

Title: Phase 2 Coal Mining Risk Assessment – Gnoll Country Park
Date: 22/02/2024
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Version: P1

1.0 Introduction

The site is located around the Gnoll Country Park situated in the town of Neath, in South Wales, approximately 11km to the northeast of Swansea. The site is situated on the eastern fringes of the town with the main entrance over the northern part of the estate accessed off Fairyland, with a second entrance from the southern end via Rockwood Close off Cimla Road.

Gnoll Country Park consists of a combination of open fields to the east and north in between areas of woodland consisting of semi mature to mature trees to the east, west and south and north. Two reservoirs are situated in the centre of the park with a pond located along the southern boundary. The area is approximately 60ha in area and is centred on National Grid Reference (NGR) 276395, 197344. The park is accessed via the main entrance to the north on Fairyland Road, with a secondary access to the south off Cimla Road. The park and wider area are within a valley and moderately slopes from east to west with levels on site ranging between 93mAOD to 61mAOD. The park levels off in the centre along the reservoirs with levels at 60mAOD which then rise slightly to the east to between 63mAOD to 65mAOD. Levels steeply drop along south eastern boundary towards the pond and secondary entrance to levels between 45mAOD to 34mAOD.

Several planning applications (P2023/0789, P2023/0732, P2023/0676 and P2023/0659) have been made by Asbri Planning Ltd on behalf of Neath Port Talbot County Council for development of the Gnoll Park Estate. The various development areas are depicted in Figure 1 below.

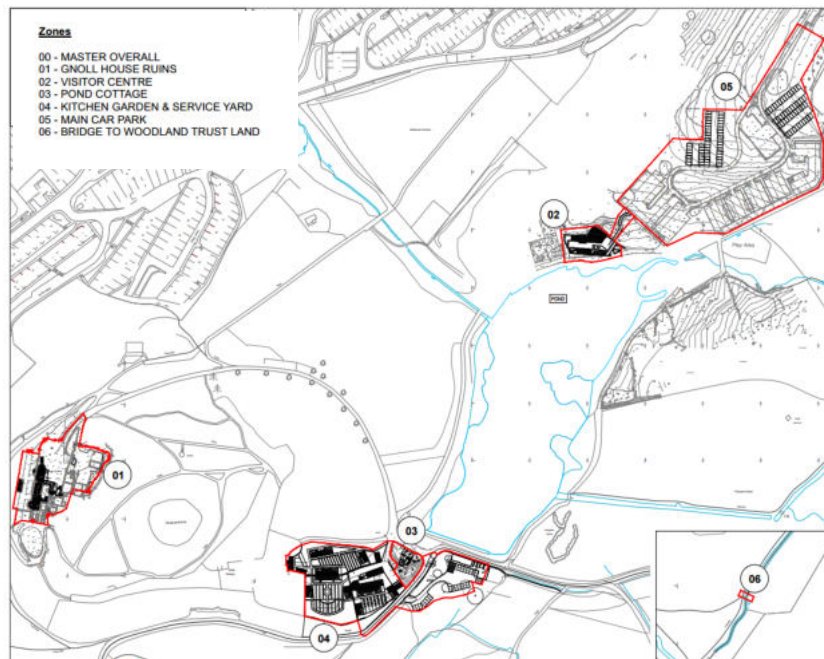


Figure 1: Proposed Development areas within Gnoll Park Estate

Planning application (P2023/0732) covers consolidation and repair works to the Gnoll House ruins (Area 1) and creation of an education interpretation centre in Gnoll House cellars.

Planning application (P2023/0659) covers demolition of the existing visitor centre (Area 2) and construction of a new 2 storey visitor centre and pedestrian routes from the existing car park together with associated landscaping and drainage works.

Planning application (P2023/0676) covers a single storey extension and change of use of Pond Cottage (Area 3) to form a tearoom/café.

Planning application (P2023/0789) covers creation of new visitor accommodation (Area 4) comprising the reinstatement and landscaping of former kitchen gardens, reconstruction of potting sheds to provide new office/reception and construction of 2no. self-catering holiday units and 14no. holiday cabins, with a new workshop and parking area within the service yard.

It is understood that the existing woodland to the south is to be retained.

The current proposals are based on the following drawings:

- *Proposed Site Plan – Kitchen Gardens, Hiraeth Architects Ltd, Dwg No. 2080-04-HIR-A-DR-00201-S2 P5, dated August 2023*
- *Proposed Ground Floor Plan – Pond Cottage, Hiraeth Architects Ltd, Dwg No. 2080-03-HIR-A-DR-01310-S2 P2, dated June 2023*

The planning application for Area 3 (P2023/0676) attracted the following Planning Condition with respect to coal mining risk in response to the submission of the Phase 1 CMRA.

- *a scheme of intrusive investigations has been carried out on site to establish the risks posed to the development by past coal mining activity, and;*
- *any remediation works and/or mitigation measures to address land instability arising from coal mining legacy, as may be necessary, have been implemented on site in full in order to ensure that the site is safe and stable for the development proposed.*
- *Prior to the occupation of the development, or it being taken into beneficial use, a signed statement or declaration prepared by a suitably competent person confirming that the site is, or has been made, safe and stable for the approved development shall be submitted to the Local Planning Authority for approval in writing. This document shall confirm the methods and findings of the intrusive site investigations and the completion of any remedial works and/or mitigation necessary to address the risks posed by past coal mining activity.*

Jubb examined the remaining planning applications and understand no other planning conditions were set out by the coal authority as far as can be determined. It is assumed these planning conditions would also apply to the neighbouring Kitchen Gardens (P2023/0789).

Jubb have been commissioned by Andrew Scott Ltd to review a Phase 1 CMRA undertaken by ESP Ltd in 2023 (Ref No. ESP.8603.3901, dated June 2023), scope the necessary Phase 2 inspections / intrusive investigations and prepare a Phase 2 Coal Mining Risk Assessment (CMRA).

This report details the findings of this work and provides recommendations with respect to the proposed development and any further works required to reduce the risk posed by the coal mining legacy below the site to acceptable levels.

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2.0 Jubb Review of ESP 2023 Phase 1 CMRA

At the request of Andrew Scott Ltd, Jubb have critically reviewed the recommendation of this with a review to possibly refining the required Phase 2 works if appropriate.

The 2023 Phase 1 CMRA identified the following high development risk areas requiring further investigation:

- Area 2 (Visitor Centre) associated with below ground mining within the Brithdir Rider Seam;
- Area 3 (Pond Cottage) associated with the outcrop of the Swansea Five Feet Seam;
- Area 4 (Kitchen Gardens) associated with the outcrop of the Swansea Five Feet Seam;
- 2 no. mine shafts within Fishpond Wood.

Upon review of the coal mining risk posed to the proposed Visitor Centre (Area 2), it is evident that this lies outside of any high development risk zone. The records suggest the shallowest coal seam below this area to be the Brithdir Rider seam. This is recorded cropping 240m northwest of the proposed Visitor Centre and associated planning application boundary at a dip of 3 degrees to the southeast. The seam is expected to lie at a minimum depth of 73m below the site and therefore beyond the zone of influence of surface or shallow founded structures as the Visitor Centre is expected use (Ref: 23157-JCE-XX-XX-GE-RP-002, dated 2023). Mining within this seam is unrecorded, whilst it is considered highly unlikely that there are any shafts associated with this seam within the red line boundary for the visitor centre it will be necessary to maintain a watching brief through construction should any unexpected ground conditions be identified.

Jubb concur with the requirement for intrusive investigations in the vicinity of Pond Cottage (Area 3) and the Kitchen Gardens (Area 4) because the areas lie within a high development risk zone. The zone is associated with the Swansea Five Feet seam which outcrops within the southern area of the Kitchen Gardens and dips 15 degrees to the north, indicating the seam to underlie both Areas 3 and 4 as shown in the extract below. Mining within this seam is unrecorded. However, it is considered highly likely for this seam to have been worked at shallow depths posing a stability risk to the proposed development.

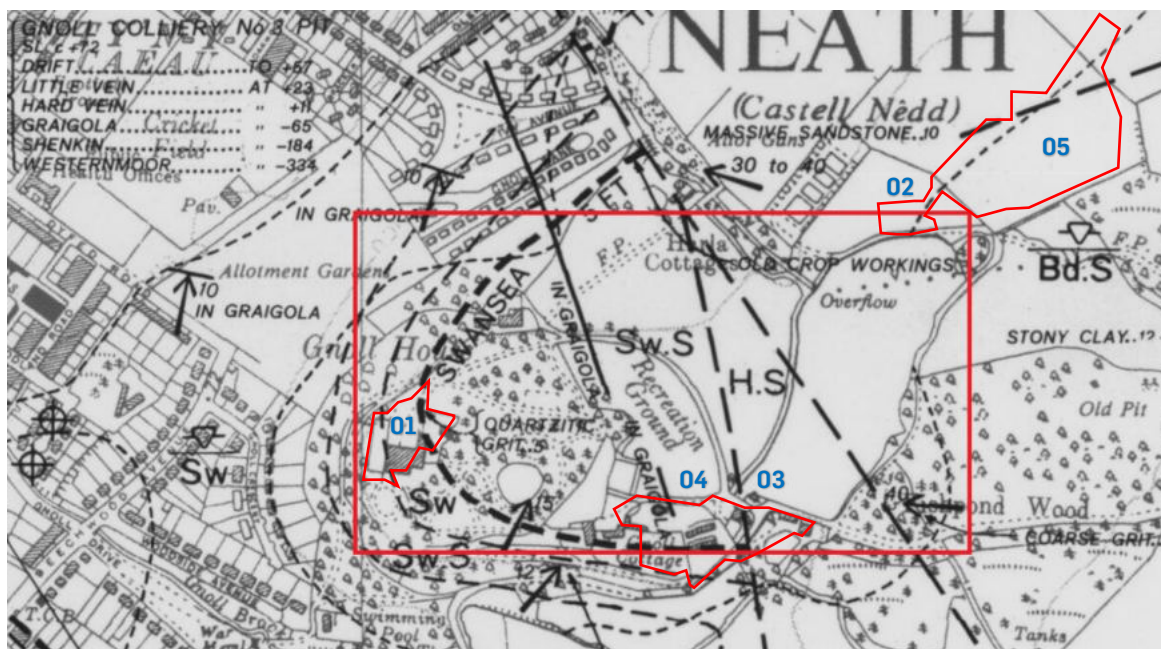


Figure 2: Extract of the BGS 1:10,560 Geological Sheet with development areas

With respect to the recorded mine entries in Fishpool Wood (close to the proposed play area and due to be opened up as public amenity space), the Coal Authority record two shafts in the location (*Ref: 276197-004/ 276197-009*). Mine Entry data sheets have been obtained for these shafts as part of this assessment and are appended to this report, these report the source plan to be *BGS Geological Map Sheet, Glamorgan 16:SW 2nd Ed, 1906*. This plan has been reviewed and an extract is provided below with the two recorded shafts circled red, which confirms Coal

Authority records (Note: ESP postulated this to be a single shaft recorded twice, the below plan shows this not to be the case).

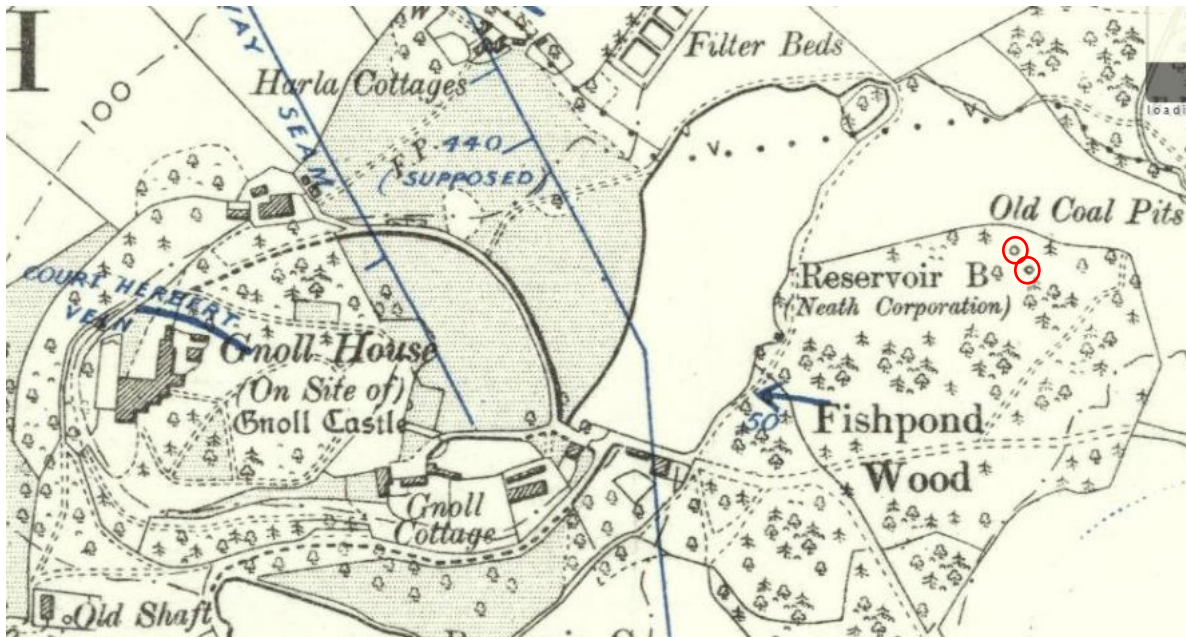


Figure 3: Extract from BGS Geological Map Sheet, Glamorgan 16:SW 2nd Ed, 1906, 1:10,560 scale.

The mine entry data sheets do not contain any further information with respect to the shafts, however review of geological mapping indicates that the shafts are likely to be more than 150m deep. The high-risk zone associated with potential collapse of the shafts is limited to within the woodland. Based on this, in the first instance a walkover inspection has been completed to inspect of surface evidence of the shafts.

2.1 Data Limitations

It did not become a legal requirement to deposit coal mining abandonment plans until the 1870's, and when initially implemented was not strictly enforced. Many shallow coal seams were worked prior to ordnance survey mapping, and therefore information on these workings is commonly not recorded or available, additionally, coal seams could have been worked by formal or informal means and it is also possible that the record of mine entries is not complete. Any recorded workings usually have associated abandonment plans.

The abandonment plans recorded beneath the site are at a depth considered not to pose a risk to ground surface stability, so have not been obtained.

3.0 Scope of Phase 2 investigations

Upon reviewing the Phase 1 CMRA discussed in section 2.0 above, the following scope of works was determined by Jubb.

3no. Rotary Boreholes were proposed to between 15.0 to 30.0m within Area 3 (Pond Cottage) and Area 4 (Kitchen Gardens). The exploratory hole locations were decided by Jubb, based on the outcropping 'Swansea Five Fleet' coal seam and the outline of the proposed buildings, although locations had to be moved during the works due to site constraints. A hole location plan is contained in **Appendix C**.

A rotary cored borehole (BH02) was positioned between Areas 3 and 4 to intersect the Swansea Five Feet seam to fully assess its location, depth and condition including full mechanical logging of the ground conditions to understand the ground model above and below the coal seam to determine presence of any workings/voids. The hole was progressed by dynamic sampling with a 113mm diameter barrel until refusal of the barrel occurred and was then continued by coring techniques, using a T6-116 core barrel. SPT testing was carried out at regular

intervals within the hole. On completion of each run the core samples were put into core boxes, labelled, photographed and logged by an engineer.

Two rotary open holes (BH01 and BH03) were positioned for generally site coverage dictated by the proposed layout to determine the coal seam location including any evidence of workings or voiding based on logging of returns and recorded penetration rates.

A site walkover was undertaken to identify the disused mine shaft located within the wooded area of Gnoll Country Park to the southeast of determine its conditions and dimensions. The findings are discussed in Section 4.2.

Andrew Scott Ltd then commissioned ESP Ltd (recommended by Jubb) to carry out the supplementary ground investigation scope. The following updated assessment is based on the information obtained from the supplementary ground investigation carried out to look for evidence of mine workings as detailed within the factual ground investigation report carried out by ESP Ltd in 2023 (*Ref No. ESP.8603.3901, dated December 2023*) and the site walkover to inspect the mine shafts.

4.0 Findings of the Phase 2 investigations and Shaft inspection

4.1 Ground Conditions Encountered – Pond Cottage & Kitchen Gardens (Areas 3 & 4)

The following section includes ground conditions encountered during the investigation, and are summarised in the table below:

Table 1: Summary of Interpreted Ground Conditions

Description	Stratum	Encountered In	Depth Range to top of stratum (m bgl)	Depth Range to base of stratum (m bgl)	Average Thickness
Sandy gravelly silty clay with mixed anthropogenic components.	Made Ground	All exploratory holes	GL	0.7 – 1.7	1.0
Gravelly cobbly clay. Gravel and cobbles of fine-grained sandstone.	Weathered Swansea Sandstone Member	All exploratory holes	0.7 – 1.7	1.0 – 6.0	2.7
Medium strong to strong grey with orange and orangish black staining fine grained SANDSTONE recovered as: grey with orange and orangish black staining medium coarse angular sandstone GRAVEL with a low angular cobble content. Interbedded with; Extremely weak to very weak brown with grey patches fine-medium grained MUDSTONE.	Swansea Sandstone Member	All exploratory holes	1.0 – 5.5	>30.0	-

4.1.1 Made Ground

Made Ground was encountered from surface across the site typically in the form of a sandy, gravelly, silty clay with mixed anthropogenic components, including brick, slag and coal, extending to depths between 0.70m to 1.7m below ground level (bgl).

The Made Ground was at its shallowest over the north/west of the site around BH01 and BH03 where it extended down to between 0.7m to 1.0mbgl. The deepest Made Ground was over to the east near Pond Cottage around

BH03 extending to a depth of 1.7m bgl. The source of the Made Ground is unclear, however given the inclusions of slag and coal, its likely associated with former industrial and demolition activities around the Kitchen Gardens and Gnoll House to the west that has been used to remodel site levels between the Kitchen Gardens and Pond Cottage.

4.1.2 Weathered Swansea Sandstone Member

The residual soils of the Swansea Sandstone Member was encountered in all three boreholes below the Made Ground and generally comprised a gravelly cobbly clay of sandstone, which extended to depths between 1.0 to 6.0m bgl.

The residual soils were at its shallowest over BH01 extending to 0.70m bgl before deepening to the east over BH02 and BH03 extending to depths between 2.0m to 6.0m bgl, suggesting a deepening weathering/clay thickening profile from a north west to south east direction.

A weathered coal seam described as a black silty clayey sand of weathered coal was identified in BH02 from 5.5m to 5.9m bgl, thought to be the Swansea Five Feet seam which was not encountered BH01 and BH03. Based on site and photographic observations there was no evidence of this seam being worked.

4.1.3 Swansea Sandstone Member

The residual clay graded into a medium strong to strong sandstone with interbedded extremely weak to very weak mudstone, encountered at depths between 1.0m to 6.0m bgl, extending to depths beyond 30.0m bgl. The dip of the bedding and discontinuities within the core was described as being hard to distinguish given the highly fractured nature of the cored material, however geological mapping suggests the Swansea beds dip north east between 12° and 15°.

The TCR and SCR value of the sandstone generally varied with depth with no discernible pattern, with values ranging between (TCR: 13% to 100% and SCR: 7% to 25%). The RQD value of the bedrock could not be determined as all core runs were classified as non-intact. These values suggest an irregular weathering profile across the site, however, will likely decrease with depths beyond 30.0m bgl.

