HORIZON NUCLEAR POWER

WYLFA NEWYDD

ENERGY WORKING FOR BRITAIN

Wylfa Newydd Project

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Wylfa Newydd Project

Horizon Nuclear Power Limited

Soils and Geology Baseline Conditions Report

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Contents

Executive Summary

This report presents the baseline condition of soils and geology which may potentially be affected by the activities which Horizon Nuclear Power Wylfa Limited (Horizon) proposes to undertake during construction, operation and decommissioning of a Logistics Centre at Parc Cybi. It has been prepared to provide a detailed, technical appendix on soils and geology to support the Environmental Statement.

The site comprises Agricultural Land Classification (ALC) Subgrade 3b (moderate quality) land in the central area, with the north-western extent and southern half of the site limited to Grade 4 (poor quality), thus it is not classified as best and most versatile (BMV) land.

For the majority of the site, published geological mapping indicates superficial deposits comprising Devensian glacial till, which was encountered as brown and grey slightly clayey medium to coarse sand with boulders during Ground Investigations. Published geological mapping also indicates glaciofluvial deposits in the south of the site area, which were encountered as light brown silty fine sand with closely spaced laminations. The study area is underlain by bedrock belonging to the New Harbour Group, comprising mica schist and psammite derived from metamorphism of sea floor sediments. A northwest to southeast trending fault bisects the study area.

A Category 1 (national importance) Aggregates Safeguarding Area has been identified for glaciofluvial superficial geology in the southwest of the study area.

A review of historical maps, Groundsure and previous Ground Investigation information resulted in the identification of a limited number of potential sources of contamination. These were associated with the presence of made ground (from demolition of historical buildings, road construction and a potentially infilled pond), presence of a spoil heap, potential presence of unexploded ordnance and historical farm activities.

The conceptual site model developed for the study area indicates that the risks to receptors were predominantly low or very low. Moderate/low risks were identified for construction and maintenance workers who have increased likelihood of contact with soils and groundwater. Moderate risks were identified for unexploded ordnance. In addition, moderate/low risks were also identified for ground gases. However, this is the lowest possible risk outcome based on the severity of the risk.

1. Introduction

1.1 Background to Wylfa Newydd Project

Chapter A2 (project overview and introduction to the developments) (Application Reference Number: 6.1.2) provides an overview of the Wylfa Newydd Project, with more detailed information on the Logistics Centre in Chapter H1 (proposed development) (Application Reference Number: 6.8.1).

1.2 The Logistics Centre

Parc Cybi is the chosen location for the Logistics Centre facility. The Logistics Centre at Parc Cybi (hereafter termed 'Logistics Centre') would be a secure temporary facility from which deliveries to the Power Station Site would be managed, to reduce traffic impacts to the local road network. Vehicles would be dispatch-controlled to relieve traffic to the Wylfa Newydd Development Area. The facility would include provision to park up to 100 heavy goods vehicles.

This section provides a brief overview of the development proposals for the Logistics Centre relevant to soils and geology. Reference should be made to Chapter H7 (soils and geology) (Application Reference Number: 6.8.7) for further details.

1.3 Study Area

The potential effects on receptors from the proposed activities relevant to soils and geology are likely to be associated with direct disturbance of ground conditions on-site or the migration of contaminants to/from areas immediately adjacent to the site. As a result, the study area has been limited to a 250m buffer around the site; this is shown on Figure 1.

1.4 Report Purpose

This report has been prepared to provide a detailed technical appendix on soils and geology to support the Environmental Statement for the Development Consent Order application for the proposed activities at the Logistics Centre. Although the Environmental Statement is aimed at a wide audience, this report is primarily aimed at stakeholders requiring a detailed, technical understanding of the baseline conditions for soils and geology.

1.5 Report Scope

This report considers the baseline conditions relating to soils and geology in the study area.

For the purpose of this report, "soils" should be taken to mean Holocene/recent unconsolidated deposits and artificial geology (e.g. made ground, filled ground and worked ground).

"Geology" should be taken to mean both superficial deposits and bedrock geology which may be affected by the development, including both listed and notified sites of geological importance and mineral resources/reserves.

2. Information Sources

2.1 Previous Assessments

A Ground Investigation and preliminary risk assessment for the site was undertaken to support the design of a vehicle storage area previously proposed for the site. The findings of the following Ground Investigation have been used to inform this report:

- *A Ground Investigation Report for Zone 7, Parc Cybi, Holyhead, Anglesey (Tier Environmental Ltd, 2015).*

2.2 Publically-available Literature

The following sources of publically available information have been consulted during the preparation of this report:

- *Geology of Britain Viewer* (British Geological Survey (BGS), 2015)*;*
- *1:50,000 Scale 'Solid and Drift Geology' Geological Map of Anglesey (Special Sheet 092)* (British Geological Survey, 1974);
- *North West Wales Aggregates Safeguarding Map* (BGS and Welsh Assembly Government, 2012);
- *North West Wales Mineral Resource Map* (BGS and Welsh Assembly Government, 2010);
- *What's In Your Backyard Online Mapping* (Environment Agency, 2015);
- *Natural Resources Wales' Flood Risk Map Viewer (*Natural Resources Wales (NRW), 2017)*;*
- *TAN 15 Development Advice Map* (Welsh Government, 2016b); and
- *Regional Unexploded Bomb Risk* (Zetica, 2015).

2.3 Site-specific Information

The following site-specific reports/data were sourced for the site:

- *Groundsure Enviroinsight, Geoinsight and Large and Small Scale Historical Mapping* (Groundsure, 2017)
- *Preliminary Unexploded Ordnance Risk Assessment* (BACTEC, 2017).

2.4 Technical Consultations

Requests for the provision of information held with regard to soils and geology (including land contamination) were made to NRW, the Isle of Anglesey County Council (IACC) and GeoMôn[1] on 10 May 2017. At the time of writing, a consultation response has been received from the IACC and NRW. A summary of the consultation response is set out below within Table 2.1.

Table 2.1: Stakeholder consultations for soils and geology

Date	Stakeholder	Description	Response
June 2017	NRW	Site incidents and complaints relating to issues that may affect the soils or geology i.e. incidents leading to ground contamination. Information on potentially contaminative	There are areas of land contamination such as the Aluminium Smelter and the Cae Glas restored landfill. I believe that these sites are outside the 250m boundary Registers for contaminated land are kept by the local authority unless the site in question is

[1] GeoMôn are the organisation that oversees the GeoMôn Geopark, which covers the whole of the Isle of Anglesey.

Date	Stakeholder	Description	Response
		land uses in the area and any other desk study information.	declared a 'Special Site' where we would assume responsibility. There is no such site in this area. Parc Cybi is a purpose built industrial park which has no previous pollution or contamination issues. All data on construction and findings should be available through the Gwynedd Planners.
May 2017	IACC	Information regarding mineral resources, potential sources of contamination and any other desk-study information held	The IACC consultation confirmed that there are no statutory areas of Contaminated Land (Part 2A), no *Pollution Prevention and Control Act 1999* permit-holders, and no former waste disposal sites within the study area. On-site, the IACC identified a former pond in the yard of Tre-fignath, active in the period of 1881-1912 which is now listed as infilled. The consultation assessed the risk of land contamination as low. Within the study area, two areas of low risk of land contamination were identified. The IACC identified that a culvert to the north of the site originates on the former aluminium works, and is connected to the marshy area at the northern extent of the site. The consultation also identified the railway tracks running parallel to the northern site boundary as a potential risk.

2.5 Site Reconnaissance

In 2015, a site reconnaissance was conducted by Tier Environmental Ltd to inform a Ground Investigation, and is referenced in this report.

On 12 May 2017, a site reconnaissance was conducted by Jacobs to further inform the baseline assessment with regard to soils and geology.

3. Soil Types and Quality

Information has been obtained from the Soil Survey of England and Wales (1983) and the *Parc Cybi Logistics Centre, Holyhead, Anglesey: Agricultural Land Classification Appraisal* (Reading Agricultural Consultants, 2017), unless otherwise stated.

3.1 Soil Type

The northern area of the site is reported to be underlain entirely by soils of the East Keswick 1 association. Table 3.1 details the characteristics of this soil association.

The central area of the site is covered with hardstanding, loose aggregate and the southern extent of the site is covered by the Parc Cybi road. Made ground is more likely to be encountered at the surface rather than natural soils in these areas.

Table 3.1 : Characteristics of soil located within the site extent (East Keswick 1 association)

Characteristic	Description
Source	Drift from Palaeozoic and Mesozoic sandstone and shale.
Composition	Deep, well-drained fine loamy soils and similar soils with slowly permeable subsoils and slight seasonal waterlogging. Low/negligible storage capacity and low natural soil fertility.
Hydrology	HOST Class 6 – free-draining permeable soils in unconsolidated loams or clays with low permeability and storage capacity. Minor risk of flooding.
Pollutant leaching potential	Soils of intermediate leaching potential which have a moderate ability to attenuate a wide range of diffuse source pollutants but in which it is possible that some non-absorbed diffuse source pollutants and liquid discharges could penetrate the soil layer.
Land use	Neutral and acid pastures, deciduous woodlands and acid communities, such as bracken and gorse in the uplands, supporting stock-rearing on permanent grassland.

3.2 Soil Quality

The economic resource value of soil is primarily measured by its ability to support agricultural uses. This is quantified by its ALC grade, which is determined through climatic, topographical and interactive soil limitations. BMV agricultural land equates to grades 1, 2, and 3a of the ALC system and is the most flexible land in terms of the range of crops that can be grown, the level and consistency of yield and the cost of obtaining yield. *Planning Policy Wales* (Edition 9) (Welsh Government, 2016a) states that BMV land should be conserved as a finite resource for future use wherever possible, and considerable weight should be given to protecting it because of its special importance.

According to Provisional ALC data for Wales (Ministry of Agriculture, Fisheries and Food, 1977), the site is reported as land predominantly for urban use. However, these data are only appropriate to provide a high-level indication of land quality for the purposes of strategic assessment; they are not suitable for the evaluation of individual sites.

Under the climatic conditions of the site, the East Keswick 1 soils present would be limited to Grade 2 or Subgrade 3a (depending on the soil texture) due to wetness and workability limitations. However, during the site walkover, wetland vegetation was observed in the northwestern extent of the site, indicative of chronic poor drainage. Grade 4 was therefore considered appropriate for this area. A large band of Subgrade 3a was mapped to the south of this across the north and northeast of the site. This was due to a potential moderate droughtiness limitation owing to predicted shallow soil depths and high stone contents. It was noted that some

of this band of Subgrade 3a is likely to be limited by wetness and workability, rather than droughtiness, to Subgrades 3a or 3b or Grade 4. There may also be a gradient limitation to Subgrade 3b in this area, as a moderately steep slope aligned southeast to northwest was observed during site reconnaissance. Subgrade 3a is considered to be a conservative assessment of the ALC grade in the absence of intrusive survey data to inform the conclusions (Reading Agricultural Consultants Ltd, 2017) (Appendix A).

Rock exposures were observed in the centre of the site, with soil depths likely to be particularly shallow. In addition, the rock exposures would render it difficult to farm land between them in practical terms. Therefore, Grade 4 land was mapped in this area. Land across the south of the site was mapped as non-agricultural due to the presence of hardstanding and rock exposures, with natural soils mostly absent.

4. Site Geology

Publically available data from the BGS *1:50,000 Scale 'Solid and Drift Geology' Geological Map of Anglesey* BGS, 1974), commercially available data (Geoinsight and Enviroinsight reports) (Groundsure, 2017) and a site reconnaissance conducted by Jacobs in May 2017 have been used to inform this subsection.

4.1 Made Ground

Published geological mapping does not indicate the presence of artificial/made ground and it is considered unlikely that made ground is present beneath the majority of the site. However, made ground is likely to be encountered in the south and southwest of the site area, associated with the road (Parc Cybi).

The site reconnaissance indicated the presence of hardstanding cover in the southern area of the site. This area includes a 10m^2 concrete remnant foundation for the Tre-fignath farmstead, which may be associated with made ground. In the northern area of the site is a concrete platform with plastic pipes inset, a concrete pipe and a concrete base supporting a large sign. Two areas of discarded material are present in the southern area of the site, including a large approximately 15m^2 spoil heap (brick, stone, rubble, general litter, office and car materials) and a second smaller approximately 2m^2 area of discarded materials (building and car materials, brick rubble and general litter).

A number of trial pits and boreholes returned made ground during the Ground Investigations (Tier Environmental Ltd, 2015). Made ground was encountered from ground level to depths between 0.3m (WS1) and 1.3m below ground level (mbgl) (WS8) and was limited to the southern, western and northern extents of the site. Encountered made ground is described as black-brown clayey gravelly cobbly medium sand, with anthropogenic material including slate, concrete and tile.

4.2 Superficial Geology

Published geological mapping indicates that the majority of the site is underlain by Devensian glacial till, described as Diamicton. It is likely that these deposits originated from seasonal and post-glacial meltwater streams. A small area extending from the centre of the site across the southwestern boundary is listed as glaciofluvial deposits consisting of sand and gravel.

Glacial till was encountered in all boreholes and trial pits during the Ground Investigation (Tier Environmental Ltd, 2015). Till occurred between ground level and 4.7mbgl, with a maximum thickness of 3.9m. The deposits were thickest at the southern margins and thinnest in the central region of the site where rock outcrops are present. The glacial till deposits were described as laterally and vertically heterogeneous brown and grey slightly clayey medium to coarse sand with boulders. Deposits consistent with glaciofluvial deposits were encountered in the northeast of the site (WS10, TP4 and TP5). Deposits were encountered between 2.0m and 3.6mbgl, with a maximum thickness of 1.6m. These were described as light brown silty fine sand with closely spaced laminations at TP4 and light brown slightly gravelly fine to coarse sand at TP5 (Tier Environmental Ltd, 2015).

Geological mapping indicates that Devensian glacial till covers the majority of the study area surrounding the site. Two areas of glaciofluvial deposits occur within the study area, one 60m to the west and the second 128m to the east of the site. Tidal flat deposits occur 195m north of the site area. Three areas where superficial deposits are absent occur within the study area, found 60m southwest, 200m southeast and 200m northeast of the site area.

4.3 Bedrock Geology

The regional geological setting of the area comprises the Precambrian to Cambrian Monian Supergroup and undifferentiated Ordovician conglomerates and sandstones. The Monian Supergroup, a 7km thick sequence of sedimentary, metamorphic and igneous rocks, can be subdivided into the Gwna Group, the New Harbour Group and the South Stack Formation.

Published geological mapping indicates that the site is underlain by the New Harbour Group, comprising mica schist and psammite derived from metamorphism of sea floor sediments. The South Stack formation, comprising psammite and pelite is mapped to be present approximately 60m west of the site area. Approximately 90m southwest of the site, an approximately 150m long Jasper bed, belonging to the New Harbour Group, is indicated to be present.

Geological mapping indicates that the site is bisected by a northwest-southeast striking fault (BGS, 1974).

Bedrock encountered during the Ground Investigation belongs to the New Harbour Group, and occurs in outcrop and at depths of up to 4.7mbgl. Recovered samples describe the New Harbour Group as light brown mica schist quartzite sand and gravel.

5. Hydrology and Hydrogeology

The Groundsure Geoinsight and Enviroinsight reports have been used to inform this subsection (Groundsure, 2017).

A secondary river is indicated to cross the southwest corner of the study area in a southwest–northeast direction. This is connected by a culvert beneath the west of the site to a watercourse, indicated as a tertiary river, near the northern site boundary. This watercourse is culverted beneath the A55 and railway to the north. A drain that runs north of the A55 is connected to this culvert. A further watercourse, indicated as a tertiary river in the Groundsure report (2017) and a drain on the historical maps, is orientated southwest to northeast approximately 150m east of the study area. This continues south in the northeast of the study area. The culvert that carries the watercourse from the site beneath the A55 and railway connects into this watercourse south of the aluminium works car park. No primary rivers are recorded within the site or study area.

The site is not located within a flood risk zone according to the *Technical Advice Note 15 Development Advice Map* (Welsh Government, 2016b).

The superficial deposits (refer to Section 4.2) underlying the majority of both the site and study area are classified by NRW as a Secondary Undifferentiated Aquifer. This classification is assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type (Environment Agency 2015). The glacio-fluvial deposits in the central and southwestern parts of the site are classed as secondary (A) aquifers, which contribute to local river base flow (Groundsure, 2017). Small areas of Secondary (A) Aquifers have also been mapped in the northeast and west of the study area.

The bedrock (refer to Section 4.3) across the entire study area has been classified as a Secondary B aquifer. These are predominantly lower permeability layers, which may store/yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering (Groundsure, 2017). The Secondary Undifferentiated Aquifer in the superficial deposits and Secondary B Aquifer are considered to be one contiguous groundwater body, such that where they both occur, they are considered as one receptor in this report, termed ‘Secondary aquifers’.

The study area is not located within a groundwater Source Protection Zone. Furthermore, there are no licensed groundwater or surface water abstractions within 1km of the site, although there is the potential for small unlicensed abstractions.

6. Sites of Geological Importance

6.1 The GeoMôn Geopark

The Isle of Anglesey was included in the European Geopark Network in 2009 as a result of its outstanding geodiversity and geological heritage. The Anglesey Geopark (called the 'GeoMôn Geopark') covers the 720km^2 of the Isle of Anglesey and has approximately 200km of coastline.

The European Geopark Network aims to protect geodiversity, promote geological heritage to the general public and support sustainable economic development of Geopark territories through the development of geological tourism. As a member of the European Geopark Network, it is also included in the Global Geopark Network.

In November 2015, the GeoMôn Geopark was designated as a UNESCO Global Geopark at UNESCO's 38th General Conference (UNESCO, 2016). The new designation is intended to raise awareness and promote respect for the environment and integrity of the landscape. The status also expresses governmental recognition of the importance of holistic management of the Geoparks. The designation is not legislative, but the key heritage sites within the Geoparks should be protected under local, regional or national legislation as appropriate. The UNESCO Global Geopark designation is not permanent. A revalidation process exists whereby a thorough re-examination of the Geopark is undertaken every four years, after which the status is either renewed for a further four years, or the management body will be allowed two years to fulfil certain criteria. Should these still not be met after the prescribed period, the park would lose the UNESCO Global Geopark status (UNESCO, 2016).

Both NRW and GeoMôn have responsibilities for protecting geosites. NRW has a statutory responsibility to protect areas notified as geological Sites of Special Scientific Interest (SSSIs) and GeoMôn leads on the conservation of Regionally Important Geological Sites within the GeoMôn Geopark. Both organisations work together to protect and promote the sustainable use of Anglesey's geoheritage.

6.2 Sites of Geological Importance

There are no Regionally Important Geological Sites or geologically designated SSSIs within the study area, and no sites have been identified that are likely to be affected by the proposed Logistics Centre facility (Wood, 2007; Natural England, 2015).

7. Geological Resources

7.1 Minerals

The following sources of information have been used to identify mineral resources within the study area:

- *Mineral Resource Map of Wales* (BGS and Welsh Assembly Government, 2010);
- *North West Wales Aggregates Safeguarding Map* (BGS and Welsh Assembly Government, 2012);
- *Hard Rock and Sand & Gravel Safeguarding Areas in Ynys Môn* (Capita Symonds, 2010); and
- extract from *BritPits* (BGS, 2017b), provided by the North Wales Minerals and Waste Planning Service.

The site and the southwestern and eastern extents of the study area have been identified as a Category 1 Aggregates Safeguarding Area for sand and gravel (British Geological Survey and Welsh Assembly Government, 2012). Category 1 Aggregates Safeguarding Areas are resources considered to be of national importance.

None of the Mineral Safeguarding Areas identified within the *Hard Rock and Sand & Gravel Safeguarding Areas in Ynys Môn* (Capita Symonds, 2010) report or the quarries identified within the extract from *BritPits* (North Wales Minerals and Waste Planning Service, 2014) are located within the study area.

8. Land Contamination

8.1 Introduction

The preliminary land contamination risk assessment presented below is based on a desk-based review of available information, primarily that presented within the Groundsure report (2017), included in Appendix B.

8.2 Approach

The process of contamination risk assessment is defined within *Model Procedures for the Management of Land Contamination: Contaminated Land Report 11* (CLR11) (Environment Agency and Department for Environment, Food and Rural Affairs, 2004). A summary of the approach, which has been adopted within this report, is outlined below.

- Hazard identification, which involves identifying contaminant sources, and undertaking a hazard assessment, which involves establishing pathways (a route or means by which a receptor can be exposed to, or affected by, a contaminant) and receptors, and identifying where a potential pollutant linkage exists. Both hazard identification and assessment stages conclude in development of the conceptual site model.
- Risk estimation, which predicts the likelihood of harm or pollution occurring (probability assessment) and the degree of harm or pollution occurring (consequence assessment). Risk estimation is only undertaken when a potential pollutant linkage exists. Risk estimation has two components:
    1) probability assessment, which relates to whether pollution/harm could occur in the short and/or long term; and
    2) consequence assessment, which relates to the magnitude of harm that could occur because of the potential pollutant linkage; that is, the degree of harm or pollution considering the sensitivity of the receptor.
- Risk evaluation, which is the process of deciding whether a risk is acceptable or not, entails the application of evaluation criteria, which may be absolute standards or recommended limit values, for example a health criterion for the intake of a substance.

8.3 Sources

A summary of information relevant to potential contamination sources within the study area is presented below.

8.3.1 Historical Map Review

The historical land use was determined from large and small-scale historical Ordnance Survey maps (Groundsure, 2017) and is presented in Table 8.1.

Table 8.1: Historical map review

Date	Scale	Site description	Remainder of study area
1887	1:10,560	The majority of the site is shown as undeveloped agricultural land. Tre-Fignarth farmstead is shown in the southeast of the site, comprising a number of farm buildings and a small pond. A small road is shown running parallel to the southern site boundary. Rocky outcrops are shown in the southeast of the site. In the northern section of the site, two small streams issue, both then flow towards and beneath the railway to the north.	The majority of the study area comprises undeveloped agricultural land, with an isolated farmstead to the west. A railway line runs parallel to the northern boundary of the site. A historical burial ground, listed as Cromlech, is present just outside the site boundary to the southeast. A watercourse runs approximately 150m east of the site boundary and a second river occurs approximately 150m to the southwest. A small watercourse or drain runs south of the railway line immediately north of the northeast site boundary. In the southern areas of the study area there are patches of marshy land.
1889	1:2,500	No significant changes to the site	No significant changes to the study area
1899	1:10,560	No significant changes to the site.	No significant changes to the study area
1900	1:2,500	No significant changes to the site	No significant changes to the study area
1924	1:2,500	No significant changes to the site	A drain was present in earlier maps just north of the northeast site boundary. The drain is no longer present and is replaced by a small area of marshy land.
1926	1:10,560	No significant changes to the site	A spring is listed at the eastern extent of the study area.
1949	1:10,560	No significant changes to the site	No significant changes to the study area
1959	1:10,560	No significant changes to the site	No significant changes to the study area
1967	1: 2,500	A marsh area is listed in the west of the site.	'Issues' are marked to the northwest of the site associated with the watercourse that crosses the northwest of the site and then flows towards and beneath the railway to the north.
1979	1: 10,560	Tre-Fignarth is no longer shown on mapping. The small pond appears to have been infilled. A small woodland area is marked.	An aluminium works is listed 250m northeast of the site, covering a large area north of the railway track.
1987	1: 2,500	No significant changes to the site	No significant changes to the study area
1993	1:2,500	Sheep pens are listed on the Parc Cybi road in the south of the site.	No significant changes to the study area
1995	1:2,500	No significant changes to the site	No significant changes to the study area

Date	Scale	Site description	Remainder of study area
2002	1:10,000	The area in the northeast of the site that was previously identified as marshy ground now contains a small pond.	The A55 has been constructed running parallel and to the south of the railway track. A disused heliport is listed 200m north of the site. A gas valve compound is listed 100m east of the site area, associated with the aluminium works.
2010	1:10,000	The small road running across the southern extent of the site is no longer marked. The present day Parc Cybi road has been constructed in its place on the site and extends in a westerly direction where the previous road was north-westerly. The southeast of the site is marked as a car park. The sheep pens are no longer present.	The disused heliport is no longer listed and the site is incorporated as part of a wider development labelled as Penhros Business Park. Parc Cybi has roundabouts both west and south of the site area.
2014	1:10,000	The southeast of the site is not marked as a car park anymore. The woodland area in the south of the site is no longer present.	A road extends from the roundabout west of the site northwards, and parallel to the western boundary of the site.

8.3.2 Summary of Historical Land Use

On-site

The majority of the site has remained undeveloped agricultural land, with the Tre-Fignarth farmstead the only developed portion of the site. Activities associated with farming are a potential (but minor) contamination source, especially in the area listed as sheep pens. Presence of made ground and contamination may be associated with demolition of the Tre-Fignarth farmstead and potential infilling of the former small pond. Furthermore, presence of made ground and localised contamination may be associated with the construction of the Parc Cybi road and removal of the previously present small road in the south of the site, and use of the southeast of the site as a car park. During the site walkover, evidence of soil, demolition rubble and small scale fly tipping was observed.

Off-site

The land immediately surrounding the site within the study area has also remained largely undeveloped agricultural land – the most significant development being construction of the A55 immediately to the north of the site. This development is shown as completed on mapping from 2002. A railway line has been present north of the A55 since the earliest available mapping from 1887.

At a greater distance, other significant developments in the study area include the construction of the aluminium works first listed in 1979, at 250m northeast of the site area. Whilst the site boundary for the aluminium works is within the study area, only the car park, railway sidings and two listed tanks fall within the study area. Another large development is the construction of the heliport 200m northwest of the site, which is first listed on mapping in 2002. The heliport was operational for 10 weeks, before developing into Penhros Business Park in 2003. The only development within the study area is an unnamed warehouse building at the northwestern extent of the study area. Little further development occurred within the study area before the development of the Parc Cybi road and associated roundabouts, first listed in 2010.

8.3.3 Contemporary Land Use

The following features were identified during the site walkover which may be of relevance to land contamination:

On-site:

- The southern area of the site is surfaced with hardstanding of tarmac and concrete (Appendix C.1)
- A spoil heap is located south of the coniferous woodland area, which includes evidence of fly tipping (brick, stone, rubble, general litter, office and car materials) (Appendix C.2).
- Fly tipping; brick, stone, rubble and general litter (Appendix C.3).

Off-site:

- No additional features of relevance were identified during the site walkover.

8.3.4 Regulatory and Archive Information

Unless otherwise stated, the information below is based on Groundsure (2017).

(a) Discharge Consents

No discharge consents have been reported within the study area.

(b) Pollution Incidents to Controlled Waters

No pollution incidents to controlled waters have been recorded within the study area.

(c) Landfill and Waste Sites

There are no records of landfills or waste sites within the study area.

(d) Potentially Contaminative Industries and Land Uses

Potentially contaminative industries and land uses listed in the Groundsure report (2017) include railway sidings and unspecified tanks, associated with the aluminium works northeast of the site. In addition, the Groundsure report records the presence of an electricity substation approximately 40m northwest of the site.

(e) Petrol/Fuel Stations

There are no petrol/fuel stations within the study area.

(f) National Gas and Electricity Supply Pipelines

The National Grid records do not indicate the presence of high-voltage electricity or high pressure gas pipelines within the study area. Nor is the presence of gas transmission pipelines indicated within the study area.

(g) Radon

The site is not located within an area affected by radon, as less than 1% of the properties in the area are above the action level.

(h) Unexploded Ordnance

The Zetica Regional Bomb Risk Map for Isle of Anglesey (Zetica, 2015) identifies that the study area is within a moderate risk area for encountering unexploded ordnance. Moderate risk regions are those that show a bomb density of 11 to 50 bombs per 1,000 acres and may contain potential World War II targets.

As a result, a site-specific *Preliminary Unexploded Ordnance Risk Assessment* (BACTEC, 2017) and subsequently an *Explosive Ordnance Desktop Threat Assessment* (Dynasafe, 2017) were obtained for the site the latter is presented in Appendix D.

The *Explosive Ordnance Desktop Threat Assessment* advised that the risk of unexploded ordnance at the site is medium. This conclusion is reached through analysis of historical information, including information regarding German air attacks on Holyhead, troop manoeuvres and the presence of an allied pillbox 240m south-east of the site (not indicated on historical maps). The report indicates that the risks from aerial bombing or anti-aircraft ammunition is low, however the risk of encountering discarded or buried ammunition from allied troops either stationed or undertaking exercises in the area cannot be ruled out and therefore there remains a medium risk of UXO being encountered.

The report therefore recommends a non-intrusive magnetometer survey and targeted investigation, and an explosive ordnance disposal engineer be present on site during shallow intrusive works.

8.3.5 Potential Contaminants of Concern

Based upon the above identified potential sources of contamination, the following contaminants of concern may be present on-site and off-site:

On-site:

- farm activities (historical farm activities, could include cesspits and sheep dips), pre-1887 – present: heavy metals, hydrocarbons, pesticides/herbicides and insecticides, ground gases;
- deconstruction of previous road, construction of Parc Cybi road and area of hardstanding (potential for ground contamination) (Appendix C.1): heavy metals, hydrocarbons, ground gas;
- location within an area potentially subject to live firing exercises or storage and disposal of ammunition; unexploded ordnance;
- spoil tip (brick, stone, rubble and general litter): heavy metals, hydrocarbons, asbestos (Appendix C.2.); and
- evidence of fly tipping (brick, stone, rubble, general litter, office and car materials): heavy metals, hydrocarbons, asbestos (Appendix C.3).

Off-site:

- operation of railway land to the north of the site; heavy metals, hydrocarbons, asbestos,

8.4 Receptors

The key receptors located within the study area and their nature, typical activity and exposure routes are described in the tables below.

8.4.1 Human Health

The human health receptors relevant to the proposed development are described in Table 8.2.

Table 8.2: Human health receptors

Receptor	Typical activity
Construction workers	All activities involved with the construction of the Logistics Centre. High likelihood of contact with site soils and likely contact with groundwater during earthworks.
Maintenance workers	Routine maintenance work. Likely contact with site soils and low likelihood with groundwater.

Receptor	Typical activity
Future site workers	Future workers at the Logistics Centre. Unlikely contact with site soils (due to abundance of hardstanding cover) and groundwater. Low (as opposed to very low) likelihood of inhalation/risk from vapours/ground gases given the presence of occupied buildings at the Logistics Centre.
Future site users	Future users of the Logistics Centre. Unlikely contact with site soils (due to abundance of hardstanding cover) and groundwater. Low (as opposed to very low) likelihood of inhalation/risk from vapours/ground gases given the access to internal areas.
Adjacent land users	Currently primarily agricultural land use, with expected future industrial/commercial uses due to developing business park at Parc Cybi. Low likelihood of inhalation of wind-blown dusts and contaminants from site.

8.4.2 Controlled Waters

The relevant environmental receptors in terms of controlled waters and sensitive environmental sites are set out in Table 8.3.

Table 8.3: Controlled waters receptors

Receptor	Description
Groundwater	Secondary A aquifer in superficial deposits beneath parts of the study area and Secondary aquifers.
Surface water	A secondary river and small (tertiary) streams and ponds on-site and within the study area.

8.4.3 Property

The relevant property receptors are set out in Table 8.4. Given the proposed use of the Logistics centre, other property receptors (crops and livestock) are not considered relevant and are not discussed further.

Table 8.4: Property receptors

Receptor	Description
Buildings/services (future site use)	Logistics Centre to be constructed on-site (including buildings).

8.5 Pathways

Potential pathways by which the on-site contaminants may affect identified human health and animal receptors at the site are:

- inhalation of contaminated soil dusts and/or vapours;
- ingestion of contaminated soil or groundwater; and
- dermal contact with contaminants.

Pathways relevant to controlled waters receptors are:

- leaching of contaminants to ground and surface waters.

Pathways relevant to property receptors are:

- direct contact with contaminated soils and groundwater; and

- migration of ground gases and vapours into voids within buildings followed by build-up and potential explosion and/or asphyxiation.

Pathways relevant to contaminants once they have entered groundwater/surface water are considered within chapter F8 (Surface water and groundwater) (Application Reference Number: 6.6.8) and appendix H8-1 (Logistics Centre - Flood Consequence Assessment) (Application Reference Number: 6.8.16) and will not be discussed further here.

8.6 Potential Pollutant Linkages

Based on the contaminant sources, receptors and pathways outlined above, potential pollutant linkages have been identified and a conceptual site model has been developed, as outlined in Table 8.5.

Table 8.5: Potential Pollutant Linkages

Source	Pathway	Receptor
On-Site		
Areas of potential made ground from demolition of historical buildings, construction of road and potential infilling of pond: - Heavy metals - Hydrocarbons - Asbestos - Ground gas	Ingestion, inhalation, dermal contact with contaminated soil/groundwater within filled areas	Construction workers Maintenance workers
	Ingestion, inhalation, dermal contact with contaminated soil within filled areas	Future site users
	Leaching of contaminants to ground and surface waters	Groundwater Surface waters
	Inhalation of wind-blown dust and contaminants from contaminated soil within potentially infilled areas	Adjacent land users
	Accumulation of ground gases within enclosed spaces leading to potential risk of asphyxiation and/or explosion	Construction workers Maintenance workers Future site workers Future site users Buildings
Spoil heap and fly tipped waste: - Heavy metals - Hydrocarbons - Asbestos	Ingestion, inhalation, dermal contact with contaminated soil/groundwater within filled areas	Construction workers Maintenance workers
	Ingestion, inhalation, dermal contact with contaminated soil within filled areas	Future site users
	Leaching of contaminants to ground and surface waters	Groundwater Surface waters
	Inhalation of wind-blown dust and contaminants from contaminated soil within potentially infilled areas	Adjacent land users
	Accumulation of ground gases within enclosed spaces leading to potential risk of asphyxiation and/or explosion	Construction workers Maintenance workers Future site workers Future site users Buildings

Source	Pathway	Receptor
Farming activities: - Heavy metals - Hydrocarbons - Pesticides, herbicides, insecticides - Ground gas	Ingestion, inhalation, dermal contact with contaminated soil/groundwater	Construction workers Maintenance workers
	Ingestion, inhalation, dermal contact with contaminated soil	Future site users
	Leaching of contaminants to ground and surface waters	Groundwater Surface waters
	Inhalation of wind-blown dust and contaminants from contaminated soil	Adjacent land users
	Accumulation of ground gases within enclosed spaces leading to potential risk of asphyxiation and/or explosion	Construction workers Maintenance workers Future site workers Future site users Buildings
Unexploded Ordnance	Explosion	Construction workers Maintenance workers
Adjacent to Site		
Areas of potential made ground from construction of A55: - Heavy metals - Hydrocarbons - Asbestos	Migration of contaminants on-site and ingestion, inhalation, dermal contact with contaminated soil/groundwater	Construction workers Maintenance workers
	Migration of contaminants on-site and ingestion, inhalation, dermal contact with contaminated soil/groundwater	Future site workers Future site users
	Migration of contaminants to aquifer beneath site and/or discharge/ surface runoff into surface waters	Groundwater Surface waters
Operation of railway land: - Heavy metals - Hydrocarbons - Asbestos	Migration of contaminants on-site and ingestion, inhalation, dermal contact with contaminated soil/groundwater	Construction workers Maintenance workers
	Migration of contaminants on-site and ingestion, inhalation, dermal contact with contaminated soil/groundwater	Future site workers Future site users
	Migration of contaminants to aquifer beneath site and/or discharge/ surface runoff into surface waters	Groundwater Surface waters
Unspecified tanks and potential presence of made ground from aluminium works site: - Heavy metals	Migration of contaminants on-site and ingestion, inhalation, dermal contact with contaminated soil/groundwater	Construction workers Maintenance workers
	Migration of contaminants on-site and ingestion, inhalation, dermal contact with contaminated soil/groundwater	Future site workers Future site users

Source	Pathway	Receptor
- Hydrocarbons	Migration of contaminants to aquifer beneath site and/or discharge/ surface runoff into surface waters	Groundwater Surface waters

8.7 Findings of Ground Investigation

A summary of the findings of the Ground Investigation undertaken by Tier Environmental (2015) is provided below.

The investigation by Tier Environmental comprised excavation of 10 hand-dug trial pits, 12 machine-excavated trial pits, three soakaways and four window sample boreholes. Environmental testing of made ground (four samples), topsoil (two samples) and glacial till (two samples) were scheduled for analysis. Soils, soil leachate and waters were tested for a suite of metals and metalloids, inorganics, organics, electrical conductivity, pH and asbestos. Further information can be found in Appendix K of the Ground Investigation report (Tier Environmental, 2015).

Made ground was encountered at a number of locations within the site area, as discussed in section 4.1 of this report. Made ground encountered can generally be described as black-brown clayey gravelly cobbly medium sand, with anthropogenic material including slate, concrete and tile.

Chemical analysis of soils was undertaken for a range of potential contaminants of concern on the site, including metals and metalloids, polycyclic aromatic hydrocarbons, hydrocarbons, asbestos and polychlorinated biphenyls. The analytical testing results were screened against Generic Assessment Criteria (GAC), comprising LQM/CIEH 'suitable for use levels' for commercial land use published in 2015, to assess potential risks to human health receptors.

Based on the assessment within Tier Environmental (2015), none of the screened contaminants of concern were reported at concentrations which are considered to present a potential risk to human health receptors.

Additionally, of the nine asbestos screen tests taken from the site, none were found to contain asbestos fibres; Tier Environmental therefore discounted asbestos as a potential contaminant of concern.

The Ground Investigation did not include chemical analysis of groundwater or surface water samples. However, Tier Environmental (2015) consider that the site does not present a potentially significant risk to controlled waters receptors, as no potentially significant sources were identified on-site and the only anthropogenic material encountered during the Ground Investigation comprised inert material such as brick, concrete and tile. There is no evidence in the Tier Environmental report that the spoil heap and fly tipped material (refer to section 8.3.5) was present on site prior to the Ground Investigation taking place, therefore it is assumed that this material has been deposited since 2015.

Ground gas monitoring installations were constructed in four window sample locations. Monitoring was undertaken for atmospheric pressure, methane, carbon dioxide, oxygen, hydrogen sulphide and gas flow rate. Based on the monitoring results, the site was considered as Characteristic Situation 1 'very low risk' (Tier Environmental, 2015). However, Tier Environmental has measured a maximum carbon dioxide concentration of 6.7%v/v and noted that this is above the threshold at which gas protection measures should be considered. Peak gas flow rate was measured at <0.1 l/h for all of the four sampled areas.

8.8 Risk Assessment

Using guidance within Contaminated Land Report 11: Model Procedures for the Management of Land Contamination. (Environment Agency and Department for Environment, Food and Rural Affairs, 2004) and CIRIA C552 '*Contaminated Land Risk Assessment - A Guide to Good Practice*' (CIRIA, 2001), a qualitative risk

assessment has been undertaken to assess the significance of each potential pollutant linkage using the criteria set out in Table 8.6 to Table 8.9.

Within the risk assessment, the consequence of occurrence (severity) takes into consideration the likely levels (concentrations) of contamination which may be present and their abundance.

The conceptual site model and risk assessment are presented in Table 8.10.

Table 8.6: Consequence of occurrence/severity

Classification	Human health	Controlled Waters	Property
Severe	Short-term (acute) risk to human health. Concentrations present are likely to result in "*significant harm*" as defined by Part 2A of the *Environmental Protection Act 1990*.	Substantial pollution of water resources such that "significant pollution" or "significant possibility of pollution" of controlled waters as defined by Part 2A is being caused.	Catastrophic damage to buildings, structures or the environment, including building collapse
Medium	Chronic damage to human health. Concentrations present that could result in significant harm.	Pollution of water resources such that there is a measurable (but not significant) reduction in water quality compared to the Water Quality Standards.	Significant damage to buildings, structures or the environment making it unsafe to occupy, or damage that may impair a scheduled ancient monument
Mild	Slight short-term health effects to humans. Exposure to human health is unlikely to lead to significant harm.	Measureable reduction in water resources compared to baseline	Minor damage to sensitive buildings, structures, services or the environment
Minor	Non-permanent health effects to human health (easily prevented by means such as personal protective clothing, etc.)	Insubstantial pollution to water resources compared to baseline	Easily repairable effects of damage to buildings or structures

Table 8.7: Estimation of probability (likelihood)

Classification	Definition
High likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	There is a pollutant linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low likelihood	There is a pollution linkage and circumstances are possible under which an event could

Classification	Definition
	occur. However, it is by no means certain even over a longer period that such an event would take place, and it is even less likely in the shorter term.
Unlikely	There is a pollutant linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

Table 8.8: Risk ratings

Risk matrix		Consequence of occurrence (severity)			
		Severe	Medium	Mild	Minor
Probability (likelihood)	High likelihood	Very high	High	Moderate	Moderate/low
	Likely	High	Moderate	Moderate/low	Low
	Low likelihood	Moderate	Moderate/low	Low	Very low
	Unlikely	Moderate/low	Low	Very low	Very low

Table 8.9: Risk definition

Risk	Risk description
Very high	There is a high likelihood of the event occurring and having severe consequences. If the risk is realised it is likely to result in a substantial liability.
High	It is likely that an event with medium or even severe consequences could arise. If the risk is realised it may result in a substantial liability.
Moderate	It is possible that an event could occur; it is either unlikely but may have severe consequences, or it is relatively likely, but the consequences would be relatively mild. Investigation would normally be required to clarify the risk and determine the potential liability.
Low risk	It is possible that an event could occur but it is likely that the consequences would be at worst medium.
Very low	It is unlikely that an event could occur, and if it happened the consequences are likely to be at worst mild.

Table 8.10: Potential Pollutant Linkages

Source	Potential contaminants	Pathway	Receptor	Consequence of occurrence	Likelihood of occurrence	Potential risk	Comments
On-site							
Potential made ground (from demolition of historical buildings, road construction across the southern area of the site and potential infilling of pond)	Heavy metals Hydrocarbons Asbestos	Ingestion, inhalation, dermal contact with contaminated soil/groundwater	Construction workers Maintenance workers	Medium	Low likelihood	Moderate/low	Presence of made ground and potential contamination likely to be restricted to southeast of the site. Ground Investigation by Tier Environmental did not encounter significant ground contamination.
		Ingestion, inhalation, dermal contact with contaminated soil	Future site workers Future site users	Medium	Unlikely	Low	
		Inhalation of wind-blown dust and contaminants from contaminated soil	Adjacent land users	Mild	Unlikely	Very low	
		Leaching of contaminants to ground and surface waters	Groundwater Surface waters	Mild	Low likelihood	Low	
	Ground gases	Accumulation of ground gases within enclosed spaces leading to potential risk of asphyxiation and/or explosion.	Construction workers Maintenance workers Future site workers Future site users Buildings	Severe	Low likelihood	Moderate	Ground gas assessment by Tier Environmental considered site to fall within Category 1 low risk; however, carbon dioxide concentrations in excess of 5% v/v were measured, although at a low flow rate.
Farming activities (including potential isolated sheep dips, cess pits, etc. if present)	Heavy metals Hydrocarbons Pesticides/herbicides and insecticides	Ingestion, inhalation, dermal contact with contaminated soil/groundwater	Construction workers Maintenance workers	Medium	Low likelihood	Moderate/low	There is unlikely to be significant contamination present as a result of the farming activities, although localised areas may be present as a result of spillages/leakages of fuels, etc. This is particularly relevant to the south-eastern extent of the site where sheep pens and a sheep dip were present.
		Ingestion, inhalation, dermal contact with contaminated soil	Future site workers Future site users	Medium	Low likelihood	Low	
		Inhalation of wind-blown dust and contaminants from contaminated soil within affected areas	Adjacent land users	Mild	Unlikely	Very low	
		Leaching of contaminants to surface and groundwater	Groundwater Surface waters	Mild	Low likelihood	Low	
	Ground gases	Accumulation of ground gases within enclosed spaces leading to potential risk of asphyxiation and/or explosion.	Construction workers Maintenance workers Future site workers Future site users Buildings	Severe	Unlikely	Moderate/low	Significant ground gas generation is considered unlikely.
Spoil heap: (brick, stone, rubble, general litter).	Heavy metals Hydrocarbons Asbestos	Ingestion, inhalation, dermal contact with contaminated soil/groundwater	Construction workers Maintenance workers	Medium	Low likelihood	Moderate/low	Spoil heap restricted to small area in the non-agricultural part of the site. Assessment and/or removal of the spoil heap would occur before works take place on site.
		Ingestion, inhalation, dermal contact with contaminated soil	Future site workers Future site users	Medium	Low likelihood	Low	
		Inhalation of wind-blown dust and contaminants from contaminated soil within affected areas	Adjacent land users	Mild	Unlikely	Very low	
		Leaching of contaminants to surface and groundwater	Groundwater Surface waters	Mild	Low likelihood	Low	
Fly tipping: (general litter, office supplied	Heavy metals Hydrocarbons	Ingestion, inhalation, dermal contact with contaminated soil/groundwater	Construction workers Maintenance workers	Mild	Low likelihood	Low	Limited amounts of fly tipping are unlikely to pose significant

Source	Potential contaminants	Pathway	Receptor	Consequence of occurrence	Likelihood of occurrence	Potential risk	Comments
and car materials).	Asbestos	Ingestion, inhalation, dermal contact with contaminated soil	Future site workers Future site users	Medium	Low likelihood	Low	contamination. Fly tipped materials would be removed from site prior to works taking place, hence risk is low.
		Inhalation of wind-blown dust and contaminants from contaminated soil within affected areas	Adjacent land users	Mild	Unlikely	Very low	
		Leaching of contaminants to surface and groundwater	Groundwater Surface waters	Mild	Low likelihood	Low	
Location within an area potentially subject to live firing exercises or storage and disposal of ammunition.	Unexploded ordnance	Explosion	Construction workers Maintenance workers Future site workers Future site users Adjacent land users	Severe	Low likelihood	Moderate	The UXO risk is determined to be medium (Dynasafe, 2017). Recommendation to undertake further survey work and targeted investigation, and an explosive ordnance disposal engineer to be present during shallow intrusive works.

Source	Potential contaminants	Pathway	Receptor	Consequence of occurrence	Likelihood of occurrence	Potential risk	Comments
Off-site							
Operation of railway land to the north of the site	Heavy metals Hydrocarbons Asbestos	Migration of contaminants on-site and ingestion, inhalation, dermal contact with contaminated soil/groundwater	Construction workers Maintenance workers	Medium	Unlikely	Low	The rail track has some potential to introduce contamination due to its proximity to the site and nearby marshy area. However, due to its location, all watercourses flow in an orientation that would take any contamination away from the site and so it is unlikely a surface water or groundwater pathway is present.
		Migration of contaminants on-site and ingestion, inhalation, dermal contact with contaminated soil/groundwater	Future site workers Future site users	Medium	Unlikely	Low	
		Migration of contaminants to aquifer beneath site and/or discharge/ surface runoff into surface waters	Secondary A aquifer Secondary aquifers Surface waters	Mild	Unlikely	Very low	

8.9 Discussion

The review and desk-based assessment of available published information, consultation responses, site reconnaissance and findings of a previous Ground Investigation identified a number of potential pollutant linkages.

The risks associated with any potential pollutant linkages are generally considered to be low or very low, with the exception of risks to construction workers and maintenance workers. These receptors have increased likelihood of contact with soils and groundwater and moderate/low risks were associated with exposure to potential contamination from on-site sources. The presence of hardstanding across much of the site will prevent future site users from coming into contact with site soils.

In addition, moderate risks have been identified to human health receptors associated with encountering unexploded ordnance. However, this risk could be mitigated through further investigation and assessment, and an explosive ordnance disposal engineer to be present on site during shallow intrusive works.

Moderate/low risks were also identified for ground gases; however, this is the lowest possible risk outcome based on the severity of the risk. As only one of four sampling locations have returned a CO2 concentration above 5%, and a low flow rate is recorded across the site, ground gas generation is likely to be low.

9. Glossary

Abbreviation	Definition
ALC	Agricultural Land Classification
BGS	British Geological Survey
BMV	Best and Most Versatile
BritPits	British Pits
Defra	Department for Environment, Food & Rural Affairs
HOST	Hydrology of soil type
IACC	Isle of Anglesey County Council
LQM/CIEH	Land Quality Management Ltd/The Chartered Institute of Environmental Health
mbgl	Metres Below Ground Level
NRW	Natural Resources Wales
NSRI	National Soil Resources Institute
PPL	Potential Pollutant Linkage
RIGS	Regionally Important Geodiversity Site
SSSI	Site of Special Scientific Interest
TP	Trial Pit
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WS	Window Sample

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11. Limitations

The potential remains for the presence of unknown, unidentified, or unforeseen surface and sub-surface contamination. Any additional evidence of such potential site contamination would require appropriate surface and subsurface exploration and testing. The findings of this report were developed in a manner consistent with a level of care and skill normally exercised by members of the environmental science and engineering profession currently practising under similar conditions.

A number of the findings and conclusions presented in this report are based on information provided by third parties and/or historical records, which Horizon Nuclear Power Wylfa Limited has relied on in good faith. Jacobs accepts no responsibility for any deficiency, misstatements, or inaccuracy contained in this report as a result of errors, omissions or misstatements of said third parties or from information obtained from these.

If new information is obtained or developed during future work (which may include excavations, borings or other studies), Jacobs should be requested to re-evaluate the conclusions of this report, and to provide amendments as required.

Figure 1. Soils and Geology Study Area

FIGURE 1

Legend

- Logistics Centre
- Logistics Centre study area

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
0	AUG 17	Initial Issue	AD	MS	KY	RB

HORIZON NUCLEAR POWER

WYLFA NEWYDD PROJECT
ENVIRONMENTAL STATEMENT

Drawing Title

SOILS AND GEOLOGY STUDY AREA

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	60PO8077	
Client No.		

Drawing No.

60PO8077_DCO_VOL_H_APP_07_01_01

0 25 50 100 150 200 250 Metres

Appendix A. Agricultural Land Classification and Soil Resources

Jacobs UK Limited

Parc Cybi Logistics Centre,

Holyhead,

Anglesey

Agricultural Land Quality Appraisal

May 2017

Reading Agricultural Consultants Ltd

Beechwood Court, Long Toll, Woodcote, RG8 0RR

www.readingagricultural.co.uk

1. Introduction

1.1. Reading Agricultural Consultants Ltd (RAC) is instructed by Jacobs UK Limited to assess the likely quality of agricultural land at Parc Cybi, Holyhead, Anglesey. The site extends to three hectares (ha) of agricultural land, predominantly under grass.

1.2. Guidance for assessing the quality of agricultural land in England and Wales is set out in the Ministry of Agriculture, Fisheries and Food (MAFF) revised guidelines and criteria for grading the quality of agricultural land (1988[1]).

1.3. Agricultural land in England and Wales is graded between 1 and 5, depending on the extent to which physical or chemical characteristics impose long-term limitations on agricultural use. The principal physical factors influencing grading are climate, site and soil which, together with interactions between them, form the basis for classifying land into one of the five grades.

1.4. Grade 1 land is excellent quality agricultural land with very minor or no limitations to agricultural use, and Grade 5 is very poor quality land, with severe limitations due to adverse soil, relief, climate or a combination of these. Grade 3 land is subdivided into Subgrade 3a (good quality land) and Subgrade 3b (moderate quality land). Land which is classified as Grades 1, 2 and 3a in the ALC system is defined as best and most versatile agricultural land.

2. Site and Climatic Conditions

2.1. The site is bounded to the south by a tarmac track, beyond which is Parc Cybi, and to the west, north and east by other agricultural grassland. A compound also lies to the west, and the A55 and a large pond lie beyond the grassland to the north.

2.2. The landform is sloping, from the highest altitude of around 15m above Ordnance Datum (AOD) in the south of the site to around 7m AOD in the north. Aerial photography shows exposed rocky outcrops in the south of the site.

2.3. Agro-climatic data for the site have been interpolated from the Meteorological Office's standard 5km grid point data set at a representative altitude of 10m AOD, and are given in Table 1. The site is warm and wet with moderate crop moisture deficits. The Field Capacity Day (FCD) regime is relatively long and is unfavourable for providing opportunities for agricultural field work.

[1] **MAFF (1988).** *Agricultural Land Classification of England and Wales. Revised guidelines and criteria for grading the quality of agricultural land.* MAFF Publications.

Table 1: Local agro-climatic conditions

Average Annual Rainfall	863mm
Accumulated Temperatures >0°C	1,477 day°
Field Capacity Days	182 days
Average Moisture Deficit, wheat	93mm
Average Moisture Deficit, potatoes	81mm

3. Agricultural Land Quality

3.1. The whole of England and Wales was mapped from reconnaissance field surveys in the late 1960s and early 1970s, to provide general strategic guidance on agricultural land quality for planners. This Provisional Series of maps was published on an Ordnance Survey base at a scale of One Inch to One Mile (1:63,360). The Provisional ALC map shows the site as Grade 4 land, which is poor quality agricultural land defined as:

> *"Land with severe limitation which significantly restrict the range of crops and/or level of yields. It is mainly suited to grass with occasional arable crops (e.g. cereals and forage crops) the yields of which are variable. In moist climates, yields of grass may be moderate to high but there may be difficulties in utilisation. The grade also includes very droughty arable land."*

3.2. However, paragraph 6.2.4 of Technical Advice Note 6[2] explains that:

> *"This map is produced for use in strategic planning and provides only a generalised indication of the distribution of land quality. The map is not suitable for use in evaluating individual sites. In such cases a resurvey at a larger scale is necessary to obtain a definitive grade."*

3.3. There is no detailed ALC data available for the site at Parc Cybi.

3.4. The Soil Survey of England and Wales soil association mapping[3] (1:250,000 scale) shows soils of the East Keswick association to be present across the site. These soils are characterised by deep, fine loamy brown earths, although the thickness varies and rocky exposures may be observed. The soils are often stony and

[2] **Welsh Assembly Government (2010).** *Planning for Sustainable Rural Communities.* Technical Advice Note No. 6

[3] **Soil Survey of England and Wales (1984).** *1:250,000 scale soil association mapping, Sheet 2 – Soils of Wales*

typically freely draining, of Wetness Class (WC) I, though locally may have slowly permeable subsoils resulting in slight seasonal waterlogging[4].

