Dulas

Hafod Road Solar Site, Wrexham

Desk Study

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Hafod Road Solar Site, Wrexham

Desk Study

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			Hannah Jeffery	Ruth Easterbrook	Claire Hooley
A	June 2025	Updated following Client comments and updated proposed development plan			
			Hannah Jeffery	Ruth Easterbrook	Claire Hooley
Report Liability Date: March 2025					

TEC is ISO 9001:2015 and ISO 14001:2015 certified by British Assessment Bureau Ltd, a UKAS Accredited Certification Body (number 8289) and ISO 45001:2018 certified by QMS International Ltd for the scope of 'Specialist consultancy services across the UK in contaminated land assessment, ground engineering, waste management and construction phase monitoring'.

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EXECUTIVE SUMMARY

This report presents the findings of the desk study undertaken at the site to determine anticipated ground conditions and establish if there are any potential geoenvironmental or geotechnical risks associated with the proposed redevelopment of the site. Pertinent information and conclusions are summarised below.

SITE DETAILS	**Hafod Road Solar Site, Wrexham, LL14 6ET. NGR: 331340, 345920**
SITE BACKGROUND INFORMATION	• Historic mapping indicates the site largely comprised an undeveloped field since c.1874, with limited, highly localised structures/features present until 1989. • Multiple extractive industries have historically been present in the vicinity of the site. Of note, the former clay pits (now landfill site) ~25m southwest and associated Brick and Tile Works ~170m northwest, potentially infilled land and spoil heaps (associated with Brick Works and former Hafod-Y-Bwch Colliery) ~150m northwest. • Geology comprises superficial Devensian Till (Secondary (Undifferentiated) Aquifer) over Etruria Formation (Secondary A Aquifer) both of Low Vulnerability. • The nearest surface water feature comprises a groundwater issue/stream in the north of the site and the Aberderfyn Brook located ~5m southwest.
INITIAL CONCEPTUAL MODEL	Based upon our current conceptual understanding of the site and the proposed end use, the main potential Significant Contaminant Linkages identified are considered to be as follows: • Human health (Future site end users and onsite indoor structures, where present) – migration, ingress and inhalation of ground gas from bulk ground gas associated with off site Hafod Quarry Landfill to the southwest and extensive potentially infilled land to the northwest; • Human Health (buildings / structures on site) – potential damage to building materials or pipes from direct contact with aggressive ground or groundwater.

The above summary should not form the basis for key decisions associated with the proposed development and a full review of the information contained within this report is recommended.

1 INTRODUCTION

1.1 Terms of Reference

1.1.1 TEC has been appointed by Dulas to undertake a Stage 1: Risk assessment, comprising a Geoenvironmental Desk Study including walkover survey of Hafod Road Solar Site, Wrexham. All works were undertaken in accordance with our proposal letter dated 04 February 2025 and referenced RVE.2310008.002.

1.2 Background

1.2.1 The site is a National Trust area of land located between Hafod Road and the A483 to the southwest of Wrexham in North Wales (Figure 1). The site covers an area of approximately 4.26 hectares, with the centre of the site at National Grid Reference 331340, 345920. The nearest postcode is LL14 6ET.

1.2.2 The site currently comprises two large irregular shaped agricultural fields bounded by hedgerows and trees. The proposed development is understood to comprise the construction of a new solar farm with associated infrastructure (see Dulas Ltd Drawing *"Hafod Road Solar, Wrexham: Proposed Layout",* prepared for National Trust. Drawing Ref.: E05797, Rev. A).

1.2.3 TEC have previously undertaken works at the site, comprising a desk-based coal mining risk assessment. The report details are as follows:

- *Hafod Road Solar Site, Wrexham: Desk Based Coal Mining Risk Assessment (CMRA*) by TEC. Report ref.: 2310008.001.01 Rev A, dated June 2025

1.2.4 Full reference should be made to the previous reporting although a summary of salient information is provided in Section 2.10 of this report.

1.2.5 It is understood that consultation by the Client with the Planning Department of the Local Authority has highlighted the requirement for works in relation to contamination, with the below information from the Local Authority Planning Department being reported to TEC as follows:

"*The site is a greenfield parcel of previously undeveloped land which is unlikely to have any potential for land contamination issues arising from past agricultural uses.*

However, the site is located within close proximity to the Hafod Enovert Landfill Site, which although regulated, is still a potential source of land contamination for the locality. As such, to negate any requests for additional information, or the imposition of conditions relating to ground contamination, it would be prudent for any future application to be accompanied by a Desk Based Contaminated Land Assessment, including any informed remediation measures where identified as necessary. I can advise however, that this document would not necessarily be required to validate any future application, but is still nonetheless recommended.

Ideally the assessment would cover the following matters:

- *Identification of any remedial measures required to deal with any hazards identified;*
- *A Remediation Strategy (where necessary), including remediation options appraisal; and*
- *A verification plan and report."*

1.2.6 Therefore, the aim of these works is to provide information on land contamination risk and the ground engineering conditions and constraints associated with the site with regard to the proposed development; and to assist in meeting regulatory requirements to determine the presence, or otherwise, of any risks associated with potential contamination and to ensure the site is suitable for redevelopment.

1.3 Site Objectives

1.3.1 The site objectives and subsequent scope of works undertaken as part of this report are presented below:

- **Tier 1: Preliminary Risk Assessment:** this phase of assessment involves development of an initial conceptual site model, based on desk study research and a site walkover/reconnaissance survey, to develop an initial conceptual site model, identify potential contaminant linkages and establish whether or not there are potentially unacceptable risks.

1.3.2 The above scope of work has been undertaken in accordance with current guidance such as LCRM - *Land contamination: risk management* (Environment Agency, 2023), BS10175+A2:2017, BS5930:2015+A1:2020 and, where appropriate, Eurocode 7 and NHBC Standards/ LABC Technical Manual.

1.3.3 From the outset, sustainability and the potential impact of climate change have been considered, to assist in identification of options to minimise the environmental, social, and economic impacts of the risk assessment approach, with reference to Sustainable Management Practices (SMPs) from Sustainable Remediation Forum UK (SuRF-UK).