Two potential features potentially associated with mining were identified within BH01 and BH03 between 23.10 to 26.6m bgl. BH01 encountered very soft mudstone with dark traces between 24.4m to 26.6m bgl, whereas BH03 encountered soft drilling including loss of air flush as well as water between 23.10m to 24.80m bgl.

4.1.4 Groundwater

The groundwater conditions identified in the investigation are summarised in the table below:

Borehole ID	Stratum	Comment on groundwater encountered
BH01	Coal Measures Bedrock	Borehole damp at 24.4m bgl (within zone of soft drilling).
BH02	Coal Measures Bedrock	Borehole wet from 6.5m bgl.
BH03	Coal Measures Bedrock	Significant ingress of water at 23.1m (possible backfilled workings).

Table 2: Groundwater Summary

Groundwater monitoring standpipes were installed in all three of the boreholes and four fortnightly monitoring visits were undertaken. The details of the installations and results of the monitoring visits are shown in the tables below.

Borehole ID	Potential Groundwater Depth (mbgl)	Installation depth (mbgl)	Reported response zone (mbgl)
BH01	24.4	30.0m	2.0 – 30.0
BH02	6.5	15.0m	2.0 – 15.0
BH03	23.1	25.0m	2.0 – 25.0

Table 3: Monitoring Well Installation Summary

Exploratory Hole	Groundwater Depth							
	22/12/2023		03/01/2024		17/01/2024		02/02/2024	
	m BGL	m AOD	m BGL	m AOD	m BGL	m AOD	m BGL	m AOD
BH01	19.95	47.85	14.54	53.26	21.31	46.49	20.88	46.92
BH02	2.73	63.87	2.09	64.51	2.90	63.7	2.67	63.93
BH03	15.86	50.74	14.54	52.06	14.54	52.06	16.61	49.99

Table 4: Groundwater Monitoring Summary

The results from the groundwater monitoring indicate groundwater levels were recorded between 64.51m AOD (BH02) and 46.49m AOD (BH01), no clear hydraulic gradient can be inferred. The groundwater within BH03 likely represents groundwater contained within the mining features at depth, however BH02 is likely perched groundwater retained between the weathered clay and sandstone bedrock contact at 6.5m bgl, which has since risen to between 2.09 to 2.90m bgl during monitoring.

4.2 Recorded Mine Shaft – Site Walkover

A site walkover around the recorded mine shaft area was undertaken during the ground investigation on 11th December 2023. A mining feature was potentially identified within the wooded area near the position of the recorded coordinates, as shown in figures below.



Figure 4: Photo 1 – Potential mining feature facing south



Figure 5: Photo 2 – Potential mining feature facing east



Figure 6: Potential mining feature and wider area facing east



Figure 7: Alternative mine shaft location based on coordinates

The potential mining feature identified in figure 5- 8 above was 1.2m x 2.0m in area and 0.4m deep with visible sides made of concrete. The full length of the feature could not be confirmed due to a collapsed tree partially covering the feature as in figures above. The feature was noted to be backfilled with soil and logs, with no evidence of ground instability in the area.

The shaft coordinates from the Coal Authority records and OS mapping were located to a position approximately 10m further northeast to a heavily vegetated area where access was not possible without clearance, as shown in Figure 7 above.

5.0 Coal Mining Risk Assessment based upon Phase 2 works

5.1 Area 3 Pond Cottage & Area 4 Kitchen Gardens

The previous CMRA report carried out by ESP Ltd in 2023 and summarised in Section 2.0, highlighted a high development risk zone associated with an outcropping coal seam identified as the 'Swansea Five Feet Coal Seam', which extended through the Pond Cottage and Kitchen Gardens sites and beyond to the existing Gnoll House ruins to the west. Jubb then refined the high development risk zone down to two areas known as Pond Cottage and Kitchen Gardens as shown in the extract below.

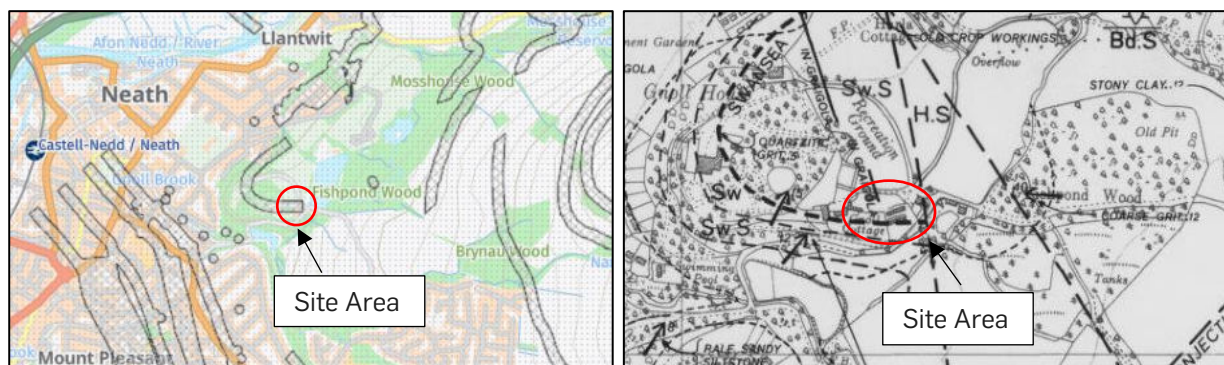


Figure 8: Extract from (<https://mapapps2.bgs.ac.uk/coalauthority/>), and BGS Geological Map Sheet SS79NE, 1:10,000 scale.

Three deep boreholes were drilled to depths of between 15m and 30m below ground levels, to assess the underlying stratum and to check for evidence of underground workings. The findings of the drilling works have been summarised in Table 4 below.

Borehole	Depth (m)	Description	Comments
BH01	0.0 – 0.7	Sandy gravelly clay with anthropogenic inclusions	Made Ground
	0.7 – 1.7	Sandy gravelly cobbly clay	Weathered Bedrock
	1.7 – 11.4	Sandstone	Bedrock
	11.4 – 17.6	Mudstone	Bedrock
	17.6 – 24.4	Sandstone	Bedrock
	24.4 – 26.6	Soft Mudstone with dark traces	Possible backfilled workings
	26.6 – 30.0	Sandstone	Bedrock
BH02	0.0 – 1.7	Mixed lithologies with anthropogenic inclusions	Superficial deposits
	1.7 – 5.5	Sandy gravelly cobbly clay	Weathered Bedrock
	5.5 – 5.9	Coal	Unknown Seam
	5.9 – 6.0	Gravelly clay	Weathered bedrock
	6.0 – 13.2	Sandstone	Bedrock
	13.2 – 13.4	Mudstone	Bedrock
	13.4 – 15.0	Sandstone	Bedrock
BH03	0.0 – 0.8	Silty gravelly sand with anthropogenic components.	Made Ground
	0.8 – 1.0	Cobbly clay	Weathered Bedrock
	1.0 – 1.2	Cobbly gravel	Weathered Bedrock
	1.2 – 6.6	Sandstone	Bedrock
	6.6 – 12.3	Mudstone	Bedrock
	12.3 – 23.1	Sandstone	Bedrock
	23.1 – 24.8	Soft Drill/ Loss of Flush	Possible backfilled workings
	24.8 – 27.0	Bedrock. No returns	Bedrock

Table 5. Summary of Drilling Works

Only one coal seam was encountered across the site and that was in BH02, where a 0.4m thick seam was encountered from 5.5m to 5.9m and described as a black silty clayey sand of weathered coal. The relatively shallow nature of the coal seam suggests this could be the Swansea Five Feet, which is recorded to be up to 1.5m in thickness based on the stratigraphic section from the BGS Geological Map Sheet SS79NE, 1:10,000 scale. The strata is shown as dipping between 12° to 15° north from the outcrop, which is located approx. 25m south, so

anticipated depths of between 5m and 7m should be expected. Given its thickness and the fact weathered coal measures recorded as clay was found above it, indicates that the seam was likely to have been worked but has since collapsed. BH02 is shown to be in close proximity to the nearby Gnoll Fault to east, which could be an indication of why there was very little intact rock recorded in the cored portion of the sandstone bedrock.

The shallow coal seam was absent from boreholes BH1 and BH3, with competent sandstone bedrock encountered from depths of 1.7m and 1.2m respectively. Both encountered softer drilling, within a band 1.7m to 2.2m thick at depths of between 24.1mbgl (BH1) and 23.1mbgl (BH3) with BH3 recording loss of drilling flush and encountered water. The softer bands were encountered beneath a significant thickness of sandstone, which could be an indication of historical workings, but no voiding was noted indicating if they were historical workings they have likely collapsed and been infilled. Penetration times were recorded during the drilling and are shown in figure 9 below.

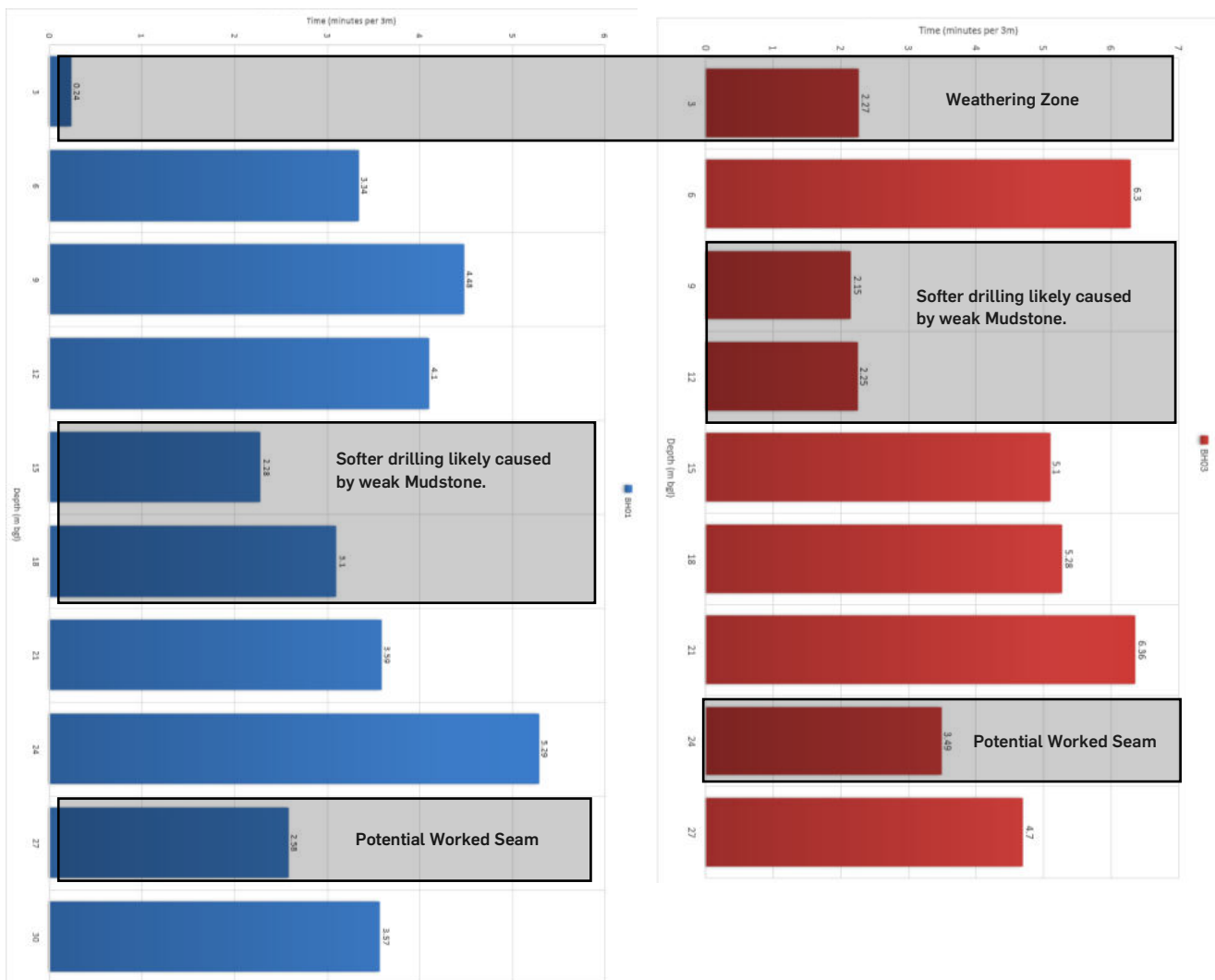


Figure 9: Recorded Drilling Penetration Time vs Depth

The figure above shows similar pattern of penetration times between BH01 and BH03 however at slightly different depths. This is evidence of the postulated ground model, knowing the Swansea Sandstone Member dips 12 to 15 degrees to the north, thus the penetration pattern occurs at deeper depths within BH01 as its positioned further north than BH03.

Penetration times are notably quicker through the section of the potentially worked seam when compared with the drilling rate in the shallower portions of the hole which is considered significant. Softer drilling was also

recorded between 9.0m to 18.0m, which based on the logs, is likely caused by the interbedding of weaker mudstone.

The open hole records show faster penetration through the zone anticipated to contain the 5ft, but did not record any other evidence of coal or mining. This suggests the coal to have been worked and fully collapsed. Conversely there is evidence of mining in the Little or Tir Edmond seam, but this is also suggested to be fully collapsed or backfilled due to lack of voiding.

The main risk identified from the initial coal mining risk assessment was for workings along the line of the coal crop shown across the part of the site with no evidence of workings on the surface observed during the initial walkover. So based on the above postulation, the seam will have likely been worked from the crop where deeper made ground and surface disturbance should therefore be anticipated.

The driller recorded no voids during the drilling of the holes however recorded significant reduction in penetration resistance as shown in figure 10 above. Based on no voiding being encountered and that the seam is no longer there and the fact that up to 20m of bedrock was recorded above any potential backfilled workings, it can be assumed that below ground coal workings are likely fully collapsed and there is no requirement to drill/grout. However, the collapsed Swansea Five Feet seam at shallow depth encountered in BH02 and foundation pressure bulbs within 1.0m of the worked seam (zone of influence) as shown in Appendix C. Therefore, any proposed structure within the zone of influence detailed on the drawing contained within Appendix C, should take additional precautions including engineering inspections/watching brief and foundation reinforcement.

The boreholes did not find any voiding and only limited evidence of possible worked ground and coal; accordingly, therefore it can be assumed that below ground workings are fully collapsed and therefore there is no need to drill and grout, The potential exists for deep Made Ground or disturbed ground, therefore a watching brief for new foundations is recommended to ensure they found within a suitable natural strata and reinforcement to mitigate potential unpredictable settlement within this strata.

The potential workings encountered at depth within BH01 and BH03 have sufficient bedrock cover to prevent void migration, so together with the fact that no voiding was encountered the risk of future void migration within influencing distance of surface is considered low.

5.2 Gas Risk

Gas monitoring wells were installed in all three boreholes and four fortnightly monitoring visits were scheduled. The monitoring results are summarised in the table below.

Date	Hole Position	Atmos. Press. (mb)	Max Gas Flow (l/hr)	Water Depth (mbgl)	Steady State Carbon Dioxide (%/vol)	Max Methane (%/vol)	Min Oxygen (%/vol)
22/12/23	BH01	1008	0.4	19.95	0.0	0.0	20.0
	BH02	1008	0.0	2.73	4.5	0.1	14.8
	BH03	1008	0.0	15.86	0.1	0.1	20.0
03/01/24	BH01	980	0.0	14.54	5.8	0.0	6.5
	BH02	980	0.0	2.09	0.5	0.0	20.1
	BH03	980	0.0	14.54	2.3	0.0	15.7

Date	Hole Position	Atmos. Press. (mb)	Max Gas Flow (l/hr)	Water Depth (mbgl)	Steady State Carbon Dioxide (%/vol)	Max Methane (%/vol)	Min Oxygen (%/vol)
17/01/24	BH01	982	0.0	21.31	6.3	0.1	6.4
	BH02	982	0.0	2.90	5.2	0.1	9.7
	BH03	982	0.0	14.54	4.6	0.0	17.2
02/02/24	BH01	1021	0.0	20.88	6.1	0.0	10.5
	BH02	1021	0.0	2.67	0.5	0.0	19.8
	BH03	1021	0.0	16.61	3.7	0.0	18.2

Table 6: Gas Monitoring Results

The results have been assessed in accordance with CIRIA C665, with Gas Screening Values calculated on a hole-by-hole basis, and a worst-case basis (highest concentration of CH₄ or CO₂, irrespective of location or monitoring date). From the 4 no. visits undertaken, positive gas flow was recorded during 1 no. visit, from a single borehole (BH01) on the 22/12/23.

A single 'worst case' gas screening value (GSV) of 0.063l/hr has been calculated within BH01, which results in a Characteristic Situation 1 – very low risk classification. However, there is a potential for mining on site, therefore a potential source, thus where elevations of carbon dioxide exceed 5% a CS1 value cannot be given irrespective of flow rates, these conditions are met within 3 no. of the 4 no. visits for CO₂ within BH01 and BH02, which results in a Characteristic Situation 2 – low risk classification within this area of site, therefore gas protection measures are required.

The guidance indicates that the site is in a moderate probability radon area (5 – 10% of homes are estimated to be at or above the Action Level) and therefore basic radon protection methods are required on site which can usually satisfy any CS2 gas protection requirements also.

5.3 Fishponds Wood (2 no. shafts)

The shafts could not be located and that their condition and propensity to collapse could not be established. It's reasonable to assume that if a collapsed would occur, the cone of influence from potential collapse to the top of the bedrock, estimated to be no more than 10.0m deep and a 45° cone, then any proposed play area more than 10m away should be safe from risk of entry collapse, i.e., any collapse would be limited to the woodland.

The mine entries recorded within Fishpond Woods is considered low risk given its proximity to the proposed children's play area. That being said, whilst the risk of future collapse is unknown, the risk to the public would be significant should it occur once the area has been opened up.

6.0 Recommendations

Based on the analysis the following recommendations are proposed:

- It cannot be confirmed that any recorded mine shaft was located in Fishpond Wood to the east of wider site during the walkover and their condition below surface remains unknown. Therefore, it is advised that further efforts should be made to locate the shafts and assess their condition. In the first instance it is suggested that low level vegetation in this area is cleared, and a further walkover completed. Consideration may then be given to the use of both geophysics and targeted trenching to try and locate the shafts.

- The Swansea Five Feet was not consistently encountered as expected, although no direct evidence of mining within this seam was recorded. It is considered likely it was mined historically from the crop but has now fully collapsed. The potential exists for deep Made Ground or disturbed ground, therefore a watching brief for new foundations is recommended to ensure they found within a suitable natural strata and reinforcement to mitigate potential unpredictable settlement within this strata.
- Gas Risk – CS₂ gas protection measures likely required which can be incorporated into the basic radon protection requirement on site.

