

REF: 2165/BGR/MRA/mjs

Dafydd Edwards
Senior Architectural Technician
Blueprint Architectural Services
Office 3K4
Redwither Tower
Redwither Business Park
Wrexham LL13 9XT

17th June 2020

Dear Dafydd,

RE: BRYN GLAS RHOS: MINING STUDY

1.0 Introduction

It is proposed to develop a site in Bryn Glas in Rhos, Wrexham. This will involve demolition of the existing bungalow on site, which will be replaced with three new houses.

However, following guidance from the Coal Authority, the Local Authority Planning Department have requested further information on the risk of shallow mining at the site.

Blueprint Architectural Services (BAS) are the architects for the scheme and they have appointed GroundSolve Ltd on behalf of the client to investigate the mining risk at the site and give recommendations on what investigation/remedial measures need to be undertaken.

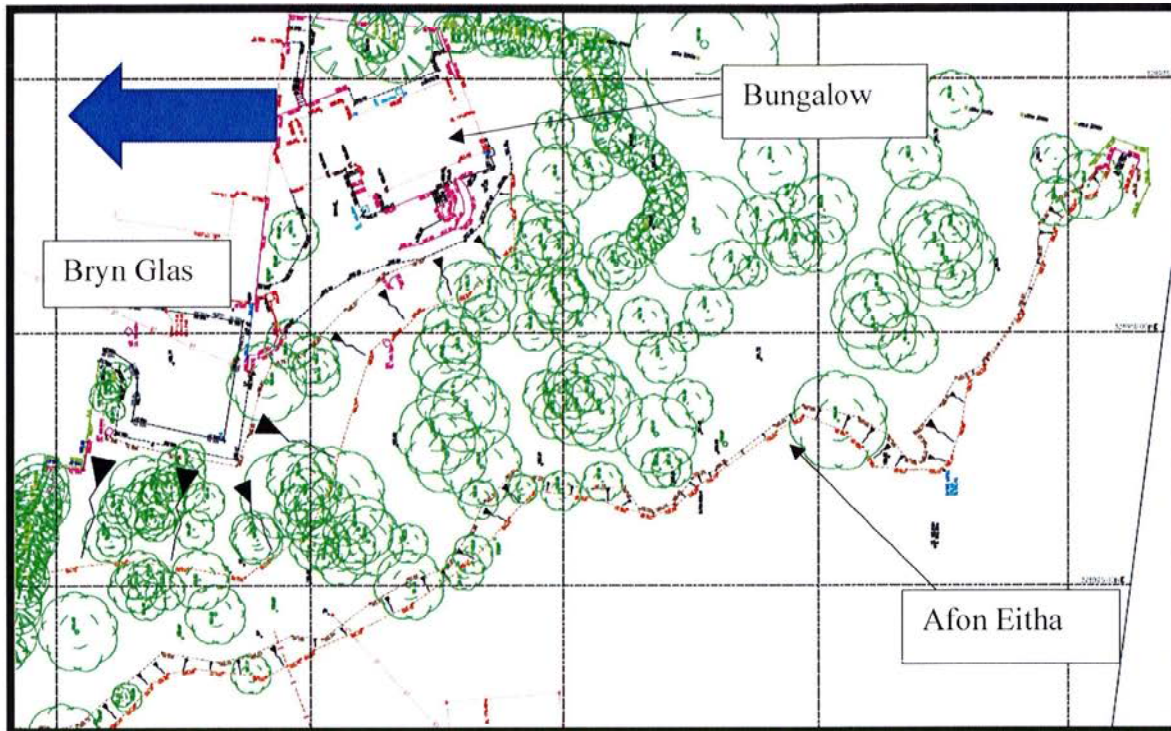
The investigation was initial limited to a desk study, which was followed by several trial pits in the vicinity of a possible shaft location on site. This work was reported in December 2018 and February 2020.

More recently the existing bungalow on site has been demolished, which has enabled a more detailed search for the shaft to be undertaken. In addition, a borehole was drilled to prove if shallow abandoned mine workings was an issue at the site.

This letter report presents the findings of the desk study, shaft searches and site investigations. It discusses the risks posed by shallow abandoned mine workings and gives geotechnical recommendations for the site.

2.0 Site Location and Description

The site is located at 57 Bryn Glas, Rhos, in Wrexham at National Grid Reference SJ 289 459. The site was originally occupied by a single brick bungalow, with the rest of the site heavily wooded, see previous site layout below.



Previous Site Layout

Recently the bungalow has been demolished and many of the trees have been felled.

The site is bounded by housing and Bryn Glas to the north, a footpath along the line of a disused railway to the east, and a stream known as the Afon Eitha to the west.

A topographical survey provided by the client revealed the existing floor slab elevation to be 167mAOD. The ground levels reducing to around 158mAOD on the southern site boundary adjacent to the Afon Eitha.

To the west of the existing house the ground level drops quite steeply, and it appears this section of the site has been filled, as the general slope towards the Afon Eitha is quite gentle.

Photographs of the site prior to / and post demolition are presented in Appendix A.

3.0 Geology

The geology of the site has been studied on the following sources:

- 1:50,000 scale geology plan, Sheet 121 Wrexham,
- Historical geology plans at a scale of 1:10,560,
- Wrexham study at a scale of 1:25,000,
- Geological memoirs.

The site is shown to be underlain by glacial till, with the superficial deposits being between 15 to 20m thick.

The Wrexham study shows the Red coal seam outcropping immediately west of the site, which is then underlain by the Fireclay Group.

The 1977 geology plan at a scale of 1:10,560 shows the Red seam outcropping to the east of the site, along the railway line, with the Fireclay Group outcropping immediately downslope of the site.

The memoirs record the following sequence in descending order:

- Red Coal,
- Stone Coal,
- Fireclay,
- Half Yard Coal,
- Fireclay,
- Firedamp Coal

The separation given between the Red Coal and the Firedamp Coal is only 15m.

4.0 Mining

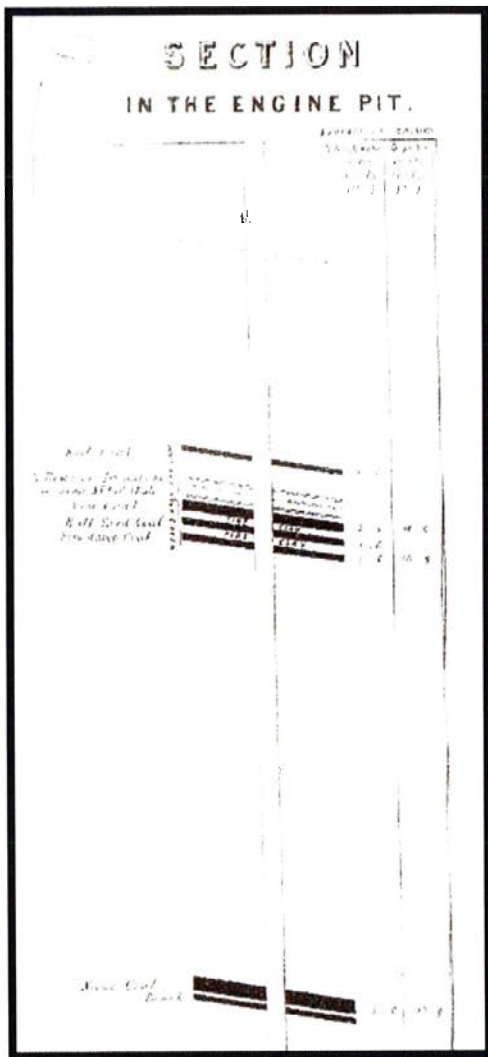
A Coal Consultants report has been obtained from the Coal Authority, the findings are summarised below, and presented in full in Appendix B.

- The site has been undermined in the Ruabon Yard (Soft five quarters) coal at an estimated depth of 17m, last mined in 1872,
- However, it also records it being worked at a depth of 54 beneath the site, last worked in 1862,
- The seam thickness was 1.0m, and dipped at 6° in an easterly direction,
- The outcrop of the Stone coal seam is shown crossing the western section of the site,
- It concluded that there are probably unrecorded mine workings beneath the site,
- A shaft is shown on the site beneath the northern section of the existing building,
- No treatment details are known for the shaft.

A sequence from the engine pit of Afon Eitha Colliery, which was just to the south of the site is presented below.

This shows the Red Seam underlain by three rows of ironstone, the New Coal (Stone), Half Yard Coal and the Firedamp Coal and their fireclays.

Seams at greater depth beneath these include the Nant, Yard, Wall and Bench and the Llwyn Ennion.



Geological Sequence beneath the site

Mine plans held by GSL show workings from the Rhos Farm Colliery, which was immediately west of the site in the Yard Coal dated 1850, which were pursued by total extraction methods. In addition, the Wall and Bench coal was worked. However, the workings were shown to the west of the site itself.

No records of workings in the Fireclay sequence were encountered.

5.0 History

The history of the site has been studied on old Ordnance Survey (OS) plans dating from 1874 through to the present day. In addition, the 1850 Public Health Plan, at a scale of 1:500 in GSL archives has been studied.

