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Mining Risk Assessment

Scout Moor II
Further Environmental Information

June 2026

Pell Frischmann

Scout Moor II Wind Farm

Mining Risk Assessment

109692-PEF-ZZ-XX-RP-GT-6001

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*This **Mining Risk Assessment** has been prepared by **Pell Frischmann** on behalf of Cubico UK Development (Wind 1) Limited ('the Applicant' or 'Cubico'). It is submitted as part of Further Environmental Information in respect of the cross-boundary applications for full planning permission ('the Applications') relating to the construction and operation of a new onshore wind farm (to be known as 'Scout Moor II'), alongside a comprehensive moorland restoration scheme (the 'Proposed Development'), on land at Rooley Moor ('the Site').*

The Site crosses the administrative boundaries of Rossendale Borough Council ('RBC') and Rochdale Metropolitan Borough Council ('RMBC') (collectively referred to as 'the Councils'). The Councils are the Local Planning Authorities ('LPA's') responsible for the determination of the Applications, which were originally submitted on 23 July 2025 and were validated by the Councils on 07 August 2025 (RBC ref. 2025/0267 and RMBC ref. 25/00680/FUL).

Following the completion of an extended period of statutory consultation on the Applications, the Applicant has evolved the Proposed Development to respond to comments received from statutory and non-statutory consultees, the public and other interested stakeholders and is hereby formally amending the Applications through the submission of Further Environmental Information ('FEI'). The FEI supersedes the information submitted in July 2025 ('the 2025 Submission') and will be subject to further statutory consultation by the Councils. A summary of the amendments to the Applications is set out in detail the Planning, Design and Access Statement (prepared by Turley), but in summary includes the reduction in turbine numbers from 'up to 17 turbines' to 'up to 12 turbines', alongside the relocation/repositioning of turbine positioning, access track layout and the layout and design of other associated infrastructure.

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1 Introduction

1.1 Scope and Objective of the Report

Pell Frischmann has been commissioned by Cubico UK Development Ltd (the *Applicant* or *Cubico*) to prepare this Mining Risk Assessment (MRA) for the proposed Scout Moor II Wind Farm (the *site*). It is submitted as part of Further Environmental Information in respect of the cross-boundary applications for full planning permission relating to the construction and operation of the new onshore wind farm, alongside a comprehensive moorland restoration scheme on Rooley Moor, approximately 20km north of Manchester.

The Site crosses the administrative boundaries of Rossendale Borough Council and Rochdale Metropolitan Borough Council. The Councils are the Local Planning Authorities responsible for the determination of the Applications, which were originally submitted on 23 July 2025 and were validated by the Councils on 07 August 2025 (RBC ref. 2025/0267 and RMBC ref. 25/00680/FUL).

The overall aim of the MRA is to investigate the presence of former coal and sandstone workings on the site to identify potential geotechnical risks which could impact upon or restrict the proposed scheme.

1.2 2026 Amendment

Following the completion of an extended period of statutory consultation on the Applications, the Applicant has evolved the Proposed Development to respond to comments received from statutory and non-statutory consultees, the public and other interested stakeholders and is hereby formally amending the Applications through the submission of Further Environmental Information ('FEI'). The FEI supersedes the information submitted in July 2025 ('the 2025 Submission') and will be subject to further statutory consultation by the Councils. A summary of the amendments to the Applications is set out in detail the Planning, Design and Access Statement (prepared by Turley), but in summary includes the reduction in turbine numbers from 'up to 17 turbines' to 'up to 12 turbines', alongside the relocation/repositioning of turbine positioning, access track layout and the layout and design of other associated infrastructure.

1.3 Site Location

The site area is just under 1,024ha and lies approximately 3.4km northwest of the centre of Rochdale (north of Manchester), as shown in Figure 1-1. The approximate National Grid Reference (NGR) for the centre of the site is 385417, 418664.

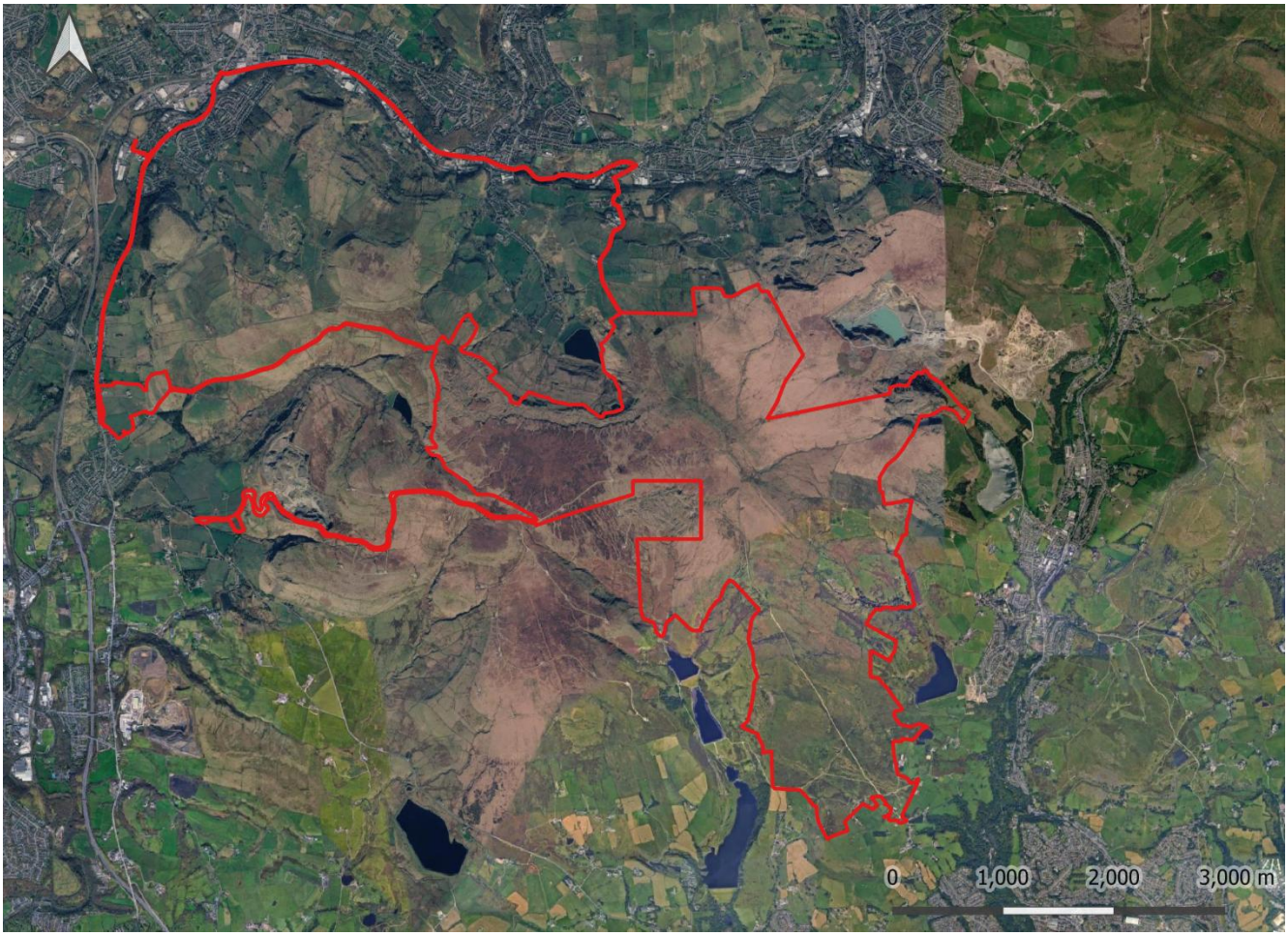


Figure 1-1: Site Location Plan

1.4 Project Description

The proposed scheme consists of twelve 180m high wind turbines (able to generate up to 100MW) with connecting cable runs, a new substation and associated access tracks. The scheme arrangement is shown in extract in Figure 1-2 and presented in the following drawing in Appendix A:

- Cubico, Scout Moor II Infrastructure Layout, 22/04/2026.

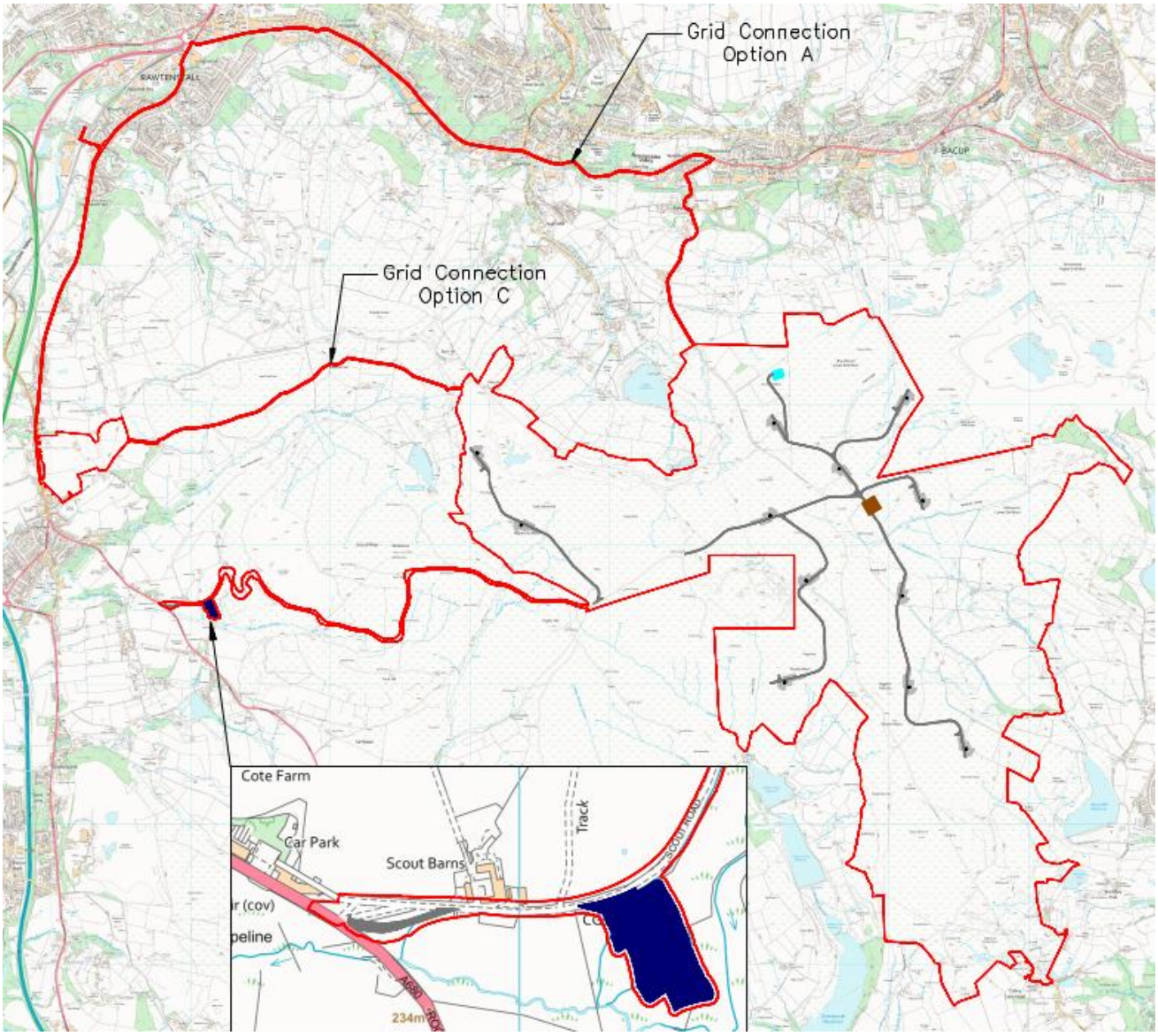


Figure 1-2: Outline layout

The main construction compound will also be located centrally within the (thin) red line boundary area (shaded in brown). It is proposed that the cable trenches (with inverts of up to 1.5mbg) will be backfilled with selected as-dug arisings to reinstate the ground in each area.

The scheme will connect into the Rossendale Bulk Supply Point (BSP) Substation in Rawtenstall (circa 3km northwest of the site). Three potential connection routes are currently being considered, which follow the existing local road network shown as follows in Figure 1-2:

- Option A: to the north, via Rooley Moor Road, Rakenhead Lane and the A681.
- Option B: to the west, via existing access track, Scout Road and the A680.
- Option C: via Burney Road using an preexisting access track.

During construction/installation, site access will be via Scout Road, from the A680 in the west and a temporary compound/laydown area will be created towards the western end of Scout Road, circa 300m east of the A680 (shaded in purple in Figure 1-2).

The scheme will also include habitat management and peatland enhancement works.

1.5 Site Topography

The site topography is generally upland moorland plateau with steep valley sides. The maximum elevation across the scheme extents is approximately 470m AOD at Hail Storm Hill reducing to approximately 375m AOD around turbine T1 at the southern extent of the scheme (reducing further within the study area beyond the scheme layout).

1.6 Historic Land Use

The historical land use and development of each study area has been established from the historical Ordnance Survey plans (1:10,560, 1:10,000, 1:1,250 and 1:2,500-scale) dating from between 1857 and 2020, obtained from Envirocheck and reproduced in Appendix D of this report. The key developments for each section have been summarised in Table 1-1. The maps are described in areas split into a 'Western Area' and an 'Eastern Area' as shown in Figure 1-3.

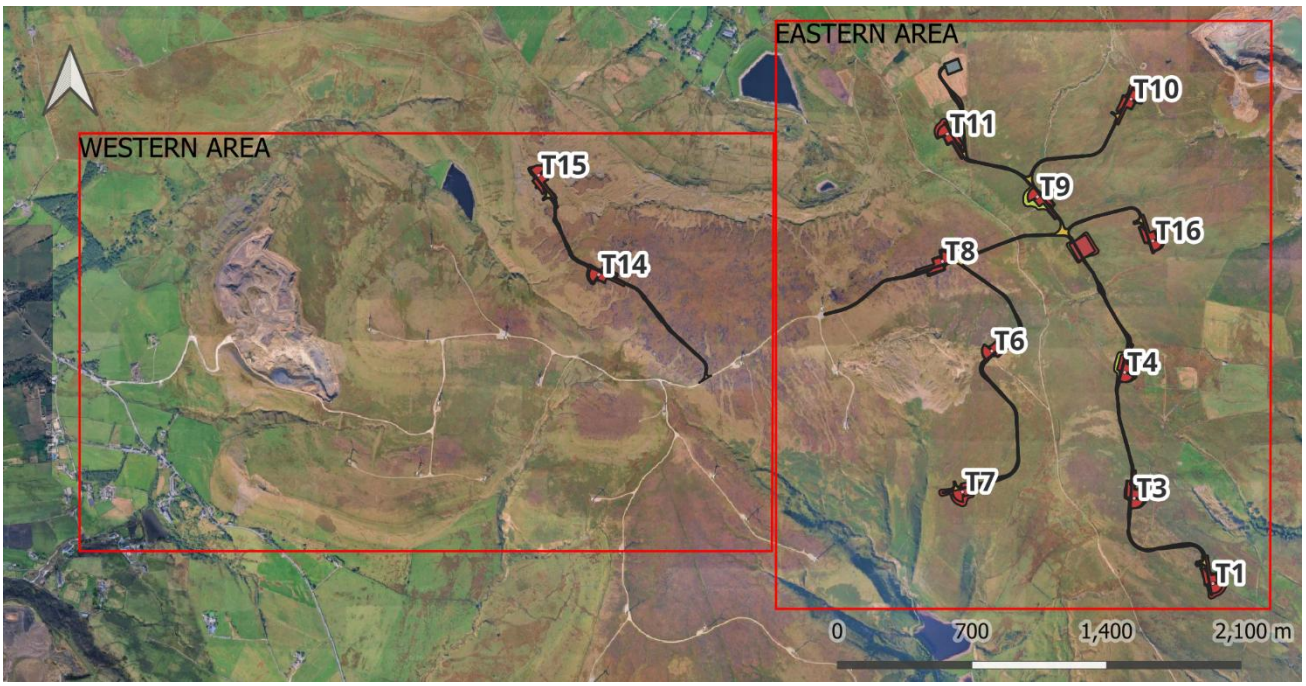


Figure 1-3: Western Area and Eastern areas used to delineate the scheme in the historical land use summary in Table 1-1.

Table 1-1: Historical Land Use

Date	Key Developments	Source
1851	Western Area (west of Hail Storm Hill) Along the Route of Proposed Option B Access Track & Turbines T14 and T15 At the point where the proposed Option B access track leaves Rochdale Road, Rochdale Road is present as an unmarked lane, to the east of which Scout Barn is present, and lanes are shown leading up to Scout Corner roughly along the route of the proposed access track. North of Scout Corner, 'Scout Delf Sandstone Quarry (Flags) is shown as a substantial quarry, the southern extent of which intercepts the proposed access track and extends approximately 450m northwards; with excavation apparently into an escarpment at the edge of the moorland plateau. Moving eastwards along the proposed access track alignment towards Twenty Acres, numerous quarries and mines are marked. A 'Colliery', a 'Sandstone Quarry', four 'Old Coal Pit'(s), and a 'Colliery are shown to the north within 150m of the track. A 'Sandstone Quarry', and five 'Old Coal Pit'(s) are shown within 150m of the south of the Option B track and a reservoir is also shown immediately south of the access track. Substantial numbers of other coal pits and quarries are shown in the track's wider vicinity, indicating substantial mining and quarrying activity across a wider area.	1:10,560 Scale (1851)

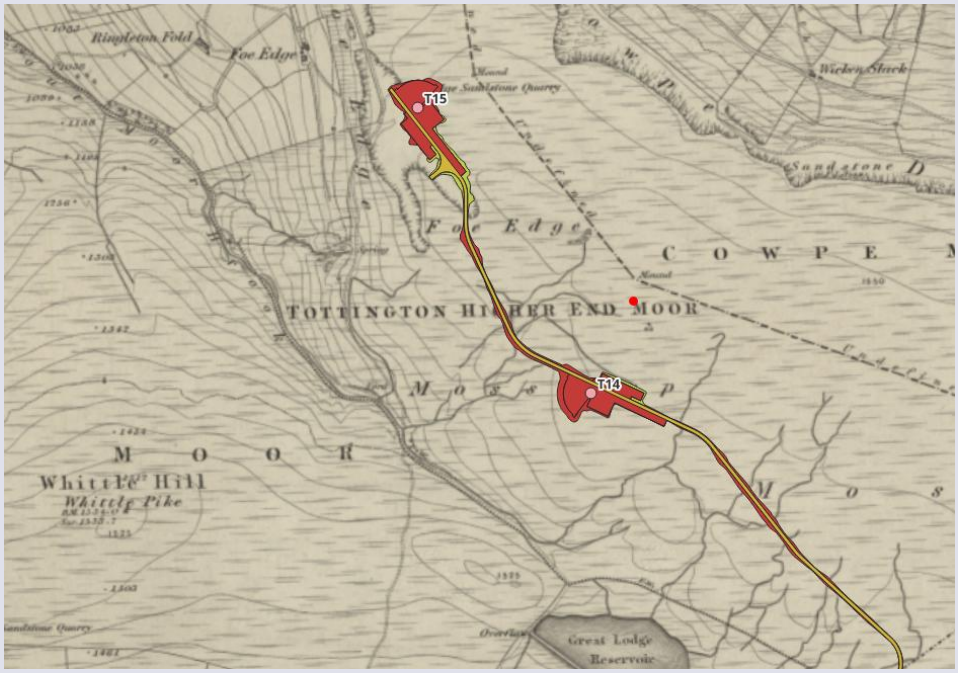
Table 1-1: Historical Land Use		
Date	**Key Developments**	**Source**
	Moving northwards along the Option B track towards Whittle Hill, a 'Sandstone Quarry' is shown approximately 200m west of the site and the track crosses 'Great Lodge Reservoir' which is shown from approximately 400m southeast of turbine T14. An extensive and largely dendritic fluvial network is shown to the north of the location of Great Lodge Reservoir at the location of turbine T14. The fluvial network appears to act as a catchment for the reservoir. 'Foe Edge Sandstone Quarry' is shown immediately north of T15 and appears to have been excavated into the edge of the moorland plateau.  **Figure 1-4: 1851 map showing Great Lodge Reservoir, Foe Edge Sandstone Quarry and the dendritic fluvial system below turbines T14 and T15** <u>Eastern Area (east of Hail Storm Hill) Along the Route of Proposed Option A Access Track & Turbines T1 to T16</u> Four Sandstone Quarries are shown between approximately 500m and 600m southeast to southwest of turbine T8; two unnamed and one marked as 'Ding Quarry (Sandstone)'. The two more southerly quarries are broadly at the head of Ding Clough. An area of moorland to the northeast is marked as 'Red Pits'.  	

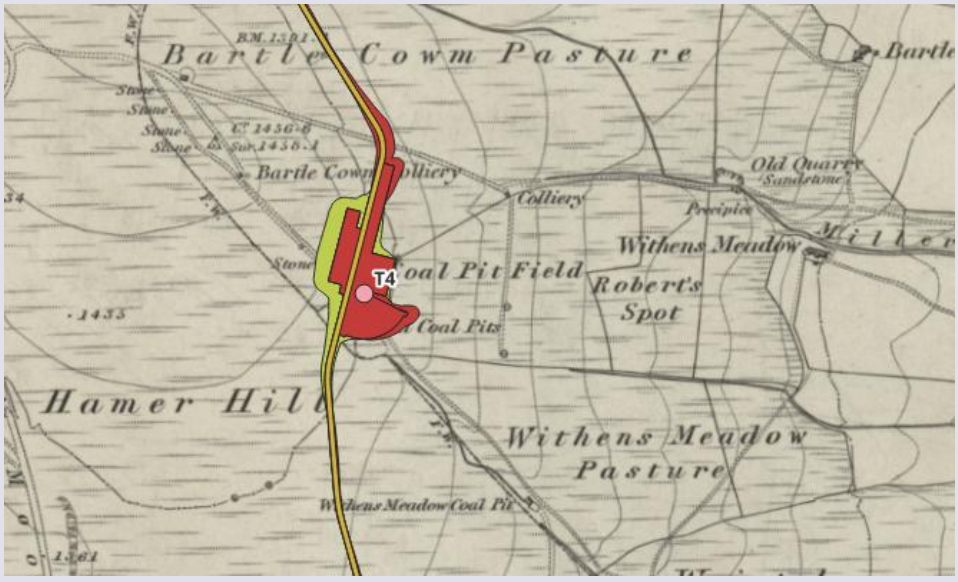
Table 1-1: Historical Land Use		
Date	**Key Developments**	**Source**
	Figure 1-5: 1851 map showing various sandstone quarries to the south of turbine T8 and west of T6. 'Old Sink Colliery', 'Old Coal Pit', 'Old Sink Colliery', 'Coal Pits' and 'Colliery' are all shown within a 300m radius south and southwest of turbine T9. Numerous 'Mounds' are also shown in this area as are a network of tracks.  **Figure 1-6: 1851 map showing various collieries and coal pits to the south of turbineT9.** 'Mounds' are shown approximately 200m west of turbine T4. 'Bartle Crown Colliery', 'Colliery', 'Coal Pit Field' and 'Old Coal Pits' are shown 200m northwest, 190m northeast, and 100m and 90m east respectively from turbine T4. 'Withens Meadow Coal Pit' is shown 260m southeast of T4 and an 'Old Quarry (Sandstone)' is shown approximately 430m east of the turbine.  **Figure 1-7: 1851 map showing various collieries and coal pits around turbine T4.** Sandstone Quarries are shown 130m southwest and 230 southeast of Turbine T3. The sites wider vicinity is generally shown to be undeveloped moorland/grassland with various tracks marked; associated with the industrial activity. A large number of stream heads/dendritic fluvial systems are shown across the wider area, indicating it to be wet or semi-wetland.	
1888-1915	Western Area (east of Hail Storm Hill)	1:2,500 Scale (1891-94)

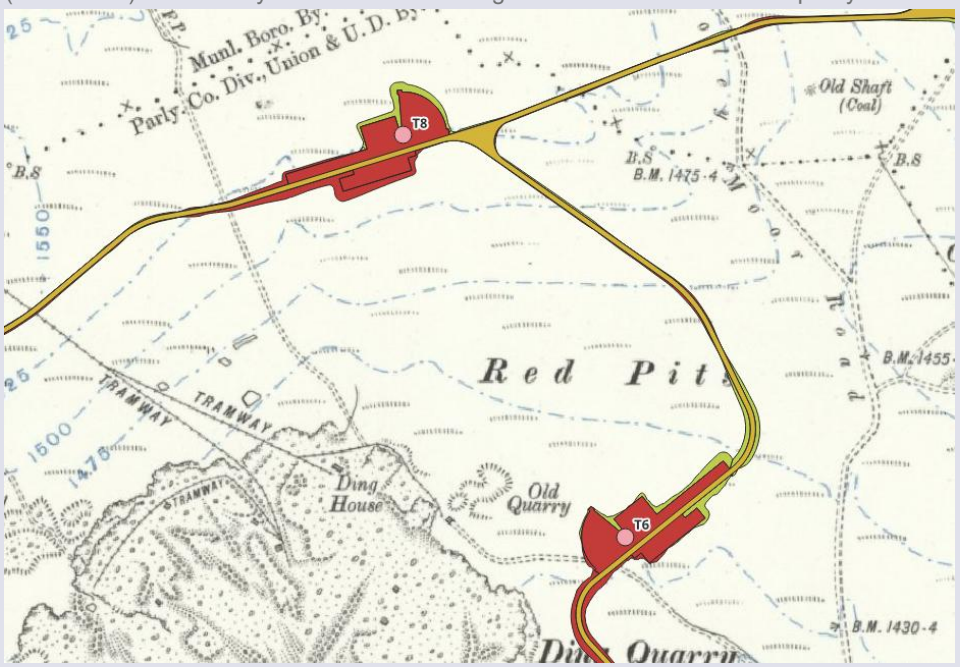
Table 1-1: Historical Land Use		
Date	**Key Developments**	**Source**
	Rochdale Road is now marked. Moving eastwards along the Option B access route, Scout Barn appears downsized, and lanes are generally present up to Scout Corner. North of Scout Corner, 'Scout Delf Sandstone Quarry (Flags) is now marked as 'Scout Moor Quarries and has increased its extents downslope and has a tramway marked. Moving eastwards along the access track alignment towards Twenty Acres, the mining features previously shown are generally no longer present although a tramway and a new 'Colliery' are shown, and a spoil pile is shown directly on the access track alignment. An 'Old Shaft' is shown at the east extent of this section at a location previously marked as 'Colliery'. Moving northwards along the track towards Whittle Hill, the quarry previously shown approximately 200m west of the site is no longer marked. A parallel drainage system is now shown discharging to the reservoir. The largely dendritic fluvial network shown to the north of the location of Great Lodge Reservoir around Turbine T14 is now shown as less complex/complicated. Foe Edge Sandstone Quarry is no longer marked although the quarried footprint is no shown to have extended beyond turbine T15 and the quarried area has merged with Cragg Quarry. <u>Eastern Area (east of Hail Storm Hill)</u> Expansion of sandstone quarrying has occurred between approximately 500m and 600m southeast to southwest of turbine T8; and the quarries have merged in to 'Ding Quarry (Sandstone)'. A tramway is now shown running north-westwards from the quarry.  **Figure 1-8: 1908 map showing expansion of Ding Quarry** Substantial quarrying associated with 'Cragg Quarry' is now shown from approximately 450m northwest of T18; the entire moorland plateau north of Cowpe Moss is now quarried. The network of lanes is less extensive although 'Rooley Moor Road' is now more clearly defined. The previous mine entries south and southwest of turbine T9 are no longer shown. Numerous 'Mounds' are also shown in this area as is a network of tracks. The mining and quarrying activity around turbine T4 is no longer shown although some earthwork features remain at entry locations. The quarries previously shown south of T3 are no longer marked. 'Bagdon Quarry (Disused)' is now shown approximately 330m east of turbine T3. The quarry is approximately 400m long and is shown to be connected by a tramway. An additional quarry is now shown approximately 240m southeast of turbine T1. 'Helm Clough Colliery' is shown approximately 250m north of turbine T10 with an adjacent northwest/southeast trending tramway.	1:10,560 Scale (1894-1895)

Table 1-1: Historical Land Use

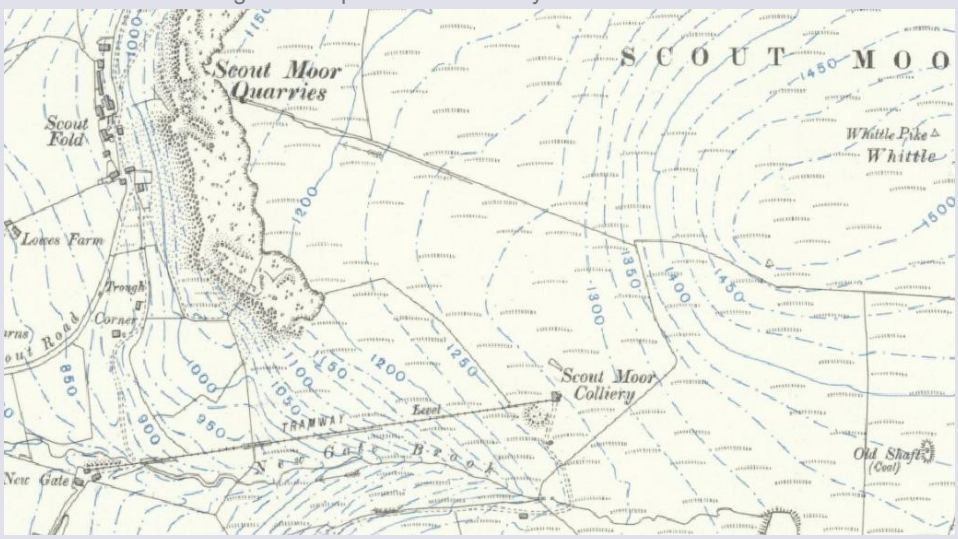
Date	Key Developments	Source
	'Hallcown Quarries' is also shown from approximately 350m east of T10. The sites wider vicinity is generally shown to be undeveloped moorland/grassland with various tracks marked and associated with the industrial activity. A large number of stream heads/dendritic fluvial systems are shown across the wider area indicative of wet or semi-wetland conditions.	
1910-1912	<u>Western Area (east of Hail Storm Hill)</u> The lane running off Rochdale Road is now marked as Scout Road. Scout Moor Quarries appear mostly unchanged. The 'Colliery' previously mentioned is now shown as 'Scout Moor Colliery' and a tramway is now marked running downslope from the colliery.  **Figure 1-9: 1911-1912 map showing a tramway now marked running downslope from a previously unmarked colliery now marked as 'Scout Moor Colliery'.** Great Lodge Reservoir is now marked as 'Great Lodge (Heywood & Middleton Water Board)' 'Scout Moor High Level Reservoir (Bury & District Joint Water Board) is now shown approximately 300m west of turbine T15. The sites surrounding area is generally not substantially changed. <u>Eastern Area (east of Hail Storm Hill)</u> Ding Quarry has undergone further expansion and is now shown 150m southwest of the T6 mast location.	1:2,500 Scale (1910-1911) 1:10,560 Scale (1911-1912)

Table 1-1: Historical Land Use

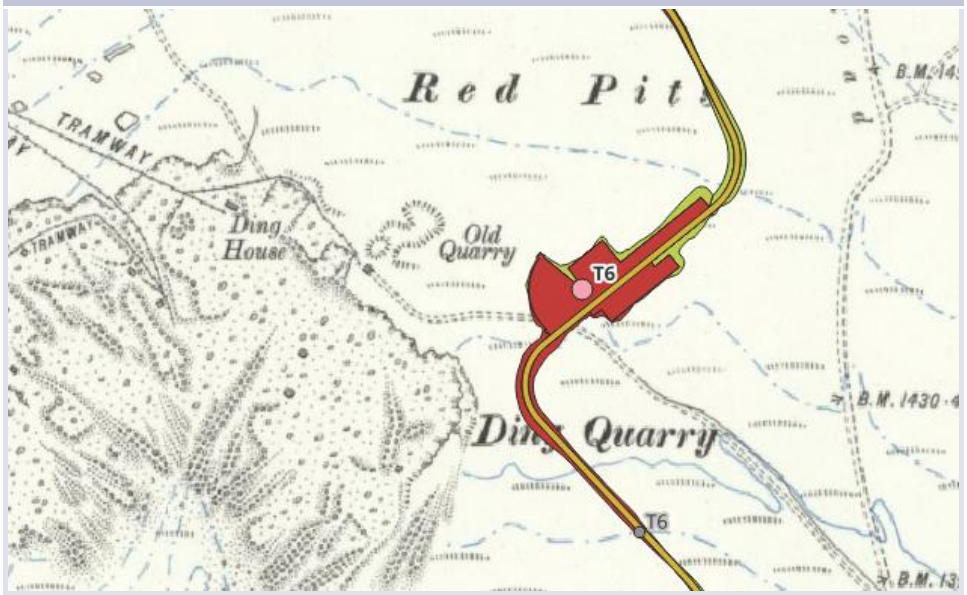
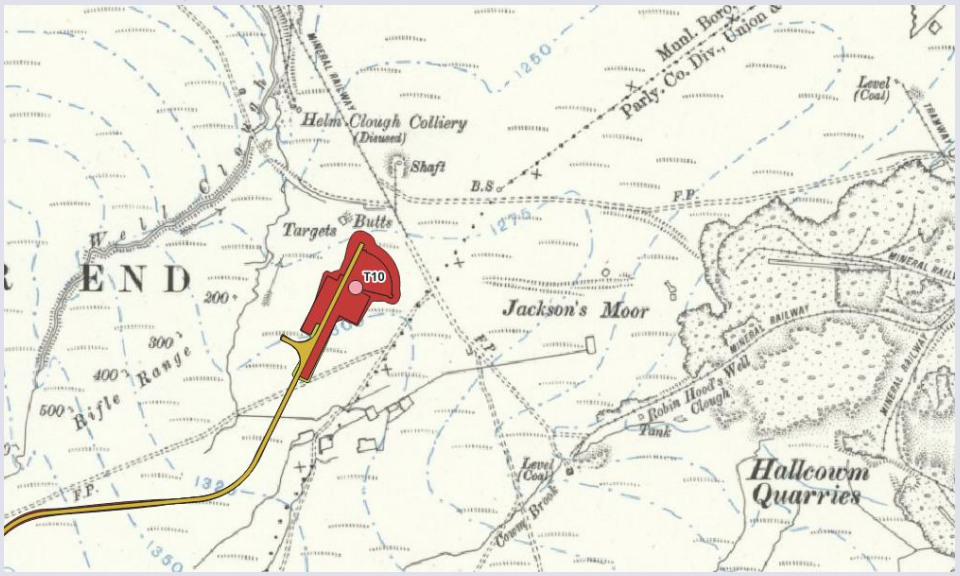
Date	Key Developments	Source
	 **Figure 1-10: 1911-1912 map showing further expansion of Ding Quarry towards the turbine T6 location.** The previous mine entries south and southwest of turbine T9 are no longer shown. Numerous 'Mounds' are also shown in this area as is a network of tracks. The mining and quarrying activity around turbine T4 is no longer shown although some earthwork features remain at entry locations respectively. The quarries previously shown south of Turbine T3 are no longer marked although the north-western quarry is still shown as an earthwork feature. An additional quarry is now shown approximately 230m southeast of turbine T1. Helm Clough Colliery is now shown as disused. A new 'Shaft' is now shown approximately 170m north of turbine T10 and a 'Rifle Range' is shown centrally between turbines T9 and T10.  **Figure 1-11: 1908 map showing Hallcowm Quarries now marked as disused, a new shaft, rifle range, and Helm Clough Colliery in proximity to turbine T10.** In the site's wider vicinity is generally shown to have remained undeveloped.	
1929-1931	<u>Western Area (east of Hail Storm Hill)</u> Scout Moor Colliery is now marked as disused. The reservoir shown south of the track off Turf Moor is shown as reduced in extent/partially infilled.	1:2,500 Scale (1929) 1:10,000 (1930-31)

Table 1-1: Historical Land Use		
Date	**Key Developments**	**Source**
	There is otherwise very little notable change to the Western Area. Eastern Area (east of Hail Storm Hill) 'Rubbing Mill Reservoir (Bacup Corp. W. W.) is now marked approximately 350m southwest of turbine T11. There is otherwise very little notable change to the Eastern Area.	
1938	Western Area (east of Hail Storm Hill) There is very little notable change to the Western Area. Eastern Area (east of Hail Storm Hill) There is very little notable change to the Eastern Area.	1:10,560 (1938)
1967-1969	Western Area (east of Hail Storm Hill) Great Lodge reservoir is now shown as reduced in extents/partially infilled/silted up. There is otherwise very little notable change to the Western Area. Eastern Area (east of Hail Storm Hill) 'Rubbing Mill Reservoir (Bacup Corp. W. W.) is now shown as largely infilled. There is otherwise very little notable change to the Eastern Area.	1:2,500 (1969) 1:10,000 Scale (1967-1968)
1993-1995	Western Area (east of Hail Storm Hill) There is very little notable change to the Western Area. Eastern Area (east of Hail Storm Hill) There is very little notable change to the Eastern Area.	1:2,500 Scale (1993-1995)

In summary there has been substantial mining development at the site with numerous collieries, shafts, tramways and evidence of earthworks associated with spoil placement and open cast mining shown in the site's vicinity. Importantly, the majority of mining activity appears to have occurred prior to the Mines Inspectorate in accordance with the Coal Mines Regulation Act and Metalliferous Mines Regulation Act 1872 and therefore is likely to be unrecorded.

There has also been substantial quarrying across the site; predominantly at lower levels but towards the tops of the hill sides at the edges of the moor top plateau.

1.7 Existing Information

The following Coal Mining reports have been ordered from to Mining Remediation Authority:

- Coal Authority (Mining Remediation Authority), Consultants Coal Mining Report, 01137 Assessment, reference: 71009810321002, 14th October 2024.

The report provides a summary of the following past underground mining activity within the scheme extents which is summarised in Table 1-2.

Table 1-2: Summary of Mining activity and geology								
Colliery	**Seam**	**Mining Remediation Authority Reference**	**Depth (m)**	**Direction to working**	**Dipping rate of seam worked (°)**	**Dipped direction of seam worked**	**Extraction thickness (cm)**	**Year last mined**
unnamed	Sand Rock	3W6L	0	Beneath Property	2	East	40	1883
unnamed	Lower Mountain	3W5Y	2	Beneath Property	11	South-West	70	1900

Table 1-2: Summary of Mining activity and geology

Colliery	Seam	Mining Remediation Authority Reference	Depth (m)	Direction to working	Dipping rate of seam worked (°)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
unnamed	Sand Rock	3VR9	4	Beneath Property	8	South	140	1900
unnamed	Sand Rock	3W6K	6	Beneath Property	2	East	40	1883
unnamed	Sand Rock	3W61	10	Beneath Property	0	East	50	1886
unnamed	Sand Rock	XXXX	12	Beneath Property	2	East	40	1883
unnamed	Lower Mountain	3W5X	13	Beneath Property	11	South-West	70	1900
unnamed	Sand Rock	3W68	14	Beneath Property	0	East	50	1850
unnamed	Sand Rock	3W62	21	Beneath Property	3	North	50	1850
unnamed	Sand Rock	3VQ7	22	Beneath Property	8	South	140	1900
unnamed	Lower Mountain	3W5U	27	Beneath Property	9.3	South-West	70	1890
unnamed	Lower Mountain	3W5V	28	Beneath Property	9.3	South	70	1890
unnamed	Sand Rock	3W60	30	Beneath Property	0	East	50	1886
unnamed	Sand Rock	3W6M	32	Beneath Property	2.5	South-West	50	1915
unnamed	Lower Mountain	3VPK	33	Beneath Property	7	South	50	1953
unnamed	Sand Rock	3W63	38	Beneath Property	5	South	40	1944
unnamed	Sand Rock	3VR8	39	Beneath Property	8	South	140	1900
unnamed	Lower Mountain	3VPJ	42	Beneath Property	7	South	50	1953
unnamed	Sand Rock	3W6D	49	Beneath Property	4	North	50	1940
unnamed	Sand Rock	3W64	79	Beneath Property	5	South	40	1944

Additionally, a search for abandonment plans has been undertaken by the Mining Remediation Authority and the following plans summarised in Table 1-3 have been provided:

Table 1-3: Summary of abandonment plans provided by the Mining Remediation Authority

Catalogue No.	Principle Seam Name	Entry Reference	Colliery	Date Abandoned	Comments
NW54	Lower Mountain	386415-004 386415-005 386415-006 386415-007	Hunger Hill	1953	Underground. Messrs Courten, Redman & Davenport

Table 1-3: Summary of abandonment plans provided by the Mining Remediation Authority

Catalogue No.	Principle Seam Name	Entry Reference	Colliery	Date Abandoned	Comments
		386415-008			
NW51 (1 of 2)	Lower Mountain	386417-001 386417-002	Rooley Moor	1952	Underground. Messrs Courten, Redman & Davenport
NW51 (2 of 2)	Lower Mountain		-	-	-
4212	Lower Mountain		Naden Head	1901	Underground. Messrs J Lomax and Co. Lim.
1625	Lower Mountain		Scout Moor	1884	Underground. Laurence Duckworth.
3522	Sand Rock	385420-004 385420-005 385420-006	Bunkers Hill	1896	Underground
NW166	Sand Rock		Scout Moor	1925	
16872	Sand Rock		Scout Moor/Duckworth	Undated	Undated, provides info about various old workings around Great Lodge Reservoir.
1591	Sand Rock		Hailstorm	1884	Underground. Messrs RS Butterworth & Brooks.
5454	Sand Rock	386415-001 386416-007 386416-008	Rooley Moor Doldrum	1909	Underground. Messrs J Lomax and Co. Ltd.
6559	Sand Rock	386420-002 387418-002 387418-003	Hall Fold	1915	Underground. 'Worked by M&M Watson from under the Withins Estate Whitworth belonging to The Hulton Trustees'.
13818 (2 of 2)	Sand Rock	386419-006 386419-007 386419-008	Hall Cowm Kruger	1944	Messrs Kenny Keys.
1843	Sand Rock		Brandwood Moor	1886	Underground. Mr David Law.
NW127	Sand Rock	386420-002 385420-003 385420-007 385420-008	Brandwood Moor	1864	Underground. R Munn Esquire. Plans show 'workings and the Coal gotten up to April 1850'.
NW1466	Sand Rock		Scout Moor (Opencast)	1991	Opencast.
OM6540	Sandstone		Brandwood Nos. 1 2	1916	Sandstone workings.

In addition, the Mining Remediation Authority also provided screen extracts showing plan location of each of the marked entries associated with the abandonment plans.

Further reference to the mining report is provided in Section 4 and Section 5.

The following coal mining risk assessments have already been undertaken for the site:

- Rooley Moor Wind Farm, Mining Risk Assessment Report, SKM, February 2012.
- Scout Moor Wind Farm Expansion – Mining Risk Assessment, Natural Power Consultants Ltd, February 2015.

Scout Moor Wind Farm Expansion – Mining Risk Assessment, Natural Power Consultants Ltd, February 2015.

The report provides are relatively comprehensive geological desk study assessment and site walkover. It provides summaries of the findings of two peat probe surveys and also summaries of the encountered ground conditions during grouting operations for the operational wind farm to the west of the scheme; apparently detailed in the following reports:

- Scout Moor Wind Farm Expansion Peat Survey Report (118_R_NPC_PEEL_4), February 2011
- A report on the Treatment of Shallow Abandoned Mine Workings, produced by Scott Wilson Ltd in 2008 has been reviewed (Report No.D110643/GEO/1232)

The most recent peat survey, conducted by Fluid Environmental Consulting in October 2024, will be used as the most up-to-date reference in place of the February 2011 report.

The Mining Risk Assessment report also gives a historical map review but doesn't include a review of abandonment plans.

The geological descriptions and sections are relatively detailed and are referenced as appropriate in this report

Rooley Moor Wind Farm, Mining Risk Assessment Report, SKM, February 2012.

The report covers central and southern areas of the present scheme extents although does not extentd westwards and the turbine and track arrangement is a substantially different twelve turbine arrangement with access apparently along Rooley Moor Road from the south. The report contains abandonment plans and considers the workings in reasonable detail with attempts at estimating depth of working near the (then proposed) turbine locations. There is also information about various unrecorded workings with attempts made to correlate likely seam targeted and possible depth and extents. Generally the report appears well considered and its findings are commonly cross referenced against the findings of this report.

2 Site Walkover

A walkover survey of the site was undertaken by PFC on the 21st March 2025 and findings of the walkover are summarised below. Where referenced, photographs are provided in Appendix E.

The walkover did not extend across the full site extents but focussed primarily on recorded entries not listed by the Mining Remediation Authority as treated within close proximity to either the access roads or turbine locations. However, a substantial portion of the scheme extents was walked over.

The proposed access route from Rochdale Road (along the existing access track) was not viewed northwest of Higher Hill and turbine locations T14 and T15 were not viewed towards the north-western scheme extents.

Turbines T10, T16 and T1 were also not viewed, and the remaining turbine locations were largely viewed from vantage points.

The scheme extents were accessed the south from Rooley Moor Road. Moving northwards from Top of Pike (hill), turbine locations T1 (photo 1) and T3 (photo 2) were not directly accessed although viewed from Rooley Moor Road and appeared to be on grassed moorland. Turbine location T3 was also approached and viewed form a vantage point (photo 3) approximately 270m northwest to a sink hole; considered to potentially to be an unrecorded mine entry or resultant of migratory collapse settlement (photo 4).

The locations for turbines T6 and T7 (on Clegg Ding/Rooley Moor) were viewed from Rooley Moor Road and appeared to be on grassed moorland with no obvious features noted when viewed from a substantial distance.

Moving northwards turbine T4 location was not directly accessed although again was viewed from a distance and was in proximity to a substantial spoil heap (photo 5).

Moving further northwards, mine entry 385419-006 was viewed to the east of Rooley Moor Road and appeared as a fenced off masonry lined circular shaft enclosed by stock fencing and partially infilled (photo 6).

Moving further northwards mine entry 385419-005 was viewed to the west of Rooley Moor Road (photo 7) and appeared as a gently sided swallow hole with no visible shaft.

Moving westwards towards the end of the existing turbine access track, turbine T8 and the proposed new access track were predominantly across grassed moorland. Where eroded within peat haggs/erosional channels, the depth of peat appeared by visual estimate to be a typical thickness of around 1.0m with light coloured sand (assumed to be residual Sandstone) typically visible within exposures through the peat.

Around Hail Storm Hill, towards the end of and to the north of the existing access track various earthwork features and semi ruined and broken-down sections of walling and other features apparently buried features and tracks were present (photo 7). The area appeared to be a former quarry and a linear feature was visible at the eastern extent running in a north-western/south-eastern orientation (photo 8).

Approximately 150m south of the quarried area intersected by the linear earthwork feature (former tramway) was another area of earthwork mounds with various relict remnants of broken down walling and various mounds and depressions (photos 9 and 10). At this location one feature approximately at the location of mine entries 384418-001 to 384419-003 was an approximately three foot wide buried channel/passage with masonry dry walling and a flag stone (apparently) cut and cover roof (photo 11). It appeared that this feature may be a remnant of the recorded adit at this location although this is unconfirmed. No other definitive signs of adits were noted in this area.

From this location there was a good vantage point of Ding Quarry and the turbine T6 location beyond (photo 12).

Moving further westwards the existing wind farm access track (the proposed route of the Scout Moor II access track) was walked to Higher Hill (photo 13) although turbine locations T14 and T15 were not directly accessed. The surrounding area appeared to generally be grassed moorland with regular peat hags and channelling and sporadic clusters of hydrophilic vegetation. The track had localised potholing but otherwise generally appeared in good condition. The pavement appeared constructed of a relatively coarse stone (up to 150mm) and top dressed with a finer stone which had worn/eroded washed off locally and exposed a 'Secugrid®' type geogrid.

At the location of marked adit 384419-010 was a sizeable spoil heap (photo 14) and immediately upslope of the spoil heap was a depression/boggy area from which a stream issued (photo 15). It is considered that the reduced level area of ground and the spring location is likely to be the adit location. Slightly upslope of this location was a raised linear feature with two animal (badger like) burrows and the arisings appeared to be typical of colliery spoil. Around 10m southeast of the issuing stream was a hole/void that appeared to be a collapse settlement feature (photo 16).

Approximately 40m southeast of the location of marked adit 384419-010, the location of marked shaft 384419-014 was also viewed with no obvious features noted.

Rooley Moor Road was then followed northwards and downslope slightly to marked adit 384419-007 where a substantial grassed over spoil heap was viewed (photo 17). From this point grassed over spoil heaps from Cragg Quarry could also be seen. Looking eastwards, the approximate location of turbine T11 could be seen (photo 18).

Returning southwards along Rooley Moor Road, marked shaft 385419-003 was viewed (photo 19) and the location of turbine T9 could be seen in the distance.

3 Review of the Geological Records

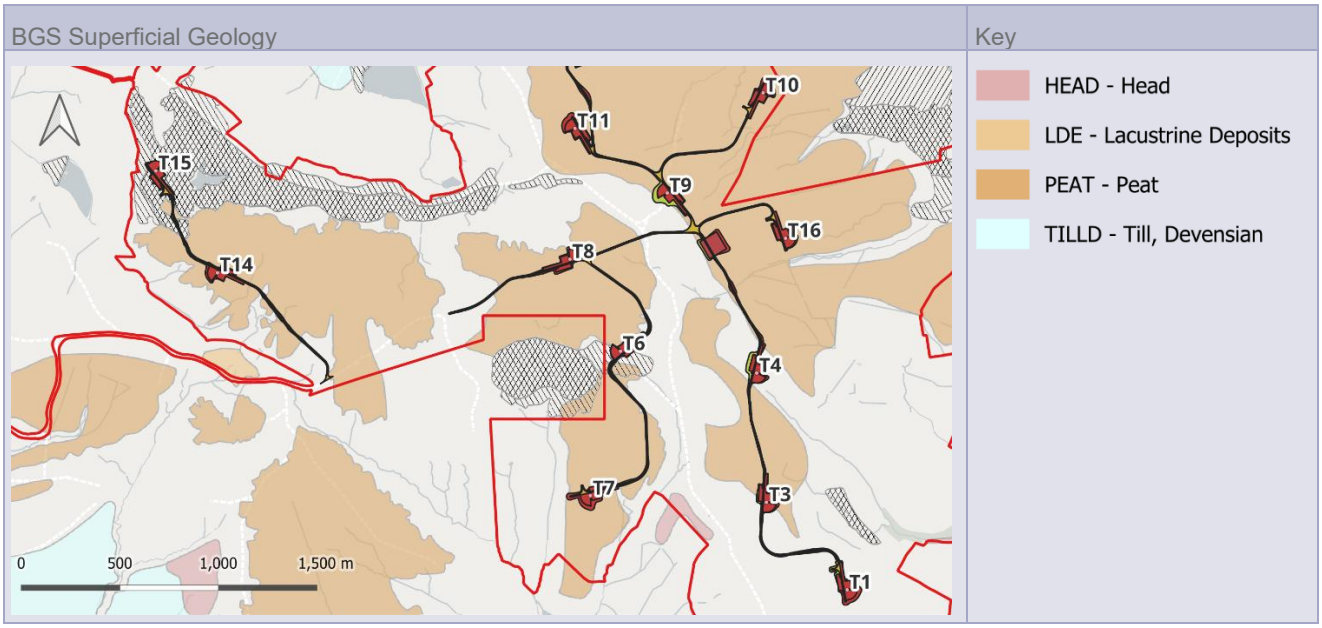
The British Geological Survey (BGS) online maps have been reviewed at 1:50,000 and 1:10,000 scale and a summary of published geology is provided below with additional reference to other existing information as relevant. The Natural Power mining risk assessment is referenced as applicable.

3.1 Superficial Geology

The British Geological Survey (BGS) online map of the area shows the site to be underlain by superficial deposits of Peat, Glacial Till and Glacial Head Deposits. Substantial areas of infilled and Made Ground are also shown.

An extract of the solid geology is provided in Figure 3-1.

Figure 3-1 Extract showing superficial Geology



3.1.1 Peat

In April 2024 and October 2024 Fluid Environmental Consulting conducted a Phase 1 and Phase 2 Peat Probing Survey on a 75m grid over the entire site extents and a 10m grid in the proposed infrastructure footprint. These surveys identified a maximum peat depth of 3.7m and an estimated peat depth of 40cm and 100cm over most of the site, with especially deep deposits in the northwestern extents of site over Cowpe Moor. From the site walkover, where eroded deposits were present, base of peat was typically around 1.0m depth.

It is understood that additional peat probing surveys have subsequently been undertaken, which are presented under separate cover and should be reviewed for further detail about the peat deposits.

3.1.2 Glacial Till

The BGS online 1:50,000 map indicates Glacial Till deposits to be sporadically present at lower level at the western, eastern and southern peripheries of the study extents but, aside from the laydown area at the far western extent of the scheme, are not shown in proximity to the scheme extents and on this basis is not considered further.

3.1.3 Head Deposits

Glacial Head deposits are locally shown in two areas within the study area but are not shown in proximity to the scheme extents and on this basis are not considered further.

3.1.1 Made Ground

Areas of Made Ground and Infilled Ground; predominantly coinciding with former quarry sites are shown across the study area. The access track leading to turbine T6 is shown to run across areas of infilled and Made Ground associated with Ding Quarry and the existing access road from Rochdale Road is shown to run across areas of Made Ground associated with (the still active) Scout Moor Quarry. The thickness of deposits is not known, although, based on visual observations and the extents of the spoil heaps on inspection will be substantial in some areas.

Substantial areas of Made Ground and Infilled Ground associated with Ding Quarry, Hallcowm Quarries, Thurns Head Quarry, Bagden Quarry and various other small quarries are also shown to the east of the scheme and are not considered further on the basis that the quarries are at lower level and not in proximity to the scheme alignment.

On inspection there are spoil heaps, old tracks, tramways, ruined building remains and various other industrial features scattered across the scheme extents and it is likely that localised areas of Made Ground will regularly be encountered.

3.1.1 Mass Movement Deposits

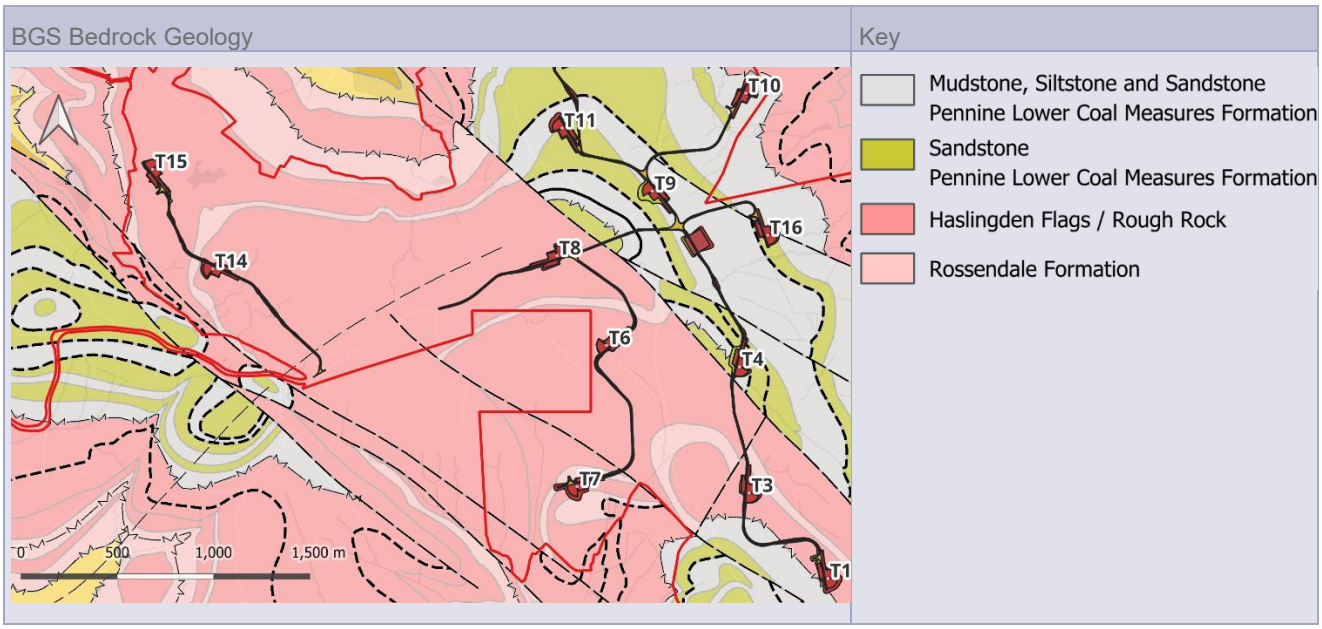
Mass Movement deposits are commonly shown within the study area on the valley sides/slopes to the plateau although are not shown in proximity to any turbine locations or associated infrastructure and on this basis are not considered further.

3.2 Solid Geology

The superficial deposits across the scheme (where present) area underlain by solid deposits of Millstone Grit and Pennine Lower Coal Measures deposits. The area is heavily faulted, and the Pennine Lower Coal Measures are present to the north-eastern extents of the scheme (below T9, T10, T11, and T16) but faulted out to the south-western extents of the scheme (below T1, T3, T6, T7, T8, T14 and T15) where Millstone Grit is present.

An extract of the solid geology is provided in Figure 3-2.

Figure 3-2 Extract showing bedrock Geology



3.2.1 Pennine Coal Measures

The BGS online lexicon describes the Pennine Lower Coal Measures as;

"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."

The relevant BGS 1:10,000 maps (SD81NE, SD81NW, SD82SE and SD82SW) have also been viewed. The map shows the Upper Foot Coal, the Lower Mountain Coal, the Lower Foot Coal and the Bassy Coal seams to all outcrop within the scheme extents. The Lower Mountain Coal is listed as 0.5-0.7m thick and is known to have been mined in this area. The Lower Foot Coal and the Bassey Coal are listed as 0.3m and 0.1m respectively and are not indicated to have commonly been mined in this area. However, at their outcrops, both seams correspond with 'areas of probably shallow mining' on the Mining Remediation Authorities online Interactive Map.

Generally, the Coal Measures within the scheme extents are towards the base of the Pennine Coal Measures Group, do not extend to depth and are underlain by rocks of the Millstone Grit Group at relatively shallow depth.

A summary of Coal seams present below the scheme is provided in Table 3-1 and an extract showing the generalised vertical section provided on BGS sheets SD81NE and DS81NW is provided in Figure 3-3.

Table 3-1: Summary of outcropping seams within the Lower Pennine Coal Measures Formation

CA code	CA Description (BGS Description)	Thickness range on BGS 1:10,000 Geological Map SD81NE (m)	Comments
-	Upper Mountain Coal	0.2	Appears eroded out within the scheme extents
-	Upper Foot Coal	0.1	No known recorded workings although may have been worked at outcrop/shallow depth
-	Lower Mountain Coal	0.5-0.7	Several recorded entries shown to have worked this seam
-	Lower Foot Coal	0.3	Potentially worked at the top of Walstead Clough as part of Old Sink Colliery. No known recorded workings although given

Table 3-1: Summary of outcropping seams within the Lower Pennine Coal Measures Formation			
CA code	**CA Description (BGS Description)**	**Thickness range on BGS 1:10,000 Geological Map SD81NE (m)**	**Comments**
			an assumed thickness of 0.3m is likely to have been worked at outcrop/shallow depth
-	Bassey Coal	0.1	No known recorded workings although may have been worked at outcrop/shallow depth

3.2.2 Millstone Grit

The Millstone Grit Group is present below the Lower Pennine Coal Measures and predominantly outcrops to the southwest of the scheme extents and at lower level across the wider study area. The main Millstone Grit units outcropping across the scheme extents are the Rough Rock (at the base of which is the Sand Rock Coal) and the Upper Haslingden Flags; which are both of the Rossendale Formation and separated by undifferentiated deposits of the Millstone Grit Group.

The Rough Rock (Sandstone) is described by the 1:10,000 BGS sheets SD81NW and SD81NE as:

> *'Sandstone, yellow-brown, coarse-grained, pebbly in part, poorly sorted, cross-bedded'*

The Upper Haslingden Flags is described by the 1:10,000 BGS sheets SD81NW and SD81NE as:

> *'Sandstone, greenish grey, very fine-grained, parallel-bedded, ripple laminated, interbedded with grey-green siltstone.'*

The Rough Rock Sandstone contains the Six-inch Coal which is recorded as 0.2m thick and the Sand Rock Coal (seam) which is recorded as ranging in thickness between 0.3m and 0.5m and so is workable. At the top of the unit the Six Inch Coal (seam).

No Coal Seams are shown within the Upper or Lower Haslingden Flags or any intergrouped undifferentiated deposits.

A summary of Coal seams present below the scheme is provided in Table 3-2 and an extract showing the generalised vertical section provided on BGS sheets SD81NE and DS81NW is provided in Figure 3-3.

Table 3-2: Summary of outcropping seams within the Millstone Grit Series			
CA code	**CA Description (BGS Description)**	**Thickness range on BGS 1:10,000 Geological Map SD81NE (m)**	**Comments**
-	Six Inch Coal	0.2	No records of this seam being worked.
-	Sand Rock Coal	0.3-0.7	Extensively worked in the area

The Rough Rock Sandstone and Upper Haslingden Flags are extensively quarried in the area; with quarrying predominantly concentrated at higher level on the hill sides. Flagstone mining is also known to have occurred and further information, provided by the Mining Remediation Authority, is provided in Section 4.1.

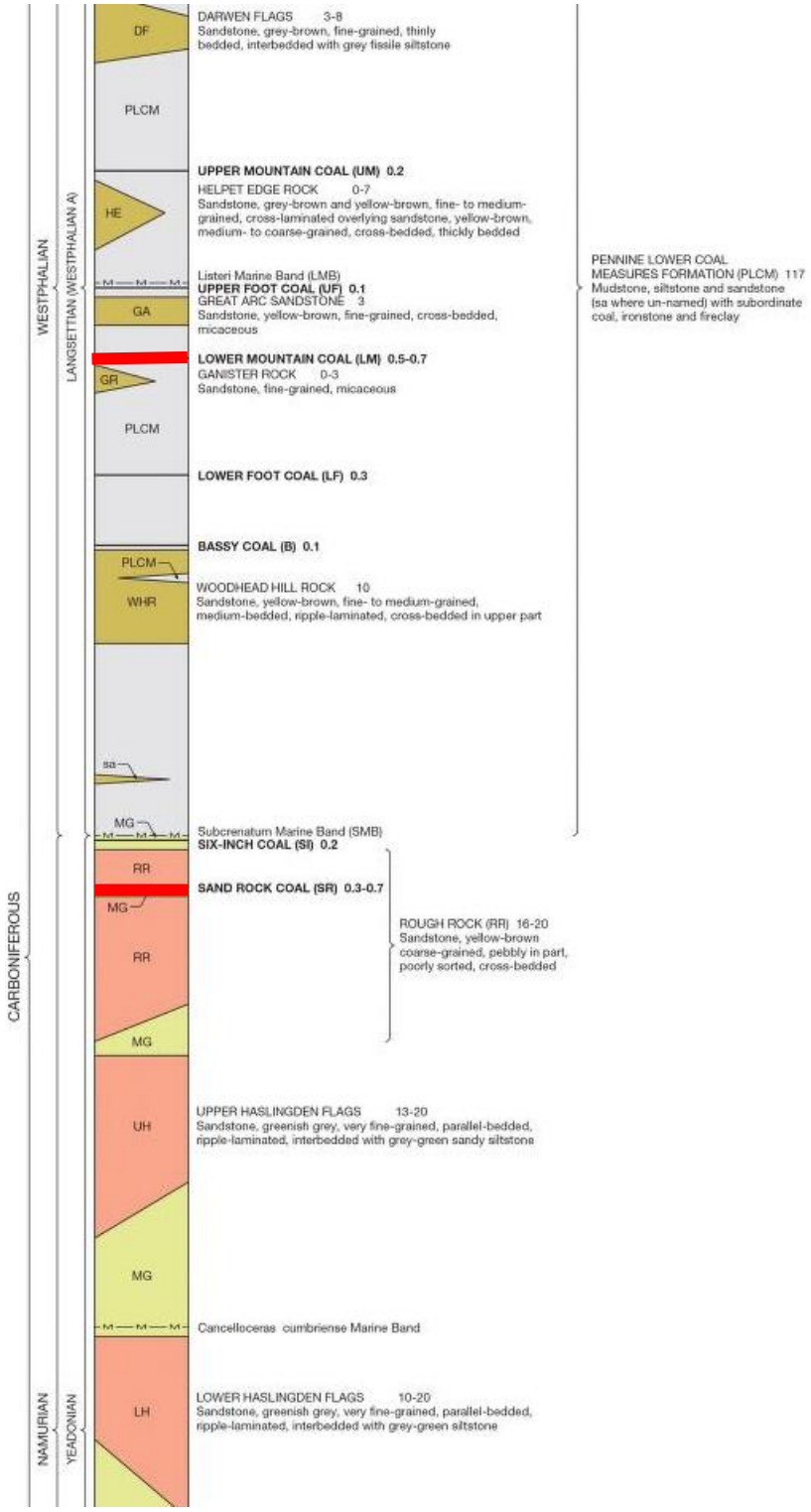


Figure 3-3: Generalised vertical section showing the worked seams in the site's vicinity (extract of sheet SD81NE). Red lines show the seams indicated by the Mining Remediation Authority report to have been worked at the site location.

3.2.1 Faulting / Linear features.

The area is heavily faulted with a tendency for faulting to strike northwest/south-eastwards and which controls the distribution of Coal Measures across the site. The key influence of faulting is that the Lower Pennine Coal Measures are faulted out on the moorland plateau across central portions of the scheme and the only workable seam at shallow depth is the Sand Rock Coal which is present within the Rough Rock at the top of the Millstone Grit series.

The present locations of T4 and T16 are also all shown to be either directly on or directly adjacent to faults as shown in Figure 3-4.

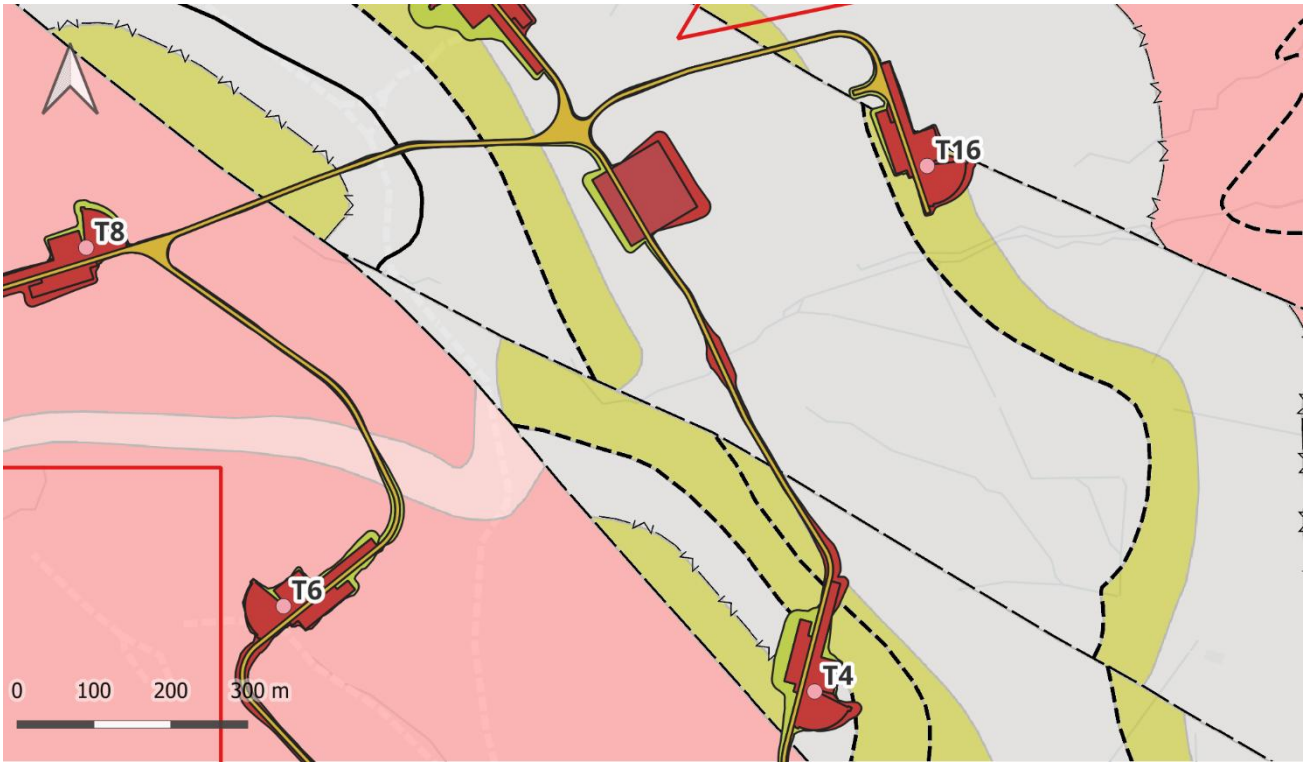


Figure 3-4: Inferred Fault locations at turbines T16 and T4.

