

Gwent Holdings Limited

PEN-RHIW BENGI FARM, OAKDALE

Coal Mining Risk Assessment

14198/LP/23/CMRA

CLIENT: Gwent Holdings Limited

PROJECT: Pen-Rhiw Bengi Farm, Oakdale

TITLE: Coal Mining Risk Assessment

JOB NO: 14198

DOCUMENT REF: 14198/LP/23/CMRA

Revision	Purpose Description	Originated	Reviewed	Authorised	Date
0	Final	LP	HP	RB	April 2023

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1.0 INTRODUCTION

1.1 GENERAL

Gwent Holdings Limited are proposing the construction of a new dwelling at Pen-Rhiw Bengi Farm which is located off Pen-Rhiw Bengi Lane in Oakdale.

Intégral Géotechnique (Wales) Limited have been appointed as the Geotechnical Engineers to undertake a Coal Mining Risk Assessment in order to support an appraisal of the viability of the site.

This report presents the findings of the desk study and coal mining searches and sets out the Coal Mining Risk Assessment in line with the Coal Authority's guidelines.

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1.2 PROPOSED DEVELOPMENT

The development proposals have not been made available to us at this stage, but it is understood that the construction of a new residential dwelling within the site has been proposed.

1.3 SCOPE OF WORKS

The objectives of the coal mining risk assessment are to:

1. Present a desk-based review of all available information within this report on the coal mining issues which are relevant to the site.
2. Use the information obtained to identify and assess the risks to the proposed development from coal mining legacy, including cumulative impact issues.
3. Set out appropriate mitigation measures to address the coal mining legacy issues affecting the site, including any necessary remedial works and/or demonstrate how coal mining issues have influenced the proposed development.

1.3 SCOPE OF WORKS (CONTINUED)

4. Demonstrate to the Local Planning Authority that the application is or can be made safe and stable to meet the requirements of the National Planning Policy Framework and the requirements of the Coal Authority in respect of their determination of planning application consultations.
5. Minimise the risks and effects of land instability on properties, infrastructure, and the public.
6. Help to ensure that various types of development should not be placed in unstable locations without appropriate precautions.
7. Bring unstable land, wherever possible, back into productive use.
8. Assist in safeguarding public and private investment by a proper appreciation of site conditions and necessary precautionary measures.

This report has been prepared in general accordance with the guidance within Section 11 of CIRIA Report C758 - Abandoned Mine Workings Manual and the Mining Risk Assessment Model Report Template and intends to demonstrate to the Local Planning Authority and the Coal Authority that the site is, or can be, made safe and stable, and to meet the requirements of the National Policy Planning Framework (NPPF).

The desk study comprised a review of:

- Old Ordnance Survey maps covering the site,
- Geological maps of the area provided by the British Geological Survey,
- A Consultants Coal Mining Report obtained from The Coal Authority,
- Available abandonment plans obtained from The Coal Authority.

1.4 LIMITATIONS

This document is intended to be a working document for further development in discussion with all concerned including the Local Planning Authority and The Coal Authority.

2.0 THE SITE

2.1 SITE LOCATION AND DESCRIPTION

The site is located on the northern edge of Oakdale, at a National Grid Reference of 318900, 198820, see Figure 1.

The site is irregular in shape and occupies an area of approximately 0.7 hectares. The boundaries of the site are defined by Pen-Rhiw Bengi Farm and associated grounds and Pen-Rhiw Bengi Lane to the west, an undeveloped mainly wooded area to the north, undeveloped fields to the east and a lane with residential development beyond to the south. A site plan is presented in Figure 2.

The site is situated on sloping ground which generally rises to the south from an approximate minimum elevation of 231m AOD in the north to an approximate maximum elevation of 240m AOD in the south.

The site comprises an undeveloped grass covered field. The field boundaries are formed by mature hedgerows and trees.

2.2 SITE OPERATIONS

The site is currently undeveloped agricultural land.

2.3 SURROUNDING LAND USE

The surrounding areas are utilised for mixed residential and rural use with residential development to the south and west of the site.

2.4 AVAILABLE SITE INVESTIGATION DATA

There is no available site investigation data for the site to our knowledge.

3.0 SITE HISTORY

The recent history of the site has been traced with the aid of the following historical maps which have been presented in Appendix A:

Map Scale	Dates
1:1,250	1960-1992, 1986-1992, 1990, 1993, 2000 (aerial photo)
1:2,500	1879, 1901, 1920, 1962
1:10,560	1886, 1902, 1922, 1938, 1949 (aerial photo), 1953
1:10,000	1964-1965, 1975-1978, 1990-1995, 1999, 2006, 2022

The earliest edition of the map dated 1879 indicated the site to comprise an undeveloped field. An existing road was located to the west which also formed the northwest boundary of the site. The nearest development at this time was Tir-berllan approximately 20m to the west which was located in between the site boundary and the road. A footpath crossed the site from Tir-berllan on an approximately southwest to northeast orientation and another footpath crossed along the southern edge of the site. Another property known as Pen-rhiw Bengi was located further along the road approximately 100m to the southwest. Waterloo Colliery was located approximately 190m to the north which was served by a network of tramways and included colliery buildings and levels, and associated spoil heaps. Quarries, coal levels and tramways were also indicated approximately 400m to the west of the site. The Sirhowy River flowed approximately 570m to the west.

The 1901 edition of the map indicated that the site had remained undeveloped, and the immediate surrounding areas had remained relatively unchanged. Waterloo Colliery to the north was disused by this time. Spoil heaps and disturbed ground remained in the vicinity of the former colliery. The Great Western Railway Pennar Branch line was indicated approximately 460m to the west of the site. All the quarries to the west and southwest were now old, but evidence of these and the old coal levels remained. Pen-rhiw Colliery was indicated approximately 580m to the southwest adjacent to the railway line.

3.0 SITE HISTORY (CONTINUED)

The 1920 edition of the map indicated that the site had remained undeveloped, but the southwest to northeast oriented footpath was no longer indicated to cross the site. Significant development had taken place in the vicinity of the site as Oakdale developed with extensive residential development taking place approximately 100m to the southwest. The property to the southwest known as Pen-rhiw Bengi was no longer evident. Oakdale Navigation Colliery had been constructed approximately 280m to the northwest of the site and was served by a new network of tramways and tracks, which connected into the Pennar Branch of the Great Western Railway to the west. Spoil heaps were indicated in between the railway and the river to the west of the site. Pen-rhiw Colliery was no longer indicated to the west.

The 1962 edition of the map indicated the site to be undeveloped but now crossed by an overhead electricity line on a northwest to southeast orientation. The road to the west was now known as Pen-Rhiw Bengi Lane and Tir-berllan was now known as Pen-Rhiw Bengi Farm. The fields beyond Pen-Rhiw Bengi Lane to the west were now indicated to be utilised as allotment gardens. Oakdale Navigation Colliery continued to expand to the northwest with the construction of more buildings and an increased tramway/rail network. A large spoil heap was now indicated approximately 100m to the northeast of the site with aerial ropeways to deposit the spoil. Residential development within Oakdale to the south and southwest of the site continued. It is understood that Oakdale Navigation Colliery ceased operations by 1967.

The edition of the map dated 1993 indicated that the site remained undeveloped but was no longer crossed by the overhead electricity line. Navigation Colliery was no longer operational and many of the buildings and infrastructure had been removed. The spoil heaps to the east had been reprofiled. Development continued to the south within Oakdale.

The year 2000 aerial photo indicated the site to be grass covered and undeveloped with more densely vegetated mature boundaries. The field to the north of the site was indicated to be more heavily vegetated. The former allotment gardens to the west had now been fully developed for residential use with a new estate known as Tir-Berllan. The fields to the south and east of the site remained undeveloped.

The site has remained undeveloped up until the present day with the fields to the south of the site developed for residential use by 2013. Pen-Rhiw Bengi Farm to the west was demolished circa 2020 and rebuilt by 2021.

4.0 SITE ENVIRONMENTAL SETTING

4.1 PHYSICAL SETTING

The site is located on the northern edge of Oakdale within a mainly residential setting.

The site is situated on sloping ground which generally rises to the south from an approximate minimum elevation of 231m AOD in the north to an approximate maximum elevation of 240m AOD in the south.

4.2 GEOLOGY

The 1:50,000 and 1:10,560 scale (Sheet No. ST 19 NE) geological maps of the area indicate the site to be underlain by bedrock of the Grovesend Formation of the Carboniferous period. These rocks typically comprise mudstones and siltstones, with well-developed coals and minor lithic Pennant sandstones. Based on the Generalised Vertical Section the strata are indicated to dip in a southerly direction. There are no dip angles recorded in the vicinity of the site, but sub-horizontal dips would be anticipated.

The conjectural outcrop of the Small Rider seam is indicated approximately 25m to the north of the site. The proven outcrop of the Mynyddislwyn seam is indicated approximately 200m to the north of the site. Due to the southerly sub-horizontal strata dips these seams would underlie the site at shallow depths. An extract from the geology map is presented in Figure 3.

No superficial deposits are indicated to overlie the solid strata, but the geological boundary of the Devensian Till deposits of the Quaternary period is indicated to encroach across the northern boundary of the site. These deposits may therefore be present within the northern area of the site but would be anticipated to be thin. The Devensian Till deposits are typically poorly sorted and variable in nature comprising clays, sands and gravel.

The site has remained historically undeveloped and therefore made ground would not be anticipated. Localised areas of disturbed ground or made ground could be present on the site boundary or in gateways associated with past site activity. Topsoil/subsoil would be anticipated across the majority of the site.

A summary of the anticipated geological succession is given below in Table 1.

4.2 GEOLOGY (CONTINUED)

Table 1: Summary of Anticipated Site Geology		
Geological unit	Horizon	Description
Recent	Topsoil/subsoil with possible localised made ground/reworked material	Various materials
Quaternary	Devensian Till (could be thin across the northern site area)	Poorly sorted and variable clays, sands and gravel
Carboniferous	Grovesend Formation	Comprise mudstones and siltstones, with well-developed coals and minor lithic Pennant sandstones

4.3 MINING

The site is located within a coal mining reporting area and therefore a Consultants Coal Mining Report has been obtained from the Coal Authority and a copy is included in Appendix B.

An appraisal of the mining data and its significance is presented below.

Past Underground Coal Mining

The Coal Authority states that there is recorded underground workings beneath the site within four seams of coal at 28m to 665m depth and last worked in 1963. The shallowest workings at depths of 28m are recorded within the Mynyddislwyn Lower Leaf seam with an extraction thickness of 1.82m. The next recorded workings are at 279m depth within the Tillery Brithdir seam. These deeper workings would be at a depth that would not cause a shallow mining risk at the surface. The deepest recorded workings are within the Five Foot Gellideg seam at a depth of 665m.

An abandonment plan extract showing the shallow workings within the Mynyddislwyn Lower Leaf seam is presented in Figure 4.

Probable Unrecorded Shallow Workings

The Coal Authority state that the probable unrecorded workings is "none". However, this does not mean that shallow unrecorded workings do not exist, but rather any information to support this has not come into the possession of the Coal Authority.

4.3 MINING (CONTINUED)

The Coal Authority indicate the conjectural outcrop of an unnamed seam approximately 25m to the north. The geology map indicates this to be the Small Rider seam. This seam is known to be a thin seam but The Coal Authority state that it is workable. The generalised Vertical Section (GVS) indicates that this seam lies approximately 25m above the Mynyddislwyn seam and could therefore be present beneath the northern area of the site at depths shallower than 5m. Unrecorded workings within both the Small Rider and the Mynyddislwyn seams at shallow depths should not be ruled out. Both seams would deepen in a southerly direction due to the rise in topography with the southern boundary of the site approximately 10m higher than the northern boundary.

Spine Roadways at Shallow Depth

The Coal Authority have indicated that shallow spine roadways are not recorded beneath the site. Unrecorded roadways should not be ruled out.

Mine Entries

The Coal Authority indicates that there are no mine entries located on site or within 100m of the site boundary. Due to the site being located within a coal mining reporting area the presence of unrecorded features should not be ruled out.

Geological Faults, Fissures and Breaklines

The Coal Authority states that there are no faults, fissures or breaklines recorded beneath the site.

There are no issues regarding faults in the area.

Opencast Mines

The Coal Authority indicates that there is one unlicensed opencast site located within 500m of the site boundary. The area is shown on the plan included within The Consultants Coal Mining Report. The site is located approximately 330m northwest of the site.

There are no issues regarding opencast workings within the site.

Coal Mining Subsidence

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

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

4.3 MINING (CONTINUED)

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

There are no recorded instances regarding subsidence.

Mine Gas

The Coal Authority confirm that the site is located within an area of previous interest and is close to an area which the Coal Authority have investigated and subsequently remediated the effects of mine gas or ground gas emissions. A Coal Authority Mine Gas Emission Report was recommended.

Unfortunately, adequate information was not available to produce a report but the available associated data from the Coal Authority is presented in Appendix C.