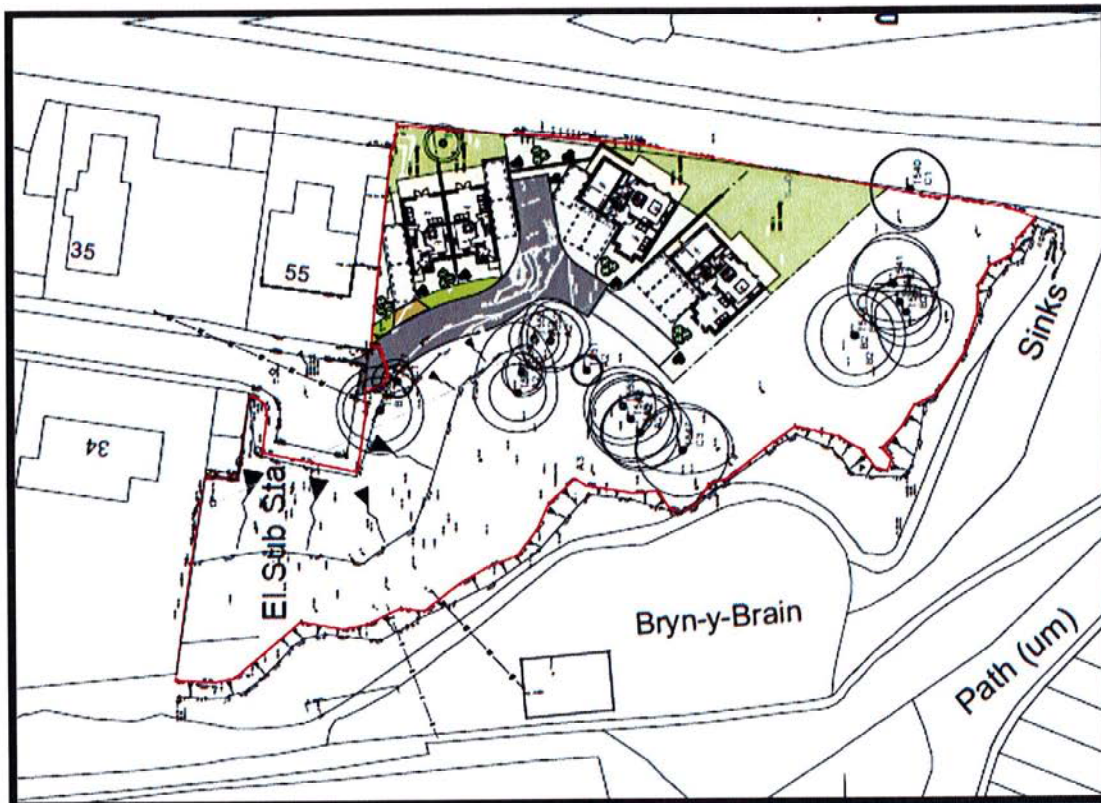
The 1850 Public Health Plan failed to reveal any shaft on site or any evidence of mining close to the site. The closest shafts were to the east of the old railway line, which had been constructed on the eastern site boundary by 1850.

An OS plan dated 1874 shows there to be an active coal shaft immediately west of the site, probably associated with Rhos Farm Colliery, with a disused shaft to the east of the site.

No other changes were noted relating to mining, and the current house had been constructed by the 1976 OS plan.

6.0 Proposed Development

The proposed development will comprise three new properties and associated gardens and access roads. The proposed development layout is presented below.



Proposed Development Layout

7.0 Previous Investigation

A borehole found on the BGS website drilled around 100m south of the site proved some 65' (19.80m) of sand and gravel, with 35' (10.67m) of shale proved beneath the sand and gravel, giving a total depth of 100' (30.50m). A total of eight boreholes were drilled with no workings being encountered.

The borehole location and log are presented in Appendix C.

8.0 This Investigation

Following submission of the desk study report, the client instructed further investigation prior to demolition of the property to assess the likelihood of the shaft actually being present. This would then enable a decision to be made on the viability of the site's development.

Evidence of the shaft being provided by:

- Brick/masonry liner to the shaft,
- Colliery spoil present around the shaft,
- Other spoil that may have been derived from excavations for the shaft construction.

It comprised five machine excavated trial pits around the existing building to a maximum depth of 1.80m, using a 3T excavator provided by the client. The pits were only excavated to prove the underlying natural ground, as the shaft would have had to pass through this material.

The work was supervised on a full-time basis by a chartered geologist from GSL. The location of the trial pits is presented in Figure 1, along with the plotted location of the shaft, with the trial pit logs presented in Appendix D.

Following demolition of the bungalow and removal of the trees it was possible to carry out a proper search for the shaft and gain access to drill a borehole to investigate the possibility of shallow abandoned mineworking's.

The search was undertaken on the 11th March 2020 by excavating to the top of the glacial till over a wide area, using a tracked excavator. The extent of the excavation is presented in Figure 2, with photographs in Appendix E.

As part of this investigation, several machine excavated trial pits were undertaken to enable foundations recommendations to be given. This was considered critical as several of the houses would be in the area where clay was present and trees had been removed, leading to concerns regarding potential ground heave.

The location of the trial pits is shown on Figure 1, with the trial pit logs presented in Appendix F.

To enable geotechnical recommendations to be given, the following physical testing was undertaken:

- Moisture Content 3No,
- Atterberg Limit tests 3 No,
- pH & Sulphate analysis 2No.

The test results are discussed in Section 9.0, with the results presented in full in Appendix G.

Finally, a rotary borehole was drilled by CCG to a maximum depth of 25m on the 17th March 2020. The borehole was supervised and logged by an engineer from GSL. Its location is presented on Figure 1, with the log presented in Appendix H.

9.0 Ground Conditions

The findings of the trial pits and borehole are summarised in the table below:

TP/BH No	Topsoil (m)	Made Ground (m)	Old topsoil layer (m)	Glacial Till (m)	Sand and Gravel (m)
1		0.0 – 0.60		0.60-1.00	
2		0.0-0.90	0.90-1.10	1.10-1.35	
3	0.0-0.30			0.30-0.55	
4	0.0-0.30			0.30-0.55	
5		0.0-1.10	1.10-1.50	1.50-1.80	
6		0.00-0.60		0.60-2.50	2.50-3.0
7		0.00 – 0.30		0.30 – 1.90	1.90 – 2.80
BH1		0.00 – 1.30		1.30 – 2.00 11.0 – 25.0	2.00 – 11.0

Made Ground

In TP 1 a thin layer of sub base overlay a dark grey to brown, silty clay, with a little gravel, tiles and roots were also observed, suggesting the sub base had been placed on the previous surface level.

TP 2 was excavated in the raised area at the front of the property. It encountered demolition debris, described as loose, brown and orange, brick and tile fragments, in a sandy gravelly matrix. This layer sat on a thin layer of sub base, resting on the old topsoil layer. This proved conclusively that this fill was placed following construction of the property.

TP 3 and 4 were excavated at the rear of the property and encountered topsoil resting directly on the glacial till.

TP 5 excavated at the front of the property, where the fill was thickest, encountered 1.10m of demolition debris, comprising loose, bricks and masonry, overlying the old topsoil layer and the glacial till.

TP 6 & TP 7 excavated post demolition encountered clay with several brick fragments.

Glacial Till

The glacial till was proved in all of the trial pits and the borehole, where it was described as firm to stiff, orange brown, silty clay, with a little to some sub angular to sub rounded fine to coarse gravel.

It comprised an upper layer, proved to a maximum depth of 2.50m, and a lower layer between at 11.50 and 25m.

Atterberg limit testing recorded liquid limits between 25 and 33%, plastic limits between 16 and 18%, with plasticity indexes between 9 and 15%, indicating a clay of low plasticity. Natural moisture contents were between 13.4 and 19%. TP 6 was excavated as the control pit, with TP 7 excavated in the vicinity of the trees.

pH values in the till were between 6.40 and 6.49, with sulphate values when measured as 2:1 water extract of between 0.018 to 0.025 g/l.

Sand and Gravel

This was described as loose to medium dense, yellowish brown, sand and gravel, in a sandy clay matrix. They were proved between 1.90 and 11.50m depth.

The superficial deposits were proven to a maximum depth of 25m, whereby, it was not possible to progress further as the drillers had run out of casing.

The sequence comprises glacial till deposited beneath advancing ice sheets, with the sand and gravel deposited by glacial meltwaters as the ice sheets retreated.

Groundwater

Groundwater was encountered in the trial pits and borehole on encountering the sand and gravel. Groundwater flows being copious when drilling the borehole.

It should be noted that the sand and gravel was encountered to a depth of 11.50m, given that the Afon Eitha is some 9m below site levels, the sand and gravel must be in hydraulic continuity with the river.

10.0 Mining Risk Assessment

Shaft

The desk study confirmed that the shaft pre dates 1850, as there is no trace of it on the 1850 Public Health Plan or the later OS plans.

In addition, the site investigation failed to reveal any evidence for the shaft, with all of the fill being demolition debris and placed following construction of the property. No colliery spoil or evidence of any other mining fill was encountered.

The site investigation has also confirmed that the development area is free of unrecorded shafts.

Therefore, the shaft is not considered to be present on site. However, the potential for the shaft to exist has to be considered within the wider mining context to allow an assessment of the potential for shallow unrecorded mine workings.

Rhos has been widely mined for shallow coals for many centuries. However, this was largely undertaken in areas where the coal seams outcrop at shallow depth, and whereby drainage of the workings was easy. I.e. over most of the area.