Further information about specific risk of the shown faults at the turbine locations is provided in Section 5.

3.3 Mine Entries

The site is in a Coal Mining area and the general area has been heavily mined. Further information is provided in Section 4.

3.4 Ground Model

No borehole information for the site is available and therefore a detailed ground model cannot be produced at this stage. An indicative geological section was presented as Figure 4.1 in the 2015 'Rooley Moor Wind Farm – Mining Risk Assessment Report' (SKM Enviros); an extract of which is shown in **Error! Reference source not found.**.

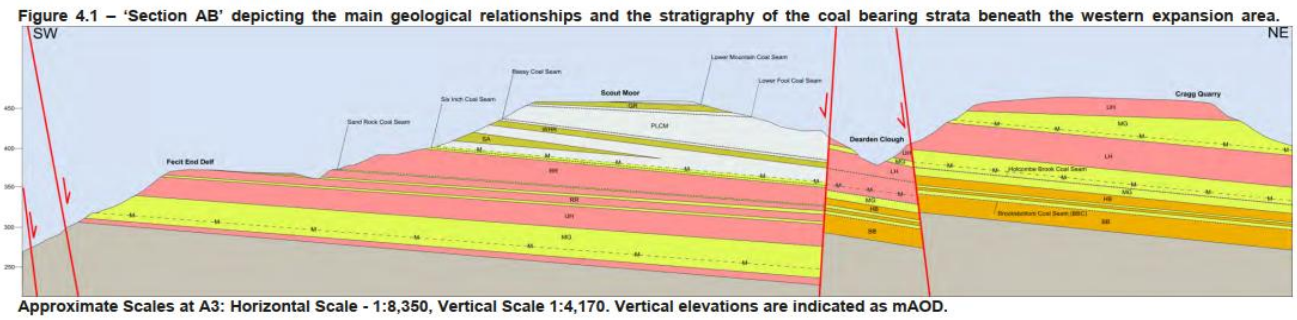


Figure 3-5 Extract of Figure 4.1 in the 2015 SKM Enviros Mining Risk Assessment showing an indicative ground model section

In summary, peat is varably present on the hill top plateau in thicknesses of up to 3m although typically 1.0-1.5m. Underlying the peat, solid deposits of Lower Pennine Coal Measures and Millstone Grit are variably anticipated at all turbine and track locations.

Further detail about likely presence of coal seams and workings is provided in Section 4.

4 Site Specific Mining Hazards

The Mining Remediation Authority report provides a summary of the following past underground mining activity within the scheme extents which is summarised in Table 4-1.

Table 4-1: Summary of Mining activity and geology

Colliery	Seam	Mining Remediation Authority Reference	Depth (m)	Direction to working	Dipping rate of seam worked (°)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
unnamed	Sand Rock	3W6L	0	Beneath Property	2	East	40	1883
unnamed	Lower Mountain	3W5Y	2	Beneath Property	11	South-West	70	1900
unnamed	Sand Rock	3VR9	4	Beneath Property	8	South	140	1900
unnamed	Sand Rock	3W6K	6	Beneath Property	2	East	40	1883
unnamed	Sand Rock	3W61	10	Beneath Property	0	East	50	1886
unnamed	Sand Rock	XXXX	12	Beneath Property	2	East	40	1883
unnamed	Lower Mountain	3W5X	13	Beneath Property	11	South-West	70	1900
unnamed	Sand Rock	3W68	14	Beneath Property	0	East	50	1850
unnamed	Sand Rock	3W62	21	Beneath Property	3	North	50	1850
unnamed	Sand Rock	3VQ7	22	Beneath Property	8	South	140	1900
unnamed	Lower Mountain	3W5U	27	Beneath Property	9.3	South-West	70	1890
unnamed	Lower Mountain	3W5V	28	Beneath Property	9.3	South	70	1890
unnamed	Sand Rock	3W60	30	Beneath Property	0	East	50	1886
unnamed	Sand Rock	3W6M	32	Beneath Property	2.5	South-West	50	1915
unnamed	Lower Mountain	3VPK	33	Beneath Property	7	South	50	1953
unnamed	Sand Rock	3W63	38	Beneath Property	5	South	40	1944
unnamed	Sand Rock	3VR8	39	Beneath Property	8	South	140	1900
unnamed	Lower Mountain	3VPJ	42	Beneath Property	7	South	50	1953
unnamed	Sand Rock	3W6D	49	Beneath Property	4	North	50	1940
unnamed	Sand Rock	3W64	79	Beneath Property	5	South	40	1944

Additionally, a search for abandonment plans has been undertaken by the Mining Remediation Authority and the following plans summarised in Table 4-2 have been provided:

Table 4-2: Summary of abandonment plans provided by the Mining Remediation Authority

Catalogue No.	Principle Seam Name	Entry Reference	Colliery	Date Abandoned	Comments
NW54	Lower Mountain	386415-004 386415-005 386415-006 386415-007 386415-008	Hunger Hill	1953	Underground. Messrs Courten, Redman & Davenport
NW51 (1 of 2)	Lower Mountain	386417-001 386417-002	Rooley Moor	1952	Underground. Messrs Courten, Redman & Davenport
NW51 (2 of 2)	Lower Mountain		-	-	-
4212	Lower Mountain		Naden Head	1901	Underground. Messrs J Lomax and Co. Lim.
1625	Lower Mountain		Scout Moor	1884	Underground. Laurence Duckworth.
3522	Sand Rock	385420-004 385420-005 385420-006	Bunkers Hill	1896	Underground
NW166	Sand Rock		Scout Moor	1925	
16872	Sand Rock		Scout Moor/Duckworth	Undated	Undated, provides info about various old workings around Great Lodge Reservoir.
1591	Sand Rock		Hailstorm	1884	Underground. Messrs RS Butterworth & Brooks.
5454	Sand Rock	386415-001 386416-007 386416-008	Rooley Moor Doldrum	1909	Underground. Messrs J Lomax and Co. Ltd.
6559	Sand Rock	386420-002 387418-002 387418-003	Hall Fold	1915	Underground. 'Worked by M&M Watson from under the Withins Estate Whitworth belonging to The Hulton Trustees'.
13818 (2 of 2)	Sand Rock	386419-006 386419-007 386419-008	Hall Cowm Kruger	1944	Messrs Kenny Keys.
1843	Sand Rock		Brandwood Moor	1886	Underground. Mr David Law.
NW127	Sand Rock	386420-002 385420-003 385420-007 385420-008	Brandwood Moor	1864	Underground. R Munn Esquire. Plans show 'workings and the Coal gotten up to April 1850'.
NW1466	Sand Rock		Scout Moor (Opencast)	1991	Opencast.
OM6540	Sandstone		Brandwood Nos. 1 2	1916	Sandstone workings.

4.1 Summary of known activities

A summary of activities and locations associated with the provided abandonment plans is provided below and the indicative locations of these workings is presented in Appendix A as Figure 1. Individual abandonment plans are provided in Appendix D.

4.1.1 Hunger Hill Colliery (NW54)

Mined the Lower Mountain Coal Seam. Plan NW54 shows the mine to be approximately 30m southwest of the unnamed reservoir on Hunger Hill. Based on Mining Remediation Authority records the colliery was worked by Messrs Courten, Redman & Davenport and was abandoned in 1953.

The plan indicates old workings were encountered which are considered likely to relate to Rooley Moor Doldrum Colliery (see Section 4.1.8).

The workings appear to be approximately 1500m south of turbine T1; the closest part of the scheme extents and on this basis the mine is not considered likely to impact the scheme and so it has not been attempted to further locate/position the workings.

4.1.2 Rooley Moor Colliery (NW51)

Mined the Lower Mountain Coal Seam. Plan NW51 shows the mine to be approximately 50m northeast of the excavation face of the former Cat Stones Quarry and approximately 200m east of Rooley Moor Road. There are two mine entries at this location and based on satellite imagery the workings appear to be within a linear depression/cleft which appears to be open cast workings. Based on Mining Remediation Authority records the colliery was worked by Messrs Courten, Redman & Davenport and was abandoned in 1952.

The plan shows the Lower Mountain Coal to be 20 inches thick and be overlain by 6 inches of ‘Coal and Dirt’. The plan also shows the ‘Edge of old opencast working (assumed to be the cleft visible from satellite imagery) and ‘Old Works’ a short distance into the shown extent of workings. A ‘Line of Dip of 1 in 5’ is shown in a south south-easterly direction.

The working extents appear localised and to terminate approximately 350m south of turbine T1 (the closest point of the scheme) On this basis it is not considered that these workings will impact the scheme and so it has not been attempted to further locate/position the workings.

4.1.3 Naden Head Colliery (4212)

Mined the Lower Mountain Coal Seam. Plan 4212 shows the mine to be approximately 300m east of Naden Middle Reservoir and approximately 400m west of Rooley Moor Road. Based on Mining Remediation Authority records the colliery was worked by Underground. Messrs J Lomax and Co. Lim. and was abandoned in 1901. Old workings are shown along eastern extents. The exact extents of the working are unclear from the plan although given the apparent limited extent of the workings and the distance away from turbines T1 and T3 (the closest point of the scheme) it is not considered that these workings will impact the scheme.

On inspection the shown extent of the workings will not impact the turbines or access tracks and so it has not been attempted to further locate/position the workings.

4.1.4 Bunkers Hill Colliery (3522)

Mined the Sand Rock Seam. Plan 3522 provides detail of three small sets of ‘Day Eyes’ on Greens Moor approximately 700m northwest of turbine T10. Based on Mining Remediation Authority records the colliery was abandoned in 1896. The plan shows the bulk the area to be ‘Old Workings’ which are considered likely to relate to Brandwood Colliery (Section 4.1.3). The plan states ‘Coal Partly Worked Old Works No record or the workings’ at the both locations. The workings appear to be present from approximately 550m to the northwest of turbine T10 at their closest point and on this basis are not considered likely to impact the scheme.

4.1.5 Scout Moor Colliery (NW166/1625)

Mining of the Sand Rock Seam (NW166)

Plan NW166 provides detail about the extents of Scout Moor Colliery issued to the Divisional Estates office by Mr Whittaker in 1941 and is stamped as received by the National Coal Board on 1956. A detailed plan and section key plan are contained on the sheet. The key plan has been aligned with Rochdale Road and various other topographical features and appears to run directly below the existing access track to the east of Scout Moor Quarry. The method of working is unclear although the main entrance appears to be an adit to the west of the workings connected with a tramway running westwards to Rochdale Road and the adit entrance appears to relate to one of two marked adits at the eastern extent of Scout Moor Quarry. Levels aren't provided although a shaft depth of 37yds is marked at the end of the adit. A northerly dip of 10 degrees is indicated to the southern extent of the workings although substantial faulting and highly variable dips are locally shown along northern sections.

Numerous 'Old Works' are marked at various locations on the plan.

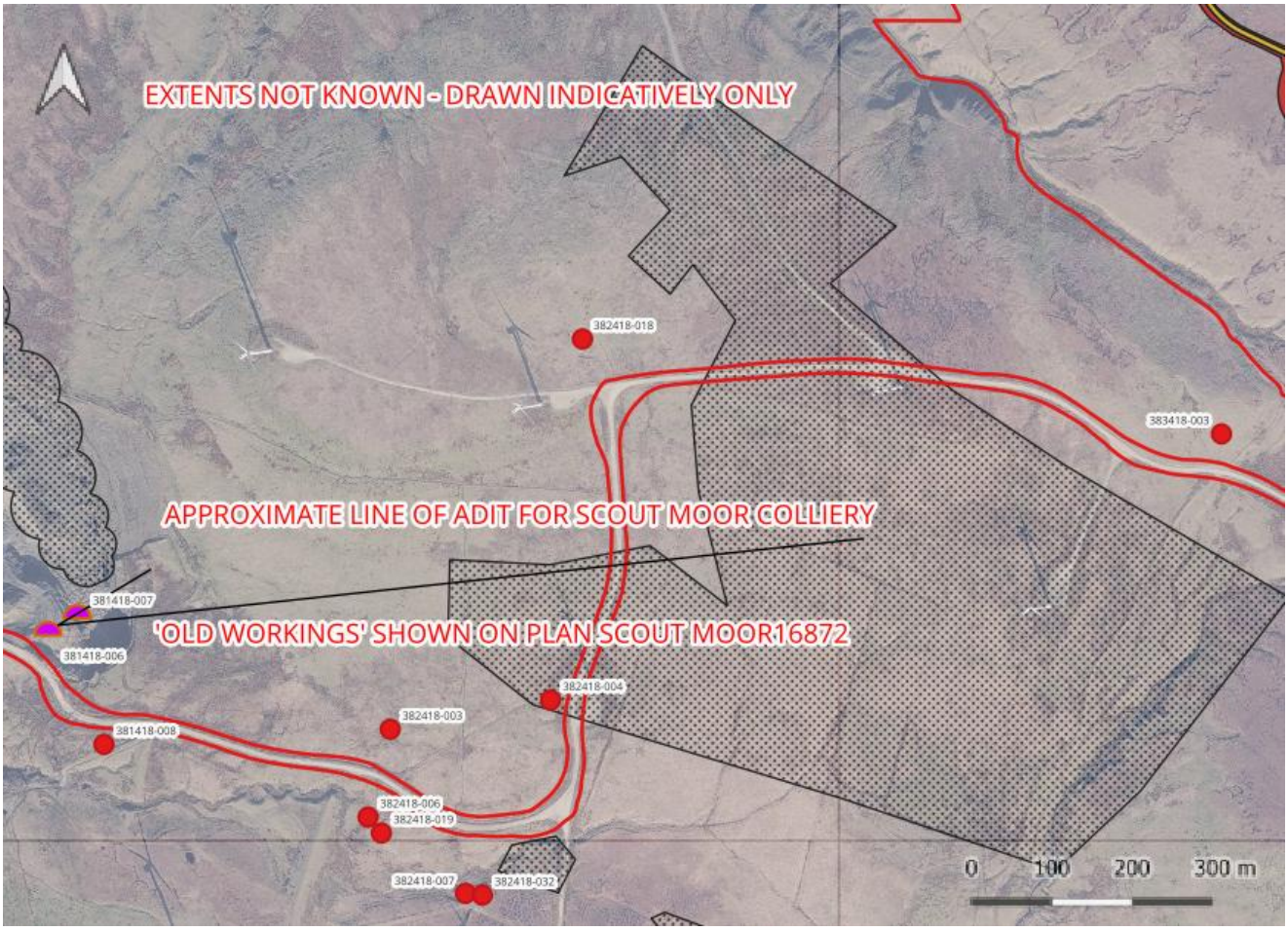


Figure 4-1: Old workings, scout moor and Duckworth colliery workings shown along the existing access track shown on provided Scout Moor Colliery Plans.

Mining of the Lower Mountain Seam (1625)

Plan 1625 provides detail about the extents of Mountain Mine, Scout Moor Colliery and date of abandonment is indicated to be 1884. The exact extent/location of the mine isn't clear although appeared to be at higher level to the east of Scout Moor Quarry, run below Whittle Pike (based on cross section annotations and the marked location of Whittle Pike on the plan) and outcrop/daylight either side of Whittle Hill. The published 1:10,000 geological plan SD81NW shows the outcropping extent of the Lower Mountain Coal and it is considered that the extents of the Mountain Mine can be demarcated by the outcropping extents of the Lower Mountain Coal

below Whittle Hill; beyond which the seam is presumably eroded out. This assumption appears reasonable as on the plan 'Outcrop' / 'Crop' is marked around the full periphery of the workings and indicates that the access track is not impacted by these workings. Eastern sections of these workings are shown on the Mining Remediation Authority online Interactive Map to be 'past shallow mine workings'.

The plan states the Sand Rock Mine is 'about 100 yards below the Mountain Mine'; indicating it to be beyond the likely depth of influence at this location.

No old workings are indicated on the plan.

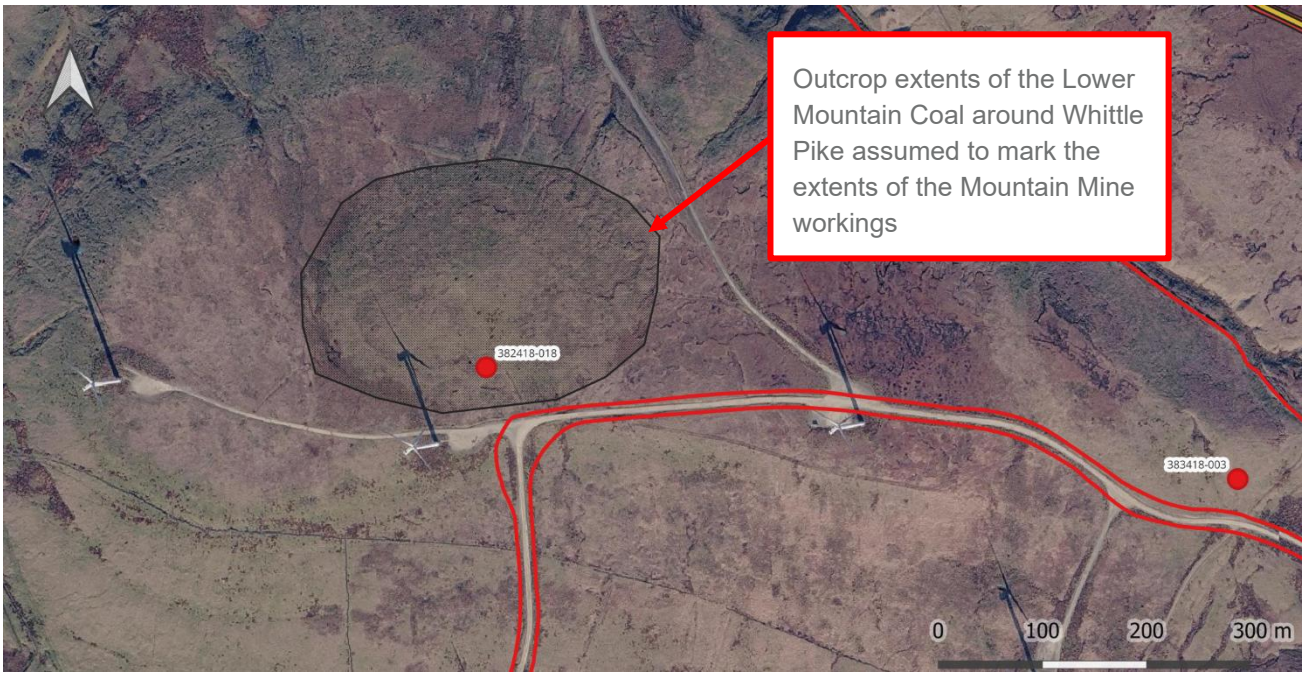


Figure 4-2: Estimated location of the (Scout Moor Colliey) Mountain Mine.

4.1.6 Scout Moor/Duckworth Colliery (16872)

Plan 16872 appears to be a land ownership drawing and details the extents of various land parcels between Rochdale Road, Scout Road and Scout Moor. The plan also provides detailed plan extents of a substantial number of 'Old Workings' to the east and south of Scout Moor quarry. One section of old workings has a recorded shaft depth of 37yds and runs directly below the existing access track as shown in Figure 4-1. The workings which extent beneath the existing access track appear to be Scout Moor Colliery shown in detail in NW166.

4.1.7 Hailstorm Colliery (1591)

The Hailstorm Colliery mined the Sand Rock Seam. Plan 1591 indicates the worked extents by Messrs Butterworth & Brooks up to 1884. Three mine entries are connected with the abandonment plan (386415-001, 386416-007 and 386416-008). No levels are provided and therefore the depth of the workings isn't known. However, the plan shows Latitude and Longitude values of a boundary stone which allows the working extents to be approximately located (as was done in the SKM Enviros MRA). Based on the coordinates the working extents appear from approximately 200m west of turbines T8 and be directly spanned by the proposed access track. These workings are shown on the Mining Remediation Authority online Interactive Map to be 'past shallow mine workings' and based on aspect/outcrop pattern the Sand Rock Seam would be anticipated to be at shallow depth at the location of the workings.

It is understood that Hailstorm Colliery was associated with/run for the benefit of Ding Quarry.

Given the proximity of the existing turbine and turn circle it is advised that ground investigation information and grouting records for the existing wind farm be obtained as this area is likely to have been previously

investigated. The adjacent area is likely to have been treated although, based on the location of the turbine and turn circle, it is considered more likely that the turbine was micro sited to avoid the workings.

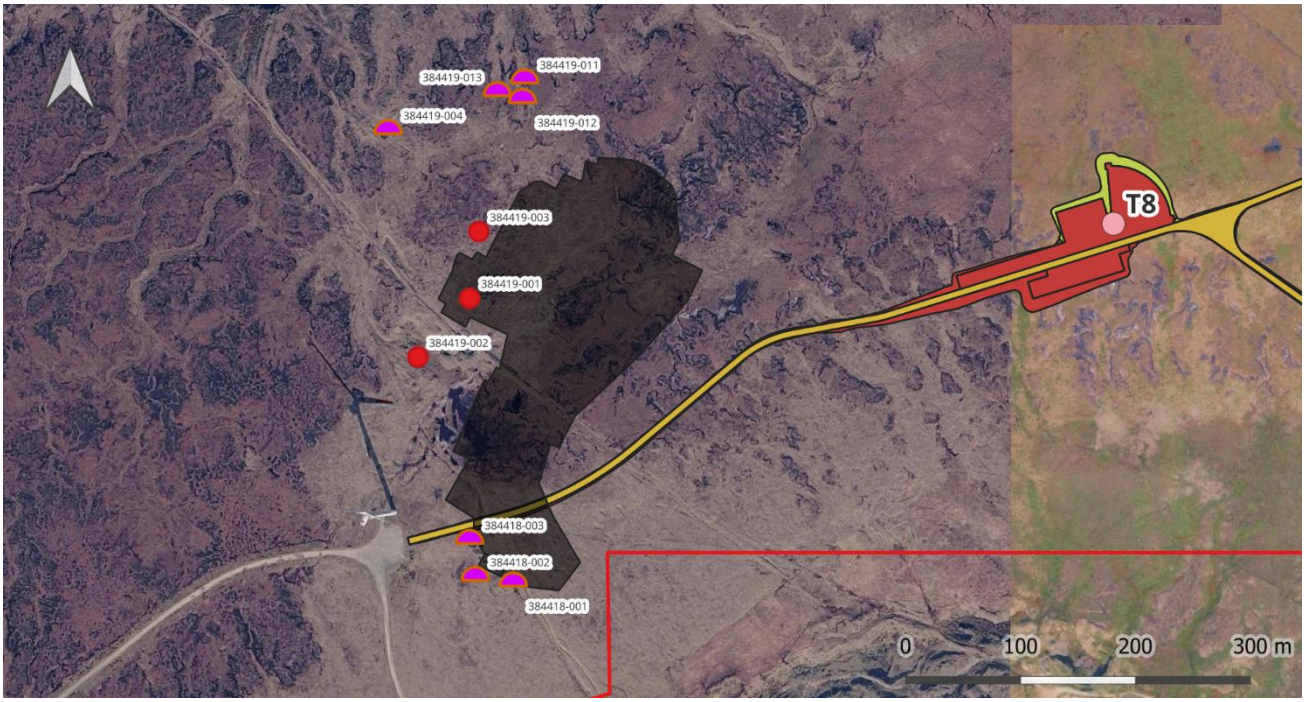


Figure 4-3: Estimated location of the Hailstorm Colliery Workings



Figure 4-4: Orientation of the adits/marked entries associated with the Hailstorm Colliery Workings

4.1.8 Rooley Moor Doldrum (5454)

Mined the Sand Rock Seam. Plan 5454 indicates the worked extents by Messrs John Lomax and Co. Ltd. The plan is undated although the Mining Remediation Authority summary indicates a date of abandonment of 1915. Three mine entries relate to the abandonment plan (386415-001, 386416-007 and 386416-008). No levels are provided and therefore the depth of the workings isn't known. However, the plan shows a small reservoir and various field boundaries in proximity to the recorded entries which shows good correlation with satellite imagery and indicate the northern extent of the recorded workings to be approximately 1km from turbine T1 location (i.e.

the southern extent of the scheme). On this basis it is not considered that Rooley Moor Doldrum Colliery will impact the scheme.

'Old Workings' are only locally shown to the south-eastern extent of the shown extents adjacent to an area which shows a pillar and stall arrangement and states 'Sand Rock Mine worked from Bank House Colliery'.

4.1.1 Hall Fold Colliery (6559)

Mined the Sand Rock Seam. Plan 6559 indicates the worked extents by M & M Watson up to 1916 and shows a pillar and stall arrangement. Three mine entries relate to the abandonment plan (386420-002, 387418-002 and 387418-003). No levels are provided and therefore the depth of the workings isn't known. However, 'Hillfields Farm Building' (marked as Withen's on early 1900 historical maps) is shown along with three 'Day Eyes'. Ruins of the farm building can be seen on satellite imagery and when overlaid with registered mine entries, the footprint of the ruined building and mine entries 386420-002, 387418-002 and 387418-003 show good correlation and indicate the western extents of the workings to be approximately 800m from turbines T3 and T4 locations and the adjoining access track at its closest point. On this basis it is not considered that Hall Fold Colliery will impact the scheme.

A localised series of tunnels at the eastern extent of the scheme are marked as 'Old Works'.

4.1.2 Hall Cowm Kruger Colliery (13818)

Mined the Sand Rock Seam. Abandonment plan 13818 (1 of 2) indicates the worked extents by Henry Heys and Henry Heys and Co. Ltd. up to 1944 when the mine was abandoned due to being uneconomical. A location plan is provided which shows various water courses and tracks/paths around Old Laurence Top and shows Walstead Clough. Because of this the working extents can more easily be estimated and indicates a proximity of around 25-50m eastwards from turbines T10 and T16 and directly over the proposed access track for T16. The elevation at the western extent of the works is approximately 1260ft (384m AOD) indicating a potential depth in the region of 30-40m in the vicinity of the turbine locations.

Numerous generally northwest/southeast striking faults are shown on the plan and the workings appear to have been terminated to the east at downthrown fault faces. The faulting appears to be of limited extent and it is considered likely that it's secondary faulting relating to the major northwest/southeast striking fault shown on the published geology to run through the turbine T16 location.

This area is therefore considered to be relatively high risk because of the proximity of the workings at depth but also the presence of what appears as an abutting and relatively extensive fault system which is likely to have resulted in brecciation and may increase risk of settlement / retrogression of collapse settlement from the workings through the fault system or piping/channelling due to water ingress down through the fault system into the workings.

To the western extent of the mine, a section of 'Old Workings' is marked in grey and mapped.

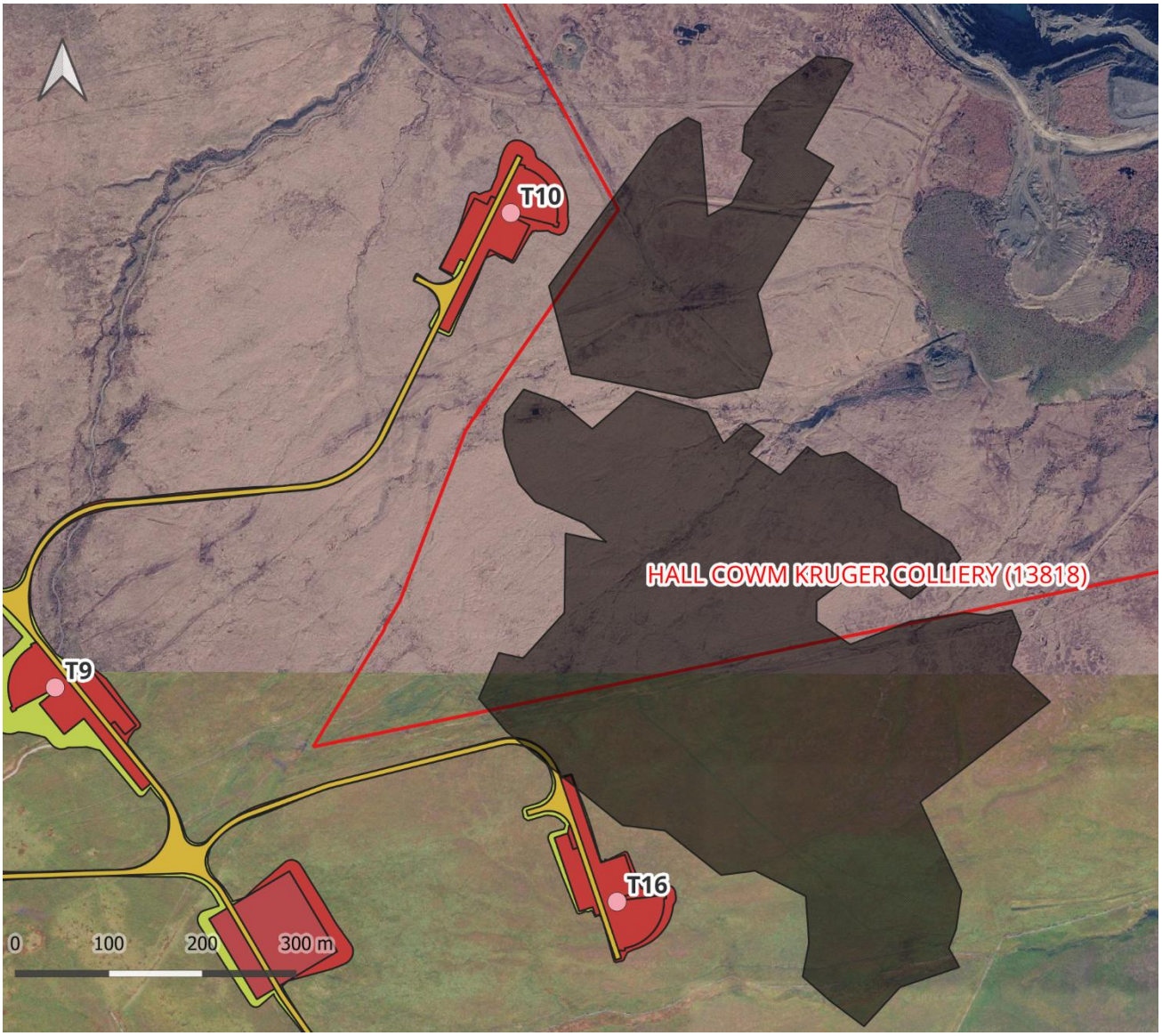


Figure 4-5: Estimated location of the Hall Cowm Kruger Colliery Workings

4.1.3 Brandwood Moor Colliery

Mined the Sand Rock Seam. Mining plan NW127 indicates the worked extents up to 1850. Four mine entries are connected with the abandonment plan (386420-002, 385420-003, 385420-007 and 385420-008) and the colliery is marked on the 1894-1895 historical maps. An entrance, several 'Day Eyes' and a section of Well Clough with an adjoining tributary are marked on the plan in proximity to the 'Day Eyes'. Based on this it is considered likely that that 386420-002, 385420-007 and 385420-008 (which appear to be located next to an adjoining tributary to Well Clough) are likely to be the 'Day Eyes' shown on the plan which would indicate that the workings likely stopped approximately 100m short of turbine T10. However, this assumption should be treated with caution and the shown location should be treated as indicative. The depth of workings is not apparent from the plan but there is there is a gain of elevation of the hill side southwards of at least 75m across the working extents indicating the workings will deepen rapidly into the hillside towards the proposed infrastructure. The RKM Enviros mining report notes the Sand Rock Seam to have a general southerly dip of 2 degrees and that based on the length the workings a depth of approximately 130m would be anticipated at an elevation of 445m AOD at the southern extent the workings; which appears broadly correct.

North-eastern (downslope) sections of these workings are shown on the Mining Remediation Authority online Interactive Map to be 'past shallow mine workings'.

Subsequent abandonment plan 1843 shows workings from the same colliery dated 1886. Rooley Moor Road is marked on the plan and based on alignment with Rooley Moor Road and shown entries on the plan against marked entries these workings appear to be centred approximately 700m east of Cowpe Reservoir. Turbine T11 is shown to be approximately 80m south of the workings and a section of access track and substation location is indicated to be directly above the workings. Generally 'Day Eyes' are shown at northern and western extents of the workings (away from the turbine infrastructure) and the 'Intake' is shown to the northwest of the working extents. The depth of workings is not apparent from the plan but a southerly dip of 1 in 24 is marked on the plan and there is a gain of elevation of the hill side southwards of a least 50m across the working extents indicating the workings will deepen rapidly into the hillside towards the proposed infrastructure.

The RKM Enviros mining report notes the Sand Rock Seam to outcrop at elevations of approximately 360-390m AOD and, based on a general southerly dip of 2-3 degrees and a maximum surface elevation of 470m AOD suggests a potential depth of greater than 100m at the southern extent the workings.

The shown location of these workings is indicative and should be treated with caution. Northern (downslope) sections of these workings are shown on the Mining Remediation Authority online Interactive Map to be 'past shallow mine workings'.

The earlier history of Brandwood Moor Colliery is unknown and it is not known if the two provided plans show all operations.

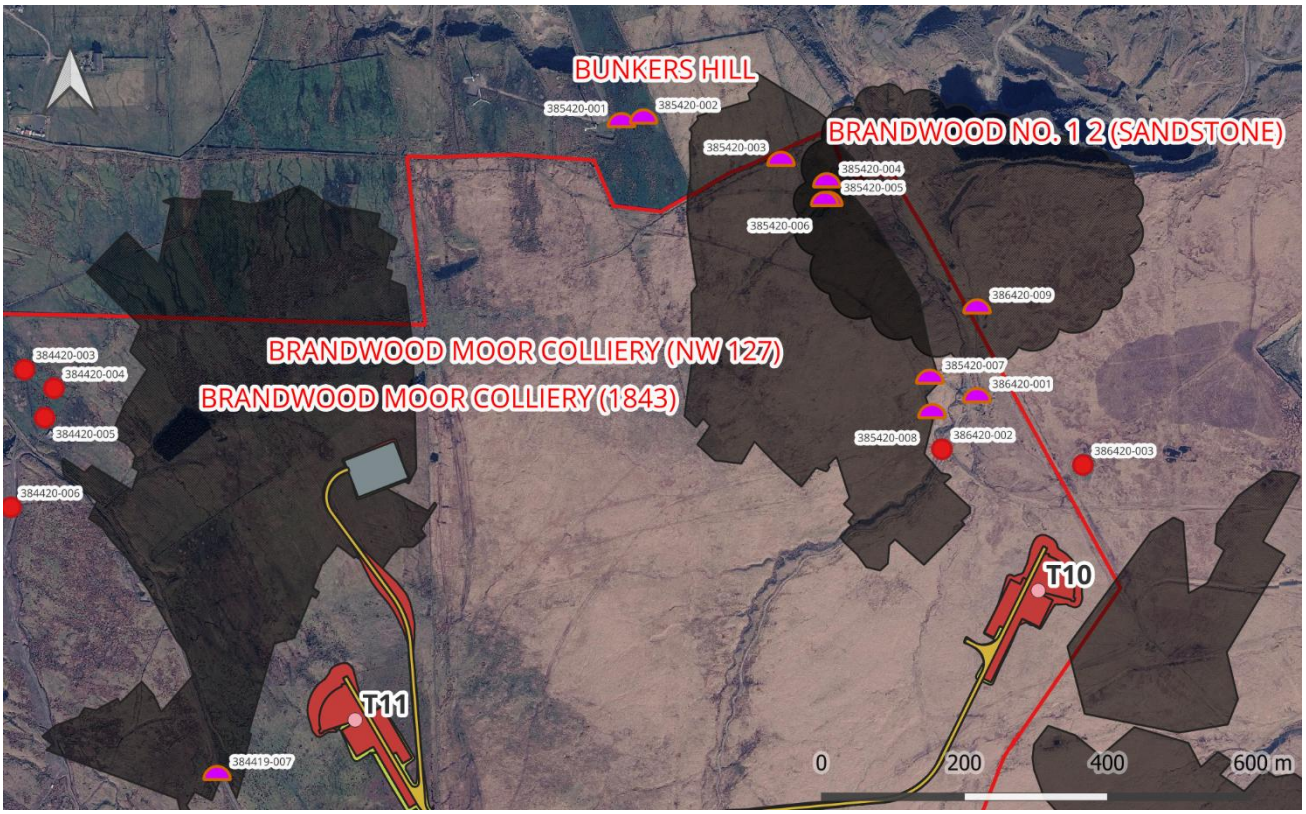


Figure 4-6: Estimated location of both phases of Brandwood Moor Colliery Workings

4.1.4 Scout Moor (Opencast) Colliery

Mined the Sand Rock Seam. Abandonment plan NW1466 indicates these workings to be open cast to extract the Sand Rock Coal (seam) in the eastern face of Scout Moor Quarry. The plan suggests the mining was undertaken by British Coal Opencast and ceased in 1991. It is considered likely that the existing access track to Scout Moor Wind Farm (which this scheme will utilise) is directly adjacent to the south-eastern extent of these open cast workings. This area was not accessed during the walkover; however, aerial imagery indicates that track runs beyond the extents of these workings.

4.1.1 Brandwood Nos. 1 2

Sandstone mine. Abandonment plan OM6540 indicates these workings to be Sandstone mines excavated into the southern face of Brandwood Quarry at the northern periphery of the study area and approximately 700m northwest of T10. The plan suggests the mining was undertaken by Henry Heys and Co Ltd and ceased in 1914. Based on the plan scale, the workings extended less than 200m southwards from the southern face of the quarry and therefore would not impact the scheme.

Figure 4-7 shows the approximate extents of the workings. On inspection the shown extent of the workings will not impact the turbines or access tracks and so it has not been attempted to further locate/position the workings.

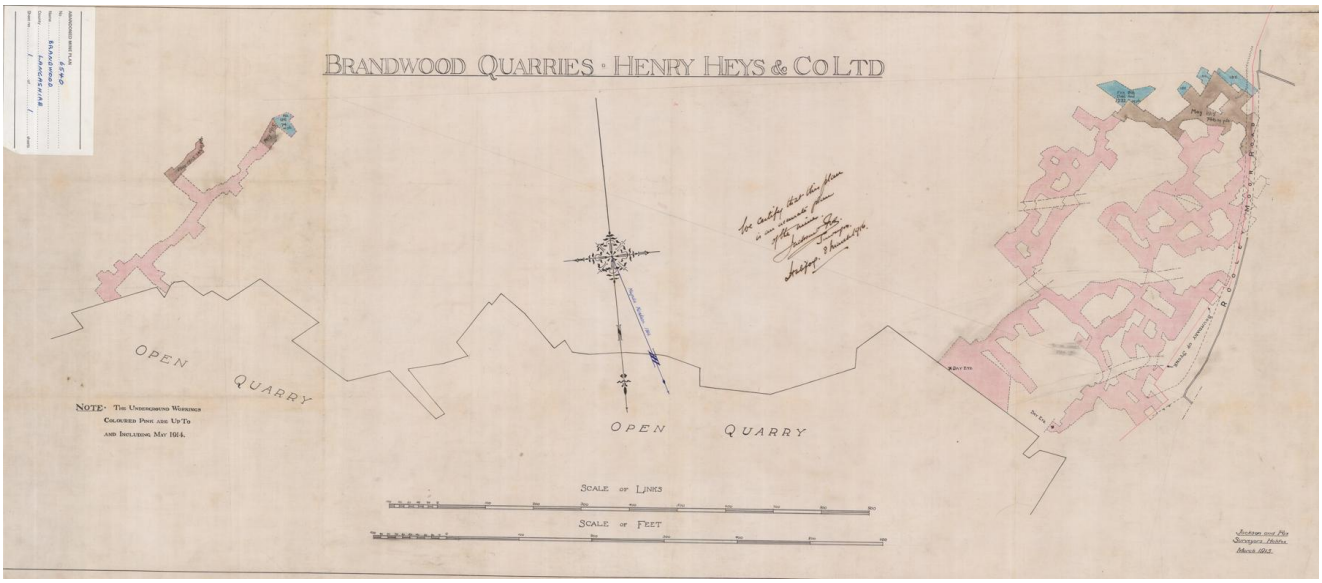


Figure 4-7: Extract showing the approximate extent of the sandstone workings to the southern face of Brandwood Colliery

4.1.2 Unrecorded workings

The majority of the abandonment plans showed that unrecorded workings were encountered within recorded workings and there are a substantial number of recorded mine entries that records have not been provided for. It is considered that that a substantial amount of mining had already occurred prior to enforcement of the Coal Mines Regulation Act (1872) which are unrecorded and the provided plans only provide a portion of relatively recent mining activity.

An example of typical features present apparently representing unrecorded mining activity is given in Figure 4-8.



Figure 4-8: Photo showing an example of unrecorded workings - stream issuing from a depression considered to be the remnant of marked adit 384419-010 and adjacent to a sizeable spoil heap shown at the right hand periphery of the photograph.

The following Collieries are also indicated by anecdotal information / sources although records have not been viewed:

- Extraction of the Holcomebrook Coal at Hugh Mill
- Extraction the Holcomebrook Coal to the rear of Cowpe Mill (approximately 1km northwest of the northern periphery of the scheme and discounted).
- Extraction of the Lower Foot Coal apparently towards the top of Walstead Clough as part of Old Sink Colliery and potentially relating to the marked entry 385418-001 400m northwest of turbine T4.
- Unnamed Colliery on 1844 plan
- Intake Colliery – believed to be approximately 450m northwest of the proposed substation to the north of the scheme and marked as ‘Old Collieries’ next to ‘Intake’ (farm) – potentially shown on the Brandwood Colliery Plans
- Part House Colliery - potentially shown on the Brandwood Colliery plans.
- Mill Moor Colliery
- Cragg Colliery
- Old Sink Colliery / Old Sink Slack Colliery (marked approximately 250m southwest of turbine T9 on the 1851 plan). Based on the published geology it’s considered likely that working was to the Lower Mountain Coal which outcrops to the southwest of and appears to dip away from turbine T9 and also appears faulted out before reaching turbine T8 to the southwest
- Unnamed shaft to the south of Old Sink Slack – referenced in the RKM report and considered likely to be 385418-001
- Bartle Cowm Colliery (marked 150m north of turbine T4 on the 1851 plan)
- Greenland Coal Pit / Whimsley Coal Pit – referenced anecdotally and considered likely to relate to entries 386418-003 386416-004, 386416-005, 386416-006, 387416-001, 387416-004 towards the southern extent of Rooley Moor Road. These entries are substantially off the scheme extents and are not considered further.

- Withens Meadow Coal Pit (marked approximately 500m southeast of turbine T1 location on the 1851 map) – substantially off the scheme extents and not considered further.

5 Summary of site specific mining hazards

A summary of site specific mining hazards at the turbine locations and more generally along the proposed access track and other infrastructure locations is provided in Table 5-2 and a summary of risk rating is provided in Table 5-1. It is a very simple qualitative risk assessment and should not be viewed as definitive. This Risk Assessment reflects the current level of understanding of mining risk to the scheme and will be subject to revision. It is considered likely that ground investigation will result in downgrading of risk rating at many locations.

Risk rating is defined by the following relationship:

Table 5-1: Risk Assessment Criteria and Rating

Risk Rating	Criteria
1	**Likely** - the assessment indicates there to be a mining feature/hazard within influencing distance of the structure that is likely to need remedial works / accommodating in any design if it can't be avoided by micro siting.
2	**Possible** – the assessment indicates there a to be a potential for mining features/hazards within influencing distance of the structure although no specific evidence of workings was noted.
3	**Unlikely** – no evidence of either mine workings or workable seams within influencing risk of the structure was noted.

Table 5-2: Summary of element specific mining hazards identified by the mining records search, site walkover and more general desk study information.

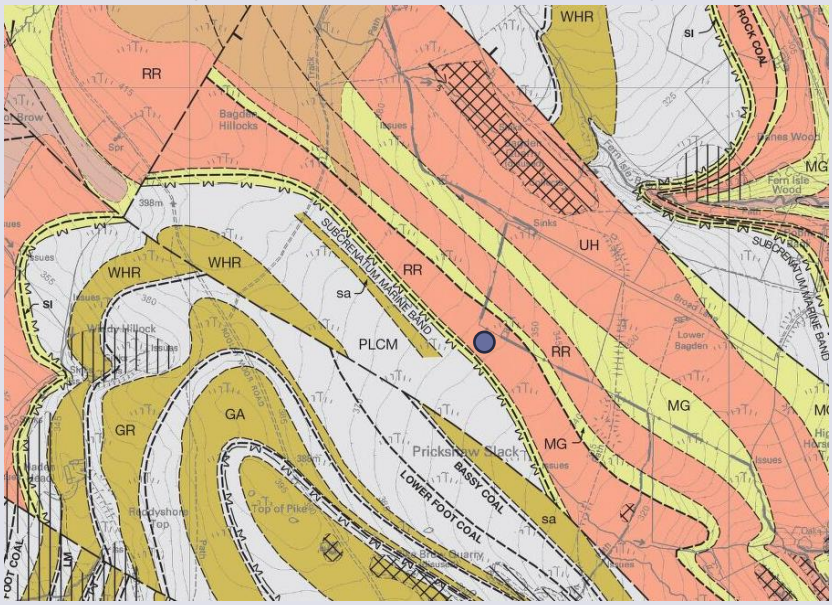
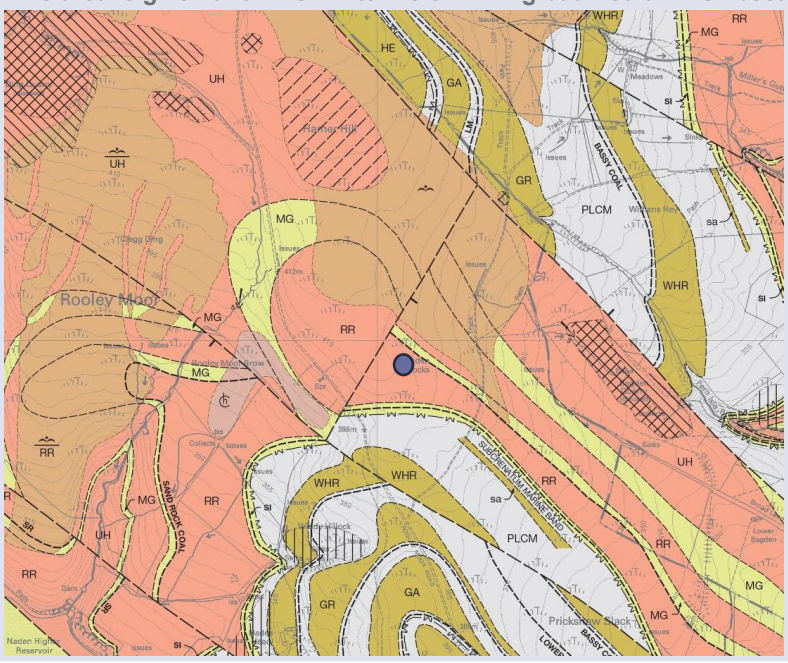
Turbine Location	Comments	Risk
T1	**Recorded workings** – Rooley Moor Quarry 400m to the south although Lower Mountain Seam appears faulted out at the site location. Several sandstone quarries are shown. **Unrecorded workings** – no recorded mine entries although site not visited. **Other** - the 1:10,000 plan shows the 6inch coal and the Sand Rock Coal directly at the site location. The area is heavily faulted and the dip of these seams directly at the site location is unclear.  **Figure 5-1: BGS map extract of sheet SD81NE showing turbineT1 location**	3
T3	**Recorded workings** – none in proximity. **Unrecorded workings** – no entries recorded. However, satellite imagery suggests numerous sink hole features; some of which were identified during the walkover. However, no seams are present in sufficient proximity to suggest shallow mining/bell pits. **Other** – position is directly on a fault. 1:10,000 plan shows 'Disturbed Ground' shortly north of the location although it seems likely to be disturbed because the peat was dug out – potentially to bring down to the Moor Cock Inn. **This area is given a low risk in terms of mining but medium risk because of the fault.** 	3

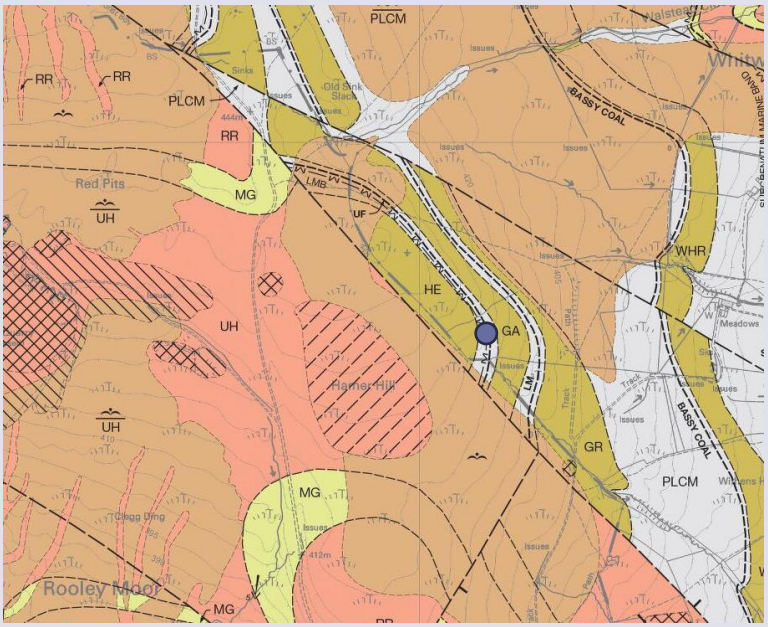
Table 5-2: Summary of element specific mining hazards identified by the mining records search, site walkover and more general desk study information.		
Turbine Location	**Comments**	**Risk**
	Figure 5-2: BGS map extract of sheet SD81NE showing turbine T3 location	
T4	**Recorded workings** – none in proximity **Unrecorded workings** – Four entries are recorded within 150-200m to the north and east of the site, none of which are indicated to have either been treated or have abandonment plans available. Furthermore, the turbine T4 location is directly within a "coal pit field" with 'Bartle Crown Colliery' and 'Old Coal Pits' denoted 150m north and 60m south of the location respectively. The geological plans suggest that north of the fault the site is underlain by the Upper Foot Coal and the Lower Mountain Coal and it seems likely the mining activity on the historic maps was to extract the Lower Mountain Coal which is of greater thickness. Withens Meadow Coal Pit is marked approximately 150m south of the turbine location and the extent and history of these workings is not known. **This area appears to be medium risk in terms of unrecorded workings.** **Other** – position is adjacent to a northwest/southeast trending fault. As above, there are numerous pre. 1850's workings, apparently down to the Lower Mountain Coal to the northeast of the fault. The area of disturbed ground shown just south of the T4 location is considered to potentially be peat excavation. **If the coal was worked up to the fault there may be an increased risk of settlement / retrogression of collapse settlement from the workings through the fault system or piping/channelling due to water ingress down through the fault system into the workings.**  **Figure 5-3: BGS map extract of sheet SD81NE showing turbine T4 location**	**2**

Table 5-2: Summary of element specific mining hazards identified by the mining records search, site walkover and more general desk study information.

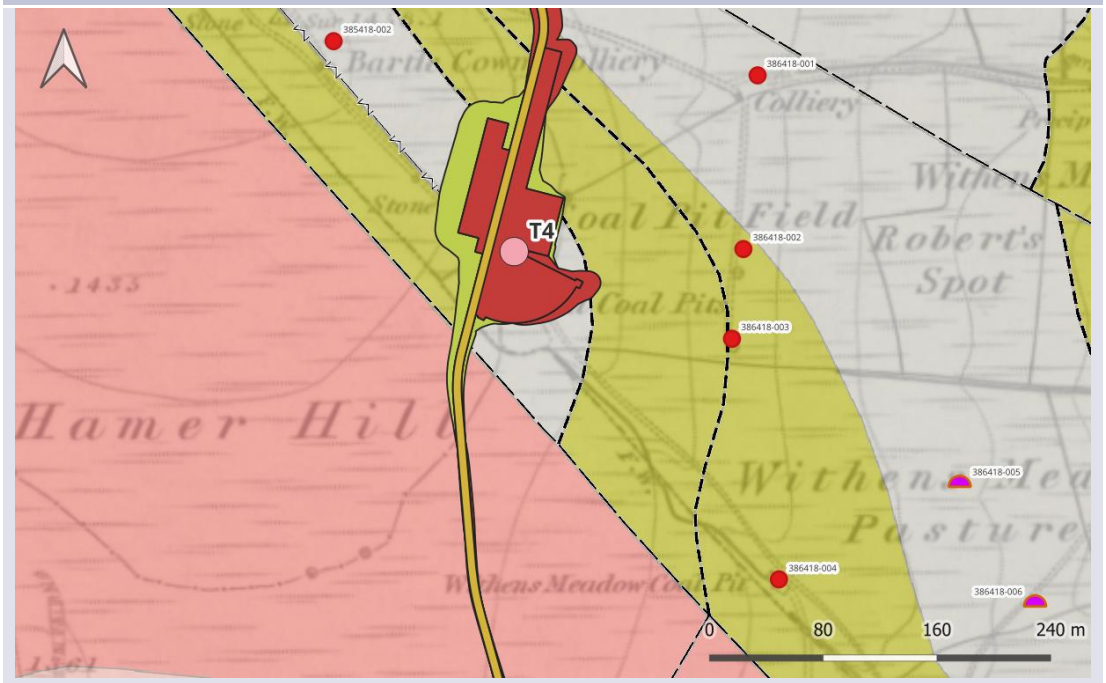
Turbine Location	Comments	Risk
	 **Figure 5-4: QGIS extract of sheet showing marked entries and 'Old Coal Pits' shown on historical maps at turbine T4 location**	
T6	**Recorded workings** – none in proximity **Unrecorded workings** – None shown. The location is shown to be underlain by made ground overlying Upper Haslington Flags; suggesting the Sand Rock Coal has been eroded out at this location (there are no older seams shown in the Millstone Grit on the vertical section) and so the coal mining risk is considered low. The area has been quarried extensively. Elsewhere on the hill sides of Scout Moor, the Haslington Flags have also been mined with excavation tending to be into the base of quarried faces; presumably when open cast excavation became uneconomical due to depth. Although there is no indication that underground mining occurred in Ding Quarry, it cannot be discounted. **Low risk in terms of mining but risk considered medium due to presence of Made Ground from backfilled quarry beneath turbine location.** **Other** – The BGS mapping shows the site to be underlain by Made Ground deposits. These are likely associated with historical quarrying.	**2**

Table 5-2: Summary of element specific mining hazards identified by the mining records search, site walkover and more general desk study information.

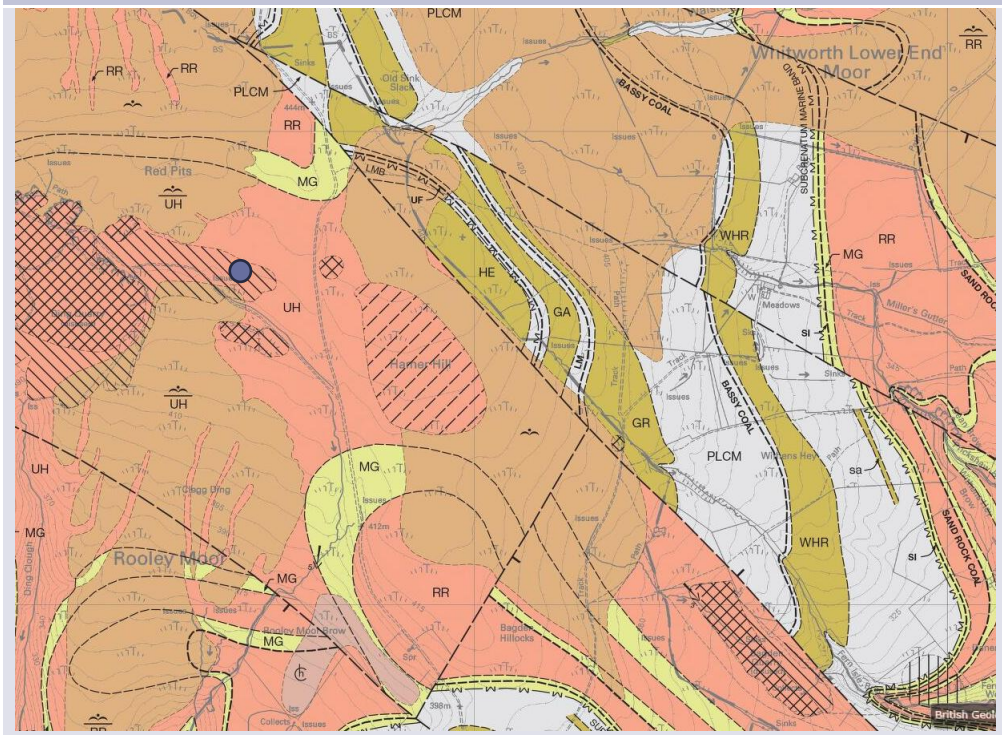
Turbine Location	Comments	Risk
	 **Figure 5-5: BGS map extract of sheet SD81NE showing turbine T6 location**	
T7	**Recorded workings** – none in proximity **Unrecorded workings** – None shown. The location appears to approximately 50m west of and downslope of the inferred outcrop of the Sand Rock Coal. On this basis there is a potential for unrecorded workings immediately upslope of the location but limited potential directly at the location as the seam will have been eroded out. **Other** – none.	**3**

Table 5-2: Summary of element specific mining hazards identified by the mining records search, site walkover and more general desk study information.

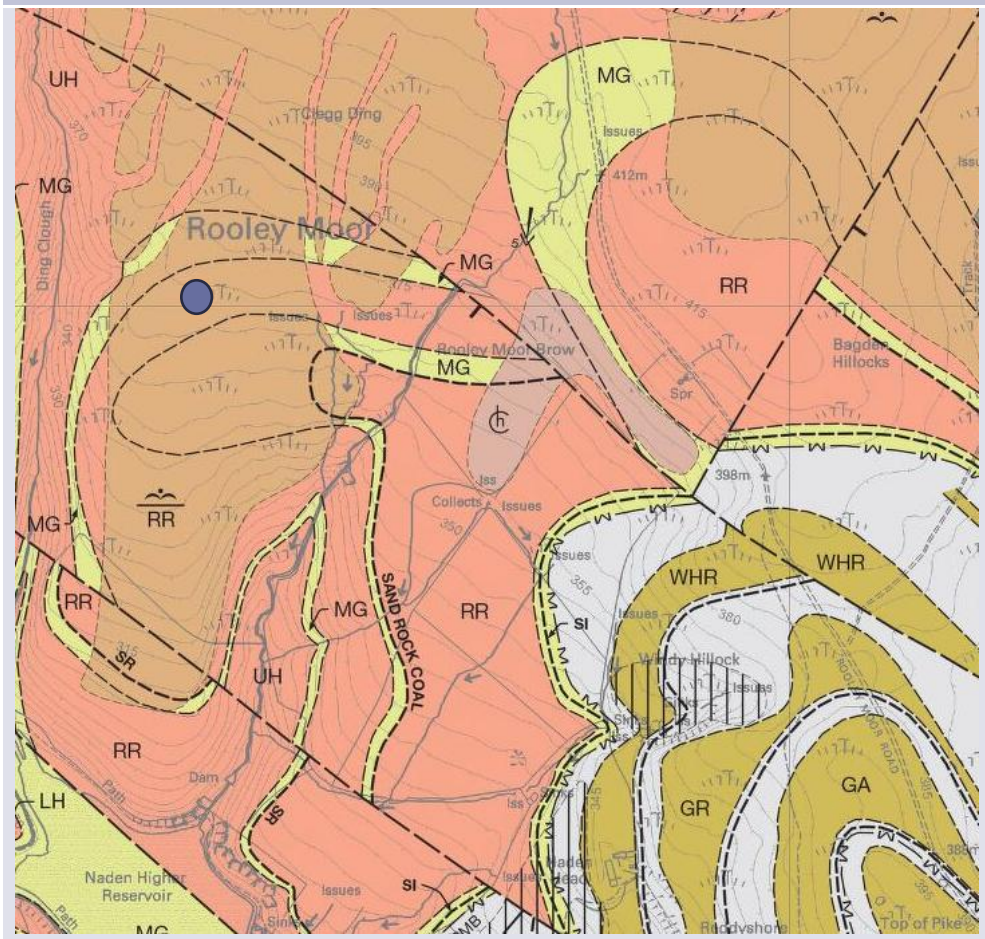
Turbine Location	Comments	Risk
	 **Figure 5-6: BGS map extract of sheet SD81NE showing turbine T7 location**	
T8	**Recorded workings** – Western extent of Hailstorm Colliery is indicated to be approximately 250m west of the location. **Unrecorded workings** – None shown in the immediate vicinity. Several marked entries are shown along the northern edge of Scout Moor approximately 400-500m north of the location with adits running towards the location. Based on the 1:10,000 geological plans the Sand Rock Coal (the oldest seam) appears locally eroded out at this location but based on the Mining Remediation Authority interactive map the seam is actually indicated to extend north-eastwards and outcrop to either side of the plateau and so underlie the location at relatively shallow depth. No dip data is given but the beds appear likely to be either sub-horizontal or synformal as there is a similar underlying sequence on both the north and southern flanks of the Scout Moor plateau at this location. **Other** – none.	**2**

Table 5-2: Summary of element specific mining hazards identified by the mining records search, site walkover and more general desk study information.

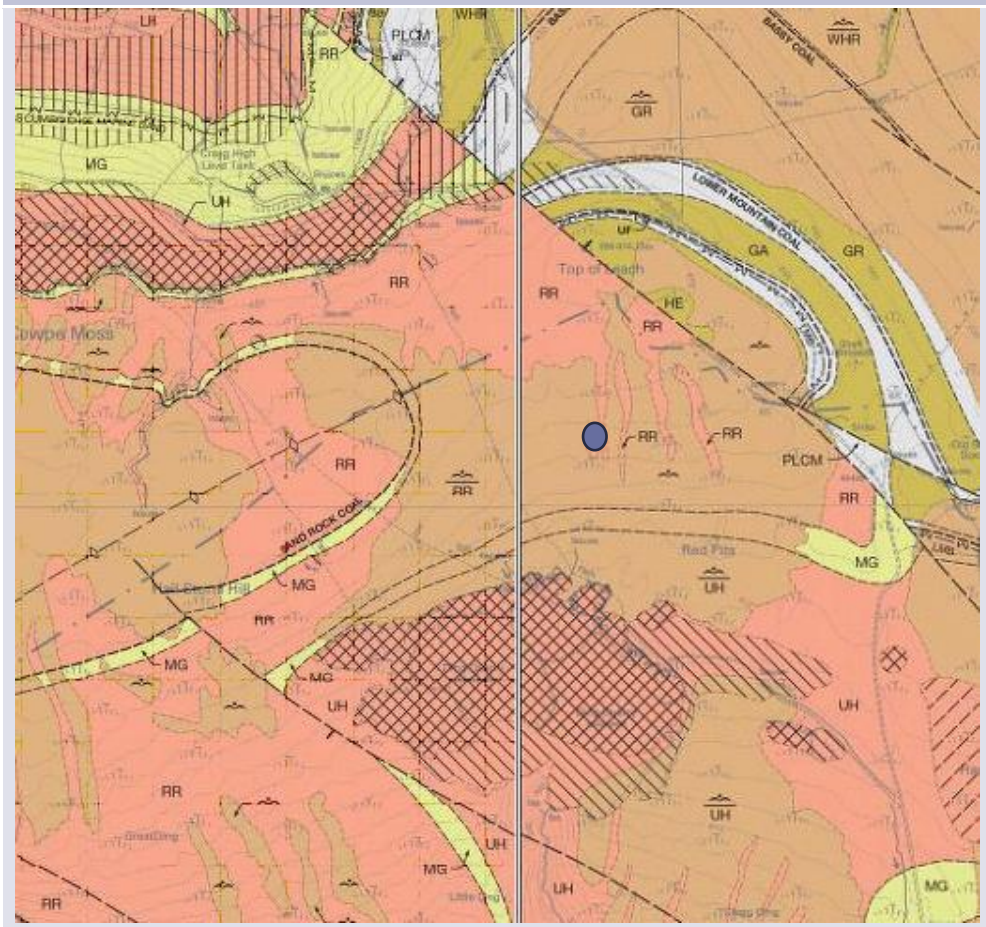
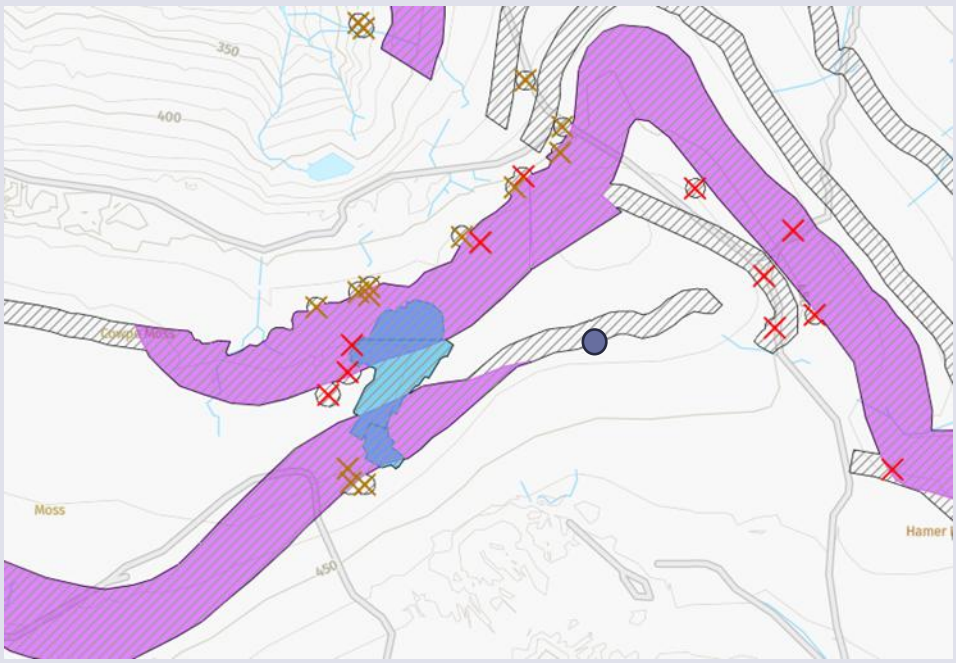
Turbine Location	Comments	Risk
	 **Figure 5-7: BGS map extract of sheets SD81NE and SD81NW showing turbine T8 location**  **Figure 5-8: Extract of the Mining Remediation Authorities Online Interactive Map showing areas considered to be at high risk of shallow mine workings (shown in purple) at the turbine T8 location.**	

Table 5-2: Summary of element specific mining hazards identified by the mining records search, site walkover and more general desk study information.