3.5. Under the climatic conditions of the site, soils of WC I with fine loamy topsoil textures will be limited to Grade 2 or Subgrade 3a where the soils are medium loams or heavy loams respectively. With slight seasonal waterlogging, the profiles may be of WC II depending upon the depth at which the slowly permeable layer occurs. Profiles of WC II with medium loam or heavy loam topsoils would be limited by wetness and workability to Subgrade 3a.

3.6. Although the crop moisture deficits are moderate and the water retention of fine loamy textures is relatively high, the specific soil depths and stone contents may result in a comparable droughtiness limitation. These variables cannot be predicted solely from the available published information and would require a field survey to be determined accurately. However, Subgrade 3a is considered a likely estimation of the droughtiness limitation when applying restricted profile depths and slight to moderate stone contents.

3.7. Aerial photography shows rock exposures in the southern part of the site, suggesting soils between the exposures and immediately surrounding this area may be particularly shallow over rock. A depth limitation is considered likely to be present. Land between the rock exposures will also be difficult to farm in practical terms. Grade 4 is likely to be an appropriate grade for the southern half of the site.

4. Summary

4.1. The site at Parc Cybi extends to 3ha of agricultural land. There is a significant rocky outcrop in the southern part of the site.

4.2. The soil type mapped at the site comprises well drained, fine loamy profiles which are often stony. Localised seasonal waterlogging of subsoil horizons may occur.

4.3. Taking into consideration the site and soil characteristics as described, it is likely that the southern half of the site will be limited to Grade 4 due to practical farming difficulties and potentially severely restricted soil depths, whilst the northern half of the site is considered likely to be of Subgrade 3a, from a likely combined limitation of soil wetness and soil droughtiness.

[4] **Rudeforth *et al.* (1984).** *Soils and Their Use in Wales.* Soil Survey of England and Wales Bulletin 11, Harpenden.

Appendix B. Groundsure Report Pack

Jacobs U.K. Limited

JACOBS UK LTD,95, BOTHWELL STREET, GLASGOW, G2 7HX

Groundsure Reference:	GS-3851522
Your Reference:	60PO8077_mpp2_Parc_Cybi
Report Date	4 May 2017
Report Delivery Method:	Email - pdf

Groundsure Enviro Insight

Address: 225810.09022030194, 380721.23260163126,

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Enviro Insight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above Groundsure reference number.

Yours faithfully,

[redacted]

Managing Director
Groundsure Limited

Enc.
Groundsure Enviroinsight

Groundsure Enviro Insight

Address:	**225810.09022030194, 380721.23260163126,**
Date:	**4 May 2017**
Reference:	**GS-3851522**
Client:	**Jacobs U.K. Limited**

NW N NE

W E

SW S SE

Aerial Photograph Capture date:	18-Apr-2015
Grid Reference:	225819,380725
Site Size:	8.81ha

Report Reference: GS-3851522
Client Reference: 60PO8077_mpp2_Parc_Cybi

Groundsure
LOCATION INTELLIGENCE

Contents Page

Overview of Findings

For further details on each dataset, please refer to each individual section in the main report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Section 1: Historical Industrial Sites	On-site	0-50	51-250	251-500
1.1 Potentially Contaminative Uses identified from 1:10,000 scale mapping	0	1	3	9
1.2 Additional Information – Historical Tank Database	0	0	4	19
1.3 Additional Information – Historical Energy Features Database	0	0	0	6
1.4 Additional Information – Historical Petrol and Fuel Site Database	0	0	0	0
1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database	0	0	0	0
1.6 Potentially Infilled Land	0	1	0	11

Section 2: Environmental Permits, Incidents and Registers	On-site	0-50m	51-250	251-500
2.1 Industrial Sites Holding Environmental Permits and/or Authorisations				
2.1.1 Records of historic IPC Authorisations	0	0	0	0
2.1.2 Records of Part A(1) and IPPC Authorised Activities	0	0	0	0
2.1.3 Records of Red List Discharge Consents	0	0	0	0
2.1.4 Records of List 1 Dangerous Substances Inventory sites	0	0	0	0
2.1.5 Records of List 2 Dangerous Substances Inventory sites	0	0	0	0
2.1.6 Records of Part A(2) and Part B Activities and Enforcements	0	0	0	1
2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations	0	0	0	0
2.1.8 Records of Licensed Discharge Consents	0	0	0	0
2.1.9 Records of Water Industry Referrals	0	0	0	0
2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site	0	0	0	0
2.2 Records of COMAH and NIHHS sites	0	0	1	1
2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents				
2.3.1 National Incidents Recording System, List 2	0	0	1	0
2.3.2 National Incidents Recording System, List 1	0	0	0	0
2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990	0	0	0	0

Section 3: Landfill and Other Waste Sites	On-site	0-50m	51-250	251-500	501-1000	1000-1500
3.1 Landfill Sites						
3.1.1 Environment Agency/Natural Resources Wales Registered Landfill Sites	0	0	0	0	0	Not searched
3.1.2 Environment Agency/Natural Resources Wales Historic Landfill Sites	0	0	0	0	1	1
3.1.3 BGS/DoE Landfill Site Survey	0	0	0	0	0	0
3.1.4 Records of Landfills in Local Authority and Historical Mapping Records	0	0	0	0	0	1
3.2 Landfill and Other Waste Sites Findings						
3.2.1 Operational and Non-Operational Waste Treatment, Transfer and Disposal Sites	0	0	0	0	Not searched	Not searched
3.2.2 Environment Agency/Natural Resources Wales Licensed Waste Sites	0	0	0	0	0	3

Section 4: Current Land Use	On-site	0-50m	51-250	251-500
4.1 Current Industrial Sites Data	0	1	2	Not searched
4.2 Records of Petrol and Fuel Sites	0	0	0	1
4.3 National Grid Underground Electricity Cables	0	0	0	0
4.4 National Grid Gas Transmission Pipelines	0	0	0	0

Section 5: Geology	
5.1 Are there any records of Artificial Ground and Made Ground present beneath the study site?	No
5.2 Are there any records of Superficial Ground and Drift Geology present beneath the study site?	Yes
5.3 For records of Bedrock and Solid Geology beneath the study site see the detailed findings section.	

Section 6: Hydrogeology and Hydrology	0-500m
6.1 Are there any records of Strata Classification in the Superficial Geology within 500m of the study site?	Yes
6.2 Are there any records of Strata Classification in the Bedrock Geology within 500m of the study site?	Yes

	On-site	0-50m	51-250	251-500	501-1000	1000-2000
6.3 Groundwater Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	0
6.4 Surface Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	0
6.5 Potable Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	0
6.6 Source Protection Zones (within 500m of the study site)	0	0	0	0	Not searched	Not searched
6.7 Source Protection Zones within Confined Aquifer	0	0	0	0	Not searched	Not searched
6.8 Groundwater Vulnerability and Soil Leaching Potential (within 500m of the study site)	0	0	0	0	Not searched	Not searched

Section 6: Hydrogeology and Hydrology

	0-500m					
	On-site	0-50m	51-250	251-500	501-1000	1000-1500
6.9 Is there any Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site?	No	No	No	No	No	No
6.10 Detailed River Network entries within 500m of the site	9	6	10	10	Not searched	Not searched
6.11 Surface water features within 250m of the study site	Yes	Yes	Yes	Not searched	Not searched	Not searched

Section 7: Flooding

7.1 Are there any Enviroment Agency Zone 2 floodplains within 250m of the study site?	No
7.2 Are there any Environment Agency/Natural Resources Wales Zone 3 floodplains within 250m of the study site	No
7.3 What is the Risk of flooding from Rivers and the Sea (RoFRaS) rating for the study site?	Very Low
7.4 Are there any Flood Defences within 250m of the study site?	No
7.5 Are there any areas benefiting from Flood Defences within 250m of the study site?	No
7.6 Are there any areas used for Flood Storage within 250m of the study site?	No
7.7 What is the maximum BGS Groundwater Flooding susceptibility within 50m of the study site?	Potential at Surface
7.8 What is the BGS confidence rating for the Groundwater Flooding susceptibility areas?	High

Section 8: Designated Environmentally Sensitive Sites

	On-site	0-50m	51-250	251-500	501-1000	1000-2000
8.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	0	0	0	2
8.2 Records of National Nature Reserves (NNR)	0	0	0	0	0	0
8.3 Records of Special Areas of Conservation (SAC)	0	0	0	0	0	3
8.4 Records of Special Protection Areas (SPA)	0	0	0	0	0	0
8.5 Records of Ramsar sites	0	0	0	0	0	0
8.6 Records of Ancient Woodlands	0	0	0	0	5	8
8.7 Records of Local Nature Reserves (LNR)	0	0	0	0	0	0
8.8 Records of World Heritage Sites	0	0	0	0	0	0
8.9 Records of Environmentally Sensitive Areas	0	0	0	0	0	0

Section 8: Designated Environmentally Sensitive Sites

	On-site	0-50m	51-250	251-500	501-1000	1000-2000
8.10 Records of Areas of Outstanding Natural Beauty (AONB)	1	0	0	0	3	79
8.11 Records of National Parks	0	0	0	0	0	0
8.12 Records of Nitrate Sensitive Areas	0	0	0	0	0	0
8.13 Records of Nitrate Vulnerable Zones	0	0	0	0	0	0
8.14 Records of Green Belt land	0	0	0	0	0	0

Section 9: Natural Hazards

9.1 What is the maximum risk of natural ground subsidence?	Very Low
9.1.1 What is the maximum Shrink-Swell hazard rating identified on the study site?	Very Low
9.1.2 What is the maximum Landslides hazard rating identified on the study site?	Very Low
9.1.3 What is the maximum Soluble Rocks hazard rating identified on the study site?	Negligible
9.1.4 What is the maximum Compressible Ground hazard rating identified on the study site?	Negligible
9.1.5 What is the maximum Collapsible Rocks hazard rating identified on the study site?	Very Low
9.1.6 What is the maximum Running Sand hazard rating identified on the study site?	Very Low
9.2 Radon	
9.2.1 Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?	The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.
9.2.2 Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment?	No radon protective measures are necessary.

Section 10: Mining

10.1 Are there any coal mining areas within 75m of the study site?	No
10.2 Are there any Non-Coal Mining areas within 50m of the study site boundary?	Yes
10.3 Are there any brine affected areas within 75m of the study site?	No

Using this report

The following report is designed by Environmental Consultants for Environmental Professionals bringing together the most up-to-date market leading environmental data. This report is provided under and subject to the Terms & Conditions agreed between Groundsure and the Client. The document contains the following sections:

1. Historical Industrial Sites

Provides information on past land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. Potentially Infilled Land features are also included. This search is conducted using radii of up to 500m.

2. Environmental Permits, Incidents and Registers

Provides information on Regulated Industrial Activities and Pollution Incidents as recorded by Regulatory Authorities, and sites determined as Contaminated Land. This search is conducted using radii up to 500m.

3. Landfills and Other Waste Sites

Provides information on landfills and other waste sites that may pose a risk to the study site. This search is conducted using radii up to 1500m.

4. Current Land Uses

Provides information on current land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. These searches are conducted using radii of up to 500m. This includes information on potentially contaminative industrial sites, petrol stations and fuel sites as well as high pressure gas pipelines and underground electricity transmission lines.

5. Geology

Provides information on artificial and superficial deposits and bedrock beneath the study site.

6. Hydrogeology and Hydrology

Provides information on productive strata within the bedrock and superficial geological layers, abstraction licenses, Source Protection Zones (SPZs) and river quality. These searches are conducted using radii of up to 2000m.

7. Flooding

Provides information on river and coastal flooding, flood defences, flood storage areas and groundwater flood areas. This search is conducted using radii of up to 250m.

8. Designated Environmentally Sensitive Sites

Provides information on the Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR), Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar sites, Local Nature Reserves (LNR), Areas of Outstanding Natural Beauty (AONB), National Parks (NP), Environmentally Sensitive Areas, Nitrate Sensitive Areas, Nitrate Vulnerable Zones and World Heritage Sites and Scheduled Ancient Woodland. These searches are conducted using radii of up to 2000m.

9. Natural Hazards

Provides information on a range of natural hazards that may pose a risk to the study site. These factors include natural ground subsidence and radon..

10. Mining

Provides information on areas of coal and non-coal mining and brine affected areas.

11. Contacts

This section of the report provides contact points for statutory bodies and data providers that may be able to provide further information on issues raised within this report. Alternatively, Groundsure provide a free Technical Helpline (08444 159000) for further information and guidance.

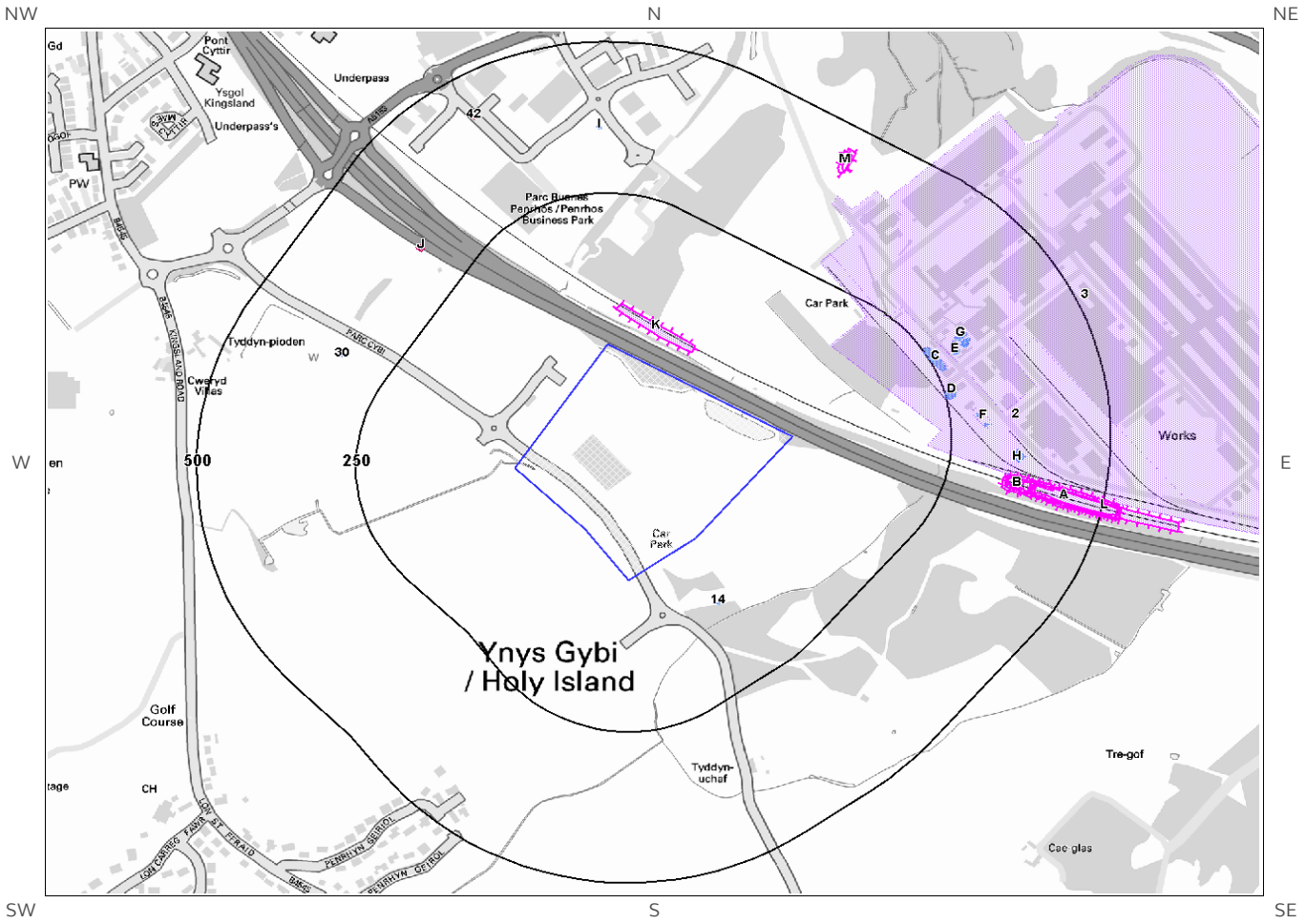
Note: Maps

Only certain features are placed on the maps within the report. All features represented on maps found within this search are given an identification number. This number identifies the feature on the mapping and correlates it to the additional information provided below. This identification number precedes all other information and takes the following format -Id: 1, Id: 2, etc. Where numerous features on the same map are in such close proximity that the numbers would obscure each other a letter identifier is used instead to represent the features. (e.g. Three features which overlap may be given the identifier “A” on the map and would be identified separately as features 1A, 3A, 10A on the data tables provided).

Where a feature is reported in the data tables to a distance greater than the map area, it is noted in the data table as “Not Shown”.

All distances given in this report are in Metres (m). Directions are given as compass headings such as N: North, E: East, NE: North East from the nearest point of the study site boundary.

1. Historical Land Use



Site Outline

250
500
Search Buffers (m)

Historical 1:10,000 and 1:10,560 scale mapping

Industrial Land Use

Potentially Infilled Land

Historical 1:2,500, 1:1,250 and 1:500 scale mapping

Energy Features

Petrol Stations

Tanks

Garages

1. Historical Industrial Sites

1.1 Potentially Contaminative Uses identified from 1:10,000 scale Mapping

The systematic analysis of data extracted from standard 1:10,560 and 1:10,000 scale historical maps provides the following information:

Records of sites with a potentially contaminative past land use within 500m of the search boundary: 13

ID	Distance [m]	Direction	Use	Date
1K	48	NE	Cuttings	1887
2	155	NE	Railway Sidings	1977
3	155	NE	Aluminium Works	1977
4C	248	NE	Unspecified Tanks	1977
5D	253	E	Unspecified Tank	1977
6F	286	E	Unspecified Tanks	1977
7B	339	E	Cuttings	1959
8A	342	E	Cuttings	1926
9A	344	E	Cuttings	1949
10A	344	E	Cuttings	1899
11B	346	E	Cuttings	1887
12A	386	E	Cuttings	1959
13L	390	E	Cuttings	1887

1.2 Additional Information – Historical Tank Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical tanks within 500m of the search boundary: 23

ID	Distance (m)	Direction	Use	Date
14	108	SE	Unspecified Tank	1967
15C	248	NE	Tanks	1973
16D	249	E	Unspecified Tank	1995
17D	250	E	Unspecified Tank	1973
18E	287	NE	Unspecified Tank	1993
19E	289	NE	Unspecified Tank	1995
20E	289	NE	Unspecified Tank	1973
21F	290	E	Unspecified Tank	1973
22E	296	NE	Unspecified Tank	1995
23F	302	E	Unspecified Tank	1973

24G	303	NE	Unspecified Tank	1993
25E	304	NE	Tanks	1993
26G	305	NE	Unspecified Tank	1973
27E	306	NE	Tanks	1995
28E	307	NE	Unspecified Tank	1973
29E	316	NE	Unspecified Tank	1973
30	327	NW	Unspecified Tank	1924
31H	349	E	Unspecified Tank	1995
32H	350	E	Unspecified Tank	1973
33I	355	N	Tanks	1987
34I	355	N	Tanks	1993
35I	356	N	Tanks	1996
36I	356	N	Tanks	1995

1.3 Additional Information – Historical Energy Features Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical energy features within 500m of the search boundary: 6

ID	Distance (m)	Direction	Use	Date
37J	326	NW	Gas Governor	1982
38J	327	NW	Gas Governor	1996
39J	327	NW	Gas Governor	1995
40J	329	NW	Gas Governor	1993
41J	329	NW	Gas Governor	1987
42	427	NW	Electricity Substation	1993

1.4 Additional Information – Historical Petrol and Fuel Site Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical petrol stations and fuel sites within 500m of the search boundary: 0

Database searched and no data found.

1.5 Additional Information – Historical Garage and Motor Vehicle Repair Database

The systematic analysis of data extracted from High Detailed 1:1,250 and 1:2,500 scale historical maps provides the following information.

Records of historical garage and motor vehicle repair sites within 500m of the search boundary: 0

Database searched and no data found.

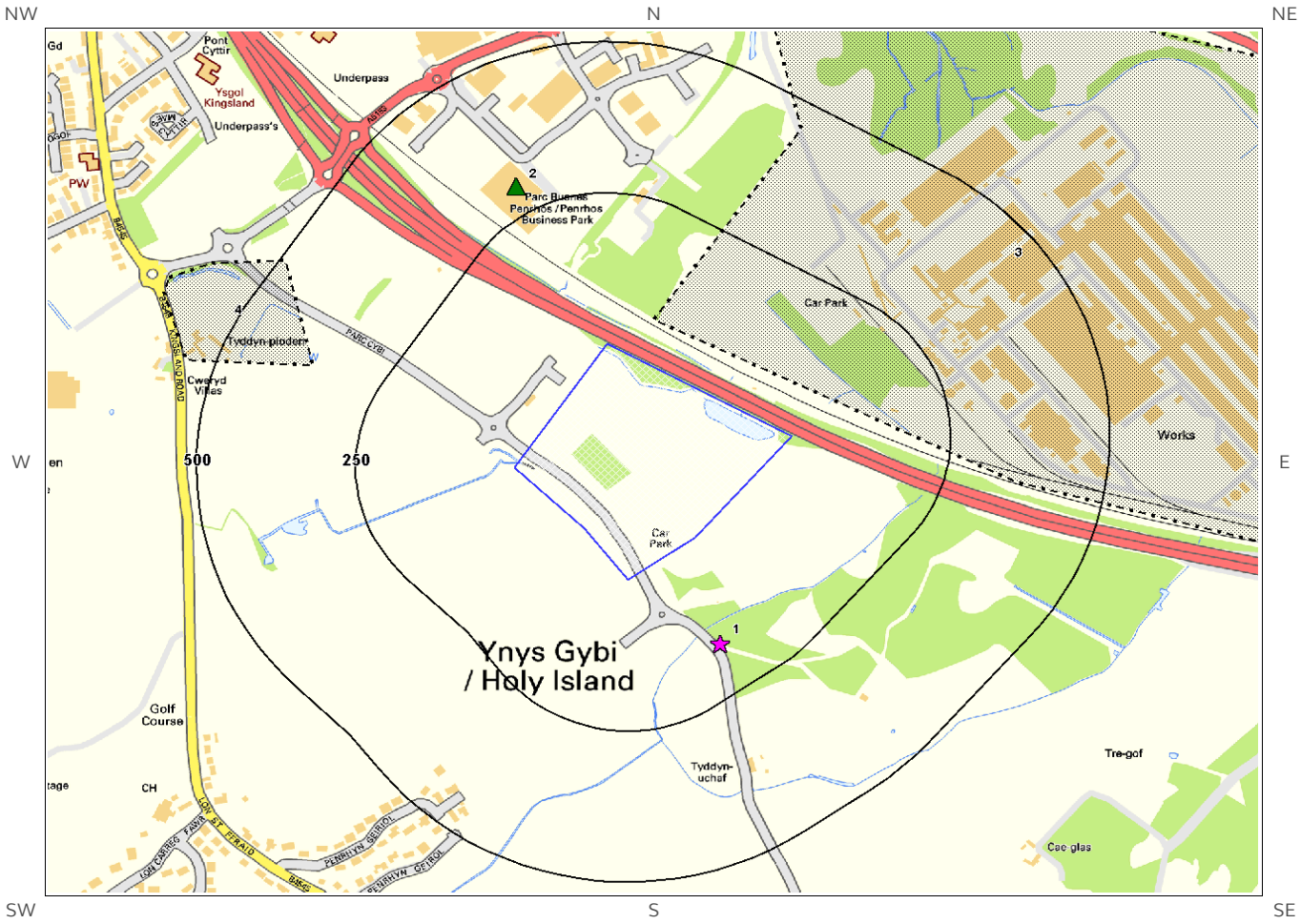
1.6 Potentially Infilled Land

Records of Potentially Infilled Features from 1:10,000 scale mapping within 500m of the study site: 12

The following Historical Potentially Infilled Features derived from the Historical Mapping information is provided by Groundsure:

ID	Distance(m)	Direction	Use	Date
43K	48	NE	Cuttings	1887
44B	339	E	Cuttings	1959
45A	342	E	Cuttings	1926
46A	344	E	Cuttings	1949
47A	344	E	Cuttings	1899
48B	346	E	Cuttings	1887
49A	386	E	Cuttings	1959
50L	390	E	Cuttings	1887
51M	418	NE	Pond	1959
52M	425	NE	Pond	1887
53M	425	NE	Pond	1899
54M	425	NE	Pond	1949

2. Environmental Permits, Incidents and Registers Map



- Site Outline
- Search Buffers (m) (250, 500)
- Recorded Pollution Incident
- Dangerous Substances (List 1)
- Dangerous Substances (List 2)
- Water Industry Referrals
- Licenced Discharge Consents
- Red List Discharge Consents
- RAS 3 & 4 Authorisations
- Part A(1) Authorised Processes and Historic IPC Authorisations
- Part A(2) and Part B Authorised Processes
- COMAH / NIHHS Sites
- Sites Determined as Contaminated Land
- Hazardous Substance Consents and Enforcements

2. Environmental Permits, Incidents and Registers

2.1 Industrial Sites Holding Licences and/or Authorisations

Searches of information provided by the Environment Agency/Natural Resources Wales and Local Authorities reveal the following information:

2.1.1 Records of historic IPC Authorisations within 500m of the study site:

0

Database searched and no data found.

2.1.2 Records of Part A(1) and IPPC Authorised Activities within 500m of the study site:

0

Database searched and no data found.

2.1.3 Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the study site:

0

Database searched and no data found.

2.1.4 Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site:

0

Database searched and no data found.

2.1.5 Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site:

0

Database searched and no data found.

2.1.6 Records of Part A(2) and Part B Activities and Enforcements within 500m of the study site:

1

The following Part A(2) and Part B Activities are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details	
2	294	NW	225594 381174	Address: Wm Morrison Supermarkets Plc, Penrhos Industrial Estate, Holyhead, LL65 2UQ Process: Unloading of Petrol into Storage at Service Stations Status: Current Permit Permit Type: Part B	Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified

2.1.7 Records of Category 3 or 4 Radioactive Substances Authorisations:

0

Database searched and no data found.

2.1.8 Records of Licensed Discharge Consents within 500m of the study site:

0

Database searched and no data found.

2.1.9 Records of Water Industry Referrals (potentially harmful discharges to the public sewer) within 500m of the study site:

0

Database searched and no data found.

2.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site:

0

Database searched and no data found.

2.2 Dangerous or Hazardous Sites

Records of COMAH & NIHHS sites within 500m of the study site: 2

The following COMAH & NIHHS Authorisation records provided by the Health and Safety Executive are represented as polygons or buffered points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	Company	Address	Operational Status	Tier
3	70	NE	Anglesey Aluminium Metal Ltd	Anglesey Aluminium Metal Ltd, Holyhead, Penrhos Works, Holyhead, Anglesey, LL65 2UJ	Historical COMAH Site	-
4	359	NW	Anglesey Aluminium Metals Ltd	Anglesey Aluminium Metals Ltd, Penrhos Works, Holyhead/anglesey, LL65 2UJ	Historical NIHHS Site	-

2.3 Environment Agency/Natural Resources Wales Recorded Pollution Incidents

2.3.1 Records of National Incidents Recording System, List 2 within 500m of the study site:

1

The following NIRS List 2 records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance (m)	Direction	NGR	Details	
1	168	SE	225913 380420	Incident Date: 27-Sep-2001 Incident Identification: 33354 Pollutant: Inert Materials and Wastes Pollutant Description: Other Inert Material or Waste	Water Impact: Category 4 (No Impact) Land Impact: Category 3 (Minor) Air Impact: Category 4 (No Impact)

2.3.2 Records of National Incidents Recording System, List 1 within 500m of the study site:

0

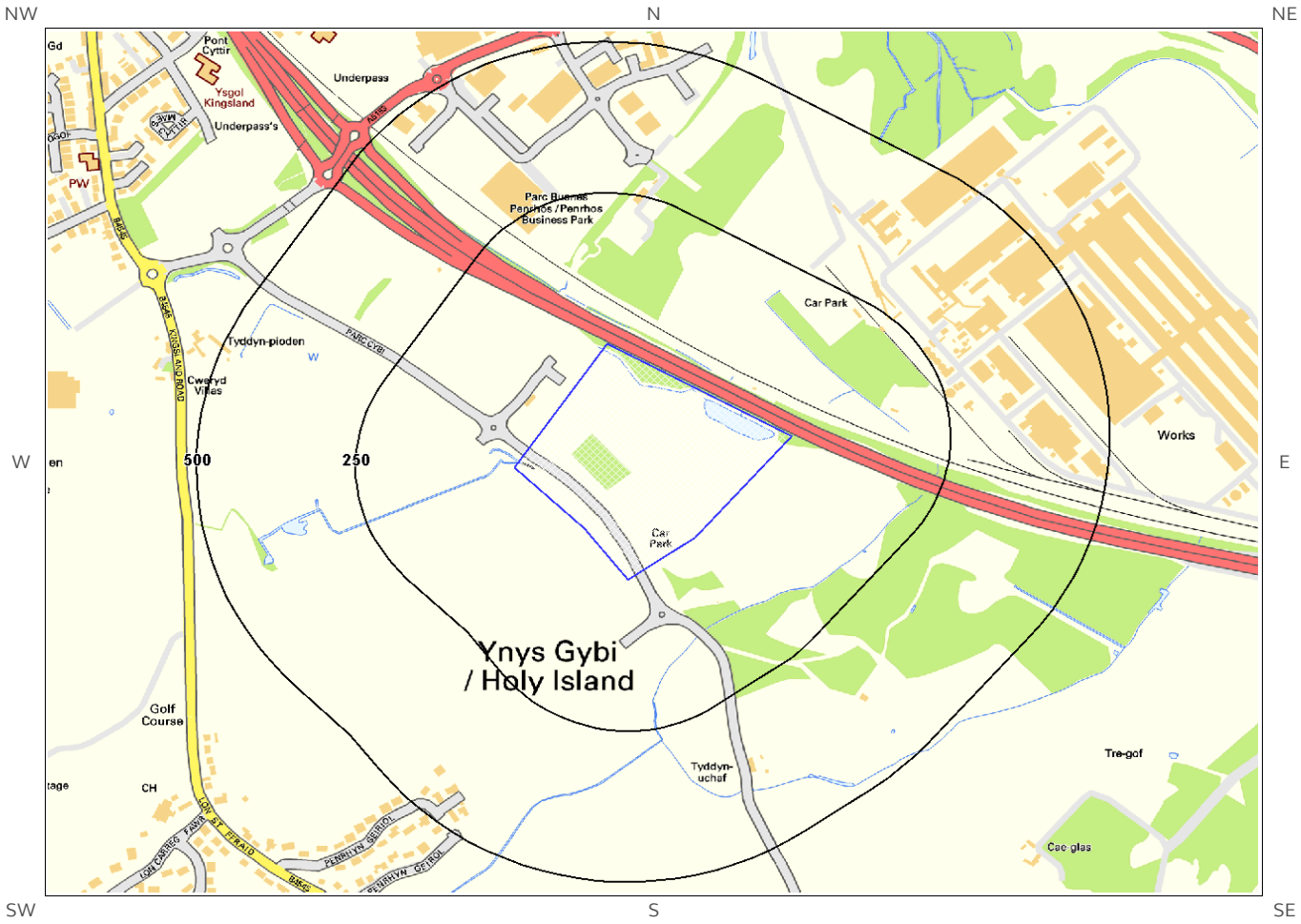
Database searched and no data found.

2.4 Sites Determined as Contaminated Land under Part 2A EPA 1990

How many records of sites determined as contaminated land under Section 78R of the Environmental Protection Act 1990 are there within 500m of the study site? 0

Database searched and no data found.

3. Landfill and Other Waste Sites Map



Site Outline

250
500
Search Buffers (m)

EA/NRW Active Landfill

EA/NRW Historic Landfill

BGS / DoE Survey Landfill

Historic and Planned Waste Sites

EA/NRW Licensed Waste Site

Local Authority/Historical Mapping Landfill Records

3. Landfill and Other Waste Sites

3.1 Landfill Sites

3.1.1 Records from Environment Agency/Natural Resources Wales landfill data within 1000m of the study site:

0

Database searched and no data found.

3.1.2 Records of Environment Agency/Natural Resources Wales historic landfill sites within 1500m of the study site:

2

The following landfill records are represented as either points or polygons on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details	
Not shown	999	NW	224900 381600	Site Address: Kingsland, Greenfield Road, Holyhead Waste Licence: Yes Site Reference: 4 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: 31-Dec-1978 Licence Surrendered: Licence Holder Address: Rail House, Holyhead Operator: - Licence Holder: Shipping and Port Manager First Recorded: 31-Dec-1978 Last Recorded: 31-Dec-1979
Not shown	1032	SE	227000 380200	Site Address: Cae Glas Road, Penrhos Waste Licence: - Site Reference: - Waste Type: Inert, Industrial, Commercial, Household, Special Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Holder Address: - Operator: - Licence Holder: Isle of Anglesey Borough Council First Recorded: 31-Dec-1968 Last Recorded: 31-Dec-1980

3.1.3 Records of BGS/DoE non-operational landfill sites within 1500m of the study site:

0

Database searched and no data found.

3.1.4 Records of Landfills from Local Authority and Historical Mapping Records within 1500m of the study site:

1

The following landfill records are represented as points or polygons on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Site Address	Source	Data Type
Not shown	1035	SE	227027 380247	Refuse Tip	1973 mapping	Polygon

3.2 Other Waste Sites

3.2.1 Records of waste treatment, transfer or disposal sites within 500m of the study site:

0

Database searched and no data found.

3.2.2 Records of Environment Agency/Natural Resources Wales licensed waste sites within 1500m of the study site:

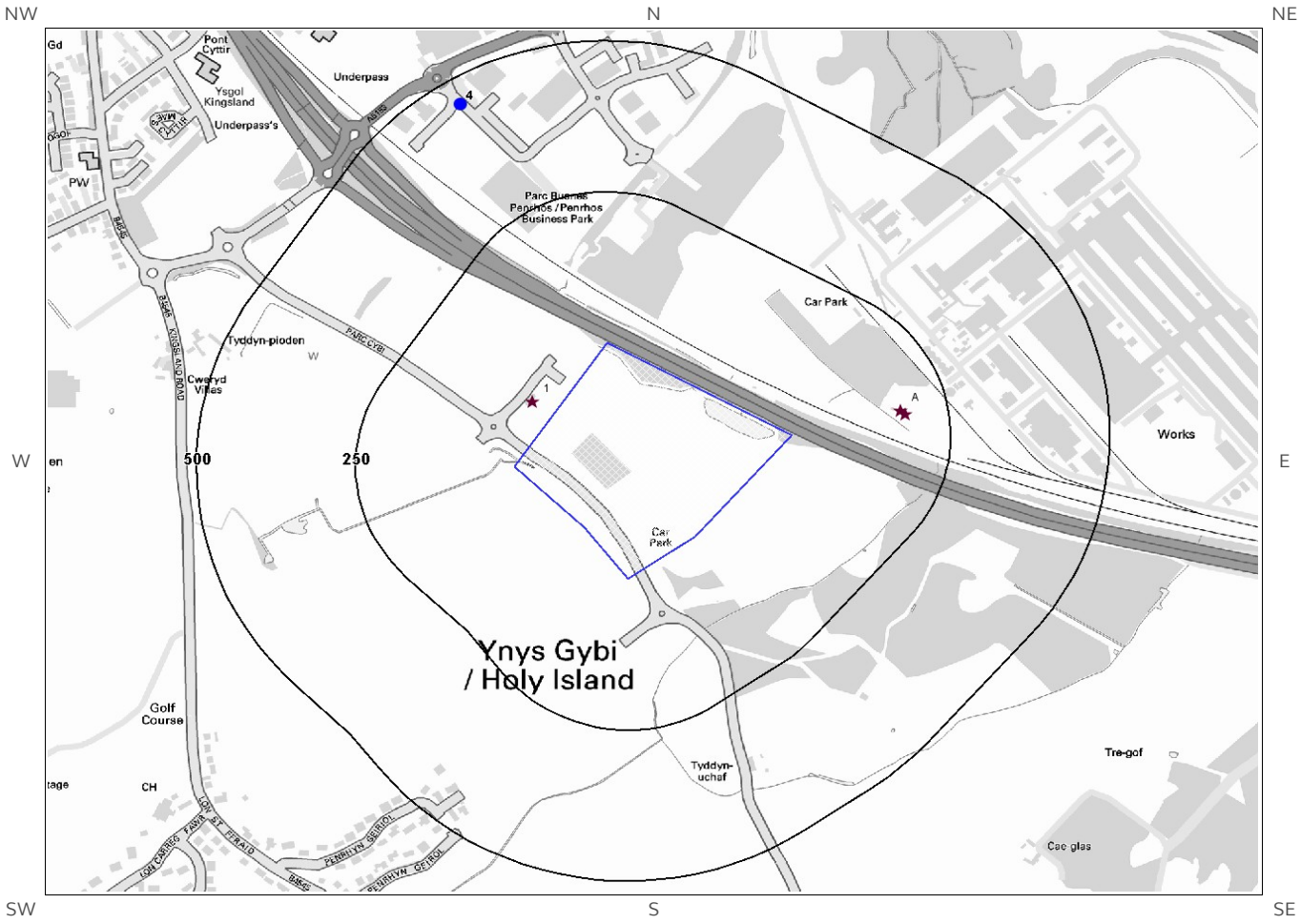
3

The following waste treatment, transfer or disposal sites records are represented as points on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1118	NW	224795 381520	Site Address: Berwyn Yard, Porthdafarch Road, Holyhead, Ynys Mon, LL65 2SA Type: Household, Commercial & Industrial Waste T Stn Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: GRA001 EPR reference: EA/EPR/WP3294FU/V003 Operator: David Owen Gray & Elizabeth Gray Waste Management licence No: 37217 Annual Tonnage: 6758.0	Issue Date: 10/11/2000 Effective Date: - Modified: 10/03/2006 Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Expired Site Name: Gray's Engineering & Plant Correspondence Address: -
Not shown	1118	NW	224795 381520	Site Address: Gray's Engineering & Plant, Holyhead, Isle of Anglesey, LL65 2SA Type: - Size: Unknown Environmental Permitting Regulations (Waste) Licence Number: WP3294FU EPR reference: - Operator: David Owen Gray & Elizabeth Gray Waste Management licence No: 0 Annual Tonnage: 0.0	Issue Date: 10/11/2000 Effective Date: 10/11/2000 Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Expired Site Name: - Correspondence Address: -

ID	Distance (m)	Direction	NGR	Details	
Not shown	1118	NW	224795 381520	Site Address: Berwyn Yard, Porthdafarch Road, Holyhead, Ynys Mon, LL65 2SA Type: Household, Commercial & Industrial Waste T Stn Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: GRA001 EPR reference: WP3294FU/V003 Operator: David Owen Gray & Elizabeth Gray Waste Management licence No: 37217 Annual Tonnage: 6758.0	Issue Date: 10/11/2000 Effective Date: - Modified: 10/03/2006 Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Expired Site Name: Gray's Engineering & Plant Correspondence Address: -

4. Current Land Use Map



Site Outline

Search Buffers (m)
250
500

Current Industrial Sites

Petrol & Fuel Sites

Electricity Transmission Cables

Gas Transmission Pipelines

4. Current Land Uses

4.1 Current Industrial Data

Records of potentially contaminative industrial sites within 250m of the study site: 3

The following records are represented as points on the Current Land Uses map.

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
1	40	NW	Electricity Sub Station	225620 380821	Electricity Sub Station, LL65	Electrical Features	Infrastructure and Facilities
2A	175	E	Gas Valve Compound	226197 380806	Gas Valve Compound, LL65	Gas Features	Infrastructure and Facilities
3A	181	E	Gas Valve Compound	226204 380800	Gas Valve Compound, LL65	Gas Features	Infrastructure and Facilities

4.2 Petrol and Fuel Sites

Records of petrol or fuel sites within 500m of the study site: 1

The following petrol or fuel site records provided by Catalist are represented as points on the Current Land Use map:

ID	Distance (m)	Direction	NGR	Company	Address	LPG	Status
4	457	NW	225507 381312	Morrisons	Morrisons Holyhead, Penrhos Industrial Estate, Penrhos Industrial Estate, Penrhos, Holyhead, Isle Of Anglesey, LL65 2UQ	No	Open

4.3 National Grid High Voltage Underground Electricity Transmission Cables

This dataset identifies the high voltage electricity transmission lines running between generating power plants and electricity substations. The dataset does not include the electricity distribution network (smaller, lower voltage cables distributing power from substations to the local user network). This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high voltage underground electricity transmission cables within 500m of the study site: 0

Database searched and no data found.

4.4 National Grid High Pressure Gas Transmission Pipelines

This dataset identifies high-pressure, large diameter pipelines which carry gas between gas terminals, power stations, compressors and storage facilities. The dataset does not include the Local Transmission System (LTS) which supplies gas directly into homes and businesses. This information has been extracted from databases held by National Grid and is provided for information only with no guarantee as to its completeness or accuracy. National Grid do not offer any warranty as to the accuracy of the available data and are excluded from any liability for any such inaccuracies or errors.

Records of National Grid high pressure gas transmission pipelines within 500m of the study site: 0

Database searched and no data found.

5. Geology

5.1 Artificial Ground and Made Ground

Database searched and no data found.

The database has been searched on site, including a 50m buffer.

5.2 Superficial Ground and Drift Geology

The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type
GFDUD-XSV	GLACIOFLUVIAL DEPOSITS, DEVENSIAN	SAND AND GRAVEL
TILLD-DMTN	TILL, DEVENSIAN	DIAMICTON

5.3 Bedrock and Solid Geology

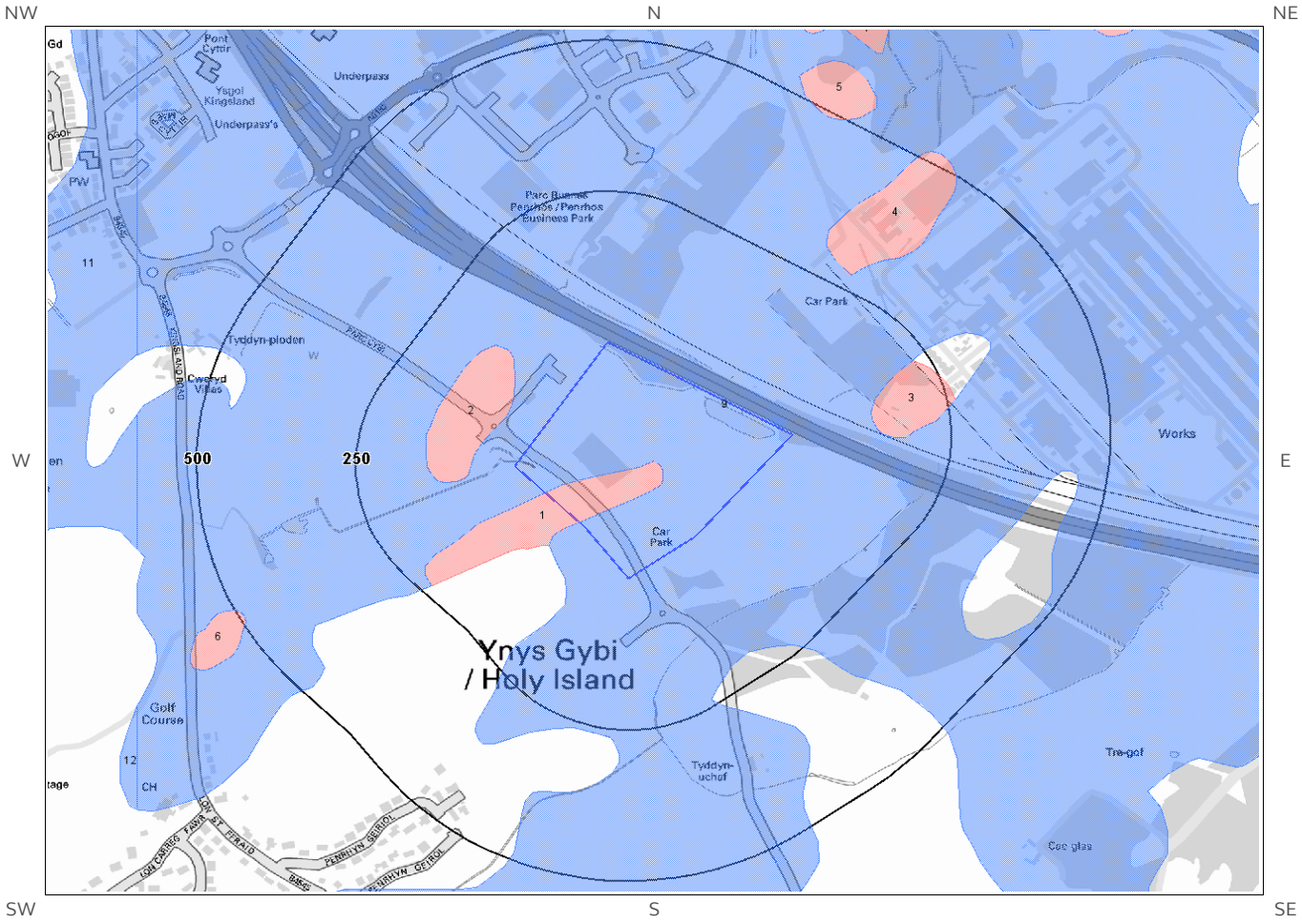
The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type
NNH-SMPS	NEW HARBOUR GROUP	MICA SCHIST AND PSAMMITE

(Derived from the BGS 1:50,000 Digital Geological Map of Great Britain)

6 Hydrogeology and Hydrology

6a. Aquifer Within Superficial Geology



Site Outline

250
500
Search Buffers (m)

Principal Aquifer

Secondary (A) Aquifer - Permeable Layers

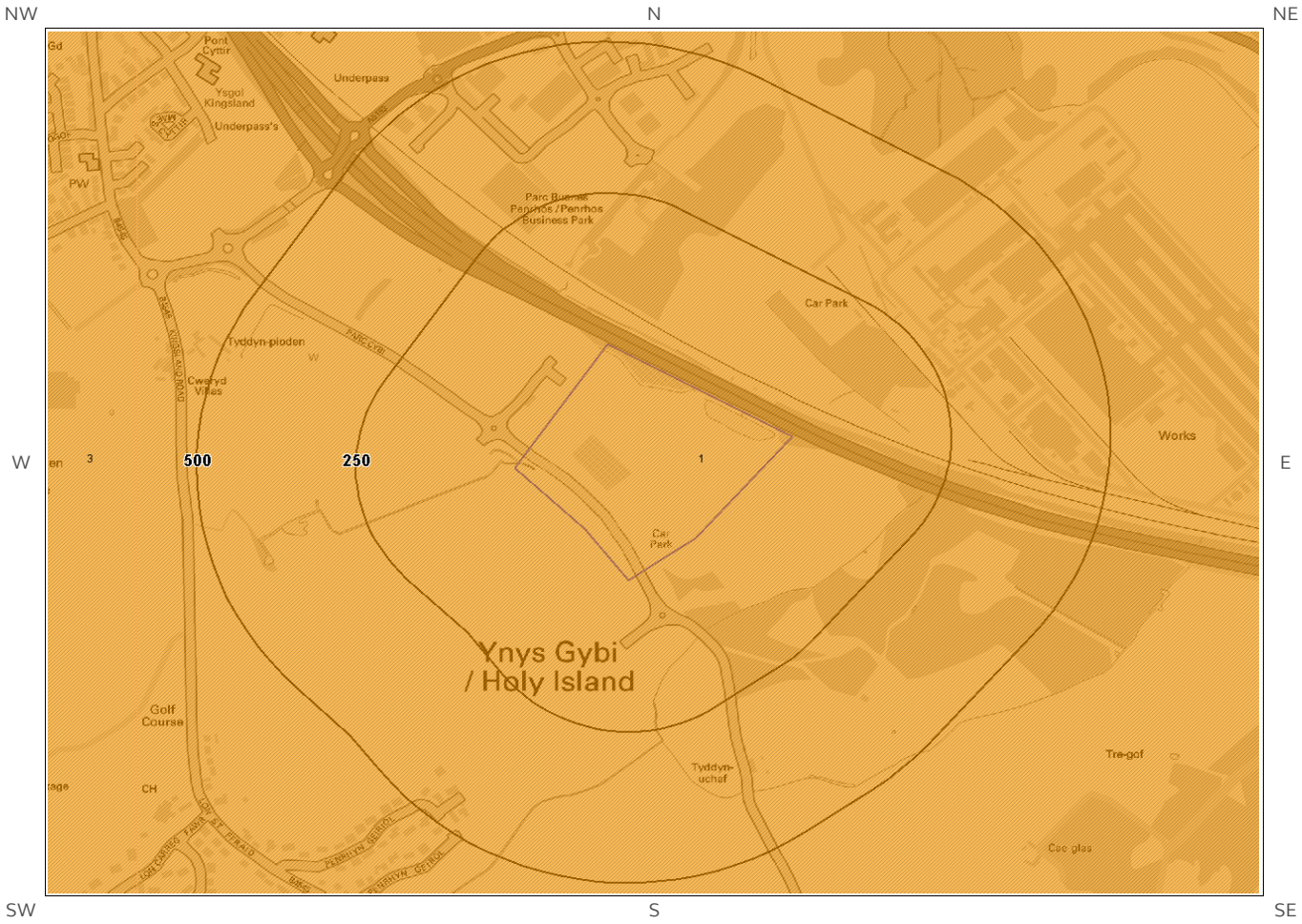
Secondary (B) Aquifer - Lower Permeability Layers

Secondary Aquifer - Undifferentiated Layers

Unproductive

Unknown (lakes and landslip)

6b. Aquifer Within Bedrock Geology and Abstraction Licenses



Site Outline

250
500
Search Buffers (m)

Principal Aquifer

Secondary (A) Aquifer - Permeable Layers

Secondary (B) Aquifer - Lower Permeability Layers

Groundwater Abstraction Licence

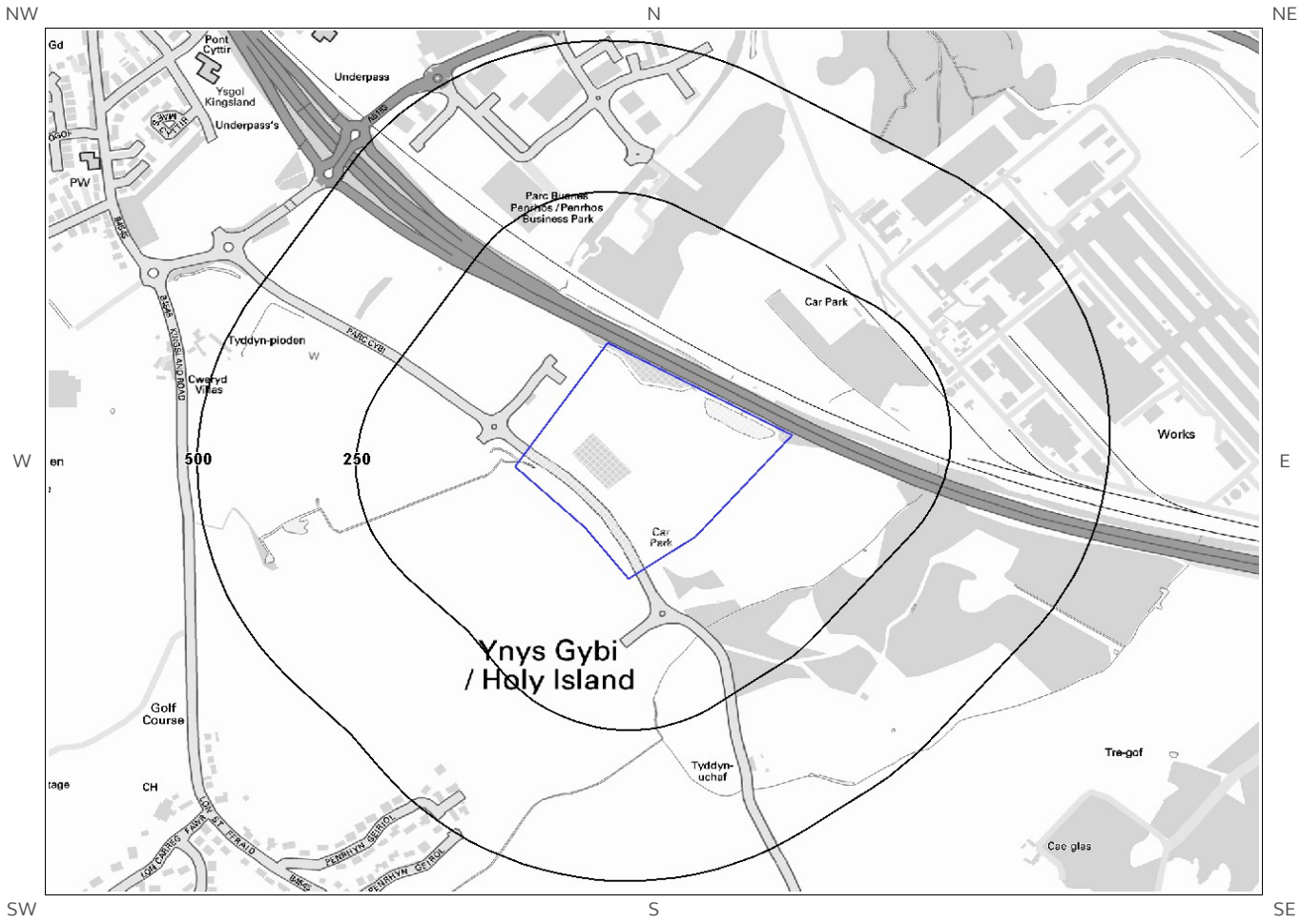
Secondary Aquifer - Undifferentiated Layers

