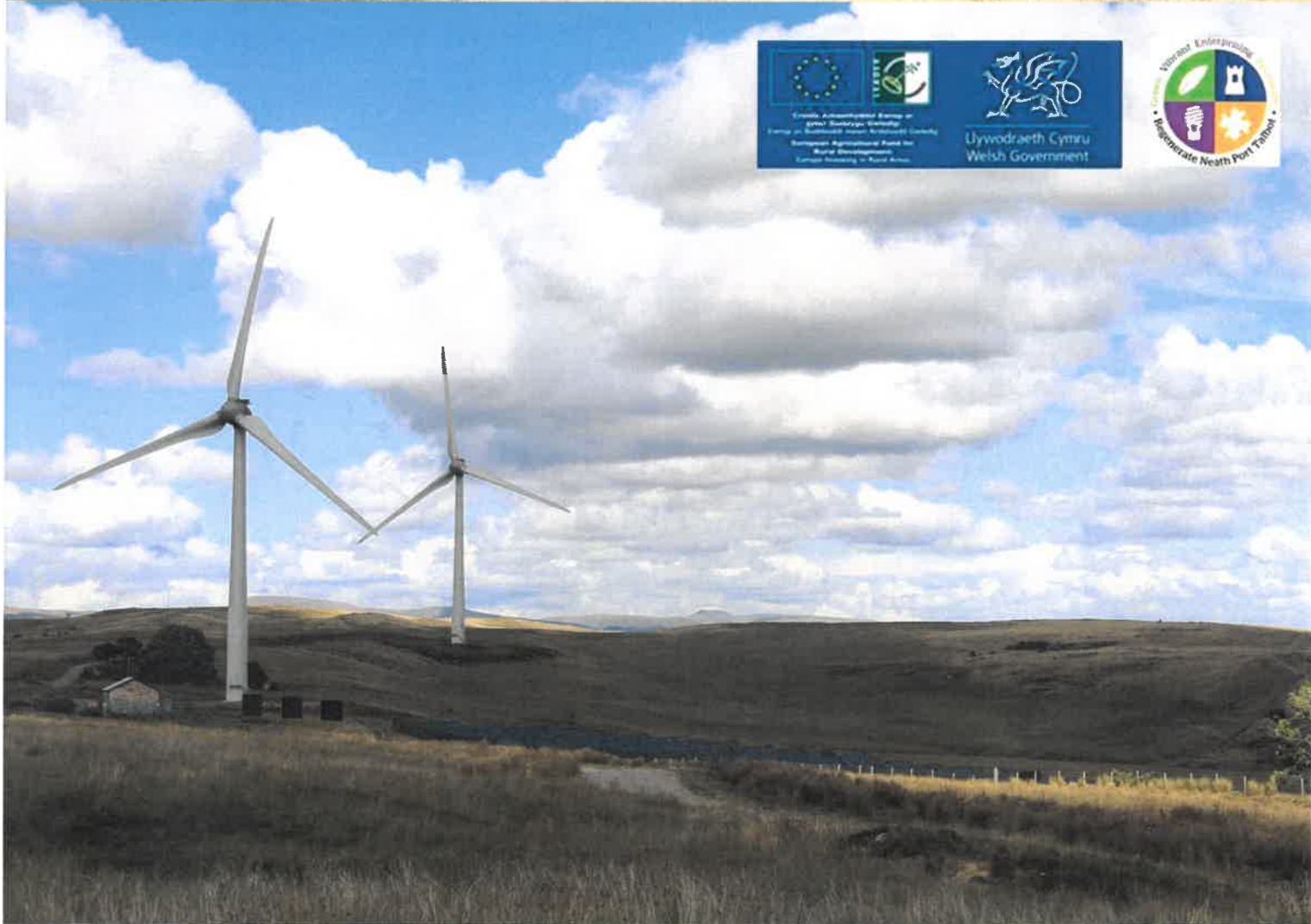


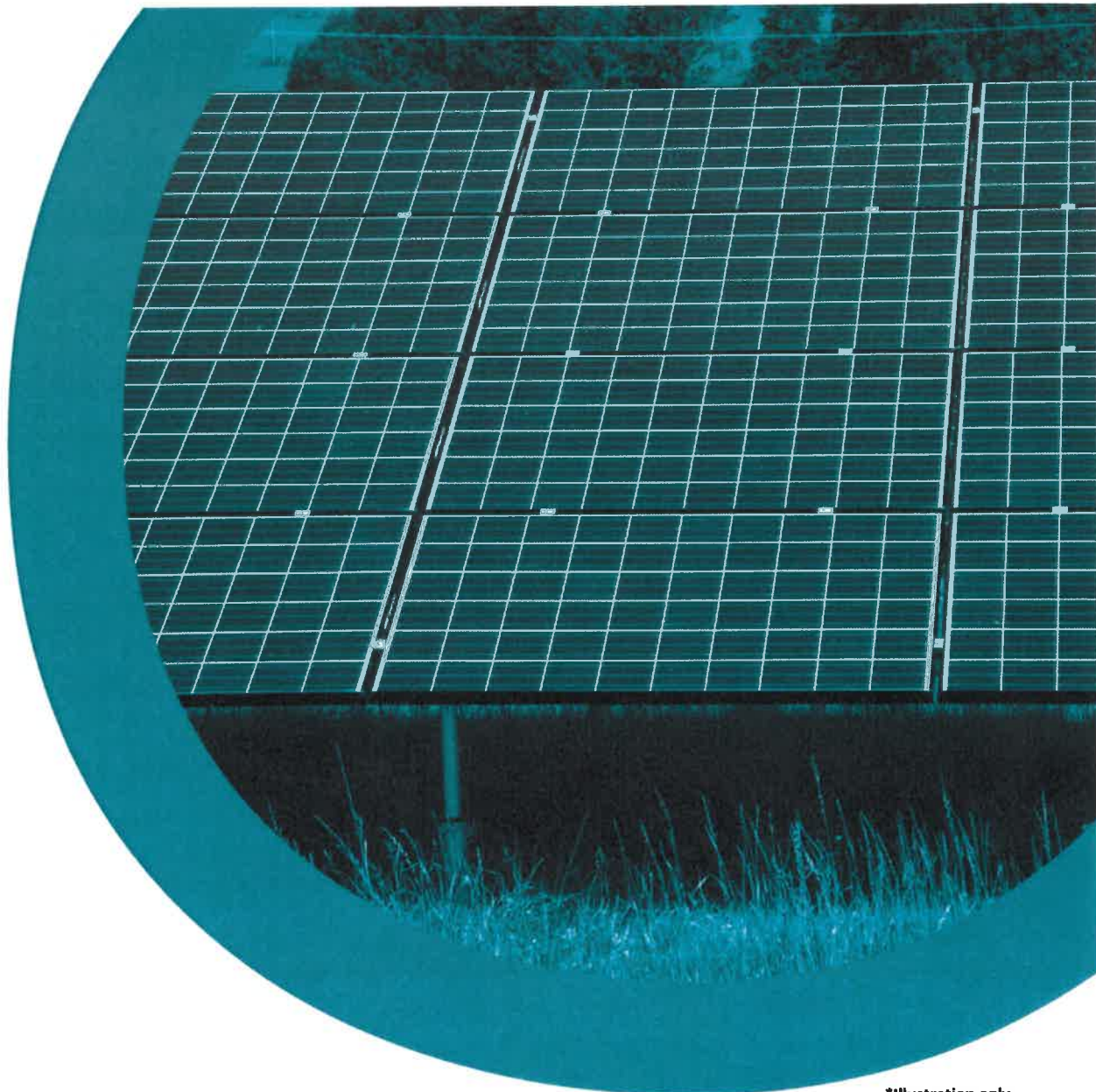
Mynydd y Gwrhyd Solar and Battery

Feasibility Study

March 2019

Volume II





***Illustration only**

Mynydd y Gwrhyd Solar Farm Design and Access Statement

Reference: E05419

Version 3 – January 2019

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1.1 PURPOSE OF THIS STATEMENT

- 1.1.1 This Design and Access Statement (DAS) outlines the design principles and access issues that have been applied in the selection, scaling and sizing of the proposed Mynydd y Gwrhyd Solar Farm (see *Figure 1-1 Site Location*).
- 1.1.2 The DAS is prepared to accompany a planning application for the solar farm proposal to Neath Port Talbot County Borough Council in order to fulfil the requirements of The Planning & Compulsory Purchase Act 2004 (paragraph 42) and TAN12, Communities and Local Government '*Guidance on information requirements and validation*' 2016, and with regard to advice set out in the Design Commission for Wales guidance '*Design and access statements in Wales: Why, What and How*' (updated 2014). A DAS is also a typical requirement of the majority of schemes that are defined as Major Developments¹, which is the case with this proposal.
- 1.1.3 Pre-application advice provided by the local planning authority (see Appendix 1-2 of the Environmental Report) has been considered during the design phase of the proposed solar farm scheme.
- 1.1.4 An explanation of the design principles as required by the above guidance is set out below, whilst a full description of the scheme resulting from the application of the site design criteria is set out in full in Section 3 of the Environmental Report.
- 1.1.5 The Applicant has additionally considered the guidelines contained within *Lighting in the countryside: towards good practice* (ODPM, 2006) in order to design a scheme that avoids light pollution in the night sky, glare hazards and potential nuisance to nearby properties. Given that lighting of the development is not proposed beyond the short construction stage no issues are anticipated.
- 1.1.6 The requirements to consider the potential effects of the development on trees have also been fulfilled, specifically in relation to the requirements of British Standard 5837: 2005 Trees in relation to construction. Felling of trees is not a requirement of the proposed development and as such no issues are anticipated.

¹ The Town and Country Planning (Development Management Procedure (Wales) (Amendment) Order 2016

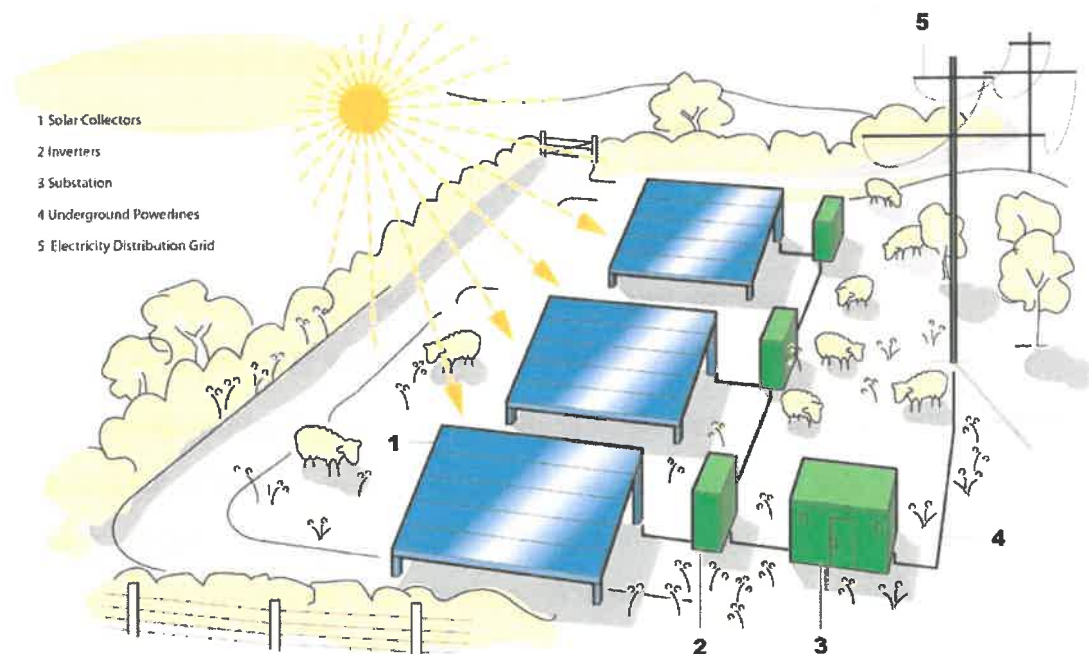
1.2 GENERAL DESIGN PRINCIPLES

Solar Power Generation

- 1.2.1 The solar photovoltaic (PV) modules are generally manufactured from silicon PV cells. These are typically categorised into either monocrystalline or multicrystalline modules. This gives the panels a distinctive, shingled appearance. Most panels are in a rectangular format for ease and efficiency of installation.
- 1.2.2 A solar panel (PV module or PV panel) is a packaged, interconnected assembly of solar cells, also known as PV cells. The solar panel can be used as a component of a larger PV system to generate and supply electricity in commercial and residential applications. Because a single solar panel can produce only a limited amount of power, many installations contain several or a large number of panels.
- 1.2.3 A commercial solar farm installation will comprise multiple solar panels arranged in arrays that are orientated in a southerly direction (in the UK) and tilted at a certain angle to maximise their potential to absorb the sun's rays. The general configuration of a solar farm is demonstrated in the following illustration:

Plate 1: Solar Farm Typical Arrangement

SOLAR FARM DIAGRAM



- 1.2.4 Multiple solar arrays are arranged as part of the overall solar farm infrastructure, and the power output is directed through inverters into the local substation facility, whereby the generated renewable energy is exported to the local distribution network. Such renewable energy generation and capacity reduces the UK's reliance on fossil fuel derived power generation and the associated contribution to global warming and polluting emissions to the environment.

1.3 THE DESIGN COMPONENT

Context

- 1.3.1 The application site is located on land to the south east of Tairgwaith, Neath Port Talbot. The site is adjacent to the existing Awel Wind Farm, situated on Mynydd Uchaf.
- 1.3.2 In devising the design for the development, the Applicant sought and considered the views of statutory advisors (see Section 1 of the Environmental Report for details) through a pre-application consultation exercise with the Council and through an EIA screening exercise. Their contribution has shaped and informed the development through advice on local sensitivities and features relevant to the area.
- 1.3.3 Prior to fixing the design of the proposed scheme, the Applicant engaged in a formal Pre-Application Consultation exercise at the request of the Council on account of the scheme being 'Major Development', and as a result of the introduction of the Planning (Wales) Act 2015 which prescribes mandatory consultations for all Major Developments. Consultations with the local community and stakeholders were conducted (PAC PENDING). The outcomes of the consultation are described in Section 1 of the Environmental Report, and any observations, advice or comments on the design of the scheme arising from stakeholders have been considered by the Applicant.
- 1.3.4 Due consideration of the information gathered on the environment, amenity, socio-economics and relevant planning regime through the undertaking of original surveys and consultations has informed the evolution and design of the proposed development. The scale and layout of the development, volumes and amounts of

infrastructure and materials, landscaping proposals and the final proposed appearance of the scheme have all been shaped in the design process. The outcome of this process has been the formulation of a proposal that is considered sustainable in its effects and longevity, and as such accords with the ambitions of the Well-being Act and the guidance within Planning Policy Wales.

Land Use

- 1.3.5 The predominant land use in which the proposed development is situated is farmland, which is used for grazing, mainly sheep and horses. There are no public rights of way or other rural or recreational uses within the Site.
- 1.3.6 To the north of the Site the land is currently utilised for wind power generation, in relation to which there is a substation facility for the management and export of the power from the wind turbines. In preference to creating a new substation facility for the solar farm, this existing facility will act as an integrate facility for both renewables schemes.

Purpose

- 1.3.7 The purpose of the development is for the generation of renewable electricity. The solar farm would generate electricity through harnessing the energy of the sun. The electrical output of the solar farm would be exported to the local electricity distribution network which will transport and deliver the electricity generated to consumers within the region.
- 1.3.8 The use of renewable energy is strongly supported at international, national and local levels for supporting measures to address climate change, which itself is the result of the increase in greenhouse gases in the atmosphere. A significant proportion of greenhouse gases arise as a result of energy generation, as well as transport and agriculture. Renewable energy is promoted because operationally it results in the emission of hardly any greenhouse gases. Renewable energy also reduces our reliance on imported forms of energy.

Amount

- 1.3.9 The overall area required for the proposed solar farm will be approximately 3.3ha, including the areas between the arrays, fencing, inverters and the battery storage containers (see *Figure 1-2 Site Layout* for siting of the individual components).
- 1.3.10 The proposed installed capacity of the entire installation is 2.23MW, comprising approximately 6,972 solar PV panels. In addition, one inverter substation will be required, along with site cabling, and battery storage containers. The inverter will be connected back to the existing wind farm substation which in turn is connected to the local distribution network.
- 1.3.11 The solar panels, mounting frames and inverter will be delivered to site in approximately 109 articulated lorry loads, which themselves will be staggered throughout the 12 week construction period. Ground-mount steel frames will be required for the panels, which will be anchored to the ground using piles (see *Figure 3-2* for details of the mounting system).
- 1.3.12 The output of electricity to be generated is estimated at 2,219,505 kWh annually, which is equivalent to the annual domestic electricity requirements of approximately 672 households per year. The electricity output would result in annual offsetting of carbon dioxide emissions associated with fossil fuels equal to approximately 630 tonnes.

Layout, including Design Considerations

- 1.3.13 The layout of the solar farm has been designed to best harness the power of the sun's irradiation whilst ensuring that adequate separation distance is maintained from drainage ditches, pockets of more sensitive ecology and other on-site features.
- 1.3.14 The site layout has been influenced by a number of different on-site constraints, including a 5m buffer of the drainage ditches, and avoidance of more sensitive areas of ecology. Subsequent to the initial design of the scheme, statutory and public consultation was undertaken to seek views on the layout of the scheme. No responses were received that led to a deviation from the layout at that time.

Scale of the Proposed Scheme

- 1.3.15 The proposed scheme red line boundary outline encompasses an area of approximately 3.3 hectares.
- 1.3.16 The area of the operational solar farm within the security fence will be approximately 3.16 hectares.
- 1.3.17 The number of solar panels and the design of the arrays are described in 1.3.10 above. Each solar panel will be approximately 1.6m x 1.0m, and will be elevated to a maximum height above ground level of 2.6m.
- 1.3.18 The inverter substation, which will be sited upon a concrete foundation, will be approximately 15.5 x 2.2m x 2.5m. It will be located either integrally with a transformer unit of roughly the same dimensions or as units side by side within the area of the main solar arrays. The external transformer will require a fenced enclosure, which will be slightly wider than the main inverter at 4.8m, as shown on *Figure 3-3 / 3-4 Typical Inverter Substation*.

1.4 ENVIRONMENTAL SUSTAINABILITY

- 1.4.1 The proposed solar farm will use a natural renewable resource, i.e. solar radiation, to generate electricity. This will offset requirements for the use of fossil fuel derived electricity, which in the case of the Mynydd y Gwrhyd Solar Farm will be equivalent to approximately 672 households per year; this figure is calculated by dividing the total expected output of the proposed solar farm by the average domestic household annual electricity use of 3,300 kWh². The proposed development, therefore, contributes to global efforts on environmental sustainability and will also reduce the UK's dependence upon imported sources of energy, typically fossil fuel based generation such as gas and oil. The proposed development will provide a long-term, decentralised form of energy that will improve the sustainability of UK based energy supplies.

² Based on an average annual electricity consumption of 3,300 kWh of electricity for a domestic property, <http://www.solar-trade.org.uk/solar-farms/>

- 1.4.2 There will be a marginal net gain to biodiversity resulting from the development where the proposed enhancements are adopted. Current land use of the site will be augmented by the planting of a new shelter along the southern boundary.

1.5 CHARACTER

Landscape

- 1.5.1 The development will result in a change to landscape character within the fields in which it would be situated but generally the proposed development is not expected to have a significant effect upon landscape character or visual amenity, as explained in Section 4 of the Environmental Report.
- 1.5.2 The proposed development will not result in the removal of landscape elements, and the proposed inclusion of tree shelter belts will make a slight positive contribution to habitat elements within the receiving environment.

Appearance

- 1.5.3 The proposed scheme will present a departure from its current visual appearance, altering from an area of unimproved grassland habitat to one that is more man-made in nature. The solar panels will appear as an expanse of blue, which is largely due to the anti-reflective coating in which they are finished. This expanse of blue will be visually contained within a much wider expanse of green and brown natural habitat and should not dominate the landscape. It is not possible to modify the appearance of the solar arrays, inverters, and fencing to accord with the local vernacular, however the applicant proposes to provide screening to the southern boundary.
- 1.5.4 As shown on the Zone of Theoretical Viability (ZTV) (Figure 4-1), the solar farm will only be visible from a limited area, predominantly to the south of the site in accordance with the site topography.
- 1.5.5 The proposed solar farm will not alter the sense of tranquillity afforded by the current rural climate and environment.

1.6 ACCESS

Transport Management

- 1.6.1 Full details of the proposed transport requirements for this proposed scheme are set out in Section 8 of the Environmental Report.

Proposed Access Arrangements

- 1.6.2 Construction vehicles, including vehicles delivering materials and workers to the Site, will use the A474 from the direction of Pontedawe.
- 1.6.3 An existing turning and public road to the right hand side of the highway when travelling northwards (opposite the Landfill Site turning) will be used to access the Site. An existing public highway onto Mynydd Uchaf will be used, which then terminates close to the property at Blaen-egel-fawr. At this point a track departs northwards and eastwards towards the wind farm; this track has suitable characteristics (as a result of wind turbine delivery) including running surface to transport solar infrastructure to the development site.