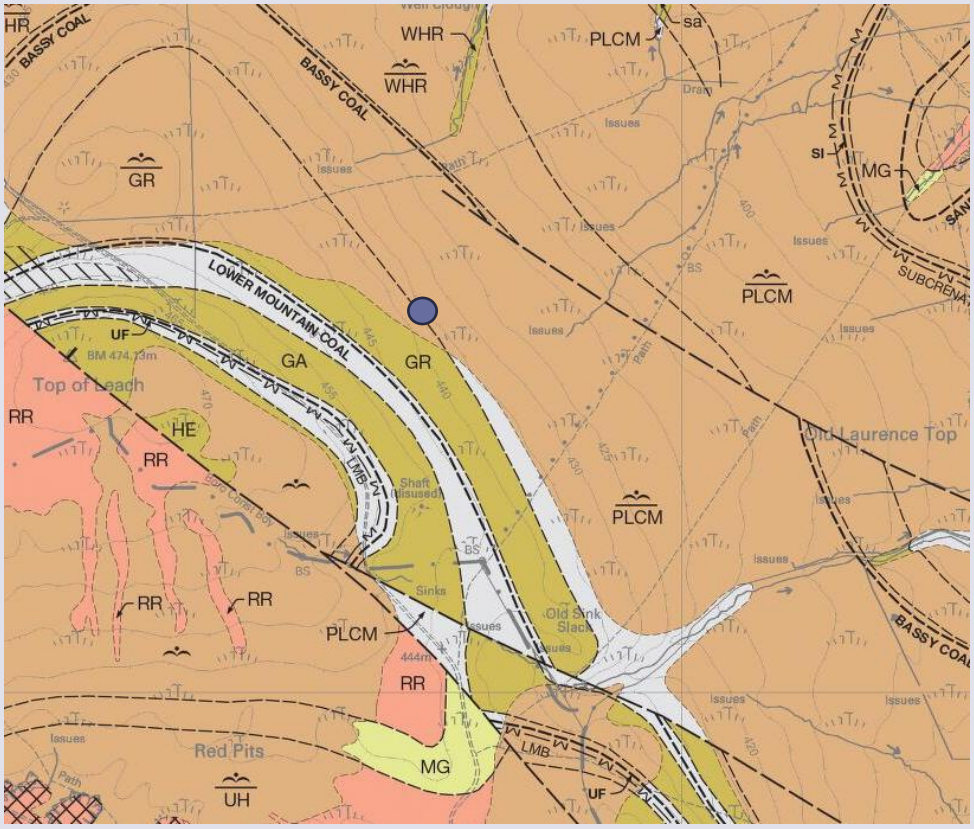
Turbine Location	Comments	Risk
T9	**Recorded workings** – none within 500m of the location **Unrecorded workings** – A marked entry is shown approximately 100m south of the site and several other marked entries are shown within 250m south and west (upslope) of the site. The Lower Mountain Coal is shown to outcrop to the southwest and upslope of the location and the entries appear to relate to extraction of the Lower Mountain Coal. The Bassey Coal is shown approximately 70m northeast (downslope) of the location, is likely to underlie the location and the Mining Remediation Interactive map shows the site to be on or near an area at risk of shallow mining; apparently due to the Bassey Coal. However, the Bassey Coal is only shown as 0.1m thick on the 1:10,000 vertical section and if this thickness is correct is unlikely to have been economical to progress underground workings. **Other** – none. **This area is given a medium risk because it is shown as being in a risk area on the Mining Remediation Interactive map**  **Figure 5-9: BGS map extract of sheet SD81NE showing turbine T9 location**	**2**

Table 5-2: Summary of element specific mining hazards identified by the mining records search, site walkover and more general desk study information.

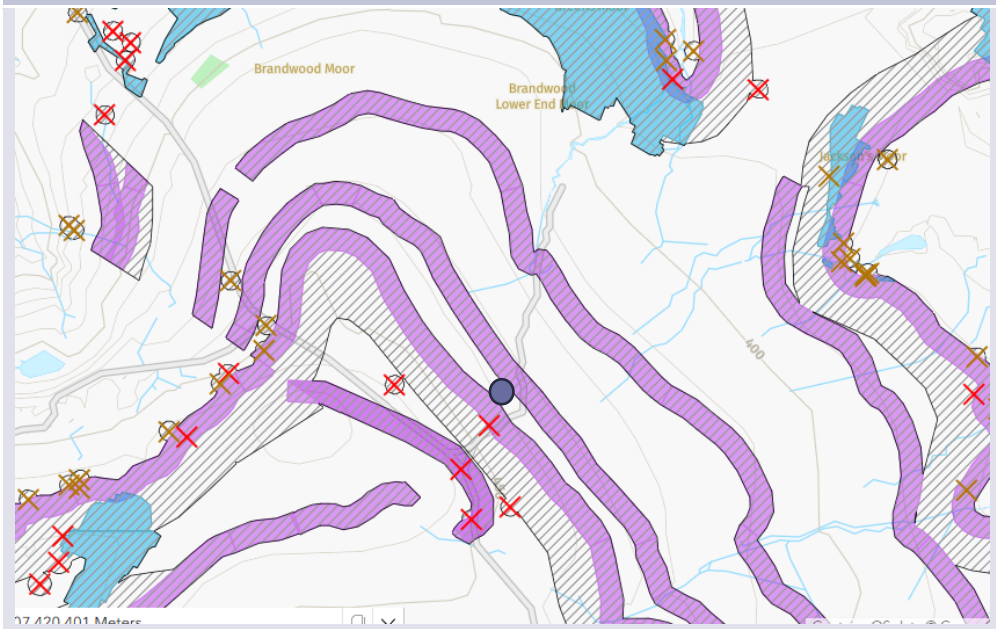
Turbine Location	Comments	Risk
	 **Figure 5-10: Extract of the Mining Remediation Authorities Online Interactive Map showing areas considered to be at risk of shallow mine workings (shown in purple) at the turbine T9 location.**	
T10	**Recorded workings** – Brandwood Moor workings are believed to terminate approximately 100m north of the site and Hall Cowm Kruger workings are believed to terminate immediately south of the site. **Unrecorded workings** – Several marked entries are shown to the north in the vicinity of Brandwood Moor and several marked entries are also shown to the south in the vicinity of Hall Cowm Kruger workings although these appear to largely relate to recorded workings. No 'Old Workings' are shown as encountered to the north of the Hall Cowm Kruger workings or the south of the Brandwood Moor workings on the respective abandonment plans which gives some confidence that the Sand Rock Coal wasn't previously worked below the site. Mining Remediation Authority Interactive map shows the site to be on or near an area at risk of shallow mining; apparently due to the Bassey Coal. However, the Bassey Coal is only shown as 0.1m thick on the 1:10,000 vertical section and if this thickness is correct is unlikely to have been economical to progress underground workings. Levels aren't provided for the northern section of workings for the Hall Cowm Kruger mine although levels to the south range between 1262ft and 1234.6ft (385m to 376m AOD) verses a surface elevation of approximately 390m AOD at the site location. Treated entry 386420-001 is shown to be an adit heading in a south-eastern direction towards the turbine location. **Other** – none. **This area is given a medium risk rating because it is shown as an at risk area because of the proximity of two known sets of workings with a potential to be at relatively shallow depth.**	**2**

Table 5-2: Summary of element specific mining hazards identified by the mining records search, site walkover and more general desk study information.

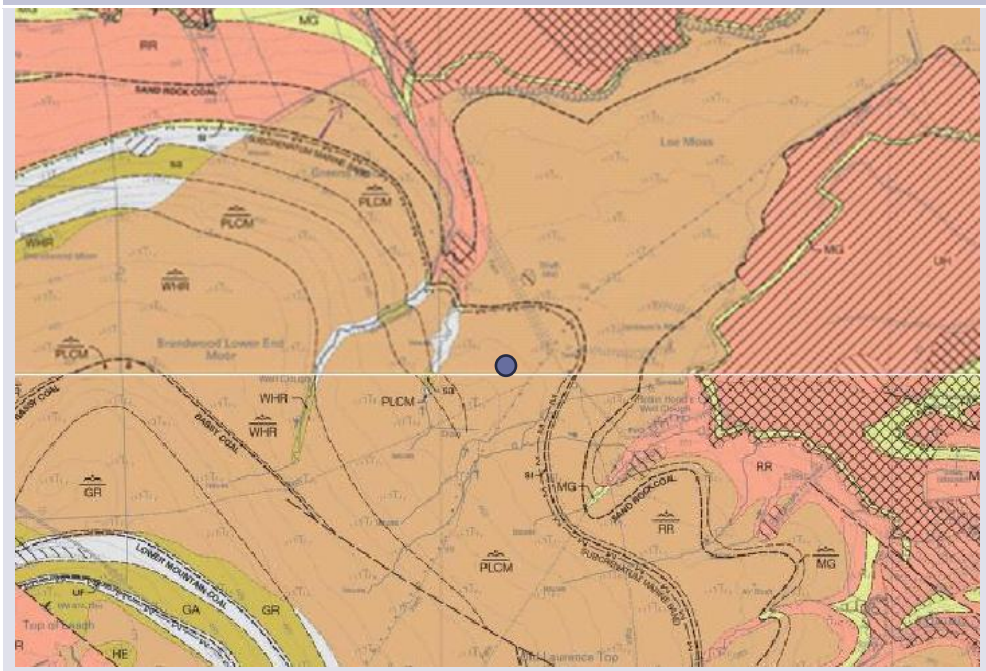
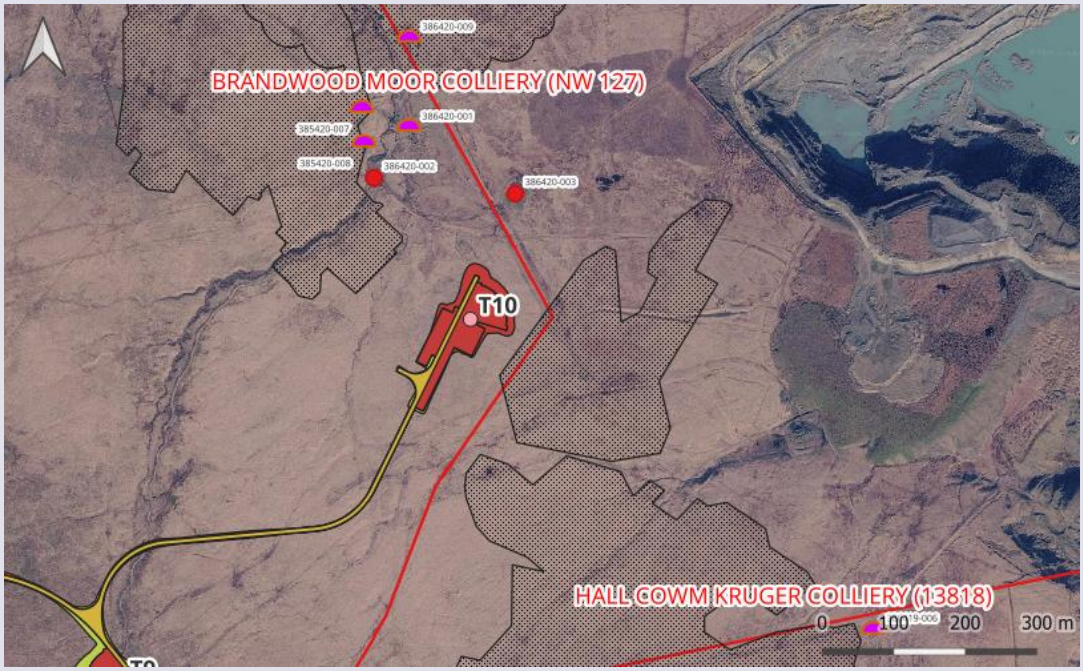
Turbine Location	Comments	Risk
	 **Figure 5-11: BGS map extract of sheets SD81NE and SD82SE showing turbine T10 location**  **Figure 5-12: Estimated locations of the Hall Cowm Kruger Colliery and Brandwood Moor Colliery workings in relation to turbine T10 location.**	

Table 5-2: Summary of element specific mining hazards identified by the mining records search, site walkover and more general desk study information.

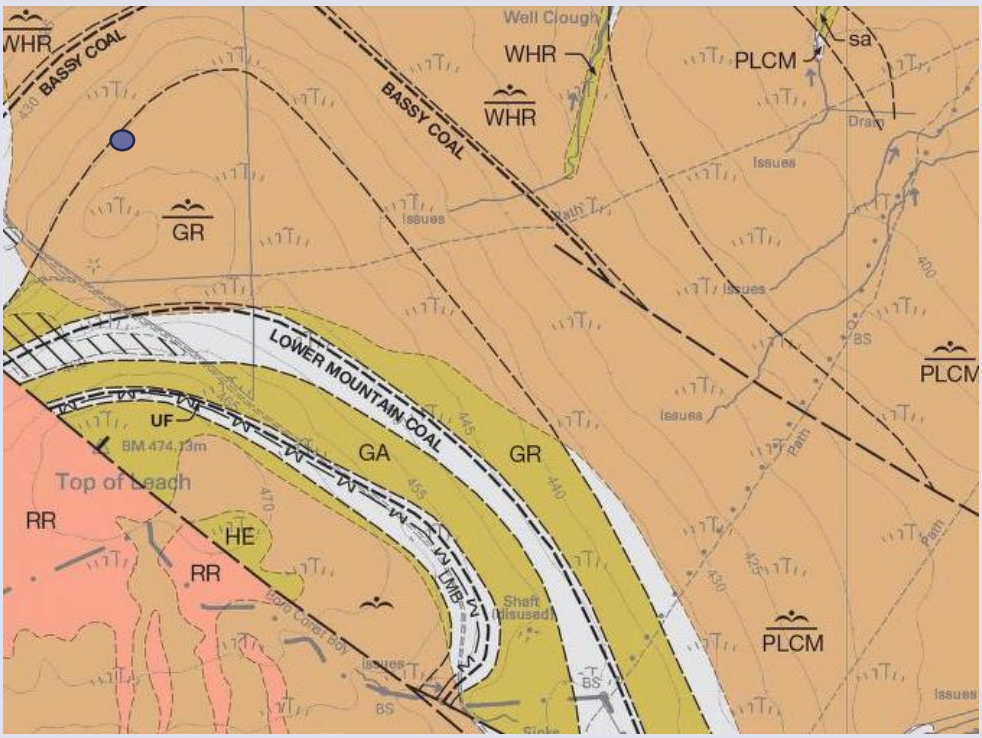
Turbine Location	Comments	Risk
	 **Figure 5-13: Direction of entry 386420-001; an adit heading broadly in the direction of turbine T10.**	
T11	**Recorded workings** – Brandwood Moor workings are believed to terminate approximately 100m northwest of the site. **Unrecorded workings** – Several marked entries are shown from approximately 150m southeast of the site; the closest of which are two adits shown to head southwards into the hillside; presumably to extract the Lower Mountain Coal which appears to have been eroded out to the north at the turbine location. The Bassey Coal is shown to underlie the site but is indicated to only be 0.1m in thickness, and unlikely to have been worked and the location appears to be upslope of the area marked by the Mining Remediation Authority as high risk. **Other** – none.  **Figure 5-14: BGS map extract of sheet SD81NE showing turbine T11 location.**	**3**

Table 5-2: Summary of element specific mining hazards identified by the mining records search, site walkover and more general desk study information.

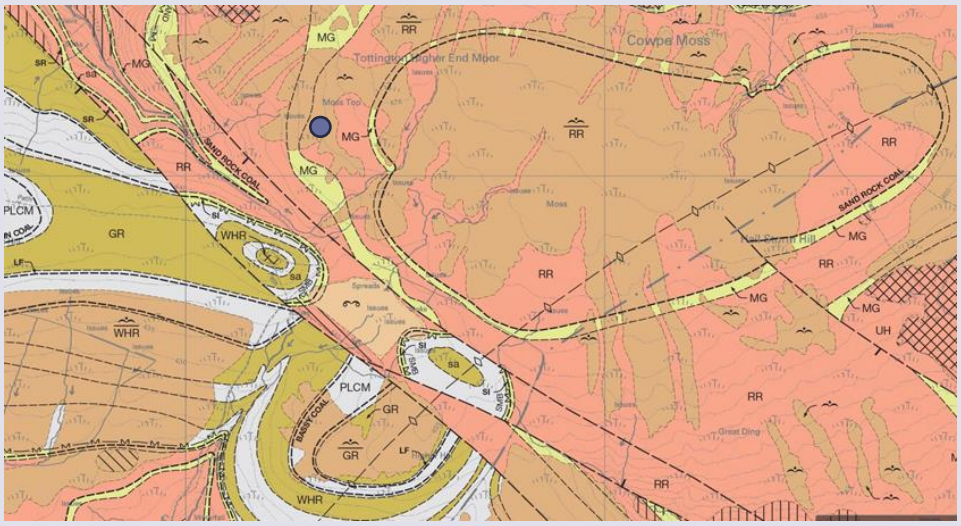
Turbine Location	Comments	Risk
T14	**Recorded workings** – Various 'Old Workings' are shown on the Scout Moor Colliery plans from approximately 400m south-westwards; however, this area appears to be faulted out. **Unrecorded workings** – no marked entries are shown in proximity. The Sand Rock Coal appears eroded out at this location. If so (noting that the same outcrop appears incorrectly mapped at its eastern extent) the mining risk at this location is considered relatively low. **Other** – none.  **Figure 5-15: BGS map extract of sheet SD81NW showing turbine T14 location**	**3**
T15	**Recorded workings** – None shown in proximity. **Unrecorded workings** – None shown in proximity. The published geology suggests the location to be below the coal bearing sequence. **Other** – The turbine location is shown to be directly underlain by infilled ground, this appears to relate to an infilled sandstone quarry. **Low risk in terms of mining but risk considered medium due to presence of Made Ground from backfilled quarry beneath turbine location.**	**2**

Table 5-2: Summary of element specific mining hazards identified by the mining records search, site walkover and more general desk study information.

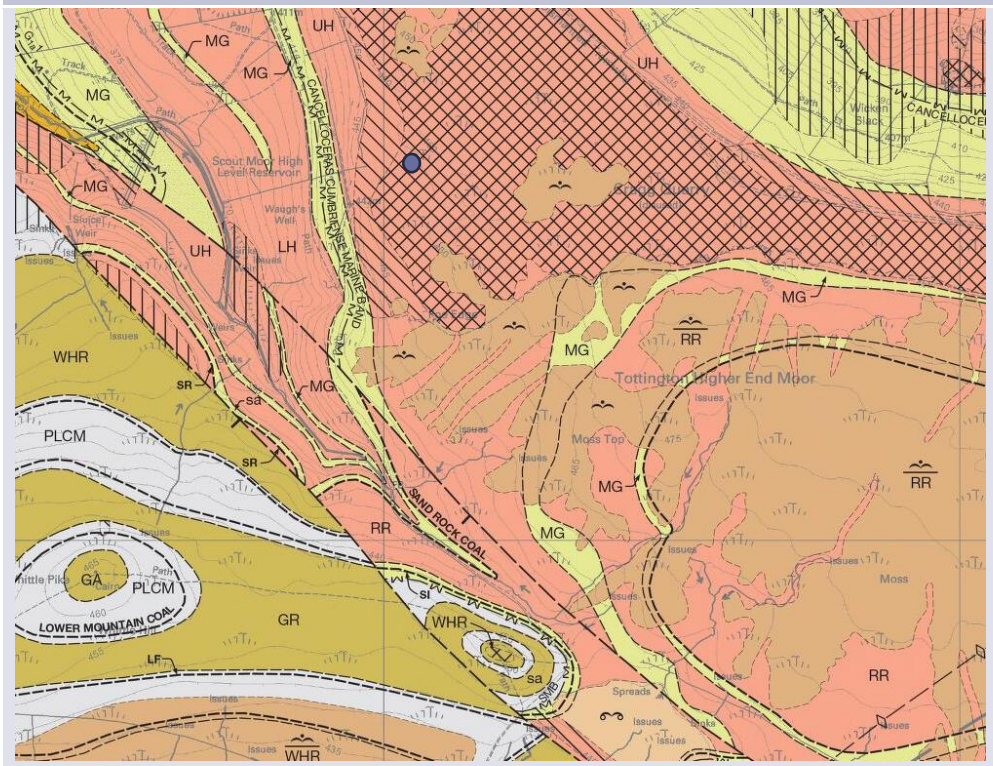
Turbine Location	Comments	Risk
	 **Figure 5-16: BGS map extract of sheet SD81NW showing turbine T15 location**	
T16	**Recorded workings** – Hall Cowm Kruger workings are shown to be immediately east of the site location with the access track passing through the workings. The Sand Rock Coal is shown to the faulted out at the western extent of the workings on the abandonment plan. An elevation of 1262ft/384m AOD is indicated at the western extent on the abandonment plans and the surface elevation at the site location is indicated to be approximately 410m AOD indicating a likely depth of cover of approximately 25m. **Unrecorded workings** – Several entries are shown to the west of and downslope of the site although these appear likely to largely relate to Hall Cowm Kruger colliery. **Other** – position is directly on a northwest/southeast trending fault. **If the coal was worked up to the fault as indicated on the abandonment plan, there may be an increased risk of settlement / retrogression of collapse settlement from the workings through the fault system or piping/channelling due to water ingress down through the fault system into the workings.**	**2**

Table 5-2: Summary of element specific mining hazards identified by the mining records search, site walkover and more general desk study information.

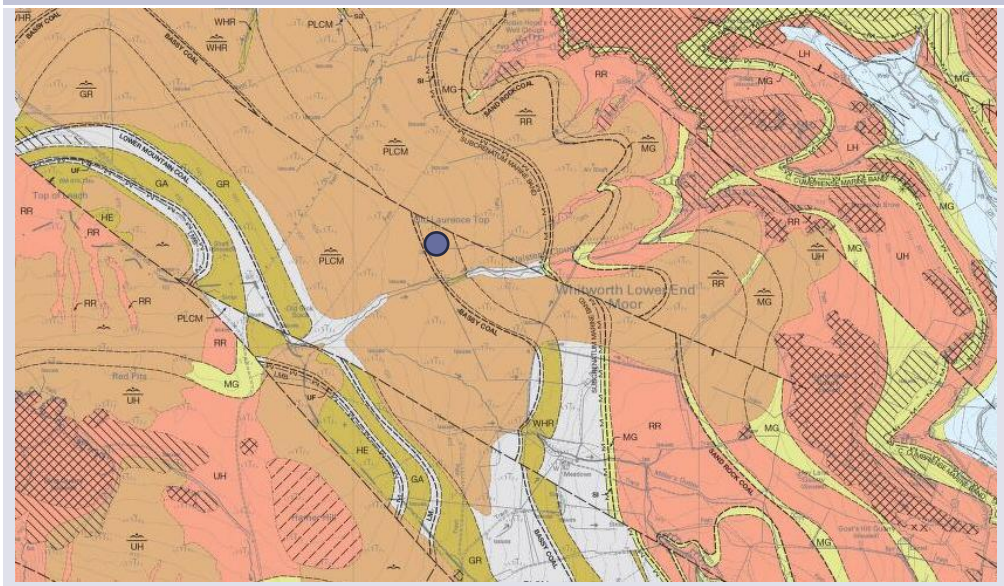
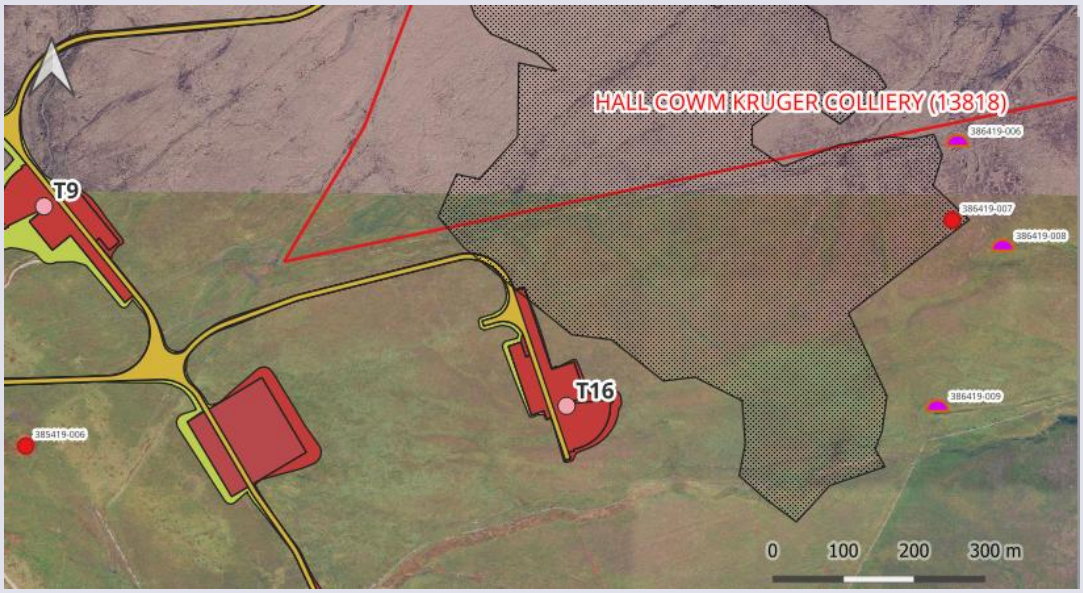
Turbine Location	Comments	Risk
	 **Figure 5-17: BGS map extract of sheet SD81NE showing turbine T10 location**  **Figure 5-18: Estimated locations of the Hall Cowm Kruger Colliery workings in relation to turbine T16 location.**	
Other: Substation site	The proposed substation location appears to be directly above the Brandwood Moor Colliery workings. However, it is estimated that these workings are at more than 50m depth and it's likely there's sufficient cover above the workings.	**2**

Table 5-2: Summary of element specific mining hazards identified by the mining records search, site walkover and more general desk study information.

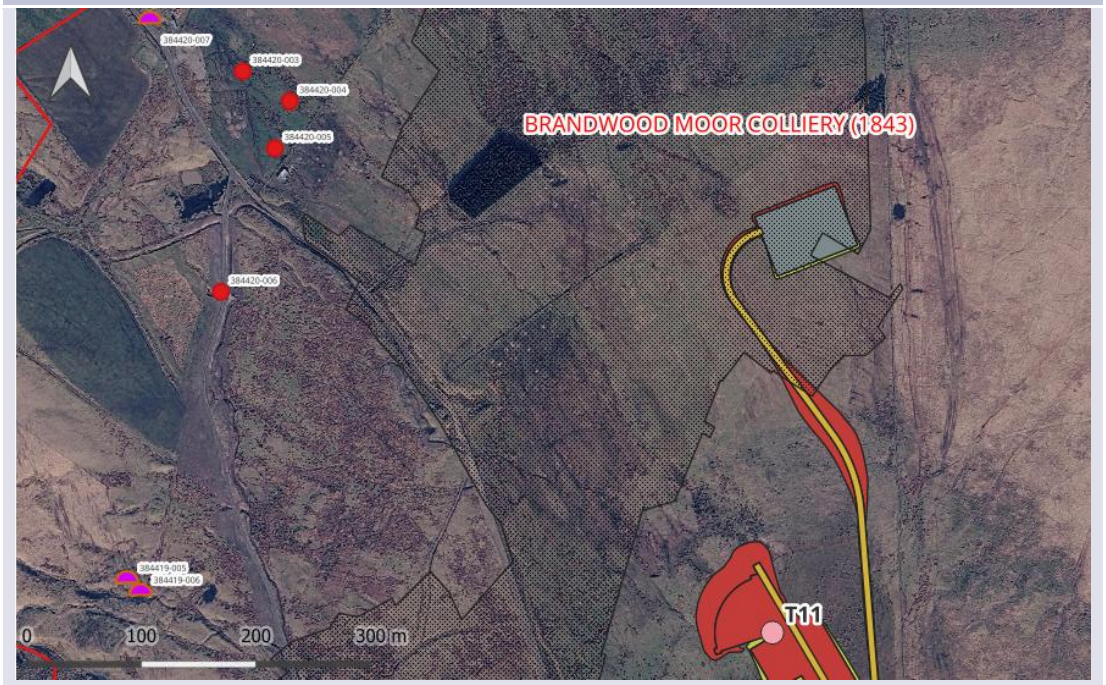
Turbine Location	Comments	Risk
	 **Figure 5-19: Estimated extents of the Brandwood Moor Colliery workings which appear to run directly below the proposed substation location**	
Laydown area	**Recorded workings** – none shown. **Unrecorded workings** - the proposed location appears to be underlain by the Holcombe Brook Coal although (based on the location being at an elevation approximately 20m higher than the local level of the seam outcrop) appears unlikely to underlie the site at shallow depth. The location falls within the areas at risk of shallow mining. **Other** – none.  **Figure 5-20: BGS 1:10,000 map sheet SD81NW showing the geology at the proposed laydown area with Quaternary Landslip deposits shown immediately south of the location.**	2

Table 5-2: Summary of element specific mining hazards identified by the mining records search, site walkover and more general desk study information.

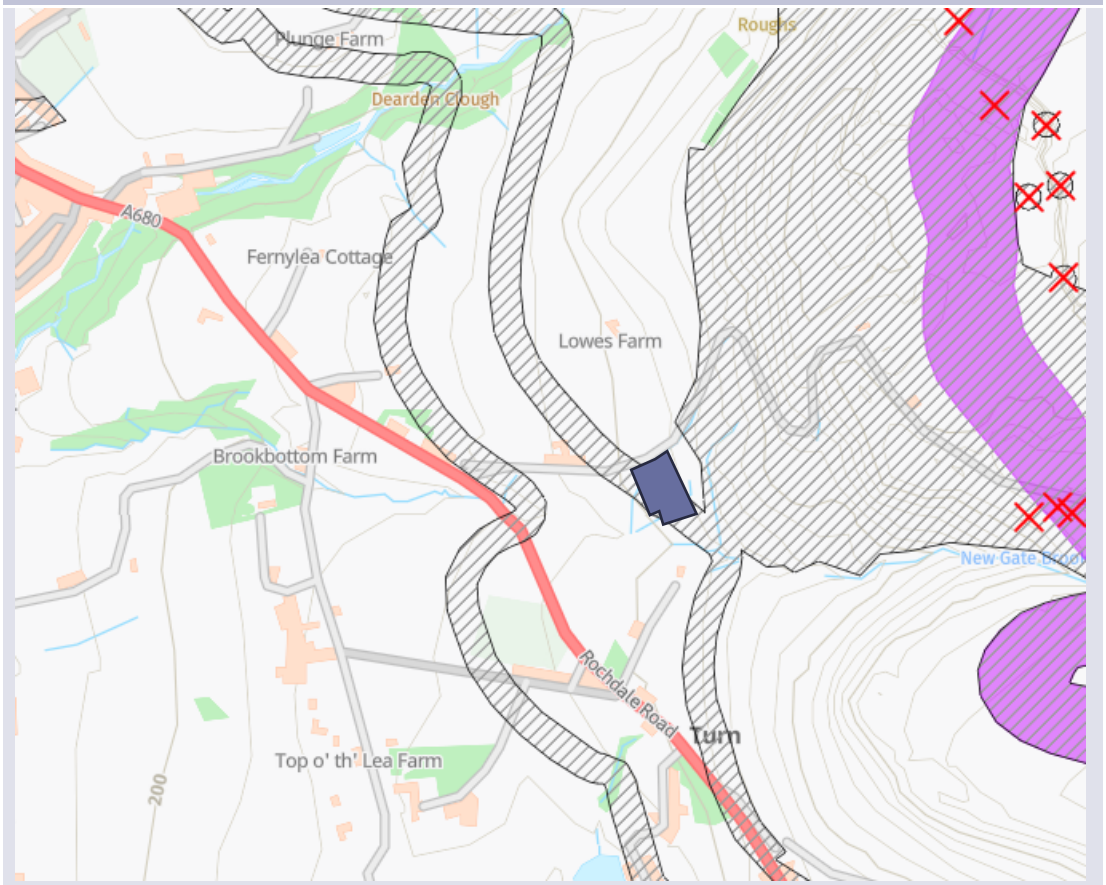
Turbine Location	Comments	Risk
	 **Figure 5-21: Extract of the Mining Remediation Authorities Interactive Map showing high risk development areas adjacent to the proposed laydown area location.**	
Compound area	**Recorded workings** – none within 500m of the location **Unrecorded workings** – A marked entry is shown approximately 150m west of the site and several other marked entries are shown within 250m south and west (upslope) of the site. The Lower Mountain Coal is shown to outcrop to the southwest and upslope of the location and the entries appear to relate to extraction of the Lower Mountain Coal. The Bassey Coal is shown approximately 15m to the east (downslope) of the location, is likely to underlie the location and the Mining Remediation Interactive map shows the site to be on or near an area at risk of shallow mining; apparently due to the Bassey Coal. However, the Bassey Coal is only shown as 0.1m thick on the 1:10,000 vertical section and if this thickness is correct is unlikely to have been economical to progress underground workings. **Other** – none.	**3**

Table 5-2: Summary of element specific mining hazards identified by the mining records search, site walkover and more general desk study information.

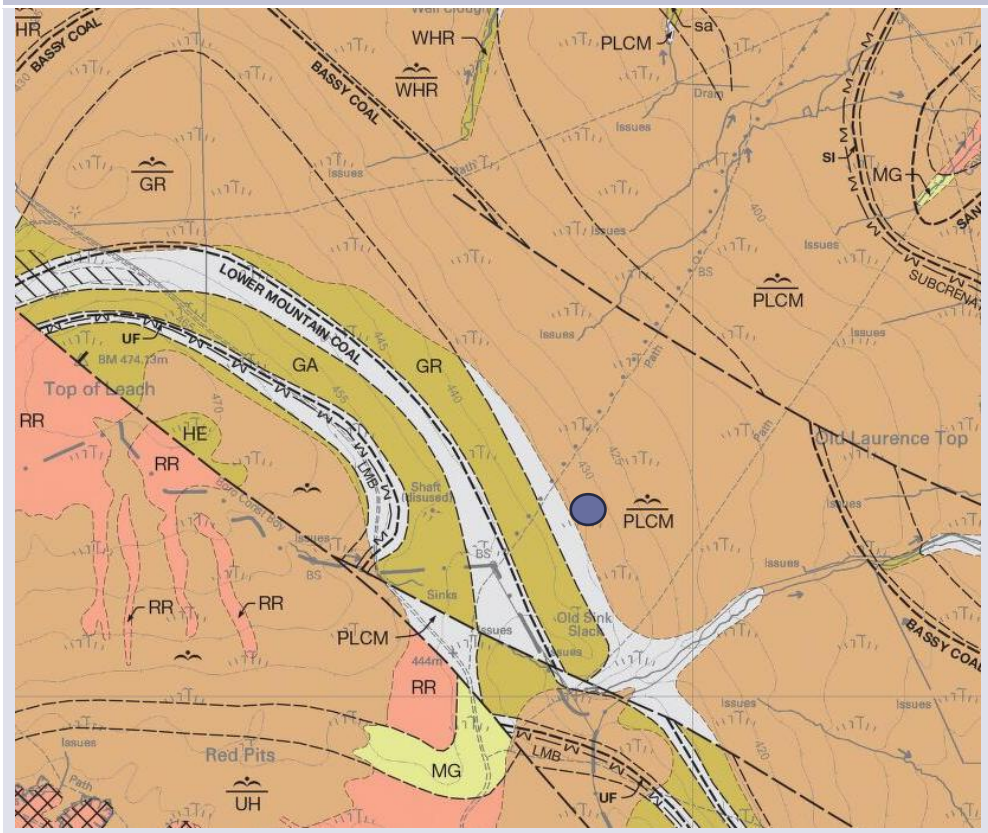
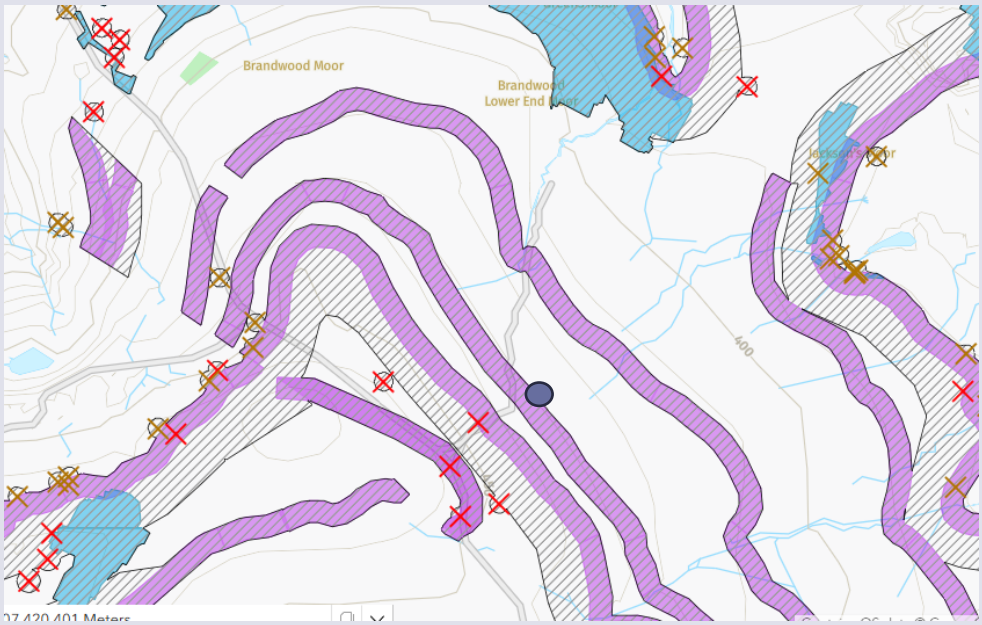
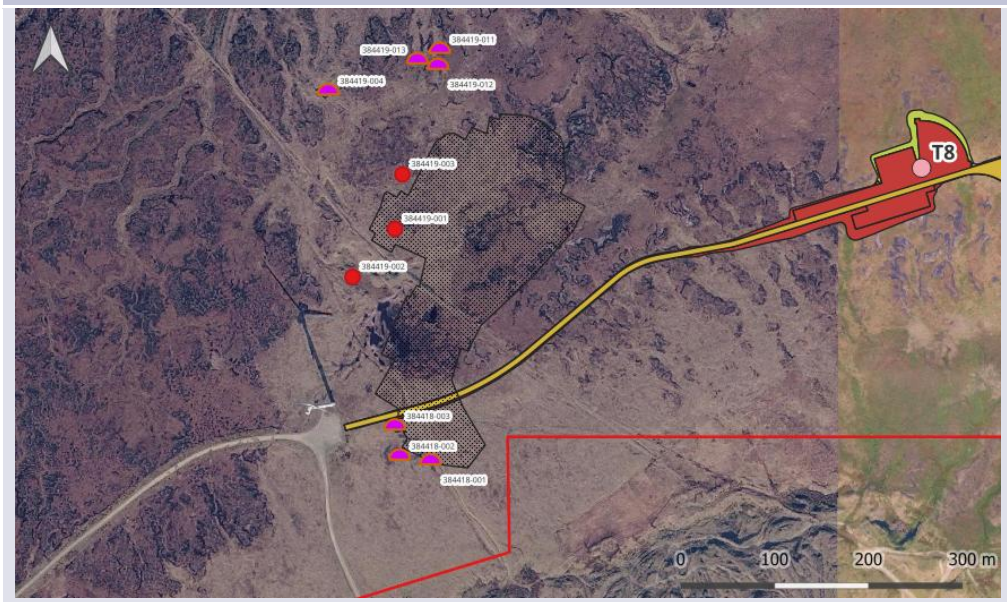
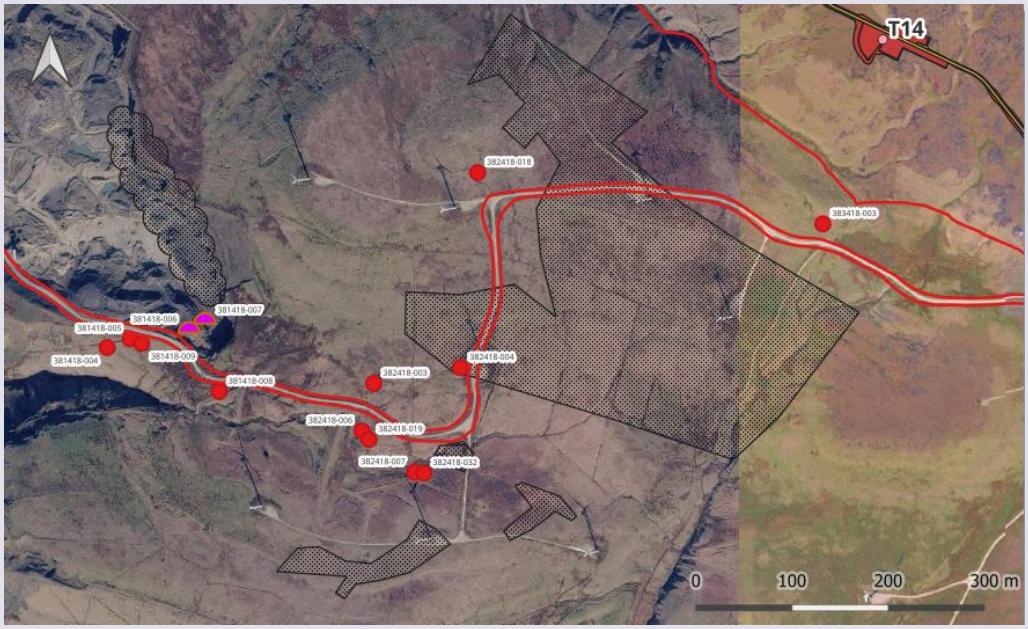
Turbine Location	Comments	Risk
	 **Figure 5-22: BGS map extract of sheet SD81NE showing turbine T9 location**  **Figure 5-23: Extract of the Mining Remediation Authorities Online Interactive Map showing areas considered to be at risk of shallow mine workings (shown in purple) at the turbine T9 location.**	
Other: New access Track	Main identified risk appears to be at the western extent of the access track linking with the existing wind farm which appears to run directly over the Hailstorm Colliery workings. **The workings are highly likely to be present at shallow depth and are considered high risk.**	**1**

Table 5-2: Summary of element specific mining hazards identified by the mining records search, site walkover and more general desk study information.

Turbine Location	Comments	Risk
	 **Figure 5-24: Estimated extents of the Hailstorm Colliery workings which appear to run directly below the far western extent of the proposed access track.**	
Other: Existing Track	There are old workings to the east of Scout Moor Quarry shown on the Scout Moor Colliery Plans. However, it's considered likely that these will have been assessed and treated as part of the existing windfarm development. It is provisionally assumed no additional assessment/ground investigation is needed for this area subject to provision of desk study assessments, mining risk assessments and (if undertaken) the remediation (grouting) report.  **Figure 5-25: Estimated extents of 'Old workings' east of Scout Moor Quarry and below the existing access track.**	3

6 Conclusion

Although the area appears to have a substantial legacy of historical coal mining, based on the present turbine arrangement most turbine locations do appear likely to avoid known areas of workings. However, there does still remain some potential for recorded and unrecorded workings to be within influencing distance of some scheme elements which will need to be accommodated in any design.

The area also has a legacy of sandstone flag mining although this mining appears to more generally have occurred at lower level on the hillsides below the moor and appears less likely than coal extraction to impact the scheme.

Although most locations do appear likely to avoid recorded workings, review of the abandonment plans does still indicate some areas where recorded workings are shown in direct proximity to scheme infrastructure and a wider review of historical maps and recorded entries listed by the Mining Remediation Authority also indicates at least some level of theoretical risk of unrecorded workings at several other turbine locations; the extents of which cannot be accurately established without intrusive investigation.

The proposed ground investigation is summarised in Section 8 and is predominantly focussed on investigating workings in the Sand Rock Coal and Lower Mountain Coal seams to confirm the depth of the seams and potential presence and extent of workings.

Several turbine locations are also shown close to inferred faults (as is common within the Pennine Coal Measures and Millstone Grit access the Pennines) and at these locations it is intended that the ground investigation will also undertake additional rotary coring to investigate the presence of brecciated rock which may indicate fault zones. Turbines 6 and 15 appear to be located on areas of Made Ground where sandstone was extracted from quarries in the past. Ground investigation is recommended at these turbine locations to determine the potential of the Made Ground for total and differential settlement considering that the quarries will not have been backfilled to an engineered standard.

The intention is to prove either the presence of workings/workable seams or prove a sufficient depth of cover of intact rockhead above the seams; assumed to be ten times combined seam and underlying fireclay thickness. It is not intended to prove workings present at greater depth.

Prior to establishing exploratory hole locations, it is advised that the turbine locations be micro sited to avoid mining and fault hazards as far as possible. This is the case particularly with T3, T4 and T16 which appear to be located close to inferred fault locations.

It is considered likely the investigation findings will allow risk level to be downgraded in many cases.

Likely mitigation at any locations where mining hazards can’t be risked out though wither micro siting and/or ground investigation is summarised in Section 7.2. Where either workable seams or workings within the depth of influence of underside of foundation are proven, it is likely that grouting in accordance with the CIRIA Abandoned Mine Workings Manual (C758D) will be advised if avoidance by micro siting appears impractical. Similar grouting may also need to be undertaken at fault locations if brecciated rock is established and turbine locations cannot be moved.

7 Recommendations

7.1 Survey works

It is advised that the survey works summarised in Section 8 be undertaken prior to detailed design of remedial works.

7.2 Likely mining mitigation for the permanent works.

Although the turbine locations generally appear sited to avoid recorded mine entries and mine workings, the working extents are not always clear and there appears to be a substantial legacy of unrecorded mining across the scheme extents.

An intrusive ground investigation is advised to confirm the depth of coal seams likely to be within influencing depth of infrastructure foundations to increase understanding of the likely presence and level of workings.

Any intrusive investigation is unlikely to provide a complete understanding of mining legacy on the site and a watching brief during excavation for the permanent works is also recommended as part of the design with accommodation made for localised treatment of workings if encountered.

If a sufficient depth of cover to either known workings or a workable seam is proved and there are no known faults, it is unlikely that grouting or any other grouting or any other ground improvements will be advised.

If faulting is present at any turbine locations and micro siting to avoid the faulting is not possible, grouting is likely to be recommended regardless of mining legacy to mitigate the risk of differential settlement resulting from variable formation strength.

Given the legacy of mining and prevalence/apparent intensity of unrecorded mining, where workable seams are encountered within the depth of influence of any foundations, it is considered likely that grouting will be advised anyway regardless of evidence of workings with no grout take indicating absence of workings.

It is considered likely that ground investigation will allow the present risk ratings to be downgraded at many locations limiting the need for ground improvements.

8 Mining Ground Investigation Scope

8.1 Additional survey works

8.1.1 Ground Investigation

The purpose of the proposed ground investigation when considering Coal Mining risk is to identify the presence of mine entries or either worked or workable coal seams and to determine if there is sufficient solid rock cover above coal workings to mitigate the risk of collapse settlement to any structure foundations. It is advisable for the ground investigation to be scoped to also provide sufficient information to progress detailed design and as such the following exploratory hole schedule lists potential geotechnical hazards as well as mining risk that require investigation in order to adequately mitigate the risk.

A summary is provided in Table 8-1.

Table 8-1: Exploratory Hole Schedule

Location	Borehole ID	Type	Scheduled Depth (m)	Installation	Purpose
T1	-	Dynamic sample borehole with rotary core follow on	17m	-	Boreholes to confirm the presence of the Sand Rock Coal and/or a minimum thickness of cover of solid strata of 15m based on an assumed extraction thickness of 1.4m (10 times thickness of workings). Rotary core is proposed to also establish a ground model and material parameters for design.
	-	Dynamic sample borehole with open rotary core follow on	17m	-	
	-	Dynamic sample borehole with rotary open hole follow on.	17m	-	Rotary open hole borehole to allow triangulation
T3	-	Dynamic sample borehole with rotary core follow on	22m	-	Boreholes to establish a ground model and material parameters for design and also investigate presence of brecciated rock which may indicate a fault line.
	-	Dynamic sample borehole with rotary core follow on	22m	-	
	-	Dynamic sample borehole with rotary core follow on	22m	-	
T4	-	Dynamic sample borehole with rotary core follow on	22m	-	Boreholes to confirm presence of workable coal seams and/or mine workings/headings and establish a ground model and material parameters for design. Additional coring proposed to investigate presence of brecciated rock which may indicate a fault line.
	-	Dynamic sample borehole with	22m	-	

Table 8-1: Exploratory Hole Schedule					
Location	**Borehole ID**	**Type**	**Scheduled Depth (m)**	**Installation**	**Purpose**
		rotary core follow on			
	-	Dynamic sample borehole with rotary core follow on	22m	-	
	-	Dynamic sample borehole with rotary core follow on	22m	-	
	-	Dynamic sample borehole with rotary core follow on	22m	-	
T6	-	Dynamic sample borehole with rotary core follow on	12m	-	Boreholes to confirm ground conditions and establish a ground model and material parameters for design. Mining risk is considered low at this location.
	-	Dynamic sample borehole with rotary core follow on	12m	-	
	-	Dynamic sample borehole with rotary open hole follow on	12m	-	Rotary open hole borehole to allow triangulation
T7	-	Dynamic sample borehole with rotary core follow on	12m	-	Boreholes to confirm ground conditions and establish a ground model and material parameters for design. Mining risk is considered low at this location.
	-	Dynamic sample borehole with rotary core follow on	12m	-	
	-	Dynamic sample borehole with rotary open hole follow on	12m	-	
T8	-	Dynamic sample borehole with rotary core follow on	17m	-	Boreholes to confirm the presence of the Sand Rock Coal and/or a minimum thickness of cover of solid strata of 15m based on an assumed extraction thickness of 1.4m (10 times thickness of workings). Rotary core is proposed to also establish a ground model and material parameters for design.
	-	Dynamic sample borehole with open rotary core follow on	17m	-	

Table 8-1: Exploratory Hole Schedule					
Location	**Borehole ID**	**Type**	**Scheduled Depth (m)**	**Installation**	**Purpose**
	-	Dynamic sample borehole with open rotary core follow on	17m	-	
T9	-	Dynamic sample borehole with rotary core follow on	12m	-	Boreholes to investigate the presence of workings on the basis that the Mining Remediation Authority Interactive Map indicates the location to be on or near an area at risk of shallow mining. Rotary core is proposed to also establish a ground model and material parameters for design.
	-	Dynamic sample borehole with open rotary core follow on	12m	-	
	-	Dynamic sample borehole with open rotary core follow on	12m	-	
T10	-	Dynamic sample borehole with rotary core follow on	17m	-	Boreholes to confirm the presence of the Sand Rock Coal and/or a minimum thickness of cover of solid strata of 15m based on an assumed extraction thickness of 1.4m (10 times thickness of workings). Rotary core is proposed to also establish a ground model and material parameters for design.
	-	Dynamic sample borehole with rotary core follow on	17m	-	
	-	Dynamic sample borehole with rotary open hole follow on.	17m	-	Rotary open hole borehole to allow triangulation.
T11	-	Dynamic sample borehole with rotary core follow on	12m	-	Boreholes to confirm ground conditions and establish a ground model and material parameters for design. Mining risk is considered low at this location.
	-	Dynamic sample borehole with open rotary follow on	12m	-	
	-	Dynamic sample borehole with rotary open hole follow on.	12m	-	Rotary open hole borehole to allow triangulation
T14	-	Dynamic sample borehole with	12m	-	Boreholes to confirm ground conditions and establish a ground

Table 8-1: Exploratory Hole Schedule					
Location	**Borehole ID**	**Type**	**Scheduled Depth (m)**	**Installation**	**Purpose**
		rotary core follow on			model and material parameters for design.
	-	Dynamic sample borehole with open rotary follow on	12m	-	Mining risk is considered low at this location.
	-	Dynamic sample borehole with rotary open hole follow on.	12m	-	Rotary open hole borehole to allow triangulation
T15	-	Dynamic sample borehole with rotary core follow on	12m	-	Boreholes to confirm ground conditions and establish a ground model and material parameters for design. Mining risk is considered low at this location.
	-	Dynamic sample borehole with open rotary follow on	12m	-	
	-	Dynamic sample borehole with rotary open hole follow on.	12m	-	Rotary open hole borehole to allow triangulation
T16	-	Dynamic sample borehole with rotary core follow on	22m	-	Boreholes to confirm presence of workable coal seams and/or mine workings/headings and establish a ground model and material parameters for design. Additional coring proposed to investigate presence of brecciated rock which may indicate a fault line.
	-	Dynamic sample borehole with rotary core follow on	22m	-	
	-	Dynamic sample borehole with rotary core follow on	22m	-	
Section of access track above Hailstorm Colliery workings.	-	Dynamic sample borehole with rotary core follow on	17m		Borehole to confirm presence of workable coal seams and/or mine workings/headings and establish a ground model and material parameters for design.
	-	Rotary open hole	17m		Rotary open hole boreholes to investigate presence of workings along the access track beneath the estimated extents of Hailstorm Colliery.
	-	Rotary open hole	17m		
	-	Rotary open hole	17m		
Substation location	-	Dynamic sample borehole with	17m	-	Borehole to confirm presence of workable coal seams and/or mine workings and establish a ground

Table 8-1: Exploratory Hole Schedule					
Location	**Borehole ID**	**Type**	**Scheduled Depth (m)**	**Installation**	**Purpose**
		rotary core follow on			model and material parameters for design.
	-	Dynamic sample borehole with open rotary follow on	17m	-	Borehole to confirm presence of workable coal seams and/or mine workings/headings and establish a ground model and material parameters for design.
	-	Rotary open hole	17m	-	Rotary open hole borehole to allow triangulation
Compound location	-	Dynamic sample borehole with rotary core follow on	17m	-	Borehole to confirm presence of workable coal seams and/or mine workings and establish a ground model and material parameters for design.
	-	Dynamic sample borehole with open rotary follow on	17m	-	Borehole to confirm presence of workable coal seams and/or mine workings/headings and establish a ground model and material parameters for design.
	-	Rotary open hole	17m	-	Rotary open hole borehole to allow triangulation
Laydown location	-	Dynamic sample borehole with rotary core follow on	12m	-	Borehole to confirm presence of workable coal seams and/or mine workings, investigate slope stability and establish a ground model and material parameters for design.
	-	Dynamic sample borehole with open rotary follow on	12m	-	Borehole to confirm presence of workable coal seams and/or mine workings/headings, investigate slope stability and establish a ground model and material parameters for design.
Scout Moor workings below existing track	Assumed area already investigated and no additional GI needed subject to review of available information. However, this is to be confirmed.				

The above boreholes are specifically for assessment of mining risk and the depths are provisional only subject to encountered ground conditions.

In addition; for the wider scheme the following additional ground investigation is provisionally advised:

- 2.0-4.5m deep machine excavated trial pit every 100m along sections of track (located off the footprint of the alignment).
- 5m deep windowless sample borehole at any water crossings.
- 1-2 dynamic sample boreholes with rotary core follow on at any borrow pit locations
- Additional ground investigation at and other structure locations not identified as part of this reporting.

With dynamic sample boreholes, standard Penetration Tests should be undertaken at the base of each inspection pit for each borehole and at every 1m depth thereafter. Disturbed samples in the form of bulk samples and airlock tubs should be taken every 1m or change in stratum.

Appendix A - Drawings

Grid Connection Option A

Grid Connection Option C

RAWTENSTALL

BACUP

WHITWORTH

Rossendale Valley

Cote Farm

Car Park

Scout Barns

Track

SCOUT ROAD

A680

234m

ROCHDALE

NOTE:

1. ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE SPECIFICATION FOR HIGHWAY WORKS AND THE TURBINE MANUFACTURERS STANDARDS AND ALL RELEVANT DRAWINGS WITHIN THE PROJECT DESIGN PACKAGE.
2. ALL WORKS TO BE EXECUTED IN ACCORDANCE WITH THE DMRB, THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS, DESIGN MANUAL FOR ROADS AND BRIDGES, AND TRAFFIC SIGNS MANUAL.
3. ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE. ALL LEVELS ARE IN METRES AND RELATE TO ORDNANCE DATUM.
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7. ALL WORKS ARE TO BE CARRIED OUT IN COMPLIANCE WITH THE REQUIREMENT OF THE STATUTORY AUTHORITIES AND CONSTRUCTION DESIGN MANAGEMENT REGULATIONS.

KEY:

- SITE BOUNDARY
- TURBINE LOCATIONS
- TURBINE HARDSTANDING
- TRACK
- CONSTRUCTION COMPOUND
- SUBSTATION
- LAYDOWN AREA

0 300 600 Meters

Cubico SUSTAINABLE INVESTMENTS

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Client

CUBICO UK DEVELOPMENT (WIND 1) LIMITED

Project

SCOUT MOOR II WIND FARM

Drawing Title

Infrastructure Layout

	Name	Date	Scale 1:10000 @ A1
Designed	CN	22.04.2026	File 260422 Scout Moor Site Plans
Checked	SM	22.04.2026	Drawing Status PLANNING

Drawing No. SK02 Revision P3

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KEY:

- MARKED SHAFT
- MARKED ADIT
- AREA OF WORKINGS
- OLD COAL — UNRECORDED WORKINGS SHOWN ON HISTORICAL MAPS
- PROPOSED ALIGNMENT

REV	DESCRIPTION	DRN	CHK	APP	DATE
P02	UPDATED INFRASTRUCTURE PLAN	KJ	ND	ND	14.05.26

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Project: SCOUT MOOR WIND FARM

Drawing Title: FIGURE 1 - CONSTRAINTS PLAN

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Revision: P02

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Appendix B - Existing Mining Reports

Rooley Moor Wind Farm

MINING RISK ASSESSMENT REPORT

February 2012

Rooley Moor Wind Farm

MINING RISK ASSESSMENT REPORT

- DRAFT
- February 2012

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SKM Enviros

Executive Summary

Introduction	Coronation Power is seeking to develop the site at Rooley Moor as a Wind Farm comprising up to 12 wind turbines at the site along with associated access roads, substations and work compounds. The site is located approximately 4km north west of Rochdale town centre. The area lies within the Lancashire coal mining field and there is a history of sandstone quarrying at the site. The assessment presents the findings of a mining desk study to give an indication of the areas of potential hazard associated with past mining.
Background	The site has had a long standing history of underground coal mine working and surface sandstone quarrying. There are numerous mining entries located across the site as well as underground workings which directly undermine parts of the site. In addition there is clear evidence that unrecorded coal mining has been undertaken at the site, for which it is difficult to determine the extent. The site also has been extensive quarried for building stone with many of the former quarries left open, partially or completely backfilled to an unknown extent with unidentified materials. The legacy of mineral extraction at the site has resulted in an un-quantified risk of ground subsidence in a number of forms, which may affect the proposed development.
Scope of Study	The scope of the study is to undertake a mining focussed desk study to identify the location and extent of former mining activities undertaken within the site boundary and to assess their risk to the proposed development.
Conclusions	The mining assessment has indicated that parts of the site have been undermined by recorded coal mine workings in two seams of coal at shallow to medium depth. There is clear evidence that coal mining has been undertaken in these seams at numerous other locations within the site boundary for which there are no records. There are 33 recorded mine entries on site and to within 20m of the site boundary comprising shafts and adits. Of these, only six are recorded as having been treated or capped. There are numerous small sandstone quarries located across the site and the much larger former Ding Quarry. The majority of these are either open or partially backfilled however, several have been completely backfilled to an unknown standard. Both the historical recorded and unrecorded mine workings and the sandstone quarrying presents an overall medium to high risk of subsidence to the development. A more detailed hazard zoning of the site areas is also provided.
Recommendations	It is recommended that micro-siting of turbines and infrastructure is undertaken away from areas of highest risk. Notwithstanding this, due to the potential for unrecorded mine workings across the site it is recommended that a suitable ground investigation is undertaken prior to development to further quantify the risks from potential mining related subsidence. Should any future ground investigation determine the present of mining related voids, they should be appropriately infilled and treated to prevent subsidence affecting the proposed development.

1. Introduction

SKM Enviros (SKME) was commissioned by Coronation Power Ltd in January 2012 to undertake a Mining Risk Assessment Report of the land at the proposed Rooley Moor Wind Farm, near Rochdale, Manchester. The work undertaken was in accordance with our proposal, agreed by email dated 20th January 2012.

1.1. Background

Coronation Power is seeking to develop the site at Rooley Moor as a Wind Farm. The site is located approximately 4km north west of Rochdale town centre. The project comprises up to 12 wind turbines at the site along with associated access roads, substations and work compounds.

The area lies within the Lancashire coal field with a number of shafts and adits located at the site. In addition, there is a history of sandstone quarrying at the site.

The objective of the assessment is to present the findings of a mining desk study, using all available information sources, to give an indication of the areas of potential hazard associated with past mining.

1.1.1. Scope of Works

The assessment comprised the following scope of works:

- Review of land use history;
- undertake a site walkover by a geotechnical engineer;
- review of published geological and hydrogeological information;
- review of a coal mining report and mining abandonment plans obtained from the Coal Authority.

1.2. Limitations

This report represents the findings and opinions of experienced geo-environmental consultants based upon the information obtained from a variety of sources as detailed within the report. SKME believes the information obtained from third parties is reliable but does not guarantee its authenticity. The information has been accepted de facto but we have used our professional judgement in its interpretation.

2. Site Profile

The following section presents the finding of a desk based study and provides the following information:

- A description of the site setting and surrounding area determined from recent and historical ordnance survey maps and a site walkover;
- the nature of the geology and hydrogeology beneath the site and a description of surface water features in the vicinity of the site obtained from British Geological Survey (BGS) and Ordnance Survey (OS) information;
- the findings of the coal mining report and mining abandonment plans obtained from the Coal Authority for the site.

2.1. Site Description and Surrounding Land Uses

The proposed site at Rooley Moor is located approximately 4km north west of Rochdale on the Pennine Hills. Most of the site is located in the unitary district of Rochdale, but it also crosses over into Rossendale in the very north of the site. The location of the site and general anticipated arrangement of the wind farm are shown in **Figure 1**.

The proposed development area currently comprises predominately open moor land, used for rough grazing. Rooley Moor Road, which is a public bridleway only used for pedestrian access, runs roughly south east to north-west through the central part of the site. There are a number of other public footpaths crossing various other parts of the site. A series of pylons with overhead electricity cables crosses south west to north east over the southern-most portion of site. A mast is also located in the southern portion of the site at Hunger Hill.

To the north of the site, the ground slopes down to the town of Rossendale and Cowpe Reservoir to the north west. Scout Moor wind farm is located on the adjacent moor land to the west along with the Greenbooth and Naden reservoirs. The Rochdale Conurbation is located to the south and south east of the site, whilst the Spring Mill and Cowm Reservoirs are located to the east along with open moorland. The active Britannia Quarries are located to the north east of the site.

2.2. Site Activities and Proposed End Use

The site is currently open moorland with parts used for grazing of livestock and it is anticipated that these activities will continue, however the main elements of the proposed wind farm development will comprise:

- Up to 12 three-bladed horizontal axis wind turbines (with foundations and associated low to medium voltage transformers and switchgear);

- emplaced crane erection areas and site access routes from the main road network, albeit these may include some of the existing on-site tracks (on-site borrow pits may be utilised during construction where feasible);
- on-site power collection system (substation and control building) with grid connection cables to external electricity network;
- drainage channels alongside on-site tracks; and
- a permanent, free-standing or guyed meteorological mast(s).

2.3. Site Walkover

A site walkover was conducted on the 31st January 2012. The weather conditions were poor with low visibility and a complete covering of snow across the entire site. As such, it was difficult to verify many of the features on site, however, the following observations were made:

- The ground surface across the site is typical undulating moorland with occasional sharper breaks of slope, especially around the periphery of the site and towards the reservoirs to the west.
- The near surface soils generally comprised a peaty topsoil, above peat and soft clays, with occasional bedrock exposures. However, towards the western part of the site, evidence of disturbed made ground was observed with cobbles and boulders noted at the surface and incorporated within the peat. Exposures of peat were also visible in this area possible related to localised cutting or excavations.
- The northern part of the site was predominantly covered with peat across the areas of Brandwood Moor, although shallow bedrock was also noted in some areas.
- The site is crossed by several surface water features, some of which may be ephemeral, and access tracks comprising former bridleways and footpaths, including Rooley Moor Road.
- Spoil heaps and slopes related to the former Ding Quarry are evident towards the west of the site.

2.4. Environmental Setting

2.4.1. Geology

Made Ground

The geological mapping available for the site does not indicate the presences of significant quantities of Made Ground. However, given the extensive history of underground mining and surface quarrying associated with site, it is highly likely that Made Ground will exist. This is likely to be located at former quarries and infrastructure locations, where material will have been used to backfill and level the ground surface. It is likely that the locally available naturally occurring materials will have been used for this such as sandstone, mudstone (of various sizes) and colliery

spoil, although peat and other superficial materials may have been used. During the walkover areas of Made Ground were observed which suggested the natural quarried bedrock had been mixed with peaty topsoils and used for backfill.

Drift

Bedrock is shown to outcrop at the surface across large areas of the site, however, Glacial Till comprising stiff overconsolidated grey brown sandy silty clay with occasional gravel and cobbles is shown across the very southern end of the site and locally around the Prickshaw areas to the south east. In addition, a small area of Glacio-fluvial deposits comprising bedded sands and rare gravels with impersistent beds of clay, is located in the area around Turnshaw Hill at the southern end of the site. A small localised area of Head deposits are also shown around the Rooley Moor Brow area comprising soliflucted materials which are likely to be glacially derived.

Finally, large areas of peat are shown on the central and northern parts of the site in the areas of Rooley Moor, Hamer Hill and Brandwood Moor. The guidance note accompanying the geological map for the site indicates that the peat is typically less than 2m thick and, though once extensive, is now much degraded and dissected due to erosion.

Solid

The bedrock beneath the site comprises rocks from the Upper Carboniferous period. The outcrop in the central part of the site comprises the Namurian Millstone Grit Series which are overlain by the Westphalian Pennine Lower Coal Measures in the southern part of the site and faulted against them in the northern part of the site. The Millstone Grits comprise a thick succession of interbedded sandstones, siltstones, mudstones, subordinate thin coals and seatearths. The Coal Measures comprise a succession of mudstone, siltstone and sandstone with subordinate coal, seatearth and ironstone.

The Millstone Grit underlying at the site comprises two principal rock strata, the Upper Haslingden Flags and the Rough Rock. The Rough Rock contains the Sand Rock Mine (SRM) coal seam which sub-crops at several areas across the site. The Lower Coal Measures comprise alternating strata of sandstone and shale and include the following notable coal seams; Bassy Mine (BM), Lower Four Foot Mine (LFFM), Lower Mountain Mine (LMM) in the northern and southern parts of the site and the Bullion Mine Rock (BMR) and the Six Inch Mine (SXM) in the southern areas only.

Structure

The site is located on the crest of the large south west trending open fold of the Rossendale Anticline. The oldest rocks of the Namurian Millstone Grit are exposed in the core of the anticline

in the central part of the site. At this location the anticline has a broadly symmetrical form with the south east and north west facing limbs of the fold dipping gently between 2° and 5°.

The site is also cut by several normal faults, orientated with the regional north west – south trend, forming a series of graben and half-graben blocks across the area. Displacements are often difficult to determine but often several hundred metres is not uncommon. Many of the faults have been mapped from the underground workings and often bifurcate at several points. At the site the following faults are recorded:

- Unnamed fault running through the Hunger Hill and Bladon High reservoir areas, trending north west to south east and downthrowing to the north east;
- Unnamed fault running from the Whimsy Hill to Clegg Ding areas. It trends north west to south east and downthrows to the north west;
- Unnamed fault trending northwest from the Prickshaw slack area before bending eastwards towards the Clegg Ding area and intersects the above fault and terminates to the south of the Ding Quarry. It down throws to the south east.
- Unanamed fault running from the Blagden Quarry area to the Red Pits area trending North West and downthrowing to the north east.

2.4.2. Mining

Underground coal mining and surface quarrying is known to have been undertaken at the site and mining features have been identified at the surface. This is discussed further in the Coal Mining Assessment presented in Chapter 3.

2.4.3. Hydrogeology and Hydrology

The bedrock beneath the site is designated as a Secondary A aquifer. These are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers. Some areas on Rooley Moor and Brandwood Moor are shown as having high vulnerability for a minor aquifer, although the majority of the site is undesignated.

There are several surface water features across the site indicated on the current and historical OS mapping listed as issues and sinks. These are located:

- adjacent to Rooley Moor Road near Pike Brow (shown on a 1851 OS plan)
- on the northern edge of Reddyshore Top,
- to the south of Whimsy Hill,
- to the south of Forsythe Brow,

- at the bottom of Rooley Moor (possibly connected to former quarrying)
- on the eastern side of Prickshaw Slack
- on Little Ding to the south of Ding Quarry
- adjacent to Rooley Moor Brow
- to the east of Blagden Hillocks
- in the areas around Old Sink Slack
- to the north of Ding Quarry
- on Brandwood Moor

These surface water features drain radially away from the site into the surrounding watercourses and reservoirs.

2.4.4. Natural Landslide Hazards

There are a number of locations on the site where natural subsidence from landslips have been identified. Namely these are Windy Hillock, Reddyshore and Cat Stones. Windy Hillock and Cat Stones are areas of naturally exposed bedrock where loose rocks and boulders may be susceptible to instability, typically by toppling, wedge or planar failure.

Reddyshore appears to be a large circular rotational failure where the overlying drift materials have slipped exposing a back scar of bedrock which may subsequently be prone to the failure mechanisms described above. From inspection of the historical maps, the morphology of Reddyshore has not changed over the last hundred and fifty years, suggesting that this is a relict landslide which is probably inactive and not in a progressive phase of instability. However, evidence from the Coal Authority (discussed in Chapter 3) indicates that mining has been undertake from adits advance within the face of the bedrock exposed in the back scar, therefore, the potential for mining related instability triggering further instability remains in this area.

In addition, the sink holes described above comprise additional planes of weakness within the bedrock resulting in the potential for underground voids to be present and therefore further potential instability.

3. Mining and Ground Stability Review

A mining review for the proposed Rooley Moor Windfarm site has been undertaken to identify potential risks of underground and surface mining within the study area. The study has involved a desk top mining assessment, comprising a review of the following information sources:

- Historical OS Maps;
- BGS Geological Mapping and associated memoirs;
- Coal Authority Mining Reports (Appendix A);
- Coal Authority Mining Abandonment Plans (Appendix B);

The BGS Borehole records archive was also inspected, however, there are no useful ground investigation boreholes present within the study area.

