

## **ENVIRONMENT**

Lightsource BP  
Project Maen Hir – South B  
Anglesey  
Phase 1 Geo-Environmental Assessment

## **ENVIRONMENT**

Lightsource BP  
Prosiect Maen Hir – South B  
Anglesey  
Phase 1 Geo-Environmental Assessment

Birmingham  
Livery Place, 35 Livery Street, Colmore Business District, Birmingham, B3 2PB  
T: 0121 233 3322

Leeds  
Whitehall Waterfront, 2 Riverside Way, Leeds, LS1 4EH  
T: 0113 233 8000

London  
11 Borough High Street, London, SE1 9SE  
T: 0207 407 3879






Manchester  
11, Portland Street, Manchester M1 3HU  
T: 0161 233 4260

**Nottingham**  
**Waterfront House, Station Street, Nottingham NG2 3DQ**  
**T: 0115 924 1100**

July 2024

## DOCUMENT ISSUE RECORD

<b>Document Number:</b>	MSF-BWB-ZZ-XX-RP-YE-0003_Ph1-South B
<b>BWB Reference:</b>	232062

Rev.	Date of Issue	Status	Author:	Checked:	Approved:
P1	Sept 2023	S2	Chris Rhodes BSc MSc (Hons)	Richard Robinson BSc (Hons) MCIWEM	Karen Sinclair BSc (Hons) MSc
					
P2	July 2024	S2	Updated Report Name		
			Chris Rhodes BSc MSc (Hons)	Richard Robinson BSc (Hons) MCIWEM	
					

### Notice

This document has been prepared for the sole use of the Client in accordance with the terms of the appointment under which it was produced. BWB Consulting Limited accepts no responsibility for any use of or reliance on the contents of this document by any third party. No part of this document shall be copied or reproduced in any form without the prior written permission of BWB.

## EXECUTIVE SUMMARY

Executive Summary	
Proposed Development	The proposed development is anticipated to comprise solar, battery storage, possibly green hydrogen, and some other alternative technologies.
Current Site Setting	The site largely comprises agricultural land utilised for grazing animals and crops. Several small derelict farm buildings are present on site. Numerous water courses are present within the site and immediate surrounding area, most of which feed into Afon Cefni, which flows from north east to south west through the site.
Site History	<p>The site has remained largely undeveloped over the historical mapping period, predominantly utilised for agricultural purposes, with limited farm buildings present. Several small old quarries and ponds have been identified across the site, with some having possibly been infilled.</p> <p>The surrounding land uses are broadly similar, comprising agricultural land with associated farm buildings. Small quarries and ponds are mapped in the surrounding area, with some possibly now infilled.</p>
Ground Conditions	<p>Ground conditions are anticipated to comprise Devensian Till and localised Alluvium overlying bedrock of the Coedana Granite/Complex, undifferentiated Central Anglesey Shear Zone and Berw Shear Zone, and Ordovician Rocks. Igneous intrusions are mapped in the south west and west of the site, with a fault mapped in the north west of site, trending in a north to south direction. Localised Made Ground is expected in the vicinity of infilled ponds and quarries.</p> <p>The Till is categorised as an undifferentiated Secondary Aquifer, whilst the Alluvium is categorised as a Secondary A Aquifer. All bedrock geologies mapped underlying the site are categorised as Secondary B Aquifers.</p>
Geotechnical Review	<p>Shallow spread foundations are likely to be viable across the majority of the site, however, shallow bedrock may need breaking out to facilitate this locally. Foundations may need to be locally deepened in areas where Alluvium is present.</p> <p>Earthworks are likely to be required where steep gradients are present.</p>
Environmental Review	Limited sources of contamination have been identified across the site given the lack of historic development. The risk to human health receptors is considered to be moderate/low risk based on the potential presence of naturally elevated radon levels across the site. The risk to controlled water receptors is considered to be very low based on the lack of an identified contamination source.
Recommendations	<p>Once the development masterplan is defined, it is recommended that ground investigation is undertaken to quantify the contaminant linkages identified within conceptual site model.</p> <p>It is recommended that intrusive ground investigation is undertaken in areas where Alluvium and bedrock outcrops are known/suspected to be present in order to inform foundation design</p>
<p>This summary should be read in conjunction with BWB's full report (ref. MSF-BWB-ZZ-XX-RP-YE-0003_Ph1-South B) and reflects an assessment of the site based on information received by BWB at the time of production.</p>	

## CONTENTS

EXECUTIVE SUMMARY .....	iii
1. INTRODUCTION.....	1
Instruction .....	1
Objectives .....	1
Scope of Work.....	1
2. THE SITE .....	3
Site Location.....	3
Site Description .....	3
3. ANTICIPATED GROUND CONDITIONS .....	5
Geology.....	5
Hydrogeology .....	7
Surface Waters.....	8
Ground Gas and Radon.....	8
Mining and Mineral Extraction .....	8
Environmental Sensitivity.....	9
4. SITE HISTORY .....	10
Operational / Company Records .....	11
Summary of Site History .....	11
5. REGULATORY SETTING.....	12
Permits Consents and Authorisations .....	12
Landfilling and Waste Management .....	12
6. GEOTECHNICAL APPRAISAL .....	13
7. PRELIMINARY ENVIRONMENTAL RISK ASSESSMENT .....	15
Introduction .....	15
Conceptual Site Model.....	15
8. CONCLUSION AND RECOMMENDATIONS .....	19
Conclusions .....	19
Recommendations.....	19
9. REFERENCES.....	20

## **FIGURES**

Figure 2:1: Site Location Plan  
Figure 3:1: Superficial Geology  
Figure 3:2: Bedrock Geology