1.7 MOVEMENT

Public access and movement in respect of the Proposed Access

- 1.7.1 A Transport Management Plan has been prepared as part of this application, details of which are set out in Section 8 of the Environmental Report. The Plan will ensure agreement among stakeholders on the proposed routing, protection of the highway, and protection of local residents during the construction phase.
- 1.7.2 The purpose of the transport plan will be to ensure the continuing free movement of traffic along the highways principally during the construction phase when vehicle movements will be at their greatest; in addition the plan will address ongoing access during the operational phase, whilst a similar plan will be prepared in advance of the decommissioning phase. In this way, the Applicant will ensure minimum disruption to the public highways network.

1.7.3 In summary the following management measures are set out as part of the proposed development:

- Vehicles approaching the site will be scheduled outside peak hours;
- Deliveries will be scheduled to access the site outside of typical busy periods and during standard working hours only. No deliveries will take place on Saturday mornings;
- Local residents will be notified of the construction programme and vehicle movements. Such residents will also have details of the appointed contact for the applicant in order to ensure concerns are addressed;
- Any damage caused to the public highway during the development will have to be rectified at cost to the applicant; and
- All vehicles will be required to clean their wheels prior to leaving the site.

1.8 COMMUNITY SAFETY

- 1.8.1 The solar farm is located on private land; consequently public access to the solar panels is prohibited. However, given the potential for third parties to enter the land under untoward circumstances, the solar farm will be surrounded by suitable fencing to prevent entry into the Site.
- 1.8.2 It is proposed that the education facility to be provided with the scheme will be used to entertain community and school groups; such groups will be strictly managed and protected from any elements of the solar farm infrastructure that may be a threat to safety.
- 1.8.3 Any additional third party visitors with agreement to visit the Site would be required to report to a pre-arranged location and they would receive site inductions prior to entry to the Site.
- 1.8.4 The solar farm would not encroach on any public right of ways and as such there are no potential threats to amenity users.
- 1.8.5 The operational history of solar farms in Europe and the UK has established that such schemes are not a threat to public safety.



Scale (at A3): 1:25,000 Date: October 2018

Prepared by: **dulus** INSPIRING SUSTAINABLE ENERGY

solar wind hydro biomass

Client: Awel Aman Tawe

Mynydd y Gwrhyd Solar Farm

Figure 1-1: Site Location

Drawn by: RK Checked by: MP Version: V1

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Notes:

- Number of PV tables: 332
- Number of PV modules per table: 21
- Predicted capacity of PV module: 320Wp
- Total potential capacity of park: 2.23MWp

Scale (@ A3) 1:1250

Date: 14 NOV 2018



Client: Awel Aman Tawe

Project: Mynydd Y Gwrhyd Solar Farm

Figure 1-2 - Site Layout

Dulas ref:
E05419

Drawn by: DR

Checked by:

Version: D

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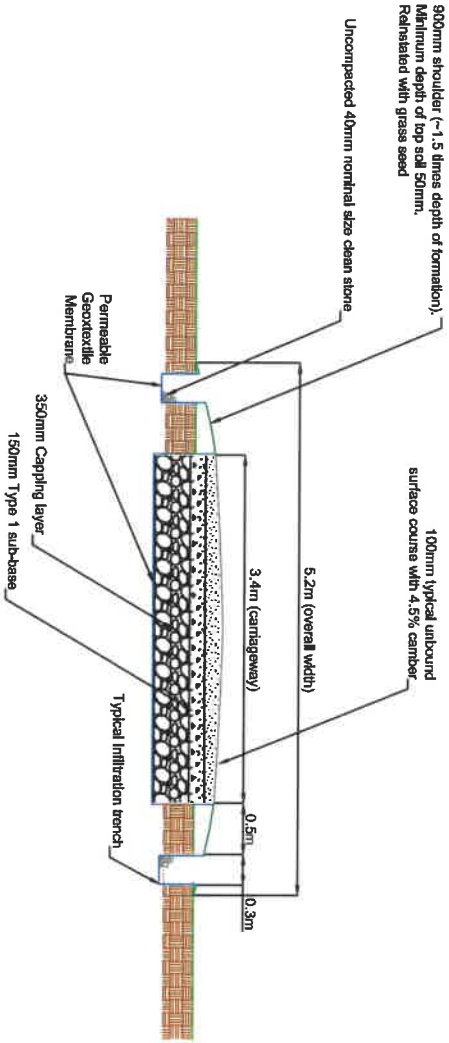






NOTES

All dimensions are indicative only and depend on ground conditions.

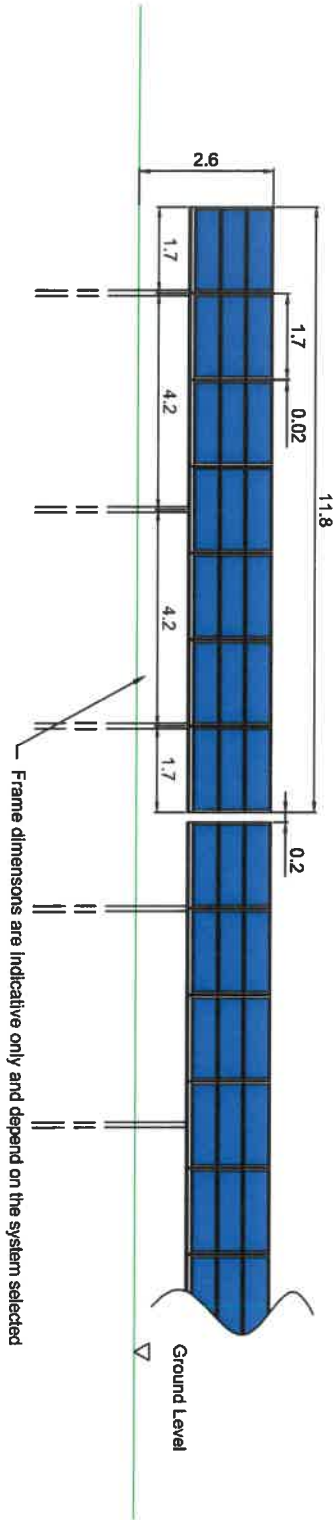
All dimensions in metres unless otherwise specified



Scale (@ A3) 1:50		Date: 14 NOV 2018	
Prepared by:			
Client: Awel Aman Tawe			
Project: Mynydd Y Gwyrhyd Solar Farm			
Figure 3-1 - Access Track Cross Section		Dulas ref: E05419	
Drawn by: RH	Checked by: RK	Version: B	
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INDICATIVE FRONT ELEVATION OF TABLE ARRAY

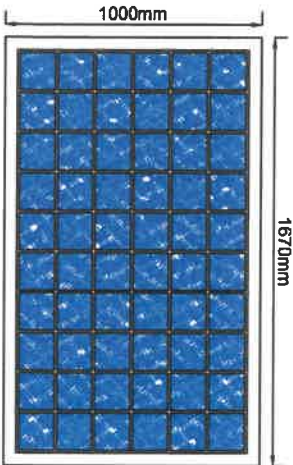
SCALE 1:100



Frame dimensions are indicative only and depend on the system selected

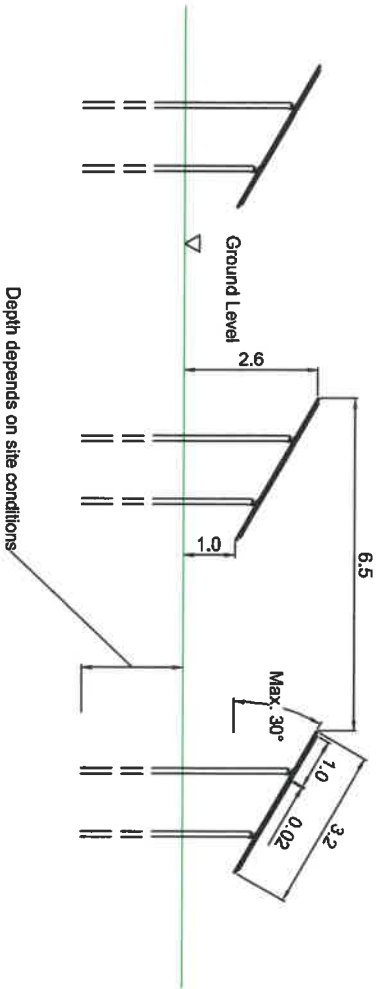
INDICATIVE SOLAR PANEL

SCALE 1:20




INDICATIVE SIDE ELEVATION OF TABLE ARRAY

SCALE 1:100



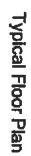
NOTES

- All dimensions are indicative only and depend on system selected.
- All dimensions in metres unless otherwise specified
- Panel tilt up to 30 degrees
- Maximum panel height above ground of up to 2.8m
- Spacing from front of panel to front of panel to be up to 10.4 metres



Scale (@ A3) As shown	Date: 14 NOV 2018
Prepared by:	
Client: Awel Aman Tawe	
Project: Mynydd Y Gwyrhyd Solar Farm	
Figure 3-2 - PV panel and Table array	Dulas ref: E05419
Drawn by: DR	Checked by: RK
Version: B	

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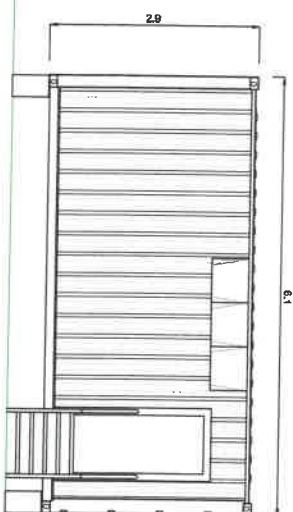


Technical drawing of the 'Banco' cabinet showing its dimensions: 34 cm width, 24 cm height, and 0.5 cm depth.

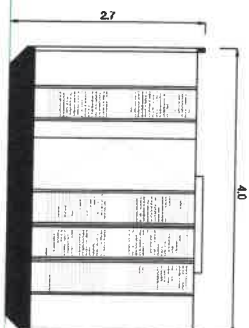
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<div> <p>Figure 3-3: Option 1:</p> <p>Combined Inverter / Transformer</p> </div>	
<div> <p>Drawn by: DR</p> <p>Checked by: RK</p> </div>	<div> <p>Version: B</p> <p>Dulles ref: EDS418</p> </div>
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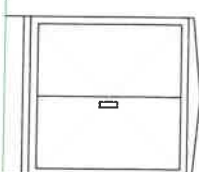
All levels and dimensions in metres unless otherwise specified



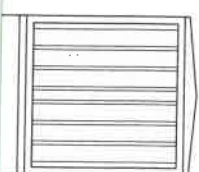
Front Elevation
Typical Inverter



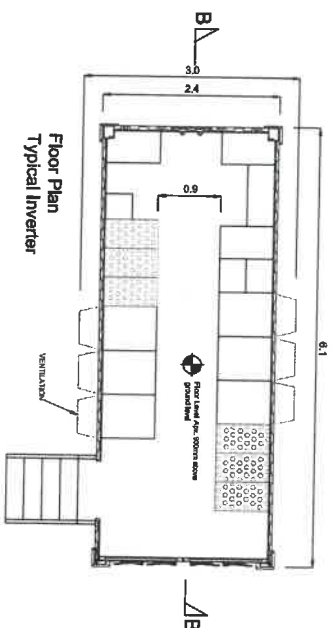
Front Elevation
Typical Transformer



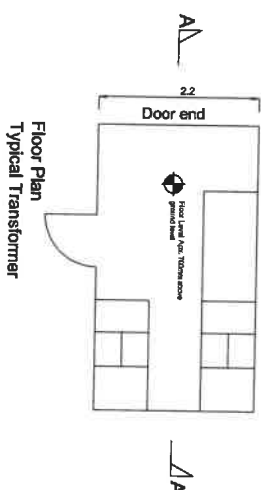
Side Elevation (Door)
Typical Transformer



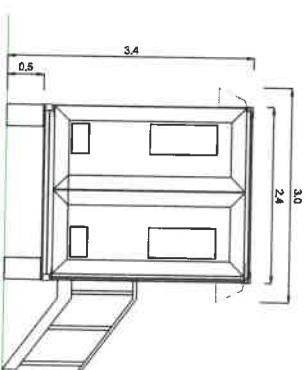
Side Elevation (Solid)
Typical Transformer



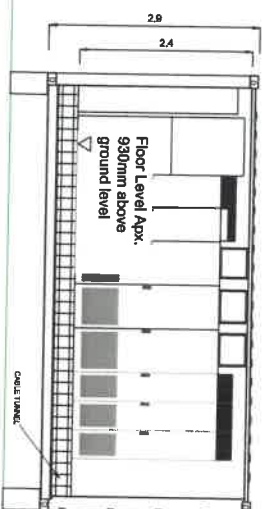
Floor Plan
Typical Inverter



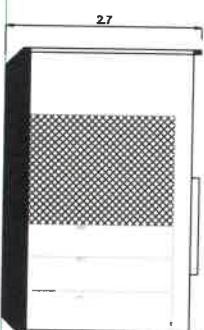
Floor Plan
Typical Transformer



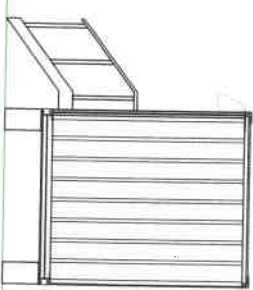
Side Elevation (Door)
Typical Inverter



Section B - B
Typical Inverter



Section A - A
Typical Transformer



Side Elevation (Solid)
Typical Inverter

Scale: (at A2) 1:50

Date: 14 NOV 2018

Prepared by:



Client: Avel Arvan Tawe

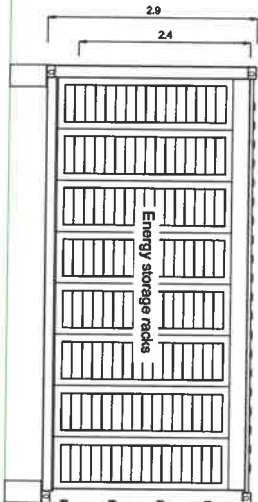
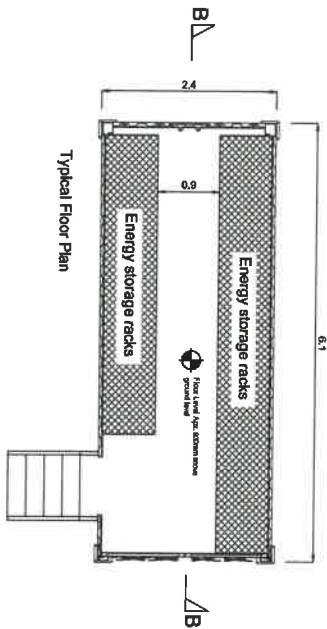
Project: Myrdd Y Gwmyd Solar Farm

Figure 3-4 Option 2:
Separate Inverter / Transformer

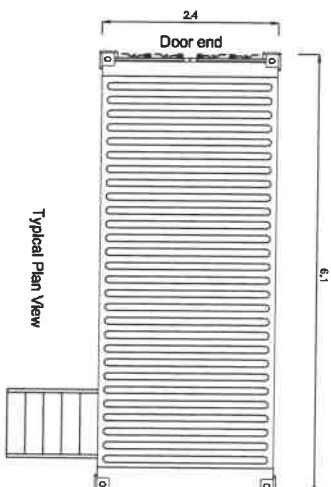
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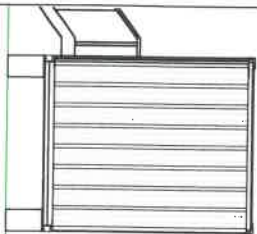




Section B - B



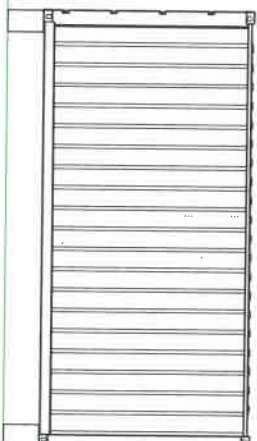
Typical Plan View



Typical End Elevation






Typical Side Elevation (Door)



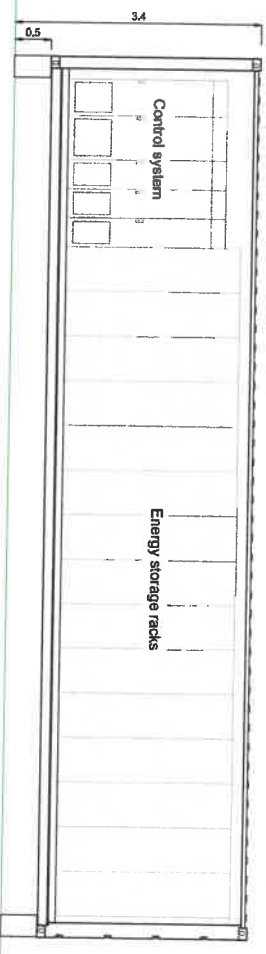
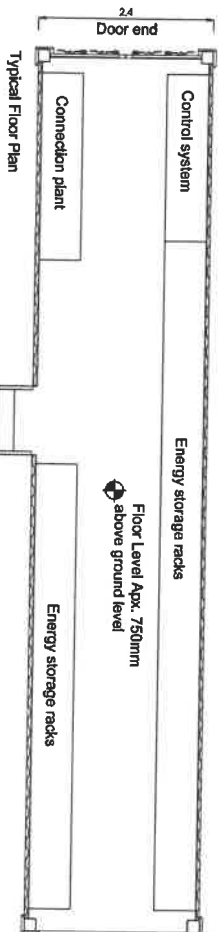
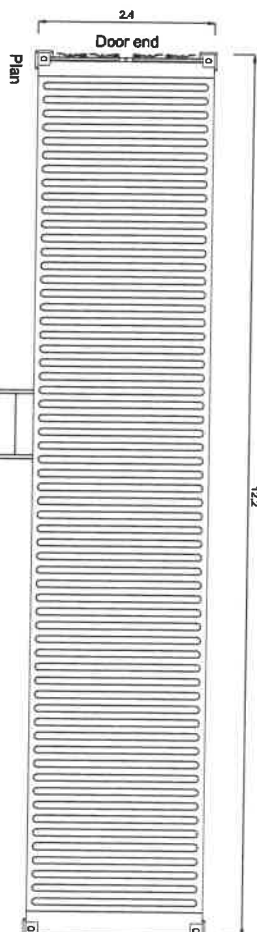
Typical Side Elevation (Solid)

NOTES
All levels and dimensions in metres unless otherwise specified
HVAC system not shown to roof of container, the sizing will depend on capacity on unit

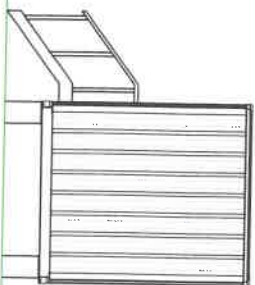
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Prepared by:		 dulas	
Client: Awel Arrian Tawe		Project: Myrdd y Gwynyd Solar Farm	
Figure 3-5 Battery Storage Container		Dulas ref: E05419	
Drawn by: DR	Checked by: RK	Version: B	
<small>Every effort has been made to ensure the accuracy of this drawing. However, the user of this drawing is responsible for ensuring that it is used in accordance with the relevant specifications and standards. The user is advised to check the relevant specifications and standards for any updates or changes. The user is also advised to check the relevant specifications and standards for any updates or changes.</small>			
			

North

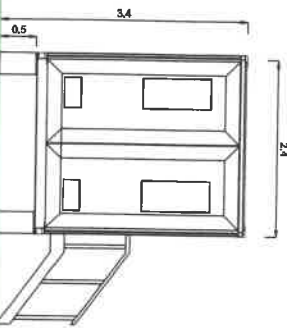
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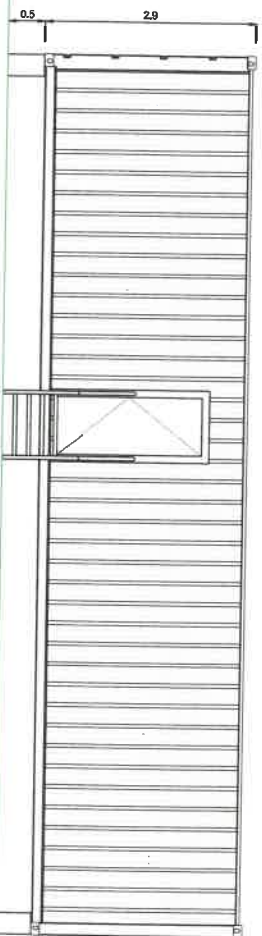
Section A - A



Typical Side Elevation (Solid)



Typical Side Elevation (Door)



Typical Front Elevation

NOTES

All levels and dimensions in metres unless otherwise specified
HVAC system not shown to roof of container, the sizing will depend on capacity on unit

Scale (@ A2) 1:50

Date: 14 NOV 2018

Prepared by:



Client: Awel Arwen Tawe

Project: Mynydd Y Gwilyd Solar Farm

Figure 3-5 Indicative Battery Power Conversion Unit

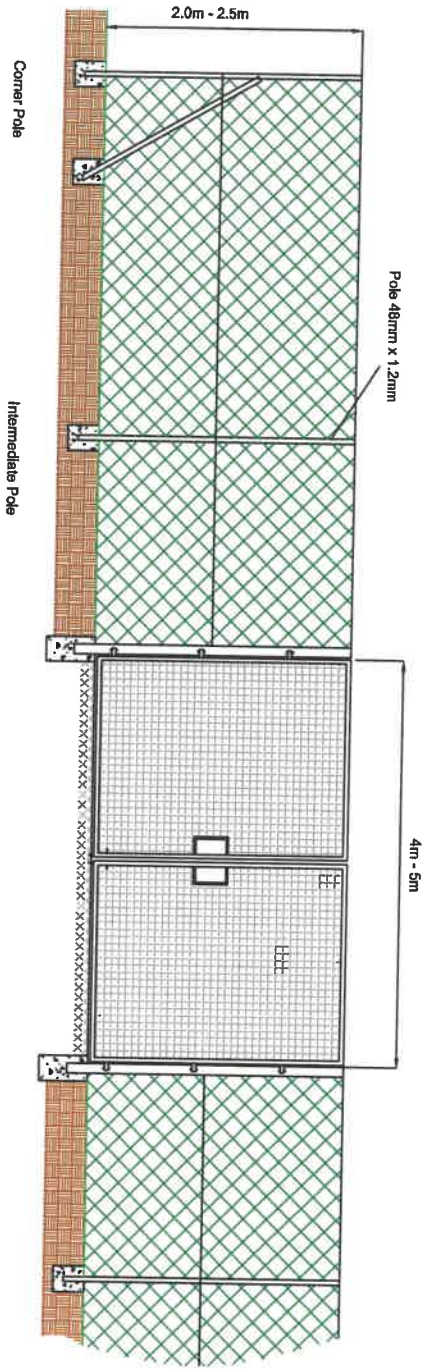
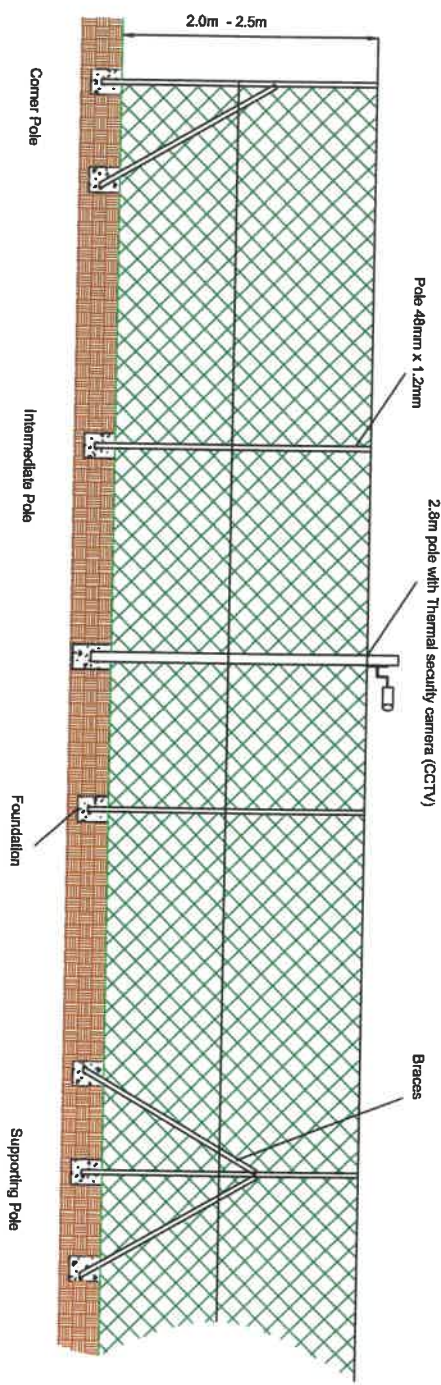
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NOTES

All dimensions in mm unless otherwise specified
Fencing to be finished in green PVC coating



Scale (@ A3) 1:50 Date: 14 NOV 2018

Prepared by:



Client: Awel Aman Tawe

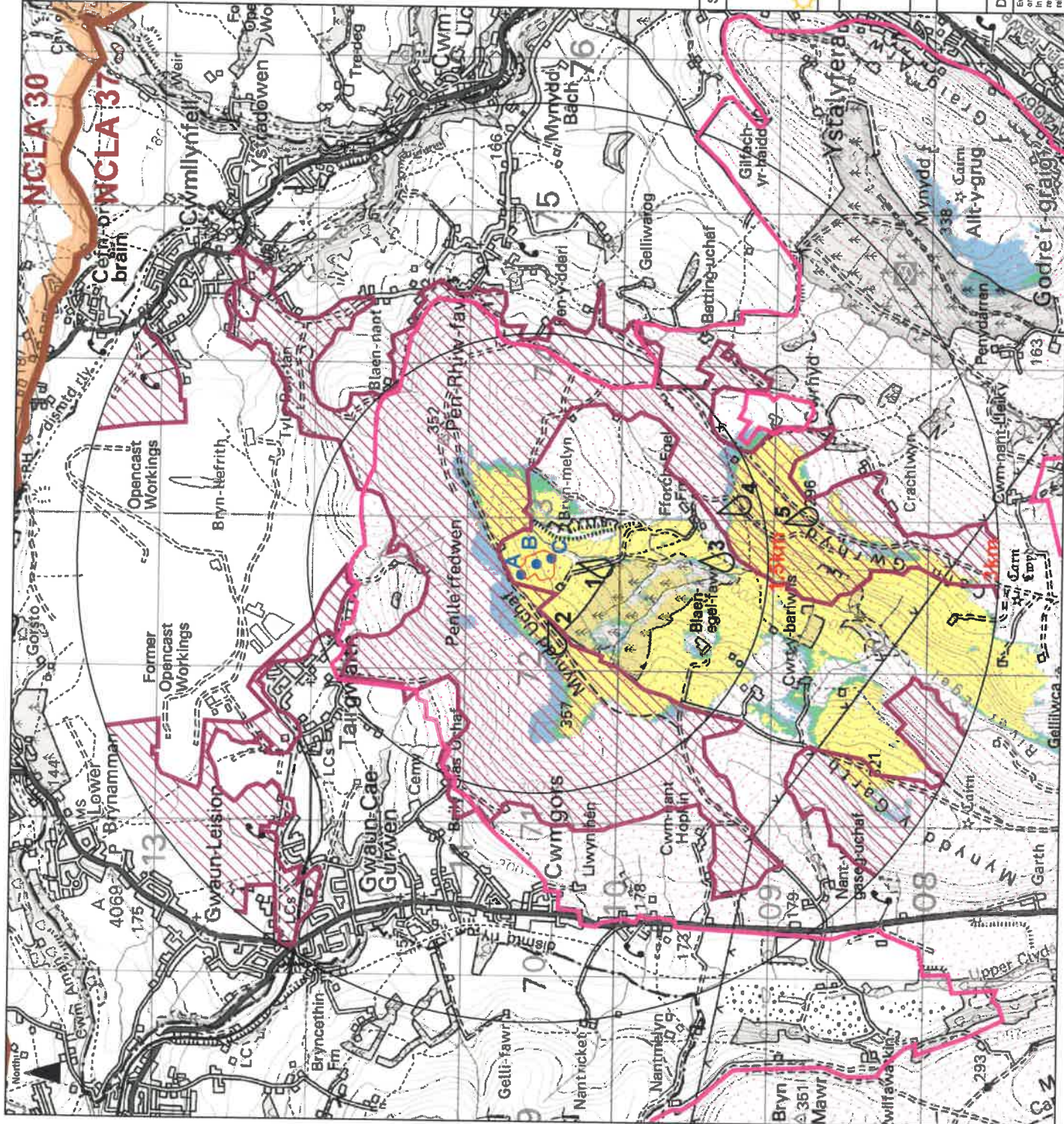
Project: Mynydd Y Gwrhyd Solar Farm

Figure 3-8 Security Fence, Gate and Camera Dulas ref: E05419

Drawn by: DR Checked by: RK Version: B

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Legend:

- Approximate location of site fence line
- Locational marker within proposed development
- National Landscape Character Areas:
- 30 - Brecon Beacons & Black Mountains
- 37 - South Wales Valleys
- ▨ Access Land
- Landscape Designation Areas:**
- ▨ Special Landscape Area
- Brecon Beacons National Park Boundary
- Viewpoint locations

Notes:

1. For information regarding the ZTV please refer to Figure 4.1.

Scale:



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Scale (at A3): 1:25,000 Date: 07-11-18

Prepared by:



Client: Awel Aman Tawe

Project: Mynydd y Gwryd Solar Farm

Figure : 4-3

Landscape Designations, NRW Landscape Character & Access Land

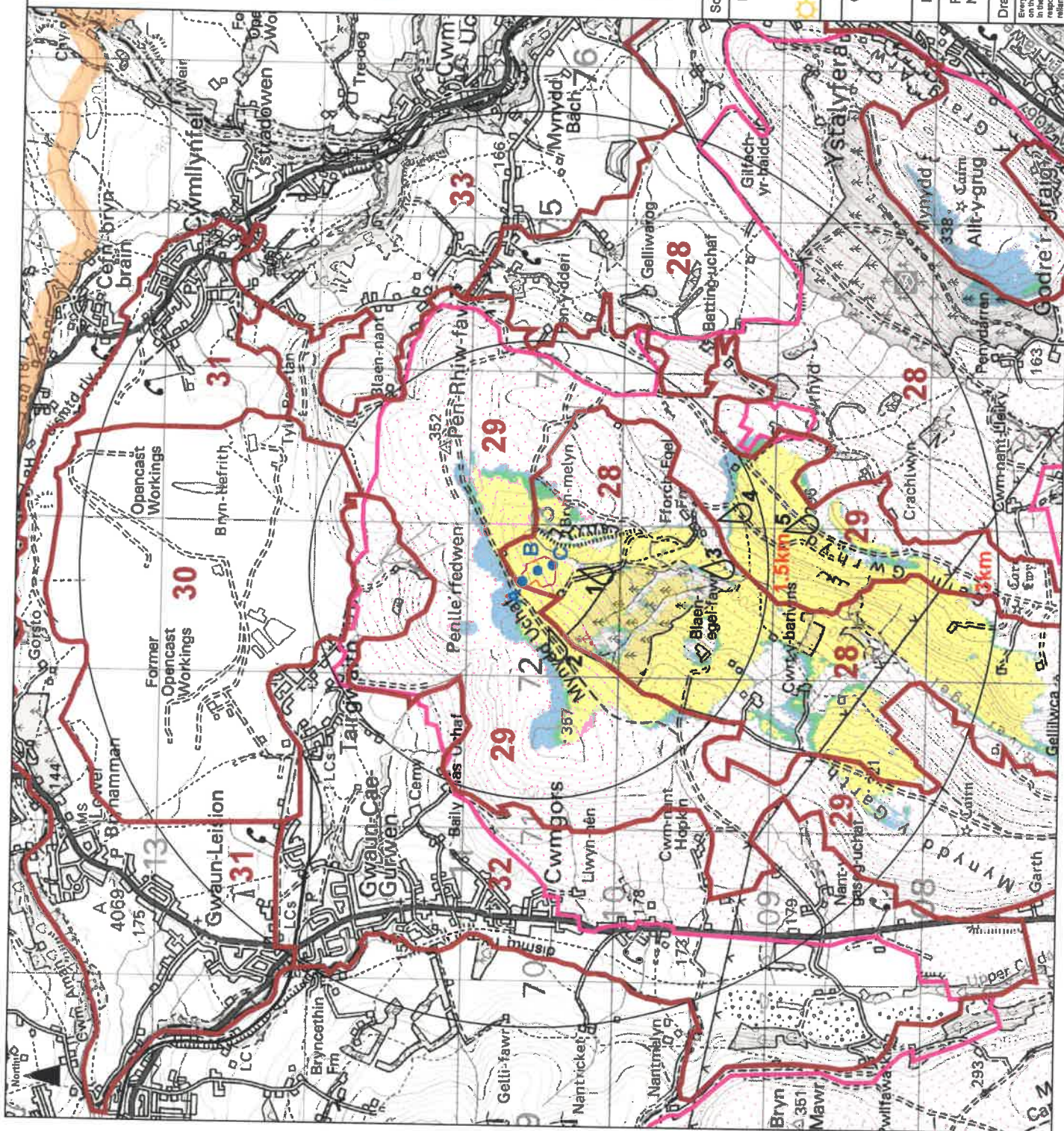
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Checked by: FNI

Version: V2

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Legend:

- Approximate location of site fence line
- Locational marker within proposed development

Landscape Character Areas:

- 28** Slopes of Cefn Gwryd & Cwm Egel
- 29** Mynydd Uchar, Mynydd Garth & Cefn Gwryd
- 30** East Pit
- 31** Cwm Aman
- 32** Cwm Gors / Gwaun Cae Gurwen / Abernant
- 33** Cwm Twrch

Landscape Designation Areas:

- Special Landscape Area
- Brecon Beacons National Park Boundary
- Viewpoint locations

Notes:

1. For information regarding the ZTV please refer to Figure 4.1.

Scale:



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Client: Awel Aman Tawe

Project: Mynydd y Gwryd Solar Farm

Figure : 4.4
Neath Port Talbot Landscape Character Areas

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VIEWPOINTS



Viewpoint 1: Track by Pen y Waun. Distance of 0.3km from proposed development. Panoramic view and photomontage both illustrate the good levels of existing vegetation local to the site, especially to the south of the site. The proposed development would be partially visible, seen in the context of existing built form. (Panorama encompasses approximately 180° view looking north).



Viewpoint 2: Mynydd Uchaf. Distance of 0.5km from proposed development. Panoramic view illustrates the wide and long distance views available from Mynydd Uchaf. Photomontage indicates the very limited proportion of the proposal that would be visible from this location. (Panorama encompasses approximately 180° degree view looking east and south).

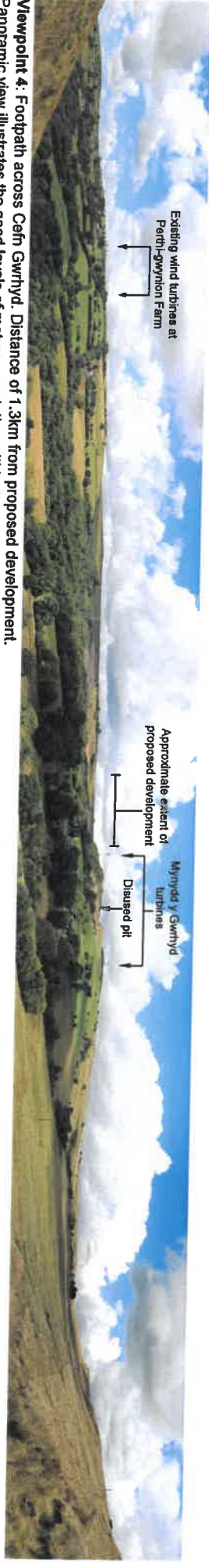
Viewpoint 1		Viewpoint 2	
Track by Pen y Waun		Viewpoint 2	
Viewpoint 1 coordinates: 272670E 210110N		Viewpoint 2 coordinates: 272165E 210400N	
Date and time of photograph: 08/08/18 15:40		Date and time of photograph: 08/08/18 16:15	
Camera Type: Canon EOS 5D with 50mm Lens.		Camera Type: Canon EOS 5D with 50mm Lens.	
Viewpoint created as an A3 panoramic image for illustrative purposes only.		Viewpoint created as an A3 panoramic image for illustrative purposes only.	
Camera Height: 1.5m AGL		Camera Height: 1.5m AGL	

Figure 4-5
Viewpoint 2
Mynydd Uchaf

VIEWPOINTS



Viewpoint 3: Footpath southwest of Fforch Egel Farm. Distance of 1.1km from proposed development. Panoramic view and photomontage both illustrate the good levels of mature vegetation within the valley. The proposed development would be entirely screened from view by this vegetation. (Panorama encompasses approximately 180° degree view looking north and east).



Viewpoint 4: Footpath across Cefn Gwrhyd. Distance of 1.3km from proposed development. Panoramic view illustrates the good levels of mature vegetation within the valley. The proposed development would be visible, seen in the context of existing built form but partially screened to the east by existing vegetation. (Panorama encompasses approximately 160° degree view looking north).

Viewpoint 3		Viewpoint 4	
Footpath southwest of Fforch Egel Farm		Footpath across Cefn Gwrhyd	
Viewpoint 3 coordinates: 272720E 208320N		Viewpoint 4 coordinates: 273100E 209215N	
Date and time of Photograph: 09/08/18 15:14		Date and time of Photograph: 09/08/18 12:29	
Camera Type: Canon EOS 6D with 50mm Lens.		Camera Height: 1.5m AGL	
Viewpoint created as an A3 panoramic image for illustrative purposes only.		Figure 4-6 Viewpoint 4	

VIEWPOINTS

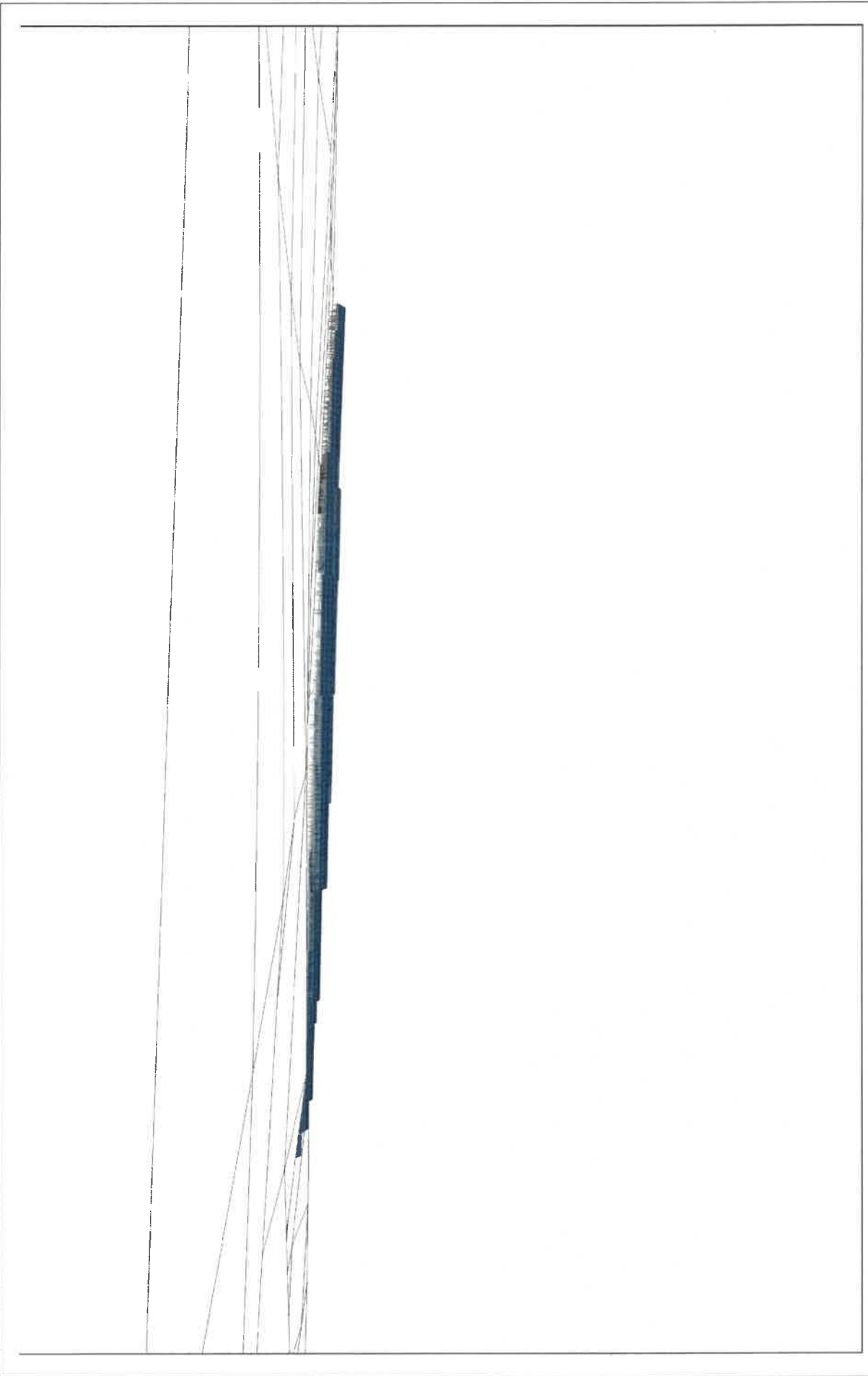


Viewpoint 5: Local road on Cefn Gwrhyd. Distance of 1.7km from proposed development.
Panoramic view and photomontage both illustrate the good levels of mature vegetation within the valley. The proposed development would be visible in the context of the existing wind farm.
(Panorama encompasses approximately 180° degree view looking north).