The assessment indicates there has been extensive past mining of coal as well as surface quarrying of sandstone in and around the site, although currently there is no mining of any kind taking place. It also indicates the site is underlain by workings in two seams of coal which could affect the stability of any proposed development. There are a number of mine entries such as shafts and adits within the site boundary, most of which have not been treated and capped to a standard which would allow construction to be carried out over or near them. There has been extensive quarrying of sandstone with the quarries partially or completely infilled, or left open. It is not known which materials have been used to infill these quarries but it is unlikely they have been infilled to a standard which would be suitable to allow development to proceed above them.

3.1. Geological Data

The available geological maps and memoirs allow a detailed picture of the sequence of strata at the site to be determined. Cross sections through the northern and southern site areas are provided as Figures 3 and 4. From the available data the table below summarises the strata beneath the site ordered from youngest to oldest.

Table 3-1 Geological Strata Present at Site

Rock Unit	Coal seam	Thickness
Darwen Flags		0 - 10m
Lower Coal Measures Mudstone & Siltstone		Unrecorded
Helplet Edge Rock (Warmden sandstone)		0 - 24m
Lower Coal Measures Mudstone & Siltstone		Unrecorded
Gear Arc Sandstone (Bullion Mine rock)	*Upper Foot Coal (Bullion Mine)*	0 - 20m *0.0 – 0.7m*
Lower Coal Measures Mudstone & Siltstone	*Lower Mountain Mine (Yard)* *Lower Foot Mine (Little)* *Bassy Mine (Shale Bed)*	Unrecorded *0.0 – 1.3m* *0.0 – 0.8m* *0.0 – 1.2m*
Woodhead Hill Rock		10 – 45m
Lower Coal Measures Mudstone & Siltstone		Unrecorded
Rough Rock	*Six Inch Mine* *Sand Rock Mine*	20 – 40m *0 – 0.25m* *0 – 0.7m*
Unlabelled Shales & Mudstones		Unrecorded
Upper Haslingden Flags		0 – 40m

3.2. Site History

The site history has been determined from a review of historical Ordnance Survey maps of the site contained on the Lancashire county council website (http://mario.lancashire.gov.uk). Copies of the

maps are not reproduced here, however, a summary of the mining related features identified are provided below and their locations identified on Figure 2.

Table 3-2 Summary of Historical Maps

Map	Unnamed Sandstone Quarrying Features	Coal Mining Features
1851 – 1:10,560	■ Un named quarries east side of Hunger Hill (Ref S1) ■ To east of reservoir near bottom of Rooley Moor (ref S2) ■ Adjacent to west of Rooley Moor Road near Clough Quarry (ref S3) ■ Adjacent to path on Forsythe Brow (ref S4) ■ To south of Whimsy Hill (ref S5) ■ Old quarry adjacent to Rooley Moor Road near Top of Pike (ref S6) ■ Three small quarries near Blagdon Hillocks (Refs, S7, S8, S9) ■ Adjacent to the east of Ding House (S10) ■ Ding Quarry, near Red Pits (ref S11) ■ Shore Quarry, bottom of Rooley Moor (ref S12) ■ Knacks Quarry, adjacent to Knack Lane (ref S13) ■ Clough Quarry, adjacent to Rooley Moor Road (Ref S14) ■ Whimsy Hill Quarry, Whimsy Hill (ref S15) ■ Cat Stone Quarry, between Warm Slack Hill and Prickshaw Slack (ref S16) ■ Pike Brow Quarry, between Warm Slack Hill and Prickshaw Slack (ref S17)	■ Old Sink Colliery, near Top of Leach (ref C1) ■ Old Coal pit, near Top of Leach (ref C2) ■ Old Sink Colliery, near Old Sink Slack (ref C3) ■ Coal pit, near Old Sink Slack (ref C4) ■ Colliery, near Old Sink Slack (ref C5) ■ Bartle Cowm Colliery, near Bartle Cowm Pasture (ref C6) ■ Withens Meadow Coal pit, near Withens Pasture (ref C7) ■ Whimsy Coal Pit, Whimsy Hill (ref C8) ■ Greenland Coal pit, Whimsy Hill, (ref C9) ■ Rooley Moor Colliery, Bottom of Rooley Moor (ref C10) ■ Colliery, Bottom of Rooley Moor, (ref C11)
1894 – 1:10,560	■ Ref S1 no longer shown ■ Ref S2 shown enlarged, abandoned. ■ Ref S3 and Clough Quarry shown enlarged, abandoned. ■ Shore Quarry and Knacks Quarry no	■ Rooley Moor Colliery now labelled as old Quarries. ■ Ref C11 now renamed as Rooley Moor Colliery (ref C12). ■ Air shaft to north of Rooley Moor

Map	Unnamed Sandstone Quarrying Features	Coal Mining Features
	longer shown ■ Old quarry shown adjacent to Rooley Moor Road (ref S18) ■ Old quarry shown, north of Whimsy Hill (ref S19) ■ Cat Stones and Pike Brow quarries labelled as disused ■ Quarry shown at Prickshaw Slack (ref S20) ■ Ding Quarry shown greatly enlarged. ■ Quarry refs, S7, S8 & S9 no longer shown. ■ Old Quarry shown to north of Brandwood Lower End Moor (ref S21).	Colliery (ref C13). ■ Whimsy and Greenland coal pits no longer shown ■ Bartle Cowm, Withens Meadow and Old Sink Slack collieries and associated coal pits no longer shown, (refs, C1 – C7)
1910/1911 – 1:10,560	■ Ding Quarry shown slightly enlarged ■ Ref S20 now labelled as Old Gravel Pit ■ Former Shore and Knacks Quarries shown unused, and not labelled.	■ Old shaft (Coal) shown at location of former Old Sink Slack Quarry (ref C5) ■ Old shaft shown located near Quarry on Whimsy Hill (ref C9), ■ Old Colliery shown adjacent to Whimsy Hill (ref C14), ■ Old shaft shown at location of original Rooley Moor Colliery (ref C10), ■ Rooley Moor colliery labelled as disused (ref C12) ■ Old shaft shown to south of Hunger Hill (ref C15)
1930 – 1:10,560	■ No significant change in either coal mining in sandstone quarrying features.	
1956 – 1:10,560	■ Most of the old quarries are not labelled with only their topographical outline shown. Only the Ding, Cat Stones and Pike Brow quarries are still named.	■ No significant change
1967/1968 – 1:10,560	■ The Ding, Cat Stones and Pike Brow Quarries are labelled as disused.	■ All the coal mining features are no longer shown with the exception of C5 and C14.

Map	Unnamed Sandstone Quarrying Features	Coal Mining Features
1981/1993 1:10,000	■ The outline of the sandstone quarry (ref S21) no longer shown.	■ No significant change
Current mapping 1:10,000	■ No significant change	

3.3. Coal Mining Information Review

3.3.1. Mining report

A Coal Authority (CA) mining report has been obtained for the site and is included in Appendix A. Accompanying the report is a plan showing the location of the mine entries as recorded by the CA. The report states the following information:

- The site is within the zone of influence from workings in 2 seams of coal from shallow depth to 70m below ground level last worked in 1953;
- The property is not within the likely zone of influence from any present underground coal mining;
- There are 33 mine entries within a 20m buffer of the site boundary. One shaft (NCB ref 386415-004) was covered with a concrete raft in 1962 and was subsequently marked with a concrete pyramid in 1968. Four other shafts (refs: 386416-005 & 006 and 387416-003 & 004) were capped by the National Coal Board in 1978. There are no treatment details for the remaining mine entries;
- In 1998 a small collapse of 0.8m in diameter was observed adjacent to an old adit (ref 386415-004) which was subsequently backfilled with local material and fenced;
- Records may be incomplete and there may be other mine entries in the area for which they have no record;
- There have been no records of mine gas emissions at the site;
- The CA has not received a damage notice for the site since 31 October 1994 ;
- In view of the previous mining circumstances a prudent developer would seek appropriate technical advice before any works are undertaken.

Given the above findings, a further request was made to the CA with regards to mining abandonment plans available for the study area. The response from the CA indicated that abandonment records associated with mining in the Sand Rock and Lower Mountain mine are held by the CA.

3.3.2. Abandonment Plans

The relevant mining abandonment plans (Appendix B) which depict the extent of workings within the above seams were obtained from the Coal Authority (eight no. in total). The plans have been reviewed as part of the mining assessment and are described below. For descriptive purposes, each of the seams has been assessed individually with respect to abandoned mine workings.

<u>Plan 1591 – Sand Rock Mine – Hailstorm Colliery</u>

This plan details the mining undertaken from the Hailstorm Colliery. The location of this colliery is not evident from inspection of the historical maps, and there are no obvious surface features on the plan to help identify its position. However, the latitude and longitude of the boundary stone

shown on the plan locates it approximately 500m north west of the former Ding Quarry in the areas labelled as Hail Storm Hill. The approximate scaled distances from the plan suggests the workings are approximately 340m from north to south and approximately 240m from west to east. As such it is possible that part of the working extend under the western edge of the site in this area to the north of the former Ding Quarry, but is unlikely to extend toward the location of T9. However, due to the inaccuracies in locating the colliery, this should be treated with some caution.

The workings were accessed from three main drift adits entering from the west, east and the south. Two air shafts are also indicated on the plan located along a long north south running gallery in the centre of the works. The mine workings were advanced on long galleries accessed from a series of roadways. Not all the galleries are shown on the plan and hand written notes indicate the coal was worked until 31st May 1883 (no start date is indicated). The coal in the Sand Rock mine is indicates as 1ft 4 inches (0.41m) with a common fireclay at the base between 2ft and 4ft thick (0.61m to 1.22m). The coal seam is indicated to dip by 2° to the south west. The plan suggests the coal extraction ratio is quite high and possible completely worked out in some areas. There is no record on the maps or in the memoirs that fireclay was mined but it would be prudent to assume that it may have been due to the history of brick making in the area. There is no information on the depth of the workings but the short lengths of the access drifts suggest the mining is quite shallow. In addition the outcrop of Sand Rock mine coal seam in this area is shown as outcropping as between 1525 and 1550 ft (465 and 472m OD). The topographic level in this area is indicated as varying between 460m OD and 470mOD, which suggests the workings are very shallow, typical less than 10 to 20m in this area.

Plan 1843 – Sand Rock Mine – Brandwood Moor Colliery

This plan details the mining undertaken from the Brandwood Moor Colliery. This colliery is located to the north of the site however the main intake shaft appears to be located to the west of the site near to Cowpe Reservoir and is possibly the disused mine shaft shown on the current OS mapping shown in this area. Access to the working also appears to be have been made from a number of drift adits or "day eyes" shown on the plan, along the alignment of Rooley Moor Road to the north west of the site

The approximate scaled distances from the plan suggests the workings are approximately 880m from north to south and approximately 660m from west to east. However, whilst the workings are extensive underneath the adjacent areas of the site, it does not appear that they extend beneath the site in this area, although due the inaccuracies in exact positioning the workings, this should be treated with some caution.

The workings were accessed from one main intake and 4 main drift adits entering predominantly from the west and north. There are very few details of galleries shown within the mine workings

and hand written notes indicate there are many other old workings in the surrounding areas which are not recorded. The coal was worked until February 1886 (no start date is indicated). The coal in the Sand Rock Mine is indicates as 1ft 5 inches (0.43m) thick with a thin layer of dirt approximately a third of the way up. A fireclay or "warrant" is indicated at the base 9 inches thick (0.23cm). The coal seam is indicated to dip by 1 in 24 to the south. The plan suggests the extraction ratio is extremely high and possibly completely worked out in most areas. There is no record on the maps or in the memoirs that fireclay was mined but it would be prudent to assume that it may have been due to the history of brick making in the area. A line on the plan indicates a line of free drainage towards the south of the workings and a second line indicates the works were extended beneath the line of free drainage. There is no information on the depth of the workings on the plan. The outcrop of the Sand Rock Mine in this area is indicated as varying from 1175 ft to 1275 ft (358 to 389m OD), which ties in well with the topographic height of the ground surface of at the location of the intake (apx 370m OD). However the ground surfaces increases south eastwards towards Brandwood Moor to a maximum height of 470m AOD and the plan indicates the coal seam dips at an angle of approximately 2° to 3° to the south. Therefore should these workings extend underneath the site boundary they are like to be in excess of 100m below ground level.

Plan 12605/01 – Sand Rock Mine, Lower East Knowle Colliery

This plan details the mining undertaken from the lower East Knowl Colliery. This colliery is located to the west of southern portion of the site on Knowl Moor. Access to the workings appears to be have been made from two drift adits or "day eyes" situated at the location of the disused mine shown on the current OS mapping.

The approximate scaled distances from the plan suggests the workings are extensive and cover an areas of 925m x 925m in plan. However, all the workings have been advanced either northward or westward from the drift locations. In addition the coal seam outcrops immediately east of the area and therefore mining could not have advanced in the direction of the site.

There are no details of galleries shown within the mine workings, just the overall extent in plan and hand written notes indicate there are many other old workings in the surrounding areas which are not recorded. The coal was worked until 4th November 1938 (no start date is indicated). The coal in the Sand Rock Mine is indicated as 8 inches (0.21m) thick with a layer of dirt 4 " thick (0.1m) separating from a thicker coal, 1 ft 2 inches (0.36m). An unrecorded thickness of fireclay or "warrant" is indicated at the base of the coal. The coal seam is indicated to dip by 1 in 12 to the south. As there are no records of the galleries it is not possible to determine the extraction ratio but it is possible that it is completely worked out in some areas. There is no record on the maps or in the memoirs that fireclay was mined but it would be prudent to assume that it may have been due to the history of brick making in the area. There are spot heights in the mine relating to OD indicating

the height varies from 377.89m AOD in the north to 335.4m AOD, in the south. An air shaft stated as 20 yards deep (18.3m) is located to the west of the drift adits.

Plan NW127 – Sand Rock Mine, Brandwood Moor Colliery

This plan details the mining undertaken from "a colliery on Brandwood Moor". It is assumed that this refers to the Brandwood Moor Colliery shown to the north of the site on the historical plans. There are very few indicators on this plan linking it to any surface features, however, the Well Clough can been seen to the east of the workings. Assuming the position of this hasn't changed, the plan indicates that the workings extend under a considerable portion of the northern areas of the site. Access to the workings appears to be have been made from three drift adits or "daylights". The first is situated at the location of the former Brandwood Colliery, and the other two are located to the east of the site running to the west. The workings appear to extend approximately 730m southwards from the Brandwood Colliery and have a maximum width in plan of 365m. However, due to inaccuracies in exact positioning of the workings this should be treated with caution.

The plan indicates coal was extracted in galleries driven from central roadways, of which there are many shown on the plan, mostly running north to south. The extraction ratio of the mine appears to be very high and in some areas the coal appears to have been worked out completely.

The coal was worked until 20th April 1850 (no start date is indicated). There are sporadic notes on the drawing which are presumed to indicate the thickness of the coal seam and range from 12.5 inches to 14.5 inches (0.32m to 0.37m). An air shaft is shown located close to the position of Well Clough. Whilst there are quantities for the amount of coal extracted and the dates they were worked, there are no details of the dip of the seam or the level of the mine relative to ordnance datum. However the outcrop of the Sand Rock mine coal seam in this area is at approximately 1175ft (358m OD) and the ground level rises sharply to the south. Assuming a typical dip of approximately 2° to the south the workings would be at a depth of approximately 130m at a ground level of 445m OD (close to the location of T12).

Plan 4212 – Lower Mountain Mine, Naden Head Colliery

This plan details the mining undertaken from Naden Head Colliery. Again there are very few indicators on this plan linking it to any surface features; however, a plan in the corner of the map shows the Reddyshore landslip feature and two small red crosses at its base. It is possible that this reflects the drift adits accessing the workings and it is assumed that the works are located here, and therefore underlie the south eastern part of the site around the Reddyshore landslip. However, due to inaccuracies in exact positioning of the workings this should be treated with caution.

The workings are very small in extent and are split into two areas, a smaller area to the south and a slightly larger working to the north. The southern working was accessed by one main drift adit of

"day eye" although a second adit is shown which appears to terminate without accessing the workings. The northern working doesn't appear to have any connected intakes or adits although two air shafts are shown. The air shafts are recorded as "few feet deep" so it is possible these were also the access points to the workings. The southern works are approximately 90m x 30m in extent and the northern workings are 150 x 85m in extent.

The plan indicates the southern workings completely worked out and the northern workings were advanced with galleries but in a random manner and it is possible that the coal has been completely extracted in this area. The plan was dated October 1900. There is no information on the thickness or orientation of the seam, however due to the short nature of the adits and the shallow air shafts, it is likely that the workings are shallow although there is no proposed infrastructure located in this area that is likely to be affected.

Plan NW51 – Lower Mountain Mine, Rooley Moor Colliery

This plan only shows the extents of two adits advanced to the north of Cat Stones Quarry. There is no information on any underground mining advanced from these adits and they are shown as relatively limited in extent. A section through the coal seams is shown which indicates 6 inches (0.15m) of coal and dirt underlain by 20 inches of coal (0.51m). The coal seam is indicated as dipping at 1 in 5 to the south west. The approximate surface levels of the northern and southern adits are given as 344 and 332m AOD. If there are other more extensive workings related to these adits advanced to the north which are not recorded, they are likely to be at shallow depth (approximately 20m) although there is no proposed infrastructure located in this area that is likely to be affected.

Plan NW54 – Lower Mountain Mine, Hunger Hill Colliery

This plan shows the extent of a small underground working undertaken in the east side of Hunger Hill. There are three adits or "day eyes" shown accessing a short series of new galleries and two further adits accessing a series of isolated old workings to the south east, the extent of which are not defined. The northernmost workings comprise six main galleries with a number of associated short headings and connections. The workings are approximately 80m in length and 20m in width at the widest point. The southerly workings comprise four galleries with a total length of approximately 95m. A section through the coal seams is shown which indicates 22 inches (0.56m) of coal underlain by an unrecorded thickness of fireclay which is not recorded as having been worked, although it may be prudent to assume that it has due to the history of brick making in the area The coal seam is indicated as dipping at 1 in 8 the south west. The approximate levels of the workings are shown vary between 300m and 296m AOD. This site is located away from any proposed infrastructure and unlikely to affect the site layout.

3.3.3. Unrecorded Workings.

As well as the mining abandonment plans there are several former coal mine entries and workings identified from the historical maps, for which there are no records. As such there is no way of determining the extent of any workings or their current condition or depth. These are summarised below:

Old Sink Slack Colliery

This comprises a series of five shafts, adits and coal pits located around the proposed position of T11 and north of T8. There is no information on the depth, or orientation of the workings, but at this location it is likely that the Lower Mountain mine seam was worked. Due to a large fault running north west to south east to the south of this location it is likely that the workings extend north and east from this colliery. A note on the geological map close to this location indicates the coal seam was 60 ft (18m) bgl, indicating that the workings are likely to be very shallow. It is also considered possible, but unlikely, that the shafts were extended down to the Sand Rock Mine in this area, although the workings would likely be in excess of 120m bgl. There is no record that any of these shafts or adits have been treated or capped. It is possible that the position of T11 may be affected by mining undertaken from this shaft.

Unnamed shaft – South of Old Sink Slack

This is a single shaft located approximately 200m to the north of T6. Again there is no information on the depth or orientation of the workings, however, due to its location and the presence of the nearby fault, it is likely that the Lower Mountain mine coal seam was worked, which is likely to be at shallow depth (approximately 20m) with the workings extending to the north and east. As above there is a small possibility that the shafts have been extended down into the Sand Rock Mine, although the working would likely be very deep (>120m bgl) at this location. There is no record of this shaft being treated or capped. It is possible but unlikely that the positions of T11 may be affected by mining undertaken from this shaft.

Unnamed shaft – East of Hamer Hill

This is a single shaft located approximately 400m to the east of T3. Again there is no information on the depth or orientation of the workings, however, due to its location and the presence of the nearby fault, it is likely that the Lower Mountain Mine coal seam was worked, which is likely to be at shallow depth (approximately 20m) with the workings extending to the north and east. As above there is a small possibility that the shafts have been extend down into the Sand Rock Mine, although the working would likely be very deep (>120m bgl) at this location. There is no record of this shaft being treated or capped. This site is located away from any proposed infrastructure and given the probable direction of workings is unlikely to affect the site layout.

Unrecorded Workings (possibly Naden Head Colliery) – Reddyshore

There have been six shafts and adits advanced in this location and it is possible that Plan 4212 relates to these workings. Again there is no information on the depth or orientation of the workings, however, from the geological plans it is likely that the Lower Mountain Mine coal seam was worked, which is likely to be at shallow to medium depth (approximately 20 to 50m) with any workings extending to the south and east. There is no record of any of these shafts or adits being treated or capped. This site is located away from any proposed infrastructure and unlikely to affect the site layout.

Unnamed shaft – Adjacent to Rooley Moor Road near Pike Brow Quarry

This is a single shaft located approximately within the former Pike Brow Quarry area adjacent to Rooley Moor Road. There is no information on the depth or orientation of the workings, however, due to its location and the presence of the nearby fault, it is likely that the Lower Mountain Mine coal seam was worked at shallow to medium depth (approximately 20 – 50m) with any workings likely extending to the north and east. There is no record of this shaft being treated or capped. This site is located away from any proposed infrastructure and unlikely to affect the site layout.

Whimsy and Greenland coals pits – Whimsy Hill

There have been six shafts and adits advanced in this location. Again there is no information on the depth or orientation of the workings, however, from the geological plans it is likely that the Lower Mountain Mine coal seam was worked, which is likely to be at shallow depth (approximately 20m) with any workings extending predominately north and east although workings to the south and west should not be ruled out. There is a record of three of these shafts being capped by the CA in 1978. It is unlikely that any infrastructure or turbine locations are likely to be affected by mining undertaken from this area.

Unnamed shaft – near Forsythe Brow.

This is a single shaft located at the original location of Rooley Moor Colliery. There is no information on the orientation of any workings, however, a note on the map indicates that the Lower Mountain Mine was encountered at a depth of 234 ft (approximately 71m bgl). Due to the presence of a fault any workings are likely to extending to the north and east. There is no record of this shaft being treated or capped. It is possible that workings could impact upon the proposed substation development.

Rooley Moor/ Hunger Hill Colliery – bottom of Rooley Moor

There have been eight shafts and adits advanced in this area adjacent to Hunger Hill. Two of the adits with limited workings are described on abandonment plan NW54, although there is no information on the rest. There is no information on the orientation of the workings, however, a note on the map indicates that the Lower Mountain Mine was encountered at depths of 216 to 281 ft (approximately 66m to 86m bgl). Due to the presence of a fault any workings are likely to extending to the north. There is no record of this shaft being treated or capped. It is unlikely that any infrastructure or turbine locations are likely to be affected by mining undertaken from this area. There is a record of one adit suffering a small collapse and being backfilled with locally available material and fenced in 1998, and one shaft being covered with a concrete raft in 1962 before being marked with a concrete pyramid in 1968. It is unlikely that any infrastructure or turbine locations are likely to be affected by mining undertaken from this area.

Unnamed shaft – Adjacent to Knacks Lane.

This is a single shaft located adjacent to the former Shore Quarry on Knacks Lane. There is no information on the orientation of any workings, however, a note on the map indicates that the Lower Mountain Mine was encountered at a depth of 150 ft (approximately 46m bgl). Due to the presence of a fault any workings are likely to extending to the south and there is a record that this shaft was capped in 1978 by the CA. It is unlikely that any infrastructure or turbine locations are likely to be affected by mining undertaken from this area.

3.4. Sandstone Quarrying

The historical map records indicate there are a number of former sandstone quarries located across the site. The majority of these are focussed on the southern area of the site around the bottom of Rooley Moor, however there are several others in the central and northern parts of the site, including the large Ding Quarry in the north west of the site. Table 3-3 below, summarises the Sandstone Quarries located at the site and their current condition, with their location shown on Figure 2.

Table 3-3, Sandstone Quarries Identified at Site

Quarry	location	Approximate maximum extent	Current condition
Unnamed quarry (ref S1)	East side of Hunger Hill	15m x 10m	Completely backfilled,
Unnamed quarry (ref S2)	To east of reservoir near bottom of Rooley Moor	100m x 40m	Open, abandoned,

Quarry	location	Approximate maximum extent	Current condition
Unnamed quarry (ref S3)	Adjacent to west of Rooley Moor Road near Clough Quarry	250m x 100m	Partially backfilled, abandoned,
Unnamed quarry (ref S4)	Adjacent to path on Forsythe Brow	100m x 25m	Partially backfilled, abandoned,
Unnamed quarry (ref S5)	To south of Whimsy Hill (ref S5)	50m x 50m	Partially backfilled, abandoned,
Unnamed quarry (ref S6)	Adjacent to Rooley Moor Road near Top of Pike	15m x 15m	Partially backfilled, abandoned,
Three small unnamed quarries (ref S7, S8, S9)	Near Blagdon Hillocks	All three approximately 15m x 15m	Completely backfilled,
Unnamed quarry (ref S10)	Adjacent to the east of Ding House	50m x 50m	Partially backfilled, abandoned,
Ding Quarry, near Red Pits (ref S11)	Between Clegg Ding and Hail Storm Hill	600m x 450mm	Open, abandoned,
Shore Quarry (ref S12)	Bottom of Rooley Moor	100m x 50m	Partially backfilled, abandoned
Knacks Quarry, (ref S13)	Adjacent to Knack Lane	100m x 50m	Open abandoned,
Clough Quarry (Ref S14)	Adjacent to Rooley Moor Road	250m x 75m	Partially backfilled, abandoned, partially flooded
Whimsy Hill Quarry (ref S15)	Whimsy Hill	50m x 50m	Partially backfilled, abandoned
Cat Stones Quarry (ref S16)	Between Warm Slack Hill and Prickshaw Slack	100m x 100m	Partially backfilled, abandoned
Pike Brow Quarry (ref S17)	Between Warm Slack Hill and Prickshaw Slack	250m x 50m	Partially backfilled, abandoned, partially flooded
Unnamed	Adjacent to Rooley Moor Road	100m x 100m	Partially backfilled, abandoned,

Quarry	location	Approximate maximum extent	Current condition
quarry (ref S18)			partially flooded
Unnamed quarry (ref S19)	North of Whimsy Hill	100m x 50m	Partially backfilled, abandoned
Unnamed quarry (ref S20)	Prickshaw Slack	50m x 50m	Partially backfilled, abandoned
Unnamed quarry (ref S21)	North of Brandwood Lower End Moor	50 x 50m	Completely backfilled

Of these several quarries refs: S3, S6, S7, S14 and S18 are located close to the route of the proposed access tracks and S3 and S18 are located close to the location of the proposed substation.

4. Potential Mining Hazards

4.1. General

The presence of old mine workings and quarries presents a hazard to the proposed wind farm development. There are a number of aspects which need to be considered:

- The possibility of ground movement by progressive development of collapsing shallow mine workings, void migration, formation of crown holes, subsidence features etc,
- The possibility of sudden collapse of backfilled or covered shafts and adits,
- The possibility of poor ground bearing capacity due to shallow backfilled excavations or loosely compacted quarry spoil.
- The possibility that the natural groundwater/ground gas regime may have been altered by historical mining which may affect the proposed development.

Parts of the site have been extensively undermined by coal mining. In addition it is possible that the underlying fireclay has also been mined for brick making, although, there is no recorded documentary evidence of this. There are also potentially extensive unrecorded coal mine workings beneath the site. The mining abandonment plans indicate that the mining was predominantly by room and pillar methods, although some of the plans indicate that the coal was completely worked out in some locations. In additional to the underground mining, extensive surface quarrying has also been undertaken for the extraction of sandstone at the site.

4.2. Effects of Shallow Mine Workings

Generally the extent to which underground mine workings can affect surface development is a function of the following factors:

- Age of the workings,
- Depth below surface of the workings,
- Height of the worked seam or roadways,
- Nature and competency of the overlying rock strata
- Nature of the roof and floor rock in the workings
- Presence of geological faults or other discontinuities
- The method of mining (e.g longwall or room and pillar)
- The extraction ratio

In addition the ground loadings imposed by proposed foundations, together with their depth and construction detail, can often initiate subsidence of underground voids by altering the ground stresses.

The review of the mining information has indicated the following information with relation to the above criteria, however it should be borne in mind that there has been much mining undertaken on site which has gone unrecorded.

- At the site, the majority of the coal workings on site appear to have been undertaken in the 19th century however, some works were continued in to the 20th century as indicated by the CA mining report with the last date of working noted as 1953.
- The depth of workings below the surface varies across the site, but it ranges from very shallow, (<20m) to deep (>100m).
- The coals seams are generally quite thin (typically <1m) however it is considered that some allowance for mining of the materials above and below the seam should be made in order to create sufficient working space. In addition, it is considered that roadways would likely be higher (up to 2m).
- The overlying rock strata varies from weak, thinly bedded and friable Coal Measures mudstone and siltstones where the Lower Mountain Mine has been extracted to competent, medium to strong, thickly bedded sandstone in the Rough Rock where the Sand Rock Mine has been extracted.
- The nature of the floor and the roof rocks are likely to be the same as indicated above, either Coal Measures mudstone or the Rough Rock sandstone.
- There are a number of faults and discontinuities crossing the site, some of these are shown close to positions of proposed turbines. In addition, a number of sink holes have been identified which may also represent a plane of weakness in the bedrock.
- The method of mining has been determined as predominantly room and pillar. Room and pillar mining involves advancing long galleries on a grid pattern with resulting pillars of rock left intact to support the mine roof. The stability of this type of mining depends on the size of the pillars left intake to support the roof of the mine.
- The extraction ratio is difficult to determine from the plans but in many cases appears to be quite high, and in some cases completely worked out. This is typical of older coal workings undertaken in the 19th century.

4.3. Subsidence

4.3.1. Coal Mining

Coal mining at shallow depth beneath the site has the potential to cause an expression of subsidence at the surface if the mining void collapses suddenly, or gradually closes overtime and the voids migrate to the surface. The amount and extent of subsidence largely depends on the issues highlighted above.

Subsidence related to room and pillar mining depends on the strength and spacing of the pillars left in place underground to support the mine roof. Typically only 30% to 50% of the coal should be removed via this method, however, often the pillars were extracted or "robbed" on the way out of the mine and the roof left to collapse. There is evidence for this in the mining undertaken at Rooley Moor. Where pillars were left in place to provide long term support, their integrity can reduce overtime due to crushing from being overloaded, spalling from the pillars, pinching through weaker underlying stratum or into weaker overlying roof rock or heave of the mine floor. If a pillar's structural capacity is exceeded, the roof will redistribute the stresses along neighbouring pillars potentially exceeding their structural capacity and initialling further collapse within the mine. Such progressive collapse of the mine roof can also be related to the action of groundwater and weathering which are time dependent factors that can lead to unpredictable surface instability. This will result in the overall collapse of the roof and an expression of subsidence at the surface over time.

Construction processes, vibration and ground loading may accelerate these processes, particularly in marginal stability areas. This is of particular importance with respect to wind farms where the surface loading from a turbine is dynamic rather than static and therefore can have a more pronounced effect on the ground. The dynamic or cyclical properties can often be very different and may give rise to failure within a soil/rock which would otherwise be stable under more traditional static loading.

In extreme cases, some pillars may collapse suddenly resulting in a drastic expression of subsidence at the surface over a short timeframe. Often the removal of minewater can also contribute to mining instability as the supporting hydrostatic pressure is lowered, and the effective weight of the overlying rock increases beyond the capacity of the pillar and subsidence is initiated.

The strata overlying the workings can continue to collapse for many years after the workings have ceased. Generally as the roof strata collapse progresses the resultant void migrates towards the surface as the collapsed material bulks and infills the void. This eventually results in infilling of the void and a stable situation as the collapse rock supports the strata above, although the collapsed material is often of a much lower density and residual void may still remain. In some cases the collapse may migrate to a stable stratum at which point it stops. However if the amount of rock cover is low, the collapse will make its way to ground level and resulting in a surface expression of subsidence.

If the amount of rock or overburden cover is large and the additional stress from development above the mine is relatively insignificant, then the risk of surface subsidence is low. However, if the overlying rock cover is thin or comprises weak or friable material then the risk of subsidence is much higher under the increased structural load. There are several approximations relating to the maximum height that collapse mine workings will migrate towards the surface. The most common accepted rule is that voids will migrate equivalent to 10 times the thickness of the mined void. For

example if the height of the workings was 2m, then void migration could potential occur to 20m of overlying rock cover. It should be noted that this relates to competent overburden, overlying superficial deposits such as glacial, fluvial and peat deposits should not be included in this ten times seam thickness estimate. It also depends on a number of other factors including the nature, strength, weathering, fracture spacing and orientation of the roof rock and whether single or multiple mine workings are present.

4.3.2. Mine Entries

The coal seams were accessed through the mine shafts and adits which enabled access to one or several seams. The locations of the mine shafts are shown on Figure 2 and on the relevant abandonment plans. The coal mining reports indicate that several open shafts and adits are present at the site. Open or partially infilled mine shafts present an additional form of instability as their condition can deteriorate with time. Collapse of mineshafts can often occur suddenly and result in dramatic surface expressions of deep "crown holes" as loose or collapsing material settles within the former void space. However, if properly infilled, treated and capped, mineshafts can present a low potential risk and can often be developed over in certain circumstances.

4.3.3. Quarry Backfill

Backfill material placed in quarries can also prevent a subsidence risk for future development. This is typically controlled by:

- Quality of the backfill material;
- Compaction of the backfill;
- Extent of backfilling;

Often material of low quality and strength was placed in former quarries to backfill the void and to reinstate the ground surface. Such material may be unconsolidated and compressible and may result in further total or differential settlement under any development loads. Similarly, backfilling may have been poorly compacted resulting in low density material which consolidates quickly under loading. Finally if the extent of the backfilling has been poorly controlled, residual voids may have been entrained with the backfill, which may migrate with time and cause additional settlement under loading.

In addition, backfilled materials are also subject to other forms of settlement such as creep and inundation settlement. Creep settlement occurs due to self weight of the backfill under constant stress and moisture level and is time dependent. This is more pronounced in loosely or poorly compacted backfills. The initial settlement due to this is greater and is approximately logarithmic with time. Inundation settlement occurs when dry backfill becomes saturated with water and can result from rising groundwater or from percolation surface water. The magnitude of movement is related to type of fill, density, moisture content, stress level and stress history. Inundation

settlement is of particular concern for sites with a mining related history as groundwater was offered lowered to allow mining to proceed. After the cessation of mining groundwater levels often rebounded back to their original levels which in many cases is within the backfill material placed to reinstate quarries and open cast workings.

As above, the performance of loosely compacted backfill material can be markedly different under the dynamic loading of a wind turbine as from a typical static structure. This also needs to be considered when determining the risk to development from backfilled quarries.

4.3.4. Extent of Shallow Mine Workings

The available abandonment plans give a good indication of the extent of mining undertaken at the site, however it is also clear that a significant coal mining and sandstone quarrying has been undertaken for which there is no record. In order to provide an indication of the level of risks associated with mining, a plan showing mining hazard zones has been compiled and this is shown in Figure 5. The criteria for assessing the zones are shown in Table 4-1 below.

Table 4-1, Mining Hazard Zonation Criteria

Zone	Risk	Criteria (one or more)			Mitigation Measures	Affected turbines
		Mining / Quarrying	Shafts / Adits	Competent Rock Cover to Seam		
1	Very High	>75% possibility of being undermined or quarried	Within 20m of known location of shaft or adit	Less than 10 times the seam/workings height	Consider re-plan to take proposed development outside hazard zone. Undertake ground investigation to confirm mining situation and consider treatment of mine workings	
2	High	50 – 75% possibility of being undermined or quarried	Within 20m of known location of shaft or adit	Less than 10 times the seam/workings height	Consider re-plan to take proposed development outside hazard zone. Or undertake ground investigation to confirm mining situation and consider treatment of mine workings	T11
3	Medium	25 – 50% possibility of being undermined or quarried	No suspected shafts or adits	Less than 10 times the seam/workings height	Carry out detailed ground investigation to check for shallow mine workings and confirm risk zone	
4	Low	<25% possibility of being undermined or quarried	No suspected shafts or adits	Between 10 and 20 times the seam/workings height	Carry out limited ground investigation to confirm geology/mining	T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T12
5	Negligible	Very low possibility of mining or quarrying	No suspected shafts or adits	Greater than 20 times the seam/workings height	None required.	

The level of risk has been based on the available data and engineering judgement. As little information is available on the height of the recorded workings at the site, a conservative assumed height of 2.5m has been adopted, correlating to the maximum likely height of roadways within the mine. This results in any areas where the amount of overlying rock cover is less than 25m, may experience void migration to the surface. Where mine shafts/collieries have been identified for which there is no associated abandonment plan, a conservative 50m buffer has been adopted where the risks are categorised as very high, however, it should be considered that workings may extend further than 50m in plan from these features.

It should be noted that although indicated as low risk, T12, T9, T8, T6 and T4 are located close to an area of high and very high risk, and the proposed substation is located within an area of very high risk. The access tracks cross areas of all risk categories at various locations, although it is predominately located in areas of low risk in the central and northern area and higher risk in the southern areas.

A conservative approach has been applied to the boundaries of the hazard zone to account for the accuracy of the old plans and difficulty in locating them to surface features. Due to the large body of evidence indicating unrecorded workings to an unknown extent at the site which cannot be quantified at this stage, it is considered that these is potential for more unrecorded workings to exist at the site. Due to this is recommended that a minimum **LOW** risk zone is applied to the entire site. The actual classification of other defined sub-areas of the site may prove to be significantly different, but it would only be possible to further define the hazard rating based on further ground investigation, which is the recommendation for low zone risk areas in any case.

In light of the above, it is considered that the site has an overall **MEDIUM** to **HIGH** risk of mining related subsidence with respect to the proposed development.

4.3.5. Further Site Investigation

The structural loadings imposed by the proposed foundations, together with their depth and construction detail, can often initiate subsidence of underground voids by altering the ground stresses. It is recommended that to fully determine the subsidence risk to the proposed development a further intrusive and non-intrusive ground investigation should be undertaken prior to construction. It is evident from the mining review that the extent and depth of potentially worked coal seams is variable beneath different areas of the site and as such, the requirements for intrusive site investigation works may vary depending on these factors.

It is considered there may be some merit in undertaking geophysical investigations to help determine the areas of the site where mineworkings are shallowest and therefore present the highest risk. This may also help identify any unrecorded mineworkings and any open, partially infilled or capped mineshafts so that they may be avoided in the layout of the proposed development. Geophysical investigations can be affected by the presence of Made Ground, water or metallic objects in the ground; all of which are likely to be present at the site. Therefore, it would be prudent

to seek advice from a specialist geophysical contractor to determine whether geophysics would be appropriate and which geophysical methods may be the most successful at the proposed site.

The intrusive investigation should comprise a series of rotary drilled boreholes to determine the extent of mining related voids or low density ground beneath the proposed turbine locations. The boreholes should be advanced to a depth below the zone of influence of the structural loads likely to be imparted by the turbines or other surface infrastructure. This should also be combined with a shallow investigation into the superficial or man-made deposits likely to occur directly at the surface at the proposed development location, especially where the risk from surface quarrying is high. Any investigation into abandoned coal mine workings will need to be developed in accordance with the CA and undertaken under a permit issued by them.

The terminal depth of the boreholes will be dependent on the number, depth and size of any workings / voids encountered. However, as minimum, boreholes should be extended to a depth of 50m. The intrusive ground investigation should be carefully designed based on the available information.

Where access roads are proposed, these should be investigated by shallow investigation techniques to ensure there are no near surface sources of subsidence, and where possible located away from relict quarrying features.

In general, turbines and infrastructure locations should be located away from former shafts and adits. However, where this is not feasible such features should be investigated by rotary drilling methods to determine their current condition.

4.3.6. Engineering Options

Should any investigation prove the absence of mineworkings and competent ground exists to an adequate depth below the zone of influence of the proposed structures, the risk of mining related subsidence would be considered low/negligible. However, should the investigation encounter open mining voids or significant quantities of low density ground (most likely in areas of hazard zone 3 or above) it is likely that it will require treatment to stabilise the ground enabling construction to proceed. The most common form of treatment for abandoned mine workings involves the injection of grout materials to infill the void space. This is usually undertaken with a cementitious material (such as Pulverised Fly Ash (PFA) blended with a low percentage of Ordinary Portland Cement OPC) which will cure or harden to form a weak concrete, providing support to the mine roof and stabilising loose material. Typically not all of the void space needs to be infilled, 75% to 90% is usually sufficient to reduce the void space to an extent where if voids collapse and migrated, they would not reach the surface. This assumes any residual void is even distributed across the mine rather than isolated large voids.

A grouting programme involving injection through a series of injection holes on a grid, will usually be developed following the ground investigation. A programme of validation drilling to determine the presence of any residual voids will be required following this. All works will need to be undertaken in accordance with the guidance set out by the CA and under their approval.

Any unstable, open or partially infilled mine shafts which exist within influencing distance should also be treated in a similar manner. Any open workings should be infilled and grouted to ensure their stability and the surface of the shaft capped in accordance with the specification set out by the CA.

Alternatively, if mine works were very shallow, it may be possible to completely excavate the ground to the base of mine void and backfill with suitable engineered granular material to provide a stable foundation layer. This would assume that there are no underlying voids or coal seams related to deeper workings. In addition piled foundations could be adopted which penetrated the base of the mine workings and terminated on competent underling strata.

4.3.7. Other Geotechnical Issues

As within any investigation into abandoned coal mine workings, there is an inherent risk of methane gas emission. This should be investigated and assessed during the ground investigation in order to the risk to be adequately classified and any necessary protection methods developed.

5. Recommendations and Conclusions

- The mining assessment has indicated that parts of the site have been undermined by recorded coal mine workings in two seams of coal at shallow to medium depth.
- There is clear evidence that coal mining has been undertaken in these seams at numerous other locations within the site boundary for which there are no records.
- There are 33 recorded mine entries on site and to within 20m of the site boundary comprising shafts and adits. Of these, only six are recorded as having been treated or capped.
- There are numerous small sandstone quarries located across the site and the much larger former Ding Quarry. The majority of these are either open or partially backfilled however, several have been completely backfilled to an unknown standard.
- Both the historical recorded and unrecorded mine workings and the sandstone quarrying present a risk of subsidence to the development. The hazard ranking from these features is shown on Figure 5.
- It is recommended that micro-siting of turbines and infrastructure is undertaken away from areas of highest risk. Notwithstanding this, due to the potential for unrecorded mine workings across the site it is recommended that a suitable ground investigation is undertaken prior to development to further quantify the risks from potential mining related subsidence.
- Should any future ground investigation determine the present of mining related voids, they should be appropriately infilled and treated to prevent subsidence affecting the proposed development.

6. References

1. Ordnance Survey Map: OL21, 1:25,00 South Pennines

2. British Geological Survey: Geological map, Lancashire sheet 80NE, 1912 solid and Drift Edition, 1:10560. 1912

3. British Geological Survey: Geological map, Lancashire sheet 80SE, 1912 solid and Drift Edition, 1:10560. 1912

4. British Geological Survey: Geological map, Sheet 76 Rochdale, 2009, Solid and Drift Edition, 1:50,000. 2009

5. Geology of the Rochdale District – A Brief Explanation of the Geological Map, 1:50,000 Sheet 76 Rochdale. Crofts, R.G., Hough, E., and Northmore, K, J., British Geological Survey, 2010.

6. http://mario.lancashire.gov.uk/agsmario. Review of historic OS maps

7. Mine abandonment plans, Coal Authority: 1591, 1843, 12605/1, NW127, 4212, NW51, NW54

Figures

Figure 1 Site location plan



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ROOLEY MOOR

CORONATION POWER

SINCLAIR KNIGHT MERZ SKM

Figure 1 -
Site Location and Boundary Plan

SCALE 1:16,000 @ A3	*PROJECT NO.* JE30481
CONTENT CD	*DRAWN* CW
CHECKED	*DATE* 06/08/2014

Legend

Development Area

REVISION: C

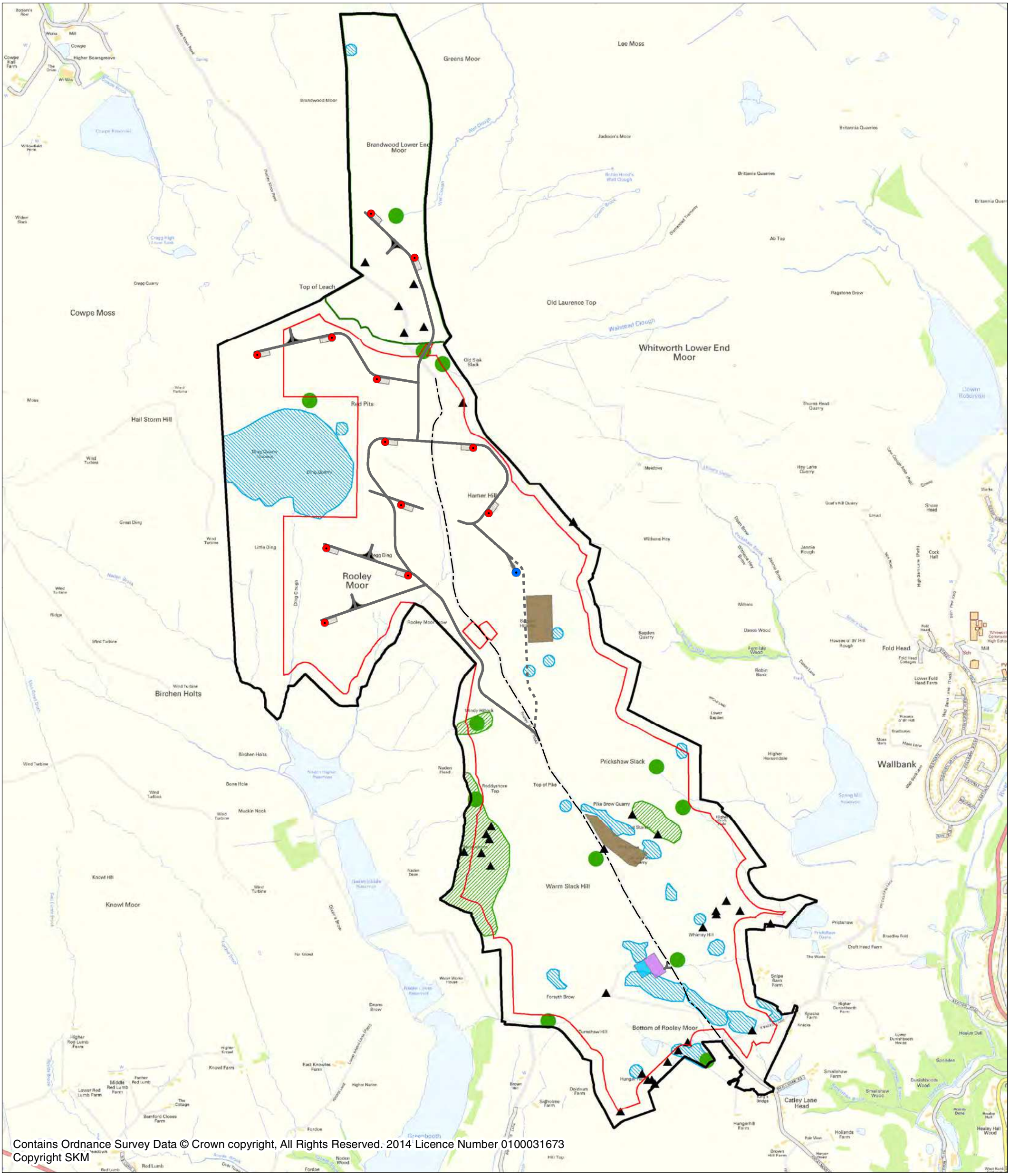
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N

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Metres

Figure 2 Geotechnical Constraints plan



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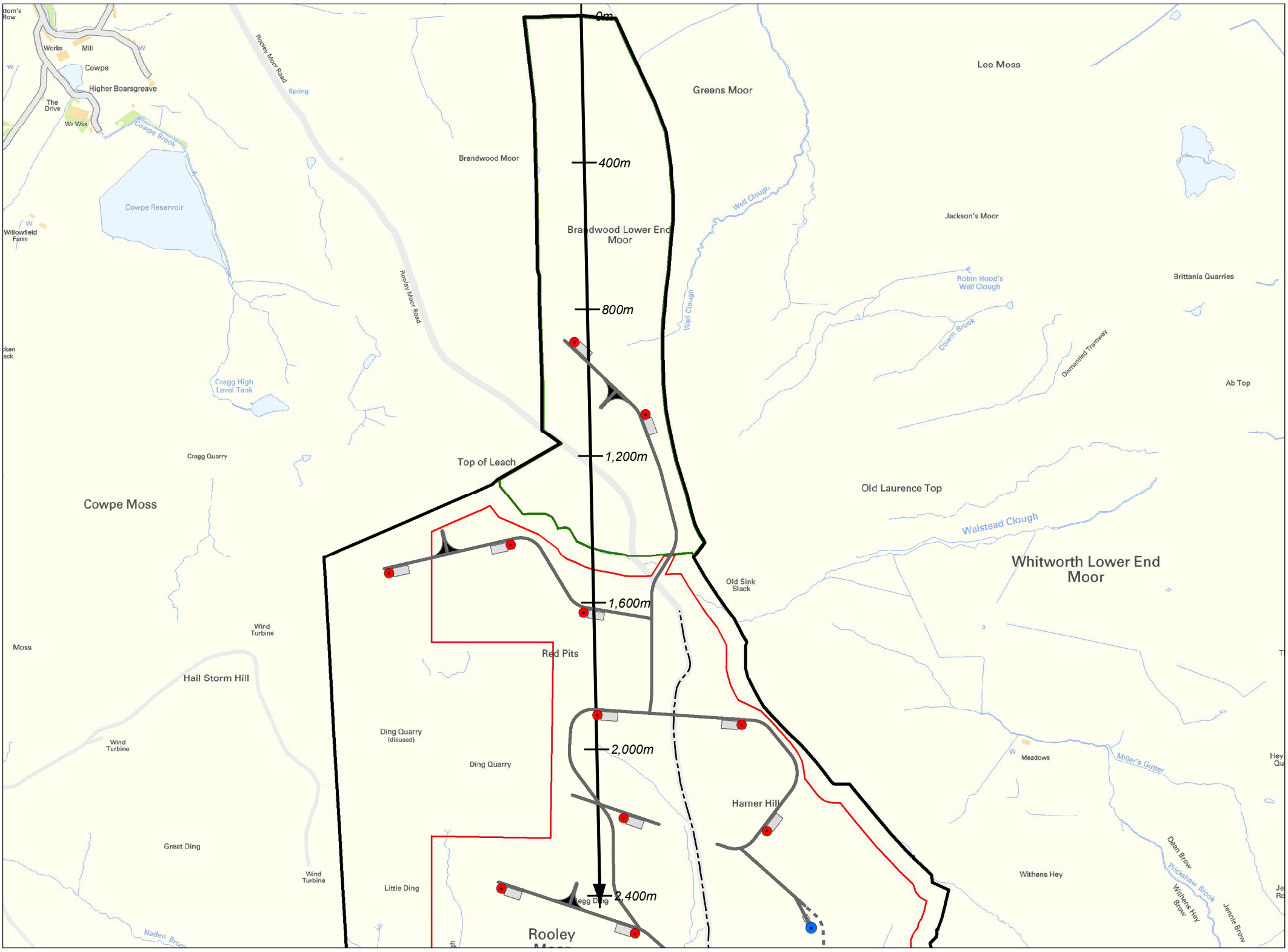
Figure 2 -
Geotechnical Constraints Plan

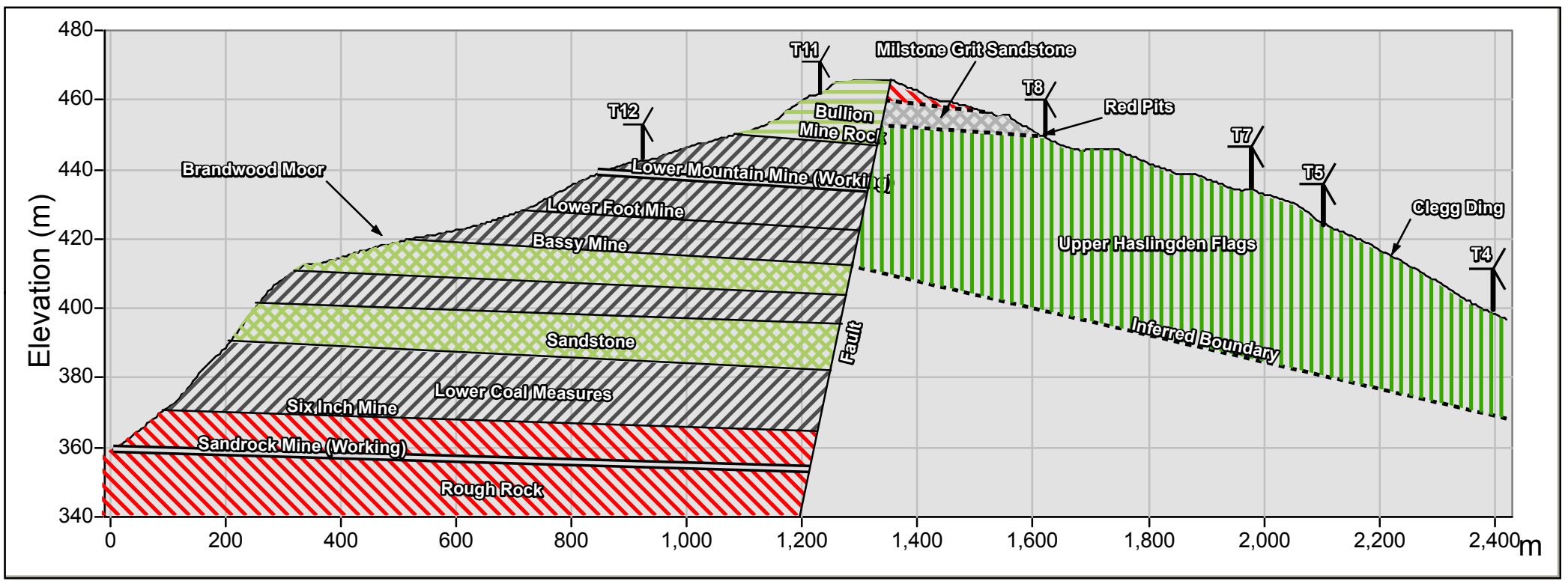
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CONTENT PS	*DRAWN* KW/CW
CHECKED	*DATE* 06/08/2014

REVISION: D

MXD: 010/g022

Figure 3 Geological Cross Section – North





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Figure 3 -
Geological Cross Section, North

SCALE 1:12,500 @ A3	PROJECT NO. JE30481
CONTENT PS	DRAWN KW/CW
CHECKED	DATE 06/08/2014

Legend

- Met Mast
- Turbine Layout
- New Track
- Temp Track
- Rooley Moor Road
- Cross Section
- Turning heads
- Crane Pad
- Development Area
- Brandwood Moor
- Option Area

REVISION: D

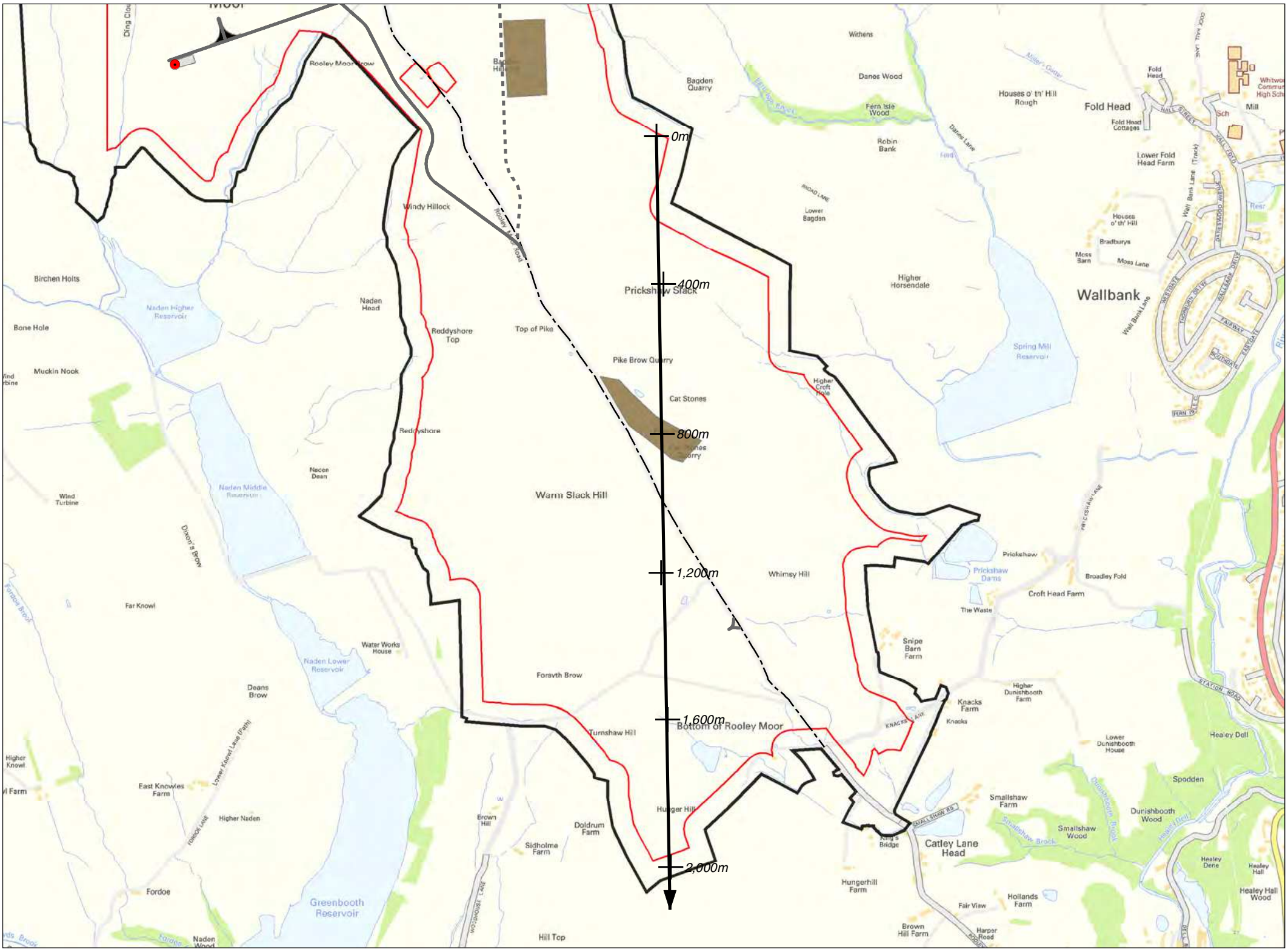
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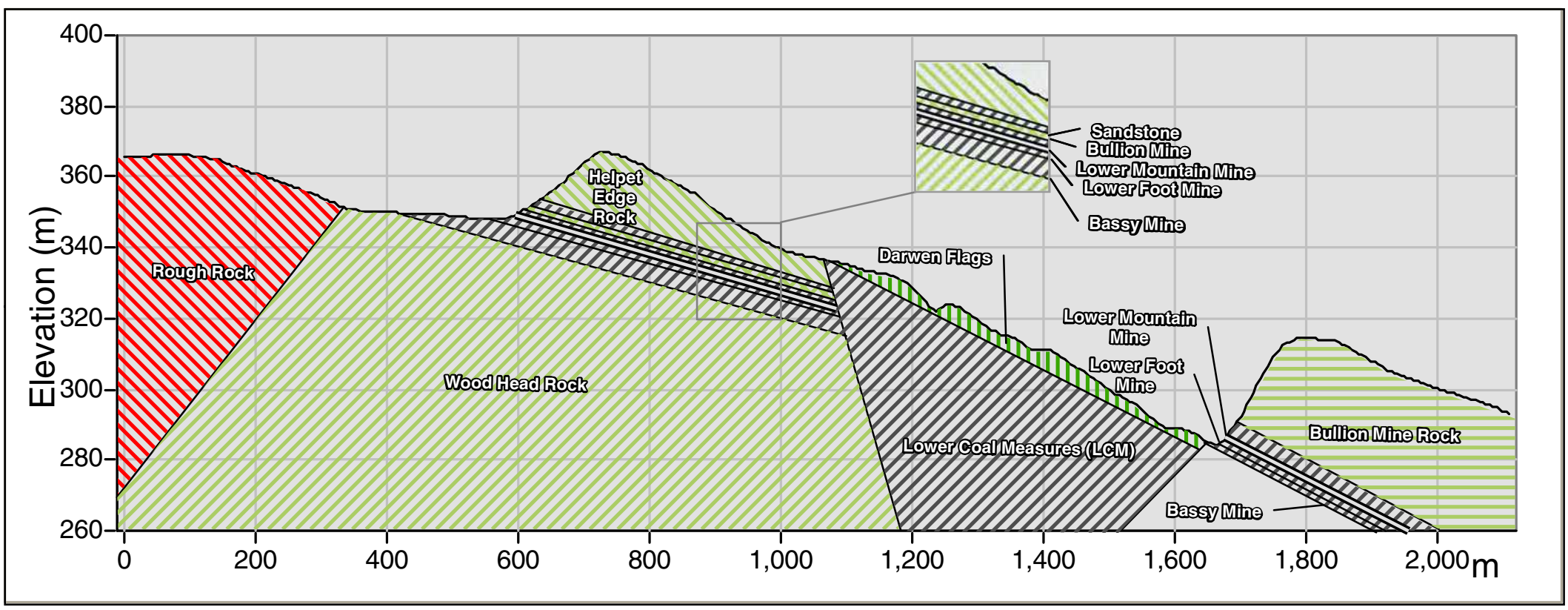
N

0 250 500 750 1,000

Metres

Figure 4 Geological Cross Section – South





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ROOLEY MOOR

Figure 4 -
Geological Cross Section, South

SCALE 1:12,500 @ A3	*PROJECT NO.* JE30481
CONTENT PS	*DRAWN* KW/CW
CHECKED	*DATE* 06/08/2014

Legend

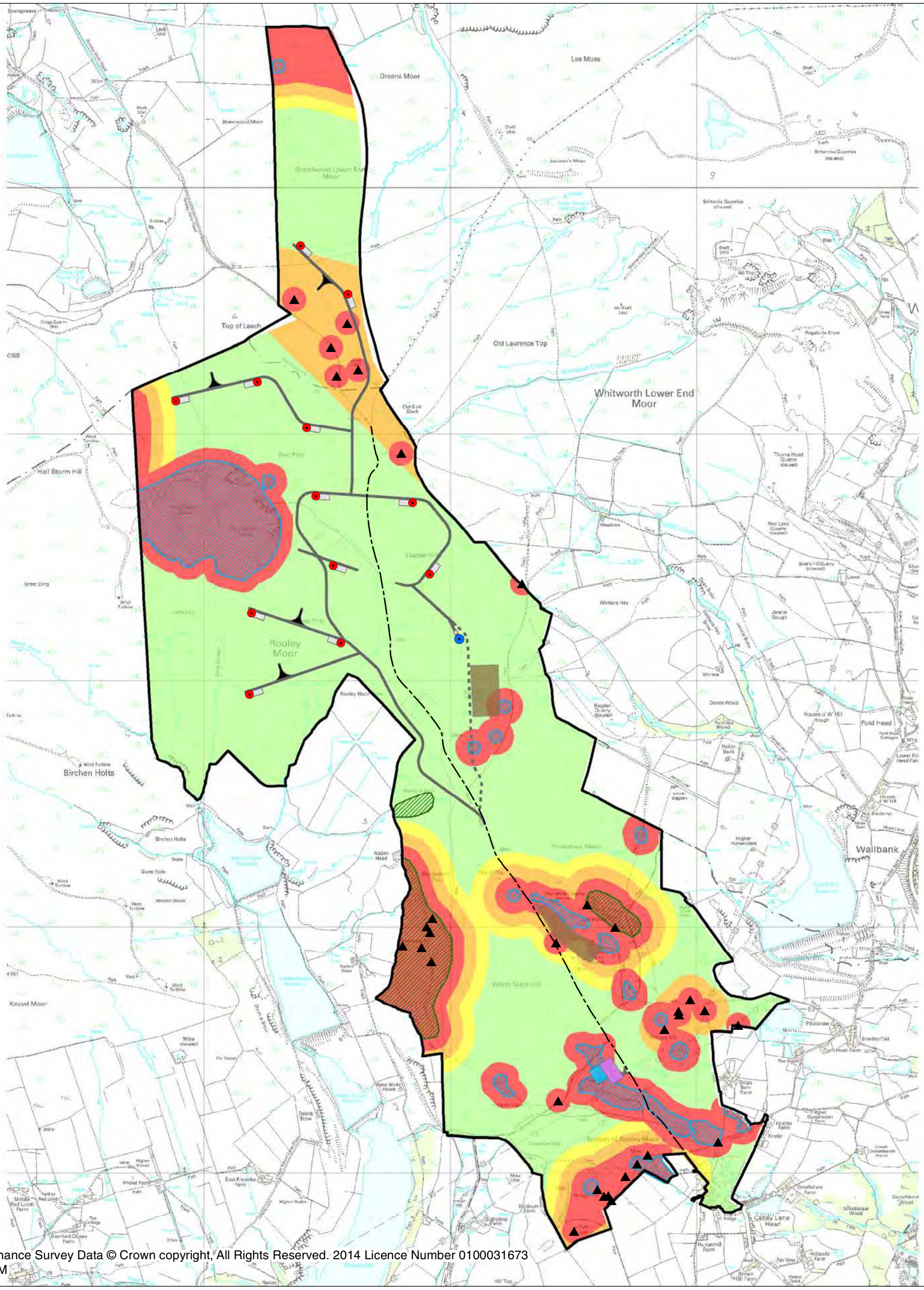
- Turbine Layout
- New Track
- Temp Track
- Rooley Moor Road
- Cross Section
- Borrow pit
- Turning heads
- Crane Pad
- Development Area
- Option Area

REVISION: D
MXD: 010/g021

N

0 250 500 750 1,000
Metres

Figure 5 Hazard Zonation Plan



ROOLEY MOOR

Figure 5 - Hazard Zonation Plan

SCALE 1:16,000 @ A3	*PROJECT NO.* JE30481
CONTENT PS	*DRAWN* KW/CW
CHECKED	*DATE* 06/08/2014

Legend

- Coal Mine Entries
- Met Mast
- Turbine Layout
- Rooley Moor Road
- New Track
- Temp Track
- Borrow pit
- Construction Compound
- Sub Station
- Turning heads
- Development Area
- Crane Pad
- Surface Quarrying
- Natural Subsidence/Landslips

Mining Related Risk

- Very High
- High
- Medium
- Low

REVISION: E

MXD: 010/g024

N

0 250 500 750 1,000

Metres

Appendices

Appendix A – Coal Mining Report

Appendix B – Mining Abandonment Plans

Appendix A Coal Mining Report

Issued by:
The Coal Authority, Mining Reports Office, 200 Lichfield Lane, Berry Hill, Mansfield, Nottinghamshire NG18 4RG
ON-Line Service: www.groundstability.com - Phone: 0845 762 6848 - DX 716176 MANSFIELD 5

VICTORIA KYLE,
SKM,
33 TRAFFORD ROAD,
SALFORD,
M5 3NN

Person dealing with this matter:	**David Clarke**
Our reference:	**00074532-11**
Your reference:	
Electronic Ref:	
RRUID:	007.00032023940001
Date of your enquiry:	**07 December 2011**
Date we received your enquiry:	**07 December 2011**
Date of issue:	**08 December 2011**

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

Non-Residential Coal and Brine Report

Rooley Moor, ., Lancashire

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	Yes
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 2 seams of coal at shallow to 70m depth, and last worked in 1953.

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 coal using underground methods.

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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

Within, or within 20 metres of, the boundary of the property there are 33 mine entries, the approximate positions of which are shown on the attached plan.

Coal Authority records disclose the following information:

386415-004. In February 1998 a small collapse some 0.8m in diameter was reported close to the entrance of this adit. The hole was infilled with locally available material and fenced due to the proximity of an adjacent footpath. These works were carried out by IMC consultants on behalf of The Coal Authority. .

386415-008. No treatment details.

386415-006. No treatment details.

386415-009. No treatment details.

386415-005. No treatment details.

386415-007. No treatment details.

386415-001. This shaft was covered with a concrete raft in 1962 and marked with a concrete pyramid in 1968. .

386416-002. No treatment details.

386416-001. No treatment details.

385419-005. No treatment details.

385417-002. No treatment details.

386416-007. No treatment details.

386417-001. No treatment details.

387416-001. No treatment details.

386416-006. This shaft was capped by the NCB in 1978. .

386416-003. No treatment details.

386416-004. No treatment details.

386416-008. No treatment details.

386417-002. No treatment details.

386416-005. This shaft was capped by the NCB in 1978. .

385416-004. No treatment details.