At the time of the possible workings, it would have been standard practice to sink the shaft and then work the coal up dip to ensure that the workings would drain by gravity, as pumping capacity at the time would have been limited. It is therefore considered highly unlikely that this shaft worked the shallow seams, as the dip would have meant working the seam at shallow depth beneath the Afon Eitha, with the inherent risks this would have entailed.

Given the findings of the borehole, which would have meant that extensive pumping would have been required. This would have made this area uneconomic when compared to nearby mines, where coal was easily accessible close to surface. It would also have meant that the shaft would have had to be lined with brick or masonry to penetrate the substantial thickness of superficial deposits.

Shallow Abandoned Mine Workings

BH 1 recorded similar ground conditions to the previous nearby borehole, which proved 19.80m of sand and gravel, with 10.67m of shale proved beneath the sand and gravel, giving a total depth of 30.50m.

The Coal Consultants report records that the site had been undermined in the Ruabon Yard at 17m depth, with the last date of mining being 1872. This is important as 1872 was the year it became legal to deposit mine plans. At this time the mining would have been by total extraction techniques. However, this report is contradictory in that it also records the same seam being worked at 54m beneath the site.

The superficial deposits were encountered to a depth of greater than 25m and the borehole drilled immediately south of the Afon Eitha is roughly along the strike of the bedrock, which dips gently in an easterly direction. Consequently, similar ground conditions would be anticipated beneath the site as in BH 1, see Appendix C.

In the previous investigation a total of eight boreholes were drilled, with no workings being encountered. The other boreholes proved between 12.2 to 24.7m of superficial deposits. In addition, these boreholes were drilled up dip of the sequence anticipated beneath the site, meaning that any coal seams would be anticipated to get shallower in a westerly direction. BH 8 the most westerly borehole drilled some 200m west of the site did not encounter any coal or workings by a depth of 30m, with 18.28m of rock proved. Therefore, given a dip of 6° in an easterly direction the strata at the base of BH 8 would be at a depth of 50m.

Therefore, based on the above, given the thickness of the superficial deposits beneath the site, it is considered unlikely that the recorded seams actually outcrop beneath the site, and if present would have been highly weathered and unlikely to be worked. In addition, the Red seam has not got a reputation for being worked.

In addition, as mentioned above, the presence of the Afon Eitha and the highly permeable sand and gravel means that shallow mining beneath the site is considered highly unlikely.

Given the findings above, the site is not considered to be at risk from shallow abandoned mine workings.

Foundations

The volume change potential of the glacial till is calculated from Table 1 of the NHBC guidance on building near trees, where:

$$I_p = I_p \times \frac{\% \text{ less than } 425\mu\text{m}}{100\%}$$

This gives modified plasticity indices of low volume change potential.

As the site is on clay soils where trees have recently been felled, an assessment of what extent the soils have been affected needs to be undertaken.

Work by the TRRL developed an apparatus that measures the pressure required to drive water out of soil and this was used to determine water content/suction relationships for very plastic soils.

This work resulted in the recommendation that if:

$$W < 0.4 W_L$$

Then significant desiccation of the clay may have occurred.

Where:

W = moisture content,

W_L = liquid limit of the clay.

A review of the test data, confirms that this method fails to record any evidence of the clay being desiccated.

In addition, BRE Digest 412, Desiccation in clay soils 1996, refers to the liquidity index of the soil being used to assess desiccation levels, which is given by the equation.

$$I_L = \frac{W - W_p}{I_p}$$

Where I_p = the plasticity index of the soil.

W_p = Plastic limit of the clay.

Values of $I_L = 0$, means that the soils water content is at the Plastic Limit, while negative values indicate the soil is drier than the Plastic Limit, i.e. showing signs of desiccation.

From the test result, a worst-case value of -0.29 has been calculated, confirming that desiccation needs to be considered. However, this value is not considered to be representative as the near surface sample failed to record any evidence of desiccation and the test at 2.0m is close to the sand and gravel, where water would be easily obtained. In addition, the root system of the trees was observed to be at shallow depth.

The detailed analysis is presented below, which shows those results where probable desiccation has been encountered.

SHRINKAGE TEST RESULTS

TP No	Depth (m)	Ip %	WL %	Wp %	W %	0.4WL	<W	IL=W-Wp	/Ip
6	1.10-1.10	15	33	18	18.2	13.2	-5	0.20	0.01
	2.0-2.10	9	25	16	13.4	10	-3.4	-2.60	-0.29
7	1.00-1.10	14	31	17	19	12.4	-6.6	2.00	0.14

Probable desiccation

The foundation depths for any plots close to remaining trees will have to be calculated in accordance with the NHBC guidelines, which will involve getting the trees identified and determining the distance of the tree from the plot.

For those in areas of felled trees, whilst the risk from ground heave is considered to be low, the consequences of any ground heave are considered to be high.

Therefore, heave protection measures should be placed around the foundations and the floor slab should be designed to be suspended.

An allowable bearing pressure of 100kN/m² can be used for the design of any foundations, which should extend a minimum of 1m below final ground levels.

The chemical test information has revealed that chemical attack of buried concrete is not an issue, and buried concrete can be designed in accordance with the following classes.

- AS – 1,
- ACEC -1.

We trust this is satisfactory, should you have any queries please call Mike Scott on 01244 661361.

Yours sincerely



Mike Scott

FIGURES

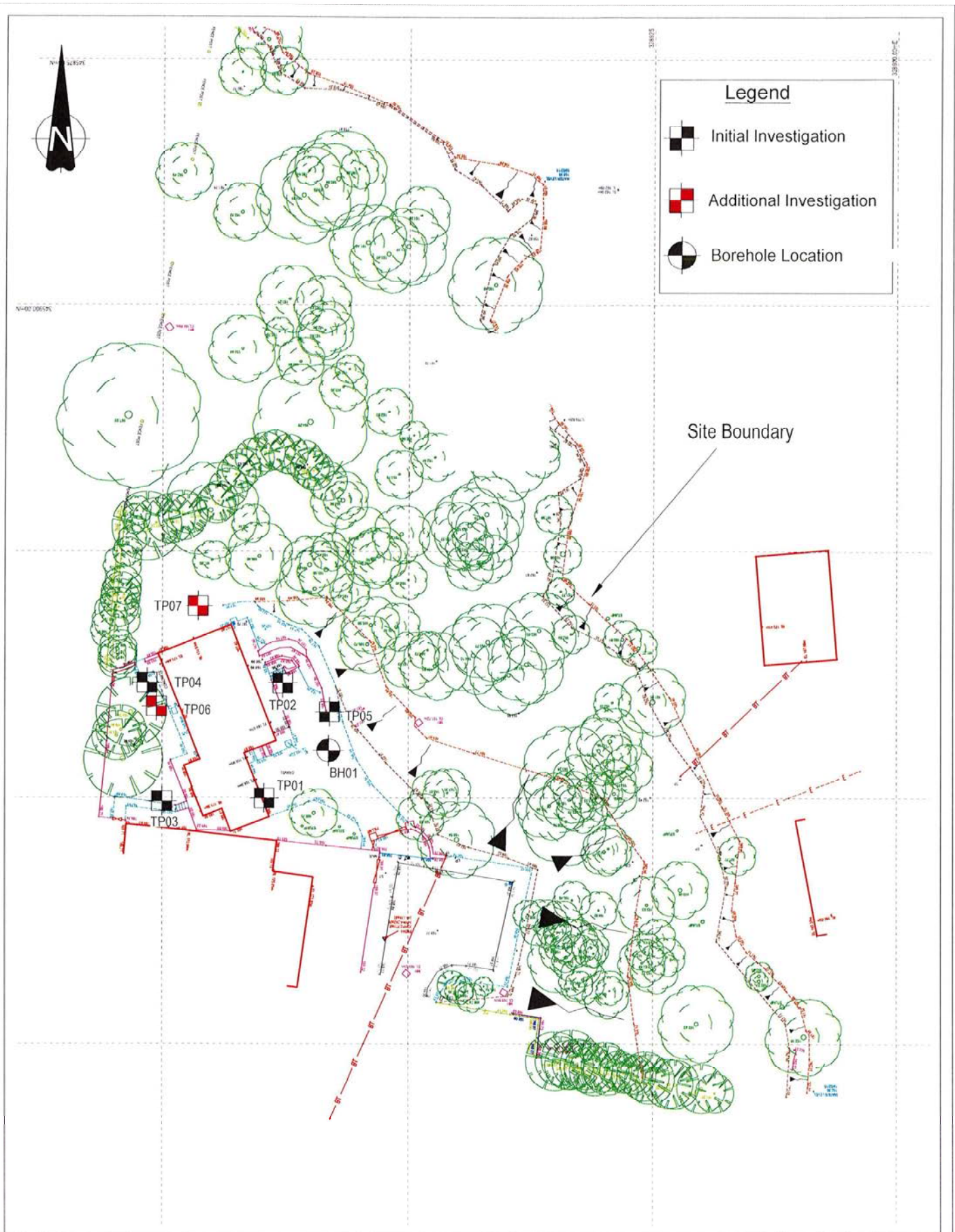
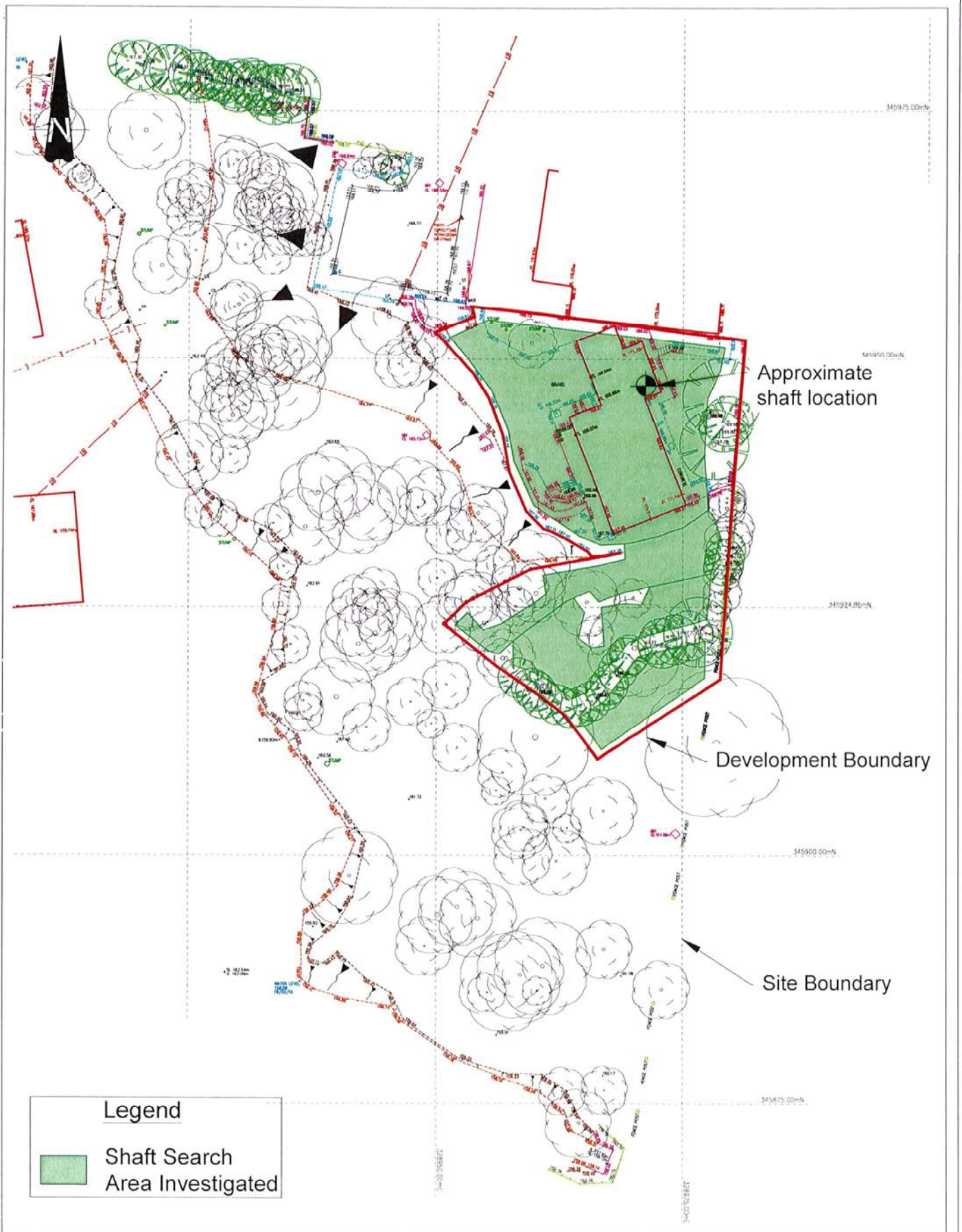


