Ffynnon Oer Wind Farm Life Extension

Neath Port Talbot, Wales

Scoping Volume 2 of 2

Appendix A2: Environmental Statement

August 2025

Prepared by Natural Power on behalf of
Ffynnon Oer Windfarm Ltd

Natural Power, Harbour House, Y Lanfa, Aberystwyth, Ceredigion, SY23 1AS, Wales, UK

NATIONAL WIND POWER



Proposed Wind Farm

Ffynnon Oer

Environmental Statement

Volume 1
Main Report and Appendices



National Wind Power

Proposed Wind Farm Ffynnon Oer, Neath Port Talbot

Environmental Statement

Volume 1 - Main Report and Appendices

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1. Introduction

1.1 Ffynnon Oer Wind Farm

National Wind Power propose to develop a wind farm at Ffynnon Oer. The site, which covers a total area of some 150 ha is located within Neath and Port Talbot County Borough. The wind farm would comprise 16 three-bladed turbines with associated crane pads, access tracks, substation and infrastructure. The maximum total height of each turbine will be 91 m to vertical blade tip.

The site is located on high ground situated to the southeast of Resolven and to the north of Abercregan. Figure 1.1 provides the location of the proposed development.

The current land use of Ffynnon Oer is agricultural with the site providing what is best described as rough grazing for sheep; the site covers a variety of ecological habitats of varying significance. There is widespread evidence of past industrial activity on the site and of earlier human settlement most notably a Roman encampment which lies outside the site boundary, to the northwest. The area identified for the erection of the turbines is bounded to the east and west by forestry plantations.

1.2 The Environmental Statement

This Environmental Statement (ES) has been prepared to report on the Environmental Impact Assessment (EIA) of the proposed wind farm at Ffynnon Oer. Environmental Impact Assessment is a process that involves collecting information about the existing environment likely to be affected by a project. The nature and scale of the project's effects on the environment are then assessed in an impartial manner and presented in a systematic way. The process is designed to allow environmental concerns and opportunities to be addressed during the planning and design of a project, by incorporating into the proposal measures to mitigate adverse effects or enhance beneficial ones. Also critical to the process is that consultation should be carried out at appropriate stages. The findings of the assessment are designed to assist consultees and, ultimately, decision-makers in coming to a view about whether or not, and how, a project should proceed.

The regulatory route for gaining planning permission for a wind farm depends on its size with larger schemes (>50 MW) being considered under Section 36 of the Electricity Act 1989 by ministers. The proposed Ffynnon Oer scheme (20.8 MW) falls below this threshold and is therefore considered through the normal Town and Country Planning process administered by the Local Planning Authority (LPA). In this case the LPA is Neath Port Talbot County Borough Council. The requirements to consider the environmental consequences of the scheme arise from the Environmental Impact Assessment (England and Wales) Regulations 1999 requiring an Environmental Statement to be submitted in support of the planning application.

This Statement sets out the results of the Environmental Impact Assessment for the proposed wind farm at Ffynnon Oer. It should be noted that this statement covers only the environmental effects associated with the construction, operation and decommissioning of the wind turbines,

access tracks and on-site substations and infrastructure. The statement does not address any overhead transmission lines that may be needed for the grid connection between the wind farm and the national electricity grid which are subject to a separate consenting process.

The document begins by outlining the nature of the proposed development followed by an explanation of the EIA and Scoping processes relevant to this wind farm. This is followed by information on how the site was selected and what alternatives to the development have been considered. The Statement then provides a summary of energy and planning policy relevant to the development followed by a number of sections covering the technical topics agreed for consideration during the scoping exercise. The final section summarises the key environmental effects of the development.

1.3 The Rationale for Renewable Energy

There is a growing awareness and acceptance that the rise in atmospheric levels of carbon dioxide (CO_2) and other greenhouse gases is leading to changes in the global climate. At the international conference on climate change held in Kyoto in 1997, the UK government accepted binding commitments to reduce greenhouse gas emissions and subsequently set a domestic goal of a 20% reduction in such emissions by 2010. In his presentation to the Economic Development Committee of the National Assembly for Wales (NAW) Sir John Houghton, Co-chair of the Scientific Assessment Working Group at the Intergovernmental Panel on Climate Change (IPCC) identified that the Earth's average surface temperature is rising at a faster rate than it has for at least 10 000 years and is projected this century to increase by 0.2 to 0.5 degrees per decade. In its Report for Consultation on Renewable Energy issued in April 2002 the Economic Development Committee noted its opinion, that both humans and ecosystems will find it difficult to adjust to this temperature increase.

The impact of climate change in Wales was also the subject of a recent report, 'Climate Changes Wales - Learning to Live Differently'. The key impacts identified were those associated with the rise in sea levels, increased winter rainfall, increased occurrences of storms and flooding and the changes in agriculture and habitat likely to result. Furthermore there were expected to be a wide range of economic consequences.

Whilst global warming is the responsibility of all governments the Economic Development Committee stated its belief that Wales is in a particularly good position to act. Wales was considered to be the ideal location for the development of renewable technologies, especially wind, tide and sea-current and both wind-power and biomass are considered to both be ideally suited for rural areas and offer jobs and investment at a time when diversification is urgently needed. In the longer term industry and business throughout Wales is considered by the Committee to benefit from a reliable supply of electricity from renewables at a competitive price.

In the whole of the UK operational wind farms annually offset the emission of 1.35 million tonnes of carbon dioxide a year. By early 2002 a total capacity of over 499 megawatts (MW) had already been installed in the UK, meeting the average electricity needs of over 250 000 homes and displacing the emission of carbon dioxide into the atmosphere. Within Wales the British Wind Energy Association (BWEA) in their submission to the NAW's Economic Development Committee on 16 January 2002 estimated that 152.7 MW of the UK total was being produced in Wales.

1.4 National Wind Power

National Wind Power Limited has developed a leading position in the UK wind power market. Formed in August 1991, the company is a subsidiary of Innogy plc - an integrated energy business. By early 2002, National Wind Power (NWP) was operating 280 MW and had developed seventeen wind farms worldwide (fourteen in the UK).

2. Description of Proposed Development

2.1 Introduction

This section of the report outlines the activities associated with the construction, operation and decommissioning at the wind farm. It includes details of the construction programme and technical information on the turbines and the associated infrastructure.

2.2 Wind Farm Principles and Design

2.2.1 Wind Farm Principles

Wind turbines are designed to convert the kinetic energy of the wind into electrical energy (Figure 2.1). Air passing over the blades of a wind turbine causes them to rotate. This low speed rotational motion is converted into electrical energy at a voltage of 690 V by a generator located inside the nacelle and is then converted to a high voltage (typically 11 kv) by a unit transformer located at the base of the turbine. Underground cables link all the turbine unit transformers to a dedicated substation 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. The wind farm substation is typically connected to an existing substation on the national electricity grid by a high voltage transmission line in this case 66 kv.

2.2.2 The Role of EIA in the Design of the Proposed Scheme

Entec has been involved throughout the design of the proposed scheme. This ensured that environmental issues have been fully considered and where feasible mitigated. This ES presents the assessment of effects of the final scheme, but it is important to note below (**Table 2.1**) the changes in the final form of development that have been made throughout the design stage in order to mitigate potentially significant environmental effects.

Table 2.1 Mitigation of Potentially Significant Effects Through Design

Iteration	Comment
Initial Layout	Taking account of known information and good design practice
Relocation of Turbine 9	This avoids the landslipped ground and entrances to former mine workings
Relocation of Turbines 1,2 and 12	Moved to an appropriate distance from public rights of way
Relocation of Turbines 15 and 16	This avoid the area identified within the Phase 1 habitat survey as acid flush
Relocation of Turbine 7	The turbine has been moved to the edge of the area identified in the Phase 1 Habitat survey as modified blanket bog
Review of Road layout	Road layout modified to minimise length on modified blanket bog
Relocation of Turbine 6	This has been moved to the edge of the area licensed by the Environment Agency for the deposal of sheep dip and outside the actual site area used by the landowner
Agreement of Operational Access Route	Agreement has been reached with the Forestry Commission to allow for operational (in addition to construction) access to take place through the forestry. There will be no need to use the access track passing through the Roman Camp
Reduction in length of Internal Track	The length of track shortened to reduce loss of habitat and lessen visual impact

2.2.3 Ffynnon Oer Wind Farm

This proposal is to construct and operate a 16 turbine wind farm and associated infrastructure including unit transformers, internal access roads and a substation. The turbines (each 1.3 mw) would have a combined maximum rated output of 20.8 MW of electricity, equivalent to the domestic needs of around 25% of households within Neath Port Talbot County Borough Council. The proposed layout of the turbines is provided at Figure 2.2 together with the access track layout and the new substation. This will be located at the southeastern end of the site closest to turbine No 9. The electricity will then be taken to a sub station located at SS8625 9505, between Croeserw and Caerau on the A4603.

2.2.4 Wind Farm Design Criteria

Once a site has been identified, the design of the wind farm is refined in order to produce a design which seeks to maximise wind power generation within the constraints of the site and potential environmental impacts. The optimal layout of a wind farm depends on a range of technical, economic and environmental criteria including:

- Ground conditions – to be suitable for the installation of wind turbines, access tracks and cables e.g. avoidance of former landslip or geologically unstable ground.
- The feedback from a range of consultation activities are also taken into account including views of the local planning authority, statutory and non-statutory consultees, the local community and landowners.

- Energy yield – the site and immediate environs are computer modelled to establish the windflow on and around the site to provide guidance on the best locations for the wind turbines, taking account of the turbulent interaction between wind turbines.
- Proximity to occupied dwellings – sufficient stand off to occupied houses to protect local noise amenity.
- Environmental constraints – features and areas that are environmentally sensitive are identified and their implications considered.
- Existing land use –the existing use of the land is considered in the layout of tracks and turbines. For example, existing track lines are used where practicable.
- Site access – for movement of materials and personnel to and from the site bearing in mind that turbine blades are over 30 m long.

2.2.5 Selection of Turbines

The wind turbines selected for this site are of the horizontal axis type, with a rotor consisting of three blades, each 29 m in length and affixed to the tower by means of a hub or nacelle which itself adds a further 2 m to the overall blade length. These are then mounted at a height to the wind turbine hub of 60 m and with a maximum rated power generation capacity of 1.3 MW. This gives a turbine with a maximum height to vertical blade tip of 91 m. The final selection of turbine will be subject to competitive tendering within these design parameters.

2.3 Construction

Construction of the wind farm at Ffynnon Oer will consist of the following main operations:

- Create and upgrade the access route from the forest into the site and install the site accommodation and compounds;
- Construct on-site access tracks including operational access road, and excavate the wind turbine foundations;
- Construct the wind turbine foundations (the grid connection is the subject of a separate consenting process);
- Construct the site substation and install grid connection;
- Excavate cable trenches and lay the power and instrumentation cables;
- Erect and commission the wind turbines;
- Carry out reinstatement works, remove temporary accommodation and clear the site.

An indicative construction programme is shown below. It is anticipated that the construction process will take seven months. Weather in particular has a strong influence on the timing of these activities. During the construction period strong wind conditions are avoided for obvious safety reasons, and during cold conditions concrete pouring for turbine bases can be halted. For

these and other reasons summer months are favoured. Current expectations are that construction work would start in August 2003.

ID	Task Name	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7
1	Access to site							
2	Site preparatory work							
3	Field access work							
4	Establish Compound							
5	Set out access tracks							
6	Site access tracks							
7	WTG foundations							
8	Sub-station building							
9	Crane hardstandings							
10	Cable laying							
11	Transformer delivery							
12	HV cable terminations							
13	LV cable terminations							
14	WTG deliveries							
15	WTG assembly and erection							
16	WTG startup							
17	WTG commissioning							
18	Re-instatement							

2.3.1 Site Access and On-site Access Tracks

Site Access

One access route is proposed to the site. Existing forest tracks to the northeast of the site joining onto the A4061 will be used during construction and decommissioning to facilitate the movement of the large turbine components and concrete lorries to and from site. They will also be used for operational access.

Layout

The layout of the access tracks has been developed from the following criteria:

- Track length should be kept to a minimum to reduce construction time, roadstone requirement and environmental impact;
- Gradients must be kept low 1:8 to allow construction plant to move safely round the site (typically less than 1:8);
- Track layout reflects contours and avoids cross slopes and deep cuts into existing terrain;
- Tracks should be routed to avoid sensitive ecological and archaeological features.

An estimated 6.2 km of track will be required to link the turbines and control compound. Of this approximately 3.2 km is new, the remainder is the existing farm track that will be upgraded. The anticipated track layout is provided at Figure 2.4.

Construction Methodology

The tracks will primarily be of a reinforced geogrid type where crushed store and geogrid membrane are laid in multiple layers. This is established practice on wind farm sites and tracks are required to cross soft peatland soils by avoiding disturbance to hydrological flows.

Within the site the access track specifications will be varied to suit the conditions. At this stage, prior to intrusive geo-technical investigations, it is expected that there will be a need to employ up to three types of track construction and details are provided at Figure 2.3. The tracks will be designed to permit access within the site by normal road-going cranes and heavy goods vehicles. The tracks will normally be 4 m wide with 0.5 m shoulders, giving a total excavated width of 5m. In some places the bends will be widened to up to 14 m to permit the turning of long vehicles. Where tracks are required over areas of softer ground, the width may also need to be increased to provide appropriate load bearing, up to approximately 7 m wide.

In constructing the tracks the vegetation and approximately 50-100 mm of topsoil will be scraped off and stored on a layer of geotextile near to the tracks for partial reinstatement alongside the completed track Geotextile will be laid directly onto the exposed subsoil and the track will then be constructed on the geotextile by laying and compacting crushed stone. Where depth to subsoil is small crushed rock up to a depth of 300 mm will typically be used. In softer ground the number of layers or geogrid membrane is increased as is total depth of stone. Areas of soft ground will be avoided where possible.

Where required, provision for surface draining will be incorporated within the track structure to maintain existing surface water run off. Similarly, running surfaces will be suitably cambered to direct surface drainage flows.

In addition to the access track, crane hardstanding areas and turning bays will be constructed adjacent to wind turbine bases. Figure 2.5 represents a typical arrangement however the precise layout required to accommodate the crane will depend upon the turbines used. The laydown areas will accommodate components ready for assembly and erection and provide a firm base for cranes used to erect the turbines. Crane pads will be left in place to allow similar plant use in case of component failure and for decommissioning.

Stone Requirement

Conventional practice on wind farm sites is to open burrow pits to win stone for track construction. This creates some additional impact but offsets significant numbers of lorry movements. At Ffynnon Oer however agreement has been reached to use the stone from the existing Bwlch Ffos Open Cast Site which is located within the forestry area to the Northeast of the site. The operator of this site has recently received planning permission to extend the operation and the stone excavated to access the coal will be used in the development of the wind farm. Borrow pits are therefore unnecessary. The location of the open cast site avoids any requirement for vehicles to use the public highway with forestry tracks providing the route. Stone will be crushed and graded at Bwlch Ffos prior to its delivery on site.

2.3.2 Site Accommodation and Temporary Works

During construction a temporary fenced off compound area of about 5000 m^2 will be situated on the southern and lower plateau as indicated in Figure 2.4. It will enclose the following:

- Temporary portacabin to be used for site offices and welfare facilities including one portacabin toilet with provision for sealed waste and storage;

- Parking for up to 30 cars and 10 construction vehicles;
- Containerised storage for tools and small parts.

The compound will be stripped of topsoil, which will be stored separately on site for eventual restorations upon completion of works and surfaced in crushed stone. Temporary fencing will be erected to prevent personnel or livestock from straying into excavations, or to prevent the public from straying into the path of vehicles close to rights of way. It will be placed around each turbine base and it will be of a post and wire construction. Fencing will also be used to protect archaeological or environmental features where appropriate.

2.3.3 Turbine Foundations

A schematic design for the proposed wind turbine foundations is shown at Figure 2.6. Each foundation will be formed from reinforced concrete, typically to a diameter of 14.5 m and a depth of approximately 3 m. The base will initially be excavated to about 1 m oversize to allow for shuttering access, and the shuttering positioned and supported. The foundation will then be filled with 100 mm of blinding and 750 mm of reinforced concrete.

An upstand of 4.5 m diameter to a depth of about 2 m is then formed and wind turbine tower fixing bolts integrated with this. Once set the remaining cavity is backfilled with compacted excavation material. Prior to the commencement of these operations the area to be used for the foundations will be stripped of topsoil and subsoil, the topsoil will be stored separately for later use.

2.3.4 Site Substation and Grid Connection

The grid connection for the wind farm will be via a new substation building to be located on the southern lower platteau of the site. Metering and switch gear will be contained within this building which will be of a local vernacular appearance. The plan and typical elevations of the substation is provided at Figure 2.6.

A transformer will also be required due to the need to step up the voltage from the wind farm to the 66 kv required for the grid connection. This will be adjacent to the substation on a concrete pad of approximately 15 x 8 m.

2.3.5 Cabling

Between the wind turbines and the substation, all the power and control cabling will be laid in trenches approximately 500 mm wide by 750 mm deep excavated directly adjacent to access tracks. These will then be back-filled with compacted fill, which will have been selected to remove large or sharp stones. In pure peat areas the peat will be replaced directly around the cables. The vegetation and top 50-100 mm of soil will be stripped and laid beside the trench and replaced to the existing ground level immediately after the cables have been installed. Clay plugs will be installed where appropriate (approximately every 50-100 m) to restrict water flow through the trench.

2.3.6 Erect and Commission Wind Turbines

Wind Turbines components will be transported to site on articulated trailers with the blades arriving via low bed trailers with rear steering. Erection will be undertaken using two mobile

road going cranes of approximately 100 and 500 tonnes IFt capacity. The maximum axle weight of the larger crane will normally be limited to 14.25 tonnes.

2.4 Wind Farm Operation

2.4.1 Wind Turbine Characteristics & Meteorological Effects

The power output from wind turbines begins when wind speed exceeds 5 m/s and it reaches a maximum output at around 15 m/s. At wind speeds above 25 m/s(60 mph), the turbine automatically shuts down. Generation output is also seasonally dependent with around two thirds of the output generated between October and March.

Although wind farms require wind for electricity generation, at high wind speeds (>25 m/s or 60 mph) they shut themselves down to avoid excessive wear on the components, and the rotor is both aerodynamically and mechanically braked. Modern wind turbines are however designed to withstand much higher windspeed, and are normally warranted against structural failure for windspeeds up to 150 mph. Lightning generally has no effect on turbines, though as with all structures there is a risk of damage if hit directly by lightning. Turbines are fitted with a lightning protection system as part of their design.

Snow and ice do not generally pose 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.

2.4.2 Wind Turbine Servicing and Emergency Operations

The wind farm would be visited once a month for general checks. Routine maintenance or servicing of turbines is required and generally carried out twice a year, with a main service at 12 monthly intervals and a minor service at 6 months. In the first year there is also an initial 3 month service after commissioning. The turbine being serviced is switched off for the duration of its service.

Site maintenance personnel would use off-road vehicles to access the wind turbines via the forest access track.

2.4.3 Habitat Management

Enhanced management of the modified bog area is proposed for the operational life of the wind farm. It is intended that following the grant of consent an outline habitat management and monitoring plan will be prepared and agreed with the local planning authority.

2.5 Decommissioning

The predicted operational lifespan of the Wind Farm is 20 years. At the end of this period the site will be decommissioned or, alternatively, a planning application maybe submitted to retain the existing turbines or replace them with new turbines. The decommissioning of this wind farm is expected to take three months to complete. It will involve the following operations.

2.5.1 Wind Turbines

These will be removed from the site entirely and their foundations broken out to below ground level. All materials arising from demolition will be disposed of in accordance with relevant waste management regulations. Foundations will be covered in topsoil and seeded with an appropriate local mix.

2.5.2 Cables

Wind turbine interconnecting cables will be de-energised and left in place at their placement depth of 750 mm. This is considered less damaging than their complete removal. Cable marker signs will be removed.

2.5.3 Substation

The demolition of the substation will involve the removal of equipment and then complete demolition of the building and compound including breakout of the foundations to below ground level. Foundations will be covered in topsoil and seeded with an appropriate local mix.

2.5.4 Access Tracks

Although removal of the site access tracks is feasible the process of track removal may cause more environmental damage than will the result of leaving them *in situ.* It is proposed that decisions on their removal be undertaken at the time of decommissioning in conjunction with the landowner and local planning authority.

2.5.5 Habitat Management

Habitat management following decommissioning is subject to discussions with the landowners. Given current policy trends it is anticipated that the land use would continue to be agricultural, but with emphasis on maintaining nature conservation and bio-diversity value.

3. The Environmental Impact Assessment

3.1 The EIA Process

EIA is a process, the key characteristics of which are that it is:

- systematic, comprising a sequence of tasks defined both by regulation and by practice;
- analytical, requiring the application of specialist skills from the environmental sciences;
- impartial, its aim being to inform the decision-maker rather than to promote the project;
- consultative, with provision being made for obtaining feedback from interested parties including local authorities and statutory agencies;
- interactive, allowing opportunities for environmental concerns to be addressed during the planning, design and implementation of a project (see Table 2.2 for how the EIA has altered the scheme design).

The interactive nature of the process relates to one of the purposes of EIA, namely the need progressively to refine the design of a proposed scheme in order to reduce its potential adverse effects (i.e. to mitigate potential effects so that they are reduced or eliminated). Where possible, measures should be taken to compensate for any significant adverse effects that it is predicted will occur and to increase the environmental benefits through environmental enhancements.

A further purpose of EIA is to evaluate the significance of the environmental effects that have been assessed. Information about the significance of the effects, and the underpinning data and assessments, are then presented in the ES.

3.2 The Steps in the EIA Process

3.2.1 Key Steps

The key steps that have been undertaken as part of this EIA process are summarised in **Table 3.1** (these are based on the EIA Regulations, Government guidance and good practice).

Table 3.1 Key Steps in the EIA Process

Key Steps in the EIA Process
• Defining the project
• Considering the need for the project and alternatives for meeting this need
• Deciding on the potentially significant effects that need to be assessed and how this assessment will be carried out (i.e. scoping)
• Consultation over the scope of the EIA and refining the scope in response to the comments that are received
• Describing the baseline environment that is relevant to the potentially significant effects (i.e. that existing before commencement of the project and assumed to develop in its absence) and establishing the sensitivity of identified receptors/resources within that environment
• Identifying measures to mitigate significant effects and liaising with the project design team to incorporate these (where possible) into the proposals
• Ongoing consultation with statutory consultees and other interested parties
• Assessing the magnitude of predicted environmental effects
• Evaluating the significance of the predicted effects
• Collating the findings in an ES and summarising the findings in a non-technical summary
• Subsequently ongoing environmental monitoring, assessment and other work, as required following the production of the ES

3.2.2 The Scoping Process

One of earliest steps in the process is to define those environmental effects that need to be assessed as part of the EIA. This focusing exercise is part of the process known as scoping. The context for this focusing exercise is provided in the EIA regulations and in DETR Circular 02/99 *Environmental Impact Assessment*. Schedule 4 of the Regulations states that the ES should include "*a description of the likely significant effects of the development on the environment...*". The Circular states that "*In many cases, only a few of the effects will be significant and will need to be discussed in the ES in any depth. Other impacts may be of little or no significance for the particular development in question and will need only very brief treatment to indicate that their possible relevance has been considered*". The focusing exercise is the means by which the likely significant effects are identified.

Against this background, the scoping process therefore uses the best available data to identify those effects that are likely to be of significant concern, which can then be taken forward for more detailed analysis. These effects should include those that are:

- known or likely to be significant;
- sufficiently uncertain that it cannot be determined this stage whether or not they are likely to be significant.

Other effects are not considered in any further detail in the EIA on the grounds that they are known to be irrelevant or that they will give rise to effects of little or no significance. This ES identifies such aspects that have been scoped out.

3.3 Terminology

The terms 'impact' and 'effect' are often used synonymously and this can lead to confusion. For this assessment they have been defined as follows:

- **Impacts** are any changes attributable to the proposed development that have the potential to have environmental effects (i.e. they are the cause of the effects).
- **Effects** are the results of the changes for specific environmental resources or receptors.
- **Mitigation** is categorised as follows:
  - **Avoidance**: measures taken to avoid impacts which could have adverse effects, such as locating the main development and its working areas and access routes away from areas of high nature conservation interest, fencing off sensitive areas during the construction period, or timing works to avoid sensitive periods.
  - **Reduction**: measures taken to reduce impacts that could have adverse effects e.g. modifications or additions to the design of the development, such as the creation of reedbed silt traps to prevent polluted water from running directly into important watercourses.
- **Compensation**: measures taken to offset/compensate for residual adverse effects that cannot be entirely mitigated. These usually take the form of replacing what will be lost e.g. the translocation of existing vegetation to another site, the restoration of damaged or badly managed habitats, or the creation of new habitats.
- **Enhancement**: the genuine enhancement of environmental interest e.g. improved management of established habitats, or the creation of new habitats over and above what is required for mitigation and compensation.