385416-002. No treatment details.

385416-005. No treatment details.

385419-006. No treatment details.

385419-004. No treatment details.

385419-003. No treatment details.

385418-001. No treatment details.

386418-004. No treatment details.

387416-003. This shaft was capped in 1978 by the NCB .

385417-001. No treatment details.

387416-004. This shaft was capped in 1978 by the National Coal Board .

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385419-007. No treatment details.

385416-003. No treatment details.

Records may be incomplete. Consequently, there may exist in the local area mine entries of which the Coal Authority has no knowledge.

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

The Coal Authority has not received a damage notice or claim for the property since 31 October 1994. There is no current Stop Notice delaying the start of remedial works or repairs to the property.

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.

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 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 in an area for which notices of entitlement to withdraw support were published in 1952,1951.

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.

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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.

The attached plan shows the approximate location of the disused mine entry/entries referred to in this report. For reasons of clarity, mine entry symbols may not be drawn to the same scale as the plan. Property owners have the benefit of statutory protection (under the Coal Mining Subsidence act 1991*). This contains provision for the making good, to the reasonable satisfaction of the owner, of physical damage from disused coal mine workings including disused coal mine entries. A leaflet setting out the rights and the obligations of either the Coal Authority or other responsible persons under the 1991 Act can be obtained by telephoning 0845 762 6848 or online at www.coal.gov.uk/services/subsidence.
If you wish to discuss the relevance of any of the information contained in this report you should seek the advice of a qualified mining engineer or surveyor. If you or your adviser wish to examine the source plans from which the information has been taken these are normally available at our Mansfield office, free of charge, by prior appointment, telephone 01623 637233. Should you or your adviser wish to carry out any physical investigations that may enter, disturb or interfere with any disused mine entry the prior permission of the owner must be sought. For coal mine entries the owner will normally be the Coal Authority.
The Coal Authority, regardless of responsibility and in conjunction with other public bodies, provide an emergency call out facility in coalfield areas to assess the public safety implications of mining features (including disused mine entries). Our emergency telephone number at all times is 01623 646333.

*Note, this Act does not apply where coal was worked or gotten by virtue of the grant of a gale in the Forest of Dean, or any other part of the Hundred of St. Briavels in the county of Gloucester.

Information from the Cheshire Brine Subsidence Compensation Board

The property lies outside the Cheshire Brine Compensation District.

Additional remarks

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 2006.

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Issued by:	The Coal Authority, 200 Lichfield Lane, Mansfield, Nottinghamshire, NG18 4RG
Date:	07 Dec 2011
Coal and Brine Report at:	Rooley Moor, ., Lancashire
Reference number:	00074532-11
Cost:	£1,216.00
Plus VAT:	£243.20
Total received:	£1,459.20
VAT registration number:	598 5850 68

Appendix B Mining Abandonment Plans

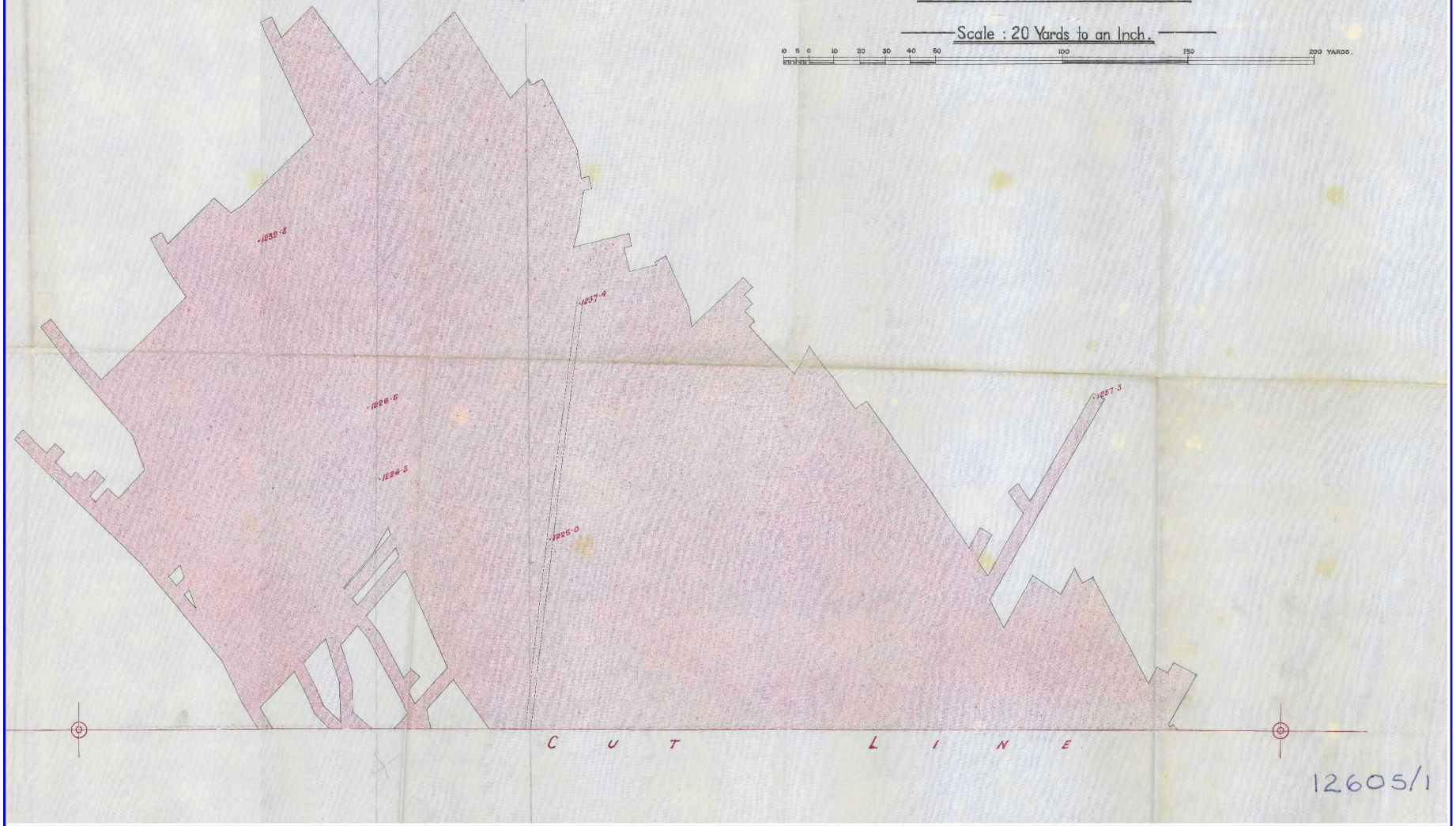
12605

LOWER EAST KNOWLE COLLIERY.

SAND ROCK MINE.

Scale : 20 Yards to an Inch.

10 5 0 10 20 30 40 50 100 150 200 YARDS.



12605/1

The Coal Authority

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Catalogue No.: 12605 Sheet Info: 1 OF 2

Date: 30/01/2012

Scale: 1 TO 1250

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PLAN No 12605

LANCASHIRE SHEET LXXX S.E.

KEY PLAN



Scale — 6 Inches to One Mile.

LOWER EAST KNOWLE COLLIERY.

SAND ROCK MINE.

Scale : 20 Yards to an Inch.

C U T L I N E

This Plan is a true copy of the Working Plan of the Mine as completed up to 4th November 1938 and I certify, after thorough examination and inquiry, that to the best of my knowledge and belief, it is an accurate plan of the Mine

J. T. Williams.

Surveyor's Certificate No. 1008.

The Red Figures denote levels in feet above Ordnance Datum.

SHALE

COAL 2'

DIRT 6"

COAL 1'-2"

WARRANT

Section of Seam.

AIR SHAFT 20 Yards deep.

Old Works

DAY EYE.

DAY EYE.

12605/2

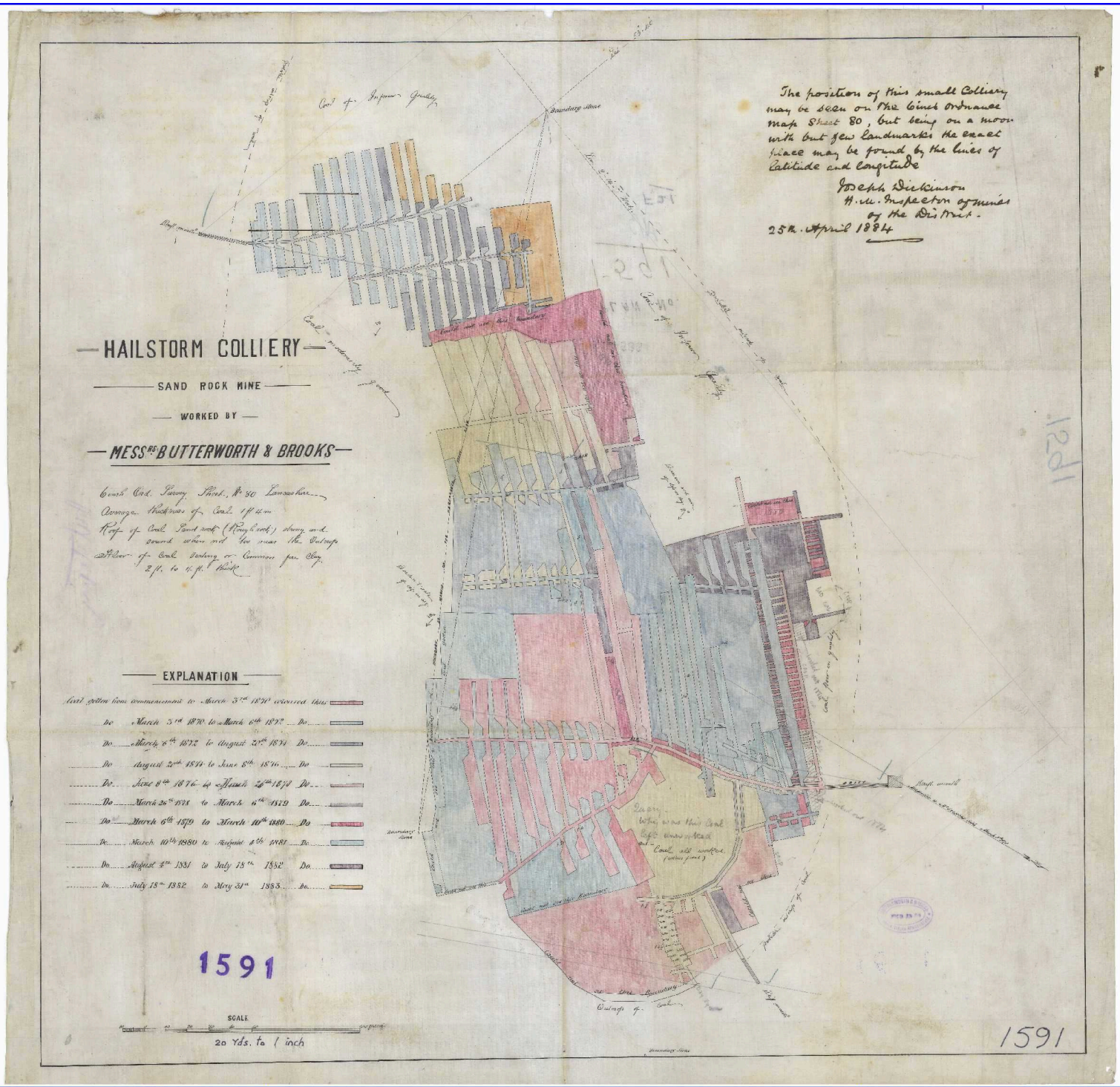
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Date 31/01/2012

Scale: 1 TO 1258

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Catalogue No.: 1591 Sheet Info:	
Date: 30/01/2012	Scale: 1 TO 1250
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Catalogue No: 1843 Sheet Info

Date: 30/01/2012

Scale: 1 TO 1250

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SAND ROCK MINE, BRANDWOOD MOOR COLLIERY WORKED BY Mr. DAVID LAW

AT INTAKE AND PART BANK IN THE HAMLET OF BRANDWOOD LOWER END

TOWNSHIP OF SPOTLAND AND COUNTY OF LANCASTER

FEBRUARY 1886

Joseph Dickinson
H.M. Inspector of Mines of the District
12 R. March 1886

Mr. Breadeys straight Board from Day Eye

COAL COTTEN BY Mr. E ASHWORTH

COAL COTTEN BY Mr. JOHN WOODHEAD

Coal which may be worked from the Brandwood Moor Colliery

DAY EYE

DAY EYE

SUPPOSED OLD WORKINGS

OLD WORKINGS

COAL COTTEN BY Mr. DAVID LAW

OLD WORKINGS

DAY EYE

INTAKE

SAND ROCK MINE

DAY EYE

TUNNEL MOUTH

Section of the Sand Rock Mine

Scale of Yards

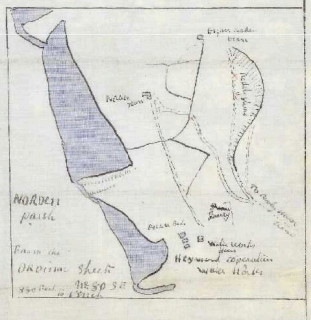
22 Yds. to 1 inch

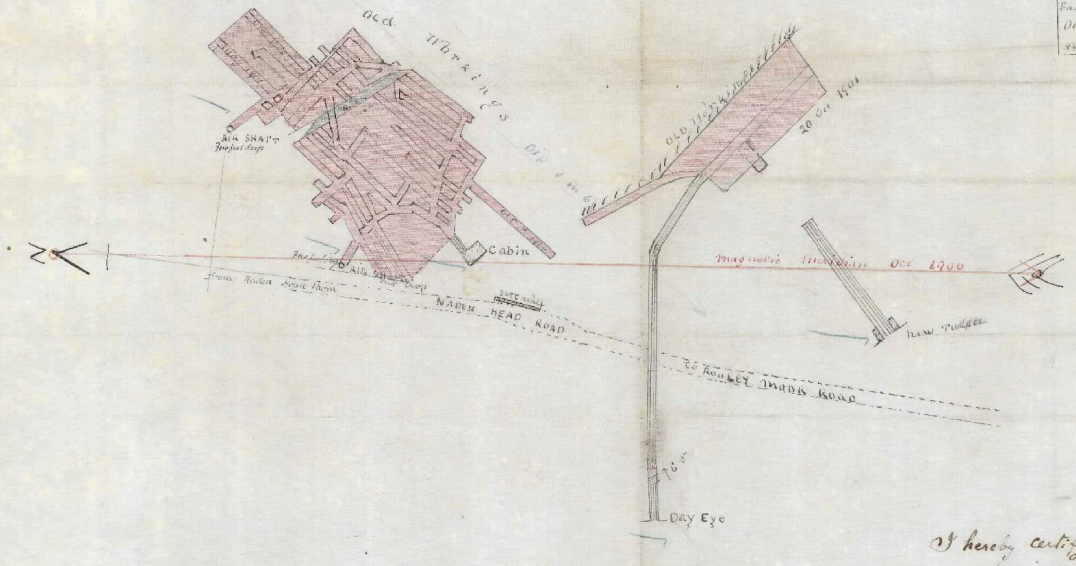
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MOUNTAIN MINE NADEN HEAD COLLIERY near Rochdale

WORKING BY

Mess^rs J Lomax and C^o Lim^ted





I hereby certify after thorough Examination and enquiry, that to the best of my knowledge and belief this plan is an accurate plan of the mine.

Signed Thos Andrews

4212

T. Andrews
Manager

4212

Scale 20 Yards to One Inch

The Coal Authority

IFTS accredited

Catalogue No.: 4212 Sheet Info:

Date: 30/01/2012

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PLAN OF THE SAND ROCK MINE ROOLEY MOOR COLLIERIES WORKED BY MESSRS JOHN LOMAX AND CO. LTD.

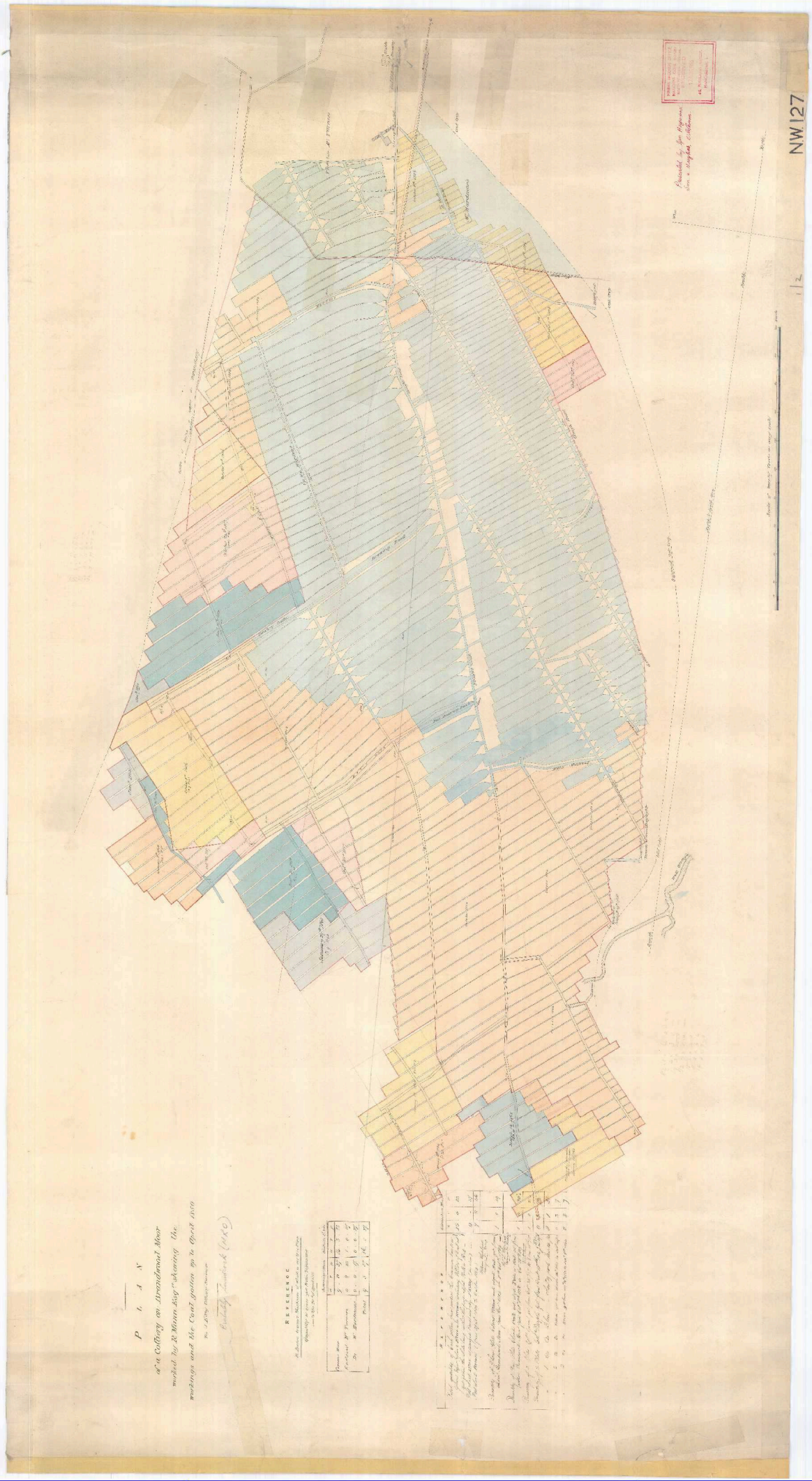
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TOWNSHIP OF NORDEN PARISH OF ROCHDALE

— COUNTY OF LANCASTER —



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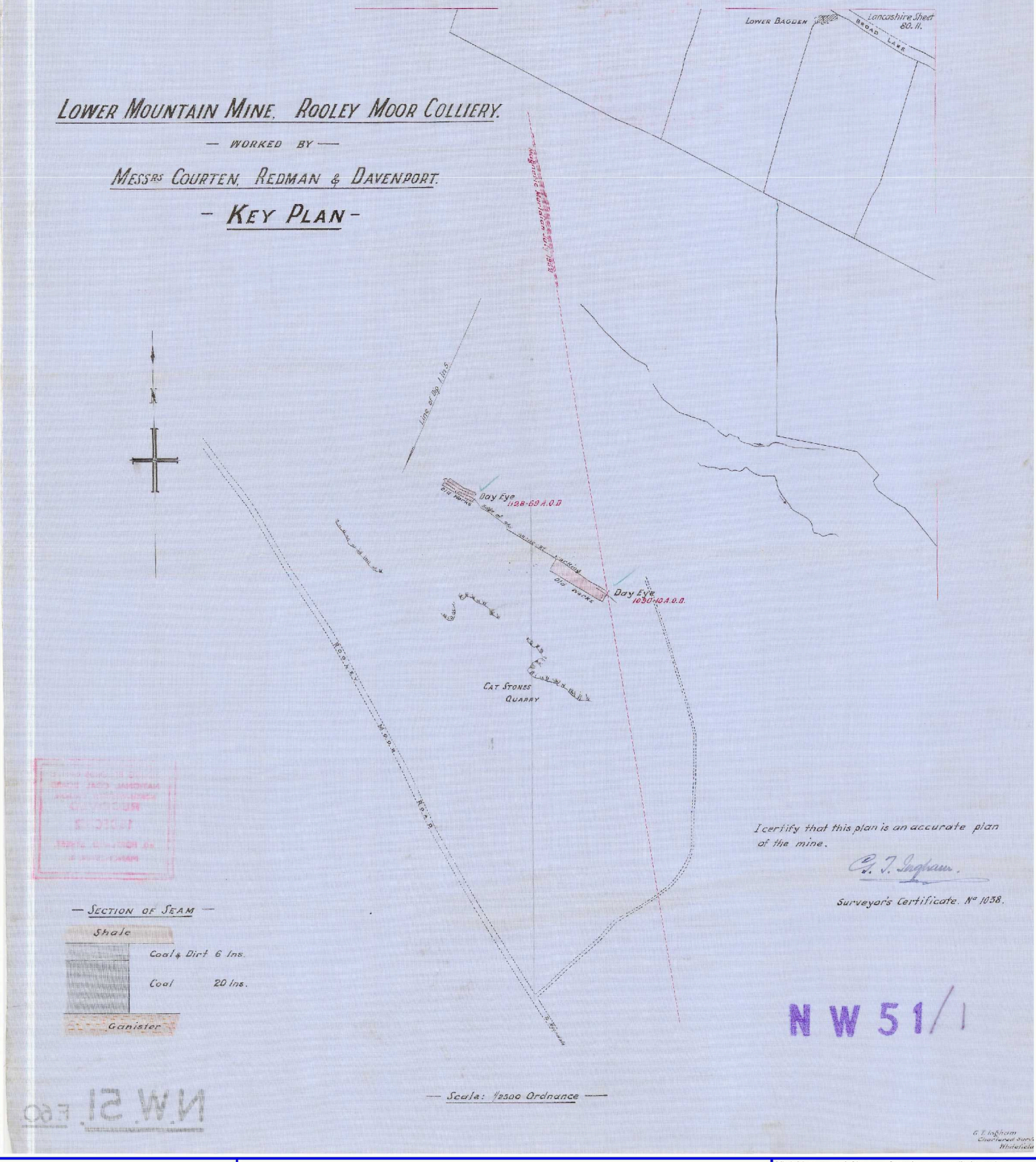
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LOWER MOUNTAIN MINE. ROOLEY MOOR COLLIERY.

— WORKED BY —

MESSRS COURTEN, REDMAN & DAVENPORT.

- KEY PLAN -



I certify that this plan is an accurate plan of the mine.

G. T. Ingham.

Surveyor's Certificate. Nº 1038.

— SECTION OF SEAM —

— Scale: 1/2500 Ordnance —

NW 51/1

NW 51 E&C

G. T. Ingham
Chartered Surv
Hinfield

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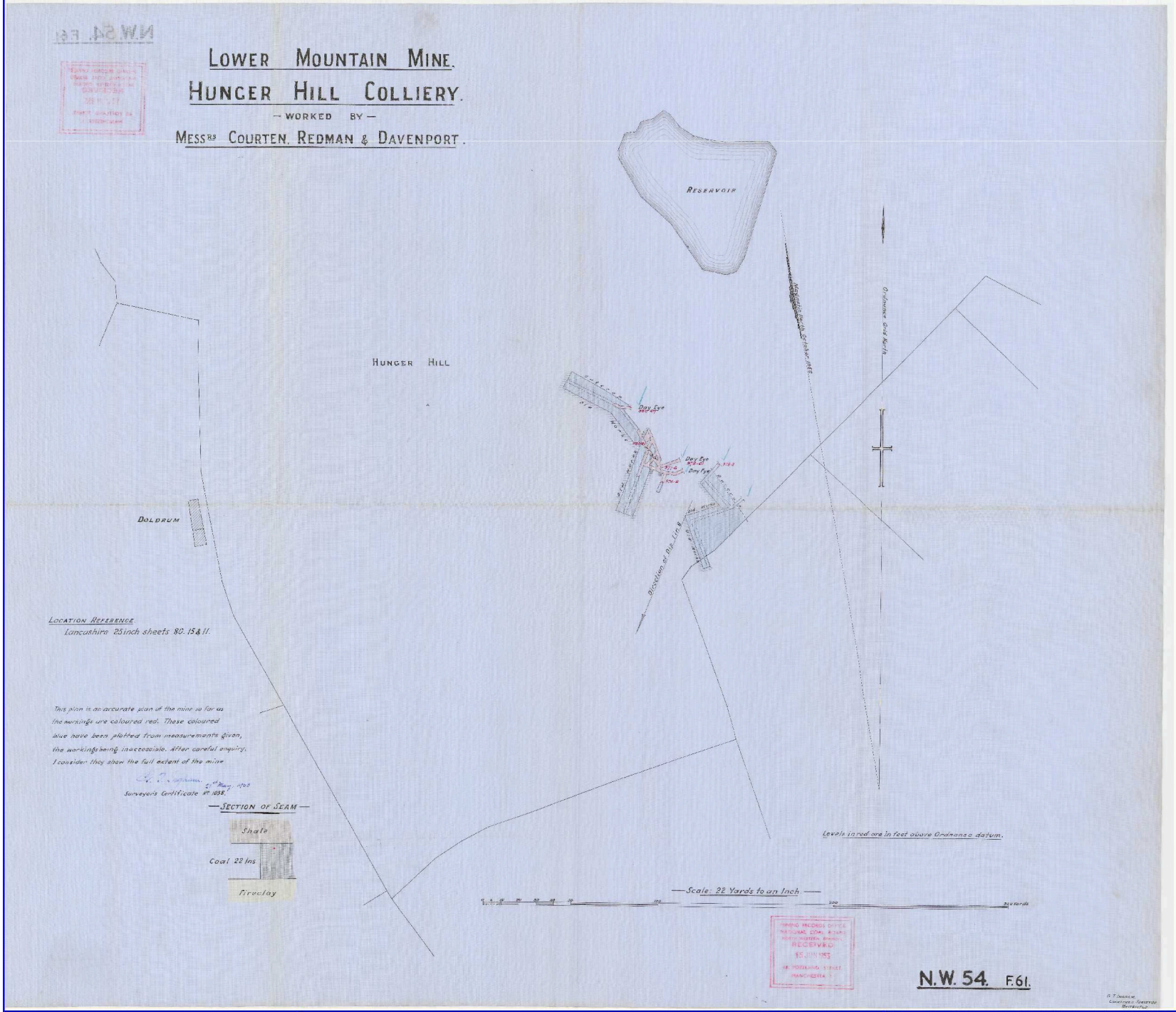
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LOWER MOUNTAIN MINE.
HUNGER HILL COLLIERY.

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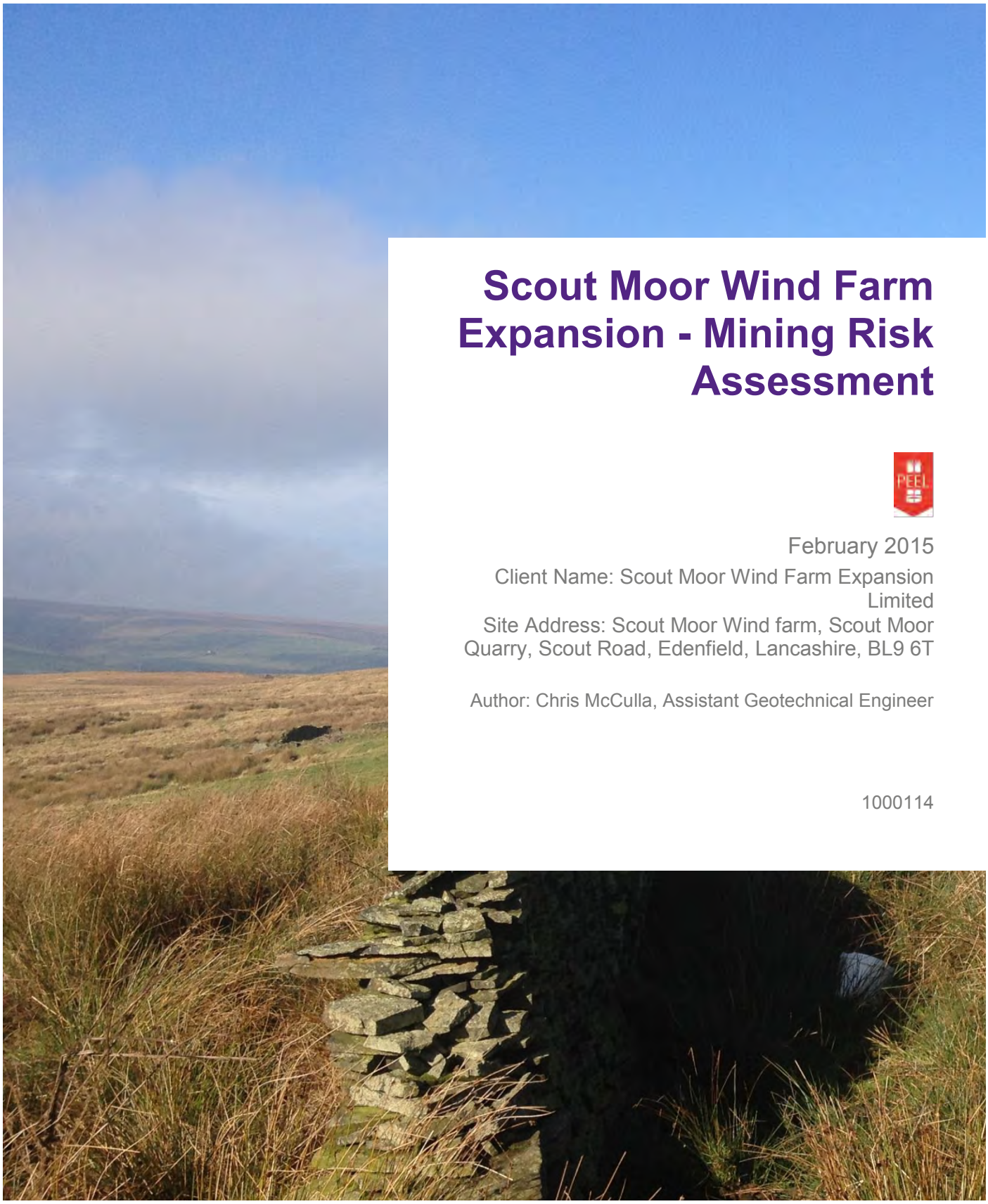
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Scout Moor Wind Farm Expansion - Mining Risk Assessment

February 2015

Client Name: Scout Moor Wind Farm Expansion Limited

Site Address: Scout Moor Wind farm, Scout Moor Quarry, Scout Road, Edenfield, Lancashire, BL9 6T

Author: Chris McCulla, Assistant Geotechnical Engineer

1000114

Planning & Development | Ecology & Hydrology | Technical
Construction & Geotechnical | Asset Management | Due Diligence

natural power



Document history

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Issue	Date	Revision Details
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1. Introduction

1.1. Location

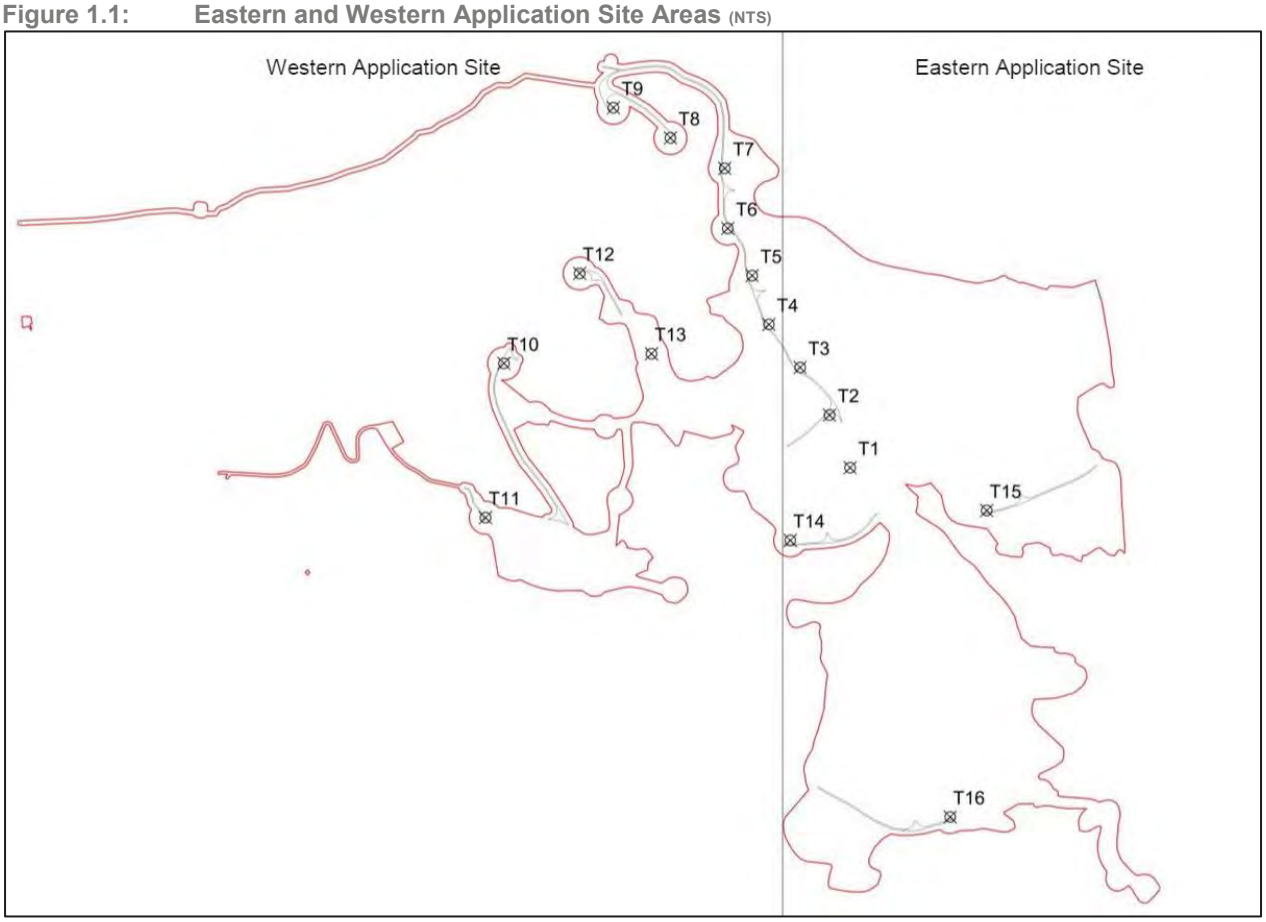
The Application Site is located within and adjacent to the existing Scout Moor Wind Farm, Lancashire. Currently there are 26 operational Nordex N80 wind turbines, set across upland moorland within the Southern Pennines. The expansion area for Scout Moor Wind Farm is situated between the village of Edenfield; 1km to the west and the town of Rochdale; approximately 5km southeast of the development boundary.

Application Site has been defined as all land within the red line planning boundary as defined in the main Environmental Statement.

Figure 1.1 provides a context for the Application Site description references used in this assessment and defines the Eastern and Western Application Site areas:

Study Area has been defined as encompassing the site and wider environs including local surroundings and localities which may extend or exist beyond the application site but may relate either directly or indirectly to this assessment.

Figure 1.1: Eastern and Western Application Site Areas (NTS)



1.2. Development

Natural Power understands Scout Moor Wind Farm Expansion Limited is exploring the possibility of expanding Scout Moor Wind Farm with 16 wind turbine generators and associated infrastructure. The detailed description of the development study area is provided within the main chapters of the Environmental Statement. The following is an outline of the proposed key infrastructure elements:

- 16 wind turbine generators founded on reinforced concrete gravity or piled foundations where ground conditions dictate.
- 16 crane hardstand areas adjacent to each wind turbine foundation. These areas will comprise a main crane pad and possible outlying trestle pads utilised in the erection and installation of wind turbine components. The final design of these elements will be subject to confirmation by the appointed turbine supplier;
- New access track infrastructure with the method of construction dictated by the peat depth and ground conditions with excavated tracks across shallower areas of peat and 'floated' track over consistently deep areas of peat. All tracks will be constructed so as to provide a minimum running width of approximately 5m with local widening at junctions, bends, passing places and turning heads;
- Underground power and control cables shall be routed between the wind turbines, running adjacent to the track routes.

Water crossings and drainage infrastructure shall be required as part of the development and shall be designed to mitigate impact on surface hydrology and peatland habitats. A comprehensive discussion of these elements is covered within Chapters 13 & 14 of the Environmental Statement.

The following temporary structures are usually a requirement of the construction phase of development:

- Construction compound;
- Temporary lay-down area

Access to the proposed expansion area is understood to be from the local highway network using existing wind farm access tracks. The main site entrance is proposed off the A680 at Scout Moor Quarry.

1.3. Site Characterisation

The site description has been compiled from a variety of sources, including Ordnance Survey mapping and GIS mapping software. A detailed site walkover survey was conducted by an experienced geotechnical / mining engineer during November 2014. This walkover covered areas within the Application Site.

1.3.1. Topography

The landforms covering the Application Site and wider locality are of broad upland moorland, rising steeply from the surrounding valleys to a maximum elevation of approximately 477mAOD (above Ordnance Datum) at the summit of 'Hail Storm Hill'. The majority of the Application Site is across the higher elevations between 330 and 472mAOD. The Scout Moor moorland plateau is typified by upland glaciated terrain which has been impacted by the advance and final retreat of ice sheets at the end of the late Devensian Glaciation (last ice age). The proceeding peri-glacial environmental conditions further eroded the steepened valleys, escarpments and rock outcrops. All these elements are now integral to the makeup of different terrain units across the Application Site. The wider post glaciated landscape including land outside of the Application Site is also mantled by a variety of superficial deposits which include, peat, glacial till and mass movement deposits which have formed since the retreat of ice sheets.

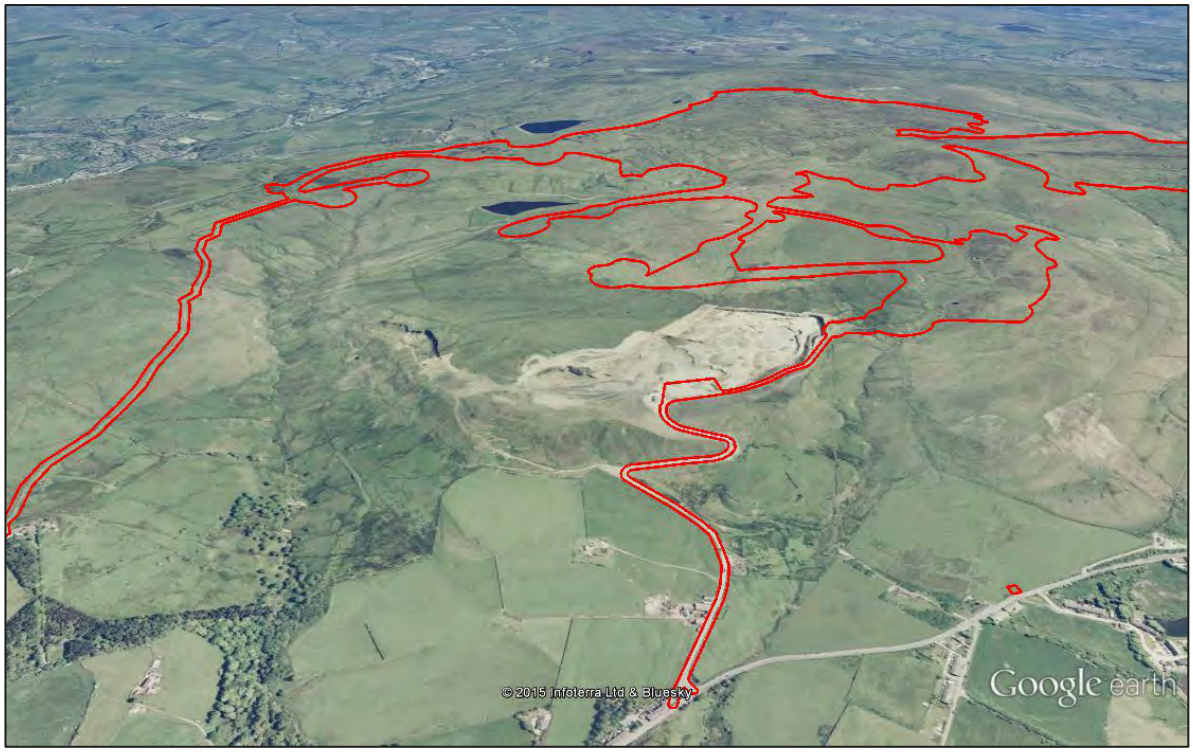
1.3.2. Application Site Description

In order to simplify description of this large scale area two zones; **East** and **West** have been defined (Figure 1.1). Table 1.3.2 below provides an overview description of each part of the expansion area and includes a 3D terrain view to establish the wider setting.

Table 1.3.2 Description of Application Site

Western Application Site

The image below depicts the western part of Application Site and combines a digital terrain model and aerial photographic imagery dating from 2005 (Google Earth Professional). The view aspect is looking towards the east. The outer red line boundary delineates the planning application boundary.



From the A680, the pre-existing access track climbs through Scout Moor Quarry towards currently existing wind turbines and the internal access track network. The Western Application Site is predominantly set across southerly and westerly aspect sloping moorland. The land surface is of modified peat land, grass and heather cover. The flat lying high plateau contains historic artificial trellised drainage networks. The steeper valley sides and escarpments are affected by a natural dendritic drainage comprising ephemeral streams minor tributaries and tertiary rivers. A dominant land form is the steep sided valley containing Dearden Brook & Scout Moor Brook which is headed by the Scout Moor High Level Reservoir. The reservoir is understood to be supplied by the upland catchment of Scout Moor. The reservoir is retained by a multi-tiered rock fill and earth embankment dam, set into a steep sided 'v-shaped' valley. Down-stream the east-west orientated valley system turns south with Dearden Brook out-flowing towards the village of Edenfield.

Across the Western Application Site there is a limited network of minor farm tracks to the north of the 'Dearden Valley' with pre-existing wind farm access tracks permitting access across the centre of this part of the development. There were determined to be no residential dwellings within the Application Site. However there are a number of residential properties surrounding this part of the development and out-with The Application Site (this list is not exhaustive):

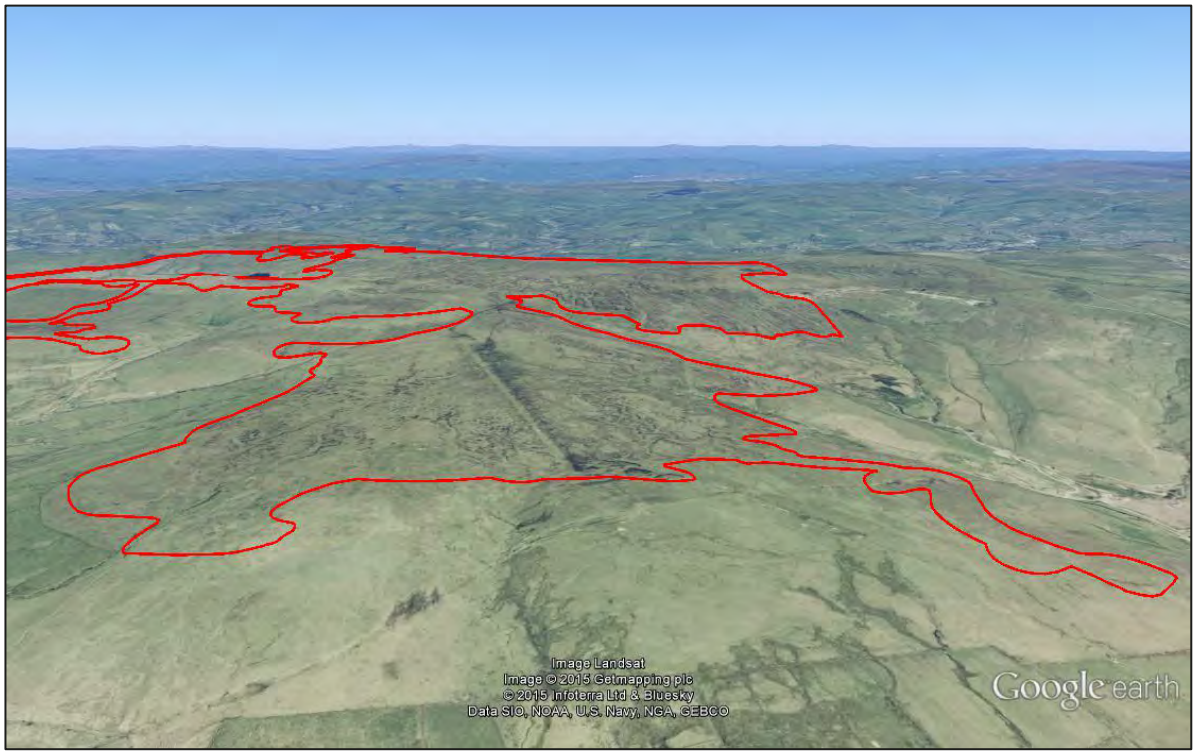
- **Higher & Lower Mount Pleasant Farms**, approximately 450m west of the nearest planning application boundary;
- **Stone Acre Farm at 'Turn'**, approximately 700m south west of the nearest planning application boundary;
- **Fecit Farm**, approximately 470m south west of the nearest planning application boundary;
- **Cowpe Hall Farm**, approximately 710m northeast of the nearest planning application boundary;

Currently the sensitive structures in terms of stability are concluded to be the operational Scout Moor Wind Farm turbines, infrastructure and the Scout Moor High Level Reservoir Dam which is out-with the Application Site.

Table 1.3.2 Description of Application Site

Eastern Application Site

The image below depicts the Eastern Application Site and combines a digital terrain model and aerial photographic imagery dating from 2005 (GEP). The view aspect is looking towards the north. The outer red line boundary delineates the approximate limit of the planning application boundary with the large areas encompassing the proposed moorland restoration areas.



Generally across this part of the Application Site, terrain slopes from the central plateau towards the south and east and into the steep sided valley which contains the Naden Higher, Middle and Lower Reservoirs (Out-with the Site). These eventually head the larger Greenbooth Reservoir (not shown) which is retained just 600m north of the village of Norden all these elements are south-east and out-with the Eastern Application Site.

T16 is proposed across the upland moorland plateau with T15 positioned around the upper reaches of the Naden valley terrain unit. The surface geomorphology of the peat land is of generally naturally and artificially drained peat with discrete areas of surface modification, a result of historical quarrying and mining activity. The pre-existing Scout Moor wind farm infrastructure stretches across the southerly limb of the upland moorland plateau with existing turbines E2, E4, E9 & E18 situated approximately on the upper rim of the Naden Valley.

There is a prolific dendritic drainage pattern which is present across the upper areas of peat land and extends down into sharply incised tributaries which flow into the Naden valley to the south. Across the flatter terrain of the upper moorland there is a multitude of minor surface ponds which may be natural or mark the sites of former quarries or mine entries. This may also be an indication that there is shallow retention of groundwater reserves across this part of the Application Site. There is drainage towards the north and down the main escarpment above the village of Cowpe to the north. Within the Eastern Application Site there is a prominent linear artificial drainage ditch which has been termed 'Man Road Ditch' by the Ordnance Survey map. This feature runs approximately north-south and is easterly adjacent to the proposed expansion turbine T16. There were determined to be no residential dwellings in this part of the study area. However there are a number of residential properties surrounding the Eastern Application Site but all out-with the red line planning boundary:

- **Higher Knowl Farm**, [SD 84665, 161020];
- **Higher Red Lumb Farm**, [SD 84095, 16132];
- Semi-detached properties on A680, [SD 82712, 16419];
- **Willowfield Farm**, [SD 83933, 20076];

Currently the sensitive structures in terms of stability within the Eastern Application Site are concluded to be the existing Scout Moor Wind Farm turbines and infrastructure.

1.3.3. Surrounding Area

The Application Site is surrounded by a semi-rural landscape with the villages Edenfield, Cowpe, Bacup, Millgate, Whitworth, Broadley Bagslate Moor and Turn situated clockwise around the Application Site. These small settlements occupy lower ground below the elevated moorland with Rochdale town centre situated approximately 5km south from the Application Site boundary.

The history and development of the local area has been strongly influenced by the industrial revolution and therefore the expansion of population centres across in the region at the start of the 19th Century. It is understood that the industrial revolution and expansion of Rochdale and Greater Manchester was strongly driven by the wool and cotton trade with a local requirement for building stone and coal to construct and power industrial development. As a consequence; the coal measures geology which forms the landscape, has been extensively quarried and mined. Open cast quarry sites were opened in order to win high quality sandstone for building material, with many mining sites implemented to win coal from underground coal seams.

Within the Application Site is an extensive area of former opencast quarry sites. These are understood to be the location of former sandstone quarrying which are now ceased. These features now remain as large open-excavations which have been allowed to flood and become partially re-vegetated. Similarly to the northwest of the Application Site, there is a large area of former sandstone quarries interspersed across the landscape however all activity across this area appears to have now ceased. Scout Moor Quarry which occupies land out-with the Application Site is understood to be still operational and producing clay, shale and sandstone.

The moorland which exists at relatively high elevations adjacent to steep sided valley systems has created ideal conditions for impounding reservoirs. The high moorland plateau creates a large upland catchment area for rainfall and as a result there are seven reservoir systems surrounding the Application Site as described in Section 1.3.2. All are out-with the Application Site.

1.4. Access

It is understood that access to the Scout Moor Wind farm Expansion will utilise the pre-existing Scout Moor Wind Farm infrastructure. Access from the public road network can be from the M66 motorway and then onto the A56, B6527 to Edenfield. From Edenfield the A680 is followed southbound to the entrance to Scout Moor Quarry. The pre-existing wind farm access track traverses the edge of Scout Moor Quarry and climbs the open moorland towards the internal wind farm access track network and the high ground of Whittle Hill.

Access when surveying the expansion area is gained from the pre-existing wind farm access track network across the western and central development areas. Access for Scout Moor High Level Reservoir also provides a quicker access to expansion areas in the north west of the study area.

2. Geological Setting

2.1. Superficial Deposits

As part of this study the British Geological Survey (BGS) England and Wales, Sheet 76, Rochdale bedrock and superficial deposits map has been reviewed in detail. Both 1:50,000 and 1:10,000 scale geological maps have been reviewed Further BGS digital map datasets are presented within the GroundSure GeoInsight Report, Appendix B. Drawing GB200361_M_039, Appendix A depicts the superficial geology across the Application Site.

2.1.1. Peat

The primary map data indicates the predominant superficial deposit to be of blanket peat which mantles the upper area of the moorland and has accumulated in greatest extent on the upper moorland plateau across relatively level and gently sloping terrain.

NPC initially completed a 'first pass' peat depth survey which is reported in the Scout Moor Wind Farm Expansion Peat Survey Report (118_R_NPC_PEEL_4), February 2011. During this survey, peat depth probes have been implemented on a 100m spaced grid set across the relevant Application Site areas (Drawing GB200361_M_041, Appendix A). This survey has identified the deepest areas of peat (1.5 – 3.0m) to be focussed in the north east and south east parts of the Application Site. There is a broad open plateau immediately to the east of the high point of Hail Storm Hill which represents the greatest expanse of deep peat. However this has been largely avoided by the footprint of the proposed infrastructure. From this phase of study, the second most significant area of deep peat is present across the southern limb of the moorland plateau which extends south from the middle of the Eastern Application Site area. Similarly deep peat exists as discrete pockets which have been identified across the Western Application Site.

The interceding areas between blanket peat deposits are likely to be a variety of mineral soils at surface. Information has been gathered from the Soils Site Report, provided by the National Soil Resources Institute at Cranfield University. This indicated that the mineral soils across the Application Site are likely to consist of well drained, coarse loamy soil over bedrock. Across the southeast and south west of the Study Area there is also indicated to be a prevalence of coarse loamy, very acid upland soils over rock. Such soils may have a wet peaty surface horizon and thin iron pan (hard layer of precipitated iron salts). There also may be more slowly permeable and seasonally waterlogged fine loamy, clayey soils throughout the site.

Detailed peat probing surveys were completed by the end of November 2014. Field surveys were undertaken by a third party at a grid resolution of up to 25m. This covers the Proposed Wind Farm Expansion layout design as depicted in the main Environmental Statement. The peat depth contour map provided in Appendix A; provides an interpolation of the peat depth using this detailed data-set. 'Kriging' was the method of mathematical interpolation used to achieve the indicative spatial depth distribution. This was deemed to provide the most accurate representation of the dataset. As can be demonstrated by the peat depth contour map the proposed expansion turbine locations have been designed away from the deepest areas of peat with T1, T2, T4 & T16 on the periphery of deeper peat areas.

2.1.2. Glacial Till

BGS 1:50,000 scale Digital Map Data reveals limited areas of glacial till mapped within the Application Site. Mapped units of glacial till are confined to the lower Dearden Valley within the north-western part of the study area. The BGS describes the glacial till to comprise clay to sandy clay, unsorted with common, gravels, cobbles and some boulders. The composition of granular material will be strongly linked to provenance from the local bedrock geology (i.e. sandstone, mudstone, siltstone and coal). The depth of glacial till deposits across the Application Site is currently not defined and is likely to be highly variable. Only through intrusive site investigation would it be possible to determine the depth of glacial till across the proposed infrastructure locations.

2.1.3. Head Deposits

Head deposits although shown to only be present across one small area are closely related to mass movement deposits. Formed on sub-aerial slope systems from material accumulated by down slope movements including landslide, debris flow, solifluction, soil creep and hill wash processes. The BGS indicate the extent of a head deposits on the valley slopes to the east of pre-existing Scout Moor wind turbine E8. This is not thought to influence any part of the Application Site. However only through intrusive site investigation would it be possible to determine the presence of head deposits at the proposed infrastructure locations.

2.2. Artificial Deposits

Information derived from the 1:50,000 scale BGS map data highlights the mapped extent of artificial ground within the Application Site. Drawing GB200361_M_039, Appendix A depicts areas of artificial ground. The principal types of artificial ground are set out below:

- **Made Ground** – man-made deposits on the original ground surface, mainly comprising colliery spoil quarry waste and possibly with some industrial and domestic waste;
- **Infilled Ground** – man-made deposits, areas where the ground has been cut away and then had artificial ground deposited, e.g. backfilled quarry, landfill site.
- **Disturbed Ground** – sites of former workings where worked ground, infilled and made ground deposits cannot be distinguished.

The GroundSure GeoInsight Report, Appendix B for the Study Area depicts the detailed distribution of artificial deposits on Map 1.1 – Artificial Ground Map.

Over the western part of the Study Area there is a large area of in-filled ground and undifferentiated made ground which covers the area of Scout Moor Quarry at the site entrance and extends north contouring along the side of Dearden Valley. These deposits are thought to mark the site of former quarrying operations now backfilled up to the operational limits of Scout Moor Quarry.

Within the northwest and north east parts of the Study Area is an area of in-filled and made ground, this extends out-with the Application Site along the prominent escarpment overlooking the Cowpe Valley and Reservoir. However the area of in-filled ground widens into the western study area and is shown to extend beneath the area of three of the proposed extension turbines (T5, T6 & T7). These artificial deposits are also understood to be sites of former sandstone quarrying which have exploited the shallow bedrock profile along the escarpment. Site walkover observations have confirmed the presence of these mapped units.

The third main area of artificial ground is situated approximately 180m east from pre-existing Scout Moor Turbine E19. Covering a circular area of approximately 500m in diameter this area of in-filled ground marks the location of a former sandstone quarrying site. There are understood to be some open quarry voids and rough tracks still remaining across this area. It is noted that these features are not in the area of the proposed expansion and out-with the Application Site.

2.3. Mass Movement Deposits

The BGS 1:50,000 scale digital geological map data highlights several areas which are mapped as landslide deposits. These are described by the BGS to comprise areas of debris slide of rock and superficial soil materials and may include mud flows. These deposits commonly lie un-conformably onto the bedrock units. The composition and internal structure of these deposits will greatly depend on the upslope provenance of material and the type of mass movement or slip failure.

At the head of the Naden Valley, there is an area of extensive sloping ground between the pre-existing Scout Moor Turbines E10 and E18. This feature has been defined as a landslip system. The mode of failure is not discernible from the primary data sources however Natural Power's local geotechnical knowledge across the Southern Pennine region points to a post glacial landslip system controlled by large and deep seated rotational slips which penetrate into the coal measures geology. These larger systems generally influence smaller multiple rotational slips down-slope which then evolve and become heavily modified by contemporaneous or later debris flow events, (Burgess, 1976). The debris flows are likely to entrain glacial till, head and peat materials. It should be noted that proposed expansion turbine T15 is

upslope from this system. A site walkover survey revealed no signs of active instability at the proposed turbine location however the risk of deep seated landslide risk remains elevated at this location.

The second main area of mass movement deposits are mapped across large areas of the mid and lower Dearden Valley below and to the west from the Scout Moor High Level Reservoir. The highest of these mass movement deposits situated approximately 275m northwest from the pre-existing E26 covering the locations of two proposed turbines (T10 and T12.) These two locations are in the upslope section of the mass movement deposits and remain at elevated risk from deep seated geological instability.

There are additional mapped areas of mass movement deposits on the periphery of the Application Site and generally on steepened ground on escarpments and valley flanks.

Mass movement deposits can often be meta-stable and present a significant geo-hazard to construction development. Mass-movement may be re-activated naturally as a consequence of changing climate or can be influenced by significant rainfall events. Modification of the mass-movement deposits through excavation or surcharge loading can also lead to re-activation or further slope failure. It should be highlighted that the geotechnical properties of mass movement complexes can present a contrast in material strength to surrounding ground conditions. Re-moulding of cohesive deposits and sliding along shear planes can cause failures to be controlled by re-moulded and residual shear strengths. Map 1.2 within the GroundSure GeoInsight Report (Appendix B) depicts the distribution of these deposits across the study area. Post consent detailed site investigation should be utilised to further investigate any possible deep seated land slip systems at the proposed expansion turbines at elevated risk (T10, T12 & T15).

2.4. Solid Geology

The solid bedrock geology beneath the Application Site is formed of the Millstone Grit Group and Pennine Coal Measures Group Rocks. Table 2.4.1 and 2.4.2 set out the simplified stratigraphic column indicating the rock formations and individual rock units which are present beneath the Application Site and wider study area. The stratigraphy beneath the Application Site has been compiled from the BGS Lexicon of Named Rock Units with the colours presented on the table coordinated with the BGS map dataset. A complete bedrock and faults map is depicted as Map 1.3 within the GroundSure GeoInsight Report, (Appendix B). A detailed solid geology map (Drawing GB200361_M_040, Appendix A) has also been provided.

This data has been collated from the BGS 1:10,000 scale solid geology map sheets SD81NW Cheeden & SD81NE Whitworth. The stratigraphic relationships seen beneath the Application Site are a direct result of the development and evolution of the Pennine area during the Carboniferous period. The Pennine range was part of a series of structurally controlled basins which were major sites of deposition derived from erosion of a growing chain of mountains (The Variscan Front). From the end of the Carboniferous to early Permian times, during further mountain building to the north of the Pennine basins, inversion of the basins occurred with tectonic movement generating deep seated faulting through the basin structures. As part of this movement the Carboniferous rocks were uplifted. Subsequent substantial erosion and planation of these formations then took place. It is assumed that no significant tectonic activity has occurred since the Tertiary period. It is postulated that contemporary tectonic movements may be associated with mining subsidence and stress relief and are likely to be focussed along pre-existing fault lines. This movement can be complexed hill cambering and interconnection with shallow mining features. Evidence of this action may be fissuring of bedrock units. Such sub-surface features should be investigated through a pre-construction phase of detailed site investigation.

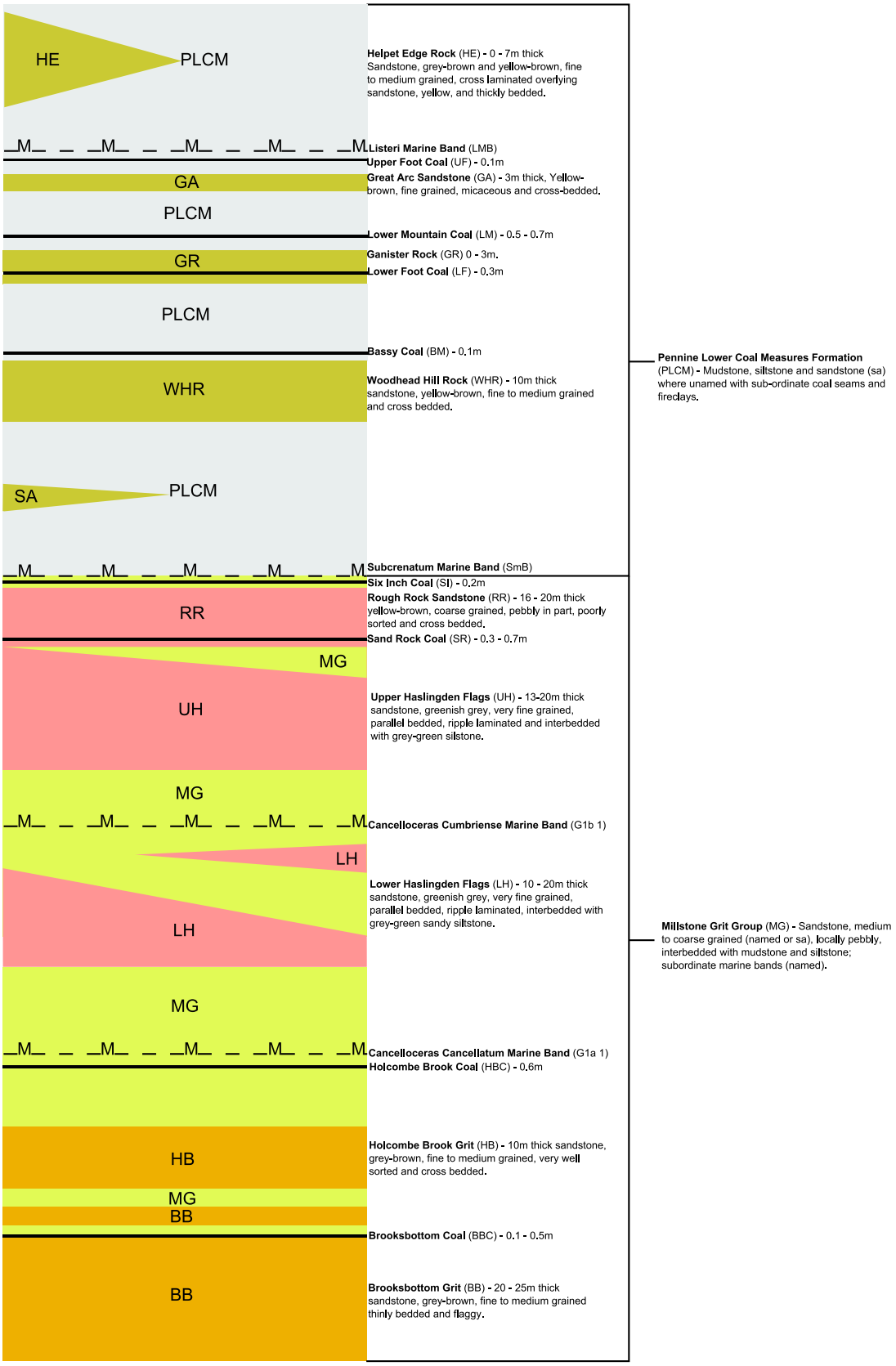
Table 2.4.1 Bedrock Geology Units & Stratigraphic Relationships		
	Rock Formation	**Rock Units**
Pennine Coal Measure Group	**Pennine Lower Coal Measures Formation** (undifferentiated mudstone – siltstone - sandstone) – Interbedded grey mudstone, siltstone and pale grey sandstone, commonly with mudstones containing marine fossils in the lower part, and more numerous and thicker coal seams in the upper part. 720m maximum thickness in Lancashire – parent unit is the Pennine Coal Measures Group.	**Great Arc Sandstone** Buff grey, fine to medium grained, micaceous, thickly bedded, cross bedded and ripple laminated sandstone. 20m maximum thickness – parent unit is the Pennine Lower Coal Measures Formation.
		Gannister Rock Sandstone – Not Defined
		Helpet Edge Rock Sandstone Massive and coarse grained sandstone often evenly bedded and flaggy. Parent unit is the Pennine Lower Coal Measures Formation.
		Woodhead Hill Rock Sandstone Coarse grained and massive fine grained and flaggy sandstone. Parent unit is the Pennine Lower Coal Measures Formation.
Millstone Grit Group	**Rossendale Formation** A fine to very coarse grained and pebbly, feldspathic sandstone, interbedded with grey siltstone and mudstone and sub-ordinate marine black shales, thin coals and seat-earths. Typically, the formation comprises a lower mudstone – dominated succession including two prominent marine shales, the Cancelloceras cancellatum and Cancelloceras cumbriense marine bands, and an upper sandstone dominated succession, including the Rough Rock and Rough Rock Flags. 130m maximum thickness in Rochdale – parent unit is the Millstone Grit Group.	**Upper Haslingden Flags** Pale buff to pale grey fine grained sandstones often micaceous. Parent unit is the Rossendale Formation.
		Rough Rock Sandstone Coarse grained feldspathic and cross bedded sandstone. Maximum thickness of approximately 30m throughout the central Pennines and the parent unit is the Rossendale Formation.
		Lower Haslingden Flags Pale buff to pale grey fine grained sandstones often micaceous. Parent unit is the Rossendale Formation.
	Marsden Formation Fine to very coarse grained and pebbly feldspathic sandstone which is interbedded with grey siltstone and mudstone, and subordinate marine black shales, thin coals and seat-earths. 600m maximum thickness and the parent unit is the Millstone Grit Group.	**Holcombe Brook Grit** Quartz-feldspathic sandstone.

Description of rock formations and units taken from the British Geological Survey Lexicon of Named Rock Units & English Heritage, (2011).

Fireclay

Sedimentary mudstones which occur as 'seatearths' beneath the majority of coal seams. A 'seatearth' represents the palaeosoil horizon on which the coal forming vegetation once grew. These are distinguished from other sedimentary units by the presence of fossil rootlets and an absence of bedding structure. The term 'fireclay' was derived from their ability to resist heat and from their original use in the manufacture of refractory bricks for lining furnaces. Fireclays are typically thin (<1m) and composed of clay minerals including kaolinite and illite together with fine grained quartz in varying proportions. This material therefore may have been extracted at the same time as the overlying coal deposits.

Table 2.4.2: Detailed stratigraphic column (thickness in metres)



2.5. BGS Borehole Records

Following the review of geological mapping data the BGS onshore geo-index was searched for all relevant exploratory borehole records. Table 2.5; below details the available borehole records in closest proximity to the Application Site. Copies of the original borehole records have been included within Appendix C. Where relevant all values have been converted to metric equivalent.

Table 2.5: Details of relevant BGS borehole records

Borehole ID	Description	NGR	Depth	Year
SD81NW1	Scout Moor Irwell Valley Water Board	380723, 419586	306m	1959
SD81NW9	Scout Moor Quarry	381610, 418810	23m	1975
SD81NW22	Higher Red Lumb Farm - Rochdale	384100, 416100	49m	1990

Source: British Geological Survey

A brief summary of each borehole record is presented below and highlights key stratigraphic horizons which may have been targeted by past shallow sub-surface mining activity. It is highlighted that unfortunately all historical borehole data pertains to point locations out-with the Application Site.

2.5.1. BGS Borehole Record SD81NW1

Table 2.5.1: Summary of key stratigraphic horizons: Borehole SD81NW1

Unit	Thickness (m)	Depth (mbgl)
Shattered Strata	2.4	81.7m
Grit with coal	1.8	203.9m
Grit with coal joints	3.6	215.5m
Coal and fireclay	'0.3	221.5m

Source: British Geological Survey

This borehole was implemented in 1959 by the Irwell Valley Water Board. The position is indicated to be approximately 82m east of a water aqueduct at a point approximately 460m north of Dearden Clough and approximately 90m south-southwest of New Hall. The borehole location is approximately 125m south from the Application Site boundary in the lower reaches of the Dearden Valley.

