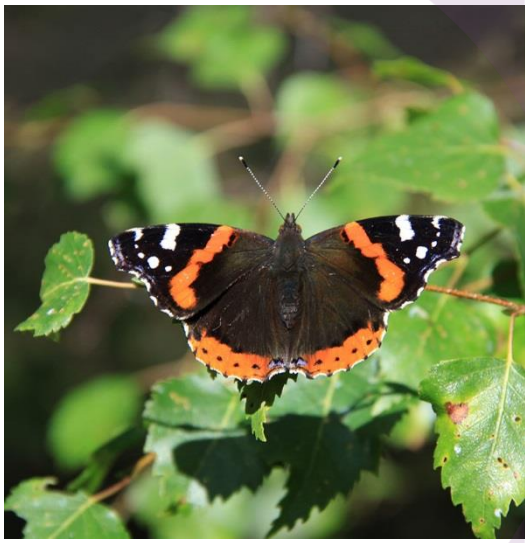
Pennant Walters (FoelT) Limited

Foel Trawsnant Wind Farm Amended Scheme

Environmental Statement

Volume 2: Text





Wood Environment & Infrastructure Solutions UK Limited – January 2019

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1 Introduction

1.1 Overview of the proposed development

In October 2014[1] Pennant Walters (FoelT) Ltd (the applicant) submitted a planning application to Neath Port Talbot County Borough Council (NPTCBC) (application number P2014/0825) for a 13-turbine wind farm on land at Foel Trawsnant. The application included the following documents:

- Environmental Statement and associated technical appendices (24311rr073i1, Amec Environment & Infrastructure Ltd[2], 2014);
- Non-technical Summary (24311rr082i2, Amec Environment & Infrastructure Ltd, 2014);
- Planning Statement (24311rr074i1, Amec Environment & Infrastructure Ltd, 2014);
- Design and Access Statement (24311rr075i1, Amec Environment & Infrastructure Ltd, 2014); and
- Construction Traffic Management Plan (24311rr081i1, Amec Environment & Infrastructure Ltd, 2014).

The application was approved by planning committee on 20 October 2014, subject to the signing of a Section 106 agreement. This s106 agreement has not yet been signed however, and the applicant is now proposing to amend certain elements of the scheme to improve its economic viability, including an increase in height to blade tip from 120m to 145m, and a reduction in the number of turbines from 13 to 11[3].

The amended scheme which this Environmental Statement (ES) considers ('the proposed development') consists of the following elements:

- Up to eleven wind turbines with a maximum height to blade tip of 145m;
- A permanent substation and compound;
- x2 temporary construction compounds;
- Temporary site offices;
- Crane pads and cabling;
- Access track construction; and
- Minor highways works on the B4282 to accommodate a new site access.

It is anticipated that the wind farm would be connected to the grid by overhead line cables. Discussions with the electricity grid network operator indicate that the most likely connection will be at 66kV depending upon the final design chosen by the electricity grid network operator. The connection between the on-site substation and the electricity grid will be the subject of a separate application for consent under section 37 of the Electricity Act 1989.

The site location is shown on **Figure 1.1**.

1 These documents superseded the original submissions made in August 2014
2 Now Wood
3 Turbines 12 and 13 have been removed from the development approved in principle

1.2 The applicant and the project team

This ES has been prepared on behalf of the developer Pennant Walters (FoelT) Ltd by Wood Environment & Infrastructure Solutions (hereafter known as Wood), with the support of the following organisations:

- Sharon Pilkington BSc (Hons) MSc CEnv MCIEEM – Botanist (Botanical Assessment).

Wood is registered with the Institute of Environmental Management and Assessment (IEMA)'s EIA Quality Mark scheme. The scheme allows organisations that lead the co-ordination of EIAs in the UK to make a commitment to excellence in their EIA activities and have this commitment independently reviewed.

A statement outlining the relevant experience and qualifications of the competent experts who have prepared this ES is provided in **Appendix 1A**. A statement from the applicant that confirms that it considers the experts to be competent is included in **Appendix 1B**.

1.3 Purpose of the Environmental Statement

This document forms the ES for the proposed amended wind farm development on land at Foel Trawsnant which lies to the north-west of Maesteg, Bridgend (albeit the site lies entirely within the Neath Port Talbot local authority area). The ES reports on the findings of an EIA which considers the likely significant effects arising from the construction, operation and decommissioning of eleven wind turbines and related infrastructure.

The proposed development requires EIA (i.e. it is 'EIA development') because it falls under paragraph 3(i) ("*Installations for the harnessing of wind power for energy production (wind farms)*" of Schedule 2 of *The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017* ('the EIA Regulations') and exceeds its thresholds for both site area and hub height. On this basis, EIA has been undertaken for the proposed development.

As stated in section 1.1, the EIA relates to amendment to a wind farm scheme already approved by planning committee, subject to the signing of a Section 106 agreement. The EIA, and its reporting in this ES, therefore concentrates on potential significant effects arising from the amendments to the scheme which has already been approved in principle.

A scoping report was prepared to identify the potentially significant environmental effects of the proposed development that needed to be assessed further and to outline the approach to undertaking the assessments of these effects (Amec Foster Wheeler[4], 2018). The report enabled statutory and non-statutory organisations and others with an interest in a proposed development ('stakeholders') to comment on the proposed scope of the assessment.

Drawing on the consultation responses and previous and subsequent assessment work, the ES reports the findings of an assessment of the potentially significant environmental effects of the proposed development. This reflects the requirement of the EIA Regulations for the ES to discuss in any depth only those effects that are likely to be significant. The EIA Regulations do not define significance; the overall approach that has been taken to defining significance, as well as further information about the approach to preparing the ES is outlined in **Chapter 2**.

Regulation 4(2) of the EIA Regulations states that an EIA must:

> *"...identify, describe and assess in an appropriate manner, in light of each individual case, the direct and indirect significant effects of proposed development on the following—*
>
> *(a) population and human health;*

[4] *Ibid*

(b) biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC(1) and Directive 2009/147/EC(2);

(c) land, soil, water, air and climate;

(d) material assets, cultural heritage and the landscape; and

(e) the interaction between the factors listed in sub-paragraphs (a) to (d)."

The EIA Regulations go on to state (Schedule 4, para 8) that the ES should include "*A description of the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of major accidents and/or disasters which are relevant to the project concerned*".

In this ES, these topics are dealt with under the chapters set out in **Table 1.1**. The ES also contains a number of appendices which are referenced throughout the document.

Table 1.1 Environmental topics to be addressed in the ES

Chapter	Topics in the EIA regulations
1. Introduction	N/A
2. Approach to Environmental Impact Assessment	N/A
3. Scoping and Consultation	N/A
4. Wind Farm Site Selection and Design	Land, Material Assets, Major Accidents and Disasters, Human Health, Landscape, Biodiversity
5. Description of the Proposed Development	Land, Material Assets, Major Accidents and Disasters, Human Health, Landscape, Biodiversity, Climate
6. National Policy, Statutory Planning Guidance and the Development Plan Policies	N/A
7. Landscape and Visual	Landscape
8. Historic Environment	Cultural Heritage
9. Non-Avian Ecology	Biodiversity, Major Accidents and Disasters
10. Ornithology	Biodiversity, Major Accidents and Disasters
11. Noise	Human Health
12. Water Resources and Ground Conditions	Water, Land, Soil, Climate, Major Accidents and Disasters
13. Traffic and Transport	Population, Human Health, Material Assets
14. Socio-economics including Recreation and Tourism	Population, Material Assets, Land, Climate
15. Shadow Flicker	Human Health
16. Aviation and Telecommunications*	Material Assets
17. Cumulative Effects	The interaction between the factors listed

* It was suggested in the Scoping report (Table 2.1) that Chapter 16 of the ES would concern Electromagnetic Interference and Telecommunications, and Chapter 17 Aviation. In this ES they have both been addressed within this single chapter.

1.4 Structure of this Environmental Statement

The ES comprises four volumes:

- Volume 1 is a Non-Technical Summary (NTS), which is also available as a standalone document.
- Volume 2 (i.e. this volume) is sub-divided into the following chapters.
  - **Chapter 2** details the approach that has been adopted in preparing the ES.
  - **Chapter 3** provides details on the scoping stage and other consultation undertaken in relation to the proposed development.
  - **Chapter 4** explains the site selection process undertaken for the Foel Trawsnant Wind Farm amended scheme; explains the need for the proposed development; outlines the main alternatives considered and indicates the main reasons for the choice of the preferred alternative.
  - **Chapter 5** provides a detailed description of the Foel Trawsnant Wind Farm amended scheme.
  - **Chapter 6** provides an overview of the legislation and policies that are relevant to the ES.
  - **Chapters 7 to 16** set out the technical assessments for the environmental topics that need to be considered in the ES.
  - **Chapter 17** then deals with the cumulative effects of this and other developments.
- Volume 3 contains the appendices referred to in the ES.
- Volume 4 contains the figures referred to in the aforementioned volumes.

1.5 Other documents

A number of other documents have been prepared, the contents of at least some of which are of direct relevance to the findings of the ES. These reports are listed below:

- Construction Traffic Management Plan (40217rr062i1).
- Planning Statement (40217rr064i1).
- Design and Access Statement (40217rr065i1).

1.6 References

Amec Foster Wheeler. Foel Trawsnant Wind Farm – Amendments to the Approved Scheme. Scoping Report. 40217i2. 2018.

Welsh Government. The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017.

2 Approach to Environmental Impact Assessment

2.1 The Environmental Impact Assessment (EIA) process

The preparation of the ES is one of the key stages in the EIA process, as it brings together information about any likely significant environmental effects, which Neath Port Talbot County Borough Council (NPTCBC), as the competent authority responsible for determining the planning application, will use to inform its decision about whether or not to grant outline permission for the proposed development.

2.2 EIA terminology

Impacts and effects

In some ESs, the terms 'impacts' and 'effects' are used interchangeably, whilst in others the terms are given different meanings. Some use 'impact' to mean the cause of an 'effect' whilst others use the converse meaning. This variety of definitions has led to a great deal of confusion over the terms, both among the authors and the readers of ESs.

The convention used in this ES is to use 'impacts' only within the context of the term EIA, which describes the process from scoping through ES preparation to subsequent monitoring and other work. Otherwise, this document uses the word 'effects' when describing the environmental consequences of the proposed development. Such effects come about as a result of:

- Physical activities that would take place if the proposed development were to proceed (e.g. vehicle movements during construction operations).
- Environmental changes that are predicted to occur as a result of these activities (e.g. loss of vegetation prior to the start of construction work or an increase in noise levels). In some cases one change causes another change, which in turn results in an environmental effect.

The environmental effects that are predicted to result are the consequences of the environmental changes for specific environmental receptors (e.g. for bats from the loss of roosting sites or foraging areas, or for people from an increase in noise levels, etc.).

This ES is concerned with assessing the environmental effects of the proposed development, rather than the activities or changes that cause them. However, this requires these activities to be understood and the likely resultant changes identified, often based on predictive assessment work.

Spatial and temporal scope

Spatial scope is the area over which changes to the environment are predicted to occur as a consequence of the proposed development. In practice, an EIA should focus on those areas where these effects are likely to be significant.

In this ES, the spatial scope varies between environmental topics and is therefore described in each of the topic chapters. For example, the spatial effects of a development on landscape and visual amenity will likely cover a much greater area to that affected by noise.

The temporal scope of likely significant effects is typically described as either:

- Temporary - temporary effects are typically related to a particular activity and will cease when that activity finishes. These activities can nevertheless be either 'short-term' or 'long-term; and

- Permanent - these are effects that will remain once the proposed development is completed and will not change.

2.3 EIA scoping

Scoping involves identifying the following:

- The people and environmental resources (collectively known as 'receptors') that could be significantly affected by the proposed development; and
- The work required to take forward the assessment of these potentially significant effects.

Our approach involves scoping being started at the outset of our work on the EIA, with the initial conclusions about the potentially significant effects of the development being set out in a scoping report. The preparation of the scoping report is informed by information about the legislative and policy context to the scheme. It is also informed by the simple rule that, to be significant, an effect must be of sufficient importance that it should influence the process of decision-making about whether or not consent should be granted for the proposed development or an element of it. In this ES, this is referred to as the 'significance test'.

At the scoping report stage, the conclusion that is made using the significance test, is based upon professional judgement, with reference to the project description, and available information about:

- The magnitude and other characteristics of the potential changes that are expected to be caused by the proposed development;
- The sensitivity of receptors to these changes;
- The effects of these changes on relevant receptors; and (where relevant); and
- The value of receptors.

If the information that is available at the scoping report stage does not enable a robust conclusion to be reached that a potential effect is not likely to be significant, the effect is then taken forward for further assessment.

Further details on the scoping stage for the proposed Foel Trawsnant Wind Farm amended scheme are provided in **Chapter 3**.

2.4 Overview of assessment methodology

Introduction

All of the topic assessments presented in the ES have been undertaken on the basis of a common understanding of the nature of the proposed development, as described in **Chapter 5**.

For each topic, the detailed assessment of likely significant effects has been undertaken by competent experts with relevant specialist skills, drawing on their experience of working on other development projects, good practice in EIA and on relevant published information. For some topics, use has been made of modelling or other methodologies, as appropriate.

With a few exceptions, each topic chapter follows a common format:

1. Introduction;
2. Limitations of this assessment;
3. Policy and legislative context;
4. Data gathering methodology;
5. Overall baseline (where appropriate, further detail is set out under the assessment of effects);
6. Scope of the assessment;
7. Environmental measures embedded into the proposed development;
8. Assessment methodology;
9. Assessment of effects - where appropriate, dealing separately with each receptor or category of receptors that could be significantly affected - the assessment is made against the predicted future baseline and, in so doing, incorporates consideration of any cumulative effects;
10. Cumulative effects;
11. Consideration of additional mitigation or compensation;
12. Conclusions of significance evaluation;
13. Implementation of environmental measures; and
14. References.

2.5 Identification of baseline conditions

As the various elements of the Foel Trawsnant Wind Farm amended scheme would be built over a period of approximately 12-24 months (depending on weather conditions) and then operated for a period of up to 25 years it cannot be assumed that the baseline conditions in the absence of the project, would be the same as the current baseline. It is assumed that construction would start in spring/summer 2020 and therefore a completion date of 2022 has been used for the assessment.

To determine the baseline conditions that should be used for the assessment of the likely significant effects of the proposed development, it is necessary to define the current baseline conditions and then to decide whether these conditions are likely to change by the 'assessment years' that are selected for the construction and operation of the proposed development. If this future baseline is more likely to occur than the current baseline, the future baseline is used for the assessment of likely significant effects. However, in many cases it will be concluded that the current baseline is just as likely, or even more likely, to occur in the assessment years than would be the case with any future baseline conditions. In this case, the current baseline is used for the assessment.

The current baseline is determined for the *'study area'* for each environmental topic by a combination of desk-based research, including consultation with the relevant statutory and non-statutory authorities, together with field survey work (where required).

In its simplest form, the study area is likely to comprise the site of the proposed development. However, for many developments, the study area is also likely to include land outside the site, especially where the effects of the proposed development are likely to extend beyond such geographical limits to reflect *'zones of influence'* (ZoIs), where the proposed development could affect off-site areas.

Details of the relevant ZoIs are discussed in the baseline section of each environmental topic chapter. These chapters also explain the basis for defining the future baseline conditions, where this is appropriate. This is based on the following:

- Information gathered about the existing environmental conditions.
- Changes that can be predicted based on reasonable assumptions and modelling calculations, e.g. the application of traffic growth factors based on relevant guidance.
- Information relating to other likely and predictable changes, e.g. climate change, which could affect current prevailing environmental conditions.
- Information about other relevant developments, including the nature of the development proposals, their likely timing and their location relative to the proposed development.

2.6 Overview of approach to significance evaluation methodology

Introduction

One of the requirements of an ES is to set out the conclusions that have been reached about the likely significant environmental effects resulting from the proposed development. Reaching a conclusion about which effects, if any, are likely to be significant is the culmination of an iterative process that involves the following stages:

- Identifying those effects that could be likely to be significant.
- Assessing the effects of the proposed development against the baseline (current or future, as appropriate).
- Concluding whether or not these resultant effects are likely to be significant.

Chapters 7 to 16 describe the approaches that have been used in relation to the stages outlined in the bullet points above, for each of the environmental topics that are considered in this ES.

Identification of potential significant effects

To inform the identification of potentially significant effects, all of those involved in the preparation of the ES were supplied, at an early stage of the assessment process, with information about the proposals for constructing and operating the Foel Trawsnant Wind Farm amended scheme. The effects to be considered concentrate on those arising from the changes to the original scheme assessed in the 2014 ES.

The identification of receptors that need to be considered draws on available information about environmental changes, which in some cases can be translated into zones of influence outside of which the changes are predicted to be sufficiently small that receptors are not likely to be significantly affected. In addition, for some environmental topics (e.g. Non-avian Ecology, Ornithology and Historic Environment), a valuation is undertaken to define those receptors that are of sufficient value that they could be significantly affected. Only those receptors that are of sufficient value and that are located within the defined zones of influence where effects could be significant, are taken forward for further assessment.

The technical assessments, undertaken in **Chapters 7 to 16** of this ES, describe how environmental changes and resulting effects for different environmental topics are assessed, together with the topic specific approaches that have been used to identify the receptors that could be significantly affected by the proposed development.

Types of effects

Paragraph 5 of Schedule 4 of the EIA Regulations states that "*The description of the likely significant effects on the factors specified in regulation 4(2) should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development*." Where appropriate, this ES considers all these types of effects where they are relevant to different environmental topic chapters, with the exception of cumulative effects, which are dealt with separately in Section 2.7.

Direct effects

Direct effects are those that result directly from a Proposed Development. For example, where a machine disturbs an area of habitat; the associated physical activity could result in a change to the receptor.

Indirect and secondary effects

Indirect and secondary effects are those that result from consequential change caused by the development. As such they would normally occur later in time or at locations farther away than direct effects. An example would be where water or gas pipes are damaged as a result of the development, and the consequences of that damage is fire or flood risk to other receptors.

Transboundary effects

Transboundary effects are those that would affect the environment in another state within the European Economic Area (EEA).

Temporal effects

As discussed in Section 4.3, temporal effects are typically defined as being permanent or temporary as follows:

- Permanent - these are effects that will remain even when the Proposed Development is complete, although these effects may be caused by environmental changes that are permanent or temporary. For example, an excavator that is temporarily driven over an area of valuable habitat could cause so much damage that the effect on this vegetation would be permanent.
- Temporary – these are effects that are related to environmental changes associated with a particular activity and that will cease when that activity finishes.

Significance evaluation

Overview

The receptors that could be significantly affected are identified within each topic chapter. The approach that is adopted to determine whether the effects on these receptors are significant is to apply a combination of professional judgement and a topic-specific significance evaluation methodology that draws on the results of the assessment work that has been carried out.

In applying this approach to significance evaluation, it is necessary to ensure that there is consistency between each environmental topic in the level at which effects are considered to be significant. Thus it is inappropriate for the assessment of one topic to conclude that minor effects are significant, when, for another topic, only comparatively major effects are significant.

In order to achieve the desired level of consistency, the specialist responsible for writing each of the technical chapters has been guided in their decision-making about likely significance by the 'significance test' that

informed the preparation of the scoping report (see section 2.3 above), as well as the relevant topic-specific significance evaluation methodology.

The conclusion about significance is arrived at using professional judgement, with reference to the project description, and available information about the magnitude and other characteristics of the potential changes that are expected to be caused by the proposed development, receptors' sensitivity to these changes and the effects of these changes on relevant receptors.

In some cases, use of the 'significance test' alone will enable a conclusion to be reached in the 'Scope of the assessment' section of the topic chapter, without the need for more detailed assessment, that a potential effect is not likely to be significant. However, in other cases, effects identified in the 'Scope of the assessment' section are taken forward for further assessment in the subsequent section(s) of each topic chapter.

For some of these effects, relatively little assessment work may be required to reach a conclusion that an effect is not likely to be significant. But, in other cases, more extensive assessment work is required. Sometimes the application of the 'significance test' is sufficient to support this conclusion but, in other cases, the relevant topic-specific significance evaluation methodology is used to inform the evaluation of significance (to determine whether an effect is or is not significant).

Having applied the relevant topic-specific significance evaluation methodology, the topic specialists check the conclusions against the significance test. If this test results in a different conclusion to that reached through the use of the significance evaluation methodology, a detailed justification is provided as to why this different conclusion is valid.

For some of the topics that are assessed in the ES, there is published guidance available about significance evaluation. Where such guidance exists, even if in draft, it has been used to inform the development of the significance evaluation methodologies that are used in this ES. For other topics, it has been necessary to develop methodologies without the benefit of guidance. This has involved technical specialists drawing on their previous experience of significance evaluation in EIA.

Evaluation matrices

Significance evaluation involves combining information about the sensitivity or value of a receptor, and the magnitude and other characteristics of the changes that affect the receptor. The approach to using this information for significance evaluation is outlined below.

Receptor sensitivity, importance, or value

The sensitivity or value of a receptor is largely a product of the importance of an asset, as informed by legislation and policy, and as qualified by professional judgement. For example, receptors for landscape, biodiversity or the historic environment may be defined as being of international or national importance. Lower value resources may be designated as being sensitive or important at a county or district level. For each environmental topic, it is necessary to provide a detailed rationale that explains the categories of value/sensitivity have been used and how these have been defined.

The use of a receptor would also play a part in its classification. For example, when considering effects on the amenity of a human population, a receptor used for recreational purposes may be valued more than a place of work as the environmental quality of the recreational receptor is more likely to be an important part of that receptor's use.

Magnitude of change

The magnitude of change affecting a receptor that would result from the development proposals would be identified on a scale from minor alterations or change, up to major changes or the total or substantial loss of the receptor. As with receptor sensitivity and value, a detailed rationale should be provided that explains how

the categories of environmental change are defined. For certain topics, the magnitude of change would be related to guidance on levels of acceptability (e.g. for air quality or noise), and be based on numerical parameters, whilst for others it will be a matter of professional judgement to determine the magnitude of change, using descriptive terminology.

Determination of significance

The determination of significance is derived with reference to information about the nature of the development, the receptors that could be significantly affected and their sensitivity or value, together with the magnitudes of change that are likely to occur.

Other than for environmental topics for which significance evaluation does not involve the use of matrices, sensitivity/value and the characteristics of environmental changes can be combined using a matrix. In addition, professional judgement is applied because, for certain environmental topics, the lines between the sensitivities or magnitudes of change may not be clearly defined and the resulting assessment conclusions may need clarifying.

Variations to this approach, which may be applicable to specific environmental topics, will be detailed in the relevant 'Significance evaluation methodology' sub-section contained in each environmental topic chapter.

Definitions of how the categories that are used in the matrix are derived for each topic are also set out in each environmental topic chapter, along with the relevant explanation and descriptions of receptor sensitivity, magnitude of change and levels of effect that are considered significant in terms of the EIA Regulations.

2.7 Cumulative effects

Introduction

Paragraph 5 of Schedule 4 of the EIA Regulations states that the "*The description of the likely significant effects on the factors specified in regulation 4(2) should cover the direct effects and any indirect, secondary,* ***cumulative***[5]*, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development.*"

Two types of cumulative effects assessment (CEA) are used in this ES, as set out below.

Inter-project effects

For each environmental topic that is dealt with in this ES, an assessment is undertaken of how the environmental effects resulting from the proposed development could combine with similar topic-related effects generated by other developments that affect a common receptor. To do this, it is important to first identify, which other developments are relevant for cumulative environmental topic assessments.

The starting point for this is to determine the Zone of Influence (ZoI) from the proposed development for each receptor that could be likely to be significantly affected under each environmental topic. In this context, although specifically intended for Nationally Significant Infrastructure Project (NSIPs), PINS Advice Note Seventeen (December 2015) provides an appropriate basis for undertaking such assessments, and is particularly helpful in identifying the other developments that should be considered in the CEA.

This involves first acknowledging that the availability of information necessary to conduct a CEA will partly depend on the current status of the relevant other developments, and develops this concept further by grouping the other developments into tiers, which reflect the likely degree of certainty attached to each

[5] Boldened for emphasis

development, with Tier 1 being the most certain and Tier 3 the least certain. This is illustrated in **Table 2.1**, which is a slightly modified version of Table 3 in the advice note to reflect that it is being applied to a *Town and Country Planning Act 1990* application.

Table 2.1 Other developments to be considered in the CEA

Hierarchy of other developments	Certainty of other developments
Tier 1	Under construction*.
	Permitted application(s), whether under the *Planning Act 2008* or other regimes, but not yet implemented.
	Submitted application(s), whether under the *Planning Act 2008* or other regimes, but not yet determined.
Tier 2	Projects on the Planning Inspectorate's Programme of Projects, and/or where a planning application has been received by a relevant local planning authority, and where a scoping report has been submitted.
Tier 3	Projects on the Planning Inspectorate's Programme of Projects, and/or the subject of pre-application discussion with a relevant LPA, where a scoping report has not been submitted.
	Identified in the relevant Development Plan (and emerging Development Plans - with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited.
	Identified in other plans and programmes (as appropriate) which set the framework for future development consents/approvals, where such development is reasonably likely to come forward.



Decreasing level of detail likely to be available

* Where other projects are expected to be completed before construction of the proposed development and the effects of those projects are fully determined, effects arising from them will be considered as part of the baseline and be considered as part of the assessment of both the construction and operational phases. This ES will therefore should clearly distinguish between projects forming part of the baseline and those in the CEA.

In the context of the proposed development that is the subject of this ES, the level of information required to undertake a CEA is available only for Tier 1 developments. Therefore such developments, where they are located within the ZoI for a given environmental topic, have been subject to CEA. These other developments are discussed, as appropriate, in the sub-section of each environmental topic chapter that deals with the assessment of cumulative effects.

The following assumptions have been made in the assessment of cumulative effects:

- The assessment has been completed based on information relating to the assessed developments which is available within the public domain;
- The assessment has not considered unplanned events; and
- Environmental measures required to minimise or avoid likely significant adverse environmental effects arising from other developments will be/have been adopted as part of the implementation of these schemes.

Inter-related effects

The second type of CEA involves assessing whether any of the individual environmental topic effects resulting from the proposed development, which are not significant in their own right, could combine to create effects that are significant.

The first step is to identify the environmental topics that have common receptors, and then to consider whether the topic effects on any common receptors are likely to combine. The most likely types of receptors that could fall into this category are those pertaining to the amenity of the relevant human population. For example the occupants of a residential property in close proximity to the proposed development might be subject to adverse effects in terms of noise, vibration, air quality, traffic, as well as with regard to visual amenity, or any combination thereof, each of which, when assessed individually, is not significant in EIA terms, but when assessed cumulatively, effects are judged to be significant.

Because this combined assessment involves different environmental topic assessments that cannot robustly be combined, the outcome of this CEA will be reliant on the application of professional judgement from, potentially, several different technical specialists. Further details on the specific approach to the proposed development are given **Chapter 17**.

2.8 Embedded environmental measures

The EIA Regulations require an assessment to be undertaken of 'the development' - not of the development with and without mitigation; such a division typically results in ESs that are longer than need be, rather than proportionate, as advocated by the Institute of Environmental Management and Assessment (IEMA). To meet this requirement, the proposed development is presented as a single entity. This means that the proposed development includes the 'environmental measures' that have been identified for adoption during the scheme design process "*...to avoid, prevent, reduce or offset any identified significant adverse effects on the environment*" (see Schedule 4(7)). The development should also incorporate, where possible, relevant good practice and enhancement measures.

The term 'environmental measures' rather than 'mitigation' is used to differentiate between the measures that are incorporated or 'embedded' into the development proposals, and those that are often associated with additional measures, which are effectively over and above what constitutes the scheme. Consequently, our approach to preparing an ES is to undertake a single assessment embedding into the scheme all the environmental measures to which the developer has signed up.

Section 5.4 of this ES provides details on the environmental measures to be embedded within the proposed development and the means by which they will be implemented.

2.9 Stages of development

Potential environmental effects have been considered in relation to the following stages of development:

- **Construction**: This covers the effects arising from the delivery of materials, the construction of foundations, tracks and crane pads. The installation of electrical and other associated infrastructure.
- **Operation**: Includes for the consideration of land use change and operation of the scheme; this covers the effects which would be associated with land use change (e.g. loss of agricultural land), new infrastructure (e.g. wind turbines on the site) and the operation of the scheme (i.e. when construction work is complete and the wind farm is operational).
- **De-commissioning**: The end of the operational life, the removal of the turbines to ground level.

2.10 References

The Planning Inspectorate. Advice Note Seventeen: Cumulative effects assessment relevant to Nationally Significant Infrastructure Projects. 2015.

Welsh Government. The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017.

3 Scoping and consultation

3.1 EIA scoping

Scoping involves identifying the following:

- The people and environmental resources (collectively known as 'receptors') that could be significantly affected by the proposed development.
- The work required to take forward the assessment of these potential likely significant effects.

Our approach involves scoping being started at the outset of our work on the EIA, with the initial conclusions about the potential likely significant effects of the development being set out in a scoping report. The preparation of the scoping report is informed by information about the legislative and policy context to the scheme. It is also informed by the simple rule that, to be significant, an effect must be of sufficient importance that it should influence the process of decision-making about whether or not consent should be granted for the proposed development or an element of it.

At the scoping report stage, the conclusion that is made is based upon professional judgement, with reference to the project description, and available information about:

- The magnitude and other characteristics of the potential changes that are expected to be caused by the proposed development;
- The sensitivity, value or importance of receptors to these changes; and
- The effects of these changes on relevant receptors.

If the information that is available at the scoping report stage does not enable a robust conclusion to be reached that a potential effect is not likely to be significant, the effect is then taken forward for further assessment.

The scoping report for the amended Foel Trawsnant Wind Farm scheme was submitted by Amec Foster Wheeler[6] for comment to the competent determining authority and others on 16 February 2018 (doc ref 40217i2). The scoping report was also informed by the ES submitted in 2014 as part of the documentation for the original Foel Trawsnant Wind Farm planning application (Amec[7], 2014).

A scoping opinion from NPTCBC was received on 27 March 2018 (doc ref DN P2018/0153; **Appendix 3A**). The EIA Regulations require that an ES in 'based on' the most recent scoping opinion issued. A response to NPTCBC's scoping opinion was therefore submitted on 20 April 2018 (reference 40217P033; **Appendix 3B**) which set out areas of agreement with the scoping opinion, and providing further information where this was sought by consultees.

The environmental topic chapters (**7-16**) detail the final scope of the assessment in relation to effects that it was assessed could be significant and therefore needed to be subject to more detailed assessment. In some cases, effects that would normally be scoped-out (because they are not likely to be significant) have been scoped-in on the basis that readers of the ES may, in the absence of an explanation being provided, may feel that the ES is deficient. All other effects (i.e. that are not referred to in the technical chapters) are not likely to be significant.

[6] Now Wood
[7] *Ibid*

3.2 Consultation

In addition to comments on the scoping report, some consultees were contacted directly regarding the technical assessment work. Further information about this additional consultation is provided in the technical chapters (**Chapters 7-16**) where relevant.

Two public exhibitions were held at the Nantyffyllon Miners Institute and the Afan Lodge in Cynonville on 10 and 11 September 2013 respectively for the original submission. A further exhibition was also held at Bryn Community Centre on 11 December 2013. Results from the consultation exercises were used to inform the final design in 2014. No further public exhibitions are proposed for the amended scheme at this stage.

3.3 References

Amec Foster Wheeler. Foel Trawsnant Wind Farm – Amendments to the Approved Scheme. Scoping Report. 40217i2. 2018.

Neath Port Talbot County Borough Council. Scoping Opinion. Reference DN P2018/0153. 2018.

Wood. Foel Trawsnant Wind Farm. The Town and Country Planning (Environmental Impact Assessment) Regulations 2017. Response to Scoping Opinion P2018-0153. 2018.

4 Wind farm site selection and design

4.1 Introduction

The approach to site selection is governed by a number of considerations that relate to the availability and reliability of an appropriate wind speed; an interest from landowners and a thorough review of environmental constraints and opportunities.

4.2 The selection process

In 2005 Pennant Walters undertook a regional site finding exercise to identify areas within the greatest potential for wind energy development in South Wales. This exercise was repeated in 2008. South Wales was chosen because it has some of the highest wind speeds within Europe and within the UK. Furthermore South Wales also benefits from an existing, comprehensive electricity distribution network, particularly in the former coal mining valleys, something which is absent from large parts of the more remote areas of Wales. Pennant Walters' existing presence within South Wales was also a determining factor in this selection process.

The site identification process included a high-level sieving exercise to identify broad areas of interest and then a more detailed review to identify specific potential sites within those areas. This was followed by a land ownership investigation. The sieving exercise took wind speed as its starting point and excluded any areas where the ETSU NOABL database did not have a mean annual average wind speed above 7 metres per second (considered by Pennant Walters at that time to be the minimum required for a commercially viable scheme).

There are several areas of South Wales with an average wind speed well above 7m/s. Those areas with wind speeds above 7m/s within the Brecon Beacons National Park, and any other national landscape designations were excluded from the search exercise. Two areas with exceptional wind resource include an area on the Neath Port Talbot/Bridgend County Boundary centred around Foel Trawsnant.

Discussion with the land agents of relative land holders in this region indicated that land at Foel Trawsnant was available to wind farm developers.

The original process of choosing possible sites also included a review of technical factors and a high-level assessment of the landscape impact of each development. The factors Pennant Walters considered in selecting the site are presented in **Table 4.1.**

Table 4.1 A summary of main factors considered in site selection

Assessment Category	Specific factor	Site performance
Wind resource	Average annual wind speed	7m/s
	Wind direction	Predominantly southwest
Electronic Infrastructure	Proximity of transmission lines	33kv, 66kv and 132kv sufficiently close to the site
	Proximity of grid connection points	Possibility on or adjoining the site
Land Value	Land ownership	Willingness of landowner
	Ecological value	Low/moderate
	Archaeological value	Low/moderate
	Landscape value (and designations)	

Assessment Category	Specific factor	Site performance
		Not within a designated landscape area, sufficiently distant from Brecon Beacons National Park
Land Form	Size of site, useable area	Predominantly flat ridge areas
	Steepness of terrain	Steep plateau to the north
	Smoothness of hill tops	Good
	Alignment of high ground to prevailing wind	Good
Land use/Land cover	Road network and access	Classified highway immediately to the north
	Radio-telecommunications masts	None identified
	Current land use	Grazing
	Nearby land use	Wind farm within 2km
	Proximity of urban settlements	Maesteg 2-2.5km to south east

The original scheme was considered to offer a good combination of the assessment factors:

- Excellent wind resource;
- Within a TAN8 Strategic Search Area;
- Large usable area;
- Low vulnerability to major accidents and disasters arising from, for example, flooding or sea level rise, due to location.
- Relatively remote from large urban settlement, minimising the potential for environmental effects on human receptors, and breaking the effect pathway between the proposed development and human receptors for potential major accidents and disasters;
- Good potential access;
- Nearby wind farm developments where cumulative visual effects could likely be accommodated;
- Available existing electric infrastructure;
- Not common land; and
- Likely low impact on ecology, archaeology, geology etc. given the baseline conditions, both from the proposed development and from potential major accidents and disasters.

4.3 Scheme need and alternatives

Need for the project

Climate change

The cabinet foreword to the Welsh Assembly Government Energy Policy Statement, 2010 summarises the current severe situation regarding climate change:

> *"Climate change is the greatest environmental, economic and social challenge facing the planet. Unless the global emissions of carbon dioxide and other greenhouse gases from energy generation and other*

> *human activities peak by around 2015 and then rapidly diminish, the world will probably see a global temperature rise of 4°C by around 2060 resulting in famine and droughts in many parts of the world, significant sea level rises, and an increasing risk of further catastrophic climate changes."*

The impact of climate change in Wales is also set out within the Climate Change Strategy for Wales 2010. It summarises the position thus:

- Our climate is changing and the scientific case for human induced climate change is clear;
- No matter how effective policies are at reducing greenhouse gas emissions, we will experience some degree of climate change; and
- Urgent and sustained action to cut emissions is needed globally to avoid the worst impacts of climate change in the future.

The 'sustainable development principle' established by the Welsh Assembly Government in the Well-being of Future Generations (Wales) Act (2015) was introduced to ensure public bodies act in a manner which seeks to ensure that the needs of the present are met without compromising the ability of future generations to meet their own needs. A key element of this is stated as "*tackling climate change by reducing the greenhouse gas emissions that cause climate change and ensuring that places are resilient to the consequences of climate change*".

Planning Policy Wales (PPW) ed. 9 (2016) further states that:

> *"Tackling climate change is a fundamental part of delivering sustainable development. Climate change is one of the most important challenges facing the world and the Welsh Government has made a commitment to tackling climate change, resolving that the Government and people of Wales will play the fullest possible part in reducing its carbon footprint … Our commitment to action on climate change is based on a scientific imperative to act and to act urgently to reduce greenhouse gas emissions and deal with the consequences of climate change."*

There is therefore a demonstrable need to tackle climate change, with renewable energy developments seen as a key element in this.

Renewable energy and energy security

Renewable energy produces energy without burning fossil fuels that release CO_2 and contribute to climate change. Renewable energy also provides a new and alternative energy source to tackle energy security issues. Increased use of renewable energy is therefore a key part of European, UK and Welsh energy strategy.

In September 2017 the Welsh Government Cabinet Secretary for Environment and Rural Affairs announced to the Welsh Assembly that it was setting a target of Wales generating 70 per cent of its electricity consumption from renewable energy by 2030 and a target for one Gigawatt of renewable electricity capacity in Wales to be locally owned by 2030[8].

Key targets for renewable energy are set out below in **Table 4.2**.

[8] Lesley Griffiths high on ambition for clean energy. Available via: http://www.assembly.wales/en/bus-home/pages/rop.aspx?meetingid=4644&assembly=5&c=Record%20of%20Proceedings#C494225 [accessed September 2018]

Table 4.2 Key renewable energy targets

Consideration	Target
Greenhouse gas reduction	34% by 2020, 60% by 2030, 80% by 2050[9]
CO_2 reduction	26% by 2020[10]
Electricity from renewable sources	70% by 2030[11]

PPW9 states that the Welsh Government will aim "*to promote the generation and use of energy from renewable and low carbon sources at all scales and promote energy efficiency, especially as a means to secure zero or low carbon developments and to tackle the causes of climate change*".

(Draft) PPW10 further states that "*the planning system has an active role to help ensure the delivery of [these[12]] targets in terms of new renewable energy generating capacity*" and "*Planning authorities should facilitate all forms of renewable and low carbon energy development, using up to date and appropriate evidence. Planning authorities should seek to ensure their area's full potential for renewable and low carbon energy generation is achieved and renewable energy targets are met*".

Onshore wind power is recognised as being a deliverable, mature technology. Wind power is one of the few energy technologies that is both low in CO_2 emissions, helping to tackle climate change, yet can also be delivered quickly, affordably and is domestically secure thereby addressing the key energy security challenges. It is this critical ability to address both issues that makes wind power a central feature in Welsh Energy policy.

At the end of 2016, 43% of Wales' electricity came from renewable sources (Welsh Government, 2016). There is therefore a clear shortfall in meeting the target of 70% by 2030.

The energy of the wind has been harnessed by man for centuries, and is currently the fastest growing form of power generation worldwide. It produces no waste or emissions to air and hence does not contribute to global climate change. Wales has one of the windiest climates in the UK, giving the country great potential to use this resource to generate electricity.

Consideration of alternatives

The EIA Regulations make two references to the consideration of alternatives, as follows:

- In paragraph 17(2)(d) of Part 5 it states, with respect to what an Environmental Statement should include, that it should contain "*a description of the reasonable alternatives studied by the applicant or appellant, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the significant effects of the development on the environment.*"
- Paragraph (2) of Schedule 4 states that an Environmental Statement should include "*A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed*

[9] 2008 UK Climate Change Act
[10] *Ibid*
[11] See footnote 7
[12] For Wales to generate 70 per cent of its electricity consumption from renewable energy by 2030; • For one Gigawatt of renewable electricity capacity in Wales to be locally owned by 2030; and • By 2020 for new renewable energy projects to have at least an element of local ownership.

project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects".

Strategic alternatives

The process by which the proposed development site was selected by the applicant is described in Section 4.2.

Alternative layout and design options

The layout, design or other proposals for the chosen alternative have evolved from a design process, which has involved the project design, planning and environmental teams working together with key stakeholders to devise the preferred scheme from an engineering and environmental perspective. Details of these design alternatives, and how these relate to the preferred scheme, are provided in Section 4.5.

4.4 Wind farm design principles

Wind farm principles

Wind turbines convert the kinetic energy of the wind into electrical energy. Air passing over the blades of a wind turbine causes them to rotate. This low speed rotational motion is stepped up via a gearbox and converted into electrical energy at a voltage of 690V by a generator located inside the nacelle, which is then converted to a high voltage (132kV) by a unit transformer, located either at the base of the turbine or within the nacelle, for transmission across the wind farm. A diagram showing the structure of a typical wind turbine is shown in **Figure 4.1**.

Underground cables link all the turbine unit transformers to a dedicated sub-station on the site where the electricity generated by the wind farm is metered, and if necessary transformed to the same voltage as the electricity grid system to which the wind farm will be connected.

Wind farm design criteria

Once a site has been selected, the design of the wind farm is optimised in order to produce a design which maximises the use of the land available for wind power generation whilst minimising the overall environmental impact of the development. The optimal layout of a wind farm depends on a range of technical, economic and environmental criteria as follows:

- Ground conditions – ground conditions must be suitable for the installation of wind turbines, access tracks and cables e.g. avoidance of areas of deep peat;
- Site topography – the site topography is computer modelled to establish the wind flow on and around the site to provide guidance on the best locations for the wind turbines;
- Distance between turbines – to minimise turbulence interaction between wind turbines (wake effect), turbines should be separated by set distances both perpendicular to, and in line with, the prevailing wind direction. This design feature is a key factor in maximising the overall power generating capacity of a site. Spacing requirements may vary between turbine manufacturers and are also subject to wind conditions;
- Proximity to occupied dwellings – wind turbines have to be located sufficiently far away from houses to protect local amenity;
- Environmental constraints – features and areas of local environmental sensitivity (ecology, archaeology, hydrology etc) are identified and their implications considered;

- Landscape and visual design considerations are taken into account and the layout modified accordingly;
- Existing land use – whilst the wind turbines and their associated infrastructure typically occupy no more than 2% of the site, the existing use of the land is considered in the layout of tracks and turbines. For example existing track lines are used where practicable;
- The presence and magnitude of woodland and forestry plantations is also important, as these can reduce energy production from wind turbines;
- Proximity to obstructions – such as tall trees or buildings;
- Available spare capacity of the electricity grid to take power from the wind farm; and
- Proximity to a road network suitable to allow the transport of construction plant, equipment and wind turbine components to the site.

In addition to the above considerations, planning guidance and discussion with statutory and non-statutory consultees and the landowners have an influence over the evolution of the design.

The role of EIA in the design of the proposed wind farm

The design of the wind farm is informed by a range of potential constraints. The EIA process begins with the collection of data for a study area the geographical extent of which is informed by the development of an indicative turbine layout. The layout is in itself informed by computer modelling of wind speeds and the identification of any obvious constraints. The computer model also takes into account necessary turbine separation, terrain gradient and visibility. Subsequent design iterations, including the final design are then informed by environmental factors identified during the EIA process. The various design iterations are described in **Table 4.3**.

Design constraints

Environmental constraints were identified from a number of desk-based and site-based surveys and data collection exercises. The constraints included the presence of protected species within the study area.

Terrain data has been used to inform the direction of tracks to ensure that they do not cut across steep gradients but following existing contours wherever possible.

Vulnerability to major accidents and disasters

Paragraph (8) of Schedule 4 of the EIA Regulations states that an Environmental Statement should describe "*the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of major accidents and/or disasters which are relevant to the project concerned*".

Due to its location, it is considered that the vulnerability of the proposed development to natural disasters such as earthquakes, and climate change and extreme climate events such as flooding or sea level rise is low. Potential effects of climate change on flood risk are however considered in **Chapter 12: Water Resources and Ground Conditions**.

The site of proposed development is located in an area of previous coal mining. An assessment of potential impacts upon the proposed development from this previous mining activity, for example from subsidence movements, was provided in Appendix 12.4 of the 2014 ES (James Associates, 2014). In conclusion the report stated:

> *"... whilst the potential for shallow level abandoned underground mine workings exist in the vicinity of several of the turbine locations, the problem can be readily engineered out by adopting standard ground stabilisation works.*

The presence of shallow level abandoned mine workings does not preclude the locating of wind turbines above them provided that the appropriate level of ground stabilisation works are undertaken prior to erection."

It is therefore considered that the risk to the proposed development of a major accident arising from land movement associated with shallow mine workings is low. The report by James Associates is provided as **Appendix 12B**.

The potential pollution of watercourses and habitats, which could arise as a result of a major accident at the proposed wind farm, and consequential effects on such habitats, and species who use them, are considered in **Chapter 9: Non-Avian Ecology, Chapter 10: Ornithology** and **Chapter 12: Water Resources and Ground Conditions**, alongside measures to avoid or reduce such effects.

Further details on measures to minimise the likelihood of major accidents arising from construction of the proposed development are provided in section 5.2.

4.5 Design statement

Consideration of alternative design and layout iterations

Wind farm design is an iterative process and is influenced by potential environmental effects identified throughout the EIA process. The proposed wind farm layout has evolved from that originally anticipated in response to a number of environmental and technical constraints.

Table 4.3 below identifies the main iterations and rationale for such changes cumulating with the final wind farm design.

Table 4.3 Development of the wind farm layout

Iteration	Comment
Initial layout	Taking account of known information and good design practice
Reduction in number of turbines from 15 to 13	Following concerns raised at the public exhibitions and initial noise assessment with regards potential effects on receptors in the Afan Valley
Relocation Turbines of 6, 11 and 12	Moved to avoid effects on telecommunications signals as a result of discussions with Telecommunications consultees
Relocation of site entrance	Site entrance relocated from original location in Nantyffyllon to B4282 with access through Michaelston Forest to reduce environmental and visual effects
Reduction in number of turbines from 13 to 11, and increase in height from 120m to 145m	Turbine heights increased to improve the economic viability of the scheme. Turbines 12 and 13 removed to reduce potential noise and visual effects from larger turbines on receptors in the Afan Valley.

Micro-siting

Notwithstanding the above the continual refinement of the scheme is likely to extend beyond the production of this ES, in response to the views and requirements of consultees throughout the application process and a final detailed inspection of the location of each turbine base. This inspection would be undertaken immediately prior to the commencement of development to ensure that there have not been any material

changes to the environmental baseline. Consequently it is established practice to seek agreement for the approval for the micro-siting of the turbines. In the case of the proposed development this distance is a radius of 35m from the approved centre point. In addition to the micro-siting of the turbines bases the developer would also expect the micro-siting to extend to the location of tracks and crossing places for the same reason.

Selection of turbines

Whilst the final commercial decision has yet to be made, the candidate wind turbine provisionally selected for this site is the Nordex N90. It is of the horizontal axis type, with a rotor consisting of three blades. The blades are mounted to the wind turbine hub, or nacelle at a height of 100m, with a rotor diameter of 90m, and maximum height to blade tip of 145m.

4.6 References

James Associates. Foel Trawsnant Wind Farm: An assessment of previous underground mine working activity and its potential impact upon the proposed Foel Trawsnant Wind Farm site. 2014.

National Assembly for Wales. Well-being of Future Generations (Wales) Act 2015.

Welsh Assembly Government. The Climate Change Strategy for Wales. 2010.

Welsh Assembly Government Energy Policy Statement, 2010.

Welsh Government. Planning Policy Wales: Edition 9. 2016.

Welsh Government. Energy Generation in Wales 2016. Version 1.2, 2017.

Welsh Government. Draft Planning Policy Wales: Edition 10. 2018.

5 Description of the proposed development

5.1 Introduction

This section provides the technical details relating to the construction and operation of the proposed wind farm. These details form the basis for the assessment of likely significant effects upon the baseline situation.

5.2 Development description

Site location

The proposed wind farm site known at Foel Trawsnant is located approximately 2.3km to the north-west of Maesteg. The central grid reference is approximately 283905, 193920. Residential settlements surrounding the site of proposed development include Nantyffyllon and Caerau to the east, Duffryn Rhondda and Cynonville within the Afan Valley to the north and Bryn to the southwest.

Existing site and surroundings

The site lies at between approximately 250 and 371m AOD altitude. Habitats present at the site include semi-improved grassland, mire communities, as well as areas of upland heath and acid grassland, with the predominant land use being stock grazing. Existing agricultural practices can continue during and following construction of the wind farm.

Access to the site is through the Afan Forest, an area of forestry subject to periodic clear-felling and management, to the south of the site, from the B4282, utilising an existing track. A number of walking routes, including the long distance Coed Morgannwg Way and St. Illtyd's Walk, and off-road cycling routes pass through the Afan Forest, and much of the forest, and site of proposed development, is designated as open access land.

Development proposals

The proposal is to construct and operate a wind farm of eleven turbines and associated infrastructure including access tracks, transformer and a sub-station. As discussed in section 1.1, this number has been reduced from the thirteen proposed in the original planning application and ES in 2014.

The turbines proposed for the development will have a maximum power output of up to 3MW, dependant on the final commercial choice, and therefore a combined maximum rated output of up to 33MW of electrical power. The annual generation expected at the site will be equivalent to the domestic needs of approximately 19,717 average households[13,14], in Britain (Source: RenewableUK).

The wind farm will be designed with an operational life of 25 years. At the end of this period the developer has three options; to decommission the wind farm and dismantle and remove the turbines; to apply for an extension to the operating period using existing equipment; or apply to install new equipment on the site. For the purposes of this assessment it is assumed that the wind farm would be decommissioned.

[13] Assuming maximum rated capacity of 33MW and capacity factor of 30% which takes into account the intermittent nature of the wind, the availability of the winds turbines and array losses. http://www.renewableuk.com/page/UKWEDExplained

[14] Homes Equivalent = rated capacity of wind farm (kW) x average load factor for wind x number of hours in a year / average household energy consumption(MWh)

Proposed site layout

The grid references for each turbine are provided within **Table 5.1**.

As stated in section 1.1, this ES considers the potential environmental effects of amendments to an existing planning application which was approved by planning committee subject to a s106 agreement. The red line planning application boundary, within which all site infrastructure is located, therefore remains unchanged, despite the proposed removal of turbines 12 and 13 from the proposals.

Figures included within the 2014 ES showed a larger 'site boundary' (pink line) on which EIA studies were based. For consistency, this area is again shown on the majority of ES figures and is titled 'site boundary' but should not be confused with the red line planning boundary.

The assessment of effects has concentrated on effects with the red line planning boundary, within which all site infrastructure would be located and any direct effects would occur, unless otherwise stated within the topic chapters. The site boundary includes additional areas under the developer's control which are available for post-development habitat management (etc.).

The site boundary, red line planning boundary and proposed turbine locations are shown in **Figure 5.1** and **Figure 5.2**. The area within the wider 'site boundary' encompasses approximately (~)117.6 hectares (ha). The red line planning area encompasses ~46.5ha.

The proposed wind farm layout, including access tracks, temporary construction compound and substation are shown on **Figure 5.1** and **5.2**.

Table 5.1 Proposed turbine locations

Turbine	Easting	Northing
1	283979	193524
2	283842	193719
3	283693	193910
4	283428	194260
5	283092	194327
6	282867	194591
7	284155	193809
8	284009	194034
9	283761	194191
10	283728	194431
11	283513	194700

Site access

The principal point of access into the site is from the B4282 which links Maesteg and the village of Bryn, north of Maesteg Golf Club. General construction traffic (site staff) and concrete, stone and turbine deliveries will enter the site at an access point to be constructed to accommodate the type and volume of vehicles proposed. **Figure 5.3** provides details of this access.

Wind farm construction

The construction period for the wind farm will last approximately 12 months possibly extending up to 24 months if poor weather conditions are experienced. The construction process will consist of the following principal activities:

- Creation of the site entrance off the B4282;
- Up-grading of existing tracks and construction of new access tracks and passing places inter-linking the turbine locations and sub-station; this will require import of suitable roadstone;
- Remedial works to public highway to facilitate delivery of turbines as necessary;
- Formation of site compound including hard standing and temporary site office facilities;
- Construction of crane hardstanding areas to facilitate erection of turbines;
- Construction of turbine foundations and transformer bases where required by the selected turbine;
- Construction of site substation;
- Excavation of trenches and cable laying adjacent to site roads;
- Connection of on-site distribution and signal cables;
- Delivery and erection of wind turbines;
- Commissioning of site equipment; and
- Site restoration.

Many of these operations will be carried out concurrently, although predominantly in the order identified, in order to minimise the overall length of the construction programme. In addition, development will be phased such that at different parts of the site, the civil engineering works will be continuing whilst wind turbines are being erected. Site restoration will be programmed and carried out to allow restoration of disturbed areas as early as possible and in a progressive manner.

On-site access tracks

Approximately 5.5km of site access tracks will be required (~679.5m less than the previous proposals in 2014), which includes 1.8km of the existing forestry track which leads from the entrance off the B4282 to the site. The track construction will be generally 5m wide, with a 2m verge either side, typically 300mm increasing to 450mm depth dependent on ground conditions. Typical track cross sections are shown in **Figure 5.4** with details of culvert crossings as **Figure 5.5**.

Further details relating to the movement of traffic on and off the site are reported in **Chapter 13: Traffic and Transport.**

Track layout design

There are various constraints which have influenced the track layout design, some generic and some site-specific:

- Track length is kept to a minimum to reduce environmental impact, construction time and material quantities (imported stone);
- Gradients are to be kept to less than 8 degrees where possible to accommodate the requirements of delivery vehicles and also to allow construction plant to move safely round the site;

- Track layout is designed to reflect contours and avoid cross slopes and deep cut and fill into existing terrain where possible; and
- Tracks are routed to avoid sensitive ecological, archaeological and hydrological features.

The final track design resulted from optimisation of these criteria.

Track construction methodology

The access tracks on site will be ~5m wide to accommodate cranes and delivery vehicles required for turbine erection. The edges of the tracks will be allowed to re-vegetate maintaining a minimum width throughout the operation and maintenance period of ~5m, with verges of ~2m. All new tracks will be unpaved and constructed from local stone (sourced from local quarries).

The access roads will bear direction on to the underlying strata. Excavated topsoil will be used to dress back the sides of the road. From a provisional review it is likely that the road depth will be 300mm to 450mm dependent of ground conditions.

Water crossings have been avoided in the site layout wherever possible. However, where required, a simple culvert type construction will be employed (see **Figure 5.5**). Further considerations of the implications of culverts on watercourses are contained within the **Water Resources and Ground Conditions** chapter of this ES (**Chapter 12**).

Construction programme

An indicative programme for construction activities is shown in **Table 5.2**. This shows a 'best case' scenario of construction within 12 months. The starting date for construction is largely a function of the date that consent might be granted.

Development phasing

There are constraints which will require cessation of construction of specific parts of the site during certain times of the year. These are discussed in later technical chapters as appropriate. Construction phasing to avoid those constraints will be agreed with the determining authorities and relevant consultees should development consent be agreed.

Turbine foundations

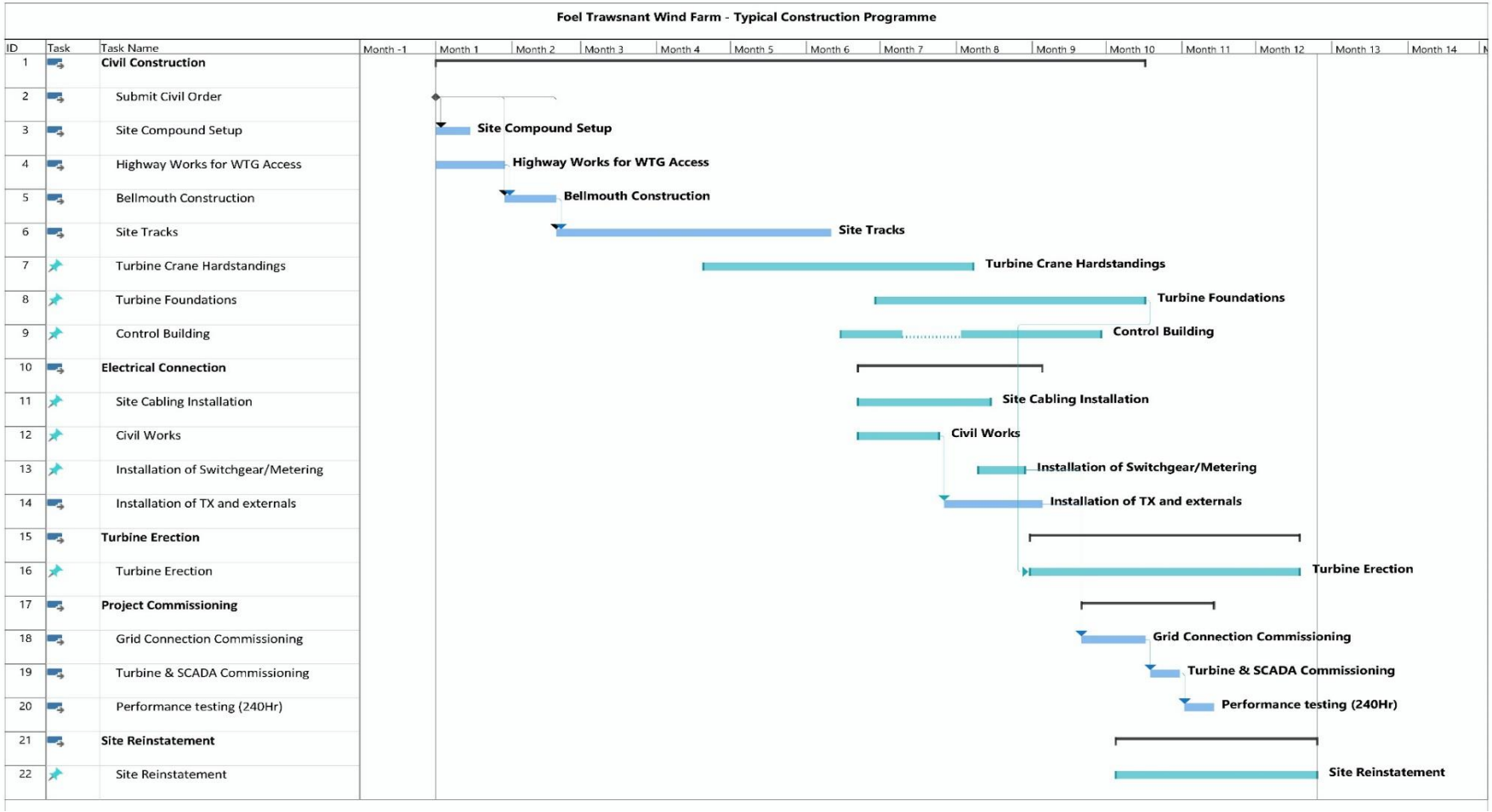
The turbines will be installed on foundations, comprising both stone and concrete. These will measure approximately 20m diameter with concrete depth of ~3.9m, dressed back with topsoil to allow re-vegetation. Turbine foundations could be larger or smaller, depending on imposed loadings, ground conditions and drainage design. A typical turbine foundation is illustrated in **Figure 5.6**.

Crane pads

Each wind turbine requires an area of hardstanding to be built adjacent to the turbine foundation. This provides a stable base on which to lay down turbine components ready for assembly and erection, and to site the two cranes necessary to lift the three tower section, nacelle and rotor into place. The crane hardstanding will be left in place following construction in order to allow for the use of similar plant should major components need replacing during the operation of the wind farm. These could also be utilised during de-commissioning at the end of the wind farms life. The total area of hard standing at each turbine location including the turbine foundations and the crane pad will be approximately 895m^2. Approximately a third of this area will be dressed back with topsoil and landscaped into the surrounding area upon completion of turbine erection. A typical crane hardstanding is illustrated in **Figure 5.7**.

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Table 5.2 Indicative programme



Stone and concrete requirements and sourcing

Stone materials for track building are expected to be imported from local quarries; no borrow pits are proposed on the site. Concrete for construction of the turbine foundations and sub-station structures will be imported to site. Further details are provided below and in the Construction Traffic Management Plan submitted alongside this ES (doc ref 40217rr062i1).

Material quantities

A number of material will be required to construct the different elements of the proposed development. **Chapter 13: Traffic & Transport** provides a detailed breakdown of the estimated material requirements for each element (e.g. site track, crane pads, turbine foundations etc), and a summary of total tonnages for each material to be used is provided in **Table 5.3**.

Table 5.3 Estimated tonnages of materials required for construction of the proposed development

Material	Estimated total tonnage
Stone	26,570
Tarmac	114
Sand	1,550
Concrete	5,409

All materials required for construction of the proposed development would be delivered from quarries and batching plants in the local area.

Cabling

Underground cables will link the turbines to each other and to the on-site sub-station. Detailed construction and trenching specifications will depend on the ground conditions encountered at the time, but typically cables will be laid in a trench 750mm deep and 450mm wide. To minimise ground disturbance, cables will be routed along the side of the access tracks wherever practicable. **Figure 5.8** shows a typical cable trench detail.

Substation and grid connection

All wind farms need to be connected into the grid distribution system, though such connections are subject to a different consenting process to the wind farms themselves. The site sub-station will connect the wind farm into the national distribution system on site (to be via a 66kv connection in the sub-station compound). The substation is to be located a short distance from Turbines 8 and 9.

The sub-station will comprise a hardstanding area of approximately 41.5m x 39m containing the main equipment (isolators, circuit breakers, transformers) a 14m x 10m single storey building which will house switchgear and metering protection and control equipment and also welfare facilities. The sub-station switchroom will be faced in stone with a slate roof, associated fencing will be either moorland green/brown or dark grey in order to blend with either the existing landscape colours or traditional building colours for the area. **Figure 5.9** provides an illustration of the switchroom and sub-station compound.

The applicant has received an offer of a grid connection is in discussion with Western Power Distribution (WPD) which is the electricity distribution company for South West England and South and West Wales. The offer is for a connection to tie into the 66kv network at Pyle substation, utilising an existing 5km tower line not currently in use, plus a new 7km stretch of wooden pole circuit.

Erection of turbines

Where rockhead, or suitable bearing, is relatively shallow (<2m), the wind turbine foundations will bear directly onto rock. Where rockhead or suitable bearing, is between 2-5m depth, the existing overburden will be excavated and replaced with suitable load-bearing material, most likely to be imported stone.

The foundation design will depend on the results from detailed ground investigation, it is currently expected that turbines will not require piled foundations. Should piling be necessary, it is proposed to agree the methodologies for this and any conditions which may be appropriate with the determining authority prior to construction. It is expected that the conditions would vary depending on the relative location of the turbine to potential receptors for any adverse environmental impacts.

Foundations will usually comprise a reinforced concrete base slab with dimensions of approximately 20m diameter x 3.9m depth. This will include a circular steel support plinth to suit the base profile of the wind turbine steel tower and will then be overlaid by stone and previously excavated overburden. The design of these foundations in terms of size and depth minimises excavation requirements, minimises visible projection above the ground and allows the re-establishment of surface vegetation following construction. The final choice of foundation design will be based on the most efficient use of materials and local ground conditions.

Wind turbine towers, nacelles and blades will be transported to site via low bed trailers, come incorporating rear steering. The towers will be delivered in three or four sections, which will be stored at each turbine lay-down area until lifted into position. Some storage of components may also be required at the site compound dependent on weather conditions and access track construction progress at the time of delivery.

Two teams will carry out erection, each using either two road-going cranes (of approximately 100 tonne capacity and 500 or 800 tonne capacity) or crawler cranes. The construction contractors would determine the actual cranes used, together with the exact programme and number of teams on site.

Site accommodation

Two temporary site construction compounds, approximate dimension 7,495m^2 and 5,055m^2 will be located within the site as shown on **Figure 5.2** and **Figure 5.3**.

Two temporary site/security offices will be constructed, one near to the site entrance from the B4282 (area 262m^2) and the second at the entrance to the turbine platform area (within the smaller of the two temporary construction compounds).

Other temporary fenced compound areas will be established on turbine craneage areas as appropriate for security of plant in remote parts of the site. These will not require any additional hardstanding to that proposed for the craneage areas.

Sustainable resource use and waste management

Stone and concrete requirements are discussed earlier in this chapter. At this stage it is not possible to estimate quantities of waste and surplus materials which would be produced on site. Any such waste materials produced, which are expected to be minimal, and surplus material excavated from constructing turbine bases, access roads and other infrastructure would be removed from site in HGVs and taken to an appropriate waste recycling or disposal facility. No other discharges are proposed from the development.

Although wind turbine development can encompass large areas of land, the actual built development covers a relatively small percentage of the land take and, in most circumstances, farming and other land based activities would continue in and around turbine development. The proposed development would therefore only result in a small land take, which is unlikely to result in significant environmental effects in terms of land.

In terms of soils, the design of tracks, turbine foundations, hardstanding etc. has minimised the amount of soil disturbance. Where soils would be excavated, they would be stored on site in accordance with the

Construction Environmental Management Plan (CEMP) which would be produced prior to construction, and then used in the restoration of the site post construction to minimise the loss of soil resource.

With regards water, the key environmental effects of this natural resource would be the use of water during the construction, operational and decommissioning phases, the potential increase in flood risk and the disturbance of surface and groundwater as a result of construction activities. With regards to construction works, the water resource would be managed in accordance with the CEMP. With regards to surface and groundwater, any effects are considered in **Chapter 12: Water Resources and Ground Conditions** of this ES.

The potential effects of the proposed development on biodiversity are considered in **Chapter 9: Non-Avian Ecology** and **Chapter 10: Ornithology** of this ES, within which appropriate environmental measures are set out in order to minimise the potential damage to habitats and species during the construction, operation and decommissioning. Environmental measures are also detailed in an Outline Habitat Management Plan.

Vulnerability to major accidents and disasters

As described in section 4.4, the location of the proposed development minimises potential risks to the Foel Trawsnant Wind Farm from major accidents and disasters, and measures to minimise the likelihood such events arising from construction of the proposed development will be set out in the Construction Environmental Management Plan (CEMP) to be produced prior to commencement of works.

The construction works for the proposed development will also be undertaken in accordance with primary health and safety legislation, including:

- The Health and Safety at Work Act 1974;
- The Management of Health and Safety and Work Regulations 1999 (as amended); and
- The Construction (Design and Management) (CDM) Regulations 2015.

As required by the CDM Regulations a Construction Phase (Health & Safety) Plan will be prepared for the works, setting out emergency procedures to be followed in the event of such an incident.

Wind farm operation

Wind turbine characteristics and meteorological effects

Wind turbine characteristics

The power output from a wind farm largely depends on the strength of the wind blowing across the site. Wind turbines start to generate electricity at a wind speed of about 4m/s, their output increasing up to their maximum rated power at a wind speed of about 12m/s. As the wind speed increases further, the output is limited to the maximum until the wind speed reaches 25m/s when the wind turbine shuts down automatically.

The proportion of time which the turbines will be generating electricity is therefore dependent on the time that the wind speed is between 4 and 25m/s. Generation output from a wind farm is also seasonally dependent, such that approximately two thirds of the total annual energy yield from the wind farm is expected to be delivered in the six months between October and March, with the remaining six months delivering the other third.

Meteorological effects

Although the wind farms require wind for electricity generation, at high wind speeds (>25m/s or 56mph) they shut themselves down to avoid excessive wear on the components; the rotor is both aerodynamically and mechanically braked. However, modern wind turbines are designed to withstand much higher wind speeds

and are normally certified against structural failure for wind speeds up to 150mph. Lightning generally has no effect on turbines, though as with all structures there is risk of damage if hit directly by lightning. Turbines are fitted with a lightning protection system as part of their design.

Snow does not generally post problems other than with access to the site. Occasionally very heavy snow and ice may affect the anemometer or aerodynamics of the turbine blades resulting in temporary automatic shutdown. The wind turbine would restart automatically after accumulations have naturally thawed.

Servicing and emergency repairs

The typical duration of servicing and repair/replacement procedures together with the equipment and personnel which would be required for different tasks is shown in **Table 5.4**. It should be noted that these figures are only estimates.

Routine maintenance or servicing of turbines is carried out twice a year, with a main service at 12 monthly intervals and a minor service at 6 months. In year 1, there is also an initial 3-month service after commissioning. The turbine being serviced is switched off for the duration of its service.

Teams of two people with a 4x4 vehicle would carry out the servicing. It takes two people (on average) one day to service each turbine.

Extended services

At regular period through the project life, oils and components will require changing which will increase the service time on site per machine.

Gearbox oil changes are required approximately every 18 months. Changing the oil and worn components will extend each turbine service by one day.

Blade inspections will occur as required (somewhere between every 2 and 5 years) utilising a 'cherry picker' or similar but may also be performed with a 50T crane and a man-basket. It could take 2 or 3 weeks to inspect the turbines on the whole site. Repairs to blades would utilise the same equipment but minor damage on every blade (not expected) would more than double the duration of the inspection period.

Blade inspection and repair work is especially weather-dependent. Light winds and warm, dry conditions are required for blade repairs. Hence mid-summer (June, July and August) is the most appropriate period for this work.

Emergency operations

The following factors could have significant effects on the duration of emergency operations:

- Working with cranes is highly weather dependant; wind speed and cloud cover being the key factors (due to crane and manhandling safety limits);
- The availability of spares will determine delivery times to site for a replacement; and
- The duration of repair on a component where there is no spare available is event specific.

It has been found that operation in the first three or four years will highlight any manufacturing and/or installation issues which may require multiple replacements. In general, unscheduled maintenance is more likely to be required at the project start up and towards the end of the 25-year period at the end of the design life.

Track maintenance

Frequency of track maintenance depends largely on the volume and nature of the traffic using the track with weathering of the track surface also having a significant effect. Heavy plant is particularly wearing. On-going maintenance will generally be undertaken in the summer months when the tracks have dried out.

Snow clearance

Safe access to the site and especially to the sub-station is required year-round. At other sites it has occasionally been necessary to clear snowdrifts to facilitate site access. Snow clearing equipment will be sourced as required. Snow tends to drift in December to March inclusive.

Table 5.4 List of expected wind farm operational and maintenance activities

Item	Personnel	Equipment and Operators/Drivers	Duration of Job
Generator	2 x fitters	50T (3 axle) or 100T (6 axle) crane	1 day
Gearbox	4 x fitters	10T flatbed lorry	6 days
Blade/Rotor	6 x fitters	50T or 100T crane	4 days
Transformer	2 x fitters	10T flatbed lorry	1 day
Track maintenance	Drivers	50T or 100T crane	5 days
Snow clearance	Driver	Articulated delivery lorry	Conditions specific
Crane pads/Hardstandings	Drivers	50T crane and or 20T flatbed lorry with own crane	2 days to install/clear and 1 day to reinstate
Dismantling a turbine	8 x fitters	Grader/roller and excavator	3 days x 10 turbines = 30 days
HV/comms. Cable faults	6 x fitters	Excavator	4 days

Wind farm decommissioning

The wind farm will be designed with an operational life of 25 years. At the end of this period the developer will have a number of options, however the options for the purposes of this ES is to assume that the turbines will be dismantled and removed.

When dismantling and removing the turbines the bases would be broken out to below ground levels and all cables cut at depth below ground level and left in the ground. Roads would either be left for use by the landowner or covered with topsoil. No stone would be removed from the site. The decommissioning works are estimated to take six months. This approach is considered to be less environmentally damaging than seeking to remove foundations and cables entirely.

The turbine components themselves will be taken to an appropriate recycling facility where applicable. Due to the timescales it is not possible to identify a specific facility at this time.

It should be noted that the developer will set up a decommissioning fund during the life of the project.

Employment proposals

It is anticipated that the proposed development would employ up to 49 people during construction and commissioning of the wind farm. Employment during operation would be considerably lower and would be limited to approximately four people for maintenance purposes.

Atmospheric emissions and climate change

The EIA Regulations (Regulation 4(2)(c)) state that an EIA must consider potential effect on climate of the proposed development. Given the non-emitting nature of a wind farm, the minimal traffic movements associated with the development (mostly confined to the construction and decommissioning phases; further details provided in **Chapter 13: Traffic & Transport** and the Construction Traffic Management Plan which accompanies this ES) and the fact it is a renewable technology, a greenhouse gas (GHG) assessment has not been undertaken as part of the EIA, as set out in the Scoping report and agreed in the Scoping opinion.

It is however widely accepted that electricity produced from wind energy has a net benefit with regard to reducing CO_2 emissions. The emissions savings associated with the generation of renewable energy at the Foel Trawsnant Wind Farm amended scheme are provided within **Table 5.5** (calculation method: RenewableUK[15]).

These figures assume a rated output of 2.5MW per machine (current candidate turbine) and a maximum output of 3MW per machine (for which the applicant is seeking permission) multiplied by a net capacity factor of 27%[16]. This factor takes into account the intermittent nature of the wind, the down time of the wind turbines due to scheduled maintenance and other energy losses which are inherent in the design and operation of the wind farm (for example losses in cabling, down time due to adverse weather etc). RenewableUK uses the Department of Business, Energy and Industrial Strategy's carbon saving figure of 430g/kWh[17] when compared against the grid average CO_2 output.

Table 5.5 Emissions to atmosphere if wind farm output replaces grid average output based on 27.5MW and 33MW wind farms operating at 27% of maximum rated output

Emissions to atmosphere avoided (tonnes)				
Pollutant	**Annual 27.5MW**	**Annual 33MW**	**Total (25yrs) 27.5MW**	**Total (25yrs) 33MW**
Carbon dioxide (CO_2)	27,554	33,065	688,850	826,625
Sulphur dioxide (SO_2)	641	769	16,025	19,225
Oxides of nitrogen (NO_X)	192	231	4,800	5,775

Note: Carbon dioxide is the main gas implicated in global warming. Oxides of sulphur and nitrogen cause acid rain. It should be noted that these figures provide the savings that would be achieved per year based on the current generation mix in the UK, which may change in the future

[15] http://www.renewableuk.com/page/UKWEDExplained
[16] *Ibid*
[17] *Ibid*

5.3 Environmental management

Construction

The contract between the developer and the civil engineers involved in construction of the wind farm will specify the measures to be taken to avoid or reduce the potential environmental effects arising from the construction process. These measures will consist of three main types:

- Firstly, conditions to be adhered to under development consent;
- Secondly, the requirements of Natural Resources Wales (NRW); and
- Thirdly, any other relevant environmental measures identified in this ES.

A copy of any conditions associated with the planning consent will be incorporated into the contract with the company constructing the wind farm, and the company will be required to adhere to these. Selection of the construction contractor will be based partly upon the contractor's record in dealing with environmental issues, and on its provision of evidence that has incorporated all environmental requirements into its method statements and its staffing and budgetary provision. The developer will retain the services of specialist advisers on e.g. archaeology and ecology, to be called on as required to advise on specific issues, including micro-siting. More detailed information on the role of such specialist advisors during construction is provided in the relevant technical sections, where appropriate.

Construction Environmental Management Plan

A CEMP provides an overview of the standard construction management measures that would be implemented as part of the proposed development. As such it aims to ensure that construction activities for the proposed development are carried out in accordance with legislation and best practice for minimising the effects of construction on the environment and local communities.

The CEMP will be produced prior to the commencement of works and made available to the appointed civil engineers and construction company, and its objectives will be to:

- Provide a mechanism for delivering many of the embedded environmental measures described in the ES.
- Ensure compliance with legislation through setting out the need for consultation with 'consultation bodies' (see Regulation 2 in the EIA Regulations), and by obtaining necessary consents and licences from relevant bodies.
- Provide a framework for monitoring and compliance auditing and inspection to ensure the environmental measures included in the scheme are being implemented.
- Ensure environmental best practices are adopted throughout the construction stage.
- Provide a framework for dealing with adverse effects as they occur.
- Ensure a prompt response should unacceptable adverse effects be identified during the works.

Dust and air quality

In the absence of appropriate mitigation there is the potential for an increase in dust during construction. Given the adoption of the environmental measures which are outlined below, it is not expected that the change in air quality, in relation to dust, will be significant. Air quality affects arising from exhaust emissions from construction plant would be so low as to be not significant.

Dust nuisance will not be assessed as part of the EIA, which will instead focus on control of dust at source and not on quantification of likely dust levels in the absence of appropriate controls. This was confirmed in the scoping process.

Control of dust effects

The environmental measures to be implemented to control dust emissions during construction and decommissioning are:

- The use of dust suppression facilities on site. This will include the provision of water bowsers with sufficient capacity and range to dampen down all areas which may lead to dust escape on site;
- Any storage on site of aggregate or fine material will be properly enclosed and screened so that dust escape from this site is avoided. Adequate sheeting will also be provided for the finer materials which are prone to 'wind whipping';
- Wheel wash facilities will be installed for vehicles entering and exiting the site where required. This facility will be able to automatically clean the lower parts of the HGVs by removing mud, clay etc from the wheels and chassis in one drive through operation;
- HGVs entering and exiting the site will be fitted with adequate sheeting to totally cover any load carried which has the potential to be 'wind whipped' from the vehicle;
- Good housekeeping or 'clean up' arrangements will be employed so that the site is kept as clean as possible. There will be daily inspections of the working areas and immediate surrounding areas to ensure that any dust accumulation or spillages are removed/cleaned up as soon as possible; and
- The appointment of site contact to whom complaints/queries about construction dust can be directed. Any complaints to be investigated and action taken where appropriate.

Dust and air quality are not considered any further within this ES.

Operation

A team of four people will be employed to manage the wind farm site, and their duties will include compliance with statutory environmental requirements.

Decommissioning

All decommissioning works would be managed by a management plan, similar to the CEMP for the construction phase, to minimise the effects of decommissioning works on the environment and local communities.

5.4 Implementation of embedded environmental measures

Table 5.6 summarises the environmental measures that form part of the proposed development, as well as the mechanisms which would be used to ensure that these measures are implemented as part of the proposed development. Greater detail on these measures can be found in each of the technical assessment chapters.

Table 5.6 Summary of environmental measures to be implemented

Environmental measure	Responsibility for implementation	Compliance mechanism	ES section reference
Design and selection of security lighting components at the construction compound	Developer/Contractor	Construction Environmental Management Plan (CEMP)	Section 7.8
Turbine colour (off grey with a semi-matt finish)	Developer/Contractor	Planning condition	Section 7.8
Visible features of archaeological interest within the vicinity of elements of the proposed development will be fenced-off to help prevent damage during the construction phase where disturbance to them can be avoided.	Developer/Contractor	Planning condition	Section 8.8
Maintenance of a watching brief during initial topsoil stripping will allow the identification and recording of any archaeology present.	Developer/Contractor	Planning condition	Section 8.8
Dust-suppression measures during construction	Construction Contractor	CEMP	Table 9.12
Watercourse pollution / sedimentation prevention measures during construction	Construction Contractor	CEMP	Table 9.12
Avoidance of key wetland habitats/ deep peat deposits and the Caerau West SINC (on-site)	Developer	Site design upon which planning application submitted for approval.	Table 9.12
Culvert design for stream crossings to be mammal friendly to allow passage of water vole and otter	Construction Contractor	CEMP	Table 9.12
50m stand-off between turbine blade tips and key bat foraging/commuting habitats (wetland habitats, walls, trees)	Developer	Site design upon which planning application submitted for approval.	Table 9.12
Avoid night-time working to avoid disturbance to bats/otter or restrict lighting used during construction	Construction Contractor	CEMP	Table 9.12
Prepare and implement non-licensed Ecological Mitigation Method Statement	Construction Contractor and Ecologist	CEMP	Table 9.12
Replacement of lost or damaged ponds along access track (if required)	Construction Contractor	CEMP	Table 9.12
Avoidance of damage or destruction of nests during construction	Site management and ecological advisor independent of the contractor acting as clerk of works	Planning condition	Section 10.8

Environmental measure	Responsibility for implementation	Compliance mechanism	ES section reference
Pre-construction surveys for breeding crossbill, and mitigation to avoid disturbance, if required	Site management and independent ecological advisor. Mitigation strategy (if required) to be submitted to NRW for agreement.	Planning condition	Section 10.8
Avoidance measures to protect breeding nightjar from disturbance	Site management and independent ecological advisor	Planning condition	Section 10.8
Habitat enhancement initiatives	Steering group consisting of Pennant Walters (FoelT) Ltd, their ecological consultants and NPTCBC.	Legal agreement	Section 10.14
Restricted working hours for most heavy vehicle movements (07:00 to 19:00 Monday to Friday, 07:00 - 12:00 Saturdays)	Developer/Contractor	Planning condition	Section 11.8
All construction activities undertaken in accordance with good practice as set out in BS5228-1:2009+A1:2014	Developer/Contractor	Planning condition	Section 11.8
All employees on the construction site will be advised of quieter methods of operating plant and tools, and to report any damage to noise control measures as soon as they are identified	Contractor	CEMP	Section 11.8
Where practicable, for any particular activity, suitable plant, machinery and working practices will be adopted. All equipment will be maintained in good working order and will be fitted with appropriate noise controls at all times (e.g. silencers, mufflers and/or acoustic hoods)	Contractor	CEMP	Section 11.8
Construction plant capable of generating significant noise and vibration levels will be operated in a manner to minimise the duration of the higher magnitude levels	Contractor	CEMP	Section 11.8
On-site measures to control sediment entrainment to surface water during construction	Contractor	Construction Method Statement (CMS) Planning condition	Section 12.8
On-site SuDS drainage features including impermeable 'plugs' in trenching runs	Contractor	Construction Method Statement (CMS) Planning condition	Section 12.8
Protection of surface water quality from spillages of fuels, oils and other chemicals during operation	Contractor	Pollution Prevention Plan (PPP) CEMP Planning condition	Section 12.8

Environmental measure	Responsibility for implementation	Compliance mechanism	ES section reference
Flood risk considerations (surface water management) and prevention of sediment entrainment in runoff	Developer/Contractor	Planning condition	Section 12.8
Geotechnical survey (site investigation works) focussing on areas around T1, T2, T3, T4, T8 and T9. Micro-siting and standard ground stabilisation techniques as appropriate.	Developer/Contractor	Production of CMS Planning condition	Section 12.8
Geotechnical survey (site investigation works) focussing of areas around T1, T2, T3, T4, T8 and T9. Micro-siting and standard ground stabilisation techniques as appropriate.	Developer/Contractor	CMS Planning condition	Section 12.8
Construction Traffic Management Plan	Contractor	Planning condition	Section 13.8
Measures to ensure that PRoW diversions are conducted appropriately	Developer/Contractor	CEMP	Section 14.8
Shadow Flicker Control Module	Developer	Planning condition	Section 15.8
Measures to mitigate effects on telemetry link by incorporating existing UHF link into fixed microwave link band	Developer	Planning condition	Section 16.8
Limit micrositing for Turbine 5, 6 and 11 to 20m	Developer	Planning condition	Section 16.8

Monitoring

If planning permission is to be granted, there is a need to consider whether it is appropriate to impose monitoring requirements via a condition imposed on the grant of planning permission; or a planning obligation.

Monitoring, where this is required, is explained further within the relevant technical chapters.

5.5 References

Renewable UK website. Wind energy statistics explained. Available from: http://www.renewableuk.com/page/UKWEDExplained. Accessed 24 September 2018.

Welsh Government. The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017.

6 Legislative and policy overview

6.1 Introduction

This section of the Environmental Statement (ES) outlines the relevant UK wide and Welsh legislative and policy framework for the development of renewable energy schemes. Current legislation, national policies, and local policy and guidance recognise climate change as a pressing concern and outline the approach to the development and consideration of renewable energy schemes. This section sets out the considerations that proposals should have regard to.

6.2 Legislative context

This section sets out the key Acts of Parliament that set out the legislative framework for consideration of renewable energy schemes. It then sets out the national strategies and policies for renewable energy that set the UK wide and Welsh national agenda for renewable energy generation.

Climate Change Act 2008

In March 2007 the European Union announced a legally binding obligation on member states to generate 20% of its electricity by renewable means by 2020. This was followed by the UK Government's consultation on the draft Climate Change Act (2008) which aimed to introduce a clear, credible, long-term framework for the UK to achieve its goals of reducing carbon dioxide emissions and for adapting to the impacts of climate change.

One of the key provisions of the Act is the introduction of legally binding targets on greenhouse gas emissions comprising reductions of at least 80% greenhouse gas emissions by 2050, and reductions in CO_2 emissions of at least 26% by 2020, against a 1990 baseline. The generation of electricity by renewable means such as wind energy is considered to be a key contributor towards meeting these targets.

The Energy Act 2008, 2011, 2013, 2016

The Energy Act (2008) implemented the legislative aspects of the 2007 Energy White Paper. The content of the Bill included strengthening the Renewables Obligation to drive greater and more rapid deployment of renewables in the UK. The Energy Act (2011) sought to increase investment in energy efficiency whilst the Energy Act (2013) put in place measures to reform the UK energy market to attract investment. The Energy Act (2016) formally established the Oil and Gas Authority as a regulator for that sector whilst it signalled the closure of the Renewables Obligation for onshore wind.

Well-Being of Future Generations (Wales) Act 2015

This Act places a duty on public bodies (including Local Authorities) to carry out sustainable development. The Act puts in place seven well-being goals to help ensure that public bodies are all working towards the same vision of a sustainable Wales. The wellbeing goals act together to ensure outcomes across economic, environmental and social sustainability strands. One of the wellbeing goals – achieving a prosperous Wales – specifically recognises the benefits of developing a low carbon society that recognises the limits of the environment and uses resources efficiently.

Environment (Wales) Act 2016

The Environment (Wales) Act 2016 provides the Welsh Ministers with powers to put in place statutory emission reduction targets, including at least an 80% reduction in emissions by 2050 and carbon budgeting to support their delivery. The Act sets out the target within the context of existing UK and EU obligations and sets a clear pathway for decarbonisation of the Welsh energy sector.

Wales Act 2017

The Wales Act 2017 sets out a number of changes to the model of devolution and provides further powers of the Welsh Government. Amongst its provisions, decisions are devolved for energy planning development consent for projects up to 350MW onshore and offshore in Welsh waters. The Act effectively removes the Secretary of State's power under the Planning Act 2008 Act to grant development consent in relation to electricity generating stations, up to those of 350MW. Such projects are effectively transferred into the Town and Country Planning regime in Wales, if they are onshore.

UK Renewable Energy Strategy (2009)

This Strategy set out the path to be taken in order for the UK to meet its legally binding target of 15% renewable energy generation by 2020, recognising that it would involve an almost seven-fold increase in the share of renewables in just over a decade (3% of all energy was generated by renewable means in 2009)[18]. The Strategy recognised that in order to achieve this target much of the renewable electricity generated would need to come from on and offshore wind (two thirds in the lead scenario) with other technologies playing an important role. Chapter 7 of the Renewable Energy Strategy, 'Benefit and Impacts,' stated that tackling climate change is essential for maintaining a healthy, resilient natural environment. A secondary, but equally important economic consideration is quoted at paragraph 7.10 which is that the Strategy will provide important benefits for energy security allowing the nation to reduce the importation of fossil fuels.

In the UK by the end of 2010 approximately 824MW of onshore wind installed capacity had been built in England, 370MW in Wales, 2,512MW in Scotland and 310MW in Northern Ireland. Combined with offshore installed capacity of approximately 1,320MW this resulted in a total of around 5,334MW provided by wind power. The Renewable Energy Strategy expected growth in wind energy generation to be a key factor in reaching the far higher 2020 targets required for energy from renewable sources and estimated that a total of 14,000MW will be needed from onshore wind sources alone by that date. However by the end of 2010 only 4,000MW was installed. A 350% increase in onshore wind capacity over the next 10 years was therefore required to meet the Strategy targets.

UK National Renewable Energy Action Plan (2010) and UK Energy Road Map (2011)

The UK Renewable Energy Action Plan (UKREAP) was published by the UK Government and sets out how the UK plans to meet its 15% renewable energy target as required by the Renewable Energy Directive. The UKREAP, which was submitted to the European Commission, retains much existing policy, but suggests policy changes informed by an in-depth analysis of the 2009 UK Renewable Energy Strategy. The UKREAP seeks to meet the 2020 target and to "*secure our energy supplies through 2020 and beyond and provide a sound framework for business to develop in the new industries, providing jobs and cutting harmful greenhouse gases*" (para. 4). The analysis within the UKREAP concluded further policies were needed across a wide range of areas in order to fulfil the target.

[18] Table 7C, Digest of United Kingdom Energy Statistics 2010. Former Department of Energy and Climate Change

Planning Our Electric Future: A White Paper for Secure, Affordable and Low carbon Electricity (2011)

This White Paper recognized the challenges facing the nation's electricity energy markets which are security of supply and de-carbonisation matched against the decommissioning of existing plant and an anticipated rise in electricity prices. In his foreword the Secretary of State (for the former Department of Energy and Climate Change) spoke of the need for a huge investment in renewables, together with nuclear and in time gas and coal with carbon capture, restating the coalition's aim to meet the 15% renewables target by 2020.

Renewable Energy Roadmap Updates (2012/2013)

The first update (December 2012) stated that the Government estimated that onshore wind should make a contribution equivalent to around 13GW by 2020. Furthermore, it stated that its ambitions extend beyond 2020, with scope for renewable energy to meet 30-40% of all energy consumed by the UK by 2030 (para. 1.3).

Published in November 2013, the 2013 update set out the progress that has been made in renewable energy over the 2012-2013 period and it illustrates the high ambitions and the challenges ahead for the sector. It stated that the UK had made good progress, with 4.1% of its energy coming from renewable sources, which is up from 3.8% in 2012.

In Wales, from July 2012 to June 2013, renewable electricity generation increased from 2.3 TWh to 2.4 TWh – a rise of 4%. Renewable electricity in Wales accounted for 5% of the total UK renewable output during this period. The report suggested a plateau is being reached in onshore wind, which was predicted in 2011 Renewable Energy Roadmap, due to a lack of available sites.

Renewable Energy Route Map for Wales (2008)

In February 2008 the Welsh Government issued a consultation paper on further development of renewable energy in Wales. The paper recorded that Wales had signed up to the EU 20% renewable energy target by 2020 and committed the Welsh Government to a 3% annual reduction in greenhouse gas emissions (para. 25). Specifically in relation to wind power the paper identified that "*technological developments now allow construction of significantly larger 2 to 3 MW (or even higher) turbines of very high efficiency*". It was noted therefore that: "*If all potential projects were to go ahead in full, wind-farms within the TAN8 strategic search areas could produce up to 2500MW of capacity: three times the existing TAN8 indicative target for 2010*". As a result of this analysis on improving efficiency of turbines Welsh Government affirmed to "*continue to pursue the proposals in TAN 8 and monitor the uptake of wind farm sites*" and to "*review TAN8, revising upwards the old targets for renewables*" (para 7.8).

A Low Carbon Revolution: Wales' Energy Policy Statement (2010)

The Energy Policy Statement (EPS) sets the objective for Wales to become a world leader in low carbon energy following consultation on the Energy Route Map. The EPS summarises the pressing arguments to tackle climate change highlighting that: "*unless we quickly reduce our emissions of greenhouse gases, the world will probably be another 3°C hotter by 2060 and there will be much higher risks of catastrophic global climate changes*". The headline target contained within the EPS is "*to renewably generate up to twice as much electricity annually by 2025 as we use today*" (page 26). With regard to onshore wind the target identified is "*to have 4.5 kWh/d/p of installed onshore wind generation capacity by 2015/2017*" (page 14). It recognises that the average electrical power consumption per person per day in Wales is approximately 22 kWh/d/p, so this target represents 20% of electricity consumption coming from onshore wind within the 7 years following publication (to 2017).

The increased potential capacity for onshore wind identified in the 2008 Consultation Paper is affirmed. 2GW of total onshore capacity is identified, of which 0.7GW was operational or already consented, leaving 1.3GW additional capacity to be delivered by 2015/17 (Appendix 1 of the EPS). The EPS states that these higher

targets will be achieved by "*optimising the use of the existing strategic search areas set out in Technical Advice Note (TAN) 8 and keeping the TAN under review in the light of progress towards these targets*" (page 14). Whilst the 2GW target for onshore wind as set out within the EPS is anticipated as coming mainly from sites within the TAN8 Strategic Search Areas there is a requirement for a contribution from sites outside of these areas.

The Climate Change Strategy for Wales (2010)

This document sets out the Welsh Government's commitments to and strategy for managing climate change in Wales through reducing greenhouse gas emissions and enabling effective adaptation in Wales. The Strategy set targets to reduce greenhouse gas emissions in Wales by 3% every year and achieve at least a 40% reduction by 2020 compared to figures from 1990.

Energy Wales: A Low Carbon Transition (2012)

Energy Wales sets out the how the Welsh Government will work in partnership with private, public and social sectors to ensure the transition to a low carbon economy to secure a wealthier, more resilient and sustainable future for Wales. Amongst other measures, the document states that the Welsh Government seeks to make the best use of commercially proven renewable energy sources, facilitate appropriate deployment to deliver against Wales's low carbon objectives and realise the significant wealth generating opportunities Wales has.

The Welsh Government wants to provide leadership on the energy agenda in Wales. It aims to improve a number of areas to ensure the energy agenda progresses to a more low carbon format. In specific relation to delivering renewable energy the statement explains that in 2010 capacity from wind farms was 562 MW, with 62% of renewable energy coming from wind or solar. The aim moving forward is to make best use of proven renewable sources, including onshore wind, and deliver against low carbon objectives. This will include improvements to the planning and consenting regime and ensure that the necessary infrastructure for a diverse portfolio of renewable energy is delivered.

Energy Wales: A Low Carbon Transition Delivery Plan (2014)

The Energy Wales Delivery Plan set how the Welsh Government would develop proposals set out in the Energy Wales (2012) document. The Delivery Plan includes a number of themes and priority project areas which are within the gift of the devolved administration to support.

Energy Generation in Wales Report (2016)

The Energy Generation in Wales 2016 Report sets outs the latest data on energy generation from renewables, The Report states that capacity had increased in Wales in recent years. It set out that 6.9TWh of energy in Wales was from renewables and by the end of 2016 Wales had 920 MW of onshore wind capacity, capable of generating over 2.3 TWh (equivalent to 39% of Welsh homes), an increase from previous capacities. This includes the 228 MW Pen y Cymoedd wind farm, which lies with within Rhondda Cynon Taf and Neath Port Talbot and is the largest onshore wind farm in England and Wales.

Energy Generation Targets for Wales: Statement to Assembly Members (2017)

In September 2017 the Welsh Government Cabinet Secretary for Environment and Rural Affairs announced to the Welsh Assembly that the Welsh Government was setting a target for Wales to generate 70% of its electricity consumption from renewable energy by 2030 and a target for 1GW of renewable electricity

capacity in Wales to be locally owned by 2030. Additionally, it set a target for all renewable energy projects to have an element of local ownership.[19]

6.3 National planning policy context

This section sets out the national planning policy context and considers relevant UK wide policy set out in National Policy Statements (NPS), Welsh national policy set out in the Wales Spatial Plan, Planning Policy Wales 9 (PPW) and relevant supplementary Technical Advisory Notes (TAN). The section also reflects on the emerging PPW 10 and National Development Framework.

Whilst NPSs were prepared to provide guidance for the consideration of nationally significant energy infrastructure projects (projects over 50MW), the Government has stated that they may be material in the consideration of applications under the Town and Country Planning Act 1990.

Overarching National Policy Statement for Energy (EN-1) (2011)

EN-1 reiterates Government policy on energy and energy infrastructure, setting out the road to 2050 and emphasising the urgency with which global emissions must start to fall and the need for the UK to wean itself off a high carbon energy generation mix. Section 3.4 sets out the role of renewable energy as envisaged by Government. EN-1 also provides advice on 'good design'. Paragraph 4.5.3 states that applicants may have opportunities to demonstrate good design in terms of siting relative to existing landscape character, landform and vegetation.

National Policy Statement for Renewable Energy Infrastructure (EN-3) (2011)

The Statement provides guidance on a range of renewable energy technologies and their potential for likely significant effects. With regard to onshore wind, and with specific relevance to Landscape and Visual issues, it notes at 2.7.48 that *"Modern onshore wind turbines that are used in commercial wind farms are large structures and there will always be significant landscape and visual effects from their construction and operation for a number of kilometres around a site."*

It goes on to state that the arrangement of turbines should be designed to minimise effects while meeting technical and operational siting requirements. However recognition is also given to the potentially significant changes which could reduce electrical output from a resulting reduction in scale.

People, Places, Futures: The Wales Spatial Plan (2008 Update)

The Plan provides spatial policy for the whole of Wales, and provides strategies for a number of sub-regions. The remit is to provide the broad strategic direction for the spatial plan areas of Wales and to influence policy. The Wales Spatial Plan is a material consideration for local authorities when determining planning applications.

With regard to ensuring that Wales becomes a low carbon region, the Wales Spatial Plan identifies, through the Sustainable Development Commission Wales, *"each Area Group (Region of Wales) will develop plans to move towards becoming a low-carbon region, in addition to reducing their wider 'eco-footprint', going beyond the impact of carbon emissions alone."*

[19] Lesley Griffiths high on ambition for clean energy. Available via: http://www.assembly.wales/en/bus-home/pages/rop.aspx?meetingid=4644&assembly=5&c=Record%20of%20Proceedings#C494225 [accessed September 2018]

Planning Policy Wales (Edition 9) November 2016

Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government. PPW Edition 9 was adopted in November 2016. PPW, with the supporting Technical Advice Notes (TAN), Circulars and Policy Clarification letters comprise national planning policy. Chapter 12 sets out the objectives for land use planning for Infrastructure and Services, with Paragraph 12.1.4 stating that the Welsh Government will aim "*to promote the generation and use of energy from renewable and low carbon sources at all scales and promote energy efficiency, especially as a means to secure zero or low carbon developments and to tackle the causes of climate change.*" Section 12.8 to 12.10 refers to Sustainable Energy.

Paragraph 12.8.1 states that "*the Welsh Government is committed to playing its part by delivering an energy programme, which contributes to reducing carbon emissions as part of our approach to tackling climate change … whilst enhancing the economic, social and environmental wellbeing of the people and communities of Wales in order to achieve a better quality of life for our own and future generations. This is outlined in the Welsh Government's Energy Policy Statement Energy Wales: A Low Carbon Transition (2012)".*

Relevant to the scope of the EIA, Paragraph 12.10.1 states that when considering applications for renewable energy a number of factors should be considered:

- The contribution a proposal will play in meeting targets and potential for renewable energy including the contribution to cutting greenhouse gas emissions;
- The wider social, environmental and economic benefits and opportunities;
- The impact on the natural heritage, the coast and the historic environment;
- The need to minimise impacts on local communities, to safeguard quality of life for existing and future generations;
- Ways to avoid, mitigate or compensate adverse impacts;
- The impacts of climate change upon the development itself;
- Grid connection issues; and
- The capacity of and effects upon the transportation network.

Planning Policy Wales (Edition 10) Draft (Emerging)

The Welsh Government has consulted on the text of a revised Planning Policy Wales 10 which seeks to fully integrate the seven goals of the Well-Being of Future Generations Act. Amongst the changes proposed to PPW 9, the draft PPW 10 states that Renewable and low carbon energy projects are in principle appropriate in all parts of Wales and planning authorities should ensure that development plan policies are supportive of such projects (paragraph 4.126).

National Development Framework (NDF) (Emerging)

Draft PPW 10 also sets out the role of the emerging National Development Framework (NDF) in the Welsh national planning policy framework. The NPF will be a 20-year framework that will concentrate on development and land use issues in Wales related to nationally important growth and infrastructure.

The Welsh Government published a Consultation Document related to the NDF on a series of issues, options and preferred option in April 2018. The Consultation Document states that Decarbonisation & Climate Change is one of three key placemaking themes to drive policies across Wales.

The draft NDF is due to be consulted on in July 2019 and adopted by Welsh Government in September 2020. When adopted it will replace the Wales Spatial Plan.

Technical Advice Note (TAN) 8 Planning for Renewable Energy (2005)

Technical Advice Note 8 (TAN8) was published to provide technical advice to supplement Welsh national policy. It provides guidance to local authorities, industry, government and agencies for the development of all renewable energy technologies, with particular focus on onshore wind power. Section 1 of TAN 8 reiterates the UK target at that time that 10% of electricity production should come from renewable sources by 2010 and sets out the Assembly's then target of 4TWh of electricity per annum to be produced by renewable energy by 2010 and 7TWh by 2020. The TAN concludes that 800MW of additional installed capacity is required from onshore wind sources to meet these targets. This target has now increased and is reflected in the PPW 9 (2016).

Information relevant to the EIA is contained mainly within Annex C. Annex C provides a description of Renewable Energy Technologies, including onshore wind and provides advice on a number of issues associated with such technology. With regard to noise, Annex C makes recommendations regarding best practice including paragraph 2.14 which states that "*well designed wind farms should be located so that increases in ambient noise levels around noise-sensitive developments are kept to acceptable levels with relation to existing background noise. This will normally be achieved through good design of the turbines and through allowing sufficient distance between the turbines and any existing noise-sensitive development*."

Annex C paragraph 2.16 states that "*The report "The Assessment and Rating of Noise from Wind Farms" (ETSU-R-97), describes a framework for the measurement of wind farm noise and gives indicative noise levels calculated to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development or adding unduly to the costs and administrative burdens on wind farm developers or planning authorities. The report presents the findings of a cross-interest Noise Working Group and makes a series of recommendations that can be regarded as relevant guidance on good practice."*

Other advice is provided on matters such as low frequency noise and vibration. Paragraph 2.17 states "*There is no evidence that ground transmitted low frequency noise from wind turbines is at a sufficient level to be harmful to human health*." and in relation to vibration studies "*Vibration levels 100m from the nearest turbine were a factor of 10 less than those recommended for human exposure in critical buildings*".

Advice is also provided on environmental topics such as Landscape and Visual, Ecology and Ornithology, Shadow Flicker and Reflected Light, Icing, Aviation, Archaeology and proximity to Highways and Railways. In each instance TAN8 is clear that a well-designed and located wind farm, which has been the subject of consultation with the appropriate consultees should not create environmental effects that are so significant as to warrant the refusal of an application.

Letter to Chief Planning Officers (July 2011)

In July 2011 the Minister for Environment and Sustainable Development wrote to Chief Planning Officers to confirm the Welsh Government's position regarding the maximum capacities for onshore wind in Wales, including individual TAN 8 Areas. The Ministerial Letter limited the development of large scale wind farms to the seven Strategic Search Areas (SSAs). Of relevance to Neath Port Talbot are:

- SSA E (Pontardawe) – Maximum capacity of 152MW.
- SSA F (Coed Morgannwg) – Maximum capacity of 430MW.

Technical Advice Note 5: Nature Conservation and Planning (2009)

TAN5 provides advice about how the land use planning system should contribute to protecting and enhancing biodiversity and geological conservation within Wales. It sets out the key principles of planning for nature conservation for both local development plans and when deciding planning applications that may affect nature conservation. These include:

- Being mindful of the principles of sustainable development, environmental limits, the precautionary principle;
- contributing to the protection and improvement of the environment;
- promoting the conservation and enhancement of statutorily designated areas and undeveloped coast;
- ensuring that appropriate weight is attached to designated sites of international, national and local importance;
- protecting wildlife and natural features in the wider environment;
- ensuring that all material considerations are taken into account and decisions are informed by adequate information about the potential effects of development on nature conservation;
- ensuring that the range and population of protected species is sustained; and
- avoiding harm to nature conservation, minimising unavoidable harm by mitigation measures, offsetting residual harm by compensation measures and looking for new opportunities to enhance nature conservation.

Technical Advice Note 6: Planning for Sustainable Rural Communities (2010)

TAN6 provides guidance on sustainable rural economies, rural services and housing and agriculture. It notes that planning authorities should support the diversification of the rural economy and that the planning system has a key role to play in supporting the delivery of sustainable rural communities. It goes on to consider the range of rural matters that the planning system should address from homes and employment opportunities to rural services whilst protecting and enhancing the natural and historic environment and safeguarding the countryside and open spaces. It also notes the need to respond to the challenges posed by climate change and identifies that one method which can contribute to this is renewable energy generation, particularly using local renewable sources. In paragraph 3.7.2, TAN6 considers farm diversification and notes the range of activities which can be sustainably located on farms and notes that the production of renewable energy is likely to be an appropriate use.

Technical Advice Note 11: Noise (1997)

TAN 11 provides advice on how the planning system can be used to minimise the adverse impact of noise, without placing unreasonable burdens on applicants. Local planning authorities must ensure that noise generating development does not cause an unacceptable degree of disturbance. They should also bear in mind that if subsequent intensification or change of use results in greater intrusion, consideration should be given to the use of appropriate conditions.

Detailed guidance on noise from wind turbines is contained in Planning Guidance (Wales), *Technical Advice Note (Wales) 8,* '*Renewable Energy*', Welsh Office, 1996, Annex A, paragraphs A28-A38.

Technical Advice Note 12: Design (2016)

The purpose of this TAN is to equip all those involved in the design of development with advice on how 'promoting sustainability through good design' may be facilitated through the planning system and the preparation and validation of mandatory design and access statements.

There are a number of key objectives in relation to design which are set out by TAN 12:

- Access - Ensuring ease of access for all;

- Character - Sustaining or enhancing local character, promoting legible development, promoting a successful relationship between public and private space, promoting quality, choice and variety and promoting inclusive design;
- Community Safety - Ensuring attractive, safe public spaces and security through natural surveillance;
- Environmental Sustainability - Achieving efficient use and protection of natural resources, enhancing biodiversity and designing for change; and
- Movement - Promoting sustainable means of travel.

Technical Advice Note 19: Telecommunications (2002)

This TAN deals with both the creation of telecommunication links and also the potential for radio interference from proposed development. It notes that large prominent structures such as wind farms can cause disruption to television and other telecommunications services due to the physical obstruction. It puts the onus on local planning authorities to satisfy themselves that the potential for interference has been fully taken into account in the siting and design of such developments, and appropriate mitigation built into the scheme if necessary.

Technical Advice Note 23: Economic Development (2014)

TAN 23 sets out guidance for the approach to economic development. Under section 3, TAN 23 reaffirms the importance of sustainable economic development in rural areas. Under paragraph 2.1.13 the TAN restates that the planning system should support (inter alia) the low-carbon economy. TAN 23 states that the balance between economic benefits and social and environment impacts need to be carefully weighed up and decisions on each case will depend on local circumstances.

6.4 Planning policy context

This section sets out the local planning policy context including the Neath Port Talbot Local Development Plan (LDP) (2011-2026) and relevant Supplementary Planning Guidance (SPG).

The adopted LDP is the starting point for consideration of planning applications within Neath Port Talbot. There are also a range of SPG documents in place for Neath Port Talbot which are also relevant to the consideration of the scheme. SPG supplement and explain the policies in the adopted LDP. SPG do not form part of the Development Plan but act as a material consideration in the decision making process.

Neath Port Talbot Local Development Plan (2011-2026) (2016)

The site falls within the administrative boundaries of Neath Port Talbot County Borough Council. Section 38 of the Planning and Compulsory Purchase Act 2004 sets out what constitutes the Development Plan. The Development Plan for Neath Port Talbot CBC is the Neath Port Talbot Local Development Plan (LDP) (2016) adopted in January 2016. The LDP replaced the Neath Port Talbot Unitary Development Plan which was adopted in 2008 and was in place when the original application was submitted.

The LDP sets out the policies to guide development in Neath Port Talbot up to 2026. The LDP sets out the vision for Neath Port Talbot and includes 25 objectives which address the key issues for the County Borough. There are four LDP objectives which are particularly relevant for the proposal:

- Objective 1: Minimise the causes and consequences of climate change through reduced greenhouse gas emissions and adapt to climate change through consideration of its effects in the design and location of new development.

- Objective 15: Conserve Neath Port Talbot's important landscapes, countryside, undeveloped coast, important wildlife, habitats and geodiversity sites, ensuring that developments throughout the County Borough respect all landscapes and minimise adverse impacts.
- Objective 19: To make a proportionate contribution towards the energy needs of Wales with a focus on renewable energy.
- Objective 22: Reduce impacts of traffic growth and congestion and promote the efficient and effective use of the transport network.
- Objective 23: Protect and enhance the County Borough's historical heritage, built environment and identity.

The LDP sets out its policies across a range of themes. Of particular relevance are:

- Overarching Policies;
- Area based policies; and
- Topic Based Policies:
  - The Economy;
  - Environment and Resources;
  - Transport and Access; and
  - Culture and Heritage.

The LDP polices relevant for the proposed development are included in **Table 6.1**. The policies are considered in more detail in the relevant following technical chapters of the ES (**Chapters 7** to **18**).

Table 6.1 Neath Port Talbot Local Development Plan (LDP) Policies

Theme	Adopted LDP policy	Policy summary
Overarching Policies	SP1 Climate Change	The policy sets out overall approach to climate change and includes (at criteria 4) the County Borough making an appropriate contribution to renewable and low carbon energy generation.
	SP2 Health	The policy sets out that a number of measures to reduce high levels of ill health including (inter alia) through reducing exposure to elements that could adversely affect ill through new development.
	SC1 Settlement limits	Development outside settlements identified in the hierarchy will be only be permitted where associated with certain types of development including (under 10.) that associated with either agriculture, forestry, minerals or energy generation.
	SP4 Infrastructure	Developments will be expected to make efficient use of existing infrastructure and make adequate provision, where required, ensuring no detrimental effects on the area.
	I1 Infrastructure requirements	In addition to necessary improvements to infrastructure additional works/funding may, where appropriate, be required to ensure that the impact of development is mitigated including (inter alia) provision for biodiversity and environmental interest, community facilities.

Theme	Adopted LDP policy	Policy summary
Area Based Policies	SP6 Development in the Valleys Strategy Area	The policy sets out policy approach to reinvigorating the economic and communities of the valleys area through a number of area-specific measures.
Topic Based Policies: **The Economy**	SP 11 Employment Growth	The policy supports existing employment uses and expanding employment development through specific measures. They include taking a flexible approach to employment proposals in the Valleys Strategy Area.
	SP 13 Tourism	The economic prosperity will be promoted through encouraging high quality tourism, resisting proposals that would result in the loss of tourism facilities and allocating land for tourism development, where appropriate.
	TO 4 Walking and cycling routes	The policy defines a number of routes where proposals that would have an adverse impact on their implementation would be resisted. This includes TO 4/3 Great Dragon Ride Route.
Topic Based Policies: **Environment and Resources**	SP 14 The Countryside and undeveloped coast	The policy seeks the protection of the countryside and undeveloped coast by (inter alia) allowing only appropriate development outside settlements, the designation and protection of Special Landscape Areas and protection of Green Wedges.
	EN 2 Special Landscape Areas	The policy designates Special Landscape Areas. The site is within Foel Trawsnant (EN2/6) SLA. The policy only permits development where it is demonstrated that there are no significant adverse impacts the features and characteristics for which the SLA is designated.
	SP 15 Biodiversity and Geodiversity	The policy sets out the approach to the protection, conservation, enhancement and management of important habitats, species and sites of geological importance.
	EN 6 Important Biodiversity and Geodiversity Sites	The policy states that proposals that would affect Regionally Important Geodiversity Sites (RIGS), Local Nature Reserves (LNRs), Sites of Interest for Nature Conservation (SINCs), sites meeting SINC criteria or sites supporting Local Biodiversity Action Plan (LBAP) or S42[20] habitats or species will only permitted where they conserve and where possible enhance importance of the site or development could not reasonable be located elsewhere. Mitigation/compensation will need to be agreed where adverse effects are unavoidable.
	EN 7 Important Natural Features	The policy only supports proposals where an adverse effect on ecologically or visually important natural features such as trees, woodlands, hedgerows / field boundaries, watercourses or ponds where full account has been taken of the relevant features to ensure they are retained and enhanced, where possible, or where the feature has been taken into account and where removal is unavoidable, mitigation measures are agreed.
	SP 16 Environmental Protection	The policy seeks the protection of air, water and ground quality and the environment generally through measures that include (inter alia) ensuring proposals have no significant adverse effects on the quality of these features and do not significantly increase pollution levels.
	EN 8 Pollution and Land Stability	The policy seeks to avoid unacceptable risk from (inter alia) air pollution, noise pollution, light pollution and states that proposals which would create new problems or exacerbate existing issues will not be acceptable unless mitigation is in place.