Project:	Mynydd y Gwrthyd	Viewpoint	Easting (ITM)	Northing (ITM)	Altitude (m)	Distance to Solar Farm (km)	Horizontal field of view (HFOV °)	40	Height of camera (m)	1.6
Location:	Track by Pen y Maun	01	272670	210110	262	0.340	Recommended viewing distance (mm):	500	Date of photograph taken	06/08/18

Figure 4-8 Viewpoint 1. Existing View - View North



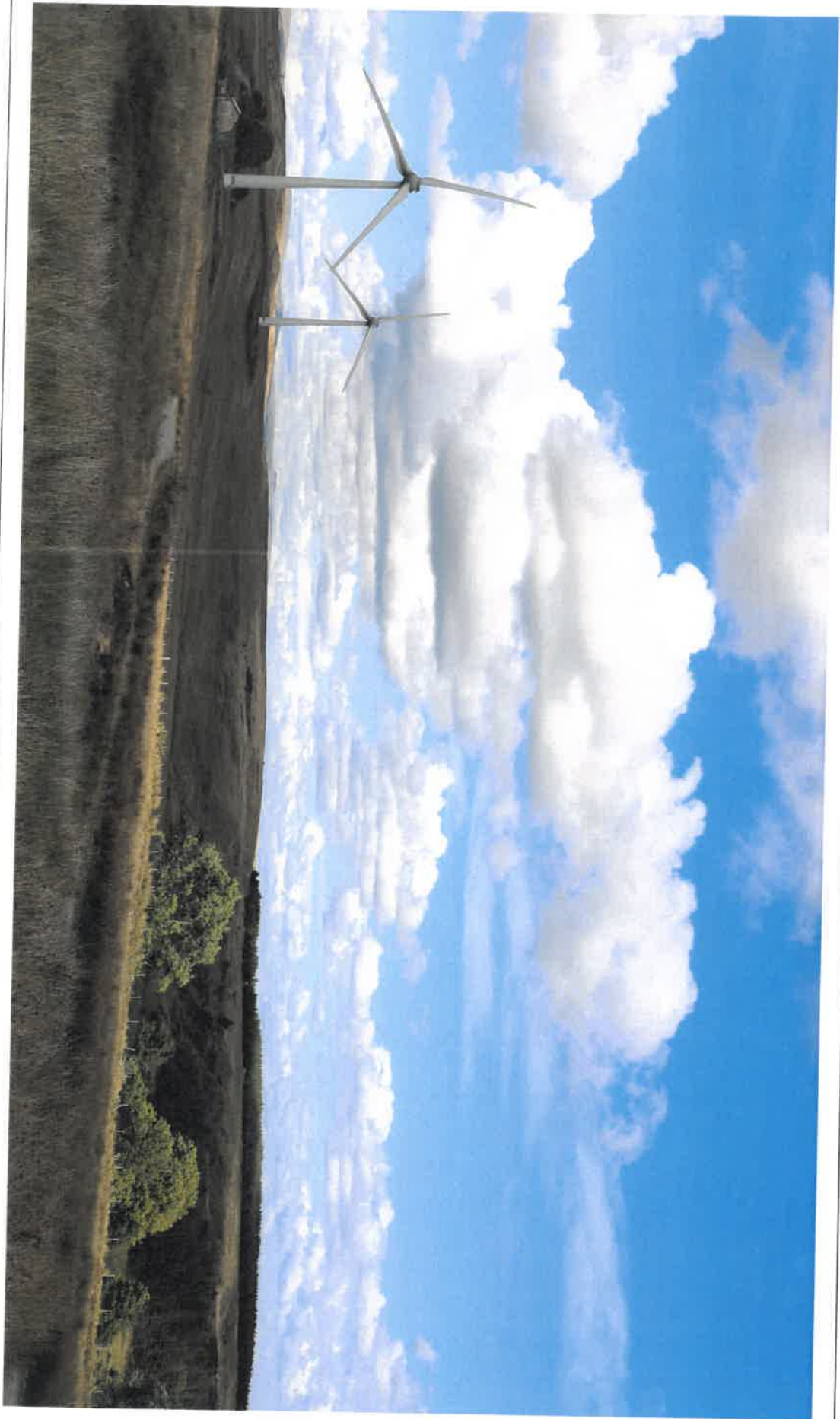


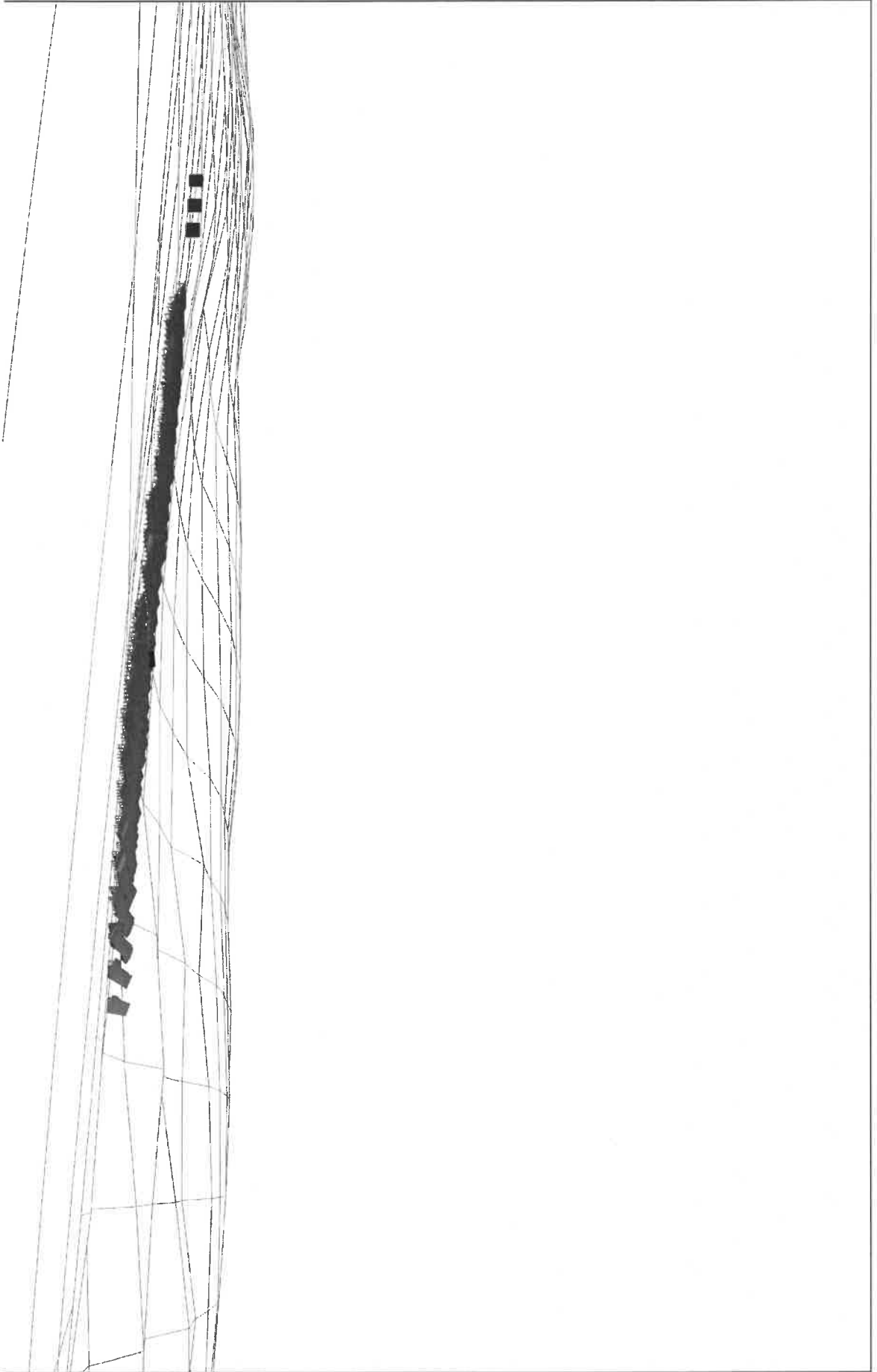


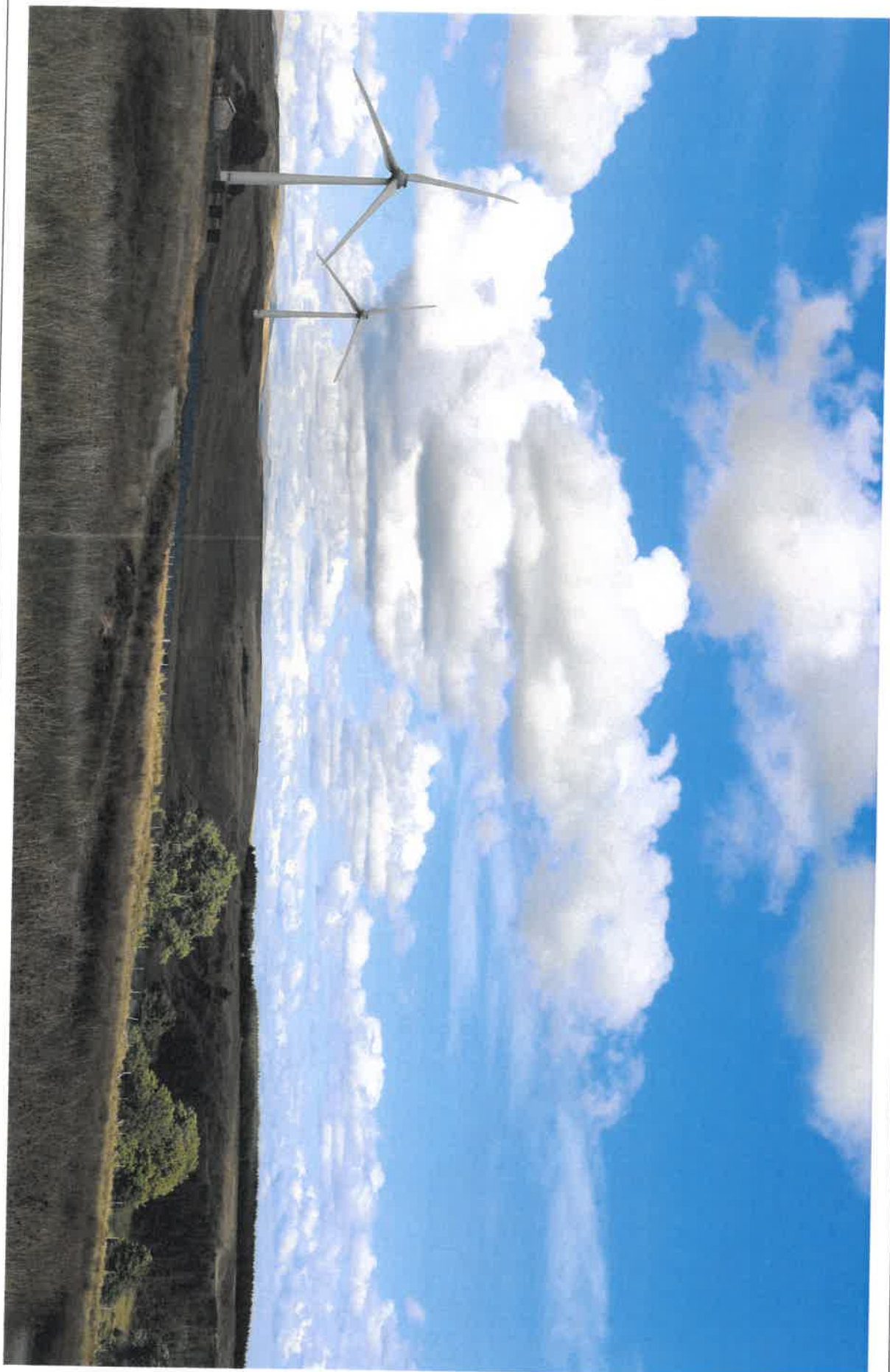


Project:	Mynydd y Gwrhyd	Viewpoint		Eastng (ITM)	Northng (ITM)	Altitude (m)	Distance to Solar Farm (km)	Horizontal field of view (HFOV °)	40	Height of camera (m)	1.6
Location:	Mynydd Uchaf	02		272165	210400	321	0.450	Recommended viewing distance (mm):	500	Date of photograph taken	08/08/18

Figure 4-9 Viewpoint 2. Existing View - View Northeast



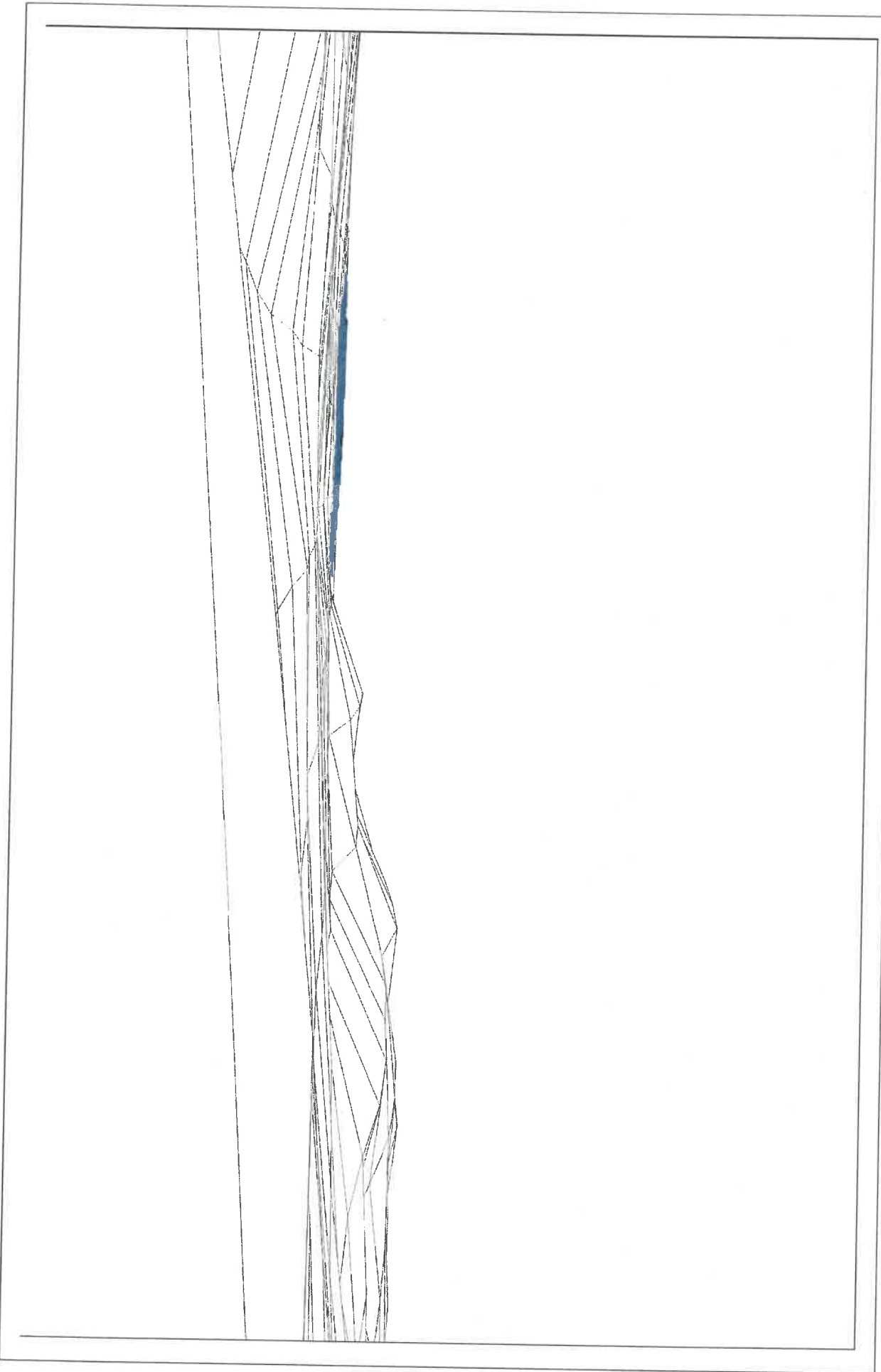




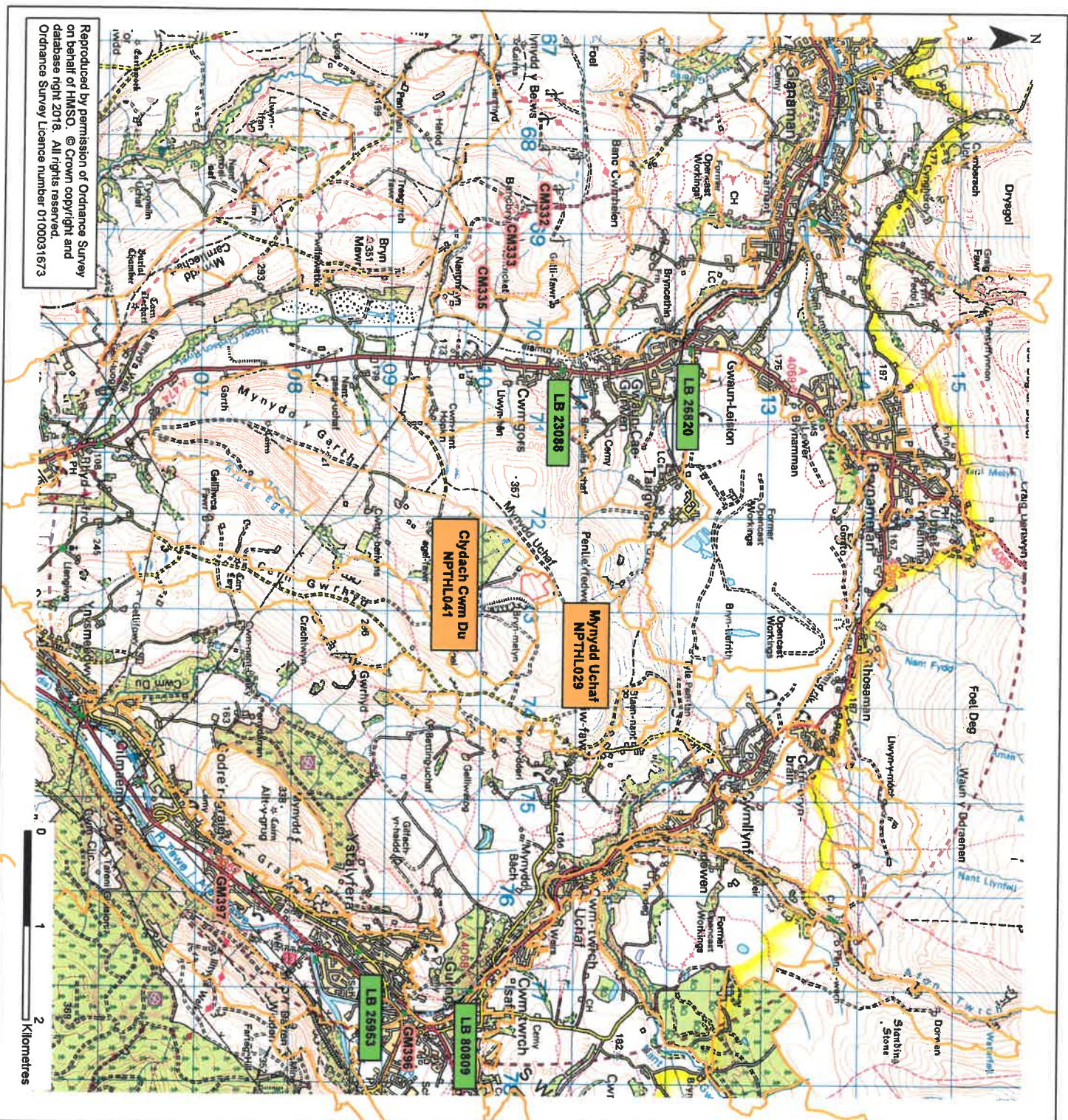
Project:	Mynydd y Gwrhyd	Viewpoint	Easting (ITM)	Northing (ITM)	Altitude (m)	Distance to Poultry Unit (km)	Horizontal field of view (HFOV °)	40	Height of camera (m)	1.6
Location:	Footpath SW of Ffiorch Egel Farm	03	272720	209320	206	1.130	Recommended viewing distance (mm):	500	Date of photograph taken	08/08/18

Figure 4-10 Viewpoint 3. Existing View – View North









Legend

- Site Location
- 5km Search Area
- Listed Buildings within 5km
- Landmap Historic Landscapes within 5km
- Scheduled Ancient Monuments within 5km

Scale (at A3): 1:40,000

Date: October 2018

Prepared by:



Client: Avel Aman Tawe

Mynydd y Gwrhyd Solar Farm

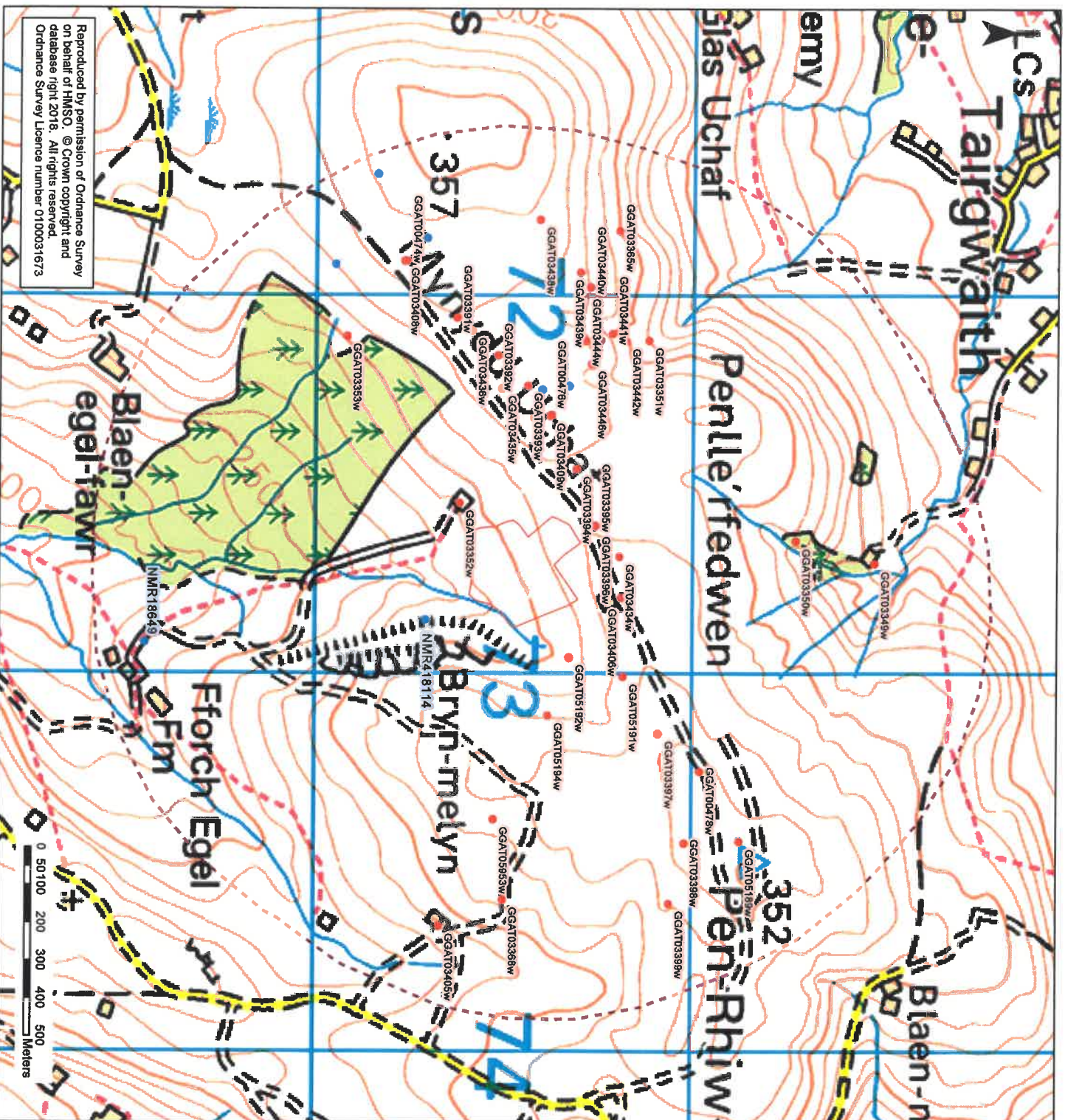
Figure 6-1: Designated archaeological sites and historic landscapes within a 5km search area around the proposed development site.

