to determine the ground conditions and the depth of any shallow coal mine workings. Therefore, rotary boreholes should be drilled to a depth of c.30m bgl. If shallow, potentially workable coal is encountered, additional boreholes may be required to determine if it has been worked.

Potential mine gasses pose a risk to the end users, therefore ground gas monitoring is also recommended.

If evidence of mine workings (voids, broken ground, significant loss of flush, etc...) is encountered, remediation (pressure injection grouting) or other protection measures may be required. This would

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be subject to a detailed appraisal which should consider the depth and thickness of the worked seam and the thickness and strength of the overlying rock cover.

It is generally accepted that there is a risk to the proposed development if the rock cover over a worked coal seam is less than ten times the seam thickness (a ratio of 1:10). There is some debate as to the exact thickness of rock cover required to mitigate the risk of collapse or disturbance at the surface, particularly where numerous closely spaced seams are encountered, however, a ratio of 1:15 (15 times seam thickness to rock cover) is generally considered acceptable. The strength, composition and homogeneity of the rock strata should be assessed to determine the risks where ratios of between 1:10 and 1:15 are encountered.

General Comments

Consideration must be made for variations to occur in the ground conditions between the exploratory hole locations for which GEO holds no responsibility. It is therefore recommended that a “watching brief” be applied to ensure that if ground conditions vary from those identified during this investigation then advice should be sought from a suitably qualified and experienced Geo-Environmental Engineer.

The recommendations and opinions expressed in this report are based on the ground conditions observed. Consequently, GEO takes no responsibility for conditions that have not been revealed or which occur between them.

The conclusions and recommendations presented within this report are considered reasonable based on the available information. However, these cannot be guaranteed to gain regulatory approval. Therefore, the report should be passed to the appropriate regulatory authorities and/ or other key stakeholders, including warranty providers in order to seek their approval of the findings prior to undertaking any site works or development on site.

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If there are any queries, please do not hesitate to contact Geo-Environmental Engineering Ltd.