Unproductive

Unknown (lakes and landslip)

Surface Water Abstraction Licence

6c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses



Site Outline

250
500
Search Buffers (m)

Source Protection Zone 1 - Inner Catchment

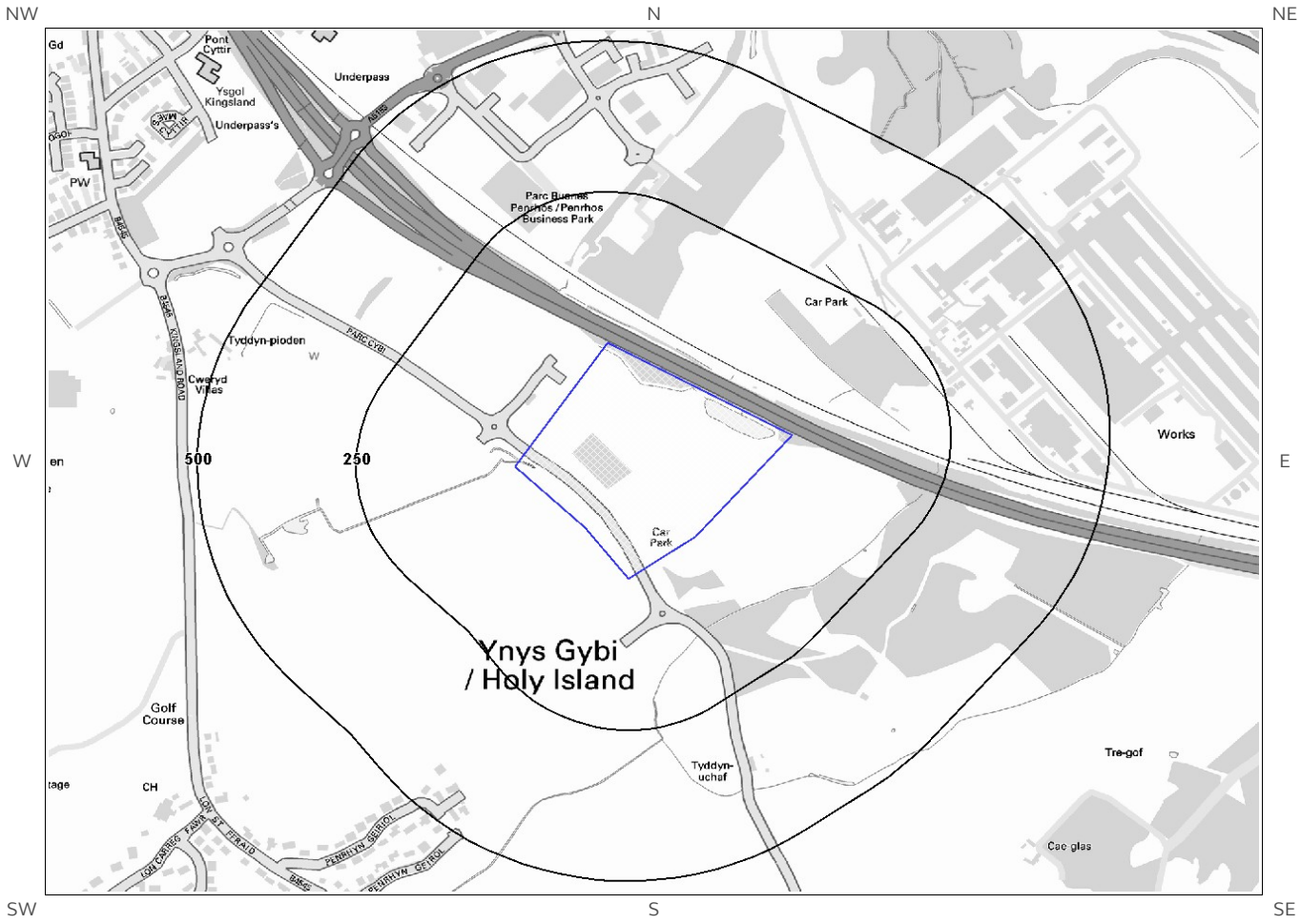
Source Protection Zone 2 - Outer Catchment

Source Protection Zone 3 - Total Catchment

Source Protection Zone 4 - Zone of Special Interest

Potable Water Abstraction Licence

6d. Hydrogeology – Source Protection Zones within confined aquifer



Site Outline

250
500
Search Buffers (m)

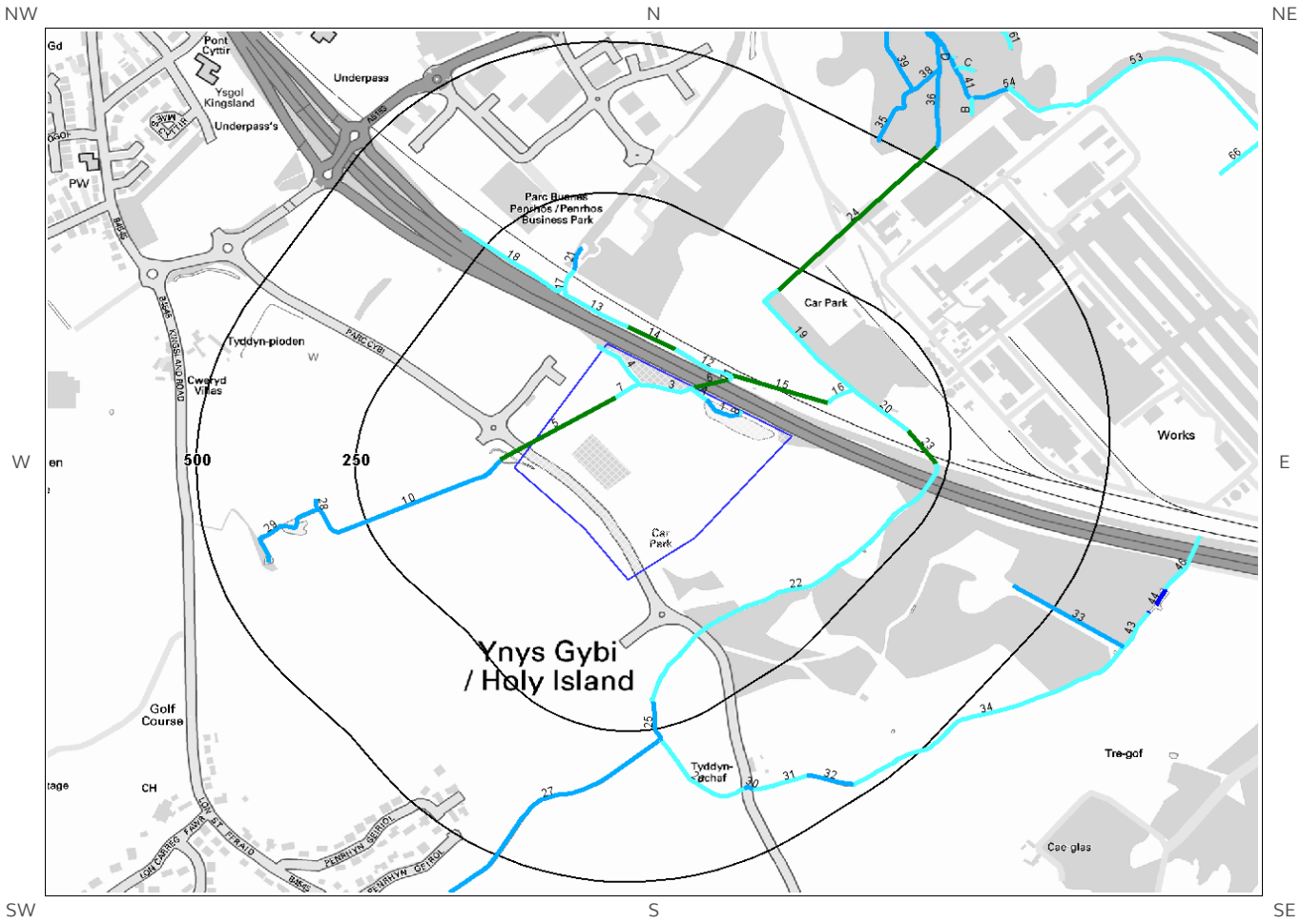
Source Protection Zone 1 - Inner Catchment

Source Protection Zone 2C - Outer Catchment within Confined Aquifer

Source Protection Zone 3C - Total Catchment within Confined Aquifer

Potable Water Abstraction Licence

6e. Hydrology – Detailed River Network and River Quality



Site Outline

250
500
Search Buffers (m)

Primary River
Secondary River
Tertiary River
Lake/Reservoir
Underground River (inferred)
General Quality Assessment: Biology
General Quality Assessment: Chemistry

Canal
Canal Tunnel
Culvert
Multiple Channel Culvert
Underground River (Potential Sewer)
Underground River (local knowledge)

6.Hydrogeology and Hydrology

6.1 Aquifer within Superficial Deposits

Are there records of strata classification within the superficial geology at or in proximity to the property? Yes

From 1 April 2010, the Environment Agency/Natural Resources Wales's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviro Insight User Guide.

The following aquifer records are shown on the Aquifer within Superficial Geology Map (6a):

ID	Distance (m)	Direction	Designation	Description
1	0	On Site	Secondary A	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
9	0	On Site	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
2	59	NW	Secondary A	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
3	128	E	Secondary A	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
4	276	NE	Secondary A	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
5	491	NE	Secondary A	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
6	492	SW	Secondary A	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

6.2 Aquifer within Bedrock Deposits

Are there records of strata classification within the bedrock geology at or in proximity to the property? Yes

From 1 April 2010, the Environment Agency/Natural Resources Wales's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviro Insight User Guide.

The following aquifer records are shown on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	Designation	Description
1	0	On Site	Secondary B	Predominantly lower permeability layers which may store/yield limited amounts of groundwater due to localised features such as fissures, thin permeablehorizons and weathering. These are generally the water-bearing parts of the former non-aquifers

6.3 Groundwater Abstraction Licences

Are there any Groundwater Abstraction Licences within 2000m of the study site? No

Database searched and no data found.

6.4 Surface Water Abstraction Licences

Are there any Surface Water Abstraction Licences within 2000m of the study site? No

Database searched and no data found.

6.5 Potable Water Abstraction Licences

Are there any Potable Water Abstraction Licences within 2000m of the study site? No

Database searched and no data found.

6.6 Source Protection Zones

Are there any Source Protection Zones within 500m of the study site? No

Database searched and no data found.

6.7 Source Protection Zones within Confined Aquifer

Are there any Source Protection Zones within the Confined Aquifer within 500m of the study site? No

Historically, Source Protection Zone maps have been focused on regulation of activities which occur at or near the ground surface, such as prevention of point source pollution and bacterial contamination of water supplies. Sources in confined aquifers were often considered to be protected from these surface pressures due to the presence of a low permeability confining layer (e.g. glacial till, clay). The increased interest in subsurface activities such as onshore oil and gas exploration, ground source heating and cooling requires protection zones for confined sources to be marked on SPZ maps where this has not already been done.

Database searched and no data found.

6.8 Groundwater Vulnerability and Soil Leaching Potential

Is there any Environment Agency/Natural Resources Wales information on groundwater vulnerability and soil leaching potential within 500m of the study site? No

Database searched and no data found.

6.9 River Quality

Is there any Environment Agency/Natural Resources Wales information on river quality within 1500m of the study site? No

6.9.1 Biological Quality:

Database searched and no data found.

6.9.2 Chemical Quality:

Database searched and no data found.

6.10 Detailed River Network

Are there any Detailed River Network entries within 500m of the study site? Yes

The following Detailed River Network records are represented on the Hydrology Map (6e):

ID	Distance (m)	Direction	Details	
1	0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
2A	0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
3	0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
4	0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
5	0	On Site	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
6	0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined

ID	Distance (m)	Direction	Details	
7	0	On Site	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
8	0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
9A	0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
10	26	NW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
11	36	NE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
12	38	NE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
13	39	NE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
14	40	NE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
15	45	NE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
16	80	NE	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
17	114	NW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
18	114	NW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
19	122	NE	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
20	124	NE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
21	132	NW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
22	134	SE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
23	183	E	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
24	205	NE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
25	205	S	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined

ID	Distance (m)	Direction	Details	
26	269	S	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
27	269	S	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
28	317	W	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
29	318	W	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
30	391	SE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
31	399	SE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
32	426	SE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
33	427	SE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
34	479	SE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
35	494	NE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined

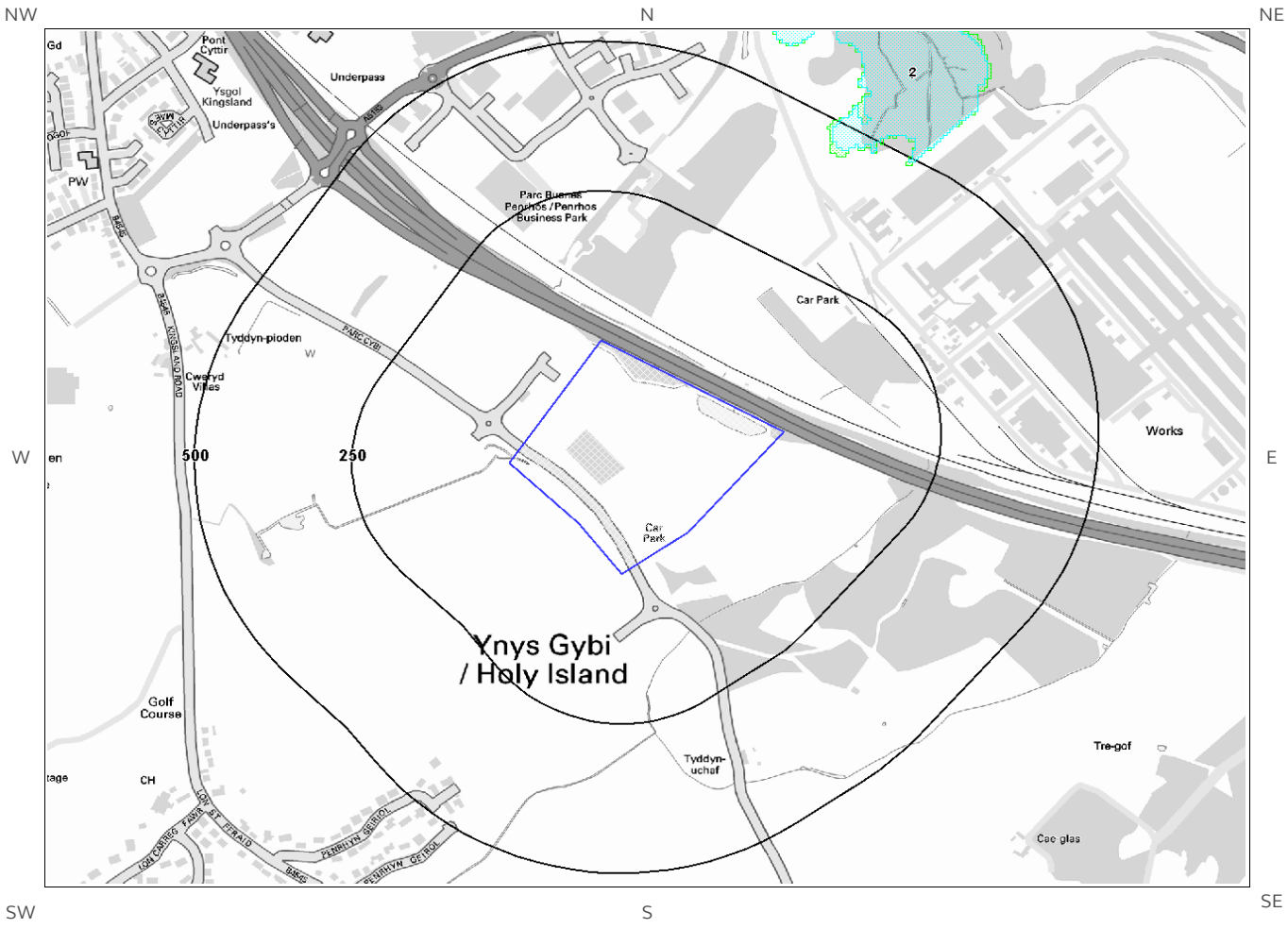
6.11 Surface Water Features

Are there any surface water features within 250m of the study site? Yes

The following surface water records are not represented on mapping:

Distance (m)	Direction
0	On Site
0	On Site
0	On Site
38	NE
40	NE
73	NW
80	NE
114	NW
122	NE
124	NE
135	SE
137	SE
205	S
205	S
208	SE
208	SE
208	SE
233	E

7a. Environment Agency/Natural Resources Wales Flood Map for Planning (from rivers and the sea)



Site Outline

Search Buffers (m)

100

250

Zone 2 Floodplain

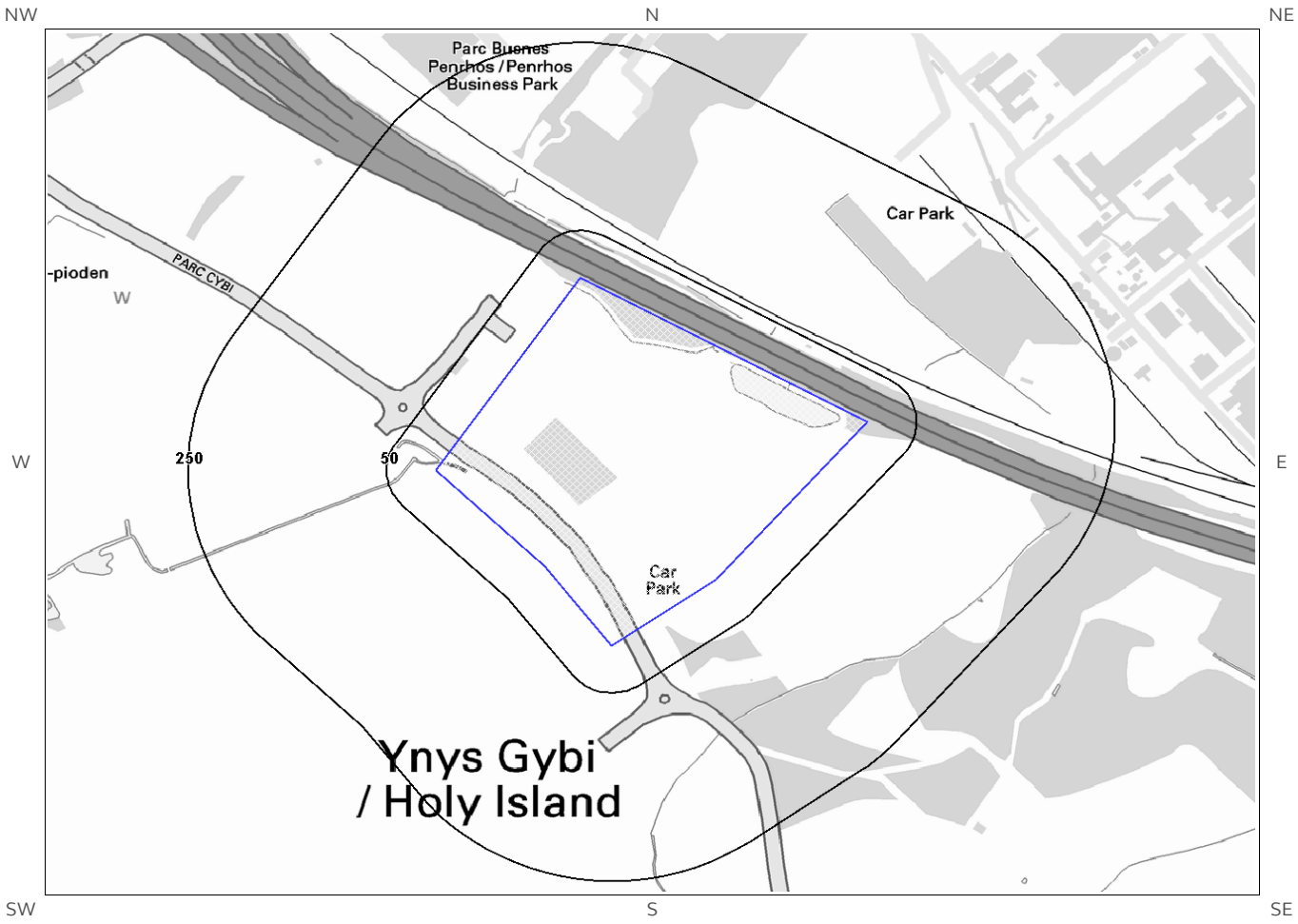
Zone 3 Floodplain

Flood Defences

Area used for Flood Storage

Area Benefiting from Flood Defences

7b. Environment Agency/Natural Resources Wales Risk of Flooding from Rivers and the Sea (RoFRaS) Map



Site Outline

100
250
Search Buffers (m)

RoFRaS Rating

Very Low

Low

Medium

High

7 Flooding

7.1 River and Coastal Zone 2 Flooding

Is the site within 250m of an Environment Agency/Natural Resources Wales Zone 2 floodplain? No

Environment Agency/Natural Resources Wales Zone 2 floodplains estimate the annual probability of flooding as between 1 in 1000 (0.1%) and 1 in 100 (1%) from rivers and between 1 in 1000 (0.1%) and 1 in 200 (0.5%) from the sea. Any relevant data is represented on Map 7a – Flood Map for Planning:

Database searched and no data found.

7.2 River and Coastal Zone 3 Flooding

Is the site within 250m of an Environment Agency/Natural Resources Wales Zone 3 floodplain? No

Zone 3 shows the extent of a river flood with a 1 in 100 (1%) or greater chance of occurring in any year or a sea flood with a 1 in 200 (0.5%) or greater chance of occurring in any year. Any relevant data is represented on Map 7a – Flood Map for Planning.

Database searched and no data found.

7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating

What is the highest risk of flooding onsite? Very Low

The Environment Agency/Natural Resources Wales RoFRaS database provides an indication of river and coastal flood risk at a national level on a 50m grid with the flood rating at the centre of the grid calculated and given above. The data considers the probability that the flood defences will overtop or breach by considering their location, type, condition and standard of protection.

RoFRaS data for the study site indicates the property is in an area with a Very Low (less than 1 in 1000) chance of flooding in any given year.

7.4 Flood Defences

Are there any Flood Defences within 250m of the study site? No

Database searched and no data found.

7.5 Areas benefiting from Flood Defences

Are there any areas benefiting from Flood Defences within 250m of the study site? No

7.6 Areas benefiting from Flood Storage

Are there any areas used for Flood Storage within 250m of the study site? No

7.7 Groundwater Flooding Susceptibility Areas

7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes

Does this relate to Clearwater Flooding or Superficial Deposits Flooding? Superficial Deposits Flooding

Notes: Groundwater flooding may either be associated with shallow unconsolidated sedimentary aquifers which overlie unproductive aquifers (Superficial Deposits Flooding), or with unconfined aquifers (Clearwater Flooding).

7.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?

Potential at Surface

Where potential for groundwater flooding to occur at surface is indicated, this means that given the geological conditions in the area groundwater flooding hazard should be considered in all land-use planning decisions. It is recommended that other relevant information e.g. records of previous incidence of groundwater flooding, rainfall, property type, and land drainage information be investigated in order to establish relative, but not absolute, risk of groundwater flooding.

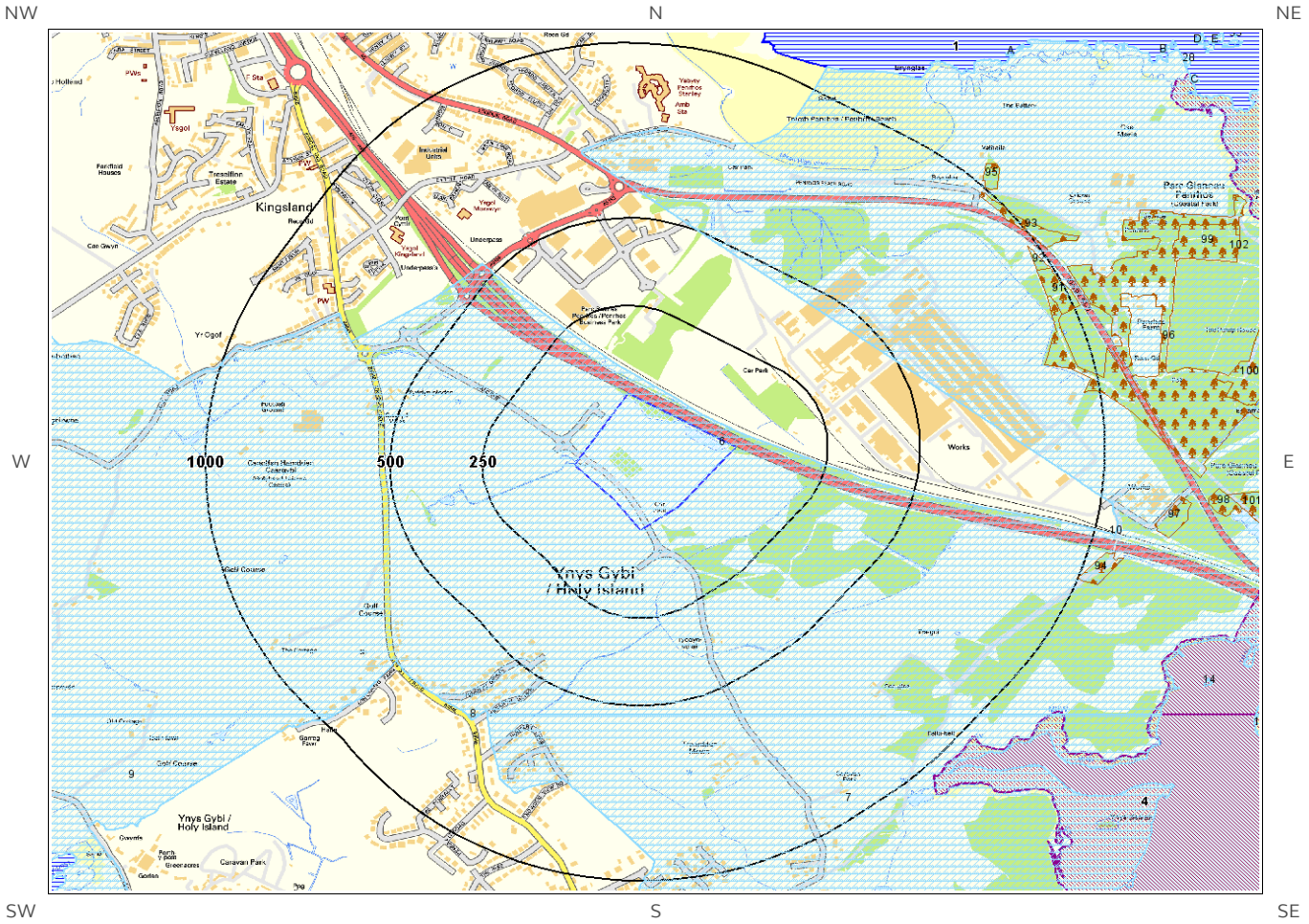
7.8 Groundwater Flooding Confidence Areas

What is the British Geological Survey confidence rating in this result? High

Notes: Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

The confidence rating is on a threefold scale - Low, Moderate and High. This provides a relative indication of the BGS confidence in the accuracy of the susceptibility result for groundwater flooding. This is based on the amount and precision of the information used in the assessment. In areas with a relatively lower level of confidence the susceptibility result should be treated with more caution. In other areas with higher levels of confidence the susceptibility result can be used with more confidence.

8. Designated Environmentally Sensitive Sites Map



Site Outline

100
250
Search Buffers (m)

AONB
National Park
SSSI
Special Protection Areas
Nitrate Vulnerable Zones
Green Belt
Environmentally Sensitive Areas
Special Areas of Conservation
World Heritage Sites
Nitrate Sensitive Areas
Ancient Woodland
National Nature Reserve
Local Nature Reserves
Ramsar Sites

8. Designated Environmentally Sensitive Sites

Presence of Designated Environmentally Sensitive Sites within 2000m of the study site? Yes

8.1 Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site:

2

The following Site of Special Scientific Interest (SSSI) records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	SSSI Name	Data Source
4	1030	SE	BEDDMANARCH-CYMYRAN	Natural Resources Wales
5	1144	SE	BEDDMANARCH-CYMYRAN	Natural Resources Wales

8.2 Records of National Nature Reserves (NNR) within 2000m of the study site:

0

Database searched and no data found.

8.3 Records of Special Areas of Conservation (SAC) within 2000m of the study site:

3

The following Special Area of Conservation (SAC) records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	SAC Name	Data Source
1	1052	N	North Anglesey Marine / Gogledd Môn Forol	Natural Resources Wales
Not shown	1226	N	North Anglesey Marine / Gogledd Môn Forol	Natural Resources Wales
3	1524	S	North Anglesey Marine / Gogledd Môn Forol	Natural Resources Wales

8.4 Records of Special Protection Areas (SPA) within 2000m of the study site:

0

Database searched and no data found.

8.5 Records of Ramsar sites within 2000m of the study site:

0

Database searched and no data found.

8.6 Records of Ancient Woodland within 2000m of the study site:

13

The following records of Designated Ancient Woodland provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	Ancient Woodland Name	Data Source
90	869	E	Unknown	Ancient and Semi-Natural Woodland
91	945	NE	Unknown	Ancient Replanted Woodland
92	959	NE	Unknown	Ancient and Semi-Natural Woodland
93	975	NE	Unknown	Ancient and Semi-Natural Woodland
94	999	E	Unknown	Restored Ancient Woodland Site
95	1001	NE	Unknown	Ancient and Semi-Natural Woodland
96	1033	NE	Unknown	Ancient and Semi-Natural Woodland
97	1155	E	Unknown	Ancient Replanted Woodland
98	1288	E	Unknown	Ancient and Semi-Natural Woodland
99	1302	NE	Unknown	Ancient Replanted Woodland
100	1313	E	Unknown	Ancient Replanted Woodland
101	1335	E	Unknown	Restored Ancient Woodland Site
102	1474	NE	Unknown	Ancient and Semi-Natural Woodland

8.7 Records of Local Nature Reserves (LNR) within 2000m of the study site:

0

Database searched and no data found.

8.8 Records of World Heritage Sites within 2000m of the study site:

0

Database searched and no data found.

8.9 Records of Environmentally Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

8.10 Records of Areas of Outstanding Natural Beauty (AONB) within 2000m of the study site:

84

The following Area of Outstanding Natural Beauty (AONB) records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	AONB/NSA Name	Data Source
6	0	On Site	YNYS MON/ANGLESEY	Natural Resources Wales
7	526	S	YNYS MON/ANGLESEY	Natural Resources Wales
8	683	SW	YNYS MON/ANGLESEY	Natural Resources Wales
9	964	SW	YNYS MON/ANGLESEY	Natural Resources Wales
10	1058	E	YNYS MON/ANGLESEY	Natural Resources Wales
11A	1335	NE	YNYS MON/ANGLESEY	Natural Resources Wales
12A	1340	NE	YNYS MON/ANGLESEY	Natural Resources Wales
13A	1367	NE	YNYS MON/ANGLESEY	Natural Resources Wales
14	1438	SE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1562	S	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1569	S	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1574	S	YNYS MON/ANGLESEY	Natural Resources Wales
18	1603	SE	YNYS MON/ANGLESEY	Natural Resources Wales
19B	1611	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1615	S	YNYS MON/ANGLESEY	Natural Resources Wales

ID	Distance (m)	Direction	AONB/NSA Name	Data Source
21C	1619	NE	YNYS MON/ANGLESEY	Natural Resources Wales
22B	1623	NE	YNYS MON/ANGLESEY	Natural Resources Wales
23C	1626	NE	YNYS MON/ANGLESEY	Natural Resources Wales
24C	1626	NE	YNYS MON/ANGLESEY	Natural Resources Wales
25B	1630	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1630	S	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1636	S	YNYS MON/ANGLESEY	Natural Resources Wales
28	1638	NE	YNYS MON/ANGLESEY	Natural Resources Wales
29B	1644	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1669	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1696	SE	YNYS MON/ANGLESEY	Natural Resources Wales
32D	1698	NE	YNYS MON/ANGLESEY	Natural Resources Wales
33D	1701	NE	YNYS MON/ANGLESEY	Natural Resources Wales
34D	1702	NE	YNYS MON/ANGLESEY	Natural Resources Wales
35D	1702	NE	YNYS MON/ANGLESEY	Natural Resources Wales
36E	1705	NE	YNYS MON/ANGLESEY	Natural Resources Wales
37D	1707	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1709	SW	YNYS MON/ANGLESEY	Natural Resources Wales
39D	1710	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1715	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1716	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1726	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1730	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1730	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1731	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1734	S	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1738	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1743	SW	YNYS MON/ANGLESEY	Natural Resources Wales
49E	1744	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1744	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1755	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1769	SW	YNYS MON/ANGLESEY	Natural Resources Wales
53	1787	NE	YNYS MON/ANGLESEY	Natural Resources Wales

ID	Distance (m)	Direction	AONB/NSA Name	Data Source
Not shown	1788	S	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1789	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1810	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1825	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1827	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1835	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1848	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1878	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1891	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1896	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1904	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1907	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1909	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1910	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1911	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1913	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1914	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1916	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1919	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1925	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1932	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1933	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1939	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1940	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1940	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1941	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1951	NE	YNYS MON/ANGLESEY	Natural Resources Wales

ID	Distance (m)	Direction	AONB/NSA Name	Data Source
Not shown	1956	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1965	NE	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1974	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1976	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1983	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1986	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1988	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	1988	SW	YNYS MON/ANGLESEY	Natural Resources Wales
Not shown	2000	SW	YNYS MON/ANGLESEY	Natural Resources Wales

8.11 Records of National Parks (NP) within 2000m of the study site:

0

Database searched and no data found.

8.12 Records of Nitrate Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

8.13 Records of Nitrate Vulnerable Zones within 2000m of the study site:

0

Database searched and no data found.

8.14 Records of Green Belt land within 2000m of the study site:

0

Database searched and no data found.

9. Natural Hazards Findings

9.1 Detailed BGS GeoSure Data

BGS GeoSure Data has been searched to 50m. The data is included in tabular format. If you require further information on geology and ground stability, please obtain a Groundsure Geo Insight, available from our website. The following information has been found:

9.1.1 Shrink Swell

What is the maximum Shrink-Swell*[*] hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Ground conditions predominantly low plasticity. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with shrink-swell clays.

9.1.2 Landslides

What is the maximum Landslide* hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.

9.1.3 Soluble Rocks

What is the maximum Soluble Rocks* hazard rating identified on the study site? Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

* This indicates an automatically generated 50m buffer and site.

9.1.4 Compressible Ground

What is the maximum Compressible Ground* hazard rating identified on the study site? Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.

9.1.5 Collapsible Rocks

What is the maximum Collapsible Rocks* hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.

9.1.6 Running Sand

What is the maximum Running Sand*[*] hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Very low potential for running sand problems if water table rises or if sandy strata are exposed to water. No special actions required, to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.

9.2 Radon

9.2.1 Radon Affected Areas

Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.

* This indicates an automatically generated 50m buffer and site.

9.2.2 Radon Protection

Is the property in an area where Radon Protection are required for new properties or extensions to existing
ones as described in publication BR211 by the Building Research Establishment? No radon protective measures are necessary.

10. Mining

10.1 Coal Mining

Are there any coal mining areas within 75m of the study site? No

Database searched and no data found.

10.2 Non-Coal Mining

Are there any Non-Coal Mining areas within 50m of the study site boundary? Yes

The following non-coal mining information is provided by the BGS:

Distance (m)	Direction	Name	Commodity	Assessment of likelihood
0.0	On Site	Not available	Vein Mineral	Sporadic underground mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered

Past underground mine workings are uncommon, localised and of limited area. The rock types present in this area are such that minor mineral veins may be present within them on which it is possible that there have been attempts to work these by underground methods and/or it is possible that small scale underground extraction of other materials may have occurred. All such occurrences are likely to be restricted in size and infrequent. It should be noted, however, that there is always the possibility of the existence of other sub-surface excavations, such as wells, cess pits, follies, air raid shelters/bunkers and other military structures etc. that could affect surface ground stability but which are outside the scope of this dataset. However, if in a coalfield area you should still consider a Coal Authority mining search for the area of interest.

10.3 Brine Affected Areas

Are there any brine affected areas within 75m of the study site? No
Guidance: No Guidance Required.

Contact Details

Groundsure Helpline
Telephone: 08444 159 000
info@groundsure.com

British Geological Survey Enquiries
Kingsley Dunham Centre
Keyworth, Nottingham NG12 5GG
Tel: 0115 936 3143.
Fax: 0115 936 3276.
Email:
Web:**www.bgs.ac.uk**
BGS Geological Hazards Reports and general geological enquiries:
enquiries@bgs.ac.uk

Natural Resources Wales
Ty Cambria
29 Newport Road
Cardiff
CF24 0TP
Tel: 0300 065 3000
Email: enquiries@naturalresourceswales.gov.uk

Public Health England
Public information access office
Public Health England, Wellington House
133-155 Waterloo Road, London, SE1 8UG
www.gov.uk/phe
Email:**enquiries@phe.gov.uk**
Main switchboard**: 020 7654 8000**

The Coal Authority
200 Lichfield Lane
Mansfield
Notts NG18 4RG
Tel: 0345 7626 848
DX 716176 Mansfield 5
www.coal.gov.uk

Ordnance Survey
Adanac Drive, Southampton
SO16 0AS
Tel: 08456 050505

Local Authority
Authority: Sir Ynys Mon - Isle of Anglesey County Council
Phone: 01248 750 057
Web: http://www.anglesey.gov.uk
Address: Council Offices, Llangefni, Anglesey, LL77 7TW

Gemapping PLC
Virginia Villas, High Street, Hartley Witney,
Hampshire RG27 8NW
Tel: 01252 845444

Acknowledgements: Site of Special Scientific Interest, National Nature Reserve, Ramsar Site, Special Protection Area, Special Area of Conservation data is provided by, and used with the permission of, Natural England who retain the Copyright and Intellectual Property Rights for the data.

Standard Terms and Conditions

Groundsure's Terms and Conditions can be viewed online at this link:
https://www.groundsure.com/terms-and-conditions-sept-2016

Groundsure
LOCATION INTELLIGENCE

Jacobs U.K. Limited

JACOBS UK LTD,95, BOTHWELL STREET,
GLASGOW, G2 7HX

Groundsure Reference:	GS-3851523
Your Reference:	60PO8077_mpp2_Parc_Cybi
Report Date	4 May 2017
Report Delivery Method:	Email - pdf

Groundsure Geo Insight

Address: 225810.09022030194, 380721.23260163126,

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the **Groundsure Geo Insight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above Groundsure reference number.

Yours faithfully,

[redacted]

Managing Director
Groundsure Limited

Enc.
Groundsure Geo Insight

Groundsure Geo Insight

Address:	**225810.09022030194, 380721.23260163126,**
Date:	**4 May 2017**
Reference:	**GS-3851523**
Client:	**Jacobs U.K. Limited**

NW N NE

W E

SW S SE

Aerial Photograph Capture date:	18-Apr-2015
Grid Reference:	225819,380725
Site Size:	8.81ha

Groundsure
LOCATION INTELLIGENCE

Contents Page

Overview of Findings

The Groundsure Geo Insight provides high quality geo-environmental information that allows geo-environmental professionals and their clients to make informed decisions and be forewarned of potential ground instability problems that may affect the ground investigation, foundation design and possibly remediation options that could lead to possible additional costs.

The report is based on the BGS 1:50,000 and 1:10,000 Digital Geological Map of Great Britain, BGS Geosure data; BRITPITS database; Non-coal mining data and Borehole Records, Coal Authority data including brine extraction areas, PBA non-coal mining and natural cavities database, Johnson Poole and Bloomer mining data and Groundsure's unique database including historical surface ground and underground workings.

For further details on each dataset, please refer to each individual section in the report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Section 1: Geology 1:10,000 Scale		
1.1 Artificial Ground	1.1 Is there any Artificial Ground/ Made Ground present beneath the study site at 1:10,000 scale?	No
1.2 Superficial Geology and Landslips	1.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site at 1:10,000 scale?*	No
	1.2.2 Are there any records of landslip within 500m of the study site boundary at 1:10,000 scale?	No
1.3 Bedrock, Solid Geology and Faults	1.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	
	1.3.2 Are there any records of faults within 500m of the study site boundary at 1:10,000 scale?	No

Section 2: Geology 1:50,000 Scale		
2.1 Artificial Ground	2.1.1 Is there any Artificial Ground/ Made Ground present beneath the study site?	No
	2.1.2 Are there any records relating to permeability of artificial ground within the study site*boundary?	No
2.2 Superficial Geology and Landslips	2.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site?*	Yes
	2.2.2 Are there any records of permeability of superficial ground within 500m of the study site?	Yes
	2.2.3 Are there any records of landslip within 500m of the study site boundary?	No
	2.2.4 Are there any records relating to permeability of landslips within the study site* boundary?	No

Section 2: Geology 1:50,000 Scale

2.3 Bedrock, Solid Geology and Faults	2.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	
	2.3.2 Are there any records relating to permeability of bedrock ground within the study site boundary?	Yes
	2.3.3 Are there any records of faults within 500m of the study site boundary?	Yes

Section 3: Radon

3. Radon	3.1Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?	The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.
	3.2Radon Protection	No radon protective measures are necessary.

Section 4: Ground Workings	On-site	0-50m	51-250	251-500	501-1000
4.1 Historical Surface Ground Working Features from Small Scale Mapping	0	1	0	Not Searched	Not Searched
4.2 Historical Underground Workings from Small Scale Mapping	0	0	0	0	0
4.3 Current Ground Workings	0	0	0	0	0

Section 5: Mining, Extraction & Natural Cavities	On-site	0-50m	51-250	251-500	501-1000
5.1 Historical Mining	0	0	0	0	0
5.2 Coal Mining	0	0	0	0	0
5.3 Johnson Poole and Bloomer Mining Area	0	0	0	0	0
5.4 Non-Coal Mining*	1	0	0	0	3
5.5 Non–Coal Mining Cavities	0	0	0	0	0
5.5 Natural Cavities	0	0	0	0	0

Section 5: Mining, Extraction & Natural Cavities	On-site	0-50m	51-250	251-500	501-1000
5.6 Brine Extraction	0	0	0	0	0
5.7 Gypsum Extraction	0	0	0	0	0
5.8 Tin Mining	0	0	0	0	0
5.9 Clay Mining	0	0	0	0	0

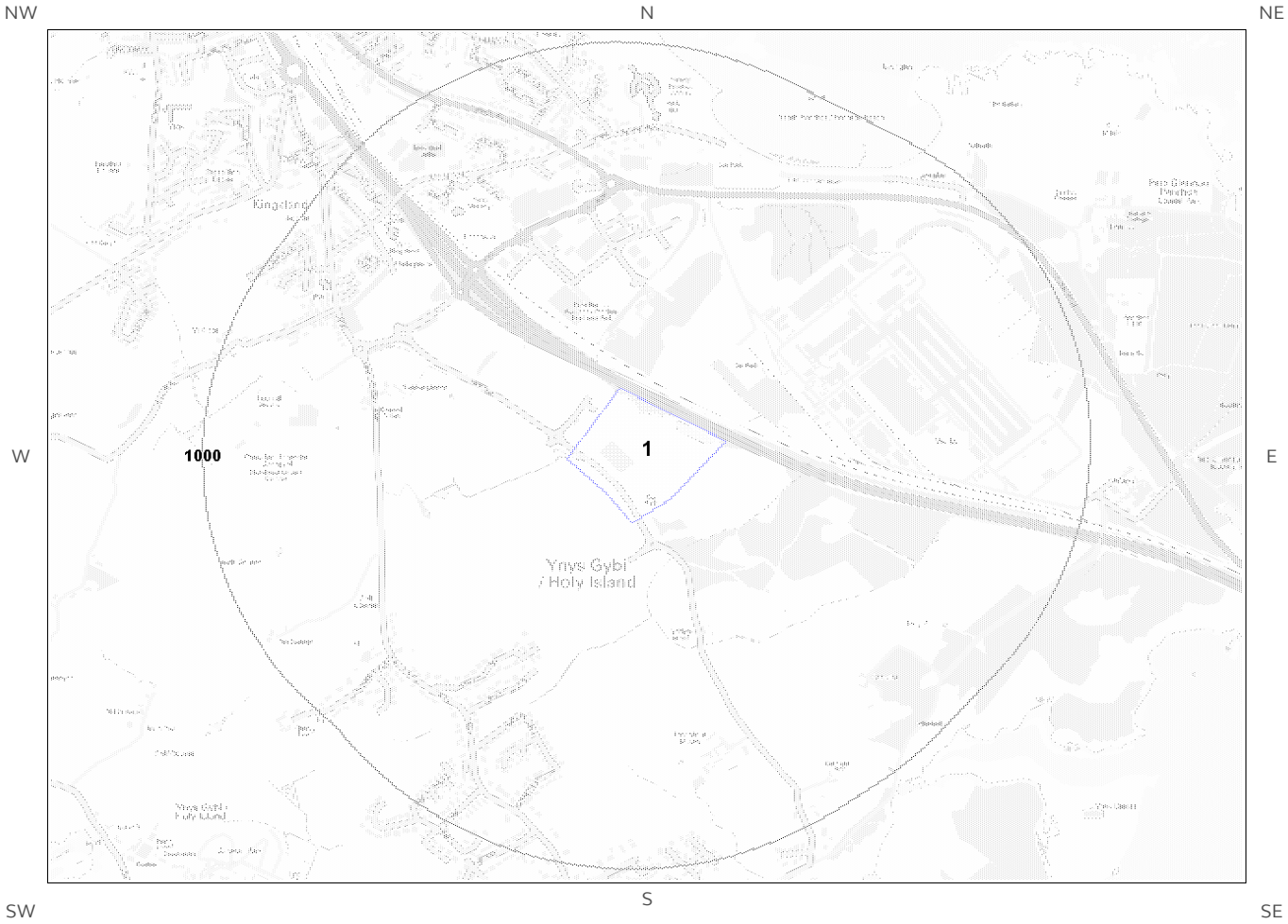
Section 6: Natural Ground Subsidence	On-site
6.1 Shrink-Swell Clay	Very Low
6.2 Landslides	Very Low
6.3 Ground Dissolution of Soluble Rocks	Negligible
6.4 Compressible Deposits	Negligible
6.5 Collapsible Deposits	Very Low
6.5 Running Sand	Very Low

Section 7: Borehole Records	On-site	0-50m	51-250
7 BGS Recorded Boreholes	0	0	14

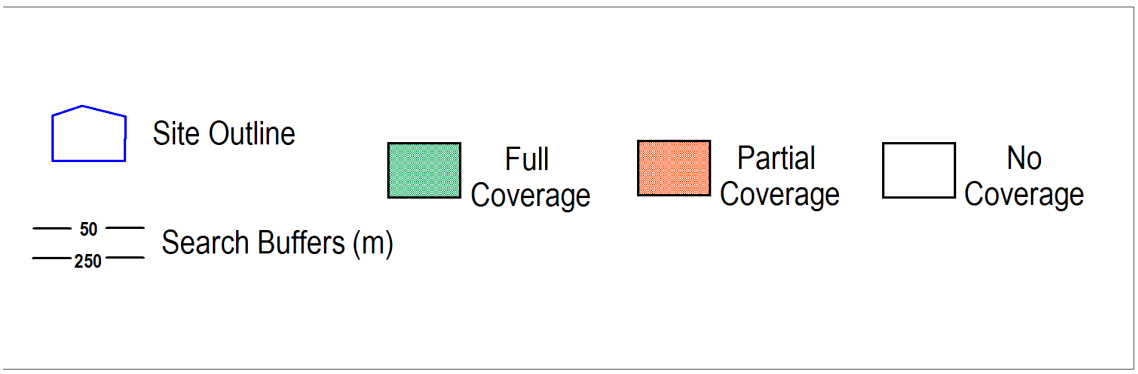
Section 8: Estimated Background Soil Chemistry	On-site	0-50m	51-250
8 Records of Background Soil Chemistry	3	1	0

Section 9: Railways and Tunnels	On-site	0-50m	51-250	250-500
9.1 Tunnels	0	0	0	Not Searched
9.2 Historical Railway and Tunnel Features	0	0	5	Not Searched
9.3 Historical Railways	0	0	0	Not Searched
9.4 Active Railways	0	0	10	Not Searched
9.5 Railway Projects	0	0	0	0

1:10,000 Scale Availability



1_10,000 Availability Legend



Availability of 1:10,000 Scale Geology Mapping

The following information represents the availability of the key components of the 1:10,000 scale geological data.

ID	Distance	Artificial Coverage	Superficial Coverage	Bedrock Coverage	Mass Movement Coverage
1	0.0	No deposits are mapped	No coverage	No coverage	No coverage

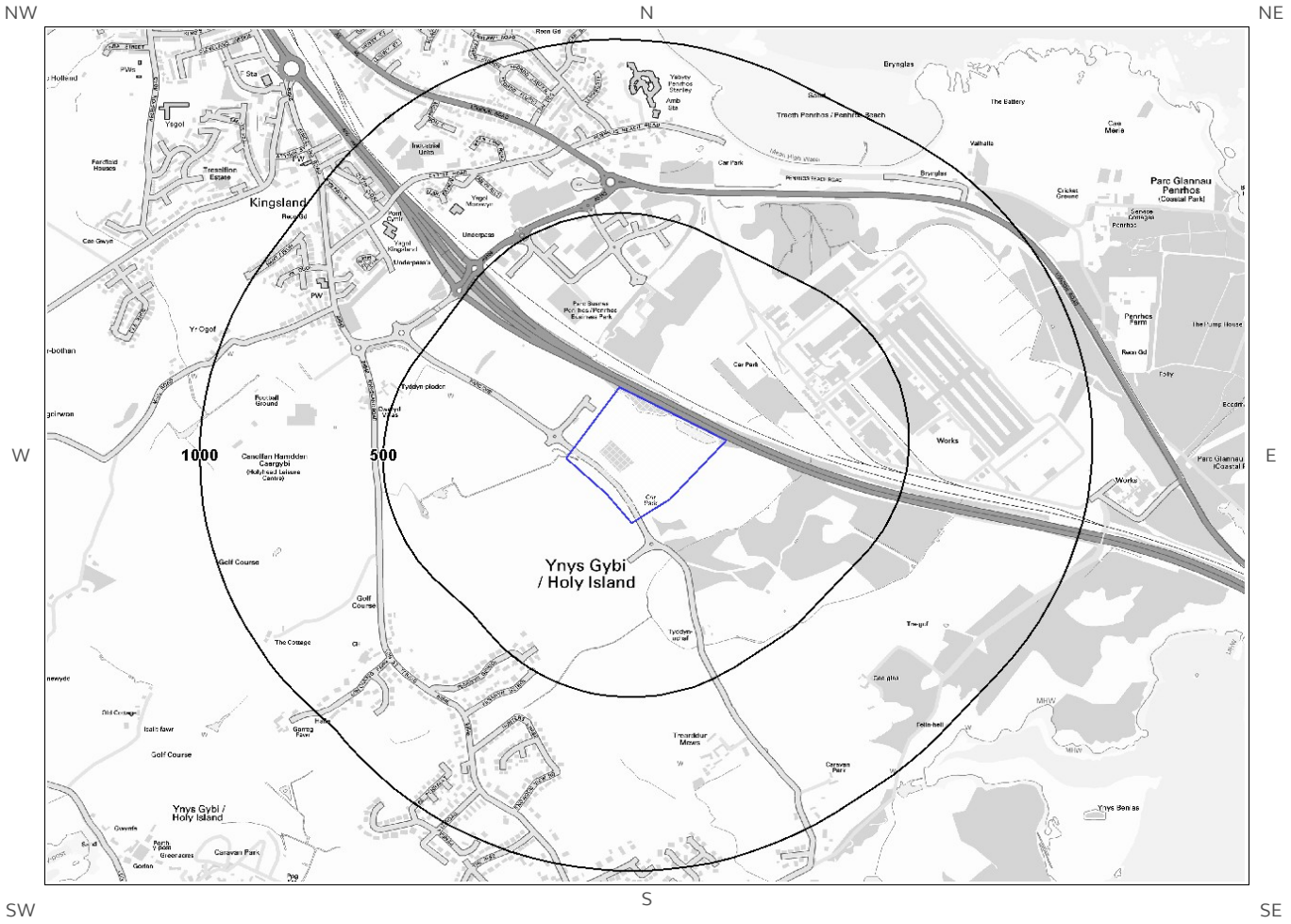
Guidance: The 1:10,000 scale geological interpretation is the most detailed generally available from BGS and is the scale at which most geological surveying is carried out in the field. The database is presented as four types of geology (artificial, mass movement, superficial and bedrock), although not all themes are mapped or available on every map sheet. Therefore a coverage layer showing the availability of the four themes is presented above.