Through the iterative EIA process that has been adopted the proposed scheme has been revised and various mitigation incorporated. The residual effects are then evaluated to assess their significance and this forms the basis for decision making on whether the scheme should proceed.

For this assessment the evaluation of significance generally takes account of the following criteria:

- the type of effect – i.e. whether it is positive negative or unknown;
- the probability of the effect occurring – i.e. certain, likely or unlikely. If there is uncertainty this will be noted;
- the policy importance (or sensitivity) – i.e. international, national, regional county, district or local/parish importance.

The findings in relation to all of these are brought together to form an assessment of significance for each effect, based on professional judgement. Effects are assessed as being either unknown, not significant or minor or major significance.

Some disciplines adopt slightly different terminology and/or definitions e.g. landscape assessment, and where this departs from that given above this is noted in the relevant technical section, along with any specific definitions of policy importance etc.

3.4 The Assessment Methodology

3.4.1 The Stages of The Development

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

- Construction: this covers preliminary site establishment, the construction of the internal access track, foundations and erection of turbines, associated facilities and infrastructure;
- Operation of the scheme: i.e. when construction work is complete and the wind farm is operational;
- Decommissioning where it is relevant.

3.4.2 Approach to the Assessment of Environmental Topics

Each of the separate assessments dealing with the environmental topics has been undertaken in relation to a 'baseline'. This relates to the existing environmental situation and how this would change if the proposed development were not to go ahead (i.e. the 'do nothing' scenario). All of the topic assessments have been undertaken on the basis of a common understanding of the nature of the proposed development (as described in Section 2).

Different methodologies are required to assess the effects relating to each of the environmental topics that have been investigated as part of the EIA. Individual methodologies are outlined at the start of each topic section and are based upon recognised good practice such as the guidelines prepared by the Institute of Environmental Assessment.

Each environmental topic follows a common format, as outlined below:

- methodology;
- description of the baseline conditions;
- description of the mitigation measures that have been proposed for inclusion in the scheme;
- identification of the predicted impacts generated during the construction and operation phases (allowing for the agreed mitigation) and an assessment of the environmental effects that these are expected to cause;
- an evaluation of the significance of the predicted effects in which these are defined as being of major, minor and no significance;
- opportunities for mitigation additional to that which it is proposed to incorporate into the development.

Again where individual disciplines may vary from this, it is noted in the relevant technical section.

3.4.3 Structure of the Environmental Statement

The environmental statement (ES) consists of a Non Technical Summary, the text (Volume 1) and the Figures (Volume 2). The text is divided into eighteen sections, as described below:

- Section 1 provides a introduction to proposed Ffynnon Oer Wind Farm and describes the role of windpower in meeting renewable energy needs. It briefly describes the EIA process and identifies the statutory duty of NWP to mitigate the environmental effects of its proposals.
- Section 2 describes the nature of the development proposed, the methodology behind its construction and operations and the changes that have been made to the development in response to the findings of the EIA.
- Section 3 provides a more detailed review of the EIA process and an outline of the impact assessment methodology used to ensure a consistent and transparent approach to assessment across topics. It outlines the structure of the ES and provides brief details of the team that has completed the EIA and compiled the ES.
- Section 4 explains the scoping process undertaken to inform the topics considered and methodologies employed in the development of the EIA.
- Section 5 reviews energy policy associated with wind farm development. It also identifies the relevant planning policy guidance including development plans and policies appropriate to the consideration of the development.
- Section 6 provides the background to the site selection exercise undertaken by NWP. It includes a review of alternatives to the production of renewable energy by wind.
- Section 7 to 15 provide the main technical body of the report considering the impact of the constructional operational and decommissioning phases of the development against the topics identified within the scoping report and agreed with the Local Planning Authority and statutory consultees.
- Section 16 assesses the likely implications of the development upon existing infrastructure, communication networks, aviation, safety and television.
- The ES concludes with a section summarising the major positive, cumulative and negative effects identified during the preceding sections.
- Section 18 forms the conclusion to the ES.

3.4.4 The Project Team

The project team that has carried out the Environmental Impact Assessment was:

National Wind Power

NWP provided the design of the development. They provided details of the construction methodology and information regarding site selection and the investigation of alternatives.

Entec UK Ltd

Entec is one of the UK's leading environmental and engineering consultancies. Consultants with the company undertook the assessment of socio-economic and community, the cultural history, landscape and visual, Public Rights of Way, Traffic and Transportation, Noise, Hydrology and hydrogeology, geology, Ecology and Nature Conservation and Infrastructural issues associated with the development. The input also included the preparation and submission of the scoping report and production of the ES and Non Technical Summary.

4. Scoping of the Proposed Development

4.1 Proposed Scope

A scoping opinion was sought from Neath Port Talbot County Borough Council (the Local Planning Authority) in order that this ES contains the information required for them to identify the environmental effects of the proposed development. To assist them in reaching their opinion, and to allow broader consultation with bodies that may be unfamiliar with the proposals, the following information was provided:

- an outline description of the proposed development;
- the site location and description;
- the purpose of the proposal;
- the proposed basis of the Environmental Statement.

The report identified a series of effects that the development was likely to have on the environment and which were proposed to be considered in more detail within the EIA. These were:

- Landscape;
- Nature Conservation;
- Noise;
- Traffic and Transport;
- Cultural Heritage;
- Geology;
- Hydrology;
- Public Access;
- Sustainability (covered within Sections 1 and 6);
- Socio-economic;
- Health and safety, including telecommunications and television and air safety.

Effects on air quality and soil were proposed to be scoped out, the former being addressed through appropriate construction practices.

A copy of the scoping report was also sent to key consultees including the Countryside Council for Wales, The Glamorgan Archaeological Trust; the Environment Agency; the Royal Society for the Protection of Birds; The Glamorgan Wildlife Trust; the National Assembly for Wales and CADW.

In addition to the formal consultation undertaken at the scoping stage National Wind Power has completed an extensive programme of public consultation. This consultation process resulted in the following highlights:

- Extensive dialogue with public representatives prior to any actions;
- The direct mailing of 10,747 residents of aged 16 or over (5451 homes) detailing the project and inviting them to two public exhibitions;
- Widespread advertising via media and posters.

Which resulted in the following results:

- 1% of those informed by the leaflet drop directly attending the exhibition;
- 0.3% of those directly informed by the leaflet drop submitting their views in writing;
- 17% of those attending submitting in writing their support compared to 7% in opposition.

Temporal Scope

The temporal scope of the EIA covered the period from commencement of construction, through the operational phase, to completion of operations, decommissioning and restoration, as appropriate.

Spatial Scope

In its broadest sense, the spatial scope of the EIA is the area over which changes to the environment would occur as a consequence of the development. In practice, the EIA focuses on those areas where these effects are likely to be significant.

The spatial scope will potentially be different within each specialist area of study. For example, the effect of the proposed development upon the landscape is likely to require a greater spatial scope than, for example, the study of cultural heritage. This is discussed in each technical section.

4.2 Agreed Scope

Neath Port Talbot responded to the submission of the Scoping Report by letter on 2 May inviting Entec and National Wind Power to a meeting to discuss the proposal. A meeting was held at the Neath Port Talbot Planning Offices on 21 May with the Local Planning Authority (LPA).

Discussion were held on to the nature of the proposed development. Contact names for consultees were also provided. The LPA. were of the opinion that those matters covered within the scoping report were sufficient to enable them to assess the proposal.

Subsequent to the meeting consultation responses have been received from the Environment Agency, the Countryside Council for Wales, the Glamorgan Archaeological Trust and the RSPB. Discussions with Highways officers at Neath Port Talbot have also confirmed that Traffic and Transport effects on the highway network can be scoped out although it has been

necessary to consider traffic implications for that section of the route which runs through Rhondda Cynon Taff.

4.2.1 Topics to be Addressed in The EIA

Schedule 4 of the EIA Regulations specify that the EIA should address *"...direct effects and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative effects..."*

Furthermore having identified the nature of the effects the evaluation should seek to establish the probability and magnitude of the effect taking place.

Schedule 4 also specifies that the ES should describe those "*aspects of the environment likely to be significantly affected by the development, including, in particular population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the inter-relationship between the above factors.*"

In this report, these topics are dealt with under the headings set out in **Table 4.1**.

Table 4.1 Environmental Topics Addressed in EIA

Topics in the EIA Regulations (SI No 293)	Section(s) Incorporating This Topic in This Report
Population	Socio-economic Issues (Section 7), Noise (Section 12), Traffic and Transportation (Section 11), Landscape and Visibility (Section 9), Public Access (Section 10), Infrastructure (Section 16)
Fauna	Hydrology and Hydrogeology (Section 13), Ecology (Section 15)
Flora	Landscape and Visibility (Section 9), Ecology (Section 15)
Soil	Scoped out
Water	Hydrology and Hydrogeology (Section 13)
Air	Scoped out
Climatic factors	Hydrology and Hydrogeology (Section 13), Energy and Planning Policy (Section 5)
Material assets, including the architectural and archaeological heritage	Landscape and Visibility (Section 9), Cultural Heritage (Section 8)
Landscape	Landscape and Visibility (Section 9)
The inter-relationship between the above factors	This are discussed within each Section as relevant

5. Energy Policy and Planning Policy

5.1 About this Section

This section presents a brief review of the main policies against which the proposed development should be considered.

It identifies those policies which are serving as driving influences for renewable energy developments. The translation of these into planning policies that provide context for the Ffynnon Oer proposal is discussed as are policies that provide constraints to the nature and location of renewable energy developments.

5.2 Energy Policy

5.2.1 UK Renewable Energy Policy

The direction of UK policy on renewable energy has been established through its commitments to international and European climate change instruments. The UK government is a signatory to the convention of the Intergovernmental Negotiating Committee on climate change which was signed at the UN Conference on Environmental Development 'The Earth Summit' in Rio de Janeiro in June 1992 which commits developed countries to formulating policies and measures:

> *"with the aim of returning individually or jointly to their 1990 levels of anthropogenic emissions of carbon dioxide and other greenhouse gases not controlled by the Montreal Protocol".*

Although these commitments at the Earth Summit were not legally binding on the signatories, at the Third Conference of the Parties to the Convention on Climate Change in Kyoto in December 1997 set binding targets on industrialised nations to reduce their emissions of six greenhouse gases to 5.2% below 1990 levels over the period 2008-2012. The Member States of the EU jointly agreed to exceed this commitment by requiring a reduction in greenhouse gas levels by 8% over 1990 levels by this period. The contribution to this target differs for each member state. The UK has accepted a legally binding target of 12.5% reduction in these greenhouse gases over 1990 levels within the identified time period. Following these binding agreements the EU Environmental Council agreed a list of priority measures to help Member States achieve their individual contributions to the overall target. Promotion of renewable energy was highlighted as one of the principal means to achieving the targets.

The current UK government has gone further and set itself targets beyond those of its legal commitments under the Framework Convention on Climate Change. Its target is to reduce greenhouse gas emissions including CO2 emissions to 20% below 1990 levels by 2010. It was recognised in the consultation document 'UK Climate Change Programme' that this would only be:

> *"a first stage towards what will be needed in the longer term."*

Policy development continues to exert upward pressure on these targets and in 2001 the UK Government announced a thorough review of UK Energy Policy to be undertaken by the Performance and Innovation Unit (PIU) in the Cabinet Office. It was generally agreed that energy policy should address all three objectives of sustainable development - economic, environmental and social - as well as energy security. In conclusion the PIU report suggests that to meet possible carbon reduction targets by 2050 it will be necessary to have:

- a reduction of at least 50% in total energy demand through energy efficiency measures;
- at least 50% of total electricity production produced from zero-carbon sources;
- substantial changes in vehicle technology to ones that provide very low carbon emissions.

The National Assembly for Wales (NAW), is understood to be unique in that it has a constitutional duty under Section 121 of the Government of Wales Act to promote sustainable development. No other national Government in the European Union has such a constitutional duty. Sustainable Development provides the over-arching framework for the development of policies and actions across the Assembly so that social, environmental and economic objectives are taken into consideration in all aspects of the Assembly's duties and functions. With regard to the impact of climate change NAW has produced a report entitled Climate Change Wales - Learning to Live Differently. Published in August 2001, the report identifies the potential impacts of climate change and the areas where there is likely to be a need for adaptation.

With regard to energy production the report identifies a NAW aim of making Wales a global showcase for clean energy production. The following key objectives are included within Better Wales, the strategic plan for the NAW:

- *generate 5% of electricity from renewable sources by 2003;*
- *pursue a course of developing Wales as a global showcase for clean energy production;*
- *to encourage the development of strong environmental goods, services and renewables industrial sectors.*

NAW has identified that it will work with the UK Government, the Scottish Executive and the Department of the Environment (Northern Ireland) to deliver the Kyoto agreement.

The commitments to using renewable sources of energy is being implemented through the new renewables obligation which places a legal obligation on licensed electricity suppliers to supply a specified proportion of their electricity supplies from renewable energy sources. During 2000 the UK Government announced its new policy on renewable energy when the Department of Trade and Industry (DTI) published a consultation document on its Renewable Obligation. The principle aim of the new policy was the stimulation of the UK renewable energy industry with the objective that by 2003, 5% of the UK electricity requirements be met by renewable resources, rising to 10% by 2010. This issue formed the basis of a number of recommendations within the Economic Development Committee (of NAW) Review of Energy Policy in Wales (April 2002). Suppliers who fail to meet their targets will be penalised at a rate of 3 pence per kilowatt-hour. The New Renewables Obligation is therefore stimulating demand for new renewable energy developments including windpower.

In summary the UK Government's renewable energy policy can be considered as having five key aims:

- to assist the UK to meet national and international targets for the reduction of emissions including greenhouse gases;
- to help provide, secure diverse, sustainable and competitive energy supplies;
- to stimulate the development of new technologies to provide the basis for continuing growth of the contribution from renewables into the longer term;
- to assist the UK renewables industry to become competitive in home and export markets and, in doing so, provide employment;
- to make a contribution to rural development.

The National Assembly of Wales has confirmed the important role that Wales plays in assisting to achieve these aims.

It is against this background of international and national energy policy and commitments that individual development proposals for renewable projects should be assessed.

5.3 Planning Policies

This section examines the planning policies against which an application for the proposed Wind Farm would be assessed. Taking each relevant policy document or plan in turn, its relevant policies are extrapolated and explained where necessary.

5.3.1 Planning Policy Wales

Planning Policy for Wales sets out the land use planning policies of the NAW. It is supplemented by a series of Technical Advisory Notes which are identified in Section 5.3.2. Procedural advice is given in NAW/Welsh Office circulars. Planning Policy Wales, Technical Advisory Notes and circulars together comprise national planning policy which need to be taken account of in the preparation of Unitary Development Plans and where material, in decisions on individual planning applications.

Planning Policy Wales identifies, within its Sustainable Energy section, that climate change is a widely accepted issue caused in part by the burning of fossil fuels. In light of this other sources of energy generation need to be developed to be consistent with UK Government energy policy to ensure a secure, diverse and sustainable supply of energy. The NAW aim is to secure the strongest economic development policies to underpin growth and prosperity in Wales and recognise in this the importance of clean energy, both as an economic driver and to take forward the Assembly's commitment to sustainable development. As part of this the Assembly Government intends to encourage the development of the renewables sector and promote energy efficiency and conservation in an economic, environmentally sound and socially acceptable way.

Renewable energy currently accounts for some 3% of Wales's electricity generation. The Assembly Government wishes to see the planning system play its part in contributing to the UK Climate Change Programme. This commitment to renewable energy sources includes water, solar, geothermal energy and biomass as well as wind.

Planning Policy Wales indicates that Local Planning Authorities should make positive provision for all forms of renewable energy by:

- Considering the contribution that their authority area can make towards developing and facilitating renewable energy and energy efficiency and conservation through their UDPs.
- Ensuring that development control decisions are consistent with national and international climate change obligations, including a contribution to renewable energy targets, having regard to emerging national and international policy on the levels of renewable energy required and on appropriate technologies.
- Recognising the environmental, economic and social opportunities that the use of renewable energy resources can make wider planning goals and objectives and the delivery of renewable energy targets.

At the same time Local Planning Authorities should:

- Ensure that international and national statutory obligations to protect designated sites, species and habitats and the historic environment are protected from inappropriate development.
- Ensure that environmental effects on local communities are minimised.

Planning Policy Wales promotes the potential of UDPs for indicating broad locations or specific areas where wind energy developments are likely to be permitted. In defining such areas the guidance states the need to balance the scale and contribution of such developments to certain levels of renewable energy against the sensitivity of the receiving environment. Small scale or domestic scale schemes may be appropriate in most locations whereas in nationally designated areas large scale deployment of renewable energy may not be appropriate.

In terms of assessing planning proposals for renewable energy generation consideration should be given to impacts on the local environment. Where a development is likely to cause demonstrable harm to a designated area, and the purposes for that designation, consideration should be given to refusing the proposal if such effects cannot be overcome.

5.3.2 Technical Advice Notes

Technical Advice Notes (TAN) provide statements of NAW policy on nationally important land use and other planning matters. A number of TANs are relevant to the determination of this application:

- TAN 5 Nature Conservation and Planning (1996);
- TAN 6 Agriculture and Rural Development (2000);
- TAN 8 Renewable Energy (1996);
- TAN 11 Noise (1997), detailed guidance pertaining to noise and wind farms is included within TAN 8.

Of particular note is TAN 8 which identifies the key issues to be assessed and taken into account with respect to wind farm proposals.

TAN 8 notes that:

> *"The principle of harnessing wind energy by wind turbines is well established, and there is no doubt about the technical feasibility of wind power."*

TAN 8 also identifies that modern wind turbines have distinctive features which must be taken into account in planning and development control, these are:

- *The need to site the machines in open, exposed locations, with annual wind speeds generally of more than 7.5 metres per second at hub height, often in rural areas, which may also be in attractive landscapes;*
- *The nature of noise emissions from the turbines;*
- *The movement of the blades;*
- *Considerations relating to the safety and electro-magnetic interference.*

With regard to wind farms TAN 8 outlines specific development issues:

> *"Wind turbines need to be positioned so that the distances between them are around 5-10 rotor diameters (about 150-300 metres). This spacing represents a compromise between compactness which minimises capital cost and the need for adequate separations to lessen energy loss through wind shadowing from upstream machines. Turbines should be sited in sympathy with local features and should respect the grain and form of the land. Turbine siting will always be a compromise between maximising energy capture and minimising visual impact."*

It also raises a number of key issues which need to be considered in relation to the siting of wind turbines:

- safety;
- proximity to airports, roads and railways;
- shadow flicker;
- noise;
- electro-magnetic production and interference;
- scattering of signal;
- siting and landscape;
- ecology;
- construction disturbance.

These subjects have all been addressed either directly within this Environmental Statement or via consultation with third party consultees.

5.3.3 Regional and Local Planning Policy

The proposed wind farm spans the former Port Talbot Borough Council and Borough of Neath Council Areas. These authorities were reorganised into the County Borough Council of Neath Port Talbot. As a result there are a number of Local Plans which impact directly upon the proposed site.

Relevant to the determination of the application.

- Southwest Wales Regional Planning Guidance;
- West Glamorgan Structure Plan (Review No 2) 1991-2006. Adopted February 1996;
- Upper Afan Valley District Plan. Adopted June 1982;
- Borough of Neath Local Plan. Adopted 1994;
- Port Talbot Local Plan. Deposit Draft Approved for Development Control Purposes 1996;
- Also within the reorganised Neath Port Talbot area the Cwmafan, Bryn, Goytre Valley and Rural Margam Local Plan 1989;
- Emerging Neath Port Talbot Unitary Development Plan. Pre-consultation deposit 2000. (Proposal will not be assessed against the content of this document but its inclusion to highlight the future direction of Neath Port Talbot is of interest).

Adjoining Authorities which could be impacted upon by the proposal.

- Mid Glamorgan Replacement Structure Plan 1991-2006. Adopted January 1999;
- Ogwr Borough Local Plan. Adopted April 1995;
- Emerging Bridgend Unitary Development Plan. Deposit Plan March 2001;
- Rhondda Local Plan 1991-2006. Adopted February 1998;
- Cynon Valley Local Plan 1991-2006. Inspectors Report 2000;
- Brecon Beacons Local Plan Adopted May 1999;
- Emerging Brecon Beacons Unitary Development Plan. Deposit March 2002.

Table 5.1 summarises the status of the development plans at the time of production of this ES.

Table 5.1 Development Plan Status

Regional Planning Guidance			
Southwest Wales Regional Planning Guidance			
Structure Plans			
West Glamorgan Structure Plan (Adopted)		Mid Glamorgan Structure Plan (Adopted)	
Local Plans			
Neath and Port Talbot County Borough Council	**Bridgend County Borough Council**	**Rhondda Cynon Taf County Borough**	**Brecon Beacons National Park Authority**
Upper Afan Valley District Plan (Adopted)	Ogwr Local Plan (Adopted)	Rhondda Local Plan (Adopted)	Brecon Beacons Local Plan (Adopted)
Cwmafan, Bryn, Goytre Valley and Rural Margam Local Plan (Adopted)	Bridgend Unitary Development Plan (Deposit Draft)	Cynon Valley Local Plan. (Adopted)	Brecon Beacons Unitary Development Plan (Deposit Version)
Borough of Neath Local Plan (Adopted)			
Port Talbot Local Plan. Deposit Draft (approved for Development Control Purposes).			
Neath Port Talbot Unitary Development Plan - Deposit anticipated Autumn 2002.			

The following table summarises the main points of the detailed review of regional and local planning policy included as Appendix A. It also identifies the context of Ffynnon Oer against these policies.

Table 5.2 Summary of Relevant Regional and Local Planning Policy and Context for Ffynnon Oer

Planning Policy Document and Detail	Ffynnon Oer Context
Southwest Wales Regional Planning Guidance "Support the development of suitable renewable and sustainable energy projects at appropriate locations within the area."	ES addresses issue of appropriate location
West Glamorgan Structure Plan 1996 • EQ1 encourages renewables • EQ2 identifies constraints which renewable energy and proposals must meet to be permitted • Policy C5 identifies constraints on development in the open countryside	ES Addresses issue of appropriate location EIA process has contributed to mitigation development and ES assesses proposals against constraints. Site is not within Brecon Beacons Park and has no nature conservation The ES provides an assessment of effects on sector economics and community and describes existent nature conservation and agricultural conditions
Upper Afan Valley District Plan 1982 • No policies, allocations or designations considered relevant to the proposals	Not applicable
Cumafan, Bryn, Goytre Valley and Rural Morgan Local Plan • Plan encourages development that is appropriate and does not have adverse effects on environment and amenities amongst other aspects • No particular policies on renewable energy are stated	ES sections on socio-economics, landscape and nature conservation consider these effects
Port Talbot Local Plan – Approved for Development Control Purposes • E13 protects low quality agricultural land of nature conservation value • E18 protection to designated landscape protection areas unless can be demonstrated that there is no detrimental effect on the ecology and landscape and these qualities are enhanced	ES section on nature conservation considers this ES section on landscape considers effects. Enhancement and compensation for nature conservation addressed in Section 14. Various ES sections address these aspects of the proposals
Borough of Neath Local Plan In addition to a number of general policies to protect sensitive environments • E64 Archaeology identifies constraints to development affecting archaeological interests	ES section on cultural heritage assesses these effects

5.4 References

- Afan Borough Council and West Glamorgan County Council. Upper Afan Valley Local Plan 1982;

- Borough of Port Talbot Cwmafan, Bryn, Goytre Valley and Rural Margam Local Plan 1990;
- West Glamorgan County Council. West Glamorgan Structure Plan 1996;
- Port Talbot Borough Council. Port Talbot Local Plan 1996;
- Borough of Neath. Neath Local Plan 1994;
- Neath Port Talbot County Borough Council. Neath Port Talbot Unitary Development Plan. Pre Deposit Consultation 2000;
- Ogwr Borough Council. Ogwr Local Plan Written Statement and Proposals Map 1995;
- Bridgend County Borough Council. Bridgend Unitary Development Plan Deposit 2000;
- Brecon Beacons National Park Authority. Brecon Beacons Local Plan 1999;
- Brecon Beacons National Park Authority. Brecon Beacons Unitary Development Plan Consultation Draft 2002;
- Rhondda Cynon Taff County Borough Council. Mid Glamorgan Replacement Structure Plan 1999;
- Rhondda Cynon Taff County Borough Council. Rhondda Local Plan (including waste policies) 1998;
- Rhondda Cynon Taff County Borough Council. Cynon Valley Local Plan Deposit Version 1997;
- Rhondda Cynon Taff County Borough Council. Cynon Valley Local Plan Proposed Response to the Inspectors Report and Proposed Modifications to the Deposit Local Plan 2000;
- Welsh Office. Technical Advice Note 8 (1996) Renewable Energy;
- National Assembly Wales. Planning Policy Wales 2002;
- National Assembly Wales. Economic Development Committee, Report for Consultation. Review of Energy Policy in Wales. Part 1: Renewable Energy. 2002;
- National Assembly Wales. Climate Change, Learning to Live Differently 2001.