## **TABLES**

Table 6:1: Ground Related Constraints & Opportunities  
Table 7:1: Potential Sources of Contamination  
Table 7:2: Relevant Potential Pathways and Receptors  
Table 7:3: Preliminary Conceptual Site Model

## **DRAWINGS**

Drawing 1: Site Layout Plan

## **APPENDICES**

Appendix 1: Site Photographs  
Appendix 2: Groundsure Report  
Appendix 3: Historical Mapping  
Appendix 4: Classification of Risk

## 1. INTRODUCTION

### Instruction

- 1.1 BWB Consulting (BWB) was instructed by Lightsource BP (the Client) to carry out a Phase 1 Geo-Environmental Assessment for the site at Prosiect Maen Hir – South B, Anglesey. Details of the project brief are included in BWB proposal reference 20230130/2/232062/MB/MB, dated 30<sup>th</sup> January 2023.
- 1.2 The proposed development is anticipated to comprise solar, battery storage (BESS), possibly green hydrogen, and some other alternative technologies.

### Objectives

- 1.3 This report has been completed to present pertinent information into the environmental risks and liabilities associated with the site. It has been completed to fulfil the requirements of a preliminary risk assessment in accordance with BS 10175:2011+A2:2017 '*Investigation of potentially contaminated sites, code of practice*' and EA Guidance on Risk Management of Land Contamination <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>.
- 1.4 The report has also been prepared with reference to land contamination technical guidance available through <https://www.gov.uk/government/collections/land-contamination-technical-guidance>.
- 1.5 The objectives of this report are to:
  - Assess historical activities at the site with respect to their potential impact on the site environment;
  - Characterise the environmental setting of the site, identify migration pathways and vulnerable receptors for contamination originating at the site, focusing on potential soil and groundwater liabilities;
  - Assess historical and current surrounding land use in relation to known or potential off-site contamination issues that may impact the site;
  - Review existing site investigation and remediation information for the site, where available;
  - Develop a preliminary Conceptual Site Model (CSM); and
  - Assess potential environmental liabilities associated with the site.

### Scope of Work

- 1.6 The scope of work included:
  - A site visit to inspect the current site and immediate surroundings, identify potential hazards associated with ground conditions or contamination and to determine potential constraints with regards to ground investigation (photographs presented as **Appendix 1**);

- A review of the following information:
  - Groundsure Report ref. GSIP-2023-13916-14904\_1 (**Appendix 2**);
  - Historical Ordnance Survey Mapping (**Appendix 3**);
  - Historical aerial photographs (Google Earth) and other imagery (Groundsure Report);
  - British Geological Survey (BGS) 1:50 000 Scale, 'Anglesey', (Sheets 92, 93, 94, 105 & 106), Drift, (1974);
  - British Geological Survey (BGS) 1:50 000 Scale, 'Anglesey', (Sheets 92, 92, 94, 105 & 106), Solid, (1980);
  - BGS online geological maps and exploratory hole records ([www.bgs.ac.uk](http://www.bgs.ac.uk));
  - MAGIC website ([www.natureonthemap.naturalengland.org.uk/magicmap](http://www.natureonthemap.naturalengland.org.uk/magicmap)); and
  - Coal Authority Interactive Map Viewer (<http://mapapps2.bgs.ac.uk/coalauthority/home.html>);
- A summary of the key hazards or uncertainties that require additional investigation in order to further characterise the associated risks; and
- Production of a Geo-Environmental Assessment (this report), concluding in a qualitative assessment of the risks from contamination and ground-related constraints which may impact on the site.