[20] Now S7 under the Environment (Wales) Act 2016

Theme	Adopted LDP policy	Policy summary
	M1 Development in Mineral Safeguarding Areas	The policy sets out criteria for assessment of proposals within mineral safeguarding areas. The site falls within an area safeguarded for sandstone resource.
	SP 18 Renewable and Low Carbon Energy	Through this policy the County Borough seeks a proportionate contribution to meeting national renewable energy targets and energy efficiency targets whilst balancing the impact of development on the environment and communities. This includes encouraging all forms of renewable/low carbon technologies, where appropriate, and ensuring there is no unacceptable impact on the environment and amenity.
	RE 1 Criteria for the Assessment of Renewable and Low Carbon Energy Development	This criteria-based policy which allows an assessment This includes a criterion related to ensuring large scale wind farm developments (>25MW) will be expected to be located within the boundaries of the refined Strategic Search Areas. Additionally all schemes will be required to demonstrate compliance with five criteria related to visual amenity and natural environment, high ways safety, radar, and site restoration (where appropriate).
Topic Based Policies: **Transport and Access**	SP 20 Transport Network	The policy ensures the transport system and infrastructure will be developed in a safe, efficient and sustainable manner through a number of measures including (inter alia) restricting development which would have an unacceptable impact on highway safety and requiring proposals to provide safe and efficient access.
	TR 2 Design and Access of New Development	The policy includes a number of criteria related to design and access which ensures highways safety is not compromised, developments is accessible and Transport Assessments and Travel Plans accompany proposals, where appropriate.
Topic Based Policies: **Culture and Heritage**	SP 21 Built Environment and Historic Heritage	The policy seeks to conserve and enhance the built environment and historic heritage by (inter alia) encouraging high quality design, safeguarding features of historic/cultural importance and identification of designated sites to enable protection and enhancement, where possible.
	BE 1 Design	Requires all development proposals to be of a high quality design which takes into account its context. The policy sets out ten criteria which must be met to satisfy the policy including: complementing and enhancing character and appearance of the site; respecting the context of the site and its place in the landscape; and using land efficiently.

Planning Obligations: Supplementary Planning Guidance (2016)

The Planning Obligation: Supplementary Planning Guidance (SPG) was adopted by Neath Port Talbot County Borough Council in October 2016. The SPG supplements LDP policies SP4: Infrastructure and I1: Infrastructure Requirements. The SPG sets out how planning obligations are necessary to ensure that developments are integrated into the local environment and fully sustainable. The SPG provides guidance on the potential approaches to providing developer contributions: either through 'in kind' contributions, where the developer provides the necessary infrastructure or facilities directly to fulfil the obligation, or through financial contributions to the Council, where monies are provided by the developer to enable the necessary infrastructure or facilities to be brought forward. The SPG also provides guidance on the process for reaching agreements.

Renewable and Low Carbon Energy: Supplementary Planning Guidance (2017)

The Renewable and Low Carbon Energy: Supplementary Planning Guidance (SPG) was adopted by Neath Port Talbot County Borough Council in July 2017. The SPG provides further detail on the consideration of application of LDP policies on renewable energy. The SPG sets out guidance for the implementation of Policy RE1 (Criteria for the Assessment of Renewable and Low Carbon Energy Development) with a focus on:

- The assessment of landscape and visual impacts;
- Cultural and historic heritage impacts;
- Biodiversity;
- Grid connections;
- Mitigation measures;
- Renewable energy and mineral resources; and
- Design and construction.

Landscape and seascape: Supplementary Planning Guidance (2018)

The Landscape and Seascape: Supplementary Planning Guidance (SPG) was adopted by Neath Port Talbot County Borough Council in May 2018. The SPG sets out guidance for interpretation of the landscape policies in the LDP and includes an explanation of how landscape and seascape considerations are dealt with in the planning process. The SPG expands upon Policy EN2: Special Landscape Areas of the LDP and sets out the features and characteristics of each Special Landscape Area (SLA) defined within Neath Port Talbot.

Biodiversity and geodiversity: Supplementary Planning Guidance (2018)

The Biodiversity and Geodiversity: Supplementary Planning Guidance (SPG) was adopted by Neath Port Talbot County Borough Council in May 2018. The SPG sets out guidance for interpretation of the biodiversity and geodiversity policies of the LDP (SP15: Biodiversity and Geodiversity; EN6: Important Biodiversity and Geodiversity Sites and EN7: Important Natural Features). The SPG sets out an approach to consider biodiversity holistically in the application process.

6.5 Other relevant policies

Swansea Bay City Region Economic Regeneration Strategy 2013–2030 (2013)

The Swansea Bay City Region was established by Welsh Government in 2013 to help drive forward growth and investment in the area. The Swansea Bay City Region includes the Local Authority areas of Pembrokeshire, Carmarthenshire, the City and County of Swansea and Neath Port Talbot. The Regeneration Strategy looks to support South West Wales and future economic development and represents an ambitious new economic growth plan for the region. The Regeneration Strategy sets out a vision for 2030 which includes the City Region being a leading centre for renewable energy.

6.6 Required authorisations

Table 6.2 summarises the authorisations required for the proposed wind farm development.

Table 6.2 Summary of required authorisations

Interest feature/ activity	Summary of legislative context	Requirement
Legally protected and controlled species	Many species of animal and plant are protected by law and works that could affect any of these species require special consent. For species protected under *The Conservation of Habitats and Species Regulations 2017 (SI 2017 No. 1012)* (e.g. bats, great crested newt or otter), licences are required from Natural Resources Wales (NRW) for any activities that will injure or kill an animal of a protected species or damage or destroy its breeding site or resting place. For European protected species of plants a licence is required for an activity which results in cutting, uprooting or destroying a plant of that species. Under the *Protection of Badgers Act 1992*, a licence is required, from NRW, for any activity that will disturb badgers or their setts. Works that affect species that are protected solely under the *Wildlife & Countryside Act 1981* may require a licence from NRW. The *Wildlife & Countryside Act 1981* also includes controls over specified non-native species.	Specific licences will be required from NRW for any work affecting certain species
Footpath diversion	Diversion of a footpath or other public right of way will require an Order under Section 257 of the *Town and Country Planning Act 1990* or Section 119 of the *Highways Act 1980*.	An Order will be required from the local planning authority or the Welsh Government
Road closures and road diversion	Temporary and permanent road closures or restrictions due to development will require Orders under Section 247 of the *Town and Country Planning Act 1990*	An Order will be required from the Welsh Government
Equipment in roads	Licences may be required under Section 50 of the *New Roads and Street Works Act 1991*.	Licences will be required from the relevant highway authority (or from the street managers in the case of an un-adopted road)
Land drainage (ordinary watercourse)	Certain works that may affect an 'ordinary watercourse' (i.e. non-main river) require consent under Section 23 of the *Land Drainage Act 1991*.	Consent will be required from the relevant Lead Local Flood Authority

7 Landscape and Visual Impact Assessment

7.1 Introduction

This chapter of the ES assesses the likely significant landscape and visual effects of the proposed development. The Landscape and Visual Impact Assessment (LVIA) should be read in conjunction with the development description provided in **Chapter 5**.

This assessment is an update of the LVIA presented in the 2014 ES (ref 24311rr073i1) for a 13-turbine wind farm on land at Foel Trawsnant with a blade tip height of 120m and hub height of 85m which was subsequently approved. A review of the 2014 LVIA for the approved (subject to s106 agreement) 13 turbine layout has informed the parameters of this updated assessment for the 11 turbine amendment as set out in Sections 7.6 and 7.7.

7.2 Limitations of this assessment

There are no limitations relating to landscape and visual issues that affect the robustness of the assessment of the potential likely significant effects of the proposed development.

7.3 Policy and legislative context

Planning policy

Table 7.1 lists the issues from the relevant planning policies that have been considered in assessing landscape and visual effects.

Table 7.1 Policy issues considered in preparing the landscape and visual impact assessment

Policy reference	Policy issues	Considered in section
National planning policies		
Overarching National Policy Statement for Energy (EN-1) (July 2011).	Paragraph 4.5.3 provides advice on 'good design' and refers to opportunities for energy developments to demonstrate good design in terms of siting to relative to existing landscape character, landform and vegetation. Section 5.9 deals with landscape and visual issues. It states that LVIAs should refer to existing landscape character assessment i.e. LANDMAP in Wales. Developments should be designed to minimise harm to the landscape. Section 5.9 states that particular attention should be paid to policies in Local Development Plans (LDPs) in Wales that are based upon landscape character assessment but that local landscape designations should not be used in themselves to refuse consent. Paragraphs 5.9.15 – 5.9.17 provide landscape and visual judgement criteria.	Section 7.10 **Appendices 7B & 7D**
National Policy Statement for Renewable Energy Infrastructure (EN-3). (July 2011).	Paragraphs 2.7.48 and 2.7.49 note that significant landscape and visual effects will always be generated by the construction and operation of modern onshore wind turbines and that the arrangement of wind turbines should be carefully designed to minimise landscape and visual effects.	Sections 7.10 & 7.11

Policy reference	Policy issues	Considered in section
	Paragraph 2.7.51 notes that mitigation in the form of a reduction in turbine scale and height may not be feasible without significantly affecting a wind farm's electricity generating output.	**Appendices 7B, 7D, 7E & 7F**
Planning Policy Wales (Edition 9) (November 2016)	PPW9 sets out the land-use planning policies of the Welsh Government and forms a strategic framework to guide development. LVIA issues are included in Chapter 5 – Conserving and Improving Natural Heritage and the Coast. Amongst the statements of particular relevance to the Foel Trawsnant Wind Farm amendments are those concerning statutory landscape designations i.e. National Parks and AONBs, including paragraph 5.3.7 that states that the duty to have regard to their purposes applies to activities affecting these areas whether those activities are located within or outside a National Park or an AONB. Paragraph 5.3.11 notes that non-statutory designations such as Special Landscape Areas can add value to the planning process but should not unduly restrict acceptable development. Paragraph 5.3.13 concerns the use of LANDMAP and its role in informing landscape assessments needed to inform local authorities in making local policy, guidance and decision making.	Section 7.10 **Appendices 7B & 7D**
Technical Advice Note (TAN) 8: Planning for Renewable Energy (2005)	TAN 8 provides technical advice to supplement Planning Policy Wales. It utilises the concept of Strategic Search Areas (SSAs): seven areas across Wales identified through technical reviews where large scale wind energy developments should be concentrated. Foel Trawsnant Wind Farm is located in SSA F – Coed Morgannwg. The boundaries of SSA F were refined, primarily using a landscape and visual assessment exercise, in 2006 commissioned by a consortium of local authorities in South Wales. The results set out in TAN 8 Annex D study of the Strategic Search Areas E and F: South Wales Valleys Final Report. Section 8.4 of Appendix D of TAN 8 states that within and immediately adjacent to SSAs it is accepted that wind turbine development will result in significant change in landscape character.	Section 7.10 **Appendices 7B & 7D**
Development plan policies		
Neath Port Talbot County Borough Council Local Development Plan (2011 – 2026). Adopted January 2016.	Strategic Policy SP14: The Countryside and the Undeveloped Coast concerns the protection of open countryside outside of settlement limits and introduces the local landscape designation: Special Landscape Areas (SLAs).	Section 7.10 **Appendices 7B & 7D**
Neath Port Talbot County Borough Council Local Development Plan (2011 – 2026). Adopted January 2016.	Strategic Policy SP18: Renewable and Low Carbon Energy seeks to ensure that development will not have an unacceptable impact on the environment and amenity of local residents.	Sections 7.10 & 7.11 **Appendices 7B, 7D, 7E & 7F**
Neath Port Talbot County Borough Council Local Development Plan (2011 – 2026). Adopted January 2016.	Policy EN2: Special Landscape Areas introduces six Special Landscape Areas (SLAs) that have been defined across the Borough in order to protect areas of highest landscape quality. Renewable energy developments located within SLAs will need to demonstrate that component elements have been designed and sited to minimise visual intrusion and adverse landscape effects.	Section 7.10 b
Neath Port Talbot County Borough Council Local Development Plan (2011 – 2026). Adopted January 2016.	Policy RE 1: Criteria for the Assessment of Renewable and Low Carbon Energy Development subparagraphs 4(a) and 4(b) state that all renewable energy development proposals minimise impacts on visual amenity and	Section 7.11 **Appendices 7E, 7F & 7G**

Policy reference	Policy issues	Considered in section
	the natural environment, and will not result in unacceptable impacts on residential amenity.	
Neath Port Talbot County Borough Council Supplementary Planning Guidance: Renewable and Low Carbon Energy. July 2017.	This document expands upon the Local Development Plan policies relating to Renewable and Low Carbon Energy including Policy RE1 and outlines how the relevant plan policies will be applied.	Sections 7.10 & 7.11 **Appendices 7B, 7D, 7E & 7F**
Neath Port Talbot County Borough Council Supplementary Planning Guidance: Landscape and Seascape. May 2018	This document expands upon Policy E2 of the Local Development Plan sets out the features and characteristics of each Special Landscape Area (SLA) defined within Neath Port Talbot.	Section 7.10 **Appendices 7B & 7D**

Legislative context

The European Landscape Convention 2000 Treaty Series No. 36

The European Landscape Convention (ELC) is a Council of Europe initiative that provides a broad framework for landscape planning and management across all member states including the UK, which ratified the ELC in 2007. The ELC defines landscape as, "*an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors*." and is committed to several core principles and actions. These commitments are implemented by existing domestic policy and legislation rather than through any ELC-specific framework.

Well-Being of Future Generations (Wales) Act 2015

This Act places a duty on public bodies (including Welsh Ministers) that they must carry out sustainable development. The Act puts in place seven well-being goals to help ensure that public bodies are all working towards the same vision of a sustainable Wales. In relation to landscape matters, the most relevant well-being goal is the achievement of 'a resilient Wales', which would include the need to conserve and enhance statutorily designated areas, the countryside and the undeveloped coast and the conservation of biodiversity, habitats and landscapes.

National Parks and Access to the Countryside Act 1949

This Act provided the framework for the creation of National Parks and Areas of Outstanding Natural Beauty, including the Brecon Beacons National Park which lies within the Defined Study Area. One of a National Park's statutory duties is the promotion of public understanding and enjoyment of each Park's special qualities steered by a National Park Authority as guided by each Park's statutory Management Plan.

Environment (Wales) Act 2016

The Environment (Wales) Act 2016 requires, under Section 6 – Biodiversity and resilience of ecosystems duty, that a public authority must seek to maintain and enhance biodiversity and promote the resilience of ecosystems. This requirement could be interpreted to include landscape as part of the ecosystems approach.

Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017

The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 require under Part 1, Section 4 (2)(d) that the environmental impact assessment must identify, describe and assess the direct and indirect significant effects of the proposed development upon the landscape.

Technical guidance

The LVIA and Cumulative Landscape and Visual Impact Assessment (CLVIA) has been undertaken in accordance with the methodology set out in **Appendix 7A** and conforms to the *Guidelines for Landscape and Visual Impact Assessment, Third Edition* (GLVIA3) which is widely accepted throughout the UK as the appropriate approach to use. A complete description of the LVIA methodology is contained in **Appendix 7A**.

Other technical guidance referred to in undertaking the LVIA includes:

- LANDMAP *Information Guidance Note 3: Using LANDMAP for Landscape and Visual Impact Assessment of Onshore Wind Turbines* (May 2013) Natural Resources Wales (NRW);
- *Designing Wind Farms in Wales* (2014);
- *Siting and Designing Wind Farms in the Landscape: Guidance* (2017);
- *Visual Representation of Wind Farms: Guidance* (2017);
- *Assessing the Cumulative Impact of Onshore Wind Developments* (2012); and
- *Landscape Institute Advice Note 01/11 Photography and photomontage in landscape and visual impact assessment* (2011).

A full list of references can be found in Section 7.16.

7.4 Data gathering methodology

Definition of the Study Areas

The LVIA uses four study areas which reflect best practice and seek to concentrate different aspects of the LVIA upon the landscape and visual receptors that have the greatest potential to sustain significant effects. The study areas used are:

- The defined study area; a site-centred 23km radius circle (**Figure 7.1**) in accordance with Wales-specific advice provided by NRW;
- The detailed study area; a site-centred 15km radius circle (**Figure 7.1**) in accordance with Wales-specific advice provided by NRW;
- The cumulative study area extending 23km from the site centre (**Figure 7.58**) in accordance with Wales-specific advice provided by NRW; and
- The residential visual amenity assessment study area extending 1.5km from any turbine (**Figure 7.31**).

Desk study

Sources of information used for the landscape and visual assessment are listed in **Table 7.2**.

Table 7.2 Sources of desk study information

Source	Data
Ordnance Survey (OS) mapping	Explorer series scale 1:25,000 (Sheets 165 Swansea and 166 Rhondda and Merthyr Tydfil)
NRW	GIS datasets for LANDMAP Geological Landscape Aspect Areas (GLAA), Landscape Habitats Aspect Areas (LHAA), Visual and Sensory Aspect Areas (VSAA), Historic Landscape Aspect Areas (HLAA) and Cultural Landscape Aspect Areas (CLAA) within Neath Port Talbot, Bridgend and Rhondda Cynon Taff Afan Valley Forest Design Plan – Management Systems Map
Neath Port Talbot County Borough Council	Landscape and Seascape Supplementary Planning Guidance (2018).
Bridgend County Borough Council	Designation of Special Landscape Areas (2010)
Forestry Commission Wales	Guides for the Rheilffordd Trail and Penhydd Trail Trail cards for the Tarren Forgen Trail, Afan Woodland Walk, River and Railway Walk, Gyfylchi Ridgetop Trail, Argoed Walk and Pencraig Isaf Walk.
Sustrans	National Cycle Network maps
Google Earth Pro	Aerial photography (imagery date August 2016)

Reference has also been made to the previous LVIA contained within the ES and associated technical appendices (24311rr073i1, Amec Environment & Infrastructure Ltd[21], 2014) submitted under application number P2014/0825.

Zones of Theoretical Visibility (ZTVs)

In addition to the sources of data listed in **Table 7.2** which have been reviewed as part of the desk study, a series of computer generated Zone of Theoretical Visibility (ZTV) maps has been prepared to determine the potential extent that the proposed development would be visible to visual receptors located in the surrounding areas. ZTV is defined in GLVIA3 as "*a map, usually digitally produced, showing areas of land within which a development is theoretically visible*" and represents the desk top component of the visibility analysis.

The ZTVs have been calculated using software that has been developed for use in respect of wind farms together with a Digital Terrain Model (DTM) (OS Terrain 5 within the 15km radius detailed study area and 'Landform Panorama' 50m DTM data for distances between 15km and 23km) to calculate the areas from where it would be potentially possible for the upper blade tip or the hub of one or more of the proposed turbines under the final turbine layout to be seen. Separate blade tip (145m) and hub height (100m) ZTVs have been produced for the detailed and defined study areas. Two versions of each ZTV have been produced; one taking account of the screening effects of forestry and one taking no account of the screening effects of forestry (i.e. a 'bare-earth' scenario). These ZTVs are shown in **Figures 7.2 – 7.9.** A further ZTV has been calculated for ground level construction activity within the detailed study area using a height of 2m as the modelled parameter and is illustrated in **Figure 7.10**.

Survey work

A number of site visits and photographic records were undertaken throughout 2012-2014 to inform the 2014 LVIA. These have been supplemented by a site visit undertaken in early February 2018 to verify any baseline

[21] Now Wood

updates including baseline conditions at the residential properties included in the residential visual amenity assessment. The five internal viewpoint panoramas have also been re-photographed.

7.5 Overall baseline

Current baseline

The proposed site area and its context

The site area

The site area measures ~118ha (although the land for which planning permission is sought, within which all infrastructure will be located, measures only ~46.5ha) and is located on the southern and western slopes of Foel Trawsnant between the Llynfi Valley to the south and east and the Afan Valley to the north. The site is ~2.3km to the north-north-west of Maesteg. The agglomerated settlements of Brynheulog, Caerau, Dyffryn, Spelter and Nantyffyllon occupy the lower slopes and floor of the Llynfi Valley and form a northern extension of Maesteg. The smaller, more nucleated settlements of Cynonville and Duffryn Rhondda are located on the lower southern slopes of the Afan Valley to the north and north-east of the site area.

The site occupies a position toward the northern end of the higher ground between the Afan and Llynfi Valleys and includes the highest point on Foel Trawsnant, at 371m AOD. The majority of the land within the site is given over to pasture in the form of semi-improved grassland although there is some dense scrub associated with the Nant yr Hwyaid Valley which incises the northern part of the site and some other areas of bracken around the site's perimeter. Pasture remains the dominant landcover across the remainder of the massif to the north of the site, which is also host to several large and prominent spoil heaps. The extensive coniferous plantations comprising the Afan Forest cover much of the upland area to the south of the site.

The wind farm site is aligned on a roughly north-west to south-east axis. Elevations within the site area generally fall gradually to the north-west, with steeper slopes associated with the valley of Nant yr Hwyaid, which flows into the Afon Afan and bisects the north-western part of the site. The northern flank of Foel Trawsnant lies to the north-east of Nant yr Hwyaid and Cefn yr Argoed lies to the south-west. The north-western boundary of the site lies at elevations slightly below 250m AOD on the higher ground to either side of Nant yr Hwyaid and at 219m AOD at its lowest point in the valley itself.

The site's relative elevation and location at the northern end of the higher ground the separates the Afan and Llynfi Valleys provides the site area with a moderately prominent role in the immediate setting of the nearby settlements to the north and east, although the higher ground to the north and east of these settlements has a more prominent role in the landscape setting even at this local level. The primary aesthetic qualities of the proposal site and its immediate environs are its large scale and senses of exposure and isolation. The sense of exposure has been increased in recent years by relatively extensive felling of some of the adjacent coniferous plantations that border the area. Its sense of isolation stems from the lack of settlement at the highest elevations and from the unavailability of views into adjacent areas because of the steep slopes surrounding the area. A series of panoramic photographs taken from five locations within the site area are provided on **Figures 7.12 - 7.16** along with a viewpoint location plan on **Figure 7.11** whilst the Phase 1 Habitat Map, shown on **Figure 9.2**, illustrates land cover within the site area.

The site's wider context

As shown in the topographical plan contained in **Figure 7.17** to the immediate east and north-east of the site the upland valley of Nant Tryfal separates the site from Foel y Dyffryn which rises to ~360m AOD and separates Foel Trawsnant from the northernmost parts of the Llynfi Valley. To the south and south-east of the site Garn Wen also rises to above 360m AOD, separating Foel Trawsnant from those parts of the Llynfi Valley

to the south of Nantyffyllon. Between Foel y Dyffryn and Garn Wen the land falls rapidly from the site boundary directly into the Llynfi Valley. The upland valley of Cwm yr Argoed lies to the immediate south-west of the site boundary, within the Afan Forest. Beyond Cwm yr Argoed elevations rise again to reach ~360m AOD at Pen Disgwylfa and ~320m AOD at Mynydd Penhydd. To the immediate north and north-west of the site boundary elevations continue to fall gradually into the Afan Valley, the floor of which has an elevation of ~100m AOD in the vicinity of the settlements of Duffryn Rhondda and Cynonville.

Similar patterns of vegetation cover to those within the site boundary are found across the adjacent landscapes to the north and the extensive coniferous plantations of Afan Forest form the primary land cover to the south. However it should be noted that the site visits and reviews of recent aerial photography allied with the *Afan Valley Forest Design Plan – Management Systems Map* (NRW, 2014) show that in the past couple of years substantial tracts of forestry have been clear felled in the parts of the Afan Forest to the south of the site. Some medium-sized forestry blocks have been retained, for example the two protruding areas of forestry shown on the site layout plan in **Figure 5.2** intruding into the southern part of the site area although these blocks themselves are scheduled to be felled between 2037 and 2041 (NRW, 2014). Likewise, the forestry block to the east of the proposed access route that overlooks Nantyffyllon has also been retained as have some other smaller compartments within the former blanket forestry. Some extensive areas have also been replanted and are likely to approach maturity in the latter years of the proposed operational period of the wind farm.

Built development is mainly confined to the valley floors, especially within the Llynfi Valley to the east. Deciduous woodland is mainly confined to the non-urban valley floors, particularly in the Afan Valley to the north of the site. This pattern of settlement in the valleys and a mosaic of pasture and coniferous plantations over higher ground is repeated throughout the detailed study area, with pasture giving way to open moorland on the higher elevations found to the east and north of the area.

As shown in the topographical plan contained in **Figure 7.18** at a broader scale, Foel Trawsnant is located near the apex of a roughly triangular area of upland bounded by the coastal plain to the south-west, the Afan Valley to the north-west and the Llynfi Valley to the east. This area itself is divided by the B4282 corridor between Maesteg and Cwmafan, with elevations to the south of this corridor not exceeding 250m AOD. At a regional scale, this area forms the south-western edge of the heavily incised massif bounded by the Vale of Glamorgan to the south, the coastal plain to the south-west, the Vale of Neath to the north-west and the Dare Valley to the north-east. The highest parts of the massif are located to the north-east of the Foel Trawsnant Wind Farm amended scheme site, with large areas located at elevations in excess of 500m AOD.

Within the defined study area as a whole the highest elevations are to be found across Mynydd Llangeinwyr, a ridge of high land between the A4064 and A4061 to the east of Foel Trawsnant which rises to a maximum elevation of 568m AOD at Werfa and within the southern fringes of the Brecon Beacons, along the northern edge of the defined study area where elevations reach between 500 and 550m AOD. The south-east and western parts of the study area are less elevated, with its south-east quadrant given over to the gently rolling, fertile farmlands of the Vale of Glamorgan. The southern half of the study area is traversed by an extensive coastline stretching from the rugged Glamorgan coast in the east via the coastal plain to the north of Porthcawl to Swansea Bay.

National Landscape Designations within the Defined Study Area

A number of nationally designated[22] landscapes lie within the defined study area as follows:

- the Brecon Beacons National Park which extends to within ~14km of the Foel Trawsnant Wind Farm amended scheme at its closest point;

[22] National Parks and AONBs are designated, whilst Heritage Coasts are defined. This differentiation is not pertinent to this assessment and all such areas are therefore referred to as designated.

- the Gower Area of Outstanding Natural Beauty (AONB) the closest point of which lies at a separation distance of 20.5km from the proposed wind farm; and
- the Glamorgan Heritage Coast located ~16km to the south of the proposed wind farm at its closest point.

Landscape effects on these nationally designated landscapes have not been considered further in this assessment on the basis that the proposed amendments to the approved scheme would not alter the conclusions of the 2014 LVIA (see Section 7.6). This approach was agreed in NRW's response to the Scoping report. As a consequence, a figure showing the distribution of these national landscape designations has not been included.

Local Landscape Designations within the Detailed Study Area

The distribution of local landscape designations in the detailed study area is shown in **Figure 7.19**.

Neath Port Talbot

The Neath Port Talbot Local Development Plan (2011-2026) identifies six Special Landscape Areas (SLAs), protected as areas of high landscape quality under Policy EN 2. These SLAs have been identified based upon recommendations made by TACP in a Landscape Advice Report to Neath Port Talbot County Borough Council in 2011. The primary landscape qualities and features included in the TACP Report for each SLA are reproduced in the Landscape and Seascape Supplementary Planning Guidance (2018).

The two SLAs considered further in the assessment are:

- SLA 5 – Mynydd y Gelli; and
- SLA 6 – Foel Trawsnant.

The latter of these would be host to the proposed Foel Trawsnant Wind Farm amended scheme. **Figure 7.19** shows the distribution of the two SLAs identified above and the primary landscape qualities and features (referred to as '*primary landscape features and characteristics*' in the *Landscape and Seascape Supplementary Planning Guidance*) for these SLAs are summarised below.

SLA 5 (EN2/5)– Mynydd y Gelli is a small SLA (~600ha) located in the east of the detailed study area, ~3km to the east of the proposed wind farm at its nearest point. The *Landscape and Seascape Supplementary Planning Guidance (2018)* includes the following as the area's primary landscape features and characteristics:

- *"The landform of Mynydd y Gelli is a coherent landscape element and relates to the Western Uplands Bridgend SLA which includes the adjacent Mynydd Llangeinwyr.*
- *Similar to Foel Trawsnant it forms an open exposed plateau area within the eastern highlands complex.*
- *The landform and topography creates an imposing presence and with its simple land cover provides a contrast to the more complex landscapes of surrounding areas.*
- *The open remote plateau has a sense of exposure and wilderness in contrast with the adjacent Afan valley.*
- *It is unspoilt by development or land use and has a coherent distinct character, with topographical and visual unity, high scenic quality and strong sense of place."*

SLA 6 (EN2/6) – Foel Trawsnant is a small SLA (~355ha) located in the centre of the detailed study area and would be host to all 11 proposed wind turbines. The *Landscape and Seascape Supplementary Planning Guidance (2018)* includes the following as the area's primary landscape features and characteristics:

- *"SLA 6 covers the steep, exposed, upland slopes in NE-SW striking N and NE dipping sandstones and coals of the South Wales Pennant Formation Llynfi-Brithdir Beds (Lower Pennant Measures).*
- *It forms part of the eastern highlands complex and is one location within the relict landscape of mixed periods which is not covered in conifer plantations.*
- *There is no development and the area feels exposed and bleak, access is via foot and bridle paths.*
- *The simple landscape features and pattern, upland grazing to 271m AOD creates a local sense of place and distinctiveness."*

Bridgend

The Bridgend Local Development Plan 2006-2021 (the LDP) was adopted by the County Borough in September 2013. Policy ENV3 of the LDP establishes nine Special Landscape Areas (SLAs) throughout the County Borough, informed by a study entitled *Designation of Special Landscape Areas*, carried out for Bridgend County Borough Council by TACP in March 2010. **Figure 7.19** shows the distribution of the SLAs within Bridgend. Three of these SLAs are considered in the assessment and the primary landscape qualities and features of each SLA are summarised below.

SLA1 - Foel y Dyffryn is a small SLA (~150ha) located to the immediate east of the proposed Foel Trawsnant Wind Farm amended scheme and is contiguous with the proposed Foel Trawsnant SLA identified in the Neath Port Talbot LDP. The primary landscape qualities and features of this SLA identified in the TACP Report include that:

- *"It is an area of distinctive upland landscape to the west of Dyffryn and Caerau and provides a visual backdrop to the setting of the urban area along the valley floor.*
- *Its upland qualities and character are reinforced by views to the Brecon Beacons to the north.*
- *Its vegetation cover is typically rough grassland, mainly upland heath, interspersed with wetland and boggy areas.*
- *The proximity to the urban edge of its eastern boundaries introduces visual and sensory detractors and is typified by a range of urban fringe management issues – fly tipping, illegal biking, conflict with landowners and farmers."*

SLA2 - Northern Uplands is a large SLA (~2,930ha) which lies at a minimum separation distance from the proposed wind farm of ~5.5km to the east and south-east. The primary landscape qualities and features of this SLA identified in the TACP Report include that:

- *"It is an open upland ridge landscape lying between ~250m and 550m AOD.*
- *The western half of the SLA consists of unenclosed uplands with slopes of relatively narrow valleys and boundaries of urban/rural interface on lower valley slopes. The Upper Ogmore Valley exhibits the classic characteristics of glaciation.*
- *The busy A4064 that follows the river course along the Afon Garw floor is a slight visual and sensory detractor due to noise and movement of traffic.*
- *Panoramic and sometimes dramatic views are available over upland and adjoining valleys.*
- *The eastern half of the SLA has steep slopes of the quite narrow Ogmore Valley, with views across the urban area on the valley floor with which it has an urban/rural interface.*
- *Attractive upland views are available within and out over Ogmore Vale and to other upland areas.*

- *Wind noise is a dominant aesthetic factor which evokes particular experience of exposure and wildness.*
- *Some visual clutter of pylons slightly detracts from this otherwise wild/exposed typical upland area with a strong sense of place.*
- *It is not remote as close to valleys and their associated urban areas."*

SLA3 - Western Uplands is a large SLA (~1,930ha) located in the south of the detailed study area at a minimum separation distance from the proposed wind farm of ~3km. The primary landscape qualities and features of this SLA identified in the TACP Report include that:

- *"It comprises a series of north eastern facing slopes, ranging from 120m to 350m AOD, typically rough grazing, with a number of plantations and small woodlands that contribute to the overall character and quality of the area.*
- *The geography of the landscape is typical of much of the area, showing evidence of glaciation including a classic U-shaped valley with truncated side valleys.*
- *Despite the presence of coal measures and other stone quarrying the area retains a largely rural, agricultural character.*
- *Important historic and cultural associations are reflected in landscape archaeology and that despite proximity of industrial towns it retains a distinct rural form and character.*
- *The main visual detractors relate to the interface of the SLA with the southern edge of Maesteg, Pont Rhyd-y-cyff, Aberkenfig and Cwmfelin."*

Landscape Character

Introduction

The selection of LANDMAP Aspect Areas to be included in the LVIA has been carried out in accordance with the methodology provided in *LANDMAP Information Guidance Note 3: Using LANDMAP for Landscape and Visual Impact Assessment of Onshore Wind Turbines,* advice received from NRW and a review of the 2014 LVIA. Detailed schedules of the attributes of each LANDMAP Aspect Area alongside a landscape sensitivity assessment which considers both value and susceptibility in accordance with GLVIA3 are included in **Appendix 7B.**

Visual and Sensory Aspect Areas (VSAAs)

A study area radius of 15km for Visual & Sensory has been recommended in advice from NRW. The VSAA which were included in the 2014 LVIA within this 15km study area are shown in **Figures 7.20** and **7.21** with six of these VSAA considered further in the updated assessment as follows:

- CYNONVS473 - Mynydd Baedan;
- CYNONVS622 - Mynydd Llangeinwyr;
- NPTVS358 - Foel Trawsnant;
- NPTVS366 - Mynydd Penhydd;
- NPTVS547 - Mynydd y Gelli; and
- NPTVS920 - Cwm Afan and Cwm Pelenna Farmed Sides.

The LANDMAP level 3 classifications for these VSAAs are shown on **Figure 7.20** and the overall evaluation (as specified in LANDMAP entry VS50) is shown on **Figure 7.21.**

Historic Landscape Aspect Areas (HLAAs)

Advice from NRW recommends a study area radius of 15km for Historic Landscape. The HLAAs which were considered in the 2014 assessment within this 15km study area are shown in **Figures 7.22** and **7.23** with three of this HLAAs considered in the updated assessment as follows:

- CynonHL227 - H01 Llangynwyd;
- CynonHL242 - H02 Maesteg; and
- NPTHL060 - Mynydd Penhydd and Foel Trawsnant.

The LANDMAP level 3 classification for these HLAAs is shown on **Figure 7.22** and the overall evaluation (as specified in LANDMAP entry HL40) is shown on **Figure 7.23**.

Cultural Landscape Aspect Areas (CLAAs)

Advice from NRW recommends a study area radius of 15km for Cultural Landscape. The CLAAs which were considered in the 2014 assessment within this 15km study area are shown in **Figures 7.24** and **7.25**. Two of these are included in the updated assessment as follows:

- CynonCL056 - Designated Landscape Areas; and
- NPTCL028 - Margam Mountain.

The LANDMAP level 3 classification for these CLAAs is shown on **Figure 7.24** and the overall evaluation (as specified in LANDMAP entry CL40) is shown on **Figure 7.25**.

Other Wind Energy Developments and Vertical Features

Power Distribution and Telecommunications Features

Although parts of the defined study area are relatively remote, the desk-based study of the relevant Ordnance Survey maps and field observations has confirmed a moderate presence of communication masts. Television and radio reception in south Wales is provided from the Wenvoe transmitting station located to the south-west of Cardiff, and then rebroadcast by several transmitters throughout the region. Within the detailed study area there are at least eighteen telecommunication masts sited at or close to the following locations:

- Mynydd Resolven;
- Two on Werfa;
- West of Glyncorrwg;
- Mynydd Abergwynfi;
- Foel Fawr;
- Between Croeserw and Caerau;
- Tonnau;
- Neath;
- Mynydd Emroch;

- Moel Fen;
- Three on Foel Fynyddau;
- Bryn Mawr;
- East of Pen y Foel;
- Craig-yr-hudol; and
- Mynydd Baedan.

Two electricity transmission lines (a 400kV and separate 275kV line) traverse the south-western half of the detailed study area on a generally north-west/south-east alignment. The more distant of these lines is the 275kV line which is generally located on the higher ground adjacent to the coastal plain. The closer 400kV line runs from north of Neath, passing south of Maesteg and to the north of Bridgend and whilst generally confined to lower lying areas, this line too crosses some higher ground. The line is ~2km from the proposed development site at its closest point, near Bryn, but only the elevated section in the vicinity of Mynydd Pen-rhys is readily discernible from within the site.

Wind Energy Developments

All wind farms which are operational, consented or proposed within the 23km radius cumulative study area are listed in **Table 7.3** with their locations shown on **Figure 7.57**.

Table 7.3 Wind energy developments within the cumulative assessment study area

Wind Farm	Distance from nearest turbine of Foel Trawsnant Wind Farm amended scheme (km)	No. of turbines	Hub Height (m)	Maximum blade tip height (m)
Existing wind farms				
Pen y Cymoedd	2	76	100	145
Ffynnon Oer	3	16	60	91
Llynfi Afan	4	12	78	118
Mynydd Brombil	7	5	60	100
Maesgwyn	13	13	70	115
Maesgwyn Extension	13	4	80	125
Mynydd Bwllfa	13	9	70 / 80	115 / 125
Maerdy	12	8	95	145
Maerdy T9	12	1	95	145
Ferndale	14	8	50	74
Pant-y-Wal	11	10	70	115
Fforch Nest	12	11	70	115
Taff Ely	15	20	35	53.5

Wind Farm	Distance from nearest turbine of Foel Trawsnant Wind Farm amended scheme (km)	No. of turbines	Hub Height (m)	Maximum blade tip height (m)
Mynydd Portref	17	11	60	86
Mynydd Portref Extension	17	7	70	110
Bwllfa Farm, Gelli	13	1	50	76
Mynydd y Betws	21	15	70	110
Mynydd y Gwrhyd	19	2	60	100
Mynydd y Gwair	21	16	80	127
Pant-y-Wal Extension	11	8	80	125
Parc Stormy, Stormy Down	14	1	63	100
Swansea Bay	14	1	50	77
Newlands Farm	10	1	50	77
Newton Down	14	2	80	125
Consented wind farms (including those under construction)				
Headwind Taff Ely	15	7	69	110
Nant-y-Gwyddon	14	1	85	121.5
Llwyncelyn Wind Project	19	2	75	125
West of Rhiwfelin Fach Farm, Llantrisant	21	1	61.5	100
Mynachdy Farm, Ynysybwl, Pontypridd	21	2	50	67.5
Abergorki	13	3	100	146.5
Proposed wind farms				
East of Melin Court	6	5	85	145
Road to Graig Fatha Farm, Brynna	19	1	50	77
Land at Pen y Waun Farm	19	1	-	130

Settlement Pattern and Transportation Networks

The detailed and defined study areas exhibit the broad settlement pattern that is present across much of 'the Valleys' area of south Wales. This pattern is of periodic dense settlements on some sections of valley bottom or lower valley sides but otherwise highly limited settlement especially in more elevated areas. As in the

nearby Llynfi Valley such valley bottom settlements can amalgamate with one another to result in a continuous tract of settlement extending along several kilometres of a valley. Other valley bottom settlements are much more discrete forming relatively dense medium sized settlements such as Bryn or Glyncorrwg or small settlements such as Cynonville.

Most of these settlements possess a tight morphology often due to the houses being terraced properties dating back to the period of nineteenth century expansion in the area. This type of housing has been interspersed with mainly mid twentieth century housing constructed by local authorities or more recent private developments which often have a less rigid layout but generally retain the high property density found in these valley settlements. Sometimes these more recent housing estates are located on the periphery of older settlements such as Brynheulog at the northern end of the Llynfi Valley. There is a tendency for settlements to be laid out in grid patterns which has the consequence of favouring outward views in particular directions and of restricting and framing many of the outward views available to the residents of such settlements.

There are only a limited number of residential properties located outside these valley bottom settlements, a good proportion of which are, or at least were, originally farmsteads. There are no examples within or in the immediate vicinity of the site area but there are a few examples close to the settlements of Cynonville and Bryn. Such properties are usually once more confined to valley bottoms and lower sides.

Recreational Facilities

National and Regional Trails and Cycle Routes

The distribution of these recreational resources within the defined study area is shown in **Figures 7.26** and **7.27** although it should be noted that only those routes which are included in the assessment are highlighted in an individual colour; the remaining distribution is shown in a single uniform shade as highlighted in the key.

There are three regional trails that pass through the detailed study area and which are considered further in the assessment as follows:

- The Coed Morgannwg Way follows a general south-north alignment through the detailed study area passing close to the south of the site area within the Afan Forest Park i.e. formerly within extensive forestry. The Way is 58km long and runs between Margam and Merthyr Tydfil. As it is routed mostly across Forestry Commission (NRW) land outward views are not always one of the Way's primary attributes and the section through the Afan Forest Park is a relatively typical section.
- St. Illtyd's Way runs through the northern part of the detailed study area before coinciding with the Coed Morgannwg Way to the west of Glyncorrwg. The route of St. Illtyd's Way is 103km long and runs between Margam and Pembury Country Parks generally at lower elevations.
- The Glamorgan Ridgeway Walk runs through the south-eastern quadrant of the detailed study area on an east-west alignment. The Walk is 43km long and runs between Margam Country Park and Caerphilly Castle.

There are a moderate number of Sustrans cycleways within and around the detailed study area however these tend to follow the flatter valley floors. As shown on **Figure 7.27** the low elevations of the cycle routes shows that they would be almost entirely outside any ZTVs even before the effects of tree screening are taken into account. Hence cycle routes are excluded from the visual assessment with the exception of the section of route number 885 between Maesteg and Cymer.

The local Public Rights of Way network

This is shown on **Figure 7.28** which shows a moderately dense network of footpaths with some bridleways in the valleys, particularly around the more populous section of the Llynfi Valley occupied by Maesteg and associated settlements. A more limited number of PRoWs extend up on the upper valleys sides or cross over the intervening higher ground, although their routes often require that they pass through extensive tracts of forestry. The site area itself contains a single bridleway which runs south-east to north-west close to the northern edge of the Afan Forestry area. Elsewhere on Foel Trawsnant a more northerly routed restricted byway runs along the northern boundary of the site. A PRoW is routed east from this byway into the site area and ends close to the proposed location of Turbine 11 although the site visit could not find any evidence of its presence other than a stile. A second PRoW is routed along the track which will form the access onto the Foel Trawsnant Wind Farm from the B4282.

In order to facilitate the visual assessment of the recreational visual receptors who use these PRoWs whilst avoiding excessive repetition, the baseline has grouped the PRoWs away from the site area and its immediate environs into a number of networks where visual effects are likely to be similar. These networks are also shown on **Figure 7.28**. Two of these groupings are not considered further in the assessment (Area C - Llynfi Valley and western slopes and Area E - areas south and west of Mynydd Penhydd and Pen Disgwylfa) but continue to be shown on the figure so as to maintain referencing with the 2014 LVIA and 2018 Scoping Report.

Country Parks

The distribution of country parks in relation to the site area and the blade tip ZTV are shown on **Figure 7.29**. The Afan Forest Park is the only County Park for which recreational visual receptors visiting the park were included in the 2014 LVIA.

The Afan Forest Park lies to the west of the site area and forms the main point of access for recreational receptors wishing to use the bridleway and byway that are routed across and close to Foel Trawsnant. The Afan Forest Park extends along both sides of this section of the Afan Valley as far north as Glyncorrwg and is marketed as a centre for walking and mountain biking. To this end Neath Port Talbot County Borough Council have produced a series of guides and downloads for mountain bike routes and walks. Whilst until recently these routes are all located within the mature forestry as already noted there has been a programme of extensive felling in many of the parts of the Forest Park traversed by these trails. This has had the consequence of visually opening up substantial proportions of these trails allowing walkers and riders to have much more extensive outward views than previously and consequently affecting the aesthetic and perceptual attributes of these trials for many users. The routes of the local promoted walks within the Afan Forest Park (and a 3km buffer from the turbines) are shown on **Figure 7.29** with locally promoted cycle routes shown in **Figure 7.30.**

Predicted future baseline

It is unlikely that the future baseline will alter markedly in the short to medium term as many of the potential forces for change within and around the Foel Trawsnant site are in relative stasis, particularly with the large reduction in renewable energy applications that has taken place subsequent to the 2014 Foel Trawsnant Wind Farm application. In the long term there is always the potential for large-scale changes in agricultural practices in response to national or international agricultural and environmental policy. The long-term continuation of the decline of 'family' farms and the amalgamation of farm units into fewer, more intensively managed farm business could gradually lead to changes such as amalgamation of fields and the introduction of larger scale, less vernacular agricultural buildings. Should livestock farming continue to decline it is likely there would be a commensurate long term decline in the management field boundaries and a subsequent decline in the strength of field patterns especially on more marginal areas.

Nearly all the large blocks of forestry that are a conspicuous landscape feature across much of the defined study area away from the coast and urban areas are coniferous. They are therefore likely to be felled as commercial crops at some point with localised landscape consequences including opening up some views and provision of visually detractive tracts of post felling areas until either natural regeneration or replanting takes place which can take several years to achieve. The relatively high level of recent felling in close proximity to the Foel Trawsnant Wind Farm site has been noted in site visits and reference has been made to the Forest Design Plans, in particular the Management Systems Map produced by NRW for the Afan Valley. Future felling will therefore be taken into account where relevant to particular receptors.

The UK climate has changed notably over the previous century and climate models indicate that this rate of change could accelerate. The predicted future baseline will alter in response to future climate change as there are aspects of climate change that could have considerable effects upon landscape character, such as higher temperatures and changes to rainfall patterns and intensity. Many of these changes will, at least initially, be subtle, for example, extended growing seasons for certain crops. The following changes with a high likelihood of occurrence could directly or indirectly affect landscape character or levels of visibility:

- Warmer summers and an associated longer growing season potentially affecting the range of crops that can be grown;
- Wetter winters with consequent local flooding;
- Decreases in soil moisture in summer and autumn and associated increased potential for drought stress on vegetation, such as, hedgerows and hedgerow trees;
- Reductions in amounts of cloud cover in summer and autumn, but some small increases in levels of winter cloud cover and possible effects upon air quality which in turn may influence visibility into, out of and within landscapes; and
- Increased levels of tree loss, especially of more mature trees, due to the anticipated increase in the incidences and severity of winter storms and the increased incidence of diseases affecting specific tree species such as chalara for ash trees and phytophthora for a variety of species including oak, beech, larch and alder.

7.6 Consultation

Table 7.4 provides a summary of the issues that have been raised by consultees and the responses given.

Table 7.4 Summary of issues raised regarding landscape and visual issues during consultation

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref
Reference to the Environment (Wales) Act and Well-Being of Future Generations Act under 'Legislation' should be included	NRW	Reference to the two Acts has been added and considered in the LVIA	7.3
It is recommended that the search area is set at 23km and detailed study area is 15km. This is in accordance with NRW's Quick Guide 7 'How we consider the effects of tall structures on landscapes and views.' These distances are considered appropriate for Very Large turbines over 109m in height.	NRW	Study areas have been amended from those used in the 2014 LVIA	Section 7.4 and **Figure 7.1**
We recommend that the LANDMAP Aspect Areas are 15km for Visual and Sensory, Historic	NRW	Study areas are now 15km for Visual and Sensory, Historic Landscape and Cultural	**Appendices 7B & 7D** and

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref
Landscape and Cultural Landscape, and 5km for Geological Landscape and Landscape Habitats		Landscape. Geological Landscape and Landscape Habitats have been scoped out of the assessment as agreed with NRW.	**Figures 7.20 to 7.25**
Based on the comparative Zones of Theoretical Visibility (ZTVs) and Quick Guide 7, LANDMAP Aspect Areas beyond the 15km study area can be scoped out for the individual proposal LVIA. Appendix A may need to be adjusted accordingly. Appendix A may also need to be adjusted with regard to visual receptors and 15km study area. Given the increase in height and scale of turbines, NRW consider 15km to be a reasonable study area.	NRW	Appendix A of the Scoping Report has been reproduced as **Appendix 7C** which accompanies the LVIA and amended accordingly to include those within the 15km LANDMAP study area	**Appendices 7B, 7C & 7D** and **Figures 7.20 to 7.25**
Cumulative LVIA is recommended at 23km	NRW	The cumulative LVIA has a study area of 23km and wind energy schemes within this study area have been mapped in **Figure 7.57**	Section 7.12 and **Figures 7.57 and 7.58.**
Forest clearance has been significant in places, partly due to the impacts of larch disease, as well as commercial clear felling. The elevated areas are likely to take 10-15 years to regenerate into woodland that has any landscape or visual effects in terms of screening. Account needs to be taken of these effects on receptors with regards to the long timeframe for regeneration	NRW	This has been taken into account where appropriate in the visual assessment	Section 7.11 and **Appendix 7E**
The comparative ZTVs show additional areas of visibility e.g. hills to the south of Melincourt and coastal areas at and around Porthcawl. Clarification is needed as to why no new receptors are considered necessary in these areas.	NRW	A response to the Scoping Opinion was submitted to NPTCBC in April 2018 and included detailed justification as to why these areas would not be subject to significant effects.	**Appendix 3B**
The methodology adopted with regards to photography and photomontage in the 2014 LVIA remain fit for purpose, however it is recommended that for key viewpoints, in addition to panoramas, single frame photographs with an approximate 40 degree horizontal field of view, reproduced at A3 should be included.	NRW	The photomontages supporting this chapter have been produced in accordance with the recommendations made by NRW.	**Figures 7.33 (a-c) to 7.56 (a-c)**
NRW agree that: • The LVIA will be carried out in accordance with GLVIA3 • The 5 aspect area layers of LANDMAP will be assessed, except where scoped out in Appendix A. • That effects on the Brecon Beacons National Park can be scoped out. • That effects on the Gower AONB can be scoped out. • That receptors accorded moderate effects, not significant have the greatest potential to increase to significant effects as a result of the amendments and that other receptors that do not fulfil these criteria could be scoped out.	NRW	The receptors considered in this LVIA accord with those set out in Appendix A of the Scoping Report (reproduced as **Appendix 7C** to this ES).	Sections 7.10 to 7.12

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref
• the cumulative (CLVIA) study area can be reduced to 23km. • that the Melin court Wind Farm should be added to the cumulative assessment, with the change in status of others included in the 2014 assessment noted. • No additional construction effects are anticipated			

7.7 Scope of the assessment

Spatial scope

The spatial scope of the landscape and visual impact assessment covers the area of the site contained within the planning boundary, together with four study areas which reflect best practice and seek to concentrate different aspects of the LVIA upon the landscape and visual receptors that have the greatest potential to sustain significant effects. The study areas used are:

- The defined study area; a site-centred 23km radius circle (**Figure 7.1**);
- The detailed study area; a site-centred 15km radius circle (**Figure 7.1**);
- The residential visual amenity assessment study area extending 1.5km from any turbine (**Figure 7.31**); and
- The cumulative study area extending 23km from the site centre (**Figure 7.57**).

The defined (referred to by NRW as the 'search area'), detailed and cumulative study areas vary from those included in the 2014 LVIA which included a 36km radius defined study area, a 11km detailed study area and a 60km cumulative study area. This variation is in accordance with Wales-specific advice provided by NRW and are considered by NRW to be appropriate for *Very Large* turbines over 109m in height. The residential visual amenity assessment study area remains unchanged from 2014.

Temporal scope

The temporal scope of the assessment of landscape and visual effects is consistent with the period over which the development would be carried out and therefore covers the 12-15 month long construction period and the subsequent 25 year long operational period.

The construction period landscape assessment undertaken in 2014 concluded that only one landscape receptor: the host VSAA – NPTVS358 Foel Trawsnant and one visual receptor: the recreational visual receptors using PRoW network within the windfarm site, would be likely to experience significant effects. Given that the proposed wind farm amendment would not require any additional construction activities and would take place over a slightly reduced geographical area, no additional significant landscape or visual effects have been identified for the construction period. Consequently, the construction period landscape and visual assessments is presented in an abbreviated form concentrating upon the closest receptors.

Potential receptors

With regard to potential receptors, consideration was given at scoping stage to the potential for the proposed increase in turbine heights to result in new significant effects for some of the landscape and visual receptors that were assessed as not experiencing significant effects under the approved wind farm. The 2014

LVIA was reviewed with regard to landscape and visual receptors for whom operational period significant effects were assessed in 2014 alongside the comparative ZTVs and draft wireframes of the proposed 11 turbine layout produced from each of the 30 viewpoints that were selected in consultation for the 2014 LVIA. The key consideration has been the potential for the proposed 25m increase in the height of 11 turbines to result in increased magnitudes of landscape or visual change such that some landscape or visual receptors would be likely or certain to experience significant effects as a consequence of the operation of the proposed wind farm amendment who would not experience significant effects as a consequence of the operation of the approved wind farm. The landscape and visual receptors with the greatest potential to be in this situation would be:

- Landscape or visual receptors accorded high sensitivity under the GLVIA2 or GLVIA3 methodology who under the approved 2014 wind farm were assessed as experiencing a low magnitude of change and therefore a '*moderate*' level of effect that would be '*not significant*' under the adopted methodology. There is potential for the presence of taller and/or more turbines in views to result in an increase in the assessed magnitude of landscape or visual change to high or medium and therefore for a '*substantial*' or '*moderate/substantial*' level of effect to arise that would be significant.
- Landscape or visual receptors accorded medium sensitivity under the GLVIA2 or GLVIA3 methodology who under the approved 2014 wind farm were assessed as experiencing a medium magnitude of change and therefore a '*moderate*' level of effect that would be '*not significant*'. There is potential for the presence of taller and/or more turbines in views to result in an increase in the assessed magnitude of landscape or visual change to high and therefore for a '*moderate/substantial*' level of effect to arise that would be significant.

The review of the comparative ZTVs and the draft wireframes from the 30 viewpoints has concluded that for the majority of the landscape and visual receptors where the magnitude of change assessed in 2014 was negligible (for high sensitivity receptors) and low or negligible (for medium sensitivity receptors), there is no potential for the proposed increase in the turbines' heights to result in an increase in the magnitude of change high enough to result in significant landscape or visual effects arising. This is because of factors such as the separation distance from the receptor to the turbines being sufficiently large to ensure that the turbines' landscape or visual role would not change.

Potentially significant effects

The landscape and visual receptors that have been taken forward for assessment are summarised as follows:

- Special Landscape Areas (SLAs):
- Neath Port Talbot SLA 5: Mynydd y Gelli;
- Neath Port Talbot SLA 6: Foel Trawsnant;
- Bridgend SLA 1: Foel Y Dyffryn;
- Bridgend SLA 2: Northern Uplands; and
- Bridgend SLA 3: Western Uplands.
- LANDMAP Visual and Sensory Aspect Areas:
- CynonVS473: Mynydd Baedan;
- CynonVS622: Mynydd Llangeinwyr;
- NPTVS358: Foel Trawsnant;
- NPTVS366: Mynydd Penhydd;

- NPTVS547: Mynydd y Gelli; and
- NPTVS920: Cwm Afan and Cwm Pelenna Farmed Sides.
- LANDMAP Historic Landscape Aspect Areas:
- CynonHL227: H01 Llangynwyd;
- CynonHL242: H02 Maesteg; and
- NPTHL060: Mynydd Penhydd and Foel Trawsnant.
- LANDMAP Cultural Landscape Aspect Areas:
- CynonCL056: Designated Landscape Areas; and
- NPTCL028: Margam Mountain.

The visual assessment takes the same overarching approach, scoping in visual receptors assessed as experiencing significant effects from the approved wind farm and those fulfilling either of the two criteria set out in the earlier bullet points.

The receptors that have been scoped out from being subject to further assessment because the potential effects are not considered likely to be significant are included in **Appendix 7C**.

7.8 Environmental measures embedded into the proposed development

A range of environmental measures have been embedded into the development proposals as outlined in section 5.4 of this ES. **Table 7.5** outlines how these embedded measures will influence the landscape and visual assessment. These were included in the 2014 ES and are equally applicable to this LVIA.

Table 7.5 Summary of the embedded environmental measures and how these influence the landscape and visual assessment

Receptor	Potential changes and effects	Embedded measures and influence on assessment
Landscape elements (coniferous trees)	Removal of coniferous trees to accommodate a short section of new entrance track and the site reception area with potential localised landscape and visual effects.	Site design has been optimised to ensure that removal would be limited to a small number of coniferous trees within a large block of existing forest.
Landscape elements	Introduction or removal of landscape elements	Site access will be largely via an existing 1.4km long forestry track from the B4282 to the south of the site thereby reducing the potential for localised landscape effects arising from the introduction new landscape elements. In a limited number of locations it will require widening to a width of up to 5m in order to accommodate delivery of the largest components, although this widening is unlikely to require the loss of any existing tree cover.
Landscape character and visual receptors	The construction compound is likely to require security lighting with the potential for increases in light spillage, glare and/or contributions to sky glow.	Potential localised adverse effects to be minimised by careful design and selection of lighting components. Mitigation strategies that could be employed include use of movement activated lighting, use of baffles to prevent light spillage and placement and direction of lighting units to ensure lighting is focused upon the compound.

Receptor	Potential changes and effects	Embedded measures and influence on assessment
Landscape character and the effects on views of visual receptors within the defined and detailed study areas	Introduction and operation of turbines	From the closest viewpoints including nearly all the viewpoints that have been selected to reflect views available from residential visual receptors, the turbines would be viewed against the background sky as opposed to a darker backdrop of more elevated ground. Consequently the turbines are proposed to be coloured off grey with a semi-matt finish to reduce their potential contrast with the background sky and reduce their reflectivity in conditions when the sunlight is at a low angle i.e. earlier and/or late in the day.

7.9 Assessment methodology

Methodology for prediction of effects

The generic project-wide approach to the assessment methodology is set out in **Chapter 2**. However, whilst this approach has informed the approach that has been used in this landscape and visual assessment, it is necessary to set out how this methodology has been applied, and adapted as appropriate, to address the specific needs of this landscape and visual assessment. The LVIA has been undertaken in accordance with a methodology that conforms to the *Guidelines for Landscape and Visual Impact Assessment, Third Edition* which is widely accepted throughout the UK as the appropriate approach to use. A complete description of the LVIA methodology is contained in **Appendix 7A**.

Significance evaluation methodology

The level of landscape and visual effect (and whether this is significant) is determined through consideration of the '*sensitivity*' of the landscape or visual receptor and the '*magnitude of change*' which would be brought about by the proposed development.

Landscape or visual sensitivity specific to this development is ranked from high, through medium to low and the magnitude of landscape or visual change is ranked from high, medium, low to negligible as indicated in **Table 7.6**. The type of effect is also considered and may be direct or indirect, temporary (reversible) or permanent, cumulative, and positive, neutral, or negative.

The landscape and visual assessment unavoidably involves a combination of both quantitative and subjective assessment and wherever possible has sought to gain a consensus of professional opinion through consultation, peer review, and the adoption of a systematic, impartial, and professional assessment approach.

The EIA Regulations require that a final judgement is made about whether or not each effect is likely to be significant. In this assessment, effects are considered to be significant or not significant according to the matrix in **Table 7.6**.

Table 7.6 Matrix of EIA Significance

		Magnitude of change			
		High	**Medium**	**Low**	**Negligible**
Sensitivity	**High**	Major (Significant)	Major (Significant)	Moderate (Not significant)	Minor (Not significant)
	Medium	Major (Significant)	Moderate (Not significant)	Minor (Not significant)	Negligible (Not significant)
	Low	Moderate (Not significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)

Note: Significant effects are those identified as 'Major'.

7.10 Assessment of effects: landscape

Baseline conditions

The landscape baseline is set out in Section 7.5.

Predicted effects and their significance

Construction period landscape effects

The assessment defines 'construction' as consisting of all of the ground based activities, including the construction of on-site access tracks, the new entrance track, the substation; temporary construction compound; turbine foundations; crane pad hard-standings, also the storage of materials including turbine constituent parts, followed by the progressive erection of the turbines on site. The only existing landscape elements that would be directly impacted would be those required for the excavation of turbine foundations, crane pads, access tracks c/w passing places, cabling trenches and contractors' compound within areas of semi-improved and marshy grassland (which represent common landscape elements within both the site area and the defined study area) and a limited number of coniferous trees in the forestry along the route of the proposed new entrance track. A good proportion of the excavated sub- and top-soil would be reinstated at the end of the construction period along the edges of the access track thereby allowing grazing to recommence although storage of this temporarily excavated material could itself require some additional short term land-take. The construction period is programmed to last between 12-15 months (depending on weather conditions). It is anticipated that the erection of the turbines and the fixing of the blades would require two cranes on site for 8-10 weeks towards the end of the construction period.

The potential landscape effects generated by the construction activities would be adverse but for all aspect areas other than the host VSAA: NPTVS338 – Foel Trawsnant, they would only result in any significant effects during the final part of the construction period when the ground level activities would be augmented by the erection, operation and dismantling of the two cranes. Even during this brief period the significant effects would be restricted to the host VSAA and a proportion of the adjacent VSAAs: NPTVS366; NPTVS920 and CynonVS473. Significant effects are assessed for the host VSAA for the majority of the construction period because of the compact nature of this VSAA which would result in the range of construction activities taking place across approximately half of the VSAA. The open nature of the VSAA would ensure that at least some of these activities would be discernible across the entire VSAA and would be likely to affect its aesthetic and perceptual qualities such as relative remoteness and isolation.

Operational period landscape effects

LANDMAP Aspect Areas

The detailed assessment of landscape effects on the visual and sensory, cultural landscape and historic landscape LANDMAP Aspect Areas considered in the assessment is contained in **Appendix 7D.** A summary of the assessments is provided in **Table 7.12**.

Special Landscape Areas

Neath Port Talbot SLA 5: Mynydd y Gelli

The sensitivity of this SLA to a wind farm development is set out in **Table 7.7**.

Table 7.7 Landscape sensitivity: Neath Port Talbot SLA 5: Mynydd y Gelli

Neath Port Talbot SLA 5: Mynydd y Gelli	
Landscape value:	Overall value is assessed as High
Susceptibility:	This SLA coincides with VSAA NPTVS547 and there are several indicators within the landscape of a low susceptibly to wind farm development. These include the '*open exposed plateau'* and *'simple landcover'*. In terms of perceptual qualities, the SLA cites a sense of exposure and wildness and a landscape which is '*unspoilt by development or land use and has a coherent distinct character, with topographical and visual unity, high scenic quality and strong sense of place*'. Since it designation, this SLA has become host to the Llynfi Afan Wind Farm which became operational in 2017 which is likely to have diluted some of these perceptual qualities and in consideration of the above indicators, the overall susceptibility is assessed as Low.
Overall landscape sensitivity:	The overall sensitivity of this landscape to a wind farm development outwith its boundaries is assessed as Medium (high value and low susceptibility).

Magnitude of Change: The western edge of this compact SLA is located within ~3km of the closest proposed turbine at Foel Trawsnant. **Figure 7.19** shows that most of the SLA's western edge and its central ridge would be within the blade tip ZTV although the majority of the SLA would remain outside the ZTV and thus could not be affected. The proposed Foel Trawsnant Wind Farm amended scheme turbine array could be a moderately prominent landscape feature across the upper Llynfi Valley. However, the presence of nine of the 12 turbines within the Llynfi Afan Wind Farm would have diluted the elevated area's '*sense of exposure and wilderness*' and the sense that it is free of conspicuous man-made development. In light of these factors, the assessment concludes that the operation of the Foel Trawsnant Wind Farm amended scheme would result in only a negligible magnitude of landscape change to the characteristics of this SLA. As a consequence, landscape effects would be negligible and not significant. This overall level of landscape effect is lower than that assessed for the 2014 approved scheme as consequence of a change to the baseline and presence of the Llynfi Afan Wind Farm although the overall conclusion of not significant remains the same.

Neath Port Talbot SLA 6: Foel Trawsnant

The sensitivity of this SLA to a wind farm development is set out in **Table 7.8**.

Table 7.8 Landscape sensitivity: Neath Port Talbot SLA 6: Foel Trawsnant

Neath Port Talbot SLA 6: Foel Trawsnant	
Landscape value:	Overall value is assessed as High
Susceptibility:	This SLA coincides with VSAA NPTVS358 and a number of recognised indicators of low susceptibility of this landscape to wind energy development are cited as features and characteristics of this SLA. These include the '*exposed, upland slopes*' and '*simple landscape features and pattern*'. Indicators which are present within this SLA and which indicate a higher susceptibility include the lack of development. In balance the overall susceptibility to wind farm development is considered to be Medium.
Overall landscape sensitivity :	The overall sensitivity of this landscape to a wind farm development is assessed as High (high value and medium susceptibility).

Magnitude of Change: As this small SLA will host all 11 proposed turbines plus most of the access tracks and the ancillary ground level elements it will experience some direct effects and the operational turbines would be dominant or at least prominent landscape elements across the SLA much of which will therefore become a '*wind farm landscape*.'

One of the stated qualities of the SLA is the absence of development which will be lost although it is likely that the associated qualities relating to the sense of exposure and bleakness will be retained. Likewise, as the on-site access tracks would not be open to the public, access would continue to only be via PRoWs. Its main differentiation from surrounding areas: that it is still open and not covered by swathes of conifers would remain effective. Indeed it could be argued that the presence of turbines would make the retention of this feature much more likely as no forestry planting would be likely. However the existing simple patterns will be diluted, especially by the access tracks and at least initially by the crane pads. Whether or not the presence of wind turbines would add to its '*local sense of place and distinctiveness*' would be a matter of personal interpretation as there are other existing and proposed wind farms relatively close by. It is pertinent to acknowledge that the SLA was defined in the knowledge that it is within SSA F which was in place when the SLA was refined in 2011 (and maintained in the 2015 SPG) so a certain amount of change from wind energy development should tacitly be expected. In light of these factors the assessment concludes that the operation of the Foel Trawsnant Wind Farm amended scheme would result in a high magnitude of landscape change arising which a proportion of people would consider to be adverse. The level of effect would therefore be major and effects would be significant. This conclusion accords with that presented in the 2014 LVIA for the approved scheme.

Bridgend SLA 1: Foel Y Dyffryn

The sensitivity of this SLA to a wind farm development outside of its boundaries is set out in **Table 7.9**.

Table 7.9 Landscape sensitivity: Bridgend SLA 1: Foel Y Dyffryn

Bridgend SLA 1: Foel Y Dyffryn	
Landscape value:	Overall value is assessed as High
Susceptibility:	This SLA coincides with the northern most part of VSAA CynonVS473 and is contiguous with Neath Port Talbot SLA 6: Foel Trawsnant. Hence it shares similar indicators of a lower landscape susceptibility to a wind farm development as SLA 6, including its '*upland landscape*' and simple landcover of rough grassland. The '*proximity to the urban edge of its eastern boundaries introduces visual and sensory detractors*' although this is likely to affect only the eastern most fringes; elsewhere across the majority of the SLA the limited access and a lack of development is comparable with that of SLA 6. In balance the overall susceptibility to wind farm development is considered to be Medium.
Overall landscape sensitivity :	The overall sensitivity of this landscape to a wind farm development is assessed as High (high value and medium susceptibility).

Magnitude of Change: This small SLA is the eastern extension of the Foel Trawsnant SLA into Bridgend CBC and as such the easternmost of the proposed turbines would be close to its western edge. However no component of the proposed wind farm would be within this SLA hence there would no direct effects upon its features. As shown in **Figure 7.19** despite its proximity, the sharp descent into the Llynfi Valley would ensure that the blade tip ZTV would not cover all of the SLA. With regard to the stated features and qualities of the SLA, whilst the turbine array would alter the visual backdrop to the setting of the urban area along the floor of the Llynfi Valley, it would not alter the role of the upland landscape within the SLA in contributing to this backdrop. The proposed Foel Trawsnant Wind Farm amended scheme would not affect the availability and composition of northern views to the Brecon Beacons. As with some of the other SLAs this SLA is within SSA F and therefore some landscape change from wind energy development is to be expected. Nevertheless the western part of this SLA would be within the wind farm landscape resulting from the nearby presence of the turbines and their movement and consequently the magnitude of landscape change in this part of the SLA must be assessed as likely to be medium. The level of effect would therefore be major and effects would be significant, a conclusion which accords with that presented in the 2014 LVIA for the approved scheme.

Bridgend SLA 2: Northern Uplands

The sensitivity of this SLA to a wind farm development outside of its boundaries is set out in **Table 7.10**.

Table 7.10 Landscape sensitivity: Bridgend SLA 2: Northern Uplands

Bridgend SLA 2: Northern Uplands	
Landscape value:	Overall value is assessed as High
Susceptibility:	This SLA coincides with VSAA CynonVS622. Amongst the primary landscape qualities and features which indicate a lower susceptibility to wind farm development is the '*open upland ridge*' topography. There are some '*panoramic and sometimes dramatic views are available over upland and adjoining valleys*' indicating higher levels of intervisibility although '*some visual clutter of pylons slightly detracts from this otherwise wild/exposed typical upland area with a strong sense of place*'. The SLA is described as not be remote as it lies '*close to valleys and their associated urban areas*' although '*wind noise is a dominant aesthetic factor which evokes particular experience of exposure and wildness*'. In balance, the overall susceptibility to a wind farm development outwith the SLA is assessed as Medium.
Overall landscape sensitivity:	The overall sensitivity of this landscape to a wind farm development is assessed as High (high value and medium susceptibility).

Magnitude of Change: Only a small proportion of this SLA: the elevated ridgeline of Mynydd Llangeinwyr, is within the blade tip ZTV and could therefore sustain landscape effects via a visual effects pathway. The landscape role that the proposed turbines would have is shown in the photomontage from Viewpoint 24 in **Figure 7.56 (a-c)** which is at the southern end of Mynydd Llangeinwyr. This shows that whilst the proposed turbines would form new elements in some of the characteristic attractive upland views the SLA's other landscape qualities and features would be unaffected. Also the incremental role that would be played by the proposed Foel Trawsnant Wind Farm amended scheme turbines has to be assessed in the context of the considerable number of turbines already present in these views including the closer turbines at Llynfi Afan and the numerous existing turbines at similar separation distances including those at Forchnest, Pant y Wal, Ferndale, Maerdy, Pen-y-Cymoedd and Ffynnon Oer. As a consequence the magnitude of change upon the landscape qualities and features of this SLA would be negligible and effects would be minor, neutral and not significant. This overall level of landscape effect is lower than that assessed for the 2014 approved scheme as consequence of a change to the baseline although the overall conclusion of not significant remains the same.

Bridgend SLA 3: Western Uplands

The sensitivity of this SLA to a wind farm development outside of its boundaries is set out in **Table 7.11**.

Table 7.11 Landscape sensitivity: Bridgend SLA 3: Western Uplands

Bridgend SLA 3: Western Uplands	
Landscape value:	Overall value is assessed as High
Susceptibility:	This SLA coincides with the southern part of VSAA CynonVS473. This is an extensive upland area with a simple landcover comprising grassland and forestry, all of which are characteristics which indicate a lower susceptibility to wind farm development outwith the SLA's boundary. High levels of intervisibility are present and the three wind farms of Pen-y-Cymoedd, Ffynnon-Oer and Llynfi Afan are visual components of north-easterly views whilst amongst key policy and management issues is the recommendation to '*Limit……intrusive vertical elements*'. In consideration of these factors the overall susceptibility to a wind farm development outwith the SLA is assessed as Medium.
Overall landscape sensitivity:	The overall sensitivity of this landscape to a wind farm development is assessed as High (high value and medium susceptibility).

Magnitude of Change: This is a moderate sized SLA with its northern edge being ~3km to the south of the proposed Foel Trawsnant Wind Farm amended scheme. **Figure 7.19** shows that a majority of the northern and central parts of the SLA would be within the blade tip ZTV, whilst the photomontage from Viewpoint 22 in **Figures 7.54 (a-c)** show that from elevated central parts of the SLA the turbine array would be readily discernible although the turbines would be small-scale elements and other turbines are already present within the operational Llynfi Afan Wind Farm and the more distant Ffynnon Oer and Pen-y-Cymoedd Wind Farms. It is assessed that the presence of the proposed turbines would not significantly affect the SLA's stated key features and qualities stemming from its glacial history, historic and cultural associations and '*distinct rural form and character*'. Hence it is assessed that the magnitude of landscape change would be Low and landscape effects would be Moderate, Neutral and Not Significant. This conclusion accords with that presented in the 2014 LVIA for the approved scheme.

Summary of landscape effects

A summary of the results of the landscape assessment is provided in **Table 7.12.**

Table 7.12 Summary of significance of adverse landscape effects

Receptor and summary of predicted effects	Sensitivity of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
Neath Port Talbot SLA 5: Mynydd y Gelli Indirect changes to the SLA's primary landscape features and characteristics via potential visual and perceptual effects pathways	Medium	Negligible	Negligible (Not Significant)	The qualities and characteristics of this SLA have been diluted by the presence of the Llynfi Afan Wind Farm which lies within the SLA with the consequence that the incremental effects of the proposed Foel Trawsnant scheme located outside of the SLA boundary would be Not Significant.
Neath Port Talbot SLA 6: Foel Trawsnant Direct and indirect changes to the SLA's primary landscape features and characteristics	High	High	Major (Significant)	This SLA would host the proposed turbines plus most of the access tracks and the ancillary ground level elements and will therefore sustain some direct effects. The operational turbines would be dominant or at least prominent landscape elements across the SLA. One of the stated qualities of the SLA is the absence of development which would be lost although it is likely that the associated qualities relating to the sense of exposure and bleakness will be retained. The operation of Foel Trawsnant would result in a high magnitude of landscape change.
Bridgend SLA 1: Foel Y Dyffryn Indirect changes to the SLA's primary landscape qualities and features via potential visual and perceptual effects pathways	High	Medium	Major (Significant)	The easternmost of the proposed turbines would be close to the western edge of this SLA. The turbine array would alter the visual backdrop to the setting of the urban area along the floor of the Llynfi Valley although it would not alter the role of the upland landscape within the SLA in contributing to this backdrop. Nevertheless the western part of this SLA would be within the wind farm landscape resulting from the nearby presence of the turbines and their movement hence the predicted medium magnitude of landscape change.
Bridgend SLA 2: Northern Uplands Indirect changes to the SLA's primary landscape qualities and features via potential visual and perceptual effects pathways	High	Negligible	Minor (Not Significant)	Only a small proportion of this SLA, the elevated ridgeline of Mynydd Llangeinwyr, is within the blade tip ZTV and could therefore be subject to landscape effects. The landscape role that the proposed turbines would be incremental to that which already exists as a consequence of the considerable number of turbines already present with the views from this landscape. As a consequence the magnitude of change upon the landscape qualities and features of this SLA would be negligible. Landscape effects would be neutral.
Bridgend SLA 3: Western Uplands Indirect changes to the SLA's primary landscape qualities and features via potential visual and perceptual effects pathways	High	Low	Moderate (Not Significant)	The majority of the northern and central parts of the SLA would be within the blade tip ZTV, from which the turbine array would be readily discernible although the turbines would be small-scale elements and other turbines are already present It is assessed that the presence of the proposed turbines would not significantly affect the SLA's stated key features and qualities stemming from its glacial history,

Receptor and summary of predicted effects	Sensitivity of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
				historic and cultural associations and '*distinct rural form and character*'. Landscape effects would be neutral.
CynonVS473: Mynydd Baedan Indirect changes to noted attributes via potential visual and perceptual effects pathways	High	Medium	Major (Significant)	ZTV coverage is concentrated in the closest northern part and more extensively in the more open southern parts where effects would be incremental to those associated with turbines at other wind farms and a sense of separation would be maintained. For the small proportion of this VSAA at its northern end, the proposed turbines would be prominent, potentially dominant landscape elements with the movement and possibly the sound of the turbines' operation altering some perceptual and aesthetic attributes. When assessing the VSAA as a single landscape receptor it is concluded that the magnitude of landscape change would be medium.
CynonVS622: Mynydd Llangeinwyr Indirect changes to noted attributes via potential visual effects pathway	High	Low	Moderate (Not Significant)	From the overwhelming majority of this VSAA the operation of the proposed wind farm would not be discernible. Where visible, the presence of the proposed turbines would only ever be an incremental increase in the existing landscape role of turbines would have minimal impacts upon the VSAA's LANDMAP noted attributes.
NPTVS358: Foel Trawsnant Direct and indirect changes to noted attributes of the host VSAA.	Medium	High	Major (Significant)	Some abundant landscape elements would be lost, mainly improved grassland areas and new landscape elements introduced, principally the 11 turbines themselves. Their proximity, scale and movement would ensure that they would become the dominant landscape elements across all but the north-east of the VSAA.
NPTVS366: Mynydd Penhydd Indirect changes to noted attributes via potential visual and perceptual effects pathways	Medium	Medium	Moderate (Not Significant)	The nearby presence of the proposed turbines could reduce the stated attributes of tranquillity and remoteness and in the closest felled parts of VSAA the turbines could become co-dominant landscape elements along with the rolling plateau topography and the remaining forestry blocks. The southern and western parts of the VSAA would be outside the blade tip ZTV and therefore unaffected by the presence of the proposed wind farm. Overall it is assessed that the forestry cover and its felling would remain the VSAA's primary landscape characteristic hence the often prominent, sometimes co-dominant (but also sometimes absent) presence of the turbines would result in a medium magnitude of landscape change across this VSAA as a whole.
NPTVS547: Mynydd y Gelli	Medium	Negligible	Negligible (Not Significant)	From the western parts of this VSAA, the turbine array would be moderately prominent above a section of the western horizon although clearly separated by

Receptor and summary of predicted effects	Sensitivity of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
Indirect changes to noted attributes via potential visual effects pathway				the Llynfi Valley and seen in the context of the characteristic panoramic views in which other wind farms are already landscape elements. This includes the Llynfi Afan Wind Farm with nine of the 12 turbines within this wind farm located within this VSAA. Main characteristics associated with its topography and the contrast of its open grassland with the prominence of commercial forestry in the surrounding VSAAs would not be affected.
NPTVS920: Cwm Afan and Cwm Pelenna Farmed Sides Indirect changes to noted attributes via potential visual and perceptual effects pathways	Medium	Medium	Moderate (Not Significant)	The VSAA is entirely within the ZTV although across most of it only the turbines in the northern part of the proposed wind farm would be discernible due to the 'table top' effect with southern turbines screened by the rising topography of the southern side of the Afan Valley. However the closer northern turbines would be visually prominent across a proportion of the VSAA above an elevated section of the southern or south-eastern horizon and would provide a contrast in terms of scale and movement with their presence becoming a characteristic of the VSAA.
CynonHL227: H01 Llangynwyd Indirect changes to noted attributes via potential visual effects pathway	Medium	Low	Minor (Not Significant)	There would be no direct effects upon any of the settlements or enclosures and the small irregular field pattern would be unchanged. Some northern parts of the HLAA are adjacent to the proposed wind farm and there could be substantial effects upon the settings of some individual features, although these should be considered in the context of the southern parts being 8km away.
CynonHL242: H02 Maesteg Indirect changes to noted attributes via potential visual effects pathway	Medium	Low	Minor (Not Significant)	The extent to which the turbine array could be visible and become a landscape element would not be universal in Maesteg and would vary between different locations. Even when the array would be prominent above a section of elevated western horizon its presence would not undermine the key stated attributes of the HLAA such as the role of the Llynfi Valley as a transportation route.
NPTHL060: Mynydd Penhydd and Foel Trawsnant Direct and indirect changes to noted attributes of the host HLAA.	High	Low	Moderate (Not Significant)	This HLAA would host the turbines and access track and there could be some direct effects, though these would be of relatively small scale in relation to this extensive HLAA. The HLAA's main feature is that it remains largely unenclosed and the presence of the wind farm would not alter the preservation of this attribute.
CynonCL056: Designated Landscape Areas Indirect changes to noted attributes via potential visual and perceptual effects pathways	High	Low	Moderate (Not Significant)	Any effects upon perceptual qualities from the sound and movement of the turbines would be restricted to a very small proportion of this extensive CLAA. There are already a considerable number of operational and consented wind turbines within and close to the CLAA and any effects would be incremental. Overall on the western fringe of the CLAA it is assessed that the magnitude of

Receptor and summary of predicted effects	Sensitivity of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
				landscape change might locally attain medium but across the overwhelming majority of the CLAA it would vary from low to none.
NPTCL028: Margam Mountain Indirect changes to noted attributes via potential visual and perceptual effects pathways	High	Low	Moderate (Not Significant)	The closest proposed turbines would be located just beyond the CLAA's north-eastern boundary whilst the access track would run along part of its eastern boundary but its operation would result in no direct effects upon the '*archaeological evidence of land husbandry*'.

1. The sensitivity of a receptor is defined using the criteria set out in section 7.9 above and Appendix 7A and is defined as low, medium and high.
2. The magnitude of change on a receptor resulting from activities relating to the development is defined using the criteria set out in section 7.9 above and Appendix 7A and is defined as negligible, low, medium and high.
3. The significance of the environmental effects is based on the combination of the sensitivity of a receptor and the magnitude of change and is expressed as major (significant) or moderate/minor/negligible (not significant) subject to the evaluation methodology outlined in section 7.9

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7.11 Assessment of effects: visual

Baseline conditions

The visual baseline is set out in Section 7.5.

Predicted effects and their significance

Construction period visual effects

A review of the 2014 LVIA prepared as part of the approved scheme indicates that significant visual effects during the construction period are restricted to recreational visual receptors that use the three PRoWs (PRoWs 37 and 40 and Bridleway 39) that either pass through, or are immediately adjacent to the proposal site and the small parcels of open access land in the same vicinity. Medium and high magnitudes of visual change would arise as a result of recreational visual receptors' proximity and the absence of any intervening screening elements. The overwhelming majority of visual receptors in all categories of visual receptor would experience 'low or more regularly negligible or no visual changes even during the brief period when the cranes would be on-site. The conclusion that almost all potential visual receptors would sustain no significant visual effects during the 12-24 month long construction period is based upon the following factors:

- The relative brevity of the construction period over 12-24 months (dependant on weather conditions), particularly the crane activities with the cranes only being present on site for an estimated 8-10 weeks;
- The topography of the site area, whose steep sides give rise to a 'table top' effect in which the majority of the site area is screened by the landform in views from the overwhelming majority of close and middle distance receptors; and
- The prevalence of plantation forestry on the elevated areas surrounding the site from which ground level construction activities might otherwise be visible.

Operational period visual effects

Detailed assessments of the level of visual effect likely to be experienced by all visual receptors included in the assessment during the operational period are set out in **Appendix 7E**. The introduction of eleven 145m high turbines into the views of visual receptors will always have the consequence that some of those visual receptors would experience changes in their existing views that could be considered to be significant, and effects that are predicted to be significant are summarised below. The locations of these visual receptors are shown on **Figures 7.26 -7.31**.

Summary of visual effects

To avoid repetition of the assessments of effects on the 63 individual or grouped visual receptors provided in **Appendix 7E**, the summary of the visual effects provided in **Table 7.13** is restricted to the 27 receptors for which visual effects are predicted to be significant.

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Table 7.13 Summary of significant visual effects

Receptor and summary of predicted effects	Sensitivity of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
Designated long distance footpaths (National and Regional Trails)				
Coed Morgannwg Way Changes in the views of people walking along a long distance trail	High	High to Medium	Major (Significant)	High magnitudes of visual change are predicted for north & southbound travellers in intermittent views from ~2km section between Cwm yr Argoed and Rhiw Tor Cymry from which the majority of turbines would be theoretically visible at minimum separation distances between 500m and 100m. This magnitude of change would reduce to Medium for north & southbound travellers in intermittent views from ~3.5km section on north side of Afan Valley from where there would be relatively clear southerly views of the wind farm at minimum separation distances of around 1.5km and northbound travellers from ~700m sections on flanks of Mynydd Bach. For the remaining sections of the 58km route, visual effects would be not significant
St. Illtyd's Walk Changes in the views of people walking along a long distance trail	High	High to Medium	Major (Significant)	For the majority of its length within the detailed study area, St. Illtyd's Walk is coincident with the Coed Morgannwg Way and the visual effects experienced by its users would be the same as those described above. Hence a high magnitude of visual change is predicted for east & westbound travellers in intermittent views from ~2km section between Cwm yr Argoed and Rhiw Tor Cymry. A medium magnitude of change is predicted for east & westbound travellers in intermittent views from ~3.5km section on north side of Afan Valley and westbound travellers from ~700m sections on flanks of Mynydd Bach. For the remainder of the 103km route, visual effects would be not significant.
Sustrans Cycle Routes				
National Route 885 Changes in the views of people cycling along a National Cycle Route	High	Medium	Major (Significant)	The clearest views of the wind farm would be available from a short section to the north of Caerau from which a Medium magnitude of visual change is predicted. These views would be available to southbound cyclists for ~500m and to northbound cyclists for ~350m, and minimum separation distances would vary between 1.4km and 2.8km. For the remainder of the 13km route, visual effects would be not significant.

Receptor and summary of predicted effects	Sensitivity of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
Prominent Elevated Locations and Viewpoints				
Foel Trawsnant Changes in the views of people visiting a prominent elevated location	High	High	Major (Significant)	As the summit of Foel Trawsnant is located within the wind farm, the turbines would be the dominant visual features in all views except those to the north-east.
Foel y Dyffryn Changes in the views of people visiting a prominent elevated location	High	High	Major (Significant)	As the summit of Foel y Dyffryn is located less than 600m to the north-east of the nearest proposed turbines, with no intervening screening elements to interrupt views, the wind farm would appear as the dominant feature in westward views.
Mynydd Pwll-yr-lwrch Changes in the views of people visiting a prominent elevated location	High	Medium	Major (Significant)	The turbines would appear as a prominent, though not dominant, medium length array on the opposite side of the Llynfi Valley. Whilst the summit is designated as open access land, it is not served by any public footpath and visitors are likely to be infrequent.
Rhiw Tor Cymry Changes in the views of people visiting a prominent elevated location	High	High	Major (Significant)	At present, the majority of this hill is given over to coniferous plantation and no views are available from the highest points. However, the hill is located to the immediate south of the proposed wind farm and where views are available from the areas outside the forestry, or if the forestry was felled (as is scheduled in the next ~15 years), the nearest turbines would be the dominant elements in north-westerly views.
Mynydd Penhydd & Pen Disgwylfa Changes in the views of people visiting a prominent elevated location	High	High	Major (Significant)	These summits form the highest points within Afan Forest Park to the west of the proposed wind farm. Much of the coniferous plantation that previously covered these hills has been felled, although some areas have also been recently replanted. The summits are designated open access land and access is gained via the network of forestry tracks and mountain biking trails that criss-cross this area. Where unobstructed eastward views are available, the proposed wind farm would present an extended regular array on the opposite side of Cwm yr Argoed to the east. At a minimum separation distance of ~1km, the turbines would be highly prominent and the wind farm would be the dominant visual element in views to the east and north-east.
Moel Gallt y Cwm, Mynydd Bach & Waun Lluest-wen	High	Medium	Major (Significant)	These three summits to the west of Maesteg are heavily afforested, with many plantations consisting of recently planted or relatively young trees. The majority of the area is designated as access land and access is achieved via a network of forestry tracks, although there is no access to any of the summits at present due to existing

Receptor and summary of predicted effects	Sensitivity of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
Changes in the views of people visiting a prominent elevated location				plantations. The clearest views northward toward the proposed wind farm are from the northern flank of Mynydd Bach, outside the forestry. The appearance of the wind turbines in these views, which contain the more distant turbines within the Pen-y-Cymoedd and Llynfi Afan wind farms, would be unchanged from that presented in the 2014 LVIA.
Mynydd Pen-rhys, Mynydd Nant-y-bar & Mynydd Rhiwgregan Changes in the views of people visiting a prominent elevated location	High	Medium	Major (Significant)	These three hills comprise the ridge on the north side of the Afan Valley at its closest point to the proposed wind farm. They are heavily afforested, but southerly views are intermittently available as a result of recent felling of forestry as described in relation to the Coed Morgannwg Way and St. Illtyd's Walk which traverse the ridgeline. In these views, the proposed wind farm would appear as a prominent, though not dominant, element on the opposite side of the valley.
Settlements in the Detailed Study Area				
Brynheulog (beyond 1.5km) Changes in the views of residents in a local community	High	High to Medium	Major (Significant)	The clearest views of the wind farm would be available from properties near the north-western corner on Maes yr Awel. These properties have a slightly south-easterly aspect, allowing the majority of the visible turbine array to be viewed from front windows. In these views, the magnitude of visual change would be high. Other properties have more southerly or south-easterly facing front elevations, permitting only oblique views of the turbines and the magnitude of visual change would reduce to medium and then to negligible or none in the south-east.
Caerau (beyond 1.5km) Changes in the views of residents in a local community	High	High	Major (Significant)	Residents of 11 properties toward the north-eastern end of the Blaencaerau Estate whose houses have south-west facing front elevations with relatively unobstructed long-distance views would experience a high magnitude of visual change. The magnitude of visual change experienced by other residents within this settlement would not exceed low and visual effects would be not significant.
Abercregan Changes in the views of residents in a local community	High	High to Medium	Major (Significant)	The proposed wind farm would occupy a prominent position on the horizon of the framed views down the Afan Valley from locations near the core of the settlement. These views or similar ones are likely to be available from the 11 westernmost houses on Prosser's Terrace, the eight easternmost houses on Alban Terrace and the two northernmost houses on Abercregan Road. The wind farm would be prominent in the primary views available from windows on the front elevations of these properties and

Receptor and summary of predicted effects	Sensitivity of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
				would result in a high magnitude of visual change to these views. Similar views are likely to be available from secondary windows and gardens of the more southerly houses on Abercregan Road. Whilst the framed nature of the views available from the centre of the settlement magnify the visual impact of the turbines, the presence of the steep sided hills to either side of the valley would result in a far lesser proportion of the wind farm being visible from properties further to the east and west. The magnitude of change to the primary views of the seven westernmost properties on Alban Terrace would be medium.
Private Residential Properties within 1.5km of a turbine				
Property ID 3: Ty'n-y-pant Farm Changes in the views of residents at individual or small groups of properties	High	Medium	Major (Significant)	The clearest views of the turbines would be available from upper storey windows on the north-east facing elevation, where the left hand half of the array would be relatively prominent at distances between ~1km and 1.4km. The right hand half of the array, particularly the closest turbine (Turbine 6), would be highly oblique in these views and would not be visible from most locations within the rooms served by these windows. Similar views may be available from lower storey windows on the same elevation, but would be subject to considerably more screening by the intervening landform. The right hand half of the array, including Turbine 6, is likely to be readily visible from the northern part of the farmyard and the garden areas to the south-west of the farm house only and may give rise to a high magnitude of visual change. In views available from within the farm house, the smaller proportion of the wind farm visible and the increased separation distance to the visible turbines would result in no more than a medium magnitude of visual change.
Property ID 4: Nant-yr-hwyaid Farm Changes in the views of residents at individual or small groups of properties	High	Medium	Major (Significant)	The clearest views of the turbines would be available from the upper storey window on the south-east facing gable end elevation. In these views, the left hand half of the array is liable to be subject to a high degree of screening due to intervening vegetation, particularly during summer months. At least three turbines would be readily apparent, with Turbine 6 being prominent. In this view, the wind farm may give rise to a high magnitude of visual change. In views available from other areas within the curtilage of this property the wind farm would result in no more than a low magnitude of visual change. Overall, the magnitude of visual change is predicted to be medium
Group ID A: North-west Brynheulog	High	High to Medium	Major (Significant)	Given the length of the visible array and the ready availability of relatively unobstructed, albeit oblique, views, it is considered that the operation of the proposed wind farm is likely to give rise to significant effects on the views available to residents

Receptor and summary of predicted effects	Sensitivity of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
Changes in the views of residents at individual or small groups of properties				in this area. Effects would be greatest in the north of the area, where a high magnitude of visual change is predicted for residents at ~14 properties which would reduce to a medium magnitude of visual change in the south of the area for residents at a similar number of properties.
Group ID L: Cynonville Changes in the views of residents at individual or small groups of properties	High	High	Major (Significant)	In views available from windows on the south-south-east and east-north-east facing elevations of Hafodwen, the relatively long array presented by the proposed wind farm with seven turbines visible to hub height would result in a high magnitude of visual change. The magnitude of visual change experienced by residents of other properties in the settlement would range from low for the two easternmost properties to the north of Pen-Twyn Road, to negligible for properties to the immediate south of Percy Road, to none for other properties and visual effects for all residents with the exception of those at Hafodwen would be not significant.
Group ID M: Neuadd-wen (~8 properties) Changes in the views of residents at individual or small groups of properties	High	Medium	Major (Significant)	The full array of turbines visible from windows on the south-south-eastern rear elevation of Crud yr Awel and the prominence of Turbine 11 is likely to result in a medium magnitude of visual change. In views available from windows on the south-east facing rear elevations of Nos. 52 & 53 Afan Road and Trawscoed, the visible turbines are likely to result in a low magnitude of visual change and visual effects would be not significant. No effects are likely to be experienced by residents of the other five properties in the settlement.
Locally Promoted Walking, Cycling and Mountain-Biking Routes within 3km of a turbine				
Tarren Forgan Trail Changes in the views of people using a locally promoted walking route	High	High	Major (Significant)	As a result of recent felling of substantial tracts of forestry, it is likely that views of the wind farm would actually be available from the majority of the length of this trail with only a limited number of exceptions. Whilst some views of the wind farm would be oblique, the wind farm would be a noticeable presence in views from most location. In the clearest views, the wind farm would present an extended array, with all 11 turbines visible from many locations. At minimum separation distances between 0.9km and 1.7km and with no intervening screening elements, the wind farm would be the dominant element in many views.

Receptor and summary of predicted effects	Sensitivity of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
Afan Woodland Walk Changes in the views of people using a locally promoted walking route	High	High	Major (Significant)	The route is intended to be walked in an anti-clockwise direction. As a result of recent felling of substantial tracts of forestry, it is likely that views of the wind farm would actually be available from the majority of its length with a limited number of minor exceptions where screening would be provided by deciduous trees. The clearest views would be available from the south-eastern corner of the route, with closest turbine being highly prominent at a distance of ~400m. Those walking the route in the intended anti-clockwise direction would initially have no view of the wind farm in the vicinity of the Miners' Museum and would experience Low magnitudes of visual change to the glimpsed views available as far as Argoed Farm. To the south of Argoed Farm, the magnitude of visual change would increase through medium to high before walkers would turn their backs on the turbines to return northward.
River and Railway Walk Changes in the views of people using a locally promoted walking route	High	Medium	Major (Significant)	The scheduled felling of woodland through which the Walk is routed in 2017-2021 would result in recreational visual receptors having clear views of the Foel Trawsnant Wind Farm amended scheme particularly from the more elevated, northern section of the Walk. From the southern and western sections of the Walk views may be partially screened by the broadleaved woodland across the valley floor. In the clearest of views, most of the wind turbines would be visible in an irregular array on the opposite side of the valley at a minimum separation distance of around 1km.
Argoed Walk Changes in the views of people using a locally promoted walking route	High	High	Major (Significant)	Recent felling of coniferous forestry has been substantial except at the lowest elevations along the route. For those walking the route in the intended anti-clockwise direction, the proposed wind farm would come into view as the path climbs out of the deciduous woodland associated with the bottom of Cwm yr Argoed. As walkers head south-east along this elevated section, the wind farm would present an extended array at a minimum separation distance of 900m to 600m and would form the dominant element in views to the east. The magnitude of visual change to these views would be high. As walkers descend back into Cwm yr Argoed, the wind farm would become progressively less visible due to the intervening landform, deciduous woodland and the direction of travel of walkers, away from the wind farm.
Penhydd Trail Changes in the views of people using a locally promoted cycling route	High	Medium	Major (Significant)	The recent felling of substantial areas of forestry would make views of the turbines available from several sections of the Trail. The clearest views would be the same as or similar to those described in relation to the Coed Morgannwg Way and the other regional and locally promoted routes that traverse this area and high or medium magnitudes of visual change would be sustained along some relatively extensive sections.

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Receptor and summary of predicted effects	Sensitivity of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
Public Rights of Way and open access land within 3km of a turbine				
Area A – Foel Trawsnant Changes in the views of people using a group of Public Rights of Way and undertaking recreational activities within an open access area.	High	High	Major (Significant)	For users of the majority of these PRoWs, the wind farm would be viewed at close range and with few or no intervening screening elements. The turbines would be the dominant elements in these views and the wind farm substation building would also be conspicuous from several locations.
Area B – higher ground to the north and east of the Llynfi Valley Changes in the views of people using a group of Public Rights of Way and undertaking recreational activities within an open access area.	High	Medium	Major (Significant)	The wind farm would be visible in the majority of the views available to those travelling westward or southward. The majority of these views would be expansive, encompassing large vistas across or along the Afan Valley and its surrounding uplands. In such views, the wind farm would be a prominent sometimes dominant element with the latter occurring from some locations in the north-west of the area. In some areas the wind farm would be obscured by woodland or forestry and in the north-east of the area PRoWs pass out of the blade tip ZTV. In these areas, there would be no effect on views.
Area F – elevated areas to the south and south-west of the proposal site Changes in the views of people using a group of Public Rights of Way and undertaking recreational activities within an open access area.	High	Medium	Major (Significant)	The majority of the area falls within the blade tip ZTV. However, whilst there has been substantial recent felling of forestry across much of the area, there has also been replanting, particularly in the eastern part of the area which would effectively screen views toward the Foel Trawsnant Wind Farm amended scheme from extensive sections of the footpaths in the east of the area. Where clear views toward the wind farm are available the turbines would typically form an extended array at close distance and would inevitably give rise to a high magnitude of visual change. These views would be available from the most elevated 600m section of the footpath to the west of the area and from the northern ends of the two footpaths in the east. Overall, the magnitude of visual change would be Medium.
Outdoor Recreational and Public Amenity Areas				
Maesteg Golf Course Changes in the views of people undertaking recreational activities across the golf course.	High	Medium	Major	The whole of the golf course falls within the blade tip ZTV of the Foel Trawsnant Wind Farm amended scheme with the number of turbines theoretically visible generally increasing with elevation from the north-east to the south-west. Whilst the Foel Trawsnant Wind Farm amended scheme would not be a dominant element in any views from the golf course, it would be prominent from several parts and overall, the magnitude of visual change is considered to be Medium.

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1. The sensitivity of a receptor is defined using the criteria set out in section 7.9 above and Appendix 7A and is defined as low, medium and high.
2. The magnitude of change on a receptor resulting from activities relating to the development is defined using the criteria set out in section 7.9 above and Appendix 7A and is defined as negligible, low, medium and high.
3. The significance of the environmental effects is based on the combination of the sensitivity of a receptor and the magnitude of change and is expressed as major (significant) or moderate/minor/negligible (not significant) subject to the evaluation methodology outlined in section 7.9

7.12 Assessment of cumulative effects

As outlined in section 2.7, consideration has been given as to whether any of the landscape and visual receptors that have been taken forward for assessment in this chapter are likely to be subject to cumulative landscape or visual effects because of landscape or visual effects generated by other developments.

Overview

The landscape and visual cumulative assessment is concerned with the evaluation of the effects that could be generated were the Foel Trawsnant Wind Farm amended scheme to become operational along with some or all of the other wind farms that are consented or are proposed i.e. within the planning system in a 23km radius circle centred on the proposed development. Other existing, under-construction, consented and application wind energy sites included within this area are shown in **Figure 7.57** whilst **Appendix 7A** provides further details regarding the methodology for the cumulative assessment.

As set out in **Appendix 7A**, the scope of the CLVIA is restricted to a summary assessment of the potential for cumulative effects to arise with the proposed East of Melin Court Wind Farm; a five turbine wind farm to be sited north of the operational Ffynnon Oer Wind Farm. A revised version of the cumulative ZTV contained within the 2014 LVIA has been produced and is included as **Figure 7.58**. This revised cumulative ZTV shows the interaction of the proposed Foel Trawsnant Wind Farm amended scheme and the proposed East of Melin Court Wind Farm along with the operational Pen-y-Cymoedd, Ffynnon Oer, Mynydd Bwllfa, Maerdy and Llynfi Afan Wind Farms. These operational wind farms are already taken into consideration in the assessments of landscape and visual effects set out in Section 7.10 and 7.11 (supported by **Appendix 7F**).

The CLVIA only assesses the effects during the operational period. This is because the construction period is comparatively brief and it is not possible to know whether the proposed East of Melin Court Wind Farm would be operational or being constructed during the Foel Trawsnant Wind Farm amended scheme's construction period. As the operational period will last approximately 25 times as long as the construction period, it is more likely that a situation akin to the one envisaged in the cumulative assessment will arise during this period.

Cumulative landscape and visual effects

The proposed East of Melin Court Wind Farm would be located at the eastern end of the central array of turbines of the now operational Pen y Cymoedd Wind Farm and to the north of the operational Ffynnon Oer Wind Farm and southern cluster of Pen y Cymoedd turbines. The operation of the five turbines proposed at East of Melin Court Wind Farm would result in a slight increase in the number of turbines visible in the extensive wind farm landscape created by what is, in landscape and visual terms, effectively a combined 109 turbine wind farm (comprising Ffynnon Oer, Pen-y-Cymoedd, Maerdy and Mynydd Bwllfa). This turbine array extends 14km along its longest axis and this would not be lengthened by the introduction of East of Melin Court Wind Farm.

In relation to landscape and visual receptors predicted to be affected by the operation of the amended Foel Trawsnant Wind Farm, it is highly likely that, where also visible, the five turbines of East of Melin Court Wind Farm would appear within the same part of the horizon already occupied by the operational Pen y Cymoedd and Ffynnon Oer Wind Farms. As a result, the incremental landscape and visual change resulting from the introduction of East of Melin Court would be low or negligible and it is not considered that this would be sufficient to give rise to significant levels of effect in combination with Foel Trawsnant Wind Farm in relation to any of the receptors assessed as being subject to effects that would be not significant in relation to Foel Trawsnant alone.

7.13 Consideration of additional mitigation or compensation

No additional mitigation measures are proposed to further reduce the landscape and visual effects that are identified in this ES. This is because all relevant and implementable measures have been embedded into the development proposals and are assessed above in this chapter. These measures are considered to be likely to be effective and deliverable and address the likely significant effects of the Foel Trawsnant Wind Farm amended scheme where possible, as discussed in **Table 7.5**.

7.14 Conclusions of significance evaluation

Landscape effects

The evaluation of the landscape effects that would be certain or likely to be generated by the 25 year long operational period of the proposed Foel Trawsnant Wind Farm amended scheme, as set out in **Table 7.12**, assessed effects upon 15 landscape receptors selected in accordance with current NRW guidance and a review of the 2014 LVIA for the approved scheme. These break down as follows:

- Five local landscape designations;
- Five LANDMAP Visual and Sensory Aspect Areas;
- Three LANDMAP Historic Landscape Aspect Areas; and
- Two LANDMAP Cultural Landscape Aspect Areas.

Of these 15 landscape receptors, the assessment concludes that significant landscape effects would be experienced by four landscape receptors:

- Local landscape designation - Neath Port Talbot Special Landscape Area 6: Foel Trawsnant;
- Local landscape designation - Bridgend Special Landscape Area 1: Foel Y Dyffryn;
- Visual and sensory aspect area - CynonVS473: Mynydd Baedan; and
- Visual and sensory aspect area - NPTVS358: Foel Trawsnant.

The landscape assessment has concluded that overall the landscape surrounding the proposed Foel Trawsnant Wind Farm amended scheme would have the capacity to accept the 11 proposed turbines of the amended scheme. Within an area extending up to ~1.5km from any proposed turbine there would be a limited number of significant landscape effects upon the same four landscape receptors assessed as being subject to significant landscape effects in the 2014 LVIA for the approved scheme. Whilst two local landscape designations would be subject to significant effects, this should be considered in the context of the extensive distribution of local landscape designations in this part of south Wales, including large parts of Strategic Search Area F (SSA F). Given Foel Trawsnant's location within both the original and refined boundaries of SSA F, this degree of landscape change would be in accordance with the implicit objective of TAN 8 to accept landscape change within and immediately adjacent to SSAs.

Similarly whilst significant effects have been concluded for two of the five assessed Visual and Sensory Aspect Areas this is a relatively small figure for a medium-sized wind farm development and should not be interpreted as the site being inappropriate for a wind farm development of this specification. Overall the landscape assessment concludes that the Foel Trawsnant site is suitable to accommodate the scale of wind energy development that is proposed.

Visual effects

The evaluation of the visual effects that would be certain or likely to be generated by the 25 year long operational period of the proposed Foel Trawsnant Wind Farm amended scheme as set out in **Appendix 7E** assessed effects upon 63 visual receptor groups selected in accordance with current NRW guidance and a review of the 2014 LVIA for the approved scheme. These break down as follows:

- Three designated long distance footpaths;
- One Sustrans cycle route;
- 14 prominent elevated locations and viewpoints;
- 17 settlements;
- 14 groups of private residential properties within 1.5km of a turbine;
- Eight locally promoted walking, cycling and mountain biking routes within 3km of a turbine;
- Five groups of PRoW and open access land within 3km of a turbine; and
- One outdoor recreational and public amenity area.

The limited number of visual receptors assessed as likely or certain to sustain significant visual effects as a consequence of the operation of the proposed 11 turbines at Foel Trawsnant are set out in **Table 7.13** as follows:

- Designated long distance footpaths: Coed Morgannwg Way and St. Illtyd's Walk along which it has been assessed that significant visual effects would be experienced from locations along a maximum of 6km of the route shared by these two regional trails (Coed Morgannwg Way and St.Illtyd's Way);
- Sustrans cycle route: National Route 885 from which it has been assessed that significant visual effects would be experienced from less than 1km of the route;
- Prominent elevated locations and viewpoints: Foel Trawsnant; Foel y Dyffryn; Mynydd Pwll-yr-lwrch; Rhiw Tor Cymry; Mynydd Penhydd & Pen Disgwylfa; Moel Gallt y cwm, Mynydd Bach & Waun Lluest-wen and Mynydd Pen-rhys, Mynydd Nant-y-bar & Mynydd Rhiwgregan.
- Settlements: Brynheulog (properties to the north-west beyond 1.5km), Caerau (11 properties beyond 1.5km) and Abercregan (31 properties).
- Groups of private residential properties within 1.5km of a turbine: Ty'n-y-pant Farm, Nant-yr-hwyaid Farm, north-west Brynheulog (28 properties), Cynonville (a single property) and Neuadd-wen (a single property).
- Locally promoted walking, cycling and mountain biking routes: Tarren Forgan Trail, Afan Woodland Walk, River and Railway Walk, Argoed Walk and Penhydd Trail.
- Groups of PRoW and open access land within 3km of a turbine: Area A – Foel Trawsnant, Area B – higher ground to the north and east of the Llynfi Valley and Area F – elevated areas to the south and south-west of the proposal site.
- Outdoor recreational and public amenity area: Maesteg Golf Course.

The conclusions of the visual assessment for the proposed amended scheme at Foel Trawsnant concur with those of the 2014 LVIA with the exception of a small number of number of receptors. The limited number of receptors for which the conclusions of the visual assessment with regard to significant differ from those presented in the 2014 LVIA include the following:

- River and Railway Walk – a greater certainty with regard to the baseline and imminent future baseline as a result of the scheduled felling of woodland through which the Walk is routed has increased the magnitude of change when compared to the scheme assessed in 2014 which would give rise to significant visual effects.
- Penhydd Trail - The magnitude of change is consistent with that presented in the 2014 LVIA for the approved scheme although the sensitivity of visual receptors has been amended in accordance with GLVIA3 hence the level of effect has increased and is significant.
- Group ID M: Neuadd-wen (~8 properties) - This conclusion varies from that presented in the 2014 LVIA whereby significant visual effects were predicted at both No. 53 Afan Road and Crud-yr-Awel, with significant visual effects now predicted at Crud-yr-Awel only as a result of the omission of turbines 12 and 13 from the amended scheme. The Foel Trawsnant Wind Farm amended scheme therefore represents a beneficial change in comparison with the approved scheme.
- Maesteg Golf Course - This magnitude of change is consistent with that presented in the 2014 LVIA for the approved scheme although the sensitivity of visual receptors has been amended in accordance with GLVIA3 hence the level of effect has increased and is significant.

The small proportions of each of the groups of visual receptors that are predicted to experience significant visual effects is a reflection of the appropriateness of the proposal site to this scale of wind energy development. The location of the proposed wind farm, set back from the edges of a steep sided elevated area, results in views of the wind farm being wholly unavailable to many close and middle-distance visual receptors that might otherwise be expected to experience significant visual effects.

Cumulative effects

The incremental effect of the introduction of Foel Trawsnant Wind Farm amended scheme into a scenario which includes the proposed East of Melin Court Wind Farm would not result in any significant landscape or visual effects in addition to those predicted to arise in relation to the baseline scenario set out in **Tables 7.12** and **7.13**, above.

Overall Landscape and Visual Assessment Conclusion

The proposed turbines at Foel Trawsnant would be introduced into a landscape context that is already influenced by wind energy development in the form of Pen-y-Cymoedd, where the closest southern-most turbines are located 2km to the north, Ffynnon Oer Wind Farm, located 3km to the north-north-east and Llynfi Afan Wind Farm located 4km to the east. In this context, the limited significant landscape effects that would arise from the operation of Foel Trawsnant Wind Farm amended scheme would effectively comprise a minor southward extension of the changes to landscape character that have resulted from the creation of the 109 turbine wind farm (i.e. the combined turbines of Ffynnon Oer, Pen-y-Cymoedd, Maerdy and Mynydd Bwllfa) in the northern part of SSA F.

With regard to visual effects, the location of the wind farm away from the adjacent steep valley sides ensures that large numbers of relatively nearby visual receptors, whose views might otherwise be significantly affected, would have no view of the turbines at Foel Trawsnant Wind Farm amended scheme. The availability of views is further reduced by the widespread presence of coniferous woodland plantations throughout much of the detailed study area and beyond. Whilst these plantations are subject to periodic felling, many areas have only recently been replanted and plantations will continue to play a role in the availability of views for many years. Taken together, these are key factors influencing the relatively small number of visual receptors predicted to experience significant levels of visual effect.

In this context, the influence of the proposed turbines upon the surrounding landscape and upon views would be limited. Whilst significant effects would occur (as is almost inevitable with commercial-scale wind

turbines), such effects would be localised in extent and the incremental influence of the turbines upon the wider landscape would not be notable. As such, the presence of the 11 proposed turbines at Foel Trawsnant would not exceed the capacity of the landscape to accommodate such development and would also be would be in accordance with the implicit objective of TAN 8 to accept landscape change within and immediately adjacent to SSAs.

7.15 Implementation of environmental measures

Table 7.14 describes the environmental measures embedded within the proposed development and the means by which they will be implemented, i.e. they will secured through planning conditions and a CEMP.

Table 7.14 Summary of environmental measures relevant to landscape and visual to be implemented

Environmental measure	Responsibility for implementation	Compliance mechanism	ES Section Reference
Design and selection of security lighting components at the construction compound	Developer/Contractor	CEMP	7.8
Turbine colour	Developer/Contractor	Planning condition	7.8

7.16 References

Publications

Amec Environment & Infrastructure Ltd. (2014). Foel Trawsnant Wind Farm Environmental Statement (Document reference 24311rr073i1)

Design Commission for Wales. (2014). Designing Wind Farms in Wales. [online]. Available at: http://cdn.dcfw.org.uk/Designing-Windfarms-in-Wales-2014.pdf

Department of Energy & Climate Change. (2011). Overarching National Policy Statement for Energy (EN-1). [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf

Department of Energy & Climate Change. (2011). National Policy Statement for Renewable Energy Infrastructure (EN-3). [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/37048/1940-nps-renewable-energy-en3.pdf

Horner & MaClennan and Envision. (2006). Visual Analysis of Wind Farms: Good Practice Guidance.