Three mine gas monitoring points were installed approximately 329m to 388m to the northwest and west of the site.

The monitoring points (Ref: L231.1, L231.2 and L231.3 Oakdale/Waterloo) are three infilled shafts with vents installed above ground level during the closure of the colliery in 1994.

These are being monitored by Coal Authority contractors every 6 months. The graphs showing the data that has been recorded at these sites between 2009 and the present day is presented in Appendix C.

The results indicated very low methane concentrations and carbon dioxide concentrations of generally less than 5% apart isolated elevation above 5% in L231.1 in 2015 and within L231.3 in 2013.

Due to the presence of shallow recorded workings, gas evolution from coal seams and accumulated sources such as abandoned tunnels and workings cannot be discounted and will require further assessment, conducted in accordance with CL:AIRE document Good Practice for Risk Assessment for Coal Mine Gas Emissions, dated October 2021.

The potential for the presence of mine gas which may affect the site cannot be ruled out and a programme of gas monitoring is recommended.

Future Underground Mining and Section 46 Notices

The Coal Authority does not have any current records relating to future underground mining.

4.3 MINING (CONTINUED)

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

There are no currently understood issues regarding future workings or subsidence.

Overall Assessment

Based on the information provided by the geology maps and the general knowledge of the seams in the area, namely the Mynyddislwyn, it is known that shallow recorded workings are present beneath the majority of the site, but likely to be at their shallowest beneath the northern area.

There are no recorded mine entries on site or within an influencing distance. The presence of additional unrecorded mine entries cannot be ruled out.

It is therefore concluded that shallow recorded workings are present beneath the site and there is also a risk of additional unrecorded workings within the Small Rider seam and the underlying Mynyddislwyn seam. The Coal Authority interactive map indicates the northern half of the site to be located within a high-risk development area associated with the shallow recorded workings within the Mynyddislwyn seam. However, due to the potential risk of unrecorded shallow workings, our desk-based research would extend the high-risk area across the entire site. Due to the topography of the site, which rises to the south, it is considered that the risk would lower towards the southern boundary of the site, subject to physical confirmation.

Further investigation to determine the level of risk including the extent of any associated voids or backfilled workings is recommended prior to development.

5.0 ASSESSMENT OF MINING CONSTRAINTS

5.1 RISKS FROM MINING LEGACY

The desk study search of the various coal mining information and maps identifies the following site-specific coal mining legacy risks to the site, see Table 2.

Table 2: Mining Legacy Risk Table				
Coal Mining Issue	Yes	No	Risk Assessment	
			Rating	Comments
Underground coal mining (recorded at shallow depths)	X		High risk	Recorded workings at shallow depth (28m) within the Mynyddislwyn Lower Leaf seam
Underground coal mining (possible at shallow depths)	X		High risk	Unrecorded workings possible beneath the site within the Small Rider and the Mynyddislwyn seams
Mine entries (shafts)		X	Low-moderate risk	No shafts indicated within the site or within 100m. Unrecorded features should not be ruled out
Mine entries (adits)		X	Low-moderate risk	No adits are located within the site or within 100m. Unrecorded features should not be ruled out
Coal mining geology (faults and fissures)		X	Low risk	No faults indicated to cross the site
Record of past mine gas emissions or potential	X		Moderate risk	Recorded shallow workings and potential for unrecorded workings. All mineworkings pose a potential gas risk which should be considered in any future investigations and development.
Recorded coal mining surface hazard		X	Low risk	None recorded.
Surface mining (opencast workings)		X	Low risk	None recorded.

A summary of the risk posed by these features is summarised after thorough analysis of the information sources. Comment on each specific coal mining issue follows below:

5.2 RISKS FROM ABANDONED MINeworkINGS

Coal mining at depths shallower than 30m beneath ground level can pose constraints to development in the form of ground stability at the surface. The magnitude of this effect depends upon the exact depth of any workings, the thickness of competent rock cover and the extraction thickness of any coal mine workings.

The Coal Mining Risk Assessment shows that there is recorded shallow workings beneath the site within the Mynyddislwyn Lower Leaf seam. Shallow unrecorded workings may also be present beneath the site within this seam and the overlying Small Rider seam.

To ensure that properties constructed over mineworkings are not affected by subsidence associated with past mining, a rock head cover in the order of ten times the maximum void thickness of the workings is generally required depending on the nature of the overlying rock strata. If shallow workings are present within the Mynyddislwyn seams, it is possible that adequate rock cover would not be present. If shallow workings are present within the Small Rider seam it is likely that adequate rock cover would not be present.

Thick superficial deposits are not anticipated across the site.

5.3 RISKS FROM THE ABANDONED MINE ENTRIES - SHAFTS

No shafts have been recorded on site or within 100m of the site boundary. However, the presence of unrecorded mine entries should not be ruled out.

Until recently, shafts were rarely treated on abandonment to any significant engineering standard. They were typically loosely backfilled, or with inferior capping constructed over them. With time, backfills may settle and caps fail, resulting in significant ground loss. Therefore, if a shaft lies partly or wholly within the site, or within a 20m buffer zone drawn outside the site boundary, then its effect should be considered in the site development. The size of buffer, or no development zone, will depend on the diameter of the shaft the depth to rockhead and an assessment of the shaft's condition.

After the validation of the shaft caps, and, depending on their condition, a 20m radius exclusion zone for buildings should be applied.

If the development constraints require building structures to be constructed within a 15m radius of the shaft position, then pressure grouting of the shaft will be required. On completion and validation of these potential works, details of a reduced radius exclusion zone may be reported to suit the development.

5.3 RISKS FROM THE ABANDONED MINE ENTRIES – SHAFTS (CONTINUED)

The development site sits within an historical mining area and therefore there is a residual risk of unrecorded mine entries to be present on site or within an influencing distance. All site operatives should be made aware of this potential risk and a watching brief should be maintained during site works.

5.4 RISKS FROM THE ABANDONED MINE ENTRIES - ADITS

No adits have been recorded on site or within 100m of the site boundary. However, the presence of unrecorded features should not be ruled out.

Until recently, adits were rarely treated on abandonment to any significant engineering standard. Whilst it is likely that an adit entrance itself would have been treated, the remainder of an adit roadway may still be intact. They may have been only loosely backfilled or might be partially collapsed. Therefore, if an adit is located within influencing distance of the surface, then treatment may be required. Normal procedure would be to establish a 20m buffer zone drawn parallel to the feature within a development site. The size of buffer or no development zone, will depend on the diameter of the adit, the depth to rockhead and an assessment of the adit condition.

Hence there will need to be checks on site using drilling techniques to determine the location, form and degree of hazard posed by the feature, if found.

The site sits within an historical mining area and therefore there is a residual risk of unrecorded mine entries to be present on site. All site operatives should be made aware of this potential risk and a watching brief should be maintained during site works.

5.5 COAL MINING GEOLOGY (FAULTS AND FISSURES)

The development site sits upon the bedrock of the Grovesend Formation.

No faults are indicated to cross the site.

5.6 RECORD OF PAST MINE GAS EMISSIONS OR POTENTIAL

There is ongoing mine gas emissions monitoring being undertaken by the Coal Authority to the northwest of the site. It should be noted that coal seams and coal mine workings pose a potential gas risk which should be considered in any future investigations and development.

5.6 RECORD OF PAST MINE GAS EMISSIONS OR POTENTIAL (CONTINUED)

At development sites with shallow coal workings, possible shallow coal mine workings, or pathway features such as mine entries and geological disturbances on or nearby the site, a more detailed gas risk assessment should be undertaken in accordance with CL:AIRE document Good Practice for Risk Assessment for Coal Mine Gas Emissions, dated October 2021.

There are many sources of gas in mine workings including desorption of gas from coal and rocks, oxidation of coal, decomposition of old wood (such as pit props) and acidic mine drainage reacting with carbonate in the rocks around the seam or shaft. These gases, if produced within the old workings, would need a viable pathway to the surface such as a shaft or fractured rock above the workings.

It is considered that there are no mine entries recorded which would provide a pathway for mine gas. However, there is considered to be a mine gas risk from the recorded shallow workings beneath the site combined with the likelihood that superficial deposits would be thin or absent. A programme of gas monitoring should be undertaken to confirm the level of gas risk and a mine gas risk assessment undertaken based on the results.

5.7 RECORDED COAL MINING SURFACE HAZARD

None recorded.

5.8 SURFACE MINING (OPENCAST WORKINGS)

None recorded.

5.9 DEVELOPMENT RISK PLAN

The site and the surrounding areas are underlain by the extensively worked Mynyddislwyn coal seam with some workings recorded at shallow depth both beneath and in the vicinity of the site. Development in areas underlain by shallow mine workings require appropriate site investigation and possibly remedial mitigation measures. The depth to any workings beneath the site, the thickness of workings and the thickness of the overlying rock cover would determine the requirement for any remedial mitigation measures. Appropriate intrusive investigation may be able to lower the risk where shallow workings are proven to have an acceptable rock cover or, where shallow workings are encountered without appropriate rock cover, mitigation measures can be designed and undertaken. Similar intrusive investigation and potential mitigation measures would have been utilised to successfully develop the surrounding areas and would be appropriate to safely develop this site.

5.9 DEVELOPMENT RISK PLAN (CONTINUED)

The site is located within a high-risk development area. It is considered that there is potential for the risk to be lowered or removed by conducting a site investigation. Intrusive works may discount any potential risk or may highlight remediation work which would be required to be undertaken prior to the site being developed.

The coal mining legacy issues outlined in this report, including the presence of shallow recorded workings and the potential for shallow unrecorded workings and unrecorded mine entries to be present within the site, will have implications for the proposed development.

Therefore, as a minimum precaution against potential localised subsidence over localised remnant voids, for preliminary purposes only, it is recommended that the foundations of the proposed buildings should be reinforced such that they are capable of spanning potential voids of up to 3m diameter, with cantilever effects of 1.5m at the edges/corners.

Although the above-described reinforced foundations would be capable of protecting against potential localised subsidence incidents, they would not be sufficient to protect against more widespread subsidence which could result if more significant or widespread remnant voids are still present beneath the site.

5.10 DEVELOPMENT PRECAUTIONS

Site Investigation and/or Remediation

Due to the presence of recorded shallow workings within the Mynyddislwyn Lower Leaf seam and the potential presence of unrecorded workings at shallow depth an intrusive site investigation will be required.

The site investigation works should be carried out in accordance with the guidance Section 12 of CIRIA Report C758 - Abandoned Mine Workings Manual.

The extent, depth and condition of the seam should be proved across the site by drilling a series of boreholes. Where voids/workings are found the degree of extraction can be estimated with more certainty to determine the potential abnormal costs for development.

The site investigations will need to be carried out by a competent contractor, considering the findings of this report. The results should be interpreted by a qualified and competent person so that an appropriate remedial strategy can be developed.

5.10 DEVELOPMENT PRECAUTIONS (CONTINUED)

Due to the difficulties in identifying coal related gas hazards and the proximity to other developments, it will be necessary to complete a mine gas risk assessment for the development site and a programme of gas monitoring is recommended. This may recommend basic gas protection measures within the foundation design, which are resistant to permanent gases (carbon dioxide, methane, carbon monoxide).

If any of these recommended boreholes should encounter significant voids, then the above assessments may need to be reviewed and drilling and grouting stabilisation measures, or more proof drilling may become required. Bearing in mind the nature of the shallow workings, the most likely ground remediation/stabilisation strategy would be grout injection to fill any mine void spaces that could lead to ground instability in or around the proposed development. This strategy would have to be designed by a qualified and competent engineer and carried out by a qualified and competent contractor.

The occurrence of unrecorded mine entries across the whole of the site cannot be discounted and consequently in areas of new build development a watching brief should be maintained throughout the site works to identify this risk. As a result, all site operatives should be made aware of this potential risk.

Coal Authority Permit

Any intrusive activities, including initial site investigation boreholes and any subsequent treatment of coal mine workings/coal mine entries for ground stability purposes require the prior written permission of the Coal Authority.

6.0 ENVIRONMENTAL RISK ASSESSMENT

There are several environmental hazards associated with the grouting of mine workings and a hazard assessment is presented in Table 3 overleaf.

Risk mitigation measures will need to be implemented to manage groundwater and mine gasses that may be encountered during the works. Consideration will also need to be given to the impact of PFA grouts on groundwater quality. A CIRIA 552 risk assessment table is presented below and demonstrates how these risks can be addressed.

6.0 ENVIRONMENTAL RISK ASSESSMENT (CONTINUED)

Table 3: Preliminary Conceptual Site Model / Conceptual Exposure Model						
Source	Pathway	Receptor	Consequence of risk being realised	Probability of risk being realised	Risk Classification	Potential risk management requirements / options
Displacement of groundwater by grout or fill	Mineworkings and fractures / discontinuities	Secondary aquifer	Minor	Unlikely	Very Low risk	Research suggests groundwater constituent monitoring in the Coal Measures has not indicated the presence of contamination. An assessment of groundwater constituent fate and transport may be required. Unlikely that the site is impacting off site receptors. It may be necessary to undertake a programme of physical and chemical groundwater monitoring of voids during and after any grouting works.
		Culverts	Minor	Unlikely	Very Low risk	Research suggests groundwater constituent monitoring in the Coal Measures has not indicated the presence of contamination. An assessment of groundwater constituent fate and transport may be required. Unlikely that the site is impacting off site receptors. It may be necessary to undertake a programme of physical and chemical groundwater monitoring of voids during and after any grouting works.