Drawn by: RK Checked by: MP Version: V1

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- Legend**
- Site Location
 - Site recorded in the Historic Environment Record
 - Additional site recorded in the National Monument Record

Scale (at A3): 1:10,000

Date: October 2018

Prepared by:



Client: Awel Aman Tawe

Mynydd y Gwrthid Solar Farm

Figure 6-2: Archaeological sites recorded within a 1km search area, labelled by reference numbers given in the main text.

Drawn by: RK Checked by: MP Version: V1

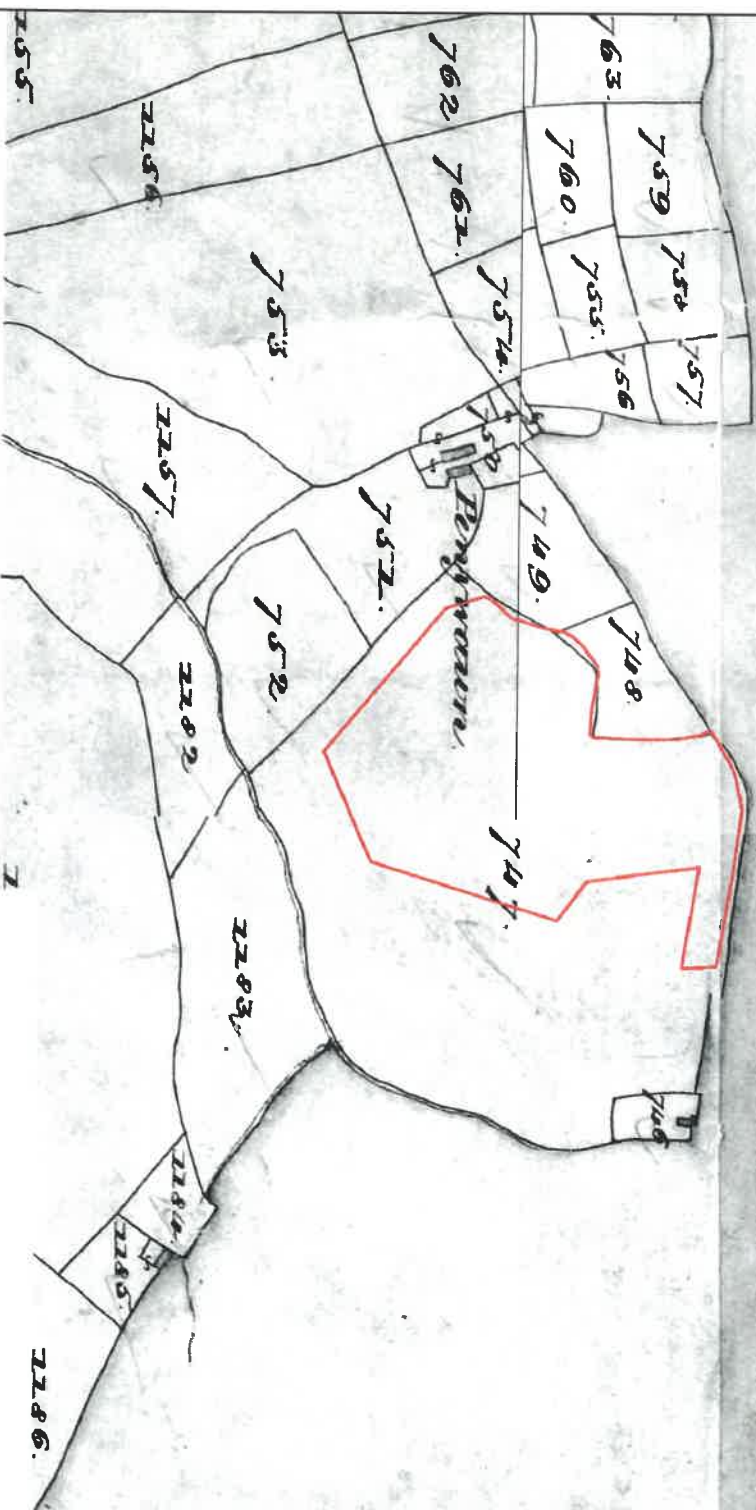
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Legend

 Site Location



Scale (at A3): NTS Date: October 2018

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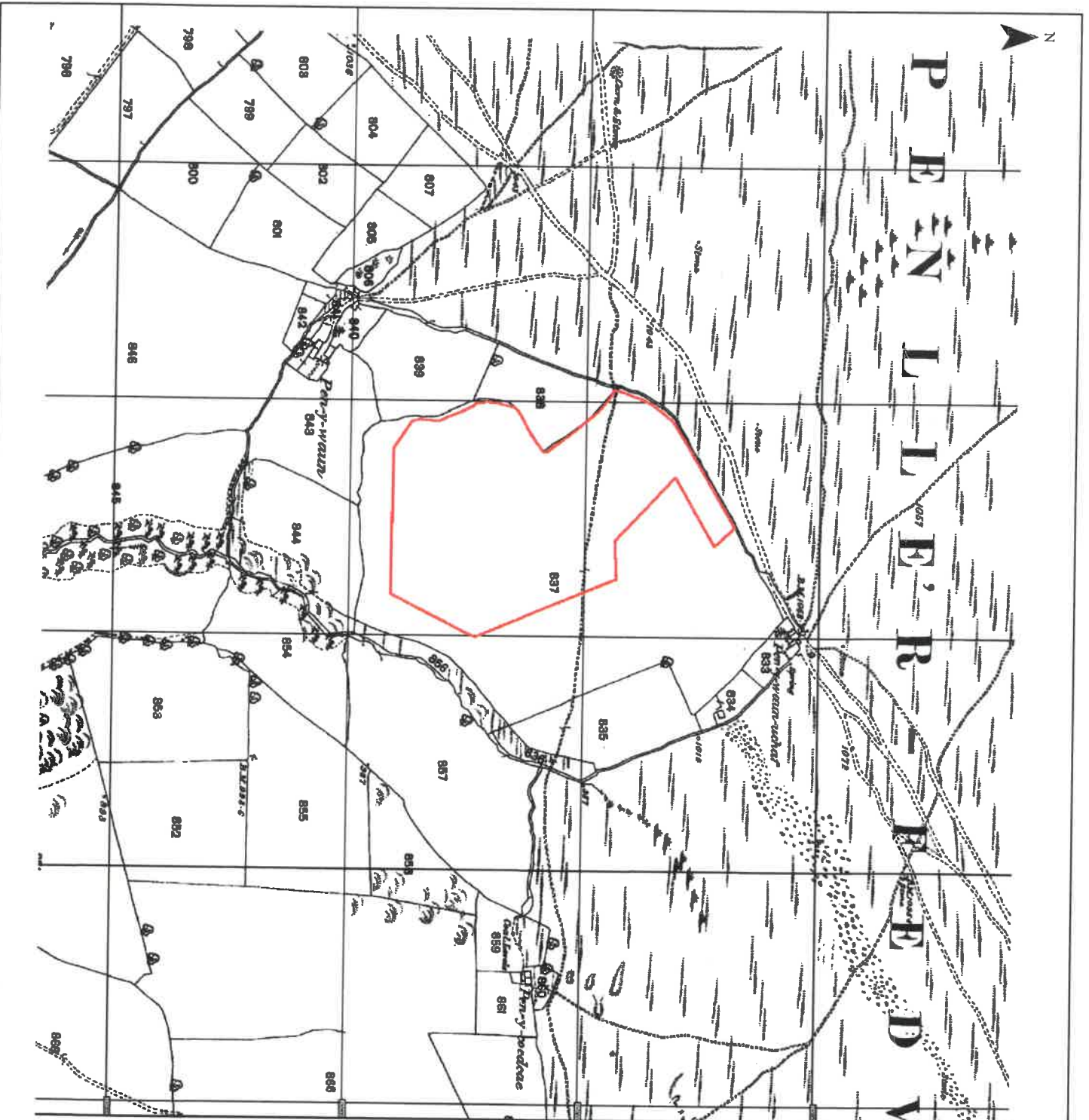
Mynydd y Gwrhyd Solar Farm

Figure 6-3: Tithe map, Llangunicke Parish 1842

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Legend

Site Location

Scale (at A3): NTS

Date: October 2018

Prepared by:



Client: Awel Aman Tawe

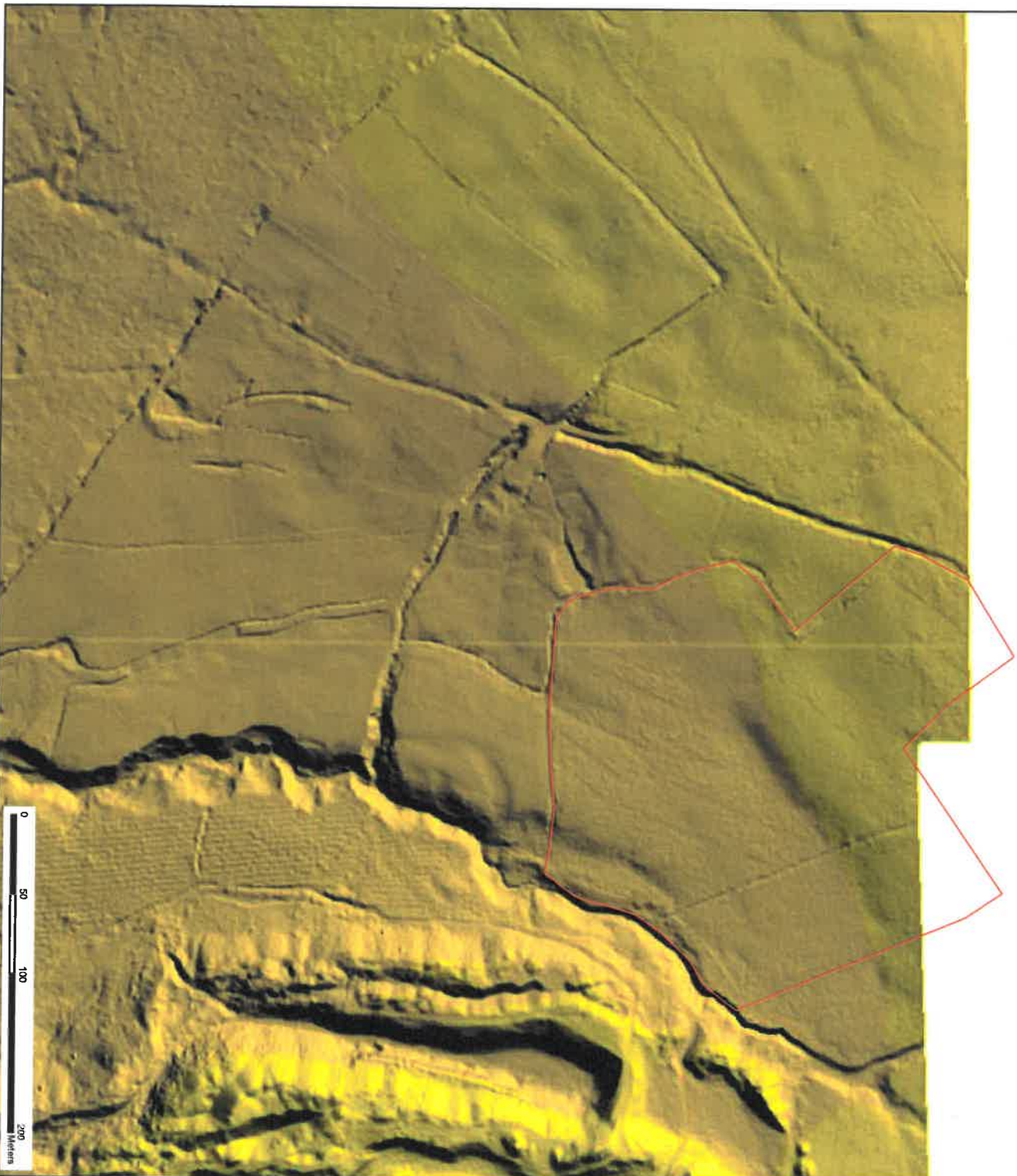
Mynydd y Gwrythd Solar Farm

Figure 6-4: Extract from the 1878 Ordnance Survey 1:2500 map

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Legend

 Site Location

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Scale (at A3): 1:2,500 Date: October 2018

Prepared by:



Client: Awel Aman Tawe

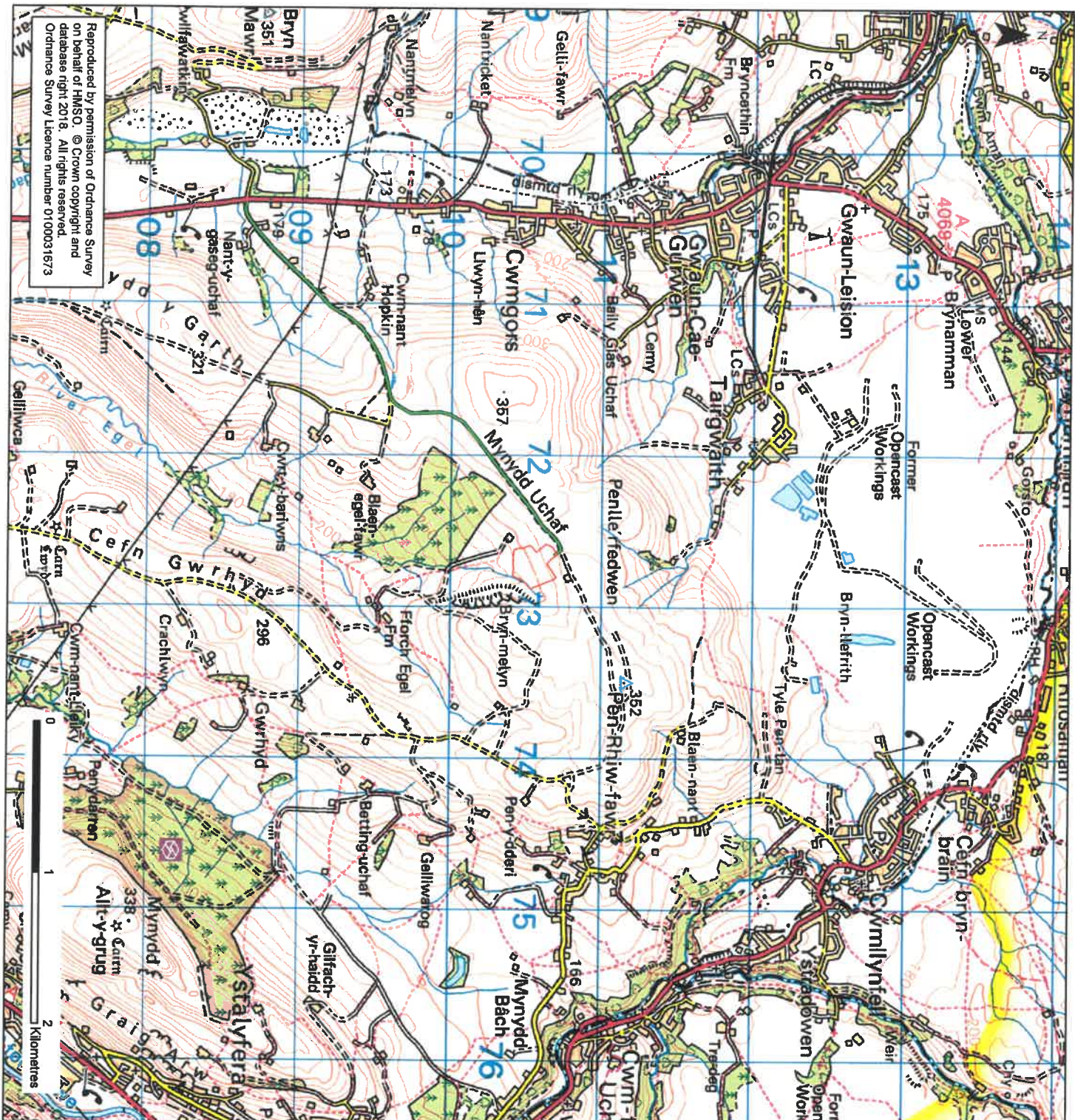
Mynydd y Gwrthid Solar Farm

Figure 6-5: Lidar data at 1m dtm overlaid with site location

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Legend

- Site Location
- Route to Site

Scale (at A3): 1:25,000

Date: November 2018

Prepared by:



Client: Awel Aman Tawe

Mynydd y Gwrhyd Solar Farm

Figure 8-2: Route to Site

Drawn by: RK

Checked by: MP

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Mynydd y Gwrhyd Ground Mounted Solar

Feasibility Report

Revision	Date issued	Author	Approved	Description
1	16/03/2018	Charlotte Norton		DRAFT

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1. Introduction

The Welsh Government's Local Energy Service is delivered by the Energy Saving Trust and provides financial and technical support to renewable energy projects which will deliver community benefits across Wales (<http://localenergy.gov.wales>). The Local Energy Service is supporting Awel Aman Tawe (<http://www.awelamantawe.org.uk>) to develop a community owned, ground mounted solar PV array which will generate energy alongside the existing 4.7 MW community owned wind farm, which is owned and operated by Awel Coop (<http://www.awel.coop>). This feasibility study has been developed by the Energy Saving Trust for the Local Energy Service.

Awel Aman Tawe are a community energy charity founded in 1998 working to make a difference to the lives of people at the top of the Swansea and Amman Valleys. The charity raises awareness of the importance of clean energy in the fight against climate change and has developed community renewable energy schemes, energy efficiency programmes, and innovative arts activities. The charity developed the community owned, Mynydd y Gwrhyd wind farm, which was commissioned in January 2017. Awel y Gwrhyd CIC is a Special Purpose Vehicle set up by Awel Aman Tawe, in order to construct, operate and maintain the wind farm. Awel Coop, a Community Benefit Society wholly owns Awel y Gwrhyd CIC and currently has approximately 1000 members. Any surplus generated by the wind farm enables Awel Aman Tawe to continue their important work and support local projects.

The existing wind farm is connected to the local distribution network and can export up to 4.7 MW of electricity at any time. Due to the variable nature of the wind, the amount of electricity generated by the wind farm fluctuates and therefore there are periods when the wind farm is not exporting 4.7 MW and there is spare capacity available within the grid connection. In order to maximise the efficiency of the grid connection and the productivity of the site Awel Aman Tawe are investigating the potential to install a ~1.2 MW solar array alongside the existing wind farm.

This report:

- Provides an initial proposed site layout for the solar array and estimates its potential annual energy production
- This estimate is compared to half-hourly export data from the wind farm for the year 20/02/2017 – 19/02/2018, to establish the level of constraint that would have been imposed during this time period on the solar PV in order to ensure that the maximum export capacity of 4.7 MW was not exceeded
- Identifies the potential technical and planning constraints that could affect the development
- Provides some initial financial analysis of the potential development
- Identifies the next steps to be pursued to progress the project

2. Proposal Description

2.1 Site location

Figures 1 and 2 show the proposed site location; alongside the existing wind farm and to the south of the existing substation.