Landscape Institute and Institute of Environmental Management & Assessment (LI and IEMA). (2013). Guidelines for Landscape and Visual Impact Assessment. 3rd Ed. Third Edition. Routledge, London and New York.

Landscape Institute. (2011). Advice Note 01/11 Photography and photomontage in landscape and visual impact assessment. [online]. Available at: https://www.landscapeinstitute.org/PDF/Contribute/LIPhotographyAdviceNote01-11.pdf

Natural Resources Wales. (2013). LANDMAP Guidance Note 3 Using LANDMAP for Landscape and Visual Assessment of Onshore Wind Turbines.

Neath Port Talbot County Borough Council. (2018). Local Development Plan 2011-2016 Adopted January 2016. [online]. Available at: https://www.npt.gov.uk/media/7321/ldp_written_statement_jan16.pdf

Neath Port Talbot County Borough Council. (2018). Local Development Plan 2011-2016 Landscape and Seascape Supplementary Planning Guidance. [online]. Available at: https://www.npt.gov.uk/media/9004/spg_landscape_seascape_may18.pdf

Neath Port Talbot County Borough Council. (2017). Local Development Plan 2011-2016 Renewable and Low Carbon Energy Supplementary Planning Guidance. [online]. Available at: https://www.npt.gov.uk/media/7241/spg_renewable_energy_july17.pdf

Neath Port Talbot County Borough Council. (2017). Local Development Plan 2011-2016 Design Supplementary Planning Guidance. [online]. Available at: https://www.npt.gov.uk/media/7237/spg_design_july17.pdf

Scottish Natural Heritage. (2017). Siting and Designing Wind Farms in the Landscape: Guidance Version 3a. [online]. Available at: https://www.nature.scot/sites/default/files/2017-11/Siting%20and%20designing%20windfarms%20in%20the%20landscape%20-%20version%203a.pdf

Scottish Natural Heritage. (2017). Visual Representation of Wind Farms: Guidance Version 2.2. [online]. Available at: https://www.nature.scot/sites/default/files/2017-07/A2203860%20-%20Visual%20representation%20of%20wind%20farms%20-%20Guidance%20-%20Feb%202017.pdf

Scottish Natural Heritage. (2012). Assessing the Cumulative Impact of Onshore Wind Developments. [online]. Available at: https://www.nature.scot/sites/default/files/2017-09/A675503%20-%20Assessing%20the%20cumulative%20impact%20of%20onshore%20wind%20energy%20developments.pdf

Welsh Government. (2016). Planning Policy Wales Edition 9. [online]. Available at: https://gov.wales/topics/planning/policy/ppw/?lang=en

Welsh Assembly Government. (2005). Technical Advice Note 8: Planning for Renewable Energy. [online]. Available at: https://gov.wales/docs/desh/publications/050701techical-advice-note-8-en.pdf

TACP (2011). Designation of Special Landscape Areas. [online]. Available at: https://www.npt.gov.uk/ldp/CoreDocuments/(4)%20Evidence%20Base%20Documents/ldp_submission_eb18.pdf

TACP (2010). Consultancy Services for the Provision of Landscape Advice Final Report. [online]. Available at: https://www.bridgend.gov.uk/media/1152/designation-of-special-landscape-areas.pdf

The Stationary Office Limited. (2017). The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017. [online]. Available at: https://www.legislation.gov.uk/wsi/2017/567/pdfs/wsi_20170567_mi.pdf

The Stationary Office Limited. (2016). Environment (Wales) Act. [online]. Available at: https://www.legislation.gov.uk/anaw/2016/3/pdfs/anaw_20160003_en.pdf

The Stationary Office Limited. (2015). Well-being of Future Generations (Wales) Act. [online]. Available at: http://www.legislation.gov.uk/anaw/2015/2/pdfs/anaw_20150002_en.pdf

The Stationary Office Limited. (2012). European Landscape Convention Treaty Series No. 36. [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/236096/8413.pdf

Websites

Natural Resources Wales. Afan Valley Forest Design Plan. [online]. Available at: https://naturalresources.wales/guidance-and-advice/business-sectors/forestry/welsh-government-woodland-estate/afan-forest-resource-plan/?lang=en (Accessed August 2018)

8 Historic Environment

8.1 Introduction

This chapter of the ES assesses the likely significant effects of the proposed development with respect to the historic environment. The historic environment is defined as (Cadw 2010):

> *"All aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and deliberately planted or managed."*

The chapter should be read in conjunction with **Chapter 5: Description of the Proposed Development**.

For completion of this assessment, the baseline data collected as part of the EIA for the approved scheme has been reviewed and updated as required. The assessment in this chapter describes the effects on the historic environment resulting from the change on the scheme from that which is currently approved (subject to a s106 agreement). As set out in the scoping report, it includes an assessment of any effects on the settings of identified historic assets which may arise as a result of the increase in the turbine height from the permitted tip height of 120m to the proposed tip height of 145m. It also takes into account the proposed reduction from the approved 13 turbines to the proposed 11.

With regard to effects on historic assets as a result of direct disturbance from construction, the proposed development will involve a reduction in the development footprint with no additional landtake. There is therefore no potential for any additional effects arising from disturbance to or loss of any historic assets which would not happen under the approved scheme. The original assessment and the updated baseline data has therefore been reviewed and where no notable change to the baseline situation has been identified, no further assessment has therefore taken place with regard to effects arising as a result of direct disturbance.

8.2 Limitations of this assessment

There are no limitations relating to historic environment that affect the robustness of the assessment of the potential likely significant effects of the proposed development.

8.3 Policy and legislative context

Planning policy

Table 8.1 lists the issues from the relevant planning policies that have been considered in assessing historic environment effects.

Table 8.1 Policy issues considered in preparing the historic environment assessment

Policy reference	Policy issues	Considered in section
National planning policies		
Planning Policy Wales (Edition 9) (November 2016)	National planning policy for Wales is set out in Planning Policy Wales (Edition 9, 2016) (PPW). Chapter 6 deals with planning policies as they relate to conservation of the historic environment. This states the Welsh Government's objectives to: • 'preserve and enhance the historic environment'; • 'protect archaeological remains, which are a finite and non-renewable resource'; • 'ensure that the character of historic buildings is safeguarded'; and, • 'ensure that conservation areas are protected or enhanced'. PPW sets out the role of local authorities in the protection of the historic environment, working with other agencies such as Cadw and the Welsh Archaeological Trusts. PPW states that development plans should reflect national policies for the protection of the historic environment. It also notes the various historic environment designations which exist for the protection of monuments, historic buildings and areas, as well as historic landscapes. PPW also sets out the treatment of the historic environment in the development management process. It states that the desirability of preserving an ancient monument and its setting is a material consideration in determining a planning application, and that there should be a presumption in favour of the physical preservation of monuments of national importance. For archaeological remains of lesser importance, it will be necessary to weigh the importance of the archaeology against other factors, such as the need for the development. Where a local authority decides that physical preservation of archaeology is not justified then it will be appropriate for provision to be made for the recording of archaeology in advance of its loss, and this can be secured through a planning condition. PPW notes the statutory requirement to have regard to the desirability of preserving listed buildings and their settings. The protection of World Heritage Sites and their settings should also be a material consideration in the determination of planning applications. Similarly, parks, garden and landscapes included in the 'Register of Parks and Gardens of Special Historic Interest in Wales' should be taken into account.	Section 8.9 **Appendix 8A**
Technical Advice Note 24: The Historic Environment (2017)	TAN 24 was adopted in May 2017 to provide guidance on how the planning system should consider the historic environment during development plan preparation and decision making on planning applications.	Section 8.9 **Appendix 8A**
Development plan policies		
Neath Port Talbot County Borough Council Local Development Plan (2011 – 2026). Adopted January 2016.	Policy SP 21 (Built Environment and Historic Heritage) states that historic heritage will be conserved through safeguarding features of historic and cultural importance and through the protection of nationally designated historic assets.	Section 8.9 **Appendix 8A**
Neath Port Talbot County Borough Council Local Development Plan (2011 – 2026). Adopted January 2016.	Policy BE 2 (Buildings of Local Importance) states that buildings that are of local historic, architectural or cultural importance will be conserved in the development process and that an inventory of 'Buildings of Local Importance' will be compiled.	Section 8.9

Legislative context

The importance of cultural heritage and archaeology is recognised in legislation and heritage assets that are deemed to be of particular importance are given legal protection. Legislation which is relevant to the historic environment assessment is:

- Historic Environment (Wales) Act 2016;
- Planning (Listed Buildings and Conservation Areas) Act 1990;
- Ancient Monuments and Archaeological Areas Act 1979; and
- National Heritage Acts 1983 and 2002.

Technical guidance

Table 8.2 lists guidance documents which are relevant to the baseline data collection and assessment of the effects on historic environment receptors.

Table 8.2 Technical guidance relevant to the Historic Environment

Guidance	Relevance
Cadw guidance	
The Setting of Historic Assets in Wales (Cadw 2017)	Sets out guidance on managing change within the settings of heritage assets.
Conservation Principles 2010 (Cadw 2010)	Sets out principles for the assessment of heritage significance and its management.
Guide to Good Practice on using the Register of Landscapes of Historic Interest in Wales in the Planning and Development Process (Cadw 2007)	Sets out a method for assessing effects of development on landscapes included in the register of landscapes of historic interest in Wales.
Industry/professional guidance	
Chartered Institute for Archaeologists (CIfA) Standard and guidance for archaeological desk-based assessment 2017 (CiFA 2017)	Sets out standards for the production of archaeological desk-based assessments.
Chartered Institute for Archaeologists (CIfA) Standard and guidance for commissioning work or providing consultancy advice on archaeology and the historic environment 2014 (CIfA 2014)	Sets out standards for the provision of consultancy advice in the historic environment.

8.4 Data gathering methodology

Desk study

This assessment has relied on the desk study completed as part of the 2014 ES as, for the most part, this information will remain valid. This desk study data comprises:

- National and county based registers of known archaeological and historical sites;
- Cartographic and historic documents;
- Place and field name evidence;

- Aerial photographs; and
- Published sources.

The desk study has been updated with up to date Historic Environment Record (HER) data from the Glamorgan-Gwent Archaeological Trust. The desk study has also made used of National Monuments Record of Wales (NMRW) data.

Survey work

Further visits to scheduled monuments included in the settings assessment have been undertaken in order to note any important changes to the baseline position.

8.5 Overall baseline

Current baseline

Historic landscape context

The planning boundary for the wind farm (the site) is almost entirely within the LANDMAP Historic Landscape Aspect Area of Mynydd Penhydd and Foel Trawsnant (NPTHL060). This area has been classed as high value for the survival of field boundaries representing a largely enclosed upland moor, though the coherence of this has been lessened by the presence of modern forestry plantation. The aspect area also contains evidence of multi-period archaeological remains, including a prehistoric circular enclosure, several clusters of medieval house platforms and extensive post-medieval industrial remains.

The site itself is predominantly agricultural, mainly used for pasture, with boundaries formed by either cloddiau (banks and ditches), dry stone walls or rail and post fencing. The site is bounded to the south by forestry, whilst the northern limit of the site are defined by an old track (designated as a Byway Open to All Traffic or BOAT) which runs from Tycanol to Hendre-Owen Farm. The western limit of the site is defined by a stoned bank and ditch field boundary incorporating a cross dyke at its southern limit. The medieval track 'Heol y Moch' (Pig's Way, suggestive of a drovers road) crosses the site to the southeast and forms the southern access route though the forestry across Garn Wen from Neath Road (B4282). Coal levels and quarries were also opened within the site.

Designated historic assets

There are no scheduled monuments or listed buildings recorded within the site (**Figure 8.1**), with the nearest being a scheduled monument of a prehistoric enclosure - Cefn yr Argoed Camp (GM245) located just over 100m from the site. Cefn yr Argoed is an Iron Age hillfort comprising a settlement defined by a dank and ditch. A further prehistoric enclosure - Nant Herbert Camp (GM244) – lies further to the west, some 700m from the site. These monuments survive as earthwork remains entirely within commercial forestry. The next nearest monuments are industrial features, Cae'r Mynydd Ventilation Furnace and Mine (GM547), the remains of the Blast Furnaces of Llynfi Ironworks in Maesteg (GM418) and a Corn-Drying Kiln (GM546). There are a further 29 scheduled monuments located within 5km of the planning boundary.

The nearest listed building is the Grade II* Salem Baptist Chapel (18495) and is located 250m from the site boundary. There are four other listed buildings within 1km of the site boundary, all of which are Grade II. The Nantyffyllon Workmen's Institute (18507), Siloh Independent Chapel (11356) and Capel Saron (18496) are situated in Nantyffyllon. The kiln block of the former Bryn Brickworks is situated in Cwm Farteg (a valley 1km to the southwest of the site). There are an additional 20 listed buildings within 2km of the site.

Non-designated historic assets

There are 10 potential features of historic environment interest recorded on the HER and the NMRW within the planning boundary (**Figure 8.2**) and these are listed in **Table 8.3**. The earliest of these is a medieval long hut (HER00710w), whilst a second medieval house platform (HER02046w) is just outside of the planning boundary on the northern side of Nant yr Hwyaid valley. A post-medieval hooded and terraced platform (NMRW15314) is also recorded by the NMRW near the location of the medieval long hut (HER00710w) and is still clearly evident. There is one cross-ridge dyke (HER01862.0m) of unknown date within the planning boundary, which is likely to date to the early-medieval period and is associated with the ancient routeway Heol y Moch (HER01077.0w).

There are an additional 5 post-medieval sites within the planning boundary. Post-medieval features within the planning boundary and immediately surrounding area are largely characterised by remnant industrial features such as small scale quarries, trial mines, coal levels, and spoil heaps.

A modern structure associated with the Upper Workings of Dyffryn Rhondda Colliery (NMRW516682) is situated within the site. The structure has been dismantled but the location is evident as a platform cut into the slope.

Table 8.3 HER entries within the planning boundary

HER Ref.	Name	Easting	Northing	Period	Type
HER00710w	Medieval long hut at Cefn yr Argoed 2.	283670	193960	Medieval	Long hut
HER01862.0m	Cross Ridge Dyke.	284182	193870	Unknown	Dyke
HER07293w	British Trackway	-	-	Post-medieval	Track
HER01077.0w	Heol y Moch (The Pigs' Way).	286040	195910	Medieval	Trackway
HER03999w	Garn Wen boundary stone II.	283968	193430	Post-medieval	Boundary stone
HER04001w	Garn Wen boundary stone IV.	283912	193205	Post-medieval	Boundary stone
HER03975w	Rhiw Tor Cymry Battle Site.	283809	192765	Post-medieval	Battlefield
NMRW516757	Foel Trawsnant Level.	283624	193994	Post-medieval	Level
-	Possible Quarry or Platform	283896	194050	Unknown	Quarry/Platform
-	Possible Quarry or Platform	283812	194253	Unknown	Monument

Historic context

Prehistoric and Romano-British Periods

Nationally and locally held historic environment datasets indicate that the landscape around the site appears to have been an area of prehistoric activity, with particular surviving evidence for occupation and funerary sites. There is also potential for upland routeways.

In general there is limited evidence for the occupation of the study area and the wider Glamorgan uplands prior to the Bronze Age. It is generally considered that occupation was focused in the low land river valleys and coastal sites (Aldhouse-Green, 2000). However, a Neolithic flint axe (HER00096m) was found in Caerau. Isolated Neolithic finds such as this are found both in the uplands and lowlands, more substantial evidence is predominantly found in the lowlands in the form of funerary monuments.

A Bronze Age barrow is known at Pendisgwylfa (HER00708w), though now nothing remains of the barrow. Two potential barrows were also identified at Foel Dyffryn (HER00094m and HER00095m), however, these have since been considered to be post-medieval mine trail dumps (GGAT HER). A standing stone known as Carreg Bica (HER00711w) was situated on Margam Mountain along the route of Heol y Moch (HER01077.0w), which is a route likely to have been in use since the prehistoric period. Many cairns appear to occur in close association to prehistoric trackways or ridgeways and standing stones (Lynch, 2000). The Carreg Bica stone is no longer in situ, attempts to identify it in the vicinity have proved unsuccessful.

As well as the barrows, the site is near two former Iron Age settlement sites, Cefn yr Argoed Camp (HER00709w) and Nant Herbert Camp (HER00926w, 00705w), suggestive of a continuous presence in the area through later prehistory. The oval or sub-rectangular enclosures are defined by a substantial bank and ditch, with a gap forming an entrance. Cefn Argoed Camp has a southern in-turned entrance with a holloway running up to it. This may have been used for driving in domestic animals from the slopes above the camp and could be closed by thorns or fencing when necessary.

There is no known Roman occupation or activity within the site or the 1km study area. There are three scheduled Roman marching camps, all within 5km of the study area. Two are located to the northwest of the site at Blaen-Cwmbach (GM258) and at Melin Court (GM343), both lie astride the natural ridgeway route followed by the trackway known as Cefn Ffordd, which was probably in use from the prehistoric until the medieval period. The third camp is known as Roman Camp (GM058) and is situated to the south of the development above Cwm Kenfig. The closest Roman forts are the auxiliary forts at Neath (Nidum) and Coelbren, with the Sarn Helen Roman road connecting them. Other sites are known at Kenfig, Glanwenny House and Cowbridge along the Cardiff to Neath Roman road, now forming the A48 (Sherman and Evans 2004). However, there is a general paucity of evidence for Roman activity within the 1km study area.

Early-medieval Period

Evidence for early-medieval activity in the study area and the Glamorgan uplands is generally scarce. It is probable that the routeway known as Heol y Moch was still in use during this period. The name translates from Welsh as meaning 'pig's way' and is suggestive of a drover's road, but it was potentially much more significant as a transport and communication corridor since the prehistoric periods.

The cross-ridge dyke (HER01862.0m) of unknown date within the site boundary, may be of early-medieval date. Cross-ridge dykes (or cloddiau) are usually associated with early-medieval routes and early-Christian sites. They are formed by short lengths of linear earthworks often spanning routeways across upland ridges. These upland routeways are generally accepted to have been established in the prehistoric periods (Lewis 2006), as with Heol y Moch (HER01077.0w).

The route of Heol y Moch starts at the end of the routeway known as St Illtud's Way (which begins in Pembrey, Carmarthenshire) and heads north passing Carreg Bica and northeast towards the Bodvoc Stone (now in the Margam Stone Collection), which stood as a monument stone on one of a line of Bronze Age cairns on Margam Mountain. The stone is inscribed with; 'BODVOCI HIC IACIT FILIUS CATOTIGIRNI PROENPUS ETERNALI VEDOMAVI' is reads '[The Stone] of Bodvoc. Here he lies, son of Cattegern [or Cattegirn], and great-grandson of Eternalis Vedomavus'. This is illustrative of the continued significance of prehistoric sites into the early-medieval period.

The site of Illtud's chapel (HER04666m) may be located within the study area. The exact location of Illtud's chapel is not known, but was known to be somewhere in the parish of Llangynwyd in Afan Argoed (GGAT HER). A second ecclesiastical site is also known to have existed within the 1km study area. The location of

Ffynnon Fair (Mary's Well) (HER01156m) is recorded in the present town of Maesteg, though no evidence of the well remains.

Medieval Period

Medieval occupation of the area is characterised by settlement and agricultural evidence as well as ecclesiastical monuments. There are two recorded medieval house platforms within the site, one near to the incised stream (HER00710w) and the second at Nant yr Hwyaid (HER02046w). Similar occupation sites are known at Cefn yr Argoed (HER02045w), Blaen Nant (HER02052w), Nant Herbert (NMRW15418) and Cwm yr Argoed (HER00703w), all outside the boundary of the site. These occupation sites were probably seasonally occupied in association with upland grazing during the summer months. These are traditionally known as the hafodtai or hafodydd (summerhouses). These summer dwellings were associated with established permanent settlements in the vicinity known as the hendrefi ('old town' literally translated) (Roberts 2003).

Post-Medieval and Modern Periods

The post-medieval landscape is largely agricultural and industrial in character. During the 19th century iron and spelter production formed the mainstay of the local economy, fuelled by the local coal mines. The Llynfi Ironworks was situated in Maesteg (NMRW18492) and the spelterworks were in Dyffryn and Caerau. There are coal mines at Cae'r Mynydd, Garn Wen, Argoed, Cwm Argoed, Foel y Dyffryn and Dyffryn Rhondda. The spoil tips of the latter dominate the local landscape, and were tipped on Foel Trawsnant via a ropeway across the valley. There were also brickworks at Argoed and Bryn and quarries at Garn Wen, Argoed and Mynydd Bach.

The industrial areas were served by a network of tramways connecting to the railways. The principal railway within the 1km study area was the Rhondda and Swansea Bay Railway (HER01701.0w), which connected the copious coal mines of the Rhondda with the docks at Swansea, enabling global trade in coal. The section of the Rhondda and Swansea Bay Railway within the study area ran along the Afan Valley and is now used for recreational purposes as a cycle path. Little remains of the track itself other than the embankments and associated infrastructure.

As with any industrial area in south Wales there was a proliferation of non-conformist chapel building during the 19th century, within the study area there are a multitude of chapels dispersed across Maesteg, Nantyffyllon, Dyffryn and Caerau (22 in all). These chapels are an important reflection of the cultural identity of the area. Many are designated as listed buildings.

Predicted future baseline

There are unlikely to be any notable changes to the historic environment baseline within the site boundary within the short to medium term, though changes to the agricultural regime affecting the condition of historic assets within the longer term cannot be entirely ruled out. Beyond the site boundary, large areas of land are within commercial forestry and these will be subject to felling and re-stocking in due course. This will alter the settings of historic assets that are within the commercial forestry. In particular, the *Coed y Cymoedd Forest District Forest Design Plan* (NRW 2017) identifies the felling programme within land to the south, west and north of the site.

8.6 Consultation

Table 8.4 provides a summary of the issues associated with the proposed development that have been raised by consultees and how regard has been given to them in this ES.

Table 8.4 Summary of issues raised during consultation regarding historic environment

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref
Time validity of the existing information	Glamorgan Gwent Archaeological Trust	Glamorgan Gwent Archaeological Trust commented that both the Assessment of the Significance of Impacts of Development on Historic Landscape (ASIDOHL) and archaeological desk based assessment should be revised and updated. As a result of this, the desk-based has been reviewed and updated, with up to date Historic Environment Record data obtained. The updated desk-based information is included in the overall baseline section of this chapter, but the baseline situation has not changed such that it would alter the conclusions of the assessment. The ASIDOHL has been updated and is included as **Appendix 8A**.	Section 8.5 **Appendix 8A**
Settings of historic assets	Cadw	Cadw confirmed that they agree with the approach to assessing effects on the settings of historic assets that is set out in the Scoping Report. This approach has been followed, with the assessment included as Section 8.9 of this Chapter.	Section 8.9
Historic Landscape	Cadw	Cadw confirmed that effects on the Mynydd Margam Landscape of Special Historic Interest should be assessed through the completion of an ASIDOHL. An updated ASIDOHL has been completed and is included as **Appendix 8A**.	**Appendix 8A**

8.7 Scope of the assessment

This section outlines the following:

- Identification of potential receptors that could be affected by the proposed development; and
- The potential effects on identified receptors that could be caused by the proposed development.
- The scope of assessment has been informed by:
- The Scoping Report (Amec Foster Wheeler[23], 2018);
- Scoping Opinion (**Appendix 3A**);
- The historic environment baseline (Section 8.5); and
- The proposed development design (**Chapter 5: Description of the Proposed Development**).

Spatial scope

The spatial scope of the assessment of effects on the historic environment covers a Zone of Influence that has formed the basis of the study area extending 5km from the site boundary.

[23] Now Wood

Temporal scope

The temporal scope of the assessment of historic environment is consistent with the period over which the development would be carried out and therefore covers the construction and operational periods.

Potential receptors

Approach to identifying potential receptors

Effects on heritage assets are judged on how and to what extent they affect the heritage significance of the asset. Heritage significance is defined in Conservation Principles as:

> *"The sum of the cultural heritage values…."*

Development can affect the heritage significance of heritage assets by both physical intervention into the fabric of an asset or by affecting the experience of the asset.

Scheduled monuments

Effects on the settings of the following scheduled monuments are included in the settings assessment:

- GM245 Cefn yr Argoed Camp;
- GM244 Nant Herbert Camp;
- GM581 Cefn Mawr cairn;
- GM059 Y Bwlwarcau;
- GM098 Pen-y-Castell;
- GM264 Cefn Morfydd Dyke & Earthwork;
- GM258 Blaen-Cwmbach Camp and GM277 Blaen-Cwmbach Earthwork;
- GM232 Mynydd Caerau Round Cairns;
- GM085 Llangynwyd Castle; and
- GM447 Glyncorrwg Mineral Railway (Parsons Folly) Section on Cefn Morfudd.

Historic Landscape

An Assessment of the Significance of Impacts of Development on Historic Landscape (ASIDOHL) was completed to assess on the Mynydd Margam Mountain Landscape of Special Historic Interest (LSHI) for the approved scheme. This has been updated to reflect the amended scheme and is provided as **Appendix 8A**.

Potentially significant effects

Direct effects

Effects arising from direct, physical intervention are often referred to as direct effects as they involve physical damage or disturbance, giving rise to a loss of heritage significance. Consequently, it is only those assets which might be physically disturbed by (i.e. within the footprint of) the proposed development and associated enabling works such as, intrusive surveys, site compounds and access tracks which are potentially subject to direct effects. Based on a review of the updated baseline data (including the HER), it is apparent

that our understanding of the baseline situation is the same as that presented within the ES for the approved scheme in 2014.

The proposed development would involve a reduction in the overall footprint with no new landtake. In addition to this, the same environmental measures agreed for the approved scheme would be implemented for the amended scheme, and these are set out in **Table 8.6**. As a result of this, the extent of any direct effects would be no greater than that assessed in the ES for the approved scheme and there will be no further assessment of direct effects within this Chapter.

Effects on setting

Heritage assets can also be affected as a result of changes to their setting with Cadw guidance setting out a methodology for considering any effects on the significance of heritage assets arising from change to setting. This methodology comprises four steps:

- Stage 1: Identify the Heritage Assets that might be affected;
- Stage 2: Define and analyse the settings to understand how they contribute to the ways in which the heritage assets are understood, appreciated and experienced;
- Stage 3: Evaluate the potential impact of the development; and
- Stage 4: Consider options to mitigate the potential impact.

Assessment of setting is most commonly associated with designated heritage assets, however non-designated heritage assets can also be affected by change to setting. The identification of those assets whose settings could be affected through changes to their settings forms Stage 1 of the assessment process. This was undertaken as part of preparation of the Scoping Report and involved the following tasks:

- Review of assessed effects on historic assets completed as part of the ES for the permitted scheme;
- Review of historic assets to identify where the assessed effect could change as a result of the changed design included within the proposed development, based on;
  - review of the updated Zone of Theoretical Visibility (ZTV); and
  - a consideration of any other changes such as noise and lighting which could contribute to a significant effect through a change in setting.

The historic environment receptors that have been taken forward for assessment are summarised in **Table 8.5**.

Table 8.5 Historic environment receptors scoped in for further assessment

Receptor	Relevant assessment criteria	Potentially significant effects
GM245 Cefn yr Argoed Camp	TAN24 Cadw (2017) Setting of Historic Assets in Wales	Loss of heritage significance due to change to setting of the asset.
GM244 Nant Herbert Camp	TAN24 Cadw (2017) Setting of Historic Assets in Wales	Loss of heritage significance due to change to setting of the asset.
GM581 Cefn Mawr cairn	TAN24 Cadw (2017) Setting of Historic Assets in Wales	Loss of heritage significance due to change to setting of the asset.
GM059 Y Bwlwarcau	TAN24 Cadw (2017) Setting of Historic Assets in Wales	Loss of heritage significance due to change to setting of the asset.

Receptor	Relevant assessment criteria	Potentially significant effects
GM098 Pen-y-Castell	TAN24 Cadw (2017) Setting of Historic Assets in Wales	Loss of heritage significance due to change to setting of the asset.
GM264 Cefn Morfydd Dyke & Earthwork	TAN24 Cadw (2017) Setting of Historic Assets in Wales	Loss of heritage significance due to change to setting of the asset.
GM258 Blaen-Cwmbach Camp and GM277 Blaen-Cwmbach Earthwork	TAN24 Cadw (2017) Setting of Historic Assets in Wales	Loss of heritage significance due to change to setting of the asset.
GM232 Mynydd Caerau Round Cairns	TAN24 Cadw (2017) Setting of Historic Assets in Wales	Loss of heritage significance due to change to setting of the asset.
GM085 Llangynwyd Castle	TAN24 Cadw (2017) Setting of Historic Assets in Wales	Loss of heritage significance due to change to setting of the asset.
GM447 Glyncorrwg Mineral Railway (Parsons Folly) Section on Cefn Morfudd	TAN24 Cadw (2017) Setting of Historic Assets in Wales	Loss of heritage significance due to change to setting of the asset.

All other potential historic environment receptors have been scoped out of any further assessment because the potential effects are not considered likely to be significant.

8.8 Environmental measures embedded into the proposed development

A range of environmental measures have been embedded into the development proposals as outlined in section 5.4 of this ES. **Table 8.6** outlines how these embedded measures will influence the historic environment assessment.

Table 8.6 Summary of the embedded environmental measures and how these influence the historic environment assessment

Receptor	Potential changes and effects	Embedded measures and influence on assessment
Historic environment features of local importance	A medieval long hut (HER00710w) and undated cross-ridge dyke (HER01862.0m) are within the planning boundary and could be affected	Visible features of archaeological interest within the vicinity of elements of the proposed development will be fenced-off to help prevent damage during the construction phase where disturbance to them can be avoided. This is expected to include features HER00710w and HER01862.0m.
Previously unrecorded archaeological remains	Presently unrecorded remains may exist within the site and could be lost to intrusive development.	Maintenance of a watching brief during initial topsoil stripping will allow the identification and recording of any archaeology present. In the event that remains of national importance are encountered, there is some scope for mitigation to be designed to protect these in situ, through micro-siting. However, it is anticipated that the preservation by record of remains encountered will represent sufficient compensation of their loss. The exact scheme for archaeological works will be agreed with GGAT, acting on behalf of the local planning authority.

8.9 Assessment methodology

Methodology for prediction of effects

The generic project-wide approach to the assessment methodology is set out in **Chapter 2**. However, whilst this approach has informed the approach that has been used in this historic environment assessment, it is necessary to set out how this methodology has been applied, and adapted as appropriate, to address the specific needs of this historic environment assessment.

To understand the significance of direct effects, the presence of any heritage assets that are known to be, or could potentially be, within the area that will be disturbed by the proposed development have been assessed. Comparison of the distribution of known and potential archaeological features within the study area allows the potential extent and nature of any direct disturbance to be characterised.

The methodology adopted for the assessment of effects arising from change in setting, follows the approach set out by Cadw. In this case, the potential for loss of heritage significance is most likely to occur as a result of intervisibility or direct views between the asset and the proposed development. Change to views of an asset from a third viewpoint, even where there is no direct intervisibility between development and asset, may also be relevant.

In addition to purely visual considerations, other effects of the proposed development, such as operational lighting or noise, may also have an effect, although this is normally only relevant in relatively close proximity to the proposed development. These effects are understood in terms of the relationship of the asset with its current setting and may be positive, enhancing the heritage significance of the asset, or value-neutral or harmful, depending on the nature of the change, the character of the setting and its contribution to the heritage significance of the asset.

Significance evaluation methodology

The assessment of significance of any effect on a heritage asset is largely a product of the heritage significance of an asset and magnitude of the effect that may give rise to harm, qualified by professional judgement. An assessment of effects on an asset involves an understanding of the heritage significance of the asset and in the case of an indirect effect, the contribution of the setting to the heritage significance of the asset.

The conservation of the significance of heritage assets is considered in Cadw guidance, in which change is characterised as an inevitable process, but one that can be managed[1]. In this context, it is important to note that loss of archaeological interest is usually considered to be only partially mitigated through archaeological fieldwork, as archaeological investigation cannot fully capture the informative potential of a heritage asset. This is often set against the knowledge that in many cases, archaeological interest of an asset may decline over time as a result of natural processes such as erosion, or cultural processes including cultivation. Heritage significance does not depend on the preservation of a feature in its current condition and can be enhanced through sensitive management.

Rather than just characterising the potential physical effects of development, any assessment therefore needs to understand the effects on the significance of heritage assets and/or significant places. The heritage significance of the asset is determined by reference to the heritage values set out in Conservation Principles[1]. These are:

- Evidential value: the potential of a place to yield evidence about the past;
- Historical value: how the past can be connected to the present through a place through association with or illustration of the past;

- Aesthetic value: how sensory and intellectual stimulation is drawn from a place either through design or fortuitous development over time; and
- Communal value: deriving from the meanings that an historic asset has for the people who relate to it.

For the purposes of assessing the significance of effects in EIA terms, heritage significance has also been assigned to one of four classes, with reference to the heritage values and relying on professional judgement as informed by policy and guidance. These are described in **Table 8.7**.

Table 8.7 Definition of heritage significance

Heritage Significance	Summary rationale	Example asset class
High	Asset has significance for an outstanding level of archaeological, architectural, historic and/or artistic interest.	Designated Heritage Assets. Nationally and internationally significant non-designated archaeological sites.
Medium	Asset has significance for a high level of archaeological, architectural, historic and/or artistic interest.	Locally listed buildings and other local/county-based designations. Regionally significant non-designated archaeological sites.
Low	Asset has significance for elements of archaeological architectural, historic or artistic interest.	Locally-significant archaeological site.
Negligible	Due to its nature of form/condition/survival, cannot be considered as an asset in its own right.	Non-extant HER record.

Magnitude of change

Direct effects are qualified by the extent and nature of remains associated with an asset which would be disturbed or lost, and the effect of this loss on the heritage significance of the asset. In respect of buried archaeological remains with no visible above ground remains, this would normally result in the loss of archaeological interest, but elements of architectural and historic interest can also be affected.

In this context, the effects of change in the setting of a heritage asset may depend on individual aspects of that setting, and assessments must be, by their nature, specific to the individual assets being considered. Cadw guidance**Error! Bookmark not defined.** advises that the following aspects of setting should be c onsidered in addition to any identified key attributes:

- The physical nature of the assets and its surroundings, including its relationship with other assets; and
- The way the asset is understood and appreciated.

It should also be noted that not all change necessarily detracts from the heritage significance of the asset. In the assessment of effects on the setting of heritage assets, the nature of the effect, i.e. positive, adverse or neutral, of development is a subjective matter, usually taken to constitute an adverse effect where change will constitute new and different elements to the setting of designated features, either to an imagined 'contemporary' setting or to their existing setting. While subjective, this decision is based on professional judgement and an informed understanding of the potential change arising through development, the asset, its heritage significance and the contribution of its present setting within a frame of reference defined by guidance (as issued by Cadw) and planning policy. The decision of whether an effect is harmful or not is a

matter of fact and degree that is explained in individual assessments, and therefore does not bias the assessment.

Effects on receptors are assigned to one of four classes of magnitude, as defined in **Table 8.8**.

Table 8.8 Methodology criteria for magnitude of change

Magnitude of change	Summary rationale
High	Loss of heritage significance of an order of magnitude that would result from total or substantial demolition/disturbance of a heritage asset or from the disassociated of an asset from its setting.
Medium	Loss of heritage significance arising from partial disturbance or inappropriate alteration of asset which will adversely affect its importance. Change to the key characteristics of an asset's setting, which gives rise to harm to the heritage significance of the asset but which still allows its archaeological, architectural or historic interest to be appreciated.
Low	Minor loss to or alteration of an asset which leaves its current heritage significance largely intact. Minor and short-term changes to setting which do not affect the key characteristics and in which the historical context remains substantially intact.
Negligible	Minor alteration of an asset which does not affect its heritage significance in any discernible way. Minor and short term or reversible change to setting which does not affect the heritage significance of the asset.

Determination of significance

The matrix in **Table 8.9** has been prepared to guide the assessment of whether effects on the historic environment for the purposes of EIA are to be considered significant or not. For this assessment, a magnitude of change judged to be Medium or High would be considered to be significant or potentially significant in EIA terms. Additionally, a Low magnitude of change may be potentially significant which would be determined depending on the heritage significance of the asset and the exercise of professional judgement.

Table 8.9 Significance evaluation matrix

		Magnitude of change			
		High	**Medium**	**Low**	**Negligible**
Heritage Significance	**High**	Major (Significant)	Major (Significant)	Moderate (Not significant)	Minor (Not significant)
	Medium	Major (Significant)	Moderate (Not significant)	Minor (Not significant)	Negligible (Not significant)
	Low	Moderate (Not significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)
	Negligible	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)	Negligible (Not significant)

8.10 Assessment of historic environment effects

GM245 Cefn yr Argoed Camp

Asset description and surroundings

The monument is an Iron Age hillfort situated at 300m AOD on ground sloping to the southwest (**Figure 8.1**), approximately 250 m southwest of the planning boundary. The sub-rectangular enclosure is 0.1ha in size and bounded by a bank and u-shaped ditch. The scheduled monument description states that the northeast and southeast sides of the defences are easily apparent, but on the northwest the defences are slightly eroded and on the southwest they are absent. A modern stone wall crosses the site from northwest to southeast causing some damage to the remains. A site visit completed as part of this assessment identified that the relatively low earthworks are currently difficult to pick out through the vegetation, though modern wall is a distinctive feature bisecting the monument.

The monument is currently situated within a mature modern forestry plantation and at present the fort is not visible from the surrounding landscape as it is entirely screened from view by forestry which is planted right up to the monument boundary. The NRW Forest Design Plan indicates that this area will not be felled until 2037-41.

Understanding and appreciation

Within its current setting of closely planted commercial forestry, the monument is difficult to appreciate as a feature of the prehistoric landscape. Its location on a southwest facing slope is clear, and this strongly suggests a link to the valley of Cwm yr Argoed and Nant Cynon.

In the surrounding forestry land, within areas which have already been felled the most distinctive features are the modern forestry tracks, though earthwork features are apparent. It is difficult to clearly identify the post-medieval quarry features to the east or Nant Herbert Camp, which may also be visible from Cefn yr Argoed Camp. The relatively low relief of the monument suggests that after felling around monument, it will not be a dominant feature and may only be identifiable from the opposite side of the valley. The principal views from the monument itself will be to Cwm yr Argoed and Nant Cynon and towards Pen Disgwylfa, all of which are entirely under modern commercial forestry and which largely remain so until after 2042. The higher ground to the north and northwest will curtail views in these directions.

The monument is within the LANDMAP Historic Landscape Aspect Area of Mynydd Penhydd (NPTHL012). The area is largely characterised by conifer plantations. Human occupation has been attested in the area since at least the Bronze Age. Human occupation in the Iron Age is well represented and was probably focussed on stock-raising. The Iron Age settlement appears to have been re-occupied in the early-medieval period. The key characteristics are the minimal impact of industrial exploitation, use of the area for recreation and the woodland.

Heritage significance

The Cadw monument description (**Appendix 8B**) states that:

> *"The monument is of national importance for its potential to enhance our knowledge of later prehistoric defensive organisation and settlement. The site forms an important element within the wider later prehistoric context and within the surrounding landscape. The site is well preserved and retains considerable archaeological potential."*

As a SM, this asset is of high heritage significance. Its setting makes a contribution to its heritage significance only in as much as the local topography will have influenced its location, and this would be important in understanding its function as a settlement and a defensive site. The surrounding commercial forestry ensures

that there are no views of, from or across the monument and so there can currently be no contribution to its heritage significance from these. This situation is likely to change once the forestry is felled, though it is difficult exactly how beyond the fact that its topographic location suggests that views to and from the valley to the southwest would be of greatest relevance.

Predicted effects and their significance

The closest turbine (T4) is approximately 214m from the monument. With the surrounding forestry plantation intact the monument would be entirely screened from the development by the densely planted trees and the magnitude of change would be negligible. The surrounding forestry is due to be felled in be felled in 2037-41, after which time the monument will have views of all turbines. Whilst the immediate setting of the monument would remain unchanged, and this would not affect outward views from the monument to the south and west, the turbines would be prominent in views to the east and to a lesser extent the north, as well as on the approach to the monument along Nant Cynon. Therefore the magnitude of change to the historic character and setting of the monument would be medium in this situation if experienced for an extended period of time. The potential start date of construction is not confirmed, but assuming a start in spring/summer 2020 with a construction period of 12-24 months (dependant on weather conditions) and with a 25 year operational period then turbines would be likely to be present until around 2046. The turbines would therefore be present for a period of in the region of 5-9 years after the felling of the forestry around the monument and would be visible from the monument during this period. This is a period of time which could be considered to be relatively short term and so overall it is considered that the magnitude of effect will be low, resulting in a moderate effect. In light of the relatively short term nature of the potentially significant effect, this is considered to be not significant.

GM244 Nant Herbert Camp

Asset description and surroundings

The Iron Age enclosure is situated on ground sloping gently to the north above Nant Herbert at 270m AOD. The enclosure is 24m in diameter and covers an area of approximately 0.5ha. It is defined by a bank and shallow ditch. The southern uphill side is best preserved with the bank being 0.5m high. The monument is also crossed by a modern wall. The monument was largely surrounded by commercial forestry until around 2012 the part of the monument northern of the wall has been damaged by forestry operations.

The earthwork is situated less than 100 m from a pair of medieval house platforms (HER00703w and NMRW15418) and a standing stone (HER00704w). A further platform was also noted at the site by the RCAHMW prior to afforestation. The HER record for Nant Herbert Camp suggests that the monument may be a medieval ringwork and the RCAHMW records it as 'undated'. It is possible that there is some association between the group and the monument, though this cannot be attested.

Understanding and appreciation

The enclosure is on a spur of land between the small valleys of the Nant Cynon to the east and a small un-named stream to the west, with the land rising to the southeast. As noted above, whilst the monument appears most likely to represent a late prehistoric enclosed settlement, its origin is not certain and it may be associated with the evidence for medieval settlement located in the near vicinity. Regardless of its exact origin, it does clearly form part of the evidence for settlement and use of this area over an extended period from the prehistoric through to the medieval.

Despite the survival of earthwork banks, the vegetation and presence of commercial forestry operations ensures that this is not a prominent monument, and there are no views or from it which clearly

The monument is within the LANDMAP Historic Landscape Aspect Area of Mynydd Penhydd (NPTHL012), as described above.

Heritage significance

The Cadw monument description (**Appendix 8B**) states that:

> *"The site forms an important element within the wider later prehistoric context and within the surrounding landscape. The site is well preserved and retains considerable archaeological potential. There is a strong probability of the presence of evidence relating to chronology, building techniques and functional detail."*

As a SM, this asset is of high heritage significance. Its setting makes a contribution to its heritage significance as the local topography will have influenced its location, and through its proximity to other elements of the historic landscape. It is also of evidential value, with potential to yield information on the later prehistoric settlement of this area. There are no views of, across or from the monument which are clearly of particular importance to its setting.

Predicted effects and their significance

Whilst the ZTV indicates that the monument will have views to all turbines, this will be fairly limited to Nant Herbert valley, which is within modern commercial forestry. The closest turbine (T6) is 1km from the monument. The development would be situated on a separate area of high ground, therefore it would not dominate views from the monument and the immediate setting formed by the spur of land on which the monument is located would not change. Therefore the magnitude of change to the historic character and setting of the monument will be low, resulting in a moderate effect. This is considered to be not significant.

GM581 Cefn Mawr cairn

Asset description and surroundings

The monument is a Bronze Age cairn situated at 430m AOD on Cefn Mawr. The mound is approximately 14.5m in diameter and 2m high, with a 0.9m deep hollow dug into the centre. The monument is largely covered in vegetation with some tightly packed stone visible.

The barrow is located on open moorland on the edge of a plateau within the Ffynnon Oer wind farm. There are also at least three other cairns similarly situated on the edge of a plateau further southwest downslope of the mountain. The cairn is a prominent feature in the immediate area but cannot be easily identified from 100m distance.

Understanding and appreciation

The monument is within the LANDMAP Historic Landscape Aspect Area of Afan Wallia (NPTHL026). This area has been classed as outstanding value as an extensive expanse of unenclosed upland moor between the Cwm Afan and Cwm Nedd. It is described as a rich multi-period landscape with evidence of continuity of human activity and adaptation of the landscape from the Mesolithic period to the present day. Modern forestry plantations have to some extent diminished the coherence of what was formerly a landscape of predominantly unenclosed upland moor.

There are wide open views from the monument which is currently set in grassy open moorland on a mountain currently in use as a wind farm. Modern commercial forestry forms part of the view from the monument to the south looking towards the development, but the view is largely dominated by the mountains punctuated with steep sided valleys. There are clear views of the spoil heaps of Dyffryn Rhondda Colliery (NMRW402097) and other remnant features of an industrial character which are still identifiable.

Heritage significance

The Cadw monument description (**Appendix 8B**) states that:

> *"The monument is of national importance for its potential to enhance our knowledge of prehistoric burial and ritual. The monument is an important relic of a prehistoric funerary and ritual landscape and retains significant archaeological potential, with a strong probability of the presence of both intact burial or ritual deposits and environmental and structural evidence, including a buried prehistoric land surface."*

As a scheduled monument, the cairn is of high heritage significance. The monument description makes it clear that this primarily for its evidential value, though it is also of historic value as it forms part of a multi-period landscape with evidence for activity from prehistory onwards. Its setting makes some contribution to this, though limited by the degree of modern change in its surroundings (forestry and windfarms) and the relative lack of prominence of the monument from beyond around 100m.

Predicted effects and their significance

Though the closest Turbine (T11) is over 3.8km away from the cairn, potentially there would be views of 11 turbines. The turbines would be seen to be located on a separate area of high ground to the monument and so would not impact its immediate setting. The turbines would be visible but not prominent features from the monument, but would be seen alongside other existing modern features such as the colliery spoils heaps, which are a dominant feature in the landscape, and the turbines of Ffynnon Oer wind farm in which the monument is located. The presence of the turbines would alter the fabric of views but it would not introduce modern structures into a view which does not already contain them. Therefore the magnitude of change to the historic character and setting of the monument would be negligible, resulting in a minor effect, which would be not significant.

GM059 Y Bwlwarcau

Asset description and surroundings

The monument is an Iron Age or possibly later hill fort or defended enclosure located at approximately 300m AOD on a spur off Mynydd Margam. It is a multi-period site with evidence of medieval occupation in the form of house platforms, but can coherently be understood. It is formed by a series of concentric curvilinear ditches and ramparts, the outermost is 4.3ha and the innermost if approximately 64m across.

Understanding and appreciation

The monument is within the LANDMAP Historic Landscape Aspect Area of Llangynwyd (CynonHL227). This area has been classed as outstanding value as a landscape with elements from multiple periods including remains of settlement and enclosure dating from the prehistoric, early medieval, medieval and post-medieval periods.

The fort is situated on ground sloping north into Cwm Cerdin, with a number of non-designated cairns, possibly agricultural clearance, rather than Bronze Age funerary monuments, to the east. The monument has clear views down the valley towards the urban areas of Maesteg and Garth. Views from the monument are generally restricted to the northeast channelled through the valley. The setting of the monument is largely defined by its position on a spur of mountain overlooking the sparely populated agricultural land to the north and the urbanised valleys to the northeast.

Heritage significance

The Cadw monument description (**Appendix 8B**) states that:

> *"The monument is of national importance for its potential to enhance our knowledge of late prehistoric defensive organisation. The monument forms an important element within the wider Iron Age context and may be expected to contain archaeological information in regard to elements such as chronology, building techniques and social organisation."*

As a scheduled monument, the hill fort is of high heritage significance. The monument description makes it clear that this primarily for its evidential and its historic value as it forms part of a wider group of Iron Age defensive, settlement and agricultural remains with evidence for activity from prehistory onwards.

It setting clearly makes a contribution to this, as the local topography will have influenced its location, and through its association with other archaeological remains in this area. In particular, the monument overlooks populated agricultural land to the north and this association also forms an important component of its setting.

Predicted effects and their significance

The view towards the development is largely screened by the higher ground of Waun Lluest-wen. The southern uphill area of the scheduled area would have views of up to six turbine tips, with up to nine tips visible from the western ramparts. Views from the monument are largely restricted to the north and northeast with very limited views towards the development. The nearest turbine is approximately 5km away from the monument and would not dominate the immediate setting, which includes views to modern urban areas and modern commercial forestry plantation. Therefore the magnitude of change to the historic character and setting of the monument would be negligible, resulting in a minor effect, which would be not significant.

GM098 Pen-y-Castell

Asset description and surroundings

Pen-y-Castell is an oval-shaped defended enclosure of unknown date situated at the summit of a sleep sided hill. It measures 72m east-west by 32m north-south. It is defined by two concentric banks approximately 10m apart, standing 0.3m high internally with an outer scarp almost 3m high. It is denuded on the eastern side with better survival on the western side. The enclosure itself is not prominent from a distance, despite the knoll on which it is located being prominent within the landscape.

Understanding and appreciation

The monument is within the LANDMAP Historic Landscape Aspect Area of Mynyddau Emroch a Bychan (NPTHL070). This area has been classed as high value as the dominant pattern of enclosed upland moor has survived essentially intact and the area has a diverse archaeological record.

The enclosure is situated at 150m AOD and crowns the top of an isolated knoll. It is situated on an area of open moorland, allowing clear views from the monument in all directions. Views to the north and east are of modern social hosing in Cwmafan and a commercial logging facility. Views to the east and south are of open unenclosed moorland hills with pockets of modern commercial forestry plantations and the B4282 road. The location is strategic and easily defended, potentially with some dominance over the immediate surroundings, particularly to the northeast in Cwmafan.

Heritage significance

The Cadw monument description (**Appendix 8B**) states that:

> *"The monument is of national importance for its potential to enhance our knowledge of late prehistoric defensive organisation. The monument forms an important element within the wider Iron Age context*

and may be expected to contain archaeological information in regard to elements such as chronology, building techniques and social organisation."

As a scheduled monument, the enclosure is of high heritage significance. The monument description makes it clear that this primarily for its evidential and its historic value as it is one of a number of Iron Age monuments in the wider area and will contain evidence on Iron Age defensive and settlement organisation. Its setting also makes an important contribution to its heritage significance. Its hill top position is of clear importance to its defensive function, and also affords it broad views in all directions. Inevitably therefore, the views from within the monument have seen considerable change during the modern period.

Predicted effects and their significance

Views to the development are limited by intervening topography which stands higher than Pen-y-Castell. ZTVs indicate (**Figure 8.1**) that the hubs of 1-3 turbines would be visible, as well as blade tips from all 11 turbines. This would be minimised taking into account the effect of intervening modern commercial forestry on Mynydd Penhydd and Pen Diswylfa. At a distance of 5km from the nearest turbine the development would not form a prominent feature or affect an appreciation of the monument within its hill top location. Therefore the magnitude of change to the historic character and setting of the monument will be negligible, resulting in a minor effect, which would be not significant.

GM264 Cefn Morfydd Dyke & Earthwork

Asset description and surroundings

The dyke and earthwork are visible as a curving earthwork bank ranging from 1m to 2.5m in height and a shallow ditch to the north. The feature is attributed to the early-medieval period. It is situated at the northern end of Mynydd Cefn Morfydd in an upland enclosed heath on a saddle between the mountain to the south and the Gwenffrwd ridge to the east. The earthwork enclosure at its western end is thought to be contemporary to the dyke, but its morphology is similar to that of Iron Age enclosures. There are also a number of Bronze Age cairns in the vicinity and an Iron Age enclosure and Roman marching camp at Blaen-Cwmbach.

Understanding and appreciation

The monument is within the LANDMAP Historic Landscape Aspect Area of Cefn Morfudd (NPTHL055). This area has been classed as outstanding value for the evidence of activity over an extended period of time including Bronze Age ritual/funerary activity, Iron Age defended settlement and Roman military activity. There are, in addition, substantial remains of medieval upland pastoral settlement and post-medieval industrial activity.

The dyke is situated in open upland pasture near modern agricultural buildings and is cut by modern tracks; despite this it is relatively well preserved. The dyke and earthwork are situated at 270m AOD with views out to the wider landscape. It is prominent in the immediate area and occupies a strategic position on the important prehistoric routeway from the uplands down to the Neath Valley known as Cefn Ffordd but is not seen from lower lying areas. A post-medieval tramway damaged the eastern end of the dyke and is also much more dominant within the immediate and wider landscape. The eastern side of the dyke has also been damaged by the Oaklands colliery, remains of which are still evident. Large modern agricultural buildings are suited less than 200m from the dyke and form part of the views from the monument.

Heritage significance

The Cadw monument description (**Appendix 8B**) states that:

> *"The monument is of national importance for its potential to enhance our knowledge of later prehistoric/medieval defensive organisation and settlement. It retains significant archaeological potential, with a strong probability of the presence of associated archaeological features and deposits. A dyke may be part of a larger cluster of monuments and their importance can further enhanced by their group value."*

As a scheduled monument, the earthwork is of high heritage significance. The monument description makes it clear that this primarily for its evidential and its historic value as it retains archaeological remains with the potential to yield information on early medieval defensive structures and is likely to be associated with further remains. The settings contributes to this heritage significance as the topography will have informed the form of the defensive structure, and this will also relate to contemporary patterns of movement within the historic landscape. Views of the monument may be important, as it could have been designed to have a clear and visible presence within the landscape, though outwards are likely to have been much less important.

Predicted effects and their significance

There would be views of up to 11 turbines from the dyke as indicated by the ZTV (**Figure 8.1**) which take into account the commercial forestry plantations. The development is situated 4.7km from the monument and would not be prominent or affect an appreciation of how this defensive structure relates to its local surroundings. Therefore the magnitude of change to the historic character and setting of the monument would be negligible, resulting in a minor effect, which would be not significant.

GM258 Blaen-Cwmbach Camp and GM277 Blaen-Cwmbach Earthwork

Asset description and surroundings

The Roman marching camp is defined by partially remaining stretches of low earthwork bank and ditch in the classic 'playing card' shape measuring approximately 800m east-northeast by 300m west-northwest. The monument appears to incorporate a prehistoric defended enclosure GM277 Blaen-Cwmbach Earthwork. The monuments are situated in an area of enclosed upland heath used for grazing. The area is crossed by the historic Cefn Ffordd routeway from the uplands to the Neath Valley and a series of modern commercial forestry and farm tracks.

Understanding and appreciation

The monument is within the LANDMAP Historic Landscape Aspect Area of Cefn Morfudd (NPTHL055).

The southwestern section of the bank and ditch of the camp and the prehistoric enclosure are visible within the immediate vicinity. The monument occupies a dominant, easily defendable location along the ridgeway and is best understood from the immediate vicinity as the earthworks are poorly preserved and cannot easily be seen from a great distance. Excavation in the 1960s and 1970s proved that occupation evidence including hearths remain preserved beneath the ground surface.

Views from the monument include Blaen-Cwmbach Farm, a post-medieval farm situated at the south-eastern corner of the camp. The area is dominated by modern forestry tracks and farm tracks which cross the camp, along with post-medieval field boundaries associated with the post-medieval farms in the vicinity. A high voltage overhead power line, modern commercial forestry and the urban valley settlement of Tonmawr feature in views to the development.

Heritage significance

The Cadw monument description (**Appendix 8B**) of GM258 states that:

> *"The monument is of national importance for its potential to enhance our knowledge of Roman military organisation. The monument forms an important element within the wider context of the Roman occupation of Wales and the structure itself may be expected to contain archaeological information concerning chronology and building techniques, together with a strong probability of environmental evidence."*

The Cadw monument description (**Appendix 8B**) of GM277 states that:

> *"The monument is of national importance for its potential to enhance our knowledge of later prehistoric defensive organisation and settlement. The site forms an important element within the wider later prehistoric context and within the surrounding landscape. Its significance is further enhanced by its location within the later Roman encampment."*

As scheduled monuments, the marching camp and earthwork are of high heritage significance. The monument description makes it clear that this primarily for their evidential and historic value as they contain archaeological remains and are also representative of the Iron Age and then Roman occupation of the area. Their setting make a contribution to this, particularly with respect to the Roman marching camp as its location was influenced by the defensive needs of an Roman military unit on the move.

Predicted effects and their significance

The south-eastern part of the camp would have no views to the turbines due to topography and commercial forestry plantations. ZTVs (**Figure 8.1**) which incorporate modern forestry suggest that tips of up to 11 would be visible from within limited parts of the camp. The turbines would be visible but not prominent features from the monument and would be seen alongside other existing modern features, including industrial features. This would not affect an understanding of the form of the monument, or its defensive function. Therefore the magnitude of change to the historic character and setting of the monument would be negligible, resulting in a minor effect, which would be not significant.

GM232 Mynydd Caerau Round Cairns

Asset description and surroundings

The scheduled monument includes nine features. Six are cairns are situated at the summit of Mynydd Caerau (Llyndwr Fawr) and three are located on a lower ridge to the south. All are turf covered low mounds ranging in diameter from 12m to 22m and in height from 0.4m to 1.2m. The largest and tallest cairn is topped with a modern OS triangulation point and is the only cairn with visible stone. The cairns were largely round in form, some being more oval. Most of them are heavily disturbed or destroyed (GGATHER). An additional non-designated cairn is also recorded at the location but has been destroyed (RCAHMW).

Understanding and appreciation

The monument is within the LANDMAP Historic Landscape Aspect Area of Mynydd Caerau and Garw Forest (CynonHL224). This area has been classed as high value for the presence of some particularly well-preserved features such as the Mynydd Caerau cairn grouping and the Bwlchgarw cross dyke, although the landscape, in overall terms, has lost a significant degree of coherence due to modern afforestation.

The upper six are located at 555m AOD and the lower three are at 540m AOD. The upper six have panoramic views, including down to the coast. The lower three have views to the west, south and east, views north are slightly screened by the summit. The majority of barrows are no longer evident and can only be understood from the immediate vicinity. They are not prominent in the immediate landscape.

Heritage significance

The Cadw monument description (**Appendix 8B**) states that:

> *"The monument is of national importance for its potential to enhance our knowledge of prehistoric burial and ritual practices. The monument is an important relic of a prehistoric funerary and ritual landscape and retains significant archaeological potential, with a strong probability of the presence of both intact burial or ritual deposits, together with environmental and structural evidence. Cairns may be part of a larger cluster of monuments and their importance can further enhanced by their group value".*

As a scheduled monument, the cairns are of high heritage significance. The monument description makes it clear that this is primarily for their evidential and historic value as they have the potential to yield information on prehistoric funerary practices and they are also a visible marker of the use of this area as part of a Bronze Age funerary landscape. This value is enhanced by the fact that this forms a group of barrows, though commercial forestry has eroded the coherence of the historic landscape. The barrows would likely have been located in order to be prominent in the landscape, though this prominence has been reduced by erosion, and outward views are likely to have been of less importance.

Predicted effects and their significance

ZTVs indicate that the monuments on the western slope would have clear views of up to 11 turbines. However, the turbines would be located on a separate area of upland over 4.7km from the monument and would not dominate views of the surrounding landscape. The turbines would be visible but would not affect an appreciation of the monuments as a group, or their relationship to the area of higher ground on which they sit. Therefore the magnitude of change to the historic character and setting of the monument would be negligible, resulting in a minor effect, which would be not significant.

GM085 Llangynwyd Castle

Asset description and surroundings

The remains of the castle are visible as scarce ruins and earthworks. It is situated on the tip of a hill between two streams. The outer court is between 80 - 90m deep and was enclosed by a 120m arc of rampart and ditch. Set at the southeast end is the walled inner court which is heart shaped and up to 37m in diameter. The inner court had a substantial rock-cut ditch, except on the north-east, with a large counterscarp bank on the west and south sides. The monument is located on the edge of an area of woodland to the south and east, and is partly wooded itself.

Understanding and appreciation

The monument is within the LANDMAP Historic Landscape Aspect Area of Llangynwyd (CynonHL227).

The castle was the centre for the upland lordship of the lords of Glamorgan in Gorfynydd cantref, annexed by 1147. The castle was devastated in 1257 and subsequently rebuilt, then burned in the riots of 1294-5 and was then left in ruin. The site was partially excavated in 1906.

Heritage significance

The Cadw monument description (**Appendix 8B**) states that:

> *"The monument is of national importance for its potential to enhance our knowledge of medieval defensive organisation. The monument forms an important element within the wider medieval context and the structure itself may be expected to contain archaeological information in regard to chronology,*

building techniques and functional detail. The large outer bailey and defensive earthwork may be expected to contain buried archaeological deposits associated with the occupation of the castle".

As a scheduled monument, the castle is of high heritage significance. The monument description makes it clear that this is primarily for its evidential and historic value as it has the potential to yield information on medieval defensive organisation and as a local centre of power during the medieval period. Its setting makes a contribution to this as it will have been located for defensive purposes and as a local demonstration of power. When built, it will have been locally prominent, though this has been considerably diminished in its current ruined state and longer distance views, either of or from the monuments do not appear to have influenced its location.

Predicted effects and their significance

There would be no views of the development from the inner court which is covered in trees and scrub. ZTVs (**Figure 8.1**) indicate that there will be theoretical views from the outer court of the tips of up to 11 turbines, the only visible remains of which are the earthworks. The surrounding landscape is largely agricultural in character but the turbines would not be imposing or especially prominent at a distance of 4.8km, and would not affect an appreciation of the castle within its local context. Therefore the magnitude of change to the historic character and setting of the monument would be negligible, resulting in a minor effect, which would be not significant.

GM447 Glyncorrwg Mineral Railway (Parsons Folly) Section on Cefn Morfudd

Asset description and surroundings

The railway embankment is 80m long and 5.0m wide. Remains of a stone wall run along the top on the southwest side. The track has been dismantled and is now used as a farm track, though several two-hole stone sleeper blocks are visible. At the northwest end is a massive stone embankment, on the summit level are two embankments and two rock cuttings. To the southeast are remains of the railway's only steam operated inclined place. The scheduled area also includes three low dams cut by the railway which controlled water for the Melincryddan Copperworks, which was established in 1695.

Understanding and appreciation

The monument is within the LANDMAP Historic Landscape Aspect Area of Cefn Morfudd (NPTHL055).

This section of the railway is important as an example of the peak of civil engineering reached by horse-operated tramroads. It was built between 1839 and 1841 to carry coal from mines in the Gwenffrwd, Pelenna and Cregan valleys, to the Neath Canal at Aberdulais. It fell out of use in 1852.

The monument is set within upland agricultural fields but is a remnant feature of the former industrial character of this area. Modern features such as agricultural buildings and overhead electricity lines form part of the views from the monument.

Heritage significance

The Cadw monument description (**Appendix 8B**) states that:

"The monument is of national importance for its potential to enhance our knowledge of the development of industrial transportation in the 18th and 19th century. The track bed, bridges, drainage systems, embankments and revetments may all be expected to contain archaeological information in regard to construction techniques and functional detail."

As a scheduled monument, the railway is of high heritage significance and this is primarily for its evidential value for its contribution to an understanding of industrial transportation during the industrial development of the area in the 18th and 19th centuries. Its setting makes some contribution to this in as much as it contributes to an understanding of how the railway functioned in relation to the coal mines which it served.

Predicted effects and their significance

Theoretically 11 turbines would be visible from the monument. However, given the industrial character of the monument the development would not impact on its character or setting which is defined by its former industrial function. Therefore the magnitude of change to the historic character and setting of the monument would be negligible, resulting in a minor effect, which would be not significant.

Mynydd Margam Landscape of Special Historic Interest

An ASIDOHL has been completed to assess effects on the Mynydd Margam Landscape of Special Historic Interest and this is included as **Appendix 8A**.

The site is not within the historic landscape and its nearest point at the edge of the Cwm Dyffryn and Cwm Farteg Railway Corridor HLCA, the historic landscape is approximately 2km from turbine locations. Therefore, there would be no direct, physical impacts on the historic landscape as a result of the proposed development. Consideration has been given to the potential for indirect, physical impacts such as severance, increased risk of exposure or erosion, or frustration of historic land use practices. There is no reason to believe that the proposed wind farm would affect the management or use of the historic landscape and so it is concluded that indirect, physical impacts would not occur. The ASIDOHL has therefore focussed solely on the potential for indirect, visual impacts resulting from the visibility of turbines in views of and from locations within the historic landscape.

Mynydd Margam Landscape of Historic Interest is a large area of upland forming the south-western edge of the Glamorgan Blaenau where it meets the low lying coastal plain of Margam and Port Talbot. The landscape is formed of a range of mountains dissected by valleys and is generally quite sparsely populated. The vast majority of the landscape is under modern commercial forestry. Prior to this the upland areas were largely used as open or enclosed upland pasture from at least the medieval period.

The historic landscape includes the remains of settlement, agriculture and defence from the prehistoric period onwards. Early settlement is largely represented by Iron Age hill forts, which also have a defensive element. Prehistoric funerary monuments are also characteristic of the uplands, in the form of Bronze Age barrows and cairns.

Margam gained importance in the medieval period with the establishment of a Cistercian Abbey, but an ecclesiastical centre is known in the area from the early-medieval period. This is evidenced by the number of early Christian monuments within the landscape, which are located along ancient trackways across the uplands. The trackways are also key characteristics of the landscape, with probable origins in the prehistoric periods. The abbey had a significant influence on the historic landscape, owning much of the land and farming it from monastic granges.

The area also includes the settlement of Llangynwyd which is particularly important for the medieval political and cultural associations, the latter continuing into the post-medieval period with the continuation of local traditions.

The proposed development would be located on higher ground to the northeast of the historic landscape. A detailed assessment of effects on the character of each of the individual character areas has been completed, taking account of potential effects on the settings of individual assets where appropriate. There are seven Character Areas that would have no views of the development due to intervening topography, as such these HLCAs have been excluded from the assessment. A summary of the assessment of effects on the HLCAs with

potential to be affected is included in Table 7.1 of the ASIDOHL, but in each case it is concluded that effects would be only slight or moderate. This reflects a number of factors including:

- The lack of any direct physical impacts;
- The lack of any indirect, physical impacts;
- The distance to turbines or lack of visibility of turbines from a number of key historic assets; and
- In some cases, the presence of existing modern elements of industrial use or infrastructure which affect the historic character of areas or key assets.

Due to the nature of the landform within the historic landscape, turbines would not be visible from Margam Abbey and its associated landscaped parkland, or from the steep southern flanks of Margam Mountain which are noted as a dominant feature of the historic landscape.

Whilst the level of predicted impact is generally low for all areas, the highest level of potential impact has been identified for the following areas:

- HLCA 005 Llangynwyd;
- HLCA 013 Upper Cwm Kenfig;
- HLCA 014 Moel Ton Mawr; and
- HLCA 017 Cwm Dyffryn: Southern Valley Sides.

Elements of the turbines would be visible from some parts of these areas and with views from the north of Llangynwyd Conservation Area comprising modern housing and a small post-medieval agricultural fieldscape. However, where turbines would be visible, they would be seen as separate and distant to the historic character areas and would not dominate them or result in a disruption to or distraction from their historic character.

Overall, and taking account of all factors outlined above, it is considered that the development would have a slight impact on the character of the historic landscape as a whole. Despite some change to some views, including those affecting designated features of national importance, the presence of turbines may add an additional visual element into the landscape, but would not remove any aspects which are currently present. Given that a wind farm is a visually permeable development, it would not change our capacity to understand and appreciate the landscape's historical meaning and significance and therefore would not fundamentally reduce its overall value. In addition, the wind farm is a relatively short term temporary development, with no residual effects capable of affecting the historic landscape.

Predicted effects and their significance

A summary of the results of the assessment of effects on the historic environment is provided in **Table 8.10**.

Table 8.10 Summary of significance of adverse historic environment effects

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
GM245 Cefn yr Argoed Camp	High	Low	Moderate (Not Significant)	The monument is currently entirely enclosed by modern forestry. Based on current understanding, this is likely to be cleared during the later phase of the wind farm operation and turbines may be visible from and on the approach to the monument for a period of only around 5-9 years.
GM244 Nant Herbert Camp	High	Low	Moderate (Not Significant)	Turbines would theoretically be visible from the monument but this would not dominate views and the immediate setting formed by the spur of land on which the monument is located will not change.
GM581 Cefn Mawr cairn	High	Negligible	Minor (Not Significant)	The turbines would be visible from the monument but at a distance of approximately 3.8-5km. The presence of the turbines would alter the fabric of views but it would not introduce modern structures into a view which does not already contain them.
GM059 Y Bwlwarcau	High	Negligible	Minor (Not Significant)	The view towards the development is largely screened by the higher ground of Waun Lluest-wen and the nearest turbine is approximately 5km away from the monument and would not dominate the immediate setting,
GM098 Pen-y-Castell	High	Negligible	Minor (Not Significant)	ZTVs indicate that the hubs of 1-3 turbines will be visible and tips of 11 turbines. This would be minimised taking into account the effect of intervening modern commercial forestry on Mynydd Penhydd and Pen Disgwylfa at a distance of 5km.
GM264 Cefn Morfydd Dyke & Earthwork	High	Negligible	Minor (Not Significant)	There would be views of up to 11 turbines from the dyke as indicated by the ZTV which take into account the commercial forestry plantations. The development is situated 4.7km from the monument and would not be prominent or affect an appreciation of how this defensive structure relates to its local surroundings.
GM258 Blaen-Cwmbach Camp and GM277 Blaen-Cwmbach Earthwork	High	Negligible	Minor (Not Significant)	The turbines would be visible but not prominent features from the monument and would be seen alongside other existing modern features, including industrial features. This would not affect an understanding of the form of the monument, or its defensive function.
GM232 Mynydd Caerau Round Cairns	High	Negligible	Minor (Not Significant)	The turbines would be visible but would not affect an appreciation of the monuments as a group, or their relationship to the area of higher ground on which they sit.

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
GM085 Llangynwyd Castle	High	Negligible	Minor (Not Significant)	ZTVs indicate that there would be theoretical views from the outer court of the tips of up to 11 turbines, but the turbines would not be imposing or especially prominent at a distance of 4.8km, and would not affect an appreciation of the castle within its local context.
GM447 Glyncorrwg Mineral Railway (Parsons Folly) Section on Cefn Morfudd	High	Negligible	Minor (Not Significant)	Visibility of up to 11 turbines from the monument, though this would not impact on the industrial character of the monument or its setting, which is defined by its former industrial function.
Mynydd Margam Landscape of Special Historic Interest	High	Low	Moderate (Not Significant)	A completed ASIDOHL has concluded that there would be a low magnitude of impact on the character of the historic landscape as a whole.

1. The sensitivity of a receptor is defined using the criteria set out in section 8.9 above and is defined as negligible, low. Medium and high.
2. The magnitude of change on a receptor resulting from activities relating to the development is defined using the criteria set out in section 8.9 above and is defined as negligible, low, medium and high.
3. The significance of the environmental effects is based on the combination of the sensitivity/importance/value of a receptor and the magnitude of change and is expressed as major (significant), moderate (potentially significant) or minor/negligible (not significant), subject to the evaluation methodology outlined in section 8.9.

8.11 Assessment of cumulative effects

As outlined in section 2.7, consideration has been given as to whether any of the historic environment receptors that have been taken forward for assessment in this chapter are likely to be subject to cumulative the historic environment effects because of the historic environment effects generated by other developments.

Reference has been made to the operational, consented and proposed wind farms identified within **Chapter 7**, **Table 7.3**. Most of the identified wind farms are operational and for the purposes of this assessment have been considered as part of the assessment. The potential for cumulative effects has been identified for consented (but not yet built) and proposed wind farms within 10km of the Foel Trawsnant site. It is considered that more distant wind farm sites would not have the potential to affect the settings of any historic assets which could also be affected by Foel Trawsnant. The only wind farm which meets this criteria is the proposed East of Melin Court Wind Farm; a five turbine wind farm to be sited north of the operational Ffynnon Oer Wind Farm. Given its location, this may affect the settings of Cefn Mawr cairn (GM581) as well as Blaen-Cwmbach Camp (GM258) and Blaen-Cwmbach Earthwork (GM277). However, the Foel Trawsnant Wind Farm amended scheme would have only a minor effect on these assets and would not contribute to a significant cumulative effect.

8.12 Consideration of additional mitigation or compensation

No additional mitigation measures are proposed to further reduce the historic environment effects that are identified in this ES. This is because all relevant and implementable measures have been embedded into the development proposals and are assessed above in this chapter. These measures are considered to be likely to be effective and deliverable and address the likely significant effects of the Foel Trawsnant Wind Farm amended scheme.

8.13 Conclusions of significance evaluation

Subject to the implementation of the environmental measures set out in Section 8.8, the proposed development would not result in any significant direct effects resulting from the disturbance to archaeological remains during the construction of the Foel Trawsnant Wind Farm amended scheme. There are a number of identified historic assets within the planning boundary, but the avoidance of known assets outside of the proposed development footprint and provision for an archaeological watching brief will avoid any significant effects.

An assessment of effects on the settings of off-site historic assets has also been completed, with a number of scheduled monuments identified as being potentially subject to significant effects. It is concluded that none of these would be subject to a significant adverse effect. Cefn yr Argoed Camp (GM245) would be approximately 214m from the nearest turbine. It is currently surrounded by commercial forestry which is planted right up to the monument boundary and this would entirely screen it from the proposed turbines. However, assuming a start of construction in 2020 and with a 25 year operational period, turbines would be visible from the monument for a period of in the region of 5-9 years, though partially screened by the rising ground east of the monument. Taking account of the relatively short duration of this period, it is concluded that there would not be a significant effect on this asset.

Effects on the Mynydd Margam Landscape of Special Historic Interest have been assessed through the completion of an ASIDOHL (**Appendix 8A**). This concluded that the development would have a slight impact (using the terminology in the ASIDOHL guidance) on the character of the historic landscape as a whole. In EIA terms, this would not be significant.

8.14 Implementation of environmental measures

Table 8.11 describes the environmental measures embedded within the proposed development and the means by which they will be implemented, i.e. they will secured through planning conditions.

Table 8.11 Summary of environmental measures relevant to historic environment to be implemented

Environmental measure	Responsibility for implementation	Compliance mechanism	ES Section Reference
Visible features of archaeological interest within the vicinity of elements of the proposed development will be fenced-off to help prevent damage during the construction phase where disturbance to them can be avoided.	Developer/Contractor	Planning condition	Section 8.8
Maintenance of a watching brief during initial topsoil stripping will allow the identification and recording of any archaeology present.	Developer/Contractor	Planning condition	Section 8.8

8.15 References

Aldhouse-Green, S. 2000. 'Palaeolithic and Mesolithic Wales', in Lynch, F., Aldhouse-Green, S. and Davies, J. L., Prehistoric Wales, Sutton Publishing.

Cadw (2010) Conservation Principles for the Sustainable Management of the Historic Environment in Wales, Welsh Assembly Government. Available at: http://cadw.gov.wales/docs/cadw/publications/Conservation_Principles_EN.pdf [Checked 23/08/2018].

Cadw, (2017). Setting of Historic Assets in Wales, [online]. Available at: http://cadw.gov.wales/docs/cadw/publications/historicenvironment/20170531Setting%20of%20Historic%20Assets%20in%20Wales%2026918%20EN.pdf [Checked 23/08/2018].

Cadw (2007). Guide to Good Practice on using the Register of Landscapes of Historic Interest in Wales in the Planning and Development Process, [online]. Available at: https://historicengland.org.uk/images-books/publications/making-changes-heritage-assets-advice-note-2/ [Checked 23/8/2018].

CiFA (2017). Standard and Guidance for Historic Environment Desk Based Assessment, [online]. Available at: https://www.archaeologists.net/sites/default/files/CIfAS%26GDBA_3.pdf [Checked 01/08/2018].

CIfA (2014). Standard and Guidance for Commissioning Work or Providing Consultancy Advice on Archaeology and the Historic Environment, [online]. Available at: https://www.archaeologists.net/sites/default/files/CIfAS&GCommissioning_1.pdf [Checked 01/08/2018].

Lewis, R. 2006. Cross Ridge Dykes of Southeast Wales: survey and excavation. Project No. GGAT 83.

Robert, R. 2003. Mynydd Margam Historic Landscape Characterisation.

Sherman, A. and Evans, E. 2004. Roman Roads in Southeast Wales: desk-based assessment with recommendations for fieldwork. Project No. GGAT 75.

Ancestry, Glamorganshire Maps, accessed January 2014 – (http://freepages.genealogy.rootsweb.ancestry.com/~genmaps/genfiles/COU_Pages/WAL_pages/GLA.htm)

Welsh Government, 2017. Technical Advice Note 24: The Historic Environment

9 Non-Avian Ecology

9.1 Introduction

Overview

This chapter of the ES assesses the potentially significant effects[24] of the proposed development with respect to non-avian ecology. It should be read in conjunction with the development description provided in **Chapter 5** and with respect to relevant parts of **Chapter 12: Water Resources and Ground Conditions**, where common receptors such as peat have been considered and where there is an overlap or relationship between the assessments of effects. The chapter provides an update to the assessment presented in the 2014 ES (Amec 2014; Ref 24311rr073i1) and the 2016 Further Ecological Information (Amec Foster Wheeler 2016; Ref 24311rr120i1), which provided supplementary environmental information and will hereafter referred to as the 'SEI Report'. The methods and results of the surveys that have been used to establish the ecological baseline are detailed in separate baseline reports (see **Appendices 9A and 9B**). Surveys generally follow the nationally recognised guidance for species or species groups, and recognised specialist methodologies where appropriate. Potentially significant effects on ornithological features are considered in **Chapter 10: Ornithology**.

The updated assessment has taken into consideration the 2018 Scoping Report and 2018 Scoping Opinion, as well as consultee comments on the 2014 ES and 2016 SEI Report. The assessment process has therefore included:

- a review and update of policy and legislation;
- a review and update of desk study information;
- a review and update of the Extended Phase 1 and certain protected species surveys;
- an update of the National Vegetation Classification (NVC) assessment;
- a botanical survey of the access track within the planning boundary to identify any species of conservation importance;
- a review of peat survey data; and
- a review and update of habitat management plan.

Throughout this chapter, 'the proposed development site' refers to the area within the red-line boundary (the planning boundary). The wider site is referred to as the 'site boundary' which refers to the area within the pink line boundary encompassing land that is under the applicant's control. Both boundaries are shown **Figures 9.1-9.4**.

Approach to Ecological Impact Assessment (EcIA)

Nature conservation is a material consideration in the determination of planning applications. This technical section identifies those habitats or species that could be affected by the proposed development, and assesses the significance of any effects taking into account mitigation that is incorporated into the

[24] Other technical chapters within this ES use the terms "likely significant effects" and "potential likely significant effects" within the assessment. However, within the non-avian ecology chapter the term "potentially significant effects" is used as it accords with CIEEM guidance and avoids confusion with the term "likely significant effects" when used in the context of a Habitats Regulations Assessment.

development and the 'nature conservation importance' of the receptors. The assessment methods are based on the current *Guidelines for Ecological Impact Assessment in the UK and Ireland* (CIEEM 2016).

The CIEEM guidelines recognise that an appropriate Ecological Impact Assessment (EcIA) cannot consider in detail every individual species or habitat that may potentially be present at a site or affected by a development. The EcIA process therefore aims to focus the assessment on those biodiversity receptors that could be 'significantly' affected by the proposed development (i.e. where the effects on the receptor are of sufficient concern that they could influence the decision about whether or not planning permission should be granted), or for which the development could result in the contravention of relevant legislation.

The EcIA process therefore includes a 'scoping' stage (which excludes those receptors that cannot be 'significantly' affected, based on the results of desk-studies; field surveys; consultations; the importance of the ecological receptor; the presence (or not) of pathways for effects; and the measures incorporated into the scheme to avoid effects occurring) and a 'detailed assessment' stage, which examines more closely the potential effects of the scheme on those receptors that could be subject to 'significant' effects. Sections 9.2 – 9.8 below therefore set out the information used to inform the 'scoping' process, and the approach for this. Sections 9.9 – 9.18 then provide detailed assessments of the effects of the scheme on those receptors that are not 'scoped out' (i.e. where a 'significant' effect is possible). Effects on receptors that are 'scoped out' of the detailed assessment are summarised in **Appendix 9D,** for transparency. Sections 9.19 – 9.21 then provide a summary of the assessment and a conclusion for the EcIA.

9.2 Limitations of this assessment

There is one minor data gap associated with the operation of the static bat detectors; this is discussed within Section 9.15, but in summary two detectors (out of nine deployed) did not collect data in one survey month (May 2018) due to equipment failure or livestock interference. However, this does not affect the robustness of the results, or the overall assessment of significance. There are no other limitations that affect the robustness of the assessment, and no major information gaps have been identified to date.

9.3 Policy and legislative context

Table 9.1 lists the issues from the relevant national planning policies that have been considered in assessing non-avian ecology effects.

Table 9.1 National planning policy issues considered within the assessment of non-avian ecology

Policy reference	Policy issues	Considered in Section
Technical Advice Note (TAN) 5: Nature Conservation and Planning (2009)	TAN5 provides advice about how the land use planning system should contribute to protecting and enhancing biodiversity conservation within Wales. It sets out the key principles of planning for nature conservation for both local development plans and when deciding planning applications that may affect nature conservation. These include: promoting the conservation and enhancement of statutorily designated areas and undeveloped coast; ensuring that appropriate weight is attached to designated sites of international, national and local importance; protecting wildlife and natural features in the wider environment; ensuring that all material considerations are taken into account and decisions are informed by adequate information about the potential effects of development on nature conservation; ensuring that the range and population of protected species is sustained; and avoiding harm to nature conservation, minimising unavoidable harm by mitigation measures, offsetting residual harm by compensation measures and looking for new opportunities to enhance nature conservation.	Sections 9.4 – 9.20

Table 9.2 lists the issues from the relevant development plan policies that have been considered in the assessment of non-avian ecological effects.

Table 9.2 Development plan policies considered within the assessment of non-avian ecology

Policy reference	Policy issues	Considered in Section
Neath Port Talbot Local Development Plan 2011-2026 (NPT LDP) **Policy SP15 (Biodiversity & Geodiversity)**	**Policy SP15 (Biodiversity & Geodiversity)** sets out the approach to the protection, conservation, enhancement and management of important habitats, species and sites of geological importance. Important habitats, species and sites of geological interest will be protected, conserved, enhanced and managed through the following measures: 1. The identification of the following Internationally and Nationally designated sites within the County Borough to enable their protection: (a) Special Areas of Conservation (SACs) and Ramsar Sites; (b) Sites of Special Scientific Interest (SSSIs); (c) National Nature Reserves (NNRs). 2. The identification and protection of sites of regional and local importance. 3. The protection of important natural heritage features.	Sections 9.4 – 9.20
NPT LDP **Policy EN 6 (Important Biodiversity and Geodiversity Sites)**	**Policy EN 6 (Important Biodiversity and Geodiversity Sites)** states that proposals that would affect Regionally Important Local Nature Reserves (LNRs), Sites of Interest for Nature Conservation (SINCs), sites meeting SINC criteria or sites supporting Local Biodiversity Action Plan (LBAP) or S7 Environment (Wales) Act 2016 habitats or species, will only be permitted where they conserve and where possible, enhance the importance of the site, or the development could not reasonably be located elsewhere. Mitigation/compensation will need to be agreed where adverse effects are unavoidable.	Sections 9.9 – 9.12

Policy reference	Policy issues	Considered in Section
NPT LDP **Policy EN 7 (Important Natural Features).**	**Policy EN 7 (Important Natural Features)**. Development proposals that would adversely affect ecologically or visually important natural features such as trees, woodlands, hedgerows / field boundaries, watercourses or ponds will only be permitted where: 1. Full account has been taken of the relevant features in the design of the development, with measures put in place to ensure that they are retained and protected wherever possible; or 2. The biodiversity value and role of the relevant feature has been taken into account and where removal is unavoidable, mitigation measures are agreed.	Section 9.12.
NPT LDP **Supplementary Planning Guidance (SPG) – Biodiversity and geodiversity (2018)**	**The Biodiversity and Geodiversity: Supplementary Planning Guidance (SPG)** was adopted by Neath Port Talbot County Borough Council in May 2018. The SPG sets out guidance for interpretation of the biodiversity and geodiversity policies of the LDP (SP15: Biodiversity and Geodiversity; EN6: Important Biodiversity and Geodiversity Sites and EN7: Important Natural Features). The SPG sets out an approach to consider biodiversity holistically in the application process.	Sections 9.4 – 9.20

Legislative context

The following legislation has been considered in the assessment of the effects on ecological features[25]:

- The Conservation of Habitats & Species Regulations 2017;
- Wildlife and Countryside Act 1981 (as amended);
- The Environment (Wales) Act 2016;
- Natural Environment and Rural Communities Act 2006 (NERC Act);
- Protection of Badgers Act 1992;
- Hedgerows Regulations 1997;
- National Parks and Access to the Countryside Act 1949 (as amended); and
- Countryside and Rights of Way Act 2000 (CRoW Act).

Technical guidance

Publications that provide guidance that is relevant to the assessment of potentially significant effects on ecological features are listed below.

- Chartered Institute of Ecology and Environmental Management (CIEEM 2016). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal. Second Edition.

Technical guidance that has been used to define the survey methods used to inform this assessment is referenced in **Appendices 9A – 9D** as required.

[25] The Chartered Institute for Ecology and Environmental Management (CIEEM) refer to biodiversity receptors within technical guidance as ecological features. This term is therefore used in this chapter in place of 'receptors' but for the purposes of the assessment they are the same

9.4 Data gathering methodology

Study area

The initial study area was based on consultations with the statutory consultees (see Section 9.6) and professional experience of similar schemes, and comprised:

- the site boundary (pink line on **Figures 9.1 – 9.4**); and
- additional areas of search outside the site, based on best practice guidance and a high-level overview of the types of ecological features present and the potential effects that could occur.

The search areas were defined on a precautionary basis to ensure that the Zones of Influence (ZoI)[26] relevant to each ecological feature were covered during baseline data collection activities. If appropriate, study areas were amended to reflect the planning boundary as the previous application ensured that the preferred position for this was known from the start of the EIA process[27].

Desk study

A data-gathering exercise was undertaken in March 2018 to obtain information relating to statutory and non-statutory biodiversity sites; species or habitats of principal importance for the conservation of biodiversity; legally protected and controlled species; and other conservation-notable habitats or species (see Boxes 1 and 2 for definitions of these terms). Given the potential for the proposed development to affect ecological features located off- as well as on-site, data were obtained for:

- European protected sites within 10km of the planning boundary;
- SSSIs within 2km of the planning boundary;
- other statutory and non-statutory sites designated for their nature conservation interest within 2km of the planning boundary;
- protected species, species of principal importance for the conservation of biodiversity (see Box 2), or other conservation-notable species recorded within 2km of the planning boundary;
- habitats of principal importance for the conservation of biodiversity (see Box 2), or other conservation-notable habitats recorded within 2km of the planning boundary; and
- known bat roosts within 10km, reflecting current guidance.

Any other sites or features that could potentially be affected by the proposed development were also identified, including:

- landscape features that may be important for protected or conservation-notable species, such as potential migration or dispersal routes;
- ponds and other waterbodies within 500m of the planning boundary (red line).

Sources of desk-study information are provided in **Table 9.3.**

[26] The ZoI in this context is the area over which an individual ecological feature may be subject to a potentially significant effect as a result of the proposed development.

[27] Although it was recognised that this might vary in response to other aspects of the revised EIA (e.g. landscape and visual impact assessments).

Box 1 – Designated Biodiversity Sites, and Priority Habitats and Species

Statutory Biodiversity Sites

European sites: Important biodiversity sites designated under international law or treaties. European sites are any **Special Area of Conservation** (SAC) from the point at which the European Commission and the UK Government agree the site as a '**Site of Community Importance**' (SCI); any classified **Special Protection Area** (SPA); any **candidate SAC** (cSAC); and (exceptionally) any other site or area that the Commission believes should be considered as an SAC but which has not been identified by the Government. The term 'European site' is term is also commonly used when referring to **potential SPAs** (pSPAs), to which the provisions of Article 4(4) of Directive 2009/147/EC (the 'new wild birds directive') apply; and to **possible SACs** (pSACs) and listed **Ramsar sites**, to which the provisions of the Habitats Regulations are applied a matter of Government policy (TAN 5 para. 5.1.3) when considering development proposals that may affect them.

Sites of Special Scientific Interest (SSSIs): Nationally important sites notified under the Wildlife and Countryside Act 1981 (as amended) that provide the best examples of the UK's flora, fauna, or geological or physiographical features (note, this assessment focuses on those sites notified for their biodiversity interest).

National Nature Reserves (NNRs): Nationally important sites notified under the National Parks and Access to the Countryside Act 1949 and the Wildlife and Countryside Act 1981 (as amended); in practice most NNRs are SSSIs also.

Local Nature Reserves (LNRs): Locally important sites that are designated under the National Parks and Access to the Countryside Act 1949 with the objective of encouraging their use for the study, research or enjoyment of nature.

Non-statutory Biodiversity Sites

Non-statutory biodiversity sites in Neath Port Talbot (NPT) area are known as **Sites of Importance for Nature Conservation (SINCs)**. The search buffer also extends into the administrative area of Bridgend County Borough Council (BCBC) which also refer to non-statutory biodiversity sites as SINCs.

Other important habitats or species

Species (or habitats) of "*principal importance for the conservation of biodiversity*" are those listed by Welsh Government pursuant to Section 7 of the Environment (Wales) Act 2016. These include most of those UK BAP priority habitats and species that occur in Wales. They are referred to as 'S.7' habitats or species.

Other conservation-notable habitats and species would include:

species listed as being of conservation concern in the relevant UK Red Data Book (RDB) or the Birds of Conservation Concern 4 Red List (Eaton et al, 2015);

Ancient Woodland Inventory Sites (AWIS; areas that have been under continuous woodland cover since at least 1600);

'Nationally Rare' and 'Nationally Scarce' species in the UK, which are species recorded from, respectively, 1-15 and 16-100 hectares (10x10km squares of the UK national grid);

habitats and species listed within the NPT or BCBC Local Biodiversity Action Plan (LBAP);

other species that NRW have identified to SEWBREC due to concerns regarding their status;

other species or assemblages such as large populations of animals considered uncommon or threatened in a wider context;

'Important Hedgerows' as defined using the habitat criteria in The Hedgerows Regulations 1997.

Box 2 – Legally Protected and Controlled Species

Legal Protection

Many species of animal and plant receive some degree of legal protection. For the purposes of this report, legal protection refers to:

- Species included on Schedules 5 and 8 of the Wildlife and Countryside Act 1981 (as amended), excluding species that are only protected in relation to their sale (see section 9[5] and 13[2]);
- Species included on Schedules 2 and 5 of the Conservation of Habitats and Species Regulations 2017 (England and Wales); and
- Badgers, which are protected under the Protection of Badgers Act 1992.

Legal Control

Schedule 9 of the *Wildlife and Countryside Act 1981* (as amended) lists species of animal that it is an offence to release or allow to escape into the wild (for example grey squirrel) and species of plant that it is an offence to plant or otherwise cause to grow in the wild (for example, Japanese knotweed).

Table 9.3 Sources of desk study information

Aspect	Data	Sources
Statutory sites	Boundary data	Magic: www.defra.magic.gov.uk
	Citations	JNCC: http://jncc.defra.gov.uk/page-4
	Other site information (e.g. Conservation Objectives; Site Improvement Plans; Condition Assessments; Views about Management; etc.)	NRW: http://lle.gov.wales/home
Non-statutory sites	Boundary data	South East Wales Biodiversity Records Centre (SEWBReC).
	Citations	
Other sites and habitats	Boundary data	Magic: www.magic.gov.uk
Tree preservation orders	Location data	Neath Port Talbot County Council
Species records	Location data	South East Wales Biodiversity Records Centre (SEWBReC).

JNCC Joint Nature Conservancy Council
Magic Web-based Government GIS for environmental information
NRW Natural Resources Wales
SEWBReC South East Wales Biodiversity Records Centre

Survey work

A list of updated ecological surveys carried out to inform the preparation of this chapter is provided in **Table 9.4**. The methods and results of these surveys are detailed in **Appendices 9A and 9B**. The previous ecological baseline surveys are provided in the 2014 ES (Amec, 2014), with supplementary ecological information provided in the 2016 SEI Report (Amec Foster Wheeler, 2016).

Table 9.4 2018 Baseline Survey

Feature / Aspect	Survey type and relevant guidelines*	Survey area	Survey period	Location of survey report
Habitats	Phase 1 habitat survey (JNCC 2010)	Site boundary plus 50m**	27 – 29 Mar 2018	**Appendix 9A**
Habitats	Phase 1 habitat survey verification (JNCC 2010)	Planning boundary plus 50m	15 – 17 Aug 2018	**Appendix 9A**
Habitats	National Vegetation Classification (Rodwell 2006)	Planning boundary plus 85m at turbines, 25m on tracks	15 – 17 Aug 2018	**Appendix 9A**
Plant species	Botanical survey	Access track between the B4282 and site boundary, plus 10m.	15 – 17 Aug 2018	**Appendix 9A**
Species (site suitability)	Presence / potential presence of protected and other conservation-notable species assessed alongside Phase 1 survey	Site boundary plus 50m**	27 – 29 Mar 2018.	**Appendix 9A**
Great crested newt	Habitat Suitability Index (Oldham *et al.* 2000)	All ponds within 500m of the planning boundary.	27 – 29 March 2018.	**Appendix 9A**
Great crested newt	Environmental DNA (Biggs *et al.* 2015).	All ponds within 500m of the planning boundary, unless dry.	19 April 2018.	**Appendix 9A**
Otters	Searches for signs (Natural England and DEFRA 2014).	Within the site boundary.	Four visits Mar – Sep 2018	**Appendix 9A**
Water voles	Searches for signs (Strachan & Moorhouse 2006).	Within the site boundary.	Three visits May – Sep 2018	**Appendix 9A**
Bats	Activity surveys (static and transects) (Bat Conservation Trust 2016; Hundt 2012; Natural England 2014).	Within the site boundary.	April – October 2018.	**Appendix 9B**

* Surveys were based on the standard guidelines referenced (where available); the precise scope of the surveys and any deviations from guidance are set out in **Appendices 9A – 9B**, although there were no significant deviations from guidance that might influence the characterisation of the baseline.
**Where access was permitted and possible

9.5 Overall baseline

The description of the ecological features below provides a summary of the biodiversity baseline as determined through desk-study and field survey. Further details of the desk study and field survey programme are provided in **Appendix 9A and Appendix 9B**.

Current baseline

Site context and surrounding habitats

The site is typical of many grazed upland areas in South Wales, dominated by semi-natural and heavily modified habitats that are characteristic of former peatlands including improved grassland, semi-improved

acid grassland, wet dwarf shrub heath, acid/neutral flush, wet modified bog and marshy grassland. The site has some steeper slopes associated with stream headwaters, and there are areas of bracken that are consistent with 'ffridd' (a complex and varied habitat mosaic found on uncultivated valley sides that typically includes large stands of bracken with scrub, heath, woodland, acid grassland and wet flushes). The site habitats are not particularly notable examples, with their condition heavily influenced by historic and current agricultural practices (drainage, burning, grazing, etc.). Parts of the site are currently grazed under an agri-environment scheme.

The surrounding area is dominated by forestry (generally coniferous plantation, parts of which are now being replanted with native deciduous trees) and improved pasture, with localised areas of ffridd and other habitats characteristic of uncultivated areas.

Designated sites

There are three statutory designated nature conservation sites (two SACs and one LNR) and 17 non-statutory nature conservation sites (16 SINCs and one Country Park) within the study area (see **Figures 9.1 and 9.2**). The interest features of these sites area summarised in **Table 9.5**. There are no Tree Preservation Orders present on or adjacent to the planning boundary.

The following sites are considered particularly relevant to this application:

- Nant-y-Crywydd SINC (immediately adjacent to the planning boundary);
- NPT 'Watercourses' SINC (within the planning boundary); and
- Caerau West SINC (immediately adjacent to the planning boundary).

Table 9.5 Designated nature conservation sites within the search areas

Site	Location*	Summary of interest features
Glaswelltiroedd Cefn Cribwr/ Cefn Cribwr Grasslands SAC**	8.7km S	The site is one of four sites representing purple moor grass (*Molinia*) meadows in south and central Wales and is one of the major UK strongholds for this habitat type. There are extensive stands of M24 *Molinia* – meadow thistle (*Cirsium dissectum*) fen-meadow, including the heathy sub-type with cross-leaved heath (*Erica tetralix*), as well as other forms with a stronger representation of grasses, rushes and small sedges. Annex I features: • *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) Annex II features: • Marsh fritillary butterfly (*Euphydrya (Eurodryas, Hypodryas) aurinia*) (Q)
Kenfig SAC**	9.7km SW	This site is a largely intact dune system situated in south Wales. Annex I features: • Fixed coastal dunes with herbaceous vegetation ("grey dunes") • Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*) • Humid dune slacks • Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. • Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) (Q) Annex II features: • Petalwort *Petalophyllum ralfsii* • Fen orchid *Liparis loeselii*

Site	Location*	Summary of interest features
Bryn Tip Local Nature Reserve**	1.4km W	This site is located to the northern end of the village of Bryn. The former coal spoil tip and supports *Molinia* grassland, acid grassland, heathland, bare areas with lichen, gorse scrub and sedge rich flushes.
Afan Mineral Railway SINC	0.49km NW	A linear site running along the middle section of the Afan Valley between Cymmer and Pontrhydyfen. The principal habitat is riparian woodland, a large proportion of which is included on the Ancient Woodland Inventory. Additional habitats include a mosaic of grassland, heath, bracken slopes and spoil elements in a valley which also holds considerable industrial heritage. In 2017 an intensive invertebrate study was undertaken by the Colliery Spoil Biodiversity Initiative finding 169 invertebrate species with at least 7 species of conservation importance. The presence of habitat specialists indicate that colliery spoil habitats of Cwm Blaenpelenna are mimicking more natural habitats. Recorded taxa include 260 vascular plants, 132 bryophytes, 169 invertebrates, 32 birds, 19 lichens, 8 fungi, 2 mammals, plus 1 each of amphibian and reptile.
Ancient Semi Natural Woodland (ASNW) SINC**	0.39km NW	Designated as it is a ASNW. No citation details are available.
Bryn Tip SINC**	1km W	This site is located to the northern end of the village of Bryn. The site is on former coal spoil tip and supports diverse vegetation including *Molinia* grassland, acid grassland, heathland, bare areas with lichen, Gorse Scrub, sedge rich rushes. There are a number of canalised and underground water courses as well as a more natural open stream in the east of the site. The site also supports good numbers of invertebrates notably Dark Green Fritillary (*Argynnis aglaja*), together with birds including Linnet (*Carduelis cannabina*) and Skylark (*Alauda arvensis*).
Dyffryn Grassland SINC**	0.62km N	Situated in the Afan Valley, this site comprises restored ground between Brytwn Road and the Afon Afan on the north side of Dyffryn. Coarse grassland dominates, which is seasonally wet in parts, with plantings and mixed native scrub along with restricted areas of heath vegetation. Given the comparative small size of the site, a total of 139 plant species indicates a moderately high level of diversity with a good number of indicator species.
Meadow Row, Bryn SINC**	1.67km W	A colliery spoil site with remnants of semi-natural grasslands situated in a small south-facing cwm immediately east of the small village of Bryn. The habitats primarily comprise a mosaic of colliery spoil vegetation, with dry acid grassland scrub and rush-pasture. Recorded taxa include 101 vascular plants, 31 bryophytes, 9 birds, 6 lichens, 1 invertebrate and 1 fungus.
'Watercourses' SINC	Coincides with site	The 'Watercourses' SINC is unusual in that it is a 'generic' designation covering all watercourses that retain a generally natural form (i.e. not culverted etc.) in NPT; citations, selection criteria or baseline data for specific watercourses are not therefore available. The designation is based on the *Guidelines for the Selection of Wildlife Sites in Wales* (Wales Biodiversity Partnership 2008). The principal local streams with catchments that coincide with the site (Nant yr Hwyaid, Nant Cynon; Nant Tryfal; Nant Drysiog; Nant Cwmfarteg; Nant y Crynwydd; and Nant y Ffyllon) are likely to meet at least one of the criteria set out in the *Guidelines for the Selection of Wildlife Sites in Wales*. The small upland tributary streams crossed by the site tracks are also considered as part of the SINC designation, although they less obviously meet the criteria summarised in the *Guidelines for the Selection of Wildlife Sites in Wales*.
Caerau North SINC	0.94km E	Marsh/Marshy grassland, fen, dry modified bog, wet modified bog, sphagnum blanket bog, semi-improved acid grassland, wet dwarf shrub heath, broad-leaved semi-natural woodland, acid dry dwarf shrub heath
Caerau West SINC	On site boundary	Marsh/marshy grassland, flush spring and acid/neutral flush, sphagnum blanket bog, sphagnum wet modified bog, wet dwarf shrub heath, dry heath acid mosaic, dry dwarf shrub heath, semi-improved acid grassland, scattered bracken.
Craig Tal-y-Fan SINC**	1.9km E	Broad-leaved semi-natural woodland, dense continuous scrub, dense continuous bracken.
Cwm Cerwyn SINC	1km SE	Broad-leaved semi-natural woodland, unimproved neutral grassland, dense continuous scrub, coniferous plantation.

Site	Location*	Summary of interest features
Cwm Sychbant SINC	1.6km S	Semi-improved neutral grassland, broad-leaved semi-natural woodland, marsh/marshy grassland, dense continuous bracken, coniferous plantation.
Nant-y-Crynwydd SINC	~5m E	Marsh/marshy grassland, semi-improved neutral and acid grassland, sphagnum blanket bog, broad-leaved semi-natural woodland, dense continuous scrub.
Sychbant Fields SINC	1.8km S	Dry dwarf shrub heath (acid).
Tudor West SINC	0.6km E	Marsh/marshy grassland, neutral grassland unimproved, broad-leaved semi-natural woodland, semi-improved acid grassland and acid/neutral flush.
Y Parc (North) SINC	0.45km SE	Broad-leaved semi-natural woodland, wet and dry dwarf heath with scattered bracken, semi-improved acid grassland, unimproved neutral grassland, wet modified sphagnum bog, marsh/marshy grassland and dense continuous scrub.
Y Parc (South) SINC	1.47km SE	Broad-leaved semi-natural woodland, marsh/marshy grassland, semi-improved neutral grassland, dense continuous scrub, wet dwarf shrub heath, blanket bog and unimproved neutral grassland.
Afan Argoed Country Park**	0.55km NW	Set in the Afan Valley in Neath Port Talbot. This 48 square mile forest park has miles of cycling trails, walking trains and several mountain bike trails.

Key

* Location relative to site boundary

** Note, these sites were not identified in the 2014 desk-study as this did not include the access track and / or (a) the information was not supplied by SEWBReC (as it was previously held by NPT or BCBC) or (b) the site appears to have been recently designated.

(Q) Interest features (habitats or species) that are qualifying features; all other habitats and species are primary reason for designation.

Annex I/II Habitats or species listed on Annex I or II (respectively) of Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive') Habitats

Habitats

The habitats present within and immediately adjacent to the site boundary are summarised in **Table 9.6**, with the approximate areas within the planning boundary (i.e. which could be directly affected by the scheme) also noted. Where habitats are large enough to map these are shown in **Figure 9.3**. It should be noted that the 2018 Phase 1 surveys (and associated review of the NVC survey) have resulted in the re-classification of some site habitats, when compared to the original May/June 2010 and May 2012 Phase 1 surveys; these changes are noted in **Table 9.6**, and considered in more detail in **Appendix 9A** and Section 9.13.

Table 9.6 Habitats within the site boundary and the approximate area of these within the planning boundary

Phase 1 Habitat	S.7 Priority Habitat*	Summary	~Area in PB**
Improved grassland	N/A	Improved grassland was found within the planning boundary at Turbines 1, 7 and 4. In addition, improved grassland was also present north of Turbine 2, south of Turbine 3 and north of Turbine 11. In these areas the sward was dominated by species such as perennial rye-grass (*Lolium perenne*), crested dog's-tail (*Cynosurus cristatus*) and white clover (*Trifolium repens*) which are all typical of a sward dominated by grasses. These areas correspond to the NVC community MG6b (see **Appendix 9A**). These areas were previously classified as semi-improved acid grassland or poor semi-improved grassland but the area generally lacks forbs and so has now been classed as improved grassland.	18.27 ha

Phase 1 Habitat	S.7 Priority Habitat*	Summary	~Area in PB**
Semi-improved acid grassland	N/A	Areas of semi-improved acid grassland are present within the planning boundary, and this habitat is more extensive than previously noted as much of the 'marshy grassland' has been recategorized at turbine locations for Turbines 6 and 5; and also south of T11. The semi-improved acid grassland is atypical as *Molinia* is over-represented, and so has some affinities with 'marshy grassland'; however, it is characterised as semi-improved acid grassland due to the presence of mat-grass (*Nardus stricta*) and general lack of species (other than *Molinia*) which would be associated with marshy grassland, such as soft rush (*Juncus effusus*), marsh thistle (*Cirsium palustre*) and marsh-bedstraw (*Galium palustre*). This corresponds to the NVC community U5d, based on the botanical assessment (see **Appendix 9A**). Upland acid grasslands are not S.7 habitats, although good examples may sometimes contribute the 'Upland heathland' S.7 habitat where they occur in mosaics with heathland habitats.	8.4 ha
Wet heath	Upland heathland	Areas of wet heath are present are present within the site boundary, and this habitat is more extensive than previously noted as much of the 'marshy grassland' east of the Nant yr Hwyaid has been recategorized (at Turbines 10, 9 and 8). The habitat is characterised by constant but sparse heather (*Calluna vulgaris)*, cross-leaved heath (*Erica tetralix)* and bilberry (*Vaccinium myrtillus)*, all of which are indicative of heath vegetation. Cross-leaved heath in particular, is a strong indicator of wet heath on shallow peaty soils. This habitat was previously classified as marshy grassland due to the over representation of deer grass (*Trichophorum germanicum*) and *Molina* being more prominent than it should be within high quality or typical wet heath habitats. The habitat corresponds to the NVC community M15d, as per the botanical assessment (see **Appendix 9A**). Much of this area is under an agri-environment scheme which may possibly account for the perceived change from marshy grassland to wet heath, although the NVC communities in these areas are largely as previously recorded. The habitat quality is variable but not exceptional; undergrazing has encouraged the dominance of deer grass and *Molinia* has invaded some areas.	10.25 ha
Acid/neutral flush	Upland flushes, fens and swamps	The mapped areas of acid/neutral flush are generally consistent with the previous Phase 1 survey, with minor changes in the area of acid/neutral flush to the north of Turbine 7. This habitat is present along the margins of a small stream extending up onto slightly higher but flushed ground. The habitat generally corresponds to the NVC community M6c as per botanical assessment (see **Appendix 9A**). The NVC notes that acid/neutral flushes are highly variable, and are most diverse where the vegetation has been poached by livestock in very wet ground; although soft-rush (*Juncus effuses)* is dominant in all the acid/neutral flush habitats the poaching allows other species to thrive alongside it. However, the habitat is not a particularly notable example.	1.26 ha
Wet modified bog	Blanket bog	The areas of wet modified bog are unchanged from those identified in the 2014 ES, being present in small amounts around streams. The bogs corresponds to the M17 *Trichophorum germanicum-Eriophorum vaginatum* blanket mire community, although they are poor-quality examples being very localised and not well developed, with common cotton-grass (*Eriophorum angustifolium*) and purple moor grass co-dominant.	0.29 ha
Marshy grassland	Upland flushes, fens and swamps	The area of marshy grassland has been substantially reduced compared to the 2014 ES as areas of *Molinia*-dominated grassland have been classified as semi-improved acid grassland or wet heath (see **Appendix 9A**). Those areas that are categorised as marshy grassland correspond to the M23b *Juncus effusus/acutiflorus-Galium palustre* rush-pasture; *Juncus effusus* sub-community; these are found within tracts of improved grassland on-site in areas of poor drainage, often (but not always) in ditches and along track edges. The marshy grassland within the wind farm site was assessed as being of poor quality (dry and species poor), although some small stands along the access track are diverse enough to be regarded as S.7 priority habitat.	1.46 ha

Phase 1 Habitat	S.7 Priority Habitat*	Summary	~Area in PB**
Dry heath	Upland heathland	There are occasional very small localised patches of dry heath located along the access track on the edges of the coniferous woodland and upon a steep embankment where there is a rock exposure (**Appendix 9A** - TN7). Species included common heather (*Calluna vulgaris*); bilberry (*Vaccinium myrtillus*); and western gorse (*Ulex gallii*).	0.25 ha
Ponds	Ponds	Ponds 3, 4, 7 and 8 are located along the access track; these are likely to be outside of the vegetation clearance zone.	None
Watercourses	Rivers	Streams are generally present within areas of acid/neutral flushes, and are crossed by the site infrastructure. However, the 'Rivers' priority habitat does not apply to stream headwaters that are not "*marked with a blue line on Ordnance Survey (OS) maps at a scale of 1:50,000*" (JNCC 2011), therefore the streams directly affected by the site infrastructure are not considered part of this classification.	0.007ha
Coniferous woodland plantation	N/A	Located along the margins of the access track and to the south of the access track.	0.83 ha
Broadleaved plantation woodland	N/A	Two small areas of broadleaved plantation woodland consisting of sessile oak (*Quercus petraea*), silver birch (*Betula pendula*) and small leaved lime (*Tilia cordata*) located to the south of the access track – see **Appendix 9A** TN8 and TN9).	0.82 ha
Other habitats and features	N/A	Other habitats included along the access track included rock exposures, wet ditches, scrub and tall ruderal vegetation. Scrub and bracken were also located adjacent to the road at the base of the access track.	N/A
Other features	N/A	Comprising of boundary fences, and tracks, as per 2014 ecological baseline report.	N/A

Key:
* Corresponding S.7 habitat based on the S.7 lists and the criteria within the *UK Biodiversity Action Plan: Priority Habitat Descriptions* (JNCC 2011).
** Approximate area within the planning boundary.

Species

Much of the site is covered by grazed grassland that is generally of limited value to most protected or conservation-notable species, although there are areas of more structurally complex grasslands and heathland which will provide habitat for a range of species. The desk study returned records of 37 protected or conservation notable species (see **Table 9.7**) from within 2km of the site boundary.