Superficial deposits described as ‘Drift and broken shale’ are recorded to 6mbgl (metres below ground level). This is underlain by a ‘Rock and Shale’ sequence to 79mbgl. A zone of ‘shattered strata’ extends to 82m and perhaps represents a fault zone or zone of consolidated mine workings. Beneath a sequence of ‘shale’ and ‘gritstone’ with occasional coal persists to 306mbgl at which point the borehole was terminated. The resting water level targeted by the water-well is indicated at 28mbgl.

2.5.2. BGS Borehole Record SD81NW9

Table 2.5.2: Summary of key stratigraphic horizons: Borehole SD81NW9

Unit	Thickness (m)	Depth (mbgl)
Sandstone Coal Mine	0.9m	3.65mbgl
Further shallow coal workings	1.15	4.55mbgl

Source: British Geological Survey

Borehole record SD81NW9 was implemented as what is thought to be a programme of prospecting for Scout Moor Quarry. The borehole dates from 1975 and is located within the area still operational as Scout Moor Quarry. This borehole is not coincident with any of the proposed expansion areas and is confirmed as out-with the Application Site.

A core log with a low level of detail records a bedrock interface at 2.0mbgl. From 2.00 to 3.65mbgl is a sandstone unit presumed on the log to represent the Upper Rough Rock Sandstone. From 3.65 to 4.55mbgl a core loss event is reported with coal traces. This has been interpreted as the 'Sand Rock' coal horizon which may have been mined out across this location. Further core loss was reported to 5.70mbgl. From 5.70 to 20.44mbgl is recorded a sequence of sandstone interpreted as the Lower Rough Rock Sandstone. From 20.44 to 20.70mbgl is reported to be a sandstone sequence reported as the 'Haslingden Flags'.

2.5.3. BGS Borehole Record SD81NW22

Table 2.5.3: Summary of key stratigraphic horizons: Borehole SD81NW22

Unit	Thickness (m)	Depth (mbgl)
Coal Seam	1.6	3.0

Source: British Geological Survey

This borehole was implemented during 1990 as part of a water well installation at Red Lumb Farm. The borehole was commissioned in order to supply water to a domestic property. The location of this borehole is approximately 900m south from the Application Site Boundary.

The borehole records 0.6m of backfill or made ground material which overlies a sequence of 'brown shale' to a depth of 3.0mbgl. A coal seam is recorded to 4.6mbgl beneath which is recorded to be a sequence of sandstone interpreted as the Rough Rock Sandstone and Haslingden Flags sandstone. The borehole was terminated at 48.7mbgl. On completion the standing groundwater level was recorded to be 1.5mbgl within the water well installation.

2.6. Previous Site Investigation Data

As part of the preparatory works for the construction of the operational Scout Moor Wind Farm a programme of ground stabilisation was implemented in order to address the issue of shallow mine workings and potential influence on wind turbine foundations and crane hard stand areas. A report on the Treatment of Shallow Abandoned Mine Workings, produced by Scott Wilson Ltd in 2008 has been reviewed (Report No.D110643/GEO/1232). The salient treatment measures are detailed in Table 2.6 below.

Table 2.6 Scout Moor Pre-existing Infrastructure Information – Treatment of Mine Workings	
Turbine ID	**Treatment Details (High – Moderate - Low Impact)**
T1	Proof drilling was carried out to a maximum depth of 16mbgl. A coal seam was identified at 3.5 to 4.0mbgl of 0.8 to 1.2m in thickness. There was no evidence of the coal seam of being worked. A grout take test was conducted owing to the presence of a nearby abandoned mine entry. There were no significant grout takes recorded and therefore no further treatment was considered necessary.
T2	Proof drilling was undertaken to 15mbgl. Voids were reported between 6 and 7mbgl with broken ground prevalent throughout the rock sequence. Intact coal seams also detected in probe holes suggested the possible presence of intact pillars supporting mined our areas. A full drilling and grouting pattern utilising a grout curtain wall and primary infill holes was scheduled for both the turbine foundation and crane pad area. Grouting of the turbine foundation was undertaken at reducing 3m...1.5m...and 0.75m spacing in order to complete a grout curtain wall. A total of 44tonnes of pea gravel was used with the primary infill holes backfilled with P200 foamed concrete (HA Class). A total of 427tonnes of P200 foamed concrete was used in the treatment of the void beneath the turbine foundation covering a plan area of 20x20m. Voiding was recorded as uniform across the crane pad area each outrigger taking similar amounts of grout. A total of 60tonnes of pea gravel and 65tonnes of P200 foamed concrete were utilised in the stabilisation works.
T3	Proof drilling has been undertaken to 12mbgl with only one probe hole recording a loss of flush and broken ground. Further proof drilling revealed a linear trend of broken ground across the south east corner of the turbine foundation area. This was orientated towards a nearby mine entry. Proof grouting was undertaken across the turbine foundations however no grout take was recorded. The zone of broken ground was considered sufficiently consolidated and no further treatment measures were taken.
T4	Proof drilling has been undertaken to 18mbgl with an intact coal seam located. No voids, flush loss, broken or soft ground was recorded across the majority of proof drill holes. Two drill holes implemented to the northeast of the turbine foundation indicated broken ground and voiding between 5.5 and 6.0mbgl. No groundwater was encountered during the drilling operations. Additional proof drilling to 10mbgl was undertaken to check the potential extent of voiding beneath the foundation all holes recorded intact coal between 5 and 7m. Proof grouting was undertaken with no significant grout take at just 0.25tonnes of grout injected. No further treatment measures were considered necessary.
T5	Proof drilling has been undertaken to 9mbgl. A large percentage of proof holes recorded an intact coal seam between 8 and 6mbgl. A single proof drill hole implemented out-with the foundation footprint recorded a void between 6.1 and 7.1mbgl. Groundwater was encountered during drilling operations in two proof drill holes at 7.5 and 8.5mbgl. Grout curtain wall holes confirmed the presence of a void along the edge the curtain wall, with all further drill holes reporting no evidence of workings however intact coal was also not confirmed. Additional proof drilling carried out beneath the turbine foundation indicated any loss of flush, voiding, broken or soft ground. With all additional holes confirming an intact coal seam. Grouting of holes where voiding was reported utilised a total of 76tonnes of grout. No further stabilisation works were undertaken at this location.
T6	Proof drilling reported coal at depths ranging from 9 to 11mbgl with no evidence of shallow mine workings. No groundwater was encountered during the drilling and no further treatment works were considered necessary.
T7, T8, T9	No information provided

Table 2.6 Scout Moor Pre-existing Infrastructure Information – Treatment of Mine Workings	
T10	Proof drilling reported coal at depths ranging from 2.2 to 5.0mbgl with no evidence of shallow mine workings. No groundwater was encountered during the drilling and no further treatment works were considered necessary.
T11	Proof drilling carried out across this location encountered extensive voiding between 5.0 and 7.5mbgl with broken ground recorded between 6.0 and 6.5mbgl. In three of the proof drill holes, an intact coal seam was reported between 7.5 and 7.7mbgl. A grout curtain wall was implemented to 9.5mbgl around the foundation area with voids again encountered between 5 and 6mbgl. Grout take across these holes varied from 0.25tonnes to 12tonnes. Secondary infill holes were implemented in order to reinforce the grout curtain wall prior to infill of the main body beneath the foundation areas. The total grout take including primary infill holes was 455tonnes with an estimated plan area of 21x21m. A total of 461tonnes of grout was utilised to treat voids beneath the crane pad outrigger positions.
T12	Proof drilling reported intact coal seams beneath the turbine foundation. No evidence of workings was identified and no further treatment works were considered necessary.
T13	Initial proof drilling was implemented to 16mbgl encountering extensive voiding between 8 and 9mbgl. Two proof drill holes recorded an intact 'Sand Rock Mine Coal Seam' between 8.0 and 8.4mbgl. Owing to the extent of voids across the foundation area, a full drill and grout programme was implemented: Drilling and grouting of a perimeter curtain wall was initially undertaken with the majority of drill holes recording voiding. The perimeter grout curtain wall required approximately 280tonnes of grout mix. The total final grout take across the turbine foundation was 329tonnes with an approximate plan area of 18x18m stabilised. At the crane pad location five of the outrigger pads only took nominal quantities of grout enough to back fill the drill holes. The remaining three outrigger areas took approximately 140tonnes of grout.
T14	Proof drilling was implemented to 15mbgl with no coal or shallow mine workings reported and no further treatment works were considered necessary.
T15	Proof drilling undertaken at this location reported no loss of flush or voiding.
T16	No information provided
T17	Initial proof drilling was conducted to depths ranging between 12 and 20mbgl. Drill flush loss was reported between 6 and 9mbgl in a single drill hole. With no further drill holes recorded flush loss above 12mbgl. It is highlighted that the drilling rate indicated a softer material across this location. Flush loss was also reported between 12 and 15mbgl in two thirds of the drill holes. The flush loss was accompanied by spouting water from previously drilled holes indicating linkages between holes at depths between 12 and 15mbgl. It was also noted that flush loss was recorded in a lower seam and air pressure was reported to be escaping from a nearby mine shaft entry. Conclusions were that shallow mine workings existed at two levels with strong evidence for open workings at the lower level. Further conclusions that broken ground above the lower seam of working is likely to be associated with the localised collapse of lower mine workings. Therefore drilling and grouting should proceed on the assumption that only the lower seams required full drilling and grouting operations, with localised collapse and broken ground above being consolidated during this process. A perimeter grout curtain was considered unnecessary at this location. There was no requirement to drill and grout the crane pad foundation positions due to the temporary nature of the loading, the cover of intact rock between foundation formation and the workings (>10m) and the reduced presence of voids due to the drilling and grouting operations carried out beneath the turbine foundation.

Table 2.6 Scout Moor Pre-existing Infrastructure Information – Treatment of Mine Workings	
T18, T19	No Information Provided
T20	Proof drilling reported no evidence of shallow mine workings. However soft ground was reported within three drill holes implemented across the crane pad area. These holes were grouted with 10:1 cement to PFA mix with a flowability of >700mm. No further treatment works were considered necessary at this location.
T21	Proof drilling undertaken at this location reported no evidence for shallow mine workings. Coal was identified in one of the proof drill holes at 9.5 to 10.0mbgl. No further treatment works were considered necessary.
T22	Proof drilling confirmed a coal seam present close to rock head level. As this seam was removed during the foundation excavation no further treatment works were undertaken.
T23	Proof drilling was carried out beneath the turbine foundation and crane pad area with no evidence of shallow mine workings was identified. No further treatment works were considered necessary at this location.
T24	Initial proof drilling was carried out to 16mbgl with coal identified at 5 to 7mbgl in six of the proof drill locations with no evidence of workings. No further treatment works were considered necessary.
T25	Initial proof drilling was implemented to 13mbgl. Three of the holes encountered voids and flush loss between 2.5 and 3.0mbgl with the remaining drill holes across the turbine foundation reporting an intact coal seam between 2.5 and 3.0mbgl. The entire crane pad area underwent proof drilling with voiding reported in seven drill holes. The final recommendation was for over-excavation of the foundation to remove the area of shallow voiding.
Met Mast	Initial proof drill holes were conducted to 15mbgl with voids reported in all drill holes between 6 and 7mbgl. No groundwater was encountered during the drilling operations. A full drilling and grouting pattern was undertaken. Approximately 140tonnes of P200 foamed concrete was used in the consolidation of the void beneath the turbine foundations covering an approximate plan area of 12x12m.

Source: Scott Wilson, 2008

3. Mining Setting

Historical Ordnance Survey (OS) Map data has been reviewed across the proposed expansion areas. Due to the large scale, the study area was split into four quadrants (A1, A2, B1, B2). The description of the historical maps is based on these areas depicted in Figure 3 below and described Table 3. All OS map data is presented within Appendix E of this report.

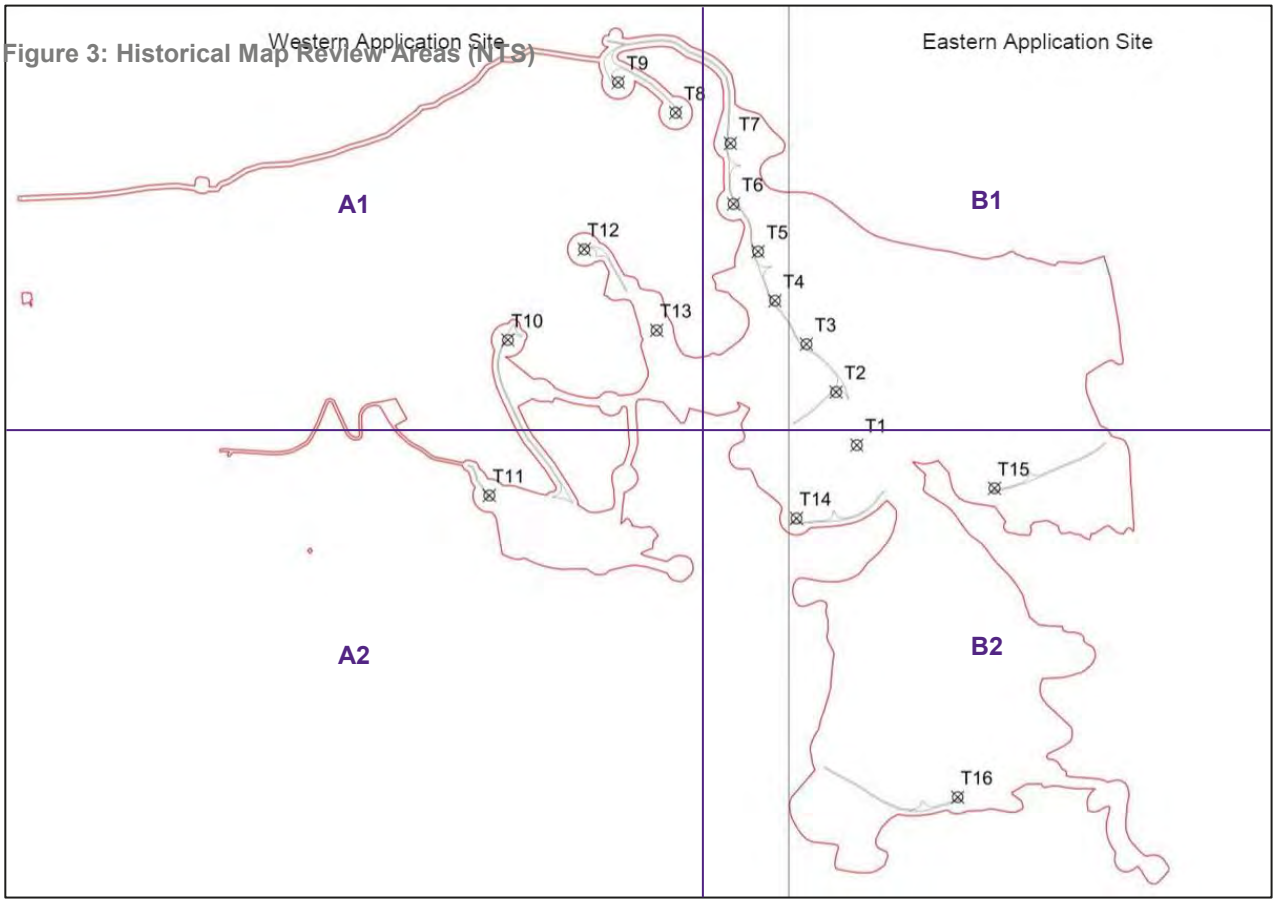


Figure 3: Historical Map Review Areas (NTS)

Table 3: Review of Historical Ordnance Survey Map Data

Date	Scale	Description of Application Site and Surrounding Area
1890 - 1891	1:10,560	**(North) Grid A1-A2** The higher elevations of the moorland plateau including the summit of Whittle Hill are devoid of any mapped features or indications of industrial development. However there is shown to be a geometric arrangement of drainage channels which may indicate the moorland and particularly the peat land was being managed and drained at this time. Drainage generally is shown to flow west and north down into the Dearden Valley or 'Dearden Clough' as it is termed on the map and eventually joining 'Scout Moor Brook' at the base of the valley. On the northern facing slopes of Dearden Valley is a network of farm tracks and quarry access tracks which interconnect a number of sheep folds and a small quarry termed 'Back o'th'Lowe Quarry'. On the western limit of the Scout Moor plateau begins an extensive area of quarrying which is serviced by a tramway. The large elongate quarry site is nestled into the westerly facing escarpment of Scout Moor, and extends from

Table 3: Review of Historical Ordnance Survey Map Data		
Date	**Scale**	**Description of Application Site and Surrounding Area**
		the present day location of the operational Scout Moor Quarry north and east into Dearden Valley. There are numerous small buildings and barns on the periphery of the quarry area. A tramway linking to a minor road and further on to local Haslingden and Rochdale tram network at an interconnector close to the present day wind farm entrance is shown. From this location the tramway runs northeast up into the Dearden Valley contouring up to the quarry sites. It is presumed that this area was wholly concerned with the extraction of sandstone. Sand Beds Lane intersects the extreme north western part of the study area on the edge of Dearden Moor which begins just north of the study area. Further east and situated on the northern and eastern head of the Dearden Valley is another extensive area shown as quarried ground. This is termed 'Foe Edge Quarry'. Again the quarry sites are serviced by a separate tramway which enters the Application Site from a larger quarry site to the north and on the top of Dearden Moor. Generally the topography within the Application Site is shown to be comparable to the present day however there is a greater proliferation of quarrying shown in the outlying areas from the development. **(South) Grid A2** The south western corner of the Application Site contains a network of artificial drains depicted across the southerly slopes of Scout Moor although this area of the development is termed 'Turf Moor' on the 1891 map edition. There is a small reservoir which is impounded by a linear earthen embankment and covers an area approximately in between the present day Scout Moor Turbines E11 and E13. A tramway is shown to traverse the south western corner of the Application Site. The alignment of this feature climbs the westerly moorland escarpment from the village of Turn and stops at a Colliery site which would be located at the eastern end of the present day Scout Moor Quarry. From the unnamed colliery the tramway runs southeast to the small aforementioned reservoir and then south and east to a termination....
1890 - 1891	1:10,560	...point close to the southern Application Site boundary. An old shaft is depicted as approximately 60m southwest from pre-existing turbine E17. This suggests mining activity has occurred across this area pre-dating the 1890's. A moderately sized quarry site termed 'Fecit End Delf' is depicted approximately 500m southwest from the proposed expansion turbine T11. The map key indicated this feature to comprise a sandstone quarry or ground working. A small track termed 'Coal Road' traversed the southern facing escarpment to 'Turf Moor' and Scout Moor. This track runs approximately east to west from the village of Turn and climbs onto the moorland contouring the steep ground and terminating approximately 100m south of pre-existing turbine WTG 14. **Grid B1** The moorland is defined as 'moss' indicating blanket peat deposits across much of this area. A small reservoir impounded by an earth embankment is depicted on the higher moorland plateau in an area which is now immediately to the north of pre-existing turbine E23. There are several small tributary streams which drain into this feature from the head slopes of the Dearden Valley and 'Whittle Hill'. There is a large quarry site named 'Ding Quarry' which existed across an area north east of proposed turbine T2. A tramway is shown to service the quarry and traverses the north central moorland in a northwest – southeast

Table 3: Review of Historical Ordnance Survey Map Data		
Date	**Scale**	**Description of Application Site and Surrounding Area**
		orientation and then descends the northern Scout Moor escarpment into an extensive quarry site named 'Cragg Quarry'. This extends east-west along the northern Application Site Boundary. Further small quarry sites are present to the north across the Cowpe valley and are interspersed amongst small farmsteads. **Grid B2** The majority of the upper moorland across this area is shown to be without any major industrial development. There is the artificial 'Man Road Ditch' which is shown as a sharp linear surface water course which drains the southern limb of the moorland plateau and carrying surface water towards the south and into 'Red Lumb Brook' to the south of the Application Site. The Naden Higher, Middle & Lower reservoir system is shown to be present to the east within the Naden Valley. The land to the south of the Application Site boundary is occupied by parcels of land indicated as pasture. There are several air shafts situated approximately 550m south-southeast from the location of pre-existing turbine E2.
1908 -1909	1:10,560	**Grid A1** Scout Moor High Level Reservoir is now shown in its present day location; No further major changes are shown within this part of the Application Site. **Grid A2** 'Fecit End Delf' sandstone quarry shows a moderate expansion in the quarry void east along the Scout Moor escarpment. The area is still out-with from the southern Application Site boundary; No further major changes are shown within this part of the study area. **Grid B1** 'Cowpe Reservoir' is now shown to the north of the Application Site and is set within the Cowpe Valley at is present day location and form; 'Cragg High Level Tank' a small reservoir is shown to be situated approximately 600m north of the existing turbine E25. No further major changes are shown within this part of the Application Site. **Grid B2** The moderately sized 'Ding Quarry' shows it has been expanded both laterally and towards the south; No further major changes are shown within this part of the Application Site.
1927 - 1928	1:10,560	**Grid A1** No further major changes are shown within this part of the Application Site. **Grid A2** 'Scout Moor Colliery' is now designated as disused; The small reservoir situated centrally on 'Turf Moor' has halved in size perhaps suggesting that by this time the reservoir was no longer being used or maintained; No further major changes are shown within this part of the Application Site. **Grid B1** Cragg Quarry on the northern Application Site boundary is described as disused; The tramway previously running through Cragg Quarry and crossing from the north into the site to 'Ding Quarry' is no longer shown with just a footpath / track in place of the tramway; No further major changes are shown within this part of the Application Site.

Table 3: Review of Historical Ordnance Survey Map Data		
Date	**Scale**	**Description of Application Site and Surrounding Area**
		Grid B2 'Lower East Knowl Colliery' is depicted approximately 250m south from pre-existing Scout Moor Turbine E2. The feature is indicated to be a drift mine, understood to be in the form of a series of inclined horizontal adits which advanced northwards beneath the Application Site; No further major changes are shown within this part of the Application Site.
1927 - 1928	1:10,560	**Grid A1** No further major changes are shown within this part of the Application Site. **Grid A2** 'Scout Moor Colliery' is now designated as disused; The small reservoir situated centrally on 'Turf Moor' has halved in size perhaps suggesting that by this time the reservoir was no longer being used or maintained; No further major changes are shown within this part of the Application Site. **Grid B1** Cragg Quarry on the northern Application Site boundary is described as disused; The tramway previously running through Cragg Quarry and crossing from the north into 'Ding Quarry' is no longer shown with just a footpath / track in place of the tramway; No further major changes are shown within this part of the Application Site. **Grid B2** 'Lower East Knowl Colliery' is depicted approximately 250m south from pre-existing Scout Moor Turbine E2. The feature is indicated to be a drift mine, understood to be in the form of a series of inclined horizontal adits which advanced northwards beneath the southern study area; No further major changes are shown within this part of the Application Site.
1938	1:10,560	No significant changes are depicted within the Application Site. Throughout the surrounding areas to the expansion areas there is interpreted to be a minor decline in the number of active quarry sites.
1949 - 1950	1:10,560	**Grid A1** Many of the sheepfolds which dotted the northern flanks of the Dearden Valley are no longer shown. No further major changes are shown within this part of the Application Site. **Grid A2** The tramway which serviced the now disused 'Scout Moor Colliery' is no longer shown. The small reservoir on top of 'Turf Moor' is no longer designated as such. No further major changes are shown within this part of the Application Site. **Grid B1** No further major changes are shown within this part of the Application Site. **Grid B2** No further major changes are shown within this part of the Application Site.
1967 - 1968	1:10,560	**Grid A1** Scout Moor Quarries which extended up into the middle Dearden valley are designated as disused; The tramway which entered the Application Site from the north and serviced 'Foe Edge Quarry' is described as dismantled;

Table 3: Review of Historical Ordnance Survey Map Data		
Date	**Scale**	**Description of Application Site and Surrounding Area**
		No further major changes are shown within this part of the Application Site. **Grid A2** Scout Moor Colliery is no longer designated as such; No further major changes are shown within this part of the Application Site.
1967 - 1968	1:10,560	**Grid B1** 'Ding Quarry' is designated as disused; The small 'Great Lodge' Reservoir situated at the head of the Dearden Valley is shown as halved in size. This may be an indication that at this time this reservoir was no longer used or maintained; No further major changes are shown within this part of the Application Site. **Grid B2** No further major changes are shown within this part of the Application Site.
1978 - 1979	1:10,000	**Grid A1** Partial coverage with no further major changes detected within this part of the Application Site. **Grid A2** No coverage **Grid B1** Limited coverage with no further major changes detected within this part of the Application Site. **Grid B2** No coverage
1987 - 1992	1:10,000	**Grid A1** No further major changes are shown within this part of the Application Site. **Grid A2** No further major changes are shown within this part of the Application Site.
1987 - 1992	1:10,000	**Grid B1** No further major changes are shown within this part of the Application Site. **Grid B2** No further major changes are shown within this part of the Application Site.
2002	1:10,000	No significant changes are depicted within the Application Site.
2011	1:10,000	Scout Moor Operational Wind Farm is now depicted

The Coal Authority provided a variety of geospatial data relevant to the Study Area. Table 3.1.1 below provides list of attributes linked to each dataset.

Table 3.1.1: Coal Authority Supplied Digital Data

Dataset ID	Description
'In Seam Level'	Point data indicating coal seam and depth below Ordnance Datum
Mine Entries	Point data indicating type of entry (shaft or adit) and the adit angle of entry where applicable
Areas of Probable Workings	Polygon data with depth indication: (Shallow, Moderate, Considerable) Shallow = 0 – 30mbgl Moderate = 30 – 100mbgl Considerable = >100mbgl

Dataset ID	Description
Spine Roadways	Polygon data indicating known underground roadways within mine workings with depth indication: (Shallow, Moderate, Considerable) Shallow = 0 – 30mbgl Moderate = 30 – 100mbgl Considerable = >100mbgl
Areas of Underground Working	Polygon data indicating the name of worked coal seam and the extraction thickness in cm.
Areas of Unlicensed Opencast	Polygon data which indicates the sites of worked opencast sites, as worked by the National Coal Board (NCB) and/or British Coal
Coal Working Dates	Point data indicating mine entries and / or coal workings with the name of the worked coal seam and the last known date of working.

Source: The Coal Authority

The Coal Authority datasets have been collated within GIS software in order to analyse the distribution of coal workings beneath the Application Site. The primary findings are discussed in detail below. Drawings GB200361_M_021 & 022 provided within Appendix A collate mine features data and depict the location of these surface and sub-surface mining features in relation to the proposed infrastructure.

3.1. Past Coal Mining

3.1.1. Underground Coal Workings in the Sand Rock Coal Seam

Western Application Site

An area of historic underground coal workings is indicated beneath the eastern part of the pre-existing Scout Moor Wind Farm. The workings are at moderate depth and indicated to be between 50 to 70mbgl. Workings are shown to extend beneath the pre-existing turbines E20 and E23 and associated wind farm access tracks. The proposed extension turbine T13 is also situated over the top of this area of workings with approximately 60m of overburden, predicted above the mine working. The Sand Rock Coal Seam targeted by these workings is indicated to be 0.5m in thickness. This overburden thickness would generally be thought of as sufficient cover to dissipate the effects of consolidation of these workings. There is however the possibility of void migration through the overburden where the geological strata is of insufficient mass strength to prevent crown hole formation. The last known year of working is reported to be 1940. From The Coal Authority data it was not possible to verify the mode of coal extraction from these workings. Although extraction is most likely to have been in the form of ‘pillar and stall’ mining inferred from the rectangular geometry at the indicated extents of the workings.

An isolated shallow underground working has been identified beneath pre-existing Scout Moor Turbine E11. The coal working is indicated to exist at approximately 10mbgl with the last known year of working reported as 1940. A further isolated small coal working is shown to be coincident beneath the pre-existing wind farm access track spur running south to existing turbine E11. The workings are predicted to exist at 10mbgl and are also understood to date from 1940.

Eastern Application Site

A second extensive area of the underground coal workings in the Sand Rock Coal Seam has been identified. The workings are indicated to extend from beneath pre-existing wind turbine E5 and cover an area to the east beneath pre-existing turbine E2. The workings then extend south and begin at the area of ‘Red Lumb’ (out-with the Application Site). The workings are indicated to be at shallow depth 13 to 21mbgl with the depth of working understood to decrease south with reducing elevation of the moorland. This working depth geometry indicates this was a drift mine implemented south of the development near ‘Red Lumb’ and worked north beneath the Scout Moor escarpment. The workings are predicted to be ~50m west from proposed expansion turbine T16. The date of working is indicated from 1900 with the last known year of working reported as 1938.

A moderately sized area of shallow coal workings is present within the north east Application Site. Extending from an area 90m east from existing turbine E25 and then northeast for approximately 370m. These are shallow coal workings reported to be between 8 and 15mbgl with the last year of working given at 1883. This area of former underground workings is not understood to be within the footprint of proposed infrastructure.

3.1.2. Underground Coal Workings in the Lower Mountain Coal Seam

Western Application Site

An approximately circular area measuring 250m in diameter at its widest extent is indicated beneath the summit of Whittle Hill. These workings begin immediately to the north of existing turbine E22. The depth of working is indicated to be approximately 40mbgl with a seam thickness reported at 0.7m. The last date of working is given as 1884. The nearest proposed expansion turbine is T13 approximately 110m NE from the edge of the workings.

3.1.3. Probable Areas of Shallow Coal Mine Workings

The Coal Authority has provided an indication as to the probable areas of historic coal mine workings (extraction now ceased). This is based on the outcrop and sub-crop areas of coal bearing strata. The known location of surface mine entries has also been considered. Table 3.1.3 below highlights the proposed expansion turbine locations which are situated above areas of shallow (<30mbgl) coal workings.

Table 3.1.3: Proposed Expansion Turbines Affected by Probable Areas of Shallow Coal Workings

Proposed Extension Turbine	Comments
T1 T11 T13	Directly above probable shallow coal workings affecting sub-surface at depth of <30mbgl.

Source: The Coal Authority

3.1.4. Mine Entries

The Coal Authority have provided no record of what steps, if any have been taken to treat the mine entries identified across the Application Site. It should also be highlighted that Coal Authority records may be incomplete and consequently, there may exist across the development and local area, mine entries of which the Coal Authority has no knowledge.

The Coal Authority has provided location data on 119 separate mine entries within the study area. The distribution of each mine entry in relation to the Application Site is shown on drawing GB200361_M_022, Appendix A. There are a total of 45 mine entries indicated to be adits and the remaining 74 mine entries indicated to be vertical shafts.

CIRIA SP32 describes shafts and adits to have been used for any number of the following operations:

- Winding and haulage of the mined coal resource;
- Access of miners;
- Pumping and removal of groundwater;
- Ventilation;
- Connection of seams at different stratigraphic levels (in such cases the shaft may be contained underground and not emerge at the ground surface)

Shafts

Shafts can be circular, oval, or rectangular, however the circular form is understood to have been most widely use throughout England. CIRIA SP32 indicates between 1800 & 1900 shaft diameters were in the range of 1 – 8m. Shafts were sunk vertically into the coal measures strata and are commonly lined where

passing though superficial deposits or weak strata. It is probable that shafts across the Study Area are lined with the local sandstone as it was readily available at surrounding quarry sites.

Adits

Adits are mine entries which enter the coal bearing strata in a sub-horizontal orientation from the ground surface. Adits are generally sited where coal outcrops at the surface with the adit forming the 'mouth' of the mine. The underground working would progress sub-horizontally along the coal seam and get progressively deeper. Across Scout Moor the adits have been sited to exploit the steep topography on the surrounding escarpments, with adits opened where coal outcrops along the escarpments and workings then progressing beneath the moorland plateau. Adits are often obscured at the surface and may have been backfilled or sealed on abandonment.

3.2. Present and Future Coal Mining

The Application Site is not indicated to be in the likely zone of influence of any operational underground coal workings. However it should be highlighted that coal reserves exist in the local area which could be worked at some point in the future.

3.3. Quarrying and Opencast Coal Mining

A total of 530 individual surface ground workings have been identified within the study area. The distribution and type of ground works has been indicated on Drawing GB200361_M_021, Appendix A. The source of this data comes from the GroundSure GeoInsight Report, Appendix B and the British Pits (BRITPITS) database, administered by the BGS.

There are two quarry sites indicated by the BGS to be currently active. Both quarries are out-with of the proposed Application Site boundary:

- Scout Moor Quarry, Edenfield [381400, 419000] is an active quarry extracting clay, shale and sandstone.
- Whitworth Quarry, Whitworth [387500, 420280] is north east of the Application Site and is actively extracting sandstone

3.4. Mining Hazards

Due to the confirmed presence of multiple shallow mine workings beneath the Application Site it is important to highlight the differing conditions and hazards, associated with different modes of coal extraction. The following discussion draws on information and guidance provided within CIRIA SP32 and includes further outline guidance from Waltham (2009).

Outlined in CIRIA SP32; the 1872 Coal Mines Regulation Act, there was a mandatory requirement to deposit accurate plans of mines with the Secretary of State following their abandonment. The prospect of unrecorded coal mining features within the site therefore cannot be discounted and it should be highlighted that the earliest mine plans were completed using rudimentary surveying methods and as such may not provide a high degree of accuracy. A report by the Mines Department Waters Dangers Commitee in 1927 concluded that plans, certainly prior to 1887, may not indicate the actual position of workings and may only be evidence that old workings exist. The committee also concluded that from 1887 the standard of accuracy improved and the mine plans become more reliable.

3.4.1. Adits and Bell Pit Workings

Early mine workings represented on the late 19th Century historical maps may indicate small scale extraction of coal through adits and bell pits. In forming a bell pit, an unsupported shaft approximately 1m diameter was sunk to the coal seam. The depth is dependent on the extent of overburden and the thickness and quality of the seam. Mining would then proceed radially from the base of the shaft until the area became too large to be naturally or artificially supported, when ventilation became restricted, or when the inflow of groundwater exceeded the rate of bailing. Bell pits were then abandoned and a new one sunk nearby. CIRIA SP32 advises that early shafts and bell pits can be up to 12m deep and may comprise of a

single shaft which serviced a number of seams. However it is highlighted that the collapse of bell pits is likely to have a relatively small scale impact on the ground.

3.4.2. Pillar and Stall

Waltham, (2009) describes pillar and stall type extraction as: sub-surface mining of coal seams through the partial extraction which was utilised for most coal workings before 1940. Between 10% and 40% of the coal is left in-situ to form pillars that support the roof of the mine. The geometry of this natural support is often random but may become more systematic and geometrical. Where coal seams have been over-worked there may be a long term subsidence threat.

Mine pillars may fail where they are left too small to support the overburden and subsequently become overloaded by surface construction activities or are affected by erosion by fluctuating groundwater flow. Pillars may puncture into underlying soft clay deposits ('seat earth' / 'fireclay') and create an issue of long term subsidence. The collapse of such features may be delayed and unpredictable. Waltham, (2009) comments that ground failure is minimal in mines greater than 50m depth, where any surface imposed loads are minimal compared to the overburden load.

3.4.3. Shafts and Mine Entries

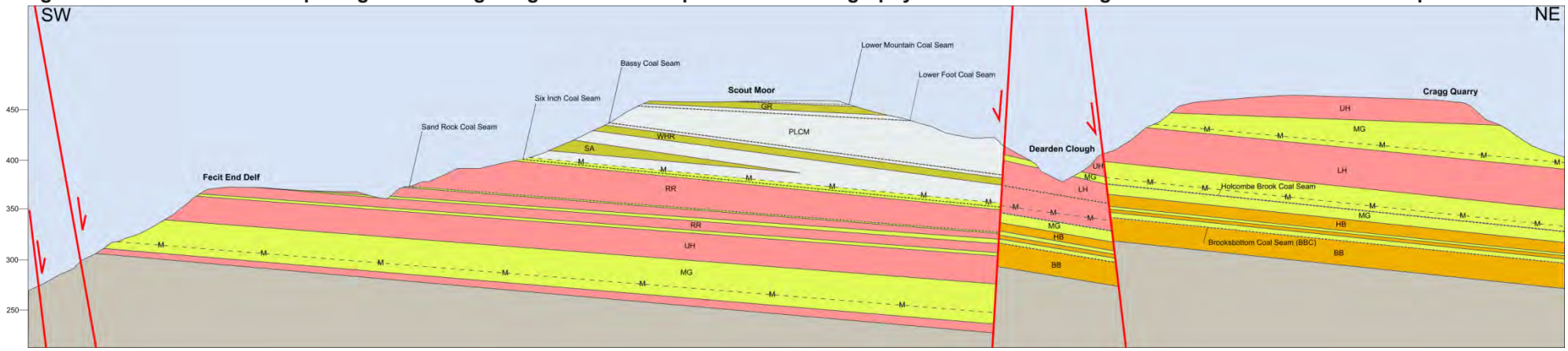
The risk of unrecorded mine shafts is considered high across the site area. Shafts and adits may be typically 1 – 8m in diameter and may extend to deeper workings in the local area which are predicted to be up to 90m below the surface. The condition of mine shafts can vary widely and may be brick or concrete lined, but likely to be dry-stone supported due to local abundance of sandstone. In worst cases shafts may be un-supported and unlined and can have loose fill or may be empty. It was common for shafts to be backfilled with colliery spoil and mine waste after the mine was abandoned however capping of these features may be absent.

4. Conclusion

4.1. Ground Model Analysis

The following geological cross section has been constructed from the BGS 1:10,000 scale composite maps represented on drawing GB200361_M_040, within Appendix A. The lines of cross section have been projected onto the geological map presented within Appendix A. The cross sections examine the relationship between the topography of the site, the superficial deposits and the underlying solid geology of the Pennine Lower Coal Measures and Millstone Grit Group. It should be highlighted that the superficial deposits may vary in thickness across the development. It should be noted that the geological cross sections have been vertically exaggerated to ensure key stratigraphic relationships are visible. The approximate scale is indicated on the section.

Figure 4.1 – 'Section AB' depicting the main geological relationships and the stratigraphy of the coal bearing strata beneath the western expansion area.



Approximate Scales at A3: Horizontal Scale - 1:8,350, Vertical Scale 1:4,170. Vertical elevations are indicated as mAOD.

4.1. MRA Conclusions

The Application Site is impacted by over one hundred years of coal extraction, predominantly from the Sand Rock Coal Seam and Lower Mountain Coal Seams which sub-crop beneath the site. Shallow abandoned mine workings (<30mbgl) have been identified across the eastern and western parts of the proposed Application Site. There are numerous surface ground workings which are relicts of sandstone quarries and open coal pits across the development. These may now exist as backfilled voids containing artificial ground or may exist as open voids at the surface.

It is highlighted that shallow mine workings present beneath the proposed Study Area may have primarily adopted a 'pillar and stall' method of coal extraction associated with 18th and early 19th Century periods. Coal seams are reached through a series of shafts and adits and the mine then opened up along the worked seam by mining out 'stalls' leaving 'pillars' of mineral supporting the roof of the mine. This method of mining is less efficient than 'long wall' as a large percentage of coal is left in-situ. Hence when such mines were abandoned it was common for 'pillars' to be 'robbed' whereby the majority of pillars were removed leaving minimum support providing short term stability. Mines abandoned in such circumstances represent an increased risk. The overlying strata are marginally stable and collapse may occur un-predictably. Mine voids may remain in the sub-surface indefinitely until disturbed from surface construction or changes in the groundwater regime.

The assessment of risk to surface development has adopted a guideline figure for 30m as a safe cover depth above shallow mine workings. This has been and reinforced by CIRIA SP32 guidance. Local ground conditions can vary over short distances due to the presence of local faulting. Poor ground conditions or a 'stacking' effect from multiple shallow workings at different levels within the sub-surface may require an increased safe cover depth.

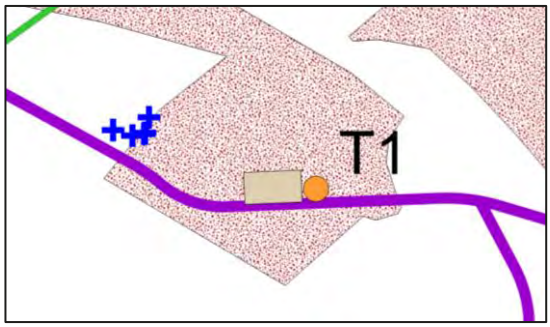
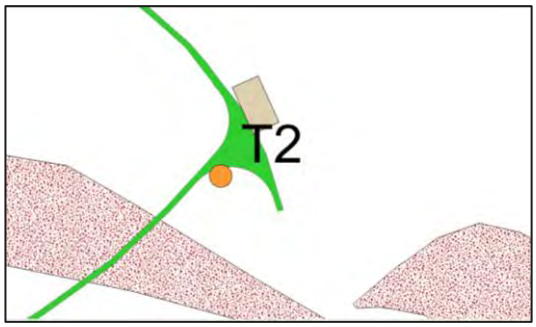
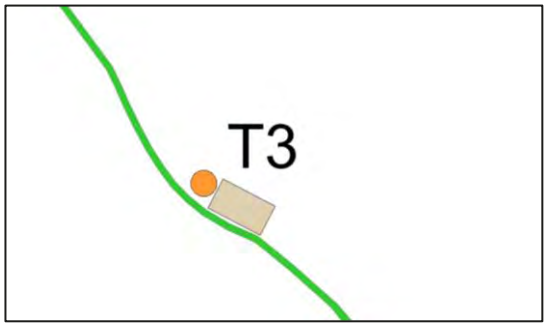
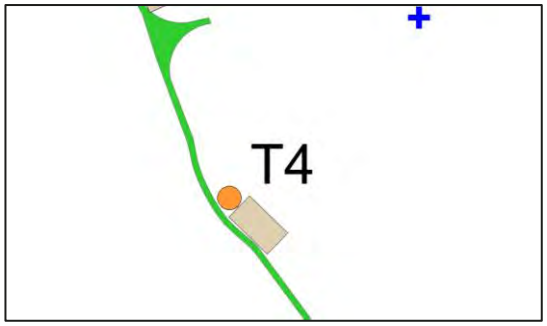
No details exist as to the nature of any treatment of abandoned mine entries and adits present in the proposed Application Site. Therefore all shaft locations should be regarded as a potential hazard. It is usual for such features to be backfilled with mine waste and spoil which would be considered artificial ground and potentially contaminated. Drawings GB200361_M_021 & GB200361_M_022 (Appendix A) depicts all known shafts, adits and colliery workings within the Application Site.

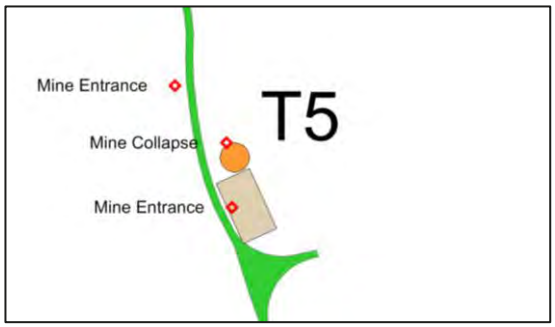
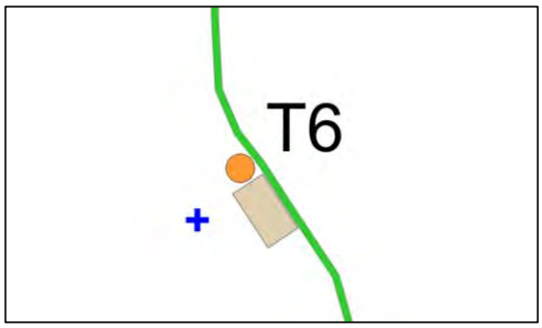
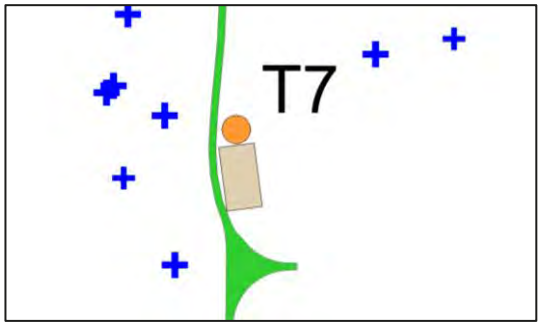
The likelihood is that any subsidence caused by any mining activity has likely ceased however there is the possibility that shallow underground workings may remain in a state of marginal stability and exist at a shallow level where any disturbance could lead to the migration of voids to the surface.

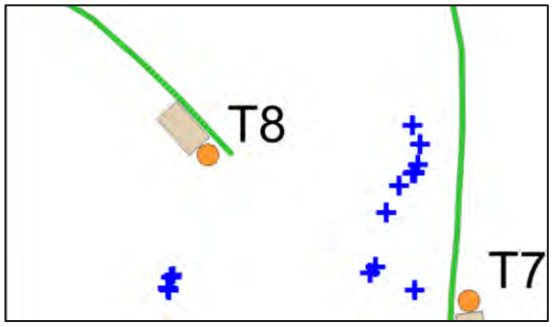
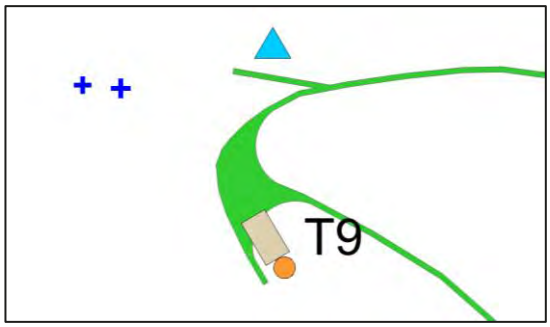
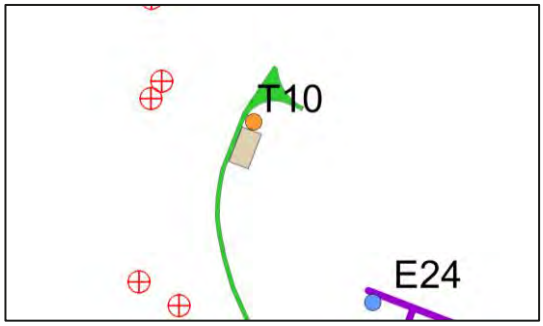
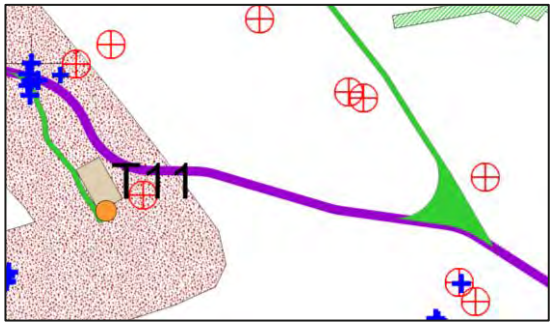
It has been concluded that subject to planning approval and as part of the pre-construction development there should be a comprehensive geotechnical investigation carried out at each proposed wind turbine and critical infrastructure sites to verify the absence / presence of shallow underground workings and refine the geotechnical ground model for the site.

Table 4.1 below provides an indication of the likely shallow mine workings and conditions to be encountered beneath each proposed expansion turbine location.

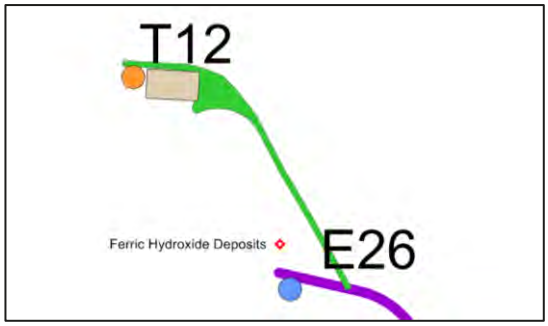
Table 4.1: Mining Risk Assessment of Expansion Turbine Locations

Turbine ID	Proximity to Historical Ground Working or Mine Entry	Recorded Shallow Mine Workings	Depth of Working (mbgl)	Risk
T1	Derelict Reservoir (449BR) – 150m west north west	Sited over probable shallow underground coal workings	<30mbgl	High
		GIS analysis of turbine position T1 in relation to area of probable shallow underground mine workings directly beneath the location and clustering of surface groundwork and derelict reservoir features 150m further to the north-west.		
T2	None Indicated	Edge of probable shallow underground coal workings 60m southwest	-	Moderate
		GIS analysis of turbine position T2 in relation to area of probable shallow underground mine workings approximately 60m to the south.		
T3	None Indicated	None Indicated	-	Low
		GIS analysis of turbine position T3, highlights no data for recorded mine or surface workings near to the proposed location.		
T4	Pond (429) – 220m northeast	None indicated	-	Low
		GIS analysis of turbine position T4, highlights no data for recorded mine or surface workings near to the proposed location. A surface ground working (now recorded as a pond) is 220m distant to the northeast. No further data was found for this location.		

Turbine ID	Proximity to Historical Ground Working or Mine Entry	Recorded Shallow Mine Workings	Depth of Working (mbgl)	Risk
T5	Probable mine entries located 30m south & 65m northwest of turbine centre	Crown collapse observed nearby from site visit 12m north west of turbine centre indicating possible meta-stable sub-surface conditions	<30mbgl	**High**
		GIS analysis with site walkover observations indicating. These display the location of a potential crown hole (mine collapse) feature evident at the surface. This is extremely close to the turbine and only 12m away which would equate to the approximate edge of the foundation base. Two further features indicative of mine entrances are also indicated at greater proximity.		
T6	Within Upper Haslingden Flags quarry recorded surface working 50m southwest.	None Indicated	-	**Moderate**
		GIS analysis of turbine position T6 showing the singular surface ground working feature approximately 50m to the southwest. This is notes as a former quarry working in the Upper Haslingden Flag Sandstone. During the site walkover there was abundant surface evidence for past quarrying activity recorded at this location.		
T7	Unspecified Heaps (46K) ~ 50m distant from turbine centre associated with surface quarry workings	None Indicated	-	**Moderate**
		GIS analysis of turbine position T7 with multiple surface ground working data points depicted around the periphery of the infrastructure. These are likely to represent historic sandstone quarrying sites. During the site walkover there was abundant surface evidence for past quarrying activity recorded at this location.		

Turbine ID	Proximity to Historical Ground Working or Mine Entry	Recorded Shallow Mine Workings	Depth of Working (mbgl)	Risk
T8	Unspecified Pit (290AD) – 115m south west	None Indicated	-	**Low**
		GIS analysis of turbine position T8. Unspecified surface ground working pits are depicted approximately 115m to the south west.		
T9	Sandstone brown hill close (1084EA) – 220m north west	None Indicated	-	**Low**
		GIS analysis of turbine position T9. Two prominent surface ground workings (former quarry sites) are depicted approximately 220m north west of the location.		
T10	None indicated	Unspecified mine entry (117296) – 125m west	<30mbgl	**Moderate**
		GIS analysis of turbine position T10, indicating relative close proximity of mine entries to the west. These are down-slope from the turbine position and therefor potential adits and shallow underground workings may extend east below the proposed position.		
T11	Unspecified mine entry (116396) – 35m north east Mineral washing (26) – 33m south west	Sited over probable shallow underground coal workings	<30m	**High**
		GIS analysis of turbine position T11, indicating high risk location with area of probably underground shallow mine workings directly beneath the location. A recorded mine entry approximately 35m to the north east.		

Turbine ID	Proximity to Historical Ground Working or Mine Entry	Recorded Shallow Mine Workings	Depth of Working (mbgl)	Risk
T12	None Indicated	Ferric Hydroxide deposits indicating coal mine drainage located ~190m south east from turbine centre	-	**Low**



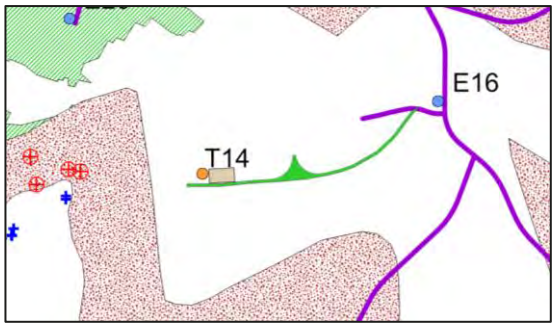
GIS analysis of turbine position T12. Limited archival data was available with no recorded underground or surface ground workings in close proximity to the position. During the site walkover a deposit of ferric hydroxide was noted in a spring, approximately 190m south east from the turbine centre. This may be a signal of subsurface coal mine workings draining groundwater which is affected by acidification. No ground information details of the operational turbine T26 were available at the time of reporting.

T13	Unspecified mine entry (114226) – 120m south west	Sited over recorded workings in sand rock coal seam	<20mbgl	**High**



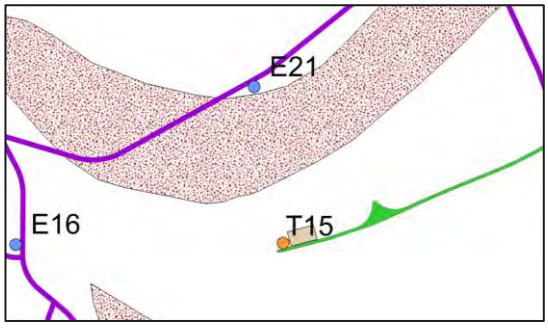
GIS analysis of turbine position T13 showing the high risk from shallow underground mine workings. The turbine is directly above recorded underground workings within the 'Sand rock' coal seam. Coal Authority data indicates these workings to influence ground at shallow depths of <20mbgl. The area of workings extends south and west of the turbine with several mine entries recorded to the south west.

T14	None Indicated	Edge of Probable shallow underground workings ~90m west from turbine position	-	**Moderate**



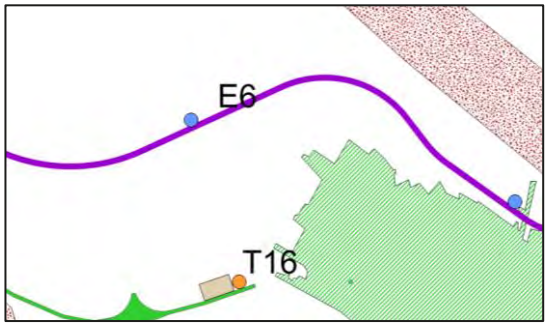
GIS analysis of turbine position T14. This location is now shown to be directly impacted by any recorded surface or underground mining features. However the zone of probable shallow underground workings is identified approximately 90m west of the location.

T15	None Indicated	Edge of Probable shallow underground workings ~100m north from turbine position	-	**Moderate**



GIS analysis of turbine position T15. A zone of probable underground shallow workings is recorded approximately 100m north from the position.

Turbine ID	Proximity to Historical Ground Working or Mine Entry	Recorded Shallow Mine Workings	Depth of Working (mbgl)	Risk
T16	None Indicated	Edge of recorded workings in sand rock coal seam ~55m east	<20mbgl	**Moderate**



GIS analysis of turbine position T16. The location is not directly impacted by any recorded surface or underground mine workings. It is clear that a zone of shallow underground coal workings exists approximately 55m east of the location. Archival data indicates the underground workings to be at <20mbgl.

Source: Natural Power; Diagrams NTS.

The mining risk assignment is based on the proximity of the proposed wind turbine location to mine entries, former quarry sites and probable and recorded areas of shallow underground mine workings. Table 4.1.1 below details criteria have been adopted for the risk assessment:

Table 4.1.1: Mining Risk Assessment Criteria

Risk Level	Criteria	Development Implication
High	Turbine position is within 50m of shallow mining feature	Turbine locations considered to be at high risk will likely require ground improvement and/or stabilisation of shallow workings beneath turbine foundations and crane hard stand areas to mitigate the risk of instability. This may consist of a programme of targeted drilling and grouting of mine workings and sub-surface voids.
Moderate	Turbine position is within 150m of shallow mining or quarry feature	Turbine locations considered to be at moderate risk have a possible requirement for ground improvement and/or stabilisation. Proof grouting may be required to confirm that workings and voids are not present within the depth of influence beneath critical infrastructure sites.
Low	Turbine position is greater than 150m from a shallow mining or quarry feature	Turbine locations considered to be at low risk are unlikely to require ground improvement and/or stabilisation prior to construction. This condition should be confirmed through targeted intrusive ground investigation.

Source: Natural Power

5. Recommendations

Subject to planning approval Natural Power recommends that a geotechnical ground investigation is undertaken in accordance with current British and European Standards (BS EN 1997: 2:2007) and should comprise the following elements:

- A Site investigation should be designed for Geotechnical Category 3 Structures with sufficient data gathered concerning the ground and groundwater conditions at and around the proposed wind turbine locations. A minimum of 2 – 6 investigation points is suggested per foundation. The final depth of investigation should be determined by the encountered ground conditions however for shallow foundations it is recommended that the investigation depth is greater than 2 times the anticipated foundation width below formation level. In specific cases, deeper intrusive ground investigation may be required to target coal seams to prove ground model predictions.

- The depth of superficial overburden deposits should be determined at all proposed temporary and permanent construction locations. There is considerable uncertainty regarding the depth superficial deposits beneath the proposed study area. A sampling regime should be adopted whereby soil, rock and groundwater samples are obtained according the geological conditions, hydro-geological conditions and the likely imposed construction loads.

- Trial pit investigation should be undertaken at each wind turbine location and along key sections of proposed infrastructure. Superficial deposits should be logged in detail with representative samples obtained and scheduled for geotechnical laboratory testing. Where appropriate in situ strength testing should be undertaken and details of any groundwater recorded. Where areas of artificial ground are identified these should be delineated and sampled against relevant geochemical suites. Where solid geology is encountered a rock mass assessment should be undertaken with details of compressive strength and discontinuity spacing recorded.

- The rock mass should be characterised to sufficient depths beneath the proposed wind turbine generators and key infrastructure sites. Site investigation for construction purposes should allow for rotary core drilling and recovery of high quality core samples necessary for establishing a geological ground model and shall be used to assess the likely design requirements of foundation structures.

- Detailed logging of all exploratory holes should be undertaken in accordance with BS EN 14688 / 14689 to define the rock mass characteristics and identify any salient shallow mining features.

- The drilling methodology should be agreed with The Coal Authority and Environment Agency prior to being undertaken and should account for the hazardous ground gas, mine water discharge and poor rock mass ground conditions. A detailed assessment of any impact upon mine water drainage should be undertaken prior to drilling with suitable contingencies plans in place.

- The prior written permission of the Coal Authority will be required to investigate and/or treat any coal seam horizons, coal mine workings or mine entries.

- Prior written permission of the Coal Authority will be required to extract and remove any incidental coal as part of construction operations.

- Geophysical investigation of targeted areas across the site should be considered prior to intrusive ground investigation. Resistivity profiling, ground probing radar (GPR), electromagnetic and gravity imaging are potential methods of identifying shafts and sub-surface voids prior to undertaking intrusive investigations. Geophysical investigation may be a cost effective non-intrusive technique of determining

the risk to construction during the pre-construction planning phase of development and to ensure efficient targeting of the intrusive ground investigation boreholes.

5.1. Hazard Mitigation and Ground Improvement Options

Following completion of a sufficiently detailed, combined mining and geotechnical ground investigation there will likely be a requirement to consider the available ground improvement and stabilisation options. This should be undertaken as part of a detailed review of the design requirements for wind turbine foundations at the Application Site. Turbine foundations and crane hard standing areas should be assessed for the requirement for drill and grout stabilisation which was required as part of the original construction design of the operational Scout Moor Wind Farm. Across areas where shallow mine risk is uncertain, proof grouting is recommended to verify any requirement for further grouting stabilisation. The following hierarchical discussion of the best practice methods for construction over shallow abandoned mine workings details the primary approaches. These methods should be considered as part of the wider concept of the wind farm layout design and the use of available micro-siting options for the wind farm infrastructure.

5.1.1. Raft Foundations

Construction of low-rise and relatively lightly loaded structures on rafts or reinforced strip footings may be a suitable solution over shallow mine workings at a marginal depth. Any subsidence would generally be accommodated across the large area of the raft foundation and therefore would only be suitable for non-sensitive structures. This may rule out the wind turbine generators but may be a viable option for control building foundations and other similar lightly loaded structures.

5.1.2. Excavation and Backfilling

This approach is only viable at depths typically of less than 5m-7m. This is due to the large volume and complex earthworks required for deeper excavation and backfill operations. Generally where voids and backfilled / collapse zones are encountered at shallow depths, these would be identified and delineated as part of the ground investigation. During site preparatory works, these areas would be excavated and backfilled with engineering grade material where appropriate. This approach effectively removes the risk from collapse of shallow and near surface mining features.

Where shallow or near surface workings are encountered the most economical approach to ground stabilisation would be excavation and backfilling. Should such features be proven to extend to deeper levels beyond 10m below ground, and of an interconnecting nature, excavation and back filing may not be a viable option.

5.1.3. Piling

A deeper foundation design may be adopted where encountered shallow mine workings are between approximately 5 and 30m below ground level. Piled foundations would transfer design loads imposed by the wind turbine generator to deeper stratigraphic levels and below the influence of shallow mine workings. Consideration should be made for the prevailing ground conditions, where deeper boring through sandstone and limestone may become un-economic. The rock mass characteristics determined during a ground investigation may also rule out a piled option as issues such as steeply dipping strata liable to sliding failure can be problematic for piled foundations. Critical to such foundation designs would be the effect of groundwater on both the stability of the foundation and on the surrounding ground. Where pathways are created during installation of deeper foundations, there may be an increased risk of destabilisation of the ground due to an increased influx of groundwater.

Furthermore the effects from unforeseeable deep mining may lead to deformation at the base of piles and is difficult to predict these effects. The final design of the wind turbine foundations should be considered by suitably qualified designers after a comprehensive ground investigation has been completed.

5.1.4. Grouting

Where a predictable distribution of shallow abandoned mine workings has been identified during a ground investigation the option of drill and grouting methods to stabilise sub-surface voids and collapse zones may be a consideration.

In accordance with guidance set out in CIRIA SP32 (Construction Over Abandoned Mine Workings); typically 100mm drill holes are advanced to the level of workings within the influence of the proposed turbine foundations. The drill holes would be arranged on a grid of between 3 – 6m across the area of the foundation. The area of grouting would generally extend beyond the footprint of a shallow gravity foundation to encompass the zone of influence from loading. Perimeter grouting is initially undertaken, whereby a seal surrounds the mined area beneath the foundation. Perimeter grout is stiffened by adding coarse gravel. The perimeter grouting operation produces cones around drill holes bored on a 1.5m centre which then coalesces to create a wall within the mine. The volume inside the grout perimeter is then injected with lower strength foamed concrete or lean rock paste to prevent the roof collapse between sound pillars of rock within the shallow workings.

Load tests should be undertaking following curing of the grouted mine workings as parts of a system of quality control and the effectiveness of the ground stabilisation tested in relation to the proposed design loads.

6. References

British Geological Survey. 2008. Rochdale. England and Wales Sheet 76. Superficial Deposits and Simplified Bedrock 1:50 000. (Keyworth, Nottingham: British Geological Survey).

Burgess, I.C., (1976) Preliminary Report on the Otley Chevin Landslips. British Geological Survey, Yorkshire and East Midlands Unit. (Keyworth, Nottingham: British Geological Survey).

English Heritage. 2011. Strategic Stone Study, A Building Stone Atlas of Greater Manchester, June 2011

Healy, P.R., and Head, J.M., 1984, CIRIA Special Publication SP32, Construction Over Abandoned Mine Workings.

Waltham, T, 2009, Foundations of engineering Geology, E & F Spon

Appendix - A – Drawings

GB200361_M_039 – Superficial Geology Map

GB200361_M_040 – Solid Geology Map

GB200361_M_041 – Peat Depth Contour Map

GB200361_M_021 – Surface Ground Workings

GB200361_M_022 – Underground Workings

Appendix - B – Groundsure Geoinsight Report

This is available to download at http://www.scoutmoorwindfarm.co.uk/ and also on the DVD.
If hard copies are required these are available on request.

Appendix - C – British Geological Survey Boreholes

NGR. 8073 1959

5

1" N.S. 76
1" O.S.
Grid Ref. 3

RECORD OF WELL (SHAFT OR BORE)

(now Irwell Valley Water Board)

At Scout Moor Borehole. Bury & District Joint Water Board.

Town or Village ____ County Lancs Six-inch quarter sheet 80 NW

Exact site 90 yds. E. of Aqueduct at a point 500 yds. N. of Dearden Clough; and about 100 yds. SSW of New Hall. in parish of ____ (A rough sketch-map or a tracing from a map is very desirable)

Level of ground surface above sea-level (O.D.) ca 850 ft. If well starts below ground surface, state how far ____ ft.

Shaft ____ ft., diameter ____ ft. Bore ____ ft. Diameter of bore: at top ____ ins.; at bottom ____ ins.

Details of permanent lining tubes (internal diameters preferred) ____

Water struck at depths of (feet) ____

Rest-level of water below / above top of well ____ feet. Suction at ____ feet. Yield on ____ hours' / days' test ____ gallons per ____ (with pump of capacity ____ g.p.h.); depressing water level to ____ feet below top. Time of recovery ____ hrs. Amount normally pumped daily ____ g.p.h. for ____ hours.

Quality (attach copy of analysis if available) ____

Sunk by ____ for Mr. ____ Date of well ____

Information from ____

SD 81 NW/1

County ____

6" Quarter Sheet ____

(For Survey use only). GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA (and any additional remarks).	THICKNESS Feet.	THICKNESS Inches.	DEPTH Feet.	DEPTH Inches.	THICKNESS Metric	DEPTH metric
	Drift and Broken Shale	21	-	21	-	6 40	6 40
	Rock	108	-	129	-	32 92	39 32
	Shale	17		146	-	5 18	44 50
	Rock	8	-	154	-	2 44	46 94
	Shale	38	6	192	6	11 73	58 67
	Rock	11	-	203	6	3 36	62 03
	Black Shale	41	-	244	6	12 49	74 52
	Rock	15	6	260	-	4 73	79 25
	Shattered Strata	8	-	268	-	2 43	81 68
	Shale	35	-	303	-	10 67	92 35
	Gritstone	36	-	339	-	10 98	103 33
	Black Shale	265	-	604	-	80 67	184 10
	Grey sandy shale	9	-	613	-	2 74	186 84
	Gritstone	50	-	663	-	15 24	202 08
	Grit with coal	6	-	669	-	1 83	203 91
	Black Shale	6	-	675	-	1 83	205 74
	Grit & Shale	20	-	695	-	6 10	211 84
	Grit with Coal Joints	12	-	707	-	3 65	215 49
	Grey Shale	4	-	711	-	1 22	216 71
	Grey Grit	15	-	726	-	4 58	221 29
	Coal & Clay	1	-	727	-	0 30	221 59
	Gritstone	43	-	770	-	13 11	234 70
	Dark Shale	51	-	821	-	15 54	250 24
	Shaly Grit	34	-	855	-	10 36	260 60
	Dark Shale	150	-	1005	-	45 72	306 32

Visited & sited on Lancs 80 N.W.W. Surface well bot c + 850. JHJ 25-9-56.

Bore not used. S.W.L. on 1st July 1961 was 12' below surface. The name is wrong, but the original thick is quoted in that the latter is right, so that the site shown is the correct site for the bore & the name is incorrect.

For Survey use only

Date received	G.S.M. Office File No.	Site marked on 1" map (use symbol)

GEOLOGICAL SURVEY AND MUSEUM, SOUTH KENSINGTON, LONDON, S.W.7.

(*11815) Wt.29051/O.369 10,000 9/39 A.& E.W.Ltd. Gp.686

SD 8075 1957

SD81/2

76/Fb

RECORD OF WELL (SHAFT OR BORE)

NEW HALL (now Irwell Valley Water Board)

At Scout Moor Borehole. Rury & District Joint Water Board

Town or Village _____ County Lancs Six-inch quarter sheet 8C N.W.

Exact site 8C yds. E. of Aqueduct at a point 500 yds. N. of Dearden Clough; and about 100 yds. SSW of New Hall. In parish of _____ (A rough sketch-map or a tracing from a map is very desirable)

Level of ground surface above sea-level (O.D.) ca 850 ft. If well starts below ground surface, state how far _____ ft.

Shaft _____ ft., diameter _____ ft. Bore _____ ft. Diameter of bore: at top _____ ins.; at bottom _____ ins.

Details of permanent lining tubes (internal diameters preferred) _____

Water struck at depths of (feet) _____

Rest-level of water below / above top of well _____ feet. Suction at _____ feet. Yield on _____ hours' / days' test _____ gallons per _____ (with pump of capacity _____ g.p.h.); depressing water level to _____ feet below top. Time of recovery _____ hrs. Amount normally pumped daily _____ g.p.h. for _____ hours.