Figure Title
LOCATION OF TRIAL PITS



APPENDIX A

Site Photographs



Photograph 1 Previous Bungalow on site



Photograph 2 Rear of Bungalow



Photograph 3 looking north post demolition



Photograph 4 Western site boundary



Photograph 5 looking south



Photograph 6 Site entrance



Photograph 7 Site entrance and Bryn Glas from the south



Photograph 8 Site entrance looking west



Photograph 9 looking south west



Photograph 10 Felled trees



Photograph 11 looking north



Photograph 12 north east corner of site at plotted shaft location

APPENDIX B

Coal Consultants Report



The Coal
Authority

Consultants Coal Mining Report

Nantcol
57 Bryn Glas
Rhosllanerchrugog
Wrexham
LL14 2EA

Date of enquiry:	13 November 2018
Date enquiry received:	13 November 2018
Issue date:	13 November 2018

Our reference:	51001967635001
Your reference:	2165/mjs



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

GROUND SOLVE LTD

Enquiry address

Nantcol
57 Bryn Glas
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Wrexham
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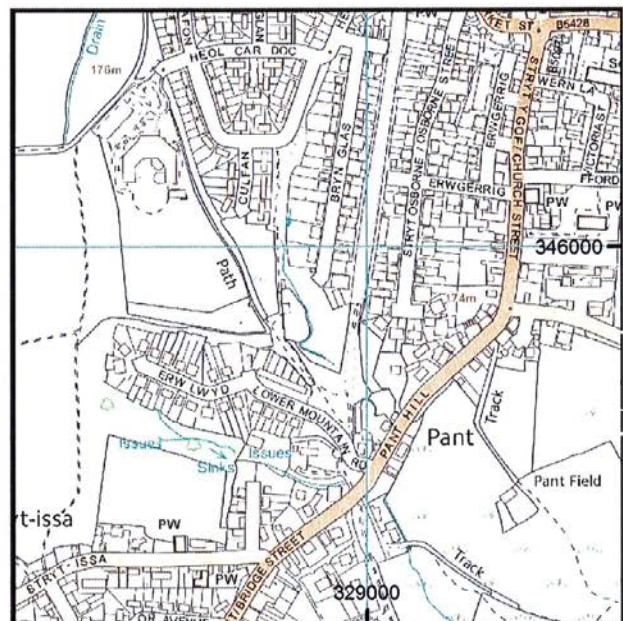
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Approximate position of property



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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	RUABON YARD (SOFT 5 QTRS)	Coal	382J	17	Beneath Property	6.0	East	100	1872
unnamed	RUABON YARD (SOFT 5 QTRS)	Coal	7BNU	54	Beneath Property	6.0	East	100	1862
unnamed	HALF YARD / QUEEN	Coal	381B	66	North-West	7.0	East	50	1868
unnamed	WALL AND BENCH	Coal	7H24	68	South-West	6.0	East	110	1850
unnamed	WALL AND BENCH	Coal	7H2Q	72	West	6.0	East	110	1860

Probable unrecorded shallow workings

Yes.

Spine roadways at shallow depth

No spine roadway recorded at shallow depth.

Mine entries

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	328345-087	328910 345937		Coal	
Shaft	328345-174	328879 345920		Coal	
Shaft	328345-175	328901 345865	This entry was grouted and plugged in 1981 by NKC Geotech to an unknown specification.	Coal	
Shaft	328345-177	328939 345806	This entry has been grouted and plugged in 1981 by NKC Geotech Ltd. The specification for these treatments is unknown.	Coal	
Shaft	328345-300	328969 345949		Coal	
Shaft	329345-200	329039 345957		Coal	
Shaft	329345-301	329018 345939		Coal	
Shaft	329345-303	329065 345858		Coal	
Shaft	329345-480	329071 345959		Coal	

Abandoned mine plan catalogue numbers

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

R289	NW1508	14896
14880	14889	0
14897	PO0	NW1507

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
STONE	Coal	Yes	Within	N/A	8

Geological faults, fissures and breaklines

No faults, fissures or breaklines 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.

Section 2 – Investigative or remedial activity

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

Site investigations

None recorded within 50 metres of the enquiry boundary.

Remediated sites

None recorded within 50 metres of the enquiry boundary.

Coal mining subsidence

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

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

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

Mine gas

None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.

Section 3 – Licensing and future mining activity

Future underground mining

None recorded.

Coal mining licensing

None recorded within 200 metres of the enquiry boundary.

Court orders

None recorded.

Section 46 notices

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

Withdrawal of support notices

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

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

Payments to owners of former copyhold land

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

Section 4 – Further information

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

Development advice

The site is within an area of historical coal mining activity. Should you require advice and/or support on understanding the mining legacy, its risks to your development or what next steps you need to take, please contact us.

For further information on specific site or ground investigations in relation to any issues raised in Section 4, please call us on 0345 762 6848 or email us at groundstability@coal.gov.uk.

Section 5 – Data definitions

The datasets used in this report have limitations and assumptions within their results. For more guidance on the data and the results specific to the enquiry boundary, please **call us on 0345 762 6848** or **email us at groundstability@coal.gov.uk**.

Past underground coal mining

Details of all recorded underground mining relative to the enquiry boundary. Only past underground workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination, will be included.

Probable unrecorded shallow workings

Areas where the Coal Authority believes there to be unrecorded coal workings that exist at or close to the surface (less than 30 metres deep).

Spine roadways at shallow depth

Connecting roadways either, working to working, or, surface to working, both in-seam and cross measures that exist at or close to the surface (less than 30 metres deep), either within or within 10 metres of the enquiry boundary.

Mine entries

Details of any shaft or adit either within, or within 100 metres of the enquiry boundary including approximate location, brief treatment details where known, the mineral worked from the mine entry and conveyance details where the mine entry has previously been sold by the Authority or its predecessors British Coal or the National Coal Board.