6. Site Selection and Alternatives

6.1 The Renewables Obligation

The Renewables Obligation (RO) came into effect on the 1 April 2002. From this date all licensed electricity suppliers were required to provide 3% of their electricity sales from renewable sources in the period to March 2003, rising to 10.4% of sales for the year ending March 2011. For the longer term, even more ambitious targets are expected to be set. The UK Government intends that the Obligation will form the framework for the development of renewable energy in this country up until at least 2027.

The RO effectively replaces the Non Fossil Fuel Obligation (NFFO) system, which had been the main driver behind renewables. Unlike the NFFO system, there is no competitive bidding for power purchase contracts. Under the RO, the electricity supply company pays a penalty (currently 3p/kWh) if it does not meet its obligation and the resulting penalties are recycled back to the supply companies in proportion to how much renewable energy they have supplied.

NWP is a wholly owned subsidiary of Innogy which is an integrated energy company and who are part of the RWE group. A sister company to NWP is Npower, the country's leading licensed electricity supply company. For this reason Npower has the largest Renewables Obligation within the UK which will, in part, be met by wind farms developed by NWP. Innogy Hydro, another division of Innogy also supply Npower with renewable electricity.

6.2 Site Selection process

This section describes the process and criteria by which potential wind farm sites are selected by National Wind Power (NWP). It explains how they where used to identify the Ffynnon Oer Wind Farm location and how consideration was given to other locations within the County Borough of Neath Port Talbot.

The selection of an appropriate site for a wind farm is a complex and lengthy process that involves the examination and balancing of a number of technical, commercial and planning and environmental issues.

6.2.1 Land Acquisition

Acquiring land for wind farm development has two possible start points. The first is a top down approach in a given area e.g. a Unitary Authority, prioritising areas for renewable development based on selection criteria. The second is assessing land that has been suggested by individual or groups of landowners as a result of their own initiative or in response to advertisements. Critical to either approach is the ability to secure the land under an agreement.

There are economies of scale to be considered in selecting sites for wind farms. Larger sites that can accommodate larger numbers of turbines will be more viable than smaller sites. It is therefore important to consider the 'potential wind power installed capacity' alongside other factors considered below.

6.2.2 Technical and Environmental

Irrespective of the start point, a desk study of each potential site must be undertaken to establish its suitability, viability and likely planning prospects. Such a desk study includes but is not limited to the following criteria:

Practical Considerations:

- Wind characteristics (initially based on the Noabl average);
- Availability of suitable grid connection;
- Construction considerations (including ground conditions, access and highway issues among others, availability of roadstone on or close to site).

Planning and Environmental Considerations:

- Planning policies at regional and national levels;
- Noise levels and relative proximity to sensitive receptors;
- Ecological considerations and presence of designated habitat and use of site by designated species;
- Existing land use and opportunities for enhancement;
- Existing site infrastructure;
- Archaeology and historic landscape issues;
- MOD and civilian aircraft issues (including radar and low flying).

This scoping process may also identify additional sites in the locality, or requirements for additional land in order to make the original site viable. If the process indicates that a site does have potential, NWP seek to carry out on site measurements and surveys to confirm its suitability. Such site work is carried out on the basis of reaching a formal agreement with the landowner(s) to allow for access, the siting of test equipment and surveying activities to be carried out.

Where tests suggest a site will be viable, a legally binding long term contract is agreed with the participating landowner(s). This allows for access, the siting of the wind turbines and access tracks and for the operation of the wind farm throughout its life, whilst minimising any disruption to the landowner's existing agriculture or land management activities. Given the capital investment required for the planning and construction of the wind farm these agreements are entered into prior to the submission of the planning application.

6.3 The Ffynnon Oer Wind Farm Site

6.3.1 Site History

The Ffynnon Oer Wind Farm site first came to the attention of NWP in 1993 following the landowner responding to advertisements in the local farming media. The above practical, planning and environmental considerations were applied in assessing the site's suitability as a

site for a wind farm. In addition to this a preliminary Landscape and Visual Assessment was undertaken by ADAS, which concluded:

> "*My preliminary evaluation is that the site is a favourable one for the location of a wind farm as there would be few primary or significant views of the wind farm from surrounding settlements. The fact that most of the site lies outside specially designated landscape areas is also an advantage*"
>
> (Mike Davis, Landscape Architect, ADAS, 1994)

The results of the site selection considerations are detailed below and do not include for the detailed investigations that have formed part of this EIA process. From the assessment it can be seen that the site was considered an excellent location for a wind farm and so following a successful period of wind speed monitoring an application was made for a power purchase contract under the third tranche of the Non Fossil fuel Obligation (NFFO) system. At the time the NFFO system was the enabling mechanism for renewable energy projects. Unfortunately the Ffynnon Oer Wind Farm site was unsuccessful with its application as it could not compete with the very windiest sites available in England and Wales. The site was not progressed further until 2001 when it was known that the RO was likely to become legislation.

6.3.2 Preliminary Considerations

Land Area:
The Ffynnon Oer site has around 150 ha of useable land on which to site wind turbines, which is ideal for a medium sized wind farm.

Wind Speed Assessment:
An anemometer mast was successfully installed at the site at SS846988 during the summer of 1995 and wind speeds were successfully recorded for several months. The results from this exercise confirmed that the site has a sufficient wind resource for a viable wind farm project. A second area to the north of the site SN845005 was also monitored, however the average wind speed was found to be too low for a viable wind farm project.

Grid Connection:
Preliminary studies showed several grid connection options, one to the Northeast (33 kV) and a second to a sub-station (66 kV) to the South.

Construction Considerations:
The proposed site is one of a relatively flat plateau on two levels, one at approximately 400-450 m above sea level and the second at 350-400 m above sea level. Although an area of degraded (drained) peat lies in the centre of the site, this would be largely avoidable through design and micro-siting.

Site access would be possible via existing forest access tracks from the A4061. These access tracks were found to be of the highest grade that the Forest Enterprise construct. Prior to the forest access tracks the A4061, A465 and the M4 were all deemed suitable. No villages or towns would be impacted upon along this route.

Whilst not essential, the existence of a open cast site with the potential to supply road stone without using public roads was also identified as having the potential to reduce the local effects of the project.

6.3.3 Planning and Environmental Considerations

Planning Policy
No national designations were found to apply. A review of local designations concluded that part of the site was classified as a Special Landscape Area within the Port Talbot Local Plan 1996-2006. Note this plan had not been formally adopted.

Noise
No local communities were within 2 km of the centre of the site and the closest property was at approximately 600 m. Initial modelling therefore showed that a wind farm could be designed with the relevant criteria regarding noise.

Ecological Consideration
A full study would be required, however the land was generally improved grassland used for grazing of sheep and cattle. The area of peat at the centre of the site had been drained to improve the grazing potential and surface grips added to improve grazing potential.

Existing Land Use
The existing land use (grazing) would be able to continue following the construction of a wind farm. No PROWs cross the site although several are close by.

Existing Infrastructure
Forest access tracks would reduce the need for new tracks to be constructed. On the actual site, several kilometres of existing tracks, albeit in bad repair, were found to exist.

Military and Civilian Aircraft
The area lies outside MOD low flying areas and over 30 km from civilian and military airports.

6.4 Alternatives in the Neath Port Talbot County Borough Area

In early 2002, the selection criteria were used to assess the potential for other wind farms within Neath Port Talbot County Borough. This was driven by the UK wide move towards devolved targets based on what an area can contribute and aimed at ensuring that every area plays its part in reaching the target of 10% of electricity supply being generated by renewable methods. Table 2.2 shows how the area of Neath Port Talbot County Borough can be reduced from an initial 450 to 69 square kilometres following the application of the selection criteria as described.

An additional screening criteria involving land under current forestry use has been included. It is the view that this land is not openly available to wind development companies, until it is cleared it has an existing permanent land use.

The result of this process was that a total of approximately 13 square kilometres was defined as being suitable for a medium sized wind farm development with Neath Port Talbot County Borough.

Table 6.1 Neath Port Talbot Land Area Assessed Using NWP Criteria

Column Heading	Area ($km^{2)}$
Total Area	450
Area with windspeed > 7 m/s	80
Area > 7 m/s, > 600 m from residences	69
Area > 7 m/s > 600 m from residences, non forested	13

The remaining 13 kilometres were then subject to desk studies which at all times used the Ffynnon Oer site as a benchmark. The following brief descriptions summarise the rationale for concluding that the Ffynnon Oer site provided the best prospects. Other sites were viable though presented a broader range of unresolved technical, planning and environmental issues.

6.4.1 Mynydd Marchwell SN760025

Wind speed prediction models estimate this site has a sufficiently high annual wind slightly lower than the Ffynnon Oer site. The site is of a ridge nature with the spine of the ridge aligned in unpreferred SW/NE direction. The ridge has steep access gradients, which could create difficulties for construction in relation to Ffynnon Oer.

6.4.2 Mynydd-y-Gaer SS765935

Wind speed prediction models estimate this site has a sufficiently high annual wind speed albeit slightly lower than the Ffynnon Oer site. The site is of a "point" nature with a very small plateau compared to Ffynnon Oer, and has an archaeology feature occupying most of the area suitable for turbines. Site access would be via C class roads, which may require upgrading and via a relatively large community with housing directly adjacent to the road including at critical junctions.

6.4.3 Foel Trawsant SS840942

Wind speed prediction models estimate this site has a lower annual wind speed than the Ffynnon Oer site. The site is of a plateau nature similar in size to the Ffynnon Oer site. Site access would be via either of two A class roads, however following the driving of these routes it is expected that significant upgrading would be required if access was possible at all. This is in contrast to the Ffynnon Oer site.

6.4.4 Cefn Morfudd SS790973

Wind seed prediction models estimate this site has a lower annual wind speed than the Ffynnon Oer site. The site is of a plateau nature similar in size to the Ffynnon Oer site, however a

significant percentage of the plateau is forested. Site access would require the use of A- C class roads via communities with steep gradients and sharp bends, which have housing adjacent. This is contrast to the Ffynnon Oer site.

6.4.5 Ergyd Isaf SS795887

Wind speed prediction models estimate this site has a similar wind speed to the Ffynnon Oer site. The site is of a plateau nature similar in size to the Ffynnon Oer Site. Access is via A-C class roads, the later of which is likely to require some upgrading unlike the Ffynnon Oer site. Final access would be via forestry tracks due to gradients within the forest. The land is completely designated as an SLA, in contrast to Ffynnon Oer site.

6.4.6 Mynydd Uchaf SN720100

Wind speed prediction models estimate this site has a similar wind speed to the Ffynnon Oer site. The site is of a plateau nature similar in size to the Ffynnon Oer Site. Access to the site would be via A-C class roads, which are likely to need upgrading. Although no local or national designation applies to the site, it is closer to the Brecon Beacons National Park (being approx 3 km from the Park boundary).

6.4.7 Hirfynydd SN825055

Wind speed prediction models estimate this site has a similar wind speed to the Ffynnon Oer site. The site is of a ridge nature with the ridgeline in the unpreferred SW/NE direction. The East facing slope is currently forested reducing the area available. A small plateau does exist. Access would be off A class roads, however a preferred route is not obvious. No local or national landscape designation applies to the site, however it is within 5 km of the Brecon Beacons National Park.

6.5 Conclusion

Whilst it is several years since the Ffynnon Oer site came to the attention of National Wind Power, the initial analysis and reason for selection are still valid. Although a benchmarking exercise involving all land deemed available within the Neath and Port Talbot County Borough has identified a number of sites which could be appropriate, Ffynnon Oer is judged to offer best fit in terms of Practical, Planning and Environmental criteria.

7. Socio-Economic and Community Issues

7.1 Introduction

The development of the wind farm may give rise to a number of socio-economic and community impacts which require assessment. These potential impacts may affect principally the local communities of Resolven, Croeserw Abercregan, Cymer Duffryn and Glencorrwg all of which are located within a 4 km radius of the site and within the district of Neath and Port Talbot. However the implications of siting the Wind Farm on the perceptions of visitors to the area, particularly those intending to visit existing and proposed attractions will also be considered.

7.2 Methodology

Published information provided by Neath and Port Talbot County Borough Council and the National Assembly of Wales has been used to provide a socio-economic and visitor profile of the area within which the wind farm would be located. The potential impacts of the proposed development on this baseline is then assessed using information commissioned by a range of organisations including National Wind Power into the public perception of wind turbines both throughout Wales and in respect of the communities surrounding this proposal.

7.3 Baseline Description

7.3.1 The Socio Economic Profile

Neath Port Talbot CBC

In March 2000 the unemployment rate of Neath Port Talbot was 6.1% against a Welsh average of 5.9% and UK average of 4.9%. Basic unemployment rates however do not in themselves provide a true picture of the socio-economic conditions of an area. This is better provided by an Index of Multiple Deprivation against which Neath Port Talbot ranks from the third to the sixth most deprived local authority area in Wales. These different positions arise because of the number of different methodologies used by the National Assembly to assess relative deprivation. The Neath Port Talbot Community Plan 2002-2012 refers to the Welsh Multiple Deprivation Index that was complied by Oxford University in 2000 on behalf of the National Assembly. This index is based upon a range of factors that can be used to judge the relative deprivation of one area compared to another, and include income, employment, health, education, housing, accessibility and child poverty. The areas used in the index are the 865 electoral wards in Wales, the 100 most deprived awards are being targeted by the Assembly for resources.

The proposed wind farm development is located principally within the Cymmer Ward with part in Pelenna and Resolven Wards. The settlements of Croeserw, Abercregan, Cymmer and Duffryn to the south of the site, are within the Cymmer Ward. The settlements of Tonmawr and

Efail-fach are within Pelenna Ward and Resolven is within the Resolven Ward. The site is also adjacent to the Glyncorrwg Ward which has the settlement of Glyncorrwgy within. Cymmer is ranked as the 8th and Glyncorrwg as the 24th most deprived wards in Wales, first and second in terms of deprivation within Neath and Port Talbot. Resolven is ranked at 278 in Wales.

The ranking for Cymmer and Glyncorrwg wards against the range of factors is shown in Table 7.1.

Table 7.1 Cymmer and Glyncorrwg Relative Deprivation

Factor	Welsh Ranking (lower figures indicate greatest deprivation)	
	Glyncorrwg	Cymmer
Employment	10	1
Health	6	3
Income	98	70
Education	74	29
Child Poverty	92	71
Overall Ranking (out of 865)	24	8

Source: Neath Port Talbot Community Plan 2002-2012

In order to address issues of deprivation the Neath Port Talbot Community Plan seeks amongst other things to tackle many of the inherent weaknesses that it has identified in the economy. It notes that jobs are fundamental to community prosperity, providing the basic income that determines local living standards and in turn the quality of life and the health and social well being of communities. The area has witnessed an increasing number of job losses, over 5700 partly offset by 3000 job gains. The availability of Objective 1 monies has enabled the Council to develop a strategy founded upon the development of skills and capabilities within the communities. Specific targets are laid down to be achieved by 2006, they include a reduction in unemployment and the delivery of community development initiatives in the 10 most deprived wards.

7.3.2 Tourism

The Neath Port Talbot Tourism Study was published by the County Borough Council and Wales Tourist Board in November 2000. This study sought to profile tourism in the County Borough. The table below demonstrates that its share of the market sector is generally small compared with the three other local authorities that make up Southwest Wales (Pembrokeshire, Carmarthenshire and Swansea).

Table 7.2 Visitors to Neath Port Talbot

1998	Percentage of Wales Share			Percentage of S W Wales Share		
	Trips %	Nights %	Spend %	Trips %	Nights %	Spend %
UK Visitors	1.0	1.0	0.7	3.8	3.9	2.4
Overseas Visitors	1.3	1.3	1.0	6.8	6.7	4.8
Tourism Day Visits	2.3	-	2.8	11.7	-	15.7

Source: Wales Tourist Board - taken from the Neath Port Talbot Tourism Study 2000

The table also illustrates the relatively increased strength of the day visitor market to the County Borough compared with longer stays.

In order to improve the attractiveness of the County Borough the Tourism Study suggested the following strategy:

- raise the profile of the tourism product by building upon existing strengths;
- re-focus, rationalise and brand promotional print;
- raise the quality of the existing tourism infrastructure;
- create stronger partnerships within the industry.

This strategy leads into the Action Plan which contains a range of actions to promote Neath Port Talbot as a visitor destination. Actions considered relevant to the wind farm development proposal are:

- Development of Afan Forest Park:

  The Park is one of South Wales's leading cycling resources. It is attempting to position itself as a future centre of excellence for off-road cycling, with walking and orienteering as supporting product offers.

- Cycle Route Development:

  The County Borough Council aims to fill in the gaps identified in the existing cycle route network including:

  - Cymmer to Glyncorrwg;
  - Extension of the Bryn Cycletrack to provide a circular route in Bryn and a link to the COED Morgannwg Way.

7.3.3 Other Developments

There are also proposals for an adventure holiday park just to the west of Croeserw for which a planning application has been submitted. This potentially provides a significant source of employment in this area.

7.3.4 Public Attitudes to Wind Farms

Public Attitudes to Wind Energy in Wales, Friends of the Earth Cymru

Published in September 2002 this short study sought to identify the level of public support for wind energy in Wales. A total of 500 adults were interviewed by telephone between 23 August to 2 September 2002. Quota were placed on gender and region. Five regions were used including 'Valleys' which consisted of Blaenau Gwent, Caerphilly, Merthyr Tydfil, Neath Port Talbot, Rhondda Cynon Taff and Torfaen. The results of the study should that 71% of adults stated that they would support a doubling of wind turbines on land in Wales. Support was highest in the SE Wales region (75%) followed jointly by Valleys and North West Wales (71%).

RSPB Research

The RSPB undertook a survey of 1000 people between September and October 2001 to investigate public opinion on energy issues, specifically:

- Awareness of different sorts of electricity power station and views on building them in future;
- Views on the disadvantages of particular methods of electricity generation;
- Awareness of the contribution to climate change made by certain methods of electricity generation;
- Whether views on the future of energy differ depending on whether people know about the perceived links between certain methods of electricity generation and their contribution to climate change.

Amongst other things the research found that:

- Two thirds of the public (68%) do not think nuclear power stations should be built in Britain in the next ten years and four fifths (82%) would not want a nuclear power plant built within three miles of their home;
- Nearly 4 in ten of the public (38%) think coal-fired power stations should not be built in Britain in the next ten years, while three in ten (29%) do not want oil-fired power stations to be built. Furthermore, 45% of the public would not like coal-fired power stations within three miles of their homes, while 38% reject the idea of oil-fired stations within three miles of home;
- By contrast, only 3% of the public are opposed to building on-shore wind farms in Britain, and only 14% do not want on-shore wind farms within 3 miles of their home.

The research also found that the public was generally well informed of the climate change debate and could link power generation through fossil fuels to production of greenhouse gasses.

Research Thesis on Behalf of the Welsh Tourism Board

Published in May 2001 this research sought to investigate the impact of wind farms on tourism in Wales. It combined desk-based and fieldwork research including a questionnaire survey of 905 domestic and foreign visitors from which there was a 14.5% (138) response rate.

The findings that came out of the questionnaire were that most people believe that the contribution of wind farms to clean energy production outweighs their impact on the landscape. Almost all visitors questioned (96%) said that they would not be put off visiting Wales if more wind farms were to be developed and 69.3% would visit an information centre if it was built.

Other General Research

Between 1990 and 1996 there were 13 studies by different independent research groups into attitudes to wind power in the UK. In total these studies have canvassed the opinion of over 3500 people. All the studies show that the majority of residents who live near a wind farm are in favour of generating power from the wind and are comfortable with a wind farm in their area. The principle issues of concern in all cases were noise and visual impact. However once operating it was shown that the majority of residents were unconcerned with these aspects. Table 10.4 shows the overall results of the surveys and included in the table are three further studies completed between 1997 and 2002.

Further to these studies, the Scottish Executive in 2002 completed a detailed study of people living in different zones of proximity to wind farms in Scotland. The results are summarised in the following bullet points:

- Respondents were generally positive about wind farms. Those who live nearest a wind farm are more likely to provide positive responses when asked about the wind farm than those in the other zones. For example, while 67% overall reported that there was something they liked about the wind farm, this proportion increases to 73% of those living in the high proximity zone (up to 5 km from a wind farm);
- The proportion of respondents who had anticipated problems prior to the development (40%) was far higher than the proportion who actually experienced problems after the development (9%). Actual noise caused by the turbines or the visual impact of the wind farm did not feature as issues for the large majority of respondents;
- Only 2% of respondents said that they disliked the wind farm because it was noisy, and although 12% of respondents had expected to experience a problem with noise, only 1% had actually experienced a problem;
- Respondents showed low levels of awareness of consultation by either the wind farm developer or the local authority. Twenty percent were aware of consultation being conducted by the wind farm developer and 17% were aware of consultation by the local authority. The most common source of information about the wind farm was local newspapers (42%), with only 7% gaining information from the local authority or the developer;
- When asked about potential future wind farm development, the positive attitude towards the wind farm is reflected in the fact that only 14% of respondents would be concerned if extra turbines were added to the existing wind farm;
- Respondents would be more concerned if a new wind farm development was proposed for their local area, with 27% saying they would be fairly or very concerned.

Although respondents were generally positive about the farms and most would not be concerned about future development, the majority think that wind farms should be located in uninhabited areas and high on hills.

Table 7.3 Findings of Research into Public Attitudes Towards Wind Farms

Location	Sponsor/Organiser	Date	In Favour	Against	Don't Know
Delabole	DTI	1992/1993	84%	4%	11%
Cemmaes	DTI	1992/1993	86%	1%	13%
Llandinam	CCW	1992/1993	83%	3%	14%
Llangwyryfon	CCW	1992/1993	78%	8%	14%
Llandinam	BBC	1994	76%	17%	8%
Rhyd-y-Groes	BBC	1994	61%	32%	7%
Taff Ely	BBC	1994	74%	9%	17%
Kirkby Moor	National Wind Power	1994	82%	9%	9%
Bryn Titli	National Wind Power (pre construction)	1996	68%	14%	19%
Bryn Titli	National Wind Power (open day)	1996	94%	3%	3%
Trysglwyn	National Wind Power (open day)	1996	96%	4%	-
Coal Clough	Liverpool University Dissertation	1996	96%	4%	-

7.4 Predicted Impacts and Effects

7.4.1 Construction

The construction of the wind farm, which will involve an investment of £16 million by National Wind Power which will in turn bring the opportunity for significant direct economic benefits to Neath and Port Talbot and the region.

Subject to planning permission being granted, National Wind Power would put the contract for the supply of the turbines and the construction of the wind farm out to competitive tender. 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. Bids for some aspects of this work can be anticipated to be likely from local companies. This could result in as much as £3 million being spent in the region with local firms.

The assumption provided above are based upon the experience of National Wind Power in the development of the Wind Farms throughout the UK.

In addition to the potential economic benefits to the Region the development of renewable energy presents opportunities for Welsh companies to benefit in the longer term from a reliable source of energy at a competitive price. This is recognised in the Consultation Report of

April 2002 issued by the Economic Development Committee of the National Assembly. This was referred to earlier in this document.

7.4.2 Operational

Following the completion of the wind farm the on-going servicing and maintenance will require 1-2 people to visit the site twice a month. Minor and major servicing will take place at six and twelve month intervals respectively. Depending on the nature of the work required servicing could be carried out either by NWP or contractors.

Following construction National Wind Power propose to erect interpretative signage along the Coed Morgannwg Way as it crosses the site of the proposed wind farm. These signs will explain the importance of renewable energy to users of the footpath and identify local points of interest.

Tourism and leisure sectors offer some opportunities for increasing employment and economic activity within the district. The results of the thesis commissioned by the Welsh Tourist Board demonstrate that the presence of the wind farm may not be detrimental to these new opportunities and indeed may become a point of interest in its own right. There is the potential for a positive effect associating the renewable technology with the positive environmental image of cycling and outdoor recreation activities.

It is NWP company practice to establish a fund to support local communities that include, or are adjacent to an operational wind farm. Two options are provided, the first which provides £21 000 pa for the life of the project, the second which provides a lump sum, followed by lower annual payments in later years. Due to the Assisted Areas status of Neath Port Talbot there is a third option that is open to the communities surrounding Ffynnon Oer. NWP are investigating the possibility of securing European Regional Development Fund Objective 1 funding from the Welsh European Funding Office to allow the community to purchase one of the 16 wind turbines. This would allow the community to earn all the revenue generated by this turbine, between £120 000 to £140 000 pa for 20 years. NWP would contract to manage and maintain the turbine and the sale of its output on behalf of the community.