6.0 ENVIRONMENTAL RISK ASSESSMENT (CONTINUED)

Source	Pathway	Receptor	Consequence of risk being realised	Probability of risk being realised	Risk Classification	Potential risk management requirements / options
PFA based grout	Groundwater	Secondary aquifer	Minor	Unlikely	Very Low risk	Check quality of proposed PFA sources.
Sediment laden drilling flush	Surface water run-off, overland flow	Drains and water courses	Medium	Likely	Moderate risk	The drilling contractor must have a methodology to reduce the risk of overland flow developing to a practical minimum and if overland flow does develop a procedure to stop and or mitigate any harmful impacts
Displacement and or release of mine gases	Boreholes, mineworkings, discontinuities in the rock mass and superficial deposits. Accumulation in enclosed spaces of future buildings on site, or migration to buildings off site, leading to asphyxiation, or risk of explosion Inhalation	Future site residents/ neighbouring residents	Severe	Medium	Moderate risk	Risk assess in accordance with CL:AIRE document 'Good Practice for Risk Assessment for Coal Mine Gas Emissions dated October 2021
		Construction workers	Severe	Low likelihood	Moderate risk	Personal monitoring to be implemented by site operatives during the investigation and drilling and grouting works. Boundary monitoring in boreholes containing monitoring standpipes.
Shallow soil and groundwater contamination	Dermal contact, ingestion, and inhalation hazardous soil constituents	Construction workers	Medium	Low likelihood	Moderate risk	Gross contamination unlikely on site but precautions in line with those set out in HSG66 and in accordance with a yellow site under BDA guidelines should be followed. All construction workers should be provided with appropriate levels of PPE to mitigate the risk of contact with potentially contaminated soils.

APPENDIX A

HISTORY AND GEOLOGY MAPS

Historical Mapping Legends

Ordnance Survey County Series 1:10,560

	Gravel Pit		Sand Pit		Other Pits
	Quarry		Shingle		Orchard
	Osiers		Reeds		Marsh
	Mixed Wood		Deciduous		Brushwood
	Fir		Furze		Rough Pasture
	Arrow denotes flow of water		Trigonometrical Station		
	Site of Antiquities		Bench Mark		
	Pump, Guide Post, Signal Post		Well, Spring, Boundary Post		
	-285 Surface Level				
	Sketched Contour		Instrumental Contour		
	Main Roads		Minor Roads		
	Sunken Road		Raised Road		
	Road over Railway		Railway over River		
	Railway over Road		Level Crossing		
	Road over River or Canal		Road over Stream		
	Road over Stream				
	County Boundary (Geographical)				
	County & Civil Parish Boundary				
	Administrative County & Civil Parish Boundary				
	County Borough Boundary (England)				
	County Burgh Boundary (Scotland)				
	Rural District Boundary				
	Civil Parish Boundary				

Ordnance Survey Plan 1:10,000

	Chalk Pit, Clay Pit or Quarry		Gravel Pit
	Sand Pit		Disused Pit or Quarry
	Refuse or Slag Heap		Lake, Loch or Pond
	Dunes		Boulders
	Coniferous Trees		Non-Coniferous Trees
	Orchard		Scrub
	Coppice		Bracken
	Heath		Rough Grassland
	Marsh		Reeds
	Saltings		
	Building		Glasshouse
	Sloping Masonry		Pylon
	Electricity Transmission Line		Pole
	Cutting		Embankment
	Standard Gauge Multiple Track		Standard Gauge Single Track
	Siding, Tramway or Mineral Line		Narrow Gauge
	Geographical County		
	Administrative County, County Borough or County of City		
	Municipal Borough, Urban or Rural District, Burgh or District Council		
	Borough, Burgh or County Constituency Shown only when not coincident with other boundaries		
	Civil Parish Shown alternately when coincidence of boundaries occurs		
	BP, BS Boundary Post or Stone		Pol Sta Police Station
	Ch Church		PO Post Office
	CH Club House		PC Public Convenience
	F E Sta Fire Engine Station		PH Public House
	FB Foot Bridge		SB Signal Box
	Fn Fountain		Spr Spring
	GP Guide Post		TCB Telephone Call Box
	MP Mile Post		TCP Telephone Call Post
	MS Mile Stone		W Well

1:10,000 Raster Mapping

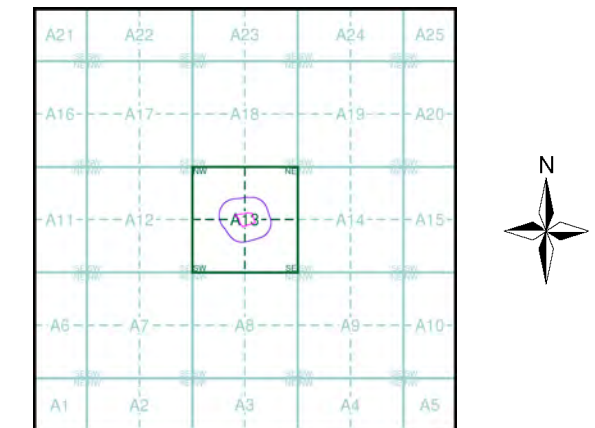
	Gravel Pit		Refuse tip or slag heap
	Rock		Rock (scattered)
	Boulders		Boulders (scattered)
	Shingle		Mud
	Sand		Sand Pit
	Slopes		Top of cliff
	General detail		Underground detail
	Overhead detail		Narrow gauge railway
	Multi-track railway		Single track railway
	County boundary (England only)		Civil, parish or community boundary
	District, Unitary, Metropolitan, London Borough boundary		Constituency boundary
	Area of wooded vegetation		Non-coniferous trees
	Non-coniferous trees (scattered)		Coniferous trees
	Coniferous trees (scattered)		Positioned tree
	Orchard		Coppice or Osiers
	Rough Grassland		Heath
	Scrub		Marsh, Salt Marsh or Reeds
	Water feature		Flow arrows
	MHW(S) Mean high water (springs)		MLW(S) Mean low water (springs)
	Telephone line (where shown)		Electricity transmission line (with poles)
	Bench mark (where shown)		Triangulation station
	Point feature (e.g. Guide Post or Mile Stone)		Pylon, flare stack or lighting tower
	Site of (antiquity)		Glasshouse
	General Building		Important Building



Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Monmouthshire	1:10,560	1886	2
Glamorganshire	1:10,560	1901	3
Monmouthshire	1:10,560	1902	4
Glamorganshire	1:10,560	1922	5
Monmouthshire	1:10,560	1922	6
Glamorganshire	1:10,560	1938 - 1945	7
Monmouthshire	1:10,560	1938	8
Monmouthshire	1:10,560	1938	9
Historical Aerial Photography	1:10,560	1949	10
Glamorganshire	1:10,560	1953	11
Monmouthshire	1:10,560	1953	12
Ordnance Survey Plan	1:10,000	1964 - 1965	13
Ordnance Survey Plan	1:10,000	1975 - 1978	14
Ordnance Survey Plan	1:10,000	1983 - 1987	15
Ordnance Survey Plan	1:10,000	1990 - 1995	16
10K Raster Mapping	1:10,000	1999	17
10K Raster Mapping	1:10,000	2006	18
VectorMap Local	1:10,000	2022	19

Historical Map - Slice A



Order Details

Order Number: 309016528_1_1
 Customer Ref: 14198/LP
 National Grid Reference: 318900, 198820
 Slice: A
 Site Area (Ha): 0.74
 Search Buffer (m): 1000

Site Details

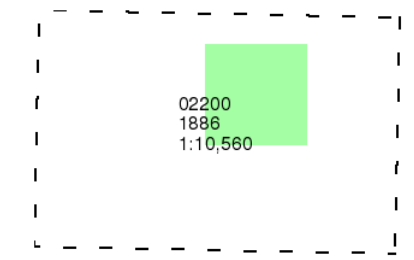
Pen-rhiw Bengi Farm, Oakdale, Blackwood, NP12 0BP



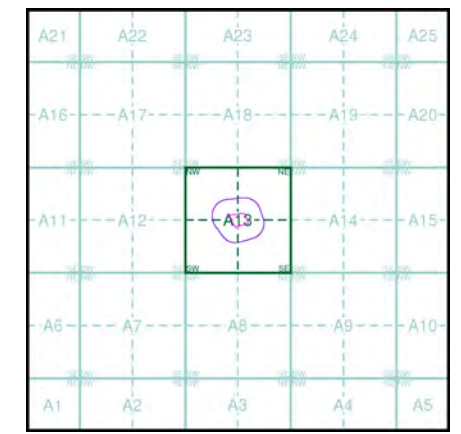
Tel: 0844 844 9952
 Fax: 0844 844 9951
 Web: www.envirocheck.co.uk

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is 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

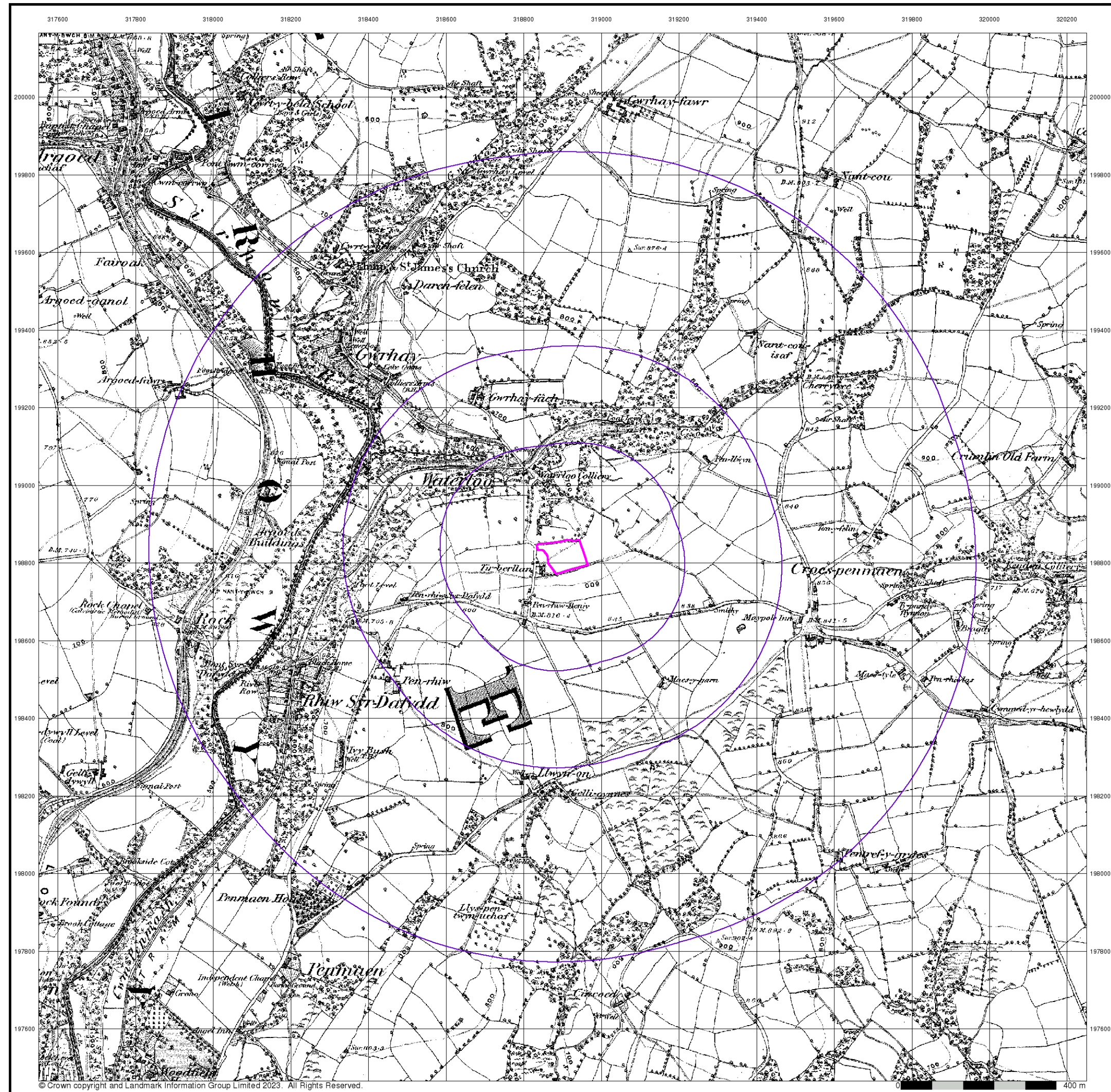


Order Details

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 National Grid Reference: 318900, 198820
 Slice: A
 Site Area (Ha): 0.74
 Search Buffer (m): 1000