Yours Faithfully

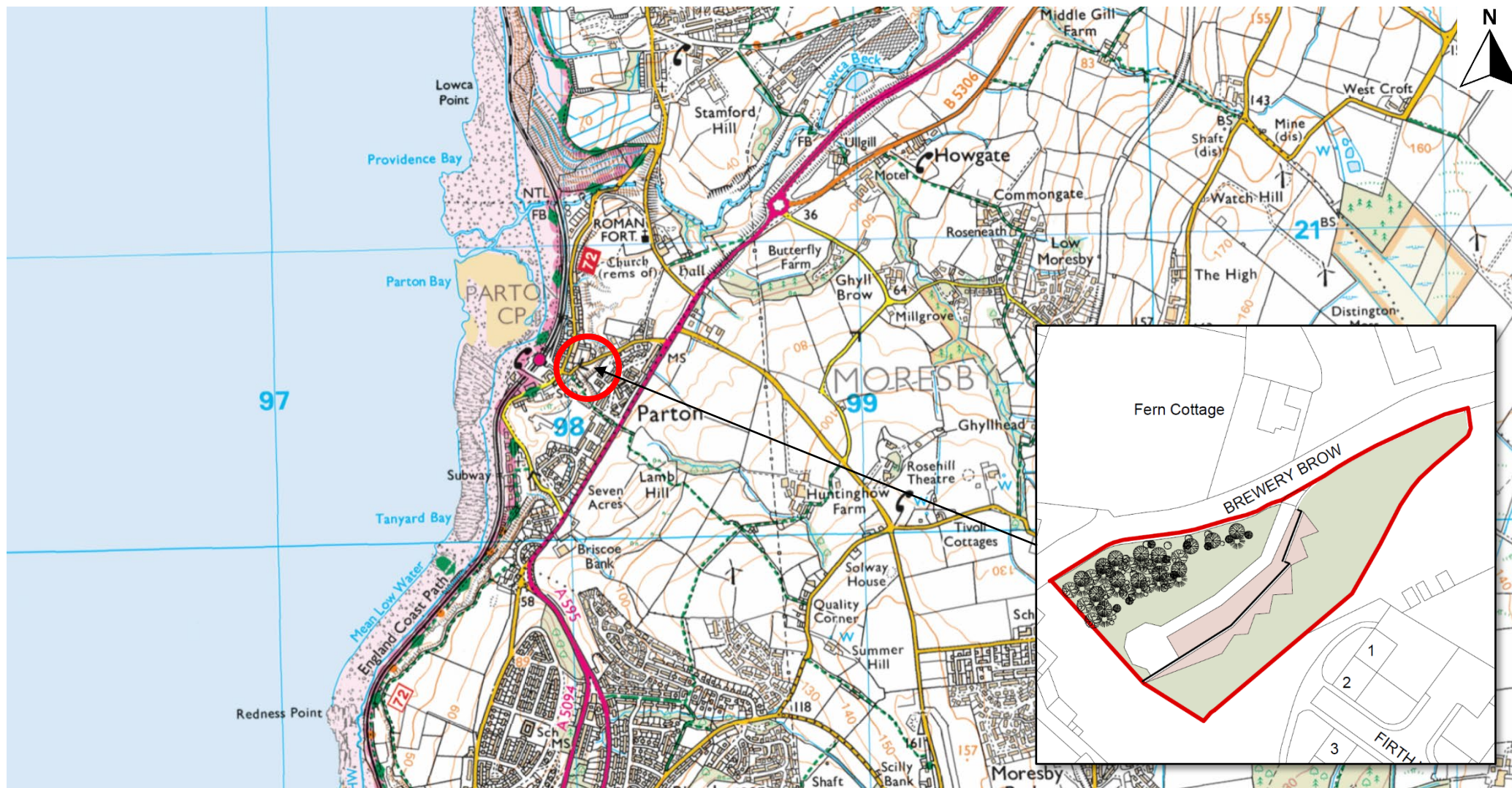


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James Brock *BSc (Hons), MSc*
Associate - Geo Environmental Engineering Ltd

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GEO2023-6313: Brewery Brow, Parton, Cumbria – Site Location