7.5 Evaluation of Effects

7.5.1 Criteria for Evaluation

The criteria for evaluation have been summarised in section 2 of the ES. In respect of the policy context the definitions used for the socio-economic assessment are:

- National (UK/Wales), regional (Southwest Wales), district (Neath Port Talbot) or local (within 5 km of the site boundary) importance.

7.5.2 Evaluation

Table 7.4 summaries the effects of the proposed development upon the socio-economic and community factors and assesses the significance of those effects.

Table 7.4 Effects and Evaluation of Significance

Socio-Economic Effect	Type of Effect	Probability of Effect Occurring	Policy Importance or Sensitivity	Magnitude of Effect	Significance Level	Significance Rationale
Contribution to the overall percentage of renewable energy generated	+ve	Certain	UK/National	Medium	Minor	Development would contribute kWhr/annum of renewable energy.
Maintenance of and increase in existing employment (both direct and indirect) during construction	+ve	Certain	Regional/Local	High	Minor	Maintain and increase construction jobs in areas which rely more heavily on that sector than others.
Maintenance of and increase in existing employment (both direct and indirect) during operation	+ve	Unlikely	Regional/Local	Low	Minor	The level of jobs created by the development will be 1-2.
Installation of interpretation signage along Coed Morgannwg Way	+ve	Likely	Local	Medium	Minor	Improvement to interpretation facilities.
Adverse effect on economy and employment in tourism and leisure sector	-ve	Unlikely	District	Low	Not significant	Survey findings show that most visitors are broadly neutral to the concept of wind farms.
Positive effect of economy and employment in tourism and leisure sector	+ve	Unlikely	District	Low	Not significant	Survey findings show that most visitors are broadly neutral to the concept of wind farms
Establishment of Community Fund and possible community purchase of one turbine	+ve	Likely	Local	High	Major	A regular substantial income for community groups if funding is provided to purchase one turbine

Key:	Type	Probability	Policy Importance	Magnitude	Significance
	- = Negative + = Positive ? = Unknown 0 = Neutral	Certain Likely Unlikely	UK National (Wales) Regional District Local	High Medium Low None	Major Minor Not Significant

7.6 Summary and Conclusions

Neath Port Talbot continues to suffer from a declining manufacturing base and this is evidenced by the higher than average unemployment figures. Furthermore the Borough contains wards which are some of the most deprived in Wales. Cymmer itself ranks 8th.

The wards which include or adjoin Ffynnon Oer are Resolven, Cymmer, Glyncorrwg and Pelenna with the first three containing settlements close to the site. The Neath Port Talbot Community Plan recognises that the inherent weaknesses within the economy need to be addressed in order to improve the overall quality of life for residents. Tourism can play an important role in the economy of the area. Whilst visitors do come to Neath Port Talbot few stay for more than one day and the Council, through its Tourism Strategy has outlined a number of actions to improve the Borough as a visitor destination.

Recent research demonstrates that the majority of residents and visitors to areas with wind farms do not consider them to be detrimental to the quality of their experience and indeed recognise them as a point of interest within the landscape. The development of Ffynnon Oer should support the aims of the Tourism Strategy.

It is also probable that the development of the wind farm will inject financial resources into the local economy and community. It should provide support the construction sector within the region.

7.7 References

- Neath Port Talbot County Borough Council Economic Development Strategy 1999-2002;
- Neath Port Talbot Economic Development Review and Action Plan 2001-2002;
- Neath Port Talbot CBC and Wales Tourist Board Tourism Study - Strategy and Action Plan;
- Neath Port Talbot Community Plan 2002-2012;
- Statistics for Wales - Mapping Social Exclusion. National Assembly for Wales March 2000;
- The GB public's views on energy issues: RSPB 2001;
- A Summary of Research Conducted into Attitudes to Wind Power from 1990-1996. British Wind Energy Association;
- The Impacts of Wind Farms on Tourism in Wales May 2001. Nicole Hofmans. Thesis, Netherlands Institute of Tourism and Transport Studies;
- Public attitudes to wind energy in Wales. Friends of the Earth Cymru, by Market Research Wales Ltd. September 2002.

8. Cultural Heritage

8.1 Introduction

This section assesses the effect of the development on features of cultural heritage. The study has been carried out by Entec UK Ltd. Figure 8.1 shows the location of features and areas of cultural heritage interest discussed in the text, in relation to the proposed development. This is an indicative plan for ease of reference.

8.2 Methodology

Cultural heritage is represented by a wide range of features, both visible and buried, that result from past human use of the landscape. These include standing buildings, many still in use, sub-surface archaeological remains and artefact scatters. It also includes earthwork monuments as well as landscape features such as field boundaries and industrial remains.

The importance of cultural heritage remains is recognised in both legislation as well as national and local policy. Certain features that are deemed to be of particular importance are given legal protection through the *Ancient Monuments and Archaeological Areas Act 1979* (Scheduled Ancient Monuments), and through planning legislation (Listed Buildings).

Further advice on how archaeology should be treated in Wales was formerly given by Planning Policy Guidance Note (PPG) 16 (Wales). This was partially superseded by Planning Guidance (Wales) *Planning Policy* (1996), but both were replaced by Welsh Office (W.O.) Circular 60/96: *Planning and The Historic Environment: Archaeology*, 1996. This states that '*Archaeological remains are a finite, and non-renewable resource, in many cases highly fragile and vulnerable to damage and destruction*' and that '*care must be taken to ensure that they are not thoughtlessly or needlessly destroyed*'.

Further advice on planning and the historic environment is given in W.O. Circular 61/96: *Planning and The Historic Environment: Historic Buildings and Conservation Areas* (and amendment Circular 1/98), which is the equivalent for Wales of the English guidance in PPG 15, *Planning and the Historic Environment* (1994).

The presence of cultural heritage features is therefore a consideration in determining planning applications, and early consultation with the local authority is encouraged in planning guidance (including that discussed above). Where there is a reason to believe that cultural heritage features may be affected by a development proposal then the first step is often the preparation of a desk-based assessment. This involves the collection of existing information that can assist in the assessment of the likely or potential impact of the development.

Site-based investigations may subsequently be required to clarify further the nature and extent of identified features. This is termed archaeological evaluation and includes field walking, geophysical survey and limited area excavation. A local authority archaeologist may request that such investigations are carried out prior to determination of a planning application if there

is insufficient information available from desk-based research to allow an 'informed and reasonable' decision to be reached.

8.2.1 Scope

In completing a desk-based assessment of the effects on cultural heritage of development it is crucial to define the known and potential nature of features that may be involved. This requires consideration of a number of factors:

- Development can affect features of cultural heritage interest not only through direct impacts (e.g. land take) but also indirect impacts, such as the setting of monuments.
- Desk-based assessment involves a review of current information only and there may be further features within the site that are not yet known. The potential for this may be assessed from the conditions of the site, features within the wider area and a history of land use within the site.
- Not all cultural heritage features are considered of equal "importance" and it is important to identify the significance of the features. This is done through reference to legislation, policy guidance and professional judgement.

8.2.2 Direct Effects

Information is required on any features that are known to be or could potentially be within the area directly affected by the proposed development. This includes the footprint of both the built area and those to be landscaped and managed as part of the overall scheme. To this end the following data sources were consulted:

- Sites and Monuments Record (SMR; a county based register of known archaeological and historical sites);
- The National Monuments Record (NMR);
- Register of Landscapes, Parks and Gardens of Special Historic Interest;
- Cartographic and historic documents;
- Aerial photographs;
- Place and field name evidence;
- Published sources.

These were obtained from the following organisations:

- Glamorgan Gwent Archaeological Trust (GGAT);
- CADW: Welsh Historic Monuments Executive Agency;
- Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW);
- West Glamorgan County Archive Service (WGCAS).

The assistance of these bodies is gratefully acknowledged.

A site walkover was also undertaken in order to view known sites of potential significance and to assess the general ground conditions.

In order to place the proposed development in its local context and to help identify the potential for known and unknown features of cultural heritage interest, data was collected for a study area extending 500 m from the proposed application area.

N.B. This assessment was originally undertaken to include a proposed access route from Glyn Gwilym Farm to the application area using existing farm tracks. Since the inception of the EA use of existing forest rides for access to the proposed wind farm has been agreed with the Forestry Commission. Features of cultural heritage interest identified as a result of the original scheme (i.e. coinciding with the access route originally proposed, and within a study area extending 500 m from it), which do not lie within 500 m of the current application area, are not considered by the following text, but remain in the tables of data (Tables 8.1 and B1) where they are marked by an asterisk (*).

The Curatorial Division of GGAT provides planning advice to Neath Port Talbot County Borough Council in respect of cultural heritage related issues. This report was undertaken in full consultation with, and according to a written brief prepared by GGAT Curatorial Division, acting on behalf of Neath Port Talbot County Borough Council.

8.2.3 Indirect Effects

Indirect effects on features of cultural heritage interest can occur as a result of significant changes to the setting of a feature, whether permanent or temporary. Based on national policy guidance, this is normally considered more relevant to designated features of national importance, such as Scheduled Ancient Monuments and Listed Buildings.

Indirect effects on features of cultural heritage interest are further discussed in the following text.

8.3 Baseline Description

8.3.1 Existing Baseline

Designated Features

Registers of designated sites have been reviewed and these show that there are no nationally designated cultural heritage features within the application area or surrounding 500 m study area.

SAMs identified by the original assessment which are outside the present study area include a Roman Marching Camp (SAM County No. GL367, 1) and a nearby defended hillside enclosure (GL366, 18), which lie to the north of the application area. CADW were consulted according to the original proposal as to the potential effects of the development on these features, but these will not now be affected. The settings of these features have nevertheless been considered in Section 8.5.

Other Recorded Features

Consultation with the GSMR resulted in the identification of 6 features of cultural heritage interest within the proposed application area, and a further 39 features within the (current) 500 m study area. Those features identified within the proposed application area and those which are encountered by the proposed access route are shown on Table 8.1. Features that lie outside the application area, but fall within the 500 m study area are shown on Table B2 (which is reproduced at Appendix B). The locations of all these features are shown on Figure 8.1. For ease of reference recorded features are numbered, whereas those identified during this assessment are located alphabetically. Features have, where possible, been numbered in a general trend from north to south.

Table 8.1 Features of Cultural Heritage Interest Within the Application Area

Entec No	GSMR/ NMRW No and Status	Grid Ref.	Name: Description	Distance from Development
2	02230w	SS84209910	Stray finds of 3 worked flints: flake, one tool type and other . No function ascribed. Exposure not specified. GGAT 66 Lithics survey 2000 -pre	
3	00686w	SS84069858	Circular earthwork, probably a cairn -BA All cairns are listed on the GSMR as 'damaged'	
4	00684w	SS83919816[1]	Circular earthwork, probably a cairn -BA	
5	00683w	SS83899813	Circular earthwork, probably a cairn -BA	
6	00685w	SS84059801	Circular earthwork, probably a cairn -BA	

AP = Aerial Photograph(s); BA = Bronze Age; C = Century; Ed = Edition; Rom = Roman; RB = Romano-British; Med = Medieval; OS = Ordnance Survey (map source); pMed = post Medieval

Compass points given as N, S, E, W, etc

No Designated Features

The principal remains of cultural heritage interest within the application area are either prehistoric monuments or industrial remains.

It should be noted that little targeted archaeological work has been undertaken within the application area. Furthermore, the relatively undeveloped nature of the site would be expected to have benefited the survival of archaeological remains.

Medieval features are not recorded within the application area and are not expected to be encountered by the proposed access route. However features thought to be of this date survive outside the application area to the north and it is possible that remains of this date may extend within the application area.

[1] The grid reference given by GSMR records appears to be inaccurate. The grid reference as noted by GPS during the site walkover is SS 83907 98199.

8.3.2 Historical Landscape Character

The area is designated by the 'Landscape Study for Neath Port Talbot -History Aspect Technical Report' (Graves-Brown, May 2000) within the 'Afan Wallia' character area (named after the former manor of the same name, see below), but the area to the north, including Glyn Gwilym Farm, is within the 'Vale of Neath' character area. The area is considered to be of high value for reasons including the survival of archaeological remains and a stated management aim for the character is as follows (pp. 66): '*The Melincwrt marching camp* [1] *is in a poor state and would benefit from protective measures to mitigate erosion*'.

The application area is dominated by the upland area of Cefn Mawr, which is a steep-sided hill surmounted by a level plateau, much of which, particularly to the north and west is covered by the earthwork remains of previous coal mining. The site also encompasses a lower lying area in the form of a natural terrace to the south and west. The identifiable prehistoric and historic components of the landscape are mostly restricted to the discreet prehistoric features discussed elsewhere in the text, and later changes to the landscape wrought by enclosure and industry. The prehistoric landscape would have been noticeably different to the existing one, and the surviving features, perhaps with the exception of the barrow on Cefn Mawr (**3**), are not defining aspects of the current landscape. Some historical features, namely land boundaries and mining remains, are still prominent, but the character of the present landscape is largely defined by existing commercial forestry and to a lesser extent modern agricultural improvement. Historical aspects worthy of note are the drystone walling on Cefn Mawr, which partly marks the original parish boundary between Glyncorrwg and Michaelston-super-Avon (before turning into Glyncorrwg parish towards Tyle Mawr), and the remains of Blaen-y-Cwm and Cefn Mawr collieries to the north of the application area.

Landscape character is further discussed in Section 9 of this report.

8.3.3 Features Identified During this Assessment

Documentary research and a site walkover undertaken during the course of this assessment has identified a further 21 features of potential cultural heritage interest within the application area, which have not previously been identified from other sources consulted. These are summarised in Table B3 (Appendix B), and their locations are shown on Figure 8.1. For ease of reference those features identified during this assessment are numbered alphabetically in a general trend from north to south. Of those features identified, one (**V**) lies outside the study area to the northwest and has been identified at the foot of the table. Sources consulted during the assessment are further discussed below.

Aerial Photographs

A comprehensive search of aerial photographs was undertaken at the NMRW. The search resulted in 35 photographs, dating from 1946 to 1992, and all of these were viewed. The search made at the NMRW incorporated those photographs held at the Central Register of Air Photography for Wales, and photographs contained within GSMR records were also consulted.

Four features of potential cultural heritage interest were identified from those aerial photographs consulted. Brief descriptions of these are given in Table 8.3 and their approximate locations are shown on Figure 8.1. Three of these (**C**, **M**, **N**) appeared to be roughly circular and would be consistent with either cropmarks indicative of sub-surface features or visible intrusions associated with mineral extraction. The fourth was a square feature (**A**) close to the northwest of Ffynnon Oer, which may represent the footings of a building or even a standing structure.

Other features of potential cultural heritage interest, as discussed elsewhere in this report were also visible within the proposed development area on those aerial photographs viewed.

Documentary Sources

A range of documentary sources were consulted at the NMRW and WGCAS. Published sources and historic maps were consulted.

The boundaries of several parishes meet within the application area. The bulk of Cefn Mawr, and the area to the south and east of the site lies within Glyncorrwg Parish, which is bordered to the north by the parish of Resolven and to the northwest by Clyne; lying to the east and west of Melin Court Brook respectively. These and Michaelston-super-Avon to the west represent only small 'wedges' of the application area. The modern parish boundaries largely reflect the historic boundaries and township sub-divisions of the former parishes of Llantwit-juxta-Neath (or Llantwit Lower) and Michaelston-super-Avon, within the Hundred of Neath, and Glycorrwg. However Michaelston-super-Avon (Higher) formerly extended much further to the east, encompassing most of Cefn Mawr. Resolven and Clyne were formerly hamlets within the larger parish of Llantwit-juxta-Neath, until Clyne became a parish in its own right and Resolven Parish was formed in 1850. The southern part of the site was formerly the township of Michaelstone-super-Avon Higher, forming the northern part of the larger parish of Michaelstone-super-Avon.

The entire area was also historically part of the Manor of Avon (Welsh; Afan) Wallia, which included the parishes of Clyne, Glyncorrwg and Michaelston-super-Avon, in addition to those of Baglan (Higher and Lower) and Blaenwrach. According to deeds held by WGCAS, the manor was in existence from at least 1687 until 1884.

The available Tithe maps and associated apportionments covering the application area and access route were consulted. Those available were Llantwit-juxta-Neath; Resolven and Clyne hamlets, and Glyncorrwg Parish. The route of Cefn Ffordd is clearly marked and named, and other tracks are also shown following very similar courses to the present, including the present route to Glyn Gwilym Farm and the '*Road from Glyncorrwg to Neath*'. Other boundaries also remain substantially unaltered, but there are no indications on this map of any archaeological features. Place and field names shown are mostly landscape descriptions, such as '*Ffynnon Oer*'; 'cold spring', or '*Tarren Cefn Mawr*'; 'great back knoll'. The area to the north of the study area containing Melin Court Camp and the IA hillfort is named simply as '*Caed cae blaen y cwm*' probably 'field at the head of the valley', although '*cae*' has various meanings including fence, hedge and clasp'. The most unusual name identified is '*Gwain pentlwyn du*' given for the western part of Carn Caca, outside the study area to the north, where '*Gwain*' means sheath or scabbard and '*du*' means black, but no translation could be found for '*pentlwyn*' (possibly a personal name). Melin Court Brook is shown here as '*Nant y Banwen*'. No references appear to be shown to coal mining within the application area or along the proposed access route.

The OS 1st Edition of 1884 details coal levels in the general location of Garth Merthyr Colliery, although no name is given. '*Blaen-y-cwm Colliery*' is also shown outside the application area to the north, serviced by a tramway, as shown on current OS editions. Earthworks are also marked in locations denoted on current OS editions as disused trial levels near the southeast boundary of the application area, although it should be noted that the 2nd Edition marks these as old quarries. The dismantled tramway that borders the south of the site is shown in use on this edition. The boundary between Michaelston-super-Avon and Glyncorrwg parishes follows Nant Cregan. A tumulus is shown on this edition in the location of **3**, but none other of the archaeological

features identified elsewhere are shown. The track around '*Taren Cefn-mawr*' (**J**), which follows part of the current parish and district boundary, is also marked as Cefn Ffordd (see also **25**) on this edition, and there is a spring shown at the foot of Cefn Mawr to the northwest, adjacent to this track. Ffynnon Oer is also shown, and several benchmarks are shown along the parish boundary to the east of it.

The OS 2nd Edition of 1900, which represents a revision of the 1st Edition in 1897 shows few more details within the application area than the previous edition. The District boundary between Glyncorrwg and Neath is now shown in its current position. An '*Old Quarry*' is shown in the side of Cefn Mawr directly to the west of Cairn **3** and trial levels are shown further to the west just outside the application area, in the location of the Waun levels. More coal levels are shown at Garth Merthyr Colliery, although here it is shown as '*Gored Merthyr Colliery*'. Blaen-y-cwm Colliery has also developed, and a '*Pile of Stones*' is shown in the location of **23**.

The OS Edition of 1921 identifies 'Cefn Mawr Colliery' in the location where coal workings had already been shown on the 2nd Edition. The tramway marked on current editions is also now shown to the west of Melin Court Brook. Gored Merthyr and Blaen-y-cwm Collieries are now shown as disused. '*Old Trial levels*' and a '*Coal Level*' are now shown in locations marked on current OS editions around Tarren Cefn Mawr. '*Posts*' are shown in various locations around Ffynnon Oer. An '*Old Sheepfold*' is shown at *c.* SS 8410 9905, just outside the application area.

The OS revision of 1914 with additions in 1948, and subsequent editions, show few significant features, although it is worth noting that the revisions of 1948 still omit the cairns **4**, **5** and **6** to the southwest of the application area. The commercial forestry plantation that currently surrounds the application area to the east, west and south is not complete until the edition of 1964, although a large area to the southwest denoted '*Michaelston Forest*' is present by 1948. The only additional feature of potential cultural heritage interest is an unidentified small circular earthwork, which is shown in the approximate location of a cropmark identified during this assessment (**N**, to the north of 'Bol Las').

No features of potential cultural heritage interest other than those discussed were identified.

Site Walkover

A site visit was made on 14 May 2002, by one of Entec's archaeologists. This was aimed at confirming the presence, condition and extent of previously recorded features of cultural heritage interest and identifying any other visible features of cultural heritage interest. General ground conditions were also noted.

A written description of visible features of cultural heritage interest was made and photographs taken. The location of and extent of each feature was measured approximately using a hand-held GPS working with an accuracy of up to 4 m. This is considered an appropriate level of detail for this study.

In the lower lying area of the application area; the natural terrace to the south and west of Cefn Mawr, peat deposits had been revealed by modern drainage channels. Past experience of such deposits suggests that the potential for the preservation of archaeological deposits, and particularly ecofactual evidence within peat deposits, is generally very high, although the extensive agricultural improvement and drainage of the land is likely to have substantially reduced the potential for the survival of such remains within the application area.

No significant boundaries, mature trees or hedgerows were noted that are not indicated on current maps. Several boundaries across the summit of Cefn Mawr represent parish boundaries, one of which is partly represented by a drystone wall (see Section 8.3.2.) and might be considered to be of historic importance.

8.3.4 Predicted Trends

Present land uses within the site include:

- Rough (and some improved) grazing;
- Unrestored past coal workings.

There is some evidence for the degradation of the earthwork remains of cairns within the southwest of the site, since the original survey records were made in the 1950s. In particular the cist internal to one of the cairns (**5**) on the lower lying ground to the southwest of Cefn Mawr is quite prominent. It is not clear whether this is a result of the use of the land for rough grazing, land improvement techniques or environmental factors. This gradual degradation may be expected to continue as a result of present land use.

No significant change to the status of any presently unrecorded sub-surface remains within the application area would be expected from the continued use of the site for current purposes. However commercial forestry activities can be highly damaging to archaeological remains and any expansion of forestry activities into the proposed application area would certainly damage any archaeological remains present.

8.3.5 Information Gaps

There is no further information that could usefully or reasonably have been collected as part of this desk-based assessment.

Where reasonably practicable and where such items exist and were available for the application area, the list of sources stated in the brief prepared by GGAT Curatorial, have been consulted. Exceptions are as follows:

- Complete OS coverage after 1948 has not been obtained. There are sufficiently few changes after this date that later editions were unnecessary;
- Aerial photographs held by NMRW (RCAHMW), Central Register of Air Photography for Wales and GSMR, including those from the OS, RAF and commercial photographs were consulted as part of this assessment. This is considered sufficient for the purposes of this assessment;
- No local archaeological or historical societies were identified with an interest application area.

8.4 Mitigation and Enhancement

There are known features of cultural heritage interest within the application area.

Planning guidance (WO Circular 60/96) states that there is a presumption in favour of preserving *in situ* archaeological sites of national importance. Current proposals do not pose any threat to such sites.

It is appropriate for significant aspects on features of archaeological interest of less than national importance to be mitigated by a programme of archaeological field investigation and preservation by record, if their destruction is unavoidable. Every effort is being made to tailor proposals in order to avoid known features of cultural heritage interest. When a layout has been established there will be the further provision for small changes to turbine locations through micro-siting. Where damage to known features of less than national importance is unavoidable, archaeological recording would represent suitable mitigation.

8.4.1 Further Mitigation

Known features of cultural heritage interest have been avoided where possible. Access tracks will cross the following features according to current proposals:

- Drystone wall (shown on Figure 8.1) on Cefn Mawr;
- Dismantled tramway (**J**) to west of Cefn Mawr;
- Revetted ditch (**R**) in southwest of application area.

A very small portion of these features will be affected and their extent is in any case already recorded by existing OS maps. These features were also photographed during the site visit undertaken for this assessment. A watching brief on works affecting **J** and **R** as part of a 'strip and record' exercise, may provide details as to their construction.

The enclosure feature (**S**) identified during this assessment to the southwest of the application area may be affected by the construction of the access track between turbines 10 and 16, according to current proposals. The extent, nature, quality and date of this feature, and the effect of construction upon it could be established by trial trench evaluation in order to inform any mitigation required. Alternatively there is scope for this feature to be avoided by micro-siting.

Known features within the application area and within the wider area suggest the potential for the survival of further archaeological features and deposits, particularly of a prehistoric date, which have not previously been recorded. Intrusive activity associated with development may therefore encounter archaeological features and deposits, especially in the lower-lying area to the south and west of Cefn Mawr, which is a suitable area for settlement. As noted in Section 8.2.1, there is also a potential for unknown archaeological remains to be present within or beneath the peat noted in this area.

In areas of intrusive activity, such as the excavations of turbine footings, where remains are not known to survive, archaeological monitoring and preservation by record, without prior field evaluation is likely to represent sufficient mitigation. In areas where the topsoil only will be removed and the resulting surface protected by a geotextile membrane, a 'strip and record' exercise may be sufficient.