Table 9.7 Protected and notable species recorded within 2km of the site boundary since 2008

Common name	Scientific Name	No. of Records	Location of Nearest Record*	Key Protections / Policy Status
European Otter	*Lutra*	1	0.37km SW	EPS, WCA and S7
Eurasian Badger	*Meles*	3	1.1km E	PBA
Brown Hare	*Lepus europaeus*	2	0.62km NE	S7
Stoat	*Mustela erminea*	1	0.04km S	NRW and LBAP (BRG)
Weasel	*Mustela nivalis*	3	0.87km W	NRW and LBAP (BRG)

Common name	Scientific Name	No. of Records	Location of Nearest Record*	Key Protections / Policy Status
Hedgehog	*Erinaceus europaeus*	9	0.6km NW	S7 and LBAP (BRG)
Adder	*Vipera berus*	16	0.44km N	WCA and S7
Common Lizard	*Zootoca vivipara*	18	0.67km SW	WCA and S7
Grass Snake	*Natrix helvetica*	6	1km E	WCA and S7
Slow-worm	*Anguis fragilis*	10	0.62km E	WCA and S7
Common Toad	*Bufo*	4	1km	S7
European Eel	*Anguilla*	2	1.75km	S7
Atlantic Salmon	*Salmo salar*	1	1.8km	EPS and S7
Brown/Sea Trout	*Salmo trutta*	3	1.3km	S7
Grayling	*Hipparchia semele*	11	1.3km	S7
Powdered Quaker	*Orthosia gracilis*	4	1.57km	S7
Forester	*Adscita statices*	1	1.8km	S7 and LBAP (NPT)
Broom Moth	*Ceramica pisi*	19	0.03km SE	S7
Blood-vein	*Timandra comae*	9	0.03km SE	S7
Dusky Brocade	*Apamea remissa*	22	0.06km SE	S7
Small Phoenix	*Ecliptopera silaceata*	22	0.07km NE	S7
Shoulder-striped Wainscot	*Leucania comma*	19	0.31km W	S7
Sallow	*Cirrhia icteritia*	6	1.23km W	S7
Buff Ermine	*Spilosoma lutea*	18	0.44km SE	S7
Rosy Minor	*Litoligia literosa*	5	1.3km W	S7
Hedge Rustic	*Tholera cespitis*	2	1.3km W	S7
Rustic	*Hoplodrina blanda*	8	1.31km E	S7
Dark Brocade	*Mniotype adusta*	4	1.47km SE	S7
Dingy Skipper	*Erynnis tages*	12	0.31km W	S7
Small Pearl-bordered Fritillary	*Boloria selene*	14	1.39km W	S7 and LBAP (BRG)
Marsh Fritillary	*Euphydryas aurinia*	3	1.39km W	EPS, WCA and S7
Small Blue	*Cupido minimus*	1	1.42km SE	WCA and S7
Violet Oil-beetle	*Meloe violaceus*	2	0.86km NW	S7
Parmotrema perlatum	*Parmotrema perlatum*	12	0.31km W	S7

Common name	Scientific Name	No. of Records	Location of Nearest Record*	Key Protections / Policy Status
Xanthoria polycarpa	*Xanthoria polycarpa*	1	1.97km SW	S7
Chamomile	*Chamaemelum nobile*	1	1.4km E	S7
Pennyroyal	*Mentha pulegium*	1	1.36km E	WCA and S7

Key:
*Closest record to main planning boundary; note, distances are approximate, particularly as some records are provided to the 1km or 10km grid square only
EPS – Species protected under the *Conservation of Habitats and Species Regulations 2010* (as amended)
WCA – Species protected under the *Wildlife and Countryside Act 1981* (as amended) (excluding in relation to sale)
S7 – Section 7 species
LBAP (BRG) – Bridgend County Borough Council Local Biodiversity Action Plan Species (now superseded by S7).
LBAP (NPT) – Neath Porth Talbot Council Borough Council Local Biodiversity Action Plan Species (now superseded by S7).
PBA – Protection of Badgers Act 1992
NRW – Natural Resource Wales Priority Species.

Generally, the 2018 desk study identified many of the same species records as the 2014 baseline report and 2016 SEI report, although it is worth noting that additional species have been identified as a result of the inclusion of the access track in the search area.

The results of the Extended Phase 1 survey and subsequent species- or species-group specific surveys are summarised in **Table 9.8**.

Table 9.8 Summary of species surveys

Species	Survey	Summary
Badger	Extended Phase 1	No evidence of badgers found; habitats arguably suitable but species is likely to be present at low densities only if at all. These results are consistent with previous surveys.
Water vole	Extended Phase 1 / Searches for evidence	No evidence of water voles found; habitats within the development area are not suitable for this species and it is considered to be absent from the site. These results are consistent with previous surveys.
Otter	Extended Phase 1 / Searches for evidence	No evidence of otters found; habitats within the development area are not particular suitable for this species although it is likely that otters periodically cross the site when moving between river catchments. These results are consistent with previous surveys.
Bats (all species)	Extended Phase 1	No trees within or adjacent to the site boundary have features suitable for roosting bats.
	Activity surveys	The bat community and its use of the site is unexceptional and consistent with the habitats present. Nine species or species groups have been recorded at the site during the transect and static detector surveys undertaken since 2010 (common, soprano and Nathusius' pipistrelle; noctule; long-eared bat species; *Myotis* species; *Nyctalus* species; *Nyctalus* or serotine; and a small number of unidentified calls that were probably bats). Activity was heavily associated with linear features (principally treelines), with activity in the open areas of the site much lower. These results are consistent with previous surveys.
Great crested newt	HSI and eDNA	eDNA surveys confirmed that GCN are absent from all surveyed waterbodies within 500m of the planning boundary.

Species	Survey	Summary
Reptiles (all species)	Extended Phase 1 / incidental observations	A common lizard was recorded incidentally along an embankment adjacent to a track near Turbine 5 during a site visit in May 2018; this was recorded near an area of semi-improved acid grassland and wet heath outside the planning boundary. Reptiles are and were previously assumed to be present in areas of the site, but in relatively low densities compared to other areas locally. Most of the site habitats are suitable but 'sub-optimal' for high density populations. Note, although reptiles were assumed to be present at the site, specific surveys were not considered essential to adequately and robustly assess the likely effects of the scheme on reptiles, or to design appropriate mitigation that would ensure no significant effects on these species.
Other protected / conservation notable species	Extended Phase 1 / incidental observations	The habitats within and immediately adjacent to the planning boundary were assessed for their potential to support populations of other protected or conservation notable species recorded by the desk-study, based on the Extended Phase 1 habitat survey. In summary, whilst the site may be occasionally or periodically used by other conservation notable species, the habitats are unexceptional locally and there is nothing to suggest that the site could support potentially significant populations of any conservation-notable species (i.e. populations that would be of county-level importance or greater).

Predicted future baseline

Determining a future baseline draws upon information about the likely future use and management of the site in the absence of development, known population trends (for species), climate change and any other proposed developments (consented or otherwise) that may act cumulatively with the proposed development to affect ecological features.

In this instance the future baseline is unlikely to be markedly different from the current baseline, in the absence of the proposed development. Land use/management is anticipated to remain largely unchanged in the absence of development and it is therefore considered appropriate to use the current baseline for the purpose of this assessment.

9.6 Consultation

This ES has taken account of:

- the representations received on the original scheme, including the scoping opinion and the post-submission response from the NPT Biodiversity Unit (Ref. 2015/347, 13 October 2015; these comments were addressed in the 2016 SEI Report);
- discussions between NPTCBC and Wood at a meeting on 10 November 2017, which agreed an appropriate survey programme to inform the revised ES;
- the scoping report issued in February 2018, which reflected the scope of the ecological surveys and assessment that was discussed with NPTCBC in November 2017; and
- the scoping opinion received from 27 March 2018 (**Appendix 3A**), which (from a non-avian ecology perspective) primarily comprised comments from NRW (note, clarification of some of these comments was sought (letter to NPTCBC dated 20 April 2018, Ref. 40217P033, **Appendix 3B**)).

Table 9.9 provides a summary of the issues that have been raised by consultees through this process, and how these are addressed within the ES.

Table 9.9 Summary of issues raised regarding non-avian ecology during consultation

Consultee(s)	Comment	Response and how considered in this chapter	Section Ref
NPTCBC	A proposed approach for updating the ecology baseline was proposed by Amec Foster Wheeler (Technical Note Ref. S40217n006) and discussed with NPTCBC at a meeting in November 2017.	NPTCBC largely agreed with the proposed approach for the desk study; extended Phase 1 survey; NVC survey; peat; otters; water voles; great crested newts; badgers; reptiles; brown hare; and Section 7 species.	All sections
NPTCBC	An appropriate level of survey effort for bats was discussed at the November 2017 meeting, given (a) the absence of any changes likely to increase the value of the site for bats; (b) off-site habitat changes (forest felling) likely to marginally increase the isolation of the site; (c) that the original surveys (2012 – 2013) are consistent with the current guidelines for survey effort; (d) that the previous surveys suggest that the site is 'low' value for bats (so perhaps supporting a reduced survey effort); (e) the benefits of replicating survey effort for data consistency; and (f) the changes in bat detector sensitivity and the potential for a more accurate representation of the bat community.	It was agreed that the bat surveys would employ at least the same survey effort as 2012-2013 (i.e. two activity transects; one activity transect survey visit per month (April – October), with at least one of the surveys being a dusk and pre-dawn survey within the same 24-hour period; static surveys to comprise a minimum of six static detectors deployed for at least five consecutive nights (April-October). This approach is consistent with current guidance. In practice, nine static detectors were deployed each month.	Section 9.15 and **Appendix 9B**
NRW	"*The Extended Phase 1 survey update should be undertaken in accordance with the NCC Phase 1 survey guidelines (NCC (1990). Handbook for Phase 1 habitat survey. NCC, Peterborough) and should be undertaken and completed during the summer to ensure the best chance of identifying the habitats present*"	The Extended Phase 1 survey uses the latest iteration of the *Handbook for Phase 1 Habitat Survey* (JNCC (2010)). An initial extended Phase 1 survey was undertaken by an experienced surveyor in late March 2018, to provide sufficient time for additional seasonally-constrained surveys to be planned and undertaken in 2018. The habitats within the planning boundary were subsequently subject to a Phase 1 habitat verification and targeted NVC surveys in August (i.e. within the optimum period for sub-montane habitats).	**Appendix 9A**
NRW	"*In addition to this, any NVC surveys more than 2 years old will need to be revisited. This may not necessarily require a full NVC survey again, however the maps produced in the original survey should be checked if they are correct. The consultants will need to provide 'DAFORs' scale of species for polygons of previously mapped vegetation to demonstrate that the vegetation map is still correct and can be used going forward*"	A targeted NVC survey within the planning boundary was undertaken. The NVC assessment targeted vegetation communities of likely conservation importance and in particular those likely to be regarded as Section 7 habitats. Other vegetation types of low conservation importance – including improved grassland – were not assessed in detail but were described and classified by eye using the surveyor's experience.	**Appendix 9A** and Section 9.13.
NRW	"*If works will be needed to widen existing forest tracks (particularly due to the increased size of the turbines) detailed botanical surveys should be carried out to identify any priority species and appropriate action proposed to maintain species*	The main access track between the B4282 Maesteg to Bryn road and the southern edge of the proposed wind farm site was surveyed, along with a proposed new short section through clear-felled woodland and retained conifer plantation. All species of higher plant encountered in the survey were noted, with particular focus on populations of species of recognised national or regional conservation importance (Appendix II) and any invasive plants listed on Schedule 9 of the Wildlife & Countryside Act 1981 (as amended).	**Appendix 9A**

Consultee(s)	Comment	Response and how considered in this chapter	Section Ref
NRW	"*NRW have advised that the previous protected species surveys are now considered to be out of date. As such the site should be comprehensively assessed for its potential to support protected species. Surveys for protected species should be undertaken by suitably qualified, experienced and where necessary, licensed surveyors in accordance with published guidance, where this exists, and best practice*"	Clarification of the NRW comments was sought (letter to NPTCBC dated 20 April 2018, Ref. 40217P033, **Appendix 3B**) as they did not reference the approach proposed in the scoping report and could be read as a requirement for bespoke surveys for all protected species regardless of the outcomes of the Extended Phase 1 survey (etc.) or the potential for development to affect them. NRW subsequently confirmed (email to NPTCBC, date not stated) that the proposed approach set out in Table 2.7 of the scoping report "*seems reasonable at this juncture*"; this approach has been followed, with additional species surveys undertaken for GCN, otters and water voles.	**Appendix 9A**
NRW	"*NRW agree that the surveys for bats should be updated. They have advised that this follow the guidance in the Bat Conservation Trust's 'Bat Surveys for Professional Ecologists. Good Practice Guidelines (3rd Edition)', and Chapter 2 of the 2nd Edition of these guidelines ('Surveying for Onshore Wind Farms') which specifically relates to development proposals of this type. The developer should note that the guidance refers also to static surveys at height. With regards to ground level static surveys and transect surveys, we advocate that sampling locations include the locations of the turbines, nearby suitable bat habitat features and areas of open habitat…*"	Clarification of the NRW comments was sought (letter to NPTCBC dated 20 April 2018, Ref. 40217P033, **Appendix 3B**) as the BCT guidance is a little more circumspect regarding surveys at height, stating that "*unless existing masts can be used to support detector microphones, automated surveys at height are often expensive and difficult to implement, so their use needs to be justified*". No masts are available at this site, and so there is no mechanism by which surveys at height could be undertaken. NRW subsequently confirmed (email to NPTCBC, date not stated) that the approach proposed in the scoping report and re-iterated in the clarification letter would be acceptable.	**Appendix 9B** and Section 9.15.
NRW	"*NRW have noted that the pond within the site boundary will be assessed using the HSI scale for its suitability to support great crested newts, with further specific surveys for GCN considered on the basis of the results of this assessment. We would urge caution over HSI results that record a waterbody as being of poor quality for GCN as, in our experience, this cannot necessarily be relied upon to rule out the presence of newts. Should the assessment come to this conclusion, we advise that the results are backed up by eDNA survey results*"	The lowest category in the HSI is 'poor', so it was assumed that NRW required eDNA surveys regardless of the HSI results. Ponds were assessed in 2018 using the HSI scale, and all ponds within 500m of the planning boundary which had water were subject to eDNA surveys. No evidence of GCN was found.	**Appendix 9A**
NRW	"*Table 2.6 of the report states notes that the 2013 peat survey found no deep peat deposits (>1m). We advise that NRW considers >0.5m as deep peat.* *We would therefore require clarified* [sic] *if deep peat deposits are present on site (in accordance with the >0.5m threshold). For any updated surveys carried out, it should be ensured that the standard practice is to carry out 1 peat probe per hectare of development area, and then 1 peat core per 10 peat probes, to be consistent NRW's advice for windfarm applications*"	There are perhaps six very localised areas of deeper 'peat' (typically 0.7 – 0.8m) that are invariably associated with existing streams or areas of localised drainage impedance, but the vast majority of these will not be affected by the development, either directly or indirectly. The effects of the scheme on 'peat' were considered in the previous ES, and the existing survey data appropriately characterises the 'peat' resource at the site. No further surveys were therefore undertaken as the reduced number of turbines will be located in the same positions as those previously assessed. The previous assessments have been amended to reflect the 0.5m threshold however.	**Appendix 9A**, Section 9.14.

9.7 Scope of the assessment

Overview

As noted, the CIEEM guidelines recognise that an appropriate EcIA cannot consider in detail every individual species or habitat that may potentially be present at a site or affected by a development. The EcIA process therefore aims to focus the assessment on those biodiversity receptors that could be 'significantly' affected by the proposed development (i.e. where the effects on the ecological features are of sufficient concern that they could influence the decision about whether or not planning permission should be granted), or for which the development could result in the contravention of relevant legislation. The EcIA process therefore includes a 'scoping' stage (which excludes those ecological features that cannot be 'significantly' affected[28]), and a 'detailed assessment' stage, which examines more closely the potential effects of the scheme on those ecological features that could be subject to 'significant' effects. Detailed assessments may also be undertaken where it is considered appropriate to examine the predicted effects on a feature in more detail, for example due to consultee comments. This section summarises the approach to and outcomes of the EcIA scoping stage.

Ecological features

The starting point for defining which ecological features were to be taken forward to the detailed assessment stage was to use the baseline data that were collected through the desk study and field surveys (see **Appendix 9A** and **Appendix 9B**) to determine which of the identified ecological features are 'important'[29] at the level of the project. Following CIEEM (2016) guidance, the importance of ecological features was determined using a geographic scale and described in relation to UK legislation and policy, and with regard to the extent of habitat or size of population that may be affected by the proposed development.

The importance of ecological features can therefore differ from that which would be conferred solely by legislative protection or identification as a conservation notable species. For example, house sparrow is important at a national level (in policy terms) because it is a S.7 species and features on the Birds of Conservation Concern red list. However, a small population that could be affected by a development might be assessed as being of local importance only due to the large, albeit declining, UK population (in excess of 5 million pairs). Similarly, a small length of hedgerow (a S.7 habitat), even if deemed to be 'important' with regard to the Hedgerow Regulations, is unlikely to be considered to have greater than 'local' importance due to the extent of this habitat type across a given county.

Wherever possible, information regarding the extent and population size, population trends and distribution of the ecological features has been used to inform the categorisation described in **Table 9.10** and to determine importance at the project level. Where detailed criteria or contextual data are not available, professional judgement was used to determine importance. A justification of all determinations of importance are provided in **Table 9.11** (for 'scoped in' ecological features) and **Appendix 9D** (for all ecological features, both those scoped in and out) to ensure transparency.

[28] Based on the results of desk-studies; field surveys; consultations; the importance of the ecological feature; the presence (or not) of pathways for effects; and the measures incorporated into the scheme to avoid effects occurring).

[29] Importance relates to the quality and extent of designated sites and habitats, habitat/species rarity and its rate of decline. Ecological features that are not considered to be important are those that are sufficiently widespread, unthreatened and resilient and with populations that will remain viable and sustainable irrespective of the proposed development.

Table 9.10 Importance of the proposed development for ecological features

Geographic context of importance	Description
International or European	• European sites including SPAs, SACs, candidate SACs and Sites of Community Importance (SCI). Potential SPAs (pSPA), possible SACs (pSACs), Ramsar sites (designated under international convention) and proposed Ramsar sites are also considered in the same manner in accordance with national planning policy. • Areas of habitat or populations of species which meet the published selection criteria based on discussions with Natural England and field data collected to inform the EcIA for designation as a European site, but which are not themselves currently designated at this level.
National (UK context)	• A nationally designated site including SSSIs and National Nature Reserves (NNRs). • Areas (and the populations of species which inhabit them) which meet the published selection criteria guidelines for selection of biological SSSIs but which are not themselves designated based on field data collected to inform the EcIA, and in agreement with NRW. • S.7 habitats and species, Red listed and legally protected species that are not addressed directly in Part 2 of the "*Guidelines for Selection of Biological SSSIs*" but can be determined to be of national importance using the principles described in Part 1 of the guidance. • Areas of Ancient Woodland e.g. woodland listed within the Ancient Woodland Inventory and ancient and veteran trees.
Wales National / UK Regional	• Regularly occurring S.7 habitats or populations of S.7 species, Red listed and legally protected species may be of regional (Wales) importance in the context of published information on population size and distribution.
County (NPT[30])	• LNRs and Non-Statutory Designated sites including: SINCs of County Importance. • Areas which based on field data collected to inform the EcIA meet the published selection criteria for those sites listed above (for habitats or species, including those listed in relevant Local Biodiversity Action Plans) but which are not themselves designated.
Local	• S.7 habitats and species, Red listed and legally protected species that based on their extent, population size, quality etc are determined to be at a lesser level of importance than the geographic contexts above. • Common and widespread semi-natural habitats occurring within the study area in proportions greater than may be expected in the local context. • Common and widespread native species occurring within the study area in numbers greater than may be expected in the local context.
Negligible	• Common and widespread semi-natural habitats and species that do not occur in levels elevated above those of the surrounding area. • Areas of heavily modified or managed land uses (e.g. hard standing used for car parking, as roads etc.)

All ecological features that were determined to be important at a 'local' or 'negligible' level were 'scoped out' of the assessment at this stage, with the exception of:

- species receiving specific legal protection or subject to legal control (e.g. invasive species); or
- features which consultees specifically indicated that the ES should consider.

[30] Note, the avian ecology assessment applies 'county' level to the area covered by Glamorgan (includes the pre-1996 counties of West, South and Mid Glamorgan. Post 1996, Glamorgan includes the administrative boundaries of Bridgend, Merthyr Tydfil, Rhondda Cynon Taf, Cardiff, Vale of Glamorgan, Neath Port Talbot, Swansea and the western half of Caerphilly) as bird data is reported at this scale.

This is because effects on features that are only important at a 'local' or 'negligible' level would not influence the decision-making about whether or not consent should be granted for the proposed development (i.e. a significant effect in EIA terms could not occur). Specific justification for the exclusion of these ecological features from detailed assessment is provided in **Appendix 9D**.

Legally protected species and ecological features that are sufficiently important, such that effects upon them as a result of the proposed development could be significant, were then taken through to the next stage of the assessment.

Spatial scope

Through an understanding of the activities associated with the proposed development and the resulting environmental change, it is possible to identify ecological features that cannot be subject to potentially significant effects due to an absence of effect pathways, or certainty that incorporated measures will be entirely successful in preventing a significant effect occurring[31]. In order to identify such ecological features, all the activities and consequent environmental changes associated with the construction, operation and decommissioning of the proposed development have therefore been considered.

The construction, operation and decommissioning of the wind farm may result in the following environmental changes, which have the potential to cause significant effects on ecological features at or near the site. Many of these aspects will operate additively or synergistically to affect ecological features.

- Construction:
  - permanent or temporary land-take/changes to habitats;
  - contamination of site run-off;
  - temporary hydrological changes (changes to sub-surface and surface water flows);
  - temporary changes in noise and vibration; and
  - temporary changes in visual intrusion / anthropogenic disturbance.
- Operation:
  - permanent land-take/changes to habitats;
  - hydrological changes (changes to sub-surface and surface water flows); and
  - physical changes to the spatial environment;
- Decommissioning:
  - As per construction stage.

It should be noted that changes in air quality during construction due to plant emissions or dust will be negligible and so this aspect has not been subject to detailed assessment within the ES (see **Chapter 5**). As set out in Section 5.3 however, measures will be implemented during construction and decommissioning to control dust emissions. Any effects on site habitats due to this mechanism will be inconsequential, and so this aspect is not considered further in this chapter.

Given these environmental changes the spatial scope of the biodiversity assessment covers the area of the proposed development, together with the ZoIs that have formed the basis of the study area described in

[31] However, note that it will still be sometimes appropriate to complete detailed assessments even where embedded controls or assessments are likely to be successful, to ensure that the effectiveness of these measures is transparently tested.

Section 9.4. However, ZoIs differ depending on the type of environmental change (i.e. the change from the existing baseline) as a result of the proposed development and the ecological feature being considered.

The most straightforward ZoI to define is the area affected by land-take and direct land-cover changes associated with the proposed development. This ZoI is the same for all affected ecological features.

By contrast, for each environmental change that can extend beyond the area affected by land-take and land-cover change (e.g. increased noise associated with construction activities within the land-take area), the ZoI may vary between ecological features, dependent upon their sensitivity to the change and the precise nature of the change. For example, a dormouse might only be disturbed by noise generated very close to its nest, while nesting marsh harrier might be disturbed by noise generated at a much greater distance; other species (e.g. many invertebrates) may be unaffected by changes in noise. In view of these complexities, the definition of the ZoIs that extend beyond the land-take area was based upon professional judgement informed as far as possible by a review of published evidence (e.g. disturbance criteria for various species) and discussions with the technical specialists who are working on other chapters of the ES.

The spatial extent of the assessment therefore reflects the area occupied by the ecological feature that is being assessed and the ZoI of the changes that are likely to affect it. Where part of a designated site which is considered as an ecological feature for the purposes of this assessment is located within the ecological ZoI relating to a particular biophysical change as a result of the proposed development, an assessment would be made of the effects on the designated site as a whole. A similar approach has been taken for areas of notable habitat. For species that occur within the ZoI, the assessment has considered the total area that is used by the affected individuals or the local population of the species (e.g. for foraging or as breeding territories).

It should be noted that the avoidance of potential effects through design are implicitly taken into account through the consideration of each ZoI.

Scope of detailed assessments

Ecological features that are scoped in to the assessment (i.e. those of sufficient importance occurring within a relevant ZoI) are summarised in **Table 9.11** along with a summary of the justification for inclusion. For each ecological feature presented in **Table 9.11** the potential environmental changes and effects resulting from the proposed development are provided.

Appendix 9D provides the same information for those ecological features of greater than local importance scoped out of further assessment based on a relevant ZoI and the potential environmental changes and effects resulting from the proposed development.

Table 9.11 Scoped in ecological features and rationale

Ecological feature	Importance Level		Scoped in rationale
	Legislation / Policy	*Development*	
Watercourses SINC	County	County	County-level importance; watercourses within the site will be directly affected by the access tracks; NPT has previously indicated that the Watercourses SINC should be considered in the assessment.
Caerau West SINC	County	County	County-level importance; immediately adjacent to site boundary and so potentially exposed to site -derived pollutants or local hydrological changes.
Nant-y-Crynwydd SINC	County	County	County-level importance; immediately adjacent to site boundary and so potentially exposed to site -derived pollutants or local hydrological changes.
Section 7 Habitats	National	Local	S.7 habitats will be directly affected by the scheme; habitats on site are of local value although NPT has previously requested that effects on these habitats be explicitly considered in the assessment.
Peat	National	Local	The 2014 ES the peat-depth studies (Walters UK Ltd, 2014) demonstrated that the vast majority of the site is underlain by 'peaty' deposits less than 0.3m deep (generally black organic-rich soils (e.g. podzols) representative of agriculturally-improved former peatlands; these are locally important only although NPT has previously requested that effects on this resource be explicitly considered in the assessment.
Bats	International	Local	The survey evidence suggests that the bat community at the site is of local value only; however, consultees have previously requested that effects on bats be explicitly considered in the assessment.
Reptiles	National	Local	The survey evidence suggests that the site is of local value only for reptile species; however, consultees have previously requested that effects on bats be explicitly considered in the assessment.
Brown hare	Regional	Local	The survey evidence suggests that the site is of local value only for brown hare; however, consultees have previously requested that effects on bats be explicitly considered in the assessment.

Temporal scope

The temporal scope of the assessment of effects on Non-avian Ecology is consistent with the period over which the development would be carried out, as defined in **Chapter 2**, and therefore covers the construction and operational periods. Effects during decommissioning are considered to be similar or no worse than during construction and have therefore not been considered. Furthermore, given the timescales involved (12-24 construction period plus 25 years operation) it is considered that an accurate assessment of decommissioning effects cannot be undertaken at this stage.

9.8 Environmental measures embedded into the proposed development

A range of environmental measures have been embedded into the development proposals as outlined in **Chapter 5**. These for the most part remain the same as in the 2014 ES with the exception of a commitment to replacing any ponds along the access track that may require removal to accommodate the access track works (although all ponds are outside the currently predicted vegetation clearance zone and so are not anticipated to be affected). **Tables 9.12** and **9.13** outline these embedded measures. This includes identifying those measures that have been considered during the scoping process and those that have been necessary to include to avoid a significant effect on one or more ecological features.

Table 9.12 General construction measures providing incidental mitigation for ecological features

Aspect	Embedded measures	Features benefitting from measure
Dust management	Construction works would be undertaken using all necessary and practical measures to minimise the release of dust including: wheel wash facilities on site, enclosed and screened storage of aggregates; damping down haul roads during dry weather; and ensuing that lorries transporting material onto or off site are sheeted when conditions warrant, e.g. during dry periods or when carrying fine materials. Adherence to all standard best-practice measures in guidance including the *Good Practice Guide for Handling Soils* (MAFF 2000), the Environment Agency *Pollution Prevention Guidance Notes* PPG1, 5, 6, 21 and 22 (EA and *Environmental Handbook for Building and Civil Engineering Projects* (Venables *et al.* 2000).	Standard best practice measures; will benefit most ecological features but particularly habitat features within 200m of construction areas including: • Designated sites • S.7 habitats
Run-off	Construction works would be undertaken using all necessary and practical measures to minimise the release of additional sediment-laden run-off into nearby watercourses including (see **Chapter 12**): Implementing a 20m buffer zone around all natural surface water features/drains and wetland areas where possible. Placing excavated spoil on downhill slopes. Using temporary lateral drains on uphill slopes. Using temporary run-off drains alongside tracks. Use of temporary silt traps and settlement lagoons. Limiting construction activities with a high run-off risk during the winter months. Regularly monitoring the effectiveness of temporary drainage/silt-capture methods during construction so that any defects can be immediately remedied. Using appropriate materials for construction of the access tracks (e.g. granular material to encourage infiltration rather than run-off; non-acidic material) Installing permanent run-off drains (vegetated swales) alongside tracks. Installing cross bars and cross-drains at regular intervals in the access track.	Standard best practice measures; will benefit most ecological features but particularly habitat features near construction areas including: • Designated sites • S.7 habitats • Downstream ecological features

Aspect	Embedded measures	Features benefitting from measure
Pollution-control	Protection of surface water quality from spillages of fuels, oils and other chemicals during operation using standard measures (drip trays, bunding, refuelling controls, etc.)	Standard best practice measures; will benefit most ecological features but particularly habitat features near construction areas including: • Designated sites • S.7 habitats • Downstream ecological features
General species safeguarding	• Appropriate pre-construction surveys or inspections will be carried out. • A method statement would be prepared under which: ▸ Vehicle movement outside of daylight hours would be restricted, vehicle speeds controlled, and operatives warned of the presence of certain species in order to reduce the risk of collisions. ▸ All excavations would have sloped sides or have a means of escape for entrapped animals. Excavations to be checked each morning by operatives prior to work within the excavation. ▸ Construction activities would be restricted to normal working hours (so largely avoiding the hours of darkness, particularly in the summer when species are most active). ▸ Site lighting will be controlled to prevent incidental spillage on to features that may be used by nocturnal species.	Standard measures to minimise the risks of death, injury or displacement during construction, e.g. due to entrapment within excavations or collisions with construction traffic; particularly relevant for: • Badgers • Otters • Brown hare • Bats

Table 9.13 Feature-specific measures accounted for in assessment

Feature	Measures
Habitats	• The wind farm infrastructure layout has been designed to avoid the loss of key habitats on-site (wetland habitats/semi-natural habitats), i.e. the infrastructure is generally located within improved grassland and semi-improved grassland. • Should a pond along the access track be damaged or destroyed a replacement pond would be provided.
Peat	• The wind farm infrastructure layout has been designed to avoid areas of substantial peat (i.e. areas >0.5m depth of peat).
Bats	• A minimum of 50m stand-off will be maintained between turbine blade tips and the nearest point of linear/foraging features likely to be well-used by bats such as trees, wetland habitats and watercourses (allowing for potential growth of vegetation during the lifetime of the scheme).
Reptiles	• Reptiles are considered likely to be present in small numbers (in common with many upland sites), and individual reptiles will be protected during construction using normal best-practice. Effects on individual reptiles during construction can be easily avoided or mitigated using standard best-practice displacement techniques, due to the spatially discrete nature of the works and the large amounts of suitable habitat that would remain accessible. • Removal of habitat or features that could support reptiles (e.g. scrub, dense tussocky grassland, rocks) will be kept to a minimum, and excavations in these areas will take place outside the hibernation period. • Refugia features will be retained on site • Scrub or tussocky grassland will be cut to ~150mm above ground level during the winter period to avoid nesting birds becoming established during the nesting season. Final removal, and grubbing out of roots, will be conducted in the spring, outside of reptile hibernation period (i.e. avoiding mid-October through to mid-April depending on seasonal temperature) to allow any individuals to move out of the area of works. • Areas of long grass and other similar vegetation that need to be removed will be strimmed prior to construction to reduce their suitability, and hand-searched as necessary to disperse reptiles from the construction area. • Vegetation clearance will be sequenced to direct reptiles away from the construction area • Measures will be outlined in non-licensed Ecological Mitigation Method statement.

Feature	Measures
Brown Hare	• As per reptiles, strimming of tussocky grassland will disperse hares. • Measures to be outlined in non-licensed Ecological Mitigation Method statement.
Invasive Non-Native Plant Species	• Stands of invasive species will be marked and a 'no access' fencing buffer of at least 10m implemented • Any works required within these buffer areas would be subject to bespoke method statements depending on the species, which will prevent the spread of these species using established control measures. • Measures will be outlined in non-licensed Ecological Mitigation Method statement.

9.9 Assessment methodology

Introduction

The generic project-wide approach to the assessment methodology is set out in **Chapter 2**. Whilst this has informed the approach that has been used in this non-avian ecology ecological assessment, it is necessary to align with the standard industry guidance provided by CIEEM (2016).

The detailed assessments are based upon not only the results of the desk study and field surveys, but also relevant published information (for example on the status, distribution, sensitivity to environmental changes and ecology of the features scoped in to the assessment, where this information is available), and professional knowledge of ecological processes and functions.

For each scoped-in ecological feature (see **Table 9.11**), effects were assessed against the predicted future baseline conditions for that feature during construction, operation and decommissioning.

Throughout the assessment process, the initial results of the assessment regarding potentially significant effects have been used to inform whether additional baseline data collection is required, together with the identification of environmental measures that should be embedded into the development proposals (see Section 9.8). The results of the assessments therefore reflect the final scheme design (i.e. incorporating the environmental measures described in **Tables 9.12** and **9.13**).

Significance evaluation methodology

Overview

CIEEM (2016) defines a significant effect as one "*that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general*".

When considering potentially significant effects on non-avian ecological features, whether these be adverse or beneficial, the following characteristics are taken into account:

- extent – the spatial or geographical area over which the potential impact from the proposed development may occur;
- magnitude – the size, amount, intensity or volume of the potential impact;
- duration – the length of time over which the potential impact may occur;
- frequency – the number of times a potential impact may occur;
- timing – the periods of the day/year etc. during which a potential impact may occur; and
- reversibility – whether the potential impact can be reversed through restoration actions.

Importance of an ecological feature

The importance of an ecological feature has been defined in **Table 9.10** in a geographical context in order to help define the scope of the assessment.

Magnitude of change

Although the characteristics described above are all important in assessing effects, a scale for the magnitude of the environmental change as a result of the proposed development has been described in **Table 9.13** to provide an understanding of the relative change from the baseline position.

Table 9.14 Guidelines for the assessment of the scale of change

Scale of change	Criteria and resultant effect
High	The change permanently (or over the long-term) affects the conservation status of a habitat/species, reducing or increasing the ability to sustain the habitat or the population level of the species within a given geographic area. Relative to the wider habitat resource/species population, a large area of habitat or large proportion of the wider species population is affected. For designated sites, integrity is compromised. There may be a change in the level of importance of the receptor in the context of the project.
Medium	The change permanently (or over the long term) affects the conservation status of a habitat/species reducing or increasing the ability to sustain the habitat or the population level of the species within a given geographic area. Relative to the wider habitat resource/species population, a small-medium area of habitat or small-medium proportion of the wider species population is affected. There may be a change in the level of importance of this receptor in the context of the project.
Low	The quality or extent of designated sites or habitats or the sizes of species' populations, experience some small-scale reduction or increase. These changes are likely to be within the range of natural variability and there are not expected to result in any permanent change in the conservation status of the species/habitat or integrity of the designated site. The change is unlikely to modify the evaluation of the receptor in terms of its importance.
Very Low	Although there may be some effects on individuals or parts of a habitat area or designated site, the quality or extent of sites and habitats, or the size of species populations, means that they would experience little or no change. Any changes are also likely to be within the range of natural variability and there would be no short-term or long-term change to conservation status of habitats/species receptors or the integrity of designated sites.
Negligible	A change, the level of which is so low, that it is not discernible on designated sites or habitats or the size of species' populations, or changes that balance each other out over the lifespan of a project.

Adverse effects

Adverse effects are assessed as being significant if the favourable conservation status of an ecological feature would be lost as a result of the proposed development. Conservation status is defined as follows:

- *"for habitats, conservation status is determined by the sum of the influences acting on the habitat and its typical species, that may affect its long-term distribution, structure and functions as well as the long-term survival of its typical species within a given geographical area; and*
- *for species, conservation status is determined by the sum of influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within a given geographical area".*

The decision as to whether the conservation status of an ecological feature has been compromised has been made using professional judgement, drawing upon the results of the assessment of how each feature is likely to be affected by the proposed development.

A similar procedure is used where designated sites may be affected by the proposed development, except that the focus is on the effects on the integrity of each site; defined as:

- *"the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified"*.

The assessment of effects on integrity draws upon the assessment of effects on the conservation status of the features for which the site has been designated. Where these features are not clearly defined (such for some SINCs) it is necessary to use professional judgement to identify the interest features.

Beneficial effects

A development may result in beneficial effects where there is a change from baseline that improves the quality of the environment (e.g. increases species diversity, increases the extent of a particular habitat etc., or halts or slows down an existing decline). For a beneficial effect to be considered significant, the level of importance of an ecological feature determined at the baseline state would need to increase by one or more geographical levels (e.g. where an ecological feature of local importance becomes of county importance following delivery of the proposed development). Furthermore, if beneficial effects occur across a range of habitats and associated species, delivering an overall biodiversity net gain, then a significant effect results.

9.10 Assessment of effects: Watercourses SINC

Baseline conditions

Current baseline

The 'Watercourses' SINC is unusual in that it is a 'generic' designation covering all watercourses that retain a generally natural form (i.e. not culverted etc.) in NPT; citations, selection criteria or baseline data for specific watercourses are not therefore available. The designation is based on the *Guidelines for the Selection of Wildlife Sites in Wales* (Wales Biodiversity Partnership 2008), which suggests that examples of the following should be considered for selection as SINCs:

i. All examples of undesignated stretches of main river where the river bed and banks remain comparatively unmodified and the water is not grossly polluted by long-term sources.

ii. All examples of undesignated stretches of smaller watercourses (i.e. streams, canals, brooks etc.) which are comparatively unmodified, which support good aquatic, emergent or bankside plant communities, and the water is not grossly polluted by long-term sources.

iii. All examples of sections of undesignated watercourses (regardless of scale) with exposed sediment and/or erosion features such as soft cliffs.

iv. All examples of undesignated systems of reens and/or ditches with a diverse aquatic flora and/or fauna (including the associated habitat, e.g. field system on coastal levels or river floodplains).

Chapter 12 of this ES provides some detail on the site catchments and the streams which drain them (see ES **Figure 12.2** in particular). In summary:

- **Main site**: the principle watercourse on the site is the Nant yr Hwyaid, a small upland stream that flows north-west to the Afon Afan from the centre of the site; most of the site infrastructure is within the catchment of this watercourse. The remainder of the main site infrastructure is

located within the catchments of the Nant Cynon and the Nant Tryfal, which lie outside the site boundary to the west and east respectively.

- **Access track**: the proposed access track crosses the catchments of the Nant Drysiog and Nant Cwmfarteg (west of the track); and the Nant y Crynwydd and Nant y Ffyllon (east of the track).

With regard to the 'Watercourses' SINC, the principal streams with catchments on site (the Nant yr Hwyaid, Nant Cynon; Nant Tryfal; Nant Drysiog; Nant Cwmfarteg; Nant y Crynwydd; and Nant y Ffyllon) are all likely to meet criteria (ii) and/or (iii) noted above. The small upland tributary streams crossed by the site tracks are also considered as part of the SINC designation, although they less obviously meet the criteria summarised in the *Guidelines for the Selection of Wildlife Sites in Wales*. The precise ecological and chemical quality of the named streams or their minor tributaries has not been quantified (they have not been subject to long-term monitoring and do not have Water Framework Directive (WFD) status) although it will strongly reflect the local land-use and the streams do not appear particularly notable in a local context. So, for example, the Nant yr Hwyaid has some evidence of eutrophication associated with agricultural improvement and livestock farming; the Nant Cynon is likely to be heavily influenced by the associated forestry (e.g. mild acidification, sedimentation, etc.). For assessment purposes it is therefore assumed that the watercourses have a 'county' importance level, although this is based principally on the 'policy importance' as SINCs rather than their intrinsic ecological value (which would be 'local' or less, as there is nothing to suggest that that they are more notable than similar upland headwater streams in NPT).

Future baseline

The watercourses on site are unlikely to be subject to significant changes in land use in the absence of the wind farm. Receiving streams off site (notably the Nant Cynon) may be altered by future forestry operations and clearance; this would probably result in a deterioration in the water quality of the Nant Cynon over the short – medium term (e.g. due to increased sedimentation), with the potential for long-term improvement depending on future land management. Given the uncertainty of this, the predicted future baseline for on- and off-site streams is assumed to be the same as the current baseline.

Predicted effects and their significance

Overview

Of the environmental changes associated with the proposed development it is considered that the Watercourses SINC feature will be potentially vulnerable (i.e. exposed and sensitive) to the following:

- Land use changes (direct effects on habitats due to track construction).
- Contamination of site run-off.
- Hydrological changes (alterations to channels; changes in run-off rates due to hard surfaces).

The following incorporated measures are taken into account in the assessment:

- Standard / established construction management and pollution control measures, including a 20m buffer zone except at watercourse crossings.
- Established site drainage protocols and the commitment to achieving greenfield run-off rates.
- The proposals within the outline Habitat Management Plan (oHMP; **Appendix 9C**).

Land use change

None of the named watercourses are directly affected by the site infrastructure, although the proposed access tracks cross two minor upland tributaries:

- a very small rush-dominated stream or seepage located on the main site, south of Turbine 9, which flows to the Nant Cynon; and
- a small tributary of the Nant Drysiog which is culverted beneath an existing forestry track on the main access track.

The proposed development will directly affect these minor tributaries of the Nant Cynon and the Nant Drysiog, due to the construction or improvement of the access tracks. The stream south of Turbine 9 (a tributary of Nant Cynon) will be culverted beneath the new track to ensure that flows are maintained, and so no significant hydrological effects would be anticipated due to this modification. A very small proportion of the SINC habitats at this location will be lost, depending on the extent to which the adjacent vegetation is (or is not) included in the designation: guidance from NPT and the Welsh Biodiversity Partnership suggests that "*a 7m vegetated buffer is also included within this designation where appropriate*", although it is not clear whether this would generally be applied to small first-order upland streams. At most, therefore, the 'loss' at this location will be approximately 0.007 ha. (i.e. assuming one new culverted crossing; a track approximately 5m wide at the crossing; and that the SINC extends ~7m either side of watercourse in this location).

The other minor stream (a tributary of Nant Drysiog) is already culverted beneath an existing forestry track; the track and culvert may require some minor upgrading works although the direct effects on this watercourse or its associated habitats will be negligible.

The effects on the watercourse habitats are obviously negligible compared to the area of the 'Watercourses' SINC within the site boundary (there are several kilometres of watercourses which might meet the designation); locally; and / or within the NPT area. The watercourses will not lose any functional value as a result of the track installation, and the loss will not affect the overall integrity of the 'Watercourses' SINC or the ecological value of the network. There will be some very minor localised changes in stream morphology as a result of the culverted crossings, although there is a sufficient body of best-practice design information to ensure that these can be minimised. On this basis, it is considered that the direct encroachment and land use change will not (on its own) be significant in EcIA terms.

Exposure to contaminated run-off

Construction of the proposed development could indirectly affect the watercourses through sediment entrainment and run-off; or through pollutants derived from site activities or stores. The risk of this can be managed through normal best-practice measures and mitigation plans, as detailed in **Chapter 5** and **Chapter 12**; therefore, whilst some construction run-off may enter local watercourses the incorporated measures (e.g. attenuation features; drainage design; etc.) will ensure that potentially substantial volumes of sediment sufficient to reduce the value of the receiving watercourse, or alter its morphology, will not enter the streams. Similarly, best-practice control and management of potential pollutants (e.g. fuels) will prevent accidental discharges. On this basis, potentially significant pollution of the watercourses due to construction is not expected to occur. Dust deposition is most likely to occur during the construction period. However, it is considered that the dust control measures outlined within **Chapter 5** will be sufficient to prevent significant deposition of construction dust in the site. Any water quality changes associated with construction will be therefore be negligible, and will not affect the integrity of the 'Watercourses' SINC; these changes will therefore not be significant in EcIA terms.

Adverse effects on water quality are not an anticipated outcome of the wind farm operation. It should be noted that some of the measures within the oHMP have the potential to result in minor improvements in water quality over the long-term as grazing intensity in some parcels is reduced; however, this effect is unlikely to be significant given the limited extent of the watercourse catchments that are covered by the

oHMP, particularly in relation to those areas with higher-impact land uses (e.g. forestry; improved grazing pasture; etc.).

Hydrological changes

Effects on downstream receptors are theoretically possible as a result of increased surface water run-off (relative to the baseline) where site track drainage or hardstanding has been installed. This can be managed during construction and operation through appropriate design of the drainage systems: Section 12.8 of the ES notes that a drainage assessment will be carried out to ensure that drainage design allows greenfield run-off rates to be achieved. Significant changes in flow volumes or frequencies within the SINC as a result of the site's development would therefore be prevented. As with water quality, some of the measures within the oHMP have the potential to result in minor improvements in the overall upland hydrology over the long-term as grazing intensity in some parcels is reduced (so potentially increasing drainage periods); however, this effect is unlikely to be significant given the limited extent of the watercourse catchments that are covered by the oHMP, particularly in relation to those areas with higher-impact land uses (e.g. forestry; improved grazing pasture; etc.).

Summary

The proposed development will have a direct effect on a minor tributary of the Nant Cynon due to the construction of an access track. A tributary of the Nant Drysiog may also be affected if an existing forestry track requires upgrading, although this watercourse is already culverted and modified in this location. These minor first-order upland streams potentially contribute to the 'Watercourses' SINC in the NPT area. The proposed development will also affect the catchments of several other watercourses, which may consequently be vulnerable to contamination from site-derived pollutants or hydrological changes.

The incorporated measures (see Section 12.8 of the ES) will ensure that indirect effects on local drainage systems, and hence the 'Watercourses' SINC, will be prevented or appropriately managed. The direct effects on the site watercourses (culverting beneath new access tracks) will be very small-scale and localised and will not affect any intrinsically high-value habitats; nor will the functional value of the watercourses alter as a result of the track installation. Overall, therefore, the effects on the 'Watercourses' SINC will be negligible, and the integrity or conservation status of this SINC will not be affected. The effects of the proposed development are consequently not significant in EcIA terms.

9.11 Assessment of effects: Caerau West SINC

Baseline conditions

Current baseline

The Caerau West SINC is a non-statutory designated site located within Bridgend CBC, and hence outside the site boundary (although a short section is immediately adjacent to the south-eastern corner of the site). However, part of the SINC is included within the area covered by the oHMP provisions (**Appendix 9C**). The SINC is a typical upland site, with interest features that include marsh/marshy grassland, flush spring and acid/neutral flush, sphagnum blanket bog, sphagnum wet modified bog, wet dwarf shrub heath, dry heath acid mosaic, dry dwarf shrub heath, semi-improved acid grassland, scattered bracken. The condition of the SINC is not stated, although part of the SINC were included in the surveys initially undertaken to inform the scheme design prior to the 2014 ES; these indicated that it was predominantly marshy grassland or wet heath / acid grassland mosaic.

Specific surveys of this SINC were not undertaken for this update of the ES, although observations during the Extended Phase 1 survey and NVC survey suggest that there has been no substantial change from the

previous baseline, and the habitats of the site appear to be similar to those found within the eastern half of the Foel Trawsnant Wind Farm site, i.e. somewhat degraded mosaics characteristic of former peatlands with an over-representation of *Molinia*.

Future baseline

The site is unlikely to be subject to significant changes in land use in the absence of the wind farm. The land use and management in the future has been assumed to remain the same with the potential for long-term improvement depending on future land management. Given the uncertainty of this, the predicted future baseline is assumed to be the same as the current baseline.

Predicted effects and their significance

Overview

The SINC will not be subject to direct encroachment effects; of the remaining environmental changes associated with the proposed development it is considered that the designated site will be sensitive to the following:

- Water quality changes (from contamination of site run-off or other site derived pollutants (e.g. dusts)).
- Hydrological changes (alterations to channels; changes in run-off rates due to hard surfaces).

The following incorporated measures are taken into account in the assessment:

- Standard / established construction management and pollution control measures.
- Established site drainage protocols and the commitment to achieving greenfield run-off rates.
- The proposals within the oHMP.

Exposure to contaminated run-off

Virtually all of the proposed development infrastructure (temporary and permanent) is outside the surface water catchment of this SINC, other than a very small area around Turbine 7 and the nearby construction compound which may (depending on microtopography) be upslope of part of the SINC around the headwaters of the Nant Tryfal. It is therefore possible that this area of the SINC (likely to be less than 0.1 ha) might be exposed to site-derived pollutants via uncontrolled surface flows or run-off. However, the risk of this will be managed through normal best-practice and incorporated measures (e.g. attenuation features; drainage design; etc.). Therefore, whilst some construction run-off will occur the incorporated measures will ensure that potentially significant volumes of sediment or other contaminants (i.e. sufficient to reduce the value of the SINC habitats) will not affect the site. Similarly, best-practice control and management of potential pollutants (e.g. fuels) will prevent accidental discharges. On this basis, potentially significant pollution of the SINC due to construction can be discounted. The site drainage design will also ensure that effects via this mechanism do not occur during operation.

Hydrological changes

As noted, a very small area around Turbine 7 and the nearby construction compound may (depending on local microtopography) be upslope of part of the SINC around the headwaters of the Nant Tryfal. Effects on the SINC are theoretically possible as a result of increased surface water run-off (relative to baseline) where site track drainage or hardstanding has been installed. However, this can be managed during construction and operation through appropriate design of the drainage systems: Section 12.8 of the ES notes that a drainage assessment will be carried out to ensure that drainage design allows greenfield run-off rates to be

achieved. Significant changes in overland flow volumes or frequencies within the SINC as a result of the site's development would therefore be prevented.

Summary

There will be no direct effects on this SINC. The incorporated measures (see Section 12.8 of the ES) will ensure that indirect effects on Caerau West SINC will be prevented or appropriately managed. Overall, therefore, the proposed development will have no effect on the integrity or conservation status of the Caerau West SINC, and the effects are considered not significant in EcIA terms.

9.12 Assessment of effects: Nant-y-Crywydd SINC

Baseline conditions

Current baseline

The Nant-y-Crynwydd SINC is a non-statutory designated site located within Bridgend CBC, and hence outside the site boundary (although a short section is immediately adjacent to the southern end of the main access track near the junction with the B4282). The SINC is a typical upland margins site, with interest features that include marsh/marshy grassland, semi-improved neutral and acid grassland, sphagnum blanket bog, broad-leaved semi-natural woodland, and dense continuous scrub; these are associated with the Nant-y-Crynwydd watercourse, which runs near the access track. The condition of the SINC is not stated, and specific surveys of this SINC were not undertaken for this update of the ES although observations during the Extended Phase 1 survey and NVC survey suggest that the site is similar to other upland and forestry margins in this area, i.e. somewhat degraded mosaics characteristic of former peatlands.

Future baseline

The site is unlikely to be subject to significant changes in land use in the absence of the increase use of the access track due to the wind farm construction and operation. The land use and management in the future has been assumed to remain the same with the potential for long-term improvement depending on future land management. Given the uncertainty of this, the predicted future baseline for on- and off-site is assumed to be the same as the current baseline.

Predicted effects and their significance

Overview

The SINC will not be subject to direct encroachment effects; of the remaining environmental changes associated with the proposed development it is considered that the designated site will be sensitive to the following:

- Water quality changes (from contamination of site run-off or other site derived pollutants (e.g. dusts)).
- Hydrological changes (alterations to channels; changes in run-off rates due to hard surfaces).

The following incorporated measures are taken into account in the assessment:

- Standard / established construction management and pollution control measures.
- Established site drainage protocols and the commitment to achieving greenfield run-off rates.

Exposure to contaminated run-off

Virtually all of the proposed development infrastructure (temporary and permanent) is outside the surface water catchment of this SINC, other than a short section of the access track which may require upgrading for turbine delivery. It is therefore possible that the Nant-y-Crynwydd watercourse might be exposed to site-derived pollutants via uncontrolled surface flows or run-off. However, the risk of this will be managed through normal best-practice and incorporated measures (e.g. attenuation features; drainage design; etc.). Therefore, whilst some construction run-off will occur the incorporated measures will ensure that potentially significant volumes of sediment or other contaminants (i.e. sufficient to reduce the value of the SINC habitats) will not affect the site. Similarly, best-practice control and management of potential pollutants (e.g. fuels) will prevent accidental discharges. On this basis, potentially significant pollution of the SINC due to construction can be discounted. The site drainage design will also ensure that effects via this mechanism do not occur during operation.

Hydrological changes

As noted, the forestry access track which will be used for site access runs close to the Nant-y-Crynwydd watercourse, which is likely to receive run-off from track. Effects on the watercourse (and hence the SINC) are possible as a result of changes in surface water run-off (relative to baseline) if site track drainage is modified. However, this can be managed during construction and operation through appropriate design of the drainage systems: Section 12.8 of the ES notes that a drainage assessment will be carried out to ensure that drainage design allows greenfield run-off rates to be achieved. Significant changes in overland flow volumes or frequencies within the SINC as a result of the site's development would therefore be prevented.

Summary

There will be no direct effects on this SINC. The incorporated measures (see Section 12.8 of the ES) will ensure that indirect effects on Nant-y-Crywydd SINC, will be prevented or appropriately managed. Overall, therefore, the proposed development will have no effect on the integrity or conservation status of the Nant-y-Crywydd SINC, and the effects are considered not significant in EcIA terms.

9.13 Assessment of effects: Section 7 Habitats

Baseline conditions

Current baseline

The habitats present on site are detailed in **Appendix 9A**. Most of these (e.g. poor semi-improved acid grassland) are common and widespread, with little intrinsic nature conservation importance, and have been scoped out of detailed assessment (see Section 9.7). However, consultation responses from NPT on the 2014 ES indicated that Section 42 (now Section 7) habitats required appropriate consideration, and so effects on these habitats are explicitly considered in this section.

The S.7 list of priority habitats is published by the Wales Biodiversity Partnership[32]. The S.7 habitat definitions and their relationships to standard vegetation community classification systems are largely as set out in the *UK Biodiversity Action Plan: Priority Habitat Descriptions* (JNCC 2011). **Table 9.14** identifies the S.7 priority habitats that occur within the site boundary, based on the Phase 1 habitat survey (**Figure 9.3**) and the NVC survey. The approximate areas of these S.7 habitats within NPT and Wales is provided, based on the Natural

[32] http://tinyurl.com/zz7gf47

Resources Wales (NRW) Phase 1 Wales GIS dataset[33] and JNCC data[34], although these data should be used cautiously due to their age, and because its resolution does not allow complex upland habitat mosaics to be easily quantified[35].

Table 9.15 Section 7 habitats (and corresponding Phase 1 habitats) present within the site boundary

S.7 Habitat	Phase 1 Habitats*	Approximate areas (ha.) of S.7 habitats			
		Site boundary	***Planning boundary***	***NPT****	***Wales*****
Upland flushes, fens and swamps	Acid neutral flush Marshy grassland	4.47	2.72	(1,890 – 3,257)†	Not stated‡
Upland heathland	Wet heath Dry heath	19.93	10.25	1,053††	79,000
Blanket bog	Wet modified bog	0.28	0.28	41††	56,200
Ponds	Ponds	-	-	-	-
Rivers	Watercourses	-	-	-	-

Table Notes

* Corresponding Phase 1 habitat classifications present at the site, based on the S.7 lists and the criteria within the *UK Biodiversity Action Plan: Priority Habitat Descriptions* (JNCC 2011).

**Based on the NRW *Phase 1 terrestrial habitat survey of Wales* dataset

*** Based on JNCC data (available at http://jncc.defra.gov.uk/page-5993).

† The NRW dataset has substantial limitations when considering the 'Upland flushes, fens and swamps' priority habitat, particularly as this is often a localised community that overlaps substantially with other habitats. The area range provided is a very coarse estimate based on an analysis of the NRW data to identify mapped land parcels in NPT where one of the Phase 1 habitats forming the 'Upland flushes, fens and swamps' S.7 habitat (i.e. 'marshy grassland' (B5); 'flush and spring' (E2); 'fen' (E3); and 'swamp' (F1), based on JNCC (2011)) is either a dominant (1890 ha.) or secondary component (1367 ha.). However, these figures must be used very cautiously: most of these land parcels are complex upland mosaics and so deriving an accurate or reasonably robust figure is not possible as the assumptions would be significant and the fundamental issues of data age and reliability would remain. However, it is clear that some of the S.7 component habitats, particularly marshy grassland, are common and widespread in Wales and frequently overlap (spatially, and in terms of species composition) with other habitats that are characteristic of current or former peatlands.

†† The approximate areas for 'Upland heathland' and 'Blanket bog' in NPT are based on an analysis of the NRW data to identify mapped land parcels in NPT where one of the Phase 1 habitats forming these S.7 habitats is either a dominant or secondary component. As with the 'Upland flushes, fens and swamps' analysis these figures must be used cautiously.

‡ JNCC do not provide a value for the total extent of 'Upland flushes, fens and swamps' in Wales, reflecting uncertainties within the data, particularly as the classification of upland habitats is difficult and variable between surveyors.

[33] The *Phase 1 terrestrial habitat survey of Wales* dataset was digitised from various programmes of field recording undertaken between 1979 and 1999, supplemented by remote sensing and analysis of aerial photography. It has known accuracy limitations, but it does provide a potential reference for estimating the extents of habitats locally or nationally. As it is the combination of several datasets collected over several years it does not provide a definitive baseline from a given point in time (although it is being updated using new remote sensing techniques), and detailed site-specific field survey frequently reveals significant land-use changes or classification variations.

[34] http://tinyurl.com/hof5wp7

[35] For example:

- Upland mosaics without field boundaries are typically mapped as single polygons with several habitat classifications noted but not ascribed absolute (ha.) or relative (%) coverage values.
- Site-specific survey data are often inconsistent with the NRW data, although it can be unclear whether this is due to changes in habitats or variability in surveyor classification: for example, the NRW data for the upland area likely to be affected by the Llynfi Afan wind farm (formerly Mynydd y Gelli) suggest that marshy grassland is the dominant habitat type over nearly 1000 ha. of upland; however, the Phase 1 plan completed for the Environmental Statement of that scheme indicates that the site is dominated by acid grassland, with marshy grassland relatively limited in extent.

Table 9.15 summarises the condition of the Phase 1 habitats that contribute to the S.7 habitats at the site, and indicates the importance level / value applied to the assessment taking into account the condition of the habitats and their extent locally and nationally. Overall, although the policy importance level is 'national' (since the S.7 habitats are identified at a national level) the intrinsic importance / botanical value of the site habitats is between 'negligible' (i.e. habitats are only notable at the site level) and 'local' (i.e. important in the Maesteg area), although some areas of wet heath might be considered to be of 'county' level importance (i.e. important in NPT) given the limited extent of this habitat within NPT.

It should be noted that the 2018 Phase 1 surveys (and associated review of the NVC survey) have resulted in the re-classification of some site habitats, when compared to the original May/June 2010 and May 2012 Phase 1 surveys. These changes are discussed in **Appendix 9A**. With regard to the S.7 habitats:

- Some areas previously classified as 'marshy grassland' (principally land parcels west of the Nant yr Hwyaid) are considered to be more consistent with a 'semi-improved acid grassland' classification, based on the presence of mat-grass *Nardus stricta* and general absence of rushes, although *Molinia caerulea* is over-represented (which influenced the original classification).
- Some areas previously classified as 'marshy grassland' (principally east of the Nant yr Hwyaid) are considered to be more consistent with 'wet heath' or possibly a 'wet heath / acid grassland mosaic' classification, based on the presence of certain indicator species (including cross-leaved heath *Erica tetralix*). The condition of these areas is poor, however, and they were previously classified as marshy grassland due to the over representation of deer grass *Trichophorum germanicum,* and *Molina* being more prominent than typical for wet heath.

Modified upland habitats such as those found at Foel Trawsnant often occur in complex and subtle mosaics with features that are not necessarily exclusive to, or indicative of, any one habitat type; the Phase 1 habitat categories are quite broad and so classification (particularly of degraded habitats) will often rely on a degree of professional judgement. In this instance the reclassifications are considered to be essentially 'technical' rather than due to any fundamental changes in the condition of the site habitats[36]; this is supported by the NVC survey review (see **Appendix 9A**), which shows that the NVC classifications are largely unchanged[37].

[36] Although it is worth noting that some land parcels east of the Nant yr Hwyaid have been in an agri-environment scheme, which may have influenced the classification shift from 'marshy grassland' to 'wet heath' if some heathland species are now more obvious.
[37] Note however that there is not always a direct corresponding relationship between the Phase 1 habitat categories and the NVC communities; the Phase 1 guidance (JNCC 2010) notes that "*few of the correspondences are exact and many NVC communities correspond to more than one Phase 1 category*".

Table 9.16 Summary of Section 7 habitats present within the planning boundary

Phase 1 Habitat	S.7 Priority Habitat*	Summary	~Area**	Importance
Wet heath	Upland heathland	Areas of wet heath are present are present within the site boundary, and this habitat is more extensive than previously noted as much of the 'marshy grassland' east of the Nant yr Hwyaid has been recategorized (at Turbines 10, 9 and 8). The habitat is characterised by constant but sparse heather (*Calluna vulgaris)*, cross-leaved heath (*Erica tetralix)* and bilberry (*Vaccinium myrtillus)*, all of which are indicative of heath vegetation. Cross-leaved heath in particular, is a strong indicator of wet heath on shallow peaty soils. This habitat was previously classified as marshy grassland due to the over representation of deer grass (*Trichophorum germanicum*) and *Molina* being more prominent than it should be within high quality or typical wet heath habitats. The habitat corresponds to the NVC community M15d, as per botanical assessment (see **Appendix 9A**). Much of this area is under an agri-environment scheme which may possibly account for the perceived change from marshy grassland to wet heath, although the NVC communities in these areas are largely as previously recorded. The habitat quality is variable but not exceptional; undergrazing has encouraged the dominance of deer grass and *Molinia* has invaded some areas.	10.25 ha	Local / County
Dry heath	Upland heathland	There are occasional very small localised patches of dry heath located along the access track on the edges of the coniferous woodland and upon a steep embankment where there is a rock exposure (**Appendix 9A** - TN7). Species included common heather (*Calluna vulgaris*); bilberry (*Vaccinium myrtillus*); and western gorse (*Ulex gallii*). These small areas are of local or negligible importance.	<0.01 ha	Local
Acid/neutral flush	Upland flushes, fens and swamps	The mapped areas of acid/neutral flush are generally consistent with the previous Phase 1, with minor changes in the area of acid/neutral flush to north of Turbine 7. This habitat is present along the margins of a small stream extending up onto slightly higher but flushed ground. The habitat generally corresponds to the NVC community M6c as per botanical assessment (see **Appendix 9A**). The NVC notes that acid/neutral flushes are highly variable, and are most diverse where the vegetation has been poached by livestock in very wet ground; although soft-rush (*Juncus effuses)* is dominant in all the acid/neutral flush habitats the poaching allows other species to thrive alongside it. However, the habitat is not exceptional and is of 'negligible' importance.	1.26 ha	Negligible
Marshy grassland	Upland flushes, fens and swamps	The area of marshy grassland has been substantially reduced compared to the 2014 ES as areas of Molinia-dominated grassland have been classified as semi-improved acid grassland or wet heath (see **Appendix 9A**). Those areas that are categorised as marshy grassland correspond to the M23b *Juncus effusus/acutiflorus-Galium palustre* rush-pasture; *Juncus effusus* sub-community; these are found within tracts of improved grassland on-site in areas of poor drainage, often (but not always) in ditches and along track edges. The marshy grassland within the wind farm site was assessed as being of poor quality (dry and species poor), although some small stands along the access track are diverse enough to be regarded as S.7 priority habitat.	1.46 ha	Negligible
Wet modified bog	Blanket bog	The areas of wet modified bog are unchanged from those identified in the 2014 ES, being present in small amounts around streams. The bogs corresponds to the M17 *Trichophorum germanicum-Eriophorum vaginatum* blanket mire community, although they are poor-quality examples being very localised and not well developed, with common cotton-grass (*Eriophorum angustifolium*) and purple moor grass co-dominant.	0.28 ha	Local

Phase 1 Habitat	S.7 Priority Habitat*	Summary	~Area**	Importance
Ponds	Ponds	Ponds 3, 4, 7 and 8 are located alongside the access track but these are likely to be outside of the vegetation clearance zone.	n/a	Negligible
Rivers	Watercourses	Streams are generally present within areas of acid/neutral flushes, and are crossed by the site infrastructure. However, the 'Rivers' priority habitat does not apply to stream headwaters that are not "*marked with a blue line on Ordnance Survey (OS) maps at a scale of 1:50,000*" (JNCC 2011), therefore the streams directly affected by the site infrastructure are not considered part of this classification.	n/a	Negligible

Key:
* Corresponding S.7 habitat based on the S.7 lists and the criteria within the *UK Biodiversity Action Plan: Priority Habitat Descriptions* (JNCC 2011).
** Approximate area within planning boundary.

The hydrogeology and soils characteristics (see **Chapter 12**) indicate that there is little linkage between surface and groundwaters; the vast majority of the site is located on 'Very acid loamy upland soils with a wet peaty surface' with the lower slopes (valley sides close to the main watercourses) are characterised as 'Freely draining acid loamy soils over rock'. These are situated on the Rhondda Member bedrock, consisting of sandstone and thin interbedded coal seams. The area also has some underlying Llynfi Member, which is a conglomerate of sandstone with thin mudstone/siltstone and thin coal interbed. The wetland plant communities on-site are therefore considered to have low groundwater dependency.

In summary, the S.7 habitats at the site are characteristic of former peatlands and are not particularly notable examples, with their condition heavily influenced by historic and current agricultural practices (drainage, burning, grazing, etc.); the relatively degraded condition, and the dominance of *Molinia* across some areas, has an influence on the habitat classification.

Future baseline

In the absence of the development, the baseline conditions of the site are unlikely to change significantly as the habitats are grazed by cattle and sheep and would probably continue to be managed in this way.

Predicted effects and their significance

Overview

Of the environmental changes associated with the proposed development it is considered that the S.7 habitats will be potentially vulnerable (i.e. exposed and sensitive) to the following:

- Land use changes (direct effects on habitats due to infrastructure construction, including habitat loss and habitat changes in reinstated area).
- Water quality changes (indirect degradation from contamination of site run-off or other site derived pollutants (e.g. dusts)).
- Hydrological changes (indirect degradation associated with local changes in sub-surface hydrology, or changes in run-off rates due to hard surfaces).

The following incorporated measures are taken into account in the assessment:

- Standard / established construction management and pollution control measures.
- Established site drainage protocols and the commitment to achieving greenfield run-off rates.
- The proposals within the oHMP.

Land use change

Table 9.16 summarises the approximate areas of each S.7 habitat at the site that are likely to be directly affected by development infrastructure; this is based on the anticipated layout for the site infrastructure (see **Figure 9.4**). This layout is subject to micro-siting but provides a reasonable basis for estimating the areas of habitat directly affected by site infrastructure. It should be noted that the micro-siting will allow some localised areas of more sensitive habitats (e.g. wet modified bog) to be avoided.

Table 9.17 indicates the approximate total areas of each S.7 habitat likely to be lost due to the development infrastructure. Around 2.4ha. of the affected S.7 habitats will be subject to reinstatement or re-seeding (i.e. the site compounds, track batters, track verges and turbine foundations). These reinstated areas are likely to support patches of characteristic semi-natural upland habitats in the medium- to long-term (e.g. flush, marshy grassland, heath), although these habitats will be localised and likely to reflect areas of differential compaction and drainage. This reinstatement will mitigate some of the effects but it is not relied on as a mitigation or offsetting measure in this assessment. The assumed loss of S.7 habitats is therefore ~4.00 ha. It should be noted that the ponds near the site are all outside the planning boundary with the exception of three alongside the access track between the B4282; these are expected to be outside the areas required for track modification and vegetation clearance, although any ponds that are lost will be replaced on a 1:1 basis.

As noted the S.7 habitats at the site are not high-quality examples or particularly notable in a national, regional or county context, and so the predicted losses would not typically be considered significant at a county level or above (i.e. significant in EcIA terms). The overall nature conservation value of the S.7 habitats is, however, influenced by their policy importance as much as their intrinsic value and so some measures to compensate the loss are appropriate. The oHMP will cover approximately 15ha of grassland, including areas of existing 'wet heath' (so guaranteeing their retention over the lifespan of the wind farm), and proposes measures (e.g. drainage control) that are likely to increase the quantity and quality of these habitats elsewhere on site. It is therefore considered that the loss of around 4ha of the upland S.7 habitats at the site will be not significant.

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Table 9.17 Approximate areas of S.7 habitats (and corresponding Phase 1 habitats) that are directly affected by temporary and permanent site infrastructure

Infrastructure	Total area of infrastructure*	Upland flushes, fens and swamps		Upland heathland		Blanket bog
		Marshy grassland	*Acid Neutral Flush*	*Wet heath*	*Dry Heath*	*Wet modified bog*
Site tracks	2.03 ha	0.081 ha	0.076 ha	0.73 ha	-	-
Turbine bases	0.44 ha	0.04 ha	0.012 ha	0.12 ha	-	-
Crane pads	1.07 ha	0.11 ha	0.004 ha	0.27 ha	-	0.001 ha
Substation	0.16 ha	-	-	0.16 ha	-	-
Site compounds†	1.15 ha	0.10 ha	-	0.69 ha	-	-
Track and turbine verges†	1.96 ha	0.10 ha	0.072 ha	0.61 ha	-	0.014 ha
Track batters†	2.78 ha	0.17 ha	0.097 ha	0.53 ha	-	0.004 ha
Attenuation waterbody†**	0.01 ha	-	-	0.01 ha**	-	-
TOTAL	**9.6 ha**	**0.601 ha**	**0.261 ha**	**3.12 ha**	**-**	**0.019 ha**

* Excluding main access track to site; this track covers an area of approximately 6.4 ha. most of which is an existing forestry road except for a small 2.4 ha. section at the junction with the B4282, which will affect an area of scrub and conifer plantation.
† Infrastructure that will be re-instated or re-vegetated
** The need for an attenuation waterbody is not certain as it will depend on the precise design of the construction site drainage (which cannot be specified in detail at this stage) and (to some extent) the weather conditions during construction. Consequently, the precise location and dimensions (if required) cannot be defined either, although it will not exceed 10m x 10m (0.01 ha.) based on the hydrological data for the site. NPTCBC raised concerns regarding the location and precise dimensions of this waterbody, and its potential effects on the site habitats; therefore, for assessment purposes, a reasonable worst-case scenario (0.01 ha. attenuation waterbody located on wet heath) is assumed.

Table 9.18 Approximate areas of S.7 habitats likely to be affected

S.7 habitat	Area lost (ha)	Area reinstated (ha)	% of NPT resource affected
Upland flushes, fens and swamps	0.323	0.539	~0.046%
Upland heathland	1.28	1.84	~0.3%
Blanket bog	0.001	0.018	~0.046%

Exposure to contaminated run-off

S.7 habitats adjacent to construction areas may be affected by site-derived pollutants (oils etc.) or emissions (dust-deposition), although this will be appropriately managed or prevented through normal best-practice measures and mitigation plans, as detailed in **Chapter5** and **Chapter 12** of the ES. In some instances, controlled run-off over rough grassland may be used to prevent potentially significant volumes of sediment entering local watercourses (i.e. rough grassland is used to attenuate run-off and reduce sediment transport, usually in conjunction with other measures); this would result in the temporary deposition of sediments on grassland habitats. This approach is a standard mitigation measure supported by the Revised Netregs Guidelines for Pollution Prevention (2017), and would not have any significant short, medium or long-term impacts on the habitats (any trapped sediments would either be re-integrated with the soil body or re-mobilised by subsequent rainfall events). Therefore, it is considered that the indirect effects of construction on adjacent habitats will be localised, temporary, and reversible in the short-term, and so will not be significant. The site drainage design will also ensure that effects via this mechanism do not occur during operation.

Hydrological changes

Chapter 12 of the ES has demonstrated that there are no significant linkages between surface and groundwaters (i.e. the site does not contain any notable groundwater-fed terrestrial ecosystems), with the 'wetter' habitats at the site maintained by rainfall, infiltration and sub-surface flows. The peat survey (**Appendix 9A**) also demonstrates that the site is underlain by shallow peaty organo-mineral soils, (essentially, former peatlands and highly organic soils that have been modified by habitat changes associated with historic climate shifts and agricultural practices, and which are typically found beneath upland acid grasslands), rather than saturated active peat deposits. These soils often have a relatively low hydraulic conductivity (so allowing some retention of rainfall).

In theory, the upland S.7 habitats could be affected through:

- Tracks providing a preferential drainage path so encouraging 'drawdown' of soil water in immediately adjacent areas; or
- Tracks impeding or diverting sub-surface flows, so reducing inputs to some down-slope areas.

With regard to preferential drainage paths, it should be noted that the site drainage systems, including those associated with the access tracks, will be designed to ensure that greenfield run-off rates are achieved (see **Chapter 12**). As permanent attenuation lagoons or similar are not proposed this means that drainage will need to be managed and impeded locally, with significant preferential drainage paths avoided. The shallow nature of the soils, and their typical hydraulic characteristics, will also ensure that there will not be a significant drawdown adjacent to a track, and hence no 'drying' of S.7 habitats over a wide area; any hydrological effects would occur in relatively close proximity to the track (almost certainly within the area of batter or verge), and the road drainage can be easily designed to ensure that water supply to damper areas is maintained.

With regard to the impedance of sub-surface flows to downslope areas, the access tracks will not be impermeable and additional cross-drainage will be incorporated to ensure that inputs to downslope areas are maintained.

The importance and volume of upslope input depends, in part, on the size of the upslope catchment that is impeded. The development infrastructure, including the tracks, is mostly located along ridges and local watershed boundaries; this means that the area upslope of the track is small or negligible, and so the volume of sub-surface flow potentially impeded will be correspondingly small. In most areas of the site direct rainfall will remain the dominant water supply mechanism.

It is therefore considered that any hydrological effects on adjacent habitats will be very local and will be moderated or avoided using standard drainage design measures that aim to retain water and achieve greenfield run-off rates. In addition, the oHMP includes management measures that will enhance approximately 15 ha. of grassland and increase the quantity of S.7 habitats at the site (so guaranteeing their retention over the lifespan of the wind farm). Significant effects as a result of hydrological changes would not therefore be expected.

Summary

Welsh Local Authorities are required by Section 6 (S.6) of the Environment (Wales) Act 2016 "*…have regard to*" the list of habitats and species that is published in accordance with S.7 of the Act. Consideration of the potential effect of the scheme on S.7 habitats is therefore appropriate.

Three S.7 habitats may be directly or indirectly affected by the proposed development ('Upland flushes, fens and swamps', 'Upland heathland', and 'Blanket bog'). The condition of these habitats is variable but they are unexceptional in a local or county context being heavily influenced by historic and current agricultural practices (drainage, burning, grazing, etc.).

The S.7 habitats at the site will be potentially vulnerable to:

- direct habitat loss due to temporary construction features and permanent site infrastructure;
- indirect degradation associated with construction derived pollutants, emissions or run-off; and
- indirect degradation associated with local changes in sub-surface hydrology.

With regard to indirect effects due to construction or hydrological changes, it is predicted that these will be avoided using normal best-practice mitigation or will be local and negligible in their effects, and would not on their own be considered significant. Furthermore, the S.7 habitats are modified and not notable in a national, regional or county context, and so the loss of ~4 ha. would not typically be considered significant at a county level or above. However, the nature conservation value is influenced by its policy importance and so some measures to offset the loss are appropriate. The oHMP will bring approximately 15 ha. of grassland into long-term management designed to improve its biodiversity value and includes measures (e.g. drainage control) that will increase the extent of S.7 habitats at the site. It is therefore considered that the effects of the proposed development on the S.7 habitats will be not significant, and will not affect the conservation status of this habitat in NPT. It should be noted that the loss of S.7 habitats under the revised proposals is less than under the currently approved scheme (4 ha compared to ~6.54 ha), although the area under the oHMP remains the same.

9.14 Assessment of effects: Peat

Baseline conditions

Current baseline

No additional surveys have been undertaken for peat. The 2014 ES peat-depth studies (Walters UK Ltd, 2014) demonstrated that the vast majority of the site is underlain by 'peaty' deposits less than 0.3m deep (generally black organic-rich soils (e.g. podzols) representative of agriculturally-improved former peatlands, underlain by either the weathered parent material or clay layers). True blanket mire (i.e. mire that is predominantly or entirely ombrotrophic) is almost entirely absent at Foel Trawsnant, with the localised areas of deeper 'peat' (>0.5m) being minerotrophic soligenous valley mires and acid flush associated with streams and areas of impeded drainage. Most of the deeper peat at the site is associated with acid / neutral flush (M6 *Carex-Sphagnum* mire) which is the most widespread soligenous mire in the British uplands, usually occurring in wet hollows, at seepage lines, on flushed slopes, in shallow gullies and along stream margins, all places with slowly moving acid groundwater. It is a sub-montane community, found in Wales up to 500m altitude or more. It nearly always lies over acid and moderately nutrient-rich deep, wet and peaty soils.

Of 772 depth probes or samples taken, only 20 were deeper than 0.5m, and only six individual cores recorded peat depths of between 0.7 and 0.8m. In all cases these areas of peat between 0.7 and 0.8m deep were found to be very localised, and none of these occur at any of the proposed locations for infrastructure. The peat resource at the site is therefore considered to be of 'local' value only.

Future baseline

In the absence of the development the peat deposition depth and extent are unlikely to change significantly.

Predicted effects and their significance

Overview

Of the environmental changes associated with the scheme it is considered that the peat habitats will be potentially vulnerable (i.e. exposed and sensitive) to the following:

- Land use changes (direct effects on habitats due to infrastructure construction, including habitat loss and habitat changes in reinstated area).
- Water quality changes (indirect degradation from contamination of site run-off or other site derived pollutants (e.g. dusts)).
- Hydrological changes (indirect degradation associated with local changes in sub-surface hydrology, or changes in run-off rates due to hard surfaces).

The following incorporated measures are taken into account in the assessment:

- Standard / established construction management and pollution control measures.
- Established site drainage protocols and the commitment to achieving greenfield run-off rates.
- The proposals within the oHMP.

Land use change

The development infrastructure will occupy approximately 9.6 ha (see **Table 9.16**). Virtually all of this is located on 'peaty' soils less than 0.3m deep that are characteristic of agriculturally-improved former

peatlands. Areas of deeper peat (>0.5m) are avoided by the site infrastructure but are, in any case, localised and of limited value. Construction will require the excavation of peaty soils, although these will be retained on site and used in the restoration and for batters. As a result, the magnitude of change is low and so the loss of 'peat' resource at the site is not significant. It should be noted that micro-siting will allow some localised areas of more sensitive habitats (e.g. wet modified bog) to be avoided.

Exposure to contaminated run-off

Peaty soils adjacent to construction areas may be affected by site-derived pollutants (oils etc.) or emissions (dust-deposition), although this will be appropriately managed or prevented through normal best-practice measures and mitigation plans, as detailed in **Chapter 5** and **Chapter 12** of the ES. In some instances, controlled run-off over rough grassland may be used to prevent potentially significant volumes of sediment entering local watercourses (i.e. rough grassland is used to attenuate run-off and reduce sediment transport, usually in conjunction with other measures); this would result in the temporary deposition of sediments on grassland habitats, although the soils themselves would not be sensitive to this change (any trapped sediments would either be re-integrated with the soil body or re-mobilised by subsequent rainfall events). Therefore, it is considered that the indirect effects of construction on adjacent peaty soils will be localised, temporary, and reversible in the short-term, and so will not be significant. The site drainage design will also ensure that effects via this mechanism do not occur during operation.

Hydrological changes

As with the S.7 habitats (see Section 9.13), the peaty soils at the site will not be significantly affected by any local changes in hydrology:

- There are no significant linkages between surface and groundwaters (i.e. the site does not contain any notable groundwater-fed terrestrial ecosystems), with the 'wetter' habitats at the site maintained by rainfall, infiltration and sub-surface flows.
- The peat survey demonstrates that the site is underlain by shallow peaty organo-mineral soils rather than saturated active peat deposits. These soils often have a relatively low hydraulic conductivity (so allowing some retention of rainfall).
- The site drainage systems, including those associated with the access tracks, will be designed to ensure that greenfield run-off rates are achieved (see **Chapter 12**).
- The shallow nature of the soils, and their typical hydraulic characteristics, will ensure that there will not be a significant drawdown adjacent to a track and hence 'drying' of peat soils over a wide area; any hydrological effects would occur in relatively close proximity to the track (almost certainly within the area of batter or verge), and the road drainage can be easily designed to ensure that water supply to damper areas is maintained.
- Access tracks will not be impermeable and additional cross-drainage will be incorporated to ensure that water inputs to downslope areas are maintained, although the site infrastructure, including the tracks, is mostly located along ridges and local watershed boundaries which means that the area upslope of the track is small or negligible, and so the volume of sub-surface flow potentially impeded will be correspondingly small.

It is therefore considered that any hydrological effects on adjacent habitats will be very local and can be easily moderated or avoided using standard drainage design measures. Significant effects on peat as a result of hydrological changes would not therefore be expected.

Summary

'Deep peat' (>0.5m) is very limited at the site, with the vast majority of the site being underlain by shallow (<0.3m) peaty organo-mineral soils rather than higher-value saturated active peat deposits. The peaty soils have a 'local' value, and will be potentially vulnerable to:

- direct habitat loss due to temporary construction features and permanent site infrastructure;
- indirect degradation associated with construction derived pollutants, emissions or run-off; and
- indirect degradation associated with local changes in sub-surface hydrology.

With regard to indirect effects due to construction or hydrological changes, it is predicted that these will be avoided using normal best-practice mitigation or will be local and negligible in their effects, and would not on their own be considered significant. Furthermore, the peaty soils are modified and not notable in a national, regional or county context, and so effects to ~9.6 ha. would not be considered significant at a county level or above.

9.15 Assessment of effects: Bats

Baseline conditions

Current baseline

The baseline for the site has been established through:

- desk studies, involving searches for statutory or non-statutory nature conservation sites within 10km for which bats are a key interest feature, or records of bat-roosts within 10km.
- surveys undertaken in 2010 (reported in the 2014 ES), comprising:
  - preliminary roost assessments; and
  - three activity transects surveyed on multiple visits between May and October 2010 (two transects surveyed on seven occasions, with one transect surveyed on five occasions);
- surveys undertaken in 2012/13 (reported in the 2014 ES), comprising:
  - preliminary roost assessments;
  - two transect routes (versions of the 2010 routes modified to reflect the revised site boundary) walked five times[38] between June and October 2012, and once in April 2013; and
  - static detectors (SM2Bat+) deployed at six locations for 5 nights per month between June and October 2012, and in April/May 2013;
- surveys undertaken in 2018 (reported in **Appendix 9B**), comprising:
  - preliminary roost assessments;
  - two transect routes surveyed each month between April and October 2018; and
  - static detectors (SM2 Bat+) deployed at nine locations around the site for seven separate periods between April and October 2018, for at least five nights in each period.

The 2018 survey approach and results are detailed in **Appendix 9B**; this also includes a summary of the 2010 and 2012/13 bat survey methods and results, and details of any constraints or data gaps. The baseline is

[38] Note, only one transect was walked in June 2012 due to equipment failure.

summarised in the following sections. It should be noted that the activity surveys (transects and statics) focused on main site and not the access track as the works here will be minimal and would not have any significant effects on bats.

Site habitats

The site is typical of many grazed upland areas in South Wales, dominated by open semi-natural and heavily modified habitats that are characteristic of former peatlands including improved grassland, semi-improved acid grassland, wet dwarf shrub heath, acid/neutral flush, wet modified bog and marshy grassland. The site has some steeper slopes and gullies associated with stream headwaters. The immediate surrounding areas are dominated by forestry (generally coniferous plantation, parts of which are now being replanted with native deciduous trees) and improved pasture, with localised areas of ffridd and other habitats characteristic of uncultivated areas.

The open mosaic of habitats, when assessed with reference to the BCT guidelines (2016), are considered to be of 'low' or perhaps 'medium' value to foraging or commuting bats and the site itself does not contain any habitats that are likely to be preferentially used by bats, relative to similar habitats in the wider landscape locally; however, features that are known to be attractive to bats (woodland edges and linear features such as streams) are present within the site or on its margins.

Roosts

The desk-study data show that 150 bat roosts (or potential roosts) within 10km of the planning boundary have been recorded since 2008 (last 10 years). The total number of roosts per species and nearest roost per species are shown in **Table 9.18**. Two 'high collision risk' species (based on the guidance in NE 2012) were identified roosting within 10km: noctule (within 6km) and Nathusius' pipistrelle (~9.4 km from the site).

Table 9.19 Summary of the bat roost records within 10km of the site boundary since 2008

Common Name	Scientific Name	No. roost records	No. bats recorded in nearest roost	Distance to nearest roost
Pipistrelle bat species	*Pipistrellus* sp.	33	Not stated	0.58km
Common Pipistrelle	*Pipistrellus pipistrellus*	38	5	0.58km
Long-eared Bat species	*Plecotus* sp.	3	3	0.58km
Bats	*Chiroptera*	13	1	3.3km
Brown Long-eared Bat	*Plecotus auritus*	10	2	6km
Noctule Bat	*Nyctalus noctula*	12	1	6km
Daubenton's Bat	*Myotis daubentonii*	2	14	6.3km
Greater Horseshoe Bat	*Rhinolophus ferrumequinum*	3	Not stated	6.4km
Lesser Horseshoe Bat	*Rhinolophus hipposideros*	4	Not stated	6.4km
Soprano Pipistrelle	*Pipistrellus pygmaeus*	23	2	6.4km
Unidentified *Myotis*	*Myotis*	6	1	7.4km
Nathusius's Pipistrelle	*Pipistrellus nathusii*	2	2	9.4km
Serotine	*Eptesicus serotinus*	1	2	9.5km

Trees and structures within 200m of the planning boundary (including alongside the access track) were assessed for their potential to support roosting bats by a licensed bat ecologist; no trees or structures with features that could be used by roosting bats were identified in this area. The static surveys did occasionally record atypically early contacts with common pipistrelles (e.g. ~3 minutes after sunset on one occasion), suggesting that bats sometimes roosted close to the site; however, these early contacts were rare and usually isolated (suggesting opportunistic roosting rather than the presence of large or regularly used roosts nearby), and the means of the earliest contact times for each species are consistent with an absence of potentially notable roosts in the vicinity of the site. The site and immediate area are certainly less valuable to roosting bats than most nearby lowland off-site areas, where roosting opportunities in buildings and trees are widely available, and overall therefore the importance of the site and immediate area to roosting bats is 'negligible'.

Bat community

A total of nine species or species groups were recorded at the site during the transect and static detector surveys (common, soprano and Nathusius' pipistrelle; noctule; long-eared bat species; *Myotis* species; *Nyctalus* species; *Nyctalus* or serotine; and a small number of unidentified bat calls). The frequency of contacts with each species or species group is summarised in **Table 9.19**.

Table 9.20 Approximate proportion of contacts by species / species group for each survey year

Year and dataset	**~Proportion of contacts by species / species group**										
	CP	***SP***	***CP/SP***	***CP/NP***	***NP***	***N***	***Nyc***	***NycSe***	***M***	***LE***	***Bat***
2010 Transects	83.6%	5.4%	3.7%	-	-	1.9%	0.3%	-	3.3%	-	1.7%
2012/13 Transects	79.3%	13.8%	2.7%	-	-	-	0.6%	-	2.1%	-	1.5%
2018 Transects	87.9%	3.2%	-	4.5%	1.5%	0.1%	-	-	2.7%	0.1%	-
2012/13 Statics	89.67%	3.62%	-	-	-	1.47%	0.39%	-	4.73%	-	0.13%
2018 Statics	89.26%	1.48%	-	-	0.02%	0.60%	0.04%	0.01%	8.09%	0.50%	-

Key
SP – soprano pipistrelle; CP – common pipistrelle; NP – Nathusius' pipistrelle; M – *Myotis* sp.; N – Noctule; Nyc – *Nyctalus* sp.; NycSe – Nyctalus or Serotine; LE – long-eared bat; Bat – unidentified bat call.

There are no substantive differences between the data collected for the 2014 ES, and the 2018 survey data; in summary, the bat community appears unexceptional, both in terms of numbers of contacts with bats and the species recorded, with the vast majority of contacts being with common pipistrelles (typically around 80 – 90% of contacts in each survey). Four species / species groups that fall into the 'high risk' species category have been recorded (noctule, *Nyctalus* sp., *Nyctalus*/Serotine and Nathusius' pipistrelle), although less than 2% of contacts (1.86% in 2012/2013; 0.67% in 2018) were with these species, and they do not therefore form a potentially significant component of the bat community at the site.

Determining the relative value of a bat community at a site can be difficult without 'reference' detector datasets from the wider countryside or region. However, the data suggest that the community at the site is less diverse than might be expected based on the desk-study records for the NPT area and on professional experience of surveys in similar habitats in south and mid-Wales. It is also worth comparing the Foel Trawsnant results with the data provided for Welsh wind farms in the Defra (2016) study (Mathews *et al.* (2016) *Understanding the Risk to European Protected Species (bats) at Onshore Wind Turbine Sites to inform Risk Management*); here, across nine wind farm sites in Wales, common pipistrelles accounted for ~71% of

contacts at ground-level; soprano pipistrelle ~18%; noctule ~7%, and Myotis sp. ~2.5%. This comparison must be made cautiously, but common pipistrelle and *Myotis* sp. bats are clearly recorded more frequently at Foel Trawsnant than might be expected based on data from other wind farm sites in Wales, with soprano pipistrelle and noctule recorded much less frequently.

Overall, therefore, the bat community is categorised as being of 'negligible' importance (i.e. no more notable than other areas locally).

Bat activity

The transect and static detector surveys sampled a range of habitats and features at the site, including proposed turbine locations, 'open' habitats, and habitat features (away from turbines) where bats would be expected to occur based on the habitats (e.g. woodland edges), which were used to provide a reference or 'control' dataset.

The 2018 survey data are consistent with the 2010 and 2012/13 data, and with similar surveys undertaken at upland sites in Wales. In summary, bats have been recorded at all locations across the site (and so will clearly use or cross the open areas of the site where turbines will be sited) but the activity was very strongly associated with features that are known to be attractive to bats (woodland edges and linear features such as streams): for example, the vast majority of contacts on static detectors (>70% in 2018 and >90% in 2012/13) were recorded at the 'control' locations (L3 and L9 in 2018 (see **Appendix 9B, Figure 3.1)**; locations 1, 2 and 4 in 2012/13) – i.e. those areas where higher levels of bat activity would be expected. The remaining detector locations (at or near turbine locations, in open areas of the site) had substantially less activity. This is unsurprising given the dominance of common pipistrelle[39] in the datasets.

With regard to the 'high-risk' species, the number of contacts was too low[40] to allow any potentially notable patterns of activity to be identified; more contacts were recorded at 'control' locations than in 'open' areas of the site, but most detector locations recorded at least one contact with one of these species (typically noctule). As noted, however, the usage of the site by these species does not appear notable and is entirely consistent with recorded activity from similar upland sites.

Summary

In summary, the bat community and its use of the site is unexceptional, and consistent with similar upland habitats and landscapes in South Wales. There is no indication that the site habitats provide a particularly unique or valuable resource in the local area, or that significant commuting routes cross the site. No roosts were identified on or in the immediate vicinity of the site, although it is likely that bats opportunistically roost in the woodlands near the site, based on occasional atypically early contact times. The importance of the site to bats, and of the bat community, is arguably 'negligible' only, although it is recognised that lower-quality upland habitats can sometimes be important for non-breeding bats that may be displaced from higher-quality areas near roosts by nursing females, and overall therefore the site (and its population) is considered to have a 'local' importance.

Future baseline

The future baseline remains the same as the previous ES. There is no reason to believe that the baseline use of the site by bats would change, as the surrounding land is likely to remain a largely upland pastoral landscape within which the extent and condition of the habitats on-site and in the immediate landscape are likely to remain unchanged. This assumes that the agricultural land use continues as per the current baseline.

[39] A species more typically associated with sheltered and linear features than some larger, hawking bats.
[40] Low enough to be susceptible to outlier events – for example, 35 of the 75 contacts with 'high risk' species in the 2018 static surveys were noctules recorded over a 30-minute period at control location L3 in June.

Predicted effects and their significance

Overview

Research from Europe and North America has found that bat species can be affected by operational wind turbines, sometimes fatally through collision or barotrauma[41]. However, the behavioural responses of bats to wind farms are complex and not fully understood, with responses varying between sites, species, sexes and times of year. For example, whilst some studies have suggested that active avoidance of wind farms by some bats may occur (e.g. Roeleke *et al.* 2016), there is good evidence that some bat species are attracted to wind turbines (Cryan *et al.* 2014) for a range of possible reasons, including the presence of insect aggregations around the structures (Cryan *et al.* 2014); ultrasound emissions (Kunz *et al.* 2007); or even attraction to red navigation lights (Voigt *et al.* 2018).

The proposed development therefore has the potential to affect bat species using the local area through the following mechanisms:

- loss of habitats used for foraging, commuting or roosting;
- disruption of flightlines or behavioural alterations due to turbines (e.g. due to presence of turbines, noise, lighting etc); and / or
- increased mortality due to collisions with turbines.

It should be noted that these effects will typically operate 'in combination' to affect the use of the landscape by bats, and therefore the assessment of effects considers the overall effect of these factors on local bat populations. The proposed development includes embedded measures that will moderate these effect pathways:

- Turbines have been located to maintain a minimum 50m blade-tip stand-off from features that are known to be favoured by bats (e.g. woodland edges).
- Construction will include a construction environmental management plan which will incorporate measures to minimise construction-stage effects on bats (specifically, ensuring that temporary lighting does not impinge on features that are known to be favoured by bats for commuting or foraging).
- Any trees requiring felling alongside the access track will be subject to appropriate roost surveys to ensure that roosting bats will not be affected, with any roosts identified replaced with equivalent bat boxes.

Note, there are no proposals for operational measures such as cut-out periods to be employed, and current research (Mathews *et al.* 2016) suggests that whilst these are effective in reducing collision risk they are not necessarily a proportionate measure except at sites where the collision risk is substantial.

Loss of supporting habitats

Construction / Decommissioning and Operation

The proposed development will affect open upland habitats (grassland etc.) and small areas of plantation woodland (along the access track, if track widening or tree-felling is required to facilitate turbine delivery). Some of these habitat changes are long-term (either permanent for the lifetime of the scheme or involving tree removal that will not be offset in the short-term), and could affect the value of the site for foraging or

[41] Damage to lungs caused by air pressure variations associated with the blades.

roosting bats; however, the effects of habitat loss on the bat community will be negligible and not significant for the following reasons:

- **Loss of roosts or roosting opportunities**: there is no evidence of potentially notable bat roosts near the site, or in areas that are likely to be affected by the construction of the proposed development (e.g. none of the trees alongside the access track currently have features that might be used by bats). As a result the proposed development will have no effect on the availability or quality of roosting opportunities locally. Any trees requiring felling will be subject to appropriate roost surveys to ensure that roosting bats will not be affected, with any roosts identified replaced with equivalent bat boxes.
- **Loss of foraging habitat**: the direct effect of habitat loss due to the road scheme on foraging opportunities will be inconsequential. The proposed development will result in the permanent loss of approximately 4 ha. of open upland habitats, including improved and acid grassland, and wet heath. These habitats will provide foraging opportunities for bats, although their exposed location and limited structural complexity ensures that they are sub-optimal as a foraging resource for many bat species. The habitats to be lost are not unique or otherwise notable in a site or local context, and their loss will have no effect on the availability or value of bat foraging habitat locally.

Behavioural changes

Bats could be displaced from foraging areas or commuting routes within or near the site by several mechanisms, although the most likely as a result of the proposed development are:

- temporary alterations in habitat use during the construction period due to construction activities or poorly designed lighting; or
- behavioural changes due to the operation of the wind farm, either due to the physical presence of the turbines, or secondary environmental changes such as alterations in noise levels due to turbine operation.

The proposed development will not result in the direct severance of linear features (e.g. hedges) that may be used by bats for commuting.

The significance of these effects depends on the bat species; the features affected; their relative importance; and the 'permeability' or connectivity of the wider landscape.

Construction / Decommissioning

With regard to temporary changes in habitat use due to site lighting or construction activities, this will be short-term and will be largely prevented with normal best-practice construction measures including controls on night-time working and the appropriate design and placement of any site lighting to avoid habitat features that may be used by commuting bats, and so displacement effects via this mechanism would be negligible. It should be noted however that the dominant species at the site (common pipistrelle) is thought to have a 'low' sensitivity to light when foraging or commuting (Stone 2014)[42], and will often exploit the foraging opportunities that artificial lighting provides; it is therefore possible that some activity will be 'displaced' towards the site lighting and (potentially) towards open areas of the site away from more sheltered habitats. This may provide a marginal benefit (e.g. increased foraging opportunities) or a marginal cost (e.g. increased predation risk in open areas; increased energy costs associated with flight in exposed areas) – however, the effect of this on bat populations will be negligible due to the short-term nature of any effects.

[42] i.e. lighting will affect foraging and commuting behaviour, but is thought likely have a negligible effect on the species' populations based on the current literature.

Operation

As noted, whilst some studies have suggested that active avoidance of wind farms by some bats may occur (e.g. Roeleke *et al*. 2016), there is also evidence that some bat species are attracted to wind turbines (Cryan *et al.* 2014) through a range of potential mechanisms. As a result, it is difficult to predict how bats will respond to the installation of turbines at this site.

The survey data demonstrate that the vast majority of the activity at the site is associated with woodland edges (which will provide commuting routes and foraging opportunities), and the turbines have been sited to provide a stand-off of at least 50m (from blade tip) from these features. This stand-off will minimise the risk of the turbines physically intruding into areas of higher activity. There may still be some displacement effects due to the general proximity of new structures, but the effects of this are likely to be negligible and it is certain that bats will continue to use features around the site margins for foraging and commuting.

With regard to turbines attracting bats, whilst this would obviously increase collision risk (see below) it would not (in itself) necessarily result in adverse effects on bat populations; the net cost or benefit of any behavioural alteration would depend on the reasons for the change. Bats continually adapt their foraging strategies based on energy costs versus benefits, and there is no reason to assume that this would not occur if the turbines created a new foraging resource (i.e. the benefit of the resource would be set against the cost of accessing it). Adverse effects are possible if bats are attracted for reasons that don't confer a benefit, such as exploring an unusual ultrasound source or lighting; however, these effects in themselves are unlikely to significantly affect bat populations: the main risk is collision and increased mortality.

Increased mortality / collision risk

Construction and Operation

Collisions with vehicles during construction are possible but extremely unlikely, and there are no circumstances where this could significantly affect local bat populations, and so this mechanism is not considered further. Risks to roosting bats will be managed through normal best-practice measures (appropriate pre-construction surveys).

The principal mechanism for significant effects on bats is therefore from fatalities/injuries caused by collision with wind turbines or barotrauma (collectively referred to herein as 'collision risk'). Unlike birds, there is currently no accepted method for quantifying collision risk for bats and so the assessment is based on evidence from existing studies and guidance from Natural England (which is also employed in Wales).

The Natural England (2014) guidance groups bat species into low, medium and high-risk categories based on their ecology and behaviour, to highlight those species likely to be at greatest risk from wind turbines (see **Table 9.20**). In addition, the guidance lists criteria to determine whether a site is low or high-risk for bats in general. Based on this guidance, Foel Trawsnant would be considered to be a low risk site due its size, exposed location and lack of suitable roosting locations.

Table 9.21 The risk of collision fatalities affecting populations of bats (*from NE 2014*)

Species	Status in Wales	Risk of collision	Population threat
Common pipistrelle	Common and widespread across Wales	Medium	Low
Soprano pipistrelle	Common and widespread across Wales	Medium*	Low
Brown long-eared bat	Widespread in low numbers across Wales	Low	Low
Grey long-eared bat	Probably absent	Low	Low

Species	Status in Wales	Risk of collision	Population threat
Daubenton's bat	Common and widespread across Wales	Low	Low
Natterer's bat	Recorded throughout Wales in all wooded landscapes	Low	Low
Whiskered bat	Widespread in low numbers across Wales	Low	Low
Brandt's bat	Widespread in low numbers across Wales	Low	Low
Serotine	Rare in Wales, population likely to be underestimated	Medium	Medium
Noctule	Widespread in low numbers across Wales	High	High
Leisler's bat	Rare throughout Wales, records concentrated in SE	High	High
Nathusius' pipistrelle	Rare; distribution uncertain but possibly widespread	High	High
Lesser Horseshoe	Rare, endangered, restricted distributions	Low	Low
Greater Horseshoe	Rare, endangered, restricted distributions	Low	Low
Barbastelle	Rare woodland specialist	Medium	Medium
Bechstein's bat	Very rare; restricted to a few colonies in South Wales	Low	Low
Alcathoe bat	Uncertain, probably rare	Low	Low

* Note, data from Mathews *et al.* (2016) may suggest that the risk of collision for soprano pipistrelles is higher than suggested by NE (2014).

The most comprehensive review of bat mortality risks to date is Mathews *et al.* (2016). This research identifies some interesting patterns, relationships and observations that are potentially relevant to the Foel Trawsnant Wind Farm amended scheme:

- There was considerable variability in mortality rates between sites, and although there were positive associations between activity and casualty rates there appears to be a high level of inherent variability in collision risk that is not explained by bat activity levels or the other variables that were explored. Consequently, some high-activity sites exhibited low casualty rates, and vice versa.
- The species identified as being at highest risk of collision were common pipistrelle, soprano pipistrelle and noctule bats; however, the proportion of soprano pipistrelle and noctule casualties was higher than their estimated relative national abundance and the relative proportions of their calls recorded in ground-level acoustic surveys.
- The risk to bats increased with the number of turbines, and with larger rotor sizes. Turbine number had a greater effect on the risk a site posed to bats than any other feature identified in the project.
- Casualties mostly occurred on nights with wind speeds less than 5m/s (~11 mph), and bat casualties are unlikely when wind speeds are above 5m/s; however, casualties on average only occurred on 3.6% of nights with low wind speeds (suggesting that curtailment may not always be a proportionate mitigation response).
- The presence of woodland within a 1500m radius of wind turbines appears to reduce the risk to pipistrelles, possibly by providing alternative foraging habitats, but increase the risk to noctule bats (although noctule bat casualties are relatively uncommon events).

- Ground-level detectors underestimate the abundance of soprano pipistrelle and noctule bats at height, although ground level monitoring may be sufficient when only common and soprano pipistrelles are at risk as activity at ground rather than height was a better predictor of fatality for these species.
- The value of pre-construction surveys in predicting collision risk is not clear, possibly due to behavioural changes induced by the installation of the turbines.

With regard to the Foel Trawsnant Wind Farm amended scheme, any assessment of collision risk obviously cannot account for potential behavioural changes that may occur as a result of turbine installation. However, it seems likely (based on the above observations and the baseline data) that the overall risk of collision is relatively low due to the cumulative effect of the following factors:

- The activity levels at the site are relatively low (based on data from other bat surveys, including wind farms and lowland areas), particularly at turbine locations.
- The site is a relatively exposed upland site where windspeeds will frequently be above 11mph.
- Those species that appear over-represented in fatality numbers relative to their estimated national abundance or relative proportions of calls (soprano pipistrelles and noctule) are recorded far less frequently at Foel Trawsnant than would be expected based on ground-level data from other sites (wind farm or otherwise) in Wales or England.
- There is a large amount of woodland within 1500m of the site.

It is likely that the proposed development will result in bat fatalities, and that these will be predominantly common pipistrelle; this species is common and widespread, and fatalities due to wind turbines are thought to present a low risk to its populations. The relatively low activity levels for 'high collision risk' species (particularly soprano pipistrelle and noctule) however suggests that the risk of significant effects on populations of these species is also low.

This assessment considers the effects of the proposed development for which consent is sought (i.e. 11 turbines with 45m blades) rather than the relative performance of the amended scheme and the consented scheme[43]. However (for transparency) it is likely that the collision-risk associated with the amended scheme is marginally greater than the consented scheme: although there are fewer turbines, so reducing risk, the increased blade length is likely to counter the reduction[44]. However, the overall risk of significant effects on local bat populations due to fatalities associated with a wind farm at Foel Trawsnant is considered to be negligible, for the reasons noted.

Summary

It is likely that the proposed wind farm will affect the use of the site by bats, and will increase the mortality risk for bats locally, particularly common pipistrelle (this being by far the most frequently recorded bat on site). However, these changes are considered unlikely to have any significant effects on local bat populations due to the relatively low activity levels at the site; the low numbers of high collision risk species recorded (both in absolute terms and (for noctule and soprano pipistrelle) relative to their estimated local and national populations); and the incorporation of stand-off distances from those features that are known to be used by bats.

[43] Partly as the amended scheme is the subject of the EcIA, not the consented scheme, and partly as there is no established method for quantifying collision risk.
[44] The airspace occupied by 45m blades is approximately 40% greater than 35m blades.

9.16 Assessment of effects: Reptile species

Baseline conditions

Current baseline

The suitability of the site for reptile species was assessed during the Extended Phase 1 survey (see **Appendix 9A**), with casual searches and observations for these species made alongside other species surveys. A common lizard was observed along an embankment adjacent to a track near Turbine 5 during a site visit in May 2018; this was recorded near an area of semi-improved acid grassland and wet heath outside the planning boundary.

Reptiles tend to prefer habitat mosaics that offer cover, basking and foraging opportunities and so the site is unlikely to support high-density populations of these species. All of the four common reptile species (adder; grass snake; common lizard; and slow worm) have been recorded within 2km of the site, although the upland habitats of the site will be most suitable for common lizard, and this species is often found in low densities in upland areas if sufficient habitat complexity (both structurally, and in terms of habitat types) is present.

Much of the Foel Trawsnant site (particularly the areas likely to be affected by the infrastructure) is dominated by grazed grassland which generally has few features or areas that are likely to be especially attractive to reptiles. The more complex habitats at the site are typically found where grazing is intentionally or incidentally limited, or in the ecotones (transitional areas between dominant habitat types) – for example, around the site and field margins, near streams and watercourses, or alongside existing access tracks (particularly in forestry areas).

For assessment purposes reptiles are assumed to be present in areas of the site, but in relatively low densities compared to other areas locally. Most of the site habitats are 'sub-optimal' for high density populations and so the site is considered to be of 'local' value for these species. Note, although reptiles were assumed to be present at the site, specific surveys were not considered essential to adequately and robustly assess the likely effects of the proposed development on reptiles, or to design appropriate mitigation that would ensure no potentially significant effects on these species. Although the value of the site to reptile species is considered 'local' only these have not been scoped-out of the detailed assessment as consultation responses from NPTCBC on the 2014 ES indicated that these species required appropriate consideration.

Future baseline

The site and surrounding areas are unlikely to be subject to significant changes in land use in the absence of the wind farm, and so their suitability for the reptile species is unlikely to change. Forestry clearance may provide new habitat opportunities, although the predicted future baseline is assumed to be the same as the current baseline.

Predicted effects and their significance

Overview

Of the environmental changes associated with the scheme it is considered that reptiles present on or near the site could be affected through:

- land use change / habitat modification (loss of habitat, particularly areas that may be suitable for shelter or concealment); or
- physical intrusion (incidental killing or injury of individuals during construction).

The following incorporated measures are taken into account in the assessment:

- Standard / established construction management and pollution control measures.
- Standard / established construction management best-practice for reptiles, including phased or directional vegetation clearance techniques in higher-risk areas, and appropriate management of excavations and materials storage (etc).
- The proposals within the Habitat Management Plan.

Land use change

The proposed development will affect a very small proportion of the habitat potentially available to reptiles at this site, most of which is grassland with few refugia, and it is extremely unlikely that the habitats lost to the development infrastructure will form a unique or critical resource for reptiles in this area. The loss of approximately 4 ha. of more structurally-complex marshy grassland habitat would not, therefore, be considered a significant effect and would not have a significant effect on the local reptile populations[45]. Indeed, the additional complexity introduced by the infrastructure (e.g. areas of 'bare ground' for basking; banks and batters; track margins) will arguably increase the number of features that may be used by reptiles at the site.

Physical intrusion/Mortality risk

Effects on individual reptiles during construction will be avoided or mitigated using standard best-practice displacement techniques, due to the spatially discrete nature of the works and the large amounts of suitable habitat that would remain accessible. In summary, the removal of habitat or features that could support reptiles (e.g. scrub, dense tussocky grassland, rocks) will be kept to a minimum, and excavations in these areas will take place outside the hibernation period. Where present, scrub or tussocky grassland will be cut to ~150mm above ground level during the winter period to avoid nesting birds becoming established during the nesting season. Final removal, and grubbing out of roots, will be conducted in the spring, outside of reptile hibernation period (i.e. avoiding mid-October through to mid-April depending on seasonal temperature) to allow any individuals to move out of the area of works. Areas of long grass and other similar vegetation that need to be removed will be strimmed prior to construction to reduce their suitability, and hand-searched as necessary to disperse reptiles from the construction area. The mortality risk will be elevated above the baseline during the construction period but the incorporated measures and the accessibility of suitable habitats immediately adjacent to the planning boundary will ensure that this elevated risk is moderated so that the reptile population at the site is not significantly affected during construction.

With regard to operation, the alteration of the site habitats may alter the mortality risk by increasing the amount of 'bare ground' that is likely to be attractive to reptiles for basking; however, the effects of this on populations will be negligible and plenty of refugia will remain close to the new areas of bare ground, and so effects will not be significant.

Summary

The site habitats are suitable for reptiles and so they are assumed to be present (given their presence in the local area) although they are unlikely to occur at high densities in the habitats affected. The proposed development will result in the loss of approximately 4 ha. of heathland grassland habitat that could potentially be used by these species (although the suitability and value of this is somewhat variable across the site, depending on grazing density). This loss will be offset by the habitat enhancement provided in the oHMP and the site infrastructure may incidentally improve some areas for reptiles by providing greater habitat complexity.

[45] It should be noted that approximately 4.3 ha. of the marshy grassland will be re-seeded (for batters, compounds etc.) and although its future suitability for reptiles is uncertain it is likely that some areas will provide suitable habitat features.

Individual reptiles will be protected using standard best-practice measures that temporarily displace them from areas likely to be affected by construction; this is entirely achievable due to the discrete nature of the works and the large amounts of suitable habitat that would remain accessible. The proposed development will therefore have no significant effects on the local reptile populations, or affect their conservation status in NPT.

9.17 Assessment of effects: Brown hare

Baseline conditions

Current baseline

The 2018 desk study identified two brown hare records from the last 10 years within 2km of the planning boundary (note, the 2014 ES identified four brown hare records within 2km of the site boundary). The site habitats are suitable for this species (areas of shorter vegetation with nearby denser cover) and so brown hares are assumed to be present, although none were observed incidentally during any of the site surveys[46]. This may suggest they are present at relatively low densities, which would be consistent with their tendency to avoid areas with significant livestock grazing (due to increased disturbance) and their preference for areas with mixed farming systems that provide them with a range of food-sources throughout the year (Hutchings & Harris 1996). Hutchings & Harris (1996) also note that higher densities in upland pastoral areas are found where some arable cropping takes place; this is not the case at Foel Trawsnant.

Brown hares do not use burrows, relying instead on concealed scrapes (known as 'forms') during the day. Some areas of the site therefore have features that are likely to provide cover for this species, particularly where grazing pressure is lower and tussocky grassland or rushes are more common. These areas are generally associated with the semi-improved acid grassland and wet heath identified on the Phase 1 plan, although these habitats are structurally quite variable across the site depending on local grazing pressure.

There is little solid data on the brown hare population in NPT (other than that available from SEWBReC). For assessment purposes they are assumed to be present at the site, but probably in relatively low densities compared to other areas of Wales or NPT; the site habitats are arguably 'sub-optimal' for high density populations to be present and so are considered to be of 'local' importance for this species.

Future baseline

The site and surrounding areas are unlikely to be subject to significant changes in land use in the absence of the wind farm, and so their suitability for brown hares is unlikely to change. Forestry clearance may provide new habitat opportunities, although the predicted future baseline is assumed to be the same as the current baseline.

Predicted effects and their significance

Overview

Of the environmental changes associated with the scheme it is considered that brown hares present on or near the site could be affected through:

- Land use change / habitat modification (loss of habitat, particularly areas that may be suitable for shelter or concealment).

[46] Although they are predominantly nocturnal, individuals are often seen during the day if present at a site.

- Physical intrusion (disturbance or displacement during construction; incidental killing or injury of individuals is less likely for this species).

The following incorporated measures are taken into account in the assessment:

- Standard / established construction management and pollution control measures.
- Standard / established construction management best-practice for ecological features, including:
  - phased or directional vegetation clearance techniques;
  - the avoidance of night-time working, or working around dusk/dawn, to reduce the likelihood of adverse effects on nocturnal species;
  - siting and designing temporary lighting to ensure that potential 'displacement' effects on nocturnal animals are avoided;
  - managing compounds and excavations to prevent species becoming trapped.
- The proposals within the oHMP.