GEO2023-6313: Brewery Brow, Parton, Cumbria – Aerial Photograph



Website: www.geoenvironmentalengineering.com

Email: info@geoenvironmentalengineering.com

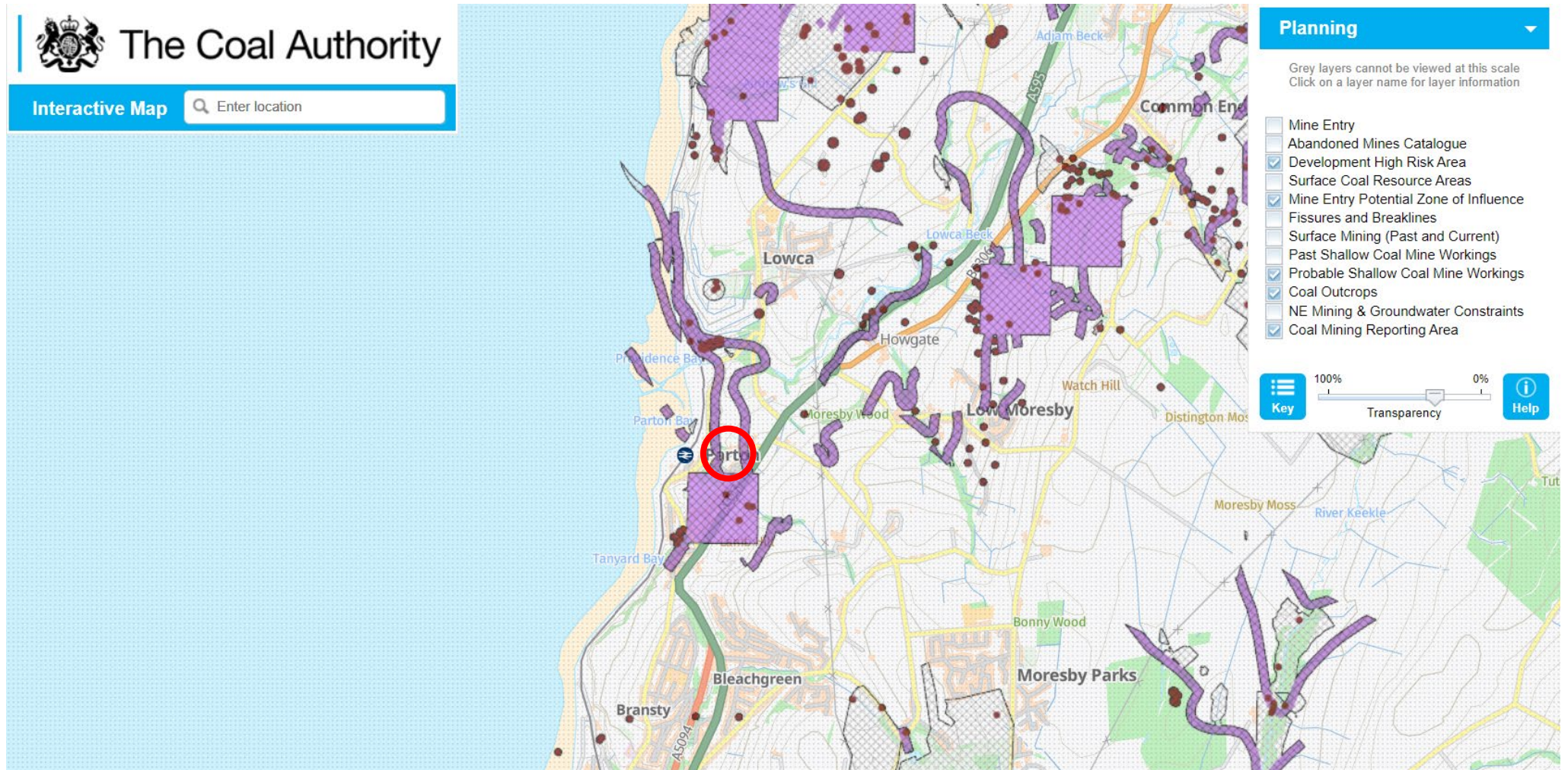
Telephone: 07883 440 186

GEO2023-6313: Brewery Brow, Parton, Cumbria – British Geological Survey, 1:10,000 Geological Map Extract & GVS