Site Details

Pen-rhiw Bengi Farm, Oakdale, Blackwood, NP12 0BP





Glamorganshire

Published 1901

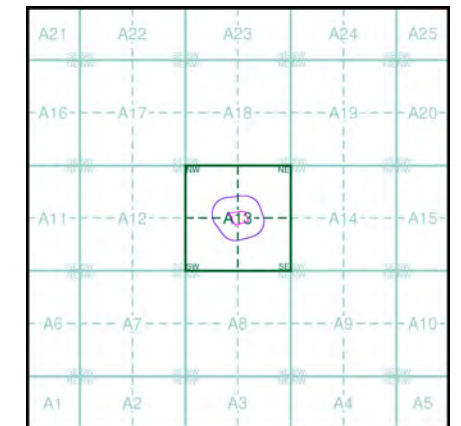
Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is 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)

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020SW	1901	1:10,560

Historical Map - Slice A



Order Details

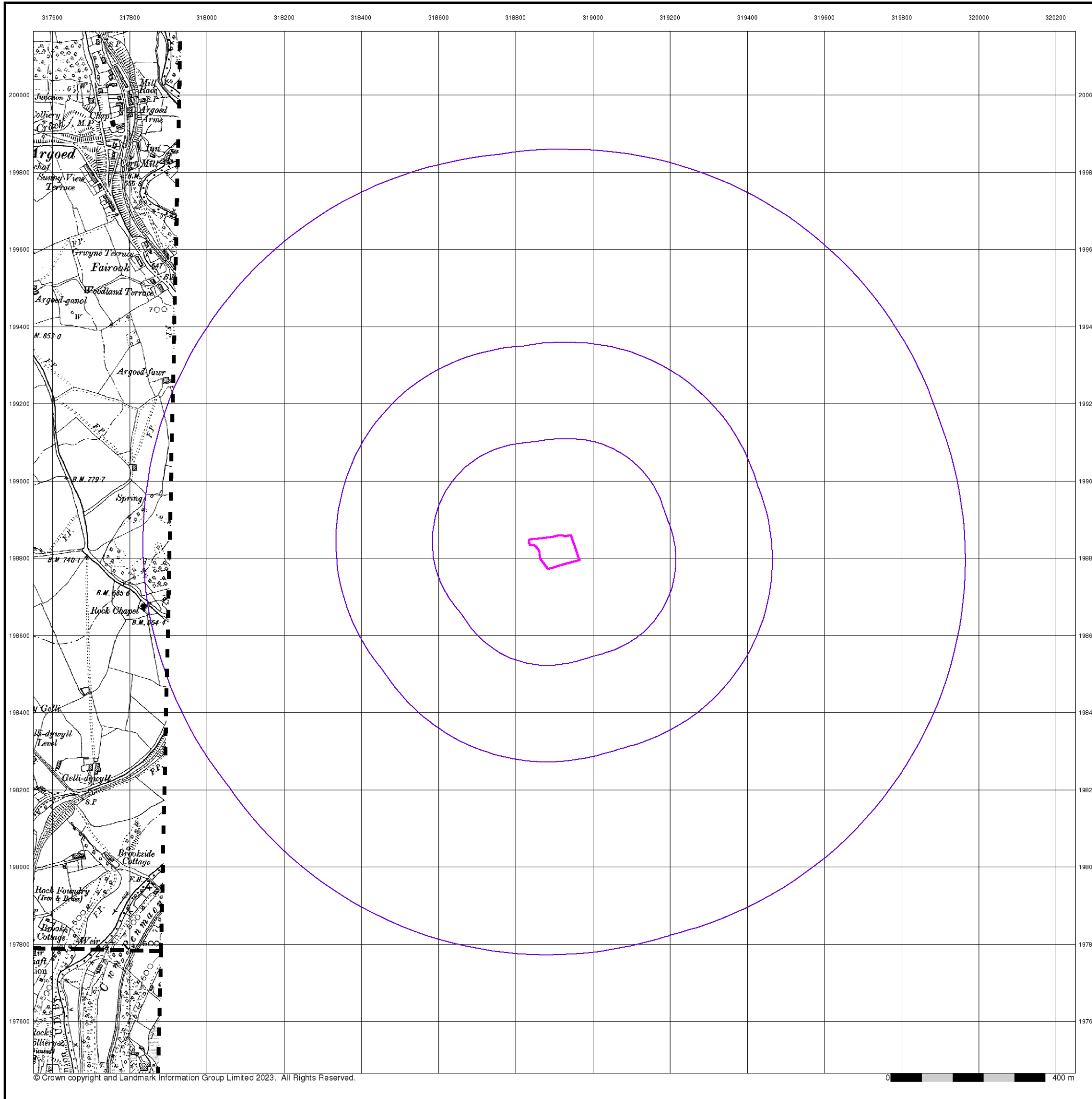
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 National Grid Reference: 318900, 198820
 Slice: A
 Site Area (Ha): 0.74
 Search Buffer (m): 1000

Site Details

Pen-rhiw Bengi Farm, Oakdale, Blackwood, NP12 0BP



Tel: 0844 844 9952
 Fax: 0844 844 9951
 Web: www.envirocheck.co.uk

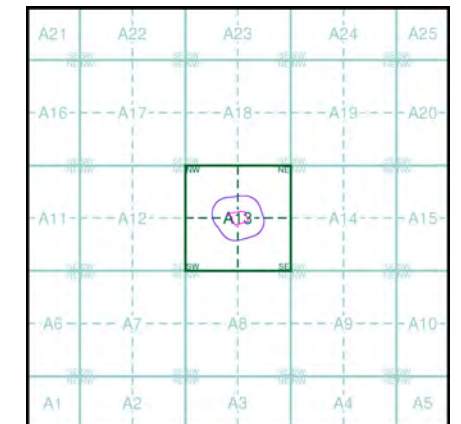


The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some 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)

022NE	1902	1:10,560
022SE	1902	1:10,560

Historical Map - Slice A

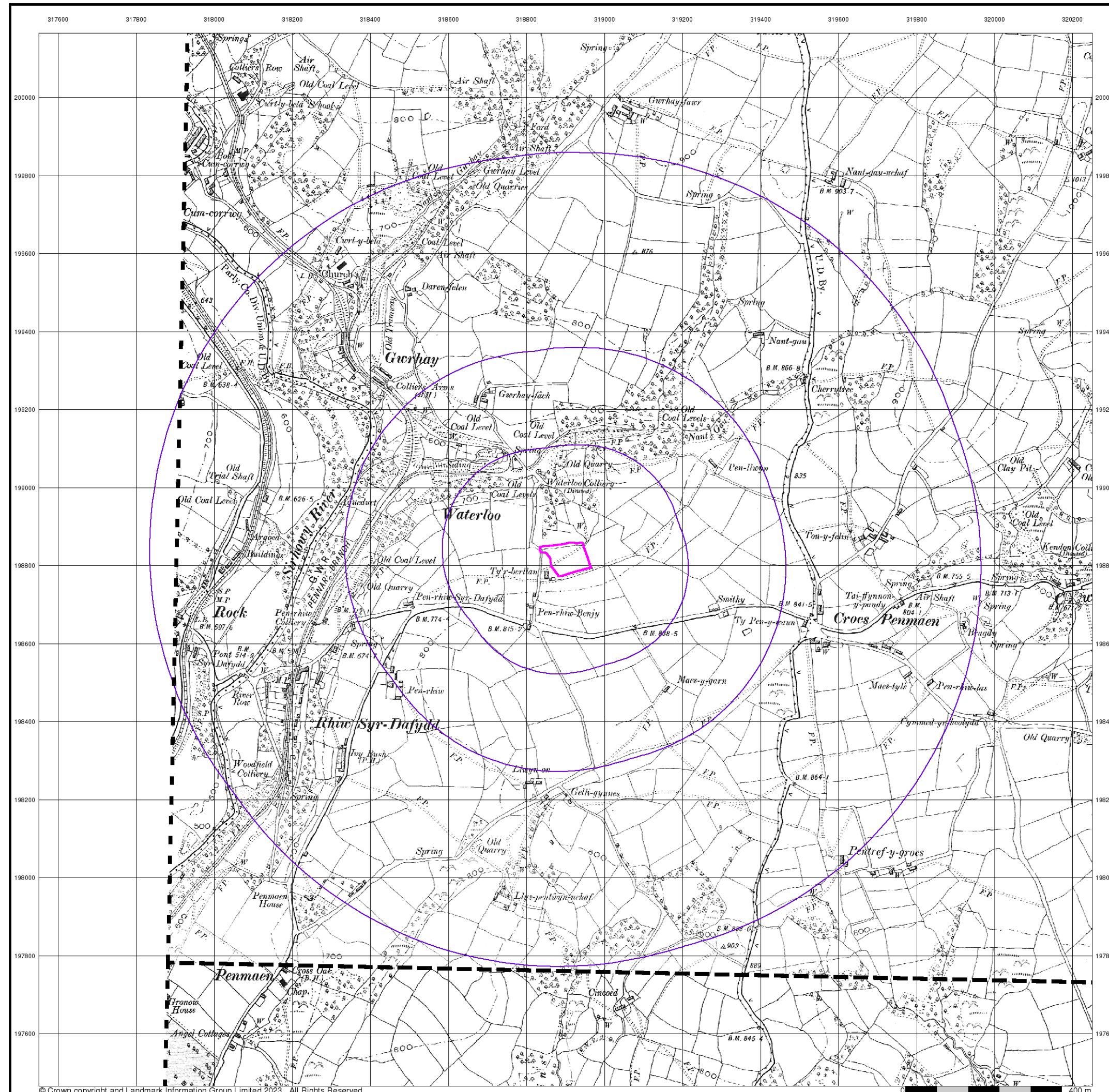


Order Details

Order Number: 309016528_1_1
 Customer Ref: 14198/LP
 National Grid Reference: 318900, 198820
 Slice: A
 Site Area (Ha): 0.74
 Search Buffer (m): 1000

Site Details

Pen-rihw Bengi Farm, Oakdale, Blackwood, NP12 0BP

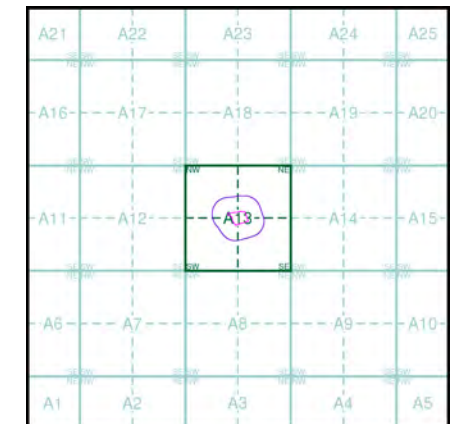


The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some 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)

020NW	1922	1:10,560
020SW	1922	1:10,560

Historical Map - Slice A

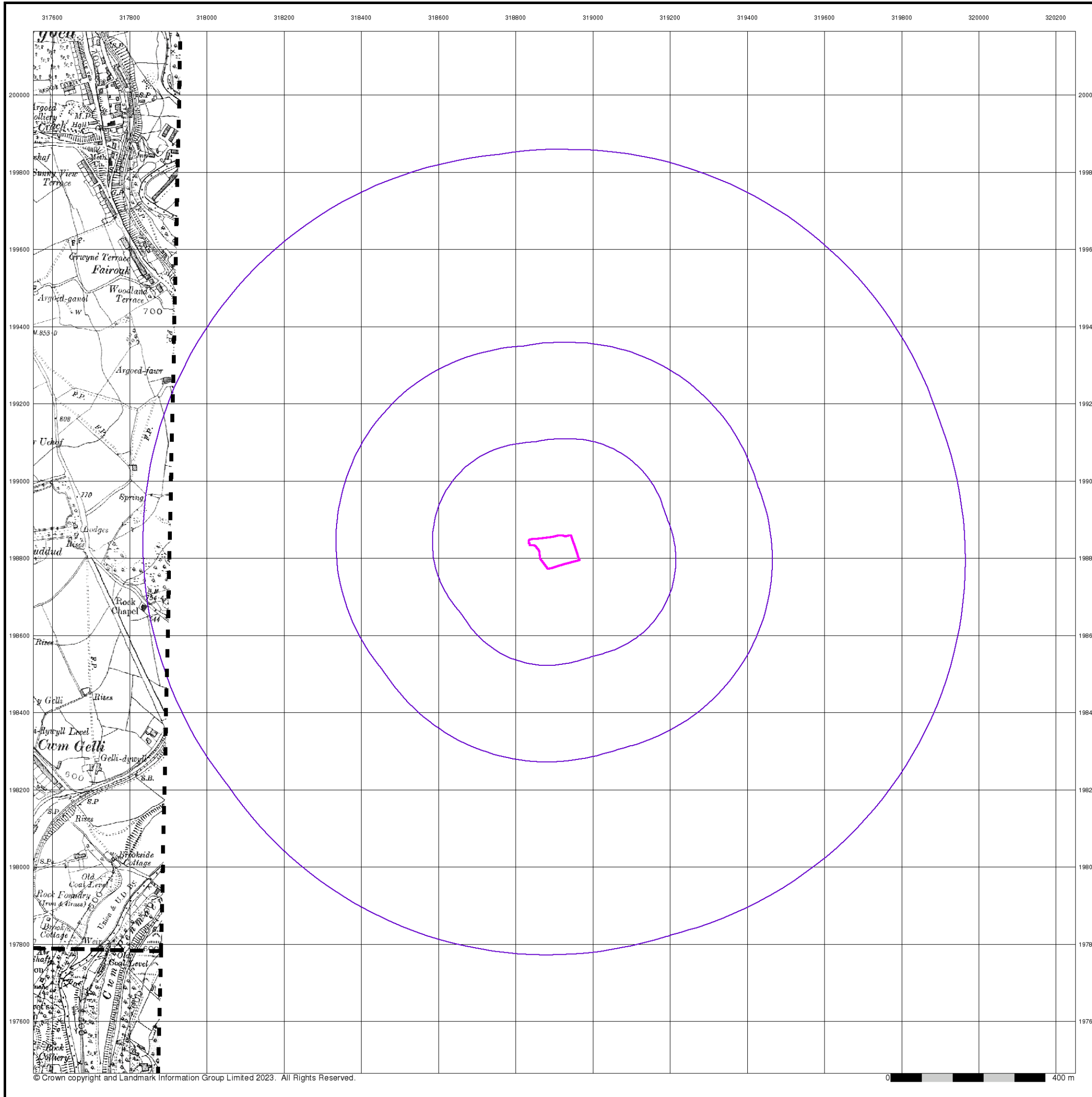


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 Customer Ref: 14198/LP
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 Slice: A
 Site Area (Ha): 0.74
 Search Buffer (m): 1000