Land use change

The proposed wind farm will affect approximately 9.6 ha. of grassland and heathland, including semi-improved acid grassland, marshy grassland and wet dwarf shrub heath that is generally more complex and so more attractive to hares. Approximately 5.9 ha. of the area affected will be re-seeded or reinstated (batters, verges, compounds, etc.). Whilst grassland is an important resource, the loss of these habitats is unlikely to affect the local brown hare population, nor will it significantly reduce the availability or accessibility of similar habitat locally; the site does not provide a unique or otherwise notable resource in the local area. JNCC (2010) note that for hares the "*…limitations to achieving BAP targets* [are] *primarily to do with farming*", with the loss of mixed farming systems being a key driver.

As noted, brown hares are not territorial so any habitat loss is unlikely to result in significant displacement or consequential effects on other local populations. The proposed habitat management measures will provide some compensation for the loss of grassland habitat. There is no evidence to suggest that wind farms cause significant behavioural changes or displacement due to the site infrastructure. The proposed development will therefore have no significant effects on the local populations of brown hare, or the maintenance of their conservation status, due to loss of habitats that may be used by this species.

Physical intrusion

It is possible that there will be some temporary disturbance and displacement of individuals during the construction period, although the working areas will be relatively discrete (compared to the total site area) and the predominantly nocturnal habits of brown hares will minimise the risk of construction affecting foraging or resource utilisation. There is little published information on the effects of direct disturbance, although the species appears resilient to this and will often remain concealed and apparently unconcerned by activities within a few tens of metres (presumably due to their rapid flight speed). Given the abundance of suitable habitat elsewhere on the site and in adjacent areas it is expected that any displacement would be temporary only.

It should be noted that brown hares are not territorial so any local displacement is unlikely to have consequential effects on other local populations. There is a small risk that unweaned leverets could be affected by construction works, since they will tend to remain close to their birthplace while suckling[47]; the

[47] Parental care in hares is relatively limited, with the doe moving away from the leverets (which are born with fur and are semi-independent) soon after birth, and only visiting subsequently for short periods of suckling.

risk of this can be minimised using the same mitigation techniques that are appropriate for breeding birds (i.e. the advanced clearance of long vegetation etc. over the winter period to displace hares from working areas prior to their breeding period). Any construction effects will therefore be not significant and will have no effect on the local populations of brown hare or the maintenance of their conservation status.

Summary

The site habitats are suitable for brown hares and so they are assumed to be present (given their presence in the local area) although it is likely that they occur at relatively low densities due to the land use and agricultural practices. The proposed development may result in the disturbance of individual animals during construction, and will result in the loss of approximately 3.7 ha of habitat (i.e. the area of habitat directly affected by construction, minus that which is reinstated) that could potentially be used by this species (although the suitability and value of this is somewhat variable across the site, depending on grazing density). However, any displacement will be temporary only and the loss of habitat is not considered significant based on the availability and accessibility of similar habitat elsewhere on site and locally, and the likely benefits of the habitat management plan. The proposed development will therefore have no significant effects on the local populations of brown hare, or the maintenance of their conservation status in NPT.

9.18 Summary of assessment

The effects of the scheme on the scoped-in ecological receptors are summarised in **Table 9.21**; note, the effects cumulatively with other proposals are discussed in Section 9.19.

Table 9.22 Summary of significance of adverse or beneficial effects

Ecological feature	Sensitivity/ importance/ value of receptor[1]	Overall magnitude of change[2]	Significance[3]	Summary rationale
Watercourses SINC	County	Negligible	Not significant	The proposed development will have a direct effect on a minor tributary of the Nant Cynon due to the construction of an access track. A tributary of the Nant Drysiog may also be affected if an existing forestry track requires upgrading, although this watercourse is already culverted and modified in this location. These minor first-order upland streams potentially contribute to the 'Watercourses' SINC in the NPT area. The proposed development also affects the catchments of several other watercourses, which may consequently be vulnerable to site-derived pollutants or hydrological changes. The incorporated measures (see Section 12.8 of the ES) will ensure that indirect effects on local drainage systems, and hence the 'Watercourses' SINC, will be prevented or appropriately managed. The direct effects on the site watercourses (culverting beneath new access tracks) will be very small-scale and localised and will not affect any intrinsically high-value habitats; nor will the functional value of the watercourses alter as a result of the track installation. Overall, therefore, the effects on the 'Watercourses' SINC will be negligible, and the integrity or conservation status of this SINC will not be affected.
Caerau West SINC	County	Negligible	Not significant	There will be no direct effects on this SINC. The incorporated measures will ensure that indirect effects on Caerau West SINC will be prevented or appropriately managed. Overall, therefore, the proposed development will have no effect on the integrity or conservation status of the Caerau West SINC.
Nant-y-Crynwydd SINC	County	Negligible	Not significant	There will be no direct effects on this SINC. The incorporated measures will ensure that indirect effects on Nant-y-Crywydd SINC will be prevented or appropriately managed. Overall, therefore, the proposed development will have no effect on the integrity or conservation status of the Nant-y-Crywydd SINC.

Ecological feature	Sensitivity/ importance/ value of receptor[1]	Overall magnitude of change[2]	Significance[3]	Summary rationale
Section 7 habitats	Local	Low	Not significant	Three S.7 habitats may be directly or indirectly affected by the proposed development ('Upland flushes, fens and swamps', 'Upland heathland', and 'Blanket bog'). The condition of these habitats is variable but they are unexceptional in a local or county context being heavily influenced by historic and current agricultural practices (drainage, burning, grazing, etc.). With regard to indirect effects due to construction or hydrological changes, it is predicted that these will be avoided using normal best-practice mitigation or will be local and negligible in their effects, and would not on their own be considered significant. Furthermore, the S.7 habitats are modified and not notable in a national, regional or county context, and so the loss of ~4 ha. would not typically be considered significant at a county level or above. Notwithstanding this, the oHMP will bring approximately 15 ha. of grassland into long-term management designed to improve its biodiversity value, and includes measures (e.g. drainage control) that will increase the extent of S.7 habitats at the site
Peat	Local	Negligible	Not significant	'Deep peat' (>0.5m) is very limited at the site, with the vast majority of the site being underlain by shallow (<0.3m) peaty organo-mineral soils rather than higher-value saturated active peat deposits. With regard to indirect effects due to construction or hydrological changes, it is predicted that these will be avoided using normal best-practice mitigation or will be local and negligible in their effects, and would not on their own be considered significant. Furthermore, the peaty soils are modified and not notable in a national, regional or county context, and so damage to ~9.6 ha. (i.e. assuming all areas of the site are underlain by peaty soils) would not be considered significant at a county level or above.
Bats	Local	Negligible	Not significant	It is likely that the proposed wind farm will affect the use of the site by bats, and will increase the mortality risk for bats locally, particularly common pipistrelle (this being by far the most frequently recorded bat on site). However, these changes are considered unlikely to have any significant effects on local bat populations due to the relatively low activity levels at the site; the low numbers of high collision risk species recorded (both in absolute terms and (for noctule and soprano pipistrelle) relative to their estimated local and national populations); and the incorporation of stand-off distances from those features that are known to be used by bats. No roosts have been identified within 200m of the site.

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Ecological feature	Sensitivity/ importance/ value of receptor[1]	Overall magnitude of change[2]	Significance[3]	Summary rationale
Reptiles	Local	Negligible	Not significant	The site habitats are suitable for reptiles and so they are assumed to be present (given their presence in the local area) although they are unlikely to occur at high densities in the habitats affected. The proposed development will result in the loss of approximately 4 ha. of heathland mosaic habitat that could potentially be used by these species (although the suitability and value of this is somewhat variable across the site, depending on grazing density). This loss will be offset by the habitat enhancement provided in the oHMP and the site infrastructure may incidentally improve some areas for reptiles by providing greater habitat complexity. Individual reptiles will be protected using standard best-practice measures that temporarily displace them from areas likely to be affected by construction; this is entirely achievable due to the discrete nature of the works and the large amounts of suitable habitat that would remain accessible.
Brown Hare	Local	Negligible	Not significant	The site habitats are suitable for brown hares and so they are assumed to be present (given their presence in the local area) although it is likely that they occur at relatively low densities due to the land use and agricultural practices. The proposed development may result in the disturbance of individual animals during construction, and will result in the loss of approximately 3.7 ha of habitat (i.e. the area of habitat directly affected, minus that which is reinstated) that could potentially be used by this species (although the suitability and value of this is somewhat variable across the site, depending on grazing density). However, any displacement will be temporary only and the loss of habitat is not considered significant based on the availability and accessibility of similar habitat elsewhere on site and locally, and the likely benefits of the habitat management plan.

The sensitivity/importance/value of a receptor is defined using the criteria set out in section 9.7 above.
The magnitude of change on a receptor resulting from activities relating to the development is defined using the criteria set out in section 9.9 above.
The significance of the environmental effects is based on the combination of the sensitivity/importance/value of a receptor, the magnitude of change and professional judgement and is significant, or not significant, subject to the evaluation methodology outlined in Section 9.9.

9.19 Assessment of cumulative effects

As outlined in Section 9.8, consideration has been given as to whether any of the ecological features that have been taken forward for assessment in this chapter are likely to be subject to cumulative effects as a result of the proposed development and by other developments. This includes the consideration of the effects summarised in **Appendix 9D** that are not significant, as a number of minor effects on an ecological feature from multiple projects may result in a significant cumulative effect.

Cumulative effects would generally be either:

- Cumulative 'zone of influence' effects whereby two or more developments affect the same specific receptor (e.g. two developments in the same river catchment); or
- Cumulative effects on the total resource (or population) of a receptor in a region due to two or more developments (e.g. two developments affect the same habitat type in a region, reducing its overall area).

Assessment of these is complex and relies on the definition of a reasonable scope for cumulative effects, and the availability of a reasonable baseline for other developments. However, the same principles of assessment apply, i.e. an effect would have to be significant at the 'county' level to be significant in EcIA terms. In addition, the assessment focuses on those occasions where two 'not significant' effects might operate cumulatively to result in a significant effect (rather than where the effects of one development on a receptor are already, on their own, considered significant).

No developments have been identified in the immediate vicinity of the site which are likely to affect those spatially discrete or range-limited receptors present on the Foel Trawsnant site or in close proximity; therefore, there will be no possibility of significant cumulative effects on:

- the Caerau West SINC or the Nant-y-Crywydd SINC (as the Foel Trawsnant Wind farm amended scheme will have negligible effects on these sites, and no other schemes (etc.) are likely to affect them);
- any species present or potentially present at the site, except for bats (all species other than bats will have relatively limited ranges and so the populations associated with the Foel Trawsnant site will not be exposed to the effects of other developments; and the proposed development itself will have a negligible effect on these populations, ensuring that the Foel Trawsnant development will make a negligible contribution to any effects on county-wide populations that may occur cumulatively with other developments); and
- any site habitats, other than S.7 habitats, as the Foel Trawsnant Wind Farm amended scheme will have negligible effects on these habitats, and they are not of sufficient value for any cumulative loss with other developments to be significant.

The following sections therefore examine the potential cumulative effects on the 'Watercourses' SINC (as off-site examples of this SINC could be affected by the proposed development and other developments); the S.7 habitats (in terms of resource loss); and bats (due to their large ranges and dependence on a range of habitats through their life-cycle).

Watercourses SINC

The watercourses on site will not be exposed to cumulative effects due to the absence of nearby developments; however, other activities within a catchment may affect water courses that are downstream of the site. The 'Watercourses' SINC is only likely to be vulnerable to cumulative effects during the construction phase and decommissioning phase, since the site tracks and drainage will be designed to limit operational run-off to greenfield rates (see **Chapter 12** of the ES) and will include features to minimise sediment

entrainment and transport. Therefore, cumulative effects will only be likely for developments or operations in the same catchment(s) as the Foel Trawsnant Wind Farm amended scheme, which are being undertaken in a similar timeframe, and which are likely to affect river reaches within approximately 5km of the wind farm (as any effects due to the proposed development are likely to be fully attenuated by flows within the receiving watercourses by this point).

It is not possible to identify all such developments since the timescales for construction of other developments that might interact with the Foel Trawsnant Wind Farm amended scheme are uncertain, and dependent on the planning process; furthermore, information on the timescales of other potentially significant activities (e.g. catchment-wide forestry felling programmes) is not readily available.

A review of the existing NPT planning database has not identified any developments with a zone of influence that is likely to intersect that of the Foel Trawsnant Wind Farm amended scheme. Furthermore, it is expected that any consented developments will be subject to their own pollution control measures to minimise the risk and magnitude of any effects on receiving watercourses. On this basis, no significant cumulative effects are likely with other developments.

It is recognised that forestry operations can have significant short-term effects on watercourses, and these are likely to be substantially greater than any effects arising from wind farm construction; cumulative effects are therefore possible if significant forest clearance operations take place in the same timeframe as construction. The felling plans for the Afan Forest have been reviewed, with those areas scheduled for felling prior to 2022 (anticipated end date for construction) identified. In summary, small stands of woodland around Garn Wen (to the south-east of the wind farm site) are scheduled for felling in 2017 – 2022, and these stands are within the catchments of minor watercourses that may also be exposed to run-off (etc.) from construction of the Foel Trawsnant amended scheme. There are a number of large woodland stands north of the site, on the far side of the Afon Afan (which ultimately receives run-off from the northern half of the site), which are also scheduled for felling in this period. It is not certain whether construction and felling periods will entirely coincide, although it would seem likely that some works will. However, the measures incorporated into the Foel Trawsnant scheme will prevent contamination of local water courses with site-derived pollutants, including significant volumes of silt (which can be conditioned and monitored), and it must be assumed that best-practice approaches will be implemented by NRW during any clearances. On this basis, significant cumulative effects on the 'Watercourses' SINC would not occur.

Section 7 habitats

The only S.7 habitats potentially vulnerable to cumulative effects associated with Foel Trawsnant Wind Farm amended scheme are 'Rivers' (since site run-off will enter local watercourses at some point) and those habitats that will be lost to the proposed development (since this will result in a reduction in the county-wide resource of these habitats).

Rivers

The 'Rivers' S.7 habitat will not be subject to significant cumulative effects for the same reasons as the 'Watercourses' SINC (see above).

Upland Flushes, Fens and Swamps, Upland Heathland and Blanket Bog

The Foel Trawsnant Wind Farm amended scheme will directly affect approximately 4 ha of 'Upland flushes, fens and swamps', 'Upland heathland' and 'Blanket bog' S.7 habitats. Batters and verges will be restored and re-seeded, which may recreate some areas, although the extent of this is uncertain. The oHMP will bring approximately 15 ha. of grassland into long-term (25 year) management, with measures that are likely to improve the intrinsic biodiversity value of the S7 habitats covered by the plan. Therefore, the net effect of the proposed wind farm on its own is likely to be 'negligible' or 'minor' but not significant in EcIA terms.

No other developments or operations are likely to affect the 'Upland flushes, fens and swamps', Upland heathland' and 'Blanket bog' S7 habitats that are present at this site in the anticipated timeframe for development, and so cumulative effects on the S7 habitats will not occur in this regard.

The contribution of the Foel Trawsnant Wind Farm amended scheme to cumulative county-wide S.7 habitat loss cannot be meaningfully assessed due to the limitations in the baseline data and the availability of detailed information on effects due to other developments. A brief review of the ESs for wind farm developments[48] that are in planning or have recently received permission indicates that the effects of these developments on habitats that contribute to the 'Upland flushes, fens and swamps' S.7 habitat is fairly limited – for example, the ES for the Llynfi Afan wind farm estimates that the development will affect only 0.6 ha. of marshy grassland, and negligible areas of flush (etc.). Similarly, Pen y Cymoedd has not affected substantial areas of heathland as the majority has been developed in forestry areas. Both of these developments have habitat management plans that will enhance existing areas of marshy grassland (among other things, including peatland restoration). Given the limited impacts of these developments, it is unlikely that the Foel Trawsnant Wind Farm amended scheme will have significant effects cumulatively with other wind farm developments on the total area of this S.7 habitat in NPT, and the proposed oHMP will partially offset or moderate the effects.

Bats

There are no accepted protocols or methods for assessing the cumulative effects of developments on local bat populations, and in reality the range of conceivable cumulative effects is as variable as the range of developments or activities that could conceivably affect bats. For example, the loss of a roost due to a barn conversion could arguably have a cumulative effect with a wind farm if this increases collision risk as bats travel further to forage.

Furthermore, it is acknowledged that accurately establishing bats' use of the wider landscape (away from a development site) is very difficult. This is due to severe practical constraints on meaningful field surveys across substantially larger areas and the inherent limitations of current bat survey techniques (e.g. areas that can be covered, effective range of detection, and so on).

The range of conceivable effects and the patchiness of survey data therefore present some difficulties when assessing any potential cumulative effects on bats. In order to keep the assessment manageable, only wind farms which are either built, consented or with submitted planning applications within 10km of Foel Trawsnant are considered for cumulative effects. This is because:

i) It is considered that the principal risks to bat populations from wind farm development are increased collision risk and (to a lesser extent) possible reductions in available upland habitat if displacement occurs. Other than vehicles, wind farms are likely to present the main collision risk for bats in rural Wales. Since very few other developments are likely to significantly increase collision risk, it is most relevant to consider cumulative collision risk from wind farm developments only. Similarly, few (if any) other developments are likely to significantly affect the availability or accessibility of upland habitat resources.

ii) Most other developments do not take place on the same geographical scale as wind farms, and therefore it is likely that any effects that other developments may have on bats can be fully mitigated locally, without significant risk of cumulative effects with local wind farms. This is particularly relevant when considering the possible cumulative effects of wind farm developments with the lowland developments that are typical of rural Wales.

[48] Wind farm developments are most likely to significantly affect the upland S.7 habitats affected by the Foel Trawsnant Wind Farm amended scheme; other potential sources of effects (e.g. agricultural improvement) are unlikely to be recorded or assessed unless sufficient in scale to trigger the *Environmental Impact Assessment (Agriculture) (Wales) Regulations* 2017.

iii) The flight range of bat species is very variable (with some flying substantial distances between winter and summer roosts), but most species tend to forage within ~5km of their roost (based on BCT 2007). On this basis, bats roosting ~5km from the proposed development at Foel Trawsnant could also be affected by other wind farms ~10km from Foel Trawsnant.

Table 9.22 identifies wind energy developments within 10km of the planning boundary.

Table 9.23 Cumulative assessment wind energy developments within 10km of the planning boundary

Windfarm	~Distance from FT turbines	No. of turbines	Hub Height	Maximum blade tip height
Pen y Cymoedd	2km	76	100m	145m
Ffynnon Oer	3km	16	60m	91m
Llynfi Afan	4km	12	78m	118m
Mynydd Brombil	7km	5	60m	100m
Newlands Farm	10km	1	50m	77m
East of Melin Court*	6km	5	85m	145m

*Proposed; all other wind farms are operational or under construction.

Direct comparison of bat survey results from different developments is not possible due to the variability in site conditions and survey effort. However, all of the studies for wind farms within 10km of the Foel Trawsnant Wind Farm amended scheme report similar patterns and conclusions, i.e.:

- Bat activity within the sites, particularly in more 'exposed' areas away from features typically used by bats, is low or too low to be detectable (although it is recognised that many bat surveys typically target areas and features where bats would be expected).
- Some areas of the sites experience relatively higher levels of activity, but these areas invariably have features that are typically favoured by foraging or commuting bats (e.g. riparian corridors; woodland edges; hedgerows; sheltered treelines or gullies).
- Use of the sites appears to be fairly strongly linked with weather conditions, presumably due to their greater exposure.
- There is limited evidence of seasonal variations in use, particularly with respect to an autumn migration peak.

The studies undertaken for other wind farms have all concluded that these wind farm developments are unlikely (on their own) to have any significant effect on either local bat populations, or their usage of the sites (this is also the conclusion reached by the assessment for Foel Trawsnant).

The primary cumulative effects of multiple wind farms are considered to be increased collision risk (and hence direct effects on population size) and the possibility of indirect effects on habitat use (i.e. the displacement of bats from foraging areas due to the presence of turbines, or 'barrier effects' (the loss or modification of flight paths, although Jones *et al.* (2009) report no documented cases of barrier effects occurring at wind farms)).

The cumulative collision risk cannot be accurately quantified, for the same reasons that collision risk cannot be quantified for individual wind farms (no established methods for quantifying site usage; limited knowledge on bat behaviour in relation to wind turbines or in upland environments; variability of survey effort / techniques between sites; etc.). However, the available ESs for the wind farms within 10km of the

proposed development indicate that bat activity across these upland sites is generally low, and that the qualitative risk of collision is therefore also low (provided that turbines are sited away from features typically used by bats). The wind farms have all benefited from bat surveys and subsequent siting of turbines to avoid features used by bats. It is therefore considered that the existing or proposed wind farms have taken appropriate measures to minimise collision risk and so avoid potentially significant effects on local bat populations.

Furthermore, the wind farms are sited in predominantly upland or upland margin habitats, away from the valley environments that are likely to provide the most significant foraging and roosting habitats locally, and the principal commuting and migration routes. The inter-connectivity of the valley systems in this area will not be meaningfully affected by the wind farms, and so the general 'permeability' of the landscape to bats is unlikely to be significantly reduced. As noted, there are no documented cases of wind farms having 'barrier effects' (Jones *et al.* 2009). There is little evidence to suggest that the upland areas (particularly on Foel Trawsnant) provide a significant habitat resource for local bat populations. It is therefore considered extremely unlikely that the wind farms within 10km of the Foel Trawsnant Wind Farm amended scheme will operate cumulatively to significantly affect local bat populations.

9.20 Consideration of additional mitigation or compensation

No additional mitigation measures are proposed to further reduce the non-avian ecology effects that are identified in this ES. This is because all relevant and implementable measures have been embedded into the development proposals (Section 5.3 and Section 5.4) and are assessed above in this chapter. These measures are considered to be likely to be effective and deliverable and address the likely potentially significant effects on the Foel Trawsnant Wind Farm amended scheme.

9.21 Conclusions of significance evaluation

In summary, the EcIA can conclude that the proposed Foel Trawsnant Wind Farm amended scheme will have no significant effects on any biodiversity receptors, alone or cumulatively with other developments.

9.22 Implementation of environmental measures

Table 9.23 describes the environmental measures embedded within the proposed development and the means by which they will be implemented, i.e. conditions to be adhered to under development consent; requirements of Natural Resources Wales (NRW) and environmental measures identified in the ES (Section 5.3 and Section 5.4)

Table 9.24 Summary of environmental measures relevant to non-avian ecology to be implemented

Environmental measure	Responsibility for implementation	Compliance mechanism	ES Section
Dust-suppression measures during construction	Construction Contractor	CEMP (planning condition)	Table 9.12
Watercourse pollution / sedimentation prevention measures during construction	Construction Contractor	CEMP (planning condition)	Table 9.12
Avoidance of key wetland habitats/ deep peat deposits and the Caerau West SINC (on-site)	Developer	Site design upon which planning application submitted for approval.	Table 9.12

Environmental measure	Responsibility for implementation	Compliance mechanism	ES Section
Culvert design for stream crossings to be mammal friendly to allow passage of water vole and otter	Construction Contractor	CEMP (planning condition).	Table 9.12
50m stand-off between turbine blade tips and key bat foraging/commuting habitats (wetland habitats, walls, trees)	Developer	Site design upon which planning application submitted for approval.	Table 9.12
Avoid night-time working to avoid disturbance to bats/otter or restrict lighting used during construction	Construction Contractor	CEMP (planning condition).	Table 9.12
Prepare and implement non-licensed Ecological Mitigation Method Statement	Construction Contractor and Ecologist	CEMP (planning condition).	Table 9.12
Replacement of lost or damaged ponds along access track (if required)	Construction Contractor	CEMP (planning condition).	Table 9.12

9.23 References

Amec (2014). *Foel Trawsnant Wind Farm Environmental Statement Volume 1: Chapter 9, Ecology and Nature Conservation*. Report produced by Amec Environment and Infrastructure UK Limited for Pennant Walters Limited, July 2014 (doc ref. 24311rr073i1).

Amec Foster Wheeler (2016). *Foel Trawsnant Wind Farm, Further Ecological Information.* Report produced by Amec Foster Wheeler Environment and Infrastructure UK Limited for Pennant Walters Limited, July 2016 (doc. ref. 24311rr120i1).

Amec Foster Wheeler (2014a). *Foel Trawsnant Wind Farm Environmental Statement Volume 2. Appendix 9.4. Outline Habitat Management Plan.* Report produced by Amec Foster Wheeler Environment and Infrastructure UK Limited for Pennant Walters Limited, July 2016 (doc. ref. 24311rr119i2).

Averis A.M, Averis A.B.G, Birks H.J.B., Horsfield D., Thompson D.B.A. and Yeo M.J.M. (2004). *An Illustrated Guide to British Upland Vegetation.* Joint Nature Conservation Committee, Peterborough.

Bat Conservation Trust (2008). *Bats and Lighting in the UK*. Bat Conservation Trust, London.

Bat Conservation Trust (2016). *Bat Surveys for Professional Ecologists. Good Practice Guidelines (3rd Edition).* BCT, London.

Battersby, J. (ed.) (2005). *UK Mammals: Species Status and Population Trends: First Report by the Tracking Mammals Partnership.* JNCC/Tracking Mammals Partnership, Peterborough.

Biggs J., Ewald N, Foster J, Valentini A, Gaboriaud C, Dejean T, Griffiths RA, Wilkinson JW, Arnell A, Brotherton P, Williams P & Dunn F (2015). Using eDNA to develop a national citizen science-based monitoring programme for the great crested newt (*Triturus cristatus*). *Biological Conservation* 183, 19-28.

Chartered Institute of Ecology and Environmental Management (2016). *Institute of Ecology and Environmental Management: Guidelines for Ecological Impact Assessment in the United Kingdom (2nd Ed).* CIEEM, Winchester.

Cryan, P.M., Gorresen, P.M., Hein, C.D., Schirmacher, M.R., Diehl, R.H., Huso, M.M., Hayman, D.T.S., Fricker, P.D., Bonaccorso, F.J., Johnson, D.H., et al. (2014). Behaviour of bats at wind turbines. *Proc. Natl. Acad. Sci. USA* **111**, 15126–15131.

English Nature (2001) *Great Crested Newts. Mitigation Guidelines.* EN, Peterborough.

European Commission (2013) *Third Report by the United Kingdom under Article 17 on the implementation of the Directive from January 2007 to December 2012*. Available at http://jncc.defra.gov.uk/page-6397. Accessed: 15 September 2018.

Gent AH. & Gibson SD., eds. (2003). *Herpetofauna Worker's Manual*. Peterborough, Joint Nature Conservation Committee.

Hill M.O., Blackstock T.H., Long D.G. and Rothero G.P. (2008). *A Checklist and Census Catalogue of British and Irish Bryophytes.* British Bryological Society.

Hundt, L. (2012) *Bat Surveys Good Practice Guidelines (2nd Edition).* BCT, London.

Institute of Environmental Assessment (1995). *Guidelines for Baseline Ecological* Assessment. E & FN Spon, London.

Joint Nature Conservation Committee (2010). *Handbook of Phase 1 habitat survey – a technique for environmental audit.* JNCC, Peterborough.

Jones G, Cooper-Bohannon R, Barlow K, Parsons K (2009). *Determining the potential ecological impact of wind turbines on bat populations in Britain: Scoping and Method Development Report*. University of Bristol, Bristol.

Kunz, T.H., Arnett, E.B., Erickson, W.P., Hoar, A.R., Johnson, G.D., Larkin, R.P., Strickland, M.D., Thresher, R.W., and Tuttle, M.D. (2007). Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. *Front. Ecol. Environ*. 5, 315–324.

Langton T, Beckett C & Foster J (2001). *Great Crested Newt Conservation Handbook*. Froglife, Suffolk.

Mackie, I.J. & Racey, P.A. (2007). Habitat use varies with reproductive state in noctule bats (*Nyctalus noctula):* Implications for conservation in *Biological Conservation 140 (2007) 70-77*

Mathews F, Richardson S, Lintott P & Hosken D (2016) *Understanding the Risk to European Protected Species (bats) at Onshore Wind Turbine Sites to inform Risk Management*. Report for Defra, Ref. WC0753. University of Exeter, Exeter.

Natural England (2014). *Bats and onshore wind turbines: interim guidance*, 3rd edition. Natural England Technical Information Note TIN051.

Natural England (2015). *Great crested newts: surveys for development projects*. Available at https://www.gov.uk/guidance/great-crested-newts-surveys-and-mitigation-for-development-projects. Accessed 15 May 2018.

Natural England and Department for Environment Food and Rural Affairs (2014). *Guidance. Otters: surveys and mitigation for development projects. Standing advice for local planning authorities to assess the impacts of development on otters*. Available at https://www.gov.uk/guidance/otters-protection-surveys-and-licences. Access 27 September 2018.

Oldham R.S., Keeble J., Swan M.J.S. & Jeffcote M. (2000). Evaluating the suitability of habitat for the Great Crested Newt (*Triturus cristatus*). *Herpetological Journal* 10 (4), 143-155.

Rodwell J.S. (2006). *National Vegetation Classification Users' handbook*. Joint Nature Conservation Committee, Peterborough.

Rodwell J.S. (Ed.) (1992). *British Plant Communities Volume 3: Grasslands and montane communities.* Cambridge University Press.

Roeleke, M., Blohm, T., Kramer-Schadt, S., Yovel, Y., & Voigt, C. C. (2016). Habitat use of bats in relation to wind turbines revealed by GPS tracking. Scientific Reports, 6, 28961. doi:10.1038/srep28961

Rydell, J., Engstrom, H., Hedenstrom, A. *et al.* (August 2012). *The Effect of Wind Power on Birds and Bats – A Synthesis.* Swedish Environmental Protection Agency, Stockholm.

Stace C.A. (2010). *New Flora of the British Isles (3rd edition)*. Cambridge University Press.

Strachan, R. and Moorhouse, T. P., (2006). *Water Vole Conservation Handbook (Second Edition)*, the Environment Agency and the Wildlife Conservation Research Unit, Oxford.

SureScreen Scientifics (2018). *Technical Report. Analysis of Environmental DNA in Pond Water for Detection of Great Crested Newts.* SureScreen Scientifics Division Ltd, Morely, Derbyshire.

Voigt CC, Rehnig K, Lindecke O, Pētersons G (2018): Migratory bats are attracted by red light but not by warm-white light: Implications for the protection of nocturnal migrants. *Ecology and Evolution* 2018;8:9353–9361.

10 Ornithology

10.1 Introduction

This chapter of the Environmental Statement (ES) assesses the potential significant effects[49] of the proposed development with respect to ornithology. It should be read in conjunction with the development description provided in **Chapter 5: Description of the proposed development.**

Throughout this chapter, 'the proposed development site' refers to the area within the red-line boundary (the Planning Boundary). The wider site area refers to land under the developer's control, this being the same area on which the EIA for the original application was based in 2014. The survey area refers to the proposed development site plus areas outwith its boundary that were included in bird surveys (e.g. all areas within buffer boundaries).

10.2 Limitations of this assessment

There are no limitations relating to ornithology that affect the robustness of the assessment of the potential significant effects of the proposed development. No major information gaps have been identified to date. All survey and desk study work were conducted as per available guidance and are considered sufficient for the evaluation process.

10.3 Policy and legislative context

Planning policy

Table 10.1 lists the issues from the relevant planning policies that have been considered in assessing ornithological effects.

Table 10.1 Policy issues considered in preparing the ornithology assessment

Policy reference	Policy issues	Considered in section
National planning policies		
National Planning Policy Framework (NPPF). Section 15. (MCLG, 2018)	With regard to paragraphs 170, 175, 176 and 177, the ES will need to demonstrate that: • Biodiversity sites, including Sites of Special Scientific Interest (SSSIs) and EU sites that are being considered for designation (e.g. potential Special Protection Areas (SPAs)) will be protected; • The Proposed Development itself, with or without cumulative effects that could be generated together with other developments, must first seek to avoid or minimize any adverse effects on biodiversity, or if such effects are unavoidable, then make appropriate compensation, be it on or off-site; • Opportunities for biodiversity enhancements within the proposal should be explored, and a net gain in biodiversity should be delivered; and	**Appendix 10C**

[49] Other technical chapters within this ES use the terms "likely significant effects" and "potential likely significant effects" within the assessment. However, within the Ornithology chapter the term "potentially significant effects" is used as it accords with CIEEM guidance and avoids confusion with the term "likely significant effects" when used in the context of the Habitats Regulations Assessment.

Policy reference	Policy issues	Considered in section
	• The Proposed Development must satisfy the requirement for no adverse effects on the integrity of any European sites (to be determined via the Habitat Regulation Assessment (HRA) appropriate assessment process). With regard to Paragraphs 180 and 181: • Consideration should be given to the effects on the natural environment of noise and light pollution arising from the Proposed Development.	
Technical Advice Note (TAN) 5: Nature Conservation and Planning (2009)	TAN5 provides advice about how the land use planning system should contribute to protecting and enhancing biodiversity conservation within Wales. It sets out the key principles of planning for nature conservation for both local development plans and when deciding planning applications that may affect nature conservation. These include: • promoting the conservation and enhancement of statutorily designated areas and undeveloped coast; • ensuring that appropriate weight is attached to designated sites of international, national and local importance; • protecting wildlife and natural features in the wider environment; • ensuring that all material considerations are taken into account and decisions are informed by adequate information about the potential effects of development on nature conservation; • ensuring that the range and population of protected species is sustained; and • avoiding harm to nature conservation, minimising unavoidable harm by mitigation measures, offsetting residual harm by compensation measures and looking for new opportunities to enhance nature conservation.	Section 10.8
Development plan policies		
Neath Port Talbot Local Development Plan 2011-2026 (2016)	**Policy SP15 (Biodiversity & Geodiversity)** sets out the approach to the protection, conservation, enhancement and management of important habitats, species and sites of geological importance. Important habitats, species and sites of geological interest will be protected, conserved, enhanced and managed through the following measures: 1. The identification of the following Internationally and Nationally designated sites within the County Borough to enable their protection: (a) Special Areas of Conservation (SACs) and Ramsar Sites; (b) Sites of Special Scientific Interest (SSSIs); (c) National Nature Reserves (NNRs). 2. The identification and protection of sites of regional and local importance. 3. The protection of important natural heritage features.	**Appendix 10C**
	Policy EN 6 (Important Biodiversity and Geodiversity Sites) states that proposals that would affect Regionally Important Local Nature Reserves (LNRs), Sites of Interest for Nature Conservation (SINCs), sites meeting SINC criteria or sites supporting Local Biodiversity Action Plan (LBAP) or S7 Environment (Wales) Act 2016 habitats or species, will only be permitted where they conserve and where possible, enhance the importance of the site, or the development could not reasonably be located elsewhere. Mitigation/compensation will need to be agreed where adverse effects are unavoidable.	**Appendix 10C**
	Policy EN 7 (Important Natural Features). Development proposals that would adversely affect ecologically or visually important natural features such as trees, woodlands, hedgerows / field boundaries,	**Appendix 10C** & Section 10.8

Policy reference	Policy issues	Considered in section
	watercourses or ponds will only be permitted where: 1. Full account has been taken of the relevant features in the design of the development, with measures put in place to ensure that they are retained and protected wherever possible; or 2. The biodiversity value and role of the relevant feature has been taken into account and where removal is unavoidable, mitigation measures are agreed.	
Biodiversity and Geodiversity: Supplementary Planning Guidance (2018)	The Biodiversity and Geodiversity: Supplementary Planning Guidance (SPG) was adopted by Neath Port Talbot County Borough Council in May 2018. The SPG sets out guidance for interpretation of the biodiversity and geodiversity policies of the LDP (SP15: Biodiversity and Geodiversity; EN6: Important Biodiversity and Geodiversity Sites and EN7: Important Natural Features). The SPG sets out an approach to consider biodiversity holistically in the application process.	N/A

Legislative context

The following legislation is relevant to the ornithology assessment:

- Council Directive 2009/147/EC on the conservation of wild birds (the codified version of Council Directive 79/409/EEC as amended) (commonly referred to as the Birds Directive);
- The Conservation of Habitats & Species Regulations 2017;
- The Environment (Wales) Act 2016; and
- Wildlife and Countryside Act 1981 (as amended).

Technical guidance

The main issues relating to birds and wind farms to be considered within the assessment are:

- the effects of direct habitat loss due to land take by wind turbine bases, tracks and other infrastructure;
- the effects of indirect habitat loss resulting from the displacement of birds from the proximity of wind turbines. Such disturbance may occur as a consequence of construction work, or due to the presence of the wind farm close to nesting or feeding sites, or on regular flight paths; and
- the effects of collisions with turbine blades, overhead wires and guy lines (i.e. killing or injury to birds) which is of particular relevance for sites regularly used by certain species of raptor and/or large concentrations of wildfowl.

In order to assess the potential effects of a wind farm, both the value of the proposed development site itself to birds and the level of flight and other activity within and around the proposed development site should be determined. To date, Natural Resources Wales (NRW) has not developed specific guidance for assessing the effects of wind farms on ornithological interest. However, specific guidance has been developed by Scottish Natural Heritage (SNH) (SNH, 2005 – amended 2010 and 2018) and Natural England (NE, 2010 - TIN069) which are generally accepted as the guidance to use in assessing wind farm proposals in the UK.

The following guidance has therefore been referred to is this assessment:

- Scottish Natural Heritage (2000). *Methodology for assessing the effects of wind farms on ornithological interests.* SNH Guidance Note Series.
- Scottish Natural Heritage (2002). *Survey methods to assess wind farm impacts on upland bird communities*. SNH, Battleby.
- Scottish Natural Heritage (2017). *Recommended bird survey methods to inform impact assessment of onshore wind farms*. http://www.snh.gov.uk/docs/C278917.pdf.
- Scottish Natural Heritage (2006, updated in 2018). *Assessing significance of impacts from onshore windfarms on birds outwith designated areas.* SNH, Battleby.
- Natural England (2010). *Assessing the effects of onshore wind farms on birds*. Technical Information Note 069.

SNH guidance on the assessment of the effects of wind farms on ornithological interests (SNH, 2000) suggests that assessment should concentrate on Target Species, for example those specially protected or those which occur at a site in regionally or nationally important numbers, as follows:

- Species protected under Schedule 1 of the *Wildlife & Countryside Act 1981* (as amended).
- Species listed on Annex 1 of the *Council Directive 2009/147/EC on the conservation of wild birds (the codified version of Council Directive 79/409/EEC as amended)* (commonly referred to as the Birds Directive).
- Regularly occurring migratory species which are either rare or vulnerable, or warrant special consideration on account of the proximity of migration routes, or breeding, moulting, wintering or staging areas in relation to the proposed wind farm.
- Species occurring at the site in regionally or nationally important numbers.
- Ornithological qualifying features of SPAs, Ramsar sites and SSSIs.

This target species approach is further advocated in SNH's guidance on survey methods for use in assessment of the impacts of onshore wind farms on bird communities (SNH, 2005 updated in 2017). These criteria are of equal relevance to Wales as the basis for the determination of target species is UK and European wide legislation and the proportion of national and regional populations that are present on a site.

10.4 Data gathering methodology

Desk study

The presence of Special Protection Areas (SPAs) and Ramsar sites within 20km and Sites of Special Scientific Interest (SSSIs) with an ornithological interest within 10km of the proposed development site was determined by accessing the Multi-Agency Geographical Information for the Countryside (MAGIC) website[50]. Details of cited features of designated sites were obtained from the NRW website[51].

Ornithological data was requested from the South East Wales Biological Records Centre (SEWBReC) to include records of all protected species, Species of Principle Importance for the conservation of biodiversity, or other conservation-notable species recorded within 2km of the proposed development site. Additional ornithological records were also obtained from the Royal Society for the Protection of Birds (RSPB) to include

[50] http://magic.defra.gov.uk/

[51] https://naturalresources.wales/guidance-and-advice/environmental-topics/wildlife-and-biodiversity/find-protected-areas-of-land-and-seas/designated-sites/?lang=en

records of protected or notable species within 5km of the proposed development site. Records of notable species have been summarised to include:

- Species listed under Schedule 1 of the *Wildlife & Countryside Act 1981* (as amended);
- Species listed under the red list of Birds of Conservation Concern (BoCC) (Eaton *et al.*, 2015);
- Species listed under Section 7 of the Environment (Wales) Act 2016; and
- Species identified within relevant Local Action Plans.

Sources of information used for the Ornithology assessment are listed in **Table 10.2**.

Table 10.2 Sources of desk study information

Source	Data
NRW	Cited features of designated sites from NRW website (https://naturalresources.wales/guidance-and-advice/environmental-topics/wildlife-and-biodiversity/find-protected-areas-of-land-and-seas/designated-sites/?lang=en).
http://magic.defra.gov.uk/	Statutory designated sites of national and international importance within 10km and 20km of the proposed development site respectively
SEWBReC	Records of protected and notable bird species within 2km of the proposed development site
RSPB	Records of protected and notable bird species within 5km of the proposed development site

Survey work

Full details of the baseline bird surveys undertaken at the proposed development site and wider site area for the original application (carried out from 2008-15) are provided in the 2014 ES (Amec[52], 2014) and the supplementary ecological information provided in 2016 (Amec Foster Wheeler[53], 2016). Further surveys were undertaken in 2017-18 to provide an up-to-date baseline to inform the assessment for the amended scheme, as follows:

- Vantage-point (VP) surveys (winter 2017/18) were undertaken in accordance with SNH (2017): 36 hours of survey was completed from each of the two VPs as used for the original application surveys from November 2017 to March 2018 inclusive.
- VP surveys (breeding season 2018): 36 hours of survey was completed from each of the two VPs from April to July 2018 inclusive.
- VP surveys (autumn passage 2018): 36 hours of survey are planned to be completed from each of the two VPs from August to October 2018 inclusive.
- Moorland Breeding Bird Survey (MBBS): a four-visit survey (undertaken from April to July 2018) based on an adaptation of the Brown & Shepherd (1993) method (as advocated by SNH based on recommendations set out in Calladine *et al.* (2009)) was used to record breeding waders, ground nesting birds (e.g. skylark) and other notable species within 500m of the wider site area.
- Breeding Raptor Survey (to include species specific effort for honey buzzard): survey visits were undertaken from April to August 2018, following the methodologies agreed with Steve Roberts

[52] Now Wood
[53] *Ibid*

for honey buzzard (see **Table 10.4**) and for the other species in Hardey *et al.* (2013), for the following Schedule 1 and/or Annex I listed raptors:

- Goshawk (mature areas of plantation within a 1km buffer of the proposed development site;
- Red kite (mature areas of plantation and woodland within 2km buffer of the proposed development site); and
- Honey buzzard (mature areas of plantation and woodland within 2km of the proposed development site).

- Breeding Nightjar Surveys: a two-visit survey (carried out in June and mid-July 2018) following the methodology for the species in Gilbert *et al.* (1998). Walkover surveys were undertaken of the wider site area and a 500m buffer around its boundary.

Following further post-scoping communications with the NPTCBC Biodiversity officer, the following surveys will also be undertaken:

- Winter walkover survey: will be undertaken in all areas of open habitat within 500m of the proposed development site boundary, once monthly from October 2018 to March 2019 inclusive. During the species records will be made of all target and secondary species and Priority species listed on Section 7 of the Environment (Wales) Act 2016.

10.5 Overall baseline

The description of the ornithological features below provides a summary of the baseline as determined through desk-study and field survey.

Current baseline

Desk study

Full results from the updated desk study are provided in Section 3.1 in **Appendix 10B**.

There are no SPAs or Ramsar sites designated for any ornithological interest within 20km of the proposed development site. There are however, two SSSIs within 10km of the proposed development site that list ornithological interest. The details of the SSSIs are provided in **Table 10.3** and their locations shown on **Figure 3.1** of **Appendix 10B**.

Table 10.3 Statutory designated sites

Site name	Approximate distance and direction from Site	Reasons for designation/notification	Potential connectivity with the Site (Connectivity distances reported from SNH (2016))
Eglwys Nunydd Reservoir SSSI	8.9km southwest	The largest area of fresh water in the county. The reservoir attracts large numbers of wintering waterfowl and passage migrants. Notable species include: great crested grebe, little grebe, mallard, gadwall, and coot now breed.	Unlikely, given there are no suitable habitats for the notified species within the proposed development site, and distance from the SSSI and the proposed development site.
Mynydd Ty-Isaf, Rhondda SSSI	7.9km northeast	The SSSI is primarily notified for its Arctic-alpine flora associated with the cliffs. The description for the SSSI also notes that the higher crags provide nesting sites for a Schedule 1 raptor species.	Unlikely, given the habitats within the proposed development site provide limited foraging opportunities, and the distance from

Site name	Approximate distance and direction from Site	Reasons for designation/notification	Potential connectivity with the Site (Connectivity distances reported from SNH (2016))
			the SSSI and the proposed development site.

Field survey

Full results from the 2017-18 surveys are presented in **Appendix 10A and 10B** for the winter period and breeding season respectively. Results for the autumn passage period VP surveys undertaken from August to October 2018 have not been included in this assessment but will be provided as a separate report in due course.

During the 2017-18 surveys, a total of six target species were recorded within the wider survey area(s): goshawk, red kite, peregrine, golden plover, dunlin and nightjar, a summary of which is provided as follows:

- Red kite: during the 2017-18 VP surveys, there were regular flights of red kite recorded across the proposed development site (primarily during winter), of which eight were at Potential Collison Height (PCH) i.e. within height band b between 50-150m in height, (see **Figure 3.2** in **Appendix 10A** and **Figure 3.2** in **Appendix 10B**). The breeding raptor survey provided evidence of one active red kite territory within 2km and a second territory 2-3km from the proposed development site (see **Confidential Figure 3.9** in **Appendix 10B**).
- Goshawk: 13 flights were recorded during the 2017-18 VP surveys (six during winter and seven during the breeding season), including one within the proposed development site, though not at PCH see **Confidential Figure 3.4** in **Appendix 10A** and **Confidential Figure 3.3** in **Appendix 10B**. Results from the breeding raptor survey indicated that there were two active goshawk territories outwith and within 1-2km and a third territory within 3-4km of the proposed development site boundary (see **Confidential Figure 3.7** in **Appendix 10B**).
- Peregrine: two flights were recorded during the breeding season VP surveys (none in winter) both outwith and to the east of the proposed development site (see **Figure 3.4** in **Appendix 10B**). There was no evidence of breeding peregrine and no suitable nesting sites within 2km of the proposed development site.
- Golden plover: six flights of three flocks of golden plover (totalling 113 bird flights) were recorded during the winter VP surveys (none in summer). Of these, four of the flights (totalling 87 birds) were at PCH within the proposed development site (see **Figure 3.4** in **Appendix 10A**).
- Dunlin: and a single flight of dunlin was recorded in July, flying high over VP1, though the bird could not be seen, and the flight not mapped.
- Nightjar: a total of five territories of were located outwith but within 500m of the proposed development site boundary, with an additional territory just outside the survey area, 500-600m south-west of the proposed development site (see **Figure 3.11** in **Appendix 10B**).

A further six secondary species were also recorded during the 2017-18 VP surveys: buzzard, sparrowhawk, kestrel, lapwing, snipe and raven.

Eleven priority species listed in Section 7 of the Environment (Wales) Act 2016 were recorded during the 2018 breeding bird surveys of which eight species were recorded breeding/holding territory within the survey area (within 500m of the proposed development site) although only skylark was recorded breeding/ holding territory within the proposed development site itself (see **Figure 3.5** in **Appendix 10B**). Nine skylark territories were located within the proposed development site boundary, with a further 21 located outwith

and primarily to the east of the proposed development site. Six territories of dunnock, three of grasshopper warbler and single territories of tree pipit, song thrush and reed bunting were located along/adjacent to the access track. The remaining territories of Section 7 species (including two cuckoo and one lesser redpoll, and further territories of tree pipit, dunnock, song thrush and reed bunting) were all located in the adjacent forestry plantation to the west and within 500m of the proposed development site. Spotted flycatcher, starling, linnet and bullfinch were recorded as passage migrants or non-breeding visitors, either infrequently or in very low numbers (see **Appendices 10A and 10B**).

Predicted future baseline

In the absence of development, it is assumed that the baseline conditions on the proposed development site will remain as they are currently.

The future baseline is likely to alter due to the effects of climate change on bird productivity, survival rates and breeding ranges, with substantial changes in species ranges predicted during the coming decades. Survey work represents a snapshot of the bird community at the time of the survey and cannot be extrapolated to predict future population trends in the wake of agricultural or climatic change.

10.6 Consultation

Consultations were undertaken for the original application submitted in 2014 with CCW (now NRW) and Neath Port Talbot County Borough Council (NPTCBC) regarding the suitability of the survey methodologies and effort; no response was recorded from RSPB. Both recommended that SNH guidance should be followed and were in general agreement that the survey methodologies seemed appropriate.

Subsequent to the submission of the application in October 2014, comments and recommendations were received from the NPT Biodiversity Unit (Ref. 2015/347, 13 October 2015). In response to this, a technical note was prepared to address the ecology and ornithology-related comments in both the formal response from the NPT Biodiversity Unit and at a meeting held on 25 November 2015 at the NPT CBC offices in Baglan Energy Park, Neath. The technical note was issued in July 2016 (Amec Foster Wheeler, 2016).

Further consultations were undertaken in 2017, in order to agree on the survey programme to be undertaken in 2017/18 to inform the ES for the revised scheme, as follows:

- Neath Port Talbot County Borough Council (NPTCBC) on 10 November 2017; and
- Natural Resources Wales (NRW) from 7-11 December 2017.

A scoping report was issued in February 2018 and a response was received from NPTCBC.

Table 10.4 provides a summary of the issues that have been raised by consultees and the responses given.

Table 10.4 Summary of issues raised regarding Ornithology during consultation

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref.
A full year of bird surveys would be required, covering the breeding (April to September) and winter seasons (October to March), and which also includes some effort during the passage periods (spring/autumn). Seasons should not be split between two years, e.g. winter should start in October and finish the following March, and breeding season should start in April and finish in September.	NPTCBC	A full year of bird survey was undertaken from November 2017 to October 2018. This was broken down into: the core winter period (November-March – see **Appendix 10A**); the breeding season (April-August – see **Appendix 10B**); and the autumn passage period (August-October).	**Appendices 10A & 10B**

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref.
Confirm that the VP locations are still suitable	NPTCBC	The VP locations used for the 2008-15 surveys were deemed suitable for the 2017-18 VP surveys as there have been no changes to the area visible from these VPs (i.e. due to vegetation/ tree growth) in the intervening years (see **Figure 2.1** in **Appendix 10A**).	**Appendix 10A**
New collision risk modelling (CRM) should be undertaken with the newly proposed turbines	NPTCBC	CRM reflects potential changes in bird activity and the new proposed turbine layout and associated turbine parameters. CRM has been undertaken for red kite and golden plover, and included as part of this assessment (see **Appendix 10D**)	**Appendix 10D**
Advised survey programme: 36 hrs per VP in winter; winter walkovers; 36 hrs per VP in breeding season*; CBC, MBS; breeding nightjar survey; and breeding honey buzzard survey (in liaison with Steve Roberts)	NPTCBC	The only exceptions to the advised survey programme was the absence of winter walkovers which was in line with and following SNH (2017) guidelines. An update of the winter walkover survey was not undertaken because conditions within the Site were largely unchanged from the previous survey period (2008-15). SNH (2017) guidance only recommends winter walkover surveys to be undertaken if waterbodies or other features on-site which could support notable populations of overwintering wildfowl or waders are present; none of these features were present.	N/A
The completion of a new ES chapter is required to supersede the current one	NPTCBC	A new ES Chapter 10 Ornithology has been completed (this document)	N/A
HMP to be agreed at the completion of the survey programme with the authority	NPTCBC	HMP will be discussed and agreed as requested and will be based on that produced for the original application in August 2014 (see **Appendix 9C** of this ES)	**Appendix 9C**
NRW responded on 07 December requesting clarification of the extent of the development, and again on 11 December, confirming that a scoping report would be required in order for them to assess the development and to provide a consultation response.	NRW	Scoping report was submitted in February 2018.	N/A
As requested by NPTCBC consultation was undertaken with Steve Roberts in late November 2017 confirming that there was no data more recent than the surveys in 2015. It was agreed that additional visits specifically aimed at surveying for honey buzzard whould be undertaken to determine current status within a 2km buffer of the site boundary. These would consist of a 2-3 day period in mid-late May (ideally 19th -21st) followed by an additional 6 visits between mid-July and the end of August	Steve Roberts	Steve Roberts confirmed the proposed survey programme undertaken in 2018 was robust and appropriate for updating honey buzzard distribution.	N/A
Response to 2018 scoping report			
In their response to the Scoping report, NPTCBC continue to highlight the need for a winter walkover survey. They note that the list of species reported was missing several that were recorded in the initial walkover, indicating that	NPTCBC	Two reports summarising the results for target and secondary species recorded during the winter bird surveys 2017/18 were provided to NPTCBC in May-June 2018	**Appendix 10A**

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref.
the incidental records are not as thorough as a walkover survey, plus the Section 7 species NPTCBC requested information on were not recorded as part of the survey. Without this information they stated they are unable to assess the potential effects of the changes to the proposed development.		(Wood 2018, 2018a). In addition to the information provided in these reports, a total of eight Section 7 species were recorded during the 2017/18 winter bird survey as incidental records or during the VP surveys (see **Appendix 10A**). A winter walkover survey of the proposed development site and a 500m buffer around its boundary will be undertaken in all open habitats, once monthly from October 2018 to March 2019 inclusive.	
NRW provided no comments that needed addressing regarding ornithological aspects of the Scoping report and had no comment to make on the survey programme for 2017/18 to inform the assessment for the amended scheme.	NRW	NRW in agreement with ornithological scope and methodologies for assessment.	N/A

10.7 Scope of the assessment

Ornithological features/Potential receptors

Scoping methodology – determining importance

The starting point for defining the scope of the assessment was to use the baseline data that were collected through the desk study and site survey (see Section 10.5) to determine which of the identified ornithological features (receptors) were important[54]. Following CIEEM (2016) guidance, the importance of ornithological features[55] was determined using a geographic scale. The importance of the ornithological features has been described in relation to UK legislation and policy and with regard to the size of population that may be affected by the proposed development[56].

Wherever possible, information regarding the population size, population trends and distribution of the ornithological features has been used to inform the categorisation described in **Table 10.5** to determine importance at the project level. In respect of the proposed development at Foel Trawsnant, the appropriate geographical units for identification of significance of impacts were deemed to be the UK (national), Wales (regional) and Glamorgan (county). A threshold of significance would therefore comprise those species present in county important numbers (>1% Glamorgan population). Where detailed criteria or contextual data are not available, professional judgement was used to determine importance.

[54] Ornithological features that are not considered to be important are those that are sufficiently widespread, unthreatened, resilient and with populations that will remain viable and sustainable irrespective of the proposed development.

[55] Other technical chapters within this ES use the terms "likely significant effects" and "potential likely significant effects" within the assessment. However, within this chapter the term "potentially significant effects" is used as it accords with CIEEM guidance and avoids confusion with the term "likely significant effects" when used in the context of the Habitats Regulations Assessment.

[56] For example, where low numbers of a Section 7 species (that is common and widespread) may be affected by the proposed development, even one with a declining population such as house sparrow, this local population would not be of national importance.

Table 10.5 Importance of ornithological features

Geographic context of importance	Description
International or European	• European sites of ornithological importance (SPAs). Potential SPAs (pSPA), Ramsar sites and proposed Ramsar sites should also be considered in the same manner in accordance with national planning policy. • Qualifying ornithological features of European sites (including Ramsar sites). • Species listed on Annex I of the Birds Directive. • Species occurring in internationally important numbers.
National (UK)	• Nationally designated sites of ornithological importance (i.e. SSSI and NNR). • Populations of bird species which inhabit the SSSI/NNR which meet the published selection criteria guidelines (e.g. for SSSI notification). • Species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). • Species occurring in nationally (UK) important numbers.
Regional (Wales)	• Priority bird species listed on Section 7 of the Environment (Wales) Act 2016. • Species occurring in regionally (Wales) important numbers.
County (Glamorgan[57])	• LNRs and non-statutory designated sites (i.e. SINCs) that are of ornithological value in the regional context. • Species occurring in County (Glamorgan) important numbers.
Local or Negligible	• Species that, based on the criteria above, are not categorized at a greater level of importance based on their population size. • Other common and widespread bird species.

All ornithological features that were determined to have an importance at local or negligible level were screened out of the assessment at this stage, as effects on them would not constitute a significant effect in EIA terms (i.e. a significant effect could not occur).

Potentially significant effects

Spatial scope

To further define the scope of the assessment following determination of the importance of ornithological features identified, it is essential to determine whether the proposed development is capable of resulting in potentially significant effects on these features. In order to identify potentially significant effects, all the activities associated with the construction and operation of the proposed development have been considered. Through defining the activity and its related environmental change, it is possible to identify ornithological features that may be subject to potentially significant effects. Key to establishing a potentially significant effect is the determination of a Zone of Influence (ZoI) for each ornithological feature (i.e. the area within which a significant effect on an ornithological feature may occur as a result of the proposed development). ZoIs differ depending on the type of effect and the ornithological feature being considered. For this Ecological Impact Assessment (EcIA), ZoIs were determined through a review of published evidence as far as possible (e.g. disturbance criteria for various species).

The spatial extent of the assessment therefore reflects the area occupied by the ornithological feature that is being assessed and the ZoI of the changes that are likely to affect it. Thus, if part of a designated biodiversity

[57] Glamorgan includes the pre-1996 counties of West, South and Mid Glamorgan. Post 1996, Glamorgan includes the administrative boundaries of Bridgend, Merthyr Tydfil, Rhondda Cynon Taf, Cardiff, Vale of Glamorgan, Neath Port Talbot, Swansea and the western half of Caerphilly.

site of ornithological importance is located within the ZoI relating to a particular biophysical change as a result of the proposed development, an assessment would be made of the effects on the designated site as a whole. For species that occur within the ZoI, an assessment would consider the total area that is used by the affected individuals or the local population of the species (e.g. for foraging or as breeding territories).

Table 10.6 details the activities and associated effects to ornithological features that may occur as a result of each phase of the proposed development.

Table 10.6 Activities, Effects and Zones of Influence

Activity	Potential significant effects	Ecological receptor	Zone of Influence
Construction Phase			
Site clearance, demolition, storage/moving of materials and construction, and on-going routine maintenance	Killing/harm of birds, destruction of nests and/or eggs	All breeding birds	Within proposed development site
Disturbance due to construction works	Loss of habitat for breeding birds due to visual disturbance, noise and vibration	Skylark, nightjar	Within 100m of the proposed development site
Operational Phase			
Land-take	Loss of habitat for breeding and wintering birds	Skylark	Within the proposed development site
Disturbance/displacement due to presence of wind farm	Loss of habitat for breeding and non-breeding birds due to visual disturbance, noise and vibration	Red kite, goshawk, golden plover and nightjar	Within 500m of the proposed development, based on disturbance distances in Ruddock & Whitfield (2007)
Collision with turbine blades	Injury/death of birds due to collision leading to population decline	Red kite and golden plover	Within the proposed development site

In the unlikely event of a major accident and disaster (MAD) at the proposed development site, the proposed environmental measures embedded within the scheme would mitigate any potential effects on ornithological resources (see Section 4.4 in **Chapter 4**, and Sections 5.2 and 5.4 in **Chapter 5**).

Temporal scope

The temporal scope of the assessment of effects on ornithological features is consistent with the period over which the development would be carried out, as defined in **Chapter 2**, and therefore covers the construction and operational periods.

Screening assessment

A full screening assessment to identify the potential for any receptors to be taken forward for more detailed assessment in Section 10.10 is provided in **Appendix 10C**. This screening assessment provides an evaluation of the importance of the proposed development site (following the guidelines in **Table 10.5** and taking account of the activities, effects and zones of influence in **Table 10.6**) to each ornithological feature recorded during the surveys or highlighted from the desk study as potentially occurring within the proposed development site.

Screened out receptors

The screening assessment (**Appendix 10C**) identified the wider site area as potentially being of county level importance or higher for breeding nightjar and grasshopper warbler and wintering golden plover. However, use of the proposed development site by wintering golden plover was infrequent with the area providing limited foraging opportunities and being well outside the usual core wintering range for the species. For breeding nightjar, the proposed development site also provided suboptimal foraging habitat. The proposed development was therefore deemed to be of no more than local importance to golden plover and nightjar. For breeding grasshopper warbler (recorded close to the access track) there is no pathway by which the species could be adversely affected by the proposed development (by collision or disturbance) and as a consequence, this species has also been screened out.

Red kite, goshawk and peregrine were recorded during the 2017-18 surveys and are species which are legally protected under Schedule 1 of the WCA. However, the level of flight activity within the proposed development site for goshawk and peregrine was very low, with the area providing very limited opportunities for foraging birds. Breeding goshawk were identified within the wider survey area, though none of the territories were within the 500m ZoI within which there was the potential for disturbance (and contravention of the WCA) to occur. Goshawk and peregrine were therefore, screened out from further detailed assessment. Red kite also did not breed within the 500m ZoI and therefore, the effects of disturbance and displacement due to the presence of the turbines on this species was also screened out, although potential for effects arising associated with collision were taken forward for further assessment.

For all other receptors (including Section 7 and Schedule 1 species), the proposed development site was deemed to be of no more than local importance (due to low numbers, infrequent occurrence and/or low levels of flight activity), and thus, no significant effects could occur under the *Town & Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017*.

Further discussion on all receptors screened out from further assessment is provided in **Appendix 10C**.

Summary

As a result of the screening assessment (in **Appendix 10C**) and taking into consideration the environmental measures embedded into the proposed development in **Table 10.7**, only the potential effects of collision on red kite have been taken forward for more detailed assessment in Section 10.10. All other receptors, including those for which the proposed development site was considered to be of less than county importance, have been screened out and are not considered further within this assessment. No Schedule 1 species were recorded breeding within any ZoI of the proposed development site, and therefore there were no pathways associated with disturbance to breeding Schedule 1 species that could potentially contravene the Wildlife and Countryside Act 1981 as amended (WCA).

10.8 Environmental measures embedded into the proposed development

A range of environmental measures have been embedded into the proposed development. **Table 10.7** outlines how these embedded measures will influence the ornithology assessment.

Table 10.7 Summary of the embedded environmental measures and how these influence the Ornithology assessment

Receptor	Potential changes and effects	Embedded measures and influence on assessment
Nesting birds (all species)	Destruction of nests during construction period	All birds are afforded protection from nest destruction or damage under the Wildlife and Countryside Act 1981 (as amended), and as such all reasonable measures should be taken to ensure that there is compliance with the legislation. In the event of the construction programme directly affecting the breeding bird season, any areas of potential nesting habitat that will need to be cleared, should be removed over the preceding winter (the breeding season runs from March until August inclusive). This would include the reduction of ground vegetation (e.g. grass sward height) to ensure that the areas affected by the proposed development are not utilised by ground nesting birds (such as skylark). Should this not be possible, then an ornithologist who is independent of the contractor would act as a clerk of works to ensure no nests are destroyed or damaged. Depending on the proximity of a nest to any proposed infrastructure, it will often be possible to put in small scale mitigation measures to limit disturbance and reduce the risk of nest destruction.
Crossbill	Disturbance to nesting birds during the construction phase	Pre-construction surveys are proposed within the Cwm yr Argoed plantation to determine the presence of nesting crossbill, which are listed in Schedule 1 of the WCA (and therefore receives additional protection from disturbance at the nest site during the breeding season, which is during late winter). The surveys will be undertaken prior to construction works during the period January to March. In the event that a nest is discovered, then activities, including vehicle movements, would be subject to a disturbance risk assessment and any measures considered necessary to safeguard the breeding attempt (e.g. exclusion zones or restrictions on timing of works) would be submitted to NRW for agreement.
Nightjar	Disturbance to nesting and foraging birds during the construction phase	No dogs will be brought to the Site by construction personnel. All lighting around works compounds within 250m of churring nightjar i.e. the works compound to the south of T1, will be minimised to reduce the potential impact on nightjar through the use of movement-activated lighting, baffles to prevent light spillage and placement and direction of lighting units to ensure lighting is focused upon the compound. Restricted hours of working for heavy vehicle movements within 250m of churring nightjar will be observed between 0700 and 1800, i.e. daylight hours during the breeding season (May-July inclusive) to avoid sensitive periods. This will limit disturbance due to construction both spatially and temporally and limit disturbance at dawn and dusk when nightjars are most active.
All birds	Disturbance as a result of noise during the construction phase	Operational noise limits will be set relative to the background noise levels. Predicted noise levels demonstrate that the derived ETSU-R-97 noise limits can be met at all times and under all wind conditions at all locations (see **Chapter 11: Noise**). Although these noise levels are set in relation to human receptors, in the absence of suitable noise limits in relation to bird species it has been assumed that these noise limits will also reduce the risks of operational noise effects on the potential biodiversity receptors within the zone of influence.

Receptor	Potential changes and effects	Embedded measures and influence on assessment
All birds	Collision risk associated with additional overhead lines	All electrical cables linking the wind turbines to each other and to the on-site substation/control building will be underground, and as such there will be no risk of birds colliding with overhead lines within the development site. In addition to which, no permanent anemometry mast is proposed.

10.9 Assessment methodology

Introduction

The generic project-wide approach to the assessment methodology is set out in **Chapter 2: Approach to Environmental Impact Assessment**. However, whilst this has informed the approach that has been used in this ornithology assessment, it is necessary to align with the standard industry guidance provided by CIEEM (2016).

The assessment is based upon not only the results of the desk study and field survey, but also relevant published information (on the status, distribution, sensitivity to environmental changes and ecology of the features scoped in to the assessment, where this information is available), and professional knowledge of ecological processes and functions.

The screening assessment identified those receptors to take forward for more detailed assessment (**Appendix 10C**). For each ornithological feature taken forward in Section 10.10, (in this case, the effects of potential collisions with infrastructure on red kite) effects were assessed against the predicted future baseline conditions for that feature during construction and operation. This future baseline was defined using information about the likely future use and management of the proposed development site in the absence of development; known species population trends; climate change; and any other proposed developments (consented or otherwise) that may act cumulatively with the proposed development to affect ornithological features.

Throughout the assessment process, the initial results of the assessment regarding potential effects have been used to inform whether additional baseline data collection is required, together with the identification of environmental measures that should be embedded into the development proposals. The results of the assessment, as set out in Section 10.10, therefore reflect the final amended scheme design (i.e. incorporating the environmental measures that have been agreed with the developer).

Significance evaluation methodology

Overview

CIEEM (2016) defines a significant effect as one "*that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general*".

When considering potential adverse or beneficial significant effects on ornithological features, the following characteristics are taken into account:

- Extent – the spatial or geographical area over which the impact from the proposed development may occur;
- Magnitude – the size, amount, intensity or volume of the potential impact being considered;
- Duration – the length of time over which the potential impact may occur;

- Frequency – the number of times an activity may occur resulting in a potential impact;
- Timing – the periods when activities may occur and during which a potential impact may be considered; and
- Reversibility – whether the potential impact on a biodiversity feature can be reversed through restoration actions.

Importance of an ornithological feature

The importance of an ornithological feature has been defined in **Table 10.5** in a geographical context in order to help define the scope of the assessment.

Adverse effects

Adverse effects are assessed as being significant if the favourable conservation status of an ecological feature would be lost as a result of the proposed development. Conservation status is defined as follows:

> "*for habitats, conservation status is determined by the sum of the influences acting on the habitat and its typical species, that may affect its long-term distribution, structure and functions as well as the long-term survival of its typical species within a given geographical area; and for species, conservation status is determined by the sum of influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within a given geographical area*".

The decision as to whether the conservation status of an ornithological feature has been compromised has been made using professional judgement, drawing upon the results of the assessment of how each feature is likely to be affected by the proposed development.

A similar procedure is used where designated sites may be affected by the proposed development, except that the focus is on the effects on the integrity of each site; defined as "*the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified*". The assessment of effects on integrity draws upon the assessment of effects on the conservation status of the features for which the Site has been designated. Where these features are not clearly defined, it is necessary to use professional judgement to identify the interest features or obtain additional information about the interest features from the designating body which is responsible for identifying these sites.

Beneficial effects

A development may result in beneficial effects where there is a change from baseline that improves the quality of the environment (e.g. increases species diversity, increases the extent of a particular habitat etc., or halts or slows down an existing decline). For a beneficial effect to be considered significant, the level of importance of an ecological feature determined at the baseline state would need to increase by one or more geographical levels (e.g. where an ecological feature of local importance becomes of county importance following delivery of the proposed development). Furthermore, if beneficial effects occur across a range of habitats and associated species, delivering an overall biodiversity net gain, then a significant effect results.

10.10 Assessment of effects

Red kite

Baseline conditions

Red kite is listed on Annex I of the Birds Directive and Schedule 1 of the WCA. In 2012, the UK population of red kite was estimated to be close to 2,500 pairs, including in excess of 1,000 pairs in Wales (Holling *et al.*, 2014). The species was described as becoming more frequent and breeding in West Glamorgan[58], with birds reported from a total of 47 locations in 2011 (Grenfell, 2012). In East Glamorgan[59], red kite is a locally common resident and rare breeder, mainly in the north (Wilson [ed] 2017).

During the VP surveys undertaken from November 2017 to March 2018 inclusive, a total of 24 flights of red kite were recorded within the wider survey area (within the 2km viewsheds + 200m), including three flights involving two birds. The flight activity was concentrated outwith and to the east of the proposed development site (see **Appendix 10A, Figure 3.2**). Of these, eight flights were recorded at PCH within the proposed development site (+200m buffer). No flights of red kite were recorded within the proposed development at PCH during the VP surveys undertaken during the breeding season (April-July 2018).

Predicted effects and their significance

There is the potential for red kite to collide with turbine blades. Mortality from collision has the potential to lead to a decline in the local population of red kite. In view of this, collision risk modelling based on red kite flight data collected from vantage point surveys undertaken from November 2017 to August 2018 inclusive was carried out. Modelling for red kite was carried out using an avoidance rate of 98%, as per the original ES (Amec, 2014) as well as at the recommended avoidance rate of 99% (SNH, 2017). The methods, working and results of the collision risk modelling for red kite are provided in **Appendix 10D**.

Results from the collision risk modelling on the 2017/18 VP survey data predict that the potential rate of collisions for red kite (based on 85% operational time and 99% avoidance) would be 0.03 collisions per non-breeding season (a total of 0.86 birds over the anticipated life-span of the proposed development of 25 years). Based on a 98% avoidance rate, the potential red kite collisions were calculated to be 0.07 per non-breeding season (a total of 1.730 birds over 25 years). This compares to potential collision rates of 0.01 and 0.005 collisions per year (for avoidance rates of 98% and 99% respectively) based on the VP survey data for 2009/10 and 2012/13 (Appendix 10.3 in the 2014 ES, Amec 2014). This increase in the potential collision rate is most likely due to the increased number of red kite flights recorded in 2017/18 (see **Appendix 10A**) when compared to previous surveys.

The effect of the loss of an individual bird on a population is influenced by several characteristics of the affected population, notably its size, density, recruitment rate (additions to the population through reproduction and immigration) and mortality rate (the natural rate of losses due to death and emigration). In general, the effect of an individual lost from the population will be greater for species that occur at low density, are relatively long lived and reproduce at a low rate.

No up-to-date population estimate for red kite in Glamorgan is available, though given the number of records reported in the East Glamorgan bird atlas and from the local bird reports (Grenfell 2012, Wilson [ed]

[58] The West Glamorgan recording area used by the Gower ornithological Society includes the pre-1996 county of West Glamorgan which comprises the current administrative boundaries of Neath Port Talbot and Swansea (which includes the Gower Peninsula).
[59] The East Glamorgan recording area (used by the Glamorgan Bird Club) includes the pre-1996 counties of South and Mid Glamorgan which comprise the current administrative boundaries of Bridgend, Cardiff, Merthyr Tydfil, Rhondda Cynon Taf, Vale of Glamorgan and the western half of Caerphilly.

2017) it is likely to be at least 20 pairs[60] and increasing. A breeding population of 20 pairs represents approximately 80 individual red kites (40 breeding adults plus 40 non-breeding birds).

The annual mortality rate for adult red kite is 39% (BTO data, www.bto.org/birdfacts/) which represents 31 birds each year (based on the county population estimate of 80 birds). The additional mortality predicted from the CRM represents an increase between 0.10% and 0.22% of the background mortality for the county population, and therefore can be considered as having a negligible magnitude at a county level.

To conclude, the effects of collision due to the proposed development would be of negligible magnitude and therefore, there would be no significant effects on the county or regional populations of red kite.

10.11 Assessment of cumulative effects

Consideration has been given as to whether any of the ornithology receptors that have been taken forward for assessment in this chapter are likely to be subject to cumulative effects because of ornithology effects generated by other developments.

Only wind farms which are either built, consented or with submitted planning applications have been considered within a distance of 20km of the proposed development site (see **Table 10.8**). There are:

- Nineteen existing wind farms within 20km of the proposed development site;
- Three consented wind farms (including those under construction); and
- Three proposed wind farms.

Details of these and other wind farms further afield are provided in **Chapter 7** and in **Figure 7.57** of this ES.

The collision risk to red kite from other wind energy developments is set out in **Table 10.8**, where contemporary information (where available) is presented for eight of the 25 sites considered. The population sizes, connectivity with other wind farms and level of use of the proposed development site by other target species (including golden plover and goshawk) was such that negligible effects are predicted at the proposed development site and therefore there would be no contribution to cumulative effects with other wind farms.

Table 10.8 Wind energy developments within the cumulative assessment study area and risk to red kite

Wind Farm	Distance from nearest turbine of proposed development site (km)	No. of turbines	Hub Height (m)	Maximum blade tip height (m)	Red kite collision risk assessment
Existing wind farms					
Pen y Cymoedd	2	76	100	145	No significant collision risk to red kite
Ffynnon Oer	3	16	60	91	Not Available
Llynfi Afan	4	12	78	118	No significant collision risk to red kite
Mynydd Brombil	7	5	60	100	No significant collision risk to red kite
Maesgwyn	13	13	70	115	No significant collision risk to red kite

[60] During the 2008-11 breeding bird atlas, red kite were recorded as possible, probably or confirmed breeders in a total of 20 tetrads in East Glamorgan (2x2km National Grid squares) http://www.eastglamorganbirdatlas.org.uk/B2008/KT.shtml. Birds were also reported from a further 68 tetrads in East Glamorgan during the breeding season. Given that the species also breeds in West Glamorgan and has increased since this period, the county population (Glamorgan) is likely to currently exceed 20 pairs.

Wind Farm	Distance from nearest turbine of proposed development site (km)	No. of turbines	Hub Height (m)	Maximum blade tip height (m)	Red kite collision risk assessment
Mynydd Bwllfa	13	9	70 / 80	115 / 125	Not Available
Maerdy	12	8	95	145	Not Available
Ferndale	14	8	50	74	Not Available
Pant-y-Wal	11	10	70	115	Not Available
Fforch Nest	12	11	70	115	Not Available
Taff Ely	15	20	35	53.5	No significant collision risk to red kite
Mynydd Portref	17	11	60	86	Not Available
Mynydd Portref Extension	17	7	70	110	Not Available
Bwllfa Farm, Gelli	13	1	50	76	Not Available
Mynydd y Gwrhyd	19	2	60	100	Not Available
Pant-y-Wal Extension	11	8	80	125	No significant collision risk to red kite
Parc Stormy, Stormy Down	14	1	63	100	Not Available
Swansea Bay	14	1	50	77	Not Available
Newlands Farm	10	1	50	77	Not Available
Consented wind farms (including those under construction)					
Headwind Taff Ely	15	7	69	110	Modelling estimates a collision rate of 2.1 birds annually for the proposed Headwind Taff Ely turbines. The collision rate is not significant at any level when compared with population sizes, but when baseline mortality rates are used, it is below national significance but significant at site level. This will result in a direct and permanent long-term effect at the site level.
Nant-y-Gwyddon	14	1	85	121.5	Not Available
Llwyncelyn Wind Project	19	2	75	125	Not Available
Proposed wind farms					
East of Melin Court	6	5	85	145	No significant collision risk to red kite
Road to Graig Fatha Farm, Brynna	19	1	50	77	Not Available
Land at Pen y Waun Farm	19	1	-	130	Not Available

Significant effects in relation to collision risk to red kite were predicted for one of the 25 sites within 20km of the proposed development at Foel Trawsnant where information was available. In the case of the Headwind Taff Ely wind farm (15km from the proposed development site), significance had been determined at a local level, where the immediate population may be affected. At a regional (Wales) scale however, the population would be unaffected. This conclusion is formed on the basis that the predicted rate of loss due to collision is low compared to the strong growth rate exhibited by the population to date. Even if the population growth rate was to slow in Neath Port Talbot, or the population were to stabilise due to density dependent factors, losses due to collision would be rapidly replaced. With regard to these sites, it is likely that any density dependent factors acting in Neath Port Talbot and the wider area would not lead to a reduction in the growth rate of the population in neighbouring counties. Any excess breeding stock in Neath Port Talbot, unable to establish a suitable breeding territory there, are likely to relocate to adjacent areas where numbers of red kite are still relatively low (i.e. in neighbouring East Glamorgan). This would ensure that the size and robustness of the red kite population in Neath Port Talbot and neighbouring areas would continue to increase in future years.

Given the negligible theoretical collision risk to red kite at the proposed development site, it is predicted that there would be no significant cumulative impact on the red kite populations at a regional or even local level.

10.12 Consideration of additional mitigation or compensation

No additional mitigation measures are proposed to further reduce any effects on birds that are identified in this ES chapter. All relevant and implementable measures have been embedded into the development proposals and are assessed above in this chapter. These measures are considered to be effective and deliverable and address the any potential adverse effects of the proposed development on the ornithological receptors identified.

10.13 Conclusions of significance evaluation

Results from the surveys and collision risk modelling indicate that the collision rate of red kite with the turbines would be negligible and would therefore not lead to a decline in the population at a county level. The cumulative assessment concludes that there would be no significant cumulative effect on the local red kite population.

10.14 Implementation of environmental measures

Table 10.9 describes the environmental measures embedded within the proposed development and the means by which they will be implemented.

Table 10.9 Summary of environmental measures relevant to ornithology to be implemented

Environmental measure	Responsibility for implementation	Compliance mechanism	ES Section Reference
Avoidance of damage or destruction of nests during construction	Site management and ecological advisor independent of the contractor acting as clerk of works	Planning condition	Section 10.8
Pre-construction surveys for breeding crossbill, and mitigation to avoid disturbance, if required	Site management and independent ecological advisor. Mitigation strategy (if required) to be submitted to NRW for agreement.	Planning condition	Section 10.8

Environmental measure	Responsibility for implementation	Compliance mechanism	ES Section Reference
Avoidance measures to protect breeding nightjar from disturbance	Site management and independent ecological advisor	Planning condition	Section 10.8
Habitat enhancement initiatives	Steering group consisting of Pennant Walters (FoelT) Ltd, their ecological consultants and NPTCBC.	Legal agreement	

10.15 References

Amec (2014). Foel Trawsnant Wind Farm Environmental Statement: Chapter 10, Ornithology (doc ref. 24311rr073i1).

Amec (2014a). Foel Trawsnant Wind Farm Baseline Survey Note. Report produced by Amec Environment and Infrastructure UK Limited for Pennant Walters Limited, December 2014 (doc. ref. 24311n094i1).

Amec Foster Wheeler (2016). *Foel Trawsnant Wind Farm, Further Ecological Information.* Report produced by Amec Foster Wheeler Environment and Infrastructure UK Limited for Pennant Walters Limited, July 2016 (doc. ref. 24311rr120i1).

Amec Foster Wheeler (2016a). *Foel Trawsnant Wind Farm, Outline Habitat Management Plan.* Report produced by Amec Foster Wheeler Environment and Infrastructure UK Limited for Pennant Walters Limited, July 2016 (doc. ref. 24311rr119i2).

Austin, K. K. (1993). *Habitat use and home range size of breeding Northern Goshawks in the southern Cascades*. M.Sc. thesis, Oregon State University, Corvallis, OR.

Balmer, D.E., Gillings, S., Caffrey, B.J., Downie, I.S., & Fuller, R.J. (2013). *Bird Atlas 2007-11: the breeding and wintering birds of Britain and Ireland*. BTO Books, Thetford.

Beier, P. & Drennan, J.E. (1997). *Forest structure and prey abundance in foraging areas of northern goshawks*. Ecological Applications 7(2), 1997, pp564-571.

Bloxton, T.D. Jr (2002). Prey Abundance, Space Use, Demography, and Foraging Habitat of Northern

Goshawks in Western Washington. Masters Thesis. University of Washington.

Brown, A.F. & Shepherd, K.B. (1993). A method for censusing upland breeding waders. *Bird Study* 40: 189-195.

Calladine, J., Garner, G., Wernham, C. & Thiel, A. (2009). The influence of survey frequency on population estimates of moorland breeding birds. *Bird Study*, 56: 3, 381-388.

Chartered Institute of Ecology and Environmental Management (CIEEM, 2016). *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal*. CIEEM, Winchester.

Conway, G., Wotton, S., Henderson, I., Langston, R., Drewitt, A. and Currie, F. (2007). Status and distribution of European Nightjars (Caprimulgus europaeus) in the UK in 2004. *Bird Study* 54, pp98–111.

Eaton, M.A., Aebischer, N.J., Brown, A.F., Hearn, R., Lock, L., Musgrove, A.J., Noble, D.G., Stroud, D. and Gregory R.D. (2015). 'Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man.' In: *British Birds* 108, pp708-746.

Currie, F. & Elliott, G. (1997). *Forests and Birds: A Guide to Managing Forests for Rare Birds*. Forestry Authority, Cambridge and Royal Society for the Protection of Birds, Sandy, UK.

De Lucas, M., Janss, G.F.E. & Ferrer, M. (2005). A bird and small mammal BACI and IG design studies in a wind farm in Malpica (Spain). *Biodiversity and Conservation* 14: 3289-3303

Devereux, C.L., Denny, M.J.H., and Whittingham, M.J. (2008). Minimal effects of wind turbines on the distribution of wintering farmland birds. pp1-6. *Journal of Applied Ecology*.

Drewitt, A.L & Langston, R.H.W. (2006). Assessing the impacts of wind farms on birds. *Ibis* 148, 29-42.

Gilbert, G., Gibbons, D. & Evans, J. (1998). *Bird Monitoring Methods*. RSPB, Sandy.

Gill, J.P., Townsley, M. and Mudge, G.P. (1996). *Review of the impacts of wind farms and other aerial structures upon birds*. SNH Review 21, 68pp.

Glen Kemp Hankinson (1998). The birds of working opencast coal sites. Unpublished report for Scottish Coal.

Good, R. E. (1998). *Factors affecting the relative use of northern goshawk (Accipiter gentilis) kill areas in south central Wyoming*. M.Sc. thesis, University of Wyoming, Laramie, WY.

Green, J. (2002). *Birds in Wales 1992-2000*. Welsh Ornithological Society.

Grenfell, H.E. [ed] (2012). *Gower Birds, the Birds of Swansea and Neath Port Talbot in 2011*. Gower Ornithological Society.

Hardey, J., Crick, H., Wernham, C., Riely, H., Etheridge, B. & Thompson, D. (2013). *Raptors: a field guide to survey and monitoring: 3rd Edition*. The Stationery Office, Edinburgh.

Hargis, C. D., McCarthy, C. & Perloff, R. D. (1994). Home ranges and habitats of Northern Goshawks in eastern California. Studies in *Avian Biology* 16:66-74.

Harris, S.J., Massimino, D., Gillings, S., Eaton, M.A., Noble, D.G., Balmer, D.E., Procter, D., Pearce-Higgins, J.W. & Woodcock, P. (2018). *The Breeding Bird Survey 2017.* BTO Research Report 706, British Trust for Ornithology, Thetford.

Holling, M. & the Rare Breeding Birds Panel (2017). Rare breeding birds in the United Kingdom in 2015. *British Birds* 110, pp 725.

Holling, M. & the Rare Breeding Birds Panel (2016). Rare breeding birds in the United Kingdom in 2014. *British Birds* 109, pp 491-545.

Holling, M. & the Rare Breeding Birds Panel (2014). Rare breeding birds in the United Kingdom in 2012. *British Birds* 107, pp 504-560.

Hötker, H., Thomsen, K.-M. & Jeromin, H. (2006). *Impacts on biodiversity of exploitation of renewable energy sources: the example of birds and bats - facts, gaps in knowledge, demands for further research, and ornithological guidelines for the development of renewable energy exploitation*. Michael-Otto-Institut im NABU, Bergenhusen.

Johnstone, I. & Bladwell, S. (2016). Birds of Conservation Concern in Wales 3: the population status of birds in Wales. *Birds in Wales*, Volume 12, No.1, September 2016).

Ketzenberg, C., Exo, K. M., Reichenbach, M. & Castor, M. (2002). *Einfluss von Windkraftanlagen aufbrütende Wiesenvögel. Natur und Landschaft* 77: 144-153.

Langston, R.H.W. & Pullan, J.D. (2003). *Wind farms and Birds: An analysis of the effects of wind farms on birds, and guidance on environmental assessment criteria and site selection issues*. Birdlife International.

Lovegrove, R., Williams, G & Williams, I. (1994). *Birds in Wales*. T & AD Poyser, London

Madders, M & Whitfield, D.P. (2006). Upland raptors and the assessment of wind farm impacts. *Ibis*, 148, 43–56.

Musgrove, A., Aebischer, N., Eaton, M., Hearn, R., Newson, S., Noble, D., Parsons, M., Risely, K. and Stroud, S. (2013). Population estimates of birds in Great Britain and the United Kingdom. *British Birds*, 106, pp 88-89.

NE (2010). *Assessing the effects of onshore wind farms on birds*. Natural England Technical Information Note 069.

Percival, S. M. (2005). Birds and wind farms: what are the real issues? *British Birds* 98:194-204.

Percival, S.M. (1998). *Birds and Turbines: managing potential planning issues*. Proc. of the 20th BWEA Conference 1998, pp 345-350.

Ruddock, M. & Whitfield, D. P. (2007). *A Review of Disturbance Distances in Selected Bird Species*. A report from Natural Research (Projects) Ltd to Scottish Natural Heritage. http://www.snh.org.uk/pdfs/strategy/renewables/BIRDSD.pdf Last accessed 11/02/09.

Shepherd, K. (2002). *Hare Hill Windfarm New Cumnock, Ayrshire. Breeding Bird Monitoring 2002*. Unpublished report to Scottish Power Plc, Glasgow.

Shepherd, K. (2003). *Hare Hill Windfarm New Cumnock, Ayrshire. Breeding Bird Monitoring 2003*. Unpublished report to Scottish Power Plc, Glasgow.

SNH (2000). *Methodology for assessing the effects of wind farms on ornithological interests*. Scottish Natural Heritage Guidance Note Series.

SNH (2002). *Survey methods to assess wind farm impacts on upland bird communities*. Scottish Natural Heritage, Battleby.

SNH (2006, updated 2018). *Assessing significance of impacts from onshore windfarms on birds outwith designated areas*. Scottish Natural Heritage, Inverness.

SNH (2016). *Assessing connectivity with Special Protection Areas*. Scottish Natural Heritage Guidance Note, Version 3, June 2016.

SNH (2017). Recommended bird survey methods to inform impact assessment of onshore wind farms. http://www.snh.gov.uk/docs/C278917.pdf.

Stroud, D.A., Mudge, G., & Pienkowski, M.W. (1990). *Protecting internationally important bird sites*. Nature Conservancy Council, Peterborough.

Thomas, D.K. (1992). *An Atlas of Breeding Birds in West Glamorgan.* Gower Ornithological Society.

Tyler, S., Lewis, J., Venables, A. and Walton, J. (1987). *The Gwent Atlas of Breeding Birds: An Atlas of breeding birds in the county of Gwent from 1981-85*. Gwent Ornithological Society.

Wilson, M.W., Balmer, D.E., Jones, K., King, V.A., Raw, D., Rollie, C. J., Rooney, E., Ruddock, M., Smith, G.D., Stevenson, A., Stirling-Aird, P.K., Wernham, C.V., Weston, J.M. & Noble D.G. (2018). The breeding population of Peregrine Falcon *Falco peregrinus* in the United Kingdom, Isle of Man and Channel Islands in 2014, *Bird Study*, DOI: 10.1080/00063657.2017.1421610.

Venables, W.A., Baker, A.D., Clarke, R.M., Jones, C., Lewis, J.M.S. and Tyler, S.J. (2007). *The Birds of Gwent.* County Avifaunas. Christopher Helm.

Wilson, J. [ed] (2017). *East Glamorgan Bird Report 2016 No.55*. Glamorgan Bird Club.

Wood (2018). *Technical note: Foel Trawsnant Wind Farm Ornithology: Briefing on Winter 2017-18 Vantage Point Surveys* (doc ref. 40217n035i1). Report produced by Wood Environmental Solutions UK Limited for Neath Port Talbot County Borough Council, May 2018.

Wood (2018a). Technical note: *Foel Trawsnant Wind Farm, Wintering Bird Surveys 2017-2018 – Incidental and Secondary Sightings* (doc ref. 40217n041i1). Report produced by Wood Environmental Solutions UK Limited for Neath Port Talbot County Borough Council, June 2018.

11 Noise

11.1 Introduction

This chapter of the ES assesses the likely significant effects of the proposed development with respect to noise. It forms an update to the noise assessment presented in the 2014 ES (ref 24311rr073i1, Amec Environment & Infrastructure UK Ltd[61]), with elements of the proposed development which have changed since the 2014 ES being reassessed. The updated assessment consists of operational noise with other aspects scoped out of detailed assessment.

This chapter references technical notes submitted to Bridgend County Borough Council (BCBC) in January 2015 (15021i1) and Neath Port Talbot County Borough Council (NPTCBC) in June 2015 (15343i2). The post submission technical notes are presented in **Appendix 11A**. The chapter should be read in conjunction with the development description provided in **Chapter 5**.

11.2 Limitations of this assessment

A detailed method statement for the construction of the proposed development will be produced in partnership between the developer and the construction contractors eventually appointed by them. The details of this will not be known until after planning determination, therefore the consideration of construction noise (i.e. scoped out of this assessment) is based upon the previous 2014 ES assessment.

There are no limitations relating to noise that affect the robustness of the operational assessment of the potential likely significant effects of the proposed development.

11.3 Policy and legislative context

Planning policy

Table 11.1 lists the issues from the relevant planning policies that have been considered in noise effects.

Table 11.1 Policy issues considered in preparing the noise assessment

Policy reference	Policy issues	Considered in section
National planning policies		
National Policy Statements	NPS EN-1 advises that applicants include for a noise assessment to include both construction and operation effects where appropriate. EN-3 at paragraph 2.7.56 states that the applicant's assessment of noise from the operation of the wind turbines should use ETSU-R-97, taking account of the latest industry good practice.	11.10
Welsh Assembly Government: Technical Advice Note (TAN) 8: Renewable Energy (2005)	TAN 8 provides general guidance and advice on the role of the planning system in helping to prevent and limit the adverse effects of noise.	11.10

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Policy reference	Policy issues	Considered in section
Welsh Assembly Government: Technical Advice Note (TAN) 11: Noise (2007)	TAN 11 provides general advice on noise and refers to TAN 8 for guidance regarding noise from wind turbines and wind farms.	11.10
Welsh Government: A Noise Action Plan for Wales 2013-2018 (2013)	A Noise Action Plan for Wales explains how the different forms of noise are being managed across Wales and by whom. The full action plan covers many issues, including those specific to wind turbine noise.	11.10
Development plan policies		
Bridgend County Borough Council Local Plan 2006 - 2021 (Draft Replacement Deposit Plan 2018 not yet available)	Policy ENV7 – Development only permitted where it could be demonstrated it would not pose unacceptable risk of harm to health, biodiversity or local amenity due to noise. Policy ENV18 – Renewable energy developments will be permitted provided that it will not detrimentally affect local amenity via noise emissions.	11.10
Neath Port Council Local Development Plan 2011 – 2026 (2016)	Policy SP16 – On environmental protection by ensuring proposals do not have significant adverse effects. Policy EN8 – Not permitting developments with unacceptable adverse effects.	11.10

Legislative context

Key relevant legislation pertaining to noise includes the following:

- The Town and Country Planning Act 1990;
- Environmental Protection Act 1990, Part III (as amended by the Noise and Statutory Nuisance Act 1993);
- Land Compensation Act 1973;
- The Pollution Prevention Control Regulations (England and Wales) Regulations 2000; and
- Control of Pollution Act 1974.

Technical guidance

Table 11.2 lists the technical guidance relevant to the consideration of noise effects.

Table 11.2 Technical guidance considered in preparing the noise assessment

Policy reference	Policy issues	Considered in section
Supplementary planning guidance		
Neath Port Talbot County Borough Council – Interim Planning Guidance – Wind Turbine Development	Guidance intended to inform developers, landowners and the community on how the authority is likely to consider proposals for wind farms. The Guidance recommends that a noise assessment is likely to be required as part of the Environmental Impact Assessment (EIA).	11.10

Policy reference	Policy issues	Considered in section
Bridgend County Borough Council - Bridgend Local Development Plan 2006 – 2021 – Renewable Energy Assessment – February 2011	A guide to establish the potential for renewable energy development in the County Borough. Outlines that planning applications would need to take into account the potential for noise.	11.10
Specific guidance on noise from wind farms		
ETSU-R-97, 'The Assessment and Rating of Noise from Wind Farms', The Working Group on Noise from Wind Turbines (ETSU-R-97, 1996)	Information and advice to developers and planners on the environmental assessment of noise from wind turbines. The guidance offers a framework for the measurement of wind farm noise and gives indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours.	11.9
The Institute of Acoustics (IoA) 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (GPG, 2013)	Presents current good practice in the application of ETSU-R-97 for all wind turbine developments above 50kW. The GPG gives information to assist consultants, developers and local planning authorities in using the correct technical and procedural methods for the assessment and determination of wind farm applications, reflecting the original principles within ETSU-R-97 and the results of research carried out and experience gained since its publication.	11.9

11.4 Data gathering methodology

Desk study

The information within this ES is largely based upon data used within the 2014 ES, the exception being data for the candidate wind turbine. Sources of information used for the noise assessment are listed in **Table 11.3**.

Table 11.3 Sources of information

Source	Data
Turbines Types	• 'Noise level, Power curves, Thrust curves. Nordex N0/2500 HS Operational modes' Nordex (2013); • 'Sound power level Repower MM70' Repower Systems (2014); • 'Summary of results of the noise emissions measurement, in accordance with IEC 61400-11' Windtest (WT 2923/03, 2003); and • 'SWT-3.0-101 DD, Hub height 90m Acoustic Emission' Siemens (2009)
Terrain	10 metre contours purchased from emapsite (www.empasite.com)

Survey work

The data sources most relevant to the assessment of noise from the proposed development are those detailed within the 2014 ES and Technical Note 'Foel Trawsnant Wind Farm: Noise assessment – response to EHO' (Amec Foster Wheeler[62], 2015), namely the comprehensive background noise surveys in 2012 and 2015.

As agreed at the scoping stage, it has been assumed that the prevailing baseline noise conditions have not changed significantly from those presented within the 2014 ES, it follows that the results of background noise monitoring, and the associated noise limits derived using methodology advocated within the ETSU-R-97 Guidance, would remain applicable for this ES. As baseline noise levels normally increase over time, the use of

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the previous background noise level to represent residential receptors is considered a conservative approach. For instance, the 2012 survey predates the construction of the Pen y Cymoedd wind farm. In addition, there are no changes to the proposed development in comparison with the 2014 ES which would require an updated baseline noise survey.

Background noise monitoring was undertaken initially at four locations surrounding the proposed development in 2012. Prior to re-assessing the cumulative noise impacts as requested by NPTCBC post submission, it was agreed with the NPTCBC Environmental Health Officer to undertake background noise monitoring at a location representing Nant-yr-hwyaid Farm (reference 'R7' in the ES), as access to this property could not be arranged during the original noise monitoring survey (presented in **Appendix 11A**). The positions of monitoring locations are shown in **Figure 11.1** and listed in **Table 11.4**. Complete details of the monitoring method is presented in **Appendix 11B**.

Noise levels at these locations are deemed representative of the nearest sensitive receptors to the site. Each monitoring location was discussed and agreed with a relevant representative of the respective Local Authority prior to noise monitoring taking place.

Table 11.4 Noise Monitoring Locations

Ref	Location	Easting	Northing	Monitoring Position
M1	Tonnau Defaid	284994	193593	The sound level meter (SLM) was placed to the west of the property in the front garden area. The SLM was attached to a small wire fence, approximately 20m from the main house and more than 10m from an adjacent cow shed. The dominant noise contributor to the noise environment was from road traffic movements to the east using the A4063. Additional noise contributors noted during the kit deployment were from occasional aircraft movements
M2	Sunnyview	285335	194643	The SLM was placed in the back garden of the property, approximately 7m from the nearest façade. The noise environment during kit deployment was dominated by rain noise, with contributions from occasional cars passing along Teras Griffiths.
M2a	Hartshorn Terrace	285309	194709	The SLM was located to the north of the house, in the backgarden area, in a free-field position approximately 4m from the nearest façade. The noise environment was relatively quiet during kit deployment, dominated by birdsong and road traffic movements along Teras Griffiths.
M3	Hendre Owen Farm	283572	195578	The SLM was located on a grass verge to the west of the main house. The SLM was 6.5m from the closest noise reflecting façade, and approximately 28m from the main house. At the SLM location the contributors to the noise environment included some water flow noise from a brook to the north, and occasional road traffic movements along the A4107. Whilst some water flow noise was audible, the representative PPO at NPTCBC confirmed that this was a representative characteristic of the existing noise environment.
M4	Ty'n-y Pant Farm	282502	195048	The SLM was located to the north-east of the property, at the top of an adjacent bank, approximately 4m from the closest façade. During the kit deployment, the main noise contributors were noted to be as distant road traffic movements along the A4107 and some dog barking noise.
M5	Nant-yr-hwyaid Farm	282847	195123	Two SLM were deployed, one to the north and one to the south of the Farm, on the opposite side of the Nant-yr-hwyaid Ford, but at a distance which would represent the dwelling. The quietest SLM data was used. The noise environment was dominated by water flow noise with additional contributions from road traffic on Pen-Twyn Road.

Noise monitoring results at M2a – Hartshorn Terrace are deemed representative of those measured at M2 – Sunnyview. The subsequent calculations of the representative background noise levels for the properties to the north-west of the proposed site have therefore collated the two sets of results. The collated results across the two monitoring locations shall hereafter be referred to as "M2 – Sunnyview".

Turbine data

A range of turbine models would be appropriate for the proposed development. The final selection of turbine will follow a competitive tendering process and thus the actual model of turbine may differ from those on which this assessment has been based. However, the final choice of turbine will be required to comply with the noise criterion levels which have been established for the development within this noise assessment.

It is understood that the proposed candidate turbines for the development will be the Nordex N90/2500 HS (2.5MW) at 100m hub height, 145m to turbine blade tip. Data taken from the 2014 ES and subsequent technical notes has been used to represent turbine sound power levels associated with other built and planned wind farms in the surrounding area for the cumulative assessment. All wind farms except Pen Y Cymoedd have been modelled using wind turbine data rather than consented levels as requested by BCBC. As discussed in the technical note responding to BCBC's EHO query in January 2015, consented levels were not available for Ffynnon Oer Wind Farm and were not set out within the planning conditions for Llynfi Afan Renewable Energy Park.

The prediction approach was undertaken to analysis noise emissions from Pen y Cymoedd and its associated noise limits at the closest properties, which demonstrated that for Pen y Cymoedd to operate to the total allocated ETSU-R-97 Guidance noise limits at key cumulative receptors it would have to breach the associated noise limits at other receptors. This is described as the 'controlling property' scenario within the IoA GPG Par 5.4.9.

The data used to represent the sound power levels for the turbines is presented in **Table 11.5**, with spectrum data presented in **Table 11.6**.

Table 11.5 Wind turbine data

Wind Farm Site	Wind Turbine	Sound power levels (dB L_{wA}) by wind speed (mph)								
		4	5	6	7	8	9	10	11	12
Foel Trawsnant	**Nordex N90***	99.5	103.0	106.0	107.0	107.5	107.5	107.5	107.5	107.5
Pen y Cymoedd	**N/A****	108.8	108.8	108.8	108.8	108.8	111.8	113.8	113.8	113.8
Ffynnon Oer	**Repower MM70**	93.5	97.5	101.0	104.2	106.0	107.0	107.5	107.5	107.5
Llynfi Afan	**Gamesa G80**	97.9	102.7	105.0	105.1	105.1	105.1	105.1	105.1	105.1

*Based on the closest available data, being a hub height of 80m.
**The Pen y Cymoedd sound power levels are based on the 'controlling property' approach rather than specific turbine data.

With the exception of the turbines at Pen y Cymoedd, all other turbines have a 2dB uncertainty correction added to data provided from manufacturer sheets as it was not certain if the sound power levels were guaranteed or included any correction for standard deviation of measurement and uncertainty.

Table 11.6 Wind turbine spectrum data

Wind Turbine	Sound power level (dB LwA(A)) by Octave Band (Hz)								
	31.5	63	125	250	500	1K	2K	4K	8K
Nordex N90	90.7	90.7	94.8	99.2	99.6	98.1	97.0	93.0	85.4
Repower MM70	84.6	84.6	93.1	98.0	98.2	100.5	99.9	95.7	82.5
Gamesa G90	87.7	87.7	94.4	98.5	100.3	98.9	94.4	87.7	77.4

Locations for other built and planned wind farms has been identified via the relevant Environmental Statements for those developments at the time they progressed through planning.

11.5 Overall baseline

Current baseline

The site is located in a remote semi-rural area and as such, the influence of road traffic noise to the prevailing noise climate is low. At a number of the closest noise sensitive receptors to the proposed amended scheme, the existing sound environment is dominated by watercourses.

Monitoring results

The measured background noise ($L_{A90,\ 5\ min}$) levels were correlated with wind speed and a 'best fit' curve applied using either 2nd or 3rd order polynomial regression lines for both day and night-time periods. A summary of the resulting background noise curves for daytime and night-time periods for wind speeds at 10 metre height from 4m/s to 12m/s at each monitoring location is given in **Table 11.7** and **Table 11.8**.

Table 11.7 Summary of background noise levels – Quiet daytime periods

REF	Background Noise ($L_{A90,\ T}$) Levels (dB) by wind speed (m/s)								
	4	5	6	7	8	9	10	11	12
M1	35.1	35.6	36.0	36.4	36.7	37.1	37.3	37.6	37.8
M2	31.6	31.8	32.2	32.9	33.8	34.9	36.3	37.9	39.8
M3	34.3	34.6	35.1	35.7	36.4	37.2	38.2	39.3	40.5
M4	31.5	32.0	32.6	33.6	34.8	36.2	37.9	39.9	42.1
M5	48.7	49.3	50.0	50.9	51.7	52.6	53.4	54.1	54.7

Table 11.8 Summary of background noise levels – Night-time periods

REF	Background Noise ($L_{A90,T}$) Levels (dB) by wind speed (m/s)								
	4	5	6	7	8	9	10	11	12
M1	30.2	30.5	31.1	31.9	32.9	34.2	35.7	37.5	39.5
M2	26.1	26.1	26.8	28.0	29.5	31.4	33.5	35.7	38.0
M3	33.8	34.1	34.6	35.3	36.1	37.1	38.2	39.5	41.0
M4	30.2	30.9	31.8	32.9	34.3	36.0	37.9	40.0	42.4
M5	49.0	49.3	49.8	50.4	51.2	52.3	53.8	55.7	58.0

Predicted future baseline

It is reasonable to assume that, over time, background noise levels in the vicinity of the proposed development would generally remain the same, with possible slight increases in road traffic noise in line with forecast traffic growth.

11.6 Consultation

Table 11.9 provides a summary of the issues that have been raised by consultees and the responses given. The comments relate to queries on the 2014 ES which were responded to with technical notes, the methods of which have been incorporated into this ES. No issues were raised by NPTCBC in response to the chapter relating to noise in the Scoping Report (Amec Foster Wheeler, 2018).

Table 11.9 Summary of issues raised regarding noise during consultation

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref
Use of consented noise levels for built and planned wind farms to predict noise at R1-R4.	Bridgend County Borough Council	Consented limits were not available for Ffynnon Oer Wind Farm and were not set out within the planning conditions for Llynfi Afan Renewable Energy Park. The 'controlling property' method of calculation was used at Pen y Cymoedd Wind Farm.	11.10
Use of lower limit of 35 dB or background noise level + 5 dB.		Lower limit of 35 dB or background noise level + 5 dB used.	
Use of lower limit of 35 dB or background + 5 dB for cumulative assessment at receptors R5 – R9.	Neath Port Talbot County Borough Council	Lower limit of 35 dB or background noise level + 5 dB used.	11.10

11.7 Scope of the assessment

Wind farm noise assessment is part of an iterative design process, the aim of which is to achieve a design from which noise emissions meet limits derived following the approach given in ETSU-R-97. Consequently, the design of the scheme is such that relevant operational noise limits are met and no environmental mitigation measures are necessary. By way of separation between receptors and turbines resulting from this process, construction noise is also limited, thus only general good-practice noise control measures are required and no specific mitigation is necessary.

The EIA Regulations 2017 require that all 'significant' effects are identified. The majority of noise related guidance and standards (including ETSU-R-97) are not directly related to the concepts of 'significant' and 'not significant' that underpin the EIA process. However, for the purposes of this assessment, the determination of effect significance is based upon compliance with the applicable noise limit; i.e. breach of the noise limits indicates a 'significant' effect, whereas compliance with noise limits indicates a 'not significant' effect.

The agreed approach and scope for this chapter is the operational noise assessment of predicted turbine noise against measured background noise levels. The noise assessment addresses the operational noise from the existing Ffynnon Oer Wind Farm, Pen y Cymoedd Wind Farm, and Llynfi Afan Renewable Energy Park.

Due to the magnitude of the separation distances involved, the potential for vibration impacts during construction and operation of the proposed wind farm have been scoped out and no assessment has been undertaken. In addition, it was agreed during consultations with NPTCBC and BCBC for the 2014 ES that due to the temporary nature of the construction phase, increased noise impacts at sensitive receptors from HGVs using the public road network would be predicted to be small. It was therefore agreed that a detailed assessment of construction traffic noise impacts would be scoped out of the assessment.

The removal of T12 and T13 from the scheme means that the closest turbines to receptors are now further away than in the 2014 ES. Construction noise for the proposed development is therefore anticipated to be less than previously assessed in 2014. In the 2014 ES it was identified that the predicted worst-case construction noise impacts from on-site sources during the construction phase would not exceed threshold values for significant effect derived from BS 5228-1:2009+A1:2014. Based on the above, on-site construction noise has also been scoped out of the assessment within this chapter. It is noted that construction should still adhere to the embedded environmental measures as per the 2014 ES and which are repeated in Section 11.8, below, for ease of reference.

Whilst not discussed within the Scoping Report, operational traffic to maintain the turbines would be minimal and not a significant noise source. Operational traffic has therefore been scoped out of further detailed assessment.

It is assumed that decommissioning noise would be generally less than or, at most, similar to that experienced during the construction period. It is therefore considered that noise effects relating to the decommissioning of wind turbines would be no worse than those experienced during construction, provided similar restrictions on working hours and transport routes are applied. Noise from decommissioning has therefore been scoped out of further assessment.

Temporal scope

The temporal scope of the assessment of noise is consistent with the aspects considered above and is therefore limited to the operational period.

Spatial scope

The spatial scope is the same as that within the 2014 ES. In defining the assessment study area in the 2014 ES, reference was made to the simplified assessment approach outlined within ETSU-R-97. The simplified assessment approach can be adopted where noise at receptors from proposed or existing wind turbines does not exceed 35dB $L_{A90,10min}$ in wind speeds up to 10 ms^{-1} at 10 metre height. Receptors that are predicted to experience wind turbine noise levels higher than 35dB $L_{A90,10min}$ have been considered to fall within the assessment study area.

Initial noise modelling of the proposed Foel Trawsnant Wind Farm amended scheme indicated that properties to the north-west and east would likely fall within the 35dB $L_{A90,10min}$ contour, and thus are considered further within this chapter as potentially experiencing a significant effect.

Potential receptors

Sensitive receptors around the development to be considered within the noise assessment were identified using Ordnance Survey maps, preliminary noise modelling and in consultation the relevant representatives of the respective Local Authorities. An additional receptor, R9 to the north of the proposed development was identified in post-submission technical notes (**Appendix 11A**) to more fully represent residential receptors in that direction. The locations considered within the assessment are listed within **Table 11.10** also identifying the representative background noise levels applied to each receptor. The monitoring location assumed for each receptor was based upon observations of the ambient noise environments during the monitoring surveys, existing dominant noise sources and local environs.

Table 11.10 Summary of receptors considered in the assessment

Ref	Location	Easting	Northing	Monitoring Position
R1	Tonnau Defaid	284994	193601	M1 – Tonnau Defaid
R2	Penylan	284781	193054	M1 – Tonnau Defaid
R3	Sunnyview	285331	194626	M2 - Sunnyview
R4	Teras Griffiths (Griffiths Terrace)	285213	194602	M2 - Sunnyview
R5	Hendre Owen Farm	283610	195530	M3 – Hendre Owen Farm
R6	Ty'n-y Pant Farm	282515	195007	M4 – Ty'n-y Pant Farm
R7	Nant-yr-hwyaid Farm	282737	195073	M5 – Nant-yr-hwyaid Farm
R8	Tycanol	282316	194987	M4 – Ty'n-y Pant Farm
R9	Neuadd-wen	283168	195414	M3 – Hendre Owen Farm

Residential receptors are all considered of high sensitivity to noise with the potential for being significantly affected by noise from the operation of the proposed wind farm. No commercial or leisure receptors are considered at risk of significant effects from the proposed development.

Ecological receptors normally become accustomed to changes in noise level overtime. Given the steady source of noise operating at low noise levels relatively to other noise sources in the environment (such as road noise) it is not considered that the operation of the turbines would have a significant effect on ecological species in the area.

11.8 Environmental measures embedded into the proposed development

Construction measures

Whilst it has been determined that construction noise would not have a significant effect on receptors, to minimise any potential disturbance the construction process would have regard to general guidance for controlling construction noise that is given in British Standard BS5228-1:2009+A1:2014 'Noise and Vibration on Construction and Open Sites. Part 1: Noise'. As good practice, the following environmental measures concerning construction noise will be implemented:

- Restricted hours of working for most heavy vehicle movements (07:00 to 19:00 Monday to Friday, 07:00 - 12:00 Saturdays), to avoid sensitive periods. Any requirement to work outside of these periods will only occur through prior agreement with the local planning authority (for example turbine erection requires low wind speed conditions and may require longer working hours if conditions are poor at the time);
- All construction activities will be undertaken in accordance with good practice as set out in BS5228-1:2009+A1:2014;
- All employees on the construction site will be advised of quieter methods of operating plant and tools, and to report any damage to noise control measures as soon as they are identified;
- Where practicable, for any particular activity, suitable plant, machinery and working practices will be adopted. All equipment will be maintained in good working order and will be fitted with appropriate noise controls at all times (e.g. silencers, mufflers and/or acoustic hoods); and
- Construction plant capable of generating significant noise and vibration levels will be operated in a manner to minimise the duration of the higher magnitude levels.

Operational measures

Wind farm noise assessment is part of an iterative design process, the aim of which is to achieve a design from which noise emissions meet limits derived following the approach given in ETSU-R-97 and/or relevant local guidelines. Consequently, the design of the scheme is such that necessary operational noise limits are met and no further environmental mitigation measures are required.

A number of site layout iterations have been modelled during the design development process. The noise impact from each design layout was assessed against the associated ETSU-R-97 noise limits at the nearest sensitive receptors, and those which resulted in any excess over the noise limits were discounted.