Abandoned mine plan catalogue numbers

Plan numbers extracted from the abandoned mines catalogue containing details of coal and other mineral abandonment plans deposited via the Mines Inspectorate in accordance with the Coal Mines Regulation Act and Metalliferous Mines Regulation Act 1872. A maximum of 9 plan extents that intersect with the enquiry boundary will be included. This does not infer that the workings and/or mine entries shown on the abandonment plan will be relevant to the site/property boundary.

Outcrops

Details of seam outcrops will be included where the enquiry boundary intersects with a conjectured or actual seam outcrop location (derived by either the British Geological Survey or the Coal Authority) or intersects with a defined 50 metres buffer on the coal (dip) side of the outcrop. An indication of whether the Coal Authority believes the seam to be of sufficient thickness and/or quality to have been worked will also be included.

Geological faults, fissures and breaklines

Geological disturbances or fractures in the bedrock. Surface fault lines (British Geological Survey derived data) and fissures and breaklines (Coal Authority derived data) intersecting with the enquiry boundary will be included. In some circumstances faults, fissures or breaklines have been known to contribute to surface subsidence damage as a consequence of underground coal mining.

Opencast mines

Opencast coal sites from which coal has been removed in the past by opencast (surface) methods and where the enquiry boundary is within 500 metres of either the licence area, site boundary, excavation area (high wall) or coaling area.

Coal Authority managed tips

Locations of disused colliery tip sites owned and managed by the Coal Authority, located within 500 metres of the enquiry boundary.

Site investigations

Details of site investigations within 50 metres of the enquiry boundary where the Coal Authority has received information relating to coal mining risk investigation and/or remediation by third parties.

Remediated sites

Sites where the Coal Authority has undertaken remedial works either within or within 50 metres of the enquiry boundary following report of a hazard relating to coal mining under the Coal Authority's Emergency Surface Hazard Call Out procedures.

Coal mining subsidence

Details of alleged coal mining subsidence claims made since 31 October 1994 either within or within 50 metres of the enquiry boundary. Where the claim relates to the enquiry boundary confirmation of whether the claim was accepted, rejected or whether liability is still being determined will be given. Where the claim has been discharged, whether this was by repair, payment of compensation or a combination of both, the value of the claim, where known, will also be given.

Details of any current 'Stop Notice' deferring remedial works or repairs affecting the property/site, and if so the date of the notice.

Details of any request made to execute preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. If yes, whether any person withheld consent or failed to comply with any request to execute preventative works.

Mine gas

Reports of alleged mine gas emissions received by the Coal Authority, either within or within 500 metres of the enquiry boundary that subsequently required investigation and action by the Coal Authority to mitigate the effects of the mine gas emission.

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.

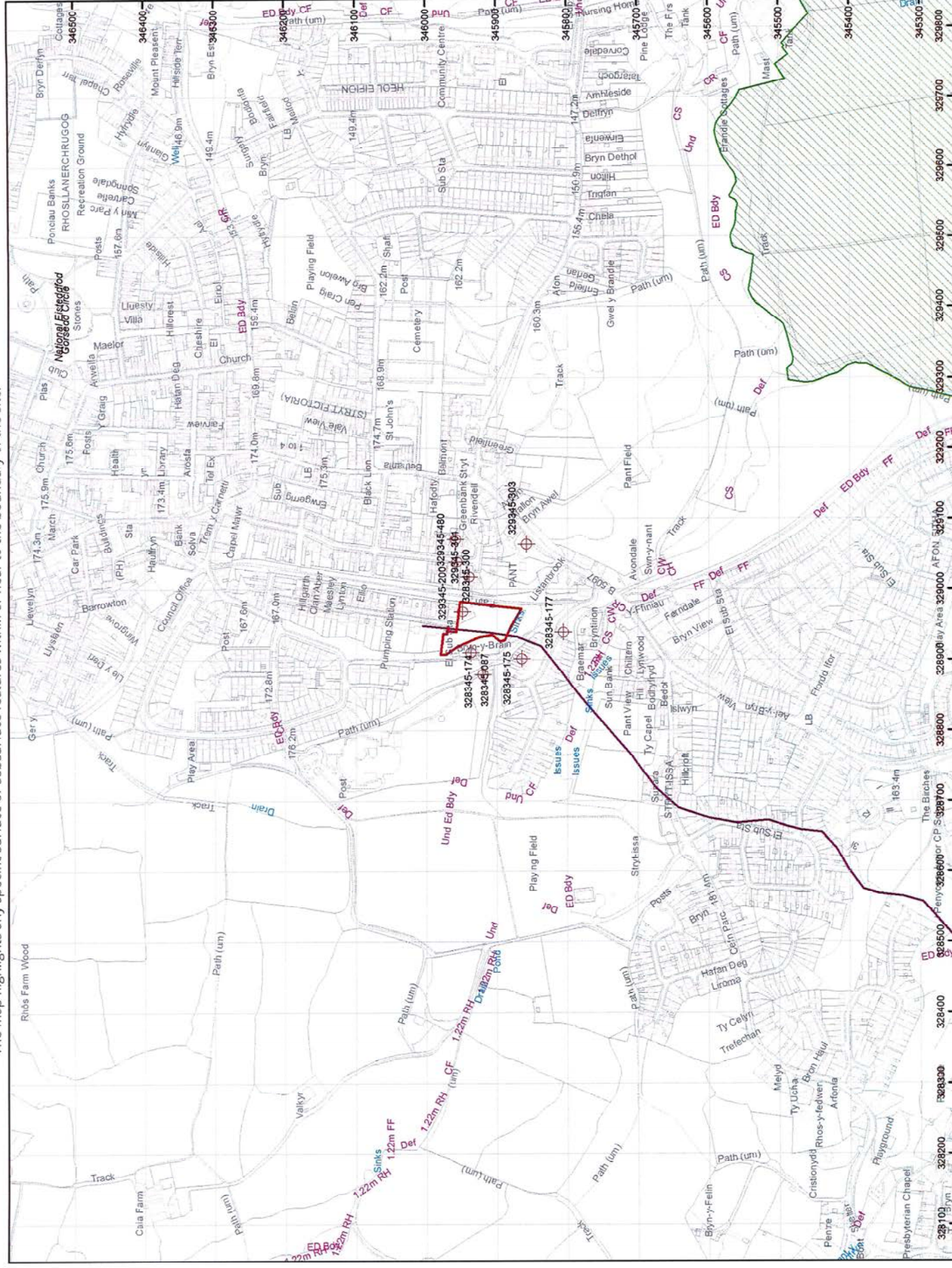
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VAT receipt

Issued by	The Coal Authority 200 Lichfield Lane Mansfield Nottinghamshire NG18 4RG
Tax point date	13 November 2018
Issued to	GROUND SOLVE LTD WELL HOUSE BARNS CHESTER ROAD BROUGHTON FLINTSHIRE CH4 0DH
Property search for	NANTCOL 57 BRYN GLAS RHOSLLANERCHRUGOG WREXHAM LL14 2EA
Reference number	51001967635001
Date of issue	13 November 2018
Cost	£106.79
VAT @ 20%	£21.36
Total received	£128.15
VAT registration	598 5850 68

Summary of findings

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



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APPENDIX C

Previous Investigation

Pen-y-cae Site 'C'. Report on Boreholes drilled in July and August 1973. With plan and sections.

1. A previous report, dated 2nd. June 1973, stated that several boreholes would be necessary on this site to prove if any very shallow workings existed.

Eight holes have been drilled, in the positions shown on the accompanying plan, numbered 1257, and sections of the holes are shown on plans numbered 1268, 1269 and 1270. Holes numbered 2, 3, 5, and 7 started in normal soil, while those numbered 1, 4, 6 and 8 started in made ground. No. 1 was in ashes to a depth of 2 feet six inches, probably part of the old railway embankments; No. 4 was in shale fill to depth of five feet six inches and No. 6 was in shale and coal fill to a depth of eight feet. No. 8 consisted of shale and brick fill to a depth of five feet, probably waste from the adjoining Pant Brickworks.

Brown Sandy Clay was then proved in all holes, with a thickness varying from four feet to seven feet six inches, followed by sand and gravel in the holes numbered 1, 2, 3 and 6, with a thickness of from nine feet to thirty six feet. Holes 4, 7 and 8 had clay and gravel instead, with a thickness of nineteen feet to thirty two feet six inches while hole No. 6 had thirty seven feet of Boulder Clay and gravel and No. 5 had sixty seven feet of Boulder Clay.

Boulder Clay appeared in all the holes except Nos. 7 and 8, which had Clay and Gravel, followed by Sand and Gravel.

A rather plastic clay was proved in Nos. 3, 4 and 6, its thickness being eleven feet to twelve feet.