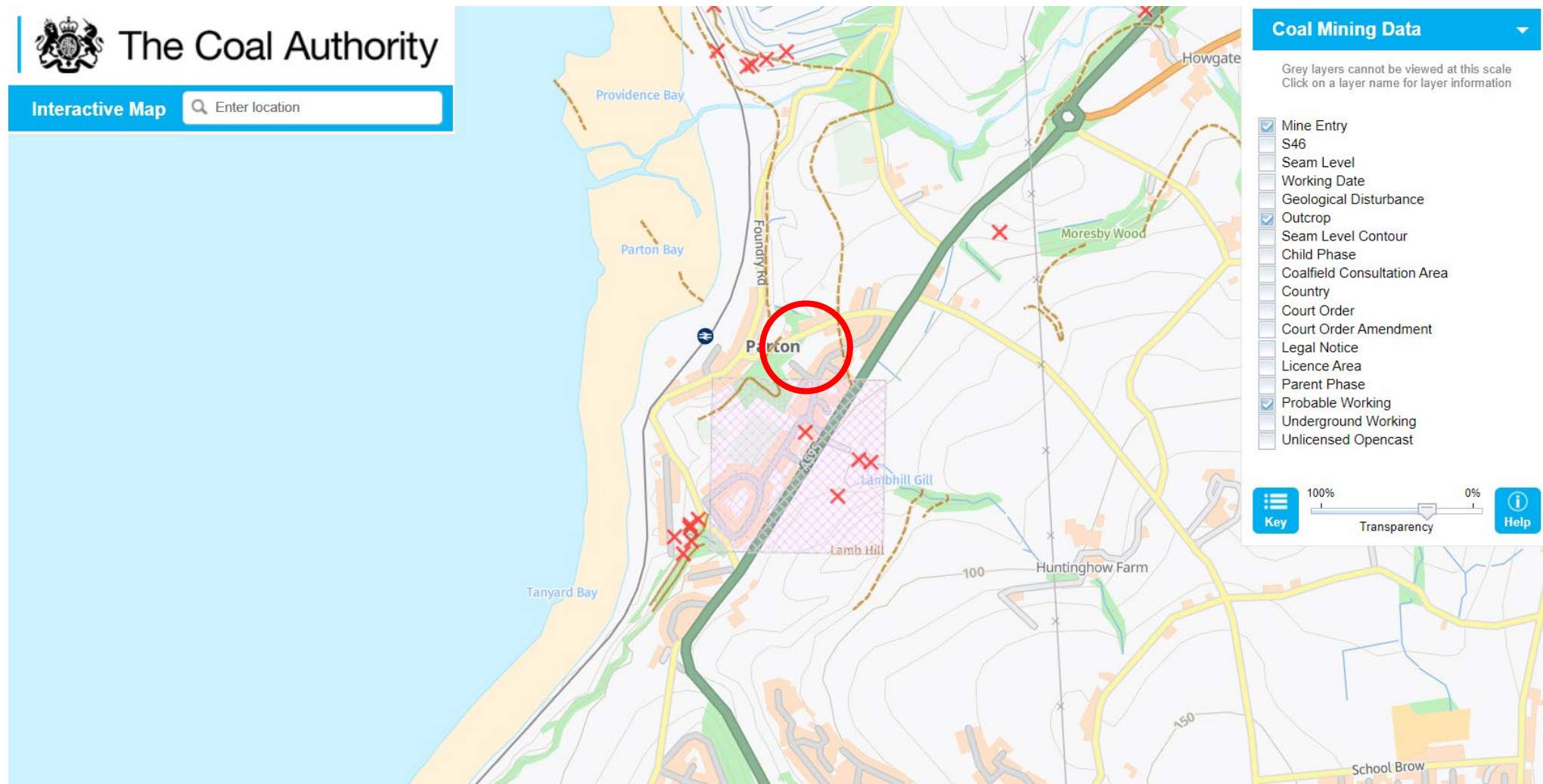


BRSY	BRASSY [LAMB GILL COALS] (BRSY) 0.5-0.9
BMT	BLACK METAL M.B. (conj.) BLACK METAL (BMT) 0.6-1.8
sd	COUNTLESS PIT SANDSTONE
FCLY	FIRECLAY [UPPER METAL] (FCLY) up to 0.75
WMT	WHITE METAL [CLEATOR MOOR 6 FOOT] (WMT) up to 1.0
SLTY	SLATY [CLEATOR MOOR 4 FOOT] (SLTY) 0.5
sd	TEN QUARTERS OR CHINA ROCK
TNO	TEN QUARTERS [CLEATOR MOOR 5 FOOT, CHINA] (TNO) 0.3-0.5
sd	BANNOCK BAND ROCK
RTLR BNOK	RATTLER (RTLR) BANNOCK (BNOK) 3.2-4.0
sd/sl	MAIN BAND ROCK
CUMN	MAIN (CUMN) up to 4.0

GEO2023-6313: Brewery Brow, Parton, Cumbria – The Coal Authority, Online Database Information (Page 1 of 2)



GEO2023-6313: Brewery Brow, Parton, Cumbria – The Coal Authority, Online Database Information (Page 2 of 2)



Website: www.geoenvironmentalengineering.com

Email: info@geoenvironmentalengineering.com

Telephone: 07883 440 186



GEO Environmental Engineering Ltd

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Consultants
&
Drilling Experts

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