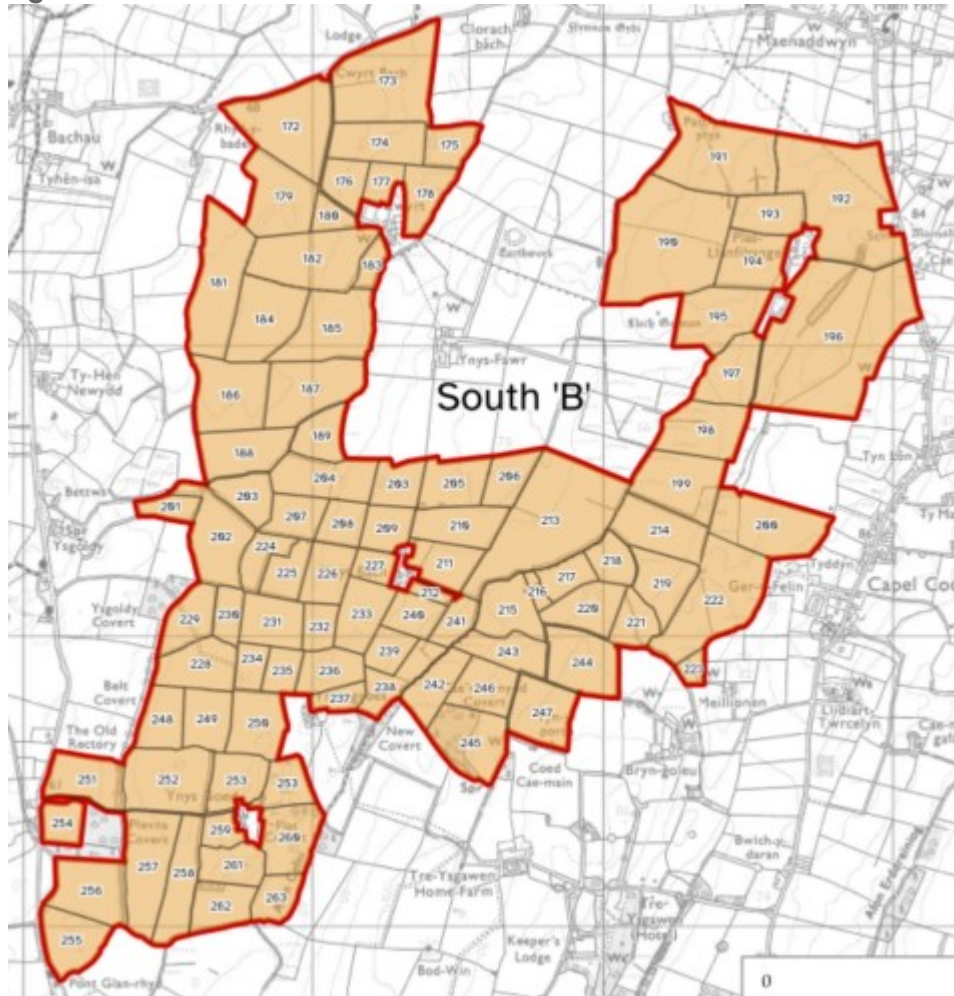


## 2. THE SITE

### Site Location

- 2.1 The site comprises numerous field parcels located to the west of Capel Coch, in Anglesey, centred at approximate National Grid reference 244389 382418. The approximate location of the site is shown below in **Figure 2:1**.

**Figure 2:1: Site Location Plan**



### Site Description

- 2.2 The site comprises an irregular shaped parcel of land covering an area of approximately 400 hectares, located to the west of Capel Coch. BWB undertook a site walkover on 15<sup>th</sup> August 2023, selected photographs are presented in **Appendix 1**. A site layout plan is presented within **Drawing 1**.
- 2.3 The site predominantly comprised agricultural fields which were undulating in nature and utilised either for growing crops or grazing cattle/sheep. Abandoned/derelict farm buildings were present in the centre and north east of site, with small stockpiles of silage wrapped in plastic present near to farm buildings in the centre of the site. Stockpiles of vegetated soils were present within a field towards the south west of site.

- 
- 2.4 Overhead services were present crossing numerous fields, with wind turbines present in the north east and west of the site. Rock outcrops were identified within several fields in the south west and north west of site.
  - 2.5 Several water courses cross the site, generally flowing towards Afon Cefni which flows from the south west to the north east of site. An area of standing water was present within a field in the south west of site, adjacent to Afon Cefni. Several small ponds are also present across the site.
  - 2.6 The surrounding areas predominantly comprised agricultural land, similar to those present on site, with farm buildings located adjacent to some of the fields across site. A slurry pit was observed adjacent to the site in the north east. A localised organic sheen, with no odour, was observed in a puddle along a track in the south east of site.

### 3. ANTICIPATED GROUND CONDITIONS

3.1 The anticipated ground conditions for the site and controlled waters vulnerability is discussed within this Section.

#### Geology

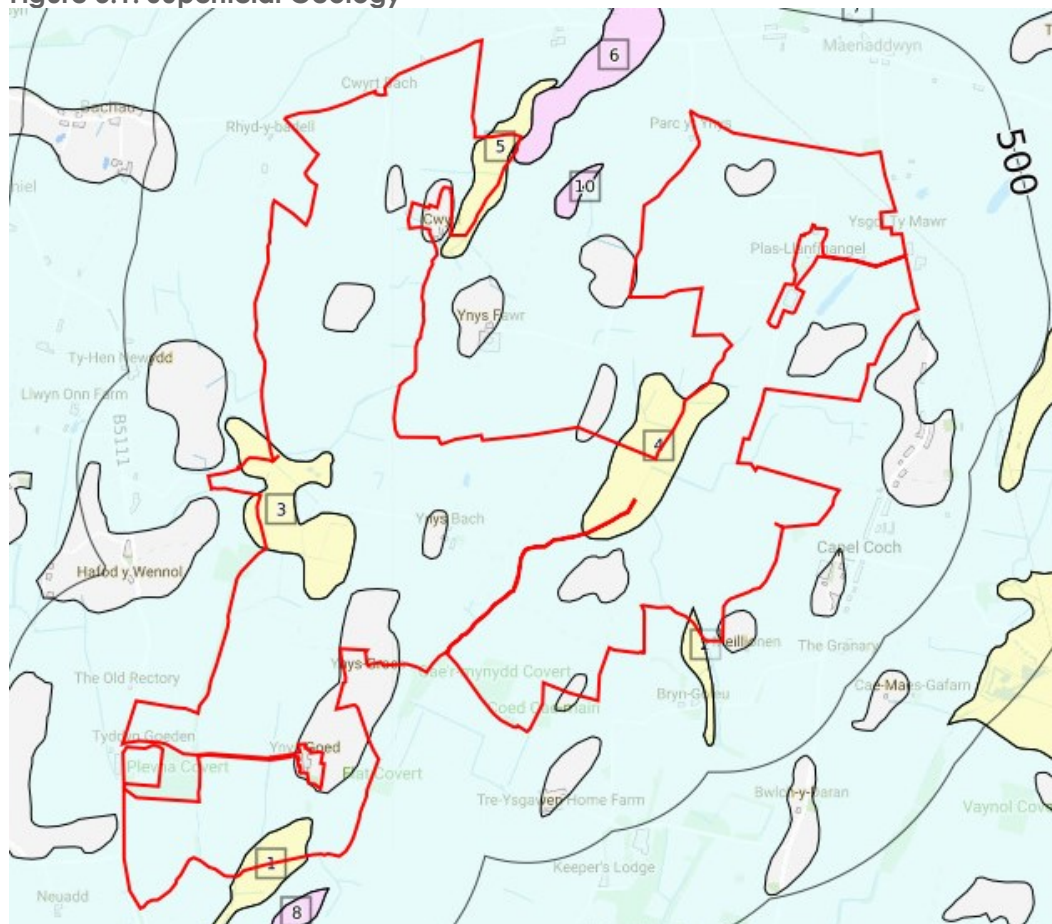
##### Made Ground

3.2 Made Ground is not mapped on site, however, there are expected to be localised areas of Made Ground around buildings, access tracks, and wind turbines.