2 TIER 1: PRELIMINARY RISK ASSESSMENT

2.1 Introduction

2.1.1 Information for this Tier 1: Preliminary Risk Assessment (PRA) has been obtained from a site reconnaissance survey and a review of an Envirocheck® report obtained for the site (Appendix B and Appendix C), together with published available information where relevant.

2.2 Site Setting

2.2.1 A site reconnaissance survey was undertaken by a suitably experienced geoenvironmental consultant from TEC on 13 March 2025. A summary of the observations is presented in Table 2.1. Photographs taken during the site reconnaissance survey are presented in Appendix A.

Table 2.1: Site Details

Feature	Description	
Site Location	The site comprises 2No. agricultural fields located between Hafod Road and the A483 to the southwest of Wrexham in North Wales. The site covers an area of approximately 4.26 hectares, with the centre of the site at National Grid Reference 331340, 345920. The nearest postcode is LL14 6ET. Access to the site is via the existing farm track off Hafod Road to the north.	
Current Site Use	The site currently comprises 2No. irregularly-shaped agricultural fields with the majority of the fields noted to comprise recently cut crops.	
Site Context	The site is located within a predominantly rural agricultural area.	
Site Boundary Features	North	Hafod House Nursing Home, Cottages and Farm (northwest) with unnamed road and a pond beyond.
	East	Woodland/hedgerows and A483 dual carriageway, with agricultural fields beyond
	South	Woodland/hedgerows and Bangor Road with agricultural fields and landfill site (southwest only) beyond.
	West	Hafod Road with Aberderfyn Nature Reserve beyond
Site Topography	The site was undulated and gently sloped from west to east cross the site with available OS mapping indicating the site is situated at ~100mAOD (above ordnance datum). A small retaining wall was noted along the central western area of the site.	
Hard and Soft Landscaping	The site was entirely lain to soft landscaping with a small area of compacted ground at the entrance to the site off the farm track to the north. The majority of the site was noted to comprise recently removed crops with rough grass noted within the northern area of the site.	
Trees	Some small semi-mature trees were noted within the north-eastern corner of the northern field area, associated with the existing culvert. No additional trees were noted within the site although semi-mature and mature trees were recorded along the boundaries of the site.	
Fuel, Hazardous Chemicals and Waste Materials Storage	No evidence of AST, USTs or chemical/waste storage was noted onsite. Within the north-western section of the southern field a small area of general rubble and builders' materials was noted.	
Asbestos Containing Materials (ACM)	No evidence of ACM was noted on the ground surface during the site reconnaissance.	
Site Drainage	A culvert outfall was noted within the north-eastern corner of the site, with water flowing in a general west-east direction and off site towards the A483. Several manholes were noted onsite, generally north to south across the site area. In addition, localised areas standing water were noted typically within the eastern area of the site and evidence of small stream was noted within the southern field along the eastern boundary.	
Evidence of Potential Contamination	No visual or olfactory evidence of contamination was noted during the site reconnaissance.	
Ground Stability Hazards	No visual evidence of ground subsidence or ground movement observed was observed within the site during the reconnaissance.	
General	Overhead electricity cables were recorded within the south-eastern corner of the site, orientated north-west to south-east.	

2.3 Site History

2.3.1 Details of the history of the site and surrounding area, relevant to this preliminary risk assessment, have been obtained through the review of historical Ordnance Survey (OS) mapping. A summary of potentially significant features is recorded in Table 2.2, which should be read in conjunction with the full map extracts contained within Appendix B.

Table 2.2: Historical Features Summary

On Site Features			OS Dates
Undeveloped field, with the route of the access road to the adjacent Hafod House and a groundwater issue/stream crossing the northern-most extent of the site. A small square structure is depicted at the boundary between the two fields, in the centre of the site, in the 1912 mapping, no longer present after the 1993 mapping. This feature is recorded as a Signal Box ("SB") on the 1992 mapping. By 1962, an electricity cables cross the southwestern area of the site connected by electricity pylons which are located off site. By 1989, the road crossing the northern boundary of the site has been re-routed and is not present on site. The groundwater issue remains present in the northern-most area of the site, flowing to the southeast, off site.			1874 - 2025
Surrounding Features	**Distance**	**Direction**	**OS Dates**
Pond	~5m ~15m ~10m ~30m ~10m Adjacent	Northwest Northwest Northeast Northwest Northwest East	1874 – 1989 1874 – 1899 1874 – 1979 1899 – 1954 1899 1962 - 1989
Aberderfyn Brook	From ~5m	Southwest	1874 - 2025
Hafod-y-bwch Colliery, with associated spoil heaps, ponds/reservoir, mineral railway sidings, slurry pond and buildings, extended north by 1912, disused by 1979	From ~445m From ~315m	Northwest	1874 1899 - 1979
Vauxhall Colliery with associated railway sidings, spoil heaps, shafts and buildings (disused by 1954)	From ~570m From ~535m	Southwest	1874 1899 - 1954
Hafod Red Brick Works with associated spoil heaps, tramways, tanks and chimneys, identified as "Works" by 1962 and "Brick & Tile Works" by 1968 and "Tile Works" by 1989, "Works" by 1992, "Factory" by 2024	From ~170m	Northwest	1899 -2025
Large clay pits with associated railway sidings/tramway, spoil heaps, wells/drains and buildings, extended/deepened south by 1912, 1953 and 1962. By 1974, all features no longer present and whole area recorded as "Clay Pit" and by 2024 area recorded as "Haford Quarry (dis)"	From ~30m	Southwest	1899 - 2024
Tramway (between clay pits and brick works)	From ~100m	West	1899 - 1974
Spoil heap (at location of former Hafod-y-bwch Colliery)	From ~325m	Northwest	1962 - 1968
Spoil heap (at location of former Vauxhall Colliery)	From ~535m	Southwest	1974
Tip (disused)	~100m	Southwest	1974
Electricity sub station	~190m	Northwest	1989 - 2025
Earthworks/embankment construction of A483 slipway and road crossing	Adjacent	Southeast Northeast	1989 - 2025
Works	~325m	Northwest	1989 - 2003
Refuse/spoil heap (at location of former Hafod-y-bwch Colliery)	~425m	Northwest	1993
Refuse/spoil heap	~115m	West	2000 - 2025
Gas governor	~65m	Southwest	2024 - 2025
Tank	~100m	Southwest	2024 - 2025

2.4 Potential for Unexploded Ordnance

2.4.1 A review of the available online Zetica UXO Risk Mapping indicates the site to be within a low-risk area and therefore, no further assessment has been undertaken in relation to potential UXO.