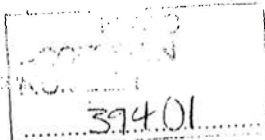
Finally, all holes passed into shale which persisted to their full depths, as follows -

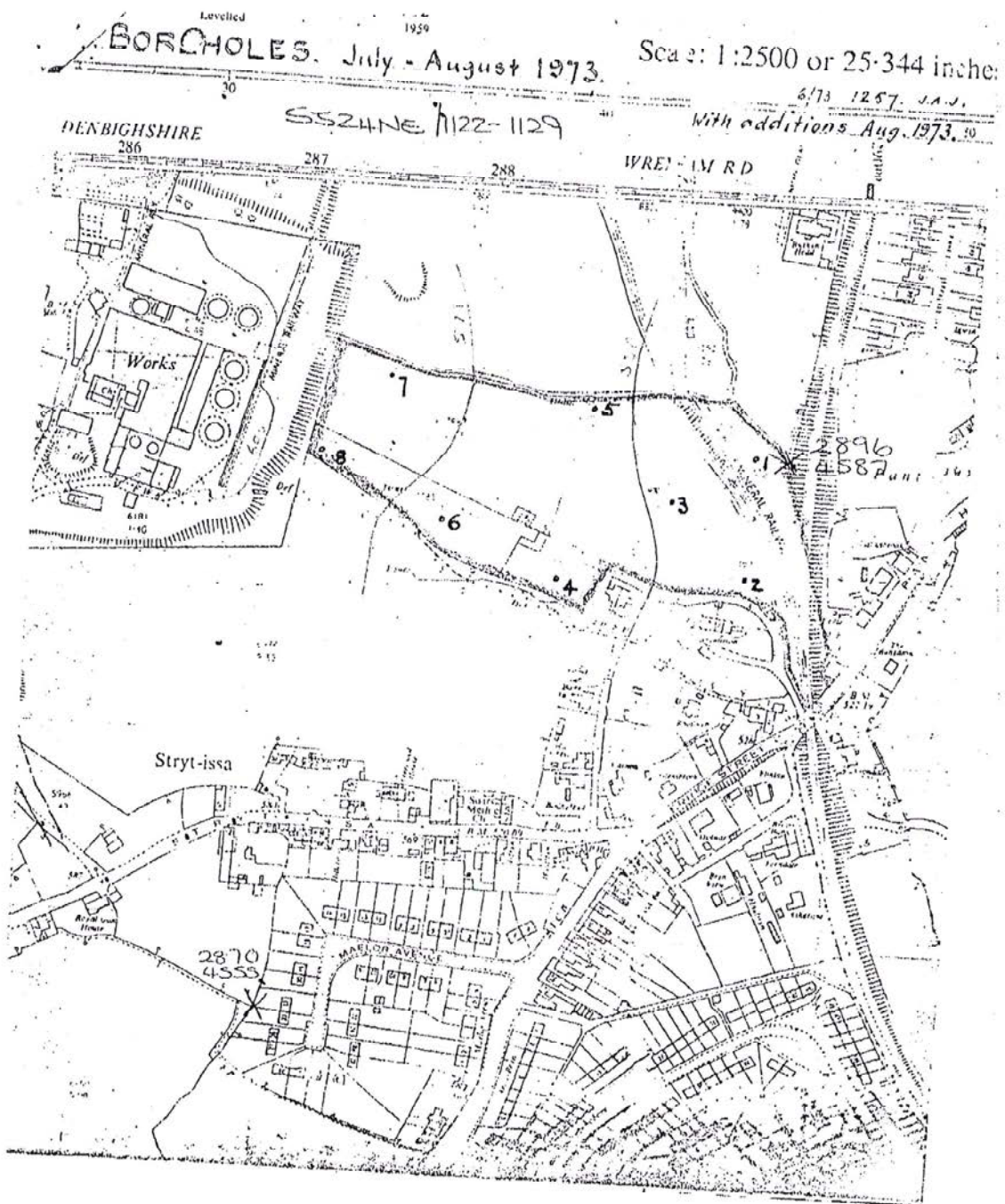
No. 1	from 65' 0"	to 100' 0"	=	35' 0"
2	76' 0"	120' 0"	=	44' 0"
3	70' 0"	100' 0"	=	30' 0"
4	81' 0"	120' 0"	=	39' 0"
5	74' 0"	120' 0"	=	46' 0"
6	64' 5"	110' 0"	=	45' 7"
7	50' 0"	100' 0"	=	50' 0"
8	40' 0"	100' 0"	=	60' 0"

2. No old workings were proved in any of the holes and only one trace of coal (2") in No. 6 Borehole. It is possible that the shale proved in all the holes is that which overlies the Nant Seam and the trace of coal in No. 6 borehole could be a trace of the Firedamp Seam.
3. In my report dated 2nd June 1973, I stated that ten seams could be present under the site but the boreholes suggest that only four actually exist under the site, namely, Nant, Lower Yard, Wall and Bench and Llwynenion Half Yard, all of which have been worked prior to 1860. Some idea of the depths of these seams may be obtained when the five shafts, present on the site, are drilled in preparation for grouting.

18th. September 1973.

J. A. Jones
Chartered Surveyor (Minerals).





753351
Ext 99

APPENDIX D

Initial Trial Pit Logs

TRIAL PIT 1

Depth (m)	Strata
0.00 – 0.10	Loose cream fine to coarse GRAVEL (SUB-BASE)
0.10 – 0.60	Dark grey changing to brown silty CLAY with a little gravel, tiles etc, with roots near surface (MADE GROUND)
0.60 – 1.00	Firm to stiff orange brown silty CLAY with a little to some sub angular to sub rounded fine to coarse gravel (Weathered GLACIAL TILL)





TRIAL PIT 2

Depth (m)	Strata
0.00 – 0.75	Loose brown and orange BRICK & TILE fragments in a sandy gravelly matrix (MADE GROUND)
0.75 – 0.90	Loose cream sub angular fine to coarse GRAVEL (SUB BASE)
0.90 – 1.10	Soft brown slightly organic CLAY with traces of old roots and gravel (OLD TOPSOIL LAYER)
1.10 – 1.35	Firm to stiff orange brown silty CLAY with a little to some sub angular to sub rounded fine to coarse gravel (Weathered GLACIAL TILL)



TRIAL PIT 3

Depth (m)	Strata
0.0 – 0.30	TOPSOIL
0.30 – 0.55	Firm to stiff orange brown silty CLAY with a little to some sub angular to sub rounded fine to coarse gravel (Weathered GLACIAL TILL)



TRIAL PIT 4

Depth (m)	Strata
0.0 – 0.30	TOPSOIL
0.30 – 0.55	Firm to stiff orange brown silty CLAY with a little to some sub angular to sub rounded fine to coarse gravel (Weathered GLACIAL TILL)



TRIAL PIT 5

Depth (m)	Strata
0.00 – 1.10	Loose BRICKS and MASONRY in a sand gravel matrix (MADE GROUND-Demolition Debris)
1.10 – 1.50	OLD TOPSOIL LAYER
1.50 – 1.80	Firm to stiff orange brown silty CLAY with a little to some sub angular to sub rounded fine to coarse gravel (Weathered GLACIAL TILL)



APPENDIX E

General Photographs of Shaft search













APPENDIX F

Additional Trial Pits

TRIAL PIT 06

Depth (m)	Strata
0.00 – 0.60	Soft brown sandy gravelly CLAY with rootlets and medium brick fragment content (MADE GROUND)
0.60 – 1.70	Soft quickly becoming firm yellowish brown locally mottled grey slightly silty slightly gravelly CLAY. Gravel is fine to coarse, sub-rounded and sub-angular (GLACIAL TILL)
1.70 – 2.50	Firm brown and yellowish brown locally mottled grey gravelly sandy silty CLAY with low cobble content. Gravel is fine to coarse, sub-rounded and sub-angular (GLACIAL TILL)
2.50 – 3.00	Loose locally medium dense yellowish-brown SAND and GRAVEL in a sandy clay matrix (GLACIAL DEPOSITS)

Notes

1. Pit walls slightly unstable from 2.50m depth.
2. Water strike encountered at 2.50m depth.
3. Physical sample taken between 1.00 – 1.10m depth for pH, Water Soluble Sulphate and Atterberg limit testing.
4. Physical sample taken between 2.00 – 2.10m depth for Atterberg limit testing.



Trial Pit 06



Trial Pit 06 – Pit Wall



Trial Pit 06– Arising

TRIAL PIT 07

Depth (m)	Strata
0.00 – 0.30	Soft brown gravelly CLAY with medium brick fragment content (MADE GROUND)
0.30 – 1.90	Soft quickly becoming firm yellowish brown locally mottled grey gravelly sandy CLAY. Gravel is fine to coarse, sub-rounded and sub- angular (GLACIAL TILL)
1.90 – 2.80	Loose yellowish-brown SAND and GRAVEL in a sandy clay matrix (GLACIAL DEPOSITS)

Notes

1. Pit walls unstable from 1.90m depth.
2. Water strike encountered at 1.90m depth.
3. Physical sample taken between 1.00 – 1.10m depth for pH, Water Soluble Sulphate and Atterberg limit testing.



Trial Pit 07



Trial Pit 07 – Pit walls



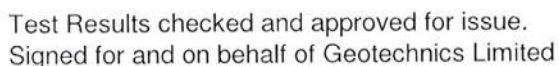
Trial Pit 07 – Arisings

APPENDIX G

Physical Test Results

Form REP008 Rev 3

Note: Any descriptions, opinions or interpretations are outside the scope of UKAS accreditation.
The results within this report relate only to the samples tested and received from the client.