##### Superficial Geology

3.3 Information published by the BGS indicates that a large proportion of the site is underlain by Devensian Till superficial deposits, indicated by the pale blue areas on **Figure 3:1** below. Localised pockets of Alluvium (clay, silt, sand and gravel) are mapped adjacent to the water courses in the north, west, south west and central areas (yellow areas). Glaciofluvial Deposits (sand and gravel) are mapped partially overlapping the northern site boundary (pink areas). Superficial deposits are locally absent across the site.

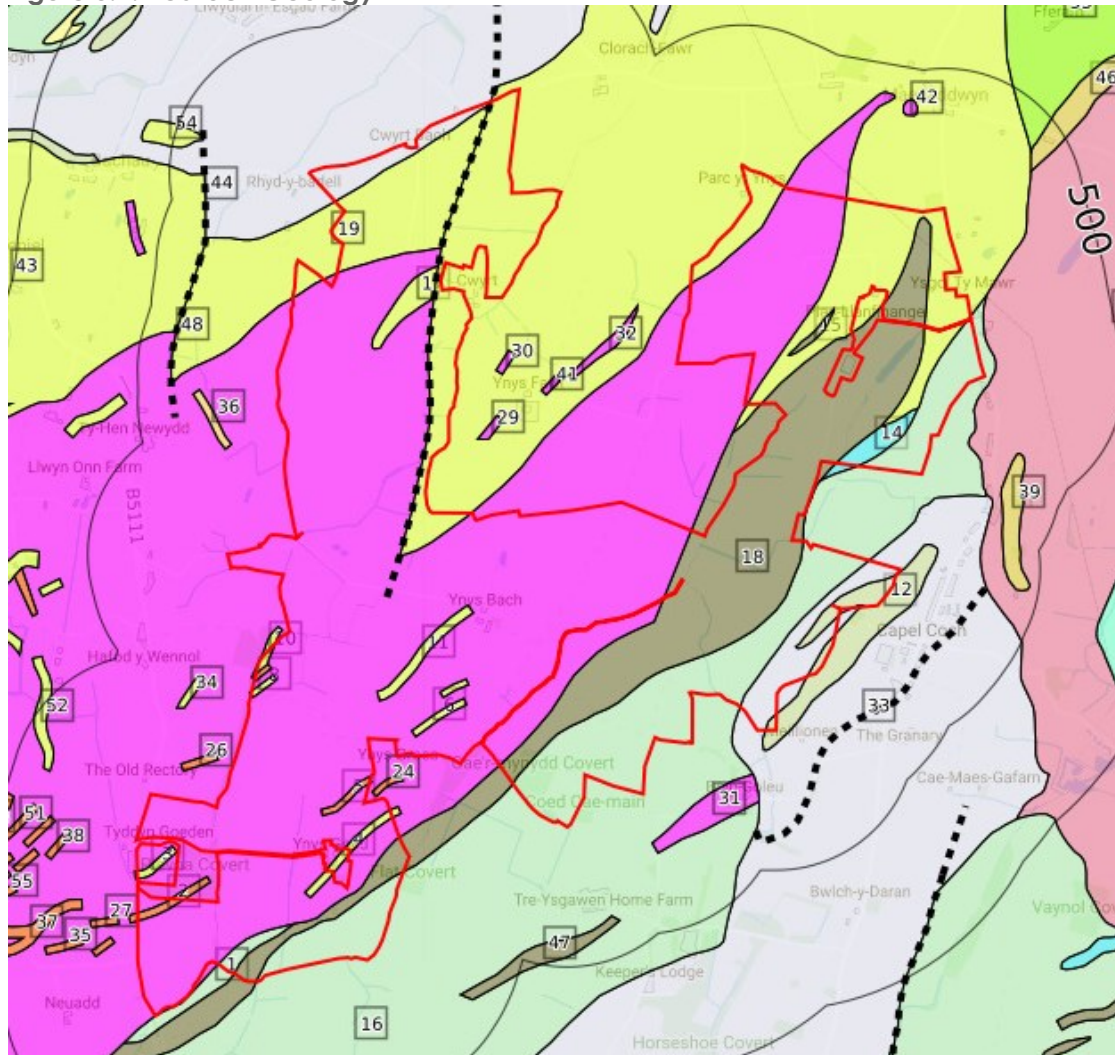
**Figure 3:1: Superficial Geology**



## Bedrock Geology

- 3.4 The underlying bedrock predominantly comprises Coedana Granite in the west and central areas (pink area west and central areas in **Figure 3:2**). Undifferentiated Central Anglesey Shear Zone and Berw Shear Zone (schist and hornblende) in the south east of site (mauve areas), with schist and mica of the same bedrock group beyond (pale green areas, ref. 16). The Coedana Complex (Hornfels) is mapped in the north of the site (shaded yellow).
- 3.5 Ordovician Rocks (interbedded mudstone and sandstone) are mapped in the far south east and north west of site (pale grey area) with interbedded sandstone and conglomerate of the same group also overlapping the south east boundary (pale green ref. 12). A small outcrop of limestone and graphitic schist of the undifferentiated Central Anglesey Shear Zone and Berw Shear Zone is mapped in the north east of site (cyan, ref. 14).
- 3.6 Igneous intrusions (felsite) are mapped in the south west and west of the site. A fault is mapped in the north west of site, trending in a north to south direction (black dashed line).

