

Table 01. Summary of Findings		
Hand Dug Pits		
Location	Peat/Topsoil/Organic Soil	Underlying Strata
1	0.00 - 0.05 Soft, black, sandy gravelly organic SILT/CLAY	0.05 - 0.20 Light brown, slightly gravelly sandy CLAY
2	0.00 - 0.28 Soft, black, organic SILT/CLAY	0.28 - 0.35 Orange-brown, slightly gravelly sandy SILT/CLAY
3	>0.40 Soft, black, organic SILT/CLAY	-
4	0.00 - 0.50 Soft, black, organic sandy SILT/CLAY	0.50 - Obstruction (Sandstone Gravel - Cobble)
5	0.00 - 0.15 Soft, black, organic SILT/CLAY	0.15 - 0.20 Orange-brown, slightly gravelly sandy SILT/CLAY
6	>0.40 Very soft, black to dark brown, clayey PEAT	-
7	>0.40 Very soft, black to dark brown, clayey PEAT	-
8	0.0 - 0.05 Soft, black, organic SILT/CLAY	0.05 - 0.20 Brown, sandy gravelly CLAY
9	0.00 - 0.08 Soft, black, organic CLAY/SILT	0.08 - 0.20 Brown, sandy gravelly CLAY
10	0.00 - 0.10 Soft, black, slightly gravelly sandy organic CLAY/SILT	0.10 - 0.20 Brown, slightly gravelly sandy SILT/CLAY
11	Ground covered with forest debris. 0.00 - 0.20 Soft, black, slightly gravelly sandy organic CLAY/SILT	0.20 - 0.25 Brown, slightly gravelly sandy SILT/CLAY
12	0.00 - 0.20 Very soft, black, slightly sandy organic CLAY/SILT	0.20 - 0.30 Brown, sandy slightly gravelly SILT/CLAY
13	0.00 - 0.18 Very soft, black, slightly sandy clayey PEAT	0.18 - 0.30 Brown slightly gravelly, sandy SILT/CLAY
14	0.00 - 0.10 Soft, black, organic SILT/CLAY	0.10 - 0.60 Grey, occasionally gravelly, very sandy SILT/CLAY
15	0.00 - 0.18 Soft, black, organic SILT/CLAY	0.18 - 0.25 Light brown sandy CLAY with gravel to cobbles.
16	0.00 - 0.24 Soft, black, organic SILT/CLAY	0.24 - 0.30 Orange-brown, very sandy CLAY with occasional gravel
17	0.00 - 0.11 Soft, black, organic SILT/CLAY	0.11 Obstruction: Sandstone
18	0.00 - 0.15 Firm, black, very sandy organic SILT/CLAY	0.15 Obstruction: Sandstone
19	0.00 - 0.17 Dark-brown to black, sandy organic SILT/CLAY	0.17 - 0.25 Light orange-brown, very sandy CLAY with occasional gravel to cobble
20	0.00 - 0.18 Very soft, black, slightly clayey PEAT	0.18 Obstruction Sandstone Cobble
21	0.00 - 0.20 Very soft, black sandy clayey PEAT	0.20 Obstruction Sandstone Cobble
22	0.00 - 0.30 Very soft, black sandy clayey PEAT	0.30 Obstruction Sandstone Cobble
23	0.00 - 0.25 Dark-brown, very sandy CLAY/SILT	0.25 Obstruction Sandstone Cobble
24	0.00 - 0.28 Soft, black, organic SILT/CLAY	0.28 - 0.35 Orange-brown, slightly gravelly sandy SILT/CLAY
25	0.00 - 0.13 Very soft, black, slightly gravelly sandy clayey PEAT	0.13 - 0.16 Brown, clayey GRAVEL of sandstone
26	0.00 - 0.20 Very soft, brown, very gravelly CLAY	0.20 - Obstruction Sandstone Cobble
27	0.00 - 0.15 Black, sandy organic SILT/CLAY	0.15 - 0.20 Grey-brown, very sandy GRAVEL to COBBLE of sandstone.
28	0.00 - 0.05 Very soft, black, slightly gravelly organic SILT/CLAY	0.05 - 0.20 orange-brown, very sandy clayey GRAVEL to gravelly CLAY.
29		Clayey sandy GRAVEL to COBBLE of sandstone with occasional boulder in felled tree roots
30	0.00 - 0.20 Soft, brown to black, organic SILT/CLAY	0.20 - 0.25 Brown GRAVEL of sandstone
31	0.00 - 0.30 Dark brown to yellow-brown, slightly sandy organic rich SILT/CLAY	0.30 - 0.40 Light brown, sandy GRAVEL of sandstone
32		In Cutting: Sandy, very gravelly CLAY
33	In Cutting: Black organic SILT/CLAY	>0.25 Orange-brown to grey, very gravelly CLAY with cobbles and boulders
34	0.00 - 0.18 Black to brown, organic SILT/CLAY	0.18 - 0.25 Grey-brown sandy CLAY
35	0.00 - 0.25 Black to brown, organic SILT/CLAY	0.25 - 0.50 Grey-brown sandy CLAY
36	0.00 - 0.18 Black to brown, organic SILT/CLAY	0.18 - 0.30 Grey-brown sandy CLAY

Measurements in meters



TRL Probes were performed in the bog area where shallow groundwater and very soft deposits made hand digging difficult. A summary of the results is presented in Table 02.

Table 02: TRL Probe	
Penetration before Significant Resistance Encountered	
T1	0.70m
T2	>2.00m
T3	>2.00m
T4	>2.00m
T5	0.60m
T6	>2.00m
T7	0.75m
T8	0.45m
T9	0.81m
T10	>2.00m
T11	0.70m
T12	>2.00m
T13	>2.00m
T14	1.80m
T15	0.90m

Note: Cobles/boulders were occasionally encountered within the peat and these may have caused premature refusal (i.e. not necessarily the base of the peat).

It can be seen from the above data that the majority of soil profiles encountered less than 300mm of organic rich soil above a boulder clay/weathered bedrock or bedrock deposit.

Small areas of sphagnum, or sphagnum interspersed with other vegetations, were encountered across the site, as were reeds interspersed with other vegetations.

A substantial area of bog, dominated by sphagnum and reeds, with thick peat deposits (with the fibrous structure of sphagnum preserved) and or other very soft deposits, and a shallow/above ground water table, was encountered in the southeast of the site, around the pond area, as indicated by the brown shading on **Drawing 01**.

We trust that the above is to your satisfaction, however, if you have any queries or require any further information please do not hesitate to contact us. In the meantime we await your further instructions.

Yours sincerely
for: Terra Firma (Wales) Ltd

David Emanuel



ANNEX A – SELECTED PLATES



Hand Dug Pit – Location 25



Hand Dug Pit – Location 26





Hand Dug Pit – Location 27



Area of bog surrounding pond





Pole leaning in bog area (possibly due to very soft founding strata)



Eastern bog area





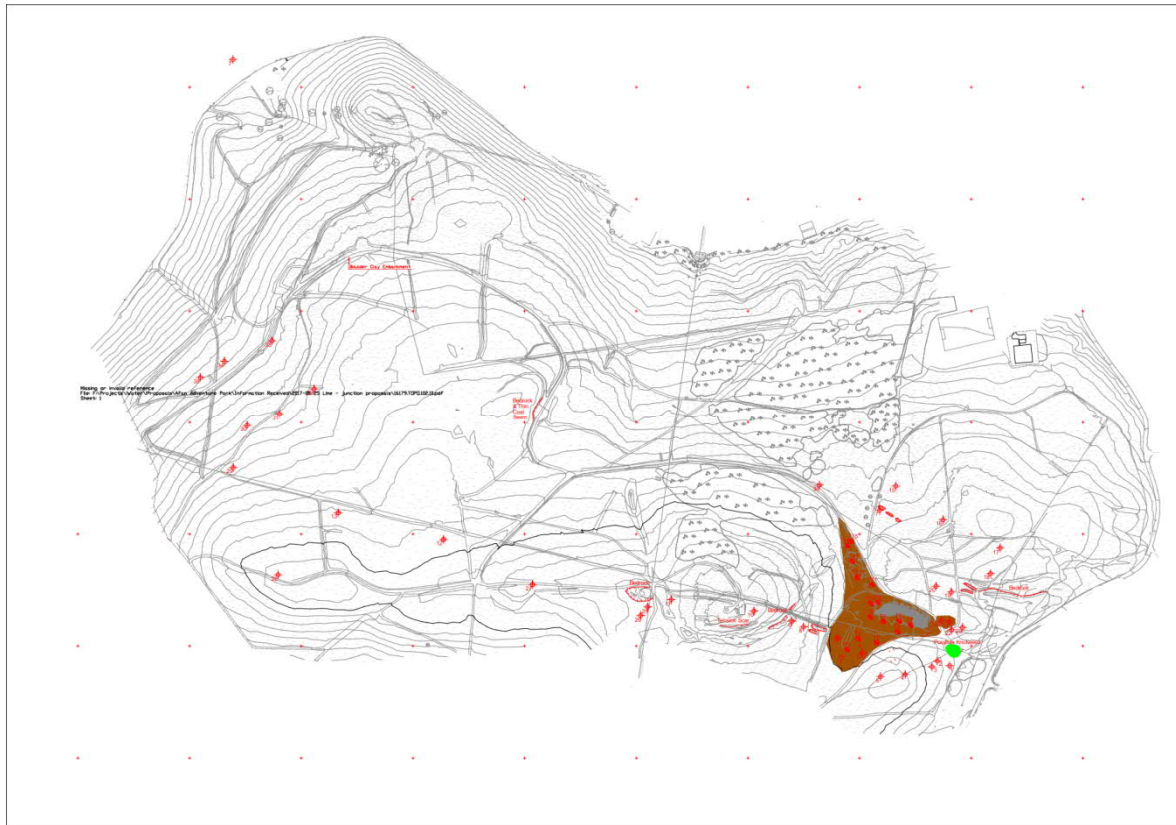
Soil profile in Embankment – Location 32





Hand dug trial pit – Location 36







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Geo-Environmental Phase I Desk Study For Northern Powerhouse Developments

16255

10 February 2017

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1.0 INTRODUCTION

1.1 Introduction

BSP Consulting has been appointed by the Client, Northern Powerhouse Developments, to undertake a Phase I Desk Study on a large parcel of land (approximately 130 hectares in area), which is located on the south side of the Afan Valley, near Cymmer, South Wales.

1.2 Project Understanding

We understand that the Client requires the completion of a Phase I Desk Study report to support a planning application for a potential new tourism related development (referenced 'Caerau Parc'), principally comprising holiday lodges, public open space and infrastructure associated with outdoor leisure activities.

The Client has provided BSP Consulting with a preliminary proposed layout plan (unreferenced), a copy of which is included in Appendix H. However, we understand that layouts/detailed design proposals are preliminary at this stage. On this basis, it may become necessary to prepare bespoke, parcel/area specific reports in due course to satisfy the Clients development aspirations and attempt to discharge relevant planning conditions etc.

The foregoing understanding has formed the basis of our assessment. Where the proposed site end-use is not consistent with our current understanding, it would be necessary to review our assessment to ensure it continues to apply.

1.3 Scope of Works

The scope of the Phase I Desk Study included the following:

- Detailed site walkover.
- Review of historical and contemporary Ordnance Survey publications.
- Review of the sites geology, hydrology and hydrogeology, including a visit to the BGS in Keyworth.
- Review of the sites radon status.
- Review of the sites coal mining status and commission of a site-specific coal mining report from the Coal Authority.
- Review of a commissioned Landmark Envirocheck Report.
- Production of a preliminary Conceptual Site Model.