Site Details

Pen-rhiw Bengi Farm, Oakdale, Blackwood, NP12 0BP

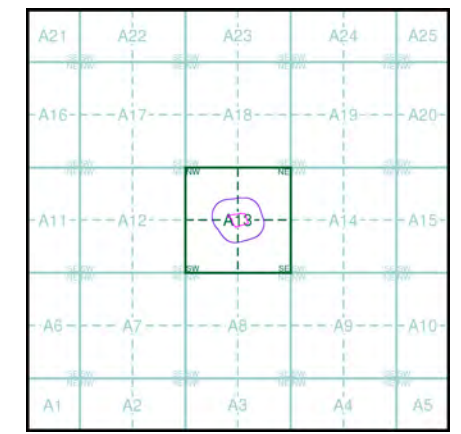


The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some 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)

022NE	1922	1:10,560
022SE	1922	1:10,560

Historical Map - Slice A

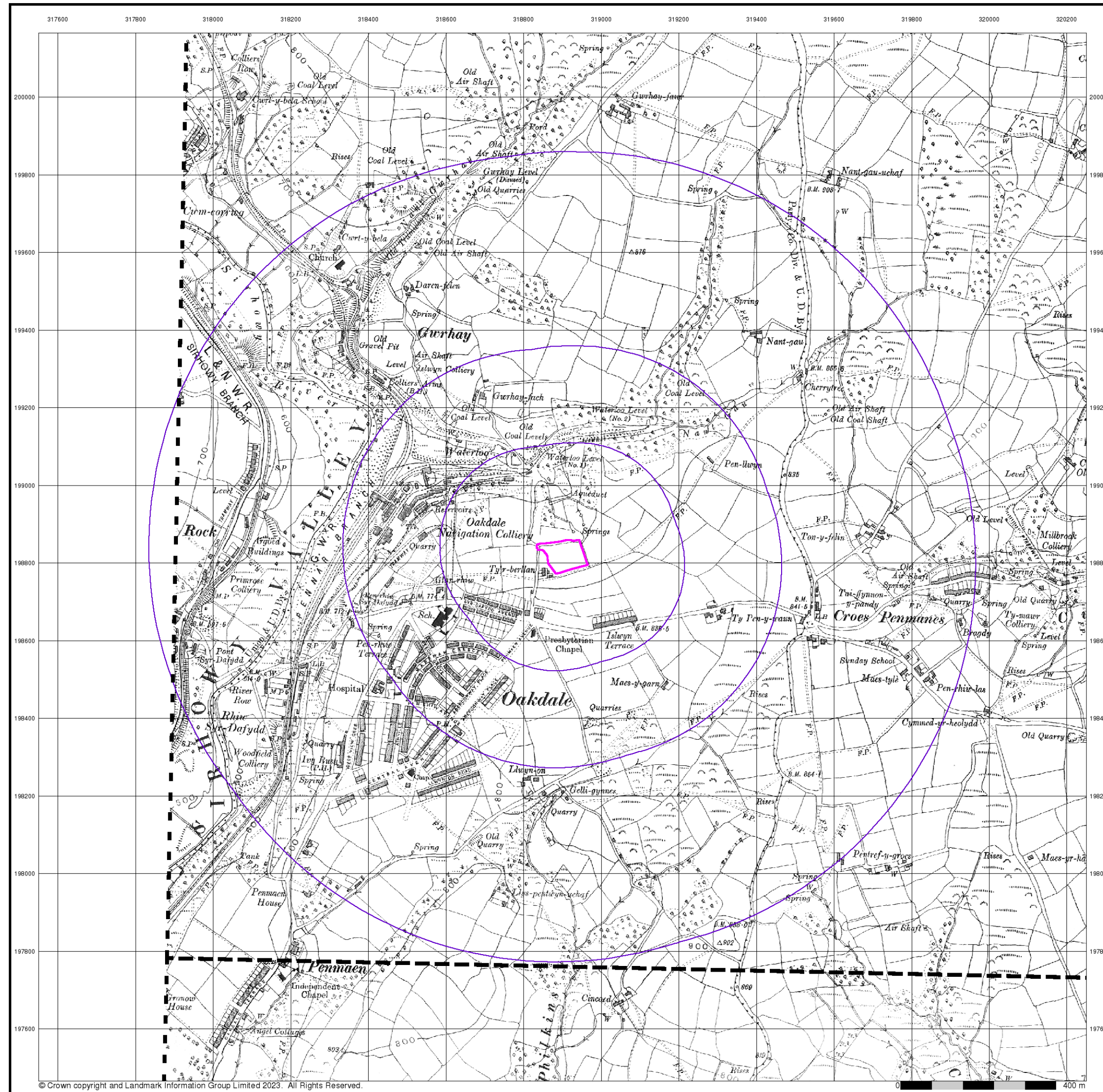


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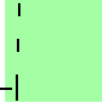
Site Details

Pen-rihw Bengi Farm, Oakdale, Blackwood, NP12 0BP

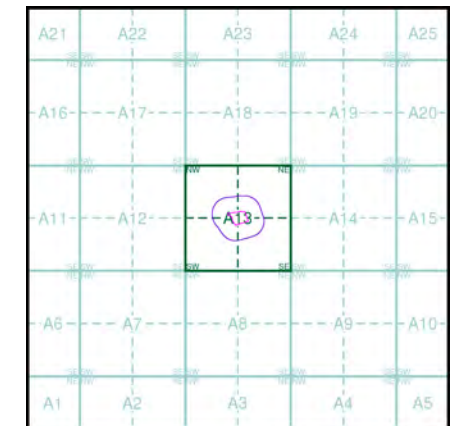


The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some 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)

020NW 1945 1:10,560	
020SW 1938 1:10,560	

Historical Map - Slice A

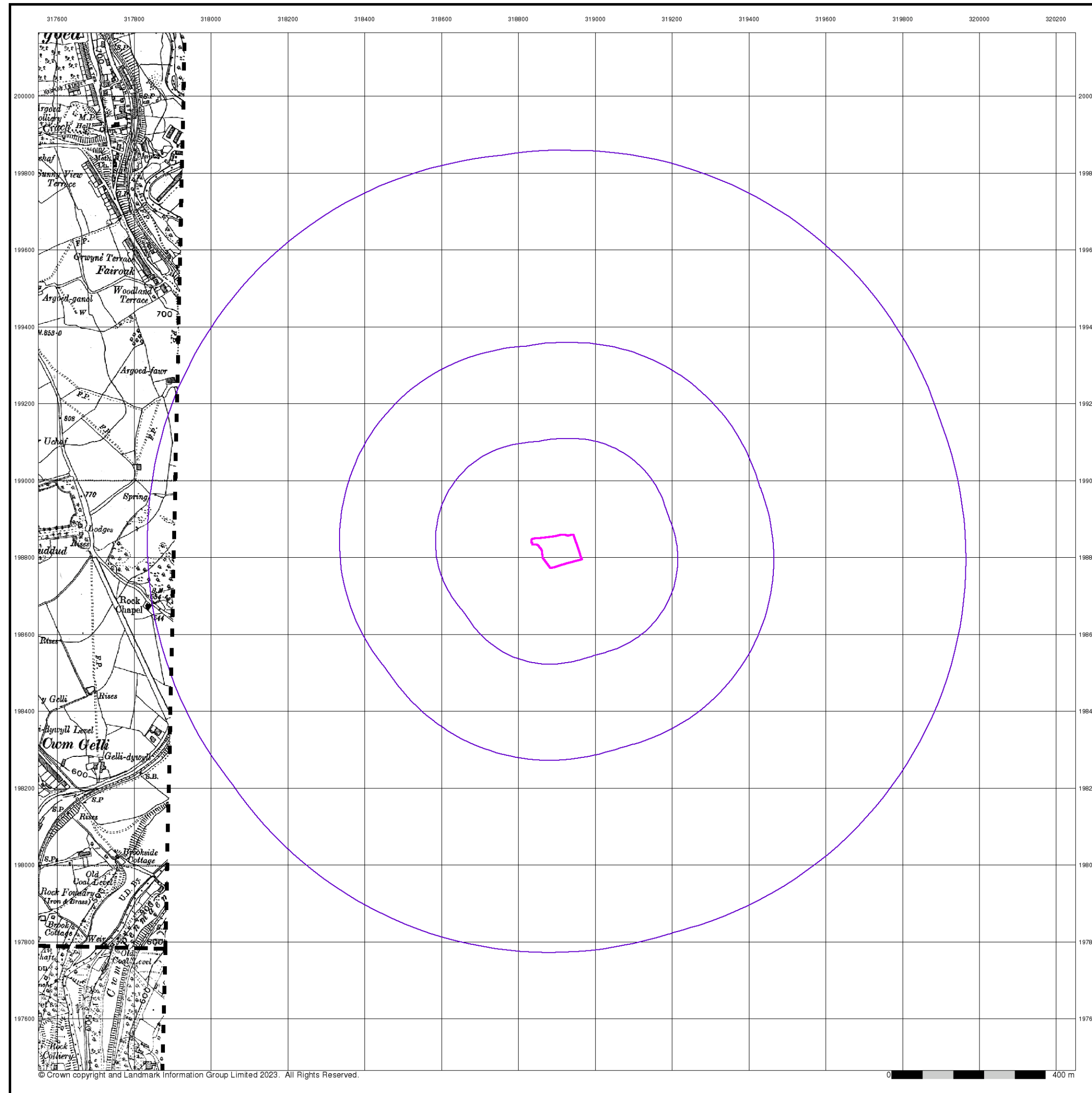


Order Details

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Site Details

Pen-rhiw Bengi Farm, Oakdale, Blackwood, NP12 0BP

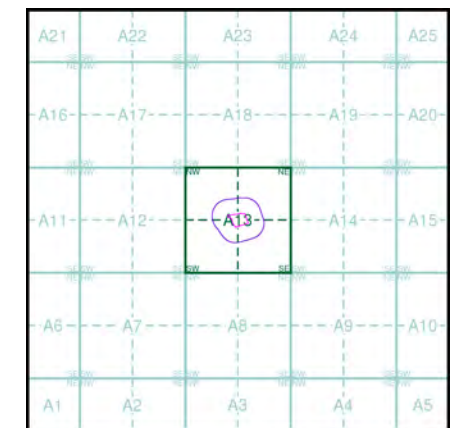


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Map Name(s) and Date(s)