Table 8.2 Mitigation Incorporated into the Proposed Development

Impact	Mitigation Incorporated into the Proposed Development	Impact Wholly Mitigated?
Construction Phase of Development		
Damage to /destruction of known archaeological remains	• Known remains have been avoided by layout design where possible. Further 'micro-siting' of turbine locations will be used as necessary	No
Damage to /destruction of previously unrecorded sub-surface archaeological remains	• Where such remains are encountered they will be suitably recorded. Further 'micro-siting' of turbine locations may be used to avoid archaeological features identified during construction	Yes
Operational Phase of Development		
No effects identified		

8.4.2 Enhancement

There is the possibility for enhancement of archaeological features as proposals are likely to cause a decrease in the intensity of grazing and a cessation of the improvement of land for agriculture, which can be damaging to earthwork features and sub-surface archaeological remains. It is proposed that the agricultural drainage of the lower lying areas within the application area will be halted, which may have a beneficial effect on sub-surface archaeological remains in that it will stop any further desiccation of any waterlogged remains that may be present.

It is also proposed that the maintenance of an archaeological watching brief on construction could be combined with the survey of some of the features noted during this assessment, in order to enhance the archaeological record. Features which would benefit from this are the possible cairn (**T**) and enclosure (**S**) identified to the southwest of the application area. There is also the possibility of recording cross sections through the linear features affected by access track construction (**J** and **R**).

The presence of the wind farm would also prevent the further encroachment of commercial forestry.

8.5 Evaluation of Effects

In order to assess the importance of an effect upon cultural heritage, features of cultural heritage can be classified in terms of whether they have a local, county or national significance. This can be a subjective process, with features being assessed in terms of their rarity, state of preservation, date, group value and historical associations.

Some sites have a national designation and therefore will always be considered to be of national importance. This applies to scheduled ancient monuments and listed buildings. Listed buildings are graded in importance, with grades I (most important), II* and II. It is worth noting that programmes for reviewing designations are ongoing, so sites that are not designated may be of local, regional or national importance. Criteria for the designation of scheduled ancient monuments and listed buildings are published in WO 61/96 and WO 60/96 respectively.

Effects are also considered in terms of the probability of occurrence and magnitude. Magnitude can be considered in terms of how much impact the development will have on a particular feature. Work which affects only the edge of a feature can be considered to have an effect of lower magnitude, than that which affects more of it.

8.5.1 Evaluation Criteria

Four criteria have been used in our evaluation of the predicted effects of the proposed development:

i) The type of effect, (i.e. whether it is positive, negative or unknown).

ii) The probability of the effect occurring based on the scale of certain, likely or unlikely. If there is uncertainty this will be noted.

iii) The policy importance (or sensitivity) for the evaluation, (i.e. international, national, county, district or local/parish importance). An effect can have a policy importance (or sensitivity) at more than one level.

iv) The magnitude is quantified using a simple scale of major, some, minor or no effect. In some cases it is not possible to quantify the magnitude of impact and therefore not quantified is used in these instances.

The findings in relation to all of these criteria are brought together to give an assessment of significance for each effect, based on professional judgement. Effects are considered to be of major, minor or no significance. Those effects rated "major" equate to the term "significant effects" in the EIA Regulations 1999.

This information is presented in Table 8.3.

In addition to those effects identified in the Table 8.3 the indirect effects on the setting of the SAMs outside the north of the study area was also considered in the early stages of this assessment, and during the site visit. Although there will be some visibility between these and aspects of the development, the nature of the development is such that sight-lines will not be affected. The landscape has already been substantially affected by features which post-date these scheduled sites, particularly industrial activity (coal mining) and commercial afforestation. In addition, the effect caused by development is largely reversible; removal of the wind turbines would restore the original character of the area (with the residual effect of remaining infrastructure). Given these factors and the intervening distance between the SAMs and the application area (over 600 m), the magnitude of effect of the proposed development is therefore considered to be minor and of low significance.

Table 8.3 Effects and Evaluation of Significance

Environmental Effect	Type of Effect	Probability of Effect Occurring	Policy Importance or Sensitivity	Magnitude of Effect	Significance	
					Level	Rationale
Construction:						
Damage to known features of cultural heritage interest - prehistoric remains	-	Unlikely	Local/ Regional	None	Not Sig	It is thought that these features will be avoided by development design
Damage to known features of cultural heritage interest - mining remains and boundary features	-	Certain	Local	Minor	Minor	Remains which may be affected are limited to boundary features and a former tramway, only small parts of which will be affected. The extent and progression of these features is recorded on OS maps, aerial photographs and by photograph as part of this assessment
Damage to known features of cultural heritage interest - other remains	-	Likely	Unknown	Some	Unknown	The enclosure feature (**S**) identified during this assessment to the southwest of the application area may be affected by the construction of the access track between turbines 10 and 16, according to current proposals. The effect of construction on this feature could be established by trial trench evaluation or alternatively the feature could be avoided by micro-siting
Potential for damage to previously unidentified sub-surface archaeological remains	-	Unknown	Unknown	Unknown	Unknown	Potential is reduced by the limited area of intrusion. Preservation by record is likely to represent appropriate mitigation Trial trench evaluation would further establish the presence or absence of such remains
Opportunity for further archaeological investigation	+	Likely	Unknown	Unknown	Unknown	The potential exists for further remains to be encountered. However, intrusive development is limited in area, and this limits opportunity

Table 8.3 (continued) Effects and Evaluation of Significance

Environmental Effect	Type of Effect	Probability of Effect Occurring	Policy Importance or Sensitivity	Magnitude of Effect	Significance	
					Level	Rationale
Operation						
No effects identified						

Key:	Type	Probability	Policy Importance	Magnitude	Significance
	- ve	Certain	International	Major	Major
	+ ve	Likely	National	Some	Minor
	? = Unknown	Unlikely	County	Minor	Not Significant (Not Sig)
		Unknown	District	None	Unknown
			Local/Parish	Unknown	
			Unknown		

8.6 Summary and Conclusions

Current proposals pose no direct threat to the designated features identified by this assessment. Indirect effects on the setting of such features will effectively be less than changes already caused by commercial forestry, and the effect is largely reversible in the event of the removal of the turbines. It should be noted that any proposals which directly affect the SAM of the Roman Camp, which is crossed by the existing track from Glyn Gwilym Farm, would require Scheduled Monument Consent. This SAM is also specifically mentioned by the Neath Port Talbot Landmap Project.

The potential effects of the proposed development on known features of cultural heritage interest identified within the application area will be avoided wherever possible by development design; namely the siting of the wind turbines. Unavoidable damage to known features will be limited to earthwork remains relating to mining activity and boundary features, which are of local importance and already sufficiently recorded by such sources as OS maps.

There is the possibility that development will encounter further archaeological remains that have not previously been identified. Archaeological trial trench evaluation of any larger areas of ground disturbance would further assess the potential for this and inform as to any mitigation required. The archaeological monitoring of smaller areas of intrusive works is likely to represent sufficient mitigation.

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9. Landscape and Visual Assessment

9.1 Introduction

9.1.1 Scope of the Landscape and Visual Assessment

This section analyses the potential landscape and visual changes and consequences resulting from the construction and operation of the proposed wind farm development at Ffynnon Oer. The assessment includes full consideration of the impacts and consequent effects of the access road, any associated buildings and the connection to the national grid. The assessment has been based upon the "*Guidelines for landscape and visual assessment*" (GLVIA) jointly published in 1995 by the Landscape Institute and the Institute of Environmental Management and Assessment[2] and the second edition published in March 2002[3].

9.1.2 Definition of the Study Area

The definition of the study area is a crucial element of the assessment and was undertaken during the Scoping Study. In accordance with paragraph 6.5 of the Countryside Council for Wales guidelines[4] the normal study area radius of 15 km has been extended to a radius of 20 km. This is to ensure that adequate consideration is provided of the potential landscape and visual impacts and consequent effects upon the southern-most fringes of the Brecon Beacons National Park. The closest area of National Park lies approximately 10 km to the north of the proposed wind farm site at the Waterfall Walk in Pontneddfechan. Overall the Brecon Beacons National Park accounts for 16% (195 km^2) of the 1257 km^2 study area.

A study area of a radius of 20 km from Ffynnon Oer will encompass large tracts of open countryside and commercial forestry as well as the towns of Neath, Port Talbot, Bridgend, Maesteg, Hirwaun and the eastern portion of the City of Swansea. It also includes several important valleys with the linear settlement development that is characteristic of this part of South Wales including the upper Rhondda Valley, the Tawe Valley north of Swansea and the Ogmore Valley. Overall the majority of the study area's population live towards its fringes, in particular its southern and southwestern fringes.

The study area also includes a number of important communications corridors that potentially could provide sequential views of the proposed wind farm and both sequential and cumulative views of the proposed Ffynnon Oer Wind Farm and other existing, permitted and proposed wind farm developments in the region (see section 9.8.1). Amongst the potential key road routes are

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[2] Guidelines for Landscape and Visual Impact Assessment. The Landscape Institute and the Institute of Environmental Assessment. Spon Press, London. 1995.

[3] Guidelines for Landscape and Visual Impact Assessment: Second Edition. The Landscape Institute and the Institute of Environmental Management and Assessment. Spon Press, London. 2002.

[4] CCW Wind Policy and Checklists. Undated CCW publication.

the M4 between junctions 35 and 46, the A465(T) along the Vale of Neath, A4067 along the Tawe Valley, the A4107, A4063 and A4061.

It is important to remember that the study area does not provide a boundary beyond which the wind farm will not be seen. Instead it defines the area within which the wind farm may have a significant landscape or visual effect. The process of specific definition of a study area as described above allows the detailed assessment to concentrate upon the area within which the potential significant effects of the wind farm are most likely to occur.

9.2 Methodology

9.2.1 General

The landscape and visual assessment was prepared according to a methodology developed by Entec based upon the previously referenced guidelines. Neath Port Talbot County Borough Council the local authority within whose boundaries the proposed wind farm site and most of the study area are located; have only recently commenced their LANDMAP landscape character assessment. There is therefore no landscape character assessment information available in the recognised LANDMAP format. Hence as part of the baseline studies the methodology of LANDMAP was used to develop a landscape character assessment for the study area. LANDMAP is the recognised tool of the Countryside Council for Wales for Landscape Character Assessments.

Photography is an essential tool in landscape and visual assessment, conveying landscape character and illustrating key views. The second edition of the Guidelines for Landscape and Visual Impact Assessment suggest that a 35 mm film format with a 50 mm focal length lens should be used as the 50 mm cameral lens is commonly accepted to best represent the naked eye. This is the format that this assessment uses for the annotated photographs in Figures 9.7a-g. However we have taken note of the best practice put forward by Scottish Natural Heritage with regard to the landscape and visual assessment of wind farms[5]. This states that experience in assessing wind farms in Scotland demonstrates that with regard to the crucial issue of photomontages, the most accurate visualisations are generated by the use of a 70 mm lens. The photomontages produced to accompany this assessment have been produced in this (70 mm) emerging best practice format.

9.2.2 Baseline Studies

The definition of the study area is followed by the baseline study, which records the existing landscape and visual resource within the study area. The baseline study is presented in five sections; firstly, an overview of the contextual landscape conditions of the study area; secondly, a more specific description of the site area; thirdly, an outline of general visibility across the study area; fourthly a description of landscape designations that are relevant in the evaluation of the landscape and visual resource; and finally a description of the factors affecting visibility.

[5] Guidelines on the Environmental Impacts of Wind farms and Small Scale Hydroelectric Schemes. Scottish Natural Heritage. SNH Publications, Perth, Scotland. February 2001.

9.2.3 Landscape Assessment

Introduction

Landscape impacts consist of the changes in the fabric, character and quality of the landscape. They include changes to the landscape as a resource such as the loss of elements or features or the alteration of the balance of features in a landscape causing a shift in the perceived landscape character.

The assessment of the predicted landscape effects is based upon information gathered through the baseline studies concerning the following factors which, in combination, make up the landscape:

- physical factors - geology, landform, soils, drainage, ecology and climate;
- human factors - archaeology/history, land-use and settlement patterns;
- aesthetic factors - visual and sensual considerations;
- associations - cultural and historic.

Landscape Receptors

The introduction of the wind farm will have *indirect* and *direct* effects on the landscape, with *indirect* effects being those that affect the landscape character and *direct* effects those that physically alter landscape elements. Four aspects of the landscape resource are considered in the assessment, with these being identified through site survey:

- On-site landscape elements that may experience *direct* physical effects;
- The contextual patterns and dynamic of development and broad scale characteristics found throughout the study area that may be *indirectly* affected through the introduction of the wind farm, and these are encompassed in the grain of the landscape;
- The various landscape character types that comprise the study area and that may be *indirectly* altered through the introduction of the wind farm. Landscape character types are drawn from the relevant SNH landscape character assessment documentation and corroborated on site;
- Designated features, such as gardens and designed landscapes and listed buildings that may be *indirectly* altered through the introduction of the wind farm.

Other than the landscape grain, which is considered as a single receptor, each of these categories covers a number of landscape receptors, which are components of the landscape that will be affected by the wind farm.

Types of Landscape Effect

The effect of the wind farm on each identified landscape receptor is classified according to its ability to accommodate the wind farm. This ability is expressed as a variable in the significance classification for the effect upon each landscape receptor, with the following definitions being used:

- **Beneficial** where it is felt to complement or contribute to the landscape, strengthening it or adding positive characteristics and qualities that were not previously available;
- **Neutral** where it neither contributes to nor detracts from the landscape, and can be accommodated comfortably by the landscape context;
- **Adverse** where it introduces elements that are not currently found in the landscape and cannot be accommodated without some detrimental effect.

The ability of landscape receptors to accommodate the wind farm is assessed through professional judgement based on the factors considered in the evaluation of the sensitivity of receptors and the magnitude of the effects and on the knowledge of the study area as a whole that the assessors have gained.

The significance of the effect of the wind farm on each of these landscape receptors is assessed through a combination of their sensitivity and the magnitude of the change that they will experience.

Magnitude

The magnitude of change is an expression of the degree of addition, change or loss that would be experienced by the baseline landscape conditions and is classified as high, medium, low or none.

The following factors are considered in the evaluation of magnitude of change:

- The **nature** of the perceived contrast, or integration, of any new features or changes with the existing landscape including the nature of the turbine layout;
- The **scale** of change in the landscape with respect to the proportion of the landscape affected by the wind farm and the degree to which it is affected;
- The **duration** and **reversibility** of the effect on the landscape.

Sensitivity

The sensitivity of each landscape receptor is dependent on its value and its ability to accommodate the wind farm, and is classified as high, medium or low. This classification is derived from consideration of a number of variables:

- **Landscape quality**: an appraisal of the state of repair or condition of landscape elements, the integrity and intactness of the landscape, and the extent to which its distinctive character is apparent in a particular area.
- **Landscape value**: an appraisal of the importance of the landscape, with consideration given to any national and local designations that may apply, the perceived value of the landscape to users and other consultees, and any intrinsic aesthetic characteristics of the landscape such as scenic quality or sense of place. These may be derived from literature, films, television programmes and guides.
- **Development of the landscape**: the ability of the landscape to accommodate the wind farm will be dependent to a large degree on the existing development within

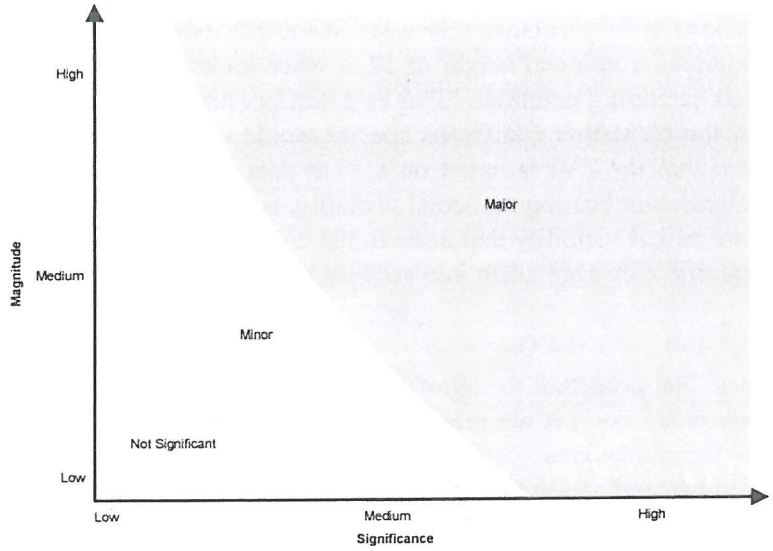
the study area, especially in cumulative views. Landscapes that are already influenced by development similar in some way to the type proposed generally have a greater capacity to accommodate the proposed changes, while those lacking any influence from built form or other human elements may be more susceptible. In this assessment the evaluation of the sensitivity of landscape receptors does assume knowledge of the nature of the development proposed.

- **Scale of the landscape**: this also affects the ability of the landscape to accommodate the wind farm. A large scale landscape of simple landform generally has a greater capacity to absorb a development of the scale of the proposed Ffynnon Oer wind farm than a smaller scale, complex setting where misleading comparisons of scale may occur.
- **Visibility**: whilst visibility is primarily a visual concern, the extent of enclosure and variation in topography has a role to play in determining the sensitivity of a particular landscape to change.

The manner in which these considerations are evaluated to derive a sensitivity category is set out in Section 9.7.1.

Significance

The significance of the effect of the proposed wind farm upon each identified is a product of the sensitivity of each receptor and the magnitude of change sustained. It must be emphasised that this is not a simple linear relationship and is dependent upon the use of professional judgement. The relationship between magnitude and sensitivity and the resultant significance levels are illustrated in the following diagram:



On the basis of experience of similar large scale assessments, it has been decided that there are three thresholds of significance have been adopted: major; minor; and not significant. The assessment of significance is on a qualitative basis and therefore as a scoring system it does not avoid subjectivity and it is recognised that to an extent it is reliant upon careful use of professional judgement.

9.2.4 Visual Assessment

Introduction

The visual assessment is based upon the identification of potential visual receptors for the wind farm. In accordance with the GLVIA the effects sustained by visual receptors within the estimated visual area are assessed as a product of their sensitivity to visual change and the predicted magnitude of that change.

Visual impacts relate to views of the landscape available from publicly accessible areas and residential dwellings and the predicted effects of these visual changes on the public and residents, i.e. receptors. Visual effects include the loss of important elements in a view, the obstruction of views or the introduction of new features or elements. Visual changes can be caused by a change of scale, bulk, colour or texture of an existing view. As with landscape effects, change can be beneficial as well as adverse or neutral. Assessment of some other subjects within this ES includes a consideration of the likely occurrence of the predicted impacts i.e. certain; likely; possible etc which are set out in the significance evaluation tables. With regard to the landscape and visual assessment no such column has been included. This is because the assessment consistently assesses the worst case scenario and as such it is considered that all effects are certain: to state that they are only 'possible' or 'likely' would be to add an unhelpful element of uncertainty into the assessment.

The visual assessment is based initially on the production of a zone of visual influence diagram (ZVI), which indicates those areas of the site surroundings that theoretically gain views over the wind farm. The ZVI generated by "Wind Farm" software programme is illustrated in Figure 9.1. It is important to remember that the ZVI is based on landform data and therefore does not normally include the screening effects of vegetation, buildings and other features that provide a visual barrier. However the potential for the screening of views by extensive Forestry Commission plantations is of particular relevance in the Ffynnon Oer study area. Hence we have given all plantations a nominal height of 12 m when undertaking the ZVI calculations to take account of their screening potential. This is a conservative estimate as under favourable conditions many of the plantation coniferous species would reach heights exceeding 20 m. It should also be noted that the ZVI is based on a 50 m data grid, and thus localised landform, which can have a significant bearing on actual visibility, is not always represented. Anomalies between the ZVI and actual visibility that arise in the course of site survey and are relevant in the evaluation of specific views are taken into account in the course of the assessment.

Visual Receptors

The wind farm has the potential to significantly effect visual receptors and their views throughout the study area. As it is not practical to individually identify and assess each of the visual receptors in the study area, potential changes to the visual resource are represented through a series of views and routes that are identified on the ZVI – and confirmed through site visits and wireline illustration production as having visibility over the wind farm site. Wireline illustrations are produced for each of the selected views and indicate the theoretical visibility of the wind farm from each receptor viewpoint. The wirelines are constructed to indicate just the turbines as these are the most highly visible of the development components.

A total of 28 views and 6 routes representing the most populous and/or potentially sensitive receptor groups are used to assess the wind farm's potential visual impacts and consequent

effects on the study area. The location of these receptor groups and their views are indicated on Figure 9.2.

- Views are chosen to represent the various types of views available to potential key visual receptors and include views where the wind farm will be seen on the skyline from a wide variety of points ranging from major roads, settlements and recognised viewpoints, to areas designated for their landscape and recreational importance such as the Brecon Beacons National Park. Whilst the views are not specifically utilised in the *landscape assessment*, consideration is given to the landscape character types to ensure that the selected views are representative of the various parts of the study area.

- Routes used in the assessment are those that have potential for sequential visibility, which may occur where a viewer following the route gains an outlook of the wind farm progressively or intermittently over a period of time. The routes selected are those considered to be of particular importance due to their high *theoretical* sequential visibility of the wind farm, their traversing of the study area, their proximity to the site and the level of usage of the route.

The potential for cumulative visibility is also considered in the visual study. Cumulative visibility may occur either where more than one wind farm is visible at the same time from a single cumulative viewpoint or, more commonly, as sequential cumulative effects where more than one wind farm may be seen whilst moving along a route within the study area.

Types of Visual Effects

The type of effect sustained by receptors located at each view or route is evaluated and classified as follows:

- **Beneficial,** where it is felt to complement or contribute to the view, strengthening it or adding positive characteristics and qualities that were not previously available;

- **Neutral,** where it neither contributes to nor detracts from the view or route, and can be accommodated comfortably by the visual context;

- **Adverse,** where it introduces elements that differ in terms of scale, form or character from the existing nature of the view and cannot be accommodated by the visual resource without detrimental effect.

The ability of views and routes to accommodate the wind farm is assessed through professional judgement based on the factors considered in the evaluation of sensitivity and the magnitude of the effects, and on the knowledge of the study area as a whole that the assessors have gained. Whilst the classification of the ability of views and routes to accommodate the wind farm is determined through this professional judgement, it is acknowledged that people have wide-ranging opinions of the effects of wind farms and that subjective judgements are frequently made as to their appearance. Opinions are therefore likely to vary and this classification may not reflect the feelings of all viewers.

The visibility study determines through the process of assessment whether or not the views and routes will be significantly effected by the construction and operation of the proposed wind farm. The significance of the effect on views and routes is assessed through a combination of their sensitivity and the magnitude of the change that they will sustain.

Magnitude

The magnitude of change is an expression of the degree of addition, change or loss undergone by the baseline views and routes and is classified as high, medium, low or none.

The following factors are considered in the evaluation of magnitude of change on views:

- The nature of the change, including the perceived contrast or integration of any new features or changes in the view, including the appearance of the turbine layout and the way that the wind farm is perceived within the context of the view;
- The duration and reversibility of the effect;
- The angle of the view over the site in relation to the main activity or orientation of the receptor;
- The extent to which the wind farm is visible in the view and the proportion of the view that is occupied by the wind farm;
- The distance of the viewpoint from the wind farm;
- The nature of the view – whether it is a transient or progressive view of the wind farm, and whether it appears on or below the skyline.

The criteria used for the nature of the change in the magnitude of change on routes is assessed slightly differently, being based on the nature of the views over the wind farm along the route rather than the contrast between the wind farm and the existing views. The definition of the nature of the change on routes is defined as follows:

- The nature of the change to the visual experience of the route, including the frequency, length and number of views, and the various aspects over the proposed location of the wind farm that are available. A fragmented series of views generally constitutes a greater change to the visual experience of a route than a continuous progressive view due to the variety of fragmented 'snapshot' situations in which the wind farm may appear, thus drawing the attention of the viewer repeatedly to the wind farm. Likewise a route that twists around with the wind farm appearing alternately closer and then further away in quick succession will constitute a greater change than a logical route where the wind farm gets progressively and steadily closer or further away. A perception of the presence of several wind farms may arise should the turbines appear at intervals along the route with a varying character, scale and appearance.

Sensitivity

The sensitivity of each view and route is classified as high, medium or low through consideration of:

- Visual quality: an appraisal of the quality of the view relating to its amenity and its integrity and intactness;
- Visual value: an appraisal of the importance given to the view, as indicated by factors such as its recognition as a tourist viewpoint with facilities provided for its enjoyment or its location within an area covered by a landscape designation.

Based on the *Guidelines for Landscape and Visual Assessment. Second Edition* the different receptor categories identified in the Ffynnon Oer Wind Farm baseline are ranked in order of their sensitivity to visual impacts as set out in Table 9.1. It should be stressed that this table is indicative only as it would be impossible to rigidly tabulate sensitivity to change.