Schiano

GEOTECHNICS
geotechnical and geoenvironmental specialists

203 Torrington Avenue, Tile Hill,
Coventry, CV4 9UT

Project No: PC207858

GEOTECHNICS
geotechnical and geoenvironmental specialists

LABORATORY RESULTS - Chemical Analysis

Project 2165 - BRYN GLAS WREXHAM

Project No: PC207858

[illegible]

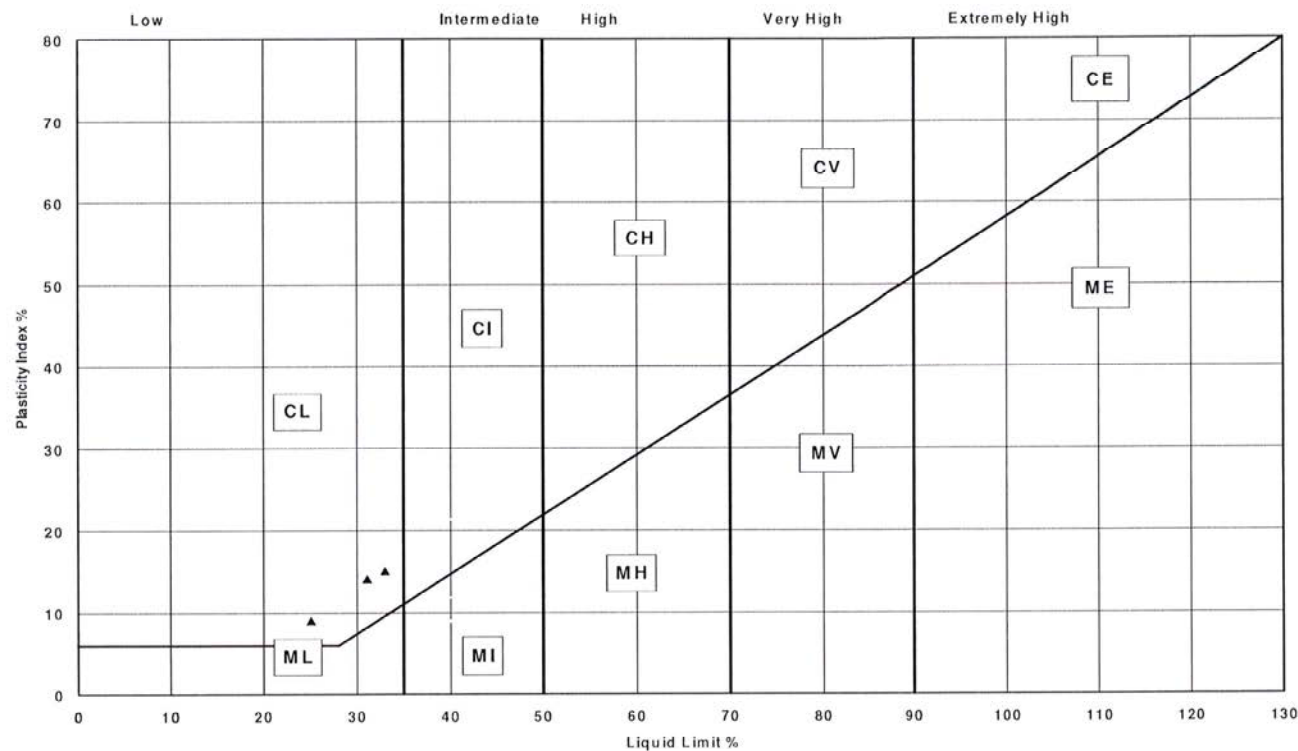
Remarks For Standards followed please see Laboratory Test Certificate
Sulphate reported as SO₃, results in brackets reported as SO₄

GEOTECHNICS
geotechnical and geoenvironmental specialists

Project: 2165 - BRYN GLAS WREXHAM

Project No: PC207858

PLOT OF PLASTICITY INDEX AGAINST LIQUID LIMIT
for all items tested



Soil Type	Plasticity Characteristics
C Clay	L Low
	I Intermediate
M Silt	H High
	V Very High
	E Extremely High

Table of Soil Types and Plasticity Characteristics from BS 5930 : 1999

Remarks

24/03/2020

Project No: PC207858

GEOTECHNICS
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United Kingdom Accreditation Service

ACCREDITATION CERTIFICATE



TESTING LABORATORY
No. 1365

Geotechnics Limited

is accredited in accordance with the recognised International Standard ISO/IEC 17025:2017 - General Requirements for the competence of testing and calibration laboratories.

This accreditation demonstrates technical competence for a defined scope as detailed in and at the locations specified in the schedule to this certificate, and the operation of a laboratory quality management system (refer joint ISO-ILAC-IAF Communiqué dated April 2017).

The schedule to this certificate is an essential accreditation document and from time to time may be revised and reissued by the United Kingdom Accreditation Service. The most recent issue of the schedule of accreditation, which bears the same accreditation number as this certificate, is available from the UKAS website www.ukas.com.

This accreditation is subject to continuing conformity with United Kingdom Accreditation Service requirements. The absence of a schedule on the UKAS website indicates that the accreditation is no longer in force.

Section Head, United Kingdom Accreditation Service

Initial Accreditation date
01 September 1993

This certificate issued on
07 August 2019

UKAS is appointed as the sole national accreditation body for the UK by The Accreditation Regulations 2009 (SI No 3155/2009) and operates under a Memorandum of Understanding (MoU) with the Department for Business, Energy & Industrial Strategy (BEIS)

Schedule of Accreditation

issued by

United Kingdom Accreditation Service

2 Pine Trees, Chertsey Lane, Staines-Upon-Thames, Middlesex TW18 3HR



1365

Accredited to
ISO/IEC 17025:2017

Geotechnics Limited

Issue No: 020 Issue date: 06 August 2019

The Geotechnical Centre
203 Torrington Avenue
Tile Hill
Coventry
CV4 9AP

Contact: Mr Stephane Schiano
Tel: +44 (0)24 7662 9024
E-Mail: sschiano@geotechnics.co.uk
Website: www.geotechnics.co.uk

Testing performed at the above address only

DETAIL OF ACCREDITATION

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
AGGREGATES	Particle size distribution - sieving method	BS EN 933-1:2012
	Water content	BS EN 1097-5:2008
ROCK	Point load strength and anisotropy indices	ISRM Commission on Testing Methods. Suggested Method for Determining Point Load Strength 1985
	Water content – method 1	International Society for Rock Mechanics – suggested methods, Part 1 Test 1: 1981
GEOTECHNICAL INVESTIGATION and TESTING - Laboratory testing of soil	Water content	BS EN ISO 17892-1:2014
	Bulk density - linear measurement method	BS EN ISO 17892-2:2014
	Determination of particle density – fluid pycnometer method,	BS EN ISO 17892-3:2015
	Determination of particle size distribution - Sieving method	BS EN ISO 17892-4:2016
	Determination of particle size distribution - Pipette method	BS EN ISO 17892-4:2016
	Incremental loading odometer test	BS EN ISO 17892-5:2017
	Unconsolidated undrained triaxial test	BS EN 17892-8:2018
	Determination of liquid limit (fall cone method)	BS EN 17892-12:2018



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Schedule of Accreditation
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Geotechnics Limited
Issue No: 020 Issue date: 06 August 2019

Testing performed at main address only

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
GEOTECHNICAL INVESTIGATION and TESTING - Laboratory testing of soil (cont'd) SOILS for civil engineering purposes	Determination of liquid limit (one-point fall cone method)	BS EN 17892-12:2018
	Determination of plastic limit	BS EN 17892-12:2018
	Determination of plasticity limits	BS EN 17892-12:2018
	Sulphate content of soil and ground water gravimetric method	BS 1377-3:1990 (withdrawn)
	pH value	BS 1377-3:1990 (withdrawn)
	California Bearing Ratio (CBR)	BS 1377-4:1990
	Unconfined compressive strength - load frame method	BS 1377-7:1990
	Undrained shear strength - triaxial compression without measurement of pore pressure	BS 1377-7:1990
	Undrained shear strength - triaxial compression with multistage loading and without measurement of pore pressure	BS 1377-7:1990
	Moisture content - oven drying method	BS 1377-2:1990
	Saturation moisture content of chalk	BS 1377-2:1990
	Liquid limit - cone penetrometer	BS 1377-2:1990
	Liquid limit - cone penetrometer - one point	BS 1377-2:1990
	Plastic limit	BS 1377-2:1990
	Plasticity index	BS 1377-2:1990
	Linear shrinkage	BS 1377-2:1990
	Density - linear measurement	BS 1377-2:1990



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Geotechnics Limited

Issue No: 020 Issue date: 06 August 2019

Testing performed at main address only

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
SOILS for civil engineering purposes (cont'd)	Particle density - gas jar	BS 1377-2:1990
	Particle density - small pycnometer	BS 1377-2:1990
	Particle density - large pycnometer	BS 1377-2:1990
	Particle size distribution - wet sieving	BS 1377-2:1990
	Particle size distribution - dry sieving	BS 1377-2:1990
	Particle size distribution - sedimentation - pipette method	BS 1377-2:1990
	Dry density/moisture content relationship (2.5 kg rammer)	BS 1377-4:1990
	Dry density/moisture content relationship (4.5 kg rammer)	BS 1377-4:1990
	Dry density/moisture content relationship (vibrating hammer)	BS 1377-4:1990
	Maximum and minimum dry densities for granular soils	BS 1377-4:1990
	Moisture condition value (MCV)	BS 1377-4:1990
	MCV/moisture content relation	BS 1377-4:1990
	Chalk crushing value	BS 1377-4:1990
	One-dimensional consolidation properties	BS 1377-5:1990
	Shear strength - small shear box	BS1377-7:1990
	Residual strength - small ring shear apparatus	BS1377-7:1990