The definitions of coverage are as follows:

Geology	Full Coverage	Partial Coverage	No Coverage
Bedrock	The whole tile has been mapped	Some but not all the tile has been mapped	No coverage
Superficial	The whole tile has been mapped	Some but not all of the tile has been mapped	No coverage
Artificial	Some deposits are mapped on this tile	-	No deposits are mapped
Mass Movement	Some deposits are mapped on this tile	-	No coverage

1 Geology (1:10,000 scale).

1.1 Artificial Ground Map (1:10,000 scale)



Artificial Ground Legend

Site Outline

500
1000
Search Buffers (m)

Made Ground (undivided)

Disturbed Ground (undivided)

Worked Ground (undivided)

Landscaped Ground (undivided)

Infilled Ground

Reclaimed Ground

1. Geology 1:10,000 scale

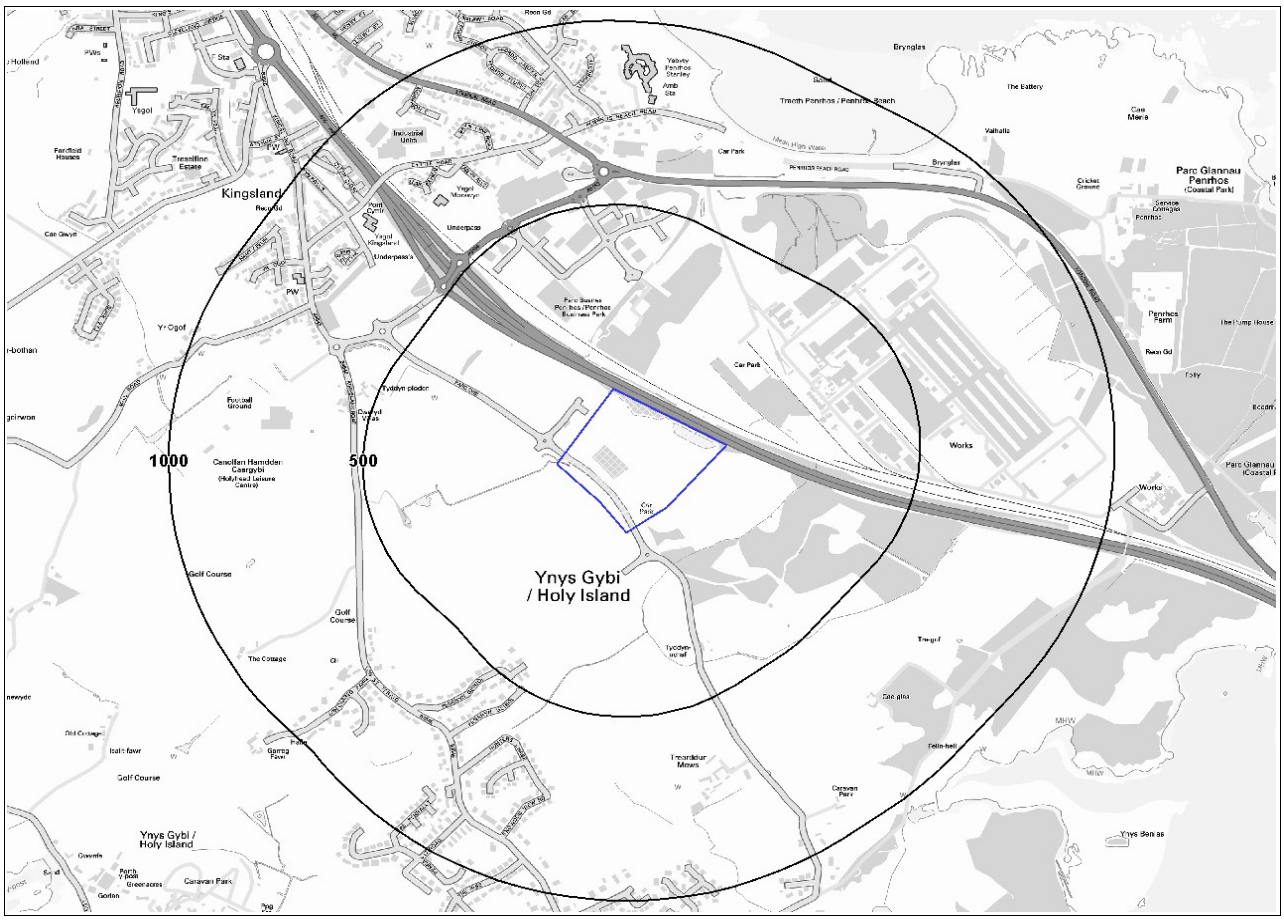
1.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

Are there any records of Artificial/ Made Ground within 500m of the study site boundary at 1:10,000 scale? No

Database searched and no data found.

1.2 Superficial Deposits and Landslips Map (1:10,000 scale)



Artificial Ground Legend

Site Outline

500
1000
Search Buffers (m)

1.2 Superficial Deposits and Landslips

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping

1.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary at 1:10,000 scale? No

Database searched and no data found.

1.2.2 Landslip

Are there any records of Landslip within 500m of the study site boundary at 1:10,000 scale?

No

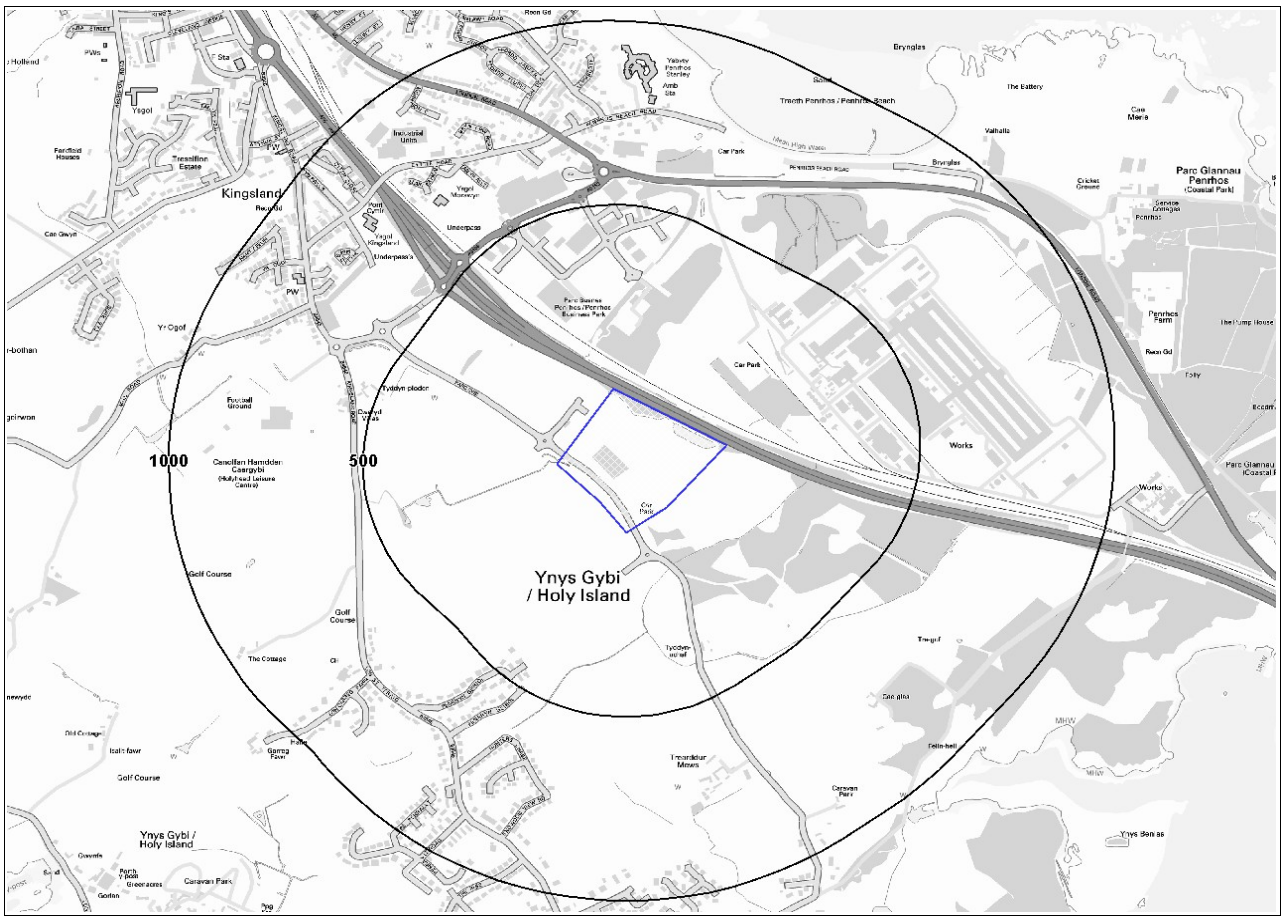
Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:10,000 scale

This Geology shows the main components as discrete layers, these are: Artificial / Made Ground, Superficial / Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

1.3 Bedrock and Faults Map (1:10,000 scale)

NW N NE



W E

SW S SE

Bedrock and Faults Legend

Site Outline

500
1000
Search Buffers (m)

1.3 Bedrock and Faults

The following geological information represented on the mapping is derived from 1:10,000 scale BGS Geological mapping.

1.3.1 Bedrock/ Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary at 1:10,000 scale.

Database searched and no data found at this scale.

1.3.2 Faults

Are there any records of Faults within 500m of the study site boundary at 1:10,000 scale? No

Database searched and no data found at this scale.

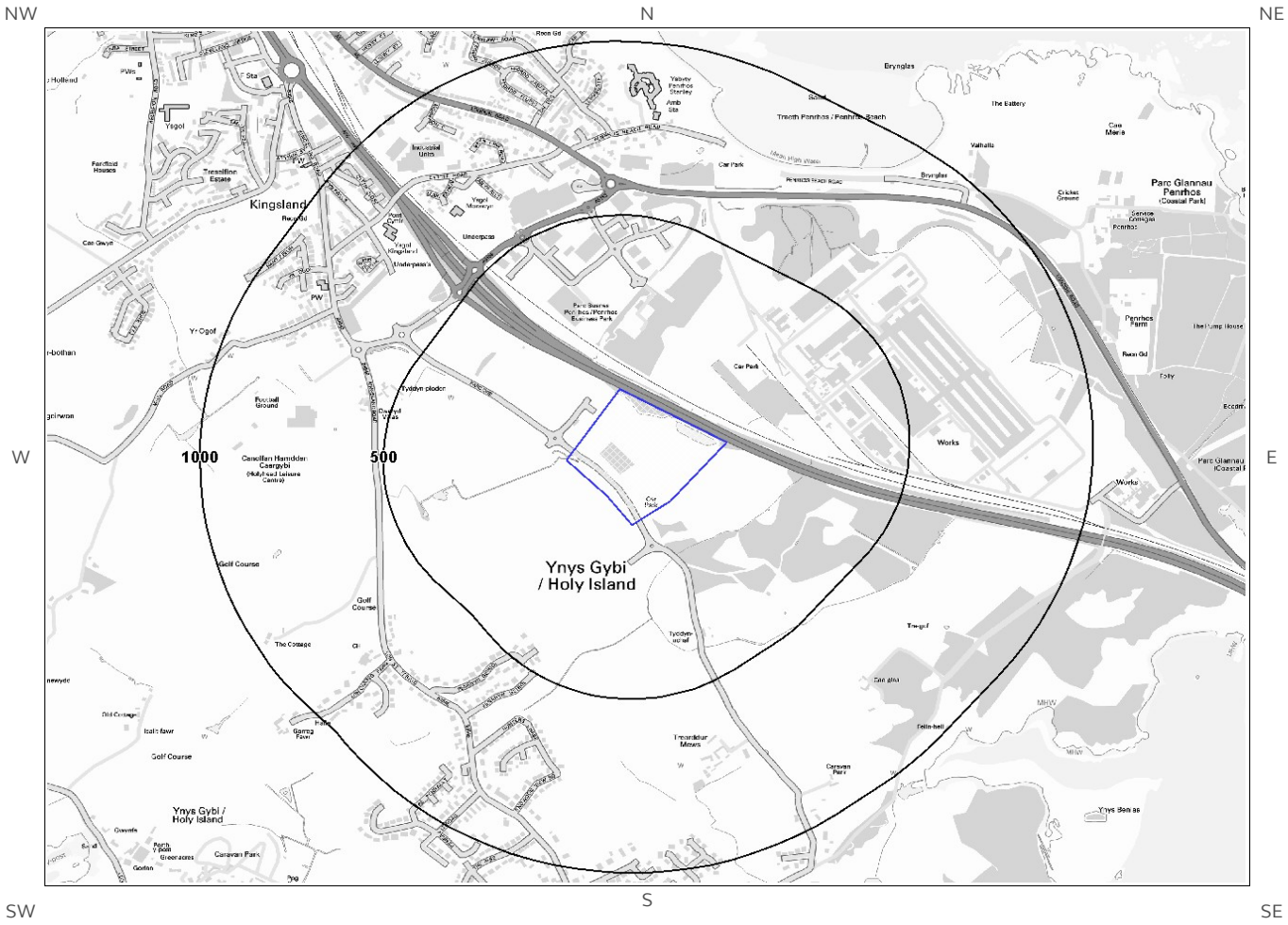
The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of great Britain at 1:10,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/ Solid Geology and linear features such as Faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

---

2 Geology 1:50,000 Scale

2.1 Artificial Ground Map



Ground Workings Legend

Site Outline

500
1000
Search Buffers (m)

Made Ground (undivided)

Worked Ground (undivided)

Infilled Ground

Disturbed Ground (undivided)

Landscaped Ground (undivided)

Reclaimed Ground

2. Geology 1:50,000 scale

2.1 Artificial Ground

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 093

2.1.1 Artificial/ Made Ground

Are there any records of Artificial/ Made Ground within 500m of the study site boundary? No

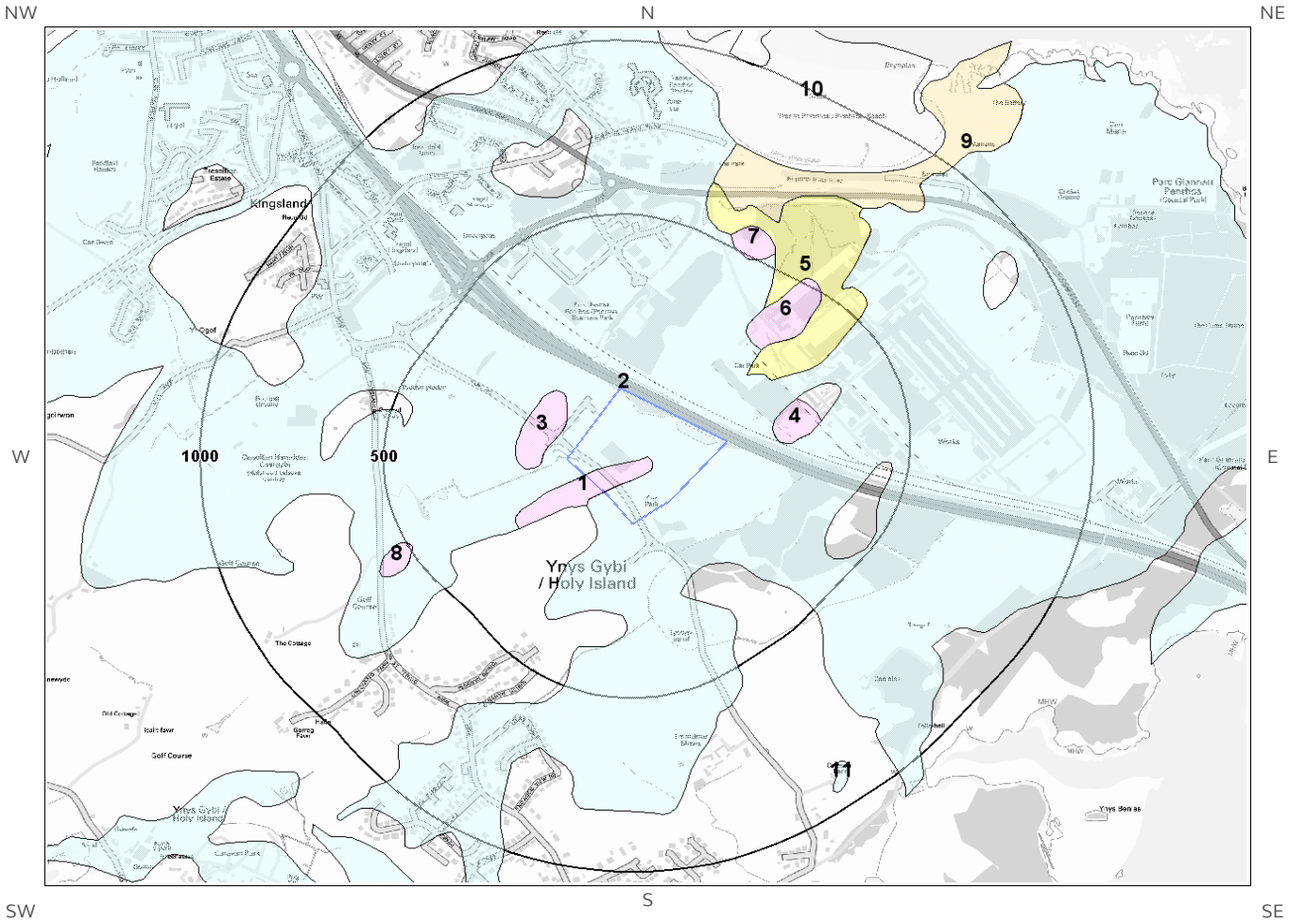
Database searched and no data found.

2.1.2 Permeability of Artificial Ground

Are there any records relating to permeability of artificial ground within the study site boundary? No

Database searched and no data found.

2.2 Superficial Deposits and Landslips Map (1:50,000 scale)



Ground Workings Legend

Site Outline

500
1000
Search Buffers (m)

2.2 Superficial Deposits and Landslips

2.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary? Yes

ID	Distance	Direction	LEX Code	Description	Rock Description
1	0.0	On Site	GFDUD-XSV	GLACIOFLUVIAL DEPOSITS, DEVENSIAN	SAND AND GRAVEL
2	0.0	On Site	TILLD-DMTN	TILL, DEVENSIAN	DIAMICTON
3	59.0	NW	GFDUD-XSV	GLACIOFLUVIAL DEPOSITS, DEVENSIAN	SAND AND GRAVEL
4	128.0	E	GFDUD-XSV	GLACIOFLUVIAL DEPOSITS, DEVENSIAN	SAND AND GRAVEL
5	195.0	NE	TFD-XCZ	TIDAL FLAT DEPOSITS	CLAY AND SILT
6	276.0	NE	GFDUD-XSV	GLACIOFLUVIAL DEPOSITS, DEVENSIAN	SAND AND GRAVEL
7	491.0	NE	GFDUD-XSV	GLACIOFLUVIAL DEPOSITS, DEVENSIAN	SAND AND GRAVEL
8	492.0	SW	GFDUD-XSV	GLACIOFLUVIAL DEPOSITS, DEVENSIAN	SAND AND GRAVEL

2.2.2 Permeability of Superficial Ground

Are there any records relating to permeability of superficial ground within the study site boundary? Yes

Distance (m)	Direction	Flow Type	Maximum Permeability	Minimum Permeability
0.0	On Site	Mixed	High	Low
0.0	On Site	Intergranular	Very High	High

2.2.3 Landslip

Are there any records of Landslip within 500m of the study site boundary? No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

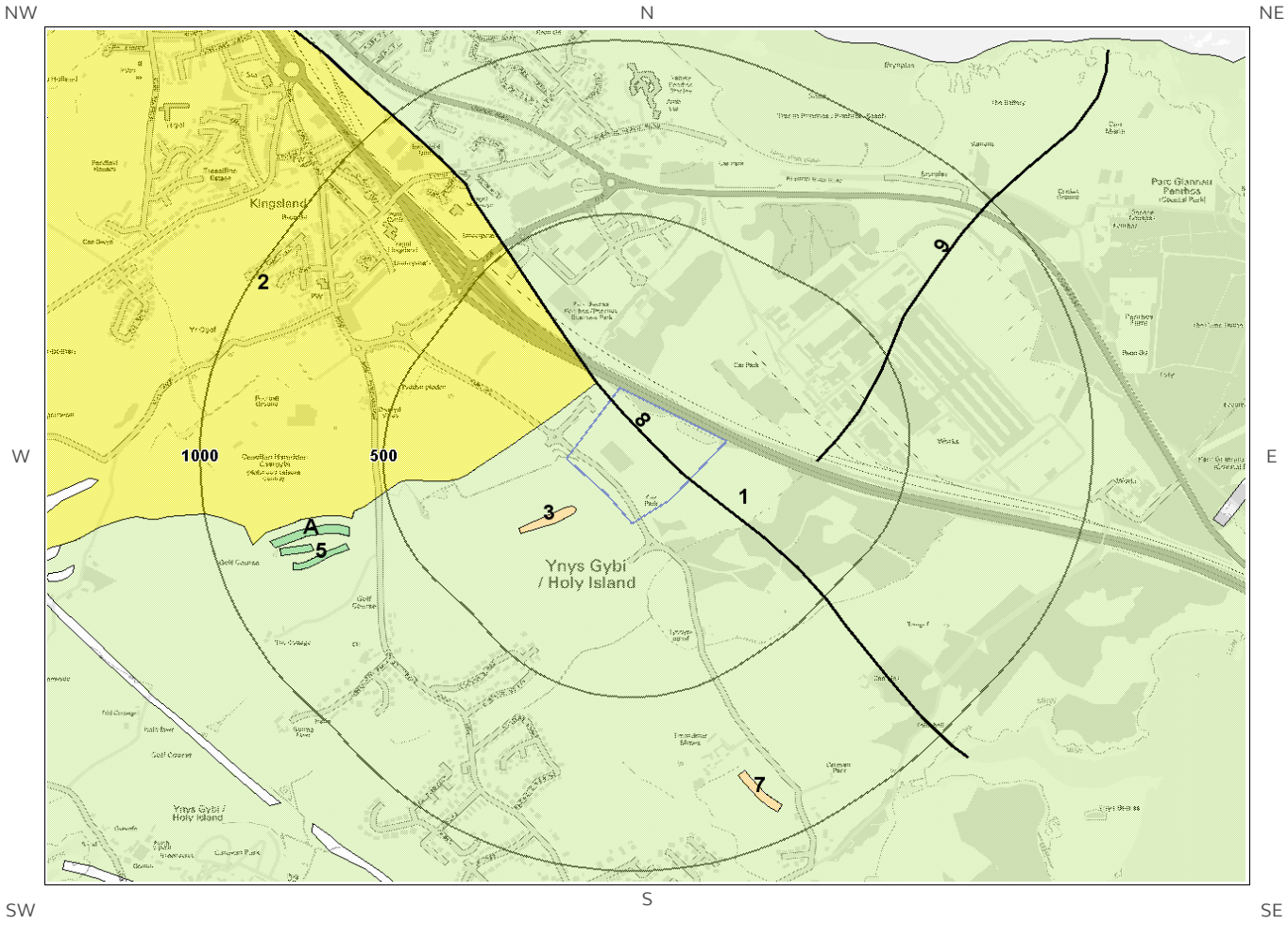
This Geology shows the main components as discrete layers, there are: Artificial/ Made Ground, Superficial/ Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

2.2.4 Landslip Permeability

Are there any records relating to permeability of landslips within the study site boundary? No

Database searched and no data found.

2.3 Bedrock and Faults Map (1:50,000 scale)



Ground Workings Legend

Site Outline

500
1000
Search Buffers (m)

2.3 Bedrock, Solid Geology & Faults

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No: 093

2.3.1 Bedrock/Solid Geology

Records of Bedrock/Solid Geology within 500m of the study site boundary:

ID	Distance	Direction	LEX Code	Rock Description	Rock Age
1	0.0	On Site	NNH-SMPS	NEW HARBOUR GROUP - MICA SCHIST AND PSAMMITE	-
2	62.0	NW	NSS-PSPE	SOUTH STACK FORMATION - PSAMMITE AND PELITE	-
3	86.0	SW	NNH-JASPER	NEW HARBOUR GROUP - JASPER	-

2.3.2 Permeability of Bedrock Ground

Are there any records relating to permeability of bedrock ground within the study site boundary? Yes

Distance	Direction	Flow Type	Maximum Permeability	Minimum Permeability
0.0	On Site	Fracture	Low	Low

2.3.3 Faults

Are there any records of Faults within 500m of the study site boundary? Yes

ID	Distance	Direction	Category Description	Feature Description
8	0.0	On Site	FAULT	Fault, inferred, displacement unknown
9	254.0	E	FAULT	Fault, inferred, displacement unknown

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/Solid Geology and linear features such as Faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nation wide coverage.

3 Radon Data

3.1 Radon Affected Areas

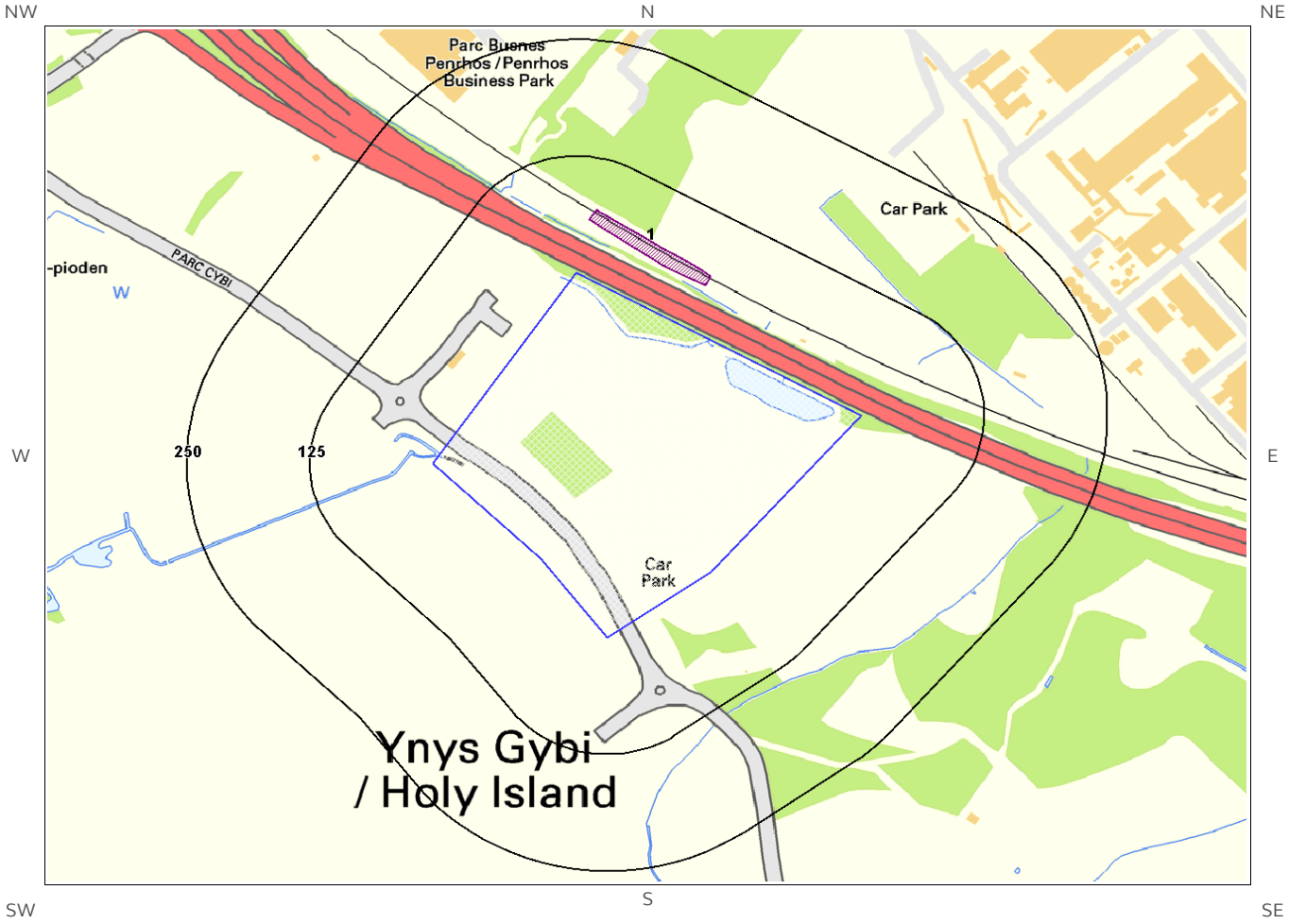
Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.

3.2 Radon Protection

Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment? No radon protective measures are necessary.

---

4 Ground Workings Map



Ground Workings Legend

Site Outline

125
250
Search Buffers (m)

Historic Surface Ground Workings

Historic Underground Workings

Current Ground Workings

4 Ground Workings

4.1 Historical Surface Ground Working Features derived from Historical Mapping

This dataset is based on Groundsure's unique Historical Land Use Database derived from 1:10,560 and 1:10,000 scale historical mapping

Are there any Historical Surface Ground Working Features within 250m of the study site boundary? Yes

ID	Distance (m)	Direction	NGR	Use	Date
1	48.0	NE	225812 380944	Cuttings	1887

4.2 Historical Underground Working Features derived from Historical Mapping

This data is derived from the Groundsure unique Historical Land Use Database. It contains data derived from 1:10,000 and 1:10,560 historical Ordnance Survey Mapping and includes some natural topographical features (Shake Holes for example) as well as manmade features that may have implications for ground stability. Underground and mining features have been identified from surface features such as shafts. The distance that these extend underground is not shown.

Are there any Historical Underground Working Features within 1000m of the study site boundary? No

Database searched and no data found.

4.3 Current Ground Workings

This dataset is derived from the BGS BRITPITS database covering active; inactive mines; quarries; oil wells; gas wells and mineral wharves; and rail deposits throughout the British Isles.

Are there any BGS Current Ground Workings within 1000m of the study site boundary? No

Database searched and no data found.

5 Mining, Extraction & Natural Cavities Map

Mining, Extraction and Natural Cavities Legend

Site Outline

250
500
Search Buffers (m)

Historical Mining

Non-Coal Mining Cavities

Natural Cavities

Non-Coal Mining

Highly likely

Likely

Unlikely

Highly unlikely

Rare

5 Mining, Extraction & Natural Cavities

5.1 Historical Mining

This dataset is derived from Groundsure unique Historical Land-use Database that are indicative of mining or extraction activities.

Are there any Historical Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

5.2 Coal Mining

This dataset provides information as to whether the study site lies within a known coal mining affected area as defined by the coal authority.

Are there any Coal Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

5.3 Johnson Poole and Bloomer

This dataset provides information as to whether the study site lies within an area where JPB hold information relating to mining.

Are there any JPB Mining areas within 1000m of the study site boundary? No

The following information provided by JPB is not represented on mapping: Database searched and no data found.

5.4 Non-Coal Mining

This dataset provides information as to whether the study site lies within an area which may have been subject to non-coal historic mining.

Are there any Non-Coal Mining areas within 1000m of the study site boundary? Yes

The following non-coal mining information is provided by the BGS:

ID	Distance (m)	Direction	Name	Commodity	Assessment of likelihood
1	0.0	On Site	Not available	Vein Mineral	Sporadic underground mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered

ID	Distance (m)	Direction	Name	Commodity	Assessment of likelihood
Not shown	526.0	S	Not available	Vein Mineral	Sporadic underground mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered
3	593.0	W	Not available	Vein Mineral	Sporadic underground mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered
Not shown	925.0	SW	Not available	Vein Mineral	Sporadic underground mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered

5.5 Non-Coal Mining Cavities

This dataset provides information from the Peter Brett Associates (PBA) mining cavities database (compiled for the national study entitled "Review of mining instability in Great Britain, 1990" PBA has also continued adding to this database) on mineral extraction by mining.

Are there any Non-Coal Mining cavities within 1000m of the study site boundary? No

Database searched and no data found.

5.6 Natural Cavities

This dataset provides information based on Peter Brett Associates natural cavities database.

Are there any Natural Cavities within 1000m of the study site boundary? No

Database searched and no data found.

5.7 Brine Extraction

This data provides information from the Coal Authority issued on behalf of the Cheshire Brine Subsidence Compensation Board.

Are there any Brine Extraction areas within 1000m of the study site boundary? No

Database searched and no data found.

5.8 Gypsum Extraction

This dataset provides information on Gypsum extraction from British Gypsum records.

Are there any Gypsum Extraction areas within 1000m of the study site boundary? No

Database searched and no data found.

5.9 Tin Mining

This dataset provides information on tin mining areas and is derived from tin mining records. This search is based upon postcode information to a sector level..

Are there any Tin Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

5.10 Clay Mining

This dataset provides information on Kaolin and Ball Clay mining from relevant mining records.

Are there any Clay Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

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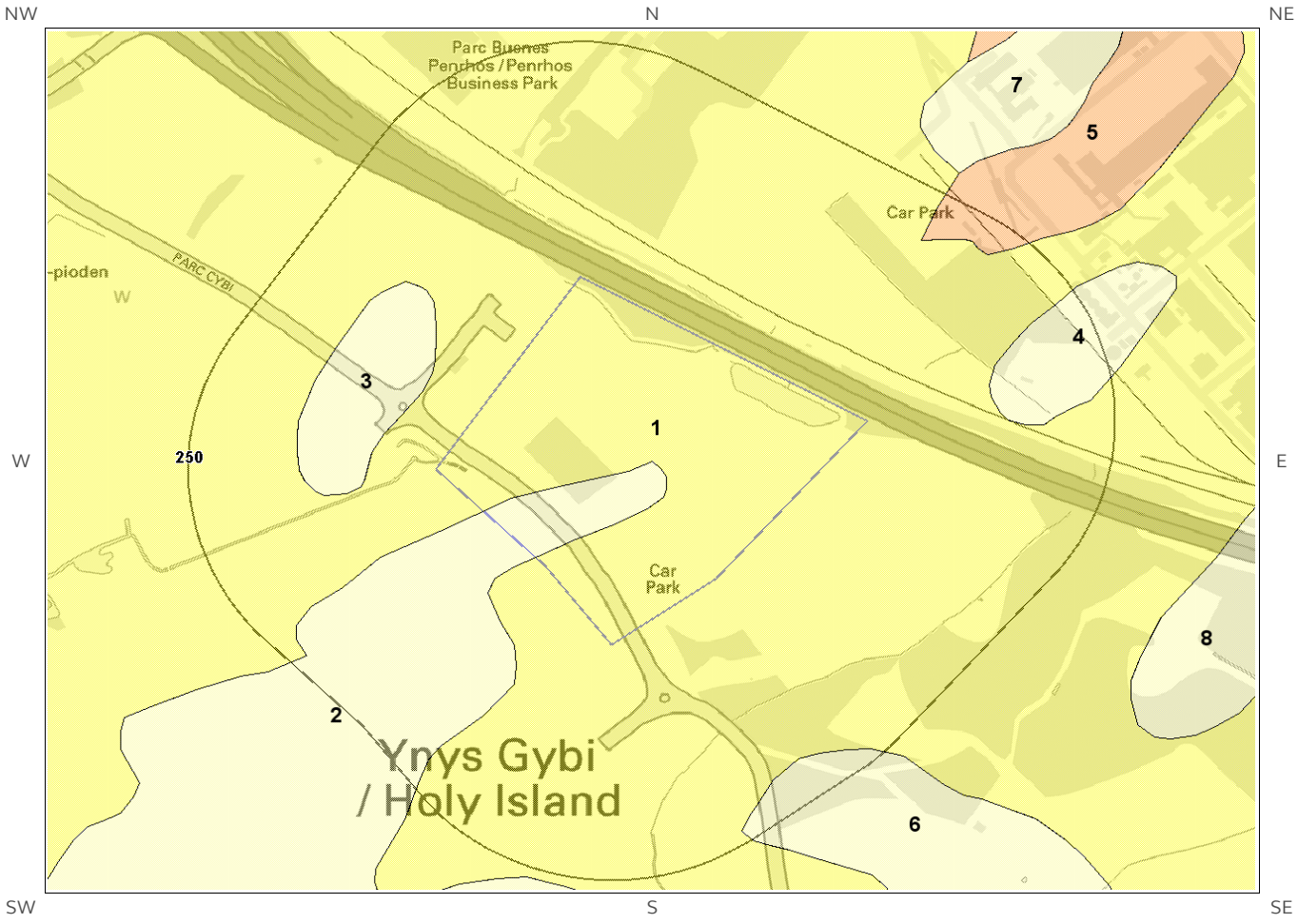
6 Natural Ground Subsidence

6.1 Shrink-Swell Clay Map



Shrink Swell Clay Legend

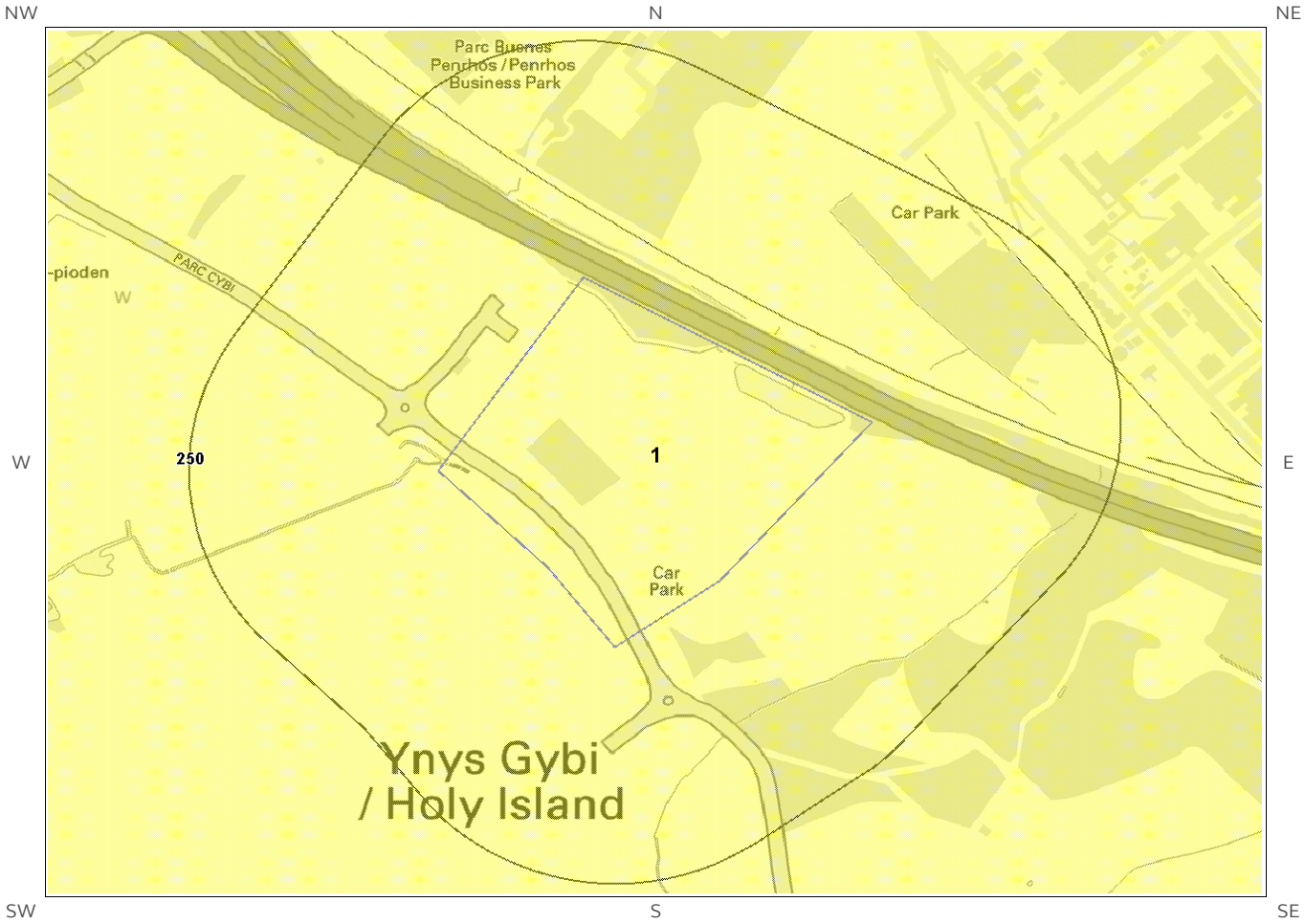
Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

6.2 Landslides Map



Landslides Legend

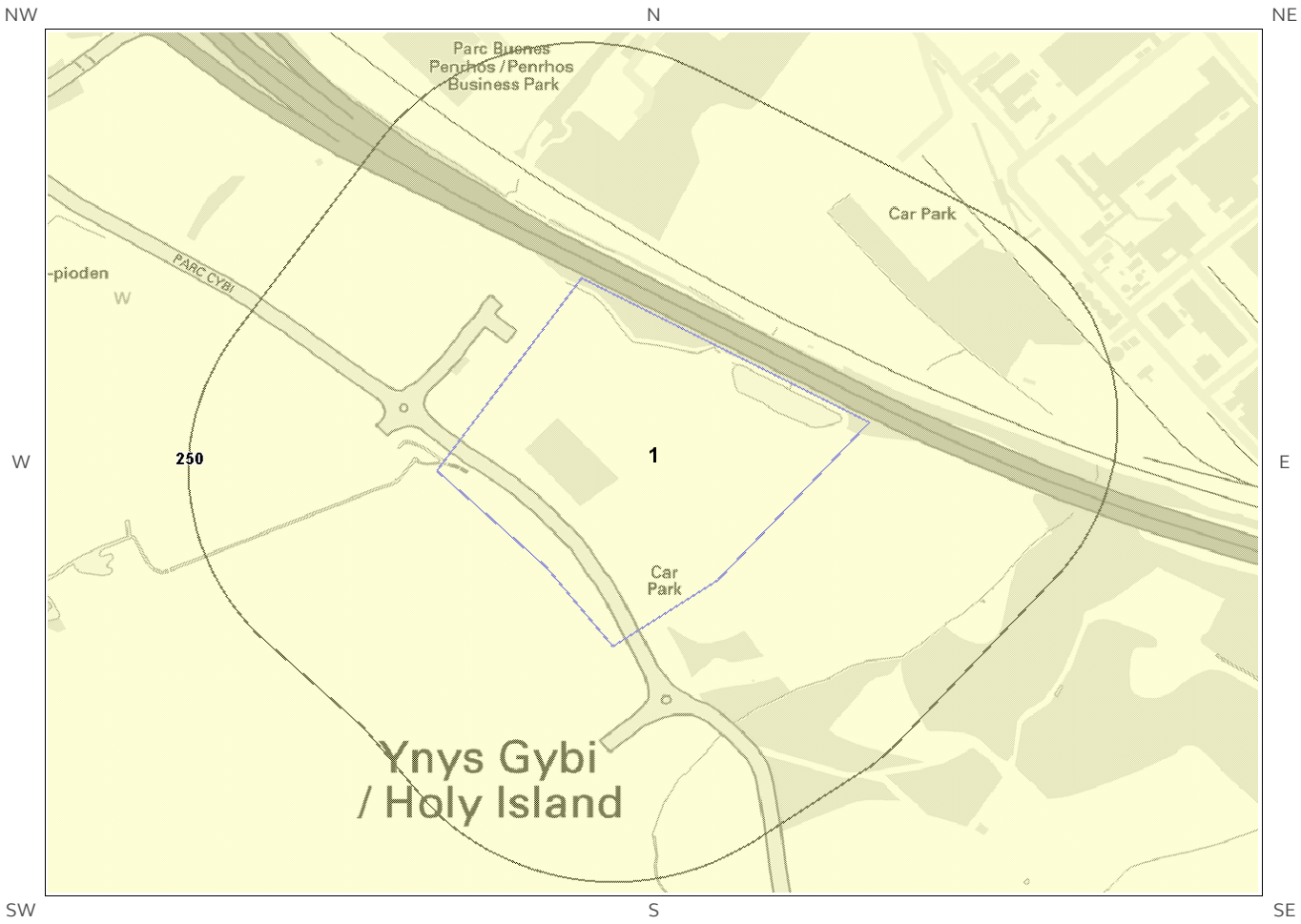
Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

6.3 Ground Dissolution of Soluble Rocks Map



Ground Dissolution Soluble Rocks Legend

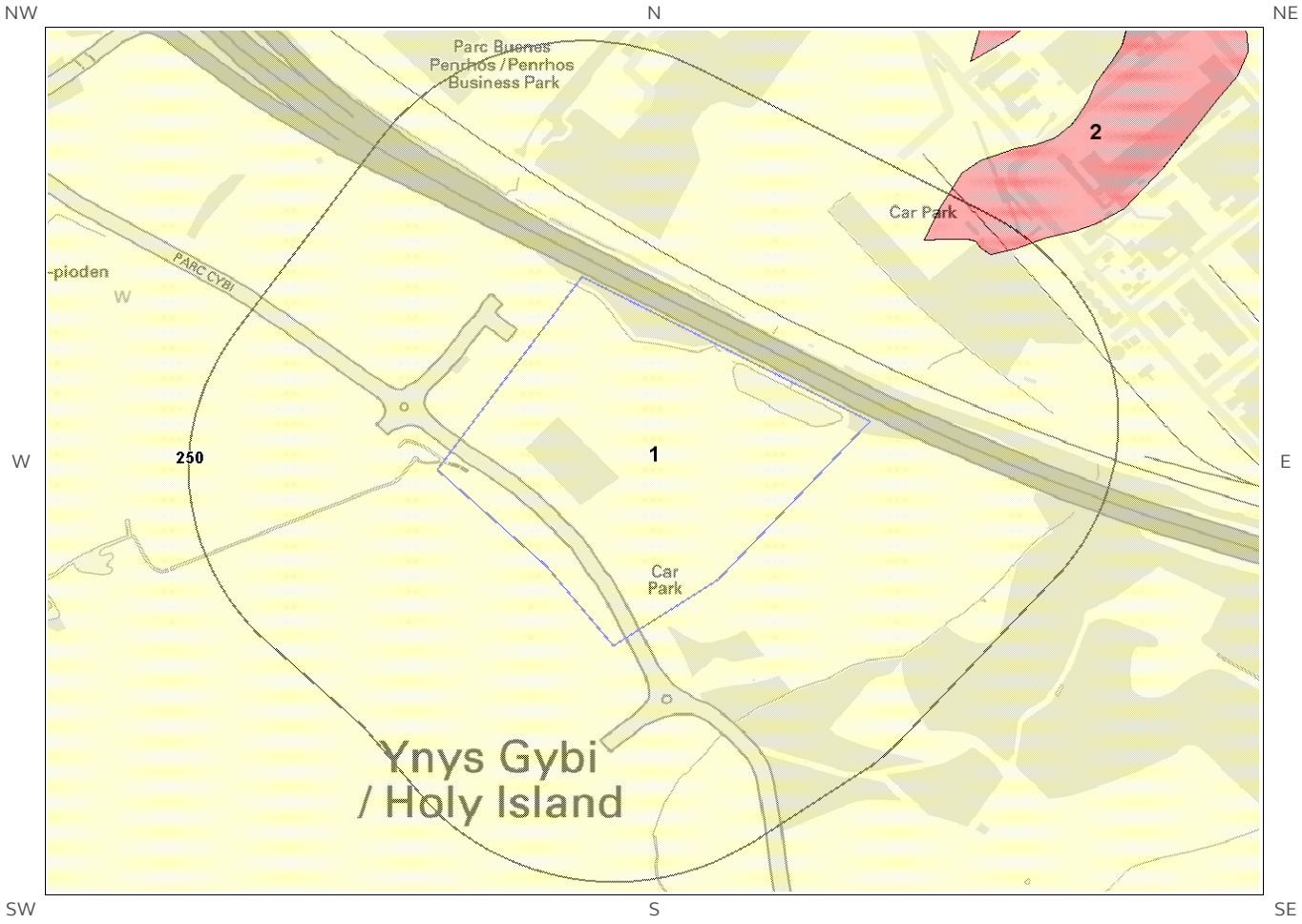
Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

6.4 Compressible Deposits Map



Compressible Deposits Legend

Site Outline

125
250
Search Buffers (m)

No Data / Null

Negligible

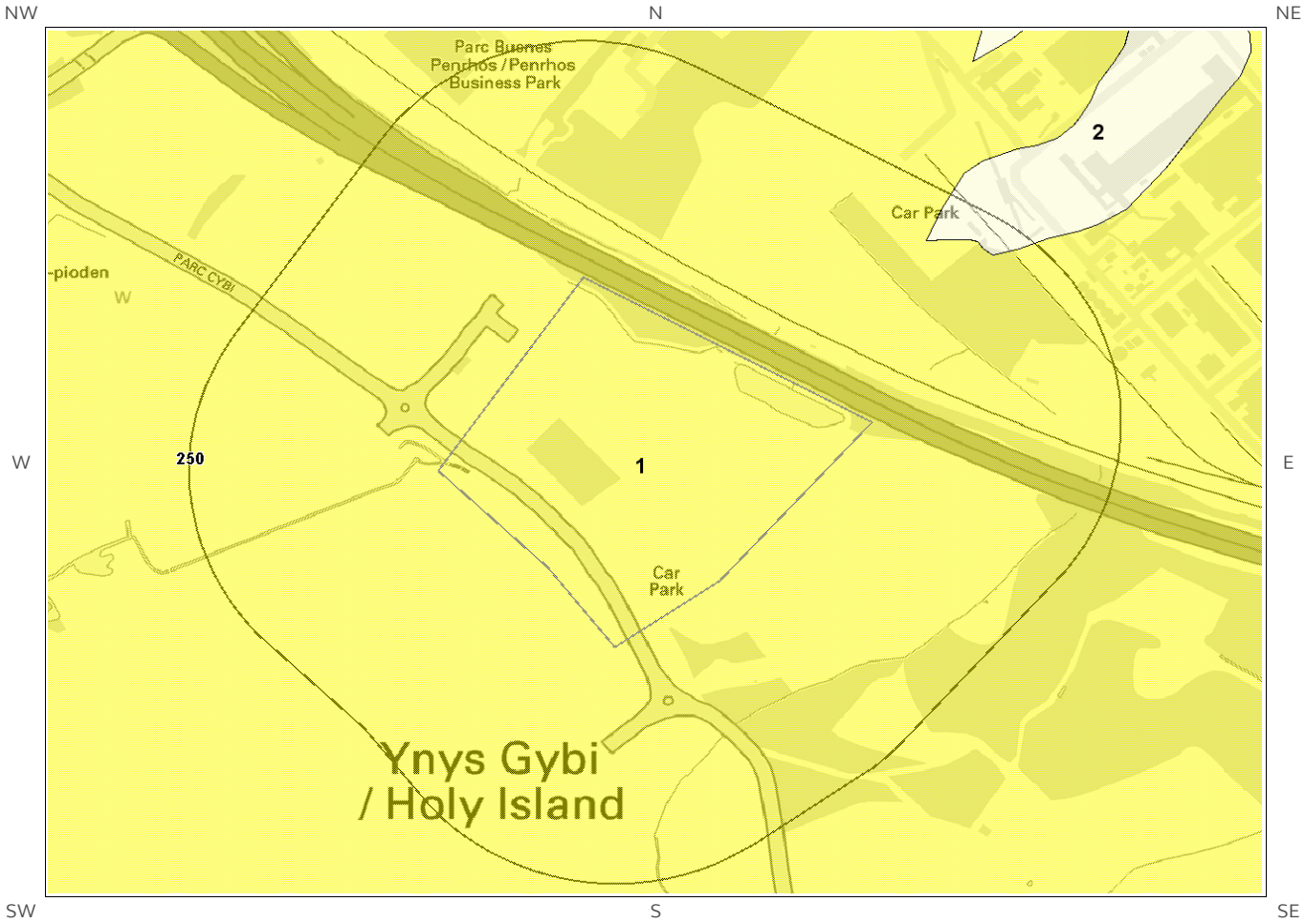
Very Low

Low

Moderate

High

6.5 Collapsible Deposits Map



Collapsible Deposits Legend

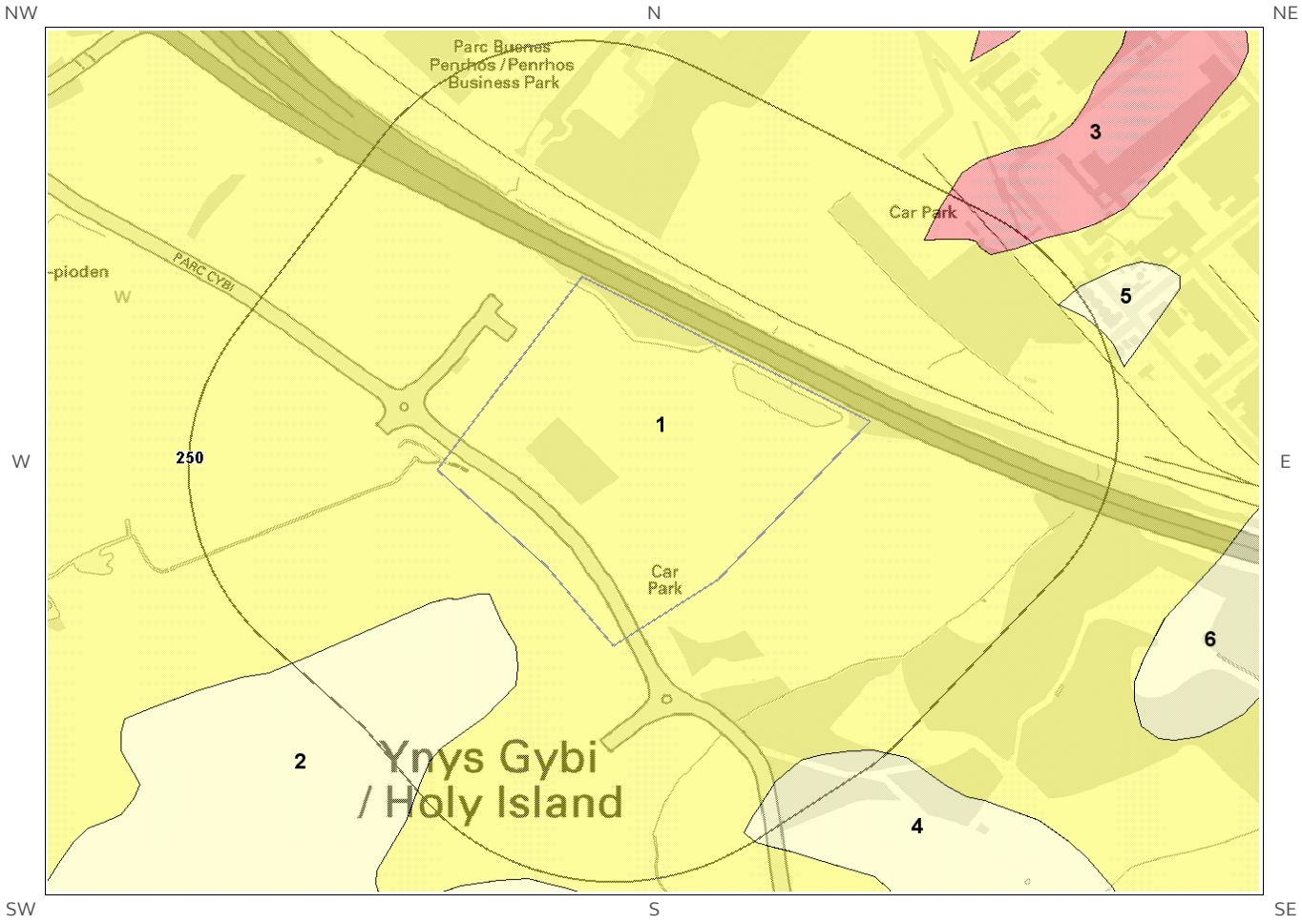
Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

6.6 Running Sand Map



Running Sand Legend

Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

6 Natural Ground Subsidence

The National Ground Subsidence rating is obtained through the 6 natural ground stability hazard datasets, which are supplied by the British Geological Survey (BGS).