Table 9.1 Sensitivity of Visual Receptors

Visual Receptor Categories	Sensitivity
• Public Rights of Way	**High**
• Residential communities	↓
• Private residential properties	
• Public and private recreational open space	**Medium**
• Rights of way associated with highways	↓
• Businesses and industry	**Low**

Significance

The sensitivity of each view or route and the magnitude of change on it are combined to arrive at a classification of significance of the effect of the wind farm. The correlation between these variables is the same as for the landscape significance matrix as illustrated in the previous section.

As with the assessment of the significance of visual effects, it must be stated that the relationship between magnitude, sensitivity and subsequent predicted significance is not a straight forward linear one and the resultant assessment of visual significance will always contain an element of professional judgement.

9.2.5 Cumulative Effects

This assessment takes account of the potential cumulative effects of Ffynnon Oer Wind Farm. Cumulative effects may be found where two or more wind farms (either existing or proposed) have an incremental effect, and can occur either where there is intervisibility of the wind farms so that they may both be viewed from a specific point, or where a viewer may gain progressive views of two or more wind farms along the course of his route. In the latter instance, the wind farms may not be intervisible at the same time, but can combine to have a cumulative effect on the viewer as he moves through the environment having a sequential series of views.

The assessment takes into consideration wind farms that are already built, those that have planning permission, and those for which the applications for consent have been submitted and are still within the determination process.

For the purpose of the assessment of cumulative effects a specific radius has been covered for each wind farm as being indicative of the area within which that wind farm may have a significant visual effect. In accordance with the CCW guidelines this radius has been set at a distance of 20 km for all the identified existing, permitted and proposed wind farms within

40 km of the Ffynnon Oer site. The desk study has demonstrated that there are two existing, permitted or proposed wind farms that need to be assessed as part of potential cumulative effects. These wind farms are listed below:

- Taff Ely an existing wind farm, grid reference 980 865, approximately 19 km southeast of Ffynnon Oer;
- Margam Wind Energy Cluster; a proposed wind farm, grid reference: 834 884, approximately 11 km south of Ffynnon Oer and adjacent to it a proposed two turbine farm at Lluest Wen.

The location of these wind farms are indicated on **Figure 9.3.**.

9.2.6 Visualisation techniques

The visual assessment is supported by careful use of visualisation techniques utilising wire frame representations and photomontages. Wire frame representations have been generated from 19 locations. Through use of digital topographical data (Ordnance Survey Panorama) and a computer generated representation of the proposals, a model of the turbines as it would appear in the landscape is produced. However whilst this process takes into account factors such as the curvature of the earth, the data used means that no account can be taken of surface features such as vegetation or man-made elements such as buildings. OS Panorama data has an accuracy of ±3 m.

The use of photomontages provides an accurate visual representation of the impact of proposals, it is a well established technique in environmental assessment. With regard to wind farm developments specific guidance has been produced, and certain aspects of the standard photomontage production process have been modified, to improve the accuracy of the images used in Wind Farm ES. Firstly the location of the seven viewpoints from which the photomontages were produced was agreed in conjunction with the relevant planning authorities and based upon the preliminary ZVIs generated using the industry standard Wind Farm software programme. Secondly at each viewpoint a panorama and a telephoto picture were taken over the course of two site visits to maximise the visibility which is a particularly important factor in the views available from the more distant agreed points. Thirdly panoramas were made up of three 50 mm focal length photographs digitally stitched together to provide the necessary site context. Finally a 70 mm focal length photograph centred on the site was taken following recent good practice in wind farm EIAs, in accordance with the previously referenced SNH guidance. It is considered that 70 mm focal length photographs most closely represent the detail that is perceived by eye when focussing upon a distant object i.e. a turbine.

The photomontages are then produced using the Wind Farm software programme. A wireframe of the site is matched to the topography in the photograph so the turbines can be rendered to produce a photo-realistic impression of the wind farm.

The final output of the photomontage process includes the panorama including the location of the 70 mm frame which is shown in outline, the topographical wireframe showing the location of the turbines and the 70 mm photomontage itself. A critical factor when looking at the photomontages is the viewing or focal distance from the eye. This is calculated by measuring the length of the uncropped negative of the picture and multiplying it by the length of the final print, then dividing it by the camera lens length. The viewing distance varies between prints

because of differences in the amount of the negative cropped in the photographic development and printing process.

9.3 Baseline Studies

The baseline study records the existing landscape and visual resource within the study area and is presented in five sections: firstly a consideration of the landscape elements within and immediately around the Ffynnon Oer site that could potentially be directly impacted by the construction and operation proposals; then an overview of landscape characteristics of the wider area, including characteristic patterns and combinations of landscape features, scenic quality and tranquillity; thirdly at a study area scale it is necessary to have an understanding of landscape character i.e. the distinct and recognisable pattern of elements that is found consistently in a particular type of landscape, and how this pattern is perceived by people; fourthly the baseline lists all the relevant landscape planning designations and policies that need to be considered in the determination of the sensitivity of landscape receptors; and finally it is necessary to provide an overview of the visibility within the study area as a whole and the ZVI in particular.

9.3.1 Landscape Elements

Landscape elements are the individual components that makeup the landscape such as woods, trees, valleys, buildings and roads.

The Proposal Site

The proposed site is situated on an upland plateau with the highest point (464 m Above Ordnance Datum) marked by a trig point. The trig point is located to the eastern area of the proposed site, approximately 250 m from the edge of Cefn Mawr forest. From the trig point the land gently falls away to the southwest before it drops steeply down to a second plateau at approximately 380 m AOD. To the north of the trig point the land falls away more into a narrow valley containing Melin Court Brook which descends from approximately 300 m AOD.

The land cover is predominately acid grassland with blanket bog located on the highest ground. Surrounding the south, east and west boundary grow the maturing coniferous plantations of Mynydd Mant-y-bar, Pelenna Forest and Cefn Mawr which screen much of the site from external views.

The remains of a drystone wall crosses the highest point of the site running a few metres from the trig point in a southeast direction towards Cefn Mawr. The old field boundary is now marked by a post and wire fence. A number of unsurfaced tracks cross the southern section of the site. One of these tracks is an old tramway; a remnant of former mining activities which were widespread throughout the surrounding area.

Woodland and Other Vegetative Cover

The proposed wind farm is sited on an area of open upland grassland surrounded by extensive coniferous forest plantations which dominate the majority of valley sides and hilltops between the Neath and Rhondda Valleys. The majority of the forests, particularly those covering the Afan Valley are made up of blocks of single coniferous species. Japanese Larch is planted

mainly on the lower fertile slopes of the valley, with Scots and Corsican Pine at higher elevations and Sitka Spruce on the most exposed, wet plateaux [6].

To the south of the proposed site, coniferous plantations continue to cover the higher ground around the town of Maesteg. On the lower levels the landscape is covered by small irregular fields of arable, pasture and meadow. Field boundaries are marked by hedgerows containing the occasional mature hedgerow tree and linear stretches of broad-leaved woodland follow the course of streams. Tall hedgerows also edge and enclose a number of the minor roads, which at times are no wider then single tracks.

Drainage Pattern

Around the study area numerous streams emerge from the mountainous uplands to feed into the larger rivers that flow in a southeasterly direction such as the Neath and the Afon, or a southerly direction such as the Llynfi, the Afon Gawr and the Ogwr Fawr. The nature of the terrain and flow of the streams and rivers has created an area rich in waterfalls, particularly within the Vale of Neath.

Other Power and Communications Features

An overhead electricity transmission line runs from north of Bridgend past the western edge of Maesteg and approximately 5 km to the west of the site of the proposed wind farm. Pylons carrying the line are visible crossing the many valleys, becoming more visually dominant when traversing elevated areas where they break the skyline. The study area contains several examples of radio and television masts situated at elevated locations that break the skyline and are visually prominent man made additions within the landscape. Pertinent examples are located at:

- Werfa south of the A4107 - Grid Ref: 914948 Altitude 565 m AOD;
- TV relay station, Maesteg - Grid Ref 842913 Altitude 250 m AOD;
- Foel Fawr, west of Croeserw - Grid Ref 858953 Altitude 340 m AOD;
- Foel Fynyddau, north of Cwmafan - Grid Ref 783936 Altitude 370 m AOD;
- Varteg Hill, eastern side of Swansea Valley - Grid Ref 777078 Altitude 352 m AOD.

Settlement Pattern

The predominant and distinctive settlement pattern is linear ribbon development situated along the route of the valleys. The dominant style of housing is long terraced rows running along the lower levels of the valleys to the extent that many valleys consist of interlinked small towns and villages. The majority of this housing dates from the nineteenth century industrial heyday of South Wales. There are remnants of the pre-industrial settlement pattern in the form of small hamlets or more frequently farmsteads that are generally located on the middle slopes of the main valley sides or at the bottom of ancillary valleys where they would have had ready access to the seasonal grazing on the upper areas on the ridgelines separating the valleys. It is

[6] Afan Forest Park leaflet, Forest Enterprise.

important to note that the upper altitude limit for such farmsteads appears to be 250 m with few being located above the 200 m contour. The upper reaches of the higher ground separating the valleys contains no settlements or isolated residential properties.

Road Network

Within the study area the road network pattern is dictated by the topography with the primary network roads running along the valley floors linking the ribbon settlements. The main route from the south is the A4063 from Bridgend which links to Maesteg and finally Cymer where is joins the A4017 which runs in an east to west linking Rhondda and Port Talbot through the Afan Valley. To the north of the proposed site the dualled A465(T) is a prominent feature running through the valley floor of the Vale of Neath. Approximately 9 km to the west of the proposed site runs the major route of the M4 linking the coastal towns and cities of South Wales. It is rare for any surfaced roads to cross directly from one valley to another over the intervening higher ground. The restriction caused by the topography also results in settlements in the more remote valleys being accessed by dead end roads which peter out beyond the settlement e.g. the road up Glyn Corrwg which ceases at Glyncorrwg; the village 2.5 km to the east of the site of the proposed wind farm.

9.3.2 Landscape Characteristics

The key characteristics of the study area are:

- Elevated landform with steep sided valleys;
- Upland landscape shaped by the influences of nature and man, particular past industrial uses of mining and smelting;
- Well wooded ridges and valleys with coniferous plantations dominating the higher levels and broad-leaved woodlands situated along the lower slopes;
- Farmland and sheltered valley landscapes at lower altitudes with woodlands, dry stonewalls, and hedgerows;
- Numerous waterfalls, streams and rivers twisting across the valley floors;
- Contiguous linear settlements situated along length of valleys;
- The strong contrast between the urban and industrial development in many valleys (especially to the east of the site) and the empty, open upland areas;
- The relative simplicity of the arrangement of the main elements of the upland landscapes and the strong contrasts in colour and texture between the forestry plantations and extensive open upland grassland;
- The availability of panoramic long distance views from open, elevated locations and the role of the forestry plantations in framing views and screening outward views.

9.3.3 Landscape Character

The landscape character is a product of a combination of a wide range of factors that contribute to the creation of a unique setting. Landscape combines geological features, geomorphic processes, plant and wildlife associations with social, economic and cultural forces. The study area covers a number of different landscape types, which as part of this assessment have been classified with reference to the methodology of LANDMAP. Due to the length of time required to produce a detailed Landscape Character Assessment using LANDMAP, the classification of landscape character areas has grouped (where appropriate) landscape types together. The following eleven landscape character areas have been identified and are illustrated on Figure 9.4.

Upland Forest /Plateau Moorland

The central region of the study area, which includes the Ffynnon Oer site, is dominated by coniferous forest plantations which cover the majority of mountain tops and valley sides. The majority of the plantations, particularly those cover the Afan Valley were planted during the 1930's and 1950's as part of an extensive afforestation programme to create a renewable national timber resource[7].

Few upland areas have remained clear of forest plantations, but in such areas patches open unenclosed grasslands exist. Moorland plateaux on mountain tops covered by rough grass (and in wet areas sphagnum moss and fragments of raised bog) enable open views and the lack of tall vegetation and boundaries creates a sense of exposure.

Although large areas of this upland are covered by modern forestry, it is given a high value by both the areas of surviving upland pasture and the wealth of archaeological remains. Within these areas are remnants from past human activity which date back from the Bronze Age to the recent industrial era. Most recent are the spoil heaps and disused mines from the twentieth and nineteenth centuries. Many of these might not seem to have much immediate value, but are non the less and important part of the area's heritage and landscape[8].

Exposed Upland / Brecon Beacons

The study area extends into the southern region of the Brecon Beacons encompassing the lower sections of the Black Mountain and Forest Ffaw. The Black Mountain is a collective of mountains that range in height from approximately 353 m AOD to 802 m AOD (although the highest level within the study area lies at approximately 500 m AOD). The mountains offer no shelter and are exposed wild landscapes which are characterised by steep sided ridges, rocky outcrops and numerous mountain streams. There are also the remnants of past human activity in the form of small quarries which scar the mountain sides.

Forest Ffaw is also a collective of mountains although its lower regions are not as open and exposed as the Black Mountain. Large pockets of coniferous plantation mixed with small clusters of deciduous woodland and a patchwork of field boundaries creating a greater sense of diversity and enclosures. The waterfalls along the route of Afon Mellte and Nedd Fechan are a distinct landscape element of the river valleys in this area.

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[7] Afan Forest Park leaflet, Forest Enterprise.

[8] Neath Port Talbot LANDMAP Project, NPT/H/26 Afan Wallia.

The height of the mountains provides the perfect opportunity for panoramic views of the surrounding landscape making them a popular tourist attraction for walkers. The natural diversity and the lack of development of this upland landscape reflect the high sensitivity of this landscape area.

Rolling Farmland

Rolling farmland tends to dominate the lower levels of the study area below the steep valley sides. Small irregular field enclosures are delineated largely by lush hedgerows, but also post and wire fencing whose location continues to reflect an early field enclosure system. Hedgerow trees are a common feature within the hedgerows as are linear clusters of deciduous woodlands that follow the route of streams running along valleys bottoms.

The landscape is relatively unspoiled however tall structures such as pylons and radio/TV masts are notable elements on the skyline. The landscape is diverse, but as the same time simple with a patch work of colour created by the contrasting types of vegetation cover.

The open nature of this landscape and the lack of modern development make this an important landscape character area of high sensitivity.

Coastal Developments

Along the southwest periphery of the study area lie a number of coastal towns and the city of Swansea. Situated around Swansea Bay the settlements have developed outwards from the mouth of the rivers that support them. The settlement developed as ports, using the rivers as transport corridors to ship metals and coal out of the valleys. Today past industrial activities have been superseded, chimneys and pipes have become common landscape elements along the coast with the development of oil refineries from the oil industry.

Running around the outskirts of settlements is the M4 a large transport corridor and a dominate feature of the landscape. This landscape area has been subjected to change and large scale development over the years.

Afan Valley

Afan Valley is a narrow steep sided valley. In prehistoric times dense broad-leaved woodland covered much of the valley but much has since been cleared over the centuries due to the activities of agriculture and mining. What remnants of native woodland that have survived are mainly restricted to the lower slopes along where the Afon Afan flows.

Within the valley are relics of former human activity such as abandoned mines, tramways and railways. In the lower part of the valley the availability of coal for smelting metal ore led to the growth of iron, copper, steel and tin plate works. Since the decline of the mining industry, forestry has taken its place and the vast majority of the steep sided slopes have been covered by modern coniferous plantations. As a result of this and the topography many views are restricted to within the valley.

Vale of Neath

The Vale of Neath is characterised by a glaciated U-shaped valley running in a northeast - southwest direction. The high valley sides are dominated by coniferous plantations with deciduous woodland covering the lower levels. Where the land is not covered by forest and woodland, pasture enclosures cover the valley slopes.

Dominating the valley floor is the A465(T) which detracts from the rural character of the valley. Ribbon settlements of various sizes nestle into the southern side of the valley bottom linked together along the B4434. Running through the bottom of the Valley is also the railway line and the watercourses of the River Neath/Afon Nedd and the Neath Canal. These watercourses are fed by numerous rivers and streams which flow from the surrounding mountains. Both provided an important function during the regions industrial period. Within the Vale there is a richness and diversity of waterfalls created by the deep gorges of the rivers Mellte, Hepste and Nedd Fechan. As well as the Aberdulais falls which were once used to power a variety of mills and factories.

Llynfi Valley

The dominant characteristic of the Llynfi Valley is a glaciated U-shaped valley created during the Ice Age. The socio-economic roots of the Valley began with iron making which expanded with the introduction of coal mining in the nineteenth century. The landscape is generally dramatic with extensive views across and out of the Valley. However, as with many of the coalfield valleys, this quality and character is undermined by the density and form of urban development in the valley floor. Ribbon settlements dominate the valley floor with 'long row' terraced housing style a common feature.

Upon higher ground moving away from the valley floor the biodiversity follows a linear patter from improved grassland to more open valley tops. Broadleaved woodland colonises the lower levels whilst the upper levels are dominated by coniferous plantations.

Rhondda Valleys

The Rhondda Valleys are dominated largely by two glaciated U-shaped valleys which run in a northwest - southeast direction; Rhondda Fawr, the largest of the two valleys and the smaller Rhondda Fach. The landscape of the valleys contain a number of glaciated features which include incipient criques and corries. The ridges of Graig Fawr and Graig Fach are prominent features of the local landscape and offer spectacular views across the valleys.

The area is closely linked with coal mining activities which are accountable for the dense settlement pattern which occurs within the mid regions of the valley. The valley floors are dominated by continuos ribbon settlements which have few boundaries to define each settlement. As typical of coalfield settlements the street pattern is dominated by the classic 'long row' form of terraced housing.

Large areas of the valley sides are covered by coniferous plantations however, within the upper region the landscape is distinctly undeveloped with rivers running through the valley floor and the land covered by marsh grassland.

Cynon Valley

As with the valleys of Rhondda, the Cynon Valley is a glaciated valley running in a northwest - southeast direction. As with much of the study area the landscape is compromised by the extent and form of the urban and industrial developments, a major example of this are the opencast sites around Rhigos. The development pattern varies, reflecting the change in the openness of the valley floor. Along the narrow valley floor settlements exist which reflect the traditional 'long row' character.

Much of the habitats within the area reflect the topography and geology of the area, together with previous history of traditional land management. On the valley sides and upland areas the landscape is largely open moorland which provides spectacular views across the valley. Patches of coniferous plantations are dispersed between areas of enclosed pasture, upland heath and grassland. Within the valley floor and lower valley levels small clusters of deciduous woodland follow the river corridor.

Bridgend and Environs

The area includes the settlement of Bridgend, its suburbs and surrounding settlements, as well as the converging valleys of Ogmore, Cwm Garw and Llyfi Valley. Large sections of the area dominated by built form and industry which obscures minor variations is topography. The M4 corridor is a dominate feature of the landscape which splices it way through the mid section of this Landscape Character Area.

The upper section of the area where Ogmore, Cwn Garw and Llyfi Valley converge the landscape is covered by wooded pasture, marshy grassland combined with areas of woodland and improved grassland. These form the southern extent of a number of habitats that extend up into and around the coalfield valleys to the north.

Swansea Valley and Environs

Within this character area runs a number of valleys, the largest of which is the Swansea Valley. A U-shaped glaciated valley running on a northeast - southwest orientation with a number of tributary valleys converging from the north. To a large extend Swansea Valley floor is covered by dense built form and industry increasing in the areas where tributary valleys converge. On the valley sides the landscape is covered by small enclosures of improved grassland combined with clusters of deciduous woodland lining the lower levels and valley floor. On the northern facing valley side is a large area of coniferous plantation.

Further west the landscape becomes more undulating with wide shallow valleys. The character is more rural and the built form is reduced to scattered settlements and hamlets within a landscape covered by enclosed fields. Deciduous woodland line the river corridors of Lower Clydach River and Upper Clydach River and hedgerows containing hedgerow trees mark many field boundaries.

9.3.4 Landscape Planning Designations and Policies

Landscape planning designations and policies are used to provide an indication of the value attributed to the landscape or visual resource by national and local government. Due to the location and size of the study area for Ffynnon Oer a number of council districts are covered.

Landscape planning designations and policies are considered in the determination of the sensitivity of landscape receptors and views as they provide an indication of the value attributed to the landscape or visual resource by other professionals.

Because of the location of the proposed wind farm and the size of the study area a number of relevant local authority landscape designations are covered, as well as the National Park designated by central government. The relevant designations are listed below and illustrated in Figure 9.5.

- *National Parks:* Situated to the north of the site lies the Brecon Beacons National Park. Visibility of the proposed wind farm development would be limited to landform which slopes towards the site, particularly those areas with the highest elevations. It should be noted however that visibility of the proposed wind farm would be dependant on clear weather conditions.

- *Landscape Protection Areas (LPA)*: The upland areas overlooking Port Talbot, Baglan and Cwmafan, Afan Forest Park and Margam Park and their environs lie within the southwest region of the study area. The ZVI demonstrates visibility would be restricted to views from upper parts of the hills that slope towards the site. However, in the draft unadopted Port Talbot Local Plan the southern section of the proposed site is designated as a LPA. Within clear upland areas the proposed wind farm would be visible.

- *Special Landscape Areas (SLA)*: The study area covers a number of a number of SLAs within regional and local levels. Much of the Vale of Neath situated to the northwest of the site is largely covered by SLAs. Visibility of the wind farm from this region would again be restricted to the upper parts of hills that slope towards the site. Situated further east of the proposed site within the Valleys of Rhondda and the Cynon Valley are designated SLAs. Along the western boundary of Cynon Valley lies an area designated as an SLA. Much of the landscape within the Valleys of Rhondda is designated as Strategic Coalfield Plateau and Associated Valley Sides which is also a SLA. The ZVI demonstrates that there would be no views of the proposed wind farm from these two areas.

- *Strategic Coalfield Plateau and Associated Valley Sides:* To the south and southeast of the study area lies the area of the Strategic Coalfield Plateau and associated Valley Sides designated as an SLA as identified in the Ogwr Local Plan. The area stretches from the western edge of Llynfi Valley top over to the eastern edge of Mynyndd Maesteg, excluding valley floors dominated by ribbon settlements. The ZVI demonstrates that views would be restricted to higher elevations of mountain sides facing the proposed site.

- *Historic Landscape*: On the southwest edge of Maesteg, approximately 9 km due south of the site lies an area of historic landscape. The ZVI demonstrates that visibility from this area would, on the whole, be restricted to small number of turbines.

- *Landscape Conservation Area (LCA)*: South of the proposed wind farm lie a number of areas designated as LCA's. On the whole these lie within the area covered by Bridgend County Borough Council. Views of the wind farm from these areas would largely be restricted by topography and screening vegetation.

In addition to these designations, the site is covered by a number of Structure and Local Plan policies. Those relevant to the landscape and visual assessment are as follows:

- Port Talbot Local Plan, Deposit Draft, policy E18;

- Borough of Neath Local Plan adopted July 1994, policies E61 and E60;

- Mid Glamorgan (Rhondda Cynon Taff County Borough Council), Replacement Structure Plan 1991-2006, policy EV4;
- Owgr Borough Council Adopted Local Plan, Policy EV8, this policy is also reflected in the Bridgend UDP Deposit Plan, policy EV10;
- Cynon Valley Local Plan, Deposit Version October 1997, policy proposal ENVP2.

9.3.5 Visibility and the Zone of Visual Influence (ZVI)

ZVI

The general visibility of the proposed wind farm reflects closely the landform of the contextual area, with uplands, plateau and valleys being mirrored in the ZVI which has been predicted for the 16 proposed turbines and depicts the visibility of turbines to their blade tip within the previously defined 20 km radius study area. This is shown in Figure 9.1. It is important to note that the boundary of the study area is not intended to be finite beyond which it would not be possible to see the wind farm, but instead it identifies the area within which the wind farm may have a significant effect on the landscape and/or visual effect.

It is important to note that the visibility shown within the ZVI plan reflects the inclusion of woodland and coniferous plantations at the height of 12 m. Many of the plantations within the study area, particularly within the Afan Valley where planted during the 1930's and 1950's and will be taller than figure. One of the smallest trees growing within the plantations is Japanese Larch which grows to a height of 25 - 30 m, compared to Sitka Spruce, one of the tallest trees which can grow to a height of 50 m. However the ZVI calculations and the assessment have used a worst case scenario based on tree heights being limited by potentially harsh environmental conditions in order that potential visual impacts are not under-estimated.