1.4 Limitations

The conclusions and recommendations made in this report are limited to those that can be made based on the findings of the investigation. Where comments are made based on information obtained from third parties, BSP Consulting assumes that all third party information is true and correct.

No independent action has been undertaken to validate the findings of third party information, unless specifically stated.

The Phase I Desk Study undertaken herein comprises entirely of non-intrusive works and provides a strategic overview of the site from a geotechnical and environmental perspective and attempts to identify any potential abnormal issues with regards to the development proposals.

This report has been prepared in accordance with our understanding of current good practice. However, new information or legislation, or changes to good practice may necessitate revision of the report after the date of its issue.

BSP Consulting has prepared this report for the sole use and reliance of the Client, Northern Powerhouse Developments, in accordance with our standard Conditions and Limitations (a copy of which is included as Appendix J). This report may not be relied upon by any third party without the explicit written agreement of BSP Consulting.

2.0 SITE DESCRIPTION & HISTORY

2.1 Site Description

The site is located on the southern side of the Afan Valley, near Cymmer, South Wales. The site may be located centred on approximate Ordnance Survey National Grid Reference 285060E 195510N and covers an area of approximately 130Ha. A site location plan (Figure No. 16255/01) is included in Appendix A of this report.

At the time of our site walkover (January 2017), the site generally comprised undulating high ground rising to a maximum height of 1139ft (347m) at the trig point close to the southern site boundary. Northern and western areas of the site tended to slope down steeply towards the River Afan, approximately 200m lower than the highest areas of the site. The eastern part of the site fell away more gently towards Maesteg/Cymer Road which ran immediately beyond the eastern site boundary. The site contours (10m intervals) are shown on the site location plan in Appendix A.

The majority of the site was covered with cut coniferous forest, represented by stumps and brushwood at the time of the walkover. Anecdotal evidence suggests that the trees were recently felled after becoming diseased. Stands of coniferous forest were still present locally in some eastern areas of the site.

A myriad of tracks and footpaths crossed the site, however the majority of these were impassable due to blockages or they were damaged as a result of the recent tree felling activity. The major footpaths and tracks, before the felling took place, are also shown on the plan in Appendix A. A burnt-out car was noted on one of the tracks in the south of the site. The areas of current and former forest were interspersed locally with smaller areas of open moorland. A more significant area of open moorland was present in the east of the site.

A small covered reservoir was located in the east of the site close to Cymer Road. A telecommunications mast and concrete shelter were located in the south of the site close to the trig point. It is understood that these features (including their access) will be retained within the proposed development, although not under the auspices of Client ownership. Several overhead electricity cables were also noted to cross the site.

A small quarry was located close to the southern site boundary to the west of the trig point. Inspection of the quarry walls indicated the presence of moderately strong grey fine to coarse grained Sandstone near surface. Two small ponds were located in the southeast of the site and streamlets (seasonal) were present across the site.

Crags were present where the ground became very steep in the northwest of the site and to the south of the trig point on the southern site boundary. The ground dropped away steeply beyond the southern site boundary towards the village of Brynheulog and was occupied by a continuation of the cut coniferous forest. The northern, eastern and western site boundaries were generally bordered by roads.

The town of Cymmer was present to the north and east of the site with a school and rugby/football ground located immediately beyond the northeastern site boundary. A small recycling depot, predominantly dealing with household waste, was present to the north of Brytwn Road.

A disused railway viaduct was noted to the north of the site spanning the River Afan. Information publicly available on the internet indicates that the railway continued beneath the site through the '*Cymmer Tunnel*' which was closed in 1970. Based on observations made during the site walkover, it appears that the northern entrance to the Cymmer Tunnel is located through the private school grounds beyond Brytwn Road to the north of the site. Anecdotal information suggests that the northern portal of the tunnel is currently blocked by a landslide. The local topography, when compared to the levels on the viaduct which carried the railway towards this feature, indicates that the tunnel is anticipated to be at significant depth as it passes beneath the site. The southern entrance was not observed during the site walkover, being a significant distance to the south of the site.

An Annotated Site Plan (Figure No. 16255/02) is included as Appendix B of this report, which shows the main features of the site and immediate surrounds. General views of the site are included on the plans in Appendix C of this report (Figure Nos. 16255/03 and 16255/04). Further general site views and selected site features are shown on Plate Nos. 16255/P1 to 16255/P4 presented in Appendix G.

2.2 Site History

Available historical and contemporary Ordnance Survey publications (detailed in Appendix D) were reviewed to obtain historical information for the site.

It should be noted that the site boundary marked on the historical sheets within the Envirocheck Report appears to 'shift' on several of the maps due to scaling inaccuracies between maps of differing dates. This is a function of Envirocheck transposition algorithms. The key findings of the historical search are summarised in Table 1.

TABLE 1 – HISTORICAL MAP INFORMATION		
Date	Features on Site	Features off Site
1870s	- The majority of the site comprises rough pasture and open fields with furze (gorse) in western areas and trees in northern areas. - The site appears to be located across a hill with small streams flowing down towards the Afan Valley to the north and west. - Tracks and footpaths are shown across the site. - Crags ('<i>Pen y Castell</i>' and '<i>Foel Fawr</i>') and shown in the northwest of the site and along part of the southern boundary. - Small buildings (possible farmstead) are shown to the immediate east of Pen y Castell with a '<i>Spring</i>' approximately 200m to the east of the buildings.	- The floor of the Afan Valley is located to the north and west of the site with the River Afan flowing to the approximate southwest. The majority of the valley is shown to be wooded with occasional residential properties and roads. A railway line follows the approximate course of the river. - The town of Cymmer is shown within the Afan Valley to the northeast of the site. - A cutting is shown to the immediate north of the site, possibly associated with the construction of the railway tunnel. - A continuation of the rough pasture which occupies much of the site is shown to the south of the site.

TABLE 1 – HISTORICAL MAP INFORMATION

Date	Features on Site	Features off Site
1870s cont.	- Three small quarries are shown in the western half of the site and a further small quarry is shown straddling the southern site boundary to the west of a trig point. - A railway '<i>Tunnel; in construction</i>' is shown to run beneath the site in an approximate north to south direction.	
1880s	The site remains essentially unchanged.	The surrounding area remains essentially unchanged.
1890s	- The '<i>Cymmer Tunnel</i>' beneath the site appears to have been completed. - Small quarries are shown close to the northern site boundary. - An '<i>Air Shaft</i>' is shown on the approximate northern site boundary. - The majority of the site remains essentially unchanged.	'<i>Glyncymmer Colliery</i>' and '<i>Duffryn Rhondda Colliery</i>' (with associated '<i>Brick Works</i>') are located to the immediate north and west of the site respectively. - A new railway line with sidings runs between the northern site boundary and the River Afan. - Several small quarries are shown within the local geographic area. - General urban development has taken place associated with the town of Cymmer to the north and northeast of the site.
1900s	A small pond labelled '<i>Reservoir</i>' is shown in the central area of the site.	The surrounding area remains essentially unchanged.
1910s	The site remains essentially unchanged.	- Expansion of the collieries is shown to the north and east of the site. - Further residential development is shown within the local geographic area including beyond the River Afan to the north of the site. - A '<i>Gas Works</i>' is shown approximately 250m to the west of the site.
1920s & 1930s	A small pond labelled '<i>Reservoir</i>' is no longer shown.	The surrounding area remains essentially unchanged; mapping incomplete.
1940s	The site remains essentially unchanged; based on the reviewed aerial images.	The surrounding area remains essentially unchanged; based on the reviewed aerial images.
1950s	The site remains essentially unchanged; mapping incomplete.	The surrounding area remains essentially unchanged; mapping incomplete.
1960s	- Coniferous forest has been planted in the south of the site in the vicinity of the trig point. - A small '<i>Covered Reservoir</i>' is shown towards the southeast corner of the site.	- A continuation of the coniferous forest is shown to the south of the site. - A rugby/football ground is shown from approximately 20m to the east of the site. - Large areas of coniferous forest are shown to have been planted on the north side of the Afan Valley.
1970s	- The majority of the site is shown to have been planted with coniferous forest, with localised areas of rough pasture and forestry tracks. - A '<i>Lookout Tower</i>' is shown to the immediate east of the trig point in the south of the site. - The railway tunnel running beneath the site is labelled '<i>Disused</i>'.	Some of the railway lines to the north of the site appear to have been dismantled.
1980s	- The lookout tower in the south of the site is indicated to have been replaced by a '<i>TV Mast</i>'. - The majority of the site remains essentially unchanged.	- Continued dismantling of the railway lines to the north of the site is shown. - The collieries and associated industrial practices to the north and west of the site are no longer identified, with much of their infrastructure no longer shown.

TABLE 1 – HISTORICAL MAP INFORMATION

Date	Features on Site	Features off Site
1990s	Two ponds are shown towards the southeast corner of the site.	The surrounding area remains essentially unchanged.
2000s	The site remains essentially unchanged.	The surrounding area remains essentially unchanged.

We would note that the presence of some of the smaller features indicated on the reviewed historical mapping (e.g. old quarries and former farmsteads etc) could not be verified during the site walkover due to the terrain. The majority of the site is currently covered with cut coniferous forest, represented by stumps and brushwood left behind following recent tree felling activity which has left the majority of the tracks and paths, particularly in the west of the site, in a state of disrepair.

We would further note that the cutting shown to the immediate north of the site on the 1870s mapping appears to have been partially infilled by 1899. A road is shown to have been constructed over the infilled ground, with the northern portal of the tunnel being moved further to the north of the site boundary.

3.0 GEOLOGY & ENVIRONMENTAL SETTING

3.1 Geological References

The following geological publications were referred to:

- BGS 1:10,560 Series Sheet XVII SW (1914, with additions in 1948).
- BGS 1:50,000 Series Sheet 148 'Pontypridd' (1975).
- BGS publication, British Regional Geology 'Wales' (2007).
- BGS Geological Report (received as part of the Landmark Envirocheck Report referenced in Section 3.6).
- The Coal Authority and The Law Society publication 'Coal Mining and Brine Subsidence Claim Searches – Directory and Guidance' Sixth Edition (2006).
- Environment Agency website: www.environment-agency.gov.uk.
- British Geological Survey website: www.bgs.ac.uk.

3.2 Geology

Landslip

The geological publications indicate two areas of 'Landslip' within the site boundary; one in the central-southern area of the site and one in the northwest of the site. A further landslip area is indicated to the immediate north-east of the site beneath much of the land occupied by the town of Cymmer. No definitive evidence of contemporary or historical landslips were noted at the site during our recent site walkover.

Drift Deposits

The referenced geological publications indicate that drift deposits are generally absent from across the site. An area of Glaciofluvial Deposits are shown within the Afan Valley to the northwest of the site, which are indicated to encroach across the site boundary into a very small area in the northwest of the site. These deposits are described as 'Sands and Gravels' within the reviewed publications. An area of Glacial Till is shown within the Afan Valley to the north of the site and is shown to encroach across the site boundary into a very small area in the north of the site on the smaller scale mapping. These deposits are described as 'Undifferentiated Boulder Clays' within the reviewed publications.

In addition, an area of Peat is shown on some of the referenced geological publications to be located to the immediate southeast of the site and a small area of Hill Peat is shown on the 1:10,560 scale geological map in the south of the site.

All of the drift deposits, (where present), are indicated to be of Quaternary age.

Solid (Bedrock) Geology

The referenced geological publications reveal the majority of the site to be underlain by strata of the Rhondda Member (part of the Upper Coal Measures) of Carboniferous age. These strata are described in the reviewed publications as ‘...*Green-grey, lithic arenites ("Pennant sandstones") with thin mudstone/siltstone and seatearth interbeds and mainly thin coals*’.