11.9 Assessment methodology

In Wales, advice specific to operational noise generated by wind energy developments can be found in Technical Advice Note 8 (TAN8): Planning for Renewable Energy. Annex C, paragraph 2.16 of this document guides the assessment process as follows:

> *"The report "The Assessment and Rating of Noise from Wind Farms" (ETSU R-97), describes a framework for the measurement of wind farm noise and gives indicative noise levels calculated to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development or adding unduly to the costs and administrative burdens on wind farm development or adding unduly to the costs and administrative burdens on wind farm developers or planning authorities. The report presents the findings of a cross-interest Noise Working Group and makes a series of recommendations that can be regarded as relevant guidance on good practice."*

Consequently, the assessment methodology adopted is that found in ETSU-R-97 'The Assessment and Rating of Noise from Windfarms'. The advice presented in the document was produced by The Working Group on Noise from Wind Turbines, a body comprising a number of interested parties including, amongst others, wind farm operators, environmental health officers, acoustic consultants and legal experts. The assessment approach was developed to address the shortcomings of other standards in addressing wind farm noise.

Noise limits

Acceptable limits for wind turbine operational noise are defined in ETSU-R-97. The test for operational noise is therefore whether or not the calculated wind turbine noise levels at receptor properties lie at or below the noise limits derived in accordance with ETSU-R-97.

Preliminary modelling for the proposed development indicated that operational noise was likely to exceed this threshold at a number of surrounding properties. The ETSU-R-97 Guidance therefore recommends that wind farm noise limits should be set relative to existing background noise levels, subject to a fixed minimum limit, and that these limits should reflect the variation in background noise with wind speed. The wind speeds that should be considered range from the cut-in speed up to 12ms^{-1}, the point at which wind turbines are usually at or above 95% of their rated power and thus no significant increases in noise emissions are expected. Wind speeds are referenced to a 10 metre measurement height (V10) on the wind farm site.

The daytime noise limit is derived from background noise data measured at residential properties during the 'quiet daytime', as defined in ETSU-R-97, which comprises:

- Weekday evenings from 18:00 - 23:00;
- Saturday afternoons from 13:00 - 23:00; and
- All day Sunday 07:00 - 23:00.

The noise measurements are plotted against the concurrent wind speed data measured at the application site and a 'best fit' correlation is established.

In low noise environments (i.e. where background noise levels are less than 30-35dB(A)), the ETSU-R-97 Guidance recommends that wind farm noise for quiet daytime periods should be limited to a lower fixed level within the range 35-40dB $L_{A90,10min}$ or 5 dB(A) above the prevailing background, whichever is the greater. The choice of which lower fixed level to use within the range is based upon a number of factors as outlined in Paragraph 22 of the ETSU-R-97 Guidance. These include:

- The number of dwellings in the neighbourhood of the wind farm;
- The effect of noise limits on the amount of electricity generated; and
- The duration and level of exposure.

A conservative approach has been taken using the lower fixed daytime noise limit for the proposed development of 35dB $L_{A90, 10mins}$ (or 5dB above prevailing background, whichever is greater). This is considered worst-case as a higher lower limit could be argued which would reflect both the scale of the proposed wind farm in terms of kWh generated and the area of the development site.

The cumulative noise assessment as presented within the 2014 ES was based upon a daytime lower fixed noise limit of 40dB (or background + 5dB, whichever is greater). This approach is advocated within the ETSU Guidance. However, based on requirements from both NPTCBC and BCBC as a response to the submission of the 2014 ES, the cumulative noise assessment has been based upon a daytime lower fixed noise limit of 35dB $L_{A90, 10mins}$ (or background + 5dB, whichever is greater).

The night-time noise limit is derived from the background noise data measured during the night-time period (23:00 to 07:00) every day. As with the daytime data, this is plotted against the concurrent wind speed data and a 'best fit' correlation established. For night time periods, the ETSU-R-97 recommended limits are 43dB $L_{A90,10min}$ or 5 dB(A) above prevailing background, whichever is the greater.

The only exception to the daytime and night-time limits outlined above is for properties with a financial involvement in the development where ETSU-R-97 limits can be increased to 45 dB $L_{A90\ 10mins}$ (or 5dB above the prevailing background, whichever is greater). The properties at R5 – Hendre Owen Farm and R6 – Ty'n-y

Pant Farm are considered as having a financial benefit from the proposed scheme, therefore the higher noise limits have been adopted for these locations.

The ETSU-R-97 noise criteria assume that the wind turbine noise contains no audible tones. Where tones are present, a correction is added to the measured or predicted noise level before comparison with the recommended limits. The level of correction will depend on how audible the tone is. A warranty will be sought from the manufacturers of the turbine selected for the proposed development such that the noise output will either not require a tonal correction (under the ETSU-R-97 Guidance) or, where tonal corrections are required, the noise criteria will be met having made the appropriate correction for any tonal component.

The ETSU-R-97 Guidance states the $L_{A90,\ 10min}$ descriptor should be used for both the background noise and wind farm noise when setting limits.

Methodology for prediction of effects

Research background

The Institute of Acoustics (IoA) published 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (IoA GPG) (May 2013). The use of the IoA GPG in the assessment of wind turbine noise has been endorsed by Welsh Government. Carl Sargeant, (Former) Minister for Housing and Regeneration, Welsh Government stated in a letter to the IoA on 22 May 2013:

> *"The assumptions listed in the section below are all confirmed within the IoA GPG as the correct approach to modelling wind turbine noise emissions."*

In line with the IoA GPG, the model used in this assessment is based upon that found in ISO 9613-2 'Acoustics - Attenuation of sound during propagation outdoors' (ISO, 1996). The model takes account of:

- Geometric divergence (attenuation with distance);
- Air absorption;
- Barriers (including buildings or topography);
- Screening (including vegetation); and
- Ground absorption and reflection.

The ISO 9613-2 algorithm has been chosen as being the most robust prediction method, based on the findings of a joint European Commission research project into wind farm noise propagation over large distances. According to this research, this model (like all the others considered in the research) tends to over-estimate noise levels at nearby dwellings, rather than under-estimate them. The conclusion of the study was that the ISO 9613-2 algorithm tended to predict noise levels that would generally occur under downwind propagation conditions.

Another important outcome of the research demonstrated that under upwind propagation conditions, between a given receiver and the wind farm, the wind farm noise level at that receiver will be as much as 10dB(A) to 15dB(A) lower than the level predicted using the ISO 9613-2 algorithm.

Operational noise modelling

For the purposes of the present assessment, noise level predictions have been based upon the following assumed model parameters:

- A receiver height of 4.0 metres above local ground level – to represent the height of a typical bedroom window;

- Mixed ground (G = 0.5) – this represents a ground cover that has equal amounts of fully reflective and fully absorptive character. For the purposes of this assessment, mixed ground represents a ground cover that is as equally absorptive of noise as it is reflective;
- Air absorption based on a temperature of 10°C and 70% relative humidity;
- $L_{A90,\ 10min}$ is 2 dB less than $L_{Aeq,\ 10min}$ for wind farm noise; and
- Predicted turbine noise levels are inclusive of any 'Canyon Effect' penalty (discussed below).

Valley effect

The IoA GPG recommends that a noise correction is applied in circumstances where the intervening terrain height between a proposed wind development and sensitive receptors drops away significantly. Where a 'valley effect' is shown to occur, a penalty of 3dB (or 1.5dB if a ground absorption factor of 0 is being used) is applied to the overall predicted noise level at receptors.

An analysis of the terrain surrounding the proposed Foel Trawsnant Wind Farm amended scheme using Ordnance Survey Landform Panorama 10m digital terrain data indicated that noise levels at none of the receptors considered within the noise assessment would qualify for the 'valley effect' penalty.

Significance evaluation methodology

The assessment of significant operational noise effects is based upon compliance with the ETSU-R-97 i.e. a breach of the noise limits indicates a 'significant' effect, whereas compliance with noise limits indicates a 'not significant' effect. It is acknowledged that the ETSU-R-97 approach does not directly aim to determine significance in an EIA context, rather it represents a balance between the need for wind energy and the need to protect residential amenities. Since the purpose of identifying significant effects during EIA is to ensure they are taken into account in the 'planning balance', for the purposes of this assessment it is assumed that noise effects up to the ETSU-R-97 noise limits have already been taken into account and thus only noise levels exceeding the ETSU-R-97 noise limits are deemed to be 'significant' and require further consideration.

11.10 Assessment of noise effects

Predicted effects and their significance

Noise levels have been predicted for the closest residential properties to the wind farm, as shown in **Figure 11.1**, and listed in **Table 11.10. Table 11.11** and **Table 11.12** present the following information for each wind speed for each of the nine properties for daytime and night-time periods respectively:

- Values of the background noise curve at the integer wind speeds, measured and adjusted for wind shear;
- The noise limits derived from the background noise curve, in accordance with the ETSU-R-97 and the IoA GPG;
- The predicted turbine noise levels from the proposed development, based on worst-case downwind noise propagation and inclusive of any 'valley effect' penalty at receptors and assuming turbines are operating simultaneously; and
- The margin by which the predicted turbine noise, inclusive of any 'canyon effect penalty', meets the noise limits at each wind speed using the worst-case downwind noise predictions (negative values indicate the predicted noise levels are lower than the noise limits).

Table 11.11 Noise Assessment - Daytime

Noise Parameter, $L_{A90, 10\ mins}$, dB	Standardised 10m Wind Speed quoted by Manufacturer (ms^{-1})								
	4	5	6	7	8	9	10	11	12
R1 – Tonnau Defaid									
Background Noise Curve	35.1	35.6	36.0	36.4	36.7	37.1	37.3	37.6	37.8
ETSU-R-97 Derived Noise Limit	40.1	40.6	41.0	41.4	41.7	42.1	42.3	42.6	42.8
Wind Farm Turbine Noise	30.6	34.1	37.1	38.1	38.6	38.6	38.6	38.6	38.6
Margin Under Noise Limit	-9.5	-6.5	-3.9	-3.3	-3.1	-3.5	-3.7	-4.0	-4.2
R2 – Pen y lan									
Background Noise Curve	35.1	35.6	36.0	36.4	36.7	37.1	37.3	37.6	37.8
ETSU-R-97 Derived Noise Limit	40.1	40.6	41.0	41.4	41.7	42.1	42.3	42.6	42.8
Wind Farm Turbine Noise	31.3	34.8	37.8	38.8	39.3	39.3	39.3	39.3	39.3
Margin Under Noise Limit	-8.8	-5.8	-3.2	-2.6	-2.4	-2.8	-3.0	-3.3	-3.5
R3 – Sunnyview									
Background Noise Curve	31.6	31.8	32.2	32.9	33.8	34.9	36.3	37.9	39.8
ETSU-R-97 Derived Noise Limit	36.6	36.8	37.2	37.9	38.8	39.9	41.3	42.9	44.8
Wind Farm Turbine Noise	28.8	32.3	35.3	36.3	36.8	36.8	36.8	36.8	36.8
Margin Under Noise Limit	-7.8	-4.5	-1.9	-1.6	-2.0	-3.1	-4.5	-6.1	-8.0
R4 – Teras Griffiths									
Background Noise Curve	31.6	31.8	32.2	32.9	33.8	34.9	36.3	37.9	39.8
ETSU-R-97 Derived Noise Limit	36.6	36.8	37.2	37.9	38.8	39.9	41.3	42.9	44.8
Wind Farm Turbine Noise	29.5	33.0	36.0	37.0	37.5	37.5	37.5	37.5	37.5
Margin Under Noise Limit	-7.1	-3.8	-1.2	-0.9	-1.3	-2.4	-3.8	-5.4	-7.3
R5 – Hendre Owen Farm									
Background Noise Curve	34.3	34.6	35.1	35.7	36.4	37.2	38.2	39.3	40.5
ETSU-R-97 Derived Noise Limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.5
Wind Farm Turbine Noise	32.0	35.5	38.5	39.5	40.0	40.0	40.0	40.0	40.0
Margin Under Noise Limit	-13.0	-9.5	-6.5	-5.5	-5.0	-5.0	-5.0	-5.0	-5.5
R6 – Ty'n-y Pant Farm									
Background Noise Curve	31.5	32.0	32.6	33.6	34.8	36.2	37.9	39.9	42.1
ETSU-R-97 Derived Noise Limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	47.1

Noise Parameter, $L_{A90, 10\ mins}$, dB	Standardised 10m Wind Speed quoted by Manufacturer (ms^{-1})								
	4	5	6	7	8	9	10	11	12
Wind Farm Turbine Noise	34.0	37.5	40.5	41.5	42.0	42.0	42.0	42.0	42.0
Margin Under Noise Limit	-11.0	-7.5	-4.5	-3.5	-3.0	-3.0	-3.0	-3.0	-5.1
R7 – Nant-yr-hwyaid Farm									
Background Noise Curve	48.7	49.3	50.0	50.9	51.7	52.6	53.4	54.1	54.7
ETSU-R-97 Derived Noise Limit	53.7	54.3	55.0	55.9	56.7	57.6	58.4	59.1	59.7
Wind Farm Turbine Noise	35.0	38.5	41.5	42.5	43.0	43.0	43.0	43.0	43.0
Margin Under Noise Limit	-18.7	-15.8	-13.5	-13.4	-13.7	-14.6	-15.4	-16.1	-16.7
R8 – Tycanol									
Background Noise Curve	31.5	32.0	32.6	33.6	34.8	36.2	37.9	39.9	42.1
ETSU-R-97 Derived Noise Limit	36.5	37.0	37.6	38.6	39.8	41.2	42.9	44.9	47.1
Wind Farm Turbine Noise	32.3	35.8	38.8	39.8	40.3	40.3	40.3	40.3	40.3
Margin Under Noise Limit	-4.2	-1.2	1.2	1.2	0.5	-0.9	-2.6	-4.6	-6.8
R9 – Neuadd-wen									
Background Noise Curve	34.3	34.6	35.1	35.7	36.4	37.2	38.2	39.3	40.5
ETSU-R-97 Derived Noise Limit	39.3	39.6	40.1	40.7	41.4	42.2	43.2	44.3	45.5
Wind Farm Turbine Noise	32.4	35.9	38.9	39.9	40.4	40.4	40.4	40.4	40.4
Margin Under Noise Limit	-6.9	-3.7	-1.2	-0.8	-1.0	-1.8	-2.8	-3.9	-5.1

Table 11.12 Noise Assessment – Night-time

Noise Parameter, $L_{A90, 10\ mins}$, dB	Standardised 10m Wind Speed quoted by Manufacturer (ms^{-1})								
	4	5	6	7	8	9	10	11	12
R1 – Tonnau Defaid									
Background Noise Curve	30.2	30.5	31.1	31.9	32.9	34.2	35.7	37.5	39.5
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.5
Wind Farm Turbine Noise	30.6	34.1	37.1	38.1	38.6	38.6	38.6	38.6	38.6
Margin Under Noise Limit*	-12.4	-8.9	-5.9	-4.9	-4.4	-4.4	-4.4	-4.4	-5.9
R2 – Pen y lan									
Background Noise Curve	30.2	30.5	31.1	31.9	32.9	34.2	35.7	37.5	39.5
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.5
Wind Farm Turbine Noise	31.3	34.8	37.8	38.8	39.3	39.3	39.3	39.3	39.3

Noise Parameter, $L_{A90, 10\ mins}$, dB	Standardised 10m Wind Speed quoted by Manufacturer (ms^{-1})								
	4	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Margin Under Noise Limit	-11.7	-8.2	-5.2	-4.2	-3.7	-3.7	-3.7	-3.7	-5.2
R3 – Sunnyview									
Background Noise Curve	26.1	26.1	26.8	28.0	29.5	31.4	33.5	35.7	38.0
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm Turbine Noise	28.8	32.3	35.3	36.3	36.8	36.8	36.8	36.8	36.8
Margin Under Noise Limit	-14.2	-10.7	-7.7	-6.7	-6.2	-6.2	-6.2	-6.2	-6.2
R4 – Teras Griffiths									
Background Noise Curve	26.1	26.1	26.8	28.0	29.5	31.4	33.5	35.7	38.0
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm Turbine Noise	29.5	33.0	36.0	37.0	37.5	37.5	37.5	37.5	37.5
Margin Under Noise Limit	-13.5	-10.0	-7.0	-6.0	-5.5	-5.5	-5.5	-5.5	-5.5
R5 – Hendre Owen Farm									
Background Noise Curve	33.8	34.1	34.6	35.3	36.1	37.1	38.2	39.5	41.0
ETSU-R-97 Derived Noise Limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	46.0
Wind Farm Turbine Noise	32.0	35.5	38.5	39.5	40.0	40.0	40.0	40.0	40.0
Margin Under Noise Limit	-13.0	-9.5	-6.5	-5.5	-5.0	-5.0	-5.0	-5.0	-6.0
R6 – Ty'n-y Pant Farm									
Background Noise Curve	30.2	30.9	31.8	32.9	34.3	36.0	37.9	40.0	42.4
ETSU-R-97 Derived Noise Limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	47.4
Wind Farm Turbine Noise	34.0	37.5	40.5	41.5	42.0	42.0	42.0	42.0	42.0
Margin Under Noise Limit	-11.0	-7.5	-4.5	-3.5	-3.0	-3.0	-3.0	-3.0	-5.4
R7 – Nant-yr-hwyaid Farm									
Background Noise Curve	49.0	49.3	49.8	50.4	51.2	52.3	53.8	55.7	58.0
ETSU-R-97 Derived Noise Limit	54.0	54.3	54.8	55.4	56.2	57.3	58.8	60.7	63.0
Wind Farm Turbine Noise	35.0	38.5	41.5	42.5	43.0	43.0	43.0	43.0	43.0
Margin Under Noise Limit	-19.0	-15.8	-13.3	-12.9	-13.2	-14.3	-15.8	-17.7	-20.0
R8 – Tycanol									
Background Noise Curve	30.2	30.9	31.8	32.9	34.3	36.0	37.9	40.0	42.4
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.0	47.4

Noise Parameter, $L_{A90, 10\ mins}$, dB	Standardised 10m Wind Speed quoted by Manufacturer (ms^{-1})								
	4	5	6	7	8	9	10	11	12
Wind Farm Turbine Noise	32.3	35.8	38.8	39.8	40.3	40.3	40.3	40.3	40.3
Margin Under Noise Limit	-10.7	-7.2	-4.2	-3.2	-2.7	-2.7	-2.7	-4.7	-7.1
R9 – Neuadd-wen									
Background Noise Curve	33.8	34.1	34.6	35.3	36.1	37.1	38.2	39.5	41.0
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.2	44.5	46.0
Wind Farm Turbine Noise	32.4	35.9	38.9	39.9	40.4	40.4	40.4	40.4	40.4
Margin Under Noise Limit	-10.6	-7.1	-4.1	-3.1	-2.6	-2.6	-2.8	-4.1	-5.6

The results show a slight exceedance of the ETSU-R-97 limits at R8 - Tycanol to the north of the development site. This would constitute a significant effect, however the receptor would not be directly downwind of all turbines at the same time, which would reduce noise levels to below the limits. Further analysis has been undertaken in the cumulative assessment taking into account the directivity of individual turbines (directivity is key in the cumulative assessment given the locations of wind farms on different sides of the receptors).

Table 11.13 and **Table 11.14** present the information summarised in the modelling approach for all wind farms contributing to the noise levels at the identified receptors, including the Foel Trawsnant Wind Farm amended scheme, Ffynnon Oer Wind Farm, Pen y Cymoedd Wind Farm, and Llynfi Afan Renewable Energy Park.

As these sites are on opposite sides of the residential receptors to the proposed Foel Trawsnant Wind Farm amended scheme, directivity of all turbines has been considered in accordance with the IoA GPG. This is because not all wind turbines will be acting directly down wind of all receptors at the same time. For instance, during the prevalent south westerly wind conditions, the noise from all other wind farms would be upwind of residential receptors and therefore noise would be significantly lower from the other sites.

Table 11.13 Cumulative Noise Assessment - Daytime

Noise Parameter, $L_{A90, 10\ mins}$, dB	Standardised 10m Wind Speed quoted by Manufacturer (ms^{-1})								
	4	5	6	7	8	9	10	11	12
R1 – Tonnau Defaid									
Background Noise Curve	35.1	35.6	36.0	36.4	36.7	37.1	37.3	37.6	37.8
ETSU-R-97 Derived Noise Limit	40.1	40.6	41.0	41.4	41.7	42.1	42.3	42.6	42.8
Wind Farm Turbine Noise	28.0	31.1	33.9	34.8	35.3	35.4	35.6	35.6	35.6
Margin Under Noise Limit	-12.1	-9.5	-7.1	-6.6	-6.4	-6.7	-6.7	-7.0	-7.2
R2 – Pen y lan									
Background Noise Curve	35.1	35.6	36.0	36.4	36.7	37.1	37.3	37.6	37.8
ETSU-R-97 Derived Noise Limit	40.1	40.6	41.0	41.4	41.7	42.1	42.3	42.6	42.8

Noise Parameter, $L_{A90, 10\ mins}$, dB	Standardised 10m Wind Speed quoted by Manufacturer (ms^{-1})								
	4	5	6	7	8	9	10	11	12
Wind Farm Turbine Noise	25.6	28.4	31.0	31.9	32.4	32.6	32.9	32.9	32.9
Margin Under Noise Limit	-14.5	-12.2	-10.0	-9.5	-9.3	-9.5	-9.4	-9.7	-9.9
R3 – Sunnyview									
Background Noise Curve	31.6	31.8	32.2	32.9	33.8	34.9	36.3	37.9	39.8
ETSU-R-97 Derived Noise Limit	36.6	36.8	37.2	37.9	38.8	39.9	41.3	42.9	44.8
Wind Farm Turbine Noise	30.3	33.1	35.8	36.7	37.2	37.4	37.7	37.7	37.7
Margin Under Noise Limit	-6.3	-3.7	-1.4	-1.2	-1.6	-2.5	-3.6	-5.2	-7.1
R4 – Teras Griffiths									
Background Noise Curve	31.6	31.8	32.2	32.9	33.8	34.9	36.3	37.9	39.8
ETSU-R-97 Derived Noise Limit	36.6	36.8	37.2	37.9	38.8	39.9	41.3	42.9	44.8
Wind Farm Turbine Noise	30.8	33.7	36.4	37.3	37.9	38.0	38.3	38.3	38.3
Margin Under Noise Limit	-5.8	-3.1	-0.8	-0.6	-0.9	-1.9	-3.0	-4.6	-6.5
R5 – Hendre Owen Farm									
Background Noise Curve	34.3	34.6	35.1	35.7	36.4	37.2	38.2	39.3	40.5
ETSU-R-97 Derived Noise Limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.5
Wind Farm Turbine Noise	35.4	36.9	38.7	39.5	40.1	40.8	41.7	41.7	41.7
Margin Under Noise Limit	-9.6	-8.1	-6.3	-5.5	-4.9	-4.2	-3.3	-3.3	-3.8
R6 – Ty'n-y Pant Farm									
Background Noise Curve	31.5	32.0	32.6	33.6	34.8	36.2	37.9	39.9	42.1
ETSU-R-97 Derived Noise Limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	47.1
Wind Farm Turbine Noise	32.6	33.7	35.2	35.8	36.5	37.5	38.6	38.6	38.6
Margin Under Noise Limit	-12.4	-11.3	-9.8	-9.2	-8.5	-7.5	-6.4	-6.4	-8.5
R7 – Nant-yr-hwyaid Farm									
Background Noise Curve	48.7	49.3	50.0	50.9	51.7	52.6	53.4	54.1	54.7
ETSU-R-97 Derived Noise Limit	53.7	54.3	55.0	55.9	56.7	57.6	58.4	59.1	59.7
Wind Farm Turbine Noise	33.2	35.1	37.2	38.1	38.7	39.2	39.8	39.8	39.8
Margin Under Noise Limit	-20.5	-19.2	-17.8	-17.8	-18.0	-18.4	-18.6	-19.3	-19.9
R8 – Tycanol									
Background Noise Curve	31.5	32.0	32.6	33.6	34.8	36.2	37.9	39.9	42.1

Noise Parameter, $L_{A90, 10\ mins}$, dB	Standardised 10m Wind Speed quoted by Manufacturer (ms^{-1})								
	4	5	6	7	8	9	10	11	12
ETSU-R-97 Derived Noise Limit	36.5	37.0	37.6	38.6	39.8	41.2	42.9	44.9	47.1
Wind Farm Turbine Noise	32.5	33.4	34.8	35.4	36.2	37.2	38.4	38.4	38.4
Margin Under Noise Limit	-4.0	-3.6	-2.8	-3.2	-3.6	-4.0	-4.5	-6.5	-8.7
R9 – Neuadd-wen									
Background Noise Curve	34.3	34.6	35.1	35.7	36.4	37.2	38.2	39.3	40.5
ETSU-R-97 Derived Noise Limit	39.3	39.6	40.1	40.7	41.4	42.2	43.2	44.3	45.5
Wind Farm Turbine Noise	34.8	35.9	37.2	37.9	38.6	39.6	40.7	40.7	40.7
Margin Under Noise Limit	-4.5	-3.7	-2.9	-2.8	-2.8	-2.6	-2.5	-3.6	-4.8

Table 11.14 Cumulative Noise Assessment – Night-time

Noise Parameter, $L_{A90, 10\ mins}$, dB	Standardised 10m Wind Speed quoted by Manufacturer (ms^{-1})								
	4	5	6	7	8	9	10	11	12
R1 – Tonnau Defaid									
Background Noise Curve	30.2	30.5	31.1	31.9	32.9	34.2	35.7	37.5	39.5
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.5
Wind Farm Turbine Noise	28.0	31.1	33.9	34.8	35.3	35.4	35.6	35.6	35.6
Margin Under Noise Limit	-15.0	-11.9	-9.1	-8.2	-7.7	-7.6	-7.4	-7.4	-8.9
R2 – Pen y lan									
Background Noise Curve	30.2	30.5	31.1	31.9	32.9	34.2	35.7	37.5	39.5
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.5
Wind Farm Turbine Noise	25.6	28.4	31.0	31.9	32.4	32.6	32.9	32.9	32.9
Margin Under Noise Limit	-17.4	-14.6	-12.0	-11.1	-10.6	-10.4	-10.1	-10.1	-11.6
R3 – Sunnyview									
Background Noise Curve	26.1	26.1	26.8	28.0	29.5	31.4	33.5	35.7	38.0
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
Wind Farm Turbine Noise	30.3	33.1	35.8	36.7	37.2	37.4	37.7	37.7	37.7
Margin Under Noise Limit	-12.7	-9.9	-7.2	-6.3	-5.8	-5.6	-5.3	-5.3	-5.3
R4 – Teras Griffiths									
Background Noise Curve	26.1	26.1	26.8	28.0	29.5	31.4	33.5	35.7	38.0
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0

Noise Parameter, $L_{A90, 10\ mins}$, dB	Standardised 10m Wind Speed quoted by Manufacturer (ms^{-1})								
	4	5	6	7	8	9	10	11	12
Wind Farm Turbine Noise	30.8	33.7	36.4	37.3	37.9	38.0	38.3	38.3	38.3
Margin Under Noise Limit	-12.2	-9.3	-6.6	-5.7	-5.1	-5.0	-4.7	-4.7	-4.7
R5 – Hendre Owen Farm									
Background Noise Curve	33.8	34.1	34.6	35.3	36.1	37.1	38.2	39.5	41.0
ETSU-R-97 Derived Noise Limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	46.0
Wind Farm Turbine Noise	35.4	36.9	38.7	39.5	40.1	40.8	41.7	41.7	41.7
Margin Under Noise Limit	-9.6	-8.1	-6.3	-5.5	-4.9	-4.2	-3.3	-3.3	-4.3
R6 – Ty'n-y Pant Farm									
Background Noise Curve	30.2	30.9	31.8	32.9	34.3	36.0	37.9	40.0	42.4
ETSU-R-97 Derived Noise Limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	47.4
Wind Farm Turbine Noise	32.6	33.7	35.2	35.8	36.5	37.5	38.6	38.6	38.6
Margin Under Noise Limit	-12.4	-11.3	-9.8	-9.2	-8.5	-7.5	-6.4	-6.4	-8.8
R7 – Nant-yr-hwyaid Farm									
Background Noise Curve	49.0	49.3	49.8	50.4	51.2	52.3	53.8	55.7	58.0
ETSU-R-97 Derived Noise Limit	54.0	54.3	54.8	55.4	56.2	57.3	58.8	60.7	63.0
Wind Farm Turbine Noise	33.2	35.1	37.2	38.1	38.7	39.2	39.8	39.8	39.8
Margin Under Noise Limit	-20.8	-19.2	-17.6	-17.3	-17.5	-18.1	-19.0	-20.9	-23.2
R8 – Tycanol									
Background Noise Curve	30.2	30.9	31.8	32.9	34.3	36.0	37.9	40.0	42.4
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.0	47.4
Wind Farm Turbine Noise	32.5	33.4	34.8	35.4	36.2	37.2	38.4	38.4	38.4
Margin Under Noise Limit	-10.5	-9.6	-8.2	-7.6	-6.8	-5.8	-4.6	-6.6	-9.0
R9 – Neuadd-wen									
Background Noise Curve	33.8	34.1	34.6	35.3	36.1	37.1	38.2	39.5	41.0
ETSU-R-97 Derived Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.2	44.5	46.0
Wind Farm Turbine Noise	34.8	35.9	37.2	37.9	38.6	39.6	40.7	40.7	40.7
Margin Under Noise Limit	-8.2	-7.1	-5.8	-5.1	-4.4	-3.4	-2.5	-3.8	-5.3

The results of the cumulative noise assessment show that predicted noise levels at all residential receptors are below the ETSU-R-97 limits. This is also the case for R8 – Tycanol, previously exceeding with noise from the Foel Trawsnant Wind Farm amended scheme only. This is because the proposed turbines on Foel

Trawsnant are also modelled as directional in the cumulative assessment, which shows that despite the turbines being aligned in rows in the direction of R8, there is sufficient differences in the alignment that directional reductions in turbine noise provides a significant reduction in total noise levels in this more realistic scenario.

The results are presented graphically in **Appendix 11C**, where graphs include both the ETSU-R-97 limits, and noise curves for the proposed development and the cumulative directivity scenario, but also the cumulative scenario without directivity considered (i.e. all wind farms and turbines downwind to each receptor). For comparison, the results tables of the cumulative scenario without directivity are presented in **Appendix 11D**.

11.11 Consideration of additional mitigation or compensation

No additional mitigation measures are proposed to further reduce the noise effects that are identified in this ES. This is because all relevant and implementable measures have been embedded into the development proposals and are assessed above in this chapter. These measures are considered to be likely to be effective and deliverable and address the likely significant effects of the Foel Trawsnant Wind Farm amended scheme.

11.12 Conclusions of significance evaluation

Exceedances of limits have been identified modelling the Foel Trawsnant Wind Farm amended scheme assuming a worst case scenario that all receptors are downwind of all turbines. However, a realistic approach using directivity of individual turbines shows that noise limits would not be exceeded. The results of this assessment have therefore shown that no significant noise effects would be predicted to occur during the operation of the Foel Trawsnant Wind Farm amended scheme.

11.13 Implementation of environmental measures

Whilst the candidate turbine might change, the residential amenity of surrounding areas would be protected by an appropriately worded planning condition based on ETSU-R-97 limits as stipulated within Section 11.10. Compliance of these limits can be proven with measurements taken at residential receptor locations once the wind farm is operational.

11.14 References

Amec Environment & Infrastructure UK Limited, Foel Trawsnant Wind Farm: Scoping Report (2012).

Amec Environment & Infrastructure UK Limited, Foel Trawsnant Wind Farm: Environmental Statement (2014).

Amec Environment & Infrastructure UK Limited, Foel Trawsnant Wind Farm: Noise Assessment – Response to EHO (15021i1, January 2015).

Amec Environment & Infrastructure UK Limited, Foel Trawsnant Wind Farm: Noise Assessment – Response to EHO (15343i2, June 2015).

Amec Foster Wheeler. Foel Trawsnant Wind Farm – Amendments to the Approved Scheme. Scoping Report. 40217i2. 2018.

British Standard (2014). 5228-1:2009+A1:2014 Noise and Vibration on Construction and Open Sites. Part 1: Noise.

Institute of Acoustics, Discussion Document on "A Good Practice Guide to the Application of ETSU-R-97 for Wind Turbine Noise Assessment", Consultation, July 2012.

ISO 9613-2 (1996) Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation. International Standards Organisation.

The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017.

Welsh Assembly Government, Technical Advice Note (TAN) 8, 'Renewable Energy' (2008).

Welsh Government, 'A noise action plan for Wales 2013-2018' (2013).

The Working Group on Noise from Wind Turbines (1996) The Assessment and Rating from Windfarms. ETSU Report ETSU-R-97.

12 Water Resources and Ground Conditions

12.1 Introduction

This chapter of the ES assesses the likely significant effects of the proposed development with respect to water resources and ground conditions, including hydrology, hydrogeology and the water quality of the proposed development at Foel Trawsnant. The area within the wider 'site boundary' encompasses 117.6ha, whereas the 'planning boundary', within which the wind farm associated infrastructure sits, encompasses 46.5ha. The 'site boundary' corresponds to the area on which previous EIA studies (2014) were based. To ensure a consistent and robust approach, the EIA for the amended scheme is also based on this 'site boundary'. Within the following chapter these terms will be referred to for the purposes of describing the baseline environment and discussing potential effects from the proposed development.

It should be read in conjunction with the development description provided in **Chapter 5** and with respect to relevant parts of **Chapter 9: Non-Avian Ecology**, where common receptors have been considered and where there is an overlap or relationship between the assessments of effects.

This chapter provides an update to the assessment presented in the 2014 ES (Ref. 24311rr073i1) for the 13 turbine wind farm on land at Foel Trawsnant which was subsequently approved. A review of the baseline and design information in the 2014 Environmental Statement (ES) for the approved 13 turbine layout has informed the parameters of this updated assessment for the 11 turbine amendment as set out in Sections **Error! Reference source not found.** and 12.10 within this chapter.

12.2 Limitations of this assessment

There are no limitations relating to water resources and ground conditions that affect the robustness of the assessment of the potential significant effects of the proposed development.

12.3 Policy and legislative context

Planning policy

Table 12.1 lists the issues from the relevant planning policies that are relevant to Water Resources and Ground Conditions.

Table 12.1 Policy issues considered in preparing the water resources and ground conditions assessment

Policy reference	Policy issues	Considered in section
National planning policies		
Technical Advice Note (TAN) 15: Development and Flood Risk (2004).	The key planning objectives of TAN15 are to avoid inappropriate development in areas of high flood risk. Flood risk zones are depicted on the Development Advice Map (DAM) based on definitions of development vulnerability. TAN15 is supplemented by additional climate change guidance published by the Welsh Government (Welsh Assembly Government, 2016). Where development has to be considered in high risk areas, only those developments that satisfy the 'Justification Test' should be located in such areas. TAN15 also discusses management of surface water (including the use of Sustainable Drainage) and climate change effects.	12.5
Planning Policy Wales (PPW) (Edition 9; 2016 and Edition 10 Consultation draft; 2018)	PPW9 sets out the land-use planning policies of the Welsh Government and forms a strategic framework to guide development. Section 4.5 requires 'planning for the consequences of climate change and states that consideration of climate change impacts should use the latest set of UK Climate Projections. The consultation draft of PPW Edition 10 was issued for review in March 2018. The responses to this consultation are currently being reviewed. The PPW10 draft does not contain any additional relevant policies further to those provided in PPW9.	12.5
Development plan policies		
Neath Port Talbot County Borough Council Local Development Plan (2016) Strategic Policy 1 (SP1) Climate Change	SP1 accounts for increased flood risk to ensure that no highly vulnerable development will be permitted within DAM Zone C2, and development will only be considered in areas where it can be demonstrated that the site can comply with the requirements set out in TAN15.	12.5
Bridgend County Borough Council Local Development Plan 2006 – 2021 (2013), section on Protecting and Enhancing the Natural Environment, ENV6 Nature Conservation	ENV6 states that proposals for development or redevelopment will be required to: In the first instance, retain, conserve, restore and enhance wherever possible existing wetlands, watercourses and ponds; and Where this is demonstrated not to be possible, suitable mitigation or compensatory measures will be required.	12.5 and 12.8
Other Local Plans		
Western Wales River Basin Management Plan (2015)	The plan sets out pressures facing the water environment in this river basin district, and the actions that will address them. It is prepared under the Water Framework Directive and is the second of a series of six-year planning cycles. The current overall status and supporting information with regards to individual watercourses is presented within the plan.	12.5

Legislative context

Water Framework Directive

The European Commission's (EC's) Water Framework Directive (WFD) is focussed on delivering an integrated approach to the protection and sustainable use of the water environment on a river basin scale (WFD, 2015). One of the primary objectives of the Directive is for individual water bodies to achieve 'good status' which, for surface water bodies, requires both good ecological status and good chemical status to be achieved. For groundwater bodies, good status is achieved when both quantitative status and chemical status are at least

good. A central principle of the WFD is that River Basin Management Plans (RBMP) are prepared to set out how the water environment within each River Basin District (RBD) will be managed over a succession of planning cycles. The second cycle of the RBMPs cover the period from 2015 – 2021. Foel Trawsnant is located within the Western Wales RBMP area.

Other relevant legislation

Other legislation relevant to the assessment of effects on water resources and ground conditions includes but is not necessarily limited to:

- Environmental Permitting (England and Wales) (Amendment) (No. 2) Regulations 2016;
- Directive on Environmental Quality Standards (2008/105/EC) also known as the Priority Substances Directive, as enacted into domestic law by the 2015 WFD (2015) Directions;
- Floods and Water Management Act 2010;
- The European Union (EU) Floods Directive (2007/60/EC), as enacted into domestic law by the Flood Risk Regulations 2009;
- Water Act 2003;
- Environment Act 1995;
- Water Resources Act, 1991;
- Environmental Protection Act 1990; and
- Control of Pollution Act 1974.

Technical guidance

Guidance related to the water environment and best practice measures during design and construction includes:

- Revised Netregs (2017) Guidance for Pollution Prevention (GPPs), including GPP2: Above ground oil storage tanks, GPP5: Works and maintenance in or near water, PPG7: Safe storage – The safe operation of refuelling facilities, and PPG21: Pollution incident response planning;
- CIRIA Report C753 (2015) The SuDS Manual;
- CIRIA Report C532 (2001) Control of water pollution from construction sites; and
- CIRIA Report C692 (2010) Environmental good practice on-site (third edition).

A list of full references can be found in Section 12.15.

12.4 Data gathering methodology

The water quality, resources and flood risk baseline has been developed based upon of information collected during a desk-based assessment of existing data and targeted site walkover surveys.

Desk study

Baseline data have been primarily derived from that held/published by Natural Resources Wales (NRW), Ordnance Survey (OS), the Coal Authority, and local authorities, comprising of Neath Port Talbot and

Bridgend County Borough Councils. Each of these organisations were contacted to receive updates to the existing information presented in the 2014 ES, in order to validate and supplement baseline findings.

Sources of information used for the Water Resources and Ground Conditions assessment are listed in **Table 12.2**.

Table 12.2 Sources of desk study information for water resources and ground conditions

Source	Data
Rainfall	Centre of Ecology and Hydrology (CEH) (2009) Flood Estimation Handbook (CD ROM v3)
Topography	Ordnance Survey mapping
Flood Risk	NRW (2018) Flood Risk mapping – risk of flooding from tidal, fluvial and surface water sources
Surface Water Quality	NRW (2018) 'Water Watch Wales Map Gallery' online interactive maps Western Wales (2015) River Basin Management Plan
Soils and Landuse	Cranfield University Soilscapes website (2018)
Geology	British Geological Survey (BGS) website (2018) Coal Authority Report (received 20 March 2018)
Groundwater	NRW '(2018) Water Watch Wales Map Gallery' online interactive maps British Geological Survey (BGS) website (2018)
Water Resources (abstractions and discharges)	Neath Port Talbot County Borough Council data request (received 26 April 2018) Bridgend County Borough Council data request (received 25 April 2018) NRW data request (received 10 April 2018)
Designated Sites	MAGIC natural environment map viewer (2018)

Survey work

A site walkover was undertaken on 30 October 2013 by hydrology and water quality technical specialists to inform the 2014 ES chapter. This was supplemented by a site walkover undertaken on the 19 April 2018 to validate and verify baseline conditions. The proposed access tracks and the 11 turbines were visited on foot during both visits in order to critically assess the draft design plans with regards to water resources and ground conditions.

12.5 Baseline conditions

Current baseline

Topography and hydrology

The site boundary extends across much of Foel Trawsnant, an upland area situated between Duffryn to the north and Nantyffyllon to the southeast, approximately 10km northeast from the south coast of Wales at Port Talbot and 15.5km southwest of the Brecon Beacons National Park boundary.

Figure 12.1 presents the elevation across the site. The maximum elevation within the site boundary is 369m AOD (peak of Foel Trawsnant). The minimum elevation within the site boundary is approximately 230m AOD on the northwest site boundary, where Foel Trawsnant slopes off towards the Afon Afan.

The site boundary is predominantly located in the surface water catchment of the Afon Afan. The site is drained by a number of tributaries of the Afon Afan which rise within its boundary. The catchment area of the Afon Afan upstream of its confluence with Nant Cynon is 53km^2. A portion of the site access road along an existing forestry track is located within the Ffrwd Wyllt catchment (Nant Drysiog sub-catchment). A small part of the eastern portion of the site boundary and access road is located within the Afon Llynfi catchment (Nant y Crynwydd sub-catchment). **Figure 12.2** displays the watercourse catchments for those tributaries concurrent with the Site boundary i.e. tributaries of the Afon Afan and the Ffrwd Wyllt. **Table 12.3** gives the area of the site which falls into each surface water catchment, as well as other key catchment information discussed in later sections.

Table 12.3 Summary of key catchment characteristics

Catchment (Main River Catchment)	**Area of Site within Catchment**	**Proportion of Site within catchment**	**Key Catchment Descriptors**			
			Total Catchment Area (km^2)	**Upper* Catchment SAAR (mm)**	**Upper* Catchment SPRHOST (%)**	**Upper* Catchment BFIHOST**
Afon Afan main river catchment						
Nant yr Hwyaid	0.679	0.597	0.82	1883	48.15	0.382
Nant Cynon	0.283	0.249	2.7	1882	47.91	0.384
Nant Tryfal	0.087	0.077	1.23	1960	43.13	0.426
Unnamed Catchment NW*	0.052	0.046	-	1883**	48.15**	0.382**
Afon Llynfi main river catchment						
Nant y Crynwydd	0.008	0.007	0.68	1795	43.5	0.389
Ffrwd Wyllt main river catchment						
Nant Drysiog	0.019	0.017	2.18	1848	40.39	0.447
Site Weighted Average			**-**	**1887**	**47.54**	**0.387**

Table notes; Blaen Nant and Nant y Ffyllon catchments are not included as the area of the proposed development site falling within these catchments is extremely small (equal to or less than 0.006km^2) and no development in planned in these areas (see **Figure 12.2**). Observations of the local topography during the walkover survey (as discussed in **Table 12.4**) confirm that the site area will not drain to the Blaen Nant catchment at all.

Data Source: (CEH) (2009) Flood Estimation Handbook (CD ROM v3)

* Referring only to that part of the catchment within the site boundary

**Not included in FEH CD ROM, area-scaled values from the closest catchment are used as substitute.

The Afon Afan and Ffrwd Wyllt are NRW 'main rivers' (none of the watercourses within the site boundary are NRW 'main rivers'). The Afon Afan is approximately 18km in length from source to its discharge to the Bristol Channel at Port Talbot.

All proposed development activities are located within the Afon Afan catchment. The area of the site within the Afon Afan catchment is split across four main tributary sub-catchments (as illustrated in **Figure 12.2**):

- Nant Cynon;
- Nant yr Hwyaid;
- Nant Tryfal; and
- an unnamed catchment ('Unnamed catchment NW').

The majority of the proposed development infrastructure (e.g. six out of the eleven turbines) is located in the Nant yr Hwyaid sub-catchment which flows in a north-easterly direction before it converges with the Afon Afan. Three turbines are located within the Nant Cynon sub-catchment which also initially flows northwest and flows into the Afon Afan downstream of the Nant yr Hwyaid. A further two turbines are located within the Nant Tryfal sub-catchment which flows north before converging with Afon Afan upstream of the Nant yr Hwyaid. There are no proposed development activities within the 'Unnamed Catchment NW'.

The Nant yr Hwyaid watercourse originates at National Grid Reference (NGR) 283590, 194380 with a reach of approximately 750m within the site boundary. Nant Tryfal originates at NGR 283950 193905 with a 200m reach within the site boundary. Two small tributaries of Nant Cynon originate at NGR 283808 193618 and 283925 194093 with reaches of 317m and 472m respectively within the site boundary.

Blaen Nant is a small watercourse with a catchment boundary that runs adjacent to the site boundary in the northeast. The walkover survey on in October 2013 confirmed that the planning application boundary does not extended into the Blaen Nant catchment due to the local topography and an embanked field boundary (see photo 946, **Appendix 12A**) that runs along the subcatchment watershed.

A small tributary ditch of the Nant Drysiog passes beneath the existing forestry track at approx. NGR 283800, 192950. Some upgrading of this forestry track may be required as part of the scheme, in order to accommodate site plant, however the extent of works here will be minimal.

The watercourse channels across the planning boundary were found to be generally small in size i.e. less than 1m in width. At the point at which the Nant yr Hwyaid crosses the site boundary it was less than 1.5m in width at the time of the site visit in October 2013 (see photo 024, **Appendix 12A**). A number of the smaller tributary channels (of all tributaries) did not contain any visible flow in their headwater sections i.e. in the region of proposed infrastructure, even though the visits in October 2013 and April 2018 were carried out after large rainfall events.

Those hydrological features identified and verified during the initial and subsequent walkover surveys are presented in **Appendix 12A**, which should be read in conjunction with **Figure 12.3** - Walkover survey map (with photograph target numbers) and **Appendix 12A** containing walkover photographs.

Table 12.4 Summary of hydrological walkover notes

Feature	Discussion (photo number - Appendix 12A)[63]
Spring PWS at NGR 283700,195300	Open topped collection tank collecting surface water for farm water supply (agricultural building supply). (937; 938). Stream likely to be partly fed by Blaen Nant watercourse, rather than pure spring fed, given land contours.
T1	The proposed turbine T1 is located on a shallow slope near to the proposed contractors compound (T1 compound) (see 001 for view of T1 location towards the access track and the proposed contractors' compound location and 002 for view of ground conditions). The location is close to the catchment boundary of the Nant y Ffyllon but the walkover confirmed that surface water drainage would be to the west, i.e. to the Nant Cynon subcatchment.
Contractors compound (nr T1)	The contractors' compound near T1 is located near to the boundary of the Nant Cynon and Nant y Ffyllon subcatchments. The hydrological walkover confirmed that its entire area would drain to the Nant Cynon catchment. Photo 006 shows the view along the existing trackway (looking approx. west) that intersects the proposed area of the contractor's compound.
T2	The proposed T2 location is located in close proximity and to the north of an area on the same slope that was found to be 'issuing' or seeping small volumes of groundwater. This small spring feature which is marked on **Figure 12.3** is propagated as an area of relatively wet ground that has a resultant difference in vegetation (Juncus sp) relative to the surrounding grass. If the access track to T2 needs to cross this distinct area of wet ground, provision for lateral drainage (horizontal drainage under the track) should be ensured to maintain this water pathway. The 'issuing' water is of a small volume and is directed into the existing plantation; it does not support any valuable habitat and the maintenance of flow pathways is of greatest importance to ensure no build-up of saturation upslope of the proposed access track.
T3	The proposed T3 location is approximately 35m from a small tributary of the Nant Cynon. Photo 010 shows the view down the shallow slope towards the tributary. Photos 011 and 012 show the view u/s and d/s respectively on this small tributary. The T3 location is on a grassed field and beyond the field boundary; rough moorland grasses and rushes form a buffer strip (approx. 5m wide) adjacent to the watercourse.
Existing pipe culvert d/s of T3	On the small watercourse d/s of the T3 location (approximately 75m from the T3 location) an existing pipe culverts the watercourse beneath a track. This 0.8m diameter culvert can be seen in 013 (d/s) and 015 (u/s). The upstream entry to the pipe would benefit from clearance of accumulated sediments to allow full conveyance of high flows.
T4	The proposed T4 location is located approx. 35m from the existing plantation boundary (upslope) in a grassed field. The view down-slope is shown in photo 016 with the ground vegetation shown in 017. Surface runoff would be towards the Nant yr Hwyaid (located >200m away).
T5	Surface water drainage from the proposed location of T5 would be back towards the plantation in a diffuse SE direction (shallow slope). The view downslope is shown in 019 and the immediate ground conditions are shown in 020. The landcover is different along the plantation at T5 compared to the grassland at T4 and the change is obvious in 018 taken looking along the field boundary at the corner of the plantation.
T6	The proposed T6 location is situated on the broad domed top of Cefn yr Argoed. The slopes are shallow and runoff will occur in a diffuse manner in a northwesterly direction. The view down-slope is shown in 021 and the ground conditions are shown in 022.
T7	The proposed T7 location is on a grassed slope (995 and 996) which will drain to the Nant Tryfal watercourse approximately 80m away. The ground conditions appeared firm and dry.
Potential small 'GW issuing' near T7	On the slope that is crossed by the proposed access track to T7, there was identified to be a distinct patch of Juncus sp vegetation which may be indicative of a small degree of groundwater seepage or 'issuing'. The slopes immediately u/s of this area are firm and dry and inspection of the

[63] Initial observations were made and photographs were taken on visit on 30th October 2013. On the subsequent visit on 19 April 2018 observations were validated.

Feature	Discussion (photo number - Appendix 12A)[63]
	area with Juncus sp cover did not find saturated ground of any degree, so any potential water issuing is of very small scale. This area is marked on **Figure 12.3** and should be avoided by the route of the access track (no additional buffer required beyond direct avoidance).
T8	Located near to the watershed boundary of the Nant yr Hwyaid and the Nant Tryfal subcatchments, but the walkovers have confirmed that surface waters likely to drain towards the Nant Tryfal. Ground conditions at the time of the walkovers were wet, but firm (see 984 for view upslope towards T8 and 987 for view down slope from adjacent to proposed T8 location). T8 proposed location approximately 25m from the nearest drain (at the point of the small culvert under an existing track – culvert at NGR 284000, 194000).
Contractors compound (nr T8)	The proposed contractors' compound near T8 covers a large, relatively flat area across the top of Foel Trawsnant, as shown in photo 974 (down-slope facing direction). The majority of the area was found (at the time of the site visits) to be dry underfoot and it is all covered by long, rough, acidic, upland grass, which would in itself act as an effective sediment runoff barrier.
Saturated ground at NGR 283922, 194093	At the catchment boundary between Nant Cynon and Nant Tryfal at NGR 283922, 194093 two water features 'issue' and flow in opposite directions, at this point it was noted that the ground was saturated and boggy, with pools of standing water (see for example photo 975). This location is situated in close proximity to T8 and the contractors' compound.
Small existing culvert at NGR 284000,194000	A small pipe culvert (979; 981; 983;985) transfers water under a little used farm track at NGR 284000,194000, near to the proposed T8 location. The culvert was blocked with debris and silt, causing an area of pooled water and overflow. Failure to transfer water effectively may be contributing to some of the saturated, boggy area noted at NGR 283922, 194093. It is also resulting in exposure of soil and track deterioration for ~10-15m from culvert in a SE direction (984).
T9	Located in an area with distinctive long moorland grasses (see Ecology discussions for habitat characterisation in Section 9.3 in **Chapter 9: Non-Avian Ecology**) (968). View down-slope shown in photograph 968. Dry underfoot. Grasses will offer especially good sediment interception potential i.e. will help to minimise any runoff of suspended sediment.
Stream crossing point	A small tributary of the Nant Cynon is proposed to be crossed at NGR 283700,194100, south of T9. Photographs of the crossing point and the tributary are shown in photos 969 to 973. The tributary was found to be a very small stream approximately 0.25m in width. This main stream channel sits at the bottom of a shallow (approx 1.2 m) v profile, the cross section of which sits below the level of the adjacent land. The cross section of this small stream thus lends itself well to a single span open culvert or piped culvert with little embankment type earth works necessary.
T10	Located in an area with distinctive long moorland grasses (see Ecology discussions for habitat characterisation) (963). Views down-slope shown in photographs 961 and 962. Grasses will offer especially good sediment interception potential i.e. will help to minimise any runoff of suspended sediment.
Source of Nant yr Hwyaid	The proposed T10 location and associated access track is located approx 145m away from the source of the Nant yr Hwyaid according to OS mapping, however field verification found that small springs appear over a large area (as marked on **Figure 12.3**) which is not clear from OS mapping– see 965; 964; 966 and 967. A buffer zone to prevent development across this area should be imposed.
Saturated area	A shallow depression in the local contours appears to have slightly different vegetation cover (greater proportion of Juncus sp) which is indicative of greater saturation (as marked on **Figure 12.3**). Potential therefore for significant shallow subsurface flow pathway (see 960). Area should be avoided.
T11	Located on the edge of a field of distinctive long moorland grasses (see Ecology discussions for habitat characterisation) (949; 957). Dry underfoot (958). Grasses will offer especially good sediment interception potential i.e. will help to minimise any runoff of suspended sediment. Western boundary of field found to have a shallow drainage ditch (955; 956) which did not contain any water at time of visit – although Juncus sp. were noted which may be indicative of saturation. The northern boundary of the field was also found to have a shallow drainage ditch (not marked on OS)

Feature	Discussion (photo number - Appendix 12A)[63]
	which the proposed infrastructure will overlay (see 950 for crossing location at NGR 283500,194700). The bed of this ditch was dry and the grass vegetation gave the impression of little water inundation (i.e. little flow occurrence). The NW corner of the field where the two boundary ditches converge is considered to be the start of the downstream tributary ditch (although even this will be largely ephemeral); this downstream ditch is shown on the OS and will form a tributary of the Nant yr Hwyaid (952 etc).
Slope 240m downgradient of T11	Located on very shallow slope on upland, grazing pasture, which is well drained, i.e. no saturation. 947 and 948 show views downslope.
Raised field boundary	A raised field boundary, which effectively isolates the Blaen Nant subcatchment from any potential influence by surface water runoff from the site works. Photo 946 shows view towards this feature and 945 shows view from top of the feature looking E down the most upstream extreme of the Blaen Nant.
Slope 360m downgradient of T11	Located on a shallow slope immediately above a steeper slope into a valley (940; 941; 943). Land cover is rough, upland pasture grassland; well drained, i.e. no saturation (942).
Manure storage in development area	Farm bedding manure is being stockpiled (944). Leachate presumably high in ammonia is 'scorching' the grass for approx 3m downslope, but no further visual effects are evident.
Nant yr Hwyaid at site boundary	For context of scale, the Nant yr Hwyaid was visited at the site boundary (approx NGR 282900,194800) (023; 024) and it was found to be less than 1.5m in width at the time of the site visit.

Flow data are available for the Afon Afan from the NRW website. The nearest gauge on the Afon Afan is located at Cwmafan, approximately 4km downstream of the site boundary. The Afon Afan has a catchment area of 81.5km^2 at this location and consequently the flow data from this gauge are not considered to be representative of flow conditions in the small watercourses draining the site.

Greenfield or rural runoff rates at the Site have been estimated using the Institute of Hydrology Report 124 (1994) (IoH124) method (see Equation 1 below) and are displayed in Error! Reference source not found..

$$QBAR\ rural = 0.00108 \times Area^{0.89} \times SAAR^{1.17} \times SOIL^{2.17} \qquad Equ.1$$

Data used for the runoff calculation are as follows:

SAAR 1888 mm/yr (CEH)

Soil type Soil class 5, soil index value (SOIL) = 0.50; from Winter Rainfall Acceptance (WRAP) Map, Flood Studies Report (FSR) Volume 5 (NERC, 1975), which equates to a very high runoff rate.

FSR Growth Region (NERC, 1975) 9

Area Drainage area considered (runoff site area), in km2

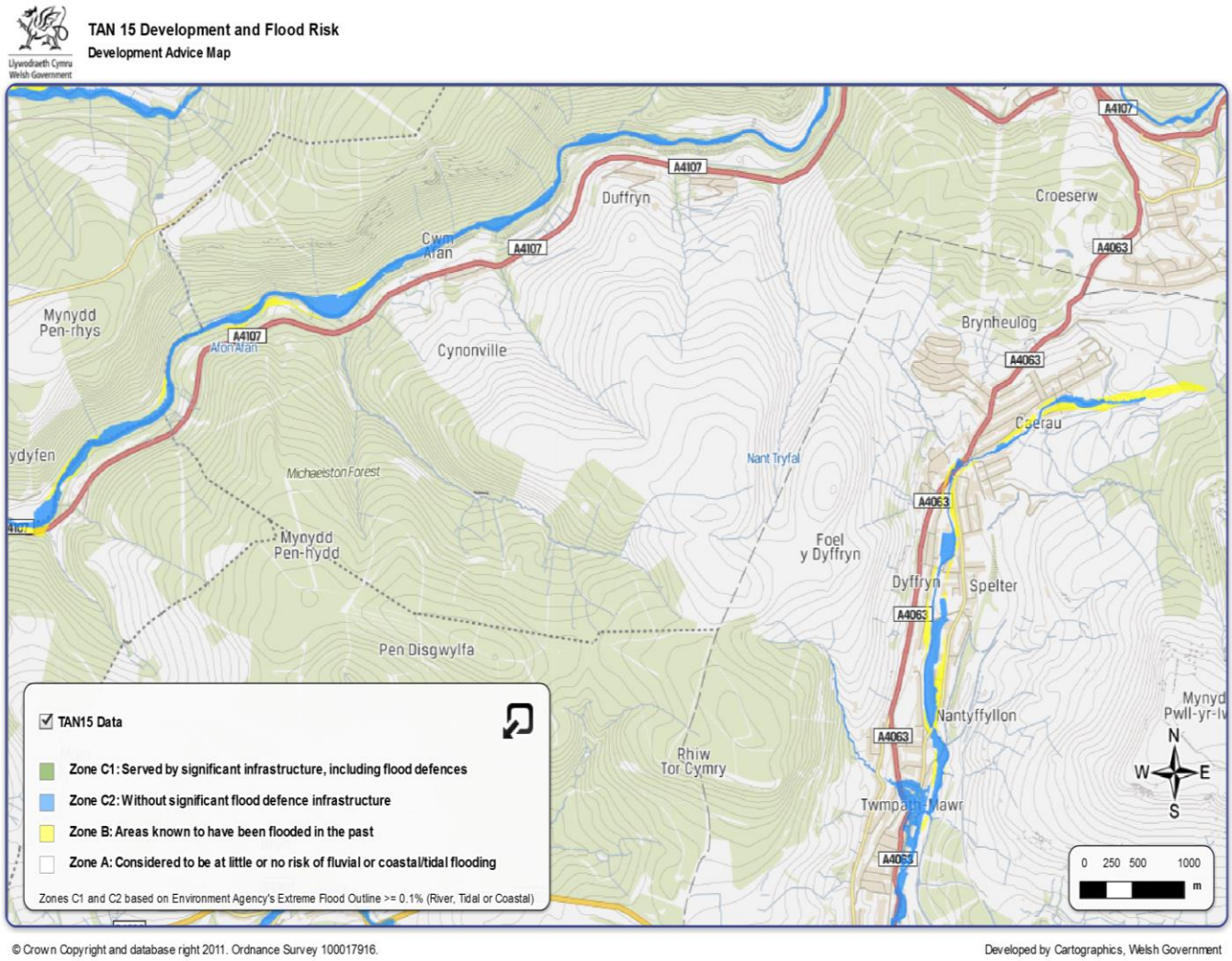
Table 12.5 Greenfield runoff rates (IoH124)

Catchment	Site area (km^2)	SOIL	SAAR	Q_{BAR} (l/s/ha)	Q100 (l/s/ha)	Q_{BAR} (l/s)	Q100 (l/s)
Site	1.137	0.50	1888	16	35.1	1831	3992

Flood risk

The TAN 15 Development Advice Map (DAM) online flood map shows some areas at risk of fluvial flooding along the Afon Afan, but these are limited to the immediate riparian corridor (<50 m from the river – see **Plate 12.1** below). The development site is entirely in Flood Zone A (considered to be at little or no risk of fluvial flooding). The TAN 15 DAM however only includes catchments of greater than 3km^2; the majority of the site falls within catchments of less than 1km^2. The steep nature of most of the site means that there is little risk of flooding from watercourses. On the edge of flatter hilltops (e.g. at Foel Trawsnant between T9 and T10) where there is peaty topsoil and surface waters 'issue' there is increased risk of flooding from waterlogged soils and standing water, which dictates that such areas should be avoided with regard to development where possible. **Figure 12.4** shows that NRW mapped surface water areas of Low Risk (between 0.1% – 1% AEP) intersect the planning application boundary, along the source headwaters of the Nant yr Hwyaid, Nant Cynon, and Nant Tryfal.

Plate 12.1 TAN 15 Development advice map



Climate

Standard Annual Average Rainfall (SAAR) for 1961-1990 information obtained from the Centre for Ecology and Hydrology (CEH) Flood Estimation Handbook (FEH) CD ROM (version 3) for each catchment is displayed in **Table 12.5**. **Table 12.3** also gives a weighted average for the site which is 1887mm.

Geology, hydrogeology and soils

Geology

The bedrock in the area is the Rhondda Member, consisting of sandstone and thin interbedded coal seams. The area also has some underlying Llynfi Member, which is a conglomerate of sandstone with thin mudstone/siltstone and thin coal interbeds. The BGS Geoscience Data Index shows isolated areas of till (diamiction) that overlie the bedrock in the valleys of Nant yr Hwyaid and the uppermost reaches of Nant Tryfal and Nant y Ffllon. It also shows that superficial deposits are absent for most of the site, including along the hilltops and side slope areas. The BGS data does not show peat coverage at the visible 1:50,000 scale. As noted there are, however discrete, isolated pockets of shallow peat which were identified on the flatter hilltops during the October 2013 site visits (see section on soils below). The BGS data also shows some very isolated, small unclassified landslide deposits within the site. There is no artificial ground within the site boundary.

A Coal Authority report confirms that the development area is within the likely zone of influence from workings in 11 seams of coal at shallow to 780m depth. The planning boundary is not in the likely zone of influence of any present underground coal workings. The planning boundary is not in an extent that is likely to be affected at the surface from any planned future workings. The coal authority report (see **Appendix 12B**) provides approximate positions of three mine entries within the planning boundary.

According to the report, the Coal Authority "*is not aware of any evidence of damage arising due to geological faults or other lines of weakness that have been affected by coal mining*".

Although it is anticipated that they will not have any cause for concern, given the proposed development overlies areas of coal, the Coal Authority should be consulted with regards final engineering design.

Hydrogeology

The solid bedrock geology beneath the site is classified as a "Secondary A" aquifer by NRW and BGS. This is defined as "*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*". Under the Water Framework Directive characterisation the entire development site is underlain by a single groundwater body, the Swansea Carboniferous Coal Measures.

Base Flow Index (BFI) was developed to help assess the low flow characteristics of rivers in the United Kingdom.

> *"The BFI may be thought of as a measure of the proportion of the river runoff that derives from stored sources; the more permeable the rock, superficial deposits and soils in a catchment, the higher the baseflow and the more sustained the river's flow during periods of dry weather". NERC (2008).*

The weighted average BFI for the site is 0.39 which indicates that the site is relatively impervious with minimal lake or reservoir storage and the soils are clayey.

The BGS Groundwater Vulnerability Map classifies the majority of the site on higher ground as 'minor aquifer low', although small areas of the lower access routes are within a 'minor aquifer high' area, which indicates that the majority of the sites minor aquifer has low vulnerability of contamination from surface land use activities. The site is not located within a groundwater Source Protection Zone.

Soils

Consultation of the Cranfield University Soilscapes website finds that the vast majority of site is characterised as having 'very acid loamy upland soils with a wet peaty surface'. All of the site (other than a short section of the access road, which follows the route of an existing forestry track) would be located on soils of this type. The peat survey carried out in 2013 (**Appendix 12C**) shows that across the majority of the site there is a thin peat layer between 0.1 and 0.3m in depth. Note that in some areas the peat is thicker (very localised depths of between 0.7 and 0.8m) and in others there is none at all.

Three known disused mine adits have been identified (see **Appendix 12B**) within the planning boundary. These adits may provide a preferential pathway by which surface waters may interact with groundwater or vice versa.

Land use

The site consists of upland grassland across its full extent, with the exception of the access track which follows existing forestry (coniferous) tracks. The grassland within the site boundary is used for rough grazing and a range of grass types are evident across the site, some more intensively grazed than others. At the time of the site visit in April 2018, sheep and cows were grazing over the majority of the site.

In the valley bottom to the north there are small former mining villages and to the east of the proposed access track is the town of Maesteg. To the west and south is woodland and to the north is further grassland.

Surface water quality

The two main rivers that the site discharges to i.e. the Afon Afan and the Ffrwd Wyllt, are characterised as WFD waterbodies, for which NRW report surface water quality in the Western Wales RBMP. The Afon Afan and the Ffrwd Wyllt waterbodies are assessed as being of Moderate overall status due to biological elements (fish) being of less than Good Status, and they are both classed as a 'Heavily Modified Water Body' (HMWB). The Afon Afan also has supporting elements (quantity and dynamics of flow) which are less than Good Status. For a HMWB ecology is measured on a scale of ecological potential, as opposed to ecological status. Ecological potential is defined as the best ecology that the water body can achieve without compromising its human use. A summary of the water quality information contained in the Western Wales 2015 RBMP for WFD Cycle 2 is presented in **Table 12.6**.

Table 12.6 Local WFD waterbody water quality data

Element	**GB110058026130**	**GB110058026100**
Waterbody	Afan-conf with Corrwg to confluence with Pelenna	Ffrwd Wyllt – headwaters to tidal limit
Current overall ecological status	Moderate (Very Certain), HMWB	Moderate (Very Certain), HMWB
Chemical Status	Good	Good
Status Objective	Good Potential by 2027	Good Potential by 2027
Biological Elements		
Fish	Moderate	Moderate
Macroinvetrates	High	High
Phytobenthos	High	High

Element	GB110058026130	GB110058026100
Chemical Elements		
Ammonia (Phys Chem)	High	High
Dissolved Oxygen	High	High
pH	High	High
Phosphate	High	High
Temperature	High	High
Copper	Good	Good
Zinc	Good	Good
Ammonia (Annex 8)	High	High
Supporting Conditions		
Quantity and Dynamics of Flow	Does not Support Good	Supports Good
Morphology	Supports Good	Supports Good

Both of the local WFD waterbodies in the vicinity of the site are failing to meet Good Ecological Potential as a result of being at less than Good status for fish. Besides fish, copper and zinc, both of the waterbodies are found to have high current status for all other constituent chemical elements. The Afon Afan and the Ffrwd Wyllt are categorised as Moderate status for fish. There are a number of reasons why fish could be failing to reach good status, for example relating to barriers to migration or as a result of recruitment issues. Overall the information in **Table 12.6** indicates that the surface water from the watercourses draining the site is either of good or high quality.

The minor watercourses draining the site boundary, and forming tributaries of these rivers, are not defined as waterbodies under the WFD, and no other data are available to define water quality within them. It is notable that almost the entire downstream area of the Nant Cynon and the Nant Drysiog subcatchments i.e. the areas downstream of the site boundary, are afforested with coniferous plantation, which is likely to have a large influence on the water quality and runoff characteristics of these tributary streams. Coniferous plantations can potentially affect the hydrological environment via (during standing and deforestation phases) acidification processes, sediment delivery, nutrient enrichment, shade and shelter, water yield and peak flow considerations etc. It is likely therefore that the sensitivity of the Nant Cynon and Nant Drysiog watercourses on site is reduced because of the land use downstream of the site.

Groundwater quality

The site is underlain by a single WFD groundwater body (GB41002G201000), the Swansea Carboniferous Coal Measures. The current overall status of the waterbody is reported by NRW within the 2015 Western Wales RBMP to be Poor, due to the chemical classification component being of Poor Status.

There are a number of disused adits within the development site, however considering the Good Chemical status of the surface water bodies in and around the site, as shown in **Table 12.6**, the current Poor Status of the groundwater body underlying the site is likely to be related to failures or features (e.g. mine workings) elsewhere, rather than in the immediate vicinity of the site.

Historic mine workings

The latest Coal Authority Report (received in April 2018) confirms that the planning boundary is within the likely zone of influence from workings in 11 seams of coal at shallow to 780m depth, which were last worked in 1980. The planning boundary is not in the likely zone of influence of any present underground coal workings and is not in an area that is likely to be affected at the surface from any planned future workings.

The previous Coal Authority Report (received in September 2013) indicated that there are 10 historic mine entries within the wider site boundary which are shown on a plan. Within 20 metres of the planning boundary, there are three historic mine entries confirmed, and the latest Coal Authority Report (**see Appendix 12B**) which is targeted around the proposed infrastructure works provides approximate positions within the planning boundary. The records disclose the following information for each historic mine working:

- 283193-008 - No treatment details;
- 284193-036 - Adit sealed with compacted brick rubble and backfilled with soil. 4.3 m square fence erected; and
- 283193-007 - No treatment details.

As already reported, the Coal Authority "*is not aware of any evidence of damage arising due to geological faults or other lines of weakness that have been affected by coal mining*".

It has not received a damage notice or claim for the site boundary or within 50m of its extent since October 1994, and it has no record of a mine gas emission requiring action.

A Coal Stability Risk Assessment, undertaken by James Associates, is presented in **Appendix 12B.** It identified six proposed turbines which lie within zones of potential impact associated with abandoned mining. The assessment recommends a programme of site investigation works be undertaken around the following turbines: T1, T2, T3, T4, T8 and T9, in addition to further mitigation measures which are suggested in Section 12.8 within this chapter.

Water abstractions

Information on licensed abstractions has been obtained from NRW (5km radius from a central NGR of 283905, 193920), which is presented within **Table 12.7**. The Glyncorrwg Ponds abstraction is located 4.1km to the north east of the site boundary, and the Nant Cwm Du is located 4.3km to the south east of the site boundary. No pathways exist via between these abstractions and the proposed development, therefore they have been scoped out from further assessment. The Maesteg Golf Club groundwater abstraction is located approximately 470m to the south of the site boundary entrance off the B4282, and this licensed abstraction has been considered further within Section 12.10.

Information on Private Water Supplies (PWS) was requested from Bridgend County Borough Council and Neath Port Talbot County Borough Council. Bridgend Council provided details of a groundwater spring situated approximately 770m to the west of the site boundary, within the Unnamed SE Catchment of Nant Llynfi. Neath Port Talbot County Borough Council provided details of a single private water supply, within the same catchment as the proposed development (Nant yr Hwyaid), as presented in **Table 12.7**. Both of these private water supplies have been considered further within Section 12.10.

Table 12.7 Abstractions in the vicinity of the site boundary

Abs No.	Information Source	Name	Grid Reference	Any Other Information	Connectivity
1	NRW	Maesteg Golf Club	283800, 191400	Agriculture and Irrigation (Groundwater spring)	<500m from site entrance (within Nant Cwmfarteg subcatchment) so potential connectivity will be assessed – see PWS discussions in Section 12.10.
2	NRW	Glyncorrwg Ponds Cooperatve Ltd	286600, 197800	Lake & Pond Throughflow	None, within different surface water catchment
3	NRW	Nant Cwm Du at Melin Pont Rhyd Y Cyff	287400, 189400	Production of Electricity Surface Water	None, within different surface water catchment
4	Neath Port Talbot County Borough Council	Nant Y Whiad Farm, Cynoville, Port Talbot	282739, 195085	Private water supply – unknown use. No further info, but likely to be surface water supply given location of stream.	Downstream of site within Nant yr Hwyaid subcatchment. so potential connectivity will be assessed– see PWS discussions in Section 12.10.
5	Bridgend Council	Garnwen Farm, Nantfyllon, Maesteg	284700, 192500	Groundwater Spring	<1km from site access track within Unnamed SE Catchment of Nant Llynfi so potential connectivity will be assessed – see PWS discussions in Section 12.10
6	Walkover	Hendre-owen PWS	283700,195300	Open topped collection tank collecting surface water for farm water supply (agricultural building supply)	None – within Blaen Nant subcatchment.

Water availability

The relevant NRW Catchment Abstraction Management Strategies (CAMS) have been reviewed (i.e. Neath, Afan and Ogmore CAMS, 2014) to provide an indication of the water availability in the local area. The extreme lower reaches of the Afon Afan are reported to be over-abstracted, which affects the freshwater input to the tidal section of the Afon Afan and limits the potential fish migration in the freshwater reaches. The entire Afon Afan water resource management unit is conservatively managed by NRW as being over-abstracted.

The Ffrwd Wyllt assessment was considered in conjunction with the Afon Afan assessment. It is deemed to be over-abstracted due to the large licensed abstraction from the docks.

The over-abstracted resource availability status of these rivers means that there is no water available for future licensing at low and medium flows.

The Afon Llynfi contributes to Water Resource Management Unit 5 of the Neath, Afan and Ogmore part of the 2014 Swansea Bay CAMS. Although a large industrial abstraction occurs on the Afon Llynfi, it is predominantly non-consumptive and the remaining abstractions are all relatively small. The resource availability status of this unit is deemed to be 'Water Available'.

Licensed discharges to water

NRW have provided details of consented discharges within a 5km radius of NGR 283905, 193920, which is presented as **Appendix 12D.** All discharges are located outside of the site boundary.

Designated sites

Defra's interactive MAGIC website has been reviewed and this confirms that there are no water dependent designated sites or species associated with the site boundary, and that there are no aquatic designated sites downstream of the site boundary.

Water dependent habitats

The most notable water dependent habitat present within the proposed development area is the presence of peat.

In order to assess the distribution and depth of peat across the proposed development site a comprehensive peat survey was undertaken as part of the 2014 ES, and the results are presented as peat spot depth and peat depth interpolated area figures presented within **Appendix 12C**.

Although the spatial extent of peat was found to be large i.e. the vast majority of the planning application boundary surveyed was found to exhibit peat deposits, the depth of the peat was generally shallow. The vast majority of the surveyed area was found to have peat depth of less than 0.3m, with large areas particularly in the north and the north west having less than 0.1m peat depth. Six individual cores recorded peat depths of between 0.7 and 0.8m. In all cases these areas of peat between 0.7 and 0.8m deep were found to be very localised. Good coverage of survey locations provides a high degree of confidence in the extent of these deeper pockets, one of which corresponds to an area (around the source of the Nant yr Hwyaid) already identified via the hydrology walkover survey as a potential 'hydrological constraint' that requires a buffer zone. No peat greater than 0.8m depth was found at any location within the planning application boundary.

Summary of the existing baseline and potential constraints to development

The site boundary is in an upland location that drains primarily to the Afon Afan to the north. The site currently comprises rough grassland. Evidence of adits reflects previous mining activity beneath the site. The baseline characterisation identified no significant hydrological constraints to development.

The pertinent aspects of the baseline hydrology and hydrogeology of the site include:

- No main rivers or WFD surface waterbodies within the site. Within 500m of the site are two main rivers. There are several small watercourses within the site boundary. Some of these channels have been found to be ephemeral and were either dry or low during the site walkover in October 2013 and April 2018. The majority of the site is drained by tributaries flowing towards the Afon Afan to the north;
- The current primary land cover is one of long, rough, acidic grasses;
- The site overlies a 'Secondary A' aquifer and a small number of private water supplies (or licensed abstractions) exist in the vicinity of the site boundary;

- Overall Ecological Status of the downstream WFD waterbodies is moderate. There is a failure to meet Good Ecological Potential due to the current assessment of fish populations which is related to physical barriers to migration;
- Water quality of the underlying WFD groundwater body is poor on account of copper concentrations; and
- The extent of peat coverage is large across the site, although depths are generally shallow (<0.3m).

Predicted future baseline

Hydrological systems do not remain constant with time. Changes to the hydrology of the site could occur in future, mainly as a result of land use change and climate change.

The Coal Authority has stated that they do not know of any plans for coal mining at the site in future, although coal is still present and so could potentially be mined again. There are unlikely to be any other substantial changes in land use during the lifetime of the wind farm, given the location and land type. Afforestation could theoretically be possible given the current adjacent forestry plantations however there are no known plans for this. Deforestation of plantation areas is a predicted future activity for large percentage areas of the Nant Cynon and the Nant Drysiog catchments, outside of and downstream of the site boundary. Even assuming good deforestation practice (adhering to UKFS guidelines on Forests and Water) such activities are likely to have considerable effect on the water quality and runoff characteristics of these streams. These activities are anticipated to occur either with or without the presence of the proposed scheme.

Future changes in global climate are predicted. For Wales, the latest climate change predictions are from UKCP09, which indicate changes from the baseline period (1961-1990):

- By the 2020s, the low, medium and high emissions scenarios all predict an increase in winter and summer temperatures. For the medium emissions scenario, the central estimate of increase in winter mean temperature is 1.3°C, and increase in summer mean temperature is 1.4°C.
- By the 2020s, the low, medium and high emissions scenarios all predict an increase in winter rainfall and decrease in summer rainfall. For the medium emissions scenario, the central estimate of increase in winter mean precipitation is 7% and decrease in summer mean precipitation is -7%. Overall there would be little change in total annual rainfall.
- By the 2050s, the low, medium and high emissions scenarios all predict further increase in winter and summer temperatures. For the medium emissions scenario, the central estimate of increase in winter mean temperature is 2°C, and san increase in summer mean temperature is 2.5°C.
- By the 2050s, the low, medium and high emissions scenarios all predict further increases in winter rainfall and decreases in summer rainfall. For the medium emissions scenario, the central estimate of increase in winter mean precipitation is 14% and decrease in summer mean precipitation is -17%. Overall there would be little change in total annual rainfall.

The higher rainfall in winter could result in higher river flows and potentially greater frequency of flooding. The lower rainfall in summer, coupled with higher temperatures, could lead to higher evapotranspiration and drier conditions during the summer months. These potential future baseline changes have been considered in relation to the vulnerability of the receiving environment to major accidents and natural disasters as part of the assessment of effects.

12.6 Consultation

Consultation was carried out with consultees including Neath Port Talbot County Borough Council and Bridgend County Borough Council, NRW and the Coal Authority. Bridgend Council did not make any comments in relation to the scope of the assessment. **Table 12.8** provides a summary of the issues that have been raised by the other consultees and the responses given.

Table 12.8 Summary of issues raised regarding water resources and ground conditions during consultation

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref
NRW advised that baseline monitoring e.g. water features survey should be updated to include any new water features that may have appeared since the last survey was completed.	NRW	The findings of the water features survey was checked and updated during a site visit which was carried out on 19 April 2018. There were no new water resources or ground conditions features encountered during this walkover.	Section 12.5 and **Appendix 12A**
The Coal Authority advised that the proposed development is located within the defined Development High Risk Area, and that the site has been subject to past coal mining activity. In accordance with the risk-based approach, past coaling mining activities should be fully considered as part of the ES; this should take the form of a risk assessment, together with any necessary mitigation measures.	Coal Authority	This assessment has taken into account the Coal Authority Consultation Report received on 20 April 2018. This has helped inform the section on existing baseline conditions, and the further assessment which takes into account appropriate mitigation measures in relation to past coaling land use activities.	Sections 12.5, and 12.10, **Appendix 12B**
The Coal Authority notes the EIA Scoping Report acknowledges that there will be an update to the assessment carried out in the Water Resources and Ground Conditions chapter of the ES, which will constitute the required Coal Mining Risk Assessment. The Coal Authority welcomes this in meeting the requirements of the National Policy. The proposed site layout should be informed by any coal mining legacy features associated with past mining operations.	Coal Authority	The past mining activities including disused mine entries have been described within the hydrogeology part of the baseline section. It has been concluded that although there are 3 disused mine entries and 11 coal seams in the vicinity the planned works area, the site is not in an area that is likely to be affected at the surface from any planned future workings. The Coal Authority will be consulted during the final engineering detailed design of the site layout.	Sections 12.5, 12.10, **Appendix 12B**
There are a number of coal mining legacy issues that can potentially pose a risk to new development and therefore should be considered as part of an Environmental Statement for development proposals within coalfield areas: - The location and stability of abandoned mine entries;	Coal Authority	This assessment has taken into account the Coal Authority Consultation Report, which includes information on these legacy issues, which have been taken into account as part of the baseline and impact assessment, supported by an appendix which investigated previous underground mineworking activity and its potential impact upon the proposed development.	Sections 12.5, 12.10, **Appendix 12B**

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref
- The extent and stability of shallow mine workings; - Outcropping coal seams and unrecorded mine workings; and - Hydrogeology, minewater and minegas			
Consideration should be afforded as part of development proposals and the ES to the following: - If surface coal resources are present, whether prior extraction of the mineral resource is practicable and viable; and - Whether Coal Authority permission is required to intersect, enter or disturb any coal or coal workings during site investigation or development work.	Coal Authority	The past mining activities including disused mine entries have been described within the hydrogeology part of the baseline section. It has been concluded that although there are three disused mine entries and 11 coal seams in the vicinity the planned works area, the site is not in an area that is likely to be affected at the surface from any planned future workings. The Coal Authority will be consulted during the final engineering detailed design of the site layout.	Sections 12.5, 12.10, **Appendix 12B**
Table 2.6 of the report states that the 2013 peat survey found no deep peat deposits (>1m). We advise that NRW considers >0.5m as deep peat. We would therefore require clarified if deep peat deposits are present on site (in accordance with the >0.5m threshold). For any updated surveys carried out, it should be ensured that the standard practice is to carry out 1 peat probe per hectare of development, and then 1 peat core per 10 peat probes, to be consistent with NRW's advice for windfarm applications.	Neath Port Talbot Council	The findings of the 2014 Final Peat Study presented in **Appendix 12C** remain valid. This study comprised of a comprehensive peat survey, with methodologies including peat probing across proposed infrastructure elements and coring at each proposed turbine base. Whilst a few areas of 'deep peat' (>0.5m) were identified, infrastructure has been microsited to avoid these. For example, Turbines 7 and 8, and a section of access track between Turbine 4 and 10, have been microsited to avoid any deeper peat pockets.	Sections 12.5, 12.10, **Appendix 12C**

12.7 Scope of the assessment

The final scope of assessment is as presented above as informed by scoping opinion responses from statutory consultees.

Spatial scope

The site boundary and a 1km surrounding radius has been included within the final study area with regards hydrogeological considerations. A 500m radius beyond the site boundary and all associated downstream watercourses have been considered where relevant to the surface water (hydrology and water quality) assessment.

Temporal scope

The temporal scope of the assessment of water resources and ground conditions effects is consistent with the period over which the proposed development would be carried out and therefore covers the 12-24 month-long construction period and the subsequent 25 year-long operational period.

Potential receptors

The potential receptors that have been identified through consideration of the baseline assessment and the proposed scheme type and extent are as follows:

- On site watercourses – Tributaries of the Nant Cynon, the Nant Hwyaid, the Nant Tryfal and a tributary ditch associated with the Nant Drysiog may potentially be directly affected by the development (in terms of water quality, water quantity and hydromorphology);
- Downstream watercourses – limited to the Afon Afan, which could be potentially indirectly affected by the scheme in terms of water quality and quantity via the pathway of the tributary watercourses which drain from the site. A lack of interaction with the single tributary ditch associated with the Nant Drysiog dictates that there will not be an impact on the downstream water quality and quantity of the Ffrwd Wyllt, which may be scoped out of further consideration in this study;
- Flood risk receptors – people and property downstream of the site boundary along the Afon Afan at risk of fluvial flooding;
- Peat hydrology – Peat is a specifically water dependent soil and habitat type;
- On-site soil hydrology – Further to consideration of peat, shallow hydrological flows within soils is defined as a receptor due to the upland nature of the environment and low weighted BFI;
- Ground stability – Geotechnical and slope considerations for the stability of the proposed development;
- Swansea Carboniferous Coal Measures WFD Groundwater body – with respect to groundwater quality and groundwater quantity; and
- Private Water Supplies (PWS) and a NRW licensed abstraction.

Potentially significant effects

The main types of hydrological issues that could potentially be of concern with respect to the proposed development include:

- The risk of pollution to onsite and downstream watercourses. Run-off, with elevated levels of suspended sediments or contaminated by polluting substances (e.g. concrete and hydrocarbons), may drain to watercourses flowing through and downstream of the proposed development site. Run-off therefore needs to be managed to prevent degradation of the surrounding water features. This would be most relevant during the construction phase due to the level of activity on site, but could also occur to some extent during the operational phase without ongoing maintenance of site infrastructure (e.g. installed trackside and Substation drainage);
- Potential changes to the flow regime in watercourses on the proposed development site and downstream. This could occur due to increasing areas of hardstanding, disruption of flow paths, or changes to drainage regime. This may occur as a result of activities during the construction phase, but with potentially long-term effects as long as the infrastructure remains.;

- Changes to the morphology of watercourses, particularly where watercourse crossings will be provided. Particular consideration needs to be given to the appropriate design of any such watercourse crossings;
- The potential risks to groundwater flow and quality as, even though the proposed development site is underlain by relatively low permeability strata, they are still classified as a Secondary A aquifer. Construction activities will require the use of substances that could be polluting to groundwater, and excavations for turbine bases have the potential to provide rapid pathways to groundwater. Good practice and mitigation therefore needs to be considered to ensure that pollution to groundwater does not occur. This is of most relevance to the construction phase;
- Potential changes to peat hydrology. The 2014 ES contained a standalone Peat Study which remains applicable given that the proposed infrastructure has remained unchanged, apart from the exclusion of two turbines (T12 and T13). Based on the careful design measures which were incorporated during wind farm layout proposals, summarised in Section 12.8 of this report, it is considered that this along with the good construction practice put forward in Section 12.8 will be sufficient to avoid any significant effects as a result of the proposed development;
- Potential implications regarding flood risk. The site boundary is not located within a floodplain (i.e. it is located in Flood Zone A) and as noted in the 2014 ES NRW confirmed it does not require a specific Flood Consequence Assessment. Assessment of fluvial and surface water flood risk is taken into account within consideration of surface water runoff and drainage within this chapter; and
- Potential effects upon private water supplies or other abstractions within the site boundary or downslope of the site boundary (where the site is found to be in the catchment area of the relevant abstraction).

12.8 Environmental measures embedded into the proposed development

A range of environmental measures have been embedded into the development proposals as outlined in Section 5.4 of **Chapter 5: Description of the Proposed Development** of this ES. Measures relating to the Water Resources and Ground Conditions are described below and summarised in **Table 12.10**.

Pollution prevention guidance and pollution prevention plan

Construction Method Statements (CMSs) will be produced for all aspects of site work. A Pollution Prevention Plan (PPP) will be implemented and monitored by the site manager as part of the CMS. The CMS will be consulted upon and approved by the local planning authority and relevant consultees, and it will apply to potentially polluting activities during all phases of the development.

As a minimum the PPP will comply with best practice guidance related to design and construction as advocated by CIRIA and the revised Netregs (2017) Guidance of Pollution Prevention (GPPs) outlined in Section 12.3. The PPP will identify site specific measures, and incorporate a Pollution Incident Plan, which will include emergency contact details, details of spill kits on site, and instructions on actions in case of spillage/emergency.

Construction phase

Buffer zones

As a precautionary measure, buffer (exclusion) zones to water features are adopted as constraints to built development and for incorporation as a construction phase buffer in relation to permissible land uses in proximity to watercourses. During construction these buffers will be avoided except at the locations of the two proposed watercourse crossings.

Establishment of intact vegetated buffer zones between infrastructure (including tracks) and water features allows:

- Protection of water quality by filtering runoff within riparian vegetation before it enters the watercourse (as per SuDS best practice);
- Space for natural fluvial processes such as channel shape and platform adjustment therefore maintaining the natural dynamic balance of river systems and associated habitats;
- Establishment/maintenance of vegetation to stabilise banks and reduce soil erosion;
- Access for the maintenance and inspection of watercourses, and for dealing with pollution incidents; and
- Habitats for plants and animals and maintains wildlife corridors, which can be associated with river networks.

The sensitivity of a watercourse and the associated extent of buffer that it should be afforded, is dependent upon a range of factors, including:

- Environmental designations associated with the watercourse or a downstream environment;
- Fisheries or ecological potential of the water feature or in the downstream environment;
- Size of water feature and its capacity to convey water;
- Water feature morphology (e.g. natural or artificial channel, substrate and banking type);
- Nature and topography of the surrounding land, i.e. wet, poorly drained soils and steep slopes (>10°) would require greater protection; and
- Other sensitivity considerations, e.g. silts/nutrient enrichment/chemical pollution.

In the absence of specific relevant guidance for Wales, additional reference has been sought from other UK sources, e.g.:

- Scottish Environmental Protection Agency (SEPA) and Scottish Natural Heritage (SNH) guidance provided in Scottish Planning Advice No.2 (2011) summarised in the following **Table 12.9**;
- PPG5 "Works in or close to water" which recommends that works such as concrete mixing and washing should take place 10m distant from watercourses; and
- Other best practice in relation to management of sediments and nutrients, e.g. standards of good agricultural and environmental condition (GAECs) under cross compliance (10m buffer around watercourses with regards to application of organic manure).

Table 12.9 SEPA and SNH guidance of watercourse buffer distances

Width of watercourse	Width of buffer strip
Ditches	3m
Less than 1m	6m
1-5m	6-12m
5-15m	12-20m
15m+	20m+

All on-site watercourses (within 100m of any planned development or access routes) are less than or at maximum 1m in width. Based upon the guidance presented in **Table 12.9** buffer strips of 6m width would be appropriate for application across the proposed development, however the scheme has been designed where possible to maximise the distance from watercourses and a presumption of a 20m+ buffer zone was employed across the development during design. Under the final proposed layout there were three locations where the final development layout necessitated a distance of less than 20m from a watercourse thus, although still in excess of the guidance presented in **Table 12.9;** further consideration and specific mitigation measures have been employed at these locations (see **Figure 12.5** and the additional design mitigation below).

Additional design mitigation where buffer zones of <20m are possible

The final wind farm layout was influenced by the requirement to maintain buffer zones around watercourses. The final layout, on account of compromises with regards to elevations and road contours for example, necessitated three locations where development is proposed within a distance of 20m from a watercourse. Further consideration of these locations was made and specific environmental measures designed to mitigate against any potential effects.

Turbine 3 (T3) is situated approximately 25m from a small tributary of Nant Cynon. The associated crane hardstanding final layout boundary was found to be located in close proximity to this small tributary (as marked on the OS 10k plan). The hydrological walkover examined the topography at the proposed T3 location and confirmed that any surface runoff would be diffuse and spread over approximately 180 degrees i.e. only a portion of runoff would be directed toward the nearby stream. Furthermore, the location of the small tributary was found to be slightly further north than represented on the OS plan i.e. the distance is in actual fact greater than shown on **Figure 12.5**. The existing field boundary fence which broadly demarcates the edge of the site boundary is installed approximately 8m parallel to the stream and maintains a riparian strip of longer grasses and rushes (e.g. *Juncus effusus*) which will serve to act as an effective buffer strip for sediments etc. Given that the distance to this watercourse is less than the 20m adopted elsewhere for this project further mitigation is proposed (to ensure a precautionary approach with regards potential water quality effects). A minimum of 60m of sediment fencing will be installed parallel and adjacent to (set back distance of approx 3m) the small tributary i.e. 20m u/s and 40m d/s of the nearest development activity. The small nature of this tributary, the parallel installation (on left bank) and the steep longitudinal slope all confirm that the sediment fencing will not present a flood risk. The sediment fencing will be maintained until such time as the T3 surrounds (bankings etc.) are fully vegetated.

The final layout of the hardstanding area associated with Turbine 11 (T11) brings it within 20m of a watercourse shown on the OS 10k map i.e. brings it within the scheme's preferred buffer zone extent. The hardstanding area is 10m from the watercourse channel therefore it is still compliant with the recommended buffer of 6m in **Table 12.9**. The watercourse which forms through a convergence of the two field boundary ditches was found during the site walkovers to be a dry ditch with little evidence of water inundation (likely

to be dry for the majority of time). It is proposed that a 20m length of sediment matting is installed in the bed of this ditch, in order to capture any suspended sediments that may be generated from the construction area upstream around T11.

The hardstanding areas associated with Turbine 8 (T8) are located 6m from a watercourse shown on the OS 10k map. The site walkover observations (see **Table 12.4**) confirmed that this feature is a very small and indistinct ditch (not a well-defined channel and generally <0.2m width) that flows eastwards to the Nant Tryfal subcatchment (in contrast to the impression given by the OS map, which indicates that it flows westwards towards the Nant Cynon). An area of saturated ground at NGR 283922, 194093 (photo 975, **Appendix 12A**) was also identified. Based upon the guidance presented in **Table 12.9** above, a buffer zone of 3m width would be appropriate for application for the watercourse in close proximity to T8 which will be maintained at all times. The small piped track crossing identified during the walkover (which is currently silted up, and blocked by debris, contributing to local surface saturation) will be upgraded at the start of the construction phase (prior to construction works at T8). Given the proximity of this small ditch and also the local ground conditions additional (precautionary) mitigation against sediment laden runoff will be implemented. The entire north and eastern boundary of the T8 works (including associated hardstanding) and associated construction compound will be surrounded by sediment fencing, which will effectively isolate the construction area from the small ditch to the north.

Access roads

There are no existing tracks across much of the site (beyond the existing forestry access track), and as a result new tracks will be required. However the track length has been kept to a minimum, and, where possible, turbines are located in series along the same track. Of the 11 turbines only T3 and T7 are located in positions that require short individual access tracks (on account of topography and to minimise the number of watercourse crossings).

In order to minimise the potential for any effects on the water environment from the introduction of access tracks, the following measures will be taken during construction:

- Finished track level will be above the surrounding ground level and the track surface will have suitable lateral fall to allow surface water to drain laterally with avoidance of drains where possible in order to retain baseline saturation levels (typical track cross sections are shown in **Figure 5.4**);
- Where drains are deemed necessary alongside tracks e.g. where overland and shallow surface water flows may collect against the upper slope face of track embankment, the drains will comprise vegetated swales to help encourage infiltration whilst diverting run-off to lateral cross drains. The correct invert depth and profile will allow excess water to drain ultimately to a watercourse, while vegetation will retain run-off from smaller events and encourage local infiltration and retain sediment. Multiple points of discharge to watercourses will ensure dispersal of discharges and minimise any impacts on existing hydrology. The location and spread of discharge points will be shown in drainage management figures that will form part of the CMS;
- Cross track drainage will be installed where ground saturation conditions indicate an area of groundwater connectivity;
- Silt traps (in the form of in-channel berms, silt fencing and silt mats) will be included in drains to capture suspended solids in runoff;
- Water bars will be placed at regular intervals in the track to slow surface water flows, facilitate settlement of entrained solids and to ensure run-off is not increased above existing greenfield run-off rates. The frequency of water bars will be influenced by the nature of the prevailing

topography, with more bars being used where the terrain is steeper, although a maximum gradient of 8 degrees should be noted;

- Where necessary the use of swales and ponds will assist in the attenuation of runoff from the site to pre-development (Greenfield) rates;
- Appropriate materials will be used for access roads construction, which do not have the potential to release harmful substances or be easily eroded (i.e. no acidic, alkaline, metal or sulphur-rich spoil from mine workings), thereby minimising the risk of pollution to watercourses. Granular material (from local quarries) will be used for the road beds as far as possible, so as not to create completely impermeable and smooth surfaces, allowing some infiltration of rainfall. There will also be a greater degree of trackside infiltration following runoff from the track surface towards adjacent swales. Limestone aggregate will not be used due to its potential to influence the acidity of surrounding water and dependent habitats (e.g. areas of acid grassland present); and
- Given the shallow nature of the peat across the entire site, there is no requirement for consideration of any 'floating road' sections, even on sloping sections (see further discussion below).

Watercourse crossings

Watercourse crossings have the potential to affect surface water quantity, quality and disrupt aquatic ecosystems. The layout of the site and the access tracks has therefore been optimised to minimise the number of watercourse crossings as far as possible. The access track has for example been routed along the saddle of the Foel Trawsnant to avoid crossing the Nant Tryfal and a tributary of the Nant Cynon.

One new crossing of a minor watercourse is required at approx. NGR 283700,194100 (shown for example on **Figure 12.2**). The watercourse at the crossing location is a small stream approximately 0.25m in width. This stream channel sits at the bottom of a shallow (approx 1.2m deep) v profile, the cross section of which sits below the level of the adjacent land. It is assumed for the purposes of this assessment that the crossing will be achieved by culverting the watercourse as per the previous planning submission i.e. assuming a worst-case scenario in terms of hydrological considerations, however the cross section of the channel lends itself well to potential installation of a single span crossing.

The only other watercourse crossing is associated with a possible upgrade to an existing crossing point (existing culvert) on the access track i.e. crossing of a small headwater tributary of the Nant Drysiog, at NGR 283800, 192950. The existing culvert is likely to need upgrading, especially if the existing forestry track requires widening.

The design of the culvert/crossings will be agreed with the Lead Local Flood Authority (LLFA) (a typical culvert detail is illustrated in **Figure 5.5**). Consultation with the LLFA regarding culvert design will take place as part of the CMS consultation and specifically with the LLFA during the determination process for a Flood Defence Consent (which is anticipated to be required under the Land Drainage Act). The culvert(s) will be designed in accordance with the CIRIA Culvert Design and Operation Guide (1997). The length of the culverts will be restricted to a minimum at both crossings. Neither of the culverts will have a significant effect on drainage or flowpaths.

Downstream of all crossing points, sediment fencing or sediment matting will be installed (and maintained) within the channel to mitigate against any increased suspended sediment runoff that may occur during the construction of the crossings or that may be associated with track runoff during subsequent phases.

Electric cables

It is assumed that electric cables will be laid in trenches alongside the access roads, thus minimising new land take and potential erosion and minimising trench slopes. As far as is practicably possible, trenches will be dug in sections (over short distances of nominally 50-100m) during drier periods, in order to reduce the possibility of them acting as alternative drainage channels, with surface material replaced carefully and quickly. **Figure 5.8** shows a typical cable trench detail. Temporary silt traps will be installed for longer trench runs and plugs of soil left in place at regular intervals in the longer trench runs to prevent their acting as preferential subsurface flow pathways. Permanent impermeable clay bunds shall be placed in trenches that run perpendicular to steep slopes over extended distances or where local conditions encountered during installation dictate, in order to prevent the formation of preferential subsurface flow routes.

Peat

Construction (e.g. tracks) upon areas of peat has the potential, without sufficient mitigation measures, to cause drainage, desiccation, and even liquefaction of the deposits. These impacts have consequences for water quality, erosion and subsequent watercourse sediment loads and water storage potential. Slumping and liquefaction of highly saturated thick peat deposits also pose issues of health and safety. These impacts are however constrained by peat thickness, saturation and hydrology.

A peat depth survey was commissioned as part of the 2014 ES to gain a greater understanding of the spatial distribution and depth of peat across the site to inform site design (see **Appendix 12C**). It is generally recognised that to minimise hydrological disruption and associated mitigation practices, peat depths exceeding around 50cm should be avoided where possible, whilst depths of less than 50cm, are unlikely to significantly constrain development layout.

The peat survey undertaken as part of the baseline characterisation established that peat depths across the site are shallow. There are no areas of peat in excess of 1m deep which may necessitate the use of 'floating track' construction methodologies as recommended within good practice guidance on floating roads on peat (SNH, 2010). The vast majority of the site is underlain by peat of less than 30cm depth and therefore there are no mitigation measures necessary beyond those that form part of good access track design.

Where, during the construction phase, ground saturation conditions are encountered that indicate areas of shallow groundwater connectivity, sufficient cross-track drainage will be installed beneath the access track to ensure maintenance of these hydrological pathways and prevent any drying out (which is deemed not to be likely on account of shallow peat cover).

Excavation and management of spoil

Soil and subsoil excavation and movement (e.g. at turbine bases) will be undertaken in accordance with best practice guidelines such as Good Practice Guide for Handling Soils (MAFF, 2000). Where practicable the upper vegetated layer will be stored separately in order to maintain vitality and used to re-cover excavations on completion of the construction phase.

Areas of stockpiled spoil, including stored peat, would not be permitted within watercourse buffer zones (20m distance from all watercourses and defined exclusion zones), where it would obstruct the flow of overland surface water, or on steep slopes defined as greater than 2:1.

Formal drainage will be designed on a bespoke basis for spoil storage areas to allow controlled dewatering and prevent washout of suspended solids to the receiving water environment. As part of the CMS a spoil management strategy will be developed by the appointed contractor for the site. The lack of substantial peat deposits present on this site reduces risks associated with spoil storage.

Wind turbine foundations & crane pads

The design of the turbine foundations is described in **Chapter 5: Description of the proposed development**, which will in part be dictated by the local ground conditions. Based on local groundwater level investigations a water exclusion strategy or pumping control measures will be adopted, based on CIRIA guidance and Netregs PPG6; typical measures are described in this section. The turbine foundation type and general ground conditions (e.g. depth to rockhead) minimise the depth of excavations required (typically to around 3m depth).

To avoid surface water run-off flowing into the excavations, cut off drains will be used on the top side of excavations. They will be designed to prevent high flow rates and will include appropriate sediment transport mitigation measures (typically sediment fencing). In the event that water should accumulate in the excavation despite the precautions taken, the excavation will be designed to allow gravity drainage as far as possible, with drainage through a limited number of controlled outlets, where sediment can be controlled through a series of settlement ponds or filtering systems and discharged onto open land (to reduce suspended sediment concentrations further). NRW will be consulted prior to construction (to be confirmed via consultation and confirmation of the CMS) to determine if Environmental Permits are required, as this is dependent on the duration of the discharge activity.

Should it become necessary to pump water from the excavation, permission will be sought for appropriate discharge locations, and NRW will be consulted to determine if Environmental Permits are required. Re-infiltration will be used where possible and the coarse, long acidic grasses characteristic of the site lend themselves to this purpose, but should local topography or ground conditions prove unsuitable for infiltration, water will be released at a controlled rate into the watercourses on site. The design for the dewatering will ensure collection and settling of suspended sediment (i.e. use of silt traps, silt fences, straw bales or lagoons) prior to discharge. Dewatering of water contaminated by cement or concrete would be retained on site for removal off-site by a licensed waste carrier in accordance with PPG requirements.

Specific drainage consideration needs to be given to Turbine 8, the proposed location of which is at the northeast corner of the proposed contractors' compound. It is situated in close proximity to an identified area of surface water ponding (see **Table 12.4**). The primary reason for this surface water ponding is the heavily silted blocked pipe culvert beneath the track at NGR 284000, 194000. This blocked pipe will be replaced with a new cross track drain at this location to assist in the effective drainage of excess surface water at this location, prior to other construction activities at T8. The construction area will be separated from the boggy area by silt fencing (see buffer zone discussions above).

For the reinforced areas of the crane pads the same mitigation measures as for access tracks will be observed in order to control sediment laden run-off. Crane pads will be reinforced using semi permeable granular material from local quarries (acidity neutral material i.e. not limestone), thus reducing surface run-off. The total area of hard standing at each turbine location including the turbine foundations and the crane pad will be approximately 990m2 (22m x 45m). Approximately a third of this area will be dressed back with topsoil and landscaped into the surrounding area upon completion of turbine erection.

The dimensions of the reinforced concrete base slab at each turbine location will be approximately 15m x 15m x 2m, which will form part of the 22 m x 45m crane pad area, and in the context of a catchment or sub-catchment scale does not represent a significant impedance or obstruction to shallow groundwater flows. All proposed turbine locations are on relatively shallow gradients and downslope shallow groundwater flows are not expected to be affected.

Turbine foundation construction will need to adopt mitigation measures to prevent contaminants entering the shallow groundwater system, associated with the local Secondary A aquifer. The main potential groundwater effect arising from the construction of the wind turbine foundations and adjacent crane pads is the risk of leaking concrete residues into the water environment. To minimise the risk, excavations and concrete pouring for the turbines should be carried out in dry weather. Prior to concrete pouring, the

excavation should be lined with geotextile material in order to prevent concrete leaking into groundwater and sulphate resistant concrete formulas will be utilised to prevent acidic erosion over time.

Sub-station and construction compound

The development proposals include a sub-station and two temporary construction compounds. The sub-station will remain in place for the lifetime of the development, while the temporary compounds will be removed once construction has been completed, with the ground surface being re-vegetated.

Sustainable drainage measures will be incorporated into the design of buildings and areas of hardstanding, for example, silt traps and vegetated swales. Any hydrocarbon or other chemical storage areas will be required to be on areas of fully impermeable hardstanding, to be bunded so that 110% of the stored capacity is provided, and to be located at least 20m from any surface watercourses or drains. Both compound locations are located at distance from watercourses. Areas for construction plant parking and refuelling will be also be on impermeable hardstanding, which will drain via a hydrocarbon interceptor, as discussed further below under 'site activities'.

Flood risk and surface water management

Given the location of the turbine bases and crane pads at the higher elevations (with broadly flat or gently sloping slopes), disruption of natural near surface flow paths will be minimal.

To minimise increased flood risk from the development, the overall strategy inherent in the scheme design is to ensure that run-off rates do not exceed the greenfield run-off rate in any of the watercourses (strictly speaking at the boundary of the site, however greenfield run-off rate will be assumed for all points at which discharges to watercourses occurs). This is in accordance with TAN 15 and will be achieved through the use of sustainable drainage systems and attenuation techniques. Given the lack of interruption and interaction with regard the natural hydrological processes, the use of SuDS measures that include features such as trackside swales, filter drains at crane pads, and infiltration/attenuation basins at construction compounds, which in conjunction with buffer zones around watercourses will ensure greenfield run-off rates. As part of the CMS, which will be prepared in consultation with NRW, where there is identified a requirement for a large settlement lagoon (nominally greater than 10m x 10m in size) then the specific characteristics of the lagoon (i.e. storage capacity and discharge infrastructure/mechanism) will be designed to ensure greenfield runoff rates are adhered to.

It is anticipated that the planning conditions for the amended scheme would include the same requirement to prepare a drainage assessment (potentially as part of the CMS) as per the current conditions (planning condition no. 8) that will include sizing of the necessary attenuation systems to restrict run off to greenfield rates, including an allowance for climate change. It is reiterated again that the topography and hydrological characteristics of the site are likely to exclude the necessity for large attenuation lagoons (i.e. beyond attenuation measures incorporated into drainage channels and existing watercourses).

Site activities

Site induction for contractors should include a specific session on good practice to control water pollution from construction activities. Contractors are to be made aware of their statutory responsibility not to "cause or knowingly permit" water pollution. As previously noted, a Construction Method Statement (CMS) will be produced detailing the mitigation measures discussed above, and a Pollution Incident Response Plan will be prepared for the site in line with Netregs PPGs and CIRIA good practice guidance. All contractors will be briefed on these plans, with copies made available on site. Equipment to contain and absorb spills will also be readily available.

Plant and machinery used during the construction phase need to be well maintained to minimise the risks of oil leaks or similar. Where it is possible, contractors will be encouraged to use (e.g. by applying a preference

at competitive appointment stage) biodegradable oils and lubricants for machinery used on-site. Maintenance and refuelling of machinery will occur only within designated areas of temporary hardstanding. Any major maintenance works will be conducted offsite. In the designated hardstanding areas, contingency plans should be implemented to ensure that the risks of spillages are minimised. Placing a drip tray beneath plant and machinery during refuelling and maintenance will contain small spillages (in addition to the hydrocarbon interceptor which will form part of the compound drainage infrastructure) and proprietary spill kits will be available.

The requirements for mitigating effects of dust and vehicle movements include the dampening down of areas potentially producing dust and the provision of wheel washing facilities. Areas where these activities occur should also provide measures for sediment capture within run-off, such as silt traps, settlement ponds or specialist silt removal plant, e.g. Siltbuster® type devices.

Throughout all phases of development best working practices will be adopted and measures to protect the water environment will be taken by adopting recommendations set out in the PPG and CIRIA guidance (as listed in Section 12.3). This will be secured through the PPP which will be implemented and monitored as part of the CMS.

Any silts that are removed from settlement features will be moved to adjacent bankings/adjacent land, where it will be allowed to drain and consolidate naturally. Sensitive habitat/sensitive vegetation will be avoided through consultation of habitat mapping undertaken in support of this environmental statement, prior to any removal and depositing of silts. Deposited silts will be reseeded at the earliest opportunity in order to allow prompt stabilisation.

Monitoring

To ensure that the measures proposed above succeed in protecting the water environment within and downstream of the site, a programme of monitoring and inspection will be carried out during all phases of development, with increased frequency at times and in locations associated with construction activities. An increased frequency of monitoring checks should also take place after periods of heavy rainfall and before periods of forecast heavy rainfall. Auditable inspections (i.e. with associated recording of inspection activities) will include visual checks of culverts, watercourse sedimentation, installed sediment fencing, pollution prevention measures, hydrocarbon interceptors, stored chemicals on site etc. Maintenance (to clear blockages or remove silt) will be carried out in periods of dry weather where practicable.

It is not deemed necessary to provide a programme of water quality sample collection and analysis on all watercourses given the assessed low risk potential for water quality pollution and the mitigation measures proposed. It is proposed that water quality sampling and testing would be undertaken on the Nant yr Hwyaid, which is the watercourse most likely to be affected by the proposed development, on account of the proportion of infrastructure within its catchment. It is proposed that during the construction phase fortnightly water quality samples would be collected from the Nant yr Hwyaid at the point at which it crosses the site boundary and these samples would be submitted to a UKAS and MCERTS accredited environmental testing laboratory for the following range of parameters:

- pH;
- alkalinity;
- total hardness;
- total ammonia;
- ammonium;
- nitrite;
- nitrate;

- soluble reactive phosphorus;
- sodium;
- chloride;
- Biochemical Oxygen Demand (BOD);
- suspended solids;
- turbidity;
- total petroleum hydrocarbons;
- sulphate;
- soluble reactive phosphorus;
- total iron;
- dissolved iron;
- dissolved organic carbon; and
- total organic carbon.

This approach would be clarified with NRW and assuming such a programme were deemed necessary by the regulator (as suggested by the NRW scoping opinion), then this would be started a number of months prior to construction in order to establish a baseline.

Geological and groundwater

Consultations with the Coal Authority have shown the location of disused adits in close proximity to T1, T2 and the access track that goes between these two turbines.

Following planning consent (should it be granted), and prior to the development of this area of the site, a targeted investigation including structural stability will be undertaken, specifically in relation to the location and risk associated with historical adits and focussed on this area of the site. This information would primarily be undertaken to inform engineering considerations i.e. to establish any risk to foundation integrity etc. It is assumed that micrositing of these turbines and the access track would allow identified adits to be avoided and any potential effects on ground stability due to shallow level abandoned mine workings may be readily engineered out by adopting ground stabilisation works. Any grouting works would be highly localised and would follow best practice; consequently negligible interaction with groundwaters is anticipated. Furthermore, given the intention to avoid adits and adopt suitable ground stabilisation works (where necessary) there will be no destabilisation of historic mine workings, or seams, as a result of the proposed infrastructure which can impact on hydrogeology and minewater in the vicinity of the site.

All excavations will be shallow and there are no proposals to excavate into bedrock, other than minor earthworks associated with establishing suitable foundations at turbine base locations. There are no proposals to establish borrow pits within the site boundary and aggregates will be sourced from offsite (established local quarries).

Tracks and crane pads have been routed and located to avoid slopes as far as practicable. Stockpiles, although anticipated to be minor given ground conditions, will not be located on steep slopes.

The peat survey confirmed no deep areas of peat which may give rise to peat slumping.