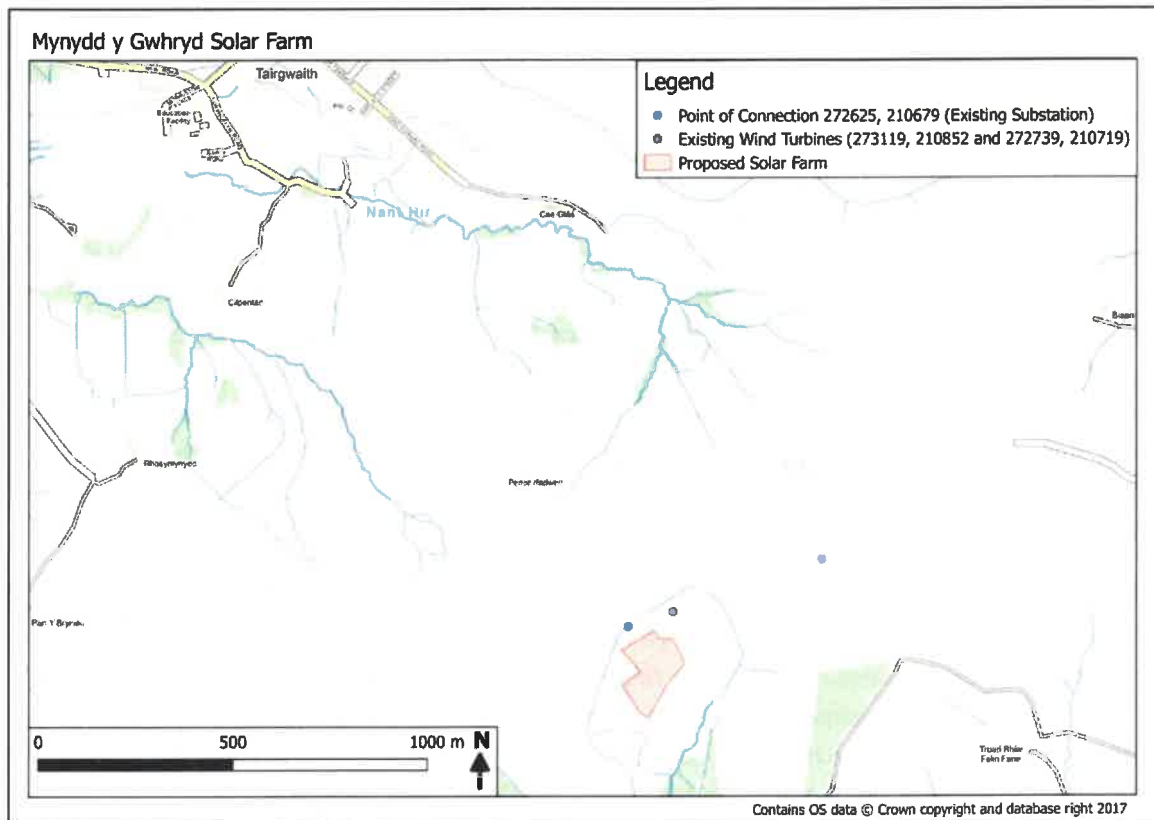


Figure 1: Location of Potential Ground Mounted Solar PV Site



Figure 2: Location of Potential Ground Mounted Solar PV Site

2.2 Site Layout and Capacity

The proposal has been discussed with Western Power Distribution (WPD). They have advised that up to 1.175 MW of solar PV export capacity can be installed alongside the existing wind farm with both generation assets permitted to export electricity simultaneously. Export limiting equipment must be installed to ensure the total export does not exceed 4.7 MW at any one time. Following this advice from WPD the proposed solar PV array has an AC output capacity of 1.1 MW and DC output capacity of approximately 1.4 MW.

Helioscope software (Folsom Labs, 2018) was used to develop a proposed site layout and estimate the annual energy production from the array, based on 10 km resolution irradiance data from the 'meteonorm' dataset within Helioscope, and assuming an availability factor of 99%. Figure 3 shows the provisional site layout of the modules, figure 4 illustrates the estimated monthly energy production and table 1 summarises the site design parameters.

Small electronic cabinets may be required within the development area, however as the solar farm will connect to the electricity network via the existing substation, no additional substation building will be required. Cabling to the substation will be installed underground.



Figure 3: Provisional Site Layout

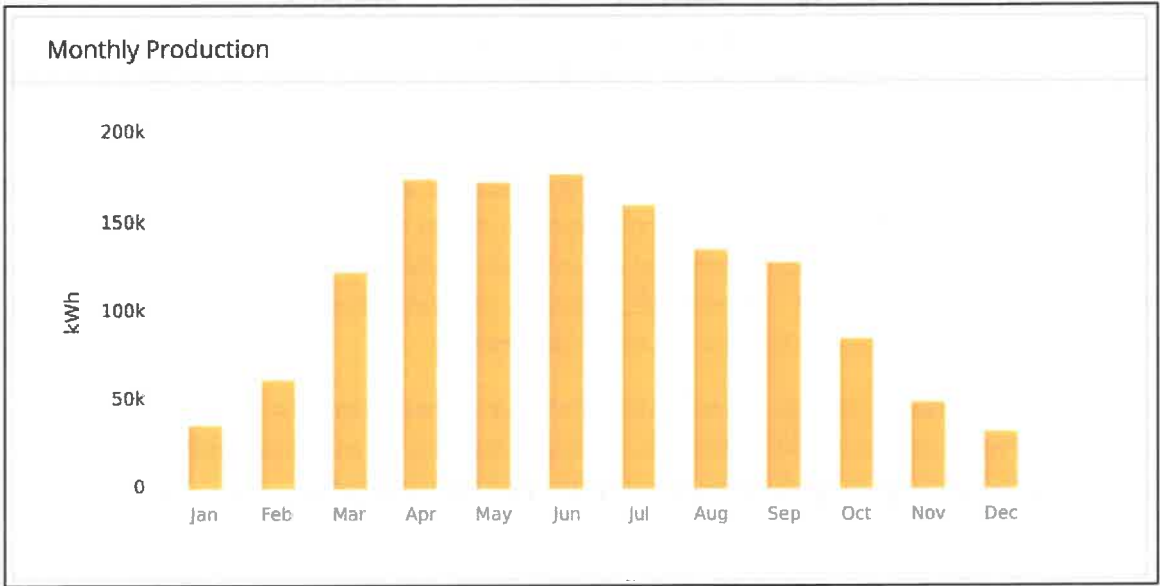


Figure 4: Monthly Energy Production

Table 1: Site Design Parameters

Number of modules	3960
DC nameplate capacity	1.37 MWp
AC nameplate capacity	1.10 MWp
Module capacity and type	345 W monocrystalline
Inverter number, type and capacity	22; Sunny Tripower Core1 CEC (SMA)
Annual yield	1.345 GWh

2.3 Site Access

Access to the site will follow the existing access tracks that were used during construction of the wind farm. No abnormal loads are required for the construction of the proposed solar farm.

2.4 Project Lifetime and Decommissioning

The project lifetime is 30 years from commissioning. At the end of the 30 years there are a number of options, these include:

- Remove all of the above ground infrastructure from the site and allow the land to re-vegetate and return to its current use as grazing land.
- Repower the site with new panels and upgraded inverters if a suitable technology exists and provides added long-term benefit
- Analyse current production at site, conduct any essential maintenance and allow continued generation if it is economical to do so.

3. Solar Generation alongside the Existing Wind Generation

WPD have stipulated that export limiting equipment will be required to ensure that the total export from the site (wind plus solar) does not exceed 4.7 MW. This equipment will look to constrain the solar output rather than the wind generation. Helioscope (Folsom, 2018) is able to output estimated hourly electricity available for export for an annual period for the solar array. This data has been compared to actual and theoretical wind generation data for the site, to understand the level of constraint that is likely to be imposed on the solar generation.

3.1 Comparison with Actual Wind Generation (February 2017 – February 2018)

The solar generation prediction data produced from Helioscope was converted to half-hourly energy data and compared to the actual half-hourly export data collected from the wind farm for the year 20 February 2017 – 19 February 2018. Two half-hourly data entries were missing from the wind farm data (01:00 and 01:30 on 26 March 2017) – these time periods were during the night and therefore wouldn't impact the solar PV export potential. The data was converted to power data and half-hourly periods where the power available for export exceeded 4.7 MW was identified, and the level of constraint required was calculated. Table 2 summarises the level of constraints required.

Table 2: Solar Generation Potential (based on solar data for 2021 and actual wind data for 20 February 2017 – 19 February 2018)

Max. Export Available	4700	kWp
No. of HH Constrained	242	Half-hourly Periods
% of Year Constrained	1%	
% of Solar Generation Time Constrained	3%	
Total kW Constrained	66,097	kW
Total kWh Constrained	33,048	kWh
Total Solar kWh Generation Potential	1,344,732	kWh
Total Solar kWh Able to be Exported	1,311,684	kWh
Overall Energy Constraint	2%	

The Feed-in Tariff (FIT) is the main government financial incentive available for small scale renewables. It provides a fixed payment for each unit of renewable electricity generated and a further optional fixed payment for every unit of electricity exported to the electricity network (a generator could choose to sell electricity to a supplier or user rather than receive the export tariff). In order to apply (pre-accredit) for the feed-in tariff a project needs to have planning consent and a secured grid connection offer. Once a community solar PV project is pre-accredited they have 18 months to complete the project installation (community projects are awarded 6 months longer than commercial projects).

The Feed-in Tariff is due to close to new applicants at the end of March 2019. The generation tariff earned by projects reduces each quarter and a specified capacity of generation (a "capacity cap") is

able to register for each quarter's tariff. If a capacity cap is met then the tariff for the next quarter is further reduced and any new applicants queue for the next quarter. As such it is possible that there will not be any available capacity for the project once it has gained its required planning consent and grid connection offer.

The Feed-in Tariff generation and export tariffs increase with inflation, assuming inflation at 2.5%; the following tariffs are predicted for the year 2019-2020:

- FIT Generation Tariff: 0.06 p/kWh (if pre-accredited by March 2019, and no further capacity caps are met)
- Export Tariff: 5.41 p/kWh

Table 3 summarises the potential impact on income that the constraint identified in table 2 would cause to the potential solar PV income based on the FIT tariffs calculated above.

Table 3: PV Generation Constraint Impact on Income (based on wind generation from Feb 2017- Feb 2018)

FIT Generation Tariff Income Lost	£20
FIT Export Tariff Income Lost	£1,789
Total Income Lost	£1,809
Remaining FIT Generation Tariff Income	£807
Remaining FIT Export Tariff Income	£70,988

These constraint levels should be used with caution; they are based on one year of wind generation data. Wind energy is variable in nature and therefore one year's wind pattern cannot be relied upon to be an indicator of another year's wind pattern, as such the constraint required in subsequent years will vary.

The total wind generation exported for the period 20 February 2017 – 19 February 2018 was 11,799 MWh. The P50 prediction for annual wind energy generation from the site is 12,404 MWh, the P90 prediction for one individual year's wind energy generation at the site is 10,257 MWh. As such the year analysed exceeded the P90 prediction, but was less than the P50 prediction, indicating that it is likely that there will be windier years of generation in the future which may cause greater solar constraints to be required.

3.2 Comparison with Predicted Wind Generation Data

In order to compare the solar data with a wind generation profile for a windier year, Homer Pro software (Homer Energy, 2018) was used to predict a hourly annual wind generation for the site and compared with the solar generation predicted by Helioscope. Homer Pro software can create synthetic time-series wind speed data for sites that do not have measured data – effectively simulating a potential annual wind profile on an hourly basis. It uses an algorithm based on the following parameters to generate the data:

- Monthly average wind speeds: see below for how this was estimated
- Weibull shape parameter: value of 2.13 was used (Dulas, 2016)

- 1-hour autocorrelation factor (Reflects how strongly the wind speed in one time step tends to depend on the wind speed in the previous time step): default value of 0.85 was used
- Diurnal pattern strength (Reflects how strongly the wind speed depends on the time of day): default value of 0.25 was used
- Hour of peak wind speed (The hour of day that tends to be windiest on average): default value of 15 was used

(Homer Energy, no date)

The algorithm produces data that mimics the characteristics of real wind speed data, including strong and sustained gusts, long lulls between windy periods, and seasonal and diurnal patterns (Homer Energy, no date).

To estimate the monthly mean wind speeds, monthly wind speed data was downloaded for the site from the NASA Surface Meteorology and Solar Energy database at 50 m height; this data showed the site to have a mean wind speed of 7.81 m/s at 50 m height. The wind energy analysis undertaken from onsite meteorological data collected at the site shows that at the met mast location (grid reference: 272725, 210710) the mean long-term wind speed is 7.02 m/s at a height of 60.17 m (Dulas, 2016). The monthly wind speeds downloaded were scaled down by Homer Pro to be representative of an annual mean wind speed of 7.02 m/s and the anemometer height was updated to 60 m, so that the monthly wind speeds provided were more representative of the onsite wind analysis report (Dulas, 2016). The roughness factor, weibull shape parameter, turbine availability/performance losses, wake effect losses, environmental losses and electrical losses were updated within Homer Pro to correspond with the figures used within the wind analysis report (Dulas, 2016) and the software algorithm was run to produce the synthetic annual hourly wind generation.

The annual energy generation calculated was 13.8 MWh. This generation figure exceeds the long-term P50 data predicted for the site by Dulas (2016) and therefore may provide an increased level of constraint that would be imposed on the solar generation. Table 4 summarises the results.

Table 4: Solar Generation Potential (based on synthetic wind data generated for the site by Homer Pro)

Max. Export Available	4700	kWp
No. of HH Constrained	281	Hourly periods
% of Yr Constrained	3%	
% of Solar Generation Time Constrained	7%	
Total kW Constrained	79,943	kW
Total kWh Constrained	79,943	kWh
Total Solar kWh Generation Potential	1,344,732	kWh
Total Solar kWh Able to be Exported	1,264,789	kWh
FIT Generation Tariff Income Lost	£49	
Overall Energy Constraint	6%	
FIT Export Tariff Income Lost	£4,327	
Total Income Lost	£4,376	
Remaining FIT Generation Tariff Income	£778	
Remaining FIT Export Tariff Income	£68,450	

4. Financial Analysis

Some initial financial modelling has been undertaken assuming the lower estimates for the amount of energy generated by the solar PV which is able to be exported provided in section 3 – based on the synthetic wind data (1,264,789 kWh). The modelling uses some typical assumptions, which are described below. As a project develops and details of a site become more certain, financial modelling should be updated to reflect the site and time-specific nature of the development.

4.1 Assumptions

The modelling uses the solar energy yields and project capacities provided in table 5. The amount of energy generated by a solar PV module decreases overtime as the module degrades. The modelling assumes that the energy yield reduces by 0.5% per year. The project is assumed to reach financial close at the end of March 2019 and complete commissioning by the end of March 2020. Inflation is assumed at 2.5% for the duration of the project.

4.1.1 Scenarios

Two scenarios have been modelled:

1. The project receives income from both the forecast FIT generation tariff for pre-accrediting a project in March 2019 (0.06 p/kWh) and the FIT export tariff (5.42 p/kWh – the current export tariff with three years of inflation at 2.5% applied)
2. The project receives income based on the forecast FIT export tariff (5.42 p/kWh), as representative of the wholesale price for electricity, but no FIT generation tariff (assumes that there is no available capacity when the project is ready to pre-accredit for the FIT).

4.1.2 Costs

Development Costs

Prior to being able to install a solar PV development, development costs will be incurred. Local Energy will be able to support the project development by undertaking some work in-house, however the following costs are forecast to be incurred during the project development:

- Legal costs (to put in place land agreements, establish a suitable project vehicle and advise on any potential local supply model and associated legal documentation required): £10,000
- Planning costs (to undertake specialist studies, e.g. ecology studies, glint and glare assessments and to pay the planning application fee): £30,000
- Share offer costs (to prepare a share offer document and market and administer the share offer): £20,000.

Please note the costs outlined above are estimated based on previous project experience. As every site and project is different the actual costs incurred may vary.

The Local Energy Service provides both grant and loan funding to help meet project development costs. The modelling assumes:

- £20,000 is provided in grant funding
- £40,000 is provided in loan funding at an interest rate of 10%.

Capital Costs

The costs associated with solar PV installations are decreasing as the number of completed installations increase. Arup carried out a review on the cost of renewable electricity generation in the UK for the UK government in 2016 (Arup, 2016); this included both current and projected future costs associated with solar PV installations in 2020, 2025 and 2030. Linear interpolation was used to estimate the capital costs in 2019 based on the forecast costs for 2020 and 2025, given in table 5 below. The proposed solar PV array utilises the access track, substation and grid connection provided by the existing wind farm, as such the capital costs are likely to be cheaper than stand-alone projects. As such the low cost estimates for 2019 have been used in the modelling.

Table 5: Forecast Capital Costs

	Year	2015	2019	2020	2025	2030
Cost per kW	Low	£ 866	£ 745	£ 704	£ 662	£ 633
	Medium	£ 1,007	£ 864	£ 816	£ 767	£ 733
	High	£ 1,156	£ 991	£ 936	£ 879	£ 839
Provided by Arup (2016)						
Calculated using linear interpolation based on forecast costs for 2015 and 2019						

(Arup, 2016)

Capital costs can be financed via a mixture of commercial loan finance, a loan from the Local Energy Service, or a share offer. Some projects have used loan funding from the Local Energy Service in the first instance and then re-financed (all or some of this funding) within the project's first year of operation with funding raised via a share offer.

The financing terms associated with the funding, will affect the cash-flow of the project, and the potential surplus or community benefit fund generated by the project. The initial results presented in this document do not take account of the project's capital financing as this will be determined as the project progresses.

Operational Costs

The Arup (2016) report also forecast solar PV operational costs, including costs associated with operation and maintenance, insurance and grid. The forecast results are provided in table 6, as with the capital costs, some of the operational costs are likely to be able to be shared between the existing wind farm and the solar farm, and therefore the low estimate for 2019 has been used in the modelling.

Table 6: Forecast Operational Costs

	Year	2015	2019	2020	2025	2030
Cost per kW	Low	£ 8	£ 7	£ 7	£ 7	£ 6
	Medium	£ 12	£ 11	£ 11	£ 10	£ 10
	High	£ 18	£ 17	£ 16	£ 15	£ 14
	Provided by Arup (2016)					
	Calculated using linear interpolation based on forecast costs for 2015 and 2019					

In addition to the costs included by Arup in their forecasting, additional costs included in this modelling are as follows:

- FCA yearly membership fee: £50 per annum
- Accountancy costs: estimated at £1,000 per annum
- Cooperative administration costs: estimated at £2,500 per annum (this assumes that the capital costs are financed at least partly by a share offer, which requires on-going administration; keeping members informed about the project, and calculating and administering interest and principal repayments).
- Rental costs: assumed to be 5% of gross revenue.

4.2 Results

4.2.1 Financial Modelling Results based on Synthetic Wind Data

For each scenario an internal rate of return (IRR) and simple payback are provided in table 7. The IRR describes the potential return on investment that a project provides. A negative IRR means that the project does not repay its initial investment. The IRR is calculated before capital financing costs are accounted for and therefore a positive IRR helps to indicate the capital financing interest rate that a project is likely to be able to withstand over the lifetime of the project. The IRR is based on a project lifetime of 25 years (which is generally associated with solar PV).

Table 7: Initial Financial Modelling Results (based on 2017-18 Wind Results)

	Scenario 1 (Receives FIT)	Scenario 2 (Doesn't Receive FIT)
IRR	3.6%	3.5%
Simple Payback	17 years	18 years

4.2.2 Analysis

The results in table 7 show a positive IRR, but relatively low returns on investment. In order to increase financial viability for the project:

- The project would need to secure very low cost capital finance,
- The costs would need to reduce more than is currently forecast, or
- The income would need to increase more than is currently forecast.

The energy system in the UK is experiencing a period of change, and the options above are all considered to be possible at the current time. Solar PV is considered to provide the greatest opportunity in the medium term of becoming financially viable at a community scale. As such it is recommended that the work on the development is continued and the financial modelling is updated as certainty in the assumptions used increases.

Battery storage is another aspect of the energy industry which is causing a change to how the energy system operates and also how solar PV projects can be modelled. Costs associated with battery storage are currently relatively high, but they are expected to “...fall rapidly in the coming years due to a combination of market growth and technology maturity, combined with significant economies of scale in manufacturing and deployment.” (Regen, 2016, p.15). Installing battery storage alongside the solar PV project (either on-site at the solar PV array or within local properties) could enable:

- The electricity generation to be better matched with local use; increasing the proportion of electricity used within a local supply model
- Buildings and households to access electrical or heat storage within their own curtilage, potentially reducing bills and making energy available when needed rather than when generated by the solar arrays
- The electricity generation to be exported at times of higher demand nationally, securing a better price for the electricity exported onto the electricity network
- The project to access additional income revenues by providing additional services to the distribution network to enable the Distribution Network Operator to operate the network smoothly.

Further information about battery storage business models is provided in a report by Regen (2016) *Energy Storage - Towards a commercial model* available at the following link: <https://www.regensw.co.uk/Handlers/Download.ashx?IDMF=c85b8d3d-9fa8-4f8e-a26e-17b124930a9b>

The impact of battery storage has not been taken account of in the modelling above due to the uncertainties surrounding future prices and revenue streams. It is however recommended that provision for battery storage is included within the planning application submitted to the LPA and the grid connection application to the DNO. This will allow battery storage to be integrated into the project, if deemed beneficial at the time of financial close and construction.

5. Planning and Technical Constraints

5.1 Energy Targets and Planning Policy

5.1.1 National Policy

Under the EU Renewable Energy Directive, the UK is required to source 15% of its energy from renewable sources by 2020 and *“The Welsh Government is committed to playing its part...”* in achieving this (Welsh Government, 2016a, p. 174).