The following GeoSure data represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

What is the maximum hazard rating of natural subsidence within the study site*[*] boundary? Very Low

6.1 Shrink-Swell Clays

The following Shrink Swell information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Ground conditions predominantly low plasticity. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with shrink-swell clays.
2	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.

6.2 Landslides

The following Landslides information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.

* This includes an automatically generated 50m buffer zone around the site

6.3 Ground Dissolution of Soluble Rocks

The following Ground Dissolution information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

6.4 Compressible Deposits

The following Compressible Deposits information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.

6.5 Collapsible Deposits

The following Collapsible Rocks information provided by the British Geological Survey:

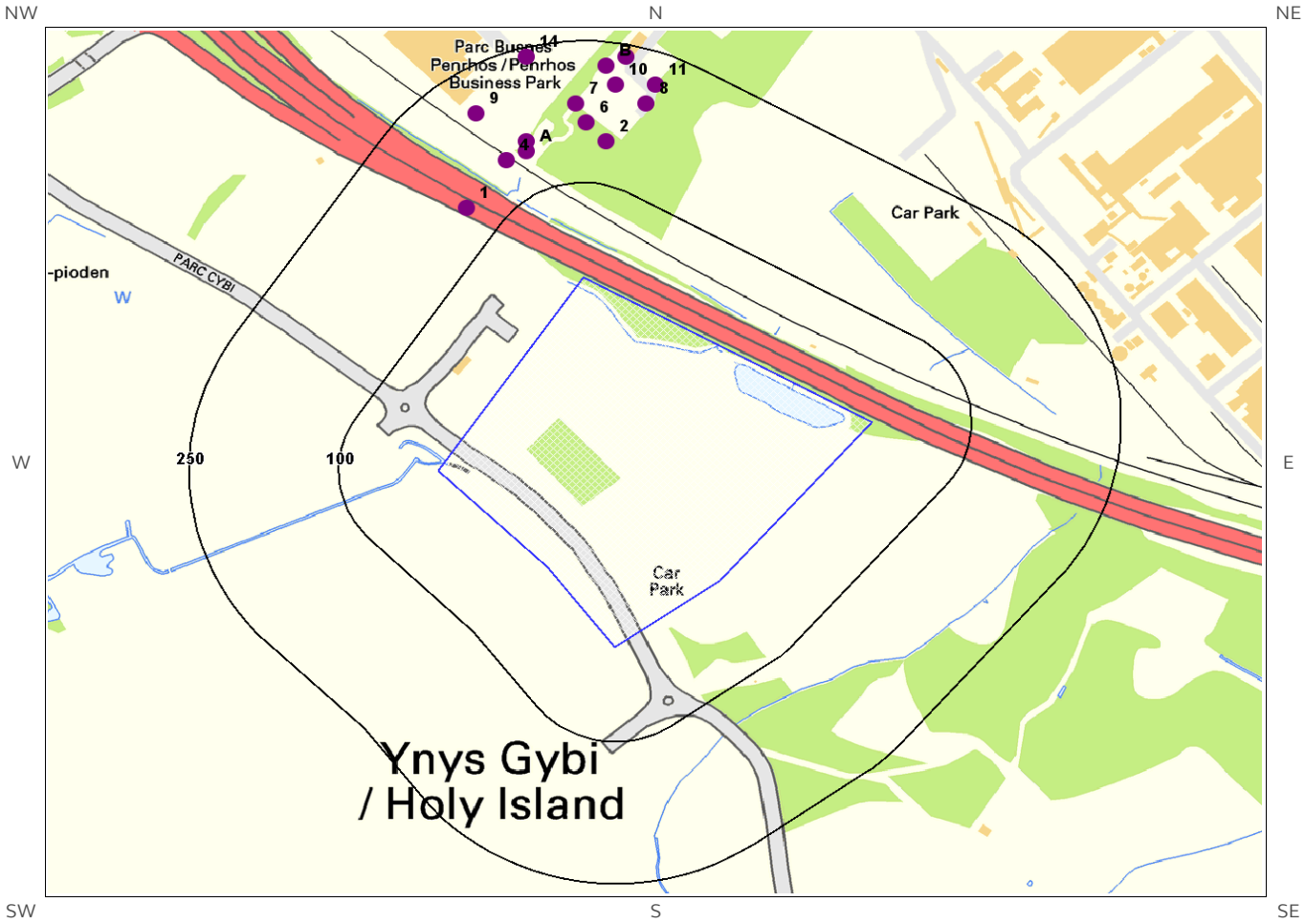
ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.

6.6 Running Sands

The following Running Sands information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Very low potential for running sand problems if water table rises or if sandy strata are exposed to water. No special actions required, to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.

7 Borehole Records Map



Borehole Records Legend

Site Outline

Borehole Locations

125
250
Search Buffers (m)

7 Borehole Records

The systematic analysis of data extracted from the BGS Borehole Records database provides the following information.

Records of boreholes within 250m of the study site boundary: 14

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
1	138.0	NW	225620 380990	SH28SE16	-1.0	HOLYHEAD WWTW RAILWAY CROSSING 12
2	144.0	N	225760 381060	SH28SE8	-1.0	HOLYHEAD WWTW ANGLESEY PHASE 1 6
3A	145.0	NW	225680 381050	SH28SE3	-1.0	HOLYHEAD WWTW ANGLESEY PHASE 1 1
4	145.0	NW	225660 381040	SH28SE15	-1.0	HOLYHEAD WWTW RAILWAY CROSSING 11
5A	154.0	N	225680 381060	SH28SE14	-1.0	HOLYHEAD WWTW RAILWAY CROSSING 1
6	163.0	N	225740 381080	SH28SE6	-1.0	HOLYHEAD WWTW ANGLESEY PHASE 1 4
7	183.0	N	225730 381100	SH28SE4	-1.0	HOLYHEAD WWTW ANGLESEY PHASE 1 2
8	193.0	N	225800 381100	SH28SE9	-1.0	HOLYHEAD WWTW ANGLESEY PHASE 1 BH7
9	204.0	NW	225630 381090	SH28SE38	-1.0	PENRHOS INDUSTRIAL ESTATE PHASE 2 HOLYHEAD TP19
10	205.0	N	225770 381120	SH28SE7	-1.0	HOLYHEAD WWTW ANGLESEY PHASE 1 BH5
11	215.0	N	225810 381120	SH28SE10	-1.0	HOLYHEAD WWTW ANGLESEY PHASE 1 BH8
12B	224.0	N	225760 381140	SH28SE5	-1.0	HOLYHEAD WWTW ANGLESEY PHASE 1 3
13B	236.0	N	225780 381150	SH28SE12	-1.0	HOLYHEAD WWTW ANGLESEY PHASE 1 10
14	240.0	N	225680 381150	SH28SE39	-1.0	PENRHOS INDUSTRIAL ESTATE PHASE 2 HOLYHEAD TP20

The borehole records are available using the hyperlinks below: Please note that if the donor of the borehole record has requested the information be held as commercial-in-confidence, the additional data will be held separately by the BGS and a formal request must be made for its release.

8 Estimated Background Soil Chemistry

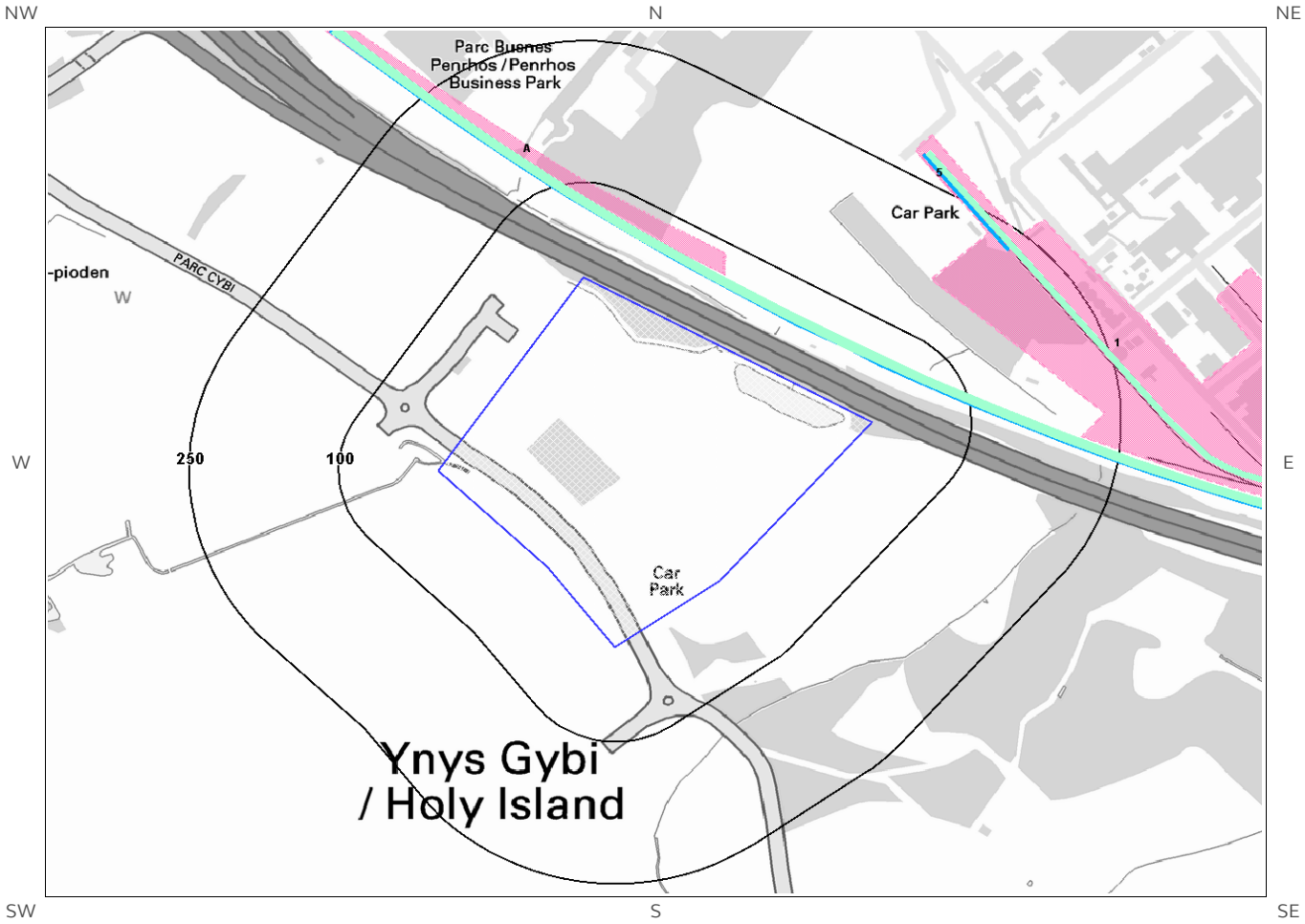
Records of background estimated soil chemistry within 250m of the study site boundary: 4

For further information on how this data is calculated and limitations upon its use, please see the Groundsure Geo Insight User Guide, available on request.

Distance (m)	Direction	Sample Type	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Lead (Pb)
0.0	On Site	Sediment	<15 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
0.0	On Site	Sediment	<15 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
0.0	On Site	Sediment	<15 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
26.0	S	Sediment	<15 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg

*As this data is based upon underlying 1:50,000 scale geological information, a 50m buffer has been added to the search radius.

9 Railways and Tunnels Map



Railways and Tunnels Legend

- Site Outline
- Search Buffers (m): 250, 500
- Underground or Partially Underground Railway / Subway System
- Railway Tunnel (OS Mapping)
- Abandoned or Dismantled Railway (OpenStreetMap)
- Railway Track (OS Mapping)
- Railway Track (OpenStreetMap)
- High Speed 2
- High Speed 2 Revised Proposed Route
- Crossrail 1
- Railway and/or Tunnel Feature from Historical Mapping

9 Railways and Tunnels

9.1 Tunnels

This data is derived from OpenStreetMap and provides information on the possible locations of underground railway systems in the UK - the London Underground, the Tyne & Wear Metro and the Glasgow Subway.

Have any underground railway lines been identified within the study site boundary? No

Have any underground railway lines been identified within 250m of the study site boundary? No

Database searched and no data found.

Any records that have been identified are represented on the Railways and Tunnels Map.

This data is derived from Ordnance Survey mapping and provides information on the possible locations of railway tunnels forming part of the UK overground railway network.

Have any other railway tunnels been identified within the site boundary? No

Have any other railway tunnels been identified within 250m of the site boundary? No

Database searched and no data found.

Any records that have been identified are represented on the Railways and Tunnels Map.

9.2 Historical Railway and Tunnel Features

This data is derived from Groundsure's unique Historical Land-use Database and contains features relating to tunnels, railway tracks or associated works that have been identified from historical Ordnance Survey mapping.

Have any historical railway or tunnel features been identified within the study site boundary? No

Have any historical railway or tunnel features been identified within 250m of the study site boundary? Yes

ID	Distance (m)	Direction	NGR	Details	Date
2A	68	NE	n/a	Railway	1897
3A	69	NE	n/a	Railway	1887
4A	69	NE	n/a	Railway	1923
1	155	NE	226250 380843	Railway Sidings	1977
5	248	NE	226095 381025	Railway Sidings	1995

Any records that have been identified are represented on the Railways and Tunnels Map.

9.3 Historical Railways

This data is derived from OpenStreetMap and provides information on the possible alignments of abandoned or dismantled railway lines in proximity to the study site.

Have any historical railway lines been identified within the study site boundary? No

Have any historical railway lines been identified within 250m of the study site boundary? No

Database searched and no data found.

Multiple sections of the same track may be listed in the detail above
Any records that have been identified are represented on the Railways and Tunnels Map.

9.4 Active Railways

These datasets are derived from Ordnance Survey mapping and OpenStreetMap and provide information on the possible locations of active railway lines in proximity to the study site.

Have any active railway lines been identified within the study site boundary? No

Have any active railway lines been identified within 250m of the study site boundary? Yes

Distance (m)	Direction	Name	Type
56	NE	Not given	Multi Track
56	NE	Not given	Multi Track
59	NE	Not given	Rail
59	NE	Not given	Rail
63	NE	Not given	Rail
63	NE	Not given	Rail
227	NE	Not given	Rail
227	NE	Not given	Rail
228	NE	Not given	Multi Track
228	NE	Not given	Multi Track

Multiple sections of the same track may be listed in the detail above
Any records that have been identified are represented on the Railways and Tunnels Map.

9.5 Railway Projects

These datasets provide information on the location of large scale railway projects High Speed 2 and Crossrail 1 .

Is the study site within 5km of the route of the High Speed 2 rail project? No

Is the study site within 500m of the route of the Crossrail 1 rail project? No

*Further information on proximity to these routes, the project construction status and associated works can be obtained through the purchase of a **Groundsure HS2 and Crossrail 1 Report**.*

The route data has been digitised from publicly available maps by Groundsure. The route as provided relates to the Crossrail 1 project only, and does not include any details of the Crossrail 2 project, as final details of the route for Crossrail 2 are still under consultation.

Please note that this assessment takes account of both the original Phase 2b proposed route and the amended route proposed in 2016. As the Phase 2b route is still under consultation, Groundsure are providing information on both options until the final route is formally confirmed. Practitioners should take account of this uncertainty when advising clients.

Contact Details

Groundsure Helpline

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info@groundsure.com

British Geological Survey Enquiries

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Tel: 0115 936 3143.
Fax: 0115 936 3276.
Email:**enquiries@bgs.ac.uk**
Web:**www.bgs.ac.uk**
BGS Geological Hazards Reports and general geological enquiries

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Leicestershire
LE12 6HX

The Coal Authority

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Mansfield
Notts NG18 4RG
Tel: 0345 7626 848
DX 716176 Mansfield 5
www.coal.gov.uk

Public Health England

Public information access office
Public Health England, Wellington House
133-155 Waterloo Road, London, SE1 8UG
https://www.gov.uk/government/organisations/public-health-england
Email: **enquiries@phe.gov.uk**
Main switchboard: 020 7654 8000

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Website: **www.jpb.co.uk**

Ordnance Survey

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SO16 0AS

Tel: 08456 050505
Website: http://www.ordnancesurvey.co.uk/

Getmapping PLC

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Hampshire RG27 8NW
Tel: 01252 845444
Website:**http://www1.getmapping.com/**

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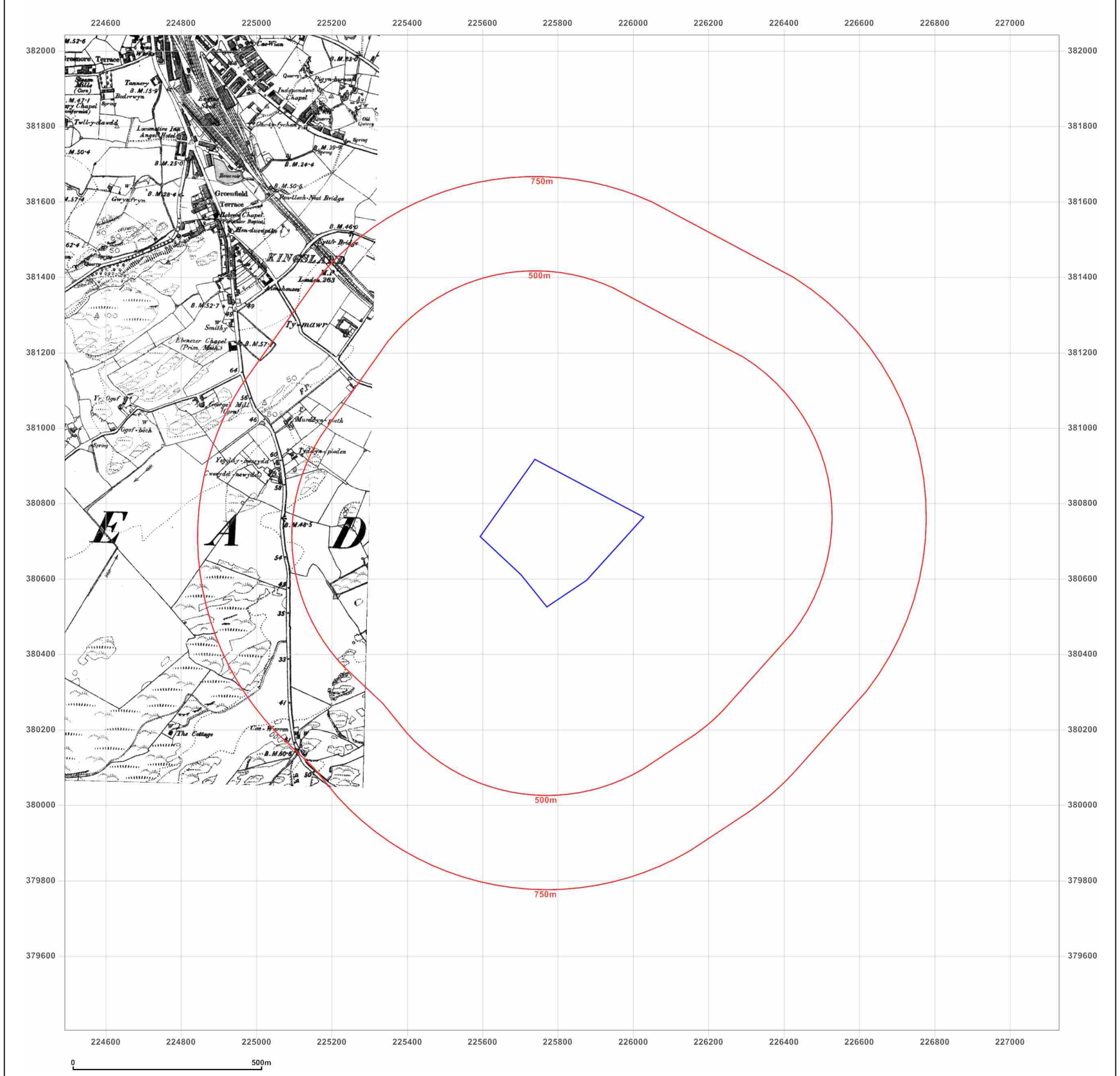
Berkshire RG1 8DN
Tel: +44 (0)118 950 0761 E-mail:**reading@pba.co.uk**
Website:**http://www.peterbrett.com/home**

Standard Terms and Conditions

Groundsure's Terms and Conditions can be viewed online at this link:
https://www.groundsure.com/terms-and-conditions-sept-2016/



Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

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Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: County Series

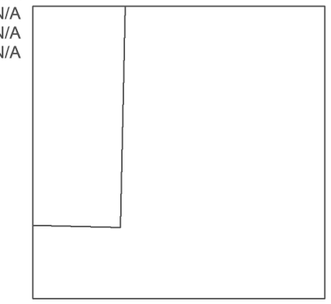
Map date: **1887**

Scale: 1:10,560

Printed at: 1:10,560

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A



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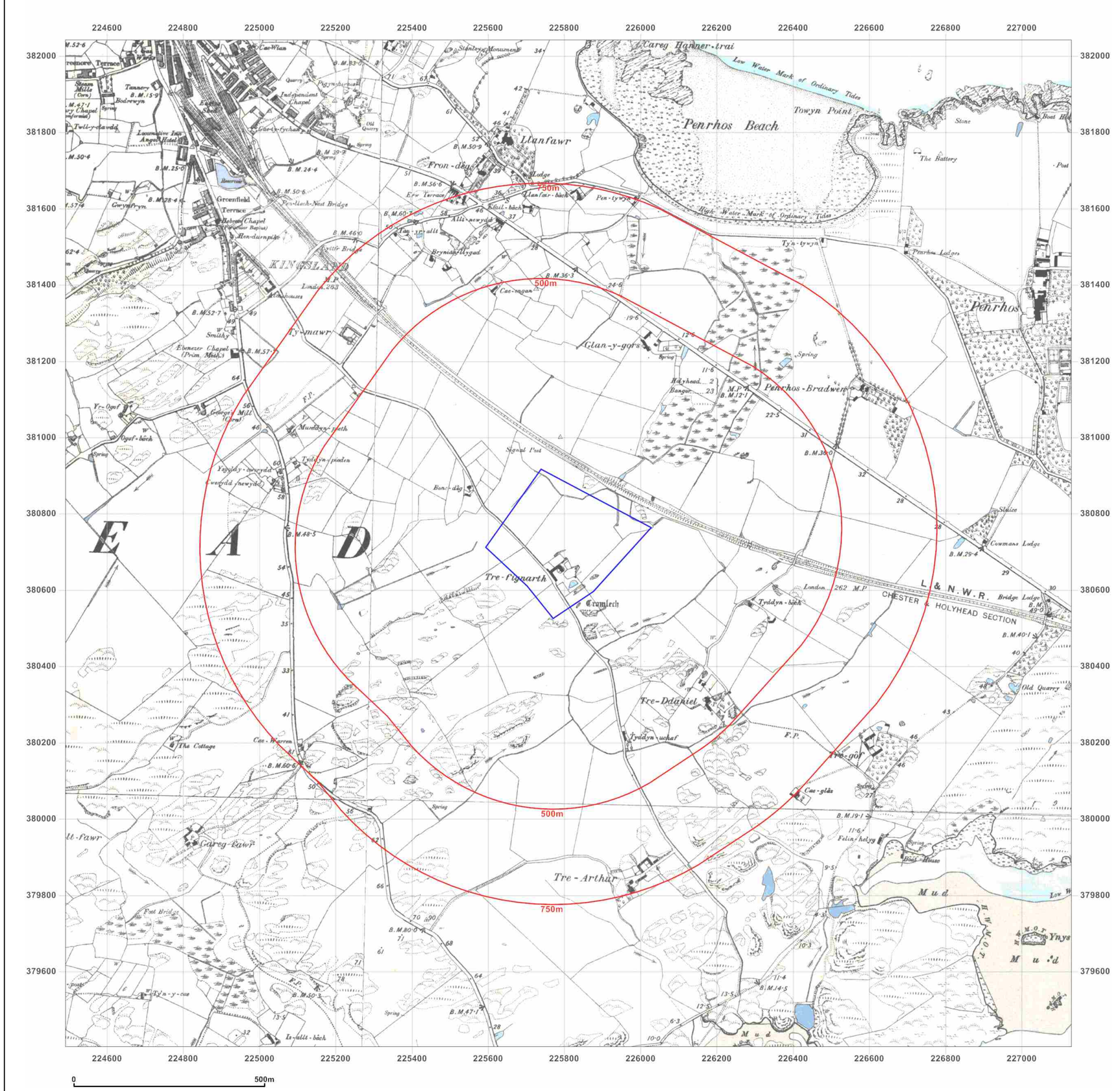
Produced by
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 04 May 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

Client Ref: 60PO8077_mpp2_Parc_Cybi
Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: County Series

Map date: **1887**

Scale: 1:10,560

Printed at: 1:10,560

N
W E
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Surveyed 1887
Revised 1887
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1887
Revised 1887
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1887
Revised 1887
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1887
Revised 1887
Edition N/A
Copyright N/A
Levelled N/A

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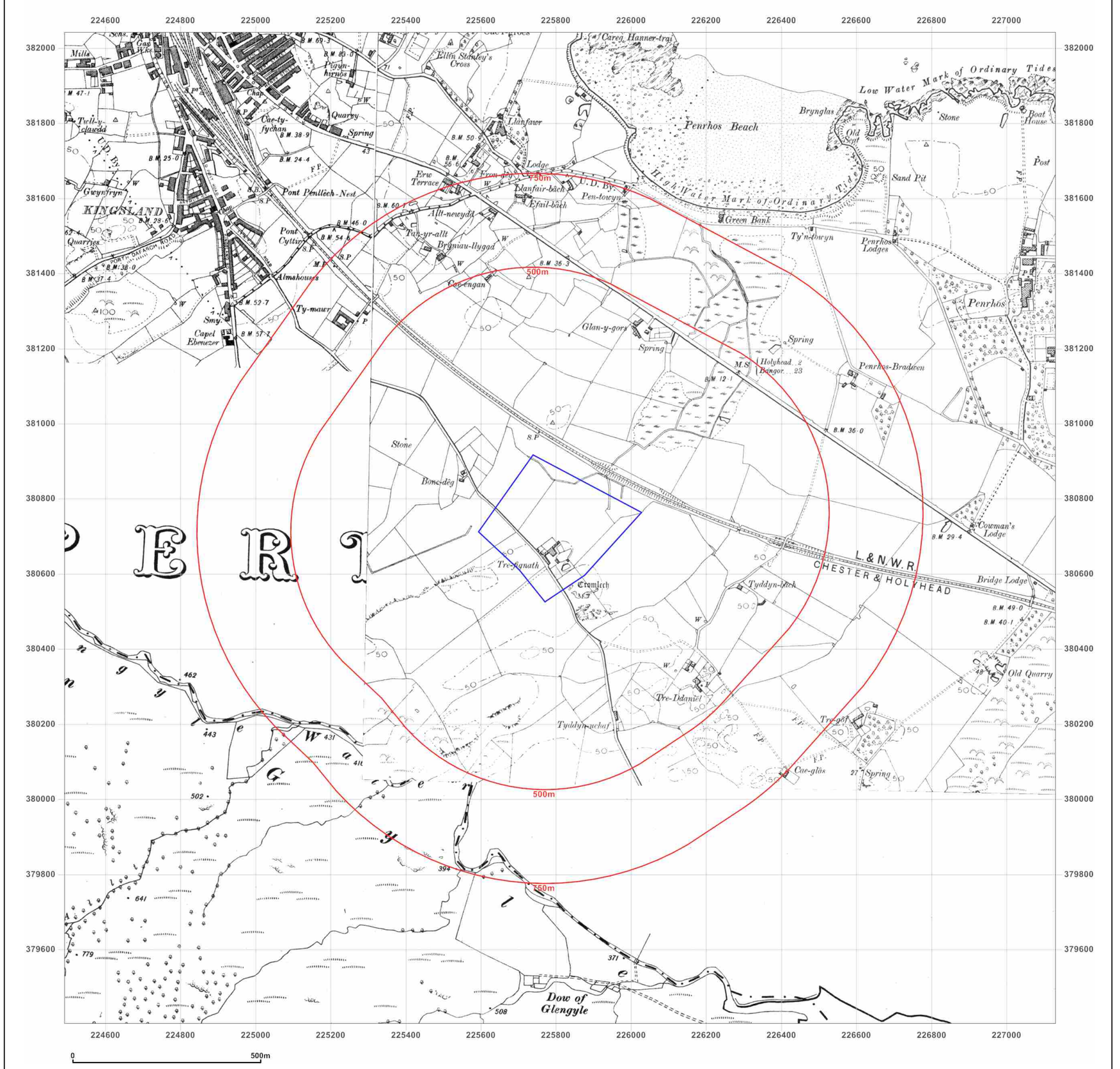
W: www.groundsure.com

Production date: 04 May 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

Client Ref: 60PO8077_mpp2_Parc_Cybi
Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: County Series

Map date: **1899**

Scale: 1:10,560

Printed at: 1:10,560

N
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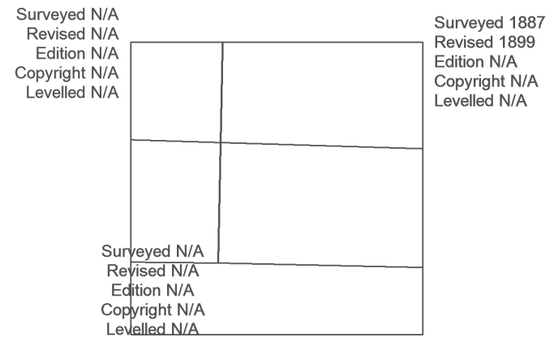

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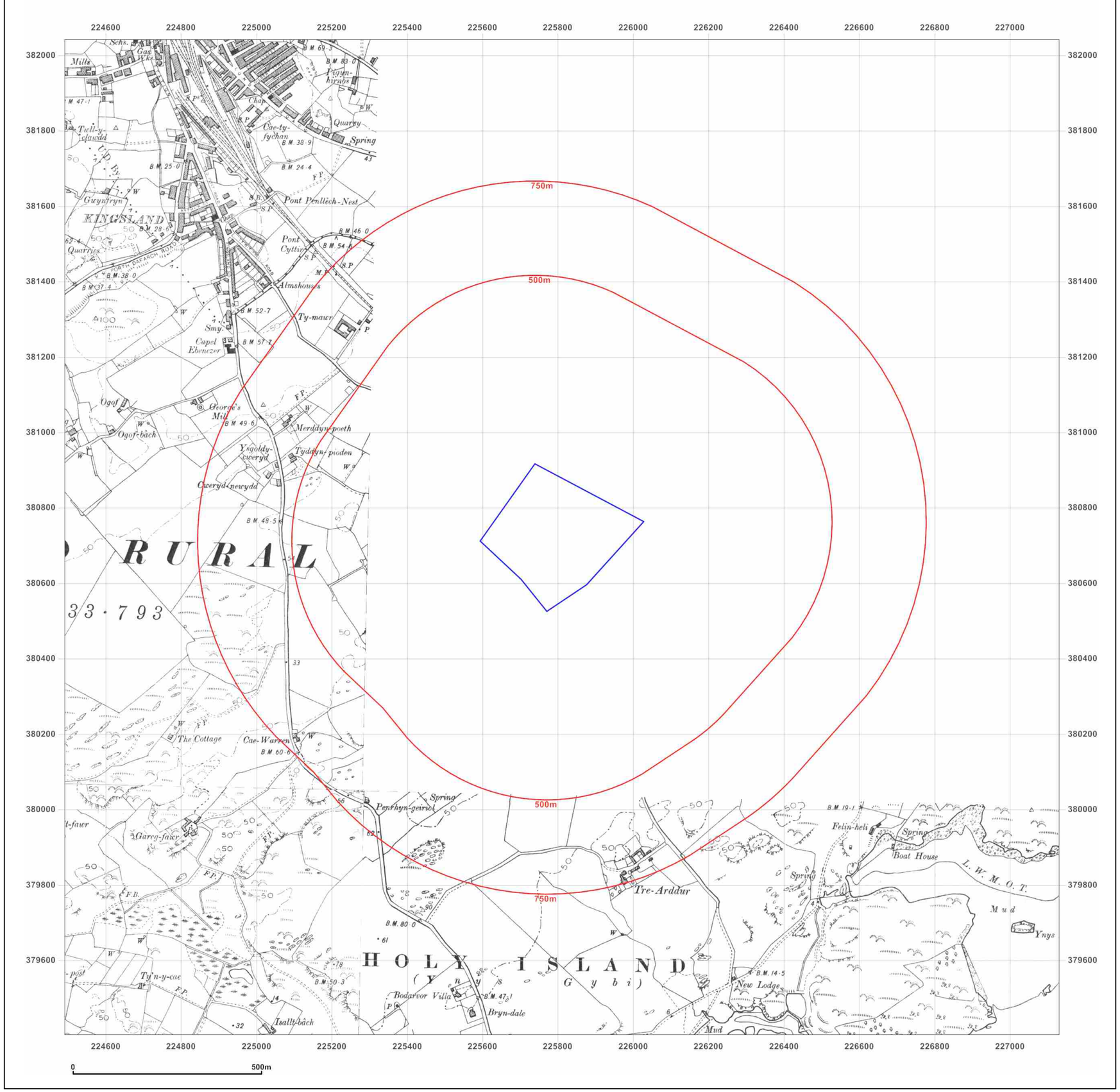
Production date: 04 May 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

Client Ref: 60PO8077_mpp2_Parc_Cybi
Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: County Series

Map date: **1899**

Scale: 1:10,560

Printed at: 1:10,560

N
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Surveyed 1887
Revised 1899
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1887
Revised 1899
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1887
Revised 1899
Edition N/A
Copyright N/A
Levelled N/A

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Production date: 04 May 2017

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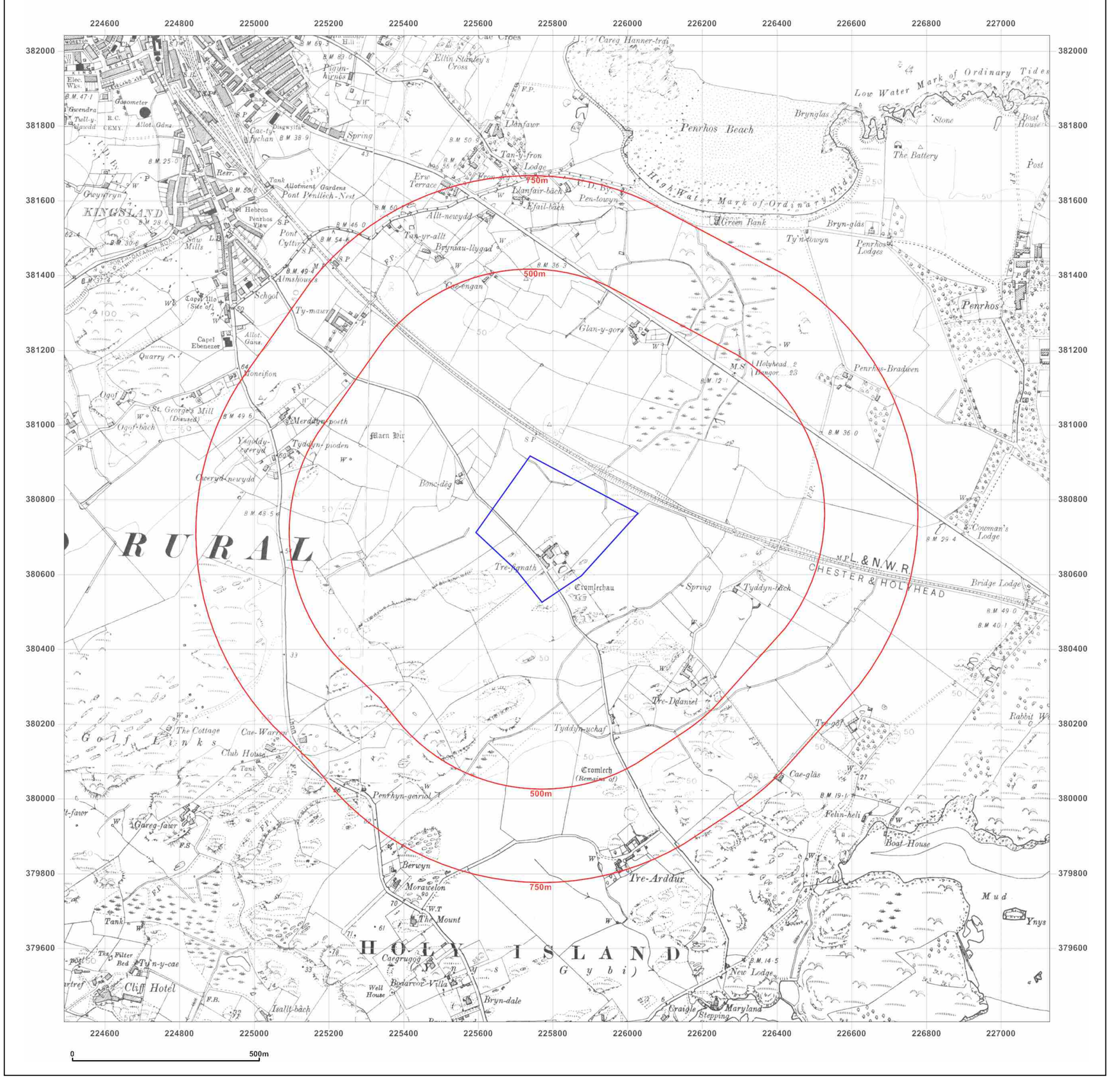

Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

Client Ref: 60PO8077_mpp2_Parc_Cybi
Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: County Series

Map date: **1923-1926**

Scale: 1:10,560

Printed at: 1:10,560

N
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Surveyed 1887
Revised 1923
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1887
Revised 1926
Edition 1926
Copyright N/A
Levelled N/A

Surveyed 1887
Revised 1926
Edition 1926
Copyright N/A
Levelled N/A

Surveyed 1887
Revised 1926
Edition 1926
Copyright N/A
Levelled N/A

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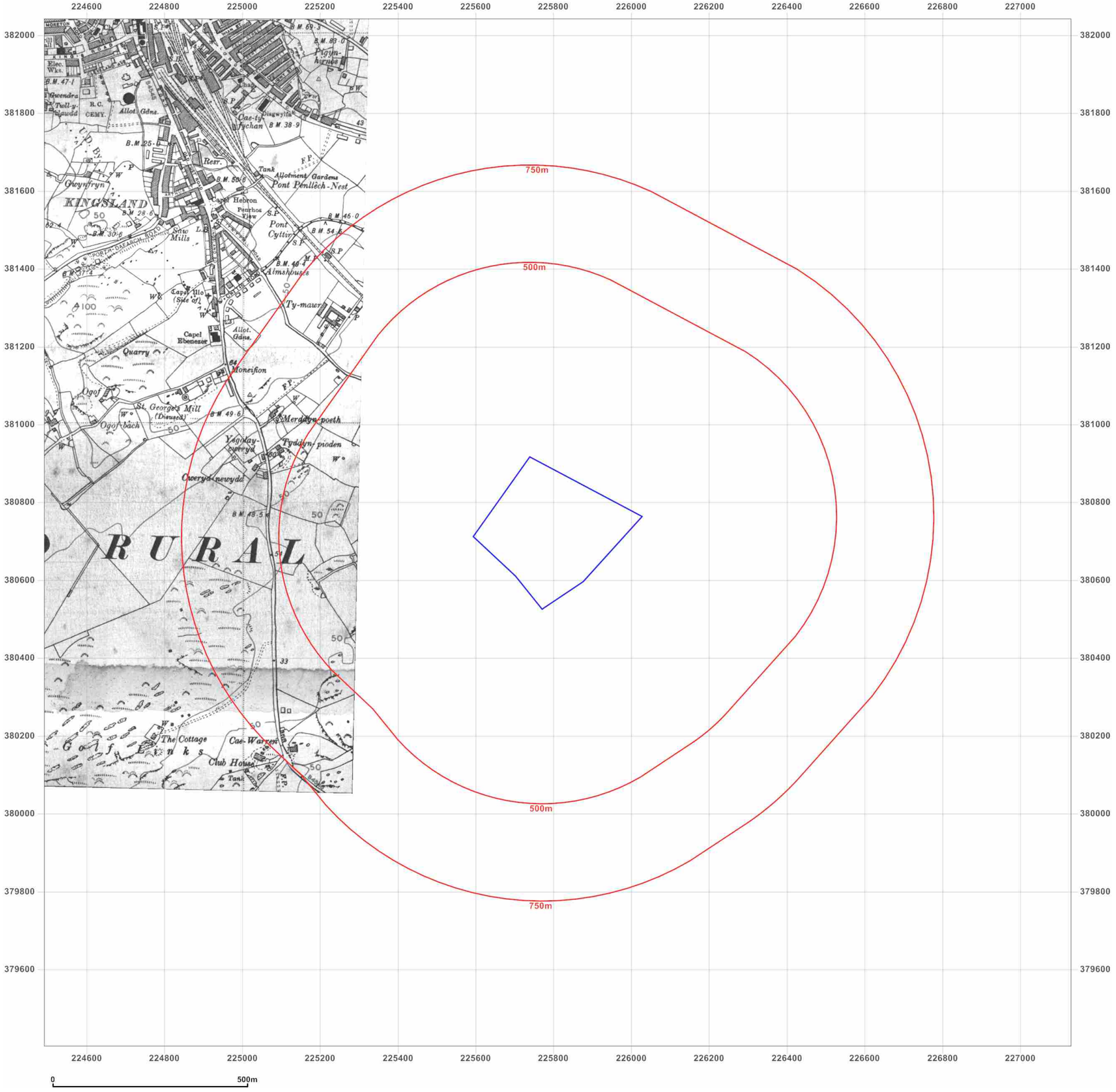
Production date: 04 May 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

Client Ref: 60PO8077_mpp2_Parc_Cybi
Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: County Series

Map date: **1938**

Scale: 1:10,560

Printed at: 1:10,560

N
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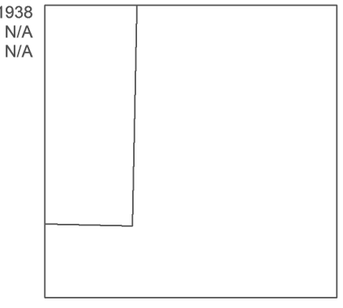
Surveyed 1887
Revised 1938
Edition 1938
Copyright N/A
Levelled N/A



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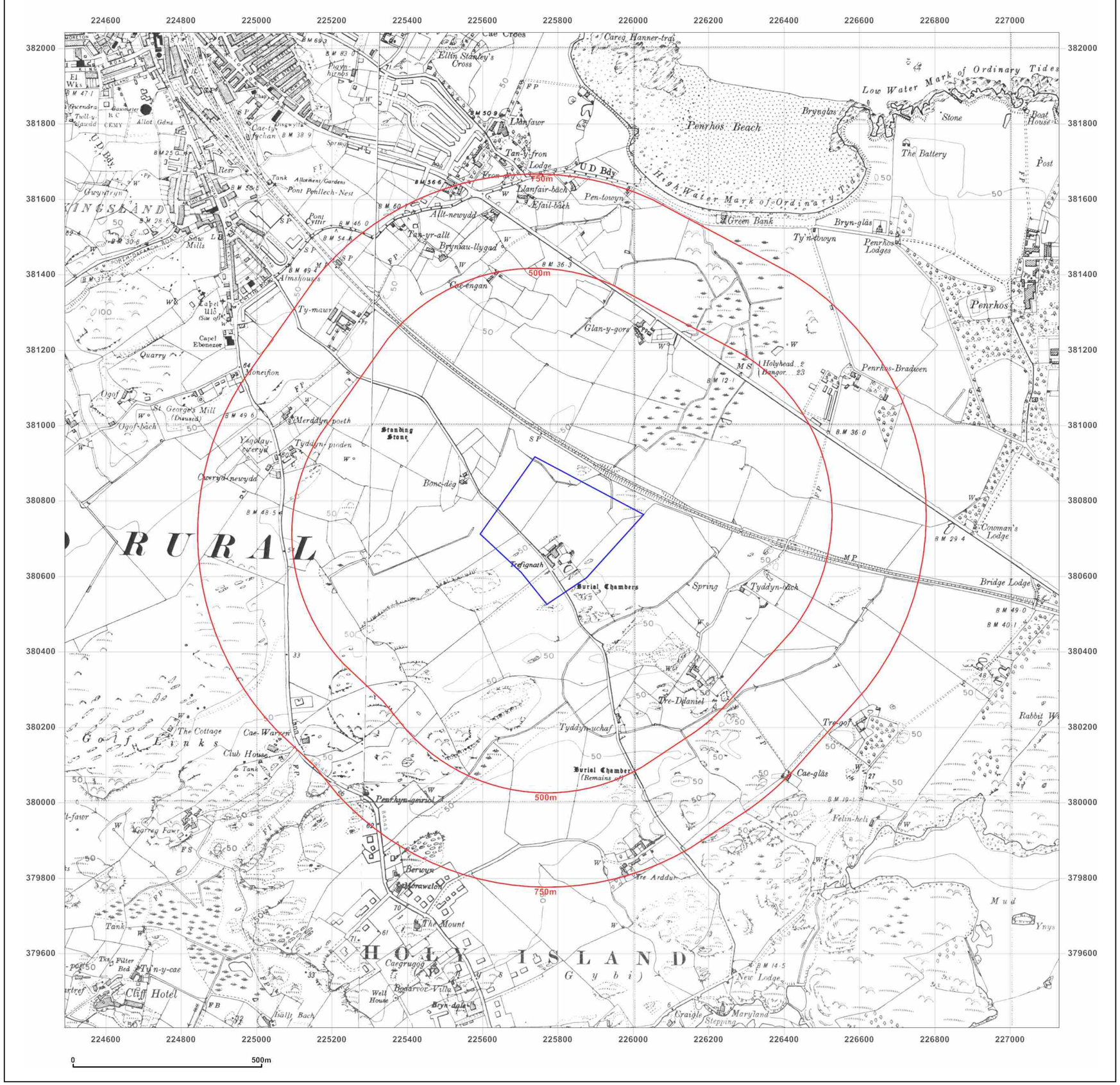
W: www.groundsure.com

Production date: 04 May 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

Client Ref: 60PO8077_mpp2_Parc_Cybi
Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: County Series

Map date: **1949**

Scale: 1:10,560

Printed at: 1:10,560

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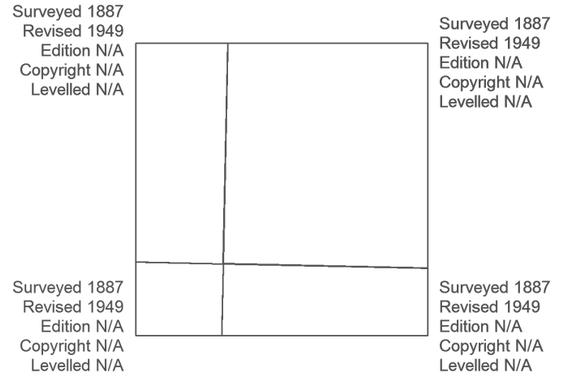

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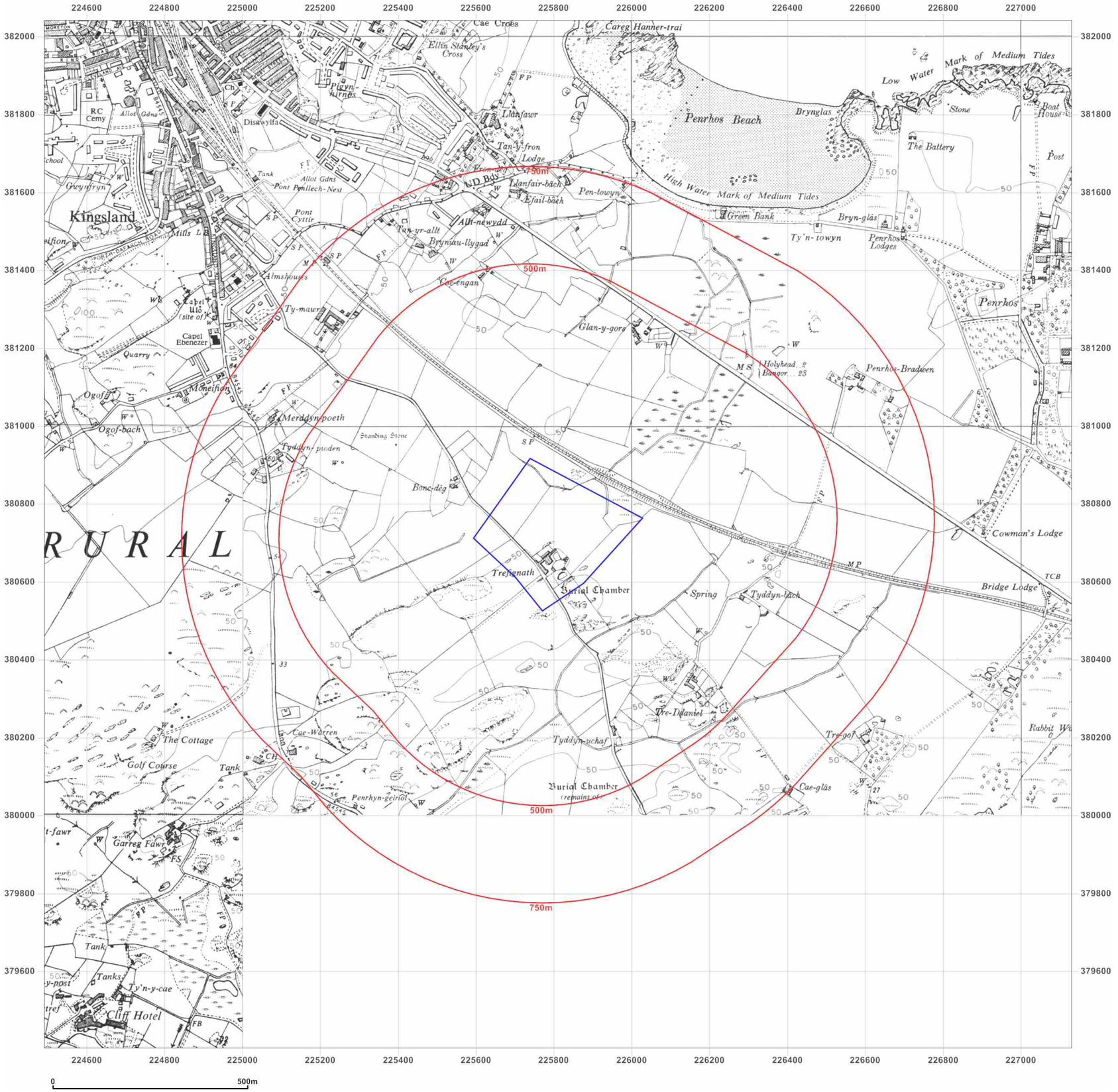

Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

Client Ref: 60PO8077_mpp2_Parc_Cybi
Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: Provisional