2.5 Geology

2.5.1 A summary of available geological information for the area is provided in Table 2.3.

Table 2.3: Geological Setting

BGS Geological Mapping (Ref. Solid and Drift 1:50,000 map – Wrexham, Sheet 121) and online BGS Geology Viewer			
Geological Unit		**Thickness**	**BGS Description**
Made Ground *(eastern and southeastern boundary only)*		Unknown	Made Ground is an area where the pre-existing (natural or artificial) land surface is raised by artificial deposits. The purpose of the made ground is unspecified.
Superficial Deposits: Devensian Till		Unknown	Diamicton.
Solid Geology: Etruria Formation *(formerly named Ruabon Marl Member)*		Up to 300m	Red, purple, brown, ochreous, green, grey and commonly mottled mudstone, with lenticular sandstones and conglomerates referred to as 'espleys'. Common pedogenic horizons, but coal seams are rare. Subordinate, lenticular sandstones and conglomerates commonly consist mostly of volcanic and lithic clasts.
BGS Borehole Records			
BGS Reference	**Distance/ Direction**	**Depth (mbgl)**	**Recorded Strata**
SJ34NW320	On site (eastern boundary)	0.0 to 0.2	Topsoil
		0.2 to 1.9	Stiff red brown sandy silty CLAY with a little fine and medium assorted gravel. (GLACIAL TILL)
		1.9 to 8.6	Firm to stiff becoming stiff brown and grey brown silty occasionally sandy CLAY with trace of fine and medium assorted gravel and occasional cobbles and boulders. (GLACIAL TILL)
		8.6 to 10.0	Dense fine to coarse assorted SAND and GRAVEL. (GLACIAL SAND and GRAVEL). Water encountered at 8.6mbgl.
SJ34NW544	On site (eastern boundary)	0.0 to ~0.3	Topsoil
		~0.3 to ~1.5	Stiff brown silty CLAY
		~1.5 to ~2.2	Stiff brown silty CLAY with SAND partings
		~2.2 to ~4.3	Stiff brown silty CLAY. Water seepage noted at ~3.0mbgl.
SJ34NW283	On site (northern boundary)	0.0 to 0.4	Topsoil
		0.4 to 4.0	Generally stiff, brown and red-brown slightly sandy silty CLAY with a trace to a little fine to coarse assorted gravel and occasional silt parting towards base. (GLACIAL TILL)
		4.0 to 7.5	Grey, silty, fine to coarse SAND and fine to coarse assorted GRAVEL with bands of sandy, very silty clay with a little fine to coarse assorted gravel. (GLACIAL SAND and GRAVEL)
		7.5 to 11.8	Stiff to very stiff, brown becoming red-brown, sandy, silty CLAY with a little fine to coarse assorted gravel. (GLACIAL TILL). Water encountered at 9.7m and 10.5mbgl.
		11.8 to 13.9	Light brown, slightly silty fine SAND. (GLACIAL SAND)
		13.9 to 16.0	Stiff reddish brown, sandy, silty CLAY with a little fine to coarse assorted gravel and occasional boulders. (GLACIAL TILL)
		16.0 to 31.5	Stiff to very stiff, dark red-brown, poorly thinly laminated, slightly silty CLAY with occasional very weak lithorelics, becoming at approximately 20.0m highly weathered thinly laminated slightly silty generally weak MUDSTONE reduced in part to clay with occasional lithorelics. (RUABON MARL)

SJ34NW284	~105m southeast	0.0 to 0.4	Topsoil
		0.4 to 2.5	Red brown silty very clayey SAND with a little becoming come fine to coarse gravel and occasional cobbles (GLACIAL SAND)
		2.5 to 7.3	Red brown silty clayey fine and medium SAND and fine to coarse assorted GRAVEL (GLACIAL SAND AND GRAVEL). Water encountered at 6.0mbgl.
		7.3 to 8.3	Firm red and grey-green mottled slightly silty CLAY with traces of fine gravel (GLACIAL TILL)
		8.3 to 15.6	Stiff to very stiff red brown slightly silty CLAY with occasional weak lithoreclics, becoming at ~11.5m highly weathered purple silty very weak calcareous MUDSTONE reduced to clay.
		15.6 to 26.0	Generally moderately weathered thinly laminated and laminated red brown silty weak to moderately weak broken calcareous MUDSTONE with occasional very weak bands (RUABON MARL)

BGS Estimated Soil Chemistry	
Element	**Estimated Concentration**
Arsenic	<15 mg/kg
Cadmium	<1.8 mg/kg
Chromium	60 - 90 mg/kg
Lead	<100 mg/kg
Nickel	15 - 30 mg/kg
Radon	
Radon Potential	**Radon Protection Requirement**
Lower Probability Radon Area (less than 1% of homes are estimated to be at or above the Action Level)	None reported to be required

2.6 Hydrogeology

2.6.1 The Envirocheck® report, Environment Agency and Natural Resources Wales information records the following hydrogeological setting of the site.

Table 2.4: Hydrogeological Setting

Aquifer Status			
Geological Unit	**Groundwater Vulnerability/ Aquifer Designation**	**Natural Resources Wales Aquifer Classification**	**Potential Hydraulic Gradient Direction**
Etruria Formation	Low Vulnerability/ Secondary A Aquifer	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.	-
Devensian Till	Low Vulnerability / Secondary (Undifferentiated) Aquifer	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.	-

Source Protection Zones		
None recorded within 1km		
Groundwater Abstractions		
1No. recorded within 1km		
Details	**Abstraction Use**	**Distance/ Direction**
Enovert North Ltd - Haford Quarry Landfill Site	Drainage Operations - dewatering	~495m west
Discharge Consents to Groundwater		
5No. recorded within 1km		
Receiving Water	**Effluent Type**	**Distance/ Direction from Site**
Groundwater (via infiltration system)	Trade Discharges – Site Drainage	3No. at ~385m north
Land / Soakaway		2No at ~385m north
BGS Groundwater Flooding Susceptibility		
On site - Potential for groundwater flooding to occur at the surface; and potential for groundwater flooding of property situated below ground level.		