022NE	1938	1:10,560
022SE	1938	1:10,560

Historical Map - Slice A

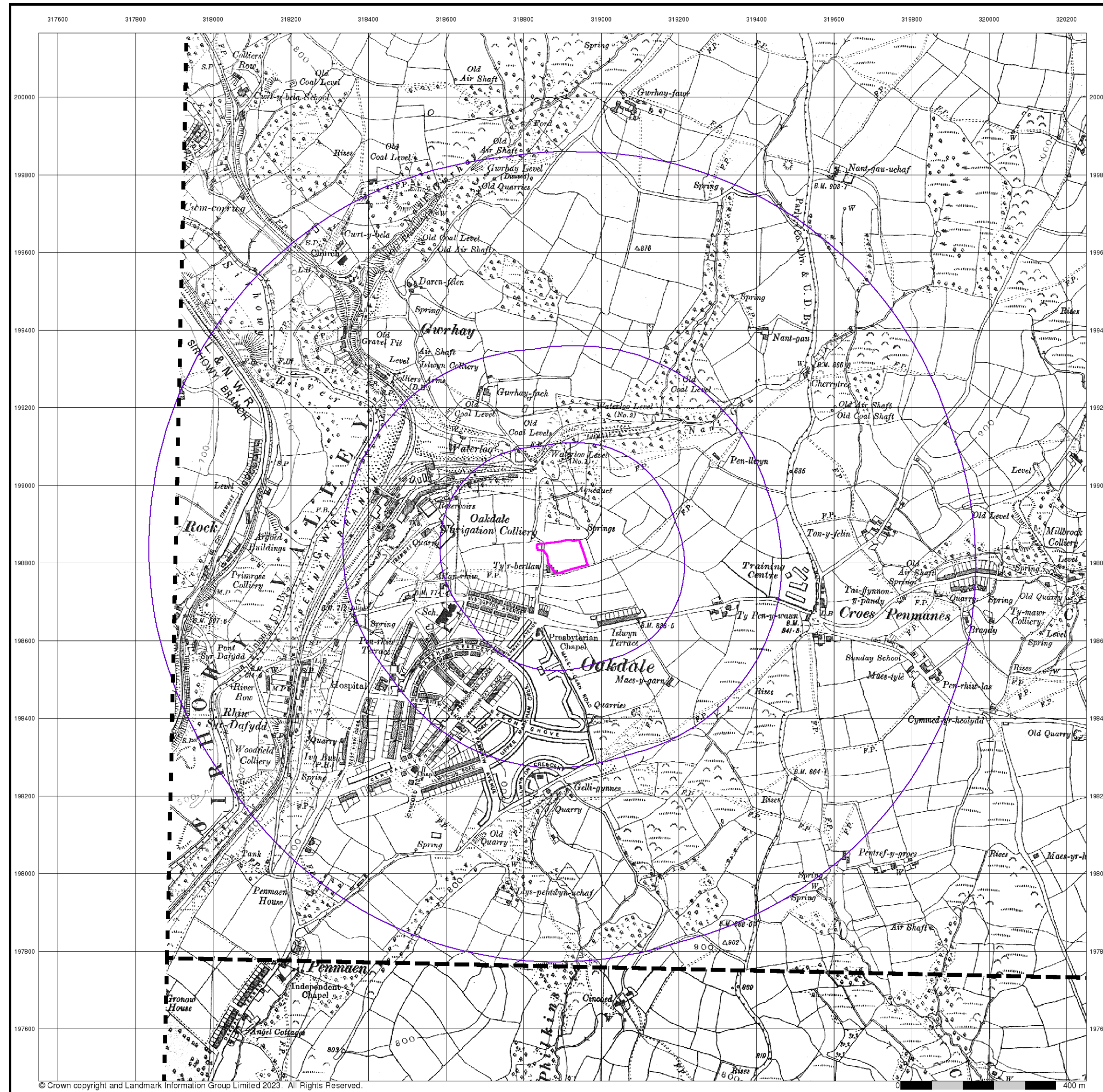


Order Details

Order Number: 309016528_1_1
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 Search Buffer (m): 1000

Site Details

Pen-rihw Bengi Farm, Oakdale, Blackwood, NP12 0BP

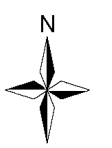
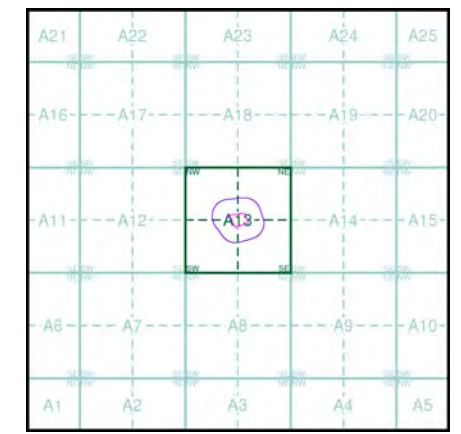


The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some 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)

022NE	1938	1:10,560
022SE	1938	1:10,560

Historical Map - Slice A

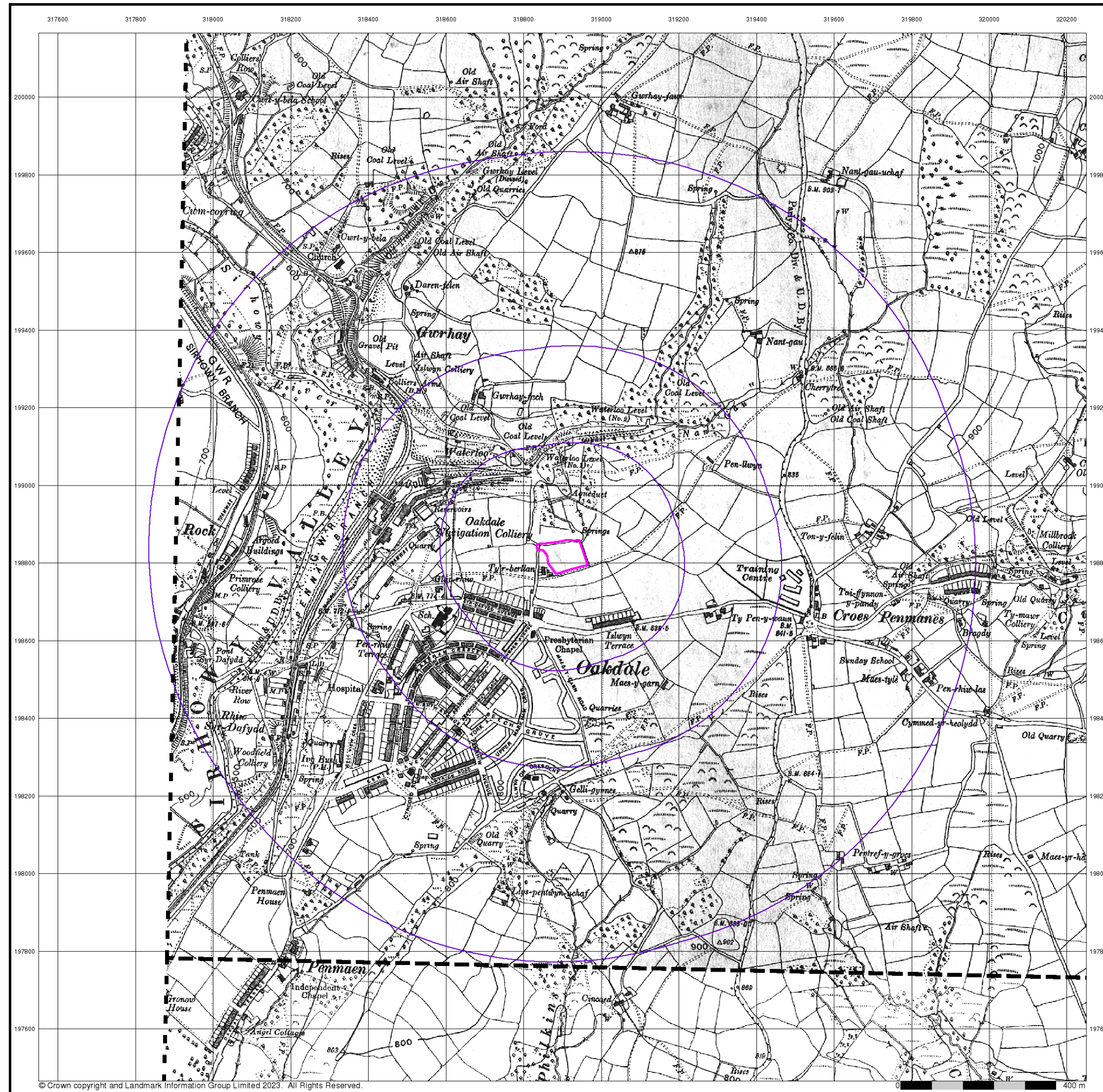


Order Details

Order Number: 309016528_1_1
 Customer Ref: 14198/LP
 National Grid Reference: 318900, 198820
 Slice: A
 Site Area (Ha): 0.74
 Search Buffer (m): 1000

Site Details

Pen-rihw Bengi Farm, Oakdale, Blackwood, NP12 0BP



Historical Aerial Photography

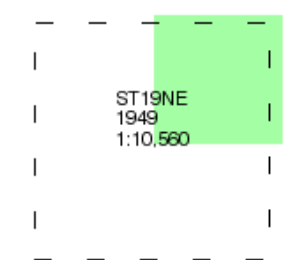
Published 1949

Source map scale - 1:10,560

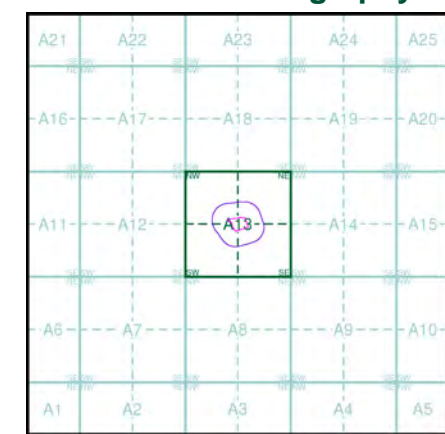
The Historical Aerial Photos were produced by the Ordnance Survey at a scale of 1:1,250 and 1:10,560 from Air Force photography. They were produced between 1944 and 1951 as an interim measure, pending preparation of conventional mapping, due to post war resource shortages. New security measures in the 1950's meant that every photograph was re-checked 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

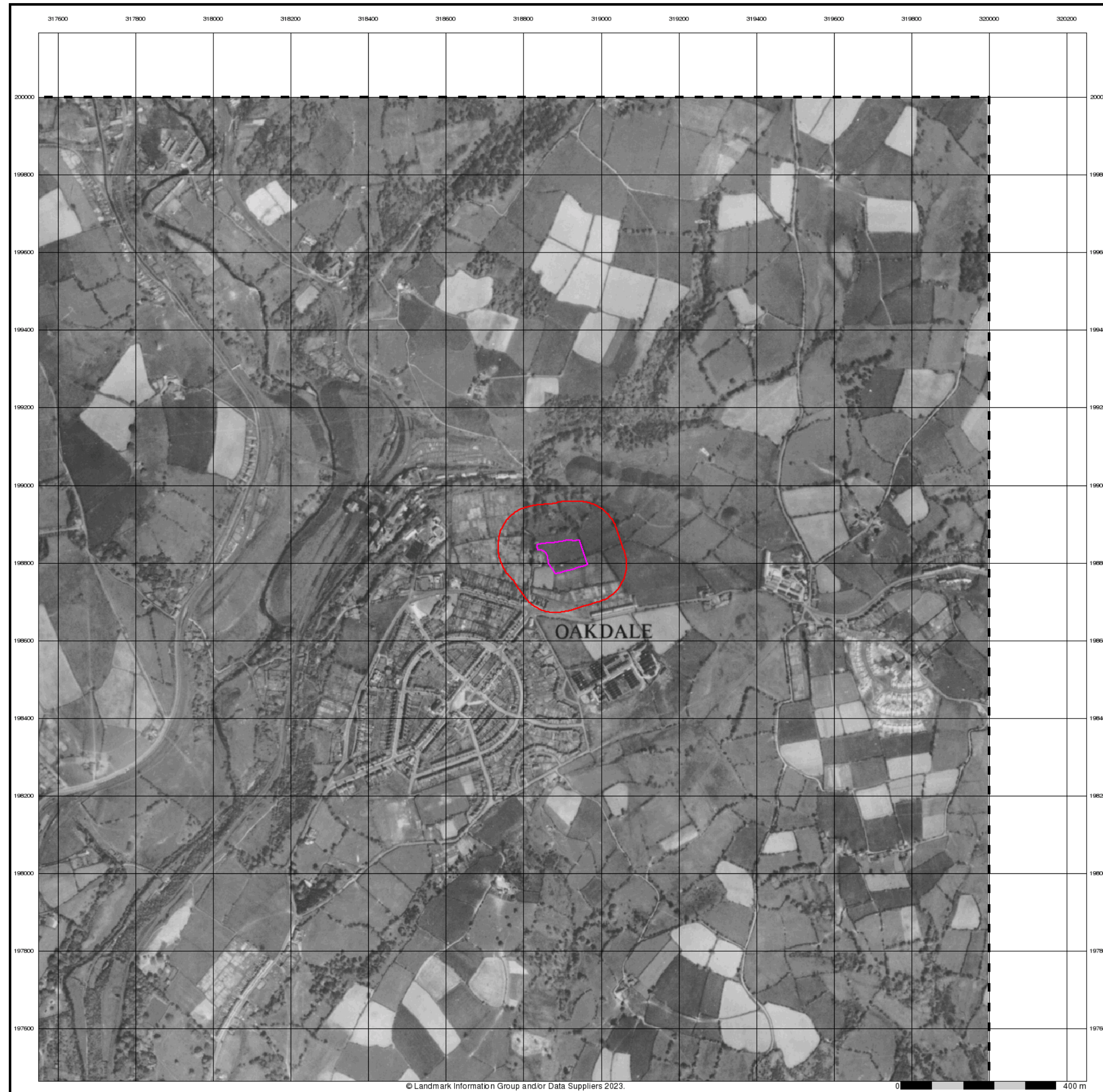


Order Details

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Site Details

Pen-rhiw Bengi Farm, Oakdale, Blackwood, NP12 0BP

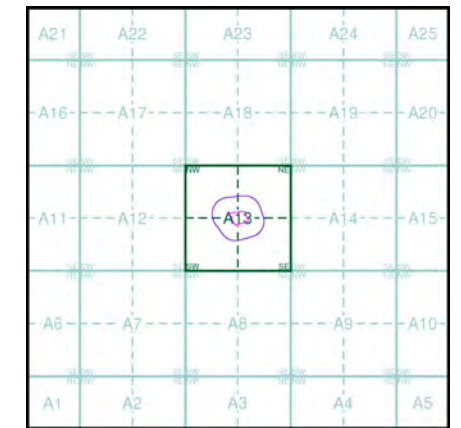


The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some 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)