The Environment (Wales) Act set a legal target of reducing greenhouse gas emissions by 80% by 2050 (Welsh Government, 2017a). In September 2017 the Cabinet Secretary for Environment and Rural Affairs announced the following targets for energy generation in Wales:

- 70% of Wales’ electricity consumption to be generated from renewable sources by 2030
- 1 GW of locally owned renewable electricity capacity in Wales by 2030
- New renewable energy projects to have at least an element of local ownership by 2020

(Welsh Government, 2017b)

Energy policy in Wales is set out in the document *Energy Wales: A Low Carbon Transition* (2012). It states that Wales will only be successful in transitioning to a low carbon economy if the community are engaged and if benefits are realised (Welsh Government, 2012). As part of the transition the Welsh Government intends to *“Work with communities and partners to ensure that the wealth generated by energy development in Wales benefits communities and lays foundations for Wales’ long term economic prosperity...”* and to *“Ensure Wales’ communities have access to advice, expertise and funding to cooperatively harness appropriate proven renewable technology, such as hydro, solar, wind and biomass, for local electricity generation...”* (Welsh Government, 2012, p.18).

The Well Being of Future Generations (Wales) Act came into force in 2015. The Act places a duty on public bodies to carry out sustainable development (Welsh Government, 2015a). The Minister for Natural Resources made it clear in 2016 in a letter to Planning Lead Members that;

“[when] taking decisions on local planning policies and individual development management decisions consideration should be given to the overall context of helping to tackle climate change and delivering the sustainable development duty placed on all public bodies by the Well-being of Future Generations (Wales) Act” (Minister for Natural Resources, 2016, p.1).

Planning Policy Wales (2016) provides the national framework for planning policy in Wales (Welsh Government, 2016a). Within it, it states that it is Welsh Government’s policy *“...to support community driven renewable energy projects where benefits from the projects are returned to the host community”* (Welsh Government, 2016a, p. 178). It requires decision-makers within the planning system to demonstrate *“...a presumption in favour of sustainable development to ensure that social, economic and environmental issues are balanced and integrated ... when taking decisions on individual planning applications”* (Welsh Government, 2016a, p. 46). By making decisions in this manner the planning system is able to *“...contribute positively to the achievement of the Well-being goals...”* set out in the Well-Being of Future Generations (Wales) Act (Welsh Government, 2016a, p. 46).

With specific reference to renewable energy developments, Planning Policy Wales (2016), states the following:

“12.8.9 Local planning authorities should facilitate the development of all forms of renewable and low carbon energy to move towards a low carbon economy (see 4.4.3) to help to tackle the causes of climate change (see 4.7.3). Specifically, they should make positive provision by:

- considering the contribution that their area can make towards developing and facilitating renewable and low carbon energy, and ensuring that development plan policies enable this contribution to be delivered;*
- ensuring that development management decisions are consistent with national and international climate change obligations, including contributions to renewable energy targets and aspirations;*
- recognising the environmental, economic and social opportunities that the use of renewable energy resources can make to planning for sustainability (see Chapter 4); and*
- ensuring that all new publicly financed or supported buildings set exemplary standards for energy conservation and renewable energy production.*

12.8.10 At the same time, local planning authorities should:

- ensure that international and national statutory obligations to protect designated areas, species and habitats and the historic environment are observed;*
- ensure that mitigation measures are required for potential detrimental effects on local communities whilst ensuring that the potential impact on economic viability is given full consideration; and*
- encourage the optimisation of renewable and low carbon energy in new development to facilitate the move towards zero carbon buildings (see 4.11 and 4.12).”*

(Welsh Government, 2016a, p. 176)

This review of national planning policy shows it to be supportive of developments such as that proposed in Kidwelly.

3.1.2 Local Planning Policy Neath Port Talbot Local Development Plan

Decisions on individual planning applications are made with respect to the adopted local and national planning policies. The current adopted local planning policies in Neath Port Talbot are set out in the Neath Port Talbot Local Development Plan (LDP), which will guide developments in the county until 2026 (Neath Port Talbot County Borough Council, 2016).

Policies SP 18 and RE 1 are relevant to the proposed solar farm:

Policy SP 18: Renewable and Low Carbon Energy

A proportionate contribution to meeting national renewable energy targets and energy efficiency targets will be made while balancing the impact of development on the environment and communities.

This will be achieved by:

- 1. Encouraging where appropriate, all forms of renewable energy and low carbon technology development;*
- 2. Encouraging energy conservation and efficiency measures in all new major development proposals;*
- 3. Ensuring that development will not have an unacceptable impact on the environment and amenity of local residents.*

(Neath Port Talbot, 2016, p.76)

Policy RE 1: Criteria for the Assessment of Renewable and Low Carbon Energy Development

Proposals for renewable and low carbon energy development will only be permitted subject to the following criteria:

- 1. Large scale wind farm developments (>25MW) will be expected to be located within the boundaries of the refined Strategic Search Areas.*
- 2. Proposals for wind farms of any size outside the SSAs will only be permitted where it is demonstrated that there will be no unacceptable impact on visual amenity or landscape character through the number, scale, size, design and siting of turbines and associated infrastructure.*
- 3. Small scale wind farm developments (<5MW) will be required to demonstrate that impacts are confined to the local scale.*
- 4. All renewable energy or low carbon energy development proposals will be required to demonstrate that:*
 - (a) Measures have been taken to minimise impacts on visual amenity and the natural environment;*
 - (b) There will be no unacceptable impacts on residential amenity;*
 - (c) The development will not compromise highway safety;*
 - (d) The development would not interfere with radar, air traffic control systems, telecommunications links, television reception, radio communication and emergency services communications; and*
 - (e) There are satisfactory proposals in place for site restoration as appropriate.*

(Neath Port Talbot, 2016, p.77)

These policies show that proposal's impact on the landscape, visual amenity and ecology, are likely to be particularly important with respect to the decision to grant planning consent.

5.2 Environmental and Historical Designations

Figures A1 and A2 in Appendix A identify the environmental and historical constraints and designations within 1km and 5km of the proposed solar PV site. The only environmental/historical designations within 1km of the site are areas of Ancient Woodland.

Located within 5km of the site is:

- The Brecon Beacons National Park approximately 3.5 km north of the site
- Swansea Canal Local Nature Reserve approximately 4.5 km south-east of the site
- Seven SSSIs (Cefn Gwrhyd, Rhydyfro – approximately 2 km south; Coed Cwm Du – approximately 3 km south, Cilmaengwyn; Cwm Twrch – approximately 3.5 km north-east; Frondeg – approximately 4.5 km south; Gwrhyd Meadows – approximately 2km south; Hafod Wennol Grasslands – approximately 4.5km west; Tairgwaith – approximately 1 km north-west)
- 25 Grade II listed buildings and 3 Grade II* listed buildings
- Seven Scheduled Ancient Monuments (Bancbryn post-medieval Lluest farmstead – approximately 4.5 km east; Bancbryn cairn cemetery – approximately 4 km east; Bancbryn platform cairn – approximately 3.5 km east; Bancbryn cairn cemetery [east] – approximately 3.5 km west; Canal Aqueduct over the River Twrch – 4.5 km east, Ystalyfera' Remains of

Local and Dry Dock at Pantyffynon – approx. 4.5km south-east; Crimea Colliery and Canal Quay – approx. 4.5km south-east).

A preliminary ecological appraisal of the site will need to be undertaken to understand any potential ecological impacts of the proposed development and whether further survey work is necessary to fully understand this. The ecological appraisal could also include suggestions for improving the biodiversity of the site as part of the development.

An assessment of the potential landscape and visual impact on the National Park should be included within the planning application.

5.3 Visual Receptors

Whilst ground mounted solar projects can be less visible than wind projects, due to the large area of land that they cover they can still have a visual impact and this requires assessment within a planning application. In addition to the impact on the National Park, the impact on local residential properties and how this impacts their amenity will also need to be assessed. The solar farm is located far from residential areas, with the closest property located approximately 1 km away, as such it is anticipated that the visual impact from the proposed development will be relatively limited.

The solar farm is located near to the Gwrhyd Common and potential impact on the amenity of users of the common will also need to be assessed. The siting of the solar farm on land set back from the common to the south of the existing substation and on land sloping away from the common is considered to have lessened the potential for visual impact on this receptor.

The site is located within Swansea Airport's consultation zone, and therefore they should be contacted regarding the development. The site is approximately 24 km away from the airport, and given this distance and the nature of the airport it is considered unlikely that the development will impact their operations.

As the site is located far from houses, airports and main access routes, it is considered that a glint and glare assessment may be unnecessary. This should be confirmed via a pre-planning enquiry with the LPA.

5.3.1 Cumulative Impact

Other renewable energy developments will need to be taken into consideration when preparing a planning application. Appendix B provides a map of nearby developments (greater than 1 MW in capacity), which are in planning, operational or under construction. The developments are identified by their technology type and the size of the scheme in MW is provided by the numbers next to the scheme identifying points.

5.4 Agricultural Land Classification

An element of the Solar Trade Association's best practice guidance for solar farm development is to focus solar farm developments on "...non-agricultural land or land which is of lower agricultural quality" (Solar Trade Association, 2017). Welsh Government state that "The only way to accurately determine the agricultural quality of land is through a detailed ALC survey in accordance with the Ministry of Agriculture, Fisheries and Food (MAFF) ALC guidelines 1988" (Welsh Government, 2017c).

The Welsh Government does however provide a predictive Agricultural Land Quality tool which provides an indication of the land quality of different parts of Wales (the tool is available at <http://lle.gov.wales/map/alc>). The tool has been consulted and it indicates that the site is covered by Grade 5; Very poor quality agricultural land (Welsh Government, 2017d). As such the land is considered likely to be suitable for development for a solar farm.

5.5 Landmap

Landmap is a tool that has been developed by Natural Resources Wales, which evaluates different aspects of the natural landscape, in terms of the following values:

- Visual and Sensory
- Cultural Landscape
- Historic Landscape
- Landscape Habitats
- Geological Landscape

(Natural Resources Wales, 2017)

It is used by Local Planning Authorities to assist in making decisions about the impact of a development on the landscape (Natural Resources Wales, 2017). Appendix C provides maps showing the overall evaluations for each of the five landmap categories in and around the proposed sites. Table 8 summarises the overall evaluations for the sites for each of the five aspect areas.

Table 8: Landmap Overall Evaluations

Aspect Area	Overall Evaluation
Visual & Sensory	High
Cultural	High
Historical	High
Geological	High
Landscape Habitats	High

It is anticipated that the Local Planning Authority will require the impact of the proposed development on the local landscape to be assessed within a Landscape and Visual Impact Assessment. The baseline assessment and evaluations of the affected landscape will be taken into consideration within this assessment.

6. Conclusions and Next Steps

The proposed development covers an area of approximately 5 acres and will accommodate a solar PV farm of 1.4 MW DC capacity/1.1 MW AC capacity. The development will share the existing grid connection to the operational wind farm maximising the efficiency of the grid connection provided. An assessment of the potential level of constraint that would have been imposed on the solar PV development based on the wind generation for February 2017-February 2018 has been undertaken. This assessment indicated that the solar PV energy generation would have been constrained by only 3%. An additional assessment has been undertaken using synthetic wind data which resulted in an annual wind generation in excess of the P50 prediction by Dulas (2016) and therefore provides a higher level of constraint. This assessment resulted in a PV constraint of 6%. Both of these figures should be used with caution; wind is variable in nature and therefore it is difficult to predict the energy generation pattern for any one year – if all of the wind generation is concentrated in the sunniest periods of the day/year the constraint imposed on the solar PV will be greater than if the all of the wind generation is concentrated in times of darkness. Additionally the PV generation prediction is a prediction based on typical conditions, and the real-life generation will vary, dependent on weather conditions and equipment used. It is recommended that further assessment is undertaken utilising an annual wind profile for the site based on the long-term wind data generated from the Measure/Correlate/Predict analysis carried out by Dulas (2016) using the meteorological data collected from the onsite met mast.

Financial modelling, assuming a 6% constraint on the estimated annual solar energy production, results in an IRR of around 3.5%. In order to improve the financial viability of the project, a higher income rate or lower capital cost than was modelled would need to be achieved. The energy industry is currently in a state of flux and therefore these scenarios are considered possible. Additionally the battery market is growing and there is potential for additional revenues to be achieved through inclusion of a battery in the scheme if costs reduce. This would need to be discussed with Western Power Distribution, as provision for this is not included in the current grid connection offer. Greater restrictions are placed on thermal/storage projects than wind/solar projects and the current grid connection offer for the addition of solar indicates that a battery at this location would not be able to be connected to the grid until upgrade works on the transmission network are complete – currently estimated to be in 2026.

The site is located outside of any environmental or historical designations, although it is located in an area which has an overall rating of high for all Landmap aspect areas. As with many renewable energy developments, visual impact is considered to be the greatest risk to gaining planning consent, and an assessment of the landscape and visual impact of the proposal should be undertaken within the planning application, taking particular regard for the impact on the Gwrhyd Common, Brecon Beacons National Park and Landmap Aspect Areas.

A preliminary ecological appraisal should be undertaken to ensure that the development does not have a negative impact on ecology, and if possible identifies some measures that could be employed to lead to an overall enhancement of the local biodiversity.

The recommended next steps are summarised in figure 17.

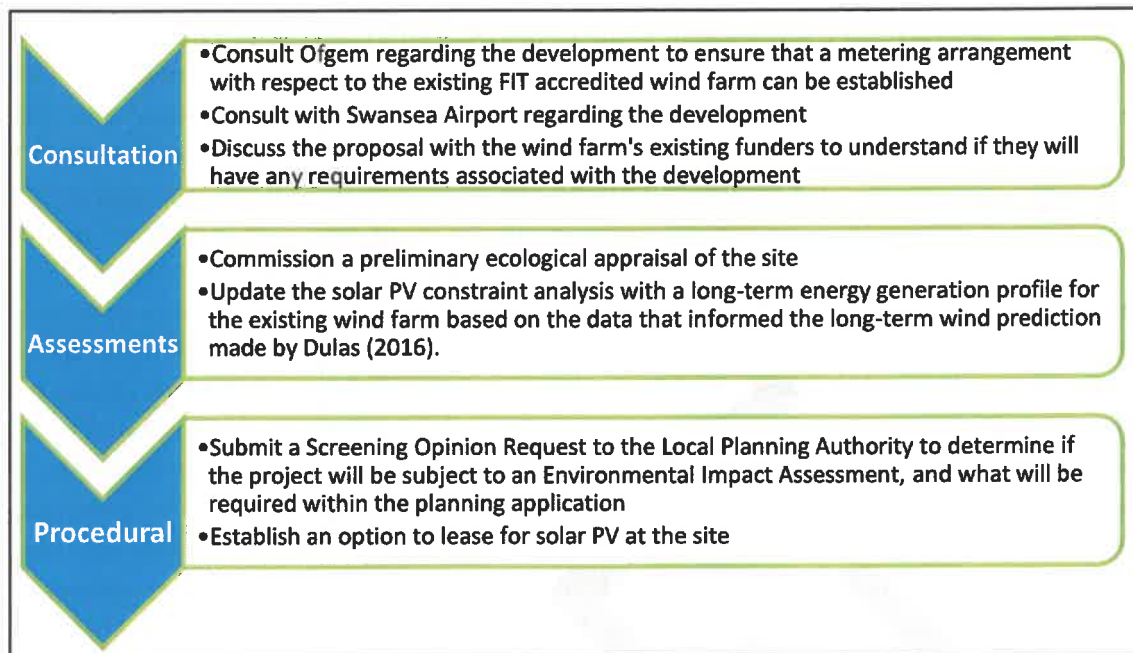


Figure 17: Next Steps to Progress the Project

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Appendix A: Environmental and Historical Constraints and Designations

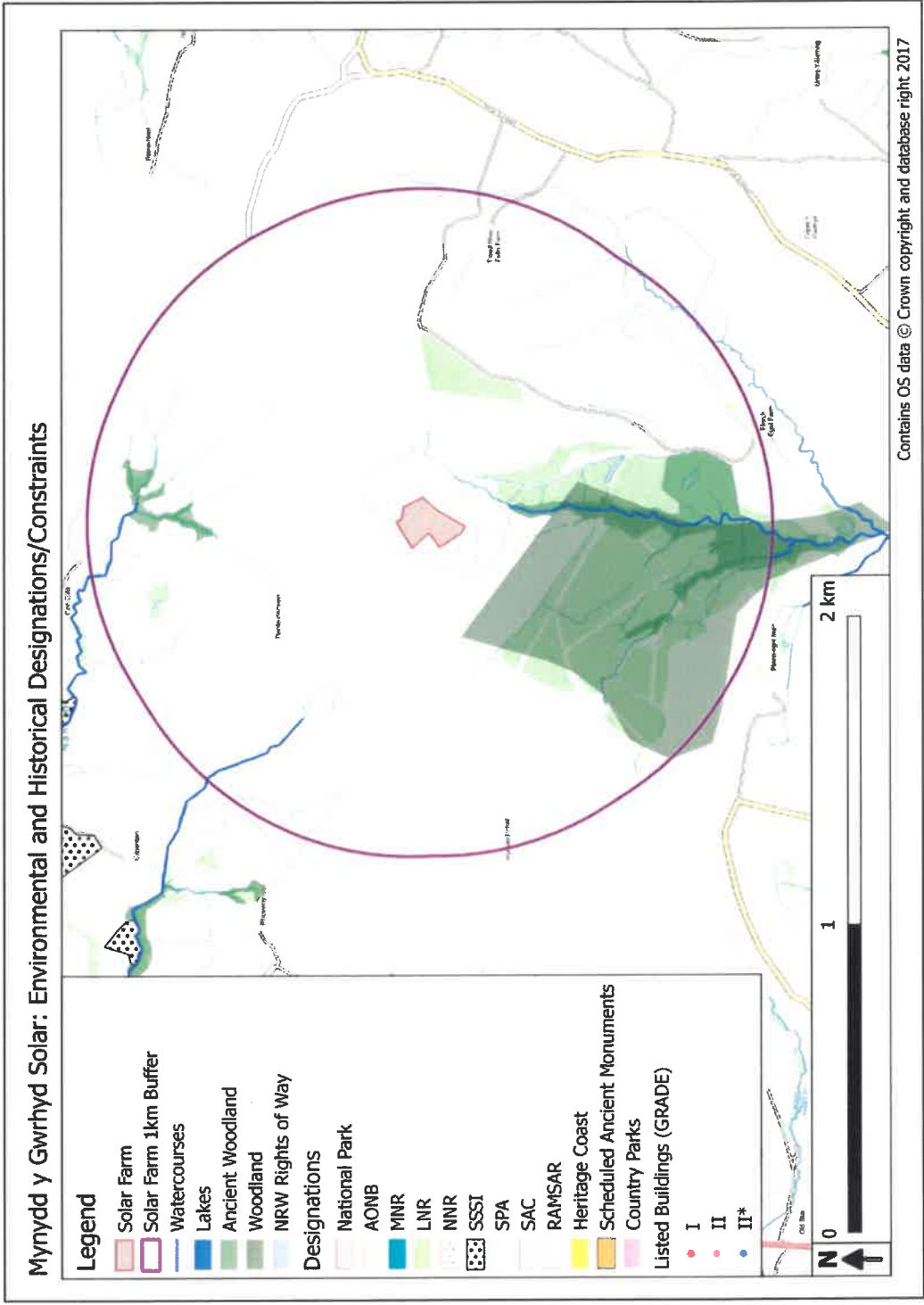


Figure A1: Environmental and Historical Constraints within 1 km



Appendix B: Nearby Developments

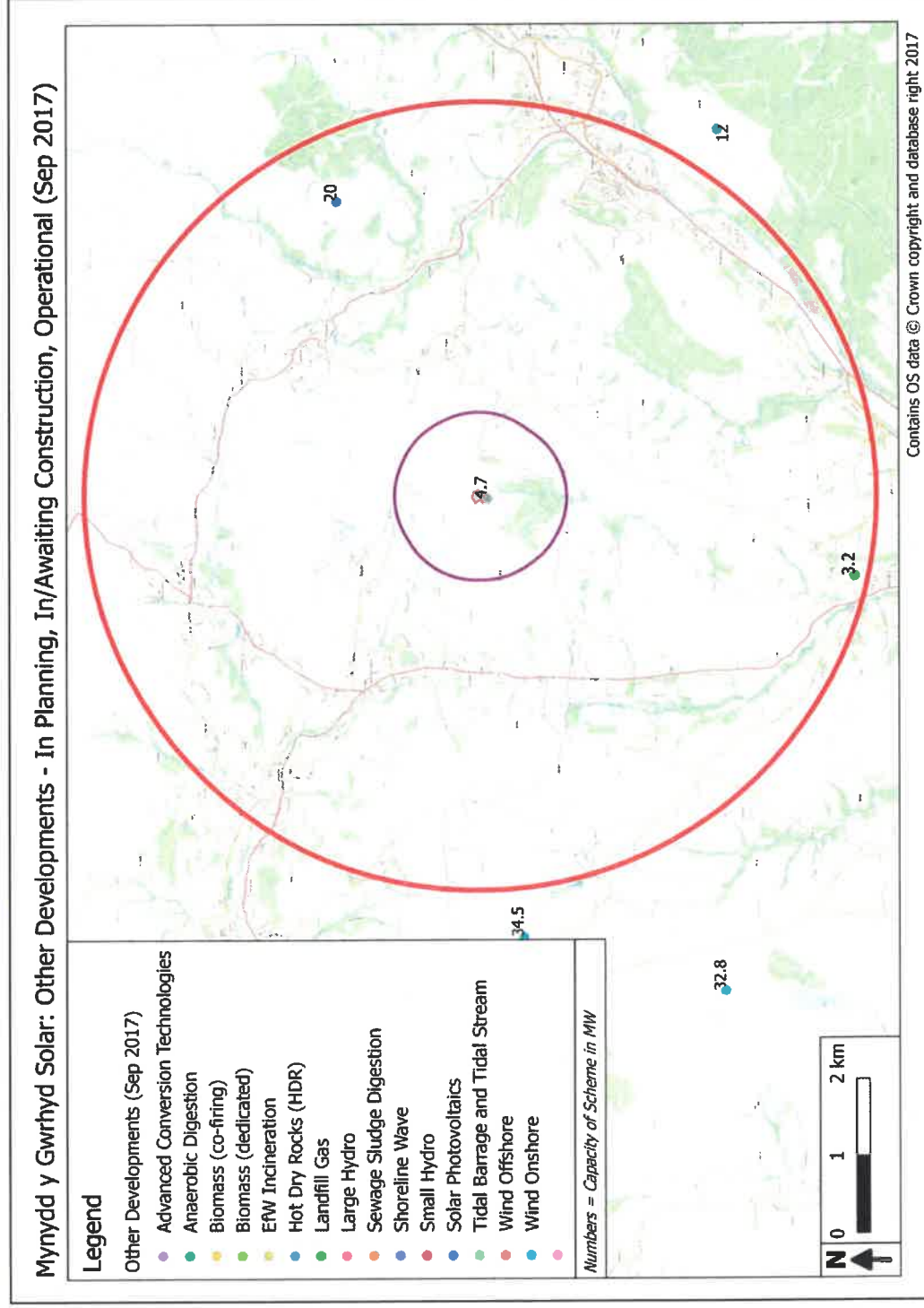


Figure B1: Nearby Renewable Energy Developments (In Planning/Operational/In Construction/Awaiting Construction)