**Figure 3:2: Bedrock Geology**



Site Specific Ground Investigation Data

3.7 There are no publicly available BGS boreholes located within the site boundary. Boreholes are mapped along the corridor of the overhead power cables which cross the north east corner of the site, however, these are privately owned.

**Hydrogeology**

3.8 The Till is categorised as an undifferentiated Secondary Aquifer, whilst the Alluvium and Glaciofluvial Deposits are categorised as Secondary A Aquifers. All bedrock geologies mapped underlying the site are categorised as Secondary B Aquifers.

3.9 The site is not indicated to be within, or within close proximity to a groundwater Source Protection Zone, as designated by Natural Resources Wales.

3.10 There are no current or historical abstraction licences relating to groundwater on site or within 1km.

- 3.11 There are no active discharge consents relating to groundwater on site. A drainage consent is mapped 300m east of site for treated sewage issuing to groundwater via an infiltration system.

### **Surface Waters**

- 3.12 Numerous water courses are present within the site and immediate surrounding area. Most are small tributaries which feed into Afon Cefni which flows from the north east to south west of site.
- 3.13 Two springs are mapped in the north east of site, two in the south west, one in the north west, one in the west and two in the south east. Numerous springs are mapped in the surrounding areas, with several adjacent to the south eastern boundary.
- 3.14 There are no potable surface water abstraction located near of the site.
- 3.15 There are no surface water discharge consents listed on site. The closest discharge consent issuing to surface waters is located 360m west relating to sewage discharges into Afon Cefni.
- 3.16 Two Water Framework Directive (WFD) surface water body catchments are mapped on site;
- Cefni Reservoir West, covering most of the site: which had an overall rating of good, a 'good' chemical rating and a 'good' ecological rating in 2016; and
  - Goch Dulas, covering the northern extents of the site: which had an overall rating of moderate with a 'good' chemical rating and a 'moderate' ecological rating in 2016.

### **Ground Gas and Radon**

- 3.17 Localised Alluvium and possibly Made Ground is present on site which represents a potential source of elevated ground gasses.
- 3.18 Radon levels across the majority of the site are indicated to be between 3% and 10% whereby basic radon protections measures would be required within buildings. Areas in the north and south east of site are reported to be in areas where radon levels are below 3%, and radon protection measures are not required.

### **Mining and Mineral Extraction**

- 3.19 The entire site is indicated to be located in an area where sporadic or localised underground mining of restricted extent is possible.
- 3.20 Ynys-bach Gravel Pit sand and gravel pit is mapped in the centre of the site, however it was not observed during the site walkover.

- 3.21 Several small historical quarries are reported both on and near to the site within the Groundsure Report. These largely correlate to the historical mapping as discussed in **Section 4**, with most dating back to pre-1880s.

### **Environmental Sensitivity**

- 3.22 The entire island of Anglesey is part of Geomon Global Geopark as designated by UNESCO.
- 3.23 The Cors Erddreiniog site of special scientific importance (SSSI), National Nature Reserve (NNR) and Special Area of Conservation (SAC) is mapped 400m east.
- 3.24 Four small areas of woodland are mapped within and immediately adjacent to the southern and south western site boundary is categorised as an Ancient Semi Natural Woodland.
- 3.25 Agricultural land classification on site ranges from a Grade 5 (very poor quality) to a Grade 2 (good quality).

## 4. SITE HISTORY

- 4.1 Historical Ordnance Survey (OS) mapping for the site area has been reviewed. These maps and plans date from 1887 to 2023. The historical plans reviewed are provided in **Appendix 3**. The key points of the historical development of the site and surrounding area are summarised below, with pertinent locations shown on **Drawing 1**.

### On site

- 4.2 The site has remained relatively undeveloped throughout mapped history and has been utilised predominantly for agricultural purposes. The following site features have been identified on the historical mapping.
- **Old Quarries** – An old gravel pit is located centrally on site from the 1900s, which is no longer labelled from the 1970s. An old quarry is mapped along the north west boundary on the earliest plans, which is no longer shown on the 1970s plans.
  - **Farm buildings** – Most farm buildings are not included within the site boundary, however, a small building is mapped in the north east (labelled as Cae'r Tyddyn) from the earliest mapping up until the 1970s. Two small buildings are present in the south east of the site (one labelled as Pig-y-rhos) from earliest mapping up until the 1950-70s. A small outbuilding is located centrally on site since the earliest mapping, which remains on site to the present day.
  - **Wind turbines** – two wind turbines are present in the north east of site and two in the west, constructed between 2012 and 2017 according to Google Earth images.
  - **Overhead cables** – Overhead cables are shown on mapping crossing the north eastern corner of site from the 1970s.
  - **Surface water features** – Two springs are mapped in the north east and one in the north west of the site from the earliest mapping. Ponds is located in the centre, north east and south east of the site throughout the mapping.

### Off-site

- 4.3 The surrounding land areas have seen similar historical land usages, predominantly being utilised for agricultural purposes with associated farm buildings. The following site features have been identified on the historical mapping.
- **Farm Buildings** – farm buildings are mapped adjacent to the north eastern, south western, and north western boundaries. A **tank** is mapped within the north western farm complex (Cwyr) throughout the mapping history. Farm buildings (Ynya-bach) are located centrally within the site, surrounded on all sides by the site, from the earliest plans. A barn structure is developed 40m south east of site from the 1970s plans.
  - **Small quarries/pits** – Numerous small old quarries are located near to the site boundary. A small old quarry is mapped adjacent to the north east site boundary.
  - **Surface water features** – numerous small ponds and springs are mapped in the areas immediately surrounding the site.
  - **St Michael's Church** – a small graveyard is mapped 20m from the north eastern site boundary from the earliest mapping.



### **Operational / Company Records**

- 4.4 No operational records have been made available for review as part of this assessment.