2.7 Hydrology

2.7.1 The hydrological setting of the site is summarised in Table 2.5.

Table 2.5: Hydrological Setting

Nearest Surface Water Features		
Feature	**River Quality (GQA Grade)**	**Distance/ Direction from Site**
Groundwater issue/Stream flowing off site into the Black Brook	-	On site (northern site area)
Aberderfyn Brook	-	~20m southwest
Surface Water Abstractions		
None recorded within 500m		
Licensed Discharge Consents		
10No. recorded within 500m		
Receiving Water	**Effluent Type**	**Distance/ Direction from Site**
Aberderfyn Brook	Trade Effluent	~100m southwest, ~490m northwest
	Unspecified	~425m west
	Trade Discharge – Site Drainage	~440m west
Black Brook	Sewage Discharges – STW Storm Overflow/Storm Tank – Water Company	2No. at ~325m west, ~385m west
	Public sewage – Storm Sewage Overflow	2No. at ~325m west
Ditch leading to Black Brook	Unspecified	~425m southeast

Pollution Incidents		
6No. recorded within 500m		
Receiving Water	**Pollutant/ Incident**	**Distance/ Direction from Site**
Not Given	Pollutant: Farmland run-off Date: 29.08.91 Severity: Category 2 – Significant Incident	~45m southwest
	Pollutant: Agricultural, silage liquor Date: 31.07.91 Severity: Category 2 – Significant Incident	~45m southwest
	Pollutant: Unknown Date: 30.10.91 Severity: Category 3 – Minor Incident	~50m southwest
	Pollutant: Agricultural: carcasses Date: 06.07.91 Severity: Category 3 – Minor Incident	~50m southwest
	Pollutant: Crude Sewage Date: 12.02.92 Severity: Category 2 – Significant Incident	~85m west
	Pollutant: Miscellaneous – fire water/foam Date: 01.05.97 Severity: Category 3 – Minor Incident	~245m west
Flooding from Rivers or Seas		
On Site Designation	**Off Site Areas of Flooding**	
Medium risk from surface water and small watercourses	Adjacent (east and south): Medium risk from surface water and small watercourses	

2.8 Environmental Data

2.8.1 Additional relevant environmental data from the Envirocheck® report for the site is summarised in Table 2.6.

Table 2.6: Additional Environmental Data Summary

Landfill Sites			
2No. current or historical landfills recorded within 500m			
Name/ Location	**Specified Waste**	**Input Dates**	**Distance/ Direction from Site**
Hafod Quarry (historic landfill/licensed waste management facility) Large (equal to or greater than 75,000 tonnes per year)	Household, commercial and industrial waste	Not supplied	From ~25m southwest (multiple records between ~30m southwest and ~100m southwest)
Hafod Quarry (registered landfill site)	Household, industrial, commercial, inert, metal waste/scrap metal, bonded asbestos	Not supplied	~450m west

Potentially Infilled Land (Water)		
4No. recorded within 500m		
Type	**Distance/ Direction from Site**	**Date on Mapping**
Unknown filled ground (pond, marsh, river, stream, dock etc)	~30m north ~30m northeast ~165m northwest ~465m west	1900 1964 1938 1938
Potentially Infilled Land (Non-Water)		
2No. recorded within 500m		
Type	**Distance/ Direction from Site**	**Date on Mapping**
Unknown filled ground (pit, quarry etc)	~150m northwest ~350m north	1993 1993

Commercial/ Industrial Land Use (Active Contemporary Trade Directories)		
11No. significant land uses identified within 500m		
Classification	**No. within 500m**	**Distance/ Direction from Site**
Waste Transfer Station (household, commercial and industrial and special waste)	7	~385m north, 2No. at ~395m north, 4No. records at ~415m northwest
Metal Recycling Site (Vehicle Dismantlers)	1	~415m northwest
Road Haulage Services	1	~55m north
Tile Manufacturers	1	~225m northwest
Concrete/Mortar Manufacturers	1	~225m northwest

Hazardous Substances (Authorisations, Consents, Incidents)		
18No. recorded within 500m		
Category	**Details**	**Distance/ Direction from Site**
Integrated Pollution Prevention and Control (IPPC)	Hafod Quarry Landfill (Cory Environmental (Central) Ltd): Waste landfilling >10t/day with capacity >25,000tonnes excluding inert waste – Associated process - Combustion	~170m west and 4No. records at ~400m southwest
	Hafod Quarry Landfill (Mersey Waste Holdings Associates Ltd): Waste landfilling >10t/day with capacity >25,000tonnes excluding inert waste and other wate disposal – non hazardous waste by biological treatment	~200m west and ~400m southwest
	Hafod Quarry Landfill Site: Activity not supplied (bespoke application)	~400m southwest
Local Authority Pollution Prevention and Controls	PG3/2 Manufacture of heavy clay goods and refractory goods	~225m northwest and ~245m northwest
COMAH and NIHHS Sites	COMAH Site: Easi Gas (UK) Ltd, Hafod Tileries (Lower Tier: Active)	~225m northwest
	NIHHS Site: Denis Ruabon Ltd, Hafod Tileries (Status: Not active)	~225m northwest
Planning Hazardous Substance Consents and Enforcements	Planning Hazardous Substance Consent: Dennis Ruabon Ltd: Hafod Tileries, Substance: unknown	~225m northwest
Substantiated Pollution Incident Register	Pollutant: Special Waste Materials Water Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact) Land Impact: Category 1 (Major Incident)	~74m northwest
	Pollutant: Contaminated Water Water Impact: Category 2 (Significant Incident) Air Impact: Category 4 (No Impact) Land Impact: Category 4 (No Impact)	~95m southwest