The geological publications reveal strata of the Llynfi Member (also part of the Upper Coal Measures and of Carboniferous age) to outcrop across a small area of the site adjacent to the southern boundary. These strata are described as ‘...*Green-grey and blue-grey, feldspathic, micaceous lithic arenites ("Pennant sandstone") with thin mudstone/siltstone and seatearth interbeds and mainly thin coals*’.

The Upper Coal Measures may weather to Clay or Sand in their near surface horizons.

Several coal seams are indicated to outcrop across the site and in the immediate vicinity of the site (typically with thicknesses of up to 1.3m). The coal seams outcropping in the southeast of the site are shown to be the ‘*Rhondda Field Vein*’ and the ‘*Rhondda Wernddu*’. The coal seams outcropping in the central and western areas of the site are shown to be the ‘*Brithdir*’ and the ‘*No.1 Rhondda Rider*’, and the coal seams outcropping in the southwest of the site are shown to be the ‘*Thin Coal*’ and the ‘*No.1 Rhondda Rider*’.

The ‘*Rhondda Field Vein*’, ‘*Rhondda Wernddu*’ and ‘*Thin Coal*’ are also all shown to outcrop in close proximity to the eastern site boundary.

The Upper Coal Measures strata within the local geographic area are generally indicated to dip shallowly to the approximate north and northwest, typically at angles of the order ten degrees from the horizontal. On this basis, it is anticipated that some of the coal seams will continue at relatively shallow depth beneath the site. The convoluted outcrop pattern of the coal seams appears to be a function of sites steep topography/hillside setting.

An extract from the BGS 1:10,560 scale geological map (Sheet XVII SW) purchased from the BGS by BSP Consulting as a reference document for our ongoing works at the site is included in Appendix I. We would note that this map does not cover some southern areas of the site, and that no 1:10,560 scale geological mapping is currently unavailable for these areas from the British Geological Survey.

3.3 Faults

A major surface fault called the ‘*Pen-y-castell Fault*’ is shown on the referenced geological publications to run through the western half of the site trending approximately north to south and downthrown to the west. Two further (unnamed) surface faults are shown to run through the eastern half of the site trending approximately north to south. Both faults cross the southern site boundary and continue beyond the boundary to the south. The faults are shown to be downthrown to both the east and west.

3.4 Man-Made Deposits

The geological publications do not show the presence of any man-made deposits (i.e. Made Ground, Worked Ground or Landscaped Ground) beneath the site or within potential influencing distance of the site (i.e. <250m). We would however note the localised presence of small historical pond and quarry features, identified on the reviewed historical mapping, which may have been infilled.

3.5 Coal Mining

The site lies in an area requiring the commission of a coal mining report in accordance with The Coal Authority and The Law Society publication '*Coal Mining and Brine Subsidence Claim Searches – Directory and Guidance*' Sixth Edition (2006). A mining report has been obtained for the site, a copy of which is included in Appendix E and the main points are summarised below.

Past Underground Mining

The report states that '*The property [i.e. the site] is in a surface area that could be affected by underground mining in 13 seams of coal at shallow to 870m depth, and last worked in 1959*'.

Present and Future Underground Mining

The site is not affected by present underground mining. The site is unlikely to be affected by plans for future workings.

Mine Entries

The report states that '*Within, or within 20 metres of, the boundary of the property there are 4 mine entries*'. The report also states that '*There may however be mine entries/additional mine entries in the local area which the Coal Authority has no knowledge of*'.

One mine entry (Coal Authority Ref: 285195-004) is described as '*filled with stone in 1977 and the surface reinstated*'. This mine entry may correspond to the air shaft shown close to the northern site boundary on the reviewed historical mapping. No evidence of current or former mine entries were observed at surface during the recent site walkover.

Coal Mining Geology

The report states that '*The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that have been affected by coal mining*'.

Opencast Mining

The report states that '*The property is not within the boundary of an opencast site from which coal has been removed by opencast methods*'.

Coal Mining Subsidence

The report states that *'The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50metres, since 31 October 1994'*.

Hazards Relating to Coal Mining

The report states that *'The property has not been subject to remedial works, by or on behalf of the Authority, under its Emergency Surface Hazard Call Out procedures'*.

Comments

The report concludes that ***'In view of the mining circumstances a prudent developer would seek appropriate technical advice before any works are undertaken.'***

Therefore if development proposals are being considered, technical advice relating to both the investigation of coal and former coal mines and their treatment should be obtained before beginning work on site. All proposals should apply good engineering practice developed for mining areas. No development should be undertaken that intersects, disturbs or interferes with any coal or mines of coal without the permission of the Coal Authority'.

The report also concludes that ***'Developers should be aware that the investigation of coal seams/former mines of coal may have the potential to generate and/or displace underground gases and these risks both under and adjacent to the development should be fully considered in developing any proposals.'***

The need for effective measures to prevent gases entering into public properties either during investigation of after development also needs to be assessed and properly addressed. This is necessary due to the public safety implications of any development in these circumstances' [BSP Consulting emphasis added].

3.6 Landmark Envirocheck Report

A Landmark Envirocheck Report was commissioned to assist in ascertaining the environmental setting of the site. The full Envirocheck Report is presented in Appendix F and has revealed the following relevant information. (Details are only listed where they are within 250m of the site).

3.6.1 Agency & Hydrological

Aquifer Status

The bedrock geology (i.e. Upper Coal Measures) is classified as a Secondary A Aquifer.

The drift deposits (where present) are generally classified as Unproductive Strata. The Glaciofluvial Deposits which are shown to encroach into the northwest corner of the site are classified as a Secondary A Aquifer.

Secondary A Aquifers are described by the Environment Agency as ‘...*permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers*’.

Unproductive Strata are described by the Environment Agency as ‘...*rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow*’.

Source Protection Zone Status

The site and immediate surrounds do not lie within a Source Protection Zone (SPZ) as designated by the Environment Agency. An SPZ relates to the protection of groundwater used for public drinking water supply.

Flood Risk Status

The site is not shown to lie in an area identified to be at risk from flooding.

Surface Water

Minor streamlets are indicated across the site and two small ponds are shown in the southeast of the site. The nearest major (primary) watercourse is the River Afan located approximately 100m to the north and west of the site, on the floor of a deep valley and flowing to the approximate southwest.

River Quality

The River Afan to the north of the site was given a grading of River Quality A (Excellent) in 2000.

Discharge Consents

There have been seven discharge consents issued within 250m of the site, and one discharge consent issued within the site boundary. The on-site consent appears to relate to the area currently occupied by the small ponds in the southeast of the site. The permit was valid between 1989 and 1994 with the discharge type unspecified (operator: Dwr Cymru Cyfynedig). The closest off-site discharge consent is indicated to be to the River Afan 152m to the north of the site and relates to sewage.

Pollution Incidents to Controlled Waters

There are nine entries listed within 250m of the site, the majority of which are categorised as Category 3 Minor Incidents. Two Category 2 Significant Incidents are shown to have taken place; one 71m to the northeast of the site relating to crude sewage in 1981, and one 97m to the southeast of the site relating to light oil in 1982. None of the above incidents are considered to have a significant impact on the proposed development.

3.6.2 Waste

There are no recorded landfill sites indicated within potential influencing distance of the site (i.e. <250m). There is a licenced waste management facility (also classified as a waste transfer site) located from approximately 77m to the northeast of the site. This facility is categorised as operational and relates to the small recycling depot (predominantly dealing with household waste) observed to the north of Brytwn Road during the recent site walkover.

Several areas of potentially infilled land are indicated within 250m of site boundary, principally relating to small historical pond and quarry features.

3.6.3 Hazardous Substances

There are no sites associated with hazardous substances (e.g. explosives) identified within 250m of the site.

3.6.4 Geological

BGS Recorded Mineral Sites

Two BGS recorded mineral sites have been recorded within the site boundary. These relate to historical sandstone quarrying by opencast methods. The quarries listed appear to correlate with two of the quarries identified in the north of the site during our review of the historical Ordnance Survey mapping.

A further fourteen BGS recorded mineral sites have been recorded within 250m of the site boundary. These relate to historical mining activity associated with either deep coal extraction or sandstone extracted by opencast methods.

Geological Hazards

Localised areas of the site and its immediate surroundings have been given a moderate to high risk rating for landslide ground instability.

No further potentially significant onerous geological issues have been identified within the Envirocheck report which relate to the site, with the exception of the site being located within an area requiring a coal mining report (see Section 3.5).

BGS Estimated Soil Chemistry Data Maps

The BGS has prepared estimated soil concentration maps for several metals (including Arsenic, Lead, Nickel, Chromium and Cadmium), which are extrapolated from records available for use within their assessments.

Whilst potentially useful for the inference of Natural Metal Enrichment (NME) of the natural soils in a general locale, the data should not be used to inform any detailed decisions with regards to the chemistry of a particular site as it does not allow for anthropogenic affects.

Estimates of the soil chemistry at the site indicate anticipated concentrations of Arsenic of <15-45mg/kg, Cadmium of <1.8mg/kg, Chromium of 40-60mg/kg, Lead of <100mg/kg and Nickel of <15-30mg/kg.

Based on the information supplied in the Landmark Envirocheck Report, the site is indicated to be located in an area where significant NME of the underlying natural soils is not anticipated to be present. However, this is only applicable to the specific determinands listed above.

Radon

Some areas of the site are identified by Landmark as requiring basic radon protective measures. It is recommended that a site specific Radon Report from the BGS is commissioned once the development aspirations of the Client have been finalised to determine the requirement for radon precautions within the proposed development.

3.6.5 Industrial Land Use

Contemporary Trade Directory Entries

Four contemporary trade directory entries have been identified within 250m of the site, the closest 35m to the north relating to a builders merchants (active).

The remaining three entries are all shown to be inactive (the closest 198m from the site boundary) and are considered unlikely to have adversely affected the subject site.

Fuel Station Entries

An obsolete fuel station is shown to have been located 205m to the northwest of the site.

Points of Interest – Public Infrastructure

Seventeen points of interest have been recorded within 250m of the site. These generally relate to services associated with the town of Cymmer. One point of interest (a playground) has been recorded within the site boundary, however (due to scaling inaccuracies) this is likely to relate to a playground immediately beyond the northern site boundary.

3.7 Land Use Assessment

As part of the land use assessment, reference has been made to the '*Desk Reference Guide to potentially Contaminative Land Uses*' produced by Mr P Syms and published jointly by the ISVA (The professional Society for Valuers and Auctioneers) in association with The Royal Institution of Chartered Surveyors (RICS) and the Chartered Institute of Environmental Health (CIEH).

We have also made reference to the Department for Environment, Food and Rural Affairs and the Environment Agency Contaminated Land Report CLR8 '*Potential Contaminants for the Assessment of Land*' (March 2002). This document identifies key contaminants which may potentially be present at a site as a result of a given historical land use, and whilst formally withdrawn is still considered to be a useful desk-based reference guide.

3.7.1 On Site Assessment

The site generally comprises undulating high ground, locally very steep with crags, rising to a maximum height of 1139ft above sea level. The majority of the site is currently covered with recently cut coniferous forest represented by stumps and brushwood, with some stands of coniferous forest still present locally in eastern areas.

Historically, the site comprised open moorland/rough pasture and open fields until the forest was planted circa 1970.

We would note the localised presence of several historical features on the site including small quarries and potential disused mine shafts in some areas of the site.