Quality (attach copy of analysis if available) _____

Sunk by _____ for Mr. _____ Date of well _____

Information from _____

(For Survey use only). GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA (and any additional remarks).	THICKNESS Feet.	THICKNESS Inches.	DEPTH Feet.	DEPTH Inches.
	Drift and Broken Shale	21	-	21	-
	Rock	108	-	129	-
	Shale	17		146	-
	Rock	8	-	154	-
	Shale	38	6	192	6
	Rock	11	-	203	6
	Black Shale	41	-	244	6
	Rock	15	6	260	-
	Shattered Strata	8	-	268	-
	Shale	35	-	303	-
	Gritstone	36	-	339	-
	Black Shale	265	-	604	-
	Grey sandy shale	9	-	613	-
	Gritstone	50	-	663	-
	Grit with coal	6	-	669	-
	Black Shale	6	-	675	-
	Grit & Shale	20	-	695	-
	Grit with Coal Joints	12	-	707	-
	Grey Shale	4	-	711	-
	Grey Grit	15	-	726	-
	Coal & Clay	1	-	727	-
	Gritstone	43	-	770	-
	Dark Shale	51	-	821	-
	Shaly Grit	34	-	855	-
	Dark Shale	150	-	1005	-
	Visited & sited on Lancs 80 NW/W.				
	Surface well tube c+850 WJ 25.4.56.				
	Bore not used. S.W.L. on 1st July 1961 was 125' below surface. The bore is tubed, but the engineer thinks it unlikely that the tubing is right, so that the S.W.L. appears to be about the position of the base of the Lower Mid Limestone Coal.				

GEOLOGICAL SURVEY AND MUSEUM, SOUTH KENSINGTON, LONDON, S.W.7.

For Survey use only

Date received	O.S.M. Office File No.	Site marked on 1" map (use symbol)

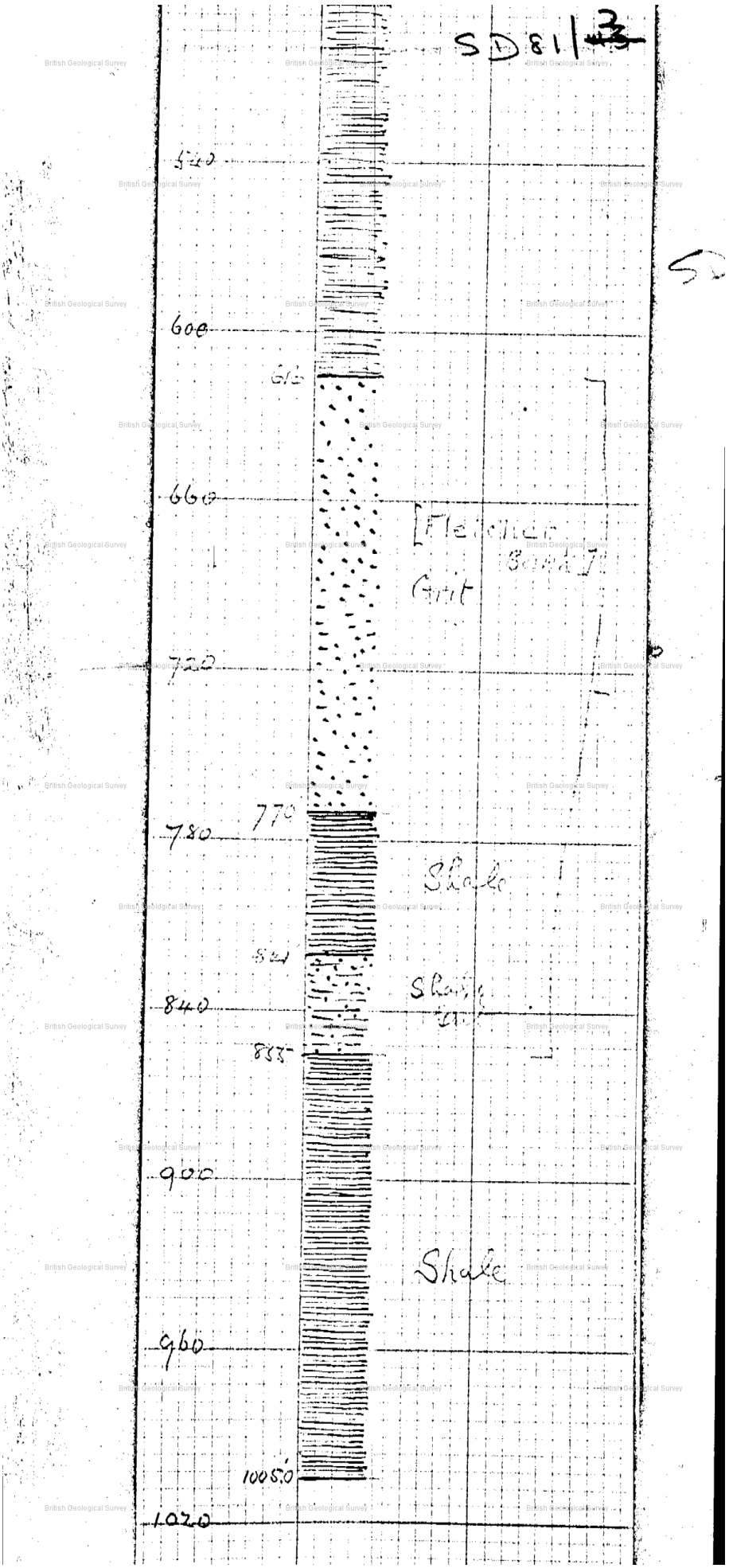
(*11815) W1.29051/0.369 10,000 9/39 A.& K.W.Ltd. Gp.684

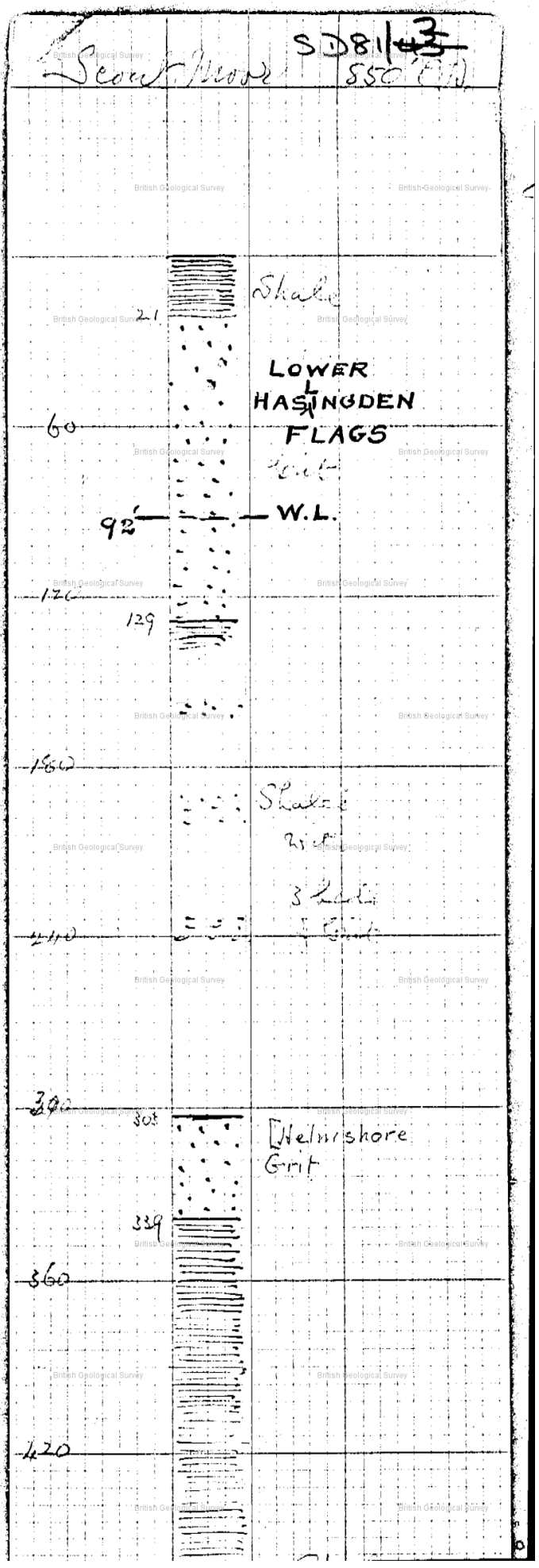
SD 81 NW/1

County _____

6" Quarter Sheet _____

THICKNESS Thickness metric		DEPTH metric	
6	40	6	40
32	92	39	32
5	18	44	50
2	44	46	94
11	73	58	67
3	36	62	03
12	49	74	52
4	73	79	25
2	43	81	68
10	67	92	35
10	98	103	33
80	67	184	10
2	74	186	84
15	24	202	08
1	83	203	91
1	83	205	74
6	10	211	84
3	65	215	49
1	22	216	71
4	58	221	29
0	30	221	59
13	11	234	70
15	54	250	24
10	36	260	60
45	72	306	32


SD81 NW 3
540
600
615
660
[Fletcher Bank]
Grit
720
770
780
Shale
824
Shale
840
855
900
Shale
960
1005
1020


Scout Moor
SD81 NE 3
550' O.D.
Shale
21
LOWER
HASLINGDEN
FLAGS
60
92'
W.L.
120
129
160
Shale
210
300
Helmshore
Grit
339
360
420

SD 81 NW/9

SD 81 NW.

READY MIXED CONCRETE (UNITED KINGDOM) LIMITED

Long Lane
Attenborough Nottingham
NG9 6BL

Telephone 0602-221221

RJH/BC

22nd July, 1975

Mrs L. C. Jones
Institute of Geological Sciences
Ring Road
Halton
LEEDS
LS15 8TQ

CONFIDENTIAL

Dear Mrs Jones,

BOREHOLES, SCOUT MOOR

Thank you for your recent letter requesting information on the above boreholes.

For a number of reasons we never completed this drilling programme. In fact only one hole was commenced and this was stopped prematurely at approximately 23.00m. The core from this borehole was logged, but not in great detail owing to our lack of interest in the site at that time for commercial reasons.

The approximate position of this hole was at SD 8161 1881, the surface altitude is unknown. Briefly I recorded :

2.0m to 3.65m	Sandstone, probably Upper Rough Rock
3.65m to 4.55m	Core lost but coal traces, presumed to be the Sandrock Mine coal horizon.
4.55m to 5.70m	Core lost.
5.70 to 20.44m	Sandstone, probably Lower Rough Rock
20.44 to 22.76m	Sandstone, probably Haslingden Flags.

I am sorry the above is not very detailed, if you have any specific questions I may be able to help if you will let me know.

Yours sincerely,

R. J. HAWKINS
Senior Geologist

Registered in London No. 885018
Registered Office:
RMC House, High Street,
Feltham, Middlesex, TW13 4HA.

DIRECTORS: P. J. Owen P. E. Bennett N. T. Grant J. S. Ornsby G. R. C. Smith F. C. S. Spinks G. S. Tyler P. L. Young

Mr. W.B. Evans, Leeds.

READY MIXED CONCRETE (UNITED KINGDOM) LIMITED

~~RMC House High Street~~
~~Feltham Middlesex~~
~~TW13 4HA~~

Nottingham 253542/3
~~Telephone xxxxxx xxx~~
Cables Readymix Hounslow

Please reply to our office at :

Long Lane
Attenborough
Nottingham NG9 6BL

Commercial
In Confidence

RJH/BC

6th December, 1973

The Director
Institute of Geological Sciences
Exhibition Road
South Kensington
LONDON SW7 2DE

DOMAGS DEPT
73/294-T
11/12/73

Dear Sir,

BOREHOLE NOTIFICATION

Under the requirements of the Mining Industry Act 1926 I am writing to inform you that my company is at present engaged in a drilling programme which is likely to involve holes in excess of 30m (100 feet).

It is hoped that a total of four holes will be completed on Scout Moor, near Edenfield and 8 km north of Bury. The purpose of these holes is to prove the thickness of the Rough Rock and Haslingden Flags. A copy of part of the O.S. 1" Sheet No. 95 showing the approximate area of drilling is enclosed.

The holes will, at least in part, be cored and the cores which will be logged by myself are to be retained at our offices in Nottingham. As our interest lies in the suitability of these rocks as a potential source of aggregate material it is intended to subject these cores to laboratory tests as soon as possible.

If there is a possibility that you will require access to the cores would you please inform me as soon as possible so that arrangements can be made.

May I take this opportunity of asking you to treat this information, and any further information which you may receive from us on this subject as confidential.

Yours faithfully,

R. J. HAWKINS
Aggregate Land Search Department

Registered in London No. 885018
Registered Office:
RMC House, High Street,
Feltham, Middlesex, TW13 4HA.

DIRECTORS: P.J.Owen P.Bennett N.T.Grant J.S.Ornsby G.R.C.Smith F.C.S.Spinks G.S.Tyler P.L.Young

British Geological Survey

GJR SD 819 185

SD 81/43 SD 81 NW/9

Lancs 80 NW

2

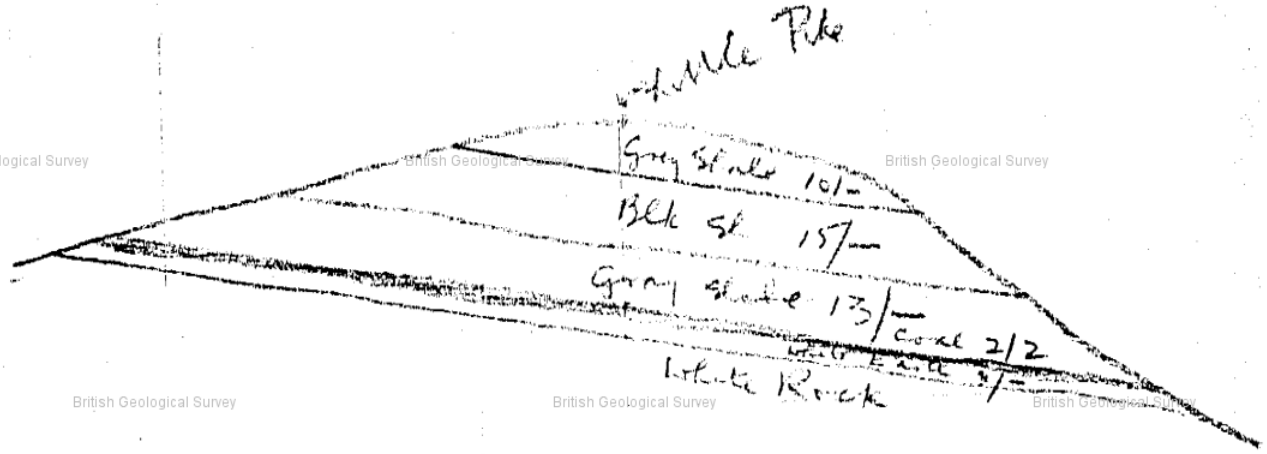
IN MINE SCOUT MOOR COLLIERY Lancs

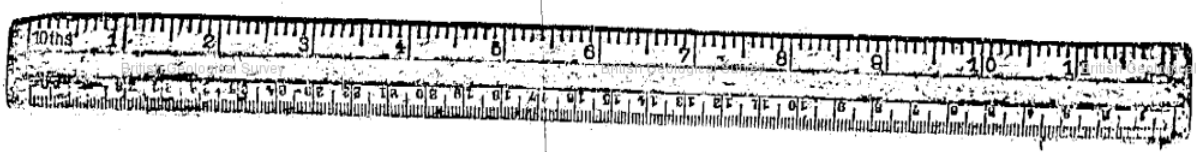
EXORS Lawrence Hacknoll

On Hill Hill — to NW

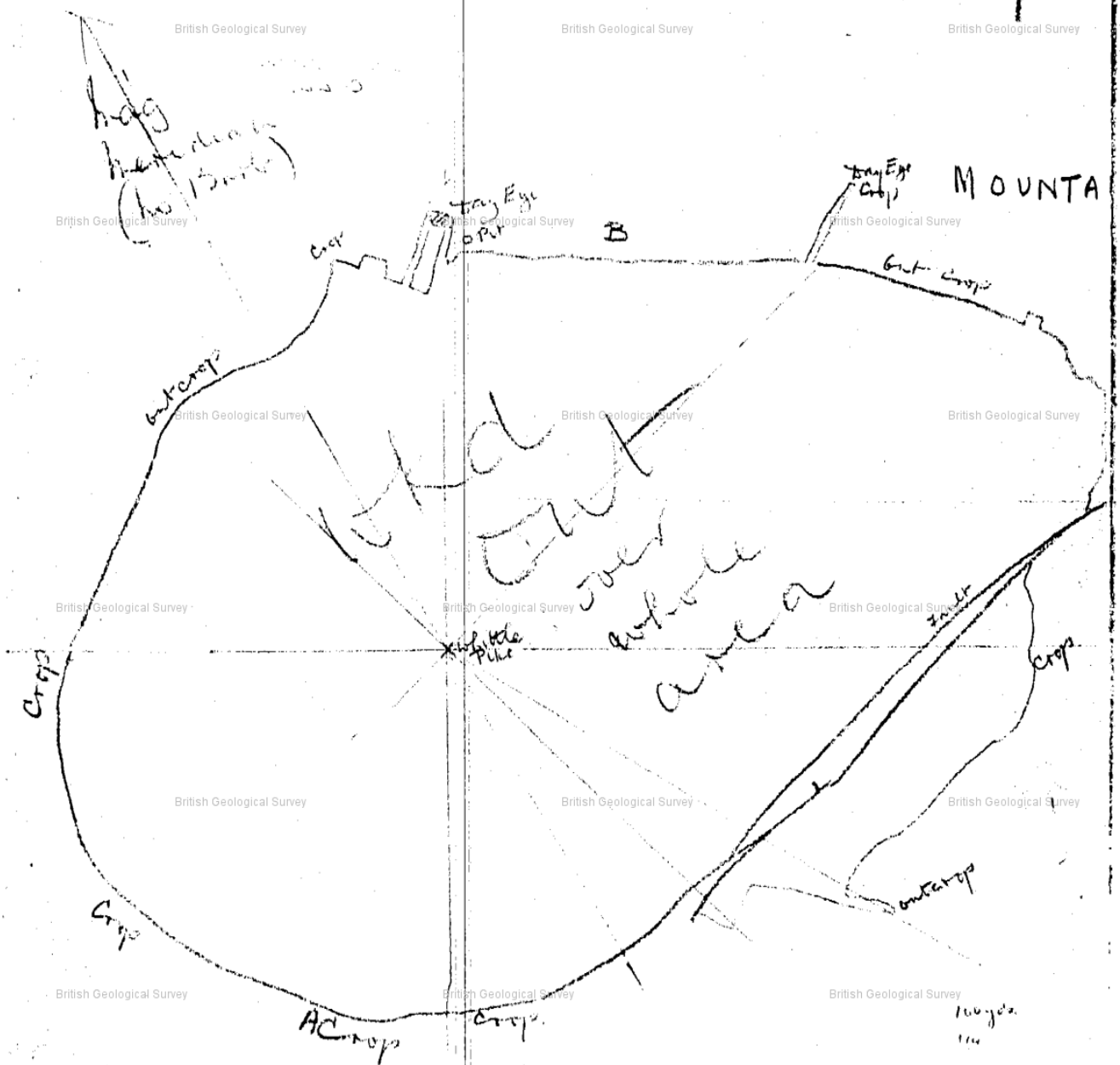
3/4 mile or Sand Rock.

CROP

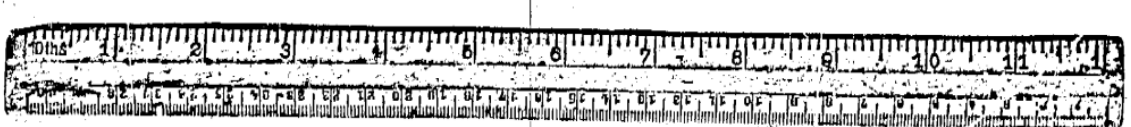




SD 81 / 43



20 yds = 1 inch.



SD 81/141

BRITISH GEOLOGICAL SURVEY

RECORD OF SHAFT OR BOREHOLE

OFFICE COPY.

J.P. WHITTER

N.R.A. COPY

DATE [redacted]

Name / Number of Shaft or Borehole: 118/35 - 1990.

Name of owner MR. SMITH, HIGHER REDLUMB FARM.

Village NORDEN County ROCHDALE.

1-in or 1:50 000 New Series Map No.	Enter 'C' if Confidential

Site (reference to a fixed point on 1-in or 1:50 000 Map) ~~SD 85 NE 155~~ SD 841 161

Purpose for which made DOMESTIC PURPOSE

Level of shaft / bore relative to O.D. _____ m. If not ground level give O.D. of beginning of shaft / bore _____ m.

Name of driller J.P. WHITTER (WATER WELL ENGINEERS) LTD Date of sinking OCTOBER 1990.

Information from J.P. WHITTER (WATER WELL ENG.) LTD Examined by _____

LANDGATE INDUSTRIAL ESTATE, WIGAN ROAD, BRYN.



Specimen Numbers and Additional Notes

PUMP DEPTH 100FT
STANDING WATER LEVEL 1½ METRES.
40FT OF 6" PLAIN WELDED STEEL TUBE GROUTED INTO PLACE

Geological Classification	Description of Strata	Thickness FEET	Depth FEET
	BACKFILL	2	0 2
	BROWN SHALE	8	2 10
	COAL SEAM	5	10 15
Millstone Grit Group (Rough Rock and Haslingden Flags)	BROWN SANDSTONE	33	15 48
	GREY SANDSTONE	14	48 52
	BROWN SANDSTONE	31	52 83
	GREY SANDSTONE	27	83 110
	BROWN SANDSTONE	2	110 112
	GREY SANDSTONE	13	112 125
	BROWN SANDSTONE	5	125 130
	GREY SANDSTONE	30	130 160
			160.

A.I. Howard
1/12/97.

Name of site Central L.S. North West Water NRA. HIGHER REDLUMB FARM

WRB No. 76. ROCHDALE. SD 81/141 76 SD81NW/22

Owner MR. SMITH

Licence no. Appn no. Cancelled

Occupier

IGS ref. no.

Nat. grid ref. SD 84061614

Status BOREHOLE - DOMESTIC

Ground Level m OD ft. OD

Aquifer

Level of well top m OD ft. OD

Code

Rest water level m bwt ft. bwt

(Date) m OD ft. OD

Construction: Method Date OCT. 1990

Summary of geological section	Thickness	Depth
BOREHOLE LOG AVAILABLE	T.D.	160ft } 48.76m }
~~See~~ enclosed sheet. On reverse side		

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Abstraction rates

gph PWL

gpd

Type of pump

Chem./bact. anal. YES/NO

Well driller J.P. WHITTER

If insufficient space has been allowed, continue in 'Notes' overleaf.

Lockie 162

NGDC ACCESSION NUMBER 21178

RECEIVED N.GD.C. DATE: 28-6-95 SIG: S.Roach

Name of site Central L.S. North West Water NRA.
HIGHER REDLUMB FARM

W R B No. SD 81/141
76 SD 81 NW 22

Owner MR. SMITH
Licence no. Appn no. Cancelled
Occupier
IGS ref. no.

Nat. grid ref. SD 84061614
Status BOREHOLE - DOMESTIC

Ground Level	m OD	ft. OD	Aquifer
Level of well top	m OD	ft. OD	Code
Rest water level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Construction: Method Date OCT. 1990

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Abstraction rates
gph PWL
gpd
Type of pump
Chem./bact. anal. YES/NO
Well driller J.P. WHITTER

Summary of geological section	Thickness	Depth
BOREHOLE LOG AVAILABLE	T.D.	160ft / 48·76m
See enclosed sheet.		

If insufficient space has been allowed, continue in 'Notes' overleaf.

Lockie 162

SD 81/141

BRITISH GEOLOGICAL SURVEY

RECORD OF SHAFT OR BOREHOLE

OFFICE COPY.

J.P. WHITTER

Serial Number of Shaft or Borehole:

118/35 - 1990.

N.R.A. COPY.

Locality made MR. SMITH, HIGHER REDLAMB FARM,

DATE [redacted]

Village NORDEN County ROCHDALE.

1-in or 1:50 000 New Series Map No.	Enter 'C' if Confidential

Site (reference to a fixed point on 1-in or 1:50 000 Map)

~~SD 85 NE 155~~ SD841 161

Purpose for which made DOMESTIC PURPOSE

Level at shaft bore relative to O.D. ——— m. If not ground level give O.D. of beginning of shaft bore ——— m.

Contractor J.P. WHITTER (WATER WELL ENGINEERS) LTD Date of sinking OCTOBER 1990.

Information from J.P. WHITTER (WATER WELL ENG.) LTD Examined by ———

LANDGATE INDUSTRIAL ESTATE, WIGAN ROAD, BRYN.



Specimen Numbers and Additional Notes

PUMP DEPTH 100FT
STANDING WATER LEVEL 1½ METRES.
40FT OF 6" PLAIN WELDED STEEL TUBE GROUTED INTO PLACE

Geological Classification	Description of Strata	Thickness FEET	Depth FEET
	BACKFILL	2	0 2
	BROWN SHALE	8	2 10
MILLSTONE	COAL SEAM	5	10 15
GRIT	BROWN SANDSTONE	33	15 48
GROUP	GREY SANDSTONE	14	48 52
(ROUGH	BROWN SANDSTONE	21	52 83
ROCK	GREY SANDSTONE	27	83 110
AND	BROWN SANDSTONE	2	110 112
MASHAMDEN	GREY SANDSTONE	13	112 125
FLAGS)	BROWN SANDSTONE	5	125 130
	GREY SANDSTONE	30	130 160
			160.

A HOWARD
11/12/97

Appendix D – Site Walkover Photos

A site walkover survey was conducted by Natural Power during November 2014. The following sequence of photos provides an overview of the expansion turbine locations and some of the characteristic surface mine features and ground workings encountered across the site.





Possible sub-surface collapse structure between T5 and T6





Possible mine entrance proximal to T5



Possible source of red staining, buried mine entry or spring between E26 and T12



Ferric-hydroxide precipitating from groundwater indicating potential coal mine water discharge source better E26 and T12.



T1 (1)



T1 (2)



T1 (3)



T1 (4)



T2 (1)



T2 (2)



T2 (3)



T2 (4)



T3 (1)



T3 (2)



T3 (3)



T3 (4)



T4 (1)



T4 (2)



T4 (3)



T4 (4)



T5 (1)



T5 (2)



T5 (3)



T5 (4)



T6 (1)



T6 (2)



T6 (3)



T6 (4)



T7 (1)



T7 (2)



T7 (3)



T7 (4)



T8 (1)



T8 (2)



T8 (3)



T8 (4)



T9 (1)



T9 (2)



T9 (3)



T9 (4)



T10 (1)



T10 (2)



T10 (3)



T10 (4)



T11 (1)



T11 (2)



T11 (3)



T11 (4)



T12 (1)



T12 (2)



T12 (3)



T12 (4)



T13 (1)



T13 (2)



T13 (3)



T13 (4)



T14 (1)



T14 (2)



T14 (3)



T14 (4)



T15 (1)



T15 (2)



T15 (3)



T15 (4)



T16 (1)



T16 (2)



T16 (3)



T16 (4)

Appendix - E – Historical Map Data

This is available to download at http://www.scoutmoorwindfarm.co.uk/ and also on the DVD.
If hard copies are required these are available on request.

What We Do

Natural Power is a leading independent renewable energy consultancy and products provider. We offer proactive and integrated consultancy, management & due diligence services, backed by an innovative product range, across the onshore wind, offshore wind, wave, tidal, solar and bioenergy sectors, whilst maintaining a strong outlook on other new and emerging renewable energy sectors. Established in the mid-1990s, Natural Power has been at the heart of many ground-breaking projects, products and portfolios for close to two decades, assisting project developers, investors, manufacturers, finance houses and other consulting companies.

With its iconic Scottish headquarters, The Green House, Natural Power has expanded internationally employing 300 renewable energy experts across Europe and the Americas and operating globally. Providing Planning & Development, Ecology & Hydrology, Technical, Construction & Geotechnical, Asset Management and Due Diligence services, Natural Power is uniquely a full lifecycle consultancy – from feasibility to finance to repowering, and every project phase in between. We are a truly trailblazing consulting organisation; Natural Power has consistently invested in product development and technical research in order to progress certain key areas within the industry such as the operational management of wind farms, the design and assessment of wind farms in complex flow and the use of remote sensing for wind measurement. From award-winning consultancy and management services, through a string of technology world-firsts, Natural Power has a successful track record and the breadth of services and deep-rooted experience that provides a wealth of added value for our diverse client base.

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Natural Power delivers services and operates assets globally for our clients, with twelve offices across Europe and North America and agencies active in South America and AsiaPac.

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Possible sub-surface collapse structure between T5 and T6





Possible mine entrance proximal to T5



Possible source of red staining, buried mine entry or spring between E26 and T12



Ferric-hydroxide precipitating from groundwater indicating potential coal mine water discharge source better E26 and T12.



T1 (1)



T1 (2)



T1 (3)



T1 (4)



T2 (1)



T2 (2)



T2 (3)



T2 (4)



T3 (1)



T3 (2)



T3 (3)



T3 (4)



T4 (1)



T4 (2)



T4 (3)



T4 (4)



T5 (1)



T5 (2)



T5 (3)



T5 (4)



T6 (1)



T6 (2)



T6 (3)



T6 (4)



T7 (1)



T7 (2)



T7 (3)



T7 (4)



T8 (1)



T8 (2)



T8 (3)



T8 (4)



T9 (1)



T9 (2)



T9 (3)



T9 (4)



T10 (1)



T10 (2)



T10 (3)



T10 (4)



T11 (1)



T11 (2)



T11 (3)



T11 (4)



T12 (1)



T12 (2)



T12 (3)



T12 (4)



T13 (1)



T13 (2)



T13 (3)



T13 (4)



T14 (1)



T14 (2)



T14 (3)



T14 (4)



T15 (1)



T15 (2)



T15 (3)



T15 (4)



T16 (1)



T16 (2)



T16 (3)



T16 (4)

Appendix C - Mining Remediation Authority Consultants Mining Report

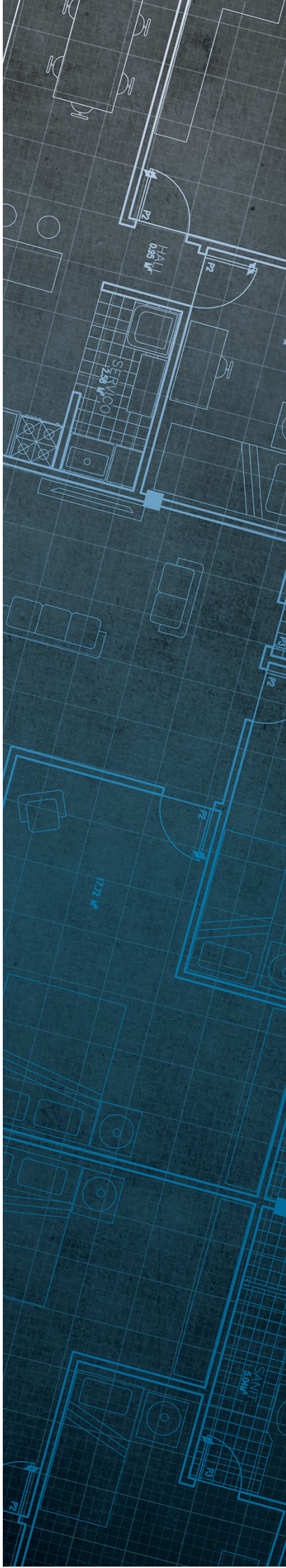
The Coal Authority

Consultants

Coal Mining Report

01137 Assessment

Date of enquiry:	**14 October 2024**
Date enquiry received:	**14 October 2024**
Issue date:	**14 October 2024**
Our reference:	**71009810321002**
Your reference:	**01137 Assessment**



Consultants
Coal Mining Report

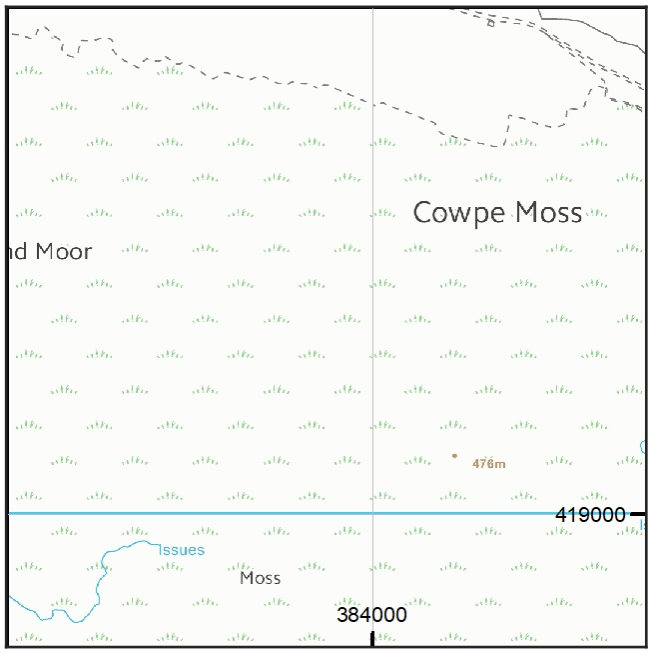
This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

NLIS Hub

Enquiry address

01137 Assessment



Approximate position of property

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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	SAND ROCK	Coal	3W6L	0	Beneath Property	2.0	East	40	1883
unnamed	LOWER MOUNTAIN	Coal	3W5Y	2	Beneath Property	11.0	South-West	70	1900
unnamed	SAND ROCK	Coal	3VR9	4	Beneath Property	8.0	South	140	1900
unnamed	SAND ROCK	Coal	3W6K	6	Beneath Property	2.0	East	40	1883
unnamed	SAND ROCK	Coal	3W61	10	Beneath Property	0.0	East	50	1886
unnamed	SAND ROCK	Coal	XXXX	12	Beneath Property	2.0	East	40	1883
unnamed	LOWER MOUNTAIN	Coal	3W5X	13	Beneath Property	11.0	South-West	70	1900
unnamed	SAND ROCK	Coal	3W68	14	Beneath Property	0.0	East	50	1850
unnamed	SAND ROCK	Coal	3W62	21	Beneath Property	3.0	North	50	1850
unnamed	SAND ROCK	Coal	3VQ7	22	Beneath Property	8.0	South	140	1900
unnamed	LOWER MOUNTAIN	Coal	3W5U	27	Beneath Property	9.3	South-West	70	1890
unnamed	LOWER MOUNTAIN	Coal	3W5V	28	Beneath Property	9.3	South	70	1890
unnamed	SAND ROCK	Coal	3W60	30	Beneath Property	0.0	East	50	1886
unnamed	SAND ROCK	Coal	3W6M	32	Beneath Property	2.5	South-West	50	1915
unnamed	LOWER MOUNTAIN	Coal	3VPK	33	Beneath Property	7.0	South	50	1953
unnamed	SAND ROCK	Coal	3W63	38	Beneath Property	5.0	South	40	1944
unnamed	SAND ROCK	Coal	3VR8	39	Beneath Property	8.0	South	140	1900
unnamed	LOWER MOUNTAIN	Coal	3VPJ	42	Beneath Property	7.0	South	50	1953
unnamed	SAND ROCK	Coal	3W6D	49	Beneath Property	4.0	North	50	1940
unnamed	SAND ROCK	Coal	3W64	79	Beneath Property	5.0	South	40	1944

Probable unrecorded shallow workings

Yes.

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Spine roadways at shallow depth

Distance to spine roadway (m)	Direction to spine roadway
Within	N/A
Within	N/A

Mine entries

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	381418-004	381749 418494		Coal	
Shaft	381418-005	381797 418512		Coal	
Adit	381418-006	381920 418525		Coal	
Adit	381418-007	381953 418544	The entrance to this adit has been filled to an unknown specification at some time in the past	Coal	
Shaft	381418-008	381983 418402		Coal	
Shaft	381418-009	381821 418503		Coal	
Shaft	382418-003	382306 418419		Coal	
Shaft	382418-004	382487 418452	This shaft was inspected in 1975 and was found to be open. Following an inspection in 2002 a galvanised grill was placed over the shaft by JMC acting on behalf of the Coal Authority.	Coal	
Shaft	382418-006	382281 418320		Coal	
Shaft	382418-007	382391 418234		Coal	
Shaft	382418-018	382523 418859		Coal	
Shaft	382418-019	382296 418302		Coal	
Shaft	382418-032	382410 418232		Coal	
Shaft	383418-003	383244 418752		Coal	
Adit	384418-001	384634 418891		Coal	
Adit	384418-002	384601 418896		Coal	
Adit	384418-003	384596 418928		Coal	
Shaft	384419-001	384596 419141		Coal	
Shaft	384419-002	384551 419090		Coal	
Shaft	384419-003	384604 419199		Coal	
Adit	384419-004	384525 419284		Coal	
Adit	384419-005	384619 419911		Coal	
Adit	384419-006	384631 419900		Coal	
Adit	384419-007	384989 419784		Coal	

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Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	384419-008	384984 419572		Coal	
Adit	384419-009	384965 419549		Coal	
Adit	384419-010	384848 419439		Coal	
Adit	384419-011	384644 419328		Coal	
Adit	384419-012	384642 419311		Coal	
Adit	384419-013	384620 419317		Coal	
Shaft	384419-014	384888 419427		Coal	
Shaft	384420-003	384720 420356		Coal	
Shaft	384420-004	384761 420330		Coal	
Shaft	384420-005	384748 420289		Coal	
Shaft	384420-006	384701 420164		Coal	
Adit	384420-007	384639 420398		Coal	
Adit	384421-003	384522 421308		Flagrock	
Adit	384421-004	384516 421081		Flagrock	
Shaft	384421-005	384568 421165		Flagrock	
Adit	385416-002	385922 416982		Coal	
Adit	385416-003	385811 416928		Coal	
Adit	385416-004	385860 416914		Coal	
Adit	385416-005	385930 416864		Coal	
Shaft	385417-001	385931 417043		Coal	
Shaft	385417-002	385909 417008		Coal	
Shaft	385418-001	385802 418924		Coal	
Shaft	385418-002	385977 418777		Coal	
Adit	385419-001	385072 419681		Coal	
Adit	385419-002	385067 419625		Coal	
Shaft	385419-003	385365 419546		Coal	
Shaft	385419-004	385581 419453		Coal	

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Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	385419-005	385517 419353		Coal	
Shaft	385419-006	385629 419266	Post and rail stock fence as per SD009 installed around mine entry and Coal Authority signage attached in January 2024	Coal	
Shaft	385419-007	385540 419238		Coal	
Adit	385420-001	385554 420695	This mine entrance was treated in August 2001 by Wardell Armstrongs acting on behalf of the Coal Authority. The adit was blocked with stone and the open end of the tunnel was broken in. The length of collapsed tunnel was then filled to surface level with stone and recovered soils were backfilled over to reinstate.	Coal	
Adit	385420-002	385585 420700	This mine entrance was treated in August 2001 by Wardell Armstrongs acting on behalf of the Coal Authority. The adit entrance was sealed with large stone. Large stone was also used to infill the exposed tunnel/culvert outbye to allow continued drainage of water. Recovered soils were then backfilled over to reinstate.	Coal	
Adit	385420-003	385777 420641		Coal	
Adit	385420-004	385841 420611		Coal	
Adit	385420-005	385844 420585		Coal	
Adit	385420-006	385838 420585		Coal	
Adit	385420-007	385985 420337		Coal	
Adit	385420-008	385988 420289		Coal	
Shaft	386415-001	386721 415997	This shaft was covered with a concrete raft in 1962 and marked with a concrete pyramid in 1968.	Coal	
Adit	386415-004	386604 415943	In February 1998 a small collapse some 0.8m in diameter was reported close to the entrance of this adit. The hole was infilled with locally available material and fenced due to the proximity of an adjacent footpath. These works were carried out by IMC consultants on behalf of The Coal Authority.	Coal	
Adit	386415-005	386631 415920		Coal	
Adit	386415-006	386630 415913		Coal	
Adit	386415-007	386647 415920		Coal	
Adit	386415-008	386660 415900		Coal	
Shaft	386415-009	386510 415777		Coal	

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Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	386416-001	386433 416947		Coal	
Shaft	386416-002	386446 416304		Coal	
Adit	386416-003	386977 416716		Coal	
Shaft	386416-004	386931 416673		Coal	
Shaft	386416-005	386926 416655	This shaft was capped by the NCB in 1978.	Coal	
Shaft	386416-006	386879 416595	This shaft was capped by the NCB in 1978.	Coal	
Shaft	386416-007	386807 416086		Coal	
Shaft	386416-008	386764 416050		Coal	
Adit	386417-001	386559 417099		Coal	
Adit	386417-002	386669 417012		Coal	
Shaft	386418-001	386275 418753		Coal	
Shaft	386418-002	386265 418631		Coal	
Shaft	386418-003	386257 418568		Coal	
Shaft	386418-004	386290 418399		Coal	
Adit	386418-005	386417 418464		Coal	
Adit	386418-006	386470 418380		Coal	
Adit	386419-006	386699 419610		Coal	
Shaft	386419-007	386693 419525		Coal	
Adit	386419-008	386751 419490		Coal	
Adit	386419-009	386676 419306		Coal	
Adit	386420-001	386051 420311	Adit has been fenced using stock proof fencing that has been stretched over the entrance and staked into place and a hole placed in it for any animals that may be using the adit.	Coal	
Shaft	386420-002	386002 420245		Coal	
Shaft	386420-003	386199 420223		Coal	
Adit	386420-009	386051 420435		Coal	
Shaft	387416-001	387037 416673		Coal	
Shaft	387416-002	387127 416409		Coal	

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Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	387416-003	387094 416138	This shaft was capped in 1978 by the NCB	Coal	
Adit	387418-001	387039 418206		Coal	
Adit	387418-002	387042 418194		Coal	
Adit	387418-003	387051 418191		Coal	
Adit	387418-004	387004 418274		Coal	
Shaft	387419-001	387142 419746		Coal	

Abandoned mine plan catalogue numbers

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

NW1466	OM15310	NW127
5454	13818	4212
16872	211	PO0

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

Seam name	Mineral	Seam workable	Distance to outcrop (m)	Direction to outcrop	Bearing of outcrop
BASSEY	Coal	Yes	Within	N/A	112
BASSEY	Coal	Yes	Within	N/A	136
BASSEY	Coal	Yes	Within	N/A	145
BASSEY	Coal	Yes	Within	N/A	186
BASSEY	Coal	Yes	19.6	South	187
BASSEY	Coal	Yes	Within	N/A	197
BASSEY	Coal	Yes	Within	N/A	201
BASSEY	Coal	Yes	Within	N/A	202
BASSEY	Coal	Yes	Within	N/A	210
BASSEY	Coal	No	Within	N/A	217
BASSEY	Coal	Yes	Within	N/A	229
BASSEY	Coal	Yes	Within	N/A	238
BASSEY	Coal	Yes	Within	N/A	264
BASSEY	Coal	Yes	Within	N/A	271
BASSEY	Coal	Yes	Within	N/A	278
BASSEY	Coal	Yes	5.7	South-West	283
BASSEY	Coal	Yes	Within	N/A	292
BASSEY	Coal	Yes	Within	N/A	295
BASSEY	Coal	Yes	Within	N/A	310
BASSEY	Coal	Yes	Within	N/A	318
BASSEY	Coal	Yes	Within	N/A	332
BROOKS BOTTOMS	Coal	Yes	Within	N/A	306
CANNEL	Coal	Yes	Within	N/A	22
LOWER FOOT	Coal	Yes	0.4	West	17
LOWER FOOT	Coal	Yes	Within	N/A	137
LOWER FOOT	Coal	Yes	Within	N/A	176

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Seam name	Mineral	Seam workable	Distance to outcrop (m)	Direction to outcrop	Bearing of outcrop
LOWER FOOT	Coal	Yes	Within	N/A	181
LOWER FOOT	Coal	Yes	Within	N/A	208
LOWER FOOT	Coal	Yes	Within	N/A	209
LOWER FOOT	Coal	Yes	Within	N/A	209
LOWER FOOT	Coal	Yes	Within	N/A	216
LOWER FOOT	Coal	Yes	Within	N/A	226
LOWER FOOT	Coal	Yes	Within	N/A	248
LOWER FOOT	Coal	Yes	Within	N/A	254
LOWER FOOT	Coal	Yes	Within	N/A	273
LOWER FOOT	Coal	Yes	Within	N/A	276
LOWER FOOT	Coal	Yes	Within	N/A	286
LOWER FOOT	Coal	Yes	Within	N/A	304
LOWER FOOT	Coal	Yes	Within	N/A	304
LOWER FOOT	Coal	Yes	Within	N/A	309
LOWER FOOT	Coal	Yes	Within	N/A	315
LOWER FOOT	Coal	Yes	Within	N/A	317
LOWER FOOT	Coal	Yes	Within	N/A	330
LOWER FOOT	Coal	Yes	Within	N/A	354
LOWER HOLCOMBE BROOK	Coal	Yes	Within	N/A	311
LOWER MOUNTAIN	Coal	Yes	Within	N/A	13
LOWER MOUNTAIN	Coal	Yes	Within	N/A	141
LOWER MOUNTAIN	Coal	Yes	Within	N/A	178
LOWER MOUNTAIN	Coal	Yes	Within	N/A	206
LOWER MOUNTAIN	Coal	Yes	Within	N/A	208
LOWER MOUNTAIN	Coal	Yes	Within	N/A	210
LOWER MOUNTAIN	Coal	Yes	Within	N/A	222
LOWER MOUNTAIN	Coal	Yes	Within	N/A	226

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Seam name	Mineral	Seam workable	Distance to outcrop (m)	Direction to outcrop	Bearing of outcrop
LOWER MOUNTAIN	Coal	Yes	Within	N/A	231
LOWER MOUNTAIN	Coal	Yes	Within	N/A	284
LOWER MOUNTAIN	Coal	Yes	Within	N/A	284
LOWER MOUNTAIN	Coal	Yes	Within	N/A	298
LOWER MOUNTAIN	Coal	Yes	Within	N/A	310
LOWER MOUNTAIN	Coal	Yes	Within	N/A	312
LOWER MOUNTAIN	Coal	Yes	Within	N/A	319
LOWER MOUNTAIN	Coal	Yes	Within	N/A	319
LOWER MOUNTAIN	Coal	Yes	Within	N/A	328
LOWER MOUNTAIN	Coal	Yes	Within	N/A	328
SAND ROCK	Coal	Yes	Within	N/A	5
SAND ROCK	Coal	Yes	Within	N/A	8
SAND ROCK	Coal	Yes	Within	N/A	12
SAND ROCK	Coal	Yes	Within	N/A	20
SAND ROCK	Coal	Yes	Within	N/A	60
SAND ROCK	Coal	Yes	Within	N/A	66
SAND ROCK	Coal	Yes	Within	N/A	75
SAND ROCK	Coal	Yes	Within	N/A	80
SAND ROCK	Coal	Yes	Within	N/A	114
SAND ROCK	Coal	Yes	Within	N/A	126
SAND ROCK	Coal	Yes	Within	N/A	152
SAND ROCK	Coal	Yes	Within	N/A	167
SAND ROCK	Coal	Yes	Within	N/A	192
SAND ROCK	Coal	No	Within	N/A	195
SAND ROCK	Coal	Yes	Within	N/A	196
SAND ROCK	Coal	Yes	6.0	West	198
SAND ROCK	Coal	No	Within	N/A	200

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Seam name	Mineral	Seam workable	Distance to outcrop (m)	Direction to outcrop	Bearing of outcrop
SAND ROCK	Coal	Yes	Within	N/A	223
SAND ROCK	Coal	Yes	Within	N/A	226
SAND ROCK	Coal	Yes	Within	N/A	228
SAND ROCK	Coal	Yes	Within	N/A	238
SAND ROCK	Coal	Yes	Within	N/A	243
SAND ROCK	Coal	Yes	Within	N/A	244
SAND ROCK	Coal	Yes	Within	N/A	247
SAND ROCK	Coal	Yes	Within	N/A	247
SAND ROCK	Coal	Yes	Within	N/A	247
SAND ROCK	Coal	Yes	48.6	South	277
SAND ROCK	Coal	Yes	Within	N/A	278
SAND ROCK	Coal	Yes	Within	N/A	279
SAND ROCK	Coal	Yes	Within	N/A	283
SAND ROCK	Coal	Yes	Within	N/A	286
SAND ROCK	Coal	Yes	Within	N/A	288
SAND ROCK	Coal	Yes	Within	N/A	305
SAND ROCK	Coal	Yes	Within	N/A	317
SAND ROCK	Coal	Yes	Within	N/A	320
SAND ROCK	Coal	Yes	29.2	East	322
SAND ROCK	Coal	Yes	12.4	East	340
SIX INCH	Coal	Yes	Within	N/A	17
SIX INCH	Coal	Yes	Within	N/A	60
SIX INCH	Coal	Yes	Within	N/A	181
SIX INCH	Coal	Yes	Within	N/A	183
SIX INCH	Coal	No	Within	N/A	200
SIX INCH	Coal	Yes	Within	N/A	207
SIX INCH	Coal	No	Within	N/A	260

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Seam name	Mineral	Seam workable	Distance to outcrop (m)	Direction to outcrop	Bearing of outcrop
SIX INCH	Coal	No	Within	N/A	261
SIX INCH	Coal	Yes	Within	N/A	285
SIX INCH	Coal	Yes	Within	N/A	308
SIX INCH	Coal	Yes	Within	N/A	315
SIX INCH	Coal	Yes	Within	N/A	341
UPPER FOOT	Coal	Yes	Within	N/A	139
UPPER FOOT	Coal	Yes	Within	N/A	139
UPPER FOOT	Coal	Yes	Within	N/A	152
UPPER FOOT	Coal	Yes	Within	N/A	153
UPPER FOOT	Coal	Yes	Within	N/A	153
UPPER FOOT	Coal	Yes	Within	N/A	197
UPPER FOOT	Coal	Yes	Within	N/A	199
UPPER FOOT	Coal	Yes	Within	N/A	284
UPPER FOOT	Coal	Yes	Within	N/A	304
UPPER FOOT	Coal	Yes	Within	N/A	318
UPPER FOOT	Coal	Yes	Within	N/A	319

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

Please refer to the “Summary of findings” map (on separate sheet) for details of any opencast areas 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

Distance to site investigation (m)	Direction
Within	N/A

See Section 4 for further information.

Remediated sites

Distance to site remediation (m)	Direction
27.8	North-East
Within	N/A
Within	N/A
20.8	West
Within	N/A

See Section 4 for further information.

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 in an area where notices to withdraw support were given in 1948, 1951 and 1952.

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.

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.

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.

Site investigations

The site is within an area of previous interest. It is close to where the Coal Authority has received information relating to past site investigations.

The site requires further investigation and may influence how you approach your risk assessment.

Remediated sites

The site is within an area of previous interest. It is close to where the Coal Authority has investigated and where necessary remediated mine entries and/or shallow coal mine workings following specific reported hazards.

The site requires further investigation and may influence your risk assessment. We recommend that you order the Coal Authority **Surface Hazards Incident Report**, which will include more information about the hazard.

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. 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.

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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

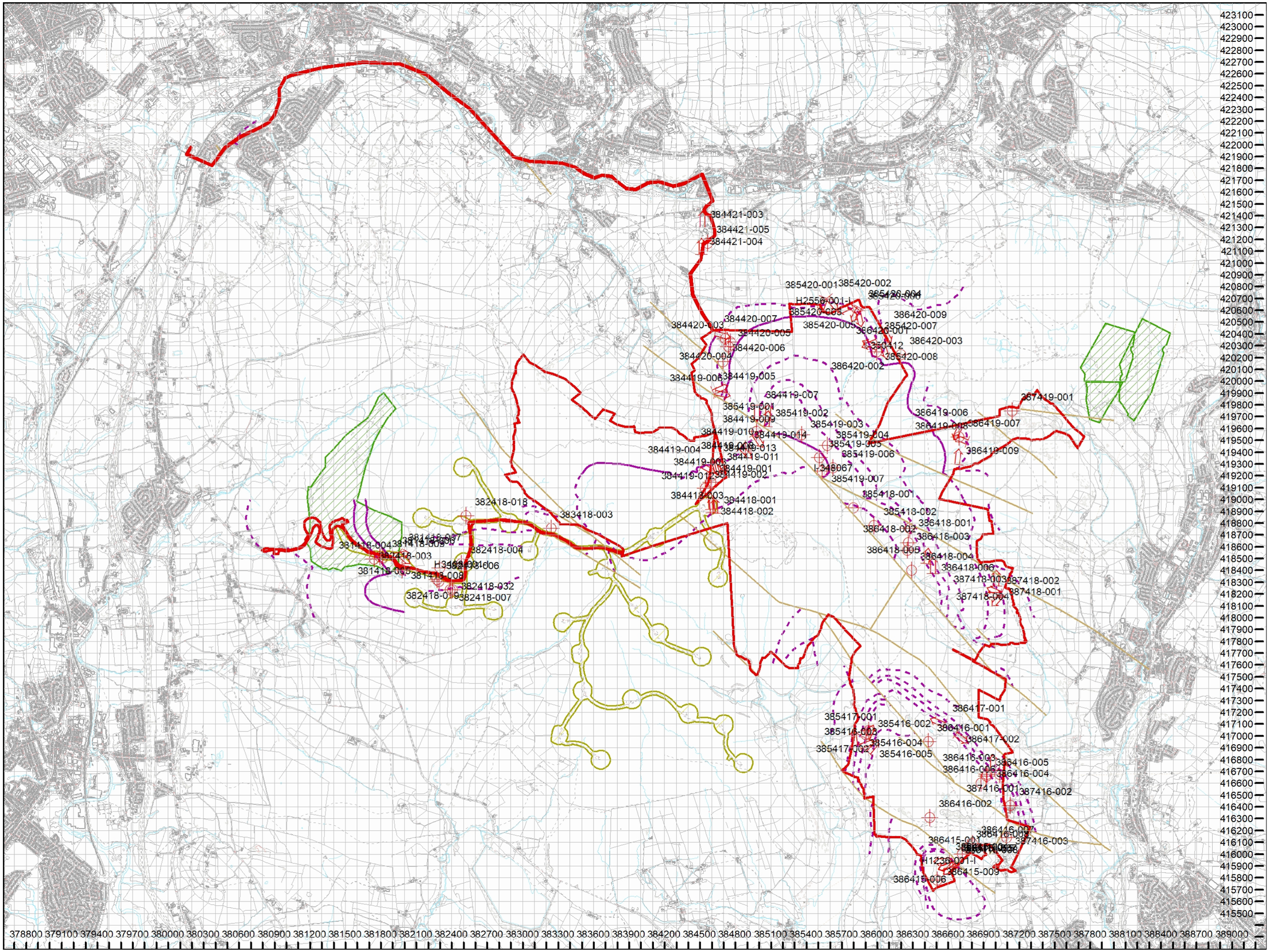
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Map data

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
- Disused adit
- Outcrop (Proven)
- Outcrop (Conjectured)
- Geological faults
- Unlicensed opencast site
- Site investigations
- Remediated sites



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

Appendix D - Abandonment plans

HAILSTORM COLLIERY

SAND ROCK MINE

WORKED BY

MESSRS. BUTTERWORTH & BROOKS

6 inch Ord. Survey Sheet, No 80 Lancashire
Average thickness of Coal 1ft 4in
Roof of Coal Sand rock (Rough rock) strong and sound when not too near the Outcrops
Floor of Coal Dealing or Common fire Clay 2ft. to 4ft. thick

The position of this small Colliery may be seen on the 6inch Ordnance Map Sheet 80, but being on a moor with but few Landmarks the exact place may be found by the lines of Latitude and Longitude

Joseph Dickinson
H.M. Inspector of Mines
of the District.
25th. April 1884

EXPLANATION

Coal gotten from commencement to March 5th 1870 coloured thus
Do March 5th 1870 to March 6th 1872 Do
Do March 6th 1872 to August 20th 1874 Do
Do August 20th 1874 to June 8th 1876 Do
Do June 8th 1876 to March 26th 1878 Do
Do March 26th 1878 to March 6th 1879 Do
Do March 6th 1879 to March 10th 1880 Do
Do March 10th 1880 to August 4th 1881 Do
Do August 4th 1881 to July 18th 1882 Do
Do July 18th 1882 to May 31st 1883 Do

SCALE
10 5 10 20 30 40 50 100 yards
20 Yds. to 1 inch

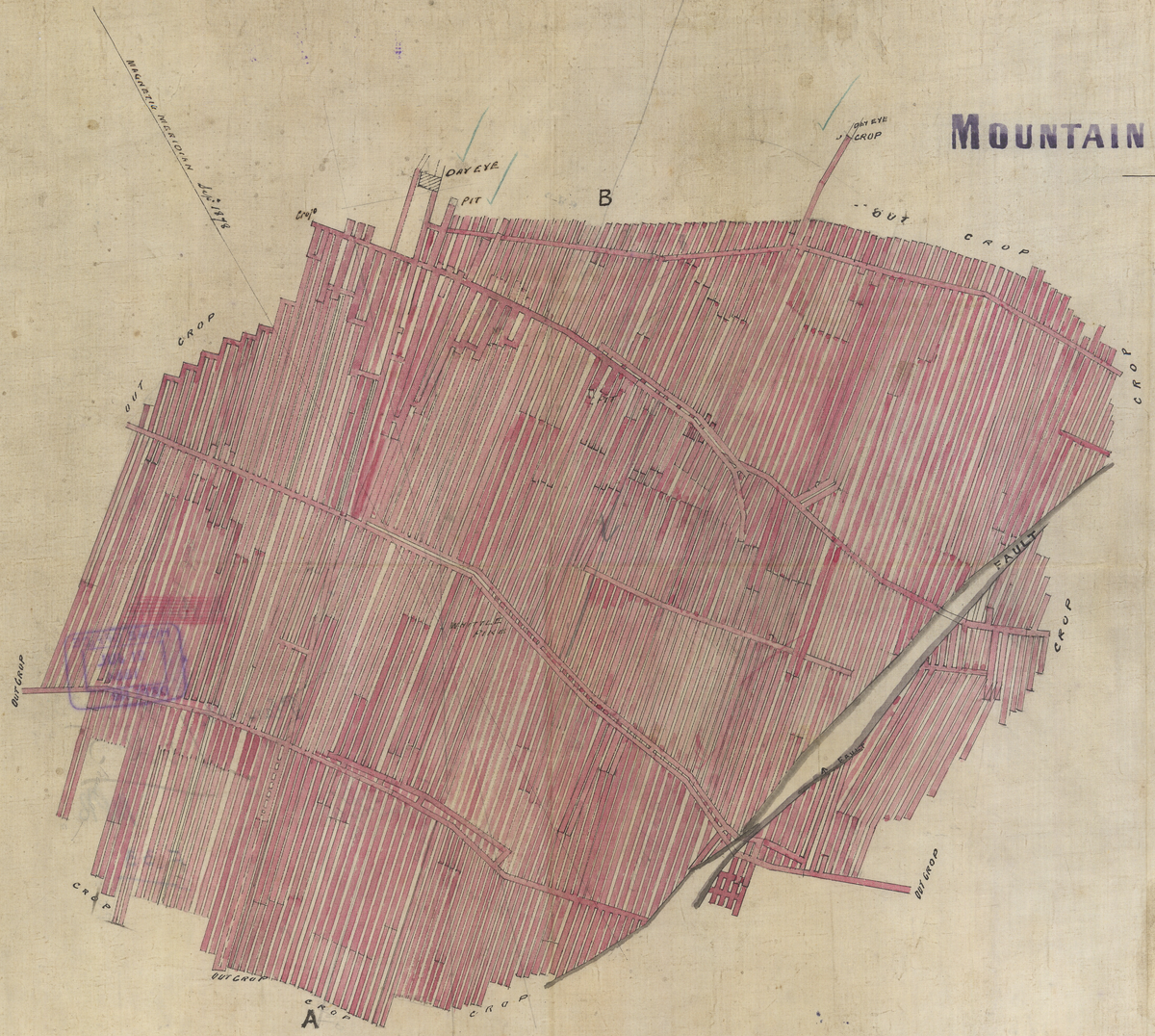
Lat — 53°-1.0
Lon. 2°-14'-7" West
Boundary Stone
Coal of Inferior Quality
Coal moderately good
Coal of Superior Quality
Could not see this boundary
Could not see this 1880
Could not see this Boundary
Could not see this
Could not see this Boundary
Could not see this Boundary
Outcrop of Coal
Boundary Stone
Boundary Stone
Boundary of Coal not worked
Coal not worked
Coal gotten
Boundary of Coal not worked
Bad Coal
Coal worked out 1874
Coal worked out 1874
Query — Why was this Coal left unworked
Ans. — Coal all worked (colour fated)
Drift
Drift mouth
Drift mouth
Outcrop of Coal
Outcrop of Coal
Boundary Stone
Direction & slope of Strata 10° 4 ft in 40 yds
Direction & slope of Strata 10° 4 ft in 40 yds
AIR
AIR
1591
1591

1625

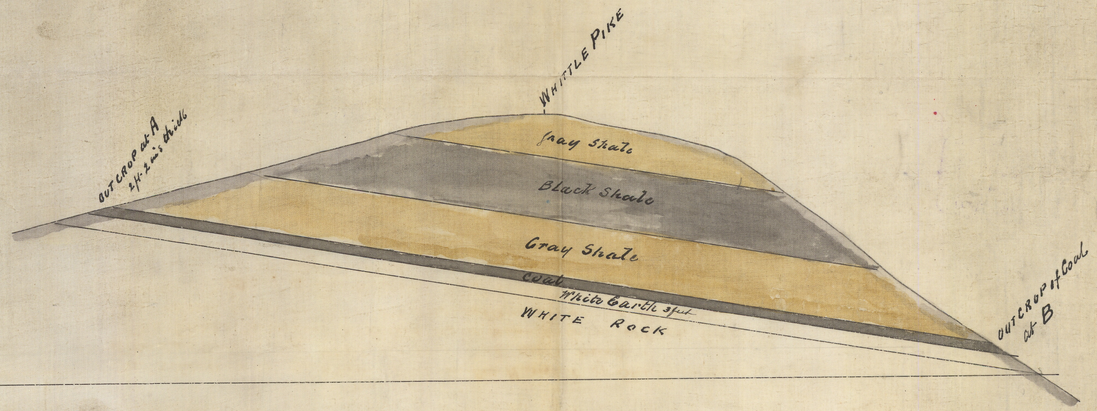
MOUNTAIN MINE, SCOUT MOOR COLLIERY, LANCASHIRE.

WORKED BY EXORS: OF LAWRENCE DUCKWORTH.

The Situation is on Whittle Hill, in the Hamlet of Shuttleworth, Lancashire - See No 80 six inch Ordnance Map.
The Three Quarters or Sand Rock mine of Coal, which lies lies about 100 yards below the Mountain mine, is still being worked.
Joseph Dickenson, H.M. Inspector of Mines.
15 August 1884



SECTION FROM A TO B.



20 Yds. to 1 inch
HORIZONTAL SCALE OF YARDS.
10 0 10 20 30 40 50 60 70 80 90 100 120

VERTICAL SCALE OF FEET
20 Feet to 1 inch

Sept 1878

1625

SAND ROCK MINE, BRANDWOOD MOOR COLLIERY WORKED BY Mr DAVID LAW

AT INTAKE AND PART BANK IN THE HAMLET OF BRANDWOOD LOWER END

TOWNSHIP OF SPOTLAND AND COUNTY OF LANCASTER

FEBRUARY 1886

Joseph Dickinson
H.M. Inspector of Mines of the District
12th March 1886

Mr Brearley's Straight Road from Day Eye

COAL COTTEN BY Mr E. ASHWORTH

Coal which may be worked from Mr Brearley's Brandwood Moor Colliery

To Old Lench Cotton Lane and Rochdale

To Quarries

COAL COTTEN BY Mr JOHN WOODHEAD

COAL COTTEN BY Mr DAVID LAW Dip of Mine 1 in 21

Distance 100 yds from Day Eye to Face of Drift

Distance 100 yds from Day Eye to Face of Drift

DAY EYE

DAY EYE

DAY EYE

DAY EYE

DAY EYE

INTAKE

SUPPOSED OLD WORKINGS

OLD WORKINGS

OLD WORKINGS

Coal cotten by Mr David Law

Coal cotten by Mr David Law

SAND ROCK MINE

Proposed Course of Road from Tunnel Mouth to Day Eye when completed

TUNNEL MOUTH

Section of the Sand Rock Mine

Rock	7 0
Top Coal	1 9
Part	0 4
Bottom Coal	0 9
Fireclay	0 9
Rock	∞

Scale of Yards

22 Yds. to 1 inch

March 5th 1886

1843

Joseph Dickinson & Sons
Mining Engineers
Radcliffe


No. 1 Day Eye.
Old Works.
Coal partly worked
no record of the
workings.
Old Works
Green's Moor
Magnetic North Nov. 1850.
Dip of Mine
1 in 18
No. 2 Day Eye.
Day Eye. No. 3
Coal found to be partly worked, no record of
workings.
Old Works
Section of Seam
Sand Rock
Coal
White
Barch
Sand Rock
Feet inches
1 - 1
2 - 0
Sand Rock Mine. Bunker's Hill Colliery.
Scale 1 Chain to one Inch.
Jno Gerrard
H.M. Inspector of Mines.

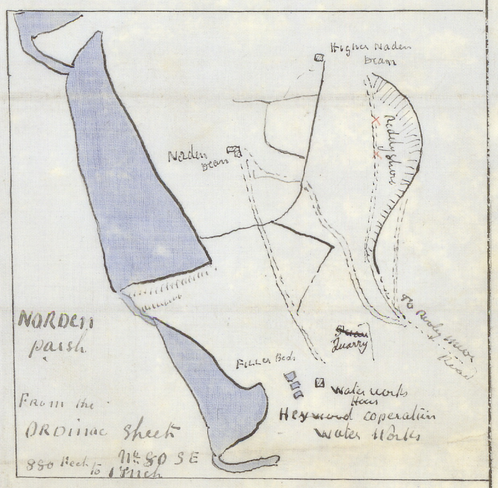
3522

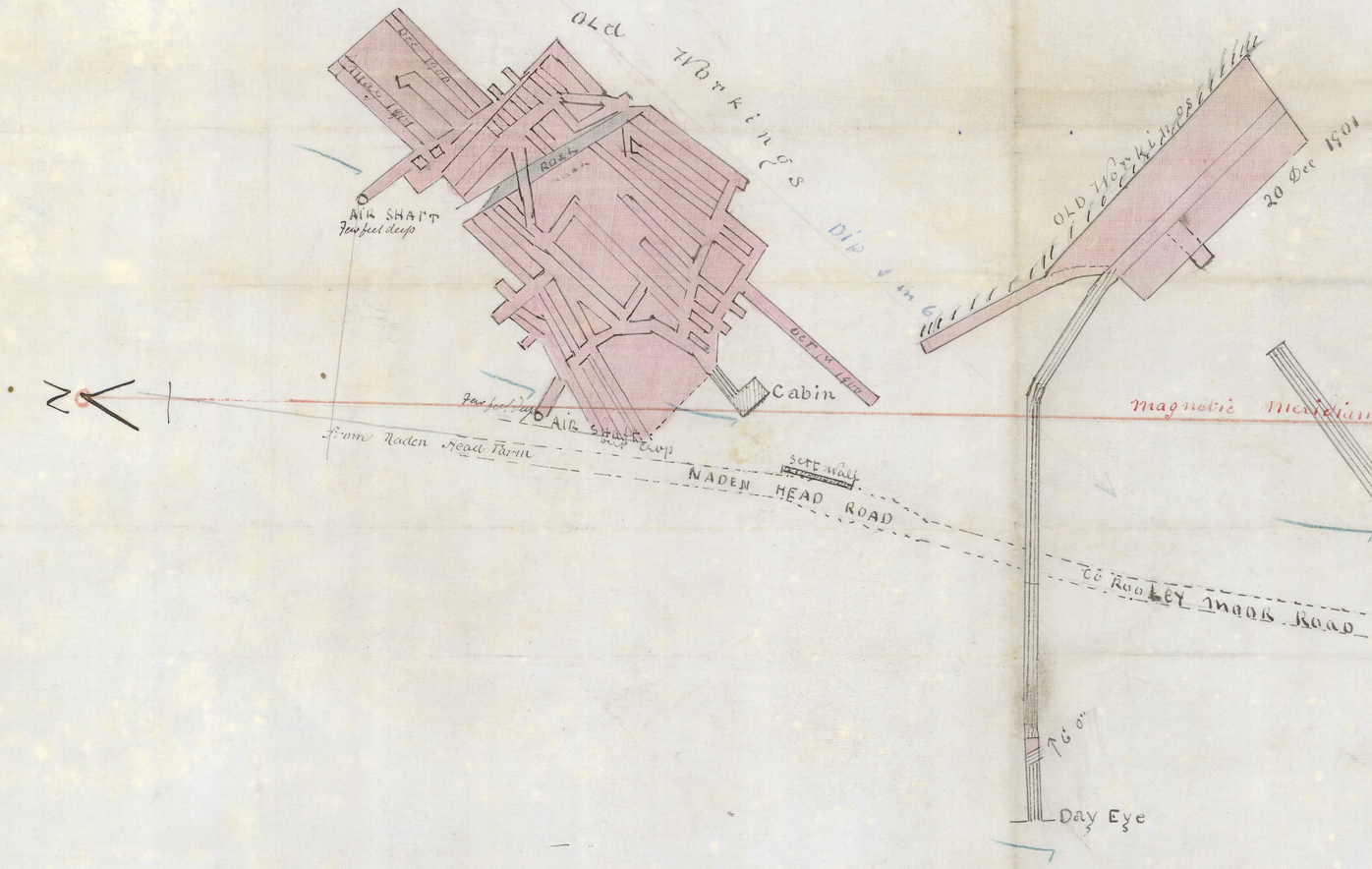
3522

MOUNTAIN MINE NADEN HEAD COLLIERY near Rochdale

WORKING BY

Messrs J Lomax and Co Limtd





I hereby certify after thorough Examination and inquiry, that to the best of my Knowledge and belief this plan is an accurate plan of the Mine

Signed Thos Andrews

4212

T. Andrews.
Manager.

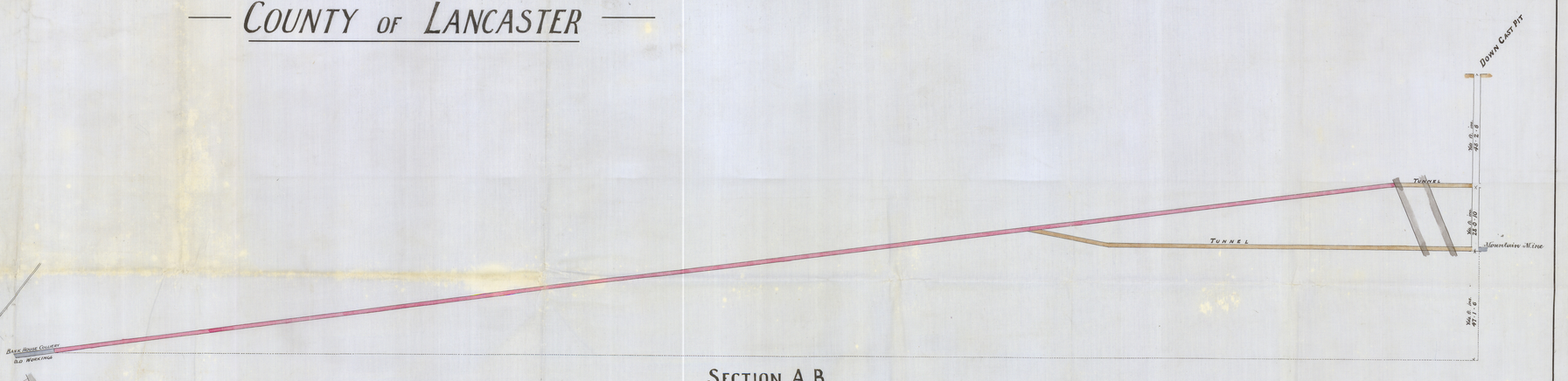
4212

Scale 20 Yards to One Inch

PLAN OF THE SAND ROCK MINE ROOLEY MOOR COLLIERIES WORKED BY MESSRS JOHN LOMAX AND CO. LTD. 5454

TOWNSHIP OF NORDEN. PARISH OF ROCHDALE.