### **Summary of Site History**

- 4.5 The site has remained largely undeveloped over the historical mapping period, predominantly utilised for agricultural purposes, with limited farm buildings present. Several small old quarries and ponds have been identified across the site, with some having possibly been infilled.
- 4.6 The surrounding land uses are broadly similar, comprising agricultural land with associated farm buildings. Small quarries and ponds are mapped in the surrounding area, with some possibly now infilled.

## 5. REGULATORY SETTING

### Permits Consents and Authorisations

- 5.1 A full listing of permits, consents and authorisations including discharge consents, pollution incidences and other environmental information, is included in the Groundsure report, presented in **Appendix 3**.
- 5.2 No significant features have been identified which are considered likely to have had a detrimental impact on the site.

### Landfilling and Waste Management

- 5.3 A full listing of EA, BGS and Local Authority recorded landfills are provided in the Groundsure report presented in **Appendix 3**.
- 5.4 There are no historical landfill sites identified within 500m of the site. A licensed waste site is listed 125m south east of site, however, the location does not match the site address, so the specific location is unclear.
- 5.5 There are no waste exemption permits listed on site, however, there are a number identified in the surrounding area. They relate to various small-scale agricultural processes including; deposits of dredging's from water courses, spreading waste on agricultural land to confer benefit, use of waste for a specified purposes, burning of waste as a fuel, burning waste in the open, use of waste in construction, storage of waste in a secure place/containers, anaerobic digestion at premises used for agriculture and burning of resultant biogas, storage of sludge, cleaning/washing/spraying/coating relevant waste, incorporation of ash into soil, use of mulch., sorting mixed waste, disposal by incineration, treatment of waste wood and waste plant matter by chipping, shredding, cutting or pulverising, and aerobic composting, all listed within 100m of the site.

## 6. GEOTECHNICAL APPRAISAL

6.1 The Groundsure report, site history, current site setting and geology setting have all been considered in order to provide an indication of the potential ground related constraints and opportunities in the context of the proposed development as set out in **Table 6:1**.

**Table 6:1: Ground Related Constraints & Opportunities**

Potential Constraint / Opportunity	Explanation	Potential Mitigation Options
Preliminary Foundation Solution	Shallow spread foundations are likely to be viable across the majority of the site, bearing onto the fill or bedrock. Where Alluvium is present, foundations may need to be locally deepened to found upon more competent strata.	Ground investigation should be undertaken to confirm ground conditions at the site and allow for in-situ and laboratory testing to inform foundation design.
Rock Outcrops	There are areas of the site where visible rock outcrops are present. Additionally, in areas where superficial deposits are absent or thin, hard bedrock deposits may be present at shallow depth.	Shallow hard bedrock may need to be broken out to facilitate the construction of foundations. It is recommended that ground investigation is undertaken in areas where superficial deposits are not mapped to see how deep the competent bedrock is.
Earthworks	Localised earthworks may be required in areas where increased gradients are present to create development plateaus,	Investigation will be required in areas of steep gradients and Made Ground to assess the viability of earthworks.
Topsoil / Made Ground	Topsoil is expected to be present across the majority of the site. Limited Made Ground is expected to be present across much of the site.	There is likely to be a surplus of Topsoil which could be retained on site or potentially sold as a commodity. Made Ground could potentially be reused on site, subject to investigation and chemical analysis.
Ground Subsidence Risks	The Groundsure Report indicates a low to negligible risk on site associated with shrink/swell clays, running sands, collapsible deposits, landslides, compressible deposits and dissolution of soluble rocks across most of the site. A moderate compressibility risk is reported where Alluvium is mapped.	Intrusive investigation is recommended to inform the potential compressibility risk.
Mineral Extraction	Several former small quarries are present on site, some of which may have been infilled. This represents a risk of Made Ground being present in these areas, or shallow bedrock.	Ground investigation should be undertaken to confirm the ground conditions in these areas.

Potential Constraint / Opportunity	Explanation	Potential Mitigation Options
Drainage Soakaways and	Soils on site are likely to have low permeability and soakaway drainage is unlikely to be viable.	Should soakaways be considered as part of the drainage strategy, it is recommended that infiltration testing in accordance with current guidance is undertaken.
UXO	Review of the unexploded ordnance risk maps available online indicates the site to be in an area of low risk from UXO.	No further assessment required.

## **7. PRELIMINARY ENVIRONMENTAL RISK ASSESSMENT**

### **Introduction**

- 7.1 The risk posed by any contaminants in soil or groundwater will depend on the nature of the hazard, the probability of exposure, the pathway by which exposure occurs, and the likely effects on the receptors. A contaminant is defined as a substance that has the potential to cause harm, while a risk is considered to exist if such a substance is present in sufficient concentration to cause harm and a pathway exists for a receptor to be exposed to the substance.
- 7.2 Three impact potentials exist for any given site, all of which need to be considered in a risk assessment, which are:
- The site impacting upon itself;
  - The site impacting on its surroundings; and
  - The surroundings impacting on the site.
- 7.3 The following sections discuss all the identified potential on and off-site sources, pathways and receptors in the context of the proposed development and plausible contaminant linkages which may represent a risk to identified receptors such as human health and/or controlled waters from the data gained from the desk study.
- 7.4 The assessment is qualitative and aimed to determine all likely contaminant linkages, with consideration of significance and allowing for uncertainties.
- 7.5 **Sources (S):** These are potential or known sources of contamination that may relate to a former land use or present site feature or process (e.g. fuel storage tanks).
- 7.6 **Pathways (P):** A pathway is defined as a mechanism or route by which a contaminant comes into contact with, or otherwise affects a receptor. Pathways by which the identified receptors may be impacted upon in the context of the proposed development.
- 7.7 **Receptors (R):** Receptors are defined as people, living organisms, ecological systems, controlled waters, atmosphere, structures and utilities that could be adversely affected by contaminant(s).