Project design measures – operational phase

Environmental measures that form part of project design during the operational phase of the development include:

- Monitoring to ensure that best practice is adhered to on site and to help avoid pollution release to watercourses by incorporating PPG guidance into ongoing operational phase management policy (including storage of any oils/lubricants on site). Monitoring proposals will be identified as part of the CMS and will include (but not be limited to) weekly visual inspections of watercourses and chemical storage facilities;
- Permanent welfare facilities will be installed as part of operational control building facilities. Foul effluent will be controlled through use of chemical facilities with periodic removal for offsite disposal;
- Regular maintenance of permanent SuDS drainage features installed during the construction phase, including unblocking of drains, maintenance of site tracks and other hard standing surfaces, and removal of silt build-up from settlement features; and
- Any servicing works on infrastructure during the operational phase would be preceded by a risk assessment, which will consider environmental, including hydrological risk. Relevant control measures will be assessed and put in place prior to relevant works. As a pre-requisite the storage, use and disposal of oils etc will be done in accordance with best practice guidance (as identified in Section 12.3).

Project design measures – decommissioning phase

Given that many of the activities that will be undertaken in the decommissioning phase are construction related and are common with the construction phase, the same measures set out above in relation to construction phase activities will be implemented during the decommissioning phase.

Where infrastructure will be removed during the decommissioning phase, this will be phased in such a way as to allow effective protection of the water environment at all times. For example, drainage infrastructure and in particular sediment control measures will be left in place until such time as all 'upstream' infrastructure is removed. Thus the order of infrastructure removal will be the reverse of the installation during the construction phase.

It is intended that turbine bases would be left in place in order to minimise the disturbance to the site, including the site hydrology.

Table 12.10 outlines how these embedded measures will influence the water resources and ground conditions assessment. These were included in the 2014 ES and are equally applicable to this chapter.

Table 12.10 Summary of the embedded environmental measures and how these influence the water resources and ground conditions assessment

Receptor	Potential changes and effects	Embedded measures and influence on assessment
Construction phase		
On site watercourses (Nant yr Hwyaid, Nant Cynon, Nant Tryfal and Nant Drysiog tributaries) and downstream watercourses (Afon Afan)	Erosion of exposed ground, exposed foundations and track surfaces producing silt-laden runoff	- Track length kept to a minimum, layout follows topography where possible; - Mapping and avoidance of key water features in design; - Cable trenches routed adjacent to tracks; - Use of SuDS techniques to control run-off, including silt traps, berms, sediment fencing, filter strips and buffer strips; - Water bars across access tracks where appropriate; - Trackside ditches and swales; - Soils stored on low gradients; - Permits to discharge applied for from NRW (if required following consultation of CMS) for any site discharges; - Micrositing to avoid key hydrological features; - Foundation design minimises excavation requirement; - Land disturbance minimised and quickly re-stabilised; - Take actions to prevent runoff from up-slope entering excavations (using cutoff drains or barriers, as appropriate); and - Works according to PPGs.
On site watercourses (Nant yr Hwyaid, Nant Cynon, Nant Tryfal and Nant Drysiog tributaries) and downstream watercourses (Afon Afan)	Generation of sediment-laden runoff from stockpiled soils	- Surface vegetation removed separately in order to recover; - Appropriate selection of stockpile locations; - Works according to PPGs; - Localised collection of stockpile drainage as appropriate; - Where long term stockpiling is unavoidable, undertake prompt reseeding; and - Stockpile peat separately to other soils.
On site watercourses (Nant yr Hwyaid, Nant Cynon, Nant Tryfal and Nant Drysiog tributaries)	Disturbance of watercourses at crossing points	- Track layout designed to minimise watercourse crossings (one small stream crossing <1m width and one small ditch crossing <1m width; -Full culverting (disturbance of bed) avoided where possible, if not practical then box culverts to be used; -Series of d/s sediment fencing in channel compulsory. - Works according to PPGs and culvert design best practice; and - Works undertaken under Flood Defence Consent
On site watercourses (Nant yr Hwyaid, Nant Cynon, Nant Tryfal and Nant Drysiog tributaries)	Effect on ground instability; potential for interaction with groundwater and/or generation of silt-laden runoff	- Steep slopes that may have landslip potential avoided in design; - Peat survey conducted and confirmation of no deep peat; - Geotechnical survey to be undertaken and micrositing of turbines conducted if necessary; to include investigation and avoidance via micrositing of known historical mine adits; and - Avoidance of steep gradient slopes for development
On site watercourses (Nant yr Hwyaid, Nant Cynon, Nant Tryfal and Nant Drysiog tributaries)	Disruption of natural flow pathways	- Minimum 20m buffer zones around all surface water courses. Exclusion of all activities from buffer zones and further hydrologically sensitive sites.
Ground stability	Potential to affect near surface ground stability	- Steep slopes that may have landslip potential avoided in design; - Peat survey conducted and confirmation of no deep peat; - Geotechnical survey to be undertaken and micrositing of turbines conducted if necessary; to include investigation and avoidance via micrositing of known historical mine adits and

Receptor	Potential changes and effects	Embedded measures and influence on assessment
		standard ground stabilisation techniques e.g. grouting, as necessary; and - Avoidance of steep gradient slopes for development
Peat hydrology	Drying out of deep peat; interruption of hydraulic pathways	- Peat survey conducted – confirmed peat depths are shallow in all areas where infrastructure proposed. No requirement for floating tracks; - Track design e.g. cross track drainage to allow continuity of shallow groundwater flow; - Vigilance ensured by contractors to stay on tracks; and -Infiltration within proximal swales will be encouraged or SuDS systems to promote re-saturation where applicable.
Peat hydrology	Disruption of natural flow pathways	- Hydrological post consent walkover survey to consider final scheme layout; - Identification and exclusion of hydrologically sensitive sites; - Micro-siting to avoid observed flow pathways; and - Cross track drainage to ensure continuity of drainage.
On site watercourses (Nant yr Hwyaid, Nant Cynon, Nant Tryfal and Nant Drysiog tributaries) & Afon Afan	Increased volumes of runoff and reduced infiltration	- Track length kept to a minimum; - Use of road camber to shed water; - Use of swales and ditches to provide temporary storage and reduce run-off rates; - Buffer zones around all watercourses; - Diffuse discharges to watercourses (if necessary at all); - Control of discharge rates to Greenfield through appropriate infiltration and attenuation storage; and - Works according to PPGs and best practice SuDS design.
On-site soil hydrology	Creation of new drainage pathways	- Avoidance of key hydrological features; - Trenches dug in stages and during dry periods, where possible, and quickly backfilled; - Silt traps in longer trench runs; - Impermeable 'plugs' installed in trenches on slopes and adjacent to saturated areas to reduce potential for longitudinal water flow; - Working areas around foundations and crane pads will be revegetated as soon as possible; and - SuDS techniques used to control site run-off.
Peat hydrology	Creation of new drainage pathways	- Avoidance of key hydrological features; - Trenches dug in stages and during dry periods, where possible, and quickly backfilled; - Silt traps in longer trench runs; - Impermeable 'plugs' installed in trenches on slopes and adjacent to saturated areas to reduce potential for longitudinal water flow; - Working areas around foundations and crane pads will be revegetated as soon as possible; and - SuDS techniques used to control site run-off.
On-site soil hydrology	Damage to soil profile	- Best practice track construction methodologies; - Stockpiling of peat and distinct soil types separately; - Soils replaced carefully and quickly from the same area they were excavated; and - Cables laid in small trenches next to access tracks, where possible.
On site watercourses (Nant yr Hwyaid, Nant Cynon,	Concrete spillages (low pH potential) reaching surface waters	- Turbines located at least 20m from watercourses; (with the exception of the hardstanding areas previously discussed at T8 and T11)

Receptor	Potential changes and effects	Embedded measures and influence on assessment
Nant Tryfal and Nant Drysiog tributaries) & Afon Afan		- Sulphate resistant concrete formulas utilised; - Water tight shuttering as standard; - Emergency planning in place; and - Works according to PPGs.
On site watercourses (Nant yr Hwyaid, Nant Cynon, Nant Tryfal and Nant Drysiog tributaries) & Afon Afan	Hydrocarbon/ chemical spillage associated with storage, refuelling and plant maintenance	- Water pollution prevention measures included in contracts to enforce good practice; - Hydrological issues included in site induction; - Refuelling undertaken on hardstanding, using drip trays and oil interceptors; - All hazardous substances (oils, chemicals or fuels) must be stored on chemical bunds which are a minimum of 110% of the largest container stored in the area; - Security on the compound maintained vigilance and lockable pumps; - Refuelling only at designated stations; - No planned maintenance activities on site; and - Works according to PPGs.
On site watercourses (Nant Hwyaid, Nant Cynon, Nant Tryfal and Nant Drysiog tributaries) & Afon Afan	Increase in flood risk	- Overall strategy to ensure run-off rates do not exceed greenfield rate; - Use of SuDS measures; - If a large settlement lagoon is required (unlikely), then discharge mechanisms will be included to limit rates to greenfield; and - CMS to be prepared and agreed in consultation with NRW, which will contain a drainage assessment.
On site watercourses (Nant Hwyaid, Nant Cynon, Nant Tryfal and Nant Drysiog tributaries)	Changes to morphology	- Buffer zones established around all watercourses; - Watercourse crossings constructed according to PPGs; - Diffuse discharges (if necessary) to watercourses; and - All discharges limited to greenfield runoff rates.
On site watercourses (Nant yr Hwyaid, Nant Cynon, Nant Tryfal and Nant Drysiog tributaries)	Discharge of welfare facility foul effluent affecting water quality	- Foul effluent to be collected and controlled through use of chemical facilities with periodic removal (by a licensed contractor) for offsite disposal.
Groundwater quality (Swansea Carboniferous Coal Measures WFD GW body)	Introduction of pollutants into groundwater through excavations/ ground stabilisation techniques	- Excavations during dry weather where possible; - Use of geotextile lining in base of excavations, to prevent concrete entering groundwater; and - Any grouting of historic, shallow mine workings to follow best practice.
Groundwater quantity (Swansea Carboniferous Coal Measures WFD GW body)	Reduction in recharge to the GW body	- Use of semi-permeable materials with regards the access tracks and temporary hardstanding areas; and - Small spatial extent and depth of impermeable turbine bases is insignificant in the context of catchment scale and will therefore not impede recharge.
Private water supplies (PWS)	Adverse chemical or quantitative effect on local PWSs	- Further discussion on PWS has been provided in Section 12.10 and found that there is no hydrological continuity with the potential catchments of the local PWS, and therefore no specific measures are required.
Operational phase		
On site watercourses (Nant Hwyaid, Nant Cynon, Nant	Erosion of track surfaces producing silt-laden runoff	- Construction phase mitigation continues to be effective; and - Periodic visual monitoring and maintenance of track surfaces and associated drainage infrastructure.

Receptor	Potential changes and effects	Embedded measures and influence on assessment
Tryfal and Nant Drysiog tributaries) & Afon Afan		
On site watercourses (Nant Hwyaid, Nant Cynon, Nant Tryfal and Nant Drysiog tributaries)	Disruption of natural flow pathways	- Construction phase mitigation continues to be effective; and - Periodic visual monitoring and maintenance of drainage infrastructure.
On site watercourses (Nant Hwyaid, Nant Cynon, Nant Tryfal and Nant Drysiog tributaries) & Afon Afan	Increased volumes of runoff & reduced infiltration	- Construction phase mitigation continues to be effective; and - Restoration of ground around turbine bases and reduced crane pad areas.
On site watercourses (Nant yr Hwyaid, Nant Cynon, Nant Tryfal and Nant Drysiog tributaries)	Creation of new/preferential flow pathways e.g. infilled cable trenches acting as drainage conduits	- Construction phase mitigation continues to be effective.
Groundwater quality – (Swansea Carboniferous Coal Measures WFD Groundwater body)	Groundwater contamination from concrete	- Mitigation measures including sulphate resistant concrete continues to be effective.
On site watercourses (Nant yr Hwyaid, Nant Cynon, Nant Tryfal and Nant Drysiog tributaries) & Afon Afan	Chemical spillage associated with refuelling and plant maintenance	- Construction phase mitigation continues to be effective, subject to periodic inspection and maintenance of plant, and equipment e.g. oil interceptors.
On site watercourses (Nant yr Hwyaid, Nant Cynon, Nant Tryfal and Nant Drysiog tributaries) & Afon Afan	Generation of silt-laden runoff from dust control and wheel washing activities	- Construction phase mitigation continues to be effective.
On site watercourses (Nant yr Hwyaid, Nant Cynon, Nant Tryfal and Nant Drysiog tributaries)	Discharge of operational phase foul effluent affecting water quality	- Foul effluent to be collected and controlled through use of chemical facilities with periodic removal (by a licensed contractor) for offsite disposal.
Decommissioning phase measures above as identified for construction phase		
On site watercourses (Nant yr Hwyaid, Nant Cynon, Nant Tryfal and Nant Drysiog tributaries) & Afon Afan	Generation of silt-laden runoff associated with decommissioning phase	In addition to mitigation measures listed under construction phase, leave turbine bases to avoid unnecessary environmental disturbance.

12.9 Assessment methodology

Methodology for prediction of effects

The generic project-wide approach to the assessment methodology is set out in **Chapter 2**. However, whilst this approach has informed the approach that has been used in this water resources and ground conditions assessment, it is necessary to set out how this methodology has been applied, and adapted as appropriate, to address the specific needs of this assessment.

The assessment methodology employed to evaluate the significance of potential effects of the proposed development on water resources and ground conditions is based on a combined evaluation of the sensitivity of the receptor and the magnitude of the environmental change, and is informed by professional judgement.

The sensitivity of the receptor is based on the value of the water feature or resource, including its use, as shown in **Table 12.11**. The approach also takes account of the baseline quality of the receptor. For instance, a wetland may have a statutory designation, but if it is significantly degraded it may be only of 'Medium' value.

Table 12.11 Definitions of sensitivity for water resources and ground conditions

Sensitivity	Criteria	Examples
High	Regional or national scale, high quality and rarity, limited potential for substitution	Principal, high quality aquifer Water-dependent habitats or species, or geologically important sites with statutory conservation designations; Direct connectivity with WFD water body status defined as high or good; Large abstractions/PWS for industry, agriculture or drinking water for potable use; Watercourse supporting self-sustaining species of international/national conservation interest (e.g. salmonids, brook lamprey, freshwater pearl mussels etc); Active Flood Plain (Flood zone C1 or C2).
Medium	District scale, medium quality, potential for substitution	Secondary aquifer Indirect connectivity with WFD water body status defined as High or Good; Direct connectivity with WFD water body with Moderate status; Medium-sized abstractions/PWS for industry, agriculture for potable use; Supports pockets of self-sustaining species of conservation interest; locally important for fisheries; Flood Zone B
Low	Local scale and use, variable quality, potential for substitution	Minor, or WFD water body status defined as Poor or Bad, or water bodies without WFD classification; Small abstractions for Industry or agriculture for non- potable use; Fish sporadically present or restricted, no designated features; Limited floodplain/ Flood Zone A; Receptor heavily engineered or artificially modified.

The magnitude of change is estimated based on the degree of the impact and is independent of the sensitivity of the feature, as described in **Table 12.12**.

Table 12.12 Magnitude of change

Magnitude	Criteria	Examples
Negligible	No measurable change to feature	No discernible change in water quality (surface or groundwater); No increase in flood risk; No measurable decline in groundwater levels or river flow.
Low	Results in minor effect on feature, with insufficient magnitude to affect its use/integrity in most circumstances	Measurable changes in attribute (e.g. a river water quality indicator) but of limited duration and magnitude. Change is not sufficient to alter WFD status class. Change equivalent to naturally occurring fluctuations. May be short-term, small scale disturbance to water dependent ecology (in relation to hydrology-related factors); Unquantifiable change to river morphology or geomorphology; Measurable decline in groundwater levels or river flow, with no consequences for use or ecology; No detectable increase in flood risk and erosion potential; No change in pressure, flow or quality to local water supply.
Medium	Results in noticeable effect on feature, of sufficient magnitude to affect its use/integrity in some circumstances	Compromise integrity of a designated site/species/habitat; Loss in productivity of a fishery (in relation to hydrology-related factors); Measurable change to river morphology over medium scale i.e. moderate changes in erosion and deposition regimes; Measurable effect on water quality, with potential to alter status of individual WFD waterbody supporting elements, but only medium risk of altering overall RBMP status. Moderate decline in groundwater levels or river flow, with consequences for use or ecology; Detectable increase in flood risk and erosion potential. Temporary loss of water supply or minor change in quality of supply with respect to Drinking Water Standards (DWS);
High	Results in major/fundamental change to feature, of sufficient magnitude to affect its use/integrity	Loss of (all or part of) a water-dependent designated site/species/habitat; Change in overall WFD status of river reach; Loss of flood storage/significant increase in flood risk; Significant and permanent change to river morphology over large scale i.e. large changes in erosion and deposition regimes Pollution or loss of water supply. Major decline in groundwater levels or river flow, with consequences for use or ecology.

Significance evaluation methodology

The significance of an effect is derived by considering both the sensitivity of the feature and the magnitude of the change. The EIA Regulations require that a final judgement is made about whether or not each effect is likely to be significant. In this assessment, effects are considered to be significant or not significant according to the matrix in **Table 12.13**.

Table 12.13 Matrix of EIA Significance

		Magnitude of change			
		High	**Medium**	**Low**	**Negligible**
Sensitivity	**High**	Major (Significant)	Major/Moderate (Significant)	Moderate (Not Significant)	Slight (Not Significant)
	Medium	Major/Moderate (Significant)	Moderate (Not Significant)	Moderate/Slight (Not Significant)	Slight/Negligible (Not Significant)
	Low	Moderate (Not Significant)	Moderate/Slight (Not Significant)	Slight (Not Significant)	Negligible (Not Significant)

Significant effects are those highlighted in grey.

12.10 Assessment of water resources and ground conditions effects

Predicted effects and their significance

Effects are more likely to occur during the construction phase of the proposed development on account of the volume and type of works undertaken during this period. There are a number of similarities between the activities that are planned for the decommissioning and the construction phases and many of the considerations and mitigation approaches that apply to the construction phase also apply to the decommissioning phase.

The significance of all potential effects is presented in **Table 12.14**. This table should be read in connection with the discussions regarding environmental measures that are incorporated into project design (see Section 12.8), which are integral to an understanding of the associated magnitude ratings in particular. Given that many of the predicted effects have been found to be 'not significant', the discussions presented below are suitably concise.

As discussed in section 4.4 and section 5.2 of this ES, due to its location it is considered that the vulnerability of the proposed development to natural disasters is low, and measures to minimise major accident or disasters from occurring during construction will be set out in a Construction Environmental Management Plan (CEMP). In the unlikely event of a major accident or disaster at the proposed development site, such as flooding, or the release of pollutants due to infrastructure failure, the measures set out in section 12.8 would mitigate any potential effects upon the identified water resource receptors (e.g. people and property, and private water supplies) to ensure that there are no significant effects arising from the proposed development.

Construction effects

Effect on dilution of downstream discharges

There will be no anticipated change to the hydrological flow characteristics of the surface watercourses that discharge from the site boundary and therefore there will be no anticipated effects on parameter concentrations associated with consented discharges downstream.

Surface watercourses: Water quality

The on-site watercourses are small and do not have WFD status or associated designation themselves and are defined as Low Sensitivity. The downstream Afon Afan is assigned a sensitivity of Medium on the basis of it being indirectly directly connected to the site and having an overall Moderate Ecological WFD status.

Effects on water quality in surface watercourses leaving the site are theoretically possible from sediment entrainment in runoff, or pollution from site activities. However implementation of the environmental measures summarised in **Table 12.10** will ensure that any effects are Low or Negligible in magnitude, as they will be limited in scale and magnitude and not sufficient to change WFD status. This will include the provision of additional design mitigation where buffer zones of <20m are possible (for T11, T3, and T8) outlined in Section 12.8 above. As a result, the effects on surface water quality from construction, operation and decommissioning activities associated with the proposed development are concluded to be not significant.

Groundwater body: Water quality

Effects on groundwater quality are theoretically possible, most notably where excavations are required for the turbine bases. This could be associated with runoff into the excavations, with concrete pouring, or from spills of pollutants. There is also the potential (if ground survey identifies the requirement) for standard ground stabilisation techniques to be employed, which may include localised grouting. However implementation of the environmental measures summarised in **Table 12.10** will ensure that any effects are Low or Negligible in magnitude. The aquifer beneath the site is currently defined as having Poor chemical status by NRW; it is also defined as a Secondary A aquifer. As a result of these designations, the groundwater body is defined as being of Low sensitivity. When the magnitude and sensitivity are considered together, it can be concluded that effects on groundwater quality from construction and operation of the proposed wind farm site are concluded to be not significant.

Surface watercourses: Drainage and flood risk (flow regime)

Effects on flood risk downstream from the site are theoretically possible as a result of increased surface water runoff. Increased runoff could occur during construction as a result of increased areas of disturbed ground and hardstanding (areas stripped of vegetation and soil for construction, spoil mounds, access tracks, turbine bases, laydown areas and works compounds), and drainage and/or dewatering from excavations. However implementation of the environmental measures summarised in **Table 12.10** will ensure that any effects are Negligible in magnitude. A drainage assessment will be carried out to ensure that the drainage design will allow greenfield runoff rates to be achieved, and it is anticipated that discussions will be carried out with Neath Port Talbot Council (as the LLFA) regarding the two proposed watercourse crossings. The site is located in Flood Zone A and this flood zone extends all the way to the Afon Afan watercourse (within channel), but since there are (limited) urban areas comprising people and property within flood zones C1 and C2 downstream from the site, the sensitivity of the downstream receptor has been defined as High in relation to flood risk. When the magnitude and sensitivity are considered together, it can be concluded that effects on flood risk from construction and operation of the proposed development are concluded to be not significant.

Peat hydrology

Effects on peat hydrology are found to have Low potential magnitude, particularly on account of the shallow depth of peat that is characteristic across the site, avoidance of areas of deeper peat through careful siting of infrastructure, track design which allows provision for cross track drainage and thus maintenance of localised drainage pathways/saturation and other measures incorporated into drainage design. The peat habitat is afforded a Medium sensitivity score on account of its water dependence. Consideration of the magnitude and sensitivity scores concludes that effects on peat hydrology are not significant.

Private water supplies

Initial consideration of the location and therefore connectivity of Abstractions 2, 3 and 6 (**Table 12.7**) dictates that these abstractions would not be affected by the proposed development.

Abstraction number 4 (**Table 12.7**) relates to a private water supply to Nant yr Hwyaid Farm, Cynonville. It is located downstream of the site boundary in the Nant yr Hwyaid sub-catchment. There is limited information available on the type and use of this abstraction. Given the proximity of a small stream (tributary of the Nant yr Hwyaid) which flows adjacent to the Nant yr Hwyaid Farm and the poor aquifer potential, it is likely that the abstraction is from surface water, however given that this is not confirmed further consideration of both a surface water and a possible groundwater abstraction at this location has been carried out.

The Nant yr Hwyaid Farm private water supply is located approximately 480m downslope of the nearest planned development i.e. Turbine 6. This is a considerable distance over which any runoff related effects would be reduced to a scale which would not be measurable, particularly given that the area between the source and the receptor and separated comprises of long grasses which would help filter out potential contaminants. Notwithstanding this, in order to provide a precautionary assessment, additional private water supply risk assessment techniques have been applied before scoping this abstraction out of further consideration. If the abstraction is a surface water or spring fed abstraction, its catchment is defined on the basis of topography on the understanding that the catchments are likely to reflect the up-gradient topography; therefore catchment analysis has been carried out on a sub-tributary scale around the Nant yr Hwyaid Farm private water supply.

The catchment analysis finds that the access track which is contiguous with the northern site boundary will effectively capture any surface drainage from the slopes of Cefn yr Argoed and direct this toward the Nant yr Hwyaid watercourse at 282900, 194800. Thus, the surface water catchment of the small tributary adjacent to the Nant yr Hwyaid is found to lie outside of the development boundary and to be non-contiguous with the catchment area in which Turbine 6 for example is located (as illustrated on **Figure 12.2**). Due to the topographical catchment divide, and the lack of hydrogeological connectivity there will not be any impacts on the water serving the Nant yr Hwyaid Farm private water supply.

The groundwater spring abstraction at Maesteg golf course (which is used for both irrigation and cooking/sanitary purposes) is located approximately 470m to the south of the proposed site entrance (where there may be superficial upgrades to the existing forestry track entrance) within a corner of the Nant Cwmfarteg catchment. Given the distance between the site entrance and the spring, and because the track upgrades will not require deep excavation, there will not be any impacts on the groundwater serving the Maesteg golf course spring.

The groundwater spring abstraction at Garnwen Farm in Nantyffyllon is located approximately 780m to the east of the existing forestry access track which may be partly upgraded. It is located in the unnamed SE catchment which is topographically disconnected from the nearest site infrastructure which straddles the top of the Nant y Crynwdd catchment (see **Figure 12.2**). Therefore there would not be any effects on the groundwater serving the Garnwen Farm spring.

This assessment finds that the proposed development would not result in any significant effects on private water supplies and the licensed abstraction.

Ground stability

Potential effects on near surface ground stability have been mitigated through the avoidance of steep slopes and the confirmation that no areas of deep peat are present. A geotechnical survey (to include mapping and exploratory drilling) will be undertaken, that will focus on the area of development around T1, T2, T3, T4, T8 and T9 as recommended by the ground stability risk assessment (**Appendix 12B**). The assessment concluded that the potential effects can be readily engineered out and that the presence of shallow level abandoned mineworking does not preclude the safe foundation of infrastructure provide the appropriate level of ground stabilisation works are undertaken prior to erection. Depending upon the findings of the site investigations it may be necessary to stabilise the disturbed over-lying strata by either partial grouting to improve the bearing capacity of specific zones or to undertake full grouting of the workings and overlying strata. The survey, investigation and avoidance via micro-siting and standard ground stabilisation works where necessary will

further reduce the potential magnitude of effect on ground stability to Low/Negligible. When the magnitude and sensitivity are considered together, it can be concluded that effects on ground stability from the proposed development are concluded to be not significant.

Operational effects

Anticipated effects on hydrological receptors that are associated with the operational phase are the same as those already identified during the construction phase, however the magnitude of potential effects are found to be (usually) much reduced (compared to the construction phase) because of the lack of activities and exposed soils etc. during the operational phase.

The main drainage control features associated with permanent infrastructure during the construction phase (e.g. crane pads, substation, and tracks) will remain in place during the operational phase. As a result, it is considered that there would be no significant effects during the operational phase.

Decommissioning effects

The activities associated with the decommissioning phase will be similar to those undertaken during the construction phase. Anticipated effects on hydrological receptors that are associated with the decommissioning phase are largely the same as those already identified during the construction phase, however the magnitude of potential effects are found to be in most cases reduced (compared to the construction phase) because the SuDS features and site tracks may be utilised in the phased removal of infrastructure.

Turbine bases will be left in place following the lifetime of the development to avoid unnecessary environmental disturbance.

The decommissioning phase will allow much of the drainage infrastructure and control mechanisms to be applied throughout much of the decommissioning phase. As a result, it is considered that there would be no significant effects during the decommissioning phase.

Summary of predicted effects

A summary of the results of the assessment of the Water Resources and Ground Conditions assessment is provided in **Table 12.14**.

Table 12.14 Summary of significance of adverse effects

Receptor	Sensitivity/ importance/ value of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
On site watercourses (Nant yr Hwyaid, Nant Cynon, Nant Tryfal and Nant Drysiog tributaries)	Low	Negligible to Low	Negligible to Slight (Not significant)	Implementation of environmental measures (see **Table 12.10**) will ensure no significant effects would result from the proposed development
Afon Afan	Medium	Negligible to Low	Negligible to Moderate (Not significant)	Implementation of environmental measures (see **Table 12.10**) will ensure no significant effects would result from the proposed development
Flood risk	High	Negligible	Slight (Not significant)	Implementation of environmental measures (see **Table 12.10**) will ensure no significant effects would result from the proposed development

Receptor	Sensitivity/ importance/ value of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
Peat hydrology	Medium	Low	Slight/Moderate (Not significant)	Implementation of environmental measures (see **Table 12.10**) will ensure no significant effects would result from the proposed development
Ground stability	Low	Negligible to Low	Negligible to Slight (Not significant)	Implementation of environmental measures (see **Table 12.10**) will ensure no significant effects would result from the proposed development. Targeted site investigation works to be carried out prior to construction.
On-site soil hydrology	Low	Low	Slight (Not significant)	Implementation of environmental measures (see **Table 12.10**) will ensure no significant effects would result from the proposed development
Groundwater quality (Swansea Carboniferous Coal Measures WFD GW body)	Low	Negligible	Negligible (Not significant)	Implementation of environmental measures (see **Table 12.10**) will ensure no significant effects would result from the proposed development. Any subsurface grouting to be highly localised and following best practice.
Groundwater quantity (Swansea Carboniferous Coal Measures WFD GW body)	Low	None	No Effect (Not significant)	Small spatial extent and depth of impermeable turbine bases is insignificant in context of catchment scale and will therefore not impede recharge.
Private water supplies (PWS)	High	None	No Effect (Not significant)	PWS assessment has confirmed no hydrological continuity with the potential catchments of local PWSs.

The sensitivity/importance/value of a receptor is defined using the criteria set out in section 12.9 above and is defined as low, medium and high.
The magnitude of change on a receptor resulting from activities relating to the development is defined using the criteria set out in section 12.9 above and is defined as negligible, low, medium and high.
The significance of the environmental effects is based on the combination of the sensitivity/importance/value of a receptor and the magnitude of change and is expressed as major (significant), or moderate/minor/negligible (not significant), subject to the evaluation methodology outlined in section 12.9.

12.11 Assessment of cumulative effects

As described above, any effects on water resources and ground conditions will be not significant due to the good practice measures to be implemented in design and construction, and specific measures that will be put in place with regards to the watercourse crossings. Nevertheless, it is important to consider potential cumulative effects with other developments that may have an effect on the same hydrological receptors.

There are no developments (current or planned) within the surface water study area i.e. relevant surface water catchments.

There may be other potential developments within the same groundwater unit (i.e. that also overlay the Swansea Carboniferous Coal Measures WFD Groundwater body), however the degree of potential interaction from the proposed development with the groundwater receptor is highly localised (and is not significant) and any cumulative effects on the groundwater receptor may be scoped out.

As a result, cumulative effects on water resources and ground conditions are concluded to be not significant.

12.12 Consideration of additional mitigation or compensation

No additional mitigation measures are proposed to further reduce the water resources and ground conditions effects that are identified in this ES. This is because all relevant and implementable measures have been embedded into the development proposals and are assessed above in this chapter. These measures are considered likely to be effective and deliverable and address the likely significant effects of the proposed development.

12.13 Conclusions of significance evaluation

Table 12.14 showed that the construction, operation and decommissioning of the proposed development is not expected to lead to any significant effects on the water environment, provided that all recommended environmental measures outlined in section 12.8 are put in place. The conclusions reflect those of the 2014 ES.

12.14 Implementation of environmental measures

This section describes the environmental measures embedded within the proposed development and the means by which they will be implemented, i.e. they will secured through the incorporation of the design requirements into Contractor's method statements (i.e. the Construction Method Statement) and operational measures in the site's Environmental Management Plan.

Geophysical survey work (to confirm any requirement for standard ground stabilisation works around shallow abandoned mine workings) will need to be undertaken early in the scheme of works for the proposed development. This will ensure that discussion, decision-making and any further investigation can be undertaken before main contract operations begin. Furthermore, micro-siting of the affected turbines and the section of access track around T1 and T3 will be necessary prior to construction of the main contractors' compound.

Table 12.15 summarises the compliance mechanisms by which the implementation of the recommended environmental measures will be ensured.

Table 12.15 Summary of environmental measures relevant to water resources and ground conditions to be implemented

Environmental measure	Responsibility for implementation	Compliance mechanism	ES Section Reference
On-site measures to control sediment entrainment to surface water during construction	Contractor	Scope/design of works e.g. SuDS design and track design will be dictated by CMS Auditable monitoring checks Water quality monitoring at exit of Nant yr Hwyaid surface watercourse from western site boundary. A planning condition will state that no works are to commence without LPA approval of the CMS, in consultation with NRW	Section 12.8
On-site SuDS drainage features including impermeable 'plugs' in trenching runs	Contractor	Scope/design of works e.g. SuDS design and track design will be dictated by CMS Auditable monitoring checks A planning condition will state that no works are to commence without LPA approval of the CMS in consultation with the LLFA (Neath Port Talbot County Borough Council)	Section 12.8
Protection of surface water quality from spillages of fuels, oils and other chemicals during operation	Contractor	Scope/design of works will be dictated by CMS which will include a PPP; Implementation of CEMP Auditable monitoring checks; Water quality monitoring at exit of surface watercourse from western site boundary A planning condition will state that no works are to commence without LPA approval of the CMS, PPP and the CEMP, in consultation with NRW	Section 12.8
Flood risk considerations (surface water management) and prevention of sediment entrainment in runoff	Developer/Contractor	Appropriate storage integrated into site design Specific consideration of drainage designs including watercourse crossing design and installation under OWCs from the LLFA, which is Neath Port Talbot County Borough Council. All drainage design to be agreed with Neath Port Talbot County Borough Council acting as the LLFA. A planning condition will state that no works are to commence without LPA approval of the CMS in consultation with NRW and the LLFA.	Section 12.8

Environmental measure	Responsibility for implementation	Compliance mechanism	ES Section Reference
Geotechnical survey (site investigation works) focussing on areas around T1, T2, T3, T4, T8 and T9. Micro-siting and standard ground stabilisation techniques as appropriate.	Developer/Contractor	Production of CMS Water quality monitoring at exit of surface watercourse from western site boundary Environmental permits would be obtained in consultation with NRW as required, and is dependent on the duration of the discharge activity A planning condition will state that no works are to commence without LPA approval of the CMS and in consultation with NRW	Section 12.8
Geotechnical survey (site investigation works) focussing of areas around T1, T2, T3, T4, T8 and T9. Micro-siting and standard ground stabilisation techniques as appropriate.	Developer/Contractor	Scope/design of works will be dictated by CMS; Pre-requisite of subsequent site access, therefore in interests (both structurally and logistically to complete early in construction program) A planning condition will state that no works are to commence without LPA approval of the CMS in consultation with Neath Port Talbot County Borough Council and NRW	Section 12.8

12.15 References

Bridgend County Borough Local Development Plan 2006 – 2021 (2013), Section on Protecting and Enhancing the Natural Environment, ENV6 Nature Conservation

British Geological Survey (2018) website, https://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html

Centre of Ecology and Hydrology (CEH) (2009) Flood Estimation Handbook (CD ROM v3)

CIRIA Report C753 (2015) The SuDS Manual;

CIRIA Report C532 (2001) Control of water pollution from construction sites; and

CIRIA Report C692 (2010) Environmental good practice on-site (third edition)

Cranfield University Soilscapes website (2018), http://www.landis.org.uk/soilscapes/

DEFRA (2018) MAGIC natural environment map viewer, http://magic.defra.gov.uk/MagicMap.aspx

Forestry Commission (2011) UK Forestry Standard Guidelines - Forests and Water.

Institute of Hydrology (1994). Report No. 124, Flood estimation of small catchments. DCW Marshall & AC Bayliss, June 1994.

James Associates. Foel Trawsnant Wind Farm: An assessment of previous underground mine working activity and its potential impact upon the proposed Foel Trawsnant Wind Farm site. 2014.

MAFF (2000) DEFRA Good Practice Guide for Handling Soils.

Neath Port Talbot County Borough Council Local Development Plan (2016) Strategic Policy 1 (SP1) Climate Change

NERC (2008). UK Hydrometric Register, Centre for Ecology and Hydrology.

NERC (1975). Flood Studies Report (5 volumes). Natural Environment Research Council (Institute of Hydrology).

NRW (2018) Lle A Geo Portal for Wales, http://lle.gov.wales/home

NRW (2014) The Swansea Bay Abstraction Licensing Strategy, May 2014

NRW (2015) Western Wales River Basin Management Plan 2015 – 2021 Summary

NRW (2018) Flood Risk mapping – risk of flooding from fluvial and surface water sources, https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en

NRW '(2018) Water Watch Wales Map Gallery' online interactive maps, http://waterwatchwales.naturalresourceswales.gov.uk/en/

Revised Netregs (2018) Guidance for Pollution Prevention (GPPs), including GPP2: Above ground oil storage tanks, GPP5: Works and maintenance in or near water, PPG7: Safe storage – The safe operation of refuelling facilities, PPG21: Pollution incident response planning;

SNH (2010) Floating Roads on Peat, A report into Good Practice, Design, Construction and Use of Floating Roads on Peat with particular reference to Wind Farm Developments in Scotland, August 2010

Welsh Assembly Government (2016) CL-03-16 – Climate Change Allowances for Planning Purposes, https://gov.wales/topics/planning/policy/policyclarificationletters/2016/cl-03-16-climate-change-allowances-for-planning-purposes/?lang=en

13 Traffic and Transport

13.1 Introduction

This chapter of the ES assesses the likely significant effects of the proposed development with respect to Traffic and Transport. It should be read in conjunction with the development description provided in **Chapter 5** and the Construction Traffic Management Plan (CTMP) submitted alongside this ES (document reference 40217rr062i1).

This assessment forms part of an updated assessment of the effects of the Foel Trawsnant amended scheme (the proposed development). The previous assessment was undertaken in 2014 (doc ref 24311rr073i1) and included an assessment of a proposed 13 turbine wind farm with 35m blades and associated infrastructure. The proposed development, assessed within this ES chapter, includes 11 turbines with 45m blades and associated infrastructure.

This updated assessment considers the baseline and the potential effects of the traffic generated by the proposed development during construction. Operational effects have been considered to be not significant as the site would not be permanently staffed. It is envisaged that only a small number of vehicle trips would be required throughout the operational life of the wind farm for maintenance purposes.

Decommissioning effects have been considered to be less than the construction effects as the growth in background traffic between the start of operation and the decommissioning of the wind farm would result in a smaller percentage impact of traffic associated with the decommissioning.

13.2 Limitations of this assessment

There are no limitations relating to Traffic and Transport that affect the robustness of the assessment of the potential likely significant effects of the proposed development.

13.3 Policy and legislative context

Planning policy

Table 13.1 lists the issues from the relevant planning policies that have been considered in assessing the Traffic and Transport effects.

Table 13.1 Policy issues considered in preparing the Traffic and Transport assessment

Policy reference	Policy issues	Considered in section
National planning policies		
Planning Policy Wales (PPW) Chapter 8: Transport (2016)	This policy provides guidance on the integration of land use, planning and transport matters to promote more sustainable transport choices for people and freight, thus reducing the need to travel, particularly by private transport.	13.8 and CTMP
National Planning Statement EN-1	This guidance sets out the methodologies to be used should the development in question be considered to give rise to significant transport effects. Travel Plans should be provided should the	13.8 and CTMP

Policy reference	Policy issues	Considered in section
	development generate significant numbers of vehicle movements during operation.	
National Planning Statements EN-3	NPS EN-3 2.7.75 – 2.7.77 advises that various routes to site should be reviewed for the delivery of material and components and the most appropriate route selected. The assessment should also consider the size of the components to be used.	13.5
TAN 18 Transport (2007)	Policy 9.8 Environmental Impact Assessment (EIA) is required for major transport proposals such as motorways, rail-lines, and aerodromes. For other transport proposals an EIA is required if the development is likely to have significant environmental effects.	13.10
	Policy 9.11 Local authorities should provide developers and others with information on the standards of design, layout and construction which they would expect new roads to follow, especially where the road is to be adopted. Over-engineered access standards should be avoided where possible. The design and standard of such access roads should have regard to the local surroundings and to fitness of purpose so that developers and future users are not unreasonably burdened with costly and/or inappropriate access roads.	13.5
	Policy 9.16 Many proposed developments will require access to the existing highway network. The type of access provided should reflect the type and nature of the road and the volume and character of traffic likely to use the access.	13.5
	Policy 9.18 The extra trips generated by a proposed development may bring forward the need for transportation improvements in the vicinity of the scheme and beyond.	13.5
Neath Port Talbot County Borough Council Local Development Plan (2011-2026)	Policy SP20 This policy states that proposals will be resisted if they are considered to cause unacceptable impact on highway safety.	13.5 and 13.10
	Policy TR2 This policy states that a proposal will only be permitted if: a)"The development does not compromise the safe, effective and efficient use of the highway network and does not have an adverse impact on highway safety or create unacceptable levels of traffic generation".	13.5 and 13.10
	Policy TR4 This policy states that proposals that would inhibit the use of certain freight facilities will be resisted "unless it can be demonstrated that the use of the route for movement of freight is not realistic or necessary".	13.5 and 13.10
	Policy 14 This policy states that proposals will be resisted if they are considered to cause unacceptable adverse impact in terms of: - a) "Traffic generation and highway safety;" b) "Poor accessibility by public transport, cycling and walking including people with disabilities; and" c) "Preventing the use or re-use of docks, harbours, wharfs or routes of railway lines." Achieving Sustainable Accessibility objectives Objective 21: "Increase accessibility, promote active travel and encourage a shift to more sustainable modes of transport for people and freight." Objective 22: "Reduce impacts of traffic growth and congestion and promote the efficient and effective use of the transport network."	13.5 and 13.10
Bridgend County Borough Council Local Development Plan 2006-2021	Policy SP3 Development proposals should reduce the negative impact of road freight transport.	13.10 and CTMP

Policy reference	Policy issues	Considered in section
	Policy PLA5 "The following transport corridors are identified as the main routes in the County Borough for the movement of people and goods": PLA5(1), M4 PLA5(2), Lynfi PLA5(3), Garw PLA5(4), ogmore PLA5(5), Aberkenfig-Brynmenyn PLA5(6), Pyle-Aberkenfig PLA5(7), Pencoed-Pyle PLA5(8), Porthcawl-Cornelly Development which would: a) Adversely affect safe and efficient movement in these corridors; and/or b) Create or exacerbate harm to the environment along them; and/or c) Not be capable of mitigation; will not be permitted".	13.5 and 13.10

Technical guidance

The only document available which sets out a methodology for assessing potentially significant transport environmental effects is the 1993 Institute of Environmental Assessment (IEA) publication Guidance Notes No. 1: Guidelines for the Environmental Assessment of Road Traffic (hereafter referred to as GEART).

13.4 Data gathering methodology

Desk study

The following data sources have been used to inform the baseline of this chapter:

- Three permanent ATC data has been extracted from the Department for Transport (DfT) Traffic Count Website available at: http://www.dft.gov.uk/traffic-counts/. This website provides traffic data for the years between 2000-2017;
- Personal Injury Accident (PIA) data for the study area was requested from Neath Port Talbot County Borough and Bridgend County Borough Councils and this request was redirected to South Wales Police. The accident information provided by the police did not provide the level of detail required and therefore data from the Crashmap online service, available at http://www.crashmap.co.uk/, was used to determine the accident history in the area; and
- TEMPro: Used to determine traffic growth factors from the base year to the year of assessment developed by the DfT.

Survey work

The following surveys have been undertaken to inform the assessment undertaken in this chapter:

- Automatic Traffic Counts (ATC) were undertaken in 2014 at eight locations covering potential routes to the development site; plus
- An ATC at location number 5 was undertaken again in April 2018, to provide a robust estimate of traffic growth between 2014 and 2018.

13.5 Overall baseline

Current baseline

The proposed development site comprises grassland and agricultural farmland in an elevated location.

One point of access is proposed to and from the site onto the B4282. The haulage routes to the site are identified in **Figure 13.1**. A preliminary design of the proposed access is included as **Figure 13.2.**

It is noted that the scope of the environmental assessment for traffic and transport relates only to the route from the M4 to the site. The M4 and the route to the relevant port are part of the Strategic Road Network (SRN) in Wales and as such is considered to be capable of accommodating the additional temporary traffic flows as a result of the construction of the turbines plus the abnormal loads that may be expected.

A4063

The proposed access route will run along 12.4km of the A4063 starting from junction 36 of the M4 to Maesteg town centre and the junction with the B4282. The road varies in standard along the 12.4km. The road starts off as a good standard dual carriageway road from junction 36 of the M4 to the junction with the B4281 (1.4km in total). The road then heads north and becomes a rural standard single carriageway road with variable speed limits and speed reduction measures (such as signage) as it passes though villages on the way to Maesteg. Street lighting is present in urban sections of the road and where they are not, retro-reflective roads studs are provided. The route follows the A4063 until it reaches the A4063/B4282 junction at Cwmfelin, where the blade abnormal indivisible load (AIL) vehicles will take a right turn onto the B4282 Mill Street, Bridgend Road. All other construction vehicle will remain on the A4063 passing through Maesteg town until a left turn at the B4282 Neath Road junction.

Several sensitive locations are identified on this section of the local road network in the following locations:

- Tondu – The road passes through this settlement near a railway station, play park, church, retail park and where there may be high pedestrian movements;
- Coytrahen – The road passes through this settlement where houses are adjacent to the carriageway, near a play park and community centre and where there may be high pedestrian movements;
- Llangynwyd - The road passes the Ysgol Gyfun Gymraeg Llangynwyd Bridgend's only Welsh medium secondary school;
- Maesteg – The road passes two further schools adjacent to the carriageway Cwmfelin Primary School and Saint Mary's and St Patrick's Catholic Primary School; and
- Maesteg – The road passes though the town centre of Maesteg where there are high pedestrian movements, businesses and residential properties adjacent to the carriageway.

B4282 Mill Street, Bridgend Road

Through the study area the B4282 Mill Street, Bridgend Road routes north from the junction with the A4063 in Cwmfelin and continues through the village of Garth and re-joins the A4063 at the A4063 Castle Street/Talbot Street junction in Maesteg. This section of the B4282 routes predominantly through residential areas where the speed limit is 30mph. Street lighting and pedestrian footways are provided throughout the route along this road.

B4282 between Maesteg and the A4107

The B4282 between Maesteg and the A4107 is some 7.2km. The road is rural in nature only passing through the village of Bryn. The road is provided with street lighting but there is little footway provision outside of Maesteg and Bryn. There is a derestricted speed limit (in this case 60mph) for the majority of the route except through Bryn where the speed limit is reduced to 20mph.

Several sensitive locations are identified on this element of the local road network in the following locations:

- Bryn – The road passes through this residential village where houses, footways and community centres are adjacent to the carriageway; and
- Maesteg –The road passes though residential areas to the west of Maesteg town centre where pedestrian flows are high.

A4107

The proposed route will run along 3.2km of the A4107 from junction 40 of the M4 to the junction with the B4282. This road is a standard single carriageway road some 7-7.5m in width. After a short distance from the motorway junction the road turns north (at a roundabout with Tan-y-Groes Place) and climbs steeply uphill around various bends in the road alignment. This continues over the entirety of the 3.2km route to the signalised junction with the B4282. The road speed limit is predominately 30/40mph with one section of 20mph with various speed reduction measures (such as signage, variable message signs, road build outs, carriageway marking) provided. There are locations where no footways are present, however street lights are provided in all the settlements.

Several sensitive locations are identified on this element of the local road network road in the following locations:

- North Port Talbot – The road passes through a residential area, and passes a church adjacent to the carriageway, pedestrian movements may be higher than average in this area; and
- Cwmafan – The road passes through a residential area, where traffic signals and pedestrian footways are present. The speed limit is 20mph in this location.

Existing traffic flows

In order to establish the baseline situation, classified traffic survey data was sought along the road network in the vicinity of the development site. The traffic counts were undertaken for a week between 14 May 2014 and 21 May 2014 by Streetwise Services. A plan setting out the location of the traffic counts is presented in **Figure 13.3**. The counts were undertaken in the following locations.

- 1 -A4107 (Tan-y-Groes Street) Port Talbot – Between the M4 Junction 36 and roundabout junction with Tan-y-Groes Place;
- 2 - A4107 (Pen-y-Cae Road) Penycae – Between junctions with Gwar-y-caeau and The Uplands;
- 3 - A4107 (Afan Valley Road) Cwmafan – Just south of junction with Ynysygwas Hill;
- 4 - B4282 (Bryngyrnos Street) Bryn – Just East of junction with Neath Road;
- 5 - B4282 (Neath Road) – West of Maesteg – North of Maesteg Golf Club;
- 6 – A4063 (Bridgend Road) – Llangynwyd – South of junction with Llan Road;
- 7 – A4063 (Maesteg Road) – Tondu – South of junction with Heol Felyn Fach; and
- 8 – A4063 – North of junction with B4281/Bridgend Road.

To understand the change in baseline traffic conditions from 2014 to 2018, an additional ATC survey was undertaken in April 2018 at count location 5, B4282 (Neath Road) – West of Maesteg. The change between this 2018 survey and its 2014 counterpart was used as a factor to estimate the 2018 traffic volumes elsewhere in the study area. The resultant factor was 1.13.

The average existing 2018 two-way weekday traffic flows between 07:00 - 19:00 (the times during which the site is likely to be open for construction) are detailed in **Table 13.2**.

Table 13.2 Average two-way weekday flows (2018)

Survey Site	Location	Total Traffic (inc. HGV)	HGV (inc. Public Service Vehicles (PSV))	HGV%
1	A4107 (Tan-y-Groes Street) Port Talbot	9,299	818	9%
2	A4107 (Pen-y-Cae Road) Penycae	5,412	340	6%
3	A4107 (Afan Valley Road) Cwmafan	4,413	470	11%
4	B4282 (Bryngyrnos Street) Bryn	4,889	467	10%
5	B4282 (Neath Road) – West of Maesteg	4,964	544	11%
6	A4063 (Maesteg Road) – Llangynwyd	12,870	1,373	11%
7	A4063 (Maesteg Road) – Tondu	12,862	1,357	11%
8	A4063 North of junction with B4281/Bridgend Road	16,120	1,141	7%

Personal injury accidents

Records of Personal Injury Accidents (PIA) have been obtained from the Crashmap website for the five year period from 2013 to 2017 for the local highway network:

- The A4063 has been assessed from the junction with the B4282 Neath Road in Maesteg to the junction with the A4061 and M4 slips in Bridgend.
- The B4282 has been assessed from the junction with the A4063 at Cwmfelin to the junction with the A4107 Afon Valley Road.
- The A4017 Afon Valley Road has been assessed from the junction with the B4282 to the junction with Tan-Y-Groes near junction 40 of the M4 motorway.

Figure 13.4 and **Table 13.3** set out the fatal, serious and slight accidents recorded on these roads over the assessed time period.

Table 13.3 Accident record 2013-2017

	Fatal	Serious	Slight
A4063	1	10	65
A4107	0	7	31
B4282	0	2	10

It is considered that the accident record for the three links show that overall there are no significant road safety issues around the assessed road network. The highway links which have been assessed are significant in length and include a number of junctions.

One fatal accident was recorded on the A4063 in Maesteg. The accident is located in the centre of a link not near a junction and there are no other accidents recorded near this accident location. It is considered that this accident is an isolated incident likely caused by driver error rather than the highway infrastructure.

Predicted future baseline

GEART recommends that:

> *"...assessment should be undertaken at the year of opening of the development or the first full year of its operation. For a phased development it may be necessary to consider the first year of each phase."*

Background traffic flows are predicted to increase on the local road network without the Foel Trawsnant Wind Farm Amended Scheme. It has been assumed for this assessment that the proposed construction of the scheme would begin in 2020 and be completed in 2021. The future year of assessment has been based on the months when most construction traffic would be evident and these occur in 2020 as set out later in this chapter.

In order to estimate future year traffic flows during 2020 a traffic growth factor specific to Neath Port Talbot has been derived from TEMPro in order to determine traffic growth from 2018. The traffic growth factor between 2018 and 2020 is 1.017 for light vehicles and 1.0275 for HGV.

The following selections were made in TEMPro to generate the growth rate set out above:

- Geographical area - Neath Port Talbot;
- Base year: 2018, future year: 2020; and
- Time period – Average weekday.

Table 13.4 below shows the resultant future base traffic flows in 2020.

Table 13.4 Predicted daily average future baseline two-way traffic flows (2020)

Survey Site	Location	Total Traffic (inc. HGV)	HGV (inc. Public Service Vehicles (PSV))	HGV%
1	A4107 (Tan-y-Groes Street) Port Talbot	9,466	840	9%
2	A4107 (Pen-y-Cae Road) Penycae	5,508	349	6%
3	A4107 (Afan Valley Road) Cwmafan	4,493	483	11%
4	B4282 (Bryngyrnos Street) Bryn	4,977	480	10%
5	B4282 (Neath Road) – West of Maesteg	5,054	559	11%
6	A4063 (Bridgend Road) – Llangynwyd	13,103	1,411	11%
7	A4063 (Maesteg Road) – Tondu	13,095	1,394	11%
8	A4063 – North of junction with B4281/Bridgend Road	16,406	1,172	7%

13.6 Consultation

Consultation has been undertaken with the local planning authority with regard to scoping of the environmental assessment.

Table 13.5 provides a summary of the issues that have been raised by consultees and the responses given.

Table 13.5 Summary of Traffic and Transport consultation

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref
Local authority require a trial run for the proposed AIL route.	Neath Port Talbot County Borough Council	This will be provided by third parties, with a desk based study presented in the CTMP.	CTMP

13.7 Scope of the assessment

The greatest potential for traffic and transport related environmental effects will be associated with HGV movements and abnormal load vehicles to and from the development site during the construction phase of the development. Impacts are therefore assessed for general construction traffic movements and then specifically for abnormal loads.

Once the turbines are in operation, minimal vehicle traffic would be required to access the development site. The turbines are designed to be monitored remotely and therefore require only routine maintenance visits from a 4x4, van or similar vehicles with very occasional need for a HGV. As per the approach in the 2014 ES, it is considered that the effects of the operational traffic would be negligible and therefore the operational phase of the development is not considered any further in this assessment.

When the turbines are decommissioned after approximately 25 years of operation, there may be an effect on the local highway network due to the movements of HGV and abnormal loads associated with the removal of equipment and materials from the development site. However, due to the retention in situ of some elements of the infrastructure the level of traffic generation during decommissioning would be less than during construction. Furthermore, the future baseline traffic flows would typically be higher due to background traffic growth. Therefore, any percentage change in traffic due to decommissioning impacts would be lower than during the construction phase and so the construction phase represents the worst case scenario.

Spatial scope

The spatial scope of the assessment of Traffic and Transport effects covers the area of the site contained within the planning boundary, together with the Zones of Influence that has formed the basis of the study area described in section 13.5.

Temporal scope

The temporal scope of the assessment of Traffic and Transport is consistent with the period over which the development would be carried out and therefore covers the construction and operational periods. It is assumed that construction will begin in the year 2020 and will be completed in the year 2021. It is assumed that the development will have an operational life of 25 years.

Potential receptors

The potential receptors for assessment are based on the roads that are likely to be subject to a change in traffic. A change in the traffic characteristics of the local roads as a result of traffic generated during construction is likely to affect users of those roads and the land uses that front them.

The Traffic and Transport receptors that have been identified for assessment are summarised as follows:

- A4107 (Tan-y-Groes Street) Port Talbot;
- A4107 (Pen-y-Cae Road) Penycae;
- A4107 (Afan Valley Road) Cwmafan;
- B4282 (Bryngyrnos Street) Bryn;
- B4282 (Neath Road) West of Maesteg;
- A4063 (Maesteg Road) Llangynwyd;
- A4063 (Maesteg Road) Tondu; and
- A4063 North of junction with B4281/Bridgend Road.

Potentially significant effects

The methodology used in this chapter (adopting that set out by the GEART) includes evaluating:

- Potential effects on local roads and the users of those roads, including public transport users, pedestrians and cyclists; and
- Potential effects on land uses and environmental resources fronting those roads, including the relevant occupiers and users.

GEART also identifies groups, locations and areas which may be sensitive to changes in traffic conditions and which should be considered for assessment. These could include areas where there is sizeable pedestrian activity, but poor pedestrian facilities, accident hotspots, sensitive groups including children, elderly and disabled and sensitive locations, e.g. hospitals, churches, schools, historical buildings.

Key traffic related environmental effects considered relevant in this assessment include:

- Severance;
- Driver Delay;
- Pedestrian Delay;
- Pedestrian Amenity;
- Fear and Intimidation; and
- Accidents and Safety.

The Traffic and Transport receptors that have been taken forward for assessment are summarised in **Table 13.6**.

Table 13.6 Traffic and Transport receptors scoped in for further assessment

Receptor	Relevant assessment criteria	Potentially significant effects
A4107 (Tan-y-Groes Street) Port Talbot	1993 Institute of Environmental Assessment (IEA) publication Guidance Notes No. 1: Guidelines for the Environmental Assessment of Road Traffic	Potential effects on local roads and the users of those roads, including public transport users, pedestrians and cyclists; and Potential effects on land uses and environmental resources fronting those roads, including the relevant occupiers and users.
A4107 (Pen-y-Cae Road) Penycae		
A4107 (Afan Valley Road) Cwmafan		
B4282 (Bryngyrnos Street) Bryn		
B4282 (Neath Road) – West of Maesteg		
A4063 (Maesteg Road) – Llangynwyd		
A4063 (Maesteg Road) – Tondu		
A4063 – North of junction with B4281/Bridgend Road		

13.8 Environmental measures embedded into the proposed development

A range of environmental measures have been embedded into the development proposals as outlined in section 5.4 of this ES. **Table 13.7** outlines how these embedded measures will influence the Traffic and Transport assessment.

Table 13.7 Summary of the embedded environmental measures and how these influence the Traffic and Transport assessment

Receptor	Potential changes and effects	Embedded measures and influence on assessment
All transport receptors	Increase in HGV traffic as a result of the proposed development.	A CTMP will be produced which will reduce the effect of the increase in construction traffic on the local highway network.

13.9 Assessment methodology

Methodology for prediction of effects

The generic project-wide approach to the assessment methodology is set out in **Chapter 2**. However, whilst this approach has informed the approach that has been used in this Traffic and Transport assessment, it is necessary to set out how this methodology has been applied, and adapted as appropriate, to address the specific needs of this Traffic and Transport assessment.

Sensitivity of Receptor

The sensitivity of each receptor is determined by professional judgement and based upon locations and areas which may be sensitive to changes in traffic conditions. These could include areas where there is sizeable pedestrian activity, but poor pedestrian facilities, accident hotspots, sensitive groups including children, elderly and disabled and sensitive locations, e.g. hospitals, churches, schools, historical buildings. An assessment of the study area road network enabled the following receptors to be classified as sensitive or not:

- Sensitive Receptors – survey sites 1, 3, 4, 5, 6 and 7; and
- Non-Sensitive Receptors – survey sites 2 and 8.

Significance evaluation methodology

In order to define the scale and extent of this assessment, GEART identifies the following rules to undertake an assessment of potentially significant traffic and transport related environmental effects:

- Rule 1: Include roads where traffic flows are predicted to increase by more than 30% (or where the number of HGV are predicted to increase by more than 30%); and
- Rule 2: Include any specifically 'sensitive' areas where traffic flows are predicted to increase by 10% or more.

The 10% threshold in Rule 2 considers daily variations in traffic levels which are typically around 10% meaning that an increase in traffic levels of less than 10% is not likely to have an undesirable effect and would not require assessment.

To determine the percentage change, the estimated traffic generation resulting from the construction phase of the proposed development is compared with future baseline traffic flows.

GEART identifies general thresholds for traffic flow increases as identified above. Where the predicted increase in traffic flows is lower than the thresholds, the guidelines suggest the significance of effects can be stated to be low or insignificant. The EIA Regulations require that a final judgement is made about whether or not each effect is likely to be significant and **Table 13.8** below summarises the significance criteria based on Rule 1 and Rule 2 above.

Table 13.8 Significance criteria

Parameter of Assessment	Significance
Change in traffic flows and HGV over 30%	Significant
Change in total traffic flows over 10% in sensitive areas	Significant
Change in traffic flows and HGV below 30%	Not Significant
Change in total traffic flows below 10% in sensitive areas	Not Significant

For those receptors where the percentage change suggests a 'significant' outcome then further investigation is required as according to GEART "*…for many effects there are no simple rules or formulae which define the thresholds of significance and there is, therefore, a need for interpretation and judgement on the part of the assessor, backed-up by data or quantified information wherever possible. Such judgements will include the assessment of the numbers of people experiencing a change in environmental impact as well as the assessment of the damage to various natural resources.*"

This further investigation is based on the advice provided within GEART and which is summarised below.

Severance

Severance is the perceived division that can occur within a community when it becomes separated by a major traffic artery and is used to describe the factors that separate people from other people and places. For example, severance may result from the difficulty of crossing a heavily trafficked road or a physical barrier created by the road itself. It can also relate to quite minor traffic flows if they impede pedestrian access to essential facilities.

The effects of severance can be applied to motorists, pedestrians or residents. GEART suggests that changes of traffic flow of 30%, 60% and 90% are regarded as producing 'slight', 'moderate' and 'substantial' changes in severance respectively. However, there are no predictive formulae which give simple relationships between traffic factors and levels of severance.

GEART states that marginal changes in traffic flow are unlikely to create or remove severance, but that consideration in determining whether severance is likely to be an important issue should be given to factors such as road width, traffic flow and composition, traffic speeds, the availability of crossing facilities and the number of movements that are likely to cross the affected route. Consideration should also be given to different groups such as the elderly and young children.

Driver delay

Delays to non-development traffic can occur at several points on the local highway network as a result of the additional traffic that would be generated by a development. GEART states that delays are only likely to be significant when the traffic on the network surrounding the development is already at, or close to, the capacity of the system.

Pedestrian delay

Changes in the volume, composition or speed of traffic may affect the ability of people to cross roads, and therefore, increases in traffic levels are likely to lead to greater increases in delay. Delays will also depend upon the general level of pedestrian activity, visibility and general physical conditions of the crossing location.

Given the range of local factors and conditions which can influence pedestrian delay, GEART does not recommend that thresholds be used as a means to establish the significance of pedestrian delay, but recommend that reasoned judgements be made instead. However, GEART does note that, when existing traffic flows are low, increases in traffic of around 30% can double the delay experienced by pedestrians attempting to cross a road.

Pedestrian amenity

Pedestrian amenity is broadly defined as the relative pleasantness of a journey, and is considered to be affected by traffic flow, traffic composition and pavement width/separation from traffic.

GEART notes that changes in pedestrian amenity may be considered significant where the traffic flow is halved or doubled, with the former leading to a beneficial effect and the latter an adverse effect.

Fear and intimidation

The scale of fear and intimidation experienced by pedestrians is dependent on the volume of traffic, its HGV composition, its proximity to people or the lack of protection caused by such factors as narrow pavement widths, as well as factors such as the speed and size of vehicles.

There are no commonly agreed thresholds that determine the significance of the effect. However, GEART notes previous work that has been undertaken which puts forward thresholds that define the degree of

hazard to pedestrians by the average traffic flow, 18hour/day heavy vehicle flow and average speed over an 18 hour day in miles per hour.

GEART also notes that special consideration should be given to areas where there are likely to be particular problems, such as high speed sections of road, locations of turning points and accesses. Consideration should also be given to areas frequented by school children, the elderly and other vulnerable groups.

Accidents and safety

Where a proposed development is expected to produce a change in the character of the traffic on the local road network, as a result of increased HGV movements for example, GEART states that the implications of local circumstances or factors which may elevate or lessen risks of accidents, such as junction conflicts, would require assessment in order to determine the potential significance of accident risk.

Abnormal loads

The route of the abnormal loads is assessed to determine if there is a risk of impact on other road users by way of driver delay arising from the slow vehicles, the wide loads and the associated potential temporary road closures. The greatest potential impact is on other road users in the form of driver delay. Swept Path Analysis is used to assess any pinch points where a material delay could occur and this is assessed in combination with the volume of abnormal load movements. The details of the swept path assessments, and routing of such loads has been included within the CTMP.

13.10 Assessment of Traffic and Transport effects

Baseline conditions

Current baseline

Please see section 13.5 for the description of the baseline conditions.

Predicted future baseline

Please see section 13.5 for the description of the future baseline conditions.

Predicted effects and their significance

Predicted construction traffic movements

Estimated traffic generation during the construction phase has been based on the project description provided in **Chapter 5** and knowledge gained from other similar studies of HGV load capacities. Estimated traffic generation has been based on the various construction activities described below.

It should be noted that, in calculating traffic generation, account is taken of the return journey of the delivery vehicle.

It is estimated that the maximum number of construction staff on-site at any one time would be approximately 20. These staff could arrive/depart by various modes of transport from/to different locations and therefore, trip generations are difficult to predict. However, it is considered that 20 staff arrivals and 20 staff departures during a 12-hour working day are sufficiently low that an assessment of potentially significant environmental effects is not considered necessary.

It is anticipated that all aggregate required to construct the proposed development would be imported, by road.

Excavated soil would, as far as possible, be re-used on-site to reinstate the construction area. Should there be a need to remove and dispose of some soils or other excavation wastes, the volumes are expected to be minimal and therefore any associated traffic movements very low. There is also the potential for vehicles transporting construction materials to the development site to be utilised for the export of any construction waste off-site.

General plant and equipment – delivery and removal

A range of plant and equipment including earth movers, mechanical excavators and dump-trucks is expected to be delivered to the development site at the onset of the works and will be removed as soon as practical at the end of the activity for which the equipment relates.

The exact equipment required is unknown but around 30 HGV deliveries is considered to be a reasonable estimate. This would result in 60 HGV movements (30 in and 30 out) to deliver the equipment at the commencement of construction and 60 movements at the end of the construction phase to remove the equipment. Therefore, it is estimated that this would require a total of 120 two-way HGV movements over the course of the construction.

Stone for on-site access tracks

It is anticipated that all stone for the on-site access tracks will be sourced from off site.

A total of 4.8km of new on site access tracks would require stone (0.3m deep) and 1.4km of existing forestry tracks will need to be resurfaced (0.15m deep). The access tracks would be 5m wide. This length amounts to a requirement of 14,602 tonnes (around 8,126m^3) of stone. It is assumed that an extra 10% is added onto this figure as a contingency. Therefore, it is predicted that a maximum of 16,062 tonnes (approximately 8,939m^3) of stone would be required. Assuming a HGV can carry 20 tonnes of stone, it is considered that some 803 deliveries of road stone would be required, resulting in a total of 1,606 HGV movements (803 in and 803 out).

Delivery of bit-mac highways surface for bellmouth

A number of HGV deliveries would be required for highways surfacing for the bellmouth onto the local highways network and a section of the access track. It is estimated this would result in 6 HGV loads or 12 two-way vehicle movements (6 in and 6 out).

Stone for crane operation pads

It is anticipated that all stone for crane operation pads would be sourced off-site.

Based on 11 turbines and assuming 483 tonnes (268m^3) of stone is required for each pad a total of 5,313 tonnes of stone would be required in total. Assuming a HGV can carry 20 tonnes of stone, it is considered that an estimated 266 deliveries of road stone would be required, resulting in a total of 532 HGV two-way movements (266 in and 266 out).

Stone for temporary construction compound and laydown area

Two stone surfaced compound areas would be constructed on the site, with one compound a reception area at the entrance to the site (a short distance from the junction with the B2482) and the other near turbine 8 within the turbine platform area. These compounds would be constructed to a thickness of 200mm. The construction compounds would include an area for temporary buildings to be used for site offices, storage of various materials and small components, car parking and welfare facilities. The total area of the compounds will be 12,550m^2 giving a requirement for 2,562m^3 or 4,612 tonnes of stone.

Assuming a HGV can carry 20 tonnes of stone, it is considered that an estimated 231 deliveries of road stone would be required, resulting in a total of 462 HGV two-way movements (231 in and 231 out).

Electrical substation

Road stone would be required to allow for the construction of a suitable base area to accommodate the substation. It is proposed the base for the substation would have dimensions of 39m by 41.5m and a depth of 0.3m. This equates to a total of 583 tonnes of stone (324m^3)

Assuming a HGV can carry 20 tonnes of stone, it is considered that an estimated 30 deliveries of road stone would be required, resulting in a total of 60 HGV movements (30 in and 30 out).

Culverting

One culvert is anticipated and it is estimated this would result in one additional HGV load or two two-way vehicle movements (one in, one out).

Geogrid

The client has informed Wood that there is currently no requirement for Geogrid, but as a contingency, one delivery of Geogrid materials has been assumed and this results in two two-way vehicle movements.

Sand

The cable would be laid in trenches that are approximately 1m deep x 600mm wide and would be protected by a maximum of 400mm of soft sand.

A total of approximately 250m^3 of sand (400 tonnes based on a density of 1.6t/m^3) is required per kilometre. As such for the total cable length of 3.9km a total of 1,550 tonnes of sand is required. Assuming a HGV can carry 20 tonnes per load this would require 78 deliveries resulting in 156 two-way HGV movements (78 in and 78 out).

Substation equipment

Deliveries of the substation, transformers, compounds and associated fencing would be required and it is estimated that this would be achieved via 20 deliveries resulting in 40 two-way HGV movements.

Electric cabling

Underground electric cabling would be installed on-site to connect the turbines with the control building. Based on the proposed turbine and control building arrangement, a maximum of 3.9km of cable would need to be served by three lines of cabling, therefore 11.6km of cable is required. Assuming that the cable is delivered in 500m drums and a HGV can carry eight drums (equating to 4km of cable), it is estimated that three loads would be required. This would therefore result in six two-way HGV movements (three in and three out).

Concrete for turbine foundations

The turbine foundations would require approximately 492m^3 of concrete per turbine. Given that eleven are proposed for the development site, a total volume of approximately 5,400m^3 of concrete would be required.

Assuming a load capacity of 6m^3 per concrete mixer, approximately 82 deliveries would be required per turbine, resulting in approximately 1,804 two-way HGV movements (902 in and 902 out). This equates to 164 two-way movements per turbine. Technical constraints may require the concrete for an individual turbine to be delivered and poured in one day to prevent joints in the mass structure. This creates a short but

disproportionate impact and has therefore been considered separately from the impact of the other traffic movements. Construction of foundations would be sequential and would likely be spread across 4 months, with a peak in month 7.

Base rings

Each turbine foundation is surmounted with a circular steel support plinth (base ring) to suit the base profile of the turbine tower. A maximum of three base rings can be loaded onto a HGV therefore four HGV loads would be required, resulting in eight two-way HGV movements (four in and four out).

Formwork and reinforcing steel

Formwork and reinforcing steel is required for the concrete bases. Each turbine would require two deliveries of steel, while one delivery of formwork would be required to cover two bases. Based on eleven turbines, a total of 28 HGV deliveries will be required resulting in 56 two-way HGV movements (28 in and 28 out).

Mobile crane delivery and removal

It is anticipated that a single team would erect the turbines, using two cranes (expected to be an 800t to 1,000t lattice tower crane with a 200t pilot or secondary crane assisting with the lift procedure) to lift the tower sections, nacelle and rotor into place.

It is assumed that mobile cranes would be used to erect the turbines. The component parts and ballast would result in 20 two-way HGV movements for delivery and a further 20 for removal, resulting in a total of 40 two-way HGV movements.

Delivery of turbine components (blades, nacelle, tower)

Eleven vehicles are required to deliver the components for each full turbine (assuming one for the nacelle, three for the blade set, four for the tower, one for the blade hub, and two for the generator/controller). Given that there are 11 turbines proposed on the site a total of 121 loads would be delivered, resulting in 242 two-way movements.

The movements into the site would be abnormal loads whereas the movements out of the site will not be as it is anticipated that the AIL vehicle will revert to standard HGV by retracting the extendible extendable trailers to approximately 16.5m.

Table 13.9 identifies the anticipated number of abnormal load deliveries per turbine section as a worst-case scenario.

Table 13.9 Abnormal loads

Turbine Section	Abnormal Load Movements per Turbine
Extendible trailer for the blades	3
Wide trailer for the tower sections	4
Nacelle assembly, drive train and hub	4
Total	11

Traffic generation summary

Table 13.10 summarises the predicted total movements with **Table 13.11** showing the expected monthly distribution. **Table 13.12** shows the predicted level of daily movements and **Table 13.13** shows these daily movements in percentage terms relative to the future baseline traffic flows. Some of the numbers in the tables have been rounded up to take into account HGV arriving and departing the site.

Table 13.10 Total traffic generation

Activity	Total Loads	Total Trips (in and out)
Delivery of plant and Equipment	30	60
Road Stone for Access Tracks	803	1,606
Delivery of Bitmac for bellmouth	6	12
Stone for Crane Operations	266	532
Delivery of Concrete for Compound Base	231	462
Stone for Substation Base	30	60
Delivery of Culvert Materials	1	2
Delivery of Geogrid	1	2
Delivery of Sand	78	156
Delivery of Substation & Equipment	20	40
Delivery of Cabling	3	6
Delivery of Concrete	902	1,804
Delivery of Base Rings	4	8
Delivery of Formwork and reinforcing steel (REBAR)	28	56
Delivery and Removal of Mobile Crane	20	40
Delivery of Turbines	121	242
Removal of Plant and Equipment	30	60
TOTAL	**2,574**	**5,148**

It is predicted that the civil construction period (involving substantive movement of HGV for access tracks, construction compound, turbine foundations etc.) would last for approximately twelve months starting in March 2020. **Table 13.11** shows an estimation of the total trips distributed according to the programme.

Table 13.11 Trips per month (two-way movements)

Activity	Month												
	1	2	3	4	5	6	7	8	9	10	11	12	Total
Delivery of Plant and Equipment	60												**60**
Stone for access tracks			536	536	534								**1,606**
Bitmac for Access Bellmouth		12											**12**
Stone for Crane Operations				132	134	132	134						**532**
Stone for Compound base		10	182	270									**462**
Stone for Substation				60									**60**
Culvert Materials		2											**2**
Geo-grid		2											**2**
Sand			78	78									**156**
Substation Equipment					40								**40**
Cabling		4	2										**6**
Concrete for Turbines						492	492	492	328				**1,804**
Base Rings					8								**8**
Formwork and Reinforcing steel				28	28								**56**
Delivery and Removal of Crane							20				20		**40**
Turbines							66	66	66	44			**242**
Removal of Plant and Equipment												60	**60**
Total	**60**	**30**	**798**	**1,104**	**744**	**624**	**712**	**558**	**394**	**44**	**20**	**60**	

In order to be compatible with the assessment required as part of an Environmental Statement, the figures from **Table 13.11** must be translated into daily flows. Therefore **Table 13.12** shows the total daily trips by month for all construction activity, based on an average of four and a half weeks per month and an average five working days per week (rounded down to 22 days per month).

Table 13.12 Approximate daily (07:00-19:00) two-way trips per day during construction period

Activity	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Excluding concrete deliveries for turbine bases*												
Per Day	4	2	36	50	34	6	10	4	4	2	2	4
Turbine Concrete deliveries only												
Per Day						164**	164**	164**	164**			

*Figures rounded up to whole numbers to account for return journeys
**Each concrete turbine foundation must be poured in one day. Therefore there are three days during month 6/7/8 when 164 HGV movements are required to deal with the concrete for three turbines. In month 9 there will be two non-consecutive days where concrete is required for the construction of two turbines It is assumed that no other deliveries would occur during these days. This figure has been rounded up to the nearest even number to equate for the return journey.

Table 13.12 shows that the maximum traffic impact associated with the construction of the proposed wind farm is predicted to occur in month 7 of the construction programme due largely to the concrete deliveries. During this month, on three non-consecutive days, 164 two-way HGV trips are predicted to be generated on each working day (82 vehicles into the site and 82 out). It is assumed that deliveries of other materials would not take place on these three days when concrete is poured.

Table 13.12 also shows that other than the concrete pour days the highest traffic impact of the development would be in month 4 when 50 movements are anticipated per day resulting in 25 arrivals and 25 departures. This is still less of an impact than the concrete pour days but would occur over a longer time frame.

As months 4 and 7 represent those with the highest predicted traffic impacts, both these months have been subject to further assessment in this ES.

Percentage impact during construction

The impact of construction related traffic identified in **Table 13.12** has been calculated in in percentage terms, relative to the future background traffic in the construction year (2020), and is presented in **Table 13.13**. This exercise has been conducted for month 4 and month 7.

Table 13.13 shows the predicted percentage impact at each of the traffic count locations.

Table 13.13 Predicted percentage impact during construction period (2020)

Site	Location	Future Baseline Total Traffic	Future Baseline HGV Traffic	Scheme Traffic (All HGV)	% Impact on Total Traffic	% Impact on HGV Traffic
Month 7 Concrete Delivery Only (From Concrete Plant in Bridgend)						
5	B4282 (Neath Road) – West of Maesteg	5,054	559	164	3.24%	29%
6	A4063 (Bridgend Road) – Llangynwyd	13,103	1411	164	1.25%	12%
7	A4063 (Maesteg Road) – Tondu	13,095	1,394	164	1.25%	12%
8	A4063 – North of Junction with A4281/Bridgend Road	16,406	1,172	164	1.00%	14%
Month 4 Standard Construction Month						
1	A4107 (Tan-y-Groes Street) Port Talbot	9,466	840	2	0.02%	0%
2	A4107 (Pen-y-Cae Road) Penycae	5,508	349	2	0.04%	1%
3	A4107 (Afan Valley Road) Cwmafan	4,493	483	2	0.04%	0%
4	B4282 (Bryngyrnos Street) Bryn	4,977	480	2	0.04%	0%
5	B4282 (Neath Road) – West of Maesteg	5,054	559	48	0.95%	9%
6	A4063 (Bridgend Road) – Llangynwyd	13,103	1,411	48	0.37%	3%
7	A4063 (Maesteg Road) – Tondu	13,095	1,394	48	0.37%	3%
8	A4063 – North of junction with B4281/Bridgend Road	16,406	1,172	48	0.29%	4%

Table 13.13 shows that the impact is mainly confined to the A4063/B4282 corridor through Maesteg. This is as a result of all concrete and stone deliveries which are assumed to arrive from quarries and batching plants in the Bridgend area.

It is not considered necessary to assess the impacts of additional traffic on the highway network further afield than the relevant stretches of these roads, as the impacts are likely to be negligible as development traffic becomes diluted by other traffic flows. It should also be noted that the impacts on the A4107 and B4282 west of the site access would be negligible increases in traffic.

For receptors 2 and 8 which were identified as 'not sensitive' and therefore subject to a threshold change of 30% in total vehicles and HGV, the results in **Table 13.13** show the anticipated change is significantly lower than this. For receptors 1, 3, 4, 5, 6 and 7 which were identified as 'sensitive' and subject to a threshold change of 10% in total vehicles and 30% in HGV, the results in **Table 13.13** show all anticipated changes are below these levels. In most cases the anticipated changes are well below their respective threshold, the

exception being the B4282 (Neath Road) – West of Maesteg (receptor 5) which sees a percentage change in HGV on concrete pouring days of 29%, just lower than the 30% threshold.

Summary

The above exercises have been conducted for the predicted worst-case months for traffic generation, months 4 and 7.

The worst-case impact shows that it is predicted that there would be an increase in total traffic flows and HGV flows during the assessment period, but that all increases would be below the appropriate thresholds.

Abnormal load movements

Abnormal loads transporting turbine blades and other components may result in driver delay because of the need to negotiate pinch points at slow speeds. The proposed route for abnormal loads is from either Port Talbot or Swansea to the site along the route below.

Table 13.14 Abnormal load route

Section	Distance	Road
Start - Dock		
Docks Local Roads	Dependant on dock used	Single then dual carriageway
M4	Dependant on dock used	Motorway
A4063 to Cwmfelin	9.8	Dual then single carriageway
B4282 Maesteg Road to Talbot Street (Blades only)	2.5	Single carriageway
A4063 Mill Street to Neath Road (All components except blades)	2.4	Single carriageway
B4282 Talbot Street (Blades only)	0.2	Single carriageway
B4282 Neath Road to the site	1.8	Single carriageway
Finish – Site Access		
Total	14km or 14.3km (for Blades)	

The route has been reviewed in its entirety. The route is of a reasonable distance with majority of the journey undertaken on the motorway and the remaining on good standard dual or single carriageway. There is a pinch point at the A4063/B4282 in Maesteg which cannot accommodate a 45m blade, but can accommodate the other abnormal loads. An alternative route for the blades has be identified by third parties via the B4282 Mill Street, B4282 Bridgend Road and A4063 Talbot Street. The associated swept path analysis drawings for this route are presented in the Construction Traffic Management Plan which accompanies this ES.

Most of these routes are dual carriageway or good standard single carriageway which would allow for overtaking. The potential for driver delay is identified at pinch points on bends and junctions where the abnormal load would have to slow down significantly (sometimes to walking pace if rear manual steering is employed).

Swept Path Analyses (SPA) of the route, presented in the CTMP, have been undertaken to show where it is necessary to temporarily suspend other traffic at certain junctions. It is likely that these abnormal load movements will travel in convoy rather than separate loads and outside of peak hours. Therefore, the number

of events of driver delay is reduced and the number of drivers delayed will be minimised. Further details of the SPA have been set out in the CTMP.

Site access

The site access would be located on the B4282 west of Maesteg and east of Bryn. The access would be constructed to DMRB standard and be capable of accommodating the abnormal loads.

A summary of the results of the assessment of the Transport and Traffic effects is provided in **Table 13.15**.

Table 13.15 Summary of significance of adverse effects

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor[1]	Significance[2]	Summary rationale
1. A4107 (Tan-y-Groes Street) Port Talbot	Sensitive	Negligible (Not Significant)	The percentage increase in total vehicles and HGV due to the development is 0.02% and 0% respectively from **Table 13.13.** Therefore according to **Table 13.8** it is considered that the change is not significant.
2. A4107 (Pen-y-Cae Road) Penycae	Not Sensitive	Negligible (Not Significant)	
3. A4107 (Afan Valley Road) Cwmafan	Sensitive	Negligible (Not Significant)	
4. B4282 (Bryngyrnos Street) Bryn	Sensitive	Negligible (Not Significant)	
5. B4282 (Neath Road) – West of Maesteg	Sensitive	Negligible (Not Significant)	
6. A4063 (Bridgend Road) – Llangynwyd	Sensitive	Negligible (Not Significant)	
7. A4063 (Maesteg Road) – Tondu	Sensitive	Negligible (Not Significant)	
8. A4063 – North of junction with B4281/Bridgend Road	Not Sensitive	Negligible (Not Significant)	

The sensitivity/importance/value of a receptor is defined using the criteria set out in section 13.9 above and is defined as sensitive or not.
The significance of the environmental effects is defined using the criteria set out in **Table 13.8** above and is defined as significant or not according to GEART.

13.11 Assessment of cumulative effects

Consideration has been given as to whether any of the Traffic and Transport receptors that have been taken forward for assessment in this chapter are likely to be subject to cumulative effects because of Traffic and Transport effects generated by other developments.

No transport cumulative developments have been identified for this assessment.

13.12 Consideration of additional mitigation or compensation

No additional mitigation measures are proposed to further reduce the Traffic and Transport effects that are identified in this ES. This is because all relevant and implementable measures have been embedded into the development proposals and are assessed above in this chapter. These measures are considered to be likely to be effective and deliverable and address the likely significant effects of the Foel Trawsnant amended scheme.

13.13 Conclusions of significance evaluation

The Traffic and Transport environmental effects of the Foel Trawsnant amended scheme have been assessed to be not significant. An assessment of the effects has been undertaken using GEART and the increase in HGV traffic has been considered to be negligible. It has therefore been derived that the effects of the Foel Trawsnant amended scheme at all receptors is negligible.

13.14 Implementation of environmental measures

Table 13.16 describes the environmental measures embedded within the proposed development and the means by which they will be implemented, i.e. they will secured through a planning condition.

Table 13.16 Summary of environmental measures relevant to Traffic and Transport to be implemented

Environmental measure	Responsibility for implementation	Compliance mechanism	ES Section Reference
CTMP	Contractor	Planning condition	Section 13.8

13.15 References

Amec Foster Wheeler. Foel Trawsnant Wind Farm – Amendments to the Approved Scheme, Scoping Report. Reference 40217i2. 2018.

Bridgend County Borough Council. Local Development Plan (2006-2021). 2013.

Department of Energy and Climate Change. Overarching National Policy Statement for Energy (EN-1). 2011.

Department of Energy and Climate Change. National Policy Statement for Renewable Energy Infrastructure (EN-3). 2011.

Institute of Environmental Assessment. Guidance Notes No. 1: Guidelines for the Environmental Assessment of Road Traffic. Horncastle: IEA. 1993.

Neath Port Talbot County Borough Council. Local Development Plan (2011-2026). 2016.

Welsh Government. Technical Advice Note 18 Transport. 2007.

Welsh Government. Planning Policy Wales (PPW) Chapter 8: Transport. 2016.

Wood. Construction Traffic Management Plan. Document reference 40217rr062i1. 2018.

14 Socio-economics including recreation and tourism

14.1 Introduction

This chapter of the Environmental Statement (ES) assesses the likely significant effects of the proposed development with respect to socio-economics including recreation and tourism. It should be read in conjunction with the development description provided in **Chapter 5**.

This chapter is an update of the socio-economics assessment presented in the 2014 ES (ref: 24311rr073i1) for a 13-turbine wind farm on land at Foel Trawsnant with a blade tip height of 120m and hub height of 85m which was subsequently approved at planning committee, subject to a s106 agreement (application ref: P2014/0825). The parameters for the assessment are set out in the Scoping Report (ref: 40217i2; Amec Foster Wheeler[64], 2018). The baseline conditions have been reviewed and updated where necessary and the amended scheme has been assessed against the latest policy framework. The chapter also takes into account the proposed reduction from the permitted 13 turbines to the proposed 11.

The Scoping Report set out that the potential effects on the 'Best and Most Versatile' agricultural land (Agricultural Land Classification (ALC) Grades 1 to 3) would not be considered further in the ES as none of the land would be directly lost to development infrastructure. The Scoping Opinion received from Neath Talbot County Borough Council (2018) agreed with the scope of assessments to be included in this chapter.

14.2 Limitations of this assessment

There are no limitations relating to socio-economics, including recreation and tourism, which affect the robustness of the assessment of the potential likely significant effects of the proposed development.

14.3 Policy and legislative context

Planning policy

Table 14.1 lists the issues from the relevant planning policies that have been considered in assessing the socio-economic effects.

[64] Now Wood.

Table 14.1 Policy issues considered in preparing the socio-economics assessment

Policy reference	Policy issues	Considered in section
UK planning policies		
National Policy Statement for Energy (EN-1) (2011)	NPS sets the UK Government's policy on energy and energy infrastructure. It states that an applicant assessment should include for consideration of all socio-economic effects, including the creation of jobs; provision of additional local services; and effects on tourism.	14.5, 14.11, 14.12
Welsh national planning policies		
Planning Policy Wales edition 9 (PPW) (November 2016) Paragraph 12.10	PPW sets out the national policy for the full range of planning matters. Paragraph 12.10 sets out a number of considerations for authorities to consider when determining applications for renewable and low carbon energy. The considerations cut across a wide range of themes and include consideration of the contribution that projects make to meeting targets for renewable energy generation and cutting greenhouse gas emissions; the impact on natural heritage and the historic environment; the impacts of climate change on such development; grid capacity issues; and the capacity of transportation network. There are three elements that are particularly relevant to socio-economic considerations. These are the need to take account of: • the wider environmental, social and economic benefits and opportunities from renewable and low carbon energy development; and • the need to minimise impacts on local communities to safeguard quality of life for existing and future generations; and ways to avoid, mitigate or compensate identified adverse impacts.	14.5, 14.10, 14.11, 14.12
PPW9 (November 2016) Paragraph 11.1.1	Tourism is considered to be vital to economic prosperity and job creation.	14.5, 14.12
PPW9 (November 2016) Paragraph 11.1.13	This paragraph encourages local authorities to protect and enhance the rights of way network of Wales.	14.5, 14.8, 14.12
Technical Advice Note (TAN) 8: Planning for Renewable Energy (2005) Paragraph 2.10	TAN 8 sets out national technical advice to supplement policy in the PPW. Local Authorities are encouraged to take a positive approach to developing local policy for Strategic Search Areas (SSA) and consider: "The possible impact on tourism and recreational opportunities in the SSA. Developers and local authorities are encouraged to enter into constructive dialogue over the positive provision for visitors to wind power projects and ways in which any negative impacts can be minimised or mitigated."	14.5, 14.10, 14.12
TAN 8: Planning for Renewable Energy (2005) Paragraph 2.15 / 2.16	With regards to local communities TAN8 states that developers should actively engage local communities on renewable energy proposals, including pre-application discussion. TAN8 recognises that major wind turbine developments provide opportunities to deliver community benefits.	14.4, 14.5
TAN 16: Sport, Recreation and Open Space (2009)	TAN 16 sets out the importance to Public Rights of Way (PROW) and their ability to connect wider open space and recreational corridors.	14.5, 14.12
TAN 23: Economic Development (2014)	TAN 23 supports the economic development of Wales and highlights the importance of delivering sustainable growth in rural areas.	14.5, 14.11

Policy reference	Policy issues	Considered in section
Development plan policies		
Neath Port Talbot County Borough Council Local Development Plan (2011 – 2026) (January 2016) Strategic Policy SP2 Health	The policy seeks to ensure that a number of measures are in place to support the health of the people of Neath Port Talbot. These measures includes the consideration of the environmental and safety impacts of new developments, the promotion of improved accessibility, and provision of new employment opportunities. The policy seeks the retention of a range of accessible leisure, recreational and community facilities throughout the County Borough.	14.5, 14.12
Neath Port Talbot County Borough Council Local Development Plan (2011 – 2026) (January 2016) Strategic Policy SP 3 Sustainable Communities	Policy SP 3 promotes the delivery of sustainable, healthy and cohesive communities and the conservation of the countryside.	14.5, 14.12
Neath Port Talbot County Borough Council Local Development Plan (2011 – 2026) (January 2016) Strategic Policy SP 11 Employment Growth	Policy SP 11 sets the County Borough Council's policy on supporting economic growth within the area.	14.5, 14.11
Neath Port Talbot County Borough Council Local Development Plan (2011 – 2026) (January 2016) Policy TO4 Walking and Cycling routes	The policy defines a number of routes where proposals that would have an adverse impact on their implementation would be resisted. This includes TO 4/3 Great Dragon Ride Route (PROW 39) within the site boundary.	14.5, 14.12
Neath Port Talbot County Borough Council Local Development Plan (2011 – 2026) (January 2016) Strategic Policy SP 13 Tourism	Policy SP 13 promotes the economic prosperity of Neath Port Talbot through encouraging growth in the tourism sector/visitor economy through the development and protection of high quality tourism.	14.5, 14.12
Neath Port Talbot County Borough Council Local Development Plan (2011 – 2026) (January 2016) Strategic Policy SP 18 Renewable and Low Carbon Energy	Policy SP 18 supports a proportionate contribution to meeting national renewable energy and energy efficiency targets whilst balancing impact of development on the environment and communities. This includes encouraging, where appropriate, all forms of renewable energy and low carbon technology, and ensuring development will not have an unacceptable impact on the environment and amenity of local residents.	14.5, 14.10
Neath Port Talbot County Borough Council Local Development Plan (2011 – 2026) (January 2016) Policy RE 1 Criteria for the Assessment of Renewable and Low Carbon Energy Development	This criteria-based policy which allows an assessment of renewable energy and low carbon schemes. This includes a criterion that large scale wind farm developments (>25MW) will be expected to be located within the boundaries of the refined Strategic Search Areas (SSAs) in the County Borough area. Additionally, all schemes will be required to demonstrate compliance with five criteria related to visual amenity and natural environment, highways safety, radar, and site restoration (where appropriate).	14.5, 14.10, 14.12

Legislative context

Climate Change Act 2008

The Climate Change Act (2008) introduced a clear, credible, long-term framework for the UK to achieve its goals of reducing carbon dioxide emissions and for adapting to the impacts of climate change. One of the

key provisions of the Act is the introduction of legally binding targets on greenhouse gas emissions comprising reductions of at least 80% greenhouse gas emissions by 2050, and reductions in CO_2 emissions of at least 26% by 2020, against a 1990 baseline. The generation of electricity by renewable means such as wind energy is considered to be a key contributor towards meeting these targets.

Well-Being of Future Generations (Wales) Act 2015

This Act places a duty on public bodies (including Welsh Ministers) to carry out sustainable development through their decision making. The Act puts in place seven well-being goals to help ensure that public bodies are all working towards the same vision of a sustainable Wales. The wellbeing goals act together to ensure outcomes across economic, environmental and social sustainability strands.

Environment (Wales) Act 2016

The Environment (Wales) Act 2016, under Part 2, places a duty on the Welsh Ministers to ensure that the net Welsh greenhouse gas emissions account in 2050 is at least 80% lower than the baseline.

Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017

The *Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017* require under Part 1, Section 4 (2) that the environmental impact assessment must identify, describe and assess the direct and indirect significant effects of the proposed development upon (inter alia) the population and climate change.

Technical guidance

There is no specific guidance for undertaking an assessment of socio-economic effects. The guidance in NPS EN1 section 5.12 has been taken into account in forming the scope of the assessment which on the focuses on the number of jobs created, the economic value of the scheme, effects on tourism and cumulative effects. The NPS also notes that socio-economic impacts may be linked to other impacts (notably visual impacts on tourism).

14.4 Data gathering methodology

Desk study

There is no prescribed methodology or standard guidance for this aspect of an EIA. The method adopted is therefore one of determining the existing circumstances (the baseline) through desk-based analysis, utilising a range of statistical information and public consultation. This statistical information has been drawn from a number of sources and covers various geographies, from ward level through to the national level. Sources of information used for the socio-economic assessment are listed in **Table 14.2**.

Reference has also been made to the previous assessment contained within the ES (24311rr073i1, Amec Environment & Infrastructure Ltd[65], 2014) submitted under application number P2014/0825, where relevant.

[65] Now Wood

Table 14.2 Sources of desk study information

Source	Data
Nomisweb **StatsWales** **Office for National Statistics (ONS)**	Population statistics Labour market profiles Local area profiles
Welsh Government	Welsh Index of Multiple Deprivation
Neath Port Talbot County Borough Council **Bridgend County Borough Council** **Welsh Government**	Baseline information on tourism nationally, regionally and with the in the Neath Port Talbot County Borough Council and Bridgend County Borough Council areas.
Neath Port Talbot County Borough Council **Bridgend County Borough Council** **Natural Resources Wales**	The location of PRoWs was confirmed using the Definitive maps. The presence or absence of Open Access areas designated under the Countryside and Rights of Way Act 2000 were obtained from the Natural Resources Wales and Neath Port Talbot County Borough Council websites.
Welsh Government	Baseline data on climate change and energy security.

14.5 Overall baseline

Current baseline

Renewable energy

Economic value in Wales

In March 2012, the Welsh Government issued its policy *Energy Wales: A Low Carbon Transition* which set out the Welsh Government's aim for Wales to be at the forefront of the low carbon energy agenda, and support the transition to a low carbon, low waste and hi-tech economy. The aim is to unlock and harness Wales' energy resources in order to maximise economic, social and environmental benefits. Energy Wales states that the Welsh Government expects energy developments to focus strongly on community engagement and seek to ensure that both the benefits and impacts are objectively explained and clearly understood.

A study of the economic opportunities from onshore wind development in Wales was undertaken in 2013 for Welsh Government (Regeneris Consulting Ltd and Welsh Economy Research Unit, 2013). The research highlighted the potential economic benefits from onshore wind development which may be felt in the local areas in which wind farm are developed and within the wider Welsh economy. Economic benefits derive from investment involved in the planning and development of schemes, construction and in operations and maintenance. It was noted that the extent to which economic benefits from construction will flow directly into the Welsh economy will partly depend on the availability of skilled labour and manufacturing capacity, but that local suppliers are often well placed to supply some types of goods, such as aggregates and non-specialist engineering services. There are generally greater opportunities for investment in operations and maintenance to remain in the Welsh economy, through such items as rental and access payments, as well as opportunities for locally-based maintenance staff.

Overall, the study concluded that should the target 2GW onshore wind capacity by 2025 be met then there is an opportunity for Wales to secure a gross value added (GVA) of £2.3 billion between 2012 and 2050, with

over 2,000 full time equivalent (FTE) jobs in this period. It was noted fully achieving this benefit would require measures to overcome barriers in the planning system and in the grid and road infrastructure, as well as a proactive approach to supply chain development. It was also noted that those local economies that stood to gain the most from development were those with a strong presence of construction and manufacturing firms.

Renewable energy capacity in Wales

Welsh Government Ministers have a duty to ensure the net Welsh carbon emissions in 2050 are 80% lower than the existing baseline in 2050; placed on them by the Environment (Wales) Act 2016. In September 2017, the Welsh Cabinet Secretary for Energy, Planning and Rural Affairs proposed the following targets for Wales:

- Wales to generate 70% of its electricity consumption from renewable energy by 2030.
- 1GW of renewable electricity capacity in Wales to be locally owned by 2030.
- By 2020 all new renewable energy projects to have at least an element of local ownership.

The Energy Generation in Wales 2016 report (Regen, 2017) sets outs the latest data on energy generation from renewables. The report states that capacity had increased in Wales in recent years. It set out that 6.9TWh of energy in Wales was from renewables and by the end of 2016 Wales had 920MW of onshore wind capacity, capable of generating over 2.3TWh (equivalent to 39% of Welsh homes), an increase from previous capacities. This includes the 228MW Pen y Cymoedd wind farm, which lies with within Rhondda Cynon Taf and Neath Port Talbot and is the largest wind farm in England and Wales.

Economy and Community

Introduction

Due to the rural nature of the development it could affect a number of towns and villages in both Neath Port Talbot and Bridgend county boroughs:

- Dyffryn/Nantyffyllon – Bridgend;
- Maesteg – Bridgend;
- Cynonville – Neath Port Talbot;
- Cymmer – Neath Port Talbot; and
- Cwmafon - Neath Port Talbot.

For the purposes of analysing the socio-economic impacts of the proposed development, ward level geographies will be used to assess the potential impact on the towns and villages listed above. The relevant wards are listed below:

- Cymmer ward (Cymmer and Cynonville);
- Bryn and Cwmafon (Cwmafon);
- Caerau (Dyffryn/Nantyffyllon);
- Maesteg East (Maesteg); and
- Maesteg West (Maesteg).

The socio-economic and baseline assessment in this ES chapter has considered the potential effect on these towns and villages.

Employment and Benefit Claimant Status

The proposed development is located in within Neath Port Talbot County Borough, which has a population of 139,812 (Census, 2011). The site is located within the ward of Cymmer but could have an economic effect on surrounding towns and villages both within Neath Port Talbot County Borough and neighbouring Bridgend County Borough. The labour market profiles of the wards set out above, for the County Boroughs of Neath Port Talbot and Bridgend, for Wales as a whole, are therefore included in **Table 14.3**.

Table 14.3 Labour Market Profiles (Key Statistics)

Area	Population age 16-64*	Employed (economically active)*+	Unemployed*+	Out of work claimants**	DWP benefit claimants**+
Wales	1,922,600 (61.5%)	1,534,000 (77.7%)	67,000 (4.3%)	44,254 (2.3%)	276,950 (14.4%)
Neath Port Talbot County Borough	88,200 (62.1%)	64,000 (72.5%)	3,600 (5.7%)	2,830 (3.2%)	16,760 (19.0%)
Bridgend County Borough	89,400 (62.0%)	66,800 (75.3%)	3,300 (5.0%)	1,825 (2.0%)	14,390 (16.1%)
Cymmer	1,741	1,059 (59.2%)	147 (13.9%)	60 (3.4%)	600 (29%)
Bryn and Cwmafon	4,118	2,956 (70.5%)	217 (7.3%)	85 (2.0%)	845 (17.3%)
Caerau	4,265	2,796 (63.2%)	357 (12.8%)	190 (4.4%)	1,470 (28.7 %)
Maesteg East	2,774	1,995 (67.5%)	200 (10.1%)	85 (3.0%	720 (20.3%)
Maesteg West	3,671	2,671 (70.8%)	243 (9.1%)	125 (3.4%)	885 (20.4%)

Source: Nomisweb

*2017 ONS population estimates for LAs and Wales. 2013 estimates for wards - % not available.
*+April 2017-March 2018 for Wales and LAs. 2011 Census data for ward figures.
** As at July 2018. This accounts for claimants under Universal Credit and Jobseekers Allowance.
**+ working age benefits excluding Universal Credit. 2011 Census data for ward figures.

Neath Port Talbot County Borough has a similar working age (16-64) population to Bridgend County Borough, with Neath Port Talbot having 0.1% more of its population categorized in this group. The number of people who were economically active in Neath Port Talbot as at March 2018 was 64,000. This equates to 72.5% of the working age population (16-64 year olds). The county has a higher number of people who are unemployed and also claiming Department of Work and Pensions (DWP) benefits than the average for Wales.

Cymmer ward, where the wind farm will be located, has a substantially lower number of people economically active than the County (13.3% less) and a higher number of people who are unemployed (13.9% as opposed to 5.7% for Neath Port Talbot). There is also a slightly higher percentage of people claiming out of work benefits than within Neath Port Talbot as a whole (3.4% as opposed to 3.2% in the County). The other ward in Neath Port Talbot (Bryn and Cwmafon) has a lower rate of unemployment, out of work benefit claimants and higher levels of employment among the economically active population than the Cymmer ward and County (except with regard to out of work claimants in the case of the County).

The wards in Bridgend all have higher rates of unemployment and out of work benefit claimants than the averages for both Bridgend and Neath Port Talbot County Boroughs, except for Maesteg East which has a lower rate of out of work benefits claimants. All the wards within Bridgend also have a lower rate of employment when compared to both counties.

Local Economic Activity

The working age population of Neath Port Talbot County Borough and Bridgend County Borough is broadly similar to the Welsh average (see **Table 14.3**) but the occupation groups which serve the population have some differences. The percentage of the people employed in management and professional occupations (groups 1-3) across Wales as a whole (totalling 40.4%) is higher than both Neath Port Talbot (30.5%) and Bridgend (35.5%). The profile for the remaining occupations is broadly similar to the Wales average in the Neath Port Talbot and Bridgend areas. Both County Boroughs have higher percentages of those employed in process plant and machinery (group 8) elementary occupations (group 9) than across Wales as a whole.

The Cymmer ward (where the site is located) has a far lower percentage of people employed in professional occupations (groups 1-3) (18.6%) than for the County Borough and Wales average. Conversely the ward has substantially people more employed in skilled trades (group 5), care and service sector (group 6), process plant and machinery (group 8) and elementary occupations (group 9) than across Neath Port Talbot and Wales as a whole. Similarly, the wards of Caerau, Maesteg East and Bryn and Cwmafon also have a large percentage of their workforce in process plant machinery (groups 8) and elementary occupations (group 9).

Table 14.4 Employment by occupation (percentage)

Occupation Group	Wales	Neath Port Talbot County Borough	Cymmer	Bryn and Cymavon	Bridgend County Borough	Caerau	Maesteg East	Maesteg West
1. Managers, directors and senior officials	9.3	7.7	5.7	7.8	9.2	5.0	6.5	7.8
2. Professional occupations	18.0	12.9	5.4	14.3	15.0	6.9	11.1	14.2
3. Associate professional and technical occupations	13.1	9.9	7.5	10.4	11.3	6.7	7.5	9.5
4. Administrative and secretarial occupations	10.5	12.8	9.8	11.9	10.7	6.9	10.1	10.2
5. Skilled trades occupations	11.8	13.4	15.7	12.9	12.6	14.9	14.7	15.0
6. Caring, leisure and other service occupations	9.8	11.3	13.9	10.2	10.6	14.5	14.4	12.5
7. Sales and customer service occupations	8.3	9.0	9.1	8.3	9.6	11.2	9.5	7.6
8. Process plant and machine operatives	7.4	10.0	13.1	11.2	8.9	14.9	11.5	11.3
9. Elementary occupations	11.3	12.8	19.7	13.0	12.1	18.9	14.7	12.0

Source: Nomis using Census 2011 data

Salaries

The earnings by place of residence for Neath Port Talbot and Bridgend are shown in **Table 14.5**. The table shows that salaries in both County Boroughs are fairly similar to the average across Wales. Gross weekly pay in Neath Port Talbot (£500.30) is slightly below the average across Wales as a whole (£505.90). However, neighbouring Bridgend has a slightly higher gross weekly pay (£512.00) than both Neath Port Talbot and Wales as a whole.

Table 14.5 Earnings by place of residence

	Wales	Neath Port Talbot	Bridgend
Gross weekly pay (£)	505.90	500.30	512.00
Hourly pay (£)	12.75	12.65	12.96

Source: Nomis using Annual survey of Hours and Earnings (ASHE) (2017)

Business Enterprises

The Welsh Government measures active businesses within Wales each year. The percentage increase in the number of active businesses between 2006 and 2016 was lower in Neath Port Talbot County Borough (6.4%) than in neighbouring Bridgend County Borough (11.6%) and across Wales (10.9%) as a whole. The percentage increase experienced across the United Kingdom as a whole (28.4%) was substantially higher than that for Wales, Neath Port Talbot and Bridgend.

Table 14.6 Active business enterprises actual/percentage change (2006-2016)

Location	2006	2011	2016	Percentage increase
UK	2,207,290	2,342,595	2,833,965	28.4%
Wales	88,800	88,590	98,445	10.9%
Neath Port Talbot	3,045	3,050	3,240	6.4%
Bridgend	3,660	3,625	4,085	11.6%

Source: StatsWales Active Business Enterprises by area and year (2017)

Deprivation

The Welsh Index of Multiple Deprivation (WIMD, 2014) is an official Welsh Government measure of deprivation in Wales. The WIMD includes a number of different measures in small geographic areas called Lower Super Output Areas (LSOA). The WIMD is designed to allow comparison of deprivation across the country with LSOAs ranked from 1 (most deprived) to 1,909 (least deprived).

A ranking for each LSOA is provided for each of the eight measures of deprivation (income, employment, health, education, access to services, community safety, physical environment, and housing). An overall score is also given (the Index). **Table 14.7** sets out the ranking for the LSOA covering the site (Cymmer 1) and the surrounding towns and villages which could be impacted by the proposed development.

Table 14.7 Welsh Index of Multiple Deprivation (WIMD) Ranking

LSOA	Overall	Income	Employment	Health	Education	Access to services	Community safety	Physical environment	Housing
Cymmer 1	372	552	481	126	412	297	806	1540	612
Cymmer 2	22	64	15	8	30	251	346	1879	1585
Bryn and Cwmafon 1	901	989	838	826	1100	250	1270	1023	1328
Bryn and Cwmafon 2	1597	1476	1175	122	1639	1557	1299	650	1868
Bryn and Cwmafon 3	310	298	227	179	465	968	684	755	1043
Bryn and Cwmafon 4	663	575	578	328	826	1203	935	1364	1214

LSOA	Overall	Income	Employment	Health	Education	Access to services	Community safety	Physical environment	Housing
Caerau 1	6	13	4	6	11	1076	81	1662	1026
Caerau 2	44	77	23	56	26	768	161	1795	980
Caerau 3	179	139	183	151	138	856	372	1853	1149
Caerau 4	293	369	253	93	249	1161	611	1298	1273
Caerau 5	812	806	576	447	844	1770	981	1133	1136
Maesteg East 1	409	412	349	219	676	1517	280	576	817
Maesteg East 2	303	361	233	174	344	399	816	1824	1386
Maesteg East 3	828	1015	613	982	737	405	948	1184	1262
Maesteg West 1	1158	1115	941	1112	1264	1721	41	1666	1550
Maesteg West 2	416	568	295	198	487	1064	314	1565	1161
Maesteg West 3	254	309	221	145	318	298	1202	1849	1032
Maesteg West 4	319	409	196	283	563	460	641	458	1243

Source: Welsh Index of Multiple Deprivation (2014)

The figures show that, overall, Cymmer 1 is within the 20% most deprived LSOAs in Wales. However, there are variations across the different measures with the LSOA in the 10% most deprived for health, and 20% most deprived for access to services whilst it is within the 50% least deprived LSOAs for physical environment.

In terms of the other LSOAs which contain the various towns and villages that could be impacted by the development, Cymmer 2, which is adjacent to Cymmer 1, is ranked 22nd out of the LSOAs across the county which places it in the top 2% most deprived LSOAs in Wales. It is also the most deprived in Neath Port Talbot County Borough.

Within neighbouring Bridgend, Caerau 1 is ranked 6th out of all LSOAs in Wales which places it in the top 1% most deprived. However, the LSOA scores comparatively well for access to services, physical environment and housing measures, for all of which it is in the 50% least deprived in Wales. However, a number of LSOAs are in the area are much less deprived with Bryn and Cwmafon 2 (Neath Port Talbot) and Maesteg West 1 (Bridgend) placed in the 50% least deprived LSOAs in Wales.

Tourism and Recreation

Regional Tourism

Tourism is worth around £6.3 billion to the Welsh economy. The Welsh Government Strategy for Tourism 2013-2020: Partnership for Growth sets out the overall approach to promoting and developing the visitor economy to deliver sustainable and ongoing benefits from tourism. Four Regional Tourism Partnerships (RTPs) covering North, Mid, South-West and South-East Wales were established to lead the implementation of four regional tourism strategies which seek to improve the competitive performance of tourism so that it makes a stronger contribution to the economic and social prosperity of Wales working with Visit Wales, local authorities, tourism businesses.

The tourism sector contributes significantly to the region's economy. The latest regional tourism data is set out in the Tourism Profile for South West Wales (2014-2016) (Welsh Government, 2018)which shows that tourism related expenditure in South West Wales from all visits to the area (overnight domestic trips, international visits and day visits) between 2013-2015 and 2014-2016 increased by 1 per cent to £1,172 million whilst the number of visits increased by 3% to 23,552 thousand.

In 2014-2016, South West Wales accounted for 20% of overnight domestic trips, 21% of international visits and 22% of day visits to Wales. The tourism market indicates:

- Dominant importance of domestic holidays - 33% of all holiday trips in 2014-16 are from Wales itself, and a significant number are from the North West/Merseyside, West Midlands and the South West;
- Visitors from Ireland, America, Germany, France and the Netherlands together account for over half of the overseas visitors;
- Both domestic and overseas visits are very seasonal. Around 39% of domestic trips and a similar proportion of all overseas trips were made during the summer quarter (July to September) in 2014-16; and
- It is estimated that there were 21 million annual leisure day trips to the region in 2014-16, representing 22% of all tourism leisure day trips in Wales that time period.

The region has some important areas of natural beauty, including the Pembrokeshire National Park, but few individual attractions. There are approximately 75 (recorded) small attractions spread around the region. Many attractions are seasonal and weather-dependent and business performance has been varied in recent years. There are a few higher profile attractions of regional significance, for example:

- The collection of historic gardens including the National Botanic Garden and Aberglasney;
- a number of leisure parks and activity centres such as Folly Farm and Oakwood; and
- A number of historic properties including Pembroke Castle and St David's Cathedral.

Local Tourism

The Neath Port Talbot Destination Management Plan 2015-2020 (Neath Port Talbot County Borough, 2016) sets out the approach to developing the visitor economy in Neath Port Talbot. The Plan states that Neath Port Talbot attracts a greater proportion of day visitors than seen in Wales overall which is confirmed by recent analysis in the 2016 Wales Visitor Survey for Neath Port Talbot (Beaufort Research for Neath Port Talbot County Borough Council, 2016) which found that 90% of visitors were from Wales which is more than across Wales a whole (59%). This is due to the proximity of the County Borough to Swansea, Gower and the Brecon Beacons National Park and highlights that the day visitor market cannot be underestimated as a key target sector for the area. Short breaks constitute a high proportion of the staying visitors in Neath Port

Talbot. Additionally, Neath Port Talbot receives a higher percentage of younger visitors aged 16-34 than across Wales as a whole (31% compared to 22% nationally) driven by younger age profile of visitors to Afan Forest (Beaufort Research for Neath Port Talbot County Borough Council, 2016), largely due to the mountain biking facilities and trails. The Plan seeks to increase the number of family visitors to the area. The proposed wind farm is within an area known as the Afan Forest, which is a local tourist attraction and includes most of the towns and villages assessed as part of this socio economic chapter.

The Scarborough Tourism Economic Activity Model (STEAM) 2016 highlights that the total economic impact of tourism on Neath Port Talbot was £110.28m, this is a 1.2% decrease from 2015 (GTS for Neath Port Talbot Borough Council, 2016). There was a 2.8% decrease in the total number of visitor days to 1.97million although the number of staying visitor days increased by 0.8% to 840,000. The total number of full time equivalent jobs supported by tourism stood at 1,578 which represented a slight decrease on 2015 of 0.4%.