020NW	1953	1:10,560
020SW	1953	1:10,560

Historical Map - Slice A

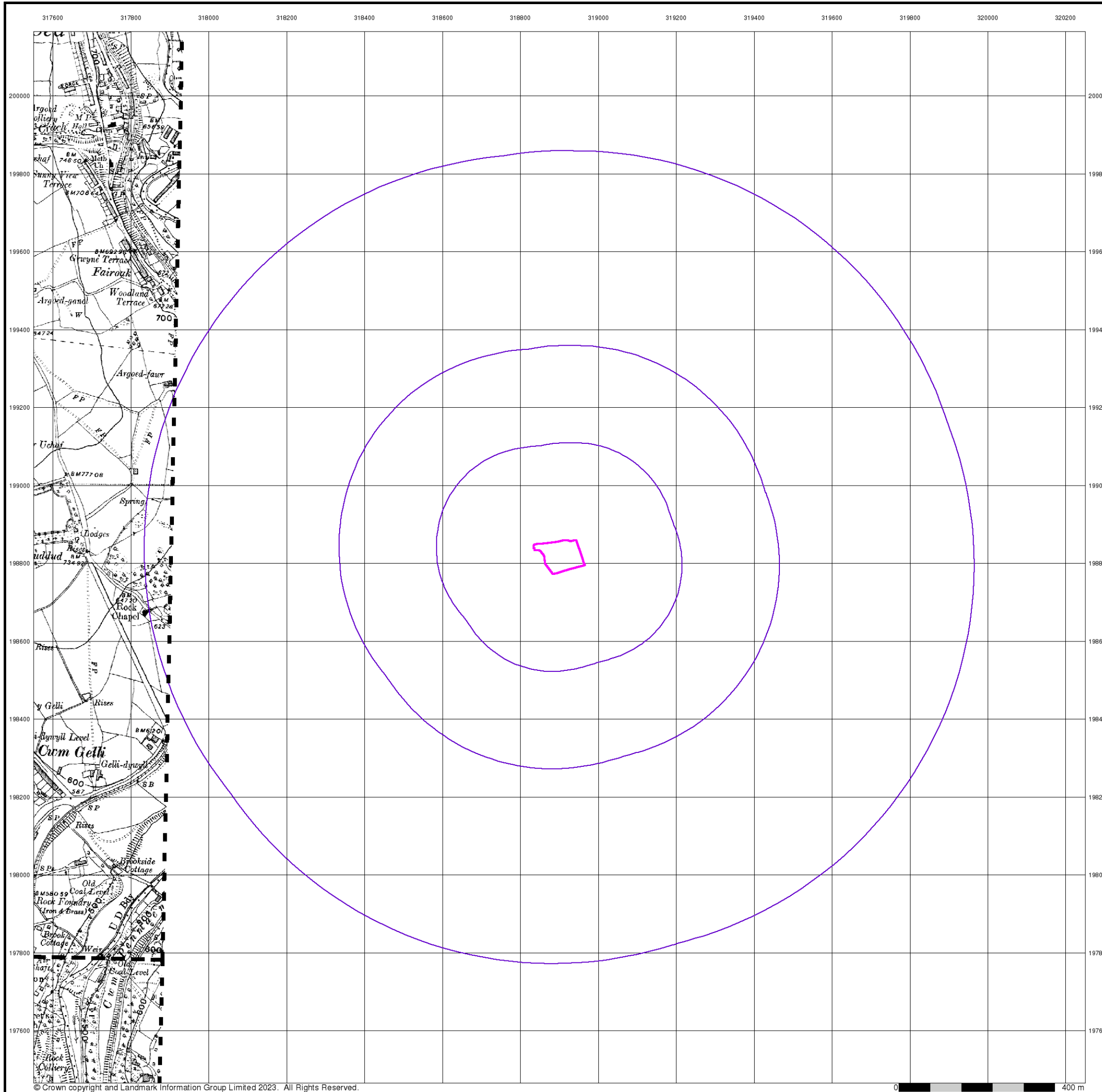


Order Details

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Site Details

Pen-rhiw Bengi Farm, Oakdale, Blackwood, NP12 0BP

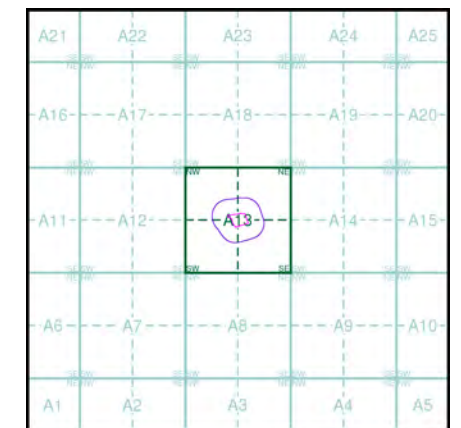


The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some 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)

022NE	1953	1:10,560
022SE	1953	1:10,560

Historical Map - Slice A

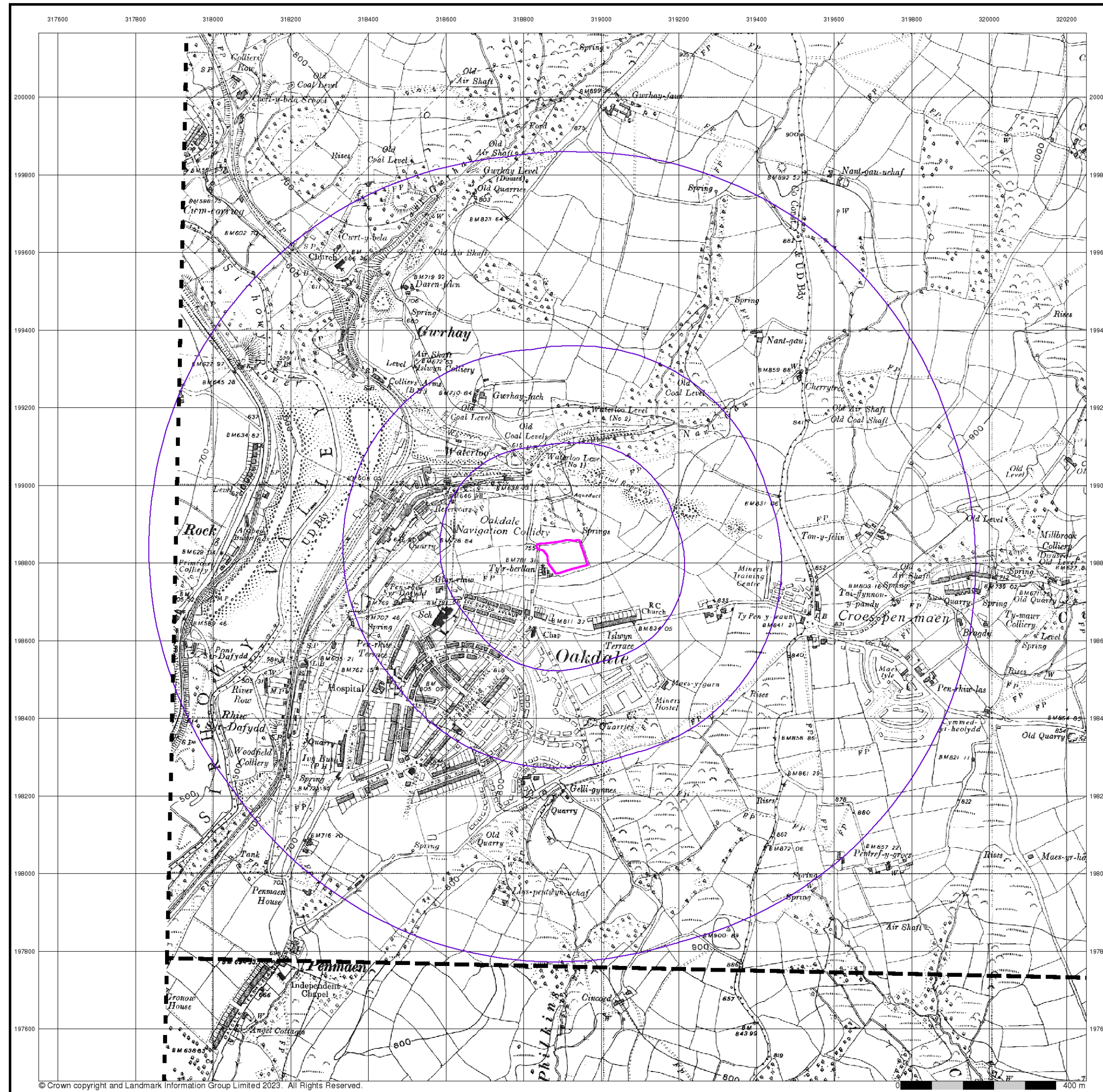


Order Details

Order Number: 309016528_1_1
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 National Grid Reference: 318900, 198820
 Slice: A
 Site Area (Ha): 0.74
 Search Buffer (m): 1000

Site Details

Pen-rihw Bengi Farm, Oakdale, Blackwood, NP12 0BP





Ordnance Survey Plan

Published 1964 - 1965

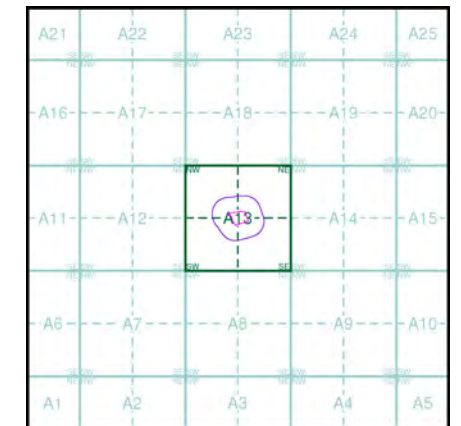
Source map scale - 1:10,000

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is 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)