Based on the Syms and CLR 8 documents, the sites current and previous land uses do not fall within any of the risk based classifications identified within these publications. Based on the information obtained from the desk study, our walkover of the site and our experience of similar sites, potential contamination that may be present could include:

- Metals or metalloids associated with any potential Made Ground beneath the site.
- Polycyclic Aromatic Hydrocarbons (PAHs) from any ashy inclusions and/or carbonaceous inclusions in the near surface soils.
- Hydrocarbons associated with the use of forestry vehicles at the site.
- Potentially hazardous ground gases (i.e. carbon dioxide and methane) from the coal bearing strata of the Upper Coal Measures beneath the site, localised potentially infilled historical quarry features and possible localised areas of Peat within the natural drift deposits.

We would note that the site is large (approximately 130Ha) and that some of the contaminants listed above are only considered key risk drivers in specific areas. Should it become necessary to prepare bespoke, parcel/area specific reports in due course to satisfy the Clients development aspirations, it is recommended that the key contaminants are reassessed on an area by area basis.

3.7.2 Off-Site Assessment

The Phase I enquiries have revealed the presence of the following sources of potentially hazardous ground gas (i.e. carbon dioxide and methane), which lie within a potential influencing distance (i.e. <250m) of the site:

- Peat deposits within the natural drift deposits surrounding the site.

We would also note the potential presence of deep Made Ground associated with the industrial legacy of the Afan Valley to the north and west of the site and potentially infilled ground, principally quarries, within the local geographic area. Although recorded within 250m of the site boundary, it is considered that these features are unlikely to represent key risk drivers at the site based on the steep topography mitigating likely pathways to on-site receptors.

4.0 PRELIMINARY CONCEPTUAL SITE MODEL

4.1 General

The DEFRA publication ‘*Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance*’ (dated April 2012) states the following with regards to the production of a Conceptual Site Model (CSM) for a site:

‘The process of risk assessment involves understanding the risks presented by land, and the associated uncertainties. In practice, this understanding is usually developed and communicated in the form of a “conceptual model”’. The development of a CSM is typically undertaken in an iterative process, reflecting the changes in understanding as more detailed site information becomes available.

In developing a CSM, and specifically in the context of land contamination, consideration needs to be given to three essential elements; which form the basis of any risk present. The statutory guidance sections 3.8 and 3.9 (April 2012) states the following with respect to Part 2A.

‘Under Part 2A, for a relevant risk to exist there needs to be one or more contaminant-pathway-receptor [CPR] linkages – “contaminant linkage” – by which a relevant receptor might be affected by the contaminants in question. In other words, for a risk to exist there must be contaminants present in, on or under the land in a form and quantity that poses a hazard, and one or more pathways by which they might significantly harm people, the environment, or property; or significantly pollute controlled waters. For the purposes of this guidance:

- (a) A “contaminant” is a substance which is in, on or under the land and which has the potential to cause significant harm to a relevant receptor, or to cause significant pollution of controlled waters.*
- (b) A “receptor” is something that could be adversely affected by a contaminant, for example a person, an organism, an ecosystem, property, or controlled waters. The various types of receptors that are relevant under the Part 2A regime are explained in later sections.*
- (c) A “pathway” is a route by which a receptor is or might be affected by a contaminant.*

The term “contaminant linkage” means the relationship between a contaminant, a pathway and a receptor. All three elements of a contaminant linkage must exist in relation to a particular land before the land can be considered potentially to be contaminated land under Part 2A, including evidence of the actual presence of contaminants. The term “significant contaminant linkage”, as used in this Guidance, means a contaminant linkage which gives rise to a level of risk sufficient to justify a piece of land being determined as contaminated land. The term “significant contaminant” means the contaminant which forms part of a significant contaminant linkage.’

With respect to the presence of background levels of contaminants, section 3.21 to 3.23 states *‘The Part 2A regime was introduced to help identify and deal with land which poses unacceptable levels of risk. It was not intended to apply to land with levels of contaminants in soil that are commonplace and widespread throughout England or parts of it, and for which in the very large majority of cases there is no reason to consider that there is an unacceptable risk.*

Normal levels of contaminants in soil should not be considered to cause land to qualify as contaminated land, unless there is a particular reason to consider otherwise. Therefore, if it is established that land is at or close to normal levels of particular contaminants, it should usually not be considered further in relation to the Part 2A regime...

For the purpose of this Guidance, “normal” levels of contaminants in soil may result from:

- (a) The natural presence of contaminants (e.g. caused by soil formation processes and underlying geology) at levels that might reasonably be considered typical in a given area and have not been shown to pose an unacceptable risk to health or the environment.*
- (b) The presence of contaminants caused by low level diffuse pollution, and common human activity other than specific industrial processes. For example, this would include diffuse pollution caused by historic use of leaded petrol and the presence of benzo(a)pyrene from vehicle exhausts, and the spreading of domestic ash in gardens at levels that might reasonably be considered typical.’*

In selecting appropriate generic assessment criteria Section 3.27 of the Guidance states:

‘It is common practice in contaminated land risk assessment to use “generic assessment criteria” (GACs) as screening tools in generic quantitative human health risk assessment to help assessors decide when land can be excluded from the need for further inspection and assessment, or when further work would be warranted’.

With respect to assessing contaminated land, section 4.17 of the Guidance states:

‘In deciding whether or not land is contaminated land on grounds of significant possibility of significant harm to human health, the local authority should use the categorisations described in paragraphs 4.19 – 4.30 below. Categories 1 and 2 would encompass land which is capable of being determined as contaminated land on the grounds of significant possibility of harm to human health. Categories 3 and 4 would encompass land which is not capable of being determined on such grounds.’

In relation to the use of GAC values in the assessment of contaminated land, section 3.29 of the Guidance states:

‘GACs relating to human health risk assessment represent cautious estimates of levels of contaminants in soil at which there is considered to be no risk to health or, at most, a minimal risk to health. With regards to such GACs:

- (a) *They may be used to indicate when land is very unlikely to pose a significant possibility of significant harm to human health. This is on the basis that they are designed to estimate levels of contamination at which risks are likely to be negligible or minimal and far from posing a significant possibility of significant harm to human health.*
- (b) *They should not be used as direct indicators of whether a significant possibility of significant harm to human health may exist. Also, the local authority should not view the degree by which the GACs are exceeded (in itself) as being particularly relevant to this consideration, given that the degree of risk posed by land would normally depend on many factors other than simply the amount of contaminants in soil.*
- (c) *They should not be seen as screening levels which describe the boundary between Categories 3 and 4 in terms of Section 4 (i.e. the two Categories in which land would not be contaminated land on grounds of risk to human health). In the very large majority of cases, these SGVs/GACs describe levels of contamination from which risks should be considered to be comfortably within Category 4.*
- (d) *They should not be viewed as indicators of levels of contamination above which detailed risk assessment would automatically be required under Part 2A.*
- (e) *They should not be used as generic remediation targets under the Part 2A regime. Nor should they be used in this way under the planning system, for example in relation to ensuring that land affected by contamination does not meet the Part 2A definition of contaminated land after it has been developed.'*

In undertaking a risk assessment and deriving a CSM for the purposes of the development of a site (i.e. planning and development control) reference has been made to both the Model Procedures for the Management of Land Contamination, as well as the National Planning Policy Framework (NPPF, dated March 2012). Reference has also been made to the Contaminated Land Statutory Guidance (referenced above), although this is primarily concerned with Local Government determinations of Statutory 'Contaminated Land', which is separate to planning framework requirements.

4.2 Contaminant [C] - Pathway [P] - Receptor [R] Considerations

The following CPR assessment has been undertaken based on the assumption of a potential new tourism related development, principally comprising holiday lodges, public open space and infrastructure associated with outdoor leisure activities.

We understand that layouts/detailed design proposals are preliminary at this stage. On this basis, it may become necessary to prepare bespoke, parcel/area specific preliminary CPR assessments in due course to satisfy the Clients development aspirations.

4.3 Consideration of Potential Sources of Contamination [C]

Based on the findings of our works, the potential key sources of contamination at the site that would require investigation as part of any Phase II Exploratory Investigation works will include the following:

- Metals or metalloids associated with any potential Made Ground beneath the site.
- Polycyclic Aromatic Hydrocarbons (PAHs) from any ashy inclusions and/or carbonaceous inclusions in the near surface soils.
- Hydrocarbons associated with the use of forestry vehicles at the site.
- Potentially hazardous ground gases (i.e. carbon dioxide and methane) from on and off-site sources.

In addition, consideration has also been given to the following:

- Radon.

The foregoing potential sources of contamination should be revisited in due course, driven by the findings of appropriate Phase II Exploratory Investigation works.

4.4 Consideration of Potential Pathways [P]

The potential pathways at the site are primarily:

- Direct ingestion of soil.
- Inhalation of dust and vapours.
- Direct skin contact with the ground.
- Direct contact with building materials.
- Vertical and lateral migration of contamination.
- Vertical and lateral migration of potentially hazardous ground gases/vapours.

4.5 Consideration of Potential Receptors [R]

The potential key receptors at the site are:

- The construction personnel (i.e. site workers) involved with the development of the site (typically short term (acute) exposure).
- The final end users (leisure facility workers - typically long term (chronic) exposure and site visitors – typically short term (acute) exposure).
- Neighbouring properties (i.e. off-site receptors).
- Controlled waters (i.e. principally underlying groundwater).
- Buildings/construction materials.

4.6 Summary

Our preliminary conceptual site model of possible CPR pollutant linkages, applicable to the proposed site usage and based on our current understanding, is summarised in Table 2.

In providing an opinion on the possible risk attributable to the appropriate CPR linkage, we have used the following hierarchy; although it should be noted that these are preliminary and subject to confirmation by appropriate Phase II intrusive works:

Unlikely < Plausible < Likely

TABLE 2 - SUMMARY OF PRELIMINARY CPR ASSESSMENT

Contaminant [C]	Pathway [P]	Receptor [R]	Comments	CPR Linkage Risk
<i>Potentially contaminated soils and/or groundwater associated with the sites current and historic usage</i>	<i>Ingestion of soil and dermal contact</i>	<i>Construction Personnel</i>	Based on the known historical and existing land uses of the site and immediate surrounds, the risk of significant soil contamination within the underlying soils is currently considered to be low. Appropriate soil testing is recommended during any Phase II intrusive works to inform the PPE requirements of construction personnel.	Unlikely/Plausible
	<i>Inhalation of dust and vapours</i>	<i>Construction Personnel</i>	Based on the known historical and existing land uses of the site and immediate surrounds, the risk of significant soil contamination within the underlying soils is currently considered to be low. Appropriate soil testing is recommended during any Phase II intrusive works to inform the PPE requirements of construction personnel. Appropriate control measures can be implemented during construction activities (i.e. dust suppression measures) which would significantly reduce the risk of exposure to dust inhalation.	Unlikely/Plausible
	<i>Ingestion of soil and dermal contact</i>	<i>Facility Users</i>	Based on the known historical and existing land uses of the site and immediate surrounds, the risk of significant soil contamination within the underlying soils is currently considered to be low.	Unlikely/Plausible
	<i>Inhalation of dust and vapours</i>	<i>Facility Users</i>	Based on the known historical and existing land uses of the site and immediate surrounds, the risk of significant soil contamination within the underlying soils is currently considered to be low. Following completion of development (as currently proposed) the generation of significant quantities of dust is considered to be low.	Unlikely/Plausible
	<i>Vertical and lateral migration/ leaching of contamination</i>	<i>Neighbouring properties (off site receptors)</i>	No significant sources of on-site contamination, that has the potential for off-site migration, have been identified by the Desk Study works. Appropriate soils testing during Phase II works will assist in assessing this potential linkage further.	Unlikely/Plausible
	<i>Vertical and lateral migration/ leaching of contamination</i>	<i>Underlying Groundwater</i>	The bedrock geology is classified as a Secondary A Aquifer. The site does not lie within a SPZ.	Unlikely