The Bridgend County Destination Management Plan 2018-2022 (Bridgend County Borough Council, 2018a) identified the key priorities to develop the tourism the offer across Bridgend and develop the potential in water sports, golf and other outdoor activities. Afan Forest is a major attraction for mountain biking in the area. For Bridgend, STEAM figures for 2016 show that visitor numbers totalled 3.83 million, an increase from 3.67 million in 2015 (Bridgend County Borough Council, 2018b). Additionally total expenditure rose from £314.02m in 2015 to £329.26m in 2016. There were 5.60 million visitor days which a slight increase from 5.4 million in 2015. There were 4,228 full time equivalent jobs in the tourism sector which again represents a slight increase from 2015, where 4,074 full time equivalent jobs in the tourism sector.

Recreation

There are a number of Public Rights of Way (PRoWs) that cross the site, which are illustrated in **Figure 14.1**:

- The access to the site runs along a PRoW (28), which is a footpath and has two bridleways branching east (1) and west (39) at the entrance to the main site. This is also used as an access track by Forestry Commission (now part of NRW) vehicles;
- The eastern bridleway (1) runs north along the edge of the site boundary;
- The western bridleway (39) runs through the site and crosses the possible site tracks close to T4 and T5, running very close to T1, T2, T3, T4 and T6;
- A PRoW footpath (40) is located within the northern area of the site and crosses the tracks close to T11; and
- A large section of the site is Open Access Land (Open Country) which relates to the Countryside and Rights of Way Act (CRoW Act) (2000).

The site is directly adjacent to Michaelston Forest, which is a part of the Afan Forest. It provides a range paths and trails for walking and cycling. Maesteg golf course is located to the south of Michaelston Forest, close to the proposed access to the site. This is about 1.7km from the centre of the site.

About 5–6 km from the centre of the site is Gnoll Estate and Country Park. The Estate has been developed into a country park surrounded by an 18th Century landscaped garden, open green spaces and wild woodlands. The Estate also includes informal and formal cascades, plus a number of historical ruins including the foundations of Gnoll House, the Ivy Tower, Half House, which tell the story of the history of the Gnoll Estate. The site has a range of facilities, which include a visitor centre, café, children's play area and adventure playground, and a 9-hole pitch and putt golf course. Other activities include orienteering or geocaching, fishing and number of way-marked woodland walks, which allow access to the countryside and wildlife the site provides.

The proposed amended wind farm is located within the boundary of the Afan Forest Park, which is a key tourist destination within the Region. The Afan Forest Park aims to promote the beautiful forest views, the

heritage of the area, which is related to its coal and metal mining past and its outdoor activities (Neath Port Talbot County Borough Council, 2018). The area encompasses Glyncorrwg in the north, Duffryn, Cynonville and Cwmafon.

At Cynonville there is a visitor centre which serves the village and the wider tourism services of the Afan Forest. The visitor centre acts as a hub of activity for recreation, it provides information services, a gift shop, bike wash, first aid station, cafe, bike hire, is the starting point for a mountain bike trail, and a cycle trail that joins to the National Cycle network, access to bridle paths, South Wales Miners Museum, the opportunity to camp and education service, which include conference facilities. The site is about 400 m from the edge of the western part of the site along the A4107.

Land use

The proposed wind farm is within an area that is primarily used for agriculture; this use will be able to continue following construction of the wind farm. Agricultural land at the site is considered to be within Agricultural Land Classification (ALC) Grade 4 and 5, and therefore is not 'Best & Most Versatile' land (ALC Grade 1 to 3).

Predicted future baseline

It is unlikely that the future baseline will alter markedly in the short to medium term. The economic profile of Neath Port Talbot is expected to be based largely on the same sectors as set out within the current baseline with higher percentages of those employed in process plant and machinery and elementary occupations than across Wales as a whole. The number, and percentage of, those who are economically active is expected to continue with no significant changes to demographics or employment activities that would suggest changes to these key baseline statistics.

The area draws a number of day visitors from Wales. The trend for this type of visit is likely to continue in the medium term with the area being seen as an 'active' visitor destination. The visitor economy may be affected by Britain's exit from the European Union in March 2019. Although this may negatively affect the number of visitors from European Union countries, due to potential impacts that may require more complex procedures for holiday visitors, there may be beneficial currency exchange rates that may prompt further spend from international visitors. However, with uncertainty around any future relationship between Britain and the European Union, it is not possible to say with certainty whether changes will have an impact on the visitor economy and the future baseline.

14.6 Consultation

Comments received in response to the 2014 Scoping Report (which informed the 2014 ES) highlighted the need to consider effects on the PRoWs, Penhydd Mountain Bike Trail and other pathways and bridleways within the area. This was further supplemented by a dialogue with the PRoW officer about possible mitigation and issues which would affect the proposed development.

The 2018 Scoping Opinion included a further response from the Local Authority's PRoW Officer. The officer identified that there are a number of public rights of way adjacent to and within the site and requested that the public right of way shall be protected at all times and any damage caused to the right of way shall be rectified to the satisfaction of the Local Authority. In addition any closure or diversions need to be identified. These responses have informed the production of this chapter for the Foel Trawsnant Wind Farm amended scheme.

Table 14.8 provides a summary of the issues that have been raised by consultees and the responses given.

Table 14.8 Summary of issues raised regarding socio-economics during consultation

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref
Concern regarding effects on PRoW, pathways/bridleways	NPTCBC PRoW officer	The chapter has set out the relevant PRoW, the measures embedded into the project to mitigate effects on the PRoW and assessed effects.	14.5, 14.8, 14.12
Concern regarding identification of rights of way, closures and diversions.	NPTCBC PRoW officer	The PRoW and any closures/diversions are set out within the ES.	**Figures 14.1 14.2, 14.3**

14.7 Scope of the assessment

Spatial scope

The spatial scope of the assessment of socio-economic effects covers the area of the site contained within the planning boundary, together with the wider county, regional and national context, which has formed the basis of the study area described in Section 14.5.

- **Climate change and energy security** – the baseline study covers the national (Wales) area as a whole;
- **Economy and community** - the baseline study has covered Wales, Neath Port Talbot County Borough, Bridgend County Borough and the wards of:
  - Cymmer ward (Cymmer and Cynonville);
  - Bryn and Cwmafon (Cwmafon);
  - Caerau (Dyffryn/Nantyffyllon);
  - Maesteg East (Maesteg); and
  - Maesteg West (Maesteg);
- **Tourism and recreation** – tourism baseline study considers tourism at local (Neath Port Talbot County Borough Council and Bridgend County Borough Council), regional (South West Wales) and national (Wales) level. The recreation baseline, related to Public Rights of Way (PRoW) and open access land, has focussed on the local context within 3km as informed by the LVIA **Chapter 7**.

The assessment therefore covers the same spatial scope as the socio-economic assessment undertaken for the 2014 ES.

Temporal scope

The temporal scope of the assessment of the socio economic effects is consistent with the period over which the development would be carried out and therefore covers the construction and operational periods. It is assumed that the construction would start in Spring 2020 with completion in 2021. The scheme is designed for an operational lifespan of 25 years.

Potential receptors

Consideration has been given to the receptors assessed in the 2014 ES. This has been informed by the Scoping Report and Scoping Opinion (2018) which confirmed the approach proposed (to take forward the basis of the 2014 assessment). The socio-economic receptors that have been taken forward for assessment are summarised as follows:

- Climate change and energy security;
- Economy and community; and
- Tourism and recreation.

Potentially significant effects

The methodology in this chapter includes evaluating:

- Achievement of national climate change and energy security targets, including renewable energy generation and achievement of SSA implied targets;
- Economic and community impacts including jobs created, expenditure in the national and regional economy; and
- Effects on the attractiveness of the area as a tourist destination and impacts on Pubic Rights of Way (PRoW).

The assessment is based on determining potential effects on the baseline conditions informed by an understanding of previous wind farm developments and using professional judgement.

Land use has been scoped out from being subject to further assessment because the potential effects are not considered likely to be significant. As noted in the 2014 ES submitted with the original application:

- In terms of the agricultural land take, of the 117.6 ha EIA site area, 8.1% of the land would be permanently taken by the wind turbines, substation, and site tracks (which include both forestry track and the onsite tracks).
- Of the actual application boundary (46.5ha) 20.6% of the agricultural land would be permanently taken.
- None of this land is considered 'Best & Most Versatile' agricultural land (ALC Grades 1, 2 or 3).

It is therefore concluded that there would be no significant effects on agricultural land use as a result of the development. The Scoping Opinion received from Neath Port Talbot County Borough Council confirmed that no further assessment was required for land use.

14.8 Environmental measures embedded into the proposed development

A range of environmental measures have been embedded into the development proposals as outlined in section 5.4 of this ES. **Table 14.9** outlines how these embedded measures will influence the socio economic assessment. These were included in the 2014 ES and are equally applicable to this updated assessment.

Table 14.9 Summary of the embedded environmental measures and how these influence the socio economic assessment

Receptor	Potential changes and effects	Embedded measures and influence on assessment
Tourism and recreation	Potential conflict between PRoW users and site traffic	Footpaths will be required to be temporarily closed during construction, but also safety signs will be required during construction and operation. Proposed measures set out in detail below for each affected footpath/bridleway.
PRoW 28	Potential conflict between PRoW users and site traffic	PRoW 28 follows the route of the proposed access track between the B4282 and the main site. The footpath itself could remain open, with appropriate management and closure limited to of abnormal loads or high traffic volumes associated with the construction activity and only closed during large traffic movements. Due to the large width of the footpath, there could be potential to segregate pedestrians from the construction traffic. In terms of operation, it is proposed that the footpath is managed by appropriate banksmen and health and safety measures to allow both vehicles and pedestrians to use the path, which could include the segregation highlighted above. Once the access track exits Michaelston Forest, the footpath has two further bridleways branching west (39) and east (1) from the main site/access point. The connection of these bridleways and main construction site access will require management with information boards and signage provided along the route to advise recreational users of the construction works taking place. This means of access will be utilized during the operation of the wind farm. Therefore signage will be required to enforce safety.
PRoW 1	Potential conflict between PRoW users and site traffic	Bridleway No.1 runs in a northerly direction along the south-eastern edge of the site. It is anticipated that this route will not require any diversions; however appropriate signage will be erected to notify recreational users of the construction site access and any diversions associated with other routes.
PRoW 39	Potential conflict between PRoW users and site traffic/operational stand off	Neath Port Talbot Council has identified a requirement for a stand-off distance between bridleways and turbines of approximately 145m (height of the wind turbine to blade tip). As identified within **Figure 14.2** Bridleway No.39 crosses the 145m radii buffer zones for T1, T2, T3, T4, T5 and T6. During construction and operation bridleway No.39 will require partial closure due to the close distance to the turbines in this location. During construction and operation, PRoW 39 could be diverted via PRoW 1 and follow a route through the centre of the site between the turbines, via permissive access, which would allow reconnection to the original PRoW 39 just north of T5, before routing around the buffer for T6 and back to the original route. This would mean avoiding all the issues presented by the buffers, but also maintaining access during the duration of the wind farm scheme. The diversion will be approximately 1,850m. There will be a need for warning signs where the proposed permissive access crosses tracks. The proposed diversion routes are illustrated on **Figure 14.3**.
PRoW 40	Potential conflict between PRoW users and site traffic	This footpath is used to access Open Access Land, therefore during construction, permissive routes can be provided to route the path around the turbine to access the Open Access Land.

Receptor	Potential changes and effects	Embedded measures and influence on assessment
		During operation a permanent diversion will be required, which will truncate the route to the edge of Open Access Land, or, if environmental constraints permit, re-route to the south of T11 where more appropriate access in relation to the 145m buffer can be found.
Open access land	Safety of uses of open access land	Open Access Land provides access to the public, making it difficult to control their movements during construction. In the interest of health and safety it is not acceptable to allow visitors to be within close proximity to construction activities. During the construction period, to mitigate the risk, it will be important the public access to this land will not be allowed to ensure health and safety of visitors. Therefore partial closure of the land will require barriers and signage to ensure visitors do not stray into the area. Once the development is operational, access will be reinstated.

14.9 Assessment methodology

Methodology for prediction of effects

The generic project-wide approach to the assessment methodology is set out in **Chapter 2**. However, whilst has informed the approach that has been used in this socio-economic assessment, it is necessary to set out how this methodology has been applied, and adapted as appropriate, to address the specific needs of this assessment.

As discussed in Section 14.7, the assessment methodology adopted is based on determining potential effects on the baseline conditions using knowledge gained from previous wind farm developments and using professional judgement. Where possible, (quantifiable) the significance will be assessed by way of a comparison of the factor (e.g. construction jobs) with the variance of related factors within the local economy. Where effects cannot be quantified, the assessment of significance will be undertaken using professional judgement and experience.

Significance evaluation methodology

The EIA Regulations require that a final judgement is made about whether or not each effect is likely to be significant. The effects have been evaluated on the basis of a professional assessment of the magnitude of the effect and the value of the receptor or importance of the policy. In this assessment, effects are considered to be significant or not significant according to the matrix in **Table 14.10**.

In respect of the policy context the sensitivity definitions used for the socio-economic assessment are: National (Wales), Regional (South West Wales), County (Neath Port Talbot County Borough Council) or local (within 5 km of the site boundary - towns and villages identified, including in Bridgend).

Climate change and energy security

The impact on climate change is assessed in the context of applicable policy and targets. The significance is based on the magnitude of change towards achievement of policies and targets that apply to Wales.

Economy and community

Conclusions on potential effects are reached based upon the magnitude of the predicted change likely to occur to the baseline situation. The sensitivity of the baseline is a further consideration to be taken into account.

Tourism and recreation

The effect on tourism has been assessed using surveys commissioned by a range of organisations into the public perception of wind turbines both in Wales and other parts of the UK. For the purpose of this assessment a 3km study area was drawn around the proposed development in order to identify the main tourist facilities and recreational locations that have the potential to be affected by the proposed development. Effects are most likely to result from the visual impact of the proposed development upon tourism receptors. The 3km study area was based upon the groups of PRoW and open access land considered likely or certain to sustain significant visual effects as a consequence of operation of the 11 turbines as determined in the 2018 LVIA (**Chapter 7**).

Potential effects on PRoW and Open Access Land have been considered using professional judgement and acceptable criteria as suggested by the Neath Port Talbot County Borough Council Public Rights of Way officer.

How this results in a predicted level of significance is set out within **Table 14.10**.

Table 14.10 Matrix of EIA Significance

		Magnitude of change			
		High	**Medium**	**Low**	**Very low**
Sensitivity	**High – Wales**	Major (Significant)	Major (Significant)	Moderate (Significant)	Minor (Not significant)
	Medium – Regional level (South West Wales)	Major (Significant)	Moderate (Significant)	Minor (Not significant)	Negligible (Not significant)
	Low – County level (NPTCBC)	Moderate (Significant)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)
	Very Low – local (within 5km)	Minor (Not significant)	Negligible (Not significant)	Negligible (Not significant)	Negligible (Not significant)

14.10 Assessment of effects: Climate change and energy security

Baseline conditions

The current baseline is set out in Section 14.5.

Predicted effects and their significance

Operation

The Foel Trawsnant Wind Farm amended scheme has a target maximum installed capacity of up to 33MW which is forecast to generate 89.33Wh per year. This could supply electricity for the domestic needs of approximately 19,717 homes[66].

In the context of national policy for greater renewable energy, the proposal makes a positive contribution. The wind farm at 33MW installed capacity represents 1.98% of the Welsh Assembly Government's implied target of 1,666MW of generation from TAN8 Strategic Search Area (SSA) wind farm sites set within the Ministerial Letter of July 2011. The social and economic benefits that are derived from this will be indirect and will include the strengthening of the nation's security of supply and the mitigation of climate change.

The site falls within SSA F: Coed Morgannwg. The 2011 Ministerial Letter set a target of 430MW wind generation in this SSA. The latest Welsh Government review of onshore wind farm development energy generation for SSA 'F' (with data as at 01 April 2017) (Welsh Government, 2017) is set out in **Table 14.11**.

In total, consented schemes (i.e. those schemes that have planning permission but have not begun operation) and operational schemes have a combined 355.5 MW of power generation. Based on these latest figures the Foel Trawsnant scheme would deliver around 44% of the capacity that remains in SSA F (noting that the existing approved 39MW scheme would be included under the awaiting determination stage at 01 April 2017). This will go some way to meeting the regional, SSAs and national wind energy priorities and help ensure that Wales moves towards a low carbon economy and country, which is the desire of the Welsh Government.

Table 14.11 Latest position regarding SSA F installed capacity (MW) (as at 01 April 2017)

Awaiting determination	Consented	Operational		Consented and Operational total	Overall Total
		Pre 2005	Post 2005		
54	9	32	314.5	355.5	409.5

The proposed development is therefore significant in the national and local policy context of action to tackle CO_2 emissions, with its potential to reduce the levels of CO_2 emitted to the air. **Table 14.12** shows how the proposed wind farm could reduce emissions going into the atmosphere by replacing that generated through fossil fuels.

[66] Assuming average UK household consumption of 3.78MWh/yr using Department of Business, Energy and Industrial Strategy (BEIS) figures from Renewable UK (available via: https://www.renewableuk.com/page/UKWEDExplained [accessed September 2018] Homes Equivalent = rated capacity of wind farm (kW) x average load factor for wind x number of hours in a year / average household energy consumption(MWh)

Table 14.12 Emissions to atmosphere avoided if wind farm output replaces fossil fuel output based on a 33MW wind farm operating at 27% average load factor

Emissions to atmosphere avoided (tonnes) [67]		
	Annual	**Total (25 years)**
Carbon dioxide (CO_2)	33,065	826,625

Note: Carbon dioxide is the main gas implicated in global warming.

A summary of the results of the assessment of the climate change and energy security is provided in **Table 14.13**.

Table 14.13 Summary of significance of beneficial effects

Receptor and summary of predicted effects	**Sensitivity/ importance/ value of receptor[1]**	**Magnitude of change[2]**	**Significance[3]**	**Summary rationale**
Climate change and energy security - operational	National	Very Low	Minor (Not significant)	The development would represent 1.98% of the Welsh Assembly Government national target for SSAs. The wind farm will represent up to 44% of the remaining 74.5MW of capacity for SSA F.

The sensitivity/importance/value of a receptor is defined using the criteria set out in section 14.8 above and is defined as very low (local), low (county), medium (regional) and high (national).
The magnitude of change on a receptor resulting from activities relating to the development is defined using the criteria set out in section 14.8 above and is defined as very low, low, medium and high.
The significance of the environmental effects is based on the combination of the sensitivity/importance/value of a receptor and the magnitude of change and is expressed as major (significant), moderate (probably significant) or minor/negligible (not significant), subject to the evaluation methodology outlined in section 14.8.

14.11 Assessment of effects: Economy and community

Baseline conditions

The current baseline is set out in Section 14.5.

Predicted effects and their significance

Construction

Employment and expenditure

The total average construction and development phase cost for onshore wind farms in Wales was estimated as £1.25m per MW of installed capacity (Regeneris Consulting Ltd and Welsh Economy Research Unit, 2013). Based on this figure the construction of the Foel Trawsnant Wind Farm would involve an investment of approximately £41.25m (based on a maximum output of up to 33MW). More recent experience by the

[67] Based on BEIS Digest of UK Energy Statistics estimated carbon dioxide emissions per GWh of electricity supplied by all of fossil fuels of 460 tonnes per GWh of electricity supplied.

developers however suggests this figure could be closer to £50m. Construction would create the opportunity for direct economic benefits to Wales, and in particular the sub-region through the opportunities available to local firms to bid for mechanical, electrical and civil engineering contracts. Criteria for selecting the wind turbine manufacturer and civil and electrical contractors would be based on price specifications and guarantees to ensure that performance and technical specifications are met in full.

Most of the jobs associated with the scheme would occur in the construction phase and there is the potential for some of the work to be undertaken by local firms. The project is expected to involve the creation of up to 49 jobs during construction. In addition, it is possible that some of the quarry materials needed for the development (e.g. for road aggregate and hardcore) could be procured from local quarries. In relation to the baseline, which shows a higher unemployment in the wards around the proposed development, the development may support some employment generation.

Other indirect benefits to the local economy would come through an increased spend in bed and breakfast and other accommodation and the use of other local services and facilities during the construction phase.

Overall, the construction of the wind farm is likely to have a significant positive effect on the socio-economic profile of the area, as there is potential for economic benefit to local construction firms, quarries, accommodation establishments and other local services.

Operation

Employment and expenditure

The proposal is expected to directly employ four people for maintenance during the operational phase. Their duties will include compliance with statutory environmental requirements. It has been estimated that the operation and maintenance of onshore wind farm involves an average expenditure of £38,600 per MW per annum, with 76% of that expected to be retained in Wales (Regeneris Consulting Ltd and Welsh Economy Research Unit, 2013). For a 33MW scheme that would result in approximately £1,273,800 of expenditure annually, with approximately £968,088 being retained in Wales.

Non Domestic Rates

At present, all Non-Domestic Rates ('business rates') (NDR) are collected and then distributed by Welsh Government by way of different social and economic criteria to Local Authorities. Therefore the local council would see no direct financial benefit from the wind farm. The previous UK Government announced plans for all business rates (including those from wind farms) to be retained by the local authority that had collected them. Through the Local Government Finance Act 2012, and regulations that followed, the Government gave local authorities the power to keep half of business rate income in their area by splitting business rate revenue into the 'local share' and the 'central share'.

This is not currently the case in Wales. The administration of NDR in Wales is devolved to the Welsh Government. Currently all NDR are collected and paid into the Welsh Government's Non-Domestic Rates Pool. These funds are then redistributed to local authorities as part of the local government revenue settlement each year. However, should legislation be enacted in Wales that rates raised can be retained by the local authority it is anticipated that Neath Port Talbot Council, or its beneficiaries, would receive the Non-Domestic Rates from the wind farm.

Community Benefits

TAN8 requires developers to consider ways to provide means to ensure that the local community can benefit from the development of wind farms. The applicant is conscious of its role and the proposed developments role within the community and wants to ensure that the local community shares some of the financial

benefits of the having the wind farm in the area. This will be implemented by a Community Benefit Fund, the mechanism of which will be decided post planning consent, should this be awarded.

A summary of the results of the assessment of the economy and community is provided in **Table 14.14.**

Table 14.14 Summary of significance of economy and community effects

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
Economy and community employment and expenditure – construction phase	Regional	Medium	Moderate (Significant)	Positive contribution to the economy of Neath Port Talbot with potential investment of £50m into the economy during the construction phase.
Economy and community non domestic rates – operational phase	County	Low	Negligible (Not significant)	Potential for boosts to Local Authority business rate funds from increased share of Welsh Government funding pot or through retention of NDR if changes to legislation implemented.
Economy and community employment and expenditure – operational phase	National	Very low	Minor (Not significant)	Expenditure of around £968,088 into the Welsh economy.

The sensitivity/importance/value of a receptor is defined using the criteria set out in section 14.8 above and is defined as very low (local), low (county), medium (regional) and high (national).
The magnitude of change on a receptor resulting from activities relating to the development is defined using the criteria set out in section 14.8 above and is defined as very low, low, medium and high.
The significance of the environmental effects is based on the combination of the sensitivity/importance/value of a receptor and the magnitude of change and is expressed as major (significant), moderate (probably significant) or minor/negligible (not significant), subject to the evaluation methodology outlined in section 14.8.

14.12 Assessment of effects: Tourism and recreation

Baseline conditions

The current baseline is set out in Section 14.5.

Predicted effects and their significance

Construction

The PRoWs that cross the proposed development site are discussed in Section 14.5. As outlined in Section 14.8 there will be a requirement to mitigate any effects on these PRoWs, including via temporary diversions and closures. There is potential for some disruption to the PRoWs, although the mitigation identified in the previous section should reduce the likelihood of any significant issues.

Indirect effects resulting from the construction activities, such as the use of the local highway network for delivery which could potentially affect visitors travelling to the area, are discussed within **Chapter 13** of this ES.

Operation

Visual effects on tourism and recreational receptors have been assessed in the LVIA section of the ES (**Chapter 7**). The 2018 assessment has concluded that, from consideration of the extensive network of

national and regional trails, national cycle routes, locally promoted walks and mountain-biking trails and other public rights of way and open access land, significant visual effects would be experienced from:

- locations along a maximum of 6km of the route shared by two regional trails (Coed Morgannwg Way and St.Illtyd's Way);
- less than 1km of a national cycle route 885;
- locally promoted mountain biking and walking routes: Tarren Forgan Trail, Afan Woodland Walk, River and Railway Walk, Argoed Walk and Penhydd Trail (the finding of significant visual effects on River and Railway Walk and Penrhydd Trail differs from the 2014 LVIA); and
- some of the PRoWs and open access areas within three of the seven geographical groups within 3km of the proposal site (Areaa A, B and F).

Additionally, the 2018 LVIA also states there are significant visual effects on Maesteg Golf Course. The LVIA notes that the magnitude of change is consistent with that presented in the 2014 LVIA for the approved scheme. However, the sensitivity of visual receptors has been amended in accordance with GLVIA3 hence the level of effect has increased and is significant.

There are a number of recreational activities taking place within the Afan Forest Park. There are a range of paths used for walking and mountain biking, which would not be affected directly by the development. The main resource for the Afan Forest Park is the visitor centre which is close to the western side of the site. The visitor centre development and its activities will continue as normal and it will remain the hub of the Afan Forest Park.

No significant effects have been identified on any noise or cultural heritage assets that might be part of the tourist resource of the area. There is no possibility for any shadow flicker effects on tourist accommodation.

As discussed in Section 14.8 measures will be required to ensure no significant effects are experienced by users of the PRoW network and Open Access Land on the site. The implementation of these measures should ensure no significant effects on these receptors.

Various studies (British Wind Energy Association, 2005 and 2006) have been commissioned into the potential effects of wind turbines upon tourists in the past. These are summarised within the Renewables UK (formerly BWEA) document '*The impact of wind farms on the tourism industry of the UK*' (BWEA, 2006). It found that surveys demonstrate that the effect of wind farms on tourism is negligible at worst, with many respondents taking a positive view to wind farms.

Furthermore, in a more recent study for Welsh Government in 2014 (Regeneris Consulting and The Tourism Company for Welsh Government, 2014) regarding the impact of wind farms and their associated grid infrastructure on the Welsh tourism sector, it was found that:

- Negligible impact on the national tourism sector from wind farms;
- Limited evidence of local tourism impacts to date;
- Wind farms are remote from Wales's key visitor assets and tourism locations;
- Reactions to wind farms are complex and may change over time;
- Higher sensitivity to wind farms for certain visitor markets;
- Some potential for positive impacts, often requiring further investment;
- No evidence that wind farms on visitor routes deter tourists; and
- No negative impacts during construction.

This study also looked at a number of case studies, including the South Wales Valleys, which hosts the site. The key points find that there is and will continue to be a concentration of wind farms around the Afan Forest Park and Neath Port Talbot. The case study highlights that these wind farms will be relatively dominant features in the landscape in some parts of this area however large areas are forested, which would limit visibility but also in former industrial areas which will limit the impact on landscapes and attractiveness for visitors. The study picks up on the diverse recreational offerings in the area which includes walking, adventure sports, mountain biking, heritage, beaches and surfing. Many of these markets are not likely to be sensitive to wind farm development which increases the potential for substitution of visitors if some visitors are deterred. Some of the key conclusions of the assessment of the impact on tourism within Neath Port Talbot (the case study looks at Rhondda Cynon Taff):

- There is no evidence to indicate that visitor numbers to Rhondda Cynon Taff and Neath Port Talbot as a whole have been affected by the wind farm development which has occurred to date. Consultees reported the strongest growth in visitor volumes over the previous five years, a period when there had been considerable wind farm development in the area.
- Wind farms are not likely to pose a threat to some of the main tourism markets, this includes mountain biking and the area is a base for exploring the South West; it is not expected from the study that either market is under threat from wind farm development.
- Despite this, it is highlighted that at a very local level there may be some impacts. Hospitality businesses in very close proximity to wind farms (less than 2km) are concerned that a large part of their customer base who visit the area for peace and quiet will not make future visits because of the dominance of wind farms on the landscape and possible noise effects, but the diversity of the visitor market suggests there is scope for these businesses to adapt compared to other parts of Wales.
- It was highlighted that *"there is an opportunity to exploit the turbines as a visitor asset."*

Overall, it is concluded that the Foel Trawsnant Wind Farm amended scheme would not have adverse effects upon the local tourism industry.

A summary of the results of the assessment of tourism and recreation is provided in **Table 14.15.**

Table 14.15 Summary of significance of tourism and recreation effects

Receptor and summary of predicted effects	Sensitivity/ importance/ value of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
Tourism and recreation - construction and decommissioning phase	Local	Medium	Negligible (Not significant)	A number of PRoW cross the site. The implementation of suitable environmental measures will ensure no significant effects are experienced by receptors.
Tourism and recreation – operational phase	Local	Medium	Negligible (Not significant)	Studies suggest that wind turbines are not a disincentive to visitors. There will be some impact on the existing PRoWs as some require permanent diversion with new permissive routes, whilst another will be truncated. CRoW Land will be reinstated as will other PRoW. No adverse effects on tourism are identified in the rest of the ES.

The sensitivity/importance/value of a receptor is defined using the criteria set out in section 14.8 above and is defined as very low (local), low (county), medium (regional) and high (national).
The magnitude of change on a receptor resulting from activities relating to the development is defined using the criteria set out in section 14.8 above and is defined as very low, low, medium and high.
The significance of the environmental effects is based on the combination of the sensitivity/importance/value of a receptor and the magnitude of change and is expressed as major (significant), moderate (probably significant) or minor/negligible (not significant), subject to the evaluation methodology outlined in section 14.8.

14.13 Assessment of cumulative effects

Consideration has been given as to whether any of the socio-economic receptors that have been taken forward for assessment in this chapter are likely to be subject to cumulative socio-economic effects because of socio-economic effects generated by other developments.

Overview

The socio-economic cumulative assessment is concerned with the evaluation of the effects that could be generated were the Foel Trawsnant Wind Farm amended scheme to be constructed and operational along with other wind farm developments in the area.

Cumulative socio-economic effects

Cumulative effects can arise from the construction and operation of other wind farms in the area, which can lead to cumulative economic, energy security and climate change benefits. The region is a hub for wind energy recognised by Welsh Government statistics on the number of existing and proposed wind turbines in the wider area[68]. The development of proposed windfarms will lead to an additional minor regional impact on the economy, which will be beneficial during construction for:

- Employment (directly and indirectly); and
- The related industries of wind energy and the supply chain.

[68] Welsh Government (2017) Technical Advice Note (TAN) 8 Database 2017

Also it is likely that the community where the turbines are located benefit from each scheme.

The cumulative visual effects upon tourism or recreation could also dissuade visitors from visiting the area and therefore impact on tourism and recreation. There are a large number of wind turbines built, consented and within the planning system in the local area as outlined in Sections 7.10, 7.11 and 7.12 of the **Chapter 7** (LVIA). **Chapter 7** states that there are 20 turbines consented/under construction or proposed within the cumulative assessment study area. There are also 251 existing turbines. The largest wind farm is the 76 turbine scheme at Pen-y-Cymoedd which became operational in 2017. Pen-y-Cymoedd is identified as the largest onshore wind farm in the England and Wales. The LVIA takes into account the operational turbines in its assessment.

The LVIA assessment examines the East of Melin Court Wind Farm; a five turbine wind farm to be sited north of the operational Ffynnon Oer Wind Farm and concludes that the five turbines would be visible within the same part of the horizon already occupied by the operational Pen y Cymoedd and Ffynnon Oer Wind Farms. The incremental visual change would be minor. Cumulative effects on tourism are therefore considered to be minor and not significant.

14.14 Consideration of additional mitigation or compensation

No additional mitigation measures are proposed to further reduce the socio economic effects that are identified in this ES. This is because all relevant and implementable measures have been embedded into the development proposals and are assessed above in this chapter. These measures are considered to be likely to be effective and deliverable and address the likely significant effects of the amended Foel Trawsnant Wind Farm amended scheme.

14.15 Conclusions of significance evaluation

Climate change and energy security

The conclusions of the assessment concur with the assessment in the 2014 ES. The amended scheme is considered to have a minor (not significant) positive effect on the achievement of Welsh Government's legal and policy commitment to increasing renewable energy production within Wales, and towards its commitments to have a positive and lasting effect on climate change.

Economy and community

The contribution to the regional economy is assessed as being moderate (significant) from the positive contribution during the construction phase. The assessment of significant effects from the economic contribution during construction is consistent with the 2014 although it is linked to an estimation of economic investment based on a lower MW production (related to the loss of two turbines in the revised scheme). With regards to the potential economic boost from domestic rates at the operational phase this is assessed as negligible (not significant) whilst expenditure at the national level is minor (not significant).

Tourism

The assessment of tourism and recreation effects has found that the amended scheme will lead to the same effects as that concluded in 2014, identified as negligible (not significant) within this assessment. Effects on users of PRoW will be minimised in the construction phase through the implementation of environmental measures including diversions and adoption of permissive paths as discussed in Section 14.8.

Cumulative effects

Cumulatively, with the addition of further turbines proposed in the area there are likely to be minor effects with regards to meeting Welsh Government climate change targets, economic investment and expenditure, and for tourism and recreation.

14.16 Implementation of environmental measures

Table 14.16 describes the environmental measures embedded within the proposed development and the means by which they will be implemented.

Table 14.16 Summary of environmental measures relevant to socio-economics including recreation and tourism to be implemented

Environmental measure	Responsibility for implementation	Compliance mechanism	ES Section Reference
Measures to ensure that PRoW diversions are conducted appropriately.	Developer/contractor	CEMP	14.8

14.17 References

Amec Environment & Infrastructure Ltd. (2014) Foel Trawsnant Wind Farm Environmental Statement (Document reference 24311rr073i1)

Beaufort Research for Neath Port Talbot County Borough Council (2016) Research Report: Wales Visitor Survey 2016 - Neath Port Talbot. Available via: http://www.npt-business.co.uk/media/8468/wales-national-visitor-survey-2016-neath-port-talbot-findings.pdf

Bridgend County Borough Council (2018a) Bridgend County Borough Destination Management Plan 2018-2022. Available via: https://democratic.bridgend.gov.uk/documents/s14930/Bridgend%20Destination%20Management%20Plan%20Appen.%201%202018-2022.pdf

Bridgend County Borough Council (2018b) Report to Cabinet: Bridgend County Destination Management Plan and Destination Action Plan. Available via: https://democratic.bridgend.gov.uk/documents/s14929/Destination%20Management%20Plan%20Cabinet%20Report%20230218.pdf

British Wind Energy Association (BWEA) (2005) BWEA Briefing Sheet: Public attitudes to wind energy in the UK

British Wind Energy Association (BWEA) (2006) 'The impact of wind farms on the tourism industry of the UK'

Department of Business, Energy and Industrial Strategy (2018) Digest of UK Energy Statistics. Available via: https://www.renewableuk.com/page/UKWEDExplained

Department of Energy & Climate Change. (2011) Overarching National Policy Statement for Energy (EN-1)

GTS for Neath Port Talbot Borough Council (2016) STEAM Summary 2016. Available via: http://www.npt-business.co.uk/media/8458/neath-port-talbot-steam-statistics-2016.pdf

Neath Port Talbot County Borough Council (2016) County Borough Neath Port Talbot Local Development Plan – 2011-2026

Neath Port Talbot County Borough Council (2016) Neath Port Talbot Destination Management Plan - 2015-2020 Available via: http://www.npt-business.co.uk/media/4345/neath-port-talbot-destination-management-plan-2015-2020-final.pdf

Neath Port Talbot County Borough Council (2018) Afan Forest Park website. Available via: http://www.afanforestpark.co.uk/

Nomis (2011) Census 2011 data. Available via: https://www.nomisweb.co.uk/reports/lmp/la/contents.aspx

Nomis (2017) Annual survey of Hours and Earnings. Available via: https://www.nomisweb.co.uk/reports/lmp/la/contents.aspx

Nomis (2018) Official Labour Market Statistics and Local Authority Labour Market Profile. Available via: https://www.nomisweb.co.uk/reports/lmp/la/contents.aspx

Office of National Statistics (ONS) (2013) Population estimates (ward). Available via: https://www.nomisweb.co.uk/reports/lmp/la/contents.aspx

ONS (2017) Population estimates (Local Authorities and national). Available via: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates

Regen for Welsh Government (2017) Energy Generation in Wales – 2016

Regeneris Consulting Ltd and Welsh Economy Research Unit, Cardiff Business School for Renewables UK Cymru, Welsh Government (2013) Economic Opportunities for Wales from Future Onshore Wind Development

Regeneris Consulting and The Tourism Company for Welsh Government (2014) Study into the Potential Economic Impact of Wind Farms and Associated Grid Infrastructure on the Welsh Tourism Sector

Stats Wales (2017) Active Business Enterprises by area and year. Available via: https://statswales.gov.wales/Catalogue/Business-Economy-and-Labour-Market/Businesses/Business-Demography

Welsh Government (2014) Welsh Indices of Multiple Deprivation. Available via: https://gov.wales/statistics-and-research/welsh-index-multiple-deprivation/?lang=en

Welsh Government (2017) Technical Advice Note (TAN) 8 Database 2017. Available via: https://gov.wales/docs/desh/publications/170905windfarm-development-database-summary-table-en.pdf

Welsh Government (2018) Tourism Profile – South West Wales 2014 – 2016. Available via: https://gov.wales/docs/caecd/research/2018/180823-regional-tourism-profiles-2014-2016-south-west-wales-en.pdf

15 Shadow Flicker

15.1 Introduction

This chapter of the ES assesses the likely significant effects of the proposed development with respect to shadow flicker. It should be read in conjunction with the development description provided in **Chapter 5**.

This is an update to the assessment presented in the 2014 ES (ref 24311rr073i1), which examined the potential effects relating to shadow flicker in the defined study area of 10 rotor diameters plus 50m micrositing. This assessment has therefore been updated taking into consideration the updated turbine dimensions, in line with the methodology outlined in the Scoping Report (Amec Foster Wheeler[69], 2018), and a reduced micrositing distance of 35m.

15.2 Limitations of this assessment

There are no limitations relating to shadow flicker that affect the robustness of the assessment of the potential likely significant effects of the proposed development.

However, it was not possible to visit the private residential properties and take accurate measurements of window locations, sizes and orientation, so an estimate of the number, orientation and location of windows has been made, based on available information such as OS maps, aerial photographs and Google Streetview.

15.3 Policy and legislative context

Planning policy

Policies relevant to the assessment of shadow flicker in Wales include:

- Planning Policy Wales, Technical Advice Note 8: Planning for Renewable Energy (TAN8), published by Welsh Assembly Government in 2005; and
- National Policy Statement for Renewable Energy Infrastructure (EN3), published by DECC in 2011.

More detailed guidance is included within the English policy documents:

- NPS EN-3 (July 2011) still refers to Planning for Renewable Energy. A Companion Guide to PPS22. However, this was formally cancelled with the publishing of 'Planning Practice Guidance for Renewable and Low Carbon Energy' in 2013, which states that it should be read alongside other planning practice guidance and the NPPF. The Companion Guide to the former PPS22 is cancelled.

An overview of current national and international best practice and guidance is provided by:

- Update of UK Shadow Flicker Evidence Base, published by DECC in 2011.

Paragraph 2.32, of Annex C to TAN8 provides a brief description of shadow flicker effects as follows:

> *"Under particular circumstances the sun may pass behind the rotors of a wind turbine and cast a shadow over neighbouring properties. The shadow flicks on and off as the blades rotate. This can be*

[69] Now Wood

disturbing for the affected residents or even have the potential of being a health problem for people who are photo-sensitive epileptics. The problem is only seasonal and lasts for a few hours per day, but needs to be investigated where any potential exists. Developers should provide an analysis of the potential shadow flicker impacting upon nearby properties."

The National Policy Statement for Renewable Energy Infrastructure (EN3) includes a fuller description of the effect and more detailed guidance. Paragraph 2.7.63 of EN3 describes shadow flicker as:

"...the effect caused when an operating turbine is located between the sun and a receptor, such as a dwelling or place of work. The effect occurs when the shadow of the rotating blades falls over the dwelling causing the light intensity within specific affected rooms of the occupied building to fluctuate."

Paragraph 2.7.64 sets out the factors affecting the potential significance of the effect and goes on to state that:

"Research and computer modelling on flicker effects has demonstrated that there is unlikely to be a significant impact at distances greater than ten rotor diameters from a turbine. Therefore if the turbine has 80m diameter blades, the potentially significant shadow flicker effect could be observed up to 800m from a turbine."

With regard to the requirements of the developer's assessment, paragraph 2.7.66 states:

"Where wind turbines have been proposed within 10 rotor diameters of an existing occupied building, a shadow flicker assessment should be carried out by the applicant. The IPC should anticipate that the intensity of the shadow of the rotating blades from turbines at distances from such buildings of 10 rotor diameters and beyond is sufficiently diminished so as to have no significant impact on occupied buildings."

With regard to human health, paragraph 2.7.70 states that:

"The maximum frequency of the shadowing effect from commercial scale wind turbines is less than 1 hertz, which is well below the frequency known to affect sufferers of epilepsy (which is above 2.5 hertz37). Therefore, shadow flicker frequencies are not in the region known to induce seizures in sufferers of epilepsy, and as such, where the frequency of potential flashes will not exceed 2.5 hertz..."

Paragraphs 35 through 37 of the PPG state:

"35. Under certain combinations of geographical position and time of day, the sun may pass behind the rotors of a wind turbine and cast a shadow over neighbouring properties. When the blades rotate, the shadow flicks on and off; the impact is known as 'shadow flicker'. Only properties within 130 degrees either side of north, relative to the turbines can be affected at these latitudes in the UK – turbines do not cast long shadows on their southern side.

36. Modern wind turbines can be controlled so as to avoid shadow flicker when it has the potential to occur. Individual turbines can be controlled to avoid shadow flicker at a specific property or group of properties on sunny days, for specific times of the day and on specific days of the year. Where the possibility of shadow flicker exists, mitigation can be secured through the use of conditions.

37. Although problems caused by shadow flicker are rare, where proposals for wind turbines could give rise to shadow flicker, applicants should provide an analysis which quantifies the impact".

In 2010 The Department of Energy and Climate Change (DECC) commissioned An Update of UK Shadow Flicker Evidence Base in order to ensure that national planning policy and guidance available was up to date and the resulting report was published in the following year. The findings of the study conclude that the recommendation within English, Scottish and Welsh planning policy and advice to assess shadow flicker impacts within 130 degrees either side of north and 10 rotor diameter distance from the nearest property is

acceptable. The study also states that it is widely accepted across Europe that at more than 10 rotor diameters from a turbine the potential for shadow flicker is very low.

Furthermore, the study concluded that there have been no extensive issues with shadow flicker in the UK and in circumstances where shadow flicker issues have been raised these have been resolved using standard mitigations, such as turbine shut down systems. Following publication of the 2011 study, DECC has confirmed that there are no plans to change current guidance on shadow flicker.

Table 15.1 lists the issues from the relevant planning policies that have been considered in assessing shadow flicker effects.

Table 15.1 Policy issues considered in preparing the Shadow Flicker assessment

Policy reference	Policy issues	Considered in section
National planning policies		
Technical Advice Note (TAN) 8: Planning for Renewable Energy (2005) – Para 2.32	Under particular circumstances the sun may pass behind the rotors of a wind turbine and cast a shadow over neighbouring properties. The shadow flicks on and off as the blades rotate. This can be disturbing for the affected residents or even have the potential of being a health problem for people who are photo-sensitive epileptics. The problem is only seasonal and lasts for a few hours per day but needs to be investigated where any potential exists. Developers should provide an analysis of the potential shadow flicker impacting upon nearby properties".	15.4 and 15.7
National Policy Statement for Renewable Energy Infrastructure (EN3)	National Policy Statement for Renewable Energy Infrastructure (EN3) includes a fuller description of the effect of shadow flicker and more detailed guidance. Paragraph 2.7.63 of EN3 describes shadow flicker as: *"...the effect caused when an operating turbine is located between the sun and a receptor, such as a dwelling or place of work.* *The effect occurs when the shadow of the rotating blades falls over the dwelling causing the light intensity within specific affected rooms of the occupied building to fluctuate."* Paragraph 2.7.64 sets out the factors affecting the potential significance of the effect and goes on to state that: *"Research and computer modelling on flicker effects has demonstrated that there is unlikely to be a significant impact at distances greater than ten rotor diameters from a turbine. Therefore, if the turbine has 90 m diameter blades, the potentially significant shadow flicker effect could be observed up to 900 m from a turbine."* With regard to the requirements of the developer's assessment, paragraph 2.7.66 states: *"Where wind turbines have been proposed within 10 rotor diameters of an existing occupied building, a shadow flicker assessment should be carried out by the applicant.* *The IPC should anticipate that the intensity of the shadow of the rotating blades from turbines at distances from such buildings of 10 rotor diameters and beyond is sufficiently diminished so as to have no significant impact on occupied buildings."* With regard to human health, paragraph 2.7.70 states that: *"The maximum frequency of the shadowing effect from commercial scale wind turbines is less than 1 hertz, which is well below the frequency known to affect sufferers of epilepsy (which is above 2.5 hertz). Therefore, shadow flicker frequencies are not in the region known to induce seizures in sufferers of*	15.4 and 15.7

Policy reference	Policy issues	Considered in section
	epilepsy, and as such, where the frequency of potential flashes will not exceed 2.5 hertz..."	
Development plan policies		
Neath Port Talbot County Borough Council Local Development Plan 2011 -2026 **Renewable and Low Carbon Energy Supplementary Planning Guidance (July 2017)** **Policy RE1**	Matters that will need to be taken into consideration in relation to all types of renewable/low carbon energy include visual amenity, cultural and residential impacts on local communities, effects on the natural environment, highway safety implications, effects on communications, and site restoration. Particular attention will need to be given to potential impacts on the landscape, townscape or seascape, nature conservation, wildlife interests, areas of historical and cultural importance and the potential for pollution, noise, dust, vibration, reflected light and shadow flicker.	15.4 and 15.7

Legislative context

There is no specific legislation relating to shadow flicker. Policies (set out above) which are relevant to the assessment of shadow flicker in Wales include:

- Planning Policy Wales, Technical Advice Note 8: Planning for Renewable Energy (TAN8), Welsh Assembly Government (2005); and
- National Policy Statement for Renewable Energy Infrastructure (EN3), DECC (2011).

An overview of current national and international best practice and guidance is provided by:

- Update of UK Shadow Flicker Evidence Base, DECC (2011).

Technical guidance

Whilst not strictly applicable in a Welsh context, the guidance in Northern Ireland provided in the draft Best Practice Guidance to Planning Policy Statement 18 (PPS 18) Renewable Energy (Northern Ireland Department of the Environment, 2009) is noteworthy. The draft guidance reaffirms the advice provided by DECC (2011) and the Welsh Government, but further recommends that "*shadow flicker at neighbouring offices and dwellings within 500m should not exceed 30 hours per year or 30 minutes per day*." The recommendation is based on a European Union sponsored study undertaken by Predac (2004), an organisation that promotes best practice in energy use and supply.

15.4 Data gathering methodology

The shadow flicker assessment comprises numerical modelling of the proposed turbines and receptors within the defined study area. It is noted that whilst there are a number of computer models available, the DECC study (2011) confirms that there are limited differences between outputs of the various packages. For Shadow Flicker assessments, Wood use one of the industry standard software packages, ReSoft Wind Farm software (version 4.2.5.2).

The calculations from this assessment process assume a worst-case scenario based on the sun shining during all daylight hours over the course of a year, no obscuring features (such as trees, hedges, other buildings) being present, the face of the rotor always being aligned towards the dwelling, and that the rotor is always turning (i.e. the wind is always blowing between 4m/s and 25m/s, and no account is taken of shut down periods for maintenance). This methodology yields a theoretical maximum indication of potential shadow

flicker incidence, together with the times of day, and dates during the year when potential incidence may occur.

The software performs calculations to determine the position of the sun throughout the year, and thus during what times of day it will theoretically cast a shadow across the windows of nearby houses within 10 rotor diameters (plus 35m micrositing). Data input into the model where shadow flicker assessment is required is as follows:

- The locations of all properties within ten times the rotor diameter (including an allowance of 35m for micrositing) and 130 degrees either side of north of any turbine;
- The dimensions and orientations of windows facing the proposed development;
- The surrounding topography (Ordnance Survey Digital Terrain Model); and
- The locations and dimensions of the turbines.

The following sources of information outlined in **Table 15.2** were used to inform this assessment.

Table 15.2 Sources of Information

Topic	Source of information
Residential properties: location in relation to the proposed development and identification of windows	Ordnance Survey (OS) 1:25,000 Mapping Google Earth Street View Bing Maps Birds Eye View
Topography Height data	OS 5m DTM data

15.5 Overall baseline

As outlined in Section 15.3 and 15.4 it is considered that shadow flicker does not have a significant effect at properties located at a distance greater than ten rotor diameters from the wind turbines. The turbines under consideration for development at this site have rotor diameters of up to 90m, meaning a study area of 900m. We have also allowed 35m for micrositing, giving a total study area of 935m.

Properties falling within this baseline will be assessed with regards to the potential to experience shadow flicker. The study area is shown in **Figure 15.1.** None of the properties considered currently experience shadow flicker from other wind farm developments.

Predicted future baseline

On the basis of the information currently available, no changes to the baseline conditions are anticipated in the event that the proposed development does not proceed.

15.6 Consultation

The approach to shadow flicker assessment was outlined in the Scoping Report (February 2018) (see **Chapter 2: Environmental Impact Assessment Process**). Neath Port Talbot County Borough Council replied with the following statement:

> *"The scoping report identifies that all properties located within a 130 degree segment either side of due north, relative to the turbines and within ten rotor diameters of a turbine (as per the guidance) will be*

identified and assessed for shadow flicker. Properties outside this area will not be affected by shadow flicker and therefore not included in the assessment. The proposed rotor diameters for the development are 90m in diameter, and therefore a 900m study area will be used. The local Authority agree with the scope of assessments to be included within the EIA".

Table 15.3 provides a summary of the issues that have been raised by consultees and the responses given.

Table 15.3 Summary of issues raised regarding shadow flicker during consultation

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref
Agree with scope and methodology of proposed shadow flicker assessment in Scoping report	Neath Port Talbot County Borough Council	Assessment undertaken as outlined in the Scoping report	15.10

15.7 Scope of the assessment

The approach to shadow flicker assessment as set out in Section 15.4 was outlined in the Scoping Report. It was stated that following determination of the final turbine layout for the proposed development, an assessment would be carried out if potential shadow flicker receptors were identified.

Spatial scope

The spatial scope of the assessment of shadow flicker assessment covers the area of the site contained within the application boundary, together with the Zones of Influence that has formed the basis of the study area described in Section 15.5.

Temporal scope

Shadow flicker is an operational effect of the wind farm and is not present during construction or decommissioning. Therefore, the temporal scope of the assessment of shadow flicker is consistent with the period over which the development would be carried out and therefore covers the operational period of the wind farm.

Potential receptors

There are 33 properties within the study area (935m) and 130º either side of north relative to the turbines, as noted in **Table 15.3.** The locations of the receptors are shown on **Figure 15.1,** with the majority located to the north of the site in the settlements of Cynonville and Duffryn along the A4107. Details of the assessed windows are found in **Appendix 15A.**

Table 15.3 Shadow Flicker Receptors within Study Area

ID	House Name/address	Distance to nearest turbine (m)	Easting	Northing
1	Hendre-owen	876	283608	195571
2	50 Afan Road	907	283263	195572
3	51 Afan Road	882	283228	195535
4	Afan Lodge Hotel	918	283187	195559
5	52 Afan Road	854	283219	195502
6	53 Afan Road	814	283164	195436
7	Nant-yr-hwyaid Farm	508	282736	195082
8	Hafodwen	647	282603	195182
9	Ty'n-y-pant Farm	572	282501	195031
10	1 – 2 Percy Road	709	282494	195195
11	3 – 4 Percy Road	704	282510	195198
12	5 – 6 Percy Road	699	282529	195203
13	7 – 8 Percy Road	693	282548	195207
14	9 -10 Percy Road	690	282565	195212
15	11 – 12 Percy Road	686	282582	195215
16	13 – 14 Percy Road	681	282600	195218
17	15 – 16 Percy Road	688	282620	195234
18	17 – 18 Percy Road	682	282639	195234
19	19 – 20 Percy Road	677	282661	195236
20	21 – 22 Percy Road	673	282680	195238
21	1 – 2 Pentwyn Road	721	282588	195256
22	3 – 4 Pentwyn Road	724	282569	195251
23	5 – 6 Pentwyn Road	729	282553	195249
24	7 – 8 Pentwyn Road	734	282535	195246
25	9 – 10 Pentwyn Road	738	282517	195241
26	11 – 12 Pentwyn Road	743	282499	195237
27	13 – 14 Pentwyn Road	747	282482	195232
28	Travancore	748	282631	195301
29	Tycanol	688	282313	194999

ID	House Name/address	Distance to nearest turbine (m)	Easting	Northing
30	Tonnau Dafydd	896	285031	193593
31	Green View/Glan yr Afron	759	282597	195301
32	Timberhops	795	282433	195258
33	Bryn Argoed	766	282400	195199

Potentially significant effects

Shadow flicker is a potential operational effect of the proposed development (with no effects during construction or decommissioning).

Photo Sensitive Epilepsy

Research has been carried out to determine whether shadow flicker from wind turbines can cause seizures in photo-sensitive epilepsy sufferers (e.g. Harding G, Harding P, and Wilkins A, [2008]: Wind turbine, flicker, and photosensitive epilepsy: Characterizing the flashing that may precipitate seizures and optimizing guidelines to prevent them. Epilepsia, 49[6]). Sufferers are usually sensitive to flickering light at frequencies from 3Hz–60Hz. For a typical 3-blade, 45m rotor diameter wind turbine the maximum rotational speed will be less than 20 revolutions per minute so the blade passing frequency is 60rpm, or 1Hz; this is well below the 3Hz–60Hz sensitivity range.

The proposed turbines will operate at varying speeds, up to 15 RPM. As the turbine rotors will have three blades, each blade will pass a particular point no more than 45 times a minute, which equates to a maximum frequency of 0.75 Hertz. This is much lower than the 3-30 Hertz frequency range generally thought to risk triggering photo-sensitive epilepsy. It is also noted in the DECC Report (2011) that "*on health effects and nuisance of the shadow flicker effect, it is considered that the frequency of the flickering caused by the wind turbine rotation is such that it should not cause a significant risk to health*".

Therefore photo-sensitive epilepsy is not considered further in this assessment.

15.8 Environmental measures embedded into the proposed development

There are no UK guidelines which quantify what exposure levels to shadow flicker would be acceptable. Therefore, where particular combinations of circumstances arise that have the potential for nuisance (particularly where rooms affected are in regular occupancy and the effect proves to be a frequent occurrence in reality), measures may be required to reduce the level of exposure to acceptable levels.

If shadow flicker effects occur in practice at a particular occupied building, it does not immediately follow that additional mitigation is required. Such effects would need to occur in a room that was occupied at the times of occurrence and for a duration that caused a nuisance. For example, if an effect was predicted to occur for a three-week period in the early hours of the morning in a room unlikely to be occupied at that time, with each occurrence lasting just a few minutes, then it is unlikely that mitigation measures would be needed.

However, until the turbine locations and technical parameters are precisely defined (following micro-siting and turbine selection through competitive tender activities), and the wind turbines are operating, neither the requirement for, nor the exact details of mitigation can be finalised.

The developer is committed to installing a shadow flicker impact control module prior to operation to turbines which have the potential to cause shadow flicker on nearby properties. Therefore if, following a complaint and appropriate investigation, shadow flicker is confirmed to result in a loss of residential amenity at any location, the technical mitigation measures built into these turbines would be activated. This covers all properties that could experience shadow flicker.

The shadow flicker control module consists of bespoke software, a clock, a timer, a switch, a wind direction sensor and a light sensor. The module can control a specific turbine (or turbines) which would be programmed to shut down on specific dates at specific times when the sun is bright enough, there is sufficient wind to rotate the blades and the wind direction is such that nuisance shadow flicker could occur. There is no specific UK guidance regarding what level of light is sufficient to cause a shadow flicker event. However, the actual light level that would trigger a turbine shut down can be manually configured onsite, following installation, to reflect local conditions.

A planning condition would provide for an appropriate form of mitigation to ensure that any complaints would be investigated within a reasonable timescale and that the rectification of any shadow flicker problem that is substantiated would be implemented promptly and effectively. As noted previously, the DECC guidance (2011) states that *"Mitigation measures which have been employed to operational wind farms such as turbine shut down strategies, have proved very successful, to the extent that shadow flicker cannot be considered to be a major issue in the UK"*.

Table 15.4 describes the environmental measures embedded within the proposed development and how these embedded measures will influence the Shadow Flicker assessment.

Table 15.4 Summary of the embedded environmental measures and how these influence the Shadow Flicker assessment

Receptor	Potential changes and effects	Embedded measures and influence on assessment
Residential and/or occupied buildings within the study area	Experiencing shadow flicker effects	Implementation of a shadow flicker control module will reduce effects to an acceptable level

15.9 Assessment methodology

The assessment approach recommended within both national and local planning guidance is for the assessment of shadow flicker effects to be carried out at properties within 130 degrees either side of north and 10 rotor diameter distance from the nearest property. A study area of 935m from each turbine has therefore been adopted for the shadow flicker assessment in order to include land within 10 times the maximum rotor diameter (based on a 90m rotor diameter in line with the worst-case access study scenario) plus a 35m micro-siting allowance.

Methodology for prediction of effects

The generic project-wide approach to the assessment methodology is set out in **Chapter 2**. However, whilst this approach has informed the approach that has been used in this shadow flicker assessment, it is necessary to set out how this methodology has been applied, and adapted as appropriate, to address the specific needs of this shadow flicker assessment.

Significance evaluation methodology

The EIA Regulations require that a final judgement is made about whether or not each effect is likely to be significant. In this assessment, effects are considered to be significant or not significant according to the matrix in **Table 15.5.**

Whilst the time and duration of shadow flicker events can be predicted accurately, the level of the effect is difficult to quantify as this would depend on the location of windows within a property, the use of the rooms affected, the level of shading surrounding the property and how susceptible the receptor is to light flicker.

As confirmed by the DECC study (2011), there is no standard UK or Welsh guidance relating to a limit for shadow flicker. The only guidance providing additional recommendations is the aforementioned Northern Irish PPS 18 (2009) guidance which recommends that for properties within 500m of the turbines, shadow flicker should not exceed 30 hours per year or 30 minutes per day.

For the purpose of this assessment, once the effect of theoretical shadow flicker has been modelled, the approach to establishing the magnitude of change is based on professional judgement.

Significance is typically defined as a function of the sensitivity of a receptor with the magnitude of change. In this case the sensitivity of the receptor (an occupied building) is considered to be high and as such significance will be defined largely as a function of the magnitude of change. A methodology for the establishment of the magnitude of change has therefore been derived based on professional experience and is presented in **Table 15.5.** This is based on the distance of the property from the turbine location along with the number of predicted hours of shadow flicker effect.

Table 15.5 Scoring Methodology for Magnitude of Change

Magnitude of Change	Distance from Turbine	And/ Or	Predicted Shadow Flicker Effect Duration
High	<500m		>30 minutes a day or >30 hours per year.
Medium	500 – 700m		>30 minutes a day or >30 hours per year.
Low	700m – 935m		<30 minutes a day or <30 hours per year.
No Change	>935m		No shadow flicker effect predicted.

The EIA Regulations require that a final judgement is made about whether or not each effect is likely to be significant. In this assessment, effects are considered to be significant or not significant according to the matrix in **Table 15.6**. Effects are rated as being either major or moderate (significant) where the magnitude of change is high or medium, or minor or negligible (not significant) where magnitude of change is low, or no change.

Table 15.6 Matrix of EIA Significance

	Magnitude of change			
Sensitivity	**High**	**Medium**	**Low**	**No change**
High	Major (Significant)	Moderate (Significant)	Minor (Not Significant)	Negligible (Not significant)

Factors limiting the occurrence of shadow flicker

There are several additional factors that can influence the amount of shadow flicker actually experienced and these cannot be readily included in a computer-based assessment.

Climatic conditions dictate that the sun is not always shining. The closest Met Office location providing long term climate summaries is Mumbles Head, located some 20km from the development site. However, this station does not record sunshine hours and so St Athan Met Station, located some 30km from the site has been used instead.

Historic Met Office data (over the period 1981–2010) gives actual sunshine hours for the St Athan Met Station to be 38% of total daylight hours[70]. Cloud cover during other times may obscure the sun and prevent shadow flicker occurrence. While some shadows may be cast under slightly overcast conditions, no shadow at all would be cast when heavy cloud cover prevails. During calm periods, or very high winds, the wind turbine blades would not rotate and shadow flicker would not occur. Turbines would also be periodically shut-down for maintenance or repair work.

Wind turbines automatically orientate themselves to face the prevailing wind direction. This means that the turbine rotors would not always face directly towards the occupied buildings. Under some wind conditions, the proposed turbines would face 'side-on' to properties, and in these conditions only a very small area of blade movement would be visible.

15.10 Assessment of Shadow Flicker effects

Baseline conditions

Baseline conditions are discussed in section 15.5.

Predicted effects: operation

Figure 15.2 shows a contour map representing the annual number of hours of potential shadow flicker effects on the occupied buildings included in the assessment.

Table 15.7 below shows the number of days per year that each occupied building could be affected by shadow flicker. It also shows the maximum number of hours per day, the mean number of hours per day and the total number of hours per year that shadow flicker could occur. The likely number of hours per year when shadow flicker could occur has been calculated using Met Office records of the number of annual sunshine hours per year at St Athan. Individual results for each receptor are provided in **Appendix 15B.**

Table 15.7 Shadow Flicker Model Results

ID	Days/Year	Turbine(s) causing shadow flicker	Distance to nearest turbine (m)	Mean no. of minutes/day	Theoretical max hours/ year	Likely hours/ year[1]
1	51	11	876	24.6	20.9	7.9
2	78	11	907	24	31.5	12.0
3	67	11	882	21	23.7	9.0
4	63	11	918	22.2	23.3	8.9

[70] http://www.metoffice.gov.uk/public/weather/climate/st-athan-vale-of-glamorgan#?tab=climateTables
Average sunshine hours of 1673 / Total number of daylight hours 4380 = 38% (last accessed 21/09/2018)

ID	Days/Year	Turbine(s) causing shadow flicker	Distance to nearest turbine (m)	Mean no. of minutes/day	Theoretical max hours/ year	Likely hours/ year[1]
5	58	11	854	22.8	21.9	8.3
6	107	6, 11	814	25.2	45.0	17.1
7	123	5, 6, 11	508	34.2	69.9	26.6
8	54	6	647	29.4	26.5	10.1
9	78	5, 6	572	28.8	37.6	14.3
10	44	6	709	27	20.0	7.6
11	48	6	704	27	21.6	8.2
12	50	6	699	26.4	22.2	8.4
13	50	6	693	27	22.7	8.6
14	52	6	690	27	23.4	8.9
15	53	6	686	27	23.6	9.0
16	54	6	681	28.2	25.2	9.6
17	56	6	688	27.6	25.8	9.8
18	57	6	682	27.6	26.0	9.9
19	58	6	677	28.2	27.0	10.3
20	59	6	673	27.6	27.4	10.4
21	52	6	721	27	23.2	8.8
22	51	6	724	26.4	22.3	8.5
23	51	6	729	25.2	21.3	8.1
24	48	6	734	25.8	20.7	7.9
25	48	6	738	25.2	20.1	7.6
26	46	6	743	25.8	19.9	7.6
27	45	6	747	25.2	19.1	7.3
28	54	6	748	25.8	23.3	8.9
29	43	6	688	25.8	18.3	7.0
30	0	-	896	0	0.0	0.0
31	52	6	759	23.4	20.5	7.8
32	44	6	795	23.4	17.2	6.5
33	41	6	766	24.6	16.7	6.3

[1] Based on average sunshine hours at the site, 38% of daylight hours.

The approach taken to the modelling assessment is theoretical and based on the worst-case scenario in that it assumes each property is occupied, that there are windows or doors facing the wind turbines, that there are no intervening obstructions, that the sun shines throughout daylight hours, that the wind blows constantly within the operating parameters of the wind turbines and that the rotor is always orientated towards the receptor.

The results show that turbines 5, 6 and 11 have the potential to cause shadow flicker effects. The assessment shows that the remaining turbines of the proposed development do not have the potential to cause any shadow flicker within the study area. However, they have been included in the model for completeness.

Examination of the detailed results of the model found in **Appendix 15B** shows that receptor 30 would not experience any shadow flicker as a result of the development. The remaining 32 receptors could experience between 16.7 and 69.9 hours of shadow flicker per year, based on the worst-case model.

If average annual sunshine hours are applied to the model, then all currently occupied buildings are likely to experience shadow flicker for no more than 26.6 hours per annum.

Due to the number of properties in the study area, a selection of properties has been chosen to illustrate the potential effects of shadow flicker. As many of the properties are grouped close together and experience similar levels of potential effect, a sample property has been chosen from each group. The representative property has the highest predicted levels of effect within the group. The groupings are shown below in **Table 15.8.**

Table 15.8 Shadow Flicker Model Results

Grouping	Description of Group	Properties included (ID)	Representative property ID
1	Hendre-owen Farm	1	1
2	Properties in Duffryn on Afan Road	2 - 6	6
3	Nany-yr-hwyaid farm	7	7
4	Ty'n-y-pant Farm	9	9
5	Properties on southern edge of Cynonville	8, 10 – 27	20
6	Properties on northern side of Cynonville	28, 32 - 33	28
7	Tycanol	29	29
8	Properties to east of site	30, 31	30

Receptor group 1

The model shows that receptor 1 could experience shadow flicker effects from turbine 11 for an average duration of 24.6 minutes from late November until mid-January between the hours of 11.56 and 12.24.

In total the property could experience up to 20.9 hours per year of potential shadow flicker. Based on the significance criteria presented in Section 15.9, the effect on this property would be low and therefore not significant according to **Table 15.6**.

Receptor group 2

The model shows that receptor 6 could experience shadow flicker effects from turbine 6 for an average duration of 25.2 minutes from mid-November until late-January between the hours of 12.35 and 13.25.

The model shows that receptor 6 could also experience shadow flicker effects from turbine 11 for an average duration of 24 minutes from late January until mid-February between the hours of 09.57 and 10.29, and in November between 09.27 and 09.59.

In total the property could experience up to 45 hours per year of potential shadow flicker. Based on the significance criteria presented in Section 15.9, the effect on this property would be medium and therefore significant according to **Table 15.6**. However, as stated in section 15.8, the developer is committed to installing a shadow flicker control module where required. This module can control a specific turbine (or turbines) which would be programmed to shut down on specific dates at specific times when the sun is bright enough, there is sufficient wind to rotate the blades and the wind direction is such that nuisance shadow flicker could occur. The effects are therefore concluded as not significant.

Receptor group 3

The model shows that receptor 7 could experience shadow flicker effects from turbine 5 for an average duration of 22.8 minutes from mid-January until early-February between the hours of 09.56 and 10.26, and in November between 09.28 and 09.58.

The model shows that receptor 7 could also experience shadow flicker effects from turbine 6 for an average duration of 34.8 minutes from late January until mid-February between the hours of 10.37 and 11.21, and between late-October and mid-November between 10.06 and 09.59.

The model shows that receptor 7 could also experience shadow flicker effects from turbine 11 for an average duration of 22.2 minutes in March between the hours of 07.36 and 08.04 and between late September and early October between 07.18 and 07.46.

In total the property could experience up to 69.9 hours per year of potential shadow flicker. Based on the significance criteria presented in Section 15.9, the effect on this property would be medium and therefore significant according to **Table 15.6**. However, as stated in section 15.8, the developer is committed to installing a shadow flicker control module where required. This module can control a specific turbine (or turbines) which would be programmed to shut down on specific dates at specific times when the sun is bright enough, there is sufficient wind to rotate the blades and the wind direction is such that nuisance shadow flicker could occur. The effects are therefore concluded as not significant.

Receptor group 4

The model shows that receptor 9 could experience shadow flicker effects from turbine 5 for an average duration of 22.8 minutes from late-January until mid-February between the hours of 09.02 and 09.28, and between late-October and mid-November between 08.32 and 08.55.

The model shows that receptor 9 could also experience shadow flicker effects from turbine 6 for an average duration of 34.8 minutes from mid-February to mid-March between the hours of 09.06 and 09.45, and in October between 08.39 and 09.17.

In total the property could experience up to 37.6 hours per year of potential shadow flicker. Based on the significance criteria presented in Section 15.9, the effect on this property would be medium and therefore significant according to **Table 15.6** However, as stated in section 15.8, the developer is committed to installing a shadow flicker control module where required. This module can control a specific turbine (or turbines) which would be programmed to shut down on specific dates at specific times when the sun is bright enough, there is sufficient wind to rotate the blades and the wind direction is such that nuisance shadow flicker could occur. The effects are therefore concluded as not significant.

Receptor group 5

The model shows that receptor 20 could experience shadow flicker effects from turbine 6 for an average duration of 27.6 minutes from mid-January and mid-February between the hours of 10.32 and 11.08, and between late-October and late November between 10.03 and 10.38.

In total the property could experience up to 27.4 hours per year of potential shadow flicker. Based on the significance criteria presented in Section 15.9, the effect on this property would be low and therefore not significant according to **Table 15.6**.

Receptor group 6

The model shows that receptor 28 could experience shadow flicker effects from turbine 6 for an average duration of 25.8 minutes from mid-January and mid-February between the hours of 10.24 and 10.56, and between late-October and late November between 09.54 and 10.27.

In total the property could experience up to 23.3 hours per year of potential shadow flicker. Based on the significance criteria presented in Section 15.9, the effect on this property would be low and therefore not significant according to **Table 15.6**.

Receptor group 7

The model shows that receptor 29 could also experience shadow flicker effects from turbine 6 for an average duration of 25.8 minutes from late February to mid-March between the hours of 08.15 and 08.49, and between late-September and mid-October between 07.52 and 08.26.

In total the property could experience up to 18.3 hours per year of potential shadow flicker. Based on the significance criteria presented in Section 15.9, the effect on this property would be low and therefore not significant according to **Table 15.6**.

Receptor group 8

The model shows that receptor 30 would not experience any shadow flicker effects from the turbines.

Predicted effects and their significance

A summary of the results of the assessment of shadow flicker is provided in **Table 15.9.**

Table 15.9 Summary of significance of adverse effects

Receptor and summary of predicted effects	Sensitivity of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
Shadow flicker effects on residential property: 14 occupied buildings	High	Medium	Moderate (Not significant)	Although, according to **Table 15.6**, moderate effects are deemed significant, any shadow flicker effects would be investigated and fully mitigated through a shadow flicker control module in turbines. No significant effects would therefore arise.
Shadow flicker effects on residential property: 18 occupied buildings	High	Low	Minor (Not significant)	Modelling has shown that significant effects are considered unlikely. Any shadow flicker effects would be fully mitigated through a shadow flicker control module in turbines.

The sensitivity of a receptor is defined using the criteria set out in section 15.9 above and is defined as high
The magnitude of change on a receptor resulting from activities relating to the development is defined using the criteria set out in section 15.9 above and is defined as no change, low, medium and high
The significance of the environmental effects is based on the combination of the sensitivity/importance/value of a receptor and the magnitude of change and is expressed as major (significant), moderate (significant) or minor/negligible (not significant), subject to the evaluation methodology outlined in section 15.9.

15.11 Assessment of cumulative effects

No cumulative effects are expected as a result of the proposed development, as there are no other operational wind farms nearby which have the potential to cause cumulative effects in combination with the proposed development.

15.12 Consideration of additional mitigation or compensation

No additional mitigation measures are proposed to further reduce the shadow flicker effects that are identified in this ES. This is because all relevant and implementable measures have been embedded into the development proposals and are assessed above in this chapter. These measures are considered to be likely to be effective and deliverable and address the likely significant effects of the Foel Trawsnant amended scheme.

15.13 Conclusions of significance evaluation

The assessment has identified the potential for significant shadow flicker effects at 14 occupied buildings, and non-significant effects at 18 occupied buildings. Mitigation has been identified in the form of a control system which automatically shuts down the wind turbine causing the effect to restrict effects to less than 30 minutes per day and/or 30 hours per year at any property.

With this measure in place no shadow flicker significant effects would arise from the proposed development.

A programme of monitoring would ensure the effectiveness of the proposed mitigation and allow for it to be adapted, e.g. to cater for turbine micrositing issues.

15.14 Implementation of environmental measures

Table 15.10 describes the environmental measures embedded within the proposed development and the means by which they will be implemented.

Table 15.10 Summary of environmental measures relevant to Shadow Flicker to be implemented

Environmental measure	Responsibility for implementation	Compliance mechanism	ES Section Reference
Shadow Flicker Control Module	Developer	Planning Condition	15.8

15.15 References

Department of Energy and Climate Change. 2011. Update of UK Shadow Flicker Evidence Base. [Online]. Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48052/1416-update-uk-shadow-flicker-evidence-base.pdf [Accessed 25/09/2018].

Harding G, Harding P, and Wilkins A. 2008. Wind turbine, flicker, and photosensitive epilepsy: Characterizing the flashing that may precipitate seizures and optimizing guidelines to prevent them. Epilepsia, 49(6).

Met Office. 2018. St Athan Climate. [Online]. Available at: https://www.metoffice.gov.uk/public/weather/climate/gcjs3tzpf [accessed 25/09/2018].

National Policy Statement for Renewable Energy Infrastructure (EN-3) (July 2011). Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47856/1940-nps-renewable-energy-en3.pdf [accessed 25/09/2018].

Neath Port Talbot County Borough Council Local Development Plan 2011 - 2026. Available at https://www.npt.gov.uk/7328 [accessed 25/09/2018].

Neath Port Talbot County Borough Council Renewable and Low Carbon Energy Supplementary Planning Guidance (July 2017). Available at https://www.npt.gov.uk/media/7241/spg_renewable_energy_july17.pdf [accessed 25/09/2018].

Northern Ireland Government 2009. Draft Northern Irish planning guidance PPS 18: Renewable Energy, Annex 1, 2009. Available at https://www.planningni.gov.uk/index/policy/planning_statements/planning_policy_statement_18_renewable_energy-2.htm [accessed 25/09/2018].

PREDAC. 2004. European Actions for Renewable Energies, Spatial Planning of Wind Turbines.

Welsh Assembly Government, *Technical Advice Note 8: Planning for Renewable Energy, 2005. Available at https://gov.wales/topics/planning/policy/tans/tan8/?lang=en [accessed 25/09/2018].*

16 Aviation and Telecommunications

16.1 Introduction

Aviation radar, microwave and other electromagnetic signals are transmitted throughout the country by a wide range of operators, including statutory agencies and commercial companies. There is potential for interference to affect the transmission of these signals from any large structure, including wind turbines. To understand the potential of the Foel Trawsnant Wind Farm amended scheme ('the proposed development') to affect radar, microwave and other radio operations in the area, consultation has been undertaken with authorities and companies working in this field in Wales.

This chapter provides a summary of the organisations that have been consulted and their responses. This is an update to the assessment presented in the 2014 ES (ref 24311rr073i), which examined the potential effects relating to shadow flicker in the defined study area of 10 rotor diameters plus 50m micrositing.

This assessment has therefore been updated taking into consideration the updated turbine dimensions, in line with the methodology outlined in the Scoping Report (Amec Foster Wheeler[71], 2018).

16.2 Limitations of this assessment

There are no limitations relating to Aviation and Telecommunications that affect the robustness of the assessment of the potential likely significant effects of the proposed development.

16.3 Policy and legislative context

Planning policy

Aviation

Table 16.1 lists the issues from the relevant planning policies that have been considered in assessing Aviation effects.

Table 16.1 Policy issues considered in preparing the Aviation assessment

Policy reference	Policy Issues	Considered in Section
National Policy		
National Policy Statement EN-1	This advises at 5.4.11 that the applicant's assessment should consult the MoD, CAA, NATS and any aerodrome – licensed or otherwise – likely to be affected by the proposed development in preparing an assessment of the proposal on aviation or other defence interests.	16.6
Technical Advice Note (TAN) 8: Planning for Renewable Energy (2005)	Paragraph 2.35 states: *"Developments within a specified radius of major airports and aerodromes are subject to mandatory consultation with the Civil Aviation Authority (CAA) and/or the Ministry of Defence (MoD) under the Town and Country Planning (Aerodromes and Technical Sites) Directive 1992. The CAA will inform the applicant of any civilian airfields that are*	16.6

[71] Now Wood

Policy reference	Policy Issues	Considered in Section
	likely to be affected, but it is the responsibility of the applicant/ planning authority to consult the airfield management at the airfield in question." Paragraph 2.36 states: *"Lights are only required on structures that are over 150 m high."* Paragraph 2.38 states: *"Any large structure is liable to show up on radar, but wind turbines can present a particular problem as they can be interpreted by radar as a moving object, which is only intermittently seen (as the nacelle rotates to face the wind). There is a consultation zone and an advisory zone around every civilian and military air traffic radar, but objections may sometimes be raised in respect of developments further afield. Consultations are also required in respect of other defence and meteorological radar. Developers will need to closely consult over aviation and other radar issues and the British Wind Energy Association web site gives details of how this can be achieved. Local planning authorities should be aware of the statutory consultees applicable to their particular area."* Paragraph 2.39 gives a list of aviation (amongst other) consultees in addition to statutory consultees. The aviation consultees referred to are: The Civil Aviation Authority (CAA), the Ministry of Defence (MoD), and National Air Traffic Services (NATS).	
CAP 168 – Licensing of Aerodromes	Chapter 4 – The Assessment and Treatment of Obstacles, Paragraph 1.1, states: "*The effective utilisation of an aerodrome may be considerably influenced by natural features and man-made constructions inside and outside its boundary. These may result in limitations on the distance available for take-off and landing and on the range of meteorological conditions in which take-off and landing can be undertaken. For these reasons certain areas of the local airspace must be regarded as integral parts of the aerodrome environment. The degree of freedom from obstacles in these areas is as important to the granting and retention of an aerodrome license as the more obvious physical requirements of the runways and their associated runways strips*".	16.6
CAP 670 – Air Traffic Services Safety Requirements	Part B, Section 4, GEN 01, sub-section 3: "*Windfarms need to be considered as a safeguarding activity. The ATS [Air Traffic Service] Provider is responsible for ensuring, as far as is reasonably practicable, that such development does not impact on the safety of the ATS environment.* *The ATS Provider is responsible for deciding whether or not it can accept any degradation to the ATS environment. If the ATS Provider predicts that the degradation is unacceptable then it should make representations to the appropriate local Authority.* *The CAA does not have the power to veto Windfarm development (other than on the land actually owned by the CAA).* *The ATS provider is responsible for mitigating against any deterioration to the Air Traffic Services caused by wind farms*".	16.6
CAP 738 – Safeguarding of Aerodromes	Chapter 1 – Safeguarding of Aerodromes, Paragraph 1.1, states: "*A process of consultation between a Local Planning Authority (LPA) and consultees, which is made obligatory by Statutory Direction, safeguards some aerodromes and aeronautical technical sites in the United Kingdom. This is called 'statutory' or 'official' safeguarding*".	16.6
CAP 764 – CAA Policy and Guidelines on Wind Turbines	Chapter 3 – Safeguarding Considerations, Paragraph 1a, states: "*Developers will be referred to the aerodrome licensee of aerodromes with a surveillance radar facility within 30km of the proposed wind turbine development or to the distance specified by the aerodrome or indicated on the aerodromes published wind turbine consultation map*".	16.6
Planning Circular 2/2003 Safeguarding of Aerodromes, Technical Sites and Military Explosive Storage Areas	Planning Circular 2/2003 sets out criteria outlining how planning authorities must consult with aviation Consultees and which processes they must follow in order to ensure that Consultee responses to proposals are taken into account. Where planning authorities are minded to award planning permission against the advice of NATS, the CAA (Civil Aviation Authority) or the MOD, they are obliged to inform Welsh Ministers.	16.6

Policy reference	Policy Issues	Considered in Section
Local Policy		
Neath Port Talbot County Borough Council Local Development Plan 2011 - 2026 Policy RE1 Criteria for the Assessment of Renewable and Low Carbon Energy Development	With respect to Aviation, this policy states: (d) The development should not interfere with radar, air traffic control systems, telecommunications links, television reception, radio communication and emergency services communications.	16.6

Telecommunications

Table 16.2 lists the issues from the relevant planning policies that have been considered with regards to Telecommunication effects.

Table 16.2 Policy issues considered in preparing the Telecommunications assessment

Policy reference	Implications	Considered in Section
National Policy		
National Policy Statements Technical Advice Note 8: Planning for Renewable Energy (TAN8). Paras 2.29-2.30	The potential for effects upon telecommunications or causes of electromagnetic interference are not referred to in NPS EN-1 and EN-3. *"A wind turbine can interfere with electromagnetic transmissions in two ways – by emitting an electromagnetic signal itself, and by interfering with other electromagnetic signals.* *Provided careful attention is paid to siting, wind turbines should not cause any significant problems of electromagnetic interference, i.e. adverse effects on communication systems which use electromagnetic waves as the transmission medium (e.g. television, radio or microwave links). Specialist organisations responsible for the operation of the electromagnetic links typically require a 100m clearance either side of a line of sight link from the swept area of turbine blades."* The document goes on to recommend a list of possible consultees referring to the Office of Communications (OFCOM) which holds a central register of all civil radio communication operators in the UK and acts as a central point of contact for identifying specific consultees relevant to a site. It does recognise that this list is not exhaustive and that it may be necessary to consult local utility companies and emergency services along with any other organisations which may be deemed relevant.	16.6
Practice Guidance – Planning Implications of Renewable and Low Carbon Energy. Welsh Assembly Government (2011). Para 3.4.24-3.4.26	The assessment will take due cognisance of the following paragraphs from the guidance document: *"Wind turbines, including micro turbines, can also interfere with telecommunications (i.e. TV, radio and phone signals) by blocking or deflecting those requiring line of sight or by the scattering of transmission signals. Links crossing the site of wind farms should be identified by consultation with Ofcom. Ofcom will check whether any part of a wind turbine site, either individual turbines or part of a wind farm, falls within 0.5 – 1.0km (depending on the signal frequency) of the path of a fixed link, and if so, will instruct the developer to contact the appropriate fixed link operator. Developers may also wish to contact interested bodies directly, including local utility companies and emergency services.* *Scattering of signals mainly affects domestic TV (both analogue and to a lesser extent digital TV) and radio broadcasts. Wind turbines can affect domestic television reception up to 5km from the turbines. Terrestrial television*	16.6

Policy reference	Implications	Considered in Section
	transmissions for domestic reception within the UK are the joint responsibility of the BBC and Ofcom. *Where fixed link signals are potentially blocked by proposed wind turbines, a detailed investigation of the likely impact should be sought from a competent supplier. It is often possible to mitigate impacts by careful siting of individual turbines within a site so that turbine blades avoid a buffer zone, typically 100m either side of the signal path. Failing this, it may be necessary for the developer to pay for a signal to be re-routed around the wind turbine(s). Where site investigations reveal a likely impact on domestic radio or TV reception, various solutions are possible including upgrading of domestic aerials or delivery of the signal by other means, for example by cable."*	
Local Policy		
Neath Port Talbot County Borough Council Local Development Plan 2011 -2026 Renewable and Low Carbon Energy Supplementary Planning Guidance (July 2017)	Matters that will need to be taken into consideration in relation to all types of renewable / low carbon energy include visual amenity, cultural and residential impacts on local communities, effects on the natural environment, highway safety implications, effects on communications, and site restoration. Particular attention will need to be given to potential impacts on the landscape, townscape or seascape, nature conservation, wildlife interests, areas of historical and cultural importance and the potential for pollution, noise, dust, vibration, reflected light and shadow flicker.	16.6

Legislative context

Legislation and Guidance relevant to the assessment of aviation in Wales include:

- Protecting Aviation Interests (Annex C: Description of Renewable Energy Technologies, Section 2: Wind), is covered within paragraph 2.35-2.38 of TAN 8 Annex C;
- CAP 168 – Licensing of Aerodromes;
- CAP 670 – Air Traffic Services Safety Requirements;
- CAP 738 – Safeguarding of Aerodromes;
- CAP 764 – CAA Policy and Guidelines on Wind Turbines; and
- Planning Circular 2/2003 Safeguarding of Aerodromes, Technical Sites and Military Explosive Storage Areas.

16.4 Data gathering methodology

A desk-based consultation exercise was undertaken to identify any telecommunications or aviation interests that may be affected by the proposed development. The results of the exercise are found in **Table 16.3** in Section 16.6.

16.5 Overall baseline

Current baseline

A number of microwave links were identified in the wider area in the 2014 ES, including a link operated by JRC that runs across the middle of the site. The links are shown on **Figure 16.1.**

Predicted future baseline

On the basis of the information currently available, no changes to the baseline conditions are anticipated in the event that the proposed development does not proceed.

16.6 Consultation

To establish the location and nature of microwave, broadcast, radio links and radar in the vicinity of the Site, the bodies and operators referred to in **Table 16.1** have been consulted about the proposal. These consultations, as well as those undertaken in relation to the 2014 ES, are summarised in **Table 16.3**.

Table 16.3 Summary of issues raised during consultation

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref
Telecommunications	BT	No Objection – 2015; one link identified 1.7km to east of site. Not identified as potentially affected by Ofcom 2018 and so not reconsulted.	16.7
	JRC	2014 ES: Initial Objection. 1 x Scanning telemetry and 1 x fixed link [Surf Telecom]) run through site. Coordination study was commissioned to examine options. Turbines 6, 12 and 13 relocated to mitigate interference to the fixed link. 2018 ES: Initial Objection. 1 x Scanning telemetry and 1 x fixed link operated by JRC run through site. Coordination study was subsequently commissioned to examine options. Ongoing negotiations with JRC and the equipment owner to identify and cost technological solution with the overall aim for the purposes of the ES to agree a planning condition that will satisfy all parties.	16.7
	MLL Telecom	2014 - Link identified ~2km from site. 2018 – Not consulted as not identified by Ofcom.	16.7
	O2	2014 - No objection. 2018 – Not consulted as not identified by Ofcom.	16.7
	Ofcom	2014 - Three fixed microwave links identified; Surf Telecom, EE and BT links found within the search area. 2018 – No fixed links identified.	16.7
	Orange (EE)	2014 - EE responded stating no objection to the proposed development. 2018 – Not consulted as not identified by Ofcom.	16.7
	Telefonica	2014 - No objection. 2018 – Not consulted as not identified by Ofcom.	16.7
	Vodafone	2014 - No links within 2km - no objection.	16.7

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref
		2018 – Not consulted as not identified by Ofcom.	
Radar and Aviation Safeguarding	Ministry of Defence (MoD) (MOD queries are handled by the Defence Infrastructure Organisation (DIO)	2014 – No Objection to Proposal. 2018 - The MOD responded stating that they had no objections to the proposed development at this time.	16.7
	Civil Aviation Authority (CAA)	2010 and 2012 - No objection. 2018 – No response.	16.7
	NATS En Route Plc ("NERL")	2014 - NATS on-line assessment tool was consulted; the proposed wind farm is not in an area where it will affect NERL infrastructure. No objection. 2018 - A follow-up exercise was undertaken for which a layout of 11 x 145m tall turbines was assessed using the online assessment maps which show that the proposed development is in an area that is not visible to NERL radar systems.	16.7
	Cardiff Airport	No objection with regard to obstacle safeguarding.	16.7

16.7 Scope of the assessment

The scope of the assessment has been derived from TAN8 and other policy guidance.

16.8 Environmental measures embedded into the proposed development

A range of environmental measures have been embedded into the development proposals as outlined in section 5.4 of this ES. **Table 16.4** outlines how these embedded measures will influence the Aviation and Telecommunications assessment.

Table 16.4 Summary of the embedded environmental measures and how these influence the Aviation and Telecommunications assessment

Receptor	Potential changes and effects	Embedded measures and influence on assessment
Telecommunications	Interference with scanning telemetry link	Options as presented by JRC – details to be finalised but agreed in principle and will mitigate effects on telemetry link by incorporating existing UHF link into fixed microwave link band.
	Interference with fixed microwave link	Limit micrositing for Turbine 5, 6 and 11 to 20m

16.9 Assessment methodology

The basis of the assessment has been to consult with a number of organisations known to have an interest within the areas stated in the scope. The consultation list was drawn together based on advice given in TAN8.

The risk of interference with telecommunications has been assessed through consultation with the relevant organisations. The consultation exercise was initially undertaken in 2013 and 2014 and consultations were repeated following the proposed changes in the scheme layout. The consultation list was drawn together based on identifying the local telecommunication bodies and other relevant parties identified by Spectrum Licensing (Ofcom).

16.10 Assessment of effects

Predicted effects: Operation

Radar and Aviation Safeguarding

No consultee with regards to radar or aviation safeguarding has identified potential for conflict to arise as a result of the proposed development.

The MOD stated that they had no objection, whilst the CAA did not respond.

No further assessment of effects with regards to radar and aviation safeguarding has therefore taken place.

Telecommunication links

If a reduction in television reception quality occurs in the surrounding area, it is most likely to be noticed when the proposed wind farm becomes operational. Should planning permission be granted and to mitigate any problems with reception arising, the developer would assess current television signals in advance of development and mitigate post-development problems to television reception arising where effects are attributable to the proposed wind farm. Consultation suggests adverse effects may not occur and that in the unlikely event that interference does occur, this would be localised. This could be controlled by planning condition that would require the developer to meet the cost of investigating and effectively rectifying any problems should they arise and to implement solutions in a timely manner so as to minimise any inconvenience to residents.

Viewing quality can be improved by considering each or a combination of the following mitigation techniques:

- Replace or upgrade the receiving aerials (e.g. with directional receiving aerials) for affected households;
- Re-tune the television receivers at affected households;
- Re-align the television aerial to an alternative transmitter and re-tune the receiver at affected households; and
- Provision of a bespoke 'self-help' solution (this could comprise a new low powered transmitter, a cable network, a satellite receiver or a combination of these measures).

In the 2018 consultation exercise, Ofcom did not identify any fixed point to point telecommunication links running across the site.

JRC identified a fixed microwave link and a 460Hz scanning telemetry link which cross the site. These links follow the same path and are shown in **Figure 16.1.** No other consultee that manages radio communications infrastructure identified potential for conflict to arise.

JRC are the only infrastructure or aviation consultee to have responded with an objection to the proposed development, due to the impact of the wind turbines on their scanning telemetry infrastructure.

Following the initial objection, a coordination study was commissioned from JRC that sought to identify the precise nature of the objection and identify any potential solutions. The summary of the assessed effects on the JRC operated infrastructure were as follows:

- The proposal does not meet JRC criteria for UHF Telemetry links with respect to six turbines.
- The proposal with 50m micrositing does not meet JRC criteria for 15 GHz class 4H links with respect to three turbines.
- The proposal with a reduced 20m micrositing for Turbine 5, 6 and 11 does meet JRC criteria for 15 GHz class 4H links.
- The proposal with 50m micrositing does meet JRC criteria for 26 GHz class 2 links.

As stated in **Table 16.4** the developer is in discussion with JRC to identify appropriate measures to avoid or reduce effects on the scanning telemetry link. The measures to be incorporated are to be finalised but are agreed in principle. With these measures in place there would be no significant effects on telecommunications assets.

16.11 Assessment of cumulative effects

No cumulative effects are expected as a result of the proposed development, as there are no other operational wind farms nearby which have the potential to cause cumulative effects in combination with the proposed development.

16.12 Consideration of additional mitigation or compensation

No additional mitigation measures are proposed to further reduce the Aviation and Telecommunications effects that are identified in this ES. This is because all relevant and implementable measures have been embedded into the development proposals and are assessed above in this chapter. These measures are considered to be likely to be effective and deliverable and address the likely significant effects of the Foel Trawsnant Wind Farm amended scheme.

16.13 Summary of effects

The degradation of microwave and other electromagnetic signals has been identified as possible as a result of consultation with stakeholders. However, interference is now considered unlikely due to the technical mitigation solutions identified as a result of these consultations. The developer is prepared to resolve any such problems should they arise as a result of construction and operation of the wind farm, and therefore there should be no resulting impact on these signals.

16.14 Implementation of environmental measures

Table 16.5 describes the mitigation measures embedded within the proposed development and the means by which they will be implemented.

Table 16.5 Summary of environmental measures relevant to Telecommunications to be implemented

Environmental measure	Responsibility for implementation	Compliance mechanism	ES Section Reference
Options as presented by JRC – details to be finalised but agreed in principle and will mitigate effects on telemetry link by incorporating existing UHF link into fixed microwave link band.	Developer	Planning condition	Section 16.8
Limit micrositing for Turbine 5, 6 and 11 to 20m	Developer	Planning condition	Section 16.8

16.15 References

CAP 168 – Licensing of Aerodromes, 2014, Civil Aviation Authority.

CAP 670 – Air Traffic Services Safety Requirements, 2014, Civil Aviation Authority.

CAP 738 – Safeguarding of Aerodromes, 2006, Civil Aviation Authority.

CAP 764 – CAA Policy and Guidelines on Wind Turbines, 2016, Civil Aviation Authority.

Department of Energy and Climate Change, Update of UK Shadow Flicker Evidence Base, 2011, http://www.decc.gov.uk/assets/decc/What%20we%20do/UK%20energy%20supply/Energy%20mix/Renewable%20energy/ORED/1416-update-uk-shadow-flicker-evidence-base.pdf

Neath Port Talbot County Borough Council Local Development Plan 2011 -2026

National Planning Policy Framework (March 2012)

National Policy Statement for Renewable Energy Infrastructure (EN-3) (July 2011)

Planning Circular 2/2003 Safeguarding of Aerodromes, Technical Sites and Military Explosive Storage Areas

Welsh Assembly Government, Practice Guidance – Planning Implications of Renewable and Low Carbon Energy (2011).

Welsh Assembly Government, Technical Advice Note 8: Planning for Renewable Energy, 2005.

17 Cumulative effects

17.1 Introduction

This chapter of the ES concerns inter-related cumulative effects and considers whether any of the individual environmental topic effects resulting from the proposed development, which are not significant in their own right, could combine to create effects that are significant. It should be read in conjunction with the development description provided in **Chapter 5**.

Potential inter-project cumulative effects arising from the combination of effects from the proposed development with similar topic-related effects generated by other developments are considered in **Chapters 7-16.**

17.2 Limitations of this assessment

There are no limitations that affect the robustness of the assessment of the potential likely significant effects of the proposed development.

17.3 Policy and legislative context

Planning policy

Planning policy relating to cumulative effects concentrates on potential effects arising from the combination of effects from the proposed development with similar topic-related effects generated by other developments. These policies have been considered within the individual topic chapters (**7-16**).

Legislative context

This assessment of cumulative effects takes into account Paragraph 5 of Schedule 4 of the Town & Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 which states that the "*The description of the likely significant effects on the factors specified in regulation 4(2) should cover the direct effects and any indirect, secondary, **cumulative**[72], transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development.*"

17.4 Data gathering methodology

The individual topic chapters (**7-16**) of this ES were reviewed and common receptors, i.e. those considered within one or more technical chapter, were identified.

17.5 Overall baseline

The baseline for the assessment is as discussed within the individual topic chapters (**7-16**).

[72] Boldened for emphasis

17.6 Consultation

Consultation has been undertaken with the local planning authority with regard to scoping of the environmental assessment.

Table 17.1 provides a summary of the issues that have been raised by consultees and the responses given.

Table 17.1 Summary of cumulative effects consultation

Issue raised	Consultee(s)	Response and how considered in this chapter	Section Ref
Local authority require that consideration is given to the interaction of effects in the ES	Neath Port Talbot County Borough Council	Agreed and considered in this chapter	S17.9

17.7 Scope of the assessment

Potential receptors

The most likely types of receptors where topic effects are likely to combine are those pertaining to the amenity of the relevant human population. For example the occupants of a residential property in close proximity to the proposed development might be subject to adverse effects in terms of noise or shadow flicker, as well as with regard to visual amenity, or any combination thereof, each of which, when assessed individually, may not be significant in EIA terms, but when assessed in combination the combined effects may be judged to be significant.

Human receptors

Fourteen receptor locations have been considered in two or more of the following chapters: **Chapter 7** (Landscape and Visual Impact Assessment [LVIA]); **Chapter 11** (Noise); **Chapter 13** (Traffic and Transport), **Chapter 14** (Socio-economics including Recreation and Tourism) and **Chapter 15** (Shadow Flicker). These have been termed 'common receptors' from hereon.

Other environmental receptors

Consideration has also been given to the potential for cumulative effects on other environmental receptors. A review of the respective ES chapters has been undertaken to identify where one non-human receptor may be affected by more than one environmental effect. One common receptor has been considered in **Chapter 9** (Non-Avian Ecology) and **Chapter 12** (Water Resources and Ground Conditions).

All receptors considered in two or more ES chapters are summarised in **Table 17.2**.

Table 17.2 Common receptors between ES chapters

Receptor	Ch 7: Landscape & Visual	Ch 11: Noise	Ch 13: Traffic & Transport	Ch 14: Socio-economics	Ch 15: Shadow flicker	Ch 12: Water resources & ground conditions	Ch 9: Non-avian ecology
Individual properties							
Tonnau Defaid (Dafydd)	X	✓	X	X	✓	X	X
Hendre Owen Farm	✓	✓	X	X	✓	X	X
Ty'n-y Pant Farm	✓	✓	X	X	✓	X	X
Tycanol	✓	✓	X	X	✓	X	X
Nant-yr-hwyaid Farm	✓	✓	X	X	✓	X	X
Neuadd-wen (53 Afan Road/Crud-yr-Awel)	✓	✓	X	X	✓	X	X
Teras Griffiths (Brynheulog)	✓	✓	X	X	X	X	X
Settlements							
Bryn	✓	X	✓	X	X	X	X
Maesteg – south of Afon Llynfi	✓	X	✓	X	X	X	X
Maesteg - Cwmfelin	✓	X	✓	X	X	X	X
Public Rights of Way							
PRoW 1 (bridleway)	✓	X	X	✓	X	X	X
PRoW 37 (BOAT)	✓	X	X	✓	X	X	X
PRoW 39 (bridleway)	✓	X	X	✓	X	X	X
PRoW 40 (footpath)	✓	X	X	✓	X	X	X
Other receptors							
Peat	X	X	X	X	X	✓	✓

Key: Common receptors

The receptors considered in this assessment are therefore:

Human receptors

- A. Tonnau Defaid (Dafydd) (Noise, Shadow flicker).
- B. Hendre Owen Farm (Visual, Noise, Shadow flicker).
- C. Ty'n-y Pant Farm (Visual, Noise, Shadow flicker).
- D. Tycanol (Visual, Noise, Shadow flicker).
- E. Nant-yr-hwyaid Farm (Visual, Noise, Shadow flicker).
- F. Neuadd-wen (53 Afan Road/Crud-yr-Awel) (Visual, Noise, Shadow flicker).
- G. Teras Griffiths (Brynheulog) (Visual, Noise).
- H. Bryn (Visual, Traffic & Transport).
- I. Maesteg – south of Afon Llynfi (Visual, Traffic & Transport).
- J. Maesteg – Cwmfelin (Visual, Traffic & Transport).
- PRoW 1 (bridleway) (Visual, Socio-economics).
- PRoW 37 (BOAT) (Visual, Socio-economics).
- PRoW 39 (bridleway) (Visual, Socio-economics).
- PRoW 40 (footpath) (Visual, Socio-economics).

Other receptors

- Peat (Water Resources and Ground Conditions, Non-avian Ecology).

These receptor locations (apart from peat, shown in **Appendix 12C**) are illustrated on **Figure 17.1.**

Whilst other receptors have been considered by other assessments, as they have been evaluated in the context of only a single effect (and effectively 'scoped out' of other assessments) they have not been considered cumulatively with other effects. Consequently, they have been scoped out from this assessment of cumulative effects.

Potentially significant effects

The purpose of EIA is to identify and assess any likely significant effects that are material to the decision-making process. In order to maintain proportionality, and in line with the EIA Regulations, this assessment therefore concentrates on where significant cumulative effects are likely to arise between topics considered in this ES.

17.8 Environmental measures embedded into the proposed development

A range of environmental measures have been embedded into the development proposals as outlined in section 5.4 and **Chapters 7-16** of this ES.

17.9 Assessment methodology

National policy guidance requires that all relevant effects should be considered objectively. However, existing policy guidance presently fails to provide advice on how such an objective assessment should be carried out. In the absence of any guidance, the cumulative assessment of effects draws upon the conclusions of the appropriate individual assessments of this ES and against each of the identified common receptors evaluates the extent to which the sum of any predicted effects may give rise to significant environmental effects.

Because this combined assessment involves different environmental topic assessments that cannot robustly be combined, the outcome of this cumulative effects assessment is reliant on the application of professional judgement.

17.10 Assessment of inter-related cumulative effects

Overview

The assessment of inter-related cumulative effects has focused on those receptors where potential significant effects have been predicted in respect of at least two or more topics and/or where the technical assessments have shown that potential individual effects are nearing the thresholds of established national criteria.

Table 17.3 sets out where significant effects, or effects close to the threshold of significance, have been identified for each common receptor identified in **Table 17.2**.

Table 17.3 Common receptors and significance of identified effects

Receptor	Landscape & Visual	Noise	Traffic & Transport	Socio-economics	Shadow flicker	Water resources & ground conditions	Non-avian ecology
Individual properties/roads							
A. Tonnau Defaid (Dafydd)					◆		
B. Hendre Owen Farm	◆						
C. Ty'n-y Pant Farm	◆◆				◆		
D. Tycanol	◆						
E. Nant-yr-hwyaid Farm	◆◆				◆		
F. Neuadd-wen (53 Afan Road/Crud-yr-Awel)	◆◆				◆		
G. Teras Griffiths (Brynheulog)	◆	◆					
Settlements							
H. Bryn	◆						

Receptor	Landscape & Visual	Noise	Traffic & Transport	Socio-economics	Shadow flicker	Water resources & ground conditions	Non-avian ecology
I. Maesteg – south of Afon Llynfi	◆						
J. Maesteg – Cwmfelin	◆						
Public Rights of Way							
PRoW 1 (bridleway)	◆◆						
PRoW 37 (BOAT)	◆◆						
PRoW 39 (bridleway)	◆◆						
PRoW 40 (footpath)	◆◆						
Other receptors							
Peat							

Key: Common receptors

◆: Effects close to significance threshold

◆◆: Significant effects

Assessment

The technical assessments (**Chapters 7-16**) in the ES have identified potential effects on common receptors as a result of the Foel Trawsnant Wind Farm amended scheme, as summarised in **Table 17.3**. The table shows that four common receptors are anticipated to experience more than one significant effect or effect close to the threshold of significance, these being:

- Ty'n y Pant Farm;
- Nant-yr-hwyaid Farm;
- Neuadd-wen (53 Afan Road); and
- Teras Griffiths (Brynheulog).

Ty'n y Pant Farm, Nant yr hwyaid Farm and Neuadd-wen (53 Afan Road/Crud-yr-Awel)

These properties, to the north of the proposed development site, are anticipated to be subject to significant visual effects, and shadow flicker effects close to the threshold of significance as a result of the Foel Trawsnant Wind Farm amended scheme. However, as discussed in detail in **Chapter 15**, all shadow flicker effects arising from the proposed development would be investigated and fully mitigated through a shadow flicker control module in turbines. This would ensure that such effects are minimised, and consequently that cumulative effects on Ty'n y Pant Farm, Nant yr hwyaid Farm and Neuadd-wen (53 Afan Road) would not be significant.

Teras Griffiths (Brynheulog)

Properties in Brynheulog, to the east/north-east of the proposed development site, are anticipated to be subject to visual and noise effects close to the threshold of significance.

As discussed in detail in **Chapter 11**, noise effects have been considered for both the Foel Trawsnant Wind Farm alone scenario, and a cumulative scenario including a number of other wind farms in the local area. The cumulative scenario is considered to be more realistic, as the model takes into account the directivity of individual turbines, including those for the proposed Foel Trawsnant Wind Farm amended scheme; this accounts for the fact that not all wind turbines would be acting directly down wind of receptors at the same time. In this scenario, predicted noise levels at receptor R3 (Sunnyview) and R4 (Teras Griffiths) are both below the ETSU-R-97 derived noise limit at all modelled wind speeds. The modelling also shows that noise levels noticeably reduce the further the receptor is from the proposed development, as highlighted in **Table 17.4** below, which is an excerpt from **Table 11.10** in **Chapter 11.** R3 is approximately 70m further away from the proposed wind farm (to the north-east) than R4.

Table 17.4 Cumulative Noise Assessment – Daytime (excerpt)

Noise Parameter, $L_{A90, 10\ mins}$, dB	**Standardised 10m Wind Speed quoted by Manufacturer (ms^{-1})**								
	4	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
R3 – Sunnyview									
Background Noise Curve	31.6	31.8	32.2	32.9	33.8	34.9	36.3	37.9	39.8
ETSU-R-97 Derived Noise Limit	36.6	36.8	37.2	37.9	38.8	39.9	41.3	42.9	44.8
Wind Farm Turbine Noise	30.3	33.1	35.8	36.7	37.2	37.4	37.7	37.7	37.7
Margin Under Noise Limit	-6.3	-3.7	-1.4	-1.2	-1.6	-2.5	-3.6	-5.2	-7.1
R4 – Teras Griffiths									
Background Noise Curve	31.6	31.8	32.2	32.9	33.8	34.9	36.3	37.9	39.8
ETSU-R-97 Derived Noise Limit	36.6	36.8	37.2	37.9	38.8	39.9	41.3	42.9	44.8
Wind Farm Turbine Noise	30.8	33.7	36.4	37.3	37.9	38.0	38.3	38.3	38.3
Margin Under Noise Limit	-5.8	-3.1	-0.8	-0.6	-0.9	-1.9	-3.0	-4.6	-6.5

With regards visual effects, **Appendix 7E (Visual Assessment)** states with regards to Group ID B 'South-west Brynheulog':

> *"The wireframe images in **Appendix 7G** from Hartshorn Terrace in the north of this area and from Rathbone Terrace in the south indicate that theoretical visibility of the Foel Trawsnant Wind Farm amended scheme would reduce with elevation from north to south across this group of properties. Whilst five turbines would be visible at hub height together with a further five visible at blade height from the northernmost part of this area, this would reduce to five blades only from its southern boundary."*

Teras Griffiths is located between Rathbone Terrace and Hartshorn Terrace, with the latter furthest from the proposed development site. The pattern for visual effects is therefore the opposite of the pattern identified for Noise effects, where effects would reduce the greater the distance from the proposed development (further to the north). **Appendix 7E** goes on to state:

> "*Whilst properties on the south-western edge of* [Brynheulog] *may have relatively unobstructed views toward the wind farm, their lower elevation would ensure that no more than two or three blade tips would be visible in primary views. Views from most lower storey windows and rear gardens would be largely or wholly screened by nearby houses and boundary walls and vegetation…magnitudes of visual change would range from Low to Negligible to None.*"

Properties on Teras Griffiths, on the south-western edge of Brynheulog, would therefore be subject to noise effects close to the threshold of significance (at certain wind speeds), but visual effects would be "*Low to Negligible to None*". Further to the north within Brynheulog, whilst visual effects would increase, noise effects would correspondingly decrease as evidenced in **Table 17.4**. It is therefore concluded that significant cumulative effects would not be experienced by receptors on Teras Griffiths, or the wider Brynheulog, as a result of the proposed development.

17.11 Consideration of additional mitigation or compensation

No additional mitigation measures, above those already identified within **Chapters 7-16**, are proposed to further reduce the effects that are identified in this ES chapter, as no significant inter-related cumulative effects have been identified.

17.12 Conclusions

The assessment of inter-related cumulative effects has considered whether any of the individual environmental topic effects resulting from the proposed development, which are not significant in their own right, could combine to create effects that are significant, on common receptors between technical topics. The assessment focused on those receptors where potential significant effects have been predicted in respect of at least two or more topics and/or where the technical assessments have shown that potential individual effects are nearing the thresholds of established national criteria.

It has been concluded that no significant inter-related cumulative effects would occur.

17.13 References

Neath Port Talbot County Borough Council. Scoping Opinion. Doc ref DN P2018/0153. 27 March 2018.

Welsh Government. The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017.

Appendix 1A
List of competent experts

Competent experts involved in the preparation of this ES are listed in the table below.

Topic	Responsibility	Name of company	Qualifications/competencies of author
Ch 1-5 Introductory chapters	Chris Prydderch	Wood	BSc (Hons), MSc, PIEMA. Over 13 years of experience in EIA.
Ch 6 Policy & Legislation	Andrew Williamson	Wood	BA (Hons), MA, MA PhD. Chartered member RTPI. Over 10 years of experience within the public sector and as a planning consultant.
Ch 7 Landscape and Visual Impact Assessment	Ian Gates	Wood	MLD, CMLI. Over 25 years of experience in LVIA and EIA.
	Kate Ward		BA (Hons), PG Dip, CMLI. Over 13 years of experience in LVIA and EIA.
Ch 8 Cultural Heritage	Simon Atkinson	Wood	BA (Hons), MCIfA. Over 28 years of experience in Cultural Heritage and EIA.
Ch 9 Non-Avian Ecology	Mike Frost	Wood	BSc (Hons), MSc. Over 17 years of experience in ecological consultancy including Ecological Impact Assessment and Habitats Regulations Assessment.
	Susan Field		MCIEEM BSc, MSc. Over 8 years of experience in ecological consultancy including Ecological Impact Assessment
Ch 10 Ornithology	Ian Simms	Wood	BSc (Hons) Over 20 years of experience in ecological consultancy including Ecological Impact Assessment and Habitats Regulations Assessment.
	Mike Raven		BSc (Hons), MIEEM. Over 20 years of experience as a professional ornithologist, including 11 years in ecological consultancy including Ecological Impact Assessment.
Ch 11 Noise	Ian Hepplewhite	Wood	BSc (Hons), MIOA. Over 39 years of experience in noise & vibration (including consultancy and EIA).
	Mark Evans		BA (Hons), MSc. PGDip. Over 10 years of experience in Noise consultancy and EIA.
Ch 12 Water Resources and Ground Conditions	Stephen Anderton	Wood	BSc (Hons), MSc, PhD. Over 12 years of experience in water EIA/FRA.
	Guy Douglas		BSc (Hons), MSc. Over 8 years of experience in water environment EIA.
Ch 13 Traffic & Transport	Helen Harding	Wood	BEng (Hons), MSc. Almost 20 years of experience in traffic assessments and EIA.
	Adam Guy		BSc (Hons). Over 5 years of experience in traffic assessments and EIA.

Topic	Responsibility	Name of company	Qualifications/competencies of author
Ch 14 Socio-economics including Recreation and Tourism	Andrew Williamson	Wood	BA (Hons), MA, PhD. Chartered member RTPI. Over 10 years of experience within the public sector and as a planning consultant.
Ch 15 Shadow Flicker	Tim Doggett	Wood	BSc (Hons), MSc. Over 10 years' experience in wind farm development and assessment.
Ch 16 Electromagnetic Interference & Telecommunications and Aviation	Tim Doggett	Wood	BSc (Hons), MSc. Over 10 years' experience in wind farm development and assessment.
Ch 17 Cumulative Effects	Chris Prydderch	Wood	BSc (Hons), MSc, PIEMA. Over 13 years of experience in EIA including cumulative effects assessment

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Appendix 1B
Developer's confirmation that experts are competent

I can confirm that I agree that Wood's technical staff who prepared this ES, as outlined in **Appendix 1A**, are competent.

Dale Hart, Managing Director

Pennant Walters (FoelT) Ltd

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Appendix 3A
Neath Port Talbot County Borough Council Scoping Opinion

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Appendix 3B
Response to Scoping Opinion