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Geotechnics Limited
Issue No: 020 Issue date: 06 August 2019

Testing performed at main address only

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
Hydraulically bound and stabilized materials for civil engineering purposes	Initial consumption of lime	BS 1924-2:2018
	California bearing ratio/immediate bearing index	BS EN 13286-47:2012
	Moisture content - oven drying method (definitive)	BS EN 17892-1:2014
	Plastic limit	BS 1924-2:2018
	Liquid limit	BS 1924-2:2018
	Plasticity index	BS 1924-2:2018
	Dry density/moisture content relationship (2.5 kg rammer)	BS 1924-2:2018 and BS EN 13826-2:2010
	Dry density/moisture content relationship (4.5 kg rammer)	BS 1924-2:2018 and BS EN 13826-2:2010
	Dry density/moisture content relationship (vibrating hammer - subsidiary method)	BS 1924-2:2018 and BS EN 13826-4:2003
	Moisture condition value (MCV)	BS EN 13826-46:2003
END		

Classification and Strength

Symbol	C - Clay (0 - containing organic matter) Plasticity	M - Silt L - Low I - Intermediate H - High V - Very High E - Extremely High
I _p	Plasticity Index	
%	% retained on 425 µm sieve, shown under I _p value	
w _L	Liquid Limit	
w _p	Plastic Limit	
NP	Non-Plastic	
NAT	Sample tested in natural state	
w	Water Content	
p _d	Particle Density	
Test	Quick undrained triaxial tests	
	SS	Single stage - 102mm diameter.
	S3	Single stage - set of 3 38mm diameter.
	MS	Multistage - 102mm diameter.
	D	Drained Test
	HV	Hand Vane
	PP	Pocket Penetrometer (kg/cm ²)
	NST	Not suitable for test
γ _b	Bulk Density	
σ ₃	Triaxial Cell Pressure	
σ ₁ - σ ₃	Deviator Stress	
##	Excessive Strain	
c _u	Undrained Cohesion	
c	Cohesion Intercept	
φ	Angle of Shearing Resistance	
Linear Shrink	Linear Shrinkage	
Stab add-	Stabiliser which is added	

Consolidation

m _v	Coefficient of Volume Compressibility
c _{v50}	Coefficient of Consolidation - Log t
c _{v90}	Coefficient of Consolidation - √t

Rock

UF	Unacceptable Failure
----	----------------------

Chemical Analysis

Acid Soluble	Total sulphate in specimen, expressed as SO ₃ %, value in brackets expressed as SO ₄ %
Water Soluble	Soluble sulphate in 2:1 water : soil extract, expressed as SO ₃ g/l, value in brackets expressed as SO ₄ g/l
In Water	Sulphate content of groundwater, expressed as SO ₃ g/l, value in brackets expressed as SO ₄ g/l
pH	pH value
Organic content	Organic content expressed as a percentage of dry weight
Chloride	Chloride Ion content expressed as a percentage of dry weight

MCV, Compaction, CBR

MCV	Moisture Condition Value at natural water content
MCC	Moisture Condition Calibration
CCV	Chalk Crushing Value

Compaction

Type	2.5	= 2.5 kg Rammer
	4.5	= 4.5 kg Rammer
	V	= Vibrating Hammer

γ_b Bulk Density

γ_d Dry Density

CBR California Bearing Ratio

Type	2.5	= Test on Specimen Recompacted using 2.5 kg Rammer
	4.5	= As above but using 4.5 kg Rammer
	V	= As above but using Vibrating Hammer
	M	= Test on open drive mould specimen cut in field
	S	= Soaked Specimen

Top CBR at top of mould

Bottom CBR at bottom of mould

ND None Detected

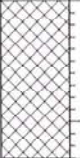
* In the Sample Description denotes a laboratory only description

APPENDIX H

Borehole Log

DRILLHOLE LOG

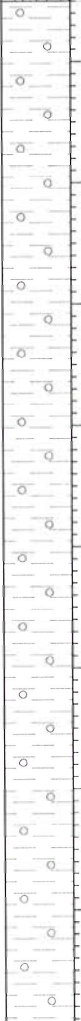
Project Bryn Glas				DRILLHOLE No BH1	
Job No 2165	Date	Ground Level (m)	Co-Ordinates ()		
Contractor CC Geotechnical				Sheet 1	

RUN DETAILS						STRATA			0	3	Geology	Instrument/ Backfill
Depth Date	TCR (SCR) RQD	(SPT)	Red'ed Level	Legend	Depth (Thick- ness)	DESCRIPTION						
						Discontinuities	Detail	Main				
					(1.30) 1.30			MADE GROUND- Demolition debris in a brown sandy clay matrix.				
					(0.70) 2.00			Soft brown slightly silty CLAY (GLACIAL TILL).				
					(9.50)			Brown SAND & GRAVEL in a sandy clay matrix. (GLACIAL DEPOSIT).				

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS	
Date	Time	Depth	Casing	Core Dia mm	Strike	Water Standing	From	To	Type	Returns		
												No loss of flush and no voids encountered. Large water flow from 2m.
All dimensions in metres Scale 1:62.5			Client Dafydd Edwards			Method/ Plant Used			Logged By			

DRILLHOLE LOG

Project Bryn Glas				DRILLHOLE No BH1	
Job No 2165	Date	Ground Level (m)	Co-Ordinates ()		
Contractor CC Geotechnical				Sheet 2	

RUN DETAILS						STRATA			Geology	Instrument/ Backfill
Depth Date	TCR (SCR) RQD	(SPT)	Red'ed Level	Legend	Depth (Thick- ness)	DESCRIPTION				
						Discontinuities	Detail	Main		
					11.50			Brown SAND & GRAVEL in a sandy clay matrix. (GLACIAL DEPOSIT). (continued)		
					(13.50)			Stiff brown gravelly CLAY/ Clayey GRAVEL. (GLACIAL TILL).		

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Strike	Water Standing	From	To	Type	Returns	
											No loss of flush and no voids encountered. Large water flow from 2m.
All dimensions in metres Scale 1:62.5			Client Dafydd Edwards			Method/ Plant Used			Logged By		

DRILLHOLE LOG

Project Bryn Glas				DRILLHOLE No BH1	
Job No 2165	Date	Ground Level (m)	Co-Ordinates ()		
Contractor CC Geotechnical					Sheet 3

RUN DETAILS						STRATA			0	3	Geology	Instrument/ Backfill
Depth Date	TCR (SCR) RQD	(SPT)	Red'ed Level	Legend	Depth (Thick- ness)	DESCRIPTION						
						Discontinuities	Detail	Main				
					25.00			Stiff brown gravelly CLAY/ Clayey GRAVEL. (GLACIAL TILL). (continued)				

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Water Strike	Standing	From	To	Type	Returns	
All dimensions in metres Scale 1:62.5							Client Dafydd Edwards		Method/ Plant Used		Logged By



**British
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

Version 2.0.6

BGS ID: 143660 : BGS Reference:

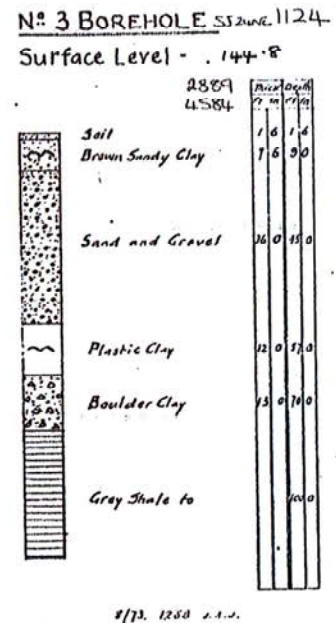
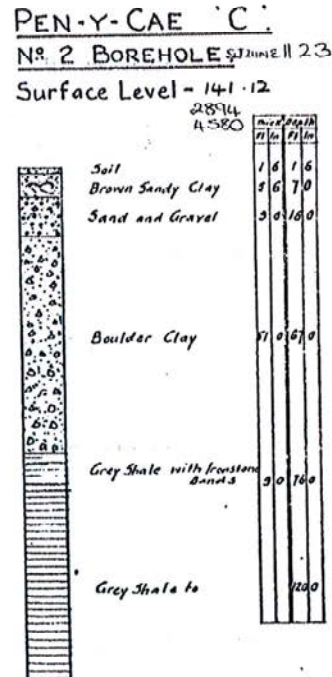
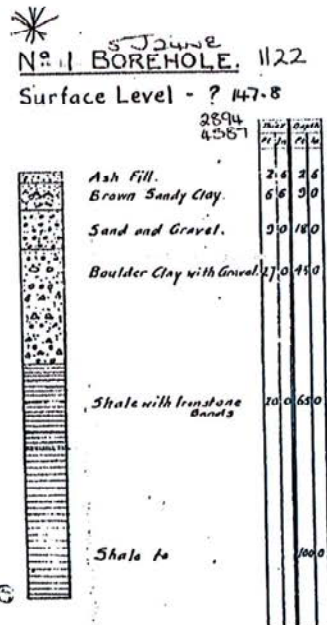
SJ24NE1123

British National Grid (27700) :

328940,345800

[Report an issue with this borehole](#)

<< < Prev Page 3 of 3 v Next > >>



HH