Appendix C: Landmap Overall Classifications

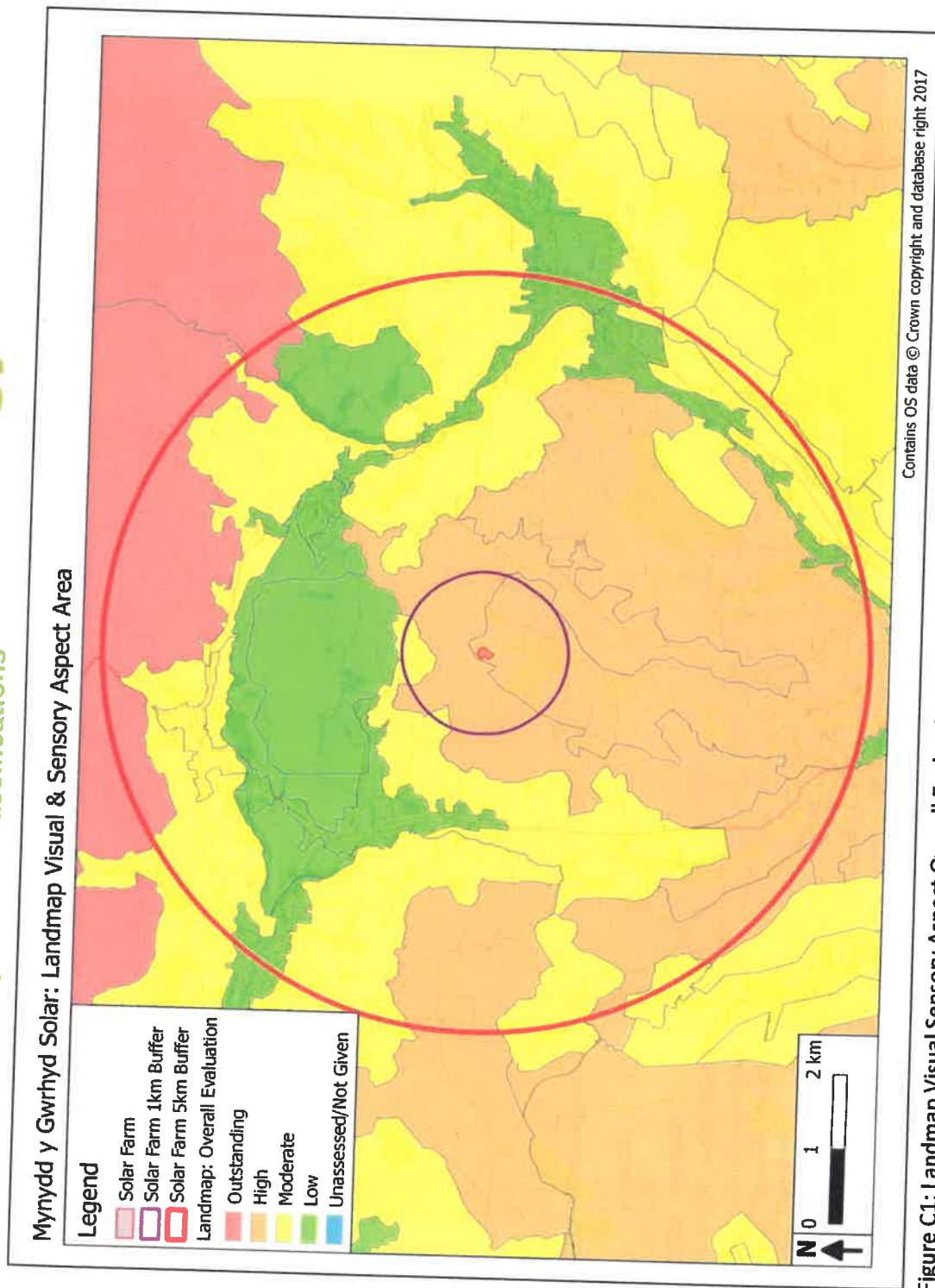


Figure C1: Landmap Visual Sensory Aspect Overall Evaluation

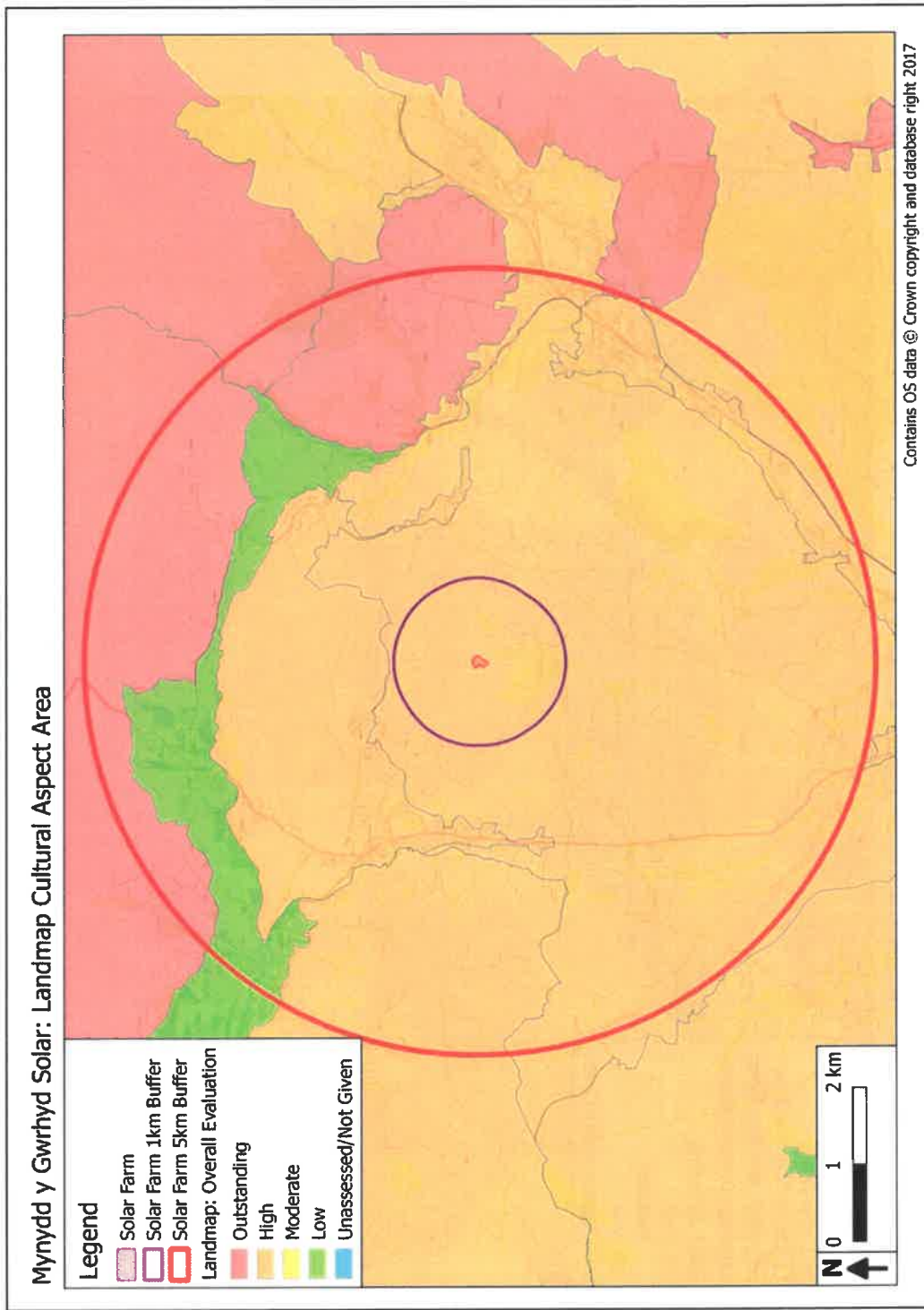


Figure C2: Landmap Cultural Aspect Overall Evaluation

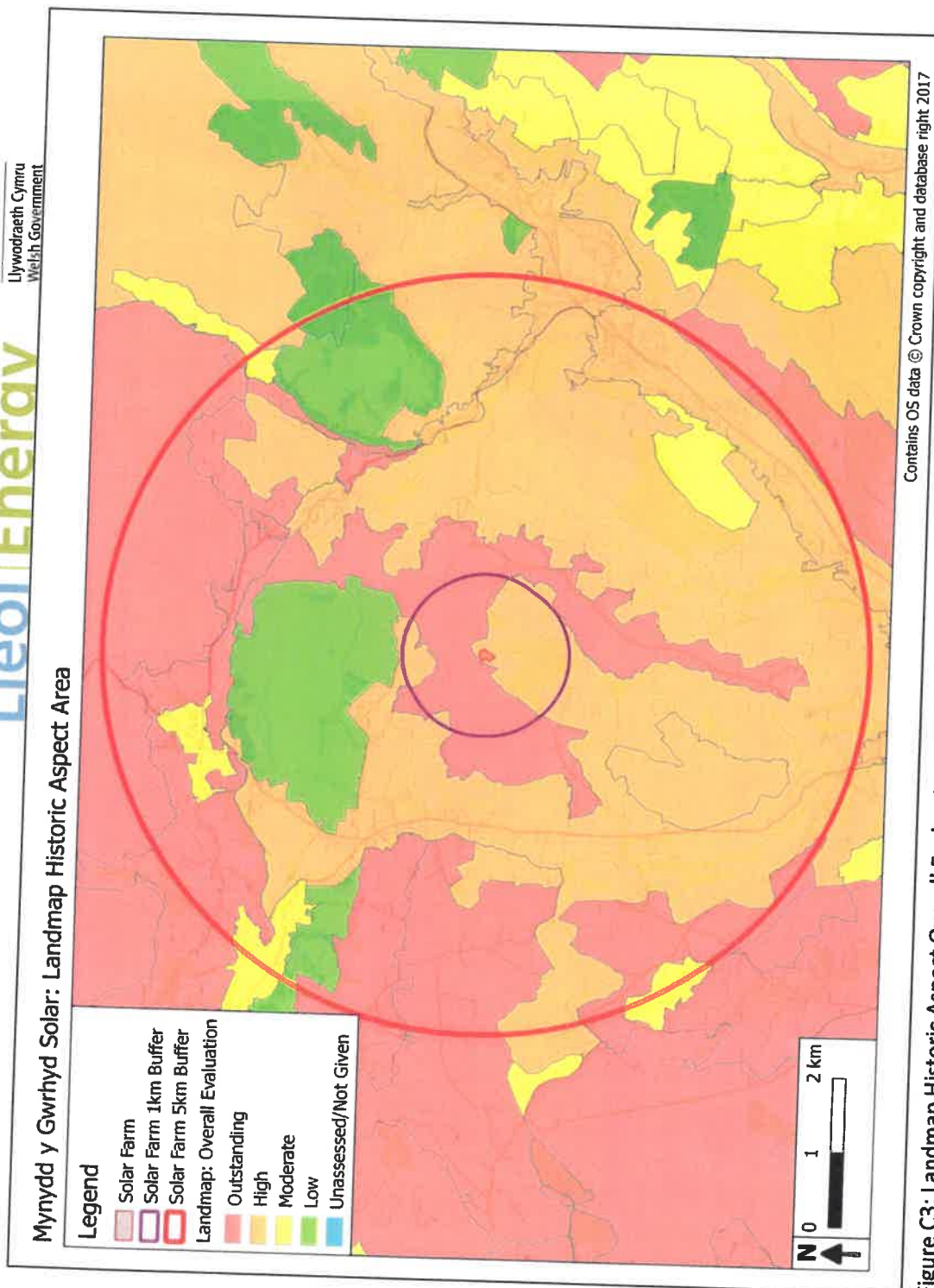


Figure C3: Landmap Historic Aspect Overall Evaluation

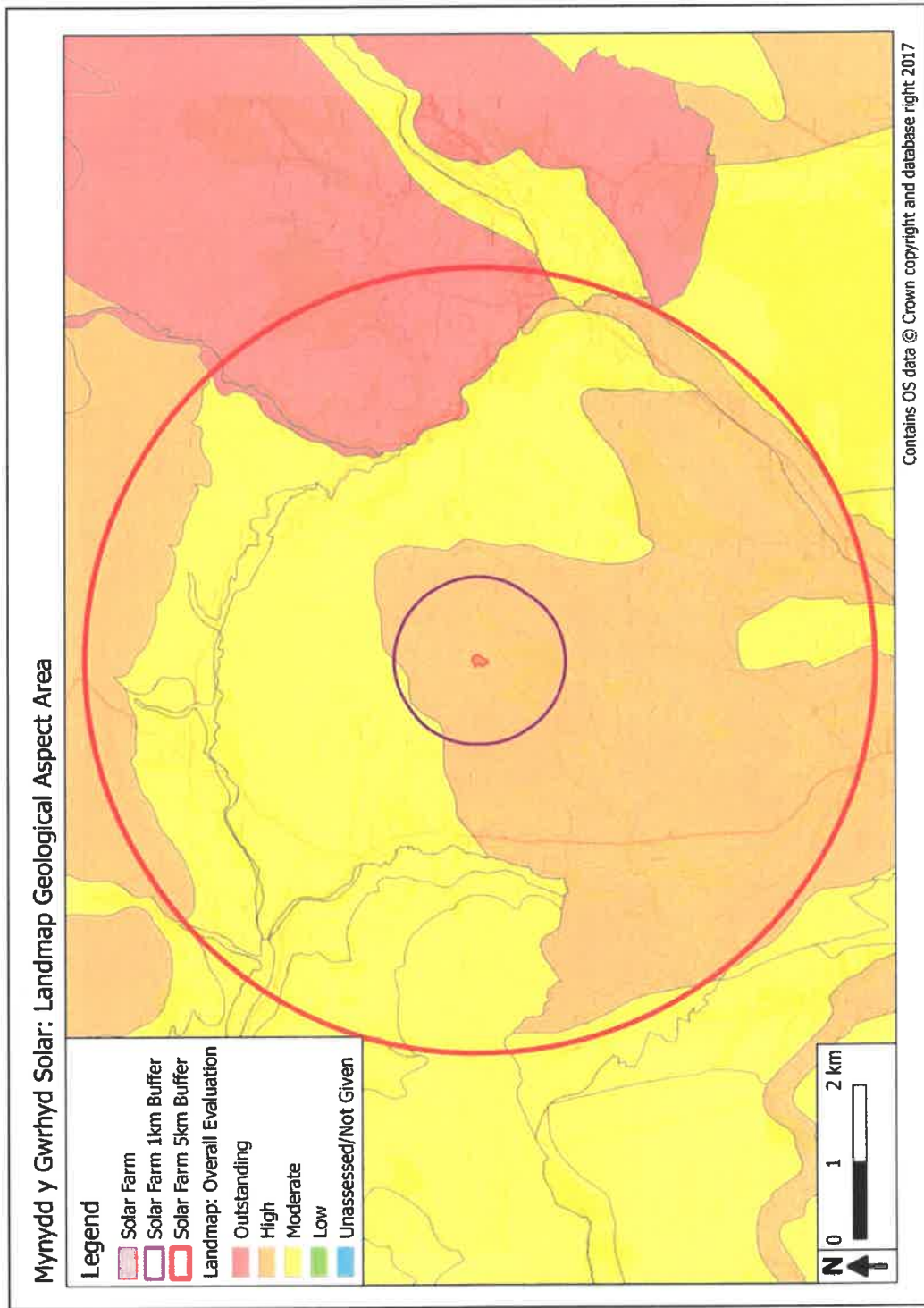


Figure C4: Landmap Geological Aspect Overall Evaluation

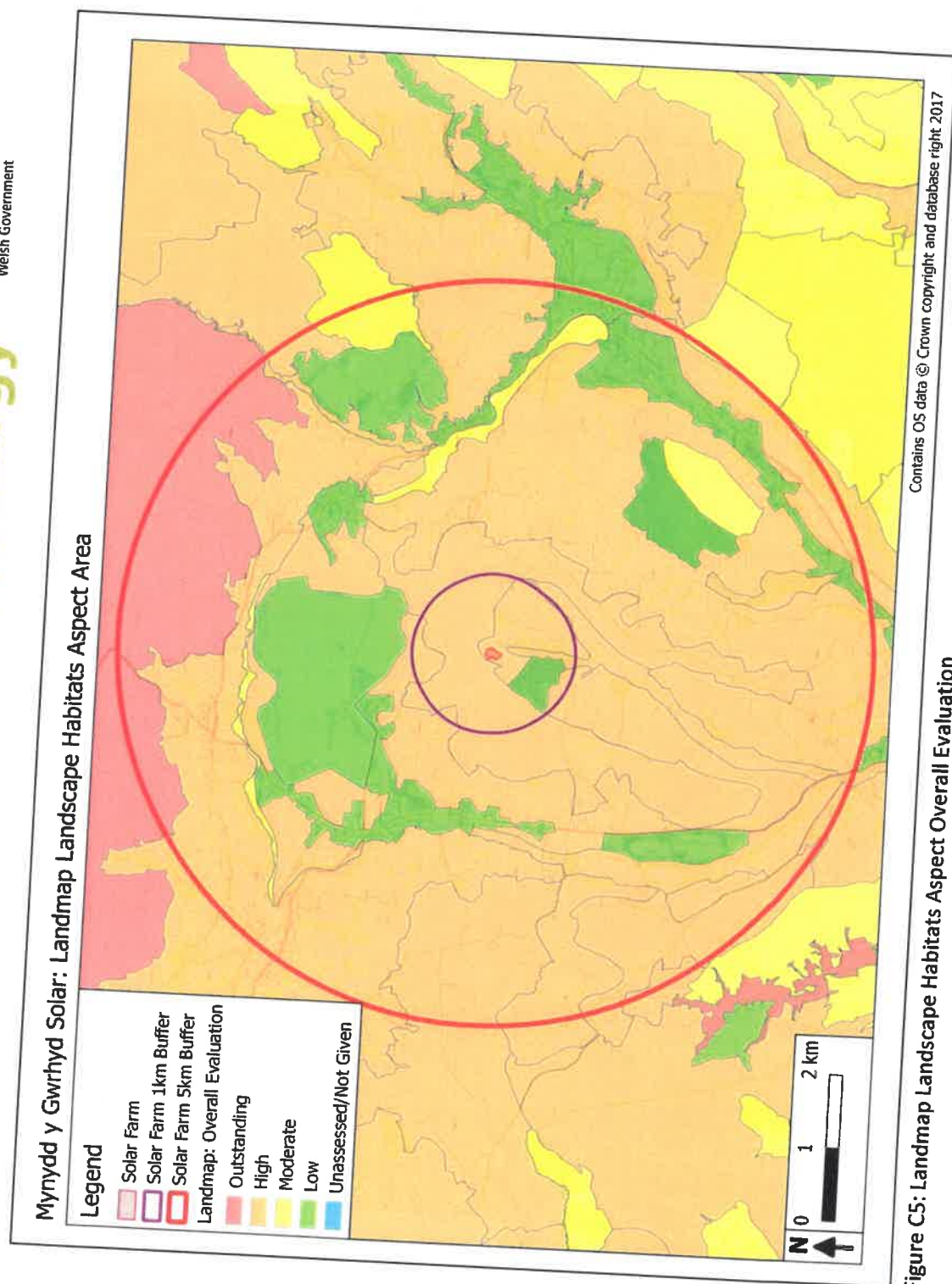


Figure C5: Landmap Landscape Habitats Aspect Overall Evaluation