Appendix A: Site Location Plan

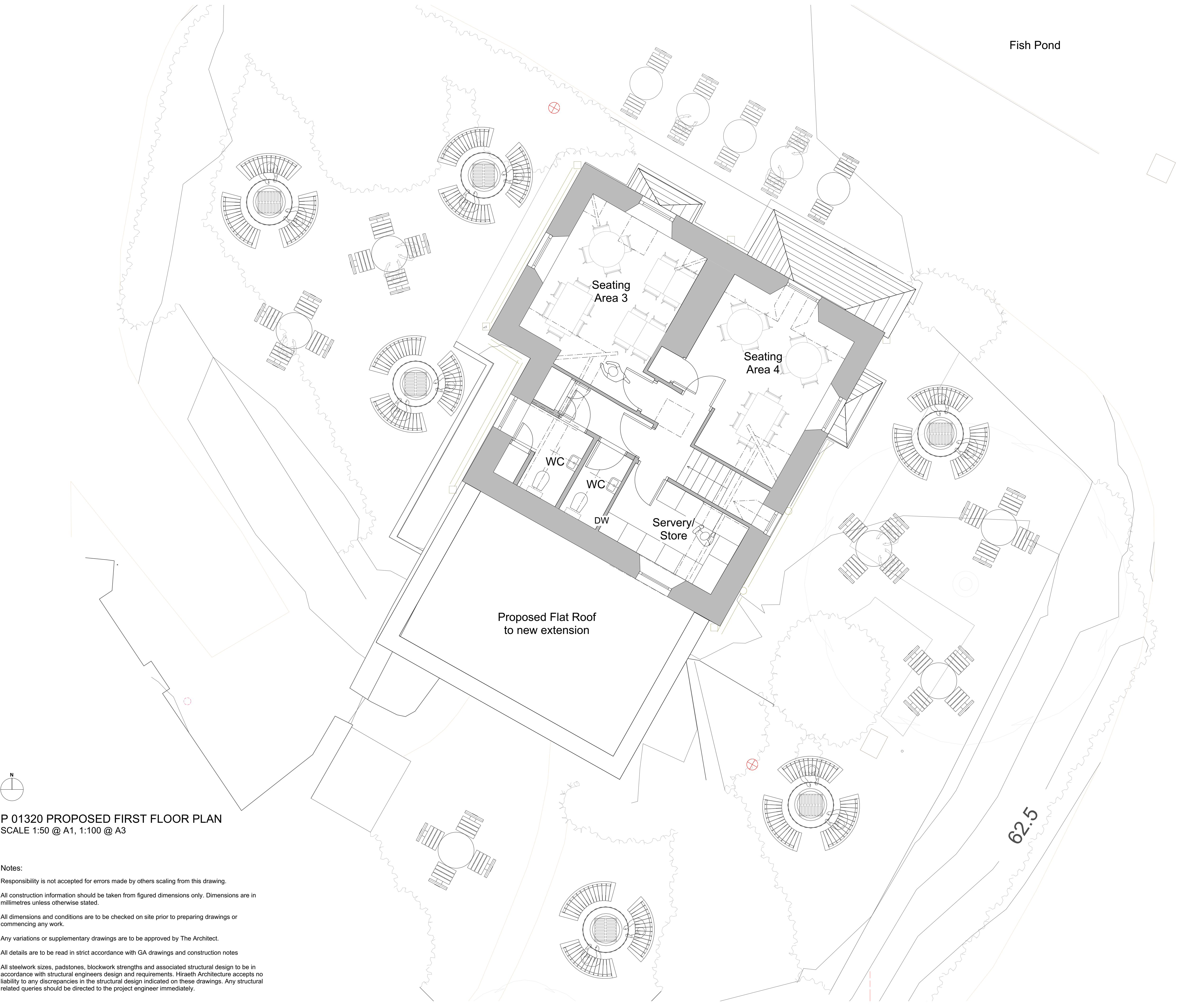


Appendix A: Site Location Plan

23157 - Gnoll Country Park, Neath



Appendix B: Proposed Plans



P 01320 PROPOSED FIRST FLOOR PLAN
SCALE 1:50 @ A1, 1:100 @ A3

Notes:

Responsibility is not accepted for errors made by others scaling from this drawing.

All construction information should be taken from figured dimensions only. Dimensions are in millimetres unless otherwise stated.

All dimensions and conditions are to be checked on site prior to preparing drawings or commencing any work.

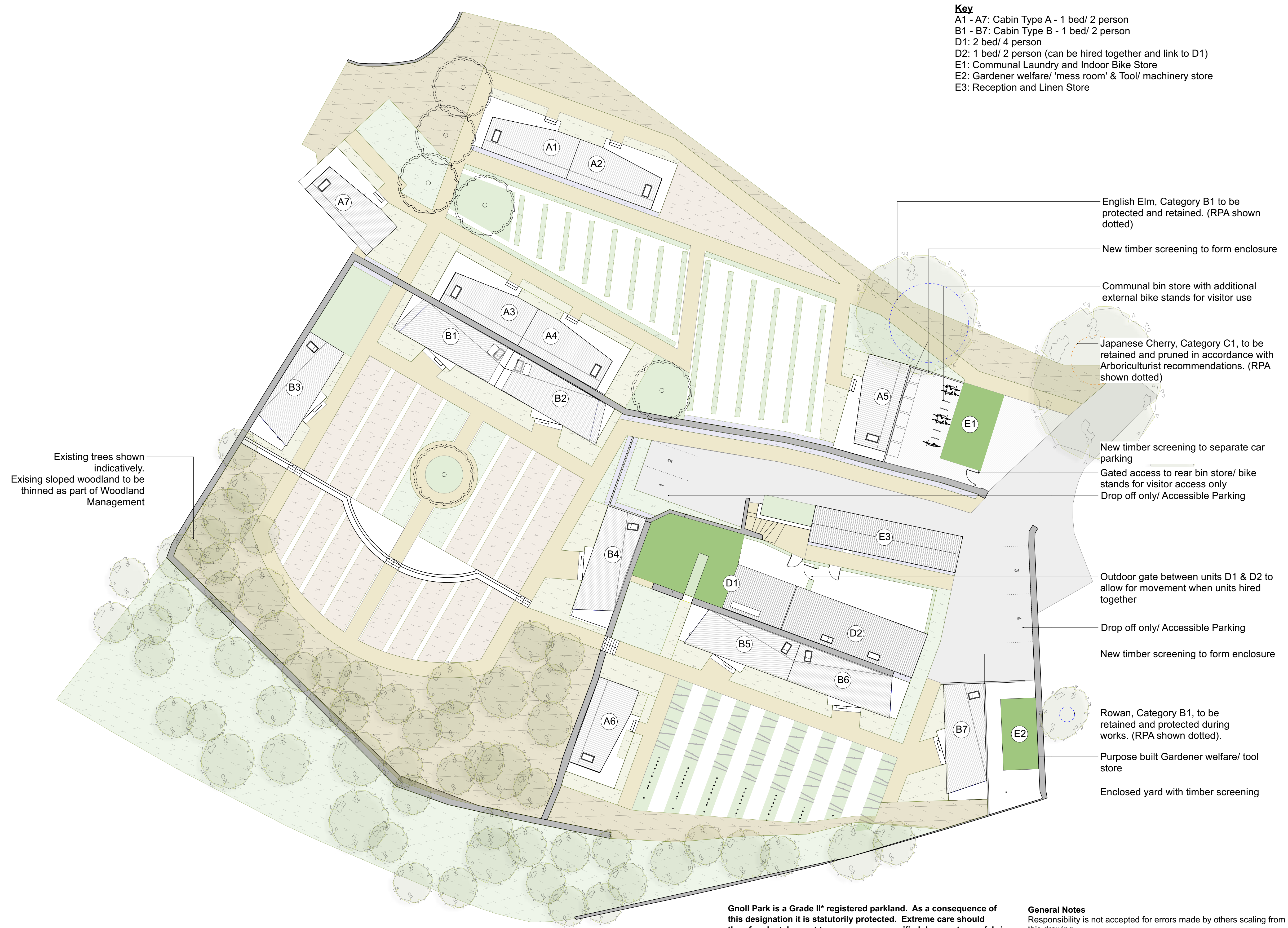
Any variations or supplementary drawings are to be approved by The Architect.

All details are to be read in strict accordance with GA drawings and construction notes

All steelwork sizes, padstones, blockwork strengths and associated structural design to be in accordance with structural engineers design and requirements. Hiraeth Architecture accepts no liability to any discrepancies in the structural design indicated on these drawings. Any structural related queries should be directed to the project engineer immediately.

SERIES		PROPOSED					
SUITABILITY		S2 - ISSUED FOR INFORMATION					
REV	DATE	NOTE					
P221/06/2023Sht No. updated from 01132 P122/05/2023							
		job number	Zone				
		2325	03				
		Neath Port Talbot CBC Gnoll Park Estate					
		Proposed First Floor Plan: Pond Cottage					
		Scale	1:50 @A1, 1:100 @A3				
		Date	06/23				
		02920 025814 office@hiraetharchitecture.co.uk The Maltings East Tyndall St Cardiff CF24 5EA					
UPRN	Zone	Originator	Role	Type	Sht number	S Code	Rev
2080	03	HIR	A	DR	01320	S2	P2

do not scale from this drawing | all dimensions to be verified on site | notify architect of all discrepancies | copyright Hiraeth architecture



- Key**
A1 - A7: Cabin Type A - 1 bed/ 2 person
B1 - B7: Cabin Type B - 1 bed/ 2 person
D1: 2 bed/ 4 person
D2: 1 bed/ 2 person (can be hired together and link to D1)
E1: Communal Laundry and Indoor Bike Store
E2: Gardener welfare/ 'mess room' & Tool/ machinery store
E3: Reception and Linen Store

- English Elm, Category B1 to be protected and retained. (RPA shown dotted)
- New timber screening to form enclosure
- Communal bin store with additional external bike stands for visitor use
- Japanese Cherry, Category C1, to be retained and pruned in accordance with Arboriculturist recommendations. (RPA shown dotted)
- New timber screening to separate car parking
- Gated access to rear bin store/ bike stands for visitor access only
- Drop off only/ Accessible Parking
- Outdoor gate between units D1 & D2 to allow for movement when units hired together
- Drop off only/ Accessible Parking
- New timber screening to form enclosure
- Rowan, Category B1, to be retained and protected during works. (RPA shown dotted).
- Purpose built Gardener welfare/ tool store
- Enclosed yard with timber screening

Existing trees shown indicatively.
Exising sloped woodland to be thinned as part of Woodland Management

Gnoll Park is a Grade II* registered parkland. As a consequence of this designation it is statutorily protected. Extreme care should therefore be taken not to cause any unspecified damage to any fabric or part of structures and landscape on or within the site when undertaking any construction works.

BAT NOTES AND METHODOLOGY

A. There are known bats in the roofs of Pond Cottage. Consequently all works need to be undertaken in accordance with the methodology as set out by the ecologist.

B. All British bat species and their roosts (occupied or not) are legally protected. It is a criminal offence to kill, injure or take a wild bat, and/or intentionally or recklessly damage, destroy, or obstruct access to, a bat roost. Prosecution could lead to fines and imprisonment. Any involved individual or company could be held liable.

C. All work carried out where bats are or have been found to be present must be supervised by and carried out to the satisfaction of the retained bat expert.

General Notes
Responsibility is not accepted for errors made by others scaling from this drawing.

All construction information should be taken from figured dimensions only. Dimensions are in millimetres unless otherwise stated.

All dimensions and conditions are to be checked on site prior to preparing drawings or commencing any work.

Any variations or supplementary drawings are to be approved by The Architect.

All details are to be read in strict accordance with GA drawings and construction notes

All steelwork sizes, padstones, blockwork strengths and associated structural design to be in accordance with structural engineers design and requirements. Hiraeth Architecture accepts no liability to any discrepancies in the structural design indicated on these drawings. Any structural related queries should be directed to the project engineer immediately.



SERIES		PLANNING	
SUITABILITY		S2 - ISSUED FOR INFORMATION	
REV	DATE	NOTE	
P3	18/07/2023	Minor amendment to graphics	
P4	28/07/2023	Layout further developed	
P5	25/08/2023	Layout amended re. ownership boundary	

Hiraeth.

02920 025814 | office@hiraetharchitecture.co.uk
The Maltings | East Tyndall St | Cardiff | CF24 5EA

UFPN

Zone

Originator

Role

Type

Sht number

S Code

Rev

job number

Zone

2325 04

NEATH PORT TALBOT CBC
GNOLL PARK

Proposed: Site Plan -
Kitchen Garden

Scale 1:200 @ A1, 1:100 @ A3

Date 06/23

2080	04	HIR	A	DR	00201	S2	P5
------	----	-----	---	----	-------	----	----

do not scale from this drawing | all dimensions to be verified on site | notify architect of all discrepancies | copyright Hiraeth architecture

Appendix C: Exploratory Hole Plans



Legend

 Site Boundary (from Planning Application: P2023/0789)

Jubb Exploratory Holes

 BH

By: JY Date: 06/02/2024

Check: JY Date: 06/02/2024

Project

Gnoll Country Park, Neath

Title

Exploratory Hole
Location Plan

Client

Andrew Scott Ltd

Scale at A3: 1:x500

Job No.

23157

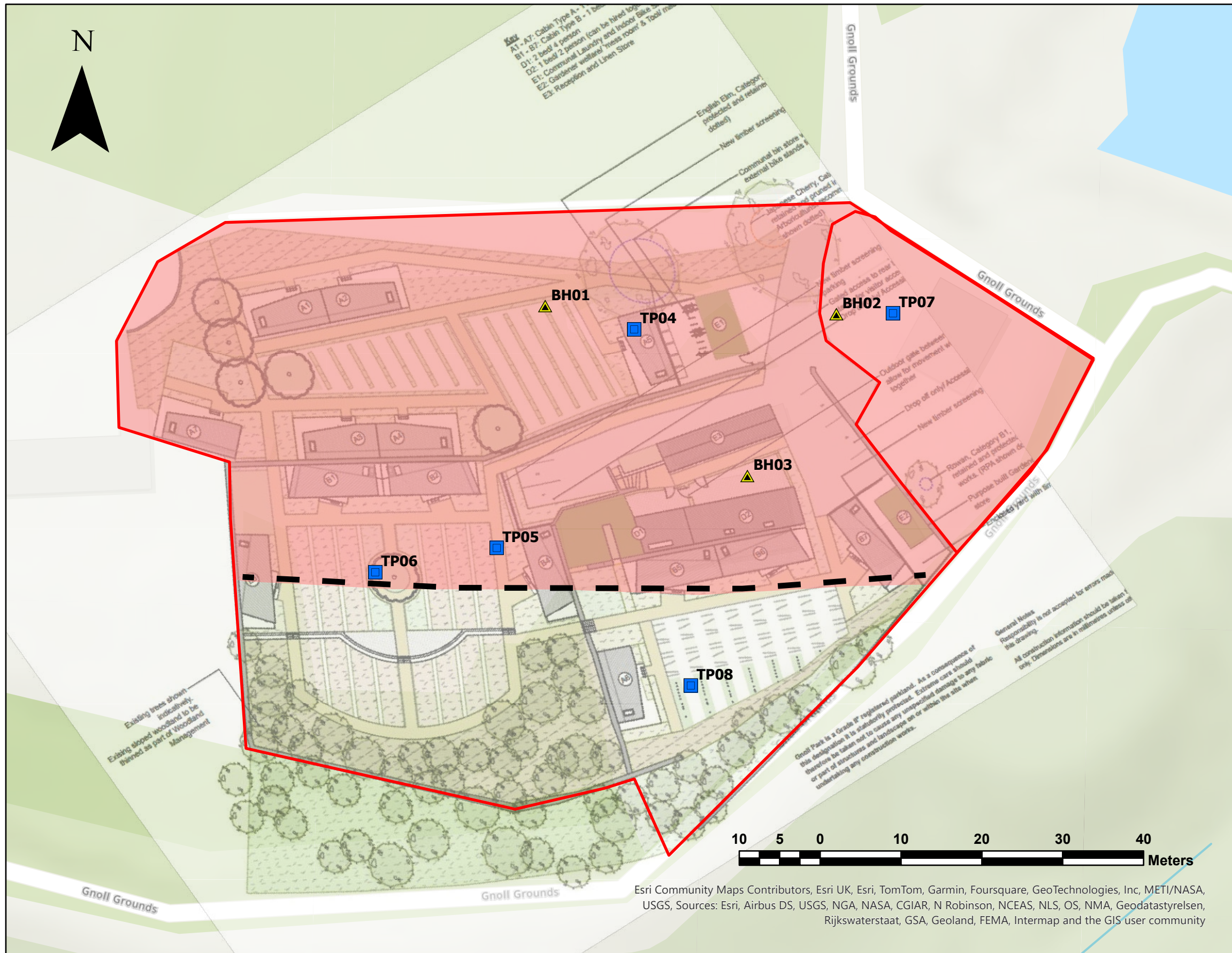
Drawing No.

003

Rev.

-





Legend

- Site Boundary (from Planning Application: P2023/0789)
- Conjectural Outcrop Line of Swansea Sft Seam
- Conjectural Zone of Influence (Foundation Precautions Required)

Jubb Exploratory Holes

Type

- BH
- TP

By: JY	Date: 06/02/2024	
Check: JY	Date: 06/02/2024	
Project		
Gnoll Country Park, Neath		
Title		
Foundation Risk Drawing		
Client		
Andrew Scott Ltd		
Scale at A3: 1:x500		
Job No.	Drawing No.	Rev.
23157	003	-

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Appendix D: Coal Authority – Mine Entry Datasheet

Issued by:

The Coal Authority, Property Search Services, 200 Lichfield Lane, Berry Hill, Mansfield, Nottinghamshire, NG18 4RG

Website: www.groundstability.com Phone: 0345 762 6848

**JUBB CONSULTING
ENSIGN HOUSE
LONGBRIDGE ROAD
PLYMOUTH
CITY OF PLYMOUTH
PL6 8LR**

Our reference:	51003399500001
Your reference:	23157
Date of your enquiry:	16 January 2024
Date we received your enquiry:	16 January 2024
Date of issue:	16 January 2024

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

Shaft Plan and Data Sheets

101 FAIRYLAND, NEATH, NEATH PORT TALBOT, SA11 3EF

I refer to the enquiry dated 16 January 2024, received 16 January 2024, in connection with the above.

As requested I enclose the mine entry data sheet(s) held for the mine entry/entries referred to.