— COUNTY OF LANCASTER —



SECTION A B.

— Scale 20 Yards to one Inch. Natural —



SECTION OF SEAM

— Scale 20 Yards to One Inch. —

5454

I certify that to the best of my knowledge this is a correct plan of the mine.
Mines Inspector's District
Manager or Viewer
Rochdale

5454

HALL FOLD

PLAN OF COAL MINE

WORKED BY M & M WATSON

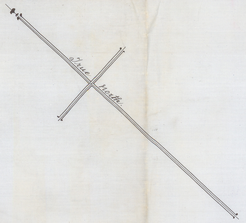
from under the

WITHINS ESTATE WHITWORTH

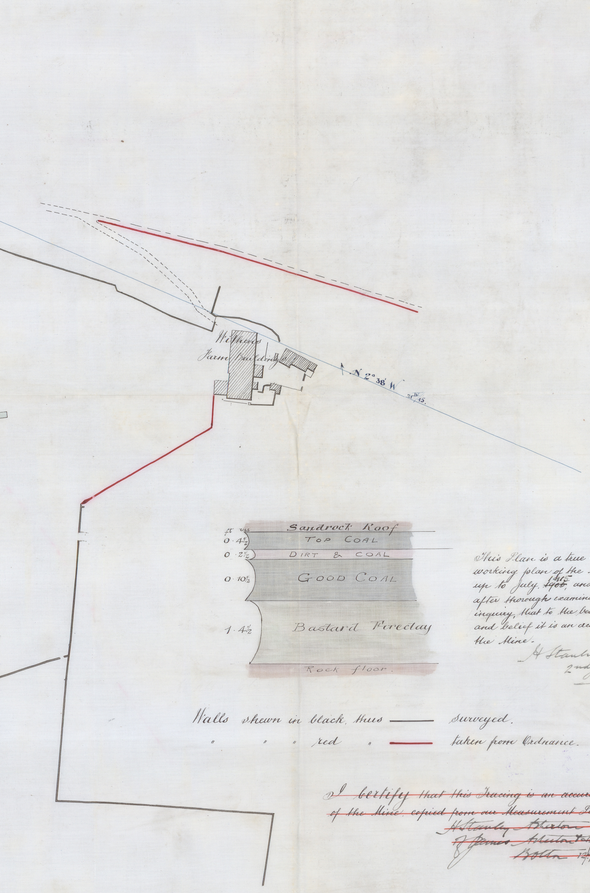
BELONGING TO

THE HULTON TRUSTEES

6559







Scale of Yards

.... 20 Yds. to 1 inch

6559

PLAN No 13818
MINES DEPT.
Supp. 3-7-1915
F.S.9

HALL COWM COLLIERY
SANDROCK MINE

13818

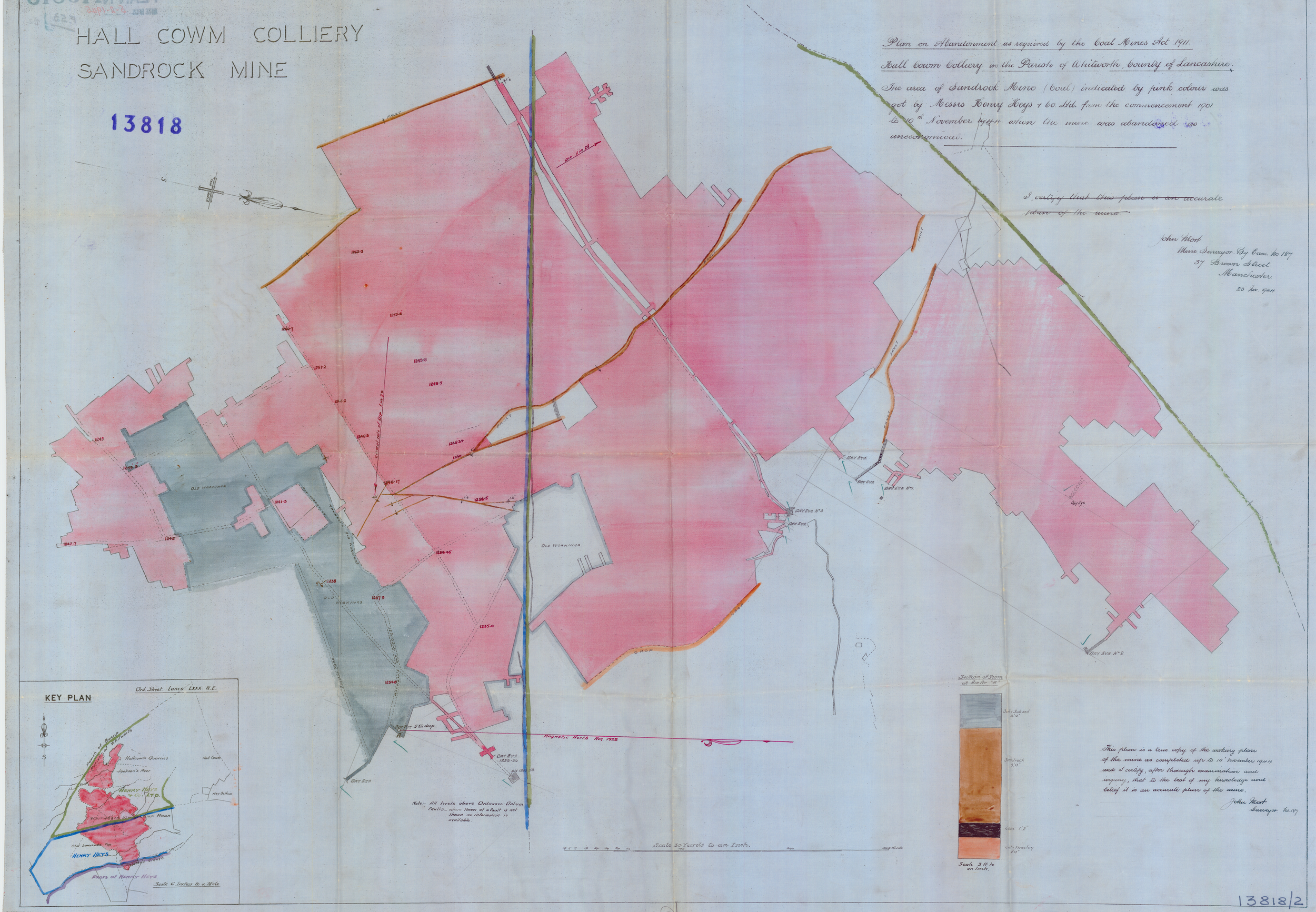
Plan on Abandonment as required by the Coal Mines Act 1911.

Hall Cowm Colliery in the Parish of Whitworth, County of Lancashire.

The area of Sandrock Mine (Coal) indicated by pink colour was got by Messrs Henry Heys & Co. Ltd. from the commencement 1901 to 10th November 1914 when the mine was abandoned as uneconomical.

~~I certify that this plan is an accurate plan of the mine.~~

John Hirst
Mines Surveyor. By Exam. No 187
37 Brown Street
Manchester.
23 Nov. 1914


FAULT
Dip 1 in 24
1262·3
1255·6
1260·7
1251·2
1243·8
1249·5
1245
1243·3
1242·7
1245
1241·2
1246·3
1246·17
1246·34
1240
1238·5
1236·45
1241·3
OLD WORKINGS
1238
1237·3
1235·0
1254·0
Dip 1 in 5 to deep
Dip 1 in 5 to deep
Dip 1 in 12
CROP
DAY EYE
DAY EYE No 1
DAY EYE No 2
DAY EYE No 3
DAY EYE No 4
DAY EYE
DAY EYE
DAY EYE

Lancashire Sheet LXXX N.W.

796/1
33/208

16872

Deardon Brook

Tramway

Shunt End Adit

Old Day Eye (Duckworth)

Old Works Here

Solid Coal

from Haslingden

Bridge Mills

Scout Moor Quarries

Scout Moor

Scout Fold

Scout Barns Scout Road

Rochdale Road

Pt 419

48

Tramway Level

Scout Moor Colliery (Dis:)

New Crate

Town Mill

Pt 442

443

40

Old Shaft (27 yards deep)

Old Shaft (18 yds)

Reservoir

OLD WORKINGS IN SANDROCK SEAM.

Old Works

Day Eye

Pt 444

Day Eye

50

Kay Barn

Lime Leach

59

Land Yellow Red-Brown edged owned by Whittakers

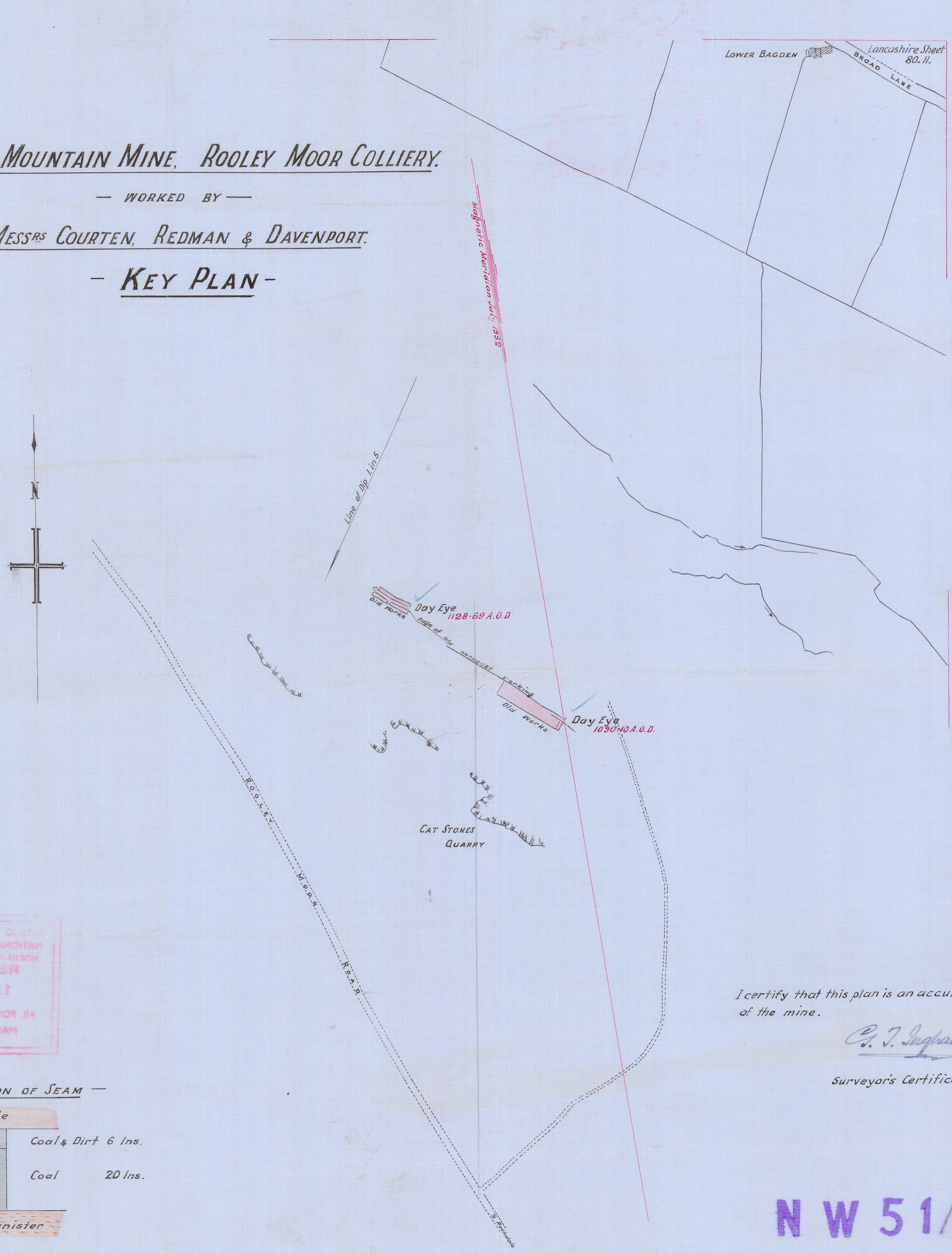
Scale 6 Inches to a Mile

LOWER MOUNTAIN MINE. ROOLEY MOOR COLLIERY.

— WORKED BY —

MESSRS COURTEN, REDMAN & DAVENPORT.

- KEY PLAN -



— SECTION OF SEAM —

— Scale: 1/2500 Ordnance —

I certify that this plan is an accurate plan of the mine.

G. T. Ingham.

Surveyor's Certificate. Nº 1038.

NW 51/1

G. T. Ingham
Chartered Surveyor
Whitefield.

28×24

LOWER MOUNTAIN MINE. ROOLEY MOOR COLLIERY.

— WORKED BY —

MESSRS COURTEN. REDMAN & DAVENPORT.

Magnetic North July 1952

Ordnance Grid North.

Line of Dip 1 in 5.

1127·54

Old Works

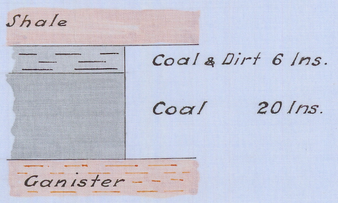
Day Eye
1128·69

Edge of old Opencast workings

Old Works

Day Eye
1090·10

SECTION OF SEAM



I certify that this plan is an accurate plan of the mine up to the date of abandonment on 6th September, 1952.

G. T. Ingham.
Surveyor's Certificate No 1038.

The levels shown in red are in feet above Ordnance datum.

— Scale: 30 Yards to an Inch —

0 5 10 20 30 40 50 100 200 300 400

N.W.51.

F.60.

MINING RECORDS OFFICE
NATIONAL COAL BOARD
NORTH-WESTERN DIVISION.
RECEIVED
18 DEC 1952
40, PORTLAND STREET,
MANCHESTER, 1.

NW 51/2

G. T. INGHAM,
Chartered Surveyor.
WHITEFIELD.

N.W.54. F.61.

MINING RECORDS OFFICE
NATIONAL COAL BOARD
NORTH-WESTERN DIVISION
RECEIVED
15 JUN 1953
40, PORTLAND STREET,
MANCHESTER, 1.

LOWER MOUNTAIN MINE,
HUNGER HILL COLLIERY.

— WORKED BY —

MESSRS COURTEN, REDMAN & DAVENPORT.

HUNGER HILL

DOLDRUM

RESERVOIR

Magnetic North October 1952

Ordnance Grid North

Old Works

Outcrop

Day Eye 982·0

Day Eye 978·61

Day Eye

977·6

974·8

975·8

Direction of Dip 1 in 8

LOCATION REFERENCE.

Lancashire 25inch sheets 80. 15 & 11.

This plan is an accurate plan of the mine so far as the workings are coloured red. Those coloured blue have been plotted from measurements given, the workings being inaccessible. After careful enquiry. I consider they show the full extent of the mine.

G. T. Ingham. 21st May, 1953

Surveyor's Certificate No 1038.

— SECTION OF SEAM —

Shale

Coal 22 Ins.

Fireclay

Levels in red are in feet above Ordnance datum.

— Scale: 22 Yards to an Inch. —

0 5 10 20 30 40 50 100 200 300 Yards

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NORTH-WESTERN DIVISION
RECEIVED
15 JUN 1953
40, PORTLAND STREET,
MANCHESTER, 1.

N.W. 54. F.61.

G. T. INGHAM,
CHARTERED SURVEYOR,
WHITEFIELD.
DEC. 1952

P L A N

of a Colliery on Brandrood Moor worked by R. Mann Esqr. shewing the workings and the Coal gotten up to April 1850

By J. Kelly Colliery Surveyor

Probably Sandrock (HKO)

REFERENCE

By Inches Average thickness of what is on this Plan

Quantities of coals got from Lancaster to the 30th of April 1850

	Outcrop of Yards			Statute Yds		
	a	r	p	a	r	p
Crowns Moor	9	0	27	16	3	33
Enclosed Mr Turners	0	2	25	1	0	07
Do Mr Hardmans	0	0	17	0	0	37
Total	9	3	27	16	0	17

REFERENCE

	Lancaster Weights		
	a	r	p
Total quantities of Coal gotten from under The Common Land or Crowns Moor Colours Plain with Brown inclining Yellow of Coal had got gotten the whole being settled the four eighth Portion (p.c.)	16	3	33
Pale blend Blue as Sampled Parcel sent by J. Kelly (no date)	9	-	27
Pale blend Brown (from April 1848 to October 1849)	7	2	26
Quantity of Three Plate Colour Yellow and blend Red got from under Standwood Moor from Oct. 1849 to April 1850	1	0	19
Quantity of Two Plate blend Pink and slight Pink or Red got from under Brandwood Moor from Oct. 1848 to Oct. 1849	1	0	30½
Quantity of 3 Plate Coal (same) got from Oct. 1847 to Oct. 1848	1	0	21½
Quantity of 2 Plate Coal Purple got from Oct. 1846 to Oct. 1847	0	3	29
" 1 Do Do Blue — sent by sorts Samples	0	1	31
" 2 Do Do Yellow got from March 1848 to Oct. 1848	0	3	7
" 2 Do Do Brown got from Nov. 1848 to Nov. 1849	0	2	7

Scale of Lengths Yards to an Inch

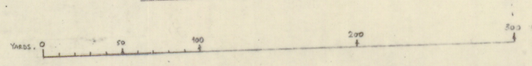
Presented by Geo. Haywood Son & Hughes Oldham.

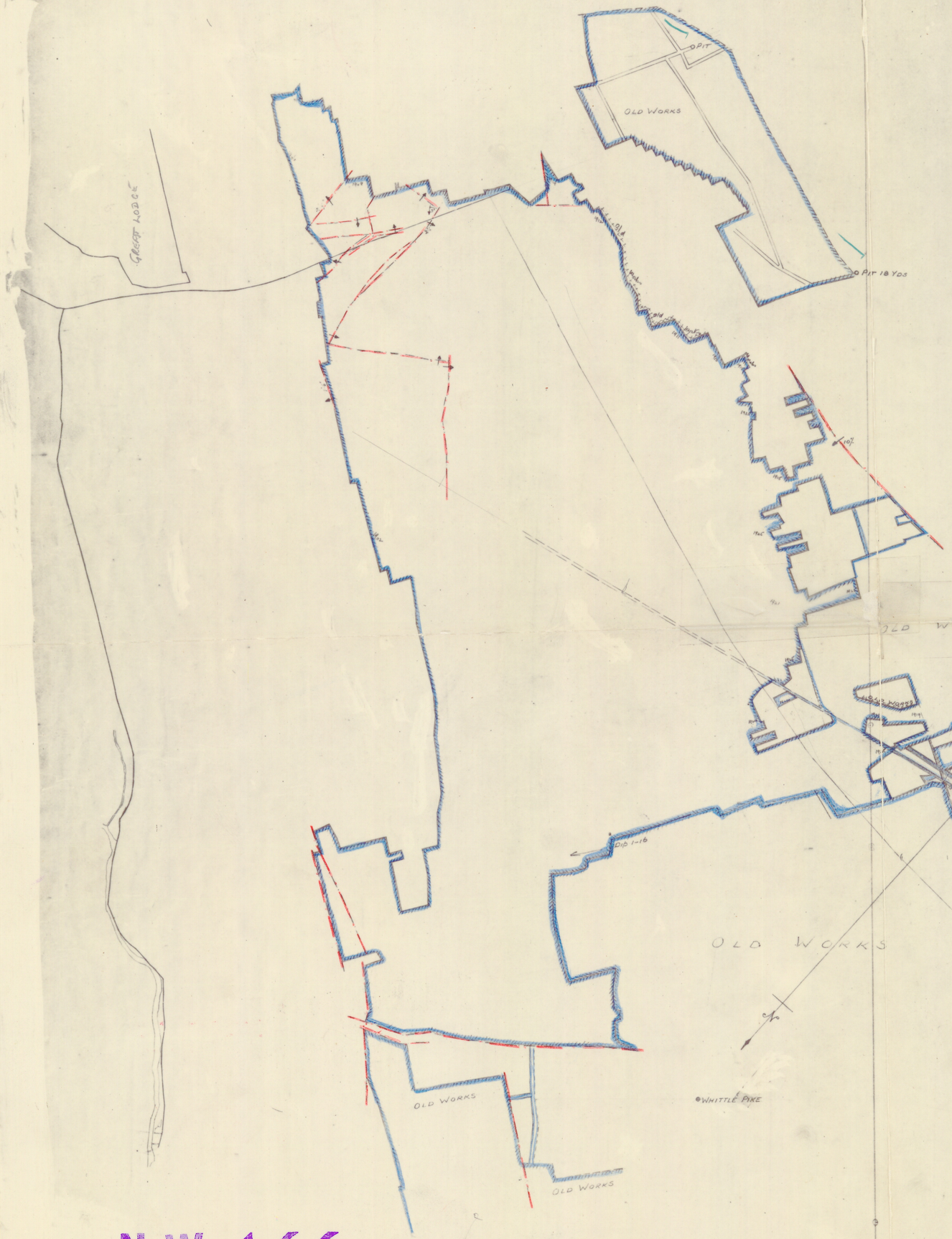
MINING RECORDS OFFICE NATIONAL COAL BOARD NORTH-WESTERN DIVISION RECEIVED 1 JAN 1953 46, PORTLAND STREET, MANCHESTER, 1.

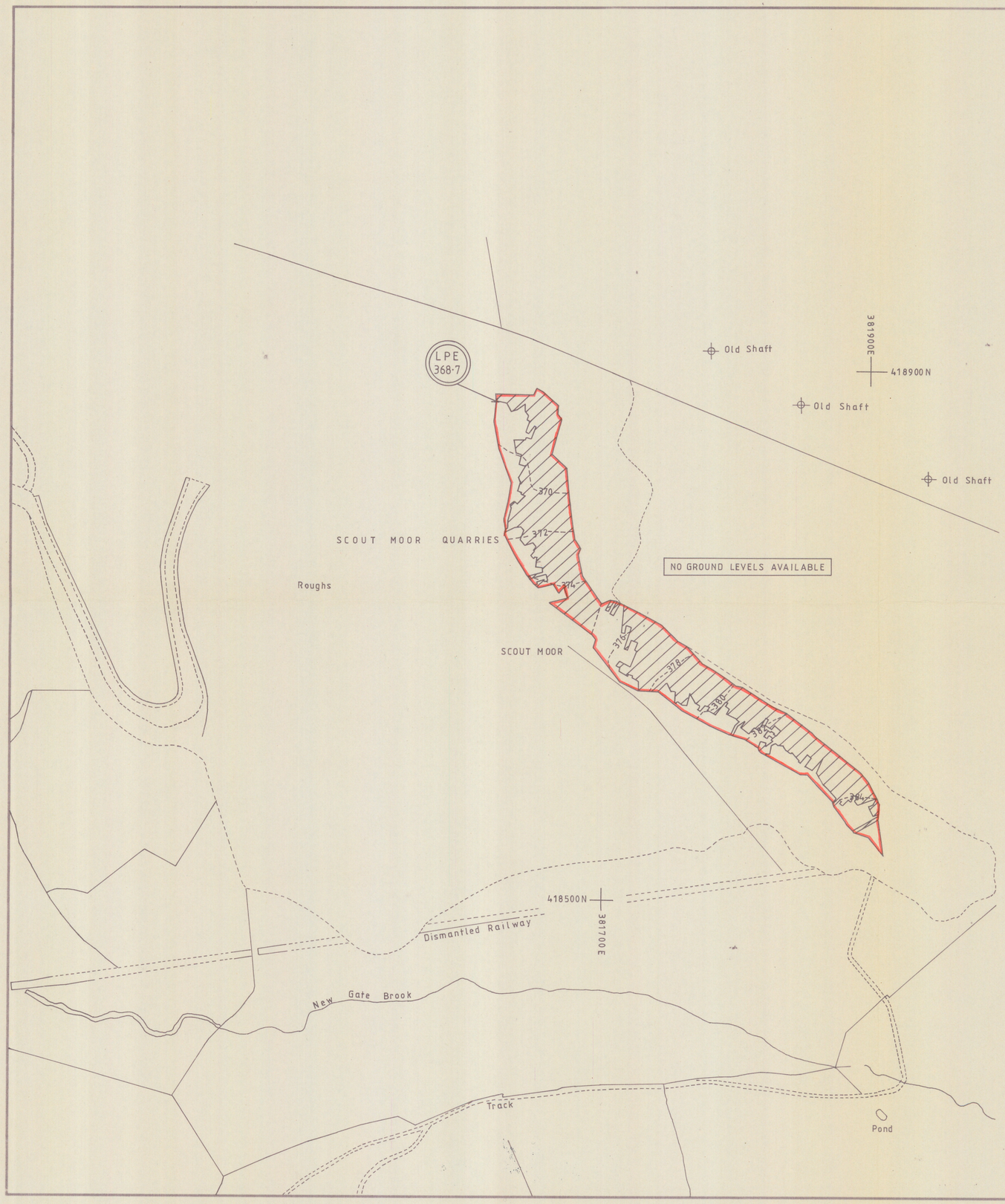
1/2

N.W.127.

SCOUT MOOR COLLIERY
SAND ROCK MINE
SCALE 1:2500.




GREAT LODGE
OLD WORKS
PIT
PIT 18 YDS
OLD WORKS
OLD WORKS
OLD WORK



NW1466

Legend

SITE BOUNDARY (Inside edge of symbol to be taken as boundary of site)

PERIMETER OF BATTER

POSITION OF KNOWN OR SUSPECTED SHAFT

POSITION OF KNOWN OR SUSPECTED ADIT

---372--- Bottom of coal contours

AREA OF SEAM WORKED (with seam code) IN GEOLOGICAL DESCENDING ORDER

Sand Rock Mine

NOTES NO OTHER INFORMATION AVAILABLE

Shafts (St etc.) Refer to Shaft Register

Site Bench Mark	E	N	L

LAND TYPE AND USAGE

BEFORE OPERATIONS: MOORLAND USED FOR HILL FARMING

AFTER RESTORATION: VOID LEFT TO FORM START OF NEW QUARRY

DETAILS OF OVERBURDEN:

DETAILS OF BACKFILL: NO BACKFILLING CARRIED OUT DUE TO AFTER-USE

NATURE OF COAL: POOR QUALITY OUTCROP COAL

OPERATIONAL DATES

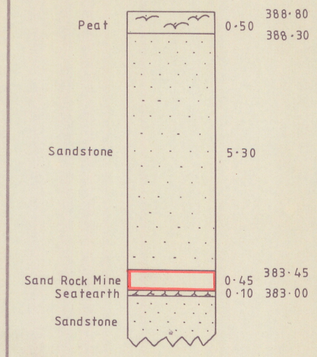
AUTHORISED:

COALING COMMENCED: 9th JULY 1985

COALING COMPLETED: 26th SEPTEMBER 1985

PLANS ISSUED:

TYPICAL SECTION



Not to scale

BRITISH COAL OPENCAST
Headquarters, 200 Lichfield Lane, Mansfield, Notts NG18 4RG

SITE NAME: SCOUTMOOR

TITLE: Completion Plan

COUNTY	DISTRICT	CIVIL PARISH
LANCASHIRE	ROSSENDALE	EDEN

LOCATION: 3 Kms N.E. of RAMSBOTTOM

O.S. SHEETS USED: Prefix SD — 8219 8319 / 8218 8318

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Drawn by MAL Date 5·4·91

Checked by RM Date 5·4·91

Scale 1/2500 Sheet 1 of 1

Drawing No. CP 1899 Contract Drawing No.

ABANDONED MINE PLAN

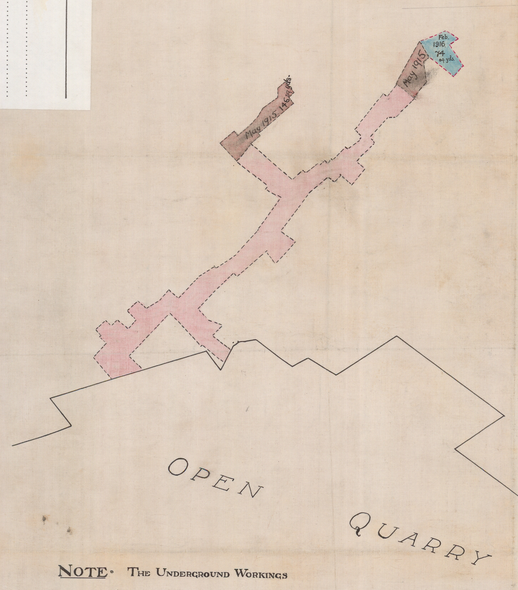
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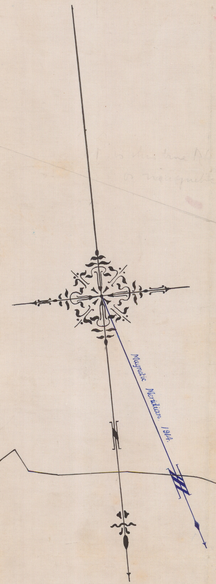
Name BRANDWOOD

County LANCASHIRE

Sheet no. 1 of 1 sheets

BRANDWOOD QUARRIES - HENRY HEYS & CO LTD





I/we certify that this plan is an accurate plan of the mines.
Jackson & Fox. Surveyors.
8 March 1916.
Halifax.



NOTE: THE UNDERGROUND WORKINGS COLOURED PINK ARE UP TO AND INCLUDING MAY 1914.

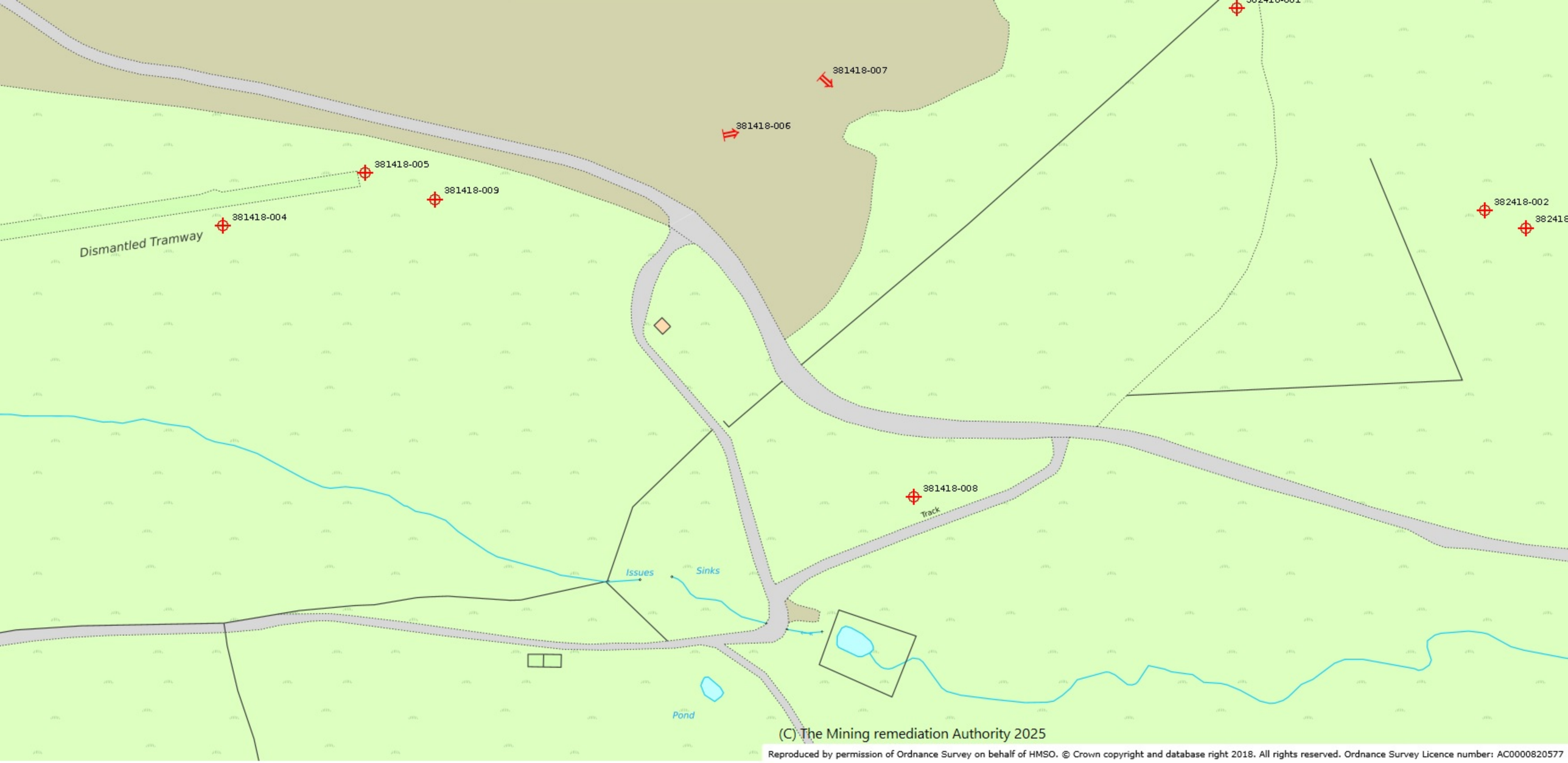
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100 80 60 40 20 0 100 200 300 400 500 600 700 800 900

SCALE OF FEET

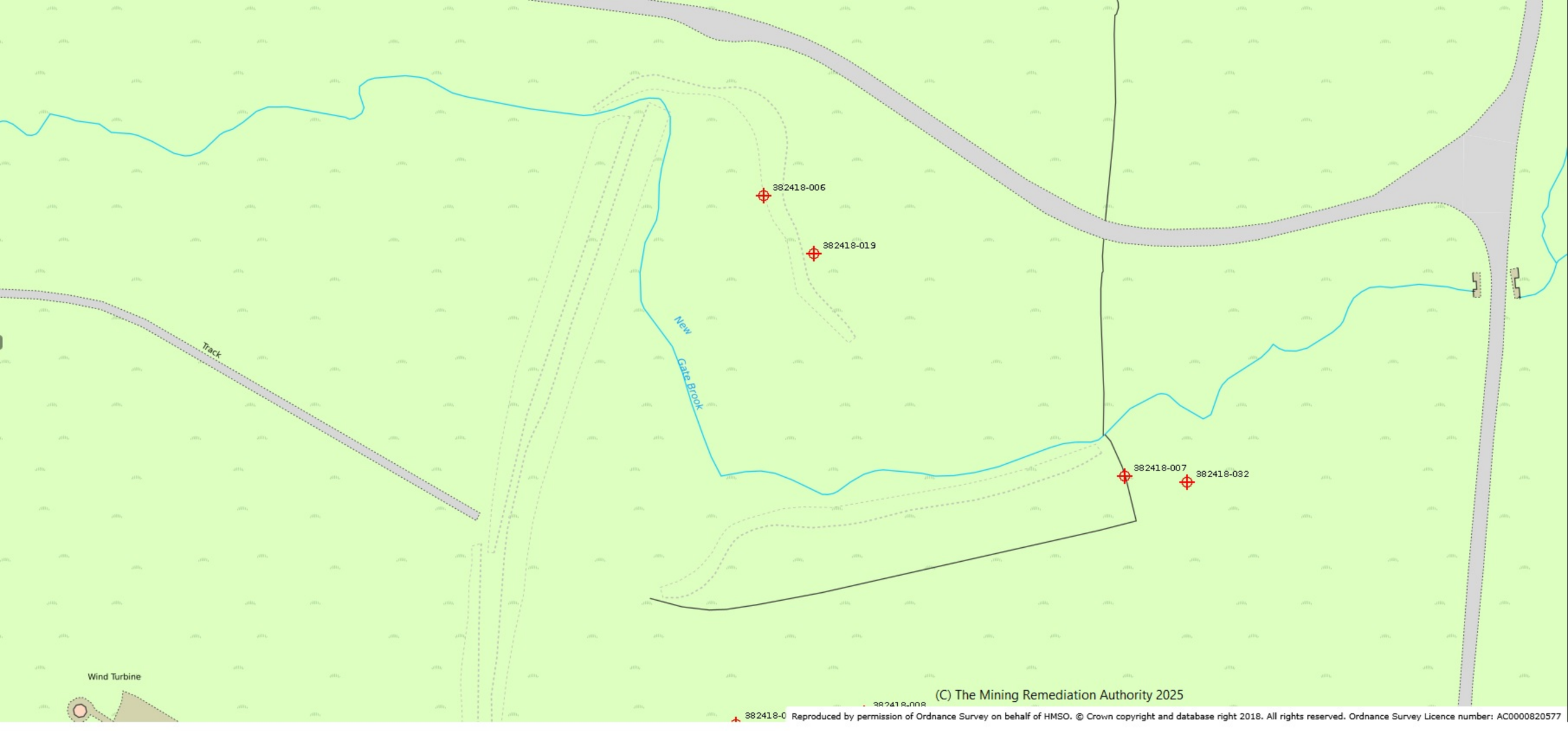
100 80 60 40 20 0 100 200 300 400 500 600

Jackson and Fox
Surveyors Halifax
March 1915

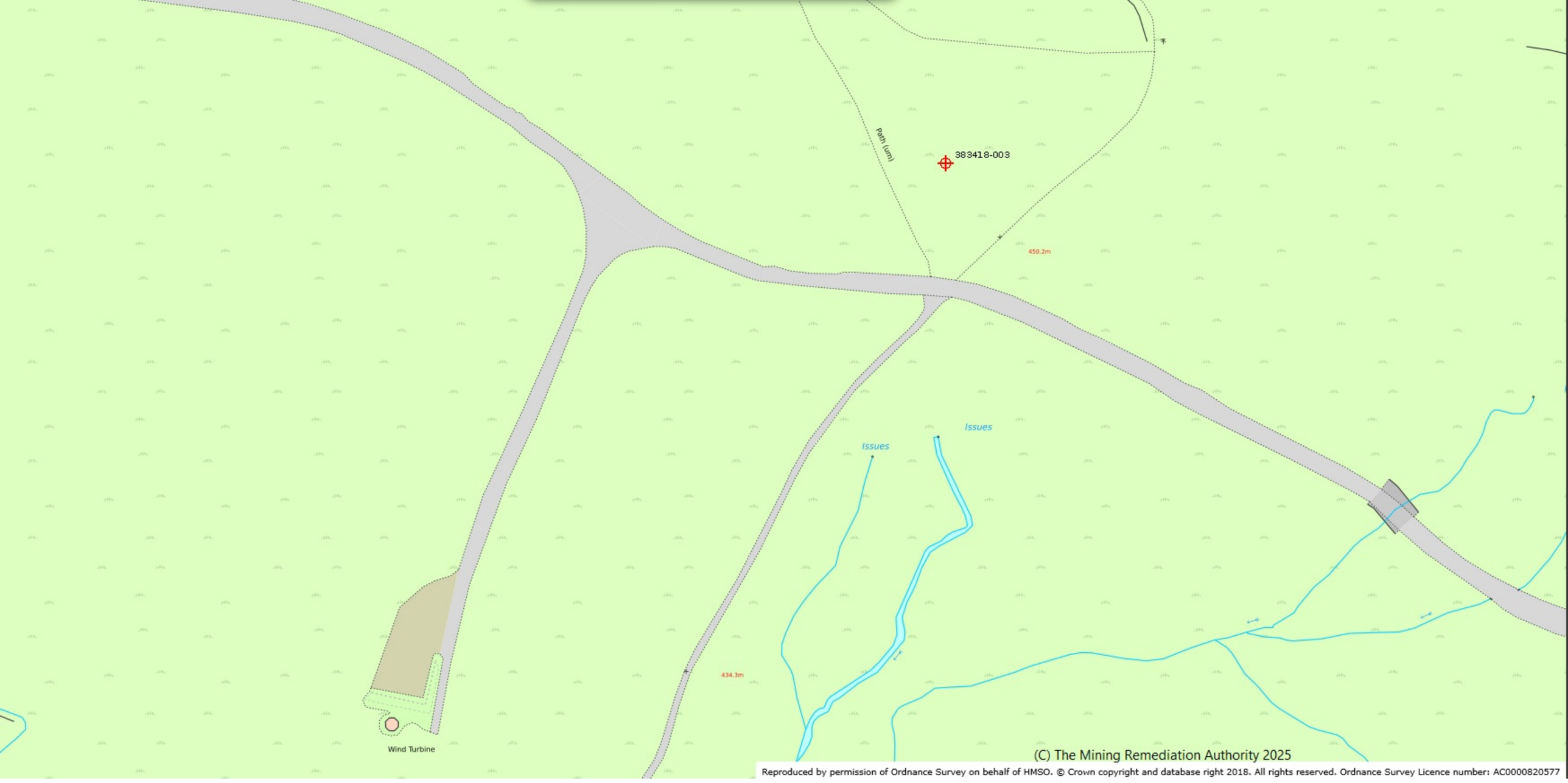


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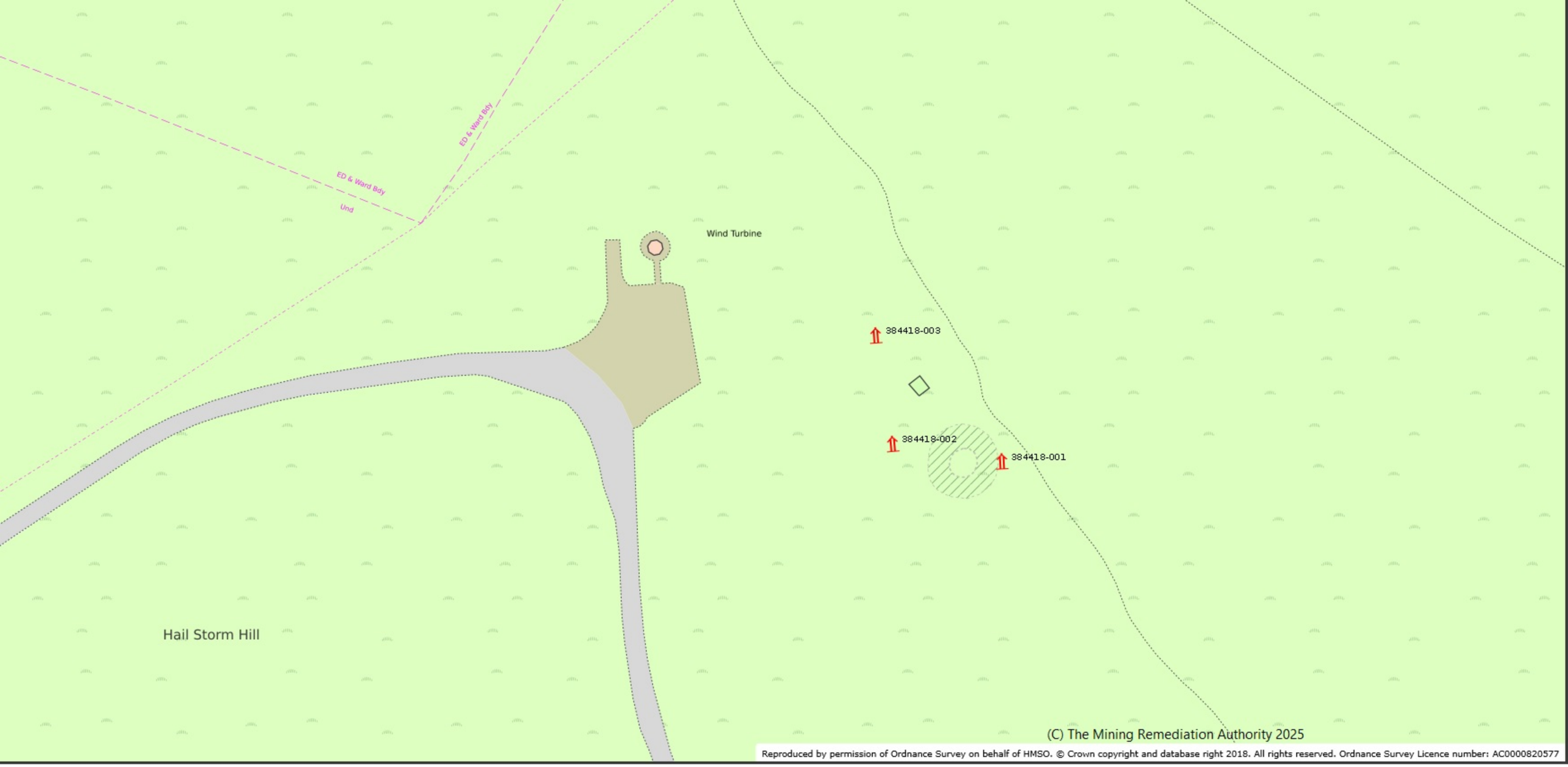

382419-001
382419-002
382419-003
Issues
Cairn
Path (uncl)
Whittle Pike
382418-018
Whittle Hill
Wind Turbine
Wind Turbine
Wind Turbine
Old Shaft
382418-031
Issues
Issues
Scout Moor
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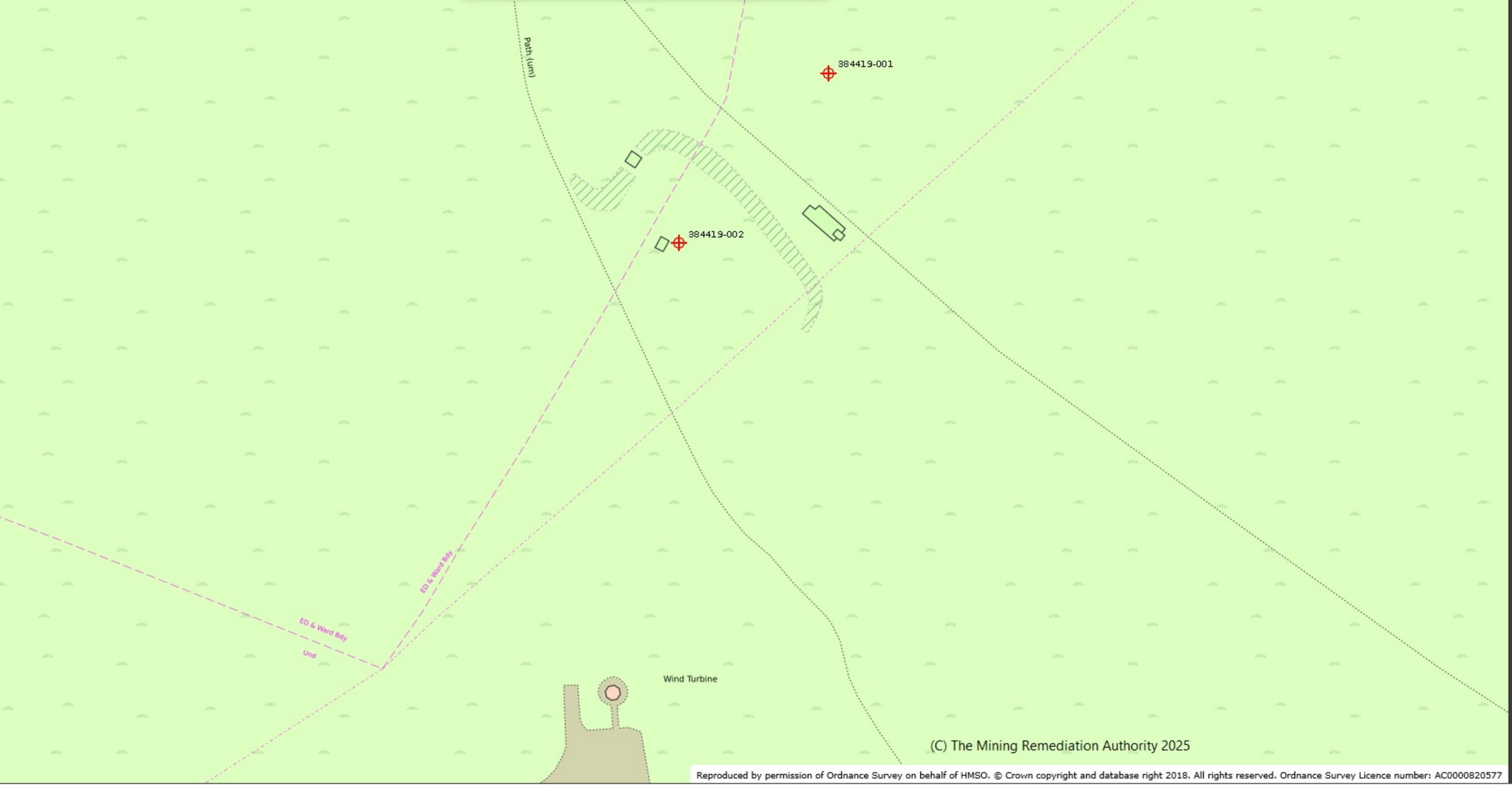


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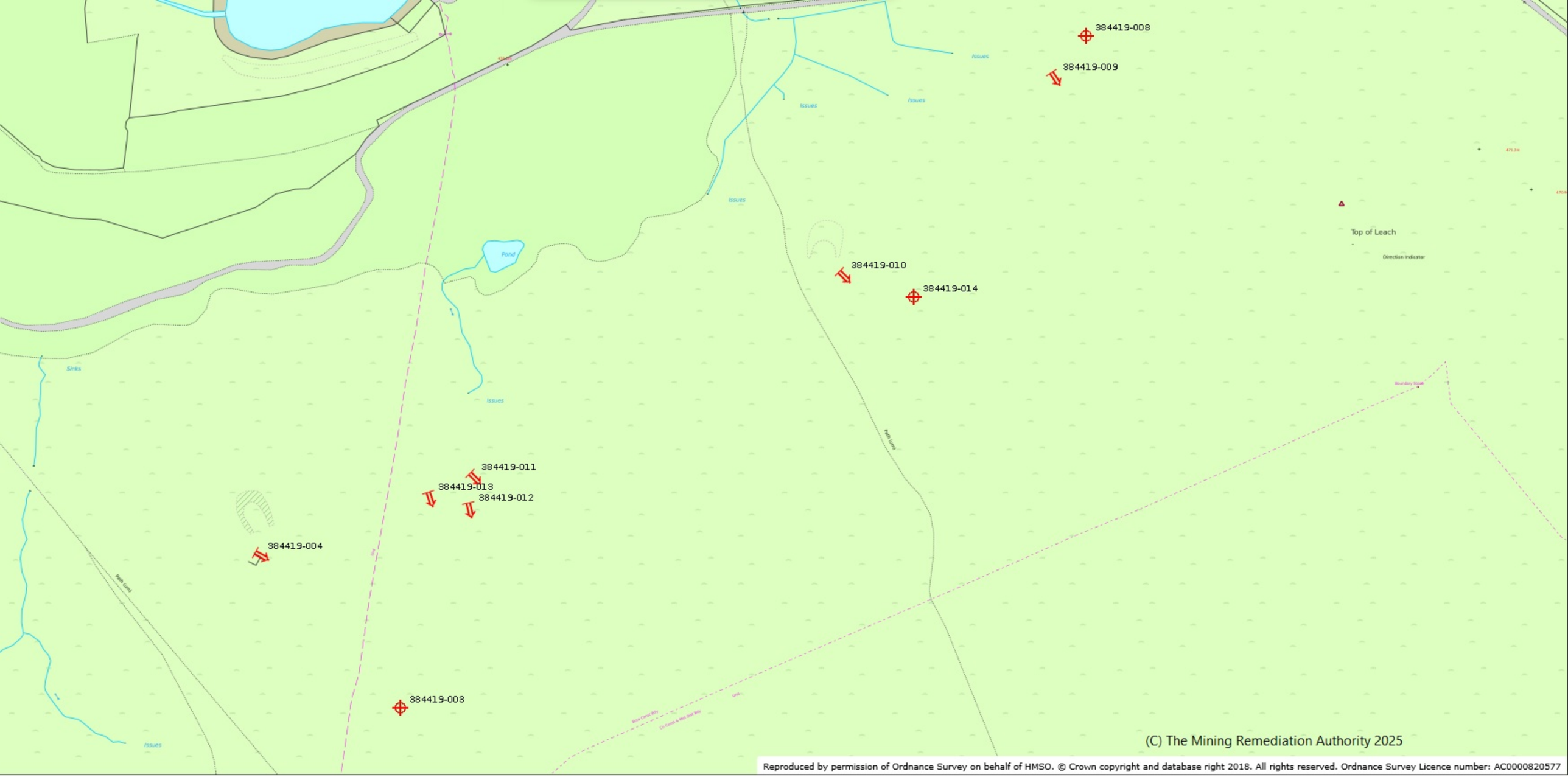


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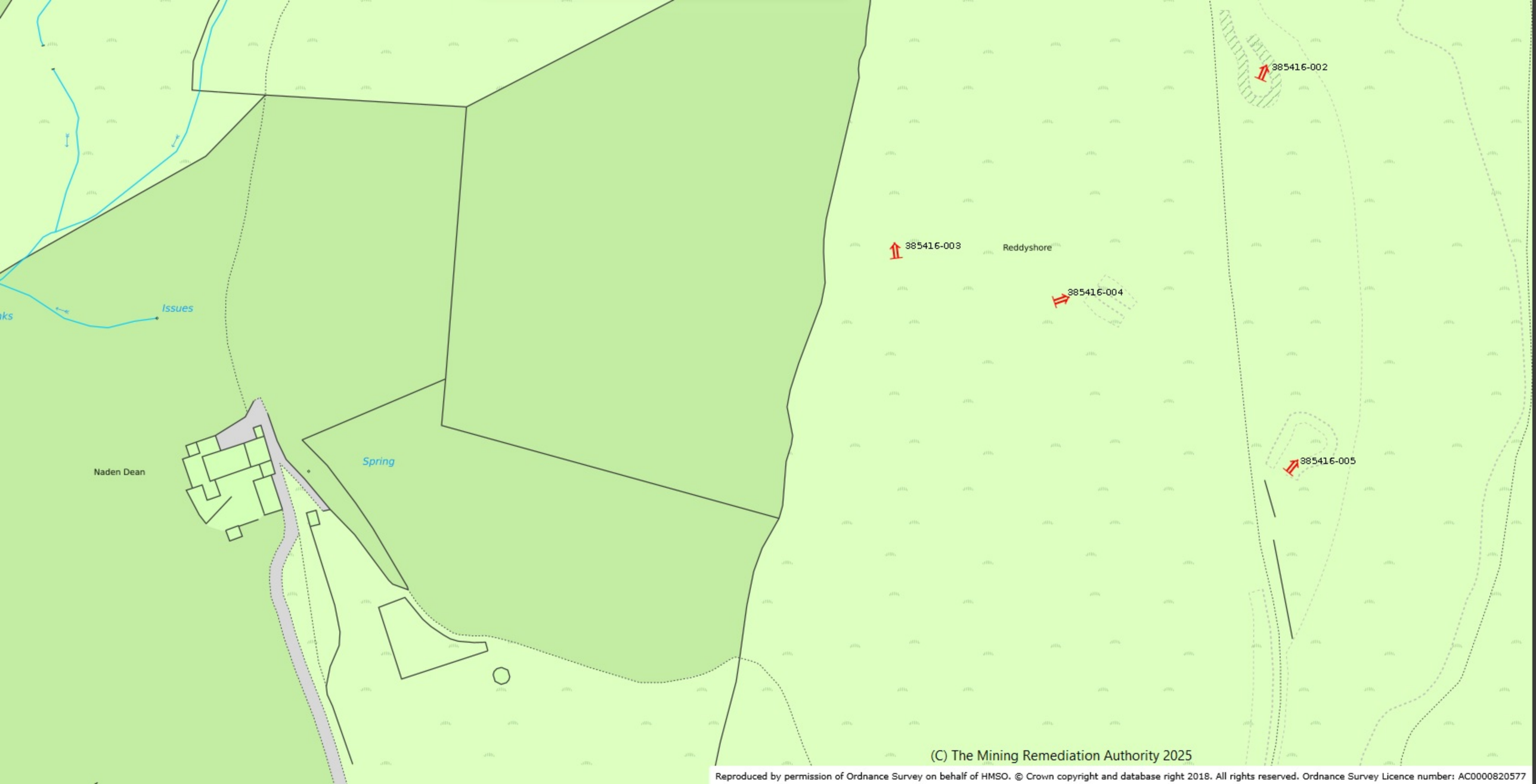

ED & Ward Bdy
ED & Ward Bdy
Und
Wind Turbine
384418-003
384418-002
384418-001
Hail Storm Hill
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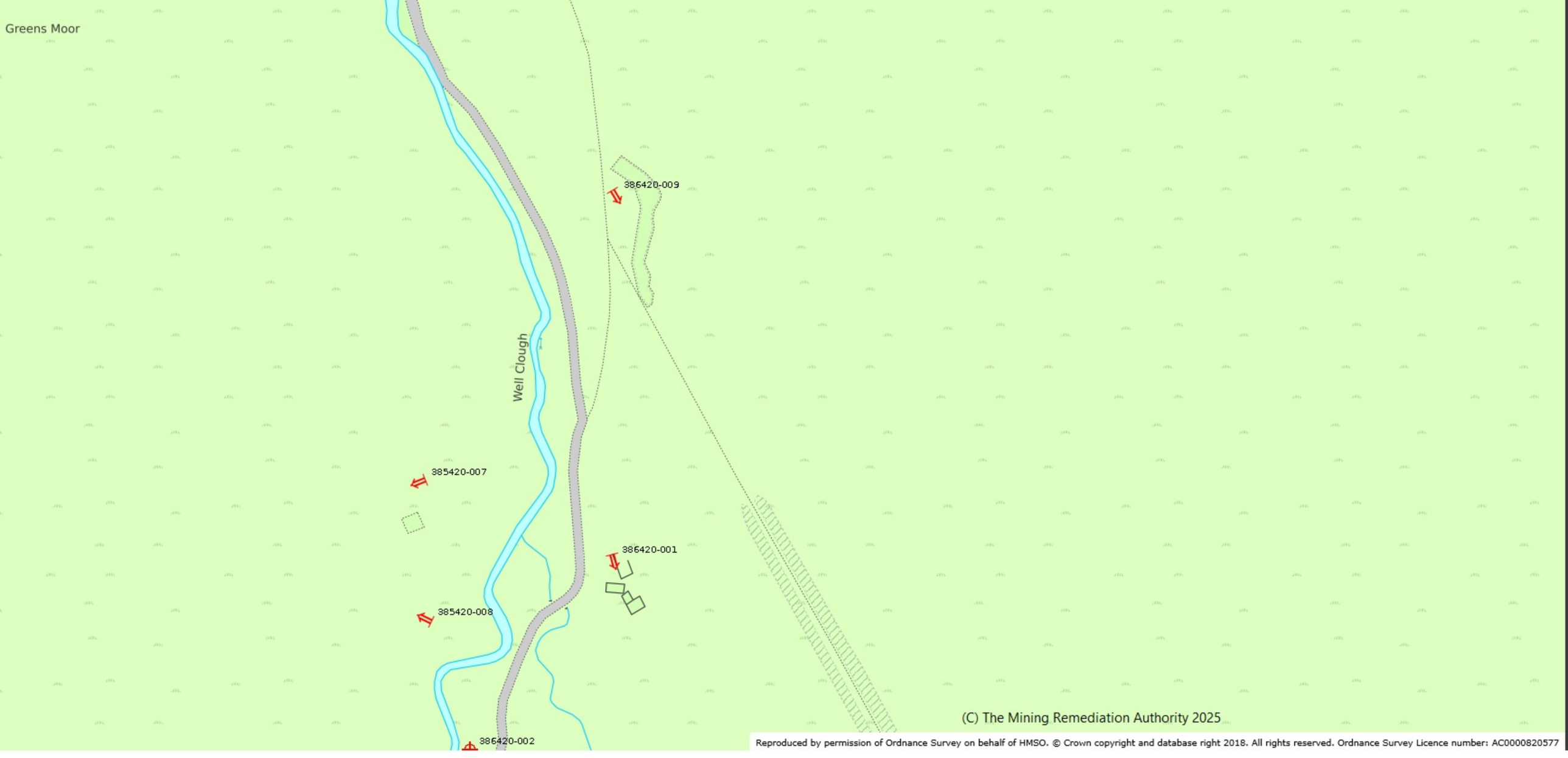
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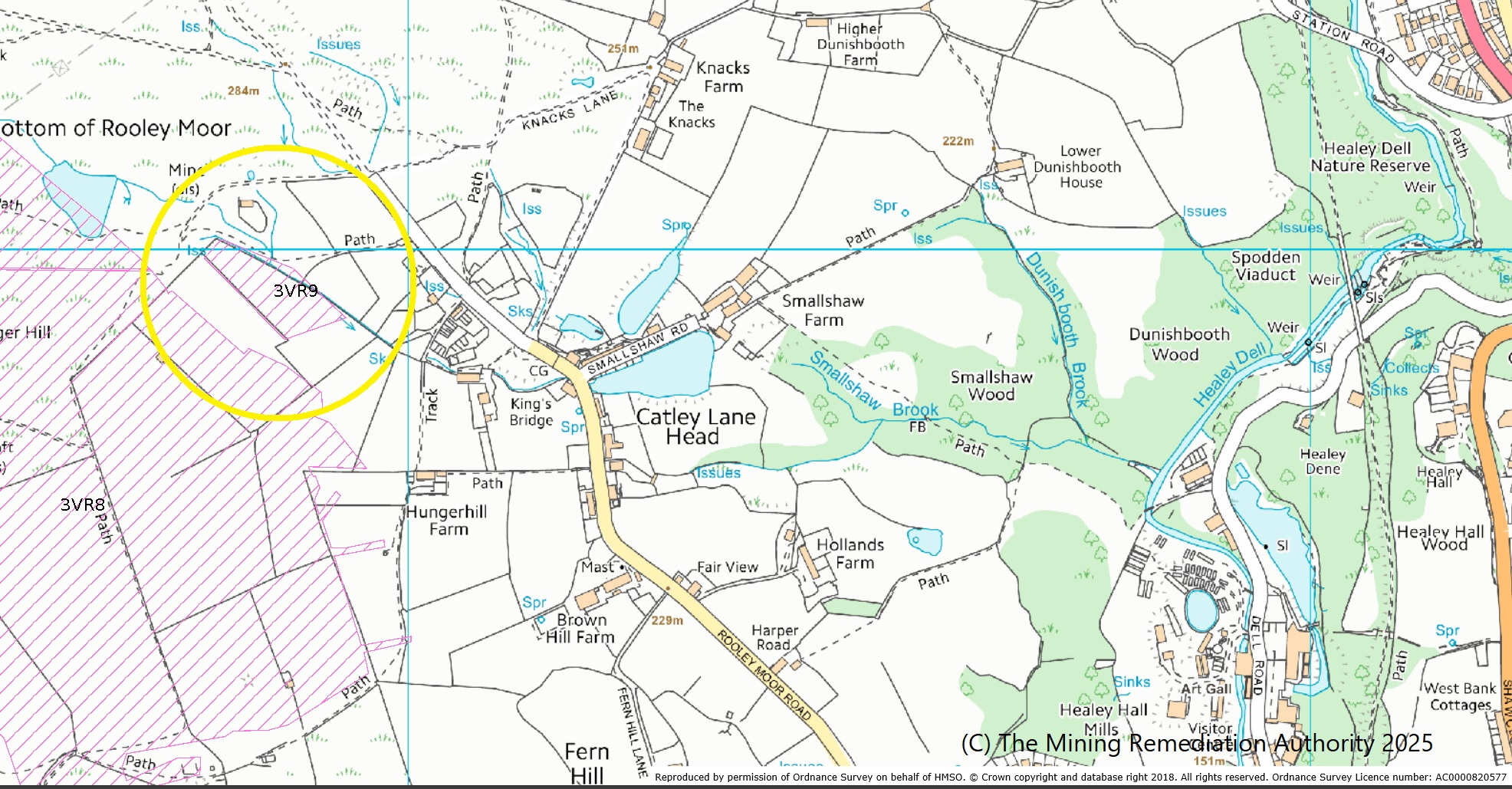
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Appendix E - Photographs



Photo 1 – looking south-eastwards towards turbine T1 location from Top of Pike section of Rooley Moor Road.



Photo 2 – looking north-eastwards towards turbine T3 location from Top of Pike section of Rooley Moor Road.



Photo 3 – looking eastwards, north of turbine T3, from moorland to the east of Rooley Moor Road.



Photo 4 – sinkhole feature approximately 270m northwest of turbine T3; a location with no recorded mine entries.



Photo 5 – spoil heap in proximity to turbine T4.



Photo 6 – mine entry 385419-006.



Photo 7 – various relict dry stone features within a depression/pit considered likely to be a former quarried area.



Photo 8 – raised linear earthwork feature running in a north-westerly direction from Ding Quarry.



Photo 9 – area of disturbed ground and relict structures approximately 150m south of the tie in point with the existing Scout Moor access track looking north-westwards.



Photo 10 – area of disturbed ground and relict structures approximately 150m south of the tie in point with the existing Scout Moor access track looking southwards.



Photo 11 – three foot wide buried channel/passage present at the 384418-003 location.



Photo 12 – view of Ding Quarry and the turbine T6 location beyond looking south-westwards from Hail Storm Hill.



Photo 13 – view of the existing wind farm track looking westwards towards Higher Hill.



Photo 14 – grassed over spoil heap at marked adit location 384419-010.



Photo 15 – stream issuing from a depression considered to potentially be the remnant of marked adit 384419-010.



Photo 16 – collapse feature approximately 10-15m southeast of marked adit 384419-010.



Photo 17 – spoil heap at the approximate location of marked adit 384419-007



Photo 18 – vantage point of approximate location of turbine T11.



Photo 19 – marked shaft 385419-003 in the foreground and location of turbine T9 beyond.