TABLE 2 - SUMMARY OF PRELIMINARY CPR ASSESSMENT

Contaminant [C]	Pathway [P]	Receptor [R]	Comments	CPR Linkage Risk
			The risk to groundwater beneath the site is considered to be low based on the unlikely presence of significant soil contamination and anticipated depth to groundwater.	
	<i>Vertical and lateral migration/ leaching of contamination resulting in direct contact</i> <i>Permeation of hydrocarbons through plastic pipe work</i>	<i>Buildings and construction materials (including potable water supply pipes/other utilities)</i>	No significant sources of on-site contamination have been identified by the Desk Study works. The requirements for specific protection measures within the proposed development should be confirmed following soils testing, as part of appropriate Phase II Exploratory Works.	Unlikely
<i>Radon (naturally occurring gas from bedrock materials)</i>	<i>Vertical and lateral migration</i>	<i>Buildings, Construction Personnel and End Users</i>	Some areas of the site are identified by Landmark as requiring basic radon protective measures.	Likely
<i>Ground gases</i>	<i>Vertical and lateral migration</i>	<i>Buildings, Construction Personnel and End Users</i>	Possible on and off-site sources of ground gases have been identified. Whilst considered to represent a generally low risk to the proposed development, it is recommended that consideration of ground gas risks are provided as part of appropriate Phase II Exploratory Investigation works.	Plausible
KEY Where text is in <i>Bold Italic</i> item is potentially present. Where normal text is used item is not present/plausible. CPR Linkage Risk Definitions: Unlikely – A significant pollutant linkage/risk has not been identified. Plausible – A significant pollutant linkage/risk has been identified that may be present at the site. Mitigation measures may be required. Likely – A significant pollutant linkage should be anticipated based on our findings to date. Mitigation measures are likely to be required.				

The foregoing preliminary conceptual model highlights the potential plausible pollutant linkages that may relate to the site and would therefore require addressing by appropriate Phase II Exploratory Works. The information contained within the conceptual model should be confirmed and revised upon completion of an appropriate intrusive investigation, where appropriate.

5.0 CONCLUSIONS

The following conclusions and recommendations are preliminary and subject to confirmation by an appropriate site-specific Phase II Exploratory Investigation. It is understood that layouts/detailed design proposals are preliminary at this stage; it is recommended that the programme of Phase II works is designed/undertaken once the development aspirations of the Client have been confirmed to enable targeting of the intrusive works.

5.1 Site Summary

- The site generally comprises undulating high ground, locally very steep, rising to a maximum height of 1139ft above sea level. The majority of the site is currently covered with recently cut coniferous forest represented by stumps and brushwood, with some stands of coniferous forest still present locally in eastern areas.
- Historically, the site has comprised open moorland/rough pasture and open fields until the forest was planted circa 1970.
- We understand that it is proposed to develop the site with a new tourism related development principally comprising holiday lodges, public open space and infrastructure associated with outdoor leisure activities.
- The geological publications reveal the site to be underlain by Upper Coal Measures strata (Secondary A Aquifer). Locally the Coal Measures are indicated to be overlain by drift deposits (Unproductive Strata) and Landslip soils.

5.2 Coal Mining

Based on the findings of the Coal Authority mining report for the site, it is considered that investigative rotary drilling will be required to assess the potential presence of shallow worked coal seams, together with the investigation of the identified former mine entries. Subject to the results of the rotary drilling, works to stabilise shallow mine workings, and treat and cap potential mine shafts, may be required prior to development.

We would recommended that a visit to the Mining Records Office is undertaken prior to any Phase II works to study any abandonment plans/records pertaining to historical coal workings. The findings may be used to help steer the proposed Phase II scope of works, where appropriate.

5.3 Geotechnical Assessment

We understand that it is proposed to construct holiday lodges and infrastructure associated with the tourism related development. The foundation solution for the proposed development will depend on the results of intrusive investigation works.

A suitable programme of Phase II Exploratory Investigation works should determine the presence and nature of any man-made deposits and provide an assessment of the depth to, and strength of, the Natural Strata, together with an assessment of the volume change potential of any potentially cohesive (i.e. clay) soils beneath the site.

Following any required mitigation works relating to shallow mining beneath the site (see Section 5.2), foundations (such as rafts, strip or trench fill) are usually suitable when founding within the types of natural strata generally anticipated beneath the site.

We would note the presence of very steep topography in some areas of the site and it is recommended that consideration should be given to any potential slope instability issues prior to finalisation of design with appropriate mitigation measures incorporated as appropriate.

Should areas with historical Landslip material be developed, it is recommended at this stage that Landslip should be treated as Made Ground due to potentially significant variations in the geotechnical properties of these soils. Dependent upon the thicknesses of these soils, an alternative deeper foundation solution may be required in these areas (such as piles). A deeper founding solution may also be required in any areas of the site where significant thicknesses of Peat are encountered within the drift deposits, to mitigate potential settlement issues.

5.4 Building Near Trees

Foundations for the proposed development may require adjusting where building near existing, proposed or recently removed trees due to the potential presence of near surface cohesive (i.e. clay) soils beneath some areas of the site.

5.5 Ground Gas

Potential sources of hazardous ground gas (i.e. carbon dioxide and methane) have been identified on-site and within a potential influencing distance (i.e. <250m) of the site.

On the basis of the foregoing, further consideration of the risks presented by ground gases should be provided during the course of any Phase II Exploratory Investigation works. At this stage, we would recommend that a programme of ground gas monitoring is undertaken at the site, in order to assist in determining the requirement for any specific precautions required for the proposed development.

5.6 Radon

Some areas of the site are identified by Landmark as requiring basic radon protective measures. It is recommended that a site specific Radon Report from the BGS is commissioned once the development aspirations of the Client have been finalised to determine the requirement for radon precautions within the proposed development.

5.7 Water

The results of the intrusive investigation will assist in establishing the groundwater regime beneath the site.

5.8 Surface Water Drainage

Areas of the site may be suitable for the use of soakaways subject to targeted in-situ testing in general accordance with BRE Digest DG 365 (2016). Based on the preliminary layout, it is understood that attenuation ponds will be created within the proposed development, which may provide an alternative means of surface water drainage.

5.9 Sources of Contamination

The Phase I Desk Study has identified the following key contaminants that may potentially be present at the site:

- Metals or metalloids associated with any potential Made Ground beneath the site.
- Polycyclic Aromatic Hydrocarbons (PAHs) from any ashy inclusions and/or carbonaceous inclusions in the near surface soils.
- Hydrocarbons associated with the use of forestry vehicles at the site.
- Potentially hazardous ground gases (i.e. carbon dioxide and methane) from on and off-site sources.

The contaminants listed above should be included within the scope of any chemical analysis undertaken as part of a programme of exploratory investigation works at the site. We would note that the site is large (approximately 130Ha) and that some of the contaminants listed above are only considered key risk drivers in specific areas. Should it become necessary to prepare bespoke, parcel/area specific reports in due course to satisfy the Clients development aspirations it is recommended that the key contaminants are reassessed on an area by area basis.

5.10 Cymmer Tunnel

A railway tunnel (the '*Cymmer Tunnel*') was constructed beneath the site in the 1870s. The Cymmer Tunnel is known to pass beneath the central area of the site in an approximate north to south direction. The local topography, when compared to the levels on the viaduct which carried the railway towards this feature, indicates that the tunnel is anticipated to be at significant depth as it passes beneath the site. We would however recommend that this feature is accurately surveyed/mapped (by others) to establish its depth beneath current site levels and ensure that it will have no influence on the proposed development, including any Phase II works.

5.11 Statutory Consultation

We would recommend that a copy of this Phase I Desk Study report is issued to the Local Planning Authority for review and comment as part of the planning application process. Any comments made by the Local Authority, or their appointed consultees, should be incorporated into the Phase II Exploratory Investigation to ensure that the intrusive investigation is acceptable to all parties.

5.12 Recommended Phase II Exploratory Investigation Works

Proposed Phase II Exploratory Works should be sufficient to investigate the possible issues raised in the Phase I Desk Study and should be undertaken in general accordance with current industry good practice. It is recommended that the programme of Phase II works is designed/undertaken once the development aspirations of the Client have been confirmed to enable targeting of the intrusive works.

Based on our current understanding (conceptual site model) it is recommended that Phase II works comprise the following, as a minimum:

- A programme of rotary drilling to determine any areas of the site where works to stabilise shallow mine workings or mine entries may be required prior to development.
- A programme of exploratory holes across the site to provide an initial inspection of the near surface ground conditions for geotechnical and environmental purposes.
- Appropriate geotechnical and environmental soil analysis.
- The installation of combined ground gas and groundwater monitoring points at the site to enable a programme of ground gas/groundwater monitoring.