	Pollutant: Inert materials and wastes (soil and clay) Water Impact: Category 4 (No Impact) Air Impact: Category 4 (No Impact) Land Impact: Category 2 (Significant Incident)	~185m west and ~250m west
	Pollutant: Atmospheric Pollutants and Effects (Smoke) Water Impact: Category 4 (No Impact) Air Impact: Category 2 (Significant Incident) Land Impact: Category 4 (No Impact)	~465m southwest
Sensitive Land Uses		
2No. recorded within 500m		
Category	**Details**	**Distance/ Direction from Site**
Special Area of Conservation	Johnstown Newt Sites	~340m northwest
Sites of Special Scientific Interest	Stryt Las Ar Hafod (Biological)	~340m northwest

2.9 Engineering Considerations

2.9.1 Engineering considerations identified from the Envirocheck® report for the site are summarised in Table 2.7.

Table 2.7: Engineering Considerations

Ground Stability Hazards						
Hazard	**Hazard Potential**					
	No Hazard	**Negligible**	**Very Low**	**Low**	**Moderate**	**High**
Collapsible ground			X			
Compressible ground			X			
Ground dissolution	X					
Landslide			X			
Running sand			X			
Shrink/swell clays			X			
Non-coal mining		X				
Coal mining	In an area which may be affected by coal mining activity (see TEC previous report 2310008.001.01)					

BGS Recorded Mineral Sites			
7No. recorded within 1km			
Site Name	**Type/Commodity**	**Status**	**Distance/ Direction from Site**
Haford Red Brick Works Clay Pits	Opencast – Common Clay and Shale (Etruria Formation)	Ceased	~230m southwest and ~275m southwest
Haford Clay Pit	Opencast – Sand and Gravel (Glaciofluvial Deposits)	Dormant	~390m southwest
	Opencast – Common Clay and Shale (Etruria Formation)	Dormant	~390m southwest
Hafod-Y-Bwch Colliery	Underground – Coal (Deep) (Etruria Formation)	Ceased	~520m north
Vauxhall Colliery	Underground – Coal (Deep) (Etruria Formation)	Ceased	~620m southwest
Wharf Cottage Sand Pit	Opencast – Sand (Glaciofluvial Deposits)	Ceased	~795m west

2.10 Previous Site Report Summary

2.10.1 TEC have previously undertaken works at the site, comprising a desk -based coal mining risk assessment. The report details are as follows:

- *Hafod Road Solar Site, Wrexham: Desk Based Coal Mining Risk Assessment (CMRA*) by TEC. Report ref.: 2310008.001.01. Rev. A dated June 2025.

2.10.2 Full reference should be made to the previous reporting although a summary of salient information is provided in Table 2.8.

Table 2.8: Previous Desk Based CMRA Summary

Geology	• British Geological Survey (BGS) mapping suggest the site is underlain by superficial Till and bedrock of the Etruria Formation, which is in turn underlain by the Pennine Coal Measures Group. • Available nearby borehole logs suggest that the Etruria Formation extends to approximately 170m below ground level.
Historical Mapping	• Earliest available mapping (circa 1879) depicts the site as undeveloped farmland, with no notable changes until the present day. • Hafod-y-bwch colliery is recorded on mapping dating up to 1962 approximately 700m north of site whilst, Vauxhall colliery is mapped 800m southwest and listed as disused from 1954.
Coal Mining Consultants Report	• Coal Authority records indicate that several coal seams have historically been worked underneath the site area, the shallowest of which is 390mbgl which had an extraction thickness of 80 - 90cm. • The Coal Authority records indicate that the last seam to be worked was in the 435m deep Quaker seam in 1968. • The Coal Authority have no records of any mine entries or shafts within 100m of the site. • There are no recorded opencast workings within the vicinity of the enquiry boundary, and the Coal Authority records indicated there to be no probable unrecorded shallow workings on or in proximity to the site. • There are no recorded cases of coal mining subsidence in proximity to the site, nor any records of mine gas emissions, mine water treatment schemes of Coal Authority managed tips.
Conclusions	• It is considered that given the depth and limited extracted thicknesses, that historical mining of the deep coal seams is unlikely to impact the proposed development. • Given the Coal Authority records and the likely thickness of the Etruria Formation overlying the Pennine Coal Measures Group, the risk from shallow/surface mining is also considered to be low.
Recommendations	• It was recommended that a careful watch is maintained during any excavations or ground works at the site to assess for any evidence of disturbed ground.

2.11 Regulatory Consultations

2.11.1 Regulatory consultations were undertaken with the relevant department at Wrexham County Borough Council, however at the time of issue of this report, responses had not yet been received. Responses will be issued as an addendum upon receipt.

2.12 Initial Conceptual Model

2.12.1 In accordance with the Environment Agency Land Contamination: Risk Management Guidance (LCRM), potential source-pathway-receptor contaminant linkages identified from the preliminary risk assessment phase are summarised in the following sections.

2.13 Potential Sources

2.13.1 The source is defined as a contaminant or pollutant that is in, on or under the land and that has the potential to cause harm or pollution. The source can potentially be present on the site or within influence of the site in the case of an off site source.

2.13.2 Potential ground gas risks associated with coal mining in proximity to the site have not been considered further for the purposes of this assessment, following conclusions drawn within the TEC Coal Mining Risk Assessment. This report indicated that given the depth and limited extraction thicknesses the historical mining of the deep coal seems is unlikely to have an impact on the proposed development. The risks of shallow mining were also considered to be low, and no mine entries are recorded within 100m of the site.

2.13.3 Potential sources of contamination identified on and within the vicinity of the site are summarised below:

Potential On Site Sources

- Localised areas of made ground of unknown chemical composition, particularly in the northern-most area of the site, associated with the former route of the unnamed road in this location and in the central site area, associated with the former signal box structure.

Potential off Site Sources

- Extensive landfill (associated with infilled former clay pits of Hafod Quarry) from ~25m southwest and extensive potentially infilled land associated with the former Hafod-Y-Bwch colliery and Brick Works (from ~150m northwest);
- Multiple spoil heaps associated with former extraction activities from ~115m west;
- Potential made ground associated with adjacent earthworks/embankment construction of A483 slipway and road crossing;
- Industrial current and historic land uses in proximity to the site (i.e. brick/tile works at ~170m northwest).

2.14 Potential Receptors

2.14.1 Receptors are defined as the entity (e.g. human, animal, water, vegetation, building services etc) which has the potential to experience adverse effects from direct or indirect exposure to potentially hazardous contaminants.