Landscape and visual assessment best practice requires that account is taken of the potential worst case scenario. With regard to the ZVI the worst case scenario is that the availability of potential screening elements is minimised. In the case of Ffynnon Oer this refers primarily to the potential screening that is predicted would be provided by the existing large-scale forestry plantations as discussed in the preceding paragraph. It is possible, although perhaps unlikely, that these commercial plantations will be substantially clear felled over the life span of the proposed windfarm. Hence the need to consider if such an action would have notable consequences on the extent of the ZVI as shown in Figure 9.1. Figure 9.1A shows the ZVI for the blade tips without the assumed 12m height for all the woodland areas shown on the Ordnance Survey 1:25 00 map. As anticipated the ZVI is extended with the majority of the areas that it is predicted would now have views of one or more of the turbines being concentrated within a 10 km radius of the proposed windfarm site. There are very few extensions to the ZVI in the Brecon Beacons National Park or in the more urbanised areas on the southern coastal plain. The new areas within the ZVI are generally located upon the sites of the felled plantations which are on the steeper valley sides or ridgelines. Given that they are presently afforested these areas contain very few residential receptors, nevertheless they are traversed by considerable sections of PROWs. However it could be argued that at least in the initial years following any large-scale clear felling the dominant visual elements for the recreational users of PROWs crossing these areas would be the visual consequences of the clear felling in all close distance views and in the foreground of most of the long distance views in which the windfarm would now be a component.

Determinants of Visibility

The proposed site lies within an upland area surrounded by ridges and valleys. To the north and east, ranging to a distance of 10 km, the majority of the elevated landform is covered by maturing coniferous plantations which screen and filter visibility. Further north the most elevated parts of the study area are located at the foothills of the Brecon Beacons approximately 13 km from the proposed site. From this area visibility is restricted to higher elevations of the Black Mountain and clear regions of Forest Fawr. To the west, around the Rhondda Valleys no views are available due to the incised nature of the landform and the large blankets of coniferous plantation situated on elevated ground.

To the south, visibility of the proposed wind farm is restricted to highest regions on the north facing side of Afan Valley. This includes the village of Croeserw and the proposed location for Afan Valley Holiday Park. The area of visibility also stretches over to Werfa and sections of the A4107. Further south a linear wedge of visibility is apparent from upland areas on the northeast facing ridge of the Llynfi Valley. From the west visibility within a 10 km radius of the proposed site is restricted to clear upland areas devoid of coniferous plantations, although there is a large area from which the site is potentially visible from more elevated parts of Swansea.

It is important to state in relation to the areas described above that whilst receptors have theoretical views of the site, intervening and close by built development and planting is always likely to screens and filters views. This situation particularly applies to more urban areas such as the parts of Swansea noted in the previous paragraph. Hence in reality there are likely to be a relatively small number of publicly accessible locations and private residences that would have uninterrupted views of the proposed wind farm.

The Influence of Weather

In addition to physical elements of the study area effecting the predicted visibility of the proposed wind farm, atmospheric condition will be a crucial consideration upon visibility, especially in long distance views. The proximity to the coast and the elevated areas produces changeable weather conditions. Low lying cloud, high rainfall and haze will all effect the clarity of which the proposed wind farm would be viewed. Data from the meteorological office[9] shows on average the rainfall for the area is 100 mm or greater for seven months of the year and on average it rains for 13 days a month. Visibility of the proposed wind farm would therefore be reduced by rainfall for approximately 25% of the year i.e. one day in four. On average there are also 27 days of the year when air frost would impact on visibility. During the summer months hazy conditions will also reduce visibility from distant locations as was demonstrated during the field assessment survey.

Cumulative Views

Opportunities for potential cumulative views, where more than one wind farm, including Ffynnon Oer, can be seen simultaneously are limited as demonstrated by Figure 9.3. This is due primarily to the visual environment of the study area, as localised screening by buildings or

[9] http://www.met-office.gov.uk/climate/uk/averages/sites/48.html Neath (62m AMSL) 1961-90 Station Averages.

other structures, tree planting, road cuttings and other local topography frequently prevents *actual* visibility despite the indication of *theoretical* visibility on the ZVI.

9.4 Mitigation and Enhancement

Mitigation of potential landscape and visual effects and opportunities for enhancement of the Ffynnon Oer site have been considered throughout the inception, siting, layout and design stages of the project. Where possible, and where it has been compatible with other factors that require consideration, mitigation and enhancement measures have been incorporated into the final scheme.

Mitigation is considered at two levels: firstly, the avoidance of potential effects that is achieved through the design of the proposals; and secondly the reduction of effects, whereby the design and layout of site components is specifically considered in order that potential effects are minimised. The nature of wind farm development is such that avoidance or reduction of effects is generally more effective than a third type of mitigation; the more superficial remediation of effects through screening with planting or mounding. This type of mitigation is also considered to be inappropriate at Ffynnon Oer, where such landscape elements would detrimentally contrast with the exposed and large-scale landform of the site and could not be of a large enough scale to be effective for any but a small number of specific receptors or views located immediately alongside such mitigation works.

9.4.1 Avoidance of Effects

The avoidance of potential landscape and visual effects is primarily effective at the site selection stage as, due to the nature of the effects, complete avoidance is difficult to implement within the restricted area of a site. There is, however, potential for the avoidance of specific localised or small-scale effects.

The initial site review process as described in Section 6 included consideration of a wide range of factors including potential landscape and visual effects. The Ffynnon Oer site was found to be favourable in respect of many of these factors, including the absence of national or regional landscape designations and its comparative lack of visibility from the main centres of population i.e. potential residential visual receptors, which are located overwhelmingly in valley bottoms and along the urbanised coastal strip.

9.4.2 Reduction of Effects

The potential for reduction of environmental effects has been considered throughout the design and assessment process for the proposed wind farm. The principal opportunity for the reduction of effects – especially visual - is through the design of the turbine layout, and the iterative design process as set out in Table 2.2 has allowed the adjustment of turbine positions as a result of the effects that become apparent through the course of the assessment.

The principal change to the turbine layout resulted from evaluation of the initial photomontage and wireline illustrations.

The following considerations have also been made with regard to reduction of potential landscape and visual effects:

- Layout - use of existing forestry access road in mature forest.
- The colour and finish of the turbines has been chosen to minimise the contrast between them and the background against which they will be viewed, which is, in the majority of situations, the sky. Based upon NWP's experience form other similar sites, a mid-grey matt finish is most likely to be used and has been incorporated within the photomontages. This selection reflects the fact that the western parts of the South Wales Valleys is subject to variable weather conditions with clouder conditions prevailing with the associated predominance of white/grey skies as illustrated in the series of photomontages. Given their elevated location in the majority of views , it is considered that the majority of views in each the turbines were an element, they would be seen against the sky. Hence a pale grey colour would be appropriate with a semi-matt finish to minimise surface reflectance.
- The alignment of the access tracks with the site and the positioning of the turbines has been designed to minimise the need for earthworks and other site disturbance. Any disturbed ground will be restored to match in with the adjacent vegetation. Also a proportion of the excavated material will be utilised to form low mounds of height of approximately 30 cm on the downhill side of any new access roads. These will be seeded with an appropriate seed mix and will aid in the visual assimilation of the new access tracks within the wider landscape by reducing visual contrast.
- Alternative designs of turbine layout considered starting with a standard grid layout and modifying the layout to take account of the characteristic s of the site with particular regard to topography and ecology.
- Take account of opportunities and constraints inherent within the site as set out in the baseline surveys.
- The site compound and sub-station have been located on one of the lowest points of the site to reduce intrusiveness and take advance of the screening provided by adjacent forestry and to ensure that in most views the background is provided by the more elevated areas of the site.
- Turbines have been located to ensure a minimum separation of 100 m from any Public Rights of Way (PROWs).The site will have no lighting during construction or operational periods thereby removing any potential for light pollution.
- Appropriate materials for buildings will be utilised where ever feasible. The external faces of the sub-station will be screened with local stone and roofed with slate to reflect the prevalent local vernacular style.

9.4.3 Compensation

The construction and operation of the proposed wind farm will provide limited opportunities for compensation for certain limited receptor groups who may sustain substantial adverse landscape and visual effects. To this end National Wind Power have instigated consultation with SUSTRANs with regard to the potential for improvements to the existing local cycle network.

SUSTRANS have requested "that resources from the developer are used for this purpose [accommodation of existing routes]"

Opportunities for enhancement of the landscape and visual resource have been identified through the professional survey and analysis of the site, and through the process of public consultation, which raised issues that local residents feel could be addressed by the wind farm development.

- National Wind Power would like to provide a series of interpretation boards at agreed locations on the local PROW network. These would explain the function of the wind farm and how it fits in with long term national energy policies and set the development in the context of the surrounding landscape and man's influence upon its development as exemplified by the nearby Roman camp and legacies from historical mining activities.
- The changes in the land-use of the site provides opportunities for habitat enrichment and a more ecologically sensitive management regime to be instigated. The main changes are likely to include the damming of land drains restore waterlogging, the cessation of the use of chemical fertilisers on site and the introduction of a less intensive grazing regime. More details are set out in Section 15.7.4.

9.5 Predicted Landscape Changes and Consequences

9.5.1 Construction Period

The principal activities that could have an impact upon the existing fabric, quality and character of the landscape during the seven month construction period are set out below in Table 9.2. Those associated with the necessary permanent land-take are considered in the subsequent operational section. The table facilitates a brief consideration of the potential landscape changes for each identified construction activity with the potential landscape changes being noted against the first three landscape categories of landscape receptors as set out in the preceding baseline section: landscape elements; landscape characteristics and landscape character. Landscape policies and planning designations can be considered separately for the construction activities as a whole.

9.5.2 Operational Period

The principal activities that could have an impact upon the existing fabric, quality and character of the landscape during the 20 year operation period are set out below in Table 9.3.

9.5.3 Overview of Landscape Changes Including Planning Policy and Designations

Tables 9.2 and 9.3 demonstrate that there may be a number of impacts upon the different components that make up the landscape during the construction and operation of the proposed wind farm. A development of this scale cannot be integrated into the landscape without having direct impacts on the landscape of the proposed site and direct and indirect impacts upon at least some of the surrounding areas.

Construction of the proposed wind farm will bring about the initial changes to the landscape character of the site. Introduction of vehicles and plant equipment represent the introduction of elements alien to this landscape character type which have a detrimental effect on the landscape character. This impact will be generated through the diminishment of existing high levels of calmness and tranquillity due to the movement of vehicles. The use of the forestry access roads to link the site will mean that these positive aesthetic characteristics are reduced over an area much larger than just the wind farm site. However the use of the existing track which requires minimal widening at certain pinch points and no strengthening means that impacts and any consequent negative landscape effects are lower than would have been the case if a new track were being constructed with the associated loss of landscape elements and changes to existing views. In addition it should be noted that the movement of forestry vehicles is an established landscape characteristic within and around most of the extensive forestry plantations within the study area.

Table 9.2 Construction Period - Predicted Landscape Changes and Consequences

Identified Activity	Landscape Change	Predicted Landscape Consequences
Movement of plant and vehicles	Landscape elements - introduction of new elements	New elements will increase movement in relatively static area
	Landscape characteristics - increased complexity	Increase in movement and disturbance will have negative impacts and generate new patterns in landscape
	Landscape character - changes over small proportion of defined landscape character area	Temporary loss of calm and tranquil upland moor, but insufficient scale to alter overall landscape character area
Use of cranes to set turbines in place	Landscape elements - introduction of temporary but very tall feature(s)	Locally predominant landscape element(s) will act as visual focus
	Landscape characteristics - contrast with existing characteristics	Undermine surrounding rural characteristics through scale and contrast with existing naturalistic characteristics
	Landscape character - changes over small proportion of defined landscape character area	Size and movement of cranes reduces calm and tranquil environment of site and is redolent of urban areas
Construction of internal site access roads	Landscape elements - loss of some elements (sections of stone wall, areas of acid grass land and modified blanket bog)	Increase of elements which already exist around the site and within forest, depending on route within the site boundary
	Landscape characteristics - trackways already a strong feature in and around the site hence extension of existing characteristic	Open moorland partitioned and divided by creation internal roads will change balance of existing elements modifying characteristics reducing sense of isolation and subdividing previously open area increasing complexity
	Landscape character - potential undermining by sub-dividing area when landscape character is partly determined by the extensive, open upland areas	Incremental changes to landscape character with particular reference to simplicity, calm and tranquillity. Predicted to be of insufficient scale to constitute a discernible change to the existing landscape character type within which the site is located

Table 9.2 (continued) Construction Period - Predicted Landscape Changes and Consequences

Identified Activity	Landscape Change	Predicted Landscape Consequences
Materials stockpiles within main compound	Landscape elements - introduction of new elements potentially with contrasting colours and textures, however will be located within main compound on the lower part of the site, set against slope	Precise consequences will depend upon the size, height and colour of any stockpiles however location within main compound will reduce the magnitude of any landscape impacts
	Landscape characteristics - increase complexity	Along with other new temporary elements they would modify landscape characteristics by making the upland plateau a more complex, less naturalistic landscape
	Landscape character - undermine the important (but erroneous) sense of naturalness on local scale but insufficient scale to undermine landscape character area	Incremental changes to landscape character with particular reference to simplicity, colour and texture. Predicted to be of insufficient scale to constitute a discernible change to the existing landscape character type within which the site is located
On-site accommodation and contractors' offices within main compound	Landscape elements - introduction of incongruous elements	Incremental increase in number of man-made elements however impact magnitude likely to be reduced by concentrating al facilities in a single location
	Landscape characteristics - increase complexity	Temporary negative consequences from contrast with existing naturalistic characteristics
	Landscape character - undermine the important (but erroneous) sense of naturalness on local scale but insufficient scale to undermine landscape character area	Incremental changes to landscape character with particular reference to simplicity, colour and texture. Predicted to be of insufficient scale to constitute a discernible change to the existing landscape character type within which the site is located
Lighting	Landscape elements - no lighting to be used	No new elements
	Landscape characteristics remain as present	No change in prevailing characteristics with regard to lighting levels
	Landscape character - no change	No change

Table 9.2 (continued) Construction Period - Predicted Landscape Changes and Consequences

Identified Activity	Landscape Change	Predicted Landscape Consequences
Temporary protection and security fencing	Landscape elements - introduction of another man-made, contrasting elements in form of chespale fencing around excavations and metal palisade fencing around main compound	Introduction of incongruous temporary landscape elements
	Landscape characteristics - sense of man-made enclosure very low in present upland landscape	Enclosure of open landscape altering landscape characteristics
	Landscape character - at site scale temporary enclosures will not undermine the openness that is a key component of the landscape character type	Dependent upon the scale and design of any temporary enclosures, but will not be of a sufficient scale to undermine landscape character type much beyond the site boundary
Disposal areas for excavated material (assuming not to be taken off-site)	Landscape elements - introduction of new elements, although given the long history of mining in area, the new elements have numerous precedents	Introduction of incongruous temporary landscape elements
	Landscape characteristics - increase complexity	Will combine with other listed new elements to substantially modify characteristics of site and immediate environs
	Landscape character - mining spoil is already a component of landscape character, albeit generally not an immediately obvious one	Assuming that re-vegetation will be encouraged and the material profiled into sympathetic small-scale landforms there should be no negative consequences for existing character

Table 9.3 Operation Period - Predicted Landscape Changes and Consequences

Identified Activity	Landscape Change	Predicted Landscape Consequences
Operation of the towers and turbines	Landscape elements - introduction of major new elements centring upon the 16 towers and turbines	Introduction of large scale structures with moving elements visible from a distance
	Landscape characteristics - scale and associated movement will determine a new arrangement of landscape characteristics	Introduction of new land-use whose principal elements are of sufficient scale to substantially modify landscape characteristics. However their scale is in accordance with the scale of many of the present site characteristics
	Landscape character - substantial change within the site with potential to modify at landscape character type scale	The landscape character type will remain as at present: Upland forest and plateau moorland. The scale of the 16 turbine wind farm proposal is insufficient to undermine the defined character, especially the key characteristics such as tranquillity, isolation, simplicity and openness. It must also be noted that that wind farms, pylons, radio and telecommunications masts are relatively common features on hilltops across the study area and in Welsh uplands in general. They can help to emphasise some of the prime determinants of these areas' landscape character such as openness, exposure and the visual dominance of ridgelines.
Land-take required for turbines	Landscape elements - potential loss of existing features such as stone walls and modified blanket bog/acid grassland balanced by introduction of new vegetative features due to damming of land drains	Negative impacts due to small-scale loss of characteristic elements unlikely to directly have negative consequences upon landscape partly countered by the habitat recreation generated by increased waterlogging.

Table 9.3 (continued) Operation Period - Predicted Landscape Changes and Consequences

Identified Activity	Landscape Change	Predicted Landscape Consequences
	Landscape characteristics - one of the prime determinants of change in landscape characteristics	Permanent change of landuse for duration of operation but vegetation can be re-established up to the base of the tower reducing the loss of bog/acid grassland. Likely to lead to mosaic of different land-uses which could locally modify textures and colours in landscape
	Landscape character - potential to locally modify landscape character	Direct loss of existing naturalistic areas will not be on a large enough scale to have negative effects upon existing landscape character type
Operation of access route	Landscape elements - potential for very small scale loss of landscape elements at specific locations along access route where localised widening may be required otherwise no elements lost as using existing route as used during construction period	Any loss of landscape resources i.e. trees and edge scrub would be very localised
	Landscape characteristics - only impacts can arise from slight increase in usage	Increase in vehicle use within forest tracks would have limited impact on landscape characteristics / character and present use of forest tracks by quarrying and logging vehicles Any tree losses too small scale to impact upon existing landscape characteristics
	Landscape character - increased usage has potential to locally modify landscape character	Given the low visibility of the access route and the slight increase in levels of use it is unlikely that there will be notable consequences for the landscape character type
Movement associated with on-site maintenance activities	Landscape elements - no new elements except occasional vehicles	Small-scale temporary modifications to existing levels of calm and tranquillity
	Landscape characteristics - occasional vehicles will temporarily add to the complexity of landscape characteristics	As above
	Landscape character - increase in movement and undermining strong sense of isolation	Temporary changes will not be of sufficient magnitude to have any negative consequences upon landscape character

Table 9.3 (continued) Operation Period - Predicted Landscape Changes and Consequences

Identified Activity	Landscape Change	Predicted Landscape Consequences
Movement associated with on-site maintenance activities	Landscape elements - no new elements except occasional vehicles	Small-scale temporary modifications to existing levels of calm and tranquillity
	Landscape characteristics - occasional vehicles will temporarily add to the complexity of landscape characteristics	As above
	Landscape character - increase in movement and undermining strong sense of isolation	Temporary changes will not be of sufficient magnitude to have any negative consequences upon landscape character
Signs and boundary treatments	Landscape elements - very small-scale introduction of new elements	If well designed and carefully located could enhance public appreciation of site and landscape context
	Landscape characteristics - compared with other landscape changes will be insignificant	As above
	Landscape character - no direct changes but could be useful for explaining landscape to the wider public	No direct effects upon landscape character but could help in interpretation
Land-take associated with connection to the National Grid network	Landscape elements - introduction of new landscape elements in form of line of wooden telegraph poles between the site and grid reference SS863951 south of Creoserw	The connection will utilise wooden telegraph poles thereby resembling an overhead phone line and as such will be an incremental increase in the extent of an existing landscape element. Levels of impacts reduced as most of the route will be within existing mature forestry plantations.
	Landscape characteristics - unnatural elements although frequently found in south Welsh landscapes	
	Landscape character - such linear features are an established part of the landscape character of all the identified character areas	

The site presently has a strong sense of unity due to the small number of landscape elements that interact within it making a relatively simple landscape. This will change with the introduction of a wider variety of landscape elements during the six month construction period. It is more informative to consider their cumulative impacts rather than their individual impacts. Such a diversity of elements is not characteristic of open upland areas and most of their impacts will stem from the contrast between these new temporary elements and activities and both the present site and the surrounding areas. The impacts upon present levels of calm and tranquillity that will be caused by the movement of plant and vehicles and the associated noise is extensively noted. Likewise all activities that involve changing the surface of the land such as excavations for internal access roads and turbine foundations and their arisings will have impacts upon dominant colours and textures which are particularly important in defining the subtle landscape character of open upland areas. However whilst the level of disturbance and associated negative landscape impacts and consequent effects will be considerable within the site and its immediate environs, they are considered to be of an insufficient scale in such a large scale landscape to have such notable impacts over the entire landscape character type or the study area as a whole.

During the operation period which lasts for forty times as long (twenty years as opposed to six months) the number of sources of potential landscape impacts reduces with in particular amounts of ground level movement reverting to something akin to present very low levels. The cessation of construction works will result in the removal of the majority of the elements that contrast most sharply with the existing colours in the landscape. Elements which are not removed can be partly or completely mitigated by re-establishment of appropriate vegetation. However the two dominant impacts remain:

- the land-take for the turbines and internal access roads;
- the introduction of the sixteen 91 m high turbines and their consequent movement.

Their elevation means that their impacts and consequent effects are sustained far beyond the confines of the site extending into areas subject to designations at least partly based upon their perceived landscape quality, most notably the Brecon Beacons National Park.

Whilst the turbines and their movement provide a contrast with the existing remote, largely tranquil and open site, it is important to note that they are still landscape elements that are strongly associated with remote upland locations, particularly in mid-Wales. Hence in some ways their presence is indicative of the degree of remoteness and exposure of the site and any negative effects that they generate beyond the site itself should be considered as visual effects being concerned with intrusiveness, as opposed to landscape effects. Similarly it must be emphasised that the turbines are not permanent landscape features. At the end of the 20 year operational period they will be decommissioned, dismantled and moved off the site which will then be returned to its present use.

Within the southern end of site a large proportion of land falls within an area designated as a Landscape Protection Area (LPA) in the unadopted Port Talbot Local Plan 1996. Policy E18 of this Local Plan states that there are a number of areas of the countryside which "*by virtue of their location or landscape appearance are deserving of retention for their own sake*". Consequently in LPAs "*...planning consent for development will only be granted where it can be clearly demonstrated that there is no detrimental effect on the environment, ecology and*

landscape of the area but rather (the development) *seeks to enhance these qualities*"[10]. Construction and operation of the proposed wind farm will impinge on this designations by changing some of the qualities of the existing landscape of the area. However the construction period will be short lived and, as mentioned above, wind turbines are landscape elements associated with remote upland locations and would therefore be seen in this context within the existing landscape. Also they will not require the loss of any landscape resources, impact upon other existing uses for the site, represent a sense of historical continuity as the site and surrounding area have a long history of exploitation of primary resources, and the wind farm development is not a permanent change of land-use.

Beyond the LPA designation lies the Special Landscape Area (SLA) of the Strategic Coalfield Plateau and associated Valley Sides as defined in the Ogwr Borough Council Local Plan (Policy EV8) and Mid Glamorgan (Rhondda Cynon Taff County Borough) Replacement Structure Plan (Policy EV4). These policies are particularly concerned with the control of development that has the potential to be visually intrusive with regard to the SLAs which are themselves defined on the basis of their perceived visual sensitivity "*...due to their being visible over a wide area*"[11]. The nearest SLA lies approximately 4 km south of the proposed site. The development is unlikely to have an adverse affect on the landscape setting of this area which extends from the southern edge of Croeserw west towards Werfa before stretching north to encompass the valleys of Rhondda. Much of the area contained within this designation is largely exposed upland with open moorland, grassland and forestry plantations. Although the height of the turbines is of sufficient scale to have negative landscape impact, the distance from the Strategic Coalfield Plateau and the large scale of the landscape character area is such that the construction and operation of the turbines would be a visual intrusion of "*acceptable levels*". A similar conclusion also applies to the potential intrusion upon the SLA situated further to the east.

At a smaller scale are the nineteen Landscape Conservation Areas (LCAs) designated in 1991 and listed in the Mid Glamorgan Replacement Structure Plan from some of which it is possible that the proposed wind farm will be visible. However these designations are principally concerned with the preservation of the distinctive characteristics of the landscapes which were considered to be under threat from the extension of the built up areas and inappropriate alterations to buildings as well as the impacts of intrusive developments. As the wind farm site is located well away from any of these LCAs and there will be no loss of resources it is not considered that the wind farm will impinge upon this designation.

9.6 Predicted Visual Changes and Consequences

9.6.1 Construction Period

This section of the assessment considers the predicted effects of the six month construction period that would be required for the proposed Ffynnon Oer wind farm upon identified visual receptors within the zone of visual influence (see Figure 9.1). A total of 28 potentially key

[10] Port Talbot Local Plan, Deposit Draft, policy E18.

[11] Mid Glamorgan (Rhondda Cynon Taff County Borough) Replacement Structure Plan 1991-2006 para 6.5.3.

groups of visual receptors, plus 6 routes, were identified during the baseline survey. These are set out in Table 9.4 and their locations shown in Figure 9.2. It should be noted that by choosing only receptors that are potentially in the ZVI several nearby communities such as Tonna, Blaengwrath and Morfa Glas are not included in the subsequent assessment tables as no views will be available.

9.6.2 Overview of Predicted Visual Changes During Construction Period

The scale of the construction works has the potential to be visually intrusive over a considerable area. For the most part ground level construction activities will not have a dramatic visual impact on the majority of visual receptors. Instead it is predicted that most adverse impacts will be caused by the use of cranes with their associated intrusion on the skyline making them a focal point especially in middle and long distance views.