Mine Entry Data

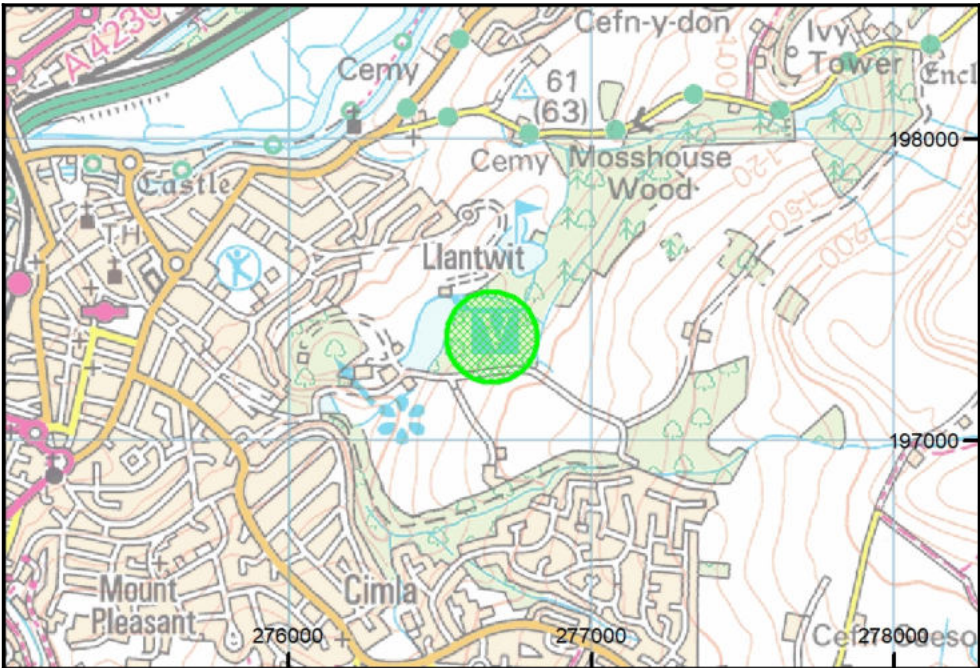
Shaft/adit:	Shaft
Reference:	276197-009
Source:	Geological Sheet Glam 16:SW 2nd Ed
Colliery name:	Unknown
Entry name:	Unknown
Date abandoned:	Unknown
Depth of superficial deposits (m):	Unknown
Depth of shaft (m):	Unknown
Diameter of shaft (m):	Unknown
Probable adit azimuth:	Not Applicable
Treatment details:	Unknown
Conveyance:	Not Applicable
Easting:	276667
Northing:	197350
Other information:	None

Mine Entry Data (continued)

Shaft/adit:	Shaft
Reference:	276197-004
Source:	OS Mastermap (2022); OS 1:2500 Glamorgan 16/9 1870, 1877, 1900, 1920; Geological Sheet Glam 16:SW 2nd Ed
Colliery name:	Unknown
Entry name:	Unknown
Date abandoned:	Unknown
Depth of superficial deposits (m):	Unknown
Depth of shaft (m):	Unknown
Diameter of shaft (m):	Unknown
Probable adit azimuth:	Not Applicable
Treatment details:	Unknown
Conveyance:	Not Applicable
Easting:	276674
Northing:	197337
Other information:	None

Location map

Approximate position of enquiry



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Ordnance Survey Licence number: 100020315

This plan shows the approximate location of the disused mine entry / entries referred to in the attached mining 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 obligations of either the Coal Authority or other responsible persons under the 1991 Act can be obtained by visiting www.groundstability.com.

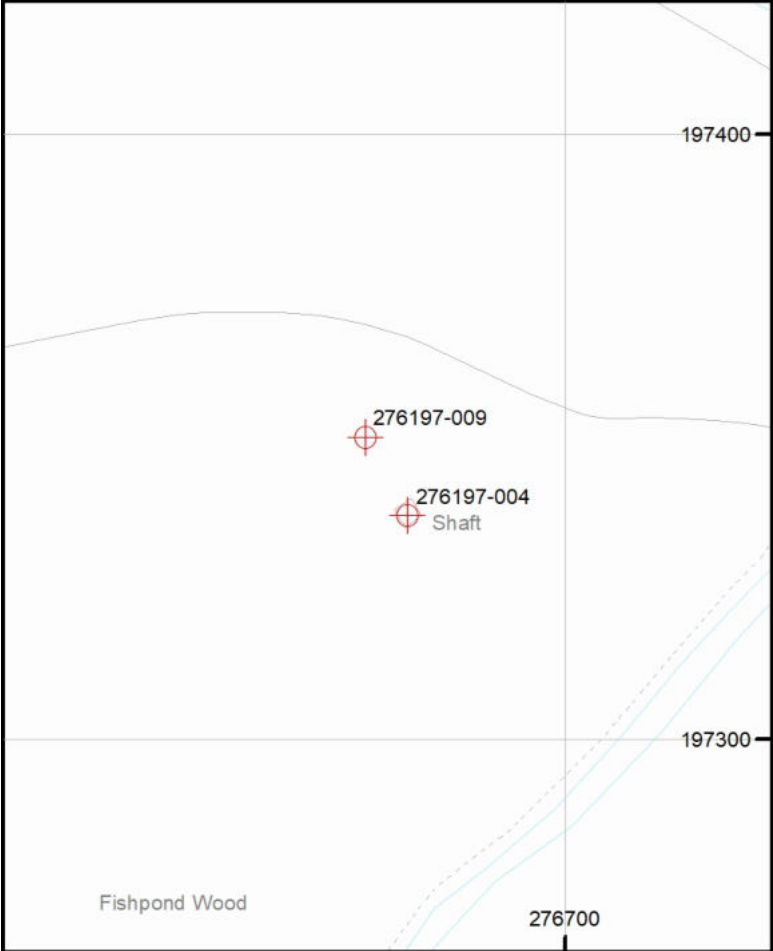
If you wish to discuss the relevance of any of the information contained in this report, you should seek the advice of a qualified mining engineer or surveyor. If you or your advisor wish to examine the source plans from which the information has been taken, these are available to view, free of charge, at our Head Office in Mansfield. To book an appointment please ring 01623 637225. Should you or your advisor wish to carry out a physical investigation that may enter, disturb or interfere with any disused mine entry, 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 is 0800 288 4242.

Key

Disused Adit or Mineshaft



Appendix E: ESP Ltd - Factual Report

Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Gnoll Country Park, Neath
Proposed Commercial & Leisure Development
Factual Ground Investigation Report
Report Reference: ESP.8603.02.4015

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Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

33 Cardiff Road, Taff's Well, CARDIFF, CF15 7RB ☎ 029 2081 3385
✉ enquiries@earthsciencepartnership.com www.earthsciencepartnership.com

Gnoll Country Park, Neath Proposed Commercial & Leisure Development Factual Exploratory Investigation

Prepared for:
Andrew Scott Ltd
The Grange
Margam
Neath Port Talbot
SA13 2SP



Report Reference: **ESP.8603.02.4015**

Revision	Status	Date	Written by	Checked by	Approved by
1	Final	February 2024	Daniel Thomas BSc (Hons) FGS	H Davies MESci CGeol FGS ROGEP Professional	M Eynon BSc MSc CGeol FGS ROGEP Specialist
0	Draft	December 2023	Daniel Thomas BSc (Hons) FGS	H Davies MESci CGeol FGS ROGEP Professional	M Eynon BSc MSc CGeol FGS ROGEP Specialist
Signature:					
Notes:	- Once issued this document is Uncontrolled, for the latest version and/or to confirm you have authorisation to use it please contact the Earth Science Partnership at enquiries@earthsciencepartnership.com or by telephone at 029 2081 3385. - This document has been optimised for double sided printing and therefore may produce some blank pages when printed single sided.				

Contents

1	Introduction	5
1.1	Background	5
1.2	Objective and Scope of Works.....	5
1.3	Report Format	6
1.4	Limitations of Report	6
2	Site Setting	7
2.1	Site Location and Description	7
2.2	Previous Investigations and Assessments	8
2.3	Geological Setting	8
2.4	Unexploded Ordnance	8
3	Exploratory Investigation	9
3.1	Investigation Points.....	9
3.2	Survey Data – Investigation Points	11
3.3	Instrumentation.....	11
3.4	Sampling Strategy	12
3.5	Evidence of Site Contamination Found During Site Works	12
3.6	Geo-environmental & Geotechnical Laboratory Testing	12
4	Summary of Ground Conditions	13
4.1	Geology	13
4.2	Groundwater.....	13
5	References	14

Figure 1 – Investigation Point Plan

- Appendix A Preliminary UXO Risk Assessment (Zetica, 2023)
- Appendix B Rotary Borehole Records
- Appendix C Photographic Rotary Borehole Records
- Appendix D Coal Authority Permit
- Appendix E Results of Spot Gas and Groundwater Monitoring

General Notes

1 Introduction

1.1 Background

Andrew Scott Ltd (hereafter known as the Client) have been appointed principal contractors to redevelop the subject site for commercial and leisure purposes. The Earth Science Partnership Ltd (ESP), Consulting Engineers, Geologists and Environmental Scientists, were instructed by Jubb (hereafter known as the designer) acting on behalf of the Client, to undertake an exploratory investigation followed by factual reporting.

The designer specified the scope of works for the investigation, as detailed in the Ground Investigation Tender document provided (ref: Gnoll Country Park. Neath. Ground Engineering Services – Ground Investigation Tender. 28th September 2023) for which this factual report has been completed to fulfil.

An interim factual report was requested by the designer following the works and was issued in December 2023 (ref: ESP.8603.02.4015 – Draft), in advance of completing the laboratory testing and gas/groundwater monitoring. In January 2024, the designer confirmed that no laboratory testing was required. Following the completion of the gas monitoring, this report is now issued as final.

Based on the scoping document provided by the designer (Jubb, 2023), the development will comprise *‘a new visitor centre, with an extension to the existing car park, with the creation of new footpaths and future enhancement throughout the park’*.

Based on the above, we understand that the proposed structures would be classified as Geotechnical Category 2 (BS5930:2020).

1.2 Objective and Scope of Works

The objective and scope of works of the investigation was developed by the designer to obtain factual information on the geotechnical character and properties of the ground beneath the site and levels of contamination.

As detailed in the designers scoping document (Jubb, 2023), the main objective of the investigation is to:

- Investigate and delineate the location of the Swansea Five Fleet coal seam within bedrock to determine presence of working/voids.
- Monitor ground gas risk from historic mining activities.

The works were tendered for by ESP, based on the specification provided by the designer and comprised a field reconnaissance visit, the supervision and direction of rotary boreholes, gas and groundwater monitoring, geotechnical and geo-environmental laboratory testing, and factual reporting. This report is the factual presentation of the ground investigation only and no interpretive assessment has been undertaken by ESP.

The contract was awarded based on a competitive tender quotation. The terms of reference for the assessment are as laid down in the revised Earth Science Partnership proposal of 3rd October 2023 (ref: ESP.8603.02.It1 Investigation BoQ - SI, Gnoll County Park, Neath).

The investigation and factual reporting were undertaken in December 2023. Ongoing gas and groundwater monitoring was completed in February 2024, including issue of this final report.

1.3 Report Format

This report is factual only, presenting the findings of the investigation undertaken in line with the scope of works provided by the designer. No other aspects have been considered in this report. This report includes details of the site setting (Section 2), details of the ground investigation undertaken of BS5930:2020 (Section 3), followed by a summary of the ground conditions identified (Section 4). This factual report is issued as a digital version only.

1.4 Limitations of Report

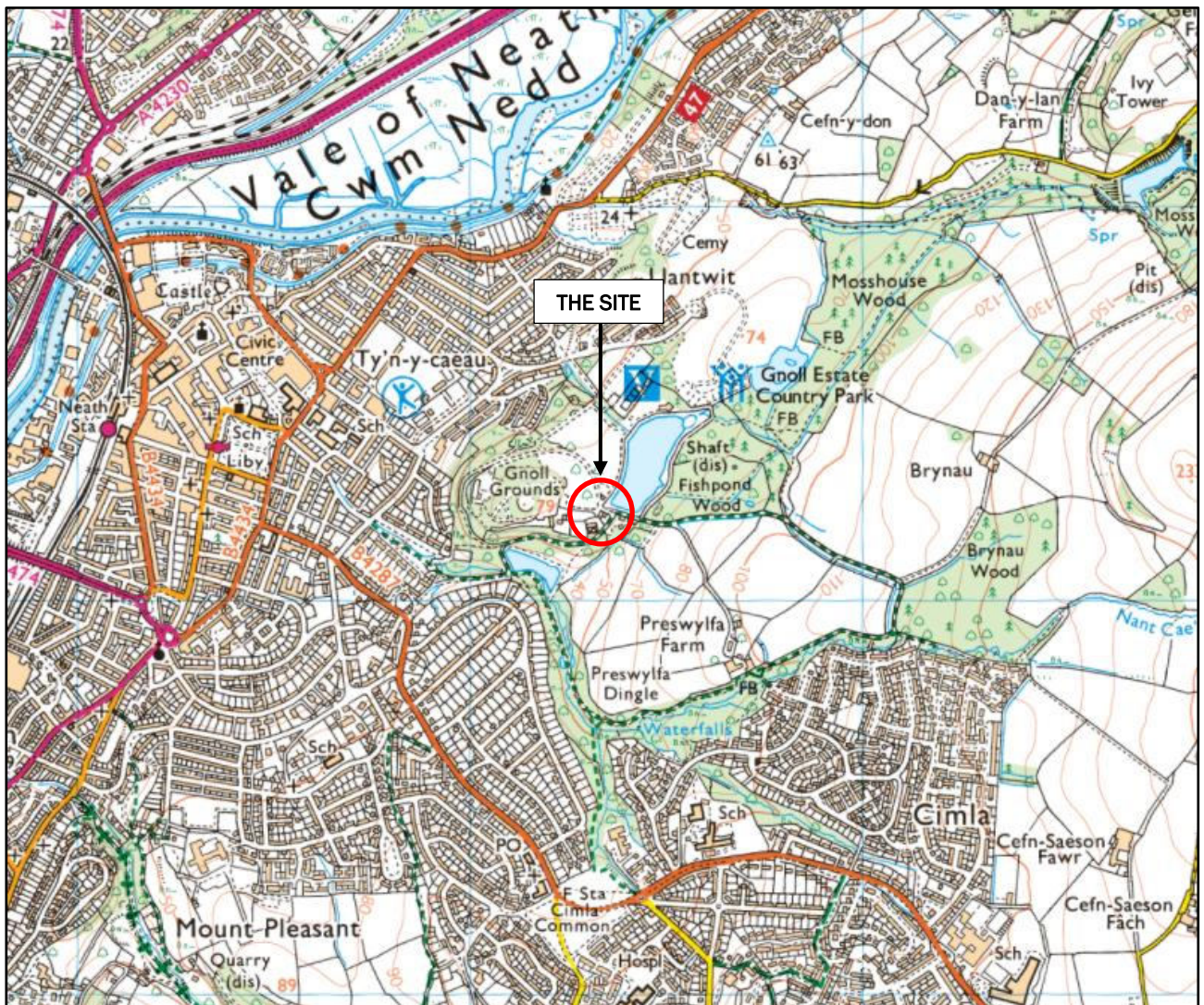
This report represents the factual findings of the scope of works provided by the designer, relating to the proposed development. The scope of works did not require any interpretation or assessment of the data and we understand that this is being undertaken by the designer.

2 Site Setting

The site description is largely based on a field reconnaissance and site inspection visit made at the site on 11th December 2023 during generally dry weather.

2.1 Site Location and Description

The site is located within Gnoll Park in the east extent of the town of Neath, north of Cimla, within Neath Port Talbot County Borough. The National Grid Reference of the approximate centre of the site is (SS) 276326, 197215 and the nearest postcode is SA11 3QJ. A Site Location Plan is presented as Insert 1 below.



Insert 1 - Site Location Plan from Ordnance Survey 1:25,000 scale map.
Reproduced with permission (OS License No.: AL100015788).

The site comprises an irregular shaped parcel of land and is occupied by several buildings/outbuildings associated with the former Gnoll Estate. The site is a mixture of hardstanding, grass, and roughly vegetated areas within the existing Gnoll Country park. Vehicular access to the site is currently gained via an access road through the park from the south off Cimla road.

The general topography in the area slopes to the north to the Afon Nedd. The site itself has variable levels between approximately 64m AOD and 66m AOD.

The designer provided ESP with a series of plans/surveys showing the locations of recorded underground services at the site and in the vicinity. These were utilised by ESP to safely locate all investigation points and where required, adjust any proposed positions provided by the designer so as not to damage any existing services.

2.2 Previous Investigations and Assessments

ESP have previously undertaken a Coal Mining Risk Assessment (CMRA) for the Client in June 2023 (ref: ESP.8603.3901 – Phase 1 Coal Mining Risk Assessment).

We understand an investigation has been undertaken by others prior to the current phase of works. No details have been provided.

2.3 Geological Setting

The published 1:50,000 scale geological map for the area of the site (Sheet 247), available on the website of the British Geological Survey, 2023) indicates the site to be underlain by bedrock of the Pennant Sandstone Formation. Made Ground may also be present given the historical development in this area.

This geological succession is confirmed in the designer's specification (Jubb, 2023).

2.4 Unexploded Ordnance

A Preliminary (Pre-Desk Study) UXO Desk Study assessment of risk has been completed by a specialist Ordnance consultant in accordance with CIRIA guidelines (Stone et al, 2009) and is presented in Appendix A (Zetica, 2023).

The assessment concludes that '*a detailed desk study, whilst always prudent, is not considered essential in this instance.*'

3 Exploratory Investigation

The scope of works was provided by the designer (Jubb, 2023).

3.1 Investigation Points

3.1.1 Introduction

The intrusive investigation was undertaken between the 11th and 15th December 2023 in accordance with BS5930:2020 and was designed by Jubb. It comprised rotary boreholes only.

Gas and groundwater monitoring is now complete, with 4no. fortnightly visits undertaken between the 22nd of December 2023 and the 2nd of February 2024.

The exploratory holes were supervised and logged by an engineering geologist in general accordance with BS5930:2020, BS EN ISO 14688-1:2002, BS EN ISO 14688-2:2018, and BS EN ISO 14689:2018, along with published weathering schemes. The investigation point positions are shown on Figure 1 (provided by the designer).

The ground levels and coordinates of the investigation points were surveyed during a monitoring visit using a GEODE GPS (+/- 0.3m AOD). The recorded levels and coordinates are presented on the investigation point records and summarised in Table 1 in Section 3.2.

3.1.2 Investigation Strategy

The investigation strategy was indicated in the designer's specification (Jubb, 2023) and the positions of the investigation points were provided by the designer prior to the works, as per the drawing presented in the specification document (ref: Appendix A - Ground Investigation Location Plan).

Where required, positions were altered relative to existing services/obstructions.

All exploratory holes were terminated in line with the specification and confirmed with the designer, with the exception of BH03, which was terminated at 27m due to the identification of possible backfilled workings; this was agreed with the designer.

3.1.3 Rotary Cored Drillholes

BH02 was constructed using rotary coring methods and where feasible, dynamic sampling was undertaken within the shallow deposits. It was completed between the 11th and 13th December 2023 to a depth of 15.0m. The borehole record is presented in Appendix B and the position is shown on Figure 1. Photographic core records are presented as Appendix C.

The shallow soils within the drillhole were attempted to be recovered using dynamic sampling techniques, whereby the soil is collected within plastic lined sampling tubes, which are then split to allow sampling and logging. The windowless sampling provided limited recovery to the depth of refusal.

Difficulties were encountered when attempting to dynamic sample the shallow soils, as the soils were likely too dense, or an obstruction (cobble) limited penetration.

Cores of nominal 92mm diameter were progressed following refusal of the dynamic sampling, recovered initially in plastic liners using a triple tube barrel system, over runs of nominal 1.5m length. The recovered cores were sealed in the plastic liners and placed in solid core boxes to prevent disturbance and swelling before logging.

The plastic liners were only cut immediately prior to logging and sampling. In addition to the nature of the rock material, the identified fractures within the rock mass were also logged in accordance with BS5930:2020 and BS EN ISO 14689:2:2018.

The Rock Quality Designation (RQD) could not be recorded as the recovered rock samples were all non-intact. Due to the poor core recovery and quality, accurate descriptions of the ground conditions throughout the borehole were limited.

Air mist was used as a flushing medium to keep the drill bits cool and return chippings to the surface.

On completion, instrumentation was installed in the borehole as instructed by the designer and detailed in Section 3.3.