Map date: **1959**

Scale: 1:10,560

Printed at: 1:10,560

N
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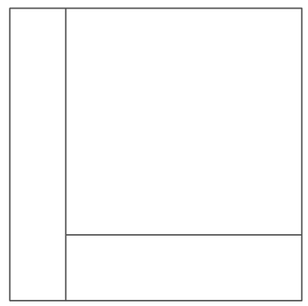
Surveyed 1959
Revised 1959
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1959
Revised 1959
Edition N/A
Copyright N/A
Levelled N/A



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W: www.groundsure.com

Production date: 04 May 2017

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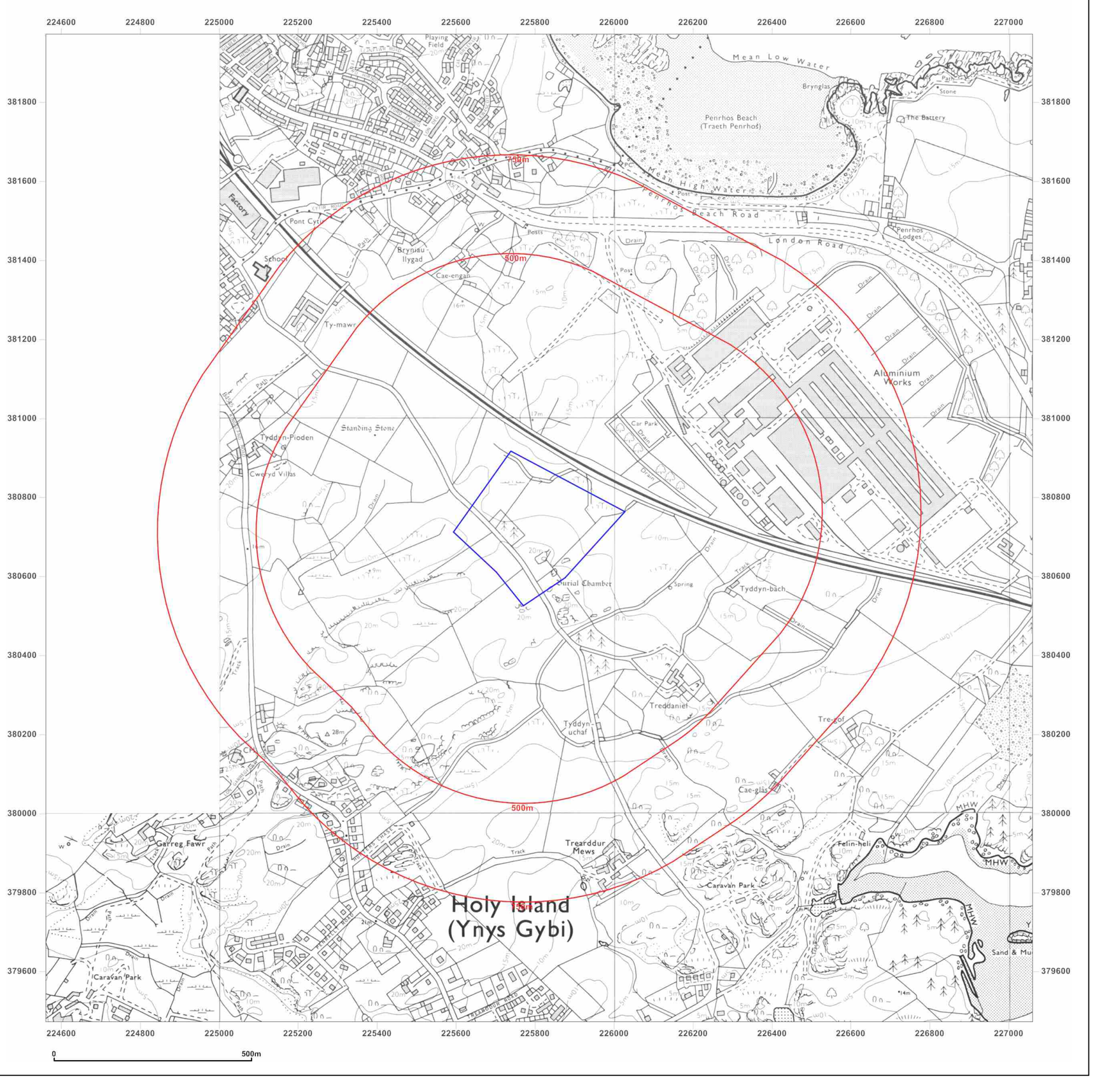

Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

Client Ref: 60PO8077_mpp2_Parc_Cybi
Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: National Grid

Map date: **1975-1979**

Scale: 1:10,000

Printed at: 1:10,000

N
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Surveyed 1973
Revised 1978
Edition N/A
Copyright 1979
Levelled 1973

Surveyed 1968
Revised 1975
Edition N/A
Copyright 1975
Levelled 1972

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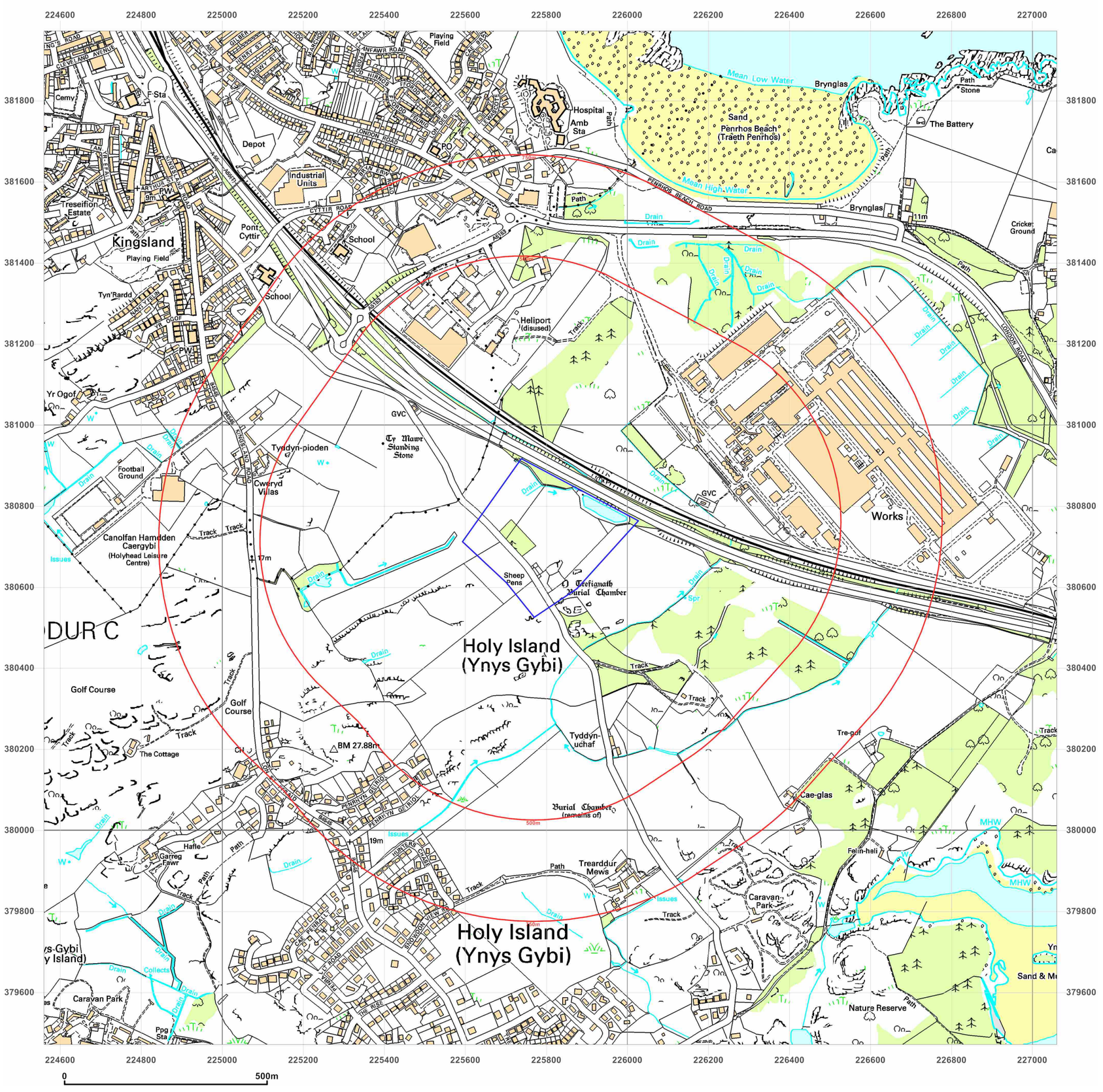
Production date: 04 May 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

Client Ref: 60PO8077_mpp2_Parc_Cybi
Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: 1:10,000 Raster

Map date: **2002**

Scale: 1:10,000

Printed at: 1:10,000

N
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2002

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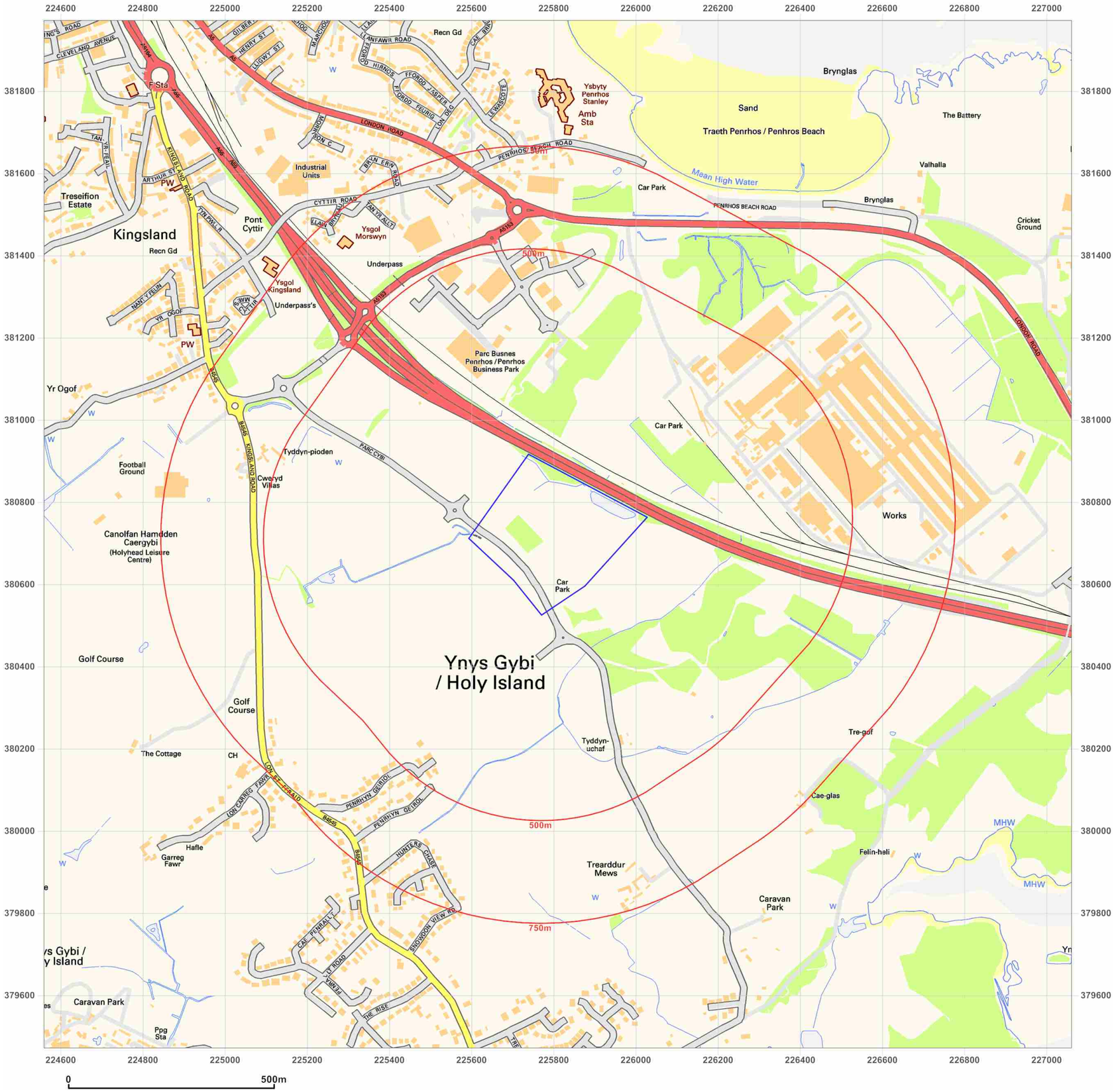
Production date: 04 May 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

Client Ref: 60PO8077_mpp2_Parc_Cybi
Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: National Grid

Map date: **2010**

Scale: 1:10,000

Printed at: 1:10,000

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2010

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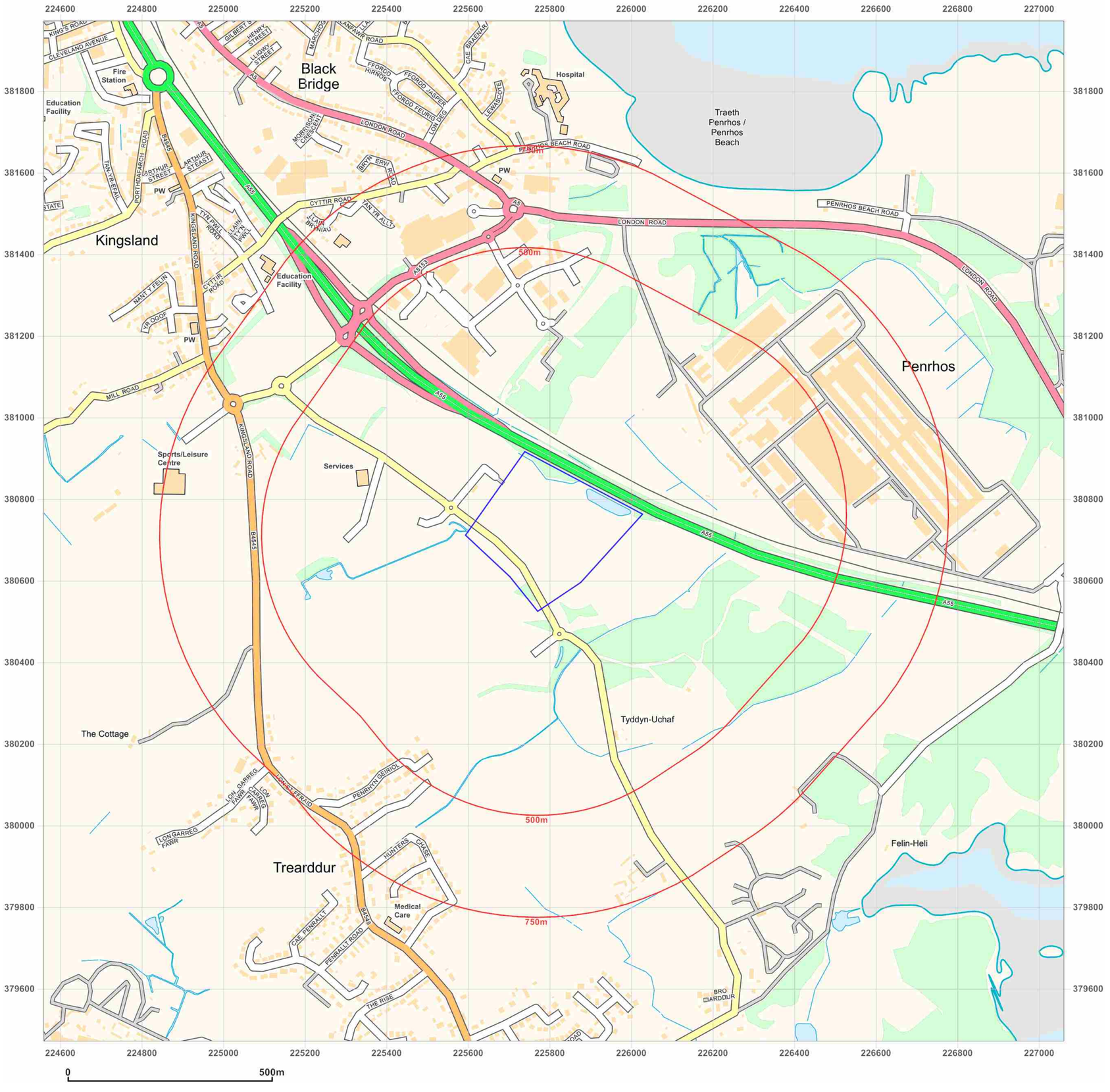
W: www.groundsure.com

Production date: 04 May 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

Client Ref: 60PO8077_mpp2_Parc_Cybi
Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: National Grid

Map date: **2014**

Scale: 1:10,000

Printed at: 1:10,000

N
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2014

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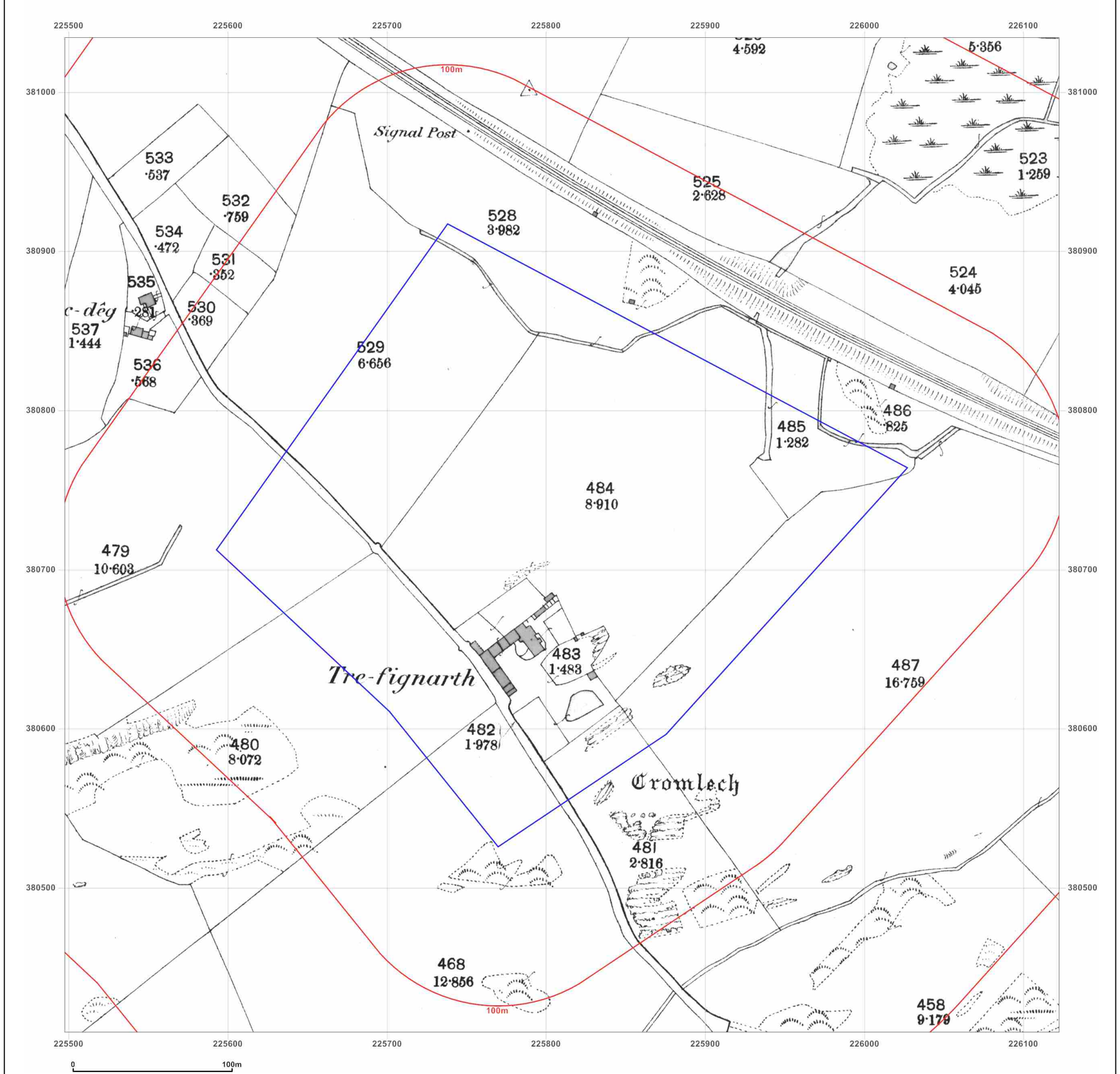
W: www.groundsure.com

Production date: 04 May 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

Client Ref: 60PO8077_mpp2_Parc_Cybi
Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: County Series

Map date: **1889**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1889
Revised 1889
Edition N/A
Copyright N/A
Levelled N/A

Powered by OS

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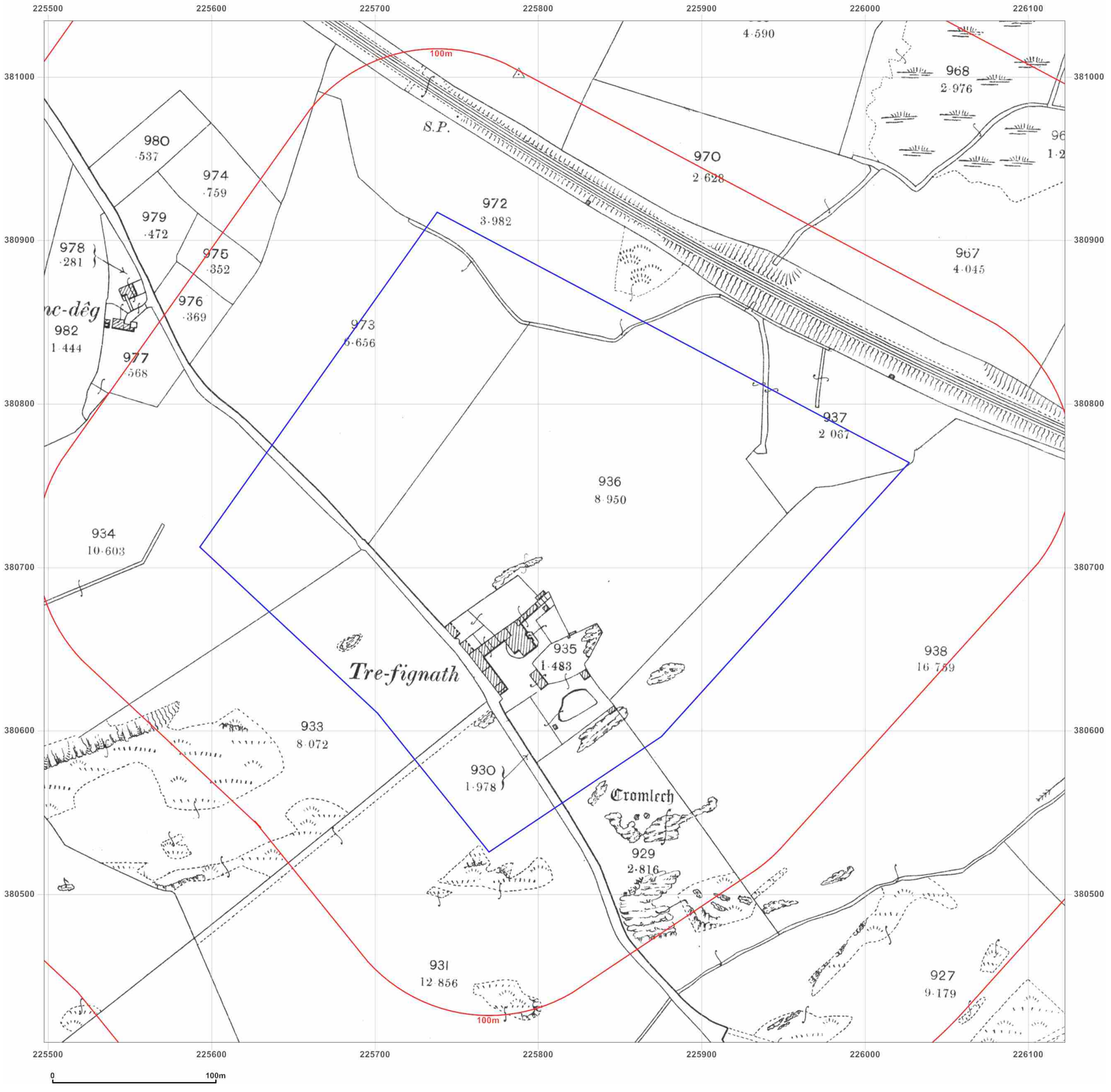
E: info@groundsure.com
W: www.groundsure.com

Production date: 04 May 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

Client Ref: 60PO8077_mpp2_Parc_Cybi
Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1900
Revised 1900
Edition N/A
Copyright N/A
Levelled N/A

Powered by

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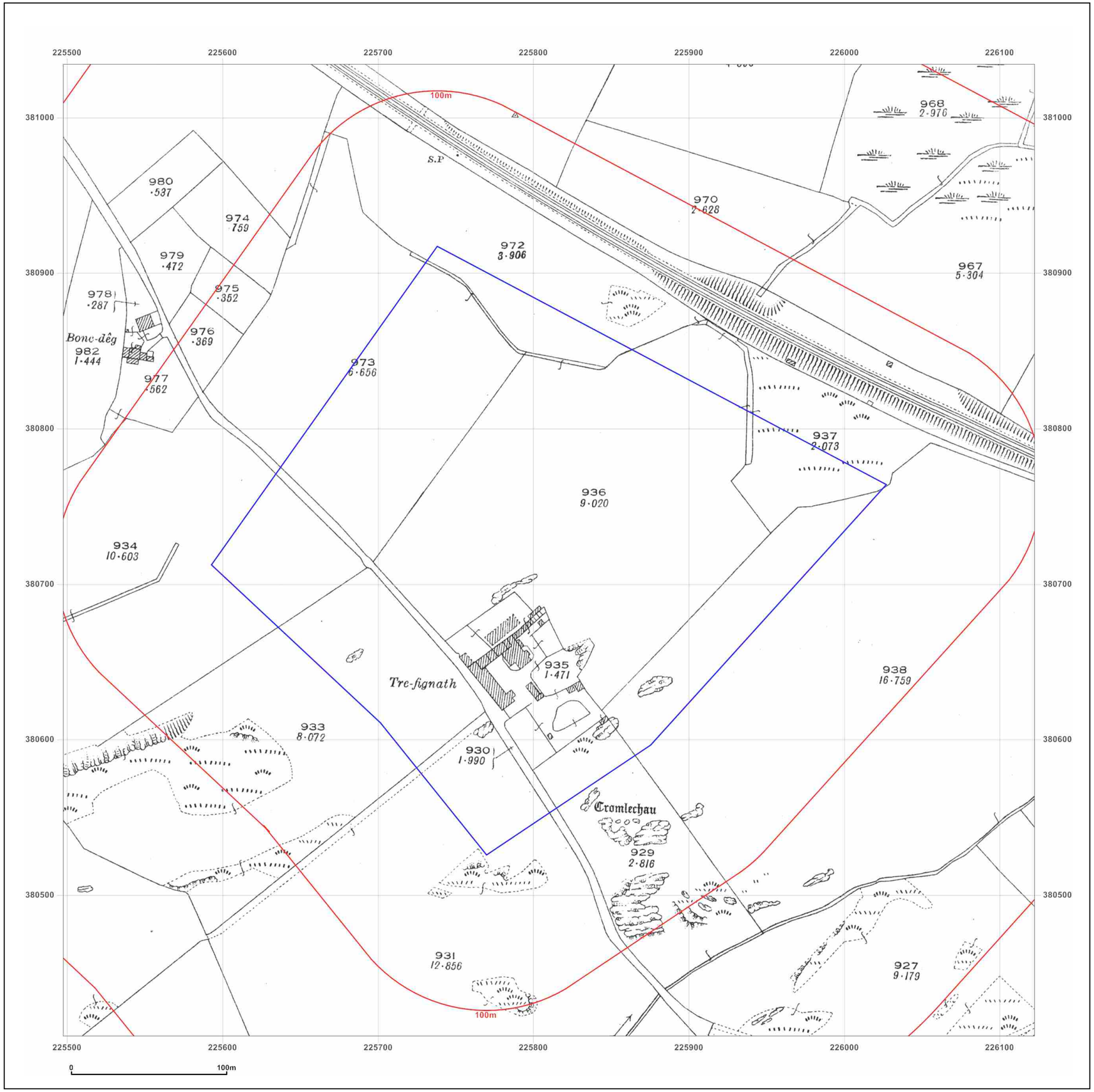
Groundsure Insights
T: 08444 159000
E: info@groundsure.com
W: www.groundsure.com

Production date: 04 May 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

Client Ref: 60PO8077_mpp2_Parc_Cybi
Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: County Series

Map date: **1924**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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Surveyed 1924
Revised 1924
Edition N/A
Copyright N/A
Levelled N/A

Powered by OS

Produced by
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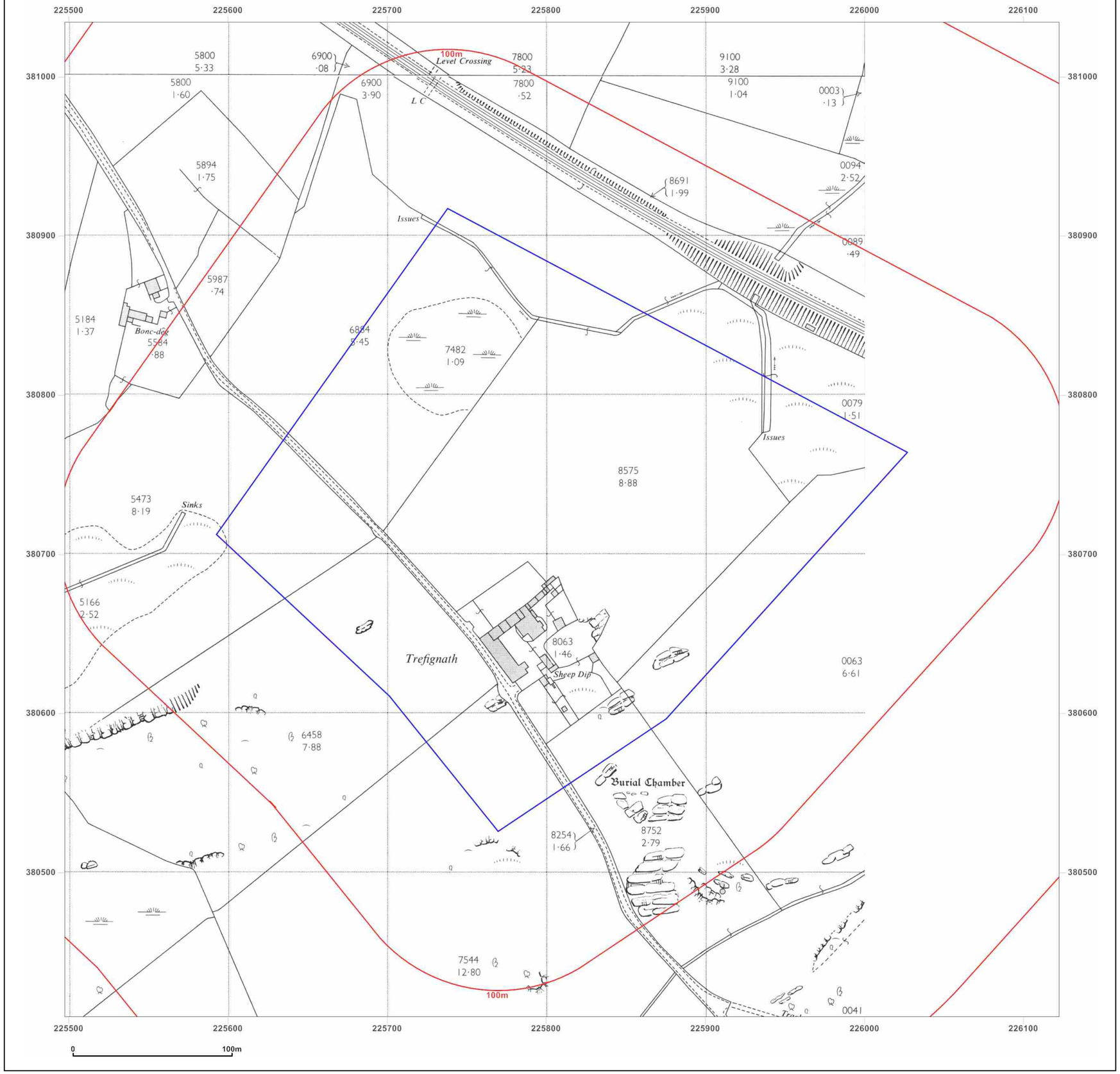
Production date: 04 May 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

Client Ref: 60PO8077_mpp2_Parc_Cybi
Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: National Grid

Map date: **1967**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1967
Revised 1967
Edition N/A
Copyright 1968
Levelled 1961

Surveyed 1967
Revised 1967
Edition N/A
Copyright 1969
Levelled 1955

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Production date: 04 May 2017

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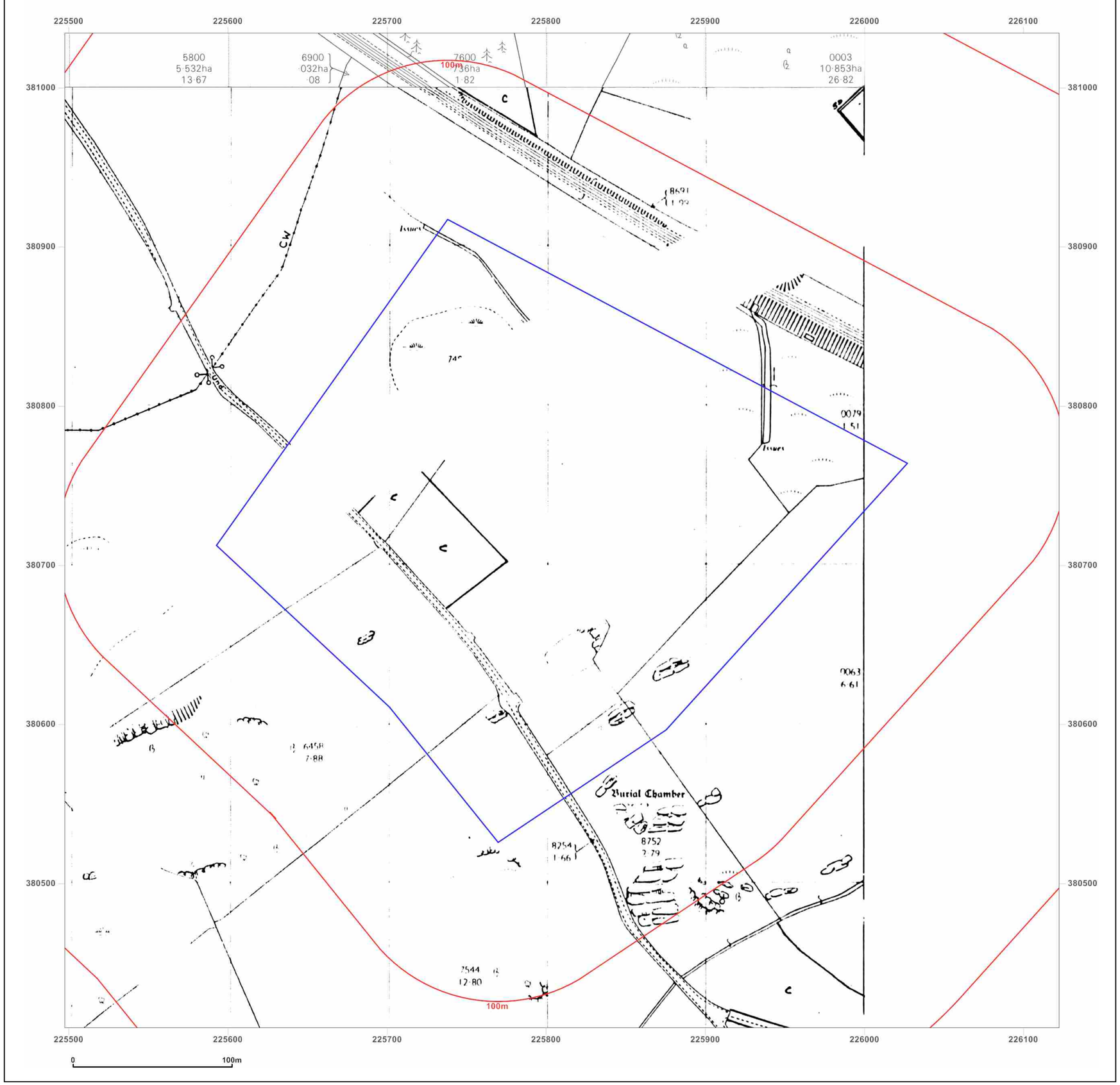

Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

Client Ref: 60PO8077_mpp2_Parc_Cybi
Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: National Grid

Map date: **1982-1986**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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Surveyed 1982
Revised 1982
Edition N/A
Copyright 1983
Levelled 1976

Surveyed 1955
Revised 1986
Edition N/A
Copyright 1986
Levelled 1955

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Production date: 04 May 2017

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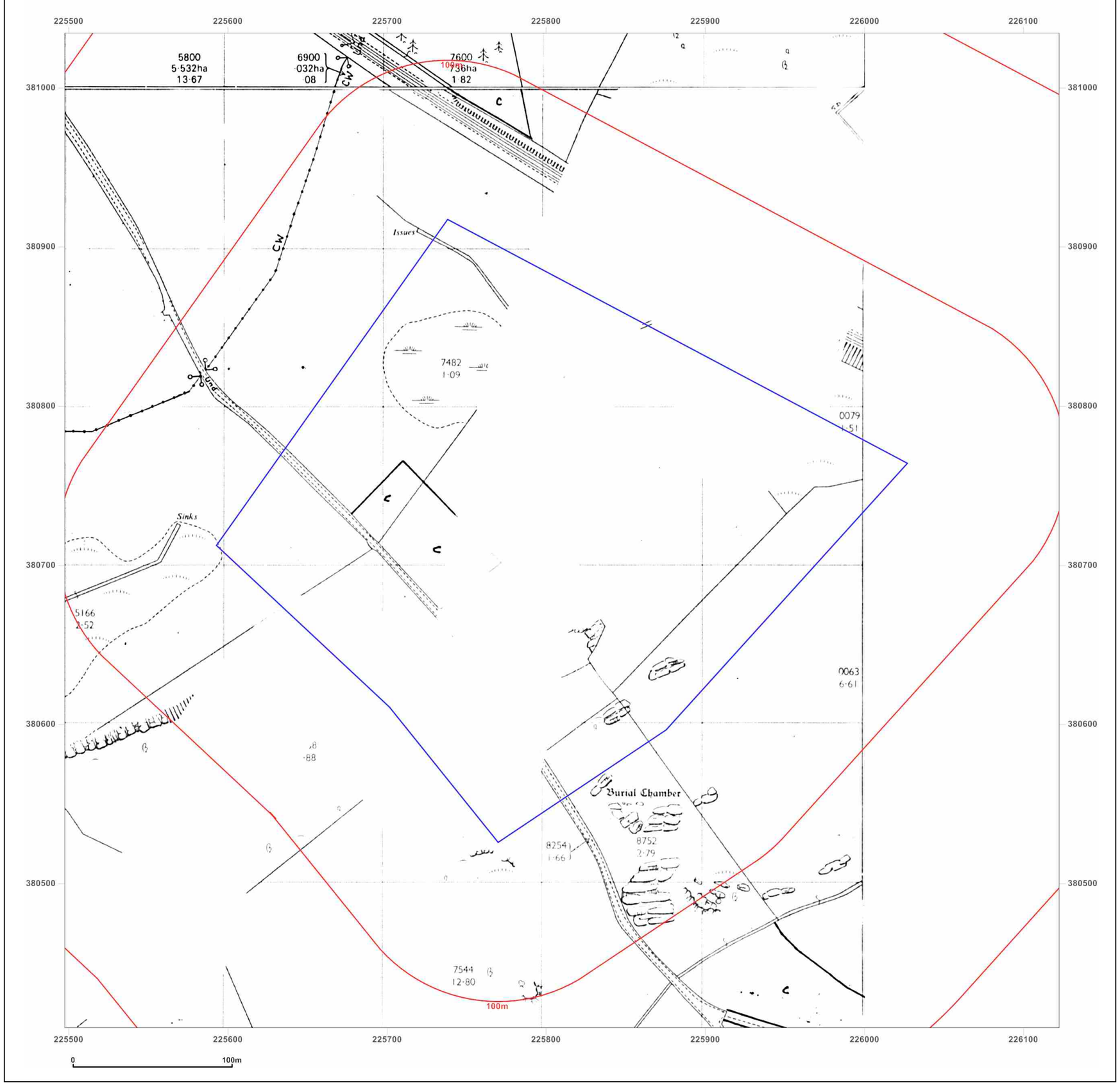

Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

Client Ref: 60PO8077_mpp2_Parc_Cybi
Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: National Grid

Map date: **1986-1987**

Scale: 1:2,500

Printed at: 1:2,500

N
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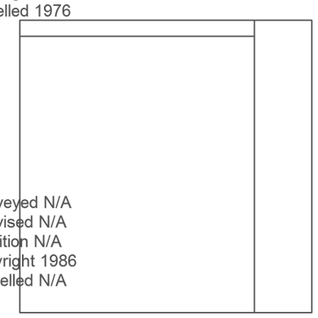
Surveyed 1976
Revised 1982
Edition N/A
Copyright 1987
Levelled 1976



Surveyed N/A
Revised N/A
Edition N/A
Copyright 1986
Levelled N/A

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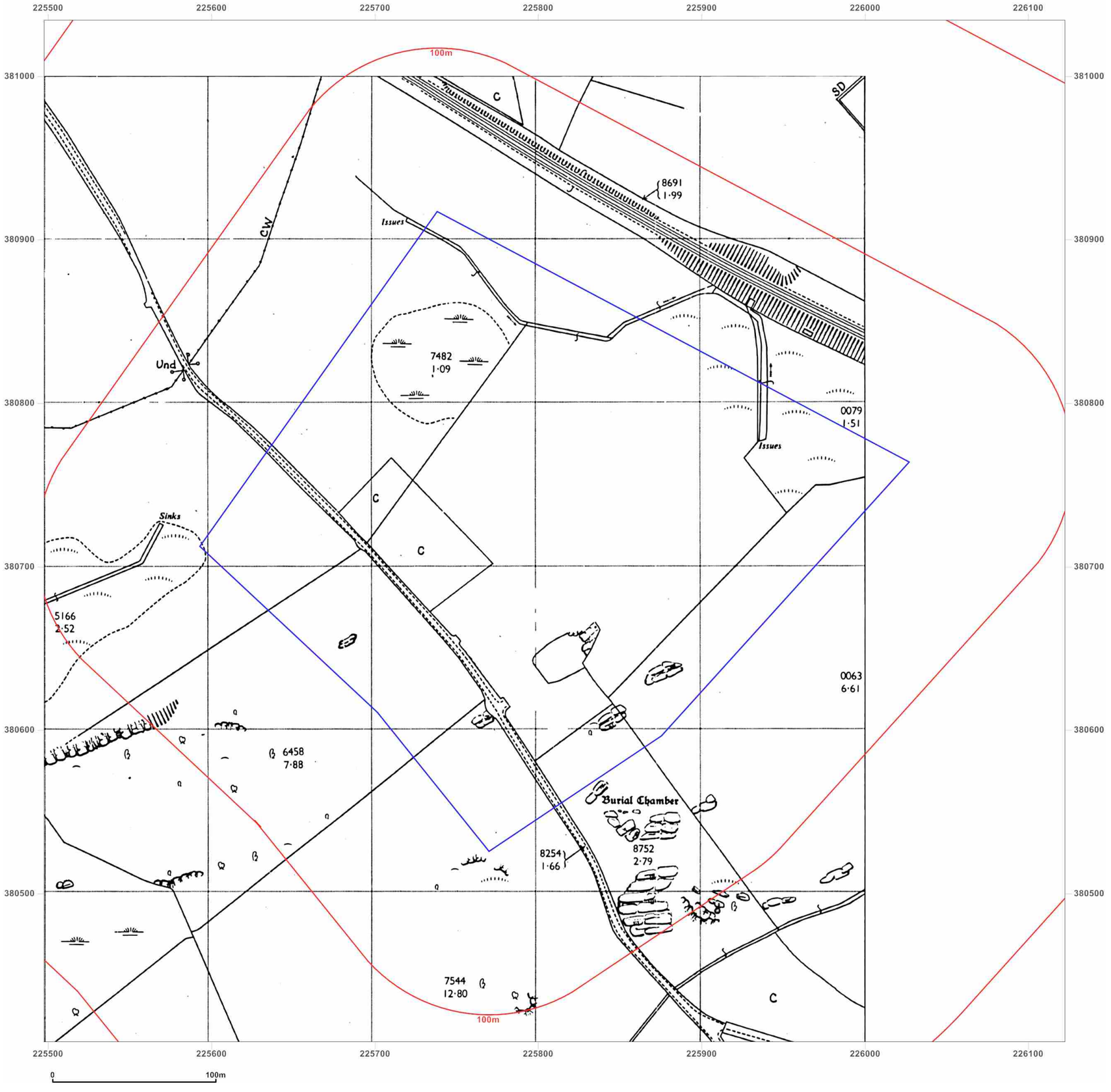
Production date: 04 May 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

Client Ref: 60PO8077_mpp2_Parc_Cybi
Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: National Grid

Map date: **1987**

Scale: 1:2,500

Printed at: 1:2,500

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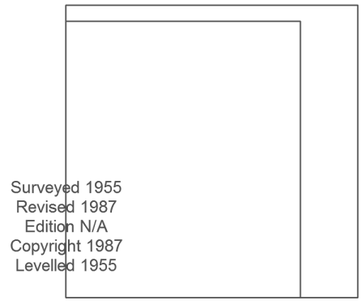

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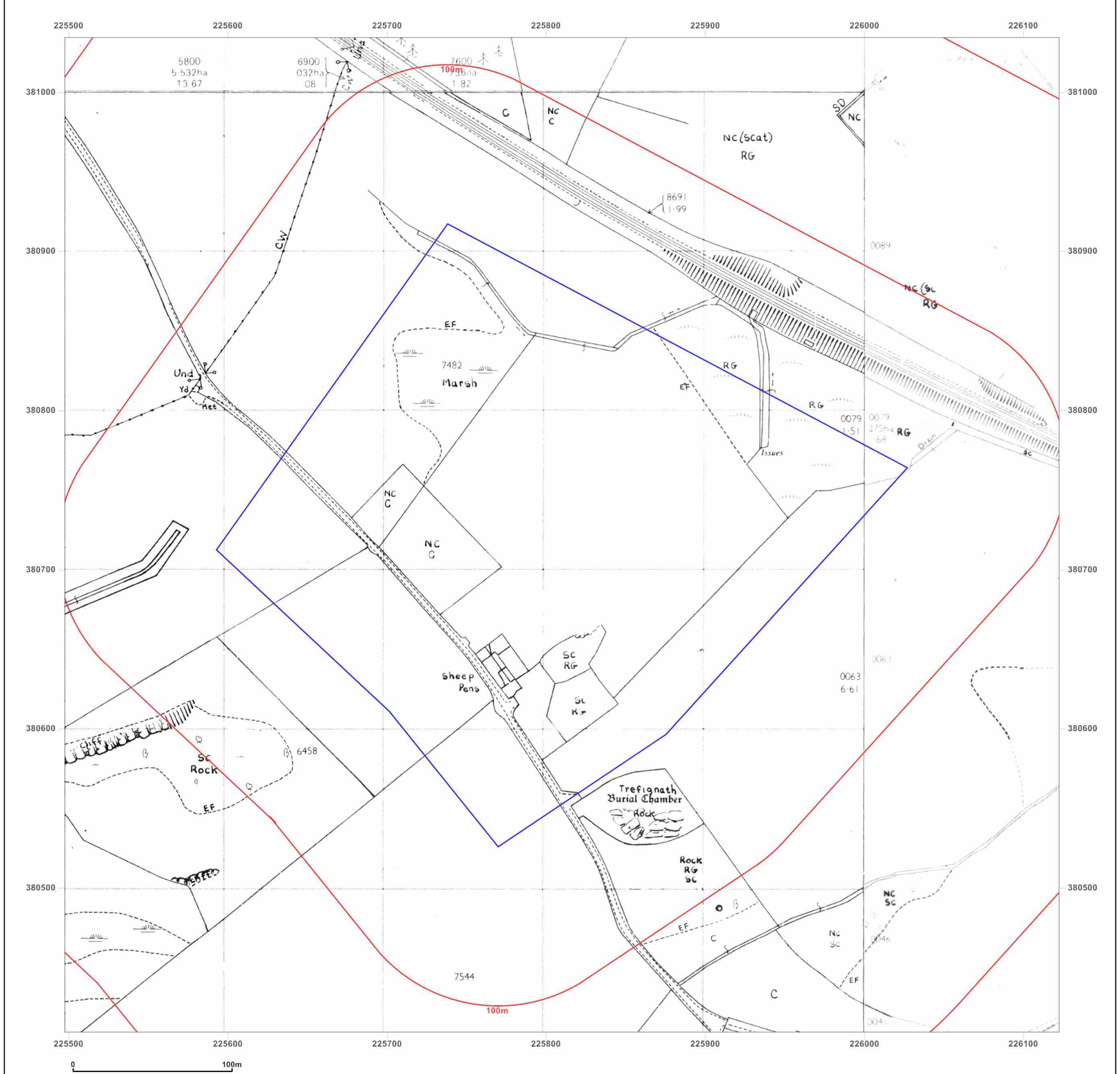
Production date: 04 May 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

Client Ref: 60PO8077_mpp2_Parc_Cybi
Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: National Grid

Map date: **1993**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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Surveyed 1976 Revised 1982 Edition N/A Copyright 1993 Levelled 1976	Surveyed N/A Revised N/A Edition N/A Copyright 1993 Levelled 1976
Surveyed 1955 Revised 1993 Edition N/A Copyright 1993 Levelled 1955	Surveyed N/A Revised N/A Edition N/A Copyright 1993 Levelled 1976

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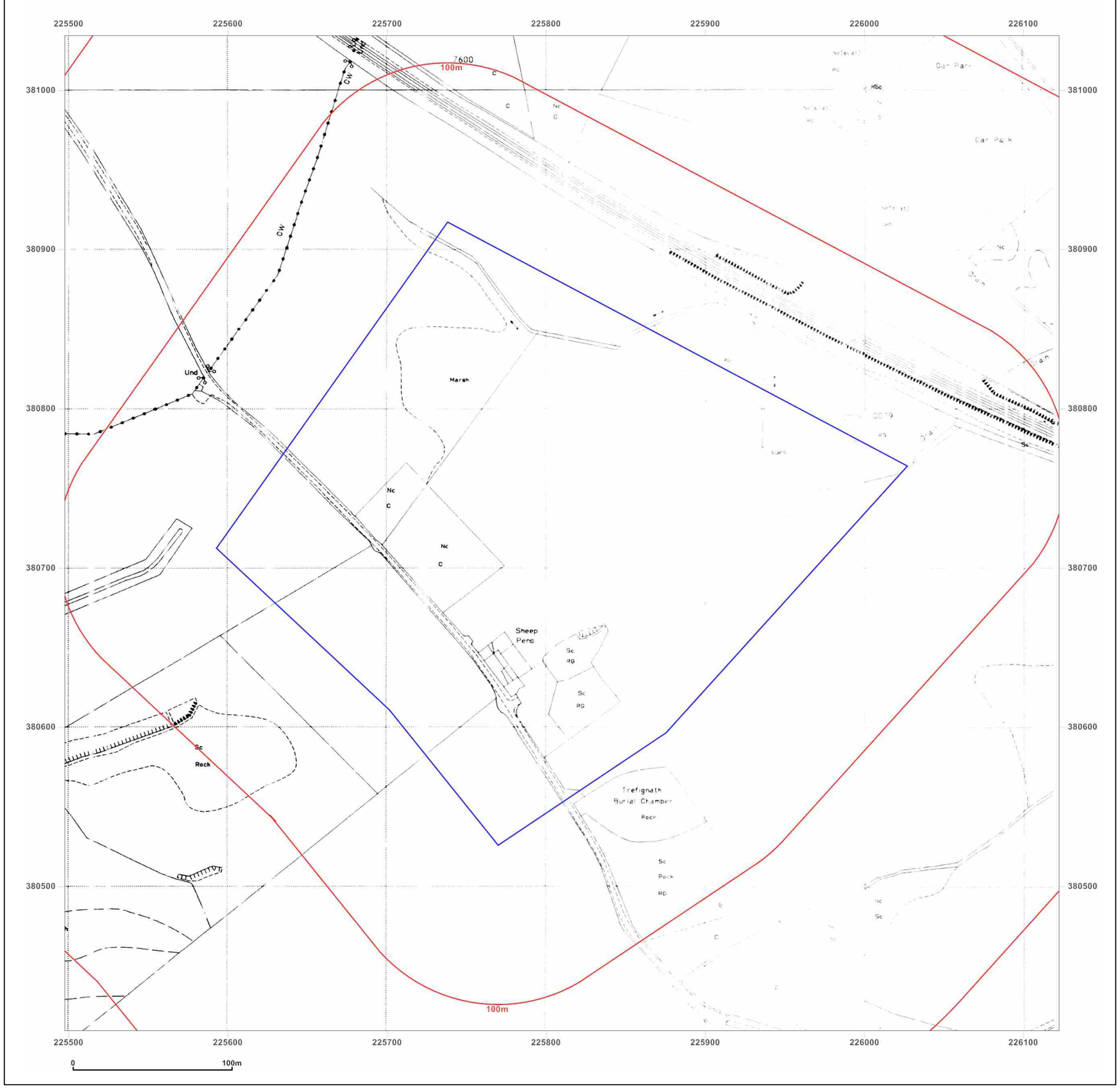
Production date: 04 May 2017

To view map legend click here *Legend*



Groundsure INSIGHTS

Site Details:

225810.09022030194,
380721.23260163126

Client Ref: 60PO8077_mpp2_Parc_Cybi
Report Ref: GS-3851524
Grid Ref: 225810, 380722

Map Name: National Grid

Map date: **1995**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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Surveyed N/A
Revised N/A
Edition N/A
Copyright 1995
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1995
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1995
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1995
Levelled N/A

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Appendix C. Site Walkover Images

C.1 An image of the hardstanding coverage in the southern area of the site.