APPENDIX A

**Site Location Plan
(Figure No. 16255/01)**



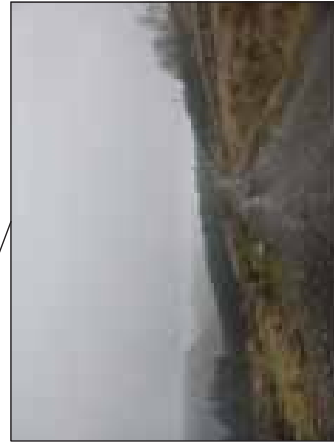
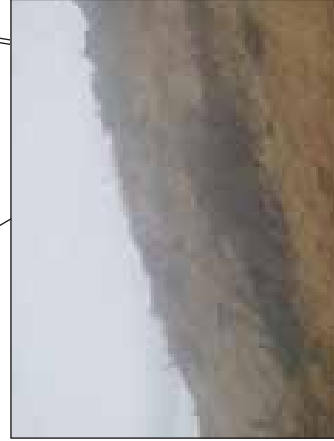
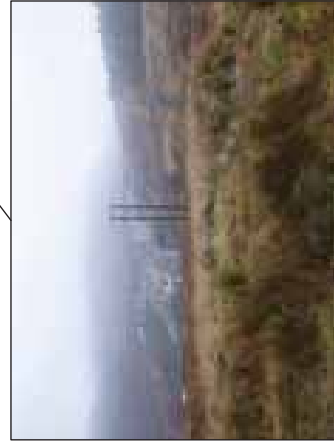
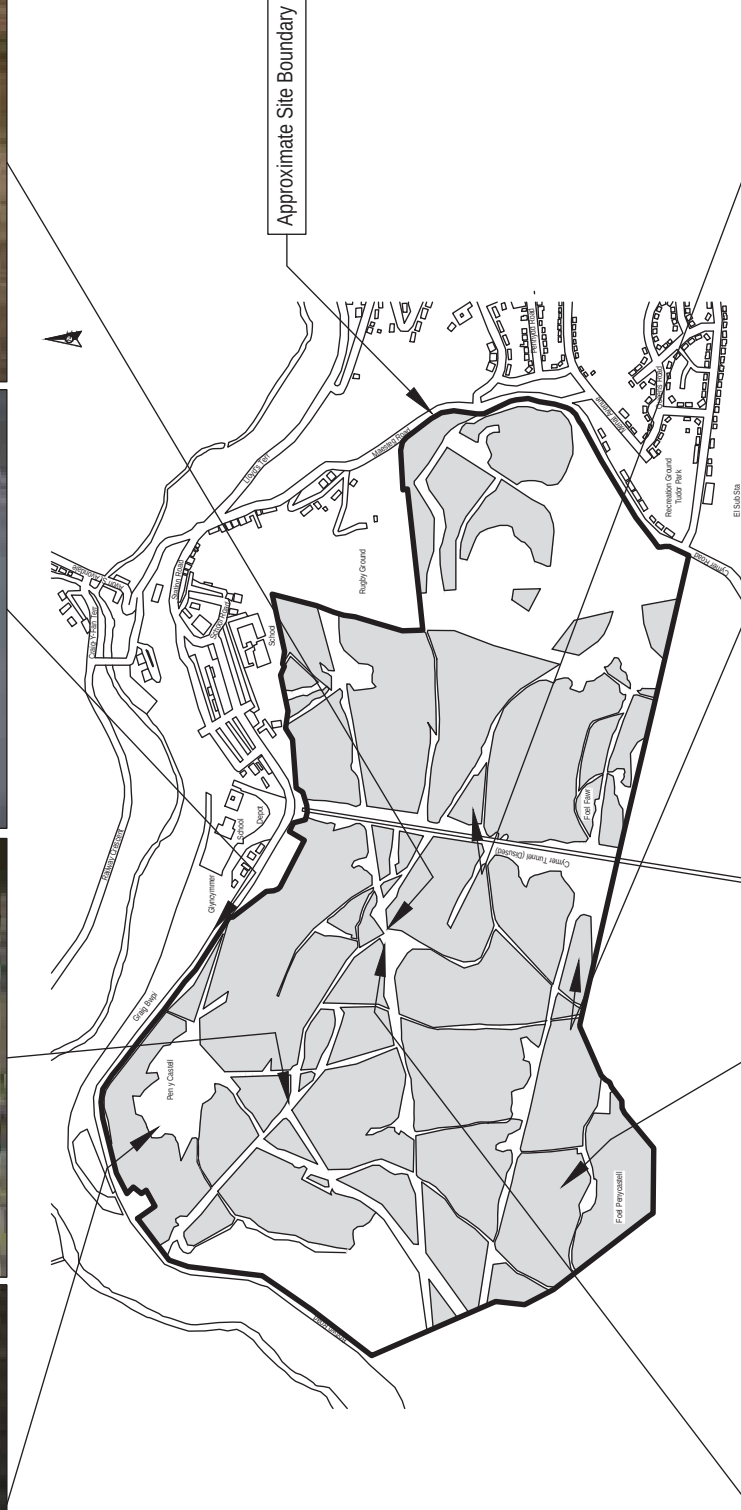
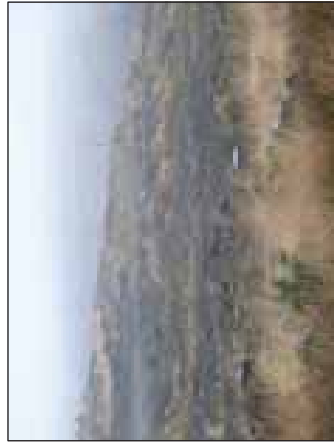
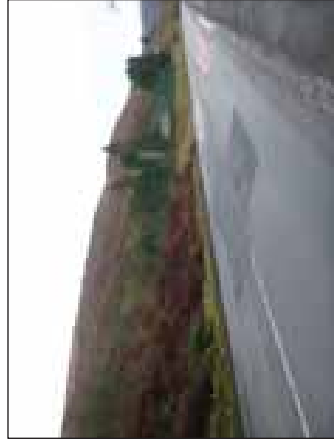
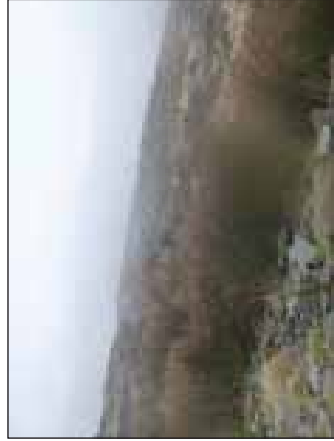
Project No.	16255	Drawn By	HW	bsp CONSULTING 12 Oxford Street Nottingham, NG1 5BG Tel : (0115) 8402227 - Fax : (0115) 8402228 e-mail : info@bsp-consulting.co.uk Also offices in Derby, Leicester and Sheffield
Client	Northern Powerhouse Developments	Checked By		
		Approved By		
Project		Scale	NTS	
		Date Drawn	06/02/2017	
Title	Site Location Plan	Revision		
		Figure No.	16255/01	

APPENDIX B

**Annotated Site Plan
(Figure No. 16255/02)**

APPENDIX C

**Site Plans Showing General Site Views
(Figure Nos. 16255/03 & 16255/04)**



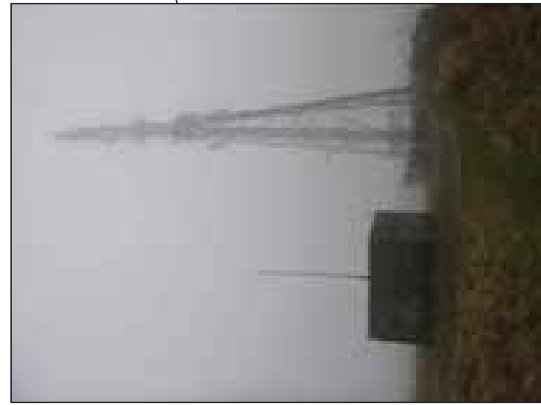
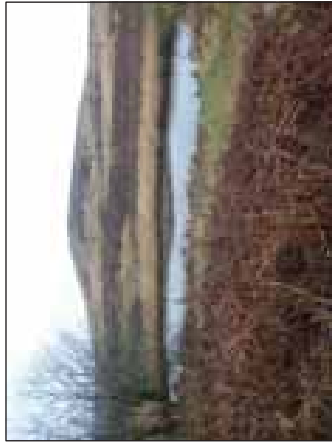
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Project	Caerau Parc, Afan Valley, Wales
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Drawn By	HW
Checked By	
Approved By	
Scale	NTS
Date Drawn	06/02/2017
Revision	
Figure No.	16255/03

- CIVIL
- STRUCTURAL
- TRANSPORTATION
- GEOTECHNICAL
- ENVIRONMENTAL



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APPENDIX D
Historical Plans

SLICE A

Envirocheck®
LANDMARK INFORMATION GROUP®

Mapping Type	Scale	Date
Glamorganshire	1:10,560	1884
Glamorganshire	1:10,560	1900
Glamorganshire	1:10,560	1921
Glamorganshire	1:10,560	1938 - 1951
Historical Aerial Photography	1:10,560	1945 - 1949
Glamorganshire	1:10,560	1963
Ordinance Survey Plan	1:10,000	1964 - 1965
Ordinance Survey Plan	1:10,000	1975
Ordinance Survey Plan	1:10,000	1982 - 1988
Ordinance Survey Plan	1:10,000	1980
10K Raster Mapping	1:10,000	1999
10K Raster Mapping	1:10,000	2006
VectorMap Local	1:10,000	2016

1:10,000 Raster Mapping

Gravel Pit	Sand Pit	Other Pits
Quarry	Dringe	Contact
Oak	Reeds	Mire
Mixed Wood	Deciduous	Bushwood
Pine	Fir	Rough Pasture
Arise borders line of water	Arise borders line of water	Trigonometrical Station
Site of Antiquities	Site of Antiquities	Search Mark
Pump, Quail Post, Signal Post	Pump, Quail Post, Signal Post	Well, Spring, Boundary Pill
Surface Level	Surface Level	
Sketches Contour	Sketches Contour	Instrumental Contour
Main Roads	Main Roads	Minor Roads
Urban Road	Urban Road	Railway Road
Road over Railway	Road over Railway	Railway over River
Railway over Road	Railway over Road	Level Crossing
Road over River or Canal	Road over River or Canal	Road over Stream
Road over Stream	Road over Stream	
County Boundary (Geographical)	County Boundary (Geographical)	
County Boundary (Administrative)	County Boundary (Administrative)	
County Boundary (Political)	County Boundary (Political)	
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County Boundary (Economics)	County Boundary (Economics)	
County Boundary (Culture)	County Boundary (Culture)	
County Boundary (History)	County Boundary (History)	
County Boundary (Geography)	County Boundary (Geography)	
County Boundary (Politics)	County Boundary (Politics)	
County Boundary (Economics)	County	

[illegible]

Symbol	Feature	Symbol	Feature
	Gravel pit		Relief 3D or ring heap
	Pond		Rock (outcrop)
	Boulders		Boulders (outcrop)
	Shingle		Mud
	Sand		Sand pit
	Slope		Top of cliff
	General detail		Underground detail
	Overhead detail		Name gauge railway
	Multi-track railway		Single track railway
	County boundary (England only)		Co-A parish or community boundary
	District, Unitary, Metropolitan, London Borough boundary		Constitutional boundary
	Area of wooded vegetation		Non-coniferous trees
	Non-coniferous trees (scattered)		Coniferous trees
	Coniferous trees (scattered)		Potted tree
	Orchard		Coppice or Osiers
	Rough Grassland		Heath
	Scrub		Marsh, Salt Marsh or Reeds
	Water feature		Flow arrows
	Mean High water (spring)		Mean low water (spring)
	Telephone line (where shown)		Electricity transmission line (with poles)
	Bench mark (where shown)		Triangulation station
	Post feature (e.g. Guide Post or Mile Stone)		Pylon, Mast etc. or lighting tower
	Site of antiquity		Glasshouse
	General Building		Important Building

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

Red numbers in the center 2x2 grid:

6	7
10	11

Order Number:	110795354_1_1
Customer Ref:	D36058
National Grid Reference:	285060, 195510
Slice:	A
Site Area (Ha):	130.06
Search Buffer (m):	250

Caerau Parc

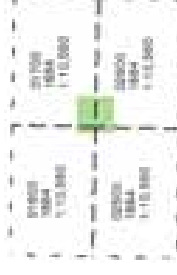
Glamorganshire

Published 1884

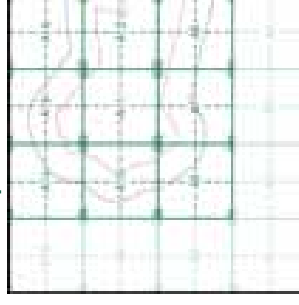
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at a 1:25,000 scale adopted for England, Wales and Scotland in the 1840's. In 1864, the Ordnance Survey published the first 1:10,560 scale maps. These maps are used to update the 1:10,560 maps. The published data is then then the maps are often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number: 110795354_1_1
 Customer Ref: D36058
 National Grid Reference: 285060, 195510
 Slice: A
 Site Area (Ha): 130.06
 Search Buffer (m): 250

Site Details

Caerau Parc

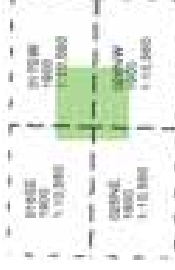
Glamorganshire

Published 1900

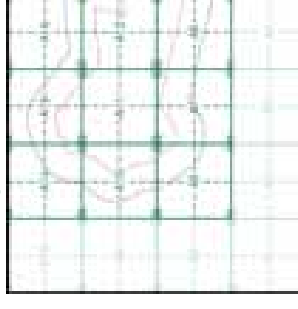
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at a 1:2500 scale adopted for England, Wales and Scotland in the 1840's. In 1854 the Ordnance Survey (OS) began to publish maps at a 1:10,560 scale. These maps are used to update the 1:10,560 maps. The published data is then then the maps are often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys in a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A

