

NKC Geotech Ltd

engineering geologist specialising in the investigation and treatment of disused mineworkings

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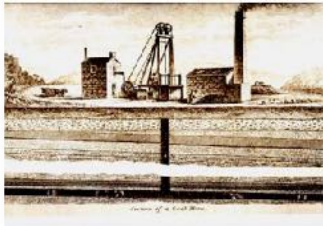
Coal Mining Risk Assessment



Bonc Wen, Rhos

**Broadgrove Ltd
Sinclair House
11 Station Road
Cheadle Hulme
Cheshire
SK8 5AF**

1613/3
26 October 2020



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Site

A proposed residential development for the North Wales Housing Association on the site of the former Rhos Community Centre and car park.

The purpose of this report is to summarise and correlate previous investigation by Nkc Geotech and others of the ground conditions of the site which is underlain by shallow coal seams and contains two recorded mineshafts shown on Coal Authority records as 328346-347 and -348.

Report, Nkc Geotech investigation and site work by

Neil Catlow B.Sc F.G.S Engineering geologist

Records inspected

Coal Authority at Mansfield

Coal Authority Report 51000659307001 dated 31 October 2014

Coal Authority Report 51002276506001 dated 20 May 2020

John Wood mining investigation for the Rhos Community Centre dated 1988

Groundsolve Coal Mining Risk Assessment dated April 2016

Datrys report 14186 dated November 2015

Strata Renewables Ltd final report SRL64 based on Terraconsult core drilling dated 27 April 2015

Denbighshire Records Office, Ruthin

Geological Survey

Ordnance Survey 1875, 1899 and 1912

CIRIA Special Publication 32 'Construction over Abandoned Mineworkings'

My previous investigations in this vicinity:

8718 dated July 1987 and October 1990: Clwyd Alyn Housing development immediately north of the site

1613 dated May 2016: Investigation of two mineshafts on this site

Geology

The site lies on Carboniferous Westphalian rocks that form the Wrexham Coalfield, dipping to the east at 1 in 8. These rocks are predominantly shales and sandstones containing seams of coal upto 3.0m in thickness at vertical intervals typically varying from 4.0m to 20.0m. The coal seams are of economic importance and given an identity when they are of sufficient quality and thickness to justify extraction by mining from the surface or at depth from mineshafts. The local coal seams relevant to the site are:

Red Coal or Crank Coal, occasionally worked in Rhos and probably outcropping in the east of the site.

Fireclay Group, a collective name for a composite seam upto 7m in total thickness which includes associated ironstones and thin coal seams sometimes individually known locally as the Stone Coal, Firedamp Coal and New Coal, proved by drilling to be present under the site and extensively mined for coal, fireclay and ironstone at several of the the horizons from 15m to 25m. There are several mined horizons within the Fireclay Group and lateral correlation can be difficult, especially as the seam names vary locally.

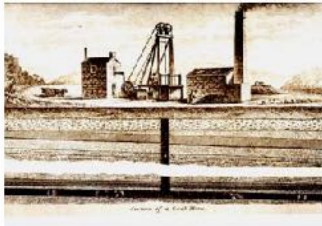
Nant Coal, of poor quality not usually mined locally in Rhos, estimated to be at a depth of 40m.

Yard Coal, 0.9m thick and extensively mined at an estimated depth of 55m.

Wall & Bench Coal, two high quality coal seams separated by a layer of shale 300mm thick and consequently extensively worked as an upper 'wall' and lower 'bench' at a recorded depth of 75m.

Llwyneinion Half Yard Coal, only 400mm thick but mined principally for the underlying fireclays. This is the lowest coal seam to be mined in the region and at 100m, too deep to be worked under the site.

Coal mining in Rhos was recorded in 1547 in the Main Coal, but the greatest extraction within 90m of the surface took place in the period 1750 to 1850.