C.2 An image of the spoil heap in the southern area of the site.

C.3 An image of the fly tipping located in the southern area of the site.

Appendix D. Detailed Unexploded Ordnance Risk Assessment

Explosive Ordnance Desktop Threat Assessment

Site: **Parc Cybi, Holyhead.**

Client: **Jacobs UK Ltd.**

Ref: **7206TA**

Date: **28th June 2017**

Dynasafe BACTEC Limited
9, Waterside Court, Galleon Boulevard, Crossways Business Park, Dartford, Kent, DA2 6NX, UK
Office: +44 (0) 1322 284 550 **www.bactec.com**

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Glossary of Terms

AAA	Anti-Aircraft Artillery
ARP	Air-raid Precautions
BDO	Bomb Disposal Officer
EOD	Explosive Ordnance Disposal (current term for “bomb” disposal)
HE	High Explosive
HG	Home Guard
IB	Incendiary Bomb
kg	Kilogram
LCC	London County Council
LM	Land Mine
LSA	Land Service Ammunition (includes grenades, mortars, etc.)
Luftwaffe	German Air Force
m bgl	Metres Below Ground Level
MoD	Ministry of Defence
OB	Oil Bomb
PM	Parachute Mine
RAF	Royal Air Force
RN	Royal Navy
SI	Site Investigation
SAA	Small Arms Ammunition (small calibre cartridges used in rifles & machine guns)
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
V-1	“Doodlebug” the first cruise type missile, used against London from June 1944. Also known as ‘Flying Bomb’.
V-2	The first ballistic missile, used against London from September 1944
WWI	First World War (1914 -1918)
WWII	Second World War (1939 – 1945)

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Executive Summary

THE SITE:

The site is centred on the approximate OS National Grid Reference: SH 25786 80749, and is located south-east of Holyhead, approximately 360m south-west of the Aluminium Works. It is bound to the north by the A55, to the east and south by open grassland, and to the west by farm buildings off Parc Cybi.

The centre of the site is occupied by an area of open ground used for agriculture / grazing. A large pond / drainage area is located in the north-eastern corner. Also, densely vegetated sections are situated towards the western extent while areas of hardstanding / compacted earth are apparent in the southern corner. Furthermore, Parc Cybi (road) runs through the southern extent of the study area.

PROPOSED WORKS:

The construction of a single building in the centre / northern extent of the site and the installation of a tank on the north-eastern boundary is proposed. The structure will include foundations to 1m bgl while the tank will require excavations to a maximum of 3m bgl. The remainder of the site will be laid to hard-standing.

Risk Assessment Methodology: In accordance with CIRIA guidelines this assessment has carried out research, analysed the evidence and considered the risks that the site has been contaminated with unexploded ordnance; that such items remained on site; that they could be encountered during any intrusive works and the consequences that could result. Appropriate risk mitigation measures have been proposed.

Explosive Ordnance Risk Rating: Taking into consideration the findings of this study, Dynasafe BACTEC considers the site to be at ***MEDIUM RISK*** from Unexploded Ordnance (UXO). This is based on the following factors:

GERMAN AIR-DELIVERED UXO:

- During WWII, Holyhead was served by a sizable harbour and railway system which were used extensively throughout the conflict. Due to Anglesey's isolated location and agricultural nature, it is likely that Holyhead would have been highlighted as the most significant Luftwaffe target in the area. Consequently, the harbour and railway were attacked on at least two occasions.
- However, the study area was located in a remote area away from central Holyhead and these targets. Anecdotal evidence suggests that no bombing occurred over the site or surrounding area.
- The site was partly occupied by farm buildings, hard-surfaced roadways and yards. A comparison between pre-and post-WWII OS mapping and WWII-era aerial photography of the site confirms that these features survived the war intact.
- Additionally, evidence of UXO will have been obvious as a UXB strike would have caused significant damage, even without detonating. Following any such incident, the damage / entry hole would have been observed and the UXB exhumed / removed.
- Had a UXB landed within pasture, dense vegetation, grassland or marshland which occupied the remainder of the site, it could conceivably have gone unobserved. Note, the entry hole of an SC50 (the most commonly deployed German bomb) could be as little as 20cm in diameter, and therefore easily obscured in these ground types. However, this scenario is considered unlikely due to the low bombing density over the area.

BRITISH / ALLIED UXO:	
Land Service Ammunition / Small Arms Ammunition	• During WWII Holyhead was defended by a series of hardened defences including a pillbox situated approximately 240m south-east of the site. • These fortifications would have been manned by local Home Guard and / or Army soldiers, who would have been issued with small arms and land service ammunition. • Experience has shown that the 'housekeeping' of WWII soldiers was often poor with items of faulty, surplus or expended UXO often burnt, buried, misplaced or otherwise discarded on requisitioned civilian land. • Furthermore, HG units often carried out anti-invasion training in open countryside or woodland on the outskirts of towns, such as the site. Therefore, it is not inconceivable that the isolated open ground on site could have been requisitioned for such use. • Therefore, the possibility of such UXO contamination within the study area cannot be entirely ruled out.
Anti-Aircraft Projectiles	No HAA batteries were situated within a 5km radius of the study area during WWII, however, anecdotal evidence confirms the presence of LAA guns in Holyhead. Unexploded AA projectiles could land several kilometres from their batteries and therefore the risk of unexploded AA shell contamination cannot be entirely ruled out.
THE RISK THAT UXO REMAINS ON SITE:	
Within the footprints of the post-war redevelopment / ground works, the risk of shallow buried UXO (especially AA shells and German 1kg incendiaries) remaining will have been partially mitigated since any such items could have been encountered and removed during excavations for foundations, services, soil stripping and levelling.	
BOMB PENETRATION ASSESSMENT:	
It has been assessed that a 500kg bomb would have had an approximate maximum bomb penetration depth of between **8-10m** below WWII ground level. Penetration depth could potentially have been greater if the UXB was larger (though only 4% of German bombs used in WWII over Britain were of that size). Note that UXBs may be found at any depth between just below the WWII ground level and the maximum penetration depth.	
RECOMMENDED RISK MITIGATION MEASURES:	
Dynasafe BACTEC recommends that the following risk mitigation measures should be deployed to support the proposed works: • Site Specific Explosive Ordnance Safety and Awareness Briefings to all personnel conducting intrusive works. • The Provision of Unexploded Ordnance Site Safety Instructions. • Non-Intrusive Magnetometer Survey and Target Investigation (greenfield land only). • Explosive Ordnance Disposal (EOD) Engineer presence on site to support shallow intrusive works (brownfield alternative to Non-Intrusive Survey).	

Should the scope of works change, please contact Dynasafe BACTEC to discuss the recommended risk mitigation measures.

Annexes

Annex A Site Location Maps

Annex B Recent Aerial Photograph

Annex C Pre and Post-WWII OS Maps

Annex D German Air-Delivered Ordnance

Annex E UXO Press Articles

Annex F Luftwaffe Target Map

Annex G WWII-era RAF Aerial Photography – August 1945

Annex H Recent UXO Incidents - Home Guard Phosphorus Incendiary Grenades

Annex I Land Service Ammunition

Annex J Small Arms Ammunition

Annex K Anti-Aircraft Artillery

Explosive Ordnance Threat Assessment

In Respect of

Parc Cybi, Holyhead

1 Introduction

1.1 Background

Jacobs has commissioned Dynasafe BACTEC Limited to conduct an Explosive Ordnance Threat Assessment for the Parc Cybi site, Holyhead, Wales.

Unexploded Ordnance (UXO) presents a significant threat to construction projects in parts of the UK as a result of enemy actions during the two 20th Century World Wars and historic British / Allied military activity.

It is estimated that over 20% of the UK landmass has been used for military training at some point and such activity can result in UXO contamination; between 2006 and 2009, over 15,000 items of mainly British / Allied ordnance (excluding small arms ammunition) were found on UK construction sites.

In addition, one of the legacies of two World Wars is buried unexploded air-dropped bombs and anti-aircraft projectiles, resulting from the failure of a proportion of such weapons to function as designed. It is commonly accepted that the failure rate of these munitions was approximately 10% and, depending on their shape, weight, velocity and ground conditions many penetrated the ground and came to rest at depth.

Intensive efforts were made during and after the war to locate and render safe all UXO but, unsurprisingly, not all were found and dealt with. This is evidenced by the regular, on-going discoveries of UXO during construction-related intrusive ground works.

As a result of a generally increased risk awareness amongst professionals involved in ground engineering works and proactive health and safety measures, the threat to life and limb from UXO has been minimised. However even the simple discovery of a suspected device during on-going works can cause considerable disruption to production and cause unwanted delays and expense.

Such risks can be more fully addressed by a better understanding of the site-specific threat and the implementation of appropriate risk mitigation measures.

2 Construction Industry Duties and Responsibilities

2.1 The UK Regulatory Environment

There is no specific legislation covering the management and control of the UXO risk in the UK construction industry but issues regarding health and safety are addressed under a number of regulatory instruments, as outlined below.

In practice, the regulations impose a responsibility on the construction industry to ensure that they discharge their obligations to protect those engaged in ground-intrusive operations (such as archaeology, site investigation, drilling, piling or excavations) from any reasonably foreseeable UXO risk.

2.2 The Health and Safety at Work Act, 1974

The Act places a duty of care on an employer to put in place safe systems of work to address, as far as is reasonably practicable, all risks (to employees and the general public) that are reasonably foreseeable.

2.3 Construction (Design and Management) Regulations 2015

CDM 2015 ensures that health and safety within the construction industry is continually improved:

- Works are sensibly planned and managed.
- Competent staff are engaged in the works.
- Risks are identified and managed.
- All parties cooperate and coordinate activities.
- Communication flows to those who require it.
- Workers are consulted and engaged about risks and how they are being managed.

In line with CDM 2015 legislation, Dynasafe BACTEC Limited are able to assist parties in their discharge of CDM duties as follows:

- Assist Principal Designers with pre-construction information and risk assessments
- Assist the Designer with the Designer's Risk Assessment.
- Issue UXO risks as have been identified, and manage risks accordingly.
- Assist the Principal Contractor with the construction phase information, in particular risk assessments and mitigation strategies.
- Plan, manage and monitor survey and clearance works under Dynasafe BACTEC Limited's control.

2.4 Other Legislation

Other relevant legislation includes the "Management of Health and Safety at Work Regulations 1999" and "The Corporate Manslaughter and Corporate Homicide Act 2007".

3 The Role of the Authorities and Commercial Contractors

3.1 The Authorities

The Police have the responsibilities for co-ordinating the emergency services in the case of an ordnance-related incident on a construction site. They will make an initial assessment (i.e. is there a risk that the find is ordnance or not?) and if they judge necessary impose a safety cordon and/or evacuation and call the military authorities (JSEODOC - Joint Services Explosive Ordnance Disposal Operations Centre) to arrange for investigation and/or disposal. In the absence of an EOD specialist on site many Police Officers will use the precautionary principle, impose cordon(s)/evacuation and await advice from the JSEODOC.

The priority given to the request by JSEODOC will depend on their judgement of the nature of the threat (ordnance, location, people and assets at risk) and the availability of resources. They will respond immediately or as resources are freed up. Depending on the on-site risk

assessment the item of ordnance may be removed or demolished (by controlled explosion) in situ. In the latter case additional cordons and/or evacuations may be necessary.

Note that the military authorities will only carry out further investigations or clearances in very high profile or high-risk situations. If there are regular ordnance finds on a site, the JSEODOC may not treat each occurrence as an emergency and will encourage the construction company to put in place alternative procedures (i.e. the appointment of a commercial contractor) to manage the situation and relieve pressure from the JSEOD disposal teams.

3.2 Commercial Contractors

In addition to pre-construction site surveys and follow-on clearance work, a commercial contractor is able to provide a reactive service on construction sites. The presence of a qualified EOD Engineer with ordnance recognition skills will avoid unnecessary call-outs to the authorities and the Contractor will be able to arrange for the removal and disposal of low risk ordnance. If high risk ordnance is discovered actions will be co-ordinated with the authorities with the objective of causing the minimum possible disruption to site operations whilst putting immediate, safe and appropriate measures in place.

4 This Report

4.1 Aims and Objectives

The aim of this report is to examine the possibility of encountering any explosive ordnance during any intrusive works along the Parc Cybi, Holyhead site. Risk mitigation measures will be recommended, if deemed necessary, to eliminate or reduce the threat from explosive ordnance during the envisaged works. The report follows the CIRIA Guidelines.

The following issues will be addressed in the report:

- The risk that the site was contaminated with unexploded ordnance.
- The risk that UXO remains on site.
- The risk that ordnance may be encountered during any intrusive works.
- The risk that ordnance may be initiated.
- The consequences of initiating or encountering ordnance.

Risk mitigation measures, appropriate to the assessed level of risk and site conditions, will be recommended if required.

4.2 Approach

In preparing this Explosive Ordnance Threat Assessment Report, Dynasafe BACTEC has considered general and, as far as possible, site specific factors including:

- Evidence of German bombing and delivery of UXBs.
- Site history, occupancy and conditions during WWII.
- The legacy of Allied military activity.
- Details of any known EOD clearance activity.
- The extent of any post war redevelopment.
- Scope of the current proposed works.

4.3 Sources of Information

Dynasafe BACTEC has carried out detailed historical research for this Explosive Ordnance Threat Assessment including accessing military records and archived material held in the public domain and in the MoD.

Material from the following sources has been consulted:

- The National Archives.
- The National Museums and Galleries of Wales.
- Council for British Archaeology.
- Cartographics, Llywodraeth Cymru.
- Available material from 33 Engineer Regiment (EOD) Archive.
- Relevant information supplied by Jacobs.
- Dynasafe BACTEC's extensive archives built up over many years of research and hands-on Explosive Ordnance Disposal activities in the UK.
- Open sources such as published books, local historical records and the internet.

4.4 General Considerations

This report is based upon research of historical evidence. Whilst every effort has been made to locate all relevant material Dynasafe BACTEC cannot be held responsible for any changes to the assessed level of risk or risk mitigation measures based on documentation or other information that may come to light at a later date.

The accuracy and comprehensiveness of wartime records is frequently difficult or impossible to verify. As a result, conclusions as to the exact location, quantity and nature of the ordnance threat can never be definitive but must be based on the accumulation and careful analysis of all accessible evidence. Dynasafe BACTEC cannot be held responsible for inaccuracies or gaps in the available historical information.

4.5 Bombing Records

During WWII, considerable efforts were expended in recording enemy air raids. Air Raid Precautions (ARP) wardens were responsible for making records of bomb strikes either through direct observation or by post-raid surveys. However, their immediate priority was to deal with casualties and limit damage, so it is to be expected that records are often incomplete and sometimes contradictory. Record keeping in the early days of bombing was not comprehensive and details of bombing in the early part of the war were sometimes destroyed in subsequent attacks. Some reports may cover a single attack, others a period of months or the entire war.

Records of raids that took place on sparsely or uninhabited areas were often based upon third party or hearsay information and are not always reliable; records of attacks on military or strategic targets were often maintained separately from the general records and have not always survived.

5 The Site

5.1 Site Location

The site is located south-east of Holyhead, approximately 360m south-west of the Aluminium Works. It is bound to the north by the A55, to the east and south by open grassland, and to the west by farm buildings off Parc Cybi.

The site is centred on the approximate OS National Grid Reference: SH 25786 80749.

Site Location Maps are presented in ***Annex A***.

5.2 Site Description

The centre of the site is occupied by an area of open ground used for agriculture / grazing. A large pond / drainage area is located in the north-eastern corner. Also, densely vegetated sections are situated towards the western extent while areas of hardstanding / compacted earth are apparent in the southern corner. Furthermore, Parc Cybi (road) runs through the southern extent of the study area.

A Recent Aerial Photograph of the site presented in ***Annex B***.

6 Scope of the Proposed Works

The construction of a single building in the centre / northern extent of the site and the installation of a tank on the north-eastern boundary is proposed. The structure will include foundations to 1m bgl while the tank will require excavations to a maximum of 3m bgl. The remainder of the site will be laid to hard-standing.

7 Ground Conditions

Ground Investigation data for the site was provided by Jacobs[1]. Data taken from several trial pits sunk on site records the following geology:

- 0.3m - 1.3m of Made Ground (clayey, gravelly, cobbly medium to coarse sand with boulders and clay. Includes slate, concrete, red brick and tile)
- 0.25m – 1.0m of Topsoil (sand, with varying proportions of clay, gravel, cobbles, boulders of schist, quartzite and slate)
- 0.2m – 3.88m of Glacial Till (medium dense to dense clayey gravelly cobbly sand with boulders, medium dense to loose slightly clayey medium to coarse sand and loose medium sand, medium dense to dense clayey sandy cobbly gravel with boulders, medium to high strength soft to firm sandy gravelly clay)
- 0.4m – 1.6m of Glacial Till (silty fine sand with closely spaced laminations and slightly gravelly fine to coarse sand)
- >1.05m of New Harbour Group bedrock (sand / gravel)

[1] *Tier Consult, A Ground Investigation Report for Zone 7, Parc Cybi, Holyhead, Anglesey, 2015*

8 Site History

8.1 Historical OS Mapping

Latest available pre-WWII and earliest available post-WWII OS maps were obtained from Groundsure Ltd. These are presented in ***Annex C*** and described below:

8.1.1 Pre-War

The 1924 (1:2,500 scale) map shows the site to be predominantly occupied by farmland with a series of buildings, likely a farm complex, at its centre. An unnamed roadway runs across the site, to the site south of the aforementioned structures. Additionally, two streams / drains are situated within the northern section of the site, occupying an area of rough pasture. A small area of denser vegetation (furze / rough pasture) is located in the south-eastern extent. The south-eastern site boundary also encroaches onto a *Cromlechau* (burial chamber / tomb) while a *Tre-fignarth* (Neolithic chambered tomb) is also labelled.

The surrounding area is shown to be a mixture of agricultural / rural in nature.

8.1.2 Post-War

The 1967 (1:2,500 scale) map shows no significant structural changes on site. A *Sheep Dip* is now identified within the farm buildings, and the *Cromlechau* is now labelled *Burial Chamber* (archaeological site). A small area of marshland is evident in the north-western section. Note, that the north-eastern extent of the site is not covered by the OS data, however would appear to be open farmland.

9 The Threat from Aerial Bombing

9.1 General Bombing History of North Wales

9.1.1 First World War

There is no evidence to indicate that Wales suffered aerial bombardment during WWI. Consequently, there is not considered to be a threat from WWI UXBs and therefore such items will not be further addressed in this report.

9.1.2 Second World War

The Luftwaffe bombing campaign in northern Wales began in May 1940, when three Luftwaffe Heinkel 111s bombed the region and eventually crashed in separate incidents over Wrexham, Malpas in Denbighshire, and Bagillt, Flint. Then in the Summer and Autumn of 1940 the Luftwaffe planned to destroy key military installations, including RAF airfields and Royal Navy bases, during a series of daylight bombing raids, mainly in southern / eastern England – The Battle of Britain.

After this campaign, which did not have a great effect on Northern Wales, German tactics were modified to include both economic and industrial sites across the whole UK. Targets included dock facilities, railway infrastructure, power stations, weapon manufacturing plants and gas works.

As a result of aircraft losses, daylight raids were reduced in favour of attacking targets under the cover of darkness. During this period merchant navy convoys were also targeted in the narrow mine swept coastal channels in the Irish Sea.

As the war progressed the strategy changed to one of attempting to destroy the morale of the civilian population by the “carpet bombing” of London and several other major British cities, including Swansea, Cardiff and Liverpool. In Wales, the vast majority of ordnance was dropped on the former two conurbations, however many other towns and isolated targets also experienced air raids.

By May 1941, concentrated attacks on both land targets and shipping ceased as the Luftwaffe was diverted east to prepare for ‘Operation Barbarossa’, the invasion of the Soviet Union. By the end of the conflict 984 people had been killed and 1,221 seriously injured in Wales.

9.2 Generic Types of WWII German Air-delivered Ordnance

The nature and characteristics of the ordnance used by the Luftwaffe allows an informed assessment of the hazards posed by any unexploded items that may remain today. Detailed illustrations of German air delivered ordnance are presented at ***Annex D***.

- HE Bombs: In terms of weight of ordnance dropped, HE bombs were the most frequent weapon deployed. Most bombs were 50kg, 250kg or 500kg (overall weight, about half of which was the high explosive) though large bombs of up to 2,000kg were also used. HE bombs had the weight, velocity and shape to easily penetrate the ground intact if they failed to explode. Post-raid surveys would not always have spotted the entry hole or other indications that a bomb penetrated the ground and failed to explode and contemporary ARP documents describe the danger of assuming that damage, actually caused by a large UXB, was due to an exploded 50kg bomb. Unexploded HE bombs therefore present the greatest risk to present–day intrusive works.
- Blast Bombs/Parachute Mines: Blast bombs generally had a slow rate of descent and were extremely unlikely to have penetrated the ground. Non-retarded mines would have shattered on most ground types, if they had failed to explode. There have been extreme cases when these items have been found unexploded, but this was where the ground was either very soft or where standing water had reduced the impact. BACTEC does not consider there to be a significant threat from this type of munition on land.
- Large incendiary bombs: This type of bomb ranged in size from 36kg to 255kg and had a number of inflammable fill materials (including oil and white phosphorus), and a small explosive charge. They were designed to explode and burn close to the surface but their shape and weight meant that they did have penetration capability. If they penetrated the ground complete combustion did not always occur and in such cases, they remain a risk to intrusive works.
- 1kg Incendiary Bombs (IB): These bombs, which were jettisoned from air-dropped containers, were unlikely to penetrate the ground and in urban areas would usually have been located in post-raid surveys. However, if bombs did not initiate and fell in water or dense vegetation, or became mixed with rubble in bomb damaged areas they could have been overlooked. Some variants had explosive heads and these present a risk of detonation during intrusive works.
- Anti-personnel (AP) Bomblets: AP bombs had little ground penetration ability and should have been located by the post-raid survey unless they fell into water, dense vegetation or bomb rubble.
- Specialist Bombs (smoke, flare, etc): These types do not contain high explosive and therefore a detonation consequence is unlikely. They were not designed to penetrate the ground.

9.3 German Air-delivered Ordnance Failure Rate

Based on empirical evidence, it is generally accepted that 10% of the German HE bombs dropped during WWII failed to explode as designed. This estimate is probably based on the statistics of wartime recovered UXBs and therefore will not have taken account of the unknown numbers of UXBs that were not recorded at the time, and is probably an underestimate.

The reasons for failures include:

- Fuze or gaine malfunction due to manufacturing fault, sabotage (by forced labour) or faulty installation.
- Clockwork mechanism failure in delayed action bombs.
- Failure of the bomber aircraft to arm the bombs (charge the electrical condensers which supplied the energy to initiate the detonation sequence) due to human error or equipment defect.
- Jettison of the bomb before it was armed or from a very low altitude. Most likely if the bomber was under attack or crashing.

War Office Statistics document that a daily average of 84 bombs which failed to function were dropped on civilian targets in Great Britain between 21st September 1940 and 5th July 1941. 1 in 12 of these (probably mostly fitted with time delay fuzes) exploded sometime after they fell - the remainder were unintentional failures.

From 1940 to 1945 bomb disposal teams dealt with a total of 50,000 explosive items of 50kg and over (i.e. German bombs), 7,000 AAA shells and 300,000 beach mines. These operations resulted in the deaths of 394 officers and men. However, UXO is still regularly encountered across the UK (see recent press articles, ***Annex E-1***).

9.4 UXB Ground Penetration

9.4.1 General Considerations

The actual penetration depth of aerial delivered bombs into the ground will have been determined by the mass and shape of the bomb, the velocity and angle of the bomb on impact (dependent on the height of release) and the nature of the ground and ground cover; the softer the ground, the greater the potential penetration. Peat, alluvium and soft clays are easier to penetrate than gravel and sand. Bombs are brought to rest or are commonly deflected by bedrock or large boulders.

9.4.2 The “j” Curve Effect

An air-dropped bomb falling from normal bombing altitude (say 5,000m) into homogeneous ground will continue its line of flight but turn in an upwards curve towards the surface as it comes to rest. This offset from vertical is generally thought to be about one third of the penetration depth, but can be up to 15m depending on ground conditions or the bomb’s angle of impact.

9.4.3 Second World War Bomb Penetration Studies

During WWII, the Ministry of Home Security undertook a major study on actual bomb penetration depths, carrying out statistical analysis on the measured depths of 1,328 bombs as reported by Bomb Disposal, mostly in the London area. They then came to conclusions as to the likely average and maximum depths of penetration of different sized bombs in different geological strata.

The median penetration of 430 x 50kg German bombs in London Clay was 4.6m and the maximum penetration observed for the SC50 bomb was 9m.

They concluded that the largest common German bomb, 500kg, had a likely penetration depth of 6m in sand or gravel but 8.7m in clay. The maximum observed depth for a 500kg bomb was 10.2m and for a 1,000kg bomb 12.7m. Theoretical calculations suggested that significantly greater penetration depths were probable.

9.5 Initiation of Unexploded Bombs

Unexploded bombs do not spontaneously explode. All high explosive requires significant energy to create the conditions for detonation to occur. In the case of unexploded German bombs discovered within the construction site environment, there are a number of potential initiation mechanisms:

- Direct impact onto the main body of the bomb: Unless the fuze or fuze pocket is struck, there needs to be a significant impact (e.g. from piling or large and violent mechanical excavation) to initiate a buried iron bomb. Such violent action can cause the bomb to detonate.
- Re-starting the clock timer in the fuze: Only a small proportion of German WWII bombs employed clockwork fuzes. It is probable that significant corrosion has taken place within the fuze mechanism over the last 60 years that would prevent clockwork mechanisms from functioning, nevertheless it was reported that the fuze in a UXB dealt with by 33 EOD Regiment in Surrey in 2002 did re-commence.
- Induction of a static charge, causing a current in an electric fuze: The majority of German WWII bombs employed electric fuzes. It is probable that significant corrosion has taken place within the fuze mechanism over the last 60 years such that the fuze circuit could not be activated.
- Friction impact initiating the (shock-sensitive) fuze explosive: This is the most likely scenario resulting in the bomb detonating.

Annex E-2 details UXB incidents where intrusive works have caused UXBs to detonate, resulting in death or injury and damage to plant.

9.6 Second World War Bombing History of Holyhead

During WWII, there was no sustained bombing campaign on Anglesey, predominantly due to its isolated location, agricultural nature and lack of major targets.

However, Holyhead housed a sizeable harbour which was used extensively throughout the conflict for the importation of explosives and ammunition, which increased significantly following the destruction of Liverpool Docks in late 1940 / early 1941. Furthermore, the exiled Royal Dutch Navy was based at Holyhead for a short period while a small naval base was established on Parry's Island and Bryn y Môr. A Luftwaffe Target Map of Anglesey, presented in ***Annex F*** shows a number of bombing targets over the harbour and town of Holyhead. Note, that the study area is situated over 1km to the south-east of these targets.

Serving the harbour was an extensive railway which took munitions and troops to and from the area and therefore it is likely that the town would have been highlighted as the most significant Luftwaffe target area on Anglesey. Consequently, it was attacked on at least two occasions. During an incident on the 9th April 1941 a quantity of HEs and IBs narrowly missed a fully loaded ammunition train, which would have caused significant damage if it was struck.

Apart from the accounts of air raids targeting specific sites, there were also additional, non-specific attacks in the area. It was speculated some of these planes were returning from raids

on Liverpool. Such incidents mostly occurred when enemy aircraft were harassed by RAF fighters / anti-aircraft fire, resulting in the pilot adopting 'tip and run'[2] tactics before returning to base.

Holyhead was attacked 11 times during WWII; with bombs dropped on nine occasions and machine gun strafing accounting for the other two raids. However, the town was never subject to the heavy Blitz type raids experienced by cities such as Swansea. No further enemy action was experienced in Holyhead after May 1942 with no loss of life as a result of bombing throughout this period.

Records of bombing incidents in the civilian areas of Holyhead were collected by the Air Raid Precautions wardens and collated by the Civil Defence Office. Some other organisations, such as the railways, maintained separate records.

Records would be in the form of typed or hand-written incident notes, maps and statistics however these various types of official records for Holyhead were unavailable during the timeframe of this report.

Dynasafe BACTEC Limited Holds Home Office statistics summarising the quantity of German bombs (excluding 1kg incendiaries and anti-personnel bombs) falling on the vast majority of Boroughs and Districts across the UK. However, such statistics for Holyhead are not known to exist. Therefore, a history of bombing has been compiled from anecdotal evidence.

9.7 Bombing Records

9.7.1 Anecdotal Bombing Records for Holyhead

Anecdotal evidence of bombing in the vicinity of the site is listed in the following table. Incidents on or in close proximity to the site have been highlighted. This list was mostly compiled from *G. Jones, Anglesey at War, 2012*. Note however that it should not be viewed as a comprehensive account of all bombing incidents on the town. All distances are approximations from the nearest site boundary.

Date	Weapon	Location	Remarks
12/07/1940	n/k	n/k	n/k
05/10/1940	HEs	Church House, Boston Street (>2km north-west)	First bombs to be dropped onto Holyhead. Church House was destroyed, and dozens of houses were damaged
08/11/1940	4 x HEs	Bryn Goleu Avenue (>2km north-west)	Caused damage to Bryn Goleu Avenue while a UXB was taken to a rifle range at Penrhosfeilw (south of Holoyhead) for disposal.
13/01/1941	n/k	n/k	n/k

[2] By randomly jettisoning bomb loads, German bombers became lighter, more manoeuvrable and were less likely to be shot down by RAF fighters or AA batteries.

Date	Weapon	Location	Remarks
25/02/1941	HEs and 2 x PMs	Harbourmasters house, Salt Island, Front Bath Street, Back Bath Street and Parliament Ditch (between 2.1km and 2.4km north-west)	Damage was caused to the Harbourmasters house and Front Bath Street; Back Bath Street and Parliament Ditch were severely damaged. There was also less severe damage in other parts of town.
12/03/1941	HE	n/k	n/k
09/04/1941	HEs and IB showers	200 yards away from Church House (approximately 2km north-west)	A HE bomb strike within 200 yards of Church House causing damage to Bethal Wesleyan Chapel, a garage, surrounding buildings and the railway across the road. Other HEs and IBs were dropping mainly in the harbour area.
06/05/1941	HEs, PMs, machine gun	n/k	n/k
07/05/1941			
09/05/1941			
10/05/1941	n/k	n/k	n/k

9.7.2 Anecdotal Evidence

Secondary source and anecdotal evidence of bombing incidents in the local area was sought from publications and web resources. The following references were found[3] (note all distances are approximations from the nearest site boundary):

- 5th October 1940 - *"The sound of gunfire could be heard, as the plane was strafing the town. We could hear anti-aircraft fire too. That became a familiar sound at night, especially the small guns known as 'pom-poms', making a sound like their nickname. The 'all clear' sounded and we discovered that* ***Church House in Boston Street*** *[>2km north-west] had been demolished totally."*

- 8th November 1940 - *"Regrettably I never saw the plane as Robert pointed to it, swooping in a diving circle over the rooftops of* ***Bryn Môr Terrace and Park Street*** *[>2km north-west].*

  I do not remember an explosion but four high explosives more from this section were dropped - three into the ***outer harbour, somewhere off Mackenzie Pier*** *[>2km north-west] I believe.*

  Damage was done in ***Bryngoleu Avenue*** *[2.3km north-west] and an unexploded 1100lb device was later dug out from the road, where it had severed a drain."*

- 25th February 1941 - *"To me, the most memorable raid on the town was the one when two parachute mines were dropped on* ***Salt Island*** [>1.7km to the north-west]*. It was a night raid on February 25, 1941, when I awoke to the most dreadful explosion I have ever heard.*

[3] *http://downloads.bbc.co.uk/wales/archive/bbc-north-west-wales-holyhead-ww2-memories-ken-roberts.pdf*

*One mine struck a patch of rough ground which was a lay-by on the left side of the road within the ferry terminal compound, now inaccessible to the public, but to the right of the limited walkway which is also closed for security. It was within yards of **Island House, the harbourmaster's residence** [2.1km north-west] on the site of the old checkpoint. **Customs and Board of Trade buildings** and the **Stanley Hospital** [2.4km north-west] were a little further away. Damage was caused but it was only superficial, and it was amazing that they survived, because the full fury of the blast was directed across the water to the town.*

*Three streets stood on the site next to the public toilets on the approach to Salt Island. They were **Front Bath Street, Back Bath Street and Parliament Ditch** [>2km north-west]. All were wrecked totally beyond repair, and the occupants never returned to them.*

*Damage continued well into the town. A door was blown off its hinges in **Cybi Place** [2.1km north-west], and windows were shattered as far as **London Road** [1.9km north-west]. The other mine blew up in the **inner harbour** [1.9km north-west] and damaged shipping…*

*All other houses experienced damage, yet not one pane of glass was lost at my home, number nine; not then or during all the other bombing incidents. **Stanley Crescent** [>2.1km north-west] was strewn with glass, debris and cardboard advertisements from shop windows…"*

- 9th April 1941 - *"Late one night, on April 9, 1941, another bomb was dropped within **two hundred yards of Church House** [2km north-west]."*
- Date unknown - "*Seven other bombs with incendiary devices were also dropped, mostly in **the outer harbour** [2.3km north]."*
- Date unknown - "*Our Sunday School was held at the Hall, so for the rest of the War it was moved to **St Seiriol's Church** [1.7km north-west]. A hole made by a 20mm shell from the plane's strafing of the town was visible in our chimney stack.*

  *Five other bombs and twenty incendiary bombs were released at the same time. Damage was done at the bottom of **Newry Fawr** [2.4km north-west]."*

9.7.3 WWII-era RAF Aerial Photography

WWII-era RAF aerial photography of the site was obtained from the Cartographics, Llywodraeth Cymru Office. An image dated August 1945 is presented in ***Annex G***.

This photograph was taken three months after the cessation of the war. It shows the site as it appears in the historical OS Mapping with all the buildings within its boundary intact and showing no obvious signs of bomb damage. No evidence of bombing across the remainder of the site is apparent however any craters as a result of a HE bomb strike could have been in-filled and ploughed prior to this photograph being taken.

9.7.4 Abandoned Bombs

A post-air raid survey of buildings, facilities and installations would have included a search for evidence of bomb entry holes. If evidence were encountered, Bomb Disposal Officer teams would normally have been requested to attempt to locate, render safe and dispose of the bomb. Occasionally evidence of UXBs was discovered but due to a relatively benign position, access problems or a shortage of resources the UXB could not be exposed and rendered safe. Such an incident may have been recorded and noted as an Abandoned Bomb.

Given the inaccuracy of WWII records and the fact that these bombs were 'abandoned', their locations cannot be considered definitive, nor the lists exhaustive. The MoD states that 'action to make the devices safe would be taken only if it was thought they were unstable'. It should

be noted that other than the 'officially' abandoned bombs, there will inevitably be UXBs that were never recorded. Dynasafe BACTEC holds no records of officially registered abandoned bombs at or near the sites.

9.8 Site Specific Bomb Penetration Considerations

When considering an assessment of the bomb penetration at the Parc Cybi, Holyhead site, the following parameters would be used:

- Geology - 0.3m-1.3m of Made Ground, 0.25m–1.0m of Topsoil, 0.2m–3.88m of Glacial Till, 0.4m–1.6m of Glacial Till, >1.05m of New Harbour Group bedrock.
- Impact Angle and Velocity – 80-90^{O} from horizontal and 267 metres per second.
- Bomb Mass and Configuration – The 500kg SC (General Purpose) HE bomb, without retarder units or armour piercing nose. This was the largest of the common bombs used against Britain.

Taking into account the above-mentioned factors it has been assessed that a 500kg bomb would have had a maximum bomb penetration depth of between **8-10m** below WWII ground level. Penetration depth could potentially have been greater if the UXB was larger (though only 4% of German bombs used in WWII over Britain were of that size). Note that UXBs may be found at any depth between just below the WWII ground level and the maximum penetration depth.

9.9 Likelihood of Post-raid UXO Detection

Utilising the available historical bombing records as reviewed in *Section 9.7*, it is possible to make an assessment of the likelihood that evidence of UXO would have been noted on a site during the war and the incident dealt with or recorded at the time. Factors such as bombing density, frequency of access, ground cover, damage and failure rate have been taken into consideration.

9.9.1 Density of Bombing

Bombing density is an important consideration for assessing the possibility that UXBs remain in an area. A very high density of bombs will have increased the likelihood of errors in record keeping at the time, as civil defence personnel and emergency services may have been overwhelmed. A higher density of bombing also increases the number of UXBs actually occurring in a given area. The type and specific location of recorded bomb strikes is also an important consideration. If a stick of bombs (one individual aircraft's bomb load) is plotted in line with a site or is shown to straddle a site, then this raises the possibility that an unrecorded UXB from the same stick struck that site.	
Based on wartime records or secondary source information, what was the bombing density over the site?	Low
Was the site ever subjected to one or more large-scale (>100 tons of ordnance) night time Blitz raids?	No
How many HE, Parachute Mine, Oil Incendiary, Phosphorus Incendiary or Fire Pot bombs (large bombs) were recorded within a 300m radius of the site?	None
What is the distance between the site boundary and the closest recorded large bomb strike?	1.7km north-west
Were any nearby sticks of large bombs recorded in line with the site?	Unknown
Were any 1kg incendiary bomb showers recorded over the site?	Unknown
Additional comments:	n/a

9.9.2 Bomb Damage Assessment

If structures or hard-standing sustained substantial HE blast damage or fire damage (resulting from incendiary bombs), quantities of rubble will have persisted on site for a time and debris will have been strewn across any adjacent open ground. Note, in Blitzed cities / towns throughout Britain, bomb sites were often not cleared of rubble until after the war and mid-war repairs to buildings were only carried out on the most vital facilities, such as power stations, gas works, weapons factories, etc. If a building sustained bomb damage to its upper floors, but the ground floor survived the incident intact, then any subsequent UXB strike to the structure will still have caused obvious damage, at ground floor level, which would have been reported and dealt with at the time. A HE bomb strike in open ground will have resulted in a large crater and a degree of soil disturbance in the immediate vicinity. Any subsequent UXB strike to such ground conditions will not have resulted in an easily identifiable entry hole and as such is likely to have gone unnoticed.	
A comparison of the historical records confirms that buildings within the site boundary sustained serious bomb damage.	✗
Direct or indirect evidence of HE bomb craters in open ground (within the site boundary) has been found.	✗
In London and south-east England, the German V1 Flying Bomb and V2 Long Range Rocket campaigns caused widespread devastation. However, these weapons began to fall on Britain after the final significant Luftwaffe air raids had occurred. Therefore, any serious bomb damage caused by a nearby V Weapon strike does not necessarily indicate an increased risk of Luftwaffe freefall UXB contamination, as is described above.	
Buildings on site were seriously damaged by a V1 and / or V2 strike.	n/a
However, if Luftwaffe freefall bombs are recorded in close proximity to buildings which appear to have also been damaged by a V Weapon strike, then it is quite possible that these buildings suffered serious damage during the September 1940 – May 1944 Blitz campaigns and the resulting evidence of this initial damage was then erased by the post-May 1944 V Weapon strike.	
Buildings on site could have been seriously damaged prior to the nearby V1 or V2 strike?	n/a
Additional comments:	n/a

9.9.3 Frequency of Access

A UXB strike at a site where human access was frequent would have had a greater chance of being observed, reported and recorded than at a site which was unoccupied / undeveloped / subject to infrequent or irregular access. The importance of a site or facility to the war effort is also an important consideration. Many vital factories, gas works, power stations, docks, etc had a team of Fire Watchers tasked with observing local air raids. They were mainly responsible for extinguishing 1kg incendiaries before they could start a fire as well as reporting any UXB strikes. However anecdotal evidence indicates that Fire Watchers did not always turn up for their shifts, in part due to the danger associated with the job, and therefore this factor should not be taken into account unless site specific evidence has been identified. In frequently bombed cities / towns, ARP Wardens were tasked with carrying out searches for UXBs within recently bombed residential areas and schools. Similarly, many large organisations, such as the docks or large factory complexes, had their own dedicated ARP teams who would perform similar duties at these commercial sites. However, such UXB mitigating activities should not be assumed in the absence of site specific evidence. With the mass evacuation of children to the countryside, many schools in the largest cities were closed during the Blitz. However, many of these schools were then requisitioned by the Civil Defence authorities to be utilised as night time First Aid posts and reception centres (providing emergency accommodation for bombed out civilians). Therefore, an increased level of access is likely at these locations.	
The site was situated in a densely populated urban area during WWII and therefore would have been accessed at the outbreak of WWII.	✗
The site was exclusively developed during WWII.	✗
The site was partially developed during WWII.	✓
Buildings on site survived WWII intact and therefore likely remained inhabited or in use, suggesting these localities and their immediate environs were accessed throughout the war.	✓
The site was crossed by roads / pavements or footpaths which would have been regularly used / subject to daily footfall.	✓
The site was occupied by small residential back yards / gardens, likely to have been put to use for cultivation as a result of the government's Dig for Victory Campaign.	✗
The site was occupied by a school during WWII.	✗
Part of the site is likely to have been subject to post-raid searches for UXO.	✗
Buildings on site sustained serious bomb damage and as a result were likely abandoned (along with any associated gardens / open ground) for the remainder of the war.	✗

A UXB strike at a site where human access was infrequent would have had a lesser chance of being observed, reported and recorded than at a site which was developed and subject to frequent and / or regular access. A UXB strike during a night time raid is more likely to have fallen unobserved than one dropped during a daylight attack. Note, the Luftwaffe tended to carry out its large-scale air raids over heavily defended cities / towns at night, to hamper the British anti-aircraft defences. If buildings sustained bomb damage, they would have been abandoned until repairs could be made, greatly decreasing the level of access to that site. Furthermore, such repairs would likely have taken place after the German bombing campaign in that area had ceased, to avoid repeat damage.	
The site was occupied by peripheral open ground / wasteland, with no apparent use, which may have been neglected.	✓
The site was occupied by recreational land / sports fields which may have only experienced seasonal access.	✗
The site was occupied by a graveyard which would have experienced limited access.	✗
The site was occupied by agricultural land, rural countryside or woodland which would not have been accessed in full, either regularly or frequently.	✓
The site was occupied by railway sidings which may not have been as regularly checked for buckling as mainline railway tracks.	✗
The site was occupied by soft railway embankments which are likely to have been neglected during the war.	✗
Additional comments:	n/a

9.9.4 Ground Cover

The quantity and type of ground cover present on a site during WWII would have had a significant effect, at ground level, on the visual evidence of buried UXO.

A UXB strike to dense vegetation could easily have remained undetected and during periods of frequent / heavy rainfall, very soft or even waterlogged fields could have obscured evidence of a UXB. Note that the entry hole of a 50kg UXB (the most commonly deployed German HE bomb) could have been as little as 20cm in diameter.

If railway tracks (supported by ballast) were laid upon soft ground, the possibility cannot be entirely discounted that a UXB entry hole within these unconsolidated aggregate conditions could have been immediately in-filled by the crushed rock surrounding the hole.

Stockpiled material, such as aggregate, coal, refuse heaps, etc. would also provide conditions into which a UXB might be leave little trace of its incidence.

Wartime records confirm that small German Incendiary Bombs, weighing just 1kg, were also capable of significant penetration into soil, resulting in complete burial. Furthermore, these sub-munitions (dispersed from large cluster bomb canisters) produced very small entry holes; approximately 5cm.

A UXB strike to any body of water would have been immediately obscured from view beneath the waterline. Had such an incident occurred within a tidal mudflat or river bank, the resulting entry hole will have remained only temporally, before becoming in-filled by water and sediment.

The site was partially or entirely abandoned, due to bomb damage, resulting in associated open ground likely becoming overgrown.	✗
The site was occupied by dense, inaccessible vegetation during WWII.	✓
The site may have been susceptible to waterlogged conditions during WWII.	✓
The site was occupied by (possibly) unmaintained grass field during WWII.	✓
The site was part occupied by a canal, river or dock basin during WWII.	✗
The site was occupied by tidal mud or marshland during WWII.	✓
The site was occupied by railway tracks crossing soft ground during WWII.	✗
The site was occupied by stockpiled material during WWII.	✗

Evidence of UXO will have been obvious at developed, yet undamaged / insignificantly damaged sites as a UXB strike to buildings or hard-surfaced ground will still have caused substantial damage or an easily identifiable and persistent entry hole, without detonating. As a result, the incident would have been reported and the UXB subsequently exhumed / removed.

Similarly, although greenfield land, it is unlikely that a HE UXB entry hole on well-maintained / manicured lawns (tennis courts, bowling greens, gold course fairways / greens, gardens in affluent areas etc.), would have been overlooked.	
The site was occupied by buildings, hard-standing or other manmade structures that did not sustain any degree of bomb damage.	✓
A comparison of the historical records confirms that buildings on site sustained inconsequential minor / moderate damage.	✗
The site was occupied by well-maintained, manicured lawn during WWII.	✗
Any HE UXB strike to elevated risk ground cover (ruins, dense vegetation, etc.) could potentially have come to rest beneath neighbouring undamaged buildings or hard-standing due to the 'J-Curve' Effect.	
Undamaged, developed parts of the site would have been vulnerable to the J-Curve Effect.	n/a
Additional comments:	n/a

9.9.5 Bomb Failure Rate Assessment:

Based on empirical evidence, it is generally accepted that 10% of the German HE bombs dropped during WWII failed to explode as designed. Note, due to manufacturing fault or failure of the bomber crew to correctly arm their munitions, whole bomb loads often failed to detonate. Therefore, the presence of reported UXBs increases the likelihood of an additional unrecorded UXB in the vicinity.	
There is no evidence to suggest that the bomb failure rate in the vicinity of the site would have been different from the "approximately 10%" figure normally used.	✓
Additional comments:	n/a

10 The Threat from Allied Military Ordnance

10.1 General

The following historical and modern facilities / activities / incidents have been considered:

- Army, Navy and RAF Bases / Installations
- Military Training Areas / Weapons Ranges
- Ordnance / Explosives Factories and Storage Depots
- Sites requisitioned for military use
- Military Fortifications and Coastal Defences

- Locations of Army Explosive Ordnance Clearance Tasks
- WWII Anti-Aircraft Batteries
- WWII Pipe Mined Locations and Beach Minefields

The most likely source of British / Allied ordnance is anti-aircraft fire and local Home Guard / Army activity, as discussed in the following sections.

10.2 Potential Sources of Explosive Ordnance

10.2.1 WWII Home Guard / Army Activity

The Home Guard (HG) was a defence organisation of the British Army, operational between 1940 and 1944. It comprised 1.5 million local volunteers, otherwise ineligible for military service, and acted as a secondary defence force, in case of enemy invasion. The HG guarded the coastal areas of Britain and other important facilities such as airfields, factories and explosives stores. They were also very active in towns, villages and countryside, within the most at-risk counties, particularly near coastal areas.

Official records were rarely kept by the HG and therefore any present-day evidence is usually anecdotal. It is understood that within the HG, No.1 Anglesey Sector, Cambrian Sub-District, there was one unit based in Holyhead, the 1st Anglesey (Holyhead) Battalion.

The main activities carried out by the HG during WWII included; road patrols, reporting on enemy airborne landings, delay the enemy at specified road-blocks, manning Observation Posts at commanding points and organising mobile fighting patrols to harry the enemy. HG patrols were issued with a variety of weapons including; rifles, shotguns, Molotov Cocktails, various grenades, Northover anti-tank Projector, Spigot mortars, Lewis machine-guns, etc.

Although no actual evidence of HG activity specifically within the site boundary was found, it is known that HG units often carried out anti-invasion training in open countryside or woodland on the outskirts of towns and any such activity (involving live ammunition) could conceivably have resulted in UXO contamination. Therefore, it is not inconceivable that the isolated open ground on site could have been requisitioned for such use.

This is particularly pertinent as information taken from the Council for British Archaeology's study of the WWII anti-invasion landscape of Britain records a pillbox approximately 240m south-east of the site. Consequently, the presence of the HG on site/in the immediate area is likely. Additionally, Penrhos House, approximately 1.2km north-east, was requisitioned by the Army at the start of WWII.

Note, on 23rd August 1940, Holyhead was the scene of a large-scale 'mock invasion', a major training exercise involving the Navy, the Army and the RAF, as well as Civil Defence services such as the Fire Brigade, the Auxiliary Fire Service, the Ambulance Service and the police. Reports detail that planes dive bombed the town, dropping smoke bombs. Tear gas was also used. 'Fifth columnists' guided 'invaders' and 'saboteurs' were dropped at various locations.[4] No details could be located to determine how wide an area this invasion exercise covered however the possibility the areas fixed defences, including pillboxes, were tested for their effectiveness cannot be discounted.

[4] *Jones, 2012*

Today, items of WWII ordnance related to the HG are occasionally encountered by members of the public and the construction industry. Experience has shown that the 'housekeeping' of WWII soldiers was often poor with items of faulty, surplus or expended UXO often burnt, buried, misplaced or otherwise discarded on requisitioned civilian land. Therefore, the possibility of such UXO contamination within the study area cannot be entirely ruled out.

Furthermore, HG personnel are known to have purposefully buried caches of ammunition and weapons in tactical positions, to be exhumed and used in case of invasion. This is substantiated by several recent HG UXO finds (see ***Annex I***).

Experience has shown that the 'housekeeping' of military personnel during WWII, in line with general military practice, was often poor with items of faulty / surplus UXO often burnt, buried, misplaced or otherwise discarded on civilian land. Whilst the possibility cannot be discounted that such items may have been disposed of on site, it is considered unlikely.

10.2.2 Anti-Aircraft Artillery

At the start of the war two types of AAA guns were deployed: Heavy Anti-Aircraft Artillery (HAA), using large calibre weapons such as the 3.7" QF (Quick Firing) gun and Light Anti-Aircraft Artillery (LAA) using smaller calibre weapons such as 40mm Bofors gun.

During the early war period, there was a severe shortage of AAA available and older WWI 3" and modified naval 4.5" guns were deployed alongside those available 3.7" weapons. The maximum ceiling height of fire at that time was around 11,000m (for the 3.7" gun and less for other weapons). As the war progressed improved variants of the 3.7" gun were introduced and, from 1942, large 5.25 inch weapons began to be brought into service. These had significantly improved ceiling heights of fire reaching over 18,000m.

Before the war all the clockwork fuses used by the Royal Artillery had come from Switzerland. When that source of supply was cut off, Britain had been forced to make its own. After four years of war, the country still lacked the engineering skills to produce a reliable fuse.

This resulted in a considerable number of AA projectiles exploding prematurely, killing the gunners or failing to explode at all; falling to the ground as UXBs. In January 1944 more people in London were killed by HAA shells than by German bombs.

The LAA batteries were intended to engage fast low flying aircraft and were typically deployed around airfields or strategic installations. These batteries were mobile and could be moved to new positions with relative ease when required. The most numerous of these was the 40mm Bofors gun which could fire up to 120 x 40mm HE shells per minute to over 1,800m.

No HAA batteries were situated within a 5km radius of the study area during WWII, however, anecdotal evidence confirms the presence of LAA guns in Holyhead. With four guns per battery firing several rounds per minute, AA batteries could expel numerous shells in even the shortest engagements. Note, however, unexploded AA projectiles could land several kilometres from their batteries and therefore the risk of unexploded AA shell contamination cannot be entirely ruled out.

10.3 The Threat Posed by British Unexploded Ordnance

10.3.1 Land Service Ammunition (LSA)

10.3.1.1 General

The term Land Service Ammunition covers all items of ordnance that are propelled, placed or thrown during land warfare. They may be filled or charged with explosives, smoke, incendiary or pyrotechnics. They can be broken into five main groups:

a. Mortars

b. Grenades

c. Projectiles

d. Rockets

e. Landmines

Unexploded or partially unexploded Mortars and Grenades are among the most common items of UXO encountered in the UK and therefore the possibility cannot be discounted that they were stores on site. They are commonly encountered in areas used by the military for training and are often found discarded on or near historic military bases. Examples of Grenades, Mortars and Home Guard weapons are presented in ***Annex J***.

Items of ordnance do not become inert or lose their effectiveness with age. Time can indeed cause items to become more sensitive and less stable. This applies equally to items submerged in water or embedded in silts, clays or similar materials. The greatest risk occurs when an item of ordnance is struck or interfered with. This is likely to occur when mechanical equipment is used or when unqualified personnel pick up munitions.