2.14.2 Potential receptors identified in relation to the proposed development as part of this preliminary risk assessment are:

- Future site users (most sensitive receptor being adult construction and maintenance workers on the proposed solar farm development);
- Construction and maintenance workers;
- Controlled waters (Secondary Aquifers and surface waters (including the groundwater issue/stream in the north of the site and Aberderfyn Brook located from ~5m southwest);
- Proposed development/ structures (below ground services and concrete, proposed structures on site). TEC understands that the proposed development comprises multiple solar panels with associated small substations. This assessment has been undertaken assuming there to be only limited, small indoor spaces (i.e. substations) which are understood to be attended periodically i.e. not daily.

2.15 Potential Pathways

2.15.1 Pathways are defined as the route contaminants take from a source to an exposed receptor. The exposure pathways can be direct or indirect transport from one medium to another.

2.15.2 Potential contaminant pathways relevant to the anticipated contaminants, ground conditions and proposed end use (receptors) include:

Human Health

- Dermal contact – Direct skin contact with contaminated soil, dust, or water. Certain contaminants can also be absorbed into the body through skin, or enter directly through open cuts or abrasions;

- Ingestion – Ingestion of soil by eating with unwashed hands causing cross contamination, or ingestion of fugitive dust from surfaces etc.; and
- Inhalation – inhalation of soil, dust, gases, or vapours which have migrated through the unsaturated zone which may result in short term acute risks of asphyxiation or toxicity, and/or long term chronic risks to human health.

Controlled Waters

- Infiltration and percolation of contaminants resulting in migration through permeable strata such as the unsaturated zone to the underlying groundwater.
- Migration of mobile/leachable contaminants by diffusion, advection, dispersion and capillary transport vertically down through any near surface unsaturated zone until meeting the groundwater table below, after which free/dissolved phase contaminants may potentially migrate beyond the site boundaries and impact off site receptors; and
- Horizontal migration of leachate causing a potential impact on surface water quality in nearby watercourses, or below the ground along preferential pathways or discontinuities and fractures within the underlying strata.

Ground Gases

- Vertical migration of gaseous contaminants through the unsaturated zone within permeable strata, or vertical and horizontal migration through preferential pathways such as fractures and discontinuities within the underlying solid geology.
- Migration of dissolved phase gases within perched and groundwater through the saturated zone and permeable pathways within the underlying bedrock such as fractures/drainage runs.
- Migration of hazardous gases to indoor air through soil and building foundations.

Building Materials/Services

- Contaminated ground: Building materials (such as membranes) can be damaged by direct contact with contaminated ground, especially if mobile groundwater is present;
- Permeation of contaminants: Contamination within soil and groundwater can permeate through water supplies; and
- Explosive risk: Potential risk of fire and/or explosion within structures (both existing and proposed) caused by hazardous gases (for example – methane).

2.16 Hazard Assessment and Risk Estimation

2.16.1 As part of the risk assessment process, it is necessary to establish the potential risk from the probability and consequence of the event. Firstly, the magnitude of the probability is considered, and then the extent of the probability is considered. The combination of the consequence and probability is the resulting level of risk.

2.16.2 Potential contaminant linkages identified as part of this preliminary risk assessment are summarised in the Initial Site Conceptual Model presented in Table 2.9. References to risk estimations are made in accordance with the methodology presented in CIRIA publication C552 (2001) titled *'Contaminated Land Risk Assessment: A Guide to Good Practice'* and summarised in Appendix D.

Table 2.9: Initial Conceptual Model

Potential Source Location	Potential Hazard/ Source	Potential Receptor	Potential Pathway to Receptors	Potential Consequence of Contaminant Linkage	Potential Probability of Contaminant Linkage	Risk Classification (Risk = Probability x Consequence)
On site	Localised made ground	Future site users and construction workers	Exposure to potential contaminants through ingestion, inhalation and dermal contact.	Medium	**Unlikely to Low Likelihood**: Given the development history recorded on site (i.e. largely undeveloped land since earliest historic mapping, with only localised features depicted), and observations made during the site reconnaissance, the presence of extensive made ground of unknown thickness and chemical composition, or shallow contaminants on site cannot is not anticipated. However, localised made ground and associated potential contaminants in the northern site area and central site area be fully discounted at this stage.	**Low to Moderate Risk**
		Controlled waters (Secondary Aquifers and surface waters)	Leaching of potential contaminants from made ground and vertical and lateral migration through the saturated zone to controlled waters.	Medium	**Unlikely to Low Likelihood**: Given the recorded history of the site, the presence of extensive, signficant made ground on site is not anticipated. However, the potential presence of localised made ground of unknown chemical composition cannot be fully discounted at this stage. Given this, and given the recorded aquifer status of the underlying strata (Secondary A Aquifer) as well as the presence of a surface water course in the northern site area and the nearby Aberderfyn Brook, a potential risk to controlled waters, whilst likely to be low, cannot be fully discounted. Notwithstanding this, the underlying ground materials (Till) are anticipated to have a significant cohesive component, which will limit the potential vertical and lateral migration of contaminants into the underlying aquifer.	**Low to Moderate Risk**
		Future site users, construction workers and proposed development	Migration, ingress and accumulation of ground gasses.	Severe	**Unlikely**: Given the development history and observations made during the reconnaissance survey, the likelihood of made ground to provide a potential ground gas source is considered to be low.	**Low to Moderate Risk**