### **Conceptual Site Model**

- 7.8 Consideration has been given to the likely sources, pathways and receptors which may be present, based on the information in the previous sections. These are presented in **Table 7:1** and
- 7.9 **Table 7:2** and further information about the risk classification scheme is included within **Appendix 4**, with reference to CIRIA C552 '*Contaminated land risk assessment - a guide to good practice*'.

7.10 A tabulated version of the Preliminary CSM based on the desk study and site observations is presented in **Table 7:3**.

**Table 7:1: Potential Sources of Contamination**

Location	Potential Source	Contaminants of Potential Concern (CoPC)
On-site	Possible localised <b>Made Ground</b> associated with <b>farm buildings, tracks, infilled ponds or quarries.</b>	<ul style="list-style-type: none"> <li>Heavy metals</li> <li>Inorganics, such as cyanides, sulphates and nitrates</li> <li>pH</li> <li>Polycyclic Aromatic Hydrocarbons (PAH)</li> <li>Petroleum hydrocarbons</li> <li>Methane, carbon dioxide</li> </ul>
	Localised organic impact track	<ul style="list-style-type: none"> <li>Possible Petroleum hydrocarbons</li> </ul>
	Elevated Radon levels	<ul style="list-style-type: none"> <li>Radon</li> </ul>
	Possible elevated ground gasses associated with potentially <b>organic rich Alluvium.</b>	<ul style="list-style-type: none"> <li>Methane, carbon dioxide</li> </ul>
Off-site	Possible elevated ground gasses associated with potentially <b>organic rich Alluvium.</b>	<ul style="list-style-type: none"> <li>Methane, carbon dioxide</li> </ul>
	<b>Made Ground</b> and potential contamination associated with neighbouring <b>farm activities, and infilled small ponds/quarries.</b>	<ul style="list-style-type: none"> <li>Heavy metals</li> <li>Inorganics, such as cyanides, sulphates and nitrates</li> <li>PAHs</li> <li>Petroleum hydrocarbons</li> <li>Methane, carbon dioxide</li> </ul>
	Small <b>Graveyard</b> near to north east corner of site.	<ul style="list-style-type: none"> <li>Water quality indicators, ammonium, total oxidised nitrogen (nitrate and nitrite), chlorine, total organic carbon, biological oxygen demand, chemical oxygen demand, alkalinity, sodium, potassium, calcium, magnesium, iron, manganese, cadmium, chromium, copper, nickel, lead, zinc, phosphorus, formaldehyde, mercury</li> </ul>

**Table 7:2: Relevant Potential Pathways and Receptors**

Receptors	Pathways
<b>Human Health:</b> <ul style="list-style-type: none"> <li>Future site users</li> <li>Intrusive maintenance workers</li> </ul>	<ul style="list-style-type: none"> <li>Dermal contact with soil or dust</li> <li>Incidental ingestion of soil and/or dust</li> <li>Inhalation of radioactive particles</li> <li>Inhalation of dust and/or fibres</li> <li>Migration and accumulation of ground gas in enclosed spaces leading to inhalation or explosion</li> </ul>
<b>Controlled Waters:</b> <ul style="list-style-type: none"> <li>Groundwater (Secondary Aquifers)</li> <li>Surface water features across site.</li> </ul>	<ul style="list-style-type: none"> <li>Leaching of soil contaminants</li> <li>Vertical and lateral migration</li> <li>Surface run-off</li> </ul>
<b>Property:</b>	<ul style="list-style-type: none"> <li>Direct Contact</li> </ul>

---

Receptors	Pathways
<ul style="list-style-type: none"><li>• Underground utilities</li><li>• Building structures</li></ul>	<ul style="list-style-type: none"><li>• Accumulation and explosion of gas</li></ul>

**Table 7.3: Preliminary Conceptual Site Model**

Source	Pathway	Receptor	Con	Prob	Risk	Potential Mitigation/Investigation Requirements
On-site sources as detailed in Table 7.1.	Dermal contact with, and incidental ingestion of soil and/or dust. Inhalation of dust and/or fibres.	Future site users	Mi	UI	VL	The potential for encountering Made Ground or contaminated soils is restricted areas adjacent to railway lines and possibly localised areas of infilled ponds/quarries. As part of the proposed development, it is anticipated that limited human interaction with the soils is likely to happen, based on the end use. Where a viable pollutant pathway exists, the provision of a clean capping layer would restrict direct access to potentially contaminated soils. It is recommended that an intrusive ground investigation be completed in order to assess the extent of any potential contamination at the site.
		Intrusive maintenance workers	Mi	Lw	L	The exposure of intrusive maintenance workers can be mitigated by the adoption of suitable working methods, utilising appropriate personal protective equipment (PPE) and maintaining good hygiene. If significant asbestos is recorded, the requirements of the Control of Asbestos Regulations (CAR) 2012 should be complied with.
	Inhalation of radioactive particles	Future site users	Md	Lw	M/L	Radon protection measures are required within buildings/enclosed spaces where naturally elevated radon levels are present.
	Migration and accumulation of ground gases in enclosed spaces leading to asphyxiation (carbon dioxide) or explosion (methane).	Future site users	Md	UI	L	Localised Alluvium is reported to be present in the centre of the site, which may contain organic material, and could represent a source of ground gas. The proposed development is likely to have limited enclosed spaces that would warrant ground gas protection measures. However, where enclosed spaces are located in the vicinity of Made Ground or Alluvium, ground gas monitoring is recommended to inform the level of mitigation required.
	Leaching and permeation through soil profile.	Groundwater: Underlying Secondary Aquifer	Mi	UI	VL	No significant source of contamination has been identified at the site that would represent a risk to controlled water receptors.
	Vertical and lateral migration of contaminants.		Mi	UI	VL	Ground investigation into areas of Made Ground should be undertaken to assess the risk to controlled waters.
	Lateral migration of contaminated groundwater.	On site water courses	Mi	UI	VL	
	Surface run-off.		Mi	UI	VL	