3.1.4 Rotary Open-hole Drillholes

2no. 100mm diameter rotary percussive open hole drillholes (BH01 and BH03) were constructed to depths of between 27m and 30m between 13th and 15th December 2023. The borehole records are presented in Appendix B and their positions are shown on Figure 1.

At the commencement of each borehole, a square of the grass landscaping was cut, and a service inspection pit excavated by hand to a depth of 1.2m.

The ODEX 115 system of simultaneous drilling and casing was used in the superficial/weathered deposits, and the depth of casing in each drillhole is shown on the drillhole records.

Given that the objective of the drillholes was to intercept coal seams/workings, they were constructed under license to the Coal Authority (Permit ref. 27582.B). In accordance with Coal Authority requirements, given the proximity to occupied properties, air mist was used as a flushing medium to keep the drill bits cool and return chippings to the surface, and the levels of ground gas were recorded at the drillhole during the drilling works.

The drillholes were constructed with the objective of locating the rock-head profile and the depth to coal seams or possible abandoned workings. During the drilling process, the rock chippings returned to the surface were described by the driller and the rate of progress monitored. The recorded penetration rates during the construction of BH01 and BH03 are presented at the end of the borehole records in Appendix B. It should be noted that, although adequate for identification purposes, the nature of the drilling method does not permit an accurate description of the strata.

On completion, instrumentation was installed in the borehole as instructed by the designer and detailed in Section 3.23.2.

3.2 Survey Data – Investigation Points

Table 1: Survey Data – Investigation Points

Investigation Point	Easting	Northing	Ground level (m AOD)
BH01	276293	197221	67.8
BH02	276329	197220	66.6
BH03	276318	197201	65.2
Notes: 1. The ground levels and coordinates of the investigation points were surveyed using a GEODE GPS (+/- 0.3m AOD). 2. Positions of investigation points shown on Figure 1.			

3.3 Instrumentation

3.3.1 Gas Well Installations

The designer specified the construction details for monitoring installations following completion of each borehole. A 50mm diameter monitoring well was installed in boreholes in general accordance with BS8576:2013 to allow monitoring of hazardous ground gases.

The wells, comprising slotted plastic pipe with a gravel surround (the response zone), bentonite seals above the response zone, and a lockable vandal proof cover, were installed as detailed on the borehole records and summarised in the table below.

Table 2: Gas Well Installations

Well ID	Date of Installation	Response Zone depth	Response Zone Stratum
BH01	15/12/23	2.0m – 30.0m	Coal Measures Bedrock
BH02	13/12/23	2.0m – 15.0m	Possible Superficial Deposits/Weathered Coal Measures and Coal measures bedrock
BH03	14/12/23	2.0m – 25.0m	Coal Measures Bedrock
Notes: 1. Installation specified by Jubb. 2. Details of each monitoring well are presented on the individual borehole records (Appendix C). 3. Positions of boreholes shown on Figure 1.			

3.3.2 ‘Spot’ Gas Monitoring

The designer specified four fortnightly visits for the gas and groundwater monitoring (Jubb, 2023), which were completed between the 22nd of December 2023 and the 2nd of February 2024. The results of the gas and groundwater monitoring are presented in Appendix E.

The monitoring was undertaken in accordance with the CLAIRE mine gas guidance (CL:AIRE, 2021). During each visit, Gas Data LMSxi G3.18e portable monitoring equipment is used to measure levels of the following ground gases within the airspace in the wells and the flow rates from the wells:

- Methane - total and percentage of Lower Explosive limit (LEL).
- Carbon dioxide.
- Oxygen.
- Hydrogen sulphide.

The percentage of nitrogen is also calculated by difference. The equipment uses infra-red methane (CH₄) and carbon dioxide (CO₂) detectors, coupled with pressure (barometric and well), temperature and flow sensors. A photo-ionisation detector (PID) with a 10.6eV lamp was used during the monitoring to measure the levels of volatile organic compounds present in the well.

Following measurement of gas levels and flow rates, the well cap is removed, and groundwater levels are measured using a dipmeter from the site surface.

3.4 Sampling Strategy

3.4.1 Soil Sampling

Soil samples were collected from the exploratory holes as per the designer's specification.

Environmental samples (denoted as ES on the exploratory holes records) were collected for possible geo-environmental laboratory testing and generally comprised a plastic tub, an amber glass jar and an amber glass vial. The sample containers provided clean by the testing laboratory appropriate for the proposed testing to be scheduled.

Immediately after collection the samples were placed in sealed cool boxes where they remained during storage and transport to the laboratory. Samples for logging and geotechnical laboratory testing purposes were collected at regular intervals within the exploratory holes.

3.5 Evidence of Site Contamination Found During Site Works

No direct visual/olfactory evidence of contamination was identified in the exploratory holes.

Made Ground was identified across the site as detailed on the borehole records.

3.6 Geo-environmental & Geotechnical Laboratory Testing

In January 2024, the designer confirmed that no laboratory testing was required.

4 Summary of Ground Conditions

The below will be reviewed and revised following receipt of the final laboratory test results and prior to issue of the final report.

4.1 Geology

The exploratory holes have identified the site to be generally underlain by Made Ground overlying possible superficial deposits/weathered Coal measures bedrock, followed by competent bedrock.

Made Ground: encountered in all boreholes to a maximum depth of 1.7m (BH02). In general, the Made ground comprised reworked soils with anthropogenic materials.

Possible Superficial Deposits/Weathered Coal Measures: encountered in all boreholes to a maximum depth of 4.85m (BH02). It should be noted that the interface between the possible superficial deposits and weathered bedrock was difficult to determine in BH02 due to the poor recovery and quality of sample recovered.

In general, this stratum comprised brown clay, with fractions of sand, gravel, and cobbles.

Coal measures Bedrock: encountered to a maximum depth of 30m, generally as a grey sandstone with bands of mudstone.

In BH02, possible weathered coal was identified between 5.5, and 5.9m depth. In BH03, possible backfilled workings were identified between 23.1m and 24.8m depth, where soft ground, water ingress and loss of flush was noted by the driller. In BH01, soft mudstone with dark traces was noted between 24.4m and 26.6m depth.

4.2 Groundwater

The groundwater conditions identified in the investigation are summarised in the table below.

Table 3 - Summary of Groundwater Ingress in the Investigation

Hole ID	Stratum	Comment on groundwater encountered
BH01	Coal Measures Bedrock	Borehole damp at 24.4m (within zone of soft drilling). Groundwater level monitored between 14.54m and 20.88m.
BH02	Coal Measures Bedrock	Borehole wet from 6.5m. Groundwater level monitored between 2.09m and 2.90m.
BH03	Coal Measures Bedrock	Significant ingress of water at 23.1m (possible backfilled workings). Groundwater level monitored between 14.54 and 16.61m.
Notes: 1. Full details of groundwater ingress presented on exploratory hole records in Appendix B.		

5 References

BRITISH GEOLOGICAL SURVEY (BGS). 2023. Website accessed December 2023.

BRITISH STANDARDS INSTITUTION (BSI). 1990. Methods of Test for Soils for Civil Engineering Purposes. BS1377, Parts 1 to 9, HMSO, London.

BRITISH STANDARDS INSTITUTION (BSI). 2002. Geotechnical Investigation and Testing: Identification and Classification of Soil, Part 1. Identification and Description. BS EN ISO 14688-1. HMSO, London.

BRITISH STANDARDS INSTITUTION (BSI). 2018. Geotechnical Investigation and Testing: Identification and Classification of Soil, Part 2. Principles for Classification. BS EN ISO 14688-2:2018. HMSO, London.

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Appendix A

Pre-Desk Study Assessment

Site:	Gnoll Country Park, Neath, Wales
Client:	Earth Science Partnership
Contact:	Hywel Davies
Date:	1 st December 2023
Pre-WWI Military Activity on or Affecting the Site	None identified.
WWI Military Activity on or Affecting the Site	None identified.
WWI Strategic Targets (within 5km of Site)	The following strategic targets were located in the vicinity of the Site: ■ Transport infrastructure and public utilities.
WWI Bombing	None identified on the Site.
Interwar Military Activity on or Affecting the Site	None identified.
WWII Military Activity on or Affecting the Site	None identified on the Site. Gnoll House, approximately 0.2km northwest of the Site, was requisitioned as a training school for Air Raid Precaution (ARP) personnel.
WWII Strategic Targets (within 5km of Site)	The following strategic targets were located in the vicinity of the Site: ■ Transport infrastructure and public utilities. ■ Industries important to the war effort, including engineering works. ■ Military barracks, camps, and training areas. ■ Anti-Aircraft (AA) and anti-invasion defences.
WWII Bombing Decoys (within 5km of Site)	2No. The nearest was located approximately 2.6km northeast of the Site.
WWII Bombing	During WWII the Site was located in the Municipal Borough (MB) of Neath, which officially recorded 59No. High Explosive (HE) bombs with a bombing density of 13.6 bombs per 405 hectares (ha). No readily available records have been found to indicate that the Site was bombed.
Post-WWII Military Activity on or Affecting the Site	None identified on the Site. After WWII, Gnoll House fell into disuse and was demolished in 1957.
Recommendation	A detailed desk study, whilst always prudent, is not considered essential in this instance.
Further information	For information about Zetica's detailed UXO desk studies and other UXO services, please visit our website: www.zeticauxo.com . Details and downloadable resources covering the most common sources of UXO hazard affecting sites in the UK can be found here . If you have any further queries, please don't hesitate to get in contact with us at uxo@zetica.com or 01993 886 682.

Appendix B

Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:
Gnoll Park.

Site Location:
Neath.

Client:
Andrew Scott Ltd.

Project No:
8603.02

Drilling method
Rotary open hole

Equipment
Fraste.

Ground Level: 67.80 mOD

Easting: 276293 m

Northing: 197221 m

BH01

Start date: 14/12/2023

End date: 14/12/2023

Backfill date: 15/12/2023

Driller: APEX.

Logged by: APEX.

Date logged: 14/12/2023

Core Details and SPT Data							Strata Details			Water	Depth		Backfill/ Install- ations
Depth (Length)	TCR (%)	SCR (%)	RQD (%)	FI	Sample	SPT-N	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	
					0.50/ES		0.5	Roughly vegetated surface followed by: soft dark brown slightly sandy slightly gravelly CLAY. Rare fragments of possible brick. Probable reworked Topsoil. (MADE GROUND).			(0.70)		
					0.80/ES						0.70	67.10	
					1.00/D		1.0	Light orangish brown sandy gravelly CLAY with a low to medium rounded to subrounded sandstone cobble content. (Possible SUPERFICIAL DEPOSITS).			(0.50)		
						24 (6,8/8,7,5,4)					1.20	66.60	
							1.5	Brown CLAY. Driller's description only. (Possible SUPERFICIAL DEPOSITS). Dynamic sample refused at 1.2m. Progress via open hole drilling.			(0.50)		
											1.70	66.10	
							2.0	Weathered SANDSTONE. Driller's description only. (Possible weathered COAL MEASURES).			(0.60)		
											2.30	65.50	
							2.5	Grey SANDSTONE. Driller's description only. (COAL MEASURES)			(0.20)		
								SANDSTONE. Driller's description only. (COAL MEASURES)			2.50	65.30	
							3.0						
							3.5						
							4.0						
							4.5						
							5.0						
							5.5						
							6.0						
							6.5						
											(8.90)		

Progress & Standing Water Levels					Water Strikes							Hole Diameter		Casing Diameter	
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
												30.00	110	115	2.50

General Remarks

1. Grid reference and ground level to be surveyed during monitoring visits following completion of borehole construction.

2. Hand excavated service inspection pit constructed to 1.2m depth prior to drilling.

3. Drilling progressed by open hole method from 1.2m. Borehole terminated at 30m and installed with monitoring well (response zone 2m to 30m) as instructed by Jubb.

Earth Science Partnership Consulting Engineers Geologists Environmental Scientists			Project Name: Gnoll Park. Site Location: Neath. Client: Andrew Scott Ltd. Project No: 8603.02		Drilling method Rotary open hole Equipment Fraste. Ground Level: 67.80 mOD Easting: 276293 m Northing: 197221 m		BH01			
Start date: 14/12/2023 End date: 14/12/2023 Backfill date: 15/12/2023		Driller: APEX. Logged by: APEX. Date logged: 14/12/2023								

Core Details and SPT Data							Strata Details			Water	Depth		Backfill/ Install- ations
Depth (Length)	TCR (%)	SCR (%)	RQD (%)	FI	Sample	SPT-N	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	
								SANDSTONE. Driller's description only. (COAL MEASURES)					
							7.5						
							8.0						
							8.5						
							9.0						
							9.5						
							10.0						
							10.5						
							11.0						
							11.5	MUDSTONE. Driller's description only. (COAL MEASURES)			11.40	56.40	
							12.0						
							12.5						
							13.0						
							13.5						

Progress & Standing Water Levels					Water Strikes							Hole Diameter		Casing Diameter	
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
												30.00	110	115	2.50

General Remarks

1. Grid reference and ground level to be surveyed during monitoring visits following completion of borehole construction.

2. Hand excavated service inspection pit constructed to 1.2m depth prior to drilling.

3. Drilling progressed by open hole method from 1.2m. Borehole terminated at 30m and installed with monitoring well (response zone 2m to 30m) as instructed by Jubb.

Earth Science Partnership Consulting Engineers Geologists Environmental Scientists			Project Name: Gnoll Park.		Drilling method Rotary open hole		BH01			
			Site Location: Neath.		Equipment Fraste.					
Start date: 14/12/2023		Driller: APEX.		Client: Andrew Scott Ltd.		Ground Level: 67.80 mOD				
End date: 14/12/2023		Logged by: APEX.		Project No: 8603.02		Easting: 276293 m				
Backfill date: 15/12/2023		Date logged: 14/12/2023				Northing: 197221 m				

Core Details and SPT Data							Strata Details			Water	Depth		Backfill/ Install- ations
Depth (Length)	TCR (%)	SCR (%)	RQD (%)	FI	Sample	SPT-N	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	
							14.5	MUDSTONE. Driller's description only. (COAL MEASURES)			(6.20)		
							15.0						
							15.5						
							16.0						
							16.5						
							17.0						
							17.5						
							17.60	SANDSTONE. Driller's description only. (COAL MEASURES)			17.60	50.20	
							18.0						
							18.5						
							19.0						
							19.5						
							20.0						
							20.5						

Progress & Standing Water Levels					Water Strikes							Hole Diameter		Casing Diameter	
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
												30.00	110	115	2.50

General Remarks

1. Grid reference and ground level to be surveyed during monitoring visits following completion of borehole construction.

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3. Drilling progressed by open hole method from 1.2m. Borehole terminated at 30m and installed with monitoring well (response zone 2m to 30m) as instructed by Jubb.

Earth Science Partnership Consulting Engineers Geologists Environmental Scientists			Project Name: Gnoll Park. Site Location: Neath. Client: Andrew Scott Ltd. Project No: 8603.02		Drilling method Rotary open hole Equipment Fraste. Ground Level: 67.80 mOD Easting: 276293 m Northing: 197221 m		BH01		
Start date: 14/12/2023 End date: 14/12/2023 Backfill date: 15/12/2023		Driller: APEX. Logged by: APEX. Date logged: 14/12/2023							

Core Details and SPT Data							Strata Details			Water	Depth		Backfill/ Install- ations
Depth (Length)	TCR (%)	SCR (%)	RQD (%)	FI	Sample	SPT-N	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	
								SANDSTONE. Driller's description only. (COAL MEASURES)			(6.80)		
							21.5						
							22.0						
							22.5						
							23.0						
							23.5						
							24.0						
							24.5	Soft MUDSTONE with dark traces. Damp. Driller's description only. (COAL MEASURES)			24.40	43.40	
							25.0						
							25.5				(2.20)		
							26.0						
							26.5						
							27.0	SANDSTONE with mudstone bands. Driller's description only. (COAL MEASURES)			26.60	41.20	
							27.5						

Progress & Standing Water Levels					Water Strikes							Hole Diameter		Casing Diameter	
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
												30.00	110	115	2.50

General Remarks

1. Grid reference and ground level to be surveyed during monitoring visits following completion of borehole construction.

2. Hand excavated service inspection pit constructed to 1.2m depth prior to drilling.

3. Drilling progressed by open hole method from 1.2m. Borehole terminated at 30m and installed with monitoring well (response zone 2m to 30m) as instructed by Jubb.

Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:
Gnoll Park.

Site Location:
Neath.

Client:
Andrew Scott Ltd.

Project No:
8603.02

Drilling method
Rotary open hole

Equipment
Fraste.

Ground Level: 67.80 mOD

Easting: 276293 m

Northing: 197221 m

BH01

Start date: 14/12/2023

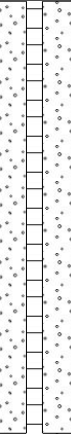
Driller: APEX.

End date: 14/12/2023

Logged by: APEX.

Backfill date: 15/12/2023

Date logged: 14/12/2023

Core Details and SPT Data							Strata Details			Water	Depth		Backfill/ Install- ations
Depth (Length)	TCR (%)	SCR (%)	RQD (%)	FI	Sample	SPT-N	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	
							28.5	SANDSTONE with mudstone bands. Driller's description only. (COAL MEASURES)			(3.40)		
							29.0						
							29.5						
							30.0				30.00	37.80	
							30.5						
							31.0						
							31.5						
							32.0						
							32.5						
							33.0						
							33.5						
							34.0						
							34.5						

Progress & Standing Water Levels					Water Strikes							Hole Diameter		Casing Diameter	
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
												30.00	110	115	2.50

General Remarks

1. Grid reference and ground level to be surveyed during monitoring visits following completion of borehole construction.

2. Hand excavated service inspection pit constructed to 1.2m depth prior to drilling.

3. Drilling progressed by open hole method from 1.2m. Borehole terminated at 30m and installed with monitoring well (response zone 2m to 30m) as instructed by Jubb.

Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:
Gnoll Park.

Site Location:
Neath.

Client:
Andrew Scott Ltd.

Project No:
8603.02

Drilling method
Rotary cored

Equipment
Fraste.

Ground Level: 66.60 mOD

Easting: 276329 m

Northing: 197220 m

BH02

Start date: 11/12/2023

Driller: APEX.

End date: 13/12/2023

Logged by: ESP-DT.