Potential Source Location	Potential Hazard/ Source	Potential Receptor	Potential Pathway to Receptors	Potential Consequence of Contaminant Linkage	Potential Probability of Contaminant Linkage	Risk Classification (Risk = Probability x Consequence)
Off site	Hafod Quarry Landfill (from ~25m southwest) and potentially infilled land (from ~150m northwest)	Future site users/construction workers and proposed development (limited indoor spaces).	Potential on-site contaminant / ground gas migration from off site source	Medium to Severe	**Low Likelihood**: Hafod Quarry landfill (infilled former clay pits) is located from ~25m southwest of the site boundary. However, based upon the proposed development plan (Dulas Ltd Drawing *"Hafod Road Solar, Wrexham: Proposed Layout",* prepared for National Trust. Drawing Ref.: E05797, Rev. A), only two small substation structures are proposed with indoor space, located ~200m from the landfill site. It is also noted that the Aberderfyn Brook is located between the site boundary in the southwest and the landfill site, thus potentially intercepting the landfill and potential off-site migration of leachate and ground gas. In addition, although it is acknowledged that extensive potentially infilled land is located from ~150m northwest of the site boundary, up assumed topographic gradient, given the distance to this feature and the anticipated cohesive component of the underlying superficial Till deposits and the scale of the proposed structures on site, significant on-site migration of contaminants/ ground gas from these features is not anticipated.	**Moderate/Low to Moderate Risk**
	Nearby industrial land uses, spoil heaps form extractive industries and earthworks associated with A483	Future site users/construction workers, controlled waters and proposed development (limited indoor spaces).	Potential on-site contaminant migration from off-site sources. Exposure to potential contaminants through ingestion, inhalation and dermal contact.	Medium	**Low Likelihood**: Potentially contaminative current and historic processes have been identified in proximity to the site, including multiple spoil heaps associated with former extraction activities from ~115m west, potential made ground associated with adjacent earthworks/embankment construction of A483 slipway and road crossing and industrial current and historic land uses in proximity to the site (i.e. brick/tile works at ~170m northwest). However, given the distances to these features, the nature of the proposed development (i.e. multiple solar panels with only limited structures which are understood to be occupied only intermittently) and the given anticipated cohesive component of the underlying superficial Till deposits, the potential for signficant onsite contaminant migration from these off site sources causing the signficant possibility of signficant harm to identified receptors is not anticipated.	**Low to Moderate Risk**
On site	Aggressive / contaminated ground	Buildings, materials and services	Contact with potentially aggressive / contaminated materials present within the underlying ground materials	Medium	**Unlikely:** The potential for aggressive ground associated with sulphate concentrations within the underlying ground materials is not anticipated but cannot be discounted at this stage.	**Low Risk**

3 PRELIMINARY GEOTECHNICAL ASSESSMENT

3.1 Proposed Development

3.1.1 The site currently comprises two large irregular shaped agricultural fields bounded by hedgerows and trees. The proposed development is understood to comprise the construction of a new solar farm with associated infrastructure (see Dulas Ltd Drawing *"Hafod Road Solar, Wrexham: Proposed Layout",* prepared for National Trust. Drawing Ref.: E05797, Rev. A). No specific details with regards to the construction of the proposed development has been provided to TEC. However, TEC understands that the proposed development comprises multiple solar panels with associated substations, which are assumed to be small indoor spaces (i.e. substations) which are understood to be attended periodically i.e. not daily.

3.2 Potential Geotechnical Hazards

3.2.1 The published geological mapping indicates the site is underlain by Superficial Devensian Till, underlain by the Etruria Formation (formerly named Ruabon Marl Member), described by the BGS as *red, purple, brown, ochreous, green, grey and commonly mottled mudstone, with lenticular sandstones and conglomerates referred to as 'espleys'. Common pedogenic horizons, but coal seams are rare. Subordinate, lenticular sandstones and conglomerates commonly consist mostly of volcanic and lithic clasts*. Nearby BGS borehole logs indicate the superficial deposits comprise both cohesive deposits (clays) and granular deposits (sands and gravels) to depths of up to 16.0mbgl.

3.2.2 The site is reported to be located within an area with a very low hazard potential for collapsible ground, compressible ground, landslide, running sand and shrink/swell clay hazards on site.

3.2.3 Historic mapping indicates the potential for extensive made ground on site to be unlikely. However, it is acknowledged that made ground is reported at the southeastern and northern site boundaries associated with the earthworks/construction of A483 slipway and road crossing.

3.2.4 There are 7No. recorded BGS mineral sites within 1km of the site. The nearest 4No. records comprise opencast clay, shale, sand and gravel pits (now ceased or dormant) from the glaciofluvial deposits (Till) and the (Etruria Formation. These are recorded between ~230m southwest and ~390m southwest.

3.2.5 3No. recorded BGS mineral sites are reported beyond 500m of the site, comprising deep underground coal mining (now ceased) from the Hafod-Y-Bwch (~520m north) and Vauxhall Collieries (~620m southwest); as well as the opencast sand pit (now ceased) located ~795m west.

3.2.6 The previous Coal Mining Risk Assessment undertaken for the site by TEC (report ref.: 2310008.001.01A) concluded that given the depth and limited extracted thicknesses, historical mining of the deep coal seams was considered unlikely to impact the proposed development and given the Coal Authority records and the likely thickness of the Etruria Formation overlying the Pennine Coal Measures Group, the risk from shallow/surface mining was also considered to be low. However, it was recommended that a careful watch is maintained during any excavations or ground works at the site to assess for any evidence of disturbed ground.

3.2.7 The site is reported to lie within a Lower Probability Radon Area (less than 1% of homes are estimated to be at or above the Action Level). No radon protective measures are reported to be required at the site.

3.3 Preliminary Geotechnical Recommendations

3.3.1 Based on the recorded geology on site, the anticipated presence of Devensian Till across the site area and the scale of the proposed structures, it is anticipated that conventional strip foundations may be appropriate for the small low-rise substation structures, although the potential for variable shallow ground conditions (i.e. cohesive and granular superficial deposits anticipated on site) as well as localised areas of made ground cannot be discounted.

3.3.2 Given the scale of the proposed development and the anticipated geology, a suitable geotechnical investigation is recommended to confirm the ground engineering conditions and constraints associated with the site. As detailed within the previous Coal Mining Risk Assessment it is also recommended that a careful watch is maintained during any excavations or ground works at the site to assess for any evidence of disturbed ground.

4 CONCLUSIONS AND RECOMMENDATIONS

4.1.1 Based upon our current conceptual understanding of the site and the proposed end use, the main potential Significant Pollutant Linkages identified are considered to be as follows:

- Human health (Future site end users and onsite indoor structures, where present) – migration, ingress and inhalation of ground gas from bulk ground gas associated with off site Hafod Quarry Landfill to the southwest and extensive potentially infilled land to the northwest.
- Human Health (buildings / structures on site) – potential damage to building materials or pipes from direct contact with aggressive ground or groundwater.