Site mining history

There are two mineshafts shown on Coal Authority records of the site. These are shafts 328346-347 and 328346-348. The shafts positions are shown only on mineplans of the later and adjacent Rhos Colliery to the east which worked the coal, fireclay and ironstone seams as far west as the current site boundary from shafts on the eastern side of High Street near the present Coop store. The Rhos Colliery mineplans are based on an initial survey of 1822 and were updated with coal extraction royalty areas upto 1866. These workings extended down the dip of the coal seams from the site towards the eastern boundary with Ponciau Colliery.

The earliest precise recorded site use is the tithe map of 1846 which lists the land as a 'Coal Works' although there is an informal and charming sketch map of Rhos and the 'Common Names' of its inhabitants dated 1835. This hand drawn sketch map by resident John Platt, whilst unusable for surveying purposes, depicts a colliery named as Pyllau yr Afon (with Rhobin Savage as Engineer) in the vicinity of the site. The sketch map clearly shows a cottage-sized single story steam winding house centrally placed between two shafts with simple head gear on mounds of spoil. The steam engine is shown as working as there is smoke issuing from the tall chimney (see Page 6).

There are no surviving plans of the Pyllau yr Afon Colliery as the mine closed prior to the Mines Act of 1887 which placed a statutory duty on mine owners to keep and preserve plans of their workings. The plan of the Wall & Bench seam worked later by Rhos Colliery in about 1850 shows a connection at seam level to the southernmost Pyllau yr Afon shaft, Shaft 348.

The Rhos branch of the GWR was constructed through the site in 1860 as a standard gauge conversion and northern extension of the 1808 Ruabon Brook Tramway which originally terminated at Pant, 250m south of the site. This railway extension cleared away the few relevant physical features shown on the 1822 Rhos Colliery mineplan. The site was occupied by an engine shed and siding from 1867, and was known as Brook Street Halt until the formal Rhos Station opened 250m north of the site, in 1890. Station House, in the immediate vicinity of Shaft 347 and recently demolished, was constructed at the same time. A gasworks was sited immediately south of the site, the dividing fence between railway and gasworks being the current southern site boundary.

John Wood investigation 1988

This was a report on an intrusive investigation of 5 rotary holes of various depths for the proposed Rhos Community Centre. The drilling contractor is not known and the logs are only abbreviated text, being simply lists of coal and voids of the Fireclay Group from 13m to 20m. Shallow workings were encountered in 3 of the 5 holes and only 3 of the holes reached the full depth of 30m.

Datrys investigation 2013

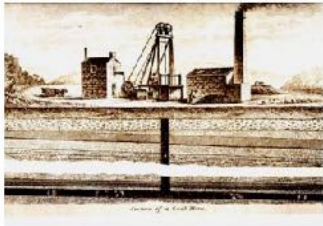
The results of the drilling are confusing and the logging crew anonymous but the four cored boreholes of various depths by Terraconsult encountered the Fireclay Group which includes the Stone Coal, the New Coal, the closely interbedded Half Yard Coal and the Firedamp Coal. The holes missed the overlying ironstones and some of the fireclays which were also mined. Old workings and rising cavitation were located from 18m but none of the boreholes were drilled to full depth of 30m so no deeper coal or workings were proved. Bh 3 stopped at 22.9m, probably above the Firedamp, and Bh 4 did not prove the floor of the (probably Firedamp) workings of which upwards cavitation commenced from 22.8m in the hole.

The strata proved in the holes generally correlate with the drilling for the Community Centre in 1988.

Groundsolve Coal Mining Risk Assessment 2016

No intrusive investigation work was carried out and the CMRA is based on the previous investigations outlined above.

Although three pages of the report are given to the theory of shallow mining subsidence, the conclusion that most voids in shallow mines have already collapsed and that there is a low risk of subsidence contradicts not



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only the borehole evidence on this site but also my own experience of drilling into shallow workings since 1973. Not every hole contains open voids at the mined horizon and it is not possible to predict or discount the extent and depth of shallow mineworkings without drilling investigation holes proportionate in number to the extent of proposed developments. A great deal of information can be missed if there is no geological awareness on the drilling team, therefore it follows that conclusions based on historic drilling work can be flawed unless the hole drilling and logging is competent, and the geology and mining simple.