SO10SE	SO20SW
1964	1965
1:10,560	1:10,560
ST19NE	ST29NW
1965	1965
1:10,560	1:10,560

Historical Map - Slice A



Order Details

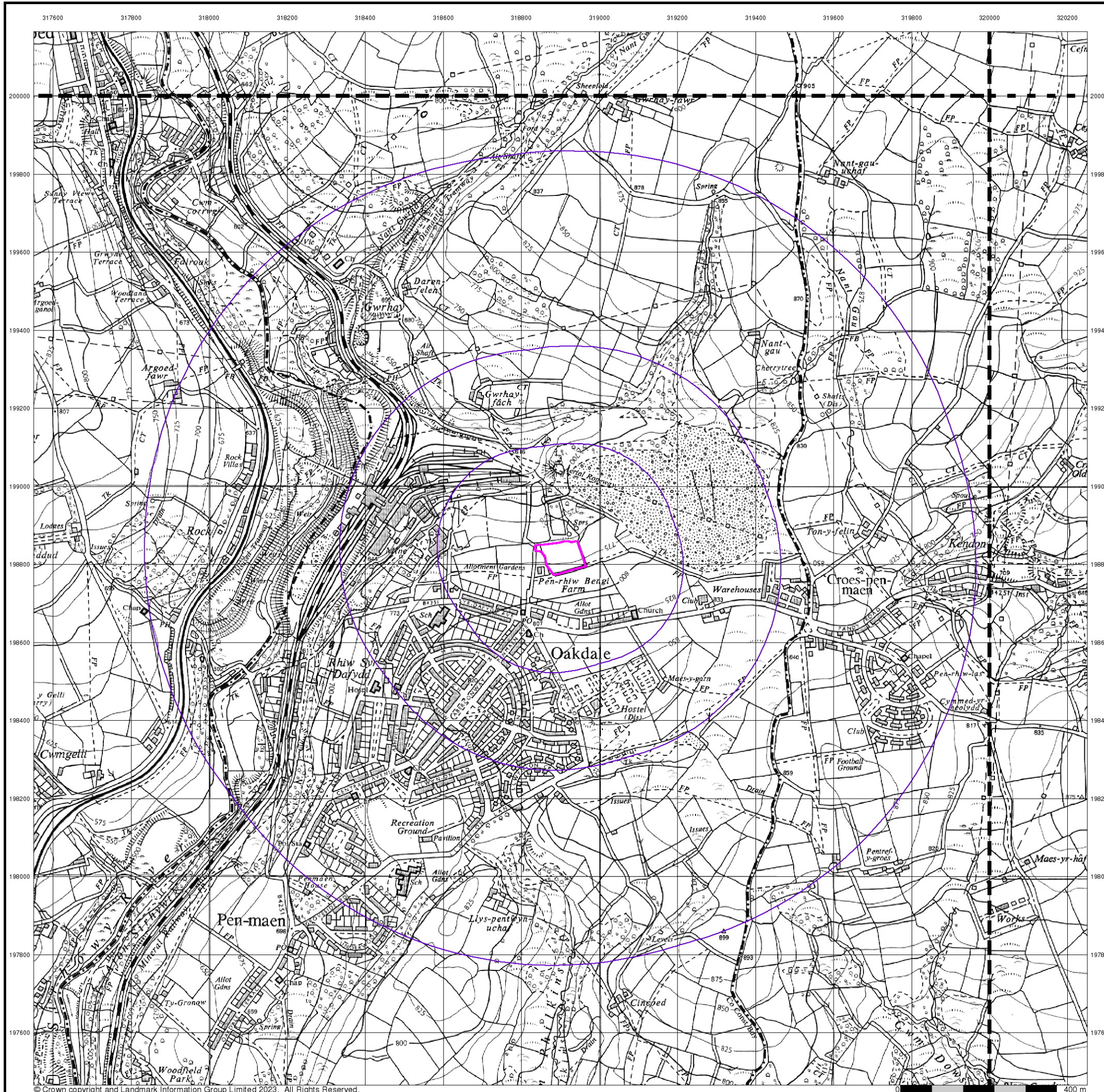
Order Number: 309016528_1_1
 Customer Ref: 14198/LP
 National Grid Reference: 318900, 198820
 Slice: A
 Site Area (Ha): 0.74
 Search Buffer (m): 1000

Site Details

Pen-rhiw Bengi Farm, Oakdale, Blackwood, NP12 0BP



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Ordnance Survey Plan

Published 1975 - 1978

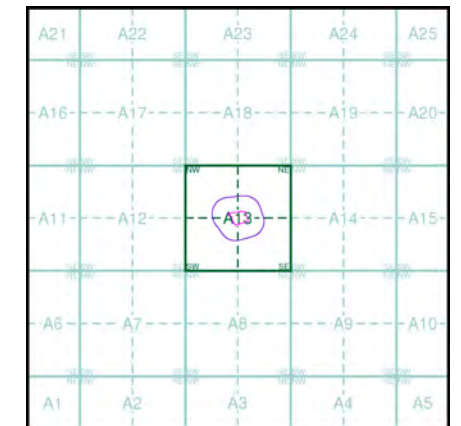
Source map scale - 1:10,000

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is 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)

SO20SW	1978	1:10,000
ST19NE	1975	1:10,000

Historical Map - Slice A

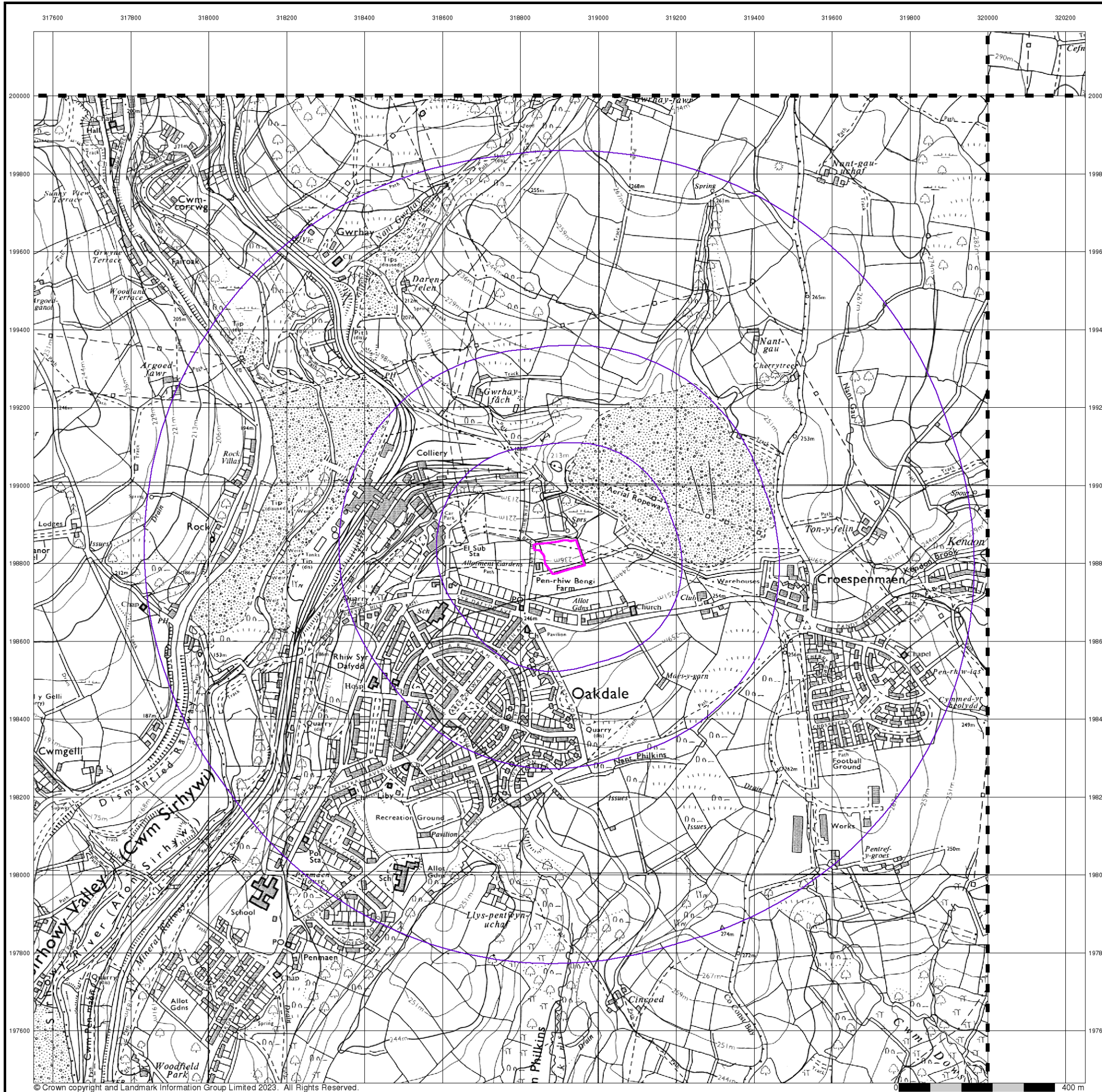


Order Details

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 Customer Ref: 14198/LP
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Ordnance Survey Plan

Published 1983 - 1987

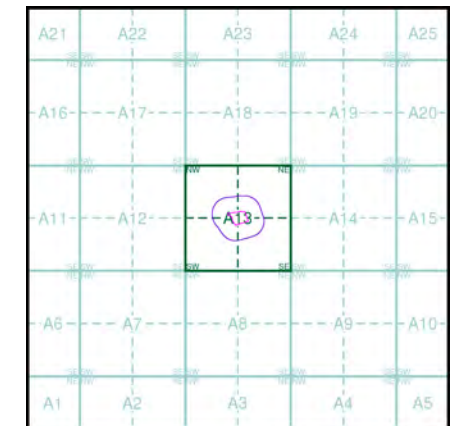
Source map scale - 1:10,000

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is 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)

SO10SE	1987	1:10,000
ST29NW	1983	1:10,000

Historical Map - Slice A



Order Details

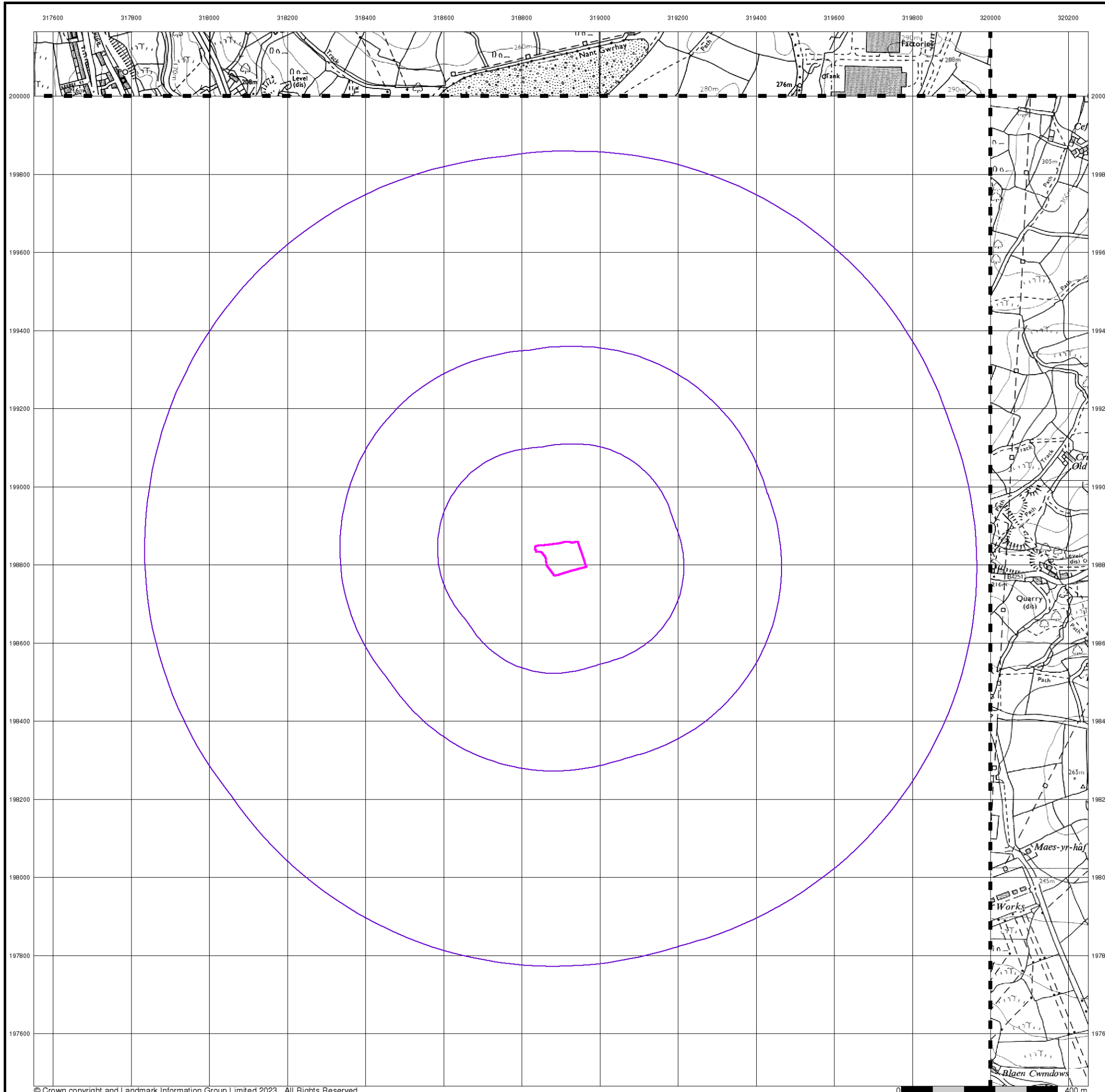
Order Number: 309016528_1_1
 Customer Ref: 14198/LP
 National Grid Reference: 318900, 198820
 Slice: A
 Site Area (Ha): 0.74
 Search Buffer (m): 1000

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Ordnance Survey Plan

Published 1990 - 1995

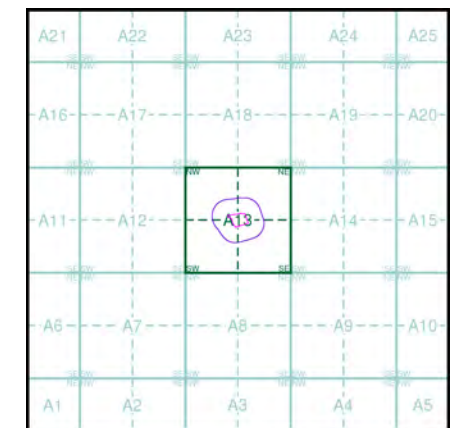
Source map scale - 1:10,000

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is 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)

SO20SW	1990	1:10,000
ST19NE	1995	1:10,000
ST29NW	1990	1:10,000

Historical Map - Slice A



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Order Number: 309016528_1_1
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