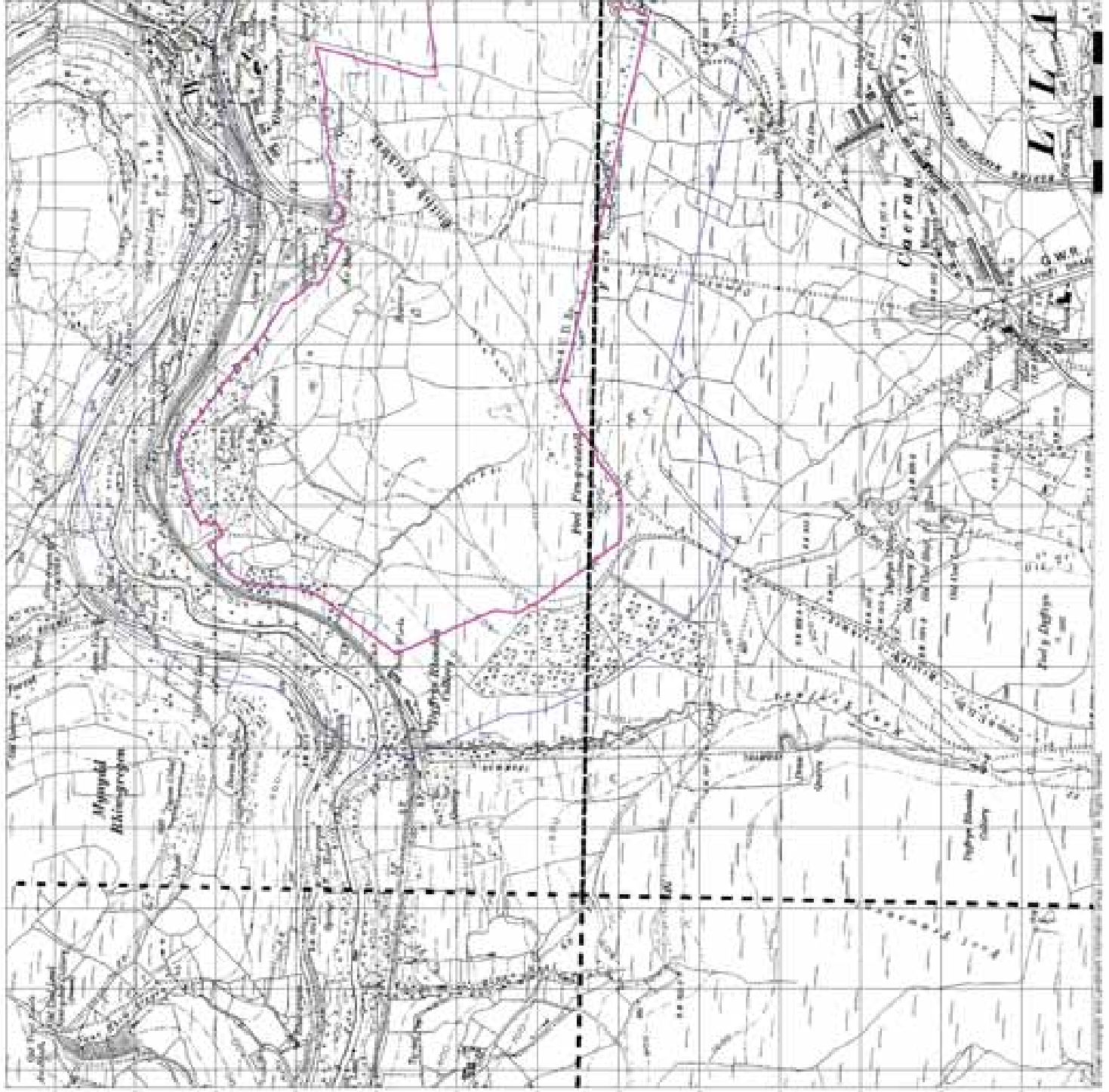


Order Details

Order Number: 110795354_1_1
 Customer Ref: D36058
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 Site Area (Ha): 130.06
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Site Details

Caerau Parc



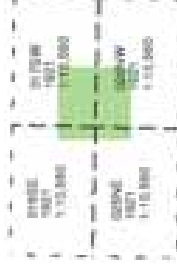
Glamorganshire

Published 1921

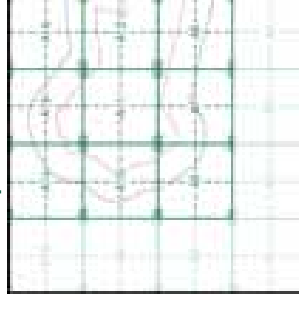
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at a 1:25,000 scale adopted for England, Wales and Scotland in the 1840's. In 1854 the Ordnance Survey began to publish maps at a 1:10,560 scale. These maps are used to update the 1:10,560 maps. The published data is then then the maps are often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A

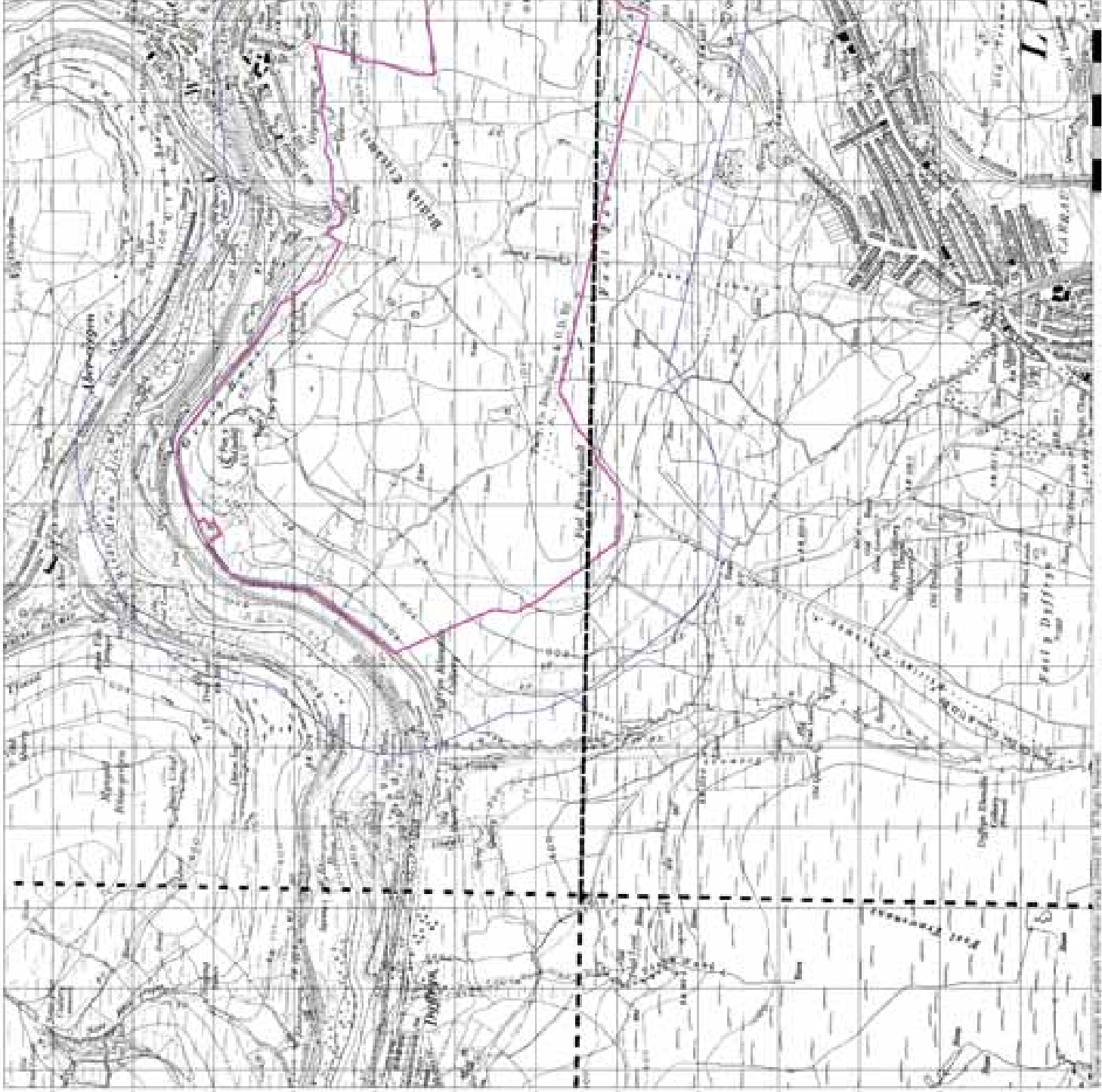


Order Details

Order Number: 110795354_1_1
Customer Ref: D36058
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Slice: A
Site Area (Ha): 130.06
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Site Details

Caerau Parc



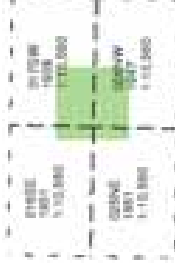
Glamorganshire

Published 1938 - 1951

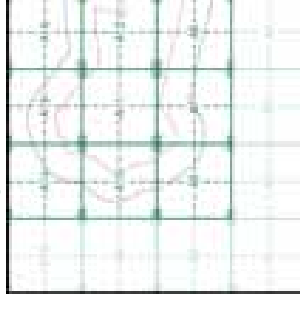
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the Ordnance Survey, which were adopted for England, Wales and Scotland in the 1840's. In 1854 the Ordnance Survey began to publish maps of the British Isles. These maps were used to update the 1:10,560 maps. The published data is then the data as it was at the time of the survey. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A

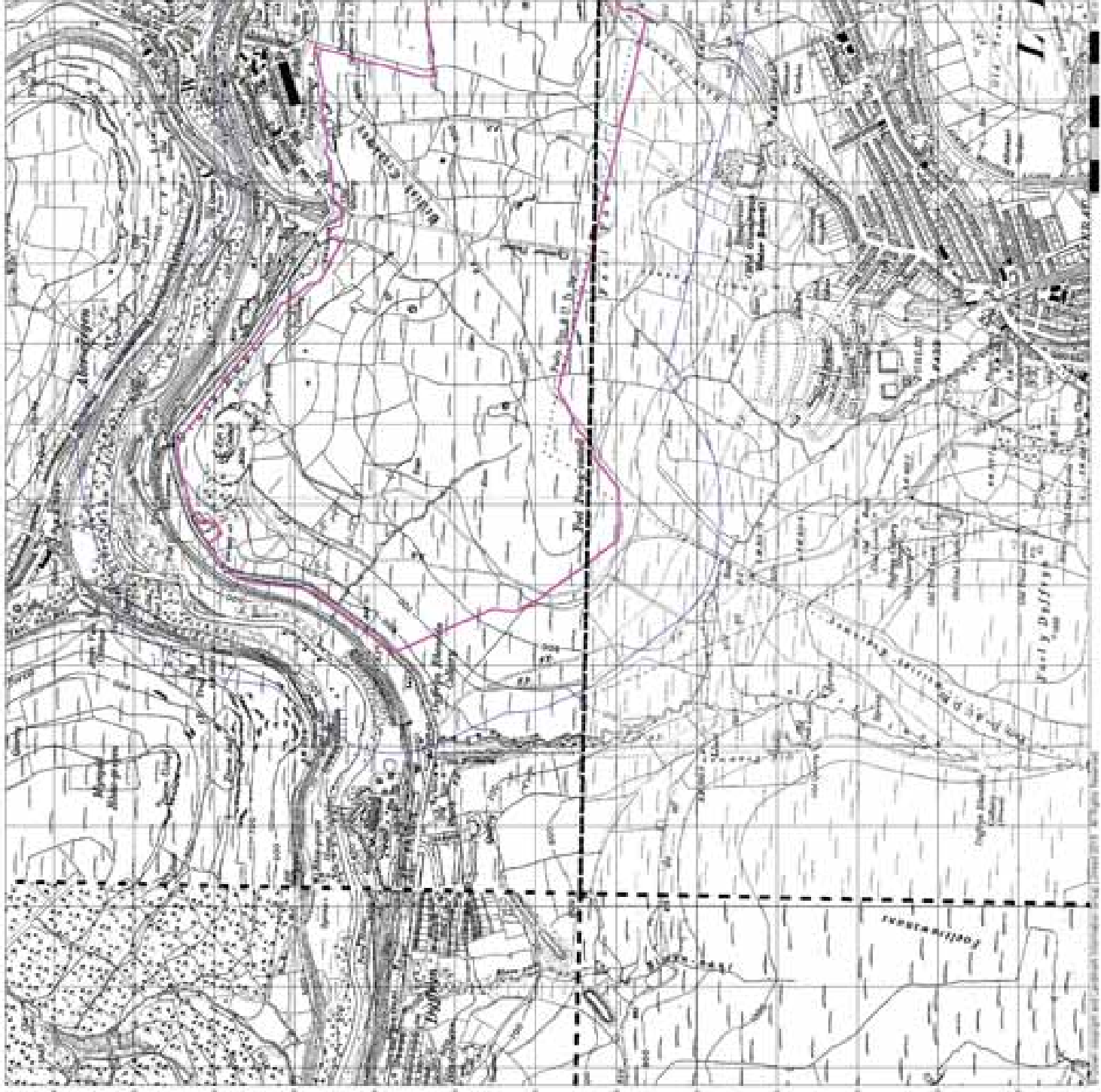


Order Details

Order Number: 110795354_1_1
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Site Details