Source	Pathway	Receptor	Con	Prob	Risk	Potential Mitigation/Investigation Requirements
	Direct contact.	Water pipes utility	Mi	UI	VL	No significant source of contamination has been identified at the site that would represent a risk to potable water supply pipes. An investigation and risk assessment should be undertaken to assess the level of protection required to pipework.
		Buried structures/foundations.	Md	UI	L	Sulphates and low pH in the ground could accelerate the degradation of buried concrete structures (e.g. foundations). Ground investigation is recommended to inform concrete design.
Off-site sources as detailed in Table 7:1.	Migration and accumulation of ground gases in enclosed spaces leading to asphyxiation (carbon dioxide) or explosion (methane).	Future site users	Md	UI	L	No significant source of off site ground gas has been identified, and limited enclosed spaces are anticipated to form part of the proposed development. Where enclosed spaces are located near to off site sources of Made Ground/Alluvium, ground gas monitoring should be undertaken to inform the risk
	Lateral migration of contaminated groundwater.	Groundwater: Underlying Secondary Aquifers	Mi	UI	VL	No significant off site source of contamination has been identified which is likely to result in a risk to the aquifer quality under the site. Ground investigation is recommended in areas adjacent to possible contamination sources to quantify this.

VH = Very High, H = High, M = Moderate, M/L = Moderate/Low, L = Low, VL = Very Low

KEY: Sv = Severe, Md = Medium, Mi = Mild, Mr = Minor, Hi = High, Li = Likely, Lw = Low Likelihood, UI = Unlikely

### Contaminant Linkage Assessment Summary

When considered in the context of the conceptual site model and the historical activities that have taken place (localised small quarrying activities), the proposed development is considered to pose a MODERATE/LOW risk to human health. It is considered that the main driver for the risk rating for human health is the potential presence of naturally elevated radon levels across the site.

The risk posed to controlled waters is predominantly considered to be VERY LOW due to the absence of a significant contamination source identified on site.

It is recommended that localised ground investigation be undertaken to quantify the identified contaminant linkages and assess likely mitigation measures.

## **8. CONCLUSION AND RECOMMENDATIONS**

### **Conclusions**

- 8.1 The site largely comprises agricultural land utilised for grazing animals and crops. Several small derelict farm buildings are present on site. Numerous water courses are present within the site and immediate surrounding area, most of which feed into Afon Cefni, which flows from north east to south west through the site.
- 8.2 The site has remained largely undeveloped over the historical mapping period, predominantly utilised for agricultural purposes, with limited farm buildings present. Several small old quarries and ponds have been identified across the site, with some having possibly been infilled. The surrounding land uses are broadly similar, comprising agricultural land with associated farm buildings. Small quarries and ponds are mapped in the surrounding area, with some possibly now infilled.
- 8.3 Ground conditions are anticipated to comprise Devensian Till and localised Alluvium overlying bedrock of the Coedana Granite/Complex, undifferentiated Central Anglesey Shear Zone and Berw Shear Zone, and Ordovician Rocks. Igneous intrusions are mapped in the south west and west of the site, with a fault mapped in the north west of site, trending in a north to south direction. Localised Made Ground is expected in the vicinity of infilled ponds and quarries.
- 8.4 The Till is categorised as an undifferentiated Secondary Aquifer, whilst the Alluvium is categorised as a Secondary A Aquifer. All bedrock geologies mapped underlying the site are categorised as Secondary B Aquifers.
- 8.5 Limited sources of contamination have been identified across the site given the lack of historic development. The risk to human health receptors is considered to be moderate/low risk based on the potential presence of naturally elevated radon levels across the site. The risk to controlled water receptors is considered to be very low based on the lack of an identified contamination source.
- 8.6 Shallow spread foundations are likely to be viable across the majority of the site, however, shallow bedrock may need breaking out to facilitate this locally. Foundations may need to be locally deepened in areas where Alluvium is present. Earthworks are likely to be required where steep gradients are present.

### **Recommendations**

- 8.7 Once the development masterplan is defined, it is recommended that ground investigation is undertaken to quantify the contaminant linkages identified within conceptual site model.
- 8.8 It is recommended that intrusive ground investigation is undertaken in areas where Alluvium and bedrock outcrops are known/suspected to be present in order to inform foundation design.

---

## 9. REFERENCES

1. BS 10175:2011+A2:2017 Investigation of potentially contaminated sites. Code of practice. British Standards Institute, 2017.
2. CIRIA C552 *Contaminated land risk assessment. A guide to good practice*. Rudland, D J, Lancefield, R M, Mayell, P N, 2001.
3. Environmental Protection Act 1990: Part 2A, Contaminated Land Statutory Guidance. Department for Environment Food and Rural Affairs (DEFRA), 2012.
4. Land Contamination Risk Management. Environment Agency, 2020.
5. <https://www.gov.uk/government/collections/land-contamination-technical-guidance>.
6. The Control of Asbestos Regulations. Health and Safety Executive, 2012.

## **DRAWINGS**

---

**Drawing 1: Site Layout Plan**

---

**APPENDICES**

---

**Appendix 1: Site Photographs**

---

**Appendix 2: Groundsure Report (Available on Request)**

---



**Appendix 3: Historical Mapping (Available on Request)**

---

**Appendix 4: Classification of Risk**

---