10.3.1.2 Mortars

A mortar bomb is a fin-stabilised munition, normally nose-fuzed and fitted with its own propelling charge (primary cartridge). Range is increased by adding extra propellant (augmenting charges). They are either HE or Carrier and generally identified by their tear-dropped shape (older variants however are parallel sided) and a finned 'spigot tube' screwed or welded to the rear end of the body housing the propellant charge.

A mortar relies on a striker hitting a detonator for explosion to occur. It is possible that the striker may already be in contact with the detonator and that only a slight increase in pressure would be required for initiation. Discarded augmenting charges are often encountered around mortar firing areas/bases.

10.3.1.3 Grenades

A grenade is a short-range weapon which may be thrown by hand, fired from the end of a rifle or projected/propelled from a special purpose grenade launcher. They are divided into two categories; HE and Carrier (generally smoke). As with mortars, a grenade striker may either be in contact with the detonator or still be retained by a spring under tension, and therefore shock may cause it to function. A grenade can have an explosive range of 15-20m. Common older variants have a classic 'pineapple' shape; modern grenades tend to be smooth-sided.

10.3.2 Small Arms Ammunition (SAA)

The most likely type of ordnance to be encountered on site are items of SAA (bullets), especially .303" ammunition which was the standard British and Commonwealth military cartridge from 1889 until the 1950s.

However even if an item such as this functioned, the explosion would not be contained within a barrel and detonation would only result in local overpressure and very minor fragmentation from the cartridge case.

Some LAA guns and RAF fighter cannons in use with British forces during WWII utilised the 20mm round. These bullets had a small fuse and a ~4gram HE or incendiary charge. Although small, this fill quantity still has the potential to cause serious injury. Images of SAA are presented in ***Annex K***.

10.3.3 Anti-Aircraft Shells

These shells are frequently mistakenly identified as small German air-delivered bombs, but are differentiated by the copper driving band found in front of the base. Although the larger unexploded projectiles could enter the ground they did not have great penetration ability and are therefore likely to be found close to WWII ground level. With a HE fill and fragmentation hazard these items of UXO also present a significant risk if encountered.

The smaller 40mm projectiles are similar in appearance and effect to small arms ammunition and, although still dangerous, present a lower risk. Pictures of AAA projectiles are presented in ***Annex L***. Details of the most commonly deployed WWII AAA projectiles are shown below:

Gun type	Calibre	Shell Dimensions	Shell Weight	HE Fill Weight
3.7 Inch	94mm	94mm x 438mm	12.7kg	1.1kg
4.5 Inch	114mm	114mm x 578mm	24.7kg	1.7kg
40mm	40mm	40mm x 311mm	0.84kg	70g

11 Ordnance Clearance and Post-WWII Ground Works

11.1 General

The extent to which any ordnance clearance activities have taken place on site or extensive ground works have occurred is relevant since on the one hand they may indicate previous ordnance contamination but also may have reduced the risk that ordnance remains undiscovered.

11.2 EOD Bomb Disposal and Clearance Tasks

Dynasafe BACTEC holds a number of official records of explosive ordnance disposal operations during and following WWII, obtained from the Explosive Ordnance Disposal (EOD) Archive Information Office at 33 Engineer Regiment (EOD), British Army. However, no records could be found to indicate that any Army EOD tasks have taken place within or close to the study area.

Note, at the end of May 1946, the Chief Constable of Anglesey issued a warning to the public regarding dangerous sites (such as bombing ranges, beach minefields and army training areas) which might contain live ammunition or mines. Fifteen such sites were identified, one of which being Plas Penrhos, approximately 1.2km north-east of the site.[5]

11.3 Post War Redevelopment

A 1977 OS map confirms the farm buildings on site to have been demolished by this date. No records of other works within the site boundary have been found.

[5] *Jones, 2012*

12 The Overall Explosive Ordnance Threat Assessment

12.1 General Considerations

Taking into account the quality of the historical evidence, the assessment of the overall threat to any intrusive works from UXO must evaluate the following risks:

- That the site was contaminated with unexploded ordnance
- That UXO remains on site
- That such items could be encountered during any intrusive works
- That ordnance may be activated by the works operations
- The consequences of encountering or initiating ordnance

12.2 The Risk that the Site was Contaminated with Unexploded Ordnance

For the reasons discussed in *Sections 9* and *10* Dynasafe BACTEC believes that there is a minimal risk that UXO contaminated the study area. This is based on the following:

GERMAN AIR-DELIVERED UXO
Elevated risk of UXO contamination:
n/a
Minimal risk of UXO contamination:
• During WWII, Holyhead was served by a sizable harbour and railway system which were used extensively throughout the conflict. Due to Anglesey's isolated location and agricultural nature, it is likely that Holyhead would have been highlighted as the most significant Luftwaffe target in the area. Consequently, the harbour and railway were attacked on at least two occasions. • However, the study area was located in a remote area away from central Holyhead and these targets. Anecdotal evidence suggests that no bombing occurred over the site or surrounding area. • The site was partly occupied by farm buildings, hard-surfaced roadways and yards. A comparison between pre-and post-WWII OS mapping and WWII-era aerial photography of the site confirms that these features survived the war intact. • Additionally, evidence of UXO will have been obvious as a UXB strike would have caused significant damage, even without detonating. Following any such incident, the damage / entry hole would have been observed and the UXB exhumed / removed. • Had a UXB landed within pasture, dense vegetation, grassland or marshland which occupied the remainder of the site, it could conceivably have gone unobserved. Note, the entry hole of an SC50 (the most commonly deployed German bomb) could be as little as 20cm in diameter, and therefore easily obscured in these ground types. However, this scenario is considered unlikely due to the low bombing density over the area.

BRITISH / ALLIED UXO	
Land Service Ammunition / Small Arms Ammunition	• During WWII Holyhead was defended by a series of hardened defences including a pillbox situated approximately 240m south-east of the site. • These fortifications would have been manned by local Home Guard and / or Army soldiers, who would have been issued with small arms and land service ammunition. • Experience has shown that the 'housekeeping' of WWII soldiers was often poor with items of faulty, surplus or expended UXO often burnt, buried, misplaced or otherwise discarded on requisitioned civilian land. • Furthermore, HG units often carried out anti-invasion training in open countryside or woodland on the outskirts of towns, such as the site. Therefore, it is not inconceivable that the isolated open ground on site could have been requisitioned for such use. • Therefore, the possibility of such UXO contamination within the study area cannot be entirely ruled out.
Anti-Aircraft Projectiles	No HAA batteries were situated within a 5km radius of the study area during WWII, however, anecdotal evidence confirms the presence of LAA guns in Holyhead. Unexploded AA projectiles could land several kilometres from their batteries and therefore the risk of unexploded AA shell contamination cannot be entirely ruled out.

12.3 The Risk that Unexploded Ordnance Remains on Site

Within the footprints of the post-war redevelopment / ground works, the risk of shallow buried UXO (especially AA shells and German 1kg incendiaries) remaining will have been partially mitigated since any such items could have been encountered and removed during excavations for foundations, services, soil stripping and levelling.

12.4 The Risk that Ordnance may be Encountered during the Works

The most likely scenarios under which a UXO could be encountered during construction works is during piling, drilling operations or bulk excavations for basement levels. The overall risk will depend on the extent of the works, such as the numbers of boreholes/piles (if required) and the volume of the excavations.

Since an air-dropped bomb may come to rest at any depth between just below ground level and its approximate penetration depth there is also a chance that such an item could be encountered during shallow excavations (for services or site investigations) into the original WWII ground level.

If the proposed works are due to be undertaken within post war fill material / made ground, the risk of encountering WWII UXO will be lower. Items of British / Allied UXO tend to be found just below WWII-era ground level and therefore even shallow excavations can encounter such UXO.

12.5 The Risk that Ordnance may be Initiated

The risk that UXO could be initiated if encountered will depend on its condition, how it is found and the energy with which it is struck. The most violent activity on most construction sites is percussive piling. As a result, items that are shallow buried present a slightly lower risk than those that are deep buried, since the force of impact is usually lower and they are more likely to be observed - when immediate mitigating actions can be taken.

12.6 The Consequences of Encountering or Initiating Ordnance

Clearly the consequences of an inadvertent detonation of UXO during construction operations would be catastrophic with a serious risk to life, damage to plant and a total site shutdown during follow-up investigations.

Since the risk of initiating ordnance is significantly reduced if appropriate mitigation measures are undertaken, the most important consequence of the discovery of ordnance will be economic. This would be particularly so in the case of high profile locations and could involve the evacuation of the public.

The unexpected discovery of ordnance may require the closing of the site for any time between a few hours and a week with a potentially significant cost in lost time. Note also that the suspected find of ordnance, if handled solely through the authorities, may also involve loss of production since the first action of the Police in most cases will be to isolate the locale whilst awaiting military assistance, even if this turns out to have been unnecessary.

12.7 Dynasafe BACTEC's Assessment

Taking into consideration the findings of this study, Dynasafe BACTEC considers the UXO risk at the Parc Cybi, Holyhead site to be ***Medium.***

	Level of Risk			
Type of Ordnance	**Negligible**	**Low**	**Medium**	**High**
German High Explosive Bombs		✓		
German 1kg Incendiary Bombs		✓		
British Anti-Aircraft Shells		✓		
British Small Arms and Land Service Ammunition			✓	

13 Proposed Risk Mitigation Strategy

13.1 General

Dynasafe BACTEC recommends the following risk mitigation measures should be deployed to support the proposed works at the Parc Cybi, Holyhead site.

13.1 Scope Specific Risk Mitigation Measures

- ***Site Specific Explosive Ordnance Safety and Awareness Briefings to all personnel conducting intrusive works:*** A specialised briefing is always advisable when there is a possibility of explosive ordnance contamination. It is an essential component of the Health & Safety Plan for the site and conforms to requirements of CDM Regulations 2015. All personnel working on the site should be instructed on the identification of UXB, actions to be taken to alert site management and to keep people and equipment away from the hazard. Posters and information of a general nature on the UXB threat should be held in the site office for reference and as a reminder.
- ***The Provision of Unexploded Ordnance Site Safety Instructions:*** These written instructions contain information detailing actions to be taken in the event that unexploded ordnance is discovered. They are to be retained on site and will both assist in making a preliminary assessment of a suspect object and provide guidance on the immediate steps to be taken in the event that ordnance is believed to have been found.
- ***Non-Intrusive Magnetometer Survey and Target Investigation (greenfield land only):*** This survey is carried out using caesium vapour magnetometers linked to a data logger. Data is interpreted using advanced proprietary software which is capable of modelling the magnetic anomalies for mass, depth and location, thus providing information which can be used to locate discrete buried objects that may be ordnance. The system will typically locate buried ordnance to a depth of **up to 4m** for a 50kg bomb (the smallest HE bomb used by the Luftwaffe) and deeper for larger bombs. Additionally, the survey will locate any buried services with a magnetic signature, will indicate areas of gross magnetic "contamination" (which may indicate unknown underground obstructions) and provide information on archaeological features.
- ***Explosive Ordnance Disposal (EOD) Engineer presence on site to support shallow intrusive works (brownfield alternative to Non-Intrusive):*** When on site the role of the EOD Engineer would include; monitoring works using visual recognition and instrumentation and immediate response to reports of suspicious objects or suspected items of ordnance that have been recovered by the ground workers on site; providing Explosive Ordnance Safety and Awareness briefings to any staff that have not received them earlier and advise staff of the need to modify working practices to take account of the ordnance threat, and finally to aid Incident Management which would involve liaison with the local authorities and Police should ordnance be identified and present an explosive hazard.

In making this assessment and recommending these risk mitigation measures, the proposed works outlined in the 'Scope of the Proposed Works' section were considered. Should the planned works be modified or additional intrusive engineering works be considered, Dynasafe BACTEC should be consulted to see if re-assessment of the risk or mitigation recommendations is necessary.

Dynasafe BACTEC Limited 28th June 2017

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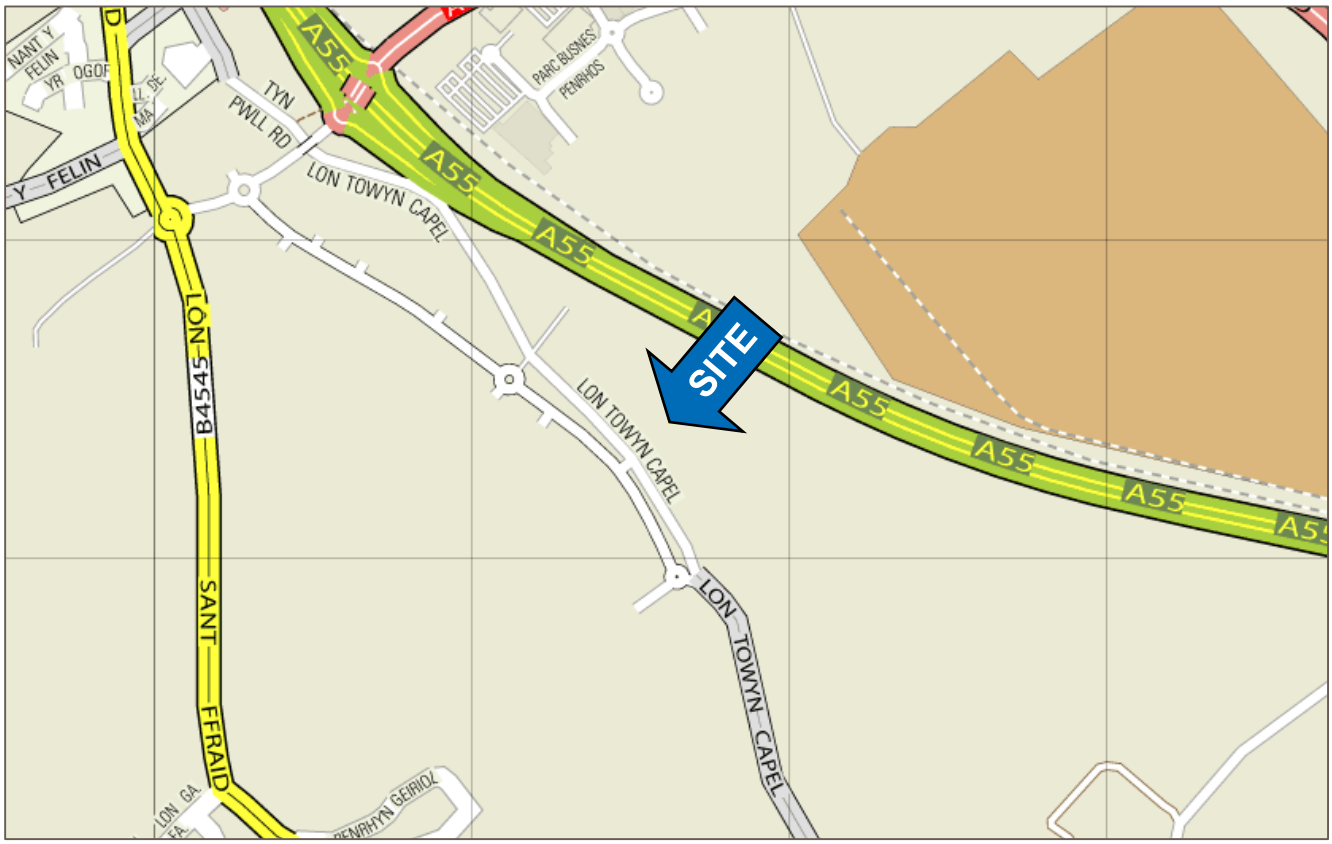


Report Reference:	Client:	
7206TA	Jacobs	DYNASAFE
	Project: Parc Cybi, Holyhead	

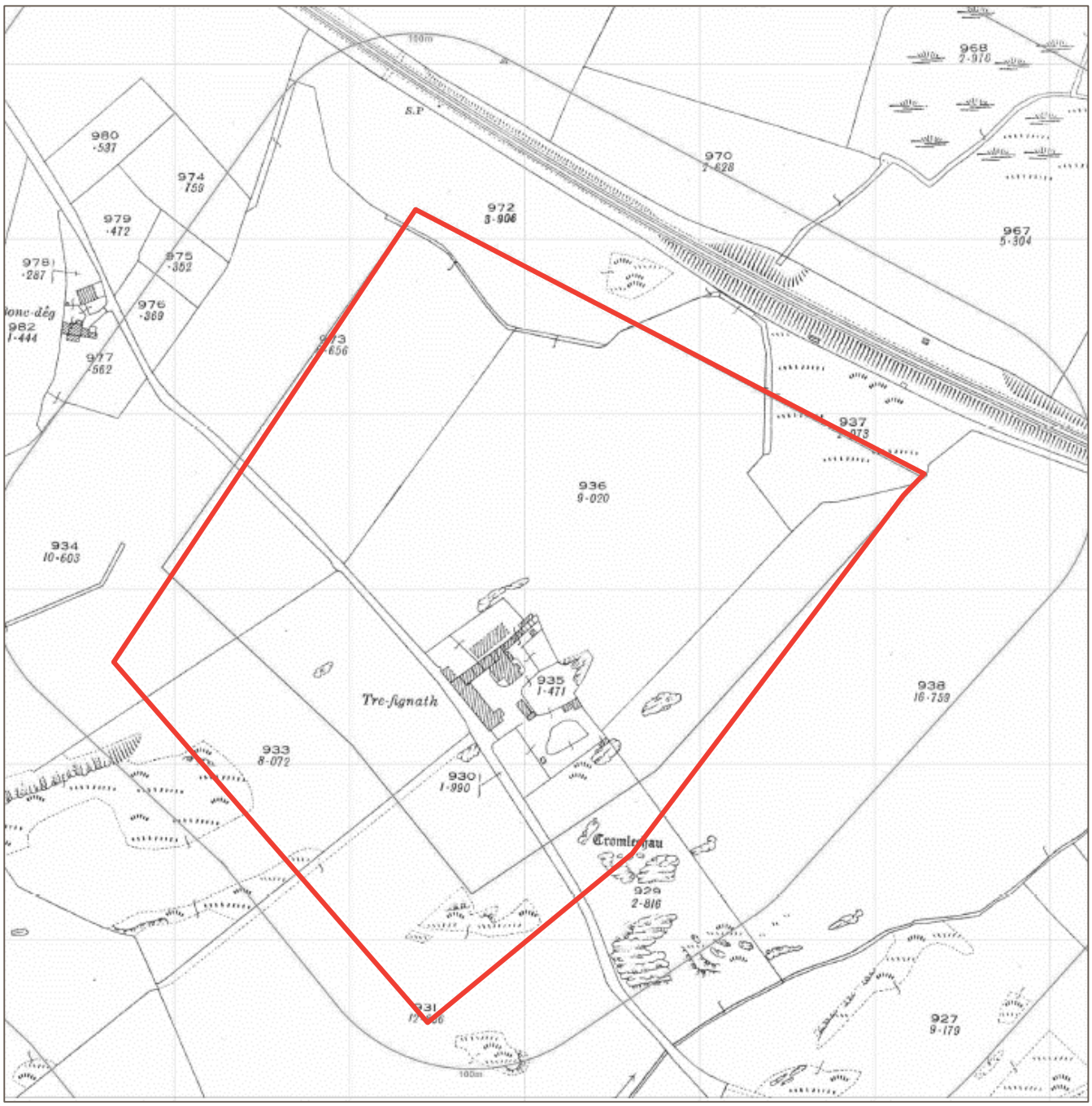
North

Approximate site boundary

Report Reference:	Client:	
7206TA	Jacobs	DYNASAFE
	Project: Parc Cybi, Holyhead	

Source: Google Earth ™ Mapping Services

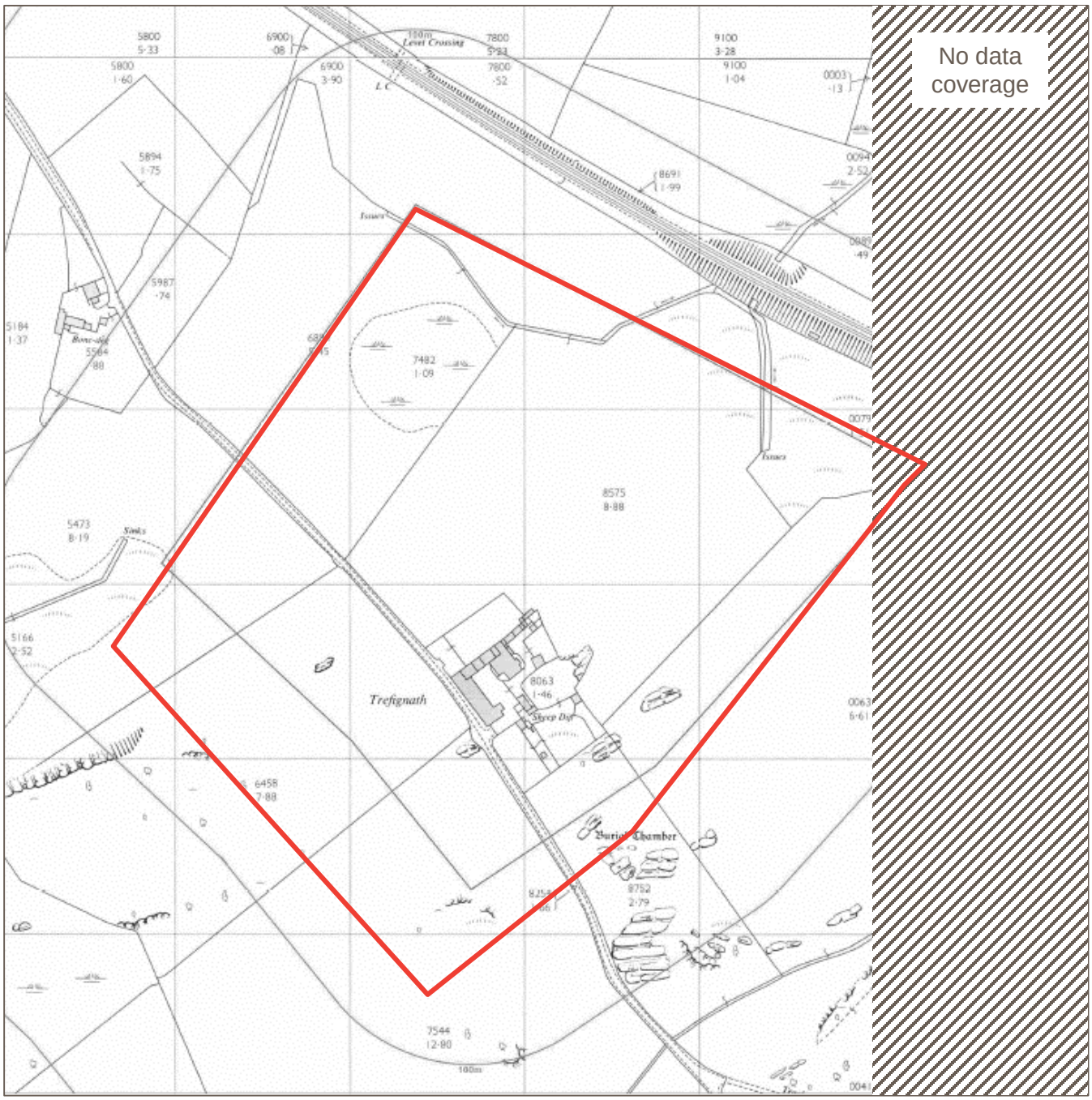
North



Approximate site boundary

Report Reference:	Client:	
7206TA	Jacobs	DYNASAFE
	Project: Parc Cybi, Holyhead	

Source: Jacobs



Report Reference:	Client:	
7206TA	Jacobs	DYNASAFE
	Project: Parc Cybi, Holyhead	

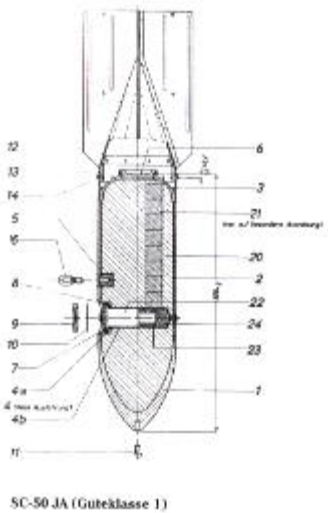
Source: Jacobs

SC 50

Bomb Weight:	40-54kg (110-119lb)
Explosive Weight:	c25kg (55lb)
Fuze Type:	Impact fuze/electro- mechanical time delay fuze
Bomb Dimensions:	1,090 x 280mm (42.9 x 11.0in)
Body Diameter:	200mm (7.87in)
Use:	Against lightly damageable materials, hangars, railway rolling stock, ammunition depots, light bridges and buildings up to three stories.
Remarks:	The smallest and most common conventional German bomb. Nearly 70% of bombs dropped on the UK were 50kg.

50kg bomb, London Docklands

Minus tail section



SC-50 JA (Gutеklasse 1)

SC 250

Bomb weight:	245-256kg (540-564lb)
Explosive weight:	125-130kg (276-287lb)
Fuze type:	Electrical impact/mechanical time delay fuze.
Bomb dimensions:	1640 x 512mm (64.57 x 20.16in)
Body diameter:	368mm (14.5in)
Use:	Against railway installations, embankments, flyovers, underpasses, large buildings and below-ground installations.

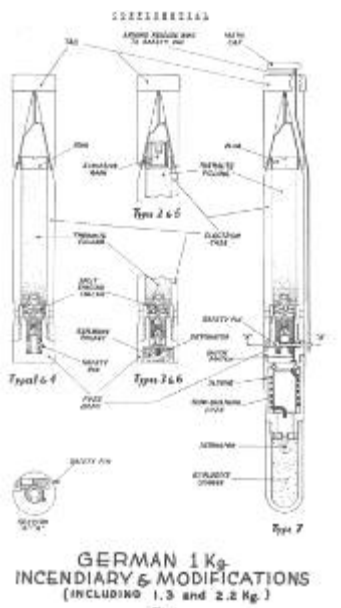
250kg bomb, Hawkinge

SC 250 JA (Gütеklasse I)

1kg Incendiary Bomb

Bomb weight:	1.0 and 1.3kg (2.2 and 2.87lb)
Filling:	680gm (1.3lb) Thermite
Fuze type:	Impact fuze
Bomb dimensions:	350 x 50mm (13.8 x 1.97in)
Body diameter:	50mm (1.97in)
Use:	As incendiary – dropped in clusters against towns and industrial complexes
Remarks:	Jettisoned from air-dropped containers. Magnesium alloy case. Sometimes fitted with high explosive charge

1. Scaffold pipe
2. Incendiary 1kg bomb
3. Incendiary bomb recently found on site in UK



GERMAN 1 Kg. INCENDIARY & MODIFICATIONS (INCLUDING 1.3 and 2.2 Kg.)

Source: Dynasafe BACTEC Limited and various historical sources

The Telegraph

11:50AM GMT 24 Mar 2015

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Giant WWII bomb dug up by builders in London

A massive evacuation procedure is carried out in Bermondsey, south London, after the 1,000lb explosive measuring 5ft long was uncovered

Mother-of-two digs up unexploded WWII bomb in garden and casually flings it on the rubbish thinking it was an old exhaust pipe

- Carole Fisher-White, 56, unearthed a mortar shell in her back garden
- It was only when sons said it looked like a bomb that the penny dropped
- Royal Navy bomb disposal team called to defuse the device
- The 29mm Spigot Mortar was was an infantry anti-tank weapon
- Also known as the Blacker Bombard it was used by the Home Guard

Unexploded Second World War grenade discovered by a curious dog

By Charlotte Cox

Police and Army bomb disposal experts were called to the address in Peakdale Avenue, Heald Green.

A dog called Snoop has sniffed out a suspected Second World War grenade in a Stockport garden.

Police and Army bomb disposal experts were called to the address in Peakdale Avenue, Heald Green.

The took the grenade to nearby parkland and destroyed in a controlled explosion.

Page last updated at 14:23 GMT, Thursday, 5 June 2008 15:23 UK

BBC

E-mail this to a friend Printable version

Unexploded bomb 'started to tick'

An unexploded World War II bomb started to tick and ooze liquid as experts tried to defuse it, police have said.

The large bomb was found in a river at Sugar House Lane, near Bromley-by-Bow Tube station in east London, on Monday.

Rush-hour travel was disrupted as overnight work to make the bomb safe continued into Thursday morning.

"It measures approximately the size and length of a man, and weighs around 1,000kg (2,200lb).

Express & Echo

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Road closed after German bomb found in Axminster garden

By Exeter Express and Echo | Posted: June 03, 2014

A major road in Axminster has been closed after an air-dropped German bomb was found in a garden.

Page last updated at 14:45 GMT, Friday, 22 May 2009 15:45 UK

E-mail this to a friend Printable version

Building site WWII bomb exploded

Building site WWII bomb exploded

A controlled explosion has been carried out on a World War II bomb found on a building site in East Sussex.

The 110lb (50kg) SC50 bomb, thought to have been dropped from a German aircraft in 1940 or 1941, was found at the Hollenden House

Royal Navy clearance divers dispose of 70-year old German bomb

Posted on August 8, 2013

The team of four from the southern Diving Unit 2 at HM Naval base Devonport, Plymouth, blew up the air dropped bomb in situ in a controlled explosion where it was found by contractors for SW Water laying a mains in a field at St Dial Rure Circuit near Wadebridge, north Cornwall yesterday.

Report Reference:	Client:	
7206TA	Jacobs	DYNASAFE
	Project: Parc Cybi, Holyhead	

Source: Various News Sources

1994

Blown up by history

RESCUE workers search for survivors after a Second World War bomb exploded at a building site in Berlin, killing three people and injuring at least eight others.

A fire brigade spokesman said he feared the final death toll could be higher. One worker was still missing, believed to be trapped under a machine. "We've found human remains 100 metres away but we can't tell if they belong to the dead already found," the spokesman said.

The blast, set off by drilling work on Frankfurter Allee, one of east Berlin's busiest avenues, trapped workers under building machinery and sent huge chunks of concrete tumbling through the air.

A large office block was being built on the site of the explosion which sent shoppers scrambling for shelter and paralysed dense afternoon traffic. One eyewitness said: "There was a bang, then silence, and then it started raining stones and dirt."

Dozens of cars within a 250-metre radius were wrecked and the top two floors of a nearby apartment block caved in.

Radio reports claimed that the total number of injured stood at 14.

2008

2006

World War II bomb kills three in Germany

Three people have been killed and six injured trying to defuse a World War II bomb in central Germany.

Workers building a sports stadium had earlier unearthed the bomb in the town of Goettingen.

It was not immediately clear why the bomb, reportedly weighing 500kg (1,100lb), had detonated.

Unexploded WWII bombs dropped by Allied planes are frequently found in Germany, though it is unusual for them to explode unexpectedly.

2010

2006

The bomb went off as the machine lifted up earth and debris

A World War Two bomb has exploded at a construction site near a west German town, killing a man and injuring eight others, police say.

Related

The explosion occurred after a digger accidentally struck the device during excavation work in Euskirchen in the state of North Rhine-Westphalia.

The machine's operator died on the spot. Two of those hurt were critically wounded, the dpa news agency reports.

2014

Top Left: WWII bomb killed 3 and injured 8 in Berlin – 1994.
Middle Left: WWII bomb killed 3 in Goettingen, Germany – 2010.
Bottom Left: Excavator operator killed by WWII bomb in Euskirchen, Germany – 2014.
Top Right: WWII bomb injures 17 at construction site in Hattingen, Germany - 2008.
Middle Right: A highway construction worker in Germany accidentally struck a WWII bomb, killing himself and wrecking several passing cars - 2006.
Bottom Right: Destroyed piling rig and dump truck after detonation of WWII UXB in Austria - 2006.

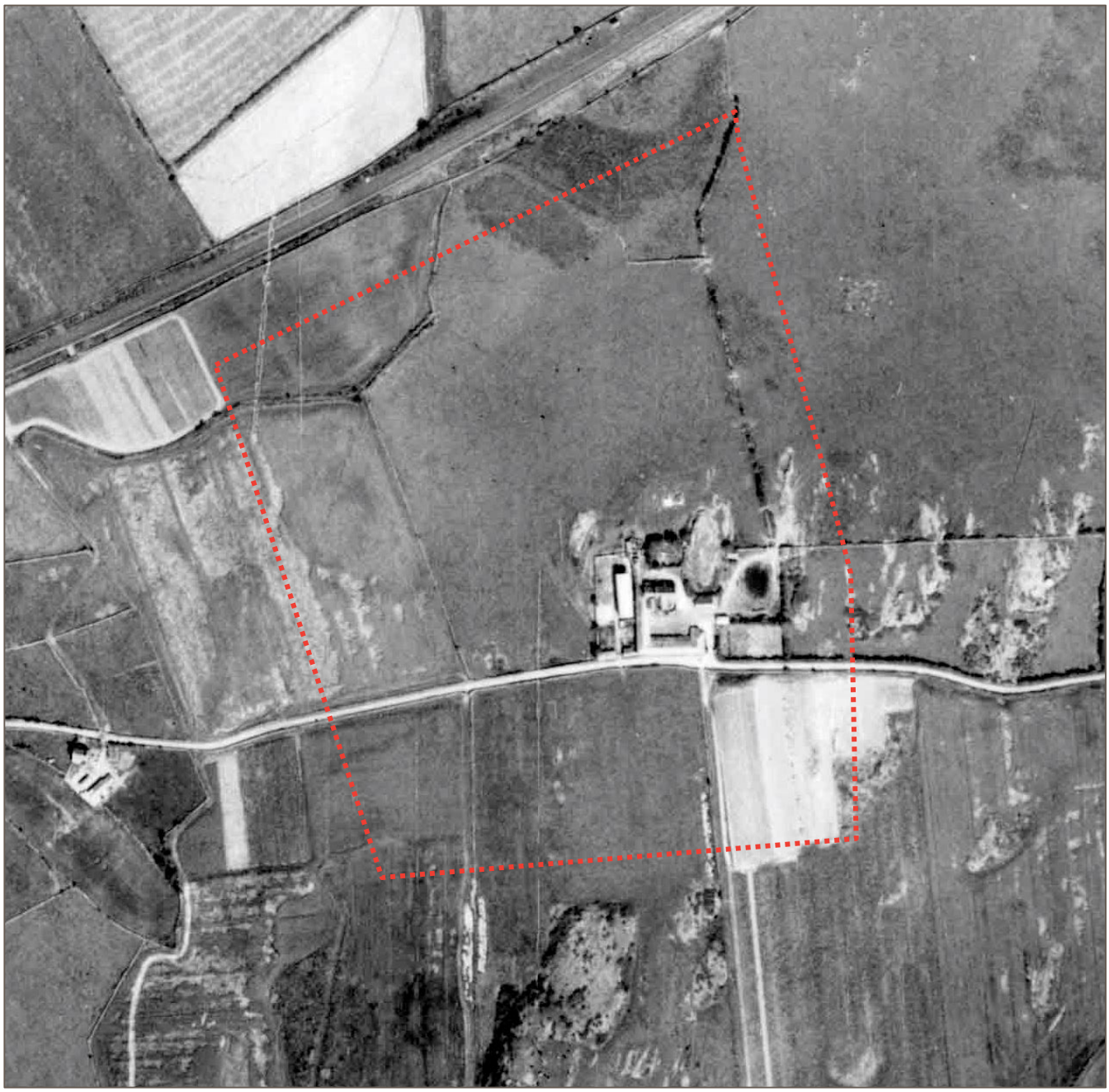
North

✖ Approximate site location

Report Reference:	Client:	
7206TA	Jacobs	DYNASAFE
	Project: Parc Cybi, Holyhead	

Source: The National Museums and Galleries of Wales

North



Approximate site boundary

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7206TA	Jacobs	DYNASAFE
	Project: Parc Cybi, Holyhead	

Source: Cartographics, Llywodraeth Cymru

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23 July 2010 Last updated at 18:28

Covert British troops 'could have buried' WWII devices

World War II incendiary devices found on a building site in Gloucestershire could have been left by covert British troops, according to researchers.

The bombs were put into vats of water to make them safe

More than 20 phosphorus bombs were unearthed in Birdlip after a digger hit one, causing it to burst into flames.

A former worker at the site said he saw a Home Guard officer burying objects there 65 years ago.

The Coleshill Auxiliary Research Team said auxiliary officers often used Home Guard uniforms as cover.

Thursday, September 10 2015

KM KentOnline

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Army bomb disposal team called to Blacksole Bridge in Herne Bay

Comments | 3

by Aidan Barlow abarlow@thekmgroup.co.uk 08 July 2015

It was like a scene from Dad's Army when Army bomb disposal experts found wartime explosives made by the Home Guard in makeshift bottles.

A team was called to the Blacksole Bridge in Herne Bay after the wartime bombs were found.

The team from the Royal Logistics Corps set up a 30 metre exclusion zone for pedestrians around the railway embankment after the suspected homemade phosphorous bombs were found.

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Treasure hunter stumbles on deadly Dad's Army bomb cache

By MAIL ONLINE REPORTER
Last updated at 4:06 PM on 9th July 2010

Comments (0) | Add to My Stories

A treasure hunter escaped serious injury when he unearthed a cache of bombs that were buried by the Home Guard during the darkest days of World War 2.

The weapons - primed to go off when they made contact with the air - were secreted on a beach by a Captain Mainwaring of the day.

Loaded with dangerous benzene and phosphorus, the Dad's Army-style team would have used them in battle against Nazi troops in the event of invasion.

'Are you sure that's wise?': The Home Guard's stash of bombs finally goes off, 70 years late

Eastbourne Herald

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VIDEO: Explosion after 80 grenades detonated in Eastbourne

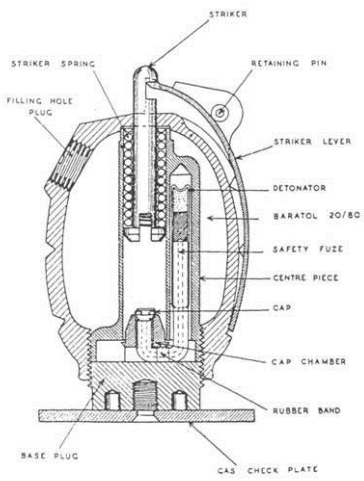
16:31 Monday 13 April 2015

Marked 'AW Bomb 1940' the grenades were thought to have been phosphorus incendiary grenades created as improvised anti-tank weapons when Britain was facing invasion following the army's evacuation from Dunkirk in 1940.

He said, "I remember the grenades being buried. It was part of the Home Guard stash, it was put there in case we were invaded. It had to be in 1943. There were a lot of them [stashes], they were all over the place."

No. 36 'Mills' Grenade

Weight:	0.7kg filled (1lb 6oz)
Type:	Hand or discharger, fragmentation
Dimensions:	95 x 61mm (3.7 x 2.4in)
Filling:	Alumatol, Amatol 2 or TNT
Remarks:	4 second hand-throwing fuse with approximate 30m range. First introduced May 1918.



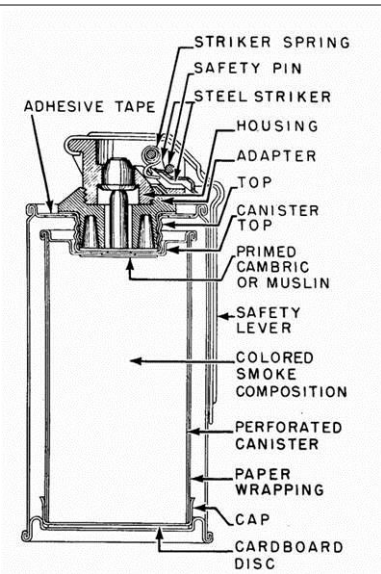
Grenade, .303 inch rifle, No. 36M, Mark I.

No. 69 Grenade

Weight:	0.38kg filled (0.8lb)
Type:	Percussion/Blast
Date Introduced:	December 1940
Remarks:	Black Bakelite body. Blast rather than fragmentation type. After unscrewing the safety cap, a tape is held when throwing the grenade releasing the safety bolt in the throwing motion. Detection is problematic due to its very low metal content.

Typical Smoke Grenade

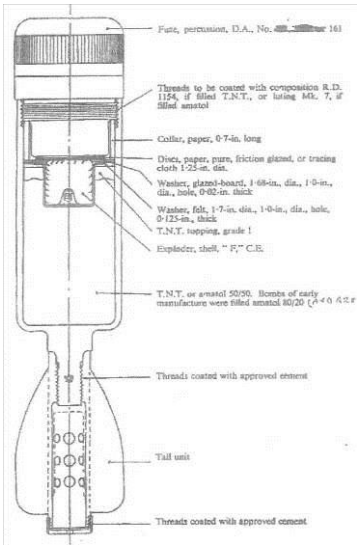
Dimensions:	Approx. 65 x 115mm (2.5 x 4.5in)
Type:	Smoke
Date Introduced:	Current MoD issue
Remarks:	Smoke grenades are used as ground-to-ground or ground-to-air signalling devices, target or landing zone marking devices, and screening devices for unit movement.



Source: Dynasafe BACTEC Limited and various historical sources

Typical 2 inch High Explosive Mortar

Bomb Weight:	1.02kg (2.25lb)
Type:	High Explosive
Dimensions:	51 x 290mm (2in x 11.4in)
Filling:	200g RDX/TNT
Maximum Range:	457m (500yds)
Remarks:	Fitted with an impact fuze which detonates the fuze booster charge (exploder) and, in turn, the high explosive charge. The main charge shatters the mortar bomb body, producing near optimum fragmentation and blast effect at the target.

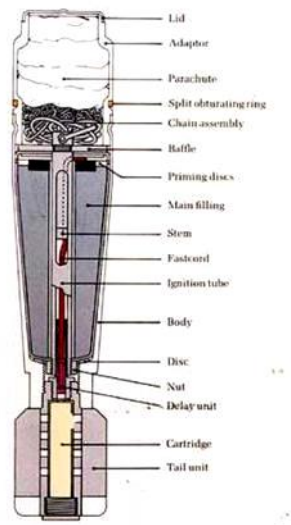


Typical 3 inch Smoke Mortar

Type:	Smoke
Dimensions:	c490 x 76mm (19.3in x 3in)
Filling:	Typically white phosphorous
Maximum Range:	2515m (2,750yds)
Remarks:	On impact, the fuze functions and initiates the bursting charge. The bursting charge ruptures the mortar bomb body and disperses the white phosphorous filler. The white phosphorous produces smoke upon exposure to the air.

Typical 2 inch Illuminating Mortar

Type:	Illum.
Dimensions:	51 x 290mm
Filling:	Various
Remarks:	The expulsion charge ignites and ejects the candle assembly. A spring ejects the parachute from the tail cone. The parachute opens, slowing the descent of the burning candle which illuminates the target.



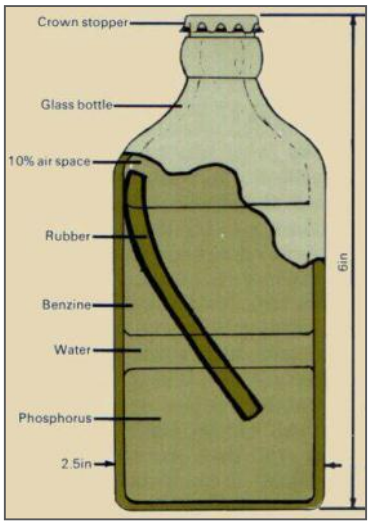
Report Reference:	Client:	
7206TA	Jacobs	DYNASAFE
	Project: Parc Cybi, Holyhead	

Source: Dynasafe BACTEC Limited and various historical sources

Self Igniting Phosphorous (SIP) Grenades

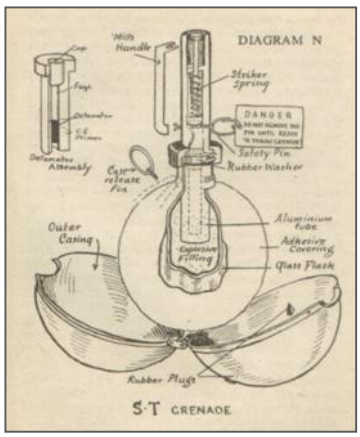
Filling: White Phosphorous and Benzene

Remarks: The grenade comprised a glass bottle with a total volume of approximately one pint. It was filled with White Phosphorus, benzene, a piece of rubber and water. Over time the rubber dissolved to create a sticky fluid which would self ignite when the bottle broke. Fired by hand or Northover Projector. Sometimes called the “A & W” (Albright & Wilson) grenade.



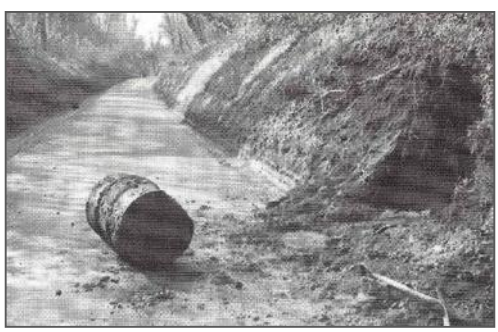
No 74 Grenade (Sticky Bomb)

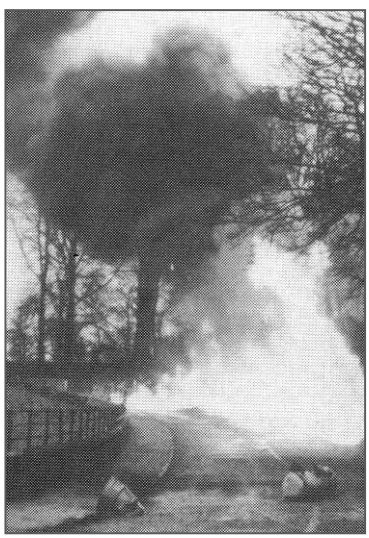
Remarks: Designed as an anti-tank grenade and used by the Home Guard. The grenade consisted of a glass ball on the end of a Bakelite (plastic) handle. Inside the glass ball was an explosive filling whilst on the outside was a very sticky adhesive covering. Until used, this adhesive covering was encased in a metal outer casing.



Flame Fougasse Bomb

Remarks: A Flame Fougasse was a weapon in which the projectile was a flammable liquid, typically a mixture of petrol and oil. It was usually constructed from a 40-gallon drum dug into the roadside and camouflaged. Ammonal provided the propellant charge which, when triggered, caused the weapon to shoot a flame 3m (10ft) wide and 27m (30 yards) long. Initially a mixture of 40% petrol and 60% gas oil was used, this was later replaced by an adhesive gel of tar, lime and petrol known as 5B.



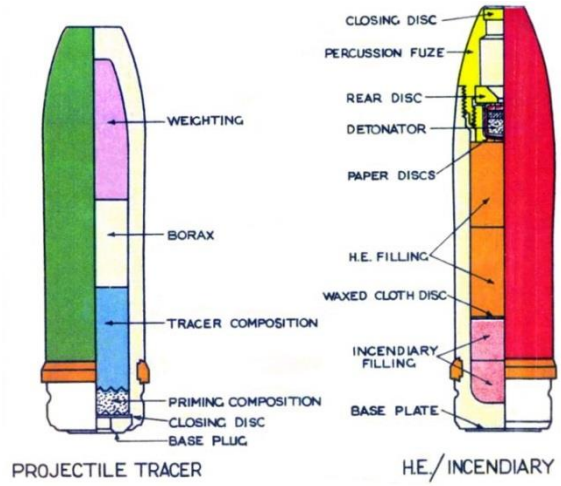


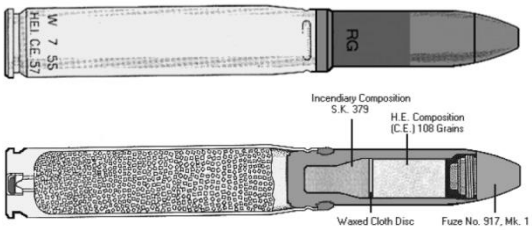
Report Reference:	Client:	
7206TA	Jacobs	DYNASAFE
	Project: Parc Cybi, Holyhead	

Source: Dynasafe BACTEC Limited and various historical sources

20mm Hispano HEI Ammunition

Type:	Live canon round
Markings:	Upper half of projectile painted 'buff' colour, lower half is red.
Cartridge Weight:	256 grams
Dimensions:	Total cartridge / projectile length - 182mm
Fuzed:	Contact fuze – No.253, No.254 or No.917
Filling:	108 grains of contact explosive + 68 grains of SR.379 incendiary composition.
Threat:	Explosives within unspent cartridge as well as the projectile.
Deployment:	Royal Navy, RAF and British Army Light Anti-Aircraft guns. Also RAF aircraft canons.
Remarks:	Cartridges are belted or supplied lose in cartons.

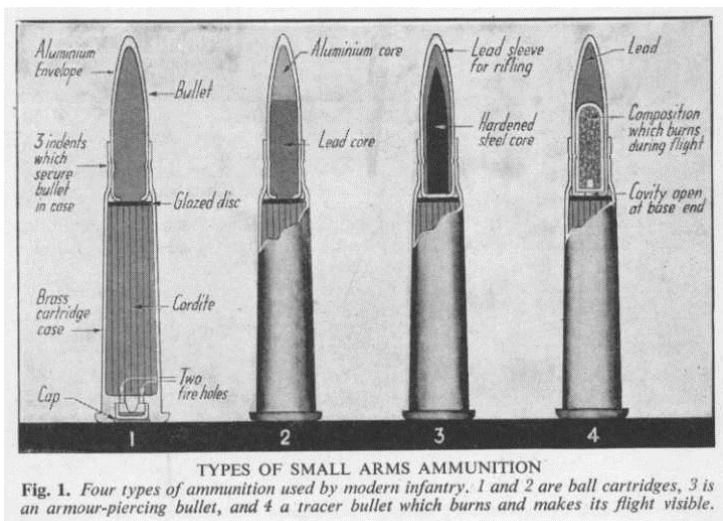




COLOUR IDENTIFICATION		
BRITISH		
NATURE OF SHELL	H.E. FILLING	COLOUR
H.E. TRACER	T.N.T.	
H.E.	T.N.T.	
PROJ. PRACTICE		
PROJ. TRACER		
H.E. INCENDIARY	T.N.T.	
H.E. INCENDIARY TRACER	T.N.T.	

.303" Ammunition

Type:	Rifle / machine gun round
Markings:	Regular round - none. Tracer round – red Primer
Bullet Weight:	150 - 180 grams
Dimensions:	Total cartridge /projectile length - 78mm
Filling:	Regular round – none. Tracer round - small incendiary fill
Threat:	Explosive cordite within unspent cartridge
Deployment:	Royal Navy, RAF and British Army Light Anti-Aircraft guns, machine guns and rifles. Standard British and Commonwealth military cartridge from 1889 until the 1950s.
Remarks:	Cartridges are belted or supplied lose in cartons.



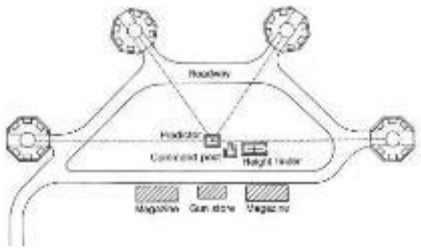
TYPES OF SMALL ARMS AMMUNITION

Fig. 1. *Four types of ammunition used by modern infantry. 1 and 2 are ball cartridges, 3 is an armour-piercing bullet, and 4 a tracer bullet which burns and makes its flight visible.*

Source: Dynasafe BACTEC Limited and various historical sources

3.7 inch Anti-Aircraft Projectile

Weight:	12.7kg (28lb)
Dimensions:	94 x 360mm (3.7 x 14.7in)
Carriage:	Mobile and Static Versions
Rate of Fire:	10-20 rounds per minute
Ceiling:	9-18,000m (29-59,000ft)
Muzzle Velocity:	792m/s (2,598ft/s)
Remarks:	4.5 inch projectiles were also commonly utilised



Layout plan for a typical HAA battery site.

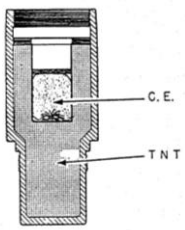
This AA shell was uncovered on a construction site in North London in February 2009.

Hyde Park 1939 3.7 Inch QF gun on mobile mounting

3.7 inch AA Projectile Minus Fuze

Rockets / Unrotating Projectiles

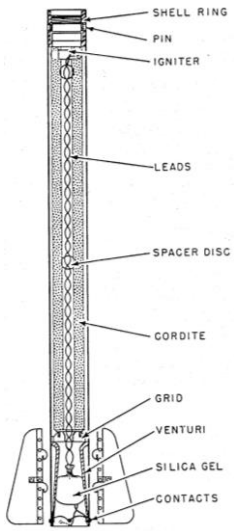
Weight:	Overall: 24.5kg (54lb) Warhead: 1.94kg (4.28lb)
Dimensions:	1930mm x 82.6mm (76 x 3.25in)
Carriage:	Mobile – transported on trailers
Ceiling:	6770m (22,200ft)
Maximum Velocity:	457mps (1,500 fps)



MK II HE Shell (3.5kg)

Rocket Battery in action

Home Guard soldiers load an anti-aircraft rocket at a 'Z' Battery



2" U.P AA Rocket

40mm Bofors Gun Projectile

Weight:	0.86kg (1.96lb)
Dimensions:	40mm x 310mm (1.6in x 12.2in)
Rate of Fire:	120 rounds per minute
Ceiling:	23,000ft (7000m)
Muzzle Velocity:	2,890 ft/s (881m/s)
Remarks:	Mobile batteries – normally few records of where these guns were located

Unexploded 40mm Bofors projectile

40mm Bofors gun and crew at Stanmore in Middlesex, 28 June 1940.

Report Reference:	Client:	
7206TA	Jacobs	DYNASAFE
	Project: Parc Cybi, Holyhead	

Source: Dynasafe BACTEC Limited and various historical sources