Backfill date: 13/12/2023

Date logged: 13/12/2023

Core Details and SPT Data							Strata Details			Water	Depth		Backfill/ Install- ations
Depth (Length)	TCR (%)	SCR (%)	RQD (%)	FI	Sample	SPT-N	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	
					0.30 - 0.40/B 0.30 - 0.40/ES 0.60/ES		0.5	Lightly vegetated surface followed by: soft brown and black slightly sandy gravelly silty CLAY. Gravel is fine- medium angular siltstone, sandstone and occasional slag. (MADE GROUND).			(0.50)		
					1.00/D 1.00 - 1.20/B 1.10/ES		1.0	Soft brown and black slightly sandy very gravelly silty CLAY with a low cobble content. Gravel is fine- medium angular siltstone and sandstone and occasional slag. (MADE GROUND).			0.50 (0.40)	66.10	
					1.20 - 1.70/D		1.5	Soft yellowish brown slightly gravelly CLAY. Gravel is fine medium angular slag and possible coal. (MADE GROUND).			0.90 (0.30)	65.70	
						38 (16,8/10,8,1 0,10)	2.0	Brown and black slightly sandy very gravelly silty CLAY with a low cobble content. Gravel is fine-medium angular siltstone and sandstone and occasional slag. (MADE GROUND).			1.20 (0.50)	65.40	
						21 (3,4/4,5,5,7)	2.5	CLAY. Driller's description only. (Possible SUPERFICIAL DEPOSITS/ GRADE VI/V COAL MEASURES).			1.70	64.90	
							3.0	Dynamic sample refused at 1.7m. Openhole to 2.5m.					
							3.5	No Recovery. (Possible SUPERFICIAL DEPOSITS/WEATHERED COAL MEASURES).			(1.50)		
							4.0	Dynamic sample refused at 2.5m. Core run 2.5 to 4.0m - no recovery.					
						49 (11,14/12,1 5,12,10)	4.5	No Recovery. (Possible SUPERFICIAL DEPOSITS/WEATHERED COAL MEASURES).			4.00	62.60	
							5.0	Stiff brown slightly gravelly CLAY. Gravel comprises grey siltstone and sandstone. (Probable GRADE VI/V COAL MEASURES).			(0.85)		
					5.00/D		5.5	Black silty/clayey fine to coarse SAND of weathered coal. Possible weathered coal seam. (Probable GRADE VI/V COAL MEASURES).			4.85 (0.65)	61.75	
5.50 - 6.50 (1.00)	90	25	0	NI	5.50 - 6.50/B 6.00/D	50 (10,15/50 for 65mm)	6.0	Stiff to very stiff brown very gravelly CLAY. Gravel comprises grey siltstone and sandstone. (Probable GRADE VI/ V COAL MEASURES).			5.50 (0.40)	61.10	
					6.40 - 6.50/D	50 (25 for 0mm/50 for 0mm)	6.5	Probably medium strong to strong grey with orange and orangish black staining fine grained SANDSTONE recovered as: grey with orange and			5.90 (0.10)	60.70	
											6.00 (1.15)	60.60	

Progress & Standing Water Levels					Water Strikes					Hole Diameter			Casing Diameter	
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed		Hole Depth	Hole Diameter
													15.00	76
														115
														6.50

General Remarks

1. Grid reference and ground level to be surveyed during monitoring visits following completion of borehole construction.

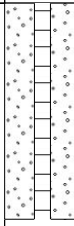
2. Hand excavated service inspection pit constructed to 1.2m depth prior to drilling.

3. Drilling progressed by dynamic sampling from 1.2m with a combination of dynamic sampling and coring as detailed on borehole record.

4. Poor core recovery and quality prevented accurate description of the ground conditions throughout the borehole.

5. Borehole terminated at 15m depth as instructed by Jubb. Borehole wet from 6.5m. Borehole installed with monitoring well (response zone 2m - 15m) as instructed by Jubb.

Earth Science Partnership Consulting Engineers Geologists Environmental Scientists			Project Name: Gnoll Park. Site Location: Neath. Client: Andrew Scott Ltd. Project No: 8603.02		Drilling method Rotary cored Equipment Fraste. Ground Level: 66.60 mOD Easting: 276329 m Northing: 197220 m		BH02		
Start date: 11/12/2023 End date: 13/12/2023 Backfill date: 13/12/2023		Driller: APEX. Logged by: ESP-DT. Date logged: 13/12/2023							

Core Details and SPT Data							Strata Details			Water	Depth		Backfill/Install-		
Depth (Length)	TCR (%)	SCR (%)	RQD (%)	FI	Sample	SPT-N	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	Install-		
13.50 - 15.00 (1.50)	13	0	0	NI	50 (25 for 0mm/50 for 0mm)		14.5	Probable extremely weak to very weak brown with grey patches fine-medium rained MUDSTONE. (Probable GRADE II/III COAL MEASURES).			(1.30)	51.60			
							15.0	Probably medium strong to strong grey with orange and orangish black staining fine grained SANDSTONE recovered as: grey with orange and orangish black staining medium coarse angular sandstone GRAVEL with a low angular cobble content.			15.00				
							15.5	(Probable GRADE II/III COAL MEASURES).							
								Possible core loss. No recovery.							
								(Probable COAL MEASURES).							
							16.0								
							16.5								
							17.0								
							17.5								
							18.0								
							18.5								
							19.0								
							19.5								
							20.0								
							20.5								

Progress & Standing Water Levels					Water Strikes						Hole Diameter			Casing Diameter	
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
												15.00	76	115	6.50

General Remarks

1. Grid reference and ground level to be surveyed during monitoring visits following completion of borehole construction.

2. Hand excavated service inspection pit constructed to 1.2m depth prior to drilling.

3. Drilling progressed by dynamic sampling from 1.2m with a combination of dynamic sampling and coring as detailed on borehole record.

4. Poor core recovery and quality prevented accurate description of the ground conditions throughout the borehole.

5. Borehole terminated at 15m depth as instructed by Jubb. Borehole wet from 6.5m. Borehole installed with monitoring well (response zone 2m - 15m) as instructed by Jubb.

Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:

Gnoll Park.

Site Location:

Neath.

Client:

Andrew Scott Ltd.

Project No:

8603.02

Drilling method

Rotary open hole

Equipment

Fraste.

Ground Level:

65.20 mOD

Easting:

276318 m

Northing:

197201 m

BH03

Start date:

13/12/2023

End date:

13/12/2023

Backfill date:

14/12/2023

Driller:

APEX.

Logged by:

APEX.

Date logged:

13/12/2023

Core Details and SPT Data							Strata Details			Water	Depth		Backfill/Installations
Depth (Length)	TCR (%)	SCR (%)	RQD (%)	FI	Sample	SPT-N	Depth	Description	Legend	Strikes/Standing	Depth (Thickness)	mOD	
					0.30/ES			Grass surface followed by: dark blackish brown slightly silty gravelly SAND. Fragments of brick, coal and possible slag noted. (MADE GROUND).			(0.80)		
					0.60/ES		0.5						
					1.00/ES		1.0	CLAY & BOULDERS. Driller's description only. (Possible SUPERFICIAL DEPOSITS/COAL MEASURES)			0.80 (0.20)	64.40	
						50 (25 for 85mm/50 for 35mm)	1.00				1.00 (0.20)	64.20	
							1.20	Unable to progress hand excavated trial pit below 0.8m due to density of ground. Progress via open hole drilling.			1.20 (0.80)	64.00	
							1.5						
							2.0	Weathered SANDSTONE. Driller's description only. (Possible weathered COAL MEASURES).			2.00	63.20	
							2.5	Grey SANDSTONE. Hard drilling. Driller's description only. (COAL MEASURES)					
							2.5	Grey SANDSTONE. Driller's description only. (COAL MEASURES)					
							3.0						
							3.5						
							4.0						
							4.5				(4.60)		
							5.0						
							5.5						
							6.0						
							6.5						
							6.5	MUDSTONE. Driller's description only. (COAL MEASURES)			6.60	58.60	

Progress & Standing Water Levels					Water Strikes							Hole Diameter		Casing Diameter	
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
					13/12/2023	12:00	23.10	2.00	0.00	0.00		27.00	110	115	2.00

General Remarks

1. Grid reference and ground level to be surveyed during monitoring visits following completion of borehole construction.

2. Hand excavated service inspection pit constructed to 1.2m depth prior to drilling.

3. Drilling progressed by open hole method from 1.2m. Borehole terminated at 27m due to difficulties drilling beyond probable backfilled workings - agreed with Jubb.

4. Borehole backfilled to 25m - attempted to clear out however drill rods becoming tight below 25m.

5. Borehole installed with monitoring well (response zone 2m to 25m) as instructed by Jubb.

Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:
Gnoll Park.

Site Location:
Neath.

Client:
Andrew Scott Ltd.

Project No:
8603.02

Drilling method
Rotary open hole

Equipment
Fraste.

Ground Level: 65.20 mOD

Easting: 276318 m

Northing: 197201 m

BH03

Start date: 13/12/2023

Driller: APEX.

End date: 13/12/2023

Logged by: APEX.

Backfill date: 14/12/2023

Date logged: 13/12/2023

Core Details and SPT Data							Strata Details			Water	Depth		Backfill/ Install- ations
Depth (Length)	TCR (%)	SCR (%)	RQD (%)	FI	Sample	SPT-N	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	
							7.5	MUDSTONE. Driller's description only. (COAL MEASURES)					
							8.0						
							8.5						
							9.0						
							9.5				(5.70)		
							10.0						
							10.5						
							11.0						
							11.5						
							12.0						
							12.5	Grey SANDSTONE. Driller's description only. (COAL MEASURES)			12.30	52.90	
							13.0						
							13.5						

Progress & Standing Water Levels					Water Strikes							Hole Diameter		Casing Diameter	
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
					13/12/2023	12:00	23.10	2.00	0.00	0.00		27.00	110	115	2.00

General Remarks

1. Grid reference and ground level to be surveyed during monitoring visits following completion of borehole construction.

2. Hand excavated service inspection pit constructed to 1.2m depth prior to drilling.

3. Drilling progressed by open hole method from 1.2m. Borehole terminated at 27m due to difficulties drilling beyond probable backfilled workings - agreed with Jubb.

4. Borehole backfilled to 25m - attempted to clear out however drill rods becoming tight below 25m.

5. Borehole installed with monitoring well (response zone 2m to 25m) as instructed by Jubb.

Earth Science Partnership Consulting Engineers Geologists Environmental Scientists			Project Name: Gnoll Park. Site Location: Neath. Client: Andrew Scott Ltd. Project No: 8603.02		Drilling method Rotary open hole Equipment Fraste. Ground Level: 65.20 mOD Easting: 276318 m Northing: 197201 m		BH03		
Start date: 13/12/2023 End date: 13/12/2023 Backfill date: 14/12/2023		Driller: APEX. Logged by: APEX. Date logged: 13/12/2023							

Core Details and SPT Data							Strata Details			Water	Depth		Backfill/ Install- ations
Depth (Length)	TCR (%)	SCR (%)	RQD (%)	FI	Sample	SPT-N	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	
								Grey SANDSTONE. Driller's description only. (COAL MEASURES)					
							14.5						
							15.0						
							15.5						
							16.0						
							16.5						
							17.0						
							17.5						
							18.0				(10.80)		
							18.5						
							19.0						
							19.5						
							20.0						
							20.5						

Progress & Standing Water Levels					Water Strikes							Hole Diameter		Casing Diameter	
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
					13/12/2023	12:00	23.10	2.00	0.00	0.00		27.00	110	115	2.00

General Remarks

1. Grid reference and ground level to be surveyed during monitoring visits following completion of borehole construction.

2. Hand excavated service inspection pit constructed to 1.2m depth prior to drilling.

3. Drilling progressed by open hole method from 1.2m. Borehole terminated at 27m due to difficulties drilling beyond probable backfilled workings - agreed with Jubb.

4. Borehole backfilled to 25m - attempted to clear out however drill rods becoming tight below 25m.

5. Borehole installed with monitoring well (response zone 2m to 25m) as instructed by Jubb.

Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:
Gnoll Park.

Site Location:
Neath.

Client:
Andrew Scott Ltd.

Project No:
8603.02

Drilling method
Rotary open hole

Equipment
Fraste.

Ground Level: 65.20 mOD

Easting: 276318 m

Northing: 197201 m

BH03

Start date: 13/12/2023

Driller: APEX.

End date: 13/12/2023

Logged by: APEX.

Backfill date: 14/12/2023

Date logged: 13/12/2023

Core Details and SPT Data							Strata Details			Water	Depth		Backfill/ Install- ations
Depth (Length)	TCR (%)	SCR (%)	RQD (%)	FI	Sample	SPT-N	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	
							21.5	Grey SANDSTONE. Driller's description only. (COAL MEASURES)					
							22.0						
							22.5						
							23.0						
							23.10	Soft drill. Lost air flush. Borehole wet. (POSSIBLE BACKFILLED WORKINGS).		→	23.10	42.10	
							23.5						
							24.0				(1.70)		
							24.5						
							24.80					40.40	
							25.0	Normal to hard drill. No returns. Driller's description only. (COAL MEASURES)					
							25.5						
							26.0				(2.20)		
							26.5						
							27.0				27.00	38.20	
							27.5						

Progress & Standing Water Levels					Water Strikes							Hole Diameter		Casing Diameter	
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
					13/12/2023	12:00	23.10	2.00	0.00	0.00		27.00	110	115	2.00

General Remarks

1. Grid reference and ground level to be surveyed during monitoring visits following completion of borehole construction.

2. Hand excavated service inspection pit constructed to 1.2m depth prior to drilling.

3. Drilling progressed by open hole method from 1.2m. Borehole terminated at 27m due to difficulties drilling beyond probable backfilled workings - agreed with Jubb.

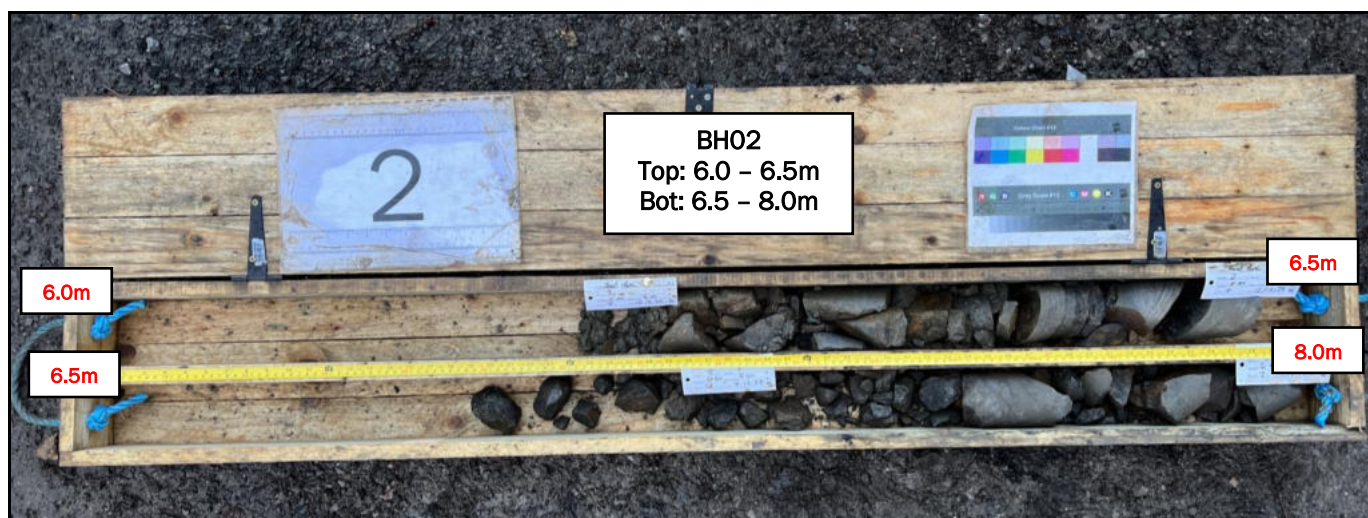
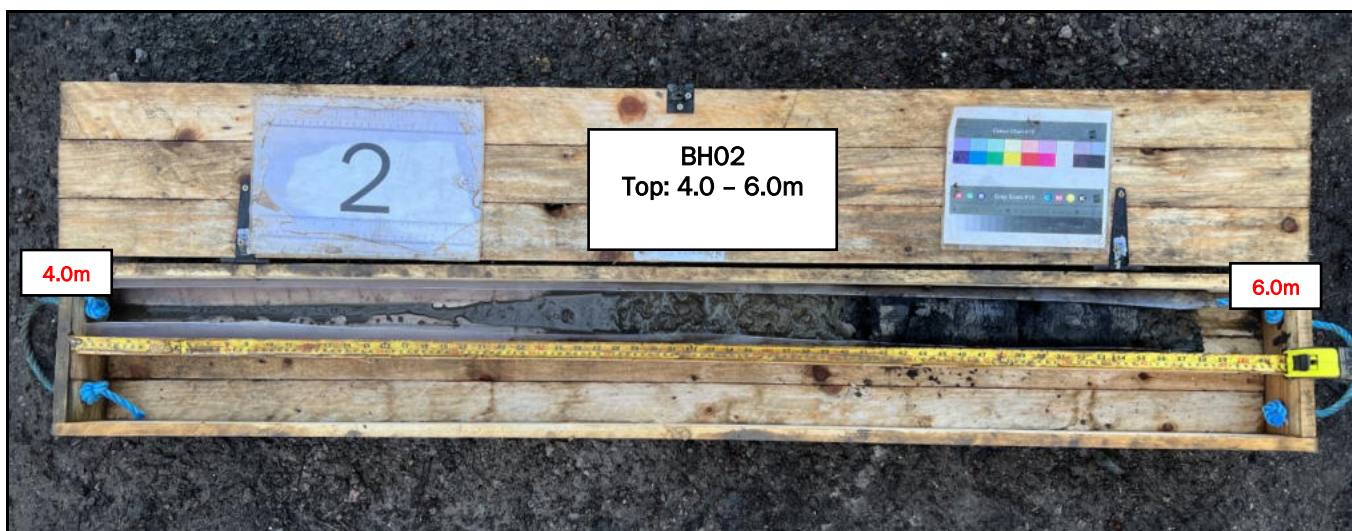
4. Borehole backfilled to 25m - attempted to clear out however drill rods becoming tight below 25m.