4.2 Geoenvironmental Risk Management Recommendations

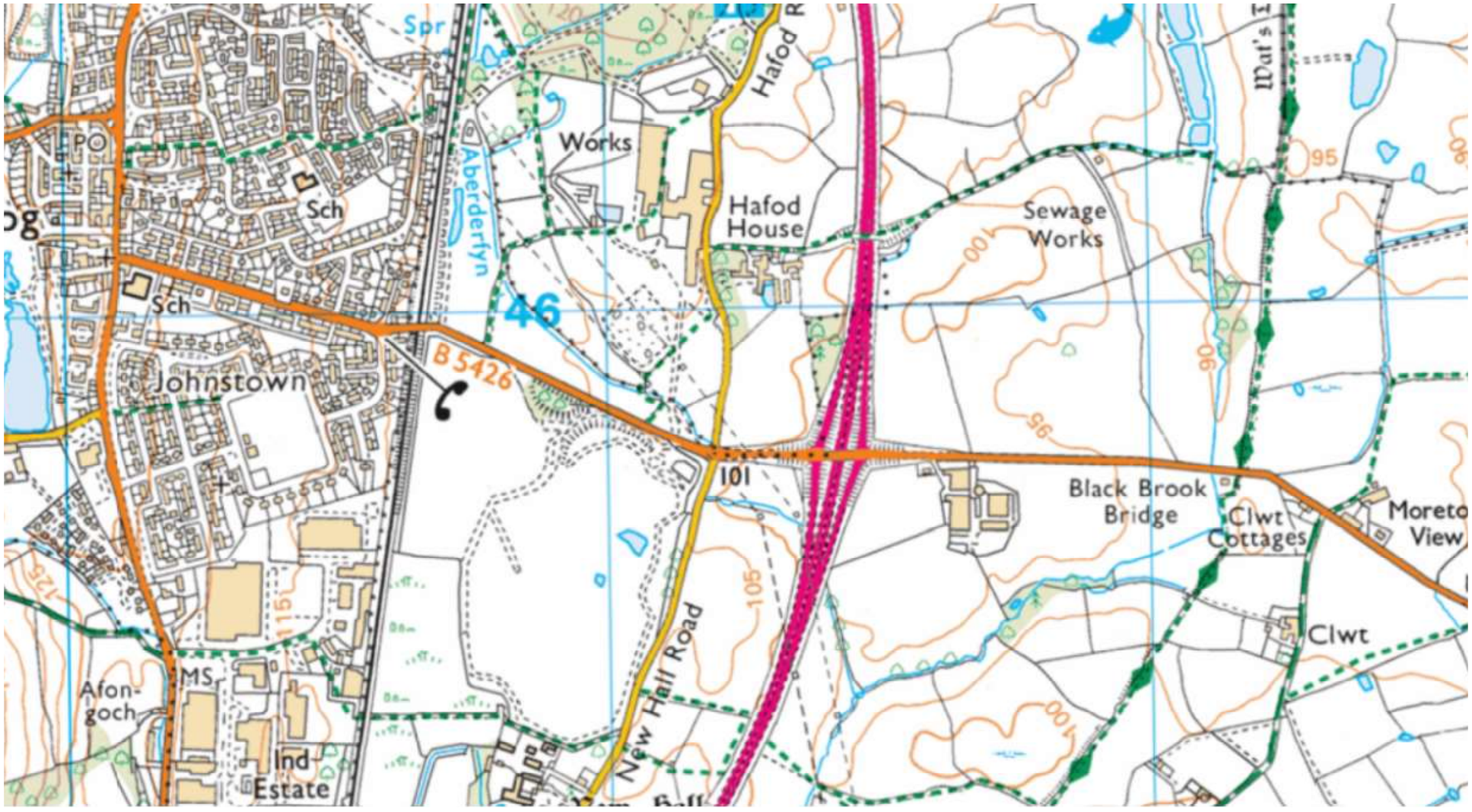
4.2.1 Given the assessment presented within this report, should indoor structure be constructed as part of the proposed development, additional works would be recommended to fully define the geoenvironmental issues associated with the site in relation to potential bulk gas migration from the nearby off site landfill in accordance with BS8485. This phase of assessment would involve refinement of the site conceptual model developed as part of the preliminary risk assessment based on the findings of an exploratory intrusive investigation, comprising near surface sampling and ground gas monitoring.

4.3 Geotechnical Risk Management Recommendations

4.3.1 Given the scale of the proposed development and the anticipated geology, a suitable geotechnical investigation is recommended to confirm the ground engineering conditions and constraints associated with the site. As detailed within the previous Coal Mining Risk Assessment it is also recommended that a careful watch is maintained during any excavations or ground works at the site to assess for any evidence of disturbed ground.

TEC

Figures and Drawings



LOCATION PLAN



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Hafod Road Solar Site, Wrexham

Site Location Plan

DATE: June 2025		
SCALE: N/A	DRN: MT	CHKD: RE
PROJECT No: 2310008.001	DATE: 03/2025	DATE: 03/2025
DRAWING No. Report Figure 1 - Site Location Plan		Rev: A

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Legend

- Planning Boundary
- Survey
- Fence
- Solar
- Temporary Compound
- Access Track
- DNO Substation
- Onsite Substation

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0 20 40 60 metres

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CLIENT: National Trust
PROJECT: Hafod Road Solar
LOCATION: Wrexham

PROJECT No.: E05797
SCALE: 1:1,503 (A3)

DRAWING TITLE: Figure 2 - Site Layout

DRAWING No.:
SHEET: 0
REVISION: A

Appendix A

Site Photographs



Photograph 1: View of northern field of the site, facing south-west.



Photograph 2: View of culvert outfall noted within the north-eastern corner of the site.



Photograph 3: View of western area of the northern field.



Photograph 4: View of central area between the two fields, facing south-west.



Photograph 5: View of southern field, facing south-west including overhead electricity cables.



Photograph 6: View of southern field, facing north.



Photograph 7: View of southern field area, facing north-east.



Photograph 8: View of builders' rubble/material noted along the western boundary of the southern field.