The Groundsolve recommendations on shaft treatment is similarly unconventional in that it states the shaft caps should be constructed on concrete plugs built up from rockhead. As rockhead is known to be at a depth of 10m, this is just not possible.

It is doubtful if the Coal Authority would allow a geotextile to be used in lieu of a concrete capping on this development. The policy of using geotextile as a 'short term support' in the event of shaft subsidence would be an unsafe procedure if the shafts are in gardens at the rear of dwellings in close proximity and if in the future the textile spans over an open mineshaft in a garden. The final paragraph states that is possible to build over shafts but this is not allowed by the Coal Authority on residential sites.

Nkc investigation 2016

A drilling investigation by myself to locate and determine the ground conditions at the two recorded shafts of Pyllau yr Afon colliery.

Shaft 328346-347

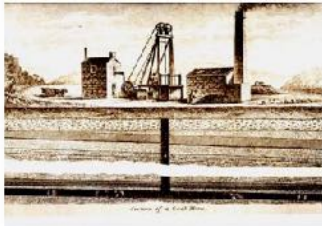
The Coal Authority position was derived solely from the 1822 Rhos Colliery mineplan and the shaft was located by probe drilling within 2m of the Coal Authority position. The shaft is located 4.4m from the footpath which forms the western site boundary and 3.5m from the southern boundary fence. External shaft diameter was proved to be 2.8m, with 3.0m of colliery fill overlying brown sandy clays and sandstone rockhead at 9.8m. There was no evidence of a shaft lining. Shaft centre is pegged and labelled, 4.4m from the footpath fence and 2.45m from the southern boundary fence. The shaft was drilled to 21.0m to prove the absence of a shallow covering. No voids were encountered.

Shaft 328346-348

The Coal Authority position was derived solely from the 1822 Rhos Colliery mineplan. The shaft was located by probe drilling within 2m of the Coal Authority position. Shaft diameter was proved to be 2.8m, with 3.5m of colliery derived fill overlying brown sandy clays and rockhead at 10.5m. There may be a sandstone lining to the shaft and foundations for the winding pulley. Shaft centre is pegged and labelled, 5.4m from the boundary fence and 2.5m from the kerb. The shaft was drilled to 21.0m to prove the absence of a shallow covering.

Car park depression

A pronounced depression 3.0m diameter is visible on the car park and this feature was drilled to determine the underlying ground conditions. The depression is underlain by very loose fill to 2.5m depth which coincides with a building shown on the 1826 Rhos Colliery mineplans and the 1875 Ordnance Survey.



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Mineshafts

Shafts 328346-347 and -348 have been shown to be located on the site and treatment to CIRIA 32 standards will comprise drilling and grouting the shaft infill followed by capping on clay at 3m depth with a reinforced concrete cap individually designed for each shaft by a structural engineer. A typical shaft cap to CIRIA32 specification would be 6.0m square and 500mm thick containing T40mm rebar in C30 concrete.

Coal Authority approval will be required for the proposed remedial scheme and a Coal Authority Permit will be required for the works. The proximity of the shafts to the site boundary may preclude a conventional capping programme, and piling around the shafts to rockhead in order to confine the works to within the site boundary may be required. This was discussed with the Coal Authority and agreed in principle as a possible treatment method with the incidental advantages that the shaft caps need only span the pile structure and the capping depth can be very shallow. The Coal Authority require any piles in the vicinity of the shafts to be bored into rockhead and not driven by percussion so that the piles are anchored in rock below the superficial deposits and shaft disturbance is minimised. The cost of piling both shafts was quoted by a specialist contractor at £100,000 in 2016.

The Coal Authority policy towards building over or within a Zone of Influence of a mine entry. This area is calculated as having a radius of 45 degrees to rockhead extending around the proven shaft location. On this site, the Zone of Influence has a radius of 10m and any building or structure (including roads, hardstanding and gardens) proposed within this area will need to be designed with suitable engineering precautions against mineshaft subsidence. A geogrid extending over the Zone of Influence and structural foundations for small buildings are typical appropriate measures and will have to be designed by the structural engineer to meet Coal Authority requirements.