5. Borehole installed with monitoring well (response zone 2m to 25m) as instructed by Jubb.

ESP.8603.02
GNOLL PARK, NEATH
ROTARY DRILLING RECORDS - DRILLING PENETRATION TIMES (BH01 & BH03)

BH01			
Drill Depth		Time	
From (m):	To (m):	Minutes	Seconds
2.5	3.0	-	24
3.0	6.0	3	34
6.0	9.0	4	48
9.0	12.0	4	10
12.0	15.0	2	28
15.0	18.0	3	10
18.0	21.0	3	59
21.0	24.0	5	29
24.0	27.0	2	58
27.0	30.0	3	57
BH03			
2.0	3.0	2	27
3.0	6.0	6	3
6.0	9.0	2	15
9.0	12.0	2	25
12.0	15.0	5	10
15.0	18.0	5	28
18.0	21.0	6	36
21.0	24.0	3	49
24.0	27.0	4	7

Appendix C



PROJECT: GNOLL PARK
NEATH

PHOTOGRAPHIC BOREHOLE RECORD – BH02

esp
ENGINEERS
GEOLOGISTS
SCIENTISTS

EARTH SCIENCE PARTNERSHIP

33 Cardiff Road, Taff's Well, Cardiff CF15 7RB

Tel: 029 2081 3385 enquiries@earthsciencepartnership.com



PROJECT: GNOLL PARK
NEATH

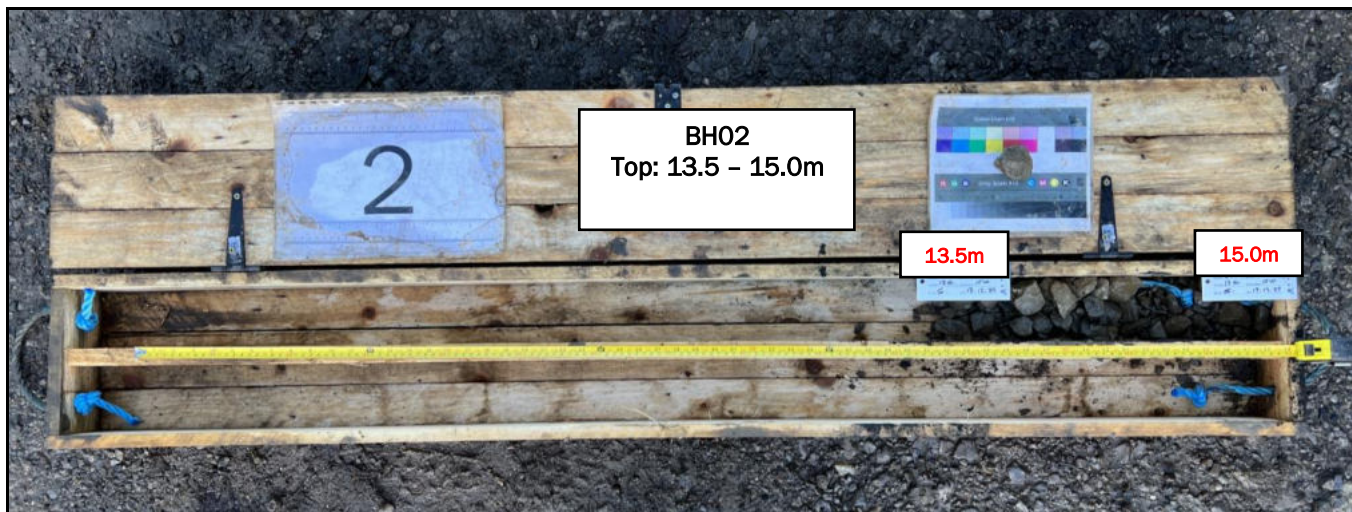
PHOTOGRAPHIC BOREHOLE RECORD - BH02

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PROJECT: GNOLL PARK
NEATH

PHOTOGRAPHIC BOREHOLE RECORD – BH02

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Tel: 029 2081 3385 enquiries@earthsciencepartnership.com

Appendix D



The Coal
Authority

Permit to Enter or Disturb Coal Authority Interests

Permit 27582.B

Name and Address of Permit Holder:

Neath Port Talbot County Borough Council
The Quays
Brunel Way
Baglan Energy Park
Neath
SA11 2GG

Site Location:

Gnoll Park
134 Fairyland
Neath
Neath Port Talbot
SA11 3EF

This certificate hereby grants the above named Permit Holder a Permit to carry out:-

Ground investigation by three boreholes to 40m to determine presence of shallow mine workings

within the Authority's interests at the identified site location above as shown on the Grant Permit Boundary (overleaf) for the period of **12 months** from the granted date shown below. *The granting of this Permit does not constitute advice given by the Authority in relation to the proposed operations. It is the Permit Holder's responsibility to obtain appropriate health, safety, environmental, technical and legal advice.*

Conditions:

- *Manned entry (i.e.) into mine entries/workings) is strictly prohibited.*
- *Air Mist flush*
- *Gas Monitoring CO, CH₄, CO₂, O₂, H₂S at borehole and rig*
- *Operators undertaking the work must be in possession of this certificate and the Permit boundary plan at the time of works*
- *Appropriate borehole sealing without delay and to withstand site level changes*

Signed: Helen Day Granted Date: _____

For and on behalf of The Coal Authority

Nominated Representative: Helen Day, Permitting Manager;

The Coal Authority, Permitting Office, 200 Lichfield Lane, Mansfield, Notts, NG18 4RG

Tel: 01623 637450; E-Mail: permissions@coal.gov.uk

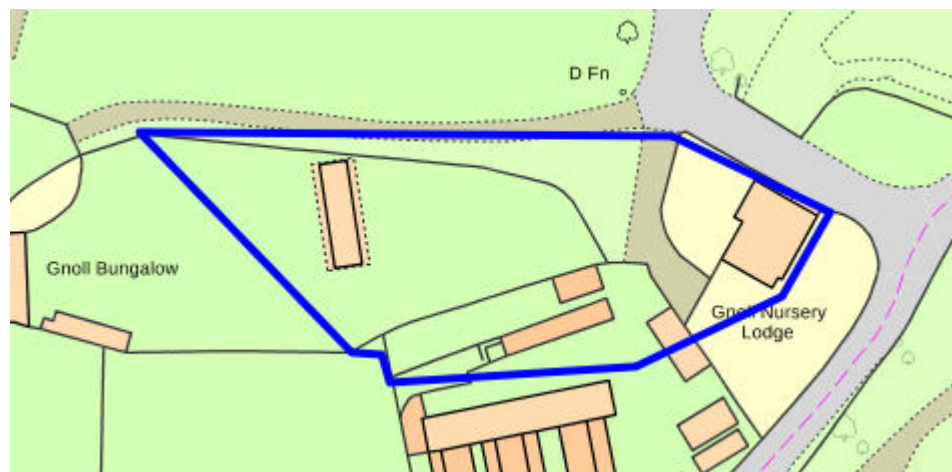


The Coal
Authority

Granted Permit Boundary

Permit Ref: 27582.B

Permit Boundary:



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Appendix E

COMMERCIAL/LEISURE DEVELOPMENT
GNOLL PARK, NEATH
Results of Hazardous Gas and Groundwater Monitoring
(Spot Monitoring)
ESP.8603.02



Monitoring Event **1**

Date:	22/12/2023	Atmospheric Pressure (start):	1.008 mb	Trend:	Rising
Time:	12:30	Atmospheric Pressure (end):	1.008 mb		
Engineer:	JA	Site Status:	Open Park		
Weather:	Dry, cool and overcast	Ground Conditions:	Waterlogged		
Instrument:	Gas Data LMSii G3.18e meter	Next Calibration Due Date:	02/08/2024		
Instrument:	Procheck 2000+ PID	Next Calibration Due Date:	06/09/2024		

Well ID:	BH01	Well dia.(mm):	50	Date installed:	15/12/2023		Response stratum:	Coal Measures Bedrock		
		Well depth (m):	30.67			Groundwater depth (m):	19.95			
Monitored Variables		dP (Pa)	LEL (%)	N ₂ (%)	CO ₂ (%)	CH ₄ (%)	O ₂ (%)	H ₂ S (ppm)	Flow (L/hr)	PID (ppm)
Immediate Reading		2.0	0.0	80.0	0.0	0.0	20.0	0.0	0.4	0.3
After 30 Seconds		0.0	0.0	79.8	0.0	0.0	20.2	0.0	0.0	0.7
After 1 Minute		0.0	0.0	79.9	0.0	0.0	20.1	0.0	0.0	0.5
After 2 Minutes		0.0	0.0	79.9	0.0	0.0	20.1	0.0	0.0	0.5
After 3 Minutes		0.0	0.0	79.9	0.0	0.0	20.1	0.0	0.0	0.5
After 4 Minutes		0.0	0.0	79.9	0.0	0.0	20.1	0.0	0.0	0.5
After 5 Minutes		0.0	0.0	79.9	0.0	0.0	20.1	0.0	0.0	0.5
After 6 Minutes		0.0	0.0	79.9	0.0	0.0	20.1	0.0	0.0	0.5
After 7 Minutes		0.0	0.0	79.9	0.0	0.0	20.1	0.0	0.0	0.5
After 8 Minutes		0.0	0.0	80.0	0.0	0.0	20.0	0.0	0.0	0.5
After 9 Minutes		0.0	0.0	80.0	0.0	0.0	20.0	0.0	0.0	0.5
After 10 Minutes		0.0	0.0	80.0	0.0	0.0	20.0	0.0	0.0	0.2
After 11 Minutes		0.0	0.0	80.0	0.0	0.0	20.0	0.0	0.0	0.2
After 12 Minutes		0.0	0.0	80.0	0.0	0.0	20.0	0.0	0.0	0.0
After 13 Minutes		0.0	0.0	80.0	0.0	0.0	20.0	0.0	0.0	0.0
After 14 Minutes		0.0	0.0	80.0	0.0	0.0	20.0	0.0	0.0	0.0
After 15 Minutes		0.0	0.0	80.0	0.0	0.0	20.0	0.0	0.0	0.0
After 16 Minutes		0.0	0.0	80.0	0.0	0.0	20.0	0.0	0.0	0.0
After 17 Minutes		0.0	0.0	80.0	0.0	0.0	20.0	0.0	0.0	0.0
After 18 Minutes		0.0	0.0	80.0	0.0	0.0	20.0	0.0	0.0	0.0
After 19 Minutes		0.0	0.0	80.0	0.0	0.0	20.0	0.0	0.0	0.0
After 20 Minutes		0.0	0.0	80.0	0.0	0.0	20.0	0.0	0.0	0.0
Steady State		0.0	0.0	80.0	0.0	0.0	20.0	0.0	0.0	0.0
	min	0.0	0.0	79.8	0.0	0.0	20.0	0.0	0.0	0.0
	max	2.0	0.0	80.0	0.0	0.0	20.2	0.0	0.4	0.7
Borehole Hazardous Gas Flow Rates Q _{NE} (max gas conc)					Methane:	0.00 L/hr	Carbon Dioxide	0.00 L/hr		
Borehole Hazardous Gas Flow Rates Q _{NE} (steady state gas conc)					Methane:	0.00 L/hr	Carbon Dioxide	0.00 L/hr		
Comments:		CO readings below limit of detection for duration.								

Well ID:	BH02	Well dia.(mm):	50	Date installed:	13/12/2023	Response stratum:	Coal Measures Bedrock			
		Well depth (m):	13.29			Groundwater depth (m):	2.73			
Monitored Variables		dP (Pa)	LEL (%)	N ₂ (%)	CO ₂ (%)	CH ₄ (%)	O ₂ (%)	H ₂ S (ppm)	Flow (L/hr)	PID (ppm)
Immediate Reading		-371.0	0.0	79.7	0.1	0.1	20.1	0.0	-34.9	0.2
After 30 Seconds		-14.0	0.0	79.4	1.5	0.1	19.0	0.0	-2.5	0.6
After 1 Minute		0.0	0.0	79.5	1.4	0.1	19.0	0.0	0.0	0.5
After 2 Minutes		0.0	0.0	79.5	1.5	0.1	18.9	0.0	0.0	0.5
After 3 Minutes		0.0	0.0	79.4	1.6	0.1	18.9	0.0	0.0	0.5
After 4 Minutes		0.0	0.0	79.4	1.6	0.1	18.9	0.0	0.0	0.5
After 5 Minutes		0.0	0.0	79.4	1.7	0.1	18.8	0.0	0.0	0.5
After 6 Minutes		0.0	0.0	79.4	1.7	0.1	18.8	0.0	0.0	0.5
After 7 Minutes		0.0	0.0	79.3	1.8	0.1	18.8	0.0	0.0	0.5
After 8 Minutes		0.0	0.0	79.3	1.9	0.1	18.7	0.0	0.0	0.5
After 9 Minutes		0.0	0.0	79.2	2.0	0.1	18.7	0.0	0.0	0.5
After 10 Minutes		0.0	0.0	79.3	2.0	0.1	18.6	0.0	0.0	0.5
After 11 Minutes		0.0	0.0	79.2	2.1	0.1	18.6	0.0	0.0	0.5
After 12 Minutes		0.0	0.0	79.1	2.2	0.1	18.6	0.0	0.0	0.5
After 13 Minutes		0.0	0.0	79.1	2.3	0.1	18.5	0.0	0.0	0.5
After 14 Minutes		0.0	0.0	79.2	2.5	0.1	18.2	0.0	0.0	0.5
After 15 Minutes		0.0	0.0	79.3	3.1	0.1	17.5	0.0	0.0	0.5
After 16 Minutes		0.0	0.0	79.7	3.7	0.1	16.5	0.0	0.0	0.5
After 17 Minutes		0.0	0.0	80.3	4.2	0.1	15.4	0.0	0.0	0.5
After 18 Minutes		0.0	0.0	80.5	4.4	0.1	15.0	0.0	0.0	0.5
After 19 Minutes		0.0	0.0	80.6	4.5	0.1	14.8	0.0	0.0	0.5
After 20 Minutes		0.0	0.0	80.6	4.5	0.1	14.8	0.0	0.0	0.5
Steady State		0.0	0.0	80.6	4.5	0.1	14.8	0.0	0.0	0.5
min		-371.0	0.0	79.1	0.1	0.1	14.8	0.0	-34.9	0.2
max		0.0	0.0	80.6	4.5	0.1	20.1	0.0	0.0	0.6
Borehole Hazardous Gas Flow Rates Q _{NE} (max gas conc)				Methane:		0.00 L/hr	Carbon Dioxide		0.00 L/hr	
Borehole Hazardous Gas Flow Rates Q _{NE} (steady state gas conc)				Methane:		0.00 L/hr	Carbon Dioxide		0.00 L/hr	
Comments: CO readings below limit of detection for duration.										

Well ID:	BH03	Well dia.(mm):	50	Date installed:	14/12/2023	Response stratum:	Coal Measures Bedrock			
		Well depth (m):	26.14			Groundwater depth (m):	15.86			
Monitored Variables		dP (Pa)	LEL (%)	N ₂ (%)	CO ₂ (%)	CH ₄ (%)	O ₂ (%)	H ₂ S (ppm)	Flow (L/hr)	PID (ppm)
Immediate Reading		0.0	0.0	79.8	0.1	0.1	20.0	0.0	0.0	0.2
After 30 Seconds		0.0	0.0	79.6	0.1	0.1	20.2	0.0	0.0	0.3
After 1 Minute		0.0	0.0	79.6	0.1	0.1	20.2	0.0	0.0	0.1
After 2 Minutes		0.0	0.0	79.6	0.1	0.1	20.2	0.0	0.0	0.0
After 3 Minutes		0.0	0.0	79.6	0.1	0.1	20.2	0.0	0.0	0.0
After 4 Minutes		0.0	0.0	79.6	0.1	0.1	20.2	0.0	0.0	0.0
After 5 Minutes		0.0	0.0	79.6	0.1	0.1	20.2	0.0	0.0	0.0
After 6 Minutes		0.0	0.0	79.6	0.1	0.1	20.2	0.0	0.0	0.0
After 7 Minutes		0.0	0.0	79.6	0.1	0.1	20.2	0.0	0.0	0.0
After 8 Minutes		0.0	0.0	79.6	0.1	0.1	20.2	0.0	0.0	0.0
After 9 Minutes		0.0	0.0	79.6	0.1	0.1	20.2	0.0	0.0	0.0
After 10 Minutes		0.0	0.0	79.6	0.1	0.1	20.2	0.0	0.0	0.0
Steady State		0.0	0.0	79.6	0.1	0.1	20.2	0.0	0.0	0.0
min		0.0	0.0	79.6	0.1	0.1	20.0	0.0	0.0	0.0
max		0.0	0.0	79.8	0.1	0.1	20.2	0.0	0.0	0.3
Borehole Hazardous Gas Flow Rates Q _{NE} (max gas conc)					Methane:	0.00 L/hr	Carbon Dioxide	0.00 L/hr		
Borehole Hazardous Gas Flow Rates Q _{NE} (steady state gas conc)					Methane:	0.00 L/hr	Carbon Dioxide	0.00 L/hr		
Comments: CO readings below limit of detection for duration.										

Key:
dP - differential pressure (well-atmosphere)
LEL - Lower Explosive Limit (methane)
N₂ - nitrogen
CO₂ - carbon dioxide
CH₄ - methane
O₂ - oxygen
H₂S - Hydrogen sulphide
PID - measure of volatile organic compounds

esp

Date:	03/01/2024	Atmospheric Pressure (start):	979 mb	Trend:	Rising
Time:	12:20	Atmospheric Pressure (end):	980 mb		
Engineer:	NS	Site Status:	Open Park		
Weather:	Dry, cool and overcast with rain showers.	Ground Conditions:	Waterlogged		
Instrument:	Gas Data LMSx3 G3.18e meter	Next Calibration Due Date:	02/08/2024		
Instrument:	Phocheck 2000+ PID	Next Calibration Due Date:	06/09/2024		

Well ID:	BH02	Well dia.(mm):	50	Date Installed:	13/12/2023	Response stratum:	Coal Measures Bedrock			
		Well depth (m):	13.24			Groundwater depth (m):	2.09			
Monitored Variables		dP (Pa)	LEL (%)	N ₂ (%)	CO ₂ (%)	CH ₄ (%)	H ₂ S (ppm)	Flow L/hr	PID (ppm)	
Immediate Reading		-76.0	0.0	79.8	0.0	20.2	0.0	-9.4	0.0	
After 30 Seconds		-9.0	0.0	79.4	0.5	0.0	20.1	0.0	-1.6	1.0
After 1 Minute		0.0	0.0	79.6	0.3	0.0	20.1	0.0	0.0	0.9
After 2 Minutes		0.0	0.0	79.6	0.2	0.0	20.2	0.0	0.0	1.1
After 3 Minutes		0.0	0.0	79.7	0.1	0.0	20.2	0.0	0.0	1.4
After 4 Minutes		0.0	0.0	79.7	0.1	0.0	20.2	0.0	0.0	1.7
After 5 Minutes		0.0	0.0	79.7	0.1	0.0	20.2	0.0	0.0	1.2
After 6 Minutes		0.0	0.0	79.6	0.1	0.0	20.3	0.0	0.0	1.0
After 7 Minutes		0.0	0.0	79.6	0.1	0.0	20.3	0.0	0.0	0.8
After 8 Minutes		0.0	0.0	79.7	0.1	0.0	20.2	0.0	0.0	0.6
After 9 Minutes		0.0	0.0	79.7	0.1	0.0	20.2	0.0	0.0	1.1
After 10 Minutes		0.0	0.0	79.7	0.1	0.0	20.2	0.0	0.0	0.7
Steady State		0.0	0.0	79.7	0.0	0.0	20.3	0.0	0.0	0.7
	min	-76.0	0.0	79.4	0.0	0.0	20.3	0.0	-9.4	0.0
	max	0.0	0.0	79.8	0.5	0.0	20.3	0.0	0.0	1.7
Borehole Hazardous Gas Flow Rates Q _{avg} (max gas conc)					Methane:	0.00 L/hr	Carbon Dioxide	0.00 L/hr		
Borehole Hazardous Gas Flow Rates Q _{avg} (steady state gas conc)					Methane:	0.00 L/hr	Carbon Dioxide	0.00 L/hr		
Comments:		CO readings below limit of detection for duration.								