Apart from those receptors within close proximity of the site, for example users of St Illtyd's Walk, Table C1 in Appendix C, setting out the predicted visual impacts during the construction period, indicates that the level of impacts for most of the considerable number of receptors living, working and undertaking recreational activities within the study area will be reduced or diminished by a combination of factors. Key factors in reducing the severity of the visual effect include:

- The influences of local topography is critical with regard to a number of areas. Although the height of the cranes will be an intrusion visible on a section of the skyline, receptors within one of the many valley floors are located within 'blind spots' created by topographical variations. A good example is Afan Valley Country Park situated located within the floor to Afan Valley. The steep sides of the valley foreshortens northeasterly views preventing views of ground level construction activities within the site.

- The screening provided by large coniferous forest plantations are a landscape characteristic of the area. Situated predominately on more elevated ground, the forest cover restricts the number of receptors impacted by views of ground level construction activities.

- The built environment of the settlements located around the site interrupts and obscures views of the majority of receptors located within and close to them. A good example of this are potential receptors situated in the northern quarter of Swansea where possible views of the site would be reduced by the density of surrounding buildings foreshortening or severely framing views.

- A final factor that will play a significant role regarding visibility of crane activities will be the weather. The majority of the receptors are located over a 5 km distance away from the site, intervening weather conditions such as rain and haze will significantly reduce visibility of the site and activities that occur within it. In particular this will reduce the availability of long distance views from the Brecon Beacons.

Overall the receptors that are predicted to sustain the greatest changes to their existing views are those in the following locations:

- Users of the St Illtyd's Walk;

- Cyclists on the Celtic Trail/High level route 47;
- Users of the Coed Morgannwg Way;
- Residents of Croeserw;
- Residents at Bryn-Caws Farm.

9.6.3 Operational Period

This section of the assessment considers the predicted effects of the twenty year operational period that would be required for the proposed Ffynnon Oer wind farm upon the same range of identified visual receptors. In order to aid visualisation the predicted view for each group of receptors or route is shown as a wire frame illustration in Figures 9.6 a-m, or photoviewpoint with wire frame illustrations in Figures 9.7 a-i, or as a Photomontage in Figures 9.9-9.15.

9.6.4 Overview of Predicted Visual Changes During Operational Period

The height of the proposed turbines is of scale which has the potential to be visually intrusive over a considerable area. Within the immediate vicinity of the site it will be inevitable that large visual impacts will be sustained, for example users of the public rights of way that surround the site.

Table C2 in Appendix C which analyses the predicted visual impacts during the operational period, however, indicates that the level of impacts for most of the considerable number of receptors living, working and undertaking recreational activities within the study area will be reduced or diminished by a number a combination of factors. Key factors in reducing the severity of the visual effect include:

- The influences of local topography is critical with regard to a number of areas. As shown on the ZVI (see Figure 9.1) a large area in the west of the study area will not be susceptible to views of the proposed wind farm. The valley topography interrupts views of a number of receptors located within valley floors, for example road users on the A4061 travel within a narrow valley which foreshortens views out of the valley and prevents views of the turbines. This is also the case for the Afan Agroed Country Park situated approx. 5 km southwest within Afan Valley.
- The screening provided by large blankets of coniferous forest plantations works in combination with the topography. Situated predominately on elevated locations, the forest cover restricts and filters a number of views experienced by receptors. The forest cover also limits the amount of the turbine tower visible for example views from the village of Croeserw. The potential for clear felling operations to substantially alter the nature of views is acknowledged but cannot be accurately predicted. See photomontage Figure 9.11 a-c.
- The built environment to the east of the site interrupts and obscures views of the majority of receptors located within and close to them.
- A final factor that will play a significant role regarding visibility of the turbines will be the weather. The majority of the receptors are located over a 5 km distance away from the site, intervening weather conditions such as rain and haze will

significantly reduce visibility of the site and activities that occur within it. In particular this will have an impact on long distance views from the Brecon Beacons. See photomontage Figures 9.9a-c and 9.10a-c.

Overall the receptors that are predicted to sustain the greatest changes to their existing views are those in the following locations:

- Residents of Croeserw;
- Residents of Cilfrew;
- Bryn-Caws Farm;
- Proposed Afan Valley Holiday Park;
- Users of the St Illtyd's Walk;
- Cyclists on the Celtic Trail / High Level Route 47;
- Users of the Coed Morgannwg Way;
- Users of public rights of way on Foel Trawsnant.

9.7 Evaluation of Landscape Effects

9.7.1 Criteria

The significance of landscape effects reflects the sensitivity of the categories of landscape resources to change (see Table 9.5) and the magnitude of that change (see Table 9.6). The evaluation of criteria and thresholds is primarily based upon professional judgement and is tailored to suit individual locations. It is important to use sensitivity criteria of an appropriate scale for the development. In some cases where criteria are chosen to reflect national sensitivities, such as designated National Parks or Areas of Outstanding National Beauty it is possible that issues of local importance are under emphasised. The opposite is also true. If the highest significance is assigned to nationally designated landscapes and the study area falls within one, there is the assumption that all of the land within that study area is of the highest sensitivity to change. This is patently not true and the sensitivity criteria should be altered accordingly. Sensitivity criteria should be reviewed on a case by case basis.

The intention of identifying criteria is to aid in the separation of fact from interpretation and to assist in demonstrating the nature and extent of the identified landscape effects. The criteria in this case for evaluating sensitivity of landscapes and the positive and negative magnitudes of effect are outlined below:

Table 9.5 Sensitivity of Landscape Resources

Landscape Resource Categories	Sensitivity
Important components or landscapes of particularly distinctive character and therefore likely to be subject to national or local designation and be vulnerable to relatively minor changes	High
	↓
Moderately valued characteristics reasonably tolerant of change	Medium
	↓
Relatively unimportant / immature or damaged landscapes tolerant of substantial change	Low

Table 9.6 Magnitude of Landscape Effects

Predicted Landscape Effects	Level
Notable changes in landscape character over an extensive area or intensive change over a more limited area/complete loss of notable features or elements	High
	↓
Moderate changes over a localised area/partial loss/alteration of notable features or elements	Medium
	↓
Little change in any landscape feature	Low

9.7.2 Significance of Landscape Effects

There has been a general consensus in recent landscape assessments on the recognition of three thresholds of significance that are derived from different combinations of landscape resource sensitivity and impact magnitudes. Once again the appraisal reflects the principles laid down with the LI/IEMA Guidelines. The three significance categories used are:

- '**Major**' meaning any combination of high or medium sensitivity with high impact magnitude;
- '**Minor**' meaning low sensitivity or low magnitude;
- '**Not Significant**'.

The assessment of significance is on a qualitative basis, as a scoring system does not avoid subjectivity and suggests a certainty that may not be present.

9.7.3 Significance of Construction and Operational Landscape Effects

The significance of the identified landscape impacts during the six month long construction period and the operational period are summarised in Tables C3 and C4 contained within Appendix C.

9.7.4 Summary of Significant Landscape Effects

Table C3 and C4 in Appendix C describe the significance of the identified landscape impacts doing construction and operational periods. Significant adverse landscape effects are predicted to be generated by four separate aspects of the six month construction period. The identified construction activities are use of cranes which will be for a short period of 1 month maximum; construction of internal site roads, temporary fencing and materials stockpiles. During the subsequent operational period the movement of the turbines will have significant neutral effects upon both landscape characteristics and landscape character.

The significant construction adverse effects are all predicted to be sustained by the landscape characteristics level of landscape resources i.e. these activities have effects upon the characteristic patterns and combinations of landscape features that contribute to the landscape character, sense of place and scenic quality. Characteristics such as openness, simplicity, harmony and tranquillity are all important components of the landscape of the site and immediate environs which will be temporarily undermined by those identified construction activities. Also they ensure that the landscape is relatively sensitive and not particularly tolerant to changes being unable to easily absorb such activities. The construction activities do not have notable impacts upon landscape elements and the elements potentially impacted are all common within the landscape character area.

Similarly at the landscape character area scale the identified individual construction impacts are not predicted to be of a sufficient magnitude to generate significant adverse effects that would alter the distinct and recognisable pattern of tangible and intangible elements that interact to form the upland forestry/plateau moorland landscape character area. The construction period is too short-lived and most of the effects are relatively localised to significantly alter the landscape character area.

The effects associated with the operational period are not all considered to be adverse, although it is recognised that this judgement will not necessarily accord with that of all receptors. The removal of all the plant and materials required for the construction period and the associated high levels of movement will allow a return to existing levels of calm and isolation, with a return to the dominance of natural colours. Nevertheless it is recognised that the movement of the 62 m diameter turbines will have landscape effects of 'major' significance upon landscape characteristics and landscape character. Their movement will remove the existing stillness from the landscape, however it is arguable that the graceful movement of the three blades does generate a sense of calmness in the landscape. Likewise wind farms are becoming an increasingly recognised element in many upland landscapes, especially mid-Wales, northern Cornwall and parts of Scotland. Their presence can emphasis certain of the more intangible elements of upland plateau landscapes such as their exposure, isolation and starkness. Hence it is considered that the effects are neutral as opposed to adverse. Their operation will not have a negative effect upon the integrity of the landscape character area as the turbines could only function in a location that exhibits many of the characteristics that underlie the definition of the landscape character area.

Finally consideration must be given to the potential for cumulative landscape impacts and consequent effects to be generated, especially in the construction period where there are numerous individual activities occurring across the site. Hence it is predicted that when considered together, all the individual listed construction activities cumulatively generate a 'major' adverse landscape effect at a landscape characteristics scale for this six month period due

to the range of new colours, forms and textures they generate and the associated noise and movement of the construction teams.

9.8 Evaluation of Visual Effects

Drawing on the previous description of predicted visual effects, this section evaluates their significance. As set out in Section 9.2.4 visual significance is dependent on two factors:

- the sensitivity of the receptor to the effect;
- the magnitude of the predicted changes as measured along an agreed continuum.

For example, motorists using the A4017, especially westbound ones, have long distance views in which the flat summit of the proposed wind farm forms a section of the western horizon. This existing view is illustrated in Figure 9.15. The wireframe and the photomontage demonstrate that all 16 turbines will be at least partially visible above a section of the horizon representing a moderate change to the existing view in good weather conditions. The magnitude of visual impact is increased by this breach of the horizon and the contrast in form between the turbines and what is otherwise a landscape with few readily apparent man-made features. This leads to an overall prediction of a 'medium' level of magnitude of impact. This evaluation when combined with the comparatively low level of sensitivity the motorist category of visual receptors is ascribed under the adopted methodology leads to a predicted operational period significance level assessed as 'minor'.

The evaluation of the previously identified visual receptor viewpoints and routes for the seven month construction period is set out in Table C5 and that for operational period in Table C6, both in Appendix C.

9.8.1 Cumulative Visual Effects

The assessment has identified that a number of the viewpoint and route visual receptors that are likely to have views of two or more of the existing, permitted or proposed wind farms in and around the study area. The cumulative ZVI is shown in Figure 9.3. Of the locations listed in Tables C5 and C6, those that are predicted to potentially sustain cumulative visual effects are listed below with a note of which wind farms will potentially be visible, along with their distance and direction and an indication of the significance of the cumulative visual effect. Sequential cumulative effects for receptors using routes through the study area i.e. users of public rights of way and motorists on key roads are assessed in a separate part of the table.

Table 9.7 Assessment of static and sequential Cumulative Visual Effects

Visual Receptor Viewpoints and Routes	Approx. Distance to Ffynnon Oer (km)	Direction of View	Name of Other Wind Farm in View and Distance (km)	Potential Significance of Cumulative Effect
Static				
Croeserw	4.5	Southeast to northwest	Margam Wind Energy Cluster Approx 9 km	Properties on elevated ground situated on the southern edge are likely to sustain mid distance views of Ffynnon Oer wind farm combined with long distance views of Margam wind farm. The significance of the cumulative effect is likely to be low due to the distance of the Margam site and the requirement of clear atmospheric conditions for the effect to be sustained
Llangynwd	10	Southwest to North	Margam Wind Energy Cluster Approx. 3.5 km	The significance of cumulative effect is limited by the orientation of buildings within the village, although close distance views of Margam wind farm are likely
Llangynwd	10	North to East	Taff Ely Approx. 13 km	As mentioned above the orientation of the buildings within the village will effect the likelihood of cumulative effect. This combined with the distance of the two wind farms and the requirement for clear weather significantly limits the cumulative effect
Properties within the northern quarter of Swansea	18	East	Margam Wind Energy Cluster Approx. 18 km	Long distance views of Proposed Ffynnon Oer and Margam wind farms, however availability of clear views would be restricted by urban development and clarity of weather conditions. The opportunity for cumulative effects is therefore considered not significant
Sequential				
Sarn Helen	5	South - Southeast	Margam Wind Energy Cluster Approx. 16 km	Users of Sarn Helen, approx. 3 km northeast of Tonna, are likely to sustain middle distance views of a high number of turbines within Ffynnon Oer Wind Farm combined with long distance views Margam Wind Farm where 1 to 5 turbines would be visible. To sustain a cumulative effect the receptor would need to be looking in the correct direction and would require clear weather conditions. The cumulative effect is therefore considered to be low

Table 9.7 (continued) Assessment of static and sequential Cumulative Visual Effects

Visual Receptor Viewpoints and Routes	Approx. Distance to Ffynnon Oer (km)	Direction of View	Name of Other Wind Farm in View and Distance (km)	Potential significance of Cumulative Effect
Ogwr Ridgeway walk	12	Northwest	Margam Wind Energy Cluster Approx. 1 km	Users of the walk would sustains close distance views of the proposed Margam Wind Farm combined with long distance views of Ffynnon Oer Wind Farm leading to both potential sequential and cumulative views. In theory a range of between 21 to 27 turbines could be viewed, however, the clarity of views containing Ffynnon proposal would strongly dependent upon weather conditions. Therefore the sequential cumulative effect is considered to be low
Ogwr Ridgeway walk	12	Northeast	Taff Ely Approx. 14 km	Sequential and cumulative long distance views of both wind farms would ensure that they were seen as part of the wider landscape composition and not focal elements within the landscape. Combined with the requirement for clear weather conditions and intervening vegetation and topography restricting the number of turbines visible, the cumulative significance is therefore considered to be low
PROW leading up to the Black Mountain in the Brecon Beacons	17	Southeast	Margam Wind Energy Cluster Approx 27 km	Long distance views of the two wind farms would require clear weather. The distance between the receptor and wind farms would ensure that any turbines visible would be viewed in context of the wider landscape composition and therefore the cumulative significance would be low
A4063	3 km at nearest section	West to North (North bound)	Margam Wind Energy Cluster Approx. 4 km at nearest section	Although Margam Wind Farm would be visible from a number of places along the road the sequential cumulative effect is likely to be limited due to the restriction of built environment and topography interrupting views of Ffynnon Oer, therefore the significance of effect will be low
M4	12 km at nearest section	North to East (North bound)	Margam Wind Energy Cluster Approx. 4 km at nearest section	As previously mentioned in the above table views of Ffynnon Oer Wind Farm would be glimpsed at speed and would require road users to be looking away from the road. Longer lived views could be sustained of Margam Wind Farm however, these would also require road users to look away from the road. Cumulative effect is therefore limited and not considered to be significant

9.8.2 Summary of Significant Visual Effects

The significant visual effects of the construction period are generally limited to those receptors situated close to the proposed site. Although the use of cranes to raise the turbines will allow a key construction activity to be seen from further afield, the crucial ground level construction activities will generally only be seen by receptors with close distance views i.e. under 2.0 km. The use of cranes is likely to be restricted to a short period of approximately 1 month. Beyond this distance of 2.0 km the local topography and the screening provided by the large-scale mature, coniferous plantations severely limit the range of available views in which receptors could clearly discern the ground level activities. Consequently potential receptors in settlements such as Abercregan and Glyncorrwg which are both within 2.0 km of the edge of the site are predicted to only have partial views of the crane activities which generates predicted visual effects assessed as only 'minor' significance. The receptor groups who are predicted to sustain 'major' adverse visual effects and the reasons for this assessment are set out below:

- Croeserw - being located above the bottom of the Afan Valley on a north-facing valley side that faces the wind farm site some of its Croeserw's residents will have good views of the operation of the cranes which will intrude prominently above a section of the horizon producing a strong visual contrast.
- The Celtic Trail, St Illtyd's Walk and other public footpaths that cross or bound the site - close distance views with minimal opportunity for screening in open upland landscape hence sweeping views of all ground level construction activities.
- The Coed Morgannwg Way - as above but additional adverse impacts due to its use as access road for 2 km.

Uninterrupted views of the site in which the ground level construction activities are likely to be visible are limited to longer distance views from similarly elevated locations. At the distances involved it is considered unlikely that individual activities will be readily discernible and the clarity of the views will be dependent upon prevalent weather conditions. A good example of this situation is Byrn-Caws Farm which is located 7.5 km to the west at elevation of 210 m and has clear long distance views (see Figure 9.7f) in which the site is an element on the eastern horizon with no intervening screening planting or topographical features. Individual construction activities are unlikely to be discernible, except the cranes. This situation applies to the long distance views available from locations in the southern fringe of the Brecon Beacons National Park where receptors are considered to be particularly sensitive.

During the subsequent operational period there will be an increase in the number of visual receptors and the magnitude of visual impacts generated due to the height and movement of the turbines. Although slimmer than the turbine towers, the introduction of the 31 m diameter blades will increase the overall height of the structures thereby increasing their visual intrusiveness which in turn is compounded by their movement. Whilst masts, pylons and large aerials are existing visual elements in many views in the study area, Ffynnon Oer would be at a larger scale than any other developments on their horizons and as such a key consideration is its intrusiveness. Once again distance, prevailing weather conditions, topography and forestry plantation screening are key determinants and account for the absence of views from many potential middle distance receptor groups, particularly communities and isolated residential receptors located on lower valley sides. The receptor groups who are predicted to sustain 'major' adverse visual effects and the reasons for this assessment are set out below:

- The public footpaths on Werfa - intrusiveness on horizon and lack of any intervening screening elements;
- The bridleway and byway on Foel Trawsnant - intrusiveness on horizon and lack of any intervening screening elements;
- The Celtic Trail - for certain sections there is an absence of screening, compounded by proximity and predicted magnitude of change;
- The Sarn Helen long distance bridleway - intrusiveness on horizon and lack of any intervening screening elements along certain sections with the potential for cumulative and sequential visual impacts;
- The Coed Morgannwg Way - paucity of screening alongside some sections, proximity and magnitude of change;
- St. Illtyd's Walk; - as above;
- Some of the residents on the eastern edge of Cilfrew - visibility of a large number (13-16) of the turbines on the skyline;
- Some of the residents in Cymmer - partial middle distance views of upper parts of turbine and blade movement will form prominent intrusion on large section of northwestern horizon;
- Some of the residents in Abercregan - as above;
- Some of the residents and visitors to Croeserw and the adjacent proposed Afan Valley Holiday Park - as above.

For the remainder of the large number of potential visual receptors with middle or long distance views the assessment considers that the magnitude of visual change that will be generated by the wind farm i.e. the turbine and blades, will not be sufficient to generate effects of 'major' significance.

9.9 Summary

A development of the scale and location of the Ffynnon Oer Wind Farm will almost inevitably generate visual impacts which have consequent effects over a large area. There is an ongoing debate on to whether wind farm turbines in locations such as Ffynnon Oer have adverse, neutral or beneficial effects upon the existing views available to receptors. Research work and public attitude surveys discussed in the previously referenced guidance documents demonstrate that people have widely differing opinions on the types and importance of visual effects caused by wind farms. Opinions are influenced by socio-economic and educational background, recreational interests and the location of the people being polled. However in the Ffynnon Oer visual assessment we have consistently assumed a worst case scenario with the consequence that all visual effects have been classified as being 'adverse'.

The GLVIA guidance makes it clear that one of the key influences upon the magnitude of potential visual impacts is the design of the access to the wind farm. Unsympathetically designed new roads potentially cut across open hillsides to form very incongruous visual elements in their own right as well as leading the eyes of receptors to the turbines. Hence it is

important to point out that this situation will not arise at Ffynnon Oer as the access road will utilise an existing forestry track whose entire length is within the mature forestry plantation. This minimises potential views of the movement of construction and then maintenance vehicles and the potential visual intrusion and landscape impact of the track itself.

Apart from the much shorter length of time that the visual impacts will be generated from the construction period compared with operational period, there are other potentially important differences. There are predicted to be more receptors for the operational period when there are 16 turbines each with a height of 91 m as opposed to the construction period when there will only be one or two elements of a similar height i.e. the cranes. Given that one of the main predicted visual differences relates to views of the ground level activities, it is predicted that receptors sustaining greatest contrasts between the two periods will be the recreational receptors using the relative extensive network of PROWs within and around the site. Nevertheless the magnitude of the visual impacts sustained by the PROW users in both periods is such that the significance of the visual effects for both periods is assessed as being 'major'.

One of the key conclusions drawn from the assessment is the influence of distance upon magnitudes of impact. The photomontages from the Brecon Beacons National Park (Figures 9.9a-c and 9.10a-c) illustrate that at distances of 18.5 km each, the relatively small number of turbines proposed for Ffynnon Oer are not predominant visual elements. Nevertheless it is acknowledged that the movement of the blades will help to draw the eye towards them. Once again the influence of the weather on the turbines visibility must be emphasised, especially the fact that 1 in every 4 days is rainy or cloudy thereby preventing long distance views.

In addition the nature of the wind farm development, with no large new visual masses e.g. buildings, means that the potential for substantially screening or foreshortening existing views does not arise, except for internal views from some PROW sections. Instead the impacts generated by the operational wind farm will be concentrated on the potential of the turbine towers and blades to frame and/or filter close or middle distance views and most importantly to form an intrusive element in sections of existing views and/or form a focal point due to their skyline location.

The elevation of the Ffynnon Oer Wind Farm and the height of the turbines will ensure that there is an extensive Zone of Visual Influence (ZVI) which in turn implies potentially a large number of visual receptors. However the ZVI shown in Figure 9.1, which uses a conservative height estimate of 12 m for all the coniferous plantations, demonstrates that the ZVI only covers approximately fifteen percent of the 1257 km^2 study area. These are overwhelmingly the more elevated areas and as such does include a proportion of areas covered by local landscape designations. Along with forestry cover, topography is the dominant influence upon the extent of the ZVI as well as the regional and road pattern. Hence a very high proportion of the potential visual receptors located in valley bottoms or on lower valley sides, thereby assuring that they are much less likely to be included within the ZVI. The corollary of this baseline situation is that there are relatively few receptors with potential close distance views i.e. views from within 2.0 km of the wind farm in which the turbines would be the dominant visual element.

Wind farm proposals usually generate concerns that they will have adverse effects upon existing landscape character which is one of the primary criteria under which landscapes are designated to provide protection against unsuitable development. The southern part of the site of is covered by a local landscape designation; the unadopted Port Talbot Local Plan Landscape Protection

Area (LPA), whilst there are other landscape designations: Special Landscape Areas (SLAs) and Strategic Coalfield Plateau and Associated Valley Sides within the study area, whilst impacts upon the nationally designated Brecon Beacons National Park has been discussed above. The key landscape designation is the unadopted LPA: whilst the landscape assessment demonstrates that no important landscape elements will be lost to cause any detrimental landscape (or environmental or ecological) effects, it is unlikely to directly enhance existing landscape qualities.

The impacts of the construction and the operation of the wind farm upon landscape elements are very limited. They will concentrate upon the loss of areas of acid grassland and raised blanket bog plus possibly short sections of a dilapidated dry stonewall; all of which are very widespread features in regional upland moorland landscape character areas. It is important to note that by utilising existing forestry roads for access the proposal avoids one of the usual adverse landscape effects associated with wind farm development, namely the requirement to construct a new access road with the associated potential loss of landscape elements and adverse impacts upon landscape characteristics.

The construction and operation impacts and consequent effects upon landscape characteristics generally have a higher level of significance, although for the operational period the assessment considers that the effects are neutral as opposed to adverse during the short-lived construction period. The wind farm's operation would modify some of the more intangible landscape characteristics such as openness, simplicity, harmony and tranquillity, especially during construction activities. The introduction of the 16 turbines would also modify tangible characteristics such as colour, movement and the balance between man-made and apparently naturalistic landscape characteristics. However it is important to bear in mind that the present landscape is itself largely a result of human activities, as witnessed by the evidence of past mining, and that the predicted landscape changes are not permanent.

Overall it is considered that the magnitude of the predicted changes during both construction and operational periods will not be sufficiently large to undermine the upland forest/plateau moorland landscape character area or any of the other defined character areas. There are many precedents within the study area of man-made features in prominent locations such as communication masts and pylons which have not undermined existing landscape character areas. The simple and large-scale character is a robust and can incorporate a development of the type and scale of the proposed wind farm. Wind farms are gradually becoming accepted features in this landscape type in Britain and Europe and their presence and associated movement can highlight many of the components of the landscape character such as exposure and remoteness.

9.10 References

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