Shallow mineworkings

The two intrusive investigations, even though limited in depth, have proved the presence of shallow mineworkings under the site in the Fireclay Group. Voids upto 1.5m in height have been proved but the total thickness of the mined horizons within the 8m of the Fireclay Group is not known because only 3 of the 9 holes were drilled to the required depth of 30m.

All the proposed development will need remedial grouting of the shallow workings in the Fireclay Group because there is less than 15m of rock cover to the workings. An intrusive investigation by drilling 10 holes to the full depth of 30m will be required prior to designing the remedial grouting works to determine the depth of the grouting holes and the extent of the remedial works. A Coal Authority Permit will be required and the holes should be logged by an identified and experienced geologist, the simplified 'drillers description' prevalent in most investigation reports will not be adequate here.

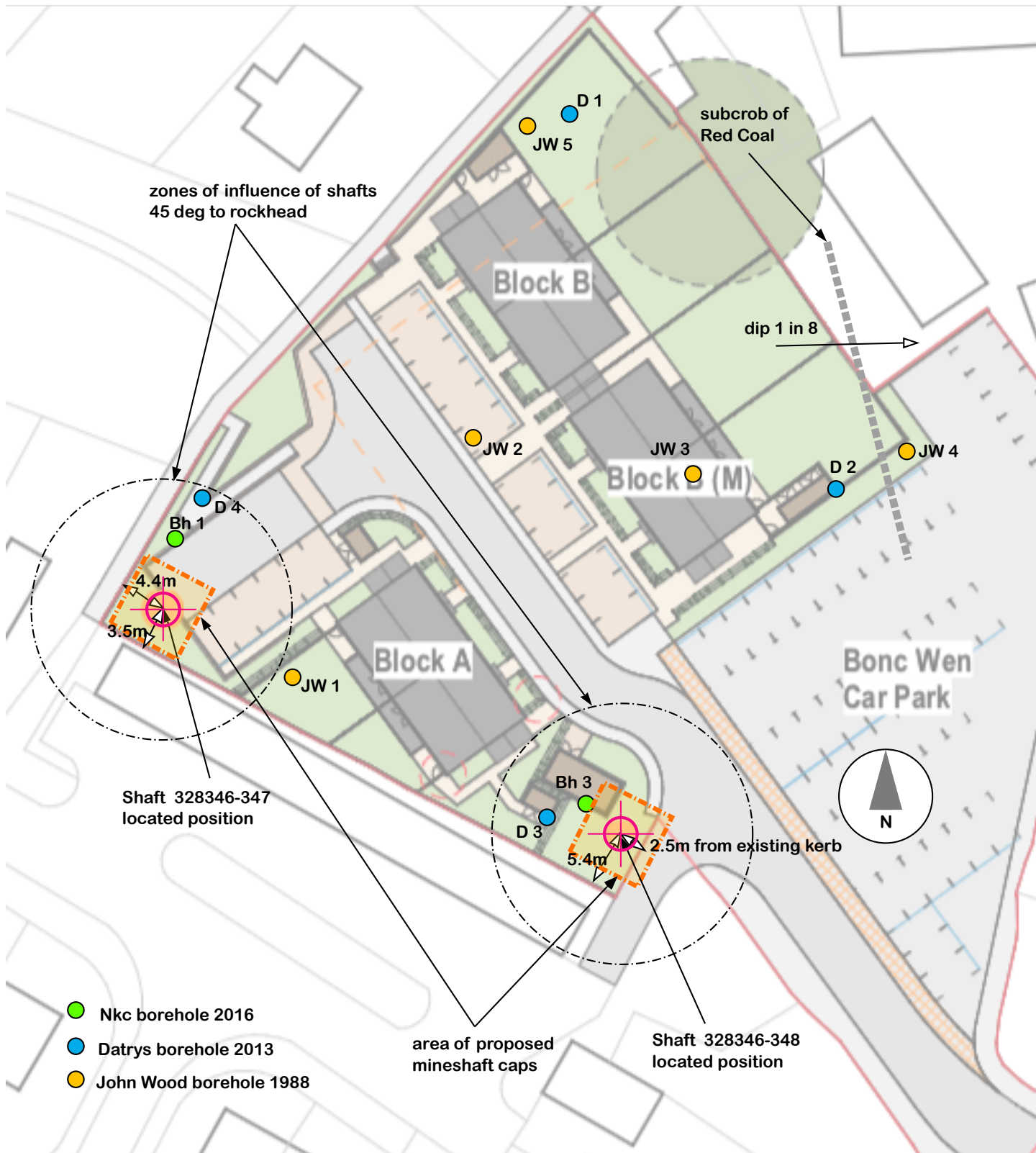
For Nkc Geotech Ltd

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Site Plan 1:500 @ A4

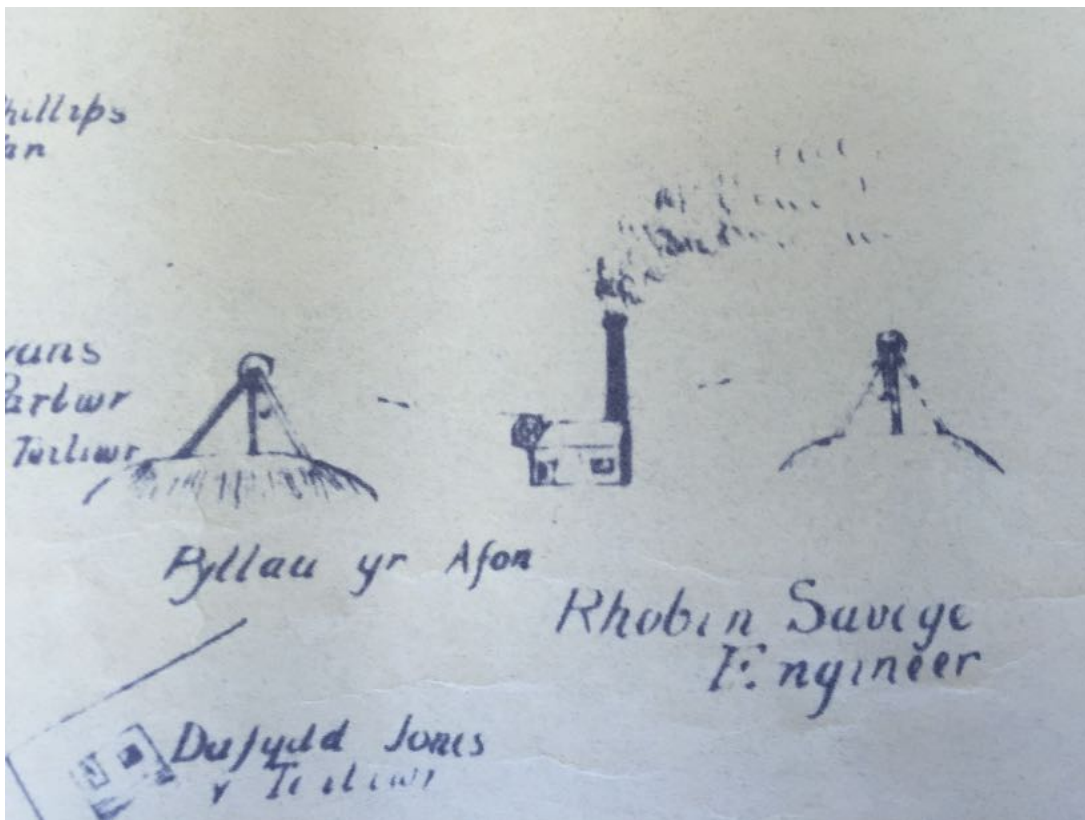




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Site plan 1:500 @ A4

Extract from the 1835 sketch plan of 'Rhos and its Inhabitants' by John Platt.
Denbighshire Records Office reference DRO NTD/640



Single or double story building containing a steam beam engine winder serving both shafts, 348 on the left and 347 on the right, with a single flat rope.

The house occupied by Dafydd Jones still stands although much extended. It is located 30m south of Shaft 348 and now known as 37 Afon yr Rhos with no access to the site.