Caerau Parc



Historical Aerial Photography

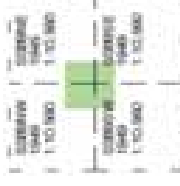
Published 1945 - 1949

Source map scale - 1:10,560

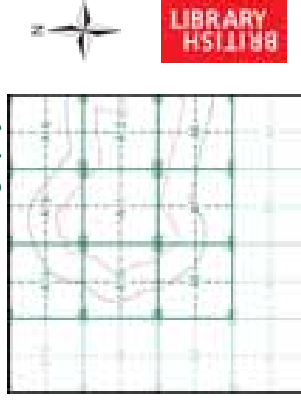
The Historical Aerial Photos were produced by the Ordnance Survey at a scale of 1:1,250 and 1:10,560 from Air Force photography. They were produced between 1944 and 1949 as a security measure. The preparation of aerial maps in 1944-1949 was a security measure. New security measures in the 1950s meant that every photograph was rechecked for potentially unsafe information with security sites replaced by fake fields or clouds. The original editions were withdrawn and only later made available after a period of fifty years although due to the accuracy of the editing, without viewing both revisions it is not easy to spot the edits. Where available Landmark have included both revisions.

© Landmark Information Group and/or Data Suppliers 2010.

Map Name(s) and Date(s)



Historical Aerial Photography - Slice A



Order Details

Order Number: 110795354_1_1
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National Grid Reference: 285060, 195510
Slice: A
Site Area (Ha): 130.06
Search Buffer (m): 250

Site Details

Caerau Parc

Glamorganshire

Published 1953

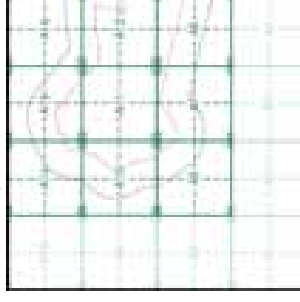
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at a 1:2500 scale adopted for England, Wales and Scotland in the 1840's. In 1854 the Ordnance Survey began to publish maps at a 1:10,560 scale. These maps are used to update the 1:10,560 maps. The published data is then then the maps are often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number: 110795354_1_1
Customer Ref: D36058
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Slice: A
Site Area (Ha): 130.06
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Site Details

Caerau Parc



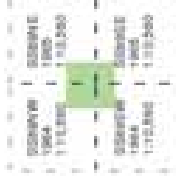
Ordnance Survey Plan

Published 1964 - 1965

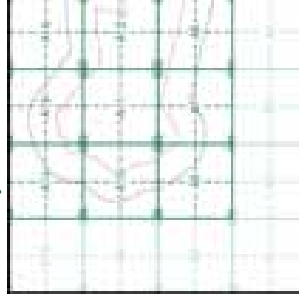
Source map scale - 1:10,000

The historical maps shown were reproduced from maps predominantly held at a 1:25,000 scale adopted for England, Wales and Scotland in the 1840's. In 1864, the Ordnance Survey introduced the 1:10,000 scale maps. These maps were used to update the 1:10,000 maps. The published data is then the data as it often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,000 mapping from a number of sources. The maps appear 'unfinished' - with all military camps and other strategic sites removed. These maps were initially overprinted with the Transverse Mercator Projection. The 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A

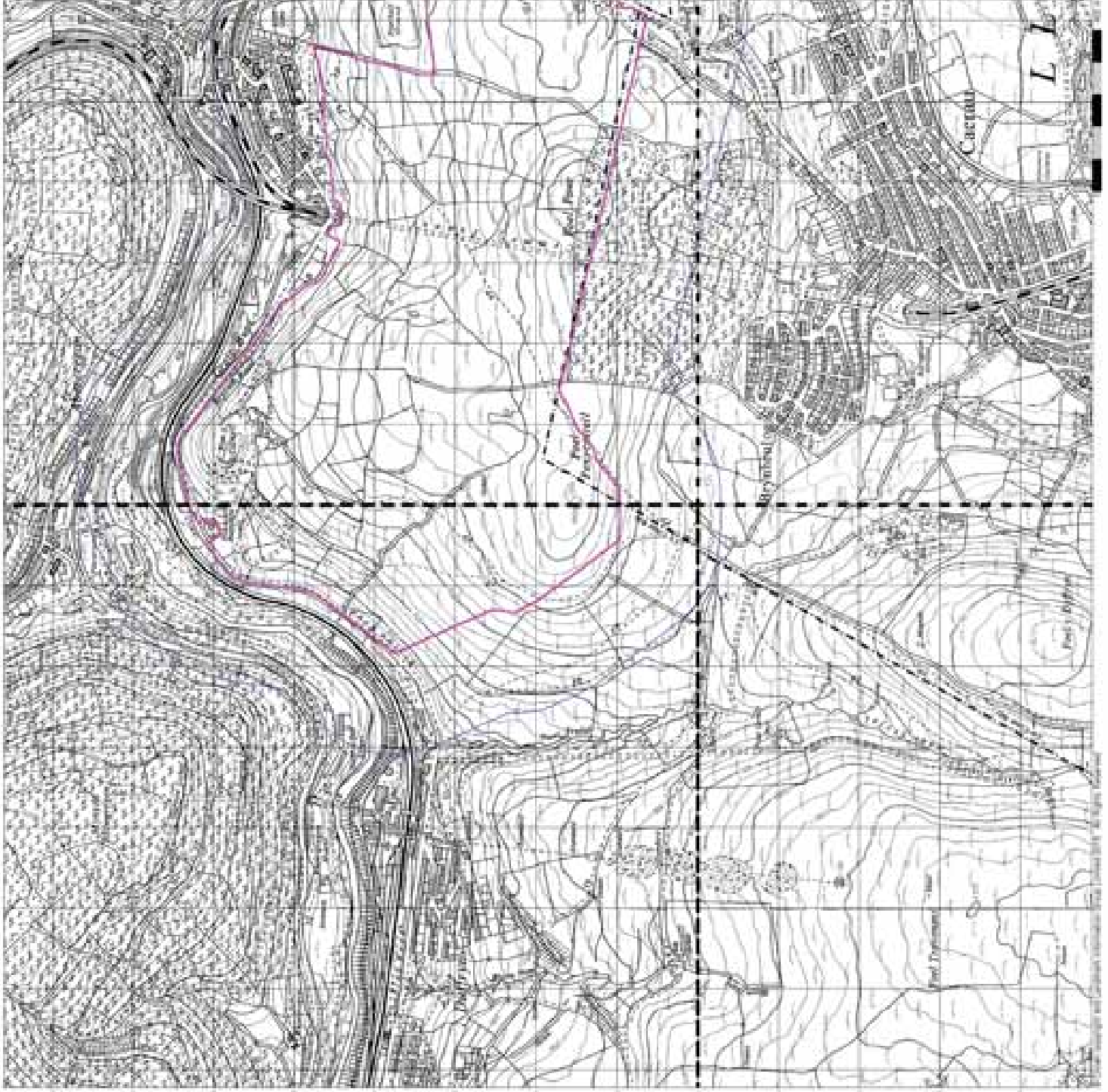


Order Details

Order Number: 110795354_1_1
Customer Ref: D36058
National Grid Reference: 285060, 195510
Slice: A
Site Area (Ha): 130.06
Search Buffer (m): 250

Site Details

Caerau Parc



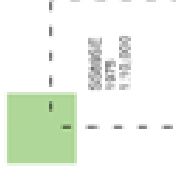
Ordinance Survey Plan

Published 1975

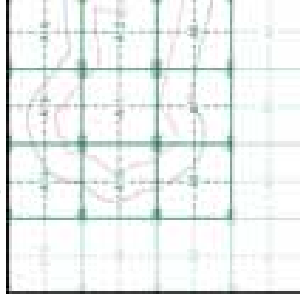
Source map scale - 1:10,000

The historical maps shown were reproduced from maps predominantly held at 1:25,000 scale adopted for England, Wales and Scotland in the 1840's. In 1854 the Ordnance Survey began to publish 1:10,000 scale maps. These maps were used to update the 1:10,000 maps. The published data then then the maps were often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,000 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

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Site Details

Caerau Parc

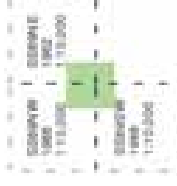
Ordnance Survey Plan

Published 1982 - 1988

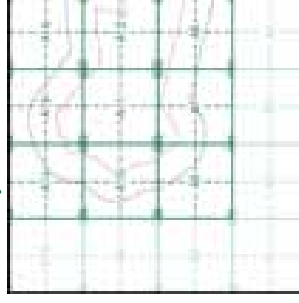
Source map scale - 1:10,000

The historical maps shown were reproduced from maps predominantly held at a 1:2500 scale adopted for England, Wales and Scotland in the 1840's. In 1854 the Ordnance Survey began to publish maps at a 1:10,000 scale. These maps are used to update the 1:10,000 maps. The published data is then checked and often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,000 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number: 110795354_1_1
Customer Ref: D36058
National Grid Reference: 285060, 195510
Slice: A
Site Area (Ha): 130.06
Search Buffer (m): 250

Site Details

Caerau Parc

Ordnance Survey Plan

Published 1990

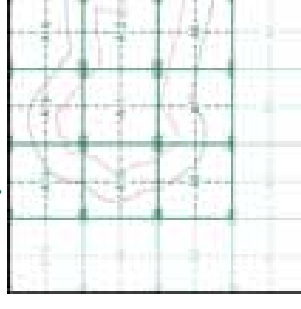
Source map scale - 1:10,000

The historical maps shown were reproduced from maps predominantly held at 1:2500 scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2500 maps were replaced by 1:10,000 maps. These maps were used to update the 1:10,000 maps. The published data then the maps were often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940's, a Provisional Edition was produced, which updated the 1:10,000 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number: 110795354_1_1
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Slice: A
Site Area (Ha): 130.06
Search Buffer (m): 250

Site Details

Caerau Parc

10k Raster Mapping

Published 1999

Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey's 1:10,000 colour raster mapping. These maps are derived from Landplan 1 which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depicts includes county, unitary authority, district, civil parish and constituency.

Map Name(s) and Date(s)