Well ID:	BH03	Well dia.(mm): 50	Date Installed:	14/12/2023	Response stratum:	Coal Measures Bedrock				
		Well depth (m): 26.04			Groundwater depth (m): 14.54					
Monitored Variables		dP (Pa)	LEL (%)	N ₂ (%)	CO ₂ (%)	CH ₄ (%)	O ₂ (%)	H ₂ S (ppm)	Flow L/hr	PID (ppm)
Immediate Reading		0.0	0.0	79.5	0.0	0.0	20.5	0.0	0.0	0.0
After 30 Seconds		0.0	0.0	79.6	0.1	0.0	20.3	0.0	0.0	0.1
After 1 Minute		0.0	0.0	79.6	0.2	0.0	20.2	0.0	0.0	0.3
After 2 Minutes		0.0	0.0	79.7	0.3	0.0	20.0	0.0	0.0	0.2
After 3 Minutes		0.0	0.0	79.8	0.5	0.0	19.7	0.0	0.0	0.4
After 4 Minutes		0.0	0.0	80.0	0.7	0.0	19.3	0.0	0.0	0.5
After 5 Minutes		0.0	0.0	80.4	1.0	0.0	18.6	0.0	0.0	0.3
After 6 Minutes		0.0	0.0	80.5	1.3	0.0	18.2	0.0	0.0	0.5
After 7 Minutes		0.0	0.0	80.8	1.6	0.0	17.6	0.0	0.0	0.4
After 8 Minutes		0.0	0.0	81.0	1.9	0.0	17.1	0.0	0.0	0.6
After 9 Minutes		0.0	0.0	81.2	2.1	0.0	16.7	0.0	0.0	0.3
After 10 Minutes		0.0	0.0	81.4	2.2	0.0	16.4	0.0	0.0	0.4
After 11 Minutes		0.0	0.0	81.6	2.3	0.0	16.1	0.0	0.0	0.5
After 12 Minutes		0.0	0.0	81.7	2.3	0.0	16.0	0.0	0.0	0.4
After 13 Minutes		0.0	0.0	81.9	2.3	0.0	15.8	0.0	0.0	0.7
After 14 Minutes		0.0	0.0	82.0	2.3	0.0	15.7	0.0	0.0	0.4
After 15 Minutes		0.0	0.0	81.9	2.3	0.0	15.8	0.0	0.0	0.4
After 16 Minutes		0.0	0.0	81.9	2.3	0.0	15.8	0.0	0.0	0.3
Steady State		0.0	0.0	81.9	2.3	0.0	15.8	0.0	0.0	0.3
	min	0.0	0.0	79.5	0.0	0.0	15.7	0.0	0.0	0.0
	max	0.0	0.0	82.0	2.3	0.0	20.5	0.0	0.0	0.7
Borehole Hazardous Gas Flow Rates Q _{hg} (max gas conc)				Methane:	0.00 L/hr	Carbon Dioxide	0.00 L/hr			
Borehole Hazardous Gas Flow Rates Q _{hg} (steady state gas conc)				Methane:	0.00 L/hr	Carbon Dioxide	0.00 L/hr			
Comments:		CO readings below limit of detection for duration.								

Key:	
dP - differential pressure (well-atmosphere)	CH ₄ - methane
LEL - Lower Explosive Limit (methane)	O ₂ - oxygen
N ₂ - nitrogen	H ₂ S - Hydrogen sulphide
CO ₂ - carbon dioxide	PID - measure of volatile organic compounds

COMMERCIAL/LEISURE DEVELOPMENT
GNOLL PARK, NEATH
Results of Hazardous Gas and Groundwater Monitoring
(Spot Monitoring)
ESP.8603.02



Monitoring Event **3**

Date:	17/01/2024	Atmospheric Pressure (start):	982 mb	Trend:	Steady
Time:	12:20	Atmospheric Pressure (end):	982 mb		
Engineer:	SW	Site Status:	Open Park		
Weather:	Dry, cold	Ground Conditions:	Waterlogged		
Instrument:	Gas Data LMSxi G3.18e meter	Next Calibration Due Date:	02/08/2024		
Instrument:	Phocheck 2000+ PID	Next Calibration Due Date:	06/09/2024		

Well ID:	BH01	Well dia.(mm):	50	Date installed:	15/12/2023	Response stratum:	Coal Measures Bedrock			
		Well depth (m):	30.34			Groundwater depth (m):	21.31			
Monitored Variables		dP (Pa)	LEL (%)	N ₂ (%)	CO ₂ (%)	CH ₄ (%)	O ₂ (%)	H ₂ S (ppm)	Flow (L/hr)	PID (ppm)
Immediate Reading		0.0	0.0	79.9	0.1	0.1	19.9	0.0	0.0	0.5
After 30 Seconds		0.0	0.0	86.4	6.0	0.1	7.5	0.0	0.0	0.6
After 1 Minute		0.0	0.0	86.9	6.2	0.1	6.8	0.0	0.0	0.5
After 2 Minutes		0.0	0.0	87.0	6.2	0.1	6.7	0.0	0.0	0.5
After 3 Minutes		0.0	0.0	87.0	6.2	0.1	6.7	0.0	0.0	0.7
After 4 Minutes		0.0	0.0	87.0	6.2	0.1	6.7	0.0	0.0	0.7
After 5 Minutes		0.0	0.0	87.1	6.2	0.1	6.6	0.0	0.0	0.5
After 6 Minutes		0.0	0.0	87.1	6.2	0.1	6.6	0.0	0.0	0.5
After 7 Minutes		0.0	0.0	87.2	6.2	0.1	6.5	0.0	0.0	0.7
After 8 Minutes		0.0	0.0	87.2	6.3	0.1	6.4	0.0	0.0	0.6
After 9 Minutes		0.0	0.0	87.2	6.3	0.1	6.4	0.0	0.0	0.5
After 10 Minutes		0.0	0.0	87.2	6.3	0.1	6.4	0.0	0.0	0.5
Steady State		0.0	0.0	87.2	6.3	0.1	6.4	0.0	0.0	0.5
min		0.0	0.0	79.9	0.1	0.1	6.4	0.0	0.0	0.5
max		0.0	0.0	87.2	6.3	0.1	19.9	0.0	0.0	0.7
Borehole Hazardous Gas Flow Rates Q _{bg} (max gas conc)				Methane:	0.00 L/hr	Carbon Dioxide	0.00 L/hr			
Borehole Hazardous Gas Flow Rates Q _{bg} (steady state gas conc)				Methane:	0.00 L/hr	Carbon Dioxide	0.00 L/hr			
Comments: CO readings below limit of detection for duration.										

Well ID:	BH02	Well dia.(mm):	50	Date installed:	13/12/2023	Response stratum:	Coal Measures Bedrock			
		Well depth (m):	13.20			Groundwater depth (m):	2.90			
Monitored Variables		dP (Pa)	LEL (%)	N ₂ (%)	CO ₂ (%)	CH ₄ (%)	O ₂ (%)	H ₂ S (ppm)	Flow (L/hr)	PID (ppm)
Immediate Reading		<<<	0.0	80.1	0.1	0.1	19.7	0.0	-65.0	0.7
After 30 Seconds		-1059.0	0.0	84.4	5.1	0.1	10.4	0.0	-55.0	0.7
After 1 Minute		-407.0	0.0	84.9	5.2	0.1	9.8	0.0	-32.0	0.8
After 2 Minutes		-262.0	0.0	84.9	5.2	0.1	9.8	0.0	-22.2	1.4
After 3 Minutes		-172.0	0.0	84.9	5.2	0.1	9.8	0.0	-15.0	2.0
After 4 Minutes		-112.0	0.0	84.9	5.2	0.1	9.8	0.0	-10.3	0.9
After 5 Minutes		-69.0	0.0	84.9	5.2	0.1	9.8	0.0	-7.0	1.1
After 6 Minutes		-39.0	0.0	84.9	5.2	0.1	9.8	0.0	-4.7	0.8
After 7 Minutes		-21.0	0.0	85.0	5.2	0.1	9.7	0.0	-3.3	0.7
After 8 Minutes		-12.0	0.0	85.0	5.2	0.1	9.7	0.0	-2.1	1.0
After 9 Minutes		-1.0	0.0	85.0	5.2	0.1	9.7	0.0	-0.9	0.8
After 10 Minutes		0.0	0.0	85.0	5.2	0.1	9.7	0.0	0.0	0.8
After 11 Minutes		0.0	0.0	85.0	5.2	0.1	9.7	0.0	0.0	0.7
After 12 Minutes		0.0	0.0	85.0	5.2	0.1	9.7	0.0	0.0	0.9
Steady State		0.0	0.0	85.0	5.2	0.1	9.7	0.0	0.0	0.7
min		-1059.0	0.0	80.1	<0.1	0.1	9.7	0.0	-65.0	0.7
max		0.0	0.0	85.0	5.2	0.1	19.7	0.0	0.0	2.0
Borehole Hazardous Gas Flow Rates Q _{bg} (max gas conc)				Methane:		0.00 L/hr		Carbon Dioxide	0.00 L/hr	
Borehole Hazardous Gas Flow Rates Q _{bg} (steady state gas conc)				Methane:		0.00 L/hr		Carbon Dioxide	0.00 L/hr	
Comments: CO readings below limit of detection for duration.										

Well ID:	BH03	Well dia.(mm):	50	Date installed:	14/12/2023	Response stratum:	Coal Measures Bedrock			
		Well depth (m):	26.04			Groundwater depth (m):	14.54			
Monitored Variables		dP (Pa)	LEL (%)	N ₂ (%)	CO ₂ (%)	CH ₄ (%)	O ₂ (%)	H ₂ S (ppm)	Flow (L/hr)	PID (ppm)
Immediate Reading		0.0	0.0	80.0	0.1	0.1	19.8	0.0	0.0	0.0
After 30 Seconds		0.0	0.0	78.1	4.4	0.1	17.4	0.0	0.0	0.0
After 1 Minute		0.0	0.0	78.2	4.4	0.1	17.3	0.0	0.0	0.0
After 2 Minutes		0.0	0.0	78.3	4.4	0.1	17.2	0.0	0.0	0.0
After 3 Minutes		0.0	0.0	78.3	4.4	0.1	17.2	0.0	0.0	0.0
After 4 Minutes		0.0	0.0	78.2	4.5	0.1	17.2	0.0	0.0	0.0
After 5 Minutes		0.0	0.0	78.2	4.5	0.1	17.2	0.0	0.0	0.0
After 6 Minutes		0.0	0.0	78.2	4.5	0.1	17.2	0.0	0.0	0.0
After 7 Minutes		0.0	0.0	78.2	4.5	0.1	17.2	0.0	0.0	0.0
After 8 Minutes		0.0	0.0	78.1	4.6	0.1	17.2	0.0	0.0	0.0
After 9 Minutes		0.0	0.0	78.1	4.6	0.1	17.2	0.0	0.0	0.0
After 10 Minutes		0.0	0.0	78.1	4.6	0.1	17.2	0.0	0.0	0.0
After 11 Minutes		0.0	0.0	78.1	4.6	0.1	17.2	0.0	0.0	0.0
After 12 Minutes		0.0	0.0	78.1	4.6	0.1	17.2	0.0	0.0	0.0
Steady State		0.0	0.0	78.1	4.6	0.1	17.2	0.0	0.0	0.0
	min	0.0	0.0	78.1	0.1	0.1	17.2	0.0	0.0	0.0
	max	0.0	0.0	80.0	4.6	0.1	19.8	0.0	0.0	0.0
Borehole Hazardous Gas Flow Rates Q _{bg} (max gas conc)				Methane:	0.00 L/hr	Carbon Dioxide	0.00 L/hr			
Borehole Hazardous Gas Flow Rates Q _{bg} (steady state gas conc)				Methane:	0.00 L/hr	Carbon Dioxide	0.00 L/hr			
Comments: CO readings below limit of detection for duration.										

Key:

dP - differential pressure (well-atmosphere)	CH ₄ - methane
LEL - Lower Explosive Limit (methane)	O ₂ - oxygen
N ₂ - nitrogen	H ₂ S - Hydrogen sulphide
CO ₂ - carbon dioxide	PID - measure of volatile organic compounds

esp

Date:	02/01/2024	Atmospheric Pressure (start):	1,021 mb	Trend:	Steady
Time:	09:30	Atmospheric Pressure (end):	982 mb		
Engineer:	JA	Site Status:	Open Park		
Weather:	Dry, cold	Ground Conditions:	Waterlogged		
Instrument:	Gas Data LMSx3 G3.18e meter	Next Calibration Due Date:	02/08/2024		
Instrument:	Phocheck 2000+ PID	Next Calibration Due Date:	06/09/2024		

Well ID:	BH02	Well dia.(mm): Well depth (m):	50 13.20	Date Installed:	13/12/2023	Response stratum: Groundwater depth (m):	Coal Measures Bedrock 2.67				
Monitored Variables		gP (Pa)		LEL (%)	N ₂ (%)	CO ₂ (%)	CH ₄ (%)	O ₂ (%)	H ₂ S (ppm)	Flow (L/hr)	PID (ppm)
Immediate Reading		0.0	0.0	0.0	79.9	0.1	0.0	20.0	0.0	0.0	0.2
After 30 Seconds		0.0	0.0	0.0	79.7	0.5	0.0	19.8	0.0	0.0	0.1
After 1 Minute		0.0	0.0	0.0	79.7	0.4	0.0	19.9	0.0	0.0	0.0
After 2 Minutes		0.0	0.0	0.0	79.7	0.3	0.0	20.0	0.0	0.0	0.0
After 3 Minutes		0.0	0.0	0.0	79.8	0.2	0.0	20.0	0.0	0.0	0.0
After 4 Minutes		0.0	0.0	0.0	79.7	0.2	0.0	20.1	0.0	0.0	0.0
After 5 Minutes		0.0	0.0	0.0	79.7	0.2	0.0	20.1	0.0	0.0	0.0
After 6 Minutes		0.0	0.0	0.0	79.8	0.1	0.0	20.1	0.0	0.0	0.0
After 7 Minutes		0.0	0.0	0.0	79.8	0.1	0.0	20.1	0.0	0.0	0.0
After 8 Minutes		0.0	0.0	0.0	79.8	0.1	0.0	20.1	0.0	0.0	0.0
After 9 Minutes		0.0	0.0	0.0	79.8	0.1	0.0	20.1	0.0	0.0	0.0
After 10 Minutes		0.0	0.0	0.0	79.8	0.1	0.0	20.1	0.0	0.0	0.0
Steady State		0.0	0.0	0.0	79.8	0.1	0.0	20.1	0.0	0.0	0.0
min		0.0	0.0	0.0	79.7	0.1	0.0	19.8	0.0	0.0	0.0
max		0.0	0.0	0.0	79.9	0.5	0.0	20.1	0.0	0.0	0.2
Borehole Hazardous Gas Flow Rates Q _{max} (max gas conc)				Methane:		0.00 L/hr	Carbon Dioxide		0.00 L/hr		
Borehole Hazardous Gas Flow Rates Q _{ss} (steady state gas conc)				Methane:		0.00 L/hr	Carbon Dioxide		0.00 L/hr		
Comments:		CO readings below limit of detection for duration.									

Well ID:	BH03	Well dia (mm): Well depth (m):	50 26.04	Date Installed:	14/12/2023	Response stream:	Coal Measures Bedrock		
Monitored Variables		dP (Pa)				Groundwater depth (m):	16.61		
Immediate Reading		LEL (%)	N ₂ (%)	CO ₂ (%)	CH ₄ (%)	O ₂ (%)	H ₂ S (ppm)	Flow (L/hr)	PID (ppm)
After 30 Seconds	0.0	0.0	79.9	0.0	0.0	20.1	0.0	0.0	0.0
After 1 Minute	0.0	0.0	78.4	3.0	0.0	18.6	0.0	0.0	0.2
After 2 Minutes	0.0	0.0	78.5	3.1	0.0	18.4	0.0	0.0	0.1
After 3 Minutes	0.0	0.0	78.4	3.2	0.0	18.4	0.0	0.0	0.0
After 4 Minutes	0.0	0.0	79.1	2.4	0.0	18.5	0.0	0.0	0.0
After 5 Minutes	0.0	0.0	79.8	0.9	0.0	19.3	0.0	0.0	0.0
After 6 Minutes	0.0	0.0	78.3	3.4	0.0	18.3	0.0	0.0	0.0
After 7 Minutes	0.0	0.0	78.3	3.5	0.0	18.2	0.0	0.0	0.0
After 8 Minutes	0.0	0.0	78.2	3.6	0.0	18.2	0.0	0.0	0.0
After 9 Minutes	0.0	0.0	79.7	1.0	0.0	19.3	0.0	0.0	0.0
After 10 Minutes	0.0	0.0	78.1	3.7	0.0	18.2	0.0	0.0	0.0
After 11 Minutes	0.0	0.0	78.3	3.5	0.0	18.2	0.0	0.0	0.0
After 12 Minutes	0.0	0.0	78.3	3.5	0.0	18.2	0.0	0.0	0.0
Steady State	0.0	0.0	78.3	3.5	0.0	18.2	0.0	0.0	0.0
min	0.0	0.0	78.1	0.0	0.0	18.2	0.0	0.0	0.0
max	0.0	0.0	79.9	3.7	0.0	20.1	0.0	0.0	0.2
Borehole Hazardous Gas Flow Rates Q _h (max gas conc)				Methane:	0.00 L/hr	Carbon Dioxide		0.00 L/hr	
Borehole Hazardous Gas Flow Rates Q _h (steady state gas conc)				Methane:	0.00 L/hr	Carbon Dioxide		0.00 L/hr	
Comments:	CO readings below limit of detection for duration.								

Key:	
dP - differential pressure (well-atmosphere)	CH ₄ - methane
LEL - Lower Explosive Limit (methane)	O ₂ - oxygen
N ₂ - nitrogen	H ₂ S - Hydrogen sulphide
CO ₂ - carbon dioxide	PID - measure of volatile organic compounds

General Notes

GENERAL NOTES

1. Earth Science Partnership (ESP) believes that providing information about limitations is essential to help clients identify and therefore manage their risks. These risks can be mitigated through further investigation or research, but they cannot be eliminated. This report may not be used for any purpose other than that for which it was commissioned.
2. This report includes available factual data for the site as obtained only from the sources described in the text. The data are related to the site on the basis of the site location and boundary information provided by the client. The findings and opinions conveyed in this assessment are based on the information obtained from a variety of sources as detailed in the report, which ESP believe are reliable. Nevertheless, ESP cannot and does not guarantee the authenticity or reliability of the information it has relied on. It is possible that the assessment failed to indicate the existence of further sources of information on the site. Assuming such sources do exist, their information could not have been considered in the formulation of the opinions and findings in this report. It should be recognised that different conditions on site may have existed between and subsequent to the various map surveys.
3. In preparing this report it has been assumed that all past and present occupants of the site have provided all relevant and other information, especially relating to known or potential hazards. This report is not required to identify insufficiencies or mistakes in the information provided by the user/owner or from any other source, but has sought to compensate for these where obvious in the light of other information.
4. Reports are normally prepared and written in the context of a stated purpose, and should not, therefore be used in a different context. Furthermore, new information, improved practices and legislation may necessitate an alteration to the report in whole or in part after its submission.
5. The opinions presented in this report are based on the findings derived from a site inspection, investigations and a review of historical and other records. The report details any indicators that may suggest that hazardous substances exist at the site at levels likely to warrant mitigation. Not finding such indicators does not mean that hazardous substances do not exist at the site. The most recent site inspection was undertaken as detailed within the report. Circumstances on sites are subject to change and certain indicators of the presence of hazardous substances that may have been latent at the time of this inspection may subsequently have become observable.
6. The work carried out for the assessment can only investigate a small portion of the subsurface conditions. Certain indicators or evidence of hazardous substances may have been outside the limited portion of the subsurface investigated, latent at the time of the work or only partially intercepted by the works, and thus their full significance could not be appreciated. In this regard, groundwater levels are particularly susceptible to variation and it should be noted that groundwater levels are subject to diurnal, seasonal, and climatic changes and are solely dependent on the time the ground investigation was carried out and the weather before and during the investigation.
7. Accordingly, it is possible that the assessment failed to indicate the presence or significance of hazardous substances. Assuming such substances exist, their presence could not have been considered in the formulation of the report's findings and opinions. The conclusions resulting from this study and contained in this report are not necessarily indicative of future conditions or operating practices at or adjacent to the site. Where differing ground conditions or suspect materials are encountered during future site works, additional specialist advice should be sought to assess whether the new information will materially affect the recommendations currently provided herein and whether further consideration is required. Any limiting factors should be assessed by an appropriately qualified specialist.
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